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U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
George K. Burgess, Director

STANDARDS AND SPECIFICATIONS IN THE WOOD-USING INDUSTRIES

NATIONALLY RECOGNIZED STANDARDS AND SPECIFICATIONS FOR WOOD AND MANUFACTURES THEREOF INCLUDING PAPER AND PAPER PRODUCTS

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THIS VOLUME represents the first attempt on the part of the Department of Commerce to collect and publish the substance of the standards and specifications in the wood-using industries formulated by the national technical societies, the trade associations having national recognition, or other organizations which speak for industry or with the authority of the Federal Government as a whole.

Criticisms and suggestions are desired from all interested persons, so that the presentation of the information concerning the nationally recognized specifications may be made most nearly universally satisfactory and that the collection of existing specifications and classification thereof may be kept as complete, accurate, and up to date as possible. All recommendations for improvement received will be given careful consideration when future editions are issued.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF STANDARDS,
Washington, June 17, 1927.

SIR: I have the honor to submit herewith for publication the manuscript for a compilation relating to "Standards and Specifications in the Wood-Using Industries."

In conformity to the plans outlined by you in 1923 a review has been made of the standards, specifications, simplifications, and testing methods in use in this country. The advisory board, composed of official representatives of 14 national organizations interested in the preparation, unification, and utilization of specifications, recommended that the material published as a result of this review be broken into two distinct parts, one part to consist of an index of existing specifications with such explanatory matter as might be necessary to elucidate the scope of each specification, and the other part to contain copies of actual specifications (or abstracts) instead of merely titles.

In 1925 the National Directory of Commodity Specifications was issued as the first part just referred to. The present compilation represents the beginning of the other part. It is the first of a series of publications dealing with the standards and specifications in various industries, to be issued as rapidly as conditions will permit.

By giving the substance of such standards and specifications as can be considered nationally recognized, the progress thus far made in standardization and simplification is pictured. By indicating the important commodities for which no nationally recognized specifications are as yet available, the lines along which standardization and simplification work might well be undertaken by the interested branches of the wood-using industries are shown.

Respectfully,

GEORGE K. BURGESS,
Director, Bureau of Standards.

Hon. HERBERT HOOVER,
Secretary of Commerce.

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INTRODUCTION

In carrying forward a program involving the formulation of nationally acceptable standards and specifications in the wood-using undustries there are encountered all of the major problems common to other industries and certain other highly important problems peculiar to these industries.

The material from which lumber is manufactured is not man-made, and to a large extent both the properties and the dimensions have limits beyond the control of man. The limits are such that the lumber industry has formulated "grading rules" for judging the suitability of lumber for various purposes rather than quality specifications to be met by lumber manufacturers.

No little confusion has been created by the lack of uniformity in the grading rules formulated by the various regional and species associations of the lumber industry and by the difference in interpretation of these rules by the lumber manufacturers, wholesalers, and retailers.

Not only in quality but also in quantity does lumber standardization present unusual problems. A piece of lumber in the green state possesses a size, or thickness, markedly different from that of the same piece some weeks or months after being cut. Moreover, the manufacturing methods to which lumber must usually be subjected before becoming suitable for use add to the change in thickness, the final result being that lumber sawed initially in a green state to 1 inch in thickness, for example, becomes, say, $\frac{25}{32}$ inch in thickness when commercially dried and surfaced. That some such variation in size is unavoidable has been fully recognized in the "American Lumber Standards" which are rapidly being introduced in all branches of the lumber industry.

The main features of the grading rules and standards actually adopted by the numerous lumber manufacturers' associations, technical societies, and consumer organizations are in good agreement with the finding and recommendation of the Forest Products Laboratory of the United States Department of Agriculture, which has been studying, investigating, and urging lumber standardization for many years. They have been developed and formulated by a Central Committee on Lumber Standards, representing the whole industry, organized as the result of general lumber conferences called by Secretary Hoover, of the United States Department of Commerce.

When revising their grading rules, the lumber manufacturers' associations nave given full recognition to the American Lumber Standards formulated by the central committee of the industry. Individual associations have applied the rules to the species of lumber handled by them, making such minor modifications and additions thereto as seemed desirable to meet the requirements of the market for their products. Considering the innumerable possibilities for differences in interpretation, the current rules of the lumber associations are found to be in remarkably good agreement. Although without judicial authority the Central Committee on Lumber Standards has been markedly successful in encouraging the putting into practice of the recommendations which have been indorsed by the general conferences representing all branches of the trade and the public.

Not in giving a historical summary of the lumber standardization movement, but rather in showing the present status of that movement and emphasizing the degree of success already attained by the industry in unifying its grading rules and conforming to the dimensional standards set up within the industry itself, resides the value of the compilation presented in this volume.

An attempt has been made to include, directly or by adequate reference, the substance of all standards and specifications in the wood-using industries formulated by the lumber manufacturers' associations and other trade associations having national recognition; the

national technical societies, including those dealing with lumber and manufactures thereof, paper, and paper products; and other organizations which speak for industry or with the authority of the Federal Government as a whole.

Use has been made of the decimal system of classification of wood and paper which was employed in the National Directory of Commodity Specifications. In utilizing this system advantage has been taken of the opportunity to insert under the proper classification numerals certain important commodities or groups of commodities for which there might well be, but are not as yet, specifications that can be referred to as nationally recognized or sponsored by nationally recognized organizations.

STANDARDS AND SPECIFICATIONS IN THE WOOD-USING INDUSTRIES

400–409 TIMBER AND OTHER UNMANUFACTURED OR PARTLY MANUFACTURED WOOD

400. GENERAL ITEMS RELATING TO LUMBER

400.0 LUMBER STANDARDIZATION

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

SOFTWOOD LUMBER

In accordance with the unanimous action on December 12 and 13, 1923, April 22, 1924, May 1, 1925, and April 27, 1926, of the general conferences of representatives of manufacturers, distributers, wholesalers, retailers, and users of lumber, and representatives of architects, engineers, and general contractors named herein, the United States Department of Commerce, through the Bureau of Standards, recommends that recognized classifications, nomenclature, basic grades, sizes, description, measurement, tally, shipping provisions, grade marking, and inspection of lumber be established as follows:

To the extent to which differences in quality of timber, in conditions of manufacture, and in the uses to which the product is put, will, in practical application, permit, the basic provisions for the grading of lumber shall be uniform.

LUMBER CLASSIFICATIONS

For the purposes of simplification of sizes and grades and of equalizing, among species used for similar general purposes, the grades of a similar name, lumber shall be classified by principal uses into (*a*) *yard lumber*, (*b*) *structural timbers*, (*c*) *factory or shop lumber*.

USE CLASSIFICATION

Lumber is the product of the saw and planing mill not further manufactured than by sawing, resawing, and passing lengthwise through a standard planing machine, crosscut to length and matched.

Lumber is classified as (*a*) *yard lumber*, (*b*) *structural timbers*, and (*c*) *factory or shop lumber*. Different grading rules may apply to each class of lumber.

(*a*) *Yard lumber.*—Lumber that is less than 6 inches in thickness and is intended for general building purposes. The grading of yard lumber is based upon the use of the entire piece.

(*b*) *Structural timbers.*—Lumber that is 6 inches or over in thickness and width. The grading of structural timbers is based upon the strength of the piece and the use of the entire piece. (See 412.0.)

(*c*) *Factory or shop lumber.*—Lumber intended to be cut up for use in further manufacture. It is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a specified, or a given minimum size and quality. (See 413.0.)

SIZE CLASSIFICATIOI

Yard Lumber

(*a*) *Strips.*—Yard lumber less than 2 inches thick and under 8 inches wide.

(*b*) *Boards.*—Yard lumber less than 2 inches thick, 8 inches or over in width.

(*c*) *Dimension.*—All yard lumber except boards, strips, and timbers; that is, yard lumber 2 inches and under 7 inches thick, and of any width.

Planks: Yard lumber 2 inches and under 4 inches thick and 8 inches and over wide.

Scantlings: Yard lumber 2 inches and under 6 inches thick and under 8 inches wide.

Heavy joists: Yard lumber 4 inches and under 6 inches thick and 8 inches or over wide.

Structural Timbers

(*d*) *Timbers.*—Lumber 6 inches or larger in least dimension.

MANUFACTURING CLASSIFICATION

Manufactured lumber is classified as (*a*) rough, (*b*) surfaced, and (*c*) worked.

(*a*) *Rough lumber.*—Undressed as it comes from the saw

(*b*) *Surfaced lumber.*—Lumber that is dressed by running through a planer. It may be surfaced on one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E), or a combination of sides and edges, (S1S1E), (S2S1E), (S1S2E), or (S4S).

(*c*) *Worked lumber.*—Lumber which has been run through a matching machine, sticker, or molder. Worked lumber may be (1) matched, (2) shiplapped, or (3) patterned.

Matched lumber: Lumber that is edge dressed and shaped to make a close tongued and grooved joint at the edges or ends when laid edge to edge or end to end.

Shiplapped lumber: Lumber that is edge dressed to make a close rabbetted or lapped joint.

Patterned lumber: Worked lumber that is shaped to a patterned or molded form.

LUMBER INSPECTION PROVISIONS AND SERVICE

Lumber must be accepted on grade in the form in which it is shipped. Any subsequent change in manufacture, millwork, or dry kilning will prohibit

an inspection for the adjustment of claims, except with the consent of all parties interested.

Official association inspection service for the inspecting of lumber sold as of standard size and standard grade shall be available to nonmembers of associations upon request and at a reasonable charge.

In case of complaint on account of the grade or tally of any shipment of standard size or standard grade, official association reinspection shall be available.

Official association inspection service shall not be required to be furnished for the inspection of "special" grades of lumber (that is, not recognized in published grading rules), and inspection service for "special" grades shall be furnished only when the exact specifications of such grades in writing are furnished to the inspector.

Where buyers demand, and will pay the cost thereof, a certificate made by a certified association inspector shall be furnished with each shipment so arranged for.

Upon receipt of complaint from the purchaser the seller shall immediately request the association under whose rules shipment has been made to provide official reinspection or remeasurement, as the case may be, according to its inspection rules in effect at the time of execution of contract; and the purchaser shall lend all reasonable assistance to facilitate the reinspection or remeasurement.

The expense of such reinspection or remeasurement may be divided between the buyer and seller, or may be borne by either, according to agreement between them, but the person calling for the reinspection shall be responsible to the association for the costs thereof.

In cases of complaint regarding grade but not involving measurement (tally), the buyer is required to accept that portion of a shipment of lumber of standard grade or standard size which is up to grade or of standard size as the case may be, holding intact that portion thereof the grade or size of which is in dispute for official association inspection; the action on the part of the buyer in accepting and using such portion of the shipment shall not be construed as his acceptance of the entire shipment; further, the buyer shall pay in accordance with the terms of sale for that portion which he accepts, but acceptance by the buyer of a part of a shipment does not prejudice his just claims on account of any unused material that is alleged by him to be below standard grade or not of standard size. The complainant buyer shall hold disputed material intact, properly protected, for not exceeding 60 days, and shall file complaint with seller within 10 days from receipt of shipment.

A shipment shall be considered as of the grade invoiced if, upon official association reinspection under the grading and inspection rules under which the lumber has been graded and sold, 95 per cent thereof or more is found to be of said grade, the material below said grade to be accepted by the buyer as of its actual grade. Where the de-grades are in excess of 5 per cent of the shipment, or where the de-grades are found upon official reinspection to be more than one grade lower than the grade invoiced, the de-grades shall be the property of the seller. These provisions shall not apply in the case of specially worked lumber.

There shall be created by the lumber manufacturers a central bureau to promote uniformity and the maintenance of high standards of grading and inspection of lumber.

Each manufacturers' association publishing lumber grading rules and conducting inspection service shall furnish to such central bureau complete information descriptive of the plan of operation and continuous regular reports of its inspection department.

In order to simplify, coordinate, and, so far as practicable, unify the methods of inspection, each such association shall be furnished by such central bureau the plan of operation and the record of performance of the inspection service of each other association.

In pursuance of national responsibility of the lumber industry for the maintenance of agreed American lumber standards, if, after original association inspection, reinspection, and if necessary after reinspection, a report thereon of the chief inspector, any complaint involving agreed and published standards of lumber size, or grade, or inspection shall not have been settled, the National Lumber Manufacturers Association, by agreement or upon request, will represent the manufacturing shipper in arrangement for arbitration.

The National Lumber Manufacturers Association will represent, by agreement, the subscribing regional associations of lumber manufacturers, and other associations of, or representing, lumber manufacturers, upon request, in matters involving the administration of inspection and the maintenance of the agreed standards of lumber size and lumber grade designated as American lumber standards.

The formulation of regulations for the conduct of inspection to secure the application of the grading rules published by lumber associations, and the administration, supervision, and conduct of inspection service, be exclusively by the lumber industry, and (or) lumber consumers (that is, by the agencies of the lumber trade, and (or) lumber consumers, and not by or under the authority, auspices, or direction of any Government agency or agencies.)

Nationally administered association lumber inspection, in the sense of a national service to replace the existing services of regional and other associations, is not now practicable.

Each association shall undertake to reinspect lumber for its members, and for nonmembers upon request.

All grading shall be done by properly supervised and qualified graders or inspectors.

So far as it is within their power, the associations within the lumber industry shall undertake, through association grades and inspection service, arbitra-

tion, and, if practicable, through grade marking and otherwise, to maintain for the benefit of the lumber-using public the standards of size and basic grade names and classifications as agreed upon and as published in the association grading and inspection rules.

The associations which make grading rules and conduct lumber inspection service shall maintain such size, grade, and inspection standards as may have been agreed to.

Each such association shall assume responsibility for the maintenance in the manner herein outlined, by its individual members or subscribers, of said size standards, basic grade classifications, and inspection standards.

The principle of responsibility of the entire organized lumber industry for the maintenance of agreed and published size, grade, and inspection standards is recognized; and for the suitable discharge of such responsibility the Central Committee on Lumber Standards or similar suitable agency shall be continued.

Lumber manufactured, graded, measured, and described, as herein provided, shall be considered American standard lumber. The purchase, sale, or shipment of lumber as American standard is construed as involving agreement to submit to official association inspection any complaint involving either standard sizes or standard grades.

Sales contracts should incorporate in substance the following clause:

> Shipment under this contract shall be in accordance with the American Lumber Standards.

In the case of shipments made or received under such contracts exemption from any provision of the American Lumber Standards shall be by special agreement and the burden of proof thereof shall be upon person claiming exemption.

NOMENCLATURE OF COMMERCIAL SOFTWOODS

The following standard commercial names for lumber cut from the principal species of softwoods shall be used in the construction of contracts and in the formulation of lumber-grading rules and the terms of purchase and sale of American standard lumber. Preferred commercial names are shown in italic.

Standard commercial name	Botanical name
Cedars	
Alaska cedar	Chamaecyparis nootkatensis.
Eastern red cedar	Juniperus virginiana.
Incense cedar	Libocedrus decurrens.
Northern white cedar	Thuja occidentalis.
Port Orford cedar	Chamaecyparis lawsoniana.
Southern white cedar	Chamaecyparis thyoides.
Western red cedar	Thuja plicata.
Cypress	
Red cypress (coast type)	Taxodium distichum.
Yellow cypress (inland type)	Taxodium distichum.
White cypress (inland type)	Taxodium distichum
Douglas fir	
Douglas fir (coast type)	Pseudotsuga taxifolia.
Red fir (intermountain type)	Pseudotsuga taxifolia.
Red fir (Rocky Mountain type)	Pseudotsuga taxifolia.
The true firs	
Alpine fir	Abies lasiocarpa.
Balsam fir	Abies balsamea and Abies fraseri (southern balsam fir).
Golden fir	Abies magnifica.
Noble fir	Abies nobilis.
Silver fir	Abies amabilis.
White fir	Abies concolor and Abies grandis (lowland white fir).
Hemlocks	
Eastern hemlock	Tsuga canadensis.
Mountain hemlock	Tsuga mertensiana.
West Coast hemlock	Tsuga heterophylla.
Larch (see also tamarack)	
Western larch	Larix occidentalis
Pines	
Arkansas soft pine	Pinus echinata and taeda.
California white pine	Pinus ponderosa and Pinus jeffreyi (Jeffrey pine).
Idaho white pine	Pinus monticola.
Jack pine	Pinus divaricata.
Loblolly pine	Pinus taeda.
Lodgepole pine	Pinus contorta.
Longleaf pine	Pinus palustris.
North Carolina pine	Pinus taeda and echinata, and Pinus virginiana (Virginia pine).
Northern white pine	Pinus strobus.
Norway pine	Pinus resinosa
Pond pine	Pinus serotina.
Pondosa pine	Pinus ponderosa.
Shortleaf pine	Pinus echinata.
Slash pine	Pinus caribaea.
Southern pine	Pinus taeda, palustris, serotina, echinata, and caribaea, and Pinus rigida (pitch pine), and Pinus glabra (spruce pine).
Sugar pine	Pinus lambertiana.
Redwood	
Redwood	Sequoia sempervirens.
Spruces	
Eastern spruce	Picea mariana (black spruce), Picea rubra (red spruce), and Picea glauca (white spruce).
Engelmann spruce	Picea engelmanni and Picea parryana (blue spruce).
Sitka spruce	Picea sitchensis.
Tamarack	
Tamarack	Larix laricina.

STANDARD LUMBER ABBREVIATIONS

The following standard lumber abbreviations when used in contracts and other documents arising in the transactions of purchase and sale of American standard lumber shall be construed as hereinafter provided:

AD	Air dried.
a.l	All lengths.
av	Average.
av.w	Average width.
av.l	Average length.
a.w	All widths.
B1S	Beaded one side.

B2S—— Beaded two sides.
BBS—— Box bark strips.
bd—— Board.
bd.ft—— Board foot; that is, an area of 1 square foot by 1 inch thick.
bdl—— Bundle.
bdl.bk.s—— Bundled bark strips.
Bev—— Beveled.
B/L—— Bill of lading.
b.m—— Board (foot) measure.
Btr—— Better.
c.&f—— (*Named port.*) *Cost and freight to a named port.* Term used when the seller is ready to go farther than the delivery of his goods upon a vessel and is willing to pay transportation to another port.
c.i.f—— (*Named port.*) *Cost, insurance, and freight to a named port.* Term used when the seller desires to quote a price covering the cost of the goods, the marine insurance on the goods, and all transportation charges to the point of delivery.
c.i.f.e—— (*Named port.*) *Cost, insurance, freight, and exchange to a named port.* This is the same as c. i. f. with the additional provision that the seller guarantees the buyer against loss due to a decline in the rate of exchange.
Clg—— Ceiling.
Clr—— Clear.
CM—— Center matched; that is, the tongue and groove joints are worked along the center of the edges of the piece.
Com—— Common.
Coop—— Cooperage (stock).
Csg—— Casing.
Ctg—— Crating.
cu.ft—— Cubic foot.
Cust—— Custom (sawed).
D&CM—— Dressed (one or two sides) and center matched.
D&H—— Dressed and headed; that is, dressed one or two sides and worked to tongue and groove joints on both the edge and the ends.
D&M—— Dressed and matched; that is, dressed one or two sides and tongued and grooved on the edges. The match may be center or standard.
D&SM—— Dressed (one or two sides) and standard matched.
D2S&CM— Dressed two sides and center matched.
D2S&M— Dressed two sides and (center or standard) matched.
D2S&SM— Dressed two sides and standard matched.
Dim—— Dimension.
D.S—— Drop siding.
E—— Edge.
E&CB1S— Edge and center bead one side; surfaced one or two sides and with a longitudinal edge and center bead on a surfaced face.
E&CB2S— Edge and center bead two sides; all four sides surfaced and with a longitudinal edge and center bead on the two faces.
ECM—— Ends center matched.
E&CV1S— Edge and center V one side; surfaced one or two sides and with a longitudinal edge and center V-shaped groove on a surfaced face.
E&CV2S— Edge and center V two sides; all four sides surfaced and with a longitudinal edge and center V-shaped groove on each of the two faces.
EM—— End matched—either center or standard.
ESM—— Ends standard matched.
exp—— Expert (lumber or timber).
FAS—— Firsts and seconds—a combined grade of the two upper grades of hardwoods.
f.a.s.vessel— (*Named port.*) *Free alongside vessel at a named port.* Term used when the seller desires to quote a price covering delivery of the goods alongside a vessel and within reach of its loading tackle.
f.bk—— Flat back.
fcty—— Factory (lumber).
F.G—— Flat grain.
Flg—— Flooring.
f.o.b—— (*Named shipment point.*) *Free on board at a named shipping point.* Term used when the price quoted applies only to an inland shipping point and the seller merely undertakes to load the goods on or in cars or lighters furnished by the railroad company serving the industry, or most conveniently located to the industry, without other designation as to routing.
f.o.b—— (*Named point.*) *Freight prepaid to* (*named point.*) *Free on board at a named point and freight prepaid to a named point.* Term used when the seller quotes a price including transportation charges to a given point without assuming responsibility for the goods after obtaining a clean bill of lading at point of origin.
f.o.b—— (*Named point.*) *Freight allowed to* (*named point.*) *Free on board at a named point and freight allowed to a named point.* Term used where the seller wishes to quote a price from which the buyer may deduct the cost of transportation to the point of destination, without the seller assuming responsibility for the goods after obtaining a clean bill of lading at the point of origin.

f.o.b. cars--- (*Named destination point.*) *Free on board cars at a named destination point.* Term used when the seller desires to quote a price covering the transportation of the goods to a given point, assuming responsibility for loss and/or damage up to that point.

f.o.b. cars--- (*Named point.*) *Free on board cars at a named point less carload lots.* Term used when the goods on which a price is quoted to a given point constitutes less than a carload lot.

f.o.b.------ (*Named port.*) *Lighterage free. Free on board at a named port with lighterage free.* Term used when seller desires to quote a price which will include the expense of transportation of the goods by rail to the seaboard, including lighterage.

f.o.b. vessel- (*Named port.*) *Free on board vessel at a named port.* Term used when the seller desires to quote a price covering all expenses up to and including delivery of the goods upon a vessel at a named port.

f.o.k------ Free of knots.

f.o.w------ First open water.

Frm ------ Framing.

ft--------- Foot or feet. Also one accent (′). *See* Symbols.

ft.b.m------ Feet board measure.

ft.s.m------ Feet surface measure.

Furn------ Furniture (stock).

G.R------- Grooved roofing.

H.bk------- Hollow back.

Hdl-------- Handle (stock).

hdwd------ Hardwood.

Hrt-------- Heart.

Hrtwd----- Heartwood.

1s&2s------ Ones and twos—a combined grade of the hardwood grades of first and seconds.

Impl------- Implement (stock).

in---------- Inch or inches. Also two accent marks (″). *See* Symbols.

KD--------- Kiln-dried.

k.d--------- Knocked down.

lbr---------- Lumber.

l.c.l--------- Less carload lots.

lgth--------- Length.

lgr---------- Longer.

lin.ft------- Lineal foot; that is, 12 inches.

Lng--------- Lining.

LR--------- Log run.

LR,MCO---- Log run, mill culls out.

Lth--------- Lath.

M---------- Thousand.

M.b.m------ Thousand (feet) board measure.

MCO------- Mill culls out.

Merch------ Merchantable.

m.l--------- Mixed lengths.

Mldg------- Moulding.

MR--------- Mill run.

M.s.m------ Thousand (feet) surface measure.

m.w--------- Mixed widths.

No--------- Number.

Ord--------- Order.

P---------- Planed.

Pat--------- Pattern.

Pky--------- Pecky.

Pln--------- Plain, as plain sawed.

Pn--------- Partition.

Prod-------- Production.

Qtd--------- Quartered—When referring to hardwoods.

rdm--------- Random.

res--------- Resawed.

Rfg--------- Roofing.

Rfrs-------- Roofers.

rip--------- Ripped.

r.l--------- Random lengths.

rnd--------- Round.

R.Sdg------- Rustic siding.

r.w--------- Random widths.

S&E--------- Surfaced one side and one edge.

S1E--------- Surfaced one edge.

S2E--------- Surfaced two edges.

S1S--------- Surfaced one side.

S2S--------- Surfaced two sides.

S1S1E------ Surfaced one side and one edge.

S2S1E------ Surfaced two sides and one edge.

S1S2E------ Surfaced one side and two edges.

S4S--------- Surfaced four sides.

S4SCS------ Surfaced four sides with a calking seam on each edge.

S&CM------ Surfaced (one or two sides) and center matched.

S&M------- Surfaced and matched; that is, surfaced one or two sides and tongued and grooved on the edges. The match may be center or standard.

S&SM------ Surfaced (one of two sides) and standard matched.

S2S&CM---- Surfaced two sides and center matched.

S2S&M----- Surfaced two sides and (center or standard) matched.

S2S&SM---- Surfaced two sides and standard matched.

Sap--------- Sapwood.

SB--------- Standard bead.

Sd---------- Seasoned.

Sdg--------- Siding.

Sel--------- Select.

S. E. Sdg---- Square edge siding.

s.f---------- Surface foot; that is, an area of one square foot.

Sftwd------- Softwood.

Sh.D-------- Shipping dry.

Ship-------- Shipment or shipments.

Shlp-------- Shiplap.

s.m--------- Surface measure.

SM--------- Standard matched.

smkd------- Smoked (dried).

smk.stnd---- Smoke stained.

s.n.d.—Sap no defect.
snd.—Sound.
sq.—Square.
Sq.E.&S.—Square edged and sound.
sqrs.—Squares.
Std.—Standard.
stnd.—Stained.
stk.—Stock.
Stp.—Stepping.
S.W.—Sound wormy.
Symbols: ″—inch or inches, as 12″.
′—foot or feet, as 12′.
x—by, as a 6 x 8 timber.
4/4, 5/4, 6/4, 8/4, etc.=1 inch, 1¼ inches, 1½ inches, 2 inches, etc., when referring to the size of lumber.
T&G.—Tongued and grooved.
TB&S.—Top, bottom, and sides.
Tbrs.—Timbers.
V1S.—V one side; that is, a longitudinal V-shaped groove on one face of a piece of lumber.
V2S.—V two sides; that is, a longitudinal V-shaped groove on two faces of a piece of lumber.
V.G.—Vertical grain.
wal.—Wider, all lengths.
Wth.—Width.
wdr.—Wider.
Wgn.—Wagon (stock).
wt.—Weight.

American Hardwood Lumber Industry.—Central Committee on Lumber Standards, nomenclature of commercial domestic hardwoods, 1927.

NOMENCLATURE OF COMMERCIAL DOMESTIC HARDWOODS

The following standard commercial names for lumber cut from the principal species, or groups of species, of domestic hardwoods shall be used in the construction of contracts and in the formulation of lumber-grading rules and the terms of purchase and sale of American standard lumber. Lumber cut from those species, or groups of species, marked with an asterisk (*) may be further designated as to region of production by the prefixes Appalachian, Northern, Southern, or Western.

Standard commercial name	Botanical name
Red alder	Alnus rubra.
	A. rhombifolia.
Aspen	Populus tremuloides.
	P. grandidentata.
* *White ash*	Fraxinus americana.
	F. biltmoreana.
	F. pennsylvanica lanceolata.
	F. pennsylvanica.
	F. quadrangulata.
Black ash	Fraxinus nigra.
Oregon ash	Fraxinus oregona.
Basswood	Tilia glabra.
	T. heterophylla.
Beech	Fagus grandifolia.
Birch	Betula lutea.
	B. lenta.
	B. nigra.
Paper birch	Betula papyrifera.
	B. populifolia.
Red birch	Heartwood of the above.
	Birches.
Alaska birch	Betula kenaica.
Buckeye	Aesculus octandra.
	A. glabra.
Butternut	Juglans cinera.
Catalpa	Catalpa speciosa.
Cherry	Prunus serotina.
* *Chestnut*	Castanea dentata.
	C. pumila.
Chinquapin	Castanopsis chrysophylla.
Coffeetree	Gymnocladus dioicus.
* *Cottonwood*	Populus deltoides virginiana.
	P. heterophylla.
	P. balsamifera.
	P. deltoides.
	P. sargentii.
* *Black cottonwood*	Populus trichocarpa.
	P. trichocarpa hastata.
	P. macdougalii.
	P. fremontii.
Cucumber	Magnolia acuminata.
Dogwood	Cornus florida.
Pacific dogwood	Cornus nuttallii.
Rock elm	Ulmus racemosa.
Soft elm	Ulmus americana. U. fulva.
Black Gum	Nyssa sylvatica.
Red gum	Liquidambar styraciflua, heartwood only.
Sap gum	Liquidambar styraciflua, sapwood only.
Hackberry	Celtis occidentalis.
	C. laevigata.
Hickory	Hicoria ovata.
	H. laciniosa.
	H. alba.
	H. glabra.
	H. ovalis.
Holly	Ilex opaca.
Ironwood	Ostrya virginiana.
Black locust	Robinia pseudoacacia.
Honey locust	Gleditsia triancanthos.
Lignumvitae	Guajacum sanctum.
Madrono	Arbutus menziesii.
Magnolia	Magnolia grandiflora.
Mahogany	Swietenia mahagoni.
Hard maple	Acer saccharum.
	A. nigrum.
Oregon maple	Acer macrophyllum
Soft maple	Acer saccharinum.
	A. rubrum.
White maple	Acer saccharum.
	Unstained sapwood.
Mulberry	Morus rubra.
Oregon myrtle	Umbellularia californica.
* *Red oak*	Quercus borealis maxima.
	Q. borealis.
	Q. velutina.
	Q. shumardii.
	Q. texana.
	Q. palustris.
	Q. phellos.
	Q. laurifolia.
	Q. rubra.
	Q. rubra pagodaefolia.
	Q. nigra.
	Q. ellipsoidalis.
	Q. coccinea.
	Q. marilandica.
	Q. kellogii.
	Q. catesbaei.
Tanbark oak	Lithocarpus densiflora.
* *White oak*	Quercus alba.
	Q. stellata.
	Q. lyrata.
	Q. bicolor.
	Q. muehlenbergii.

Standard commercial name	Botanical name
White oak—Contd.	Q. garryana.
	Q. prinus.
	Q. montana.
	Q. macrocarpa.
	Q. lobata.
	Q. virginiana.
	Q. douglasii.
	Q. utahensis.
	Q. emoryi.
	Q. arizonica.
	Q. oblongifolia.
White (live) oak	Quercus wislizenii.
	Q. agrifolia.
	Q. chrysolepis.
Osage orange	Toxylon pomiferum.
Pecan	Hicoria pecan.
	H. cordiformis.
	H. cordiformis elongata.
Persimmon	Diospyros virginiana.
Sassafras	Sassafras variifolium.
Silverbell	Halesia carolina.
Sycamore	Platanus occidentalis.
Tupelo	Nyssa aquatica.
Black walnut	Juglans nigra.
Willow	Salix nigra.
Yellow poplar	Liriodendron tulipifera.

American Railway Engineering Association, revisions of Manual, Bulletin 293, January, 1927.

WOODEN BRIDGES AND TRESTLES

The use, size, and manufacturing classification of timber and lumber for railway use are identical with the American Lumber Standards, 400.0.

The commercial names for lumber and timber cut from the principal species of softwood are identical with the American Lumber Standards, 400.0.

The definition of maximum defect and blemishes are American Lumber Standards, 400.0, with the following additions and variations:

CHECKS

Honeycombing: Checks occuring in the interior of a piece, often not visible on the surface. On a cross section they usually appear as slits or as open pockets whose width may appear very large in proportion to the radial length.

CROSS GRAIN

Wood in which the cells or fibers do not run parallel with the axis, or sides, of a piece. It may be classified as spiral, diagonal, wavy, dip, curly, and interlocked grain. The slope of the grain can be determined by observing the direction of surface checks, resin ducts, pores of the wood, annual layers of growth, etc. A drop of stained liquid, such as ink, tends to elongate in the direction of the grain when placed on a smooth surface of the piece.

SPIRAL GRAIN

Wood in which the fibers take a more or less winding or spiral course, such as occurs in a twisted tree. It may be detected on the flat grain (plain sawed or tangential) surface.

DIAGONAL GRAIN

Wood in which the fibers extend at an angle (that is, diagonally) across a piece as result of sawing at an angle across the annual layers of growth. It may appear on either the radial or tangential surface.

WAVY GRAIN

Wood in which the fibers take the form of waves or undulations as indicated by the wavy surface of the split piece. It may appear on either the radial or tangential surfaces.

DIP GRAIN

Wood which has one wave or undulation of the fibers such as occurs around knots, pitch pockets, etc.

CURLY GRAIN

Wood in which the fibers are distorted so that they take a curled direction as in "bird's-eye wood." These patches may vary up to several inches in diameter.

INTERLOCKED GRAIN

Wood which shows spiral grain in one direction for a number of years and then the slope of the grain in the succeeding annual layers of growth turns in a reverse direction around the tree, then later reverses back, etc.

The standard lumber abbreviations are the same as American Lumber Standards, 400.0.

American Hardwood Lumber Iudustry, Central Committee on Lumber Standards, hardwood lumber abbreviations—same as those for softwood. See page 3.

400.1 PHYSICAL ANALYSIS OF LUMBER

400.11 Descriptions of Lumber

American Lumber Industry, classifications of lumber and nomenclature of softwoods. See 400.0.

400.12 Properties and Uses of Lumber

American Association of State Highway Officials, unit stresses for structural grades of timber, December, 1926.

The following unit stresses for structural grades of timber are for use with computed stresses which contain no allowance for live-load impact.

Species of wood	Axial tension and bending in extreme fiber		Compression parallel to grain, short columns, Cs		Compression perpendicular to grain, all grades	Horizontal shear in beams		Ultimate modulus of elasticity, all grades
	Select	Common	Select	Common	Cp	Select	Common	
Cedar:								
Northern white	650	550	500	400	140	70	60	800, 000
Port Orford	1, 000	800	825	700	200	100	80	1, 200, 000
Western red	800	650	700	600	150	80	65	1, 000, 000
Chestnut	850	700	700	600	200	90	75	1, 000, 000
Cypress, southern	1, 200	900	1, 000	800	250	100	80	1, 400, 000
Fir:								
Douglas (coast)	1, 400	1, 100	1, 000	800	225	90	75	1, 600, 000
Douglas (coast), dense select	1, 600		1, 150		275	90		1, 600, 000
Red (intermountain)	900	750	800	650	225	85	70	1, 200, 000
Gum, black	900	750	750	625	200	100	80	1, 200, 000
Hemlock, west coast	1, 100	900	900	750	225	75	60	1, 400, 000
Larch, western	1, 100	900	1, 000	800	225	100	80	1, 300, 000
Oak, red and white	1, 200	1, 000	900	750	375	125	105	1, 500, 000
Pine:								
Idaho white, northern white, Pondosa, and sugar	800	650	750	625	150	85	70	1, 000, 000
Norway	1, 000	800	800	650	175	85	70	1, 200, 000
Southern yellow	1, 400	1, 100	1, 000	800	225	110	90	1, 600, 000
Southern yellow, dense select	1, 600		1, 150		275	110		1, 600, 000
Redwood	1, 000	800	900	750	150	70	60	1, 200, 000
Spruce:								
Eastern and Sitka	900	750	750	625	150	85	70	1, 200, 000
Engelmann	650	550	550	450	140	70	60	800, 000
Tamarack	1, 100	900	900	750	225	100	80	1, 300, 000

NOTE.—Values for direct shear parallel to grain in details of joints may be taken 50 per cent greater than the values for horizontal shear in beams.

American Railway Engineering Association, standard specifications for structural grades of lumber and timber, adopted 1927.

WORKING STRESSES

Notes on Tables of Working Stresses

1. *Authority.*—The working stresses in the table on page 10 are recommended by the Forest Products Laboratory, United States Forest Service, for structural grades complying with basic provisions for structural material of American Lumber Standards, including, also, stresses for red and white oak, as the same structural grades can be applied to hardwoods as to soft. In beam and stringer, and post and timber grades, stresses are given only for the species commonly cut to those sizes. Stresses for any other species can be obtained from the Forest Products Laboratory.

2. *Minimum strength value.*—Structural grades are devloped to insure minimum strength values. The defects permitted in the common grades provide material having not less than 60 per cent of the strength of green clear wood, and in the select grades, of 75 per cent, although in Douglas fir and southern pine the stresses recommended in compression and in extreme fiber in bending are 80 per cent of green clear wood strength on account of the limitation on rate of growth.

3. *Exposure.*—Working values are given for three conditions of exposure during use: (*a*) Continuously dry, (*b*) occasionally wet but quickly dried, (*c*) more or less continuously damp or wet. Judgment should be exercised as to the values to be used in a particular case.

(*a*) *Continuously dry.*—Continuously dry contemplates use in interior or protected construction not subject to conditions of excessive dampness or high humidity.

(*b*) *Occasionally wet.*—Occasionally wet but quickly dried assumes use in such exterior structures as bridges, trestles, grandstands or bleachers, and exposed frame work of open sheds.

(*c*) *Usually wet.*—More or less continuously damp or wet would apply to material exposed to waves or tidewater, or in contact with earth, or used in a building in portions that would be more or less continuously wet.

4. *Impact.*—The working values recommended may be used without allowance for impact up to 100 per cent.

5. *Maximum horizontal shear.*—Working values given for horizontal shear are maximum values. The maximum unit horizontal shear at any point in a beam as calculated is 3/2 of the average unit shear obtained by dividing the total shear at that point by the area of the cross section.

6. *Analysis for shear stress.*—Recognition of all loads in designing for moving loads, or loads concentrated near a support, gives a calculated shearing stress higher than is actually developed. In calculating the shear at one end of a beam, the concentrated loads between that end and a point distant three times the depth of the beam from it may be considered as acting at that point. In moving loads, as on highway bridges or railway stringers, in computing the shear at one end it is safe to ignore all wheel loads between that end and a point three times the depth of the beam or stringer from it when the balance of the span is assumed loaded so as to give a maximum shear stress.

7. *Shear stresses for joint details.*—Shear stresses for details may be taken as 50 per cent greater than the values for horizontal shear given in the table.

8. *Permanent set.*—Timber constantly yields under long continued loading, acquiring a permanent set. This set with a fully loaded beam is about equal to the deflection using the modulus of elasticity as given in the tables. In order to minimize the results of sag, it is advisable to use values one-half those given in the tables.

9. *Compression in short columns.*—The working stresses for compression parallel to grain are for use on posts, struts, etc., with unsupported length not greater than ten times their least dimension. They are also for use in end bearing on compression members, as a short column or strut is more likely to fail at the end than at any other point in its length, and the variations in moisture content are greater there.

10. *Compression in medium-length columns.*—For columns of intermediate length, the Forest Products Laboratory finds from tests recently made that a fourth-power parabola, tangent to the Euler curve, is a conservative representation of the law controlling the strength. That is, from the short block to the long column in which the strength is dependent in stiffness, there is a falling off in ultimate strength which follows a smooth curve, very flat at first but curving sharply to become tangent to the Euler curve at two-thirds of the ultimate crushing strength.

11. *Formula.*—For columns from $\frac{P}{A}=S$ *to* $\frac{P}{A}=\frac{2S}{3}$.

$$\frac{P}{A}=S\left[1-\frac{1}{3}\left(\frac{l}{Kd}\right)^4\right]$$

where P = total load in pounds,
A = area in square inches,
$\frac{P}{A}$ = unit compressive stress,
S = safe stress in compression parallel to grain or short columns.
l = unsupported length in inches,
d = least dimension in inches,
E = modulus of elasticity,
K = the $\frac{l}{d}$ at the point of tangency of the parabolic and Euler curves, at which $\frac{P}{A}=\frac{2}{3}S$. The value of K for any species and grade is

$$\frac{\pi}{2}\sqrt{\frac{E}{6S}}$$

12. *Influence of defects.*—The influence of defects on the compressive strength of columns of constant cross section decreases as the length increases. When $\frac{l}{d}$ equals the value of K for the species and grade, defects such as are allowable in the grade have little influence on the strength as a column. Beyond this length the investigation of the strength of columns indicated that the Euler formula is quite accurate for long wooden columns with pin-end connections and that the maximum load is dependent upon stiffness. In such columns, a factor of safety of 3 should be applied to values of modulus of elasticity in order to obtain safe loading.

13. The laboratory does not, with the present data and under ordinary conditions, find justification for increasing the stresses on square-end columns over those for carefully centered pin-end columns. Tests to determine the influence of end conditions are still being made and it is probable that under special conditions higher stresses can be used.

14. *Long columns.*—For long columns, with factor of safety of

$$3=\frac{P}{A}=\frac{\pi^2}{36}\frac{E}{\left(\frac{l}{d}\right)^2}$$

15. *Maximum length.*—Columns should be limited in slenderness to $\frac{l}{d}=50$.

16. *Direct tension.*—For direct tension, the same values as for extreme fiber stress in bending may be used. Straight-grained wood has greater resistance to tension than to any other kind of stress. It has been found practically impossible, however, to design joints that will develop anywhere near the full tensile strength.

17. *Joists and beams in direct tension.*—Grades of joists of beams may be used for members in direct tension, as in bottom chords of trusses, increase in size of defects toward ends being permissible because of the gradual application of stresses through splice plates or end connections.

18. *Joist and plank, vertical or horizontal.*—The provisions of the joist and plank grades are such that working stresses for these grades may be applied to material used with wide faces vertical or horizontal. In material 5 inches and thicker with loads applied to the wide face, the knot requirements for this face are those for the narrow face as given in the rules.

19. *Working stresses in timbers nearly square.*—Where working stresses in bending are required for caps, bridge ties, etc., they should be graded on

beam and stringer grades, but as such material is often square or has horizontal faces wider than the vertical faces, in contrast to beams and stringers in which the narrow faces are horizontal faces and the wide faces are vertical, care should be exercised that the knot limitations are applied to the proper faces.

20. *Two-span stringers.*—In railway stringers of two spans length, defects throughout the center two-thirds should be limited as in the center third of single span stringer, for the maximum moment will be over the center support and although the full positive moment would not be developed in either span as long as there was resistance to negative moment over the center support, there might be circumstances in which full positive moment of resistance at the centers of the two spans would be desirable.

Factors of Safety

21. *Elastic limit and breaking strength.*—In determining working stresses, the Forest Products Laboratory has considered both elastic limit and breaking strength. Elastic limit, however, is more variable and less definite than ultimate strength, and the latter is taken as the more dependable basis for the determination of safe working stresses.

22. *Factor of safety.*—The factor of safety at a given working stress varies materially with the duration of the stress. At the recommended working stresses, given in the table for continuously dry locations, the average timber in buildings has a factor of safety of 6 on impact loading,[1] a factor of 4 for five-minute loads, and 2¼ for long-time loading, with a minimum factor of safety of 2 on 75 per cent of the pieces under long-time loading. About 1 piece in 100, or very light weight and with maximum defects for the grade, would be expected to break at one and one-half times the recommended stress under loading of approximately 10 years duration. For new timbers in bridge construction, the factors of safety are about 15 per cent greater.

Factors Affecting Working Stresses

23. *Basis of working strength.*—Working stresses are based on the strength of the clear wood of the various species and, in some properties, on grade as fixed by limitation on size and location of knots, extent of shake and checks, and extent of cross grain, on conditions of exposure during use, and on size of piece. In southern pine and Douglas fir working stresses in some properties are increased for limitation on rate of growth and for requirement of percentage of summerwood.

24. *Variations, exposure, grade, size.*—Working stresses for extreme fiber in bending are varied with grade, extent of exposure, and size of piece; in horizontal shear, they are varied with grade; in compression parallel to grain, with grade and exposure; in compression perpendicular to grain, with exposure.

Working stresses in shear are not varied with size or extent of exposure; in compression parallel to grain they are not varied with size; in compression perpendicular to grain they are not varied with grade or size; in modulus of elasticity they are taken as the same in all grades.

26. *Rate of growth and density.*—In southern pine and Douglas fir, working stresses in extreme fiber in bending, compression parallel to grain and compression perpendicular to grain, in any grade, may be increased $\frac{1}{15}$ for material of close grain, or $\frac{1}{6}$ for dense material, over material not so selected. Values in these species in shear may be increased $\frac{1}{6}$ for dense material, but not for limitation on rate of growth. Modulus of elasticity is not varied with these properties.

27. *Variations in working stresses.*—

Property	Governing defects	Conditions of exposure	Grade	Size of piece	Rate of growth	Density
Extreme fiber stress in bending	Knots and angle of grain	(1)	(1)	(1 2)	(1)	(1)
Horizontal shear	Shake and checks	(3)	(1)	(3)	(2)	(1)
Compression parallel to grain	Knots and angle of grain	(1)	(1)	(3)	(1)	(1)
Compression perpendicular to grain.		(1)	(3)	(3)	(1)	(1)
Modulus of elasticity		(3)	(3)	(3)	(3)	(3)

[1] Varies with. [2] Dry location only. [3] Does not vary with.

Working stresses recommended by Forest Products Laboratory, United States Forest Service, for grades complying with basic provisions for structural grades of American Lumber Standards for joist and plank and beams and stringers

CONTINUOUSLY DRY

SELECT GRADE

Species	Extreme fiber in bending	Compression perpendicular to grain	Maximum horizontal shear	Modulus of elasticity
	Lbs./in.²	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*
Cedar:				
Western red	900	200	80	1,000,000
Northern and southern white	750	175	70	800,000
Port Orford	1,100	250	90	1,200,000
Alaska	1,100	250	90	1,200,000
Cypress, southern	1,300	350	100	1,200,000
Douglas fir:				
Coast region—				
Select	1,600	345	90	1,600,000
Dense select	1,750	380	105	1,600,000
Rocky Mountain region	1,100	275	85	1,200,000
Fir:				
Balsam	900	150	70	1,000,000
Golden, noble, silver, white	1,100	300	70	1,100,000
Hemlock:				
West coast	1,300	300	75	1,400,000
Eastern	1,100	300	70	1,100,000
Larch, western	1,200	325	100	1,300,000
Pine:				
Southern—				
Select	1,600	345	110	1,600,000
Dense select	1,750	380	128	1,600,000
California, Idaho and northern white, Pondosa, and sugar	900	250	85	1,000,000
Norway	1,100	300	85	1,200,000
Redwood	1,200	250	70	1,200,000
Spruce:				
Red, white, Sitka	1,100	250	85	1,200,000
Englemann	750	175	70	800,000
Tamarack, eastern	1,200	300	95	1,300,000

[1] If impact stresses are neglected when less than 100 per cent of the live load producing them, the factor of safety for such loads would be reduced from 6 to a minimum of 3.

Working stresses recommended by Forest Products Laboratory, United States Forest Service, etc.—Con.

CONTINUOUSLY DRY—Continued

COMMON GRADE

Species	Extreme fiber in bending	Compression perpendicular to grain	Maximum horizontal shear	Modulus of elasticity
	Lbs./in.²	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*
Cedar:				
Western red	720	200	64	1,000,000
Northern and southern white	600	175	56	800,000
Port Orford	880	250	72	1,200,000
Alaska	880	250	72	1,200,000
Cypress, southern	1,040	350	80	1,200,000
Douglas fir:				
Coast region	1,200	325	72	1,600,000
Rocky Mountain region	880	275	68	1,200,000
Fir:				
Balsam	720	150	56	1,000,000
Golden, noble, silver, white	880	300	56	1,100,000
Hemlock:				
West coast	1,040	300	60	1,400,000
Eastern	880	300	56	1,100,000
Larch, western	960	325	80	1,300,000
Pine:				
Southern	1,200	325	88	1,600,000
California, Idaho and northern white, Pondosa, and sugar	720	250	68	1,000,000
Norway	880	300	68	1,200,000
Redwood	960	250	56	1,200,000
Spruce:				
Red, white, Sitka	880	250	68	1,200,000
Englemann	600	175	56	800,000
Tamarack, eastern	960	300	76	1,300,000

OCCASIONALLY WET BUT QUICKLY DRIED

SELECT GRADE

Species	Extreme fiber in bending		Compression perpendicular to grain	Maximum horizontal shear	Modulus of elasticity
	4 inches and thinner	5 inches and thicker			
	Lbs./in.²	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*
Cedar:					
Western red	710	800	150	80	1,000,000
Northern and southern white	580	-------	140	70	800,000
Port Orford	890	1,000	200	90	1,200,000
Alaska	890	-------	200	90	1,200,000
Cypress, southern	980	-------	250	100	1,200,000
Douglas fir:					
Coast region—					
Select	1,240	1,385	240	90	1,600,000
Dense select	1,370	1,515	265	105	1,600,000
Rocky Mountain region	800	900	225	85	1,200,000
Fir:					
Balsam	670	-------	125	70	1,000,000
Golden, noble, silver, white	800	-------	225	70	1,100,000
Hemlock:					
West coast	980	1,100	225	75	1,400,000
Eastern	800	-------	225	70	1,100,000
Larch, western	980	1,100	225	100	1,300,000
Pine:					
Southern—					
Select	1,240	1,385	240	110	1,600,000
Dense select	1,370	1,515	265	128	1,600,000
California, Idaho and northern white, Pondosa, and sugar	710	-------	150	85	1,000,000
Norway	890	-------	175	85	1,200,000
Redwood	890	1,000	150	70	1,200,000
Spruce:					
Red, white, Sitka	800	900	150	85	1,200,000
Englemann	580	-------	140	70	800,000
Tamarack, Eastern	980	-------	225	95	1,300,000

Working stresses recommended by Forest Products Laboratory, United States Forest Service, etc.—Con.

OCCASIONALLY WET BUT QUICKLY DRIED—Contd.

COMMON GRADE

Species	Extreme fiber in bending		Compression perpendicular to grain	Maximum horizontal shear	Modulus of elasticity
	4 inches and thinner	5 inches and thicker			
	Lbs./in.²	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*
Cedar:					
Western red	600	640	150	64	1,000,000
Northern and southern white	490	-------	140	56	800,000
Port Orford	760	800	200	72	1,200,000
Alaska	760	-------	200	72	1,200,000
Cypress, southern	830	-------	250	80	1,200,000
Douglas fir:					
Coast region	980	1,040	225	72	1,600,000
Rocky Mountain region	680	720	225	68	1,200,000
Fir:					
Balsam	570	-------	125	56	1,000,000
Golden, noble, silver, white	680	-------	225	56	1,100,000
Hemlock:					
West coast	830	880	225	60	1,400,000
Eastern	680	-------	225	56	1,100,000
Larch, western	830	880	225	80	1,300,000
Pine:					
Southern	980	1,040	225	88	1,600,000
California, Idaho and northern white, Pondosa, and sugar	600	-------	150	68	1,000,000
Norway	760	-------	175	68	1,200,000
Redwood	760	800	150	56	1,200,000
Spruce:					
Red, white, Sitka	680	720	150	68	1,200,000
Englemann	490	-------	140	56	800,000
Tamarack, eastern	830	-------	225	76	1,300,000

MORE OR LESS CONTINUOUSLY DAMP OR WET

SELECT GRADE

Cedar:					
Western red	670	750	125	80	1,000,000
Northern and southern white	530	-------	100	70	800,000
Port Orford	800	900	150	90	1,200,000
Alaska	800	-------	150	90	1,200,000
Cypress, southern	800	-------	225	100	1,200,000
Douglas fir:					
Coast region—					
Select	950	1,065	215	90	1,600,000
Dense select	1,050	1,165	235	105	1,600,000
Rocky Mountain region	620	700	200	85	1,200,000
Fir:					
Balsam	530	-------	100	70	1,000,000
Golden, noble, silver, white	710	-------	200	70	1,100,000
Hemlock:					
West coast	800	900	200	75	1,400,000
Eastern	710	-------	200	70	1,100,000
Larch, western	800	900	200	100	1,300,000
Pine:					
Southern—					
Select	950	1,065	215	110	1,600,000
Dense select	1,050	1,165	235	128	1,600,000
California, Idaho and northern white, Pondosa, and sugar	670	-------	125	85	1,000,000
Norway	710	-------	150	85	1,200,000
Redwood	710	800	125	70	1,200,000
Spruce:					
Red, white, Sitka	710	800	125	85	1,200,000
Englemann	440	-------	100	70	800,000
Tamarack, eastern	800	-------	200	95	1,300,000

Working stresses recommended by Forest Products Laboratory, United States Forest Service, etc.—Con.

MORE OR LESS CONTINUOUSLY DAMP OR WET—Con.

COMMON GRADE

Species	Extreme fiber in bending: 4 inches and thinner	Extreme fiber in bending: 5 inches and thicker	Compression perpendicular to grain	Maximum horizontal shear	Modulus of elasticity
	Lbs./in.²	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*	*Lbs./in.²*
Cedar:					
Western red	570	600	125	64	1,000,000
Northern and southern white	450	-------	100	56	800,000
Port Orford	680	720	150	72	1,200,000
Alaska	680	-------	150	72	1,200,000
Cypress, southern	680	-------	225	80	1,200,000
Douglas fir:					
Coast region	750	800	200	72	1,600,000
Rocky Mountain region	530	560	200	68	1,200,000
Fir:					
Balsam	450	-------	100	56	1,000,000
Golden, noble, silver, white	600	-------	200	56	1,100,000
Hemlock:					
West coast	680	720	200	60	1,400,000
Eastern	600	-------	200	56	1,100,000
Larch, western	680	720	200	80	1,300,000
Pine:					
Southern	750	800	200	88	1,600,000
California, Idaho and northern white, Pondosa, and sugar	570	-------	125	68	1,000,000
Norway	600	-------	150	68	1,200,000
Redwood	600	640	125	56	1,200,000
Spruce:					
Red, white, Sitka	600	640	125	68	1,200,000
Englemann	370	-------	100	56	800,000
Tamarack, eastern	680	-------	200	76	1,300,000

Safe Loads for Wooden Columns

1. The unit working stresses in compression parallel to grain for columns whose ratio of unsupported length to least dimension does not exceed 10 shall be not greater than that given for the species in the accompanying table of working stresses.

2. For columns the ratio of whose unsupported length to least dimension is greater than 10 the following formula shall be used until the reduction in allowable stress equals one-third the stress for short columns:

$$\frac{P}{A}=S\left[1-\frac{1}{3}\left(\frac{l}{Kd}\right)^4\right]$$

where P=total load in pounds,

A=area in square inches,

$\frac{P}{A}$=unit compressive stress,

S=safe stress in compression parallel to grain for short columns,

l=unsupported length in inches.

d=least dimension in inches,

E=modulus of elasticity,

K=the $\frac{l}{d}$ at the point of tangency of the parabolic and Euler curves, at which $\frac{P}{A}=\frac{2}{3}S$.

The value of K for any species and grade is

$$\frac{\pi}{2}\sqrt{\frac{E}{6S}}$$

3. For columns of greater length the Euler formula below, which includes factor of safety of 3, shall be used:

$$\frac{P}{A}=\frac{\pi^2}{36}\frac{E}{\left(\frac{l}{d}\right)^2}$$

4. Columns shall be limited in slenderness to $\frac{l}{d}=50$.

Values of "K" for columns of intermediate length

Species	Continuously dry: Select	Continuously dry: Common	Occasionally wet: Select	Occasionally wet: Common	Usually wet: Select	Usually wet: Common
Cedar:						
Western red	24.2	27.1	24.2	27.1	25.1	28.1
Port Orford	23.4	26.2	24.6	27.4	25.6	28.7
Douglas fir:						
Coast region—						
Select	23.7	27.3	24.9	28.6	27.0	31.1
Dense select	22.6	24.9	23.8	26.1	25.8	28.3
Rocky Mountain region	24.8	27.8	24.8	27.8	26.5	29.7
Hemlock, west coast	25.3	28.3	25.3	28.3	26.8	30.0
Larch, western	22.0	24.6	23.1	25.8	25.8	28.8
Oak, red and white	24.8	27.8	26.1	29.3	27.7	31.1
Pine, southern:						
Select	23.7	27.3	24.9	28.6	27.0	31.1
Dense select	22.6	24.9	23.8	26.1	25.8	28.3
Redwood	22.2	24.8	23.4	26.1	25.6	28.6
Spruce, red, white, Sitka	24.8	27.8	25.6	28.7	27.5	30.8

Strength of columns of intermediate length in per cent of strength of short columns

Values for the expression $\left[1-\frac{1}{3}\left(\frac{l}{Kd}\right)^4\right]$

in the formula: $\frac{P}{A}=S\left[1-\frac{1}{3}\left(\frac{l}{Kd}\right)^4\right]$

K	Percentage $=\left[1-\frac{1}{3}\left(\frac{l}{Kd}\right)^4\right]$																		
22	97	96	95	93	91	88	85	81	77	72	67								
23	98	97	95	94	92	90	87	84	81	77	72	67							
24	98	97	96	95	93	92	89	87	84	80	76	72	67						
25	98	98	97	96	94	93	91	89	86	83	80	76	72	67					
26	99	98	97	96	95	93	92	91	89	86	83	80	76	72	67				
27	99	98	98	97	96	95	93	92	90	88	85	82	79	74	71	67			
28	99	98	98	97	96	95	94	93	91	89	87	85	82	79	75	71	67		
29	99	99	98	98	97	96	95	94	92	91	89	87	84	82	79	75	71	67	
30	99	99	98	98	97	97	96	95	94	92	90	88	86	84	81	78	75	71	67
31	99	99	99	98	98	97	96	95	94	93	92	90	88	86	84	81	78	75	71	67
$\frac{l}{d}$	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Ratio of length to least dimension in rectangular timbers

This table can also be used for columns not rectangular, the l/d being equivalent to $0.289\ l/r$, where r is the least radius of gyration of the section.

Working stresses recommended by Forest Products Laboratory, United States Forest Service, for grades complying with basic provisions for structural grades of American Lumber Standards for posts and timbers 6 by 6 inches and larger

CONTINUOUSLY DRY

Select Grade

Species	Compression parallel to grain Ratio of length to least dimension (L/D)											Modulus of elasticity
	10	12	14	16	18	20	25	30	35	40	50	
Cedar, western red	700	686	674	656	629	592	438	304	224	171	110	1,000,000
Douglas fir:												
Coast region—												
Select	1,175	1,149	1,127	1,093	1,045	975	702	487	358	274	175	1,600,000
Dense select	1,285	1,251	1,222	1,176	1,112	1,022	702	487	358	274	175	1,600,000
Rocky Mountain region	800	786	774	753	726	688	526	365	268	206	132	1,200,000
Hemlock, west coast	900	885	872	852	823	783	614	426	313	240	153	1,400,000
Larch, western	1,100	1,068	1,041	999	937	851	570	396	291	223	142	1,300,000
Pine, southern:												
Select	1,175	1,149	1,127	1,093	1,045	975	702	487	358	274	175	1,600,000
Dense select	1,285	1,251	1,222	1,176	1,112	1,022	702	487	358	274	175	1,600,000
Redwood	1,000	972	947	910	856	781	526	365	268	206	132	1,200,000
Spruce, red, white, Sitka	800	786	774	753	726	688	526	365	268	206	132	1,200,000

Common Grade

Cedar, western red	560	553	547	538	524	505	425	304	224	171	110	1,000,000
Douglas fir:												
Coast region	880	870	861	847	826	796	675	487	358	274	175	1,600,000
Rocky Mountain region	640	632	627	617	602	582	500	365	268	206	132	1,200,000
Hemlock, west coast	720	712	706	696	680	660	573	426	313	240	153	1,400,000
Larch, western	880	863	849	823	798	752	570	396	291	223	142	1,300,000
Pine, southern	880	870	861	847	826	796	675	487	358	274	175	1,600,000
Redwood	800	786	773	754	726	688	526	365	268	206	132	1,200,000
Spruce, red, white, Sitka	640	632	627	617	602	582	500	365	268	206	132	1,200,000

OCCASIONALLY WET BUT QUICKLY DRIED

Select Grade

Cedar, western red	700	686	673	654	628	591	438	304	224	171	110	1,000,000
Douglas fir:												
Coast region—												
Select	1,065	1,045	1,028	1,003	968	915	702	487	358	274	175	1,600,000
Dense select	1,165	1,139	1,118	1,083	1,036	971	702	487	358	274	175	1,600,000
Rocky Mountain region	800	785	772	753	728	688	526	365	268	206	132	1,200,000
Hemlock, west coast	900	885	871	851	824	783	612	426	313	240	153	1,400,000
Larch, western	1,000	976	955	922	877	810	570	396	291	223	142	1,300,000
Pine, southern:												
Select	1,065	1,045	1,028	1,003	968	915	702	487	358	274	175	1,600,000
Dense select	1,165	1,139	1,118	1,083	1,036	971	702	487	358	274	175	1,600,000
Redwood	900	879	861	834	794	738	526	365	268	206	132	1,200,000
Spruce, red, white, Sitka	750	738	728	712	690	657	525	365	268	206	132	1,200,000

Common Grade

Cedar, western red	560	552	546	537	523	504	425	304	224	171	110	1,000,000
Douglas fir:												
Coast region	800	792	784	773	758	736	644	487	358	274	175	1,600,000
Rocky Mountain region	640	632	625	616	602	582	502	365	268	206	132	1,200,000
Hemlock, west coast	720	712	705	695	681	659	572	426	313	240	153	1,400,000
Larch, western	800	787	777	760	736	704	564	396	291	223	142	1,300,000
Pine, southern	800	792	784	773	758	736	644	487	358	274	175	1,600,000
Redwood	720	709	700	685	666	637	518	365	268	206	132	1,200,000
Spruce, red, white, Sitka	600	594	588	580	568	552	485	365	268	206	132	1,200,000

MORE OR LESS CONTINUOUSLY DAMP OR WET

Select Grade

Cedar, western red	650	638	629	614	594	565	437	304	224	171	110	1,000,000
Douglas fir:												
Coast region—												
Select	905	893	883	867	846	814	683	487	358	274	175	1,600,000
Dense select	990	974	961	940	910	871	698	487	358	274	175	1,600,000
Rocky Mountain region	700	690	681	669	651	623	514	365	268	206	132	1,200,000
Hemlock, west coast	800	789	780	766	745	717	600	426	313	240	153	1,400,000
Larch, western	800	787	776	760	736	704	565	396	291	223	142	1,300,000
Pine, southern:												
Select	905	893	883	867	846	814	683	487	358	274	175	1,600,000
Dense select	990	974	961	940	910	871	698	487	358	274	175	1,600,000
Redwood	750	737	727	712	690	657	525	365	268	206	132	1,200,000
Spruce, red, white, Sitka	650	642	635	625	611	589	500	365	268	206	132	1,200,000

Working stresses recommended by Forest Products Laboratory, United States Forest Service, for grades complying with basic provisions for structural grades of American Lumber Standards for posts and timbers 6 by 6 inches and larger—Continued

MORE OR LESS CONTINUOUSLY DAMP OR WET—Continued

COMMON GRADE

Species	Compression parallel to grain Ratio of length to least dimension (L/D)											Modulus of elasticity
	10	12	14	16	18	20	25	30	35	40	50	
Cedar, western red	520	514	509	502	491	475	413	304	224	171	110	1,000,000
Douglas fir:												
Coast region	680	675	670	664	655	641	588	482	358	274	175	1,600,000
Rocky Mountain region	560	554	551	544	535	521	465	365	268	206	132	1,200,000
Hemlock, west coast	640	634	629	622	612	598	537	426	313	240	153	1,400,000
Larch, western	640	633	627	618	606	588	519	396	291	223	142	1,300,000
Pine, southern	680	675	670	664	655	641	588	482	358	274	175	1,600,000
Redwood	600	594	538	580	568	552	483	365	268	206	132	1,200,000
Spruce, red, white, Sitka	520	515	512	507	500	489	446	365	268	206	132	1,200,000

CLASSIFICATION OF THE USES OF TIMBER AND LUMBER UNDER AMERICAN RAILWAY ENGINEERING ASSOCIATION SPECIFICATIONS

The grades recommended are those which would ordinarily be used. For work of the highest character, a grade higher could be used, and for temporary work, a grade lower.

In yard material, standard grades of one producing region compare as closely with those of other regions as the variations in the species will permit.

Structural grades apply equally to all species, hence the structural grades of American Lumber Standards can be applied to any species if grades conforming to the structural grades of American Lumber Standards are not included in the standard grades of the region producing that species.

Details of heartwood, sapwood, wane, and square-edge specification are not included in these grades, but are left to the discretion of the person consulting this reference and ordering material.

1. Bridge and Construction Timber

A. Combination and Howe truss spans:

1. Compression members — Select structural posts and timbers.
2. Tension — Select structural joist and plank.
3. Diagonals subject to reversal of stress — Select structural posts and timbers.
4. Floor beams — Select structural or dense select structural beams and stringers.
5. Stringers — Select structural or dense select structural beams and stringers.
6. Ties — Select structural timbers.
7. Guard timbers — Common structural timbers.
8. Railing — No. 1 common dimension.
9. Stiffeners — No. 1 common dimension.
10. Splices — No. 1 common dimension.
11. Nailing strips — No. 1 common dimension.
12. Grillage — Common structural timbers.
13. Deck plank — No. 1 common dimension.
14. Bridging — No. 2 common boards.

B. Pile and frame trestles:

1. Sills and mud sills — Select structural timbers.
2. Posts — Select structural posts.

B. Pile and frame trestles—Continued.

3. Caps — Select structural timbers.
4. Sash bracing — Common structural plank.
5. Cross bracing — Common structural plank.
6. Longitudinal bracing — Common structural plank.
7. Girts — Common structural timbers.
8. End planks — Common structural plank.
9. Stringers — Select structural or dense select structural stringers.
10. Ties — Select structural timbers.
11. Guard timbers — Common structural timbers.
12. Planking for ballasted deck — Select structural plank.
13. Railing — No. 1 common dimension.

C. Falsework:

1. Sills and mud sills — Common structural timbers.
2. Posts — Common structural posts.
3. Caps — Common structural timbers.
4. Stringers — Select structural stringers.
5. Truss timbers — Common structural timbers.
6. Centering — No. 1 common dimension.
7. Lagging — No. 1 common dimension.
8. Bracing — Common structural plank.
9. Wedges — No. 1 common dimension.
10. Scaffolding — No. 2 common dimension.

D. Concrete forms:

1. Dimension lumber — No. 1 common dimension.
2. D & M planks — No. 2 common boards.
3. Bracing — No. 2 common boards.

E. Tanks and supports:

1. Sills — Common structural timbers.
2. Posts — Select structural posts.
3. Caps — Select structural timbers.
4. Bracing — Common structural plank.
5. Joists — Select structural joists.
6. D & M flooring — C flooring.
7. Staves — C tank stock.
8. Rafters — No. 1 common dimension.
9. Roof — No. 1 common ship-lap.
10. Ladders, etc — C ladder stock.
11. Frost-box material — No. 1 common ship-lap.

F. Docks and wharves:

1. Timber sheet piling — Common structural timbers.
2. Timber in cribs — Common structural timbers.
3. Caps — Select structural timbers.
4. Stringers — Select structural or dense select structural stringers.
5. Bracing — Common structural plank.
6. Guard timbers — Common structural timbers.
7. Ties — Select structural timbers.
8. Plank decking — Select structural plank.
9. Mooring posts — Select structural timbers.
10. Fenders and wales — Common structural timbers.
11. Warehouse. *See* Frame buildings.

G. Coaling stations and ore stations:

1. Sills and mud sills — Common structural timbers.
2. Posts — Select structural posts.
3. Caps — Select structural timber.
4. Bracing — Common structural plank.
5. Stringers — Select structural or dense select structural stringers.
6. Joists — Select structural joists.
7. Bin lining — No. 1 common dimension.
8. Rafters — No. 1 common dimension.
9. Flooring — No. 1 common boards.
10. Chutes — No. 1 common boards.
11. Decking — No. 1 common boards.
12. Coal pockets and bins — No. 1 common dimension.
13. Roofing — No. 2 common ship-lap.

H. Tunnels:

1. Posts — Select structural timbers.
2. Sills — Select structural timbers.
3. Caps — Select structural timbers.
4. Segments — Select structural timbers.
5. Lagging — No. 1 common dimension.
6. Struts — No. 1 common dimension.

J. Caisson — Select structural timbers.

2. Frame Buildings

A. Station buildings, passenger, freight, platform shelters:

1. Caps — Common structural timbers.
2. Sills — Common structural timbers.
3. Posts — Common structural timbers.
4. Stringers — Select structural stringers.
5. Joists — Common structural joists.
6. Bridging — No. 3 common boards.
7. Subflooring — No. 2 common ship-lap.
8. Finish flooring — A or B flooring (for natural finish). C or D flooring (for paint finishes).
9. Studding and plates — No. 1 common dimension.
10. Sheathing — No. 2 common ship-lap.
11. Furring — No. 2 common strips.
12. Siding — B or C siding.

A. Station buildings, passenger, freight, platform shelters—Continued.

13. Ceiling — B ceiling (for natural finishes). C ceiling (for paint finishes).
14. Truss timbers — No. 1 common dimension.
15. Purlins — No. 1 common dimension.
16. Rafters — No. 1 common dimension.
17. Roof boards — No. 2 common ship-lap.
18. Shingles on roofs and side walls — A (for roofs). B (for side walls).
19. Door and window frames — C finish.
20. Outside finish lumber — C finish.
21. Inside finish lumber — A or B finish (for natural finishes). C or D finish (for paint finishes).
22. Millwork:
    - (*a*) Moldings — A molding stock or C molding stock.
    - (*b*) Stairs — A finish or C finish.
23. Partitions — B partition or C partition.
24. Shelving — C finish.

B. Engine house:

1. Caps — Common structural timbers
2. Sills — Common structural timbers
3. Posts — Common structural timbers
4. Stringers — Select structural stringers.
5. Joists — Select structural joists.
6. Bridging — No. 3 common boards.
7. Flooring — No. 1 common dimension.
8. Pit timbers — Common structural timbers.
9. Studding — No. 1 common dimension.
10. Furring — No. 2 common strips.
11. Siding — C or D siding.
12. Ceiling — C ceiling.
13. Truss lumber — No. 1 common dimension.
14. Purlins — No. 1 common dimension.
15. Rafters — No. 1 common dimension.
16. Roof boards — No. 2 common ship-lap.
17. Shingles — A.
18. Door and window frames — C finish.
19. Outside finish lumber — C or D finish.
20. Inside finish lumber — C finish.
21. Millwork — C finish.
22. Sleepers — No. 2 common dimension.

C. Machine shops:

1. Caps — Common structural timbers.
2. Sills — Common structural timbers.
3. Posts — Common structural timbers.
4. Stringers — Select structural stringers.
5. Joists — Select structural joists.
6. Bridging — No. 3 common boards.
7. Flooring — No. 1 common dimension.
8. Studding — No. 1 common dimension.

C. Machine shops—Continued.

9. Sheathing	No. 2 common ship-lap.
10. Furring	No. 2 common strips.
11. Siding	C or D siding.
12. Ceiling	C or D ceiling.
13. Truss timbers	Select structural timbers.
14. Purlins	No. 1 common dimension.
15. Rafters	
16. Roofing boards	No. 2 common ship-lap.
17. Shingles	A.
18. Door and window frames	C finish.
19. Outside finish lumber	
20. Inside finish lumber	
21. Millwork	
22. Sleepers	No. 2 common dimension.

D. Section houses:

1. Posts	No. 2 common dimension.
2. Sills	
3. Caps	
4. Joists	No. 1 common dimension.
5. Bridging	No. 3 common boards.
6. Subflooring	No. 2 common ship-lap.
7. Finish flooring	B flooring (for natural finishes). C flooring (for paint finishes).
8. Studding and plates	No. 1 common dimension.
9. Sheathing	No. 2 common ship-lap.
10. Furring	No. 2 common strips.
11. Siding	C or D siding.
12. Ceiling	C or D ceiling.
13. Rafters	No. 1 common dimension.
14. Roof Boards	No. 2 common ship-lap.
15. Shingles	A.
16. Door and window frames	C finish.
17. Outside finish lumber	
18. Inside finish lumber	
19. Millwork	

E. Miscellaneous small buildings:

1. Posts	No. 2 common dimension.
2. Sills	
3. Caps	
4. Joists	Common structural joists.
5. Bridging	No. 3 common boards.
6. Subflooring	No. 2 common ship-lap.
7. Finish flooring	C flooring.
8. Studding and plates	No. 1 common dimension.
9. Sheathing	No. 2 common ship-lap.
10. Furring	No. 3 common strips.
11. Siding	C or D siding.
12. Ceiling	C or D ceiling.
13. Rafters	No. 1 common dimension.
14. Roof boards	No. 2 common ship-lap.
15. Shingles	C.

E. Miscellaneous small buildings—Continued.

16. Door and window frames	C finish.
17. Outside finish lumber	
18. Inside finish lumber	
19. Millwork	

F. Warehouses:

1. Caps	Common structural timbers.
2. Sills	
3. Posts	
4. Stringers	Select structural stringers.
5. Joists	Select structural joists.
6. Bridging	No. 2 common boards.
7. Subflooring	No. 2 common ship-lap.
8. Finish flooring	C flooring.
9. Studding and plates	No. 1 common dimension.
10. Sheathing	No. 2 common ship-lap.
11. Furring	No. 2 common strips.
12. Siding	C or D siding.
13. Ceiling	C or D ceiling.
14. Truss timbers	No. 1 common dimension.
15. Purlins	
16. Rafters	
17. Roof boards	No. 2 common ship-lap.
18. Shingles	A.
19. Door and window frames	C finish.
20. Outside finish lumber	
21. Inside finish lumber	
22. Millwork	
23. Sleepers	No. 2 common strips.

G. Ice houses:

1. Sills	Common structural timbers.
2. Caps	
3. Posts	
4. Stringers	Select structural stringers.
5. Joists	No. 1 common dimension.
6. Bridging	No. 2 common boards.
7. Sleepers	No. 2 common strips.
8. Subflooring	No. 2 common ship-lap.
9. Finish flooring	C flooring.
10. Studding	No. 1 common dimension.
11. Sheathing	No. 2 common ship-lap.
12. Furring	No. 3 common strips.
13. Siding	C or D siding.
14. Ceiling	C or D ceiling.

3. Miscellaneous Roadway Material

A. Crossing plank	No. 1 common dimension.

B. Platforms:

1. Posts	No. 1 common dimension.
2. Caps	
3. Sills	
4. Stringers	Select structural stringers.
5. Joists	Select structural joists.
6. Bridging	No. 3 common boards.

B. Platforms—Continued.
- 7. Planking, 8. Railing: No. 1 common dimension.
- 9. Steps: No. 1 common boards.
- 10. Skids: No. 1 common dimension.

C. Stock guards:
- 1. Posts: No. 1 common dimension.
- 2. Ties: Select structural timbers.
- 3. Wing fences and aprons, 4. Slats: No. 1 common boards.
- 5. Fillers: No. 2 common boards.

D. Signs and posts:
- 1. Posts: No. 1 common dimension.
- 2. Bracing: No. 2 common dimension.
- 3. Sign boards: C finish.
- 4. Molding: C molding stock.

E. Fencing, including snow fence:
- 1. Posts: No. 1 common dimension.
- 2. Bracing: No. 2 common boards.
- 3. Stringers: No. 1 common dimension.
- 4. Fence boards: No. 2 common boards.
- 5. Gate materials: No. 1 common boards.
- 6. Stakes: No. 2 common boards.

F. Culverts and drains:
- 1. Sills: Common structural.
- 2. Bracing: No. 2 common boards.
- 3. Timbers: Common structural timbers.
- 4. Planking: No. 2 common dimension.
- 5. Grillage: Common structural timbers.

G. Stock pens:
- 1. Posts, 2. Sills, 3. Fencing, 4. Studding: No. 1 common dimension.

G. Stock pens—Continued.
- 5. Sheathing: No. 2 common ship-lap.
- 6. Rafters: No. 1 common dimension.
- 7. Roof boards: No. 2 common ship-lap.
- 8. Shingles: B.
- 9. Outside finish lumber: C finish.

H. Poles: Select structural timbers.

I. Conduits: No. 1 common dimension.

J. Bumping blocks: Select structural timbers.

American Society for Testing Materials, proposed standard specifications for structural wood joist, planks, beams, stringers, and posts, serial D245, 1927.

(Working stresses are those recommended by the Forest Products Laboratory, United States Forest Service, for grades complying with the basic provisions for structural material of American Lumber Standards (412.0). These stresses are set forth on page 10 under the items relating to the American Railway Engineering Association.)

United States Department of Agriculture, Bureau of Public Roads, Timber Structures, revised April, 1923.

Permissible stresses.

When used with specifications shown in 412.0 the stresses in pounds per square inch, indicated on page 18, are permissible for structural timbers.

United States Department of Commerce, Report of Building Code Committee, Recommended Building Code Requirements for Working Stresses in Building Material, June, 1926.

Working stresses for structural grades of American Lumber Standards conform to those adopted by the American Railway Engineering Association as given in full on page 10.

Common and botanical name	Axial tension and bending stress	Horizontal shear in bending	Compression parallel to the grain			Compression perpendicular to grain	Shear parallel to grain
			End bearing	$\frac{L}{D}$ 0 to 10	$\frac{L}{D}$ 10 to 30		
Locust, black [1] (*Robinia pseudacacia*)	2,200	220	1,800	1,600	$1,800-25\frac{L}{D}$	600	350
Maple, sugar or hard [2] (*Acer saccharum*)	1,600	150	1,200	1,000	$1,200-25\frac{L}{D}$	350	220
Oak, Spanish (lowland) [2] (*Quercus pagodaefolia*)	1,600	150	1,200	1,000	$1,200-25\frac{L}{D}$	350	220
Oak, tanbark [3] (*Quercus densiflora*)	1,600	150	1,200	1,000	$1,200-25\frac{L}{D}$	350	220
Oak, white [3] (*Quercus alba*)	1,600	150	1,200	1,000	$1,200-25\frac{L}{D}$	350	220
Pine, Cuban [3] (*Pinus heterophylla*)	1,600	120	1,200	1,000	$1,200-25\frac{L}{D}$	250	180
Pine, longleaf [3] (*Pinus palustris*)	1,600	120	1,200	1,000	$1,200-25\frac{L}{D}$	250	180
Fir, Douglas (coast region) [3] (*Pseudotsuga taxifolia*)	1,600	100	1,200	1,000	$1,200-25\frac{L}{D}$	250	150
Pine, shortleaf [2] (*Pinus echinata*)	1,600	100	1,200	1,000	$1,200-25\frac{L}{D}$	250	150
Larch, western [3] (*Larix occidentalis*)	1,400	100	1,100	900	$1,100-25\frac{L}{D}$	240	150
Oak, Pacific post [3] (*Quercus garryana*)	1,400	100	1,100	900	$1,100-25\frac{L}{D}$	240	150
Oak, bur [3] (*Quercus macrocarpa*)	1,400	100	1,100	900	$1,100-25\frac{L}{D}$	240	150
Pine, loblolly [2] (*Pinus taeda*)	1,400	100	1,100	900	$1,100-25\frac{L}{D}$	240	150
Pine, table mountain [2] (*Pinus pungens*)	1,400	100	1,100	900	$1,100-25\frac{L}{D}$	240	150
Tamarack [2] (*Larix Laricina*)	1,400	100	1,100	900	$1,100-25\frac{L}{D}$	240	150
Cypress, bald [1] (*Taxodium distichum*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Fir, Douglas (mountain region) [3] (*Pseudotsuga taxifolia*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Hemlock, western [2] (*Tsuga heterophylla*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Hemlock, eastern [3] (*Tsuga canadensis*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Pine, Norway [2] (*Pinus resinesa*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Pine, pitch [2] (*Pinus rigida*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Redwood [1] (*Sequoia sempervirens*)	1,200	90	1,000	800	$1,000-25\frac{L}{D}$	180	130
Cedar, western red [1] (*Thuja plicata*)	1,000	80	800	700	$900-25\frac{L}{D}$	160	120
Chestnut [1] (*Castanea dentata*)	1,000	80	800	700	$900-25\frac{L}{D}$	160	120
Pine, western yellow [2] (*Pinus ponderosa*)	1,000	80	800	700	$900-25\frac{L}{D}$	160	120
Spruce, red [2] (*Picea rubens*)	1,000	80	800	700	$900-25\frac{L}{D}$	160	120
Spruce, Sitka [2] (*Picea sitchensis*)	1,000	80	800	700	$900-25\frac{L}{D}$	160	120
Cedar, white [1] (*Thuja occidentalis*)	800	70	700	600	$800-25\frac{L}{D}$	140	100
Pine, Lodgepole [2] (*Pinus contorta*)	800	70	700	600	$800-25\frac{L}{D}$	140	100
Spruce, Englemann [2] (*Picea englemanni*)	800	70	700	600	$800-25\frac{L}{D}$	140	100
Spruce, white [2] (*Picea canadensis*)	800	70	700	600	$800-25\frac{L}{D}$	140	100

NOTE.—L equals length of column, and D equals least side or diameter, both dimensions in the same unit either feet or inches. The unsupported length of wooden columns and compression members shall not exceed 30 times the diameter of least side.

[1] Very durable. [2] Perishable. [3] Durable.

400.13 Tests of Lumber

American Society for Testing Materials and Forest Service of the United States Department of Agriculture, joint sponsors for the preparation of specifications for methods of testing wood, under the rules of procedure of the American Engineering Standards Committee, A. E. S. C. No. 0–4.

(Specifications not yet completed.)

American Society for Testing Materials, standard methods of testing small clear specimens of timber, D143–27, 1927.

(The methods represent the entire procedure from the selection of the trees to the manipulation of the test, thus controlling the factors, such as the size and proportion of test specimens and rate of loading, which may influence the results. The methods conform closely to those used by the United States Forest Service, and the forestry branch of the Department of the Interior, Canada, in performing many thousands of tests under a single comprehensive plan.)

American Society for Testing Materials, standard methods of conducting static tests of timber in structural sizes, D198–27, 1927.

(The methods presented are the outgrowth of years of experience and research, largely on the part of the United States Forest Service. The tests of certain types of timbers, such as bridge stringers and joists, are definitely covered, and testing procedure for other structural timber forms is also suggested.)

400.14 Inspection of Lumber.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See Lumber inspection provisions and service, of American Lumber Standards, No. 400.0.

American Railway Engineering Association, revisions of Manual, Bulletin 293, January, 1927, Wooden Bridges and Trestles.

The lumber inspection provisions and service for yard lumber conform to the American Lumber Standards, No. 400.0.

Arkansas Soft Pine Bureau, inspection of lumber, March 23, 1927.

This association's inspection and shipping provisions conform to the lumber inspection provisions and service of the American Lumber Standards, No. 400.0.

California Redwood Association, standard specifications for eastern grades of California redwood lumber, inspection and shipping provisions, April, 1927.

The inspection and shipping provisions of this association conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0.

California White and Sugar Pine Manufacturers' Association, inspection of lumber, May 1, 1926.

The inspection service of this association conforms to lumber inspection provisions and service of American Lumber Standards, 400.0.

Maple Flooring Manufacturers Association, inspection of lumber, August 25, 1926.

CUSTOM GOVERNING REINSPECTION

A shipment shall be considered as of the grade invoiced if, upon official inspection by an official inspector of the Maple Flooring Manufacturers Association, 95 per cent thereof or more, in feet, is found to be of grade invoiced, the flooring below said grade to be accepted as of its actual grade. Where the de-grades are in excess of 5 per cent, in feet, of the shipment, the de-grades in excess of the 5 per cent shall be the property of the manufacturer of the flooring.

Unless otherwise agreed upon, the cost of reinspection shall be borne by the complainant in the event that the amount below grade is found to be 5 per cent or less, in feet, of the total amount of the item complained of; if more than 5 per cent, in feet, the expense shall be borne by the manufacturer of the flooring.

The quality of the flooring in the condition in which it leaves the manufacturer is held to govern the grade, as subsequent lack of care and improper treatment in laying, scraping, or finishing are not chargeable to the manufacturer.

Because of modern methods of laying hardwood floors, and the improved nail now used, the boring of dressed and matched flooring is no longer of practical value; consequently, the practice of boring has been discontinued by the manufacturers and as it is not an essential feature in the manufacture and grading of flooring the absence of it will not be considered a basis for any reclamation.

ADVANTAGES OF STANDARD LENGTHS

It will be found more advantageous to specify and use the standard run of lengths in the different grades instead of special long lengths because lengths selected 4 or 6 feet and longer are much more expensive without compensating benefits.

Modern perfected methods of manufacturing hardwood flooring produce a larger proportion of shorter lengths than the old-time methods, because the defects are cut out closer, thus improving the average quality of the flooring, and experience has demonstrated that shorter lengths cost no more to lay and make as good or better floor at a material saving in cost than all long lengths. The shorter lengths can also be used to advantage in closets and other small spaces.

The sentiment in favor of conservation of forest resources is strongly in favor of the utilization to the greatest extent of these valuable woods, especially when the result attained in the finished floor is in nowise depreciated.

GUARANTEED FLOORINGS

The letters MFMA on maple, beech, or birch flooring signify that the flooring is standardized and guaranteed by the Maple Flooring Manufacturers Association.

National Hardwood Lumber Association, inspection of lumber, January, 1927.

ORIGINAL NATIONAL INSPECTION REGULATIONS

1. All applications for original national inspection must be made by a member of the association to the secretary or a licensed inspector. Any member who applies for inspection on lumber which he has neither bought nor sold is subject to suspension or expulsion from the association. Members will avoid delay by mailing requests for original inspection direct to the inspector nearest the point where the inspection is to be made, sending carbon copy to the association, 2008 Straus Building, Chicago, Ill.

2. Inspectors are required to inspect the full amount of lumber contained in an original shipment, and they are expressly forbidden to apply national inspection to a portion of a shipment after selections have been made therefrom, unless both seller and buyer agree thereto.

3. In the absence of instructions to the contrary, a national inspector will inspect and measure lumber according to "standard inspection" and the "general instructions" as provided by the association's rules. In all cases in which any special inspection is to apply, either in the matter of grade or size, it is incumbent upon the shipper or party applying for inspection to furnish the national inspector with a copy of the order (prices may be omitted) and a clear and definite interpretation of same as agreed to by the buyer and seller.

4. When an inspection by an authorized inspector of the National Hardwood Lumber Association is completed, the inspector shall deliver to the member requesting the inspection a certificate in duplicate, certifying to the amount and grade of lumber so inspected. This certificate is final for settlement between buyer and seller in all cases where an agreement as to the application of national inspection exists between the parties.

5. It should be thoroughly understood that neither this association nor any of its members possesses authority to impose "official national inspection" in any of the markets except through the mutual agreement of the parties at interest; and when such official inspection has been made, it is binding only upon those parties who agreed beforehand to recognize it in the individual transaction in which it is involved. A buyer or seller may desire national rules of grading and measurement to apply to a contract and thus specify "national rules to govern," without necessarily obligating either party to the application of those rules by a licensed inspector of this association. It is therefore absolutely necessary, in any transaction involving the sale or purchase of lumber in which a member of this association relies upon the efficacy of the inspection department of the association for the just protection of his interests, that it be clearly stated in the contract of sale or purchase that national inspection is to prevail. The following form for such a clause in contracts of that nature is recommended:

The lumber is to be inspected according to the rules and regulations of the National Hardwood Lumber Association by a national inspector.

6. With the foregoing clause in a contract, the shipper may apply national inspection at loading point, or it may be inspected at destination. The point of inspection may be governed by the convenience in securing the services of a national inspector.

7. If it is desired that the contract provide for national inspection at destination in the event of a difference between the inspection of the seller and buyer, it is necessary that the contract contain a clause so specifying, or else it can only be made binding by the mutual consent of both parties after a dispute has arisen. The following form is recommended when desiring to cover the above conditions in the contract:

The lumber is to be inspected according to the rules and regulations of the National Hardwood Lumber Association, and in the event of disapproval of the inspection of the shipper, inspection by a national inspector shall govern.

8. When national inspection is agreed to either in a sales or purchase contract, or subsequently, the arrangement should also provide for the disposition of the expense of the inspection as such disposition is entirely subject to arrangement between buyer and seller. It may be divided between them or may be borne entirely by either, but a bill of expenses will be rendered by the secretary against the member calling for the inspection, which bill is due and payable upon demand.

9. In all transactions in which the official bonded inspection certificate of the association is the agreed basis between buyer and seller and the inspection is applied at point of shipment the shipper, in order to obtain the full protection of the association, must *promptly forward one copy of the inspection report to the buyer.* If copy of the certificate is not in the hands of the buyer at time of arrival at destination of the shipment covered by the certificate, the seller can not insist upon settlement on basis of such certificate.

10. In all transactions in which the official bonded certificate of the association is the agreed basis between buyer and seller and the inspection is applied at destination, the buyer in order to obtain the full protection of the association must forward copy of the certificate promptly to the shipper and not later than three days after receipt of certificate from the inspector.

11. Where a member makes a sale to a buyer who is not a member, such sale being based on official national inspection and the buyer desires and it is so agreed that such inspection be applied at destination, it shall be the duty of the seller as a member of the National Hardwood Lumber Association to call for official inspection on the shipment within five days after receipt of notice of its arrival at destination.

12. If any member of the association declines to recognize official inspection after agreeing to be governed by it, the secretary is instructed on receipt of sufficient evidence of the repudiation to *drop such member from the rolls;* if any buyer not a member violates agreement to settle for any ship-

ment on the basis of official national inspection, the name of such buyer will be published in the official monthly bulletin of the association, together with a statement of the facts in the case.

13. When original national inspection is made at loading point according to agreement it shall be considered a repudiation of the inspection if the buyer fails to settle in full for the shipment as shown by the association certificate.

14. When original national inspection is made at destination according to agreement, it shall be considered a repudiation of the inspection if the buyer fails to settle in full for that portion of the shipment which the association certificate shows to be in accordance with the specifications of the order, provided that the portion of the shipment which is below the grades specified does not amount to more than 5 per cent of the total footage of the shipment. Off-grade stock may be held for the disposition of the shipper or accepted in accordance with any adjustment upon which buyer and seller may be able to agree.

NATIONAL REINSPECTION REGULATIONS AND GUARANTY

1. Should either party to the transaction involving an original inspection be dissatisfied with the result of the same, it is within his right, whether a member of the association or not, to call for reinspection, provided stock is intact.

This class of inspection can only be obtained by applying to the secretary.

2. All applications for reinspection shall be made within 10 days from receipt of lumber at destination, provided the original inspection was made at point of shipment, or within 10 days from date of original inspection, if same is made at destination.

3. Upon approval of application for the reinspection of a block of lumber for which a certificate has been regularly issued by a national inspector, the chief inspector shall proceed as promptly as possible to reinspect the lumber in person, or by a deputy, other than the inspector making the original inspection.

4. If the reinspection results in a difference, in favor of the party complaining, of more than 4 per cent in money value from the original inspection, the party complaining may receive the amount of such difference directly from this association by sending to the secretary an itemized statement showing in detail the items and amounts as shown on the original certificate and the reinspection certificate. No claim on reinspection will be paid until prices placed on off-grade items are approved by the executive committee. The association does not under any circumstances take possession of the lumber or dispose of it.

5. In all cases where claims develop on the 4 per cent money value clause, the association will assume handling charges not to exceed the fee per thousand feet charged by the association for conducting the original inspection. No claim will be approved and passed for payment where handling charges are in excess of these rates. In cases where claims are approved, the association charges for the reinspection will be canceled. The association assumes no liability on account of demurrage, or for any expense other than herein provided.

6. If the difference does not exceed 4 per cent the party demanding the reinspection shall pay all expenses connected therewith.

7. This guaranty does not apply on certificate issued on lumber loaded green; nor on lumber inspected and piled down at point of shipment and reinspected at destination; nor on lumber that has been kiln-dried, dressed, or worked after original inspection has been applied. The association reserves the right to decline official reinspection on lumber shipped in leaky cars or delayed beyond a reasonable period in transit, or which does not arrive at destination in its original container.

SPECIAL INSPECTION

No. 1 common and better.

No. 1 common and better means the full run of the logs with all grades below No. 1 common excluded.

Log run.

Log run means the full run of the logs, with all grades below No. 2 common excluded.

Mill run.

Mill run means the full run of the logs, No. 3 common and better.

No. 1 common face.

No. 1 common face is the same as the standard grade of No. 1 common, except that inspection shall be made from the good face. The reverse side of the cuttings must be sound.

No. 2 common face.

No. 2 common face is the same as the standard grade of No. 2 common, except that inspection shall be made from the good face. The reverse side of the cuttings must be sound.

No. 2 common clear cutting.

Where the No. 2 common grade specifies sound cuttings, a special grade of No. 2 common may be made, specifying clear face instead of sound cuttings.

No. 2 common sound cutting.

Where the No. 2 common grade specifies clear cuttings, a special grade of No. 2 common may be made, specifying sound instead of clear face cuttings.

No. 3–A and No. 3–B common.

No. 3–A common must work 33⅓ per cent clear face in cuttings not less than 3 inches wide by 2 feet long, graded from the poor side of the piece. This grade will also admit pieces which grade not below No. 2 common on the good face, the reverse side of the cuttings to be sound. No. 3–B common consists of all No. 3 common below the grade of No. 3–A common.

North Carolina Pine Association (Inc.), general inspection rules, January 1, 1927.

(This association's general classification and inspection rules conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0. The following special instructions are added:

INSPECTION

Standard.

All lumber shall be sound, sap no objection. Wane may be allowed one-eighth of the width of the piece measured across face of wane, extending one-fourth of the length on one corner or its equivalent on two or more corners, provided that not over 10 per cent of the pieces of any one size shall show such wane.

Merchantable.

All sizes under 9 inches shall show some heart entire length on one side; sizes 9 inches and over shall show some heart the entire length on two opposite sides. Wane may be allowed one-eighth of the width of the piece measured across face of wane, and extending one-fourth of the length of the piece on one corner or its equivalent on two or more corners; provided, that not over 10 per cent of the pieces of any one size shall show such wane.

Prime.

Flooring shall show one heart face, regardless of sap on opposite side, free from through or round shakes or knots exceeding 1 inch in diameter, or more than four in a board on the face side.

Boards 7 inches and under wide shall show one heart face and two-thirds heart on opposite side; over 7 inches wide shall show two-thirds heart on both sides all free from round or through shakes, large or unsound knots.

Plank 7 inches and under wide shall show one heart face, over 7 inches wide shall show two-thirds heart on both sides, all free from round or through shakes, large or unsound knots.

Scantling shall show three corners heart, free from through or round shakes or unsound knots.

Dimension sizes: All square lumber shall show two-thirds heart on two sides, and not less than one-half heart on two other sides. Other sizes shall show two-thirds heart on faces and show heart two-thirds of length on edges, excepting when the width exceeds the thickness by 3 inches or over, then it shall show heart on the edge for one-half the length.

Stepping shall show three corners heart, free from shakes and all knots exceeding half inch in diameter, and not more than six in a board.

Rough edge, or flitch, shall be sawed from good heart timber, and shall be measured in the middle, on the narrow face, free from injurious shakes or unsound knots.

Wane on not over 5 per cent of the pieces in any one size shall be allowed as on merchantable quality.

Northern Hemlock and Hardwood Manufacturers Association, inspection of lumber, February 1, 1927.

This association's inspection and shipping provisions conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0.

Northern Pine Manufacturers Association, inspection of lumber, April 5, 1925.

This association's inspection and shipping provisions conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0.

Southeastern Forest Products Association, inspection of lumber, September 1, 1925.

This association's inspection and shipping provisions conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0.

Southeastern Forest Products Association, Interstate Rules of 1916, inspection of southern yellow pine lumber, edition of June 1, 1926.

This association's inspection rules for yellow pine lumber in standard, merchantable, prime, and dimension sizes are the same as the rules of the North Carolina Pine Association, 400.14.

Southern Cypress Manufacturers Association, inspection of lumber, June 15, 1925.

This association's shipping and inspection provisions conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0.

Southern Pine Association, inspection of lumber, March 23, 1927.

This association's inspection and shipping provisions conform to the lumber inspection provisions and service of the American Lumber Standards, 400.0.

Western Pine Manufacturers Association, inspection of Pondosa pine, Idaho white pine, larch and fir, white fir, cedar, and spruce lumber, July 1, 1925.

This association's lumber inspection provisions and service conform to that of the American Lumber Standards, 400.0.

400.2 SOFTWOOD GRADING RULES

400.20 General Items

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

DEFINITIONS OF MAXIMUM DEFECTS AND BLEMISHES

A *defect* is defined as any irregularity occurring in or on wood that may lower some of its strength, durability, or utility values.

A *blemish* is defined as anything, not classified as a defect, marring the appearance of the wood.

The commonly recognized defects and blemishes occurring in (names of species manufactured) yard lumber are:

Bark pockets.
Bird's-eye.
Checks.
Cross breaks.
Cross grain.
Decay.
Gum spots or streaks.
Holes.
Imperfect manufacture.
Knots.
Pitch.
Pitch pockets.
Pitch seams.
Pitch streaks.
Pith.
Pith flecks.
Shake.
Splits.
Stain or discoloration.
Wane.
Warp.

BARK POCKETS

A *bark pocket* is a patch of bark partially or wholly inclosed in the wood. In size it is classified the same as pitch pockets.

BIRD'S-EYE

"*Bird's-eye*" is a small central spot with the wood fibers arranged around it in the form of an ellipse, so as to give the appearance of an eye. "Bird's-eye," unless unsound or hollow, shall not be considered a defect.

CHECKS

A *check* is a lengthwise separation of the wood, which occurs usually across the rings of annual growth.

A *surface check* is a check occurring on the surface of the piece.

A *small surface check* is a perceptible opening not over 4 inches long.

A *medium surface check* is one not over $\frac{1}{32}$ inch wide and over 4 but not more than 10 inches long.

A *large surface check* is one over $\frac{1}{32}$ inch wide and over 10 inches long.

An *end check* is one occurring on an end of a piece.

A *through check* is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

A *heart check* is one starting at the pith and extending toward but not to the surface of a piece.

CROSS BREAKS

A *cross break* is a separation of the wood cells across the grain, such as may be due to tension resulting from unequal shrinkage or mechanical stresses.

CROSS GRAIN

Cross-grained wood is that in which the cells or fibers do not run parallel with the axis, or sides, of a piece.

Slight cross grain is a slope of the grain not over 1 inch in a length of 15 inches.

Medium cross grain is a slope of the grain over 1 inch in a length of 15 inches but not more than 1 inch in a length of 10 inches.

Steep cross grain is a slope of the grain over 1 inch in a length of 10 inches.

DECAY

Decay is a disintegration of the wood substance due to the action of wood-destroying fungi. The words "dote" and "rot" mean the same as decay.

Incipient decay is the early stage of decay in which the disintegration has not proceeded far enough to soften or otherwise change the hardness of the wood perceptibly. It is usually accompanied by a slight discoloration or bleaching of the wood.

Firm red heart is a stage of incipient decay characterized by a reddish color produced in the hardwood, which does not unfit the wood for the majority of yard purposes.

Water soak (*or stain*) is a term applied to a generally water-soaked area in heartwood, which is usually interpreted as the incipient stage of certain wood rots.

Advanced (*or typical*) *decay* is the older stage of decay in which the disintegration is readily recognized because the wood has become punky, soft and spongy, stringy, ring shaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent.

A *pocket rot* is typical decay which appears in the form of a hole, pocket, or area of soft rot, usually surrounded by apparently sound wood.

GUM SPOTS AND STREAKS

A *gum spot* or *streak* is an accumulation of gum-like substance occurring as a small patch or streak in a piece. It may occur in conjunction with a bird peck, or other injury to the growing wood. In size they are classified the same as pitch pockets or pitch streaks.

HOLES

Holes in wood may extend partially or entirely through the piece and be from any cause. When holes are permitted, the average of the maximum and minimum diameters measured at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

A *pin worm hole* is one not over $\frac{1}{16}$ inch in diameter.

A *medium worm hole* is one over $\frac{1}{16}$, but not more than $\frac{1}{4}$ inch in diameter.

A *large worm hole* is one over $\frac{1}{4}$ inch in diameter.

IMPERFECT MANUFACTURE

Imperfect manufacture includes all defects or blemishes which are produced in manufacturing, such as chipped grain, loosened grain, raised grain, torn grain, skips in dressing, hit and miss, variation in sawing, miscut lumber, machine burn, machine gouge, mismatching, and insufficient tongue or groove.

Chipped grain means that a part of the surface is chipped or broken out in very short particles below the line of cut. It should not be classed as torn grain and, as usually found, shall not be considered a defect, unless it is present in excess of 25 per cent of the area.

Loosened grain means that a small portion of the wood has become loosened but not displaced.

Raised grain is a roughened condition of the surface of dressed lumber in which the hard summer wood is raised above the softer spring wood, but not torn loose from it.

Torn grain means that a part of the wood is torn out in dressing, and in depth is of four distinct characters; slight, medium, heavy, and deep.

Slight torn grain is not over $\frac{1}{32}$ inch in depth.

Medium torn grain is over $\frac{1}{32}$, but not more than $\frac{1}{16}$ inch in depth.

Heavy torn grain is over $\frac{1}{16}$, but not more than $\frac{1}{8}$ inch in depth.

Deep torn grain is over $\frac{1}{8}$ inch in depth.

A *skip* is an area on a piece that failed to surface.

A *slight skip* is one that failed to surface smoothly, whose area does not exceed the product of the width of the piece in inches multiplied by 6.

A *heavy skip* is one that the planer knife did not touch.

Hit and miss is a series of skipped spots with surfaced areas between, or with skips the entire length when not over $\frac{1}{16}$ inch in depth.

Variation in sawing is a deviation from the line of cut. Slight variation is not more than $\frac{1}{16}$ inch in 1-inch material, $\frac{1}{8}$ inch in 2-inch, $\frac{3}{16}$ inch in 3 to 7 inch, and $\frac{1}{4}$ inch in 8 inches and up.

Miscut lumber is that which has a greater variation in thickness or width at different places on the piece than specified for variation in sawing.

A *machine burn* is a darkening or charring of the wood due to overheating by the machine knives.

A *machine gouge* is a groove across a piece due to the machine cutting below the desired line of cut.

Mismatched material is worked material that does not fit tightly at all points of contact between adjoining pieces, or in which the surfaces of adjoining pieces are not in the same plane.

Slight mismatch is a surface variation not over $\frac{1}{64}$ inch.

Medium mismatch is a surface variation over $\frac{1}{64}$ but not more than $\frac{1}{32}$ inch.

Heavy mismatch is a surface variation over $\frac{1}{32}$ inch.

KNOTS

A *knot* is a branch or limb embedded in the tree which has been cut through in the process of lumber manufacture. Knots are classified according to size, form, quality, and occurrence. The average of the maximum and minimum diameters shall be used in measuring the size of knots, unless otherwise stated.

SIZE

A *pin knot* is one not over $\frac{1}{2}$ inch in diameter.

A *small knot* is one over $\frac{1}{2}$ inch, but not more than $\frac{3}{4}$ inch in diameter.

A *medium knot* is one over $\frac{3}{4}$ inch, but not more than $1\frac{1}{2}$ inches in diameter.

A *large knot* is one over $1\frac{1}{2}$ inches in diameter.

FORM

A *round knot* is one oval or circular in form.

A *spike knot* is a branch or limb sawed in a lengthwise direction.

QUALITY

A *sound knot* is solid across its face, as hard as the surrounding wood, and shows no indications of decay. It may vary in color from red to black.

An *unsound knot* is solid across its face, but contains incipient decay.

A *decayed knot* is softer than the surrounding wood and contains advanced decay.

A *tight knot* is one so fixed by growth or position that it will firmly retain its place in the piece.

An *intergrown knot* is one whose rings of annual growth are completely intergrown with those of the surrounding wood.

A *water-tight knot* is one whose rings of annual growth are completely intergrown with those of the surrounding wood on one surface of the piece, and which is sound on that surface.

NOTE.—Definitions for sound, tight, intergrown, or water-tight knots may be combined in one or more definitions.

An *encased knot* is one whose rings of annual growth are not intergrown and homogeneous with those of the surrounding wood. The encasement may be partial or complete; or pitch or bark.

A *"not firm" knot* is one which under ordinary conditions will hold its place in a dry board and yet under pressure can be started but not easily pushed out of the piece.

A *loose knot* is one not held firmly in place by growth or position and can not be relied upon to remain in place in the board.

A *pith knot* is a sound knot with a pith hole not more than $\frac{1}{4}$ inch in diameter.

A *hollow knot* is an apparently sound knot with a relatively large hole in it.

OCCURRENCE

A *single knot* is one occurring by itself with the fibers of the wood in which it occurs deflected around it.

A *knot cluster* is two or more knots grouped together as a unit with the fibers of the wood deflected around the entire unit. A group of single knots is not a knot cluster.

Branch knots are two or more knots branching from a common center.

PITCH

Pitch is a poorly defined accumulation of resin in the wood cells in a more or less irregular patch.

Light pitch is the lightly evident presence of pitch.

Medium pitch is a slightly more evident trace of pitch than is the light.

Heavy pitch is the very evident presence of pitch showing by its color and consistency.

Massed pitch is a clearly defined accumulation of solid pitch in a body by itself in a piece of lumber.

PITCH POCKETS

A *pitch pocket* is a well-defined opening between rings of annual growth, usually containing, or which has contained, more or less pitch, either solid or liquid. Bark also may be present in the pocket.

A *very small pitch pocket* is one not over $\frac{1}{8}$ inch in width and not over 2 inches in length.

A *small pitch pocket* is one not over $\frac{1}{8}$ inch in width and not over 4 inches in length, or not over $\frac{1}{4}$ inch in width and not over 2 inches in length.

A *medium pitch pocket* is one not over $\frac{1}{8}$ inch in width and not over 8 inches in length, or not over $\frac{3}{8}$ inch in width and not over 4 inches in length.

A *large pitch pocket* is one whose width or length exceeds the maximum stated as permissible for a medium pitch pocket.

A *closed pitch pocket* is one that does not show an opening on both sides of the piece.

PITCH SEAMS

A *pitch seam* is a shake or check which is filled with pitch.

PITCH STREAKS

A *pitch streak* is a well-defined accumulation of pitch in a more or less regular streak.

A *small pitch streak* is one not over one-twelfth the width by one-sixth the length of the surface on which it occurs.

A *medium pitch streak* is one over one-twelfth but not more than one-sixth the width by over one-sixth but not more than one-third the length of the surface on which it occurs.

A *large pitch streak* is over one-sixth the width by one-third the length of the surface on which it occurs.

PITH

Pith is the small soft core occurring in the structural center of a log. The wood immediately surrounding the pith often contains small checks, shakes, or numerous pin knots, and is discolored; any such combination of defects and blemishes is known as *heart center*.

PITH FLECKS

A *pith fleck* is a narrow streak resembling pith usually brownish, up to several inches in length on the surface of a piece resulting from burrowing of larvæ in the growing tissue of the tree.

SHAKE

A *shake* is a lengthwise separation of the wood, which occurs usually between and parallel to the rings of annual growth.

A *fine shake* is one with a barely perceptible opening.

A *slight shake* is one with more than a perceptible opening but not over $\frac{1}{32}$ inch in width.

A *medium shake* is one with an opening over $\frac{1}{32}$ but not more than $\frac{1}{8}$ inch wide.

An *open shake* is one with an opening over $\frac{1}{8}$ inch wide.

A *through shake* is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

SPLITS

A *split* is a lengthwise separation of the wood, due to the tearing apart of the wood cells.

A *short split* is one whose length does not exceed either the width of a piece or one-sixth its length.

A *medium split* is one whose length exceeds the width of a piece, but does not exceed one-sixth its length.

A *long split* is one whose length exceeds one-sixth the length of a piece.

STAIN (OR DISCOLORATION)

Stain is a discoloration, occurring on or in lumber, of any color other than the natural color of the piece on which it appears. It is classified as light, medium, and heavy.

Light stain is a slight difference in color which will not materially impair the appearance of the piece if given a natural finish.

Medium stain is a pronounced difference in color which, although it does not obscure the grain of the wood, would customarily be objectionable in a natural but not in a painted finish.

Heavy stain is a difference in color so pronounced as practically to obscure the grain of the wood.

WANE

Wane is bark, or the lack of wood or bark, from any cause, on the edge or corner of a piece.

Slight wane is not over $\frac{1}{4}$ inch wide on the surface on which it appears, for one-sixth the length and one-fourth the thickness of the piece.

Medium wane is over $\frac{1}{4}$ inch but not more than $\frac{1}{2}$ inch wide on the surface on which it appears, for one-sixth the length and one-fourth the thickness of the piece.

Large wane is over $\frac{1}{2}$ inch wide on the surface on which it appears, and/or over one-sixth the length and one-fourth the thickness of the piece.

WARP

Warp is any variation from a true or plane surface. It includes bow, crook, cup, or any combination thereof.

Bow is a deviation flatwise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line.

Crook is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line. It is known as slight, small, medium, and large.

Based on a piece 4 inches wide and 16 feet long, the distances for the different degrees of crook shall be: For *slight crook*, a maximum of 1 inch; *small crook*, 1½ inches; *medium crook*, 3 inches; and *large crook*, over 3 inches. For wider pieces it shall be $\frac{1}{8}$ inch less for each additional 2 inches of width. Shorter or longer pieces may have the same curvature.

Cup is a curve in a piece across the grain or width of a piece. It is measured at the point of greatest deviation from a straight line drawn from edge to edge of a piece. It is known as slight, medium, and deep.

Based on a piece 12 inches wide, the distances for the different degrees of cup shall be: For *slight cup*, a maximum of $\frac{1}{4}$ inch; *medium cup*, $\frac{3}{8}$ inch; and *deep cup*, $\frac{1}{2}$ inch. Narrower or wider pieces may have the same curvature.

Arkansas Soft Pine Bureau. Definitions of defects and blemishes for soft pine, March 23, 1927. Similar to American Lumber Standards.

California White and Sugar Pine Manufacturers Association. Definitions of defects and blemishes for California white pine, sugar pine, white fir, Douglas fir, May 1, 1927. Similar to American Lumber Standards.

North Carolina Pine Association (Inc.). Definitions of defects and blemishes for North Carolina pine, January 1, 1927. Similar to American Lumber Standards.

Northern Hemlock and Hardwood Manufacturers Association. Definitions of defects and blemishes for hemlock and tamarack, February 1, 1927. Similar to American Lumber Standards.

Northern Pine Manufacturers Association. Definitions of defects and blemishes for northern white pine, spruce, and tamarack, April 15, 1927. Similar to American Lumber Standards.

Red Cedar Lumber Manufacturers Association. Definitions of defects and blemishes for western red cedar, August 1, 1925. Similar to American Lumber Standards.

Southeastern Forest Products Association. Definitions of defects and blemishes for southern pine, September 1, 1925. Similar to American Lumber Standards.

Southern Cypress Manufacturers Association. Definitions of defects and blemishes for cypress, June 15, 1925. Similar to American Lumber Standards.

Southern Pine Association. Definitions of defects and blemishes for southern pine, August 1, 1926. Similar to American Lumber Standards.

Southern Pine Association, the Gulf Coast Classification. Definitions of defects and blemishes for pitch pine resawn lumber and sawn timber, March 15, 1923. Similar to American Lumber Standards.

West Coast Lumbermen's Association. Definitions of defects and blemishes for Douglas fir, Sitka spruce, west coast hemlock, and western red cedar, July 1, 1926. Similar to American Lumber Standards.

Western Pine Manufactures Association. Definitions of defects and blemishes for Pondosa pine, Idaho white pine, larch, fir, white fir, cedar, and spruce, July 1, 1925. Similar to American Lumber Standards.

400.21 Cedar grading rules.

American Lumber Industry. Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

For the standard sizes and basic grading rules for American softwood lumber see American Lumber Standards 400.0 to 413.0, inclusive.

National Hardwood Lumber Association, cedar grading rules, January, 1927.

AROMATIC RED CEDAR

All lumber to be well and evenly manufactured, edged as near parallel sides as possible, and to run good average widths and lengths. Taper sawed lumber to be measured one-third distance from the narrow end. Sound knots, sound heart, and white streaks are not to be considered defects. All odd lengths must be measured. Free wane or its equivalent in other defects along edges and ends shall be admitted.

Firsts and seconds.

Three inches and wider, 4 feet and longer, the 4-foot lengths to be not less than 4 inches wide. Lumber to grade sound with one face practically free from sap. If sap shows on face side, reverse side to grade not less than 50 per cent red.

Pieces 4 inches and over wide, 6 feet and over long, shall admit one unsound standard defect.

No. 1 common.

Three inches and wider, 3 feet and longer. The 3-foot lengths to grade No. 1 quality; the 4-foot lengths to cut not less than 75 per cent in two sound red faced cuttings. Five-foot and longer lengths to cut not less than two-third sound red face cutting, no cutting considered less than 3 inches wide and 24 inches long.

No. 1 common and better.

To consist of a combined grade of firsts and seconds and No. 1 common, comprising the full product of the log of the grades specified, but not to exceed 40 per cent of the No. 1 common grade. Not to exceed 10 per cent under 6-foot lengths. Not to exceed 10 per cent 3-inch widths.

No. 2 common.

Two inches and wider, 2 feet and longer; not to exceed 20 per cent of 2-foot lengths. Must work 33⅓ per cent sound cuttings, no cutting to be considered which does not contain 48 square inches. Sap no defect.

Pacific Lumber Inspection Bureau, cedar grading rules, Schedule M, 1925.

GENERAL INSTRUCTIONS

Bark seams or pockets are well-defined markings between the grains of the wood containing more or less bark.

A small bark seam or pocket is one not to exceed ⅛ inch in width and not over 4 inches in length.

A medium bark seam or pocket is one ⅛ inch, but not to exceed $\frac{3}{16}$ inch in width, over 4 inches but not over 6 inches in length.

A large bark seam or pocket is over $\frac{3}{16}$ inch in width and over 6 inches long.

An oil streak is a well-defined accumulation of cedar oil and shall not be considered a defect.

PORT ORFORD CEDAR

Rough green clears.

Defects based on 8-inch widths 12 feet long. Defects in all cases to be considered in connection with the size of the piece.

Short clears: Widths in short clears will be 3 inches and wider in multiples of 1 inch. Lengths 3 feet to 7 feet 6 inches long in multiples of 6 inches.

Long clears: Widths in long clears will be 3 inches and wider in multiples of 1 inch. Lengths 8 feet and longer in multiples of 6 inches.

No. 2 clear and better edge grain.

Under 3 inches thick: Must be sound lumber, well manufactured. Angle of grain to be within the angle of 45° from vertical. Will allow occasional variations in sawing and light-colored sap one-fourth the width; in addition, will allow on face side, which is the best side, small bark seams, if not extending through the thickness of the piece; bird's-eye burls

showing on both sides and on the reverse side; knots, characteristic of the species, if not in clusters, up to and including ¾ inch in diameter and/or bark burls or bark pockets if not extending through the thickness of the piece or equivalent defects. Three defects allowed for each 12 linear feet on each face and/or corresponding half of edges.

Dimensions, 3 inches and up, but not including 5 inches thick.

Dimension 3 inches and up, but not including 5 inches thick, must be sound lumber, well manufactured. Angle of grain to be within the angle of 45° from vertical. Will allow occasional variations in sawing and light-colored sap one-third the width, in addition, will allow on face side, which is the best side and/or corresponding half of edges, small bark seams if not extending through the thickness of the piece, bird's-eye burls showing on both sides. On the reverse face and/or corresponding half of edges, knots, characteristic of the species, if not in clusters, up to and including 1½ inches in diameter, varying according to the size of the piece, and/or medium bark seams or pockets if not extending through the thickness of the piece or equivalent defects. Three defects allowed for each 12 linear feet on each face or corresponding half of edges. Edge grain must show at least two-thirds of face width. Slight seasoning checks no defect. One split or check not longer than the width of the piece allowed.

Dimensions, 5 inches and thicker.

Dimension, 5 inches and thicker, must be sound lumber, well manufactured. Angle of grain to be within the angle of 45° from vertical. Will allow occasional variations in sawing and light-colored sap one-third the width; in addition, will allow on the face side, which is the best side, and/or corresponding half of edges medium bark seams if not extending through the thickness of the piece; or bird's-eye burls showing on both sides; and on the reverse side and/or corresponding half of edges, knots, characteristic of the species, if not in clusters, 2 inches and less in diameter, varying according to the size of the piece, or equivalent defects. Three defects allowed for each 12 linear feet on each face or corresponding half of edges. Edge grain must show for at least two-thirds of face widths. Slight seasoning checks no defect. One split or check not longer than the width of the piece allowed. An occasional piece 18 feet or longer may contain one larger defect showing on one or two surfaces if so placed that by cutting it out the shortest cutting will be 8 feet or longer, provided balance of piece is practically free from other defects.

No. 2 clear and better flat grain.

No. 2 clear and better flat grain, under 3 inches in thickness must be sound lumber, well manufactured. Will allow occasional variations in sawing and light-colored sap one-quarter the width and three-quarters the thickness, or its equivalent; in addition, will allow on the face side, which is the best side, small bark seams, if not extending through the thickness of the piece, or bird's-eye burls showing on both sides; and on the reverse side and/or corresponding half of edges, knots, characteristic of the species, if not in clusters, not over ½ inch in diameter in 1-inch stock and varying according to the thickness of the piece up to 1 inch and/or small bark seams if not extending through the thickness of the piece or equivalent defects. Three defects allowed for each 12 linear feet on each face or corresponding half of edges. Edge grain may be included at shipper's option.

Dimensions, 3 inches and up but not including 5 inches thick.

Dimensions 3 inches and up, but not including 5 inches thick, must be sound lumber, well manufactured. Will allow occasional variations in sawing and light-colored sap one-third the width and three-quarters the thickness or its equivalent; in addition, will allow on face side, which is the best side and corresponding half of edges small bark seams if not extending through the thickness of the piece; bird's-eye burls showing on both sides and on the reverse side and corresponding half of edges, knots, characteristic of the species, if not in clusters, up to and including 1½ inches in diameter, varying according to the size of the piece and/or medium bark seams or pockets, if not extending through the thickness of the piece, or equivalent defects. Three defects allowed for each 12 linear feet on each face or corresponding half of edges. Edge grain may be included at shipper's option. Slight seasoning checks no defect. One split or check not longer than the width of the piece allowed.

Dimensions, 5 inches and thicker.

Dimensions 5 inches and thicker must be sound lumber, well manufactured. Will allow occasional variations in sawing and light-colored sap one-third the width and three-quarters the thickness or its equivalent; in addition, will allow, on the face side, which is the best side, medium barks seams, if not extending through the thickness of the piece, or bird's-eye burls showing on both sides. On reverse side or corresponding half of edges, knots, characteristic of the species, if not in clusters, 2 inches and less in diameter, varying according to the size of the piece, or equivalent defects. Three defects allowed for each 12 linear feet on each face and/or corresponding half of edges. Slight seasoning checks no defect. One split or check not longer than the width of the piece allowed. An occasional piece 18 feet or longer may contain one larger defect, showing on one or two surfaces if so placed that by cutting it out the shortest cutting will be 8 feet or longer, provided balance of piece is practically free from other defects.

In sizes 8 by 8 and larger, boxed hearts are admissible provided material of this description is not coarse grained.

Edge grain may be included at shipper's option.

No. 3 clear, edge and/or flat grain at shipper's option; defects based on 10-inch widths, 12 feet long.

Under 3 inches in thickness must be sound lumber, well manufactured. Will allow occasional varia-

tions in sawing and bright or slightly discolored sap one-third the width or its equivalent; in addition, will allow on the face side sound and tight 1-inch knots or small bark seams, well scattered bird's-eye burls showing on one or two sides, slight seasoning checks, or equivalent defects; on the reverse side, knots, characteristic of the species, bark seams, or pockets. Four defects allowed for each 12 linear feet on each face and/or corresponding half of edges.

Dimensions, 3 inches thick up to but not including 5 inches thick.

Dimensions, 3 inches thick up to but not including 5 inches thick, to be graded from the best face, the defects on reverse face to be slightly in excess of those on the best face, must be sound lumber, well manufactured. Will allow occasional variations in sawing and bright or slightly discolored sap one-third the width, or its equivalent; in addition, will allow sound and tight knots up to 1¼ inches in diameter, medium bark seams, well scattered bird's-eye burls, slight seasoning checks, or equivalent defects. Knots characteristic of the species permitted on the poorest face and/or corresponding half of edges. Four defects allowed for each 12 linear feet on each face and/or corresponding half of edges.

Dimensions, 5 inches and thicker.

To be graded from the best face, defects on the reverse face to be only slightly in excess of those on the best face, must be sound lumber, well manufactured. Will allow occasional variations in sawing and bright or slightly discolored sap one-third the width, or the equivalent; in addition, will allow sound and tight knots up to 1½ inches in diameter or medium bark pockets, or a split or check not longer than the width of the piece, well scattered bird's-eye burls, or equivalent defects. Slight seasoning checks no defect. Knots, characteristic of the species, permitted on the poorest face and/or corresponding half of edges. Four defects allowed for each 12 linear feet on each face and/or corresponding half of edges. In sizes 8 by 8 and larger boxed hearts are admissible provided material of this description is not coarse grained. An occasional piece 18 feet or longer may contain one larger defect, showing on one or two surfaces if so placed that by cutting it out the shortest cutting will be 8 feet or longer, provided the balance of piece is practically No. 2 clear.

Special factory stock.

Special factory stock, 2 inches and thicker, 6 inches and wider, odd and/or even widths, 7 feet or longer multiples of 1 foot. Each piece to contain 70 per cent or more clear cuttings 3 feet or longer.

Port Orford cedar sap clear.

This grade will admit any amount of bright sap; otherwise than this the grade will follow the grade as outlined for No. 2 clear and better or No. 3 clear.

Red Cedar Lumber Manufacturers' Association, cedar grading rules, August 1, 1925.

Common grades.

Discoloration through exposure to the elements shall not be considered a defect in the common grades.

All common grades, including timbers, either rough or dressed are subject to shrinkage.

All common lumber shipped rough must be well manufactured to sizes ordered.

Occasional slight variation in sawing will be allowed.

West Coast Lumbermen's Association, cedar grading rules, July 1, 1926.

WESTERN RED CEDAR

Color of wood is not a defect. This applies to all grades. (Investigation in the Forest Products Laboratory, College of Forestry, University of Washington, Seattle, Wash. (1916–17) proved that the "brown streaks" or discoloration of western red cedar does not detract from its durability or make it in any way unserviceable.)

Bevel, bungalow, or colonial siding is produced by resawing lumber surfaced four sides, on a bevel so as to produce two pieces thicker on one edge than the other. It shall be graded from the face side, and the thick edge considered part of the face.

In 4-inch siding it is considered that ¾-inch will be covered; in 6-inch siding 1 inch; and in siding wider than 6 inch, 1½ inch.

Slash and/or vertical grain. Color is not a defect. Occasional slight variation in thickness, not to exceed a total of $\frac{1}{16}$ inch in any two pieces. Defects on thin edge which will cover when laid should not be given the same consideration as defects elsewhere.

Western Pine Manufacturers' Association, cedar grading rules, July 1, 1925.

Rules for grading white fir, cedar, and spruce lumber are the same as the rules of this association for grading white fir, cedar, and spruce lumber, 400.23.

400.22 Cypress Grading Rules.

Southern Cypress Manufacturers' Association, cypress grading rules, June 15, 1925.

The grade standards and yard and industrial size standards of this association conform to the American Lumber Standards, 411.0.

400.23 Fir Grading Rules.

West Coast Lumbermen's Association, standard grading and dressing rules for Douglas fir, Sitka spruce, west coast hemlock, and western red cedar lumber, July 1, 1926.

GENERAL INSTRUCTIONS

The inspection of lumber is the analysis of the quality of the product. Inflexible rules for the inspection of lumber are impossible; therefore, variations determined by practical experience must be allowed. The analysis being visual, mathematical precision is impossible and, therefore, a reason-

able difference of opinion between inspectors must be recognized. A shipment shall be considered as on grade if, upon official reinspection, 95 per cent or more is found to be of the grade invoiced. In mixed car shipments, each grade and kind shall be considered separately.

The grade of all lumber is determined by the number, size, character, and position of defects visible in a piece. The number or size permitted in a grade varies as the area of the piece increases or decreases in relation to the basic size piece specified. With this in view, each piece is considered and its grade determined by its general character and the sum of all its defects.

When defects are encountered which are not described in these grading rules they shall be considered as equivalent to described defects in ratio to their effect.

Equivalent means equal in effect, and in construing and applying these rules the defects allowed, whether specified or not, are understood to be equivalent in effect to those mentioned applying to stock under consideration.

Defects in rough stock which can be removed in working to standard size, shall not be considered when determining the grade of the piece.

Splits and checks shall be considered as to length and direction as herein specified.

Bright sap is not limited in any grade, except as specifically provided.

A grade must be representative and not made up of either high and/or low line pieces. The number, size, and kind of defects allowed in a grade do not represent the average of the grade, but indicate the low line piece. The average of a grade represents the gradation from the low line of the grade to the low line piece of the next higher grade. The reverse side should be approximately within one grade of the face grade.

Where a base grade and better is ordered, for instance No. 2 and better common, it shall mean principally No. 2 common with a small percentage of the higher grade of common. This does not contemplate furnishing a log-run grade, but merely a grade of common. The grade of C and better shall mean principally C. Such grades are not standard and should be covered by special contract.

If "mill run" or "log run" is ordered, it shall mean the entire product of the log, with all culls eliminated. Culls shall be defined as all lumber falling below No. 3 common.

A shipment of random or mixed widths shall contain some of each width. A shipment of random or mixed lengths shall contain some of each length.

Material not conforming to standard sizes and grades shall be governed by special contract.

Lumber, rough or surfaced two sides (except dimension) shall be graded from the face or best side, and lumber which is dressed on one side only shall be graded from the dressed side, except when otherwise specified. Dimension and timbers are graded for strength; defects must be considered in relation to their effect on the strength of the piece.

Flooring, ceiling, rustic, and drop siding, at shipper's option, may be shipped S1S or S2S, reverse side partially surfaced, hollow, or scratched back.

Flat grain flooring, ceiling, partition, drop siding, and rustic, in B and C grades, may include, at shipper's option, 15 per cent West Coast hemlock.

Flooring, ceiling, partition, drop siding, and rustic, in D grade, may be Douglas fir and/or West Coast hemlock.

(*a*) Pieces of flooring, drop siding, partition, and rustic, with a tongue $\frac{1}{16}$ of an inch scant, and pieces of ceiling with $\frac{1}{8}$ of an inch or more of tongue, will be admitted in any grade.

(*b*) In car siding, lining, or roofing, pieces with $\frac{3}{16}$ of an inch or more of tongue will be admitted in any grade, provided such scant tongue does not run more than one-third the length of the piece.

(*c*) Pieces of shiplap having in No. 1 common a lap of $\frac{5}{16}$ of an inch, in No. 2 a lap of $\frac{1}{4}$ inch, and in No. 3 a lap of $\frac{1}{8}$ inch, will be admitted in these grades.

Bevel, bungalow, and colonial siding thicknesses are, by reason of methods of resawing, subject to variation as specified in each grade.

Bevel, bungalow, and colonial siding are furnished in separately bundled lengths or "new bundling" at shipper's option. New bundling means tying short pieces in bundles with long, but the percentage of short lengths shall not exceed 30 per cent of 3-foot to 7-foot, and shall be securley tied with not less than four ties. All lengths shall be multiples of 1 foot.

In factory lumber $5/4$ and thicker, used for the manufacture of doors, sash, etc., which must show on both sides, the grade is determined by the quantity of suitable cuttings obtained in each piece.

All lumber must be full to the length specified. It need not be square butted unless so specified, but must be of sufficient length to allow trimming square to the specified length.

Standard lengths for lumber are multiples of 1 foot or 2 feet.

Lumber of standard size shall be tallied board measure. On lumber of standard thickness less than 1 inch (board measure), the board-foot measurement shall be based on the surface dimensions.

The board measurement of dressed lumber of standard size shall be based upon the corresponding standard dimensions of rough green lumber.

Lumber finished to special size shall be counted (tallied) as of the standard rough size necessarily used in its manufacture.

Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or condition will prohibit a reinspection for the adjustment of claims except with the consent of all parties interested.

Standard dressed sizes apply at commercially shipping-dry condition. "Commercially shipping-dry" lumber is defined as lumber in condition which will permit of close piling during the ordinary shipping period without deterioration from stain

or decay. "Shipping period" is defined as the time reasonably necessary for delivery to destination.

Common grades up to and including 2 by 12 may be surfaced green or dry. If surfaced green, shall be accepted by the purchaser if upon receipt of shipment the sizes are within 4 per cent of dressed size. Two by fourteen and wider, timbers and all lumber thicker than 2 inches, if ordered surfaced, are surfaced green. All lumber shipped green is subject to natural shrinkage of 4 per cent.

In shipments measured with a board rule, a piece tally in feet shall be made and this tally shall be the number of feet, board measure, of 1-inch lumber. The tally of lumber thicker than 1 inch shall be multiplied by the thickness as expressed in inches and fractions of an inch.

In material measured with a board rule on actual widths, pieces measuring to the even half foot shall be alternately counted as of the next higher and lower foot count; fractions below the one-half foot shall be dropped and fractions above counted as of the next higher foot.

REINSPECTION AND SHIPPING PROVISIONS

This association's reinspection and shipping provisions conform to lumber inspection provisions and service of American Lumber Standards, 400.0.

Western Pine Manufacturers Association, grading rules for Pondosa pine, Idaho white pine, larch and fir, white fir, cedar, and spruce, July 1, 1925.

STANDARD SIZE OF ROUGH LUMBER

The rough-dry sizes conform to the rough-dry sizes of yard lumber, American Lumber Standards, 411.0.

RULES FOR GRADING WHITE FIR, CEDAR, AND SPRUCE LUMBER

White fir, cedar, and spruce boards, strips, and thicker stocks are graded under the rules that are used for the inspection of Idaho white pine.

In mixed woods, the stocks of selects and common carry the same appearance, grade for grade in the general measurement of defects, as do stocks of Idaho white pine.

The individuality of each wood is maintained in the preparation of stocks for shipments, except under special agreement between buyer and seller for a mixed wood stock.

400.24 Hemlock Grading Rules.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 400.0 to 413.0, American Lumber Standards for the basic grading rules for softwood lumber.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for hemlock lumber, February 1, 1927.

This association's grade standards, yard and industrial size standard, description, measurement and tally for yard lumber conform to the American Lumber Standards, 411.0

Pacific Lumber Inspection Bureau, hemlock grading rules, Schedule M, 1925.

Pacific hemlock is graded under the same rules as apply to Douglas fir, except black knots typical of the species and sap shall not be considered defects. See 400.14, 402.43, and grading rules for other products of Douglas fir.

West Coast Lumbermen's Association, hemlock grading rules, July 1, 1926.

West Coast hemlock products (except bungalow siding, bevel siding, and box lumber) are graded by the same rules as govern Douglas fir for like products with the following variations:

Bark pockets are interchangeable with pitch pockets.

Bark seams are interchangeable with pitch seams.

Black burls are interchangeable with knots.

General instructions and definitions of defects for Douglas fir, 400.23 apply to West Coast hemlock as well as other West Coast species.

Dark streaks peculiar to West Coast hemlock shall not be considered a defect in any grade.

Black burls shall not be considered defects in common grades.

Sizes are the same as for Douglas fir of like stock except when otherwise specified.

West Coast Lumber Trade Extension Bureau, grading rules and sizes for west coast hemlock, 1927.

Grading rules and sizes.

The grading rules are the same as those of the West Coast Lumbermen's Association, above. The sizes conform to the American Lumber Standards, 411.0.

400.25 Larch and Tamarack Grading Rules.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for tamarack lumber, February 1, 1927.

This association's grade standards, yard and industrial size standard, description, measurement, and tally for yard lumber conform to the American Lumber Standards, 411.0.

Northern Pine Manufacturers Association, grading rules for tamarack, April 15, 1925.

This association has adopted the American Lumber Standard grades of yard lumber, in accordance with 411.0.

Additional grades and sizes are the same as for pine, 400.26.

Western Pine Manufacturers Association, grading rules for larch, July 1, 1925.

This association's grading rules conform to the American Lumber Standards, 411.0. (See 400.26, grading rules for pine lumber.)

400.26 Pine Grading Rules.

Arkansas Soft Pine Bureau, grading rules for soft pine lumber, March 23, 1927.

This association's grade standards and yard and industrial size standards conform to standards and industrial size standards of the American Lumber Standards, 411.0.

The thickness and width of heavy joists are the same as the thickness and width of joist and plank, structural material, American Lumber Standards, 412.0.

California White and Sugar Pine Manufacturers Association, grading rules for California pine, May 1, 1926.

GRADES AND NOMENCLATURE

The accompanying rules are adopted by the California White and Sugar Pine Manufacturers Association for the grading of California white and sugar pine, white fir, Douglas fir, and incense cedar.

They express as clearly as it is possible to define them the grades of lumber now being made under the supervision of the association's corps of inspectors.

The interpretation of rule and decision on grade is vested in a "bureau of grades" maintained for this purpose by the California White and Sugar Pine Manufacturers Association.

Yard Lumber

Following are the standard grades adopted and the names by which they are to be known.

Finishing:
- No. 1 and 2 clear, or
- B select and better
- C select,
- D select.

Common boards
- (S1S, S2S, or S4S, D. & M. ship-lapped, grooved roofing.)
- No. 1 common.
- No. 2 common.
- No. 3 common.
- No. 4 common.
- No. 5 common.

Bevel siding.

Colonial siding.

Bungalow siding:
- B and better.
- C.
- D.
- E.

Flooring, drop siding.

Ceiling, partition:
- C select and better.
- D select.
- No. 1 common.
- No. 2 common.
- No. 3 common.

Molding.

Tank stock.

Dimension:
- No. 1 dimension.
- No. 2 dimension.
- No. 3 dimension.

Factory Lumber

Factory plank:
- No. 3 clear factory.
- No. 3 clear.
- No. 1 shop.
- No. 2 shop.
- No. 3 shop.

Inch factory:
- Inch No. 3 clear factory.
- Inch shop.

Stained shop:
- Box—
  - No. 1 box.
  - No. 2 box.

Pencil stock.

Lath

No. 1 lath.

No. 2 lath.

GENERAL INSTRUCTIONS

Grading.

The purpose of grades is to maintain a standard for measure of value between mills manufacturing the same or similar woods and to harmonize the natural differences existing between different stocks of lumber regardless of the character of the logs from which they are produced, so that a given grade will represent the same value regardless of the mill from which it comes. Uniform grades also provide both buyers and sellers of lumber with a measure by which each can determine whether he is buying or selling full value.

No arbitrary rules for the inspection of lumber can be maintained with satisfaction; the variations from any given rule are numerous and suggested by practical common sense, so nothing more definite than the general features of different grades should be attempted by rules of inspection.

All lumber is graded with special reference to its suitability for the use intended. With this in view, each piece is considered and its grade determined by its general character, including the location and sum of all its defects and blemishes.

Imperfections in rough stock which can be removed in dressing to standard size shall not be considered in determining the grade under these rules.

Planing-mill work should be taken into consideration in all grades of dressed lumber, and its effect on a piece must be left largely to the judgment of the grader.

Wane in lumber is a defect which can not be covered by rule with satisfaction, and, therefore, must be left to the judgment of the grader.

The lowering of grade on account of wane or other serious defects on the reverse side should be governed by grade, width, and defects in the piece.

Due consideration in rough stock should be given for the amount of wane that would be surfaced off in milling.

When special sizes or patterns of lumber are ordered, unless a special agreement is made, it shall be permissible to ship all of the lower grades that develop in their manufacture at the usual differential in prices for these grades, provided that this does not exceed 15 per cent of the quantity shipped.

Sizes.

The following thicknesses, widths, and lengths shall be considered standard nominal sizes. All other sizes shall be considered as special.

Thicknesses: 5/16, 7/16, 9/16, 11/16, 1, 1¼, 1½, 2, 2½, and 3 inches and up in multiples of 1 inch.

Widths: One inch and up in multiples of 1 inch on stock width shipments.

Lengths: Eight feet and up in multiples of 1 foot in yard lumber and 6 feet and up in factory lumber. Not over 5 per cent of 8 and 9 foot lengths shall be included in random-length shipments of yard lumber. The foregoing does not apply to classes of stock covered contrarily by specific rule.

Dressed lumber shall be finished according to the sizes prescribed in these specifications.

All lumber is turned out from the sawmill on a practiced economy of thickness and width that safely provides for the dressed sizes, and stock sold in the rough must of necessity be taken from lumber so manufactured. Because of shrinkage and other factors beyond the control of the manufacturer, rough, dry lumber may be less than the nominal size, but shipments of rough stock should provide approximately ⅛-inch more than the standard finished thickness and width for dressing.

Measurement and tally.

Lumber of standard size shall be tallied board measure. On lumber of standard thickness less than 1 inch board-foot measurement shall be based on surface dimensions.

The board measurement of dressed lumber of standard size shall be based upon the corresponding standard dimensions of rough green lumber.

Lumber finished to special size shall be counted as of the standard rough size necessarily used in its manufacture.

Material shipped on stock sizes shall be tallied by the number of pieces of each size and length.

In shipments measured with a board rule, a piece tally, in feet, shall be made and this tally shall be the number of feet, board measure, of 1-inch lumber. The tally of lumber thicker than 1 inch shall be multiplied by the thickness as expressed in inches and fractions of an inch.

In material measured with a board rule on actual widths, pieces measuring to the even half foot shall be alternately counted as of the next higher and lower foot count; fractions below the one-half foot shall be dropped and fractions above counted as of the next higher foot.

Because of the variable human element in the application and use of a board rule, a difference of not to exceed 1½ per cent shall be considered a reasonable variation between tallies.

In computing the footage of cut stock ⅛ inch shall be added to the width. Fractional inches in length shall be computed as of the next higher exact inch.

In shipments of rough lumber, pieces ½ inch or more above the count thickness, such as may be produced by uneven sawing, may, at the option of the buyer, be rejected or accepted and paid for at the market price for the next lower grade.

Shipments of mixed widths and/or mixed lengths shall contain a fair assortment of each width or each length.

The average length of a shipment of lumber shall be computed by dividing the total length in feet by the total number of pieces in shipment.

The average width of a shipment of lumber 1 inch or less in thickness shall be computed by dividing the total board feet by the total length in feet and multiplying the result by 12. The total board-foot tally of lumber thicker than 1 inch shall be divided first by the thickness as expressed in inches and fractions of an inch.

Unedged lumber shall be measured across the average width of the board on the narrow face in 1-inch, 1¼-inch, and 1½-inch lumber. The width of 2-inch and thicker material shall be one-half of the sum of the average widths of the narrow and wide faces.

RULES FOR YARD LUMBER

Special provisions.

The term "yard lumber" as here used means lumber that is manufactured and classified into those sizes, shapes, and qualities required for ordinary building and industrial uses. Heavy timbers for structural purposes, softwood factory lumber, and other special-use materials are not considered yard stock. In this association, finishing lumber, especially in stock widths; common boards, rough, S1S, S2S, S4S, D. & M. or worked shiplap, siding, flooring, ceiling and partition, dimension, moldings, and tank stock will be considered yard lumber.

All thicknesses and width of yard lumber shall be graded according to the following rules:

The grades of yard lumber, rough or surfaced two sides, shall be determined from the best side of the piece, except in dimension lumber. Lumber which is surfaced one side only shall be graded from the surfaced side except when covered contrarily by specific rule. The reverse side of the piece should not be of such a nature as to interfere with the use of the piece in its intended grade. In Nos. 1 and 2 clear or B select and better more consideration shall be given to the back than in C select.

A shipment of any grade must consist of a fair average of that grade and can not be made up of an unfair proportion of the better or poorer pieces that would pass in that grade.

In a general way, all stock run to a pattern shall receive the same general inspection as stock run S2S or S4S.

The rules prescribe the number and extent of defects and blemishes permitted in the poorest pieces admissible in each grade, and a series of defects is described for some grades, the very nature of which would prevent all of them from appearing in any one piece.

The number and extent of defects and blemishes permitted varies as the area of the piece to be graded increases or diminishes. Defects should be well distributed.

When defects or blemishes not described in these grading rules are encountered, they will be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration.

On the basis of quality, yard lumber is divided into two main divisions (1) select lumber and (2) common lumber. These are again divided into two classes—select lumber into (*a*) that suitable for natural finishes, and (*b*) that suitable for paint finishes; common lumber into (*a*) that which can be used without waste, and (*b*) that which permits some waste. Each of these four classes is further divided into quality classes or grades. The requirements of each subclass must be kept in mind by the grader as well as the limitations of the grade itself.

COMMON LUMBER

Lumber 2 inches or less in thickness, except dimension, containing knots and other defects in varying degrees, which is to be used when appearance is of minor importance, shall be graded as common boards. Such stock may be: Rough: S1S, S2S, or S4S; dressed and matched (D. & M.); shiplap or grooved for roofing.

Checks in tight knots are not considered a defect in common lumber unless the opening is so pronounced as to injure the piece for the purpose for which the grade was designed.

VARIATIONS FROM AMERICAN LUMBER STANDARDS

The California White and Sugar Pine Manufacturers' Association has indorsed the American Lumber Standards movement from the first. Because of manufacturing conditions peculiar to the region, however, certain sizes in addition to those comprising American Lumber Standards have been added as standard sizes of this association. These sizes, for the most part, refer to thicknesses, and are, with one exception, in excess of the American Lumber Standards.

These additional thicknesses are as follows:

Finishing.

$1\frac{5}{32}$ extra standard for $1\frac{1}{4}$ inch nominal.
$1\frac{13}{32}$ extra standard for $1\frac{1}{2}$-inch nominal.
$1\frac{13}{16}$ extra standard for 2-inch nominal.
$2\frac{3}{8}$ extra standard for $2\frac{1}{2}$-inch nominal.
$2\frac{3}{4}$ extra standard for 3-inch nominal.
$3\frac{3}{4}$ extra standard for 4-inch nominal.

Boards.

$1\frac{1}{8}$ extra standard for $1\frac{1}{4}$-inch nominal.
$1\frac{3}{8}$ extra standard for $1\frac{1}{2}$-inch nominal.
$1\frac{3}{4}$ extra standard for 2-inch nominal.

Dressed and matched.

$\frac{13}{16}$ extra standard for 1-inch nominal.
$1\frac{1}{8}$ extra standard for $1\frac{1}{4}$-inch nominal.
$1\frac{3}{8}$ extra standard for $1\frac{1}{2}$-inch nominal.
$1\frac{3}{4}$ extra standard for 2-inch nominal

Shiplap.

$\frac{13}{16}$ extra standard for 1-inch nominal.
$1\frac{3}{4}$ extra standard for 2-inch nominal.

Flooring.

$\frac{13}{16}$ extra standard for 1-inch nominal.

$^{11}/_{16}$-inch sizes.

In addition, a nominal size of $^{11}/_{16}$-inch for finishing, boards, dressed and matched, shiplap, flooring, ceiling, drop siding, and partition has been added. Manufacturing practice and the character of the timber cut in California make it possible to produce this useful size very economically, and it is sold for many purposes which it serves to better advantage than thicker lumber. The dressed size is the same as the nominal size.

National Hardwood Lumber Association, pine grading rules, January, 1927.

SOUTHERN YELLOW PINE

The National Hardwood Lumber Association has adopted the rules of the Southern Pine Association, New Orleans, La.

North Carolina Pine Association (Inc.), pine grading rules, January 1, 1927.

The general grading rules of this association conform to the general provisions of the grade standards, 411.0, American Lumber Standards.

LONG LEAF YELLOW PINE LUMBER

General rules.

Must be sound, commercial long leaf yellow pine (pine combining large coarse knots with coarse grain is excluded under these rules), well manufactured, full to size and saw butted, except 25 per cent may be $\frac{1}{16}$ inch scant in thickness and/or $\frac{1}{8}$ inch scant in width, and shall be free from the following defects: Unsound, loose and hollow knots, worm holes and knot holes, through shakes or round shakes that show on the surface, and shall be square edge unless otherwise specified.

All lumber grading better than the grade sold shall be accepted as the grade sold.

A through shake is hereby defined to be through or connected from side to side, or edge to edge, or side to edge.

In the measurement of dressed lumber the width and thickness of the lumber before dressing must be taken—less than 1 inch thick shall be measured as 1 inch.

The measurement of wane shall always apply to the lumber in the rough.

Where terms one-half and two-thirds heart are used they shall be construed as referring to the area of the face on which measured.

In the dressing of lumber, when not otherwise specified, $\frac{1}{8}$ inch shall be construed as taken off by each planer cut.

Flooring.

Flooring shall embrace 4, 5, and 6 quarter inches in thickness by 3 to 6 inches in width, excluding $1\frac{1}{2}$ by 6. For example, 1 by 3, 4, 5, and 6; $1\frac{1}{4}$ by 3, 4, 5, and 6; $1\frac{1}{2}$ by 3, 4, and 5.

Boards.

Boards shall embrace all thicknesses under $1\frac{1}{2}$ inches by over 6 inches wide. For example, $\frac{3}{4}$, 1, $1\frac{1}{4}$, and $1\frac{3}{8}$ inches thick by over 6 inches wide.

Plank.

Plank shall embrace all sizes from $1\frac{1}{2}$ to under 6 inches in thickness by 6 inches and over in width. For example, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, $5\frac{1}{4}$, $5\frac{3}{4}$ by 6 and over in width.

Scantling.

Scantling shall embrace all sizes exceeding 1½ and under 6 inches in thickness, and from 2 to under 6 inches in width. For example, 2 by 2, 2 by 3, 2 by 4, 2 by 5, 3 by 3, 3 by 4, 3 by 5, 4 by 4, 4 by 5, and 5 by 5.

Dimension.

Dimension sizes shall embrace all sizes 6 inches and up in thickness by 6 inches and up in width. For example, 6 by 6, 6 by 7, 7 by 7, 7 by 8, 8 by 9, and up.

Stepping.

Stepping shall embrace 1 to 2½ inches in thickness by 7 inches and up in width. For example, 1, 1¼, 1½, 2, and 2½ by 7 and up in width.

Rough edge, or flitch.

Rough edge, or flitch, shall embrace all sizes 1 inch and up in thickness by 8 inches and up in width, sawed on two sides only. For example, 1, 1½, 2, 3, 4, and up thick by 8 inches and up wide, sawed on two sides only.

Northern Pine Manufacturers' Association, grading rules for northern white and Norway pine, spruce, and tamarack, April 15, 1925.

This association has adopted the American Lumber Standard grades of yard lumber in accordance with 411.0. The following additional grades are furnished.

Siding: E.

Dimensions and timbers: Tank; select common.

STANDARD SIZES FOR DRESSED LUMBER

The sizes of softwood lumber adopted by the Northern Pine Manufacturers' Association are American Lumber Standard sizes, 411.0, except the following which are thicker than the American Lumber Standards unless otherwise noted:

Finish.

Nominal thicknesses, board measure	Dressed thicknesses, S1S or S2S	Nominal widths, board measure	Dressed widths, S1E or S2E
Inches	*Inches*	*Inches*	*Inches*
1¼	1⅛	6	5⅝
1½	1⅜	8	7½

Bevel siding.

4 inch—(*a*) $\frac{7}{16}$ inch by $\frac{3}{16}$ inch by 3½ inches.

6 inch—(*a*) $\frac{7}{16}$ inch by $\frac{3}{16}$ inch by 5½ inches.

(*a*) The thick edge is $\frac{1}{16}$ inch thinner than American Lumber Standards.

Common boards and strips.

Nominal thicknesses, board measure	Dressed thicknesses, S1S or S2S	Nominal widths, board measure	Dressed widths S1E or S2E
Inches	*Inches*	*Inches*	*Inches*
1¼	1⅛	6	5⅝
1½	1⅜	8	7½

GROOVED ROOFING AND BEVELED CRIBBING

Thicknesses of 1-inch grooved roofing and beveled cribbing shall be $\frac{25}{32}$ inch.

Widths of grooved roofing and beveled cribbing shall be the same as the nominal and standard over-all widths for dressed and matched or shiplapped stock.

Dimension.

The sizes for dimension conform to American Lumber Standards 411.0, yard and industrial size standards.

Timbers.

S1S1E or S4S to ½ inch less than nominal size.

FACTORY LUMBER

Shop common.

1 inch S1S or S2S to $\frac{25}{32}$ inch thick.
1¼ inch S1S or S2S to 1⅛ inch thick.
1½ inch S1S or S2S to 1⅜ inch thick.
2 inches S1S or S2S to 1¾ inch thick.

Standard sizes of rough lumber.

The standard sizes of rough lumber conform to the rough dry sizes of yard lumber, American Lumber Standards, 411.0.

GENERAL INSTRUCTIONS

Grading.

The aim of uniform grading inspection is to harmonize the natural differences which exist in the characteristics of the different stocks cooperating in this bureau, making lumber of the same grades, at the different manufacturing points, of practically equal value, whether the logs from which the lumber is cut are large or small, coarse knotted, fine knotted, black knotted, red knotted, sound, or shaky.

1. All yard lumber is graded with reference to its suitability for general use as yard lumber. With this in view, each piece is considered and its grade determined by its general character, including the location and sum of all its defects and blemishes. Material not conforming to standard sizes or grades shown herein and that intended for special uses, such as car siding, roofing, etc., shall be covered by special contract and inspection.

2. No arbitrary rules for the inspection of lumber can be maintained with satisfaction. The variations from any given rule are numerous and suggested by practical common sense, so nothing more definite than the general features of the different grades should be attempted by rules of inspection. The following, therefore, are submitted as the general characteristics of the different grades.

3. The grading of lumber can not be considered an exact science, because it is based on a visual inspection of each piece and on the judgment of the grader. The provisions of these specifications, however, are sufficiently explicit to establish 5 per cent below grade as a reasonable variation between graders.

4. In the grading of finishing lumber in common practice there is a recognized difference in classifying inch lumber, and lumber thicker than inch. A

small percentage of the 1¼, 1½, and 2 inch lumber goes into work requiring each face to be shown, as in doors, sash, etc. With inch lumber, except shop common and partition, the uses are quite different, the almost invariable practice being that one face of the board is shown and that face the better one.

5. The face side of the lumber is the side showing the best quality or appearance.

6. C and better Norway graded for ladder stock should be a two-faced piece.

7. Third C select, except for factory purposes, should be graded on its best side or face, not so much attention being given to the back; but in the grade of B select and better, the backs should as a rule more nearly approach the face side in quality.

8. Yard lumber worked two sides shall be graded from its better side or face; lumber worked one side shall be graded from its surfaced face.

9. The grade of partition shall be determined from its poorer side.

10. The rules for yard lumber prescribe the number and extent of defects and blemishes permitted in the poorest pieces admissible in each grade, though a series of defects may be described as admissible in some grades the very nature of which would prevent all of them from appearing in one piece. A shipment of any grade shall contain all the lumber of that quality that is produced from the log.

11. Defects in lumber should be distributed in proportion to the size of the piece. Long or wide pieces of the same grade may contain more and greater defects than shorter or narrower pieces. The same percentage should be observed in both long and short, wide and narrow.

12. When defects or blemishes not described in these grading rules are encountered, they will be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration.

13. Equivalent means equal, and in constructing and applying these rules, the defects allowed, whether specified or not, are understood to be equivalent in damaging effect to those mentioned applying to the stock under consideration.

14. The lowering of grade on the face side on account of wane should be governed by grade, width, and defects in the piece.

15. Wane or other imperfections in rough stock which can be removed in dressing to standard size shall not be considered in determining the grade under these rules.

16. Lumber when worked shall be graded the same as the respective grades when in the rough.

17. Imperfect manufacture in dressed stock, such as torn grain, loosened grain, broken knots, mismatching, insufficient tongue, groove, or lap, etc., shall be considered as defects, but their effect on the use of the piece must be left largely to the judgment of the inspector. The amount by which they will lower the grade shall be governed by the grade, width, and other defects in the piece and according to whether they are slight or serious in the effect on the use of the piece.

18. Heavy skip on the reverse side of a piece surfaced two sides is admissible up to and including 25 per cent of the area of the reverse side. If in excess of that amount, it will lower the piece one grade from its face.

19. In a general way, D & M stock, except No. 3, should have a good bearing on back, and lumber S1S or S2S shows nearly a full face.

20. When special grades or patterns of lumber are ordered, unless a special agreement is made, it shall be permissible to ship all of the lower grades that develop in their manufacture at the usual differential in prices for these grades, provided that this does not exceed 20 per cent of the quantity shipped.

21. "Log-run" shall be construed to mean the entire merchantable lumber product of the log.

22. Bright sap shall not be considered a defect in any of the grades provided for and described in these rules.

23. Light stain is admissible in the grade of "B" select and better and medium to heavy stain in all grades below "B" select.

Sizes.

24. The following nominal thicknesses, widths, and lengths of yard lumber shall be considered standard. All other sizes shall be considered special.

Thicknesses: 1, 1¼, 1½, 2, 2½, 3, and 4 inches, board measure.

Widths: Four inches and up, board measure, in multiples of 2 inches.

Lengths: Six feet and up in multiples of 2 feet, except for bevel siding 4 feet and longer in which multiples of 1 foot may apply.

25. Yard lumber of standard size shall be described by these standard dimensions, and the dressed sizes shall conform to those prescribed elsewhere in these specifications.

Measurement and tally.

Measurement and tally for this association conforms to measurement and tally of American Lumber Standards, 411.0 yard lumber.

Grades for yard lumber.

The basic grades for yard lumber are the same as the basic grades of yard lumber of American Lumber Standards, 411.0.

Southeastern Forest Products Association, grading rules for southern pine yard lumber, September 1, 1925.

This association's grade standards and yard and industrial size standards conform to the grade standards and industrial size standards of the American Lumber Standards, 411.0.

The thickness and width of heavy joists are the same as the thickness and width of joist and plank, structural material, American Lumber Standards, No. 412.0.

Southeastern Forest Products Association, Interstate Rules of 1916 for southern yellow pine, June 1, 1926.

The size classification of this association for southern yellow pine plank, scantling, dimension, stepping, and rough edge or flitch is the same as the size classification for these products of the North Carolina Pine Association for long leaf yellow pine lumber, 400.26.

Southern Pine Association, grading rules for southern pine yard lumber, March 23, 1927.

This association's grade standards and yard and industrial size standards conform to the grade standards and industrial size standards of the American Lumber Standards, 411.0. The thickness and width of heavy joists are the same as the thickness and width of joist and plank, structural material, American Lumber Standards, 412.0.

Western Pine Manufacturers Association, grading rules for Pondosa pine, Idaho white pine, larch, and fir, white fir, cedar, and spruce, July 1, 1925.

GENERAL INSTRUCTIONS

The purpose of grades is to maintain a standard or measure of value, between mills manufacturing the same or similar woods, by harmonizing the natural differences existing between different stocks of lumber regardless of the character of the logs from which they are produced, so that a given grade will represent the same value and can be used for the same purpose regardless of the mill from which it comes. Uniform grades also provide both buyers and sellers of lumber with a measure by which each can determine whether he is buying or selling full value.

1. No arbitrary rules for the inspection of lumber can be maintained with satisfaction; the variations from any given rule are numerous and suggested by practical common sense, so nothing more definite than the general features of different grades should be attempted by rules of inspection. The following, therefore, are submitted as the general characteristics of the different grades.

2. In grading finish and common lumber the practice is to use the better face of the board for inspection to determine grade. The face side of the board is the side showing the best quality or appearance.

3. The appearance and quality of the back of a piece of finish lumber is a factor in determining grades, with more consideration given to the back of B and better select pieces than to C select.

4. The grade of partition should be determined from its poorer side, and is a special grade.

5. A large amount of lumber is manufactured in five-quarter and six-quarter, and eight-quarter, and thicker for factory demand and this stock is graded under the special rules that are provided for the grading of shop lumber.

6. Unless otherwise provided for, lumber worked two sides shall be graded from its better side or face; lumber worked one side shall be graded from its surfaced face.

7. In a general way, all stock run to a pattern shall receive the same general inspection as stock run S2S or S4S.

8. The lowering of grade on the face side on account of wane, or other serious defects on the back, should be governed by grade, width, and defects in the piece.

9. Due consideration in rough stock should be given for the amount of wane or other imperfections that would be surfaced off in milling.

10. The thickness and width of dressed lumber is governed by standardization of sizes and lumber S1S, S2S, or S4S should be of a uniform thickness and width.

11. Planing-mill work or imperfect manufacture should be taken into consideration in all grades of dressed lumber, and its effect on a piece must be left largely to the judgment of the grader.

12. Defects in lumber should be distributed in proportion to the size of the piece. Long or wide pieces of the same grade may contain more and greater defects than shorter or narrower pieces. The same percentage should be observed in both long and short, wide and narrow.

13. Lumber when worked should be graded the same as the respective grades when in the rough.

14. Wane, cup, and crook in lumber are defects which can not be covered by rule with satisfaction, and, therefore, must be left to the judgment of the grader.

15. The interpretation of any grade is intended to cover all lumber between the next higher grade above and the next grade below.

16. No grade under these rules is made with the idea of its fitness for any one specific use, although certain grades are strongly recommended for certain specific uses.

17. Each piece is considered and its grade determined by its general character, including the location and sum of all its defects and blemishes.

18. When defects or blemishes not described in these grading rules are encountered, they shall be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration.

19. Bright sap shall not be considered a defect in any of the grades provided for and described in these rules.

20. The interpretation of these rules and decision on grade is vested in the bureau of grades maintained for this purpose by the Western Pine Manufacturers Association.

White Pine Association of the Tonawandas, pine grading rules, 1922.

GRADES OF NORTHERN WHITE PINE LUMBER AS MADE IN THE TONAWANDAS

Uppers.

Highest grade of white pine made in this market, consisting of first and second clear, 8 inches and wider, 10 to 16 feet long, first clear being strictly clear both sides, second clear admitting of slight sap on edges or ends of piece or one or two pencil knots.

Suitable for pattern purposes, organ and piano building, or any place where practically clear lumber is required.

Selects.

The second grade of white pine, put up 8 inches and wider, 10 to 16 feet long and what is known as third clear, admitting of a slight amount of sap and an occasional pin knot, varying in number and size according to the width and thickness of the piece.

Suitable for the same purposes as uppers where slightly greater defects are admitted.

Fine common.

The third grade of white pine is put up 8 inches and wider, 10 to 16 feet long, admitting of bright sap, covering half of the face of the board, some stain on back and occasionally a little running over on one or two edges. Admits of a few small pencil knots, varying in size and number according to the width and thickness of the piece. Practically free from shake, but admitting of slight shake showing only on one side or one end of piece. The grade is usually free from stain.

Suitable for high-grade finishing lumber, for exterior and interior work requiring practically clear face stock.

No. 1 cuts.

Put up 6 inches and wider, 10 to 16 feet long. This grade is put up with a view of cutting good sized sections of clear lumber and must cut 66⅔ per cent or more clear except bright sap in reasonable length sections. This grade is not intended for use in the full length of the board, but cuts up exceptionally well for pattern lumber, shop use, or any purpose where clear lumber is wanted.

Suitable for making patterns, door and trim factories, and general cutting up purposes.

No. 2 cuts.

Graded the same as No. 1 cuts, except that the percentage of cutting required is from 50 to 66⅔ per cent in somewhat shorter sections.

This grade is suitable for sash, door and trim factories, and pattern lumber where short sections are required, and for general cutting up purposes.

No. 3 cuts.

The next lower grade of cutting up lumber, containing 35 to 50 per cent clear cutting in short sections. A slight amount of stain admitted.

Suitable for the manufacture of sash and blinds or any purpose where short sections of clear lumber are used.

No. 1 Moldings.

4 to 7 inches wide, 10 to 16 feet long, practically free from defects on one face except bright sap, admitting of a slight amount of stain or other defect on back which does not interfere with the use of the board for one face purposes.

This is particularly suitable for making good moldings or clear face trim or for any purpose where clear face lumber is wanted.

No. 2 moldings.

This grade is the reject from No. 1 moldings and admits of slightly more defect and stain on face. Same widths and lengths.

Suitable for a cheaper grade of molding and trim. Very desirable for finishing lumber where narrow widths are wanted, admitting of slight defects to be used without waste in cutting.

Stained saps.

Four inches and wider, 10 to 16 feet long, No. 1 cuts and better, largely fine common and better for knot, admitting of any amount of stained sap, but practically free from shake and other defect.

Very suitable for any outside or inside finish or low price grade of moldings and trim where the work is to be painted.

Star clear.

Four inches and wider, 10 to 16 feet long, the rejects of fine common and better on account of slight shake. No. 1 cuts and better, largely fine common and better for knot, admitting of shake, but practically free from other defect.

Very suitable for inside trim and any purpose where clear lumber is desired and slight shake defect is not objectionable.

No. 1 shelving and dressing.

This is a high grade of finishing lumber and admits of small, sound knots, is practically free of other defects. Knots not usually larger than a 25-cent piece, and varying slightly in size and number according to the width and thickness of the piece.

Very desirable for inside and outside finishing lumber where small sound knots are not objectionable. Also suitable for pattern lumber for large work and a small, sound knotted grade can be used.

No. 2 dressing.

This grade is put up No. 1 barn and better for knot, admitting slight shake or stain defect. The majority of the knots are the same as contained in No. 1 shelving and dressing.

It is particularly suitable for mill purposes and for inside and outside work where a slightly lower grade of lumber is wanted than No. 1 shelving and dressing.

No. 1 shelving.

This grade is put up 1 by 10 inches and wider stock widths, the same grade as No. 1 shelving and dressing with the exception that the same must show two good edges.

This grade is intended for high-class shelving, exterior finish, and for other purposes requiring high-class stock pine board.

No. 2 shelving.

No. 1 barn and better for knot, showing one good edge, but practically free from other defects.

Used for the same purposes as No. 1 shelving where only one good edge shows, or a slightly lower grade is wanted.

No. 1 barn.

May contain any reasonable number of small, sound knots, usually red, largely round, but admitting of an occasional branch knot of small size, free from shake or stain, the size of the knot varying in accordance with the width of the board. The 5/4 and thicker admitting of slightly larger sound knots than inch boards.

Very suitable for outside finish, stepping, flooring, cornice, novelty siding, and any exterior purpose requiring a lasting, sound, and desirable wood.

No. 2 barn.

Admits of larger sized knots than No. 1 barn, practically all red knotted, free from shake or stain and free from any knots that will impair the strength of the board.

Suitable where slightly larger knots can be used. Very desirable for barn siding, novelty siding, flooring, shelving, fencing, etc.

No. 3 barn.

Admits of coarse, sound knots, free from knots that will knock out in dressing, practically free from shake, admitting of stain where the board is otherwise No. 2 barn and better for knot.

Suitable for barn siding, cheap novelty siding, fencing, cellar partitions, or any outside work where a coarse, sound board of long-lasting qualities is desired.

No. 1 box.

This grade admits coarse knots, regardless of size, also a reasonable amount of shake or stain. The Tonawanda grade of No. 1 box is a good practical board for coarse work, including the manufacture of high-grade boxes, shelving, flask purposes, and cheap flooring, also very desirable for sheathing, and subfloors for high-grade houses where lasting qualities are desired.

400.27 Redwood Grading Rules.

California Redwood Association, standard specifications for eastern grades of California redwood lumber, April, 1927.

This association's definition of standard defects, rough dry sizes of yard lumber, grading provisions, and description, measurement, and tally conform to the American Lumber Standards for Yard Lumber, 411.0.

400.28 Spruce Grading Rules.

Northern Pine Manufacturers Association, grading rules for Spruce, April 15, 1925.

This association has adopted the American Lumber Standard grades of yard lumber, in accordance with 411.0.

Additional grades and sizes are the same as for pine, 400.26.

Pacific Lumber Inspection Bureau, spruce grading rules, Schedule M, 1925.

Sitka spruce rough green clears.

Defects based on 8-inch widths 12 feet long. Defects in all cases to be considered in connection with the size of the piece and its general quality.

No. 2 clear and better, edge and/or flat grain.

No. 2 clear and better, edge and/or flat grain, under 3 inches thick, must be sound lumber, well manufactured. Will allow occasional variation in sawing, light-colored sap, one-quarter width and three-quarters the thickness or its equivalent; in addition, will allow on face side, which is the best side, narrow pitch pockets and/on pitch blisters, each not over 4 inches in length, if not extending through the thickness of the piece and on the reverse face tight knots, if not in clusters, not over one-half inch in diameter in 1-inch stock and varying according to the thickness of the piece, up to 1 inch, and/or pitch pockets and/or pitch blisters, each not over 4 inches in length, if not extending through the thickness of the piece or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Edge grain may be included with flat grain at shipper's option. Slight seasoning checks no defect.

Dimensions, 3 inches and up to but not including 5 inches thick.

Dimensions 3 inches and up to but not including 5 inches thick, must be sound lumber, well manufactured. Will allow occasional variations in sawing, light-colored sap one-third the width and three-quarters the thickness or its equivalent; in addition, will allow on the face side, which is the best side, and corresponding half of edges narrow pitch pockets and/or pitch blisters each not over 6 inches in length, if not extending through the thickness of the piece and on the reverse face and corresponding half of edges tight knots up to and including 1½ inches in diameter, if not in clusters, varying according to the size of the piece and/or narrow pitch pockets and/or pitch blisters, each not over 6 inches in length, if not extending through the thickness of the piece or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Slight seasoning checks no defect. One split or check not over the width of the piece allowed. Edge grain may be included with flat grain at shipper's option.

Dimensions, 5 inches and thicker.

Dimensions 5 inches and thicker must be sound lumber, well manufactured. Will allow occasional variation in sawing, light-colored sap one-third the width of piece and three-quarters the thickness, or its equivalent; in addition, will allow on the face side, which is the best side, and corresponding half of edges narrow pitch pockets and/or pitch blisters each not over 6 inches in length, if not extending through the thickness of the piece, and on the reverse face and corresponding half of edges tight knots, if not in clusters, 2 inches and less in diameter, varying according to the size of the piece or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Slight seasoning checks no defect. One split or check not over the width of piece allowed. An occasional piece, 18 feet or longer, may contain one larger defect, showing on one or two surfaces, if so placed that, by cutting it out, the shortest cutting will be 8 feet or longer, provided balance of piece is practically free from other defects. In sizes 8 by 8 inches and larger boxed hearts are admissible, provided material of this description is not coarse grained. Edge grain may be included with flat grain at shipper's option.

No. 3 clear edge grain and/or flat grain.

No. 3 clear edge grain and/or flat grain at shipper's option, under 3 inches thick. Defects based on 10-inch widths, 12 feet long. To be graded from best face. The defects on the reverse face to be only slightly in excess of those allowed on the best face. Must be sound lumber, well manufactured. Will allow occasional variations in sawing. Slightly stained or discolored sap or heart one-third width or its equivalent. Bright sap no defect; in addition, will allow sound and tight knots up to 1 inch or narrow pitch pockets and/or pitch blisters, each not over 4 inches long (an occasional 6-inch pitch pockets and/or pitch blister may be included), or one split or check not over the width of piece or its equivalent in both ends. Slight seasoning checks no defect. Four defects allowed for each 12 linear feet on each face and corresponding half of edges.

Dimensions, 3 inches thick up to but not including 5 inches thick.

Dimensions 3 inches thick up to, but not including 5 inches thick. To be graded from best face, the defects on the reverse face to be only slightly in excess of those allowed on the best face. Must be sound lumber well manufactured. Will allow occasional variations in sawing, slightly stained or discolored sap or heart one-third the width or its equivalent. Bright sap no defect; in addition, will allow sound and tight knots up to 1¼ inches or narrow pitch pockets and/or pitch blisters, each not over 6 inches long (an occasional 8-inch pitch pocket may be included) or one split or check not over the width of piece or its equivalent in both ends. Slight seasoning checks no defect. Four defects allowed for each 12 linear feet on each face and corresponding half of edges.

Dimensions, 5 inches and thicker.

Dimensions 5 inches and thicker. To be graded from the best face. The defects on the reverse face to be only slightly in excess of those allowed on the best face. Must be sound lumber well manufactured. Will allow occasional variations in sawing. Slightly stained or discolored sap or heart one-third the width or its equivalent. Bright sap no defect; in addition, will allow sound and tight knots up to 1½ inches or narrow pitch pockets and/or pitch blisters each not over 6 inches long (an occasional 8-inch pitch pocket and/or pitch blisters may be included), or one split or check not over the width of piece or its equivalent in both ends. Slight seasoning checks no defect. An occasional piece 18 feet or longer may contain one larger defect showing on one or two surfaces if so placed that, by cutting it out the shortest cutting will be 8 feet or longer provided that balance of piece is practically free from other defects. Four defects allowed for each 12 linear feet on each face and corresponding half of edges. In sizes 8 by 8 and larger boxed hearts are admissible provided material of this description is not coarse grained.

Sitka spruce merchantable.

This grade shall consist of sound, strong lumber, well manufactured and suitable for good substantial constructional purposes, free from loose or rotten knots, knot holes, shakes, rot, or other defects which materially impair the strength of the piece. Will allow occasional variations in sawing, sound knots, pitch pockets, and pitch blisters, the dimensions of which are to be considered in connection with the size of the piece, and sap one-half the width or its equivalent.

In sizes 6 by 12 inches and larger, intended for remanufacturing purposes and so indicated at time order is placed, a grade of lumber may be shipped which will admit of pieces in which strength values as a whole might be impaired by some localized major defect. Provided that material so described would in other respects grade higher than merchantable, except for the major defect which otherwise would also exclude it from the grade of merchantable. This grade will be shipped only when special agreement is made, and should be marked for identifications.

In timber 10 by 10 inches and larger, a split or check in one end not over the width of the piece will be allowed. Sap shall not be considered a defect, and wane not exceeding 2 inches in 10 by 10 inches and varying up to 4 inches on 24 by 24 inches measured across one corner, or the equivalent on two or more corners, for one-quarter the length will be allowed.

General: Defects in all cases to be considered in connection with the size of the piece and its general quality.

Discoloration through exposure to the elements: Discolored sap other than black sap and seasoning checks shall not be deemed defects excluding lumber from this grade, if otherwise conforming to merchantable grade.

Sitka spruce, common.

This grade shall consist of a quality suitable for ordinary constructional purposes. Defects to be considered in connection with the size of the piece. Will allow occasional variations in sawing, bright, stained or discolored sap, a limited amount of heart stain, large bright and/or black knots, large pitch pockets and pitch blisters, and a reasonable amount of wane. Discoloration through exposure to the elements and seasoning checks shall not be deemed defects, excluding lumber from this grade, if otherwise conforming to the grade of common.

In 10 by 10 inches wane not exceeding 3 inches and varying up to 6 inches in 24 by 24 inches measured across one corner, or the equivalent on two or more corners allowed, also a split or check not over twice the width of the piece when appearing in one end or its equivalent in both ends.

West Coast Lumbermen's Association, spruce grading rules, July 1, 1926.

The grading rules of this association for Sitka spruce are the same as their grading rules for Douglas fir, 400.23.

Western Pine Manufacturers Association, spruce grading rules, July 1, 1925.

The rules of this association for grading spruce are the same as their rules for grading fir, No. 400.23.

400.3 HARDWOOD GRADING RULES.

400.30 General Items.

American Hardwood Lumber Industry, Central Committee on Lumber Standards, standards for hardwood lumber, 1917.

(The standards for hardwood lumber, established by the Central Committee and given below, were formulated after years of study by the National Hardwood Inspection Rules Committee largely, and by the Hardwood Manufacturers Institute, the National Lumber Manufacturers Association, and the Central Committee on Lumber Standards, with the assistance of the Forest Products Laboratory of the United States Forest Service, and of the Department of Commerce. These basic grading provisions were approved by the Hardwood Consulting Committee on June 2, 1926, subject to further development, which has subsequently been done by the above-mentioned groups in the industry and incorporated in these standards, and thus were approved June 16, 1927, by unanimous vote of the Central Committee on Lumber Standards, which is made up of representatives of lumber producers, distributers, and consumers.)

To the extent to which differences in quality of timber, in conditions of manufacture, and in the uses to which the product is put, will, in practical application, permit, the basic provisions for the grading of different species of hardwood lumber shall be uniform; and when in conformity with the following such provisions shall be considered American standard hardwood lumber.

I. SIZES

Lumber of standard sizes, as hereinafter described, shall be tallied board measure. On lumber of standard thickness less than 1 inch (board measure) the board-foot measurement shall be based on surface dimensions.

Lumber finished to special size shall be counted (tallied) as of the standard rough size necessarily used in its manufacture.

THICKNESSES

The following nominal thicknesses of hardwood lumber shall be considered standard: 3/8, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, 3, 3 1/2, 4, 4 1/2, 5, 5 1/2, and 6 inches. All other thicknesses shall be considered special.

WIDTHS

Standard widths shall be 3 inches and wider in random widths, and in stock widths where specified.

LENGTHS

Standard lengths shall be 4 to 16 feet in multiples of 1 foot.

II. GRADE STANDARDS

GENERAL PROVISIONS

The grade of hardwood lumber shall be determined by the percentage of the area of each piece available in cuttings of given minimum sizes and qualities.

The basic provisions for hardwood lumber define the poorest pieces admissible in a given grade, and each such grade shall contain all pieces of a quality up to that of the next higher grade.

DEFINITIONS AND QUALITY OF CUTTINGS

The word "cutting" as used in these provisions means a portion of a board or plank obtained by crosscutting, by ripping, or by both. A cutting must be flat enough to surface two sides to standard surfaced thickness after it has been removed from the board.

The term "clear face cutting" as used in these provisions means a cutting having one face clear and the reverse face sound.

The term "sound cutting" as used in these provisions means a cutting free from rot, heart center, and shake, and free from other defects which materially impair the strength of the cutting.

DEFINITIONS OF ADMISSIBLE DEFECTS

Season checks which are so serious in character as to damage the lumber shall not be admitted. Ordinary season checks shall be admitted.

There shall be no restriction upon bright sapwood in any given grade unless otherwise required and specified.

Except in grades of woods where it is specifically admitted, stain shall not be admitted unless it will dress out in surfacing to the standard thickness for surfaced lumber.

Where order or contract specifies freedom from stain, stain shall not be admitted unless it will dress out in surfacing to standard thickness for surfaced lumber.

Burls that do not contain knots or unsound centers shall be admitted.

STANDARD GRADES

The standard grades of hardwood lumber shall consist of firsts, seconds, selects, No. 1 common, No. 2 common, sound wormy, No. 3A common, and No. 3B common.

Firsts and seconds may be combined as one grade, and when so combined the percentage of firsts shall not be less than 20 per cent in any wood.

Selects and No. 1 common may be combined as one grade, and when so combined and specified shall be understood to include all selects that the logs produce.

No. 3A common and No. 3B common may be combined as one grade, No. 3 common, and when so combined and specified shall be understood to include all the No. 3A common that the logs produce.

BASIC GRADING PROVISIONS FOR HARDWOOD LUMBER

Firsts and Seconds

Widths, 6 inches and wider.

Lengths, 8 to 16 feet.

Heart center admitted, equal in length in inches to the surface measure of the piece in feet.

Splits admitted, equal in length in inches to twice the surface measure of the piece in feet.

Wane (bark or the lack of wood) admitted that does not exceed in the aggregate one-half the length and one-fourth the width, or one-fourth the length and one-half the width.

Minimum size of cuttings: 4 inches wide by 3 feet long or 3 inches wide by 4 feet long.

Firsts

Firsts shall admit pieces that will cut 91⅔ per cent ($\frac{11}{12}$) clear face in cuttings equal in number to the surface area of the piece in feet divided by five and dropping fractions, except in pieces of 4 feet surface measure, where one cutting will be allowed.

Seconds

Seconds will admit pieces that will cut 83⅓ per cent ($\frac{10}{12}$) clear face in cuttings equal in number to the surface area of the piece in feet divided by four and dropping fractions, and in addition pieces that will cut 91⅔ per cent ($\frac{11}{12}$) clear face with one additional cutting.

Selects

Widths, 4 inches and wider.

Lengths, 6 to 16 feet.

Selects shall admit pieces of 2 and 3 feet surface measure that will cut 91⅔ per cent ($\frac{11}{12}$) clear face in one cutting on the good face with the reverse side of the cutting sound, and pieces 4 feet and over surface measure that will cut on one face as required in the grade of firsts and seconds with either the reverse face of the piece not below the grade of No. 1 common, or the reverse side of the cuttings sound.

No. 1 Common

Widths, 3 inches and wider.

Lengths, 4 to 16 feet.

Heart center admitted, equal in length in the aggregate to one-half the length of the piece.

Minimum size of cuttings: 4 inches wide by 2 feet long, or 3 inches wide by 3 feet long.

No. 1 common shall admit pieces that will cut clear face as follows:

One foot surface measure, clear.

Two feet surface measure, 75 per cent in one cutting.

Three and four feet surface measure, 66⅔ per cent in one cutting or 75 per cent in two cuttings.

Five feet surface measure, 66⅔ per cent in two cuttings, with one additional cutting allowed for each additional 3 feet surface measure.

No. 2 Common

Widths, 3 inches and wider.

Lengths, 4 to 16 feet.

Heart center admitted, equal in length in the aggregate to three-fourths the length of the piece.

Minimum size of cuttings: 3 inches wide by 2 2 feet long.

No. 2 common shall admit pieces that will cut clear face as follows:

One foot surface measure, 66⅔ per cent in one cutting.

Two and three feet surface measure, 50 per cent in one cutting, or 66⅔ per cent in two cuttings.

Four feet and over surface measure, 50 per cent in cuttings equal in number to the surface measure of the piece in feet divided by two and dropping fractions.

Sound Wormy

Sound wormy shall admit pieces not below the grade of No. 1 common, except that worm holes, bird pecks, sound stain, small sound knots not exceeding three-fourths inch in diameter, and other sound defects which do not exceed in extent or damage the defects described, shall be admitted in the cuttings.

No. 3A Common

Widths, 3 inches and wider.

Lengths, 4 to 16 feet.

No. 3A common shall admit pieces that will cut 33⅓ per cent clear face in cuttings not less than 3 inches wide by 2 feet long, and in addition all pieces which grade not below No. 2 common on the good face with the reverse side of the cuttings sound

No. 3B Common

Widths, 3 inches and wider.

Lengths, 4 to 16 feet.

No. 3B common shall admit pieces that will cut 25 per cent sound, no cutting to be narrower than 1½ inches or to contain less than 36 square inches.

Below Grade

Lumber poorer in quality than the lowest grade described under these provisions shall be tallied and reported as "below grade."

Hardwood Manufacturers Institute, sales code, January 20, 1927.

No official inspection shall be made until the buyer and seller fail to reach an agreement on any claim made; then the disputed material shall be subject to inspection by the National Hardwood Lumber Association according to the rules of that association, and the regulations of its inspection department. * * *. The inspection by the National Hardwood Lumber Association shall form the basis of settlement between the buyer and seller, and shall be final and binding on both parties.

National Hardwood Lumber Association, hardwood grading rules, January, 1927.

GENERAL INSTRUCTIONS

1. Inspectors are instructed to study these rules carefully and use their best judgment in applying them.

2. All lumber shall be inspected according to these rules as defined under general instructions and standard inspection unless otherwise specified. The rules defined under special inspection shall be applied only when specified in the contract between buyer and seller. The rules under standard inspection

and special inspection shall not be applied under any contract which specifies grade names different from those listed herein, except by special agreement between buyer and seller.

3. Exceptions to the general instructions are stated under the caption of the respective woods and grades.

4. Lumber must be inspected and measured as the inspector finds it, of full length and width. He shall make no allowance for the purpose of raising the grade.

5. Inspection must be made from the poor side of the piece.

6. These rules define the poorest piece in any given grade, but the respective grades must contain all pieces up to the next higher grade.

7. All widths, lengths, and thicknesses mentioned in these rules shall be inclusive.

Manufacture.

8. Lumber should be properly manufactured of good average widths and lengths. It should be edged and trimmed carefully to produce the best possible appearance while conserving the usable product of the log. It must be of standard thickness when shipping dry, with the exception that in the cutting grades, the percentage not included in the required cuttings may be scant in thickness, provided the cuttings are of standard thickness, and there is no greater variation in the thickness of the board than is allowed in the rule describing miscut lumber. Dressed lumber sold or shipped as rough lumber shall be accepted and inspected under the rules governing rough lumber.

Miscut lumber.

9. Lumber having greater variation in thickness between any two points than shown in the following table must be measured for thickness at the thinnest part and classed as miscut, and must be graded and reported as such:

$\frac{1}{16}$ inch in thicknesses of $\frac{1}{2}$ inch or less.
$\frac{1}{8}$ inch in thicknesses of $\frac{5}{8}$ inch and $\frac{3}{4}$ inch.
$\frac{1}{4}$ inch in thicknesses of 1 inch to 2 inches.
$\frac{3}{8}$ inch in thicknesses of $2\frac{1}{2}$ inches to $3\frac{1}{2}$ inches.
$\frac{1}{2}$ inch in thicknesses of 4 inches to 6 inches.

Minimum widths.

10. Ninety per cent of the minimum widths mentioned in all grades of lumber must be full width; the remaining 10 per cent may be $\frac{1}{4}$ inch scant in width.

Standard lengths.

11. Standard lengths are 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16 feet, but not over 25 per cent of odd lengths will be admitted.

Standard thicknesses.

12. Standard thicknesses are $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, and 6 inches. One inch and thicker may also be expressed in quarter inches as follows: 4/4, 5/4, 6/4, 8/4, 10/4, 12/4, 14/4, 16/4, 18/4, 20/4, 22/4, and 24/4.

NOTE.—For lumber thinner than $\frac{3}{8}$ inch see veneer, thin lumber, and plywood, No. 413.52.

13. Standard thicknesses for surfaced lumber are as follows:

Rough	Surfaced
$\frac{3}{8}$ inch S2S to	$\frac{3}{16}$ inch.
$\frac{1}{2}$ inch S2S to	$\frac{5}{16}$ inch.
$\frac{5}{8}$ inch S2S to	$\frac{7}{16}$ inch.
$\frac{3}{4}$ inch S2S to	$\frac{9}{16}$ inch.
1 inch S2S to	$\frac{13}{16}$ inch.
$1\frac{1}{4}$ inches S2S to	$1\frac{1}{16}$ inches.
$1\frac{1}{2}$ inches S2S to	$1\frac{5}{16}$ inches.
2 inches S2S to	$1\frac{3}{4}$ inches.
$2\frac{1}{2}$ inches S2S to	$2\frac{1}{4}$ inches.
3 inches S2S to	$2\frac{3}{4}$ inches.
$3\frac{1}{2}$ inches S2S to	$3\frac{1}{4}$ inches.
4 inches S2S to	$3\frac{3}{4}$ inches.

14. Lumber surfaced on one side only must be $\frac{1}{16}$ inch full of the above surfaced thicknesses.

Measurement and tally.

15. In the measurement of lumber of random widths fractions of over one-half foot, as shown on the board rule, must be counted up to the next higher figure; fractions of exactly one-half foot and less, as shown on the board rule, must be counted back to the next lower figure. Fractional lengths in standard grades must be measured as of the next lower standard length.

NOTE.—Unless otherwise specified, when reference is made to percentages, calculation shall be on the basis of board feet, except that on lumber less than 1 inch thick it shall be on the basis of surface feet and not on the number of pieces.

16. Tapering lumber in standard lengths must be measured one-third the length of the piece from the narrow end.

17. A piece tally in feet must be made of all lumber. All random width lumber of standard grades and thicknesses must be tallied face or surface measure and this tally must be the number of feet, board measure, of 1-inch lumber. If the lumber is thicker than 1 inch, then the tally so obtained must be multiplied by the thicknesses as expressed in inches and fractions of an inch. All lumber less than 1 inch must be counted face measure.

18. When strips or stock widths are measured, a tally showing widths and lengths must be made.

19. All dimension stock of specified sizes shall be counted on the basis of exact contents board measure.

Season checks.

20. Season checks which are so serious in character as to damage the lumber shall be considered defects, but ordinary season checks shall not be considered defects.

Sapwood.

21. There is no restriction to bright sapwood except as otherwise specified.

Stain.

22. Stain shall be considered a defect unless it will dress out in surfacing to the standard thickness for surfaced lumber, except in grades of woods where it specifically states stain is no defect.

22–B. Where order or contract specifies free from stain, stain shall be considered a defect unless it will dress out in surfacing to standard thickness for surfaced lumber.

Burls.

23. Burls that do not contain knots or unsound centers shall not be considered defects.

DEFINITIONS

24. The word *cutting* as used in these rules means a portion of a board or plank obtained by cross-cutting, by ripping, or by both. A cutting must be flat enough to surface two sides to standard surfaced thickness after it has been removed from the board.

25. The term *clear face cutting* as used in these rules means a cutting having one face clear and the reverse face sound. The clear face of the cutting must be on the poor side of the board except when otherwise specified.

26. The term *sound cutting*, as used in these rules, means a cutting free from rot, heart center and shake, and free from other defects which materially impair the strength of the piece.

27. The term *good edge*, as used in these rules, means an edge free from unsound defects except a slight amount of wane not exceeding one-third the length and one-third the thickness of the piece, or its equivalent in other defects.

QUARTERED WOODS

28. In woods where figure is not required, first and seconds shall be considered quartered when the radial grain is at an angle of 45° or less with 80 per cent of one face of the piece in the aggregate. Selects shall be considered quartered when the radial grain is at an angle of 45° or less with 80 per cent of the face side of the piece in the aggregate. No. 1 common and No. 2 common shall be considered quartered when one face of each required cutting shows the radial grain at an angle of 45° or less with 80 per cent in the aggregate.

28–A. In all quartered woods 10 per cent may be $\frac{1}{16}$ inch scant on one edge provided the other edge is full standard thickness when shipping dry, in thicknesses up to and including 6/4; in thicknesses of 8/4 and thicker 10 per cent may be $\frac{1}{8}$ inch scant on one edge provided the other edge is full standard thickness when shipping dry.

STANDARD DEFECTS

The following paragraphs describe standard defects:

29. One knot 1¼ inch in diameter.

30–A. Two ⅝-inch diameter knots, or their equivalent. Not more than two standard defects of this character can be accepted by the inspector; each additional equivalent defect shall be considered as one additional standard defect.

30–B. Defects larger than one standard defect, excepting wane and split, shall be considered on the following average diameter measurement:

2½-inch knots or their equivalent shall be two standard defects.

3¾-inch knots or their equivalent shall be three standard defects.

5-inch knots or their equivalent shall be four standard defects.

31. One split equal in length in inches to the surface measure of the piece in feet and diverging not more than 1 inch to the foot in length.

32. Wane or its equivalent in other defects, 1 inch wide, one-sixth the length of the piece along the edge, or its equivalent at one or both ends. In the wane defect, wane may extend through the full thickness of the piece, showing on both faces.

33. Worm, grub, knot, and rafting pinholes, not exceeding in extent one standard knot defect described above.

EQUIVALENT DEFECTS

34. Heart center and other defects not defined as standard defects, that do not damage the piece more than the standard defects allowed, are equivalent defects and must be so considered by the inspector.

STANDARD GRADES

[Subject to general instructions]

35. The standard grades of hardwood lumber are firsts, seconds, selects, No. 1 common, No. 2 common, sound, wormy, No. 3 common and other grades mentioned under the caption of the respective woods. Firsts and seconds are combined as one grade, and the percentage of firsts in the combined grade shall not be less than the following: Poplar, 40 per cent; Philippine mahogany, 40 per cent; African and Mexican mahogany, 35 per cent; tupelo, sycamore, white ash, plain oak, chestnut, red gum, sap gum, black gum, cottonwood, magnolia, locust, hackberry, willow, and aspen, 33⅓ per cent; cherry, beech, soft elm, buckeye, quartered oak, and quartered gum, 25 per cent; hard maple, soft maple, birch, black ash, and basswood, 20 per cent.

Selects and No. 1 common may be combined as one grade, except in mahogany, walnut, and cherry, and when so combined and specified shall be understood to include all the selects that the logs produce.

Firsts and seconds.

36. Lengths are 8 to 16 feet, admitting 25 per cent of 8 to 11 feet, of which 25 per cent one-half may be 8 and 9 feet.

37. The number of defects admitted in any piece must be determined from the poor face.

38. Heart center, where the extent or damage does not exceed the equivalent of standard defects allowed, will be admitted.

39. Six inches of straight split in one end, or its equivalent in both ends, will not be considered a defect.

40. Splits in excess of the equivalent of two standard defects will not be admitted.

41. In any series of special widths sold 10 inches or wider, splits in excess of the equivalent of one standard defect will not be admitted.

42. Wane along the edge not exceeding one-sixth the length of the piece, or its equivalent at one end or both ends, not exceeding in thickness one-half the thickness of the piece, and not exceeding in width as shown in the following table shall not be considered a defect:

½ inch in width in ½-inch to ¾-inch lumber.
¾ inch in width in 1-inch to 2-inch lumber.
1 inch in width in 2½-inch and thicker lumber.

42–A. Unless otherwise specified, ½-inch free side bend shall be admitted in pieces 8 and 9 feet long; ¾-inch free side bend shall be admitted in pieces 10 to 12 feet long; 1¼ inch free side bend shall be admitted in pieces 13 to 16 feet long. Each additional ½ inch of side bend in all lengths shall be considered one standard defect, except that not more than two such defects shall be allowed in any piece.

43. Firsts must be 6 inches and over wide, 8 feet and over long. Pieces 4 to 9 feet surface measure must be clear, except that free wane and free split (see 402.42) shall be admitted. Pieces 10 to 15 feet surface measure may have one standard defect or its equivalent. Pieces 16 feet and over surface measure may have two standard defects or their equivalent.

44. Seconds must be 6 inches and over wide, 8 feet and over long, except that clear pieces 5 inches wide, 10 feet and over long, will be admitted not to exceed 5 per cent of the footage. (Or 5 per cent of the firsts and seconds in the combined grade.)

Standard defects will be admitted according to surface measure as follows:

5 feet, one standard defect or its equivalent.
8 feet, two standard defects or their equivalent.
12 feet, three standard defects or their equivalent.
16 feet, four standard defects or their equivalent.
20 feet, five standard defects or their equivalent.

Selects.

45. Widths, 4 inches and over.

46. Lengths are 6 to 16 feet admitting 30 per cent 6 to 11 feet, of which 30 per cent one-sixth may be 6 and 7 feet.

47. Pieces 6 and 7 feet long must be 5 inches and over wide, and must be clear one face; the reverse side must have two good edges, otherwise sound and not below No. 1 common.

48. Pieces 4 inches wide, 8 feet and over long, must have one clear face and two good edges; the reverse side not below No. 1 common.

49. Pieces 5 inches wide, 8 feet and over long, must have one clear face and two good edges, except that pieces 12 feet and over long will admit one standard defect except wane; the reverse side not below No. 1 common.

50. Pieces 6 inches and over wide, 8 feet and over long, must grade not below seconds on the best face and not below No. 1 common on the reverse side.

51. This grade will also admit pieces 6 inches and over wide, 10 feet and over long, containing defects which do not cause a waste of more than 12 inches long in one crosscutting or its equivalent at both ends; the clear face cuttings must be 3 feet and over long by the full width of the piece and the reverse side of the cuttings sound. The poor side of the piece must not be below No. 1 common.

52. This grade will also admit pieces 7 inches and over wide, 10 feet and over long, containing defects along the edges which do not cause a waste of more than 1 inch in width by the full length of the piece. The clear face cutting must be sound on the reverse side. The poor side of the piece must not be below No. 1 common.

53. In lumber 6/4 inch and thicker, this grade will admit pieces 6 inches and over wide, 8 feet and over long, with one clear face except will admit free wane and free split defined in standard grade of firsts and seconds; the reverse side must have two good edges, otherwise sound and not below No. 2 common.

54. In lumber 5/4 inch and less in thickness, this grade will admit pieces that grade not below seconds on the best face and not below No. 2 common on the reverse side, provided the reverse side will work 80 per cent sound; but not more than 20 per cent in quantity of such pieces will be admitted.

54–A. Unless otherwise specified, ½-inch free side bend shall be admitted in pieces 6 to 9 feet long; ¾-inch free side bend shall be admitted in pieces 10 to 12 feet long; 1¼-inch free side bend shall be admitted in pieces 13 to 16 feet long. Each additional ½ inch of side bend in all lengths shall be considered one standard defect, except that not more than two such defects shall be allowed in any piece.

No. 1 common.

55. Widths, 3 inches and over, admitting 5 per cent of 3-inch widths.

56. Lengths, 4 to 16 feet, admitting 10 per cent of 4 to 7 foot lengths, of which 10 per cent one-half may be 4 and 5 feet.

57. Pieces 4 and 5 feet long must be clear.

58. Pieces 3 and 4 inches wide, 6 and 7 feet long, must be clear.

59. Pieces 3 inches wide, 8 to 13 feet long, must work 66⅔ per cent clear face in not over two cuttings. Pieces 3 inches wide, 14 to 16 feet long, must work 66⅔ per cent clear face in not over three cuttings. No cutting to be considered which is less than 3 feet long by the full width of the piece.

60. Pieces 4 inches wide, 8 to 13 feet long, must work 66⅔ per cent clear face in not over two cuttings. Pieces 4 inches wide, 14 to 16 feet long, must work 66⅔ per cent clear face in not over three cuttings. No cutting to be considered which is less than 2 feet long by the full width of the piece.

61. Pieces 6 feet long, 5 to 8 inches wide, may have one standard defect; 9 inches and over wide, two standard defects.

62. Pieces 5 to 7 inches wide, 7 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 feet and over long, in not over three cuttings.

63. Pieces 8 inches and over wide, 7 to 9 feet long, must work 66⅔ per cent clear face in not over two cuttings; 10 to 13 feet long, in not over three cuttings; 14 feet and over long, in not over four cuttings.

64. No cutting shall be considered in pieces 5 inches and over wide which is less than 4 inches wide by 2 feet long or 3 inches wide by 3 feet long.

65. No piece shall be admitted which contains heart center exceeding one-half its length in the aggregate.

No. 2 common.

66. Widths, 3 inches and over.

67. Lengths, 4 to 16 feet, admitting 30 per cent of 4 to 7 feet lengths, of which 30 per cent one-third may be 4 and 5 feet.

68. Pieces 3 to 7 inches wide, 4 to 10 feet long, must work 50 per cent clear face in not over three cuttings; 11 feet and over long, in not over four cuttings.

69. Pieces 8 inches and over wide, 4 to 9 feet long, must work 50 per cent clear face in not over three cuttings; 10 to 13 feet long, in not over four cuttings; 14 feet and over long, in not over five cuttings.

70. No cutting shall be considered which is less than 3 inches wide by 2 feet long.

71. No piece shall be admitted which contains heart center exceeding three-fourths its length in the aggregate.

Sound wormy.

72. This grade is not below No. 1 common, except that worm holes, bird pecks, sound stain, small sound knots not exceeding ¾ inch in diameter, and other sound defects which do not exceed in extent or damage the defects described, will be admitted in the cuttings.

NOTE.—When lumber is purchased under specifications combining the term "sound wormy" with the names of standard grades, such as "firsts and seconds sound wormy," "No. 1 common and better sound wormy," it shall be understood that the required yield shall be the same as specified under the standard grades, except that the defects and blemishes admitted in the cuttings as defined in the standard grade of "sound wormy" shall be admitted.

When lumber is purchased under specifications combining the term "worm holes no defect" with the names of standard grades, such as "firsts and seconds, worm holes no defect," "No. 1 common and better, worm holes no defect," it shall be understood that the required yield shall be the same as specified under the standard grades, except that worm holes shall be admitted without limit.

No. 3 common.

73. Widths, 3 inches and over.

74. Lengths, 4 to 16 feet, admitting 50 per cent of 4 to 7 feet lengths, of which 50 per cent one-half may be 4 and 5 feet.

75. All pieces must work 25 per cent sound; minimum width of cuttings 1½ inches, and no cutting considered which contains less than 36 square inches.

Below grade.

76. Lumber poorer in quality than the lowest grade described under these rules shall be tallied and reported as "below grade."

Surfaced lumber D2S.

Surfaced lumber D2S shall be inspected according to the standard grades under the caption of the respective woods, with the following exceptions:

Firsts, and seconds.

Inspection shall be made from the good face. The reverse side will admit one additional standard defect or its equivalent. Torn or chipped grain and slight stain shall not be considered defects on the reverse side, and slight chipped or torn grain 6 inches long by the width of the piece or its equivalent on the good face shall not be considered a defect.

Poplar saps.

Poplar saps shall be subject to the exceptions stated under firsts and seconds.

Selects.

Slight chipped grain 12 inches long by the width of the piece or its equivalent on the good face will not be considered a defect.

The "clear" cutting grades.

In the clear cutting grades, such as shop cypress and selects Cuban mahogany, chipped grain on one side of the cuttings shall not be considered a defect.

The "clear face" cutting grades.

Inspection shall be made from the good face; the reverse side of the cuttings must be sound.

Slight chipped grain 18 inches long by the width of the piece or its equivalent on the good face shall not be considered a defect.

The "sound" cutting grades.

The sound cutting grades, including cypress common and boxing, shall be inspected according to the rules for rough lumber. Chipped grain and slight skips in surfacing shall not be considered a defect.

Surfaced lumber D1S.

Lumber surfaced on one side shall be inspected according to the rules governing lumber dressed two sides, except that inspection shall be made from the dressed face.

Surfaced lumber "hit or miss."

Lumber ordered dressed hit or miss shall be inspected as rough lumber unless otherwise specified.

400.31 Basswood Grading Rules.

National Hardwood Lumber Association, basswood grading rules, January, 1927.

Firsts: Standard.
Seconds: Standard.
Selects: Standard.
No. 1 common: Standard.
No. 2 common.

Standard, with the following exception: Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common: Standard.

NOTE.—Black spots or streaks, if excessive, will reduce a piece one grade only. In the grade of No. 1 common, streaks extending over more than one-sixth of the face of the required cuttings in the aggregate, shall be considered excessive. In firsts and seconds, streaks extending over more than one-sixth of the poor face of the piece in the aggregate, shall be considered excessive.

400.32 Birch Grading Rules.

National Hardwood Lumber Association, red birch grading rules, January, 1927.

RED BIRCH

[When specified]

In the grade of firsts and seconds pieces 5 inches wide must be all red one face; 6 inches and over wide must be not less than 75 per cent red one face.

Firsts: Standard. (See 400.30.)

Seconds.

Standard, with the following exceptions: Widths 5 inches and over; pieces 5 inches wide must be clear.

Selects.

Standard, with the following exceptions:

All pieces 6 inches and over wide, 8 feet and over long, must be not less than 75 per cent red on the best face.

Where the word "clear" appears in the standard grade, substitute the term "clear red" except in selects, 400.30.

No. 1 common.

Standard, with the following exceptions:

Each cutting must have one clear red face.

Pieces 4 to 6 feet long, and pieces 3 and 4 inches wide, 7 feet long, must have one red face.

Will admit 30 per cent 4 to 9-foot lengths, of which 30 per cent one-third may be 4 and 5-foot lengths.

STANDARD INSPECTION

Birch

Long ash.

Specified lengths of 18 feet and over in ash will admit 5-inch pieces in firsts and seconds.

Firsts.

Standard, with the following exception; 30 per cent, 8 to 11 feet admitted.

Seconds.

Standard, with the following exception; 30 per cent, 8 to 11 feet admitted.

Selects: Standard.
No. 1 common: Standard.
No. 2 common: Standard.
Sound wormy: Standard.
No. 3 common: Standard.

400.33 Gum Grading Rules.

National Hardwood Lumber Association, grading rules for gum lumber, January, 1927.

SAP GUM AND BLACK GUM

NOTE.—A National Hardwood Lumber Association inspector will not make any distinction in species between black gum and tupelo.

Sound stain is no defect in any grade. (See 400.30, general instructions for stain.)

Sap gum is lumber produced from the red gum tree, containing sapwood in excess of the quantity admitted into the grades of red gum lumber.

Firsts: Standard. (See 400.30.)
Seconds: Standard.
Selects: Standard.
No. 1 common: Standard.
No. 2 common.

Standard, with the following exception:

Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common: Standard.

QUARTERED SAP GUM AND QUARTERED BLACK GUM

No figure is required.

Ten per cent may be $\frac{1}{16}$ inch scant on one edge, provided the other edge is full standard thickness, when shipping dry, in thicknesses up to and including 6/4; in thicknesses of 8/4 and thicker 10 per cent may be $\frac{1}{8}$ inch scant on one edge provided the other edge is full standard thickness when shipping dry.

Sound stain shall not be considered a defect in any grade.

Firsts: Standard.
Seconds.

Standard with the following exceptions: Widths, 5 inches and over; pieces 5 inches wide must be clear.

Selects: Standard.
No. 1 common: Standard.
No. 2 common.

Standard.

Pieces below the grade of No. 2 common shall be graded as sap gum or black gum.

"Ribbon stripe."

When ribbon stripe figure is specified, each piece shall be selected for the stripe effect caused by the wavy grain, brought out in quarter sawing process. In the grades of firsts and seconds and selects 90 per cent of one face of each piece, and in the cutting grades the face side of each cutting, must show such ribbon stripe effect.

PLAIN RED GUM

Red gum is lumber produced from the red gum tree, containing sufficient heart wood to be admitted into the grades defined under the caption of red gum.

Firsts and seconds will admit 1 inch of sapwood in the aggregate on one face and one-fifth of the piece in the aggregate on the reverse face.

Sound stain shall not be considered a defect in the sapwood admitted in any grade.

Firsts: Standard. (See 400.30.)

Seconds: Standard.

Selects.

Standard with the following exceptions:

Where the word "clear" appears in the standard grade, substitute the words "clear red," except in 400.30—standard grades for selects.

All pieces 6 inches and over wide, 8 feet and over long, will admit 1 inch of sapwood in the aggregate on the good side. Sapwood is no defect on the reverse side.

No. 1 common.

Standard, with the following exceptions:

Each cutting must have one clear red face. The grade must be made from the red side of the board

with the reverse side of the cuttings sound. The sap side of the board must not be below the standard grade of No. 1 common.

Pieces 4 to 6 feet long, and pieces 3 and 4 inches wide, 7 feet long, must have one red face.

No. 2 common.

Standard, with the following exceptions:

Each cutting must have one clear red face. The grade must be made from the red side of the board with the reverse side of the cuttings sound. The sap side of the board must not be below the standard grade of No. 2 common.

Pieces below the grade of No. 2 common shall be graded as sap gum.

PLAIN SAWN RED GUM, FIGURED WOOD

[When Specified]

Each piece shall be especially selected for markings and color tones producing a variegated effect.

In the grades of firsts and seconds and selects, 90 per cent of one face of each piece, and in the cutting grades the face side of each cutting must show such markings. Otherwise the rules for plain red gum shall be applied.

QUARTERED RED GUM

No figure is required.

Ten per cent may be 1/16 inch scant on one edge provided the other edge is full standard thickness when shipping dry, in thicknesses up to and including 6/4; in thicknesses of 8/4 and thicker 10 per cent may be ⅛ inch scant on one edge provided the other edge is full standard thickness when shipping dry.

In the grade of firsts and seconds, pieces 5 inches wide must be free from sapwood on one face; pieces 6 inches and 7 inches wide may have ¾ inch of sapwood on one face in the aggregate; pieces 8 inches and over wide may have 1 inch of sapwood on one face in the aggregate. The reverse face of any piece will admit sapwood in the aggregate one-fifth of its surface.

Sound stain will not be considered a defect in the sapwood admitted in any grade.

Firsts: Standard. (See 400.30.)

Seconds.

Standard, with the following exception: Widths, 5 inches and over; pieces 5 inches wide must be clear.

Selects.

Standard, with the following exceptions:

Where the word "clear" appears in the standard grade, substitute the words "clear red" except in standard grades for selects, 400.30.

The clear face mentioned in 400.30, standard grades for selects, will admit the same amount of sapwood as firsts and seconds quartered red gum.

Sapwood is no defect on the reverse side.

No. 1 common.

Standard, with the following exceptions:

Each cutting must have one clear red face.

Pieces 4 to 6 feet long and pieces 3 and 4 inches wide, 7 feet long, must have one red face.

No. 2 common.

Standard, with the following exceptions:

Each cutting must have one clear red face.

Pieces below the grade of No. 2 common shall be graded as sap gum.

"Ribbon stripe."

When ribbon stripe figure is specified each piece shall be selected for the stripe effect caused by the wavy grain brought out in quarter-sawing process. In the grades of firsts and seconds and selects 90 per cent of one face of each piece, and in the cutting grades the face side of each cutting, must show such ribbon stripe effect.

QUARTERED RED GUM, FIGURED WOOD

[When Specified]

Each piece shall be especially selected for markings and color tones producing a variegated effect.

In the grades of firsts and seconds and selects, 90 per cent of one face of each piece, and in the cutting grades the face side of each cutting, must show such markings.

Otherwise the rules for quartered red gum shall be applied.

400.34 Hickory Grading Rules.

National Hardwood Lumber Association, grading rules for hickory, rock (or cork) elm, and pecan, January, 1927.

HICKORY, ROCK (OR CORK) ELM, AND PECAN

NOTE.—A National Hardwood Lumber Association inspector will not make any distinction in species between pecan and hickory.

Bird pecks not exceeding ½ inch in length, ¼ inch in width, will not be considered a defect, if sound, in firsts and seconds and No. 1 common cuttings; but if excessive, will reduce a piece one grade only. In the grade of No. 1 common, bird pecks extending over more than one-sixth of the face of the required cuttings in the aggregate, shall be considered excessive. Firsts and seconds, bird pecks extending over more than one-sixth of the poor face of the piece in the aggregate, shall be considered excessive.

Firsts and seconds will admit 30 per cent of 8 to 11 foot lengths, of which 30 per cent one-half may be 8 and 9 feet.

No specified percentage of firsts is required in the combined grade of firsts and seconds.

There is no grade of selects in rock elm, hickory, and pecan.

Firsts: Standard. (See 400.30.)

Seconds.

Standard, with the following exceptions:

Widths, 4 inches and over. Pieces 4 inches wide must be clear. Pieces 5 inches wide, having 5 feet or over surface measure may have one standard defect.

No. 1 common.

Standard with the following exceptions:

There is no specified maximum percentage of short lengths.

Pieces 3 to 7 inches wide, 6 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 feet and over long, in not over three cuttings.

Pieces 8 inches and over wide, 6 feet long, must work 66⅔ per cent clear face in not over two cuttings.

No. 2 common.

Standard, with the following exceptions:

There is no restriction as to heart center.

Bird pecks are no defect.

Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common: Standard.

400.35 Mahogany Grading Rules.

National Hardwood Lumber Association, mahogany grading rules, January, 1927.

MEXICAN AND AFRICAN MAHOGANY

Honduras, Nicaraguan, Guatemalan, and other Central and South American mahoganies.

Lengths, 2 feet and over. Odd lengths shall be admitted without limit.

Fractions of over one-half foot in length must be counted up, and fractions of one-half foot or less in length must be dropped, except in the grade of shorts.

One inch of bright sapwood in the aggregate is one standard defect in the grade of firsts and seconds. Bright sapwood is no defect in selects and below.

Cross breaks shall be considered as equivalent standard defects.

Counters (when specified).

Widths 18 to 24 inches.

Lengths 12 to 40 feet.

Counters must be free from all defects on one face; the reverse side must not grade below firsts and seconds. Splits must be measured out.

Firsts.

Standard (see 400.30), with the following exceptions:

Firsts must be 7 inches and over wide, 10 feet and over long, and free from all defects, except that free wane and free split (see 402.42–firsts and seconds) shall be admitted; pieces 10 feet and over surface measure may have one standard defect or its equivalent.

Seconds.

Standard, with the following exceptions:

Standard defects will be admitted according to surface measure as follows—

6 feet, 1 standard defect or its equivalent.

9 feet, 2 standard defects or their equivalent.

13 feet, 3 standard defects or their equivalent.

18 feet and over, 4 standard defects or their equivalent.

For each additional 5 feet surface measure, 1 additional standard defect will be admitted.

Selects.

Eliminate the standard grade and substitute the following:

Selects must grade firsts and seconds, according to the above rule, on one face and not below No. 1 common on the reverse side.

No. 1 common.

Standard with the following exceptions:

Widths, 4 inches and over.

Lengths, 6 feet and over.

Pieces 4 inches wide, 6 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 to 16 feet long, in not over three cuttings.

Pieces 5 inches and over wide, 6 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 to 16 feet long in not over three cuttings.

Each additional 4 feet in length in pieces over 16 feet long will admit one additional cutting.

No. 2 common.

Standard with the following exceptions:

There is no restriction as to heart center.

Lengths, 6 feet and over.

There is no limit to the number of cuttings.

No. 3 common.

Standard with the following exception: Lengths, 2 feet and over.

Clear strips.

Standard with the following exception: Lengths, 6 feet and up, admitting 10 per cent of 6 and 7 foot lengths.

No. 1 common strips.

Standard with the following exceptions: Lengths of 6 and 7 feet may have one standard defect. Each cutting must have clear edges.

Wormy strips.

Widths, 1½ to 3¾ inches.

Lengths, 6 feet and over.

Inspection must be made from the best face.

Must work 50 per cent sound, no cutting to be considered which is less than 1½ inches wide by 2 feet long and without limit to the number of cuttings.

One edge of each piece must be square; the other edge will admit wane not exceeding in thickness or width the thickness of the piece and not exceeding one-third the length of the piece or the equivalent of such aggregate, wane at one or both ends.

Pinworm holes, clean or stained pinworm grooves, burls, sound sap, sound stain, hair checks, small sound knots not exceeding ¾ inch in diameter, or sound defects which do not exceed in extent or damage the defects described will be admitted without limit.

Selected firsts and seconds pin wormy (N. O. grade).

Width 6 inches and over.

Lengths, 6 feet and over, not over 20 per cent of 6 and 7 foot lengths.

One face of each board must work 75 per cent clear of pinworm holes and other defects, in cuttings of not less than 144 square inches each, and without limit to the number of cuttings.

The reverse side must grade firsts and seconds pin wormy (A wormy) or better.

First and seconds pin wormy (A wormy).

Widths, 6 inches and over.

Lengths, 6 feet and over, not over 20 per cent of 6 and 7 foot lengths.

Must grade firsts and seconds except as to lengths and except that pinworm holes or grooves, sound sap and sound stain will not be considered defects.

Stained pinworm grooves that damage the piece more than the standard defects allowed are equivalent defects and must be so considered by the inspector.

No. 1 common pin wormy (N wormy).

Widths 4 inches and over.

Lengths 6 feet and over.

Must grade No. 1 common except that pin wormholes or grooves, burls, sound sap, sound stain, or sound defects which do not exceed in extent or damage the defects described will be admitted in the cuttings. Fifty per cent of the required cuttings in the aggregate must be free from stained pinworm grooves.

No. 2 common pin wormy (B wormy).

Widths, 3 inches and over.

Lengths, 6 feet and over.

Must grade No. 2 common except that pinworm holes, clean or stained pinworm grooves, burls, sound sap, sound stain, hair checks, small sound knots not exceeding ¾ inch in diameter and other sound defects which do not exceed in extent or damage the defects described will be admitted in the cuttings.

Firsts and seconds shorts.

Widths, 4 inches and over.

Standard lengths, 2, 2½, 3, 3½, 4, 4½, 5, and 5½ feet.

Fractional lengths other than standard must be measured as of the next lower standard length.

Shorts must be measured and tallied as if four times the actual standard length and the resulting tally divided by four.

Pieces 4 and 5 inches wide must be clear.

Pieces 6 inches and over wide will admit standard defects according to the above basis of surface measure (four times the actual surface measure) as follows:

8 feet, 1 standard defect or its equivalent.

16 feet, 2 standard defects or their equivalent.

22 feet, 3 standard defects or their equivalent.

26 feet, 4 standard defects or their equivalent.

Common shorts.

Widths, 3 inches and over.

Standard lengths, 2, 2½, 3, 3½, 4, 4½, 5, and 5½ feet.

Fractional lengths other than standard must be measured as of the next lower standard length.

Shorts must be measured and tallied as if four times the actual standard length and the resulting tally divided by four.

Must cut 50 per cent clear face in not over two cuttings.

No cutting should be considered which has less than 36 square inches.

Pin wormy shorts.

Widths, 3 inches and over.

Standard lengths, 2, 2½, 3, 3½, 4, 4½, 5, and 5½ feet.

Must be measured in the same manner as firsts and seconds shorts.

Must grade firsts and seconds shorts except as to widths and with exceptions that pinworm holes or grooves, burls, sound sap, sound stain, or other sound defects which do not exceed in extent or damage the defects described will be admitted without limit.

CUBAN AND SAN DOMINGO MAHOGANY

Odd lengths shall be admitted without limit.

First and seconds.

Forty-five per cent of 8 and 9 foot lengths shall be admitted.

Firsts and seconds are one grade, which is standard with the exception that defects will be admitted according to widths as follows:

Pieces 8 and 9 feet long, 6 and 7 inches wide, one standard defect and ¾ inch of sapwood in the aggregate.

Pieces 8 and 9 feet long, 8 and 9 inches wide, one standard defect and 1 inch of sapwood in the aggregate, or two standard defects if there is no sapwood or 2 inches of sapwood if there is no defect.

Pieces 8 and 9 feet long, 10 inches and over wide, two standard defects and 2 inches of sapwood in the aggregate, or 3 inches of sapwood if there is no defect.

Pieces 10 feet and over long, 6 and 7 inches wide, one standard defect and 1 inch of sapwood in the aggregate.

Pieces 10 feet and over long, 8 and 9 inches wide, two standard defects and 2 inches of sapwood in the aggregate.

Pieces 10 feet and over long, 10 and 11 inches wide, three standard defects and 2 inches of sapwood, or two standard defects and 3 inches of sapwood.

Pieces 10 feet and over long, 12 inches and over wide, three standard defects and 3 inches of sapwood, or 4 inches of sapwood if there is no defect.

Selects.

Standard (see 400.30), with the following exceptions:

Pieces described in 400.30 will admit the same amount of sapwood on the best face as firsts and seconds.

Admit 50 per cent of 6 to 9 foot lengths, of which 50 per cent one-fifth may be 6 and 7 feet.

No. 1 common.

Standard, with the following exceptions:

Length, 5 feet and over.

The restrictions as to percentage of widths and lengths do not apply.

All widths and lengths must work 66⅔ per cent in clear face cuttings.

There is no limit to the number of cuttings.

Each cutting must contain not less than 144 square inches, and must not be less than 3 inches wide and not less than 2 feet long.

No. 2 common.

Standard, with the following exceptions:

Lengths, 5 feet and over.

The restrictions as to percentage of lengths do not apply.

There is no restrictions as to heart center.

There is no limit as to the number of cuttings.

Each cutting must contain not less than 72 square inches and must not be less than 2 inches wide.

Each cutting must be clear heartwood on the best side of the board and may be all sapwood on the sap side of the board.

No. 3 common: Standard.

Log run.

Log run shall be 5 feet and over long and shall include the full run of the log with all grades below No. 2 common excluded.

Firsts and seconds shorts.

Widths, 4 inches and over.

Standard lengths, 2, 2½, 3, 3½, 4, 4½, and 5 feet.

Fractional lengths other than standard must be measured as of the next lower standard length.

Shorts must be measured and tallied as if four times the actual standard length and the resulting tally divided by four.

Pieces 4 and 5 inches wide must be clear.

Pieces 6 inches and over wide will admit standard defects according to the above basis of surface measure (four times the actual surface measure) as follows:

8 feet, 1 standard defect or its equivalent.

16 feet, 2 standard defects or their equivalent.

22 feet, 3 standard defects or their equivalent.

26 feet, 4 standard defects or their equivalent.

Wormy.

Widths, 3 inches and over.

Lengths, 6 feet and over.

Wormy shall not grade below No. 1 common, except that sound sap and sound stain and wormholes shall not be considered defects.

Pin wormy shorts.

Widths, 3 inches and over.

Lengths, 2 to 5½ feet.

Must grade the same as Mexican and African mahogany No. 1 common shorts, except that sound sap and sound stain and pin wormholes admitted in this grade without limit.

PHILIPPINE MAHOGANY

Rules for the inspection of Mexican and African mahogany (see above) shall apply in the grades of counters, firsts, seconds, selects No. 1 common, No. 2 common, and No. 3 common, except that in view of the very fine character of the pin and needle wormholes in Philippine mahogany, only those shall be considered defects which are visible in the rough to the natural eye, and they shall be estimated on the basis of standard defects or their equivalent.

The following grades shall be the same as standard mahogany grades, except that fine needle wormholes shall be admitted without limit.

Firsts and seconds fine needle wormy.

Selects fine needle wormy.

No. 1 common fine needle wormy.

No. 2 common fine needle wormy.

No. 3 common fine needle wormy.

400.36 Maple Grading Rules.

National Hardwood Lumber Association, maple grading rules, January, 1927.

SOFT MAPLE

Firsts: Standard. (See 400.30.)

Seconds: Standard.

Selects: Standard.

No. 1 common: Standard.

No. 2 common.

Standard, with the following exception: Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common: Standard.

NOTE.—Black spots or streaks, if excessive will reduce a piece one grade only. In the grade of No. 1 common, streaks extending over more than one-sixth of the face of the required cuttings in the aggregate shall be considered excessive. In firsts and seconds, streaks extending over more than one-sixth of the poor face of the piece in the aggregate shall be considered excessive.

WHITE MAPLE

Grades: Firsts, seconds, and No. 1 common.

White maple, when specified, will be divided into No. 1 white maple and No. 2 white maple. No. 1 white maple, firsts and seconds, must have both sides and both edges white. No. 1 white maple, No. 1 common grade, cuttings must have both sides and both edges white. No. 2 white maple, firsts and seconds, must have one face and both edges white and the reverse side not less than 50 per cent white. No. 2 white maple, No. 1 common grade, cuttings must have one face and both edges white, and the reverse side of the cuttings not less than 50 per cent white.

No specified percentage of firsts is required in the combined grade of firsts and seconds.

The term "white" as used in these rules means "bright sapwood."

Firsts: Standard. (See 400.30.)

Seconds.

Standard, with the following exceptions:

Widths, 4 inches and over.

Lengths: 30 per cent under 12 feet will be admitted.

Pieces 4 and 5 inches wide must be clear.

No. 1 common.

Standard, with the following exceptions:

Lengths, 6 to 16 feet.

Pieces 3 and 4 inches, 12 to 16 feet long, may have three cuttings.

Pieces 5 inches and over wide, 8 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 to 16 feet long, in not over three cuttings.

HARD (OR SUGAR) MAPLE

Firsts.

Standard (see 400.30), with the following exception: 30 per cent, 8 to 11 feet, admitted.

Seconds.

Standard, with the following exception: 30 per cent, 8 to 11 feet admitted.

Selects: Standard.

No. 1 common: Standard.

No. 2 common: Standard.

Sound wormy: Standard.

No. 3 common: Standard.

400.37 Oak Grading Rules.

National Hardwood Lumber Association, grading rules for oak, January, 1927.

PLAIN RED AND WHITE OAK AND LOCUST

In the grade of firsts and seconds bright sapwood on one face is no defect.

On the reverse face 1 inch of bright sapwood in the aggregate is no defect. Each additional 1 inch of bright sapwood in the aggregate must be considered as one standard defect.

Bright sapwood is no defect in selects and the common grades.

Firsts: Standard. (See 400.30.)

Seconds: Standard.

Selects: Standard.

No. 1 common: Standard.

No. 2 common: Standard.

Sound wormy: Standard.

No. 3 common: Standard.

NOTE.—Streaks, if excessive, will reduce a piece one grade only. In the grades requiring clear-face cuttings, streaks extending over more than one-sixth of the face of the required cuttings in the aggregate shall be considered excessive. In firsts and seconds, streaks extending over more than one-sixth of the poor face of the piece in the aggregate shall be considered excessive.

QUARTERED RED AND WHITE OAK

In the grades of firsts and seconds, 1 inch of bright sapwood in the aggregate is no defect; each additional 1 inch of bright sapwood in the aggregate must be considered as one standard defect.

Bright sapwood is no defect in selects and the common grades.

Ten per cent may be $\frac{1}{16}$ inch scant on one edge provided the other edge is full standard thickness when shipping dry in thicknesses up to and including 6/4; in thickness of 8/4 and thicker 10 per cent may be $\frac{1}{8}$ inch scant on one edge provided the other edge is full standard thickness when shipping dry.

Firsts and seconds and selects must show figure on one face not less than 90 per cent in the aggregate. The cuttings in No. 1 common and No. 2 common must show figure on one face.

Firsts: Standard. (See 400.30.)

Seconds: Standard.

Selects: Standard.

No. 1 common: Standard.

No. 2 common: Standard.

Sound wormy: Standard.

No. 3 common: Standard.

NOTE.—Streaks, if excessive, will reduce a piece one grade only. In the grades requiring clear-face cuttings, streaks extending over more than one-sixth of the face of the required cuttings in the aggregate shall be considered excessive. In firsts and seconds, streaks extending over more than one-sixth of the poor face of the piece in the aggregate shall be considered excessive.

BENDING OAK

Bending oak, unless otherwise specified, will include both red and white oak and must be cut from live timber. The grain must not diverge more than 2 inches to the foot.

Sound stain, spot and pin wormholes scattered or in clusters not less than 6 inches apart with not more than three wormholes to the cluster shall not be considered defects.

Green lumber $5/4$ inches and thicker must be sawn $\frac{1}{8}$ inch thicker than specified thickness except that 10 per cent $\frac{1}{16}$ inch thicker will be admitted.

No specified percentage of firsts is required in firsts and seconds

Firsts: Standard. (See 400.30)

Seconds.

Standard, with the following exceptions:

Widths, 5 inches and over.

Lengths, 6 to 16 feet.

No. 1 common.

Standard, with the following exceptions:

Lengths, 5 to 16 feet.

All widths and lengths must work 66⅔ per cent clear, in cuttings not less than 3 inches wide by 5 feet long.

There is no limit to the number of cuttings.

RULES FOR GRADING HARDWOODS FOR CONSTRUCTION WORK

Grades: Select car stock, select dimension, freight car stock, common dimension, bridge and dock timbers, bridge plank, crossing plank, and sheet piling.

When stock sold under these rules subject to inspection at destination is found not up to the quantity invoiced, unless it is held intact for verification or acceptance of tally by shippers, the receiver should make at least two independent tallies of the material, confirming his measurement, and be prepared to furnish an affidavit to substantiate it if desired. When a difference in grade only is claimed at destination not exceeding 10 per cent of each shipment, the receiver may at his option use the stock that is acceptable and hold for inspection and adjustment the stock in question, provided it is usable at a reasonable reduction to be mutually agreed upon. Should claim of off-grade stock exceed 10 per cent of shipment, the entire shipment should be held intact for inspection unless by agreement of buyer and seller to the contrary.

The term "white oak" shall be understood to mean the white oak group, including: White oak, burr oak, post oak, chestnut oak, cow oak,

overcup oak, swamp white oak, live oak, chinquapin oak, and other less-known varieties of this character.

The term "mixed oak" shall be understood to include any or all woods of the red or black oak group, not necessarily containing any of the white oak group unless specified. This red oak group includes: Red oak, black oak, yellow oak, scarlet oak, spanish oak, turkey oak, willow oak, pin oak, black jack, water oak, and other less known varieties of this character.

All stock under these rules being for construction work where strength is essential, should be cut green, full to sizes and lengths specified. Ten per cent in any shipment may be ¼ inch scant in size and shall be accepted at full measure unless otherwise specified. Ordinary season checks shall not be considered defects.

400.38 Walnut and Butternut Grading Rules.

National Hardwood Lumber Association, walnut and butternut grading rules, January, 1927

Odd lengths shall be admitted without limit.

Firsts and seconds.

Fifty-five per cent of 8 and 9 foot lengths shall be admitted.

Firsts and seconds are one grade, which is standard with the exception that defects will be admitted according to widths as follows:

Pieces 8 and 9 feet long, 6 and 7 inches wide, one standard defect and ¾ inch of sapwood in the aggregate.

Pieces 8 and 9 feet long, 8 and 9 inches wide, one standard defect and 1 inch of sapwood in the aggregate, or two standard defects if there is no sapwood or 2 inches of sapwood if there is no defect.

Pieces 8 and 9 feet long, 10 inches and over wide two standard defects and 2 inches of sapwood in the aggregate, or 3 inches of sapwood if there is no defect

Pieces 10 feet and over long, 6 and 7 inches wide, one standard defect and 1 inch of sapwood in the aggregate.

Pieces 10 feet and over long, 8 and 9 inches wide, two standard defects and 2 inches of sapwood in the aggregate.

Pieces 10 feet and over long, 10 and 11 inches wide, three standard defects and 2 inches of sapwood, or two standard defects and 3 inches of sapwood.

Pieces 10 feet and over long, 12 inches and over wide, three standard defects and 3 inches of sapwood, or 4 inches of sapwood if there is no defect.

Pieces 14 feet and over long, 6 and 7 inches wide, two standard defects, and 1 inch of sapwood in the aggregate.

Selects.

Standard (see 400.30), with the following exceptions:

Wherever grades are mentioned it shall be understood that reference is to walnut grades, not standard grades

Where the word "clear" appears in the standard grade, substitute the words "clear black," except in paragraphs 51, 52, and 53, on page 44.

Pieces described in paragraphs 51, 52, and 53, on page 44, will admit the same amount of sapwood on the best face as firsts and seconds walnut.

Admit 50 per cent of 6 to 9 feet lengths, of which 50 per cent, one-fifth may be 6 and 7 feet.

Pieces 6 feet long must be 4 inches and over wide.

No. 1 common.

Standard (see 400.30), with the following exceptions:

The restrictions as to percentages of widths and lengths do not apply.

All widths and lengths must work 66⅔ per cent in clear face cuttings.

There is no limit to the number of cuttings.

Each cutting must contain not less than 144 square inches, and must be not less than 3 inches wide and not less than 2 feet long.

Each cutting must be clear black on the black side of the board, and may be one-half sapwood in the aggregate on the sap side of the board.

No. 2 common.

Standard with the following exceptions:

The restrictions as to percentage of lengths does not apply.

There is no restriction as to heart center.

There is no limit to the number of cuttings.

The minimum width of a cutting is 2 inches, and any cutting that is 2 inches wide or wider, and contains 72 square inches, is the minimum size cutting.

Each cutting must be clear black on the black side of the board and may be all sapwood on the sap side of the board.

No. 3 common: Standard.

Steamed walnut.

When walnut has been standard and is sold and specified as "steamed walnut," it shall be graded according to the above rules, except sapwood shall not be considered.

400.39 Grading Rules for Other Hardwoods.

National Hardwood Lumber Association, grading rules for other hardwoods, January, 1927.

COTTONWOOD, TUPELO, MAGNOLIA, WILLOW, AND ASPEN

NOTE.—A National Hardwood Lumber Association inspector will not make any distinction in species between black gum and tupelo.

Sound stain is no defect in any grade. (See 400.30, par. 22–B, general instructions for stain.)

Firsts: Standard. (See No. 400.30.)

Seconds: Standard.

Selects: Standard.

No. 1 common: Standard.

No. 2 common.

Standard, with the following exception: Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common: Standard.

SOFT ELM AND BUCKEYE

Firsts: Standard. (See No. 400.30.)

Seconds: Standard.

Selects: Standard.

No. 1 common: Standard.

No. 2 common.

Standard, with the following exception: Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common.

Black spots or streaks, if excessive, will reduce a piece one grade only. In the grade of No. 1 common, streaks extending over more than one-sixth of the face of the required cuttings in the aggregate shall be considered excessive. In firsts and seconds, streaks extending over more than one-sixth of the poor face of the piece in the aggregate shall be considered excessive.

NOTE.—In soft elm bird pecks not exceeding ½ inch in length, ¼ inch in width, will not be considered a defect, if sound, in firsts and seconds and No. 1 common cuttings; but if excessive, will reduce a piece one grade only. In the grade of No. 1 common, bird pecks extending over more than one-sixth of the face of the required cuttings in the aggregate shall be considered excessive. In firsts and seconds, bird pecks extending over more than one-sixth of the poor face of the piece in the aggregate shall be considered excessive.

QUARTERED POPLAR

No figure is required.

No specific percentage of firsts is required in the combined grade of firsts and seconds.

Bright sapwood is no defect.

Firsts: Standard. (See 400.30.)

Seconds.

Standard, with the following exceptions: Widths, 5 inches and over.

Standard defects will be admitted according to surface measure as follows:

6 feet, one standard defect or its equivalent.

9 feet, two standard defects or their equivalent.

13 feet, three standard defects or their equivalent.

18 feet and over, four standard defects or their equivalent.

No. 1 common.

Standard, with the following exception: Lengths, 8 to 16 feet.

Slight stain will not be considered a defect.

NOTE.—Pieces below the grade of No. 1 common shall be graded according to the rules for poplar and specified as No. 2–A common, No. 2–B common, and No. 3 common quartered poplar.

ASH, BEECH, HACKBERRY, AND SYCAMORE

Long ash: Specified lengths of 18 feet and over in ash will admit 5-inch pieces in firsts and seconds.

Firsts.

Standard (see 400.30), with the following exception: 30 per cent, 8 to 11 feet admitted.

Seconds.

Standard, with the following exception: 30 per cent, 8 to 11 feet admitted.

Selects: Standard.

No. 1 common: Standard.

No. 2 common: Standard.

Sound wormy: Standard.

No. 3 common: Standard.

CHESTNUT

Firsts: Standard. (See 400.30.)

Seconds: Standard.

Selects: Standard.

No. 1 common: Standard.

Sound wormy.

Standard, with the following exceptions:

There is no limitation as to size of defects, provided the required cuttings are sound.

Heart center extending three-fourths the length of the piece in the aggregate is admitted.

No. 2 common.

Standard, with the following exceptions:

Where the term "clear face" appears in the standard grade, substitute the word "sound."

Wormholes shall be admitted in this grade without limit.

No. 3 common: Standard.

CHERRY

One inch of bright sapwood in the aggregate is a standard defect in the grades of firsts, seconds, and selects.

Gum spots, if excessive, will reduce a piece in grade.

Firsts: Standard. (See 400.30.)

Seconds: Standard.

Selects.

Standard, with the following exception: Where the word "clear" appears in the standard grade, substitute the words "clear red."

No. 1 common.

Standard, with the following exceptions:

Each cutting must be clear red on the red side of the board and may be one-half sapwood in the aggregate on the sap side of the board.

Pieces 4 and 5 feet long, and pieces 3 and 4 inches wide, 6 and 7 feet long, must have one red face and may have one-half bright sapwood in the aggregate on the reverse side.

Pieces 6 feet long, 5 inches and over wide, must have one red face and may be all bright sapwood on the reverse side.

No. 2 common.

Standard, with the following exceptions:

Each cutting must be clear red on the red side of the board and may be all sapwood on the sap side of the board.

Gum spots are no defect.

There is no restriction as to heart center.

No. 3 common: Standard.

QUARTERED SYCAMORE

Quartered sycamore shall be graded according to the rules for quartered oak, except that bright sapwood shall not be considered a defect in any grade.

POPLAR

In firsts and seconds 10 inches and wider, bright sapwood one-third the width of the piece in the aggregate on one face is no defect; each additional 1 inch of bright sapwood in the aggregate is one standard defect. On the reverse side, 1 inch of bright sapwood in the aggregate is no defect; each additional 1 inch of bright sapwood in the aggregate is one standard defect. Bright sapwood is no defect in pieces 18 inches and over wide.

In the grades of firsts, seconds, and selects, mineral stain not exceeding one-sixth the surface of the piece in the aggregate will not be considered a defect. In saps and the common grades, mineral stain shall not be considered a defect.

Firsts.

Standard (see 400.30), with the following exceptions:

Widths, 8 inches and over.

Lengths, 10 to 16 feet.

Pieces 8 and 9 inches wide must be free from sapwood on one face; the reverse side may have 2 inches of bright sapwood in the aggregate; otherwise they must be clear, except that free wane and free split (see 400.30—standard grades for firsts and seconds) shall be admitted.

Pieces 13 to 16 feet surface measure will admit one standard defect or its equivalent.

Pieces 17 feet or over surface measure will admit two standard defects or their equivalent.

Seconds.

Standard, with the following exceptions:

Pieces 6 inches wide must be free from defects including sapwood.

Pieces 7 inches wide will admit 1 inch of bright sapwood in the aggregate, but no other defect.

Pieces 8 and 9 inches wide, 5 to 7 feet surface measure, will admit 1 inch of bright sapwood in the aggregate, but no other defect; 8 and 9 inches wide, 8 feet and over surface measure, will admit 1 inch of bright sapwood in the aggregate and one standard defect, or 2 inches of bright sapwood in the aggregate if there is no other defect.

Pieces 10 inches and over wide will admit standard defects according to surface measure, as follows:

Six feet, one standard defect or its equivalent.

Ten feet, two standard defects or their equivalent.

Fifteen feet, three standard defects or their equivalent.

Twenty-one feet and over, four standard defects or their equivalent.

Saps.

Widths, 5 inches and over.

Lengths, 8 to 16 feet.

Pieces 5 inches and over wide may have one straight split not exceeding in length the width of the piece, or its equivalent.

Pieces 6 inches and over wide may have wane along the edge not exceeding one-sixth the length of the piece, not exceeding one-half the thickness of the piece, and not exceeding 1 inch in width, or its equivalent at one or both ends.

Otherwise pieces 5 inches wide must be clear; pieces 6 to 8 inches wide will admit one standard defect or its equivalent, except standard wane or split defects; pieces 8 inches and over wide may have one standard defect or its equivalent.

NOTE.—See general instructions regarding stain 400.30.

Selects.

Eliminate the standard grade and substitute the following: Selects must grade firsts and seconds poplar on one face, and not below No. 1 common on the reverse side.

Stained saps.

This grade is the same as saps, except that sound stain shall not be considered a defect.

No. 1 common.

Standard, with the following exceptions:

Slight stain shall not be considered a defect.

Fifteen per cent of 3 and 4 inch widths, of which 15 per cent one-third may be 3 inches wide.

Lenghts 6 to 16 feet, admitting 20 per cent 6 to 9 feet, of which 20 per cent one-half may be 6 and 7 feet.

Pieces 6 and 7 feet long, 3 to 5 inches wide, must be clear; 6 inches and over wide may have one standard defect.

Pieces 3 and 4 inches wide, 8 to 16 feet long, may have one standard defect or its equivalent.

Pieces 5 inches wide, 8 to 16 feet long, must work 66⅔ per cent clear face in not over two cuttings.

Pieces 6 to 9 inches wide, 8 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 feet and over long, in not over three cuttings.

Pieces 10 inches and over wide, 8 and 9 feet long, must work 66⅔ per cent clear face in not over two cuttings; 10 to 13 feet long, in not over three cuttings; 14 to 16 feet long, in not over four cuttings.

No. 2 common.

No. 2 common may be divided into No. 2–A common and No. 2–B common, but unless otherwise specified will be considered as a combined grade.

No. 2–A common.

Standard grade of No. 2 common, with the following exception: Sound stain is no defect.

No. 2–B common.

Standard grade of No. 2 common, with the following exception: Where the term "clear face" appears in the standard grade, substitute the word "sound."

No. 3 common: Standard.

LOCUST

See No. 400.37.

ROCK (OR CORK) ELM AND PECAN

See 400.34.

Southern Cypress Manufacturers Association, grading rules for other hardwoods, June 15, 1925.

TUPELO (BAY POPLAR) LUMBER

General Instructions for the Manufacture, Inspection, and Measurement of Tupelo (Bay Poplar) Lumber

Lumber must be inspected and measured as the inspector finds it, of full length and width. He shall make no allowance for the purpose of raising the grade.

Exceptions to the general rules are stated under the caption of the respective grades.

Inspection must be made from the poor side of the piece, except as otherwise specified.

These rules define the poorest piece in any given grade, but the respective grades must contain all pieces up to the next higher grade.

In the following rules all widths and lengths mentioned are inclusive.

Manufacture.

Lumber should be properly manufactured, trimmed and edged, of good average widths and lengths. It must be of standard thickness when shipping dry, with the exception that in the grades of common, the percentage not included in the cutting may be scant in thickness, provided the cuttings are of standard thickness and that there is no greater variation in the thickness of the board than is allowed in the rule describing missawn lumber.

Lumber showing greater variation in thickness than $\frac{1}{16}$ inch at any point in stock cut ½ inch thick or less, or ⅛ inch in ⅝ inch and ¾ inch stock, or ¼ inch in 1 inch to 2 inch stock, or ⅜ inch in 2½ inch and thicker stock, must be measured at the thinnest part and classed as missawn, and graded and reported as such.

Minimum widths.

Ninety per cent of the minimum widths mentioned in all grades of lumber must be full width; the remaining 10 per cent may be ¼ inch scant in width.

Measurement.

In the measurement of lumber of random widths, fractions of over ½ foot, as shown on the board rule, must be counted up to the next higher figure; fractions of exactly ½ foot and less, as shown on the board rule, must be counted back to the next lower figure.

A board rule on which the ½ foot is clearly marked should be used.

Tapering lumber in standard lengths must be measured one-third the length of the piece from the narrow end.

Tally.

A piece tally in feet must be made of all lumber. All lumber of standard grades and thicknesses must be tallied face or surface measure, and this tally must be the number of feet, board measure, of 1-inch lumber. If the lumber is thicker than 1 inch then the tally so obtained must be multiplied by the thickness as expressed in inches and fractions of an inch. All lumber less than 1 inch must be counted face measure. When strips or stock widths are measured, a tally showing widths and lengths must be made.

Heart.

Heart, where the extent or damage does not exceed the equivalent of standard defects allowed, will be admitted in the grade of firsts and seconds.

In the grade of No. 1 common, no piece shall contain heart to exceed one-half its length in the aggregate.

Season checks.

Ordinary season checks are not to be considered defects, but if of so serious a character as to damage the lumber they are to be considered by the inspector.

Splits.

Six inches of straight split in one end, or its equivalent in both ends, will not be considered a defect in the grade of firsts and seconds.

Sap.

Bright sap is no defect unless so stated under caption of the respective grades.

Stain.

Stain that will surface off in dressing to the standard thickness must not be considered a defect.

Burls.

Burls that do not contain knots or unsound centers shall not be considered defects.

Wane.

In the grade of firsts and seconds, wane along the edge not exceeding one-sixth the length of the piece, or its equivalent at one end or both ends, not exceeding in thickness one-half the thickness of the piece, and not exceeding in width as shown in following table, is not a defect:

½ inch in width in ½, ⅝, and ¾ inch lumber.

¾ inch in width in 1, 1¼, 1½, 1¾, and 2 inch lumber.

1 inch in width in 2½ inch and thicker lumber.

Standard defects.

One knot 1¼ inches in diameter.

Two knots not exceeding in extent or damage one 1¼-inch knot.

Splits—in lumber of random widths, one split not diverging more than 1 inch to a foot, and not exceeding in length in inches the surface measure of the piece in feet; but not more than two defects of this character are admitted in a piece of the grade of firsts and seconds. Firsts and seconds sold in any series of special widths 10 inches or wider will not allow more than one standard defect of this character in any piece.

Wane in excess of free wane allowed in firsts and seconds grade must be considered as standard defects in the proportion of 1 inch in widths, one-sixth the length of the board, extending parallel with the edge, or its equivalent at one or both ends, as one standard defect.

Worm, grub, knot and rafting pinholes, not exceeding in extent or damage one 1¼-inch knot.

Heart and other defects not enumerated as standard defects that do not damage the piece more than the standard defects allowed are equivalent defects and must be so considered by the inspector.

Cuttings.

The word "cutting" as used in these rules means a portion of a board or plank obtained by cross-cutting, by ripping, or by both.

The term "clear face cutting," as used in these rules, means a cutting having one face clear and the reverse face sound.

The term "sound cutting," as used in these rules, means a cutting free from rot and shake and other defects which materially impair the strength of the piece.

Good edge.

The term "good edge," as used in these rules, will admit no unsound defects, excepting a slight amount of wane, not to exceed one-third the length and one-third the thickness of the piece, or its equivalent in other defects.

Standard grades.

The standard grades of tupelo lumber are as follows: Firsts, seconds, No. 1 common, No. 2 common, No. 3 common, wagon box boards, B and better, and C.

Firsts and seconds are combined and the percentage of firsts in the combined grade shall not be less than 33⅓ per cent.

Standard lengths.

Standard lengths are 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16 feet, but not over 15 per cent of odd lengths are admitted.

In the grade of firsts and seconds the lengths are 8 to 16 feet, but there must not be more than 20 per cent under 12 feet and not to exceed 10 per cent of 8 and 9 foot lengths, except as otherwise specified.

Standard thicknesses.

The standard thicknesses of tupelo lumber are: ¼, ⅜, ½, ⅝, ¾, 1, 1¼, 1½, 1¾, 2, 2½, 3, 3½, 4, 4½, 5, 5½, and 6 inches.

The standard thicknesses for surfaced lumber are as follows:

Rough	Surfaced (inch)
⅜-inch surfaced two sides to	$\frac{3}{16}$
½-inch surfaced two sides to	$\frac{5}{16}$
⅝-inch surfaced two sides to	$\frac{7}{16}$
¾-inch surfaced two sides to	$\frac{9}{16}$
1-inch surfaced two sides to	$\frac{13}{16}$
1¼-inch surfaced two sides to	$1\frac{3}{32}$
1½-inch surfaced two sides to	$1\frac{11}{32}$
1¾-inch surfaced two sides to	1½
2-inch surfaced two sides to	1¾
2½-inch surfaced two sides to	2¼
3-inch surfaced two sides to	2¾
3½-inch surfaced two sides to	3¼
4-inch surfaced two sides to	3¾

Lumber surfaced on one side only must be $\frac{1}{16}$ inch full of the above thickness.

Weights.

All weights are the same as cypress.

Firsts.

Firsts must be 6 inches and over wide, 8 feet and over long. Pieces 4 to 9 feet surface measure must be clear. Pieces 10 to 15 feet surface measure may have one standard defect or its equivalent. Pieces 16 feet and over surface measure may have two standard defects or their equivalent.

Seconds.

Seconds must be 6 inches and over wide.

Standard defects are admitted according to surface measure as follows:

5 feet, one standard defect or its equivalent.
8 feet, two standard defects or their equivalent.
12 feet, three standard defects or their equivalent.
16 feet, four standard defects or their equivalent.
20 feet, five standard defects or their equivalent.

No. 1 common.

Sound discolored sap permitted.

No. 1 common must be 4 inches and over wide.

Lengths: four feet and over long, not over 30 per cent shorter than 10 feet, and not to exceed 10 per cent of 4 and 5 foot lengths.

Pieces 4 and 5 feet long must be clear.

Pieces 4 inches wide, 6 and 7 feet long, must be clear.

Pieces 4 inches wide, 8 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; pieces 4 inches wide, 12 to 16 feet long, must work 66⅔ per cent clear face in not over three cuttings. No cutting to be less than 2 feet long by the full width of the piece.

Pieces 6 feet long, 5 to 8 inches wide, may have one standard defect; pieces 6 feet long, 9 inches and over wide, may have two standard defects.

Pieces 5 to 7 inches wide, 7 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; pieces 5 to 7 inches wide, 12 feet and over long, must work 66⅔ per cent clear face in not over three cuttings.

Pieces 8 inches and over wide, 7 to 9 feet long, must work 66⅔ per cent clear face in not over two cuttings; pieces 8 inches and over wide, 10 to 13 feet long, must work 66⅔ per cent clear face in not over three cuttings; pieces 8 inches and over wide, 14 feet and over long, must work 66⅔ per cent clear face in not over four cuttings.

No cutting to be considered which is less than 4 inches wide by 2 feet long or 3 inches wide by 3 feet long.

No. 2 common.

No. 2 common must be 3 inches and over wide, 4 feet and over long, not to exceed 10 per cent of 4 and 5 foot lengths.

Pieces 3 to 7 inches wide, 4 to 10 feet long, must work 50 per cent sound in not over three cuttings; pieces 3 to 7 inches wide, 11 feet and over long, must work 50 per cent sound in not over four cuttings.

Pieces 8 inches and over wide, 4 to 9 feet long, must work 50 per cent sound in not over three cuttings; pieces 8 inches and over wide, 10 to 13 feet long, must work 50 per cent sound in not over four cuttings; pieces 8 inches and over wide, 14 feet and over long, must work 50 per cent sound in not over five cuttings.

No cutting to be considered which is less than 3 inches wide by 2 feet long.

No. 3 common.

No. 3 common must be 3 inches and over wide, 4 feet and over long, and must contain at least 25 per cent of sound cuttings. Minimum width of cuttings 1½ inches, and no cutting considered which contains less than 36 square inches.

400.4 PRESERVATIVE TREATMENT OF WOOD.

400.40 Definitions and Standards.

American Railway Association, Signal Section, specifications for creosoting timber used in the telegraph and telephone plant, 1926.

This specification provides for treatment with creosote oil of poles, conduit, plank, cross arms, and other timber for use in telegraph and telephone construction. Timber treated under this specification shall conform to the requirements of the specifications and drawings furnished by the purchaser. The preservative used under this specification shall conform to A. R. A. specification for creosote oil, grade 1.

Peeling.

All round timbers shall be thoroughly peeled before treatment. No piece shall be considered thoroughly peeled unless all of the rough bark and at least 80 per cent of the inner bark shall have been removed. In no case shall any piece of inner bark be over ⅜ of an inch wide or over 8 inches long, and there shall be 1 inch of clean wood surface between any two such strips.

Any cross section measured in circumference having more than 20 per cent of its surface covered with inner bark shall be repeeled, although the entire surface of the pole may contain less than the allowable 20 per cent.

Seasoning.

The moisture content of the wood before treatment should be reduced, preferably by air seasoning, to not more than 20 per cent of its oven-dry weight, or to a constant weight basis.

When there is not sufficient time for proper air seasoning or in cases of poles and large-dimension timbers which will not air season successfully throughout without deterioration, artificial seasoning by steaming before treatment may be resorted to if approved by the purchaser's inspectors.

When, in the judgment of the purchaser's inspector, steam seasoning is necessary for adequate treatment, poles and other heavy timbers may be steamed in the cylinder at not more than 20 pounds pressure per square inch for not more than 12 hours at not more than 270° F.; smaller timbers, such as conduit and plank, may be steamed in the cylinder at not more than 15 pounds pressure per square inch for not more than 5 hours at not more than 250° F., which pressure and temperature maxima shall not be reached in less than 2 hours in the case of poles and other heavy timber and 1 hour and 30 minutes in the case of smaller timber, such as conduit and plank. The cylinder shall be provided with vents to relieve it of air and insure proper circulation of steam. After steaming is completed a minimum vacuum of 22 inches shall be maintained for not less than 15 minutes. The cylinder shall be relieved continuously or frequently enough to prevent condensate from accumulating in sufficient quantity to reach the wood. Before the preservative is introduced the cylinder shall be drained of condensate.

Framing.

All timber shall be framed, shaped, and bored before treatment.

Treatment.

Timber may be treated under this specification by the full-cell process, by the empty-cell process with final vacuum or by the empty-cell process with initial air and final vacuum as directed by the purchaser.

Limitation of timber in a charge.

Any charge of timber shall be confined to one kind or designated group or kinds of wood, of pieces approximately equal in size and moisture and sapwood content, into which approximately equal quantities of preservative can be injected and so separated as to insure contact of preservative, and steam if used, with all surfaces.

Manner of treatment.

The ranges of pressure, temperatures, and time duration shall be controlled so as to result in maximum penetration of the quantity of preservative injected. The vacuum requirements stipulated are those at sea level, and necessary corrections shall be made for altitude.

Plant equipment.

Treating plants shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages of treatment, and all equipment shall be maintained in condition satisfactory to the purchaser. The apparatus and chemicals necessary for making the analyses and test required by the purchaser shall also be provided by plant operators, and kept in condition for use at all times.

Treatment operations.

(The treatment operations are similar to those of the American Wood-Preservers' Association.)

American Railway Engineering Association, wood preservation, 1921.

GENERAL REQUIREMENTS

1. Creosote oil and zinc chloride are effective wood preservatives when properly applied and when used under proper conditions.

2. Accurate records should be kept in order to form proper conclusions as to the merit of different methods and processes.

3. Preserved wood may be destroyed by mechanical action long before it is decayed, and therefore should be protected by economical devices when the mechanical life limits the life of the tie.

4. There should be a standard temperature at which creosote oil is measured. The temperature of 100° F. is recommended.

5. It is essential that timber should be properly grouped in order that a successful treatment may be obtained. The species, in proportion of heartwood and sapwood, condition of the timber with respect to its moisture content and the wood structure will, in general, determine this grouping.

6. It is desirable to air season timber in order to prepare it for treatment. Most woods can be best treated after being air seasoned.

7. Chemicals used should be tested for purity from time to time. Either the chemists for the company will do this themselves or indicate some simple tests which may be applied by operatives at the works.

8. In operating with zinc chloride, the strength of the solution should be varied from time to time to conform to the kind and condition of the ties, so as to inject the required quantities; but in no case should the strength of the solution exceed 5 per cent.

9. It is better to inject quantities of the chemicals in excess of the requirements than to skimp the treatment in any way.

10. Daily reports should be kept at the works, and duplicates sent to the general office, if desired, in order to check the operation.

11. Ties treated with zinc chloride should dry for some little time (to harden the outer surface) before they are put in the tracks. This is preferably done in piles, arranged to induce drying without checking as evaporation takes place.

12. For best results it is recommended that certain sections of track be selected on each railroad for the purpose of making accurate tests covering the life of treated and untreated ties of various kinds of timber and under various treatments, and that an accurate record be kept of the life of all ties in these test sections of track in order to be able hereafter to improve on the treatment. All ties inserted in such test sections shall be marked with dating nails, and, if necessary, with their identification marks.

13. In order to judge of the penetration of the oil, borings should be made with an augur, ¾ to 1 inch in diameter, in not less than six ties in each cylinder load. The holes should be plugged with creosoted turned plugs of diameter $\frac{1}{16}$ inch larger than the holes.

14. Bridge material intended for treatment should be framed, as far as possible, before timbers are placed in the treating cylinder. This includes the boring of the necessary holes.

GROUPING OF TIMBERS FOR ANTISEPTIC TREATMENT

1. Ties of approximately the same period of seasoning should be grouped together for treatment; green ties should never be mixed with seasoned ones.

2. Pine ties should be separated on the basis of heartwood and sapwood; it would also be advisable in some cases to group hardwoods on the same basis, but it is not generally practical to do so.

3. Grouping on the basis of species and families, as, for example, red oaks, pine, beech, etc., if a further division into heartwood classes is made with pine, is usually a satisfactory practice. From this it follows that red oak, beech, long-leaf pine, loblolly pine, and gum should be treated separately. Birch and hard maples and certain other combinations, depending on the locality, can be grouped together to advantage.

4. The separation in the yard, on the basis the ties are to be grouped for treatment, is an essential and economical practice.

Specifications for preservatives. (See 400.41.)

American Wood-Preservers' Association, standard definitions of creosote and tar, 1921.

CREOSOTE

Creosote, in the scientific sense, may be properly defined as any and all distillate oils boiling between 200 and 400° C., which are obtained by distillation from tars consisting principally of compounds belonging to the aromatic series, and containing well-defined amounts of phenoloids.

TAR

Tar, in the scientific sense, may be properly defined as a nonaqueous liquid product obtained in the destructive distillation of complex organic matter. Tars vary greatly in character, both chemically and physically. They may be roughly divided into three classes:

Class A. Tars consisting principally of compounds belonging to the aromatic series, and containing well-defined amounts of phenoloids.

Class B. Tars consisting principally of compounds belonging to the aromatic series, but lacking phenoloids.

Class C. Tars consisting principally of compounds belonging to the aliphatic series.

American Wood-Preservers' Association, standards for the purchase and preservation of treatable timber, 1926.

Quality of wood.

Preservative treatment should be limited to kinds of wood which are not in themselves resistant to decay, thus making available timber which otherwise would be useless, and which is obtainable at low cost as compared with durable species.

The wood accepted for treatment should be of such a character as to be treated at least throughout the sapwood, except in the case of Douglas fir, and if the heartwood is not capable of treatment, it should be in itself resistant to decay.

Only sound timber, free from defects which would reduce its value for the purposes to be used, should be treated. Treatment will not cure decay nor defects of any kind.

Where strength is required, not only the defects which might reduce the strength but also the quality as determined by density should be specified; but where strength is not an essential only the soundness of the timber and the sapwood requirements as determining penetrability need be considered.

Ties or timbers which have been allowed to stand on their ends should not be accepted.

1. Piles for use in salt water where ravages of marine borers are extremely severe: Specify not less than 2½ inches of sapwood nor more than 5 inches.

2. Piles for use in salt water where ravages of marine borers are less severe than in Group 1: Specify not less than 1 inch of sapwood, nor more than 3 inches.

3. Piles for use in fresh water or foundation work on land: No sapwood restrictions are necessary.

Delivery.

So far as practical arrange delivery of material so that the seasoning period may be during the seasons of minimum rainfall and humidity.

Peeling.

All round timbers shall be thoroughly peeled before treatment. No piece shall be considered thoroughly peeled unless all of the rough bark and at least 80 per cent of the inner bark shall have been removed. In no case shall any piece of inner bark be over ¾ inch wide or over 8 inches long, and there shall be 1 inch of clean wood surface between any two such strips.

Should the strips of inner bark remaining on the pole be less than ¾ inch wide, the clear space required between any two such strips may be proportionately less than 1 inch.

No circumference may have more than 20 per cent of its surface covered with inner bark, although the entire surface of the pole may contain less than the allowable 20 per cent.

Seasoning before treatment.

The moisture content of the wood before treatment should be reduced, preferably by air seasoning, to not more than 20 per cent of its oven dry weight, or to a constant weight basis.

Whenever conditions will permit, thoroughly air season all structural timber, track ties, piles, and other materials before treatment.

When there is not sufficient time for proper air seasoning, or, in cases of piling and large-dimension timbers which will not air season successfully throughout without deterioration, artificial seasoning by steaming or boiling before treatment must be resorted to.

All efficient plants should be equipped to steam material which occasion requires.

In steaming, the pressure should at no time exceed 30 pounds per square inch.

The temperature in the treating cylinder should never be raised above 274° F. in steaming.

The seasoning yard should be in the open where the prevailing winds will strike it freely; should not be in a low and humid situation of any kind if it can be avoided; should have good drainage; and should be kept free from weeds and grass and decaying wood material.

Oak ties should be given a minimum of 8 months' seasoning, and should preferably be seasoned 12 months; yellow pine, if seasoned in the south, 4 to 6 months; hemlock, tamarack, and jack pine, 12 months; gum, beech, birch, and hard maple, 4 to 6 months. (The references are to the seasoning months of the year.)

Stacking.

Support all stacks of material for seasoning on treated sills, and in all cases at least 6 inches of air space should be allowed underneath. To allow proper air circulation, the alleys between the piles should extend in continuous lines across the seasoning yard and should be not less than 3 feet wide in the working spaces and 1 foot wide in other directions.

In a moist climate and under humid conditions, season all material in open piles, which will provide free circulation of air and exposure to the sun. By open piles is meant the common 1 by 7, 1 by 8, or 7 by 2 piling system, or other arrangement which gives a minimum contact and the maximum of open spaces between the ties. Insist that the stringers be placed as near the end of the ties as possible, and then in case of decay from contact the defect will not occur at the rail bearing. In arid climates with low humidity, season in close piles to prevent checking and warping.

Both gum and beech should be seasoned only in wide open piles and watched very carefully for rot.

Antisplitting devices.

Ties and timbers which have a tendency to check should be protected with S irons, or other devices.

Framing.

Wherever possible, all timbers should be framed or bored before treatment, and in lieu of this, unimpregnated wood exposed by framing or boring after treatment should be thoroughly painted with hot creosote.

Adzing and boring.

To insure uniform bearing surface and maximum penetration under the rail seat, all ties should be bored and adzed before treatment. Although sawn ties may have a uniform surface, the boring increases the penetration at the point it is most needed.

Treating.

Adjust the treatment, including preservative and process, as far as possible to the mechanical life and service requirements of the material.

Base efficiency of treatment primarily on the extent of distribution of a stated amount of preservative, rather than on final retention per cubic foot. At railroad plants and for railroad material, the recommendations of the American Railway Engineering Association (p. 631, Bulletin 163) may be followed:

> It is therefore recommended that at railroad plants the absorption be based on the treatment which will give the most complete penetration for each kind or class of timber, specifying complete penetration of the sapwood and as much of the heart as is possible for the particular species or charge; payment to be based on the amount of perservative used plus operating and other charges.

In specifying the amount of creosote to be injected, use gallon as the unit for track ties, posts, crossties, and other material of uniform size, and pounds

per cubic foot for piles, poles, and similar material of variable size (p. 631, Bulletin 163 of the American Railway Engineering Association).

In treating with creosote, it is recommended that a maximum injection of creosote sufficient to insure the penetration of all treatable wood be required. All of the sapwood and as much of the heartwood as is possible for the particular species shall be thoroughly impregnated. This applies equally to full-cell and empty-cell treatments.

A penetration of ½ inch on the heart faces may be recommended as a safe minimum on structures above ground.

The use of the full-cell process is recommended for piles and other marine timbers where subject to the attack of marine borers, and that in such situations an injection of at least 12 pounds per cubic foot for Douglas fir and 20 pounds per cubic foot for other species, or treatment to practical refusal, should be given; while in marine and land situations where decay is the principal source of failure, treatments may range down to 10 pounds per cubic foot by the full-cell process and to 6 pounds by the empty-cell processes, the injection in all cases to be sufficient to penetrate all the sapwood, except in the case of Douglas fir.

The full-cell treatment is recommended for permanent structures not subject to mechanical wear when conditions are favorable to wood-destroying organisms, and particularly where the cost of renewals or replacement would be high.

In all outside situations it is recommended that a maximum injection of creosote, or sufficient to insure the penetration of all treatable wood, be required and that not less than an average of 5 pounds of creosote per cubic foot be left in the treatable portions of the wood by any empty-cell process; while it is urged as a definitely specified requirement, that at least all of the sapwood and as much of the heartwood as is possible for the particular species shall be thoroughly impregnated, except in the case of Douglas fir, and the depth or extent of the penetration be equal to that of the full-cell treatment.

The temperature in the treating cylinder should never be raised above 200° F. during oil immersion, with possible exceptions in the case of some Pacific coast timbers which may require higher temperatures, (when) in the boiling process the oil temperature may be increased to 220° F.

In treating with zinc chloride it is essential that all timber be treated to refusal.

It is recommended that where zinc chloride alone is used treatment be by the standard A. W. P. A. process for the treatment of material with zinc chloride, and that a full impregnation which will insure the retention of a minimum of ½ pound of dry salt per cubic foot of timber be given.

The zinc-chloride treatment is suggested in arid and semiarid regions, particularly for crossties and other material with mechanical life limited to the expectation of life from decay and checking. It should not be used where mechanical wear is eliminated, nor in situations where the treated timber is in permanent or intermittent contact with either stagnant or flowing water. Consideration should also be given to its use on overhead trestles and similar structures.

Under usual conditions three months' seasoning after zinc treatment is advisable.

Creosote zinc in mixture is fundamentally effective because composed of the two most widely accepted preservatives. In situations where the mixture is preferable to a single preservative, it should be used according to the judgment of the consumer as to its greater economy and efficiency under local conditions.

Handling after treatment.

To secure the best results it is necessary to protect treated material from mechanical abrasion both in handling and under service conditions.

Federal Specifications Board, United States Government master specification No. 395, for wood preservatives and processes of treatment, April 1, 1926.

This specification follows the recomendation of the technical committee of the board: "That the specifications of the American Wood-Preservers' Association in effect on the date of promulgation of this specification, and subsequent revisions thereof as far as they may be practicable, be used by the Federal Government." The committee added the following remark: "These specifications are based upon the results of exhaustive research work and experimentation in the field of wood preservation by both Government and private agencies and have had wide practical application by Federal and State agencies, steamship lines, electric light and power companies, and in other fields."

400.41 Preservative Solutions.

American Association of State Highway Officials, standard specifications for highway bridges and incidental structures—timber preservatives—1926.

(Specifications for coal-tar paving oil and for coal-tar distillate oil for creosoted wood blocks, same as those of the American Wood-Preservers' Association.)

(Specifications for creosote oil, grades 1, 2, and 3, coal-tar solution, anthracine oil and heavy creosote oil, same as those of the American Wood-Preservers' Association.) The following specification is given for zinc chloride:

Zinc chloride shall be acid free and shall not contain more than 0.1 per cent iron. Fuzed or solid zinc chloride shall contain at least 94 per cent chloride of zinc. Concentrated zinc chloride shall contain at least 50 per cent chloride of zinc.

American Electric Railway Engineering Association, specifications for No. 1, No. 2, and No. 3 grade creosote oil and for creosote-coal-tar mixture, water-gas-tar distillate, and water-gas-tar mixture, serial Nos. WP108, WP109, WP110, WP111, WP112, and WP113, 1926.

These specifications are similar to the standard specifications of the American Wood-Preservers' Association given on following pages.

American Electric Railway Engineering Association, specification for carbolineum and similar wood preserving oils, serial No. WP114, 1926.

General.

The material desired under these specifications is a high boiling wood preserving oil derived from the products of distillation of gas tar; the gas tar being produced by the destructive distillation of bituminous coal either in the manufacture of coal gas or in the manufacture of coke by the by-product process. It shall be without adulteration.

The right is reserved to take representative samples of the oil and test the same wherever desired.

Requirements.—All oil furnished under these specifications shall conform to the following requirements:

(*a*) The specific gravity at 38° C. shall be not less than 1 nor more than 1.13.

(*b*) The flashing point shall be not less than 120° C.

(*c*) The burning point shall be not less than 165° C.

(*d*) When 100 grams of the oil are distilled in accordance with the specifications for the analysis of carbolineum and similar oils hereinafter referred to:

(1) The distillate coming over below 235° C. shall not exceed 2.5 per cent.

(2) The distillate coming over between 235° and 300° C. shall not exceed 20 per cent.

(3) The residue above 360° C. shall not exceed 35 per cent. This residue shall be soft and plastic at 20° C.

(4) The tar acids in the distillate coming over below 300° C. shall not exceed 2 per cent by volume of the entire sample.

(5) The sulphonation residue from the fractions distilling between 300 and 330° C. shall not exceed 0.25 cubic centimeters.

(*e*) The constituents of the oil insoluble in benzol shall not exceed 0.25 of 1 per cent by weight.

(*f*) The oil shall be liquid at a temperature of 38° C.; that is, there shall be no separation of solid substances at that temperature.

(*g*) The ash left on ignition shall not exceed 1 per cent.

Subsidiary Specifications.—The recommended specifications of the American Electric Railway Engineering Association for the analysis of carbolineum and similar oils are considered as forming a part of the above specifications.

American Electric Railway Engineering Association, specifications for heavy creosote oil suitable for brush and open tank treatment, serial No. WP115, 1924.

This specification is similar to the standard specification for creosote oils for nonpressure treatments (brush or spray treatment) of the American Wood-Preservers' Association.

American Railway Engineering Association, specifications for creosote oils, creosote-coal-tar solution, and zinc chloride, 1921.

CREOSOTE OILS

(Specifications for creosote oils, grades Nos. 1, 2, and 3, same as those of the American-Wood Preservers' Association.)

CREOSOTE-COAL-TAR SOLUTION

(Specifications same as those of the American Wood-Preservers' Association, with the added statement that the specific gravity of the fraction between 235° C. and 315° C. shall not be less than 1.03 at 38° C. compared with water at 15.5° C.)

ZINC CHLORIDE

(Specifications same as those of the American Wood-Preservers' Association with the statement that in any solution specified the percentage of zinc chloride specified shall be the amount of soluble zinc chloride required.)

American Society for Testing Materials, standards and tentative standards for testing wood preservatives.

(This society has formulated detailed methods for testing wood preservatives, as follows:

D 38–24, 1924, standard method of sampling and analysis of creosote oil; D 168-23T, 1923, tentative methods of test for coke residue of creosote oil; D 199–24T, 1924, tentative method of chemical analysis of zinc chloride; D 246–26T, 1926, tentative method of test for distillation of creosote oil.)

American Wood-Preservers' Association, standard specification for creosote coal-tar solution for ties and structural timbers, 1923.

1. The oil shall be a coal-tar product of which at least 80 per cent shall be a distillate of coal-gas tar or coke-oven tar, and the remainder shall be refined or filtered coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall not contain more than 3 per cent of water.

3. It shall not contain more than 2 per cent of matter insoluble in benzol.

4. The specific gravity of the oil at 38° C. compared with water at 15.5° C. shall be not less than 1.05 or more than 1.12.

5. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 5 per cent.

Up to 235° C., not more than 25 per cent.

6. The residue above 355° C., if it exceeds 26 per cent, shall have a float test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 6 per cent coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specifications for creosote oils for nonpressure treatments, 1923.

Open-tank treatment can be accomplished in two general ways, namely, by dipping and by hot and cold bath. See 400.43.

Specifications for creosote oil, grades Nos. 1, 2, and 3. (Same as for creosote oil for ties and structural timbers.)

BRUSH OR SPRAY TREATMENT

This treatment consists in applying the hot preservatives to the dry timber by means of a brush or spray. Two coats, 24 hours apart, are customarily applied. The following are the specifications for cresoote oil for this process:

1. The oil shall be a pure distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall be fluid at 15° C. and crystal free at 38° C.

3. It shall not contain more than 1 per cent of water.

4. It shall not contain more than 0.5 per cent of matter insoluble in benzol.

5. The specific gravity of the oil at 38° C. compared with water at 15.5° C. shall not be less than 1.06.

6. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 1 per cent.

Up to 235° C., not more than 10 per cent.

Up to 355° C., not less than 65 per cent.

7. The residue above 355° C., if it exceeds 10 per cent, shall have a float test of not more than 50 seconds at 70° C.

8. The oil shall yield not more than 2 per cent coke residue.

9. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specifications for creosote oil for ties and structural timber, grade Nos. 1, 2, and 3, 1924.

1. The oil shall be distillate of coal-gas or coke-oven tar. It shall comply with the following requirements:

2. It shall contain not more than 3 per cent of water.

3. It shall contain not more than 0.5 per cent of matter insoluble in benzol.

4. The specific gravity of the oil at 38° C. compared with water at 15.5° C. shall be not less than 1.03.

5. The distillate, based on water-free oil, shall be within the following limits:

	Grade 1, not less than—	Grade, 2 not less than—	Grade 3, not less than—
	Per cent	*Per cent*	*Per cent*
Up to 210° C	5	8	10
Up to 235° C	25	35	40

6. The residue above 355° C., if it exceeds 5 per cent, shall have a float test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 2 per cent coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specification for high boiling or anthracene oil for brush or spray treatment, 1924.

1. The oil shall be a pure distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall be fluid at 15° C. and crystal free at 38° C.

3. It shall not contain more than 1 per cent of water.

4. It shall not contain more than 0.5 per cent of matter insoluble in benzol.

5. The specific gravity of the oil at 38° C., compared with water at 15.5° C., shall not be less than 1.09 nor more than 1.13.

6. The distillate, based on water-free oil, shall be within the following limits:

Up to 235° C., not more than 2½ per cent.

Between 235 and 300° C., not more than 20 per cent.

Up to 355° C., not less than 50 per cent.

7. The residue above 355° C., if it exceeds 35 per cent, shall have a float test of not more than 50 seconds at 70° C.

8. The oil shall yield not more than 2 per cent coke residue.

9. The foregoing tests shall be made in accordance with the standard tests of the American Wood-Preservers' Association except the distillation test which shall be made by the method hereto described.

In addition to the above requirements, the following are sometimes deemed advantageous:

(*a*) The flash point by the Cleveland open-cup tester shall not be less than 120° C.

(*b*) The fire point by the Cleveland open-cup tester shall not be less than 165° C.

(*c*) The tar acids as determined by the contraction method of the association shall not exceed 3 per cent by volume of the total oil.

American Wood-Preservers' Association, standard specifications for preservatives for flooring and paving blocks, 1923.

COAL-TAR PAVING OIL

1. The oil shall be a coal-tar product, of which at least 65 per cent shall be a distillate of coal-gas tar or coke-oven tar, and the remainder shall be refined or filtered coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall not contain more than 3 per cent of water.

3. It shall not contain more than 3 per cent of matter insoluble in benzol

4. The specific gravity of the oil at 38° C. compared with water at 15.5° C. shall not be less than 1.07 nor more than 1.14

5. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 5 per cent.

Up to 235° C., not more than 25 per cent.

6. The residue above 355° C., if it exceeds 35 per cent, shall have a float test of not more than 80 seconds at 70° C.

7. The oil shall yield not more than 10 per cent coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

COAL-TAR DISTILLATE OIL

1. The oil shall be a distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall not contain more than 3 per cent of water.

3. It shall not contain more than 0.5 per cent of matter insoluble in benzol.

4. The specific gravity of the oil at 38 °C. compared with water at 15.5° C. shall not be less than 1.06.

5. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 5 per cent.

Up to 235° C., not more than 15 per cent.

6. The residue above 355° C., if it exceeds 10 per cent, shall have a float test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 2 per cent of coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

REFINED WATER-GAS TAR

1. The preservative shall be refined water-gas tar. It shall comply with the following requirements:

2. It shall contain not more than 3 per cent of water.

3. It shall contain not more than 2 per cent of matter insoluble in benzol and chloroform.

4. The specific gravity of the preservative at 38° C. compared with water at 15.5° C., shall not be less than 1.110 nor more than 1.140.

5. The distillates, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 5 per cent.

Up to 235° C., not more than 15 per cent.

Up to 315° C., not more than 40 per cent.

Up to 355° C., not less than 25 per cent.

6. The specific gravity of the total distillate below 355° C. shall not be less than 0.99 nor more than 1.02 at 38° C. compared with water at 15.5° C.

7. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specification for water-gas-tar distillate for use with zinc chloride.

1. The oil shall be a distillate of water-gas tar which shall comply with the following requirements:

2. It shall not contain more than 3 per cent of water.

3. It shall not contain more than 0.5 per cent of matter insoluble in benzol.

4. The specific gravity of the oil at 38° C., compared with water at 15.5° C., shall not be less than 1.02.

5. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 5 per cent.

Up to 235° C., not more than 25 per cent.

Up to 355° C., not less than 70 per cent.

6. The residue above 355° C., if it exceeds 5 per cent, shall have a float test of not more than 50 seconds at 70° C.

7. The oil shall not yield more than 2 per cent of coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specification for water-gas-tar solution for use with zinc chloride.

1. The oil shall be product of water-gas tar of which at least 60 per cent shall be a distillate of water-gas tar and the remainder refined or filtered water-gas tar.

2. It shall not contain more than 3 per cent of water.

3. It shall not contain more than 2 per cent of matter insoluble in benzol.

4. The specific gravity of the oil at 38° C., compared with water at 15.5° C., shall not be less than 1.03 nor more than 1.07.

5. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 8 per cent.

Up to 235° C., not more than 20 per cent.

Up to 355° C., not less than 60 per cent.

6. The residue above 355° C., if it exceeds 25 per cent, shall have a float test of not more than 50 seconds at 70° C.

7. The oil shall not yield more than 10 per cent of coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specification for zinc chloride.

The zinc chloride shall be acid-free and shall not contain more than 0.1 per cent iron. Fused or solid zinc chloride shall contain at least 94 per cent chloride of zinc. Concentrated zinc chloride shall contain at least 50 per cent chloride of zinc.

Western Red Cedar Association, specifications for butt-treating cedar poles in open tanks, March 10, 1922.

CREOSOTE

(Specifications for creosote are similar to those for creosote oil, No. 1 of the American Wood-Preservers' Association, above.)

CARBOLINEUM

Derivation of carbolineum.

The carbolineum shall consist of the higher boiling factions of pure coal tar and must not contain any admixture of any other tar oil or residue obtained from petroleum or any other source.

Specific gravity.

The specific gravity of the oil compared with water at 15.5° C. shall not be more than 1.135 nor less than 1.09 at 38° C.

Flashing point.

The flashing point shall not, in general, be below 140° C.

Burning point.

The burning point shall not, in general, be below 170° C.

Fractional distillation.

The amount of distillate coming over 300° C. shall not exceed 15 per cent, of which not to exceed 2 per cent shall distill below 235° C.

Tar acid content.

The tar acid in the distillate coming over below 300° C. shall not exceed 2 per cent by volume of entire sample.

Sulphonation test for impurities.

A sulphonation test of the fraction between 300 and 360° C. should yield in residue not more than one-tenth of 1 per cent by volume of entire sample.

Insoluble residue.

The percentage of residue insoluble in benzol shall not exceed 0.25 of 1 per cent by weight.

400.42 Pressure Processes.

American Association of State Highway Officials, standard specifications for highway bridges and incidental structures—preservative treatment for timber, pressure processes—1926.

(Specifications for pressure treatments for southern yellow pine by the full-cell process and the empty-cell process with and without initial air, and for Douglas fir by the full-cell process and the empty-cell process with initial air, similar to those of the American Wood-Preservers' Association, with the following statement as to the amount of preservative to be used.)

AMOUNT OF PRESERVATIVE

Unless otherwise specified the amount of preservative retained shall be as follows:

(*a*) *Creosote or creosote coal tar.*

1. For piles and timber in general bridge construction:

Full-cell process, not less than 12 pounds of oil per cubic foot of timber, or empty-cell process, not less than 8 pounds of oil per cubic foot of timber.

2. For piles or timber in salt water subject to attack by marine borers:

Full-cell process—southern yellow pine, not less than 20 pounds of oil per cubic foot of timber; Douglas fir, not less than 15 pounds of oil per cubic foot of timber.

(*b*) *Zinc chloride.*

1. For timber or lumber to be painted or not subject to water leaching: Not less than ½ pound of dry salt per cubic foot of timber.

American Electric Railway Engineering Association, specifications for preservative treatment of wood by pressure process, serial No. WP104, 1926.

This specification is similar to the specification for preservative treatments of wood adopted by the American Railway Engineering Association below.

American Electric Railway Engineering Association, specification for pressure treatment of pine poles, serial No. WP105, 1926.

This specification is similar to the standard specification for the preservative treatment of poles by pressure process of the American Wood-Preservers' Association.

American Wood-Preservers' Association, standard specifications for the preservative treatment of Douglas fir piles by pressure processes, 1926.

GENERAL REQUIREMENTS

1. The following general requirements (2 to 8) apply to each of the treatment processes:

2. *Conditioning.*—Piles shall be conditioned for treatment in accordance with American Wood-Preservers' Association "standards for the purchase and preservation of treatable timber."

3. *Seasoning.*—(*a*) Piles shall be seasoned, by air or by boiling under vacuum as agreed upon, until in the judgment of the purchaser's representative any moisture in the wood will not prevent the injection and proper distribution and penetration of the specified amount of preservative. (*b*) When, in the judgment of the purchaser's representative, seasoning by boiling under vacuum is necessary for adequate treatment, piles shall be held in creosote under a vacuum at temperatures which do not exceed 220° F. The seasoning period shall be maintained until condensation passing off from the piles is approximately 1 to 10 pounds per cubic foot of piles per hour. A minimum vacuum of 20 inches shall be maintained during seasoning.

4. *Preparation for treatment.*—Any charge of piles shall be confined to Douglas fir, of pieces approximately equal in moisture and sapwood content, into which approximately equal quantities of preservative can be injected, on which all necessary framing, boring, incising, or chamfering shall have been done where possible.

5. *Manner of treatment.*—The ranges of pressure, temperature, and time duration shall be controlled so as to result in maximum penetration by the quantity of preservative injected, which shall permeate the wood to the depth required in section 7. The vacuum requirements stipulated are those at sea level, and necessary corrections shall be made for altitude.

6. *Retention of preservative.*—No charge shall contain less than 90 per cent nor more than 110 per cent of the quantity of preservative that may be specified, but the average retention of preservative by the material treated under any contract or order shall be at least 100 per cent of the quantity specified. The amount of preservative retained shall

be calculated on the basis of preservative at 100° F., from readings of working tank gauges, or scales, or from weights before and after treatment of loaded trams on suitable track scales, taking into consideration the quantity of preservative absorbed during the boiling, and checked as may be desired by the purchaser's representative.

7. *Determination of penetration.*—Penetration shall be determined by sampling piles in each charge, as may be desired by the purchaser's representative. Any holes which may be bored shall be filled with tight-fitting treated plugs.

Any borings of a pile shall be made midway of its length and shall show a radial penetration by oil not less than as follows:

Full-cell process.

After retention of 12 pounds per cubic foot, ¾ inch of creosoted wood.

After retention of 14 pounds per cubic foot, ⅞ inch of creosoted wood.

After retention of 16 pounds per cubic foot, 1 inch of creosoted wood.

Empty-cell process.

After retention of 8 pounds per cubic foot, ¾ inch of creosoted wood.

8. *Plant equipment.*—Treating plants shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages of treatment, and all equipment shall be maintained in condition satisfactory to the purchaser. The apparatus and chemicals necessary for making the analyses and tests required by the purchaser shall also be provided by plant operators and kept in condition for use at all times.

PRESERVATIVES

9. The preservative used shall be whichever of the following standards of the American-Wood Preservers' Association is stipulated:

For use in salt water:

Grade 1 creosote oil for ties and structural timber.

For use in fresh water or other locations where marine borers are not present:

Grade 1 creosote oil for ties and structural timber.

Grade 2 creosote oil for ties and structural timber.

Grade 3 creosote oil for ties and structural timber.

Creosote-coal-tar solution for ties and structural timber.

AMOUNT OF PRESERVATIVE TO BE USED

10. For use in salt water:

Full-cell process, not less than 12 pounds per cubic foot of piles.

For use in fresh water or other locations where marine borers are not present:

Full-cell process, not less than 10 pounds per cubic foot of piles.

Empty-cell process with initial air, not less than 8 pounds per cubic foot of piles.

Empty-cell process without initial air, not less than 8 pounds per cubic foot of piles.

TREATING OPERATIONS

11. *Heating.*—Whenever it is desirable to warm dry piles they shall be heated in preservative that is introduced at a temperature of 160 to 180° F., and the temperature gradually raised to 200° F. and held at that temperature for not more than six hours.

12. *Full-cell process.*—Following the heating period, in the case of dry piles, or the seasoning-by-boiling-under-vacuum period, in the case of green piles, the cylinder shall be filled with preservatives between 160 and 200° F. The pressure shall then be raised to a minimum of 75 pounds per square inch and maintained within a maximum of 175 pounds per square inch until the quantity of preservative required to insure the final retention stipulated is injected into the wood, or, failing this, until the purchaser's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 160° F., nor more than 200° F., and shall average at least 180° F.

After pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum of at least 20 inches promptly created and maintained until the piles can be removed from the cylinder free of dripping preservative.

13. *Empty-cell process with initial air.*—(*a*) Following the heating period, in the case of dry piles, or the seasoning-by-boiling-under-vacuum period, in the case of green wood, piles shall be subjected to air pressure of sufficient intensity and duration to provide under a vacuum the ejection of surplus preservative and to insure a retention and proper distribution of the stipulated number of pounds of preservative per cubic foot of wood. (*b*) The preservative shall be introduced between 160 and 200° F., the cylinder pressure being maintained constant until the cylinder is filled with preservative. The pressure shall then be rasied to a minimum of 125 pounds per square inch and maintained within a maximum of 200 pounds per square inch until there is obtained the largest practicable volumetric injection that can be reduced to the required retention by a quick high vacuum, or, failing this, until the purchaser's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 160° F., nor more than 200° F., and shall average at least 180° F.

After pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum of at least 20 inches promptly created and maintained until the piles can be removed from the cylinder free of dripping preservative. Or, after pressure is completed and before removal of preservative from the cylinder, the preservative surrounding the piles may be reheated to a maximum of 220° F., the steam to be turned off immediately the maximum temperature is reached. The preservative shall then be removed from the cylinder and a vacuum applied as specified above.

14. *Empty-cell process without initial air.*—Following the heating period, in the case of dry piles, or the seasoning-by-boiling-under-vacuum period, in the case of green piles, the preservative between 160 and 200° F. shall be introduced to the piles until the cylinder is filled. Pressure shall then be raised to a minimum of 100 pounds per square inch and maintained within a maximum of 200 pounds per square inch until there is obtained the largest practicable volumetric injection that can be reduced to the required retention by a quick high vacuum, or failing this, until the purchaser's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 160° F., nor more than 200° F., and shall average at least 180° F.

After pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum of at least 20 inches promptly created and maintained for not less than 30 minutes until the quantity of preservative injected is reduced to the required retention and the piles can be removed from the cylinder free of dripping preservative. Or, after pressure is completed and before removal of preservative from the cylinder, the preservative surrounding the piles may be reheated to a maximum of 220° F., the steam to be turned off immediately the maximum temperature is reached. The preservative shall then be removed from the cylinder and a vacuum applied as specified above.

American Wood-Preservers' Association, standard specifications for the preservative treatment of Douglas fir ties by pressure processes, 1926.

GENERAL REQUIREMENTS

(Similar to those for Douglas fir piles with added statements relating to seasoning, and certain additions to the preservatives used, and the amounts employed, as indicated below.)

Seasoning.

When, in the judgment of the purchaser's representative, steam seasoning is necessary for adequate treatment, crossties may be steamed in the cylinder at not more than 20 pounds pressure per square inch for not more than six hours at not more than 260° F., which pressure and temperature maxima shall not be reached in less than two hours. The cylinder shall be provided with vents to relieve it of air and insure proper circulation of steam. After steaming is completed a minimum vacuum of 22 inches shall be maintained for not less than 30 minutes. The cylinder shall be relieved continuously or frequently enough to prevent condensate from accumulating in sufficient quantity to reach the wood. Before the preservative is introduced the cylinder shall be drained of condensate.

Preservatives.

The preservative or preservatives used shall be whichever of the following standards of the American Wood-Preservers' Association is stipulated:

Grade 1 creosote oil for ties and structural timber.
Grade 2 creosote oil for ties and structural timber.
Grade 3 creosote oil for ties and structural timber.
Creosote-coal-tar solution for ties and structural timber.
Zinc chloride.
Water-gas-tar distillate for use with zinc chloride.
Water-gas-tar solution for use with zinc chloride.

AMOUNT OF PRESERVATIVES TO BE USED

(*a*) *Creosote.*

Full-cell process, not less than 10 pounds per cubic foot of ties.

Empty-cell process with initial air, not less than 6 pounds per cubic foot of ties.

Empty-cell process without initial air, not less than 6 pounds per cubic foot of ties.

(*b*) *Zinc chloride.*

Not less than ½ pound of dry salt per cubic foot of ties.

(*c*) *Creosote-zinc chloride.*

Not less than 2 pounds of oil and ½ pound of dry salt per cubic foot of ties.

TREATING OPERATIONS

(The requirements for oil treatment by the full-cell process and the empty-cell process with and without initial air are the same as those for Douglas fir piles. The requirements for salt treatment and oil-salt treatment are given below.)

Salt treatment.

(*a*) The treating solution, which shall not have a strength exceeding 5 per cent determined by the American Wood-Preservers' Association "standard method of analysis for zinc chloride," and which shall be no stronger than necessary to obtain the required retention of preservative with the largest volumetric absorption practicable, shall be thoroughly mixed before use.

(*b*) Air-seasoned ties shall not be given a preliminary steaming in the cylinder, except it is needed to obtain the required temperature of solution in the cylinder, when the ties may be steamed for not less than one hour nor more than two hours, at a temperature of not more than 250° F. After steaming is completed a vacuum of not less than 22 inches shall be maintained for not less than 30 minutes or until the wood is as dry and free of air as practicable. When no preliminary steaming is employed the ties shall be subjected to a vacuum of not less than 22 inches for 30 minutes before the preservative is admitted to the cylinder. If the vacuum is broken while the condensate is being drained from the cylinder a second vacuum as high as the first shall be created. The preservative shall be introduced between 160 and 200° F., without breaking the vacuum until the cylinder is filled. The pressure shall then be raised to a minimum of 125 pounds per square inch and maintained within a maximum of 175 pounds per square inch until the quantity of preservative required to insure the final retention stipulated is injected into the ties or until less than 2 per cent of the total quantity required has been injected during

the latter half of one hour throughout which the rate of injection has persistently decreased while the pressure has been held continuously at the maximum. The temperature of the preservative during the pressure period shall be not less than 150° F., nor more than 200° F., and shall average at least 180° F. After the pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

Oil-salt treatment.

(*a*) The preservative mixture shall be composed of the volumetric proportions of creosote oil and zinc-chloride solution of the necessary strength required to obtain the stipulated retention with the largest volumetric injection that is practicable, and shall be agitated in the working tank and cylinder so as to insure thorough mixing before and while the cylinder is being filled with preservative and while the preservative is being injected into the ties. The strength of the zinc-chloride solution shall not exceed 5 per cent and shall be determined by the American Wood-Preservers' Association "standard method of analysis for zinc chloride."

(*b*) Air-seasoned ties shall not be given a preliminary steaming in the cylinder, except it is needed to obtain the required temperature of solution in the cylinder, when the ties may be steamed for not less than 1 hour nor more than 2 hours, at a temperature of not more than 250° F. After steaming is completed a vacuum of not less than 22 inches shall be maintained for not less than 30 minutes or until the wood is as dry and free of air as practicable. When no preliminary steaming is employed the ties shall be subjected to a vacuum of not less than 22 inches for 30 minutes before the preservative is admitted to the cylinder. If the vacuum is broken while the condensate is being drained from the cylinder a second vacuum as high as the first shall be created. The mixture of preservatives shall be introduced between 160 and 200° F., without breaking the vacuum until the cylinder is filled. The pressure shall then be raised to a minimum of 125 pounds per square inch and maintained within a maximum of 175 pounds per square inch until the quantity of preservative required to insure the final retention stipulated is injected into the ties or until less than 2 per cent of the total quantity required has been injected during the latter half of 1 hour throughout which the rate of injection has persistently decreased while the pressure has been held continuously at the maximum. The temperature of the preservative during the pressure period shall be not less than 150° F. nor more than 200° F., and shall average at least 180° F. After the pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

American Wood-Preservers' Association, standard specifications for the preservative treatment of yellow-pine piles by pressure processes, 1926.

GENERAL REQUIREMENTS

(Similar to those for timber. However, the steam-seasoning treatment may be applied to the piles for not more than 24 hours at not more than 274° F., and the preservatives are limited to creosote oils, grades 1, 2, and 3, and to creosote coal-tar solution.)

The amount of preservative to be used is:

For use in salt water.

Full-cell process, not less than 22 pounds per cubic foot of piles.

For use in fresh water.

Full-cell process, not less than 15 pounds per cubic foot of piles.

For use in dry soil.

Full-cell process, not less than 12 pounds per cubic foot of piles.

Empty-cell process with initial air, not less than 8 pounds per cubic foot of piles.

Empty-cell process without initial air, not less than 8 pounds per cubic foot of piles.

TREATING OPERATIONS

(Same as those for timber, but limited to the full-cell and the empty-cell processes.)

American Wood-Preservers' Association, standard specifications for the preservative treatment of posts by pressure processes, 1926.

GENERAL REQUIREMENTS

(Similar to those for timber for general construction except in water. However, the steam-seasoning treatment may be applied to the posts for not more than 10 hours at not more than 259° F.)

TREATING OPERATIONS

(Same as those for timber, but limited to the full-cell and empty-cell processes.)

American Wood-Preservers' Association, standard specifications for the preservative treatment of timber, by pressure processes, excluding Douglas fir, larch, or tamarack, 1926.

GENERAL REQUIREMENTS

1. The following general requirements (2 to 8) apply to each of the treatment processes:

2. *Conditioning.*—Timber shall be conditioned for treatment in accordance with American Wood-Preservers' Association "standards for the purchase and preservation of treatable timber."

3. *Seasoning.*—(*a*) Timber shall be seasoned by air or steam as agreed upon until, in the judgment of the purchaser's representative, any moisture in the wood will not prevent the injection and proper distribution of the specified amount of preservative. (*b*) When, in the judgment of the purchaser's representative, steam seasoning is necessary for adequate treatment, timbers may be steamed in the cylinder at not more than 30 pounds pressure per square inch for not more than 20 hours at not more than 274° F., which pressure and temperature maxima shall not be reached in less than two hours.

The cylinder shall be provided with vents to relieve it of air and insure proper circulation of steam. After steaming is completed a minimum vacuum of 22 inches shall be maintained for not less than 15 minutes. The cylinder shall be relieved continuously or frequently enough to prevent condensate from accumulating in sufficient quantity to reach the wood. Before the preservative is introduced the cylinder shall be drained of condensate.

4. *Preparation for treatment.*—Any charge of timber shall be confined to one kind or designated group or kinds of wood, of pieces approximately equal in size and moisture and sapwood content, into which approximately equal quantities of preservative can be injected, on which all necessary framing, boring, or chamfering shall have been done, where possible, and so separated as to insure contact of preservative, and steam if used, with all surfaces.

5. *Manner of treatment.*—The ranges of pressure, temperature, and time duration shall be controlled so as to result in maximum penetration by the quantity of preservative injected, which shall permeate all of the sapwood, and as much of the heartwood as practicable. The vacuum requirements stipulated are those at sea level, and necessary corrections shall be made for altitude.

6. *Retention of preservative.*—No charge shall contain less than 90 per cent, nor more than 110 per cent, of the quantity of preservative that may be specified; but the average retention of preservative by the material treated under any contract or order shall be at least 100 per cent of the quantity specified. The amount of preservative retained shall be calculated on the basis of preservative at 100° F., from readings of working tank gauges, or scales, or from weights before and after treatment of loaded trams on suitable track scales, checked as may be desired by the purchaser's representative.

7. *Determination of penetration.*—Penetration shall be determined by sampling timbers in each charge, as may be desired by the purchaser's representative. Any holes which may be bored shall be filled with tight-fitting treated plugs.

8. *Plant equipment.*—Treating plants shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages of treatment, and all equipment shall be maintained in condition satisfactory to the purchaser. The apparatus and chemicals necessary for making the analyses and tests required by the purchaser shall also be provided by plant operators, and kept in condition for use at all times.

PRESERVATIVES

9. The preservative or preservatives used shall be whichever of the following standards of the American Wood-Preservers' Association is stipulated:

Grade 1 creosote oil for ties and structural timber.
Grade 2 creosote oil for ties and structural timber.
Grade 3 creosote oil for ties and structural timber.
Creosote-coal-tar solution for ties and structural timber.
Zinc chloride.
Water-gas-tar distillate for use with zinc chloride.
Water-gas-tar solution for use with zinc chloride.

AMOUNT OF PRESERVATIVES TO BE USED

10. (*a*) *Creosote:*

For use in coastal water:

Full-cell process, not less than 16 pounds per cubic foot of timber.

For general construction, except in coastal water.

Full-cell process, not less than 10 pounds per cubic foot of timber.

Empty-cell process with initial air, not less than 5 pounds per cubic foot of timber.

Empty-cell process without initial air, not less than 5 pounds per cubic foot of timber.

(*b*) *Zinc chloride:*

For general construction, except in water, not less than ½ pound of dry salt per cubic foot of timber.

(*c*) *Creosote-zinc chloride:*

For general construction, except in water, not less than 2 pounds of oil and ½ pound of dry salt per cubic foot of timber.

TREATING OPERATIONS

Oil treatment.

11. *Full-cell process.*—(*a*) Timber shall be subjected to a vacuum of sufficient intensity and duration to insure that the wood is as dry and free from air as practicable, and to permit a retention of the specified number of pounds of preservative per cubic foot of wood.

(*b*) The preservative shall be introduced between 165 and 200° F., and the cylinder filled without breaking the vacuum. The pressure shall then be raised to and maintained at a minimum of 100 pounds per square inch or until the quantity of preservative required to insure the final retention stipulated is injected into the wood, or until the purchaser's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 150° F., nor more than 200° F., and shall average at least 180° F. After the pressure is completed the cylinder shall be emptied speedily of preservative, and a vacuum of not less than 22 inches promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

12. *Empty-cell process with initial air.*—(*a*) Timber shall be subjected to air pressure of sufficient intensity and duration to provide under a vacuum the ejection of surplus preservative, and to insure a retention and proper distribution of the stipulated number of pounds of preservative per cubic foot of wood.

(*b*) The preservative shall be introduced between 165 and 200° F., the cylinder pressure being maintained constant until the cylinder is filled with preservative. The pressure shall then be raised to and maintained at a minimum of 150 pounds per square inch or until there is obtained the largest

practicable volumetric injection that can be reduced to the stipulated retention by a quick high vacuum, or until the purchaser's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 150° F., nor more than 200° F., and shall average at least 180° F. After pressure is completed the cylinder shall be emptied speedily of preservative, and a vacuum promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

13. *Empty-cell process without initial air.*—The preservative between 165 and 200° F. shall be introduced to the timber until the cylinder is filled. Pressure shall then be raised to and maintained at a minimum of 100 pounds per square inch or until there is obtained the largest practicable volumetric injection that can be reduced to the stipulated retention by a quick high vacuum, or until the purchaser's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 150° F., nor more than 200° F., and shall average at least 180° F. After pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum of not less than 22 inches promptly created and maintained for not less than 30 minutes until the quantity of preservative injected is reduced to the required retention and the wood can be removed from the cylinder free of dripping preservative.

Salt treatment.

14. (*a*) The treating solution which shall not have a strength exceeding 5 per cent, determined by the American Wood-Preservers' Association "standard method of analysis for zinc chloride," and which shall be no stronger than necessary to obtain the required retention of preservative with the largest volumetric absorption practicable, shall be thoroughly mixed before use

(*b*) Air-seasoned timber may be steamed in the cylinder for not less than one hour, nor more than two hours, at a pressure of not more than 20 pounds per square inch. After steaming is completed a vacuum of at least 22 inches shall be maintained for not less than 15 minutes, or until the wood is as dry and free of air as practicable. If the vacuum is broken while the condensate is being drained from the cylinder a second vacuum as high as the first shall be created. The preservative shall be introduced without breaking the vacuum until the cylinder is filled. The pressure shall then be raised to and maintained at a minimum of 100 pounds per square inch until the quantity of preservative to insure the final retention stipulated is injected into the timber, or until less than 5 per cent of the total quantity required has been injected during the latter half of one hour throughout which the rate of injection has persistently decreased while the pressure has been held continuously at 125 or more pounds per square inch. The temperature of the preservative during the pressure period shall be not less than 140° F., nor more than 200° F., and shall average at least 150° F. After the pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

Oil-salt treatment.

15. (*a*) The preservative mixture shall be composed of the volumetric proportions of creosote oil and zinc-chloride solution of the necessary strength required to obtain the stipulated retention with the largest volumetric injection that is practicable, and shall be agitated in the working tank and cylinder so as to insure thorough mixing before and while the cylinder is being filled with preservative, and while the preservative is being injected into the timber. The strength of the zinc-chloride solution shall not exceed 5 per cent and shall be determined by the American Wood-Preservers' Association "standard method of analysis for zinc chloride."

(*b*) Air-seasoned timber may be steamed in the cylinder for not less than one hour, nor more than two hours, at a pressure of not more than 20 pounds per square inch. After seasoning is completed a vacuum of at least 22 inches shall be maintained for not less than 15 minutes or until the wood is as dry and free of air as practicable. If the vacuum is broken while the condensate is being drained from the cylinder, a second vacuum as high as the first shall be created. The mixture of preservatives shall then be introduced without breaking the vacuum until the cylinder is filled. The pressure shall then be raised to and maintained at a minimum of 100 pounds per square inch until the quantity of preservative required to insure the final retention stipulated is injected into the timber, or until less than 5 per cent of the total quantity required has been injected during the latter half of one hour throughout which the rate of injection has persistently decreased while the pressure has been held continuously at 125 or more pounds per square inch. The temperature of the preservative during the pressure period shall be not less than 150° F., nor more than 200° F., and shall average at least 180° F. After the pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

American Wood-Preservers' Association, standard specifications for the preservative treatment of poles by pressure processes, excluding Douglas fir, larch, or tamarack, 1926.

GENERAL REQUIREMENTS

(Similar to those for timber, for general construction work except in water, with the preservatives limited to creosote oils, grades 1, 2, and 3, and to creosote-coal-tar solution. However, in applying the empty-cell processes with or without initial air, the amount of preservative shall be not less than 6 pounds per cubic foot of poles.)

TREATING OPERATIONS

(Same as those for timber, but limited to the full-cell and empty-cell processes.)

American Wood-Preservers' Association, standard specifications for the preservative treatment of ties by pressure processes, excluding Douglas fir, larch, or tamarack, 1926.

GENERAL REQUIREMENTS

(Similar to those for the treatment of timber for general construction except in water. However, the steam-seasoning treatment may be applied to the ties for not more than 10 hours at not more than 274° F.)

TREATING OPERATIONS

(Same as those for timber.)

American Wood-Preservers' Association, standard definitions of pressure processes, 1921.

1. *Allardyce.*

Not patented. Used chiefly for ties.

Consists essentially of the following steps:

(*a*) A solution of zinc chloride is forced into the wood at a maximum pressure of 75 to 100 pounds per square inch until the desired absorption is obtained (commonly ¼ to ½ pound dry salt per cubic foot).

(*b*) The zinc chloride is then drained from the retort, and creosote admitted and injected into the wood at a pressure of about 100 to 150 pounds per square inch until the desired absorption (usually 3 to 4 pounds per cubic foot) is obtained.

The pressures used under (*a*) and (*b*) depend upon the character and condition of the wood under treatment. The pressure under (*b*) however must be higher than that under (*a*).

2. *Bethell (full-cell process).*

Patented by John Bethell in England in 1838. (See British patent No. 7731, July, 1838.) Commonly used for the creosoting of piles, poles, cross arms, paving blocks, structural timber, lumber, and ties. As now practiced consists essentially of the following steps:

(*a*) Preliminary vacuum one-half to one or more hours.

(*b*) Oil injected under pressure, maximum usually between 100 and 180 pounds per square inch, but sometimes as low as 25 pounds.

(*c*) Final vacuum (sometimes omitted).

Green timber is usually subjected to a live steam bath at about 20 pounds pressure for several hours before the preliminary vacuum. Seasoned timber is not usually steamed, except in the case of paving blocks. The amount of oil injected depends upon the specifications of the purchaser, but the absorption per cubic foot is usually within the following ranges:

Lumber, poles, structural timbers, cross arms, ties, fresh water and land piles, 6 to 12 pounds.

Paving blocks, 12 to 20 pounds.

Salt water piles, 16 to 24 pounds.

3. *Boiling.*

Patented by William G. Curtis and John D. Isaacs in 1895 and reissued the same year. (U. S. patent 545222 and reissues No. 11515.)

Used chiefly for creosoting Douglas fir piles, timber, lumber, ties, and paving blocks.

Consists essentially of the following steps:

(*a*) Wood (either green or seasoned) in the treating cylinder is covered with oil at about 160 to 190° F.

(*b*) Oil heated above 212° F. at atmospheric pressure and vapors passed through a condenser. (The practice with regard to temperature limits varies with different plants. In some cases a range of 215 to 225° F. is used, in others 225 to 250° F.)

(*c*) Heating continued until rate of condensation falls to one-sixth to one-tenth of a pound of water per cubic foot of wood per hour. This sometimes requires 40 to 60 hours or more for green timber, but may be as low as 10 hours for dry timber.

(*d*) Treating cylinder partially emptied and refilled with cooler oil to lower oil temperature before starting pressure.

(*e*) Pressure applied, maximum 120 to 180 pounds per square inch, until desired absorption obtained; usually 10 to 16 pounds per cubic foot.

4. *Boulton (boiling under vacuum).*

Patented by S. B. Boulton in England and the United States (see U. S. patent 247602, issued September 27, 1881). The first mention of boiling under vacuum, however, appears in Bethell's British patent No. 7731, July, 1838. Patent modification applied for in 1915, by O. P. M. Goss. Used chiefly for the treatment of Douglas fir piles, timber, ties, lumber, and paving blocks. As now practiced it consists essentially of the following steps:

(*a*) Timber is immersed in hot creosote and subjected to a vacuum, and the escaping vapors drawn through a condenser.

(*b*) Temperature (usually 190 to 215° F.) and vacuum maintained until the rate of condensation of water falls to a specified amount per cubic foot of wood per hour—usually one-sixth to one-tenth of a pound.

(*c*) Vacuum discontinued and pressure applied until desired absorption obtained. This is commonly 12 to 16 pounds per cubic foot for paving blocks, 12 to 14 pounds for piles, 8 to 12 pounds for lumber and timber, and 5 to 8 pounds for ties.

The object of the vacuum is to evaporate the water from the wood at a lower temperature than in the ordinary steaming or straight boiling processes.

The Goss modification provides for a heating period of several hours at atmospheric pressure in oil at a temperature of 190 to 215° F. before the vacuum is applied and a heating bath in oil at atmospheric pressure after the oil pressure period.

5. *Burnett.*

Patented in 1838 in England by William Burnett. (See British patent No. 7747, July, 1838.)

In general use for treating ties, lumber, and timber with zinc chloride. As now practiced consists essentially as follows for seasoned wood:

(*a*) Preliminary vacuum.

(*b*) Zinc chloride solution applied under pressure of 100 to 175 pounds per square inch to approximate refusal.

For green timber, a steaming period of 1 to 5 or more hours at about 20 pounds is usually applied before the vacuum. The strength of the zinc chloride solution is generally so regulated that at refusal the timber will have absorbed from ¼ to ½ pound, usually the latter, of dry zinc chloride per cubic foot.

The original Burnett patent covers only the use of zinc chloride by soaking the wood in 2.4 per cent solution of it for 10 to 21 days. The use of pressure with zinc chloride is a later development.

6. *Card.*

Patented by J. B. Card in 1906. (U. S. patent No. 815404.) Used chiefly for ties, lumber, and timber. The essential parts of the process are:

(*a*) The use of a mixture containing about 80 per cent of zinc-chloride solution and 20 per cent of oil.

(*b*) The method of keeping the zinc chloride and oil mixed during treatment by means of a rotary pump, which draws the mixture from the top of the treating cylinder and returns it at the bottom through a perforated pipe.

The use of steaming, vacuum, and pressure are the same as in the Bethell process.

It is customary to inject about ½ pound of dry zinc chloride and 2 to 3 pounds of oil per cubic foot

7. *Lowry (empty-cell process).*

Patented by C. B. Lowry in 1906 (U. S. patent No. 831450.) Used chiefly for creosoting air-seasoned cross ties, but also for poles, posts, paving blocks, and silo staves.

Consists essentially of the following steps:

(*a*) Without first drawing a vacuum, creosote at not to exceed 200° F. is injected into the wood to refusal, or to a specified amount.

(*b*) A quick vacuum is drawn to remove the excess oil from the timber. The air imprisoned by injecting the oil without a preliminary vacuum expands during the final vacuum, forcing out a certain amount of oil with it. For this reason the process is classed as "empty cell." It is customary to leave in ties a net of about 2½ gallons of creosote per tie (6 to 8 pounds per cubic foot) and 6 to 10 pounds per cubic foot in other timber.

8. *Rueping (empty-cell process).*

Patented in the United States in 1902 and 1911 by Max Rueping. (U. S. patents 709799 and 1008864. The first patent was reissued No. 12707, October, 1907.)

Used chiefly for ties and lumber.

As commonly used, the process consists of the following:

(*a*) Treating cylinder, containing the wood, is filled with compressed air and so held for an hour or more.

(*b*) Treating cylinder filled with oil allowing air to escape, but without reducing pressure.

(*c*) When treating cylinder is full of oil, pressure is increased to a maximum of 150 to 200 pounds per square inch, and held to refusal, or until specified absorption obtained.

(*d*) Oil drained, and vacuum drawn to remove excess of oil from the wood. The air imprisoned during (*a*) expands during (*d*) forcing out a certain amount of oil with it, and the process is, therefore, called an "empty-cell" process. If desired, (*a*) may be omitted, and the air pressure applied after (*c*).

If green timber is treated, it is first artificially seasoned by steaming, boiling or boiling under vacuum, before the pressure is applied.

Net absorption, usually 4 to 6 pounds per cubic foot.

9. *Steaming (Colman process):*

Not patented.

Used almost exclusively for the treatment of Douglas fir piles.

Consists essentially of the following steps:

(*a*) Timber steamed at a pressure of 50 to 100 pounds per square inch for 3 to 8 hours; time and pressure varying according to dimension and previous degree of seasoning.

(*b*) Steam released and vacuum drawn until timber is considered seasoned. This usually requires from 7 to 14 hours. The temperature within the treating cylinder during the vacuum period is usually maintained between 180 and 212° F.

(*c*) Oil injected at a pressure of 80 to 140 pounds per square inch until desired absorption is obtained.

10. *Wellhouse.*

Patented in 1879 by William Wellhouse and Erwin Hagen. (See U. S. patent 216589.)

Used chiefly for ties.

Consists essentially of the following steps:

(*a*) A solution consisting of 1½ to 3 per cent of zinc chloride and ½ per cent of glue is injected into the wood at a pressure of about 125 pounds per square inch for 3 to 6 hours.

(*b*) The pressure is released, cylinder drained and a ½ per cent solution of tannin is injected at a pressure of about 125 pounds per square inch for about 2 hours.

The object of the glue, followed by the tannin, is to form a leathery precipitate to plug the pores in the wood and retard the leaching of the zinc chloride.

United States Department of Agriculture, Bureau of Public Roads, specification for piling, revised May 14, 1924.

Treatment of piles.

When noted on the plans piles shall be treated with the creosote oil or creosote coal-tar solution described in the specifications for timber structures, revised May 14, 1924, above.

The ranges of pressure, temperature, and time duration of treatment shall be controlled so as to result in maximum penetration of the quantity of

preservative injected, which shall permeate all of the sapwood, and as much of the heartwood as practicable.

For general construction, not in sea water, piles shall be treated to retain not less than 12 pounds of the preservative per cubic foot of wood by any full-cell process or not less than 8 pounds by any standard empty-cell process.

Piles for use in water liable to be infested by marine borers along the North Atlantic coast shall be treated to retain not less than 20 pounds of grade 1 creosote oil by any standard full-cell process, and along the Pacific coast not less than 16 pounds of grade 1 creosote oil by any standard full-cell process for all kinds of timber except Douglas fir. Douglas fir shall be treated to retain not less than 12 pounds of grade 1 creosote oil by any standard full-cell process. Timber for other uses in these waters shall be treated by a full-cell process so as to have full penetration of all sapwood and as much of the heartwood as practicable and to retain not less than 12 pounds of grade 1 creosote oil, except Douglas fir, which shall be treated to retain not less than 10 pounds by any standard full-cell process.

Piles for use in water liable to be infested by marine borers along the South Atlantic and Gulf coasts shall be treated to retain not less than 24 pounds of grade 1 creosote oil by any standard full-cell process. Timber for other uses in these waters shall be treated by any standard full-cell process so as to have full penetration of all sapwood and as much of the heartwood as practicable and to retain not less than 16 pounds of grade 1 creosote oil.

Treated piles and timbers shall be carefully handled without sudden dropping, breaking of outer fibres, bruising or penetrating the surface with tools. They shall be handled with rope slings. Cant dogs, hooks, or pile poles shall not be used.

All places where the surface of treated piles or timbers is broken by cutting, boring or otherwise shall be thoroughly coated with hot creosote oil and then with a coating of hot tar pitch. Hot creosote oil shall be poured into the bolt holes before the insertion of the bolts in such manner that the entire surface of the holes shall receive a coating of the oil.

After the necessary cutting has been done to receive the cap, the heads of treated piles shall be given three coats of hot creosote oil. They shall then be covered with a coat of hot tar pitch over which shall be placed a sheet of three-ply roofing felt or galvanized iron, or a covering may be built up of alternate layers of hot tar pitch and loose woven fabric similar to membrane waterproofing using four layers of pitch and three of the fabric. The cover shall measure at least 6 inches more in each dimension than the diameter of the pile and shall be bent down over the pile and the edges fastened with large-headed nails or secured by binding with galvanized wire.

U. S. Department of Agriculture, Bureau of Public Roads, specification for timber structures, revised May, 1924.

The preservative treatment for timbers used in timber structures is similar to the empty-cell and full-cell methods of treatment of the American Wood-Preservers' Association, above.

400.43 Brush and Open-Tank Treatment Processes.

American Association of State Highway Officials, standard specifications for highway bridges and incidental structures—preservative treatment for timbers, surface treatments—1926.

OPEN-TANK TREATMENTS

Open tank treatment shall consist of a hot-bath treatment or a hot and cold bath treatment as may be specified.

Equipment.

All tanks used in the open-tank process shall be of sufficient size to allow free circulation of the liquid around the largest amount of timber being treated in any operation.

Sufficient liquid shall be maintained in the tanks to completely immerse the timber. When a number of pieces are being treated at each operation, each stick shall be separated from the others on all sides by square or round spacers not less than ¼ inch in least dimension. Suitable slings and handling devices shall be provided to make the material transfers necessary during the complete process without disturbing the stacked position of the pieces in the bundle.

For hot-bath treatments at least one tank shall be supplied having suitable steam coils or other heating device to keep the liquid at a uniform temperature throughout the tank of not less than 240° F. during the complete process.

For hot and cold bath treatments at least one hot tank shall be supplied as for the hot-bath treatment and one cold tank having the same capacity as the hot tank. The cold tank shall be equipped with suitable cold water coils or water jackets so that the temperature of the liquid at the time of immersion of each batch of timber shall be no higher than the surrounding atmospheric temperature.

Preparation of material.

All timber to be treated shall be free from dirt, grease, or other foreign matter which will in any way hinder the free penetration of the preservative. Framing shall be done before treatment. Round timber or timber with wane shall have the rough bark and inner bark removed as specified for wood piling by this association in 412.0.

Time of immersion.

The time of immersion as specified herein is for southern yellow pine, northern white cedar, chestnut, black gum, West Coast hemlock, red oak, lodge pole pine, Norway pine, and Pondosa pine. The specified time of immersion shall be increased 66⅔ per cent for southern cypress, Douglas fir and red fir, Idaho white pine and northern white pine, and 100 per cent for white oak and eastern, Engelmann, and Sitka spruce.

Single or hot-bath treatment.

The timber shall be completely immersed in preservative in the hot tank, which shall be maintained at a temperature of 190° F. for seasoned timber and 230° F. for timber not seasoned. A tolerance of 10° in either direction is permissible. For seasoned timber the immersion shall be for a period of not less than 15 minutes for 2-inch timber with an increase of 5 minutes in the immersion period for each additional inch in thickness. For timber other than seasoned the immersion period shall be doubled.

Ordinary hot and cold treatment.

The timber shall be completely immersed in preservative in the hot tank, which shall be maintained at a temperature of 190° F. for seasoned timber and 230° F. for timber not seasoned. A tolerance of 10° in either direction is permissible. For seasoned timber the immersion shall be for a period of not less than 15 minutes for 2-inch timber with an increase of 5 minutes in the immersion period for each additional inch in thickness. For timber other than seasoned the immersion period shall be doubled. At the end of this period the timber shall be removed from the hot tank and immediately immersed in the cold tank. At the time of transfer the preservative in the cold tank shall have a temperature as low as possible, but in no case higher than the surrounding air temperature. The timber shall be completely immersed in the cold tank for a period one-half as long as the hot bath.

Successive charges from the hot tank may be placed first in one cold tank and the next in a second cold tank in order to keep the cold-tank temperature as low as possible at the time of immersion. Should the contractor supply a cold tank capable of handling all material and with a cooling system which will keep the temperature at the time of all cold treatments as specified, only one cold tank may be required. Single cold-tank equipment shall be subject to the approval of the engineer.

Heavy hot and cold treatment.

The requirements for this treatment are the same as those specified above for the ordinary hot and cold treatment, except that the time of immersion in the cold bath shall be the same as the time of immersion in the hot bath.

BRUSH TREATMENT

All timber to be given brush treatment shall be free from atmospheric moisture and in no case shall brush treatment be applied when the surface of the timber is wet. The surfaces to be treated shall be free from dirt, grease, or other foreign matter which will in any way hinder the maximum penetration of the preservative.

The preservative shall be heated in proper receptacles immediately adjacent to the point of application and shall be applied within the temperature range of 170 to 190° F. for seasoned wood and 220 to 240° F. for unseasoned wood.

A minimum of two coats shall be applied to all surfaces to be treated except cut ends, joints, and mortises which shall be given three coats. Each coat shall be allowed to penetrate before applying the next coat. All checks, bolt holes, and cracks shall be run full of the preservative oil and an extra heavy treatment shall be given to knotty spots.

SPRAY TREATMENT

The condition of the timber prior to spray treatment shall conform to the requirements specified for brush treatment.

The temperature of the preservative shall be maintained at 240° F. The shortest length of hose practicable shall be used to prevent undue chilling between the spray tank and nozzle. Preservative shall be renewed frequently in the spray tank to prevent chilling. The spray shall be applied with a good pressure and only fine enough to prevent waste until the preservative begins to run. Equipment employing air pressure which has a cooling effect on the hot preservative shall not be used.

Two liberal applications shall be made, allowing sufficient time for the absorption of the first application before the second is made.

American Electric Railway Engineering Association, specification for nonpressure (open tank, brush, and spray) treatments in general, serial No. WP106, adopted 1926.

This specification is similar to the standard specifications for highway bridges and incidental structures—preservative treatment for timbers, surface treatments of the American Association of State Highway Officials given in full above.

American Electric Railway Engineering Association, specification for brush treatment of wood, poles, serial No. WP107, approved 1926.

1. *Treatment of new poles prior to installation.*

The pole must have all outer and inner bark removed, and for the best results the hard surface of sapwood should be shaved off in the area near the ground line where decay generally occurs in any particular locality. This should be at least 1 foot above the ground line and 2 feet below the ground line, but in some localities it will be found that decay occurs deeper and the area to be treated should be determined by a consideration of local conditions. This prepared area, knots, broken surfaces, gains, and roofs should be treated with two coats of hot carbolineum or heavy grade creosote oil applied at a temperature of from 175 to 200° F. If poles have been exposed for a long period in the pole yard after treatment an additional coat of preservative should be applied just prior to installation. Before the preservative is applied it is essential that all traces of decayed wood be removed and sound wood exposed. This decayed wood should be burned in order to prevent the spread of decay to good timber. The oil should be applied hot with a wire-bound bristle brush with a long handle and worked well into the checks, leaving a liberal excess on the entire surface being treated. If the preservative coating is damaged in any way during handling or otherwise, another coat should be applied to such points of damage.

2. *Treatment of wood poles in place where decay has started at ground line but has not progressed to the point where removal would be justified.*

The earth should be removed for about 2 feet below the surface of the ground or to such depth as decay has progressed and all trace of rot cut away and destroyed. A long-handled chisel or other convenient tool should be used so that the cutting can be worked from the top and bottom toward the center. It must be remembered that any trace of decay will allow the spread of the wood-destroying fungi in the sound wood. After the sound wood has become thoroughly dried it should be given at least two coats of hot carbolineum or heavy grade creosote oil applied at the same temperature as under No. 1 above.

Rotted wood at knots or elsewhere should be entirely cut away and the exposed sound wood treated.

3. *Treatment of poles which have been removed and decayed to a small extent but where decay has not progressed sufficiently to warrant scrapping the pole or cutting back to shorter length before reusing.*

These poles should be treated in the same manner as under No. 2 above, except that the work can be done more conveniently and effectively when the pole is out of the ground or in the pole yard.

4. *Treatment of poles at the new ground line when cutting back to shorter length after removing, or on account of decay.*

The new ground line will be in an area of weathered wood which will take treatment very readily and which would decay very rapidly without treatment. The area to be treated should be given not less than two and preferably three coats of hot carbolineum in the same manner as under No. 1, above.

5. *Treatment of poles which have become weakened by decay and are to be strengthened or reinforced in place with a jacket of plain concrete or reinforced concrete.*

All decayed wood should be cut away and destroyed by burning and the wood pole treated as under No. 2 above before the reinforcement has been applied. Otherwise the growth of wood-destroying fungi will continue although at a reduced rate. The application of the carbolineum or heavy grade creosote oil will prevent further decay and will have no effect on the concrete.

6. *Treatment of a stub pole lashed to a pole that has failed due to decay at the ground line or otherwise.*

This stub pole should be treated in the same manner as a new pole or as an old pole that has been cut back.

American Railway Association, Telephone and Telegraph Section, specification for butt treatment of cedar poles in open tanks, 1925.

This specification covers the butt treating of cedar poles with creosote or dead oil of coal tar. Poles treated under this specification shall conform to A. R. A. specification for cedar poles.

Dead oil of coal tar.

The dead oil of coal tar used for impregnating poles under this specification shall conform to the requirements of A. R. A. specification for creosote grade 1.

Preparation for treatment.

When poles are subjected to a perforating treatment the perforations must be made by machine and the method used must be such as to avoid tearing the fiber of the pole at the point of perforation. The perforations shall not exceed ½ inch in depth or ⅛ inch in width. The distance between the edges of the adjacent perforations measured along the surface shall not be less than ⅜ inch in a plane perpendicular to the axis of the pole and not less than ⅝ inch in any other plane.

Draw shaving.—All outer bark and all foreign substances shall be thoroughly removed from the required minimum length of treated surface specified below. All inner fibrous bark shall be removed from at least the upper 3 feet of the required minimum length of surface to be treated.

Seasoning.—All poles which are held for seasoning shall be stacked on land from which the underbrush has been removed. The bottom layer of any pile of poles held for seasoning shall be supported upon skids so that no part of the poles will be less than 1 foot above the surface of the ground, or any vegetation growing thereon.

Poles to be treated shall be separated with respect to their period of seasoning into groups for separate treatments. Poles shall be considered as seasoned, partially seasoned, and green when the holding period is in accordance with length of time specified in the following table:

Seasoning group	Duration of holding period	
	For poles held in a location north of the thirty-eighth degree of latitude	For poles held in a location south of the thirty-eighth degree of latitude
"S" (seasoned)	Poles which have been held either from Apr. 1 to Oct. 1, or otherwise for not less than 9 months.	Poles which have been held either from May 1 to Sept. 1, or otherwise for not less than 6 months.
"PS" (partially seasoned).	Poles which have been held for at least 3 months between Apr. 1 and Oct. 1, or otherwise for not less than 6 months.	Poles which have been held for at least 2 months between Oct. 1, or otherwise for not less than 4 months.
"G" (green)	Poles not included in either of the above groups.	Poles not included in either of the above groups.

Classification for treatment.

Only poles of the same seasoning group shall be treated in the same charge. Poles of different lengths or different classes shall not be treated in the same charge, unless the level of the oil in the tank will insure the required minimum length of treated section for the longest pole, and provided there will be no additional cost to the purchaser for the extra treatment of the shorter poles.

Length of section to be treated.—The butts of all poles furnished under this specification shall be treated with creosote to at least the height set forth in the accompanying table:

Length of section to be treated

Length of pole in feet	Minimum length of treated section for each class of pole, measured from butt to pole			
	Class AA	Class A	Class B	Classes C and D
	Feet	Feet	Feet	Feet
15	6	5½	5½	5½
18	6	5½	5½	5½
20	6½	6½	6	5½
22	6½	6½	6	5½
25	7	6½	6½	6
30	7½	7	6½	6½
35	7½	7½	7	6½
40	8	7½	7½	7
	Feet		Feet	
45	8		7½	
50	8½		8	
55	8½		8	
60	9		8½	
65	9½		9	
70	9½		9	
75	10		9½	

Temperature of creosote.—The temperature of the creosote used must not exceed 230° F. at any time during the treating period.

Ground line.—The distance of the ground line from the butt for the various classes and lengths of poles is given in the following table:

Location of standard ground line

Length of pole in feet	Distance of ground line from butt of pole			
	Class AA poles	Class A poles	Class B poles	Class C and D poles
	Feet	Feet	Feet	Feet
15	4½	4½	4	4
18	4½	4½	4	4
20	5	5	4½	4
22	5	5	4½	4
25	5½	5	5	4½
30	6	5½	5	5
35	6	6	5½	5
40	6½	6	6	5½
	Feet		Feet	
45	6½		6	
50	7		6½	
55	7		6½	
60	7½		7	
65	8		7½	
70	8		7½	
75	8½		8	

Western Red Cedar Association, specifications for butt treating cedar poles in open tanks, March 10, 1922.[2]

[2] In 1926 the Western Red Cedar Association cooperated with the American Wood-Preservers' Association in the preparation of specifications for the preservative treatment of poles of the durable species by nonpressure processes. These specifications have been tentatively accepted, subject to final action.

Condition and preparation of poles for butt treatment.

Poles shall be seasoned at least four seasoning months before treatment.

SEASONING CALENDAR

Calendar months:	Seasoning month
January equals	⅛
February equals	⅛
March equals	¼
April equals	½
May equals	¾
June equals	1
July equals	1
August equals	1
September equals	1
October equals	¾
November equals	⅜
December equals	⅛

All fibrous inner bark and foreign substance must be thoroughly removed from that portion of the pole between the points of 1 foot above and 2 feet below the ground line.

Ground line and minimum length of treated section

Length of pole in feet	Distance of ground line above butt	Minimum length of treated section, measured from butt of pole
	Feet	Feet
20 or less	4	5½
25	5	6
30	5½	6½
35	6	7
40	6	7
45	6½	7½
50	7	8
55	7½	8½
60	8	9
65	8½	9½
70	9	10

There are three classes of treatment: "B," "AA," and "A."

TREATMENT "B"

Alternate hot and cold treatment for a minimum duration of six hours creosote, as preservative.

Method and duration of treatment.

The poles shall be placed in upright tanks with the butts fully and continuously submerged in the preservative, to the height as shown in the above table. The duration of treatment shall be divided between a hot and cold bath. The poles shall remain in the hot bath for a minimum of four continuous hours, after which they shall be subjected to the cold bath in which they shall remain for a minimum of two hours.

Preservative.

Creosote. (See 400.41.)

Temperature of the preservative.

The preservative constituting the hot bath shall be heated to a temperature of 212° F., at least once in every four hours and shall not be allowed to fall below 180° F. or reach above 230° F.

The temperature of the preservative constituting the cold bath shall not exceed 112° F. at the conclusion of the treatment.

TREATMENT "AA"

Creosote as preservative.

Method and duration of treatment.

The poles shall be placed in an upright tank with the butts fully and continuously submerged in the preservative, to the height as shown in the above table, for not less than 15 minutes when the atmospheric temperature is 70° F. or higher, and a proportionately longer time when the temperature is below that point; that is, during the colder weather the time of immersion must be sufficiently longer to result in the wood becoming as thoroughly heated as it would be under a 15-minute treatment when the atmospheric temperature is 70° F. or higher.

Preservative.

Creosote. (See 400.41.)

Temperature of the preservative.

The preservative shall be heated to a temperature of 215° F., and shall not be allowed to fall below 180° F. or reach above 230° F.

TREATMENT "A"

Carbolineum as preservative.

Specifications for this treatment are the same as those for treatment "AA," except that the preservative used will be carbolineum. (See 400.41.)

American Wood-Preservers' Association, standard definitions of nonpressure processes, 1921.

BRUSH TREATMENT

Used frequently on poles and construction timber.

Consists in applying the hot preservatives to the dry timber by means of a brush. Two coats, 24 hours apart, are customarily used.

OPEN-TANK TREATMENT

Can be accomplished in two general ways:

(*a*) *Dipping.*

Consists in submerging the wood in hot preservative for 5 to 15 minutes.

(*b*) *Hot and cold bath.*

More effective than (*a*).

Consists essentially of the following steps:

(*a*) The wood is heated in oil at 200 to 225° F. for one or more hours.

(*b*) It is then either quickly transferred to a tank of cool creosote and allowed to stand several hours, or the heating is discontinued after (*a*) and the wood and oil allowed to cool together. These methods are frequently used for posts, poles, and other timbers in cases where it is not desirable to use a more effective treatment.

KYAN (KYANIZING)

Patented in England by John H. Kyan in 1832. (British patents No. 6253, September, 1832, and No. 7001, March, 1836.)

Used for ties and construction timber.

Consists in soaking seasoned wood in a solution of mercuric chloride (usually 1 per cent) in an open vat of wood or concrete. It is customary to allow the wood to soak one day, or more than one day, for each inch in thickness.

The original Kyan patent specified a solution of 1 pound of corrosive sublimate to 5 gallons of water (about 2.4 per cent), and the wood was soaked from 14 to 21 days.

Other preservatives, such as zinc chloride or sodium fluoride in water solutions, may be used in the same manner, except that the solution should be stronger.

The term Kyan process, or Kyanizing, however, is limited to the use of mercuric chloride. When other preservatives are used the process is called "steeping" or "soaking."

400.5 FIRE RETARDING TREATMENT FOR WOOD.

There are no nationally recognized specifications for fire-retarding treatments for lumber. The National Bureau of Standards, the Forest Product Laboratory, and the National Lumber Manufacturers Association, are preparing to conduct tests and investigations in the effort to determine the basis for specifications for processes for treatment and standard fire tests of combustible material.

American Society for Testing Materials, tentative specification for fire tests of building construction and material, C19–26T, 1926.

This specification was proposed by the Sectional Committee on Fire Test Specifications, under the joint sponsorship of the National Bureau of Standards, the A. E. S. C. Fire Protection Group, and the American Society for Testing Materials; functioning under the procedure of the American Engineering Standards Committee.

This specification is a review of the existing standard (A. S. T. M. C19–18) approved March 1, 1919, as a tentative American standard by the American Engineering Standards Committee.

The test methods are applicable to assemblies of masonry units and to composite assemblies of structural materials for buildings, including bearing and other walls and partitions, columns, girders, beams and slabs, and composite slab and beam assemblies for floors and roofs. They are also applicable to other assemblies and structural units which constitute permanent integral parts of a finished building.

It is the intent that classifications shall register performance during the period of exposure and shall not be construed as having determined suitability for use after fire exposure.

The complete specification includes:

I. Control of fire tests.

II. Classification as determined by test.

III. Test structures.
IV. Test samples.
V. Conduct of fire tests.
VI. Tests of bearing walls and partitions.
VII. Tests of nonbearing walls and partitions.
VIII. Tests of columns.
IX. Tests of floors and roofs.
X. Tests of finish for walls, partitions, and ceilings.

401. RAW AND HEWN TIMBERS.

(See also 412.)

401.1 RAILROAD TIES.

401.10 General Items.

American Electric Railway Engineering Association, standard specifications for crossties, serial No. W26–26, 1926.

These specifications are identical with the specifications for ties formulated by the American Railway Engineering Association and the United States Forest Service as sponsors, and approved by the American Engineering Standards Committee, and published by the American Railway Association, engineering division. The latter specifications are given below.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

SPECIFICATION FOR CROSSTIES

Material

Kinds of wood.[3]

1. Before manufacturing ties, producers shall ascertain which of the following kinds of wood suitable for crossties will be accepted:

Ashes	Hickories.
Beech.	Larches.
Birches.	Locusts
Catalpas.	Maples.
Cedars.	Mulberries.
Cherries.	Oaks.
Chestnut.	Pines.
Cypresses.	Poplars.
Douglas fir.	Redwoods.
Elms.	Sassafras.
Firs (true).	Spruces.
Gums.	Sycamores.
Hackberries.	Walnuts.
Hemlocks.	

Others will not be accepted unless specially ordered.

PHYSICAL REQUIREMENTS

General quality.

2. Except as hereinafter provided, all ties shall be free from any defects that may impair their strength or durability as crossties, such as decay, large splits, large shakes, large or numerous holes or knots, grain with slant greater than 1 in 15.

[3] Each railway will specify only the kind or kinds of wood it desires to use.

Resistance to wear.

3. When so ordered, ties from needle-leaved trees shall be of compact wood throughout the top fourth of the tie, where any inch of any radius from the pith shall have six or more rings of annual growth.

Resistance to decay.

4. Ties for use without preservative treatment shall not have sapwood wider than one-fourth the width of the top between 20 inches and 40 inches from the middle of the tie, and will be designated as "heart" ties. Those with more sapwood will be designated as "sap" ties.

Design

Dimensions.[4]

5. Before manufacturing ties, producers shall asertain which of the following lengths, shapes, or sizes will be accepted, and whether ties are to be hewed or sawed, and in either case whether on the sides as well as the top and the bottom.

6. Except as hereinafter provided, standard-gauge railway ties shall be 8 feet, 8 feet 6 inches, or 9 feet long.

7. Except as hereinafter provided, ties shall measure as follows throughout both sections between 20 inches and 40 inches from the middle of the tie:

8.

Size	Sawed or hewed top, bottom, and sides	Sawed or hewed top and bottom
0	5 inches thick by 5 inches wide on top.[1]	5 inches thick by 5 inches wide on top.
1	6 inches thick by 6 inches wide on top.[1]	6 inches thick by 6 inches wide on top.
2	6 inches thick by 7 inches wide on top.	6 inches thick by 7 inches wide on top.
3	6 inches thick by 8 inches wide on top.	6 inches thick by 8 inches wide on top. 7 inches thick by 7 inches wide on top.[2]
4	7 inches thick by 8 inches wide on top.	7 inches thick by 8 inches wide on top.
5	7 inches thick by 9 inches wide on top.	7 inches thick by 9 inches wide on top.
6	7 inches thick by 10 inches wide on top.	7 inches thick by 10 inches wide on top.

[1] None accepted in standard-gauge railway ties.
[2] Railways which specify both 6 by 8 inch and 7 by 7 inch ties manufactured on top and bottom only and which desire to separate the 6-inch from the 7-inch ties will designate the 7 by 7 inch as size 3A.

Manufacture

9. Except as hereinafter provided, all ties shall be straight, well hewed or sawed, cut square at the ends, have bottom and top parallel, and have bark entirely removed.

Inspection

Place.

10. Ties will be inspected at suitable and convenient places satisfactory to the railway, at points of shipment, or at destination. Ties will be inspected

[4] Each railway will specify only the length or lengths, shape or shapes, and size or sizes it desires to use; but each railway will use the standard designation for whatever size of tie it specifies. For example, a railway desiring 6 by 8 inch ties only will designate them as size 3; a railway desiring 7 by 9 inch ties only will designate them as size 5. A railway shall not, for instance, designate 6 by 8 inch ties as size 1 and 6 by 6 inch as size 2 or 7 by 9 inch as size 1 and 7 by 8 inch as size 2.

at points other than the railway's property whenever in the judgment of the railway there is sufficient number to warrant it; but the shipper shall provide accommodations for the inspector, at the expense of the railway, while away from rail or steamer lines, and transport him from and to a railway station or steamer landing.

Manner.

11. Inspectors will make a reasonably close examination of the top, bottom, sides, and ends of each tie. Each tie will be judged independently, without regard for the decisions on others in the same lot. Rafted or boomed ties too muddied for ready examination will be rejected. Ties handled by hoists will be turned over as inspected, at the expense of the producer.

Decay.

12. The following decay will be allowed: In cedar and in cypress, "pipe or stump rot" and "peck," respectively, up to the limitations as to holes; in chestnut, "bark disease" up to ¼ inch deep. "Blue stain" is not decay and is permissible in any wood.

Holes.

13. A large hole, other than one caused by "pipe or stump rot" in cedar, is one more than ½ inch in diameter and 3 inches deep within, or more than one-fourth the width of the surface on which it appears and 3 inches deep outside, the sections of the tie between 20 inches and 40 inches from its middle. A cedar tie with a pipe or stump rot hole more than 1½ inches in diameter and 15 inches deep will be rejected. Numerous holes are any number equaling a large hole in damaging effect. Such holes may be caused in manufacture or otherwise.

Knots.

14. A large knot is one whose average diameter exceeds one-fourth the width of the surface on which it appears; but such a knot may be allowed if it occurs outside the sections of the tie between 20 and 40 inches from its middle.

Numerous knots are any number equaling a large knot in damaging effect.

Shake.

15. One which is not more than one-third the width of the tie will be allowed.

Split.

16. One which is not over 10 inches long will be allowed, provided a satisfactory antisplitting device has been properly applied.

Manufacture.

7. A tie will be considered straight (1) when a straight line along the top from the middle of one end to the middle of the other end is entirely within the tie, and (2) when a straight line along a side from the middle of one end to the middle of the other end is everywhere more than 2 inches from the top and the bottom of the tie.

18. A tie is not well hewed or sawed when its surfaces are cut into with score marks more than ½ inch deep or when its surfaces are not even.

19. The top and bottom of a tie will be considered parallel if any difference in the thicknesses at the sides or ends does not exceed ½ inch.

Dimensions

20. The lengths, thicknesses, and widths specified will be considered met by ties 1 inch shorter and ¼ inch thinner and narrower than the standard sizes. Ties over 1 inch, but not over 2 inches, more in thickness than the maximum ordered will be accepted as one size below the largest tie ordered. Those over 2 inches more in thickness, those over 3 inches more in width, or those over 2 inches more in length than the maximum ordered will be rejected. Ties will be sized up by their smaller ends and sized down by their larger ends. The dimensions of the tie will not be averaged.

21. All thicknesses and widths apply to the sections of the tie between 20 and 40 inches from the middle of the tie. All determinations of width will be made on the top of the tie, which is the narrower of the horizontal surfaces, or the one with narrower or no heartwood if both horizontal surfaces are of the same width.

Delivery

22. Ties delivered on the premises of a railway for inspection shall be stacked not less than 10 feet from the nearest rail of any tract at suitable and convenient places, but not at public crossings, nor where they will interfere with the view of trainmen or of people approaching the railway. Standard-gauge ties shall be stacked in alternate layers of 2 and 7, the bottom layer to consist of 2 ties kept at least 6 inches above the ground. The next layer shall consist of 7 ties laid crosswise of the first layer. When the ties are rectangular, the 2 outside ties of the layers of 7 and the layers of 2 shall be laid on their sides. The ties in layers of 2 shall be laid at the extreme ends of the ties in the layers of 7. No stack may be more than 12 layers high, and there shall be 5 feet between stacks to facilitate inspection. Ties which have stood on their ends on the ground will be rejected.

23. Each stack shall have fastened to it a tag on which is written the owner's name and address, the date when stacked, and the number of ties of each kind of wood in the stack.

24. All ties are at the owner's risk until accepted. All rejected ties shall be removed within one month after inspection.

25. Ties shall be stacked as grouped below. Only the kinds of wood named in a group may be stacked together.

26. Class U —Ties which may be used untreated:

Group Ua	Group Ub
"Heart" black locust.	"Heart" Douglas fir.
"Heart" white oaks.	"Heart" pines.
"Heart" black walnut.	"Heart" larches.

Group Uc

"Heart" cedars.
"Heart" cypresses.
"Heart" redwood.

Group Ud

"Heart" catalpas.
"Heart" chestnut.
"Heart" sassafras.
"Heart" red mulberry.

27. Class T.—Ties which should be treated:

Group Ta

Ashes.
Hickories.
"Sap" black locust.
Honey locust.
Red oaks.
"Sap" white oaks.
"Sap" black walnut.

Group Tc

Beech.
Birches.
Cherries.
Gums.
Hard maples.

Group Tb

"Sap" cedars.
"Sap" cypresses.
"Sap" Douglas fir.
Firs (true).
Hemlocks.
"Sap" larches.
"Sap" pines.
"Sap" redwood.
Spruces.

Group Td

"Sap" catalpas.
"Sap" chestnut.
Elms.
Hackberries.
Soft maples.
"Sap" mulberries.
Poplars.
"Sap" sassafras.
Sycamores.
White walnut.

Shipment

28. Ties forwarded in cars or vessels shall be separated therein according to the above groups, and also according to the above sizes if inspected before loading, or as may be stipulated in the contract or order for them.

SPECIFICATION FOR SWITCH TIES

Material

Kinds of wood.[5]

1. Before manufacturing ties, producers shall ascertain which of the following kinds of wood suitable for switch ties will be accepted:

Ashes.
Beech.
Birches.
Cedars.
Cherries.
Chestnut.
Cypresses.
Douglas fir.
Elms.
Firs (true).
Gums.
Hemlocks.
Larches.
Locusts.
Maples.
Oaks.
Pines.
Redwood.
Spruces.
Walnuts.

Others will not be accepted unless specially ordered.

Physical Requirements

General quality.

(Same as for crossties. See above.)

Resistance to wear.

(Same as for crossties.)

Resistance to decay.

4. Ties for use without preservative treatment shall not have sapwood wider than one-fourth the width of the top between 12 inches from each end of the tie and will be designated as "heart" ties. Those with more sapwood will be designated as "sap" ties.

Design

Dimensions.[6]

5. Before manufacturing ties, producers shall ascertain what sizes will be accepted and whether ties are to be hewed or sawed, and in either case whether on the sides as well as on the top and the bottom.

6. Except as hereinafter provided, all ties shall be either 6 or 7 inches thick as ordered.

7. Except as hereinafter provided, ties sawed or hewed on top, bottom, and sides shall be not less than either 7, 8, or 9 inches wide on top throughout the section between 12 inches from each end of the tie, as ordered; ties sawed or hewed on top and bottom only shall be not less than either 6 or 7 inches wide on top throughout the section between 12 inches from each end of the tie, as ordered.

8. Each tie shall be of a length specified below:

(Insert complete bill of material here.)

Manufacture

(Same as for crossties.)

Inspection

Place.

(Same as for crossties, except for holes, knots, and dimensions which are as given below.)

Holes.

13. A large hole, other than one caused by "pipe or stump rot" in cedar, is one more than ½ inch in diameter and 3 inches deep within, or more than one-fourth the width of the surface on which it appears and 3 inches deep outside, the section of the tie between 12 inches from each end of the tie. A cedar tie with a pipe or stump rot hole more than 1½ inches in diameter and 15 inches deep will be rejected. Numerous holes are any number equaling a large hole in damaging effect. Such holes may be caused in manufacture or otherwise.

Knots.

14. A large knot is one whose average diameter exceeds one-fourth the width of the surface on which it appears; but such a knot may be allowed if it occurs outside the section between 12 inches from each end of the tie. Numerous knots are any number equaling a large knot in damaging effect.

Dimensions.

20. The lengths, thicknesses, and widths specified will be considered met by ties 1 inch shorter and ¼ inch thinner and narrower than the standard sizes. Ties over 1 inch more in thickness, over 3 inches more in width, or over 2 inches more in length than the maximum ordered will be rejected. The dimensions of the tie will not be averaged.

[5] Each railway will specify only the kind or kinds of wood it desires to use.

[6] Each railway will specify only the shape or shapes and size or sizes it desires to use.

21. All thicknesses and widths apply to the section of the tie between 12 inches from each end of the tie. All determinations of width will be made on the top of the tie, which is the narrower of the horizontal surfaces, or the one with narrower or no heartwood if both horizontal surfaces are of the same width.

Delivery

22. Ties delivered on the premises of a railway for inspection shall be stacked not less than 10 feet from the nearest rail of any track at suitable and convenient places; but not at public crossings, nor where they will interfere with the view of trainmen or of people approaching the railway. Ties shall be stacked at least 6 inches above the ground. No tie shall be unsupported for more than 10 feet of its length. Each layer of ties and the ties in each layer shall be not less than 1 inch apart. Any stacking strips used shall not be over 4 inches wide. If rectangular ties are used to separate the layers, such strip ties shall be laid on their sides and the two outside ties as near as possible to the extreme ends of the ties. No ties shall be permitted to overhang more than 2 feet. No stack of ties shall be wider than 10 feet.

23. Each stack shall have fastened to it a tag on which is written the owner's name and address, the date when stacked, and the number of ties of each kind of wood in the stack.

24. All ties are at the owner's risk until accepted. All rejected ties shall be removed within one month after inspection.

25. Ties shall be stacked as grouped below. Only the kinds of wood named in a group may be stacked together.

26. Class U.—Ties which may be used untreated:

Group Ua	Group Ub
"Heart" black locust.	"Heart" Douglas fir.
"Heart" white oaks.	"Heart" pines.
"Heart" black walnut.	"Heart" larches.
Group Uc	**Group Ud**
"Heart" cedars.	"Heart" chestnut.
"Heart" cypresses.	
"Heart" redwood.	

27. Class T.—Ties which should be treated:

Group Ta	Group Tb
Ashes.	"Sap" cedars.
"Sap" black locust.	"Sap" cypresses.
Honey locust.	"Sap" Douglas fir.
Red oaks.	Firs (true).
"Sap" white oaks.	Hemlocks.
"Sap" black walnut.	"Sap" larches.
	"Sap" pines.
	"Sap" redwood.
	Spruces.
Group Tc	**Group Td**
Beech.	"Sap" chestnut.
Birches.	Elms.
Cherries.	Soft maples.
Gums.	White walnut.
Hard maples.	

Shipment

28. Ties forwarded in cars or vessels shall be separated therein according to the above groups, and also according to the above sets or lengths if inspected before loading, or as may be stipulated in the contract or order for them.

National Association of Railroad Tie Producers, specifications for railroad ties, July, 1926.

This association cooperated in the preparation of the specifications for ties formulated under the auspices of the American Engineering Standards Committee, and approved as American Standard, with the American Railway Engineering Association and the United States Forest Service as sponsors. The specifications were published in the Cross Tie Bulletin of the association, July, 1926.

National Hardwood Lumber Association, grading rules for ties, January, 1927.

The National Hardwood Lumber Association has adopted the specifications for ties formulated by the American Railway Engineering Association and the United States Forest Service as sponsors, and approved by the American Engineering Standards Committee, and published by the American Railway Association, engineering division. These specifications are given above.

401.11 Cedar Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10 include cedar ties.

Northern White Cedar Association, grading rules for white cedar ties, January 31, 1923.

SPECIFICATIONS FOR STANDARD TIES

Standard ties shall be either sawed or hewn on two parallel faces from timber measuring not less than 8 inches and not more than 12 inches in diameter inside the bark at the small end. They shall be not less than 6 inches and not more than 8 inches in thickness. They shall be not less than 7 feet 10½ inches and not more than 8 feet 1½ inches in length and shall have ends sawed square. If sawed on three sides they shall have at least 7 inches of face, and if sawed on four sides they shall have at least 8 inches of face. On sawed ties wane is permissible as long as the serviceability of the tie is not impaired.

Standard ties shall include the run of the tie timber measuring 8 inches and larger in diameter inside the bark at the small end. Standard ties may be divided into classes as follows:

Class A shall include the run of the tie timber measuring not less than 9 inches and up to and including 12 inches in diameter inside the bark at the small end and not less than 6¾ inches in thickness. Ties sawed on three sides and with face of 7

inches or over shall be class A ties. Ties sawed on four sides with face of 8 inches or over shall be class A ties.

Class B shall include the run of the tie timber measuring 8 inches and up to, but not including, 9 inches in diameter inside the bark at the small end. Ties sawed on three sides and having less than 7 inches of face shall be class B ties.

It is understood that the measurement of the face shall be made at the rail bearing.

Ties made of hemlock, tamarack, pine, oak, birch, or other hardwood must be sound. Ties made of cedar must be serviceably sound.

Pacific Lumber Inspection Bureau, grading rules for Port Orford cedar ties, Schedule M, 1925.

PORT ORFORD CEDAR RAILROAD TIES

No. 1 ties shall be sound, cut square, and free from large knots or knot holes where the rails lie, or defects materially impairing the strength or durability. Will allow knots, which approximately shall not be more than one-third the width in diameter of any one side in which they appear; or well scattered, decomposed knots or knot holes not exceeding 1½ inches in diameter. In addition to the above the following will be permitted: Occasional variations in sawing; bark seams; bright sap; sap stain; wane not to exceed 1 inch on one corner measured across the face of tie; season checks, or a few well scattered, small, shallow, decomposed spots appearing on one face or end of tie.

No. 2 ties will allow a variation of 2 inches over or under in length, ½ inch in thickness, and 1 inch over or under in width. Defects not ordinarily allowed in No. 1 ties permitted, provided, however, that each piece must be suitable for tie purposes on sidings. Wane on one corner that does not reduce the face width more than 2 inches or the equivalent on two or more corners, permitted.

PORT ORFORD CEDAR DEGRADE TIES

Will be of ordinary tie grades as described above with this exception, that ties having too much wane or other defects which prevent them being used in the size of which they were originally intended will be shipped and accepted at measurements for thickness and/or width taken inside of defects, provided such measurements, eliminating defects, leave a usable tie size.

401.12 Chestnut Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10, include chestnut ties.

401.13 Cypress Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10, include cypress ties.

Southern Cypress Manufacturers Association, grading rules for cypress railroad ties, June 15, 1925.

RAILROAD MATERIAL

No. 1 Switch ties.

Shall be cut to size and length specified.

Ends of ties shall be sawed square. A variation of ½ inch longer or shorter than the length ordered will be allowed. Shall be graded same as No. 1 timbers.

Standard No. 1 peck crossties.

Shall be cut to size and length specified.

A variation of 1 inch longer or shorter than the length ordered will be allowed. Shall be practically all heart, free from damaging knots, shake, and splits. Peck will be admitted, but there must be enough of sound wood in the ties to permit of proper spiking.

401.14 Fir Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10, include fir ties.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir railroad ties, Schedule M, 1925.

DOUGLAS FIR RAILROAD TIES AND CROSSINGS

Ties and crossings must be cut square, free from large knots where the rails lie, and also free from stain, rot, and large shakes. Will allow wane on one corner not to exceed one-eighth of the face width. Occasional variations in sawing allowed. Sap allowed.

West Coast Lumbermen's Association, grading rules for Douglas fir railroad ties, July 1, 1926.

TIES

Select ties.

Shall be sound timber, well manufactured, and shall average not less than six annual rings per inch in the top one-fourth of the tie. In the sections of the tie between 20 and 40 inches from the middle must be free from large knots, shake, splits, decay, heart stain, and wane. Shall not have sap more than 2 inches wide on the top of the tie in the sections between 20 and 40 inches from the middle.

No. 1 ties.

Shall be sound timber, well manufactured. In the sections of the tie between 20 and 40 inches from the middle must be free from large knots, unsound knots, shake, splits, large pitch seams, decay, and wane on corners reducing face width more than 1 inch.

No. 2 ties.

Must be free from rot, and suitable for sidetrack purposes. Will admit large knots, shake, pitch pockets, sap stain, heart stain, and wane on one corner that does not reduce the face width more than 2 inches, or the equivalent on two or more corners; variation in sawing ½ inch over or under in thickness and/or width, or 2 inches over or under in length.

401.15 Oak Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10 include oak ties.

401.16 Pine Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10 include pine ties.

401.17 Redwood Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10 include redwood ties.

401.18 Walnut Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10 include walnut ties.

401.19 Miscellaneous Specifications for Ties.

American Railway Engineering Association and United States Forest Service, joint sponsors under procedure of the American Engineering Standards Committee, standard specifications for ties, A. E. S. C. No. 03–1926. (Published by the American Railway Association, engineering division.)

These specifications, given under 401.10 include species of wood other than those classified above.

401.2 POSTS.

401.21 Cedar Posts.

Northern White Cedar Association, standard specifications governing the manufacture and grading of northern white cedar posts, February 15, 1927.

Live timber.

All posts shall have been cut and manufactured from live, green growing northern white cedar timber.

NOTE.—The test of live timber is to whittle a shaving from the sapwood. If the sap is white, the timber was live when cut, no matter how discolored the piece may be on the outside.

Limit of maximum defects.

No post shall contain both the maximum crook and the maximum butt rot.

Percentage of maximum defects.

Not more than 10 per cent of the number of pieces of any lot or shipment shall contain the maximum crook or butt rot.

Sizes and method of measuring.

Minimum size of tops shall be as follows:

Diameter measurement

Designated size (inches)	Green or water-soaked	When seasoned
	Inches	*Inches*
2	2	1¾
3	3	2¾
4	4	3¾
5	5	4¾
6	6	5¾
7	7	6¾
8	8	7¾
9	9	8¾

Size of a post not perfectly round shall be determined by its average top diameter. Exception: Sawed posts to have minimum measurement as follows:

⅞ quarters—11¾ inches around the post, 4 inches from top.

$\frac{9}{10}$ quarters—14½ inches around the post, 4 inches from top.

5-inch halves—4¾ inches across face of post, 4 inches from top.

6-inch halves—5¾ inches across face of post, 4 inches from top.

7-inch halves—6¾ inches across face of post, 4 inches from top.

8-inch halves—7¾ inches across face of post, 4 inches from top.

Special requirements for sawed posts.

Sawed posts must be sufficiently straight grained so that the grain entering the post at one corner shall not leave the post on the opposite side.

Lengths.

A variation of 2 inches longer or shorter allowed on all lengths.

Manufacture.

All posts shall be peeled their entire length, knots closely trimmed, and both ends sawed square.

Knots.

Sound knots are permitted if smoothly trimmed. Entirely hollow knots extending in close to center of post not permitted.

Short kinks.

Short kinks not permitted.

Twists.

Winding twist permitted unless very unsightly and exaggerated.

Cat faces.

Not permitted.

Rot.

Butt rot not to exceed 5 per cent of the area of the butt shall be permitted.

(*a*) No post shall be sap rotted, have woodpecker holes, plugged holes, or evidence of having been eaten by ants.

(*b*) Tops must be sound, except that one pipe rot is permitted in posts 5 inches and larger.

(*c*) Length of rot on the face of sawed halves shall not exceed one-half of the length of the post; width of rot shall not average more than 20 per cent of the width of the post for one-half of the length of the post.

(*d*) Rot on corners of sawed quarters shall not exceed an average of half an inch in depth if for entire length of post; 1 inch for half of the length; and 1½ inches for one-fourth of the length.

Discoloration.

Discoloration not considered a defect under these specifications.

Crook or sweep.

Posts 7 and 8 feet—one-way sweep not to exceed 3 inches between top and butt permitted. Posts 10 to 14 feet, inclusive—one-way sweep not exceeding 4 inches between top and butt is permissible.

NOTE.—If the distance between the tape and post does not exceed 3 inches in posts 7 and 8 feet, or 4 inches in post 10 to 14 feet, inclusive in length, the post conforms in grade as outlined by specifications.

401.22 Chestnut Posts.

(No nationally recognized specifications available.)

401.23 Cypress Posts.

(No nationally recognized specifications available.)

401.24 Locust Posts.

(No nationally recognized specifications available.)

401.25 Oak Posts.

(No nationally recognized specifications available.)

401.26 Pine Posts.

(No nationally recognized specifications available.)

401.3 POLES, HEWN AND SAWN.

401.30 General Items.

American Engineering Standards Committee, Telephone Group, proposed specifications for wood poles, 1927.

The telephone group of the American Engineering Standards Committee has in preparation wood pole specifications for approval as American Standards.

These specifications will include the standardization of dimensional classification; defect descriptions and limitations, manufacturing practices and inspection rules for eastern cedar, western cedar, chestnut, and southern pine poles; also standardization of fiber strength for these species in pole sizes.

401.31 Cedar Poles.

American Electric Railway Engineering Association, standard specification for eastern white cedar poles, revised 1926, serial No. D8–26.

To determine the character of poles to be used in trolley-line construction, they may be divided into three classes—A, B, and C.

Class A.

For span construction on streets or rights of way where a 35-foot span is required, or for heavy feeder lines carrying from 1 to 6 cross arms.

Class B.

For span or bracket construction where spans are not more than 35 feet, or bracket-line construction carrying 2 transmission circuits, 1 feeder arm, and 2 telephone and signal arms.

Class C.

For constructing telephone, signal, and other light auxiliary lines where no side strain is required.

EASTERN WHITE CEDAR POLES

General.

The material desired under this specification consists of poles of the best quality of either seasoned or live green cedar of the dimensions hereinafter specified. Seasoned poles shall have preference over green poles, provided they have not been held for seasoning long enough to have developed any of the timber defects hereinafter referred to. All poles shall be reasonably straight, well proportioned from butt to top, shall have both ends squared, the bark peeled, and all knots and limbs closely trimmed.

Dimensions.

The dimensions of the poles shall be in accordance with the following table, the top measurement being the circumference at the top of the pole, and the butt measurement the circumference 6 feet from the butt.

The dimension requirement at the 6-foot mark shall be rigidly followed in all cases. Class A, B, and C poles may have top circumference not more than ½ inch less than these shown in the following table. No pole shall be over 6 inches longer or 3 inches shorter than the length for which it is accepted; if any pole is more than 6 inches longer than is required, it shall be cut back.

Minimum dimensions of eastern white cedar poles (circumference)

Length of poles (feet)	Class A		Class B		Class C	
	Top	Six feet from butt	Top	Six feet from butt	Top	Six feet from butt
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
30	24	40	22	36	18¾	33
35	24	43	22	38	18¾	36
40	24	47	22	43	18¾	40
45	24	50	22	47	18¾	43
50	24	53	22	50	18¾	46
55	24	56	22	53	18¾	49
60	24	59	22	56	------	------

Quality of timber.

(*a*) *Dead poles.*—The wood of a dead pole is grayish in color. No dead poles, and no poles having dead streaks covering more than one-quarter of their surface, shall be accepted. Poles having dead streaks covering less than one-quarter of their surface shall have a circumference greater than otherwise required. The increase in the circumference shall be sufficient to afford a cross-sectional area of sound wood equivalent to that of sound poles of the same class.

(*b*) *Fire-killed or river poles.*—No dark red or copper-colored poles, which when scraped, do not show good live timber shall be accepted.

(*c*) *Twisted, checked, or cracked poles.*—No pole shall have more than one complete twist for every 20 feet in length or shall have a large season check.

(*d*) *"Cat faces."*—Poles shall have no "cat faces" unless they are small and perfectly sound and the poles have an increased diameter at the "cat faces" nor have "cat faces" near the 6-foot mark or within 10 feet of their tops.

(*e*) *Shaved poles.*—Poles shall not be shaved.

(*f*) *Miscellaneous defects.*—No pole shall contain sap rot, evidence of internal rot as disclosed by a careful examination of all black knots, hollow knots, woodpeckers' holes, or plugged holes, and no poles shall show evidence of having been eaten by ants, worms, or grubs, except that poles containing worm or grub marks below the 6-foot mark will be accepted.

(*g*) *Crooked poles.*—No pole shall have a short crook or bend, a crook or bend in two planes, or a reverse curve. The amount of sweep, measured between the 6-foot mark and the top of the pole, that may be present in poles, is shown in the following table:

Length (feet)	Sweep not over—
	Inches
35	10½
40	12
45	10
50	10
55	11
60	12

(*h*) *Defective tops.*—All poles shall have sound tops, with no pencil holes. Poles with double tops or double hearts shall be free from rot where the two parts or hearts join.

(*i*) *Defective butts.*—No pole shall contain ring rot (rot in the form of a complete or partial ring).

Poles may have hollow hearts under the conditions shown in the following table:

Average diameter of hollow heart (inches)	Add to butt requirements of—		
	30-foot poles	35, 40, and 45 foot poles	50,55, 60,and 65 foot poles
	Inches	*Inches*	*Inches*
2	Nothing.	Nothing.	Nothing.
3	1	Nothing.	Nothing.
4	2	Nothing.	Nothing.
5	3	1	Nothing.
6	4	2	1
7	Reject.	4	2
8	Reject.	6	3
9	Reject.	Reject.	4
10	Reject.	Reject.	5
11	Reject.	Reject.	7
12	Reject.	Reject.	9
13	Reject.	Reject.	Reject.

Scattered rot, unless it is near the outside of the pole, may be estimated as being the same as heart rot of equal area.

(*j*) *Wind shakes.*—Poles with cup shakes (checks in the form of rings) which also have heart or star checks may be considered as equal to poles having hollow hearts of the average diameter of the cup shakes.

Rejection.

All poles which fail to meet the requirements hereinabove specified may be rejected.

American Electric Railway Engineering Association, standard specification for western red cedar poles, revised 1926, serial No. D8–26.

To determine the character of poles to be used in trolley-line construction, they may be divided into three classes—A, B, and C. (Same as for eastern white cedar, above.)

WESTERN RED CEDAR POLES

General.

The material desired under this specification consists of poles and guy stubs of the best quality of either seasoned or live green cedar of the dimensions hereinafter specified. The poles covered by this specification are of western red cedar, otherwise known as red cedar, western cedar, or Idaho cedar. Seasoned poles shall have preference over green poles provided they have not been held for seasoning long enough to have developed any of the timber defects hereinafter referred to. All poles shall be reasonably straight, well proportioned from butt to top, shall have both ends squared, sound tops, the bark peeled, and all knots and limbs closely trimmed.

Dimensions.

The dimensions of the poles shall be in accordance with the following table, the top measurement being

the circumference at the top of the pole, and the butt measurement the circumference 6 feet from the butt. The dimensions given are the minimum allowable circumferences at the point specified for measurement and are not intended to preclude the acceptance of poles of larger dimensions. No pole shall be over 6 inches longer or 3 inches shorter than the length for which it is accepted. If any pole is 6 inches longer than is required it shall be cut back.

Minimum dimensions of poles (circumference)

Length of poles (feet)	Class A	Class B	Class C
	Top 28 inches	Top 25 inches	Top 22 inches
	Butt	Butt	Butt
	Inches	*Inches*	*Inches*
30	37	34	30
35	40	36	32
40	43	38	34
45	45	40	36
50	47	42	38
55	49	44	40
60	52	46	41
65	54	48	43

Quality of timber.

(*a*) *Dead poles.*—No dead poles and no poles having dead streaks covering more than one-quarter of their surface shall be accepted. Poles having dead streaks covering less than one-quarter of their surface shall have a circumference greater than otherwise required. The increase in the circumference shall be sufficient to afford a cross-sectional area of sound wood equivalent to that of sound poles of the same class.

(*b*) *Twisted, checked, or cracked poles.*—No poles shall have more than one complete twist for every 20 feet in length or shall have a large season check or crack.

(*c*) *Crooked poles.*—No pole shall have a short crook or bend, a crook or bend in two planes, or a reverse crook or bend. The amount of sweep measured between the 6-foot mark and the top of the pole shall not exceed 1 inch to every 6 feet in length.

(*d*) *"Cat faces."*—Poles shall have no "cat faces" unless they are small and perfectly sound, and the poles have an increased diameter at the "cat face," nor have "cat faces" near the 6-foot mark, or within 10 feet of their tops.

(*e*) *Shaved poles.*—Poles shall not be shaved.

(*f*) *Wind shakes.*—No poles having cup shakes (checks in the form of rings) shall contain heart or star shakes which inclose more than 10 per cent of the area of the butt.

(*g*) *Butt rot.*—No poles shall have butt rot covering in excess of 10 per cent of the total area of the butt. The butt rot, if present, must be located close to the center.

(*h*) *Knots.*—Large knots, if sound and trimmed close, shall not be considered a defect. No poles shall contain hollow or rotten knots.

(*i*) *Miscellaneous defects.*—No pole shall contain sap rot, woodpecker's holes, or plugged holes, nor show evidence of having been eaten by ants, worms, or grubs.

Rejection.

All poles which fail to meet the requirements hereinbefore specified may be rejected.

American Railway Association, Signal Section, specification No. 3012 for eastern white cedar poles, 1912.

General.

(*a*) Poles shall be of the best quality of either seasoned or live green cedar of the dimensions hereinafter specified. Seasoned poles shall have preference over green poles, provided they have not been held for seasoning long enough to have developed any of the timber defects hereinafter referred to. All poles shall be reasonably straight, well proportioned from butt to top, squared at both ends, and with all knots and limbs closely trimmed.

Classes of poles.

(*a*) Poles shall be classed and used according to the line wire conductors they carry, or ultimately will carry:

1. Class A, over 40 wires.
2. Class B, from 21 to 40 wires.
3. Class C, from 13 to 20 wires.
4. Class D, from 7 to 12 wires.
5. Class E, from 3 to 6 wires.
6. Class F, 2 wires carried on brackets.

Dimensions of poles.

(*a*) The minimum dimensions in inches of poles shall be in accordance with the following table, the top measurement being the circumference at the top of the pole, and the butt being the circumference 6 feet up from the butt end:

Length of poles in feet	Class A		Class B		Class C		Class D	Class E	Class F
	Top	Butt	Top	Butt	Top	Butt	Top	Top	Top
20	------	------	------	------	18¾	27	17¼	15½	15½
22	------	------	22	30	18¾	28½	17¼	15½	15½
25	24	36	22	32	18¾	30	18¾	17¼	15½
30	24	40	22	36	18¾	33	18¾	18¾	15½
35	24	43	22	38	18¾	36	18¾	18¾	17¼
40	24	47	22	43	18¾	40	18¾	18¾	17¼
45	24	50	22	47	18¾	43	22	22	------
50	24	53	22	50	18¾	46	22	22	------
55	24	56	22	53	18¾	49	22	22	------
60	24	59	22	56	------	------	------	------	------

(*b*) When the dimension at the butt is not given, the poles shall be reasonably well proportioned throughout their entire length.

(*c*) No poles shall be over 6 inches longer, or 3 inches shorter, than the length for which it is accepted. If any pole is more than 6 inches longer than is required, it shall be cut back.

Quality of timber.

(Requirements similar to those of the American Railway Engineering Association.)

Northern White Cedar Association, rules governing the manufacture and grading of white cedar poles, effective March 1, 1925.

1. Live timber.

All poles shall have been cut and manufactured from live green cedar timber.

NOTE.—The test of live timber is to cut into sapwood. If sapwood is white the timber was alive when cut.

2. Manufacture.

All poles shall be peeled their entire length, knots trimmed close, and butt and top sawed square.

3. Lengths.

Any pole may be short of its specified length ½ inch for each 5 feet of its specified length, or it may be 6 inches longer than its specified length.

4. Top measurements.

Designated top size	Circumference	
	Green and water-soaked	Seasoned
Inches	*Inches*	*Inches*
4	12½	12
5	16	15
6	19½	18½
7	23	22
8	25	24

5. Defects.

(*a*) *Rot.*—Butt and ring rot combined shall not exceed 5 per cent of the area of the butt in all poles 5-inch top 25 feet long and smaller, and shall not exceed 8 per cent of the area of the butt in all poles 6-inch top 25 feet long and larger.

(*b*) *Top.*—Tops are to be sound.

(*c*) *Crook.*—No pole shall have a short crook or bend, a crook or bend in two planes, or a reverse curve. The maximum amount of sweep, measured between the ground line and the top, shall not be in excess of 1 inch for each 5 feet of the length of the pole. The ground line is understood to be 4 feet from the butt on poles 16, 18, and 20 feet in length, 6 feet from butt on poles 25 feet and longer. The sweep below the ground line shall not exceed one-half the diameter of the butt.

(*d*) *Miscellaneous defects.*—No pole containing sap rot, hollow knots, woodpecker holes, or plugged holes, and no poles showing evidence of having been eaten by ants, worms, or grubs shall be accepted, except that poles containing surface worm or grub marks below the ground line may be accepted.

(*e*) *Cat faces.*—Small cat faces permitted if sound and not within 1 foot below or 3 feet above the ground line and if their distance from the top of the pole is not less than 20 per cent of the full length of the pole.

(*f*) *Twist.*—Winding twist permitted unless unsightly and exaggerated, except that there shall not be more than one complete twist or grain for any 20 feet of length.

(*g*) *Maximum defects.*—No poles shall contain both the maximum crook and the maximum butt rot.

Western Red Cedar Association, specifications for western red cedar poles, April 30, 1918.

(The specifications for western red cedar poles are similar to those of the Northern White Cedar Association given above.)

401.32 Chestnut Poles.

American Electric Railway Engineering Association, standard specification for chestnut poles, revised 1926, serial No. D8–26.

To determine the character of poles to be used in trolley line construction, they may be divided into three classes—A, B, and C. (Same as for eastern white cedar, 401.31.)

CHESTNUT POLES

General.

The poles covered by this specification shall be of the best quality of live white chestnut of the dimensions hereinafter specified. All poles shall be reasonably straight, well proportioned from butt to top, shall have both ends squared, and all knots and limbs closely trimmed.

Dimensions.

The dimensions of the poles shall be in accordance with the following table, the "top" measurement being the circumference at the top of the pole and the "butt" measurement the circumference 6 feet from the butt. No poles shall be over 6 inches longer or 3 inches shorter than the length for which it is accepted. If any pole is more than 6 inches longer than required, it shall be cut back.

Minimum dimensions of chestnut poles (circumference)

Length of poles (feet)	Class A		Class B		Class C	
	Top	Six feet from butt	Top	Six feet from butt	Top	Six feet from butt
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
25	24	36	21	31	20	30
30	24	40	22	36	20	33
35	24	43	22	40	20	46
40	24	45	22	43	20	40
45	24	48	22	47	20	43
50	24	51	22	50	20	63
55	22	54	22	53	20	49
60	22	57	22	56	-------	-------
65	22	60	22	59	-------	-------
70	22	63	22	62	-------	-------
75	22	66	22	65	-------	-------

Quality of timber.

(*a*) *Seasoned poles.*—No pole shall have been cut over two years.

(*b*) *Dead or dry poles.*—No pole shall have been cut when dead.

(*c*) *Shaved poles.*—Poles shall not be shaved.

(*d*) *Checked and cracked poles.*—No pole shall have a crack or large season checks.

(*e*) *Crooked poles.*—No pole shall have a short crook or a crook or sweep in two places, or a short reverse curve. Poles over 30 feet in length should have less sweep than the shorter poles, as follows:

Length (feet)	Sweep not over—
	Inches
35	10
40	11
45	10
50	11
55	12
60	13
65	14
70	15

The sweep shall be measured between the 6-foot mark and the top of the pole.

(*f*) *Bad tops.*—All poles shall have sound tops. Poles with double tops should be examined carefully for split tops or rot where the two parts join.

(*g*) *Bad butts.*—All poles shall have reasonably sound butts. Hollow butts shall be carefully examined, and poles having them rejected, if the hole runs over 4 feet. Poles with hollow butts shall be rejected if there is evidence of decay at the further end of the hole inside the pole.

(*h*) *Sap rot.*—No pole shall have sap rot.

(*i*) *"Cat faces."*—Poles shall have no "cat faces," unless they are sound and small and the pole has an increased diameter at the "cat face." No poles shall have "cat faces" near the 6-foot mark or within 10 feet of the top.

(*j*) *Knots.*—All poles shall be examined carefully for black knots, hollow knots, or projections caused by overgrown knots. Overgrown knots shall be trimmed off. Such knots shall be examined for internal rot. No poles shall show evidence of rot at knot holes nor have large hollow knots.

(*k*) *Woodpecker's holes.*—No pole shall have a woodpecker's hole.

(*l*) *Ants.*—No pole shall show evidence of ants.

(*m*) *Worm or grub eaten poles.*—No pole shall be worm or grub eaten.

(*n*) *Plugged holes.*—No pole shall have a top, butt, or black knot which has been plugged.

Rejection.

All poles which fail to meet the requirements hereinabove specified may be rejected.

401.33 Cypress Poles.

(No nationally recognized specifications available.)

401.34 Fir Poles.

(No nationally recognized specifications available.)

401.35 Oak Poles.

(No nationally recognized specifications available.)

401.36 Pine Poles.

American Society for Testing Materials, standard specifications for southern yellow-pine piles and poles to be creosoted, D25–20, 1920. See 401.46.

401.37 Redwood Poles.

(No nationally recognized specifications available.)

401.4 PILING, HEWN AND SAWN.

401.40 General Items.

American Association of State Highway Officials, specifications for timber piles, December, 1926.

Specifications for quality and sizes of wood piling are included with this association's grading rules for structural timber, lumber, and piling, 412.0.

U. S. Department of Agriculture, Bureau of Public Roads, specification for piling, revised May 14, 1924.

TIMBER PILES

Description.

Timber piling shall consist of round or square timber of the kind and dimensions specified, placed in the location and to the elevations shown on the plans or as directed and in conformity with these specifications.

Foundation piles.

These piles may be of any species which will satisfactorily stand driving. They shall be cut from live, sound trees, shall be solid, and free from defects, such as injurious ring shakes, large, unsound or loose knots, decay, or other defects which might impair their strength or durability. They shall be cut above the ground swell and have a uniform taper, and shall be free from short bends. A straight line drawn from the center of the butt to the center of the tip shall lie wholly within the body of the pile. Piles shall be peeled soon after cutting. All knots shall be trimmed close to the body of the pile. For round piles, the minimum diameter at the tip shall be 8 inches, and at the butt shall be 12 inches. The maximum diameter at the butt shall be 20 inches. Square piles shall be uniform in cross section, not less than 10 by 10 inches for lengths up to 30 feet nor less than 12 by 12 inches for lengths over 30 feet.

If possible, piles shall be full length. Where the length required is greater than is practical to obtain they may, upon written approval of the engineer, be spliced. All splices shall be made in accordance with detail plans prepared to meet the special conditions encountered and which shall be approved before the piles are driven.

The tops of foundation piles shall be embedded in the concrete footing at least 1 foot, and where seals of concrete deposited in water are used with piles the piles shall project at least 1 foot above the top of the seal concrete. They shall be cut off level at such an elevation that the tops of the piles will be always wet.

The load per pile shall generally not exceed 15 tons with a maximum limit of 20 tons.

Trestle piles and foundation piles for trestle bents.

These piles shall meet the requirements for timber foundation piles, except that they shall be of durable timber, and peeled. The species will be given on the plans or in the specifications.

Foundation piles for framed bents shall be cut off level approximately 3 feet above the surface of the ground and the cap rigidly secured to each pile by drift bolts extending at least 9 inches into the pile.

Trestle piles shall be cut off level at the elevation shown on the plans and the caps secured as described above. If the cut off is 10 feet or more above the ground line, timber piles shall be braced by diagonal cross bracing composed of 3 by 10 inch timbers secured to the piles by ¾-inch diameter through bolts.

In bents of untreated piles the heads of the piles shall be thoroughly coated with a thick coat of red lead paint, hot tar, hot asphaltum, or hot coal-tar creosote before the caps are placed.

The load per pile shall generally not exceed 10 tons with a maximum limit of 12 tons.

NOTE.—The complete specification includes general data, preservative treatment, driving, and specifications for concrete piles. Preservative treatment is included under No. 400.42.

401.41 Cedar Piling.

Western Red Cedar Association, specifications for standard cedar piling, January 13, 1914.

STANDARD CEDAR PILING

All piling must be cut from live, growing cedar timber, peeled, knots trimmed close, butts and tops sawed square. Tops must be sound. Butts may contain rot, the average diameter of which is not over 10 per cent of the diameter of the butt. (This rot not to exceed 1 per cent of the area of the butt.)

Length.

All piling shall be furnished in the following lengths: 16 feet, 20 feet, and multiples of 5 feet over 20 feet. Owing to the inaccuracies of cutting cedar in the woods by hand, a variation of 6 inches in length is allowable.

Tops.

Piling 30 feet and shorter must measure at small end not less than 30 inches in circumference.

Piling 35, 40, and 45 feet must measure at small end not less than 28 inches in circumference.

Piling 50 feet to 70 feet, inclusive, must measure not less than 25 inches in circumference at small end.

Butts.

Must measure not less than 14 inches or more than 20 inches in diameter the widest way.

Crook.

Piling may contain crook one way providing a line drawn from the center of the top to the center of the butt does not fall outside the body of the piling at any point.

Cat faces and dry streaks.

A sound cat face not to exceed 10 per cent of the length of a piling is permissible. A sound, dead, or dry streak shall not be considered a defect when it does not materially impair the strength of the piling.

401.42 Chestnut Piling.

(No nationally recognized specifications available.)

401.43 Cypress Piling.

(No nationally recognized specifications available.)

401.44 Fir Piling.

(No nationally recognized specifications available.)

401.45 Oak Piling.

(No nationally recognized specifications available.)

401.46 Pine Piling.

American Society for Testing Materials, standard specifications for southern yellow-pine piles and poles to be creosoted. D25–20, 1920.

GENERAL REQUIREMENTS

1. The specifications as to strength shall agree with the requirements of the standard definitions of terms relating to structural timber (serial designation D9) of the American Society for Testing Materials. See 412.0.

SAPWOOD

2. All piles or telegraph poles shall show 40 per cent sapwood in cross section, or there shall be a ring of sapwood not less than 1 inch in thickness all around the heartwood.

QUALITY

3. (*a*) Piles and poles shall be cut from sound, live trees of straight grain and regular taper, without crooks exceeding one-fourth the diameter of the stick at middle of crook when peeled. They shall be free from rot, red heart, holes or rotten knots, shakes, and felling checks.

(*b*) All piles and poles shall have the bark and inner skin carefully removed when the tree is felled; all limbs and knots trimmed flush and butts cut square.

MINIMUM DIAMETER

The minimum diameter of piles after peeling shall be as follows:

Length	Butts	Tops
	Inches	*Inches*
36 feet and under	14	10
38 feet and under 50 feet	14	9
50 feet and over	15	9

No pile with butt diameter over 18 inches, nor top diameter over 13½ inches, will be accepted. The length of each pile shall be legibly marked on the butt with white or black paint.

Southern Pine Association, specifications for grades of southern pine sheet piling, August 1, 1926.

The sizes of sheet piling conform to the table of sizes for factory flooring, heavy roofing, decking, and sheet piling of the American Lumber Standards, 411.0.

401.47 Redwood Piling.

(No nationally recognized specifications available.)

401.49 Miscellaneous Specifications for Piling.

American Association of State Highway Officials, standard specifications for highway bridges and incidental structures—sheet piling—1926.

TIMBER SHEET PILING

The timber, unless otherwise definitely noted upon the plans or specified, may consist of any species which will satisfactorily stand driving. It shall be sawn or hewn with square corners and shall be free from wormholes, loose knots, wind shakes, decayed or unsound portions, or other defects which might impair its strength or tightness.

The piles shall be of the thickness specified or directed and shall be provided with tongues and grooves of ample proportions, either cut from the solid material or made by building up the piles of three plank securely fastened together. The piles shall be drift sharpened at their lower ends so as to wedge the adjacent piles tightly together.

The tops of the piles shall be cut off to a straight line at the elevation indicated and shall be braced with a waling strip, properly lapped and joined at all splices and corners. The wales shall preferably be in one length between corners and shall be bolted near the tops of the piles.

National Hardwood Lumber Association, grading rules for sheet piling, January, 1927.

Sheet piling shall be graded the same as crossing plank except that heart may show through on both faces if tight enough to admit of driving.

401.5 SHIPS' KNEES.

(No nationally recognized specifications available.)

401.6 CORDWOOD.

(No nationally recognized specifications available.)

402. ROUGH LUMBER.

402.0 GENERAL ITEMS.

(See 400.13.)

402.1 SAWN STAKES AND CROSS ARMS.

American Electric Railway Engineering Association, recommended specification for overhead line material, serial No. D102–21, 1921.

WOOD CROSS ARMS

Material requirements.

Cross arms may be of cypress, Douglas fir, Norway pine, or yellow pine, but shall be thoroughly seasoned, sound, and free from wane or defects which would reduce strength; the grain shall be close and not out of parallel with any edge of arm more than 1 inch in 3 feet of length.

Pitch pockets.

Pitch pockets not exceeding 2 inches in depth, up to 12 inches in length or ¼ inch in width, not entering pin or bolt holes on top or sides of arm, will be permitted provided the area does not exceed ½ square inch if within 1 foot of center bolt hole, nor exceed 1 square inch if outside the 1-foot limit. Pitch seams or streaks which do not open the grain are not considered "pockets."

Shakes and checks.

Ring shakes, end checks, or other checks entering pin or bolt holes will not be permitted; a few fine checks not entering pin or bolt holes, nor exceeding 6 inches in length nor ½ inch in depth, will be allowed.

Knots.

No knots will be allowed within 24 inches of center of any arm, nor entering any pin or bolt hole. Sound knots not exceeding ¾ inch diameter, but not entering any pin or bolt hole will be allowed between limits 24 inches and 36 inches from center of any arm; outside limit 36 inches from center of any arm, sound knots not entering a pin or bolt hole may increase in size to not exceed 1 inch diameter at end of arm.

Sapwood.

Cypress arms shall be free from sapwood or pitch heart; Douglas fir, Norway pine, and yellow-pine arms may contain, on top or one side only, clear sapwood of maximum cross section not exceeding 15 per cent of total cross section of arm.

Warp.

Cross arms shall be out of wind, shall not be bent edgeways in any direction nor sideways in more than one direction, and a straight edge applied to concave side shall not show offset exceeding ⅛ inch per foot of length of arm.

Finish.

Arms shall be delivered unpainted with every face planed, square to adjacent faces, and bored as specified. Holes shall be accurately located, square with face, clean cut, not badly splintered where bit passed out, and within $\frac{1}{32}$ inch of correct diameter.

Boring.

(*a*) All cross arms shall have holes 1½ inches diameter on center line of top, one on either side of and with center 15 inches from arm center, others 12 inches apart center to center on light service arms, and 10 inches on heavy service arms.

(*b*) All cross arms shall have one center hole $\frac{11}{16}$ inch diameter in center of side.

(*c*) All cross arms to be strap braced shall have two holes each $\frac{7}{16}$ inch diameter on center line of side, one on either side of center hole; 12 inches distant for two pin arms and 19 inches distant for all others.

(*d*) All cross arms to be angle braced shall have two holes, each $\frac{9}{16}$ inch diameter on center line of bottom, and spaced one either side of middle, 21 inches distant for 4 pin and 6 pin arms and 30 inches distant for 8 pin arms.

Classes and section.

Cross arms are of two classes: Light service arms, 3¼ inches wide by 4¼ inches deep; and heavy service arms, 3¾ inches wide by 4¾ inches deep.

Lengths.

Cross arms lengths shall be as follows:

Size of arm	Light service	Heavy service
	Ft. in.	*Ft. in.*
2-pin	3 0	-- --
4-pin	5 0	4 10
6-pin	7 0	6 6
8-pin	9 0	8 0

American Railway Association, Signal Section, specification No. 2512 for wood cross arms, 1912.

Material.

(*a*) Cross arms shall be made of red cypress or Douglas fir.

Workmanship.

(*a*) Workmanship shall be first class in all particulars. The boring for the pin and bolt holes shall be smooth and straight, and surface of the arm shall not be splintered by auger or machine bit.

Quality.

(*a*) Cypress cross arms shall be free from pith heart and sapwood.

(*b*) Douglas fir cross arms may contain sapwood, provided it is clear and does not form over 15 per cent of the cross section of the cross arm. Cross arms shall be cut so that the sapwood shall be on the top or sides.

(*c*) Cross arms shall be reasonably straight grained. The grain shall not depart from parallelism to any edge of cross arm by an amount greater than 1 inch to 3 feet length of cross arm.

(*d*) Cross arms shall be out of wind.

(*e*) Cross arms shall be free from pitch pockets exceeding 5 inches in length and ¼ inch in width, and from all pitch pockets which enter the pin or bolt holes on top or sides of the cross arms.

(*f*) Cross arms shall be free from loose or unsound knots.

(*g*) Ten pin cross arms shall be free from knots at the fourth, fifth, sixth, and seventh pinholes and at bolt holes; 8 pin cross arms shall be free from knots at the third, fourth, fifth, and sixth pinholes and at bolt holes; 6 and 4 pin cross arms shall be free from knots at the two middle pinholes and at bolt holes.

(*h*) Ten pin cross arms may have sound knots not over ¾ inch in diameter between the fourth and seventh pinholes; 8 pin cross arms may have sound knots not over ¾ inch in diameter between the third and sixth pinholes; and 6 and 4 pin cross arms may have sound knots not over ¾ inch in diameter between the middle pinholes.

(*i*) Sound knots larger than ¾ inch will not be considered a defect under the following conditions: They shall be outside the fourth and seventh pinholes in 10 pin cross arms, the third and sixth pinholes in 8 pin arms and the middle pins in 6 and 4 pin arms; they shall not exceed ¾ inch in diameter near the above-mentioned pinholes, but may gradually increase in size to one-half the cross section of the arm at the ends.

(*j*) Cross arms shall be free from wane.

(*k*) Cross arms shall be free from through shakes and from other shakes or checks exceeding 3 inches in length.

(*l*) Cross arms will be rejected that are bent in more than one direction or edgewise. A straight edge laid lengthwise the full length of cross arm on the concave side, shall not show an offset greater than 1 inch on 10 or 8 pin arms, or greater than ¾ inch on a 6 pin arm, or greater than ½ inch on a 4 pin arm.

(*m*) Cross arms shall be free from loose hearts, red hearts, rot dote, or wormholes.

West Coast Lumbermen's Association, grading rules for Douglas fir sawn stakes and cross arms, July, 1926.

Cross arms must be sound lumber, well manufactured. Will admit sound and tight pin knots, well scattered; small pitch pockets, none through thickness, well scattered; bright sap, 20 per cent of cross section.

402.2 FENCING, GUARDRAILS, SCAFFOLDS, AND FALSE WORK.

(No nationally recognized specifications available.)

402.3 BLOCKS FOR PAVEMENTS AND FLOORS.

American Association of State Highway Officials, standard specifications for highway bridges and incidental structures—creosoted wood blocks, 1926.

The wood from which the blocks are manufactured shall be southern yellow pine, Douglas fir, tamarack, or Norway pine. Only one kind of wood shall be used in any one bridge floor.

(Specifications for pine and tamarack blocks are similar to those of the American Society for Municipal Improvements. The following specifications relate to the treatment of Douglas fir blocks.)

Treatment of Douglas fir blocks.

The timber may be either air seasoned or green. Green timber and seasoned timber shall not, however, be treated together in the same charge. The blocks shall be treated in an air-tight cylinder with coal-tar paving oil or coal-tar distillate oil. (See 400.41.) They shall be treated by the boiling process substantially as follows:

The charge shall be boiled in creosote at not to exceed 190° F. under vacuum of at least 20 inches for not less than 2 hours and not more than 6 hours, depending upon the degree of dryness of the timber. The minimum temperature shall be sufficient to vaporize the moisture under the existing vacuum. Pressure shall then be applied not to exceed a maximum of 125 pounds until the preservative has been absorbed in an amount about 3 pounds per cubic foot in excess of the specified quantity. The temperature of the surrounding creosote shall then be raised to, and held at, 225° F. for 1 hour. The creosote is then exhausted from the retort, the steam is shut off from the coils and a quick vacuum of 20 to 25 inches applied for a period of 30 minutes to 1 hour. In any charge, blocks of Douglas fir shall contain at least 12 pounds of water-free oil per cubic foot of wood at the completion of the treatment.

American Society for Municipal Improvements, specifications for wood block paving, 1921.

TIMBER

Kind.

The wood from which the blocks are to be manufactured shall be southern yellow pine, Douglas fir, tamarack, Norway pine, hemlock, or black gum. Only one kind of wood shall be used in any one contract.

Quality.

The blocks must be sound and must be well manufactured, square butted, square edged, free from unsound, loose or hollow knots, knotholes, and other defects, such as shakes, checks, etc., that would be detrimental to the blocks.

The number of annual rings in the 1 inch which begins 2 inches from the pith of the block shall not be less than 6, measured radially; provided, however, that blocks containing between 5 and 6 rings in this inch shall be accepted if they contain 33⅓ per cent or more summer wood. In case the block does not contain the pith, the 1 inch to be used shall begin 1 inch away from the ring which is nearest to the heart of the block. The blocks in each charge shall contain an average of at least 70 per cent of heartwood. No one block shall be accepted that contains less than 50 per cent of heartwood.

Size of blocks.

The blocks shall be from 5 to 10 inches long, but should preferably average two times the depth; they shall preferably be 4 inches in depth for very heavy traffic, and 3 inches in depth for light traffic. They may be from 3 to 4 inches in width, but in any one city block all of them shall be of uniform width. A variation of $\frac{1}{16}$ inch shall be allowed in the depth, and ⅛ inch in the width of the blocks from that specified. In all cases the width shall be greater or less than the depth by at least ¼ inch.

PRESERVATIVE

Kind.

The preservative to be used may be either a coal-tar paving oil or a coal-tar distillate oil, as herein specified; or where refined water-gas tar is desired, the specification as below suggested may be used.

(Specifications for coal-tar, paving oil, coal-tar distillate oil, and water-gas tar are similar to those of the American Wood-Preservers Association. See 400.41.)

TREATMENT

The timber may be either air seasoned or green, but should preferably be treated within three months from the time it is sawed. Green timber and seasoned timber shall not, however, be treated together in the same charge. The blocks shall be treated in an air-tight cylinder with the preservative heretofore specified. In all cases, whether thoroughly air seasoned or green, they shall first be subjected to live steam at a temperature between 220 and 240° F., for not less than 2 hours nor more than 4 hours, after which they shall be subjected to a vacuum of not less than 22 inches, held for at least 1 hour. While the vacuum is still on, the preservative oil, heated to a temperature of between 180 and 220° F., shall be run in until the cylinder is completely filled, care being taken that no air is admitted. Pressure shall then be gradually applied not to exceed 50 pounds at the end of the first hour, and then maintained at not less than 100 pounds nor more than 150 pounds until the wood has absorbed the required amount of oil.

After this, a supplemental vacuum shall be applied, in which the maximum intensity reached shall be at least 20 inches, and shall continue for a period of not less than 30 minutes. If desired, this vacuum may be either preceded or followed by a short steaming period.

In any charge the blocks shall contain at least 16 pounds of water-free oil per cubic foot of wood at the completion of the treatment. The blocks after treatment shall show satisfactory penetration of the preservative, and in all cases the preservative must be diffused throughout the sapwood. To determine this, at least 25 blocks shall be selected from various parts of each charge, and sawn in half at right angles to the fibers, through the center, and if more than one of these blocks show untreated sapwood, the charge shall be re-treated. After re-treating, the charge shall again be subjected to a similar inspection.

The surface of the blocks after treatment shall be free from deposit of objectionable substances, and all blocks that have been materially warped, checked, or otherwise injured in the process of treatment shall be rejected.

Handling blocks after treatment.

Blocks shall preferably be laid in the street as soon as possible after being treated. If they can not be laid within two days, provision shall be made to prevent them from drying out by stacking in close piles and covering them, and if possible, sprinkling them thoroughly at intervals. The blocks shall be well sprinkled, under direction of the purchaser, about two days before being laid.

Inspection.

All material herein specified and processes used in the manufacture of the blocks therefor, shall be subject to inspection, acceptance, or rejection at the plant of the manufacturer, which shall be equipped with all the necessary gauges, appliances, and facilities to enable the inspector to satisfy himself that the requirements of the specifications are fulfilled.

The purchaser shall have the further right to inspect the blocks after delivery upon the street, for the purpose of rejecting any blocks that do not meet these specifications, except that the plant inspection shall be final with respect to the oil and treatment.

American Society for Testing Materials, standard specifications for wooden paving blocks for exposed pavements, D52–20, 1920.

These specifications cover wooden paving blocks for pavements exposed to alternate wet and dry conditions, as distinguished from pavements which are used under cover and protected from atmospheric influences.

TIMBER AND TREATMENT

(Specifications for timber and treatment same as those of the American Society for Municipal Improvements above.)

PRESERVATIVE

The preservative used shall be coal-tar paving oil or distillate oil, as specified by the purchaser. (See 400.41.)

American Wood-Preservers' Association, standard specifications for interior creosoted wood-block flooring, 1923.

TIMBER

The wood from which the blocks are to be manufactured shall be air-dried southern yellow pine, Douglas fir, tamarack, or Norway pine. Only one kind of wood shall be used in any one contract.

(Quality of blocks same as for creosoted wood-block paving.)

SIZE OF BLOCKS

(Size of blocks same as for paving except that length is limited to 8 inches and not to exceed three times the depth.)

PRESERVATIVE

(Preservatives same as for creosoted wood-block paving.)

TREATMENT

The blocks shall be treated in air-tight cylinders in accordance with any standard empty-cell process adopted by the American Wood-Preservers' Association, leaving in the blocks at the end of the treatment not less than 6 pounds of water-free creosote oil per cubic foot of wood. The gross absorption of oil injected during the process of treatment shall be sufficient to insure thorough impregnation by the preservative.

The blocks, after treatment, shall show satisfactory penetration of the preservative, and in all cases the oil must be diffused throughout the sapwood. To determine this at least 25 blocks shall be selected from various parts of each charge and sawn in half at right angles to the fibers through the center, and if more than one of these blocks show untreated sapwood the charge shall be re-treated. After re-treating, the charge shall be again subjected to a similar inspection.

The surface of the blocks after treatment shall be free from deposits of objectionable substances, and all blocks that have been materially warped, checked, or otherwise injured in the process of treatment shall be rejected.

American Wood-Preservers' Association, standard specification for creosoted wood-block street paving, 1923.

The wood from which the blocks are to be manufactured shall be southern yellow pine, Douglas fir, tamarack, or Norway pine. Only one kind of wood shall be used in any one contract.

(Specifications for timber and the treatment for southern yellow pine, tamarack, and Norway pine are similar to those of the American Society for Municipal Improvements, above.)

TREATMENT FOR DOUGLAS FIR

The timber may be either air seasoned or green. Green timber and seasoned timber shall not, however, be treated together in the same charge. The blocks shall be treated in an air-tight cylinder with the preservative agreed upon. They shall be treated by the boiling process substantially as follows:

The charge shall be boiled in creosote at not to exceed 190° F. under vacuum of at least 20 inches for 2 hours and not to exceed 6 hours, depending upon the degree of dryness of the timber. The minimum temperature shall be sufficient to vaporize the moisture under the existing vacuum. Pressure shall then be applied not to exceed a maximum of 125 pounds until the preservative has been absorbed in an amount about 3 pounds per cubic foot in excess of the specified quantity. The temperature of the surrounding creosote shall then be raised to and held at 225° F. for 1 hour. The creosote is then exhausted from the retort, the steam is shut off from the coils and a quick vacuum of 20 to 25 inches applied for a period of 30 minutes to 1 hour.

In any charge, the blocks shall contain at least 12 pounds of water-free oil per cubic foot of wood at the completion of treatment. The blocks after treatment shall show the preservative well diffused throughout the wood and the sapwood shall be entirely and well treated. To determine this at least 25 blocks shall be selected from various parts of each charge, and if more than one of these blocks show untreated sapwood, the charge shall be re-treated. After re-treating, the charge shall again be subjected to a similar inspection.

The surface of the blocks after treatment shall be free from heavy pitch of tarlike deposits, and all blocks that have been materially warped, checked, or otherwise injured in the process of treating shall be rejected.

PRESERVATIVE

The preservative to be used may be either a coal-tar paving oil or a coal-tar distillate oil. See specifications for coal-tar oil and distillate oil for flooring and paving blocks 400.41.

402.4 YARD LUMBER. (See also 411.)

402.41 Strips.

Arkansas Soft Pine Bureau, grading rules for strips, March 23, 1927.

The grading rules for strips are the same as the grading rules for common boards of the Southeastern Forest Products Association and the Southern Pine Association, 402.42.

American Lumber Industry, Simplified Practice Recommendation, No. 16, American Lumber Standards, revised July 1, 1926.

See 400.0, classification of American Lumber Standards and 411.0, yard lumber, American Lumber Standards for grades and sizes of strips.

The National Hardwood Lumber Association, grading rules for strips, January, 1927.

STRIPS

Standard grades: Clear, No. 1 common and No. 2 common. Exceptions to these standard grades are stated below under caption of the woods.

Standard widths, 2, 2½, 3, 3½, 4, 4½, 5, and 5½ inches.

Strips may be ⅛ inch scant of standard widths when shipping dry. In the grade of clear strips, tapering pieces must be measured at the narrow end. In the grades of common strips, tapering pieces must be measured one-third the length of the piece from the narrow end.

Inspection must be made from the good face.

Bright sapwood is no defect.

Clear.

Lengths, 8 to 16 feet.

Clear strips must have one clear face and two good edges. The reverse side must be sound.

No. 1 common.

Lengths, 8 to 16 feet.

Pieces 6 and 7 feet long must have one clear face and two good edges; the reverse side must be sound.

Pieces 2 to 3 inches wide, 8 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 feet and over long, in not over three cuttings. No cutting shall be considered which is less than 2 feet long by the full width of the piece.

Pieces 3½ to 5½ inches wide, 8 to 11 feet long, must work 66⅔ per cent clear face in not over two cuttings; 12 feet and over long, in not over three cuttings. No cutting shall be considered which is less than 3 inches wide by 2 feet long.

Cuttings must have good edges and the reverse side sound.

No. 2 common.

Lengths, 6 to 16 feet.

No. 2 common strips must work 50 per cent clear face. No cutting to be considered which is less than 2 inches wide by 2 feet long. The reverse side of the cuttings must be sound.

Cherry Strips

Clear must be free from sap wood on the face side.

No. 1 common cuttings must be free from sapwood on the face side.

Mahogany Strips

See this association's grading rules for mahogany, 400.35, for the sizes and grades of mahogany strips.

Plain and Quartered Oak Strips

Grades: Clear, clear sap, No. 1 common, and No. 2 common.

Quartered oak strips must have the radial grain running 45 degrees or less with one face of the piece.

Clear.

Clear will admit sapwood on the face side as follows:

2 to 3 inch widths, ½ inch of bright sapwood in the aggregate.

3½ to 4½ inch widths, ¾ inch of bright sapwood in the aggregate.

5 to 5½ inch widths, 1 inch of bright sapwood in the aggregate.

Clear sap.

This grade is the same as the standard grade of clear.

Poplar Strips

Grades: Clear, sap, No. 1 common, and No. 2 common.

Widths, 2½, 3, 3½, 4, 4½, 5, 5½, and 6 inches.

Clear.

Clear must be clear on both faces and must be free from sapwood except 1 inch in the aggregate on one face.

Sap.

This grade is the same as clear poplar strips except that bright sapwood will be admitted without limit. Pieces free from sapwood will admit one sound standard defect or its equivalent.

No. 1 common.

Pieces 6 and 7 feet long must be clear on both faces. Both faces of the cuttings must be clear. All cuttings must be the full width of the piece. Sound stain shall not be considered a defect.

No. 2 common.

Standard except that sound stain shall not be considered a defect.

North Carolina Pine Association (Inc.), grading rules for strips, January 1, 1927.

The grading rules for strips are identical with the grading rules of this association for common boards, 402.42, with the following exception:

B AND BETTER BARK STRIPS

This grade shall consist of lumber containing bark and may be inspected from either side; and within the limitations hereinafter described, bark shall not be considered a defect in this grade, viz, 90 per cent of any amount inspected shall show not less than ½ inch of wood from end to end of piece on edges. Ten per cent of any amount inspected may show less than ½ inch of wood on edges, but only on condition that the side containing bark shall show 75 per cent of wood. With the exceptions above stated this grade is to be equal to B and better lumber.

BOX BARK STRIPS

This grade shall contain all bark strips falling below the description of Nos. 1 and 2. When resawed the mill inspection and tally to be final.

Northern Hemlock and Hardwood Manufacturers' Association, grading rules for strips, February 1, 1927.

The grading rules for strips are the same as the grading rules of this association for common boards, 402.42.

Northern Pine Manufacturers' Association, grading rules for strips, April 15, 1925.

The grading rules for strips are the same as the rules of this association for common boards, 402.42.

Southeastern Forest Products Association, grading rules for strips, September 1, 1925.

The grading rules for strips are the same as this association's grading rules for common boards, 402.42.

Southern Pine Association, grading rules for strips, March 23, 1927.

The grading rules for strips are the same as this association's grading rules for common boards, 402.42.

Southern Pine Association, the Gulf coast classification of pitch pine, March 15, 1923, grading rules for strips.

RIVER PLATE STANDARD

Kiln Dried Strips

Sizes: 1 by 3, 1 by 4, and 1 by 6.

Lengths: 10 feet and up; 5 per cent, 8 and 9 feet allowed.

Must be kiln-dried, bright, and free from unsound knots, loose knots, pith knots, knot holes, pinworm holes, grubworm holes, through shakes, and rot. Firm red heart permissible if not in excess of one-quarter of the area of the face. Wane ½ inch wide, measured across the face of the wane, extending one-fifth the length of the piece on one corner or the equivalent on two or more corners on 20 per cent of the pieces, shall be permitted on all widths on the poorest side. Eighty per cent free of knots. Knots ½ inch or under in size not to be considered a defect. Splits in ends are permissible if not over 6 inches in length.

WEST INDIAN

First Class Strips

Sizes: 1 by 3 to 1 by 12; 1¼ by 3 to 1¼ by 12; 1½ by 3 to 1½ by 12; and 2 by 8 to 2 by 12.

Lengths: 10 feet and up; 5 per cent 8 and 9 feet allowed.

Must be free from knot holes, grubworm holes, rot, through splits and through shakes exceeding 12 inches in length. One-third of the pieces will permit wane 1½ inches wide, measured across the face of the wane and extending one-third the length of the piece on one corner, or the equivalent on two or more corners. Pieces combining coarse grain and coarse knots or coarse grain and numerous permissible defects, shall be excluded.

Second Class Strips

Sizes: 1 by 3 to 1 by 12; 1¼ by 3 to 1¼ by 12; 1½ by 3 to 1¼ by 12; 2 by 8 to 2 by 12.

Lengths: 10 feet and up; 5 per cent 8 and 9 feet allowed.

Will permit lumber that does not grade first class, except that through splits and through shakes over 2 feet in length, and rot extending through the piece shall be excluded. Will admit coarse-grained material, sap stain, red heart, pith knots, loose knots, unsound knots, wormholes, and wane if not over 2 inches wide measured on any face of the piece, when not over one-third the length of the piece on one corner, or the equivalent on two or more corners.

85 PER CENT HEART

Sizes:

Strips, boards, planks	Scantling	Deals
1 by 3 to 1 by 12. 1¼ by 3 to 1¼ by 12. 1½ by 3 to 1½ by 12. 2 by 8 to 2 by 12.	2 by 3, 2 by 4, 2 by 5, 2 by 6, 3 by 3 to 3 by 8. 4 by 4 to 4 by 8.	3 by 9 and wider. 4 by 9 and wider.

Lengths: Strips, boards, and planks, 10 feet and up; 5 per cent 8 and 9 feet allowed. Scantling and deals, 12 feet and up; 5 per cent 10 and 11 feet allowed.

Must conform to the classifications of first class for boards and planks, also scantling and deals, as herein, and, in addition, each piece shall be 85 per cent or better heart.

ALL HEART

Sizes:

Strips, boards, planks	Scantling	Deals
1 by 3 to 1 by 12. 1¼ by 3 to 1¼ by 12. 1½ by 3 to 1½ by 12. 2 by 8 to 2 by 12.	2 by 3, 2 by 4, 2 by 5, 2 by 6, 3 by 3 to 3 by 8. 4 by 4 to 4 by 8.	3 by 9 and wider. 4 by 9 and wider.

Lengths: Strips, boards, and planks, 10 feet and up; 5 per cent 8 and 9 feet allowed. Scantling and deals, 12 feet and up; 5 per cent 10 and 11 feet allowed.

Must conform to the classifications of first class for boards and planks, also scantling and deals, as herein, and, in addition, each piece must be all heart.

Western Pine Manufacturers Association, grading rules for strips, revised July 1, 1925.

PONDOSA PINE

The grading rules for Pondosa pine strips are the same as the grading rules of this association for Pondosa pine boards, 402.42.

IDAHO WHITE PINE

The grading rules for Idaho white pine strips are the same as the grading rules of this association for Idaho white pine boards, 402.42.

402.42 Boards (Including Box Lumber).

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0 for yard lumber.

American Railway Association, Freight Container Bureau, specifications for lumber for crating stoves and ranges; circulars 15, 17, and 20.

Material for Crates

Lumber must be well seasoned. For the purposes of this specification seasoned lumber has an average moisture content of not more than 20 per cent, based on the weight of the wood after oven drying to a constant weight.

Lumber must be reasonably sound. The edge members, struts, and diagonal braces must not be

excessively weakened by decay or dote, and must be free from excessive cross grain, knots that would interfere with nailing, and knots or knot holes occupying more than one-half the width of the face of the piece in which the knot occurs.

Grouping of woods.

The principal woods used in the construction of crates are classed for the purpose of this specification into four groups, as follows:

Group 1

Alpine fir.	Lodgepole pine.
Aspen.	Magnolia.
Balsam fir.	Noble fir.
Basswood.	Norway pine.
Buckeye.	Redwood.
Butternut.	Spruce.
Cedar.	Sugar pine.
Chestnut.	Western yellow pine.
Cottonwood.	White fir.
Cucumber.	White pine.
Cypress.	Willow.
Jack pine.	Yellow poplar.

Group 2

Douglas fir.	Southern yellow pine.
Hemlock.	North Carolina pine.
Larch.	

Group 3

Black ash.	Sap gum.
Black gum.	Sycamore.
Maple (soft or silver).	Tupelo.
Pumpkin ash.	White elm.
Red gum.	

Group 4

Beech.	Maple, hard.
Birch.	Oak.
Hackberry.	Rock elm.
Hickory.	White ash.

Dimension of parts.

Lumber (framework).—Lumber of the following minimum dimensions must be used in the construction of the edge members, struts, and diagonal braces of the crate:

Weights of crate and contents (pounds)	For edge members and struts		For diagonal braces	
	Authorized thickness	Corresponding minimum width	Authorized thickness	Corresponding minimum width
	Inches	*Inches*	*Inches*	*Inches*
Up to 25	9/16 to 13/16	1 5/8	1/2 to 5/8	1 5/8
	7/8 and over	1	11/16 and over	1
Over 25 to 50	1/2 to 9/16	2 1/4	7/16	2 5/8
	5/8 to 7/8	1 5/8	1/2 to 9/16	2 1/4
	1 and over	1	5/8 to 7/8	1 5/8
			1 and over	1
Over 50 to 100	5/8 to 25/32	2 1/4	1/2	2 5/8
	13/16 and over	1 5/8	9/16 to 25/32	2 1/4
			13/16 and over	1 5/8
Over 100 to 250	11/16	3 1/4	5/8 to 13/16	3 1/4
	3/4 to 13/16	2 5/8	3/4 to 13/16	2 5/8
	7/8 and over	2 1/4	7/8 and over	2 1/4

If box-type corner is used, connecting edge members may be reduced 25 per cent in thickness provided the cross-sectional area of each of the members forming the edges is increased 25 per cent over the required minimum.

Crates for Cast-iron Household Cook Stoves and Ranges (Bulletin No.. 20)

Lumber.

Lumber must be well seasoned and reasonably sound and free from bad cross grain and knots which would interfere with nailing or knots or knot holes which are greater than one-third the width of the face of the piece in which they occur.

Dimensions of parts.

Lumber used as sheathing and double diagonal bracing must be as wide as the frame members and at least 1/4 inch thick for spans of 2 feet or less. For every additional foot of span or fraction thereof the lumber must have a corresponding increase of 1/8 inch in thickness. No unsupported span shall exceed 6 feet in length.

Lumber used in the construction of the frame and single diagonal braces must be of the following minimum dimensions. A commercial variation of 1/16 inch will be allowed.

Weight of crate and contents (pounds)	Minimum dimensions of lumber used for struts, frame members, and single diagonal braces
	Inches
Up to 100	3/4 by 2 1/4
101 to 250	7/8 by 2 5/8
251 to 400	7/8 by 3 7/8
401 to 600	7/8 by 4 7/8
	1 by 3 7/8
601 to 800	1 by 4 7/8
	1 3/16 by 3 7/8

The above dimensions may be reduced 1/8 inch in thickness or 1/4 inch in width if woods from groups 3 or 4 are used.

Crates for Gas and Electric Domestic Cook Stoves (Bulletin No. 15)

Dimensions of parts.

Lumber (sheathing).—The following table shows the minimum thickness of lumber required on all faces of crates:

Length of span (feet)	Required minimum thickness
	Inches
0 to 2	1/4
2 to 3	3/8
3 to 4	1/2
4 to 5	5/8
5 to 6	3/4

No sheathing shall be placed with a span of more than 6 feet.

Lumber (framework and braces).—Lumber of the following minimum must be used in the construction of the framework and braces of the crate:

Weight of crate and contents (pounds)	Minimum size of members			
	For framework		For braces	
	Thickness	Width	Thickness	Width
	Inches	*Inches*	*Inches*	*Inches*
Up to 25	¾	1½	½ to 11/16	1⅝
			¾	1½
26 to 50	¾	1⅝	¾	1⅝
51 to 100	⅞	1⅝	¾ to 11/16	2⅛
			⅞	1⅝
101 to 250	⅞	2⅛	⅞	2⅛
251 to 400	⅞	3⅛	⅞	3⅛
401 to 600	1	3⅛	1	3⅛
	⅞	4⅛	⅞	4⅛
601 to 800	1	4⅛	1	4⅛
	1 3/16	3⅞	1 3/16	3⅞

When necessitated by commercial variation of manufacture a reduction of ⅛ of an inch below the specified size of lumber may be accepted for framework and braces.

American Railway Association, Freight Container Bureau, six-basket crates for fresh fruits and vegetables, Circular No. 19, 1925.

Lumber for basket crates.

Lumber must be well seasoned. For the purposes of this specification, well-seasoned lumber shall be considered to have an average moisture content of not more than 18 per cent based on the weight of the wood after oven drying to a constant weight.

Lumber must be reasonably sound; it must be free from defects, such as bad cross grain, excessive decay, and knots that seriously effect the strength of the piece or interfere with nailing or stapling.

Headsticks and divider sticks must be entirely free from cross grain which runs across the piece in either direction within one-half of the length; divider sticks must be entirely free from knots.

Any suitable species of wood may be used. Headsticks and divider sticks must be sawed; all other parts may be rotary cut or sawed.

Basket material must be rotary cut and free from knots, pitch pockets, and other defects that either effect its strength or expose contents to damage.

American Society for Testing Materials, tentative general specifications [7] for wooden boxes, nailed and lock-corner construction D 68–22T, D 44–20T, 1920, and 1922.

The requirements for box boards as to seasoning of wood, defects and the classification of the principal woods used for boxes, are the same as the American Railway Association, Freight Container Bureau, given above.

American Society for Testing Materials, tentative general specification [8] for 4-one boxes and similar type boxes, D118–21T, 1921.

[7] The complete specification includes dimensions of parts, methods of manufacture, and other data pertaining to wooden boxes.

[8] The complete specification includes dimension of parts, methods of assembling, and other data pertaining to boxes with wedge-lock ends and boxes with detached tops.

Grouping of woods.

Box lumber suitable for the purpose of these specifications is classed into four groups, the same as given above for the American Railway Association, Freight Container Bureau.

Material.

Each cleat shall be sound, free from knots and from cross grain which runs across it within a distance equal to one-half its length.

Cleats shall be not less than ¾ inch thick (parallel to the length of the box) and not less than ⅞ inch in width.

The thin boards shall be sound (free from decay and dote), well seasoned and cut so that adjacent faces of boxes will be at right angles to each other. All defects that would materially lessen the strength, expose the contents of the box to damage, or interfere with the proper assembly of the box shall be eliminated.

When the thickness of thin boards as specified is less than 3/16 inch, thin boards made of woods of Groups 3 and 4 may be 1/32 inch less than the specified thickness, except that the minimum thickness of thin boards of any kind of wood shall be ⅛ inch.

The variation in thickness of thin boards below the thickness specified shall be not more than ⅛ of the thickness of the thin board and this variation below the specified thickness shall not extend over more than 10 per cent of the face of that particular board.

Thin boards less than 2½ inches in width at either end shall not be used.

Arkansas Soft Pine Bureau, grading rules for boards, March 23, 1927.

Similar to the grading rules of the Southeastern Forest Products Association and the Southern Pine Association given below.

California Redwood Association, standard specifications for eastern grades of California redwood common boards, April, 1927.

The sizes of boards are as shown in this association's table of sizes for yard lumber, 411.0.

The grades of common boards are as follows:

Grades.—No. 1 common, No. 2 common, and No. 3 common.

Lengths.—Standard lengths shall be 10 to 20 feet, inclusive, in multiples of 2 feet, admitting 10 per cent of 6 and 8 foot lengths.

Special provisions.

Medium crook shall be permissible in No. 1 and No. 2 common grades.

Medium cup shall be permissible in No. 1 common grade and deep cup in No. 2 and No. 3 common grades.

Workings.—Pieces of D&M with 3/16 inch or more of tongue and ship-lap with 5/16 inch or more of lap, will be admitted in No. 1 common pieces of D&M having not less than 3/16-inch tongue, and ship-lap having not less than ⅛-inch lap will be admitted in No. 2 common. Pieces with 1/16-inch lap will be admitted in No. 3 common ship-lap.

Standard workings.—Dressed and matched (CM), ship-lap, barn siding, and grooved roofing shall be worked to the patterns published by the California Redwood Association.

No. 1 common must be high-class general utility lumber suitable for use without waste, and will admit the following defects or their equivalent; sound tight knots, the average diameter of any one knot not to exceed approximately 1½ inches in 4 and 6 inch widths; 2 inches in 8 and 10 inch widths and 2½ inches in 12-inch widths; an occasional small unsound knot permitted up to a maximum diameter of 1¼ inches provided the knot be fixed in position; surface checks; hollow bird's-eye; defects in manufacture which will not cause waste; slight shake that does not go through, equal in length to width of piece; short split; medium stain; bright sound sap not exceeding 20 per cent of the width of the piece.

No. 2 common must be suitable for ordinary construction and will admit the following defects or their equivalent; tight knots and knots not necessarily sound, the average diameter of any one knot not to exceed approximately 2 inches in 4-inch widths, 2½ inches in 6-inch widths, 3 inches in 8 and 10 inch widths and 3½ inches in 12-inch widths; season checks, not to exceed one-half the length of the piece; wormholes or hollow bird's-eye; defects in manufacture which will not cause waste; through shakes not to exceed one-fourth the length of the piece; splits not to exceed one-sixth the length of the piece; heavy stain and any amount of sapwood; heart checks; streaks of advanced decay not going through the board equal in area to a streak ½ inch wide by one-sixth the length of the piece.

Pieces containing one knot hole or equivalent defect, not more than 3 inches in diameter, or two knot holes not exceeding 1½ inches in diameter, may be permitted, provided the rest of the piece is No. 1 common quality.

Miscut or mismanufactured 1-inch common, which does not fall below ¾ inch in thickness, shall be admitted in No. 2 common, provided the grade of such stock is otherwise as good as No. 1 common.

No. 3 common will admit coarse knots; decayed, loose, or unsound knots; knot holes; through checks, shakes, and splits; wormholes and hollow bird's-eye; serious defects in manufacture; advanced decay, sapwood, and heavy stain; and wane; provided each piece as a whole is of such a nature as to permit its being handled without a waste to exceed 15 per cent.

California White and Sugar Pine Manufacturers Association, grading rules for white and sugar pine boards, May 1, 1926.

STANDARD SIZES

Boards.

(S1S, S2S, S1S1E, or S4S).

Thickness

Nominal	Dressed	
	Standard	Extra standard
11/16	11/16	
1	25/32	13/16
1¼	1 1/16	1 1/8
1½	1 5/16	1 3/8
2	1 5/8	1¾

Width

Nominal	Dressed
3	2⅝
4	3⅝
6	5⅝
8	7½
10	9½
12	11½

STANDARD GRADES

For the grades of boards, see the grades of this association for ship-lap, No. 411.5.

California White and Sugar Pine Manufacturers Association, grading rules for white fir, Douglas fir, and incense cedar boards, May 1, 1926.

COMMON BOARDS

Standard sizes.

White fir, Douglas fir, and incense cedar boards when rough S1S, S2S, S4S, D&M, or ship-lap shall conform to the standard sizes of dressed pine boards.

STANDARD GRADES

No. 1 common.

No. 1 common shall present a generally smooth appearance and be high class general utility lumber. It permits any of the following defects not in serious combination:

Sound and intergrown knots: 1½ inches in diameter in 4-inch and 6-inch widths, 2 inches in 8-inch and 10-inch, 2½ inches in 12-inch and not over 3 inches in wider widths and smaller black knots if firmly set; slight shake that does not go through equal in length to width of piece; surface checks, small cup, medium pitch pockets which do not show an opening through the piece, light pitch, medium stain, pin wormholes well scattered, patch of torn grain, slight skip.

No. 2 common.

No. 2 common permits any of the following defects, but no combination of them so serious as to prevent the use of each piece as a whole:

Sound and tight knots.—2 inches in diameter in 4 and 2½ in 6-inch widths, 3 inches in 8 and 10 inch, 3½ inches in 12-inch, and not over 4 inches in wider widths. Smaller unsound and pith knots, provided they be fixed in position. Spike or branch

knots which do not weaken the piece at any point more than the knots heretofore specified, medium crook, medium cup, medium pitch pockets, medium pitch, small grub wormholes, pin wormholes, heavy stain, fir red heart, pith, deep torn grain, and slight skips.

No. 3 common.

No. 3 common permits more numerous and coarser defects than No. 2 common, such as large spike knots, loose or decayed knots or an occasional knot hole, shake, checks, or splits, wane, or skips in dressing, heavy stain, heavy pitch, or grub wormholes.

It should be suitable for use as a whole for sheathing and similar uses.

No. 3 and better common.

Grades of 1, 2, and 3 common may be combined under the grade name of No. 3 and better common.

No. 4 common.

The defects common to this grade are similar to those found in No. 3 common, but exist to a greater degree.

The most serious defects are knot holes, advanced decay or its equivalent in heavy massed pitch, and serious check. Other types are extremely coarse knotted, waney, shaky, badly split, or checked.

No. 5 common.

No. 5 common is the lowest recognized grade and admits all defects known in lumber, provided each piece is strong enough to hold together when carefully handled.

No. 1 box.

No. 1 box shall be graded as No. 3 common boards.

No. 2 box.

No. 2 box shall be graded as No. 4 boards.

Federal Specifications Board, proposed master specification [9] for wooden boxes, nailed and lock-corner construction, May, 1927.

The requirements for box boards as to seasoning of wood, defects, and the classification of the principal woods used for boxes are the same as the American Railway Association, Freight Container Bureau, given above.

National Hardwood Lumber Association, grading rules for cypress boards, January, 1927.

CYPRESS

Grades.—Tank (when specified), first and seconds, selects, No. 1 shop, No. 2 shop, No. 1 common, No. 2 common, No. 1 boxing, No. 2 boxing and peck.

All grades will be shipped in random widths unless otherwise specified.

All rough cypress must be of sufficient thickness when dry to surface to the standard thicknesses for surfaced lumber. Rough lumber when shipped in specified widths may be ¼ inch scant in width.

Lengths.—4 to 20 feet, admitting 25 per cent of odd lengths.

Bright sapwood is not a defect in grades below firsts and seconds.

There is no restriction as to heart center in grades below selects.

Timbers and plankings, when such grades are specified, may contain all the defects admitted in No. 2 common, but each piece must be suitable for planking, foundation material, and similar purposes.

First and seconds.

Widths.—4 inches and over, admitting 5 per cent of 4 and 5 inch widths.

Lengths.—8 feet and over, admitting 20 per cent of 8 to 11 feet, of which 20 per cent one-half may be 8 and 9 feet.

Pieces 6 inches and over wide, will admit free wane defined in first and seconds under standard grades.

One split not exceeding in length the width of the piece, or its equivalent, shall not be considered a defect in pieces 6 inches and over wide.

Eight and nine foot lengths must be clear except that bright sapwood will be admitted in pieces 8 inches and over wide according to the corresponding widths in 10 feet and over long.

In pieces 10 feet and over long, bright sapwood and sound standard defects will be admitted as follows, except that in pieces 10 inches and over wide, one of the standard defects admitted may be an unsound standard defect other than standard wane or split defects.

Four and five inches wide, 1 inch of bright sapwood in the aggregate showing on one face, but otherwise clear.

Six inches wide, 1 inch of bright sapwood in the aggregate, or one sound standard defect or its equivalent.

Eight inches wide, 2 inches of bright sapwood in the aggregate, or one sound standard defect or its equivalent.

Ten inches wide, 2 inches of bright sapwood in the aggregate and one sound standard defect or its equivalent; or 1 inch of bright sapwood in the aggregate and two sound standard defects or their equivalent; or 3 inches of bright sapwood in the aggregate.

Twelve inches wide, 4 inches of bright sapwood in the aggregate and one sound standard defect or its equivalent; or 2 inches of bright sapwood in the aggregate and two sound standard defects or their equivalent; or three sound standard defects or their equivalent.

Thirteen inches wide, any amount of bright sapwood and three sound standard defects or their equivalent.

Sixteen inches and over wide, any amount of bright sapwood and four sound standard defects or their equivalent.

Selects.

Widths.—4 inches and over, admitting 10 per cent under 6 inches wide.

[9] The complete specification includes dimension of parts, methods of manufacture, and other data pertaining to wooden boxes.

Lengths.—8 feet and over, admitting 30 per cent under 12 feet.

Inspection must be made from the good face. The reverse side must not be below No. 1 common or No. 1 shop.

One split not exceeding in length the width of the piece, or its equivalent, shall not be considered a defect in pieces 6 inches and over wide.

Free wane defined in first and seconds under standard grades of general instruction shall be admitted on the good face of pieces 6 inches and over wide.

Pieces 4 and 5 inches wide must have one clear face and two good edges.

Sound standard defects will be admitted according to widths as follows, except that in pieces 10 inches and over wide, 10 feet and over long, one of the standard defects admitted may be an unsound standard defect other than standard wane or split defects:

Six inches, one sound standard defect or its equivalent.

Seven inches, two sound standard defects or their equivalent.

Ten inches, three sound standard defects or their equivalent.

Thirteen inches and over, four sound standard defects or their equivalent.

Pieces 10 inches and over wide, free from other defects, will admit pin wormholes one-tenth the width of the piece on one edge.

In the absence of other defects a slight amount of sound stain will be admitted.

No. 1 common.

Widths.—3 inches and over.

Lengths.—6 feet and over admitting 10 per cent of 6 and 7 feet.

Inspection must be made from the good face. The reverse side must not be below No. 2 common.

This grade will admit sound stain, pin wormholes, season checks, slight peck, slight shake not extending through, sound knots, an occasional unsound knot not exceeding 1 inch in diameter and not extending more than half through the piece, slight wane on one or both edges not exceeding one-third the length or one-half the thickness of the piece, and one split not exceeding in length the width of the piece or its equivalent in one or both ends, or defects equivalent to the above that do not prevent the use of each piece in its full width and length.

No. 2 common.

Widths.—3 inches and over.

Lengths.—6 feet and over.

In addition to the defects admitted in No. 1 common, larger and coarser defects of the same character, through shake, grub wormholes and slight peck showing through, unsound knots that do not show through, and one split one-third the length of the piece or its equivalent, will be admitted. Pieces comparatively free from coarse defects will admit scattered knot holes not exceeding 1 inch in diameter. However, the above-mentioned defects shall not be sufficient to seriously impair the strength or to prevent the use of each piece in its full width and length for fencing, sheathing and other common purposes.

No. 1 boxing.

Widths.—3 inches and over.

Lengths.—6 feet and over.

No. 1 boxing must work 66⅔ per cent in cuttings not less than 3 inches wide by 2 feet long, or 4 inches wide by 18 inches long.

Each cutting may contain sound stain, pin wormholes, unsound knots and peck that do not show through, season checks and other defects that do not prevent its use for boxing purposes.

No. 2 boxing.

Widths.—3 inches and over.

Lengths.—4 feet and over.

No. 2 boxing must work 50 per cent in cuttings as described in No. 1 boxing.

Peck.

Widths.—3 inches and over.

Lengths.—6 feet and over.

This grade will admit any amount of peck, or its equivalent in other defects, but each piece shall have sufficient nailing strength to permit its use for very common purposes.

North Carolina Pine Association (Inc.), grading rules for boards, January 1, 1927.

COMMON BOARDS AND STRIPS

Rough, dressed, D&M, ship-lap, barn siding, and grooved roofing.

Grades.—No. 1 common, No. 2 common, No. 3 common.

Lengths.—Standard lengths are 4 to 16 feet, inclusive, with not over 15 per cent of 8 feet and under.

All 1-inch common lumber which is ordered dressed one or two sides, may be dressed on one edge to bring the width ⅛ inch scant of the nominal width.

In stock widths of No. 1 and No. 2 common boards and strips, rough, or dressed on one or two sides, no piece shall be counted as standard width that is more than ¼ inch scant in width in 7-inch and under, ⅜ inch scant in 8-inch to 12-inch, and ½ inch scant in wider widths. Pieces narrower than the above should be measured as the next lower standard width and not reduced in grade.

Pieces of D&M with $\frac{3}{16}$ inch or more of tongue, and ship-lap with $\frac{5}{16}$ inch or more of lap, will be admitted in No. 1 common. Pieces of D&M having not less than $\frac{1}{16}$ inch tongue, and ship-lap having not less than ⅛ inch lap, will be admitted in No. 2 common. Pieces with $\frac{1}{16}$ inch lap will be admitted in No. 3 common ship-lap.

No. 1 common boards and strips.

No. 1 common boards and strips, rough, or dressed one or two sides are graded same as No. 2 common grade or No. 1 box.

No. 1 common dressed and matched.

No. 1 common dressed and matched (CM), ship-lap, and barn siding shall be graded according to the rules for No. 1 common boards and strips, except that wane shall not be so deep as to extend into the tongue or for one-half the thickness of the top lip on the groove in D&M, or for over one-half the thickness of the lap in ship-lap, on the face side.

No. 1 common grooved roofers.

No. 1 common grooved roofers shall be graded according to the rules for No. 1 common boards and strips, except pith knots, wormholes, and checks and splits that show an opening through, shall not be permitted.

No. 2 common boards and strips.

No. 2 common boards and strips, rough, or dressed one or two sides, dressed and matched (CM), ship-lap, barn siding, and grooved roofers, will admit the following defects or their equivalent: Knots not necessarily sound, the average diameter of any one knot not to exceed approximately 1½ inches in 3-inch widths, 2½ inches in 4-inch widths, 3 inches in 6-inch widths, 3½ inches in 8-inch widths, 4 inches in 10-inch widths, 4½ inches in 12-inch, and 5 inches in wider widths; wormholes; deep torn grain or other machine defects which will not cause waste; pitch pockets; pith; through shakes not to exceed one-half the length of the piece; splits not to exceed one-fourth the length of the piece; streak of advanced decay not to exceed ½ inch wide by one-fourth the length of the piece; or its equivalent in unsound red heart; stain; wane 2 inches wide, one-half the length of the piece. A knot hole or the equivalent, not to exceed 2 inches in diameter, will be admitted in No. 2 common.

Miscut or mismanufactured 1-inch common, which does not fall below ¾ inch in thickness, shall be admitted in No. 2 common, provided the grade of such stock is otherwise as good as No. 1 common.

No. 3 common boards and strips.

No. 3 common boards and strips, rough, or dressed one or two sides, dressed and matched (CM), ship-lap, and barn siding will admit coarse knots; loose or decayed knots and knot holes; through checks, shakes, and splits; serious defects in dressing; pitch pockets and heavy pitch; advanced decay; stain; wane; or other defect which will not prevent its use as a whole for cheap sheathing or which will cut 75 per cent of lumber as good as No. 2 common.

NOTE.—Crooks in common boards and strips. The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 and No. 2 common grades:

3, 4, 5, and 6 inch widths	3-inch crook.
7 and 8 inch widths	2½-inch crook.
9 and 10 inch widths	2-inch crook.
11 and 12 inch widths	1¾-inch crook.

Pieces longer or shorter than 16 feet may have proportionate amounts of crook. A greater amount of crook shall be permissible in No. 3 and 4 common grades.

1913 RULES FOR THE CLASSIFICATION AND INSPECTION OF AIR-DRIED NORTH CAROLINA PINE BOARDS

Air-dried North Carolina pine boards in thicknesses of 2 inches and under, and in lengths of 8 feet and over, in multiples of 2 feet, shall be graded and inspected as follows:

B and better.

Same as B and better finish under grades of rough and dressed lumber, but admitting stain not exceeding 25 per cent.

Nos. 1 and 2 shop lumber.

Same as rules for shop lumber and No. 2 shop lumber under grades of rough and dressed lumber, but admitting stain not exceeding 25 per cent.

No. 1 common.

Same as rule for No. 1 common boards and strips under grades of rough and dressed lumber, but admitting 50 per cent stain.

No. 2 common.

Same as rule for No. 2 common grade or No. 1 box, under grade of rough and dressed lumber, but admitting 75 per cent stain.

No. 3 common.

Same as rule for No. 3 common or No. 2 box, under grade of rough and dressed lumber, but admitting 100 per cent stain.

NOTE.—By "stain" in above rules is meant the usual blue sap stain. Weather stain which is superficial, and will be removed by the usual dressing, is not to be considered a defect.

No. 1 common boards and strips, rough, or dressed one or two sides.

Must be suitable for use without waste, and will admit the following defects or their equivalent: Any number of sound knots, the average diameter of any one knot not to exceed approximately 1½ inches in 3 and 4 inch widths, 2 inches in 6 and 8 inch widths, 2½ inches in 10-inch widths, 3 inches in 12-inch widths, and not over 3½ inches in wider widths; two pith knots; checks; a limited number of pin wormholes, well scattered; loosened or heavy torn grain, or other machine defects which will not cause waste; pitch pockets; pitch; pith, one-sixth the length of the piece; shake that does not go through the piece; the equivalent of one split, not to exceed in length the width of the piece; firm red heart; stain; wane equivalent to 1 inch in width, ½ inch in depth, and one-third the length of the piece.

No. 2 common grade or No. 1 box.

Shall consist of lumber below the grade of No. 1 common containing pinholes, pin, standard, large, reasonably sound knots, stain not exceeding 25 per cent and pith knots, encased knots, and spike knots which do not seriously affect strength of pieces; stained pieces otherwise B and better, which show over 50 per cent stain, stained pieces otherwise grading No. 1 common and showing not more than 33⅓ per cent stain; and pitchy pieces which are not allowed in C and better lumber which would otherwise grade C and better containing 50 per cent firm red heart, will be admitted to this grade.

No. 3 common or No. 2 box.

This grade shall consist of boards below the grade of No. 2 common (excepting bark strips) and which can be used with a waste not exceeding 25 per cent. This will admit red heart. Eight, ten, and twelve inch shall crosscut sound in the widths for which they are shipped within the above limit of waste.

Merchantable red heart.

This grade shall consist of red heart boards which may be used with a waste of not exceeding 25 per cent; except that 8, 10, and 12 inch shall crosscut sound in the widths for which they are shipped within the above limit of waste.

Dunnage.

This grade shall consist of all lumber below the grade of merchantable red heart.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for hemlock and tamarack boards, February 1, 1927.

COMMON BOARDS AND STRIPS

Lumber containing numerous defects which preclude it from use for finishing purposes, but which is suitable for general utility and construction purposes, shall be graded as common lumber. It is 1, 1¼, and 1½ inches in thickness and may consist of common boards, either rough; S1S, S1S1E, S2S, or S4S; D&M (dressed and matched); or ship-lapped.

Common boards, S1S, S1S1E, S2S, or S4S.

Thicknesses and widths of 1, 1¼, and 1½ inch common boards shall conform to those specified for finishing lumber.

Rough common boards.

Lengths.—Standard lengths of common boards, either rough, S1S, S1S1E, S2S, or S4S dressed and matched, or worked ship-lap, shall be 4 to 20 feet, in multiples of 2 feet, and the following percentages of short lengths may be included in all miscellaneous or mixed shipments:

No. 1 common	15 per cent, 8-foot.
No. 2 common	5 per cent, 6-foot.
	15 per cent, 8-foot.
No. 3 common	10 per cent, 6-foot.
	15 per cent, 8-foot.
No. 4 common	5 per cent, 4-foot.
	25 per cent, 6 and 8 foot.
No. 5 common	50 per cent, 4, 6, and 8 foot.

Thicknesses and widths of rough common boards shall be standard and will conform to those specified in rough dry sizes, American Lumber Standards, 400.0, lumber classification and in the following rules of this association:

The widths of common boards, finish and dimension, rough and commercially dry, 7 inches and narrower, shall be not more than ¼ inch less than the nominal widths; widths 8 to 12 inches (board measure) shall be not more than ⅜ inch less than the nominal widths; and widths of 13 inches and wider board measure shall be not more than ½ inch less than the nominal widths. These widths shall also apply to stock width shipments of lumber, dressed on one or two sides. Pieces narrower than above should be counted as next lower standard width and not reduced in grades.

Grades.—No. 1 common, No. 2 common, No 3 common, No. 4 common, and No. 5 common.

Special provision.—The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 and No. 2 common grades: In boards, strips, D&M, ship-lap, flooring, ceiling, partition, drop siding, and bevel siding:

3, 4, 5, and 6 inch widths	3-inch crook.
7 and 8 inch widths	2½-inch crook.
9 and 10 inch widths	2-inch crook.
11 and 12 inch widths	1¾-inch crook.

Pieces longer or shorter than 16 feet may have proportionate amounts of crook. A greater amount of crook shall be permissible in Nos. 3 and 4 common grades.

No. 1 common boards.

Lengths.—8 feet to 20 feet, 15 per cent of 8-foot and approximately 15 per cent of 16-foot.

General.—Suitable for use without waste and admitting any of the following defects, or equivalent combination of defects:

Knots: Any number of sound tight knots, black or red, not larger than—

1½-inch in 4-inch widths.
2-inch in 6-inch widths.
2½-inch in 8 and 10 inch widths.
3-inch in 12-inch widths.

Checks: Small number slight checks.

Torn grain: If not affecting appearance.

Machine gouge: Not affecting strength or appearance.

Shake: Tight shake not extending through and not over one-third the width by one-fourth the length of the piece.

Water stain: Not more than 5 per cent of the area.

Split: One straight split in the end far enough from the edge to permit nailing; and not longer than one and one-half times the width of the piece.

Wane: Not exceeding 1 inch wide, one-half the thickness by one-fourth the length. If shorter, may be deeper, but must not show through on the opposite face.

Rough spots: In dressed lumber not to exceed in length the width of the piece.

Mill worked: Same rules except in D and M, DS and ceiling, wane on back shall not extend through the tongue or into the top lip on the groove, or in ship-lap, not over one-half the thickness of the lap on either side.

No 2 common boards.

Lengths.—6 feet to 20 feet, 5 per cent of 6-foot, 15 per cent of 8-foot; or 20 per cent of 8-foot.

General.—Suitable for use without waste and admitting any of the following defects, or equivalent combination of defects:

Knots: Any number, black or red, average diameter not exceeding—

2-inch in 4-inch widths.
2½-inch in 6-inch widths.
3-inch in 8 and 10 inch widths.
4-inch in 12-inch widths.

Machine gouge: Not affecting strength or appearance.

Shake: Tight two-thirds the length of the piece, or fine through shake one-half the length.

Season checks: Not more serious in effect than the shake allowed.

Water stain: If firm and hard not over 50 per cent of area.

Soft rot: Occasional spot or streak not going through the piece.

Split: One straight split in the end far enough from the edge to permit nailing, and not longer than twice the width of the piece.

Wane: Not exceeding one-fourth the width, one-half the thickness by one-half the length of the piece, or if shorter may go deeper, but not to show on the opposite face.

Knot holes: None in 4-inch and 6-inch stock 8 feet or shorter. In stock 10 feet and longer one knot hole, equal in diameter to the knots permitted in each width of the No. 1 common grade, or two knot holes one-half that size.

Torn grain or rough spots: In dressed lumber equal in area to the width of the piece by twice the width in length.

No. 3 common boards.

Lengths.—6 feet to 20 feet, 10 per cent 6-foot, 15 per cent 8-foot; or 25 per cent 8-foot.

General.—All defects described not permitted in one piece. Lumber must be suitable for use without waste.

Knots: Any number round or spiked.

Season checks: Any number.

Shake: Through shake that does not seriously weaken the piece for sheathing.

Water stain: Any amount of firm rot or water stain.

Soft rot: An occasional spot not impairing the usefulness of the piece.

Wane: Not to exceed one-fourth the width, three-fourths the thickness by three-fourths the length of the piece, or if shorter may go deeper, but not showing on the opposite face or on the corners of ends to prevent nailing.

Rough spots: Permitted in dressed lumber if the combined area is not more than one-half the area of the piece.

Torn grain: Any amount if not too deep.

Split: Not to exceed in length two and one-half times the width of the piece and not prevent firm nailing.

Knot holes: Stock shorter than 8 feet. One knot hole in 5 board feet and less surface measure. Two knot holes in all stock containing over 5 feet surface measure. Stock 8 feet and longer permits knot holes not larger than the maximum size knots specified for No. 2 common, but limited as follows:

One knot hole in 4-inch width.
One knot hole in 6-inch width.
Two knot holes in 8 and 10 inch widths.
Three knot holes in 12-inch width.
Or equivalent in smaller holes.

No. 4 common boards.

Lengths.—4 feet to 20 feet, 5 per cent 4-foot, 25 per cent 6 and 8 foot; or 30 per cent 6 and 8 foot.

Knots: Any number, any size.

Knot holes: Any number.

Loose shake: Permitted.

Excessive torn grain: Permitted.

Soft rot: Permitted.

Wane: Not exceeding one-third the width, three-fourths the thickness by the full length of the piece on one edge or the equivalent in two or more places.

Splits: Three if the combined length does not exceed one-half the length of the piece.

General.—Must work 50 per cent firm stock suitable for crating, or be useful for sheathing with not over 25 per cent waste.

No. 5 common boards.

Lengths.—Fifty per cent 4, 6, and 8 feet. All lumber below the grade of No. 4.

Northern Pine Manufacturers Association, grading rules for northern white and Norway pine, spruce and tamarack boards, April 15, 1925.

COMMON LUMBER

The characteristic of common lumber, as distinguished from finish, consists of a general coarseness of appearance, caused by various defects and combinations of defects, in a greater or less degree according to the grade.

Common lumber 1¼ inches and thicker shall be graded the same as inch lumber.

No. 1 common boards and strips.

No. 1 common boards and strips may consist of white or Norway pine, or a mixture of both, unless otherwise specified. This grade includes all sound, tight, knotted stock, whether red or black knots, free from very large, coarse knots, or any imperfections that will weaken the piece.

This grade should be of a character fitting it for ordinary use, except finished purposes.

Knots, medium stain, or a small amount of shake are admissible if they do not affect the general utility of the piece.

No. 2 common boards and strips.

No. 2 common boards and strips may consist of white or Norway pine, or a mixture of both, unless otherwise specified, and are subject to the same general inspection as No. 1, except that coarser and larger knots, not necessarily sound, more stain and shake are allowed. V and coarse limb knots, heart shake or slight trace of rot, when firm, or occasional wormholes are defects admissible in this grade.

No. 3 common boards and strips.

No. 3 common boards and strips may consist of northern pine or a mixture of these species.

The general appearance of this grade of lumber is coarse, admitting:

Large loose or unsound knots.

An occasional knot hole.

A great deal of shake.

Some red rot.

Large wormholes.

Heavy stain.

Not a serious combination of these defects in any one piece is admissible.

No. 4 common boards and strips.

The predominating defect characterizing this grade is red rot.

Other types are pieces showing numerous large wormholes, or several knot holes, or pieces that are extremely coarse knotted, waney, shaky, or badly split.

Pieces when extremely cross checked, are admissible in this grade.

No. 5 common boards and strips.

This is the lowest recognized grade and admits of all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

Pacific Lumber Inspection Bureau, grading rules for Pacific hemlock and Sitka spruce boards, Schedule M, 1925.

The value and grade of this lumber is determined from its adaptability for the manufacture of ordinary packing boxes. Wide boards, or those of special widths, will admit of more defects than narrow or random widths. It is not intended that boxes shall be of clear material and defects which do not impair the strength or the usefulness of ordinary boxes are not considered as making such material unsuited for box purposes. Must be sound lumber, well manufactured. Will allow occasional variations in sawing, knots, bark pockets, and sap or other defects, if not rendering the piece unfit for box-cutting purposes, providing stock will produce 75 to 90 per cent of box cuttings, ranging in size from 4 to 12 inches wide and not to exceed 18 inches in length. Such cuttings do not necessarily have to be clear for box-making purposes, so they may contain small sound knots and/or small bark pockets. In hemlock box, larch, a kindred wood, may be shipped.

Sitka spruce, merchantable box.

The value and grade of this lumber is determined from its adaptability for the manufacture of ordinary packing boxes. Wide boards or those of special widths will admit of more defects than narrow or or random widths. It is not intended that boxes shall be of clear material, and defects which do not impair the strength or the usefulness of ordinary boxes are not considered as making such material unsuited for box purposes. Must be sound lumber, well manufactured. Will allow occasional variations in sawing, knots, bark pockets, and sap or other defects if not rendering the piece unfit for box-cutting purposes, providing stock will produce 75 to 90 per cent of box cuttings, ranging in size from 4 to 12 inches wide and not to exceed 18 inches in length. Such cuttings do not necessarily have to be clear for box-making purposes, so they may contain small sound knots and/or small bark pockets, pitch pockets, and pitch blisters.

Red Cedar Lumber Manufacturers Association, grading rules for boards, August 1, 1925.

BOARDS

Nominal thicknesses (inches)	Standard finished thicknesses S1S or S2S	Finished widths S1E and S2E
	Inches	*Inches*
1	$\frac{13}{16}$	3 to 7, $\frac{3}{8}$ inch off.
1¼	$1\frac{3}{16}$	8 to 12, ½ inch off.
1½	$1\frac{7}{16}$	13 and wider, 1 inch off.

Widths of surfaced stock 13 inches and wider with edges rough, ½ inch less than nominal.

Lengths.—Multiples of 2 feet.

American Lumber Standard thicknesses can be furnished on contract.

Select common.

Shall be square edged, well manufactured, and will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and intergrown knots, approximately 1 inch in 4-inch to 6-inch widths, and 1½ inches in 8-inch to 12-inch widths; medium stained sap on 25 per cent of face; heavy torn grain; seasoning checks (none through) and slight end checks.

No. 1 common.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 2 inches in 4-inch to 6-inch widths; 2½ inches in 8-inch widths, 3 inches in 10-inch widths, 4 inches in 12-inch widths, and one-third width of piece in widths over 12 inches. Will also admit encased medium knots; spike knots; torn grain; wane 1½ inches wide, ½ inch deep, not over 3 feet long; wormholes, limited and well scattered; sap stain, any amount; seasoning checks; streak of rot 1½ inches wide, ½ inch deep for one-third the length; and edge defects due to machining.

No. 2 common.

Must be suitable for low-grade sheathing. Will admit of stock below No 1 common. May contain any number of sound knots, five standard knot holes in any one piece or equivalent number of smaller knot holes. In addition, will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Wane; splits; shake; stained sap; decayed streaks; decayed sap; rotten spots, well scattered; wormholes, any number; variation in thickness and mismatched.

Cull grade.

This grade will admit anything that is below the No. 2 grade of common and is suitable for crating or other similar uses.

Southeastern Forest Products Association, grading rules for boards, September 1, 1925.

COMMON BOARDS AND STRIPS

Grades.—No. 1 common, No. 2 common, No. 3 common, and No. 4 common.

Lengths.—Standard lengths are 4 to 20 feet, inclusive, in multiples of 2 feet, and the following percentages of short lengths may be included in all miscellaneous or mixed length shipments:

No. 1 common	5 per cent, 8-foot.
No. 2 common	5 per cent, 4-foot.
Nos. 3 and 4 common, 8 inches and wider	5 per cent, 4-foot. 5 per cent, 6-foot. 5 per cent, 8-foot.
3 and 6 inch widths	25 per cent may be under 10-foot.

The above percentage of short lengths is customary, and in the interest of conservation, will be included, so far as practicable, in all shipments of mixed lengths, except as may be hereinafter specified.

Special provision.—The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 and No. 2 common grades:

3, 4, 5, and 6 inch widths	3-inch crook.
7 and 8 inch widths	2½-inch crook.
9 and 10 inch widths	2-inch crook.
11 and 12 inch widths	1¾-inch crook.

Pieces longer or shorter than 16 feet may have proportionate amounts of crook. A greater amount of crook shall be permissible in Nos. 3 and 4 common grades.

Based on a piece 12 inches wide, ⅜-inch cup shall be permissible in No. 1 common grades and ½-inch in No. 2 common and poorer grades. Narrower or wider pieces may have proportionate amounts of cup.

All 1-inch common lumber which is ordered dressed one or two sides may be dressed on one edge to bring the width ⅛ inch scant of the nominal width.

In stock widths of No. 1 and No. 2 common boards and strips, rough, or dressed on one or two sides, no piece shall be counted as standard width that is more than ¼ inch scant in width in 7-inch and under, ⅜ inch scant in 8 to 12 inch, and ½ inch scant in wider widths. Pieces narrower than the above should be measured as the next lower standard width and not reduced in grade.

Pieces of D&M with $\frac{3}{16}$ inch or more of tongue, and ship-lap with $\frac{5}{16}$ inch or more of lap, will be admitted in No. 1 common. Pieces of D&M having not less than $\frac{1}{16}$ inch tongue and ship-lap having not less than ⅛ inch lap will be admitted in No. 2 common. Pieces with $\frac{1}{16}$ inch lap will be admitted in No. 3 common ship-lap.

Standard workings.—Dressed and matched (CM), ship-lap, and barn siding shall be worked to the patterns shown in Figures 9 to 13; 136 and 137.

The size of the groove in grooved roofing shall be ½ inch wide, ¼ inch deep, and located $1\frac{3}{16}$ inches from the outer edge of the groove to the edge of board, as shown in Figure 143.

No. 1 common boards and strips.

No. 1 common boards and strips, rough, or dressed one or two sides, must be suitable for use without waste, and will admit the following defects or their equivalent; any number of sound knots, the average diameter of any one knot not to exceed approximately 1½ inches in 3 and 4 inch widths, 2 inches in 6 and 8 inch widths, 2½ inches in 10-inch widths, 3 inches in 12-inch widths, and not over 3½ inches in wider widths; two pith knots; checks; a limited number of pin wormholes, well scattered; loosened or heavy torn grain, or other machine defects which will not cause waste; pitch pockets; pitch; pith, one-sixth the length of the piece; shake that does not go through the piece; the equivalent of one split, not to exceed in length the width of the piece; firm red heart; stain; wane equivalent to 1 inch in width, ½ inch in depth, and one-third the length of the piece.

No. 1 common dressed and matched (CM), ship-lap, and barn siding.

No. 1 common dressed and matched (CM), ship-lap, and barn siding shall be graded according to the rules for No. 1 common boards and strips, except that wane shall not be so deep as to extend into the tongue or for one-half the thickness of the top lip on the groove in D&M, or for over one-half the thickness of the lap in ship-lap, on the face side.

No. 1 common grooved roofing shall be graded according to the rules for No. 1 common boards and strips, except pith knots, wormholes, and checks and splits that show an opening through shall not be permitted.

No. 2 common boards and strips, dressed and matched (CM), ship-lap, barn siding, and grooved roofing.

No. 2 common boards and strips, rough, or dressed one or two sides, dressed and matched (CM), ship-lap, barn siding, and grooved roofing will admit the following defects or their equivalent: Knots not necessarily sound, the average diameter of any one knot not to exceed approximately 1½ inches in 3-inch widths, 2½ inches in 4-inch widths, 3 inches in 6-inch widths, 3½ inches in 8-inch widths, 4 inches in 10-inch widths, 4½ inches in 12-inch, and 5 inches in wider widths; wormholes; deep torn grain or other machine defects which will not cause waste; pitch pockets; pitch; pith; through shakes not to exceed one-half the length of the piece; splits not to exceed one-fourth the length of the piece; streak of advanced decay not to exceed ½ inch wide by one-fourth the length of the piece, or its equivalent in unsound red heart; stain; wane 2 inches wide and one-half the length of the piece.

A knot hole or the equivalent, not to exceed 2 inches in diameter, will be admitted in No. 2 common.

Miscut or mismanufactured 1-inch common, which does not fall below ¾ inch in thickness, shall be admitted in No. 2 common, provided the grade of such stock is otherwise as good as No. 1 common.

No. 3 common boards and strips, rough, or dressed one or two sides, dressed and matched (CM), shiplap, and barn siding.

Will admit coarse knots; loose or decayed knots and knot holes; through checks, shakes, and splits; serious defects in dressing; pitch pockets and heavy pitch; advanced decay; stain; wane; or other defects which will not prevent its use as a whole for cheap sheathing or which will cut 75 per cent of lumber as good as No. 2 common.

No. 4 common boards and strips.

Shall include all pieces that fall below the grade of No. 3 common, excluding such pieces, however, as will not be held in place by nailing after wasting one-fourth the length of the piece by cutting into two or three pieces; mill inspection to be final.

Southern Cypress Manufacturers Association, grading rules for boards, June 15, 1925.

No. 1 common.

Thickness.—1 inch and thicker.

Width.—Shall be specified widths, 3, 4, 5, 6, 8, 10, and 12 inches wide.

Length.—8 to 20 feet.

Will admit stained sap, shake, season checks, pin wormholes, sound tight knots, straight-end splits not exceeding in length the width of the piece, a slight amount of peck on one or both sides of pieces comparatively free from other defects, slight wane on one or both edges, not to exceed one-third the length of the piece, and other defects which will not prevent its use for usual common purposes in its full length and width. This grade is not intended for tank purposes.

No. 2 common.

Thickness.—1 inch and thicker.

Width.—Shall be specified widths, 3, 4, 5, 6, 8, 10, and 12 inches wide.

Length.—6 to 20 feet.

Will admit all defects allowed in No. 1 common, and will also admit unsound knots and slight peck on both sides. The defects shall not, however, be sufficient to prevent the use of each piece in its full length and width for common sheathing and fencing purposes.

No. 3 common.

Thickness.—1 inch and thicker.

Width.—Specified or random, 3 inches and wider.

Length.—6 to 20 feet.

Admits coarser and more numerous defects than No. 2 common, including an occasional knot hole, but no piece will admit a sufficiently serious combination of defects to prevent its use for sheathing or similar purposes.

No. 4 common.

Thickness.—1 inch and thicker.

Width.—Specified or random, 3 inches and wider.

Length.—6 feet and longer.

Defects common to this grade are similar to those found in No. 3 common, but exist to a greater degree. The most common serious defects are knot holes, extremely coarse knots, wane, shakes and splits, and peck.

Peck.

Thickness.—1 inch and thicker.

Width.—Shall be random or specified, 3 inches and wider.

Length.—6 to 20 feet.

Shall admit the product of that part of the log known as pecky. Each piece shall have sufficient strength to permit its use as a low-grade sheathing, fencing, or foundation material.

Southern Pine Association, grading rules for boards, March 23, 1927.

Similar to the grading rules of the Southeastern Forest Products Association for boards. (See above.)

Southern Pine Association, the Gulf coast classification of pitch pine, grading rules for boards, March 15, 1923.

BOARDS AND PLANKS

Sizes of boards.

1 by 8 and wider.
1¼ by 8 and wider.
1½ by 8 and wider.
1¾ by 8 and wider.

Sizes of planks.

2 by 7 and wider.
2¼ by 7 and wider.
2½ by 7 and wider.
2¾ by 7 and wider.

Lengths.—10 feet and up; 5 per cent 8 and 9 feet allowed.

Grades.

Crown, prime, Genoa prime, merchantable, square edge.

Crown.

Boards must be bright, one heart face, except will permit sap 1 inch wide on the heart side measured across the face of the piece on one corner, or the equivalent on two corners; must be free from unsound knots, loose knots, pith knots, knot holes, pin wormholes, grub wormholes, rot, pith, wane, pitch pockets exceeding ¼ inch in width, through splits, through shakes and centers. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Not to have more than one knot 1¼ inch on the 8 to 10 inch, or one knot 1½ inch on the 11 inch and up, to each 6 feet or fraction thereof; provided that 90 per cent of the pieces shall be free of knots.

Planks must be bright, one heart face, except will permit sap 1 inch wide on the heart side measured across the face of the piece on one corner, or the equivalent on two corners; must be free from unsound knots, loose knots, pith knots, knot holes, pin wormholes, grub wormholes, rot, wane, pitch pockets exceeding ¼ inch in width, through splits and through shakes; except that in 15 per cent of the pieces, splits, not to exceed in length one-half the width of the piece, may be allowed on one or both ends of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Not to have more than one knot 1½ inch on the

7 to 10 inch, or one knot 1¾ inch the 11 inchon and up, to each 6 feet or fraction thereof; provided that 90 per cent shall be free of knots, and 90 per cent free of centers.

Prime.

Boards must be one heart face and two-thirds heart surface on the opposite side, the heart to show the entire length; must be free from unsound knots, loose knots, pith knots, knot holes, pin wormholes, grub wormholes, rot, wane, pitch pockets exceeding ⅜ inch in width, and through splits and through shakes, except that in 15 per cent of the pieces, splits, not to exceed in length one-half the width of the piece, may be allowed on one or both ends of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Not to have more than one knot 1¼ inch on the 8 to 10 inch, or one knot 1½ inch on the 11 inch and up, to each 6 feet or fraction thereof; provided that 75 per cent shall be free of knots and 85 per cent free of centers.

Planks must be one heart face and two-thirds heart surface on the opposite side; must be free from unsound knots, loose knots, pith knots, knot holes, pin wormholes, grub wormholes, rot, wane, pitch pockets exceeding ⅜ inch in width, and through splits and through shakes, except that in 15 per cent of the pieces, splits, not to exceed in length one-half the width of the piece, may be allowed on one or both ends of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Not to have more than one knot 1¾ inch on the 7 to 10 inch or one knot 2 inch on the 11 inch and up, to each 6 feet or fraction thereof; provided that 75 per cent shall be free of knots and 85 per cent free of centers.

Genoa prime.

Boards and planks must be one heart face, two-thirds heart surface on the opposite side, except that the 9-inch and under on the heart side may have 1 inch sap on one corner or the equivalent on two corners, and the 10-inch and up may have 1½ inches of sap on one corner or the equivalent on two corners, measured across the face of the piece. Must be free from pith knots, unsound knots, loose knots, pin wormholes, grub wormholes, knot holes, rot, wane, and through splits and through shakes the length of which exceeds the width of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face.

Merchantable.

Boards and planks must show two-thirds heart surface on two opposite sides, or the equivalent; must be free from unsound knots, loose knots, pin wormholes, grub wormholes, knot holes, rot, and through splits and through shakes, the length of which exceeds the width of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Fifteen per cent of the pieces will permit wane 1½ inches wide measured across the face of the wane, one-quarter of the length of the piece on one corner, or the equivalent on two or more corners.

Square edge.

Boards and planks must be free from unsound knots, loose knots, knot holes, grub wormholes, rot, through splits and through shakes the length of which exceeds the width of the piece. Twenty-five per cent of the pieces will permit wane 1½ inches wide, measured across the face of the wane, one-third of the length of the piece on one corner, or the equivalent on two or more corners.

RIVER PLATE STANDARD

Boards and planks.

Sizes.—1 to 2 inches by 8 to 12 inches.

Lengths.—10 feet and up; 5 per cent 8 and 9 feet allowed.

Must be free from unsound knots, loose knots, grub wormholes, knot holes, rot, and through splits and through shakes, the length of which exceeds the width of the piece. One-third of the pieces will permit wane 1½ inches wide, provided not over one-half the thickness of the piece and extending one-third the length of the piece on one corner, or the equivalent on two or more corners.

West Indian

First-class boards and planks.

Sizes.—

1 by 3 to 1 by 12.
1¼ by 3 to 1¼ by 12.
1½ by 3 to 1½ by 12.
2 by 8 to 2 by 12.

Lengths.—10 feet and up; 5 per cent 8 and 9 feet allowed.

Must be free from knot holes, grub wormholes, rot, through splits and through shakes, exceeding 12 inches in length. One-third of the pieces will permit wane 1½ inches wide, measured across the face of the wane and extending one-third the length of the piece on one corner, or the equivalent on two or more corners. Pieces combining coarse grain and coarse knots or coarse grain and numerous permissible defects, shall be excluded.

Second-class boards and planks.

Sizes.—

1 by 3 to 1 by 12.
1¼ by 3 to 1¼ by 12.
1½ by 3 to 1¼ by 12.
2 by 8 to 2 by 12.

Lengths.—Ten feet and up; 5 per cent 8 and 9 feet allowed.

Will permit lumber that does not grade first class, except that through splits and through shakes over 2 feet in length, and rot extending through the piece, shall be excluded. Will admit coarse-grained material, sap stain, red heart, pith knots, loose knots, unsound knots, wormholes, and wane if not over 2 inches wide measured on any face of the piece, when not over one-third the length of the piece on one corner, or the equivalent on two or more corners.

85 PER CENT HEART

The grading rules for boards are the same as the grading rules of this association for strips, No. 402.41.

ALL HEART

The grading rules for boards are the same as the grading rules of this association for strips, No. 402.41.

West Coast Lumbermen's Association, grading rules for Douglas fir, West coast hemlock, Sitka spruce boards, July 1, 1926.

DOUGLAS FIR

Common grades.

Discoloration through exposure is not a defect in the grades of common.

All common grades, including timbers either rough or dressed, are subject to shrinkage.

Boards

Nominal thicknesses (inches)	Standard yard thicknesses S1S or S2S	Finished widths S1E and S2E
	Inches	
1	25/32	2 to 7 inches, 3/8 off.
1¼	1 1/16	8 to 12 inches, ½ off.

Standard industrial.—1 inch S1S or S2S to 13/16 inch.

Lengths.—Multiples of 2 feet.

Selected common boards.

Shall be square edged, well manufactured, and will admit any number of the following defects, equivalent defects, or equivalent combinations of defects; sound and intergrown knots, approximately 1 inch in 4 inches to 6-inch widths, 1½ inches in 8 inches to 12-inch widths; pitch pockets, not over 6 inches in length, none through; heavy torn grain; medium sap stain, 25 per cent of face; seasoning checks, none through; slight end checks.

No. 1 common boards.

Must be firm, sound, and suitable for use without waste. May be Douglas fir and/or west coast hemlock. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 1½ inch in 4 to 6 inch widths, 2 inches in 8 to 10 inch widths, 2½ inches in 12-inch widths, 3 inches in widths over 12 inches; small spike knots which do not materially weaken the piece; medium pitch pockets, none open through; pitch streaks; wane ½ inch deep on edge, 1 inch wide on face, one-sixth lengths; splits, not longer than width of piece or equivalent of end checks; pin wormholes, limited; medium sap stain, 25 per cent of face; firm heart stain; seasoning checks; deep torn grain; slight edge defects due to machining.

No. 2 common boards.

May be Douglas fir and/or west coast hemlock. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and unsound tight knots, approximately 2 inches in 4 to 6 inch widths, 2½ inches in 8-inch widths, 3 inches in 10-inch widths, 4 inches in 12-inch widths, one-third width of piece in widths over 12 inches; incased medium knots; spike knots; pitch pockets; pitch streaks; fine shake or checks; splits, not longer than twice the width of the piece; wane 2 inches wide if not extending into the other face; wormholes, limited, well scattered; sap stain, any amount; heart stain, any amount; torn grain; edge defects due to machining; two medium or equivalent smaller knot holes in a 12-foot board, if other defects limited.

No. 3 common boards.

Must be suitable for low-grade sheathing, and will admit any or all west coast species. Will admit stock below No. 2 common, variation in thickness and any number of the following defects, equivalent defects, or equivalent combinations of defects: Large knots; loose knots; unsound knots; knot holes; wane; splits, one-fourth length of piece; pitch; pitch pockets; shake; heart or sap stain; decayed streaks; decayed sap; rotten spots, well scattered; wormholes, any number.

WEST COAST HEMLOCK

Box Lumber

Standard finished thickness S2S (inch)	Standard industrial finished thickness S2S
	Inch
25/32	13/16

The value and grade of this lumber is determined from its adaptability for the manufacture of ordinary packing boxes, ordinary sizes being defined as boxes not over 20 inches in length nor more than 15 inches in width. Wide boards, or those of special widths, will admit of more defects than narrow or random widths. It is not intended that boxes shall be of clear material, and defects that do not impair the strength or the usefulness of ordinary boxes are not considered as making such material unsuited for box purposes.

Specified widths.

Whenever west coast hemlock box lumber is ordered of specified width, then the cuttings used in computing percentages shall be of the same width as the lumber ordered. In such case the percentage of each grade shall be 15 per cent less; that is, No. 1 box shall contain 60 per cent or more of cuttings, No. 2 box shall contain 45 to 60 per cent, and No. 3 box shall contain 25 to 45 per cent.

Grades

There shall be three recognized grades of box lumber, viz, No. 1, No. 2, and No. 3

No. 1.—Shall be generally sound and contain 75 per cent and over of cuttings suitable for boxes of ordinary size and quality, as referred to above. In computing percentages, cuttings of assorted sizes shall be used. Assorted sizes are defined as pieces running in widths from 6 to 12 inches and in lengths from 12 to 20 inches.

No. 2.—Generally similar in character to No. 1, containing from 60 to 75 per cent of box cuttings.

No. 3.—Shall consist of all lumber below the grade of No. 2 and shall contain 40 to 60 per cent of box cuttings.

SITKA SPRUCE

Box Lumber

Standard thickness S2S, $\frac{25}{32}$ inch. Standard industrial S2S, $\frac{13}{16}$ inch.

The value and grade of this lumber is determined from its adaptibility for the manufacture of ordinary packing boxes, ordinary sizes being defined as boxes not over 20 inches in length nor more than 15 inches in width. Wide boards, or those of special widths, will admit of more defects than narrow or random widths. It is not intended that boxes shall be clear material, and defects that do not impair the strength or the usefulness of ordinary boxes are not considered as making such material unsuited for box purposes.

Specified widths.

Whenever spruce box lumber is ordered of specified width, then the cuttings used in computing percentages shall be the same width as the lumber ordered. In such case the percentage of each grade shall be 15 per cent less; that is, No. 1 box shall contain 60 per cent or more of cuttings, No. 2 box shall contain 45 to 60 per cent, and No 3. shall contain 25 to 45 per cent.

Grades.

There shall be three recognized grades of box lumber, viz, No. 1, No. 2, and No. 3.

No. 1.—Shall be generally sound and contain 75 per cent and over of cuttings suitable for boxes of ordinary size and quality, as referred to above. In computing percentages, cuttings of assorted sizes shall be used. Assorted sizes are defined as pieces running in widths from 6 to 12 inches and in lengths from 12 to 20 inches.

No. 2.—Generally similar in character to No. 1 containing from 60 to 75 per cent of box cuttings.

No. 3.—Shall consist of all lumber below the grade of No. 2 and shall contain 40 to 60 per cent of box cuttings.

West Coast Lumbermen's Association, grading rules for western red cedar boards, July 1, 1926.

WESTERN RED CEDAR

Common grades.

Discoloration through exposure is not a defect in the grades of common.

All common grades, including timbers either rough or dressed, are subject to shrinkage.

Boards

Nominal thicknesses (inches)	Standard yard thicknesses S1S or S2S	Finished width S1E and S2E
	Inches	
1	$\frac{25}{32}$	2 to 7 inches, $\frac{3}{8}$ off.
1¼	1$\frac{1}{16}$	8 to 12 inches, ½ off.

Standard industrial 1-inch S1S or S2S to $\frac{13}{16}$ inch.

Lengths.—Multiples of 2 feet.

Selected common.

Shall be square edged, well manufactured, and will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and intergrown knots, approximately 1 inch in 4 to 6 inch widths, 1½ inches in 8 to 12 inch widths; medium stained sap, 25 per cent of face; heavy torn grain; seasoning checks, none through; slight end checks.

No. 1 common.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 2 inches in 4 to 6 inch widths, 2½ inches in 8-inch widths, 3 inches in 10-inch widths, 4 inches in 12-inch widths, ⅓ width of piece in widths over 12 inches; encased medium knots; spike knots; torn grain; wane 1½ inches wide, ½ inch deep, not over 3 feet long; wormholes, limited, well scattered; sap stain, any amount; seasoning checks; streaks of rot 1½ inches wide, ½ inch deep, one-half length; edge defects due to machining.

No. 2 common.

Must be suitable for low-grade sheathing. Will admit of stock below No. 1 common, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Large knots; loose knots; unsound knots; knot holes; wane; splits; shake; stained sap; decayed streaks; decayed sap; rotten spots, well scattered; wormholes, any number; variation in thickness.

Western Pine Manufacturers Association, grading rules for larch and fir boards, July 1, 1925.

LARCH AND FIR

Standard sizes.

Boards S1S or S2S to $\frac{25}{32}$ inch—boards S4S.

4-inch to $\frac{25}{32}$ by 3⅝.
6-inch to $\frac{25}{32}$ by 5⅝.
8-inch to $\frac{25}{32}$ by 7½.
10-inch to $\frac{25}{32}$ by 9½.
12-inch to $\frac{25}{32}$ by 11½.

Western Pine Manufacturers Association, grading rules for Pondosa pine, Idaho white pine, white fir, cedar, and spruce boards, July 1, 1925.

Standard sizes of boards and strips.

S2S to $\frac{25}{32}$.

S4S to $\frac{25}{32}$ by ⅜ inch scant of full width on all widths.

PONDOSA PINE

The characteristics of common lumber as distinguished from finishing are a general coarseness of appearance, caused by various defects and combination of defects in a greater or lesser degree according to the grade.

Checks in tight red knots in common lumber are not considered a defect unless the opening is so pronounced as to injure the piece for the purpose for which the grade was designed.

Common lumber 1¼ inches and thicker shall be graded the same as inch lumber.

No. 1 common boards and strips.

No. 1 common boards and strips includes all sound tight knotted stock with the size of the knot the determining factor of the grade.

This grade is of a character that fits it for shelving, cornice, fine barn board, and all uses where best quality and appearance of common lumber is required.

Knots, light pitch, light stain, season checks, and small pitch pockets are admissible if they do not affect the general utility of the piece.

No. 2 common boards and strips.

No. 2 boards and strips are subject to the same general inspection as No. 1 common, except that coarser and larger knots, not necessarily sound, or their equivalent, form the basis of inspection.

Some of the most common types of knots admissible in this grade are large knots, branch knots, checked knots, and those not firmly set in the piece. Other defects common to this grade are season checks, heart shake, heart pith, pitch, pitch pockets, slight traces of firm rot, and occasional wormholes. No serious combination of the above defects is admissible in any one piece.

Stain covering the entire face is admissible when not in serious combination with other limit defects.

No. 3 common boards and strips.

The grade of No. 3 takes in much of the lower product of the log and while the appearance of a part of the grade is coarse the stock has the inherent qualities of the soft and lasting pines.

The defects common to this grade are:

(*a*) Large, loose, or unsound knots, or an occasional knot hole.

(*b*) Considerable heart shake, season checks, pitch or pitch pockets.

(*c*) Any amount of stain and large branch knots.

(*d*) Some red rot and large wormholes.

(*e*) Roughness caused by skips in dressing, and roller splits.

A serious combination of the above defects is not admissible in any one piece.

No. 4 common boards and strips.

The defects common to this grade are much the same as those found in No. 3, but exist to a greater degree.

The most common serious defects are knot holes, either red rot or its equivalent, in heavy massed pitch or serious checks. Other types are extremely coarse knotted, waney, excessive heart shake, badly split or badly checked pieces.

No. 5 boards.

A No. 5 board is the lowest recognized grade and admits all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

IDAHO WHITE PINE

No. 1 common boards and strips.

No. 1 common boards and strips include all sound tight knotted stock whether red or black knots, free from very large, coarse knots, or any imperfections that will weaken the piece.

This grade should be of a character fitting it for ordinary use, except finishing purposes.

Knots, small pitch pockets, light season checks, or light pitch are admissible if they do not affect the general utility of the piece.

Light stain covering the entire face is admissible if not in combination with other marked defects.

No. 2 common boards and strips.

No. 2 boards and strips are subject to the same general inspection as No. 1 except that coarser and larger knots, not necessarily sound, more pitch pockets and season checks are allowed. Coarse branch knots, heart shake or slight traces of rot when firm, or occasional wormholes, are defects admissible in this grade.

Stain covering the entire face of the piece is admissible when not in combination with other marked defects.

No. 3 common boards and strips.

The general appearance of a part of this grade of lumber is coarse, admitting:

1. Large, loose, or unsound knots.
2. An occasional knot hole.
3. A great deal of pitch and pitch pockets.
4. Some red rot and pieces that are badly season checked, or have considerable heart shake.
5. Large wormholes and any amount of stain.
6. Roughness caused by skips in dressing and roller splits.

A serious combination of these defects in any one piece is not admissible.

No. 4 common boards and strips.

The predominating defects characterizing this grade are red rot and knot holes.

Other types are pieces showing numerous large wormholes, pieces that are extremely coarse knotted, waney, or showing excessive heart shake, extremely pitchy, or badly checked or split.

No. 5 boards.

A No. 5 board is the lowest recognized grade and admits all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

Inch box lumber.

This grade shall consist of random widths, 3 inches and wider, 6 to 20 feet long. Each piece shall contain not less than 66⅔ per cent of sound cuttings, 3 inches wide or wider and 18 inches long or longer. Sound cuttings will admit all of the defects allowed in the grade of No. 2 common. Waste material may be thin or practically worthless.

Lumber 1¼ inches and thicker may be graded under this rule if so specified.

Short box.

Short box shall include lumber 12 to 47 inches long, inclusive, 3 inches and wider, and No. 4 and better.

White Pine Association of the Tonawandas, grades of northern white pine lumber for boxes, 1922.

(This association's grade of white pine lumber suitable for boards for boxes is shown in 400.26 under No. 1 box lumber.)

402.43 Dimension Lumber.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 400.0 for lumber classification.
See 411.0 for yard lumber.
See 412.0 for structural material.
See 413.0 for softwood factory and shop lumber.

Arkansas Soft Pine Bureau, grading rules for dimension lumber, March 23, 1927.

The grading rules of this association for the following are the same as those of the Southeastern Forest Products Association and the Southern Pine Association. (See below.)

Dimension and heavy joists.

Grades.
Lengths.
Special provisions.

The grading rules of this association for the following are the same as those of the North Carolina Pine Association (Inc.). (See below.)

No. 1 common dimension and heavy joists.
No. 2 common dimension and heavy joists.
No. 3 common dimension.

California Redwood Association, standard specifications for eastern grades of California redwood squares, April, 1927.

SQUARES

Squares shall be manufactured in sizes as ordered, 4 by 4 inches and larger, rough or S4S ½ inch off each way.

Grades.—Clear heart (Redwood Association grade) and A (American Standard Redwood grade).

Clear heart squares shall be straight and well manufactured and in the rough may contain any defects that will work out in dressing. Sapwood on one corner one-quarter the width of the piece and in size 8 by 8 inches and larger not to exceed five small sound knots whose combined diameters do not exceed 1¼ inches, will be allowed.

"A" squares will admit any amount of bright sap and slightly crooked stock, and, in addition, not to exceed five small knots, or their equivalent, whose combined diameters do not exceed 2 inches.

California Redwood Association, standard specifications for eastern grades of California redwood dimension, heavy joists, and small timbers, April, 1927.

The sizes of dimension stock are given in the table of sizes for yard lumber, 411.0.

The grades of dimension, heavy joists, and small timbers are as follows:

In the grading of dimension, heavy joists and small timbers strength, stiffness, and uniformity of size are important, with appearance as a secondary consideration in the higher grades. Defects, therefore, will be admitted in the various grades primarily in accordance with their effect upon the strength of the piece.

Grades.—No. 1 common, No. 2 common, and No. 3 common.

Lengths.—Standard lengths shall be 6 to 20 feet, inclusive, in multiples of 2 feet, admitting 10 per cent of 6 to 8 foot lengths.

Special provisions.—Material 2 by 14 inches and wider and 2½ inches and thicker by 6 inches and wider may be dressed to standard sizes either green or commercially dry.

Material rough, green, or dry shall be not more than ¼ inch scant in thickness or width.

The amount of crook and cup permissible shall be the same as allowed in No. 1 and No. 2 common boards.

Miscut material which is not more than ⅛ inch scant of the standard dressed size may be permitted provided the piece shall be free from other defects at the point of miscut.

No. 1 common dimension, heavy joists, and small timbers must be suitable for high-class construction purposes without waste and will admit any of the defects or their equivalent allowed in No. 1 common boards, and, in addition, will allow knots toward the center of the piece one and one-half times the maximum size knot of similar character permitted in No. 1 common boards and wane equivalent to one-third the thickness, one-fourth the width, and one-third the length of the piece.

No. 2 common dimension, heavy joists, and small timbers must be suitable for use for ordinary construction, without waste, and will admit any of the defects or their equivalent allowed in No. 2 common boards, and, in addition, will allow knots toward the center of the piece one and one-half times the maximum size knot of similar character permitted in No. 2 common boards and wane equivalent to one-half the thickness and one-third the width of the piece.

No. 3 common dimension, heavy joists, and small timbers will admit all pieces falling below the grade of No. 2 common but which are suitable for use as cheap building material or for crating purposes without a waste to exceed 25 per cent of each piece.

California White and Sugar Pine Manufacturers Association, grading rules for dimension lumber, May 1, 1926.

DIMENSION

Lumber manufactured in standard stock sizes for use in construction where strength, stiffness, and uniformity of size are essential shall be considered as dimension and graded under the following rules:

Standard Sizes

Thickness and width conform to American Lumber Standards, 411.0, lumber classification, except 2½-inch thickness board measure is not included.

Standard lengths shall be 8 feet and up in multiples of 2 feet.

Standard Grades

No. 1 dimension.

This grade must consist of sound stock, well manufactured, and suitable for all ordinary con-

struction purposes without waste. It will admit sound knots, which may be approximately 1½ inches in diameter in a 2 by 4; 2 inches in a 2 by 6; 2½ inches in a 2 by 8; and 3 inches in 2 by 10 and wider. Smaller defective knots and branch or spike knots which do not weaken the piece more than the above knots may also be admitted. Wane one-third the thickness, one-third the width, and one-third the length, or a proportionate amount on both edges for a shorter distance will be allowed. In any case, one side and two edges should allow a good nailing surface.

Stain, heavy pitch, pitch pockets, season checks, one straight split in the end not exceeding the width of the piece, a few scattered wormholes, torn grain, or occasional skips in dressing due to a slight variation in sawing will be allowed. A piece may have a crook of 1 inch (providing it does not all occur near the end) in 2 by 4 by 16 and ⅛ inch less in each additional 2 inches. Pieces longer or shorter than 16 feet may have crook in proportion.

A serious combination of above defects will not be permitted in any one piece.

No. 2 dimension.

This grade shall be suitable for use in a cheaper class of construction than No. 1 dimension. It will allow large coarse knots which should not be larger than 2½ inches in diameter in a 2 by 4; 3 inches in a 2 by 6, and one-half the width in 2 by 8 and wider. Loose, unsound, and spike knots and an occasional knot hole if they are smaller and do not weaken the piece more than the above-described knots may be admitted. Considerable wane or decayed sap leaving a fair nailing surface the full length, shake, wormholes, dozy streaks, large pitch pockets, a small amount of hard rot, straight close split not exceeding one-fourth the length of piece, or other defects that will not weaken or impair the piece to such an extent as to render it unfit for use will be allowed. A crook of not more than 2 inches in a 2 by 4 by 16, and ⅛ inch less in each additional 2 inches in width will also be allowed. Lengths longer or shorter than 16 feet may contain crook in proportion to the above.

A variation of not more than ⅛ of an inch in width and thickness will be allowed, providing the piece is sound and strong at the point where variation occurs.

A serious combination of the above defects will not be allowed in any one piece.

No. 3 dimension.

This grade will admit all defects allowed in No. 2 dimension but in a much more pronounced form.

It will admit large, coarse, loose, and unsound knots and knot holes, a great deal of shake, any number of wormholes, soft or firm rot, a large amount of wane, decayed sap, splits, and crooks.

A piece may have a combination of the above defects providing it is not rendered unsuitable as a whole for cheap and temporary construction; or it may have 25 per cent of waste, providing the balance of piece is of No. 2 dimension quality in not over two pieces.

This is the lowest recognized grade of dimension and is recommended for temporary construction or crating purposes only.

National Hardwood Lumber Association, grading rules for dimension lumber, January, 1927.

CYPRESS TURNING SQUARES

Sizes.—4 by 4 inches, 5 by 5 inches, 6 by 6 inches 7 by 7 inches, and 8 by 8 inches.

Lengths.—8 feet and over.

Turning squares will admit bright sapwood one-fourth the width on two faces and may contain five ¾-inch sound knots or their equivalent and other defects which will be removed in turning the square to a size ½ inch less than the rough size.

Squares.

Grades.—First and seconds, No. 1 common, sound, No. 2 common, and No. 3 common.

Sizes.—3 by 3, 4 by 4, 5 by 5, 6 by 6, 7 by 7, 8 by 8, 9 by 9, 10 by 10, and 12 by 12.

In the grades of firsts and seconds and sounds, one-third of the pieces may have wane on one corner that will be removed in turning the square to its working size.

Splits not exceeding 6 inches in length in one end in the grades of first and seconds and sound shall not be considered defects; splits longer than 6 inches shall not be admitted in these grades.

Walnut, cherry, and red gum squares will not admit more sapwood than will be removed in turning the square to its working size. Squares, in other woods, will admit any amount of bright sapwood. Sound stain shall not be considered a defect in sap gum and cottonwood, nor in No. 1 common tupelo, black gum, and magnolia.

Heart center shall not be admitted in the grades of first and seconds and sound and in the cuttings of the common grades.

First and Seconds

Lengths.—8 to 16 feet.

Sound standard defects will be admitted according to the size of the square, as follows:

3 by 3, 4 by 4, and 5 by 5 - 1 sound standard defect.
6 by 6 and 7 by 7 - 2 sound standard defects.
8 by 8 and 9 by 9 - 3 sound standard defects.
10 by 10 and over - 4 sound standard defects.

No. 1 common.

Slight stain is no defect in this grade.

Lengths.—6 to 16 feet.

No. 1 common must work 66⅔ per cent in cuttings 2 feet or over long, by the full size of the square; three sides of each cutting must be clear; the fourth side may have one sound standard defect or its equivalent.

Sound.

Lengths.—8 to 16 feet.

Sound stain shall not be considered a defect.

Sound squares must work sound full length.

No. 2 common.

Lengths.—6 to 16 feet.

No. 2 common squares must work 50 per cent sound in cuttings 2 feet or over long, by the full size of the square.

No. 3 common.

Lengths.—4 to 16 feet.

No. 3 common squares must work 25 per cent sound in cuttings 2 feet or over long, by the full size of the square.

STANDARD TURNING SQUARES

Standard sizes are ½ inch to 2½ inches in multiples of ⅛ inch; and 2½ inches to 5 inches in multiples of ¼ inch.

Standard lengths are 18 to 24 inches in multiples of 1 inch and 24 inches and over in multiples of 2 inches, but there must not be more than 20 per cent of 24 inches and shorter.

Standard grades are No. 1 and No. 2, which are combined as one grade unless otherwise specified. The combined grade must not contain more than 30 per cent of No. 2.

Standard turning squares must be sawn full size and length when shipping dry. Oversize variation of not more than ⅛ inch shall be allowed. Squares having an oversize variation of more than ⅛ inch shall be classed as miscut.

Wane or other defects that will be removed in turning the square to its working size shall not be considered as defects. End checks not exceeding ½ inch in length will not be considered as defects. Sapwood is no defect unless otherwise specified. No heart center will be admitted.

Otherwise No. 1 standard turning squares must be clear. No. 2 standard turning squares will admit one sound ⅜-inch knot or its equivalent for each 18 inches of the length of the piece.

Select dimension.

This grade is the same as select car stock and will include any hardwood specified. For select car stock see 413.23.

Common dimension.

This grade will include any hardwood specified, and is the same as freight-car stock, except that 4 by 4 inches and larger will admit firm tight heart boxed or showing on one face in 25 per cent of the pieces; hearts should be boxed in 6 by 6 inches and larger. Sizes of 2 and 3 inches must be practically free from heart. For freight-car stock see 413.23.

Bridge plank.

Widths.—6 inches and over.

Lengths.—8 feet and over.

Grades.—No. 1 and No. 2.

Two inches and thicker may be ¼ inch scant in thickness unless otherwise specified.

No. 1.

One face and two edges must be sound, except that slight wane as defined in the term of "good edge" (see 400.30) will be admitted and firm heart center, pin, shot, and spot wormholes and an occasional grub or knot hole will be admitted. The reverse side will admit defects that do not seriously impair the strength or prevent the use of the piece for purposes of strength in its full width and length.

No. 2.

No. 2 must work 75 per cent in cuttings 2 feet or over long by the full width of the piece. Each cutting will admit the same defects as No. 1. No. 2 will admit pieces 4 to 6 feet long that otherwise grade No. 1.

Crossing plank.

Widths.—6 inches and over.

Lengths.—8 feet and over.

Two inches and thicker may be ¼ inch scant in thickness except when otherwise specified. One face and two edges must be sound, except that slight wane as defined in "good edge" (see 400.30), firm tight heart, pin, shot, and spot wormholes, and an occasional grub or knot hole, will be admitted.

The reverse side may contain defects that do not seriously impair the strength or prevent the use of the piece for purposes of strength in its full width and length.

North Carolina Pine Association (Inc.), grading rules for dimension lumber, January 1, 1927.

DIMENSION AND HEAVY JOISTS

Grades.

No. 1 common.
Sound and square edge.
No. 2 common.
No. 3 common.

Lengths.

Standard lengths are 4 to 16 feet, inclusive, in multiples of 2 feet except that 9 and 11 foot shall be standard in 2 by 4, 6, and 8 inches, 13-foot in 2 by 8 and 10 inches, and 15-foot in 2 by 10 inches. Lengths shorter than 10 feet shall not be included in miscellaneous or mixed length shipments of No. 1 and No. 2 common, except by agreement; 20 per cent of 6 and 8-foot lengths may be permitted in No. 3 common.

Special provisions.

Heavy joists 2 by 14 inches and wider and 2½ inches and thicker by 6 inches and wider may be worked S1S1E, S1S2E, S2S1E, or S4E to standard sizes, either green or commercially dry.

Heavy joists.

Heavy joists, rough, green, or dry, must not be more than ¼ inch scant in thickness or width.

The grading of dimension and heavy joists is a question of strength and uniformity of size, with appearance a secondary consideration; and defects, therefore, will be admitted in the various grades, primarily, in accordance with their effect upon the strength of the piece.

No. 1 common dimension and heavy joists.

No. 1 common dimension and heavy joists must be suitable for use without waste as substantial structural material, and will admit the following defects or their equivalent; any number of sound, encased, and pith knots, the average diameter of any one knot not to exceed 2 inches in 2 by 4's, and in wider stock, not to exceed approximately one-third of the cross section of the piece, in the

rough, at any point throughout its length if located at the edge, nor more than one-half the cross section if located away from the edge; unsound, loose, or hollow knots, one-half the diameter of maximum size sound knots permitted; surface or through checks; a limited number of medium wormholes, well scattered; loosened or torn grain, or other machine defects which will not cause waste; pitch pockets; pitch; pith; splits in end that do not exceed in length the width of the piece; firm red heart; stain; wane, one-half the thickness, one-quarter the width, and one-third the length of the piece.

Sound and square edge.

Dimension shall embrace all sizes from 1½-inch to under 6-inch in thickness by 4-inch and over in width, for example: 1½-inch, 2-inch, 2¼-inch, 2½-inch, 3-inch, 3¼-inch, 3½-inch, 4-inch, 4¼-inch, 4½-inch, 5-inch, 5¼-inch, 5½-inch, 5¾-inch by 4-inch and over in width.

Small timbers shall embrace all sizes 6-inch and up in thickness, by 6-inch and up in width, for example: 6 by 6 inches, 6 by 7 inches, 7 by 7 inches, 7 by 8 inches, 8 by 9 inches, and up.

Must be well manufactured, full to sizes, and saw butted, except 25 per cent may be $\frac{1}{16}$ inch scant in thickness and/or ⅛ inch scant in width, and shall be free from the following defects: Wane, rot unsound, loose and hollow knots, wormholes and knot holes, through shakes or round shakes that show on the surface, except as hereinafter provided for.

A through shake is hereby defined to be through or connected from side to side, or edge to edge, or side to edge.

Wane may be allowed one-eighth of the width of the piece measured across face of wane, and extending one-fourth of the length of the piece on one corner or its equivalent on two or more corners, provided that not more than 10 per cent of the pieces in one size shall show such wane.

Knots otherwise sound but containing twig holes not more than ⅜ inch in diameter not to be considered defects. Knots having decayed surface not over 1 inch in diameter and ⅜ inch deep not to be considered defects.

Large or branch knots no defect if sound, unless bunched or so frequent as to materially impair the strength of the piece.

A limited amount of pin wormholes well scattered in sound sap not to be considered a defect. Blue or stained sap if sound, no defect.

In the measurement of dressed lumber, the width and thickness of the lumber before dressing must be taken.

No. 2 common dimension and heavy joists.

No. 2 common dimension and heavy joists must be suitable for use without waste, and will admit the following defects or their equivalent; knots not necessarily sound, the average diameter of any one knot not to exceed approximately one-half the cross section of the piece, in the rough, at any point throughout its length if located at the edge, nor more than two-thirds of the cross section if located away from the edge; loose, hollow, or decayed knots, and knot holes, one-half the diameter of maximum size knots permitted; through checks; large wormholes; deep torn grain, or other machine defects; through pitch pockets; pitch; pith; through shakes; splits or streaks of advanced decay, not to exceed one-quarter the length of the piece; unsound red heart; stain; wane.

Miscut or mismanufactured common stock 2 inches and thicker, which is not more than ⅛ inch scant of standard dressed thickness or width, shall be admitted in No. 2 common, provided such pieces are, in all other respects, as good as No. 1 common at point of miscut.

No. 3 common dimension.

No. 3 common dimension will include all pieces falling below the grade of No. 2 common which are suitable for use as cheap building material without wasting more than 25 per cent of each piece of one-third of the number of pieces in any item of a shipment, but it must not be more than ½ inch scant of standard finished width nor more than ⅜ inch scant of standard finished thickness.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for hemlock and tamarack dimension lumber, February 1, 1927.

RULES FOR GRADING HEAVY JOISTS

Heavy joists shall include material larger than dimension, as described below, and smaller or wider than timbers as described under the rules for grading timbers (412.1). It will be manufactured in sizes as specified, and be graded, as follows:

No. 1 common 4 by 8 inches and wider plank, and 6 by 10 inches and wider plank.

The grade of No. 1 common will admit of the following defects: Shake, both shell and loose, that does not impair the strength of the piece; also knots, black or red, round or horn shape. If sound and well scattered in size up to 3 inches, also wane on one or two corners for one-third length extending over back of piece 1½ inches on one end or its equivalent for full length of piece. Open-heart checks on one side for one-half length of piece.

No. 2 common 4 by 8 inches and wider plank, and 6 by 10 inches and wider plank.

This grade will admit of all defects known in the No. 1 common grade except they are more pronounced and not necessarily sound. Defects, such as shake, large, unsound knots, loose knots, cross checks, wane, but not a serious combination of these defects are admissible in any one piece. Open-heart checks full length of piece, unsound streaks scattered over face of piece for two-thirds length.

DIMENSION OR PIECE STUFF

Lumber manufactured at the sawmill in standard sizes for use where strength, stiffness, and uniformity of size are essential, shall be graded as dimension or piece stuff. It is usually 2 inches in thickness, occasionally thicker, and 2 inches and up in width.

Thicknesses and widths.

Two-inch dimension either S1S and 1E, S1S and 2E, S2S and 1E, or S4S shall be dressed to the "extra standard" thickness of 1¾ inches and to the following standard widths:

Nominal width board measure (inches)	Dressed width
	(*Inches*)
3	2⅝
4	3⅝
6	5⅝
8	7½
10	9½
12	11½

Standard thickness for 3-inch dimension ⅜ inch less than nominal thickness.

Rough 2-inch dimension shall conform to the extra standard rough thickness specified in American Lumber Standards 411.0, yard lumber for rough-dry sizes.

The rough standard widths shall be as the widths of common boards, finish and dimension, rough and commercially dry, 7 inches and narrower, shall be not more than ¼ inch less than the nominal widths; widths 8 to 12 inches (board measure) shall be not more than ⅜ inch less than the nominal widths; and widths of 13 inches and wider (board measure) shall be not more than ½ inch less than the nominal widths. These widths shall also apply to stock widths shipments of lumber, dressed on one or two sides. Pieces narrower than above should be counted as next lower standard width and not reduced in grades.

Lengths.

The standard lengths of dimension shall be 4 to 24 feet.

Grades.

No. 1 common, No. 2 common, No. 3 common, No. 4 common, and No. 5 common.

In the grading of dimension, strength, stiffness, and uniformity of size are important, with appearance as a secondary consideration in the higher grades. Defects, therefore, will be admitted in the various grades primarily in accordance with their effect upon the strength of the piece.

No. 1 common dimension.

The following amount of crook, based on 16-foot lengths shall be permissible in No. 1 common dimension and heavy joists.

4-inch widths ..... 1½-inch crook.
6-inch widths ..... 1⅜-inch crook.
8-inch widths ..... 1¼-inch crook.
10-inch widths ..... 1⅛-inch crook.
12-inch widths ..... 1-inch crook.

In No. 2 common, crook ½ inch more than the above is permissible. In either grade pieces longer or shorter than 16 feet may have proportionate amount of crook.

Lengths.—8 to 24 feet.

Knots.—Sound, red spiked knots that do not weaken the piece. Any number of tight round knots, black or red not larger than 2 inches in 2 by 4 and 2 by 6, 3 by 4 and 3 by 6; 2½ inches in 2 by 8 and 2 by 10, 3 by 8 and 3 by 10; 3 inches in 2 by 12 and 3 by 12, or wider.

Surface checks.—That do not weaken the piece.

Shake.—Tight shake not extending through.

Torn grain.—That does not weaken the piece.

Machine gouge.—Not affecting strength or utility.

Water stain.—Not to exceed 5 per cent of the area.

Wane.—Not to exceed 1 inch wide on the face in 4 inches and 6-inch stock and 1½ inches wide on the face in wider stock for one-third the thickness and one-third the length of the piece, or if shorter may go deeper, but not so deep at the ends of the piece as to prevent toe nailing for joist or studding.

Split.—One straight split in the end not to exceed one and one-half times the width of the piece.

General.—Suitable for use without waste as substantial structural material. A serious combination of these defects must not be permitted in any one piece.

No. 2 common dimension.

Lengths.—8 to 24 feet.

Knots.—Not necessarily sound, and not to exceed approximately one-third the cross section of the piece in the rough. Spike knots that do not weaken the piece.

Knot holes.—Loose, hollow, or decayed knots, and one knot hole limited as follows:

1½-inch in 2 by 4.
2-inch in 2 by 6.
2½-inch in 2 by 8 and 2 by 10.
3-inch in 2 by 12.
Or two knot holes one-half that size.

Torn grain.—Not over three-fourths the length of the piece.

Shake.—Fine shake not over two-thirds the length of the piece, or tight through shake, not over one-half the length of the piece.

Season checks.—Medium season checks if running parallel with the edge of the piece.

Water stain.—Not to exceed one-half the width by one half the length.

Split.—One split in the end, not to exceed in length twice the width of the piece.

Wane.—Not to exceed one-fourth the width, one-half the thickness by one-half the length, or if shorter in length may go deeper but not so deep as to show on the opposite face or on the corners so as to prevent toe nailing for joist or studding.

Rot.—A small patch or streak of soft that does not go through or seriously weaken the piece.

No. 3 common dimension.

Lengths.—8 to 24 feet.

Knots.—Large round or spiked knots not necessarily sound, the average diameter of any one knot not to exceed approximately one third the cross section of the piece in the rough.

Loose hollow or decayed knots and any number of knot holes not to exceed in diameter the size of knots specified for No. 1 common if located away from the edge of the piece, or smaller holes on the edge.

Shakes.—Tight or through two thirds the length of the piece.

Torn grain.—Excessive torn grain that does not impair the usefulness of the piece.

Rot.—Firm or soft that does not impair the usefulness of the piece or prevent toe nailing, or nailing lath or sheathing.

Water stain.—That does not impair the usefulness of the piece.

Wane.—Not to exceed one-third the width, one-half the thickness by two-thirds the length of the piece, or if shorter may go deeper but not so deep on the edges or corners as to prevent toe nailing for joists or studding.

General.—The stock must be suitable for use for ordinary construction where strength is not the principal factor.

No. 4 common dimension.

Lengths.—4 feet and longer; 30 per cent, 8 feet and shorter; can contain all the stock below No. 3 dimension that will resaw into No. 4 boards.

No. 5 common dimension.

All stock below No. 4 that will stand one handling.

Northern Pine Manufacturers Association, grading rules for dimension lumber, April 15, 1925.

The grading rules for No. 1, No. 2, and No. 3 dimension are the same as the rules of this association for timbers (412.1).

SELECT COMMON

Select common is a special grade of dimension lumber and is the best or high line type selected out of No. 1 dimension.

It shall be of dimension sizes, and of a smooth common appearance on the face side.

White sap shall not be considered a defect in this grade.

A slight amount of shake may show on the face when not in combination with other marked defects.

A slight amount of stain is admissible on the face and any amount of sound, stained sap on the back.

Any quantity of sound knots, red or black, that do not give too coarse an appearance to the piece are admissible.

The face of the piece should be practically free from wane, while the back may show a moderate amount, as well as other defects.

Pacific Lumber Inspection Bureau, grading rules for dimension lumber, Schedule M, 1925.

Port Orford cedar merchantable.

Under 2 inches in thickness. This grade shall consist of sound, strong lumber, well manufactured and suitable for good substantial constructional purposes, free from loose or rotten knots, knot holes, shakes, rot or other defects which materially impair the strength of the piece.

Will allow occasional variations in sawing, sound knots, bark seams and burls, the dimensions of which are to be considered in connection with the size of the piece and bright sap one-half the width or its equivalent.

Two inches and thicker, but not including 10 by 10 or larger to conform to merchantable grade for Douglas fir with the exception that knots and bark seams and/or bark burls characteristic of the species and moderate wane permitted.

Ten by ten and larger to conform to merchantable grade for Douglas fir with the exception that knots and bark seams and/or bark burls characteristic of the species permitted. Will allow a split or check in one end not longer than the width of the piece or the equivalent in two ends, bright sap, wane not exceeding 2 inches in 10 by 10, varying up to 4 inches in 24 by 24 measured across the corner, or equivalent on two or more corners, for one-fourth the length.

Discoloration through exposure to the elements and moderate seasoning checks shall not be deemed defects excluding lumber from this grade, if otherwise conforming to merchantable grade. Defects in all cases to be considered in connection with the size of the piece and its general quality.

Port Orford cedar common.

Must be well manufactured. Will allow occasional variations in sawing any number of large sound knots, well distributed, decayed knots or knot holes not to exceed one-fourth the width of the face in which they occur; well distributed small decayed spots, a limited number of wormholes, moderate heart shake or wane, any amount of bright or discolored sap. A serious combination of above defects not permitted in any one piece. Defects in all cases to be considered in connection with the size of the piece and its general quality.

Douglas fir merchantable.

This grade shall consist of sound, strong lumber, well manufactured and suitable for good substantial constructional purposes, free from loose or rotten knots, knot holes, shakes, rot or other defects which materially impair the strength of the piece.

Will allow ocasional variations in sawing, sound knots, pitch pockets and pitch blisters, the dimensions of which are to be considered in connection with the size of the piece, and sap one-half the width or its equivalent.

In sizes 6 by 12 and larger, intended for remanufacturing purposes and so indicated at time order is placed, a grade of lumber may be shipped which will admit of pieces in which strength values as a whole night be impaired by some localized major defect. Provided that material so described would in other respects grade higher than merchantable except for the major defect which otherwise would also exclude it from the grade of merchantable. This grade will be shipped only when special agreement is made, and should be marked for identification.

In timbers 10 by 10 inches and larger a split or check in one end not over the width of the piece will be allowed. Sap shall not be considered a defect, and wane not exceeding 2 inches in 10 by 10 inches and varying up to 4 inches on 24 by 24 inches measured across one corner, or the equivalent on two or more corners, for one-quarter the length will be allowed.

General.—Defects in all cases to be considered in connection with the size of the piece and its general quality.

Discoloration through exposure to the elements. Discolored sap other than black sap and seasoning checks shall not be deemed defects excluding lumber from this grade, if otherwise conforming to merchantable grade.

Douglas fir common.

This grade shall consist of a quality suitable for ordinary constructional purposes. Defects to be considered in connection with the size of the piece.

Will allow occasional variations in sawing, bright, stained, or discolored sap, a limited amount of heart stain, large knots, large pitch pockets and pitch blisters, and a reasonable amount of wane. Discoloration through exposure to the elements and seasoning checks shall not be deemed defects excluding lumber from this grade if otherwise conforming to the grade of common.

In 10 by 10 inch wane not exceeding 3 inches and varying up to 6 inches in 24 by 24 inches measured across one corner or the equivalent on two or more corners allowed, also a split or check not over twice the width of the piece when appearing in one end or its equivalent in both ends.

Douglas fir rough green clears.

Defects based on 8-inch widths 12 feet long. Defects in all cases to be considered in connection with the size of the piece and its general quality.

No. 2 clear and better edge grain.

No. 2 clear and better edge grain, under 3 inches thick, must be sound lumber, well manufactured. Angle grain to be within the angle of 45° from vertical. Will allow occasional variations in sawing, light-colored sap one-quarter the width; in addition, will allow on face side, which is the best side, narrow pitch pockets each not over 4 inches in length, if not extending through the thickness of the piece and on the reverse face, tight knots up to and including ¾ inch in diameter, if not in clusters, and/or narrow pitch pockets each not over 4 inches in length if not extending through the thickness of the piece or equivalent defects, allowed on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Widths 10 inches and wider must show edge grain for at least two-thirds of the face width. Slight seasoning checks no defect.

Dimensions 3 inches and up.

Dimensions 3 inches and up, but not including 5 inches thick, must be sound lumber, well manufactured. Angle of grain to be within the angle of 45° from vertical. Will allow occasional variations in sawing light-colored sap, one-third the width; in addition, will allow on the face side which is the best side and corresponding half of edges narrow pitch pockets, each not over 6 inches in length, if not extending through the thickness of the piece and on the reverse face and corresponding half of edges, tight knots up to and including 1½ inches in diameter, if not in clusters, varying according to the size of the piece and/or narrow pitch pockets each not over 6 inches long if not extending through the thickness of the piece, or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Edge grain must show for at least two-thirds of the face width. Slight seasoning checks no defect. One split or check not over the width of piece allowed.

Dimensions 5 inches and thicker.

Dimensions 5 inches and thicker must be sound lumber, well manufactured. Angle of grain to be within the angle of 45° from vertical. Will allow occasional variations in sawing, light-colored sap one-third the width, and, in addition, will allow on the face side, which is the best side and corresponding half of edges narrow pitch pockets not over 6 inches in length, if not extending through the thickness of the piece and on the reverse face and corresponding half of edges tight knots, if not in clusters, 2 inches and less in diameter, varying according to the size of the piece, or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Edge grain must show for at least two-thirds of the face width. Slight seasoning checks no defect. One split or check not over the width of piece allowed. An occasional piece, 18 feet or longer, may contain one larger defect, showing on one or two surfaces, if so placed that, by cutting it out, the shortest cutting will be 8 feet or longer, provided balance of piece is practically free from other defects.

No. 2 clear and better flat grain, under 3 inches.

No. 2 clear and better flat grain, under 3 inches in thickness, must be sound lumber, well manufactured. Will allow occasional variations in sawing, light-colored sap, one-quarter the width and three-quarters the thickness or its equivalent; in addition, will allow on face side, which is the best side, narrow pitch pockets and or pitch blisters, each not over 4 inches in length, if not extending through the thickness of the piece and on the reverse face tight knots, if not in clusters, not over ½ inch in diameter in 1-inch stock and varying according to the thickness of the piece, up to 1 inch, and/or pitch pockets and/or pitch blisters, each not over 4 inches in length when not extending through the thickness of the piece, or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Edge grain may be included at shipper's option.

Dimensions 3 inches and up to but not including 5 inches thick.

Dimension 3 inches and up to but not including 5 inches thick must be sound lumber, well manufactured. Will allow occasional variations in sawing, light-colored sap one-third the width and three-quarters the thickness or its equivalent; in addition, will allow on the face side, which is the best side, and corresponding half of edges narrow pitch pockets and/or pitch blisters, each not over 6 inches in length, if not extending through the thickness of the piece and on the reverse face and corresponding half of edges tight knots up to and including 1½ inches in diameter, if not in clusters, varying according to the size of the piece and/or narrow pitch pockets and/or pitch blisters, each not over 6 inches in length, if not extending through the thickness of the piece, or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Slight seasoning checks no defect. One split or check not over the width of the piece allowed. Edge grain may be included at shipper's option.

Dimensions 5 inches and thicker.

Dimensions 5 inches and thicker must be sound lumber, well manufactured. Will allow occasional variation in sawing, light-colored sap one-third the width of piece and three-quarters the thickness, or its equivalent; in addition, will allow on the face side, which is the best side, and corresponding half of edges narrow pitch pockets, and/or pitch blisters each not over 6 inches in length if not extending through the thickness of the piece, and on the reverse face and corresponding half of edges tight knots, if not in clusters, 2 inches and less in diameter, varying according to the size of the piece, or equivalent defects on both faces. Three defects allowed for each 12 linear feet on each face and corresponding half of edges. Slight seasoning checks no defect. One split or check not over the width of piece allowed. An occasional piece 18 feet or longer, may contain one larger defect, showing on one or two surfaces, if so placed that, by cutting it out the shortest cutting will be 8 feet or longer provided balance of piece is practically free from other defects. In sizes 8 by 8 inches and larger boxed hearts are admissible provided material of this description is not coarse grained. Edge grain may be included at shipper's option.

No. 3 clear edge grain and/or flat grain.

No. 3 clear edge grain and/or flat grain at shipper's option, under 3 inches thick. Defects based on 10-inch widths, 12 feet long. To be graded from best face. The defects on the reverse face to be only slightly in excess of those allowed on the best face. Must be sound lumber, well manufactured. Will allow occasional variations in sawing. Slightly stained or discolored sap or heart one-third the width or its equivalent. Bright sap no defect. In addition, will allow sound and tight knots up to 1 inch or narrow pitch pockets, and/or pitch blisters, each not over 4 inches long (an occasional 6-inch pitch pocket and/or pitch blister, may be included) or one split or check not over width of piece or its equivalent in both ends. Four defects allowed for each 12 linear feet on each face and corresponding half of edges.

Dimensions 3 inches thick up to, but not including 5 inches thick.

To be graded from best face, the defects on the reverse face to be only slightly in excess of those allowed on the best face. Must be sound lumber well manufactured. Will allow occasional variations in sawing, slightly stained or discolored sap or heart one-third the width or its equivalent. Bright sap no defect. In addition, will allow sound and tight knots up to 1¼ inches or narrow pitch pockets and/or pitch blisters, each not over 6 inches long (an occasional 8-inch pitch pocket and/or pitch blister, may be included) or one split or check not over width of piece or its equivalent in both ends. Slight seasoning checks no defect. Four defects allowed for each 12 linear feet on each face and corresponding half of edges.

Dimensions 5 inches and thicker.

To be graded from best face. The defects on the reverse face to be only slightly in excess of those allowed on the best face. Must be sound lumber well manufactured. Will allow occasional variations in sawing. Slightly stained or discolored sap or heart, one-third the width or its equivalent. Bright sap no defect. In addition, will allow sound and tight knots up to 1½ inches or narrow pitch pockets and/or pitch blisters, each not over 6 inches long (an occasional 8-inch pitch pocket and/or pitch blister may be included) or one split or check not over width of piece or its equivalent in both ends. Slight seasoning checks no defect. An occasional piece 18 feet or longer may contain one larger defect showing on one or two surfaces if so placed that, by cutting it out, the shortest cutting will be 8 feet or longer provided that balance of piece is practically free from other defects. Four defects allowed for each 12 linear feet on each face and corresponding half of edges. In sizes 8 by 8 and larger boxed hearts are admissible, provided material of this description is not coarse grained.

Western red cedar merchantable.

Must be of strong character. Shall be well manufactured and free from all injurious knots and knot holes. Occasional variation in sawing allowed. Will admit a small amount of wane, a small amount of heart shake or one or two small rotten spots not over ½ inch deep will also be admitted, provided they do not affect the strength of the piece. It is understood, however, that a combination of these defects will not be admitted in any one piece, which must be consistent with the species suitable for good substantial constructional purposes.

Common.

Occasional variation in sawing allowed. Will admit any number of sound knots, loose knots; knot holes, not more than one-third the width of the piece, when not less than 4 feet apart, a limited

number of wormholes, heart shake, or wane in moderation, small rotten spots or a streak of rot 1½ inches wide, ½ inch deep, and not over 3 feet long.

A combination of these defects will not be admitted in any one piece which must be usable full length without waste and suitable for ordinary constructional purposes.

Merchantable green.

Shall consist of lengths 6 to 24 feet and longer, regardless of grain and conforming to the grade of merchantable before milling. Imperfect edges, such as knots torn out in machining and occasional scant tongue not less than ⅛ inch, shall not exclude lumber from this grade. Slightly discolored sap no defect.

Common Pacific hemlock.

This grade shall consist of a quality suitable for ordinary constructional purposes. Defects to be considered in connection with the size of the piece.

Will allow occasional variations in sawing, bright, stained, or discolored sap, a limited amount of heart stain, large bright and/or black knots, large bark pockets, a small amount of heart shake that does not affect the strength of the piece and a reasonable amount of wane. Discoloration through exposure to the elements and seasoning checks shall not be deemed defects excluding lumber from this grade if otherwise conforming to the grade of common.

In 10 by 10 inches wane not exceeding 3 inches and varying up to 6 inches in 24 by 24 inches measured across one corner or the equivalent on two or more corners allowed, also a split or check not over twice the width of the piece when appearing in one end or its equivalent in both ends.

Red Cedar Lumber Manufacturers' Association, grading rules for dimension lumber, August 1, 1925.

PLANK

Nominal thicknesses (inches)	Standard Thicknesses S1S or S2S	Finished widths S1E and S2E
	Inches	
2	1⅝	
2½	2⅛	2 to 7 inches, ⅜ inch off.
3	2⅝	
3½	3⅛	8 inches and wider, ½ inch off.
4	3⅝	

Lengths.—Multiples of 1 foot.

Extra standard 2-inch S1S or S2S to 1¾ inches.

Widths same as standard.

No. 1 common.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects:

Sound and tight knots approximately:

1½ inches in 4 and 6 inch widths.
2 inches in 8-inch widths.
2½ inches in 10-inch widths.
3 inches in 12-inch widths.
3¼ inches in 14-inch widths.
3½ inches in wider widths.

Will also admit spike knots which do not weaken the piece more than knots above specified; checks, pin wormholes, limited; sap stain, 15 per cent of face.

Southeastern Forest Products Association, grading rules for dimension lumber, September 1, 1925.

DIMENSION AND HEAVY JOISTS

Grades.

No. 1 common, No. 2 common, and No. 3 common.

Lengths.

Standard lengths are 4 to 24 feet, inclusive, in multiples of 2 feet; except that 9 to 11 foot shall be standard in 2 by 4 inches, 6 inches and 8 inches, 13 foot in 2 by 8 inches and 10 inches, and 15 foot in 2 by 10 inches. Lengths shorter than 10 feet shall not be included in miscellaneous or mixed-length shipments of No. 1 and No. 2 common, except by agreement; 20 per cent of 6 and 8 foot lengths may be permitted in No. 3 common.

Special provisions.

Heavy joists 2 by 14 inches and wider and 2½ inches and thicker by 6 inches and wider may be worked S1S1E, S1S2E, S2S1E, or S4S to standard sizes, either green or commercially dry.

Heavy joists, rough, green, or dry, must not be more than ¼ inch scant in thickness or width.

The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 common dimension and heavy joists:

4-inch widths	1½-inch crook.
6-inch widths	1⅝-inch crook.
8-inch widths	1¼-inch crook.
10-inch widths	1⅛-inch crook.
12-inch widths	1-inch crook.

In No. 2 common, crook ½ inch more than the above is permissible. In either grade, pieces longer or shorter than 16 feet may have proportionate amounts of crook.

The grading of dimension and heavy joists is a question of strength and uniformity of size, with appearance a secondary consideration; and defects, therefore, will be admitted in the various grades, primarily, in accordance with their effect upon the strength of the piece.

No. 1 common dimension and heavy joists.

The grading rules for No. 1 common dimension and heavy joists are the same as the grading rules of the North Carolina Pine Association (Inc.) 402.43 for No. 1 common dimension and heavy joists.

No. 2 common dimension and heavy joists.

The grading rules for No. 2 common dimension and heavy joists are the same as the grading rules of the North Carolina Pine Association (Inc.) 402.43 for No. 2 common dimension and heavy joists.

No. 3 common dimension.

The grading rules for No. 3 common dimension are the same as the grading rules of the North Carolina Pine Association (Inc.) 402.43 for No. 3 common dimension.

Southern Cypress Manufacturers Association, grading rules for cypress dimension lumber, June 15, 1925.

Turning squares.

Sizes.—4 by 4 inches to 8 by 8 inches.

Length.—8 feet and longer.

Will admit one-quarter their size in sap on one corner, showing on two faces, and may contain one to five small sound knots.

Southern Pine Association, grading rules for dimension lumber, March 23, 1927.

The grading rules of this association for the following are the same as those of the Southeastern Forest Products Association. (See above.)

Dimension and heavy joists.

Grades.
Lengths.
Special Provisions.

The grading rules of this association for the following are the same as those of the North Carolina Pine Association (Inc.). (See above.)

No. 1 common dimension and heavy joists.
No. 2 common dimension and heavy joists.
No. 3 common dimension.

Southern Pine Association, the Gulf coast classification of pitch pine, grading rules for dimension, lumber, March 15, 1923.

Air-dried saps.

Sizes.—

1 by 3, 4, 5, 6, 7, and wider.
1¼ by 3, 4, 5, 6, 7, and wider.
1½ by 3, 4, 5, 6, 7, and wider.
1¾ by 3, 4, 5, 6, 7, and wider.
2 by 3, 4, 5, 6, 7, and wider.
2½ by 3, 4, 5, 6, 7, and wider.
3 by 3, 4, 5, 6, 7, and wider.

Lengths.—Ten feet and up; 5 per cent 8 and 9 feet allowed.

Must be air seasoned and conform to the grade of kiln-dried saps, except that sap stain shall be permissible if the grade face of the piece is 50 per cent free of stain.

Southern Pine Association, Gulf coast classification of pitch pine, March 15, 1923.

The Gulf coast classification of pitch pine resawn lumber and sawn lumber, issued by the Southern Pine Association, March 15, 1923, for dimension lumber, including planks, joists, and scantling.

The grading rules, sizes, and trade names for planks are included with the grading rules, sizes, and trade names of this association for boards, 402.42.

DEALS

Sizes.—

3 by 9 and wider.
4 by 9 and wider.
5 by 9 and wider.

Lengths.—Twelve feet and up; 5 per cent 10 and 11 feet allowed.

Grades.

Crown, prime, Genoa prime (Rio), merchantable, square edge.

Crown.—Must be one heart face, free from unsound knots, loose knots, pith knots, knot holes, pinworm holes, grubworm holes, wane, rot, and through splits and through shakes, except that in 15 per cent of the pieces, splits, not to exceed in length one-half the width of the piece, may be allowed on one or both ends of the piece. Firm red heart permissible if not in excess of 15 per cent of the area of the face. May permit pitch pockets not exceeding ¼ inch wide on the 9 and 10 inch widths and ⅜ inch wide on the 11-inch and up. Not to have more than one knot 1½-inch on the 3 and 4 inch and one knot 1¾-inch on the 5-inch to each 6 feet or fraction thereof; provided that 80 per cent shall be free of knots and 100 per cent free of centers.

Prime.—Must be one heart face and two-thirds heart surface on the opposite side; must be free from unsound knots, loose knots, pith knots, pinworm holes, grubworm holes, knot holes, wane, rot, and through splits and through shakes, except that in 15 per cent of the pieces splits, not to exceed in length one-half the width of the piece, may be allowed on one or both ends of the piece. Will permit knots not exceeding 2 inches on the 3 and 4 inch, or 2¼ inches on the 5-inch, to each 6 feet or fraction thereof; provided that 70 per cent shall be free of knots and 70 per cent free of centers. Firm red heart permissible, if not in excess of 15 per cent of the area of the face.

Genoa prime (Rio).—Must be one heart face, two-thirds heart surface on the opposite side, except that the 9-inch may have 1 inch sap on one corner of the face or the equivalent on two corners; the 10-inch and up may have 1½ inches of sap on one corner or the equivalent on two corners of the face. Must be free from pith knots, unsound knots, loose knots, knot holes, pinworm holes, grubworm holes, wane, rot, through splits and through shakes, the length of which exceeds the width of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face.

Merchantable.—Must show two-thirds heart surface on two opposite sides, or the equivalent; must be free from unsound knots, loose knots, pinworm holes, grubworm holes, knot holes, rot, and through shakes and through splits the length of which exceeds the width of the piece. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Fifteen per cent of the pieces will permit wane 1½ inches wide measured across the face of the wane, one-quarter of the length of the piece on one corner, or the equivalent on two or more corners.

Square edge.—Must be free from unsound knots, loose knots, knot holes, grubworm holes, rot, and through splits and through shakes the length of which exceeds the width of the piece. Twenty-five per cent of the pieces will permit wane 1½ inches wide measured across the face of the wane, one-third of the length of the piece on one corner, or the equivalent on two or more corners.

SCANTLING

Sizes.—

2 by 2, 3, 4, 5, and 6.
3 by 3, 4, 5, 6, 7, and 8.
4 by 4, 5, 6, 7, and 8.
5 by 5, 6, 7, and 8.

Lengths.—Twelve feet and up; 5 per cent 10 and 11 feet allowed.

Grades.

Crown, prime, Genoa prime, merchantable, square edge.

Crown.—Must be three corners heart; must be free from unsound knots, loose knots, pith knots, knot holes, pin wormholes, grubworm holes, rot, wane, and through splits and through shakes, but may permit pitch pockets not exceeding ¼ inch in width. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. The 2 by 2, 2 by 3, 2 by 4, 3 by 3, and 3 by 4 to have no knots exceeding 1¼ inches, the 2 by 5, 2 by 6, 3 by 5, 3 by 6, 4 by 4, 4 by 5, and 4 by 6 exceeding 1½ inches and the other sizes exceeding 2 inches; provided that 80 per cent shall be free of knots and 90 per cent free of centers.

Prime.—Must be three corners heart; must be free from unsound knots. loose knots, pith knots, knot holes, pin wormholes, grubworm holes, rot, wane, and through shakes and through splits exceeding 8 inches in length. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. The 2 by 2, 2 by 3, 2 by 4, 3 by 3, and 3 by 4, to have no knots exceeding 1¼ inches, the 2 by 5, 2 by 6, 3 by 5, 3 by 6, 4 by 4, 4 by 5, and 4 by 6, exceeding 1½ inches and the other sizes exceeding 2 inches.

Genoa prime.—Must be one heart face and one-half heart surface on the opposite side, except that the 5-inch and under may have 1-inch sap on the heart face and the 6-inch and up may have 1½-inch sap on the heart face. Must be free from unsound knots, loose knots, grubworm holes, knot holes, rot, wane, and through splits and through shakes exceeding 8 inches in length. Firm red heart permissible if not in excess of 15 per cent of the area of the face.

Merchantable.—Must show some heart the entire length on one face and some heart on the opposite side. Must be free from unsound knots, loose knots, knot holes, grubworm holes, rot, through shakes and through splits exceeding 12 inches in length. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Fifteen per cent of the pieces will permit wane one-fourth of the width of the piece, measured across the face of the wane, and extending one-fourth the length of the piece on one corner, or the equivalent on two or more corners.

Square edge.—Must be free from unsound knots, loose knots, knot holes, grubworm holes, rot, through splits and through shakes exceeding 12 inches in length. Twenty-five per cent of the pieces will permit wane not over one-fourth of the width of the piece, measured across the face of the wane, and extending one-third of the length of the piece on one corner, or the equivalent on two or more corners.

DIMENSION

Sizes.—

6 by 6 and wider.
7 by 7 and wider.
8 by 8 and wider.
9 by 9 and wider.
10 by 10 and wider.
11 by 11 and wider.
12 by 12 and wider.
13 by 13 and wider, etc.

Lengths.—Fourteen feet and up; 5 per cent 12 and 13 feet allowed.

Grades.

Crown, prime, merchantable, square edge.

Crown.—Must be heart, except sap permissible on each corner not to exceed one-sixth the width of the widest face, measured on faces; must be free from loose knots, unsound knots, knot holes, pith knots, pin wormholes, grubworm holes, rot, and through splits and shakes extending to the surface. Firm red heart permissible, if not in excees of 15 per cent of the area of the face on which it appears. The 6 and 7 inch must be free from knots exceeding 2 inches. Wane will be allowed one-twelfth of the width of the piece, measured across the face of the wane on one corner, or the equivalent on two or more corners on pieces having a 10-inch or wider face.

Prime.—All square lumber shall show two-thirds heart on two sides and not less than one-half heart on two other sides. Other sizes shall show two-thirds heart on faces and show heart two-thirds of length on edges, excepting when the width exceeds the thickness by 3 inches or over then it shall show heart on the edges for one-half the length. Must be free from unsound knots, loose knots, pith knots, knot holes, pinworm holes, grubworm holes, rot, and shakes extending to the surface. Firm red heart permissible, if not in excess of 15 per cent of the area of the face on which it appears. Ten per cent of the pieces will permit wane one-eighth of the width of the piece, measured across the face of the wane and extending one-fourth of the length of the piece on one corner or the equivalent on two or two or more corners.

Merchantable.—All sizes under 9 inches in width shall show some heart the entire length on one side; sizes 9 inches and over in width shall show some heart the entire length on two opposite sides. Must be free from unsound knots, loose knots, knot holes, grubworm holes, rot, and shakes extending to the surface. Firm red heart permissible, if not in excess of 15 per cent of the area of the face on which it appears. Fifteen per cent of the pieces will permit wane one-sixth of the width of the piece, measured across the face of the wane and extending one-fourth of the length of the piece on one corner or the equivalent on two or more corners.

Square edge.—Must be free from rot, unsound knots, loose knots, knot holes, grubworm holes, and shakes extending to the surface. Twenty-five per cent of the pieces will permit wane one-fourth of the width of the piece, measured across

the face of the wane and extending one-third of the length of the piece on one corner or the equivalent on two or more corners.

KILN-DRIED SAPS

Sizes.—
1 by 3, 4, 5, 6, 7, and wider.
1¼ by 3, 4, 5, 6, 7, and wider.
1½ by 3, 4, 5, 6, 7, and wider.
1¾ by 3, 4, 5, 6, 7, and wider.
2 by 3, 4, 5, 6, 7, and wider.
2½ by 3, 4, 5, 6, 7, and wider.
3 by 3, 4, 5, 6, 7, and wider.

Lengths.—Ten feet and up; 5 per cent 8 and 9 feet allowed.

May be any species of southern yellow pine. Must be kiln-dried, bright and free from unsound knots, loose knots, pith knots, knot holes, pinworm holes, grubworm holes, shakes, and rot. Pitch permissible if not in excess of one-fourth of the area of the face; firm red heart may be permitted under the same limitation as pitch. The 1-inch to 1¾ inches thick not to have more than one 1-inch knot on the 3 and 4 inch widths, one 1¼-inch knot on the 5 to 7 inch widths, or one 1½-inch knot on the 8-inch and wider, to each 6 feet or fraction thereof; the 2 to 3 inch thick not to have more than one 1½-inch knot on the 3 to 7 inch widths, or one 1¾-inch knot on the 8 inch and wider, to each 6 feet or fraction thereof; provided that 80 per cent of the pieces shall be free of knots. Pitch pockets over ¼ inch wide shall be considered equal to a 1-inch knot. Will permit splits in ends the length of which do not exceed the width of the piece. Twenty per cent of the pieces will permit wane not to exceed one-twelfth the width and one-half the thickness and extending one-sixth the length of the piece on one corner, or the equivalent on two or more corners.

Southern Pine Association, Gulf coast classification of pitch pine, March 15, 1923.

RIVER PLATE STANDARD

Grading rules for planks are the same as the grading rules of this association for boards, 403.42.

Scantling and Deals

Sizes.—
Scantling—
2 by 3, 2 by 4, 2 by 5, 2 by 6.
3 by 3, 3 by 4, 3 by 5, 3 by 6, 3 by 7, 3 by 8.
4 by 4, 4 by 5, 4 by 6, 4 by 7, 4 by 8.
Deals—
3 by 9 and wider.
4 by 9 and wider.

Lengths.—Twelve feet and up; 5 per cent 10 and 11 feet allowed.

Must be free from unsound knots, loose knots, grub wormholes, knot holes, rot, and through splits and through shakes over 8 inches in length. One-third of the pieces will permit wane 1½ inches wide, provided not over one-half the thickness of the piece, extending one-third the length of the piece on one corner, or the equivalent on two or more corners.

WEST INDIAN (FIRST CLASS)

Scantling and Deals

Sizes.—
Scantling—
2 by 3, 2 by 4, 2 by 5, 2 by 6.
3 by 3 to 3 by 8.
4 by 4 to 4 by 8.
Deals—
3 by 9 and wider.
4 by 9 and wider.

Lengths.—Twelve feet and up; 5 per cent 10 and 11 feet allowed.

Must be free from unsound knots, loose knots, knot holes, grubworm holes, rot, through splits, and through shakes the length of which exceeds the width of the piece. One-third of the pieces will permit wane 2 inches wide, measured across the face of the wane and extending one-third the length of the piece on one corner, or the equivalent on two or more corners. Pieces combining coarse grain and coarse knots, or coarse grain and numerous permissible defects shall be excluded.

WEST INDIAN (SECOND CLASS)

Scantling and Deals

Sizes.—
Scantling—
2 by 3, 2 by 4, 2 by 5, 2 by 6.
3 by 3 to 3 by 8.
4 by 4 to 4 by 8.
Deals—
3 by 9 and wider.
4 by 9 and wider.

Lengths.—Twelve feet and up; 5 per cent 10 and 11 feet allowed.

Will permit lumber that does not grade first class, except that through splits and through shakes over 2 feet in length, and rot extending through the piece, shall be excluded. Will admit coarse-grained material, sap stain, red heart, pith knots, loose knots, unsound knots, wormholes, and wane if not over 2 inches wide measured on any face of the piece, when not over one-third the length of the piece on one corner, or the equivalent on two or more corners.

EIGHTY-FIVE PER CENT HEART

The grading rules for 85 per cent heart dimension lumber are the same as the rules of this association for strips, 402.41.

ALL HEART

The grading rules for all-heart dimension lumber are the same as the rules of this association for strips, 402.41.

West Coast Lumbermen's Association, grading rules for Douglas fir, Sitka spruce, and west coast hemlock dimension lumber, July 1, 1926.

Rough clears—Air dried or kiln dried, flat grain and/or vertical grain.

Defects based on 8 inches by 12 feet. In vertical grain stock, angle of grain not more than 45° from vertical.

Nominal thicknesses (inches)	Seasoned thicknesses	Nominal widths	Seasoned widths
	Inches	*Inches*	*Inches*
1	1 $\frac{23}{32}$	2 and wider	2 to 3, ¼ off. 4 to 7, ⅜ off. 8 to 12, ½ off.
1¼	1 1$\frac{3}{16}$		
1½	1 1$\frac{7}{16}$		
2	1 1¾		

[1] Two and one-fourth and thicker ⅛ inch over standard dressed sizes. Twenty per cent of shipment may be $\frac{1}{32}$ inch scant of these thicknesses.

Lengths.—Multiples of 2 feet.

"B and better" F. G. and/or V. G.—Shall be well manufactured. Will admit slight cup; wane or other defects that will dress out in working to standard finished sizes; split on end not longer than width of piece, in 5 per cent of pieces. With the above, will admit the following defect, an equivalent defect, or an equivalent combination of defects; 3 very small (2-inch) pitch pockets, none through.

"C" F. G. and/or V. G.—Will admit light sap stain, 25 per cent of face; slight cup; small seasoning checks; split on end not longer than width of piece, in 5 per cent of pieces. With any one of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: 2 sound and tight small knots or equivalent of sound and tight pin knots; 4 small (4-inch) pitch pockets, 2 of which may be through, or equivalent of slightly larger pockets; small pitch streak. Will also admit wane or other defects that will dress out in working to standard finished sizes, in addition to other permissible defects.

Rough green clears—F. G. and/or V. G.—In V. G. stock, angle of grain not more than 45° from vertical.

One to two inch.—Defects based on 8 inches by 12 feet.

Nominal thicknesses (inches)	Nominal widths	Lengths
1 1¼ 1½ 2	*Inches* 3 and wider	Multiples of 2 feet.

"B and better" green clears.—Will admit occasional slight variation in sawing; bright sap; split on end not longer than width of piece in 5 per cent of pieces. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three small (4-inch) pitch pockets, none through. Reverse side shall be "C" or better.

"C" green clears.—Will admit occasional slight variation in sawing; medium sap stain, 25 per cent of face; split on end not longer than width of piece in 5 per cent of pieces. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three 1-inch sound and tight knots, or equivalent of pin knots; 4 small (4-inch) pitch pockets, 2 of which may be through, or equivalent slightly larger pockets; small pitch streak.

Two and one-half to five inch.—Defects based on 8 inches by 12 feet.

Nominal thicknesses (inches)	Nominal widths	Lengths
2½ to 5	*Inches* 3 and wider	Multiples of 2 feet.

"B and better" green clears.—Will admit occasional slight variation in sawing; bright sap. With the above, will admit on face and corresponding half of edges the following defect, an equivalent defect, or an equivalent combination of defects: Three pitch pockets not over 6 inches in length, none through thickness; and on reverse side and corresponding half of edges, one of the following defects, an equivalent defect, or an equivalent combination of defects: Four pitch pockets not over 6 inches in length, none through thickness; 3 sound and tight 1-inch knots.

"C" green clears.—Will admit occasional slight variation in sawing; medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three 1-inch sound and tight knots, or equivalent of pin knots; 4 pitch pockets not over 6 inches in length; medium pitch streak.

Six-inch and thicker.—Defects based on 8 inches by 12 feet.

Nominal thicknesses (inches)	Nominal widths	Lengths
6 and thicker	*Inches* 6 and wider	Multiples of 2 feet.

"B and better" green clears.—Will admit occasional slight variation in sawing; bright sap. With the above will admit on face and corresponding half of edges, the following defect, an equivalent defect, or an equivalent combination of defects: Three pitch pockets not over 6 inches in length, none through thickness; and on the reverse side and corresponding half of edges, one of the following defects, an equivalent defects, or an equivalent combination of defects: Four pitch pockets not over 6 inches in length, none through thickness; 3 sound and tight 1½-inch knots.

"C" green clears.—Will admit occasional slight variation in sawing; medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three medium (1½-inch) sound and tight knots; 4 pitch pockets not over 6 inches in length; medium pitch streak.

"B and better" turning squares.—If surfaced, finished size shall be ½ inch scant each way.

Must be free from heart centers. Will admit such defects as will be removed in dressing or turning, and any minor defects that will cover well with paint after working. With the above, one of the following defects, an equivalent defect, or an equivalent combination of defects: A few small sound and tight knots; small pitch pockets.

West Coast Lumbermen's Association, grading rules for dimension lumber, July 1, 1926.

DOUGLAS FIR AND WEST COAST HEMLOCK

Dimension and plank.

Nominal thicknesses (inches)	Standard yard thicknesses S1S or S2S	Finished widths S1E and S2E
	Inches	
2	1⅝	2 to 7 inches, ⅜ off.
2½	2⅛	8 inches and wider, ½ off.
3	2⅝	
3½	3⅛	
4	3⅝	

Standard industrial 2 inches S1S or S2S to 1¾ inches.

Lengths.—Multiples of 2 feet.

Selected common dimension.

Shall be well manufactured. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Medium sap stain, 25 per cent of face; sound and tight knots, approximately 1 inch in 4 to 6 inch widths, 1⅜ inches in 8-inch widths, 1¾ inches in 10-inch widths, 2 inches in 12-inch widths, 2¼ inches in 14-inch widths, not over 2½ inches in wider widths; pitch pockets not over 6 inches in length; seasoning checks; heavy torn grain.

No. 1 common dimension.

Must be sound stock, well manufactured, suitable for ordinary construction. In 2 by 2 to 2 by 6, inclusive, may be Douglas fir and/or west coast hemlock. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 1½ inches in 4 to 6 inch widths, 2 inches in 8-inch widths, 2½ in 10-inch widths, 3 inches in 12-inch widths, 3¼ inches in 14-inch widths, not over 3½ inches in wider widths; loose knots one-half the maximum diameter of allowable tight knots; short splits equal in length to width of piece; spike knots which do not weaken the piece more than knots heretofore specified; seasoning checks; wane, one-fourth thickness, one-fourth width, one-third length of piece; pitch pockets; pitch streaks; pin wormholes, limited; medium sap stain, 40 per cent of face; firm heart stain, 10 per cent of face; torn grain; occasional skips which are not more than ⅛ inch scant of the standard dressed size.

No. 2 common dimension.

May be Douglas fir or west coast hemlock. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound, unsound, and loose knots, approximately 2 inches in 4-inch widths, 2½ inches in 6-inch widths, 3 inches in 8-inch widths, 3½ inches in 10-inch widths, 4 inches in 12-inch widths, not over one-third width of piece in wider widths; spike knots which do not weaken the piece more than knots heretofore specified; splits, not over twice the width of piece; fine through checks or shakes; wane one-third thickness on edge, one-third width, one-third length of piece; large through pitch pockets; large pitch streak; large wormholes, two per surface foot; sap stain; firm heart stain; streak of advanced decay, not through, equal in area to a streak one-half inch wide by one-sixth length of piece; torn grain. Skips which are not more than one-eighth inch scant of the standard dressed size permitted. Miscut pieces which are not more than one-eighth inch scant of standard dressed size in width and/or thickness, shall be admitted in No. 2 common, provided such pieces are in all other respects as good as No. 1 common at point of miscut.

No. 3 common dimension.

Will admit any or all west coast species 4 feet and up. Will include all stock below the grade of No. 2 dimension, and will admit the following defects: Large, coarse, loose, and unsound knots; knot holes; shake; large pitch pockets; wane, leaving approximately one-fourth inch edge; splits, one-fourth length of piece; heart stain, any amount; sap stain, any amount; moldy stock; white speckled heart, scattered small decayed spots; wormholes; mismanufactured pieces.

SITKA SPRUCE

Dimension and plank.

The grading rules for Sitka spruce dimension and plank are the same as the grading rules of this association for Douglas fir dimension and plank (see above).

Selected common dimension.

Shall be well manufactured. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Medium sap stain; sound and tight knots, approximately 1 inch in 4 to 6 inch widths, 1⅜ inches in 8-inch widths, 1¾ inches in 10-inch widths, 2 inches in 12-inch widths, 2¼ inches in 14-inch widths, not over 2½ inches in wider widths; seasoning checks; pitch pockets not over 6 inches in length.

No. 1 common dimension.

Must be sound stock, well manufactured, suitable for ordinary construction. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 1½ inches in 4 to 6 inch widths, 2 inches in 8-inch widths, 2½ inches in 10-inch widths, 3 inches in 12-inch widths, 3¼ inches in 14-inch widths, not over 3½ inches in wider widths; loose knots one-half the maximum diameter of allowable sound knots; short split equal in length to width of piece; spike knots which do not weaken the piece more than knots heretofore specified; seasoning checks; wane, one-fourth thickness, one-fourth width, one-third length of piece; pitch pockets; pitch streak; pin wormholes, limited; medium sap stain, limited; firm heart stain, 10 per cent of face; occasional skips, which are not more than one-eighth inch scant of the standard dressed size.

No. 2 common dimension.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound, unsound, and loose knots, approximately 2 inches in 4-inch widths, 2½ inches in 6-inch widths, 3 inches in 8-inch widths, 3½ inches in 10-inch widths, 4 inches in 12-inch widths, not over one-third width of the piece in wider widths; spike knots which do not weaken the piece nore than knots heretofore specified; splits, not over twice width of piece; fine through checks or shakes; wane one-third thickness on edge, one-third width of piece, one-third length of piece; large through pitch pockets; large pitch streak; large wormholes, 2 per surface foot; sap stain; firm heart stain; streak of advanced decay, not through, equal in area to a streak one-half inch wide by one-sixth length of piece. Skips which are not more than one-eighth inch scant of the standard dressed size permitted. Miscut pieces which are not more than one-eighth inch scant of standard dressed size in width and/or thickness, shall be admitted in No. 2 common, provided such pieces are in all other respects as good as No. 1 common at point of miscut.

No. 3 common dimension.

Will include all stock below the grade of No. 2 dimension and will admit the following defects, equivalent defects, or equivalent combinations of defects: Large, coarse, loose, and unsound knots; knot holes; shake; large pitch pockets; wane, leaving approximately one-fourth inch edge; splits one-fourth length of piece; heart stain, any amount; sap stain, any amount; moldy stock; white speckled heart; scattered small decayed spots; wormholes; mismanufactured pieces.

WESTERN RED CEDAR

Plank.

The grading rules for western red cedar plank are the same as the rules of this association for Douglas for dimension and plank. (See above.)

No. 1 common.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 1½ inches in 4 and 6 inch widths, 2 inches in 8-inch widths, 2½ inches in 10-inch widths, 3 inches in 12-inch widths, 3¼ inches in 14-inch widths, 3½ inches in wider widths; spike knots which do not weaken the piece more than knots heretofore specified; checks; pin wormholes, limited; sap stain, 15 per cent of face.

No. 2 common.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound, unsound, and loose knots, approximately 2 inches in 4-inch widths, 2½ inches in 6-inch widths, 3 inches in 8-inch widths, 3½ inches in 10-inch widths, 4 inches in 12-inch widths, not over one-third width of piece in wider widths; spike knots which do not weaken the piece more than knots heretofore specified; splits not over twice the width of the piece; checks or shakes; wane one-third thickness, one-third width, one-third length of piece; large wormholes; sap stain; streak of advanced decay equal in area to a streak 1 inch wide, one-half length of piece; torn grain; skips which are not more than one-eighth inch scant of standard dressed size.

Western Pine Manufacturers Association, grading rules for white fir, cedar, and spruce dimension lumber, July 1, 1925.

No. 1.

No. 1 dimension must be of a good sound character, but will admit of defects that do not impair the strength of the piece.

On basis of 2 by 4; wane on edge is admissible one-half inch deep, for half the length, or a proportionate amount for a shorter distance or on both edges. In any case, one side and two edges should allow a good nailing surface, it being understood, however, that the wane shall in no case extend over more than one-half the side of the piece.

Small dimension must be moderately straight and larger dimension must be more so. A few wormholes are admissible. Stained sap is not considered a defect. Dimension, heavy planking, and timbers may be made up of fir, larch, and pine in any proportion.

No. 2.

No. 2 will admit of large, coarse knots, not necessarily sound, considerable wane; also shake, wormholes, dozey streaks, crooked pieces or other defects which weaken or impair the piece to such an extent as to render it unfit for No. 1 grade. A serious combination of these defects is not admissible in any one piece.

No. 3.

No. 3 will admit a great deal of rot and all the imperfections allowed in No. 1 and No. 2, but in a much more pronounced form.

Western Pine Manufacturers Association, grading rules for larch and fir dimension lumber, July 1, 1925.

Larch and fir standard sizes.

Dimension S1S1E—

2 by 4 to 1⅝ by 3⅝.
2 by 6 to 1⅝ by 5⅝.
2 by 8 to 1⅝ by 7½.
2 by 10 to 1⅝ by 9½.
2 by 12 to 1⅝ by 11½.
3 by 4 to 2½ by 3⅝.
3 by 6 to 2½ by 5⅝.
3 by 8 to 2½ by 7½.
3 by 10 to 2½ by 9½.
3 by 12 to 2½ by 11½.

402.5 LATHS AND SHINGLES.

402.51 Lath.

Arkansas Soft Pine Bureau, grades for soft pine lath, March 23, 1927.

No. 1 and No. 2 lath.

Grades identical with those of the North Carolina Pine Association (Inc.). (See page 126.)

Arkansas Soft Pine Bureau, specifications for grades of soft pine byrkit lath, March 23, 1927.

Identical with those of the North Carolina Pine Association (Inc.) for pine byrkit lath.

Patterns.

Patterns for byrkit lath are illustrated in Figures 1 and 2.

California Redwood Association, standard specifications for eastern grade of California redwood lath, April, 1927.

Size.—Redwood lath shall be ⅜ inch thick by 1½ inches wide by 32 and 48 inches long, with allowable scantness, either green or dry, of $\frac{1}{16}$ inch in width and thickness, and ¼ inch in length.

Grade.—Redwood lath shall be of sound material and will admit pin wormholes or hollow bird's-eye, pin knots which do not weaken the piece, stain, and wane not to exceed one-third the thickness, one-third the width, and one-fourth the length of the piece.

California White and Sugar Pine Manufacturers Association, grades for California white pine, sugar pine, white fir, and Douglas fir lath, May 1, 1926.

Lath grades.—Owing to the rapidity with which lath are manufactured and necessarily handled in grading, the misplacement of an occasional piece is practically unavoidable. For this reason a variation of 10 per cent or less off grade is provided for in the rules. This provision is intended to cover accidentally misplaced pieces only, and every reasonable effort should be made to have the grades conform to the specifications without regard to this percentage provided for misplaced pieces.

No. 1 lath.—No. 1 lath shall be butted to not less than 31¾ inches or 47¾ inches long, not more than one-eighth of an inch scant of 1½ inches wide; and not more than one-sixteenth of an inch scant of three-eighths of an inch thick, and of sound material.

Will admit wane one-third the thickness and one-third the width for one-third the length on one side of the piece or its equivalent when not in combination with other serious defects.

Any number of pin knots, three or four three-quarter inch knots well scattered, or more smaller knots, all well set, firm, and sound, that do not weaken the piece, are admissible in a 4-foot and a proportionately less amount in a 32-inch No. 1 lath.

Firm, fine shake extending over one-half the surface of the piece that does not materially impair its strength is admissible when not in serious combination with other defects. Moderate pitch extending over one-half the surface of the piece that does not materially impair the usefulness is admissible when not in serious combination with other defects.

A few wormholes in an otherwise sound piece are admissible.

Stain shall not be considered a defect, although mold that has caused the surface of the piece to decay or scale off is a defect not admissible in this grade.

Ten per cent or less of No. 2 lath shall be allowed in this grade.

No. 2 lath.—May be of No. 1 quality with average of not more than one-fourth inch scant in width and one-eighth inch scant in thickness; may contain firm streaks of rot, sound knots or an occasional loose knot, dead wood, wormholes, wane, and season checks. Defects must not be in combinations that will seriously impair the usefulness of the piece.

Both ends of a No. 2 lath should have at least an inch in width of firm wood for nailing.

Ten per cent above or below grade is admissible.

National Hardwood Lumber Association, grades for cypress lath, January, 1927.

Lath grades.—Nos. 1 and 2, standard thickness, ⅜ inch; standard width, 1½ inches; standard lengths, 32 and 48 inches.

No. 1 lath.—No. 1 lath must not vary more than one-sixteenth inch from standard thickness nor more than one-eighth inch from standard width and must not be more than three-eighth inch scant of standard lengths and will admit any number of sound defects which do not occupy more than one-third the cross section of the piece at any point, slight peck, slight shake, wane not exceeding one-third the thickness, one-third the width, and one-third the length of the piece or its equivalent, and sound discolored sapwood.

No. 2 lath.—No. 2 lath must not vary more than one-eighth inch from standard thickness and must not vary more than one-fourth inch from standard width and must not be more than one-half inch scant of standard lengths and may contain unsound defects which do not occupy more than one-third the cross section of the piece at any point, or sound defects which do not occupy more than two-thirds of the cross section at any point, sound stain and splits, or through shake not exceeding half the length of the piece.

National Hardwood Lumber Association, grades for hardwood lath, January, 1927.

Lath grades.—Nos. 1 and 2, count shall be made by the piece.

No. 1 lath.—Thickness, green, should be not less than six-sixteenths inch and five lath should measure 2 inches.

Thickness, dry, should be not less than 1⅝ inches to five lath.

Width, green, should be not less than $1\frac{7}{16}$ inches.

Width, dry, should be not less than $1\frac{5}{16}$ inches.

Length, 4 feet. Pieces one-half inch short will be admitted.

Sound stain shall not be considered a defect.

Pin wormholes, one ½-inch sound knot, wane ¼ inch wide, 6 inches long, ⅛ inch deep, or equivalent defects will be admitted.

No. 2 lath.—Width, dry, not less than 1¼ inches.

Thickness, dry, not less than ¼ inch.

Length, 4 feet. Pieces ¾ inch short will be admitted.

No. 2 will admit wane, wormholes, knots, and other defects that will not prevent the use of the piece full length.

North Carolina Pine Association (Inc.), grades for North Carolina pine laths, January 1, 1927.

No. 1 lath.—No. 1 lath, when green, should measure 2 inches in thickness to every five lath, with the minimum thickness of any one lath not less than $\frac{5}{16}$ inch, and should not be less than $1\frac{7}{16}$ inches in width. When dry they should measure $1\frac{5}{8}$ inches in thickness to every five lath, and should not be less than $1\frac{5}{16}$ inches in width. Length 4 feet, with not more than 20 per cent of a shipment which may be as much as $\frac{1}{2}$ inch short in length. Will admit wane $\frac{1}{8}$ inch deep, $\frac{1}{4}$ inch wide on the face, and 6 inches long, pinworm holes, and one pin knot. Stain shall not be considered a defect.

No. 2 lath.—No. 2 lath shall consist of pieces that fall below the grade of No. 1 which are not less than $1\frac{1}{4}$ inches in width, $\frac{1}{4}$ inch thick, when dry, and not more than $\frac{3}{4}$ inch short in length. They will admit wane, wormholes, knots, and other defects that will not prevent their use without waste.

North Carolina Pine Association (Inc.), inspection rules for pine byrkit lath, January 1, 1927.

Size, $\frac{3}{4}$ by $3\frac{1}{2}$ and $5\frac{1}{4}$ inches; lengths, 4 feet and up.

Standard byrkit lath shall consist of material that will be held firmly in place and support plaster by ordinary nailing by not wasting more than 10 per cent of any piece and that will present a full surface with no openings over $\frac{1}{2}$ inch in width and 3 inches in length. The ends of pieces of byrkit lath are not expected to meet on studding, and only such quantity shall be counted waste as is necessary to remove a defect.

Northern Hemlock and Hardwood Manufacturers Association, official grading rules for hemlock and tamarack lath, February 1, 1927.

Size, $\frac{3}{4}$ by $3\frac{1}{4}$ and $\frac{3}{4}$ by $5\frac{1}{4}$ face from 4 and 6 inch strips. Shall consist of Nos. 2 and 3 grade worked as per byrkit pattern. Should be even lengths and retain strength enough to be suitable for general plastering purposes with waste of not more than 10 per cent.

Northern Hemlock and Hardwood Manufacturers Association, grades for hemlock lath, February 1, 1927.

Lath grades.—Identical with those of the California White and Sugar Pine Manufacturers Association with the added statements that "the standard lengths shall be 32 and 48 inches and no longer" and that "no tamarack is admitted into any grade of hemlock unless specified at the time of selling. This association has also the following additional grade.

No. 3 lath.—This grade will admit all pieces below a No. 2 that are $\frac{3}{16}$ inch and thicker up to $\frac{7}{16}$ inch and 1 inch and wider up to $1\frac{3}{4}$ inches not over 15 per cent below the standard width, admitting all defects characteristic of hemlock lath, such as wane, knots, knot holes, sound and unsound, that would leave it strength enough. Pieces with bark full length and width, with face of wood, soft rot in small spots going through piece, and any other defects that bar it from the better grades. Special attention should be given to length and must be the same length as upper grades; also should have reasonably sound ends to admit nailing.

Patterns.

Patterns for byrkit lath are illustrated in Figures 1 and 2.

Northern Pine Manufacturers Association, grades for white pine and spruce lath, April 15, 1925.

No. 1 and No. 2 white pine lath.—Grades identical with those of California White and Sugar Pine Manufacturers Association with the added statement that "No. 2 lath may consist of any proportion of northern pine and spruce."

No. 1 mixed lath.—No. 1 mixed lath shall be graded by the same rules and specifications and subject to the same percentage of No. 2 given for No. 1 white pine lath, and may consist of a mixture in any proportion of northern pine and spruce.

Pacific Lumber Inspection Bureau, grades for Douglas fir lath, Schedule M, 1925.

Douglas fir lath—one grade.

Shall measure 1 inch in thickness to every three laths. Shall be practically clear and must be evenly manufactured. Occasional variation in width not to exceed $\frac{1}{16}$ of an inch when green, allowed. Will admit a small number of pin wormholes or small pitch pockets or an occasional pin knot; slight barkwane on one side. All laths to be butted not more than $\frac{1}{4}$ inch scant of nominal length. Season or sap stain no defect.

Port Orford cedar lath—one grade.

This is identical with the rules for Douglas fir above, with the added statement that "seasoned laths shall measure not less than $\frac{15}{16}$ inch in thickness to every three laths, nor less than $1\frac{5}{16}$ inch in width.

Red Cedar Lumber Manufacturers Association, grades for western red cedar lath, August 1, 1925.

No. 1 lath.

Grades identical with those of the Pacific Lumber Inspection Bureau for Douglas fir lath, with the added statements that "seasoned laths shall measure not less than $\frac{15}{16}$ inch in thickness to every three laths, not less than $1\frac{13}{32}$ inches in width" and "due to the rapidity with which lath is manufactured, making misplacement of occasional pieces practically unavoidable, a variation of 10 per cent or less off-grade is necessary and allowable."

No. 2 lath.

No 2 lath shall consist of pieces that fall below the grade of No. 1, which are not less than $1\frac{1}{4}$ inches in width, $\frac{1}{4}$ inch thick when dry, and are not more than $\frac{3}{4}$ inch short in length.

Will admit knots, small knot holes, wane, wormholes, and other defects that will not prevent their use without waste.

Scutheastern Forest Products Association, grades for southern pine lath, September 1, 1925.

No. 1 and No. 2 lath.

Grades identical with those of the North Carolina Pine Association (Inc.) with the added statement that lath 1 inch wide and 48 inches long or 32 inches wide may be furnished when ordered on specification for No. 1 lath.

Southeastern Forest Products Association, specifications for southern pine byrkit lath, September 1, 1925.

Identical with those of the North Carolina Pine Association for pine byrkit lath.

Patterns.

Patterns for byrkit lath are illustrated in Figures 1 and 2.

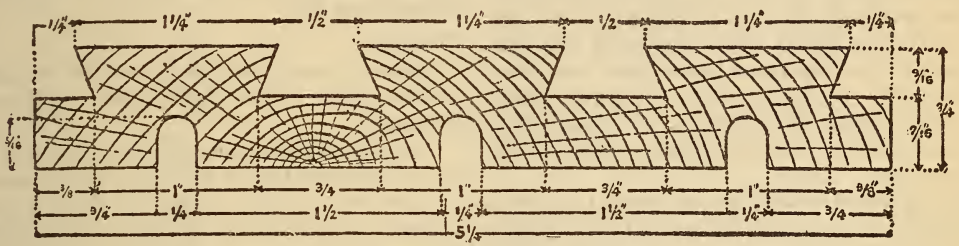


FIG. 1.—*Standard pattern byrkit lath*

Arkansas Soft Pine Bureau
Northern Hemlock and Hardwood Manufacturers Association
Southeastern Forest Products Association
Southern Pine Association

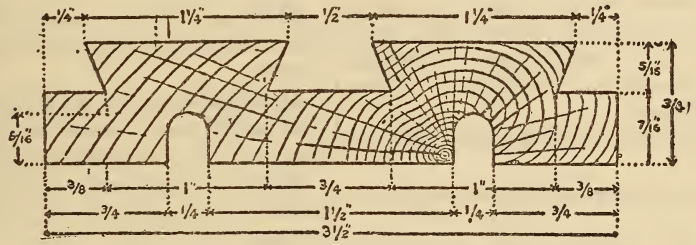


FIG. 2.—*Standard pattern byrkit lath*

Arkansas Soft Pine Bureau
Northern Hemlock and Hardwood Manufacturers Association
Southeastern Forest Products Association
Southern Pine Association
West Coast Lumbermen's Association

Southern Pine Association, grades for southern pine lath, March 23, 1927.

No. 1 and No. 2 lath.

Grades identical with those of the North Carolina Pine Association (Inc.). (See above.)

Southern Pine Association, standard specifications for grades of southern pine byrkit lath, March 23, 1927.

Identical with those of the North Carolina Pine Association for pine byrkit lath.

Patterns.

Patterns for byrkit lath are illustrated in Figures 1 and 2.

West Coast Lumbermen's Association, standard grading rules for Douglas fir and west coast hemlock byrkit lath, July 1, 1926.

Identical with those of the North Carolina Pine Association for pine lath.

West Coast Lumbermen's Association, grades for Douglas fir, hemlock, spruce, and western red cedar lath, July 1, 1926:

Grades Nos. 1 and 2.

Grades identical with those of the Red Cedar Lumber Manufacturers Association for western red cedar lath

Patterns.

Patterns for byrkit lath are illustrated in Figures 1 and 2.

Western Pine Manufacturers Association, grades for Pondosa pine, Idaho white pine, black pine, spruce, fir, cedar, and larch lath, July 1, 1925.

Standard sizes.

Standard, 4 feet. Lath, ⅜ by 1½ inches.

Grades.

No. 1 and No. 2 lath.—Grades identical with those of the California White and Sugar Pine Manufacturers Association with the added statement that No. 2 lath may consist of any proportions of any two or more of the following named woods: Pondosa pine, Idaho white pine, black pine, spruce, fir, cedar, and larch.

No. 1 mixed lath.—No. 1 mixed lath shall be graded by the same rules and specifications, and subject to the same percentage of No. 2 given for No. 1 pine lath, and may consist of any two or more of the following named woods: Pondosa pine, Idaho white pine, black pine, spruce, fir, cedar, and larch.

402.52 Shingles.

GENERAL RULES RELATING TO SHINGLES

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

All A and B grades shingles must be parallel (a 16 or 18 inch A or B shingle not over ¼ inch off parallel or a 24-inch A shingle not over ⅜ inch off parallel shall be considered parallel), uniform in thickness, and well manufactured. This means shims and feather tips are not permitted; smoothness of faces and butts must be first class. Badly cross-grained shingles not permitted.

No full flat-grain shingle wider than 10 inches permitted in grade B, and no shingle wider than 14 inches permitted in A and B grades; 1 inch over and under in length is permitted in 10 per cent. Shingles cut from equalized blocks may be ¼ inch less than the standard length. C grade admits slight irregularities in thickness. A shingle in C grade, not over ⅜ inch off parallel, shall be considered parallel.

Where reference is made to edge grain, percentage of edge grain shall be determined by the proportion of actual lineal measurement of edge grain to full lineal measurement of shingles.

In 16 and 18 inch A and B grades not more than 10 per cent of any shipment may be less than 4 inches in width.

All shingles to be packed in straight courses in regulation frames 20 inches in width with band sticks not less than 19½ inches long. Openings shall not exceed an average of 1 inch to the course in random width shingles.

Discrepancy in inspection in any grade shall not exceed 4 per cent.

Grades.—The basic grades of shingles shall be A, B, C, and D.

Sizes.—16-inch 6/2 shingles and 18-inch 5/2 shingles be eliminated. Dimension shingles shall be sold full net count, no dimension shingle to be less than ⅛ inch scant of the specified width when dried.

Shipping provisions.—The kiln-dried weight of shingles be not more than 10 per cent under the present association shipping weights. The openings shall not exceed an average of 1 inch to the course in random-width shingles.

American Railway Engineering Association, rerevision of manual, Bulletin 293, wooden bridges and trestles, January, 1927.

The basic grades, sizes, and shipping provisions for shingles are identical with the American Lumber Standards, above.

The specifications for red cedar shingles differ from the recommended specifications of the American Lumber Standard as follows:

Grade A.

Twenty-four-inch shingles 4/2 inch.—No shingle to be narrower than 4 inches. To be packed 14/14 courses to bunch; 9 bunches to "M"; 4 bunches to "square" 7½ inches exposure, 3 bunches to "square" 10 inches exposure. Bunches must measure 7 inches across butts when green, 6¾ inches when dry.

Grade B.

To be strictly clear. Not less than 50 per cent edge grain, with not to exceed ½ inch sap on any portion of the 5 inches measured from the butt, on one edge only.

Grade C.

Twenty-four-inch shingles 4/2 inch.—No shingle to be narrower than 3 inches. To be packed 14/14 courses to bunch; 9 bunches to "M"; 4 bunches to "square" 7½ inches exposure, 3 bunches to "square" 10 inches exposure. Bunches must measure 6¾ inches across butts when green, 6½ inches when dry.

Grade D.

Six-inch clear butts for 16 and 18 inch shingles, 10-inch clear butts for 24-inch shingles. Sap permitted.

Twenty-four-inch shingles 4/2 inch.—No shingle to be narrower than 2 inches. Permits shims and feather tips 20 inches long. To be packed 14/14 courses to bunch; 9 bunches to "M"; 4 bunches to "square" 7½ inches exposure, 3 bunches to "square" 10 inches exposure. Bunches must measure 6¾ inches across butts when green, 6½ inches when dry.

General rules.

The general rules for red cedar shingles are identical with those of the American Lumber Standards, above.

Arkansas Soft Pine Bureau has adopted rules for grading soft pine shingles identical with those of the Southern Pine Association given on page 130.

California Redwood Association, standard specifications for eastern grades of California redwood shingles, April, 1927.

Sizes.—16-inch, 5 to 1¾ inches, and 5 to 2 inches.

Grades.—Clear V.G. and star A star.

Special provisions.—Redwood shingles are packed as follows:

Random width, 20 inches wide, 25 course, 4 bunches to M.

Dimension 6-inch, 150 pieces to bunch.

Dimension 5-inch, 200 pieces to bunch.

Clear V.G. shingles shall be strictly clear, all vertical grain, well manufactured from sound live timber, and free from sapwood and all defects.

Star A star shingles shall be 8 inches clear, and will admit flat grain, dark sound wood, hard streaks, and burls. They shall be well manufactured, except feather tips when 14 inches, and thick and thin shingles will be allowed.

CYPRESS SHINGLES

National Hardwood Lumber Association, grading rules for cypress shingles, January, 1927.

Bests.—A dimension shingle, 4, 5, and 6 inches wide, 16 inches long, each width packed separately,

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

RECOMMENDED SPECIFICATIONS FOR STANDARD GRADES OF RED CEDAR SHINGLES

A	B	C	D
To be strictly clear, edge grain, and free from sap. Random widths.	To be strictly clear, mixed edge grain and flat grain, ½ inch sap, measured 5 inches from butt, on one edge only permitted.	10-inch clear butts and better for 16 and 18 inch shingles and 16-inch clear butts and better for 24-inch shingles not permitted in higher grades. Sap permitted.	6 to 10 inch clear butts. Sap permitted.
24-inch Shingles 4/2 inch			
No shingle to be narrower than 4 inches. If packed by "M" must count 18/18 courses to bunch, 7 bunches to "M." Bunches must measure 9 inches across butts when green, 8¾ inches when dry. If packed by "square" must count 17/18 courses to bunch, 3 bunches to square. Bunches must measured 8½/9 inches across butts when green, 8¼/8¾ inches when dry.	None.	No shingle to be narrower than 3 inches. If packed by "M" must count 18/18 courses to bunch, 7 bunches to "M." Bunches must measure 8¾ inches across butts when green, 8½ inches when dry. If packed by "square" must count 17/18 courses to bunch, 3 bunches to square. Bunches must measure 8¼/8¾ inches across butts when green, 8/8½ when dry.	No shingle to be narrower than 2 inches. Permits shims and feather tips 20 inches long. If packed by "M" must count 18/18 courses to bunch. 7 bunches to "M." Bunches must measure 8¾ inches across butts when green, 8½ inches when dry. If packed by "square" must count 17/18 courses to bunch, 3 bunches to square. Bunches must measure 8¼/8¾ inches across butts when green, 8/8½ inches when dry.
18-inch Shingles 5/2¼ inch			
No shingle to be narrower than 3 inches. If packed by "M" must count 20/20 courses to bunch, 5 bunches to "M." Bunches must measure 9 inches across butts when green, 8¾ inches when dry. If packed by the "square" must count 18/18 courses to bunch, 4 bunches to square. Bunches must measure 8⅛ inches across butts when green, 7⅞ inches when dry.	No shingle to be narrower than 3 inches. If packed by "M" must count 20/20 courses to bunch, 5 bunches to "M." Bunches must measure 9 inches across butts when green, 8¾ inches when dry. If packed by the "square" must count 18/18 courses to bunch, 4 bunches to square. Bunches must measure 8⅛ inches across butts when green, 7⅞ inches when dry.	No shingle to be narrower than 2½ inches. If packed by "M" must count 20/20 courses to bunch, 5 bunches to "M." Bunches must measure 8¾ inches across butts when green, 8½ inches when dry. If packed by the "square" must count 18/18 courses to bunch, 4 bunches to square. Bunches must measure 7⅞ inches across butts when green, 7⅝ inches when dry.	No shingle to be narrower than 2 inches. Permits shims and feather tips 16 inches long. If packed by "M" must count 20/20 courses to bunch, 5 bunches to "M." Bunches must measure 8¾ inches across butts when green, 8½ inches when dry. If packed by the "square" must count 18/18 courses to bunch, 4 bunches to square. Bunches must measure 7⅞ inches across butts when green, 7⅝ inches when dry.
16-inch Shingles 5/2 inch			
No shingle to be narrower than 3 inches. If packed by "M" must count 25/25 courses to bunch, 4 bunches to "M." Bunches must measure 10 inches across butts when green, 9¾ inches when dry. If packed by the "square" must count 20/20 courses to bunch, 4 bunches to square, or 5 to "M." Bunches must measure 8 inches across butts when green, 7¾ inches when dry.	No shingle to be narrower than 3 inches. If packed by "M" must count 25/25 courses to bunch, 4 bunches to "M." Bunches must measure 10 inches across butts when green, 9¾ inches when dry. If packed by "square" must count 20/20 courses to bunch, 4 bunches to square, or 5 to "M." Bunches must measure 8 inches across butts when green, 7¾ inches when dry.	No shingle to be narrower than 2½ inches. If packed by "M" must count 25/25 courses to bunch, 4 bunches to "M." Bunches must measure 9¾ inches across butts when green, 9½ inches when dry. If packed by the "square" must count 20/20 courses to bunch, 4 bunches to square, or 5 to "M." Bunches must measure 7¾ inches across butts when green, 7½ inches when dry.	No shingle to be narrower than 2 inches. Permits shims and feather tips 14 inches long. If packed by "M" must count 25/25 courses to bunch, 4 bunches to "M." Bunches must measure 9½ inches across butts when green, 9¼ inches when dry. If packed by the "square" must count 20/20 courses to bunch, 4 bunches to square, or 5 to "M." Bunches must measure 7½ inches across butts when green, 7¼ inches when dry.

five butts to measure 2 inches in thickness, and free from sapwood and all defects.

Primes.—A dimension shingle, 4, 5, and 6 inches wide, 16 inches long, each width packed separately, five butts to measure 2 inches in thickness, admitting tight knots and sapwood, but free from shake and other defects; no knots to be within 8 inches of the butts.

This grade may contain shingles clipped two-thirds of the width and one-eighth of the length on the point.

Star A star.—A random width shingle 3 inches and wider, 14 to 16 inches long, otherwise the same as Primes.

Economy.—Dimensions 4, 5, and 6 inches each width separately bunched, admitting sapwood and sound knots, slight peck 5 inches from butts, imperfections on points and admitting 14-inch shingles.

Clippers.—All shingles below the above grades which are sound for 5 inches from the butts, wormholes and slight peck excepted, random widths 2½ inches and wider, admitting 12-inch shingles which are otherwise at least one grade higher.

The count of shingles of all grades is based on 4,000 lineal inches in width, making 1,000 standard shingles, consequently there would be only six hundred and sixty-seven 6-inch shingles packed and counted as 1,000 standard shingles; 5-inch dimension being counted in like proportion.

WHITE CEDAR SHINGLES

Northern Hemlock and Hardwood Manufacturers Association has adopted the shingle grading rules of the Northern White Cedar Shingle Manufacturers Association.

Northern White Cedar Association specifications (grading rules) for shingles are identical with those of the Northern White Cedar Shingle Manufacturers Association.

Northern White Cedar Shingle Manufacturers Association, specifications (grading rules) for white cedar shingles. (Current.)

Grade.

"Extra star A star."—Strictly 8-inch and better clear from butt, with all clears in. At least 95 per cent should be 4 inches and wider, but no shingles less than 3 inches wide, the latter to be strictly clear. To be well manufactured. Five butts to measure 2 inches when sawn. The length should be 16 inches, with an allowance of 1 inch in not to exceed 10 per cent of the bunch. To have clear wrappers.

"Standard star A star."—Strictly 5 to 8 inch clear from butt. Not less than 2½ inches in width. To be well manufactured. Five butts to measure 2 inches when sawn. The lengths should be 16 inches, with an allowance of 2 inches in not to exceed 10 per cent of the bunch. To have "extra" wrappers.

"Sound butts."—Strictly sound knotted 4 inches from butt. Not less than 2 inches in width or 12 inches in length.

General.—Four per cent will be allowed in all grades for error in manufacturing. Openings shall not average more than 1¼ inches to the course.

SOUTHERN PINE SHINGLES

Southeastern Forest Products Association has adopted rules for grading southern pine shingles, identical with those of the Southern Pine Association given below.

Southern Cypress Manufacturers Association has grading rules identical with those of the National Hardwood Lumber Association given above. In addition thereto it has adopted the following rules: Each bundle of cypress shingles should contain the manufacturer's name and be plainly marked with the grade and the number of bundles to the thousand shingles. It should also contain the association trade-mark.

Southern Pine Association, grading rules for southern pine shingles, March 23, 1927.

Size.—All shingles shall be not less than $\frac{7}{16}$ inch thick at butt, when dry, tapered to $\frac{1}{16}$ inch at thin end, 4 inches wide, and 18 inches long, except as to variations hereinafter specified.

Select grade shall be all heart, practically free from defects, and well manufactured, allowing a variation of ½ inch in length and ¼ inch in width.

No. 1 grade shall be all heart, free from unsound knots, but will admit sound tight knots, not exceeding 2 inches in diameter, if not located within 6 inches of butt end; slight pitch streaks; clipped ends in not to exceed 10 per cent of the shingles; and a variation of ½ inch in length and ¼ inch in width.

Prime grade may be all sapwood, practically free from defects and well manufactured, allowing a variation of ½ inch in length and ¼ inch in width. Stain shall not be considered a defect in this grade.

No. 2 grade may be all sapwood, and will admit sound tight knots, not exceeding 2 inches in diameter, if not located within 6 inches of butt end; firm red heart; stain; pitch; pitch pockets that do not show through; wane, or absence of wood, not exceeding ½ inch in width, that does not extend within 6 inches of butt end; a variation not exceeding 1 inch in length and ½ inch in width; clipped ends in not to exceed 20 per cent of the shingles; and slight defects in manufacture.

NOTE.—The count of shingles is based on 4,000 lineal inches in width to 1,000 shingles.

Washington and Oregon Shingle Association, grading rules effective January 1, 1926, identical with American Lumber Standards given above. This association has also the following rules for dimension shingles and packing rules.

Dimension shingles.

Dimension shingles shall be sold full net count, no dimension shingle to be less than ⅛ inch scant of the specified width when dried.

Twenty-four-inch shingles 4/2, 6 inches wide.—To be strictly clear, edge grain, and free from sap.

Eighteen-inch shingles 5/2¼, 4, 5, and 6 inches wide.—To be strictly clear with not to exceed ½ inch sap on any portion of the 5½ inches measured from butt on one edge only. Flat grain permitted.

Sixteen-inch shingles 5/2 inches, 4, 5, and 6 inches wide.—To be strictly clear with not to exceed ½ inch sap on any portion of the 5 inches measured from butt on one edge only. Flat grain permitted.

Packing rules.

Twenty-four by six inch, 4/2.—Packed 14/14 courses to the bunch, 9 bunches to M, 4 bunches to "square" 7½ inches exposure, 3 bunches to "square" 10 inches exposure. Net count, 84 pieces to bunch.

Eighteen by four-inch, 5/2¼ inches.—If packed by M must count 18/18 courses to bunch, with 5 additional cross shingles, net count 185 pieces to bunch, 5 bunches to M. If packed by "square" must count 16/16 courses to bunch, with 5 additional cross shingles, net count 165 pieces to bunch, 4 bunches to square.

Eighteen by five inch, 5/2¼ inches.—If packed by M must count 18/18 courses to bunch, with 4 additional cross shingles, net count 148 pieces to bunch, 5 bunches to M. If packed by "square" must count 16/16 courses to bunch, with 4 additional cross shingles, net count 132 pieces to bunch, 4 bunches to square.

Eighteen by six inch, 5/2¼ inches.—If packed by M must count 19/19 courses to bunch, with 8 additional cross shingles, net count 122 pieces to bunch, 5 bunches to M. If packed by "square" must count 17/17 courses to bunch, with 8 additional cross shingles, net count 110 pieces to bunch, 4 bunches to square.

Sixteen by four inch, 5/2 inches.—If packed by M must count 22/23 courses to bunch, with 6 additional cross shingles, net count 231 pieces to bunch, 4 bunches to M. If packed by "square" must count 17/18 courses to bunch with 10 additional cross shingles, net count 185 pieces to bunch, 4 bunches to square, 5 to M.

Sixteen by five inch, 5/2 inches.—If packed by M must count 2/23 courses to bunch, with 5 additional cross shingles, net count 185 pieces to bunch, 4 bunches to M. If packed by "square" must count 18/18 courses to bunch, with 4 additional cross shingles, net count 148 pieces to bunch, 4 bunches to square, 5 to M.

Sixteen by six inch, 5/2 inches.—If packed by M must count 24/24 courses to bunch, with 9 additional cross shingles, net count 153 pieces to bunch, 4 bunches to M. If packed by "square" must count 19/19 courses to bunch, with 8 additional cross shingles, net count 122 pieces to bunch, 4 bunches to square, 5 to M.

402.6 STRUCTURAL TIMBERS AND SHOP LUMBER.

(See 412. and 413.)

402.7 SOFTWOOD LUMBER SPECIFICATIONS.

(See 400.2.)

402.8 HARDWOOD LUMBER SPECIFICATIONS.

(See 400.3.)

402.9 MISCELLANEOUS SAWN LUMBER.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See American Lumber Standards 400.0 to 413.0 for softwood lumber standards.

National Hardwood Lumber Association, grading rules for miscellaneous specification for sawn lumber, January, 1927.

Plain sawn flitch.

Plain sawn flitch shall be graded according to the general rules applying to the kind of lumber, except that measurement must be made on the narrow or sap side in the center of the piece inside the wane or bark. There is no restriction to heart center in the cutting grades.

This rule does not apply to veneer flitch.

Red Cedar Lumber Manufacturers' Association, grading rules for miscellaneous specification for sawn lumber, August 1, 1925.

Capping and grooved trunking.

Sizes.—Worked to sizes and patterns ordered.

Lengths.—4 to 20 feet, multiples of 1 foot; 25 per cent or more, 16 feet; 15 per cent, 4 to 9 feet, inclusive.

A variation of one-sixteenth inch in all sizes either way will be allowed.

Dimensions of groove are minimum, an increase of ⅛ inch in size will be allowed as a maximum; practically all heart; suitable for use as a whole without waste; square edged; must be water-tight stock; sides of groove may be sawn but bottom must be knife cut.

Trunking.

Will admit the following defects, equivalent defects, or equivalent combinations of defects: Medium torn grain; sound and intergrown knots well scattered, approximately 2-inch in 4-inch widths; 3-inch in 6-inch widths; splits on end not longer than width of piece.

Capping.

Will admit the following defects, equivalent defects, or equivalent combinations of defects: Medium torn grain; sound and intergrown knots, well scattered, approximately 1-inch in 4-inch widths; 2-inch in 6-inch widths.

West Coast Lumbermen's Association, grading rules for western red cedar miscellaneous specifications of sawn lumber, July 1, 1926.

The grading rules of West Coast Lumbermen's Association for cedar capping and grooved trunking are the same as the grading rules of Red Cedar Lumber Manufacturers Association for cedar capping and grooved trunking. (See above.)

403. SURFACED AND WORKED LUMBER.

403.1 DRESSED LUMBER.

(See 411.)

403.2 MATCHED, SHIP-LAPPED, AND PATTERNED LUMBER.

(See 411.)

410. GENERAL ITEMS.

(See 400.0.)

411. YARD LUMBER FOR GENERAL BUILDING PURPOSES.

411.0 GENERAL ITEMS.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

YARD LUMBER

The term "yard lumber" as here used means lumber that is manufactured and classified into those sizes, shapes, and qualities required for ordinary construction and general-purpose uses. (Heavy timbers for structural purposes, softwood factory lumber, hardwood factory lumber, and other special-use materials are not considered yard stock.)

Grade Standards

On the basis of quality yard lumber is divided into two main divisions: (*a*) Select lumber and (*b*) common lumber. These are again divided into two classes—Select lumber into (1) that suitable for natural finishes and (2) that suitable for paint finishes; common lumber into (1) that which can be used without waste and (2) that which permits some waste. Each of these four classes is further divided into quality classes or grades.

Select lumber.—Lumber which is generally clear, containing defects limited both as to size and number, and which is smoothly finished and suitable for use as a whole for finishing purposes or other uses in which large, clear pieces are required, shall be considered *select lumber.*

Two classes shall be recognized. The first shall be suitable for natural finishes. The second class permits similar defects, and, in addition, blemishes of somewhat greater extent than those of the first class, but of a type which can be covered by paint

Grade names: A, B, C, and D.

Common lumber.—Lumber containing numerous defects and blemishes which preclude it from use for finishing purposes, but which is suitable for general utility and construction purposes, shall be considered *common lumber.*

Two general classes shall be recognized. The first shall be suitable for use as a whole for purposes in which surface covering or strength is required. Defects and blemishes permitted in this class must be sound. The second class permits very coarse defects which may cause waste in the use of the piece.

Grade names: No. 1 common, No. 2 common, No. 3 common, No. 4 common, and No. 5 common.

Dimension grade names: No. 1 common, No. 2 common, and No. 3 common.

Basic grade classifications for yard lumber

Total products of a typical log arranged in series according to quality as determined by appearance.	SELECT: Lumber of good appearance and finishing qualities.	Suitable for natural finishes.	Grade A.—Practically free from defects.
			Grade B.—Allows a few small defects or blemishes.
		Suitable for paint finishes.	Grade C.—Allows a limited number of small defects or blemishes that can be covered with paint.
			Grade D.—Allows any number of defects or blemishes which do not detract from a finish appearance, especially when painted.
	COMMON: Lumber containing defects or blemishes which detract from a finish appearance but which is suitable for general utility and construction purposes.	Lumber suitable for use without waste.	No. 1 common.—Sound and tight knotted stock. Size of defects and blemishes limited. May be considered water-tight lumber.
			No. 2 common.—Allows large and coarse defects. May be considered grain-tight lumber.
		Lumber permitting waste.	No. 3 common.—Allows larger and coarser defects than No. 2 and occasional knot holes.
			No. 4 common.—Low quality lumber admitting the coarsest defects, such as decay and holes.
			No. 5 common.—Must hold together under ordinary handling.

Definitions of defects and blemishes.—The defects and blemishes, enumerated in the rules for grading yard lumber of any species under the American Lumber Standards, shall be defined within the limits of the "Definitions of maximum defects and blemishes." (See 400.20.)

General provisions.—The grading of lumber can not be considered an exact science, because it is based on a visual inspection of each piece and on the judgment of the grader. The provisions of these specifications, however, are sufficiently explicit to establish 5 per cent below grade as a reasonable variation between graders.

Except in dimension, the grade of yard lumber, rough or surfaced two sides, shall be determined from the better or face side of the piece, and lumber which is surfaced one side only shall be graded from the surfaced side.

The rules for yard lumber prescribe the number and extent of defects and blemishes permitted in the poorest pieces admissible in each grade.

The number of defects and blemishes permitted varies as the area of the piece to be graded increases or diminishes in respect to the standard size specified, but the size of the defects must not exceed that allowed by the grading rules.

When defects or blemishes, or combinations thereof, not described in these grading rules are encountered, they will be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration.

Material shall be considered vertical grain when the rings (so-called grain) form an angle of 45° or more with the surface of the piece. When the angle becomes less than 45° at any point, the material shall be known as flat (slash) grain.

Mixed grades other than the two highest recognized grades for each species, not specifying the proportion of each grade, are not American standard grades

Yard and Industrial Size Standards

Dressed sizes.—The terms "standard yard board" and "standard industrial board," and "standard yard dimension" and "standard industrial dimension" shall be the designations for 1-inch boards and 2-inch dimension, respectively.

$\frac{25}{32}$ inch, S1S or S2S (measured at standard commercially dry shipping weight and moisture content for each species), shall be the thickness for the standard yard board; $\frac{26}{32}$ inch, S1S or S2S, for the standard industrial board.

$1\frac{5}{8}$ inches, S1S or S2S (measured at standard commercially dry shipping weight and moisture content for each species), shall be the thickness for standard yard dimension not more than 12 inches wide; $1\frac{3}{4}$ inches, S1S or S2S, for standard industrial dimension.

The finished widths of finish S1E or S2E (measured at standard commercially dry shipping weight and moisture content for each species) shall be $\frac{3}{8}$ inch off on lumber of standard width of 3 inches; the finished widths of finish S1E or S2E (based on kiln-dried lumber) shall be $\frac{1}{2}$ inch off on lumber of standards widths of 4 to 7 inches, inclusive, and $\frac{3}{4}$ inch off on lumber of standard widths of 8 to 12 inches, inclusive; and the finished widths of boards and dimension S1E or S2E (measured at standard commercially dry shipping weight and moisture content for each species) shall be $\frac{3}{8}$ inch off on lumber of standard widths less than 8 inches and $\frac{1}{2}$ inch off on lumber of standard widths of 8 to 12 inches.

The thicknesses and widths of finished lumber, 1SS or S2S and/or S1E or S2E, shall be as follows:

Finish, common boards and strips, and dimension

[The thicknesses apply to all widths and the widths to all thicknesses]

Product	Size, board measure		Dressed dimensions at standard commercially dry shipping weight and moisture content		
	Thickness	Width	Standard thickness, yard	Standard thickness, industrial	Standard width
	Inches	*Inches*	*Inches*	*Inches*	*Inches*
Finish	----------	3	$\frac{5}{16}$	----------	$2\frac{5}{8}$
	----------	4	$\frac{7}{16}$	----------	[1] $3\frac{1}{2}$
	----------	5	$\frac{9}{16}$	----------	[1] $4\frac{1}{2}$
	----------	6	$\frac{11}{16}$	----------	[1] $5\frac{1}{2}$
	1	7	$\frac{25}{32}$	$\frac{26}{32}$	[1] $6\frac{1}{2}$
	$1\frac{1}{4}$	8	$1\frac{1}{16}$	----------	[1] $7\frac{1}{4}$
	$1\frac{1}{2}$	9	$1\frac{5}{16}$	----------	[1] $8\frac{1}{4}$
	$1\frac{3}{4}$	10	$1\frac{7}{16}$	----------	[1] $9\frac{1}{4}$
	2	11	$1\frac{5}{8}$	$1\frac{6}{8}$	[1] $10\frac{1}{4}$
	$2\frac{1}{2}$	12	$2\frac{1}{8}$	----------	[1] $11\frac{1}{4}$
	3	----------	$2\frac{5}{8}$	----------	----------
Common boards and strips	1	3	$\frac{25}{32}$	$\frac{26}{32}$	$2\frac{5}{8}$
	$1\frac{1}{4}$	4	$1\frac{1}{16}$	----------	$3\frac{5}{8}$
	$1\frac{1}{2}$	5	$1\frac{5}{16}$	----------	$4\frac{5}{8}$
	----------	6	----------	----------	$5\frac{5}{8}$
	----------	7	----------	----------	$6\frac{5}{8}$
	----------	8	----------	----------	$7\frac{1}{2}$
	----------	9	----------	----------	$8\frac{1}{2}$
	----------	10	----------	----------	$9\frac{1}{2}$
	----------	11	----------	----------	$10\frac{1}{2}$
	----------	12	----------	----------	$11\frac{1}{2}$
Dimension	2	2	$1\frac{5}{8}$	$1\frac{6}{8}$	$1\frac{5}{8}$
	$2\frac{1}{2}$	4	$2\frac{1}{8}$	----------	$3\frac{5}{8}$
	3	6	$2\frac{5}{8}$	----------	$5\frac{5}{8}$
	4	8	$3\frac{5}{8}$	----------	$7\frac{1}{2}$
	Over 4	10	Off $\frac{3}{8}$	----------	$9\frac{1}{2}$
	----------	12	----------	----------	$11\frac{1}{2}$

[1] Based on kiln-dried lumber.

Siding, flooring, ceiling, partition, shiplap, and dressed and matched

[The thicknesses apply to all widths and the widths to all thicknesses]

Product	Size, board measure		Dressed dimensions at standard commercially dry shipping weight and moisture content	
	Thickness	Width	Standard thickness	Standard face width
	Inches	*Inches*	*Inches*	*Inches*
Bevel siding	----------	4	[1] 7/16 by 3/16	3 1/2
	----------	5	10/16 by 3/16	4 1/2
	----------	6	----------	5 1/2
Rustic and drop siding	----------	4	9/16	[2] 3 1/8
	----------	5	3/4	[2] 4 1/8
	----------	6	----------	[2] 5 1/16
	----------	8	----------	[2] 7 1/8
Flooring	----------	2	5/16	1 1/2
	----------	3	7/16	2 3/8
	----------	4	9/16	3 1/4
	1	5	25/32	4 1/4
	1 1/4	6	1 1/16	5 3/16
	1 1/2	----------	1 5/16	----------
Ceiling	----------	3	5/16	2 3/8
	----------	4	7/16	3 1/4
	----------	5	9/16	4 1/4
	----------	6	11/16	5 3/16
Partition	----------	3	3/4	2 3/8
	----------	4	----------	3 1/4
	----------	5	----------	4 1/4
	----------	6	----------	5 3/16
Ship-lap	1	4	25/32	3 1/8
	----------	6	----------	5 1/8
	----------	8	----------	7 1/8
	----------	10	----------	9 1/8
	----------	12	----------	11 1/8
Dressed and matched	1	4	25/32	3 1/4
	1 1/4	6	1 1/16	5 1/4
	1 1/2	8	1 5/16	7 1/4
	----------	10	----------	9 1/4
	----------	12	----------	11 1/4

[1] Minimum, 1/16.

[2] Ship-lapped; face widths for D&M are 1/8 inch wider than for ship-lapped.

In patterned material 1,1 1/4, and 1 1/2 inches thick, board measure, the tongue shall be 1/4 inch wide in tongued-and-grooved lumber, and the lap 3/8 inch wide in ship-lapped lumber, with the over-all widths 1/4 inch and 5/8 inch wider, respectively, than the face widths shown above.

Factory flooring, heavy roofing, decking, and sheet piling

[The thicknesses apply to all widths and the widths to all thicknesses

Size, board measure		Dressed dimensions at standard commercially dry shipping weight and moisture content			
			Standard face width		
Thickness	Width	Standard thickness	D&M	Shiplapped	Grooved for splines
Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
2	4	1⅝	3⅛	3	3½
2½	6	2⅛	5⅛	5	5½
3	8	2⅝	7⅛	7	7½
4	10	3⅝	9⅛	9	9½
-------	12	-------	11⅛	11	11½

In patterned material 2 inches and thicker, the tongue shall be ⅜ inch wide in tongued-and-grooved lumber, and the lap ½ inch wide in shiplapped lumber, with the over-all widths ⅜ inch and ½ inch wider, respectively, than the face widths shown above.

Rough dry sizes.—The standard rough dry thickness of the standard yard board shall be not less than $\frac{29}{32}$ inch, with an allowance of 20 per cent of the shipment, which may be not less than $\frac{28}{32}$ inch, and the standard rough dry thickness of the standard industrial board shall be not less than $\frac{30}{32}$ inch, with an allowance of 10 per cent of the shipment, which may be not less than $\frac{29}{32}$ inch.

The standard rough dry thickness of finish, common boards, and dimension of standard sizes 1¼ inches and thicker, board measure, shall be not less than ⅛ inch thicker than the corresponding standard finished dry thickness, with an allowance of 20 per cent of the shipment, which may be not less than $\frac{3}{32}$ inch thicker than the corresponding standard finished dry thickness.

The widths of finish, rough, and commercially dry of 3-inch width, board measure, shall be not more than ¼ inch less than the nominal width; the widths of finish, rough and kiln dried, of widths 4 to 7 inches, inclusive, board measure, shall be not more than ⅜ inch less than the nominal widths, and widths 8 to 12 inches, inclusive, board measure, shall be not more than ⅝ inch less than the nominal widths; and the widths of common boards and dimension, rough and commercially dry, 7 inches and narrower, shall be not more than ¼ inch less than the nominal widths, and the widths 8 to 12 inches, board measure, shall be not more than ⅜ inch less than the nominal widths.

Lengths.—With the exception of the following enumerated odd lengths, which shall be standard, odd lengths in yard lumber and in structural material be not considered in American Lumber Standards:

2 by 4 inches, 6 and 8 inches—9 and 11 feet.

2 by 8 inches and 10 inches—13 feet.

2 by 10 inches—15 feet.

8 by 8 inches, 10 by 10 inches, 10 by 12 inches, 12 by 12 inches, 14 by 14 inches, 16 by 16 inches, 18 by 18 inches—11 and 13 feet.

6 by 16 inches, 6 by 18 inches, 8 by 16 inches, 8 by 18 inches—15 and 17 feet.

The marketing practice covering lengths of yard lumber shall permit the buyer to secure specified lengths and/or specified assortments of lengths.

Shipping weights.—The weights to be used in determining thickness and width shall be the commercially dry shipping weights of the regional groups of manufacturers issued after approval by the Central Committee on Lumber Standards and in effect when shipment is made.

Workings.—The standard working of flooring, 4 inches or under in width, be S2S, SM, scratch back.

Unless otherwise stated in the contract of purchase, yard lumber shall be double end-trimmed with a tolerance of not to exceed 3 inches in excess of the nominal length.

Moldings.—The "standard designs and universal sizes" of wood moldings, as shown in 411.42, shall be considered standard. All other designs and sizes shall be considered special.

Description, Measurement, and Tally

The thicknesses and widths of lumber as specified in the tables shown above shall be considered *standard.* All other sizes shall be considered *special.*

Lumber of standard size shall be described by those standard dimensions.

Lumber of standard size shall be tallied *board measure.* On lumber of standard thickness less than 1 inch (board measure), the board-foot measurement shall be based on the surface dimensions.

The board measurement of dressed lumber of standard size shall be based upon the corresponding nominal dimensions of rough green lumber.

Lumber finished to special size shall be counted (tallied) as of the standard rough size necessarily used in its manufacture.

The measurement and description of the dimensions of lumber shall be as follows:

Thickness of lumber measured and described as—	Minimum thickness, S1S or S2S; at standard commercially dry shipping weight and moisture content
	Inches
1 inch, board measure, to be not less than	$\frac{25}{32}$
1¼ inches, board measure, to be not less than	$1\frac{1}{32}$
1½ inches, board measure, to be not less than	$1\frac{9}{32}$
1¾ inches, board measure, to be not less than	$1\frac{7}{16}$
2 inches, board measure, to be not less than	1⅝
2½ inches, board measure, to be not less than	2⅛
3 inches, board measure, to be not less than	2⅝
3½ inches, board measure, to be not less than	3⅛
4 inches, board measure, to be not less than	3⅝

Widths of finish, measured and described as 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 inches, board measure, to be, respectively, not less than 2⅝, S1E or S2E, at standard commercially dry shipping weight and moisture content, and 3½, 4½, 5½, 6½, 7¼, 8¼, 9¼, 10¼, and 11¼ inches, S1E or S2E, based on kiln-dried lumber; widths of boards and dimension, measured and described as 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 inches, board measure, to be, respectively, not less than 1⅝, 2⅝, 3⅝, 4⅝, 5⅝, 6⅝, 7½, 8½, 9½, 10½, and 11½ inches, S1E or S2E, at standard commercially dry shipping weight and moisture content.

The description of thickness of dressed stock less than 1 inch thick, board measure, S1S or S2S, to be its actual thickness at standard commercially dry shipping weight and moisture content.

NOTE.—It is to be understood that the standard dimensions of rough lumber, commercially dry, are in excess of the dimensions of finished lumber of the corresponding size, board measure, by the amount necessary to permit of surfacing either one side or two sides and/or one edge or two edges.

Material shipped on stock sizes shall be tallied by the number of pieces of each size and length in the shipment.

In shipments measured on board measure a piece tally in board feet shall be made.

In material measured with a board rule on actual widths, pieces measuring to the even half foot shall be alternately counted as of the next higher and lower foot count; fractions below the one-half foot shall be dropped and fractions above the one-half foot shall be counted as of the next higher foot.

Shipping Provisions

The *actual* thickness and width of lumber shipped *when not of standard size* shall be indicated on invoice.

In order to encourage the maintenance of standard sizes as agreed to, lumber manufactured and sold as *standard*, if grade marked, shall be marked by an appropriate brand or insignia to indicate that it is of standard size.

In shipments of rough finish, and boards, pieces one-half inch or more above the count thickness, such as may be produced by uneven sawing, may, at the option of the buyer, be rejected, or accepted as of the next lower grade.

The average length of a shipment of lumber shall be computed by dividing the total length in feet by the total number of pieces in a shipment.

Each length of bundle stock shall be bundled separately.

Grade Marking

The principle of grade marking of lumber is approved.

On lumber when grade marked:

(*a*) The grade be marked on lumber of grades equivalent to No. 4 common and better grades, and on lower grades the grade mark be optional.

(*b*) If marked at all, *all* pieces of a given grade be grade marked (except that unavoidable mechanical skips are, of course, allowed).

(*c*) An easily branded mark or insignia, copyrighted and nationally uniform, be used in connection with the grade mark and be available to identify shipments from all mills of lumber manufactured in accordance with American Lumber Standards.

(d) An appropriate mark symbolizing American Lumber Standards be copyrighted and its use be available to those mills which shall have agreed to maintain the agreed standards of size and grade and to submit their lumber product upon complaint to official association inspection.

Tally Cards

Cards be placed in cars of lumber at mill of origin, showing piece tally by grades and sizes: *Provided*, That wholesale dealer, or other buyer or shipper, may, by arrangement with mill of origin, provide for use, for this purpose, of wholesaler's or buyer's or shipper's car card: *Provided*, That in such case said wholesaler, buyer, or shipper whose name appears on card is financially responsible for the correctness of the tally as shown on such car card: *And provided*, That this shall not be construed as relieving the manufacturer from his responsibility if any, to such wholesaler, buyer, or shipper.

The grades thus required to be entered on tally card be the official association grades as defined in published grading rules: *Provided*, That this requirment is not construed as prohibiting the entry on tally cards of special grades, but that such entry is not recognized under American Lumber Standards.

The American Lumber Standards be understood as not applying to "special" grades (that is, not recognized in published grading rules) whether entered on tally cards or not.

Shingles

Grades.—The basic grades of shingles shall be A, B, C, and D.

Sizes.—16-inch 6/2 shingles and 18-inch 5/2 shingles be eliminated.

Dimension shingles shall be sold full net count, no dimension shingle to be less than ⅛ inch scant of the specified width when dried.

Shipping provisions.—The kiln-dried weight of shingles be not more than 10 per cent under the present association shipping weights.

The openings shall not exceed an average of 1 inch to the course in random-width shingles.

Specifications for red cedar shingles.—The specifications of 24, 18, and 16 inch red cedar shingles shall be as shown in 402.52.

American Railway Engineering Association, revision of manual, bulletin 293, wooden bridges and trestles, January, 1927.

The grade standard, general provisions, yard and industrial size standards and rough dry sizes of yard lumber are identical with the American Lumber Standards, 411.0.

Lengths.

The standard odd lengths of yard lumber and structural material are the same as the American Lumber Standards, but include the following additional odd lengths which are necessary in railroad work: 7 by 16 inches, 9 by 16 inches, 9 by 18 inches—15 and 17 feet.

Moldings.

The American Lumber Standard designs and universal sizes of wood moldings, the 7,000 series, illustrated in 411.42 are not included in the American Railway specifications for yard lumber.

The description, measurement, and tally and and shipping provisions for yard lumber are identical with the American Lumber Standards, 411.0, yard lumber.

California Redwood Association, standard specifications for eastern grades of California redwood lumber, grade standards and yard and industrial size standards, April, 1927.

The grade standards of this association for yard lumber conform to the grade standards of the American Lumber Standards, 411.0.

The thickness and width of finished California redwood yard lumber S1S or S2S and/or S1E or S2E D and M or ship-lapped, except as indicated thus (*) conform to the American Lumber Standards, 411.0, and are as follows:

Finish, common boards and strips, and dimension

[The thicknesses apply to all widths and the widths to all thickness]

Product	Size, board measure		Dressed sizes at commercially dry shipping weight and moisture content		
	Thickness	Width	Standard thickness yard	Standard thickness industrial	Standard width
	Inches	*Inches*	*Inches*	*Inches*	*Inches*
Finish, based on kiln-dried lumber		3	5/16		2 5/8
		4	7/16		3 1/2
		5	9/16		4 1/2
		6	11/16		5 1/2
	1		13/16*	13/16	6
	1 1/4	8	1 1/16	1 5/32	7 1/2*
	1 1/2		1 5/16	1 13/32	8*
		10	7/16		9 1/2*
	2		1 3/4*	1 3/4	10*
	2 1/2	12	2 1/8		11 1/2*
	3		2 5/8		
Common boards and strips	1	3	25/32	13/16	2 5/8
	1 1/4	4	1 1/16		3 5/8
	1 1/2	5	1 5/16		4 5/8
		6			5 5/8
		7			6 5/8
		8			7 1/2
		9			8 1/2
		10			9 1/2
		11			10 1/2
		12			11 1/2
Dimension	2	2	1 5/8	1 3/4	1 5/8
	2 1/2	4	2 1/8		3 5/8
	3	6	2 5/8	2 3/4	5 5/8
	4	8	3 5/8	3 3/4	7 1/2
	Over 4	10	Off 3/8		9 1/2
		12			11 1/2

Siding, flooring, ceiling, partition, ship-lap, and dressed and matched
[The thicknesses apply to all widths and the widths to all thicknesses]

Product	Size, board measure		Dressed sizes at commercially dry shipping weight and moisture content	
	Thickness	Width	Standard thickness	Standard face width
	Inches	*Inches*	*Inches*	*Inches*
Bevel siding (½-inch)		4	15/32 by 3/16	3½
		5		4½
		6		5½
		8		7½
*Bungalow siding (⅝-inch)		8	9/16 by 3/16	7½
		10		9½
*Bungalow siding (¾-inch)		8	11/16 by ¼	7½
		10		9½
		12		11½
Rustic and drop siding (ship-lapped)		4	9/16	3⅛
		6	¾	
		8		5 1/16
				6⅞*
Rustic and drop siding, D and M		4	9/16	3¼
		6	¾	5 3/16
		8		7*
Flooring		2	5/16	1½
		3	7/16	2⅜
		4	9/16	3¼
	1	5	25/32	4¼
	1¼	6	1 1/16	5 3/16
	1½		1 5/16	
*Ceiling		3	5/16	2⅜
		4	7/16	3¼
		5	9/16	4¼
		6	11/16	5 3/16
Partition		3	¾	2⅜
		4		3¼
		5		4¼
		6		5 3/16
Ship-lap	1	4	25/32	3⅛
		6		5⅛
		8		7⅛
		10		9⅛
		12		11⅛
Dressed and matched	1	4	25/32	3¼
	1¼	6	1 1/16	5¼
	1½	8	1 5/16	7¼
		10		9¼
		12		11¼

Factory flooring, heavy roofing, decking, and sheet piling.

The sizes of factory flooring, heavy roofing, decking, and sheet piling are the same as given in the table for yard and industrial size standards, American Lumber Standards, 411.0.

Federal Specifications Board, proposed revision to supersede softwood part of F. S. B. No. 24 master specification for lumber, softwood, yard, and factory, 1927.

The following requirements shall govern the purchase of lumber for the use of the departments and independent establishments of the Government.

Softwood lumber, including yard lumber and factory or shop lumber, purchased by the Federal Government shall be bought, whenever it is practicable, under the current grading rules of the various lumber associations where such grading rules are approved by the central committee on lumber standards as in conformance with American Lumber Standards. [1]

Where it is advisable for the Goverment to purchase softwood yard lumber or softwood factory or shop lumber of species not graded under association or commercial rules conforming with American Lumber Standards,[1] as interpreted by the central committee on lumber standards, specifications for

[1] American Lumber Industry, Simplified Practice Recommendation No. 16, Softwood Lumber Standards, revised July 1, 1926.

such lumber shall be prepared by the Government based on American Lumber Standards.

In exceptional cases, where lumber is needed for special purposes, such lumber shall be purchased under specifications prepared by the Government organization which needs it with such assistance as they may deem necessary. Airplane lumber is an example. It is believed that special lumber will be a very small proportion of the total amount of lumber purchased by the Government, and that in many cases special lumber can be obtained more cheaply and promptly by buying one of the standard grades and selecting or cutting the special lumber from it. The foregoing requirements have to do with softwood lumber, exclusive of structural material. Hardwood lumber and softwood structural material will be considered by the Federal Specifications Board at a later date.

Softwood lumber is divided into three classes (*a*) yard lumber, used with little or no further cutting for general building purposes; (*b*) structural material, used where strength is the primary consideration and working stresses are required; and (*c*) factory or shop lumber, used for cutting into comparatively small pieces required in the manufacture of sash and doors and general millwork.

It is believed that the grading of softwood lumber should be founded on basic principles and uniform provisions and is in hearty accord with such principles and provisions as embodied in American Lumber Standards for softwood lumber, adopted by the various general conferences of manufacturers, distributers, and consumers of lumber at Washington, D. C.,[2] and hopes it will be possible to proceed steadily with the development of American Standards for lumber, particularly with respect to standards of dryness at which the sizes apply and definite definitions of basic grade quality. The board also heartily indorses grade marking and recommends the purchase of grade-marked lumber wherever feasible.

(To accompany the proposed specification there has been prepared an enumeration, reported and approved by the central committee on lumber standards, of the extent, as of January 1, 1927, to which the grading and inspection rules of the important associations of softwood lumber manufacfacturers, who have adopted the American Lumber Standards and published rules based thereon, provide for sizes, grade names, grade qualities, and inspection and shipping practices that are in conformity with the American Lumber Standards; with exceptions or additions thereto, if any; and the species of softwoods covered in each instance.)

North Carolina Pine Association (Inc.), official inspection rules for yard and industrial lumber, January 1, 1927.

The yard and industrial lumber sizes are the same as the American Lumber Standard sizes given above. In addition, this association furnishes the following sizes which are designated as "North Carolina pine superstandard."

North Carolina pine super standard sizes of finished lumber S1S or S2S and/or S1E or S2E

[The thicknesses apply to all widths and the widths to all thicknesses]

Product	Size—board measure		Dressed dimensions at standard commercially dry shipping weight	
			North Carolina pine super standard	
	Thickness	Width	Thickness	Width
	Inches	*Inches*	*Inches*	*Inches*
Finish		3	5/8	2 5/8
		4	1/2	3 5/8
		5	5/8	4 5/8
		6	3/4	5 5/8
	1	7	1 3/32	6 5/8
	1 1/4	8	1 1/16	7 1/2
	1 1/2	9	1 5/16	8 1/2
	1 3/4	10	1 9/16	9 1/2
	2	11	1 13/16	10 1/2
	2 1/2	12	2 1/4	11 1/2
	3		2 3/4	
Common boards and strips	1	3	1 3/32	2 5/8
	1 1/4	4	1 5/16	3 5/8
	1 1/2	5	1 5/16	4 5/8
		6	1 13/4	5 5/8
		7		6 5/8
		8		7 1/2
		9		8 1/2
		10		9 1/2
		11		10 1/2
		12		11 1/2
Dimension	2	2	1 3/4	1 3/4
	2 1/2	4	2 1/4	3 3/4
	3	6	2 3/4	5 3/4
	4	8	3 3/4	7 3/4
	Over 4	10		9 3/4
		12		11 3/4
Bevel siding		4	1/2 by 3/16	3 5/8
		5	5/8 by 3/16	4 5/8
		6		5 5/8
Rustic and drop siding		4	13/16	Ship-lap 3 1/8
		5		4 1/8
		6		5 1/8
		8		7 1/8
Flooring		2	3/8	1 1/2
		3	1/2	2 1/2
		4	5/8	3 1/2
	1	5	13/16	4 1/2
	1 1/4	6	1 1/16	5 1/2
	1 1/2		1 5/16	
Ceiling		3		
		4	2 7/16	3 1/2
		5	3 5/8	4 1/2
		6	3/4	5 1/2
Partition			13/16	2 1/2
				3 1/2
				4 1/2
				5 1/2
Ship-lap	1	4	13/16	3 1/8
		6		5 1/8
		8		7 1/8
		10		9 1/8
		12		11 1/8
Dressed and matched	1	4	13/16	3 1/2
	1 1/4	6	1 1/16	5 1/2
	1 1/2	8	1 5/16	7 1/2
		10	1 3/4	9 1/2
		12		11 1/2

[1] Same thickness and widths as American Standard industrial lumber.
[2] Finished thickness 13/32 inch, or 1/32 inch thinner than American Standard.
[3] Finished thickness 9/16 inch, as American Standard.

[2] See Department of Commerce publication, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

Factory flooring, heavy roofing, decking, and sheet piling

Size—board measure		Thickness	Widths		
			North Carolina pine super standard		
Thickness	Width	North Carolina pine super	D and M	S/L	Grooved [1]
2	4	1¾	3½	3⅛	3¾
2½	6	2¼	5½	5⅛	5¾
3	8	2¾	7½	7⅛	7¾
4	10	3¾	9½	9⅛	9¾
	12		11½	11⅛	11¾

[1] Grooved for splines.

Thickness of yard lumber measured and described as follows:

	Super standard
	Inches
1 inch, board measure, to be not less than	$\frac{13}{16}$
1¼ inches, board measure, to be not less than	$1\frac{1}{16}$
1½ inches, board measure, to be not less than	$1\frac{5}{16}$
1¾ inches, board measure, to be not less than	$1\frac{9}{16}$
2 inches, board measure, to be not less than	1¾
2½ inches, board measure, to be not less than	2¼
3 inches, board measure, to be not less than	2¾
3½ inches, board measure, to be not less than	3¼
4 inches, board measure, to be not less than	3¾

North Carolina Pine Association (Inc.), official inspection rules for yard and industrial lumber, January 1, 1927.

Count and sizes.

All dressed stock shall be measured and sold strip count, viz, full size of rough material, when in condition for commercial use, necessarily used in its manufacture.

Finish to be $\frac{13}{16}$ inch thick in North Carolina Pine Association super standard and 3⅝, 4⅝, 5⅝, 6⅝, 7½, 8½, 9½, 10½, and 11½ inches wide and $\frac{25}{32}$ inch in standard thickness and 2⅝, 3½, 4½, 5½, 6½, 7¼, 8¼, 9¼, 10¼, and 11¼ inches wide.

Roofers (American standard) to be worked $\frac{25}{32}$ inch thick by 5¼, 7¼, 9¼, 11¼ inches wide, when dressed two sides and center matched.

Roofers (North Carolina super standard) to be worked $\frac{13}{16}$ inch thick by 5½, 7½, 9½, 11½ inches wide, when dressed two sides and center matched.

Ship-lap roofers (American standard) to be worked $\frac{25}{32}$ inch thick by 5⅛, 7⅛, 9⅛, and 11⅛ inches wide, with ⅜-inch rabbet.

Ship-lap roofers (North Carolina super standard) to be worked $\frac{13}{16}$ inch thick by 5⅛, 7⅛, 9⅛, 11⅛ inches wide, with ½-inch rabbet.

One-quarter inch width shall be allowed on North Carolina super standard factory flooring when grooved for splines and ½ inch when tongued and grooved.

One-half inch in width shall be allowed for working molding base and casing, except on all patterns finished on the quarter inch or three-quarter inch, for which shall be allowed one-quarter inch.

Drop siding (American standard) shall be finished $\frac{9}{16}$ inch and ¾ inch thick and $5\frac{1}{16}$ inches wide, with ⅜-inch rabbet. North Carolina super standard thickness $\frac{13}{16}$ inch and 5⅛ inches wide, with ½-inch rabbet. Bevel siding to be ½ inch thick on one edge, $\frac{3}{16}$ inch on the other edge.

American standard and North Carolina super standard ⅜ inch in width shall be allowed for dressing 7 inches and under four sides, but ½ inch shall be allowed for dressing boards wider than 7 inches.

Two by four North Carolina super standard when S4S shall be 1¾ by 3¾ inches. American standard when S4S shall be 1⅝ by 3⅝ inches.

Matching.

All flooring, ceiling, and partition, ¾ inch thick and over, shall be dressed two sides and center matched. All ceiling under ¾ inch thick shall be dressed one side and matched.

Dressing.

North Carolina super standard ⅛ inch shall be allowed to dress 4/4 and 5/4 stock and edge boards one side, and $\frac{3}{16}$ inch shall be allowed to dress 4/4, 5/4, and 6/4 stock and edge boards two sides. American standard $\frac{7}{32}$ inch shall be allowed to dress 4/4 stock and edge boards two sides and $\frac{3}{16}$ inch in 5/4 and 6/4.

One-fourth inch shall be allowed to dress 8/4 and thicker one or two sides.

One-fourth inch shall be allowed in dressing various thicknesses of factory flooring.

Log run.—This grade shall consist of the product of the log with the exception of cull red heart.

Lengths of rough lumber.—8 to 16 feet, not exceeding 5 per cent of 8-foot lengths.

Thickness of 4/4, 5/4, 6/4, 7/4, 8/4, 10/4, and 12/4 rough lumber (N. C. pine super standard) is 1, 1¼, 1½, 1¾, 2, 2½, and 3 inch, respectively, but 25 per cent may be $\frac{1}{16}$-inch scant.

Widths of stock boards are 4, 5, 6, 8, 10, and 12 inches (N. C. pine super standard), but 10 per cent may be ⅛ scant of such widths in B and better. For common lumber, see No. 402.42 lengths under common boards and strips.

Thin boards are those cut thinner than required in standard thickness of 4/4 lumber, but will dress two sides to 5/8, and may be graded the same as standard thickness.

Miscut lumber brought to standard thickness of 1 inch or over by dressing on one or two sides to equalize same will be considered as rough lumber, and to be graded from the best side.

Special provisions crooked lumber.

The following amount of crook, based on 16-foot lengths, shall be permissible in all grades of finish:

	Crook
1 and 1¼ inches by 3 inches	3-inch.
1 and 1¼ inches by 4 inches	2½-inch.
1 and 1¼ inches by 5 and 6 inches	2-inch.
1 and 1¼ inches by 7 and 8 inches	1¾-inch.
1 and 1¼ inches by 9 and 10 inches	1¼-inch.
1 and 1¼ inches by 11 and 12 inches	1-inch.

For 1½ and 2 inch thicknesses, crook ½ inch less than above is permissible. Pieces longer or shorter than 16 feet may have proportionate amounts of crook.

The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 and No. 2 common grades:

	Crook
3, 4, 5, and 6 inch widths	3-inch.
7 and 8 inch widths	2½-inch.
9 and 10 inch widths	2-inch.
11 and 12 inch widths	1¾-inch.

Pieces longer or shorter than 16 feet may have proportionate amounts of crook. A greater amount of crook shall be permissible in Nos. 3 and 4 common grades.

Pacific Lumber Inspection Bureau, grading rules for yard lumber, Schedule M, 1925.

GENERAL NOTES

Merchantable lumber, as described in these grading rules will be graded taking into consideration its suitability for good substantial constructional purposes in the shape and sizes in which it is ordered and shipped.

It is not intended to supply a grade suitable for remanufacturing into smaller sizes.

All fractions of a foot in length when ordered shall be measured as of contents of the next longer even length.

All lumber sawn less than 1 inch in thickness shall be measured as of 1 inch; that is, surface measure for sale purposes.

All rough lumber, 1 inch and over in thickness, shall be measured at board measure contents.

All worked or surfaced lumber shall be measured at the board measure contents before working.

Sizes 4 inches and under in thickness and 6 inches and under in width will be worked ⅛ inch less for each side or edge surfaced.

Sizes over 4 inches in thickness and 6 inches and over in width will be worked ¼ inch less for each side or edge surfaced.

In sizes 4 inches and under in thickness and over 6 inches in width each side will be surfaced ⅛ inch less and each edge ¼ inch less.

In the absence of a special agreement between buyer and seller, for each order, all dressed lumber will be finished to the sizes specified in these rules.

Flooring, rustic siding, ceiling, and ship-lap will be worked in accordance with the official patterns for such items included in this list.

At shipper's option, flooring, ceiling, and rustic siding may be shipped S1S, S2S, or with bottom side partially surfaced. Should S1S stock be required it must be specifically so stated by buyer at time order is placed.

In kiln dried or air dried stock, bright sap is not to be considered a defect.

Edge grain clears in widths 10 inches and wider will be so graded when showing grain on edge for at least two-thirds of the face width.

Variation in sawing as specified in these rules shall mean a deviation from a given straight line.

Equivalent, in the application of these rules, means that the defects allowed, whether specified or not, are understood to be equivalent in effect to those specially mentioned.

The face or best side, of a piece of lumber, shall be used to determine the grade. Unless otherwise provided, lumber worked or surfaced two sides shall be graded from the best side; lumber worked or surfaced one side shall be graded from the surfaced side.

All dimensions are sold subject to any natural shrinkage, whether green, partially or wholly seasoned. As it is a well-known fact that all lumber does not shrink alike, therefore, where seasoned lumber is shipped, especially so in the grades of clears it will, at the time of loading, be considered by the supervisor and inspector whether it will work to the dry standards in its size in accordance with the official patterns for worked sizes, included in this list.

The enumerated defects herein described in any grade are intended to be descriptive of the coarsest piece such grades may contain.

Western Pine Manufacturers Association, grading rules for yard lumber, July 1, 1925.

RULES FOR GRADING LARCH AND FIR LUMBER

Because of its strength and durability, pleasing appearance, and easy working qualities, western larch is steadily gaining in favor as an all-purpose wood wherever its merits are known.

The following rules are drawn with the special purpose of dividing the product of the log into units of value best adapted to the requirements of the trade and to assure the customer of receiving uniform grades of larch and fir at all times from any mill affiliated with the Western Pine Manufacturers Association.

The rules apply to all widths and thicknesses whether rough, S2S, or S4S, or worked to any pattern.

Red fir is of similar character and quality and is permitted in all grades of larch.

C and better larch.

C and better shall consist of C and all the better product of the stock. The fact that it contains a large proportion of practically perfect stock tends to give the grade as a whole a clear appearance. On the basis of 1 by 4 by 12, five or six pin knots or three or four small knots will be allowed if well scattered, or one or two larger knots if well located. In the absence of knots, or with fewer knots, slightly torn or raised grain, small season checks, small pitch pockets or other small defects common to larch and fir will be admitted.

A serious combination of the above defects will not be allowed in any one piece nor any defect that will destroy the high quality and appearance of the grade.

D larch.

The grade of D includes all stock between C and better and the common grades and will admit quite serious defects if at the same time the piece retains

a good appearance. Fine seasoning checks over the entire face or several larger seasoning checks will be admitted, also numerous small knots, pitch pockets, raised grain, torn grain, or other defects common to larch and fir that do not give a coarse or common appearance to the piece. One cut not to exceed 4 inches of waste will be allowed in high line pieces 12 feet long or longer.

Common larch.

In the common grades, larch and fir, which are usually mixed, will carry the same appearance, grade for grade, in the general measurement of defects as Pondosa pine.

411.1 SIDING.

Arkansas Soft Pine Bureau, sizes and grades for soft pine drop, bevel, and barn siding, March 23, 1927.

Similar to those of the Southeastern Forest Products Association and the Southern Pine Association. (See pages 145 and 147.)

End matching.

All end-matched drop siding are manufactured to American Lumber Standards sizes. The grades are similar to those of the Southern Pine Association. (See page 147.)

Patterns.

Patterns for siding are illustrated in Figures 9, 10, 12, and 13.

California Redwood Association, standard specifications for eastern grades of California redwood bevel and bungalow or colonial siding, April, 1927.

The sizes of siding are as shown in this association's table of sizes of yard lumber, 411.0.

Bevel and bungalow or colonial siding.

The grades of siding are based on a piece 12 feet long by the width being graded; on this basis longer pieces will admit a proportionate number of defects.

Grades.—Clear heart (Redwood Association grade), and A and B (American Standard redwood grades).

Lengths.—Standard lengths shall be 3 to 20 feet, inclusive, in multiples of 6 inches up to and including 5 feet 6 inches; in multiples of 1 foot up to and including 9 feet; and in multiples of 2 feet in 10 to 20 feet, admitting not to exceed 10 per cent of 3 to 7 foot lengths.

Special provisions.—All grades of siding will admit slight imperfections on the thin edge which will be covered by the lap when laid.

Small crook shall be permissible in clear heart and A siding and medium crook in B siding.

Slight cup shall be permissible in all grades of siding.

Clear heart siding shall be heartwood, well manufactured, and free from all defects except a small amount of sound bird's-eye and sap on thin edge which will be covered by lap when laid, will be allowed.

A siding will admit sound tight bird's-eye, any amount of bright sapwood, and in addition any one of the following defects, equivalent defects, or combinations thereof: Three small surface checks; two slight defects in manufacture; three sound and tight pin knots; light stain 5 per cent of area.

B siding will admit any of the following defects or their equivalent: Three small surface checks; pin wormholes or unsound bird's-eye, one per surface foot; slight defects in manufacture or seasoning; two small sound and intergrown knots; any amount of medium or heavy stain; or any combination of defects in pieces 10 feet and longer that can be removed in two cuts with waste not to exceed 10 per cent of the length, provided not more than 20 per cent of the pieces in any one bundle shall be of said cutting type.

Drop siding.

The basis of grade, lengths, special provisions, and standard workings specified for flooring, ceiling, and partition shall apply to drop siding, D&M or ship-lapped.

Grades.—Clear heart (Redwood Association grade), A, B, and No. 1 common (American Standard redwood grades).

Drop siding, dressed and matched or ship-lapped, shall be graded according to the rules for the respective grades of finish and common boards.

B grade will admit the cut-out allowed in B flooring, ceiling, and partition.

California Redwood Association, standard specifications for eastern grades of California redwood barn siding, April, 1927.

The grades of barn siding are the same as common boards 402.42.

California White and Sugar Pine Manufacturers Association, sizes and grades for California white pine, sugar pine, white fir, Douglas fir, and incense cedar bevel siding, May 1, 1926.

Sizes.

Bevel siding is produced by resawing lumber, surfaced four sides, on a bevel so as to produce two pieces, thicker on one edge than the other. Bevel siding shall be $\frac{3}{16}$ inch thick on the thin edge by $\frac{7}{16}$ inch thick on the thick edge. Widths shall be $\frac{1}{2}$ inch less than nominal. Standard lengths of bevel siding shall be 2 feet and longer in 6-inch intervals. Random length shipments may contain not to exceed 20 per cent under 10 feet in length. Except when specified in the terms of the sale, not more than 5 per cent of the shipment shall consist of lengths shorter than 6 feet.

Bevel siding should be graded from the face side, and the thick edge shall be considered part of the face. Defects on the thin edge which will cover when laid should not be given the same consideration as defects elsewhere. The lap shall be $\frac{3}{4}$ inch on 4-inch, 1 inch on 5 and 6 inch, and $1\frac{1}{2}$ inches on wider stock.

Grades.

B and better, C, D, and E.

B and better siding.—This grade will admit of three or four small knots, if well located, or a pitch pocket, $\frac{1}{8}$ by 2 inches, if it does not show through,

or two smaller pitch pockets if a considerable distance apart and not showing through the piece, a small amount of light stain, slight traces of pitch or other minor defects, but not a serious combination of the above defects.

C siding.—This grade will admit of two or three small sound knots not exceeding 1 inch in diameter, or more knots when smaller; also small pitch pockets that do not show through. Medium stain covering one-third of the face or a greater area of lighter stain is admitted if not in combination with other marked defects. Defects requiring one cut not to exceed 4 inches of waste are allowed in high line pieces 12 feet long and longer, but not more than 20 per cent of such pieces shall be permitted in this grade.

D siding.—This grade will admit season checks, pitch, defective mill work, and a number of small knots if well scattered over the face of piece, medium stain covering the entire piece is allowed if not in combination with other marked defects. Pieces 12 feet long or longer may have two defects causing waste not exceeding 4 inches each, provided the balance is of B and better quality. In pieces 10 feet long or longer requiring one cut, one of the remaining pieces must be of C select or better quality.

E siding.—This is the lowest recognized grade of beveled siding and will admit of stain, knots, pitch pockets, pitch and season checks, not admissible in D siding.

Many pieces showing seriously defective mill work or imperfect manufacture are also admitted in this grade.

Varieties.

Colonial and bungalow siding.

Colonial siding.—This grade may be either plain or rabbeted thick edge. It shall be graded on the surfaced side, on the basis of bevel siding grades, similar defects, grade for grade, being permitted proportional to the area of the piece.

Standard thicknesses.—$\frac{11}{16}$ inch on the thick edge and $\frac{3}{16}$ inch on the thin edge. Any other specified thicknesses are considered special.

Bungalow siding.—This grade is considered the same as colonial siding, except that bungalow siding is made to lay resawn (rough) side out, and is therefore graded from the rough side.

California White and Sugar Pine Manufacturers Association, sizes and grades for California white pine, sugar pine, white fir, Douglas fir, and incense cedar drop siding, May 1, 1926.

Standard thicknesses.

Nominal (inches)	Finished	
	Standard	Extra standard
	Inches	*Inch*
$\frac{9}{16}$	$\frac{9}{16}$	
$\frac{11}{16}$	$\frac{11}{16}$	
1	$\frac{25}{32}$	$\frac{13}{16}$
$1\frac{1}{4}$	$1\frac{1}{16}$	

Standard widths.

Nominal (inches)	Face (D&M)	Face (ship-lap)	Over-all width
	Inches	*Inches*	*Inches*
3	$2\frac{3}{8}$		$2\frac{5}{8}$
4	$3\frac{1}{4}$	$3\frac{1}{8}$	$3\frac{1}{2}$
5	$4\frac{1}{4}$	$4\frac{1}{8}$	$4\frac{1}{2}$
6	$5\frac{1}{4}$	$5\frac{1}{8}$	$5\frac{1}{2}$
8	$7\frac{1}{4}$	$7\frac{1}{8}$	$7\frac{1}{2}$

Standard lengths.

Shall be 8 feet and up in multiples of 1 foot.

Standard grades.

Shall be graded according to the rules for finishing and common boards. Defective machine work resulting in broken tongue or groove is serious and must be given consideration by the grader.

Patterns.

Patterns for siding are similar to those of the West Coast Lumbermen's Association.

National Hardwood Lumber Association, grading rules for cypress siding, January, 1927.

Sizes.

Siding shall be made from 4, 5, and 6 inch widths S4S to $\frac{27}{32}$ inch by $3\frac{1}{2}$, $4\frac{1}{2}$, and $5\frac{1}{2}$ inches, and resawed on a bevel.

Lengths.

Four to twenty feet. Grades A and B shall be 8 to 20 feet long.

Grades.

A, B, C, and D. (Inspection shall be made from the finished side.)

A siding.—This grade will admit 1 inch of bright sapwood on the thin edge and two small round defects that will be covered by the lap.

B siding.—Bright sapwood is not a defect. This grade may have three $\frac{3}{4}$-inch sound defects or one sound standard defect and slight wane not exceeding $\frac{1}{2}$ inch in width on the thin edge, or its equivalent in other defects covered by the lap. Pieces free from other defects will admit a small amount of stained sapwood.

C siding.—This grade will admit sapwood (bright or stained), scattered pinworm holes, and in addition may have one sound standard defect or four $\frac{3}{4}$-inch sound defects. Twenty per cent of the quantity may contain unsound defects in pieces 10 feet and over long that will not cause a waste of more than one-twelfth of the piece in two crosscuttings.

D siding.—This grade will admit any number of sound defects. Thirty per cent of the pieces may have unsound defects that will not cause a waste of more than one-third of the pieces in three crosscuttings.

North Carolina Pine Association (Inc.), sizes and grades for bevel and drop siding, January 1, 1927.

Lengths.

Same as in ceiling, No. 411.3.

Grades.

Same as in finish, No. 411.4.

Patterns.

Patterns for siding are similar to those of the West Coast Lumbermen's Association.

North Carolina Pine Association (Inc.), sizes and grades for barn siding, January 1, 1927.

Lengths and grades same as those for common boards, No. 402.42.

Northern Hemlock and Hardwood Manufacturers Association, sizes and grading rules for hemlock drop siding and bevel siding, February 1, 1927.

Thickness.

Three-fourths inch.

Width in inches

	Nominal board measure	Face width	Over-all width
Drop siding (dressed and matched)	4	3¼	3½
	6	5 3/16	5 7/16
Drop siding (ship-lap)	4	3⅛	3½
	6	5 1/16	5 7/16

Bevel siding shall be worked to 7/16 by 3/16 inch and 5/8 by 3/16 inch in nominal widths of 4, 5, and 6 inches dressed to 3½, 4½, and 5½ inches, respectively.

Lengths.

Same as for flooring. (See 411.24.)

Grades.

D and better, No. 1 common, No. 2 common, No. 3 common. Same as for flooring except D and better, which is as follows:

D and better grade of drop siding and bevel siding.—Will allow small, well seated, sound black or red knots, well scattered, and should be free from shake and wane, and useful without waste.

Bevel siding should be sound and smooth stock worked to standard size. It admits defects on thin edge which will cover when laid to 2½, 3½, and 4½ inches to weather.

(NOTE TO MANUFACTURER.—Great care should be used in selecting stock when making bevel siding from hemlock strips. It should be taken from straight grained, small timber as free from sap as possible.)

Patterns.

Patterns for siding are illustrated in figures 20 to 46.

Northern Pine Manufacturers Association, rules for the grading of northern white and Norway pine, eastern spruce, and tamarack bevel siding, April 15, 1925.

Sizes (American Lumber Standards).

4-inch, 7/16 by 3/16 by 3½ inches.
6-inch, 7/16 by 3/16 by 5½ inches.

Grades.

B and better, C, D, and E. Graded from the face side only and based on a piece 6 inches wide and 16 feet long. (Defects on the thin edge which will cover when laid should not be given the same consideration as defects elsewhere.)

B and better siding.—This grade shall consist of B siding and all the better product of the stock. It will admit of two or three sound pin knots, or their equivalent of minor defects well scattered over the face of the piece.

C siding.—This grade will admit one or two medium knots, not exceeding 1 inch in diameter, or more smaller knots, or a small pitch defect, or slight shake, or season checks, but no serious combination of these defects in any one piece. A small amount of medium stain is admissible on thick edge. Defects requiring one cut not to exceed 4 inches of waste are allowed in high line piece 12 feet and longer.

D siding.—This grade will admit of medium stain covering the entire face of the piece if no other defects, or light stain when in combination with other defects. Considerable fine shake or season checks, which do not show through the piece, and a number of small knots well scattered over the face are admissible, but not in serious combination so as to cause waste to exceed 4 inches in two cuts in pieces 11 feet and longer.

E siding.—This is the lowest recognized grade of bevel siding and will admit of the stain, knot, and shake defects not admissible in D siding. Many pieces showing seriously defective mill work are found in this grade.

Northern Pine Manufacturers Association, rules for the grading of northern white and Norway pine, spruce, and tamarack drop siding, April 15, 1925.

Drop siding shall be graded under the same rules as dressed and matched. (See No. 411.6.)

Pacific Lumber Inspection Bureau, grading rules for Douglas fir kiln-dried rustic siding, Schedule M, 1925.

Sizes.

(See illustrations in Figures 3 to 8.)

Grade.

No. 2 clear and better. (Defects based on a piece 1 by 4 inches by 12 feet, rules to be applied proportionately on narrow and wider stock.)

No. 2 clear and better, flat grain, kiln-dried, 4, 6, and 8 inch. Shall be well manufactured, admitting slight roughness in dressing. Will allow one sound and tight knot ¾ inch or less in diameter or four pitch pockets and/or pitch blisters each not over 4 inches in length, if not extending through the thickness of the piece, or equivalent defects. A piece 12 feet and longer may have one defect located 4 feet or more from either end which can be cut out by wasting not more than 2½ inches of the length, providing balance of piece be practically free from defects. Bright sap no defect. Edge grain may be included at shipper's option.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir green siding, Schedule M, 1925

Grades.

Green No. 2 clear and No. 3 clear.

No. 2 clear and better, edge and/or flat grain, green. Shall be well manufactured. Will admit slight roughness in dressing, bright sap one-half of width. One of the following is also permitted with

one of the foregoing two defects; three pitch pockets, or pitch blisters, each not over 2 inches in length if not extending through the thickness of the piece, one sound tight knot ¾ inch or less in diameter, or equivalent defects. Edge grain may be included with flat grain at shipper's option.

No. 3 clear green shall consist of lengths 6 feet and longer regardless of grain. Will admit of roughness in dressing, slightly discolored sap, three sound tight knots each 1 inch or less in diameter, or four pitch pockets not over 4 inches in length and/or pitch blisters, any two pockets of which may extend through the thickness of the piece; or equivalent defects. A piece 12 feet or longer otherwise as good as No. 2 clear may have a defect which can be cut out and the piece laid with a waste of not more than 2½ inches in its length, providing the defect is 4 feet or more from either end of the piece. Imperfect edges, such as small knots torn out in machining and occasional scant tongue, not less than ⅛ inch, shall not exclude lumber from this grade.

Patterns.

Patterns for siding are illustrated in Figures 3 to 8.

Red Cedar Lumber Manufacturers Association, standard grading rules for western red cedar bevel and bungalow siding, August 1, 1925.

General grading rules.

Slash and/or vertical grain. Color is not a defect. Occasional slight variation in thickness permitted, but not to exceed a total of $\frac{1}{16}$ inch in any two pieces. Defects on thin edge which will cover when laid should not be given the same consideration as defects elsewhere. All bevel and bungalow siding shall be surfaced one side and two edges.

Sizes for bevel siding.

Finished thicknesses.—½ inch thick edge, $\frac{5}{32}$ inch thin edge.

Finished widths.—3½ inches, 4½ inches, 5½ inches.

Lengths.—Multiples of 1 foot.

Standard bundles are 8 feet and up, 10 layers to each bundle. In bundles 10 feet and longer 30 per cent shorter lengths shall be included in each bundle.

Grades for bevel siding (defects based on 12 feet).

Clear, A, B, and C.

Clear.—Shall be well milled on face and edges and practically free from all defects. Bright sap ½ inch wide on thin edge admitted. Minor defects on thin edge which will cover when laid. Usable full length without waste, containing no defect that will not cover with paint.

A.—Bright sap no defect. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; slight raised grain; occasional small rough spots on thick edge; minor defects on thin edge which will cover when laid.

Usable full length without waste, containing no defect that will not cover with paint.

B.—Admits siding below A grade. Stained sap no defect. Will admit slight torn grain and slight raised grain. With one of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Four sound and tight small knots; occasional slight skips on face and edges; a few pin wormholes, well scattered; heavy skips, holes, or other defects that can be cut out by wasting not more than 20 per cent of the length of the piece by not exceeding two cut-outs in pieces 10 feet and longer, provided the pieces resulting are 3 feet or longer.

C.—Will admit all pieces falling below B grade on account of imperfect manufacture or other defects.

Especially is this grade intended to cover stock too thin to dress to standard sizes and, consequently, will be mostly rough. This grade will take all lengths and no specified percentages are guaranteed.

Sizes for bungalow or colonial siding.

Defects based on 8 inches by 12 feet.

Finished thicknesses.—

½-inch stock, $\frac{5}{32}$ inch thin edge, ½ inch thick edge.

¾-inch stock, $\frac{3}{16}$ inch thin edge, ¾ inch thick edge.

Finished widths.—7½, 9½, 11½ inches.

Lengths.—Multiples of 1 foot.

(Standard bundles are 8 feet and up. One-half inch stock is bundled 10 layers to bundle. In bundles 10 feet and longer 3 layers of shorter lengths shall be included in each bundle. Three-fourths inch stock is bundled 6 layers to bundle. In bundles 10 feet and longer 2 layers of shorter lengths shall be included in each bundle.)

Grades for bungalow or colonial siding.

No. 1 and No. 2.

No. 1 bungalow or colonial siding is produced from stock carefully graded in the rough, and No. 1 grade includes all stock that will lay clear without waste and containing no defects that will not cover with paint, making a smooth job. Vertical and/or flat grain permitted.

No. 2 admits siding below No. 1 grade. Vertical and/or flat grain permitted. Stained sap no defect. Will admit slight torn grain and slight raised grain. With one of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Four sound and tight small knots; occasional slight skips on face and edges; a few pin wormholes, well scattered; heavy skips, holes or other defects that can be cut out by wasting not more than 20 per cent of the length of the piece by not exceeding two cut-outs in pieces 10 feet and longer provided the pieces resulting are 3 feet and longer.

Southeastern Forest Products Association, sizes and grades for southern pine drop siding and bevel siding, September 1, 1925.

Sizes.

	Width	Dressed dimensions at commercially dry shipping weight		
		Thickness	Face width	Overall width
	Inches	*Inches*	*Inches*	*Inches*
Bevel siding	4	$\frac{7}{16}$ by $\frac{5}{16}$	$3\frac{1}{2}$	$3\frac{1}{2}$
	5	$\frac{10}{16}$ by $\frac{7}{16}$	$4\frac{1}{2}$	$4\frac{1}{2}$
	6		$5\frac{1}{2}$	$5\frac{1}{2}$
Rustic and drop siding (D and M)	4	$\frac{5}{16}$	$3\frac{1}{4}$	$3\frac{1}{2}$
	5	$\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$
	6		$5\frac{3}{16}$	$5\frac{7}{16}$
	8		$7\frac{1}{4}$	$7\frac{1}{2}$
Rustic and drop siding (shiplapped)	4	$\frac{5}{16}$	$3\frac{1}{8}$	$3\frac{1}{2}$
	5	$\frac{3}{4}$	$4\frac{1}{8}$	$4\frac{1}{2}$
	6		$5\frac{3}{16}$	$5\frac{7}{16}$
	8		$7\frac{1}{8}$	$7\frac{1}{2}$

Bevel siding lengths.

Standard lengths and percentages of short lengths shall be the same as in drop siding.

Grades of bevel siding.

A, B, No. 1 common, No. 2 common, and No. 3 common.

All grades same as for drop siding, and will admit, in addition, slight imperfections on the thin edge, which will be covered by the lap when laid $2\frac{1}{2}$, $3\frac{1}{2}$, or $4\frac{1}{2}$ inches to the weather.

Drop siding lengths.

Standard lengths are 4 to 20 feet, inclusive, and the following percentages of short lengths may be included in all miscellaneous or mixed length shipments:

A and B	5 per cent 8 and/or 9-foot.
No. 1 common	5 per cent 6 and/or 7-foot.
	5 per cent 8 and/or 9-foot.
No. 2 common	5 per cent 4 and/or 5-foot.
	5 per cent 6 and/or 7-foot.
	5 per cent 8 and/or 9-foot.
No. 3 common	Not to exceed 20 per cent 4 and 6 foot lengths.

NOTE.—The above percentage of short lengths is customary, and in the interest of conservation, will be included, so far as practicable, in all shipments of mixed lengths.

Grades.

A, B, No. 1 common, No. 2 common, and No. 3 common.

The grades of drop siding are based on a piece 6 inches by 12 feet long as compared with a piece 4 inches by 12 feet long. With the exception of the change in the unit of grading the grades are identical with the similarly named grades of flooring. See No. 411.27.

Patterns.

Patterns for siding are illustrated in Figures 9 to 13.

Southeastern Forest Products Association, sizes and grades for southern pine barn siding, September 1, 1925.

Lengths and grades are the same as those for common boards, 402.42.

Patterns.

Patterns for barn siding are illustrated in Figures 9 to 13.

Southern Cypress Manufacturers Association, standard grades and classifications for tupelo drop siding and bevel siding, June 15, 1927.

Sizes of drop siding.

Thickness.—$\frac{13}{16}$ inch.

Widths.—Standard, worked from 4 to 6 inch stock.

Lengths.—8 to 20 feet admitting 15 per cent of 8, 9, and 10 foot lengths, and not to exceed 5 per cent of lengths under 10 feet. Odd lengths are not standard above 10 feet. May also be specified 4 to 7 feet.

Grade of drop siding.

C and better.

C and better grade may be worked to any standard pattern desired, tongued and grooved or shiplapped if so desired. Sound sap, slightly discolored, and two standard knots, or their equivalent in small knots, or other defects, will be admitted.

Sizes of bevel siding.

Thickness.—$\frac{1}{2}$ inch.

Widths.—Standard, worked from 4, 5, and 6 inch stock.

Lengths.—8 to 20 feet admitting not over 15 per cent of 8, 9, and 10 feet, and not to exceed 5 per cent under 10 feet. Odd lengths are not standard above 10 feet. Shall be graded from the finished side, B and better, and C, and 4 to 7 foot lengths C and better.

Grades of bevel siding.

B and better and C.

B and better will admit sound sap slightly discolored, and other small defects which may be covered by the lap.

C shall comprise stock not up to the grade of B, and may contain defects or imperfections in manufacture which may be removed in two cuts with waste not exceeding 10 per cent of the length of any one piece.

Southern Cypress Manufacturers Association, standard grades and classifications for cypress bevel siding and bungalow siding, June 15, 1925.

Sizes of bevel siding.

Thickness.—$\frac{1}{2}$ by $\frac{3}{16}$ inch.

Width.—4, 5, and 6 inches wide.

Length.—8 to 20 feet, admitting not over 15 per cent of 8, 9, and 10 feet, and not to exceed 5 per cent under 10 feet. Odd lengths are not standard above 10 feet.

Grades of bevel siding.

A, B, C, and D, and 4 to 7 foot lengths C and better. (Graded from the finished side.)

A siding.—May have 1 inch of bright sap on thin edge and may contain one small sound knot.

B siding.—Bright sap is not a defect in this grade. May have three small sound knots or in lieu of knots a few pin wormholes, and may have slight wane on

the thin edge. In the absence of other defects, a small amount of stained sap will be admitted.

C siding.—May have one medium knot or four small sound knots or a few pin wormholes well scattered over the piece. Sound sap, bright or stained, will be admitted.

D siding.—Admits more and coarser defects than C siding, but none that will preclude full-length use.

Sizes of bungalow siding.

Thickness.—½ by $\frac{3}{16}$ inch, $\frac{9}{16}$ by $\frac{3}{16}$ inch, and $\frac{11}{16}$ by $\frac{3}{16}$ inch.

Width.—8, 10, and 12 inches.

Length.—8 to 20 feet, admitting not more than 15 per cent of 8, 9, and 10 feet, and not to exceed 5 per cent under 10 feet.

Grades of bungalow siding.

Shall be worked and graded same as bevel siding except that the A grade will admit 2 inches of bright sap.

Southern Cypress Manufacturers Association, standard grades and classifications of cypress drop siding, June 15, 1925.

Thickness.

¾ inch.

Width.

Shall be specified widths, 3, 4, 5, and 6 inches wide.

Length.

8 to 20 feet (except in D grade), admitting 15 per cent of 8, 9, and 10 foot lengths, and not to exceed 5 per cent of lengths under 10 feet. Odd lengths are not standard above 10 feet. May also be specified 4 to 7 feet.

Shall be graded from the finished side, or if both sides are finished, it shall be graded from the better side, A, B, C, and D.

A, B, C, and D grades are the same as for flooring. See No. 411.22.

Southern Pine Association, sizes and grades for southern pine drop, bevel, and barn siding, March 23, 1927.

Similar to the Southeastern Forest Products Association, with the following additional statement relating to end matching:

End matching.

All end-matched drop siding manufactured to American Lumber Standard sizes, as provided in the Southern Pine Association rules, will be graded on Southern Pine Association standard rules, except No. 2 common, which will lay a serviceable wall without cutting.

All end-matched drop siding will be bundled to the nearest foot, the shortest bundle to be 2 feet and trimmed in multiples of 1 foot or a fraction thereof, and with the following regulation in respect to length:

	Feet
A, minimum average	9
B and better, minimum average	8
B, minimum average	7
All commons, minimum average	5

Patterns.

This association's patterns for siding are illustrated in Figures 9, 10, 12, and 13.

West Coast Lumbermen's Association, sizes and grading rules for Douglas fir, west coast hemlock, Sitka spruce, and western red cedar siding, July 1, 1926.

Douglas fir drop siding, kiln dried, flat grain, and/or vertical grain.

Thickness, finished.—$\frac{5}{8}$ to $\frac{9}{16}$ inch; 1 to ¾ inch.

Widths, nominal: 4, 6, and 8 inches.

Widths, finished: ¾, $5\frac{3}{16}$, and 7 inches.

Lengths.—Multiples of 1 foot.

Douglas fir drop-siding grades, flat grain, and/or vertical grain.

B and better, C, and D.

B and better.—Shall be well manufactured and will admit slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three sound and tight pin knots; 4 small (4-inch) pitch pockets, none through. Will admit wane (on reverse side) in addition to other permissible defects, one-third width, one-sixth length, not into tongue.

C.—Will admit medium torn grain; medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three 1-inch sound and tight knots; 5 small (4-inch) pitch pockets, 3 of which may be through; 3 small seasoning checks; small number of pin wormholes. Will also admit cut-out of $2\frac{1}{2}$ inches for a defect 4 feet or more from either end in pieces 12 feet or longer, if piece is otherwise as good as B; wane (on reverse side) in addition to other permissible defects, one-third width, one-sixth length, not into tongue.

D.—Will admit the following defects, equivalent defects, or equivalent combination of defects: 1-inch sound and tight knots; numerous small pitch pockets (several of which may be through), or equivalent medium to large pitch pockets; short splits; large pitch streaks; heart stain; medium sap stain; 4 heavy skips, each not over 12 inches long based on 12-foot length; groove edge, hit and miss; scant tongue; torn grain; pinworm holes; seasoning checks; 1 knot hole in pieces 8 to 14 feet long, and 2 knot holes in pieces 16 feet or longer; wane (on reverse side) in addition to other permissible defects, one-third width, one-third length of piece.

Douglas fir rustic siding, kiln dried.

Thicknesses, finished—

Widths, nominal: 4, 6, and 8 inches.

Face, finished: $3\frac{1}{8}$, $5\frac{1}{16}$, and $6\frac{7}{8}$ inches.

Lengths.—Multiples of 1 foot.

Grades.—Same as for drop siding above.

Douglas fir bungalow or colonial siding.

Thickness, finished.—$\frac{11}{16}$ by ¼ inch.

Width, finished: 8 inches and wider, ¾ inch off.

Lengths.—Multiples of 1 foot.

Bundling.—Standard bundles are 8 feet and up. One-half inch stock is bundled 10 layers to bundle. In bundles 10 feet longer 3 layers of 3 to 7 foot

lengths shall be included in each bundle. Three-fourths-inch stock is bundled 6 layers to bundle. In bundles 10 feet and longer 2 layers of 3 to 7 foot lengths shall be included in each bundle.

Grade (defects based on 10 inches by 12 feet): B and better.

B and better.—Will admit occasional slight variation in thickness, not to exceed a total of $\frac{1}{16}$ inch in any two pieces; slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three sound and tight pin knots; four very small (2-inch) pitch pockets, none through. This grade will permit of the inclusion of not over 15 per cent of material with machine defects (such as torn grain or slight skips) in greater amount than ordinarily permitted in B and better. Defects on thin edge which will cover when laid not to be given same consideration as defects elsewhere.

Douglas fir bevel siding, kiln dried.

Thickness, finished.—$\frac{1}{2}$ by $\frac{3}{16}$ inch.

Widths, finished: $3\frac{1}{2}$, $4\frac{1}{2}$, and $5\frac{1}{2}$ inches.

Lengths.—Multiples of 1 foot.

Bundling.—Standard bundles are 8 feet and up, 10 layers to each bundle. In bundles 10 feet and longer, 30 per cent shorter lengths shall be included in each bundle.

Grades (defects based on 6 inches by 12 feet): A, B, and C.

Bright sap no defect.—Will admit occasional slight variation in thickness, not to exceed a total of $\frac{1}{16}$ inch in any 2 pieces. Defects on thin edge which will cover when laid not to be given same consideration as defects elsewhere.

A, bevel siding.—Shall be well manufactured. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; two very small (2-inch) pitch pockets, none open through. Shall be suitable for use full length without waste, containing no defects that will not cover with paint.

B, bevel siding.—Will admit slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Four sound and tight pin knots; four small (4-inch) pitch pockets, none open through; occasional slight skips on face or edges; light sap stain, 15 per cent of face. Shall be suitable for use without waste.

C, bevel siding.—Stained sap no defect. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects; stained sap; torn grain; raised grain; slight skips on face; sound and tight knots; pitch pockets, not through. Pieces 8 feet and longer, will admit rough edges; heavy skips; knot holes; through pitch pockets, or equivalent defects that can be cut out with a waste not exceeding $33\frac{1}{3}$ per cent of the length of the piece, provided the pieces resulting are 3 feet or longer. Not more than 2 cut-outs allowed, however, in any one piece. Percentage of lengths not guaranteed. Large percentage of shorts permitted at shipper's option.

West coast hemlock drop siding, rustic siding, and bungalow or colonial siding.

Sizes and grades identical with those for Douglas fir. (See above.)

West coast hemlock bevel siding, kiln dried.

Sizes identical with those for Douglas fir. (See above.)

Bundling.—Standard bundles are 8 feet and up, 10 layers to each bundle. In bundles 10 feet and longer, 30 per cent 3 to 7 foot lengths shall be included in each bundle.

Grades.

B and better, C, and D.

Bright sap no defect.—Will admit occasional slight variation in thickness, not to exceed a total of $\frac{1}{16}$ inch in any two pieces. Defects on thin edge which will cover when laid not to be given same consideration as defects in each bundle.

B and better.—Shall be well manufactured. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; three very small (2-inch) bark pockets, none open through. Suitable for use full length without waste, containing no defects that will not cover with paint.

C.—Will admit slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects; four sound and tight pin knots or equivalent black burls; four (4-inch) bark pockets, none open through; occasional slight skips on face or edges; light sap stain 15 per cent of face. Suitable for use full length without waste.

D.—Stained sap no defect. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Stained sap, torn grain, raised grain, slight skips on face, sound and tight knots, and pitch pockets, not through. Pieces 8 feet and longer, will admit rough edges; heavy skips; knot holes through pitch pockets, or equivalent defects that can be cut out with a waste not exceeding $33\frac{1}{3}$ per cent of the length of the piece, provided the pieces resulting are three feet or longer. Not more than two cut-outs allowed, however, in any one piece. Percentage of lengths not guaranteed. Large percentage of shorts permitted at shipper's option.

Sitka spruce bungalow or colonial siding, kiln dried.

Sizes identical with those for Douglas fir. (See above.)

Bundling.—Standard bundles are 8 feet and up. One-half inch stock is bundled 10 layers to bundle. In bundles 10 feet and longer 3 layers of 3 to 7 foot lengths shall be included in each bundle. Three-fourths-inch stock is bundled 6 layers to bundle. In bundles 10 feet and longer 2 layers of 3 to 7 feet lengths shall be included in each bundle.

Grade.

B and better. Defects based on 8 to 10 inches by 12 feet.

B and better.—Will admit slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Two sound and tight pin knots; two

3-inch pitch pockets, none through. One additional pin knot or pitch pocket allowed for each additional 2 inches increase in width. This grade will permit of the inclusion of not over 15 per cent of material with machine defects, such as torn grain or slight skips, in greater amount than ordinarily permitted in B and better.

Defects on thin edge which will cover when laid not to be given same consideration as defects elsewhere.

Sitka spruce bevel siding, kiln dried.

Sizes and grades identical with those for Douglas fir. (See above.)

Western red cedar bungalow or colonial siding.

Thicknesses, finished.—½ by $\frac{5}{32}$ inch and ¾ by $\frac{3}{16}$ inch.

Widths, finished: 7½, 9½, and 11½ inches.

Lengths.—Multiples of 1 foot.

Bundling.—Standard bundles are 8 feet and up, 10 layers to each bundle. In bundles 10 feet and longer, 30 per cent shorter lengths shall be included in each bundle.

Grade (defects based on 8 inches by 12 feet).

There is only one recognized grade of bungalow or colonial siding. It is produced from stock carefully graded in the rough. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; 1 inch bright sap; ½ inch additional sap allowed for each additional 2 inches increase in width. Will also permit of the inclusion of not over 15 per cent of material with machine defects in greater amount than ordinarily permitted.

Western red cedar bevel siding.

Sizes identical with those for Douglas fir. (See above.)

Bundling.—Identical with Douglas fir. (See above.)

Grades (defects based on 12-foot length.)

Clear, A, B, and C.

Clear.—Shall be well milled on face and edges and practically free from all defects. Bright sap ½-inch wide on thin edge admitted. Minor defects on thin edge which will cover when laid. Usable full length without waste, containing no defect that will not cover with paint.

A.—Bright sap no defect. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; slight raised grain; occasional small rough spots on thick edge; minor defects on thin edge which will cover when laid; usable full length without waste, containing no defect that will not cover with paint.

B.—Admits siding below A grade. Stained sap no defect. Will admit medium torn grain; medium raised grain. With one of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Four sound and tight small knots; occasional slight skips on face and edges; a few pin wormholes, well scattered. Heavy skips, holes, or other defects, that can be cut out by wasting not more than 20 per cent of the length of the piece by not exceeding two cut-outs in pieces 10 feet and longer provided the pieces resulting are 3 feet or longer.

C.—Will admit all pieces falling below B grade, on account of imperfect manufacture or other defects. Especially is this grade intended to cover stock too thin to dress to standard sizes and consequently will be mostly rough. This grade will take all lengths and no specified percentages are guaranteed.

Patterns.

Patterns for siding are illustrated in Figures 14 to 44.

Western Pine Manufacturers Association, rules for the grading of Pondosa pine, Idaho white pine, white fir, cedar, and spruce drop siding and beveled siding, July 1, 1925.

Sizes of drop siding.

Thickness.—1 inch dressed to $\frac{25}{32}$ inch.

Width.—

3-inch dressed to 2¼-inch face.
4-inch dressed to 3¼-inch face.
6-inch dressed to 5¼-inch face.
8-inch dressed to 7¼-inch face.
10-inch dressed to 9¼-inch face.
12-inch dressed to 11¼-inch face.

Pattern 106 is the standard for drop siding. All other patterns of drop siding are considered special. (Similar to pattern 106 of the West Coast Lumbermen's Association illustrated in fig. 27.)

Sizes of beveled siding.

Thickness.—½ inch dressed to $\frac{3}{16}$ inch thin edge and $\frac{7}{16}$ inch thick edge.

Width.—

4-inch dressed to 3½ inches.
5-inch dressed to 4½ inches.
6-inch dressed to 5½ inches.

Grades of beveled siding.

B and better, C, D, and E.

Beveled siding shall be graded from the face side only. The thick edge is considered part of the face. Defects on the thin edge which will cover when laid shall not be given the same consideration as defects elsewhere. In 4-inch siding it is considered that ¾ inch will be covered; in 6-inch siding, 1 inch; and in siding wider than 6-inch, 1½ inches.

B and better beveled siding.—Shall consist of B siding and all the better product of the stock. B and better siding will admit of two or three small sound tight knots and other minor defects well scattered over face of piece, or with fewer knots, a small amount of stain, or slight traces of pitch if local.

C siding.—Will admit of 2 or 3 small knots, not exceeding 1 inch in diameter, or more knots when smaller, or a small amount of pitch or light season check.

Medium stain covering one-half the face, or a greater area of lighter stain, is admitted if not in combination with marked defects.

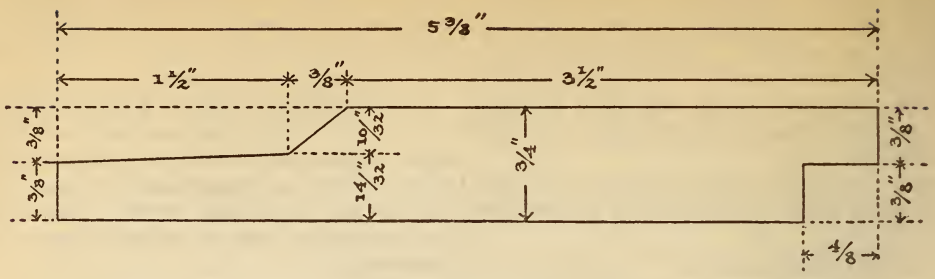


FIG. 3.—*1 by 6 inch kiln-dried channel rustic; green, 5½ inches over all*

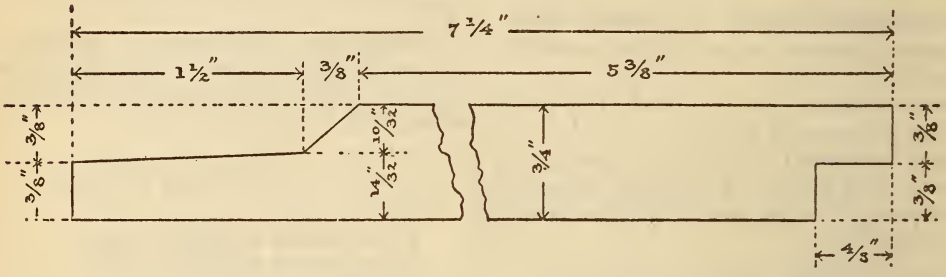


FIG. 4.—*1 by 8 inch kiln-dried channel rustic; green, 7½ inches over all*

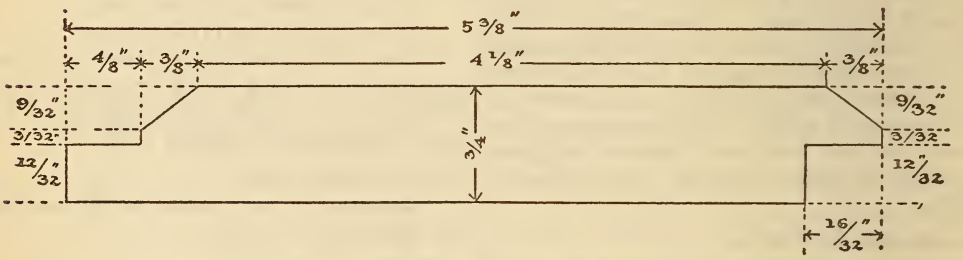


FIG. 5.—*1 by 6 inch kiln-dried V. rustic; green, 5½ inches over all*

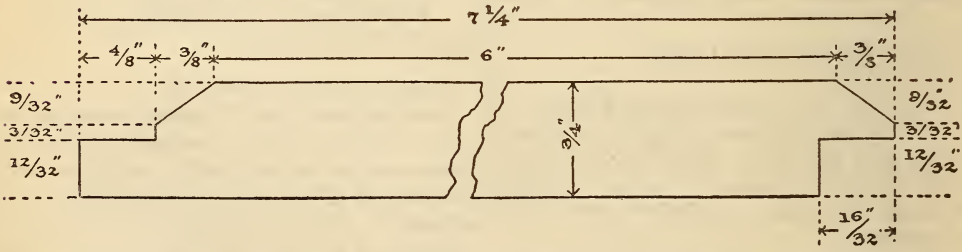


FIG. 6.—*1 by 8 inch kiln-dried V. rustic; green, 7½ inches over all*

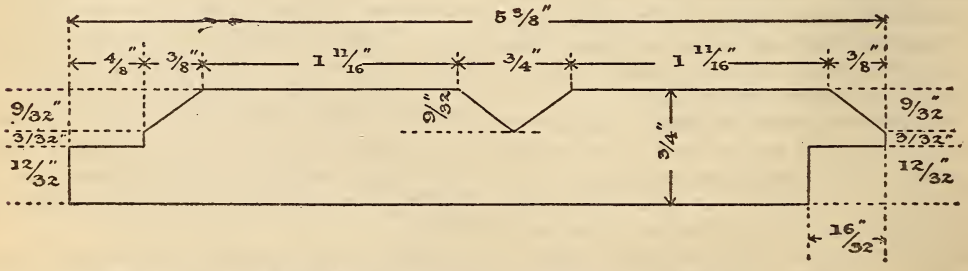


FIG. 7.—*1 by 6 inch kiln-dried double V. rustic; green, 5½ inches over all*

All Pacific Lumber Inspection Bureau

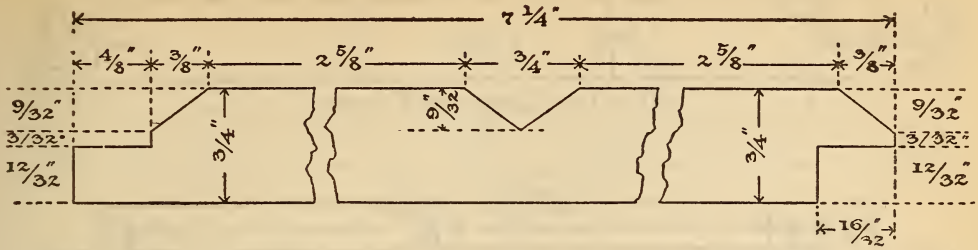


FIG. 8.—*1 by 8 inch kiln-dried double V. rustic; green, 7½ inches over all*

Pacific Lumber Inspection Bureau

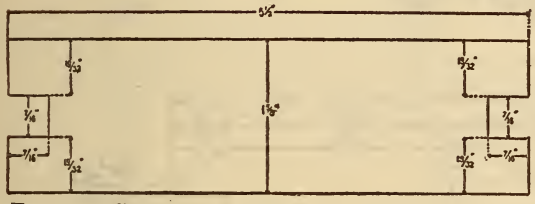


FIG. 9.—*Grooved for splines if surfaced on two sides*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

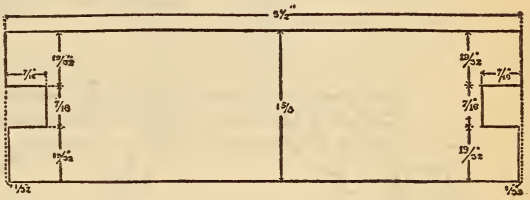


FIG 10.—*Grooved for splines if surfaced on one side*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

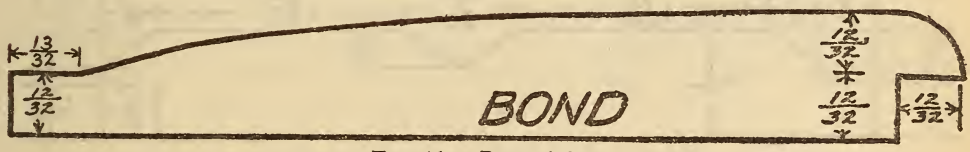


FIG. 11.—*Drop siding*

Southeastern Forest Products Association

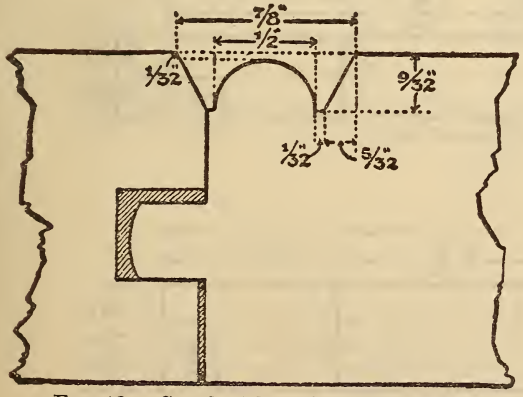


FIG. 12.—*Standard bead for thick material*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

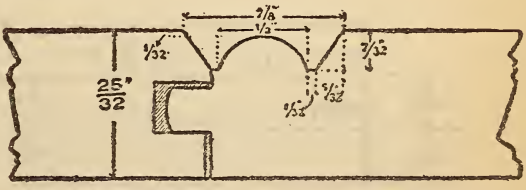


FIG. 13.—*Standard bead for 1 inch barn siding*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

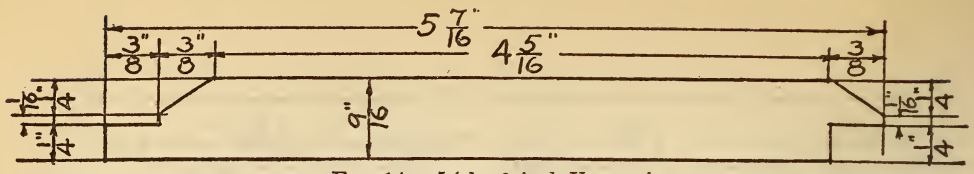


FIG. 14.—*5/8 by 6 inch V. rustic*

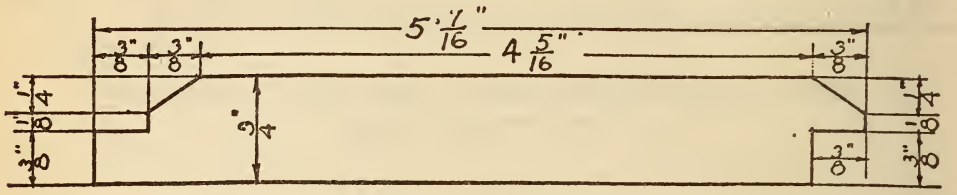


FIG. 15.—*1 by 6 inch V. rustic*

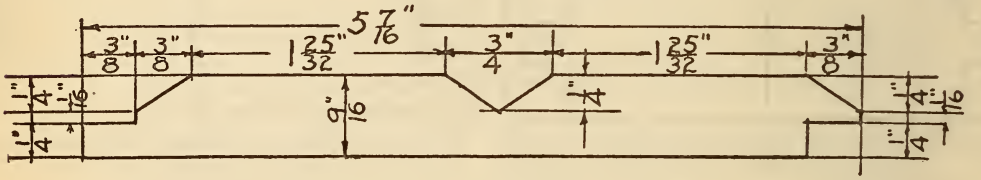


FIG. 16.—*5/8 by 6 inch V. and C. V. rustic*

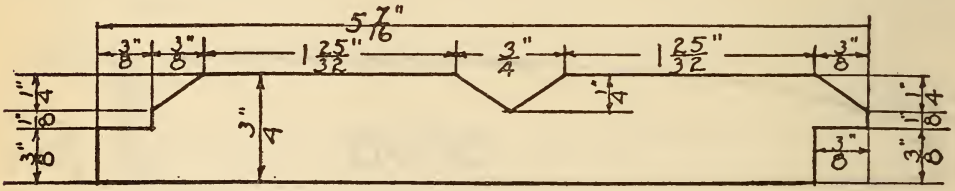


FIG. 17.—*1 by 6 inch V. and C. V. rustic*

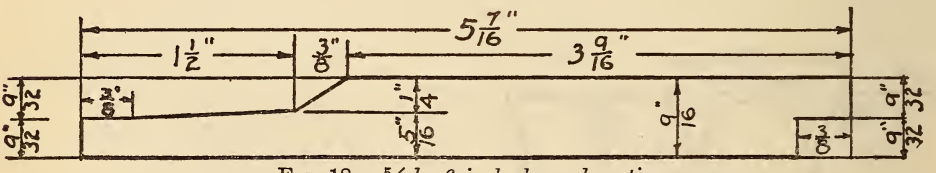


FIG. 18.—*5/8 by 6 inch channel rustic*

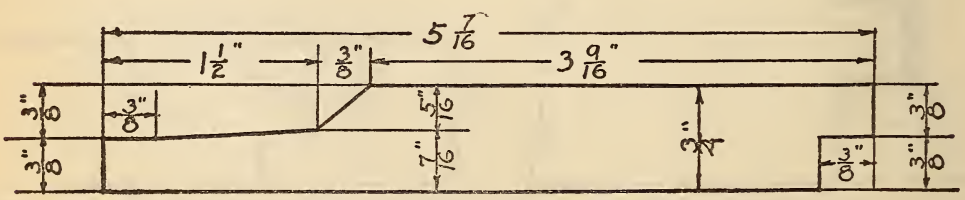


FIG. 19.—*1 by 6 inch channel rustic*

All West Coast Lumbermen's Association

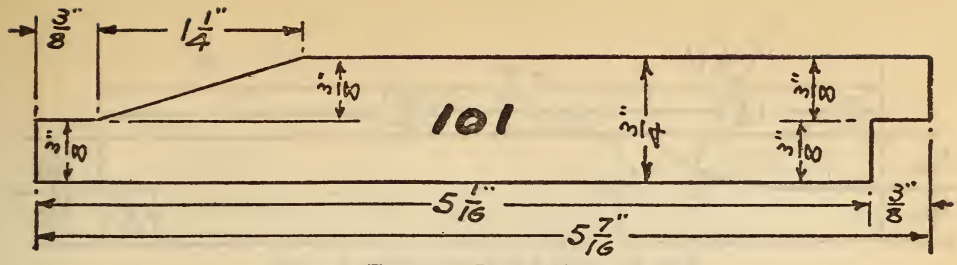


FIG. 20.—*Drop siding*

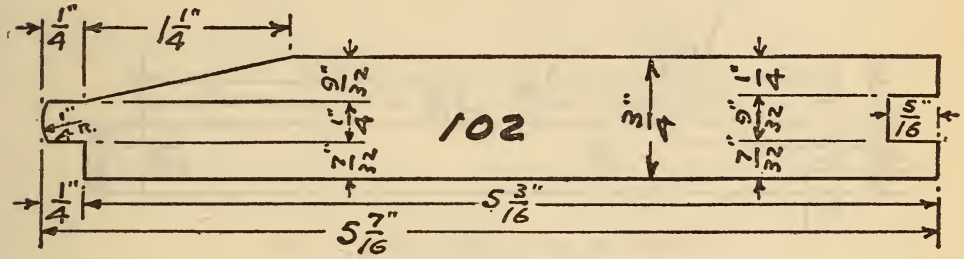


FIG 21.—*Drop siding*

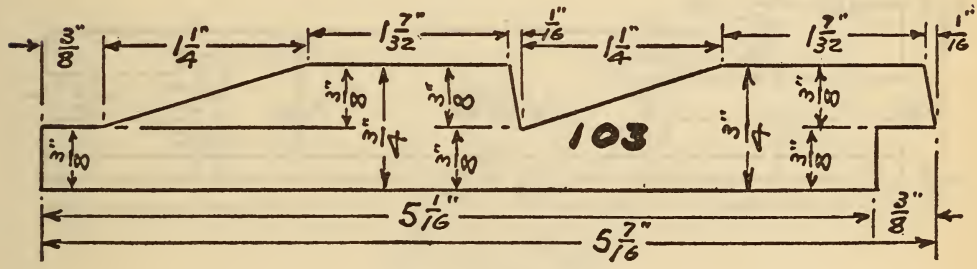


FIG. 22.—*Drop siding*

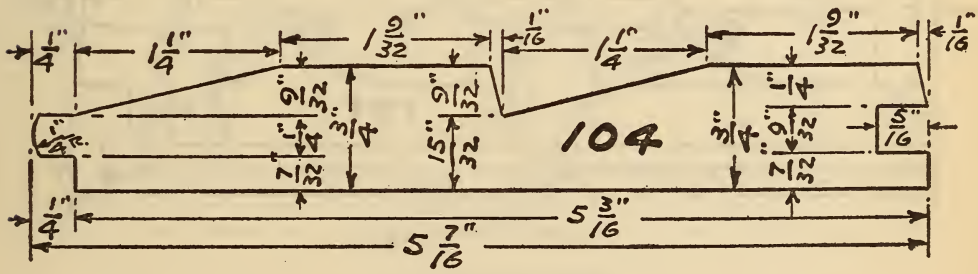


FIG. 23.—*Drop siding*

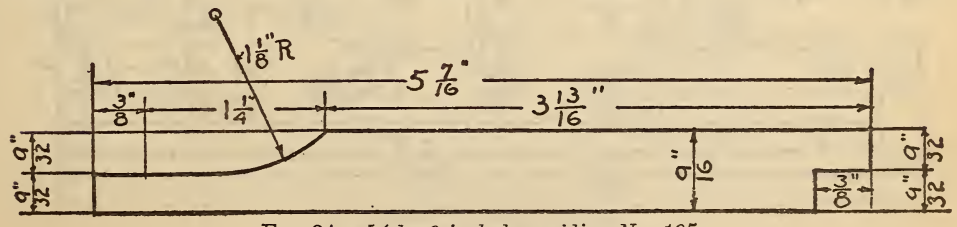


FIG. 24.—*5/8 by 6 inch drop siding No. 105*

All West Coast Lumbermen's Association

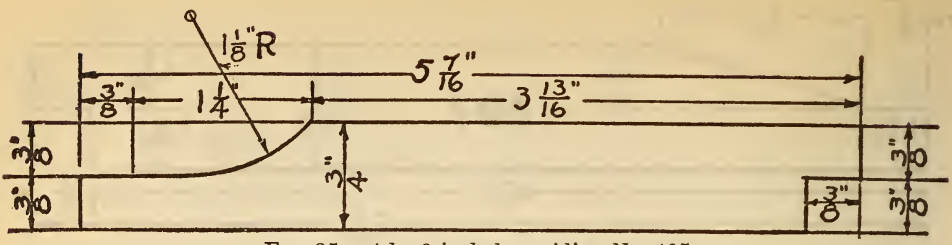


FIG. 25.—*1 by 6 inch drop siding No. 105*

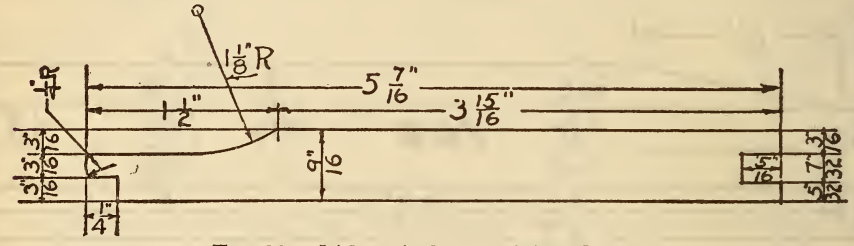


FIG. 26.—*5/8 by 6 inch drop siding No. 106*

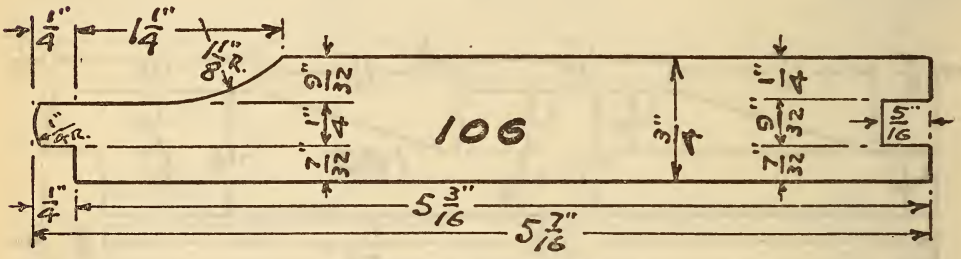


FIG. 27.—*Drop siding*

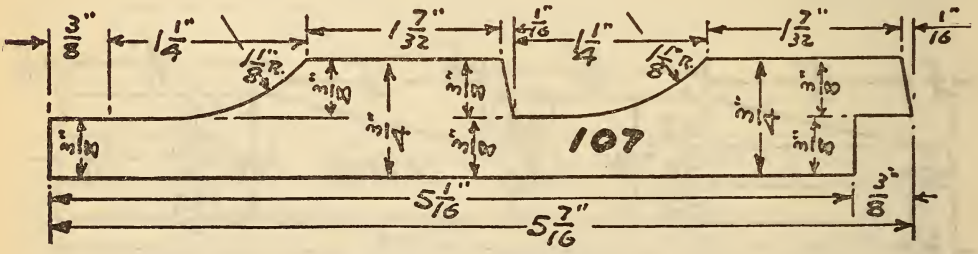


FIG. 28.—*Drop siding*

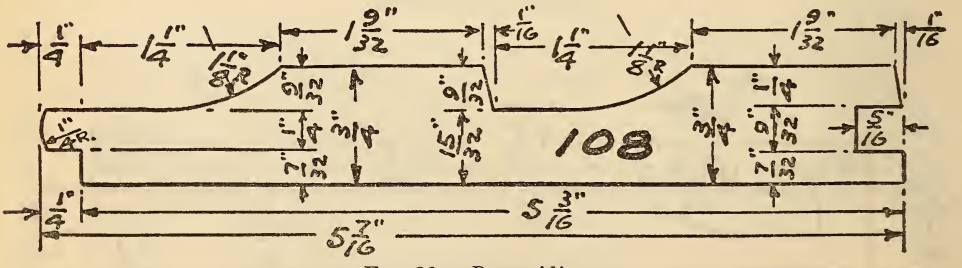


FIG. 29.—*Drop siding*

All West Coast Lumbermen's Association

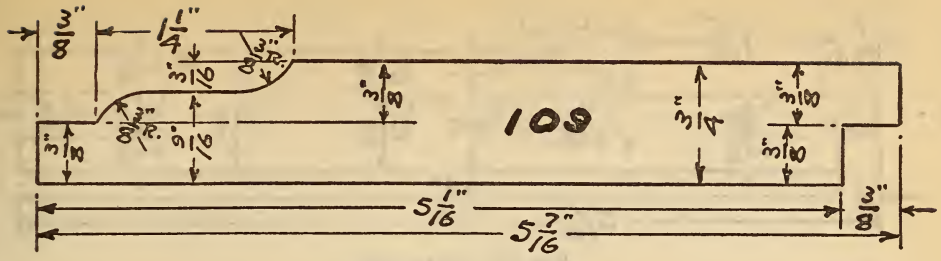


FIG. 30.—*Drop siding*

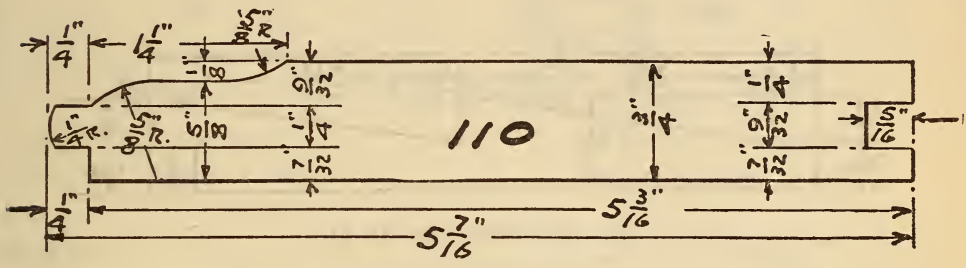


FIG. 31.—*Drop siding*

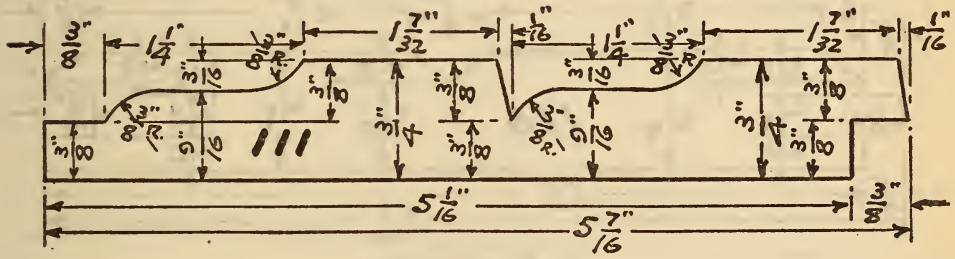


FIG. 32.—*Drop siding*

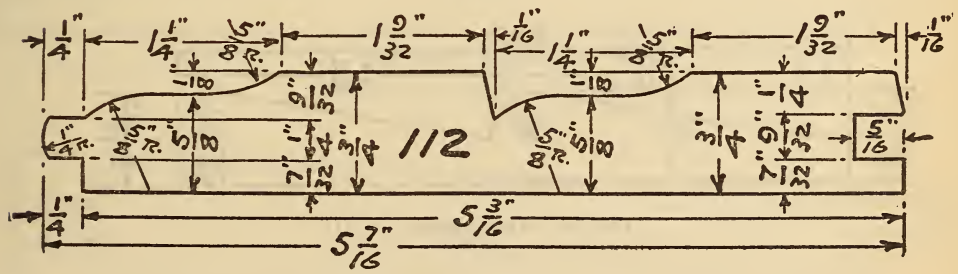


FIG. 33.—*Drop siding*

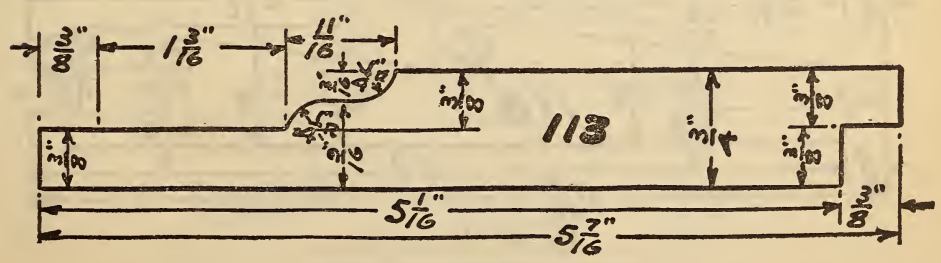


FIG. 34.—*Drop siding*

All West Coast Lumbermen's Association

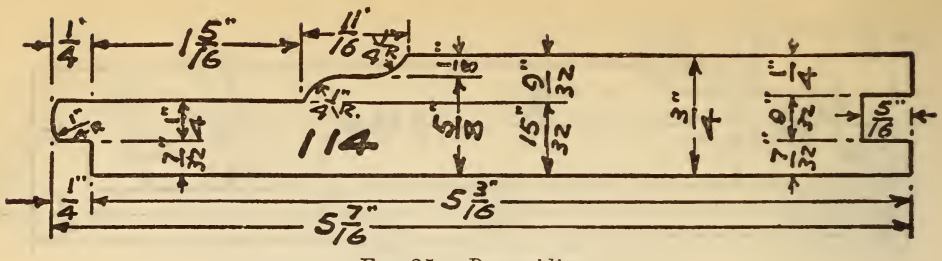


FIG. 35.—*Drop siding*

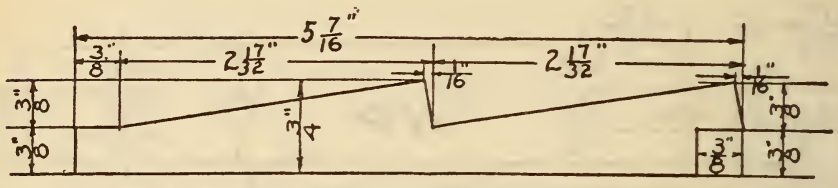


FIG. 36.—*Drop siding No. 115*

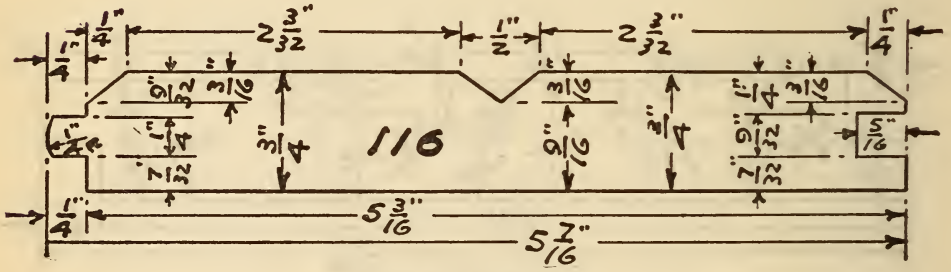


FIG. 37.—*Drop siding*

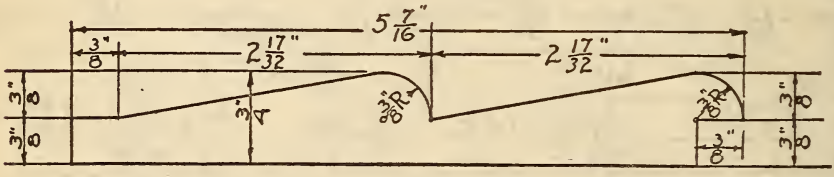


FIG. 38.—*Drop siding No. 117*

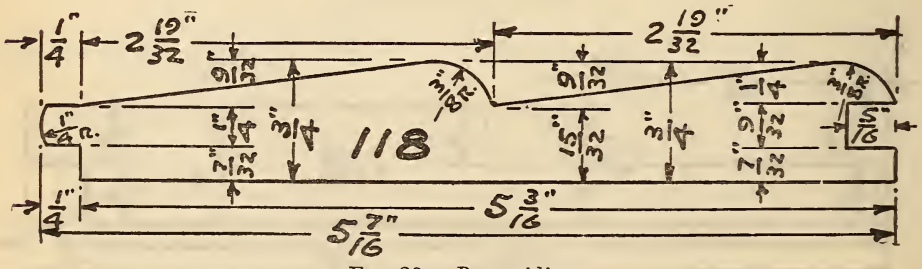


FIG. 39.—*Drop siding*

All West Coast Lumbermen's Association

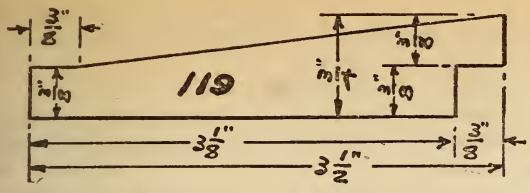


FIG. 40.—*Drop siding*

West Coast Lumbermen's Association

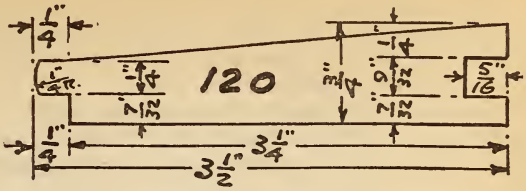


FIG. 41.—*Drop siding* £

West Coast Lumbermen's Association X

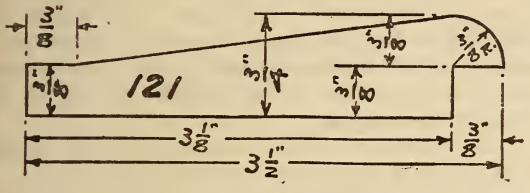


FIG. 42.—*Drop siding*

West Coast Lumbermen's Association

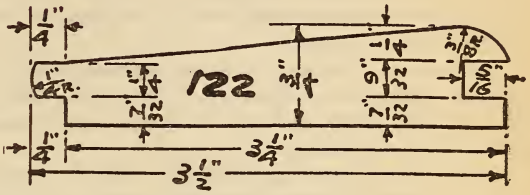


FIG. 43.—*Drop siding* £

West Coast Lumbermen's Association X

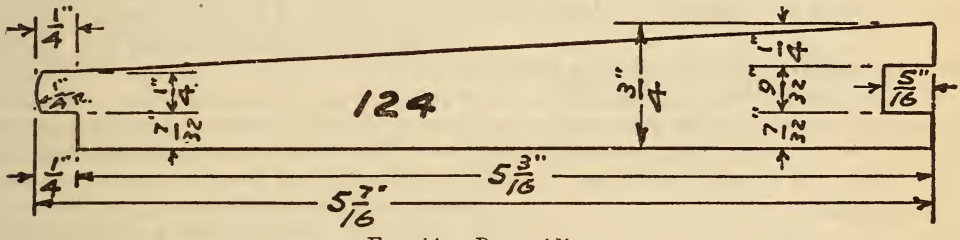


FIG. 44.—*Drop siding*

West Coast Lumbermen's Association

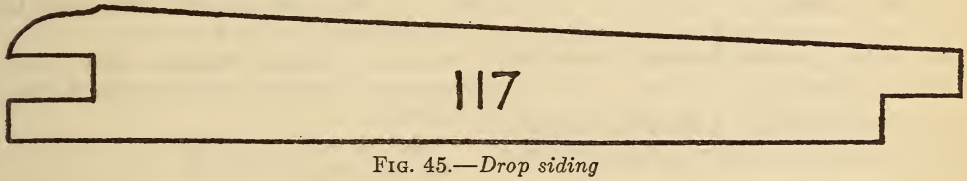


FIG. 45.—*Drop siding*

Western Pine Manufacturers Association

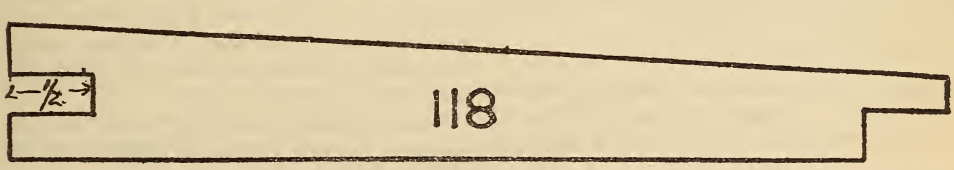


FIG. 46.—*Drop siding*

Western Pine Manufacturers Association

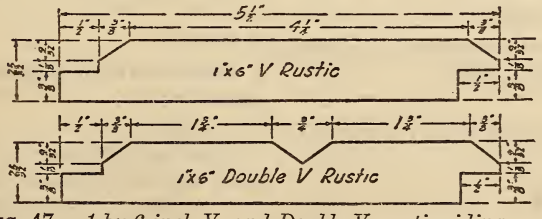


FIG. 47.—*1 by 6 inch V. and Double V. rustic siding*

Western Pine Manufacturers Association

Defects requiring one cut not to exceed 4 inches of waste, are allowed in high-line pieces 12 feet long and longer, but not more than 20 per cent of such pieces shall be permitted in this grade.

D siding.—Will admit of considerable pitch and season checks; with or without either of these defects a piece may have a number of small knots well scattered.

Medium stain covering the entire piece is allowed if not in combination with other marked defects.

Defects requiring 2 cuts with a combined waste not to exceed 8 inches are allowed in high-line pieces 12 feet long and longer.

E siding.—This is the lowest recognized grade of beveled siding and will admit of the stain, knot, pitch pocket, pitch, and season check defects not admissible in D siding.

Many pieces showing seriously defective mill work or imperfect manufacture are admitted in this grade.

Patterns.

Patterns for siding are illustrated in Figures 45 to 47.

White Pine Association of the Tonawandas, grades of northern white pine lumber for siding, 1922.

The following grades of white pine lumber, as shown in 400.26 for this association, are suitable for siding: No. 1 barn, No. 2 barn, No. 3 barn.

411.2 FLOORING.

411.20 General Items.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July, 1926.

For American Lumber Standard, yard and industrial sizes of lumber, including flooring. (See 411.0.)

411.21 Cedar Flooring.

West Coast Lumbermen's Association, standard sizes and grading rules for western red cedar flooring, July 1, 1926.

The sizes for standard thicknesses and standard widths for western red cedar flooring are the same as those for Douglas fir. (See 411.23.)

Grades B and better and C.

B and better.—Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; one sound and tight pin knot.

C.—Will admit the following defects, equivalent defects, or equivalent combinations of defects: Medium torn grain; light sap stain, 15 per cent of face; two sound and tight small knots.

Western Pine Manufacturers Association, grading rules for cedar flooring, July 1, 1925.

Patterns.

Flooring patterns are illustrated in Figures 76 and 77.

411.22 Cypress Flooring.

National Hardwood Lumber Association, grades for cypress flooring, January, 1927.

Widths.—2¼, 3¼, 4¼, and 5¼ inches face as specified, measured ¾ inch wider than the face.

Lengths.—4 to 20 feet.

Grades.—A, B, C, and D.

Inspection shall be made from the face side, or if surfaced two sides and center-matched, from the good side.

The reverse side of A and B may contain sound defects and slight wane one-sixth the length of the piece which does not extend into the tongue or groove or its equivalent in other unsound defects; C and D may contain, in addition, short tongue if sufficient to hold the piece properly in place, and wane or other unsound defects, provided the piece has sufficient bearing of full thickness to support it in the floor or ceiling.

A flooring must be 8 feet and over long and must be free from sapwood and other defects.

B flooring must be 6 feet and over long and will admit bright sapwood and one ¾-inch sound knot or its equivalent to every 4 feet in length. Pieces free from other defects may have slight stain one-sixth the surface of the piece in the aggregate.

C flooring must be 6 feet and over long and will admit sound sapwood, slight imperfections in dressing, and one ¾-inch sound knot or its equivalent to every 3 feet in length. Twenty per cent of the pieces 10 feet and over long may contain unsound defects that do not prevent the use of 90 per cent of each piece in two cuttings.

D flooring must be 4 feet and over long and will admit sound knots, stain, pin wormholes and a slight amount of surface shake. Twenty per cent of the pieces may contain unsound defects that do not prevent the use of three-fourths the length of the piece in crosscutting 2 feet and over long.

Southern Cypress Manufacturers Association, grades and classification for cypress flooring, June 15, 1925.

Thickness.—$\frac{5}{16}$, $\frac{7}{16}$, $\frac{9}{16}$, $\frac{11}{16}$, 1, 1¼, and 1½ inches.

Widths.—Shall be specified widths, 3, 4, 5, and 6 inches wide.

Length.—8 to 20 feet (except in D grade), admitting 15 per cent of 8 feet, 9, and 10 feet lengths, and not to exceed 5 per cent of lengths under 10 feet. Odd lengths are not standard above 10 feet. May also be specified 4 to 7 feet.

Shall be graded from the finished side, or if both sides are finished, it shall be graded from the better side, A, B, C, and D.

A flooring.

Must be all heart. The face side must be free from all defects.

B flooring.

Bright sap is not a defect, and will admit two small sound knots.

C flooring

May have all sound sap, bright or stained, or may have one to five knots, the whole not aggregating over 3 inches; a few pin wormholes, or other defects that will not prevent the use of each piece in its full length.

D flooring.

Lengths run 6 feet and longer, admitting 25 per cent of 6, 7, 8, 9, and 10 foot lengths, provided that not more than 5 per cent shall be shorter than 8 feet.

Will admit coarser and more numerous defects than C flooring, but each piece must be capable of use in its full length.

Patterns.

Flooring patterns are illustrated in Figures 70 to 72.

411.23 Fir and Douglas Fir Flooring.

California White and Sugar Pine Manufacturers Association, sizes and grades for white fir and Douglas fir flooring, May 1, 1926.

See table of sizes and grading rules of this association, 411.1.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir flooring, dressed and matched, Schedule M, 1925.

Defects based on a piece 1 by 4 inches by 12 feet.

Rules applied proportionately on narrower and wider stock. In edge-grain stock the angle of grain shall be within the angle of 45° from the vertical.

Grades, kiln-dried.

No. 1 clear edge grain, No. 2 clear edge grain, No. 3 clear edge grain, and No. 3 clear flat grain.

No. 1 clear edge grain, kiln dried, 3, 4, and 6 inch.—Shall be well manufactured, must have perfect edges and be practically free from all defects. Bright sap no defect.

No. 2 clear edge grain, kiln dried, 3, 4, and 6 inch.—Shall be well manufactured. Will admit of slight roughness in dressing and three narrow pitch pockets each not over 2 inches in length if not extending through the thickness of the piece, or equivalent defects. Bright sap no defect.

No. 3 clear edge grain, kiln-dried, 3, 4, and 6 inch.—Will admit of roughness in dressing, three sound and tight knots each 1 inch or less in diameter or four pitch pockets each not over 4 inches in length, any two of which may extend through the thickness of the piece. It is generally understood that this grade will admit such defects or combination of defects as will not impair its utility for cheap floors and/or sheathing. A piece 12 feet or longer otherwise as good as No. 2 clear may have a defect which can be cut out and the piece laid with a loss of not more than 2½ inches in its length, providing the defect is 4 feet or more from either end of the piece. Slightly stained or discolored sap or heart no defect. Occasional scant tongue not less than ⅛ inch will be admitted in this grade.

No. 3 clear flat grain, kiln-dried, 3, 4, and 6 inch.—Will admit of roughness in dressing; three sound and tight knots each 1 inch or less in diameter, or four pitch pockets and/or pitch blisters, each not over 4 inches in length, any two of which may extend through the thickness of the piece; or equivalent defects. A piece 12 feet or longer, otherwise as good as No. 2 clear and better, may have a defect which can be cut out and the piece laid with a waste of not more than 2½ inches in its length, providing the defect is 4 feet or more from either end of the piece. It is generally understood that this grade will admit such other defects or combinations of defects as will not impair its utility for cheap floors and/or sheathing. Edge grain may be included at shipper's option. Slightly stained or discolored sap or heart no defect. Occasional scant tongue not less than ⅛ inch will be admitted.

Grades, green.

No. 1 clear edge grain,No. 2 clear edge grain, No. 2 clear and better edge and/or flat grain, and No. 3 clear regardless of grain.

No. 1 clear edge grain, green, 3, 4, and 6 inch.—Shall be well manufactured and free from all defects except one-quarter the width of bright sap.

No. 2 clear edge grain, green, shall be well manufactured.—Will admit slight roughness in dressing, bright sap one-half of width and three pitch pockets, each not over 2 inches in length if not extending through the thickness of the piece, or equivalent defects.

No. 2 clear and better, edge and/or flat grain green.—Shall be well manufactured. Will admit slight roughness in dressing, bright sap one-half of width. One of the following is also permitted with one of the foregoing two defects; three pitch pockets, or pitch blisters, each not over 2 inches in length if not extending through the thickness of the piece, one sound tight knot ¾ inch or less in diameter, or equivalent defects. Edge grain may be included with flat grain at shipper's option.

No. 3 clear, green.—Shall consist of lengths 6 feet and longer regardless of grain. Will admit of roughness in dressing, slightly discolored sap, three sound tight knots each 1 inch or less in diameter, or four pitch pockets not over 4 inches in length and/or pitch blisters, any two pockets of which may extend through the thickness of the piece; or equivalent defects. A piece 12 feet or longer otherwise as good as No. 2 clear may have a defect which can be cut out and the piece laid with a waste of not more than 2½ inches in its length, providing the defect is 4 feet or more from either end of the piece. Imperfect edges, such as small knots torn out in machining and occasional scant tongue not less than ⅛ inch, shall not exclude lumber from this grade.

Patterns.

Flooring patterns are illustrated in Figures 61 to 69.

West Coast Lumbermen's Association, sizes and grading rules for Douglas fir flooring, July 1, 1926.

Standard thicknesses—
Nominal: 1, 1¼, and 1½ inches.
Finished: $\frac{25}{32}$, $1\frac{1}{16}$, $1\frac{5}{16}$ inches.
Standard widths—
Nominal: 3, 4, and 6 inches.
Finished face: $2\frac{3}{8}$, $3\frac{1}{4}$, and $5\frac{3}{16}$ inches.
Lengths.—Multiples of 1 foot.

Defects based on 1 by 4 inches by 12 feet, kiln dried.

Vertical grain and flat grain symbols.—V. G. and F. G. angle of grain not more than 45° from vertical is classed as vertical grain; other flooring as flat grain.

Grades A, B, B and better, C, and D.

A—V. G. flooring.—Shall be well manufactured on face and edges, and practically free from all defects. Bright sap one-third face admitted.

B—V. G. flooring.—Shall be well manufactured. Will admit slight torn grain. With the above, will admit the following defect, an equivalent defect, or an equivalent combination of defects: Three very small (2-inch) pitch pockets, none through.

B and better—F. G. flooring.—Shall be well manufactured. Will admit slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: One sound and tight pin knot; 3 very small (2-inch) pitch pockets, none through.

C—F. G. or V. G. flooring.—Will admit medium torn grain; light sap stain, 15 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Two sound and tight small knots; 4 small (4-inch) pitch pockets, 2 of which may be through. Will admit cut-out of 2½ inches for a defect 4 feet or more from either end in pieces 12 feet and longer if piece is otherwise as good as B.

D—F. G. and/or V. G. flooring.—Will admit the following defects, equivalent defects, or equivalent combinations of defects: One inch sound and tight knots; numerous small pitch pockets (several of which may be through) or equivalent medium to large pitch pockets; large pitch streak; heart stain; medium sap stain; four heavy skips, each not over 12 inches long, based on 12-foot length; groove edge, hit and miss; scant tongue; torn grain; pin wormholes; seasoning checks; 1 knot hole in pieces 8 to 14 feet long, and two knot holes in pieces 16 feet or longer; wane (on reverse side) in addition to other permissible defects, one-third width, one-sixth length of piece.

Patterns.

Flooring patterns are illustrated in Figures 74 and 75.

Western Pine Manufacturers Association, grading rules for fir and white fir flooring, July 1, 1925.

Patterns.

Flooring patterns are illustrated in Figures 76 and 77.

411.24 Hemlock Flooring.

Northern Hemlock and Hardwood Manufacturers Association, sizes and grading rules for hemlock flooring, February 1, 1927.

Lumber of select or common quality manufactured according to size and pattern for flooring shall be manufactured in the following sizes and in conformity with the American Lumber Standard patterns and shall be graded according to the rules specified as follows:

Thickness and widths.

Thickness		Width		
Nominal board measure	Finished	Nominal board measure	Face width	Over-all width
Inches	*Inches*	*Inches*	*Inches*	*Inches*
1	25/32	3	2 3/8	2 5/8
1¼	1 1/16	4	3 1/4	3 1/2
1½	1 5/16	6	5 1/16	5 7/16

Lengths.

Standard lengths of flooring shall be 4 to 20 feet; with not to exceed 20 per cent of 8 or 9 foot lengths in mixed-length shipments of D and better flooring. In addition to these percentages, mixed-length shipments will admit 5 per cent of 6 and 7 foot in No. 1 common grades and an additional 5 per cent of 4 and 5 foot in No. 2 common grades. No. 3 grades shall admit lengths 4 to 20 feet, inclusive, with not to exceed 20 per cent of 4 and 6 foot lengths.

NOTE.—The above percentages of short lengths are customary and in the interest of conservation will be included so far as practicable in all shipments of mixed lengths.

Grades.

D and better, No. 1 common, No. 2 common, and No. 3 common.

Special provisions.—The face of the piece should be smoothly dressed and be free from wane on face side in No. 1 common and better grades. The reverse side of the piece must be of such a nature as not to cause waste in No. 1 common and better grades.

The tongue in matched patterns may be broken out over a length of 6 inches. In any grade the tongue or the covered edge may be ⅛ inch scant in width. Tongue or covered edge down to 1/16 inch wide may be admitted in No. 2 common, but scantness to this extent shall be considered a serious defect. Wane may extend not over half the thichness of the tongue or covered edge for a distance of one-third the length of a piece in No. 1 common and better grades.

The upper lip of the groove in matched patterns must be full width and without wane in No. 1 common and better grades. Wane extending completely through the lower lip will be permitted for one-third the length of a piece in No. 1 common and better grades.

D and better.—D and better flooring shall be graded according to the rules for D and better finishing, subject to the special provisions noted above.

All material must be of select appearance and quality.

The maximum size knots admissible in this grade shall not exceed ¾ inch in 4-inch flooring, or 1 and 6 inch widths.

The face of the piece shall be free from shake.

Pieces, 10 feet and longer, containing a knot hole or equivalent defect which may be removed in one cut without waste exceeding 4 inches in length may

be permitted, provided the balance of the piece is practically free from defects.

No. 1 common.—No. 1 common flooring shall be graded according to the rules for No. 1 common boards, subject to the special provisions noted above.

No. 2 common.—No. 2 common flooring is suitable for general building purposes and admits all defects permitted in No. 2 common boards, subject to the special provisions noted above.

No. 3 common.—No. 3 common flooring shall be graded according to the rules for No. 3 common boards, subject to the special provisions noted above.

Patterns.

Flooring patterns are illustrated in Figures 59, 60, and 73.

West Coast Lumbermen's Association, standard sizes and grading rules for west coast hemlock flooring, July 1, 1927.

Identical with those of this association for Douglas fir No. 411.23.

411.25 Maple Flooring.

Maple Flooring Manufacturers Association, grading rules and sizes for maple flooring, revised, effective September 1, 1927.

Grades.

First, second, and third.

First grade.—$\frac{25}{32}$ inch and thicker, shall have the face practically free of all defects, but the varying natural color of the wood shall not be considered a defect. Standard lengths in all widths in this grade shall be trimmed 2 to 16 feet; the proportion of lengths, 2 to 3½ feet, inclusive, shall be what the stock will produce up to 25 per cent.

This grade combines appearance and durability and has a face free of defects that will materially mar the appearance of the finished floor or impair its durability. It will be noted that the standard of appearance is that of a finished floor, not the top of a piano. A practical application of this rule will admit of mild discolorations, an occasional small firm pin knot not over ⅛ inch in diameter, occasional dark green or black spots or streaks not over ¼ inch wide and 3 inches long (or its equivalent) which may contain a slight check not over ½ inch long, birds-eye's and small burls, a slightly torn grain or similar defect which can be readily removed by the ordinary method of smoothing the floor when it is laid, a slightly shallow place not over 12 inches long on under side of flooring if it does not extend to either end of the piece, an otherwise perfect tongue which is one-half short for 25 per cent of length of piece is admissible, but the face must be free of shake and the wood must be live and sound.

Second grade.—$\frac{25}{32}$ inch and thicker will admit of tight, sound knots and slight imperfections in dressing, but must lay without waste. Standard lengths in all widths in this grade shall be trimmed 1½ to 16 feet; the proportion of lengths 1½ to 3½ feet, inclusive, shall be what the stock will produce up to 40 per cent.

This grade is made for service rather than appearance. It admits of tight, sound knots prominent discolorations, numerous dark green or black spots or streaks, slight checks not exceeding 3 inches in length and running parallel with and well inside of the edges of the strip, dark spots or streaks with slight checks in center, small rough spots which can not be wholly removed by the ordinary method of smoothing the floor when it is laid, slightly torn edges, short tongue if sufficient to hold properly in the floor, shallow or waney back of piece has sufficient bearings of full thickness to support it in floor, and slight variation in angle of end matching. While these and similar features are admissible, sufficient attention is given to appearance to make this grade desirable and satisfactory for use in stores, school houses, and similar places where a waxed or varnished floor is not required.

Third grade.—$\frac{25}{32}$ inch and thicker must be of such character as will lay and give a good serviceable floor. Standard lengths in all widths in this grade shall be trimmed 1 to 16 feet; the proportion of lengths 1 to 3½ feet, inclusive, shall be what the stock will produce up to 60 per cent.

The factory grade is suitable for factory, warehouse, and kindred uses where good wearing qualities are required, together with medium cost and appearance. This grade may contain all defects common to maple, beech, and birch, but the wood must be firm and serviceable. It will not admit of voids on edges or knot holes over ⅜ inch in diameter; partially unsound knots where the unsound portion is over 1 inch in diameter; or shakes, heart checks, badly split ends and imperfections in manufacture which materially impair the serviceability of the flooring for the purpose intended.

Special grade.—White clear maple is special stock, selected for uniformity of color. It is almost ivory white and is the finest grade of maple flooring it is possible to produce.

Standard thicknesses and faces.

Clear, No. 1 and factory grades

Standard thickness (inches)	Faces or widths (inches)
$\frac{25}{32}$	1½ 2 2¼ 3¼
Special thicknesses	
$\frac{33}{64}$ $\frac{41}{64}$ $\frac{53}{64}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$	--- 2 2¼ 3¼ 1½ 2 2¼ ---

Standard measurement.

Flooring ⅝ inch and thicker, all faces, is measured ¾ inch waste for matching.

Flooring ½ inch and thinner, all faces, is measured ½ inch waste for matching.

Jointed flooring, all thicknesses and faces, is measured ½ inch waste.

Kiln drying.

Flooring shall not be considered of standard grade unless the lumber from which the flooring is manufactured has been properly kiln dried.

End matching.

All flooring shall be end matched unless otherwise specified.

Custom in bundling.

It is the custom in bundling flooring to give and take by including pieces of flooring 3 inches over and 3 inches under the length marked on the bundle, and to include some pieces of flooring 3 inches under the minimum lengths specified in the grading rules.

National Hardwood Lumber Association has adopted the maple flooring grading rules of the Maple Flooring Manufacturers Association, above.

411.26 Oak Flooring.

National Hardwood Lumber Association has adopted the oak flooring grading rules of the Oak Flooring Manufacturers Association of the United States, below.

Oak Flooring Manufacturers' Association of the United States, grading rules for flooring, March 4, 1927.

Of the following rules those for clear, sap clear, and select, apply to quarter sawed flooring and those for clear, select, No. 1 common, and No. 2 common apply to plain sawed flooring.

Clear.

Shall have one face practically free of defects except ⅜ of an inch of bright sap; the question of color shall not be considered.

Sap clear.

Shall have one face practically free of defects, but will admit unlimited bright sap. The question of color shall not be considered.

Select.

May contain sap, and will admit pin wormholes, streaks, slight imperfections in working or a small, tight knot, not to exceed one to every 3 feet in length.

No. 1 common.

Shall be of such nature as will make and lay a sound floor without cutting.

No. 2 common.

May contain defects of all characters, but will lay a serviceable floor with some cutting.

Bundles to be 1¼ feet and up. Average length 2½ feet.

NOTE.—Oak flooring is bundled by averaging the lengths. A bundle may include pieces from 6 inches under to 6 inches over the nominal length of the bundle. No piece shorter than 9 inches admitted.

The percentage under 4 feet referred to above apply on total feetage in any one shipment of the item.

Three-fourths inch allowance shall be added to the tongue on the end matching when measuring the lineal length of each piece of oak flooring.

Standard thicknesses and widths

$\frac{13}{16}$ inch thickness; widths 1½, 2, and 2¼ inch face.

⅜ inch thickness; widths 1½ and 2 inch face.

½ inch thickness; widths 1½ and 2 inch face.

Above tongued and grooved and end matched

$\frac{5}{16}$ inch thickness; square edge, 1½, 2 inch, and special faces.

Standard measurement

$\frac{13}{16}$ inch thickness all faces, count ¾ inch allowance for matching.

⅜ inch thickness all faces, count ½ inch allowance for matching.

½ inch thickness all faces, count ½ inch allowance for matching.

$\frac{5}{16}$ inch thickness square edge all faces, count face count.

Standard counts of oak flooring

Nominal	Actual	Counted
Inches	*Inches*	*Inches*
$\frac{13}{16}$ by 2¼	$\frac{25}{32}$ by 2¼	1 by 3
$\frac{13}{16}$ by 2	$\frac{25}{32}$ by 2	1 by 2¾
$\frac{13}{16}$ by 1½	$\frac{25}{32}$ by 1½	1 by 2¼
⅜ by 2	$\frac{11}{32}$ by 2	1 by 2½
⅜ by 1½	$\frac{11}{32}$ by 1½	1 by 2
½ by 2	$\frac{15}{32}$ by 2	1 by 2½
½ by 1½	$\frac{15}{32}$ by 1½	1 by 2
$\frac{5}{16}$ by 2	$\frac{5}{16}$ by 2	Face count.
$\frac{5}{16}$ by 1½	$\frac{5}{16}$ by 1½	Face count.

411.27 Pine Flooring.

Arkansas Soft Pine Bureau, sizes and grades for soft pine flooring, March 23, 1927.

The sizes and grades for soft pine flooring are similar to those of the Southeastern Forest Products Association and the Southern Pine Association. (See below.)

Arkansas Soft Pine Bureau, sizes and grades for soft pine factory flooring, March 23, 1927.

The sizes and grades for soft pine factory flooring are similar to those of the Southeastern Forest Products Association and the Southern Pine Association. (See below.)

Patterns.

Flooring patterns are illustrated in Figures 59, 60, and 73.

California White and Sugar Pine Manufacturers Association, sizes and grades for California white pine and sugar pine flooring, May 1, 1926.

See table of sizes and grading rules of this association in 411.1.

North Carolina Pine Association (Inc.), sizes and grades for kiln-dried and air-dried North Carolina pine flooring, January 1, 1927.

Standard sizes identical with American Lumber Standards. In addition thereto the association has the following "super standards."

Thicknesses in inches: ⅜, ½, ⅝, $\frac{13}{16}$, $1\frac{1}{16}$, and $1\frac{5}{16}$.

Widths in inches: 1½, 2½, 3½, 4½, and 5½.

Grades.

B and better, No. 1 common, and No. 2 common.

The grades of flooring are based upon a piece 4 inches wide by 12 feet long, or a piece having 4 square feet, surface measure; on this basis, larger or smaller pieces will admit a proportionate number of defects.

Mismatch, due to variation in manufacture, or change in moisture content not to exceed $\frac{1}{32}$ inch shall be permissible in B and better flooring.

Variations in width not to exceed $\frac{1}{32}$ inch will be permissible in B and better flooring, and not to exceed $\frac{1}{16}$ inch in No. 1 and No. 2 common flooring.

Pieces of flooring with $\frac{3}{16}$ inch or more of tongue will be admitted in any grade.

Pieces of flooring having not less than $\frac{1}{16}$ inch of tongue will be admitted in No. 2 common.

B and better flat flooring will admit two or combination of two of any of the following defects or their equivalent: Small surface checks; four pin worm holes; slight torn grain, three pin knots, two small knots, one standard knot, three small pitch pockets, two medium pitch pockets, one standard pitch pocket, three small pitch streaks, two medium pitch streaks, one standard pitch streak, 15 per cent firm red heart, 5 per cent stain.

No. 1 common and better grades of flooring, wane on the reverse side, equivalent to one-third the width and one-sixth the length of the piece, is admissible provided the wane does not extend into the tongue or groove; it may, however, extend into the groove or for one-half the thickness of the tongue for a length of 10 inches, provided the maximum width and length decrease in proportion to the increase in depth.

No. 1 common flat flooring will admit the following defects or their equivalent: Surface checks; limited number of pin worm holes, well scattered; loosened or heavy torn grain or other machine defects that will lay without waste; sound knots not over one-half the cross section of the piece in the rough; three pith knots; pitch pockets; pitch; pith, not exceeding 6 inches in length; shake that does not go through; short split, equal in length to width of piece; firm red heart; stain.

Pieces otherwise as good as B and better flooring may have one defect, such as a knot hole, that can be cut out by wasting not to exceed 2 inches of their length, provided both pieces are 32 inches or over in length after cutting out such defects.

No. 2 common flooring will admit all pieces that will not grade as good as No. 1 common flooring which can be used for cheap floors without a waste of more than one-fourth the length of any one piece.

Lengths of flooring are from 6 to 16 feet in multiples of 1 foot, not to exceed a total of 10 per cent of 6, 7, 8, and 9 foot lengths.

Special grading provisions.

The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 common and better grades of flooring:

3-inch widths	3½-inch crook.
4-inch widths	3-inch crook.
6-inch widths	2½-inch crook.

Lengths longer or shorter than 16 feet may have proportionate amounts of crook.

Factory flooring.

Lengths same as above.

Grade same as No. 2 common (except as to crooks).

Unless otherwise specified, factory flooring shall be worked tongued and grooved.

Patterns.

Flooring patterns are illustrated in Figures 48 to 58.

Northern Pine Manufacturers Association, rules for the grading of northern white and Norway pine flooring, April 15, 1925.

Size.

The location and size of tongue and groove, bead, and other workings shall conform to the patterns of the American Lumber Standards or as published by the Northern Pine Manufacturers Association.

Grades.

D, No. 1 common, No. 2 common, and No. 3 common.

D flooring.—D flooring shall be graded according to the rule for D finish. In the knotty type the knots must be smaller and fewer in number than in No. 1 common flooring. Medium stain covering the entire piece is allowed, or tight local shake, season checks, and defective machine work, or any other defects admissible in D select finish that will not cause waste in the use of the piece; except defects requiring one cut, with not to exceed 4 inches of waste, are allowed in high-line pieces 12 feet long and longer.

No. 1 common dressed and matched flooring.—This should be simply sound No. 1 common and of the character, when worked, described under the title of No. 1 common boards and strips. (See 402.41 and 402.42.)

No. 2 common dressed and matched flooring.—This should be simply No. 2 common, and of the character, when worked, described under the title of No. 2 common strips. (See 402.41.)

No. 3 common dressed and matched flooring.—No. 3 common dressed and matched may contain coarse knots, an occasional knot hole, splits, wane, wormholes, streaks of red rot, and a great deal of shake, but not a serious combination of these defects.

Special grading provisions.—The face of the piece must be smoothly dressed and be free from wane, except in drop siding where wane equivalent to admissible torn grain will be allowed. The reverse side of pieces of flooring must be of such a nature as to not cause waste in No. 1 common and better grades, except as specified in D grade, and wane not exceeding one-third the width and one-sixth the length of the piece may be allowed.

In D and No. 1 common the tongue or lap may be broken out over a length of 6 inches. In any grade the tongue or covered edge may be $\frac{1}{16}$ inch scant in width. Tongue or covered edge down to $\frac{1}{16}$ inch wide may be admitted in No. 2 common. Wane may exceed not over one-half the thickness of the tongue or covered edge, and completely through the lower lip of the groove for a distance of one-fourth the length of the piece. The upper lip of the groove

or upper lap must be full width and without wane in No. 1 common and better grades.

Defects, such as loose knots or knot holes on the thin or covered edge of siding, or the lap of ship-lap, which will be covered when laid, should not be given the same consideration as defects elsewhere.

Small crook will be allowed in all grades.

Six-inch flooring and all other matched patterns shall be worked S1S or S2S and CM.

Southeastern Forest Products Association, sizes and grades for southern pine flooring, September 1, 1925.

Identical with those of the Southern Pine Association, with the following statements relating to short length end-matched flooring.

Short length end-matched flooring.

Standard finished thicknesses.—$\frac{7}{16}$, $\frac{25}{32}$, and $1\frac{1}{16}$ inches.

Special finished thicknesses.—$\frac{13}{16}$ inch.

Standard face widths.—1½, 2⅜, and 3¼ inches.

Special face widths.—2 and 2½ inches.

Standard lengths.—12 inches to 7 feet 6 inches in multiples of 1 inch or fraction thereof.

Standard grades.

A, B, C, D, No. 1 common, No. 2 common, and No. 3 common.

A end-matched flooring must be practically free from defects on the face side and well manufactured.

B end-matched flooring will admit one of the following defects in lengths up to and including 7 feet 6 inches: Small surface checks; 2 pin wormholes; slight torn grain; pin knot; small pitch pocket; small pitch streak.

C end-matched flooring will admit two or a combination of two of any of the following defects or their equivalent in lengths up to and including 7 feet 6 inches: Surface checks; 6 pin wormholes; medium torn grain; pin knots; small pitch pockets; small pitch streaks; 5 per cent stain; 10 per cent firm red heart.

D end-matched flooring will admit any one of the following defects or their equivalent in lengths up to and including 7 feet 6 inches: Surface checks; limited number of pin wormholes; heavy torn grain or other machine defects that will lay without waste; sound knots, not to exceed 1 inch in diameter; 3 pin knots; 1 standard pitch pocket; 3 small pitch pockets; 10 per cent pitch; shake that does not go through; 15 per cent firm red heart or stain.

No. 1 common end-matched flooring is the combined grades of C and D, and will admit all pieces that will not grade B, and are better than No. 2 common.

No. 2 common end-matched flooring must lay a serviceable floor without cutting, and will admit any number of the following defects or their equivalent: Sound knots, or knots not necessarily sound, but so fixed by growth or position that they will retain their place in the piece, the average diameter of any one knot not to exceed one-half the cross section of the piece in the rough; checks; pin wormholes; loosened or heavy torn grain or other machine defects; pitch pockets; pitch; shakes; firm red heart; stain.

No. 3 common end-matched flooring will admit all pieces which will not grade as good as No. 2 common end-matched flooring and may contain, in addition, the following defects: Knots not necessarily sound; wormholes; rough skips in dressing; slight wane; deep torn grain; splits; shakes; red heart; or other equivalent defects.

Special grading provisions.

D and better end-matched flooring will admit wane on the reverse side equivalent to one-third the width and one-sixth the length of the piece, provided the wane does not extend into the tongue or groove.

Southeastern Forest Products Association, sizes and grades for southern pine factory flooring, September 1, 1925.

The sizes of pine factory flooring conform to the table of sizes for factory flooring, heavy roofing, decking, and sheet piling of the American Lumber Standards, 411.0, yard lumber.

Grades.

No. 1 common.

Lengths.

Standard lengths are 10 to 24 feet, inclusive, in multiples of 2 feet.

Special provisions.

The amount of crook permissible in heavy patterned material will be the same as permitted in dimension of the same grade, width, and length.

Pieces of D and M with $\frac{5}{16}$ inch or more of tongue and ship-lap with ⅜ inch or more of lap, will be admitted in No. 1 common. Pieces of D and M having not less than ⅛-inch tongue, and ship-lap having not less than $\frac{3}{16}$-inch lap, will be admitted in No. 2 common.

In No. 1 common, wane on the reverse side, equivalent to one-third the width and one-sixth the length of the piece is admissible, provided the wane does not extend into the tongue or groove in dressed and matched stock or for one-half the thickness of the lap in ship-lapped stock. It may, however, extend into the groove or through the lap, or for one-half the thickness of the tongue, for a length of 10 inches, provided the maximum width and length decrease in proportion to the increase in depth.

Standard workings.

The standard workings for heavy flooring shall be as follows: For 2 and 2½ inch material, the tongue should be ⅜ inch thick and ⅜ inch wide. For 3-inch and thicker material, the tongue should be ¾ inch thick and ⅜ inch wide. The groove in heavy matching should be $\frac{1}{16}$ inch wider than the thickness of the tongue and $\frac{1}{16}$ inch deeper than the width of the tongue. (See figs. 59, 60, and 73.)

Tongue and groove shall be located one-fourth the thickness of the rough material from the bottom of the piece. (See figs. 59, 60, and 73.)

In 2 inches and thicker material grooved for splines, the groove should be the same width and depth as is provided for in matched material of the same thickness. (See figs. 9 and 10.)

The lap in heavy ship-lap shall be ½ inch wide, occupying one-half the finished thickness of the piece. (See fig. 137.)

No. 1 common factory flooring, decking, and heavy ship-lap.—Must be suitable for use without waste, and will admit the following defects, or their equivalent: Any number of sound knots, the average diameter of any one knot not to exceed approximately one-half of the cross section of the piece, in the rough, at any point throughout the length; pith knots which will not cause a leakage of grain; surface checks; a limited number of pin wormholes; loosened or heavy torn grain, or other machine defects that will lay without waste, and will not cause a leakage of grain; pitch pockets; pitch; pith, one-sixth the length of the piece; shakes that do not go through; firm red heart; stain; wane ¼ inch deep on the edge, ½ inch wide, and one-sixth the length of the piece.

Patterns.

Flooring patterns are illustrated in Figures 59, 60, and 73.

Southern Pine Association, sizes and grades for southern pine flooring, March 23, 1927.

The grades of flooring are based upon a piece 4 inches wide by 12 feet long, or a piece having 4 square feet, surface measure; on this basis, larger or smaller pieces will admit a proportionate number of defects.

Grades are designated as A, B, C, D, No. 1 common, and No. 2 common, flat grain and vertical grain.

Thicknesses and widths.

Size, board measure		Dressed dimensions at commercially dry shipping weight		
Thickness	Width	Thickness	Face width	Over-all width
Inches	*Inches*	*Inches*	*Inches*	*Inches*
----------	2	5/16	1½	1¾
----------	3	7/16	2⅝	2⅝
----------	4	9/16	3¼	3½
1	5	25/32	4¼	4½
1¼	6	1 1/16	5 5/16	5 7/16
1½	----------	1 5/16	----------	----------

The thicknesses apply to all widths and the widths to all thicknesses, except for over-all widths, as follows: In tongued and grooved flooring 5/16, 7/16, and 9/16 inch thick, board measure, the tongue shall be 3/16 inch wide, and the over-all widths 1/16 inch less than shown above.

Lengths.

Standard lengths are 4 to 20 feet, inclusive, and the following percentages of short lengths may be included in all miscellaneous or mixed-length shipments:

A and B----------	5 per cent 8 and/or 9 foot.
C, D, and No. 1 common----------	5 per cent 6 and/or 7 foot. 5 per cent 8 and/or 9 foot.
No. 2 common----------	5 per cent 4 and/or 5 foot. 5 per cent 6 and/or 7 foot. 5 per cent 8 and/or 9 foot.
No. 3 common----------	Not to exceed 20 per cent 4 and 6 foot lengths.

Special grading provisions.

The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 common and better grades of flooring:

3-inch widths----------	3½-inch crook.
4-inch widths----------	3-inch crook.
6-inch widths----------	2½-inch crook.

Lengths longer or shorter than 16 feet may have proportionate amounts of crook.

Mismatch, due to variation in manufacture, or change in moisture content, not to exceed 1/32 inch shall be permissible in C and better flooring.

Variations in width not to exceed 1/32 inch will be permissible in B flooring, and not to exceed 1/16 inch in C and D flooring.

Standard knots shall not exceed 1¼ inches in diameter in 3-inch flooring.

Pieces of flooring with 3/16 inch or more of tongue will be admitted in any grade.

Pieces of flooring having not less than 1/16 inch of tongue will be admitted in No. 2 common.

In D and better grades of flooring, wane on the reverse side, equivalent to one-third the width and one-sixth the length of the piece, is admissible, provided the wane does not extend into the tongue or groove; it may, however, extend into the groove or for one-half the thickness of the tongue for a length of 10 inches, provided the maximum width and length decrease in proportion to the increase in depth.

Southern pine flooring shall be classified as to grain, as vertical (edge) grain and flat (slash) grain. Material shall be considered vertical grain when the rings (so-called grains) form an angle of 45° or more with the surface of the piece. When the angle becomes less than 45° at any point, the material shall be classed as flat (slash) grain.

Standard Workings.

The standard working of flooring, 1, 1¼, and 1½ inches thick, 4 inches and under in width, shall be S2S, standard matched (SM) and scratched or hollowed back, with tongue or groove located 7/32 inch from bottom of piece.

Center matched flooring (S2S and CM) shall be required to come up to grade on one side only, and the defects admissible on the reverse side of standard matched flooring shall be allowed.

Grades.

A flat grain flooring must be practically free from defects on the face side and well manufactured.

B flat grain flooring will admit two or combination of two of any of the following defects or their equivalent: Small surface checks; four pin wormholes; slight torn grain; three pin knots; two small knots; one standard knot; three small pitch pockets; two medium pitch pockets; one standard pitch pocket; three small pitch streaks; two me-

dium pitch streaks; one standard pitch streak; 15 per cent firm red heart; 5 per cent stain.

C flat grain flooring will admit two or combination of two of any of the following defects or their equivalent: Surface checks; 12 pin wormholes; medium torn grain, or other machine defects that will lay without waste; six pin knots; four small knots; two standard knots; six small pitch pockets; four medium pitch pockets; two standard pitch pockets; two standard pitch streaks or their equivalent; slight shake that does not go through; 25 per cent firm red heart; 15 per cent stain.

D flat grain flooring will admit the following defects or their equivalent: Surface checks; limited number of pin wormholes, well scattered; loosened or heavy torn grain, or other machine defects that will lay without waste; sound knots, not over ½ the cross section of the piece in the rough; three pith knots; pitch pockets; pitch; pith, not exceeding 6 inches in length; shake that does not go through; short split, equal in length to width of piece; firm red heart; stain.

Pieces otherwise as good as B flooring may have one defect, such as knot hole, that can be cut out by wasting not to exceed 2 inches of their length, provided both pieces are 32 inches or over in length after cutting out such defects.

No. 1 common flooring is the combined grades of C and D flooring, and will admit all pieces that will not grade B, and are better than No. 2 common.

No. 2 common flooring will admit all pieces that will not grade as good as D flooring, which can be used for cheap floors without a waste of more than ¼ the length of any one piece.

NOTE.—All pieces that can not be used as No. 2 common flooring, but are suitable for use as cheap sheathing or lathing, without a waste of more than one-fourth the length of any one piece will be graded as No. 3 common sheathing. Vertical grain flooring shall be graded under the same rules as flat grain, except as to the angle of the grain. Heart face flooring shall be free from sapwood on the face side.

Southern Pine Association, sizes and grades for southern pine factory flooring, March 23, 1927.

The sizes and grades for southern pine factory flooring of this association are the same as those of the Southeastern Forest Products Association. (See above.)

Patterns.

Flooring patterns are illustrated in Figures 59, 60, and 73.

Southern Pine Association, Gulf coast classification of pitch pine flooring, 1923.

Thicknesses and widths (in inches).

1 by 3, 3½, 4, 4½, 5, 6, 7.
1¼ by 3, 3½, 4, 4½, 5, 6, 7.
1½ by 3, 4, 5, 6, 7.
1¾ by 3, 4, 5, 6, 7.

Lengths.

Ten feet and up; 5 per cent 8 and 9 feet allowed.

Grades.

Heart rift, sap rift, crown or french flooring, prime, Genoa prime, merchantable, square edge.

Heart rift.—Must be all heart, except that 1-inch of sap on one corner, measured across the corner, will be permitted; must show rift grain of an angle of not more than 45° from the vertical the entire length, and be free from unsound knots, loose knots, pith knots, knot holes,through splits, shakes, wane, rot, pin wormholes, grubworm holes, pitch pockets exceeding ⅛ inch in width, pith on face and knots exceeding 1 inch in diameter; provided that 80 per cent shall be free from knots. Pitch permissible, if not in excess of one-fourth of the area of the face. Firm red heart permissible, if not in excess of 15 per cent of the area of the face.

Sap rift.—Must be kiln dried and grade the same as heart rift, but may be part or all sap and will permit sap stain on 20 per cent of the pieces, provided no piece shall show sap stain on more than 15 per cent of its face.

Crown or French flooring.—Must be bright, one heart face, except ½ inch sap, measured across the face of the piece, will be permitted on the heart side on not over 20 per cent of the pieces; must be free from unsound knots, loose knots, pith knots, knot holes, through splits, through shakes, pitch pockets exceeding ⅛ inch in width, wane, pin wormholes, grubworm holes, rot, and pith. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Not to have more than one knot 1 inch on the 3, 3½, 4, and 4½ inch; or one knot 1¼ inch on the 5, 6, and 7 inch, to each 6 feet or fraction thereof; provided that 90 per cent shall be free of knots. Pitch permissible if not in excess of 25 per cent of the area of the face.

Prime.—Must be one heart face, except ½ inch sap, measured across the face of the piece, will be permitted on the heart side on not over 20 per cent of the pieces; must be free from unsound knots, loose knots, pith knots, knot holes, through splits, through shakes, pitch pockets exceeding ¼ inch in width, wane, pin wormholes, grubworm holes, rot, and pith. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Not to have more than one knot 1 inch on the 3, 3½, 4, and 4½ inch; or one knot 1¼ inch on the 5, 6, and 7 inch, to each 6 feet or fraction thereof; provided that 80 per cent shall be free of knots.

Genoa prime.—Must be one heart face, except ½ inch sap, measured across the face of the piece, permissible on one corner of the heart face; must be free from pith knots, unsound knots, loose knots, knot holes, pin wormholes, grubworm holes, wane, rot, through splits, and through shakes. Firm red heart permissible, if not in excess of 15 per cent of the area of the face.

Merchantable.—Must show two-thirds heart on the face and show some heart on the opposite side; must be free from unsound knots, loose knots, grubworm holes, knot holes, rot, through splits, and through shakes. Firm red heart permissible, if not in excess of 15 per cent of the area of the face. Twenty per cent of the pieces will permit wane 1 inch wide measured across the face of the wane, one-fourth the length of the piece on one corner, or the equivalent on two or more corners.

Square edge.—Must be free from unsound knots, loose knots, knot holes, grubworm holes, rot, and splits and shakes, the length of which exceeds the width of the piece. Twenty-five per cent of the pieces will permit wane 1 inch wide measured across the face of the wane, one-third of the length of the piece on one corner, or the equivalent on two or more corners.

Western Pine Manufacturers Association, grading rules for Pondosa pine and Idaho white pine flooring, July 1, 1925.

Patterns.

Flooring patterns are illustrated in Figures 76 and 77.

411.28 Spruce Flooring.

Northern Pine Manufacturers Association, rules for the grading of spruce flooring, April 15, 1925.

Sizes.

The location and size of tongue and groove, bead, and other workings shall conform to the patterns of the American Lumber Standards or as published by the Northern Pine Manufacturers Association.

Grades.

Identical with those for pine. (See 411.27.)

West Coast Lumbermen's Association, standard sizes and grading rules for spruce flooring, July 1, 1926.

The sizes for standard thicknesses and standard widths for spruce flooring are the same as those for Douglas fir. (See 411.23.)

Grade "B and better."

B and better flooring.—Shall be well manufactured. Will admit slight torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: One sound and tight pin knot; three very small (2-inch) pitch pockets, none through.

Western Pine Manufacturers Association, grading rules for spruce flooring, July 1, 1925.

Patterns.

Flooring patterns are illustrated in Figures 76 and 77.

411.29 Miscellaneous Flooring.

California Redwood Association, standard specifications for eastern grades of California redwood flooring, April, 1927.

The sizes of flooring are as shown in this association's table of sizes for yard lumber, 411.0.

The grades of flooring are based upon a piece 4 inches wide by 12 feet long, or a piece having 4 square feet surface measurement; on this basis larger or smaller pieces will admit a proportionate number of defects.

Grades.

Clear heart (Redwood Association grade), and A and B (American Standard redwood grades).

Lengths.

Standard lengths shall be 4 to 20 feet, inclusive, in multiples of 1 foot up to and including 9 feet; and in multiples of 2 feet in 10 to 20 feet; admitting not to exceed 15 per cent of 4 to 9 foot lengths.

Special provisions.

Small crook shall be permissible in clear and A grades and medium crook in B grade.

Pieces of flooring with tongue not more than $\frac{1}{16}$ inch scant of standard width will be admitted in any grade. In B grade the tongue may be broken out over a length of 6 inches.

Standard workings.

Flooring shall be worked to the patterns published by the California Redwood Association.

Flooring shall be graded according to the rules for the respective grades of finish, except that any amount of sapwood will be allowed.

In B grade pieces 10 feet and longer, containing defects that can be removed in two cuts with waste not to exceed 10 per cent of the length, will be allowed, provided that not more than 20 per cent of any one bundle shall be of said cutting type.

California Redwood Association, standard specifications for eastern grades of California redwood factory flooring, April, 1927.

The sizes of factory flooring are as shown in the table of sizes for factory flooring, heavy roofing, decking and sheet piling, American Lumber Standards, yard lumber, 411.0.

The grades of factory flooring, heavy roofing, and decking are as follows:

Grades.

No. 1 common and No. 2 common.

Lengths.

Standard lengths shall be the same as specified for dimension and heavy joist.

Special provisions.

Factory flooring, etc., may be worked to standard sizes either green or commercially dry.

The amount of crook and cup permissible in factory flooring, etc., shall be the same as allowed in No. 1 and No. 2 common boards.

Standard workings.

Pieces of D and M with $\frac{5}{16}$ inch or more of tongue and ship-lap with $\frac{3}{8}$ inch or more of lap will be admitted in No. 1 common. Pieces of D and M having not less than $\frac{1}{8}$-inch tongue and ship-lap having not less than $\frac{3}{16}$ inch lap, will be admitted in No. 2 common.

No. 1 common factory flooring, etc., will admit any of the defects or their equivalent allowed in No. 1 common dimension, except wane on the reverse side equivalent to one-third the width and one-sixth the length of the piece, may be permitted provided it does not extend into the tongue and groove in dressed and matched stock or for one-half the thickness of the lap in ship-lapped stock on the face side.

No. 2 common factory flooring, etc., will admit any of the defects or their equivalent allowed in No. 2 common dimension.

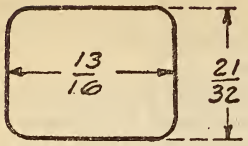


FIG. 48.—*Standard spline for 2, 2½, and 3 inch factory flooring*

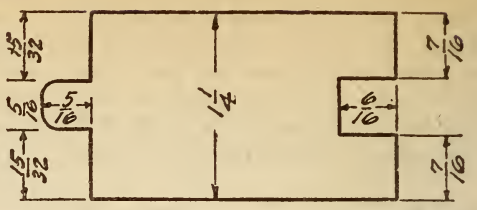


FIG. 49.—*1½-inch T. and G. factory flooring*

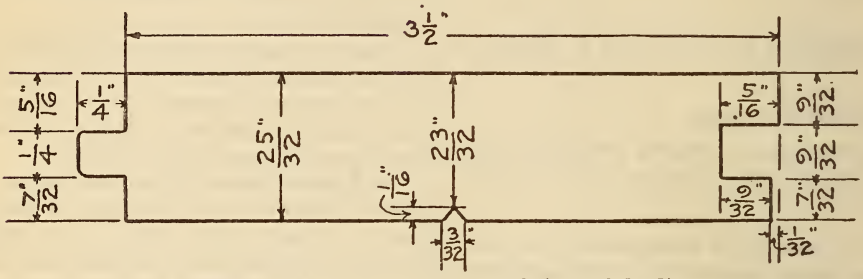


FIG. 50.—$\frac{25}{32}$ *flooring standard match (scratch back)*

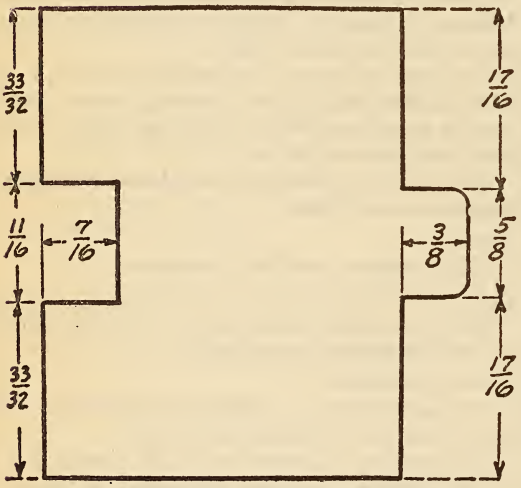


FIG. 51.—*3-inch T. and G. factory flooring*

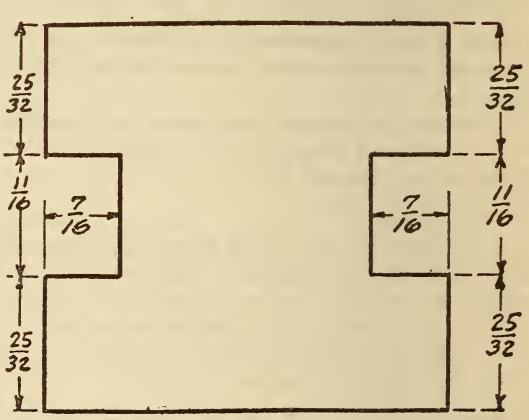


FIG. 52.—*2½-inch factory flooring grooved for splines*

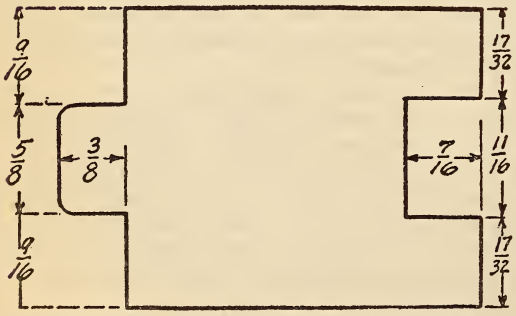


FIG. 53.—*2-inch T. and G. factory flooring*

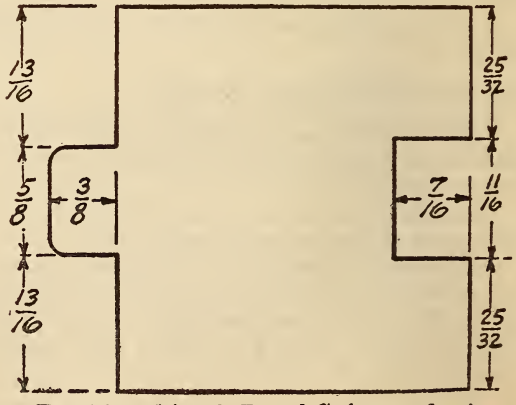


FIG. 54.—*2½-inch T. and G. factory flooring*

All North Carolina Pine Association

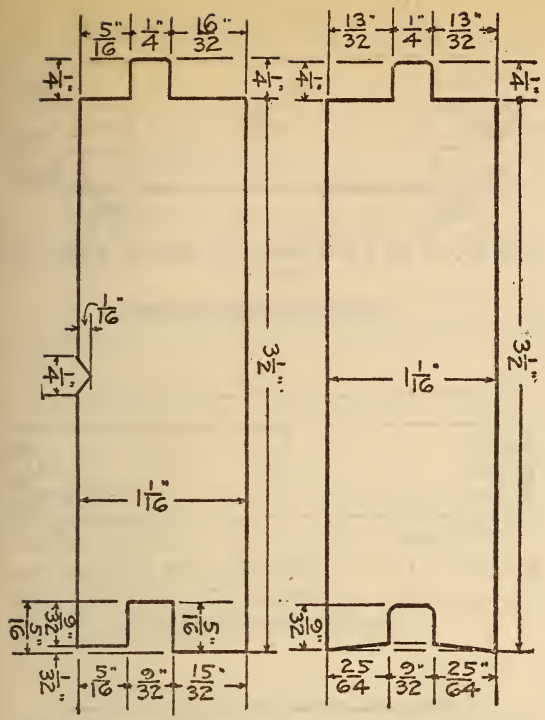


FIG. 55.—*5/4 flooring (standard match, scratch back)*

FIG. 56.—*5/4 flooring (center match)*

North Carolina Pine Association

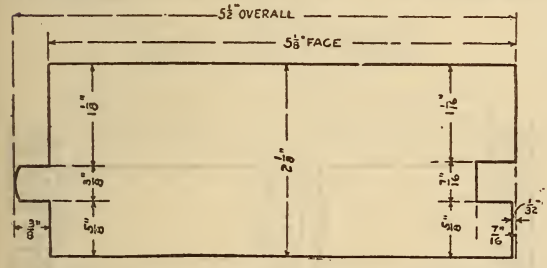


FIG. 59.—*Standard sizes of hemlock heavy flooring, 2½-inch flooring*

Northern Hemlock and Hardwood Manufacturers Association
Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

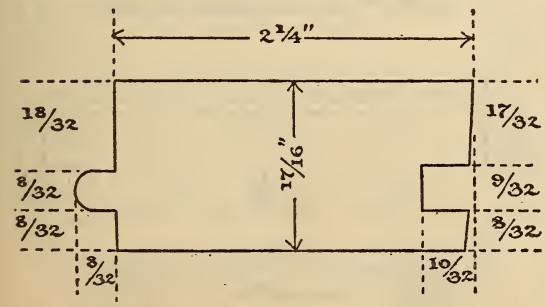


FIG. 61.—*1¼ by 3 inch kiln-dried flooring, green, 2⅜-inch face*

Pacific Lumber Inspection Bureau

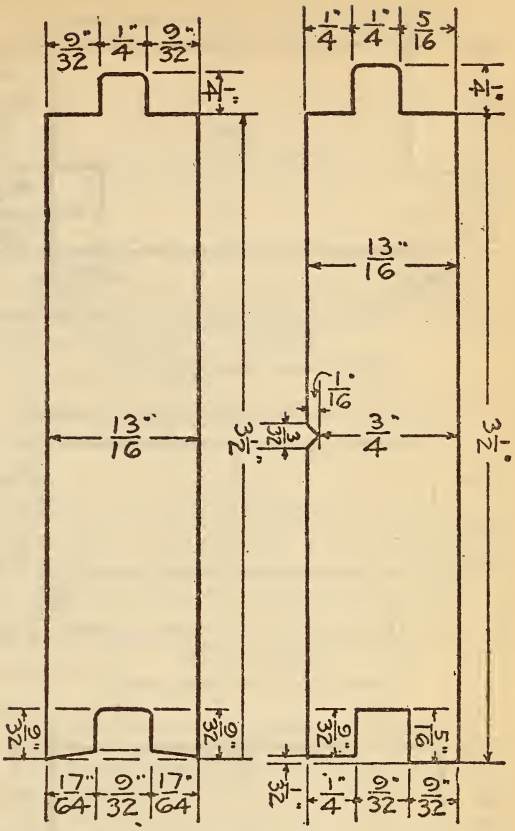


FIG. 57.—*13/16 flooring (center match)*

FIG. 58.—*13/16 flooring (standard match, scratch back)*

North Carolina Pine Association

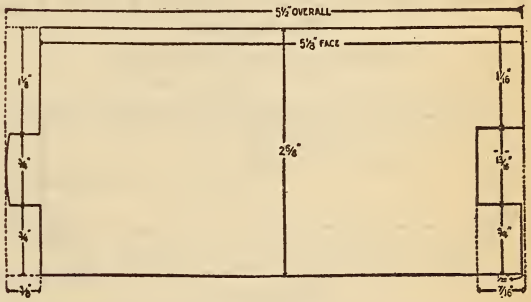


FIG. 60.—*Standard sizes of hemlock heavy flooring, 3 by 6 flooring*

Northern Hemlock and Hardwood Manufacturers Association
Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

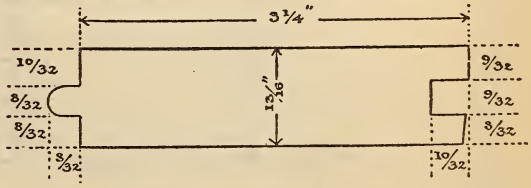


FIG. 62.—*1 by 4 inch kiln-dried flooring, green, 3⅜-inch face*

Pacific Lumber Inspection Bureau

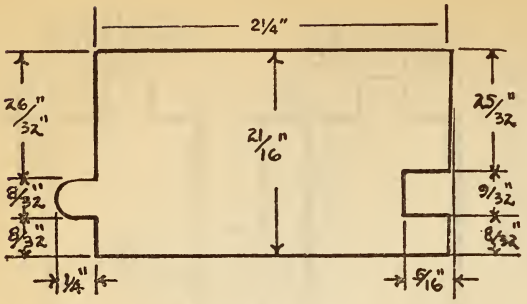


FIG. 63.—*1½ by 3 inch kiln-dried flooring, green, 2⅜-inch face*

Pacific Lumber Inspection Bureau

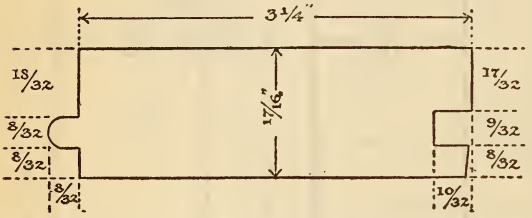


FIG. 65.—*1¼ by 4 inch kiln-dried flooring, green, 3⅜-inch face*

Pacific Lumber Inspection Bureau

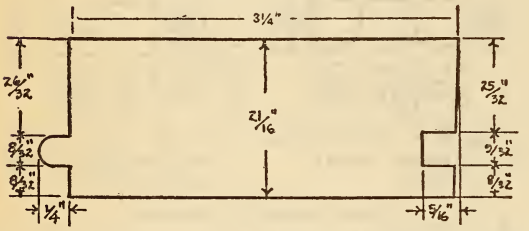


FIG. 67.—*1½ by 4 inch kiln-dried flooring, green, 3⅜-inch face*

Pacific Lumber Inspection Bureau

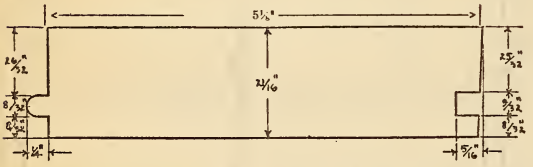


FIG. 69.—*1½ by 6 inch kiln-dried flooring, green, 5⅜-inch face*

Pacific Lumber Inspection Bureau

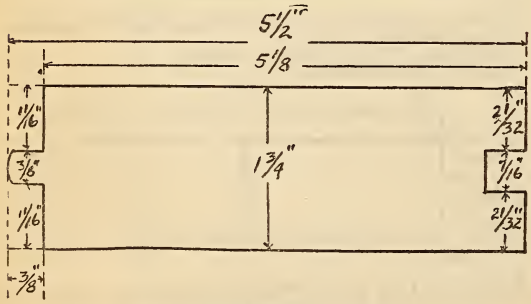


FIG. 71.—*2 by 6 flooring*

Southern Cypress Manufacturers Association

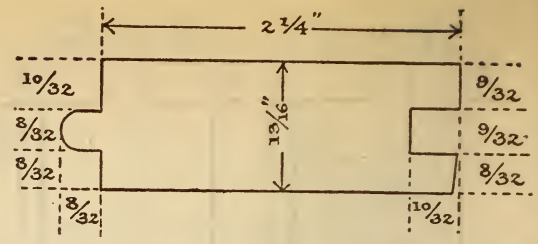


FIG. 64.—*1 by 3 inch kiln-dried flooring, green, 2⅜-inch face*

Pacific Lumber Inspection Bureau

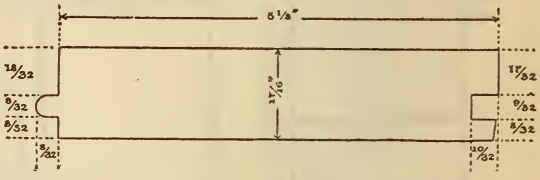


FIG. 66.—*1¼ by 6 inch kiln-dried flooring, green, 5⅜-inch face*

Pacific Lumber Inspection Bureau

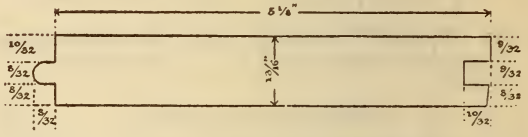


FIG. 68.—*1 by 6 inch kiln-dried flooring, green, 5⅜-inch face*

Pacific Lumber Inspection Bureau

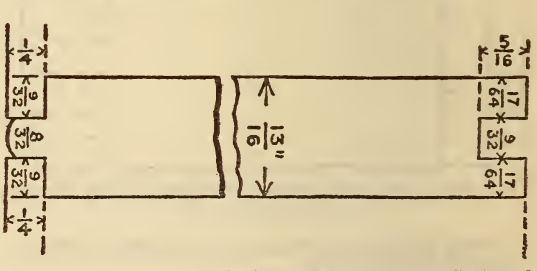


FIG. 70.—*Inch floor S2S to 13/16 inch and CM with reduction in nominal widths of ¾ inch*

Southern Cypress Manufacturers Association

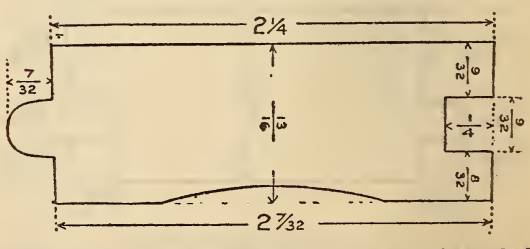


FIG. 72.—*1 by 3 inch tupelo flooring, also furnished in 1½ and 3¼ inch widths*

Southern Cypress Manufacturers Association

Maple Flooring Manufacturers Association, grading rules and sizes for beech and birch flooring, August 25, 1926.

Identical with this association's grading rules and sizes for maple flooring. See 411.25 with the following special grades:

Red clear beech and red clear birch manufactured from all red face stock, especially selected for color. The color is a rich warm tint peculiar to no other wood.

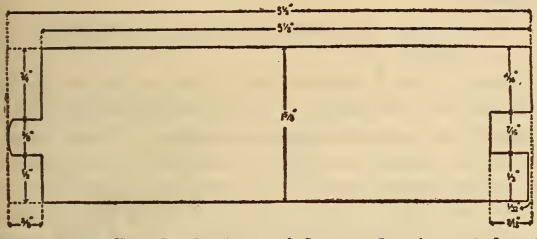


FIG. 73.—*Standard sizes of heavy flooring; 2 by 6 flooring*

Arkansas Soft Pine Bureau
Northern Hemlock and Hardwood Manufacturers Association
Southeastern Forest Products Association
Southern Pine Association

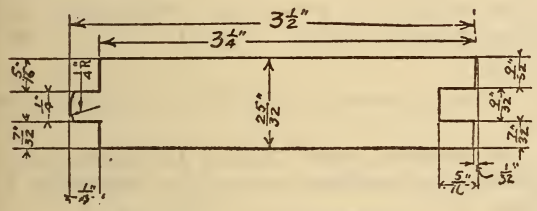


FIG. 74.—*1 by 4 inch flooring*
West Coast Lumbermen's Association

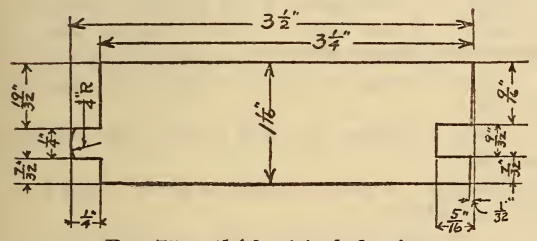


FIG. 75.—*1¼ by 4 inch flooring*
West Coast Lumbermen's Association

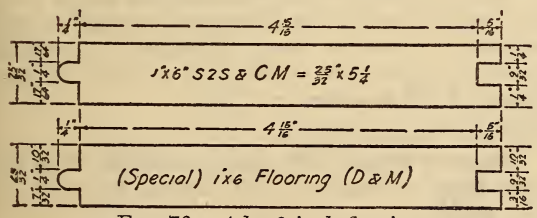


FIG. 76.—*1 by 6 inch flooring*
Western Pine Manufacturers Association

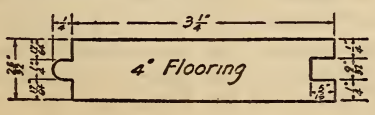


FIG. 77.—*4-inch flooring*
Western Pine Manufacturers Association

Northern Pine Manufacturers Association, rules for the grading of tamarack flooring, April 15, 1927.

Sizes.

The location and size of tongue and groove, bead, and other workings shall conform to the patterns of the American Lumber Standards or as published by the Northern Pine Manufacturers Association.

Grades.

Identical with those for pine. (See 411.27.)

Southern Cypress Manufacturers Association, standard grades and classifications for tupelo flooring, June 15, 1925.

Thicknesses and widths.

Thickness, $\frac{13}{16}$-inch hollow back; widths, 1½, 2¼, and 3¼ inches face.

Lengths.

Eight to twenty feet admitting 15 per cent of 8, 9, and 10 foot lengths, but not to exceed 5 per cent of 8 and 9 foot lengths. Odd lengths are not standard above 10 feet. May also be specified 4 to 7 feet.

Shall be graded from the finished side, B and better, and C.

Grades.

B and better, and C, graded from the finished side.

B and better shall admit sound sap without limit, but must be otherwise free from defects.

C shall comprise stock not up to grade B, admitting unsound defects, and imperfections in manufacture which may be removed in two cuts with waste not exceeding 10 per cent of the length of the piece.

The question of color shall not be considered in standard grades of flooring.

B and better flooring may be furnished end matched 2 feet and longer in odd or even foot and half-foot lengths; the proportion of lengths, 2 to 3½ feet, shall be what the stock will produce up to 15 per cent. End-matched flooring may be furnished selected for color.

Patterns.

Flooring patterns are illustrated in Figures 70, 71, and 72.

Western Pine Manufacturers Association, grading rules for larch flooring, July 1, 1925.

Patterns.

Flooring patterns are illustrated in Figures 76 and 77.

411.3 CEILING LUMBER.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

For American Lumber Standard, yard and industrial sizes of lumber, including ceiling. See 411.0.

Arkansas Soft Pine Bureau, standard grades of soft pine ceiling, March 23, 1927.

Similar to those of the Southeastern Forest Products Association and the Southern Pine Association given on page 179.

Patterns.

Ceiling patterns are illustrated in Figures 89 to 93.

California Redwood Association, standard specifications for eastern grades of California redwood ceiling, April, 1927.

The grades of ceiling are the same as for redwood flooring, 411.29.

California White and Sugar Pine Manufacturers Association, sizes and grades for California white pine, sugar pine, white fir, Douglas fir, and incense cedar ceiling, May 1, 1926.

See table of sizes and grading rules of this association 411.1.

National Hardwood Lumber Association, grades for cypress ceiling, January, 1927.

Widths.

2¼, 3¼, 4¼, and 5¼ inches face as specified, measured ¾ inch wider than the face.

Lengths.

4 to 20 feet.

Grades.

A, B, C, and D, identical with the grades for cypress flooring 411.22.

North Carolina Pine Association (Inc.), inspection rules for ceiling, January 1, 1927.

Lengths.

Lengths 6 to 16 feet in multiples of 1 foot not to exceed 5 per cent of 6 and 7 foot lengths.

Grade.

Same as flooring. (See 411.27.)

Patterns.

Ceiling patterns are illustrated in Figures, 78 to 80.

Northern Hemlock and Hardwood Manufacturers Association, sizes and grading rules for hemlock ceiling, February 1, 1927.

Thicknesses.

$\frac{5}{16}$, $\frac{7}{16}$, $\frac{9}{16}$, and $\frac{11}{16}$ inch.

Widths and lengths same as for flooring. (See 411.24.)

Special grading provisions for ceiling same as for flooring. (See 411.24.)

Grades.

D and better, No. 1 common, No. 2 common, and No. 3 common, same as for flooring except for D and better and No. 1 common grades, which are as follows:

D and better grade ceiling.—Should be free from defects on face side and be properly manufactured.

No. 1 common grade ceiling.—Will admit the following defects: Slight torn grain; small knots, red or black, that will finish on face side; back not below No. 1 common grade. Should be well manufactured.

Patterns.

Ceiling patterns are illustrated in Figures 93 and 101.

Northern Pine Manufacturers Association, rules for the grading of northern white and Norway pine, spruce and tamarack, April 15, 1925.

Ceiling shall be graded under the same rules as dressed and matched flooring, 411.27.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir kiln dried ceiling, Schedule M, 1925.

Defects based on piece 1 by 4 inches, 12 feet. Rule to apply proportionately on narrower and wider stock.

Grade.

No. 2 clear and better, flat grain, kiln-dried, 3, 4, and 6 inch.

Shall be well manufactured, will admit of slight roughness in dressing. One of the following is also permitted with the foregoing defect. Three pitch pockets and/or pitch blisters, each not over 2 inches in length if not extending through the thickness of the piece, one sound and tight knot ¾ inch or less in diameter, or equivalent defects. Edge grain may be included at shipper's option. Bright sap no defect.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir green ceiling, Schedule M, 1925. Identical with this association's grading rules for Douglas fir green siding. (See 411.1.)

Patterns.

Ceiling patterns are illustrated in Figures 81 to 88.

Southeastern Forest Products Association, specifications for southern pine ceiling, September 1, 1925.

Grades.

A, B, No. 1 common, No. 2 common, and No. 3 common. Based upon a piece 4 inches wide by 12 feet long, larger or smaller pieces proportionately.

Grade A same as grade A flat grain flooring, 411.27.

Grade B similar to grade B flat grain flooring, 411.27.

Grade No. 1 common same as grade D flat grain flooring, 411.27.

No. 2 common ceiling same as No. 2 common flooring, 411.27.

No. 3 common ceiling will admit all pieces that can not be used as No. 2 common ceiling, but are suitable for use as cheap sheathing or crating material, without a waste of more than ¼ the length of any one piece.

Special grading provisions.

Pieces of ceiling with tongue not more than $\frac{1}{16}$ inch scant of standard width will be admitted in any grade.

Pieces of ceiling having not less than $\frac{1}{16}$-inch tongue or lap will be admitted in No. 2 common.

In No. 1 common and better grades of ceiling, wane on the reverse side, equivalent to ⅓ the width and ⅙ the length of the piece, is admissible, provided the wane does not extend into the tongue or groove; it may, however, extend into the groove or for ½ the thickness of the tongue for a length of

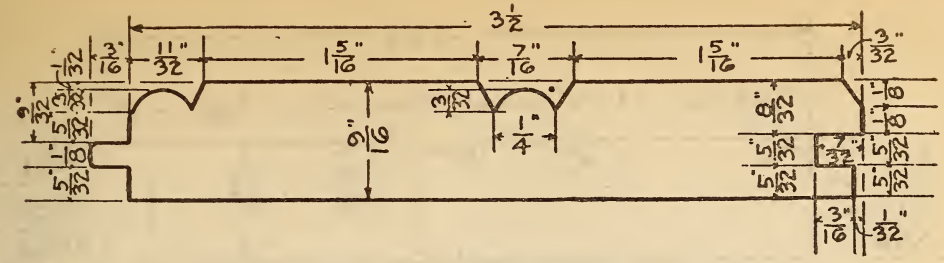


FIG. 78.—$\frac{5}{8}$ *ceiling (finish* $\frac{9}{16}$*)*

North Carolina Pine Association

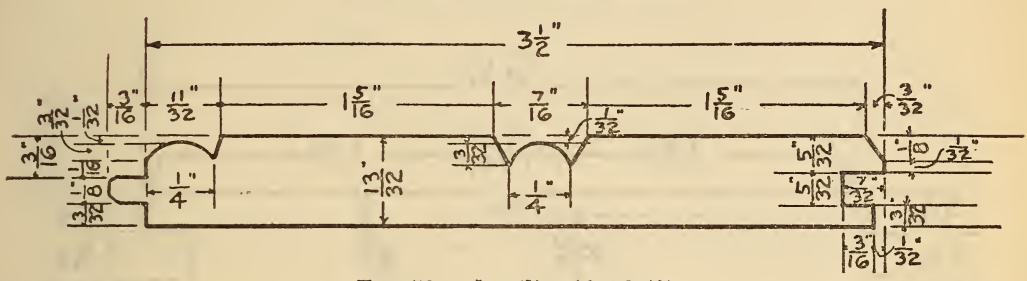


FIG. 79.—$\frac{7}{16}$ *ceiling (finish* $\frac{13}{32}$*)*

North Carolina Pine Association

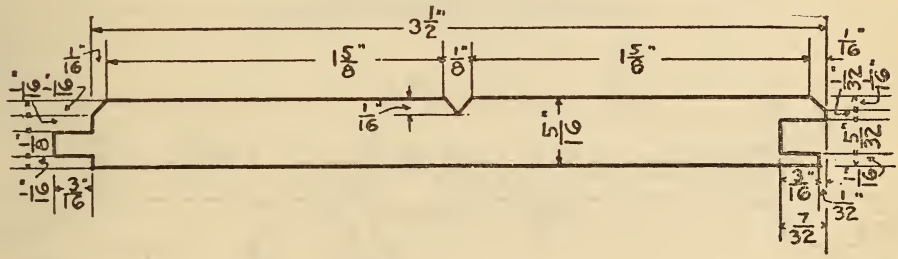


FIG. 80.—$\frac{5}{16}$ *ceiling*

North Carolina Pine Association

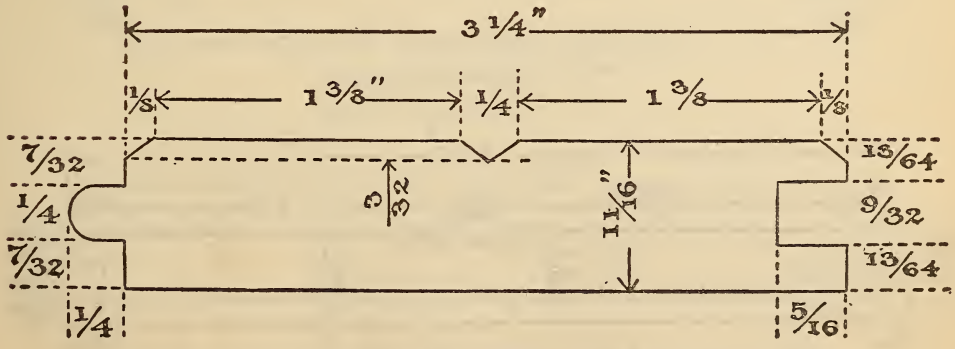


FIG. 81.—*1 by 4 inch kiln-dried double V. ceiling, green 3⅜-inch face*

Pacific Lumber Inspection Bureau

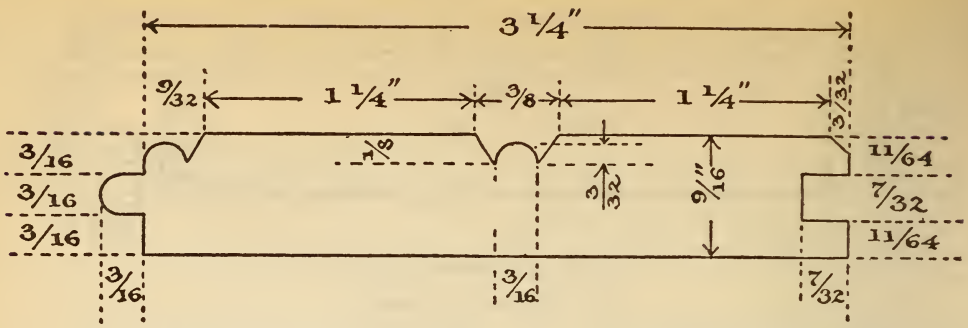


FIG. 82.—*5/8 by 4 inch kiln-dried double beaded ceiling, green 3 3/8-inch face*

Pacific Lumber Inspection Bureau
Southern Cypress Manufacturers Association

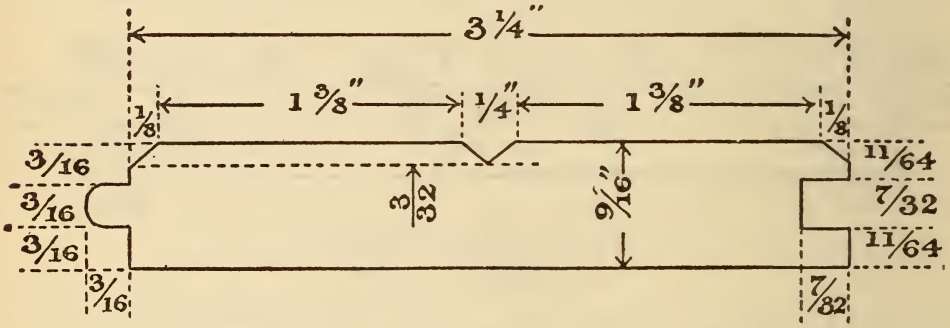


FIG. 83.—*5/8 by 4 inch kiln-dried double V. ceiling, green 3 3/8-inch face*

Pacific Lumber Inspection Bureau
Southern Cypress Manufacturers Association

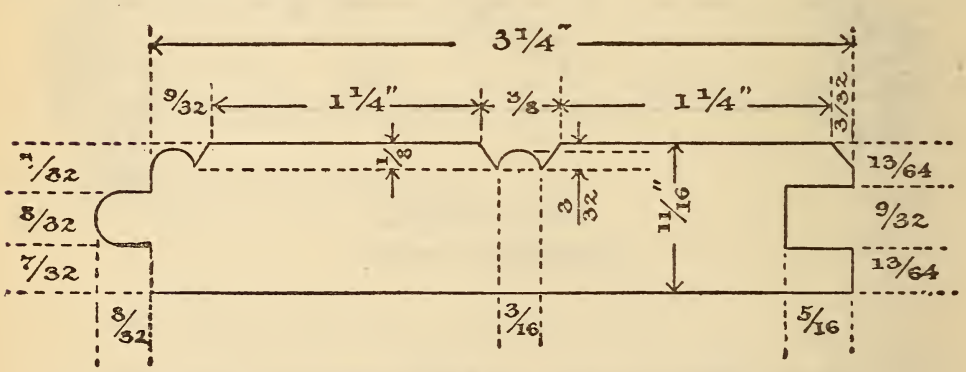


FIG. 84.—*1 by 4 inch kiln-dried double beaded ceiling, green 3 3/8-inch face*

Pacific Lumber Inspection Bureau

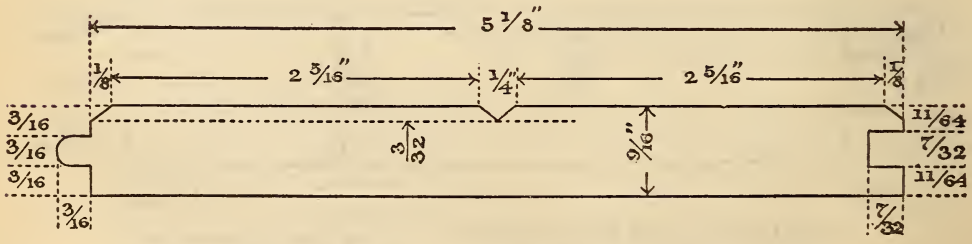


FIG. 85.—*5/8 by 6 inch kiln-dried double V. ceiling, green 5 3/8-inch face*

Pacific Lumber Inspection Bureau

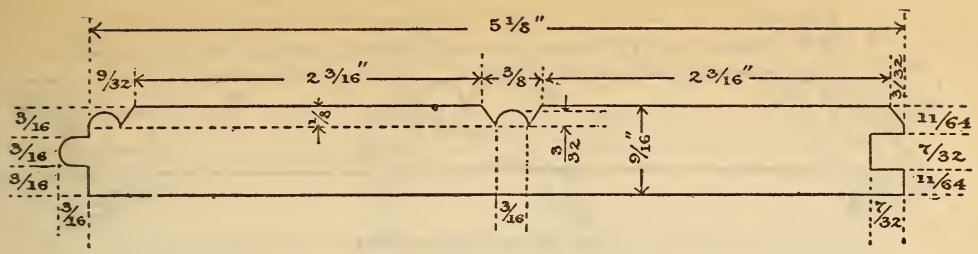


FIG. 86.—*5/8 by 6 inch kiln-dried double beaded ceiling, green 5 3/8-inch face*

Pacific Lumber Inspection Bureau

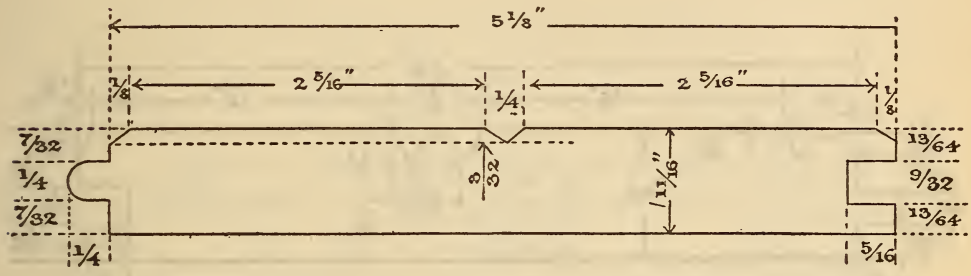


FIG. 87.—*1 by 6 inch kiln-dried double V. ceiling, green 5 3/8-inch face*

Pacific Lumber Inspection Bureau

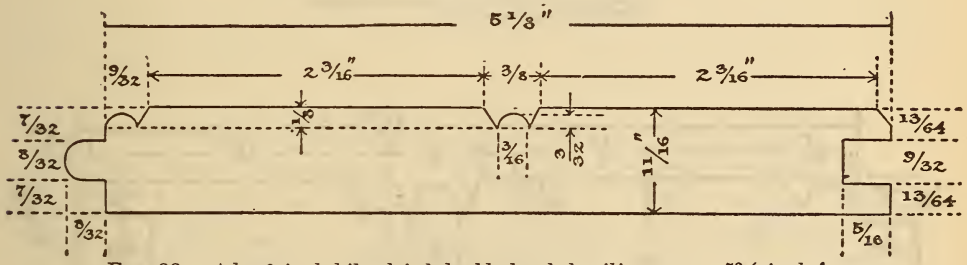


FIG. 88.—*1 by 6 inch kiln-dried double beaded ceiling, green 5 3/8-inch face*

Pacific Lumber Inspection Bureau

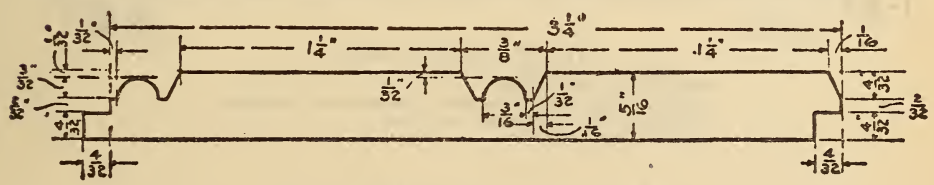


FIG. 89.—*5/16-inch ceiling ship-lapped*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

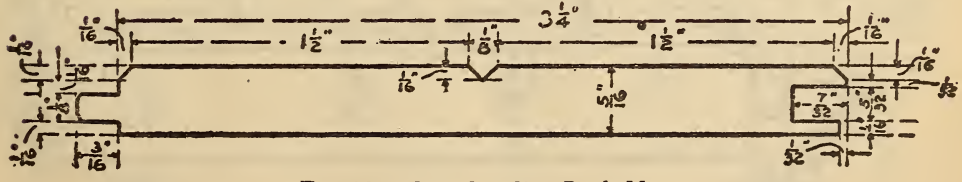


FIG. 90.—*5/16-inch ceiling D. & M.*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

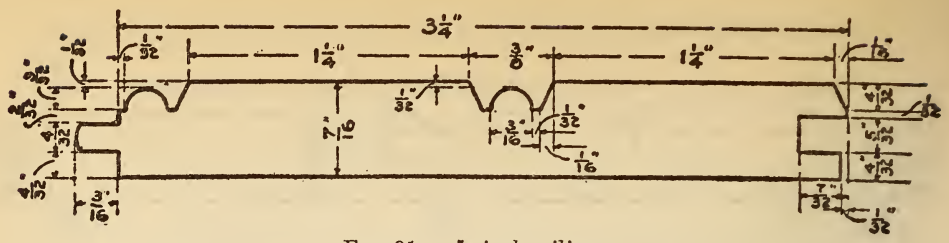


FIG. 91.—$\frac{7}{16}$-*inch ceiling*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

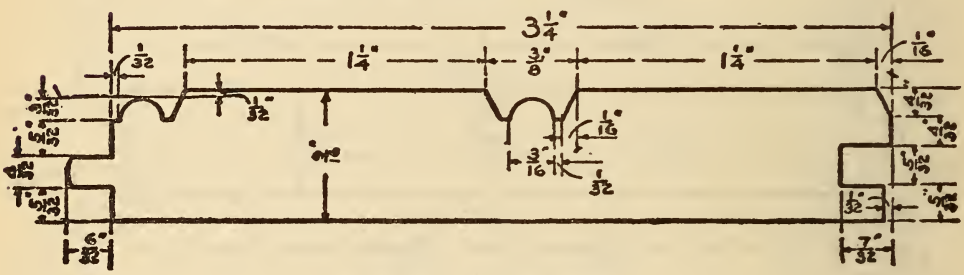


FIG. 92.—$\frac{9}{16}$-*inch ceiling*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

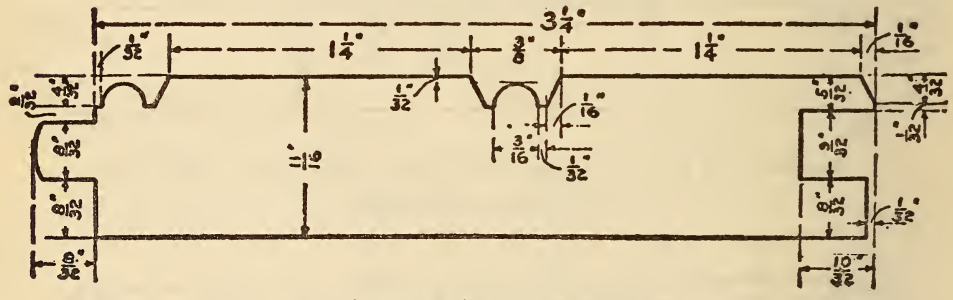


FIG. 93.—$\frac{11}{16}$-*inch ceiling*

Arkansas Soft Pine Bureau
Northern Hemlock and Hardwood Manufacturers Association
Southeastern Forest Products Association
Southern Pine Association

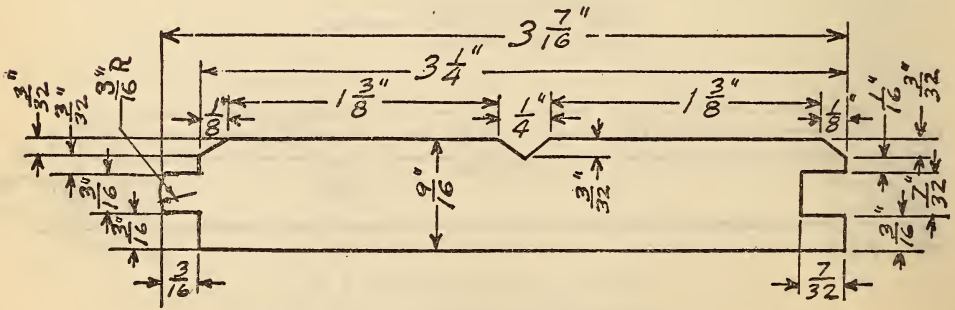


FIG. 94.—½ *by 4 inch V. and C. V. ceiling*

West Coast Lumbermen's Association

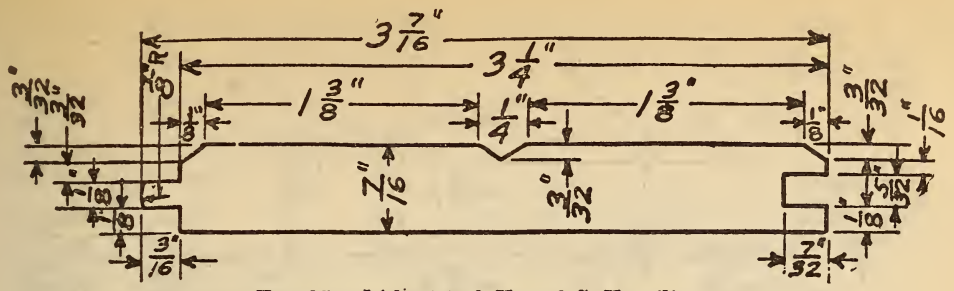


FIG. 95.—*⅝ by 4 inch V. and C. V. ceiling*

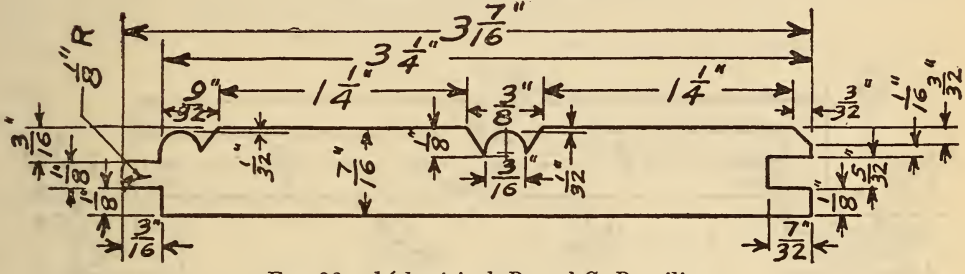


FIG. 96.—*½ by 4 inch B. and C. B. ceiling*

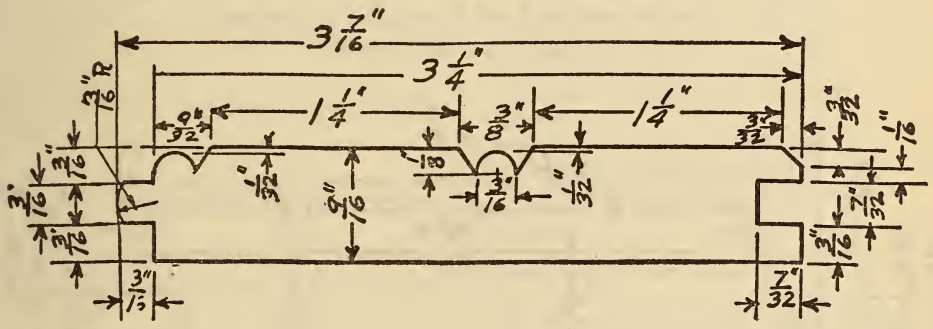


FIG. 97.—*⅝ by 4 inch B. and C. B. ceiling*

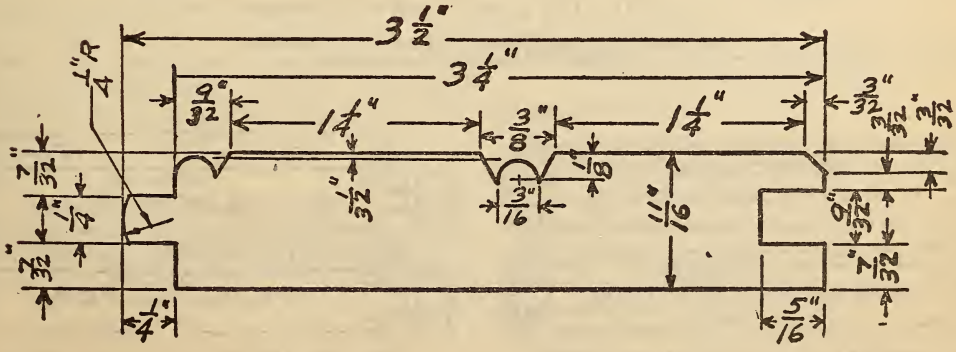


FIG. 98.—*1 by 4 inch B. and C. B. ceiling*

All West Coast Lumbermen's Association

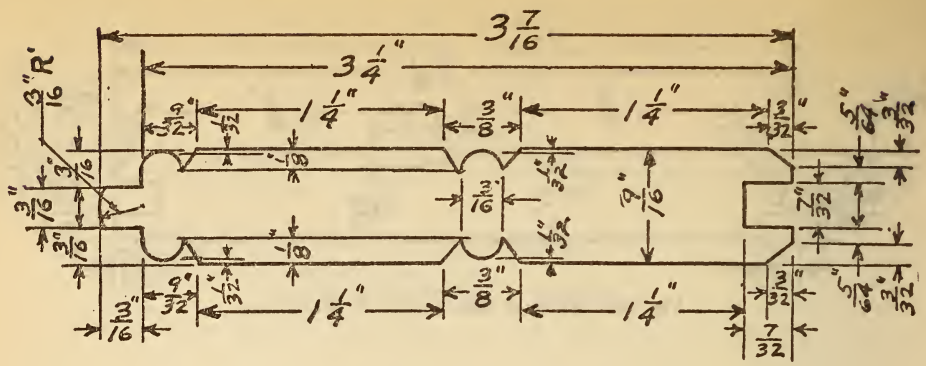


FIG. 99.—*5/8 by 4 inch B. and C. B. 2S ceiling*

West Coast Lumbermen's Association

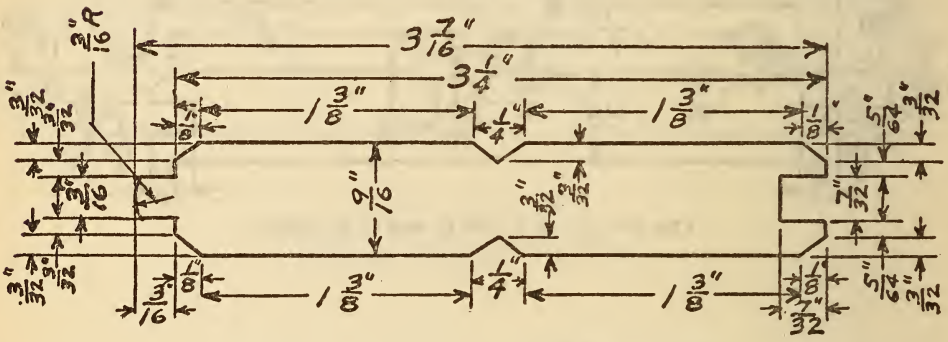


FIG. 100.—*5/8 by 4 inch V. and C. V. 2S ceiling*

West Coast Lumbermen's Association

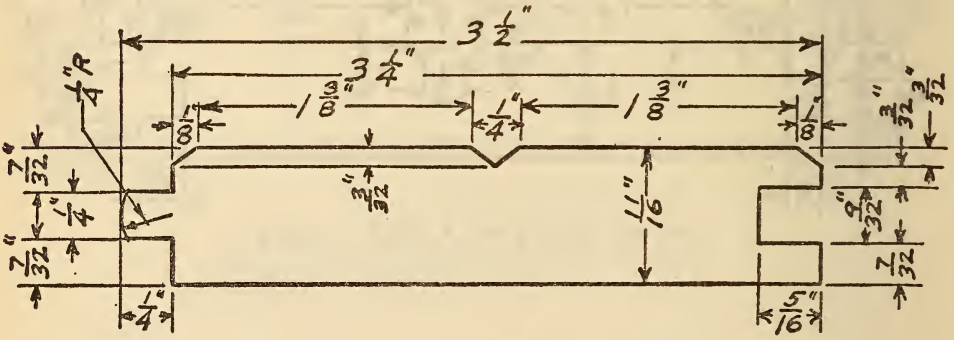


FIG. 101.—*1 by 4 inch V. and C. V. ceiling*

Northern Hemlock and Hardwood Manufacturers Association
West Coast Lumbermen's Association

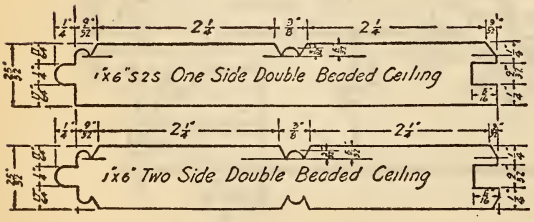


FIG. 102.—*1 by 6 inch double beaded ceiling*

Western Pine Manufacturers Association

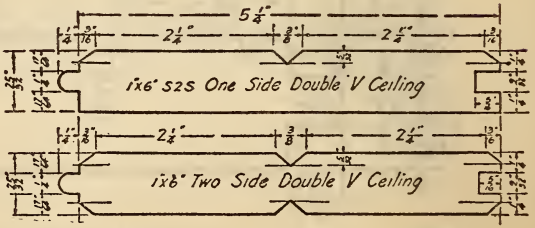


FIG. 103.—*1 by 6 inch double V. ceiling*

Western Pine Manufacturers Association

10 inches, provided the maximum width and length decrease in proportion to the increase in depth.

The bead on all ceiling shall be depressed $\frac{1}{32}$ inch below the surface of the piece.

Southeastern Forest Products Association, sizes and grades for short length end-matched southern pine ceiling, September 1, 1925.

Special finished thicknesses.

$\frac{5}{16}$, $\frac{7}{16}$, $\frac{9}{16}$, and $\frac{11}{16}$ inch.

All other sizes and grades identical with this association's specifications for short length end-matched southern pine flooring. (See 411.27.)

Patterns.

Ceiling patterns are illustrated in Figures 89 to 93.

Southern Cypress Manufacturers Association, grades and classification for cypress ceiling, June 15, 1925.

Thicknesses.

$\frac{5}{16}$, $\frac{7}{16}$, $\frac{9}{16}$, and $\frac{11}{16}$ inch.

Width.

Shall be specified widths, 3, 4, 5, and 6 inches wide.

Length.

8 and 20 inches (except in D grade), admitting 15 per cent of 8, 9, and 10 foot lengths, and not to exceed 5 per cent of lengths under 10 feet. Odd lengths are not standard above 10 feet. May also be specified 4 to 7 feet.

Shall be graded from the finished side, or if both sides are finished, it shall be graded from the better side, A, B, C, and D.

A, B, C, and D grades are the same as for flooring. (See 411.22.)

Patterns.

Ceiling patterns are illustrated in Figures 82 and 83.

Southern Cypress Manufacturers Association, standard grades and classifications for tupelo ceiling, June 15, 1925.

Identical with those of this association for flooring (411.29) with the added requirement that ceiling shall be graded from the better side.

Patterns.

Ceiling patterns are illustrated in Figures 82 and 83.

Southern Pine Association, standard grades of southern pine ceiling, March 23, 1927. Identical with those of the Southeastern Forest Products Association.

Patterns.

Ceiling patterns are illustrated in Figures 89 to 93.

West Coast Lumbermen's Association, sizes and grading rules for Douglas fir, hemlock, and Sitka spruce ceiling, July 1, 1927.

Standard thicknesses.

Nominal $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, 1 inch.
Finished $\frac{5}{16}$, $\frac{7}{16}$, $\frac{9}{16}$, $\frac{11}{16}$ inch.

Standard widths.

Nominal 3, 4, 6 inches.
Finished face $2\frac{3}{8}$, $3\frac{1}{4}$, $5\frac{3}{16}$ inches.

Lengths.

Multiples of 1 foot.

Grades.

Grades, flat-grain and/or vertical grain, B and better (for Douglas fir, hemlock, and Sitka spruce), C (for Douglas fir and hemlock), and D (for Douglas fir and hemlock).

Identical with grades B, C, and D for Douglas fir flooring, No. 411.23, with the following addition to the B and better grade. Will admit wane (on the reverse side) in addition to other permissible defects, $\frac{1}{3}$ width, $\frac{1}{6}$ length, not into tongue.

Patterns.

Ceiling patterns are illustrated in Figures 94 to 101.

Western Pine Manufacturers Association, rules for grading Pondosa pine, Idaho white pine, larch and fir, white fir, cedar, and spruce ceiling, July 1, 1925.

Thickness.

$\frac{25}{32}$ dressed from 1 inch. (Also given as $\frac{5}{8}$ to $\frac{9}{16}$.)

Widths.

Pondosa pine, Idaho white pine, white fir, cedar, and spruce—

$2\frac{1}{4}$ face, dressed from 3-inch.
$3\frac{1}{4}$ face, dressed from 4-inch.
$5\frac{1}{4}$ face, dressed from 6-inch.
$7\frac{1}{4}$ face, dressed from 8-inch.
$9\frac{1}{4}$ face, dressed from 10-inch.

Larch and fir—

$3\frac{1}{4}$ face, dressed from 4-inch.
$5\frac{1}{4}$ face, dressed from 6-inch.
$7\frac{1}{4}$ face, dressed from 8-inch.

Thickness.

$\frac{5}{8}$ to $\frac{9}{16}$ inch.

Grades.

Species grading rules 400.21 for cedar, 400.23 for fir, 400.25 for larch, 400.26 for pine, and 400.28 for spruce.

Patterns.

Ceiling patterns are illustrated in Figures 102 and 103.

411.4 PARTITIONS, MOLDINGS, FINISH, AND BASEBOARDS. (See also 423.)

411.41 Partitions.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0, yard lumber, American Lumber Standards for the grades and sizes of partition.

Arkansas Soft Pine Bureau, grading rules for soft pine partition, March 23, 1927.

The grades and lengths of soft pine partition are similar to those of the Southern Pine Association for ceiling, 411.3.

End matching.

All end-matched partition are manufactured to American Lumber Standard sizes; grades are similar to those of the Southern Pine Association given below.

Patterns.

Patterns for partition are illustrated in Figure 104.

California Redwood Association, standard specifications for eastern grades of California redwood partition, April, 1927.

The sizes of partition are as shown on this association's table of sizes for yard lumber, 411.0.

The grades of partition are the same as redwood flooring, 411.29.

California White and Sugar Pine Manufacturers Association, sizes and grades for California white pine, sugar pine, white fir, Douglas fir, and incense cedar partition, May 1, 1926.

See table of sizes and grading rules of this association 411.1.

National Hardwood Lumber Association, grading rules for cypress partition, January 1, 1927.

Cypress partition.

Partition shall be inspected the same as flooring and ceiling, except that the inspection must be made from the poor face.

North Carolina Pine Association (Inc.), grading rules for pine partition, January 1, 1927.

Bark strip partition.

This grade shall consist of partition made from B and better bark strips as described under 402.41, 90 per cent of each lot inspected to show not less than seven-sixteenths of wood on both edges from end to end of piece, while admitting not over 10 per cent showing less than seven-sixteenths of wood on edges; provided grading size is 75 per cent clear of bark or wane; to be otherwise equal to the grade of B and better lumber.

Partition.

Lengths.—Same as in ceiling, 411.3.

Grades.—Same as in flooring, 411.27.

Partition shall be graded according to the rules for flooring 411.27, but the reverse side shall not be more than one grade lower than the face side.

Patterns.

Partitions patterns are illustrated in Figure 105.

Northern Hemlock and Hardwood Manufacturers Association, sizes and grading rules for hemlock partition, February 1, 1927.

Thickness.

¾ inch.

Width (in inches).

Nominal board measure	Face width	Overall width
4	3¼	3½
6	5 3/16	5 7/16

Lengths.

Same as for flooring, 411.24.

Special grading provisions.

Same as for flooring, 411.24.

Grades.

D and better, No. 1 common, No . 2 common, No. 3 common. Same as for flooring, except D and better which is as follows:

D and better grade.—Partition in D and better should be graded according to ceiling rules and provide for stock worked two sides same pattern and graded from poor side of piece. D and better will allow small sound knots well scattered that will finish, slight torn grain not over 1/16 inch deep or over ¼ inch wide or over 1½ inch long. Must be free of wane, and must be well manufactured.

Patterns.

Partition patterns are illustrated in Figure 104.

Northern Pine Manufacturers Association, rules for the grading of northern white and Norway pine, spruce, and tamarack, April 15, 1925.

Partition shall be graded under the same rules as dressed and matched flooring, 411.27, but the grade shall be determined from its poor side.

Southeastern Forest Products Association, grading rules for yellow pine partition, September 1, 1925.

Grades and lengths.

Similar to those of the Southern Pine Association, given below.

Patterns.

Partition patterns are illustrated in Figure 104.

Southern Cypress Manufacturers Association, grading rules for cypress partition, June 15, 1925.

Shall be same widths, lengths, and thickness as flooring and ceiling, but shall be graded from the poorer side, A, B, C, and D, under flooring (see 411.29) and ceiling (see 411.3) rules.

Southern Pine Association, grading rules for southern pine partition, March 23, 1927.

Grades.

A, B, No. 1 common, No. 2 common, and No. 3 common.

Lengths.

Standard lengths and percentages of short lengths shall be the same as in ceiling, 411.3.

Partition shall be graded according to ceiling rules, and must meet the requirements of the specified grades on the face side only, but the reverse side shall not be more than one grade lower, and shall not cause waste in No. 1 common and better grades.

End matching.

All end-matched partition manufactured to American Lumber Standard sizes, as provided in the Southern Pine Association rules, will be graded on Southern Pine Association standard rules, except No. 2 common which will lay a serviceable wall without cutting.

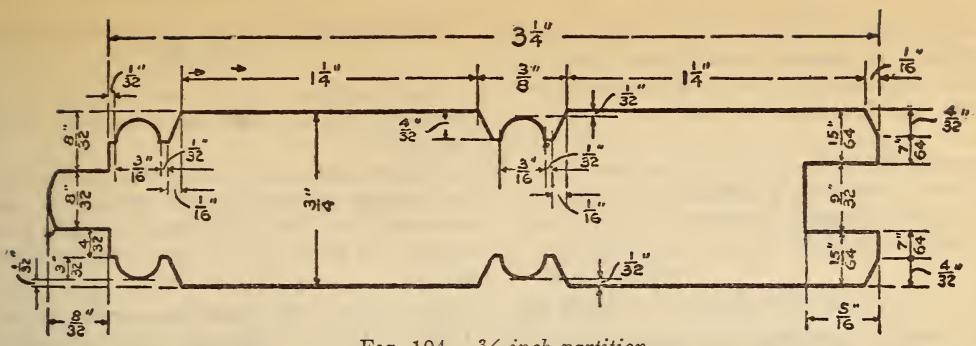


FIG. 104.—*¾-inch partition*

Arkansas Soft Pine Bureau
Northern Hemlock and Hardwood Manufacturers Association
Southeastern Forest Products Association
Southern Pine Association

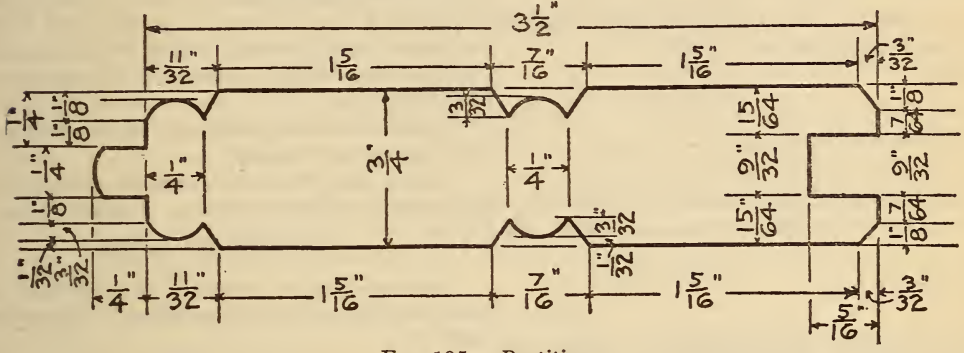


FIG. 105.—*Partition*

North Carolina Pine Association

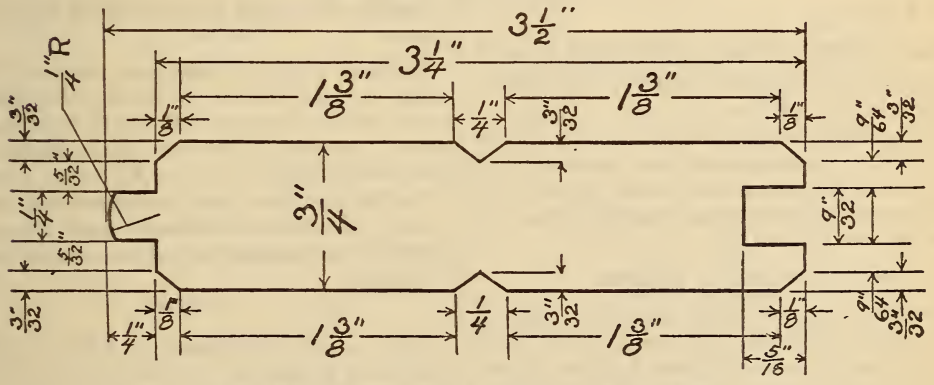


FIG. 106.—*1 by 4 inch V. and C. V. 2S partition*

West Coast Lumbermen's Association

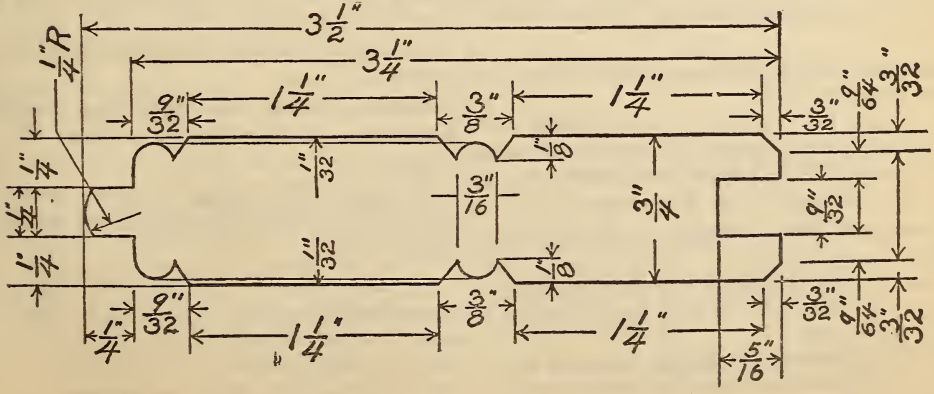


FIG. 107.—*1 by 4 inch B. and C. B. 2S partition*

West Coast Lumbermen's Association

All end-matched partition will be bundled to the nearest foot, the shortest bundle to be 2 feet, and trimmed in multiples of 1 foot or a fraction thereof, and with the following regulation in respect to length:

	Feet.
A (minimum average)	9
B and better (minimum average)	8
B (minimum average)	7
All commons (average)	5

Patterns.

Partition patterns are illustrated in Figure 104.

West Coast Lumbermen's Association, grading rules for Douglas fir, west coast hemlock and Sitka spruce partition, July 1, 1926.

Partition (K. D.).

To be graded by same rules as govern ceiling (411.3), but from poorer side.

Thicknesses.

Nominal (inch)	1
Finished (inch)	¾

Widths.

Nominal (inches)	4	6
Finished face (inches)	3¼	5 3/16

Lengths.

Multiples of 1 foot.

Patterns.

Partition patterns are illustrated in Figures 106 and 107.

411.42 Moldings.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0, yard lumber, American Lumber Standards for the grades and sizes of yard lumber. The patterns for moldings referred to in 411.0, yard lumber, and generally known as the 7000 series, are shown in Figures 108 to 135.

AMERICAN STANDARD MOLDINGS

The outline drawings shown herein are not all drawn to scale. They are for design of the faces only. The correct sizes are shown in figures below the serial numbers in the designs. Both the name and serial number, as hereinafter shown, should be specified in all orders for American standard moldings.

Arkansas Soft Pine Bureau, grading rules for moldings, March 23, 1927.

Grading rules for moldings, molded casing and base, window and door jambs are similar to those of the Southeastern Forest Products Association and the Southern Pine Association given below.

Arkansas Soft Pine Bureau, wood moldings, March, 1925.

This association has adopted the American Lumber Standards 7000 series of moldings, illustrated in Figures 108 to 135.

California Redwood Association, standard specifications for eastern grades of California redwood moldings, April 1927.

CASING AND BASE, WINDOW AND DOOR FRAME STOCK, JAMBS, ETC.

Casing and base shall be worked to the American standard sizes and patterns, illustrated in Figures 108 to 135.

Window and door frame stock, jambs, etc., will be dressed, rabbetted, and plowed as ordered, excepting that the thickness or width shall not exceed that prescribed by the American standards.

Grades.

Clear heart (Redwood Association grade), and A and B (American Standard Redwood grades).

Lengths.

Standard lengths of casing and base shall be 3 to 20 feet, inclusive, in multiples of 6 inches up to and including 5 feet 6 inches; in multiples of 1 foot up to and including 9 feet; and in multiples of 2 feet in 10-foot and longer, admitting 10 per cent of 3 to 7-foot lengths.

Lengths of frame stock and jambs shall be covered by special contract.

Casing, base, etc., will be graded according to the rules for the respective grades of finish, 411.43.

MOLDINGS AND LATTICE

Moldings shall be worked to the American standard sizes and patterns illustrated in Figures 108 to 135.

Grade.

A and better (see rules governing finish 411.43.)

Lengths.

Standard lengths of moldings shall be 6 foot and longer in multiples of 1 foot up to and including 9 feet and in multiples of 2 feet in 10 to 20 foot lengths, admitting not more than 15 per cent of 6 to 9 foot lengths.

Moldings shall be well manufactured, smoothly dressed, and free from defects, except occasional pin knots and any amount of bright sound sapwood will be allowed.

BATTENS

Battens will be furnished in A and better grade equivalent in quality to those described for finish (411.43), and in sizes and patterns conforming to those published by this association, or by members thereof, or to special order.

Clear heart grade in above items shall be by special contract.

California White and Sugar Pine Manufacturers Association, grading rules for moldings, May 1, 1926.

Patterns.

Moldings shall conform to the American Lumber Standards, illustrated in Figures 108 to 135.

Grade.

Moldings shall be manufactured from stock of generally high quality and shall be equivalent in grade to C select and better, except as herein provided. Defects similar to those allowed in C select will be permitted, due consideration being given to the number and size of the defects in proportion

to the size of the molding. The grade is determined from the face of the piece, portions showing when in place being the face.

Pieces 12 feet long or longer requiring one waste cut not less than 4 feet from one end, and not to exceed 3 inches in length, will be permitted if one of the pieces thus obtained is equal to B and better grade. Not more than 15 per cent of this type is allowed in a shipment.

Standard lengths.

Four feet and longer in multiples of 1 foot.

Random-length shipments shall consist of not more than 20 per cent under 10 feet in length, as follows:

	Per cent
4 and 5 feet	2
6 and 7 feet	6
8 and 9 feet	12

When less than the full quota of the shorter lengths are included, proportionately more of the next longer lengths may be shipped. The balance of random-length shipments shall consist of 10 feet and longer lengths, reasonably proportioned. Each length shall be bundled separately.

When moldings requiring 3 inches wide or wider stock are ordered to be made from any specified grade of lumber, it shall be permissible to ship the full product after milling.

Hardwood Interior Trim Manufacturers Association, rules and regulations for hardwood interior trim and molding, May 26, 1926.

RULES AND REGULATIONS FOR GRADE "A" INTERIOR TRIM AND MOLDING

Grading

Grading.

Grading from face side.

Defects allowed.

Those covered by member moldings, or covered when the stock is installed; also defects on the reverse side that do not impair its use.

1. *Natural*—(*a*) *Knots.*—Maximum size ½ inch greatest diameter, tightly encased and smoothly dressed, not over two in any one piece, one knot to every 6 linear feet, or its equivalent, maximum allowance 5 per cent of total shipment board foot basis. Burls that do not contain knots or unsound centers shall not be considered a defect.

(*b*) *Sap.*—Bright sap allowed. Sap gumwood (plain and quartered), black gumwood, tupelo, poplar, basswood, and buckeye may contain sound discolored sap without limit. On red gum 5 per cent of quantity may contain sap, but not more than 25 per cent of any one piece.

(*c*) *Stain.*—Not to cover more than 25 per cent of surface measure of any one piece and not more than 5 per cent of total shipment, board-foot basis.

(*d*) *Streaks.*—Slight streaks in oak and chestnut permitted in not over 10 per cent of shipment, board-foot basis.

(*e*) *Wormholes.*—Not accompanied by stain, not larger than $\frac{1}{16}$ inch in diameter, not over three in any one piece, maximum allowance 5 per cent of total shipment, board-foot basis.

2. *Working.*—Slight defects in working, which can be eliminated at negligible cost, such as rough spots in sanded stock which can be hand smoothed.

3. *Seasoning*—(*a*) *End splits.*—¼ inch in length for each linear foot per piece, or its equivalent.

(*b*) *Surface checks.*—$\frac{1}{32}$ inch maximum width, 1 inch maximum length, one check to each foot surface measure, or equivalent per piece; maximum allowance 5 per cent of total shipment, board foot basis.

(*c*) *Warp.*—If stock will lay flat or straight, with ordinary nailing.

Manufacturing

Designs.

1. Standard.—Conform to the American Lumber Standards, and known as the 7000 series molding, illustrated in Figures 108 to 135.

2. Special.—As per full-size detail drawing (inside of line to govern).

As per sample.

As per template (stock must fit flush, not tight at time of machining).

Sizes.

1. Standard.—Conform to the American Lumber Standards, and known as the 7000 series molding, illustrated in Figures 108 to 135.

2. Special.—As specified.

Variation in size.

$\frac{1}{32}$ inch tolerance.

Width.

Conform to the American Lumber Standards, and known as the 7000 series molding, illustrated in Figures 108 to 135.

Length.

1. Random.—4 to 16 foot subject to variation of less than 6 inches, over or under, counted on 6 inch breaks, measurement obtained by average, and bundled accordingly. Shipments may contain not more than 20 per cent of lengths under 8 feet and 5 per cent may consist of lengths under 6 feet.

2. Specified.—Stock shall be usable for purpose intended without waste. Lengths up to 4 feet 6 inches, inclusive, count on even half-foot breaks. *Example.*—3 feet 3 inches count as 3 feet 6 inches; 3 feet 6 inches count as 3 feet 6 inches. Lengths 4 feet 7 inches to 7 feet 6 inches, inclusive, counted 6 inches over the next even half foot. *Example.*—5 feet 9 inches count as 6 feet 6 inches; 6 feet count as 6 ft 6 inches. Lengths 7 feet 7 inches and longer counted 12 inches over the next even half-foot. *Example.*—8 feet 3 inches count as 9 feet 6 inches; 9 feet 6 inches count as 10 feet 6 inches.

Dryness.

Kiln dried to moisture content, not to exceed 10 per cent when shipped from the mill.

Torn grain.

$\frac{1}{32}$ inch maximum depth permitted on machine run stock in not over 10 per cent of length, in the aggregate, in any one piece.

Machine sanding.

Maximum allowance $\frac{1}{32}$ inch below machine size for sanding one face, when specified.

National Hardwood Lumber Association, grading rules for moldings, January, 1927.

Cypress battens.

Battens shall be flat or O. G.

Sizes, 1 by 3 inches S4S to $\frac{13}{16}$ by 2½ inches and resawed; 1 by 2¾ to 3 inches S2S and resawed.

Battens will admit all the defects allowed on the face side of No. 1 common, but none that will seriously impair the strength of the piece or prevent its use for the purpose intended.

Hardwood molding and trim.

The National Hardwood Lumber Association has adopted the American standard sizes for molding illustrated in Figures 108 to 135.

North Carolina Pine Association (Inc.), grading rules for moldings, January 1, 1927.

Moldings.

Lengths.—Lengths 6 to 16 feet, in multiples of 1 foot.

Grade.—B and better.

Moldings are manufactured in one grade, unless by special contract.

B and better molding shall be well manufactured and ⅛ of the pieces of any item may contain any one of the following defects or its equivalent: Three pin wormholes; slight defects in dressing; one pin knot; one small pitch pocket; pitch 1 inch wide by 6 inches long or its equivalent in pitch streaks; and 10 per cent of stain.

Base and casing.

Lengths.—Lengths same as ceiling, 411.3.

Base and casing shall be graded same as flooring, 411.27, and ceiling, except the edges shall not be of lower grade than the face, but the reverse side or back may be No. 2 common or better.

Southeastern Forest Products Association, grading rules for moldings, September 1, 1925.

Molded casing and base, window and door jambs.

Molded casing and base shall be worked to the American Lumber Standard sizes and patterns illnstrated in Figures 108 to 135.

Window and door jambs will be dressed, rabbeted, and plowed as ordered.

Grades.—A, B, and C.

Casing, base, and jambs will admit the same defects as are admissible in finish of the same grades except wane.

Moldings.

Moldings shall be worked to the American Lumber standard sizes and patterns illustrated in Figures 108 to 135.

Lengths.—Standard lengths are 6 feet and longer, and in shipments of mixed lengths, 5 per cent of 6 and/or 7 feet shall be admitted, even though the number of feet of each length be specifically stated.

Grade.—B and better.

B and better molding shall be well manufactured and ⅛ of the pieces of any item may contain any one of the following defects or its equivalent: Three pin wormholes; slight defects in dressing; pin knot; one small pitch pocket; pitch 1 inch wide by 6 inches long or its equivalent in pitch streaks.

Southern Cypress Manufacturers Association, grading rules for cypress moldings, June 15, 1925.

Moldings.

Sizes.—Standard.

Quality.—B and better.

Battens.

Battens, both flat and O. G., are not moldings. Same are invariably used with common lumber and shall, therefore, be graded No. 1 common and better, admitting all defects allowed in No. 1 common, but none that will prevent the use of each piece in full length for batten purposes. ⅜-inch battens shall be 1-inch strips S2S to $\frac{13}{16}$ by 2½ inches, and resawed, or 1 by 2¾ inches to 3 inches S2S and resawed. Unless otherwise specified, ⅜ inch or flat battens shall be S2S only and resawed. O. G. battens shall be made according to molding-book patterns.

Southern Pine Association, grading rules for moldings, March 23, 1927.

Grading rules for moldings, molded casing and base, window and door jambs are the same as those of the Southeastern Forest Products Association, above.

West Coast Lumbermen's Association, grading rules for West Coast hemlock, Douglas fir, and Sitka spruce molding, July 1, 1926.

Molding stock.

Shall consist of lumber suitable for ripping molding strips from 1 to 6 inches wide, 8 to 20 feet long. Will admit pitch pockets and splits, running lengthwise of the piece, or other recognized defects. This grade shall contain not less than 60 per cent of rippings, running 1 inch and wider, 8 feet and longer, 25 per cent of which should average 3 inches and wider; 80 per cent to be 12 feet and longer.

Moldings.

For sizes and patterns see various molding books of association members for items desired.

Lengths.—Moldings 4 to 20 feet, not exceeding 15 per cent 4 to 7 feet.

Bundling.—Each length bundled separately.

Bright sap no defect.—Defects based on 12-foot lengths. Light sap stain, 25 per cent of face permissible in outside moldings. Hit and miss permitted on back of crown, bed, and sprung cove patterns.

B and better K. D. moldings under 2½ inches wide.

Shall be well manufactured. Will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Slight torn grain ($\frac{1}{64}$ inch deep), 25 per cent of face; 1 pitch pocket, not to exceed 1½ inches in length; 1 small sound and intergrown knot; 1 small pitch streak.

B and better K. D. moldings 2½ inches and wider.

Shall be well manufactured. Will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Slight torn grain ($\frac{1}{64}$

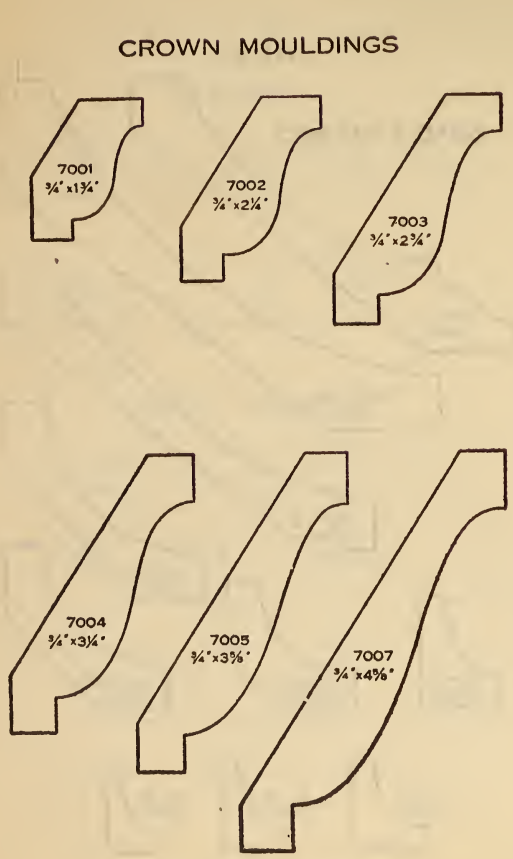


Fig. 108

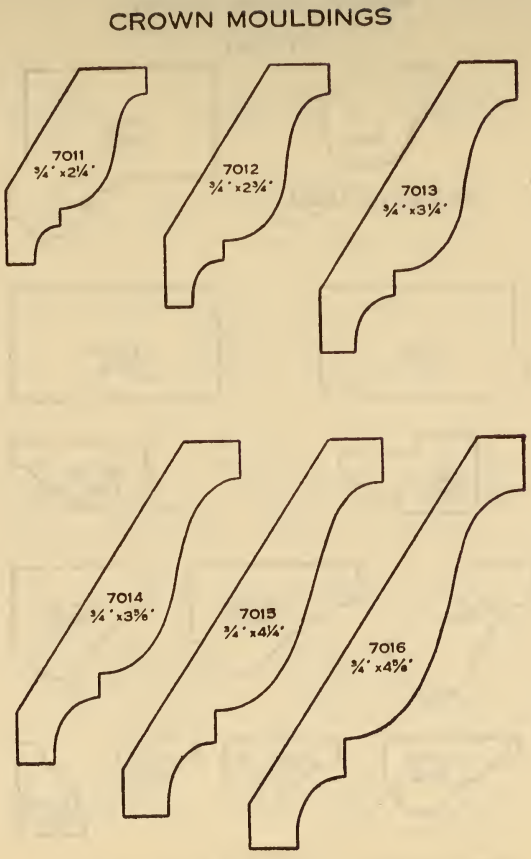


Fig. 109

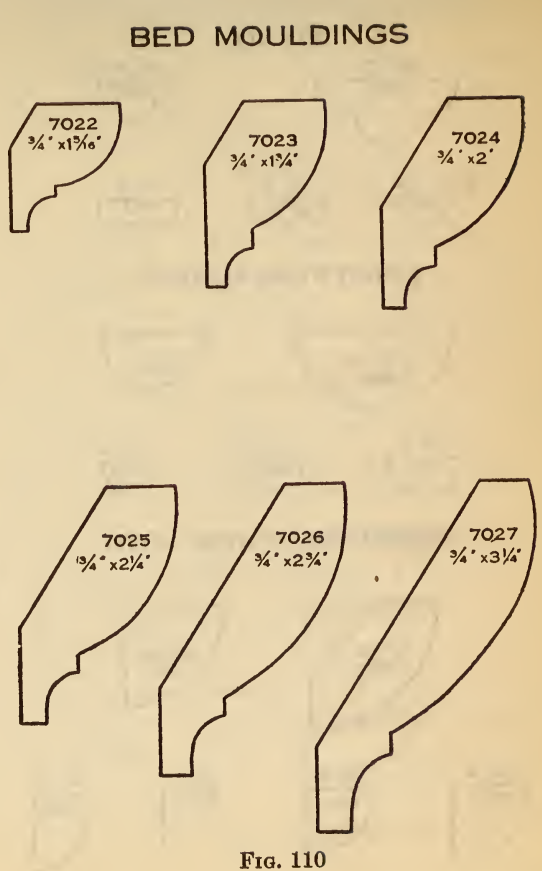


Fig. 110

American standard moldings

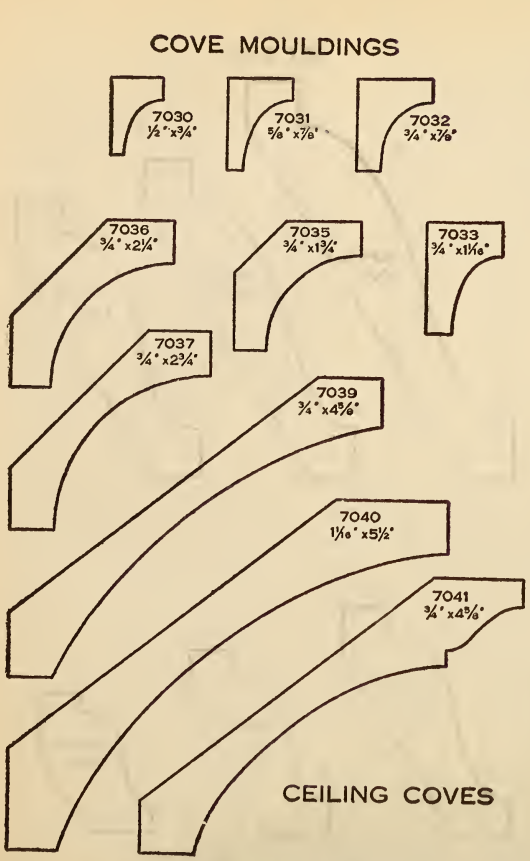


Fig. 111

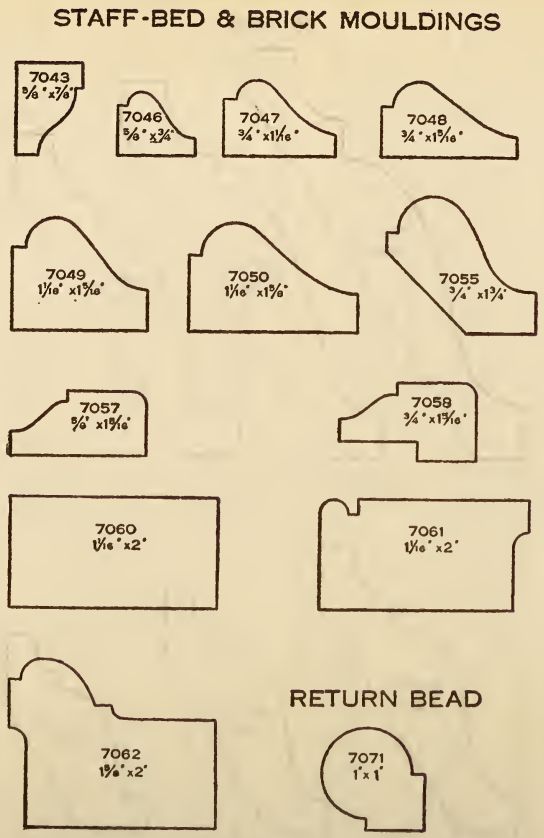


Fig. 112

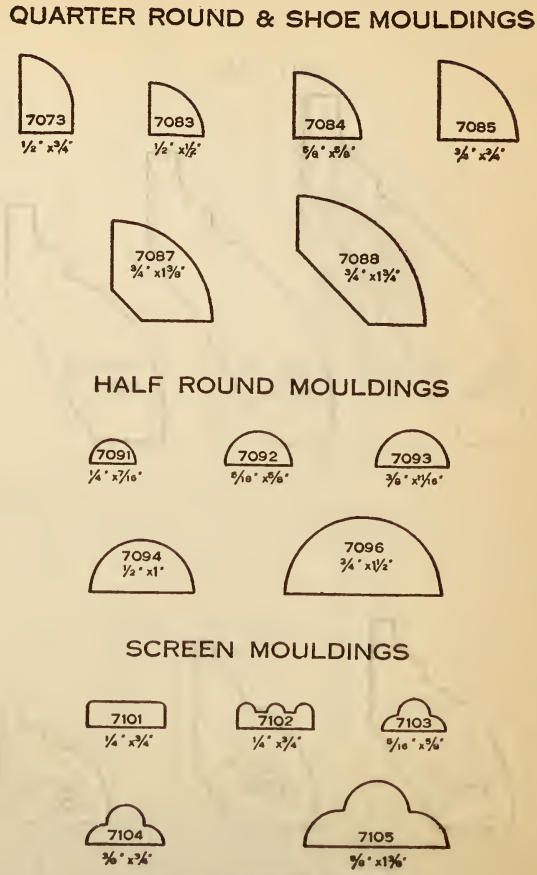


Fig. 113

American standard moldings

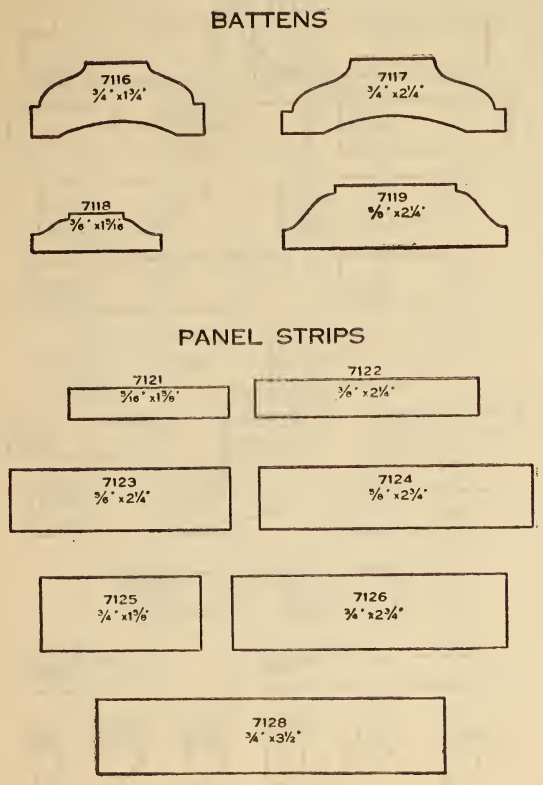


Fig. 114

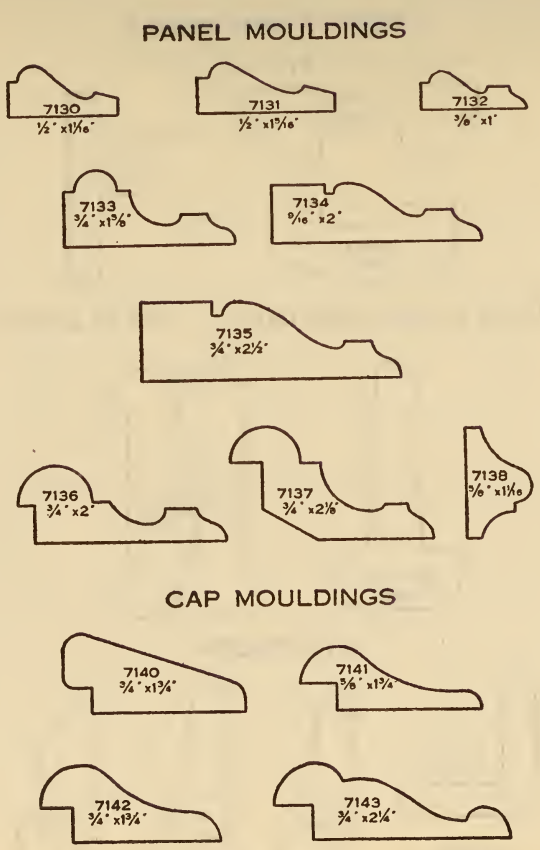


Fig. 115

American standard moldings

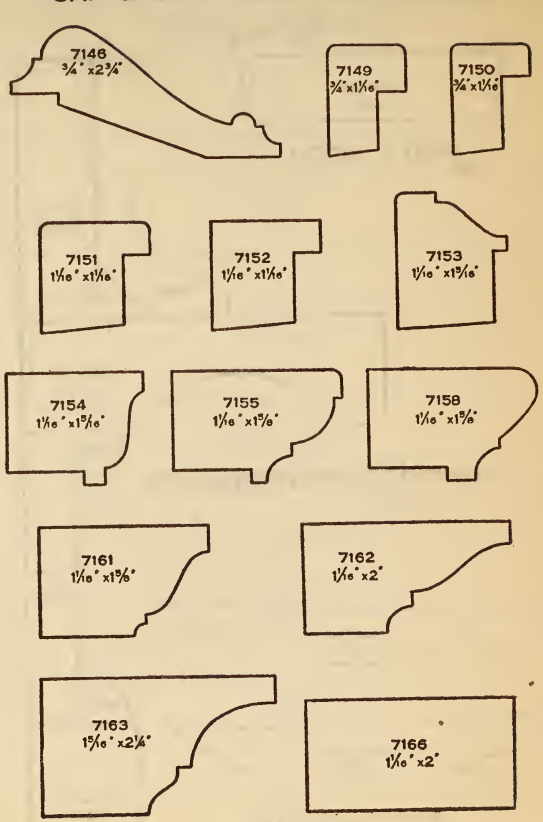


Fig. 116

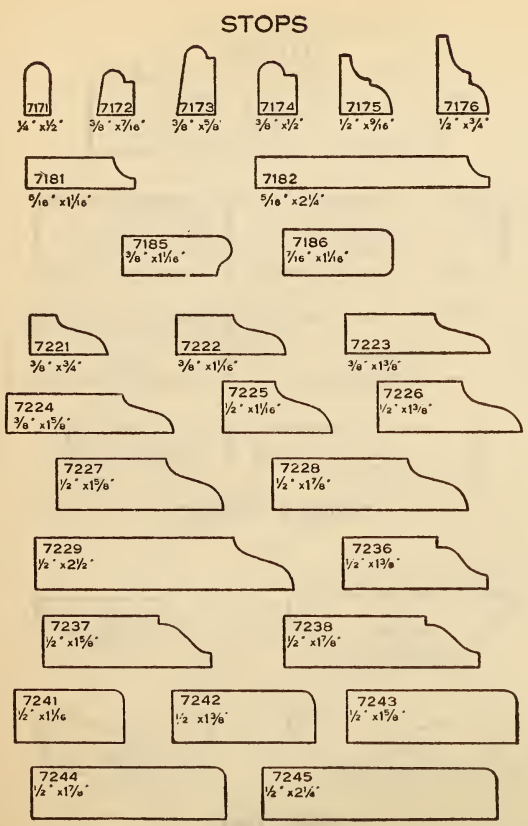


Fig. 117

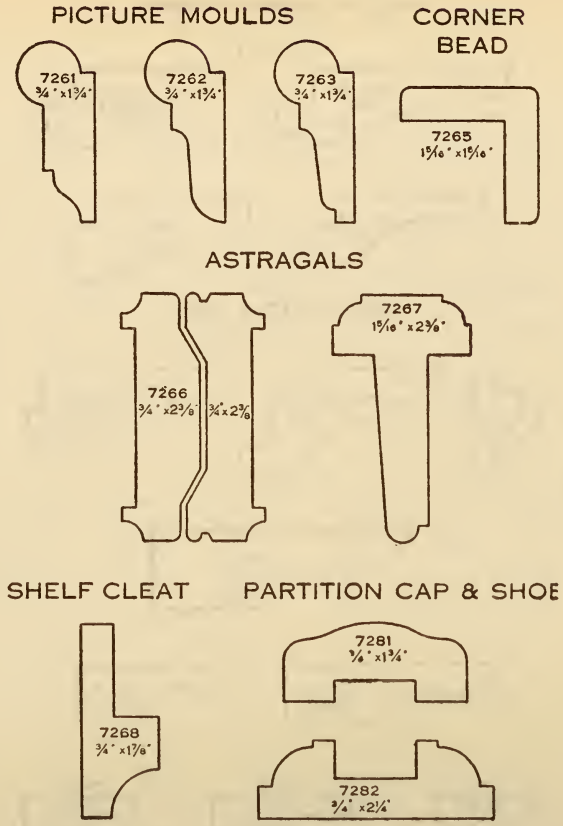


Fig. 118

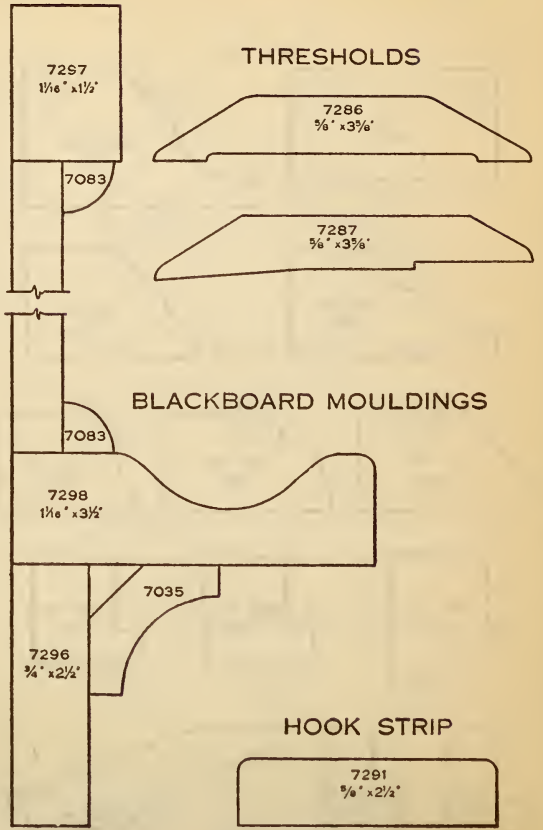


Fig. 119

American standard moldings

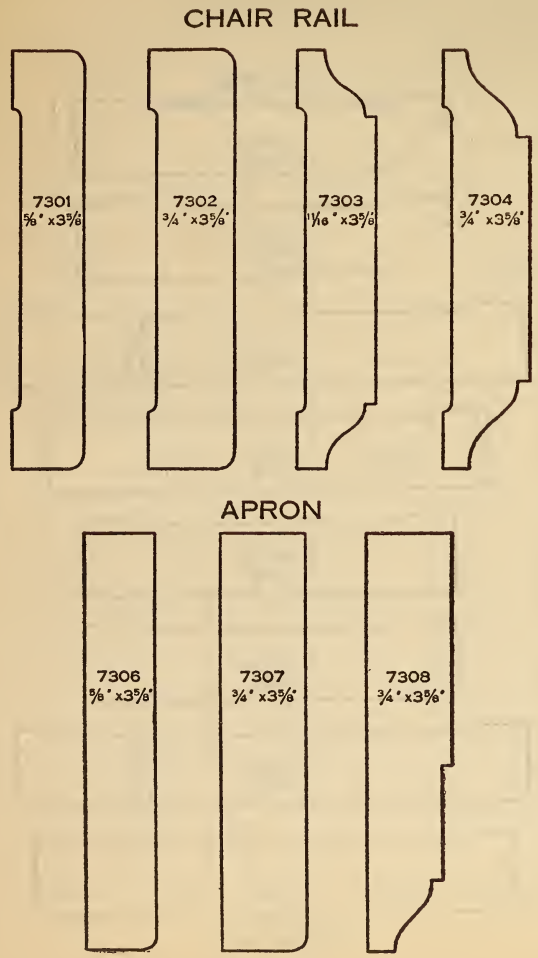


FIG. 120

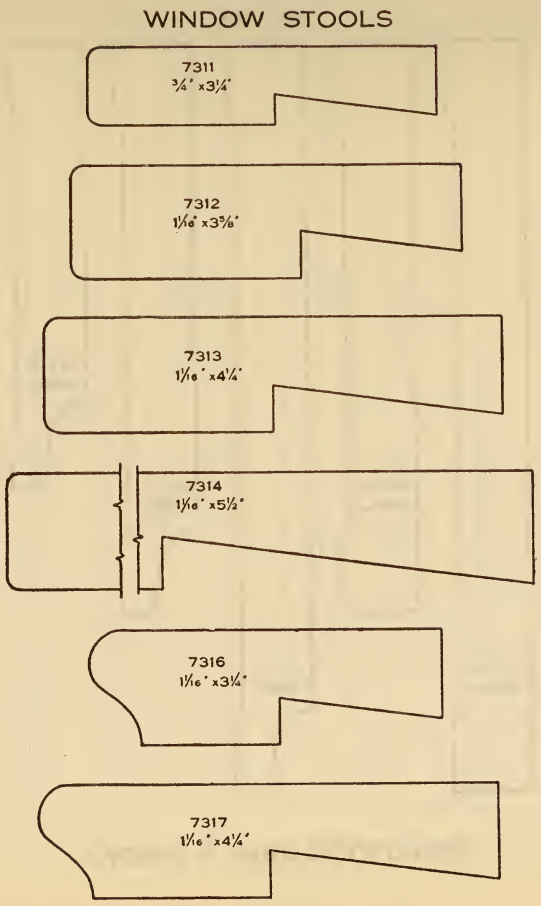


FIG. 121

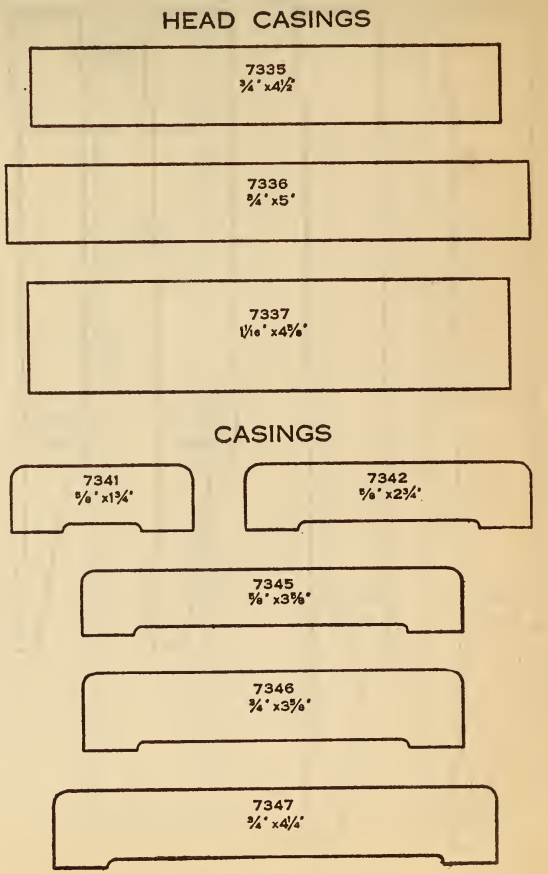


FIG. 122

American standard moldings

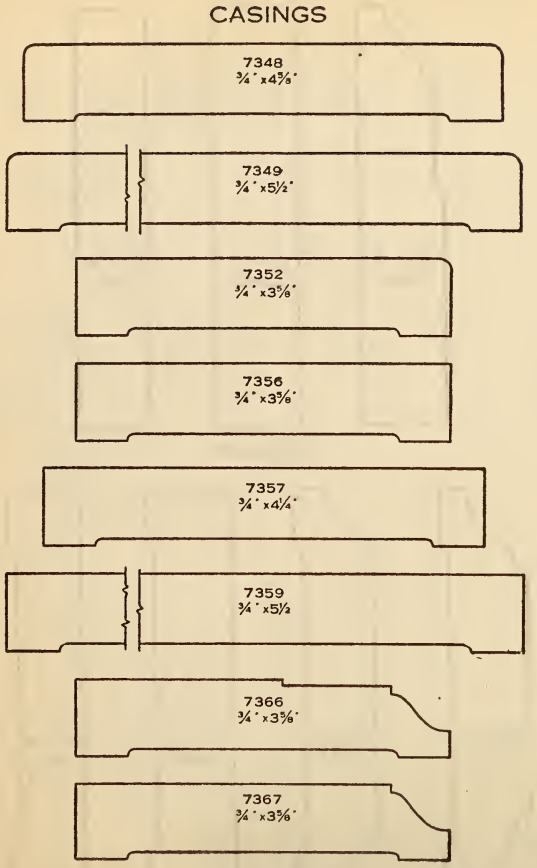


FIG. 123

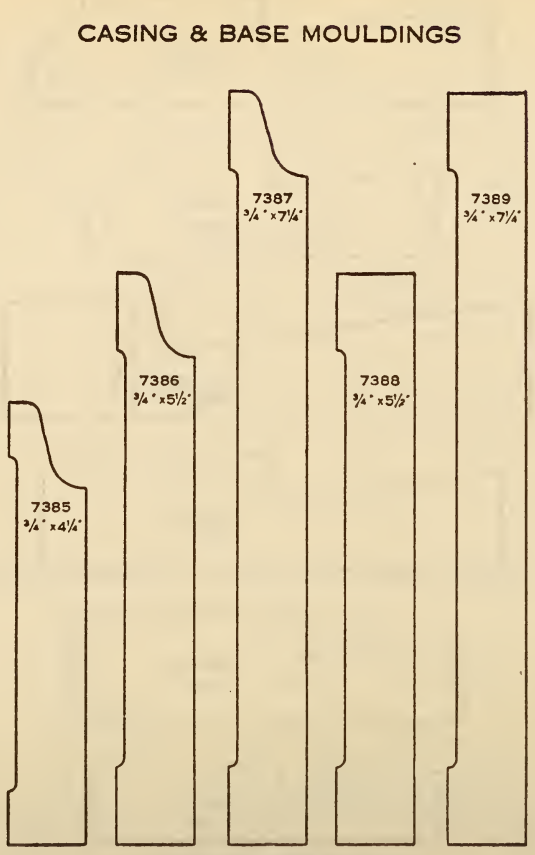


FIG. 124

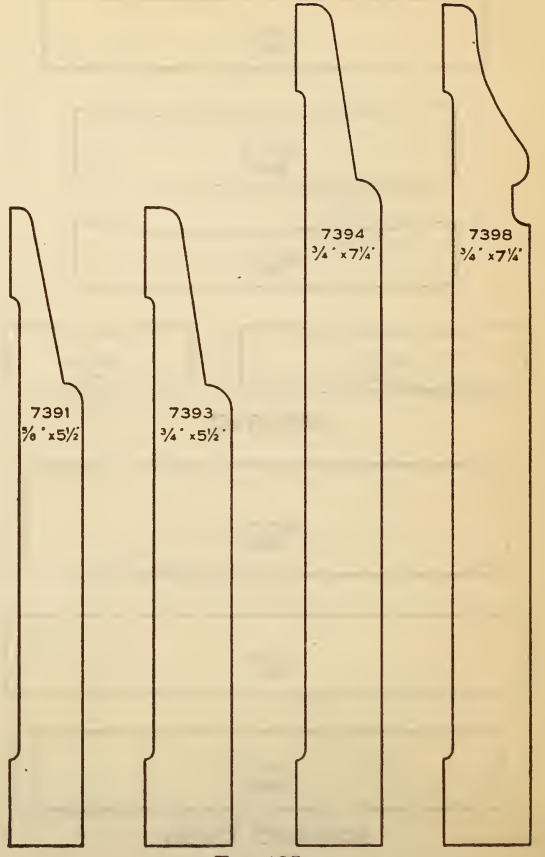


FIG. 125

American standard moldings

BASE MOULDINGS

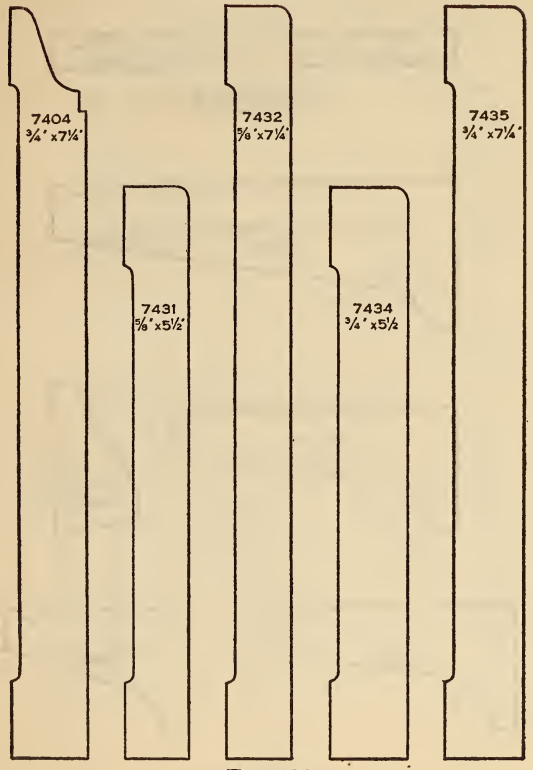


FIG. 126

BASE & SHOE MOULDINGS

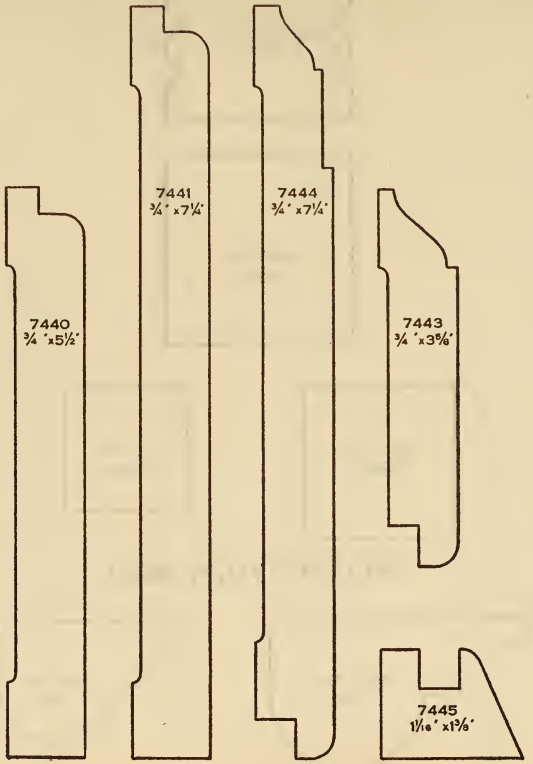


FIG. 127

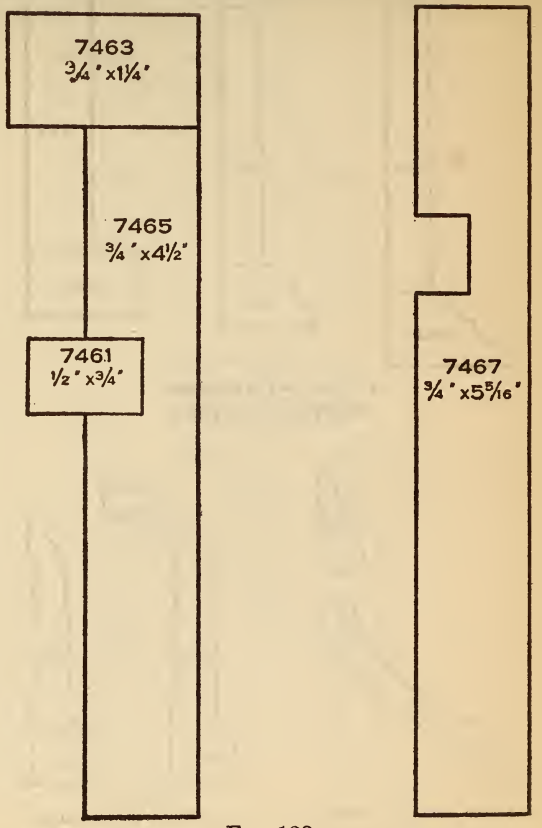


FIG. 128

American standard moldings

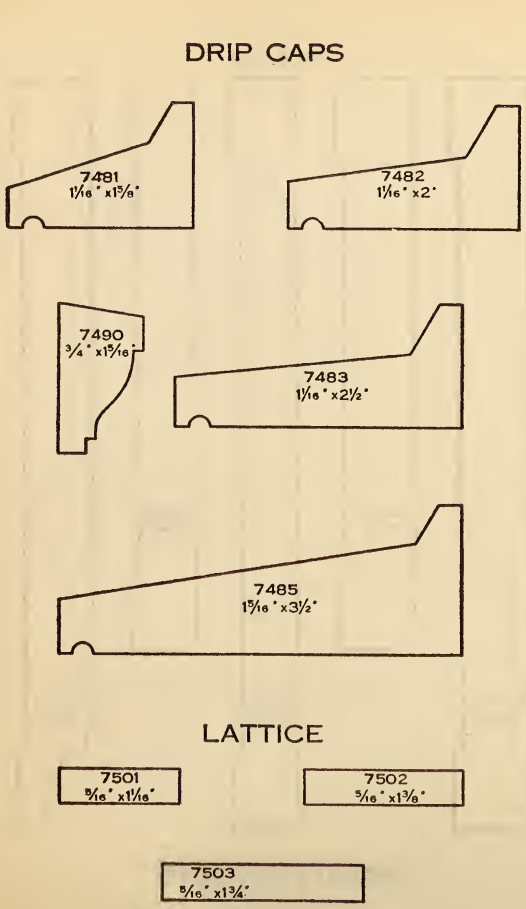


Fig. 129

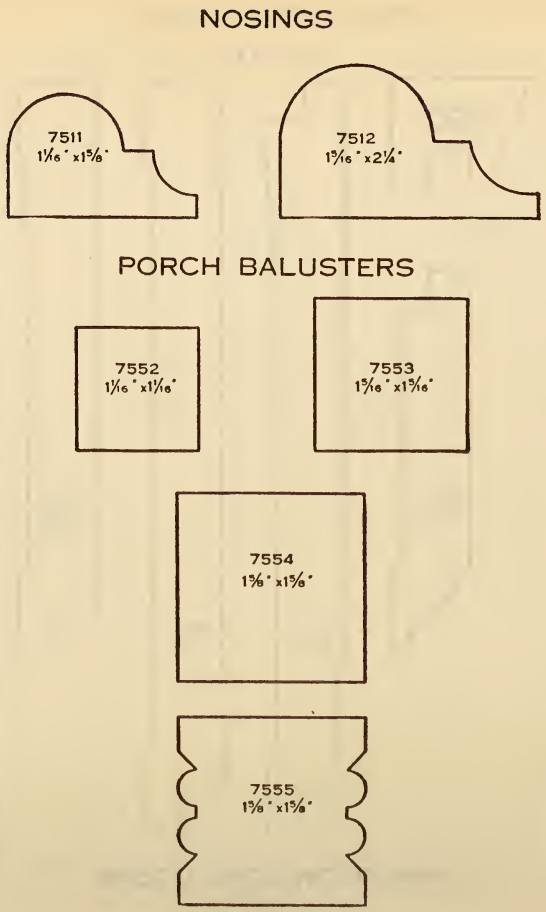


Fig. 130

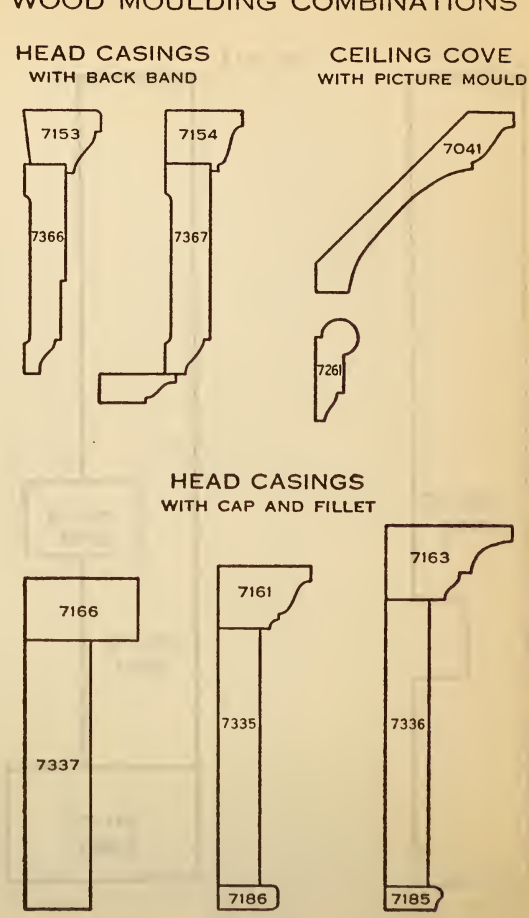
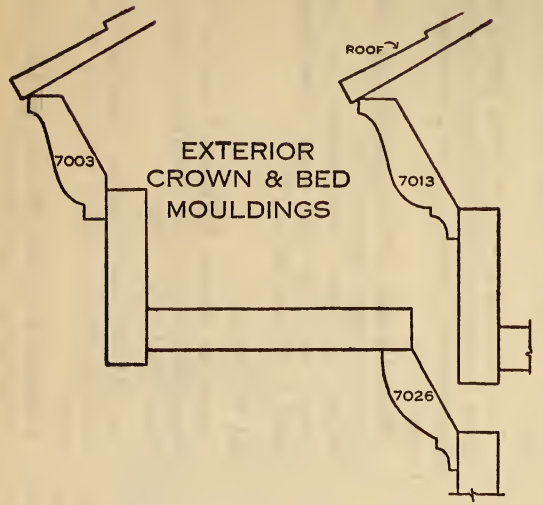


Fig. 131

American standard moldings



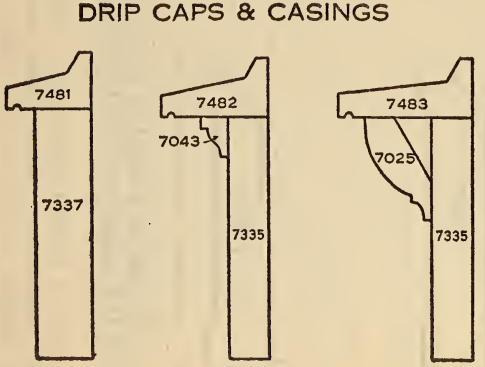


Fig. 132

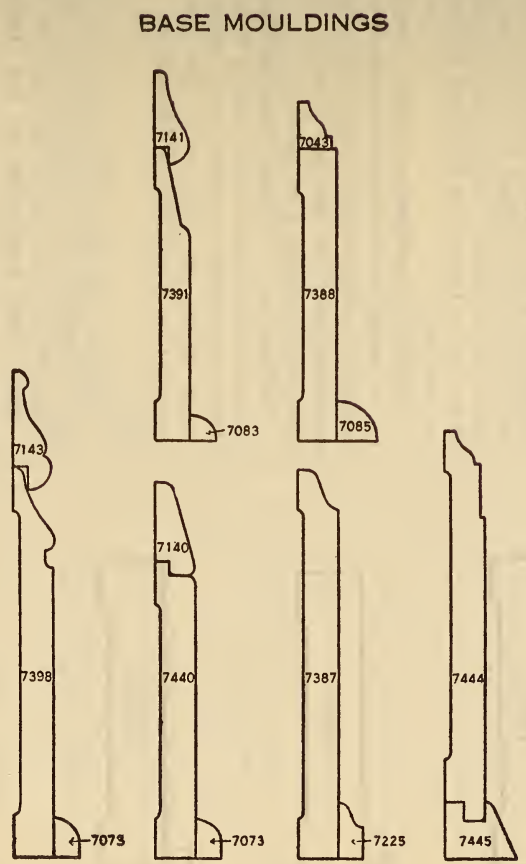


Fig. 133

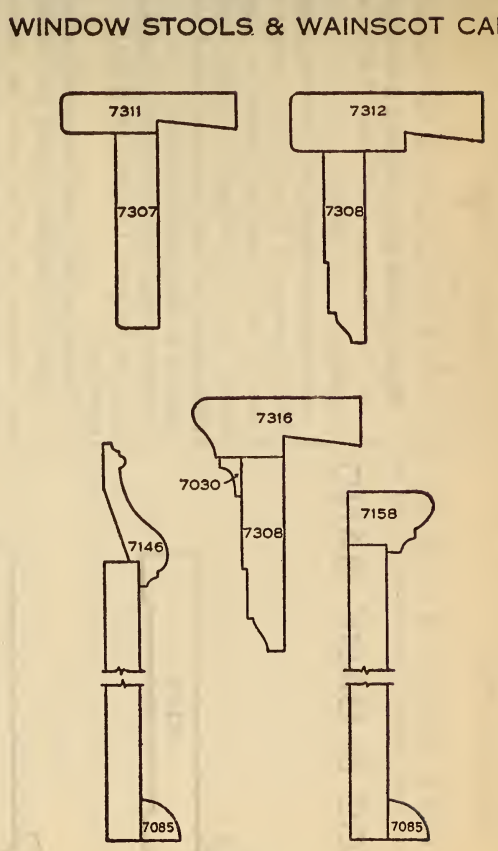


Fig. 134

American standard moldings

inch deep), 25 per cent of face; 1 pitch pocket, equal in length to width of piece; 1 small sound and intergrown knot; 1 small pitch streak.

Battens.

3-inch flat, shall be finished to $\frac{5}{16}$ by 2½ inches net; 2-inch O. G. shall be finished to ¾ by 1¾ inches

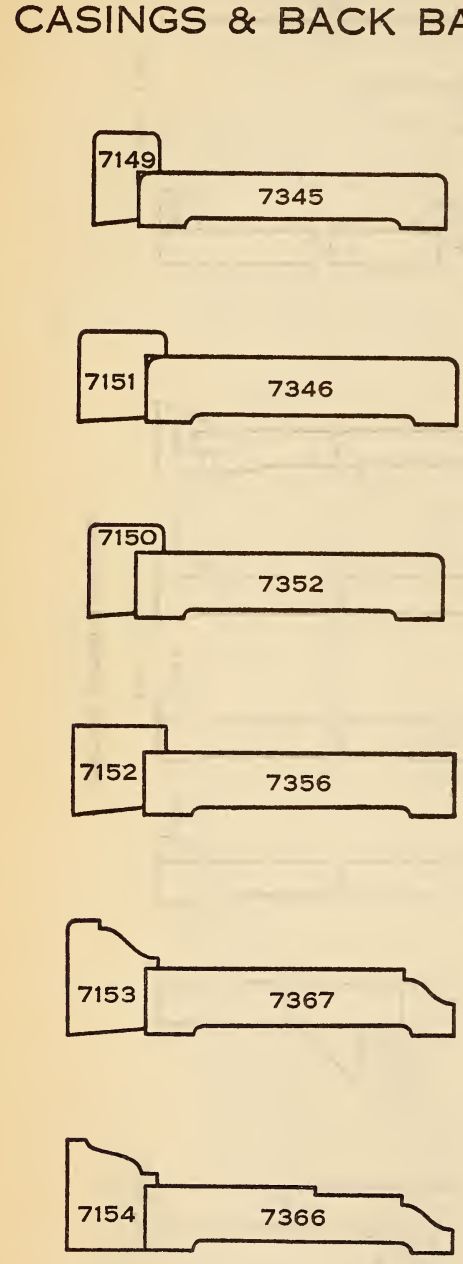


FIG. 135.—*American standard moldings*

net; 2½-inch O. G. shall be finished to ¾ by 2¼ inches net; 3-inch O. G. shall be finished to ¾ by 2½ inches net.

Fir battens shall be of good, sound stock. Will admit sound and tight knots ½ width of piece; small (4-inch) pitch pockets, several of which may be through; deep torn grain; medium sap stain and discoloration; firm heart stain. Unless specific instructions are given, surfacing will be S1S2E or S4S, at shipper's option.

Casing and base.

To be graded by same rules as finish, 411.43.

Western Pine Manufacturers Association, grading rules for Pondosa pine and Idaho white pine moldings, July 1, 1925.

Standard moldings shall have the general quality and appearance of C and better beveled siding and, proportional to size, will admit the same defects, except that in the case of inside moldings only slight stain is allowed when this defect appears on a piece in an appreciable amount.

Defects that will not show when piece is laid shall not be given the same consideration as defects elsewhere.

Defects requiring one cut not to exceed 4 inches of waste, to eliminate a knot hole or other defect too serious to go in the grade, are allowed in high line pieces 12 feet long and longer, the balance of such pieces after cutting to approximate B and better beveled siding in quality; but not more than 20 per cent of the cutting type shall be permitted in any one item.

Lengths shall be 8 feet and longer, in multiples of 1 foot, lengths to be bundled separately or at the option of the shipper short lengths up to the allowed percentage may be matched in with the longer stock to produce the given length.

Moldings may be ordered "standard grade," or in the case of moldings 3 inches wide or wider may be ordered, separately or mixed, in any of the regular lumber grades provided for by the rules of the Western Pine Manufacturers Association.

Sizes.

Moldings are the 7000 series, the American standard patterns illustrated in Figures 108 to 135. Other patterns shall be considered as specials.

White Pine Association of the Tonawandas, grades of northern white pine lumber for moldings 1922.

The following grades of white pine lumber, as shown in 400.26 for this association, are suitable for moldings—No. 1 moldings; No. 2 moldings; stained saps.

Wholesale Sash and Door Association, design and sizes of moldings, March, 1925.

This association has adopted the American Lumber Standards 7000 series of moldings, illustrated in Figures 108 to 135.

411.43 Finish.

Amercian Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0, yard lumber, American Lumber Standards for the grades and sizes of finishing lumber.

Arkansas Soft Pine Bureau, grading rules for finishing lumber, March 23, 1927.

The grading rules for finishing lumber are similar to those of the Southeastern Forest Products Association and the Southern Pine Association given below.

California Redwood Association, standard specifications for eastern grade of California redwood finishing lumber, April, 1927.

The sizes of finishing lumber are as shown in this association's table of sizes of yard lumber, 411.0.

The grades of finish are as follows:

The grades of finish are based on a piece 8 inches wide by 12 feet long, or a piece having 8 square feet, surface measure; on this basis larger or smaller pieces will admit a proportionate number of defects.

Grades.

Clear heart (Redwood Association grade), and A and B (American Standard Redwood grades).

Lengths.

Standard lengths shall be 8 to 20 feet, inclusive, in multiples of 2 feet, admitting not to exceed 10 per cent of 8-foot lengths.

Special provisions.

Small crook shall be permissible in clear heart and "A finish," and medium crook in "B finish."

California White and Sugar Pine Manufacturers Association, grading rules for California white and sugar pine, white and red fir, Douglas fir, and incense cedar finish, May 1, 1926.

CALIFORNIA WHITE AND SUGAR PINE

Finishing Lumber

Lumber that is generally clear, but containing defects limited both as to size and number, and which is smoothly dressed and suitable for use as a whole for finishing purposes or other uses in which large clear pieces are required, shall be graded as finishing lumber. Grade descriptions are based on stock 12 inches wide and 16 feet long.

Standard sizes.

THICKNESS

Nominal (inches)	Dressed (S1S or S2S)	
	Standard	Extra standard
	Inches	*Inches*
11/16	11/16	
1	25/32	13/16
1¼	1 1/16	1 5/32
1½	1 5/16	1 13/32
2	1 5/8	1 13/16
2½	2 1/8	2 5/8
3	2 5/8	2 3/4
4		3 3/4

WIDTH

Nominal (inches)	Dressed (S1S or S4S)
	Inches
4	3 5/8
5	4 5/8
6	5 5/8
7	6 5/8
8	7½
9	8½
10	9½
12	11½
14	13½
16	15½
18	17½
20	19½

Standard lengths shall be 8 feet and up in multiples of 1 foot, but no shipment shall contain more than 5 per cent of 8 and 9 foot lengths.

Standard grades

No. 1 and No. 2 clear or B select and better.

The grade of No. 1 and No. 2 clear or Bselect and better shall comprise the better product of the log and possess natural finishing qualities. Much of this stock is free from defects, but typical pieces generally contain one or two minor defects or blemishes which do not detract from its usefulness. Four to six inch pieces shall be practically free from defects.

Random width shipments shall consist of 95 per cent or more 8 inches wide and wider.

The poorest pieces, based on stock 12 inches wide and 16 feet long, admitted in a shipment may contain two or combination of two of any of the following defects: Three small surface checks, slight crook, one sound and tight knot that does not exceed 1 inch in diameter, two small sound and tight knots, three sound and tight pin knots, small pitch pocket, light pitch, light stain—5 per cent of area, patch slight torn grain, slight chipped grain.

C select.

This grade is primarily based on the idea of furnishing a high class paint finish and its qualities are necessarily of a nature fitting it for the tests that will be demanded of it.

The defects admissible are the same as those in No. 1 and No. 2 clear or B select and better, but exist to a greater degree.

Medium stain covering ⅓ of the face, or a greater area of lighter stain, is admissible, when not in combination with other marked defects.

Crook, based on 16-foot lengths, shall be permissible in both the grades of C select and D select in accordance with the following:

	Inches
1 and 1¼ inches by 4 inches	2
1 and 1¼ inches by 5 and 6 inches	1½
1 and 1¼ inches by 7 to 10 inches	1¼
1 and 1¼ inches by 11 and 12 inches	1

For 1½ and 2 inch thicknesses, crooks ½ inch less than above is permissible. Pieces longer or shorter than 16 feet may have proportionate amounts of crook.

Based on a piece 12 inches wide, ¼ inch cup shall be permissible in C select and D select. Narrower or wider pieces may have proportionate amounts of cup.

The above maximums not allowed when in serious combination with other defects.

The poorest piece in this grade, based on stock 12 inches wide and 16 feet long, would contain four or a combination of four of the defects listed under the grade of No. 1 and No. 2 clear or B select and better.

D select.

This grade of lumber belongs between the higher finishing lumber and the common grades and partakes somewhat of the nature of both. It is made up largely of pieces that carry a finish appearance on but one side only, the back of the piece often carrying a mass of defects. Other pieces have the defects of the higher grades of finish, but of a more serious nature from a quality standpoint; other pieces have a high intrinsic value as compared to the next lower common grade, but not a high appearance as compared to the higher finish grades. Another type often placed in this grade is a high line piece requiring a cut to eliminate a defect too serious to go into finish work.

Medium stain over the entire face is admissible when not in combination with other serious defects.

WHITE FIR, DOUGLAS FIR, AND INCENSE CEDAR

Finishing Lumber

Sizes.

White fir, Douglas fir, and incense cedar finishing shall be finished according to the sizes specified for pine finishing.

Standard Grades

C select and better.

C select and better shall consist of C select and all the better products of the log.

On the basis of 1 by 8–16, the poorest piece admitted in the grade may have five small knots well scattered, or three larger knots if well located. In the absence of knots, or with fewer knots, slightly torn or raised grain, fine season checks, small pitch pockets, or other small defects common to these species will be admitted.

Approximately 33⅓ per cent of medium blue stain, or a greater area of lighter stain, if not in combination with other marked defects will be allowed, also a small percentage of split ends, the splits not to exceed the width of the piece.

A serious combination of the above defects will not be allowed in any one piece.

D select.

The grade of D includes all stock between C and better and the higher common grades and will admit quite serious defects if at the same time the piece retains a good appearance. Fine seasoning checks over the entire face, or several larger seasoning checks, will be admitted, also numerous small knots, pitch pockets, medium pitch, raised grain, or other defects common to fir provided they do not give a coarse or common appearance to the piece. One cut not exceeding 4 inches in length will be allowed in high line pieces 12 feet and longer.

A serious combination of the above defects will not be allowed in any one piece.

National Hardwood Lumber Association, grading rules for cypress, poplar, cottonwood, and gum finish, January, 1927.

Cypress finish (when specified).

Widths.—Stock widths 4 inches and over, as specified. Rough widths may be ¼ inch scant of the width specified. Widths surfaced two edges must be ½ inch less than the specified rough widths.

Lenghts.—8 feet and over.

Inspection shall be made from the good face, the reverse side of A, B, and C shall not be more than one grade lower. A and B may be combined in one grade, as B and better.

Finish shall be surfaced two sides to standard surfaced thicknesses unless otherwise specified.

A finish.

Pieces 4 and 5 inches wide must be clear and free from sapwood.

Defects and sapwood in the aggregate will be admitted according to width as follows:

6 inches, one ¾-inch sound defect or 1 inch of bright sapwood.

7 inches, one ¾-inch sound defect or 2 inches of bright sapwood.

9 inches, one ¾-inch sound defect and 1½ inches of bright sapwood; or two ¾-inch sound defects; or 3 inches of bright sapwood.

12 inches, one ¾-inch sound defect and 2 inches of bright sapwood; or one sound standard defect or its equivalent; or 4 inches of bright sapwood.

14 inches and wider will admit defects in proportion to the multiple of 7 to 12 inch widths.

B finish.

Pieces 4 to 11 inches wide, free from other defects, may be all bright sapwood; in pieces 12 inches and over wide bright sapwood is no defect. Otherwise defects and sapwood in the aggregate will be admitted according to widths as follows:

4 inches, two ¾-inch sound defects and 2 inches of bright sapwood.

7 inches, two ¾-inch sound defects and 3 inches of bright sapwood.

9 inches, one sound standard defect or three ¾-inch sound defects, and 4 inches of bright sapwood.

12 inches, one sound standard defect or four ¾-inch sound defects well scattered.

14 inches and wider will admit sound defects in proportion to the multiple of 7 to 12 inch widths.

C finish.

This grade will admit pin wormholes, sound stain, ¾-inch sound knots and other sound defects that do not prevent the use of each piece in its full width and length as a paint grade.

D finish.

This grade will admit all the defects allowed in C finish, and, in addition, will admit slight shake and other defects that will not prevent the use of each piece in its full width and length as a common paint grade. The reverse side will admit defects that do not seriously impair the strength of the piece.

Cypress panel (when specified).

Widths.—8 inches and wider.

Lengths.—8 to 20 feet, admitting 15 per cent of odd lengths.

Inspection shall be made from the poor side, and shall be the same as B and better finish.

PANEL AND WIDE NO. 1

Poplar, cottonwood, and gum.

Panel and wide No. 1 are a combined grade and must contain not less than 50 per cent panel.

Widths.—18 inches and over.

Splits not exceeding 6 inches in length in one end shall not be considered defects.

Bright sapwood is no defect.

Sound stain not exceeding 3 inches on each edge in the aggregate shall not be considered a defect in poplar and cottonwood.

Sound stain shall not be considered a defect in gum.

Panel

Lengths.—8 to 16 feet, admitting 30 per cent of 8 to 11 feet.

Fifty per cent of the total quantity must be clear on both sides. The balance of the quantity will admit defects provided 90 per cent of the piece can be used for panels in cuttings 4 feet or over long by the full width of the piece.

Wide No. 1

Lengths.—6 to 16 feet, admitting 30 per cent of 6 to 11 feet.

Pieces 6 and 7 feet long must be clear.

Pieces 8 feet and over long will admit defects provided 75 per cent of the piece can be used for panels in cuttings 4 feet or over long by the full width of the piece.

North Carolina Pine Association (Inc.), grading rules for pine finish, January 1, 1927.

B and better finish.

1, 1¼, 1½, and 2 inches thick up to and including 10 inches in widths in addition to the equivalent of one split in end which should not exceed in length the width of the piece, will admit any two of the following or their equivalent of combined defects: Slight torn grain, 3 pin knots, 1 standard knot, 3 small pitch pockets, 1 standard pitch pocket, 1 standard pitch streak, 5 per cent of sap stain, wane not to exceed 1 inch in width, ¼ inch in depth and one-sixth the length of the piece; small surface checks; reverse side to grade C or better, except 1½ inches and thicker may grade No. 2 common or better.

11 inches and wider B finish will admit three of the above defects or their equivalent, but sap stain shall not exceed 10 per cent.

C finish.

C finish will admit, in addition to one split in end which should not exceed in length the width of the piece, two or combination of two of any of the following defects or their equivalent: Surface checks; pin wormholes, 4 per surface foot; medium torn grain; 6 pin knots, 4 small knots; 2 standard knots; 6 small pitch pockets; 4 medium pitch pockets; 2 standard pitch pockets; 2 standard pitch streaks; pith, not exceeding ¼ inch in width by 3 inches in length; slight shake, equal in length to width of piece; 25 per cent firm red heart; 25 per cent stain; wane 1 inch in width, ½ inch in depth, and one-third the length of the piece.

Defective dressing or slight skips in dressing, that will not prevent its use as finish without waste, will also be allowed.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for hemlock and tamarack finishing lumber, February 1, 1927.

Finishing lumber.

The thickness and widths of finishing lumber S1S or S2S and/or S1E or S2E conform to the sizes of finish of the American Lumber Standards, 411.0, yard lumber.

Lengths.

Standard lengths of finish shall be 8 to 20 feet, and in shipments of mixed lengths, 20 per cent of 8-foot in D and better shall be admitted.

The above percentage of short lengths is customary and in the interest of conservation, will be included, as far as practical, in all shipments of mixed lengths.

Special provision.

The following amount of crook, based on 16-foot lengths, shall be permissible in all grades of finish:

	Inches
1 and 1¼ inches by 3 inches	3
1 and 1¼ inches by 4 inches	2½
1 and 1¼ inches by 5 and 6 inches	2
1 and 1¼ inches by 7 and 8 inches	1¾
1 and 1¼ inches by 9 and 10 inches	1¼
1 and 1¼ inches by 11 and 12 inches	1

For 1½ and 2 inch thicknesses, crook ½ inch less than above is permissible. Pieces longer or shorter than 16 feet may have proportionate amounts of crook.

Grades D and better.

This grade is especially adapted for interior finish where only the face or best side is expected to show with some attention given to the back of the piece.

The face shall show no wane, but the back may show such an amount of wane or other defects as will not interfere with the use of the piece for finishing purposes.

No shake or season check shall be allowed on the face side, but a very little tight shake and medium checks may appear on the back of the piece.

This grade will admit on the face side several tight pin knots not over ⅜ of an inch in diameter. In 4 and 6 inch pieces, 12 feet and longer, not more than three knots are admissible, and proportionately more in wider pieces.

Ten and twelve inch pieces 12 feet and longer, will not admit more than three sound and tight knots, not to exceed ¾ inch in diameter. Narrower and shorter pieces will admit of fewer medium knots, but not a combination of such knots and other defects.

Pieces 12 feet and longer are admissible that will, with not more than 10 per cent of waste, produce two clear cuts each 4 feet long or longer.

Northern Pine Manufacturers Association, grading rules for northern pine, Norway pine, spruce and tamarack finishing lumber, April 15, 1925.

B select and better.

B select and better shall consist of B select and all the better product of the stock and may be 4 inches or wider, and suitable for natural finish.

In this grade white sap is not considered a defect.

Knots, shake, season checks, and a small amount of stained sap are admissible.

A 4 or 6 inch piece should have but very little shake. Wider pieces can have more shake, but it should be local and not scattered over the face of the piece.

Season checks equivalent to shake defects are admissible.

Slightly stained sap is admissible when other defects are not of a serious nature, the amount of stained sap depending upon the width of the piece.

C select.

C select may be 4 inches or wider. The grade of C select shall possess finishing qualities and be suitable for high-class paint finishes. The defects admissible are the same as those in B select, but exist to a greater degree. Medium stain covering one-third the face of the piece will be allowed, if not in combination with other marked defects.

D select.

D select may be 4 inches or wider, and embraces all thicknesses manufactured in pine lumber.

This grade of lumber belongs between the higher finish lumber and the common grades and partakes somewhat of the nature of both. It is made up largely of pieces that carry a finish appearance on but one side only, the back of the piece often carrying a mass of defects. Other pieces have the defects of the higher grades of finish but of a more serious nature from a quality standpoint, other pieces have a high intrinsic value as compared to the next lower common grade, but not a high appearance as compared to the higher finish grades. Another type often placed in this grade is a high line piece requiring a cut to eliminate a defect too serious to go into finish work.

Medium stain covering entire face, or season checks equivalent to shake defects will be admitted if not in combination with other marked defects.

Red Cedar Lumber Manufacturers Association, grading rules for red cedar finishing lumber, August 1, 1925.

Defects based on 8 inches by 12 feet.

Nominal thickness (inches)	Standard finished thickness, S1S or S2S	Finished widths, S1E and S2E
	Inches	*Inches*
1	13/16	3 to 7, ⅜ inch off.
1¼	1 1/32	8 to 12, ½ inch off.
1½	1 11/32	13 and wider, 1 inch off.
2	1¾	

Widths of surfaced stock 13 inches and wider with edges rough, ½ inch less than nominal.

Lengths.

Multiples of 1 foot.

American Lumber Standard thicknesses (see 411.0) can be furnished on contract.

No. 2 and better.

Slight torn grain permitted. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Bright sap; two pin knots. One additional knot permitted for each additional 2 inches increase in width.

Southeastern Forest Products Association, grading rules for finishing lumber, September 1, 1925.

The grades of finish are based on a piece 8 inches wide by 12 feet long, or a piece having 8 square feet, surface measure; on this basis, larger or smaller pieces will admit a proportionate number of defects.

Grades.

A, B, and C.

Lengths.

Standard lengths are 8 to 20 feet, inclusive, and in shipments of mixed lengths, 5 per cent of 8-foot in "C" and better grades shall be permissible.

The above percentage of short lengths is customary, and in the interest of conservation, will be included, so far as practicable, in all shipments of mixed lengths.

Special provisions.

The following amount of crook, based on 16-foot lengths, shall be permissible in all grades of finish:

	Inches
1 and 1¼ inches by 3 inches	3
1 and 1¼ inches by 4 inches	2½
1 and 1¼ inches by 5 and 6 inches	2
1 and 1¼ inches by 7 and 8 inches	1¾
1 and 1¼ inches by 9 and 10 inches	1¼
1 and 1¼ inches by 11 and 12 inches	1

For 1½ and 2 inch thicknesses, crook ½ inch less than above is permissible. Pieces longer or shorter than 16 feet may have proportionate amounts of crook.

Based on a piece 12 inches wide, ¼-inch cup shall be permissible in all grades of finish. Narrower or wider pieces may have proportionate amounts of cup.

In case both sides are desired, A, B, or C grade, or free from all defects, special contract must be made. Defective dressing or slight skips in dressing, on the reverse side of finish, are admissible.

"A" finish, up to and including 12 inches in width, must show one face practically clear of all defects except it may have such wane as would dress off if surfaced four sides.

"A" finish, 13 inches and wider, will admit two small defects or their equivalent.

"B" finish will admit, in addition to one split in end which should not exceed in length the width of the piece, two or combination of two of any of the following defects or their equivalent: Small surface checks; slight torn grain; 3 pin knots; 2 small knots; 1 standard knot; 3 small pitch pockets; 2 medium pitch pockets; 1 standard pitch pocket; 2 small pitch streaks; 1 standard pitch streak; 5 per cent stain; or firm red heart; wane 1 inch in width, ¼ inch in depth, and ⅙ the length of the piece.

"C" finish will admit, in addition to one split in end which should not exceed in length the width of the piece, two or combinations of two of any of the following defects or their equivalent: Surface checks; pin wormholes, 4 per surface foot; medium torn grain; 6 pin knots; 4 small knots; 2 standard knots; 6 small pitch pockets; 4 medium pitch pockets; 2 standard pitch pockets; 2 standard pitch streaks; pith, not exceeding ¼ inch in width by 3 inches in length; slight shake, equal in length to width of piece; 25 per cent firm red heart; 25 per cent stain ; wane 1 inch in width, ½ inch in depth, and ⅛ the length of the piece.

Defective dressing or slight skips in dressing, that will not prevent its use as finish without waste, will also be allowed.

Southern Cypress Manufacturers Association, grading rules for cypress finish, June 15, 1925.

Clear heart finish (special grade).

Thicknesses.—1 to 4 inches.

Widths.—Shall be specified widths, 4, 5, 6, 8, 10, 12, 14, 16, 18, and 20 inches and wider, and 24 inches and wider, and may be furnished in assorted widths, 4 to 12 inches, admitting 20 per cent of 7, 9, and 11 inch widths, and may also be furnished in random widths 13 inches and wider.

Lengths.—8 to 20 feet.

Shall be all heart and the face side shall be free from defects.

Grade A.

Thicknesses.—1 to 4 inches.

Widths.—Shall be specified widths, 4 5, 6, 8, 10, 12, 14, 16, 18, and 20 inches and wider and 24 inches and wider, and may be furnished in assorted widths, 4 to 12 inches, admitting 20 per cent of 7, 9, and 11 inch widths, and may also be furnished in random widths 13 inches and wider.

Lengths.—8 to 20 feet.

Pieces 12 inches and narrower shall be practically free from defects, on the face side, and sap shall be limited as follows:

1 inch on pieces under 8 inches wide.

2 inches on pieces 8 to 9 inches wide.

3 inches on pieces 10 to 11 inches wide.

4 inches on pieces 12 inches wide.

Pieces wider than 12 inches will admit any amount of bright sap.

Grade B.

Thicknesses.—1 to 4 inches.

Widths.—Shall be specified widths, 4, 5, 6, 8, 10, and 12 inches wide. May also be furnished in assorted widths 4 to 12 inches, admitting 20 per cent of 7, 9, and 11 inch widths, and may also be furnished in random widths, 13 inches and wider.

Lengths.—8 to 20 feet.

Pieces 4 to 6 inches wide will admit one or two small sound knots.

Pieces wider than 6 inches will admit small sound knots in proportion as the width increases.

Grade C.

Thicknesses.—1 to 4 inches.

Widths.—Shall be specified widths, 4, 5, 6, 8, 10, and 12 inches. May be furnished in assorted widths, 4 to 12 inches, admitting 20 per cent, 7, 9, and 11 inch widths.

Lengths.—8 to 20 feet.

This grade will consist to a considerable extent of droppings from the B grade, and, while admitting stained sap, a few pin wormholes well scattered and coarser and more numerous defects than B, is intended for use full length and width on paint jobs.

Grade D.

Thicknesses.—1, 1¼, 1½, and 2 inches.

Widths.—Shall be specified widths, 4, 5, 6, 8, 10, and 12 inches. May also be furnished in assorted widths, 4 to 12 inches, admitting 20 per cent 7, 9, and 11 inch widths.

Lengths.—8 to 20 feet.

This is intended as a cheaper paint finish, and the defects shall be so restricted in number and character as to produce a practically sound face. Will not admit open shake nor loose or unsound knots, nor will it admit wane exceeding one-half of the thickness of the piece at any point, and that on one edge only. No wane on face side. The reverse side may have coarse defects, and need not be of a finishing type.

Southern Pine Association, grading rules for finishing lumber, March 23, 1927.

The grading rules for finishing lumber of this association are the same as those of the Southeastern Forest Products Association, above.

West Coast Lumbermen's Association, grading rules for Douglas fir, West Coast hemlock, Sitka spruce, and western red cedar finish, July 1, 1926.

DOUGLAS FIR AND WEST COAST HEMLOCK

Finish, K. D.

Defects based on 8 inches by 12 feet.

THICKNESSES

Nominal (inches)	Standard yard S1S or S2S	Standard industrial S1S or S2S
	Inches	*Inches*
1	25/32	13/16
1¼	1 1/16	
1½	1 5/16	
2	1 5/8	1¾
2½ to 4	5/8 off	

WIDTHS

Nominal (inches)	S1E or S2E
	Inches
2 to 3	⅜ off
4 to 7	½ off
8 to 12	¾ off
Over 12	1 off

Lengths.—Multiples of 1 foot.

B and better grade—F. G. and/or V. G. finish.

Shall be well manufactured. Will admit slight torn grain; slight cup; splits on end not longer than width of piece, in 5 per cent of pieces. With the above, will admit the following defect, an equivalent defect, or an equivalent combination of defects: Three very small (2-inch) pitch pockets, none through.

C grade—F. G. and/or V. G. finish.

Will admit medium torn grain; light sap stain, 25 per cent of face; slight cup; small seasoning checks; split on end not longer than width of piece, in 5 per cent of pieces. With any one of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Two sound and tight small knots or equivalent of sound and tight pin knots; 4 small (4-inch) pitch pockets, 2 of which may be through, or equivalent of slightly larger pockets; occasional slight skips on edges and back; small pitch streak. Will admit cut-out of 1½ inch for a defect 4 feet or more from either end in pieces 12 feet or longer, if piece is otherwise as good as B grade.

D grade—F. G. and/or V. G. finish.

Will admit the following defects, equivalent defects, or equivalent combinations of defects: Four 1-inch sound and tight knots; short splits; deep cup; numerous small pitch pockets (several of which may be through), or equivalent medium to large pitch pockets; heart stain; medium sap stain; 4 heavy skips, each not over 12 inches long, based on 12-foot length; torn grain; pin wormholes; seasoning checks; cut-out of 3 inches for a defect 4 feet or more from either end in pieces 12 feet and longer.

SITKA SPRUCE

Finish K. D.

Defects based on 12 feet.

THICKNESSES

Nominal (inches)	Standard yard S1S or S2S	Standard industrial S1S or S2S
	Inches	*Inches*
1	25/32	13/16
1¼	1 1/16	
1½	1 5/16	
2	1 5/8	1¾
2½ to 4	⅜ off	

WIDTHS

Nominal (inches)	S1E or S2E
	Inches
2 to 3	⅜ off
4 to 7	½ off
8 to 12	¾ off
Over 12	1 off

Lengths.—Multiples of 1 foot.

B and better finish.

Defects based on 4 to 6 inches by 12 feet. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; one sound and tight pin knot; one 2-inch pitch pocket, not through.

B and better finish.

Defects based on 8 to 10 inches by 12 feet. Will admit slight torn grain; slight cup; split on end not longer than width of piece, in 5 per cent of pieces. With the above, will admit one of the following defects, or an equivalent defect, or an equivalent combination of defects: Two sound and tight pin knots; two 3-inch pitch pockets, none through. One additional pin knot or pitch pocket allowed for each 2-inch increase in width.

C finish.

Defects based on 8 inches by 12 feet. Will admit medium torn grain; light sap stain; 25 per cent of face; slight cup; small seasoning checks; split on end not longer than width of piece, in 5 per cent of pieces. With any of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three 1-inch sound and tight knots, or equivalent of pin knots; 4 small (4-inch) pitch pockets, 2 of which may be through, or equivalent of slightly larger pockets; occasional slight skips on edges and back. Cut-out of 1½ inches for a defect 4 feet or more from either end in pieces 12 feet or longer, if piece is otherwise as good as B and better.

WESTERN RED CEDAR

Finish, K. D.

Defects based on 8 inches by 12 feet.

THICKNESSES

Nominal (inches)	Standard yard S1S or S2S	Standard industrial S1S or S2S
	Inches	*Inches*
1	25/32	13/16
1¼	1 1/16	
1½	1 5/16	
2	1 5/8	1¾
2½ to 4	⅜ off.	

WIDTHS

Nominal (inches)	S1E or S2E
	Inch
2 to 3	3/8 off.
4 to 7	1/2 off.
8 to 12	3/4 off.
Over 12	1 off.

Lengths.—Multiples of 1 foot.

B and better.

Will admit slight torn grain; 1-inch bright sap. With the above, will admit the following defect, an equivalent defect, or an equivalent combination of defects: Two sound and tight small knots. One additional knot or 1/2-inch sap allowed for each additional 2 inches increase in width.

Western Pine Manufacturers Association, grading rules for Pondosa pine, Idaho white pine, white fir cedar, and spruce finish lumber, July 1, 1925.

The following are the standard manufactured sizes of finish:

Thick common, finish, and tank plank S4S.

1¼ to 1⅛ by ⅜ scant of full width.
1½ to 1⅜ by ⅜ scant of full width.
2 to 1¾ by ⅜ scant of full width.

Thick common and finish, D and M or S2S and C. M.

1¼ by 4 to 1⅛ by 3¼ face.
1½ by 6 to 1⅜ by 5¼ face.
2 by 4 to 1¾ by 3¼ face.

RULES FOR GRADING PONDOSA PINE AND IDAHO WHITE PINE FINISH LUMBER

B select and better.

B select and better shall consist of B select and all the better product of the stock and may be 4 inches or wider and embraces all thicknesses manufactured in pine lumber.

Knots, light stain, and light traces of pitch or small season checks are admissible.

A 4 or 6 inch piece should show but very slight traces of pitch or season check. Wider pieces can have more pitch or season checks, but it should be local and not scattered over the face of the piece.

The fact that the defects admissible in the grade B and better must be of a nature that will not allow them to interfere with the high quality or appearance of this grade, tends to make of this a stock almost without defect.

C select.

C select may be 4 inches or wider and embraces all thicknesses manufactured in pine lumber.

This grade is primarily based on the idea of furnishing a high class outside paint finish and its qualities are necessarily of a nature fitting it for the tests that will be demanded of it.

The defects admissible are the same as those in B select but exist to a greater degree, yet in no single piece are found numerous and serious defects.

Medium stain covering one-third of the face or a greater area of lighter stain is admissible when not in combination with other marked defects.

D select.

D select may be 4 inches or wider and embraces all thicknesses manufactured in pine lumber.

This grade of lumber belongs between the higher finishing lumber and the common grades and partakes somewhat of the nature of both. It is made up largely of pieces that carry a finish appearance on but one side only, the back of the piece often carrying a mass of defects. Other pieces have the defects of the higher grades of finish, but of a more serious nature from a quality standpoint; other pieces have a high intrinsic value as compared to the next lower common grade, but not a high appearance as compared to the higher finish grades. Another type often placed in this grade is a high-line piece requiring a cut to eliminate a knot hole or other defect too serious to go into finish work.

Medium stain over the entire face is admissible in otherwise high-line pieces.

Western Pine Manufacturers Association, grading rules for larch and fir finish lumber, July 1, 1925.

The following are the standard manufactured sizes of finish:

Finish S1S and S2S.

1 to $\frac{25}{32}$.
1¼ to $1\frac{1}{16}$.
1½ to $1\frac{5}{16}$.

Finish widths S1E or S2E.

4 and 6 inch, ⅜-inch scant of full width.
8, 10, and 12 inch, 1/2-inch scant of full width.

Larch and fir finish are graded by the rules for larch and fir lumber, 400.0.

White Pine Association of the Tonawandas, grades of northern white pine lumber for finish, 1922.

The following grades of white pine lumber, as shown in 400.26 for this association, are suitable for finishing lumber—fine common, stained saps, No. 1 shelving and dressing, No. 1 barn.

411.44 Baseboards.

(See finish No. 411.43.)

411.5 SHIP-LAP.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1927.

(See 411.0, yard lumber, for grades and sizes of ship-lap.)

Arkansas Soft Pine Bureau, sizes and grades for ship-lap, March 23, 1927.

The grades of heavy ship-lap are similar to the grades of the Southern Pine Association for pine flooring, 411.27.

The grading rules for ship-lap are similar to those of the Southeastern Forest Products Association for common boards, 402.42.

Patterns.

Heavy ship-lap patterns are illustrated in Figures 136 and 137.

California Redwood Association, standard specifications for eastern grades of California redwood ship-lap, April, 1927.

The sizes of ship-lap are as shown in this association's table of sizes for yard lumber, 411.0.

The grades of ship-lap are the same as for common boards, 402.42.

California White and Sugar Pine Manufacturers Association, grading rules for ship-lap, May 1, 1926.

THICKNESSES

Nominal (inches)	Dressed	
	Standard	Extra standard
	Inches	*Inches*
1	11/16	
1	25/32	13/16
2	1 5/8	1 3/4

WIDTHS

4	3 1/8	3 1/2
6	5 1/8	5 1/2
8	7 1/8	7 1/2
10	9 1/8	9 1/2
12	11 1/8	11 1/2

NOTE.—In 2-inch thickness the lap shall be ½ inch and the face width ⅛ inch less than shown.

Standard lengths shall be 8 feet and up in multiples of 2 feet.

STANDARD GRADES

No. 1 common.

This grade is of a character that fits it for cornice, fine barn boards, and all uses where the best quality and appearance of common lumber are required.

No. 1 common boards include all sound, tight knotted stock, free from very large knots with the size of the knot the determining factor of the grade, as follows:

Sound and intergrown knots which do not exceed 1½ inches in diameter in 4 and 6 inch widths, 2 inches in 8 and 10 inch, 2½ inches in 12-inch, and not over 3 inches in wider widths. Knots of approximately maximum size shall be restricted in number and placement to conform to the general appearance of the grade, seldom more than two such knots being allowed in any one piece except when such occurrence does not seriously detract from the general appearance of the grade.

Black and encased knots, provided they be sound and immovably fixed in position, which do not exceed one-half the diameter of sound and intergrown knots permitted up to a maximum diameter of 1¼ inches.

Some of the defects permitted in this grade when not in serious combination are surface checks, slight crook, slight cup, small pitch pockets, light pitch, pin wormholes well scattered, light stain, medium torn grain, and slight skip.

No. 2 common.

No. 2 boards are subject to the same general inspection as No. 1, except that coarser and larger knots or their equivalent form the basis of inspection, as follows:

Sound and tight knots which do not exceed 2 inches in diameter in 4-inch, and 2½ inches in 6-inch widths, 3 inches in 8 and 10 inch, 3½ inches in 12-inch, and not over 4 inches in wider widths, and an occasional smaller knot that is not firmly set. Knots of approximately maximum size shall be restricted in number and placement to conform to the general appearance of the grade, seldom more than two such knots being allowed in any one piece except when such occurrence does not seriously detract from the general appearance of the grade.

Spike or branch knots which are sound and do not weaken the piece at any point more than the knots heretofore specified.

Some of the defects admitted to this grade are season checks, heart pith, pitch pockets, occasional wormholes, medium crook, medium cup, medium pitch, torn grain and slight skips, but no serious combination of defects is permissible in any one piece. Medium stain covering the entire face is admissible in high-line pieces.

No. 3 common.

The general appearance and character of this grade is coarse, admitting loose or unsound knots, large branch knots, an occasional knot hole, considerable heart shake, check, pitch, or pitch pockets, any amount of heavy blue stain in a high-line piece, firm red rot to a certain extent, or large wormholes. Another type often placed in this grade are pieces showing a No. 2 common face, with the backs having several skips in dressing, the combined length of which is often from 4 to 8 feet, or the back may have been split by the planer roller, up to 6 or 8 feet in length. Other defects which will not materially affect the usefulness of the piece for this grade are also found.

A serious combination of the above defects is not admissible in any one piece.

No. 4 common.

The defects common to this grade are much the same as those found in No. 3, but exist to a greater degree.

The most common serious defects are knot holes, either red rot or its equivalent in heavy massed pitch or serious check. Other types are extremely coarse knotted, waney, having excessive heart shake, badly split or badly checked pieces.

No. 5 common.

No. 5 common is the lowest recognized grade and admits of all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

North Carolina Pine Association (Inc.), grading rules for ship-lap, January 1, 1927.

The grading rules for ship-lap are the same as the grading rules of this association for common boards, 402.42.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for ship-lap, February, 1927.

The sizes for ship-lap are the same as for D and M, 411.6.

The special provision for ship-lap is the same as for flooring, 411.24.

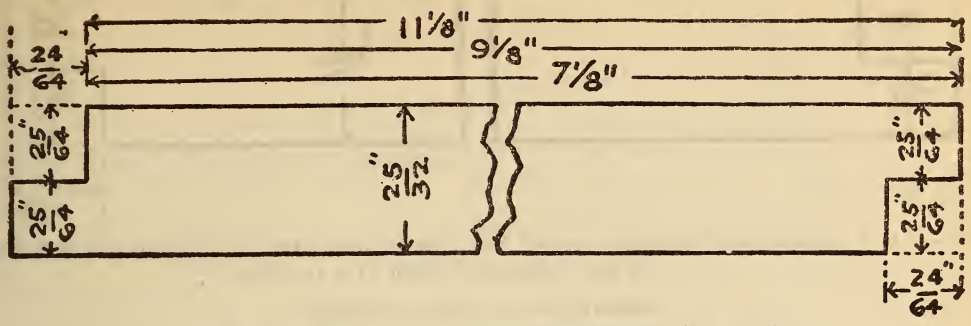


FIG. 136.—*8, 10, and 12 inch hemlock ship-lap (standard)*

Arkansas Soft Pine Bureau
Northern Hemlock and Hardwood Manufacturers Association
Southeastern Forest Products Association
Southern Pine Association

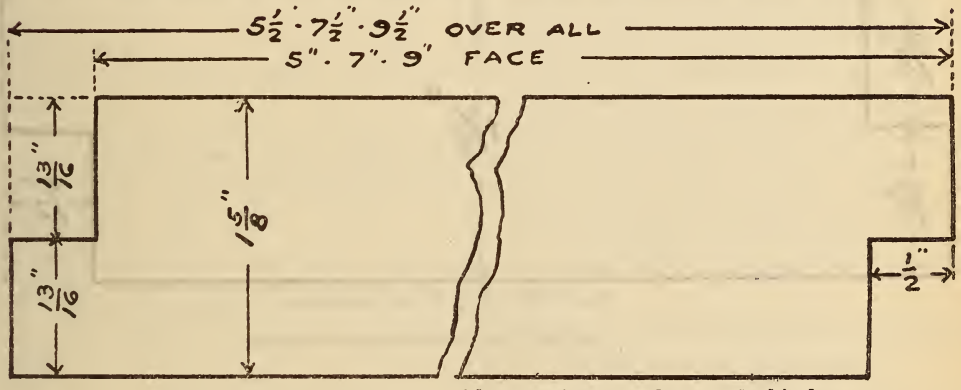


FIG. 137.—*Standard sizes of heavy ship-lap; 2 by 6 inch ship-lap*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

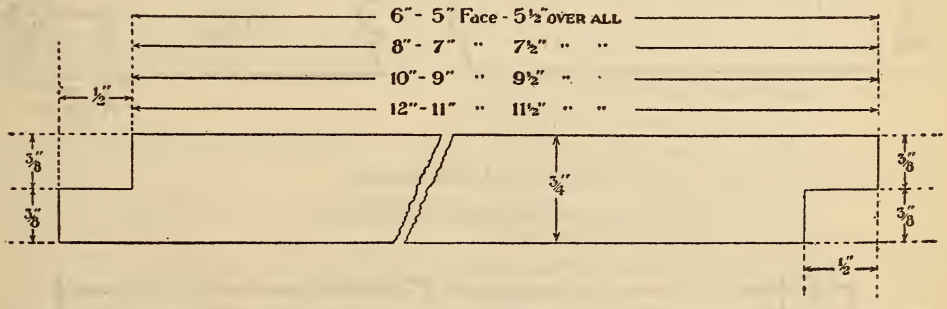


FIG. 138.—*6, 8, 10, and 12 inch ship-lap, green*

Pacific Lumber Inspection Bureau

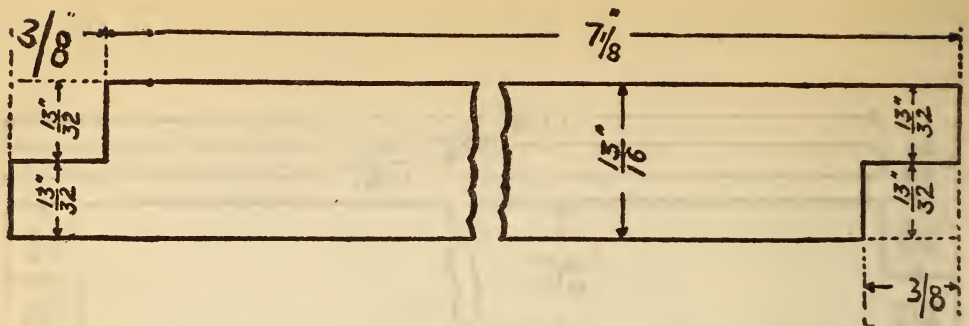


FIG. 139.—*1 by 8 inch ship-lap furnished 7⅛-inch face; 1 by 10 inch ship-lap furnished 9⅛-inch face; 1 by 12 inch ship-lap furnished 11⅛ inch face*

Southern Cypress Manufacturers Association

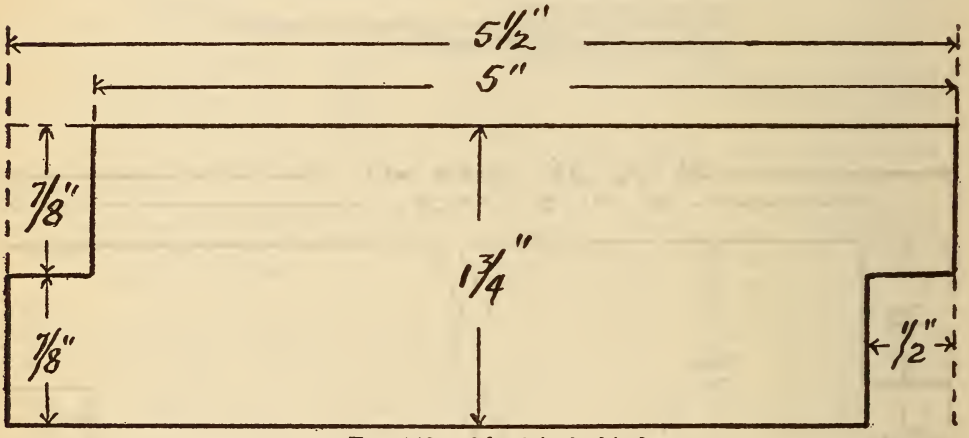


FIG. 140.—*2 by 6 inch ship-lap*

Southern Cypress Manufacturers Association

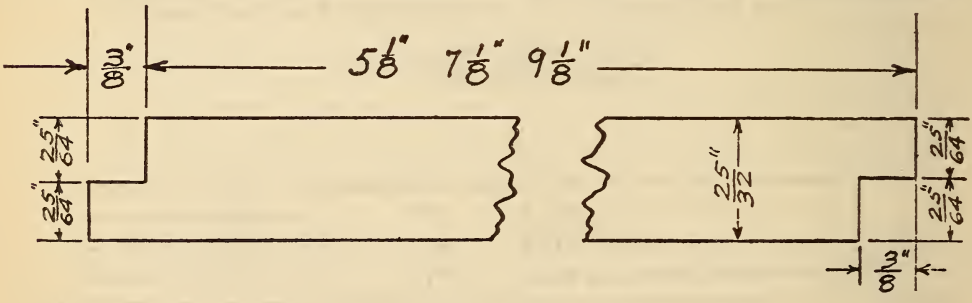


FIG. 141.—*1-inch ship-lap*

West Coast Lumbermen's Association

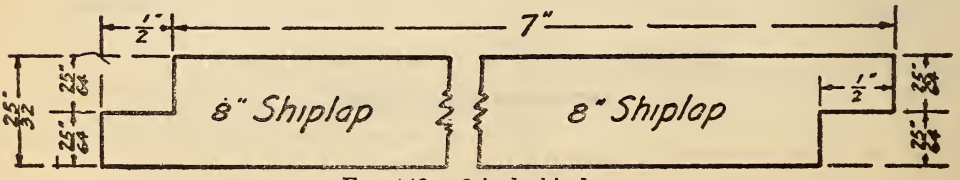


FIG. 142.—*8-inch ship-lap*

Western Pine Manufacturers Association

The grades for ship-lap are the same as for common boards, 402.42.

Patterns.

Ship-lap patterns are illustrated in Figure 136.

Pacific Lumber Inspection Bureau, grading rules for ship-lap, Schedule M, 1925.

Patterns.

Ship-lap patterns are illustrated in Figure 138.

Red Cedar Lumber Manufacturers Association, grading rules for ship-lap, August 1, 1925.

Nominal thicknesses (inches)	Finished thicknesses S1S and S2S	Rabbet	Finished face widths
	Inch	*Inch*	*Inch*
1	$\frac{25}{32}$	$\frac{3}{8}$	$\frac{1}{8}$ off.

Lengths.—Multiples of 2 feet.

Ship-lap shall be graded by the same rules as govern boards, 402.42.

Southern Cypress Manufacturers Association, grades and classification for cypress ship-lap, June 15, 1925.

Thickness.—1 inch.

Width.—Shall be specified widths, 3, 4, 5, and 6 inches wide.

Length.—8 to 20 feet (except in "D" grade) admitting 15 per cent of 8, 9, and 10 foot lengths, and not to exceed 5 per cent of lengths under 10 feet. Odd lengths are not standard above 10 feet. May also be specified 4 to 7 feet.

Shall be graded from the finished side, or if both sides are finished, it shall be graded from the better side, "A," "B," "C," and "D."

A, B, C, and D grades are the same as for flooring. (See 411.22.)

Patterns.

Ship-lap patterns are illustrated in Figures 139 and 140.

Southeastern Forest Products Association, sizes and grades for ship-lap, September 1, 1925.

The grades of heavy ship-lap are the same as the grades of this association for pine flooring, 411.27.

The grading rules for ship-lap are the same as the grading rules of this association for common boards, 402.42.

Patterns.

Heavy ship-lap patterns are illustrated in Figures 136 and 137.

Southern Pine Association, sizes and grades for ship-lap, March 23, 1927.

The grades of heavy ship-lap are the same as the grades of this association for pine flooring, 411.27.

The grading rules for ship-lap are the same as the grading rules for common boards 402.42.

Patterns.

Heavy ship-lap patterns are illustrated in Figures 136 and 137.

West Coast Lumbermen's Association, grading rules for Douglas fir and West Coast hemlock and western red cedar ship-lap, July 1, 1926.

Sizes.

Nominal thicknesses (inches)	Finished thicknesses S1S and S2S	Rabbet	Finished face width
	Inch	*Inch*	*Inch*
1	$\frac{25}{32}$	$\frac{3}{8}$	$\frac{1}{8}$ off.
1½	(See Standard pattern.)		

Lengths.—Multiples of 2 feet.

Grades.

The grades are the same as the grades of this association for boards, 402.42.

Patterns.

Ship-lap patterns are illustrated in Figure 141.

Western Pine Manufacturers Association, grading rules for larch and fir ship-lap, July 1, 1925.

Standard sizes.—

4-inch to $\frac{25}{32}$ by 3-inch face, ½-inch lap.
6-inch to $\frac{25}{32}$ by 5-inch face, ½-inch lap.
8-inch to $\frac{25}{32}$ by 7-inch face, ½-inch lap.
10-inch to $\frac{25}{32}$ by 9-inch face, ½-inch lap.
12-inch to $\frac{25}{32}$ by 11-inch face, ½-inch lap.

Western Pine Manufacturers Association grading rules for Pondosa pine, Idaho white pine, white fir, cedar and spruce ship-lap, July 1, 1925.

1 by 8 to $\frac{25}{32}$ by 7 inch face, ½ inch lap.
1 by 10 to $\frac{25}{32}$ by 9 inch face, ½ inch lap.
1 by 12 to $\frac{25}{32}$ by 11 inch face, ½ inch lap.

Patterns.

Ship-lap patterns are illustrated in Figure 142.

411.6 DRESSED AND MATCHED.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0, yard lumber, for grade standards and yard and industrial size standards.

Arkansas Soft Pine Bureau, grading rules for soft pine dressed and matched lumber, March 23, 1927.

The grading rules for dressed and matched are similar to those of the Southeastern Forest Products Association and the Southern Pine Association for common boards, 402.42.

California Redwood Association, standard specifications for eastern grade of California redwood, dressed and matched, April, 1927.

The size of dressed and matched are as shown in this association's table of sizes for yard lumber, 411.0.

The grades of dressed and matched are the same as common boards, 402.42.

California White and Sugar Pine Manufacturers Association, standard grading rules for dressed and matched lumber, May 1, 1926.

THICKNESS

Nominal (inches)	Finished	
	Standard	Extra standard
	Inches	*Inches*
1	25/32	13/16
1¼	1 1/32	1 1/16
1½	1 5/16	1 3/8
2	1 5/8	1¾

WIDTH

Nominal (inches)	Face width	Over-all width
	Inches	*Inches*
3	2¼	2½
4	3¼	3½
6	5¼	5½
8	7¼	7½
10	9¼	9½
12	11¼	11½

NOTE.—In 2-inch thicknesses the tongue shall be 3/8 inch and the face width 1/8 inch less than indicated.

North Carolina Pine Association (Inc.), grading rules for dressed and matched lumber, January 1, 1927.

The grading rules for D and M are the same as the grading rules of this association for common boards, No. 402.42.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for dressed and matched hemlock and tamarack, February 1, 1927.

Thicknesses.

Thicknesses of 1, 1¼, and 1½ inch dressed and matched and 1-inch ship-lap shall conform to those specified for finishing lumber.

(Dressed and matched and ship-lap in extra standard thicknesses are considered special.)

Special provision.

The special provision for dressed and matched lumber is the same as for flooring, 411.24.

Widths.

Widths of common boards, dressed and matched and worked ship-lap, shall be as follows:

Nominal width, board measure (inches)	D and M face width	Ship-lap face width	D and M and ship-lap over-all width
	Inches	*Inches*	*Inches*
4	3¼	3⅛	3½
5	4¼	4⅛	4½
6	5¼	5⅛	5½
8	7¼	7⅛	7½
10	9¼	9⅛	9½
12	11¼	11⅛	11½

Grades.

Grades for D and M are the same as for common boards, 402.42.

Red Cedar Lumber Manufacturers Association, grading rules for dressed and matched red cedar lumber, August 1, 1925.

Nominal thicknesses (inches)	Finished thicknesses S1S and S2S	Finished face widths
	Inch	*Inch*
1	25/32	¾ off.
1½		

Lengths.—Multiples of 2 feet.

D and M shall be graded by the same rules as govern boards, 402.42.

Southeastern Forest Products Association, grading rules for southern pine dressed and matched lumber, September 1, 1926.

The grading rules for dressed and matched are the same as the rules of this association for common boards, 402.42.

Southern Pine Association, grading rules for southern pine dressed and matched lumber, March 23, 1927.

The grading rules for dressed and matched are the same as the rules for common boards, 402.42.

West Coast Lumbermen's Association, grading and dressing rules for dressed and matched lumber, Douglas fir, West Coast hemlock, and western red cedar, July 1, 1926.

D and M to be graded by same rules as govern boards, 402.42.

Nominal thicknesses (inches)	Finished thicknesses S1S and S2S	Finished face widths
	Inch	*Inch*
1	25/32	¾ off.
1½	(See Standard pattern.)	

Lengths.—Multiples of 2 feet.

Western Pine Manufacturers Association, rules for the grdaing of Pondosa pine, Idaho white pine, white fir, cedar, and spruce dressed and matched lumber, July 1, 1925.

Standard sizes.

Thick common and finish, D and M or S2S and CM.

1¼ by 4 to 1⅛ by 3¼ face.
1½ by 6 to 1⅜ by 5¼ face.
2 by 4 to 1¾ by 3¼ face.

Standard sizes (larch and fir).

Thick D and M or S2S and CM.

1¼ by 3 inches to 1 1/16 by 2¼ face.
1¼ by 4 inches to 1 1/16 by 3¼ face.
1¼ by 6 inches to 1 1/16 by 5¼ face.
1½ by 3 inches to 1 5/16 by 2¼ face.
1½ by 4 inches to 1 5/16 by 3¼ face.
1½ by 6 inches to 1 5/16 by 5¼ face.

411.7 ROOFING.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0, yard lumber, for grade standards, and yard and industrial size standards.

Arkansas Soft Pine Bureau, grading rules for soft pine roofing, March 23, 1927.

The sizes of heavy roofing conform to the table of sizes for factory flooring, heavy roofing, decking, and sheet piling of the American Lumber Standards, 411.0.

The grades of grooved roofing are the same as those of the Southeastern Forest Products Association and the Southern Pine Association for strips and common boards, 402.41 and 402.42.

Patterns.

Roofing patterns are illustrated in Figure 143.

California Redwood Association, standard specifications for eastern grades of California redwood grooved roofing, April, 1927.

The grades of grooved roofing are the same as common boards, 402.42.

California Redwood Association, standard specifications for eastern grades of California redwood heavy roofing, April, 1927.

The sizes of heavy roofing are as shown in the table of sizes for factory flooring, heavy roofing, decking, and sheet piling, American Lumber Standards, yard lumber, 411.0.

The grades of heavy roofing are the same as for factory flooring, 411.29.

North Carolina Pine Association, grading rules for roofing, January 1, 1927.

The grading rules for roofing are the same as the grading rules of this association for common boards, 402.42.

RULES GOVERNING THE WORKING AND GRADING OF NORTH CAROLINA PINE AIR-DRIED ROOFERS

The following rules have been adopted to cover the inspection of air-dried roofers, which shall be inspected and graded as to its full length unless so marked by shipper as to indicate distinctly that a portion of a board has been omitted from measurement to allow for defects.

Air-dried roofers, A grade.

Air-dried roofers, embracing all widths, viz, 4, 6, 8, 10, and 12 inches may show reasonably sound knots, which includes pith, encased or spike knots, which do not seriously affect strength of same. Stain no objection. Reverse side may be one grade lower.

Air-dried roofers, B grade.

This grade shall consist of boards below A grade which can be used with a waste not exceeding 25 per cent of any one piece.

Air-dried roofers, C grade.

This grade shall consist of boards below B grade which can be used with a waste not exceeding 50 per cent of any one piece.

Ship-lap.

$\frac{25}{32}$ by 5⅛, 7⅛, 9⅛, and 11⅛ inches. Stock orders $\frac{13}{16}$-inch thick or any other special working becomes a special contract.

Dressings.

D2S and M $\frac{25}{32}$ inch by 5¼, 7¼, 9¼, and 11¼ inches. Beading optional.

D2S and D4S $\frac{25}{32}$ by 5⅝, 7½, 9½, and 11½ inches. ¾ roofers will be furnished if desired. Special contract.

It is understood in roofer grade that the basis of inspection be the better side of the board, irrespective of beading.

Where log-run lumber is furnished due consideration may be given to shipment as regards the better grade found in same.

Southeastern Forest Products Association, specifications for southern pine yard lumber, including rules for roofers, September 1, 1925.

The grading rules for roofing are the same as the grading rules of this association for common boards, No. 402.42.

STANDARD ROOFERS S4S, S2S&CM, S2S&CME&CB1 OR 2S, AND/OR SHIP-LAPPED

Standard sizes.

Dressed four sides, $\frac{25}{32}$-inch thick by 5⅝, 7½, 9½, and 11½ inches wide. Dressed and matched, $\frac{25}{32}$-inch thick by 5¼, 7¼, 9¼, and 11¼ inches face widths, with tongue ¼-inch wide. Ship-lapped $\frac{25}{32}$-inch thick by 5⅛, 7⅛, 9⅛, and 11⅛ inches face widths, with lap ⅜-inch wide.

Grades.

No.2 common and No. 3 common.

Lengths.

Standard lengths are 4 to 20 feet, inclusive, and the following percentages of short lengths may be included in all miscellaneous or mixed-length shipments:

No. 2 common	5 per cent 4 and/or 5 foot. 5 per cent 6 and/or 7 foot. 5 per cent 8 and/or 9 foot.
No. 3 common	Not to exceed 20 per cent 4 and 6 foot lengths.

Special provisions.

Pieces of D and M roofers having not less than $\frac{1}{16}$-inch tongue and ship-lapped roofers having not less than ⅛-inch lap will be admitted in No. 2 common. Pieces with $\frac{1}{16}$-inch lap will be admitted in No. 3 common ship-lapped roofers.

No. 2 common standard roofers will admit the following defects or their equivalent: Knots not necessarily sound, the average diameter of any one knot not to exceed approximately 3 inches in 6-inch widths, 3½ inches in 8-inch widths, 4 inches in 10-inch widths, and 4½ inches in 12-inch widths; through checks, not to exceed one-half the length of the piece; wormholes; deep torn grain, or equivalent machine defects; pitch pockets; pitch; pith; through shakes not to exceed one-fourth the length of the piece; streak of advanced decay not to exceed ½ inch wide by one-fourth length of the piece, or its equivalent in unsound red heart; stain; wane on the reverse side, three-fourths the thickness on the edge in S4S, or not extending into the tongue or for more than one-half the thickness of the top lip on the groove in D and M, or for more than one-half the thickness of the lap in ship-lap on the face side; or other defects that will not cause waste to exceed one-fourth the length of any one piece.

No. 3 common standard roofers will admit all pieces that can not be used as No. 2 common standard roofers, but are suitable for use as cheap sheathing or lathing, without waste of more than one-fourth the length of any one piece.

GEORGIA-FLORIDA THREE-QUARTER INCH ROOFERS, S4S S2S&CM, S2S&CME&CB1 OR 2S, AND/OR SHIP-LAPPED

Sizes.

Dressed four sides, ¾ inch thick by 5½, 7½, 9½, and 11½ inches wide. Dressed and matched, ¾ inch thick by 5¼, 7¼, 9¼, and 11¼ inch face widths, with tongue ¼ inch wide. Ship-lapped, ¾ inch thick by 5⅛, 7⅛, 9⅛, and 11⅛ inch face widths, with lap ⅜ inch wide.

Grades.

No. 2 and No. 3.

Lengths.

Standard lengths and percentages of short lengths shall be the same as for standard roofers.

Special provisions.

Scantness of tongue or lap, permissible in No. 2 and No. 3 Georgia-Florida ¾- inch roofers, shall be the same as in No. 2 and No. 3 common standard, roofers.

No. 2 Georgia-Florida ¾-inch roofers will admit the following defects or their equivalent: Knots not necessarily sound, the average diameter of any one knot not to exceed one-half the cross section of the piece in the rough; wormholes; deep torn grain or equivalent machine defects; through checks or shakes; splits; streak of advanced decay not to exceed ½ inch wide by one-fourth the length of the piece, or its equivalent in unsound red heart; stain; wane on the reverse side, three-fourths the thickness on the edge in S4S, or not extending into the tongue or for more than one-half the thickness of the top lip on the groove in D and M, or for more than one-half the thickness of the lap in ship-lap on the face side; or other defects that will not cause waste to exceed one-eighth the length of any one piece.

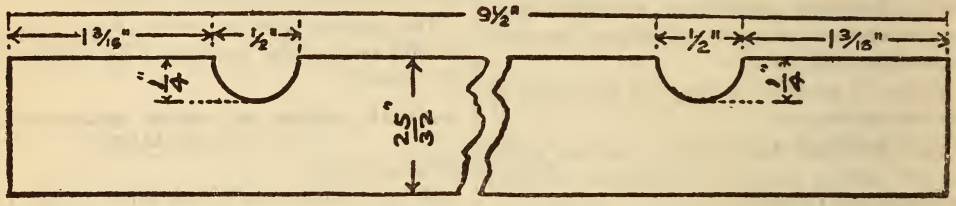


FIG. 143.—*Standard groove for grooved roofing*

Arkansas Soft Pine Bureau
Southeastern Forest Products Association
Southern Pine Association

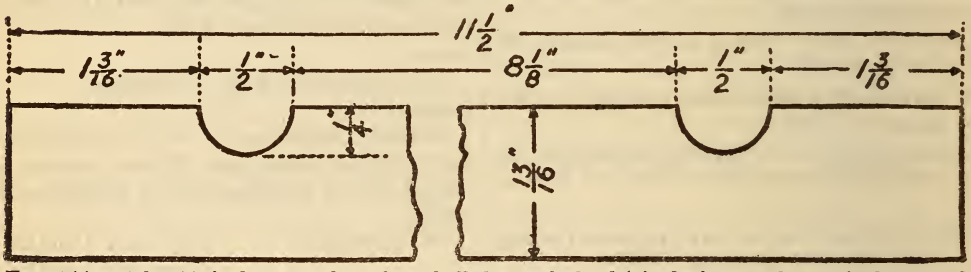


FIG. 144.—*1 by 10 inch grooved roofing shall be worked 9½-inch face; 1 by 12 inch grooved roofing shall beworked 11½-inch face*

Southern Cypress Manufacturers Association

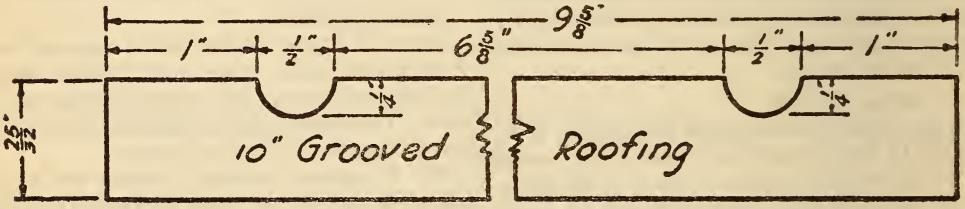


FIG. 145.—*10-inch grooved roofing*

Western Pine Manufacturers Association

Grades.

Knots not necessarily sound, the average diameter of any one knot not to exceed one-half the cross section of the piece in the rough; wormholes; deep torn grain or equivalent machine defects; through checks or shakes; splits; streak of advanced decay not to exceed ½ inch wide by one-fourth the length of the piece, or its equivalent in unsound red heart; stain; wane on the reverse side, three-fourths the thickness on the edge in S4S, or not extending into the tongue or for more than one-half the thickness of the top lip on the groove in D and M, or for more than one-half the thickness of the lap in ship-lap on the face side; or other defects that will not cause waste to exceed one-eighth the length of any one piece.

No. 3 Georgia-Florida ¾-inch roofers will admit all pieces that can not be used as No. 2 Georgia-Florida ¾-inch roofers, but are suitable for use as cheap sheathing or lathing, without a waste of more than one-fourth the length of any one piece.

Southeastern Forest Products Association, grading rules for southern pine roofing, September 1, 1925.

Grades and sizes conform to the tables of sizes for factory flooring, heavy roofing, decking, and sheet piling of the American Lumber Standards, No. 411.0.

The sizes of grooved roofing conform to the sizes of this association for common boards, No. 402.42.

Patterns.

Roofing patterns are illustrated in Figure 143.

Southern Cypress Manufacturers Association grading rules for roofing, September 1, 1925.

Patterns.

Roofing patterns are illustrated in Figure 144.

Southern Pine Association, grading rules for southern pine roofing, March 23, 1927.

The sizes of heavy roofing conform to the table of sizes for factory flooring, heavy roofing, decking, and sheet piling of the American Lumber Standards, 411.0.

The grades of grooved roofing conform to the grades of this association for No. 1 and No. 2 common boards and strips 402.42 and 402.41.

Patterns.

Roofing patterns are illustrated in Figure 143.

Western Pine Manufacturers Association, grading rules for pondosa pine, Idaho white pine, white fir, cedar, and spruce grooved roofing, July 1, 1925.

Standard sizes.

Same as boards S4S, 402.42.

Patterns.

Roofing patterns are illustrated in Figure 145.

411.8 SHELVING.

Pacific Lumber Inspection Bureau, grading rules for Sitka spruce shelving, Schedule M,1925.

Sitka spruce shelving, rough.

No. 3 clear or better, flat and/or edge grain must be sound lumber, well manufactured. Will allow occasional variations in sawing and light-colored sap one-fourth the width; in addition, will allow pitch pockets, each not over 4 inches long, or 1-inch knots, provided one edge of board is clear. Four defects, pitch pockets and/or knots allowed for each 12 linear feet. Based on 1 by 8, 12 feet long.

White Pine Association of the Tonawandas, grades of northern white pine lumber for shelving, 1922.

The following grades of white pine lumber, as shown in 400.26 for this association, are suitable for shelving: No.1 shelving and dressing; No. 2 dressing; No. 1 shelving; and No. 2 shelving and No. 1 box.

411.9 MISCELLANEOUS BUILDING LUMBER.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 411.0, yard lumber, for grade standards and yard and industrial size standards.

National Hardwood Lumber Association, grading rules for miscellaneous building lumber, January, 1927.

Kiln-dried lumber.

Kiln-dried lumber shall be inspected as follows: Season checks and warp shall not be considered defects unless otherwise specified.

Step plank.

Grades.—Firsts and seconds, and common.

Widths.—11 to 15 inches.

Thicknesses.—1¼, 1½, and 2 inches.

Lengths.—10 to 16 feet.

Firsts and seconds.

Firsts and seconds must be clear one face and one edge. The reverse side must be sound, except that one good edge as defined in 400.30 definitions shall be admitted. Firsts and seconds may have a split not exceeding 12 inches in length or its equivalent.

Common.

Common must work 66⅔ per cent in cuttings 4 feet or over long by the full width of the piece.

Each cutting must have one face and one edge clear; the reverse side and edge must be sound, except that one good edge, as defined in 400.30 definitions shall be admitted.

North Carolina Pine Association (Inc.) grading rules for miscellaneous building lumber, January 1, 1927.

Stepping.

Lengths.—Same as ceiling, No. 411.3.

Grades.—Same as finish excepting the worked edge shall not be of lower grade than the face, but the reverse side or back may be No. 2 common or better.

Pacific Lumber Inspection Bureau, grading rules for miscellaneous building lumber, Schedule M, 1925.

Douglas fir green stepping.

No. 2 clear and better edge grain, in widths 8 to 14 inches. Ten inches and wider must show edge grain for at least two-thirds of the face width. Defects based on piece 10 inches wide and 12 feet long. Shall be well manufactured. Will allow light-colored sap one-eighth the width, slight roughness in dressing, 5 pitch pockets each not over 2 inches in length or their equivalent of larger pockets. With one of the foregoing defects may have 1 to 3 knots that do not show more than 1½ inches on riser edge of the face side.

Red Cedar Lumber Manufacturers Association, grading rules for miscellaneous building lumber, red cedar, August 1, 1925.

Porch decking.

Defects based on 1 by 4 inches by 12 feet.

Nominal thicknesses (inches)	Finished thicknesses	Finished face widths
	Inches	*Inches*
1	13/16	2⅜
1¼	1 3/16	3¼
1½	1 7/16	5¼

Lengths.—Multiples of 1 foot.

Porch decking shall be graded in the same manner as finish.

West Coast Lumbermen's Association, grading rules for Douglas fir, Sitka spruce, and west coast hemlock, July 1, 1926.

Clear grades.

Stepping.—V. G. K. D.—Defects based on 10 inches by 12 feet.

Nominal thicknesses (inches)	Finished thicknesses	Finished widths
	Inches	*Inches*
1¼	1 1/16	7¼
1½	1 5/16	9¼
2	1⅝	11¼
		Wider widths 1 inch off

Lengths.—Multiples of 1 foot.

B and better V. G. stepping.—Angle of grain to be not more than 45° from vertical for three-fourths of face from wearing edge. Shall be well manufactured, and will admit slight torn grain. With the above will admit the following defects, equivalent defects, or equivalent combinations of defects: Five very small (2-inch) pitch pockets or equivalent of slightly larger pockets, none through; defects that do not show more than 1½ inches on face of riser edge.

"C" V. G. stepping.—Angle of grain to be not more than 45° from vertical for half of face from wearing edge. Will admit medium torn grain; small seasoning checks, not through; light sap stain, 25 per cent of face. With any one of the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Eight small (4-inch) pitch pockets, or equivalent of slightly larger pockets; 1 small pitch streak; 4 small sound and tight knots; two 1-inch knots. Will also admit defects that do not show more than 1½ inches on face side of riser edge; cut-out of 1½ inches for a defect 4 feet or more from either end in pieces 12 feet and longer if piece is otherwise as good as B grade.

West Coast Lumbermen's Association, grading rules for western red cedar, July 1, 1926.

Porch decking.

Finished sizes.—See Flooring, K. D., 411.23.

B and better.

Will admit the following defects, equivalent defects, or equivalent combinations of defects: Slight torn grain; one sound and tight pin knot.

C.

Will admit the following defects, equivalent defects, or equivalent combinations of defects: Medium torn grain; light sap stain, 15 per cent of face; 2 sound and tight small knots.

412. STRUCTURAL TIMBERS AND BRIDGES.

412.0 GENERAL ITEMS.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

STRUCTURAL MATERIAL

Basic Provisions for the Selection and Inspection of Softwood Dimension and Timbers Where Working Stresses are Required

The following basic provisions are to be used as bases for the preparation by the manufacturers of grading rules for structural material to be submitted by the Central Committee on Lumber Standards for consideration as American lumber standards at the next general conference.

GRADES AND CLASSIFICATIONS

Grades: (*a*) *Dense select*, (*b*) *select*, and (*c*) *common.*

Uses: (*a*) *Joist and plank.*—Joists, rafters, scaffold plank, factory flooring, etc.; (*b*) *beams and stringers.*—Beams, girders, stringers, etc.; and (*c*) *posts and timbers.*—Posts, caps, sills, timbers, etc.

GENERAL PROVISIONS

All grades shall contain only sound wood, unless decay is specifically permitted.

The measurement of a knot shall be made on the section of the knot appearing on the surface under consideration.

In post and timber grades, and on the wide faces of joist and plank, the measure of a knot shall be on the mean or average diameter.

On the narrow faces of joist and plank and beams and stringers, the size of a knot shall be taken as its width between lines parallel to the edges of the timber.

On the wide or vertical faces of beams and stringers, the smallest diameter of a knot shall be taken as its size.

Knots on the edges of wide faces of beams and stringers are limited to the same size as on the adjacent narrow faces.

Knots on narrow faces and edges of wide faces of joist and plank and beams and stringers may increase proportionately from the size allowed in the middle third to twice that size at the ends of the piece.

The size of knots on the wide faces of joist and plank and beams and stringers may increase proportionately from the size allowed at the edge to that allowed at the center line.

Cluster knots and knots in groups are not permitted.

Knot holes and holes from other causes than knots shall be limited as provided for knots.

Shake shall be measured on the ends of a piece and its size shall be taken as its width between lines parallel to the wide faces of the piece. Checks and splits shall be limited as provided for shakes. No checks or combinations of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

No combination of wane and knots is permitted which would reduce the strength more than the maximum allowable knot.

No pieces of exceptionally light weight shall be permitted in any grade, except that very light pieces otherwise of select grade may be accepted in the common grade.

No heartwood requirements are provided in these grades. Heartwood requirements when ordered should be specified in terms of heartwood required on the girth or on each face, side or edge. Girth shall be measured at the point where the greatest amount of sapwood occurs.

Methods of measurement of Douglas fir and southern pine for rate of growth and density are given for use with the dense select and select grades.

Wane is permitted in all grades, but square edges may be specified when appearance or use requires.

SELECTION FOR RATE OF GROWTH

DOUGLAS FIR OR SOUTHERN PINE

Douglas fir or *southern pine* selected for close grain shall average on either one end or the other not less than 6 nor more than 20 annual rings per inch, measured over a 3-inch portion of a radial line representative of the average growth on the cross section located as described below. When such radial line is not representative, it shall be shifted sufficiently to present a fair average, but the distance from the pith of the 3-inch portion of the line shall not be changed. In case of disagreement two radial lines shall be chosen, and the number of rings shall be the average of these lines.

LOCATION OF RADIAL LINE

Douglas fir.—In side cut pieces the line shall be at a right angle to the annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the piece. In boxed heart pieces the line shall run from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of 1 inch from the pith. When the least dimension is more than 6 inches, the 3-inch portion of the line shall begin at a distance from the pith equal to 2 inches less than one-half the least dimension of the piece. If a 3-inch portion of the radial line can not be obtained the measurement shall be made over as much of the 3-inch portion as is available.

Southern pine.—In boxed heart pieces the rate of growth shall be counted over the third, fourth, and fifth inches from the pith along the radial line. In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3 inches on an approximate radial line beginning at the edge nearest the pith in timbers over 3 inches in thickness and on the second inch nearest to the pith in timbers 3 inches or less in thickness. In material containing the pith, but not a 5-inch radial line, which is less than 2 inches by 8 inches in section or less than 8 inches in width that does not show over 16 square inches on the cross section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-inch radial line, the inspection shall apply to the 3 inches farthest from the pith.

SELECTION FOR DENSITY

DOUGLAS FIR OR SOUTHERN PINE

Douglas fir or *southern pine* selected for density shall average on either one end or the other not less than six annual rings per inch and, in addition, one-third or more, summer wood, over the same portion of a radial line as provided for selection for rate of growth. Coarse-grained material excluded by this rule shall be accepted as dense if averaging one-half or more summer wood. The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerable above the minimum requirement for summer wood. In case of disagreement two radial lines shall be chosen and the summer wood and number of rings shall be the average of these lines.

JOIST AND PLANK

JOISTS, RAFTERS, SCAFFOLD PLANK, FACTORY FLOORING, ETC.

Nominal thicknesses: 2 to 4 inches.

Nominal widths: 4 inches and wider.

Standard thicknesses, S1S or S2S: 3/8 inch off.

Extra standard thickness, 2 inches, S1S or S2S: 1/4 inch off.

Standard widths, 4 to 7 inches, S1E or S2E: 3/8 inch off; 8 inches and wider, S1E or S2E: 1/2 inch off.

Standard lengths: Multiples of 2 feet.

Knots on wide faces

Width of face in inches	Dense select and select		Common	
	On or near edge middle third of length	Center line of face	On or near edge middle third of length	Center line of face
	Inches	*Inches*	*Inches*	*Inches*
4	3/4	1 1/4	1	1 3/4
6	1	2	1 1/2	2 1/2
8	1 3/8	2 5/8	2	3 3/8
10	1 3/4	3 1/4	2 1/2	4 1/4
12	2 1/8	4	3	5 1/8
14	2 3/8	4 1/4	3 1/4	5 5/8
16	2 1/2	4 5/8	3 3/8	6

Knots on narrow faces of boxed heart pieces, middle third of length

Thickness of piece in inches	Size of knot	
	Dense select and select	Common
	Inches	*Inches*
2	5/8	7/8
3	1	1 1/4
4	1 1/4	1 3/4

Sum of diameters of knots, center half of length on any face, not to exceed

Dense select and select

One and one-half times width of face.

Common

Two times width of face.

Shakes and checks

	Dense select and select	Common
Green	¼ width of end	$\frac{4}{10}$ width of end
Seasoned	⅓ width of end	$\frac{4}{9}$ width of end

Angle of grain, center half of length

Dense select and select	Common
1 in 12	1 in 10

Wane

Dense select and select	Common
⅛ thickness and/or width	¼ thickness and/or width

Douglas fir or southern pine of select grade to be selected for rate of growth. Douglas fir or southern pine of dense select grade to be selected for density.

Beams and Stringers

BEAMS, GIRDERS, STRINGERS, ETC.

Nominal thicknesses: 5 inches and thicker.
Nominal widths: 8 inches and wider.
Standard lengths: Multiples of 2 feet.

S1S, S1E, S2S, or S4S: ½ inch off each way.

Knots

Width of face in inches	Dense select and select		Common	
	Narrow face and edge of wide face middle third of length	Center line of wide face	Narrow face and edge of wide face middle third of length	Center line of wide face
	Inches	*Inches*	*Inches*	*Inches*
5	1¼		2	
6	1½	1½	2⅜	2⅜
8	1¾	2	2¾	3⅛
10	2	2½	3⅛	4
12	2⅛	3	3⅜	4¾
14	2¼	3¼	3⅝	5⅛
16	2⅜	3⅜	3⅞	5½
18		3⅝		5⅞
20		3⅞		6⅛
22		4		6½
24		4¼		6¾

Sum of diameters of knots, center half of length on any face, not to exceed

Dense select and select	Common
Width of face	1½ times width of face

Shakes and checks

	Dense select and select	Common
Green	¼ width of end	$\frac{4}{10}$ width of end
Seasoned	⅓ width of end	$\frac{4}{9}$ width of end

Angle of grain, center half of length

Dense select and select	Common
1 in 15	1 in 10

Wane

Dense select and select	Common
⅛ thickness and/or width	¼ thickness and/or width

Douglas fir or southern pine of select grade to be selected for rate of growth. Douglas fir or southern pine of dense select grade to be selected for density.

Posts and Timbers

POSTS, CAPS, SILLS, TIMBERS, ETC.

Nominal sizes: 6 by 6 inches and longer.
Standard lengths: Multiples of two feet.

S1S, S1E, S2S, or S4S: ½ inch off each way.

Knots

Width of face in inches	Size of knots	
	Dense select and select	Common
	Inches	*Inches*
6	1½	2⅜
8	2	3⅛
10	2½	4
12	3	4¾
14	3¼	5⅛
16	3⅜	5½
18	3⅝	5⅞
20	3⅞	6⅛
22	4	6½
24	4¼	6¾

Sum of diameters of all knots within any 6 inches of length not to exceed twice size of maximum knot allowable; nor to be two of maximum allowable knots in same 6 inches of length on any one face.

Shakes and checks

	Dense select and select	Common
Green	$\frac{4}{10}$ width of end	½ width of end
Seasoned	½ width of end	$\frac{6}{10}$ width of end

Angle of grain

Dense select and select	Common
1 in 10	1 in 8

Wane

Dense select and select	Common
⅛ thickness and/or width	¼ thickness and/or width

Douglas fir or southern pine of select grade to be selected for rate of growth. Douglas fir or southern pine of dense select grade to be selected for density.

American Association of State Highway Officials, specifications for structural timber, lumber, and piling, December, 1926.

SPECIES OF WOODS

The common and botanical names of the species of woods recognized in these specifications are defined as follows:

Common name	Botanical name
Cedar, northern white.	Thuja occidentalis.
Cedar, Port Orford.	Chamaecyparis lawsoniana.
Cedar, western red.	Thuja plicata.
Chestnut.	Castanea dentata.
Cypress, southern.	Taxodium distichum.
Fir, Douglas.	Pseudotsuga taxifolia (coast type).
Fir, red.	Pseudotsuga taxifolia (intermountain type).
Gum, black.	Nyssa sylvatica.
Hemlock, West Coast.	Tsuga heterophylla.
Larch, western.	Larix occidentalis.
Oak, red, includes red oak.	Quercus borealis and Quercus borealis maxima.
Black oak.	Quercus velutina.
Southern red oak.	Quercus rubra.
Water oak.	Quercus nigra.
Willow oak.	Quercus phellos.
Scarlet oak.	Quercus coccinea.
Pin oak.	Quercus palustris.
Shumard red oak.	Quercus shumardii.
Swamp red oak.	Quercus rubra pagodaefolia.
Blackjack oak.	Quercus marilandica.
Laurel oak.	Quercus laurifolia.
Texan red oak.	Quercus texana.
Oak, white, includes—	
White oak.	Quercus alba.
Chestnut oak.	Quercus montana.
Post oak.	Quercus stellata.
Bur oak.	Quercus macrocarpa.
Overcup oak.	Quercus lyrata.
Swamp chestnut oak.	Quercus prinus.
Swamp white oak.	Quercus bicolor.
Live oak.	Quercus virginiana.
Chinquapin oak.	Quercus muehlenbergii.
Pine, Idaho white.	Pinus monticola.
Pine, lodgepole.	Pinus contorta.
Pine, northern white.	Pinus strobus.
Pine, Norway.	Pinus resinosa.
Pine, Pondosa.	Pinus ponderosa.
Pine, southern yellow, includes—	
Loblolly pine.	Pinus taeda.
Longleaf pine.	Pinus palustris.
Pitch pine.	Pinus rigida.
Pond pine.	Pinus serotina.
Shortleaf pine.	Pinus echinata.
Slash pine.	Pinus caribaea.
Pine, sugar.	Pinus lambertiana.
Redwood.	Sequoia sempervirens.
Spruce, eastern, includes—	
Black spruce.	Picea mariana.
Red spruce.	Picea rubra.
White spruce.	Picea glauca.
Spruce, Engelmann, includes—	
Engelmann spruce.	Picea engelmanni.
Blue spruce.	Picea parryana.
Spruce, Sitka.	Picea sitchensis.
Tamarack.	Larix laricina.

LIMITATION OF USE

Timbers of the following species shall not be used in exposed structures without preservative treatment: The red oaks, black gum, and shortleaf, lobolly, and pond pine.

LUMBER AND STRUCTURAL TIMBER

Heart Requirements

All timber to be used without preservative treatment shall show not less than the following amounts of heartwood:

Stringers, floor beams, and flooring; 80 per cent of heart on any girth.

Caps, sills, and posts; 75 per cent of heart on each of the four sides measured across the side.

Bracing, struts, rails, etc.; 80 per cent of heart on both sides measured across the side.

For timber which is to be pressure treated with creosote oil there shall be no heartwood requirement and the amount of sapwood shall not be limited.

Grading of Lumber and Timber

Yard lumber and structural timber shall be graded in accordance with grading rules, adopted by the regional associations of lumber manufacturers, which conform to the basic provisions of American Lumber Standards, above.

Lumber ordered in multiple lengths shall be graded after having been cut to length.

Basic Grades of Lumber and Timber

The grades recognized by this specification are as follows:

Yard lumber.

Grade D select.—Allows any number of defects or blemishes which do not detract from a finish appearance, especially when painted.

No. 1 common.—Sound and tight knotted stock. Size of defects and blemishes limited. May be considered water-tight lumber.

No. 2 common.—Allows large and coarse defects. May be considered grain-tight lumber.

Structural timbers.

Dense select (Douglas fir and southern yellow pine only), select, and common.

The structural grades are further divided, on the basis of use, size and defects, into the following subgrades: Joist and plank, beam and stringer, and post and timber.

Basic Grading of Structural Timber

This association's specifications for structural material including—

1. Grades and classification,
2. General provisions,
3. Selection for rate of growth,
4. Selection for density,
5. Sizes and grades of joist and plank,[3]
6. Sizes and grades of beams and stringers,
7. Sizes and grades of posts and timbers,

are identical with the American Lumber Standards above, except as noted for widths of joist and plank.

[3] The standard widths of joist and plank are 4 to 7 inches, S1E or S2E, ⅜ inch off in American Lumber Standards. This association specifies widths of 2 to 7 inches for joist and plank.

Hewn and Round Timbers

Hewn timbers used in place of sawed timbers shall conform in all respects to the grading rules for structural timber

Round timbers used in place of sawed timbers shall be of a quality equal to that hereinafter specified for timber piles. The effective size of a round timber shall be considered the same as that of a square timber having sectional dimensions equal to those of the inscribed square of the round timber at the critical section.

Hewn and round timbers shall not be used except when specified or approved by the engineer.

TIMBER PILES

General

Timber piles which will be below water level at all times, may be of any species of wood which will satisfactorily withstand driving.

In untreated piling for use in exposed work, the diameter of the heartwood shall be not less than $\frac{8}{10}$ of the required diameter of the pile.

Quality

All wood piling shall be cut from sound and solid trees, preferably during the winter season. They shall contain no unsound knots. Sound knots will be permitted, provided the diameter of the knot does not exceed 4 inches or $\frac{1}{3}$ of the diameter of the stick at the point where it occurs. Any defect or combination of defects which will impair the strength of the pile more than the maximum allowable knot shall not be permitted. The butts shall be sawed square and the tips shall be sawed square or tapered to a point not less than 4 inches in diameter as directed by the engineer.

Unless otherwise specified, all piles shall be peeled by removing all of the rough bark and at least 80 per cent of the inner bark. No strip of inner bark remaining on the stick shall be over $\frac{3}{4}$ inch wide or over 8 inches long, and there shall be at least 1 inch of clean wood surface between any two such strips. Not less than 80 per cent of the surface on any circumference shall be clean wood.

Piles shall be cut above the ground swell and shall taper from butt to tip. A line drawn from the center of the tip to the center of the butt shall not fall outside of the center of the pile at any point more than 1 per cent of the length of the pile. In short bends, the distance from the center of the pile to a line stretched from the center of the pile above the bend to the center of the pile below the bend shall not exceed 4 per cent of the length of the bend or 2½ inches. All knots shall be trimmed close to the body of the pile.

Dimensions

Round piles shall have a minimum diameter at the tip, measured under the bark, as follows:

Length of pile	Tip diameter, inches
Less than 40 feet	8
40 to 60 feet	7
Over 60 feet	6

The minimum diameter of piles at a section 4 feet from the butt, measured under the bark, shall be as follows:

Length of pile	Diameter	
	Douglas fir, southern yellow pine, and southern cypress	All other species
	Inches	*Inches*
20 feet and under	11	11
20 to 30 feet	12	12
30 to 40 feet	12	13
Over 40 feet	13	14

The diameter of the piles at the butt shall not exceed 20 inches.

Square piles shall have the dimensions shown on the plans.

American Association of State Highway Officials, specifications for timber structures, December, 1926.

TIMBER STRUCTURES

Materials.

Lumber and timber.—Lumber and timber shall conform to the requirements of structural timber, lumber and piling, above. For the various structural purposes the following grades shall be used with the corresponding unit stresses specified in 400.12, table of unit stresses for structural grades of timber.

(*a*) Truss members, floor beams, stringers, and flooring shall be dense select structural or select structural, as specified. Flooring, if untreated shall be thoroughly air seasoned or kiln dried.

(*b*) Caps, posts, sills and mud sills, and nailing strips shall be select structural, or common structural, as specified.

(*c*) Guard timbers and retaining pieces; sash, cross and longitudinal bracing; and girts shall be common structural.

(*d*) Bulkheads shall be common structural or No. 1 common, as specified.

(*e*) Rails, rail posts, and truss housing shall be grade D select or No. 1 common, as specified. Rails and rail posts, if untreated, shall be thoroughly air seasoned or kiln dried.

(*f*) Scupper blocks and cross bridging shall be No. 1 common.

(*g*) Inside sheathing for truss housing shall be No. 1 or No. 2 common, as specified.

(*h*) For temporary structures which are for use only during erection, members specified above to be of the dense select and select structural grades may be of the common structural grade. Members specified above to be of the common structural grade may be of No. 1 common.

NOTE.—The complete specification contains paragraphs on storage of material, workmanship, handling of material, methods of construction, and other details in connection with timber structures.

American Railway Engineering Association, standard specifications for structural grades of lumber and timber, adopted, 1927.

A. STRUCTURAL GRADES OF LUMBER AND TIMBER AND THE METHOD OF THEIR DERIVATION

1. *Purpose.*—The purpose of structural grades is to offer means for selecting structural material for strength, and for uniformity in strength, in order that appropriate working stresses may be assigned for its use.

2. *Factors of strength.*—The most important factors which influence the strength of structural material are the size, number, and location of defects, and the extent of exposure to moisture during use. These factors must all be considered in design or grading if the maximum utilization is to be obtained from the material used.

3. *Structural grades and strength.*—Structural grades control defects by limiting their size and location in accordance with their effect upon strength. Working stresses for each species are recommended by the Forest Products Laboratory, United States Forest Service, and take into consideration the allowable defects, the moisture content as determined by conditions of use, and, in the case of southern yellow pine and Douglas fir, rate of growth and percentage of summer wood.

4. *Moisture.*—Moisture affects the strength of structural timbers both directly and indirectly. The direct effect of loss of moisture is the stiffening and strengthening of the wood fibers. This increase in strength, however, is accompanied by checking, splitting, warping, and twisting; as a consequence, some of the strength due to drying is lost. Timbers are also subject, during use, to varying conditions of moisture, from the dry location of a heated building, to the continually wet condition of some pier and dock timbers. All of these conditions are taken into account in recommending working stresses under different conditions of use.

5. *Size effects.*—In dimension material, 4 inches and less in thickness, the development of defects during seasoning does not offset the increase in strength from drying as much as in larger sizes, and in these sizes used in dry locations, higher working stresses in extreme fiber in bending can be recommended than in pieces of larger size having proportionately equivalent defects.

6. *Defects.*—The principal defects which must be limited in structural grades are knots, shakes and checks, and angle of grain.

7. *Influence of knots.*—The influence of a knot is determined by its location in a beam and the area of its projection on the cross section of the piece, the method of measurement being such as to give the best approximation of this influence. Knots in posts and heavy beams, which are likely to show only on one face or to run diagonally through the piece, reduce the strength in practically direct proportion to their size as measured. In dimension sizes, such as joist, in which the knot is likely to run directly through the piece, the strength is measured by the square of the effective depth, assuming the knot in its worst position, near the edge of the piece, and the reduction in strength due to the knot is approximately twice the ratio of the size of the knot to the width of the face. In similar material used flat, as plank, the influence of a knot is directly proportional to the size, as on the top and bottom edges of beams.

8. *Location of knots, joist, and plank.*—Knot limitations on edges of wide faces of dimension sizes, for use as joist, are more severe than would be required for use flat, as plank, the sizes applying along the center lines of the wide faces as joist being those which could theoretically apply at any point across the width if used only as plank. It has been found, however, that under practically all conditions of use, knots along the edges of planks are more objectionable than knots along the center lines and this is recognized in some commercial yard grades of plank in a stricter limitation of knots along the edges of the wide faces than along the center lines. The same knot limitations are applied, therefore, to material to be used either as joist or plank, and the same working stresses are assigned for use either on edge or flat.

9. *Increase in size of knots.*—In both joist and beams, knots reduce strength most along the top and bottom edges through the center portion. The sizes of knots permitted in various portions of a joist or beam are limited in accordance with the stresses, and they are allowed to increase toward the ends and toward the center lines of the vertical faces, no knot, however, being permitted of more than double the size allowed at the point of maximum stress.

10. *Small and large knots.*—There is greater proportional distortion of grain around a large knot than around a smaller one, and shrinkage in seasoning causes greater internal stresses, so knot sizes are increased proportionately to width of faces only up to 6-inch top and bottom faces of beams, 12-inch vertical faces of beams and 12-inch faces of posts. Beyond these widths of face, increase is proportional to the square root of the ratio of the wider faces to these widths. The distribution and aggregate diameter of knots is limited, as well as the maximum size of the single knot. The aggregate diameter of all knots in the center half of the length on any face of a beam or stringer shall be limited, in direct proportion to an aggregate diameter of twice the width of the face in a grade having 50 per cent of the strength of clear wood. In joist and plank, in dry locations, the aggregate diameter of knots in the center half of the length of any face may be greater by one-half the width of the face than the aggregate diameter permitted in beams and stringers. In posts and columns, the aggregate diameter of all knots in any 6 inches of length, in any grade, shall not exceed twice the size of the maximum knot allowable.

11. *Knots in joist and plank.*—In joist and plank, the mean or average diameter of a knot is taken as its size. In such thin and relatively wide material, whether used on edge or flat, this is a safe measure of the influence of knots on strength, and has the commercial advantage of being directly

applicable to yard grades of lumber. This method of measurement will exclude damaging spike knots, and can be applied to them as well as to round or oval knots.

12. *Knots in beams.*—On the top or bottom of a beam, the influence of knots is measured largely by the surface fibers cut. The projection of the knot on a line at a right angle to the edge is, therefore, used. On the vertical face of a beam, the depth to which a knot penetrates is of great importance, while the influence of the number of surface fibers cut, and the amount of grain distortion, is considerably less important than on the horizontal faces. The smallest diameter of the knot is, therefore, used.

13. *Spike knots.*—One of the best examples illustrating the reason for the smallest diameter being taken on the vertical face is the splitting of a boxed-heart timber into two pieces. The long spike knots which might be opened up in this way would be no more injurious to the strength of the two pieces than they would as a single knot in a boxed-heart piece, and the two pieces so cut would be less subject to seasoning checks than a boxed-heart piece.

14. *Knots in columns.*—In columns there are two factors—area of cross section occupied by a knot, which would probably be measured best by the small diameter of the knot, and the influence of bending stresses when the column begins to fail, probably measured best by the projection of the knot. In short columns, the area of the cross section is of primary importance; as the column gets longer, the factor of bending strength increases in importance until the condition of the Euler formula is reached, when stiffness, on which knots have practically no influence, becomes the ruling factor. The average diameter, therefore, is used as that which applies best to the average condition.

15. *Knots and holes.*—In grades for structural uses, no distinction is made between intergrown knots and encased knots or knot holes, observation at the Forest Products Laboratory in recent tests having shown that intergrown knots reduce strength fully as much as encased knots or knot holes.

16. *Shakes and checks.*—Shakes reduce the area of a beam acting in resistance to shear, and the limitations placed on shakes are based on this reduction. Checks are limited on the same basis as shakes, and no combination of shakes and checks is permitted which would reduce strength to a greater extent than would the allowable size of either separately.

17. Shakes and checks in dense select and select joist and plank shall not exceed when green ¼ the width of end nor when seasoned ⅛ the width of end.

Shakes and checks in common joist and plank shall not exceed when green $\frac{4}{10}$ the width of end nor when seasoned $\frac{4}{9}$ the width of end.

Shakes and checks in dense select and select beams and stringers shall not exceed when green ¼ the width of end nor when seasoned ⅓ the width of end.

Shakes and checks in common beams and stringers shall not exceed when green $\frac{4}{10}$ the width of end nor when seasoned $\frac{4}{9}$ the width of end.

Shakes and checks in dense select and select posts and timbers shall not exceed when green $\frac{4}{10}$ the width of end nor when seasoned ½ the width of end.

Shakes and checks in common posts and timbers shall not exceed when green ½ the width of end nor when seasoned $\frac{6}{10}$ the width of end.

18. *Slope of grain.*—Slope of grain, resulting either from diagonal sawing or from spiral or twisted grain in the log, is limited in accordance with the recommendation of the Forest Products Laboratory, based on the results of detailed study of the effect of cross and spiral grain upon strength, and the weakening of material by checks which invariably develop and, without exception, follow the grain.

There is not much reduction in strength from cross grain until an angle of grain of 1 in 40 is reached. From that slope in a beam an angle of grain of 1 in 20 reduces the strength about ⅛; 1 in 15, about ¼; 1 in 11, about ⅜; and 1 in 8, about ½. In a post or column an angle of grain of 1 in 15 reduces the strength about ⅛; 1 in 11, about ¼; 1 in 8, about ⅜; and 1 in 6, about ½.

19. *Wane and knots.*—Wane is limited by such consideration as bearing area, nailing edge, appearance, etc., rather than by effect on strength. The percentage reduction in strength resulting from wane toward the center of a beam is about double the percentage reduction in cross-sectional area. No combination of wane and knots is permitted which would reduce the strength more than the maximum allowable knot. The occurrence of maximum wane and maximum knot in the same cross section at the center of a beam would be so rare, however, and the effect of allowable maximum wane is so small a percentage of the effect of maximum allowable knot, that the additional reduction in strength beyond the effect of the knot would be slight and it is usually unnecessary to give attention to combination of wane and knot.

20. *Pitch pockets.*—Pitch pockets are ordinarily not defects in a structural grade. A large number, however, indicates a general lack of bond, and such a piece should be carefully inspected for shakes.

21. *Heartwood and sapwood.*—Heartwood and sapwood have been found by the Forest Products Laboratory to be of equal strength, and no requirement of heartwood need be made when strength alone is the governing factor. Heart requirement, when durability of untreated material under exposure is a factor, as in bridges, trestles, docks and piers, or in damp buildings, or buildings in which conditions of high humidity prevail, may be specified in any grade, according to exposure and use. When preservative treatment is to be applied, there should be no restriction as to sapwood, as sapwood is easier to treat than heartwood and a large amount is to be preferred.

22. *Density and strength.*—The density of the wood substance of all species is practically the same. The dry weight is, therefore, a measure of the

amount of wood substance present; and on the amount of wood substance present depends the strength of the clear wood. No pieces of exceptionally light weight are permitted in the select grades, but light weight pieces otherwise of select grade may be accepted in the common grades.

23. *Density and summer wood.*—In southern pine and Douglas fir, the proportion of summer wood, the dark portion of the annual ring, furnishes a practical means of estimating density. Selection of these species for density, to the extent that dense material is commercially available, assures material of the highest character from the standpoint of strength, and uniformity in strength, in the clear wood.

24. *Rate of growth and strength.*—Selection of these species for rate of growth is not as great an assurance of increased strength as selection for percentage of summer wood, but for many purposes selection for rate of growth will assure material of suitable type. Close grain, that is, not less than six nor more than twenty annual rings per inch, is required in the select structural grades of these species.

25. *Contrast between summer wood and spring wood.*—In acceptance for density the contrast in color between summer wood and spring wood should be distinct. Absence of contrast occasionally occurs in bands of growth rings which appear on the whole darker in color than the adjacent material. The summer wood merges into the spring wood abnormally with a gradual change of color, leaving practically no material which has the normal appearance of spring wood. Such material has been called by a number of names, including proud wood, red wood, and compression wood. It has a decided end shrinkage, is weak in tension, and even a small part of a cross section of this character is undesirable in high-class structural timbers.

26. *Minimum requirements, maximum defects.*—Structural grades specify minimum requirements and maximum defects, all of which may be present at one time. When a particular piece which is being inspected, therefore, is slightly below the provisions of the grade in some respects but is of average density or above, the relative effect on the properties affected should be given consideration.

27. *Reinspection.*—In inspection for density, reasonable variation of opinion between inspectors should be recognized. A fair provision for reinspection of a particular lot of timbers for density would be that for every three timbers accepted as having one-third or more summer wood, one of the remaining timbers be accepted if having between 30 and 33⅓ per cent summer wood.

28. *Yard grades and cutting grades.*—A large percentage of material in standard yard grades of Dimension and Timbers will meet the additional requirements of structural grades for joist and plank, and posts and timbers, and material to meet these requirements can easily be selected from local stocks: Select from select common and merchantable grades, and common from No. 1 common grade. Beams and stringers vary materially in size and are not stocked extensively. These are essentially special-order grades.

29. *Joist and plank, beams and stringers.*—As previously noted the provisions of the joist and plank grades are such that material graded by them may be used on edge, as joist or rafters, or flat, as scaffold plank or factory flooring. Joist and plank grades apply to material not thicker than 4 inches. Material thicker than 4 inches for use in bending should be graded by beam and stringer grades.

30. *Timbers used as beams and stringers.*—Material to be used for such purposes as caps, bridge ties, etc., where strength in bending is a factor, should be specified in beam and stringer grades although of shape more commonly considered as of timber grades, as the method of measuring knots in post and timber grades makes it impracticable to assign bending stresses to them. Caps and bridge ties are often square or have horizontal faces wider than the vertical faces, in contrast to beams and stringers in which the narrow faces are horizontal faces and the wide faces are vertical, and this should be noted in applying the knot provisions of the beam and stringer grade to such material.

Introduction to Structural Rules

31. The following rules for structural grades conform to the basic provisions for the selection and inspection of softwood dimension and timbers where working stresses are required accepted at the General Lumber Conference, Washington, D. C., May 1, 1925, as the basis for the preparation of grading rules for structural material.

32. They are complete rules, covering all conditions necessary for consideration in structural grading, and are divided into sections from which combinations are made covering specific purposes and conditions.

33. These specifications may be used for mill orders, selection from or appraisal of stock on hand in either manufacturers', middleman's, or users' stock.

34. The rules cover the following grades and use classifications:

Grades.

Dense select	Douglas fir and southern pine.
Select	Douglas fir and southern pine.
Select	Other softwood species.
Common	All softwood species.

Uses.

Joist and plank	Joist, rafters, bracing, scaffold plank, factory flooring, etc.
Beams and stringers	Beams, girders, stringers, bridge ties, caps, etc.
Posts and timbers	Posts, sills, caps, timbers, etc.

Optional provisions.

Wane	Where permissible.
Square edges	Where required or desired.
Heartwood requirements.	For durability of untreated timbers.
Sapwood permissibility	For material to be treated.

Sizes of joist and plank (joist, rafters, scaffold plank, factory flooring, etc.).

Nominal thickness ..... 2 to 4 inches.
Nominal widths ..... 4 inches and wider.
Standard thickness ..... S1S or S2S, 3/8 inch off.
Standard widths [4] ..... 2 to 7 inches, S1E or S2E, 3/8 inches off.; 8 inches and wider, S1E or S2E, 1/2 inch off.

Sizes of beams and stringers (beams, girders, stringers, etc.).

Nominal thickness ..... 5 inches and thicker.
Nominal widths ..... 8 inches and wider.

Sizes of posts and timbers (posts, caps, sills, timbers, etc.).

Nominal sizes ..... 6 by 6 inches and larger.

B. SPECIFICATION REQUIREMENTS FOR STRUCTURAL JOIST, PLANK, BEAMS, STRINGERS, AND POSTS

Timber Size Requirements

1A. *Joist and plank, surfaced.*—Structural joist and plank shall be when surfaced S1S or S2S not thinner than the nominal dimension less 3/8 inch and when surfaced S1E or S2E not narrower than the nominal width less 3/8 inch for sizes 2 to 7 inches, inclusive, and less 1/2 inch for sizes 8 inches and wider.

1B. *Beams, stringers, posts, timbers, surfaced.*—Structural beams, stringers, posts and timbers shall be when surfaced S1S, S1E, S2S, S4S not smaller than the nominal size less 3/8 inch for sizes 7 inches and narrower and less 1/2 inch for sizes 8 inches and over.

1C. *Joist and plank, rough.*—Rough structural joist and plank shall be not thinner than the nominal dimension less 1/4 inch and not narrower than the nominal width less 1/4 inch for sizes 2 to 7 inches, inclusive, and less 3/8 inch for sizes 8 inches and wider.

1D. *Beams and stringers, posts and timbers, rough.*—Rough structural beams and stringers, posts and timbers shall not be smaller than the nominal size less 1/4 inch for sizes 7 inches and less, and less 3/8 inch for sizes 8 inches and over.

Grade Requirements

2. *Sound wood.*—This material shall contain only sound wood.

GENERAL

3. (*a*) *Weight.*—No pieces of exceptionally light weight shall be permitted, except that lightweight pieces otherwise of select grade may be accepted in common grade.

(*b*) *Shake, check, and split.*—Shake shall be measured on the ends of a piece, and its size shall be taken as the shortest distance between lines inclosing the shake and parallel to the wide faces of the piece. Checks and splits shall be limited as provided for shakes. No checks or combinations of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

(*c*) *Wane and knots.*—Where wane is permitted there shall be no combination of wane and knots which would reduce the strength more than the maximum allowable knot.

(*d*) *Cluster knots.*—Cluster knots and knots in groups are not permitted.

(*e*) *Holes.*—Knot holes and holes from other causes than knots shall be permitted as provided for knots.

(*f*) *Knot measurement.*—The size of a knot shall be measured on the section of the knot appearing on the surface under consideration.

(*g*) *Mean diameter.*—When the mean or average diameter of a knot is specified, the size shall be taken as the average of the maximum and minimum diameters.

(*h*) *Spike knots.*—Knot sizes specified shall be applied to spike knots as well as to round knots.

(*i*) *Spike knot mean diameter.*—The mean or average diameter of a spike knot shall be taken as the average of its length and its maximum width.

KNOTS

Joist and plank.

4. (*a*) *Wide faces.*—On the wide faces of joist and plank, the measurement of a knot shall be made on the mean or average diameter.

(*b*) *Narrow faces.*—On the narrow faces of joist and plank, the size of a knot shall be taken as its width between lines parallel to the edges of the piece.

(*c*) *Increase to ends.*—The size of knots on the narrow faces and edges of wide faces of joist and plank may increase proportionately from the size allowed in the middle third to twice that size at the ends of the pieces.

(*d*) *Increase to center.*—The size of knots on the wide faces of joist and plank may increase proportionately from the size allowed at the edge to that allowed at the center line.

Beams and stringers.

5. (*a*) *Narrow faces.*—On the narrow or horizontal faces of beams and stringers the size of a knot shall be taken as its width between lines parallel to the edges of the timber.

(*b*) *Wide faces.*—On the wide or vertical faces of beams and stringers the smallest diameter of a knot shall be taken as its size.

(*c*) *Edges.*—Knots on the edges of wide or vertical faces of beams and stringers are limited to the same size as on the adjacent narrow or horizontal faces, except that the size is measured on the least diameter of the knot instead of on its width between lines parallel to the edges of the timber.

(*d*) *Increase to ends.*—The size of knots on the narrow or horizontal faces and edges of wide or vertical faces of beams and stringers may increase proportionately from the size allowed in the middle third to twice that size at the ends of the piece.

[4] American Lumber Standards, 412.0, standard widths are 4 to 7 inches; S1E or S2E, 3/8 inch off.

(*e*) *Increase to center.*—The size of knots on the wide or vertical faces of beams and stringers may increase proportionately from the size allowed at the edge to that allowed at the center line.

Posts and timbers.

6. *Mean diameter.*—In posts and timbers, the measurement of a knot shall be made on the mean or average diameter.

7. Maximum size of knots in dense select and select joist and plank

[(*a*) Knots on wide faces]

Width of face, in inches	Size of knot	
	On or near edge middle third of length	Center line of face
	Inches	*Inches*
4	3/4	1 1/4
6	1	2
8	1 3/8	2 5/8
10	1 3/4	3 1/4
12	2 1/8	4
14	2 3/8	4 1/4
16	2 1/2	4 5/8

[(*b*) Knots on narrow faces of boxed-heart pieces]

Thickness of piece, in inches	Size of knot, middle third of length
	Inches
2	5/8
3	1
4	1 1/4

(*c*) The sum of the diameters of all knots within the center half of the length of a joist or plank on any face shall not exceed one and one-half times the width of the face on which they occur.

8. Maximum size of knots in common joist and plank

[(*a*) Knots on wide faces]

Width of face, in inches	Size of knot	
	On or near edge middle third of length	Center line of face
	Inches	*Inches*
4	1	1 3/4
6	1 1/2	2 1/2
8	2	3 3/8
10	2 1/2	4 1/4
12	3	5 1/8
14	3 1/4	5 5/8
16	3 3/8	6

8. Maximum size of knots in common joist and plank—Continued

[(*b*) Knots on narrow faces of boxed-heart pieces]

Thickness of piece, in inches	Size of knot, middle third of length
	Inches
2	7/8
3	1 1/4
4	1 3/4

(*c*) The sum of the diameters of all knots within the center half of the length of a joist or plank on any face shall not exceed two times the width of face on which they occur.

9. (a) Maximum size of knots in dense select and select beams and stringers

Width of face, in inches	Size of knot	
	Narrow or horizontal face middle third of length	Center line of wide or vertical face
	Inches	*Inches*
5	1 1/4	1 1/4
6	1 1/2	1 1/2
8	1 3/4	2
10	2	2 1/2
12	2 1/8	3
14	2 1/4	3 1/4
16	2 3/8	3 3/8
18	----------	3 5/8
20	----------	3 7/8
22	----------	4
24	----------	4 1/4

(*b*) The sum of the diameters of all knots within the center half of the length of a beam or stringer on any face shall not exceed the width of the face on which they occur.

10. (a) Maximum size of knots in common beams and stringers

Width of face, in inches	Size of knots	
	Narrow face or horizontal face, middle third of length	Center line of wide face or vertical face
	Inches	*Inches*
5	2	2
6	2 3/8	2 3/8
8	2 3/4	3 1/8
10	3 1/8	4
12	3 3/8	4 3/4
14	3 5/8	5 1/8
16	3 7/8	5 1/2
18	----------	5 7/8
20	----------	6 1/8
22	----------	6 1/2
24	----------	6 3/4

(*b*) The sum of the diameters of all knots within the center half of the length of a beam or stringer on any face shall not exceed one and one-half times the width of the face on which they occur.

11. (*a*) *Maximum size of knots in dense select and select posts and timbers*

Width of face, in inches	Size of knots
	Inches
6	1½
8	2
10	2½
12	3
14	3¼
16	3⅜
18	3⅝
20	3⅞
22	4
24	4¼

(*b*) The sum of the diameters of all knots in any 6 inches of length of a post or timber shall not exceed twice the size of the maximum knot allowable.

12. (*a*) *Maximum size of knots in common posts and timbers*

Width of face, in inches	Size of knots
	Inches
6	2⅜
8	3⅛
10	4
12	4¾
14	5⅛
16	5½
18	5⅞
20	6⅜
22	6½
24	6¾

(*b*) The sum of diameters of all knots in any 6 inches of length of post or timber shall not exceed twice the size of the maximum knot allowable.

13. Maximum shake and checks in dense select and select joist and plank

Width of end in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
2	½	⅝
3	¾	1
4	1	1¼

14. Maximum shake and checks in common joist and plank

Width of end in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
2	¾	⅞
3	1⅛	1¼
4	1½	1¾

15. Maximum shake and checks in dense select and select beams and stringers

Width of end in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
6	1½	2
8	2	2⅝
10	2½	3¼
12	3	4
14	3½	4⅝
16	4	5¼
18	4½	6
20	5	6⅝
22	5½	7¼
24	6	8

16. Maximum shake and checks in common beams and stringers

Width of end in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
5	2	2⅛
6	2⅜	2⅝
8	3⅛	3½
10	4	4⅜
12	4¾	5¼
14	5½	6⅛
16	6⅜	7
18	7⅛	8
20	8	8⅞
22	8¾	9⅝
24	9½	10⅝

17. Maximum shake and checks in dense select and select posts and timbers

Width of end in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
5	2	2½
6	2⅜	3
8	3⅛	4
10	4	5
12	4¾	6
14	5½	7
16	6⅜	8
18	7⅛	9
20	8	10
22	8¾	11
24	9½	12

18. Maximum shake and checks in common posts and timbers

Width of end in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
6	3	3½
8	4	4¾
10	5	6
12	6	7⅛
14	7	8⅜
16	8	9½
18	9	10¾
20	10	12
22	11	13⅛
24	12	14⅜

SLOPE OF GRAIN

19A. *Dense select and select joist and plank.*

The slope of grain in the center half of length shall not exceed 1 in 12.

19B. *Common joist and plank.*

The slope of grain in the center half of length shall not exceed 1 in 10.

19C. *Dense select and select beams and stringers.*

The slope of grain in the center half of length shall not exceed 1 in 15.

19D. *Common beams and stringers.*

The slope of grain in the center half of length shall not exceed 1 in 10.

19E. *Dense select and select posts and timbers.*

The slope of grain shall not exceed 1 in 10.

19F. *Common posts and timbers.*

The slope of grain shall not exceed 1 in 8.

WANE AND SQUARE EDGES

Wane, dense select, and select grade.

20A. *Wane one-eighth.*—Wane is permitted, not exceeding one-eighth the width of any face.

Wane, common grade.

20B. *Wane one-fourth.*—Wane is permitted, not exceeding one-fourth the width of any face.

Square edges.

20C. *Square.*—All edges must be square.

HEARTWOOD AND SAPWOOD

Durability untreated.

Heartwood requirements shall be specified as required from the following:

Heartwood provisions.

21A. *Joist and plank.*—Joist and plank shall have not less than 85 per cent of heart on the two faces, as measured across the faces anywhere in the length of the piece.

22B. *Beams and stringers.*—Beams and stringers shall have not less than 85 per cent heart on each of the four faces measured across the faces anywhere in the length of the piece.

22C. *Timbers 85 per cent.*—These timbers shall have not less than 85 per cent heart on each of the four faces, measured across the face anywhere in the length of the piece.

22D. *Timbers one face all heart, others 85 per cent.*—These timbers shall have all heart on one narrow face; the other narrow face and the two sides shall have not less than 85 per cent of heart, measured across the face or sides anywhere in the length of the piece.

22E. *Timbers one face all heart, others 75 per cent.*—These timbers shall have all heart on one narrow face; the other narrow face and the two sides shall have not less than 75 per cent of heart, measured across the face or sides anywhere in the length of the piece.

For treatment.

Provision for sapwood for timber to be treated is covered by the following:

Sapwood provisions.

22. *Sapwood not restricted.*—There is no restriction as to sapwood for this material.

RATE OF GROWTH AND DENSITY

Select.—Southern pine or Douglas fir of select grade is to be selected for close grain.

Dense select.—Southern pine or Douglas fir of dense select grade is to be selected for density.

Close grain.

23. *Close grain.*—Douglas fir or southern pine shall be of close grain, averaging on either one end or the other not less than 6 nor more than 20 annual rings per inch measured over a 3-inch portion of a radial line located as described below and representative of the average growth on the cross section. Pieces averaging from five to six annual rings per inch shall be accepted as the equivalent of close grain if having one-third or more summer wood.

Density.

24. *Dense.*—Douglas fir or southern pine shall be dense, averaging on either one end or the other not less than six annual rings per inch and, in addition, one-third or more summer wood measured over a 3-inch portion of a radial line located as described below and representative of the average growth on the cross section. The contrast in color between summer wood and spring wood shall be distinct. Coarse-grained material excluded by this rule shall be accepted as dense if averaging one-half or more summer wood.

Close grain or density.

25. *Radial line not representative.*—When the radial line specified is not representative, it shall be shifted sufficiently to present a fair average, but the distance from the pith to the beginning of the 3-inch portion of the line in boxed heart pieces shall not be changed.

26. *Close grain on two radial lines.*—In case of disagreement in the measurement of close grain, two radial lines shall be chosen and the number of rings shall be the average determined on these lines.

27. *Density on two radial lines.*—In case of disagreement in the measurement of density, two radial lines shall be chosen and the number of rings and summer wood shall be the average determined on these lines.

Location of radial line in Douglas fir.

28. (*a*) *Side-cut pieces.*—In side-cut pieces of Douglas fir the radial line shall be at a right angle to the annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the piece.

(*b*) *Boxed-heart pieces.*—In boxed-heart pieces, the line shall run from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of one inch from the pith. When the least dimension is more than 6 inches, the 3-inch portion of the line shall begin at a distance from the pith equal to 2 inches less than one-half the least dimension of the piece.

(*c*) If a 3-inch portion of the radial line can not be obtained, the measurement shall be made over as much of the 3-inch portion as is available.

Location of radial line in southern pine.

29. (*a*) *Boxed-heart pieces.*—In boxed-heart pieces of southern pine, the measurement shall be made over the third, fourth, and fifth inches from the pith along the radial line.

(*b*) *Pith not present.*—In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the inspection shall be made over 3 inches on an approximate radial line beginning at the edge nearest the pith in timbers over 3 inches in thickness and on the second inch nearest to the pith in timbers 3 inches or less in thickness.

(*c*) *Pith present but less than 5-inch radial line.*—In material containing the pith but not a 5-inch radial line, which is less than 2 by 8 inches in section or less than 8 inches in width, that does not show over 16 square inches on the cross section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-inch radial line, the inspection shall apply to the 3 inches farthest from the pith.

C. STRUCTURAL GRADES AND REFERENCE CODE

Specifications are divided into sections with general numbers for reference.

Where alternate specifications are listed, each has a capital letter added to the general number. For any material, appropriate choice must be made of such paragraphs.

Where several paragraphs occur under the general number and each is designated by a small letter, all such paragraphs must be used in making a complete specification.

In cases where only a small number of sizes are ordered it is permissible to shorten the tables of maximum defects by copying sizes of defects corresponding only with the sizes being ordered.

Three complete specifications are shown to illustrate the application of the code.

Following is a complete list of numbered specifications, brief description of material and appropriate code numbers of sections required to write a complete specification for this material.

Index to numbers of specifications

BEAMS AND STRINGERS

Grades	Additional requirements						
	For use untreated					For treating	
	For durability heartwood required			No heartwood or sapwood required		Sapwood not restricted	
	One face 100 per cent; other three faces 85 per cent	All faces 85 per cent	One face 100 per cent; other three faces 75 per cent				
	Square edge			Square edge	Wane permitted	Square edge	Wane permitted
Dense select:							
Douglas fir or southern pine	-------	1	-------	2	3	4	5
Select:							
Douglas fir or southern pine	-------	6	-------	7	8	9	10
Any other softwood	-------	11	-------	12	13	14	15
Common:							
Any softwood	-------	16	-------	17	18	19	20
JOIST AND PLANK							
Dense select:							
Douglas fir or southern pine	-------	21	-------	22	23	24	25
Select:							
Douglas fir or southern pine	-------	26	-------	27	28	29	30
Any other softwood	-------	31	-------	32	33	34	35
Common:							
Any softwood	-------	36	-------	37	38	39	40
POSTS AND TIMBERS							
Dense select:							
Douglas fir or southern pine	61	41	65	42	43	44	45
Select:							
Douglas fir or southern pine	62	46	66	47	48	49	50
Any other softwood	63	51	67	52	53	54	55
Common:							
Any softwood	64	56	68	57	58	59	60

D. CODED SPECIFICATIONS FOR STRUCTURAL GRADES

Dense select—Beams and stringers.

No. 1. Beams and stringers, Douglas fir or southern pine, dense select, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 21*B*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 2. Beams and stringers, Douglas fir or southern pine, dense select, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 3. Beams and stringers, Douglas fir or southern pine, dense select, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*A*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 4. Beams and stringers, Douglas fir or southern pine, dense select, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 22, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 5. Beams and stringers, Douglas fir or southern pine, dense select, sapwood wanted for treatment, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*A*, 22, 24, 25, 27, 28 (*a*+*b*+*c*) Dougals fir or 29 (*a*+*b*+*c*) southern pine.

Select beams and stringers.

No. 6. Beams and stringers, Douglas fir or southern pine, select 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 21*B*, 23, 25, 26, 28 (*a*+*b*+*c*), Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 7. Beams and stringers, Douglas fir or southern pine, select, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 8. Beams and stringers, Douglas fir or southern pine, select, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*A*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 9. Beams and stringers, Douglas fir or southern pine, select, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 22, 23, 25, 26, 28, (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 10. Beams and stringers, Douglas fir or southern pine, select, sap wood wanted for treatment wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C* 20*A*, 22, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No.11. Beams and stringers, select, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 21*B*.

No. 12. Beams and stringers, select, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*.

No. 13. Beams and stringers, select, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1 *D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*A*.

No. 14. Beams and stringers, select, sapwood wanted for treatment, square edges:

1*B* (surface) or 1*D* (rough), 2, 3, (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*C*, 22.

No. 15. Beams and stringers, select, sapwood wanted for treatment, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 9 (*a*+*b*), 15, 19*C*, 20*A*, 22.

Common beams and stringers.

No. 16. Beams and stringers, common, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*),10 (*a*+*b*), 16, 19*D*, 20*C*, 21*B*.

No. 17. Beams and stringers, common, no heartwood or sapwood requirement, square edges:

1B (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 10 (*a*+*b*), 16, 19*D*, 20*C*.

No. 18. Beams and stringers, common, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 10 (*a*+*b*), 16, 19*D*, 20*B*.

No. 19. Beams and stringers, common, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 10 (*a*+*b*), 16, 19*D*, 20*C*, 22.

No. 20. Beams and stringers, common, sapwood wanted for treatment, wane, permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 5 (*a*+*b*+*c*+*d*+*e*), 10 (*a*+*b*), 16, 19*D*, 20*B*, 22.

Dense select joist and plank.

No. 21. Joist and plank, Douglas fir or southern pine, dense select, 85 per cent heartwood, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 21*A*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 22. Joist and plank, Douglas fir or southern pine, dense select, no heartwood or sapwood requirement, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 23. Joist and plank, Douglas fir or southern pine, dense select, no heartwood or sapwood requirement, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*A*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 24. Joist and plank, Douglas fir or southern pine, dense select, sapwood wanted for treatment, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 22, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 25. Joist and plank, Douglas fir or southern pine, dense select, sapwood wanted for treatment, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*A*, 22, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

Select joist and plank.

No. 26. Joist and plank, Douglas fir or southern pine, select, 85 per cent heartwood, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 21*A*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 27. Joist and plank, Douglas fir or southern pine, select, no heartwood or sapwood requirement, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 28. Joist and plank, Douglas fir or southern pine, select, no heartwood or sapwood requirement, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*A*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 29. Joist and plank, Douglas fir or southern pine, select, sapwood wanted for treatment, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 22, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 30. Joist and plank, Douglas fir or southern pine, select, sapwood wanted for treatment, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*A*, 22, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir, or 29 (*a*+*b*+*c*) southern pine.

No. 31. Joist and plank, select, 85 per cent heartwood, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 21*A*.

No. 32. Joist and plank, select, no heartwood or sapwood requirement, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*.

No. 33. Joists and plank, select, no heartwood or sapwood requirement, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*A*.

No. 34. Joist and plank, select, sapwood wanted for treatment, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*)) 7 (*a*+*b*+*c*), 13, 19*A*, 20*C*, 22.

No. 35. Joist and plank, select, sapwood wanted for treatment, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 7 (*a*+*b*+*c*), 13, 19*A*, 20*A*, 22.

Common joist and plank.

No. 36. Joist and plank, common, 85 per cent heartwood, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 8 (*a*+*b*+*c*), 14, 19*B*, 20*C*, 21*A*.

No. 37. Joist and plank, common, no heartwood or sapwood requirement, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 8 (*a*+*b*+*c*), 14, 19*B*, 20*C*.

No. 38. Joist and plank, common, no heartwood or sapwood requirement, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 8 (*a*+*b*+*c*), 14, 19*B*, 20*B*.

No. 39. Joist and plank, common, sapwood wanted for treatment, square edges:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 8 (*a*+*b*+*c*), 14, 19*B*, 20*C*, 22.

No. 40. Joist and plank, common, sapwood wanted for treatment, wane permitted:

1*A* (surfaced) or 1*C* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 4 (*a*+*b*+*c*+*d*), 8 (*a*+*b*+*c*), 14, 19*B*, 20*B*, 22.

Dense select posts and timbers.

No. 41. Posts and timbers, Douglas fir or southern pine, dense select, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*C*, 24, 25, 27, 28 (*a*+*b*+*c*), Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 42. Posts and timbers, Douglas fir or southern pine, dense select, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 43. Posts and timbers, Douglas fir or southern pine, dense select, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*A*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 44. Posts and timbers, Douglas fir or southern pine, dense select, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 22, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 45. Posts and timbers, Douglas fir or southern pine, dense select, sapwood wanted for treatment, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*A*, 22, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

Select posts and timbers.

No. 46. Posts and timbers, Douglas fir or southern pine, select, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*C*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 47. Posts and timbers, Douglas fir or southern pine, select, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 48. Posts and timbers, Douglas fir or southern pine, select, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*A*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 49. Posts and timbers, Douglas fir or southern pine, select, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 22, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 50. Posts and timbers, Douglas fir or southern pine, select, sapwood wanted for treatment, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*A*, 22, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 51. Posts and timbers, select, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*C*.

No. 52. Posts and timbers, select, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*.

No. 53. Posts and timbers, select, no heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*A*.

No. 54. Posts and timbers, select, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 22.

No. 55. Posts and timbers, select, sapwood wanted for treatment, wane permitted:

1*B* (surfaced), or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*A*, 22.

Common posts and timbers.

No. 56. Posts and timbers, common, 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*d*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*), 18, 19*F*, 20*C*, 21*C*.

No. 57. Posts and timbers, common, no heartwood or sapwood requirement, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*),18, 19*F*, 20*C*.

No. 58. Posts and timbers, common, no, heartwood or sapwood requirement, wane permitted:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*), 18, 19*F*, 20*B*.

No. 59. Posts and timbers, common, sapwood wanted for treatment, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*), 18, 19*F*, 20*C*, 22.

No. 60. Posts and timbers, common, sapwood wanted for treatment, wane permitted:

1*B* (surfaced), or 1*D* (rough) 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*), 18,19*F*, 20*B*, 22.

Special posts and timbers.

No. 61. Posts and timbers, Douglas fir or southern pine, dense select, one narrow face all heartwood other narrow face and sides 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*D*, 24, 25, 27, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 62. Posts and timbers, Douglas fir or southern pine, select, one narrow face all heartwood, other narrow face and sides 85 per cent heartwood, square edges:

1*B* (surfaced), or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*) 17, 19*E*, 20*C*, 21*D*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 63. Posts and timbers, select, one narrow face all heartwood, other narrow face and sides 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*D*.

No. 64. Posts and timbers, common, one narrow face all heartwood, other narrow face and sides 85 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*), 18, 19*F*, 20*C*, 21*D*.

No. 65. Posts and timbers, Douglas fir or southern pine, dense select, one narrow face all heartwood, other narrow face and sides 75 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*E*, 24, 25, 27, 28 (*a*+*b*+*c*), Douglas fir, or 29 (*a*+*b*+*c*) southern pine.

No. 66. Posts and timbers, Douglas fir or southern pine, select, one narrow face all heartwood, other narrow face and sides 75 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*E*, 23, 25, 26, 28 (*a*+*b*+*c*) Douglas fir or 29 (*a*+*b*+*c*) southern pine.

No. 67. Posts and timbers, select, one narrow face all heartwood, other narrow face and sides 75 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 11 (*a*+*b*), 17, 19*E*, 20*C*, 21*E*.

No. 68. Posts and timbers, common, one narrow face all heartwood, other narrow face and sides 75 per cent heartwood, square edges:

1*B* (surfaced) or 1*D* (rough), 2, 3 (*a*+*b*+*c*+*d*+*e*+*f*+*g*+*h*+*i*), 6, 12 (*a*+*b*), 18, 19*F*, 20*C*, 21*E*.

EXAMPLES OF APPLICATION OF CODE

Three complete specifications are shown to illustrate the application of the code.

EXAMPLE NO. 1—SPECIFICATION NO. 1

Dense Select Beams and Stringers (Southern Pine) with Square Edges and Heartwood Requirement for Use Untreated, Rough

SPECIFICATION REFERENCE NO. 1 IN SUBDIVISION D ON CODED SPECIFICATIONS

Size requirements.

1D. Rough structural beams and stringers shall not be smaller than the nominal size less ¼ inch for sizes 7 inches and less, and less ⅜ inch for sizes 8 inches and over.

Grade requirements.

2. This material shall contain only sound wood.

General.

3. (*a*) No pieces of exceptionally light weight shall be permitted except that light-weight pieces otherwise of select grade may be accepted in common grade.

(*b*) Shake shall be measured on the ends of a piece, and its size shall be taken as the shortest distance between lines inclosing the shake and parallel to the wide faces of the pieces. Checks and splits shall be limited as provided for shakes. No checks or combinations of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

(*c*) Where wane is permitted there shall be no combination of wane and knots which would reduce the strength more than the maximum allowable knot.

(*d*) Cluster knots and knots in groups are not permitted.

(*e*) Knot holes and holes from other causes than knots shall be permitted as provided for knots.

(*f*) The size of a knot shall be measured on the section of the knot appearing on the surface under consideration.

(*g*) When the mean or average diameter of a knot is specified, the size shall be taken as the average of the maximum and minimum diameters.

(*h*) Knot sizes specified shall be applied to spike knots as well as to round knots.

(*i*) The mean or average diameter of a spike knot shall be taken as the average of its length and its maximum width.

Knots—Beams and stringers.

5. (*a*) On the narrow or horizontal faces of beams and stringers the size of a knot shall be taken as its width between lines parallel to the edges of the timber.

(*b*) On the wide or vertical faces of beams and stringers the smallest diameter of a knot shall be taken as its size.

(*c*) Knots on the edges of wide or vertical faces of beams and stringers are limited to the same size as on the adjacent narrow or horizontal faces, except that the size is measured on the least diameter of the knot instead of on its width between lines parallel to the edges of the timber.

(*d*) The size of knots on the narrow or horizontal faces and edges of wide or vertical faces of beams and stringers may increase proportionately from the size allowed in the middle third to twice that size at the ends of the piece.

(*e*) The size of knots on the wide or vertical faces of beams and stringers may increase proportionately from the size allowed at the edge to that allowed at the center line.

9. (*c*) *Maximum knots in dense select and select beams and stringers*

Width of face in inches	Size of knot	
	Narrow or horizontal face, middle third of length	Center line of wide or vertical face
	Inches	*Inches*
5	1¼	1¼
6	1½	1½
8	1¾	2
10	2	2½
12	2⅛	3
14	2¼	3¼
16	2⅜	3⅜
18	----------	3⅝
20	----------	3⅞
22	----------	4
24	----------	4¼

(*b*) The sum of the diameters of all knots within the center half of the length of a beam or stringer on any face shall not exceed the width of the face on which they occur.

Shake and checks.

15. *Maximum shake and checks in dense select and select beams and stringers*

Width of end in inches	Size of skake or check	
	Green	Seasoned
	Inches	*Inches*
6	1½	2
8	2	2⅝
10	2½	3¼
12	3	4
14	3½	4⅝
16	4	5¼
18	4½	6
20	5	6⅝
22	5½	7¼
24	6	8

19*C*. The slope of grain in center half of length shall not exceed 1 in 15.

20*C*. All edges must be square.

21*B*. Beams and stringers shall have not less than 85 per cent heart on each of the four faces measured across the faces anywhere in the length of the piece.

24. Southern pine shall be dense, averaging on either one end or the other not less than six annual rings per inch and, in addition, one-third or more summer wood measured over a 3-inch portion of a radial line located as described below and representative of the average growth on the cross section. The contrast in color between summer wood and spring wood shall be distinct. Coarse-grained material excluded by this rule shall be accepted as dense if averaging one-half or more summer wood.

25. When the radial line specified is not representative, it shall be shifted sufficiently to present a fair average, but the distance from the pith to the beginning of the 3-inch portion of the line in boxed-heart pieces shall not be changed.

27. In case of disagreement, two radial lines shall be chosen, and the number of rings and summer wood shall be the average determined on these lines.

29. (*a*) In boxed-heart pieces of southern pine, the measurement shall be made over the third, fourth, and fifth inches from the pith along the radial line.

(*b*) In cases where the timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the inspection shall be made over 3 inches on an approximate radial line beginning at the edge nearest the pith in timbers over 3 inches in thickness and on the second inch nearest to the pith in timbers 3 inches or less in thickness.

(*c*) In material containing the pith but not a 5-inch radial line, which is less than 2 by 8 inches in section or less than 8 inches in width, that does not show over 16 square inches on the cross section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-inch radial line, the inspection shall apply to the 3 inches farthest from the pith.

EXAMPLE NO. 2.—SPECIFICATION NO. 50

Select Posts and Timbers (Douglas Fir) with Wane Permitted and Sapwood Wanted for Treatment, Surfaced Four Sides

Size requirements.

1*B*. Structural posts and timbers shall be when surfaced S1S, S1E, S2S, S4S, not smaller than the nominal size less ⅜ inch for sizes 7 inches and less, and less ½ inch for sizes 8 inches and over.

Grade requirements.

2. This material shall contain only sound wood.

General.

3. (*a*) No pieces of exceptionally light weight shall be permitted, except that light-weight pieces otherwise of select grade may be accepted in common grade.

(*b*) Shake shall be measured on the ends of a piece, and its size shall be taken as the shortest distance between lines inclosing the shake and parallel to the wide faces of the piece. Checks and splits shall be limited as provided for shakes. No checks or combination of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

(*c*) Where wane is permitted there shall be no combination of wane and knots which would reduce the strength more than the maximum allowable knot.

(*d*) Cluster knots and knots in groups are not permitted.

(*e*) Knot holes and holes from other causes than knots shall be permitted as provided for knots.

(*f*) The size of a knot shall be measured on the section of the knot appearing on the surface under consideration.

(*g*) When the mean or average diameter of a knot is specified, the size shall be taken as the average of the maximum and minimum diameters.

(*h*) Knot sizes specified shall be applied to spike knots as well as to round knots.

(*i*) The mean or average diameter of a spike knot shall be taken as the average of its length and its maximum width.

Knots.

6. In posts and timbers, the measurement of a knot shall be made on the mean or average diameter.

11. (a) Maximum knots in dense select and select posts and timbers

Width of face, in inches	Size of knot
	Inches
6	1½
8	2
10	2½
12	3
14	3¼
16	3⅜
18	3⅝
20	3⅞
22	4
24	4¼

(*b*) The sum of the diameters of all knots in any 6 inches of length of a post or timber shall not exceed twice the size of the maximum knot allowable.

Shake and checks.

17. Maximum shake and checks in dense select and select posts and timbers

Width of end, in inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
5	2	2½
6	2⅝	3
8	3⅛	4
10	4	5
12	4¾	6
14	5½	7
16	6⅜	8
18	7⅛	9
20	8	10
22	8¾	11
24	9½	12

19*E*. The slope of the grain shall not exceed 1 in 10.

20*A*. Wane is permitted, not exceeding one-eighth the width of any face.

22. There is no restriction as to sapwood for this material.

23. Douglas fir shall be of close grain, averaging on either one end or the other not less than 6 nor more than 20 annual rings per inch measured over a 3-inch portion of a radial line located as described below and representative of the average growth on the cross section. Pieces averaging from 5 to 6 annual rings per inch shall be accepted as the equivalent of close grain if having one-third or more summer wood.

25. When the radial line specified is not representative, it shall be shifted sufficiently to present a fair average, but the distance from the pith to the beginning of the 3-inch portion of the line in boxed-heart pieces shall not be changed.

26. In case of disagreement, two radial lines shall be chosen, and the number of rings shall be the average determined on these lines.

28. (*a*) In side-cut pieces of Douglas fir, the radial line shall be at a right angle to the annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the piece.

(*b*) In boxed-heart pieces the line shall run from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of 1 inch from the pith. When the least dimension is more than 6 inches the 3-inch portion of the line shall begin at a distance from the pith equal to 2 inches less than one-half the least dimension of the piece.

(*c*) If a 3-inch portion of a radial line can not be obtained, the measurement shall be made over as much of the 3-inch portion as is available.

EXAMPLE NO 3.—SPECIFICATION NO. 38

Common Joist and Plank with Wane Permissibility and No Heartwood or Sapwood Requirement, Surfaced S1S, S1E

Size requirements.

1*A*. Structural joist and plank shall be, when surfaced S1S or S2S, not thinner than the nominal dimension less ⅜ inch and when surfaced S1E or S2E not narrower than the nominal width less ⅜ inch for sizes 2 to 7 inches, inclusive, and less ½ inch for sizes 8 inches and wider.

Grade requirements.

2. This material shall contain only sound wood.

General.

3. (*a*) No pieces of exceptionally light weight shall be permitted, except that lightweight pieces otherwise of select grade may be accepted in common grade.

(*b*) Shake shall be measured on the ends of a piece, and its size shall be taken as the shortest distance between lines inclosing the shake and parallel to the wide faces of the piece. Checks and splits shall be limited as provided for shakes. No checks or combination of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

(*c*) Where wane is permitted there shall be no combination of wane and knots which would reduce the strength more than the maximum allowable knot.

(*d*) Cluster knots and knots in groups are not permitted.

(*e*) Knot holes and holes from other causes than knots shall be permitted as provided for knots.

(*f*) The size of a knot shall be measured on the section of a knot appearing on the surface under consideration.

(*g*) When the mean or average diameter of a knot is specified, the size shall be taken as the average of the maximum and minimum diameters.

(*h*) Knot sizes specified shall be applied to spike knots as well as to round knots.

(*i*) The mean or average diameter of a spike knot shall be taken as the average of its length and its maximum width.

Knots.

4. (*a*) On the wide faces of joist and plank, the measurement of a knot shall be made on the mean or average diameter.

(*b*) On the narrow faces of joist and plank, the size of a knot shall be taken as its width between lines parallel to the edges of the piece.

(*c*) The size of knots on the narrow faces and edges of wide faces of joist and plank may increase proportionately from the size allowed in the middle third to twice that size at the ends of the pieces.

(*d*) The size of knots on the wide faces of joist and plank may increase proportionately from the size allowed at the edge to that allowed at the center line.

8. (a) Maximum knots in common joist and plank: knots on wide faces

Width of face, in inches	Size of knot	
	On or near edge, middle third of length	Center line of face
	Inches	*Inches*
4	1	1¾
6	1½	2½
8	2	3⅜
10	2½	4¼
12	3	5⅛
14	3¼	5⅝
16	3⅜	6

(*b*) *Knots on narrow faces of boxed-heart pieces*

Thickness of piece, in inches	Size of knot, middle third of length
	Inches
2	⅞
3	1¼
4	1¾

(*c*) The sum of diameters of all knots within the center half of the length of a joist or plank on any face shall not exceed two times the width of face on which they occur.

Shake and checks.

14. *Maximum shake and checks in common joist and plank*

Width of end, inches	Size of shake or check	
	Green	Seasoned
	Inches	*Inches*
2	¾	⅞
3	1⅛	1¼
4	1½	1¾

19B. *Common joist and plank.*—The slope of the grain in the center half of the length shall not exceed 1 in 10.

20B. *Wane, common grade.*—Wane is permitted, not exceeding one-fourth the width of any face.

American Society for Testing Materials, proposed standard specifications for structural wood joist, planks, beams, stringers, and posts, serial D245, 1927.

These specifications are the same as the specifications of the American Railway Engineering Association, above, for structural grades of lumber and timber under the following headings:

A. Structural grades of lumber and timber and the method of their derivation.

B. Specification requirements for structural wood joist, plank, beams, stringers, and posts.

C. Structural grades and reference code.

D. Coded specifications for structural grades.

Southern Pine Association, standard specifications for grade of dense longleaf and shortleaf southern yellow pine structural timbers, joist and plank, and utility timbers, March 23, 1927.

Southern yellow pine.

This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as longleaf pine (Pinus palustris), shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), Cuban pine (Pinus heterophylla), and pond pine (Pinus serotina).

Under this heading two classes of timber are designated: A, dense southern yellow pine, and B, sound southern yellow pine.

The rules for dense and sound grades are reprinted from American Society for Testing Materials specification D10–15,[5] 1915.

General timber specifications.

Southern yellow pine timbers are graded in accordance with the several rules herein described. The defects enumerated and admitted in the various grades are described as follows: Definitions for knots, wane, and shakes conform to American Lumber Standards, 400.20.

Sizes.—All rough timbers, except No. 1 common, must be full size when green. One-quarter inch shall be allowed for each side surfaced.

Lengths.—Standard lengths are multiples of 2 feet, 8 to 20 feet, inclusive; extra lengths are multiples of 2 feet, 22 feet, and longer. When lineal average is specified, standard of lengths shall be multiples of 1 foot.

Heart timbers.

All timber specifications, except "merchantable," "dense heart," and "select structural timbers," specifying heart requirements, shall be considered as a special contract, and shall specify whether the heart requirements refer to surface or girth measurements in each piece.

[5] American Society for Testing Materials specification D10–15, has been superseded by tentative specification serial D245–27, 1927, referred to above.

Grades of timbers.

Southern yellow pine timbers are graded and classified according to intended use into timbers for structural use and for utility purposes. The grades of structural timbers and structural joists and plank are based on the provisions provided in American Lumber Standards as bases for the preparation of grading rules for structural material.

Structural timbers.

Knot measurement.—Knot measurement for structural timbers, joists, and plank conform to the American Lumber Standards, above.

Select structural material.

Select structural timbers shall conform to the definition of dense southern pine as adopted by the American Society for Testing Materials August 21, 1915, referred to above.

Shall contain only sound wood and be well manufactured, and shall be free from end shakes and checks exceeding one-sixth the width of end and diagonal grain with slope greater than 1 inch in 20 inches.

Unless otherwise specified, select structural material shall show 85 per cent of heart, girth measurement, measured anywhere in the length of the piece. Any greater or lesser requirement as to heart shall be expressed in terms of per cent of girth measurement.

May contain sound knots, provided that the size of any one knot in the center half of the length of the piece shall not exceed the following, measured on the face in which it appears:

1-inch on 6-inch face.
1-inch on 8-inch face.
1½-inch on 10-inch face.
1½-inch on 12-inch face.
2-inch on 14-inch face.
2-inch on 16-inch face.
2½-inch on 18-inch face.

Knots on narrow faces located outside the center half of the lengths of a timber may increase proportionately from the size allowed in the center half to twice that size at the ends of the piece.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

Dense heart.

Dense heart timber shall conform to the definition of dense southern pine as adopted by the American Society for Testing Materials August 21, 1915, referred to above.

Shall be well manufactured; free from end shakes and checks exceeding one-fourth the width of end; and diagonal grain with slope greater than 1 inch in 15 inches

All sizes under 9 inches shall show some heart the entire length on one side; sizes 9 inches and over shall show some heart the entire length on two opposite sides.

Wane not exceeding one-eighth of the dimension of the face and one-fourth of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed 10 per cent of the pieces, shall be admitted.

May contain sound knots, provided that the size of any one knot in the center half of the length of piece shall not exceed the following, measured on the face in which it appears.

Timber with unequal sides:

1½-inch on 6-inch face.
1¾-inch on 8-inch face.
2-inch on 10-inch face.
2-inch on 12-inch face
2½-inch on 14-inch face.
2½-inch on 16-inch face.
3-inch on 18-inch face.

Square timbers:

1½-inch in 6 by 6 inch.
2-inch in 8 by 8 inch.
2½-inch in 10 by 10 inch.
3-inch in 12 by 12 inch.
3-inch in 14 by 14 inch.
3½-inch in 16 by 16 inch.
3½-inch in 18 by 18 inch.

In timbers with unequal sides the sum of the smallest diameters of the knots in the center half of the length of any face shall not exceed the width of the face. Knots on narrow faces located outside the center half of the length of a timber may increase proportionately from the size allowed in the center half to twice that size at the ends of the piece.

In square timbers the sum of the diameters of the knots on all sides within any 6 inches of length shall not exceed twice the maximum size knot allowable, nor shall there be two maximum-size allowable knots in the same 6 inches of length of any face.

Structural square edge and sound.

Structural square edge and sound timbers shall conform to the definiton of dense southern pine as adopted by the American Society for Testing Materials August 21, 1915, referred to above.

Shall contain only sound wood and be well manufactured; shall be free from end shakes and checks exceeding one-third the width of end and diagonal grain with slope greater than 1 inch in 12 inches.

Wane not exceeding one-eighth of the dimension of the face and one-quarter of the length of the piece on corner, or the equivalent on two or more corners on not to exceed 10 per cent of the pieces, shall be admitted.

May contain sound knots, provided that the size of any one knot in the center half of the length of the piece shall not exceed the following, measured on the face in which it appears:

Timber with unequal sides:

2¼-inch on 6-inch face.
2¾-inch on 8-inch face.
3-inch on 10-inch face.
3¼-inch on 12-inch face.
3½-inch on 14-inch face.
3¾-inch on 16-inch face.
4-inch on 18-inch face.

Square timbers:

2¼-inch in 6 by 6 inch.
3-inch in 8 by 8 inch.
4-inch in 10 by 10 inch.

4½-inch in 12 by 12 inch.
5-inch in 14 by 14 inch.
5½-inch in 16 by16 inch.
6-inch in 18 by 18 inch.

In timbers with unequal sides the sum of the smallest diameters of knots in the center half of the length of any face shall not exceed one and one-half times the width of the face. Knots within 1 inch of the edge of wide faces in the center half of the length shall not exceed in size the knots permitted on the adjacent narrow face. Knots on narrow faces located outside the center half of the length of a timber may increase proportionately from the size allowed in the center half to twice that size at the ends of the piece.

In square timbers the sum of the diameters of knots on all sides within any 6 inches of length shall not exceed twice the maximum size knot allowable, nor shall there be two maximum size allowable knots in same 6 inches of length of any face.

Structural joists and plank.

Structural joists and plank shall embrace the following nominal size: 2 to 5 inches in thickness and from 4 to 16 inches in width.

The thicknesses and widths of joists and plank S1S1E or S4S shall be in accordance with the following table:

Thickness		Widths	
Board measure (inches)	Dressed dimensions, green or commercially dry	Board measure (inches)	Dressed dimensions, green or commercially dry
	Inches		*Inches*
2 to 5 inches	⅝ inch off.	4	3⅝
		6	5⅝
		8	7½
		10	9½
		12	11½
		14	13½
		16	15½

Dense heart.

Dense heart joists and plank shall conform to the definition of dense southern pine as adopted by the American Society for Testing Materials, August 21, 1915, referred to above.

Shall be well manufactured; free from end shakes and checks exceeding one-fourth the width of end; and diagonal grain with slope greater than 1 inch in 12 inches.

All sizes under 9 inches shall show some heart the entire length on one side; sizes 9 inches and over shall show some heart the entire length on two opposite sides.

Wane not exceeding one-eighth of the dimension of the face and one-fourth of the length of the piece on one corner, or the equivalent on two or more corners, or not to exceed 10 per cent of the pieces, shall be admitted.

May contain sound knots, provided that the size of any one knot in the center half of the length of the piece shall not exceed the following, measured on the face in which it appears:

½-inch on 2-inch face.
¾-inch on 3-inch face.
1-inch on 4-inch face.
1¼-inch on 6-inch face.
1½-inch on 8-inch face.
1¾-inch on 10-inch face.
2-inch on 12-inch face.
2¼-inch on 14-inch face.
2½-inch on 16-inch face.

The sum of the smallest diameters of knots in the center half of the length of any face shall not exceed one and one-half times the width of the face. Knots on narrow faces located outside the center half of the length of the piece may increase proportionately from the size allowed in the center half to twice that size at the ends of the piece.

Structural square edge and sound.

Structural square edge and sound joists and plank shall conform to the definition of dense southern pine as adopted by the American Society for Testing Materials August 21, 1915, referred to above.

Shall contain only sound wood and be well manufactured; shall be free from end shakes and checks exceeding one-third the width of end, and diagonal grain with slope greater than 1 inch in 10 inches.

Wane not exceeding one-eighth of the dimension of the face and one-fourth of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed 10 per cent of the pieces, shall be admitted.

May contain sound knots, provided that the size of any one knot in the center half of the length of the piece shall not exceed the following, measured on the face in which it appears:

¾-inch on 2-inch face.
1-inch on 3-inch face.
1¼-inch on 4-inch face.
1½-inch on 6-inch face.
2-inch on 8-inch face.
2½-inch on 10-inch face.
3-inch on 12-inch face.
3¼-inch on 14-inch face.
3½-inch on 16-inch face.

The sum of the smallest diameters of knots in the center half of the length of any face shall not exceed two times the width of the face. Knots on the narrow faces located outside the center half of the length of the piece may increase proportionately from the size allowed in the center half to twice that size at the ends of the piece.

U. S. Department of Agriculture, Bureau of Public Roads, specification for timber structures, revised May 14, 1924.

Description.

Timber structures shall be built where shown on the plans or directed by the engineer and shall be constructed in accordance with the plans and specifications. This item shall include only such timber as is a part of the completed work. All timber for erection purposes, as false work, forms, bracing, sheeting, etc., shall be furnished by the contractor at his own expense.

Quality.

All timber shall be sound and sawed standard size, straight, out of wind, and shall be free from defects, such as decay; wormholes; injurious shakes; checks and crooked, cross or spiral grain; large, loose, or unsound knots; knots in groups; large pitch pockets; or other defects that might impair its strength and durability. Wane may show on only one corner of a piece. Wane shall not exceed one-half the length of the piece nor measure more than 1 inch across the face of the wane. Not more than 10 per cent of the pieces of one size may show any wane.

Size.

Rough timbers when sawed to standard size, shall mean that they shall not be over ¼ inch scant from actual size specified. For instance, a 12 by 12 inch timber shall measure not less than 11¾ by 11¾ inches.

Dressed.—Standard dressing means that not more than ¼ inch shall be allowed for dressing, each surface. For instance, a 12 by 12 inch timber shall, after dressing four sides, not measure less than 11½ by 11½ inches.

Dense timber.

Dense timber shall be used for truss members, floor beams, stringers, caps, and flooring.

(*a*) Dense timber of longleaf pine, shortleaf pine, and Cuban pine shall show at one end or the other an average of at least six annual rings per inch and at least one-third summer wood, all measured over the third, fourth, and fifth inches on a radial line from the pith. Wide-ringed material excluded by this rule shall be acceptable, provided the amount of summer wood as above measured shall be at least one-half. The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color except in pieces having more than one-half summer wood.

In cases where timbers do not contain pith, and it is impossible to locate it with any degree of accuracy, same inspection shall be made over 3 inches in an approximate radial line beginning at the edge nearest the pith in timbers over 3 inches in thickness and in the second inch of the piece nearest to the pith in timbers 3 inches or less in thickness.

In dimension material containing the pith but not a 5-inch radial line, which is less than 2 by 8, which is in section, or less than 8 inches in width, that does not show over 16 square inches on the cross section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-inch radial line the inspection shall apply to the 3 inches farthest from the pith.

(*b*) Dense timber of coast region Douglas fir shall be strong timber of medium rate of growth and show on one end or the other an average of at least six annual rings per inch and at least one-third summer wood measured over 3 inches on a line located as hereinafter described. Wide-ringed material, excluded by this rule, shall be acceptable, provided the amount of summer wood as above measured shall be at least one-half. Material in which the proportions of summer wood is not clearly discernible shall not be used.

Any timber whose least dimension is less than 5 inches shall not show the pith on the inspection end; pieces whose least dimension is 5 inches or more may contain the pith.

When the least dimension is 5 inches or more, the pith being present, the line over which the rate of growth and percentage of summer wood measurements shall be made, shall run from the pith to the corner farthest from the pith. The 3-inch line shall begin at a distance from the pith equal to 2 inches less than one-half the least dimension of the piece.

For all pieces not having the pith present the center of the 3-inch line shall be at the center of the end of the piece and the direction of the 3-inch line shall be at right angles to the annual rings.

If a radial line of 3 inches can not be obtained, the measurement shall be made over the entire radial line that is available.

(*c*) *Timber of other species.*—Other species of timber for truss members, floor beams, caps, and flooring shall be strictly first quality.

Sound timber.

Timber for columns, sills, wheel guards, bulkhead sheeting, bracing, and timber for other purposes, unless otherwise specified, shall fulfill the foregoing requirements except the density rules given above.

Heart requirement.

All untreated timber shall show at least 85 per cent heartwood on any girth.

Untreated timber.

For designs based on a fiber stress in bending of 1,500 to 1,600 pounds per square inch, one of the following species of timber shall be used:[6]

Douglas fir from Pacific coast region (Pseudotsuga taxifolia).

Longleaf pine (Pinus palustris).

Cuban pine (Pinus heterophylla).

White oak (Quercus alba).

Spanish oak from lowland (Quercus pagodaefolia).

Tanbark oak (Quercus densiflora).

Treated timber.

For designs based on a fiber stress in bending of 1,500 to 1,600 pounds per square inch, one of the following species of timber shall be used:[1]

Douglas fir from Pacific coast region (Pseudotsuga taxifolia).

Longleaf pine (Pinus palustris).

Cuban pine (Pinus heterophylla).

Shortleaf pine (Pinus echinata).

White oak (Quercus alba).

Spanish oak from lowland (Quercus pagodaefolia).

Tanbark oak (Quercus densiflora).

Timber treated by a pressure method to retain 8 to 12 pounds of oil per cubic foot and so treated

[6] See table for unit stresses for use with these specifications under 400.12.

that all sapwood is entirely impregnated with creosote oil shall fulfill the requirements for untreated timber except that there shall be no heart wood requirement.

NOTE.—The complete specification describes the construction, preservative treatment, and painting of timber structures. Table of working stresses appended to this specification is included under No. 400.12.

412.1 TIMBERS.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 412.0, structural material, for the basic provision for the selection and inspection of softwood dimension and timbers where working stresses are required.

American Association of State Highway Officials, specifications for timber cribbing, December, 1926.

Material.

Timber.—Timber used for cribbing shall conform to the requirements of structural timber, lumber and piling, 412.0 and unless otherwise specified shall be 1 common dimension.

Logs.—Logs used for cribbing shall conform in quality to the requirements specified for timber piles in structural timber, lumber and piling, No. 412.0.

Preparation.

When timber or logs are to be treated, all framing shall be completed before treatment and all surfaces cleaned of dirt and grease.

All timber and log framing shall be done in a workmanlike manner and true to line and angle.

Dimensions.

Timber.—When cribs are constructed of sawed timber no timber shall be less than 8 inches in least dimension. The face timber in the base tier shall be not less than 10 inches in least dimension.

Logs.—When cribs are constructed of logs, no face log shall have a diameter at the small end of less than 10 inches and tie logs shall be not less than 8 inches in diameter at the small end. The face log in the base tier shall be not less than 12 inches in diameter at the small end.

All logs for cribbing shall be selected with as small an amount of taper as possible from the logs available. The length of logs used shall be somewhat dependent upon the taper.

National Hardwood Lumber Association, grading rules for timber, January, 1927.

Bridge and dock timbers.

Bridge and dock timbers in any hardwood shall grade substantially the same as freight car stock, with allowance for additional and coarser defects, according to size and purpose intended.

Sound square edge.

Sound square-edge plank and timbers shall be sawn to specified sizes and shall be free from unsound defects that seriously impair the strength or prevent the use of the piece for purposes of strength in its full width and length.

Firm, tight heart-center boxed or showing on the surface, wormholes, an occasional grub hole, an occasional knot hole not extending through the piece, and slight wane on one or two corners, as defined in "good edge," in general instructions (400.30) will be admitted. Season checks are no defect.

Common timbers.

Common timbers for building and other purposes will admit wane on one or two corners as defined in "good edge," in general instructions (400.30), or its equivalent on one face; boxed heart or firm tight heart showing on one face; slight shake not over ⅙ the length of the piece; pin, shot, and spot wormholes, knots, split, and other defects that do not impair the strength or prevent the use of the piece for purposes of strength in its full size and length. Season checks are no defect.

Northern Hemlock and Hardwood Manufacturers Association, grading rules for hemlock and tamarack timbers, February 1, 1927.

RULES FOR GRADING TIMBERS

No. 1 common.

4 by 4 and 4 by 6 should be made of sound timber containing reasonably sound knots that will not weaken the piece for its general use where 4 by 4 are required. Wane on one or two corners extending over one or two faces ¾ inch for ⅓ the length of pieces or its equivalent on four corners.

6 by 6 or 6 by 8 should be cut from sound stock. Reasonable sound knots red or black, round or horn shape, wane on one or two corners extending over face one inch for ⅓ the length of piece or its equivalent on all four corners. Season checks that will not weaken piece for the purpose where timber of this size is used, admissible.

8 by 8 and larger should be cut from sound stock sound large round or horn-shaped knots well scattered, shell shake that does not weaken piece for ½ the length on surface. Shake of a loose character should be considered by the inspector and limited to the location of the defect. Wane on all corners extending over face 2 inches for ⅓ length of piece or its equivalent full length of piece.

No. 2 common.

4 by 4 and 4 by 6 sound timbers with unsound defects, such as large unsound knots, round or horn-shaped, wane on two corners extending over face 1½ inches for ½ length of piece or its equivalent on all four corners, shell shake that does not weaken piece admissible in No. 2 common 4 by 4.

Mine and dock structural timber grade.

10 by 10 or larger timbers used in mines or dock building should be of a useful grade and all manner of defects admissible, such as wane, knots, whether sound or unsound, shake of a serious character extending through piece on one end for ⅓ length of piece. All defects to be considered by inspectors with regard to the utility of the piece and strength required for mining and dock purposes.

Northern Pine Manufacturers Association, grading rules for northern white and Norway pine, spruce, tamarack, April 15, 1925.

No. 1 timbers.

No. 1 timbers must be of a good, sound character, but will admit of defects that do not impair the strength of the piece.

On basis of 2 by 4, wane on edge is admissible, ½ inch deep, for half the length, or a proportionate amount for a shorter distance or on both edges. In any case one side and two edges should allow a good nailing surface, it being understood, however, that the wane shall in no case extend over ½ the side of the piece.

A few wormholes admissible.

Stain is not considered a defect.

Timbers and 3-inch plank admit proportionately greater defects.

No. 2 timbers.

No. 2 will admit of large, coarse knots not necessarily sound, considerable wane, also shake, wormholes, streaks of red rot, slightly crooked pieces or other defects which weaken or impair the pieces to such an extent as to render them unfit for No. 1 grade.

No. 3 timbers.

No. 3 will admit a great deal of rot and all the imperfections allowed in No. 1 and No. 2, but in a much more pronounced form, and any amount of tamarack.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir timbers, Schedule M, 1925.

Douglas fir mining timber.

This grade shall consist of lumber free from rot, serious shakes, or splits. Will allow variations in sawing, sap stain, solid heart stain extending over not more than ½ of piece, large knots, a few small scattered wormholes, and wane 3 inches on one corner or its equivalent on two or more corners.

Timber for remanufacturing purposes.

This grade is intended to furnish timbers for remanufacturing purposes, and will admit pieces whose strength value as a whole might be impaired by some localized major defect.

They will be furnished in square sizes and/or not to exceed 4 inches out of square 10 by 10 inches to 24 by 24 inches and/or 24 by 28 inches progressing by odd and/or even inches. No lengths shorter than 10 feet to be shipped, except an occasional 6½ and/or 8 feet may be included.

Will allow variations in sawing, a reasonable amount of slightly stained heart, slight amount of fine, closed heart or wind shake if appearing on one side only of the piece; straight shake or split in one end up to ⅕ the length or equivalent in both ends. Pitch pockets, one pitch streak ⅙ the width and ⅓ the length of the piece or equivalent of smaller ones. Tight closed pitch seams, any number of tight knots varying according to the size of the piece and to a maximum of ¼ the width or thickness. Wane on two or more corners equivalent to 2 inches in 10 by 10 inches to 13 by 17 inches, 4 inches in 14 by 14 inches to 17 by 21 inches, 6 inches in 18 by 18 inches to 21 by 25 inches, 8 inches in 22 by 22 inches to 24 by 28 inches. If wane on one corner, only ¾ the amount is allowed. Bright or discolored sap, discoloration through exposure to the elements and seasoning checks shall not be considered defects.

Red Cedar Lumber Manufacturers Association, grading rules for red cedar timber, August 1, 1925.

6 by 6 inches and larger, S1S, S1E, S2S, S4S, ½ inch off each way.

Common.

Shall be well manufactured.

Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Knots; splits; rotten streaks; rotten sap; wormholes, any number; wane 3 inches on one, or equivalent on two or more corners in a 10 by 10; larger or smaller sizes in proportion.

Southern Cypress Manufacturers Association, grading rules for cypress timbers, June 15, 1925.

No. 1 timbers.

Shall be practically all heart, free from damaging knots, shake, and splits.

Slight peck shall not be considered a defect.

Southern Pine Association, standard specification for grades of long leaf and short leaf southern yellow pine utility timbers, March, 1927.

Merchantable timbers.

May be specified dense.

All merchantable timbers shall be well manufactured and shall be free from defects, such as injurious ring or round shakes and through shakes that extend to the surface, unsound and loose knots, and knots in groups that will materially impair the strength. Seasoning checks and sap stain shall not be considered defects.

Sizes under 9 inches on the largest dimension shall show two-thirds or more heart surface on one of the wide faces; sizes 9 inches and over on the largest dimension shall show two-thirds or more heart on both of the wide faces. When sticks are square, the face showing the most heart shall govern the inspection on sizes under 9 inches and the two faces showing the most heart shall govern the inspection when 9 inches and over. Heart showing the full length, even if not two-thirds of the area as above, shall meet the requirements of this quality.

Wane not exceeding one-eighth of the dimension of the face and one-quarter of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed 10 per cent of the pieces, shall be admitted.

Square edge and sound timbers.

May be specified dense.

Unless otherwise specified, this grade will admit any amount of sapwood.

Square edge and sound timbers shall be well manufactured and shall be free from defects, such as injurious ring or round shakes and through shakes that extend to the surface, unsound and loose knots, and knots in groups that will materially impair the strength. Seasoning checks and sap stain shall not be considered defects.

Wane not exceeding one-eighth of the dimension of the face and one-fourth of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed 10 per cent of the pieces, shall be admitted.

No. 1 common timbers.

Unless otherwise specified, this grade will admit any amount of sapwood.

Common timbers, rough, 6 by 6 and larger, may be ¼ inch scant in either or both of its dimensions, shall be well manufactured, and may have 1½-inch wane on one corner one-third the length of the piece, or its equivalent on two or more corners, the wane measured on its face.

Timbers 10 by 10 in size may have 2-inch wane as above; the larger sizes may have wane as above in proportion to sizes.

Common timbers may contain sound knots and pith knots, provided that the diameter of any one knot shall not exceed the following in size:

2-inch in 6 by 6 inch.
2½-inch in 6 by 8 to 8 by 10 inch.
3-inch in 10 by 10 to 10 by 12 inch.
3½-inch in 12 by 12 to 12 by 14 inch.
4-inch in 14 by 14 to 14 by 16 inch.
4½-inch in 16 by 16 to 16 by 18 inch.

In sizes not mentioned, the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on same basis as above specified.

In determining the size of knots, mean or average diameter shall be taken, or the equivalent of the above in grouped knots at any one point.

Will admit shakes extending one-sixth the length of the piece, round or ring shakes, unsound knots 1½ inches or less in diameter, a limited number of pin wormholes well scattered, sap stain, and seasoning checks. Unless otherwise specified, this grade will admit any amount of sap stain.

Southern Pine Association, the Gulf Coast classification of pitch pine, March 15, 1923.

Merchantable sawn lumber.

Lengths.—16 feet and up; 2 per cent 14 and 15 feet allowed.

Must show some heart on all four sides and be free from unsound knots, loose knots, knot holes, grub wormholes, and rot. Firm red heart permissible, if not in excess of 15 per cent of the area of the face on which it appears. Must be free from shakes extending to the surface, but will permit wane as specified below and natural or growth defects except as herein excluded. Wane that a ⅝-inch hook will catch is not to be considered as wane. The sapwood on this quality is not limited or restricted otherwise than that each of the four faces of each piece shall show some heart. Sap stain is no defect.

Eleven inches and under.

Will permit 1½-inch wane in widest place not to exceed ⅓ the length of stick on one corner, or if on more than one corner, ⅓ the length in the aggregate.

From 12 to 14 inches.

Will permit 2½-inch wane in widest place not to exceed ⅓ the length of stick on one corner, or if on more than one corner, ⅓ the length in the aggregate.

Fifteen inches and up.

Will permit 3½ inches of wane in widest place not to exceed ⅓ the length of stick on one corner, or if on more than one corner, ⅓ the length in the aggregate.

West Coast Lumbermen's Association, grading rules for Douglas fir and western red cedar, July 1, 1926.

6 by 6 inches and larger S1S, S1E, S2S, or S4S, ½ inch off each way. Lengths, multiples of 2 feet.

Structural timbers.

Must be sound stock, well manufactured and close grained, as defined herein; angle of grain, not more than 1 in 10 inches. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound, intergrown, or encased knots or spike knots, measured as defined herein, approximately:

1¼-inch on a 6-inch face.
1½-inch on an 8-inch face.
2-inch on a 10-inch face.
2½-inch on a 12-inch face.
2¾-inch on a 14-inch face.
3-inch on a 16-inch face.
Not over 3½-inch on wider faces.

Shake on end of piece not more than $\frac{4}{10}$ width of piece, green; nor ½, seasoned; seasoning checks; pitch pockets not over 6 inches in length; medium sap stain; wane, ⅛ width of face.

The size of a knot shall be taken as the average of the maximum and minimum dimensions. The size of a spike knot shall be taken as the average of the length and maximum width. Cluster knots or knots in groups are not permitted. In this grade no distinction is made between intergrown and encased knots.

The width of a shake on the end of a piece shall be taken as the distance between lines parallel to the wide faces of the piece. No checks, or combinations of checks with shakes, which would reduce the strength to a greater extent than the allowable shake shall be permitted.

Close grain shall mean an average on either one end or the other of a piece of not less than 6 nor more than 20 annual rings per inch, measured over 3 inches on a line located as follows:

In boxed heart pieces, the line shall run from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of 1 inch from the pith. When the least dimension is more than 6 inches and not over 10 inches, the 3-inch portion of the line shall begin at a distance of 2 inches from the pith. When the least dimension is more than 10 inches, the 3-inch portion of the line shall begin at a distance of 3 inches from the pith.

In side cut pieces, the line on which the measurement shall be made shall run at a right angle to the annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the

piece. When the rings are very irregular, it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the 3-inch line in boxed heart pieces must not be changed.

Pieces averaging from 5 to 6 annual rings per inch shall be accepted as the equivalent of close grain if having one-third or more summer wood.

Selected common timbers.

Must be well manufactured. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, if not in clusters, approximately 1¼-inch on a 6-inch face, 1½-inch on an 8-inch face, 2-inch on a 10-inch face, 3½-inch on a 12-inch face, 2¾-inch on a 14-inch face, 3-inch on a 16-inch face, not over 3½-inch on wider faces; pitch pockets, not over 6 inches in length; medium sap stain, limited; seasoning checks; wane, 1 inch wide, ⅙ length on one corner or equivalent, based on 10 by 10.

No. 1 common timbers.

Must be well manufactured. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, approximately 2-inch on a 6-inch face, 2¼-inch on an 8-inch face, 2½-inch on a 10-inch face, 3-inch on a 12-inch face, 3½-inch on a 14- inch face, 4-inch on a 16-inch face, not over 4½-inch on wider faces; spike knots; pitch pockets; pitch streaks; seasoning checks; medium sap stain, 25 per cent of any face; firm heart stain, slight streak ¼ length; wane 2-inch wide on one corner or equivalent, based on 10 by 10.

No. 2 common timbers.

May be Douglas fir or west coast hemlock or white fir. Will admit any number of the following defects, equivalent defects or equivalent combinations of defects: Large, loose or decayed knots; spike knots; shake or decay that does not impair its utility for temporary work; wormholes; pitch pockets; pitch streaks; sap stain; heart stain; wane, 3-inch wide on one corner or equivalent, based on 10 by 10.

Mining.

Must be free from serious rot, shake, or splits. Will admit 15 per cent west coast hemlock. Will admit variation in sawing, and the following defects, equivalent defects, or equivalent combinations of defects: Large, loose knots; pitch pockets; sap stain; pitch; firm heart stain; a few well-scattered wormholes; wane 3 inches wide on one corner or equivalent.

Stringers, girders, beams, etc.

Nominal thicknesses (inches)	Nominal widths	Lengths
	Inches	
5 and thicker	8 and wider	Multiples of 2 feet.

S1S, S1E, S2S, or S4S, ½ inch off each way.

Structural stringers.

Must be sound stock, well manufactured, and close grained as defined herein. Angle of grain in center half of length, not more than 1 inch in 15 inches. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound, intergrown, or encased knots or spike knots measured as defined herein, approximately:

Width of face (inches)	Size of knot on narrow face and edges of wide face	Size of knot on center line of wide face
	Inches	*Inches*
5	1	
6	1	
8	1¼	2
10	1½	2¼
12	2¾	2½
14 and wider	2¼ maximum.	3 maximum.

Pitch pockets not over 6 inches in length; seasoning checks; shake on end of piece not more than ¼ width of narrow face, green; nor ⅓ seasoned; wane not more than ⅓ width of narrow face; bright and/or medium stained sap not to exceed ¼ the thickness and ¼ the width at widest point.

The diameter of a knot on the narrow or horizontal face shall be taken as the width of the knot between lines parallel to the edges of the timber. On the wide or vertical face the smallest dimension of a knot shall be taken. Knots on the edges of a wide face are limited to the same size as on the adjacent narrow face, but the size may increase proportionately from the edge to the size allowed at the center line.

Knots toward the end of a piece are not so serious as in the middle half of the piece, and an occasional knot ½ inch larger than the size specified may be permitted, if not more than ¼ the length of the piece from the end. Cluster knots or knots in groups are not permitted. In this grade no distinction is made between intergrown and encased knots.

The width of a shake on the end of a piece shall be taken as the distance between lines parallel to the wide face of the piece. No checks, or combinations of checks with shakes, which would reduce the strength to a greater extent than the allowable shake shall be permitted. Close grain shall mean an average on either one end or the other of a piece of not less than 6 nor more than 20 annual rings per inch, measured over 3 inches on a line located as follows: In boxed heart pieces, the line shall run, from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of 1 inch from the pith. When the least dimension is more than 6 inches and not over 10 inches, the 3-inch portion of the line shall begin at a distance of 2 inches from the pith. When the least dimension is more than 10 inches, the 3-inch portion of the line shall begin at a distance of 3 inches from the pith.

In side-cut pieces, the line on which the measurement shall be made shall run at a right angle to the

annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the piece.

When the rings are very irregular, it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the 3-inch line must not be changed.

Selected common stringers.

Must be sound stock, well manufactured. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots or spike knots, if not in clusters, approximately:

1¼-inch on a 6-inch face.
1½-inch on an 8-inch face.
2-inch on a 10-inch face.
2¼-inch on a 12-inch face.
Not over 2½-inch on wider faces.

Seasoning checks; pitch pockets not over 6 inches in length; medium sap stain, limited; wane, 1 inch wide, ⅙ length, based on a 10-inch face.

No. 1 common stringers.

Must be sound stock, well manufactured. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots or spike knots, approximately:

1½-inch on a 6-inch face.
2-inch on an 8-inch face.
2½-inch on a 10-inch face.
3-inch on a 12-inch face.
3½-inch on a 14-inch face.
Not over 4-inch on wider faces.

Seasoning checks; pin wormholes, limited; pitch pockets; pitch streaks; medium sap stain, 25 per cent of any face; firm heart stain, 10 per cent of any face; wane, 2 inches wide on one corner, or equivalent based on a 10-inch face.

Western red cedar.

Timbers, 6 by 6 inches and larger, S1S, S1E, S2S, S4S, ½ inch off each way.

Common dimension shall be well manufactured. Will admit occasional slight variation in sawing and any number of the following defects, equivalent defects, or equivalent combinations of defects: Knots; splits; rotten streaks; rotten sap; wormholes, any number; wane, 3 inches on one, or equivalent on two or more corners, in a 10 by 10; larger or smaller sizes in proportion.

Western Pine Manufacturers Association, grading rules for timbers, July 1, 1925.

The grading rules for timbers are the same as this association's grading rules for dimensions. (See 402.43.)

Larch and fir.

Timbers S1S1E or S4S—
4 by 4 to 3⅝ by 3⅝.
4 by 6 to 3⅝ by 5⅝.
6 by 6 to 5⅝ by 5⅝.
6 by 8 to 5⅝ by 7½.
8 by 8 to 7½ by 7½.

412.2 BRIDGES.

(See No. 412.0.)

413. SHOP OR FACTORY LUMBER.

413.0 GENERAL ITEMS.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

SOFTWOOD FACTORY AND SHOP LUMBER

General Provisions

The grade of factory lumber shall be determined by the percentage of the area of each board or plank available in cuttings of specified or given minimum sizes and qualities.

The grade of softwood factory boards or plank, or shop lumber, shall be determined from the poor face, although the quality of both sides of each cutting must be considered.

When lumber is crooked, bowed, cupped, or twisted the cuttings must be so laid out as to be flat and straight along the edges.

Board measurement shall be used in measuring factory lumber. When measured with a board rule, pieces measuring to the even half foot shall be alternately counted as of the next higher and the next lower surface foot; fractions below the half foot shall be dropped, and fractions above the half foot shall be counted as of the next higher foot. To determine the board foot contents of material thicker than 1 inch, the surface measure should be multiplied by the nominal thickness in inches and fractions of an inch.

The board measurement of dressed factory lumber of standard and extra-standard size shall be based upon the corresponding standard dimensions of rough green lumber.

SIZES

DRESSED THICKNESSES

The following thicknesses of factory lumber shall be considered standard. All other thicknesses shall be considered special.

Size, board measure in inches	Finished thicknesses, S1S or S2S, at commercially dry shipping weight and moisture content	
	Standard	Extra-standard
	Inches	*Inches*
1	25/32	29/32
1¼	1 5/32	
1½	1 13/32	
2	1 29/32	
2¼	2 1/32	
2½	2 3/8	
3	2 7/8	
4	3 7/8	

NOTE.—It is to be understood that any association, which publishes and administers rules for factory lumber under the American Lumber Standards, will not be required to furnish 1-inch factory number in both the standard and extra-standard thicknesses.

WIDTHS

Standard widths shall be 5 inches and over; factory lumber is usually shipped in random widths, though specified widths may be shipped. Five-inch widths must be full size in the rough dry condition.

LENGTHS

Standard lengths shall be 6 feet and over in multiples of 1 foot.

Factory Plank

In determining the percentage of door cuttings, consideration must be given to the fact that planks are to be ripped full length before crosscutting, in such manner as will yield the highest grade and largest percentage of door cuttings, except in such cases where planks will yield a higher value by first being crosscut for rails. In instances where stock is crosscut for rails and some of the stock so obtained contains stiles or muntins or top rails, which can be obtained by ripping this crosscut stock, the door cuttings so obtained may be figured in when determining percentages.

Basic grade classifications for softwood factory plank

- FACTORY PLANK — Factory lumber graded with reference to its use for doors, sash, and other cuttings.
  - FACTORY CLEARS — Upper grades of factory plank containing a high percentage of best-quality cuttings.
    - Nos. 1 and 2 clear factory—Lumber, practically clear in wide sizes, to contain not less than 85 per cent of No. 1 door cuttings, not including pieces with over two muntins, or muntins only.
    - No. 3 clear factory—Lumber containing not less than 70 per cent of No. 1 door cuttings, not including pieces with over two muntins, or muntins only.
  - SHOP — Lower grades of factory plank yielding smaller percentages in smaller and lower quality cuttings.
    - No. 1 shop—Lumber of high quality factory grade containing not less than 50 per cent of No. 1 door cuttings, allowing, if necessary, one No. 2 stile in any piece, but no pieces with over two mintins, or muntins only.
    - No. 2 shop.—Lumber containing not less than 25 per cent of No. 1 door cuttings, or 40 per cent No. 2 door cuttings, or 33⅓ per cent of mixed door cuttings.
    - No. 3 shop—Lumber of a shop type below the grade of No. 2 shop and better than box lumber.

QUALITY OF CUTTINGS

In determining the grades of factory plank two grades of cuttings shall be recognized. These shall be known as No. 1 and No. 2 cuttings and shall conform to the following rules:

No. 1 cuttings shall be free from defects on both sides. No restrictions shall be made upon bright sapwood.

No. 2 cuttings shall admit any one of the following defects:

Light blue stain on one side, not larger in extent than one-half the area of the side.

Medium brown kiln or heart stain covering half the surface on one face, or a greater area of lighter stain, or a proportionate amount on two sides.

A small, sound and tight knot which does not exceed five-eights of an inch in diameter.

A small pitch pocket not over one-eighth of an inch wide nor over 2 inches long in west coast woods and not over one-eighth of an inch wide nor over 1 inch long in western pine and California pine.

One or more small season checks whose combined length does not exceed 8 inches.

Light pitch or small pitch streaks that do not form a pronounced defect.

Slightly torn grain on one side.

SIZES OF CUTTINGS

Stiles shall be 5 and 6 inches wide by 6 feet 8 inches to 7 feet 6 inches long. They may be either No. 1 or No. 2 in quality.

Bottom rails shall be 9 and 10 inches wide by 2 feet 4 inches to 3 feet long. They may be either No. 1 or No. 2 in quality.

Muntins shall be 5 and 6 inches wide by 3 feet 6 inches to 4 feet long. They may be either No. 1 or No. 2 in quality.

Top rails shall be 5 and 6 inches wide by 2 feet 4 inches to 3 feet long. They must be of No. 1 cutting quality, but shall be considered as No. 2 cuttings.

Sash cuttings shall be 2½ and 3½ inches in width by 28 inches and over in length.

In computing the area of cuttings in each piece of factory plank the sizes listed below shall be used. After each cutting size is shown the exact surface area in square feet. For convenience in computing, the figures shown on the right, representing the area to the nearest one-fourth square foot, shall be used.

STILES

Size of cutting in board or plank	Actual area in square feet	Nominal area to be used in application of grading rules
5 inches by 6 feet 8 inches	2.78	3
5 inches by 6 feet 10 inches	2.85	
5 inches by 7 feet	2.92	
5 inches by 7 feet 2 inches	2.99	
5 inches by 7 feet 4 inches	3.06	
5 inches by 7 feet 6 inches	3.13	
6 inches by 6 feet 8 inches	3.33	3¼
6 inches by 6 feet 10 inches	3.42	3½
6 inches by 7 feet	3.50	
6 inches by 7 feet 2 inches	3.58	
6 inches by 7 feet 4 inches	3.67	3¾
6 inches by 7 feet 6 inches	3.75	

BOTTOM RAILS

9 inches by 2 feet 4 inches	1.75	1¾
9 inches by 2 feet 6 inches	1.875	
9 inches by 2 feet 8 inches	2.0	2
9 inches by 2 feet 10 inches	2.125	
9 inches by 3 feet	2.25	2¼
10 inches by 2 feet 4 inches	1.94	2
10 inches by 2 feet 6 inches	2.08	
10 inches by 2 feet 8 inches	2.22	2¼
10 inches by 2 feet 10 inches	2.36	
10 inches by 3 feet	2.50	2½

MUNTINS

5 inches by 3 feet 6 inches	1.46	1½
5 inches by 3 feet 8 inches	1.53	
5 inches by 3 feet 10 inches	1.60	
5 inches by 4 feet	1.67	1¾
6 inches by 3 feet 6 inches	1.75	
6 inches by 3 feet 8 inches	1.83	
6 inches by 3 feet 10 inches	1.92	2
6 inches by 4 feet	2.0	

TOP RAILS

Size of cutting in board or plank	Actual area in square feet	Nominal area to be used in application of grading rules
5 inches by 2 feet 4 inches	0.97	1
5 inches by 2 feet 6 inches	1.04	
5 inches by 2 feet 8 inches	1.11	
5 inches by 2 feet 10 inches	1.18	1¼
5 inches by 3 feet	1.25	
6 inches by 2 feet 4 inches	1.17	
6 inches by 2 feet 6 inches	1.25	
6 inches by 2 feet 8 inches	1.33	
6 inches by 2 feet 10 inches	1.42	1½
6 inches by 3 feet	1.50	

Shop Lumber

Basic grade classifications for softwood shop lumber

SHOP LUMBER	FOR SHOP LUMBER 1 INCH IN THICKNESS [1]	FOR SHOP LUMBER OF ALL THICKNESSES [2]
Shop lumber graded for cuttings of minimum and larger sizes with reference to its use for general cut-up purposes.	Select: Lumber to contain not less than 70 per cent of (*a*) and/or (*b*) cuttings.	No. 1 shop—Lumber to contain not less than 60 per cent of (*a*) and/or (*b*) cuttings.
	Shop: Lumber to contain not less than 50 per cent of (*a*) and/or (*b*) cuttings.	No. 2 shop—Lumber to contain not less than 40 per cent of (*a*) and/or (*b*) cuttings.

NOTE.—The Central Committee on Lumber Standards, on June 16, 1927, unanimously approved the following modification and enlargement of the basic grade classification for softwood shop lumber:

SHOP LUMBER	FOR SHOP LUMBER 1 INCH IN THICKNESS [1]	FOR SHOP LUMBER OF ALL THICKNESSES [2]
Shop lumber graded for cuttings of minimum and larger sizes, or for permissible defects, with reference to its use for general cut-up purposes.	Select: Lumber to contain not less than 70 per cent of (*a*) and/or (*b*) cuttings.	Tank and boat stock—Lumber admitting sound defects that do not impair the usefulness of each piece for the use intended. Firsts and seconds—Lumber of C select or better quality on the reverse side, suitable for remanufacture into products requiring both faces of good quality. Selects—Lumber of C select or better quality on the face side, suitable for remanufacture into products requiring one face of good quality.
	Shop: Lumber to contain not less than 50 per cent of (*a*) and/or (*b*) cuttings.	No. 1 shop—Lumber to contain not less than 60 per cent of (*a*) and/or (*b*) cuttings. No. 2 shop—Lumber to contain not less than 40 per cent of (*a*) and/or (*b*) cuttings. Box—Lumber below the grade of No. 2 shop, to contain not less than 66⅔ per cent sound cuttings not less than 3 inches wide and 18 inches long.

[1] For northern, western, and California pine, and west coast woods.
[2] For cypress, redwood, and North Carolina pine.

In determining the grades of either shop or cut-up lumber two grades and sizes of cuttings shall be recognized and shall conform to the following rules:

SIZES OF CUTTINGS

(*a*) Cuttings shall be 9½ inches wide or wider by 18 inches long or longer.

(*b*) Cuttings shall be 5 inches wide or wider by 3 feet long or longer.

QUALITY OF CUTTINGS

Cuttings less than 3 feet long shall be free from all defects on both sides. No restriction need be made upon bright sapwood.

(*a*) Cuttings 3 feet long or longer and (*b*) cuttings shall have a C select or better face in all softwoods except Douglas fir, Sitka spruce, and west coast hemlock, where the face of the cuttings shall be equal to B or better finish.

American Railway Engineering Association, revision of manual, bulletin 293, January, 1927.

Wooden Bridges and Trestles.

The general provisions, sizes, grade classifications, quality and size of cuttings for softwood factory lumber, and the grade classifications and size and quality cuttings for softwood shop lumber are identical with the American Lumber Standards, No. 413.0, the finished thickness for 1-inch boards is extra standard or 25/32 inches.

California Redwood Association, standard specifications for eastern grades of California redwood shop lumber, April, 1927.

The sizes of shop lumber are the same as the American Lumber Standard sizes 413.0, softwood factory, and shop lumber. The finished thickness for 1-inch boards is extra standard, or 25/32.

The grades of shop lumber are as follows:

Grades.

Nos. 1 and 2 clear V. G. pattern lumber; Nos. 1 and 2 clear F. G. pattern lumber; and No. 1 shop.

Nos. 1 and 2 clear V. G. pattern lumber shall be soft selected stock, with vertical grain for 70 per cent or more of its face and not less than 12 rings of annual growth per inch, and strictly clear and free from hard streaks or other defects that will render it unfit for selected pattern lumber for the full length of the piece.

Nos. 1 and 2 clear F. G. pattern lumber shall be of the same quality as Nos. 1 and 2 clear V. G. pattern lumber, but will allow any amount of flat grain stock and rings of annual growth.

No. 1 shop shall contain not less than 60 per cent of cuttings 5 inches and wider by 3 feet and longer. Any such cutting will admit bright, sound sapwood and, in addition, any one of the following defects: Small surface check; sound tight bird's-eye; slight roughness in dressing; sound and tight pin knot; light stain, 5 per cent of area.

Federal Specifications Board, proposed revision to supersede softwood parts of F. S. B. No. 24, master specification for lumber, softwood, yard and factory, 1927. (See 411.0.)

Western Pine Manufacturers Association, rules for the grading of Pondosa pine, Idaho white pine, larch and fir, white fir, cedar, and spruce, July 1, 1925.

Standard sizes.

Shop and factory—

1 S2S to 25/32.	2¼ S2S to 2⅛.
1¼ S2S to 1 5/32.	2½ S2S to 2⅜.
1½ S2S to 1 13/32.	3 S2S to 2¾.
2 S2S to 1 26/32.	4 S2S to 3¾.

413.1 TANK STOCK.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

California Redwood Association, standard specifications for eastern grades of California redwood tank stock, April, 1927.

Grades of tank stock are based on a piece 8 inches wide by 12 inches long, or a piece having 8 square feet surface measure; on this basis larger or smaller pieces will admit a proportionate number of defects.

Grades.

Clear heart (Redwood Association grade) and A (American Standard Redwood grade).

Lengths.

Standard lengths shall be the same as for finish, 411.43.

Clear heart tank stock shall be well manufactured and free from all sapwood. It will admit sound, tight bird's-eye, sound and tight pin or small knots which show on one face only and any other defects on the edges which will dress off in working.

A tank stock will admit such defects as are not admitted in clear heart and which do not render it unfit for the purpose intended. It will admit sapwood on one edge, not extending to the face of the piece; sound tight bird's-eye; sound and tight pin or small knots; light stain; small crook.

California White and Sugar Pine Manufacturers Association, grading rules for tank stock, May 1, 1926.

Tank stock shall be graded with the view of supplying stock that can be used for the construction of water tanks.

Each piece shall be comparatively straight and practically free from wane.

All defects natural to common lumber are admissible in this grade provided they do not destroy the usefulness of the piece for tank purposes.

Particular care should be exercised in selecting the stock so that there may be no defects on the edges that would lead to leakage in preparation of the grooves or in smoothing for close fitting.

A sound-edge knot shall not be considered a defect provided it does not extend through more than half the thickness.

NOTE.—Tank stock should be of the sizes carried in thick common lumber. When tank stock of a particular appearance is wanted, it can be ordered selected from No. 1, No. 2, or No. 3 common grades; otherwise it will be selected without regard to appearance.

National Hardwood Lumber Association, grading rules for tank stock, January, 1927.

Tank (when specified).

Widths.—5 inches and over.

Lengths.—8 feet and over.

Sound defects that do not damage the piece for tank purposes will be admitted.

Pieces 5 inches wide must be free from sapwood. Pieces 6 inches and over wide may have 1 inch of sound sapwood in the aggregate not exceeding half the thickness of the piece.

Northern Pine Manufacturers Association, grading rules for tank stock, April 15, 1925.

Tank stock shall be of dimension sizes, square-edged, practically free from wane and shake, and may have any number of sound, water-tight knots

White sap is no defect.

Southern Cypress Manufacturers Association, grading rules for tank stock, June 15, 1925.

Tank and boat stock.

Thickness.—1, 1¼, 1½, 2, 2½, 3, and 4 inches.

Width.—Shall be random widths, 5 inches and over wide.

Length.—8 feet and longer.

Shall be graded from the poorer side. Shall be free from sap. Sound knots that do not impair the usefulness of the piece for tank or boat purposes will be admitted.

West Coast Lumbermen's Association, grading rules for tank stock, July 1, 1926.

Tank stock, rough green.

Defects based on 2 by 6 inches by 12 feet.

Tank stock, F. G. and/or V. G.

Surfaced ¼ inch less in thickness than nominal. Surfaced ½ inch less in width than nominal. Must be well manufactured to full sizes ordered. Edges must not contain defects that will prevent a water-tight joint when worked. Two-inch stock, practically no sap admitted; 3-inch and thicker, 6-inch and wider, bright sap 25 per cent of face, not to exceed ¾ inch on edges. Will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Two small (4-inch) pitch pockets, neither through; 2 small sound and tight knots, neither through; 1 additional pitch pocket or knot for each 2 additional inches in width.

Western Pine Manufacturers Association, grading rules for tank stock, July 1, 1925.

Tank stock shall be graded with the view of supplying a stock that can be used entirely for the construction of water tanks.

Each piece shall be practically straight and practically free from wane.

All defects natural to common lumber are admissible in this grade provided they do not destroy the usefulness of the piece for tank purposes.

Particular care should be exercised in selecting the stock so that there may be no defects on the edges that would lead to leakage in preparation of the groove or in smoothing for close fitting.

A sound edge knot shall not be considered a defect provided it does not extend through more than half the thickness.

NOTE.—Tank stock should be of the sizes carried in thick common lumber. When tank stock of a particular appearance is wanted, it can be ordered selected from No. 1, No. 2, or No. 3 common grades; otherwise it will be graded without regard to appearance.

413.2 CAR STOCK.

413.20 General Items.

American Railway Association, Mechanical Division, specifications for lumber, 1910.

Description of various woods used by railroad companies for car and locomotive lumber.

Ash	To cover white, black, blue, green, and red ash.
Basswood	To cover linden, linn, lind, or lime tree.
Beech	To cover red and white beech
Birch	To cover red, white, yellow, and black birch.
Buckeye	To cover wood from horse-chestnut tree.
Butternut	To cover wood from tree of that name, also known as white walnut.
Cherry	To cover sweet, sour, red, black, and wild cherry.
Chestnut	To cover wood from tree of that name.
Cottonwood	To cover wood from tree of that name. (Do not confuse with popple or poplar.)
Cypress	To cover red, gulf, yellow, and east coast cypress, also known as bald cypress.
Elm, soft	To cover white, water, gray, red, or slippery and winged elm.
Elm, rock	To cover rock or cork elm.
Douglas fir	To cover yellow, red, western Washington, Oregon, Puget Sound fir or pine, northwest and west coast fir.
Gum	To cover red gum, sweet gum, or satin walnut.
Hemlock	To cover southern and eastern hemlock; that is, hemlock from all States east of and including Minnesota.
Western hemlock	To cover hemlock from Pacific coast.
Hickory	To cover shellbark, kingnut, mockernut, pignut, black, shagbark, and butternut.
Western larch	To cover the species of larch or tamarack from the Rocky Mountain and Pacific coast regions.
Maple, soft	To cover soft and white maple.
Maple, hard	To cover hard, red, rock, and sugar maple.
White oak	To cover white, burr, or mossy cup, rock, post or iron, overcup, swamp post, live chestnut or tan bark, yellow or chinquapin, and basket or cow oak.
Red oak	To cover red, pin, black, water, willow, spanish, scarlet, turkey, black jack or barn, and shingle or laurel oak.
Pecan	To cover wood from tree of that name.
Southern yellow pine	To cover longleaf and shortleaf yellow pine grown in the southern States.
White pine	To cover wood from tree of that name grown in Maine, Michigan, Wisconsin, Minnesota, and Canada.
Norway pine	To cover Norway or red pine grown in Michigan, Minnesota, Wisconsin, and Canada.
Idaho white pine	To cover variety of white pine grown in western Montana, northern Idaho, and eastern Washington.
Western pine	To cover timber known as white pine grown in Arizona, California, New Mexico, Colorado, Oregon, and Washington; sometimes known as western yellow or ponderosa pine, or California white pine or western white pine.
Poplar	To cover wood from the tulip tree, otherwise known as whitewood, yellow poplar and canary wood.
Redwood	To cover wood from tree of that name.
Spruce	To cover eastern spruce; that is, the spruce timber coming from points east of and including Minnesota and Canada, covering white, red, and black spruce.
Western spruce	To cover the spruce timber from the Pacific coast.
Sycamore	To cover wood from tree of that name, otherwise known as buttonwood.
Tamarack	To cover tamarack or eastern tamarack, grown in States east of and including Minnesota.
Tupelo	To cover tupelo gum and bay poplar.
Walnut	To cover black walnut (for white walnut, see butternut).

In 1916 the following schedule of lumber, indicating the kind and grade that should be used in each part, was adopted.

Schedule of lumber

Detail part	Kind of lumber	Grade (M. C. B. specifications)
Battens, door	White pine	No. 1 common.
	Yellow pine	
Bolsters, truck	Oak	Car timber.
Bolsters, body	do	Do.
Beams, bumper	do	Do.
Beams, needle	do	Do.
	Longleaf pine	
Belt rail	Oak	Do.
	Yellow pine	
Braces	Yellow pine	No. 1, common heart, new.
		No. 1, common heart, repairs.
	Oak	Car timber.
	Poplar	
Boards: Card	White pine	No. 1, common.
Boards: Legend	Cypress	C. and better.
Boards: Number		
Boards for solid coke racks	Oak	Car timber.
	Yellow pine	
Boards, deck, for stock cars	Oak	Car timber.
	Yellow pine	No.1, common heart.
Carline	Oak	Car timber.
	Yellow pine	No. 1, common heart.
Decking or flooring	Yellow pine and oak (open cars)	All heart and heart face, car timber.
	Yellow pine (box cars)	Heart face and No. 1 common.
	Yellow fir	Edge grain
Door header	Yellow pine	No. 1, common heart.
	Oak	Car timber.
	Yellow fir	
Door, grain	May be made of any kind of wood sufficiently sound to prevent leakage of grain. Only 10 per cent in any shipment to be less than 6 inches wide.	
Door, side	Yellow pine	B. and better, new.
		No. 1, common, repairs.
	Cypress	C. and better.
	Yellow fir	
Draft timbers	Oak	Car timbers.
Dust guards	Basswood	
Fascia	White pine	B. and better, new.
		C. and better, new.
		No. 1, common, repairs.
	Cypress	C. and better.
	Fir	No. 2, clear and better, flat grain.
	Poplar	No. 2.
Framing, car	Oak	Car timber.
	Fir	No. 2 clear and better, edge and flat grain.
	Yellow pine	
Frame for box car side door	Oak	Car timber.
	Yellow pine	No. 1 common heart.
Lining:		
Refrigerator and box car without siding	Yellow pine	B. and better.
		No. 1, common.
	Fir	No. 2, clear and better, flat grain.
	Cypress	C. and better.
Refrigerator and box car with siding	Yellow pine	No. 1, common.
	Fir	No. 3, clear.
	Cypress	Car lining.
Lagging	White pine	No. 1, common.
Plank:		
Side	Yellow pine	No. 1, common heart.
End	Oak	Car timber.
	Yellow pine	No. 1, common heart.
Spring	Oak	Car timber.
Platform	do	Do.
Truss	do	Do.
Roofing:		
Single board and outside double board	White pine	No. 1 common.
	Norway pine	
	Eastern spruce	
	Yellow pine	B. and better.
	Fir	No. 2, clear and better, flat grain.
	Cypress	C. and better
Double board inside	White pine	No. 3 common.
	Norway pine	
	Eastern spruce	
	Yellow pine	No. 1 common.
	Fir	No. 3, clear.
	Cypress	Car lining.
Running boards	Yellow pine	No. 1, common.
	White pine	B. and better.
Ridge pole	Oak	Car timber.
	Yellow pine	No. 1, common heart.
Rack, slats for coke	Oak	Car timber.
	Yellow pine	

Schedule of lumber—Continued

Detail part	Kind of lumber	Grade (M. C. B. specifications)
Siding	Yellow pine	B. and better.
		No. 1, common.
	Fir	No. 2, clear and better, flat grain.
	Cypress	C and better.
	Poplar	No. 2.
Sills:		
Center	Yellow pine	Heart face.
Intermediate		
Side		
Center filling	Fir	No. 2, clear and better, edge grain.
Nailing		
Deck		
Stakes	Oak	Car timber.
	Yellow pine	No. 1.
Steps, brake	Oak	Car timber.

413.21 Fir Car Stock.

American Lumber Industry, Simplified Practice Recommendation, No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0.

American Railway Association, Mechanical Division, specifications for lumber, 1910.

CLASSIFICATION AND GRADING RULES FOR DOUGLAS FIR CAR AND LOCOMOTIVE MATERIAL

1. The term "Douglas fir" will cover the timber known likewise as yellow, red, western, Washington, Oregon, or Puget Sound fir or pine, norwest and west coast fir.

2. Douglas fir lumber shall be graded and classified according to the following rules and specifications as to quality, and dressed stock shall conform to the subjoined table of standard sizes, except where otherwise expressly stipulated between buyer and seller.

3. Recognized defects in Douglas fir are knots, knot holes, splits, checks, wane, rot, rotten streaks, wormholes, dog or picaroon holes, pitch seams, shake, pitch pockets, chipped grain, torn grain, loose grain, solid pitch, stained heart, sap stain and imperfect manufacture.

Knots.

4. Knots shall be classified as pin, small, standard and large, as to size; round and spike as to form, and tight, loose and rotten, as to quality.

5. A pin knot is tight and not over ½ inch in diameter.

6. A small knot is tight and not over ¾ inch in diameter.

7. A standard knot is tight and not over 1½ inches in diameter.

8. A large knot is tight and any size over 1½ inches in diameter.

9. A round knot is oval or circular in form.

10. A spike knot is one sawn in a lengthwise direction.

The mean or average diameter of knots shall be considered in applying and construing these rules.

11. A tight knot or sound knot is one solid across its face, is as hard as the wood it is in, and is so fixed by growth or position that it will retain its place in the piece.

12. A loose knot is one not held firmly in place by growth of position.

13. A rotten knot is one not as hard as the wood it is in.

Pitch.

14. Pitch pockets are openings between the grain of the wood, containing more or less pitch and surrounded by sound grain wood; they shall be classified as small, standard, and large pitch pockets.

15. A small pitch pocket is one not over $\frac{1}{8}$ of an inch wide.

16. A standard pitch pocket is one not over $\frac{3}{8}$ of an inch wide, or 3 inches in length.

17. A large pitch pocket is one over $\frac{3}{8}$ of an inch wide or over 3 inches in length.

18. A pitch shake or seam is a clearly defined opening between the grain of the wood and may be either filled with granulated pitch or not, but in either case is considered a defect in any of the grades hereinafter described.

19. A pitch streak is a well-defined accumulation of pitch at one point in the piece, and when not sufficient to develop a well-defined streak, or where fiber between grains is not saturated with pitch it shall not be considered a defect.

20. A small pitch streak shall be equivalent to not over one-twelfth the width and one-sixth the length of the piece it is in.

21. A standard pitch streak shall be eqivalent to not over one-sixth the width and one-third of the length of the piece it is in.

Wane.

22. Wane is bark, or the lack of wood, from any cause on edge.

Sap.

23. Bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

24. Sap stain shall not be considered a defect, except as provided herein.

25. Discoloration of the heart of the wood, or stained heart, must not be confounded with rot or rotten streaks. The presence of rot is indicated by decided softness of the wood where it is discolored or by small white spots resembling pin wormholes.

Miscellaneous.

26. Defects in rough stock caused by improper manufacture and drying will reduce grade, unless they can be removed in dressing such stock to standard sizes.

27. All stock, except car sills and framing, shall be inspected on the face side to determine the grade. Stock surfaced one side, the dressed surface shall be considered the face side. Stock rough or dressed two sides, the best side shall be considered the face, but the reverse side of all such stock shall not be more than one grade lower.

28. Chipped grain consists in a part of the surface being chipped or broken out in small particles below the line of the cut, and as usually found, should not be classed as torn grain and shall be considered a defect only when it unfits the piece for use intended.

29. Torn grain consists of a part of the wood being torn out in dressing. It occurs around knots and curly places, and is of four distinct characters—slight, medium, heavy, and deep.

30. Slight torn grain shall not exceed $\frac{1}{32}$ of an inch in depth; medium $\frac{1}{16}$ of an inch, and heavy $\frac{1}{8}$ of an inch. Any torn grain heavier than $\frac{1}{8}$ of an inch shall be termed deep.

31. Loosened grain consists in a point of one grain being torn loose from the next grain. It occurs on the heart side of the piece and is a serious defect, especially in flooring.

32. The grade of all regular stock shall be determined by the number, character, and position of the defects visible in any piece. The enumerated defects herein described admissible in any grade are intended to be descriptive of the coarsest piece such grades may contain, but the average quality of the grade shall be midway between the highest and the lowest pieces allowed in the grade.

33. Lumber and timber sawed for specific purposes must be inspected with a view to its adaptability for the use intended.

34. All dressed stock shall be measured strip count, viz, full size of rough material necessarily used in its manufacture.

35. Equivalent means equal, and in construing and applying these rules, the defects allowed, whether specified or not, are understood to be equivalent in damaging effect to those mentioned applying to stock under consideration.

36. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or millwork will prohibit an inspection for the adjustment of claims, except with the consent of all parties interested.

37. The foregoing general observation shall apply to and govern the application of the following rules.

The rules referred to under sections 38, 39, and 40 govern 4 or 6 inch strips and are intended to cover strips used for car siding, car roofing, and car lining.

The term "edge grain" is here used as synonymous with vertical grain, rift-sawn, or quarter-sawed. The term "flat grain" is synonymous with slash grain or plain sawed.

No. 2 clear and better edge grain.

38. Material of this grade shall be well manufactured, with angle of grain not less than 45°. This stock shall be kiln dried and practically free from all defects, but will admit of bright sap on the face; not exceeding three small close pitch pockets not over 2 inches long, one pin knot, slight roughness in dressing, but not a serious combination of these defects.

No. 2 clear and better flat grain.

39. Material of this grade shall be well manufactured. The stock shall be kiln dried and practically free from all defects, but will admit of bright sap on the face; not exceeding three small close pitch pockets not over 2 inches long, one pin knot, slight roughness in dressing, but not a serious combination of these defects.

No. 3 clear.

40. Material of this grade shall be sound common lumber and will admit of roughness in dressing, bright sap, and also may contain 5 pin, 3 small and 1 standard knot, and 5 pitch pockets in any continuous 5 feet of length of the piece; or any combination of tight knots or pitch pockets equivalent to those mentioned above. This grade particularly refers to stock used for inside lining of freight cars.

Standard car decking or flooring.

41. Material of this grade shall be well manufactured from sound, live timber and shall be free from splits, shakes, rot, bark or waney edges, and unsound knots, or pitch pockets, pitch seams, or large knots which would weaken the piece for the use intended. This grade will admit of sound knots not to exceed one-third width of the piece, provided they are not in clusters, and sap.

Common car sills and framing.

42. Material of this grade shall be well manufactured from sound, live timber, sawed full size to sizes ordered and free from rot, unsound knots, cross grain, bark or waney edges or shakes, but will admit of sap and any number of sound knots, provided they are not in clusters, and do not exceed one-third width of piece; pitch pockets or pitch seams that would not weaken the piece for the purpose intended.

43. Sizes up to 6 inches in width shall measure full when green, and not more than ⅛-inch scant when dry or part dry. Sizes 6 to 12 inches in width shall measure full when green and not more than ¼-inch scant when dry or part dry. Sizes 12 to 16 inches in width shall measure full when green and not more than ⅜-inch scant when dry or part dry. Unless otherwise specified, ¼ inch shall be allowed for each side which is to be dressed. In pieces 3 by 6 inches and under when ordered in lengths exceeding 30 feet, sound knots shall not exceed one-fourth the width of the face through which they project, and the grain shall not cross sufficiently to impair the strength.

44. Standard lengths:

Car siding.—8, 9, 10, and 12 feet or multiples.
Car roofing.—5 feet or multiples.
Car lining.—8, 9, 10, 12, 14, 16, 18, and 20 feet or multiples.
Car decking.—9 and 10 feet or multiples.

All orders shall be shipped in standard lengths, unless otherwise specified, but no lengths of either car siding, lining, or roofing shall be shipped, except in the lengths specified or multiples thereof. Those who do not desire stock shipped in multiple lengths should so specify.

West Coast Lumbermen's Association, grading rules for fir stock, July 1, 1926.

RAILWAY AND CAR MATERIAL

Car sills, ridge poles, purlins, plates, gondola sides, framing, carlines, fascias, running boards, slats, etc., for car construction.

Sizes and lengths as ordered. Surfaced, faces narrower than 8 inches, ⅜ inch off; faces 8 inches and wider, ½ inch off. Running boards ordered S1S shall be graded from the rough face.

Selected common.

Must be sound stock, well manufactured. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots or spike knots, if not in clusters, approximately:

1¼-inch on 4 to 6 inch faces.
1½-inch on an 8-inch face.
1¾-inch on a 10-inch face.
2-inch on a 12-inch face.
Not over 2½ inch on wider faces.

Seasoning checks; pitch pockets not over 6 inches in length; heavy torn grain; medium sap stain.

No. 1 common.

Must be sound stock, well manufactured. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots or spike knots, if not in clusters, approximately:

1¾-inch on 4 to 6 inch faces.
2-inch on an 8-inch face.
2½-inch on a 10-inch face.
3-inch on a 12-inch face.
Not over 3½-inch on wider faces.

Loose knots ½ the maximum diameter of allowable tight knots; seasoning checks; short splits, equal in length to width of piece; pin wormholes, limited; pitch pockets; pitch streaks; torn grain; medium sap stain; firm heart stain, 10 per cent of any face; wane, ¼ thickness, ¼ width, ⅓ length of piece.

Structural grade.

Must be sound stock, well manufactured, and close grained as defined herein; angle of grain, not more than 1 inch in 12 inches. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound, intergrown, or encased knots or spike knots, measured as defined herein approximately:

Width of face (inches)	Sizes of knots: (a) on narrow faces; (b) on edges of wide faces	Sizes of knots on center lines of wide faces
	Inches	*Inches*
2	½	
3	½	1
4	¾	1¼
5	⅞	1½
6	1	2
8	1⅜	2½
10	1¾	2¾
12	2	3
14	2¼	3¼
16	[1] 2½	[1] 4

[1] Maximum.

Shake on end of piece not more than ¼ width of narrow face, green; nor ⅓ seasoned; seasoning

checks; pitch pockets not over 6 inches in length; torn grain; medium sap stain; wane, ⅛ thickness, ⅛ width, ⅙ length of piece.

The size of a knot shall be taken as the average of the maximum and minimum dimensions. The size of a spike knot shall be taken as the average of the length and maximum width. The sizes of knots on wide faces may increase proportionately from the edges to the sizes allowed at the center line. Cluster knots or knots in groups are not permitted. In this grade no distinction is made between intergrown and encased knots.

The width of a shake on the end of a piece shall be taken as the distance between lines parallel to the wide faces of the piece. No checks, or combinations of checks with shakes, which would reduce the strength to a greater extent than the allowable shake, shall be permitted.

Close grain shall mean an average on either one end or the other of a piece of not less than 6 nor more than 20 annual rings per inch, measured over 3 inches on a line located as follows:

In boxed heart pieces, the line shall run from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of 1 inch from the pith. When the least dimension is more than 6 inches and not over 10 inches, the 3-inch portion of the line shall begin at a distance of 2 inches from the pith. When the least dimension is more than 10 inches the 3-inch portion of the line shall begin at a distance of 3 inches from the pith.

In side cut pieces, the line on which the measurement shall be made shall run at a right angle to the annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the piece.

When the rings are very irregular, it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the 3-inch line in boxed heart pieces must not be changed.

Pieces averaging from 5 to 6 annual rings per inch shall be accepted as the equivalent of close grain if having one-third or more summer wood.

CAR DOOR AND CORNER POSTS

B and better.

Two faces clear.—Must be sound stock, well manufactured. Will admit on two adjacent faces occasional slight variation in sawing; seasoning checks; torn grain; small pitch pockets. On the other two faces will admit, in addition to above defects, sound and tight medium knots; spike knots not exceeding 1½ inches in least dimension; pitch pockets not over 6 inches in length.

C and better.

One face clear.—Face to be clear must be specified. Must be sound stock, well manufactured. Will admit on specified face occasional slight variation in sawing; seasoning checks; torn grain; small pitch pockets; medium sap stain. Other faces will admit, in addition to above defects, sound and tight medium knots; spike knots not exceeding 1½ inches in least dimension; pitch pockets not over 6 inches in length.

D and better.

Must be sound stock, well manufactured. Will admit occasional slight variation in sawing, and any number of the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight 1-inch knots; spike knots not exceeding 1 inch in least dimension; seasoning checks; pitch pockets not over 6 inches in length; torn grain; medium sap stain.

Material required kiln dried or air dried must be so specified.

Car siding.

Bundling.—4 inches, 4 pieces; 6 inches, 4 pieces to the bundle. Defects based on 9-foot lengths. Lengths as specified.

B and better car siding.

VG or FG.—If specified VG, angle of grain 30°, or more, from horizontal. Must be well manufactured and will admit slight torn grain; crook, ½ inch in 9-foot lengths, 1½ inches in 18-foot lengths. With the above will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three small seasoning checks, none through; 3 small pitch pockets, none through; pockets extending from face into edges, causing leakage, not permitted. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

C car siding.

VG or FG.—If specified VG, angle of grain 30°, or more, from horizontal. Will admit medium torn grain; slight skips; crook, ½ inch in 9-foot lengths, 1½ inches in 18-foot lengths; heart stain or medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Small seasoning checks, none through; 3 sound and intergrown pin knots; 5 small pitch pockets, none through; pockets extending from face into edges, causing leakage, not permitted. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

D car siding.

FG and/or VG.—Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Torn grain; small skips on face; heavy skips on back; crook, ¾ inch in 8-foot lengths, 2 inches in 18-foot lengths; heart stain or medium sap stain; seasoning checks; pin wormholes; sound and intergrown or encased medium knots; numerous small pitch pockets, several of which may be through, or equivalent of medium to large pitch pockets; pitch streaks; wane on reverse side, one-third width and one-sixth length of piece.

Car lining.

Bundling.—4 inches, 6 pieces; 6 inches, 4 pieces to the bundle. Defects based on 12-foot lengths. Lengths as specified.

B and better car lining.

FG and/or VG.—Will admit medium torn grain; crook, ½ inch in 8-foot lengths, 1½ inches in 20-foot lengths. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three small seasoning checks, none through; 3 small pitch pockets, none through. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

C car lining.

FG and/or VG.—Will admit medium torn grain; slight skips; crook, ½ inch in 8-foot lengths, 1½ inches in 20-foot lengths; heart stain or medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Small seasoning checks; three sound and intergrown small knots, or equivalent of pin knots; 5 small to medium pitch pockets. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

Selected common car lining.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Torn grain; small skips; crook, ½ inch in 8-foot lengths, 1½ inches in 20-foot lengths; heart stain; medium sap stain, 25 per cent of face; seasoning checks; pin wormholes; sound and intergrown medium knots; pitch pockets, not over 6 inches in length, none through. If specified S2S, skips on back permitted, totaling not more than 40 per cent of area.

No. 1 common car lining.

Must be well manufactured and suitable for use without unreasonable waste. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Deep torn grain; skips; heart stain or sap stain; seasoning checks; splits not longer than width of piece, or equivalent of end checks; pin wormholes; sound and intergrown knots; encased medium knots; large pitch pockets; pitch streaks; slight edge defects due to machining; wane, ½ inch on edge 1 inch on face, ⅙ length. If specified S2S, skips on back permitted, totaling not more than 60 per cent of area.

Insulation.

Douglas fir and/or west coast hemlock. Will admit torn grain; heart stain or medium sap stain; seasoning checks; sound knots; pitch pockets. S1S or S2S as specified.

Car roofing.

Bundling.—4 inches, 6 pieces; 6 inches, 4 pieces to the bundle. Defects based on 5-foot lengths. Lengths as specified.

B and better car roofing.

FG and/or VG.—Will admit medium torn grain; heart stain or medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Two small seasoning checks, not through; 2 small pitch pockets, not through; pockets extending from face into edges, causing leakage, not permitted. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

C car roofing.

FG and/or VG.—Will admit medium torn grain; slight skips; heart stain or medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Small seasoning checks, none through; 2 sound and intergrown small knots; 4 small pitch pockets, none through; pockets extending from face into edges, causing leakage, not permitted. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

Selected common car roofing.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Torn grain; small skips; heart stain; medium sap stain, 25 per cent of face; seasoning checks; pin wormholes; sound and intergrown medium knots; small pitch pockets, several of which may be through, or equivalent of larger pockets. If specified S2S, skips on back permitted, totaling not more than 40 per cent of area.

No. 1 common car roofing.

Must be well manufactured and suitable for use without unreasonable waste. This grade is intended to supply a cheap longitudinal roofing. Will admit any number of the following defects, equivalent defects, or equivalent combination of defects: Deep torn grain; skips; heart stain or sap stain: seasoning checks; splits not longer than width of piece, or equivalent end checks; pin wormholes; sound and intergrown knots; encased medium knots; medium knot holes; large pitch pockets; pitch streaks; slight edge defects due to machining; wane, ½ inch on edge, 1 inch on face, ⅙ length of piece. If specified S2S, skips on back permitted, totaling not more than 60 per cent of area.

Car decking.

Defects based on 9-foot lengths. Lengths as specified.

B and better car decking.

VG or FG.—If specified VG, angle of grain 30°, or more, from horizontal. Will admit medium torn grain. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three small seasoning checks, none through; 3 sound and intergrown small knots; 3 small pitch pockets, none through; 1 medium pitch pocket, not through. On back of piece will admit, in addition to above defects, 2 encased small knots, not through. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

C car decking.

FG and/or VG.—Will admit heavy torn grain; slight skips; heart stain or medium sap stain, 25 per

cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Small seasoning checks, none through; 4 sound and intergrown small knots; 5 small pitch pockets, or equivalent of larger pockets, none through. On back of piece will admit, in addition to above defects, 3 encased small knots, none through. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

Selected common car decking.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Heavy torn grain; small skips; heart stain; sap stain, 25 per cent of face; seasoning checks; sound and intergrown medium knots; pitch pockets not over 6 inches in length, none through. One back of piece will admit in addition to above defects, 3 encased medium knots, none through. If specified S2S, skips on back permitted, totaling not more than 40 per cent of area.

No. 1 common car decking.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Deep torn grain; skips; heart stain or sap stain; seasoning checks; sound and intergrown knots, ⅓ width of piece; encased knots, ⅙ width of piece; small to large pitch pockets, none through. If specified S2S, skips on back permitted, totaling not more than 40 per cent of area.

Horizontal car sheathing.

Defects based on 4 to 6 inch widths by 18-foot lengths. Lengths as specified.

A horizontal sheathing.

VG or FG.—If specified VG, angle of grain 30° or more, from horizontal. Will admit slight torn grain; crook, ½ inch in 18-foot lengths; 4 very small pitch pockets.

B horizontal sheathing.

VG or FG.—If specified VG, angle of grain 30° or more, from horizontal. Will admit slight torn grain; crook, ½ inch in 18-foot lengths. With the above, will admit any two of the following defects, equivalent defects, or equivalent combinations of defects: 3 small seasoning checks, none through; 3 sound and intergrown small knots; 3 small pitch pockets, none through; pockets extending from face into edges, causing leakage, not permitted; pitch streak, ½ inch wide by 12 inches long. On back of piece will admit, in addition to above defects, 2 encased small knots, not through. If specified S2S small skips on back permitted, totaling not more than 20 per cent of area.

C horizontal sheathing.

FG and/or VG.—Will admit heavy torn grain; slight skips; crook, ½ inch in 10-foot lengths; heart stain or medium sap stain, 25 per cent of face. With the above, will admit any two of the following defects, equivalent defects, or equivalent combinations of defects; small seasoning checks, none through; 4 sound and intergrown small knots; 4 small pitch pockets, or equivalent of larger pockets, none through; pockets extending from face into edges, causing leakage, not permitted. On back of piece will admit, in addition to above defects, 3 encased small knots, none through. If specified S2S, small skips on back permitted, totaling not more than 20 per cent of area.

Selected common horizontal sheathing.

Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects; heavy torn grain; small skips; heart stain; sap stain, 25 per cent of face; seasoning checks; sound and intergrown small knots; encased small knots, none through; small pitch pockets, none through. If specified S2S, skips on back permitted, totaling not more than 20 per cent of area.

Special provisions.

Close grain shall mean an average on either one end or the other of a piece of not less than 6 nor more than 20 annual rings per inch, measured over 3 inches on a line located as follows:

In boxed-heart pieces, the line shall run from the pith to the corner farthest from the pith. When the least dimension is 6 inches or less, the 3-inch portion of the line shall begin at a distance of 1 inch from the pith. When the least dimension is more than 6 inches and not over 10 inches, the 3-inch portion of the line shall begin at a distance of 2 inches from the pith. When the least dimension is more than 10 inches the 3-inch portion of the line shall begin at a distance of 3 inches from the pith.

In side cut pieces, the line on which the measurement shall be made shall run at a right angle to the annual rings and the center of the 3-inch portion of the line shall be at the center of the end of the piece.

When the rings are very irregular, it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the 3-inch line in boxed heart pieces must not be changed.

Pieces averaging from 5 to 6 annual rings per inch shall be accepted as the equivalent of close grain if having ⅓ or more summer wood.

The requirements for density are identical with the rules of American Lumber Industry, Simplified Practice Recommendation No. 16, for American Lumber Standards, No. 412.0, selection for density.

Heart timbers, car-construction lumber, or other special material may carry specifications limiting the sapwood; that is, all heart, 95 per cent heart, 90 per cent heart, 85 per cent heart, etc., but when so ordered, specifications must be in terms of heartwood required on the girth, or on each face, side or edge. Girth shall be measured at the point where the greatest amount of sapwood occurs.

Square edged.

This designation, when used, shall mean that each piece shall be entirely free from wane.

413.22 Mahogany Car Stock.

(No nationally recognized specifications available.)

413.23 Oak Car Stock.

American Railway Association, Mechanical Division, specifications for lumber, 1910.

Classification and grading rules for locomotive, freight, and passenger car oak.

General instruction.

Those who are not familiar with the anatomy of the oak tree should, when reading over these rules, take into consideration that the rule describes the poorest piece that goes into the grade and that a large percentage is above the grade described.

Definition of oak for construction purposes.

The term construction oak means all such products of oak in which the strength and durability of the timber is the controlling element in its selection and use. The following is a list of products which are recommended for consideration as construction oak:

Construction oak.

(*A*), (*B*), (*C*) } Cover maintenance of way material.

(*D*) Locomotive timbers: Sills, end, and truck timbers.

(*E*) Car timbers: Car framing, including upper framing, car sills, end, and truck timbers, car decking, inside lining.

(*F*), (*G*), (*H*), (*I*), (*J*), (*K*), (*L*) } Cover maintenance of way material.

Standard defects.

Definition of defect.—Fault, blemish, mark of imperfection that will materially injure the strength.

Measurements which refer to the diameter of knots or holes shall be considered as referring to the mean or average diameter.

(*A*) *Knots.*

Sound knot.—A sound knot is one which is solid across its face, and which is as hard as the wood surrounding it; it may be any color and contain checks.

Loose knot.—A loose knot is one not firmly held in place by growth or position.

Pith knot.—A pith knot is a sound knot with a pith hole not more than ¼ inch in diameter in the center.

Rotten knot.—A rotten knot is one that is not sound and not as hard as the wood surrounding it.

Pin knot.—A pin knot is a sound knot not over ¾ inch in diameter.

Standard knot.—A standard knot is a knot not over 2 inches in diameter.

Large knot.—A large knot is a sound knot more than 2 inches in diameter.

Round knot.—A round knot is one which is oval or circular in form.

Spike knot.—A spike knot is one sawn in lengthwise direction. The mean or average width shall be considered in measuring this knot.

Bird peck.—Bruises apparently caused by bird pecks during the growth process of the timber. Considered no defect.

(*B*) *Worm defects.*

Pin wormholes.—Pin wormholes are very small holes caused by minute insects or worms. These holes usually are not over $\frac{1}{16}$ inch in diameter, or smaller, and the wood surrounding them is sound and does not show any evidences of the wormhole having any effect on the wood other than the opening.

Spot worm defects (also known as flag worm defects).—Spot worm defects are caused, like pin wormholes, by minute insects or worms working on the timber during its growth. The size of the hole is about the same as pin wormholes, but the surrounding wood shows a colored spot as evidence of the defect. This spot is usually sound and does not affect the strength of the piece.

Grub wormholes.—Grub wormholes are usually from about ⅛ to $\frac{3}{16}$ inch in width and vary in length from about $\frac{3}{16}$ inch to 1 inch, and are caused by grub worms working in the wood.

Wooden rafting pinholes.—The defect sometimes appears on river timber which has been rafted and holes bored in the solid wood for tying the timber, and a solid plug or pin driven in the hole filling it completely. These defects must be treated and considered the same as knot defects. Ordinary metal rafting pin or chain dog hole is considered no defect.

(*C*) *Sap.*

Definition of sap.—The alburnum of a tree—the exterior part of the wood next to the bark; sapwood not considered a defect.

Sound heart.—The term sound heart is used in these rules whenever heart of piece is split or opened and shows on outside of piece and its condition is sound and solid, not decayed. Openings between annual rings are checks not considered a defect.

(*D*) *Wane.*

Wane is bark or lack of wood from any cause on edges of timber.

(*E*) *Shakes.*

Definition of shakes.—Shakes are splits or checks in timber which usually cause a separation of the wood between the annual rings.

Ring shakes.—Ring shakes are openings between the annual rings usually showing only on the end of the timber.

Through shakes.—Through shakes are shakes which extend between two faces of the timber.

Checks.—A small crack in the wood due to seasoning; not considered a defect.

(*F*) *Grain.*

Crooked or cross grain.—Crooked or cross grain occurs where the grain crosses the piece within a section of 24 inches in running length of the piece. This is only considered a defect in certain smaller sizes of dimension for specific purposes.

(*G*) *Rot.*

Any form of decay which may be detected as giving the timber a doty or rotten texture is a rot defect, including what is commonly known as dry rot. Water stain, or what are sometimes called scalded or burned spots, usually caused by timber lying in the water under certain conditions before it is sawed, and burned spots where the timber is improperly piled green, not considered defects, as they do not affect the strength of the piece.

Standard names for construction oak.

Standard names for construction oak timbers; white oak and red oak.—Unless specially mentioned these terms include the following:

White oak	*Red oak*
White oak.	Red oak.
Burr or mossy cup oak.	Pin oak.
Rock oak.	Black oak.
Post or iron oak.	Water oak.
Overcup.	Willow oak.
Swamp post oak.	Spanish oak.
Live oak.	Scarlet oak.
Chestnut or tanbark oak.	Turkey oak.
	Black jack or barn oak.
Basket or cow oak.	Shingle or laurel oak.
Yellow or chinquapin oak.	

Term.—Mixed oak means any kind of oak.

Standard specifications for structural oak timbers.

General requirements.—Except as noted, all structural timbers shall be white oak, to be sound timber and sawed specified sizes; free from ring shakes, crooked grain, rotten knots, large knots in groups, rot, dote, and wane in amounts greater than allowed in these specifications.

Boxed hearts.—Boxed hearts are permitted in pieces 5 by 5 square and larger. The center of the heart shall be boxed as near the center of the piece as practical, and not to exceed 30 per cent of the pieces can have the center of the heart nearer than 1½ inches from any face; 20 per cent may show one heart face, corner or edge, not to exceed 75 per cent of the length of the piece.

(*A*) *Wane.*

Explanation.—The term "20 per cent of number of pieces or amount shipped" refers to each item and size of each car shipped.

(*a*) Pieces 5 by 5 to 8 by 8 square may show 1 inch wane, side measurement on any two corners or edges, and this wane not to exceed more than 25 per cent of the length of the piece singly, or 50 per cent in aggregate. In the absence of wane on all corners excepting one, the one corner may contain wane 50 per cent of the length of the piece as above described; not to exceed 20 per cent of number of pieces may have this defect.

(*b*) Pieces over 8 by 8, including 12 by 12 square, may show 1½ inches wane, side measurement, edge of any two corners or edges, and this wane not to exceed more than 33⅓ per cent of the length of the piece singly, or 66⅔ per cent in aggregate. In the absence of wane on all corners excepting one, the one corner may contain wane 66⅔ per cent of the length of the piece as above described; not to exceed 20 per cent of number of pieces may have this defect.

(*c*) Pieces over 12 by 12 square may show 1¾ inches, side measurement, any two corners or edges, and this wane not to extend more than 40 per cent of the length of the piece singly, or 80 per cent in aggregate. In the absence of wane on all corners excepting one, the one corner may contain wane 80 per cent of the length of the piece as above described; not to exceed 20 per cent of number of pieces may have this defect.

(*d*) In event that pieces have two faces as wide as above described and two faces narrower, the proportion of the amount of wane is admissible.

(*e*) Pieces 1 to 5 inches thick, not exceeding 8 inches wide, are governed by defect specifications above mentioned, with the exception that they shall not contain wane, and not to exceed 20 per cent of pieces 2 inches and thicker may show sound heart on one face; pieces under 2 inches thick must be free of heart. Pieces 8 inches and wider may contain wane as per paragraphs (*b*) and (*d*).

(*f*) Rough sizes of structural timber shall not vary more than ¼ inch scant of specified size. Dressed sizes may be ½ inch scant after dressing.

(*B*) *Locomotive timber oak. Passenger car dimension oak. Refrigerator car dimension oak.*

Thickness cut to order, widths cut to order, lengths cut to order. Unless otherwise noted, must be cut from white oak. This stock, wherever practical, should be cut outside the heart and must be free of heart shake in pieces under 6 by 6 square. No attempt should be made to box the heart in pieces smaller than 5 by 7, unless heart is very small and tight. When heart is well boxed it must be firm and tight, and the center of the heart must not be nearer than 2 inches from any face. Must be sawed full to sizes with square edges, and cut from sound timber and free from wormholes, with the exception of a few small pin wormholes well scattered, and an occasional spot worm. None of these defects, however, to affect the serviceability of the piece for the purpose intended. Must be free from split, rot or dote, large, loose, rotten or unsound knots, or, in other words, free of all defects affecting the strength and durability of the piece. Sound standard knots well scattered not considered a defect.

(*C*) *Freight car timber.*

Freight car dimensions, including all cars other than refrigerator and passenger cars. Sizes cut to order. Unless otherwise ordered, must be sawed from good merchantable white or red oak timber. This stock must be free of rot, shakes, and splits, large, loose, rotten or unsound knots, any of which will materially impair the strength and durability of the piece for the purpose intended. This stock is intended to work full size and length without waste for side posts, braces and end sills, end plates, drafting timbers, crossties, etc., used in the construction of ordinary freight or stock cars. On pieces

3 by 4 inches or equivalent girth measurement and larger (nothing under 2 inches thick), heart check showing on one corner, admitted on 20 per cent of the pieces in each car shipment. Well-boxed, sound hearts admitted in this material in pieces 5 by 6 and larger.

On pieces 3 by 4 to 6 by 6, inclusive, or equivalent girth measurement and larger (nothing under 2 inches thick), in absence of heart defects, wane on one corner, ¾ inch side measurement, admitted on not to exceed 20 per cent of the number of pieces in each car shipment.

Pieces over 6 by 6 square may contain 1 inch wane, side measurement, on one corner, with other conditions same as 3 by 4 to 6 by 6 sizes.

National Hardwood Lumber Association, grading rules for oak car stock, January, 1927.

SELECT CAR STOCK

For passenger and refrigerator cars and locomotive work.

Select car stock shall be sawn to specified sizes and lengths, and unless otherwise specified must be white oak. This stock, wherever practical, should be cut outside the heart and must be free from shake in pieces under 6 by 6 inches. No attempt should be made to box the heart in smaller than 5 by 7 inches unless the heart is very small and tight. When the heart is boxed it must be firm and tight and not nearer than 2 inches to any face. This stock must be sawn full to sizes, with square edges, cut from sound timber and free from wormholes with the exception of a few pin wormholes well scattered and an occasional spot wormhole. None of these defects, however, shall be sufficient to affect the serviceability of the piece for the purpose intended. This stock must be free from splits, rot, large, loose, or unsound knots, and all defects that seriously impair the strength and durability of the piece. Sound standard knots, well scattered, will be admitted.

FREIGHT CAR STOCK

Freight car stock must be sawn to specified sizes and lengths from either white oak, or red oak, for use as side posts, braces, end sills, end plates, drafting timbers, etc., used in the construction of all cars other than passenger and refrigerator cars.

This stock must be free from rot, shake, splits, and large, loose, or unsound knots, any of which seriously impair the strength or prevent the use of the piece for the purpose intended. Sound standard knots or their equivalent in other defects and scattered pin or spot wormholes will be admitted.

Pieces 5 by 6 inches and larger will admit firm, tight heart well boxed.

Pieces 3 by 4 inches and 2 by 5 inches, and larger, will admit heart check on one corner or side on 20 per cent of the pieces in any shipment.

Pieces 3 by 4 inches and 2 by 5 inches, to 6 by 6 inches, free from heart defects, will admit wane ¾ inch wide, on one corner, on 20 per cent of the pieces in any shipment.

Pieces over 6 by 6 inches, free from heart defects, will admit wane 1 inch wide on one corner, on 20 per cent of the pieces in any shipment.

413.24 Pine Car Stock.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

American Railway Association, Mechanical Division, specifications for lumber, 1910.

Classification, grading, and dressing rules for northern pine car material, including white and Norway pine and eastern spruce.

1. Norway pine to cover Norway or red pine grown in Michigan, Minnesota, Wisconsin, and Canada.

White pine to cover wood from tree of that name grown in Maine, Michigan, Wisconsin, Minnesota, and Canada.

Spruce to cover eastern spruce; that is, the spruce timber coming from points east of and including Minnesota and Canada, covering white, red, and black spruce.

2. Northern pine lumber shall be graded and classified according to the following rules and specifications as to quality, and dressed stock shall conform to the subjoined table of standard sizes, except where otherwise expressly stipulated between buyer and seller.

3. Recognized defects in northern pine are knots, knot holes, splits, shake, wane, wormholes, pitch pockets, torn grain, loosened grain, sap, sap stain, checks, and rot.

Knots.

4. Knots shall be classified as pin, small and large or coarse, as to size, and round or spike as to form, and as sound, loose, encased, pith, and rotten, as to quality.

5. A pin knot is sound and shall not exceed ½ inch in diameter.

6. A small knot is larger than a pin knot and shall not exceed 1½ inches in diameter.

7. A large or coarse knot is one of any size over 1½ inches in diameter.

8. A round knot is oval or circular in form.

9. A spike knot is one sawn in a lengthwise direction.

The mean or average diameter of knots shall be considered in applying and construing these rules.

10. A sound knot is one solid across its face; is as hard as the wood it is in and is so fixed by growth or position that it will retain its place in the piece.

11. A loose knot is not firmly set, but still retains its place in the piece.

12. A pith knot is a sound knot with a pith hole not more than ¼ inch in diameter.

13. An encased knot is one surrounded wholly by bark or pitch.

14. A rotten knot is one not as hard as the wood it is in.

Pitch.

15. Pitch pockets are openings between the grain of the wood containing more or less pitch or bark, and shall be classified as small, standard, and large pitch pockets.

16. A small pitch pocket is one not over ⅛ of an inch wide.

17. A standard pitch pocket is one not over ⅜ of an inch wide, or 3 inches in length.

18. A large pitch pocket is one over ⅜ of an inch wide or over 3 inches in length.

19. A pitch pocket showing open on both sides of the piece ⅛ of an inch or more in width shall be considered the same as a knot hole.

Wane.

20. Wane is bark, or the lack of wood, from any cause, on edge.

Sap.

21. White or bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

Miscellaneous.

22. Defects in rough stock caused by improper manufacture and drying will reduce grade, unless they can be removed in dressing such stock to standard sizes.

23. All lumber for uses described in these rules shall be inspected on the face side to determine the grade, and the face side is the side showing the best quality or appearance.

24. Chipped grain consists in a part of the surface being chipped or broken out in small particles below the line of the cut, and as usually found should not be classed as torn grain, and shall not be considered a defect.

25. Torn grain consists in a part of the wood being torn out in the dressing. It occurs around knots and curly places, and is of four distinct characters; slight, medium, heavy, and deep.

Slight torn grain shall not exceed $\frac{1}{32}$ of an inch in depth, medium $\frac{1}{16}$ of an inch, and heavy ⅛ of an inch. Any torn grain heavier than ⅛ of an inch shall be termed deep.

26. The grade of all regular stock shall be determined by the number, character, and position of the defects visible in any piece. The enumerated defects herein described admissible in any grade are intended to be descriptive of the coarsest pieces such grades may contain, but the average quality of the grade shall be midway between the highest and lowest pieces allowed in the grade.

27. Lumber and timber sawed for specific purposes must be inspected with a view to its adaptability for the use intended.

28. All dressed stock shall be measured strip count, viz, full size of rough material necessarily used in its manufacture.

29. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or millwork will prohibit an inspection for the adjustment of claims, except with the consent of all parties interested.

30. The foregoing general observations shall apply to and govern the application of the following rules: The rules referred to under sections 31, 32, 33, 34, and 35 govern 4 or 6 inch strips, and are intended to cover strips used for car siding, car lining, and car roofing.

B and better white pine.

31. Material of this grade shall be practically clear and free of all defects, except will admit of not exceeding four pin knots and bright sap not to exceed 25 per cent of the face of the piece.

C and better Norway pine.

32. Bright sap is no defect in this grade and stained sap will be admitted to the extent of not exceeding one-fifth the surface of the face of the piece, if not in combination with other defects. This grade shall be free from shake, rot, and splits, but will admit of not exceeding four pin knots.

No. 1 common white pine, Norway pine, and eastern spruce.

33. This grade admits of small sound knots, but shall be free from large or coarse knots, knot holes, should have practically no shake, wane, or rot, but will admit of bright sap to any extent.

No. 2 common white pine, Norway pine, and eastern spruce.

34. This grade is similar to No. 1, described above, except that it will admit of spike knots, bright or stained sap, slight shake, slight wane on reverse side, but not a serious combination of any of these defects.

No. 3 common white pine, Norway pine, and eastern spruce.

35. This grade, in addition to the defects mentioned in No. 2, described above, will also admit of large or coarse knots, more shake, sap, wane on reverse side that does not affect the tongue or groove, and torn or loosened grain, checks, pin wormholes, and splits, but no loose knots or knot holes nor a serious combination of the defects named.

No. 1 common Norway pine car decking or flooring.

36. This grade will admit of sound knots, any amount of sap, and shall be free from shake, wane, rot, and large or coarse spike knots.

37. *Standard lengths.*—

Car siding—8, 9, 10, and 12 feet or multiples.
Car roofing—5 feet or multiples.
Car lining—8, 9, 10, 12, 14, 16, 18, and 20 feet or multiples.
Car decking—9 and 10 feet or multiples.

All orders shall be shipped in standard lengths, unless otherwise specified, but no lengths of either car siding, lining, or roofing shall be shipped except in the lengths specified or multiples thereof. Those who do not desire stock shipped in multiple lengths should so specify.

American Railway Association, Mechanical Division, specifications for lumber, 1910.

Classification, grading, and dressing rules for southern yellow pine car material.

1. Southern yellow pine to cover longleaf and shortleaf yellow pine grown in the Southern States.

2. Southern yellow pine lumber shall be graded and classified according to the following rules and specifications as to quality, and dressed stock shall conform to the subjoined table of standard sizes, except where otherwise expressly stipulated between buyer and seller.

3. Recognized defects in southern yellow pine are knots, knot holes, splits (either from seasoning, ring hearts, or rough handling), shake, wane, red heart, pith, rot, rotten streaks, dote, wormholes, pitch streaks, pitch pockets, torn grain, loosened grain, seasoning or kiln checks and sap, sap stains, and imperfect manufacture.

Knots.

4. Knots shall be classified as pin, standard and large, as to size; and round and spike as to form; and as sound, loose, encased, pith, and rotten, as to quality.

5. A pin knot is sound and not over ½ inch in diameter.

6. A standard knot is sound and not over 1½ inches in diameter.

7. A large knot is one any size over 1½ inches in diameter.

8. A round knot is oval or circular in form.

9. A spike knot is one sawn in a lengthwise direction.

The mean or average diameter of knots shall be considered in applying and construing these rules.

10. A sound knot is one solid across its face, is as hard as the wood it is in, and is so fixed by growth or position that it will retain its place in the piece.

11. A loose knot is one not held firmly in place by growth or position.

12. A pith knot is a sound knot with a pith hole not more than ¼ inch in diameter.

13. An encased knot is one surrounded wholly or in part by bark or pitch. Where the encasement is less than ⅛ of an inch in width on both sides, not exceeding one-half the circumference of the knot, it shall be considered a sound knot. (See secs. 10 and 17.)

14. A rotten knot is one not as hard as the wood it is in.

Pitch.

15. Pitch pockets are openings between the grain of the wood containing more or less pitch or bark, and shall be classified as small, standard, and large pitch pockets.

16. A small pitch pocket is one not over ⅛ of an inch wide. A standard pitch pocket is one not over ⅜ of an inch wide or 3 inches in length.

A large pitch pocket is one over ⅜ of an inch wide or over 3 inches in length.

17. A pitch pocket showing open on both sides of the piece ⅛ of an inch or more in width shall be considered the same as a knot hole.

18. A pitch streak is a well-defined accumulation of pitch at one point in the piece, and when not sufficient to develop a well-defined streak, or where fiber between grains is not saturated with pitch, it shall not be considered a defect.

19. A small pitch streak shall be equivalent to not over $\frac{1}{12}$ the width and ⅙ the length of the piece it is in.

A standard pitch streak shall be equivalent to not over ⅙ the width and ⅓ of the length of the piece it is in.

Wane.

20. Wane is bark, or the lack of wood, from any cause, on the edge.

Sap.

21. Bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

Shake.

22. Shakes are splits or checks in timbers which usually cause a separation of the wood between annual rings.

Through shake.—A shake which extends between two faces of a timber.

Ring shake.—An opening between the annual rings.

Miscellaneous.

23. Defects in rough stock caused by improper manufacture and drying will reduce grade, unless they can be removed in dressing such stock to standard sizes.

24. All stock except car sills and framing shall be inspected on the face side to determine the grade. Stock surfaced one side, the dressed surface shall be considered the face side. Stock rough or dressed two sides, the best side shall be considered the face, but the reverse side of all such stock shall not be more than one grade lower.

25. Pieces of siding, lining, or roofing with $\frac{3}{16}$ of an inch or more of tongue will be admitted in any grade, provided it does not run more than ⅓ the length of the piece.

26. In all grades lower than B and better, wane on the reverse side, not exceeding ⅓ the width and ⅙ the length of any piece is admissible, provided the wane does not extend into the tongue, or over one-half the thickness below the groove.

27. Chipped grain consists in a part of the surface being chipped or broken out in small particles below the line of the cut, and as usually found shall not be classed as torn grain and shall not be considered a defect.

28. Torn grain consists in a part of the wood being torn out in dressing. It occurs around knots and curly places, and is of four distinct characters—slight, medium, heavy, and deep.

Slightly torn grain shall not exceed $\frac{1}{32}$ of an inch in depth; medium, $\frac{1}{16}$ of an inch; heavy ⅛ of an inch; any torn grain heavier than ⅛ of an inch shall be termed deep.

29. Loosened grain consists in a point of one grain being torn loose from the next grain. It occurs on the heart side of the piece and is a serious defect, especially in flooring.

30. Rot, dote, and red heart.—Any form of decay which may be evident either as a dark red discoloration not found in the sound wood, or the presence of white or red rotten spots, shall be considered as a defect.

Firm red heart shall not be considered a defect in any of the grades of common lumber.

31. The grade of all regular stock shall be determined by the number, character, and position of the defects visible in any piece. The enumerated defects herein described admissible in any grade are intended to be descriptive of the coarsest pieces such grades may contain, but the average quality of the grade shall be midway between the highest and lowest pieces allowed in the grade.

32. Lumber and timber sawed for specific purposes must be inspected with a view to its adaptability for the use intended.

33. All dressed stock shall be measured strip count, viz, full size of rough material necessarily used in its manufacture.

34. Equivalent means equal, and in construing and applying these rules, the defects, whether specified or not, are understood to be equivalent in damaging effect to those mentioned applying to stock under consideration.

35. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or millwork will prohibit an inspection for the adjustment of claims, except with the consent of all parties interested.

36. The foregoing general observations shall apply to and govern the application of the following rules:

37. B and better car siding, lining and roofing, car siding for double-sheathed cars, lining for cabin and refrigerator cars, lining for box cars with outer steel posts, and roofing such as old-style Winslow roof, will admit any two of the following, or their equivalent of combined defects: Sap stain not to exceed 5 per cent; firm red heart not to exceed 15 per cent of the face; three pin knots; one standard knot; 3 small pitch pockets; 1 standard pitch pocket; 1 standard pitch streak; slight torn grain, or small kiln or season checks. Where no other defects are contained, six small pin wormholes will be admitted.

38. Select car siding will admit of one standard pitch streak, one standard pitch pocket, or their equivalent; and, in addition, will admit of not exceeding 5 pin knots and 2 standard knots, or their equivalent; 10 per cent sap stain; firm red heart; slight shake; heavy torn grain; defects in manufacture or seasoning checks. Pieces otherwise good enough for B, but containing a limited number of pin wormholes shall be graded select. This grade is intended to be accumulated from running B and better stock, and will consist of all the droppings which do not contain defects in excess of those mentioned in this paragraph.

39. Select car lining and roofing will admit of 1 standard pitch streak; 1 standard pitch pocket, or their equivalent, and, in addition, sound knots not over one-half the width of the piece in the rough; 10 per cent sap stain; firm red heart; slight shakes; heavy torn grain; defects in manufacture, or seasoning checks. Pieces otherwise good enough for B, but containing a limited number of pin wormholes shall be graded select. This grade is intended to be accumulated from running B and better stock, and will consist of all the droppings which do not contain defects in excess of those mentioned in this paragraph.

40. No. 1 common car lining and roofing will admit of the following defects or their equivalent: Sound knots, not over one-half of cross section of the piece at any point throughout its length or width; three pin knots or their equivalent; wane ½ inch deep on edge not exceeding 1½ inches wide and one-half the length of the piece; torn grain; pitch pockets, pitch, sap stains; seasoning checks; slight shakes; firm red heart and a limited number of pin or small wormholes well scattered. This grade is intended to be worked from fencing stock, either kiln or air dried.

41. No. 2 common car siding, lining and roofing will admit the following defects or their equivalent: Knots not necessarily sound, the mean or average diameter of any one knot shall not be more than one-half the cross section if located on the edge and shall not be more than two-thirds of the cross section if located away from the edge; one split one-fourth the length of the piece; wormholes; rotten streaks one-fourth the length of the piece, or the equivalent of unsound red heart; shake or wane, but must not cut to waste. Pieces of siding, lining or roofing with one-eighth of an inch or more of tongue will be admitted in this grade, provided it does not run more than one-third the length of the piece.

42. Standard patterns. (Insert B/P reference, showing net sizes after working.)

NOTE.—For material furnished in accordance with sections 43 to 47, the following density rule may be applied where so specified by the purchaser:

(*a*) Dense southern yellow pine shall show on either end an average of at least 6 annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth, and fifth inches on a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp, and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

(*b*) Sound southern yellow pine shall include pieces of southern pine without any ring or summer-wood requirement.

43. All-heart car decking or flooring will admit sound knots not over ⅓ of the cross section of the piece at any point throughout its length, provided they are not in groups; pitch pockets; firm red heart; shake and seasoning checks which do not go through the piece; loose or heavy torn grain, or other machine defects, which will lay without waste or will not cause a leakage in cars when loaded with grain. Must be strictly all heart on both sides and both edges.

44. *Heart face car decking or flooring* will admit of sound knots not over ⅓ the cross section of the piece at any point throughout its length; provided

they are not in groups; pitch pockets; firm red heart; shake and seasoning checks which do not go through the piece; loosened or heavy torn grain, or other machine defects, which will lay without waste or will not cause a leakage in cars when loaded with grain. Will admit of any amount of sap provided all of the face side of the piece is strictly all heart.

45. No. 1 common car decking or flooring will admit of sound knots not over ½ the cross section of the piece at any point throughout its length, provided they are not in groups; pitch pockets; sap stain; firm red heart; shake and seasoning checks which do not go through the piece; a limited number of pin wormholes; loosened or heavy torn grain, or other machine defects, which lay without waste, or will not cause a leakage in cars when loaded with grain.

46. Standard lengths.—

Car siding.—8, 9, 10, and 12 feet or multiples.

Car lining.—8, 9, 10, 12, 14, 16, 18, and 20 feet or multiples.

Car roofing.—5 feet or multiples.

Car decking or flooring.—9 and 10 feet and multiples.

All orders shall be shipped in standard lengths, unless otherwise specified, but no lengths of either car siding, lining, or roofing shall be shipped, except in the lengths specified or multiples thereof. Those who do not desire stock shipped in multiple lengths should so specify.

Car sills and framing.

47. No. 1 common heart car sills and framing will admit of sound knots, provided they are not in groups, the mean or average diameter of which shall not exceed 2 inches; pitch; pitch pockets; slight shake; seasoning checks, or other defects which will not impair its strength more than the defects aforementioned. Must be sawed from sound timber, free from doty or rotten red heart and true to measurements, or at least the measurements at no point on the sill shall be less than the size required.

Measurement of the girth at any point throughout the length of the piece must show at least 75 per cent heartwood.

Cubical contents shall not be used as basis for obtaining percentage of heartwood under this rule.

48. No. 1 common car sills and framing will admit of sound knots, provided they are not in groups, the mean or average diameter of which shall not exceed 2 inches; pitch; pitch pockets; slight shake; seasoning checks; sap; sap stain; or other defects which will not impair its strength more than the defects aforementioned. Must be sawed true to measurements and from sound timber free from doty or rotten red heart; must be square cornered, except that 1 inch of wane on one corner or ½ inch of wane on two corners is admissible.

49. Sizes up to 6 inches in width shall measure full when green, and not more than ⅛ inch scant when dry or part dry. Sizes 6 to 12 inches in width shall measure full when green and not more than ¼ inch scant when dry or part dry. Sizes 12 to 16 inches in width shall measure full when green and not more than ⅜ inch scant when dry or part dry. Unless otherwise specified, ¼ inch shall be allowed for each side which is to be dressed. In pieces 3 by 6 inches and under when ordered in lengths exceeding 30 feet, sound knots shall not exceed ¼ the width of the face through which they project, and the grain shall not cross sufficiently to impair the strength.

Southern Pine Association, specifications for southern yellow pine car material, July 1, 1919.

Yellow pine.

B and better car siding, lining and roofing will admit any two of the following, or their equivalent of combined defects: Sap stain not to exceed 5 per cent; firm red heart not to exceed 15 per cent of the face; 3 pin knots, 1 standard knot, 3 small pitch pockets, 1 standard pitch pocket, 1 standard pitch streak, slight torn grain, small kiln or season checks. Where no other defects are contained, 6 small pin wormholes will be admitted.

No. 1 common car siding will admit of the following defects or their equivalent: Sound knots, not over ½ of cross section of the piece at any point throughout its width; 3 pith knots or their equivalent; wane ⅛ inch deep, ¼ inch wide and 10 inches long; torn grain, pitch pockets, pitch streaks, sap stain, seasoning checks, slight shakes, firm red heart and a limited number of small wormholes well scattered. This grade is intended to be worked from fencing stock, either kiln or air dried.

No. 1 common car lining and roofing will admit of the following defects or their equivalent: Sound knots not over ½ the cross section of the piece at any point throughout its length; torn grain, pitch pockets, sap stain, seasoning checks, firm red heart and a limited number of pin or small wormholes well scattered. This grade is intended to be worked from fencing stock, either kiln or air dried.

No. 2 common car siding, lining and roofing will admit coarse and unsound knots, knot holes, grub wormholes, rotten streaks and other defects that will not prevent its use for a cheap lining by wasting not more than 25 per cent of the length of any one piece.

Standard patterns: (Insert B/P reference, showing net sizes after working.)

All-heart car decking or flooring will admit sound knots not over ⅓ of the cross section of the piece, in the rough, at any point throughout its length, provided they are not in groups; pitch pockets, firm red heart, shake and seasoning checks which do not go through the piece, loose or heavy torn grain, or other defects, which will lay without waste or will not cause a leakage in cars when loaded with grain. Must be strictly all heart on both sides and both edges.

This grade can only be secured in small quantities, on short notice.

Heart-face car decking or flooring will admit of sound knots not over ⅓ the cross section of the piece, in the rough, at any point throughout its length, provided they are not in groups; pitch pockets, firm red heart, shake and seasoning checks which do not

go through the piece, loosened or heavy torn grain, or other defects, which will lay without waste, or will not cause a leakage in cars when loaded with grain. Will admit of any amount of sap provided the face side of the piece is strictly all heart.

This grade can only be secured in small quantities, on short notice.

No. 1 common car decking or flooring will admit of sound knots not over ½ the cross section of the piece, in the rough, at any point throughout its length, provided they are not in groups; pitch pockets, sap stain, firm red heart, shake, and seasoning checks which do not go through the piece, a limited number of pin wormholes, loosened or heavy torn grain, or other defects, which will lay without waste, or will not cause a leakage in cars when loaded with grain.

Car sills and framing.

No. 1 common heart car sills and framing will admit of sound knots, provided they are not in groups the mean or average diameter of which shall not exceed ⅓ the cross section of the piece in the rough; pitch, pitch pockets, slight shake, seasoning checks or other defects which will not impair its strength more than the defects aforementioned. Must be sawed from sound timber, free from dote or rotten red heart, and true to measurements, or at least the measurements at no point on the sill shall be less than the size required.

Measurement of the girth at any point throughout the length of the piece must show at least 75 per cent heartwood.

Cubical contents shall not be used as basis for obtaining percentage of heartwood under this rule.

This grade can only be secured in small quantities, on short notice.

No. 1 common car sills and framing will admit of sound knots, provided they are not in groups, the mean or average diameter of which shall not exceed ⅓ the cross section of the piece in the rough; pitch, pitch pockets, slight shake, seasoning checks, sap, sap stain, or other defects which will not impair its strength more than the defects aforementioned. Must be sawed true to measurements and from sound timber free from dote or rotten red heart; must be square cornered, except that 1 inch of wane on one corner or ½ inch of wane on two corners is admissible.

Sizes up to 6 inches in width shall measure full when green, and not more than ⅛ inch scant when dry or part dry. Sizes 6 to 12 inches in width shall measure full when green and not more than ¼ inch scant when dry or part dry. Sizes 12 to 16 inches in width shall measure full when green and not more than ⅜ inch scant when dry or part dry. Unless otherwise specified, ¼ inch shall be allowed for each side which is to be dressed. In pieces 3 by 6 inches and under, when ordered in lengths exceeding 30 feet, sound knots shall not exceed ¼ the width of the face through which they project, and the grains shall not cross sufficiently to impair the strength.

Standard lengths.

Car siding.—8, 9, 10, and 12 feet or multiples.

Car lining.—8, 9, 10, 12, 14, 16, 18, and 20 feet or multiples.

Car roofing.—5 feet or multiples.

Car decking or flooring.—9 and 10 feet or multiples.

All orders shall be shipped in standard lengths unless otherwise specified, but no lengths of either car siding, lining, or roofing shall be shipped, except in the lengths specified or multiples thereof. When stock is not desired in multiple lengths, order should so specify.

413.25 Spruce Car Stock.

(No nationally recognized specifications available.)

413.26 Hemlock Car Stock.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

West Coast Lumbermen's Association, grading rules for West Coast hemlock car stock, July 1, 1926.

Car siding.

The grades of car siding are the same as the grades of this association for fir car stock siding, 413.21.

Car lining.

The grades of car lining are the same as the grades of this association for fir car stock lining, 413.21.

Car roofing.

The grades of car roofing are the same as the grades of this association for fir car stock roofing, 413.21.

413.29 Miscellaneous Car Stock Lumber.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

American Railway Association, Mechanical Division, specifications for lumber, 1910.

Classification and grading rules for cypress car material.

1. Cypress to cover red, gulf, yellow, and East Coast cypress, also known as bald cypress.

2. Cypress lumber shall be graded and classified according to the following rules and specifications as to quality, and dressed stock shall conform to the subjoined table of standard sizes, except where otherwise expressly stipulated between buyer and seller.

3. Recognized defects in cypress are knots, knot holes, sap, wormholes, shake, season checks, splits, and wane.

Knots.

4. Knots shall be classified as standard and small, as to size, and sound or rotten, as to quality.

5. A standard knot is sound and not to exceed 1¼ inches in diameter.

6. A small knot is one not exceeding ¾ inch in diameter.

7. A sound knot is one solid across its face, is as hard as the wood it is in.

8. A rotten knot is one not as hard as the wood it is in.

Sap.

9. Stained sap or bright sap shall not be considered a defect in the material specified in these rules.

Season checks.

10. Ordinary season checks are such as occur in lumber properly covered on yard or season checks of equal size in kiln-dried lumber.

Wane.

11. Wane is bark or lack of wood from any cause on edge.

Miscellaneous.

12. The grade of all regular stock shall be determined by the number, character, and position of the defects visible in any piece. The enumerated defects herein described admissible in any grade are intended to be descriptive of the coarsest pieces such grade may contain, but the average quality of the grade shall be better than the coarsest pieces allowed in the grade.

13. Lumber sawed for specific purposes must be inspected with a view to its adaptability for the use intended.

14. All dressed stock shall be measured strip count, viz, full size of rough material necessarily used in its manufacture.

15. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or millwork will prohibit an inspection for the adjustment of claims, except with the consent of all parties interested.

16. The foregoing general observations shall apply to and govern the application of the following rule. The rule referred to in the following section is intended to govern 4 or 6 inch strips and to cover strips used for car siding, car roofing, and car lining.

Car roofing and siding.

C and better grade.—This grade will admit sound knots, stained sap, pin wormholes, very slight shake, and other defects, but none that will prevent the use of each piece in its full width and length for car roofing and car siding; may be random or specified lengths and may be worked to pattern specified and graded from pattern side or S2S and CM and graded from the better side.

Car lining.

Shall be specified widths and 8 to 20 feet in length. Will admit tight knots, stained sap, pin wormholes, slight shake, and other defects, but none that will prevent the use of each piece in its full width and length for car-lining purposes.

National Hardwood Lumber Association, grading rules for miscellaneous car stock lumber, January, 1927.

Cypress car lining.

Car lining shall be specified widths and 8 to 20 feet in length, and will admit tight knots, stained sapwood, pin wormholes, slight shake, and other defects, but none that will prevent the use of each piece in its full width and length for car-lining purposes.

Cypress car roofing and car siding.

Car roofing and car siding shall be specified widths and lengths, or random lengths 4 feet and longer, and shall be graded from the pattern face or, when S2S and CM, from the good face.

C and better will admit sound knots, sound discolored sapwood, pin wormholes, very slight shake, and other defects, but none that will prevent the use of each piece in its full width and length for car roofing and car siding.

Southern Cypress Manufacturers Association, grading rules for miscellaneous car stock lumber, June 15, 1925.

Car roofing and siding.

C and better grade.—This grade will admit sound knots, stained sap, pin wormholes, very slight shake, and other defects, but none that will prevent the use of each piece in its full width and length for car roofing and car siding; may be random or specified lengths and may be worked to pattern specified and graded from pattern side or S2S and CM and graded from the better side.

Car lining.

Shall be specified widths and 8 to 20 feet in length.

Will admit tight knots, stained sap, pin wormholes, slight shake, and other defects, but none that will prevent the use of each piece in its full width and length for car lining purposes.

413.3 AIRPLANE STOCK.

413.31 Softwood Airplane Stock.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

Pacific Lumber Inspection Bureau, grading rules for softwood airplane stock, Schedule M, 1925.

Port Orford cedar sawn airplane material.

Must be sound lumber, well manufactured and practically clear four sides. Will allow bright sap and/or, a few small, well scattered, tight bark seams, each not to exceed 1½ inches in length. In place of bark seams will admit a couple of burls or sound knots not exceeding ¼ inch in diameter. Defects, with exception of sap, to be so placed in wing beam stock as to appear in the webb. Deviation of grain, either spiral or diagonal, from a line parallel with edges not to exceed 1 inch in 20 inches.

Material must have 6 or more annual growth rings per inch, or an average of not less than 18 rings to 3 inches, measured across the grain over the coarsest growth. Measurements shall be as follows: Thickness in fractions of ¼ inch, widths in fractions of ½ inch, and lengths in fraction of ½ foot.

Port Orford cedar airplane cants unedged.

Must be well manufactured. Logs shall be blocked out parallel to the bark to insure straightness of grain. Deviation of grain must not exceed 1 inch in 20 inches, either spiral or diagonal. Cants

less than 3 inches thick must have not less than 6 annual growth rings per inch, measured over the coarsest part. Cants 3 inches and over in thickness shall have not less than 18 annual growth rings to 3 inches, measured over the coarsest part across the grain. Each cant to contain as much material as possible as described in the preceding paragraph for sawn airplane material.

Widths shall be measured in multiples of 1 inch, measurements to be taken inside the bark. If, at time of shipment sap has stained, measurements for width shall be taken inside the sap. The width used as a basis for computing the board contents shall be the mean or average width taken at a point at or about half the length of the cant where the narrow and wide face shall be measured, the average of such two measurements shall constitute the width. Lengths shall be in multiples of 1 foot.

West Coast Lumbermen's Association, grading rules for softwood airplane stock, July 1, 1926.

Airplane stock.—Subject to contract.

413.32 Hardwood Airplane Stock.

(No nationally recognized specifications available.)

413.4 SHIP STOCK.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

Arkansas Soft Pine Bureau, sizes and grades for soft pine decking, March 23, 1927.

The sizes of decking conform to the table of sizes for factory flooring, heavy flooring, decking, and sheet piling of the American Lumber Standards, 411.0, yard lumber.

The grades are the same as those of the Southeastern Forest Products Association and the Southern Pine Association for pine flooring, 411.27.

California Redwood Association, standard specifications for eastern grades of California redwood decking, April, 1927.

The sizes of decking are as shown in the table of sizes for factory flooring, heavy roofing, decking, and sheet piling, American Lumber Standards for yard lumber, 411.0.

The grades of decking are the same as factory flooring, 411.29.

Pacific Lumber Inspection Bureau, grading rules for ship stock, Schedule M, 1925.

Douglas fir ship plank.

Including out-board planking, garboard, wales, clamps, rails, and lumber for similar purposes, shall be firm grain free from large knots or other defects, impairing its use for the purposes intended. Will allow small, tight, hard knots when not on face corners or calking seam. Bright sap on face side edges not exceeding one-fourth the width or thickness. Small pitch pockets and/or pitch blisters not extending through the thickness of the piece. Said defects to be considered in connection with size of piece and its quality otherwise. Occasional variations in sawing allowed.

Douglas fir decking.

Rules for Douglas fir decking are the same as the rules of this association for Port Orford cedar, 413.4.

Port Orford cedar ship decking.

Must be uniformly sawn and must be free from knots on face side and upper half of calking edges. Will allow one small narrow bark seam not to exceed 3 inches in length for each 12 linear feet, bright sap whether green or seasoned on face side corner not exceeding one-fourth the width and one-half the thickness. On underside and lower half of calking edges will allow small knots 1 inch or less in diameter and/or small bark seams or bird's-eye burls. Defects in all cases to be considered in connection with size of piece. Flat sizes shall show edge grain on broad face.

Port Orford cedar No. 1 boat boards or planks.

Boat boards or plank shall be of sound lumber, well manufactured, occasional variations in sawing permitted. Must be free from heart centers, rot and dote; otherwise shall be as follows: Width, 6 inches and wider in multiples of 1 inch. Length, 12 to 32 feet. Anything over 32 feet at mill's option or special contract.

Standard thickness.—1, 1¼, 1½, and 2 inches.

Measurements.—Lengths shall be measured in multiples of 1 foot.

Standard defects allowed as follows: A knot or burl not over ¾ inch in diameter, showing on two sides. A knot or burl not over 1 inch in diameter, showing on one side only. Two ½-inch knots or burls not exceeding in extent or damage one 1-inch knot. A small bark seam, if not 3 inches in length not extending through the piece. Straight split not exceeding in length the width of the piece.

Bright sap shall not be considered a defect.

Slight wane that will cut out in shaping the plank shall not be considered a defect.

Defects permitted in standard lengths.—Widths 6 to 8 inches, inclusive, will admit 1 standard defect; 9 to 12 inches wide, inclusive, will admit 2 standard defects; 13 to 15 inches, inclusive, will admit 3 standard defects; 16 inches and wider will admit 4 standard defects. Based on length of 22 feet. Defects permitted and enumerated are intended to mean the admission of such defect in the finished board or plank.

Port Orford cedar No. 2 boat boards or plank.

Will permit any board regardless of defects, if 70 per cent of the board will make, permitting standard defects in finished board, a boat board, it being understood that the boat board extends the full length of the piece.

Port Orford cedar No. 1 unedged or tapering boat boards.

Widths.—8 inches and wider to average at least 12 inches wide. Lengths, 12 to 40 feet to average 20 feet. Standard thickness, 1, 1¼, 1½, and 2 inches.

Measurements.—Lengths shall be multiples of 1 foot: Widths in multiples of 1 inch. Tapering lumber will be measured for width at a point one-third the length from the narrow end. Unedged lumber will be measured on the narrow face inside the bark or wane at the middle of the length.

Standard defects permitted as follows: (1) A knot or burl not over ¾ inch in diameter, showing on two sides. (2) A knot or burl not over 1 inch in diameter showing on one side only. (3) Two small knots or burls not exceeding in extent or damage one 1-inch knot. (4) A small bark seam if not extending through the thickness of the piece. (5) A straight split not exceeding 12 inches in length.

Bright sap or wane shall not be considered defects.

Defects allowed in standard lengths.—8 to 12 inches wide, inclusive, may have 2 standard defects: 13 to 15 inches wide, inclusive, may have 3 standard defects; 15 inches and wider may have 4 standard defects. Defects enumerated and permitted are intended to mean the admission of such defects in the finished board or plank.

Port Orford cedar No. 2 unedged or tapering boat boards.

Any board permissible regardless of defects if 70 per cent of the board will make, permitting standard defects in the finished board, a boat board; it being understood that the boat board extends the full length of the piece.

Widths, 8 inches and wider. Lengths, 12 to 40 feet. Standard thickness, 1, 1¼, 1½, and 2 inches.

Measurements.—Lengths shall be measured in multiples of 1 foot. Widths in multiples of 1 inch. Tapering lumber will be measured for width at a point one-third the length from the narrow end. Unedged lumber will be measured on the narrow face inside the bark or wane at the middle of the length. Split ends over 12 inches will be deducted from the length of the piece at the time of shipment.

Southeastern Forest Products Association, sizes and grades for southern pine decking, September 1, 1925.

The sizes of pine decking conform to the table of sizes for factory flooring, heavy flooring, decking, and sheet piling of the American Lumber Standards, 411.0, yard lumber.

The grades are the same as the grades of this association for pine flooring, 411.27.

Southern Cypress Manufacturers Association, grading rules for ship stock, June 15, 1925.

The grades of boat stock are the same as the grades of this association for tank stock, No. 413.1.

Southern Pine Association, sizes and grades for southern pine decking, March 23, 1927.

The sizes of decking conform to the table of sizes for factory flooring, heavy flooring, decking, and sheet piling of the American Lumber Standards, 411.0, yard lumber.

The grades are the same as the grades of this association for pine flooring, No. 411.27.

Southern Pine Association, the Gulf coast classification of pitch pine, grading rules for ship stock, March 15, 1923.

Decking.

Sizes.—

2 by 3, 4, 5.
3 by 3, 4, 5.
4 by 4, 5.

Lengths.—18 feet and up.

First quality.

Must be all heart, free from centers, knots, knot holes, splits, shakes, wane, red heart, rot, pitch pockets, and wormholes, except as follows: On best face and half of depth of edges adjoining best face, will permit sound knots not exceeding ½ inch in diameter, provided not located on corners. Sap ½ inch in width permitted on one corner of the face and both corners of the back. On back and half of depth of edges adjoining back, will permit sound knots and pith knots not exceeding 1½ inches in diameter, also pitch pockets.

Second quality.

Must be heart face, free from centers, knots, knot holes, rot, splits, shakes, wane, red heart, pitch pockets over ¼ inch wide, and wormholes, except as follows: Sound knots permitted on face if not over 1 inch in diameter; sound knots and pith knots on edges and back may be 2 inches in diameter. Pitch pockets no defect on edges or back.

West Coast Lumbermen's Association, grading rules for ship stock, July 1, 1926.

Ship decking.

Rules for ship decking are the same as the rules of the Pacific Lumber Inspection Bureau for Port Orford Cedar Ship Decking, No. 413.4.

Ship plank, rough.—Out-board planking, garboards, wales, clamps, rails, and lumber for similar purposes shall be free from large or rotten knots. Must be well manufactured. Will admit small sound and tight knots when not on face side corners of calking seam; bright sap on face side corners not exceeding ¼ width or thickness; small (4-inch) pitch pockets not extending through the piece. Defects to be considered in connection with size and length of piece and its quality otherwise.

413.5 STOCK FOR HANDLES, FURNITURE, AND VEHICLES.

413.51 Handle Stock.

(No nationally recognized specifications available.)

413.52 Veneer and Plywood.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

American Society for Testing Materials, tentative specifications for canned food boxes, wire-bound construction [7] D45–17T, 1917.

Manufacture.

Boxes shall be well manufactured from sound (free from decay or dote), well-seasoned veneer and

[7] The complete specification includes methods of assembly and other data pertaining to the construction of wire-bound boxes.

cleat lumber. Kiln drying by excessively high temperatures or low humidities or below 6 per cent moisture shall be avoided. Veneer shall be free from knot holes, loose or rotten knots greater than 1 inch in diameter. Cleats shall be free from knots and from excessive cross grain. No knots will be permitted which will interfere with proper nailing or stapling. Each side, top, and end shall be of a single piece of veneer; the bottoms shall consist of not more than two pieces, no piece less than 4 inches in width.

Cleats.—Each end shall be cleated with four cleats not less than $\frac{15}{16}$ by $\frac{11}{16}$ inch, or any other size cleats that have equally large cross section. One end of each cleat shall be provided with a tenon $\frac{1}{4}$ inch thick and $\frac{15}{16}$ inch long and the other end with the corresponding mortise. Cleats may be made of any of the following species of wood:

Red gum.	Oak.
Black gum.	Sycamore.
Maple.	Ash.
Birch.	Hickory.
Beech.	Hackberry.
Tupelo.	Yellow pine.
Elm.	

American Veneer and Plywood Industry. Simplified Practice Recommendation No. 59, Rotary-Cut Lumber Stock for Wire-Bound Boxes, effective November 1, 1926.

In accordance with the unanimous action on September 23, 1926, of a general conference of producers and consumers of rotary-cut lumber stock for wire-bound boxes, the Department of Commerce, through the Bureau of Standards, recommends the establishment of the following simplified list of dimensions for air and kiln dried stock produced from gum and pine and other soft woods:

Table 1

Lengths	inches	32, 36, 40, 48, 54, 60.
Widths	do	10, 12, 13, 14, 15, 16.
Thicknesses	do	$\frac{1}{6}$, $\frac{3}{16}$, $\frac{7}{32}$, $\frac{1}{4}$.

Table 2

Thicknesses [8]	inches	$\frac{1}{8}$, $\frac{5}{16}$.

This recommendation is to be effective from November 1, 1926, subject to regular semiannual revision by a similar conference or the standing committee of the industry.

National Hardwood Lumber Association, rules for the measurement and grading of rotary cut veneer, January, 1927.

ROTARY CUT COTTONWOOD, CYPRESS, GUM, POPLAR, SYCAMORE, TUPELO (OR BAY POPLAR), AND YELLOW PINE

Stock shall be of uniform and standard machine gauge thickness. Stock of all grades and kinds must be cut solid and dried so that it will not mold or damage in transit, and be sufficiently flat to straighten under the press without splitting.

Surface dimensions shall always be given: First, the thickness; second, the width across the grain; and third, the length with the grain.

All specifications for special stock, not covered by these rules, shall be a matter of special contract between the buyer and the seller.

Measurement.

All log run and sheet stock of random widths shall be measured by taping, and all dimension stock in all grades shall be computed on the basis of the sizes given and without allowance for trimming.

Cutting.

The word "cutting" as used in these rules means a portion of a sheet of veneer obtained by crosscutting or ripping, or both. The term "clear face cutting" as used in these rules means a portion of the sheet of the veneer to be face grade and to be obtained by crosscutting or ripping, or both.

Dimension stock.

All dimension stock, in any thickness, in any kind of wood, shall be machine cut to the length specified, and if allowance is desired for trimming, buyer's specifications should be for length required, including trimming, and stock is to be billed and measured at actual length cut and all dimension sizes may be a trifle full as to width. Unless otherwise specifically stated, all stock for dimension sizes is to be cut to the sizes specified in one piece stock, and, in addition, to include what part pieces the logs produce, provided the amount of part pieces does not exceed the percentages of part pieces as prescribed in these rules under the captions "cross banding" and "core, or center stock." Part pieces are to be of sufficient width to make allowance for jointing and part pieces are to be as wide as possible.

All dimension stock must be cut so that it will square to the dimension specified.

STANDARD GRADES

The standard grades of commercial rotary-cut veneer shall be as follows:

Faces.
Sound backs.
Reject backs.
Drawer bottoms.
Cross banding.
Core, or center stock.
Selected, or unselected log run.
Selected, or unselected sheet stock.

Faces.

Stock of any thickness, in any kind of wood, unselected for color and shall be free from all defects except slight splits that will close in laying. Selected or figured face stock of any thickness to be the same grade as face stock, except that it shall be selected as to color or figure

Sound backs.

Stock of any thickness, in any kind of wood, unselected for color, and shall admit sound knots, splits that will close in laying, pin wormholes and sound discolorations. Stock to be smoothly cut.

[8] The volume of consumption of $\frac{1}{8}$ and $\frac{5}{16}$ inch thickness rotary-cut lumber stock being problematical at this time, both of the thicknesses are included in this recommendation until future surveys indicate their complete elimination or retention as standards.

Stock of any thickness, in any kind of wood, unselected for color, and shall admit knots, wormholes, discolorations, grub or knot holes not over 1 inch in diameter, rough or loose cutting, open splits or checks not to exceed ½ inch in width and 25 per cent of the length of the piece.

Drawer bottoms.

Stock of any thickness in any kind of wood to be unselected for color. To be free from splits, but may permit small tight knots, sap stains, and slight discolorations; otherwise to be face grade.

Cross-banding.

Stock of $\frac{1}{16}$-inch or less in thickness, in any kind of wood, to be unselected for color, free from open defects, but shall admit pin wormholes, sound discolorations and splits that will close in laying (splits to be not more than 15 per cent of the length of the piece); not less than 50 per cent of each size shall be free from knots and splits.

All stock not exceeding 40 inches in length shall contain not to exceed the following percentages of part pieces:

All stock up to and including 30-inch widths, 15 per cent in two and three pieces.

All stock 31 to 44 inch widths, inclusive, 25 per cent in two and three pieces.

All stock 45 to 59 inch widths, inclusive, 35 per cent in two and three pieces.

All stock 60 to 73 inch widths, inclusive, 50 per cent in two, three, and four pieces.

All stock 74 to 86 inch widths, inclusive, 65 per cent in two, three, and four pieces.

(On piece stock ½ inch must be allowed on each piece for jointing.)

Core, or center stock.

Stock of $\frac{1}{15}$-inch or thicker, in any kind of wood, to be unselected for color, to be free from open defects, but shall admit pin wormholes, sound discolorations, splits that will close in laying and other sound defects (splits to be no more than 15 per cent of the length of the piece).

All stock not exceeding 40 inches in length shall contain not to exceed the following percentages of part pieces:

All stock up to and including 30-inch widths, 25 per cent in two and three pieces.

All stock 31 to 44 inch widths, inclusive, 35 per cent in two and three pieces.

All stock 45 to 59 inch widths, inclusive, 40 per cent in two and three pieces.

All stock 60 to 73 inch widths, inclusive, 55 per cent in two, three, and four pieces.

All stock 74 to 86 inch widths, inclusive, 70 per cent in two, three, and four pieces.

(On piece stock ½ inch must be allowed on each piece for jointing.)

Log run.

Log-run stock must grade no less than 30 per cent clear face cutting, in one or more cuttings, the full length or full width of the sheet, and no less than 50 per cent cutting in one or more cuttings, in core stock grade the full length or full width of the sheet; no cutting to be considered that is less than 6 inches in width.

In all thicknesses up to and including $\frac{1}{15}$ inch, the stock shall be 6 inches and up wide, not less than 50 per cent 18 inches and up wide; to be 36 inches and up long and at least 50 per cent 60 inches and longer.

In all thicknesses of $\frac{1}{12}$ inch and thicker, the stock shall be 6 inches and up wide, not less than 50 per cent 16 inches and up wide; to be 36 inches and up long and at least 50 per cent 60 inches and longer.

Selected log run shall be of the same specifications except that it shall be selected for color.

Sheet stock.

Stock of any thickness must grade at least 50 per cent clear face cutting, in one or more cuttings, with not over 35 per cent core stock cutting, in one or more cuttings, all cuttings to be full length of full width of the sheet, no cutting to be considered that is less than 6 inches wide.

In all thicknesses up to and including $\frac{1}{15}$ inch the stock shall be 7 inches and up wide, to be 36 inches and up long, with at least 75 per cent 62 inches and longer, and at least 60 per cent 74 inches and longer.

In all thicknesses of $\frac{1}{12}$ to ⅛ inch, inclusive, stock shall be 6 inches and up wide, at least 75 per cent 11 inches and wider; to be 36 inches and up long, at least 80 per cent 60 inches and longer, and must have at least 75 per cent of the total 82 inches and longer, with at least 60 per cent of the total 86 inches and longer.

In all stock thicker than ⅛ inch, the stock shall be 6 inches and up wide, at least 75 per cent 11 inches and wider; to be 36 inches and up long, at least 80 per cent 60 inches and longer, and must have not less than 75 per cent of the total 74 inches and longer.

Selected sheet stock shall be of the same specifications, except that it shall be selected for color or figure.

When crating is specified in sheet grade, the veneer shall be crated one length to the crate and random widths.

ROTARY-CUT RED OAK, WHITE OAK, AND CHESTNUT

Bright sap which shows the same character and grain figure as heartwood shall not be regarded as a defect.

Faces.

Stock of any thickness shall be free from all defects except slight splits that will close in laying, and except slight mineral streaks.

Sound backs.

Stock of any thickness, unselected for color, and shall admit sound knots, splits that will close in laying, pin wormholes and sound discolorations. Stock to be smoothly cut.

Reject backs.

Stock of any thickness, unselected for color, and shall admit knots, wormholes, discolorations, grub or knot holes not over 1 inch in diameter, rough or

loose cutting, open splits or checks not to exceed ½ inch in width and 25 per cent of the length of the piece.

Sheet stock.

Stock of under $\frac{1}{12}$ inch in thickness must grade at least 50 per cent clear face cuttings, in one or more cuttings, the full length of the sheet.

Stock of $\frac{1}{12}$ inch and thicker when 82 inches and longer must grade at least 50 per cent clear face cuttings, in one or more cuttings, not less than 82 inches long.

Stock of $\frac{1}{12}$ inch and thicker when under 82 inches in length must grade at least 50 per cent clear face cuttings, in one or more cuttings, either the full length or full width of the sheet.

In all thicknesses no cutting is to be considered that is less than 6 inches wide.

In all thicknesses up to and including $\frac{1}{15}$ inch the stock shall be 6 inches and up wide, at least 90 per cent 8 inches and up wide, and at least 60 per cent 11 inches and up wide; to be 36 inches and up long, with at least 75 per cent 62 inches and longer, and at least 60 per cent 74 inches and longer.

In all thicknesses of $\frac{1}{12}$ inch and thicker the stock shall be 6 inches and up wide, in all lengths 82 inches and longer; stock under 82 inches long to be 6 inches and up wide, with at least 75 per cent 9 inches and up wide, the entire shipment to be at least 60 per cent 11 inches and wider; to be 36 inches and up long, at least 75 per cent of the total 82 inches and up long, with at least 60 per cent of the total 86 inches and up long.

Where crating is specified on sheet stock grade, the veneer shall be crated one length to the crate and in random widths.

ROTARY-CUT ASH, BASSWOOD, BEECH, BIRCH, ELM, AND MAPLE

No. 1 grade (faces).

Sheets of any thickness will admit sap, splits that close, and slight discolorations, otherwise must be clear.

Select No. 1.

Sheets of any tkickness, graded the same as the No. 1 grade except that it shall be selected as to color.

No. 2 grade (sound backs, cross banding center stock, and drawer bottoms).

Sheets of any thickness shall admit sound knots, firm doze, splits that close, pin wormholes, discolorations smoothly cut.

No. 3 grade (reject backs and box stock).

Sheets of any thickness shall admit knots, worm holes, discoloration, grub or knot holes, not over 1 inch in diameter, rough or loose cutting, open splits and checks, not to exceed ½ inch in width and 25 per cent of length of piece.

Selected sheet stock.

Each sheet must be clear face, unselected for color random widths, 5¼ to 38 inches wide; 42 inches long and longer. In all thicknesses up to and including $\frac{1}{15}$ inch the sheet shall be 9 to 38 inches wide; to be 42 inches and longer with 75 per cent 62 inches and longer. In all thicknesses of $\frac{1}{12}$ to ⅛ inch, inclusive, the sheets shall be 5¼ to 38 inches wide, 50 per cent 11 inches and wider; to be 42 inches and up long, 75 per cent to be 82 inches and longer.

No. 1 sheet stock.

Unselected for color and random widths, 5¼ to 38 inches wide; 42 inches long and longer. In all thicknesses up to and including $\frac{1}{15}$ inch, the sheets shall be 9 to 38 inches wide; to be 42 inches long and longer, with 75 per cent 62 inches and longer. Each sheet to grade 75 per cent clear face cutting and each cutting to be either full length or full width of the sheet. No cutting considered less than 9 inches wide. In all thicknesses of $\frac{1}{12}$ to ⅛ inch, inclusive, the sheet shall be 5¼ to 38 inches wide, 50 per cent 11 inches and wider; to be 42 inches and up long, 75 per cent to be 82 inches and longer. Each sheet to grade 75 per cent clear face cutting, and each cutting to be either full length or full width of the sheet. No cutting considered less than 5¼ inches wide.

No. 2 sheet stock.

No. 2 sheet stock shall consist of stock of any thickness unselected for color and random widths and lengths 6 to 38 inches wide, 42 inches and up long, 75 per cent to be 12 inches and up wide, 50 per cent to be 82 inches and up long. Each sheet to contain at least 50 per cent of No. 1 face cuttings, no cutting to be figured less than 6 inches wide or under 42 inches long. Balance of the sheet shall be suitable for No. 2 and No. 3 grades.

RULES FOR THE MEASUREMENT AND GRADING OF SAWN AND SLICED VENEER

Measurement.

Tape measure shall be the standard measurement in all thicknesses, and the width shall be taped midway of the flitch.

In computing the feet in a flitch the actual length of the flitch shall be used. To obtain the number of square feet the flitch contains, multiply the width in feet and inches as shown by the tape by the length of the flitch in feet and ¼ feet.

In determining the width of the bevel flitch, the average width of the sheets shall be the width of the flitch.

In computing cuttings, the flitch shall be taken as a unit.

Cutting.

The term "clear" and the term "cutting," as used in these rules, means a piece of veneer free from defects, excepting as may be otherwise specified under the captions of the respective woods and grades. Cuttings may be obtained by crosscutting, by ripping, or by both crosscutting and ripping.

QUARTERED WHITE AND RED OAK

Grades

Selected.
Standard.
Common.

All flitches must show 90 per cent of figure in the aggregate.

Selected, $\frac{1}{16}$ inch and thinner.

Thickness.—$\frac{1}{16}$ inch and thinner.

Widths.—(*a*) 6 inches to 9¾ inches, inclusive, not to exceed 10 per cent of total feetage under 7 inches; (*b*) 10 inches to 11¾ inches, inclusive; (*c*) 12 inches and up.

Lengths.—8 feet and longer.

Fifteen per cent of bright sap wood in the aggregate admitted in this grade.

Veneer must be smoothly manufactured and uniform in thickness.

Flitches 6 to 9¾ inches wide, 8 to 9 feet long, inclusive, must produce at least one cutting 56 inches long; 10 to 11 feet long, inclusive, must produce at least one cutting 56 inches long, and one cutting 36 inches long; 12 feet and longer must produce two cuttings 56 inches long or longer, excepting that at least 25 per cent of the 16-foot flitches must produce three cuttings, 56 inches long or longer. Each cutting must be at least 95 per cent of the width of the heart wood.

All flitches of 10 inches and wider to be graded under the above rules for flitches 6 inches to 9¾ inches wide, excepting that each cutting must be at least 90 per cent of the width of the heartwood.

Standard, $\frac{1}{16}$ inch and thinner.

Thicknesses.—$\frac{1}{16}$ inch and thinner.

Widths.—(*a*) 6 to 9¾ inches, inclusive, not to exceed 40 per cent of total feetage under 8 inches; (*b*) 10 to 11¾ inches, inclusive; (*c*) 12 inches and up.

Lengths.—6 feet and longer.

Bright sapwood is not a defect.

Veneer must be smoothly manufactured and uniform in thickness.

Slight mineral streaks or other slight discolorations are not to be considered a defect in this grade.

All flitches must produce at least 80 per cent cuttings; no cutting to be considered which is less than 6 inches wide and 24 inches long.

Common, $\frac{1}{16}$ inch and thinner.

Thicknesses.—$\frac{1}{16}$ inch and thinner.

Widths.—5 inches and wider.

Lengths.—4 feet and longer.

Sapwood is not a defect.

Mineral streaks or other discolorations are not to be considered a defect in this grade.

All flitches must produce at least 60 per cent cuttings; no cutting to be considered which is less than 5 inches wide and 18 inches long.

Standard, $\frac{1}{12}$ inch and thicker.

Thicknesses.—$\frac{1}{12}$ inch and thicker.

Widths.—(*a*) 5 to 9¾ inches, inclusive, 50 per cent must be 7 to 8 feet, and 14 to 16 feet long; (*b*) 10 to 11¾ inches, inclusive, random lengths; (*c*) 12 inches and up, random lengths.

Lengths.—7 feet and longer.

Bright sapwood is not a defect.

Veneer must be smoothly manufactured and uniform in thickness.

Slight mineral streaks or other slight discolorations are not to be considered a defect in this grade.

Flitches 5 to 6¾ inches wide, 7 to 8 feet long, must be clear; 9 to 11 feet long must produce at least one cutting 7 feet long; 12 to 13 feet long must produce at least one cutting 7 feet long, and one cutting 3 feet long; 90 per cent of the 14 and 16 foot lengths must produce at least two cuttings 7 feet long. The remaining 10 per cent of these lengths must produce at least one cutting 7 feet long. These cuttings to be by the width of the flitch.

Flitches 7 to 9¾ inches wide, 7 to 11 feet long, must produce one cutting 7 feet long or longer; 12 to 13 feet long, must produce at least one cutting 7 feet long, and one cutting 3 feet long; 90 per cent of the 14 to 16 foot lengths must produce at least two cuttings 7 feet long, the remaining 10 per cent of these lengths must produce at least one cutting 7 feet long. No cutting to be considered which is less than 6 inches wide.

Flitches 10 inches and wider, 7 feet long and longer, must produce at least 75 per cent of cuttings 3 feet long or longer by the width of the flitch.

Common, $\frac{1}{12}$ inch and thicker.

Thicknesses.—$\frac{1}{12}$ inch and thicker.

Widths.—5 inches and wider.

Lengths.—4 feet and longer.

Sapwood is not a defect.

Mineral streaks or other discolorations are not to be considered a defect in this grade.

All flitches must produce at least 60 per cent cuttings; no cutting to be considered which is less than 4 inches wide and 24 inches long.

PLAIN WHITE AND RED OAK

Grades

Standard.

Common.

Standard, $\frac{1}{16}$ inch and thinner.

Thicknesses.—$\frac{1}{16}$ inch and thinner.

Widths.—(*a*) 6 to 9¾ inches, inclusive; (*b*) 10 inches and up.

Lengths.—7 feet and longer.

Bright sapwood is not a defect.

Veneer must be smoothly manufactured and uniform in thickness.

Slight streaks, slight mineral stains, or other slight discolorations, and burls which do not contain knots or unsound centers, are not to be considered defects in this grade.

All flitches must produce at least 80 per cent cuttings; no cutting to be considered which is less than 6 inches wide and 24 inches long.

Common, $\frac{1}{16}$ inch and thinner.

Thicknesses.—$\frac{1}{16}$ inch and thinner.

Widths.—5 inches and wider.

Lengths.—4 feet and longer.

Sapwood is not a defect.

Streaks, mineral stains, or other discolorations, widely scattered small sound knots, not exceeding ⅛ inch in diameter, and burls which do not contain knots or unsound centers, are not to be considered defects in this grade.

All flitches must produce at least 60 per cent cuttings; no cutting to be considered which is less than 5 inches wide and 18 inches long.

Standard, $\frac{1}{12}$ inch and thicker.

Thicknesses.—$\frac{1}{12}$ inch and thicker.

Widths.—(*a*) 5½ to 9¾ inches, inclusive, 50 per cent must be 7 to 8 feet and 14 to 16 feet; (*b*) 10 to 11¾ inches, random lengths; (*c*) 12 inches and up, random lengths.

Lengths.—7 feet and longer.

Bright sapwood is not a defect.

Veneer must be smoothly manufactured and uniform in thickness.

Slight streaks, slight mineral stains, or other slight discolorations, widely scattered small sound knots, not exceeding ⅛ inch in diameter, and burls which do not contain knots or unsound centers, are not to be considered defects in this grade.

Flitches 5½ to 6¾ inches wide, 7 to 8 feet long must be clear; 9 to 11 feet long must produce at least one cutting 7 feet long; 12 to 13 feet long must produce at least one cutting 7 feet long and one cutting 3 feet long; 90 per cent of the 14 and 16 foot lengths must produce at least two cuttings 7 feet long, the remaining 10 per cent of these lengths must produce at least one cutting 7 feet long. These cuttings to be by the width of the flitch.

Flitches 7 to 9¾ inches wide, 7 to 11 feet long, must produce one cutting 7 feet long or longer; 12 to 13 feet long must produce at least one cutting 7 feet long, and one cutting 3 feet long; 90 per cent of the 14 to 16 foot lengths must produce at least two cuttings 7 feet long, the remaining 10 per cent of these lengths must produce at least one cutting 7 feet long. No cutting to be considered which is less than 6 inches wide.

Flitches 10 inches and wider, 7 feet long and longer must produce at least 75 per cent of cuttings 3 feet long or longer by the width of the flitch.

Common, $\frac{1}{12}$ inch and thicker.

Thicknesses.—$\frac{1}{12}$ inch and thicker.

Widths.—5 inches and wider.

Lengths.—4 feet and longer.

Sapwood is not a defect.

Streaks, mineral stains, or other discolorations, widely scattered small sound knots, not exceeding ⅛ inch in diameter, and burls which do not contain knots or unsound centers, are not to be considered defects in this grade.

All flitches must produce at least 60 per cent clear cuttings; no cutting to be considered which is less than 4 inches wide and 24 inches long.

RULES FOR THE GRADING AND MEASUREMENT OF SAWN RED GUM VENEER

Measurement.

Identical with the rules of this association for the measurement and grading of sawn and sliced veneer. (See 413.52.)

Cutting.

Identical with the rules of this association for the measurement and grading of sawn and sliced veneer. (See 413.52.)

Grades.

Standard.

Common.

QUARTERED RED GUM, FIGURED

Standard, $\frac{1}{12}$ inch and thicker.

Thicknesses.—$\frac{1}{12}$ inch and thicker.

Widths.—(*a*) 5 to 9¾ inches, inclusive, 50 per cent must be 7 to 8 feet, and 14 to 16 feet long; (*b*) 10 to 11¾ inches, inclusive, random lengths; (*c*) 12 inches and up, random lengths.

Lengths.—7 feet and longer.

Each flitch shall be especially selected for markings and color tones.

Ten per cent of bright sap wood is not a defect.

Veneer must be smoothly manufactured and uniform in thickness.

Otherwise standard grade of quartered red gum figured veneer to be graded under the rules applying to standard grade of quartered sawn oak veneer $\frac{1}{12}$ inch thicker.

Common, $\frac{1}{12}$ inch and thicker.

Thicknesses.—$\frac{1}{12}$ inch and thicker.

Widths.—5 inches and wider.

Lengths.—4 feet and longer.

Each flitch shall be especially selected for markings and color tones.

Twenty per cent bright sapwood is not a defect.

All flitches must produce at least 60 per cent cuttings; no cutting to be considered which is less than 4 inches wide and 24 inches long.

QUARTERED RED GUM, UNFIGURED

Rules for grades of standard and common as specified for quartered red gum figured shall apply, except that it is not required that stock shall be especially selected for markings and color tones.

RULES FOR THE GRADING AND MEASUREMENT OF SAWN AND SLICED PIANO RIM STOCK

Tape measure to govern for the full width and length of each sheet; measurement to include up to 1 inch in excess of width ordered.

There is no limit to sapwood or heartwood in this grade.

Sixty per cent of the quantity of each order shall be practically free of defects excepting that one 6-inch split, pin wormholes, or equivalent defects may be admitted in each sheet. Each sheet to be of such quality as to permit of smooth laying.

Forty per cent of the quantity of each order may contain sound or discolored wood, wormholes, unsound knots, if not located on the edge, heart cracks ¼ inch by 24 inches or equivalent defects. Each sheet to be used for center stock.

PLYWOOD

Specifications for faces of panels and tops, grade A.

Figured and plain woods, matched for uniform figure and color. Excessive discoloration, face depressions, sap, knots, and wormholes eliminated. Smooth finished. (See Notes 2 and 3.)

Grade 1.

Random figure or grain, matched for color only. Tight joints, sap, slight discoloration and sound pin knots not considered defects. Patches properly made permissible. Sanded or scraped. (See Notes 2 and 3.)

Grade 2.

Not matched for color or grain. Slightly open joints, sap with discoloration, burls, sound knots, and patches permissible. Sanded or scraped.

NOTE 1.—Any specifications for face and back veneer other than these rules shall be a matter of special contract between buyer and seller.

NOTE 2.—In some instances it is desirable to include sap to produce best effect in matching in walnut, figured gum, and other woods on the faces; therefore, the matter of eliminating sap is considered optional.

NOTE 3.—Slight mineral streaks are not considered a defect in plain and quartered oak.

Grade 3.

Any kind or kinds of wood. Doze, stain, pithy knots, discolorations, burls, loose cutting, and open joints permissible. Not sanded. Tape not removed.

Specifications for Backs of Panels and Tops

Good backs.

Specifications same as for grade 1 faces.

Sound backs.

Specifications same as for grade 2 faces.

Reject backs.

Any kind or kinds of wood. Supplied on panels with one good face unless another grade is specified. May contain doze, stain, unsound knots, wormholes, checks, loose or rough cutting, splits, and open joints. Not sanded. Tape not removed.

SPECIFICATIONS FOR LUMBER CORES

Grade A.

Made from any suitable core wood. Mixed woods in the same core not permitted. Sound knots, patching, and minor defects permissible. All joints machined and tightly glued. All exposed edges must be sound.

Grade 1.

Any suitable wood. Mixed wood not permitted in the same core. Slightly open joints permitted.

Grade 2.

Any kind or kinds of wood permitted, and may be mixed in the same core. Must be reasonably sound, but doze, stain, small open knots, or pin wormholes and checks are permitted.

NOTE.—Any specifications for lumber cores other than these rules shall be a matter of special contract between buyer and seller.

413.53 Other Furniture Stock.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413.0 for softwood factory and shop lumber.

National Hardwood Lumber Association, grading rules for other furniture stock, January, 1927.

FURNITURE DIMENSION STOCK

Squares and Flat Stock

Stock shall be straight, flat, and square edged. Sap a defect in red gum, cherry, mahogany, and unsteamed walnut unless otherwise specified.

Lengths.

Must be of full length and should be ½ to 2 inches longer than specified. All pieces must be free from end checks the full lengths specified. Pieces may be in multiple lengths.

Thickness.

Flat stock will admit 10 per cent not more than 1/16 inch scant in thickness in 1¼ inches and thinner, and not more than ⅛ inch scant in 1½ inches and thicker. Squares will admit 10 per cent not not more than 1/16 inch scant in one or both dimensions in sizes 1¼ inches or smaller and not more than ⅛ inch scant in one or both dimensions in sizes 1½ inches or larger. General instructions as to miscut lumber shall apply.

Widths.

Flat stock will admit not exceeding 10 per cent not more than 1/16 inch scant in widths 3 inches and narrower and ⅛ inch scant in widths over 3 inches.

NOTE.—Six per cent of the shipment may consist of pieces having defects on the edge or end, or both, which must be measured off to make the grade or a smaller size.

Furniture Squares

Clear.

Clear four sides and two ends.

Selects.

Clear three corners and two adjacent faces, the remaining corner and two faces to be clear ½ length, the other half will permit sound defects and wane not exceeding ¼ the thickness of the pieces.

Common.

Admit pin and spot wormholes, sound bird pecks, small sound knots not exceeding ½ inch in diameter and other sound defects which do not exceed in extent or damage the defects described, except that knots will not be admitted on the corners.

Furniture Flat Stock

Clear.

Clear four sides and two ends.

Select.

Clear two edges and two ends and to have one clear face, wane not exceeding ¼ thickness of the piece admitted on the reverse side of 25 per cent of the pieces.

Common.

Admits pin and spot wormholes, sound bird pecks, small sound knots not exceeding ½ inch in diameter and other sound defects which do not exceed in extent or damage the defects described, except that knots will not be admitted on the corners.

NOTE.—Dimension stock for purposes not defined in these rules, shall be subject to contract between buyer and seller; where inspection is necessary, inspector must be furnished with a copy of the specifications and contract.

West Coast Lumbermen's Association, grading rules for other furniture stock, July 1, 1926.

Piano posts, b and better.

Subject to contract.

Piano posts, sounding-board stock.

Subject to contract.

413.54 Wagon and Vehicle Stock. (See also 400.3 and 426.)

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

See 413. 0 for softwood factory and shop lumber.

Arkansas Soft Pine Bureau, grading rules for wagon and vehicle stock, March 23, 1927.

The grading rules for wagon and vehicle stock are the same as those of the Southeastern Forest Products Association and the Southern Pine Association given below.

National Association of Farm Equipment Manufacturers, grading rules for wagon and vehicle stock, 1921.

WAGON STOCK

Standard dimensions.

The following dimensions are the sizes adopted by this association for rough materials in the green state (unless otherwise specified) and are those in common demand by our members.

The star (*) prefixing any size indicates that that size is more in demand than the unmarked sizes.

Axles, hickory (6 feet long).

Inches	Inches	Inches
2¾ by 3¾	3¾ by 4¾	*4½ by 5½
*3 by 4	*4 by 5	*5 by 6
*3¼ by 4½	4 by 5½	5½ by 6½
*3½ by 4½	4¼ by 5¼	6 by 7

Grading and inspection rules No. 1, or wagonmakers' grade.

Adopted jointly by this association and the National Hardwood Lumber Association.

Grade.—Live, tough, black or shellbark hickory, cut 6 feet in length, to include all the clear and perfect stock. Defects as follows admissible:

Stain.—Penetrating not more than $\frac{1}{16}$ inch, and which has not developed into a rotting condition.

Knots.—Four sound pin knots not exceeding ¼ inch in diameter, or two sound knots ¾ inch in diameter near the center line longitudinally on top or side and not over 12 inches of center or more than 6 inches of ends. Knots (except pin knots) not to be closer than 12 inches apart

Splits.—On either end, extending not more than 6 inches in axle or 3 inches on both ends.

Season checks.—Not more than ½ inch deep and not more than 12 inches long.

Hearts or heart rings.—None.

Shakes.—That will plane out with ⅛-inch cut.

Wormholes and grub holes.—Not more than two pin wormholes not nearer than 6 inches to each other. Not more than two grub holes that will penetrate more than 6 inches at either end of the piece.

Bird pecks.—Bird pecks allowed if sound, or if unsound, part is not to exceed ½ inch in diameter and not over ¼ inch in depth.

Wane.—Axles with wane will be measured excluding the wane.

Sap.—Bright sap considered no defect.

Grain.—Grain can cross 3 inches in entire length of axle.

Defects removable.—If defects not admitted can be cut out so as to reduce axle to a smaller size used and ordered by the buyer, it shall be so inspected.

Hewn axles shall be measured to square to the size they are ordered.

Defects at ends of axles that will admit of piece working 5 feet 6 inches long will be admitted.

Maple axles (size same as hickory; No. 1, or wagonmakers' grade).

(These rules have not been adopted either by the wagon manufacturers or mills, but are suggested as being fair and equitable to both.)

To be cut from live, tough, hard maple (no bird's-eye or curly maple admitted), cut 6 and 12 foot lengths, to include all the clear and perfect stock. Defects as follows admissible:

Stain.—Penetrating not more than $\frac{1}{16}$ inch and which has not developed into a rotting condition.

Knots.—Four sound pin knots not exceeding ¼ inch in diameter, or two sound knots ¾ inch in diameter, near the center line longitudinally on top or side and not over 12 inches of center or more than 6 inches of ends. Knots (except pin knots) not to be closer than 12 inches apart.

Splits.—Splits on either end, extending not more than 6 inches in the axle or 3 inches on both ends.

Season checks.—Not more than ½ inch deep and not more than 12 inches long.

Hearts or heart rings.—None.

Shakes.—That will plane out with ⅛ inch cut.

Wormholes and grub holes.—Not more than two pin wormholes not nearer than 6 inches to each other. Not more than two grub holes that will penetrate more than 6 inches at either end of the piece.

Bird pecks.—Bird pecks allowed if sound, or if unsound, part is not to exceed ½ inch in diameter and not over ¼ inch in depth.

Wane.—Axles with wane will be measured excluding the wane.

Sap.—Bright sap considered no defect.

Grain.—Grain can cross 3 inches in entire length of axle.

Curls.—None.

Twelve-foot lengths to be inspected as two 6-foot lengths.

Defects removable.—If defects not admitted can be cut so as to reduce axle to smaller size used and ordered by the buyer, it shall be so inspected.

Bolsters, hickory or oak (length 4 feet 1 inch and 4 feet 6 inches or multiples).

Inches	Inches	Inches
3 by 4	3¼ by 4¼	3¾ by 5½
3 by 4½	3¼ by 5	4 by 5
3 by 5	3½ by 4½	4 by 6
3 by 7	3¾ by 4¾	

Grading and inspection rules (No. 1, or wagonmakers' grade.

Grade.—To be cut from good, tough, straight-grained oak or hickory (when oak is specified it will be understood as being white or red oak) suitable

for wagon material. To be clear and perfect stock, excepting the following defects, which will be admissible:

Stain.—Penetrating not more than $\frac{1}{16}$ inch and which shows no signs of rot.

Knots.—One sound knot not over ½ inch in diameter, not more than 12 inches from the center of the piece, or three sound pin knots not exceeding ¼ inch in diameter located in same manner.

Splits.—None.

Season checks.—Not more than ½ inch deep nor more than 12 inches long.

Heart rings.—None.

Shakes.—If they can be planed out with ⅛-inch cut.

Wormholes.—Not more than 6 pin wormholes in a bolster, these holes not to be in cluster of more than three holes 6 inches apart.

Bird pecks.—Allowed if sound.

Wane.—Will be measured excluding the wane.

Sap.—Bright sap accepted.

Grain.—Grain can cross 2 inches in length of bolster as maximum.

Defects removable.—If defects not admitted can be cut so as to reduce bolster to a smaller size used and ordered by the buyer, it shall be so inspected.

Sandboards, hickory or oak (length 4 feet 1 inch and 4 feet 6 inches or multiples).

Inches	Inches	Inches
2¾ by 3½	3¼ by 3¾	3½ by 4½
3 by 3½	* 3½ by 4	* 4 by 5
* 3 by 4		

Grading and inspection rules (No. 1, or wagonmakers' grade).

(Same as bolsters.)

Reaches, hickory or oak.

* 2 by 4 inches 2 by 4½ inches	8 and 10 feet long.
2¼ by 4½ inches * 2½ by 4½ inches 2½ by 5 inches	10, 12, and 14 feet long.

Grading and inspection rules (No. 1, or wagonmakers' grade).

Grade.—To be cut from good, tough, straight-grained oak or hickory (when oak is specified it will be understood as being white or red oak) suitable for wagon material. To be clear and perfect stock, free from knots, splits, hearts, grub holes, heart rings, shakes, bird pecks, or wane. Bright sap accepted. The following defects will be admitted:

Stain.—Penetrating not more than $\frac{1}{16}$ inch and which shows no signs of rot.

Season checks.—Not over ¼ inch deep or 12 inches long.

Wormholes.—Not more than six pin wormholes in a reach, these holes not to be in clusters of more than three holes 6 inches apart.

Wane.—Stock with wane will be measured excluding the wane.

Poles, ash or oak.

For drop poles

* 2½ by 4 by 4 by 4, 12 feet.
2½ by 4½ by 4½ by 4½, 12 feet.

For stiff poles

2½ by 2½ by 2½ by 5, 12 feet.
2¾ by 2¾ by 2¾ by 5, 12 feet.
3 by 3 by 3 by 5, 12 feet.
3¼ by 3¼ by 3¼ by 5, 12 feet.

Grading and inspection rules (No. 1, or wagonmakers' grade).

Grade.—To be cut from good, tough, straight-grained oak or ash (when oak is specified it will be understood as being white or red oak) suitable for wagon material. To be clear and perfect stock free from knots, splits, hearts, grub holes, heart rings, shakes, or bird pecks. Bright sap accepted. The following defects will be admitted:

Stain.—Penetrating not more than $\frac{1}{16}$ inch and which shows no signs of rot.

Season checks.—Not over ¼ inch deep or 12 inches long.

Wormholes.—Not more than six pin wormholes in a pole, these holes not to be clusters of more than three holes 6 inches apart.

Wane.—Stock with wane will be measured, excluding the wane.

Eveners, hickory.

2 by 4 inches 2 by 4½ inches	4 feet 2 inches long.
2¼ by 4½ inches 2½ by 5 inches	4 feet 6 inches long.

Grading and inspection rules (No. 1, or wagonmakers' grade).

Grade.—To be cut from good, tough, straight-grained hickory suitable for wagon material. To be clear and perfect stock, free from knots, splits, hearts, grub holes, heart rings, shakes, wormholes, or wane. The following defects are admissible:

Stain.—Penetrating not more than $\frac{1}{16}$ inch and which shows no signs of rot.

Season checks.—Not over ¼ inch deep or 12 inches long.

Wormholes.—None.

Bright sap.—No objection.

Bird pecks.—Sound bird pecks admitted.

Hickory, turned singletrees (oval diameters).

At center	At ends	Lengths
Light, 2 by 2½ inches	1½ by 1⅝ inches	34 and 36 inches long.
Medium, 2¼ by 2¾ inches.	1⅝ by 1⅞ inches	Do.
Heavy, 2½ by 3 inches	1¾ by 2 inches	36 inches long.

Hickory, turned neckyokes (diameters).

At center	At ends	Lengths
Light, 2½ inches	1½ inches	40 and 44 inches long.
Medium, 2¾ inches	1⅞ inches	40, 44, and 48 inches long.
Heavy, 3 inches	2 inches	44 and 48 inches long.

No adopted rules for grading singletrees and neckyokes, but stock must be absolutely clear and made from young, tough hickory.

Sawed fellies, oak (26 pieces to set).

The sizes given are for green fellies cut full.

Sizes most common

Inches	Inches	Inches
1¾ by 2½	2¾ by 2¾	2¾ by 3
*2 by 2¾	3¼ by 2¾	3¼ by 3
2½ by 2¾	2¼ by 3	4½ by 3

Circles 2 feet 11 inches and 3 feet 6—3 feet 2 inches and 3 feet 10—3 feet 6 inches and 4 feet 2.

Grading and inspection rules (No. 1, or wagonmakers' grade).

Grade.—Sound white or red oak, free from knots and all other defects, except that $\frac{1}{16}$-inch stain will be allowed if said stain shows no sign of rot. Must be manufactured so that grain will run straight through center of each piece. Cut full sizes and proper circles.

Bent rims (8 pieces to set).

The sizes given are for green rims.

Sizes most common

Inches	Inches	Inches
1¾ by 1¾	3 by 2	4¼ by 2¼
2 by 2	3¼ by 2⅛	5 by 2
2½ by 2	4 by 2	5¼ by 2¼

Circles 3 feet 2 inches and 3 feet 10—3 feet 6 inches—4 feet 2—3 feet 10 inches and 4 feet 6.

Grade (wagon manufacturers' grade).

(To replace what was formerly XXX.)

These rules agreed upon jointly by the Wagon and Rim Manufacturers, November 21, 1906.

Materials.—Oak (any desirable species).

Quality.—Clear and straight grained, but not excluding reasonably straight, the grain not to cross the rim in a less distance than 24 inches; to be sound, free from bark, wane, checks (except checks on tread side), shakes, splits, knots, and wormholes, but admitting not more than three small, sound knots, not more than ½ inch in diameter on tread side, also small wormholes not closer than 6 inches apart. Not over 15 per cent of any shipment of rims shall be with knots or wormholes, as above specified.

Workmanship.—Planed on top and bottom sides; no skips, tears, or imperfect planing. Bending to be on the true circle of the diameter specified. To be free from flats or humps, kinks, breaks, or buckles and no straight or drop ends.

Hubs (oak or black birch).

Sizes most common

Inches	Inches	Inches
7½ by 8½	9 by 10	10 by 11
8 by 8½	9 by 11	10 by 12
8½ by 9	9½ by 11	10½ by 12
8½ by 10		

Wagon box boards.

Material.—Basswood, bay poplar (tupelo), cottonwood, gum, poplar, and magnolia.

Widths.—Wide, 13 to 17 inches; narrow, 9 to 12 inches.

Lengths.—11 to 16 feet.

Thickness.—Must be 1 inch thick when shipping dry.

Defects.—Bright or sound discolored sap or a few scattered pin wormholes may be admitted; 11-foot lengths will admit 3-inch splits in one end, or their equivalent in one or both ends; 12, 13, 15, and 16 foot lengths will admit of a 12-inch split in one end or its equivalent in one or both ends; 14-foot lengths will admit 6-inch splits in one end or their equivalent in both ends; otherwise each piece in 11 to 13 foot lengths may contain defects that do not prevent the piece from cutting one side; or in each piece 14 to 16 feet long; one side and one end; sides to work 10 feet 6 inches long, ends to work 3 feet 6 inches long by the full width of the piece. Each side and end may contain one sound standard defect, or its equivalent, showing on one side.

NOTE.—Five per cent in feet of a shipment that can be reduced in measurement by cutting the end or edge of both to a size ordered must be accepted and measured as box boards; separate tally to be kept of such boards, showing reduction in measurement. Inspectors are cautioned that "wooly" cottonwood and lumber so warped and checked that it can not be used for box boards must be excluded from this grade.

Box bottom lumber.—Yellow pine.

13–16 D&M 3¼ face 12 feet long.

13–16 D&M 5¼ face 12 feet long, square one edge.

(Put up in sets 38 and 42 inches in width.)

Some factories purchase standard dressed and matched flat-grained flooring for this purpose, of the same dimensions.

Grading and inspection rules (No. 1, or wagonmakers' grade).

Material.—Yellow or Norway pine or Oregon fir. Must be well manufactured, full size, clear, except no more than three small sound knots not exceeding ½ inch in diameter. No splits.

WHITE OAK WAGON SPOKES (Wagonmakers' Grades)

Second-growth grade.

Material.—Spokes of this grade are to be made from first-quality timber, practically clear and straight grained, of heavyweight and very dense growth that will indicate the very greatest strength.

Checks.—Small, fine, season checks not to exceed 2 inches in length and not running into the shoulder admitted.

Splits.—None admitted.

Cross grain.—Grain which does not run at a greater angle at any one point than 1 inch in 24 inches admitted.

Curly spokes are considered cross-grained and not admitted.

Knots.—Spokes having knots will not be admitted, but spokes showing a small sound spot having the appearance of a knot but which is only a surface blemish will be admitted.

Sap.—Half sap that is bright and sound admitted.

Bastard.—Not more than half bastard will be admitted.

Other defects.—Evident defects not above enumerated not admitted.

A grade.

Material.—Spokes of this grade are to be made from live timber of dense growth, good weight, practically clear and straight grained.

Checks.—Small, fine, season checks not to exceed 2 inches in length and not running into the shoulder admitted.

Splits.—None admitted.

Cross grain.—Grain which does not run at a greater angle at any one point than 1 inch in 20 inches will be admitted. Spokes reduced from the second growth grade by reason of cross grain will be admitted in this grade when the grain does not cross at a greater angle than 1 inch in 18 inches. Curly spokes not admitted.

Knots.—Knots will not be admitted, but spokes showing a small sound spot having the appearance of a knot but which is only a surface blemish will be admitted.

Sap.—Half sap that is bright and sound admitted, but when of the second growth grade or very dense growth reduced by reason of having too much bright sap will be admitted to the extent of two-thirds bright sap.

Bastard.—Not more than half bastard will be admitted.

Dips.—Spokes having dips not more than one in a spoke and located anywhere except at shoulder or tenon admitted, provided such dip is not more than ¼ inch in depth and less than 4 inches in length.

Other defects.—Evident defects not above enumerated not admitted.

B grade.

Material.—Spokes of this grade are to be made from timber of a weight and growth that will indicate fairly good strength.

Checks.—Small, fine, season checks not to exceed 2 inches in length and not running into the shoulder admitted.

Splits.—None admitted.

Cross grain.—Grain which does not run at a greater angle at any one point than 1 inch in 16 inches admitted.

Spokes reduced from the second-growth grade because of excessive cross grain, but in which the grain does not run at a greater angle at any one point than 1 inch in 14 inches admitted.

Spokes reduced from the A grade for cross grain will be admitted to this grade if grain does not run at a greater angle than 1 inch in 15 inches.

Knots.—Knots will not be admitted, but spokes showing a small sound spot having the appearance of a knot but which is only a surface blemish will be admitted.

Spokes reduced from the second growth and A grades having one sound knot not over ¼ inch in diameter showing only on one side and not within 5 inches of either end of the spoke admitted here.

Sap.—Half sap that is bright and sound will be admitted.

Bright all-sap spokes of second growth admitted.

Spokes of A grade having three-fourths sap admitted.

Bastard.—Not more than half bastard will be admitted.

Spokes of second-growth grade will be admitted in this grade where full bastard.

Spokes of A grade will be admitted in this grade where three-fourths bastard.

Dips.—Will be admitted in this grade where not more than one in a spoke and located anywhere except at shoulder or tenon, provided such dip is not more than ¼ inch in depth and less than 4 inches in length.

Wormholes.—Black and pin wormholes in either second growth of A grades of timber will be admitted here to the extent of not more than three in any spoke, but these must not be bunched. Powder post wormholes not admitted.

Other defects.—Evident defects not above enumerated not admitted.

Grading rules for No. 2 wagon stock.

Defects which will be removed in working the piece for the purpose intended shall not be considered. Sound stain, sound bird pecks, season checks well inside the edges of the piece, scattered pin wormholes, spot wormholes in clusters so located that they do not impair the strength of the piece, and ½ inch of wane on one corner that will not work off will be admitted in the No. 2 grade unless otherwise specified. Heart, heart rings, and heart shakes will not be admitted.

Any defects described in these rules combined or located in such a manner as seriously to impair the utility of the piece for the purpose intended shall not be admitted.

Any defects not admitted that can be cut out so as to reduce the piece to a smaller size used and ordered by the buyer shall be so inspected.

No. 2 axles.

No. 2 axles will admit ¾ and 1¼ inch sound knots not less than 12 inches apart near the center lines longitudinally on top or side and not over 12 inches from center or more than 6 inches from the end; season checks 1 inch deep and 24 inches long; grain crossing in not less than the length of the piece; 1 inch of wane; two grub holes showing on one or two sides; end splits not exceeding 8 inches in length on one end or its equivalent on both ends; or other defects equivalent to the above.

Hewn axles shall be measured to square to the size they are ordered. Defects at ends of axles that will admit working 5 feet 6 inches to be accepted.

No. 2 bolsters, sand boards, and brake beams.

Grading rules as specified for No. 2 axles to apply, except that no splits are admissible.

No. 2 poles and reaches.

No. 2 poles and reaches will admit ¾-inch sound knots that do not show through the piece and are so located that they will not materially impair the strength of the piece; two grub holes showing on bottom or sides; splits 6 inches long in one end

or the equivalent in both ends; grain crossing in not less than one-third of the piece; a vertical or lateral bend diverging not more than 1 inch from a straight line the length of the piece; or other defects equivalent to the above.

No. 2 eveners, singletrees, and neck yokes.

No. 2 eveners, singletrees, and neck yokes will admit two ½-inch sound knots not to be less than 6 inches from the center of the piece or their equivalent in other defects.

No. 2 sawed fellies.

No. 2 sawed fellies will admit two ½-inch sound knots or their equivalent; two ¾-inch sound knots or their equivalent well inside the edges of the piece on the tread side; grain diverging 2 inches from the center line of the piece in three-fourths its length.

National Hardwood Lumber Association, grading rules for wagon and vehicle stock, January, 1927.

Vehicle lumber.

Scattered pin wormholes, spot wormholes with not more than three holes in a cluster and clusters not less than 12 inches apart, sound bird pecks, sound ¼-inch knots, sound stain and streaks, or their equivalent, shall not be considered defects in firsts and seconds and in the cuttings in the common grades.

No specified percentage of firsts is required in firsts and seconds.

Firsts.—Standard.

Seconds.—Standard, with the following exceptions: Widths, 4 inches and over. Pieces 4 inches wide must be clear.

No. 1 common.—Standard, with the following exceptions: No cutting shall be considered which is less than 3 inches wide by 3 feet long.

Pieces 3 to 7 inches wide, 6 to 11 feet long, must work 66⅔ per cent clear in not over two cuttings; 12 to 16 feet long, in not over three cuttings.

Pieces 8 inches and over wide, 6 feet long, must work 66⅔ per cent clear in not over two cuttings.

No. 2 common.—Standard.

Wagon stock, box boards.

Poplar, cottonwood, gum, tupelo, magnolia, and basswood.

Widths.—Wide box boards, 13 to 17 inches; narrow box boards, 9 to 12 inches.

Lengths.—11 to 16 feet.

Thickness.—1 inch when shipping dry.

The 11 to 13 foot lengths must contain one cutting (side) 10 feet 6 inches long by the full width of the piece.

The 14 to 16 foot lengths must contain one cutting (side) 10 feet 6 inches long by the full width of the piece, and one cutting (end) 3 feet 6 inches long by the full width of the piece.

Each cutting will admit one sound standard defect or its equivalent, showing on one face, and sound stain and a few scattered pin wormholes.

The portion of each board not included in the cuttings may contain any defects and may be thin, except that split defects shall be limited as follows:

The 11-foot lengths may have 3-inch splits in one end or their equivalent in both ends.

The 12, 13, 15, and 16 foot lengths may have 12-inch splits in one end or their equivalent in both ends.

The 14-foot lengths may have 6-inch splits in one end or their equivalent in both ends, which shall not be considered defects.

NOTE.—Five per cent of a shipment may consist of boards having defects on the edge or end, or both, which must be measured off in order to make the grade. A tally must be made showing the number of such pieces and the reduction in measurement.

"Woolly" cottonwood and lumber so warped and checked that it can not be used for box boards shall not be admitted.

Axles, bolsters, sand boards, poles, reaches, eveners, singletrees, brake beams, neck yokes and sawn fellies.

Grades, No. 1 and No. 2.

Sizes and lengths specified.

Bright sapwood is no defect.

Pieces containing defects not admitted may be measured for a smaller size used and ordered if such cut in measure will eliminate the defects.

Hewn pieces and pieces oversize and overlength shall be inspected and measured as if squared down to the sizes and lengths specified.

Defects combined or located in such a manner as to seriously impair the use and durability of the piece for the purpose intended shall not be admitted.

Heart center and shake will not be admitted.

No. 1 must be good, tough, straight-grain material suitable for wagon work. Sound stain $\frac{1}{16}$ inch deep shall not be considered a defect.

No. 2 will admit sound stain, sound bird pecks, season checks well inside the edges of the piece, scattered pin wormholes, spot wormholes in clusters not less than 6 inches apart and not more than five holes to a cluster, and ½ inch of wane on one corner that will not work off.

Otherwise No. 1 and No. 2 shall be inspected as follows:

Axles.

Hickory, unless otherwise specified.

Length, 6 feet. Defects at the ends that will be removed in working the piece 5 feet 6 inches long will be admitted.

No. 1.

No. 1 shall include all the clear and perfect stock and will admit defects as follows:

Knots.—Four sound ¼-inch knots or two sound ¾-inch knots near the center lines of the piece on top or side not more than 12 inches from the center or 6 inches from the ends of the piece; ¾-inch knots must be not less than 12 inches apart.

Splits.—Six inches long in one end or their equivalent in both ends.

Season checks.—One-half inch deep and 12 inches long.

Wormholes and grub holes.—Two pin wormholes not less than 6 inches apart. Two grub holes penetrating 6 inches at either end of the piece.

Bird pecks.—If sound; if unsound must not exceed ½ inch in diameter and ¼ inch in depth.

Wane.—Must be measured off.

Cross grain.—Diverging 3 inches in the full length of the piece.

No. 2.

No. 2 will admit ¾-inch sound knots; 1¼-inch sound knots not less than 12 inches apart, or their equivalent in smaller defects; season checks 1 inch deep and 24 inches long; end splits not exceeding 8 inches in length; cross grain diverging not more than 1 inch in 12 inches; 1 inch of wane; two grub holes showing on one or two sides; or other defects equivalent to the above.

Bolsters and sand boards.

Oak and hickory, unless otherwise specified.

No. 1.

No. 1 will admit defects as follows:

Knots.—One sound ½-inch knot or three sound ¼-inch knots, not more than 12 inches from the center of the piece.

Season checks.—One-half inch deep and 12 inches long.

Wormholes.—Not more than six wormholes, not more than three holes in a cluster, and clusters not less than 6 inches apart.

Sound bird pecks.

Cross grain.—Diverging 2 inches in the length of the piece.

No. 2.

No. 2 will admit ¾-inch sound knots; 1¼-inch sound knots not less than 12 inches apart, or their equivalent in smaller defects; season checks 1 inch deep and 24 inches long; 1 inch of wane; two grub holes showing on one or two sides; or other defects equivalent to the above.

Reaches and poles.

Reaches shall be oak or hickory unless otherwise specified.

Poles shall be oak or ash unless otherwise specified.

No. 1.

No. 1 must be straight and free from all defects, except season checks ¼ inch deep and 12 inches long; 6 wormholes with not more than 3 holes in a cluster and clusters not less than 6 inches apart; grain crossing in the length of the piece.

No. 2.

No. 2 will admit ¾-inch sound knots that do not show through the piece; two grub holes showing on bottom or sides; splits 6 inches long in one end or the equivalent in both ends; grain crossing in not less than one-third the length of the piece; a vertical or lateral bend diverging not more than 1 inch from a straight line the length of the piece, or other defects equivalent to the above.

Eveners, singletrees, brake beams, and neck yokes.

Hickory, unless otherwise specified.

No. 1.

No. 1 shall be free from all defects except season checks ¼ inch deep and 12 inches long and sound bird pecks.

No. 2.

No. 2 will admit two ½-inch sound knots not less than 6 inches from the center of the piece, or their equivalent in other defects

Sawn fellies.

Oak, unless otherwise specified.

No. 1.

No. 1 must be cut full size to pattern and must be free from all defects. Grain must run straight through the center of the piece.

No. 2.

No. 2 will admit two ½-inch sound knots or their equivalent; two ¾-inch sound knots or their equivalent, well inside the edges of the piece on the tread side; grain diverging 2 inches from the center line of the piece in three-fourths its length.

Southeastern Forest Products Association, grading rules for wagon and vehicle stock, September 1, 1925.

Wagon bottoms.

Wagon bottoms, unless otherwise ordered, shall be made in sets of 38 and 42 inch face width, and from stock 4 inches or over in width, board measure. The standard thickness shall be $\frac{25}{32}$ inch.

Grades.

A and B.

Wagon bottoms.

Unless otherwise ordered, shall be graded under the rules for A and B flat flooring.

Southern Cypress Manufacturers Association, grading rules for wagon and vehicle stock, June 15, 1925.

Wagon-box boards, tupelo.

The grading rules for tupelo wagon-box boards are the same as the rules of the National Association of Farm Equipment Manufacturers.

B and better.

Thicknesses.—1 to 2 inches.

Widths.—Shall be specified, 4, 5, 6, 8, 10, and 12 inches, and may be furnished in assorted widths 4 to 12 inches, admitting 20 per cent of 7, 9, and 11 inch widths. May also be furnished in random widths 13 inches and wider.

Lengths.—8 to 20 feet.

Shall be graded from the better side. Slightly discolored sap is no defect.

Pieces 4 and 5 inches wide shall be free from defects.

Pieces 6 to 8 inches wide may have one standard knot or an equivalent defect.

Pieces 10 inches wide may have one standard knot and one other equivalent defect.

Pieces 12 inches wide may have two standard knots and one other equivalent defect.

Pieces wider than 12 inches will admit additional defects in proportion as width increases.

C.

Thicknesses.—1 to 2 inches.

Widths.—Shall be specified, 4, 5, 6, 8, 10, and 12 inches, and may be furnished in assorted widths 4 to 12 inches, admitting 20 per cent 7, 9, and 11 inch widths.

Lengths.—6 to 20 feet.

Shall be graded from the better side. Sound discolored sap is no defect. Standard knots, pin worm-

holes, and other defects will be admitted, but none that will prevent the use of each piece in its full length and width as a paint grade.

Southern Pine Association, grading rules for wagon and vehicle stock, March 23, 1927.

The grading rules for wagon and vehicle stock are the same as those of the Southeastern Forest Products Association, above.

West Coast Lumbermen's Association, grading rules for wagon and vehicle stock, July 1, 1926.

Wagon bottoms, K. D.

Finished sizes, $\frac{25}{32}$ and $1\frac{1}{16}$ inches by 38 and 42 inches. To be graded on same rules as "B and better," F. G., or "B" V. G. flooring.

413.6 PATTERN LUMBER.

California Redwood Association, standard specifications for eastern grades of California redwood pattern lumber, April, 1927.

The sizes of pattern lumber are the same as the American Lumber Standard sizes 413.0, softwood factory and shop lumber. The finished thickness for 1-inch boards is extra standard, or $\frac{26}{32}$.

The grades of pattern lumber are the same as shop lumber, 413.0.

White Pine Association of the Tonawandas, grades of northern white-pine lumber for pattern stock, 1922.

The following grade of white-pine lumber, as shown in 400.26 for this association, are suitable for pattern stock: Uppers, No. 1 cuts, No. 1 shelving and dressing.

413.7 COOPERAGE STOCK. (See 421.)

413.8 DOOR, WINDOW, AND MILLWORK LUMBER.

American Lumber Industry, Simplified Practice Recommendation No. 16, American Lumber Standards, revised July 1, 1926.

General provisions, sizes and grade, quality and size of cuttings of factory plank and grade, quality and size of cuttings of shop lumber, are as shown in No. 413.0, softwood factory and shop lumber.

California White and Sugar Pine Manufacturers Association, grading rules for factory lumber, revised May 1, 1926.

The special provisions, standard dressed sizes, grades of cuttings for factory lumber, factory plank, and shop lumber conform to American Lumber, Standards, No. 413.0. This association furnishes the 1-inch factory lumber in extra standard thickness.

National Hardwood Lumber Association, grading rules for cypress door, window, and millwork lumber, January, 1927.

No. 1 shop.

Widths, 4 inches and over.

Lengths, 6 feet and over, admitting 10 per cent of 6 and 7 feet.

Pieces 4 inches wide, 8 feet and over long, must work 66⅔ per cent clear in cuttings 4 feet and over long by the full width of the piece.

Pieces 5 inches and over wide, 8 feet and over long, 1 inch and less in thickness, must work 66⅔ per cent clear in cuttings 2 inches and over wide by the full length of the piece; or cuttings not less than 5 inches wide by 3 feet long or 9½ inches wide by 18 inches long.

Pieces 5 inches and over wide, 8 feet and over long, 1¼ inches and thicker, must work 66⅔ per cent clear in cutting 2 inches and over wide by the full length of the piece; or cuttings not less than 5¼ inches wide by 3 feet long or 9 inches wide by 28 inches long.

No. 2 shop.

Widths, 4 inches and over.

Lengths, 6 feet and over.

Pieces 4 inches wide must work 50 per cent clear in cuttings 4 feet or over long by the full width of the piece.

Pieces 5 inches and over wide must work 50 per cent clear in the same size cuttings described in No. 1 shop.

North Carolina Pine Association (Inc.), grading rules for factory lumber, January 1, 1927.

Shop lumber.

No. 1 shop shall consist of boards 6 inches and over wide, 8 feet and over long, average 8 inches wide, not less than 60 per cent of each board to cut or rip, or both, clear pieces at least 3 inches by 4 feet or 6 inches by 3 feet.

No. 2 shop, same as No. 1 shop, except the percentage of cuttings and rippings shall be 40 per cent or better.

Northern Pine Manufacturers Association, grading rules for northern white and Norway pine, spruce, and tamarack factory lumber, April 15, 1925.

Rules for grades of factory plank, shop common, inch shop common, short box, door cuttings conform to American Lumber Standards, 413.0.

Pacific Lumber Inspection Bureau, grading rules for factory lumber, Schedule M, 1925.

Grading rules for Douglas fir door stock in door lengths rough kiln dried, Port Orford cedar factory lumber, Port Orford cedar factory select and better, Port Orford cedar No. 1 shop common, Port Orford cedar No. 2 shop common, 1-inch factory select, and 1-inch shop common conform to American Lumber Standards 413.0.

Pacific Lumber Inspection Bureau, grading rules for factory lumber, Schedule M, 1925.

WESTERN RED CEDAR

Rough green clear panel flitches.

Must be sound lumber well manufactured; occasional variations in sawing allowed; edges to be square. Will allow light-colored sap not exceeding one-fourth of the face and edge. No face shall be considered edge grain unless the angle of grain is within 45° from the vertical the full width of that face. Edge-grain pieces thinner than 10 inches must be edge grain on the wide face. Pieces 10 by 10 inches and thicker and wider shall be considered

edge grain provided one face or both edges are edge grain. Defects based on 3 inches thick by 10 inches wide, 6½ feet long. One face and corresponding one-half of both edges shall be free of defects; reverse side and corresponding one-half of both edges may contain up to two ¾-inch knots or the equivalent thereof.

No. 2 clear and better.

Under 3 inches thick, based on 6-inch widths 12 feet long. Graded from the face side, which is the best side. Must be well manufactured, and have practically square edges. Will allow occasional variations in sawing. Bright sap and color no defect. In addition, will admit small knots ½ inch in diameter on face side and corresponding half of edges and up to ¾ inch on reverse face and corresponding half of edges if not in clusters. Machining defects, such as dogholes and nigger punches, small closed bark seams, and bark burls, on reverse face and corresponding half of edges. Wane and such other defects which will work out in dressing to standard sizes admitted. Two defects as specified for respective faces allowed to each 12 linear feet.

No. 2 clear and better, 3 inches thick and up to but not including 5 inches thick.

Based on 6-inch widths 12 feet long. Graded from face side, which is the best side. Must be well manufactured and have practically square edges. Will allow occasional variations in sawing; bright sap and color no defect. In addition, will admit small knots ½ inch in diameter on face side and corresponding half of edges, and up to 1½ inches on reverse face and corresponding half of edges if not in clusters. Machining defects, such as dogholes and nigger punches, small closed bark seams not over 6 inches in length, and bark burls, on reverse face and corresponding half of edges. Wane and such other defects which will work out in dressing to standard sizes admitted. Three defects as specified for respective faces allowed to each 12 linear feet.

No. 2 clear and better, 5 inches and thicker.

Based on 6-inch widths 12 feet long graded from the face side which is the best side. Must be well manufactured and have practically square edges. Will allow occasional variations in sawing. Bright sap and color no defect. In addition, will admit small knots ¾ inch in diameter on face side and corresponding half of edges and up to 2 inches, according to size of piece on reverse face and corresponding half of edges if not in clusters. Machining defects, such as dogholes and nigger punches, small closed bark seams not exceeding 6 inches long, and bark burls, on reverse face and corresponding half of edges. Wane and other defects which will work out in dressing to standard sizes admitted. Three defects as specified for respective faces allowed to each 12 linear feet. It is, however, provided that any piece 3 inches and thicker, 10 inches and wider, 12 feet or longer may contain one large defect showing on one or two surfaces, if so placed that by cutting out, the shortest cutting will be at least 3 feet long, with a combined loss not exceeding 5 per cent provided the balance of the piece is practically free of all other defects.

Gang saw flitch.

Based on 6 by 12 inches. Rule to apply proportionately on narrower and/or wider widths and so indicated at time order is placed. Must be suitable for remanufacturing into clear cuttings, such as panel stock and other finishing lumber. To be graded from best face which will permit a small amount of wane and one large defect or four small ones, such as knots, knot holes, or bark seams. Reverse face should not be below grade of common except for the one large defect, which may extend through the piece. Half of edge corresponding with the best face should be practically clear, allowing only minor defects such as small ¾-inch knots or small bark seams. The one large defect permitted on face may also appear on the edge of flitch.

Southern Cypress Manufacturers Association, grading rules for cypress factory lumber, June 15, 1925.

First and second.

Thickness.—1, 1¼, 1½, 2, 2½, 3, and 4 inch.

Width.—Shall be random widths, 4 inches and over wide, admitting not more than 5 per cent under 6 inches. Will not be furnished in specified widths.

Length.—8 feet and longer, admitting not more than 15 per cent shorter than 12 feet, and not more than 5 per cent shorter than 10 feet.

Shall be graded from the poorer side.

Pieces 4 to 8 inches may have ½ inch of bright sap on each edge or its equivalent on one or both edges; otherwise they must be clear. Pieces 8 to 10 inches may have 1 inch of bright sap on each edge or its equivalent on one or both edges; otherwise they must be clear.

Pieces 10 inches and under 12 inches may have 1½ inches of bright sap on each edge or its equivalent on one or both edges, and may have one medium knot or its equivalent.

Pieces 12 inches wide may have 2 inches of bright sap on each edge or its equivalent on one or both edges, and may have one medium knot, or in lieu of sap, may have two medium knots or their equivalent.

Pieces wider than 12 inches may admit of defects as specified above in proportion as width increases.

Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece.

Pieces 12 inches and less in width, free from other defects, may have bright sap across one face at one end, but this sap shall not exceed in length one-tenth of the length of the piece.

In pieces 13 inches and wider bright sap is not a defect.

Selects.

This grade shall be random widths, and will not be furnished in specified widths, and shall be graded from the better side, but the reverse side shall not be lower than No. 1 common or No. 1 shop.

This grade may be 4 inches and wider, but will not be furnished wider than 12 inches, admitting not over 10 per cent under 6 inches; shall be 1 to 4 inches thick.

Length.—8 feet and over, admitting not over 30 per cent under 12 feet, nor more than 10 per cent under 10 feet.

Pieces 10 inches and under in width shall admit two medium knots or their equivalent and an additional medium knot or its equivalent of every 2 inches in width over 10 inches. Pieces free from other defects, 10 inches and over in width, to admit pin wormholes on one edge one-tenth the width of the piece. Bright sap is not a defect in this grade. Slight wane on pieces 10 inches and over in width is allowed on one edge not over 3 feet in length. When no other defect appears, slight amount of stained sap may be allowed. Pieces 10 inches and wider may admit of one end split which shall not exceed in length the width of the piece.

No. 1 shop.

Thickness.—1, 1¼, 1½, 2, 2½, 3, and 4 inch.

Width.—4 inches and over.

Length.—6 feet and over, not exceeding 5 per cent under 8 feet.

In this grade 1 inch shall cut for shop use 60 per cent or better of the following clear cuttings or rippings or both: 5 inches wide or wider, by 3 inches long or longer; and 9½ inches wide or wider, by 18 inches long or longer; and strips 2 inches wide, or wider, ripped the entire length of the piece from pieces 8 feet to 12 feet long, and strips 2 inches wide or wider, 12 feet long or longer, ripped from pieces 14 feet long or longer. In this grade 1¼ inches and thicker shall cut for shop use 60 per cent or better of the following clear cuttings or rippings, or both: 5¼ inches wide or wider by 3 feet long or longer; 9 inches wide or wider by 2 feet 4 inches long or longer; and strips 2 inches wide or wider, ripped the entire length of the piece from pieces 8 feet to 12 feet long, and strips 2 inches wide or wider, 12 feet long or longer, ripped from pieces 14 feet long or longer, provided that pieces under 5 inches wide in 4/4 inch stock and under 5¼ wide in 5/4 inch and thicker stock shall cut full width of the piece. In the above cuttings bright sap shall be admitted.

No. 2 shop.

Thickness.—1, 1¼, 1½, 2, 2½, 3, and 4 inch.

Width.—4 inches and over.

Length.—6 feet and over, not exceeding 5 per cent under 8 feet.

This grade shall cut for shop use 40 to 60 per cent of the same size cuttings or rippings, or both, as the corresponding thicknesses in No. 1 shop.

In the above cuttings stained sap shall be admitted.

Box.

Thickness.—1 to 2 inches.

Width.—Shall be random widths, 3 inches and wider.

Length.—6 to 20 feet.

Each piece shall contain 66⅔ per cent or more of sound cuttings, no single cutting to contain less than 72 square inches. No piece of cutting can be shorter than 2 feet nor narrower than 3 inches. Sound cuttings will admit all the defects allowed in No. 1 common. The waste material may be thin or absolutely worthless.

Panel stock.

Thickness.—$\frac{5}{16}$, $\frac{7}{16}$, $\frac{9}{16}$, and $\frac{11}{16}$ inch.

Width.—Shall be random widths, 8 inches and wider.

Length.—6 to 20 feet, admitting not over 15 per cent of 6 to 10 feet and not to exceed 5 per cent under 10 feet. Odd lengths admitted.

Shall be graded from the poorer side, B and better, except that bright sap will not be considered a defect.

Window and door frame stock, jambs, etc.

Window and door frame stock, rabbeted or plowed, shall be graded from the worked side, B and better and C and better.

Short lumber.

Short lumber is defined as lumber shorter than minimum standard length and, except as to lengths, shall be graded according to the rules governing standard grades.

West Coast Lumbermen's Association, standard grading and dressing rules for factory lumber, July 1, 1926.

The sizes and grades of factory and shop lumber and the sizes of cuttings for door and window stock conform to American Lumber Standards No. 413.0.

The following grading rules apply to cut door stock.

Cut door stock, kiln dried.

Cut to lengths and widths.

Nominal thicknesses (inches)	Finished thicknesses, S2S
	Inches
1⅜	1$\frac{5}{32}$
1⅝	1$\frac{13}{32}$
2	1$\frac{13}{16}$

	Lengths	Widths
Stiles	6 feet 8 inches to 7 feet 6 inches.	5 to 8 inches.
Bottom rails	2 to 3 feet	7 to 10 inches.
Top rails	do	5 to 6 inches.
Muntins	3 feet 6 inches to 4 feet.	Do.

Five-inch widths rough must be full 4⅞ inches wide when dry. Bright sap no defect in any grade. Allowance must be made for defects on face and edges that will stick, tenon, or sand out. Door stock must show on two sides; therefore, the grade must be determined from the poorer face.

Stiles.

No. 1 stiles.—Will admit slight torn grain $\frac{1}{64}$ inch deep. With the above will admit one of the following: One 3-inch pitch pocket located 35 inches or less from end of stile, not through thickness or into edge; one 4-inch pitch pocket located 24 inches or less from end of stile, not through thickness or into edge.

No. 2 stiles.—Will admit slight torn grain $\frac{1}{64}$ inch deep. With the above will admit one of the following or equivalent combinations of defects: Two 4-inch pitch pockets, not through thickness or into edge; two sound and tight knots, not over $\frac{5}{8}$ inch in diameter; light stain, not over 50 per cent of surface of one side of piece; one or more season checks with a combined length of not over 8 inches; small streak of light pitch.

No. 3 stiles.—Will admit slight torn grain. With the above will admit one of the following: Stain; small amount of pin wormholes on one side; sound and tight knots not over $1\frac{1}{2}$ inches in diameter; pitch pockets not over 8 inches in length; light pitch.

Bottom rails and lock rails (over 6 inches wide).

No. 1 rails.—Will admit slight torn grain $\frac{1}{64}$ inch deep; one 3-inch pitch pocket, not through thickness or into edge.

No. 2 rails.—Will admit slight torn grain $\frac{1}{64}$ inch deep. With the above will admit one of the following defects or equivalent combination of defects: Two 4-inch pitch pockets, not through thickness or into edge; two sound and tight knots, not over $\frac{5}{8}$ inch in diameter; light stain, not over 50 per cent of surface of one side of piece; one or more season checks, with a combined length of not over 8 inches; small streak of light pitch.

No. 3 rails.—Graded by same rules as govern No. 3 stiles.

Top rails, narrow lock rails, and muntins.

No. 1.—Will admit slight torn grain $\frac{1}{64}$ inch deep.

No. 2.—Will admit slight torn grain $\frac{1}{64}$ inch deep. With the above, will admit one of the following: One 4-inch pitch pocket, not through thickness or into edge; one sound and tight knot, not over $\frac{5}{8}$ inch in diameter; light stain, not over 50 per cent of surface of one side of piece; one or more season checks, with a combined length of not over 8 inches; small streak of light pitch.

No. 3.—Graded by same rules as govern No. 3 stiles, but defects must be proportionate.

Western Pine Manufacturers Association, grading rules for factory lumber, July 1, 1925.

Rules for measurement of factory plank and for grading Pondosa pine and Idaho white pine factory and shop lumber conform to American Lumber Standards, 413.0.

White Pine Association of the Tonawandas, grades of northern white pine lumber for door, window, and millwork, 1922.

The following grades of white pine lumber, as shown in 400.26 for this association, are suitable for door, window, and millwork lumber: No. 1 cuts, No. 2 cuts, No. 3 cuts, and No. 2 dressing.

413.9 MISCELLANEOUS SHOP AND FACTORY LUMBER.

American Lumber Industry, Simplified Practice Recommendation No. 16 for American Lumber Standards, revised July 1, 1926.

See 413.0, softwood factory and shop lumber.

California White and Sugar Pine Manufacturers Association, grading rules for miscellaneous shop and factory lumber, May 1, 1926.

Incense cedar pencil stock.

Pencil stock shall contain 50 per cent or more of clear squares, 8 inches or multiples of 8 inches in length, and equal to the thickness of the piece in width.

National Cigar Box Manufacturers' Association, grading rules for miscellaneous shop and factory lumber, in effect October 24, 1923.

The following recommendations were adpoted for the standardization of cigar box lumber, imitation and veneered cedar, made from sawed bay poplar lumber:

Imitation cedar, No. 1 grade.

Tops must be $\frac{5}{32}$ inch thick.

Ends or thick stock, must be $\frac{7}{32}$ inch thick.

Standard lengths shall be 3 feet and up.

No shipment of No. 1 stock shall contain more than 15 per cent of 3-foot lengths.

All 3 and 4 foot lengths shall be clear.

Five and six foot lengths will permit one sound knot not over 1 inch in diameter, or a split not over 4 inches long.

Seven and eight foot lengths may contain two sound knots not over 1 inch in diameter and a split not over 4 inches long.

Veneered cedar, No. 1 grade.

Three and four foot lengths must be free of blisters.

Five and six foot lengths may contain two $1\frac{1}{2}$-inch blisters.

Seven and eight foot lengths may contain not over three $1\frac{1}{2}$-inch blisters, or two 2-inch blisters.

Five to eight foot lengths will permit of an occasional loose edge on the veneer when it does not extend back over $\frac{1}{2}$ inch, and not over one-third the length of the board.

Pacific Lumber Inspection Bureau, grading rules for miscellaneous shop and factory lumber, Schedule M, 1925.

Douglas fir green pipe stock.

Flat grain.—Will allow sound and tight knots or small pitch pockets which do not go through the thickness of the piece, bright sap on the inside of the stave not extending more than halfway through the piece. Edges must be practically clear and contain no defects that will prevent a water-tight joint when worked. Edge grain may be included at shipper's option.

Port Orford cedar battery board stock.

No. 2 clear and better.—One inch and/or thicker, widths as specified, lengths 3 feet or longer, flat and/or edge grain, to contain not less than 90 per cent strictly clear full width cuttings, 6 inches and longer based on widths as specified. Cross, spiral, burly, and/or interlocking grain, wormholes, cat's-paws, bark seams, bird's-eyes, bark burls, knots, splits, wane, shake, and rot are considered defects. Allowing one of the above defects based on a board

1 inch thick, 6 inches wide, 6½ feet long. Seasoned sap no defect.

Battery board No. 1 shop.—Allowing 75 per cent or more of the above cuttings for No. 2 clear and better.

Battery board No. 2 shop.—Allowing 60 per cent or more of the above cuttings for No. 2 clear and better.

Battery board No. 3 shop.—Allowing 40 per cent or more of the above cuttings for No. 2 clear and better.

Southern Cypress Manufacturers Association, grading rules for miscellaneous shop and factory lumber, June 15, 1925.

Washing machine tub stock.

This stock shall grade B and better on the poorer face, shall be full specified thickness in the rough, and, when ordered in specified widths, shall be full width.

In consideration of the difficulty in grading this stock, it should be borne in mind that detail inspection on each and every piece is impractical, but it is contemplated that this stock shall be selected with a view to its suitability for its intended use.

West Coast Lumbermen's Association, grading rules for miscellaneous shop and factory lumber, July 1, 1926.

Windmill stock.

4 by 4 inches S1S1E or S4S, ⅜ inch off; 5 by 5 inches and 6 by 6 inches S1S1E or S4S, ½ inch off, each way. To be graded by same rule as structural timbers, No. 412.1.

Pipe stave stock rough green.

Defects based on 2 by 6 inches by 12 feet.

Pipe stave stock, F. G. and/or V. G.

Bright sap, not more than half the thickness from the inside of the piece. Edges must not contain defects that will prevent a water-tight joint when worked. Will admit the following defects, equivalent defects, or equivalent combinations of defects: Sound and tight knots, none through the piece; small (4-inch) pitch pockets, none through the piece.

Grading rules for Douglas fir, west coast hemlock, and Sitka spruce ladder stock.

Ladder stock.

Defects based on 4 inches by 12 feet.

Must be well manufactured and free from spiral or diagonal grain with a slope of more than 1 inch in a length of 15 inches, except that 15 per cent of any shipment may have a slope of grain of not more than 1 inch in a length of 12 inches, and free from curly spots or any other defects rendering it unfit for ladder stock. Will admit the following or equivalent defects: Bright sap, 25 per cent of face, and three very small (2-inch) pitch pockets.

Pole stock, rough green.

Defects based on 7-inch widths by 10-foot lengths.

Must be well manufactured and free from spiral or diagonal grain with a slope of more than 1 inch in 12 inches, and free from curly spots or any other defects rendering it unfit for the above uses. Will admit the following or equivalent defects: Bright sap, 25 per cent, and four very small (2-inch) pitch pockets in the piece.

414. RAW CORK, RATTAN, AND REED.

(See also 425.)

414.1 CORK.

Federal Specifications Board, United States Government Master Specification No. 338 for ground cork for insulating purposes, October 1, 1925.

I. General specifications.

There are no general specifications applicable to this specification.

II. Grade.

Ground cork shall be furnished in one grade only.

III. Material and workmanship.

The cork shall be of good quality, granulated to specifications, and baked to a dark brown color.

IV. General requirements.

The general requirements shall be as stated in Section V.

V. Detail requirements.

Ground cork shall be ground so that all passes through a ½-inch screen and be caught on a No. 8 screen. It shall weigh not less than 5½ pounds or more than 6½ pounds per cubic foot.

VI. Methods of inspection and tests.

Samples shall be selected by the inspector from each lot and tested to insure that the material submitted complies with all requirements of this specification.

VII. Packing and marking.

All ground cork shall be delivered in burlap bags containing 35 pounds.

Each bag shall be marked with the name of the material and the gross and net weight.

Each delivery shall be tagged with the name of the material, the quantity, the name of the contractor, and the purchase order number.

VIII. Notes.

Ground cork is intended to be used for insulating purposes.

414.2 RATTAN.

(No nationally recognized specifications available.)

414.3 REED.

(No nationally recognized specifications available.)

421. COOPERAGE, BARRELS, BOXES, AND SHOOKS.

421.0 GENERAL ITEMS.

American Railway Association, Freight Container Bureau, circular No. 14, woods used for making barrels and casks, April 30, 1924.

Material for and Manufacture of Outside Container.

Grouping of woods.—The principal woods used for the construction of shipping containers are classed for the purpose of this specification into four groups as follows:

Group 1

Alpine fir.	Lodgepole pine.
Aspen.	Magnolia.
Balsam fir.	Noble fir.
Basswood.	Norway pine.
Buckeye.	Redwood.
Butternut.	Spruce.
Cedar.	Sugar pine.
Chestnut.	Western yellow pine.
Cottonwood.	White fir.
Cucumber.	White pine.
Cypress.	Willow.
Jack pine.	Yellow poplar.

Group 2

Douglas fir.	Southern yellow pine.
Hemlock.	North Carolina pine.
Larch.	

Group 3

Black ash.	Sap gum.
Black gum.	Sycamore.
Maple (soft or silver).	Tupelo.
Pumpkin ash.	White elm.
Red gum.	

Group 4

Beech.	Hickory.
Birch.	Oak.
Hackberry.	Rock elm.
Maple (hard).	White ash.

Federal Government, standard apple barrel, August 3, 1912. (Public No. 252, H. R. 21480.)

The standard barrel for apples shall have the following dimensions when measured without distention of its parts: Length of stave, 28½ inches; diameter of head, 17⅛ inches; distance between heads, 26 inches; circumference of bulge, 64 inches outside measurement, representing as nearly as possible 7,056 cubic inches: *Provided*, That steel barrels containing the interior dimensions provided for in this section shall be construed as a compliance therewith.

Federal Government, standard barrel for fruits, vegetables, and other dry commodities, March 4, 1915. (38 Stat., ch. 158, p. 1186, 63d Cong.)

The capacities of the standard barrel for fruits, vegetables, and other dry commodities,[1] other than cranberries, and its subdivisions, are as follows:

Size	Cubic inches	Bushels [1]	Quarts [1]
Barrel	7,056	3.281	105
¾ barrel	5,292	2.461	78¾
½ barrel	3,528	1.641	52½
⅓ barrel	2,352	1.094	35

[1] Struck measure.

The capacities of the standard cranberry barrel and its subdivisions are as follows:

Size	Cubic inches	Bushels [1]	Quarts [1]
Cranberry barrel	5,826	2.709	86 4/11
¾ cranberry barrel	4,369.5	2.032	65 1/11
½ cranberry barrel	2,913	1.355	43 3/11
⅓ cranberry barrel	1,942	.903	28 7/11

[1] Struck measure.

The following standard dimensions and tolerances have been promulgated by the Director of the National Bureau of Standards and approved by the Secretary of Commerce.

The standard dimensions of a barrel for fruits, vegetables, and other dry commodities other than cranberries, and of a barrel for cranberries, with which the actual measured dimensions are to be compared, are as follows:

Dimensions	Barrel for fruits, vegetables, and other dry commodities other than cranberries	Barrel for cranberries
	Inches	*Inches*
Diameter of head	17⅛	16¼
Effective diameter of head	16¾	15⅞
Distance between heads	26	25¼
Circumference of bulge, outside measurement	64	58½
Length of stave	28½	28½

In the case of all subdivisions of the barrel for fruits, vegetables, and other dry commodities other than cranberries, and all subdivisions of the barrel for cranberries, the following dimensions are hereby standardized for the purpose of the application of tolerances, and the actual measured dimensions are to be compared with these:

[1] Lime is not included within the purview of the law or of these rules and regulations, since a more recent act (Public, No. 228, 64th Cong., approved Aug. 23, 1916) has established standard barrels especially for lime upon a weight basis.

Subdivisions of barrel for fruits, vegetables, and other dry commodities other than cranberries

Dimensions	¾ barrel	½ barrel	⅓ barrel
	Inches	*Inches*	*Inches*
Effective diameter of head	15¼	13⅜	11⅝
Distance between heads	23½	20½	18
Circumference of bulge, outside measurement	58½	51½	45¼

Subdivisions of barrel for cranberries

Dimensions	¾ barrel	½ barrel	⅓ barrel
	Inches	*Inches*	*Inches*
Effective diameter of head	14⅜	12⅝	11
Distance between heads	23	20	17½
Circumference of bulge, outside measurement	53⅜	47	41⅜

For the purpose of the application of tolerances, barrels for fruits, vegetables, and other dry commodities other than cranberries, are divided into two classes, as follows:

Class 1 shall include (*a*) all barrels no dimension of which is in error by more than the following amounts, and (*b*) all barrels one or more of the dimensions of which are in error by more than the following amounts, and which in addition have no dimension in error in the opposite direction:

	Error, inches
Effective diameter of head	¼
Distance between heads	¼
Circumference of bulge, outside measurement	1½

Class 2 shall include all barrels at least one dimension of which is in error by more than the amounts given above, but which in addition have at least one dimension in error in the opposite direction. (This class includes all barrels mentioned in sec. 1 of the law in the proviso reading: "*Provided*, That any barrel of a different form having a capacity of seven thousand and fifty-six cubic inches shall be a standard barrel.")

The tolerances to be allowed in excess or in deficiency on the dimensions of all barrels of class 1 shall be as follows:

	Tolerance, inches
Diameter of head	¼
Effective diameter of head	¼
Distance between heads	¼
Circumference of bulge, outside measurement	1½
Length of stave	½

The tolerance to be allowed in excess or in deficiency on all barrels of class 2 shall be 1½ inches (1.5 inches).

The tolerances to be allowed in excess or in deficiency on the dimensions of all barrels for cranberries shall be as follows:

	Tolerance, inches
Diameter of head	¼
Effective diameter of head	¼
Distance between heads	¼
Circumference of bulge, outside measurement	1⅜
Length of stave	½

The tolerances to be allowed in excess or in deficiency on all subdivisions of the standard barrel for fruits, vegetables, and other dry commodities other than cranberries, and on all subdivisions of the standard barrel for cranberries, shall be the values given in the following table:

Size of subdivision	Tolerance	
	For fruits, vegetables, and other dry commodities	For cranberries
	Inches	*Inches*
¾ barrel	1⅜ (1. 375)	1¼ (1. 25)
½ barrel	1¼ (1. 25)	1⅛ (1. 125)
⅓ barrel	1⅛ (1. 125)	1 (1. 00)

Federal Government, standard lime barrel, August 23, 1916. (Public, No. 228, 64th Cong.)

The act to standardize lime barrels, established a large and a small barrel of lime, the large barrel containing 280 pounds and the small barrel 180 pounds, net weight.

The following standard tolerances have been promulgated by the Director of the National Bureau of Standards and approved by the Secretary of Commerce.

When lime is packed in barrels, the tolerance to be allowed on the large barrel or the small barrel of lime shall be 5 pounds in excess or in deficiency on any individual barrel: *Provided, however*, That the average error on 10 barrels of the same nominal weight and packed by the same manufacturer shall in no case be greater than 2 pounds in excess or in deficiency. In case all the barrels available are not weighed, those which are weighed shall be selected at random.

When lime is packed in containers of less capacity than the standard small barrel, the tolerance to be allowed in excess or in deficiency on individual containers of various weights, shall be the values given in the column headed "Tolerance on individual package," of the following table, provided, however, that the average error on 10 containers of the same nominal weight and packed by the same manufacturer shall in no case be greater than the values given in the column headed "Tolerance on average weight," of the following table. In case all the containers available are not weighed, those which are weighed shall be selected at random:

Weight of package	Tolerance on individual package	Tolerance on average weight
	Pounds	*Pounds*
Not greater than 50 pounds	1½	⅝
More than 50 pounds and not greater than 100 pounds	2	¾
More than 100 pounds and not greater than 150 pounds	3	1¼
More than 150 pounds and less than 180 pounds	4	1½

When lime in bulk is sold, charged for, or purported to be delivered as a definite number of large or small barrels, the tolerance to be allowed in excess or in deficiency on such amounts of lime shall be 15 pounds per 1,800 pounds (10 small barrels), or 25 pounds per 2,800 pounds (10 large barrels).

421.1 TIGHT STAVES.

Associated Cooperage Industries of America, grade rules and specifications covering tight barrel staves and heading, November 9, 1926.

White oak bucked bourbon barrel staves.

Shall be manufactured of white oak and species of white oak that will be suitable for the purpose to be equalized 34, 35, or 35½ inches long, as agreed; to be, when thoroughly kiln-dried, ⅞ inch thick; and to average in width when close-jointed, free of sap, not exceeding 21 staves to the barrel; and to be free of seed or wormholes of any kind, cat faces or checks, and crooks inside or outside. (A twist, not varying to exceed ¾ inch from a straight line shall be allowed.) Crooks with hollow to back of stave, not exceeding ½ inch in variation to 12 inches in length, shall be allowed. Reverse crooks not admitted. Sound streaks that do not go through stave will be admitted, provided they are on inside of stave and over 6 inches from ends. (See notes 1, 2, 4, and 5 below.)

Bucked alcohol and whisky barrel-staves.

Same specifications as bucked bourbon staves, except length is to be 34 inches, and thickness ¾ inch after being thoroughly kiln-dried. (See notes 1, 2, 4, and 5 below.)

Sawed spirit, bourbon and rye whisky-barrel staves.

Shall be manufactured of white oak and species of white oak that will be suitable for the purpose, sawed with the grain from straight grain bolts, and equalized 34, 35, or 36 inches long, as agreed; to be evenly sawed and of uniform thickness throughout, and when thoroughly kiln-dried to be full ¾, ⅞, or 1 inch thick, respectively, when planed on inside or outside, and full $\frac{13}{16}$, $\frac{15}{16}$, and $1\frac{1}{32}$ inches thick, respectively, when not planed. To average in width when close-jointed, free of sap, not exceeding 21 staves to the barrel, and to be free of seed or wormholes of any kind, cat faces, or checks. Sound streaks that do not go through staves will be admitted, provided they are on inside of stave and over 6 inches from ends. The grain of the stave must be such that a straight line drawn at right angles across the thickness at the ends of a stave must pass through not less than three lines of grain at any one place. (See notes 1, 2, 4, and 5 below.)

Bucked or sawed half whisky and alcohol staves.

Same specifications as sawed spirit, bourbon, and rye whisky-barrel staves, length 26 to 30 inches, as agreed; thickness $\frac{11}{16}$ or ¾ inch, as agreed; and to average in width when close-jointed and free of sap not less than 19 staves to a half barrel. (See notes 1, 2, 4, and 5 below.)

Sawed wine-barrel staves.

Shall be manufactured of white oak and species of white oak that will be suitable for the purpose, sawed with the grain from straight-grain bolts, and equalized, 34 inches long, and to be when kiln-dried and planed on both sides, $\frac{11}{16}$ inch thick, and when planed on one side to be ¾ inch scant thick; to average in width when close-jointed, not exceeding 21 staves to the barrel. Slight defects not showing through on both sides admissible. (See notes 1, 2, 4, and 5 below.)

White and red oak oil-barrel or tierce staves.

Shall be equalized, 34, 35, or 36 inches long, as agreed, and to be, when thoroughly dry, ¾ inch thick, evenly sawed, and of uniform thickness throughout; to average in width when close-jointed, including sound sap, not exceeding 22 staves to the standard barrel. To be free from seed holes, cat faces which show through on both sides, wind shakes, and rotten sap.

It will be permissible to furnish kiln-dried and jointed staves of the above dimensions in bundles not to exceed 24 staves to a bundle, provided said bundles contain at least 10 per cent wide staves for bung staves averaging not less than 4 inches. (See notes below.)

Turpentine-barrel staves.

Shall be equalized, 34 inches long, and to be when thoroughly kiln-dried and planed, not less than ¾-inch thick, evenly sawed, and of uniform thickness throughout; to average in width, when close jointed, including sound sap, not exceeding 22 staves to the standard barrel. To be free from seed holes, cat faces, rotten sap, wood want, or proof. (See notes 1, 4, and 5; also note 2 as to length only.)

Cuban tierce staves.

Shall be equalized 35 inches long, and when thoroughly dry, to measure 1 inch thick; otherwise to grade same as ¾-inch oil or tierce; to average in width, when close jointed, including sap, not exceeding 22 staves to a barrel. (See notes below.)

Pork staves.

Shall be made of white oak, red oak, or ash, as agreed. Shall be equalized, 30 inches long, and when thoroughly dry, to measure ⅝ inch thick, evenly sawed, and of uniform thickness throughout; to average in width, when close jointed, including sound sap, not exceeding 19 staves to the barrel. To be free from seed holes, cat faces, wind shakes, and rotten sap. Slight defects not showing through on both sides of staves admissible. Pumpkin ash not permitted. (See notes below.)

Gum staves.

Gum staves shall be the same specifications as oil-barrel staves, 34 to 36 inches in length, as agreed, and manufactured of gum timber; tupelo gum not permitted unless otherwise agreed upon.

Half-barrel gum staves.

Half-barrel gum staves shall be the same specifications as the whole-barrel gum stave, either ⅝ or ¾ inch, as agreed, and 30 inches and under in length, as agreed.

All gum staves 30 inches and under shall be sawed ¾ or ⅝ inch, as agreed; otherwise specifications same as whole-barrel gum staves.

Mill-run white oak staves.

Mill-run white oak staves shall consist of the run of the saw, and grade oil staves and/or better.

No. 2 tight-barrel staves.

Any tight-barrel stave that is not suitable for a No. 1 grade and that will bend without breaking is to be considered as No. 2 grade.

Notes referred to above.

NOTE 1.—All staves must be evenly equalized, so as to be square on the ends.

NOTE 2.—Variations in staves. All staves must not be less than the standard measurement herein stated, but if ⅛-inch shorter or longer, or $\frac{1}{16}$-inch over or under specifications in thickness on one edge, will not affect the grade.

NOTE 3.—Wormholes: Sound wormholes in sawed oil tierce or pork stave, not exceeding two in a straight line across the width of the staves within 12 inches of the center, not more than five wormholes in any one stave, and 10 per cent of the number of staves in carload will be admitted.

NOTE 4.—All staves must have a proper circle; no flat staves will be accepted. A twist not varying to exceed ¼ inch from straight line shall be allowed.

NOTE 5.—When not otherwise agreed the following average widths shall apply as a basis of purchase and settlement: All staves over 30 inches in length, 4½ inches; all staves (including cut-offs) 26 to 30 inches in length, 4¼ inches; under 26 inches and over 18 inches, 4 inches; 18 inches and under, 3½ inches.

NOTE 6.—Unless otherwise specified by the buyer, all oil-barrel staves averaging 18 to 81 inches shall be jointed with a ¾-inch bilge, and for each stave in excess of 18 staves the bilge shall be reduced $\frac{1}{16}$ of an inch.

NOTE 6a.—Unless otherwise specified, kiln-dried and jointed staves shall measure to the set at the bilge as follows:

	Inches
34 inches and larger	81
28 to 30 inches, inclusive	68

NOTE 7.—That no regularly sawn or cut-off stave 30 inches in length or over when jointed shall be under 2½ inches or more than 6 inches in width, and no regularly sawn or cut-off stave under 30 inches in length when jointed shall be under 2 inches or more than 4½ inches in width; when exceeding these widths ¾ of an inch shall be allowed for splitting.

On all cut-off staves a variation of 1 inch over the length ordered should be permissible.

NOTE 7a.—Mill-run cut-off staves shall mean staves less than 34 inches in length which have been made from longer staves that were strictly mill run, and there shall be no sorting either before or after the stock is cut down. These short staves as well as the 34-inch shall grade oil grade or better.

NOTE 8.—A close listed whisky stave, measuring at the bilge ⅛ inch sap proof on outside of stave and ⅛ inch of wood want on heart edge outside, is permissible.

A close list on oil staves shall be permitted to show one-third the thickness of stave or wood want on the outside, measuring at the bilge.

(Note that this does not prevent parties contracting for staves on basis of any other width if they prefer. These specifications are to apply where there is no specific agreement.)

California Redwood Association, standard specifications for eastern grades of California redwood silo staves, April, 1927.

Silo staves will be dressed to the same standard thicknesses as finish and in widths and lengths as ordered, except as specifically provided for in contract.

Grades.

Clear heart (Redwood Association grade) and A (American Standard redwood grade).

Silo stave material shall be graded according to the rules for tank stock, 413.1.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir staves, Schedule M, 1925.

No. 1 staves.

No. 1 staves 1 by 3 inches by 4 feet. Sawn full size clear. If seasoned will allow ⅛ of an inch scant in width and thickness. Bright sap no defect.

No. 2 staves.

No. 2 staves 1 by 3 inches by 4 feet. Will allow variations in size of ⅛ of an inch in thickness and ⅛ of an inch in width. Two sound, hard knots not over ¾ of an inch in diameter allowed. Slightly discolored sap no defect.

West Coast Lumbermen's Association, grading and dressing rules for Douglas fir silo staves, July 1, 1926.

Silo staves.

Defects based on 2 by 6 inches by 12 feet.

Finished seasoned thicknesses (inches)	Finished green thicknesses (inches)	Finished seasoned face widths (inches)	Finished green face widths (inches)
1⅝	1⅝	5¼ outside 5⅛ inside	5⅜ outside. 5¼ inside.

"B and better" silo.

Must be water-tight full length of piece. Bright sap no defect. Will admit slight torn grain. With the above will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Three sound and tight small knots; 3 small dark-colored knots, none through; 2 small (4-inch) pitch pockets or equivalent of slightly larger pockets, none through thickness; small seasoning checks; 1 seasoning check $\frac{1}{16}$-inch wide, ¾-inch deep, 12 inches long. Warp or crook not admitted.

"Selected common" silo.

Must be water-tight full length of piece. Bright sap no defect. Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Medium sound and intergrown knots; pitch pockets not exceeding 6 inches in length, none through thickness; medium sap stain, 25 per cent of face. Warp or crook not admitted.

421.2 SLACK STAVES.

American Railway Association, Freight Container Bureau, circular No. 14, slack staves, April 30, 1924.

Material for staves.

The material for staves used in these containers must be good, sound lumber thoroughly seasoned so that it does not contain more than 12 per cent moisture based on the weight of the wood after over-drying to a constant weight, free from defects that materially lessen the strength of part, or interfere with proper nailing or constuction, or expose contents to damage. Decayed wood, slanting shakes, cross-grained material the grain of which runs out in less than two-thirds the length of stave, unsound knots, or knots greater than one-sixteenth the width of stave are considered as bad defects and must be eliminated.

The staves must be manufactured according to the following requirements:

Class	Minimum thickness		Bilge
	Groups I and II	Groups III and IV	
	Inches	*Inches*	*Inches*
A	6 to 2	6 to 2	¾
B	5 to 2	5 to 1⅞	¾
C	1⅝	5 to 1⅞	⅝
D	1½	5 to 1⅞	⅝
E	1⅜	1½	¾

The maximum, minimum, and approximate averge width of staves must be as follows:

Class	Approximate average	Maximum	Minimum
	Inches	*Inches*	*Inches*
A	3½	4⅔	2⅓
B	4	5⅓	2⅔
C	4	5⅓	2⅔
D	4	5⅓	2⅔
E	4½	6	3

Associated Cooperage Industries of America, standard specifications and grading rules for slack barrel staves, May 4, 1926.

Elm and gum staves 28½ inches and longer shall be cut five staves to 1⅞ inches in thickness.

Cottonwood and basswood staves 28½ inches and longer shall be cut five staves to $1\frac{15}{16}$ inches in thickness.

Elm, gum, cottonwood, and basswood staves 24 inches and shorter shall be cut six staves to 2 inches in thickness.

Hardwood staves, oak, beech, and maple 28½ inches and longer shall be cut six staves to 2⅛ inches in thickness.

Hardwood staves, oak, beech, and maple, 24 inches and shorter, shall be cut six staves to 2 inches in thickness.

White ash staves shall be cut five staves to 2⅛ inches in thickness.

No. 1 staves, except ash, shall be of uniform thickness, well equalized, circled and jointed, free from knots, slanting shakes, wormholes or dozy wood, except that moderate stain, slight roughness, flat staves less than 4 inches in width across the bilge, cross grained which will not break or splinter in tressing or slight warpage shall not be considered defects.

Meal-barrel staves shall be free of slanting shakes over 1½ inches long, knot holes, and unsound knots (but sound knot not over ¾ inch in diameter shall be allowed), and shall consist of good, sound, workable staves. Moderate stain, mildew, or discoloration no defect.

Mill-run staves shall consist of the run of the knife, well equalized, made from regular run of stave logs, and shall contain 40 per cent or more of No. 1 staves. All dead culls out.

No. 2 staves shall, unless otherwise specified, contain the meal-barrel grade and be free from dead culls. Mildew and stain no defect.

Standard bilge on staves, unless otherwise specified, shall be as follows: 18 to 22 inches in length, both inclusive, ½-inch bilge; 23 to 28½ inches in length, both inclusive, ⅝-inch bilge; 30 inches in length, ¾-inch bilge; 32 and 34 inches in length, ⅝-inch bilge.

Standard quarter shall be as follows: On staves 18 to 22 inches in length, 4½ to 5 inches, both inclusive; staves 23 or 24 inches, 6 or 6½ inches; on staves 27 to 29 inches both inclusive, 8 inches; 30 inches, 8½ inches; 32 and 34 inches, 9 inches.

No. 1 staves longer than 24 inches shall not be less than 2 inches nor exceed 5½ inches in width measuring across the bilge. No. 2 staves of same lengths may be from 2 to 6 inches in width.

All barrel staves 28½ inches and longer to average in measurement, after being jointed, 4 inches per stave, or 4,000 inches per thousand staves.

Half-barrel staves, 23, 23½, or 24 inches, 3½ inches to the stave, or 175 inches to the bundle of 50 staves.

Keg staves to measure 160 inches to the bundle of 50 staves except that 18-inch staves for use in the manufacture of apple barrelettes or half barrels to average 3½ inches to the stave and to be packed 175 inches to the bundle.

All staves shall be thoroughly air dried before jointing and shall be measured across the center of the bilge. Unless otherwise specified, it will be presumed that staves are to be air dried.

No. 1 white ash staves shall be of uniform thickness, smoothly cut, free from knots, slanting shakes, dozy timber, wormholes, stains or mold of any kind which make the stave unfit for use in the manufacture of No. 1 butter tubs, and to average not less than 75 per cent white.

No. 2 ash staves: Same specifications as No. 2 gum and elm. (Except as to bilge. See next paragraph.)

All ash staves shall be jointed with ⅝-inch bilge unless otherwise specified.

Mill-run apple barrel staves, unless otherwise specified, shall be cut six staves to 2 inches in thickness and shall consist of the run of the mill from the regular run of stave logs. An average of not less than 60 per cent of the staves in each bundle to be bright on the outside. At least 40 per cent of all staves to be No. 1. Mold on No. 1 staves no defect. All mill-run apple-barrel staves, unless otherwise specified, shall be jointed with $\frac{19}{32}$-inch bilge.

Cement barrel and all other staves not specifically mentioned should be sold according to the local custom or by special agreement. Same will apply as well to bilge of such staves.

Dead cull staves are staves containing knot holes of over 1 inch in diameter; staves with large, course knots near the quarter or within 1 inch of either end preventing staves from being tressed in barrels or properly crozed; staves cross-grained near the quarter to such an extent as will result in stave breaking when being tressed in barrel; staves under ¼ inch in thickness; staves with bad slanting shakes exceeding 6 inches in length or with rot that seriously impairs strength.

The term "gum mixed timber staves" shall be understood to include sycamore, elm, hackberry, maple, sweet gum, red gum, and birch, but not to include cypress, oak, ash, tupelo gum, cottonwood, pine, black gum, beech, or box elder.

421.3 HEADINGS AND HOOPS.

American Railway Association, Freight Container Bureau, circular No. 14, slack barrels and slack casks, April 30, 1924.

Material for heading.

The material for heading must be of good, sound lumber thoroughly seasoned so that it does not con-

tain more than 12 per cent moisture content based on the weight of the wood after oven drying to a constant weight, free from defects that materially lessen the strength of part or interfere with proper nailing or construction or expose contents to damage. Unsound knots or knots greater than one-third the width of cant, decayed wood and cross-grained lumber, the grain of which runs out in less than half the length of piece, are considered as bad defects and must be eliminated.

The number of cants per head must be not more than five for class E and four for all other classes; no cant less than 3 inches wide must be used.

The material must be finished so that the outside surface of head will be sufficiently smooth to permit of legible marking.

The heads must be properly circled; a variation of not more than 1 per cent between the largest and smallest diameter is allowable. They must be furnished with a 90° bevel ¼ inch wide on the face side of head, except as provided herein for contaniers with outer and inner head liners. The beveled faces forming the 90° bevel must form a triangle with a line perpendicular to face of head.

The heads must be not less than the following thicknesses:

Class	Minimum thickness	
	Groups I and II	Groups III and IV
	Inch	*Inch*
A	½	7/16
B	½	7/16
C	½	½
D	11/16	5/8
E	¾	5/8

Material for hoops.

The material for hoops must conform to the following:

Wooden ("patent") hoops.—Hoops must be made of elm or other timber of similar efficiency. The material must be made from good, sound timber, free from all defects that lessen strength of part or interfere with proper construction. Knots, decayed wood, and cross-grained material, the grain of which runs out in less than three feet, are considered as bad defects and must be elimated.

Oval bark hoops—The oval bark hoops must be made from oak or hickory saplings, preferably those cut down during the winter months The saplings must not be so large that the resultant hoops cut therefrom will be too large or difficult to apply to container. The hoops, at time of applying, must not be rotten or full of wormholes.

Wooden ("patent") hoops.—Thickness one edge 9/32 inch, other edge 5/32 inch, width 1⅜ inches when finished and properly seasoned in accordance with modern manufacturing methods. These dimensions apply for classes A, B, C, D, and E.

The ends of "patent" wooden hoops must be fastened together with at least three nails, staples, or tacks clinched at least ¼ inch on the inside.

Oval bark hoops.—The flat shaved part of oval bark hoops (so-called shaved hoops) must be not less in width than 1⅛ inches. The locks of such hoops must be made in accordance with best cooperage practice, and, in addition, the locks must be secured by not less than three nails driven through hoop and staves and clinched not less than ¼ inch on the inside.

Associated Cooperage Industries of America, grading rules for slack barrels, May 4, 1926.

Coiled elm hoops.

Standard dimensions of coiled elm hoops, 5 feet 6 inches and longer to be, when finished and seasoned, 9/32 by 5/32 by 1⅜ inches.

Dimensions of keg hoops 5 feet and shorter may be 4/16 by 2/16 by 1¼ inches, or standard dimension, as provided above.

No. 1 hoops shall be of good, sound timber, up to specifications, well finished and free from broken and other defective hoops in the coil in excess of 3 per cent on hoops over 5 feet in length, 5 per cent on 5-foot hoops, and 8 per cent on hoops less than 5 feet long which are unfit for use on a barrel, and to be dry when shipped.

Slack barrel heading.

No. 1 basswood, cottonwood, or tupelo gum heading shall be manufactured from good, sound timber, thoroughly kiln-dried, turned true to size, and shall be ½ inch in thickness after being dressed on one side, and free from all defects making it unfit for use in No. 1 barrels. Stain or discoloration on under side no defect. To be jointed straight unless otherwise specified.

No. 1 hard wood, gum and gum mixed timber heading shall be of the same specifications as in paragraph above, excepting that the thickness after being dressed shall be 7/16 inch.

Mill-run heading shall consist of the run of the saw from the regular run of heading bolts or logs, without any previous culling to select out the better grade, well manufactured, of standard thickness and kiln dried. All dead culls out, and to contain not less than 50 per cent No. 1 pieces or cants.

Pine heading, all sizes up to and including 16½ inches in diameter, shall be 7/16 inch in thickness after being dressed on one side: larger sizes shall be ½ inch in thickness after being dressed on one side. Specifications otherwise to be the same as provided for other species except as to thickness.

No. 2 heading shall be manufactured from heading blanks culled in the process of manufacturing No. 1 heading and shall be workable and free from dead culls.

All heading to be well bundled, 15 sets to the bundle, sizes 14⅛ to 19¾ inches, inclusive; two wires to the bundle, sizes under 19⅛ inches; three wires to the bundle, sizes 19⅛ and over. (See specifications following covering bundling of pine heading.) Number of pieces to the head not to exceed the following:

No. 1 and M. R. grades, above 13½ inches and to 17⅛ inches, inclusive, three and four pieces, at least 50 per cent to be three pieces, or less.

No. 1 and M. R. grades, 18 to 19½ inches, inclusive, three, four, and five piece, at least 50 per cent to be four piece, or less.

Heading that contains knot holes of over 1 inch diameter, bad slanting shakes, rotten timber, or other defects that make it unworkable shall be considered as dead culls.

All stock not specifically mentioned, staves, hoops, or heading, should be bought and sold on specifications agreed upon between the buyer and seller.

All heading, including pine heading, to be turned with a 90° bevel and ¼ inch wide on the face side of head unless otherwise specified.

Pine heading, up to and including 12½ inches, 25 sets to bundle, 2 wires.

Pine heading, over 12½ inches, to but not including 17⅛ inches, 20 sets to bundle, 3 wires.

Pine heading, 17⅛ inches and over, including 20 inches, 15 sets to bundle, 3 wires.

Pine heading, over 20 inches, 12 sets to bundle, 3 wires.

Associated Cooperage Industries of America, grading rules for tight barrel staves and heading, November 9, 1926.

STANDARD SPECIFICATIONS, TIGHT BARREL HEADING (CIRCLED)

Bourbon-barrel heading.

Shall be made of white oak and species of white oak, free of sap, that will be suitable for the purpose. All heading shall be sawed with the grain from straight-grained timber, properly seasoned, thoroughly kiln-dried, properly jointed, doweled and flagged, and to be 1 inch thick when finished.

Heading shall be planed on face side and uniformly circled to the required size not to exceed 20⅞ inches in diameter. Where heading is to be recircled by the purchaser the allowance of wood want on the bevel to make the required size, to be agreed by the buyer and seller. Sound streaks that do not go through heading will be admitted provided they are on inside of head and not less than 1 inch from bevel.

Heading to be composed of not exceeding five pieces, and no piece of the heading shall be under 3 inches in width.

⅞-inch whisky or bourbon barrel heading.

Same specifications as 1-inch bourbon-barrel heading, except that it shall be ⅞ inch in thickness when finished.

Spirit-barrel heading.

Same specifications as bourbon-barrel heading, except that it shall be ¾ inch in thickness when finished.

Wine-barrel heading.

Same specifications as bourbon-barrel heading, except that it shall be $\frac{11}{16}$ or ¾ inch in thickness, as agreed. Slight defects not showing through on both sides are permissible.

Half-barrel spirit heading.

Same specifications as whole spirit-barrel heading, except that it shall be not less than $\frac{11}{16}$ inch in thickness and not exceeding 17½ inches in diameter.

Half-barrel wine heading.

Same specifications as whole wine-barrel heading, except that it shall be not less than $\frac{11}{16}$ inch in thickness and not exceeding 17½ inches in diameter.

White oak oil barrel heading.

Shall be made of white oak timber and its species. Shall be evenly sawed, practically with the grain, and of uniform thickness, properly seasoned, thoroughly kiln-dried, properly jointed, doweled and flagged, and to be ¾ inch thick when finished.

Heading shall be planed on face side and uniformly circled to the required size not to exceed 20¾ inches in diameter unless otherwise agreed. Properly plugged wormholes, cat faces which do not show through on both sides, discolored sound sap will be permitted. No rotten sap permitted.

Not over 15 properly plugged wormholes in any one head to be permitted, and not more than 5 per cent of the carload to be of such stock. No plugged wormholes in the top bevel of the head to be permissible.

Heading to be composed of not exceeding five pieces, except 5 per cent of six-piece heading allowed.

Red oak oil-barrel heading.

Same specifications as white oak oil-barrel heading, except that it shall be made of red oak timber and its species.

Pork-barrel heading.

Shall be made of white oak, red oak, or ash timber and of the same specifications as the oil-barrel heading, except that it shall be ⅝ inch in thickness, not exceeding 17½ inches in diameter, unless otherwise agreed

Ash tierce heading.

Same specifications as oil-barrel heading, except that it shall be manufactured of ash timber, pumpkin ash not permitted.

Turpentine-barrel heading.

Shall be made of white oak timber and its species of white ash timber. Same specifications as oil-barrel heading except as follows: Two wormholes properly plugged in each piece of heading and one cat face which does not go through, in each head, shall be permitted. No discolored sap permitted.

White oak heading shall be ¾ inch to 1 inch in thickness. White ash heading shall be $\frac{15}{16}$ inch to 1 inch thickness and shall not exceed 20¾ inches in diameter.

Gum barrel heading

Same specifications as oil-barrel heading, except that it shall be manufactured from gum timber and shall not exceed 21 inches in diameter.

Gum half-barrel heading.

Same specifications as gum barrel heading, except that it shall be not less than ⅝ inch in thickness and not exceeding 17½ inches in diameter.

Keg heading.

Shall be of same specifications as to grades governing the different classes of whole barrel heading and shall not be less than ⅝ inch in thickness, and diameter as agreed upon by buyer and seller.

No. 2 tight barrel heading.

All tight barrel heads that are not suitable for No. 1 grade shall be classed as No. 2 grade, and all knots and knot holes to be permissible in No. 2 grade heading.

STANDARD SPECIFICATIONS, TIGHT BARREL HEADING (SQUARE)

(Adopted by Tight Heading Group, June 17, 1920)

Spirit heading, square.

Fifteen-sixteenth inch in thickness, 22 to 24 inches in length, 11-inch average. If no length is specified, 22 inches shall be considered standard length. For specifications as to grades, see bourbon-barrel heading (circled). (See note.)

Half-barrel spirit heading, square.

Thirteen-sixteenth inch thickness, 19 inches in length, 9 inch average. For specifications as to grades see bourbon-barrel heading (circled). (See note.)

Oak oil and tierce heading, square.

Seven-eighth inch thickness, 22 to 24 inches in length, 11-inch average. If no length is specified, 22 inches shall be considered standard length. For specifications as to grades see white oak oil-barrel heading (circled). (See note.)

Pork-barrel heading, square.

Three-fourth inch thickness, 19 inches in length, 9-inch average. For specifications as to grades see pork-barrel heading (circled). (See note.)

Ash tierce heading, square.

Fifteen-sixteenth inch thickness, 22 to 24 inches in length, 11-inch average. If no length is specified, 22 inches shall be considered standard length. For specifications as to grades see ash tierce heading (circled). (See note.)

Gum barrel heading, square.

Shall be cut plump 7/8 inch in thickness when green to finish up full 3/4 inch thickness when dry and planed, 22 to 24 inches in length, 11-inch average. If no length is specified, 22 inches shall be considered standard length. For specifications as to grades see gum barrel heading (circled). (See note.)

Gum half-barrel heading, square.

Shall be cut plump 7/8 inch in thickness when green to finish up 3/4 inch thickness when dry and planed, 19 inches in length, 9-inch average. For specifications as to grades see gum half barrel heading (circled). (See note.)

NOTE.—No piece under 3 inches in width permissible.

STANDARD SPECIFICATIONS FOR MEASURING FLAG

Twenty-four-inch butt flag shall measure 27 inches in circumference at the center, tied reasonably tight and well cured or seasoned.

BEER STAVE AND HEADING SPECIFICATIONS

A. Beer staves must be made from sound white oak timber free from short crooks and seed holes. Two sound wormholes in a piece may be allowed, but 90 per cent of each lot must be free from such defects.

B. Grain: They must be straight grain, or nearly so, and will be classed as culls if the grain has an angle of over 45°.

C. Checks: They must be free from heart checks, of such a nature as to make them unfit for the purpose for which they were intended.

D. Streaks: Staves may have black or red streaks on the inside, if they do not show through at any point between chimes, nor more than 1/4 inch deep at end; on outside if they do not show through at any point between chimes, nor more than 1/4 inch deep at end.

E. Minimum width of 1–1 barrel staves is to be 3 1/2 inches; 1/2 barrel and 1/4 barrel staves, 3 inches; 1/6 and 1/8 staves, 2 3/4 inches. Measurement taken on back of staves at bilge, including 1/4 inch of sap.

F. Each shipment is to be inspected by buyer, piece by piece, and the rejects, if any, laid aside for shipper's disposal.

G. Specifications: All staves are sold on listed basis, and the average width is to be arrived at by measuring 4 per cent of the prime staves taken at random from several parts of each carload, such average to be arrived at by measuring with a steel tape the over-all width of 50 or 100 staves at a time laid side by side. In case any of said staves have excess wane edges or surplus sap, deductions are to be made accordingly from such over-all measurement. Shipments must be accepted as prime when the percentage of rejects does not exceed 2 per cent.

H. The following dimensions are for green stock and constitute a standard stave, and a variation of 1/16 of an inch in thickness is allowed.

Dimensions

Size	Length	Thickness at—		Average width	Length of shoulder
		End	Bilge		
	Inches	*Inches*	*Inches*	*Inches*	*Inches*
1/8	16 1/2	1 1/4	1	3 3/4	2 1/2
1/6	18	1 1/4	1	3 3/4	2 1/2
1/4	20 1/2	1 1/2	1 3/16	4	3
1/2	25 1/2	1 5/8	1 5/16	4 1/4	3 1/2
1–1	31	1 3/4	1 7/16	4 1/2	4
Ale bbls	34	1 3/4	1 5/16	4 1/2	4
Ale hhds	40	1 7/8			

Beer heading.—Workmanship: Sawed, chipped, flat bucked. Specifications as to quality and grain, to be same as in staves, except as otherwise herein specified; streaks shall be allowed on one side only if same does not pass through over one-third of the thickness of the piece at the ends of same.

Size	Length of piece	Width per heading	Thickness
	Inches	*Inches*	*Inches*
1/8 heading	10 1/2	10 1/2	1 1/4
1/4 heading	13	13	1 1/2
1/2 heading	16 1/2	16	1 5/8
1–1 heading	18 1/2	18 1/2	1 3/4

Minimum width.—Shall be 3 inches full thickness, clear of sap; average pieces per set shall not exceed 5 pieces for ⅛, 6 pieces for ¼, 7 pieces for ½ and 1–1.

Memoranda.—Clauses F and G: These specifications to apply to heading also, and measurement and width on prime pieces only, and said measurement shall include ¼ inch sap on each piece.

Provisional memoranda.—Wane edges: Wane is to be included in the measurement of width of two-thirds of the total quantity where such wane measures ¾-inch thick on ⅛, ¼, and ½ pieces, and 1 inch on 1–1 pieces. One sound knot, not exceeding 1 inch in diameter showing only on one side and not within 1 inch of finished joint or bead will be admitted in prime heading, but not on more than 5 per cent of the quantity.

421.4 SHOOKS. (See also 421.3.)

National Association of Wooden Box Manufacturers, grading rules for white pine, cottonwood, gum, poplar and basswood, boxes and box shooks, August 15, 1905.

WHITE PINE BOXES

For Northwest Territory

Clear grade.

This grade is to have top, sides, and ends practically clear of all defects, except white sap, an occasional sound red knot, no larger than a dime. Bottoms may have small to medium red knots and some blue sap.

Grade No. 1.

Tops, sides, and ends shall contain no rot, black knots, wane, or wormholes, but may contain small to medium sized tight red knots. Bottoms may contain small to medium sized black knots, blue sap, stain, and some small wormholes, but no defect that will weaken the piece.

Grade No. 2.

Top, sides, and ends may contain the following defects, but not enough to weaken the piece: Large and small tight red knots, small black knots, a limited amount of red streak, shake; blue sap stain in small percentages will be allowed by this grade. Small wormholes will be allowed, but not numerous enough to make the box appear unsightly. Bottoms may be colored, but must be strong.

Grade No. 3.

This grade will admit of coarse knots, blue sap shake, red streaks, and a few wormholes, but must be strong for carrying heavy goods.

Grade No. 4.

Lumber in this grade may contain the following defects: Red streaks, soft rot, but soft rot shall not prevail in the complete box to a greater extent than 15 per cent. Coarse knots, wormholes, wane, and shake will be admissible in this grade. A large amount of blue stain shall not be considered a defect.

Grade No. 5 (large cleated boxes).

This grade will admit of coarse knots, blue sap, shake, soft rot, wormholes, waney, and narrow strips; in fact, anything that will hold nails and is suitable for carrying light, bulky goods. Not matched.

Grade No. 6.

This grade of box may contain many defects, such as soft rot, loose knots, wormholes, shakes; almost any defect will be admissible in this grade.

WHITE PINE STANDARD CANNED GOODS BOXES

(Two and Three Pound)

Grade No. 1. Style No. 1.

Standard thickness, ⅞ to ⅜ inch.

One piece side and end of standard thickness. This grade of boxes must be tight knotted and of good appearance and well manufactured.

Grade No. 2. Style No. 1.

Standard thickness, ⅞ to ⅜ inch.

This box can be made one-piece ends and two-piece sides. Will admit of red or black knots, a limited amount of red streaks, sap, and wormholes. Bottoms may be coarse, but not enough to weaken the box.

Grade No. 3. Style No. 5.

Standard thickness, ⅞ to ⅜ inch.

This box, style No. 5, inside cleats, may contain many defects, such as soft rot, loose knots, and wormholes, but must be strong enough to carry the contents.

WHITE PINE LEAF TOBACCO CASES

Grade No. 1. Style No. 5.

Sound red or black knots; will admit of some shake, blue sap, red streaks, wormholes. Tops and bottoms of three equal pieces, sides and ends of four pieces, no piece less than 4 inches wide.

Grade No. 2. Style No. 5.

This grade will admit coarse knots, and some loose knots if not too large, soft rot, shake, and wormholes, but must be strong enough to hold nails and carry the required weight of contents. All parts of four or more pieces, no piece less than 2½ inches wide, and defects must not materially weaken the pieces.

BASSWOOD GRADING RULES

Clear grade.

Lumber in this grade of boxes must be practically free from knots, and must be good color, running largely to white basswood. This grade can contain, however, 15 to 20 per cent of red color, but must not contain black or brown.

Grade No. 1.

Lumber in this grade of boxes must be good, sound material of mixed colors, light and brown, and should contain at least 50 per cent of reasonably light colored basswood. Small sound knots will be allowed in this grade, and some stain.

Grade No. 2.

Lumber in this grade of boxes shall be resaonably strong, but shall not be graded as to colors. Brown basswood can prevail in this grade; small knots and shake can prevail, but not in sufficient quantities

to materially weaken pieces. Some stain will be allowed in this grade.

Grade No. 3.

Lumber in this grade of boxes shall not be graded as to color. Black knots and stain will be allowed in this grade.

COTTONWOOD, POPLAR, AND GUM

Clear grade.

This grade is to have top, sides, and ends practically clear of all defects except white sap. The bottom may contain small, sound knots, a small amount of stained sap, and a few small wormholes.

Grade No. 1.

This grade is to have top, sides, and ends free from rot, shake, wane, or wormholes, but small sound knots are permissible. The bottoms may contain stain, small wormholes, and sound knots, but no defects that will materially weaken the piece.

Grade No. 2.

This grade is to have top, sides, and ends in which sound knots, a limited amount of stain, rot, shake, or wormholes are permissible, but not enough to materially weaken the piece. The bottom may be coarser, but must be strong.

Grade No. 3.

This grade will admit of coarse knots, small knot holes, splits, shake, rot, wane, stain, wormholes, and sound narrow strips, but must be strong for carrying heavy goods.

Grade No. 4.

This grade may contain many defects, such as coarse knots, knot holes, rot, wane, shake, splits, wormholes, black stain, and narrow strips; anything that will hold nails and be suitable for carrying light, bulky goods.

COTTONWOOD, POPLAR, AND GUM STANDARD CANNED GOODS BOXES

(Two and Three Pound)

Grade No. 1.

This grade is to have one-piece sides and ends. Boxes must be tight knotted and of good appearance and well manufactured. Standard thicknesses $\frac{9}{16}$ and $\frac{5}{16}$ inch.

Grade No. 2.

This box can be made with one-piece ends and two-piece sides, or vice versa. Sound knots, stain, and some splits, shake, rot, and wormholes will be permitted, but not enough to materially weaken the box. Standard thicknesses $\frac{9}{16}$ and $\frac{5}{16}$ inch.

Grade No. 3.

This grade may contain many defects, such as rot, coarse knots, small knot holes and wormholes, black stain, shake and splits, and is intended to be made style 5, inside cleats $\frac{5}{8}$ by $\frac{3}{8}$ inch. Standard thicknesses, $\frac{1}{2}$ and $\frac{1}{4}$ inch.

Western Pine Manufacturers Association, Box Bureau, rules for grading western pine box shooks and crating, May, 1925.

GENERAL INSTRUCTIONS

It is not intended that these rules shall apply without exception to every kind of box or crate made, for western pine shooks are made for every purpose and of a grade that will suit each individual buyer's requirements.

The rules are, however, an expression of the prevailing custom for grading the principal kinds of shooks manufactured in the inland empire, and as such represent the low line of each grade.

The grades are based on Pondosa pine, but shall apply to all inland empire woods for the present.

All stock shall be dried to a moisture content not to exceed 25 per cent.

Every precaution shall be exercised in cutting, ripping, and resawing, where resawing is called for, to produce rectangular shooks accurately cut to length, width, and thickness; but occasional pieces are admissible if variation from exact size is not more than $\frac{1}{8}$ inch in width, $\frac{1}{16}$ inch in pieces $\frac{11}{16}$ inch and over thick, and $\frac{1}{32}$ inch in thinner pieces.

Recognized defects are the same, in so far as applicable, as those specified in the lumber grading rules issued by the Western Pine Manufacturers Association.

Cleats shall be free from any defects that weaken them.

Shook edges may be rough, as in rough lumber if produced therefrom, and roughness does not constitute a defect.

Knots on ends or side edges that interfere with nailing are not admissible in any grade.

A knot shall be no larger than $\frac{1}{2}$ the width of the piece, and width shall be understood to be maximum measurement across the piece regardless of the position or shape of knot.

In shooks of larger size than given for the grade, knots may be more numerous but none larger in size than the maximum width stated.

Cross-grained lumber is not admissible in any narrow shooks; neither are spike or branch knots that are more than 3 inches long, in any shooks.

Reasonable effort shall be made not to include in fresh fruit packages any shooks that contain serious pitch defects.

As far as possible, shooks shall always be cut to exact specifications and grade. However, occasional off-grade pieces are practically unavoidable, and to cover these a variation from the rules of 5 per cent or less is provided.

Interpretation of the rules and decision on grade is vested in the Box Bureau, Western Pine Manufacturers Association and its representatives.

REINSPECTION

In case of a claim on grade, tally, or manufacture, upon the part of the buyer, reinspection is available upon request to the association.

The same stipulations and charges as are provided for lumber and are printed in the lumber grading rules shall also apply to claims on box shooks and crating.

In part, these are that the complainant buyer shall hold disputed material intact for not exceeding 60 days after filing complaint, and shall file complaint with seller within 10 days after receipt of shipment; otherwise material may be presumed to be accepted as invoiced.

A shipment shall be considered as of the grade invoiced if upon official reinspection 95 per cent thereof or more is found to be of grade invoiced, the material below said grade to be accepted as of its actual grade if usable.

Unless otherwise agreed upon the cost of reinspection shall be borne by the customer in the event that the amount below grade is found to be 5 per cent or less of the total amount of the item complained of. If more than 5 per cent, the expense shall be borne by the shipper.

Gross feetage shall be used as the basis for determining percentage below grade.

BOX AND CRATE SPECIFICATIONS

Detailed cutting specifications for the principal types of containers manufactured can be found in "Box and Crate Specifications," published and distributed by the Box Bureau.

Grades.

Select.—This grade includes macaroni, dried fruit, and other boxes requiring a neat, tight package, and may contain any two of the following defects in a piece 15½ by 9¾ inch surface measure, and proportionately more or less defects in larger or smaller pieces:

A.—Two 1½-inch round, tight red knots, or two ¾-inch tight black knots or equivalent in combination. Checked red knots that are not opened up are admissable. More small knots having same relative value are admissible.

B.—Heart pith ½ inch in width by one-half the length of piece stapled when necessary in one piece stock, but then only an occasional piece admissible.

C.—Slight traces of pitch or three small, dry pitch pockets, providing defect does not lessen high quality or appearance of piece.

D.—Light blue or red stain in sides, tops, and bottoms, but not to exceed 10 per cent in any shipment. Ends must be bright.

Powder boxes come in this grade and are graded as above with this difference: Light stain is admissible up to 25 per cent in any one shipment, and a piece may contain one round, tight red knot 2½ inches in diameter if otherwise practically clear and knot is at least 3 inches from any nailing edge.

Lumber for this grade must be surfaced clean on both sides before resawing.

Loose knots, branch knots, knot holes, wane, heart shake, season checks extending through piece, rot, and wormholes are not admissible.

Standard.—This is the usual grade manufactured and is supplied when grade is not specified.

The high line of the grade, which includes shooks having slightly more pronounced defects than will admit them in *select*, includes glass-bottle containers, candy boxes, soap boxes, milk boxes, and casket cases.

The low line includes all fresh-fruit packages, such as apple, pear, prune, peach boxes, and berry crates, also cannery cases, and may contain any three of the following defects, excepting *A*, in which case, 2½ to 3½ inch knots should be about the only defect in a piece 19¾ by 10½ inch surface measure, and proportionately more or less defects in larger or smaller pieces.

A.—One 3½-inch or two 2½-inch round or oblong sound, tight red knots when placed at least 3 inches from any nailing edge, and with practically no other defect in piece; or one 2-inch and one 1½-inch black knot if well set; or two 1-inch loose knots or knot holes, provided same are no closer than 2 inches from any nailing edge.

B.—Heart pith, stapled where necessary in one piece stock.

C.—Massed pitch over less than one-fourth surface area, or three or four dry pitch pockets, or equivalent in combination.

D.—Light to medium blue or red stain over entire surface of tops and bottoms, and an occasional side and end, not to exceed 20 per cent in any one shipment.

E.—Firm white-pitted red stain, not to exceed 10 per cent in any shipment.

F.—Slight season checks and heart shake permissible.

Merchantable.—This grade covers meat boxes, vegetable crates, machinery crates, and similar containers, and, in addition to defects mentioned in standard grade, may contain the following, but all pieces must be serviceable and strong. Slight wane where it does not weaken nailing edge; light to heavy blue or red stain up to 35 per cent in any shipment; more pronounced heart shake and season checks; and a few small wormholes.

421.5 BOXES, BARRELS, CASKS, AND HOGSHEADS. (See also 402., 421., and 492.)

American Society for Testing Materials, tentative specifications for canned-food boxes, wire-bound construction, D45–17T, 1917.

Boxes shall be well manufactured from sound (free from decay or dote), well-seasoned veneer and cleat lumber. Kiln-drying by excessively high temperatures or low humidities or below 6 per cent moisture shall be avoided. Veneer shall be free from knot holes, loose or rotten knots greater than 1 inch in diameter. Cleats shall be free from knots and from excessive cross grain. No knots will be permitted which will interfere with proper nailing or stapling. Each side, top, and end shall be of a single piece of veneer; the bottoms shall consist of not more than two pieces, no piece less than 4 inches in width.

Boxes for two dozen No. 2½, two dozen No. 3, and two dozen extra-size No. 3 cans shall be constructed as follows:

Each end shall be cleated with four cleats not less than $\frac{15}{16}$ by $\frac{11}{16}$ inch, or any other size cleats that have equally large cross section. One end of each cleat shall be provided with a tenon ¼ inch thick and $\frac{15}{16}$ inch long and the other end with the corresponding mortise. Cleats may be made of any of the following species of wood:

Red gum.	Oak.
Black gum.	Sycamore.
Maple.	Ash.
Birch.	Hickory.
Beech.	Hackberry.
Tupelo.	Yellow pine.
Elm.	

The sides, top, bottom, and ends shall be of ⅛-inch gum veneer. The box shall be bound with four equally spaced No. 16 gauge 0.0625-inch diameter, basic annealed wires. End wires shall be attached to cleats with No. 16 gauge by 1⅛-inch bright, soft Bessemer staples driven through the veneer into the center of the width of the cleats. Six staples shall be driven into each top and bottom cleat and four into each side cleat. Interior wires shall be attached to the veneer by No. 18 gauge, bright, soft Bessemer staples driven through and clinched, six staples connecting each wire to top and bottom and four to each side.

The ends shall be attached to each side cleat by four No. 18 gauge by $\frac{13}{16}$-inch staples equally spaced, driven into the center of the cleat and at an angle of 45° to 60° with the grain of the end; or by four nails ⅞ inch by 15 gauge by ¼-inch head, driven into the center of the cleat and equally spaced.

Boxes for two dozen No. 1, four dozen No. 1, and two dozen No. 2 cans shall be constructed as follows: These boxes shall be the same as those for No. 3 cans, except that wires shall be stapled to the tops and bottoms with four staples to each wire and to the sides with three staples to each wire.

Federal Specifications Board, Specification No. 271, U. S. Government master specification for vegetable crates, January 22, 1925.

Crates for potatoes.

Crates shall be made from a good, sound grade of box lumber, free from knot holes and loose or decayed knots. No knot shall be on nailing edges. Shall have inside dimensions as follows: 12 inches high, 15 inches wide, 31 inches long, and shall contain about 120 pounds net weight of potatoes. Ends and center partition shall be octagonal, 12 inches high by 15 inches wide, planed on both sides, and not less than ⅞ inch when finished. Ends shall be one or two pieces. If two pieces are used, shall have two corrugated metal fasteners at least 1 inch long and ½ inch wide; center partition shall be one, two, or three pieces. If two pieces, two corrugated metal fasteners shall be used, and if three pieces, four corrugated metal fasteners shall be used.

Tops and bottoms each shall have two slats 4½ inches wide, or one 4 inches and one 5 inches wide, shall be resawed and not less than $\frac{7}{16}$ inch in thickness. Remaining sides shall have eight slats not less than 2⅞ inches wide and not less than $\frac{7}{16}$ inch in thickness.

All nailing edges shall be well nailed with six-penny standard cement-coated nails, not less than 2 inches in length. Slats 4 inches wide or more shall have not less than three nails at each nailing edge and two at center. No slats shall have less than two nails at each nailing edge and one at center. Each end and center shall be well strapped with ½-inch flat iron, ends overlapping.

National Association of Wooden Box Manufacturers, specifications for boxes, 1921.

(In a publication entitled "Wooden Box and Crate Construction" are set forth the association's tentative general specifications for nail and lock-corner boxes, specific specifications for nailed and locked-corner boxes and general specifications for 4-one and similar boxes. These specifications are similar to those of the American Society for Testing Materials, designated as D44–20T, 1920, D68–22T, 1922, D118–21T, 1921. They cover both the dimensional requirements for the boxes and the mechanical and strength properties of the wood. See 402.42.)

422. BASKETS.

National Conference on Weights and Measures, specifications and tolerances for berry baskets or boxes, 1916.

The following specifications and tolerances were adopted by the Eleventh Annual Conference on the Weights and Measures of the United States, 1916, and recommended by the National Bureau of Standards for adoption by the several States:

Specifications.

Baskets or boxes for berries or small fruits, of a capacity of 1 dry quart or less, shall be of one of the following sizes: 1 quart, 1 pint, or ½ pint, dry measure.

Tolerances.

The tolerances to be allowed in excess or deficiency, on baskets or boxes for berries or small fruits, constructed of wood, shall not be greater than the following values:

Capacity of basket	Tolerance	
	In excess	In deficiency
	Cubic inches	*Cubic inches*
1 quart	3	1.5
1 pint	2	1.0
½ pint	1	.5

The tolerances to be allowed in excess or deficiency on baskets or boxes for berries or small fruits, constructed of pasteboard or fiber, shall not be greater than the following values:

Capacity of basket	Tolerance	
	In excess	In deficiency
	Cubic inches	*Cubic inch*
1 quart	2.0	1.0
1 pint	1.0	.5
½ pint	.5	.25

Federal Government, standards for Climax baskets for grapes and other fruits and vegetables, August 31, 1916 (39 U. S. Stat. L., p. 673).

The standard baskets for grapes and other fruits and vegetables are the 2-quart basket, the 4-quart basket, and the 12-quart basket, respectively.

The standard 2-quart Climax basket shall be of the following dimensions: Length of bottom piece, 9½ inches; width of bottom piece, 3½ inches; thickness of bottom piece, ⅜ inch; height of basket, 3⅞ inches, outside measurement; top of basket, length 11 inches and width 5 inches, outside measurement. Basket to have a cover 5 by 11 inches, when a cover is used.

The standard 4-quart Climax basket shall be of the following dimensions: Length of bottom piece, 12 inches; width of bottom piece, 4½ inches; thickness of bottom piece, ⅜-inch; height of basket, $4\frac{11}{16}$ inches, outside measurement; top of basket, length 14 inches, width 6¼ inches, outside measurement. Basket to have cover 6¼ inches by 14 inches, when cover is used.

The standard 12-quart Climax basket shall be of the following dimensions: Length of bottom piece, 16 inches; width of bottom piece, 6½ inches; thickness of bottom piece, $\frac{7}{16}$ inch; height of basket, $7\frac{1}{16}$ inches, outside measurement; top of basket, length 19 inches, width 9 inches, outside measurement. Basket to have cover 9 by 19 inches, when cover is used.

That the standard basket or other container for small fruits, berries, and vegetables shall be of the following capacities, namely, dry one-half pint, dry pint, dry quart, or multiples of the dry quart.

(*a*) The dry half pint shall contain $16\frac{8}{10}$ cubic inches.

(*b*) The dry pint shall contain $33\frac{6}{10}$ cubic inches.

(*c*) The dry quart shall contain $67\frac{2}{10}$ cubic inches.

The following tolerances in holding capacity and dimensions have been authorized under the rules and regulations of the Secretary of Agriculture:

Standard capacity	Tolerances and variations	
	Excess	Deficiency
	Cubic inches	*Cubic inches*
1 bushel	50	30
½ bushel	30	18
12 quarts	23	15
1 peck	16	10
½ peck	10	6½
2 quarts	5	3¼
1 quart	3	2
1 pint	2	1½
½ pint	1	¾

Dimensions	Tolerances and variations	
	Excess	Deficiency
	Inch	*Inch*
Length of bottom piece of 2-quart, 4-quart, or 12-quart Climax basket	⅛	⅛
Width of bottom piece of 2-quart, 4-quart, or 12-quart Climax basket	⅛	⅛
Thickness of bottom piece of 2-quart, 4-quart, or 12-quart Climax basket	$\frac{1}{32}$	$\frac{1}{32}$
Height of 2-quart, 4-quart, or 12-quart Climax basket, outside measurement	⅛	⅛
Length of cover of 2-quart, 4-quart, or 12-quart Climax basket	⅛	⅛
Width of cover of 2-quart, 4-quart, or 12-quart Climax basket	⅛	⅛
Combined length and width of top of 2-quart Climax basket, outside measurement	½	¼
Combined length and width of top of 4-quart Climax basket, outside measurement	⅝	⅜
Combined length and width of top of 12-quart Climax basket, outside measurement	¾	½

423. MILLWORK.

423.0 GENERAL ITEMS.

General Conference of Northeastern Millwork Interests, at Department of Commerce, division of simplified practice, April, 1925.

At a general conference of Northeastern Millwork Interests held under the auspices of the division of simplified practice at the Department of Commerce, Washington, D. C., on April 29, 1925, the following recommendations were adopted as the ones best calculated to meet the varying needs of the different localities in the Northeast.

RECOMMENDATIONS

That for the purpose of establishing the size of opening 4 inches in width and 6 inches in height over the glass measurement of two light windows be adopted as standard for all stock types of windows.

That for all standard windows the over-all sizes of component parts be as follows:

	Inches
Stiles and top rails	2¼
Meeting rails	1⅜
Bottom rails	3⅜
Muntins and bars	¾
Rabbets	¼
Parting beads	½

That for the present no recommendations be made on details of sticking.

That the finished thicknesses of standard windows and sash be 1⅛, 1⅜, and 1¾ inches.

That in standard casement and cellar sash the same widths of stiles, rails, muntins, bars, and rabbets be used as in standard window sash.

That for standard transoms and rim sash 2¼ inches over-all size of styles and rails be adopted; also ¾-inch muntins and ¼-inch rabbets.

That for stock panel doors—

Widths to be 1 foot 6 inches, 2 feet, 2 feet 4 inches, 2 feet 6 inches, 2 feet 8 inches, and 3 feet.

Heights to be 6 feet, 6 feet 6 inches, 6 feet 8 inches, and 7 feet.

Finished thicknesses to be 1⅛, 1⅜, and 1¾ inches.

That for stock sash doors, common designs—

Widths to be 2 feet, 2 feet 4 inches, 2 feet 6 inches, 2 feet 8 inches, and 3 feet.

Heights to be 6 feet 6 inches, 6 feet 8 inches, and 7 feet.

Finished thicknesses to be 1⅜ and 1¾ inches.

That for stock French doors—

Widths to be 1 foot 6 inches, 2 feet, 2 feet 4 inches, 2 feet 6 inches, 2 feet 8 inches, and 3 feet.

Heights to be 6 feet 6 inches, 6 feet 8 inches, and 7 feet.

Finished thicknesses to be 1⅜ and 1¾ inches.

That for sash doors, front door design—

Widths to be 2 feet 6 inches, 2 feet 8 inches, and 3 feet.

Heights to be 6 feet 6 inches, 6 feet 8 inches, and 7 feet.

Finished thicknesses to be 1⅜ and 1¾ inches.

That for garage doors—

Widths to be 4 feet each in pairs; 2 feet 8 inches each in sets of three.

Heights to be 7 feet 6 inches and 8 feet.

Thickness to be 1¾ inches.

That because of the special nature of the work no stock sizes be recommended for storm doors or cupboard doors.

That for the present no recommendations be made on stock sizes of blinds or shutters.

Southern Sash, Door and Millwork Manufacturers' Association, millwork catalogue of sash, doors, blinds, and general millwork, 1919.

(Catalogue of sizes of sash, doors, blinds, and general millwork supplied by the member companies. The association has adopted grading rules similar to those of the Wholesale Sash and Door Association.)

Wholesale Sash and Door Association, standard lists of open sash, glazed sash, panel doors, and outside blinds, 1926.

(Lists of standard designs and sizes of sashes and doors supplied by the member companies. There are also included the following grading rules for doors, windows, and blinds:)

Doors.

No. 1 quality.—Material in No. 1 doors must be clear, except defects not more serious in nature than a tight, sound knot, ¼ inch in diameter. No piece to contain more than one such defect, and no door more than a total of five such defects. In addition, stiles may contain one small pitch streak on one side.

White sap, light brown water stain, and light red kiln burn not considered defects.

Workmanship must be good.

Door with white pine stiles and rails and laminated panels are, unless otherwise specified, to have No. 1 quality stiles and rails. Panels to be three-ply, good two sides and may contain two or three piece faces if joints are well made.

No. 2 quality.—Material in No. 2 doors may contain pitch streaks, fine season checks, pitch pockets if silvered, light-blue sap showing on not to exceed 25 per cent of the area of any piece, and defects not more serious in nature than a tight, sound knot, ¾ inch in diameter.

No piece to contain more than two such defects, and no door to contain more than eight such defects on each side.

Plugs admitted, but regarded as defects.

Slight defects in workmanship admitted.

No. 3 quality.—Material for No. 3 doors may contain all blue sap, small wormholes, season checks, pitch streaks, pitch pockets, fine shake, and defects not more serious in nature than a tight knot 1¾ inches in diameter. No piece to contain more than 4 such defects and no door to contain more than 20 such defects on each side.

Plugs admitted, but regarded as defects.

Slight defects in workmanship admitted.

No. 4 quality.—Material for No. 4 doors may contain an unlimited number of coarse defects except rot, but each piece must be sound.

Defects in workmanship admitted.

Windows.

Check rail windows may contain one knot ¼ inch in diameter in each piece of a window. White sap may be admitted. Workmanship must be good.

Plain rail windows and sash may contain blue sap and small knots.

Blinds.

No. 1 outside blinds for paint must be made of sound lumber, and may contain small, sound pin knots, water stain, and white sap. Slight imperfections in workmanship also admitted.

No. 2 outside blinds must be made of sound stock which may contain sound knots up to ½ inch in diameter and any amount of either white or blue sap. Slight imperfections in workmanship admitted.

Wood admissible.

Wood other than Michigan, Wisconsin, and Minnesota or western pine may be admitted in doors, blinds, and windows.

423.1 DOORS. (See 413.8.)

423.2 SASH. (See 413.8.)

423.3 SLAT BLINDS. (See 413.8.)

423.4 SLATS. (See 413.8.)

423.5 PICKETS AND PALINGS.

Arkansas Soft Pine Bureau, grading rules for soft pine pickets, March 23, 1927.

The grading rules for pickets are the same as those of the Southeastern Forest Products Association and the Southern Pine Association given below.

California Redwood Association, standard specifications for eastern grades of California redwood pickets, porch rail, and other millwork items, April, 1927.

Pickets, porch rail, and other millwork items will be furnished in A and better grade equivalent in quality to those described for finish, and in sizes and patterns conforming to those published by this association, or by members thereof, or to special order.

Clear heart grade in above items shall be by special contract.

National Hardwood Lumber Association, rules for the measurement and inspection of cypress pickets, January, 1927.

Sizes.

1 by 1 inch, 1¼ by 1¼ inches, 1½ by 1½ inches, 1 by 3 inches, S4S to $\frac{13}{16}$ inch, $1\frac{1}{16}$ inches, $1\frac{5}{16}$ inches, and ¾ by 2½ inches, respectively, and headed.

Grades.

No. 1 and No. 2.

No. 1.—Must be straight and may have bright sapwood and one ½-inch sound knot or its equivalent.

No. 2.—Will admit sound defects that do not seriously impair the strength, or two ½-inch unsound knots or their equivalent showing on one face only, and slight shake in pieces free from other defects.

Pacific Lumber Inspection Bureau, grading rules for Douglas fir pickets, Schedule M, 1925.

Pickets, 1 by 3 inches, 4 feet; 4 feet 6 inches, 5 feet. Will allow variations in size ⅛ inch in thickness and ⅛ inch in width. Pitch pockets and two sound, hard knots not over 1 inch in diameter allowed. Slightly discolored sap no defect.

Southeastern Forest Products Association, grading rules for southern pine pickets, September 1, 1925.

Square pickets.

Square pickets, from 1½-inch stock, shall be worked to $1\frac{5}{16}$ by $1\frac{5}{16}$ inches, 3 and 4 feet long, dressed on four sides and pointed; 1¼-inch stock shall be worked to $1\frac{1}{16}$ by $1\frac{1}{16}$ inches, 3 and 4 feet long, dressed on four sides and pointed.

Flat pickets.

Flat pickets from 1 by 3 stock shall be worked to ¾ by 2¼ inches, 3 and 4 feet long, dressed on four sides and headed.

Southern Cypress Manufacturers Association, grading rules for cypress pickets, June 15, 1925.

Grades.

No. 1 and No. 2.

1 by 1 inch shall be headed and S4S to $\frac{13}{16}$ by $\frac{13}{16}$ inch.

1¼ by 1¼ shall be headed and S4S to $1\frac{1}{16}$ by $1\frac{1}{16}$ inches.

1½ by 1½ inches shall be headed and S4S to $1\frac{5}{16}$ by $1\frac{5}{16}$ inches.

1 by 3 inches shall be headed and S4S to ¾ by 2½ inches.

No. 1.—Shall be well manufactured, bright sap no defect, and may contain one small sound knot.

No. 2.—Shall admit stained sap, sound knots, pin wormholes, slight shake, and pickets thrown out of the No. 1 grade because of poor manufacture.

Southern Pine Association, grading rules for southern pine pickets, March 23, 1927.

Grading rules for pickets are the same as for Southeastern Forest Products Association, above.

West Coast Lumbermen's Association, standard grading and dressing rules for Douglas fir pickets, July 1, 1926.

Pickets, green or A. D.

1¼-inch square S4S to $1\frac{1}{16}$ by $1\frac{1}{16}$ inches.

1½-inch square S4S to $1\frac{5}{16}$ by $1\frac{5}{16}$ inches.

1 by 3 flat S4S to ¾ by 2¼ inches.

Square pickets will admit minor defects, such as slight torn grain or occasional pin knot, or two small pitch pockets. Flat pickets will admit slight torn grain, and two small pitch pockets, or two small sound and tight knots.

423.9 MISCELLANEOUS MILLWORK.

Red Cedar Lumber Manufacturers' Association, grading rules for red cedar porch columns and newels, August 1, 1925.

Specifications are the same as those of the West Coast Lumbermen's Association, below.

West Coast Lumbermen's Association, grading and dressing rules for porch columns and newels, July 1, 1926.

WESTERN RED CEDAR

Porch columns and newels.

Defects based on 8-foot lengths. Bright sap, no defect. No. 1 columns to grade 80 per cent clear, the balance of 20 per cent to admit the following defect, an equivalent defect, or an equivalent combination of defects: Four small sound and tight knots on the smooth part of the turned shaft or on the square. Boring to be at the option of the manufacturer. If bored, shall be as follows: The 5 by 5 inch and 6 by 6 inch shall be bored through with not less than 1¾-inch bit; the 4 by 4 inch to be bored through the square ends. The colonial columns shall be bored through with not less than a 2-inch bit.

DOUGLAS FIR

Turned porch columns. Green or A.D.

Defects based on 8-foot lengths. Bright sap, no defect. No. 1 columns to grade 80 per cent clear, and balance of 20 per cent to admit one of the following defects, equivalent defects, or an equivalent combination of defects: Four small sound and tight knots on the smooth part of the turned shaft or on the square; four small pitch pockets. Boring to be at the option of the manufacturer. If bored, shall be as follows: The 5 by 5 inch and 6 by 6 inch shall be bored through with not less than 1¾-inch bit; the 4 by 4 inch to be bored through the square ends; the colonial columns shall be bored through with not less than a 2-inch bit.

424. TANKS. (See 413.1.)

425. MANUFACTURES OF CORK.

425.1 STOPPERS (Cork).

(No nationally recognized specifications available.)

425.2 CORK BOARD OR COMPRESSED CORK.

Federal Specifications Board, specification No. 337, U. S. Government master specification for compressed cork (cork board), October 1, 1925.

Grade.

Compressed cork shall be furnished in but one grade.

Material and workmanship.

The material shall consist of pure granulated cork, compressed into board form, baked and held together by the natural cork gum as a binder.

Detail requirements.

Compressed cork shall not disintegrate or show an expansion in excess of 2 per cent in any of its linear dimensions after being subjected to the boiling test.

The weight per cubic foot shall be not less than 8 pounds nor more than 12 pounds.

The cork shall be furnished in blocks 36 by 12 inches, in thickness of 1, 2, 3, 4, 5, or 6 inches, as specified.

The boards shall be true to form and dimensions. A tolerance of $\frac{1}{16}$ inch under the specified thickness will be permitted.

Method of inspection and tests.

Representative samples shall be selected by the inspector from each lot of the same thickness, carefully checked as to dimensions, and submerged in boiling water at atmospheric pressure for three hours. Immediately upon removal from the boiling water the samples shall again be measured.

Packing and marking.

Each delivery shall be marked with the name of the material, the name of the contractor, and the purchase order number.

Notes.

Compressed cork shall be purchased on the basis of surface measurements, the unit price based on 1 square foot of a given thickness.

The material covered by this specification is intended to be used for insulating purposes.

Federal Specifications Board, specification No. 338, U. S. Government master specification, for ground cork for insulating purposes. (See 414.1.)

425.3 LIFE PRESERVERS, BELTS, AND BUOY RINGS (Cork).

Federal Government, Steamboat Inspection Service, Department of Commerce.

(Among the general rules prescribed by the Board of Supervising Inspectors for ocean and coastwise service are requirements relating to the safety features of life boats, life rafts, life preservers, and life buoys. Lists are issued of such life-saving equipment as has been officially approved for use on vessels.)

426. VEHICLES. (See also 400.3 and 413.54)

Society of Automotive Engineers, standards for wood spokes for motor truck and passenger automobile wheels, current 1927.

(These are dimensional standards for wood spokes conforming to those of the Automotive Wood Wheel Manufacturers Association.)

427. ELECTRICAL EQUIPMENT. (See also 401.3, 402.1, and 429.7.)

American Railway Association, Signal Section, specification No. 5716 for capping and grooved trunking for the protection of rubber insulated wires, 1916.

Finish.

It shall be surfaced four sides unless otherwise specified. Sides of groove may be sawed, but bottom shall be knife cut.

Dimensions.

(*a*) When surfaced four sides, it shall conform to dimensions in accordance with drawings; a variation of $\frac{1}{16}$-inch either way will be allowed in outside dimensions.

(*b*) The dimensions for the groove, as shown on the drawing, shall be adhered to as a minimum, and an increase in size of $\frac{1}{8}$-inch will be allowed as a maximum.

(*c*) It shall be shipped in lengths from 8 to 20 feet, but no shipment shall contain less than 30 per cent of 16-foot lengths nor more than 5 per cent less than 10 feet long. Odd lengths will be permitted.

General quality.

(*a*) Lumber shall be practically all heart.

(*b*) Knot holes will not be allowed.

(*c*) Shake, except as provided for elsewhere in this specification, will not be allowed.

(*d*) Wane will not be allowed.

(*e*) Any defects shall not be sufficient to impair the strength or prevent the use of any piece for the purpose intended in its full length and width.

(*f*) More than one split will not be allowed in any piece of trunking, and this shall not exceed in length the width of the piece. No split will be allowed in capping.

White or Norway pine.

(*a*) Sound tight knots not larger than $\frac{1}{2}$ inch, well scattered in any piece, will be allowed in capping.

(*b*) Sound tight knots not larger than $1\frac{1}{2}$ inches, well scattered in any piece, will be allowed in trunking.

Longleaf yellow pine or fir.

(*a*) Sound tight knots not larger than $\frac{1}{2}$ inch, well scattered in any piece, will be allowed in capping.

(*b*) Sound tight knots not larger than $1\frac{1}{2}$ inches, well scattered in any piece, will be allowed in trunking.

(*c*) Small pitch pockets not over 4 inches in length will be allowed.

Cedar.

(*a*) Lumber to be "select common and better" cedar, sound, and water-tight.

(*b*) Sound tight knots not larger than 1 inch, well scattered in any piece, will be allowed in capping.

(*c*) Sound tight knots not larger than 2 inches, well scattered in any piece, will be allowed in trunking.

(*d*) Knots shall be tightly interwoven with the fiber of the surrounding wood.

Cypress.

(*a*) Lumber shall be what is usually known as black or red cypress, and must, in all cases, be cut within 200 miles of salt water and at an elevation under 150 feet above sea level.

(*b*) It shall be free of splits, coarse peck, and shall be water-tight. A very slight amount of surface peck, season checks, and pin wormholes in the sides or bottom of the trunking will be allowed, provided such defects do not extend through from the outer surface into the groove. None of these defects will be allowed in capping.

(*c*) Sound tight knots not larger than ¾ inch will be allowed in capping or trunking. Sound tight knots not larger than 2 inches, well scattered in any piece, will be allowed in 3 by 4 inch trunking. Sound tight knots not larger than 3 inches, well scattered in any piece, will be allowed in trunking larger than 3 by 4 inches.

(*d*) A slight amount of shell shake that will not damage the nailing surface or cause a split will be allowed in trunking. Shell shake will not be allowed in capping.

(*e*) Capping 1½ inches thick or less shall be all heart. Capping thicker than 1½ inches may have 1 inch sap in sides and ½ inch in face.

(*f*) Trunking 3 by 4 inches and larger in the rough may have 1 inch sap on the corners of the bottom measured diagonally. Trunking smaller than 3 by 4 inches may have ½ inch sap on the corners of the bottom measured diagonally.

American Railway Association, Signal Section, Specification No. 1323 for hard fiber for use in railroad-track joints, switch rods, etc., for track-circuit insulation, 1923.

Samples for tests.

Three samples shall be selected at random by the purchaser or his representative from each lot or part thereof of 25 sheets of the same specified thickness or 500 fabricated pieces of the same specified thickness. Test pieces of the required size shall be sawed from each sample selected and shall be free from burs. If any of the samples fail to meet the requirements of any of the specified tests, the tests shall be repeated on two additional samples selected at random from different pieces of the same lot. Failure of one or both of these samples to meet the requirements of the tests will be sufficient cause for rejection of the lot.

Electrical test.

Using a voltmeter connected in series with pin-point electrodes, the points of the latter being spaced not to exceed ⅛ inch apart, and firmly pressed against the common face of the fiber, after the surface skin has been scraped from contact surface of fiber, there shall be no deflection of voltmeter needle with application of 220 volts.

Specific gravity.

Fiber shall have a specific gravity of not less than 1.3.

Compression test.

(*a*) A standard testing machine shall be used and the load applied through a metal tup ½ by ½ inch with corners rounded to 1/64 inch radius, arranged in such manner as to insure an equal bearing of the test sample over the entire surface of tup. A test piece 1 by 1 inch by the thickness shall be placed under an initial load of 100 pounds and the zero reading taken. A load of 5,000 pounds shall then be applied. The depth of depression shall be measured by the mean reading of two suitable measuring and indicating appliances mounted on the upper crushing head of machine, the samples being supported on the lower crushing head, and shall not exceed the following:

Specified thickness	Mean depression
Inch	*Inch*
⅛	0.024
3/16	.030
¼	.038
⅜	.052

(*b*) Bushing shall not be subject to compression test.

Absorption test.

A test piece 1 by 1 inch by the thickness shall be weighed and placed in water at room temperature. It shall be removed from the water at the expiration of six hours, the excess moisture wiped off, and the test piece weighed immediately. The increase in weight shall not exceed 0.67 gram.

Allowable variation in sizes.

(*a*) Sheets and fabricated parts, except as noted below, shall be within the following tolerances of thickness:

Specified thickness (inch)	Maximum thickness	Minimum thickness
	Inch	*Inch*
⅛ (0.125)	0.135	0.113
3/16 (0.187)	.197	.170
¼ (0.250)	.270	.230
⅜ (0.375)	.395	.355

(*b*) Head pieces and base pieces for use in insulated rail joints, each bar of which has three bearing surfaces, shall be within the following tolerances of thickness:

Specified thickness (inch)	Maximum thickness	Minimum thickness
	Inch	*Inch*
⅛ (0.125)	0.133	0.123
3/16 (0.187)	.195	.185

(*c*) Bushings of ferrules shall not vary either way more than 0.0075 inch on inside diameter nor more than 0.0075 inch on outside diameter, allowing maximum variation in thickness of wall of 0.015 inch. Maximum variation in length of bushings or ferrules shall be 1/32 inch.

(*d*) End posts shall not, in contour, exceed the contour of the proper rail section at any point, but may come within the rail section contour by not more than 1/32 inch. At the option of the purchaser, the height of head may be decreased by ⅛ inch to meet worn rail conditions.

Workmanship.

Edges shall be generally free from burs, fins, splits, and other defects.

Waterproofing.

An approved waterproofing substance shall be applied to the material after it has been accepted by the inspector.

American Railway Association, Signal Section, specification No. 6418 for impregnated fiber conduit for the protection of insulated wires and cables, 1918.

Material.

The conduits shall be made of finely divided wood pulp or fiber, thoroughly saturated with bituminous insulating compound.

Properties.

(*a*) The inner surface of the conduit shall be free from dents or obstructions and from flaky areas or any considerable excess of the impregnating compound.

(*b*) The bore shall be straight and shall not vary in cross section more than ⅛ inch from a true circle and shall be uniform in dimension as gauged by the ability to pass a mandrel 36 inches in length of ¼ inch less in diameter than the normal size of the conduit.

(*c*) Pieces up to 15 per cent of the shipment may be less than 5 feet, but shall be not less than 3 feet in length.

(*d*) The conduit shall have an inside diameter of 1½, 2, 2½, 3, 3½, or 4 inches, as specified.

Joints, fittings, and bends.

(*a*) Joints shall be of the socket type with the mortise on one end and the tenon on the other end of all conduits, fittings, and bends. The mortise and tenons of the joints shall be slightly tapered not less than ⅜ inch long and machine turned to a close fit.

(*b*) Fittings and bends shall be made of the same material as the conduit and shall possess the same mechanical strength and insulating quality.

(*c*) Bends shall be 45°, 90°, and S shape, and shall conform to the following dimensions:

45° and 90°			S bends	
Diameter (inches)	Length	Radius	Offset	Radius
	Feet	*Inches*	*Inches*	*Inches*
1	5	12-18-24-36	20	36
1½	5	12-18-24-36	20	36
2	5	12-18-24-36	20	36
2½	5	18-24-36	20	36
3	5	18-24-36	20	36
3½	5	18-24-36	20	36
4	5	18-24-36	20	36

(*d*) Conduit for bootlegs shall be 2 inches inside diameter, with a 12-inch radius, 90° bend at one end of a 5-foot section.

Tests.

(*b*) Manufacturer shall provide, at point of production, apparatus and labor for making the required tests under supervision of the purchaser.

(*d*) Tests shall be made as required on requisite sheet.

(*e*) Ten complete tests, enumerated below, shall be made from conduit selected at random from each carload lot; and two complete tests, enumerated below, shall be made from conduit selected at random from less than carload lots.

1. Acid.
2. Heat.
3. Insulation.
4. Deflection.
5. Crushing.
6. Moisture absorption.

Description of tests.

(*a*) *Acid test.*—Six samples of conduit shall not be injuriously affected by being immersed for 18 hours in 10 per cent solutions at 70° F. (21.1° C.) of sodium carbonate, nitric acid, hydrochloric acid, and sulphuric acid. The conduit shall be free from all substances which might injuriously affect rubber-covered wire or lead-sheath cable.

(*b*) *Heat test.*—Wall of the conduit shall be compact; a 6-inch sample shall not disintegrate, separate into layers, or collapse after lying on its side in water for 1½ hours at a temperature of 212° F.

(*c*) *Insulation test.*—Wall of the conduit after being immersed in pure water at 70° F. for 48 hours shall not puncture when alternating current of 20,000 volts is applied, by mercury contacts, to each side of the wall at opposite points.

(*d*) *Deflection test.*—Conduit at 70° F. resting on supports 26 inches apart shall not exceed the deflection and shall not break under load indicated in the following table, when the load is centrally suspended between the supports.

(*e*) *Crushing test.*—A 6-inch length of conduit at 70° F. shall not be crushed when placed between two flat surfaces under pressure of weight shown in the following table:

Inside diameter (inches)	Thickness of wall	Deflection	Breaking weight	Crushing weight
	Inches	*Inches*	*Pounds*	*Pounds*
1	¼	½	150	575
1½	¼	⅝	200	575
2	¼	¾	300	506
2½	¼	¾	450	500
3	¼	¾	550	347
3½	¼	⅝	800	317
4	¼	⅝	900	310

(*f*) *Moisture absorption test.*—Six inches of conduit shall be thoroughly dried at a temperature of 110° F. for 4 hours, then weighed, and after immersion for 48 hours in pure water at 70° F. shall show less than 4 per cent increase in weight.

American Railway Association, Telegraph and Telephone Division, specification for creosoted wood conduit, 1920.

Material.

The conduit shall be made of sound yellow pine, Norway pine, or black gum. Each section of conduit shall be free from loose, rotten, or hollow knots, knot or wormholes, rot or rotten streaks. No section of conduit shall contain splits (either from seasoning, ring hearts, rough handling, or incident to preservative treatment) which increase the over-all dimensions of the conduit beyond the specification limits or which extend through the wall and run back beyond the mortise and tenon ends. Wane edge shall not be considered an objection, provided a flat surface of at least 3 inches remains, and provided further that the thickness of shell is not less than ⅝ inch. No conduit shall contain plugged knot holes.

Dimensions.

(*a*) Unless otherwise specified, no section of conduit in any shipment shall be less than 2 feet in

length, not more than 2 per cent of the conduit shall be between 2 and 3 feet in length, and not more than 15 per cent shall be between 3 and 6 feet in length. The remainder of the conduit shall be between 6 and 8 feet in length.

(*b*) All conduit shall be of uniform section and shall not vary more than $\frac{1}{16}$ of an inch from 4½ inches square outside. A straightedge laid lengthwise on the concave side of a length of conduit 8 feet long shall not show an off-set greater than ½ inch.

The allowable bow in short lengths shall be proportionate to the limits specified for 8-foot lengths. No length of conduit shall be twisted, bent in more than one direction, or bent in one direction on edge.

(*c*) The wall of each length of conduit shall be not less than ⅝-inch thick at its thinnest part.

(*d*) Each length of conduit shall be provided with a tenon at one end and a mortise at the other end, as hereinafter specified. All tenons and all mortises shall be of uniform size throughout. Each tenon shall be at least 1⅛ and not more than 1¼ inches in length and not less than $\frac{5}{16}$ inch thick. Each mortise shall be at least 1¼ and not more than 1⅜ inches in length. The outside diameter of each tenon shall be not more than $3\frac{11}{16}$ inches. The mortise shall be of a diameter to admit a tenon not greater than $3\frac{11}{16}$ inches outside diameter. The tenon shall be a snug fit in the mortise, but not so tight as to cause the conduit to split on being driven together.

Creosoting process.

All conduit shall be impregnated with dead oil of coal tar or coal-tar creosote, in accordance with specification for creosoting timber (to be issued later). The average impregnation of each cylinder load shall be not less than 15 pounds per cubic foot of wood.

The oil used in creosoting the conduit shall conform to specification for dead oil of coal tar or coal-tar creosote. The oil shall be tested in accordance with specification for the analysis of dead oil of coal tar or coal-tar creosote. (Specifications mentioned, to be issued later.)

American Railway Association, Telegraph and Telephone Division, specification for creosoted wood plank for use in underground construction, 1920.

Material.

All plank shall be made of yellow-pine timber, and shall be free from dry rot or decay of any kind; wane extending through the thickness of the plank; loose, rotten, or hollow knots; wormholes; through shakes over 6 inches in length; and round shakes. Sapwood is not considered objectionable.

Dimensions.

(*a*) Unless otherwise specified, plank shall be either 1 or 1½ inches thick, and either 4½, 9, or 13 inches wide.

(*b*) All plank shall be of uniform section, with ends sawed square. The plank shall be not over ¼ inch scant in thickness or in width from the size specified. No plank shall be less than 10 feet in length, and 50 per cent of the planks shall be not less than 16 feet in length.

Creosoting.

All plank shall be impregnated with dead oil of coal tar or coal-tar creosote, in accordance with specification for creosoting timber. The average impregnation for each cylinder load shall be not less than 15 pounds per cubic foot of wood, unless otherwise specified.

American Railway Association, Telegraph and Telephone Division, specification for impregnated fiber conduit for the protection of wires and cables, 1920.

Properties.

(*a*) The inner surface of the conduit shall be free from dents or obstructions and from flaky areas or any considerable excess of the impregnating compound.

(*b*) The bore shall be straight and shall not vary in cross section more than ⅛ inch from a true circle.

(*c*) Pieces up to 15 per cent of the shipment may be less than 5 feet but not less than 3 feet in length.

Joints, fittings, and bends.

(*a*) Mortise and tenon of the socket joints shall be a close fit and not less than ⅜ inch long and slightly tapered.

(*b*) Sleeve and ends of sleeve type joints shall be turned to a close fit.

(*c*) Fittings and bends shall be made throughout of the same material as is used in the conduit and shall possess the same mechanical strength and insulating qualities.

(*d*) Bends shall be made 90° and shall conform to the following dimensions:

Inside diameter (inches)	Length	Radius
	Feet	*Inches*
1½	5	18–24–36
2	5	18–24–36
2½	5	24–36
3	5	36
3½	5	36
4	5	36

Tests.

(*a*) The material shall not be affected by acids or alkalies which may be present in the ground and shall itself be free from all substances which might injuriously affect rubber-covered wire or lead-sheath cable.

(*b*) Walls shall be compact and shall not disintegrate when heated to a temperature of 212° F.

(*c*) The bore shall be uniform, as gauged by the ability to pass a mandrel 36 inches in length of ¼ inch less diameter than the normal size of the conduit.

(*d*) The wall of the conduit after being immersed in pure water at 70° F. for 48 hours shall not puncture when alternating current at a pressure of 20,000 volts is applied by mercury contacts to each side of the wall at adjacent points.

(*e*) Sample of conduit at 70° F. resting on supports 26 inches apart shall not exceed the deflection and shall not break under the load as shown in table, paragraph (*f*), when the load is centrally suspended between the supports.

(*f*) A 6-inch sample of conduit at 70° F. shall not be crushed when placed between two flat surfaces under the pressure of a weight shown in the following table:

Inside diameter (inches)	Thickness of wall	Deflection	Breaking weight	Crushing weight
	Inch	*Inch*	*Pounds*	*Pounds*
1¼	¼	⅝	200	475
2	¼	¾	300	506
2½	¼	¾	450	500
3	¼	¾	550	347
3½	¼	⅝	800	317
4	¼	⅝	900	310

(*g*) A 6-inch sample of conduit shall be thoroughly dried at a temperature of 110° F. for 4 hours, then weighed, and after immersion for 48 hours in pure water at 70° F. shall show less than 4 per cent increase in weight due to absorption of water.

(*h*) Tests may be made at point of production or on samples submitted and may also be made at destination.

(*i*) Contractor shall give purchaser sufficient notice of time when material will be ready for testing and cooperate to set a time convenient to the purchaser for inspection.

(*j*) Contractor shall provide at point of production apparatus and labor for making the required tests under supervision of the purchaser.

428. HANDLES, OARS, AND PADDLES.

428.1 HANDLES FOR AGRICULTURAL IMPLEMENTS.

Ash Handle Association, rules for the grading of ash handles, April 27, 1927. (These rules were approved as the recommended practice of the industry at a general conference called by the division of simplified practice on August 19, 1927.)

FORK, HOE, RAKE, AND SHOVEL HANDLES

XX Grade.

Color.—White, light red, mixed white, and light red. Dark red brown at tool end, extending not more than 10 inches from end.

Weight.—Heavy.

Texture.—Tough.

Growth.—Not less than 5 and not more than 17 rings of annual growth per inch of radius.

Grain.—Straight, allow slight cross at one end only, crossing at pitch of 1 to 8 inches, cross not to extend more than 7 inches from end. Grain may cross in entire length of handle.

Blemishes.—One allowed for each 24 inches of length or fraction thereof, but blemishes must be 12 inches or more apart.

(*a*) Butterfly marks that do not materially affect appearance.

(*b*) Pin twig marks.

(*c*) Cat faces that do not materially affect appearance.

(*d*) Mineral streaks, sound, not over 1 inch in length.

(*e*) Barky ends that will chuck off.

(*f*) Flat handles that can be worked.

X grade.

Color.—White, red, mixed white and red, slightly black and brown. Calico ash, if not too variegated.

Weight.—Medium.

Texture.—Medium.

Growth.—Not less than 3 and not more than 21 rings of annual growth per inch of radius.

Grain.—Allow cross, if not less than a pitch of 1 to 12 inches. Allow one cross end only, at a pitch of 1 to 6 inches, extending not more than 12 inches from end.

Blemishes.—Two allowed for each 18 inches of length or fraction thereof, but blemishes must be 6 inches or more apart.

(*a*) Butterfly marks if not too large and too black.

(*b*) Knurls, not more than two to a handle, not more than $\frac{3}{16}$ inch deep, at least 3 inches long.

(*c*) Cat faces, not more than 1 inch in its longest diameter.

(*d*) Curly stock, not more than one handle in four.

(*e*) Barky ends that will chuck off.

(*f*) Flat handles that can be worked.

(*g*) Mineral streaks, sound, that do not affect service.

(*h*) Knots, two not over ⅛ inch each if sound and not too dark and if located at ends.

(*i*) Pin twig marks.

No. 1 grade.

Texture.—Serviceable for this grade.

Grain.—Allow cross, if not less than a pitch of 1 to 6 inches. Allow cross on knob end at a pitch of 1 to 3 inches, extending not more than 6 inches from end.

Blemishes.—The following are allowed:

(*a*) Butterfly marks.

(*b*) Knurls that do not affect service for this grade.

(*c*) Cat faces.

(*d*) Curly stock.

(*e*) Barky ends that will chuck off.

(*f*) Flat handles that can be worked.

(*g*) Mineral streaks, sound.

(*h*) Knots that do not affect the service for this grade.

428.2 HANDLES FOR TOOLS.

Hickory Handle Association, grades for hickory tool handles, 1927. (These rules were approved as the recommended practice of the industry at a general conference called by the division of simplified practice on August 19, 1927.)

Material.

To be made from all commercial species of hickory.

Classification.

Handles to be classified according to following:

GENERAL RULES

Strength as shown by the growth, weight, resiliency of the handles.

Defects, blemishes, imperfections, with relation to serviceability.

Color and general appearance of the wood.

NOTE.—Weight and resiliency are to be determined by the inspector's knowledge of the weight and required density of the wood. Rings of annual growth will not be counted unless question arises regarding grade, when decision will be based on annual rings.

GRADES

Handles 24 Inches and Longer

Grades.

AA.—Handles having not over 17 rings of annual growth per inch of radius, heavy weight, thrifty growth, all white, free from all defects.

AW and AR.—Handles having not over 22 rings of annual growth per inch of radius, good weight, live growth, free from all defects. Handles of this grade will be supplied in all white wood, the grade symbol being AW; or in red, white, or mixed red and white, for which the symbol will be AR.

BW and BR.—Handles having not over 27 rings of annual growth per inch of radius, good weight, live growth. Permitting such handles as have slight iron streaks not exceeding four in number running the entire length of the handle or the equivalent in shorter lengths. To be free from defects except in the first third of the length from the grasp end, or in the eye where is permitted one sound or tight knot or bird peck not over ¼ inch in diameter or two such knots or bird pecks where combined diameters do not exceed ¼ inch in diameter or slight deflection of grain. Handles of this grade will be supplied in white wood, the grade symbol being BW; or in red, white, or mixed red and white, for which the symbol will be BR.

C.—Serviceable handles, which due to defects are not permitted in the higher grades.

Hammer and Hatchet Handles

Grades.

SAW and SAR.—Handles having not over 17 rings of annual growth per inch of radius, heavy weight, thrifty growth, free from all defects. Handles of this grade will be supplied in all white wood, the grade symbol being SAW; or in red, white, or mixed red and white, for which the symbol will be SAR.

SBW and SBR.—Handles of medium weight, live growth, permitting two slight iron streaks the entire length, or their equivalent in shorter streaks. Free from all defects. Handles of this grade will be supplied in all white wood, the grade symbol being SBW; or in red, white, or mixed red and white, for which the symbol will be SBR.

C.—Handles of fair weight, live growth, allowing light iron streaks or slight discoloration from sap. To be free from defects except in the first third of the length from the grasp end, or in the eye where is permitted one sound or tight knot or bird peck not over $\frac{3}{16}$ inch in diameter or two such knots or bird pecks where combined diameters do not exceed $\frac{3}{16}$ inch in diameter or slight deflection of grain. White, mixed red and white, and red wood.

Hickory Handle Association, grading rules for hickory railway handles, 1923.

Physical requirements.

General quality.—All handles shall be of thoroughly seasoned wood (not over 12 per cent moisture) free from any defects that may impair their serviceability, such as decay, diagonal grain with slant greater than 1 in 50, excessive dip grain; wormholes; hollow, large, loose, or numerous knots; shakes or splits; bird pecks in handles 42 inches or less in length; and large or numerous bird pecks in handles more than 42 inches long.

Strength.—No handle shall have more than 20 or 25 rings of annual growth per inch of radius (see plans of handles for required rate of growth and weight of each design) nor a specific gravity of less than 0.60.

Design.

All handles shall be in accordance with the designs and dimensions on the plans which accompany and form a part of the buyer's specification.

Manufacture.

All handles shall be smooth and waxed, unless otherwise specified on the plan for a given handle.

Inspection.

Place.—Handles shall be inspected at suitable and convenient places mutually satisfactory to both parties at interest.

Inspectors representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the handles ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the handles are being furnished in accordance with these specifications.

Manner.—Inspectors will make a reasonably close examination of each handle. Handles will be accepted or rejected for strength on the basis of the buyer's inspector's knowledge of the appearance and weight of wood of the required density; rings of annual growth will not be counted, nor handles weighed by scale unless inspectors' decisions are questioned. Exactness of shape and size will be determined by accurate measurements of handles taken haphazardly. Each handle will be judged independently, without regard for the grading of others in the same lot.

Knots.—In handles 42 inches or less in length a large knot is one of any size elsewhere than in the first third of the length from the grasp end, or one where more than one-quarter the minimum diameter of the handle where it occurs. Numerous knots are any number equaling a large knot in damaging effect.

In handles more than 42 inches long a large knot is one more than one-sixth the minimum diameter of the handle where it occurs. Numerous knots are any number exceeding three ½-inch knots in damaging effect.

Bird pecks.—A large bird peck is one more than one-quarter the minimum diameter of the handle where it occurs. Numerous bird pecks are any number exceeding a large bird peck in damaging effect.

Dip grain.—Dip grain is an abrupt deflection of wood fibers, and will be permitted only in the sec-

tions where knots are allowed, provided the deflected fibers do not extend farther from the surface than one-eighth the minimum diameter of the handle where the grain is deflected.

Size.—All handles will be considered in accordance with the dimensions required if lenghts are within one sixty-fourth of those specified and all other dimensions are within $\frac{1}{16}$-inch of those specified.

428.3 OARS AND PADDLES.

(No nationally recognized specifications available.)

429. OTHER MANUFACTURES OF WOOD.

429.1 WOODENWARE (Dishes and Kitchen Utensils).

(No nationally recognized specifications available.)

429.2 TOOLS.

(No nationally recognized specifications available.)

429.3 POLE BRACKETS AND STEPS.

(No nationally recognized specifications available.)

429.4 LADDERS.

American Mining Congress, sponsor under American Engineering Standards Committee procedure for ladders and stairs for mines (A. E. S. C. No. M 12).

(Standards not yet formulated.)

American Society of Safety Engineers, Engineering Division, National Safety Council, sponsor under American Engineering Standards Committee procedure for safety code for ladders (A. E. S. C. No. A 14–1923).

(This code contains rules governing the safe construction and use of ladders of various types, including fixed, portable extension, fire, step, trolley, sectional and trestle.)

429.5 ROLLERS.

(No nationally recognized specifications available.)

429.6 STAKES.

(No nationally recognized specifications available.)

429.7 WOODEN INSULATORS AND INSULATOR PINS.

American Electric Railway Engineering Association, recommended specification for overhead line material, serial No. D102–21, 1921.

Wood insulator pins and brackets.

General.—Pins and brackets shall be well formed with smooth surfaces, true to size, having threads smooth, uniform, and square with axis of pin.

Character.—Wood for insulator pins and brackets shall be live, close, and straight grained, thoroughly seasoned yellow or black locust, clear and free from any defects which would impair the strength or life. Small knots not over $\frac{1}{8}$ inch diameter or small season checks will be allowed on shoulder and on lower half of shank of not over 5 per cent of order; sapwood will be allowed on the shoulder provided it does not extend to the shank.

Feeder pin.—Feeder insulator pin shall be 9 inches long over all, having a thread section $\frac{63}{64}$ inch diameter at top and 2½ inches long; a shoulder between 1¾ and 2 inches in diameter, 4½ inches below top of pin; and a shank 4½ inches long, 1½ inches diameter at shoulder, and $1\frac{7}{16}$ inches diameter at base.

Bracket pins.—Bracket pin shall have total length of 11½ inches, with a body 6¾ inches long, 2 inches wide, ⅜ inch thick at base, and 2½ inches thick at head, having two nail holes at right angles to pole edge and on center line. The pole edge shall make angle of approximately 20° with pin axis. Taper shall change from rectangle of body to cylinder of thread in a length of 2¾ inches. Thread shall be 2 inches long and $\frac{63}{64}$ inch diameter at top, and grain of wood shall be sufficiently nearly parallel to axis to extend from either lower edge to at least the bottom thread on opposite side of pin.

National Electrical Manufacturers' Association, Supply Division, standards for wood strain insulators, current, 1927.

(This association has developed standard dimensions and insulation requirements for wood strain insulators used in overhead line construction.)

429.8 WHEELS. (See 413.54.)

429.9 WOOD PRODUCTS NOT ELSEWHERE CLASSIFIED.

American Society for Testing Materials, standard specifications for turpentine, D13–24, 1924.

Properties and tests.

Turpentine shall be pure and conform to the following requirements:

Appearance.—The turpentine shall be clear and free from suspended matter and water.

Color.—The color shall be "standard" or better.

Odor.—The odor shall be characteristic of the variety of turpentine specified and, if desired, shall conform to the odor of the sample agreed upon.

Other properties.—Other properties shall be as follows:

	Maximum	Minimum
Specific gravity, 15.5°/15.5° C	0.875	0.862
Refractive index at 20° C.:		
Gum spirits	1.478	1.468
Wood turpentine	1.478	1.465
Residue after polymerization with 38 *N* H_2SO_4:		
Gum spirits—		
Volume, per cent	2.0	
Refractive index at 20° C		1.500
Wood turpentine—		
Volume, per cent	2.5	
Refractive index at 20° C		1.48
Initial boiling point at 760 mm pressure, ° C	160	150
Distilling below 170° C. at 760 mm pressure, per cent		90

The complete specifications include the following paragraphs in connection with sampling and testing:

Detection and removal of separated water.

Sampling.

Laboratory examination.

American Society for Testing Materials, standard methods of sampling and testing turpentine, D233–26, 1926.

This specification includes the following paragraphs in connection with the method of sampling and testing turpentine:

Detection and removal of separated water.

Sampling.

Laboratory examination.

American Society for Testing Materials, tentative specifications for destructively distilled wood turpentine, D236–26T, 1926.

These specifications apply only to destructively distilled wood turpentine obtained in the destructive distillation of resinous wood.

Properties and tests.

The destructively distilled wood turpentine shall be pure and conform to the following requirements:

It shall be clear and free from suspended matter and water.

The color shall be "standard" or better.

The odor shall be characteristic of destructively distilled wood turpentine and, if desired, shall conform to the odor of the sample agreed upon.

Other properties shall be as follows:

	Maximum	Minimum
Specific gravity, 15.5°/15.5° C	0.875	0.860
Refractive index at 20° C	1.483	1.463
Residue after polymerization with 38 *N* H_2SO_4:		
Volume, per cent	2.0	
Refractive index at 20° C		1.480
Initial boiling point at 760 mm pressure, ° C	157	150
Distillation below 170° C. at 760 mm pressure, per cent		60
Distilling below 180° C. at 760 mm pressure, per cent		90

Methods of test.

The sampling and methods of testing shall be conducted in accordance with the standard methods of sampling and testing turpentine (serial designation, D233, referred to above).

Federal Specifications Board, Specification No. 7b, U. S. Government master specification for turpentine (gum spirits of turpentine and steam distilled wood turpentine), revised August 7, 1926.

Gum spirits of turpentine, commonly known as gum spirits, or spirits of turpentine. This is the product distilled from the oleoresin exuding from living pine trees.

Steam-distilled wood turpentine which is distilled with steam from the oleoresin within the wood.

Gum spirits of turpentine or steam-distilled wood turpentine, as specified in contract, shall be pure and shall conform to the following requirements:

Appearance.—Shall be clear and free from suspended matter and water.

Color.—Shall be "standard" or better.

Odor.—Shall be mild, aromatic, and characteristic of the type of turpentine specified. If desired, shall conform to the odor of the sample agreed upon.

	Maximum	Minimum
Specific gravity, 15.5°/15.5° C	0.875	0.860
Refractive index at 20° C	1.478	1.465
Residue after polymerization with 38 *N* H_2SO_4:		
Volume, per cent	2.0	
Refractive index at 20° C		1.500
(This residue shall be viscous and its color straw or darker.)		
Initial boiling point at 760 mm pressure, ° C	160	150
Distilling below 170° C. at 760 mm pressure, per cent		90

Methods of inspection, tests, and basis of purchase.

(The complete specification includes methods of inspection, tests, and basis of purchase. The specification does not cover what is known as destructively distilled wood turpentine.)

U. S. Government Naval Stores Act, standards for spirits of turpentine, approved March 3, 1923.

The regulations for the enforcement of the naval stores act, effective March 1, 1924, established the following standards for spirits of turpentine:

Standards for spirits of turpentine.

Until other standards for spirits of turpentine are established by the Secretary, the following standards are in effect:

(*a*) *Gum spirits of turpentine.*—The spirits of turpentine made from gum (oleoresin) from a living tree.

(*b*) *Steam-distilled wood turpentine.*—Wood turpentine distilled with steam from the oleoresin within or extracted from the wood.

(*c*) *Destructively distilled wood turpentine.*—Wood turpentine obtained in the destructive distillation of the wood.

In addition to the regulation given above, other regulations are provided for the enforcement of the act.

U. S. Government Naval Stores Act, standards for grading and classifying rosin, approved March 3, 1923.

The regulations for the enforcement of the naval stores act, effective March 1, 1924, established the following standards for grading and classification of rosin.

Standards for grading and classification of rosin.

Unless and until other standards for rosin are established by the Secretary, the standards for rosin are the rosin types prepared and recommended by the Secretary prior to March 3, 1923, and the various grades of such standards, from highest to lowest, shall be designated, unless and until changed, by the following letters, respectively, X, WW, WG, N, M, K, I, H, G, F, E, D, and B, together with the designation "gum rosin" or "wood rosin" as the case may be.

(The "types" for color proposed from colored glass by the Department of Agriculture were made to duplicate the average type sample of rosin long used in the industry.)

In addition to the regulation given above, other regulations are provided for the enforcement of the act.

West Coast Lumbermen's Association, grading rules for Douglas fir well tubing and corn cribbing, July 1, 1926.

Well tubing.

D&M or A. D.—Defects based on 6 inches by 12 feet. Worked to diameter ordered.

"C and better" F. G. and/or V. G.—Shall be watertight full length of piece. Will admit medium torn grain; medium sap stain, 25 per cent of face. With the above, will admit one of the following defects, an equivalent defect, or an equivalent combination of defects; three small sound and intergrown knots; four small (4-inch) pitch pockets, none through; small number of pin wormholes.

Corn cribbing.

Green or A. D. defects based on 1 by 6 inches by 12 feet.

Finished thicknesses (inch)	Finished widths (inch)	Lengths
	Inch	
1½	⅝ off	Multiples of 2 feet.

"C and better" corn cribbing F. G. and/or V. G.—Shall be well manufactured, and will admit medium torn grain; small seasoning checks. With the above will admit one of the following defects, an equivalent defect, or an equivalent combination of defects: Four small (4-inch) pitch pockets, two of may be through; three sound and tight small knots.

"Selected common" corn cribbing.—Will admit any number of the following defects, equivalent defects, or equivalent combinations of defects: Medium torn grain; sound and intergrown 1-inch knots located away from edge; pitch pockets not over 6 inches in length; medium sap stain, 25 per cent of face.

431 HOUSEHOLD FURNITURE.

(Except Chairs.)

431.1 BEDROOM FURNITURE.

431.11 Beds.

American Furniture Industry, Simplified Practice Recommendation No. 2, beds, springs, and mattresses, November 25, 1922.

In accordance with the unanimous action of the joint conference of representatives of manufacturers, distributers, and users, the United States Department of Commerce, through the Bureau of Standards, recommends that recognized types and sizes of beds, springs, and mattresses be reduced to those shown in the following tables:

TABLE 1.—*Wood beds*

Type	Description	Size	Length	Width
			Minimum length of side rails Ft. in.	*Between rails* Ft. in.
Straight foot	Wood side rails.	Full	6 2[1]	4 6
Do	do	Single	6 2[1]	3 3
			From head to foot panels	
Bow foot	do	Full	6 4[1 2 3]	4 6
Do	do	Single	6 4[1 2 3]	3 3
			Inside length between cross angles Ft. in.	*Outside to outside of side rails* Ft. in. / *Inside to inside of side rails* Ft. in.
Straight foot	Metal side rails.	Full	6 2	4 5¼ / 4 2¼
Do	do	Single	6 2	3 2¼ / 2 11¼
			Inside opening, head to foot	
Bow foot	do	Full	6 5[3]	4 5¼ / 4 2¼
Do	do	Single	6 5[3]	3 2¼ / 2 11¼

[1] Where necessary to use blocks to hold bed rail hook pins, blocks must not extend over ⅜-inch inside rails.
[2] Crossbars or braces where necessary in bow ends shall be set even with, or below, the top of slat bearer. It is preferred these crossbars be eliminated if possible.
[3] All bow-foot beds are to be made with radius not exceeding 7 inches.

TABLE 2.—*Iron, steel, or brass beds*

Type	Description	Size	Length	Width
			Inside length between cross angles Ft. in.	*Outside to outside of side rails* Ft. in. / *Inside to inside of side rails* Ft. in.
Straight foot	Metal side rails.	Full	6 2	4 5¼ / 4 2¼
Do	do	4′ 0″	6 2	3 11¼ / 3 8¼
Do	do	3′ 3″ (twin.)	6 2	3 2¼ / 2 11¼
Do	do	3′ 0″	6 2	2 11¼ / 2 8¼
			Inside opening, head to foot	
Bow foot	do	Full	6 5[1]	4 5¼ / 4 2¼
Do	do	Single	6 5[1]	3 2¼ / 2 11¼

[1] All bow-foot beds are to be made with radius not exceeding 7 inches.

TABLE 3.—*Springs*

Class	Type	Size	Length	Width: Top	Width: Bottom
			Ft. in.	*Ft. in.*	*Ft. in.*
Spiral or coil wire.	With metal bases.	Full	6 1	4 4	4 4¾
		4′ 0″	6 1	3 10	3 10¾
		3′ 3″ (twin.)	6 1	3 1	3 1¾
		3′ 0″	6 1	2 10	2 10¾
				Length of end rail	*Width of hangers*
Metal frame	With link, slat, cable, or woven-wire fabric.	Full	6 1	4 4¾	4 4¾
		4′ 0″	6 1	3 10¾	3 10¾
		3′ 3″ (twin.)	6 1	3 1¾	3 1¾
		3′ 0″	6 1	2 10¾	2 10¾

NOTE.—It is recommended that springs for bow-foot beds be provided with a 7-inch radius corner at the foot end to conform to similar radius in bow-foot beds.

Mattresses.

It is recommended that mattresses be made to conform to spring dimensions given above.

431.12 Bureaus and Chiffoniers.

(No nationally recognized specifications available.)

431.13 Cots.

Federal Specifications Board, Specification No. 240, U. S. Government specification for folding canvas cot, November 5, 1924.

Type.

1. Folding canvas cots shall be of but one type.

Material and workmanship, etc.

2. Folding canvas cots shall be of first-class material and workmanship.

General requirements.

3. The length of cot, when opened, shall be 6 feet 6 inches; height, 17 inches; width, 27 inches.

Detail requirements.

(*a*) *Woodwork.*—All woodwork shall be of rock elm, beech, or hard maple, thoroughly air dried and finished smoothly. Frame shall consist of side rails, end sticks, and three sets of legs; two rails on each side, 1¼ by 1½ by 38 inches, including ½-inch tenon at one end. The holes in rails for riveting steel L's shall be ⅝ inch from end, omitting tenon, and for the T's shall be $1\frac{9}{16}$ inches from end, and shall be ¼ inch in size. End of rails fastened to T's shall be rounded on one side to avoid friction in folding. Each rail shall be bored for one cross rivet at ends to prevent spreading. This rivet at the tenon end shall be placed 1¼ inches from the end, not counting the tenon or projection for the end stick, and the cross rivet in the other end shall be 1⅛ inches from the end. Two end sticks 1 by 1¼ by 31 inches, with two holes ⅝ inch diameter and ⅝ inch deep for reception of rail tenon. Center of holes 2⅝ inches from end of sticks. End sticks shall be gouged out on inside tenon hole on one

end to adjust same on cot more easily. In order to prevent loss of end sticks in transit, attached to each end stick shall be a staple 1 by ¾ inch points, 15-gauge wire, at a distance of 8 inches from the end of the end stick which is gouged out. All rails and end sticks shall be rounded on outer side like sample. Three sets of legs, each set to consist of one long piece and two short pieces, the latter called upper and lower halves, all legs to be 1 3/16 by 1¼ inches thick. The long leg shall be 29⅜ inches in length with two holes 3/16 inch in diameter bored at the upper end, placed diagonally 1⅛ inches apart, the first ½ inch from the end, also one end hole perpendicularly to these two 14⅛ inches from the same end. The upper half leg shall be 13¼ inches long, with a bevel of about 40° with two 3/16-inch holes bored at the upper end, diagonally placed 1⅛ inches apart, the first to be ½ inch from the end to center of hole, and at the beveled end two 3/16-inch holes on one side 1½ inches apart, the first 1⅞ inches from the end. The lower half of leg shall be 14⅝ inches long, with the same bevel at one end and three 3/16-inch holes bored 1½ inches apart on one side, the first 2 inches from the end. All long legs shall run the same way on the cot. All parts of legs resting on the floor shall be rounded like sample. Upper parts of end legs shall be gouged out like sample, allowing them to fold without friction on tenons.

(*b*) *Steelwork.*—Shall be 14-gauge, hard-rolled open-hearth plate, baked maroon or electro galvanized. All holes for rivets shall be 3/16 inch diameter. Two steel B's, S-shaped, shall be used to join each set of legs, rights and lefts, 11 inches long and 1¼ inches wide, with four ⅜-inch flanges at each end on opposite sides with sufficient angle to make close joint. These flanges shall be pressed into the wood after assembling. Each B shall have three holes in lower and two in upper end and 1½ inches from center to center, beginning ⅜ inch from end, and one hole midway between upper and lower curve. Eight L's, rights and lefts, 3 3/16 by 2¾ by 1¼ inches, with 1¼-inch flange, shall be used in joining end sets of legs to rails, with three holes for rivets, two placed diagonally in flange part and one ½ inch from the other end. Four T's, rights and lefts, 4¼ by 3⅛ by 1¼ inches, with ¼-inch flange, shall be used to join center set of legs to rails with two ¼-inch bolt holes in top of T's ½ inch from either end and two 3/16-inch holes in upright part, bored diagonally 1½ inches apart. All holes shall be located and bored to exact measurements.

(*c*) *Rivets.*—All rivets shall be steel, 3/16 inch diameter. Cross rivets in the rails shall be wagon box head style, 1⅝ inches long, placed with heads on rounded side of rail and secured in position with ½-inch washer riveted down tight; 1½-inch rivets shall be used in fastening T's and L's to legs, and 1⅝-inch for fastening end legs to rails; 1 7/16-inch for fastening B's to upper and lower halves of legs and 1½-inch rivets shall be used for joining B's to long legs and 1¾ by ¼ inch roundhead stove bolts for fastening center legs to rails.

(*d*) *Dipping.*—The frames, when completed, shall be dipped in a solution of 75 per cent dipping oil and 12½ per cent each of filler and drier.

(*e*) *Cover.*—The cover shall be of No. 8 standard commercial unbleached duck, 34 inches wide, in one piece, about 86 inches long, capable of sustaining a strain of not less than 190 pounds in the warp and of 165 pounds in the filling to the inch, tested in the piece.

From each side of the cover, at center, a piece 7 inches wide by 7 inches deep, of an oval shape, shall be cut out to allow for folding; also from each of the four corners shall be cut a piece 7 inches deep by 12 inches long; the edge thus exposed shall be turned over ½ inch all around and shall be bound with strong webbing 1 inch wide, to match the duck. Each end of the cover shall be turned over 4 inches and hemmed with two rows of stitching, about ⅜ inch apart, edge turned in, leaving a space of 2½ inches for end sticks to pass through.

(*f*) *Thread.*—Shall be No. 20, four-cord cotton, white Intrinsic brand or equal.

(*g*) *Tacks.*—The finished cover shall be fastened to side rails with No. 12 double-pointed tacks, tinned, not less than 80 to a cover. In order that the cot may fold properly, the cover shall be tacked to the frame evenly, or if so specified by the purchaser the cover shall be as follows:

(*h*) *Cover.*—The cover shall be 18-ounce standard khaki duck, 36 inches wide; shall contain not less than 44 threads of warp, nor have less than 30 threads of filling to the inch, colored khaki. It shall be capable of sustaining a strain of not less than 190 pounds in the warp and 165 pounds in the filling to the inch, tested in the piece, and weighing not less than 18 ounces to the linear yard. The cover shall be of one piece, about 86 inches long. From each side of the cover at the center an oval piece about 7 inches wide by 8 inches deep shall be cut out to allow for folding; also from the four corners shall be cut a piece 7½ inches deep by 11 inches long, the raw edges thus exposed to be turned over and bound with strong khaki drab webbing ⅞ inch wide. Ends of cover shall be turned over 3½ inches and hemmed with two rows of stitching, ½ inch apart, edge turned in, leaving a space of 2½ inches for end sticks, and sides of cover turned over 4½ inches and hemmed with two rows of stitching to be backstitched to prevent seams from ripping.

(*i*) *Thread.*—Thread shall be of good quality No. 20, four-cord cotton, silk finish, khaki fast color.

(*j*) *Straps.*—Cot, when folded, shall be bound together by means of two strong khaki web straps ¾ inch wide and 26 inches long. One end of strap shall be fitted with a ⅞-inch release buckle. The buckle shall be brass electro galvanized or bronze finished. The buckle shall be secured with a strap by a double coppered steel round-head rivet. The end of the strap that is fastened with a buckle shall be tucked under and riveted so that no raw edge will be exposed. The other end shall be finished with a ⅞-inch die-struck metal tip, which shall extend to a depth of not less than 3/16 inch along the selvages of web and extend from the selvages and from the end of the web toward the center of the fabric for a distance of not less than 3/16 inch. The metal tips shall be brass electro galvanized or bronze

finish. The straps shall be fastened to the end leg of the cot by a ½-inch bifurcated steel rivet or staple.

(*k*) *Handle.*—The handle shall be made of duck of the same material as the cover, of one piece 11 inches long and 4 inches wide, folded to make four thicknesses 1 inch wide, turned in at ends and single stitched on each side. Handle shall be attached to the cot by a ¾-inch No. 10 round-head blue screw, with washer, in such manner as to distribute weight equally on either side.

(*l*) *Weight.*—Cot in finished state shall not exceed 21½ pounds in weight when made of rock elm or 22½ pounds when made of maple or beech.

(*m*) *Instructions.*—Printed instructions for folding shall be printed on cloth and sewed on the under side and near one end of the cover of each cot.

431.14 Wardrobes.

(No nationally recognized specifications available.)

431.2 NURSERY FURNITURE.

(No nationally recognized specifications available.)

431.3 BATHROOM FURNITURE.

(No nationally recognized specifications available.)

431.4 DINING-ROOM FURNITURE.

(No nationally recognized specifications available.)

431.5 KITCHEN FURNITURE.

431.51 Kitchen Tables.

(No nationally recognized specifications available.)

431.52 Refrigerators.

Federal Specifications Board, Specification No. 274, U. S. Government, master specification, for refrigerators, March 28, 1925.

This specification covers three types of refrigerators—type A, wood exterior; type B, vitreous porcelain exterior; type C, white-enamel exterior, each being built in six sizes, as follows:

Size	Width	Depth	Height	Ice capacity
	Inches	*Inches*	*Inches*	*Pounds*
1	48	24	66	250
2	36	21	52	100
3	29½	20¾	54	75
4	23½	18	53	65
5	85	33	75	600
6	68	33	75	400

General requirements.

1. Tolerances permitted in dimensions of 1 inch, plus or minus, will be allowed for sizes 1 to 4, inclusive, and 2 inches plus or minus for sizes 5 and 6.

2. *Ice compartment.*—All ice-compartment linings, including sides and inner face of doors, ceiling, and floor, shall not be lighter than No. 22 U. S. standard gauge (0.0312-inch) galvanized steel or iron. All linings shall be soldered together with even surfaces around all joints. All shall receive one heavy coat of red-lead paint on unexposed surface before being put in place.

3. *Ice racks.*—Ice compartments shall be equipped with easily removable strong, galvanized-steel ice racks, hot galvanized after fabrication.

4. *Ice capacity.*—Tolerance in ice capacity shall not be more than 5 per cent less than that given in table. Ice capacity shall be figured as follows. Assume a standard-size cake of manufactured ice as 11 by 22 inches cross section. Multiply the one dimension of this cake which approaches nearest the height or width of the ice door by the other dimension of the ice door less 1 inch for clearance; multiply this product by the depth of the ice chamber from the inside face of the ice door, less 1 inch for clearance, and divide by 1,728 to obtain the cubic-foot capacity; multiply this result by 57 to obtain the rated ice capacity in pounds. Cubical contents of ice chamber shall be approximately one-third of cubical capacity of the interior of entire refrigerator. The dimensions of the ice chamber and clear ice-door opening of refrigerators shall be of size to allow economical cutting of standard ice cake.

5. *Framing.*—Framing material shall be of No. 1 shop spruce free from large or loose knots, sap, shakes, or other imperfections, thoroughly seasoned and kiln-dried. All framing shall be substantial and properly joined together. The framing for bottom of ice chambers shall be specially designed to sustain such shocks as may be encountered from depositing ice. Sizes 5 and 6 shall be built sectional. All framing shall be done in such a manner that, when joined together, it will be accurately fitted and rigid. All sections shall be assembled with wrought-steel lag screws, galvanized, and brass screws.

6. *Insulation.*—Sizes 1, 2, 3, and 4 shall be insulated on all sides, top, and bottom, including doors, with sheet-insulating material not less than 1½ inches thick; sizes 5 and 6, with not less than 2 inches thick. The insulating material shall have a thermal conductivity not greater than 0.35 B. t. u. per hour, square foot, and temperature gradient of 1° F. per inch thickness. Insulating material shall be properly sealed in with two thicknesses of waterproof paper on all sides of the insulating material.

7. *Arrangement of doors.*—The ice compartments of sizes 1, 2, and 6 shall be in the upper right-hand part of refrigerator and enter through a door in the front. The small food compartment underneath shall have one door; large food compartment to the left shall have two doors. Sizes 3 and 4 shall have ice compartment at upper part, with one door in front; food compartment underneath shall have one door. Size 5 shall have ice door in upper center, with food compartment underneath, two small doors to the right, and one full length door to the left of center section. Alternate arrangements with ice chamber on left will be approved. All doors shall be double or triple rabbeted overlapping, thoroughly fitted to assure tight compartments. All doors shall be paneled. The stiles and rails of all doors shall have neat moldings worked in the solid.

8. *Hardware.*—All hardware shall be of the best commercial quality, extra strong, sanitary design, hard brass, and heavily nickel plated. Handles shall be of the lever wedging type and shall function without the use of springs. When specified handles shall be designed to include lugs for the

use of padlocks and for attaching padlock chains. Hasps separate from the handles will be permitted. All hasps shall be so attached to the refrigerator that they can not be removed when the doors are closed except by the use of a metal cutting tool. Sizes 1, 2, 3, and 4 shall be fitted with casters of noncorrodible metal with lignum-vitæ wheels. Refrigerators for use on board ships shall be provided with fittings as called for by the purchaser, in lieu of casters.

9. *Drain and trap.*—The drain pipe from the ice compartment shall be of light, seamless, genuine wrought iron, heavily galvanized on interior and exterior. It shall be readily removable for cleaning and shall be arranged with water-tight joints to the ice chamber and water-tight connection through the insulation in the bottom of the refrigerators. The drain pipe shall be fitted with an efficient deep seal, cast brass, or aluminum trap of an approved design readily accessible for cleaning.

Detail requirements (type A, wood exterior).

(*a*) *Exterior.*—Type A refrigerators shall be of wood exterior, either paneled or tongued and grooved construction. When paneled, refrigerators shall have the front, sides, and doors paneled; the stiles and rails of doors and all panel work shall have neat moldings worked in the solid; the tops shall be plain, no paneling. When tongued and grooved, sizes 1, 2, 3, and 4 shall have exterior of tongued and grooved boards V'd and center V'd not less than ¾ inch thick, with finished face of 3 inches or less. Sizes 5 and 6 shall have tongued and grooved boards V'd and center V'd not less than ¾ inch thick and finished face of 4 inches or less. All tops shall be plain and all doors shall be paneled. The tongued and grooved boards shall be glued up in sections of size required. All joints in tops shall be doweled together. All case work and doors shall be mortised and tenoned or doweled together. All joints or parts requiring glue shall be well fitted. The stock for case work shall be warmed before gluing together.

All mortises, tenons dowels, dowel holes, and all joints shall be thoroughly glued. The glue must be of a high-grade hide glue, sweet and free from any deleterious substances. After the glue is thoroughly dry all sections and rear surfaces of doors and bottom shall be given one heavy coat of lead and oil paint, allowing it to dry before handling. Sections shall be nailed to ends, front, and back. The front, sides, and top of refrigerators 1, 2, 3, and 4 shall be of No. 1 oak or ash, and the tops of 5 and 6 shall be of No. 2 clear spruce or Douglas fir, not less than ¾ inch thick with finished face of 4 inches or less. All of the above lumber shall be clear on face side free from knots, sap, shakes, or other imperfections. All shall be of uniform grain, thoroughly kiln dried; brash stock shall be eliminated. The sides, front and top of refrigerators, except tops of 5 and 6, after being assembled shall be surfaced and sandpapered off to a smooth surface, before finish is applied.

(*b*) *Interior sheathing.*—All walls, ceiling, floor, and the inner face of all doors, of the interior of refrigerators 1, 2, 3, 4, and the walls, ceiling, floor, and the inner face of doors in ice chambers 5 and 6 shall be sheathed with tongued and grooved boards of No. 2 clear spruce or fir flooring, not less than ¾ inch thick and not more than 4-inch face, free from sap, knots, or shakes. All shall be given one coat of lead and oil paint on both surfaces; all joints shall be painted when put in place.

(*c*) *Metal lining of food compartment.*—Refrigerators 1, 2, 3, and 4 shall have food compartment lining, including inner face of doors of not lighter than No. 20 United States standard gauge (0.0375-inch) steel or iron. Compartment linings shall be made up in one piece, with rounded and welded corners and edges. Linings shall be coated with vitreous porcelain. The ground coat shall thoroughly cover both sides of all metal. The porcelain shall be fused on at a temperature of about 1,800° F., snow white, glossy, free from all discoloration or imperfections, and shall show no signs of edges where metal is joined together.

(*d*) *Supports and shelving.*—Shelf supports shall be of hard brass, nickel plated, or of steel, tinned, of proper weight and strength, and shall be securely fastened in place. Sizes 1, 2, 3, and 4 shall be fitted with an approved number of wire shelves not lighter than No. 12 B and S gauge (0.08-inch) steel wire, 1 inch square mesh, electrically welded to frame of $^{5}/_{16}$-inch round steel, tinned and heavily retinned after fabrication, or approved shelving equal in construction and strength.

(*e*) *Outside sheathing for backs and bottoms.*—The sheathing for backs and bottoms, sizes 1 to 6, inclusive, and the tops of 5 and 6 shall be of No. 1 common spruce or Douglas fir, not less than ¾ inch thick and not more than 4-inch face, tongued and grooved, given one heavy coat of lead and oil paint on inside surface before being put in place.

(*f*) *Food compartment lining.*—The food compartment linings in sizes 5 and 6 shall be of No. 1 clear spruce or Douglas fir not less than ¾ inch thick, not wider than 3 inches on face, tongued and grooved. Each corner shall have a tongued member forming a cove or convex corner. All exposed surfaces shall be thoroughly sandpapered. All shall be painted on back before being put in place. All joints shall be well glued. When glue is thoroughly dry, all shall be surfaced off and sandpapered smooth. Provision shall be made for expansion of interior exposed surfaces.

(*g*) *Floor pan.*—Food compartment floor in refrigerators 5 and 6 shall have No. 22 U. S. standard gauge (0.0312-inch) galvanized sheet steel floor pans, which shall extend up 3 inches on sides and rear, on front up to door sills, all corners rounded and soldered. The underneath surface of floor pan shall be painted with one heavy coat of red lead paint.

(*h*) *Guards, sizes 5 and 6.*—Ice chambers shall be equipped with easily removable guards on sides, rear, and the inner face of doors. Frames shall be of $\frac{5}{16}$ inch round steel bars with horizontal bar in center of frame. The guards shall be of $\frac{3}{16}$ inch

round steel rods, arranged vertically and spaced ⅞ inch on centers. All steel in guards shall be galvanized and electrically welded to frame and cross bars and heavily regalvanized or tinned after fabrication. All guards shall be held in place on galvanized or tinned steel hook brackets.

(*i*) *Shelving, sizes 5 and 6.*—The bars and slats for shelving shall be of No. 1 clear birch, oak, or hard maple, worked to shape, with all corners slightly rounded, rigidly and neatly constructed and thoroughly oiled. All shelving shall be removable. Shelf supports shall be of a standard make, secured in place in an approved manner.

(*j*) *Meat racks, sizes 5 and 6.*—Full-length food compartment in size 5 and the upper left food compartment in size 6 shall be fitted with 4 meat racks, 2 in back and 1 on each side, 30 hooks, of which 15 are for beef and 15 small piece hooks. The rails for meat racks shall be constructed of flat bar steel ⅜ by 1½ inches, or equivalent. Brackets securing rails in place shall be of strength sufficient to withstand the greatest possible load, and securely riveted to rails. All hooks shall be of wrought iron and shall be shaped to drop over edge of rails, adjustable and easily removable for cleaning. The rails, brackets, and hooks after being worked to shape shall be heavily coated with pure tin. All meat racks shall be secured to walls with brass or steel screws sherardized.

(*k*) *Painting and finishing.*—The exterior surfaces of backs and bottoms of refrigerators 1 to 6, and the tops of 5 and 6, shall be painted with two coats of lead and oil paint of an approved color. The sheathing and metal linings of ice compartments shall be painted as called for in Section I, 1 (*b*), 1 (*e*), 1 (*f*), 1 (*g*), 2 (*b*), 2 (*f*), 3 (*a*), 3 (*b*), 3 (*d*), and 3 (*e*). Stain all exposed surfaces with a penetrating oil stain producing a dark oak finish, or of color as directed, all surfaces shall be of a uniform color. After the stain has thoroughly dried in, all surfaces shall be rubbed off before any varnish is applied. Fill all surfaces with best-quality silex pigment paste filler, of exterior case work, except backs, bottoms, and tops of 5 and 6, of an approved and uniform color as directed. Rub all surplus filler from the surface before it is allowed to dry. Apply two coats of approved water and heat-proof spar varnish, sandpaper between coats. All varnish shall be put on in even coats, leaving no light edges. It shall be applied at a temperature of not less than 70° F. Full time shall be allowed for the different coats to dry before applying the next coat. The walls and inside faces of doors in food compartments of refrigerators 5 and 6 shall be given two coats shellac; cut 3 pounds of "U. S. S. A. standard TN" gum to the gallon of denatured alcohol. First coat when thoroughly dry shall be sandpapered to a smooth surface before applying second coat. Doors shall remain open until the shellac is thoroughly dry.

431.6 LIBRARY FURNITURE.

431.61 Bookcases.

(No nationally recognized specifications available.)

432. LAWN AND PORCH FURNITURE.

(No nationally recognized specifications available.)

433. CAMP FURNITURE.

(No nationally recognized specifications available).

434. HOSPITAL FURNITURE.

(No nationally recognized specifications available.)

435. OFFICE FURNITURE.

435.1 BOOKCASES. (See 431.61.)

435.2 CHAIRS AND STOOLS.

Federal Specifications Board, Specification No. 409, U. S. Government master specification for office chairs, May 22, 1925.

This specification includes the following items:

Rotary armchair, leg armchair, rotary chair without arms, leg chair without arms, rotary chair, judge's rotary chair, rotary stool with back, and rotary chair (typewriter chair).

I. General specification.

There are no general specifications applicable to this specification.

Types.

These chairs are designed for general office purposes and shall include rotary armchair No. 1–C, leg armchair No. 2–C, rotary chair without arms No. 3–C, leg chair without arms No. 4–C, rotary chair No. 5–C, judge's rotary chair No. 6–C, rotary stool with back No. 7–C, rotary stool without back No. 8–C, and rotary chair No. 1026. These chairs are to have wood slat backs and wood saddle-type seats, except No. 6–C, which is to have leather upholstered seat and back. Alternates for No. 1–C and No. 2–C may have perforated leather seats properly reinforced.

Material and workmanship.

All workmanship shall be of the best quality known to the trade. The wood material used in the chairs shall be quartered white oak or mahogany, as may be called for, or of selected birch wood properly finished to match mahogany.

General requirements.

Construction.—Framing shall be in strict accordance with the department drawings. Seats of chairs shall be built up of strips not less than 4 inches nor more than 9 inches wide, and shall have at least two hardwood dowels in each joint or an interlocking construction the entire length of each joint. This interlocking construction may be multiple tongue and groove construction or driven dovetail.

Upholstery.—Chair seats of No. 6–C shall be upholstered on 4-inch red stripe webbing; springs shall be japanned tempered steel, using as many as can be placed, thoroughly tied down and together with soft-finished hemp twine; understuffing shall be approved moss, thoroughly quilted and covered with closewoven and heavy burlap; no tow or excelsior or whalebone will be allowed; shaping shall

be long curled hair of ample quantity and thickness covered with heavy muslin. Leather shall be in accordance with United States Government master specification for upholstery leather, Federal Specifications Board specification No. 183. The leather shall be secured in place with approved gimp and approved head nails to match; underside of seat shall be covered with black cotton cloth; back shall be upholstered, both front and back, with long curled hair, covered both sides with muslin under the leather. Samples of all materials for upholstering shall be submitted with bid.

Detail requirements.

Hardware.—Casters shall be of the grip neck socket type, roller or ball bearing. Vulcanized red fiber or felt composition wheel of not less than the following dimensions: 1⅜ inches in diameter, ¾ inch face, and with brass bushing of not less than 21 gauge. Axle to be cold-rolled steel not less than $\frac{3}{16}$ inch in diameter. Horn shall be brass or steel, bronze finish, not less than 16-gauge metal. All leg chairs shall be fitted with domes.

Revolving chairs shall have four-way spiders of the following description, except No. 1026, which may have two-way spider: Double spiral springs, tension and adjustable from front, arms at right angles, screw adjustment for height, device for maintaining height and for attaching base to seat.

Finish.—Woodwork shall be thoroughly smoothed; plugs over concealed screws shall have raised and rounded surfaces, and all parts whatsoever shall be finished. Finish of exposed parts shall consist of stain and filler thoroughly cleaned, leaving no dark spots due to rough work or imperfect cleaning; one coat of shellac and three coats of varnish of approved brand, each well brushed out (no gum runs will be permitted) and allowed to dry hard. The first two coats shall be sandpapered smooth and the last shall be rubbed to semidead gloss with pumice and oil and cleaned off with water. Finish of unexposed parts shall be satin, one coat shellac and one coat varnish. All pumice shall be removed.

Color.—Final colors shall match the standard colors adopted by the General Supply Committee, Washington, D. C.

Method of inspection.

The chairs may be inspected at the factory by a representative of the Government at any time during the process of manufacture, the purpose of this factory inspection being to determine compliance with the terms of the specifications and drawings, as to workmanship, materials, details of construction, hardware, and finish. Final inspection will be made at point of delivery.

Packing and marking.

Packing.—All chairs when shipped from factory shall be so crated, packed, or wrapped as to insure delivery at destination in first-class condition, either for domestic or foreign delivery, in accordance with the best commercial practice.

Marking.—Each chair shall be suitably marked in stencil with ink on the under side of seat, with the designating number, name of manufacturer, and date of manufacture. Letters and numbers shall be ¾ inch in height.

435.3 DESKS AND TABLES.

Federal Specifications Board, Specification No. 358a, U. S. Government master specification for wood desks, April 25, 1927.

This specification covers the following types of desks: Flat-top single desks; flat-top double desks; roll-top desks; typewriter desks, flat top, drop at right or left side, drop at center; and with typewriter compartment in either right or left pedestal.

General specifications.

There are no general specifications applicable to this specification.

Types and sizes.

Desks shall be of the sanitary type, with log bases; the distance from floor to bottom of pedestal shall be not less than 9 inches. Sizes of the various desks are as follows, these sizes being the approximate commercial desk dimensions, and a variation of 1 inch will be permitted, except in height, which shall be 30½ inches from floor to top of writing bed. If variation is more than 1 inch, bidders must state exact sizes and such variations will be considered in connection with price.

A. Flat-top single desks, 42 inches long, 32 inches wide.

B. Flat-top single desks, 55 inches long, 34 inches wide.

C. Flat-top single desks, 60 inches long, 34 inches wide.

D. Flat top single desks, 66 inches long, 36 inches wide.

E. Flat top double desks, 60 inches long, 48 inches wide.

F. Flat-top double desks, 66 inches long, 54 inches wide.

G. Roll-top desks not over 44½ inches to top of deck.

H. Roll-top desks, 60 inches long, 34 inches wide.

I. Roll-top desks, 66 inches long, 34 inches wide.

J. Typewriter desks, flat top, drop at either right or left side as ordered, 44 inches long, 32 inches wide.

K. Typewriter desks, flat top, drop at center, 57 inches long, 32 inches wide.

L. Typewriter desks, flat top, with typewriter compartment in either right or left pedestal, as ordered, three drawers in other pedestal, 55 inches long, 34 inches wide; also 60 inches long, 34 inches wide.

Material and workmanship.

All workmanship shall be of the best quality known to the trade. Oak shall be strictly white oak, all finished surfaces to show quartered grain, and veneers to be selected for uniformity of color and flake and to be perfectly matched for figure and color in any one desk. Mahogany to be well figured and perfectly matched for figure and color in any one desk. Birch shall be of selected grade of a kind to match mahogany, when finished, as closely as possible. All hardware shall be the best of the kind specified in detail requirements.

General requirements.

Design.—Shall be plain, lines generally straight, legs tapering, few or no moldings, plain panels. Drawer fronts may be raised panels; edges of beds and decks shall be square, corners and arrises slightly eased, and the general effect solid, substantial, and dignified.

Construction.—Generally to be veneered, 3 and 5 ply, all veneers hardwood, finish veneers to be not less than $\frac{1}{16}$ inch when laid, framing preferably by mortise and long tenon.

Detail requirements.

Legs.—Legs shall have built-up core or shall be mitered and shall show figured stock on exterior sides. Single desks shall have legs 2 inches square; double desks shall have legs 2¼ inches square. All legs shall be fitted with brass foot socket about 1⅜ inches high, of sheet metal not lighter than 16 gauge, with joint brazed, or of cast metal, the exterior of metal foot to be flush with woodwork of leg above, and foot of the leg to be finished with a sliding caster, either as a part of the ferrule or separately screwed on (16 gauge equals approximately 0.0613 inch).

Panels.—Panels shall be 5 ply on exterior; interior panels may be 3 or 5 ply, all hardwood, set in deep rabbet all around. Bottom panels in pedestals to be sheet iron, with rust-resisting finish on both sides, securely held in place with the cleat above and below, the nails which hold the bottom cleat to be driven also through the edge of the sheet metal, or framed panels, 3 ply.

Tops, beds, and decks.—Shall be 5-ply construction, with core of white pine, chestnut, or basswood, built up of strips not more than 4 inches wide with band of finish material. Tops of single desks shall be 1⅜ inches thick and tops of double desks 1½ inches thick; decks shall be 1⅜ inches thick.

Slides.—Shall be of the same construction as tops and decks, except that edge on side of slides may be omitted.

Drawers.—Shall have side dovetailed to front and back, back same width and height as front; drawer bottoms 3-ply hardwood, paneled in all around. Drawers shall have full but not excessive clearance to avoid sticking from swelling. Drawer runs, stops, and guide rails shall be hardwood, and preference will be given to runs housed into legs and of sufficient width to reach inside of side panels and to be glued to panels entire length of runs. Stops shall be screwed and glued in place. Drawer side, runs, and guides shall be perfectly smooth, and the sides shall be finished with a nonvolatile lubricating compound. Drawer partitions to be manufacturers' standard.

Pedestal partition rails.—Shall be not less than ¾ inch by 1¼ inches and mortised into posts not less than 1 inch.

Curtains.—Of roll-top desks shall be laid on 10-ounce duck with 6-inch wide reinforced strip of same at center and ends. Edge of curtain rail to show quartered face.

Sweep arms.—Shall have at least 1¾-inch face, and the face shall be veneered.

Typewriter beds.—Shall be rigid, give clearance over the desk bed for all standard machines, shall balance properly, and have separate slide to carry machine except when machine goes into pedestal.

Fittings.—Lower drawer in right side of all flat and roll top desks, except typewriter desks, shall be double height, trimmed double, and be fitted with vertical filing device with follower block. Double desks shall have both sides so fitted. Roll-top desks shall have pigeonhole case fitted with document boxes, drawers, and a private compartment with door to lock.

Hardware.—Drawer pulls of wood will be preferred and shall be glued on before finish is applied to drawer front and secured with two screws from the back, countersunk flush. Drawer locks shall be brass-case cabinet locks, two flat keys each. Curtain locks shall have pin tumblers, escutcheon, and corrugated flat keys, shall lock into sweep arms, not into bed, automatically when closed, locking all drawers except center drawer at the same time. Center drawer to have separate lock and in flat-top desks shall automatically lock all drawers on the sides. Drawer-locking devices shall be so built as to permit a drawer left open to be closed after roll or master drawer is locked. All hardware shall be heavy brass or bronze, brush finished and lacquered.

Finish.—On exposed parts, the finish shall consist of stain and filler thoroughly cleaned, leaving no dark spots due to rough work or imperfect cleaning, one coat of shellac, and three coats of varnish of approved brand and allowed to dry hard; the first two coats shall be sandpapered smooth and the last coat shall be rubbed to semidead gloss with pumice and oil and cleaned off with water. Finish of unexposed parts may be stain, one coat shellac and one coat varnish.

Color.—Colors shall match the standard colors adopted by the General Supply Committee, Washington, D. C.

Method of inspection.

The desks may be inspected at the factory, by a representative of the Government at any time during the process of manufacture, the purpose of this inspection being to determine compliance with the terms of the specification as to workmanship, material, detail of construction, hardware, and finish. Final inspection shall be made at point of delivery.

Packing and marking of shipments.

Packing.—All desks when shipped from factory shall be so crated, packed, or wrapped as to insure delivery at destination in first-class condition, either for domestic or foreign delivery, in accordance with the best commercial practice.

Marking.—Each desk shall be suitably marked, with a small brass plate or by stencil, in an inconspicuous location, showing the designating number of the desk and the name of the manufacturer.

Federal Specifications Board, Specification No. 478, U. S. Government master specification for tables and stands, wood, April 25, 1927.

General Specifications.

There are no general specifications applicable to this specification.

Types, grades, and sizes.

Tables shall be of the types and grades required for general office use of a style to harmonize with office desks.

Sizes shall be the usual stock commercial sizes as produced by various manufacturers, the height to be 30½ inches in all sizes, except typewriter stands, which shall be approximately 26 inches high.

Material and workmanship.

All workmanship shall be of the best in every respect. Oak shall be white oak, all finished surfaces to show quartered grain, and veneers to be selected for uniformity of color and flake, and be perfectly matched for figure and color in any one table. Mahogany to be well figured and perfectly matched for figure and color in any one table. Birch shall be of selected grade of a kind to match mahogany when finished.

General requirements.

Design shall be plain, with lines generally straight, legs tapering. Drawer fronts may be flush with rails or with slightly raised panels.

Construction shall be substantial, of a type to produce a rigid table, rails to be joined to legs preferably by mortise and tenon or dovetail and strongly braced at all four corners. Joints shall be true and perfect. Glued joints shall be glued throughout and held under pressure until thoroughly set. In knockdown construction cross bracing at corners shall be securely screwed to rails and fastened to leg with lag screw or bolt with nut let into the table leg.

Detail requirements.

Tops.—Shall be 5-ply construction with core of white pine, chestnut or basswood, built up of strips not more than 4 inches wide with band of finish material. Finish veneers to be approximately $\frac{1}{16}$ inch thick when laid.

Legs.—Shall have built-up core or shall be mitered, and shall show figured stock on all four sides. All legs shall be fitted with brass foot sockets and metal sliding casters.

Drawers.—Shall have sides dovetailed to front and back, bottoms to be 3 ply, outer ply to be hardwood paneled in all around. Sides and backs shall be hardwood. Clearance of drawers shall be sufficient to avoid sticking due to swelling. Runs, stops, and guide rails shall be hardwood, glued and screwed in place.

Pulls may be of wood, or brass, brush finish, securely fastened to drawer fronts.

Finish.—On exposed parts the finish shall consist of stain and filler, thoroughly cleaned, leaving no dark spots due to rough work or imperfect cleaning, one coat of shellac, and three coats of varnish, the final coat to be rubbed to semidead gloss. Finish of unexposed parts may be stain, one coat of shellac and one coat of varnish.

Color of finish shall match any standard color adopted by the Government.

Method of inspection.

The tables may be inspected at the factory by a representative of the Government at any time during the process of manufacture. Final inspection will be made at point of delivery.

Packing and marking of shipments.

Packing.—Tables when shipped from factory shall be so crated, packed, or wrapped as to insure delivery in first-class condition. Packages shall be clearly marked. When intended for foreign delivery packing shall be in accordance with rules of the Department of Commerce.

Marking.—Each table shall be suitably marked, with a small brass plate, or by stencil in an inconspicuous location, showing the stock number and the name of manufacturer.

Note.

This specification applies to tables of stock commercial design, for general office purposes, but does not apply to tables intended for some special purpose, such as for laboratory, testing, mechanical, or post-offices uses.

435.4 DOCUMENT BOXES.

(No nationally recognized specifications available.)

435.5 FILING CASES AND CABINETS.

Federal Specifications Board, Specification No. 359a, U. S. Government master specification for furniture, office sectional, cabinets and trays, wood, revised April 25, 1927.

The specification includes small sections; upright sections; trays and cabinets, card filing.

General specifications.

There are no general specifications applicable to this specification.

Types.

Wood sectional office furniture, including small sections, upright sections, trays and cabinets, card filing.

Material and workmanship.

All workmanship shall be the best known to the trade; all material shall be the best of the kind specified.

(*a*) Lumber shall be bright and harmonious in color, thoroughly air-seasoned, properly kiln-dried, and free from knots, shakes, sap, discolorations, or other defects. Quartered white oak shall be strictly white oak; no part of any piece shall have the medullary ray at a greater angle than 40° to the quartered face; and all pieces in any one article shall be well matched in color, figure, and grain. All exterior surfaces on articles specified as quartered oak shall show strictly white oak, edges of stiles on face of case shall be veneered, and legs of sanitary bases shall be built up with interlocking joint to show quartered face on four sides.

(*b*) Poplar, ash, beech, or birch shall be used for all interior framing.

General requirements.

All sectional devices shall intermember with and match in size, exterior appearance, and design the standard sections adopted by the General Supply Committee, Washington, D. C.

Gauges of all sheet metal shall be quoted. The U. S. standard gauge shall be followed in all cases.

Detail requirements.

Small sections and horizontal sections shall be of the following outside dimensions: 16½ and 33 inches wide by 17 and 25 inches deep, these sections to advance in height in multiples of 6⅝ inches.

Construction.—(*a*) Framing shall be by mortise and tenon or dovetail, as may be most suitable. Mortise shall be as deep as possible, tenons full depth, and not less than one-third the thickness of the material.

(*b*) Dovetail shall extend full width of the joint and shall be finished flush and show no openings.

(*c*) Joints shall be true and perfect, well glued throughout, and held under pressure until glue has set. Best Irish glue shall be used and shall not be used after reheating has affected its strength.

(*d*) All moldings shall be worked on solid wood; no moldings except glass beads shall be nailed on.

(*e*) All detachable ends of upright sections shall be paneled. Panels shall be ½ inch thick, built up 5 ply.

(*f*) All base sections shall have glue blocks at angle of rail and leg, to run full width of rail and of ample thickness, shall be of hardwood, and well glued.

(*g*) Exteriors and partitions shall be secured to the frames by dado or dovetail construction, well glued and nailed.

(*h*) Backs shall be ½ inch thick, 3 ply; exterior shall be beech, birch, or red gum, except when finished backs are ordered, when exterior ply shall match the wood insides of section; finish veneer shall be not less than $\frac{1}{16}$ inch thick when laid. Ends shall be rabbeted to back, and back shall be securely glued and nailed to ends and interior frames with cement-coated nails.

(*i*) All partitions shall be solid; face edge shall be lipped to match the rest of the unit; partitions and rails to finish flush on front of section.

(*j*) *Tops.*—Top panel of top section shall be 5 ply; core shall be of chestnut glued up in narrow widths, cross veneered on both sides with hardwood; finish veneers shall be not less than $\frac{1}{16}$ inch thick when laid.

(*k*) Top and bottom frames for horizontal sections shall be made of oak, poplar, birch, or red gum with front edge lipped to match the rest of cabinet. The frames shall have at least three rails for full-width sections, grooved to accept 3-ply panels $\frac{9}{16}$ inch, inclosing top and bottom of section. Top and bottom frames shall be dovetailed to ends of end stiles, and rails shall be dadoed to ends.

(*l*) Panels at ends of horizontal sections shall be 3-ply, $\frac{9}{16}$ inch thick. Finish veneers shall be not less than $\frac{1}{16}$ inch thick when laid. Panels shall be set in plow not less than ⅜ inch deep.

(*m*) All shelves and partitions shall be lipped with material to match unit.

(*n*) *Drawers.*—Sides and backs shall be cherry, beech, birch, maple, sycamore, or steel. When made of wood, shall be dovetailed front and back. Bottoms of large drawers shall be 3 ply, ⅜ inch thick, and where no guide rod is used, shall be set in plow ⅜ inch deep on all sides. Where guide rods are used, bottom in two pieces shall be set in plow on front and sides and securely nailed to back. In small drawers, thickness of bottoms shall be proportioned to the size of the drawer, wooden drawers to show an opening of not more than $\frac{1}{16}$ inch in bottom.

All filing drawers and trays shall be fitted with follower blocks, which will hold papers or cards in proper position, and move backward or forward easily.

All card index, document file, and check file drawers shall be fitted with bale extension to prevent drawer from being pulled out without lifting.

All drawer fronts to project ⅛ inch, with corners rounded with ⅛-inch radius.

Drawer fronts for upright sections for cabinets and letter and cap-size drawers for horizontal sections shall be 3 ply or 5 ply. Finish veneers shall be not less than $\frac{1}{16}$ inch thick when laid.

Where extension slides are used, sides shall be fastened to drawer fronts with driven dovetail running full width of side. Where steel sides are used, steel shall be bent at front to form angle ¼ inch long, which shall be bedded to edge of drawer front and sides, securely screwed to same.

Drawer suspensions.—All vertical file drawers, such as letter, legal, and bill size, and similar drawers with subdivisions, space permitting, shall be fitted with steel side-arm suspension slides. Where the width of the cabinet will not permit the use of side-arm slides, bottom steel extension slides shall be used, of the type known as progressive drawer slides. The steel used for the side slide arms, for the housing in which the slides operate, and for the runner attached to the drawer shall be rust resistant and not lighter than No. 16 gauge. The slides shall travel easily and smoothly with the drawer and the mechanism shall be sufficiently strong to sustain the weight of the drawer when loaded to capacity. All slide rollers shall have at least ¼ inch bearing surface and be accurately lathe turned from drawn screw stock; no stamped or formed rollers will be permitted. Slides with traveling rollers or fixed rollers with ball bearings are preferred, but other methods will be considered. Special note will be made of the method of assembling the rollers and roller housings or retainers to the slide arm. Preference will be given solid or tubular riveting over electric spot-welding for the assembling of these parts. Vertical file drawers more than 16 inches in width and 10 inches in height shall be fitted with two pairs of extension slides (16 gauge=approximately 0.0613 inch).

All drawer sides and runs shall be hardwood or steel; when made of wood, runs shall be screwed and glued in place.

Upright sections.—Outside dimensions, 52⅜ inches high by 25 inches deep by such width as may be required. These sections shall be so constructed that detachable leg bases 4⅝ inches may be attached, bringing the total height to 57 inches.

End frames and frames between drawers may be without panels. Finished detachable ends shall be paneled. Rails between drawers either mortised or dovetailed into sides of section. Legs shall be detachable to allow sections to be stacked one upon another, and when so stacked to have interlocking device of approved design.

Bookcase sections.—With disappearing glass-panel door, outside dimensions shall be 33 inches wide by 13 inches deep by 12¾, 14¾, 16¾, or 18¾ inches high. Inside dimensions shall be 31 inches wide by 10½ inches deep by 9½, 11½, 14, or 16 inches high. Bookcase sections without doors shall have same outside dimensions and inside dimensions, except that the inside heights shall be 11, 13, 15, or 17 inches and the depth 12 inches.

Front rails shall be the same material as unit.

Construction of doors shall be mortise and tenon.

Glass shall be set in rabbet secured by beads securely nailed to frame.

All doors, except sliding doors, to close in rabbet formed by molding ¼ inch by ½ inch, securely glued on ends inside the section, the doors to run on metal track and shall be fitted with equalizing attachment or other approved nonbinding device. Sliding doors shall have concealed sheaves at bottom of doors. Glass shall be free from defects and shall be AA, double thick.

(*q*) Miscellaneous cabinets and trays shall be of dovetail construction, with rubber feet, cloth disk, or cloth-covered bottoms; back of cabinets shall be finished same as front and sides.

Finish.—Preparation: All surfaces shall be smooth, and those to be varnished, except unexposed surfaces, shall be made perfectly smooth by scraping and sandpapering. Any article which shows dark spots due to filler sticking to surfaces not properly smoothed shall be rejected. The use of putty is prohibited except in nail holes.

Stain and filler shall not cloud the grain and shall leave the flake in quartered oak as clear as possible. Shellac shall be white shellac cut in ethyl alcohol. Varnish shall be approved brand of standard manufacture. Samples of varnish shall be submitted.

Standard finish: Hardwood exteriors shall be stained, thoroughly filled to an even color, the filler thoroughly cleaned up, allowed to set, given one coat of shellac, sandpapered smooth, and three coats of varnish, each allowed to dry hard, and shall be sandpapered smooth before the next coat is applied; the last coat shall be rubbed with pumice and oil to a semidead gloss. No gum runs shall be allowed.

Interiors of all articles, including drawers and pigeonholes, except surfaces to be lubricated, shall have one coat of shellac and one coat of varnish. The front edges of shelves and division pieces under ¼ inch thick shall match the exterior in color and receive the same finish as exterior. Drawer sides and runs shall be lubricated with paraffin oil. Panels shall be stained and filled before setting. Interior of doors shall be rubbed, same as exterior, after last coat.

Unexposed parts: Tops, bottoms, backs, and all unexposed parts, except drawer sides and runs, which can be reached after assembling, shall have one coat of shellac and one coat of varnish.

Interior of bookcase sections shall be stained and shall receive one coat of shellac and one coat of varnish.

Sides, backs, and bottoms of drawers when made of metal shall be finished with baked enamel, guaranteed against rust.

Hardware.—Pulls, label holders, rod fronts, etc., shall be solid cast bronze, brush finish. The mixture of metals for this bronze shall consist of 88 per cent copper, 10 per cent tin, and 2 per cent zinc.

Color.—Colors shall match the standard colors adopted by the General Supply Committee, Washington, D. C.

Method of inspection and tests.

Samples.—Bidders are required to furnish a sample of one cap-size horizontal section, one letter-size upright section, one horizontal section for 3 by 5 inch cards, one horizontal legal-blank section, one half-height section for 5 by 8 inch cards, one small cap-size section, and one truck base, one sanitary base, one top section, one bookcase section, one of each style tray, one two-drawer cabinet for 3 by 5 inch cards, two drawers wide by one drawer high, and one 6-drawer cabinet for 3 by 5 inch cards, three drawers high by two drawers wide.

Samples to receive consideration shall be in strict compliance with this specification and represent exactly what the bidder proposes to furnish in the event of his receiving an award.

The articles may be inspected at the factory, by a representative of the Government, at any time during process of manufacture, the purpose of this factory inspection being to determine compliance with the terms of this specification, as to workmanship, material, details of construction, hardware, and finish. Final inspection will be made at point of delivery.

Packing and marking of shipments.

Packing.—All furniture when shipped from factory shall be so crated, packed, or wrapped as to insure delivery at destination in first-class condition, either for domestic or foreign delivery, in accordance with the best commercial practice.

Marking.—Each article shall be clearly marked in an inconspicuous place with the stock number, the name of the manufacturer, and date of manufacture.

Note.

The technical terms herein employed shall be interpreted in accordance with the highest and best known standards of actual commercial practices in the art of high-grade furniture construction and design.

435.6 WASTE-PAPER BASKETS.

(No nationally recognized specifications available.)

435.9 OTHER OFFICE FURNITURE.

Federal Specifications Board, Specification No. 359a, U. S. Government master specification for small sections; upright sections; trays and cabinets, card, filing, revised April 25, 1927.

This specification includes trays and miscellaneous cabinets. (See 435.5.)

Federal Specifications Board, Specification No. 360, U. S. Government master specification for rulers, December 24, 1925.

General specifications.

There are no general specifications applicable to this specification.

Type, grade, and sizes.

Rulers shall be 12, 15, 18, and 24 inches in length only and of one grade, and made of one kind of wood.

Material and workmanship.

The material shall be selected maple, natural finish, with two coats of varnish.

General requirements.

There are no general requirements applicable to this specification.

Detail requirements.

Rulers furnished under this specification shall be of the lengths specified in Section II, at least 1¼ inches but not more than 1½ inches wide, and at least ¼ of an inch thick. They shall be scaled in black in inches and sixteenths of an inch on the edge, which shall be beveled. A brass edge, at least $\frac{3}{32}$ inch in width shall be inserted in the beveled edge and securely fastened in place.

Method of inspection and test.

No details specified.

Packing and marking.

Rulers purchased under this specification shall be packed and marked as required by the purchaser.

436. STORE FURNITURE AND FIXTURES.

(No nationally recognized specifications available.)

437. CHURCH, SCHOOL, AND THEATER FURNITURE.

(No nationally recognized specifications available.)

438. CHAIRS.

438.1 DINING CHAIRS.

(No nationally recognized specifications available.)

438.2 OFFICE CHAIRS. (See 435.2.)

438.3 FOLDING CHAIRS AND CAMP STOOLS.

(No nationally recognized specifications available.)

438.4 WHEEL CHAIRS.

(No nationally recognized specifications available.)

439. OTHER FURNITURE.

(No nationally recognized specifications available.)

439.1 BAMBOO, RATTAN, AND REED FURNITURE (Except Chairs).

(No nationally recognized specifications available.)

439.2 SCREENS.

(No nationally recognized s pecifications available.

470. GENERAL ITEMS RELATING TO PAPER.

470.1 DEFINITIONS AND CLASSIFICATION OF PAPER.

American Paper Industry, classification and definitions of paper.

(An elaborate classification with definitions has been prepared by a committee of the industry, representing the American Paper and Pulp Association, the National Research Council, and the National Bureau of Standards. In this section of the present publication use has been made of this classification in an abbreviated form.)

National Association of Waste Material Dealers, standard classification for waste paper, current 1927.

(Classification of the waste paper from printing establishments, manufacturers of paper products, and similar sources.)

470.2 SIZES OF PAPER.

American Paper Industry, Simplified Practice Recommendation No. 22, for paper, July 1, 1924.

In accordance with the action of a general conference of representatives of manufacturers, distributers, and users of paper, which met at the National Bureau of Standards on June 19, 1923, the Department of Commerce recommends that the sizes of paper and their doubles, listed below, shall be recognized standards; and, further, that all paper substance weights shall be stated in terms of the basic 25 by 40 inch size. This recommendation became effective July 1, 1924, and is subject to regular annual review by the industry with such yearly revision as may be shown to be desirable by experience and the investigations of the standing committee of the industry.

Stock sizes, general printing and publishing:

26 by 29 inches, 29 by 52 inches.
25 by 38 inches, 38 by 50 inches.
32 by 44 inches, 44 by 64 inches.
35 by 45½ inches.

Stock sizes, book publishers:

30½ by 41 inches, 41 by 61 inches.

Forms and letterheads:

17 by 22 inches, 22 by 34 inches.
17 by 28 inches, 28 by 34 inches.
19 by 24 inches, 24 by 38 inches.

470.3 TESTS OF PAPER.

Federal Specifications Board, Specification No. 394, United States Government general specification for paper, April 1, 1926.

I. General requirements.

1. The United States Government master specifications for the various kinds of paper represent the lowest quality of paper that will be accepted. All specifications definitely state the minimum or maximum limits as to stock, strength, folding endurance, ash, and other qualities which will be accepted. Contractors must adjust their materials and processes so as to insure the delivery of finished paper which will fully comply with the requirement of the specifications.

2. All the paper in the several classes must be of the specified weight, exclusive of cases, wrappers, twine, and cores.

3. A variation above or below the ordered ream weight of more than 5 per cent will not be allowed. Roll paper will be paid for at the net weight unless more than 2.5 per cent over the ordered ream weight, in which case the weight in excess of 2.5 per cent will be deducted. Flat paper will be paid for at the ordered ream weight unless more than 2.5 per cent under weight, in which case payment will be made for net weight. Payment will not be made for cases, wrappers, or other packing materials.

4. "*Mill count.*"—Five hundred perfect sheets to the ream must be accurate on all grades of paper. Verification of "ream count" will be made by the receiving office, and deliveries may be rejected for incorrect count. Shortage will be deducted in case the delivery is accepted.

5. If latent defects should be discovered after paper has been accepted, it shall be rejected and the contractor required to replace it.

6. *Tub-sized with animal glue.*—The term "tub-sized with animal glue" as used in the specifications shall be construed to mean that the paper has been tub-sized with animal glue and that it contains not less than 1.5 per cent of animal glue and has good writing, ruling, and erasive qualities.

7. *Air-dried.*—The term "air-dried" as used in the specifications shall be construed to mean that the paper, after passing through the sizing tub, shall be dried without contact with internally heated driers and not under applied tension. This definition includes the processes commonly known as air, loft, or pole dried.

II. General packing requirements.

1. All paper, unless ordered in rolls or otherwise specified, shall be packed in tight cases. The cases shall be made from dry lumber not less than ⅞ inch thick.

2. All coated book, writing, map, bond, parchment and ledger paper shall be ream-trimmed square on four sides. All other flat paper shall be cut square on four sides. All flat paper shall be put up flat in cases, approximately 600 pounds to the case of even reams, and, unless otherwise provided, each ream shall be "slipped" with projecting colored paper marker. Where the specifications require that the paper be securely banded full width, the

width of band shall be full length of ream and go around the narrow way.

3. All roll paper shall be wound tight, at even tension, and shall contain the least possible number of splices. All necessary splices shall be neatly made and flagged at both ends of the roll with projecting colored markers. Roll paper shall be carefully wrapped, with ends well protected, and delivered in good condition. The diameter of the rolls shall be specified in the order. Roll paper intended for ocean shipment shall be packed in tight cases and if wound on paper cores the cores shall be protected at both ends with wooden or other suitable material.

III. Method of inspection and tests.

1. *Sampling of delivery for testing.*—Not less than three rolls, cases, or bundles of a delivery shall be sampled for testing. Should delivery consist of more than 30 units, not less than 10 per cent shall be sampled, except when a delivery consists of more than 100 units, in which event at least 10 units shall be sampled. The samples taken from each unit of a delivery shall be collated so that the test samples which shall consist of not less than 10 sheets, shall be representative of each unit sampled.

2. *Testing instruments.*—The testing instruments designated in these specifications are simply those upon which the results used in preparing the paper specifications were obtained. The fact that these instruments are designated is not to be construed as indicating superiority over other instruments for the several tests. All instruments employed for testing and all gauges and measuring devices shall be kept in accurate working condition at all times. Information shall be furnished upon request as to the approved type of standard testing instruments used for determining thickness, bursting strength, and folding endurance.

3. *Atmospheric testing conditions.*—All physical tests shall be made under uniform temperature and relative humidity conditions of 70 to 75° F. temperature and 50 per cent relative humidity. Samples should be exposed, suspended from wires in the room at least 4 hours (perferably 12 hours) before testing.

4. Fiber analysis.—(*a*) Apparatus: Any compound microscope equipped with lenses to give magnifications of approximately 50 diameters or more, and preferably fitted with a mechanical stage.

(*b*) Preparation of sample: A piece about 5 mm square shall be cut from each of 10 sheets of the delivery sample being tested. These pieces shall be placed in a 50 or 100 cc beaker or Erlenmeyer flask with approximately 20 cc of 2 per cent solution of potassium hydroxide, then boiled and washed thoroughly with water. This sample shall then be rolled into a ball and worked between the fingers to loosen the fibers. This can best be done by rolling between the index finger and thumb. The ball of paper shall then be placed in a test tube approximately 15 by 125 mm. Fill tube about three-fourths full with water and shake thoroughly until fibers are completely separated. After shaking, transfer about 5 cc of the thoroughly mixed pulp to another test tube and fill tube about three-fourths full with water and shake well. As small a sample as can be conveniently handled shall be removed with needles or fine forceps, placed on a glass slide and water removed by means of hard filter or blotting paper.

(*c*) Stains for identification and determination of fiber content: Full details relative to the various stains for use in fiber analysis will be found in Paper Testing Methods, issued by the Technical Association of the Pulp and Paper Industry, and in textbooks dealing with paper technology.

(1) Herzberg stain: For distinguishing rag, chemical wood (coniferous and deciduous), ground wood, and manila or jute.

(2) Lofton-Merritt stain: For distinguishing unbleached sulphite and unbleached sulphate pulp.

(3) C. G. Bright's stain: For distinguishing bleached and unbleached pulps.

(*d*) Method: The slide shall be prepared by removing several samples of pulp from test tube, as described under preparation of sample, and stained in accordance with details of the respective methods outlined under stains. The prepared slide shall be examined by means of the microscope, the slide being moved systematically so that the whole slide is covered. The percentage fiber determination shall be made only by thoroughly trained analysts familiar with the fiber analysis of paper. The determination of the percentage of pulp shall be made by a recognized standard method and at least 300 fibers counted. Report the determined percentage of each kind of fiber on the basis of 100 per cent fiber.

5. *Ash.*—Use 2 g sample of the paper; burn in porcelain, nickel, or alundum crucible; cool, weigh, and calculate percentage of ash.

6. *Weight per ream.*—Samples for weight may be cut to any convenient size, accurately measured and the exact size recorded. Standard types of paper-weighing scales accurately calibrated which indicate the equivalent weight in pounds of a 500-sheet ream shall be used.

7. *Bursting strength.*—The bursting strength shall be determined with a machine by which the paper is firmly clamped against a rubber diaphragm through which the pressure is applied to a circular area of approximately 1 square inch. The pressure required to burst the paper is registered on an accurate Bourdon tube-type gauge, the readings of which are designated as points. The bursting strength will be ascertained by taking the average of not less than 20 tests.

8. *Thickness.*—The thickness of paper shall be determined by use of a standard type of paper micrometer having a foot 0.5 to 0.6 inch in diameter. Thickness shall be measured at several places on each of 10 sheets of the sample and the average of all measurements recorded as average thickness.

9. *Folding endurance.*—Folding endurance of paper shall be determined on any instrument by which a strip of paper 15 mm in width is clasped horizontally on edge and is folded backward and forward upon itself under a tension applied by a movable spring clamp at each end and under a tension that varies from 1,000 g when the paper is under the maximum tension to approximately 730

g when under the minimum tension. Average folding endurance shall be determined by at least 10 tests (each on a different sheet of the paper being tested) in each direction.

10. *Animal glue sizing.*—Qualitative test: Place 5 g of the paper to be tested in a 100 cc beaker with approximately 25 cc of distilled water and heat to boiling. Pour off liquid into test tube and cool. Add 3 to 5 drops of tannic acid (2 per cent solution) to the liquid in the test tube. If a cloudiness of solution or a precipitate is obtained, which upon heating forms a horny mass which adheres to the sides of the test tube, or solution does not become clear, the presence of glue or of casein is indicated. Should the presence of starch render the results uncertain, boil ½ g of the paper with 10 cc of water. Cool, filter, and add half as much ammonium molybdate solution (dissolve 3 g ammonium molybdate in 250 cc distilled water and add slowly, with stirring, 25 cc 1.2 sp. gr. nitric acid). A white voluminous precipitate indicates the presence of glue or casein.

Quantitative determination: Treat an accurately weighed 3 to 5 g sample of paper by the Kjeldhal method to determine the amount of nitrogen present. The percentage of nitrogen obtained multiplied by 5.8 will give the percentage of glue in the paper.

11. *Starch sizing.*—Qualitative test: Place a few drops of a pale yellow dilute solution of iodine in potassium iodide on the sample of paper. The development of a blue color indicates the presence of starch.

12. *Other methods of test.*—Other methods of test for papers for special uses are given in the respective specifications.

Technical Association of the Pulp and Paper Industry, official paper testing methods, 1926.

SAMPLING PAPER FOR TESTING

I. Test sample.

The test sample, unless otherwise specified, shall consist of sheets at least 11 by 11 inches in size, and having a total area of not less than 1,500 square inches. The sample sheets shall be kept flat, free from wrinkles and folds, and protected from exposure to liquids, direct sunlight, and other harmful influences.

II. Methods of sampling.

Not less than 10 per cent of the total number of units (rolls, cases, frames, or bundles, etc.), composing a lot of paper shall be sampled if the lot consists of not more than 100 units. If the lot consists of more than 100 units, not less than 5 per cent of the total number of units shall be sampled. The sample sheets shall be so selected from the different units that they will be representative of the entire lot of paper.

The samples shall be taken as follows:

1. *From rolls.*—The sample sheets shall be taken from the first unharmed layer of each roll.

2. *From cases, frames, and bundles.*—The sample sheet shall be taken from the top and center of each case, frame, or bundle sampled.

The sample sheets shall be so cut that their edges are exactly parallel with the machine and cross direction of the paper.

III. Resampling.

In case of necessity for resampling a lot of paper, the samples shall be taken as described above, except that the paper sheets shall be taken from different units than those previously sampled. If the identity of the original units is lost, and the paper is not in rolls, cases, frames, or bundles, the whole lot shall be so sampled that all the different components of it will be represented by the test sample.

DETERMINING FIBER COMPOSITION OF PAPER

I. Apparatus.

A microscope capable of giving not less than 100 diameters magnification is necessary for determination of fiber composition. It should be of the compound type and have a mechanical stage.

II. Specimen.

1. *Composition.*—The specimen for test shall consist of pieces having a total area of not less than 6 square centimeters (1 square inch) cut from different portions of the test sample, so as to be representative of it.

2. *Preparation for examination.*—Place the specimen in a small beaker and completely cover it with a 0.5 per cent caustic soda or caustic potash solution, heat to boiling, transfer the contents of the beaker to a small 200-mesh metal sieve and wash thoroughly with water. Roll the moist pieces of paper into a ball and work between the fingers to loosen the fibers. Transfer to a test tube and shake until the fibers are completely separated. Pour a portion of the mixture into a second test tube and dilute to a fiber concentration of about 0.1 per cent. Transfer the fibers to a microscope slide by means of a dropper consisting of a glass tube 20 cm (6 inches) long and 6 mm (¼ inch) internal diameter, fitted at one end with a rubber bulb. Thoroughly mix the fibers and water, quickly insert the dropper into the mixture 5 cm (2 inches) below the surface, expel two bubbles of air from the dropper, then fill the tube to a distance of about 13 mm (½ inch). Transfer the contents of the dropper to the slide, making four drops, completely emptying it.[1] Repeat this procedure until the slide is uniformly covered with drops of the mixture, then place the slide in an air bath until dry. Add stain as specified in Section III, 2, to the dried fibers and press down on them a second slide or large cover glass. Remove excess moisture from the edges of the slides with absorbent paper. One slide shall be sufficient for ordinary determinations. In case of dispute not less than 3 slides shall be examined.

III. Method.

1. *Methods of observation.*—A. Official: The prepared slide shall be examined microscopically, observations being made at various points in a straight line, twice lengthwise and four times cross-

[1] Microscopic paper fiber analysis, G. K. Spence and J. M. Krauss, Paper, 20, No. 11, p. 11, May 23, 1917.

wise of the slide, each line of the observations starting at a different point. A magnification of not less than 100 diameters shall be used. A magnification of 100 diameters is desirable as with lower magnification it is difficult to observe the characteristic structure and shape of the fibers, both of which aid materially, in addition to the color developed by the stain, in identifying the fibers. The number of each kind of fiber present in at least 25 different fields and a total of not less than 200 fibers shall be counted, using the diameter of the field as observed through the microscope as the unit of measurement. The amount of each kind of fiber present shall be computed as a percentage of the total fiber composition.

B. Tentative:[2] To avoid the undesirable personal equation involved in estimating the relative sizes of the fibers, the following method of counting is recommended for trial with the view of future adoption as the official method if found satisfactory. A round microscope cover glass at whose center is a very small black spot (point) or the intersection at right angles of fine lines or cross hairs, shall be placed on the diaphragm of the eyepiece. The slide shall then be moved across the field of view, and each fiber, or part of a fiber, which passes directly under the spot shall be counted. If the fibers are long, some may pass under the spot more than once during the count, but they shall be counted each time, regardless of the number of times they pass under the spot.

2. *Stains.*—For all purposes except as specified below, either the Herzberg or the Sutermeister stain shall be used. These shall be prepared and used as follows:

Herzberg:[3] Prepare the following solutions: (A) An aqueous solution of C. P. zinc chloride saturated at 70° F. (B) 0.25 g of C. P. iodine and 5.25 g C. P. potassium iodide dissolved in 12.5 cc of distilled water.

Mix 25 cc of solution (A) measured at 70° F. with solution (B). Pour into a narrow cylinder and allow to stand until clear. Decant the supernatant liquid into an amber colored, glass-stoppered bottle and add a small piece of iodine to the solution. Thoroughly moisten the fibers with this solution and remove the excess with blotting paper. The solution should be tested with known fibers and readjusted if necessary by addition of either zinc chloride or iodine. The following colors are developed by this stain:

Red—linen, cotton, bleached manila hemp.

Blue—chemically prepared fibers low in lignocellulose, from wood, straw, and esparto.

Yellow—fibers high in lignocellulose, such as ground wood, jute, and unbleached manila hemp.

Sutermeister:[4] Prepare the following solutions: Solution (A)—1.3 g iodine and 1.8 g potassium iodide dissolved in 100 cc of water; solution (B)—a clear, practically saturated solution of calcium chloride.

In using this stain, apply solution (A) after moistening the fibers with water, allow to remain about one minute, remove the excess by blotting, and then add solution (B).

The colors developed by the Sutermeister stain are, in general:

Red or brownish red—cotton, linen, hemp, ramie.

Dark blue—bleached soda pulps from deciduous woods.

Bluish or reddish violet—bleached sulphite fibers and thoroughly cooked unbleached sulphite fibers.

Greenish—jute, manila hemp and the more lignified fibers in unbleached sulphite.

Yellow—ground wood.

Lofton-Merritt:[5] This stain shall be used for differentiating between unbleached sulphate (kraft) and unbleached sulphite fibers. It shall be prepared as follows: (A) Malachite green, 2 g; water, 100 cc. (B) Basic fuchsine, 1 g; water, 100 cc.

These shall be mixed in the proportion of one part (A) to two parts (B). As dyes from different sources vary, it is necessary to test them by staining known fibers. Unbleached sulphate fibers are stained blue or blue-green and unbleached sulphite fibers purple or lavender. If any purple fibers appear in unbleached sulphate fibers, this indicates there is too much fuchsine present and more malachite green solution must be added. The opposite is indicated if some unbleached sulphite fibers develop a green or blue color.

The Lofton-Merritt stain shall be used as follows: Add the compound stain to the fibers and allow to remain two minutes. Remove excess stain by means of a hard filter paper and add a few drops of 0.1 per cent hydrochloric acid. After about 30 seconds remove the excess acid. Next add a few drops of distilled water and remove the excess.

Bright stain:[6] This stain shall be used for differentiating between bleached and unbleached fibers. The solutions required are: (A) 2.7 g ferric chloride ($FeCl_3$ $6H_2O$) per 100 cc distilled water. (B) 3.29 g potassium ferricyanide (K_2 Fe $(CN)_6$) per 100 cc distilled water. (C) 3 g of crude (not treated with sodium carbonate) substantive red dye per 500 cc of distilled water. The dye used shall be Dupont Purpurine 4 B concentrated, or its equivalent.

These solutions must all be made with cold water.

Filter solutions (A) and (B) and keep in separate stock bottles at a temperature not exceeding 20° C. Make solution (C) fresh each day it is used. For staining use tall narrow beakers, suspending the microscope slides in the beakers from clamps. Mix 10 cc each of solutions (A) and (B) in one beaker and add an equivalent amount of solution (C) to another beaker. Set the beakers in a water bath, the temperature of which must be maintained constantly within ±1° of 20° C. Place a thermometer in the stains. When their temperature is 20° C, dip the slide containing the dry fibers in distilled

[2] Suggested by H. T. Case, Sears, Roebuck & Co.

[3] Papier Prüfung, Wilhelm Herzberg.

[4] Chemistry of Pulp and Paper Making, E. Sutermeister, p. 390.

[5] Method for Differentiating and Estimating Unbleached Sulphite and Sulphate Pulps in Paper, R. E. Lofton and M. F. Merritt, Technologic Paper No. 189, U. S. Bureau of Standards.

[6] Microscopy of Paper Fiber, C. G. Bright, Paper, **20**, No. 25, p. 11, Aug. 29, 1917. As modified by the author.

water to moisten it uniformly (so that no air bubbles will be formed when it is stained), then place the slide in stain (A-B) and allow it to remain 20 minutes. Wash by dipping in distilled water six times, then renew the water and repeat the washing process. Dry the contents of the slide and repeat the processes of moistening, staining, washing, and drying, using the (C) stain. It is desirable to fix the top glass on the fibers with a drop of balsam. The colors developed by the Bright stain are:

Red—bleached fibers or fibers practically free from lignocellulose.

Blue—unbleached fibers or fibers containing lignocellulose.

IV. Report.

The proportion of the various fibers found shall be reported in terms of percentages of the total fiber composition, to the nearest 5 per cent. The following nomenclature, which covers the fibers commonly dealt with, shall be used in reporting results: Chemical wood fiber; chemical deciduous wood fiber; chemical coniferous wood fiber; groundwood fiber; manila fiber; jute fiber; rag fiber; linen fiber; cotton fiber; esparto fiber; straw fiber.

CONDITIONING PAPER FOR TESTING

I. Relative humidity and temperature.

Whenever required in the test method, the paper sample shall be conditioned and tested in an atmosphere maintained at 65 per cent relative humidity and 21° C. (70° F.) temperature. A tolerance of plus or minus 2 per cent in relative humidity (63–67 per cent) and of plus 5° C. (9° F.) in temperature is permissible.

II. Conditioning.

Each specimen of the paper sample, after preparation for application of the test as specified in the test method, shall be so suspended that the conditioning atmosphere will have free access to all surfaces. Means shall be provided for so circulating the air of the conditioning and testing chamber that its humidity and temperature will be uniformly maintained. The conditioning time shall be sufficient for the moisture content of the specimen to attain equilibrium with the conditioning atmosphere, this to be determined by conditioning to constant weight, weighing at intervals of not less than ½ hour.

NOTE.—A conditioning period of two hours is usually sufficient for papers of ordinary weight and composition. Some papers, however, such as boards and certain specialties made water resistant, may require much longer periods.

III. Determination of humidity and temperature.

The relative humidity of the conditioning atmosphere shall be determined by means of either (1) a sling psychrometer, or (2) a stationary type of psychrometer having the air circulated over the thermometer bulbs mechanically. In both cases the circulation of air around the thermometer bulbs must be at the rate of not less than 3 meters (10 feet) per second. When the sling type is used, care must be taken to make the readings as quickly as possible after bringing it to rest.

The thermometers used for determining humidity and temperature must be accurately calibrated by comparison with certified standard thermometers and any corrections found necessary applied to the readings.

NOTE.—It is recommended that thermometers approaching as closely as possible to the following specifications be used: Range 0° C. (32° F.) to 50° C. (122° F.); graduations, 0.2°.

DETERMINING BURSTING STRENGTH OF PAPER

I. Apparatus.

The testing instrument shall consist of: (1) A circular aperture 31.5 mm (1.24 inches) in diameter in a plane surface, the aperture registering exactly with a similar aperture in a second plane surface. One aperture shall communicate with a hydraulic chamber and the other shall be movable along the axis passing through the centers of the two apertures. (2) Means of firmly clamping the two plane surfaces together. The clamping pressure and the extent of the contacting plane surfaces shall be such that there shall occur no slipping or creeping during the test of a specimen clamped between the plane surfaces and no injury to the specimen so clamped. (3) A rubber diaphragm firmly secured to the inner side of the aperture in the hydraulic chamber so as to close it off and expand through it when hydraulic pressure is applied. (4) Means of applying hydraulic pressure through a noncompressible fluid to the rubber diaphragm. (5) Means of accurately and continuously registering the pressure maintained in the hydraulic chamber, the bourdon tube pressure gauge being preferred.

II. Specimen.

Specimens for test shall be so selected from a sample secured by the official sampling method as to be representative of the sample.

III. Method.

The specimen shall be firmly clamped in position and pressure applied within the hydraulic chamber at a uniform rate such that the noncompressible fluid shall be displaced against the rubber diaphragm and through the aperture at a rate of 75 cc per minute[7] until the paper bursts. The gauge used must be such that the bursting strength of the paper tested will not be greater than three-fourths of its capacity nor less than one-fourth of its capacity. The gauge reading shall be recorded to the nearest 2 per cent of the total reading. At least 10 bursts shall be made, each of a different specimen of the sample and an equal number from each side of the specimen. Bursting strength tests shall be made on specimens conditioned according to the official method for conditioning, and in the atmospheric conditions therein specified.

IV. Calibration.

The gauge shall be calibrated at intervals of not more than 30 days. The calibration shall be performed as follows: The gauge shall be removed and calibrated in a horizontal position with a dead-weight

[7] This rate is equivalent to turning the hand wheel of the ordinary type of bursting strength paper tester at a rate of 120 r. p. m.

gauge tester of the piston type. A record shall be kept of any deviations from the indicated readings and corresponding corrections made in test results secured with the gauge. The gauge shall be replaced and the pressure chamber refilled with sufficient glycerin to leave the rubber diaphragm, when placed in position, slightly depressed, taking care to eliminate all air bubbles. The rubber diaphragm shall be renewed at least every 30 days.

V. Report.

The report shall include the average, the minimum, and maximum test results. The readings of the gauges shall be reported to the nearest 2 per cent of the total reading and shall be expressed as "points."

DETERMINING TENSILE BREAKING STRENGTH OF PAPER

I. Apparatus.

The instrument shall consist of (1) two clamps whose centers shall be in the same plane parallel with the direction of motion of the stressing clamp and so aligned that they will hold the test specimens wholly in one plane, (2) a pendulum so attached to one clamp as to accurately balance the load applied to the test specimen, (3) a device attached to the pendulum to indicate on a graduated scale the breaking load of the test specimen, (4) a scale graduated in weight units (preferably metric) which may be read to an accuracy of not less than 0.2 per cent of the total reading, and (5) a means of moving the stressing clamp at a uniform rate. The machine shall preferably be power driven.

II. Specimens.

Specimens for test shall be cut accurately in each principal direction of the paper, not less than 12.7 mm (0.5 inch) nor more than 25.4 mm (1 inch) wide and not less than 140 mm (5.5 inches) in length. The edges of the specimens must be clean cut and parallel to the opposite edges. The specimens must be accurately cut to the predetermined width. They shall be so selected from the sample secured by the official sampling method as to be representative of the sample.

III. Method.

The ratio of the clearance distance between jaws to the width of the specimen shall be not less than 5:1, nor more than 12:1. The test specimen shall be firmly clamped squarely in the jaws of the clamps and the stressing jaw then operated at a speed of 30.5 cm (12 inches) per minute until the specimen breaks. The breaking load shall be recorded to the nearest 2 per cent of the total indicated reading. The tester shall be of such capacity that the tensile strength of the paper tested will be not greater than 90 per cent, nor less than 10 per cent of the capacity of the tester. Not less than 10 strips cut in each principal direction of the paper shall be tested. All the readings obtained when the paper breaks at or in the jaws shall be rejected. Tensile strength tests shall be made on paper conditioned according to the official method, and in the atmospheric conditions therein specified.

IV. Calibration.

The machine shall be accurately leveled in both of the principal directions. The stressing clamp shall be displaced or removed and accurate weights corresponding to various divisions of the scale markings shall be suspended from the pendulum actuating clamp. The weights shall be held at the start and released slowly so that the pendulum is actuated at a rate similar to that specified above and other conditions must simulate the paper testing conditions as closely as possible. A record shall be made of deviations from the scale readings and corresponding corrections shall be made in the test results. The machine shall be calibrated at intervals of not more than 30 days.

V. Report.

The result shall be reported in kilograms per 15 mm width to the nearest 2 per cent of the total reading. The average, maximum, and minimum tensile strength for both of the principal directions of the paper shall be reported. The report shall include the width of the specimen in millimeters.

QUANTITATIVE DETERMINATION OF PARAFFIN IN PARAFFINED PAPER

I. Apparatus.

A suitable extraction apparatus, such as the Soxhlet or the Underwriter's, is required for this determination.

II. Specimen.

The test specimen shall consist of not less than 1 gram of paper obtained by cutting strips approximately ½ inch wide from the sample in such a way as to be representative of it.

III. Method.

Weigh the air-dry paper to an accuracy of 1 centigram. Fold the strips into numerous crosswise folds, and place them in the siphon cup of the extractor. Extract with carbon tetrachloride (CCl_4) at least five times, and more if found necessary. Remove the paper and determine its air-dry weight. The difference between the original weight of the paper and its weight after extraction shall be regarded as the amount of paraffin present.

IV. Report.

The paraffin content shall be expressed as a percentage of the air-dry paper to the nearest 1 per cent.

QUANTITATIVE DETERMINATION OF ACTIVE SULPHUR IN PAPER

I. Apparatus.

The special apparatus required for this determination consists of a 500 cc round-bottom distillation flask having a neck about 5 cm (2 inches) long and 2.5 cm (1 inch) in diameter, and a tube 10 cm (4 inches) long so connected to the mouth of the flask that all gases generated in the flask will pass through a filter paper clamped between the mouth of the flask and the end of the tube, and then out through the tube.

The balance used for weighing shall be sensitive to 1 mg.

II. Specimen.

The specimen shall consist of 0.25 g of air-dry paper either ground or thoroughly disintegrated by shaking in water.

III. Reagents.

Small pieces of C. P. stick zinc, free from sulphur and arsenic, activated as follows: Cover the zinc with a C. P. copper sulphate solution in the proportion of 10 cc of copper sulphate solution, containing 0.002 g copper to 1 g of zinc. After allowing to stand a few minutes for deposition of the copper, wash the zinc with distilled water until free from zinc sulphate. The zinc can be reactivated several times.

Concentrated C. P. hydrochloric or phosphoric acid, free from sulphur and arsenic.

C. P. lead acetate, 10 per cent solution.

C. P. sodium thiosulphate, 0.001 per cent solution.

Sulphur-free surgical absorbent cotton prepared by boiling in a dilute solution of sodium hydroxide and washing thoroughly with distilled water.

IV. Method.

Transfer the weighted specimen to the distillation flask with 20 cc of distilled water and add approximately 2 g activated zinc cut in small pieces, and 10 cc of concentrated hydrochloric or phosphoric acid. Insert in the neck of the flask a loose wad of surgical absorbent cotton about 4 cm (1½ inches) long. Clamp between the mouth of the flask and the tube a hardened filter paper (such as Schleicher and Schülls' No. 575) which has been freshly moistened with a 10 per cent solution of lead acetate. Place another wad of absorbent cotton in the tube above the filter paper. Prepare flasks under duplicate conditions containing in place of the paper under test, pure, sulphur-free cotton and measured amounts of sodium thiosulphate solution. Set all the flasks in a steam bath for one hour, frequently agitating the contents. Remove the filter papers and allow them to air-dry. The per cent of sulphur present is found by comparing the depth of the color developed by the sulphur from the specimen with that developed by the known amounts of sulphur evolved from the thiosulphate solutions.

As 0.000001 g sulphur will give a distinct stain, care must be taken to protect the paper under test from contamination. It must be protected from atmospheric fumes and should not be handled with the bare hands.

V. Report.

The amount of sulphur shall be reported as a percentage of the air-dry paper.

NOTE.—In respect to the tarnishing effect of sulphur, a paper containing not more than 0.0008 per cent of sulphur is required for wrapping silverware.

VI. Reference.

Chemistry of Pulp and Paper Making, Edwin Sutermeister, page 422.

DETERMINATION OF AMOUNT OF COATING OF MINERAL COATED PAPER

I. Apparatus.

No special apparatus is required for this determination.

II. Specimen.

The specimen for test shall consist of a piece of the sample cut 5 by 13 cm (2 by 5 inches).

III. Method.

Obtain the air-dry weight of the specimen. Place the specimen in a flat bottom tray and pour over it a warm 5 per cent solution of hydrochloric acid. After a few moments pour off the excess acid and add a warm 5 per cent solution of ammonia, moving the paper around so that the solution comes in contact with all parts of it. After this treatment has continued for a few minutes, place the paper on a pane of glass and brush off the coating with a camel's-hair brush, taking care not to dislodge any of the paper fiber. After the coating is entirely removed, stand the glass pane at a slight angle and wash the paper by means of a wash bottle, holding the paper on the glass by one corner. Dry the specimen and obtain the air-dry weight. The difference between this weight and the original weight of the specimen is the amount of coating material present. Not less than two determinations shall be made, and the average of these computed.

IV. Report.

The amount of mineral coating shall be reported (1) as a percentage of the decoated air-dry paper and (2) as pounds per 500 sheets of the decoated air-dry paper, 25 by 40 inches in size. The weight of the decoated air-dry paper on this same weight basis shall also be included in the report.

V. Reference.

Suggested by Edwin Sutermeister.

QUANTITATIVE DETERMINATION OF RESIN IN PAPER

I. Apparatus.

A suitable extraction apparatus such as the Soxhlet or the Underwriter's is especially required for this determination. In addition, if glue or other nitrogenous sizing agents are present, two 300 cc separatory funnels are necessary. The balance used shall be sensitive to 1 mg.

II. Specimen.

The test specimen shall consist of not less than 5 grams of paper obtained by cutting strips approximately ½ inch wide from the sample in such a way as to be representative of it. It is recommended that the specimens be shredded or ground.

III. Method.

Obtain the air-dry weight of the specimen. If the paper is not shredded or ground, fold the strips into numerous crosswise folds and place them in the siphon cup of the extractor. Extract with acidulated alcohol (95 per cent, alcohol; 90 per cent, glacial acetic acid; 0.5 per cent water, 9.5 per cent by volume), siphoning at least twelve times or as many more as may be necessary until the solvent siphons over colorless. If nitrogenous sizing agents are present, they must be separated from the resin as follows, this not being necessary in absence of such materials: Wash the alcoholic extract of rosin,

which may contain foreign material, into a beaker and evaporate to a few cc on a steam bath. Cool, take up in about 25 cc of ether, transfer to a 300 cc separatory funnel containing about 150 cc of distilled water to which has been added a small quantity of sodium chloride to prevent emulsification, shake thoroughly, and allow to separate. Draw off the water into a second separatory funnel and repeat the treatment with a fresh 25 cc portion of ether. Combine the ether extracts which contain the resin and any other ether-soluble material, and wash twice or until the ether layer is perfectly clear and the line between the ether and the water is sharp and distinct, with 100 cc portions of distilled water to remove salts and foreign matter. Should any glue, which may be extracted from the paper, interfere by emulsifying with the ether, it may be readily removed by adding a strong solution of sodium chloride to the combined ether extracts. Shake thoroughly and draw off the aqueous solution, repeating if necessary before dashing with distilled water. Transfer the alcoholic or the ether extract to a weighed evaporating dish, evaporate to dryness, dry the residue exactly 1 hour at 100° C., and weigh to an accuracy of 0.1 mg. Not less than two determinations shall be made, and the average of the results computed. The percentage results of duplicate determinations of resin should agree within 0.2.

IV. Report.

The resin content shall be expressed as a percentage of the air-dry paper, to the nearest 0.1 per cent.

Reference: Quantitative Determination of Rosin in Paper, C. F. Sammet, Ind. & Eng. Chem., Vol. V, p. 732, Sept., 1913.

DETERMINATION OF MACHINE DIRECTION OF PAPER

I. Terminology and definition.

The two major directions of paper shall be termed:

Machine direction.—The direction of paper parallel to its forward movement on the paper machine.

Cross direction.—The direction of the paper at right angles to the machine direction.

II. Specimens.

The test specimens shall be cut with sides parallel to the major directions of the original paper sample sheets. The major directions of both the sample sheets and the test specimens shall be so marked that they can be respectively identified. For method 1, a piece approximately 50 mm (2 inches) square or a circular piece 2 inches in diameter, and for method 2, two strips approximately 12.5 mm (0.5 inch) wide and 152 mm (6. 0 inches) long, cut at right angles to each other, shall be used.

III. Methods.

A positive result obtained by one of the following methods shall be regarded as a conclusive determination.

1. Float the specimen on water and note the direction of the curl. The axis of the curl is parallel to the machine direction of the paper. Paper which absorbs water readily should not be exposed to the water for than a few seconds.

2. Hold the two strips by the ends in a horizontal position, one over the other, placing first one and then the other on top. The strip cut in the cross direction will bend the more and fall away from the one cut in the machine direction.

3. Burst the specimen, using the instrument described in the official method for determination of bursting strength. The chief line of rupture will be at right angles to the machine direction of the paper.

IV. Report.

In reporting test results the terms "machine direction" and "cross direction" shall be used. When the strength of paper in the two major directions is reported, it shall be understood that the line of bending or rupture of the paper was at right angles to the major direction specified.

V. Additional information.

By the term "grain" as applied to paper is meant the machine direction of the paper.

DETERMINATION OF REAM WEIGHT OF PAPER

I. Apparatus.

The balance used for weighing paper shall have a sensitivity of not less than 0.25 per cent of the load applied and shall be so graduated that readings of this degree of accuracy can be made. The balance shall preferably be a specially constructed sheet-weighing device indicating the equivalent weight of a 500-sheet ream and a 480-sheet ream in pounds when a specimen consisting of one sheet of designated size is weighed. The balance must be protected from air currents.

The scale used for measuring the size of the specimen shall be graduated not more than 0.05 inch (1.27 mm).

For trimming the specimens to the desired size, a special paper cutter with an attachment for insuring parallelism of the opposite cut edges is recommended.

II. Calibration.

The balance shall be calibrated at intervals of not more than 30 days, both with increasing and decreasing load, by applying accurate weights. Care must be taken that before calibrating the balance is properly leveled and gives zero reading with no load.

III. Method.

The specimen for test shall consist whenever possible of at least 10 sheets, 10 by 10 inches (254 mm) in size, of book or writing papers and equivalent amounts of other kinds of paper of greater or less weight than these. The specimen shall be conditioned by the official method, cut accurately as to parallelism of opposite edges, its exact dimensions measured to the nearest 0.05 inch (1.27 mm), and its weight then determined to the nearest 0.25 per cent of its total weight, the entire operation being carried out in the official atmospheric conditions. When a balance is used which does not

indicate the ream weight directly, the weight in grams of a single sheet multiplied by 1.102 gives the equivalent weight in pounds of a 500-sheet ream for sheets having the size of the sheet weighed. Duplicate determinations when calculated to ream weight shall agree within 1 per cent of the ream weight.

IV. Report.

The report shall give the equivalent ream weight in pounds for a ream consisting of 500 sheets, 25 inches (635 mm) by 40 inches (1,016 mm) in size, and also the equivalent weight for the basic weight area commonly used by the paper industry for the particular kind of paper. The weight shall be reported to the nearest 1 per cent of the total ream weight.

V. Additional information.

To convert the weight of a standard ream of 500 sheets, 25 by 40 inches in size, to the weight of a ream of 500 sheets of trade custom size, multiply the former by one of the factors given below:

Kind of paper	Trade custom size	Factor
	Inches	
Blotting	19 by 24	0.456
Blue and brown print	17 by 22	.374
Boards:		
Bristol and tag	22½ by 28½	.641
Card	22 by 28	.616
Book	25 by 38	.950
Cover	20 by 26	.520
News	24 by 36	.864
Tissue	20 by 30	.600
Wrapping	24 by 36	.864
Writing	17 by 22	.374

DETERMINATION OF THE THICKNESS OF PAPER

I. Apparatus.

(*a*) A micrometer of the spring-actuated, dial type shall be used. The plunger shall be capable of being raised by the application of an upward pressure to it. The plunger surface shall be circular in shape and not less than 9.7 mm (0.38 inch) nor more than 16 mm (0.63 inch) in diameter. The dial shall be graduated preferably in divisions indicating a thickness of 0.0127 mm (0.0005 inch) and in no case greater than 0.025 mm (0.001 inch). Graduations indicating a thickness of 0.0254 mm (0.001 inch) shall be at least 3 mm (0.12 inch) apart. Convenient means shall be provided for setting the pointer to zero position.

(*b*) The surfaces of the plunger and anvil shall be plane and parallel to within 0.005 mm (0.0002 inch).

(*c*) Under normal operating conditions the downward pressure of the plunger shall be not less than 709 g (25 ounces) and not more than 1418 g (50 ounces), at a reading of 3.81 mm (0.15 inch).

(*d*) Measurements made on standard steel thickness gauges shall be within the following tolerances:

Intervals	Permissible deviation of reading from actual thickness of standard steel gauge
0 to 0.25 mm (0 to 0.01 inch inclusive)	0.0025 mm (0.0001 inch).
Over 0.25 mm to 1.02 mm (0.01 to 0.04 inch)	0.0051 mm (0.0002 inch).
Over 1.02 mm to 3.05 mm (0.04 to 0.12 inch inclusive)	0.0102 mm (0.0004 inch).

II. Specimens.

The test specimens shall consist of original sample sheets so selected as to be representative of the entire sample.

III. Method.

At least 10 thickness tests shall be made, each on a different specimen except in the case of paper less than 0.05 mm (0.002 inch) in thickness when a sufficient number of specimens shall be placed together and tested so that a reading on the scale of not less than 0.13 mm (0.005 inch) is obtained. Thickness tests shall be made on specimens conditioned by the official method and in the atmospheric conditions therein specified.

IV. Calibration.

(*a*) For testing for compliance with section 1 (*b*), a hard steel ball, 4.77 mm (0.125 inch) in diameter, shall be placed at different points on the anvil and the thickness readings observed. It is recommended that the ball be fixed in a flat piece of metal, part of which acts as a handle.

(*b*) For testing for compliance with section 1 (*c*), the pressure must be measured by means of a suitable balance device applied to the plunger. (Details of such device may be obtained from the National Bureau of Standards.)

V. Report.

The average maximum and minimum thickness shall be reported in parts of an inch to the nearest 0.0025 mm (0.0001 inch).

VI. Additional information.

A Study of Commercial Dial Micrometers for Measuring the Thickness of Paper, P. L. Houston and D. R. Miller, Technologic Paper No. 226, National Bureau of Standards.

QUANTITATIVE DETERMINATION OF MOISTURE OF PAPER

I. Apparatus.

The special apparatus required for this determination is an air-tight container in which the specimen is dried and weighed. For the minimum size specimen designated, a weighing bottle approximately 65 mm (2.56 inches) in height and 45 mm (1.77 inches) in diameter is suitable. For larger specimens proportionately larger containers should be used.

The oven used to dry the paper shall be equipped with means for ensuring adequate temperature control and air circulation and preferably equipped with means of drying the air entering the oven.

II. Specimen.

The specimen for test shall consist of not less than 2 g of paper obtained by cutting small strips from different portions of the test sample in such a way as to be representative of it.

NOTE.—When the paper under test is not in moisture equilibrium with the surounding atmosphere, care must be taken to minimize the time of exposure of the test sample to the atmosphere as much as possible, gain or loss of moisture being very rapid under this condition.

III. Method.

The specimen shall be placed in a weighed air-tight container, the container closed and the weight of the

specimen obtained. The cover of the container shall be removed and the paper dried in the container in an oven having an adequate circulation of air at 100 to 105° C. (212 to 221° F.) for one hour. The container shall then be closed in the oven, removed to a desiccator, and cooled in the desiccator to room temperature. The container and paper shall be weighed and the entire process repeated until the weight is constant. All weighings shall be made to an accuracy of 1 mg. The percentage results of duplicate determinations of moisture shall agree within 0.2.

IV. Report.

The amount of moisture shall be reported as a percentage, (1) of the original weight of the paper and (2) of the bone-dry paper, to the nearest 0.1.

QUANTITATIVE DETERMINATION OF ASH OF PAPER

I. Apparatus.

A crucible, such as platinum, alundum, or porcelain, which will not change in weight under the ignition conditions used and with a tightly fitting lid; a balance sensitive to 1 mg; and a desiccator, are necessary for this determination. An electric muffle furnace is recommended for burning the paper.

II. Specimen.

The test specimen shall consist of not less than 1 g of air-dry paper obtained by cutting small strips from different portions of the sample in such a way as to be representative of it.

III. Method.

The specimen of paper shall be weighed in the crucible and completely ignited. To avoid loss of small particles of the specimen care must be taken to heat it slowly and to protect the contents of the crucible at all times from strong drafts. When the paper is completely burned, as indicated by absence of black particles, the crucible shall be removed to desiccator, covered and allowed to remain until its temperature has reached equilibrium with that of the surrounding atmosphere. The crucible and contents shall then be weighed and the ignition and weighing repeated until the weight is constant. All weighings shall be made to an accuracy of 1 mg. The percentage results of duplicate determinations of ash shall agree within 0.2.

IV. Report.

The amount of ash shall be reported as a percentage of the air-dry paper to the nearest 0.1 per cent.

DETERMINING THE TEARING STRENGTH OF PAPER

I. Apparatus.

The testing apparatus shall consist of a stationary jaw, a movable jaw carried on a pendulum, a slitting device, and a device for registering the tearing force. The pendulum shall preferably be in the shape of a sector and carry on it a scale, the graduation of which shall indicate the tearing force, preferably directly in grams, from 0 to 100, laid off on the sector within approximately 50° of arc. A stop shall be provided for holding the sector in its initial displaced position and for releasing it quickly. With the pendulum in its initial position ready for a test, the two jaws shall be separated by an interval of about 3 mm (0.12 inch) and shall be in line so that the specimen clamped in them lies in a plane perpendicular to the plane of oscillation of the pendulum and so that the tops of the jaws are in a horizontal line. The movable jaw shall be so placed on the sector that a line in the plane of the sector from the point of suspension of the pendulum to a point where the top of the jaw is in contact with the specimen shall be about 10 cm (4 inches) long and shall make an angle of about 30° with the plans of the specimen. The slitting device shall be so arranged as to cut an initial slit in the specimen halfway between the two jaws and extending from the lower edge of the specimen to a distance of about 4 mm (0.16 inch) above the top of the jaws.

II. Specimens.

Specimens for test shall be cut accurately in each principal direction of the paper not less than 6.3 cm (2.5 inches) in length (the horizontal position when placed in the jaws) and of such width that the paper shall extend exactly 4.3 cm (1.69 inches) above the apex of the initial slit. The edges of the specimens must be clean-cut and the opposite edges parallel. The specimens shall be so selected from a sample secured by the official method as to be representative of it.

III. Method.

Enough sheets shall be torn at one time so that the readings on the scale shall be not less than 20 g and not more than 40 g. The test specimen shall be so placed in the jaws that it rests evenly on their bottom plates and so that the paper extends a distance of not less than 2.5 cm (1 inch) into the movable jaw. Readings obtained when the tear deviates more than 6.3 mm (0.25 inch) from the line of the initial slit shall be rejected. The sector stop must be released sharply in operating the instrument. The knife for making the initial slit shall be maintained sharp. Not less than five tearing tests shall be made in each principal direction of the paper and the results shall be computed in grams per single sheet of paper by multiplying the readings of the instrument by 16 and dividing by the number of sheets tested at one time. Tearing-strength tests shall be made on paper conditioned by the official method and in the atmospheric conditions therein specified.

IV. Calibration.

With the sector raised to its initial position and resting against its stop the jaws shall be accurately aligned, readjusting the stop if necessary. The ball bearings shall be adjusted so as not to bind and shall be well oiled. The instrument shall be leveled so that the edge of the stop against which the sector rests in its initial position lies vertically below the point of suspension of the sector. A white line is usually placed on the sector for convenience in making this adjustment. With the sector freely suspended and at rest this mark should be in line with the edge of the stop. Verify the position of the

mark with a plumb line cutting the axis of suspension of the sector. After being leveled the instrument shall be operated several times with nothing in the jaws (movable jaw closed) to find if it registers zero with no tearing load. If necessary the pointer stop shall be adjusted until the zero reading is correctly registered. Place the pointer exactly on zero. Without again touching the pointer operate the instrument three times, being very careful each time not to jar the pointer in setting the sector against its stop. The pointer will be pushed beyond zero for a distance which measures the maximum pointer friction. This should be equivalent to not more than 3 g (compare with distance from zero to 3 on scale). If necessary to reduce this friction, clean pointer sleeve and groove (washing with gasoline if necessary) and apply fresh oil.

NOTE.—The friction error allowed has been compensated for at its maximum value by the shifting of the pointer stop in adjusting the zero reading.

V. Report.

The results shall be reported in grams to the nearest 1 g. The average, maximum, and minimum tearing strength for both of the principal directions of the paper shall be reported. The report shall include the number of sheets torn at one time.

VI. Additional information.

Tearing strength test for paper, A. Elmendorf, Paper, Vol. 26, folio page 302, April 21, 1920. Tearing strength of paper, supplementary study of commercial instruments of determining, P. L. Houston, Paper Trade Journal, Vol. 74, No. 10, page 43, March 9, 1922.

QUALITATIVE DETERMINATION OF CASEIN IN PAPER

A positive result obtained by the following method shall be regarded as conclusive evidence of the presence of casein in paper.

Millon method.

Boil 0.5 g of paper several minutes with 10 cc of a 1 per cent solution of caustic soda. (Caustic soda is required to dissolve casein that has been hardened by formaldehyde or other agents.) Filter off the aqueous extract, cool to room temperature, add a suitable indicator, such as phenolphthalein, and exactly neutralize with nitric acid. Add several cc of Millon's reagent prepared as follows: Dissolve 20 g of c. p. mercury in 40 g of concentrated c. p. nitric acid and dilute the solution to 180 cc with distilled water. Upon heating the presence of casein is indicated by the development of a red coloration. (This reaction is dependent on the presence of tyrosine which occurs in casein to the extent of approximately 5 per cent, but has been reported only in rare instances as occurring in animal glue and gelatine, and then only in doubtful traces.)

QUALITATIVE DETERMINATION OF ROSIN IN PAPER

A positive result obtained by both of the following methods shall be regarded as conclusive evidence of the presence of rosin in paper.

I. *Lieberman-Storch method.*

Place 1 g of paper cut in small pieces in a clean, dry test tube. Add 5 cc of c. p. acetic anyhdride and boil down to about 1 cc. (The fumes of anhydride are very irritating and should be burned as they leave the test tube.) Pour the liquid residue into a clean, dry porcelain crucible and cool to room temperature. If any waxy particles separate, they should be filtered off. Add carefully, down the side of the crucible, one drop of concentrated sulphuric acid. A fugitive rose-violet coloration formed when the acid meets the anhydride indicates rosin.

II. *Raspail method.*

Place the paper on a glass or porcelain plate and apply a drip of strong solution of sugar. After a few moments remove the excess strong solution with filter paper. Add a drop of concentrated sulphuric acid to the sugar on the paper. A raspberry-red coloration indicates the presence of rosin.

QUALITATIVE DETERMINATION OF NITROGENOUS PROTEINACEOUS MATERIALS IN PAPER

A positive result obtained by the following method shall be regarded as conclusive evidence of the presence of nitrogenous (proteinaceous) materials, such as glue and casein, in paper.

I. *Ammonium molybdate method.*

Boil 0.5 g of paper for several minutes with 10 cc of a 1 per cent solution of caustic soda. (Caustic soda is necessary, as the nitrogenous materials may have been made insoluble in water by hardening treatment with formaldehyde or other agents.) Filter off the aqueous extract and after cooling add a suitable indicator, such as phenolphalein, then exactly neutralize with hydrochloric acid. Prepare Schmidt's reagent by dissolving 3 g of c. p. ammonium molybdate in 250 cc of distilled water and adding 25 cc of c. p. nitric acid of 1.2 specific gravity. (This reagent is not permanent and should be made freshly at frequent intervals.) Add one volume of the reagent to two volumes of the aqueous extract. A white precipitate shows the presence of nitrogenous materials derived from proteins.

II. *Additional information.*

References, Carson, F. T., Detection of animal size in surface sized papers, Paper Trade Journal, April 10, 1924. Griffin, R. C., Technical methods of analysis. Chem. Zeitung, vol. 36, p. 313 (1912); Farber-Zeitung, vol. 24, p. 97 (1913); Schmidt.

NOTE.—This test is very delicate. If no precipitate or only a slight precipitate is obtained there can be no appreciable amount of proteinaceous materials present.

QUANTITATIVE DETERMINATION OF PROTEINACEOUS NITROGEN IN PAPER

I. Apparatus.

A Kjeldahl digestion and distillation apparatus is required for this determination. A 500 cc Kjeldahl flask is a suitable size. The balance used shall be sensitive to 1 mg.

II. Specimen.

The specimen shall consist of from 3 to 5 g of air-dry paper obtained by cutting small strips from

different portions of the test sample, in such a way as to be representative of it. The strips shall be cut into pieces approximately 6 mm (0.25 inch) square.

III. Method.

The Gunning method is used. Place the specimen, weighted to an accuracy of 1 mg in theKjeldahl flask and add 10 g of powder anhydrous sodium sulphate, a small crystal of copper sulphate (about 0.2 g), and 25 cc of concentrated sulphuric acid. Heat the flask gently until frothing has ceased and then digest with increasing temperature until oxidation is complete; that is, for a short time after the mixture becomes clear and colorless or nearly so. Cool and dilute with about 200 cc of distilled water.

Add about 2 cc of liquid petrolatum to prevent foaming and about 2 g of 30-mesh granulated zinc to prevent bumping during the distillation. Add a saturated solution of sodium hydroxide to the contents of the flask in such amount (usually 75 cc) that there is an excess of 5 cc of the saturated sodium hydroxide solution present. This solution must be poured carefully down the side of the flask so that it does not mix with the acid contents.

The total volume of the solution should be about 400 cc. Immediately connect the flask to a condenser having its delivery tube just beneath the surface of a known amount of $N/10$ sulphuric acid diluted to 100 cc (30 cc of $N/10$ acid is usually sufficient). Mix the contents of the Kjeldahl flask by shaking the flask, then heat it gradually and distill the contents for about 45 minutes, taking care to avoid spurting.

The total volume of the distillate should be about 200 cc. Titrate the contents of the receiver flask with $N/10$ alkali, using methyl red indicator. The difference between the cc of $N/10$ alkali used and the cc of $N/10$ sulphuric acid added to the receiver flask is the cc of $N/10$ acid equivalent to the nitrogen present. This number multiplied by 0.014 is the nitrogen found. The percentage results of duplicate determinations of nitrogen shall agree within 0.02. A blank determination shall be made on all reagents used and any nitrogen found subtracted.

IV. Report.

The amount of nitrogen shall be expressed as a percentage of the air-dry paper to the nearest 0.01 per cent. If it is desired to report the per cent of glue or of casein present, it shall be calculated by multiplying the per cent of nitrogen found by 5.6 and 6.3, respectively.

NOTE.—As these factors vary with different kinds and grades of material they should be determined whenever the nitrogenous material is available, and whenever possible the nitrogen in the paper before addition of the nitrogenous material should be determined and subtracted from the total nitrogen found.

QUALITATIVE DETERMINATION OF STARCH IN PAPER

A positive result obtained by the following method shall be regarded as conclusive evidence of the presence of starch in paper:

Boil 0.5 g of paper for several minutes with 10 cc of water. Filter off the extract and cool it. Add one drop of a 0.01 normal solution of iodine. A blue coloration indicates starch. If only a faint violet coloration is obtained, this should be disregarded, as nonstarch constituents of paper sometimes give such reaction.

I. Apparatus.

A reflux condenser is necessary for this test. The balance used for weighing shall be sensitive to 1 mg.

II. Specimen.

The specimen shall consist of not less than 5 g of air-dry paper obtained by cutting small strips from different portions of the test sample in such a way as to be representative of it. The strips shall be cut into small pieces about 6 mm (0.25-inch) square.

III. Reagents.

Fehling's solution.—(*a*) 69.3 g of crystallized copper sulphate are dissolved in water and the solution diluted to 1,000 cc; (*b*) 346 g of Rochelle salt and 120 g of sodium hydroxide are dissolved in water and the solution diluted to 1,000 cc. Allow to stand two days and filter. Solutions (*a*) and (*b*) are kept separate and equal volumes of them mixed just before use.

Indicator solutions.—A 10 per cent solution of potassium ferrocyanide and a 50 per cent solution of acetic acid are used.

IV. Method.

Place the weighed specimen of paper in a 500 cc flask; add 200 cc of water and 5 cc of glacial acetic acid. Connect the flask to a reflux condenser and boil the contents vigorously for 1½ hours. Pour the contents of the flask on the perforated plate of a Buchner funnel and wash the pulp on the plate with 50 cc of hot water using suction. Add 15 cc of 37 per cent hydrochloric acid to filtrate and boil it for 30 minutes, allowing the volume to decrease by evaporating to about 200 cc. Neutralize the hot solution by adding solid sodium carbonate until effervescence ceases. Cool to room temperature and adjust to a measured volume by means of a volumetric flask. Titrate this solution into a measured quantity of Fehling's solution diluted to 25 cc. After each addition of the titrating solution, boil the reaction mixture for one minute. The end point is determined on a spot plate by adding a drop of the mixture to a mixture of one drop each of the ferrocyanide and acetic acid solutions, and is that point at which no immediate color is produced on the plate. The cc of Fehling's solution used multiplied by 0.005 is the grams of starch equivalent to the volume of the titrating sugar solution used. The results of duplicate determinations of starch shall agree within 0.05 per cent of the total percentage found. As the factor for converting cc of Fehling's solution to grams of starch varies with different kinds and grades of starch, when the starch used in the paper is available, its exact factor should be determined by the following procedure:

Dry the starch at 100 to 105° C. (212 to 221° F.) for three hours. Weigh 0.05 g and boil with about 190 cc of a 4 per cent hydrochloric acid solution for 30 minutes. Neutralize with solid sodium carbonate, cool, adjust to a definite volume and titrate a

definite volume of Fehling's solution as described above.

V. Report.

The amount of starch shall be reported as a percentage of the air-dry paper to the nearest 0.01 per cent.

VI. Additional information.

Quantitative estimation of starch in paper, V. Voorhees and O. Kamm, Paper, Vol. 24, folio page 1091, August 27, 1919.

U. S. Congress, Joint Committee on Printing, December 9, 1926. Standard methods of inspection and tests of paper used by the testing section of the U. S. Government Printing Office, Washington, D. C.

Sampling.

Not less than three rolls, cases, or bundles of a delivery will be sampled for testing. If a delivery consists of more than 30 units not less than 10 per cent will be sampled, except when a delivery consists of more than 100 units, in which event at least 10 units will be sampled.

Before rejection of any delivery one or, if necessary, two additional samples will be taken in the same manner, preferably from other units of the shipment, and tested.

Testing instruments.

All testing instruments are of standard types, all gauges and measuring devices being tested at regular intervals for accuracy. Information will be furnished upon request as to the approved types of standard testing instruments used by the Government Printing Office upon which the requirements of these specifications are based for determining thickness, bursting strength, and folding endurance.

Atmospheric testing conditions.

All physical tests are made under uniform temperature of 70 to 75° F. and 50 per cent relative humidity conditions. Samples are exposed in the testing room, suspended from wires for 12 hours previous to testing.

Fiber analysis.

The following method is used in the determination of stock:

Apparatus.—The compound microscope used is equipped to give magnifications of 50 diameters or more, and is fitted with a mechanical stage.

Preparation of sample.—Ten pieces, each about 5 mm square, are cut from 10 sheets of the delivery sample. These pieces are placed in a 50 or 100 cc beaker or Erlenmeyer flask with approximately 20 cc of 2 per cent solution of potassium hydroxide, then boiled, and washed thoroughly with water. The sample is then rolled into a ball and worked between the fingers to loosen the fibers. This is best done by rolling between the index finger and thumb. The ball of paper is then placed in a test tube approximately 15 by 125 mm and the tube filled about three-fourths full of water and shaken thoroughly until the fibers are completely separated. After shaking, about 5 cc of the thoroughly mixed pulp is transferred to another test tube, the tube being filled to within about three-fourths with water and shaken well. As small a specimen as can be conveniently handled is removed with needles or fine forceps, placed on glass slide and the water removed by means of hard filter or blotting paper.

Stains for identification and determination of fiber content.—Full details relative to the various stains for use in fiber analysis will be found in "Paper Testing Methods," issued by the Techincal Association of the Pulp and Paper Industry, and in textbooks dealing with paper technology.

Herzberg stain.—For distinguishing rag, chemical wood (coniferous and deciduous), ground wood, and manila or jute fiber.

Lofton-Merritt stain.—For distinguishing unbleached sulphite and unbleached sulphate fiber.

C. G. Bright's stain.—For distinguishing bleached and unbleached fiber.

Method.—The slide is prepared by removing several specimens of pulp from the test tube as described under preparation of sample and stained in accordance with details of the respective methods outlined under stains. The prepared slide is examined by means of the microscope, the slide being moved systematically so that the whole slide is covered. The percentage fiber determination is made only by thoroughly trained analysts familiar with the fiber analysis of paper. The determination of the percentage of pulp is made by the count method and at least 300 fibers counted. The determined percentage of each kind of fiber is reported on the basis of 100 per cent fiber.

Weight.

The weight is determined by cutting the samples to convenient size, accurately measuring and recording the exact size. Standard types of paper-weighing scales are used, graduated in ¼ pounds, accurately calibrated, which indicate the equivalent weight in pounds of 500 sheets. Approximately 20 to 40 sheets, 10 by 10 inches, of each delivery sample are weighed.

Thickness.

The thickness of paper is determined by use of an approved standard type of paper micrometer having a foot 0.5 inch in diameter. Thickness is measured at several places on each of 10 sheets of the sample and the average of all measurements recorded as average thickness.

Bursting strength.

The bursting strength is determined with an approved standard type of tester by which the paper is firmly clamped against a rubber diaphragm through which the pressure is applied to a circular area of approximately 1 square inch. The pressure required to burst the paper is registered on an accurate gauge, the readings of which are designated as points. The bursting strength is ascertained by taking the average of not less than 20 tests. Before a delivery of paper is rejected not less than 40 tests are made.

Folding endurance.

Folding endurance is determined with an approved standard type of folding tester, using a strip 15 mm in width and a tension of 1,000 g. Folding endurance is ascertained by taking the average of not less than 10 tests in each direction. Before a delivery of paper is rejected not less than 20 tests are made in each direction.

Ash.

Ash is determined by using 2 g of the test sample and burning in a porcelain or nickel crucible. The ash after being cooled in desiccator is weighed and percentage of ash calculated.

Absorption.

The absorption of blotting paper is determined by placing a 4 by 4 inch piece of the paper, with wire side of sheet up, slightly dished to insure that the ink will remain in one pool, on top of a tumbler and then 1 cc of the standard ink flowed on to the center of the paper from a 1 cc pipette, delivering in 3 to 6 seconds, and held ½ inch above the paper. The formula for the standard ink is as follows:

	Grams
Tannic acid	23.4
Gallic acid	7.7
Ferrous sulphate	30.0
Dilute hydrochloric acid (U. S. P.)	25.0
Phenol	1.0
Soluble blue, S. & J. No. 478	2.2
Water to make a volume of 1,000 cubic centimeters at 15.6° C.	

The average time, beginning when the ink starts to flow from the pipette, required for the complete absorption of the ink is the absorption time of the paper. For details, especially as to preparation of standard ink, see Industrial and Engineering Chemistry, 10, page 44 (1918).

Animal glue sizing.

The following methods are used for qualitative and quantitative determination of animal glue sizing:

Qualitative test.—Animal glue sizing is determined qualitatively by placing 5 g of the paper to be tested in a 100 cc beaker with approximately 25 cc of distilled water and heating to boiling. The liquid is then poured off into a test tube, cooled, and 3 to 5 drops of tannic acid (2 per cent solution) added. If a cloudiness or a precipitate is obtained which upon heating forms a horny mass that adheres to the sides of the test tube, or the liquid does not become clear, the presence of glue or of casein is indicated.

Quantitative determination.—Animal glue sizing is determined quantitatively by treating 3 to 5 g of the sample of paper by the Kjeldahl method to determine the amount of nitrogen present. The percentage of nitrogen multiplied by 5.6 will give the percentage of glue in the paper.

471. ABSORBENT PAPER.

471.1 BLOTTING PAPER.

Federal Specifications Board, Specification No. 127a, United States Government master specification for 25 per cent rag blotting paper, white and colored, revised August 8, 1925.

Same as specification for white and colored blotting paper (F. S. B. No. 327) except for types and detailed requirements, which are as follows:

I. Types.

This specification is for the purchase of 25 per cent rag blotting paper, white, salmon, and buff, weighing 80 pounds per ream, 19 by 24 inches, 500 sheets; flat.

IV. Detail requirements.

(Same as those of the Joint Committee on Printing, of the U. S. Congress.)

Federal Specifications Board, Specification No. 327, United States Government master specification for white and colored blotting paper, September 16, 1925.

I. Types.

This specification is for the purchase of blotting paper, white, salmon, and buff, weighing 80 pounds per ream, 19 by 24 inches, 500 sheets; flat.

II. Material and workmanship.

See Detail requirements.

III. General requirements.

Samples.—Ten sheets 8 by 10½ inches, to show color and finish, shall be submitted with bid.

IV. Detail requirements.

(Same as those of the Joint Committee on Printing, of the U. S. Congress.)

V. Method of inspection and tests.

1. *Absorption.*—Same as method of the Joint Committee on Printing of the U. S. Congress. (See 470.3.)

2. All tests shall be made in accordance with United States Government general specification for paper (F. S. B. No. 394), in effect on date of proposal. See No. 470.3.

Federal Specifications Board, Specification No. 128a, United States Government master specification for desk blotting paper, colored, revised August 8, 1925.

I. Type.

This specification is for the purchase of desk blotting paper, moss green, blue, and buff, weighing 100 pounds per ream, 19 by 24 inches, 500 sheets; flat.

II. Material and workmanship.

See Detail requirements.

III. General requirements.

Samples.—Ten sheets 8 by 10½ inches, to show color and finish, must be submitted with bid.

IV. Detail requirements.

(Same as those of the Joint Committee on Printing of the U. S. Congress.)

V. Method of inspection and tests.

See General specifications, Section VIII, below.

VI. Packing and marking.

1. *Packing.*—Shall be in wrapped ½ ream bundles (250 sheets).

2. *Marking.*—Each package shall be marked to show name, color, and quantity of material, specification or stock number, and name of contractor.

VII. Additional information.

No details specified.

VIII. General specifications.

United States Government general specification for paper (F. S. B. No. 394) in effect on date of proposal, shall form part of this specification. See No. 470.3.

U. S. Congress, Joint Committee on Printing, specification for blotting paper, white and colored, December 9, 1926,

Stock: Free from ground-wood pulp.
Ash: Not to exceed 25 per cent.
Weight: 19 by 24, 1,000----------lbs-- 160
Bursting strength: Average not less than ----------pts-- 15
Absorption (1 cc standard ink): Not to exceed 80 seconds.
Finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 25 per cent rag blotting paper, white and colored, December 9, 1926.

Stock: Not less than 25 per cent rag; the remainder free from ground-wood pulp.
Ash: Not to exceed 10 per cent.
Weight: 19 by 24, 1,000----------lbs-- 160
Bursting strength: Average not less than ----------pts-- 18
Absorption (1 cc standard ink): Not to exceed 80 seconds.
Finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for desk blotting paper, colored, December 9, 1926.

Stock: Free from ground-wood pulp.
Ash: Not to exceed 25 per cent.
Weight: 19 by 24, 1,000---------lbs-- 200
Bursting strength: Average not less than ----------pts-- 25
Finish: Deliveries must conform to the standard sample, be well rolled, and sufficiently firm not to rub off readily.

471.2 FILTER PAPER.

(No nationally recognized specifications available.)

471.3 TOWELINGS.

(No nationally recognized specifications available.)

472. BOARDS.

472.0 GENERAL ITEMS.

Paperboard Industry, Simplified Practice Recommendation No. 44, box-board thicknesses, effective October 1, 1925.

In accordance with the unanimous action on July 29, 1925, of the general conference of representatives of manufacturers, distributers, and users of box board, the United States Department of Commerce, through the National Bureau of Standards, recommends that a simplified list of thickness be established, as follows:

Gauge list No. 1—Nonbending boards

[Plain straw and plain chip boards, solid jute, dry finish; filled wood pulp, filled news board, single news vat-lined chip, and single white vat-lined chip]

Number of 25 by 40 inch sheets per 50-pound bundle	No. 1 finish, high sheetage and rough [1]	No. 2 finish, medium	No. 3 finish, low sheetage and smooth [1]	No. 4 finish, extra smooth
	Inch	*Inch*	*Inch*	*Inch*
35	0.064	0.060	0.057	0.051
40	.056	.053	.050	.045
45	.050	.047	.045	.040
50	.045	.042	.040	.036
55	.041	.038	.036	.033
60	.038	.035	.033	.030
65	.035	.032	.030	.028
70	.032	.030	.028	.026
75	.030	.028	.027	.024
80	.028	.026	.025	.023
85	.026	.024	.023	.022
90	.025	.023	.022	.020
95	.024	.022	.021	.019
100	.022	.020	.019	.018
110	.020	.019	.018	.017
120	.018	.017	.016	.015

[1] The term "sheetage" signifies the relation of the area of a given caliper of box board to its weight. For example, when the board is run through many calendar rolls it acquires a high finish and has more body but less surface area or less "sheetage" per pound.

Gauge list No. 2

[Bending boards, cracker shell board, plain shell board, colored one side; colored box board, chip back; colored box board, chip center, news back; any combination board with solid news back; any combination board with solid wood back; single manila lined chip; bleached manila lined, chip center, news back; bleached manila lined chip; bleached manila lined, chip center, news back; double manila lined chip, and manila colored shell; colored suit box board, chip back; colored suit box board, chip center, news back; mist colored suit box board, chip back; mist colored suit box board, chip center, news back; test jute; test chip board; jute lined chip board; jute lined chip board, news back; imitation jute; filled jute (chip center, solid jute bending)]

Number of 25 by 40 inch sheets per 50-pound bundle	No. 1 finish, high sheetage and rough	No. 2 finish, medium	No. 3 finish, low sheetage and smooth	No. 4 finish, extra smooth
	Inch	*Inch*	*Inch*	*Inch*
40	0.050	0.047	0.045	0.043
45	.045	.043	.041	.038
50	.040	.038	.036	.034
55	.037	.035	.033	.031
60	.034	.032	.030	.028
65	.031	.030	.028	.026
70	.029	.028	.026	.024
75	.027	.026	.024	.023
80	.025	.024	.023	.021
85	.024	.023	.022	.020
90	.023	.022	.020	.019
95	.022	.020	.019	.018
100	.020	.019	.018	.017
105	.019	.018	.017	.016
110	.018	.017	.016	.015
120	.017	.016	.015	.014

Gauge list No. 3

[Solid news and solid wood pulp board]

Number of 25 by 40 inch sheets per 50-pound bundle	No. 1 finish, high sheetage and rough	No. 2 finish, medium	No. 3 finish, low sheetage and smooth	No. 4 finish, extra smooth
	Inch	*Inch*	*Inch*	*Inch*
40	0.063	0.060	0.055	0.050
45	.056	.054	.050	.045
50	.050	.048	.044	.040
55	.046	.044	.040	.036
60	.042	.040	.037	.033
65	.039	.037	.034	.031
70	.036	.034	.031	.029
75	.033	.032	.029	.027
80	.031	.030	.027	.025
85	.029	.028	.026	.023
90	.028	.026	.024	.022
95	.026	.025	.023	.021
100	.025	.024	.022	.020
110	.022	.021	.020	.019
120	.021	.020	.019	.018

Gauge list No. 4

[Pasted chip board]

Number of 25 by 40 inch sheets per 50-pound bundle	No 1 finish, medium	No 2 finish, low sheetage and smooth	No. 3 finish, extra smooth
	Inch	*Inch*	*Inch*
10	0.212	0.200	0.180
15	.142	.133	.120
20	.106	.100	.090
25	.085	.080	.072
30	.070	.067	.060
35	.060	.057	.051

Gauge List No. 5

[Container board]

Number of 25 by 40 inch sheets per 50-pound bundle	No. 3 finish	Minimum test	Weight 1,000 square feet
	Inch	*Pounds*	*Pounds*
15	0.120	300	480
18	.100	275	420
23	.080	200	340
29	.060	175	260

Furnished in 3, 4, or 5 ply pasted and conforms to railway and express requirement.

Gauge list No. 6 and ream weight table

[Patent coated: Solid manila back and solid manila board, news back, news center manila back, chip back, blue or colored back]

Caliper thickness of individual sheets in inches	Weight per 500 sheets		
	24 by 36 inches (864 square inches)	28 by 44 inches(1,232 square inches)	25 by 40 inches(1,000 square inches)
	Pounds	*Pounds*	*Pounds*
0.011	154	220	178
0.012	168	240	194
0.013	182	260	210.60
0.014	189	270	218.75
0.015	195	278	225.69
0.016	208	297	240.70
0.018	230	328	266.20
0.020	245	350	283.56
0.022	264	377	305.55
0.024	288	412	333.33
0.026	312	445	361.10
0.028	336	480	388.88
0.030	360	513	416.65
0.032	384	544	444.48
0.034	408	578	472.26
0.040	460	660	532.40

Gauge list No. 7 and ream weight table

[Patent coated, two sides]

Caliper thickness of individual sheets in inches	Weight per 500 sheets	
	24 by 36 inches (864 square inches)	25 by 40 inches (1,000 square inches)
	Pounds	*Pounds*
0.011	159	184.02
0.012	174	201.38
0.013	188	217.59
0.014	196	226.85
0.015	202	233.79
0.016	216	250
0.018	239	276.62
0.020	255	295.13
0.022	275	318.28
0.024	300	347.22
0.026	325	375.44
0.028	350	404.32
0.030	375	433.20

Gauge list No. 8 and ream weight table

[Double manila wood pulp filled board]

Caliper thickness of individual sheets in inches	Weight per 500 sheets		
	24 by 36 inches (864 square inches)	28 by 44 inches(1,232 square inches)	25 by 40 inches(1,000 square inches)
	Pounds	*Pounds*	*Pounds*
0.015	180	256	207.8
0.016	192	273	221.6
0.018	216	307	249.2
0.020	230	327	265.4
0.022	244	348	282.5
0.024	264	376	305.2
0.026	286	408	331.2
0.028	308	439	356.3
0.030	315	449	364.4

Rules for figuring weight of odd sizes.

Grades under gauge lists 6, 7, and 8.

(1) Use gauge list covering the kind of material wanted. (2) In column 1 find the thickness wanted; in the last column find its weight (per 1,000 square inches). (3) Multiply this weight by the area of the odd size wanted. (4) Move decimal point to left three places to obtain weight.

Example: Wanted double manila wood pulp filled board 25 by 20 inches (0.030 inch thick). (1) Use gauge list No. 8. (2) Column 1, last line gives thickness 0.030; last column, last line gives weight 364.4 pounds (per 1,000 square inches). (3) $364.4 \times (25 \times 20 = 500) = 182{,}200.0$. (4) Moving decimal point 3 places to left=182.2=weight in pounds of odd size desired.

Paperboard Industries Association, paperboard standards, revised January 20, 1927.

DEFINITIONS

1. *Basis of regular sizes.*

(*a*) Patent coated or manila board: 24 by 36 inches, containing 864 square inches.

(*b*) All other grades of board: 25 by 40 inches, containing 1,000 square inches.

These regular sizes are used as bases for all computations.

2. *Standard package.*

A standard package of patent coated or solid manila board is a ream of 500 sheets.

These grades are sometimes packed, for convenience, in fractions or multiples of a ream, depending upon the size of the sheet.

3. *Bundle.*

A bundle is a package containing 50 pounds of box board. The weight of board in a "bundle" does not vary.

4. *Regular number.*

The number or regular number corresponds to the number of standard-sized sheets (25 by 40) of box board required to make a bundle of 50 pounds.

5. *To determine count.*

To determine the count or number of odd-sized sheets in a bundle proceed as follows:

(1) Knowing the kind, finish, and caliper of board desired, ascertain from the proper gauge list the regular number of such board.

(2) Divide the number of square inches in a bundle of such regular-sized board by the number of square inches in the odd-sized sheet which is desired, and the result is the count or number of odd-sized sheets in a bundle.

Thus, a purchaser desiring to order plain chip board in sheets 20 by 30 inches, No. 2 finish, and 0.060-inch caliper, refers to gauge list No. 1, which shows that the regular number of this board is 35. The number of square inches in a bundle of such regular-sized board is 35,000. A sheet of 20 by 30 board contains 600 square inches; 35,000 divided by 600 equals 58.3. It follows that a standard bundle will contain approximately 58 sheets of the odd size in question.

6. *To determine number.*

Where the count or number of odd-sized sheets in a bundle is known, and it is desired to ascertain the number of regular-sized sheets in a similar package, proceed as follows:

(1) Compute the number of square inches in the odd-sized sheet;

(2) Multiply the result by the count or number of odd-sized sheets in a bundle;

(3) Divide by the number of square inches in the regular sized sheet; and

(4) The result is the number of regular-sized sheets in a bundle. Thus—

(*a*) An odd-sized sheet 20 by 30 inches contains 600 square inches.

(*b*) If there are 58 of such sheets to a bundle, 600 multiplied by 58 equals approximately 35,000, which represents the total number of square inches in the bundle.

(*c*) 35,000 divided by 1,000 (the number of square inches in a regular-sized sheet) equals 35, which represents the number of regular-sized sheets in a bundle.

7. *Basis of gauge lists.*

In gauge lists 1 to 5, inclusive, the numbers in the first column express the number of sheets of regular size contained in a bundle of 50 pounds.

Thus, on gauge list No. 1, No. 35 board means board, 35 regular sheets of which will weigh 50 pounds. The figures in the remaining columns (except the last two columns of list No. 5) represent decimals of an inch, and express the thickness of the various numbers of board finished according to the several methods indicated.

Thus, on gauge list No. 1, one sheet of board No. 35, No. 1 finish, has a thickness of 0.064 inch. The same board, No. 2 finish, has a thickness of 0.060 inch.

In gauge lists Nos. 6, 7, and 8 the figures in the first column represent decimals of an inch, and express the thickness of the various types of board. The remaining columns represent the ream weight in pounds of 500 sheets of the several sizes indicated.

These gauge lists are used exclusively for patent coated, solid manila, patent coated two sides, and double manila wood pulp filled boards.

These grades are usually furnished wrapped in ream or half-ream bundles.

Gauge lists Nos. 1 to 8, inclusive, are the simplified thicknesses as given in Simplified Practice Recommendation No. 44, above.

TEST CONTAINER BOARD STANDARDS

1. *General.*

(*a*) All rolls to be wound tight and true.

(*b*) All breaks or splices are to be flagged.

(*c*) Rolls are to be furnished with or without cores, as agreed upon between buyer and seller.

(*d*) *Minimum order.*—Not less than 10 tons of a grade and not less than 1 ton of a size. Less quantities in special sizes are subject to extra charges.

2. *Trim of machine.*

Specifications must come within a minimum of 5 per cent of the maximum trim of the machine.

3. *Bursting strength test.*

(*a*) One sample, 12 inches square, shall be taken from the second or third ply of each roll in the car.

(*b*) Six tests (three each way), shall be made on each sample.

(*c*) All samples on which not more than one test is below the minimum specified in the car, shall constitute satisfactory delivery.

4. *Moisture.*

Moisture shall not exceed 10 per cent nor be less than 6 per cent.

5. *Bending qualities.*

A board to be considered a "bender," must fold flat under pressure of the fingers, twice each way (forward and back) in the same crease, both with and across the grain without breaking the surface fibers.

6. *Waterproofing.*

A board to be considered "waterproof" must, when folded into tray form and suspended, hold water for a period of three hours without showing moisture on the opposite surface, except where sand holes appear.

7. *Caliper.*

A variation of 0.001 inch (1 point) either way is allowable.

8. *Samples for weight basis.*

Three samples from each roll in the car must be taken to secure the average. (The average weight of all samples taken from the car must not exceed the weight basis.)

9. *Weight basis—test boards.*

The average weight of rolls in a car shall not exceed the maximum weight basis.

However, a variation of 5 per cent in weight of individual rolls is permitted.

The weight bases are as follows:

Maximum weight per 1,000 square feet

Caliper (inch)	Jute	Cylinder kraft	Fourdrinier kraft
	Pounds	*Pounds*	*Pounds*
0.016	70	56	48
0.018	78	63	----
0.023	95	80	----
0.030	120	100	----

10. *Weight basis of nontest boards.*

Nontest boards are subject to the same general basis of weight as applies on test boards. The weight bases are as follows:

Caliper and description	Maximum weight per 1,000 square feet
	Pounds
0.009 chip board	34
0.016 chip board	62
0.009 strawboard	38
0.009 chestnut pulpboard	34
0.009 pine wood fiber board	25

All other matters are details between buyer and seller to be agreed upon mutually at the time the order is placed. Nothing in these specifications shall be understood to prevent individual agreements between buyer and seller contrary to these rules.

472.1 COMBINATION (Nonhomogeneous, One Operation).

(No nationally recognized specifications available.)

472.11 Chip (Jute Lined, Manila Lined, News Vat Lined).

(No nationally recognized specifications available.)

472.12 Manila Board (Clay Coated, Patent Coated).

(No nationally recognized specifications available.)

472.13 News Board (Manila Lined, Patent Coated).

(No nationally recognized specifications available.)

472.14 Pulp Board.

(No nationally recognized specifications available.)

472.15 Strawboard (Jute Lined, Manila Lined, Vat Lined).

(No nationally recognized specifications available.)

472.2 PASTED (Two Operations).

(No nationally recognized specifications available.)

472.21 Pasted Chip.

(No nationally recognized specifications available.)

472.22 Sheet-lined Chip.

(No nationally recognized specifications available.)

472.23 Sheet-lined Straw.

(No nationally recognized specifications available.)

472.24 Wall Board.

(No nationally recognized specifications available.)

472.3 SOLID (Homogeneous, One Operation).

(No nationally recognized specifications available.)

472.31 Chip (Plain, Tack Board, Test).

(No nationally recognized specifications available.)

472.32 Cloth Board (Binders, Tar).

(No nationally recognized specifications available.)

472.33 Friction Board.

(No nationally recognized specifications available.)

472.34 Jute Board.

U. S. Congress, Joint Committee on Printing, specification for jute tag board, December 9, 1926.

Stock: Not less than 50 per cent manila and (or) jute pulp; the remainder coniferous chemical wood pulp.

Weight: 22½ by 28½, 1,000--lbs--	200	240	280
Bursting strength: Average not less than----------pts--	100	120	140

Color and finish: Deliveries must conform to the standard sample.

472.35 Leather Board.

(No nationally recognized specifications available.)

472.36 Pressboard.

U. S. Congress, Joint Committee on Printing, specification for pressboard, colored, December 9, 1926.

Bursting strength: Average not less than----------pts--	80	250
Thickness----------inch--	0. 0140	0. 0300

Texture and surface: Must be close in texture, of uniform thickness, with hard and smooth surfaces free from irregularities and blisters.

Color: Deliveries must match in color the sample furnished with order.

472.37 Pulp Board.

(No nationally recognized specifications available.)

472.38 Strawboard.

(No nationally recognized specifications available.)

472.9 MISCELLANEOUS BOARDS.

472.91 Fish Paper.

(No nationally recognized specifications available.)

472.92 Fuller Board.

(No nationally recognized specifications available.)

472.93 Fiber Board.

(No nationally recognized specifications available.)

472.94 Millboard.

(No nationally recognized specifications available.)

473. BUILDING PAPER.

(No nationally recognized specifications available.)

473.1 ASBESTOS PAPER.

(Mineral product.)

473.2 FELTS (Carpet Lining, Deadening, Saturating).

(No nationally recognized specifications available.)

473.3 THERMAL INSULATING PAPER AND FIBER.

American Railway Association, Mechanical Division, recommended specifications for insulation paper for refrigerator cars, 1917.

Insulation paper shall be made of good quality fibrous material, thoroughly saturated with an asphaltum bitumen. It shall be furnished in either of two weights, known as 90-pound or 110-pound paper.

Physical properties and tests before exposure.

Porosity test.—A test sample 1 foot square shall not show a leakage of more than 8 ounces of water when subjected for two hours to a water column of 55 inches at 60 to 80° F.

Mullen test.—The strength of a test sample, as determined by the standard "Mullen" test, made at a temperature of 70° F., and with load applied at the rate of 3 to 4 pounds per second, shall be as follows: 90-pound paper, not less than 55 pounds; 110-pound paper, not less than 70 pounds.

Bending test.—Paper shall be so pliable, after being cooled in water at a temperature of 32 to 35° F., and while at this temperature, that it may be bent flat upon itself without breaking.

Ash.—The total amount, by combustion of a test sample, of inorganic matter or ash shall not be more than 6 per cent of the original weight.

Physical properties and tests after exposure.

Mullen test.—The strength of a test sample, as determined by the standard "Mullen" test, made at a temperature of 70° F., shall not be affected more than 10 per cent of the original by exposure to a temperature of 150° F., or to air saturated with water vapor at room temperature for seven days.

Bending test.—After exposure to a temperature of 150° F., or to air saturated with water vapor at room temperature for seven days, paper shall be so pliable at temperature of 32 to 35° F., and while at this temperature, that it can be bent flat upon itself without breaking.

Drying and absorption.—The original weight shall not decrease more than 3 per cent by exposure to a temperature of 150° F., nor increase more than 10 per cent by exposure to air saturated with water vapor at room temperature for seven days.

Sampling.—The inspector shall examine and weigh 5 per cent of the paper in each lot offered, and select one sample from each lot of 200 rolls or fraction thereof. Not more than one sample shall be taken from any one roll. Each sample shall have the lot number stenciled on it.

Permissible variations.

Weight.—The average weight of the roll shall correspond within 1 per cent of the weight as indicated by test sample, or the respective weights per 1,000 square feet shall not be less than 85 or 104 pounds for the two weights of paper specified above.

Inspection and rejection.

Inspection.—(*a*) The inspector representing the purchaser shall have free entry, at all time while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of charge, all reasonable facilities and necessary assistance to satisfy him that the material is being furnished in accordance with these specifications. Tests and inspection at the place of manufacture shall be made prior to shipment.

(*b*) The purchaser may make the tests to govern the acceptance or rejection of the material in his own laboratory or elsewhere. Such tests shall be made at the expense of the purchaser.

Rejection.—(*a*) Material represented by samples which fail to conform to the requirements of these specifications will be rejected.

(*b*) Material which, subsequent to test and inspection at the factory or elsewhere and its acceptance, shows defect or imperfections will be rejected and shall be replaced by the manufacturer.

Rehearing.—Samples tested in accordance with these specifications, which represent rejected material, shall be held for fourteen days from date of test report.

473.4 SHEATHING (Waterproof, White Fiber).

(No nationally recognized specifications available.)

474. CARDBOARD.

(No nationally recognized specifications available.)

474.1 BLANKS.

474.11 Nonpasted Blanks.

U. S. Congress, Joint Committee on Printing, specification for railroad board, white and colored, December 9, 1926.

Stock: Facing sheets free from ground-wood pulp.

Ply	4	8	14
Thickness, inch	0.0180	0.0300	0.0480

Coating: Facing sheets must be coated.

Color and finish: Deliveries must conform to the standard sample.

474.12 Pasted Blanks.

(No nationally recognized specifications available.)

474.2 INDEX BRISTOLS.

U. S. Congress, Joint Committee on Printing, specification for sulphite index, white and colored, single-ply paper, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.
Ash: Not to exceed 5 per cent.
Weight: 22½ by 28½, 1,000 ---- lbs -- 182 230 280 362
Bursting strength: Average not less than ---- pts -- 60 75 91 118
Writing and erasure: Must have good writing and erasive qualities.
Color and finish: Deliveries must conform to the standard sample in finish and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag index, white and colored, single-ply paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 2 per cent for white and 3 per cent for colored
Weight: 22½ by 28½, 1,000 ---- lbs -- 182 230 280 362
Bursting strength: Average not less than ---- pts -- 71 90 109 142
Writing and erasure: Must have good writing and erasive qualities.
Color and finish: Deliveries must conform to the standard sample in finish and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 100 per cent rag white index, single-ply, tub-sized, air-dried paper, December 9, 1926.

Stock: 100 per cent rag.
Ash: Not to exceed 2 per cent.
Sizing: Tub-sized with animal glue.
Weight: 22½ by 28½, 1,000 ---- lbs -- 206
Bursting strength: Average not less than ---- pts -- 100
Thickness: Not less than 0.0090 inch, nor more than 0.0100 inch.
Writing and erasure: Must have good writing and erasive qualities.
Color, finish, and formation: Deliveries must conform to the standard sample.

474.3 MILL BRISTOLS (Folders, Tags, etc.).

U. S. Congress, Joint Committee on Printing, specification for manila board, December 9, 1926.

Weight: 22 by 28, 1,000 ---- lbs -- 232 268 392
Bursting strength: Average not less than ---- pts -- 60 68 100
Color and finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for wood bristol board, colored, December 9, 1926.

Weight: 22½ by 28½, 1,000 ---- lbs -- 200
Bursting strength: Average not less than ---- pts -- 50
Thickness: Average ---- .0110
Color and finish: Deliveries must conform to the standard sample in finish and match in color the sample furnished with order.
Surface: Must be suitable for writing on with either ink or pencil.

U. S. Congress, Joint Committee on Printing, specification for U. S. postal card bristol board, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 5 per cent.
Weight: 22½ by 28½, 1,000 ---- lbs -- 188 208
Bursting strength: Average not less than ---- pts -- 48 50
Thickness: (188 pound) Not less than 0.0080 inch nor more than 0.0090 inch, (208 pound) not less than 0.0090 inch nor more than 0.0100 inch.
Color, finish, and formation: The paper must be firm, snappy, and free from curl and flimsiness, and match in color the standard sample. It shall be as clean and free from dirt, specks, fuzz, and discoloration as the standard sample; and without water finish, crushed spots, or calendar marks. It must be suitably sized, uniformly run, calendered, and finished on both sides with a smooth, even, firm, surface suitable for writing on with either ink or pencil and for printing.
Moisture content: Shall be approximately 5 per cent.

474.4 WEDDING BRISTOLS.

(No nationally recognized specifications available.)

474.5 TAG BOARDS.

U. S. Congress, Joint Committee on Printing, specification for high-finish sulphite manila tag board, December 9, 1926.

Stock: 100 per cent coniferous chemical wood pulp.
Weight: 24 by 36, 1,000 ---- lbs -- 160 200 240 280
Bursting strength: Average not less than ---- pts -- 64 80 96 112
Color and finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for wood manila tag board, December 9, 1926.

Weight: 22½ by 28½, 1,000 ---- lbs -- 150 180
Bursting strength: Average not less than ---- pts -- 32 40
Thickness: Average ---- inch -- 0.012
Color and finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for calendered tag board, manila and colored, December 9, 1926.

Stock: 100 per cent coniferous chemical wood pulp.
Ash: Not to exceed 2 per cent.
Weight: 22½ by 28½, 1,000 ---- (approximately) lbs -- 150

Bursting strength: Average not less than
----------pts-- 50
Thickness: Not less than 0.0068 inch, nor more than 0.0077 inch, except lot No. 225.
Color and finish: Deliveries must conform to the standard sample and must be firm, snappy, and free from curl or flimsiness. The board must be uniformly run, free from pinholes, have a smooth, even surface on both sides, and be suitable for use on tabulating machines. Board must be run to thickness, weight may be waived.

475. COVER PAPER, NEWS PAPER, AND PRINTING PAPER.

475.1 COATED COVER PAPER.

U. S. Congress, Joint Committee on Printing, specification for coated cover paper, colored, December 9, 1926.

Stock: Free from ground-wood pulp.
Ash: Not to exceed 35 per cent.
Weight: 20 by 26, 1,000----------lbs-- 100
Bursting strength: Average not less than
----------pts-- 22
Color and finish: Deliveries must conform to the standard sample in finish and match in color the sample furnished with order.

475.2 PASTED COVER PAPER.

(No nationally recognized specifications available.)

475.3 UNCOATED COVER PAPER.

U. S. Congress, Joint Committee on Printing, specification for sulphite machine-finish cover paper, colored, December 9, 1926.

Stock: Free from ground-wood pulp.
Ash: Not to exceed 12 per cent.
Weight: 20 by 26, 1,000----------lbs-- 100
Bursting strength: Average not less than
----------pts-- 35
Color and finish: Deliveries must conform to the standard sample in finish and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 25 per cent rag machine-finish cover paper, colored, December 9, 1926.

Stock: Not less than 25 per cent rag; the remainder free from ground-wood pulp.
Ash: Not to exceed 12 per cent.
Weight: 20 by 26, 1,000----------lbs-- 100
Bursting strength: Average not less than
----------pts-- 35
Color and finish: Deliveries must match in color and finish (smooth or antique) the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag antique cover paper, colored, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from ground-wood pulp.
Ash: Not to exceed 12 per cent.
Weight: 20 by 26, 1,000----------lbs-- 100
Bursting strength: Average not less than
----------pts-- 40
Color and finish: Deliveries must conform to the standard sample in finish and match in color the the sample furnished with order.

475.4 HANGING PAPER (News).

(No nationally recognized specifications available.)

475.5 NEWSPRINT.

U. S. Congress, Joint Committee on Printing, specifications for standard newsprint paper, December 9, 1926.

Weight: 24 by 36, 1,000----------lbs-- 64
Bursting strength: Average not less than
----------pts-- 10
Color, finish, and formation: Deliveries must conform to the standard sample.

475.6 COATED PRINTING PAPER.

U. S. Congress, Joint Committee on Printing, specification for single-coated book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 30 per cent.
Weight: 25 by 38, 1,000----------lbs-- 140
Bursting strength: Average not less than
----------pts-- 18
Color and finish: Deliveries must conform to the standard sample.
Coating and surface: Shall be suitable for printing half tones of 150-line screen on both sides of the sheet and must not flake, pick, lift, or pulverize.

U. S. Congress, Joint Committee on Printing, specification for double-coated book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 35 per cent.
Weight: 25 by 38, 1,000----------lbs-- 140 160
Bursting strength: Average not less than----------pts-- 18 20
Color and finish: Deliveries must conform to the standard sample.
Coating and surface: Shall be suitable for printing half tones of 200-line screen on both sides of the sheet and must not flake, pick, lift, or pulverize.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag double-coated book paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 35 per cent.
Weight: 25 by 38, 1,000----------lbs-- 140 160
Folding endurance: Average, each direction, not less than-----double folds-- 15 15
Bursting strength: Average not less than----------pts-- 22 25
Color and finish: Deliveries must conform to the standard sample.
Coating and surface: Shall be suitable for printing half tones of 200-line screen on both sides of the sheet, and must not flake, pick, lift, or pulverize.

475.7 UNCOATED PRINTING PAPER.

(No nationally recognized specifications available.)

475.71 Bible Paper.

(No nationally recognized specifications available.)

475.72 Book Paper.

U. S. Congress, Joint Committee on Printing, specification for machine-finish book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 12 per cent.

Weight: 25 by 38, 1,000 lbs	70	80	100	120	140
Bursting strength: Average not less than pts	11	12	15	19	22
Thickness: Average inch	0.0025	0.0030	0.0033	0.0040	0.0050

Color, finish, formation, and opacity: Deliveries must conform to the standard sample in finish, formation, and opacity and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for machine-finish book end paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 10 per cent.
Weight: 25 by 38, 1,000 lbs 160
Bursting strength: Average not less than pts 35
Color, finish, and formation: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for antique book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 15 per cent.
Weight: 25 by 38, 1,000 lbs 100
Bursting strength: Average not less than pts 12
Color, finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for lightweight machine-finish book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 15 per cent.
Weight: 25 by 38, 1,000 lbs 60
Bursting strength: Average not less than pts 10
Thickness: Average inch 0.0025
Color, finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag light weight machine-finish book paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 15 per cent.
Weight: 25 by 38, 1,000 lbs 60
Bursting strength: Average not less than pts 10
Thickness: Average inch 0.0025
Color, finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag machine-finish book paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 12 per cent.

Weight: 25 by 38, 1,000 lbs	80	90
Bursting strength: Average not less than pts	14	16
Thickness: Average inch	0.0035	0.0040

Color, finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for supercalendered book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 15 per cent.

Weight: 25 by 38, 1,000 lbs	90	100
Bursting strength: Average not less than pts	12	14
Thickness: Average inch	0.0025	0.0030

Color, finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag supercalendered book paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 12 per cent.

Weight: 25 by 38, 1000 lbs	80	90
Bursting strength: Average not less than pts	14	16
Thickness: Average inch	0.0025	0.0030

Color, finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for half-tone book paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 20 per cent.
Weight: 25 by 38, 1,000 lbs 140
Bursting strength: Average not less than pts 16
Thickness: Average inch 0.0040
Color and finish, formation, and opacity: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for machine-finish lithograph paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 12 per cent.
Weight: 25 by 38, 1,000 lbs 160
Bursting strength: Average not less than pts 20
Color, finish, and formation: Deliveries must conform to the standard sample and be suitable for wet or dry process lithograph printing on both sides of the sheet.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag supercalendered lithograph paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 3 per cent.
Weight: 25 by 38, 1,000 ---- lbs -- 160
Bursting strength: Average not less than ---- pts -- 35
Color, finish, and formation: Deliveries must conform to the standard sample, and be suitable for wet or dry process lithograph printing on both sides of the sheet.

475.73 Coating Paper.

(No nationally recognized specifications available.)

475.74 Mimeograph Paper.

Federal Specifications Board, Specification No. 130a, United States Government master specification for mimeograph paper, revised August 8, 1925.

Type.

This specification is for the purchase of soft-finish, wove impression paper weighing 50 pounds per ream 25 by 38 inches, 500 sheets. This paper is suitable for general duplicating work by mimeograph or other stencils.

Material and workmanship.

See detail requirements, Section IV, below.

General requirements.

Samples.—50 sheets 8 by 10½ inches, to show color and finish, shall be submitted with bid.

Detail requirements.

1. *Weight.*—25 by 40, 500; 52.6 pound basis (25 by 38, 50).
2. *Average bursting strength.*—Shall be not less than 15 points.
3. *Stock.*—Shall be free from unbleached or ground-wood pulp.
4. *Ash.*—Shall not exceed 15 per cent.
5. *Color, finish, and formation.*—Deliveries must conform to the accepted sample and be suitable for mimeographing.
6. *Size.*—6 by 9, 8 by 10½, 8 by 13 inches, as specified in proposal.

Method of inspection and tests.

United States Government general specifications for paper (F. S. B. No. 394) in effect on date of proposal, shall form part of this specification. See No. 470.3.

Federal Specifications Board, Specification No. 131a, United States Government master specification for 50 per cent rag mimeograph paper, revised August 8, 1925.

Same as for mimeograph paper (F. S. B. No. 130a) except for type and detail requirements, which are as follows:

Type.

This specification is for the purchase of 50 per cent rag mimeograph paper, wove, white, weighing 50 pounds per ream 25 by 38 inches, 500 sheets; flat. This paper is suitable for duplicating work by mimeograph or other stencil, and sufficiently sized to be written on with ink.

Detail requirements.

1. *Weight.*—25 by 40, 500; 52.6 pounds basis (25 by 38, 50).
2. *Average bursting strength.*—Shall be not less than 16 points.
3. *Stock.*—Shall be not less than 50 per cent rag; the remainder shall be free from unbleached or ground wood pulp.
4. *Ash.*—Shall not exceed 12 per cent.
5. *Sizing.*—Shall be sufficiently sized to be written on with ink.
6. *Color, finish, and formation.*—Deliveries must conform to the accepted sample and be suitable for mimeographing.
7. *Size.*—8 by 7, 8 by 10½, or 8 by 13 inches, as specified in proposal.

U. S. Congress, Joint Committee on Printing, specification for ground-wood mimeograph paper, December 9, 1926.

Weight: 25 by 38, 1,000 ---- lbs -- 76
Bursting strength: Average not less than ---- pts -- 14
Color, finish, formation, and opacity: Deliveries must conform to the standard sample.
Mimeograph quality: Deliveries must be equal to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for chemical wood mimeograph paper, white and colored, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 15 per cent.
Weight: 17 by 22, 1,000 ---- lbs -- 40 56
Bursting strength: Average not less than ---- pts -- 16 22
Color, finish, formation, and opacity: Deliveries must conform to the standard sample in finish, formation, and opacity, and match in color the sample furnished with order.
Mimeograph quality: Deliveries must be equal to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 30 per cent rag mimeograph paper, December 9, 1926.

Stock: Not less than 30 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 12 per cent.
Weight: 17 by 22, 1,000 ---- lbs -- 40 48
Bursting strength: Average not less than ---- pts -- 18 22
Sizing: Shall be sufficiently sized to be written on with ink.
Color, finish, formation, and opacity: Deliveries must conform to the standard sample.
Mimeograph quality: Must be suitable for mimeographing on both sides of the sheet, and equal to the standard sample in this respect.

475.75 Music Paper.

(No nationally recognized specifications available.)

475.76 Offset Paper.

(No nationally recognized specifications available.)

476. TISSUE PAPER.

476.0 GENERAL ITEMS.

American Paper Industry, Simplified Practice Recommendation No. 46, for tissue paper, March 31, 1926.

In accordance with the unanimous action by the general conference, held in Chicago, Ill., October 8, 1925, of manufacturers, distributers, and consumers of tissue paper, the United States Department of Commerce, through the National Bureau of Standards, recommends that the sizes, weights, and counts of tissue paper be established as follows:

TABLE 1.—*No. 1 and No. 2 sheet tissue*

	Inches
Sizes	20 by 30
	24 by 36

Weight on a 24 by 36, 480-sheet basis = 10 pounds. (Equivalent on a 25 by 40, 500-sheet basis = 12.1 pounds.)

TABLE 2.—*Tissue for shoes*

	Inches
Sizes	8½ by 15
	11 by 20
	12 by 24
	13 by 26

Weight on a 24 by 36, 480-sheet basis = 10 pounds. (Equivalent on a 25 by 40, 500-sheet basis = 12.1 pounds.)

TABLE 3.—*Napkins*

	Inches
Plain tissue	13 by 13
Full crêpe	13½ by 13½
Semicrêpe	13 by 13
Oversize	18 by 18

Weight on a 24 by 36, 480-sheet basis = 10 pounds. (Equivalent on a 25 by 40, 500-sheet basis = 12.1 pounds.)

Bulk flat napkins shall be packed in units of 1,000.

TABLE 4.—*Toilet paper*

	Inches
Sheet toilet	5 by 7

Shall be packed in units of 500 and 1,000.

Weight on a 24 by 36, 480-sheet basis = 10 pounds. (Equivalent on a 25 by 40, 500-sheet basis = 12.1 pounds.)

	Inches
Roll toilet	4½ by 5
	4½ by 4¾
	4½ by 4½

In rolls of 1,000 and 2,000 sheets.

Weight on a 24 by 36, 480-sheet basis = 10 pounds. (Equivalent on a 25 by 40, 500-sheet basis = 12.1 pounds.)

On unbanded toilet paper the label shall be placed on the carton.

1. Size and count shall be placed on all shipping containers of all of the above grades.

2. The label "Made in accordance with Simplified Practice Recommendation No. 46 of the Department of Commerce," is to be used on all of these standards.

These recommendations are effective from March 31, 1926, subject to annual revision by the standing committee of the industry.

476.1 COPYING TISSUE. (See 476.21.

476.2 INDUSTRIAL TISSUES.

476.21 Carbon Paper.

Federal Specifications Board, Specification No. 425, United States Government master specification for lightweight black carbon paper for typewriter use, August 7, 1926.

Same as specification for standard-weight black carbon paper (F. S. B. No. 426) except for type and detail requirements, which are as follows:

Type.

This specification is for the purchase of black carbon paper, light weight, coated one side, for typewriter use; for use in making from 6 to 15 carbon copies at a time.

Detail requirements.

Stock.—Shall be 100 per cent rag or manila hemp or jute rope stock, or a mixture of these.

Weight uncoated.—20 by 30 inches, 500; shall not exceed 5 pounds.

Coating.—Shall be black carbon, and shall make a permanent black record.

Serviceability.—Shall make not less than 10 clean, clear, legible first carbons.

Number of copies.—Shall make not less than 10 clean, clear, legible carbon copies at a time, using elite type, a No. 16, 50 per cent rag bond first sheet and No. 7 manifold bond copy sheets, against a rubber platen; and not less than 15 similar carbon copies at a time, using all No. 7 manifold bond paper, against a brass platen.

Size.—8 by 7, 8 by 10½, 8 by 13, 14 by 17, and 16 by 21 inches, as specified in proposals, or as specified in order, not exceeding 18 by 24 inches.

Federal Specifications Board, Specification No. 426, United States Government master specification for standard-weight black carbon paper for typewriter use, August 7, 1926.

General specifications.

All tests not herein specified shall be made in accordance with United States Government general specification for paper, Federal Specifications Board specification No. 394, in effect on date of proposal. See No. 470.3.

Type.

This specification is for the purchase of black carbon paper, standard weight, coated one side, for typewriter use; for use in making 1 to 5 carbon copies at a time.

Materials and workmanship.

See detail requirements.

General requirements.

Samples.—One sealed package (25 sheets) of 8 by 10½ inch paper, to show general character shall be submitted with bid.

Detail requirements.

1. *Stock.*—Shall be free from ground-wood pulp.

2. *Weight uncoated.*—20 by 30 inches; 500, shall not exceed 9 pounds.

3. *Coating.*—Shall be black carbon, and shall make a permanent black record.

4. *Serviceability.*—Shall make not less than 12 clean, clear, legible first carbons.

5. *Number of copies.*—Shall make not less than 5 clean, clear, legible carbon copies at a time, using elite type, a No. 16, 50 per cent rag bond first sheet and No. 9 manifold bond copy sheets, against a rubber platen.

6. *Size.*—8 by 7, 8 by 10½, 8 by 13, 14 by 17, and 16 by 21 inches, as specified in proposals, or as specified in order not exceeding 18 by 24 inches.

Method of inspection and tests.

1. *Weight uncoated.*—Removal of the carbon coating, for determination of weight of basic paper used, shall be effected by means of the "Carson paper extractor and friction cleanser." (Paper Trade Journal, March 19, 1925. Copies of article may be secured from the National Bureau of Standards, Washington, D. C.) The paper shall be treated in the apparatus for a period of five minutes. After drying the weight of the decarbonized paper shall be determined in the usual way.

2. *Serviceability.*—Shall be determined on any standard typewriter having elite type, using a No. 16, 50 per cent rag bond first sheet and a No. 7 or a No. 9 manifold bond copy sheet, and the sample to be tested by securely fastening a piece approximately 1 inch square of the sample with paper stickers to the back of the first sheet so that the coated side of the sample will come in contact with the copy sheet in the usual way. After placing the paper in the typewriter, the first sheet shall be fastened securely with pins or in other suitable way to the back of the carriage in such a manner that it remains stationary while the second sheet can be moved with the platen as the platen rotates in spacing the lines. The same set of letters or phrases shall then be written on the same portion of the sample fifteen times, line spacing the copy sheet for each writing. The record on the first line of the copy sheet shall be clear and distinct and shall show no tendency to rub or smut. The record on the twelfth line of the copy sheet shall be clear and legible. Preference will be given to carbon papers from which copies show gradual loss of distinctness.

3. *Number of copies.*—Shall be determined on any standard typewriter having elite type, against a rubber platen, using single space.

4. For other methods of inspection and tests, see Section I.

Packing and marking.

1. *Packing.*—Shall be in paper folders, 100 sheets to a folder, each folder containing a sheet of cardboard, 5 folders to a sealed package, unless otherwise specified in order.

2. *Marking.*—Each package shall be marked to show name, size, and quantity of material, specification or stock number, name of contractor, and with the following notice: For making 1 to 5 manifold copies, use the carbon paper covered by this specification. For making 6 to 15 manifold copies, use lightweight carbon paper, United States Government master specification No. 425.

Notes.

This paper is that heretofore generally known as 7-pound paper.

476.22 Cigarette Paper.

(No nationally recoginezd specifications available.)

476.23 Electrical Insulating Tissue Paper.

(See 492.)

476.24 Pattern Paper.

(No nationally recognized specifications available.)

476.25 Stereotyping Paper.

U. S. Congress, Joint Committee on Printing, specification for facing stereo tissue, December 9, 1926.

Stock: 100 per cent rag.
Ash: Not to exceed 2 per cent.
Weight: 19 by 24, 1,000 ---------- lbs -- 9
Bursting strength: Average not less than ---------- pts -- 7
Color, finish, and formation: Deliveries must conform to the standard sample and be satisfactory for the making of stereotype matrices.

U. S. Congress, Joint Committee on Printing, specification for white stereotype molding paper, December 9, 1926.

Stock: Free from ground-wood pulp.
Ash: Not to exceed 10 per cent.
Weight: 19 by 24, 1,000 ---------- lbs -- 120
Bursting strength: Average not less than ---------- pts -- 24
Molding quality: Shall be satisfactory for making wet stereotype mats.

U. S. Congress, Joint Committee on Printing, specification for red stereotype molding, December 9, 1926.

Stock: Free from ground-wood pulp.
Ash: Not to exceed 10 per cent.
Weight: 19 by 24, 1,000 ---------- lbs -- 80
Bursting strength: Average not less than ---------- pts -- 14
Molding quality: Shall be satisfactory for making wet stereotype mats.

476.3 SANITARY TISSUES.

476.31 Napkins.

(See 476.0.)

476.32 Toilet Paper.

(See 476.0.)

476.4 TISSUE WRAPPING PAPER.

(No nationally recognized specifications available.)

476.9 MISCELLANEOUS TISSUE PAPER.

U. S. Congress, Joint Committee on Printing, specification for white tissue paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Weight: 21 by 32, 1,000----------lbs-- 18
Bursting strength: Average not less than ----------pts-- 5
Color, finish, and formation: Deliveries must conform to the standard sample.

477. WRAPPING PAPER.

(See 476.4.)

477.0 GENERAL ITEMS.

American Paper Industry, Simplified Practice Recommendation No. 42, for paper grocers' bags October 15, 1925.

In accordance with the unanimous action on May 26, 1925, of the general conference of representatives of manufacturers, distributers, and users of paper grocers' bags, the United States Department of Commerce, through the National Bureau of Standards, recommends that capacities, colorse qualities, and strengths of paper grocers' bags b, established as follows:

RECOMMENDED STANDARDS FOR CAPACITY

TABLE 1.—*Self-opening grocers' bags*

Size in pounds	Standard capacity	Minimum capacity	Size in pounds	Standard capacity	Minimum capacity
	Cubic inches	*Cubic inches*		*Cubic inches*	*Cubic inches*
¼----------	16. 87	16. 17	8----------	304. 04	304. 04
½----------	30. 84	30. 18	10----------	350. 17	350. 01
1----------	51. 66	51. 18	12----------	433. 28	433. 11
2----------	83. 78	83. 24	14----------	545. 92	545. 19
3----------	119. 98	119. 10	16----------	593. 60	593. 05
4----------	151. 98	151. 21	20----------	700. 48	700. 29
5----------	191. 80	191. 07	25----------	779. 97	779. 07
6----------	240. 40	240. 09			

TABLE 2.—*Square grocers' bags*

Size in pounds	Standard capacity	Minimum capacity	Size in pounds	Standard capacity	Minimum capacity
	Cubic inches	*Cubic inches*		*Cubic inches*	*Cubic inches*
¼----------	16. 41	16. 21	7----------	277. 45	277. 04
½----------	30. 076	30. 03	8----------	304. 76	304. 02
1----------	51. 80	51. 17	10----------	350. 25	350. 00
2----------	83. 50	83. 04	12----------	433. 81	433. 01
3----------	119. 23	119. 08	14----------	545. 42	545. 01
4----------	151. 18	151. 02	16----------	593. 47	593. 04
5----------	191. 61	191. 02	20----------	700. 69	700. 05
6----------	240. 40	240. 04	25----------	779. 23	779. 11

TABLE 3.—*Flat grocers' bags*

Size in pounds	Standard capacity	Minimum capacity	Size in pounds	Standard capacity	Minimum capacity
	Cubic inches	*Cubic inches*		*Cubic inches*	*Cubic inches*
¼----------	16. 41	16. 03	7----------	277. 45	277. 04
½----------	30. 076	30. 03	8----------	304. 76	304. 10
1----------	51. 80	51. 18	10----------	350. 52	350. 00
2----------	83. 50	83. 04	12----------	433. 81	433. 02
3----------	119. 23	119. 01	14----------	545. 42	545. 01
4----------	151. 18	151. 07	16----------	593. 47	593. 04
5----------	191. 61	191. 02	20----------	700. 59	700. 07
6----------	240. 40	240. 06	25----------	779. 23	779. 11

These recommendations are to become effective October 15, 1925, subject to regular annual revision by the standing committee of the industry.

477.1 BOGUS WRAPPING PAPER.

(No nationally recognized specifications available.)

477.2 MANILA WRAPPING PAPER.

Federal Specifications Board, Specification No. 132a, United States Government master specification for wood manila wrapping paper, revised August 8, 1925.

Types.

This specification is for the purchase of wood manila wrapping paper weighing 30, 40, 50, and 60 pounds per ream 24 by 36 inches, 500 sheets; flat or in rolls as specified in proposals.

Material and workmanship.

See Detail requirements.

General requirements.

Strength.—Must vary proportionately with the weight.

Samples.—10 sheets 8 by 10½ inches, to show color and finish, must be submitted with bid.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Method of inspection and tests.

United States Government general specification for paper (F. S. B. No. 394) in effect on date of proposal shall form part of this specification. (See No. 470.3.)

Packing and marking.

Packing.—Shall be folded and wrapped bundles (500-sheet reams) or in wrapped rolls, as ordered.

Marking.—Each package shall be marked to show name, size, and quantity of material, specification or stock number, and name of contractor.

Federal Specifications Board, Specification No. 133a, United States Government master specification for rope manila wrapping paper, revised August 8, 1925.

Same as specification for wood manila wrapping paper (F. S. B. No. 132a) except for types and detail requirements which are as follows:

Types.

This specification is for the purchase of rope manila wrapping paper weighing 60, 70, 80, and 140 pounds per ream 24 by 36 inches, 500 sheets; flat or in rolls as specified in proposals.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

U. S. Congress, Joint Committee on Printing, specification for wood manila paper, December 9, 1926.

Weight: 24 by 36, 1,000--lbs--	60	80	100	120
Bursting strength: Average not less than----------pts--	12	16	20	24

Color and finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for rope manila paper, December 9, 1926.

Stock: Not less than 75 per cent manila and (or) jute pulp; the remainder coniferous chemical wood pulp.

Weight: 24 by 36, 1,000 lbs--	120	140	160	280
Bursting strength: Average not less than ------pts--	60	70	80	120

Color and finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for oiled manila tympan paper, December 9, 1926.

Weight: 24 by 36, 1,000 (approximately) lbs-- 172
Bursting strength: Average not less than--pts-- 33
Oil: Must be evenly distributed and odorless, and the paper must not be greasy to the touch.
Surface: Must be uniform, even, and free from lumps.

U. S. Congress, Joint Committee on Printing, specification for plate-wiping paper for embossing presses, December 9, 1926.

Weight: 24 by 36, 1,000----------lbs-- 100
Bursting strength: Average not less than ----------pts 25
Surface: Deliveries must conform to the standard sample, be smooth, free from lumps, and satisfactory for plate-wiping purposes.

477.3 NO. 1 KRAFT PAPER.

Federal Specifications Board, Specification No. 177a, United States Government master specification for kraft wrapping paper, revised August 8, 1925.

Same as specification for wood manila wrapping paper (F. S. B. No. 132a. See 477.2) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of kraft wrapping paper weighing 30, 40, 50, 60, 70, and 80 pounds per ream, 24 by 36 inches, 500 sheets; flat or in rolls as specified in proposals.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

U. S. Congress, Joint Committee on Printing, specification for No. 1 kraft paper, December 9, 1926.

Stock: 100 per cent sulphate pulp.

Weight: 24 by 36, 1,000------lbs--	120	160
Bursting strength: Average not less than----------pts--	60	80
Folding endurance: Average, each direction, not less than ----------double folds--	1,200	2,000

Color and finish: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for back-lining paper for case-making machines, December 9, 1926.

Weight: 24 by 36, 1,000----------lbs-- 180
Bursting strength: Average not less than ----------pts-- 20

477.4 NO. 2 KRAFT PAPER.

U. S. Congress, Joint Committee on Printing, specification for No. 2 kraft paper, December 9, 1926.

Stock: 100 per cent sulphate pulp.

Weight: 24 by 36, 1,000-------lbs--	60	80	100	120	140	160
Bursting strength: Average not less than----------pts--	27	36	45	54	63	72
Folding endurance: Average, each direction, not less than ----------double folds--	200	300	500	600	800	1,000

Color and finish: Deliveries must conform to the standard sample.

477.5 SANITARY WRAPPING PAPER.

U. S. Congress, Joint Committee on Printing, specification for white paraffin paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Weight: 24 by 38, 1,000----------lbs-- 32
Bursting strength: Average not less than ----------pts-- 5
Paraffin: Not less than 20 per cent nor more than 30 per cent and shall be uniformly applied.

477.6 SCREENINGS.

(No nationally recognized specifications available.)

477.7 SULPHITE WRAPPING PAPER.

Federal Specifications Board, Specification No. 178a, United States Governemnt master specification for sulphite manila wrapping paper, revised August 8, 1925.

Same as specification for wood manila wrapping paper (F. S. B. No. 132a, see 477.2) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of sulphite manila wrapping paper weighing 50, 60, 70, and 80 pounds per ream 24 by 36 inches, 500 sheets; flat or in rolls as specified in proposals.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

U. S. Congress, Joint Committee on Printing, specification for sulphite manila paper, December 9, 1926.

Stock: 100 per cent coniferous chemical wood pulp.

Weight: 24 by 36, 1,000 ----------lbs--	100	120	140	160
Bursting strength: Average not less than--------pts--	40	48	56	64

Color and finish: Deliveries must conform to the standard sample.

477.8 WATERPROOF WRAPPING PAPER.

478. WRITING PAPER.

(No nationally recognized specifications available.)

478.1 COMMERCIAL WRITING PAPER.

478.11 Bond Writing Paper.

Federal Specifications Board, Specification No. 319, United States Government master specification for 100 per cent rag white bond paper, September 16, 1925.

Types.

This specification is for the purchase of 100 per cent rag bond paper, white, glazed and unglazed,

substance Nos. 13, 16, 20, and 24; tub-sized and air-dried; flat; suitable for most important correspondence and permanent records.

Material and workmanship.

See Detail requirements below.

General requirements.

Strength.—Shall vary proportionately with the weight, except as noted.

Samples.—10 sheets 8 by 10½ inches, to show color and finish, shall be submitted with bid.

Detail requirements.

Stock.—100 per cent rag.

Weight.—25 by 40, 500; 34.7-pound basis (No.13); 42.8-pound basis (No. 16); 53.5-pound basis (No.20); 64.2-pound basis (No. 24).

Average bursting strength.—Not less than 30 points for No. 13; not less than 36 points for No. 16; not less than 45 points for No. 20; not less than 54 points for No. 24.

Average folding endurance (each direction).—Not less than 300 double folds for No. 13; not less than 500 double folds for Nos. 16, 20, and 24.

Ash.—Not to exceed 2 per cent.

Sizing.—Tub-sized with animal glue.

Color, finish, and formation.—Deliveries shall conform to the accepted sample in formation, and match in color and finish the sample furnished with order.

Watermark.—Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter.

Size.—6 by 9, 8 by 10½, 8 by 13, and 16 by 21 inches, as specified in proposals.

Method of inspection and tests.

For details of methods of inspection and tests, see United States Government general specification for paper (F. S. B. No. 394) which shall form part of this specification. (See No. 470.3.)

Federal Specifications Board, Specification No. 320, United States Government master specification for 50 per cent rag bond paper, white and colored, September 16, 1925.

Same as specification for 100 per cent rag white bond paper (F. S. B. No. 319) except for types and detail requirements which are as follows:

Types.

This specification is for the purchase of 50 per cent rag bond paper, white, blue, buff, green, pink, salmon, and yellow, glazed and unglazed, substance Nos. 13, 16, 20, and 24; tub-sized and air-dried; flat.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 328, United States Government master specification for sulphite bond paper, white and colored, September 16, 1925.

Same as specification for 100 per cent rag white bond paper (F. S. B. No. 319) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of sulphite bond paper, white, blue, buff, green, pink, salmon, and yellow, substance Nos. 16 and 20; flat.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 329, United States Government master specification for sulphite writing paper, white and colored, September 16, 1925.

Same as specification for 100 per cent rag white bond paper (F. S. B. No. 319), except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of sulphite writing paper, white, blue, buff, pink, green, salmon, and yellow, substance Nos. 16 and 20; flat.

Detail requirements.

Stock.—Shall be 100 per cent bleached coniferous sulphite pulp.

Weight.—25 by 40, 500; 42.8 pound basis (No. 16); 53.5 pound basis (No. 20).

Average bursting strength.—Shall be not less than 16 points for No. 16, not less than 20 points for No. 20.

Average folding endurance (each direction).—Shall be not less than 20 double folds.

Ash.—Shall not exceed 5 per cent.

Color, finish, and formation.—Deliveries shall conform to the accepted sample in finish and formation, and match in color the sample furnished with order.

Size.—8 by 10½, 8 by 13, or 17 by 22 inches, as specified in proposals.

U. S. Congress, Joint Committee on Printing, specification for sulphite bond paper, white and colored, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.
Ash: Not to exceed 3 per cent.

Weight: 17 by 22, 1,000----lbs--	26	32	40	48
Folding endurance: Average, each direction, not less than ----------double folds--	30	40	40	40
Bursting strength: Average not less than----------pts--	16	20	25	30

Color, finish and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 30 per cent rag bond paper, white and colored, tub sized, air dried, December 9, 1926.

Stock: Not less than 30 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 2 per cent for white and 3 per cent for colored.
Sizing: Tub sized.

Weight: 17 by 22, 1,000----lbs--	26	32	40	48
Folding endurance: Average, each direction, not less than ----------double folds--	30	50	50	50
Bursting strength: Average not less than----------pts--	19	24	30	36

Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag bond paper, white and colored, tub sized, air dried, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.

Ash: Not to exceed 2 per cent for white and 3 per cent for colored.

Sizing: Tub sized with animal glue.

Weight: 17 by 22, 1,000----lbs--	26	32	40	48
Folding endurance: Average, each direction, not less than ----------double folds--	65	100	100	100
Bursting strength: Average, not less than----------pts--	22	28	35	42

Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

Watermark: Only the seal of the United States on a basis of four times on a sheet 16 by 21 inches, once in each quarter. The copy of this design to be supplied by the Public Printer.

U. S. Congress, Joint Committee on Printing, specification for 75 per cent rag white bond paper, tub-sized, air-dried, December 9, 1926.

Stock: Not less than 75 per cent rag; the remainder free from unbleached or ground wood pulp.

Ash: Not to exceed 2 per cent.

Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000 ----------lbs--	26	32	40	48
Folding endurance: Average each direction, not less than-------double folds--	130	200	200	200
Bursting strength: Average not less than--------pts--	26	32	40	48

Color, finish, and formation: Deliveries must conform to the standard sample.

Watermark: Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter. The copy of this design to be supplied by the Public Printer.

U. S. Congress, Joint Committee on Printing, specification for 100 per cent rag white bond paper, tub-sized, air-dried, December 9, 1926.

Stock: 100 per cent rag.

Ash: Not to exceed 2 per cent.

Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000----lbs--	32	40	48	
Folding endurance: Average, each direction, not less than ----------double folds	900	900	900	
Bursting strength: Average not less than----------pts--	40	50	60	

Color, finish, and formation: Deliveries must conform to the standard sample.

Watermark: Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter. The copy of this design to be supplied by the Public Printer.

U. S. Congress, Joint Committee on Printing, specification for declaration bond paper, tub-sized, air-dried, December 9, 1926.

Stock: 100 per cent rag.

Ash: Not to exceed 2 per cent.

Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000----------lbs--	32	40
Folding endurance: Average, each direction, not less than-----double folds--	900	900
Bursting strength: Average not less than----------pts--	40	50

Color, finish, and formation: Deliveries must conform to the standard sample.

Watermark: Must conform with that of the standard sample. Four localized watermarks must appear in each 17 by 22 inch sheet. All sheets shall lay so that the watermark will read in the same direction. The "dandy roll" used to effect the watermark shall be furnished by the contractor at his expense and will immediately become the property of the United States, and must be delivered to the Public Printer or his authorized agent whenever demand is made therefor. The watermark shall read as follows:

U. S. A. U. S. A.
Declaration
of
Intention
U. S. A. U. S. A.

478.12 Flat Writing Paper.

(No nationally recognized specifications available.)

478.13 Ledger Paper.

Federal Specifications Board, Specification No. 321, United States Government master specification for 100 per cent rag ledger paper, white, September 16, 1925.

Types.

This specification is for the purchase of 100 per cent rag ledger paper, white, substance Nos. 24, 28, 32, 36, 40, and 48; tub-sized and air-dried; flat.

Material and workmanship.

See Detail requirements.

General requirements.

Strength.—Shall vary proportionately with the weight, except as noted.

Samples.—10 sheets 8 by 10½ inches, to show color and finish, shall be submitted with bid.

Detail requirements.

Similar to those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 322, United States Government master specification for 75 per cent rag ledger paper, white and colored, September 16, 1925.

Same as specification for 100 per cent rag ledger paper (F. S. B. No. 321) except for detail requirements, which are as follows:

Detail requirements.

Similar to those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 330, United States Government master specification for 100 per cent rag heavy ledger paper, white, September 16, 1925.

Same as specification for 100 per cent rag ledger paper (F. S. B. No. 321) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of 100 per cent rag heavy ledger paper, white, single-ply, substance No. 60; tub-sized and air-dried; not watermarked; flat.

Detail requirements.

Stock.—Shall be 100 per cent rag.

Weight.—25 by 40, 500; 160.4 pound basis (No. 60).

Average bursting strength.—Shall be not less than 100 points.

Ash.—Shall not exceed 2 per cent.

Sizing.—Shall be tub-sized with animal glue.

Writing and erasure.—Shall have good writing and erasive qualities.

Color, finish, and formation.—Deliveries shall conform to the accepted sample in finish and formation, and match in color the sample furnished with order.

Size.—20½ by 30½ or 21 by 32½ inches, as specified in proposals.

Color, finish, and formation.—Deliveries shall conform to the accepted sample in finish and formation, and match in color the sample furnished with order.

Watermark.—Not watermarked, or watermarked Government seal or mill brand, as specified in proposals.

Size.—As specified in proposals.

Method of inspection and tests.

For details of methods of inspection and test, see United States Government general specifications for paper (F. S. B. No. 394) which shall form part of this specification. See No. 470.3.

Packing and marking.

Packing.—Each ream to be wrapped with manila paper and sealed.

Marking.—Each package to be marked to show name, size, and quantity of material, specification or stock number, and name of contractor.

U. S. Congress, Joint Committee on Printing, specification for sulphite ledger paper, white and colored, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.
Ash: Not to exceed 3 per cent.

Weight: 17 by 22, 1,000 ---- lbs --	56	64	80
Folding endurance: Average, each direction, not less than -- double folds --	30	30	30
Bursting strength: Average not less than ---- pts --	35	40	50

Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag ledger paper, white and colored, tub-sized, air-dried, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 2 per cent for white and 3 per cent for colored.
Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000 ---- lbs --	48	56	64	72	80	88
Folding endurance: Average, each direction, not less than ---- ---- double folds --	100	100	100	100	100	100
Bursting strength: Average not less than -- pts --	38	44	50	56	58	60

Writing and erasure: Must have good writing and erasive qualities.
Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.
Watermark: Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter, except substance Nos. 80 and 88. The copy of this design to be supplied by the Public Printer.

U. S. Congress, Joint Committee on Printing, specification for 75 per cent rag ledger paper, white and colored, tub-sized, air-dried, December 9, 1926.

Stock: Not less than 75 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 2 per cent for white and 3 per cent for colored.
Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000 ---- lbs --	48	56	64	72	80	88
Folding endurance: Average, each direction, not less than ---- ---- double folds ----	200	200	200	200	200	200
Bursting strength: Average not less than pts	42	49	56	63	65	67

Writing and erasure: Must have good writing and erasive qualities.
Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.
Watermark: Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter, except substance Nos. 80 and 88. The copy of this design to be supplied by the Public Printer.

U. S. Congress, Joint Committee on Printing, specification for 100 per cent rag white ledger paper tub-sized, air-dried (for permanent records), December 9, 1926.

Stock: 100 per cent new white or cream rags.
Ash: Not to exceed 2 per cent.

Residual chemicals: Must not show presence of injurious chemicals.

Sizing: Tub-sized with high-grade animal glue. Starch not to be used. Rosin not to exceed 1.5 per cent.

Weight: 17 by 22, 1,000 ---- lbs --	48	56	64	72	80	88
Folding endurance: Average each direction, not less than -- double folds --	800	800	800	800	800	800
Bursting strength: Average not less than ---- pts --	55	64	73	82	88	94

Writing and erasure: Must have good writing and erasive qualities.

Color, finish, and formation: Deliveries must conform to the standard sample.

Watermark: Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter, except substances Nos. 80 and 88. The copy of this design to be supplied by the Public Printer.

478.14 Linen Paper.

(No nationally recognized specifications available.)

478.15 Papeterie Paper.

(No nationally recognized specifications available.)

478.16 Parchment Deed Paper.

U. S. Congress, Joint Committee on Printing, specification for parchment deed paper, tub-sized, air-dried, December 9, 1926.

Stock: 100 per cent rag.

Ash: Not to exceed 2 per cent.

Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000 ---- lbs -- 64

Folding endurance: Average, each direction, not less than ---- double folds -- 900

Bursting strength; Average not less than ---- pts -- 70

Color, finish, and formation: Deliveries must conform to the standard sample.

478.17 Railroad Writing Paper.

(No nationally recognized specifications available.)

478.18 Wedding Writing Paper.

(No nationally recognized specifications available.)

478.19 Miscellaneous Commercial Writing Paper.

U. S. Congress, Joint Committee on Printing, specification for sulphite writing paper, white and colored, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.

Ash: Not to exceed 5 per cent.

Weight: 17 by 22, 1,000 ---- lbs --	26	32	40	48
Folding endurance: Average, each direction, not less than ---- double folds --	15	20	20	20
Bursting strength: Average not less than ---- pts --	13	16	20	24

Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation, and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 100 per cent rag white writing paper, tub sized, air-dried, December 9, 1926.

Stock: 100 per cent rag.

Ash: Not to exceed 2 per cent.

Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000 ---- lbs -- 56

Bursting strength: Average not less than ---- pts -- 48

Color, finish, and formation: Deliveries must conform to the standard sample.

Watermark: Only the seal of the United States, on a basis of four times on a sheet 16 by 21 inches, once in each quarter. The copy of this design to be supplied by the Public Printer.

478.2 DUPLICATING PAPER.

(No nationally recognized specifications available.)

478.21 French Folio Paper.

(No nationally recognized specifications available.)

478.22 Manifold Paper (Includes Stencil Paper).

Federal Specifications Board, Specification No. 323, United States Government master specification for 100 per cent rag manifold paper, white and colored, September 16, 1925.

Types.

This specification is for the purchase of 100 per cent rag manifold paper, white, blue, buff, green, pink, salmon, and yellow, unglazed; substance Nos. 7 and 9; tub sized and air dried; flat.

Material and workmanship.

See detail requirements, below.

General requirements.

Quality.—Shall be suitable for permanent records.

Strength.—Shall vary proportionately with the weight.

Samples.—10 sheets 8 by 10½ inches, to show color and finish, shall be submitted with bid.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Method of inspection and tests.

For details of methods of inspection and test, see United States Government general specifications for paper (F. S. B. No. 394), which shall form part of this specification. (See 470.3.)

Federal Specifications Board, Specification No. 331a, United States Government master specification for 50 per cent rag manifold paper, white and colored, glazed, revised May 12, 1927.

Same as specification for 100 per cent rag manifold paper (F. S. B. No. 323) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of 50 per cent manifold paper, white, blue, buff, green, pink, salmon, and yellow; substance No. 8; glazed; flat.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 484a, United States Government master specification for 50 per cent rag manifold paper, white and colored, unglazed, revised May 12, 1927.

Same as specification for 50 per cent rag manifold paper, glazed (F. S. B. No. 331a) except for finish, weight, and bursting strength, which are as follows:

Finish.—Deliveries shall match in finish the sample furnished with the order.

Weight.—25 by 40, 500; 18.7-pound basis (17 by 22, 500; 7, No. 7 substance) 24.1-pound basis (17 by 22, 500; 9, No. 9 substance).

Average bursting strength.—Shall be not less than 11 points for No. 7; not less than 14 points for No. 9.

U. S. Congress, Joint Committee on Printing, specification for sulphite manifold paper, white and colored, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.
Ash: Not to exceed 3 per cent.
Weight: 17 by 22, 1,000----------lbs-- 18
Bursting strength: Average not less than---
----------pts-- 10
Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag manifold paper, white and colored, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 2 per cent for white and 3 per cent for colored.
Sizing: Shall be sufficiently sized to be written on with ink.
Weight: 17 by 22, 1,000----------lbs-- 14 18
Bursting strength: Average not less than
----------pts-- 11 14
Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag white glazed manifold paper, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 3 per cent.
Weight: 17 by 22, 1,000----------lbs-- 16
Bursting strength: Average not less than
----------pts-- 12
Color, finish, and formation: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 100 per cent rag manifold paper, white and colored, tub-sized, air-dried, December 9, 1926.

Stock: 100 per cent rag.
Ash: Not to exceed 2 per cent for white and 3 per cent for colored.
Sizing: Tub-sized with animal glue.
Weight: 17 by 22, 1,000----------lbs-- 14 18
Bursting strength: Average not less than
----------pts-- 14 18
Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation and match in color the sample furnished with order.

478.23 Onionskin Paper.

(No nationally recognized specifications available.)

478.3 INDUSTRIAL PAPER.

478.31 Chart and Map Paper.

Federal Specifications Board, Specification No. 129a, United States Government master specification for chart paper, revised August 8, 1925.

Type.

This specification is for the purchase of first-class chart paper, white or cream white, lithograph finish, weighing 48 pounds per ream, 17 by 22 inches, 500 sheets; carefully sized and of a quality to withstand frequent handling.

Material and workmanship.

See detail requirements.

General requirements.

Samples.—Ten sheets 28 by 32 inches, to show color and finish, must be submitted with bid.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing, except folding endurance, which is 500 double folds.

Method of inspection and tests.

United States Government general specifications for paper (F. S. B. No. 394) in effect on date of proposal, shall form part of this specification. (See 470.3.)

Federal Specifications Board, Specification No. 324, United States Government master specification for lithograph-finish map paper, September 16,1925.

Types.

This specification is for the purchase of lithograph-finish map paper for color printing, substance Nos. 16 and 20; flat.

General requirements.

Strength.—Shall vary proportionately with the weight.

Samples.—Ten sheets 8 by 10½ inches, to show color, finish, formation, and cleanliness, shall be submitted with bid.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 325, United States Government master specification for 50 per cent rag lithograph-finish map paper, September 16, 1925.

Same as specification for lithograph finish map paper (F. S. B. No. 324) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of 50 per cent rag lithograph-finish map paper for color printing, substance Nos. 20, 24, and 28, tub-sized and air-dried; flat.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Federal Specifications Board, Specification No. 326, United States Government master specification for 75 per cent rag lithograph-finish map paper, September 16, 1925.

Same as specification for lithograph-finish map paper (F. S. B. No. 324) except for types and detail requirements, which are as follows:

Types.

This specification is for the purchase of 75 per cent rag lithograph-finish map paper for color printing, substance Nos. 16, 20, 24, and 28, tub-sized and air-dried; flat.

Detail requirements.

Same as those of the U. S. Congress, Joint Committee on Printing.

Method of inspection and tests.

All tests shall be made in accordance with United States Government general specifications for paper (F. S. B. No. 394) in effect on date of proposal, which shall form part of this specification. (See 470.3.)

U. S. Congress, Joint Committee on Printing, specification for lithograph-finish map paper, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.
Ash: Not to exceed 3 per cent.

Weight: 17 by 22, 1,000 ---------- lbs --	32	40
Folding endurance: Average, each direction, not less than ------- double folds --	30	30
Bursting strength: Average not less than ---------- pts --	20	25

Color, finish, formation, and cleanliness: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 50 per cent rag lithograph-finish map paper, tub-sized, air-dried, December 9, 1926.

Stock: Not less than 50 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 3 per cent.
Sizing: Tub-sized.

Weight: 17 by 22, 1,000 -------- lbs --	40	48	56
Folding endurance: Average, each direction, not less than ---------- double folds --	60	60	60
Bursting strength: Average not less than ---------- pts --	30	36	42

Color, finish, formation, and cleanliness: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 75 per cent rag lithograph-finish map paper, tub-sized, air-dried, December 9, 1926.

Stock: Not less than 75 per cent rag; the remainder free from unbleached or ground-wood pulp.
Ash: Not to exceed 3 per cent.
Sizing: Tub-sized with animal glue.

Weight: 17 by 22, 1,000 ---------- lbs --	32	40	48	56
Folding endurance: Average, each direction, not less than ------- double folds --	125	150	150	150
Bursting strength: Average not less than -------- pts --	28	35	42	49

Color, finish, formation, and cleanliness: Deliveries must conform to the standard sample.

U. S. Congress, Joint Committee on Printing, specification for 100 per cent rag white chart paper, lithograph finish, tub-sized, air-dried, December 9, 1926.

Stock: 100 per cent rag.
Ash: Not to exceed 3 per cent.

Weight: 17 by 22, 1,000 ---------- lbs --	96
Folding endurance: Average, each direction, not less than ---------- double folds --	2, 000
Bursting strength: Average not less than ---------- pts --	75

Thickness: Approximately 0.007 inch.
Sizing: Tub-sized with animal glue.
Erasure: To be of a quality to withstand redrawing in ink where erasures are made.
Color and finish: Deliveries must conform to the sample submitted with order, and be suitable for printing nautical charts from engraved copper, stone, aluminum, and zinc plates.
Formation: Shall be close, even, and free from wet-end crush marks.
Sorting: Shall be closely sorted to insure absence of specks, size spots, lumps, or particles that may injure the plates.

478.32 Drawing Paper.

(No nationally recognized specifications available.)

478.33 Safety Writing Paper.

U. S. Congress, Joint Committee on Printing, specification for blue U S M O safety writing paper, safety or sensitive design, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.
Ash: Not to exceed 5 per cent.

Weight: 17 by 22, 1,000 ---------- lbs --	32
Folding endurance: Average, each direction, not less than ---------- double folds --	20
Bursting strength: Average not less than ---------- pts --	20

Color, finish, and formation: Deliveries must conform to the standard sample. The surface of the paper must contain a dye or other substance very sensitive to the action of chemical reagents such as are used for removing ink, and should clearly show any attempt at mechanical erasure. The dyed or impregnated fibers should form a pattern only on the surface of the paper. The safety properties of the paper must be equal to those of the standard sample.
Watermark: Must bear such design as the Public Printer may prescribe. The device used to effect the watermark shall be furnished by the contractor

at his expense, and will immediately become the property of the United States, and must be delivered to the Public Printer or his authorized agent whenever demand is made therefor. This paper must also show such safety device as may be prescribed by the Public Printer. These safety devices shall not be used in the manufacture of any paper but that ordered by the Government.

U. S. Congress, Joint Committee on Printing, specification for U S M O writing paper, white and blue, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.

Ash: Not to exceed 5 per cent.

Weight: 17 by 22, 1,000----------lbs-- 32

Folding endurance: Average, each direction, not less than----------double folds-- 20

Bursting strength: Average not less than ----------pts-- 20

Color, finish, and formation: Deliveries must conform to standard sample in finish and formation, and match in color the sample furnished with order.

Watermark: Must bear the letters U S M O or such design as the Public Printer may prescribe. The device used to effect the watermark shall be furnished by the contractor, at his expense, and will immediately become the property of the United States, and must be delivered to the Public Printer or his authorized agent whenever demand is made therefor. This paper must also show such safety device as may be prescribed by the Public Printer. These safety devices shall not be used in the manufacture of any paper but that ordered by the Government.

U. S. Congress, Joint Committee on Printing, specification for safety writing paper, colored, December 9, 1926.

Stock: 100 per cent bleached coniferous chemical wood pulp.

Ash: Not to exceed 5 per cent.

Weight: 17 by 22, 1,000----------lbs-- 40

Bursting strength: Average not less than ----------pts-- 24

Color, finish, and formation: Deliveries must conform to the standard sample in finish and formation, and match in color the sample furnished with order.

Safety device: The surface of the paper must contain a dye or other substance very sensitive to the action of chemical reagents such as are used for removing ink, and should clearly show any attempt at mechanical erasure. The dyed or impregnated fibers should form a pattern only on the surface of the paper. The safety properties of the paper must be equal to those of the standard sample.

Bidder must submit sample of safety design which he proposes to furnish and deliveries must conform to the accepted sample.

478.34 Sensitizing Paper.

Federal Specifications Board, Specification No. 179, United States Government master specification for No. 1 grade blue print paper (sensitized and unsensitized), June 30, 1924.

Types.

This specification is for the purchase of No. 1 grade blue print paper, sensitized and unsensitized, thin, medium, and thick; sensitized, in 10 or 50 yard rolls and weights as specified in proposals; unsensitized, rolls and weights as specified in proposals.

See detail requirements.

Material and workmanship.

See Detail requirements.

General requirements.

Quality.—Must be suitable for permanent records which are subject to frequent handling.

Samples.—3-yard 36-inch roll of each weight, to show printing quality, must be submitted with bid.

The name of the manufacturer must be stated in bid.

Detail requirements.

	Thin	Med.	Thick
Weight: Basis 25 by 40, 500 ----------pounds--	45	65	75
Stock: Shall be 100 per cent rag.			
Folding endurance (each direction): Shall be not less than_ -----double folds--	300	400	400
Wet tensile strength:			
Machine direction, shall be not less than ----------grams--	500	700	700
Across machine direction, shall be not less than--------grams--	300	400	400

Coating and finish.—Unsensitized paper shall be suitably sized and finished to take coating solution evenly. Sensitized paper shall be evenly and satisfactorily coated. There must be no surface disintegration or linting in the process of printing. Failure to comply with any of these provisions will be considered cause for rejection.

Width.—30, 36, and 42 inches, as specified in proposals.

Packing and marking.

Packing.—Each roll must be wound on a stiff core, be securely wrapped to protect it from light and moisture, and be well packed for shipment.

Marking.—Each package must be marked to show grade, weight, width, quantity of material, and speed of printing.

Federal Specifications Board, Specification No. 180, United States Government master specification for No. 2 grade blue print paper (sensitized and unsensitized), June 30, 1924.

Same as specification for No. 1 grade blue print paper (F. S. B. No. 179) except for detail requirements for folding endurance which are as follows:

Detail requirements.

	Thin	Med.	Thick
Weight; Basis 25 by 40, 500 pounds----------	45	65	75
Folding endurance (each direction): Shall be not less than ----------double folds--	200	300	300

Federal Specifications Board, Specification No. 181, United States Government master specification

for No. 3 grade blue print paper (sensitized and unsensitized), June 30, 1924.

Same as specification for No. 1 grade blue print paper (F. S. B. No. 179) except for detail requirements for weight, stock, and folding endurance which are as follows:

Detail requirements.

	Med.	Thick
Weight: Basis 25 by 40, 500 pounds	65	75
Stock: Shall be not less than 50 per cent rag; remainder shall be free from unbleached or ground-wood pulp.		
Folding endurance (each direction): Shall not be less than double folds	100	100

Federal Specifications Board, Specification No. 182a, United States Government master specification for brown process paper (sensitized and unsensitized), revised September 25, 1926.

General specification.

United States Government general specification for paper (F. S. B. No. 394) in effect on date of issuance of proposal, shall form part of this specification. (See 470.3.)

Types.

This specification is for the purchase of brown process paper, sensitized and unsensitized, thin and medium; sensitized, in 10 or 50 yard rolls and weights as specified in proposal; unsensitized, rolls and weights as specified in proposal.

Material.

See Detail requirements.

General requirements.

Quality.—Shall be suitable for permanent records which are subjected to frequent handling.

Samples.—6-yard 36-inch roll of each weight, to show printing quality, shall be submitted with bid.

The name of the manufacturer shall be stated in bid.

Detail requirements.

	Thin	Med.
Weight: Basis 25 by 40, 500 pounds	45	65
Thickness: shall not exceed inch	0. 0035	0. 0045
Stock: Shall be 100 per cent rag.		
Folding endurance (each direction): Shall be not less than double folds	300	400
Wet tensile strength—		
Machine direction: Shall be not less than grams	600	800
Across machine direction: Shall not be less than grams	400	500

Coating and finish.—Unsensitized paper shall be suitably sized and finished to take coating solution evenly. Sensitized paper shall be evenly and satisfactorily coated and yield uniformly developed negative free from defects. There shall be no surface disintegration or linting in the process of printing. Failure to comply with any of these provisions shall be considered cause for rejection.

Width.—30, 36, 42, and 54 inches, as specified in proposal.

Method of inspection and tests.

Sensitized paper shall be exposed, developed, and dried before testing.

Packing and marking.

Packing.—Unsensitized paper shall be wound on a stiff core; sensitized paper shall be wound with or without core, as specified in order. All paper shall be securely wrapped to protect it from light and moisture, and be well packed for shipment.

Marking.—Each package shall be marked to show grade, weight, width, quantity of material, and speed of printing.

478.35 Tracing paper.

(No nationally recognized specifications available.)

479. MISCELLANEOUS SPECIFICATIONS FOR PAPER.

479.1 TRANSFER PAPER.

(No nationally recognized specifications available.)

479.2 GUMMED PAPER.

U. S. Congress, Joint Committee on Printing, specification for gummed paper, white and colored, December 9, 1926.

Stock: Free from unbleached or ground-wood pulp.

Weight (ungummed): 17 by 22, 1,000 lbs 40

Curl: Paper must lie flat under normal conditions.

Color, finish, and adhesive quality: Deliveries must conform to the standard sample in finish and adhesive quality and match in color the sample furnished with order.

480–489 BOOKS AND OTHER PRINTED MATTER

481. BOOKS AND PAMPHLETS.
(No nationally recognized specifications available.)

482. MAPS, CHARTS, AND MUSIC.
(See No. 478.31.)

483. LITHOGRAPHIC PRINTS.
(No nationally recognized specifications available.)

484. BOOKLETS.
(No nationally recognized specifications available.)

491. CONTAINERS. (See also 402. 42 and 421.)

American Railway Association, Freight Container Bureau, specifications for shipping containers, current 1927.

(Information concerning construction details of wood and fiber containers is given in the following circulars and bulletins:)

Circular No. 1, porch rocking chairs; No. 3, wooden boxes for boots and shoes; No. 4, wooden boxes for eggs (in the shell) and inside packing; No. 6, solid fiber and plyboard boxes for boots and shoes; No. 7, crates for refrigerators; No. 8, wooden chairs; No. 9, cans for eggs (shelled and frozen) and outside containers; No. 10, crates for furniture and lamps (reed and fiber); No. 11, corrugated strawboard boxes for boots and shoes; No. 12, crates for upholstered furniture; No. 14, slack barrels and slack casks and inside packing for pottery; No. 15, crates for gas and electric domestic cook stoves (steel or steel and cast-iron construction, not including stoves constructed principally of cast-iron) and parts thereof when separate crating is required; No. 17, crates for oil cook stoves (steel or steel and cast-iron construction) and parts thereof when separate crating is required; No. 18, four basket crates (with tapered ends) for fresh fruits and vegetables; No. 19, six-basket crates for fresh fruits and vegetables; No. 20, crates for cast-iron household cook stoves and ranges.

Bulletin No. 2, on wooden crates; No. 5, crates for parlor heaters (circulating type); No. 6, general information on crating; No. 7, packing and crating oak heaters; No. 8, crates for warm-air furnaces.

Bureau of Explosives, specifications for shipping containers, current 1927.

(This bureau functions as an agency for cooperation between the Interstate Commerce Commission and the American Railway Association so far as concerns the standardization of containers for explosives and other dangerous articles. Specifications of such containers are published by the bureau in accordance with the regulations of the commission. Much information concerning construction details of fiber and wood containers, intended for the transportation of dangerous articles by freight and express and as baggage, is given in the following I. C. C. specifications:)

No. 1, boxed carboys; No. 2, metal cans, glass or earthenware containers, wooden or metal pails or kits, etc., and boxes for outside containers of same; No. 6, boxes (wooden, fiber, etc.); Nos. 9 and 10, wooden barrels and kegs (tight); No. 11, wooden barrels and kegs (slack); Nos. 12, 12A, 14, 15, and 16, wooden boxes; No. 17, wooden boxes (lined); No. 18, metal cans and wooden boxes as outside containers for same; No. 19, wooden boxes; No. 21, fiber drums; No. 22, wooden veneer drums; No. 24, fiber cases; No. 29, mailing tubes; No. 31, jugs in tubs; No. 34, turned wooden drums; No. 35, wooden barrels with removable heads; No. 36, wooden boxes with metal lining; No. 37, "peak top" wooden boxes; No. 37A, "ridge top" wire-bound wooden boxes; No. 40, wooden boxes; No. 41, double-wall corrugated strawboard boxes; No. 108, lined, coated, or treated wooden-stave metal-hooped tanks for mounting on or to form part of a car; No. 108A, metal jacketed, coated, wooden stave metal hooped tanks for mounting on or to form part of a car.

Consolidated (Freight) Classification Committee, specifications for wood and fiber containers, current 1927.

(Information concerning safety requirements for barrels, casks, hogsheads, kegs, tierces; fiber board, pulpboard or double-faced corrugated strawboard and wood boxes and other containers, is given in "Consolidated Freight Classification" issued by this committee.)

National Paper Box Manufacturers' Association, terminology for the set-up paper box industry.

(This association has adopted and promulgated terminology of box construction, materials, machines, etc.; terminology of processes, and methods of measuring boxes of various types.)

Paperboard Industries Association, corrugated and solid fiber-board products, 1924.

(In the Handbook of the National Container Association—superseded by the Paperboard Industries Association—descriptions and illustrations of various types of fiber containers in most general use are given, together with freight container specifications of the Consolidated Freight Classification; express container specifications of the Official Express Classification; shipping container specifications of the Interstate Commerce Commission and parcel-post regulations of the U. S. Post Office Department.)

United States Department of Commerce, Advisory Board on Domestic Packing, recommended specifications for containers, 1927.

(Information concerning the construction of various types of wood and fiber containers is given in a series of bulletins issued by the Bureau of Foreign and Domestic Commerce, upon recommendation of the Advisory Board of the United States Department of Commerce on Domestic Packing, as follows:)

No. 3, paper-wrapped packages for parcel-post and express shipment; No. 10, fiber containers; No. 11, cleated plywood boxes; No. 12, wire-bound boxes; No. 13, cooperage and steel barrels; No. 14, wooden boxes; No. 15, nailed wooden crates; No. 16, baling.

492. ELECTRICAL INSULATING PAPER.

National Electrical Manufacturers Association, Supply Division, standard laminated phenolic condensation plate, paper base material.

(This standard covers allowable variations in the thickness of laminated phenolic condensation plate made of paper as a base material.)

493. PAPER PULLEYS.

(No nationally recognized specifications available.)

TECHNICAL SOCIETIES, TRADE ASSOCIATIONS, AND OTHER ORGANIZATIONS ISSUING STANDARDS AND SPECIFICATIONS IN THE WOOD-USING INDUSTRIES

There are given below the names and addresses of organizations, the standards and specifications of which are reproduced herein either in full or in substance by means of abstracts and cross references.

American Association of State Highway Officials, W. C. Markham, executive secretary, 638–639 Munsey Building, Washington, D. C.

American Electric Railway Engineering Association, J. W. Welsh, executive secretary, 292 Madison Avenue, New York, N. Y.

American Engineering Standards Committee, P. G. Agnew, secretary, 29 West Thirty-ninth Street, New York, N. Y.

American Furniture Industry, National Bureau of Standards, division of simplified practice, Washington, D. C.

American Hardwood Lumber Industry, Central Committee on Lumber Standards, Arthur T. Upson, executive secretary, Transportation Building, Washington, D. C.

American Lumber Industry, National Bureau of Standards, division of simplified practice, Washington, D. C.

American Mining Congress, J. F. Callbreath, secretary, Munsey Building, Washington, D. C.

American Paper Industry, National Bureau of Standards, division of simplified practice, Washington, D. C.

American Railway Association, Freight Container Bureau, Edward Dahill, chief engineer, 30 Vesey Street, New York, N. Y.

American Railway Association, mechanical division, V. R. Hawthorne, secretary, 431 South Dearborn Street, Chicago, Ill.

American Railway Association, signal section, H. S. Balliet, secretary, 30 Vesey Street, New York, N. Y.

American Railway Association, telegraph and telephone section, W. A. Fairbanks, secretary, 30 Vesey Street, New York, N. Y.

American Railway Engineering Association, E. H. Fritch, secretary, 431 South Dearborn Street, Chicago, Ill.

American Society for Municipal Improvements, C. W. S. Sammelman, secretary, 315 Commercial Building, St. Louis, Mo.

American Society of Safety Engineers, engineering division, national safety council, W. H. Cameron, managing director, 108 East Ohio Street, Chicago, Ill.

American Society for Testing Materials, C. L. Warwick, secretary, 1315 Spruce Street, Philadelphia, Pa.

American Veneer and Plywood Industry, National Bureau of Standards, division of simplified practice, Washington, D. C.

American Wood-Preservers' Association, E. J. Stocking, secretary, 111 West Washington Street, Chicago, Ill.

Arkansas Soft Pine Bureau, B. Greaves, assistant secretary, Boyle Building, Little Rock, Ark.

Ash Handle Association, W. H. Bryant, secretary, Bryant Manufacturing Co., Wapakoneta, Ohio.

Associated Cooperage Industries of America, C. G. Hirt, secretary and manager, B–20 Railway Exchange Building, St. Louis, Mo.

Bureau of Explosives, Col. B. W. Dunn, chief inspector, 30 Vesey Street, New York, N. Y.

California Redwood Association, R. F. Hammatt, secretary-manager, 24 California Street, San Francisco, Calif.

California White and Sugar Pine Manufacturers Association, C. Stowell Smith, secretary-manager, 600 Call Building, San Francisco, Calif.

Central Committee on Lumber Standards, Arthur T. Upson, executive secretary, Transportation Building, Washington, D. C.

Consolidated Classification Committee (freight), R. C. Fyfe, chairman, 516 West Jackson Boulevard, Chicago, Ill.

Federal Specifications Board, N. F. Harriman, secretary, National Bureau of Standards, Washington, D. C.

Forest Products Laboratory, United States Forest Service, C. P. Winslow, director, Madison, Wis.

Hardwood Interior Trim Manufacturers Association, William R. Friedel, secretary, 63 South Third Street, Memphis, Tenn.

Hardwood Manufacturers Institute, J. H. Townsend, executive vice president, Bank of Commerce Building, Memphis, Tenn.

Hickory Handle Association, Guy E. Basye, secretary-treasurer, care of W. E. Bruner & Sons, Heber Springs, Ark.

Maple Flooring Manufacturing Association, E. C. Singler, secretary, 332 South Michigan Avenue, Chicago, Ill.

National Association of Farm Equipment Manufacturers, H. J. Sameit, secretary, 608 South Dearborn Street, Chicago, Ill.

National Association of Railroad Tie Producers, E. A. Morse, secretary, 1244 Syndicate Trust Building, St. Louis, Mo.

National Association of Waste Material Dealers, C. M. Haskins, secretary, Times Building, New York, N. Y.

National Association of Wooden Box Manufacturers, Paul L. Grady, secretary-treasurer, 844 Rush Street, Chicago, Ill.

National Cigar Box Manufacturers Association, Hobart B. Hankins, secretary-treasurer, 236 Chestnut Street, Philadelphia, Pa.

National Committee on Wood Utilization, Axel H. Oxholm, director, United States Department of Commerce Building, Washington, D. C.

National Conference on Weights and Measures, F. S. Holbrook, secretary, National Bureau of Standards, Washington, D. C.

National Electrical Manufacturers Association, supply division, A. E. Waller, managing director, 420 Lexington Avenue, New York, N. Y.

National Hardwood Lumber Association, Frank F. Fish, secretary-treasurer, 2008 Straus Building, Chicago, Ill.

National Lumber Manufacturers' Association, Wilson Compton, secretary and manager, Transportation Building, Washington, D. C.

National Paper Box Manufacturers Association, Frank S. Records, executive secretary and treasurer, 802 Liberty Trust Building, Philadelphia, Pa.

North Carolina Pine Association (Inc.), J. M. Gibbs, secretary-treasurer, 1217 National Bank of Commerce Building, Norfolk, Va.

Northeastern Millwork Interests, National Bureau of Standards, division of simplified practice, Washington, D. C.

Northern Hemlock and Hardwood Manufacturers Association, O. T. Swan, secretary-manager, Oshkosh, Wis.

Northern Pine Manufacturers Association, W. A. Ellinger, secretary, 1103 Lumber Exchange, Minneapolis, Minn.

Northern White Cedar Association, N. E. Boucher, secretary, 702 Lumber Exchange, Minneapolis, Minn.

Northern White Cedar Shingle Manufacturers Association, O. T. Swan, secretary, Oshkosh, Wis.

Oak Flooring Manufacturers Association of the United States, W. L. Claffey, secretary, 155 North Clark Street, Chicago, Ill.

Pacific Lumber Inspection Bureau, F. W. Alexander, secretary-manager, 5554 Stuart Building, Seattle, Wash.

Paperboard Industries Association, G. R. Browder, general manager, 608 South Dearborn Street, Chicago, Ill.

Paperboard Industry, National Bureau of Standards, division of simplified practice, Washington, D. C.

Red Cedar Lumber Manufacturers Association, J. R. Blunt, secretary-manager, 4449 Stuart Building, Seattle, Wash.

Society of Automotive Engineers, C. F. Clarkson, secretary and general manager, 29 West Thirty-ninth Street, New York, N. Y.

Southeastern Forest Products Association, C. H. Lee, auditor, Jacksonville, Fla.

Southern Cypress Manufacturing Association, J. R. Black, secretary manager, Barnett National Bank Building, Jacksonville, Fla.

Southern Pine Association, H. C. Berckes, secretary and manager, New Orleans, La.

Southern Sash, Door, and Millwork Manufacturers' Association, C. B. Harman, secretary, 1621 Candler Building, Atlanta, Ga.

Technical Association of the Pulp and Paper Industry, W. G. MacNaughton, secretary-treasurer, 18 East Forty-first Street, New York, N. Y.

United States Congress, Joint Committee on Printing, Washington, D. C.

United States Department of Agriculture, Bureau of Public Roads, Washington, D. C.

United States Department of Agriculture, Forest Service, Washington, D. C.

United States Department of Commerce, Advisory Board on Domestic Packing, Washington, D. C.

United States Department of Commerce, Building Code Committee, Washington, D. C.

United States Department of Commerce, National Bureau of Standards, division of building and housing, Washington, D. C.

United States Department of Commerce, National Bureau of Standards, division of simplified practice, Washington, D. C.

United States Department of Commerce, Steamboat Inspection Service, Washington, D. C.

Washington and Oregon Shingle Association, J. R. Blunt, secretary-manager, 4449 White-Henry-Stuart Building, Seattle, Wash.

West Coast Lumber Trade Extension Bureau, C. J. Hogue, acting manager, 562 White-Henry-Stuart Building, Seattle, Wash.

West Coast Lumbermen's Association, Robert B. Allen, secretary, 562 White-Henry-Stuart Building, Seattle, Wash.

Western Pine Manufacturers Association, A. W. Cooper, secretary-manager, 510 Yeon Building, Portland, Oreg.

Western Red Cedar Association, F. S. Fulweiler, secretary, Peyton Building, Spokane, Wash.

White Pine Association of the Tonawandas, Henry Adema, secretary, North Tonawanda, New York.

Wholesale Sash and Door Association, N. I. Godfrey, secretary, 28 Jackson Boulevard, Chicago, Ill.