UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Utilities Service

BULLETIN 1728F-700

SUBJECT: **RUS Specification for Wood Poles, Stubs and Anchor Logs**

Incorporated by reference in 7 CFR Parts 1728 and 1755

TO: All RUS Electric Borrowers

EFFECTIVE DATE: April 15, 2019

OFFICE OF PRIMARY INTEREST: Engineering Standards Branch, Electric Program

INSTRUCTIONS: This bulletin replaces RUS Bulletin 1728F-700, RUS Specification for Wood Poles, Stubs and Anchor Logs, issued May 2011. File with 7 CFR Part 1728 (Electric Borrowers).

AVAILABILITY: This bulletin can be accessed via the Internet at:
http://www.rd.usda.gov/publications/regulations-guidelines/bulletins/electric

PURPOSE: To describe: (1) The minimum acceptable quality of wood poles, stubs, and anchor logs permitted to be purchased by or for RUS borrowers; and (2) the plans of procurement under which these wood products may be purchased.

Christopher A. McLean
Assistant Administrator, Electric Program

4/15/19
Date

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ABBREVIATIONS

ACA - Ammoniacal Copper Arsenate
ACZA - Ammoniacal Copper Zinc Arsenate
ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
AWPA - American Wood Protection Association
CCA - Chromated Copper Arsenate
CuN - Copper Naphthenate
RUS - Rural Utilities Service
SPIB - Southern Pine Inspection Bureau
USDA - United States Department of Agriculture
WCLIB - West Coast Lumber Inspection Bureau

DEFINITIONS

Butt_treated – poles that are only treated in the section of the pole in contact with the ground.

Certificate of compliance – a written certification by an authorized employee of the producer that the material shipped meets the requirements of this specification and any supplemental requirements specified in a purchase order from a borrower or the borrower's contractor.

Contractor – an organization retained by a RUS borrower to construct a power line in accordance with the contract under which the RUS borrower and contractor execute. The contractor agrees to provide and utilize only wood products that meet the requirements of this specification.

Independent inspection – refers to examination of material by a trained inspector employed by a commercial agency.

Inspection – an examination of material in sufficient detail to ensure conformity with all requirements of the specification under which it was purchased.

Producer – refers to the party who manufactures poles. In some cases the producer may also be the treating plant.

Purchaser – refers to either the RUS borrower or a contractor acting as a RUS borrower's agent, except where a part of the specification specifically refers to only the borrower or the contractor.

Quality control supervisor – refers to an employee of the producer designated to be responsible for quality control procedures carried out by said producer.

Reserve treated stock – treated material held in storage by a producer for purchase and immediate shipment to a borrower.

Supplier – term that may refer to the producer, the treater, or to a third party broker or distributorship involved in supplying RUS products to the borrowers.

Transmission poles – unless otherwise indicated, are any poles 50 feet or longer.

Treating charge – all the material treated in a cylinder at one time.

Treating plant – refers to the facility that applies the preservative treatment to the poles.

1 SCOPE

a This specification describes the minimum acceptable quality of wood poles, stubs, telephone pedestal stubs, and anchor logs (hereinafter called poles, except where specifically referred to as stubs or anchor logs) purchased by or for RUS borrowers. Where there is conflict between this specification and any other specification referred to herein, this specification shall govern.

b The requirements of this specification implement contractual provisions between RUS and borrowers receiving financial assistance from RUS. The contractual agreement between RUS and a RUS borrower requires the borrower to construct its system in accordance with RUS accepted plans and specifications. Each RUS electric and telecommunications borrower shall purchase only wood poles, stubs, and anchor logs produced in accordance with this specification. Each RUS electric or telecommunications borrower shall require a written confirmation from their selected contractor that all material utilized shall be produced in accordance with this specification.

2 RELATED SPECIFICATIONS

The following specifications may be considered as pertinent to this specification, subject to the restrictions in the paragraph under "Scope." All AWPA references shall be those in effect in the 2017 AWPA Book of Standards.

a ANSI O5.1.2017 - American National Standard Specifications and Dimensions for Wood Poles (2008);

b ASTM D9-12 - Standard Technology Relating to Wood and Wood Based Products (2005);

c Standard No. 17 Grading Rules for West Coast Lumber, West Coast Lumber Inspection Bureau, (2015);

d. Standard Grading Rules for Southern Pine Lumber, Southern Pine Inspection Bureau, (2014);

e AWPA U1-18- Use Category: System User Specification for Treated Wood

f AWPA T1-18- Use Category System: Processing and Treatment Standard

g AWPA M1-18 - Standards for the Purchase of Treated Wood Products

h AWPA M4-15 - Standard for the Care of Preservative-Treated Wood Products

i AWPA A6-15 - Method for the Determination of Oil-Type Preservatives and Water in Wood

j AWPA A7-18 - Standard Wet Ashing Procedure for Preparing Wood for Chemical Analysis

k AWPA A9-18 - Standard Method for Analysis of Treated Wood and Treating Solutions by X-ray Spectroscopy

3 GENERAL STIPULATIONS

a Quality control and inspection shall be in accordance with Bulletin 1728H-702, RUS Specification for Quality Control and Inspection of Timber Products. Provisions of this specification and ANSI O5.1, which are positive in their wording, shall not be interpreted or subjected to judgment by the quality control supervisor or a third party inspector. Judgment, although used by quality control personnel and independent inspectors, shall not be the basis for acceptance of material which does not conform to the minimum requirements of this specification.

b Each purchase order shall contain a provision that requires the producer to comply with the provisions of this specification.

c Purchase Plans. Plans which are acceptable for supplying poles under this specification include:

(1) Quality Assurance Plans: Under such plans, the producer furnishes poles conforming to this specification which have been inspected in accordance with the provisions of an RUS approved quality assurance plan. RUS borrower groups or agents for borrower groups endeavoring to operate Quality Assurance Plans shall submit their plans to the Chairman, Technical Standards Committee "A", Rural Utilities Service, 1400 Independence Ave, S.W., Stop 1569, Washington, DC 20250-1569. Written RUS approval of a submitted plan must be received from RUS before said plan can be implemented.

(2) Independent Inspection Plan: Under this plan, the producer furnishes poles meeting this specification, with all poles subsequently inspected by a qualified inspector.

The RUS borrower has the prerogative to contract directly with the agency for the inspection service. The borrower shall, where practical, select the inspection agency so that the inspector's continued employment is dependent only on performance acceptable to the borrower. The selected agency shall not subcontract the service to any other agency.

d With the exception of reserve treated stock, all invoices for treated timber products shall be accompanied by a copy of the producer's Certificate of Compliance and either a copy of the independent inspection report or a certificate

confirming that the material was produced under a RUS approved quality assurance plan.

e The method of inspection described in this section shall be used no matter which purchase plan timber products are purchased under.

f Poles failing to conform to any provision covered by this specification shall not be shipped to the purchaser. The producer shall remove all brands, quality or inspection marks from any such material.

g Poles shall be warranted to conform to this specification. Any pole found not in conformance with this specification, within 1 year from date of delivery to the purchaser, shall be promptly replaced by the producer.

h Pole producers shall take out and maintain liability insurance for not less than $1 million. Upon request, evidence of compliance shall be forwarded to RUS annually. The evidence shall be in the form of a dated certificate of insurance signed by a representative of the insurance company, that includes a provision that no changes in, or cancellation of said insurance will be made without prior written notice to the Chairman Technical Standards Committee "A", Rural Utilities Service,1400 Independence Ave, S.W., Stop 1569, Washington, DC 20250-1569.

4 QUALITY CONTROL

a It is the responsibility of each producer to maintain a functional internal quality control system. In addition to maintaining plant and yard conditions that do not promote decay, the following are considered to be mandatory requirements of any plant involved in the production of RUS white or treated materials:

(1) Quality control shall be the responsibility of an experienced, competent individual designated for that specific purpose (quality control supervisor), together with such staff as may be required. The quality control supervisor shall have the necessary training to carry out both the analytical and product inspection procedures detailed in this specification and shall verify each step in the production process before releasing white or treated material for verification of conformance by a third party inspector. No material shall be treated before it has been inspected in the white and has the required quality assurance/inspection marks placed in the tips.

(2) The quality control supervisor and the third party inspector shall each perform all examinations, tests, and required analytical work individually and independently. Neither shall rely on the other individual's results in the discharge of their duties.

(3) Treating and inspection records for all RUS materials shall be maintained by the producer for a minimum of two years from the original date of treatment.

(4) Throughout the production process, the plant quality control supervisor shall withdraw all poles deemed non-conforming. Poles failing to meet all treatment requirements may be re-treated not more than twice, provided that the total allowable steaming times and temperatures are not exceeded. The producer shall promptly remove face brands/tags from all material found to be non-conforming, subject to the foregoing provision for re-treatment.

b The producer shall provide the inspector with all supplemental customer specification requirements (drawings, etc.) contained in a purchase order received from a borrower.

c Providing "Treating Service Only" does not relieve the treating plant of any responsibilities associated with RUS poles being treated at said facility. The plant quality control supervisor shall verify that all poles are treated within 30 days of conditioning if kiln dried and within 10 days after being inspected in the white.

d The producer shall maintain its own properly staffed and equipped analytical laboratory or contract with an independent testing laboratory at or near the treating plant to provide the required analytical service. On a case-by-case basis, with written permission from RUS, a producer with more than one treatment facility may be allowed to use a central laboratory.

5 RESERVE TREATED STOCK

Reserve treated stock shall be subject to the following conditions:

a Producers shall treat material for reserve treated stock under any of the purchase plans (paragraph 3 c) described in the specification.

b No material treated with creosote, pentachlorophenol, or copper naphthenate shall be shipped for use on an RUS borrower's system later than 1 year following the original treatment date branded on the material, unless it complies as follows:

(1) The material shall be reassayed by the producer. If conforming to preservative retention requirements, as shown in Table 10, Exhibit H, it may be shipped. Reassayed poles shall be identified on the sawed butt surface with a metal tag showing date of reassay.

(2) If the reassayed material fails to meet retention requirements and is less than two years from its original treatment date, the producer must retreat, reassay and butt tag said material per the tagging requirements in 5.b.1.

(3) Waterborne treated poles need not be reassayed.

c No pole shall be shipped to an RUS borrower more than two years after its original treatment date.

6 MATERIAL REQUIREMENTS (see Appendix A)

All poles shall conform to the material requirements shown in Appendix A.

7 PRESERVATIVES

Creosote, water-borne preservatives, pentachlorophenol and copper naphthenate shall conform to current AWPA Standard U1-17.

8 PRESERVATIVE TREATMENT

a Conditioning Prior to Treatment: All poles, except as stated below, shall be sterilized by heating the pith center of the pole for one hour, at not less than 150°F, unless stated otherwise.

(1) Treatment Group "A" poles (see Table 2, Appendix A of this bulletin) may be seasoned by natural air circulation. Extreme care shall be taken to ensure that air seasoned poles do not have pretreatment decay in them. (refer also to paragraph 5.b of Appendix A). Treatment Group "A" poles are not required to be sterilized

(2) Treatment Group "B","C" and "D" poles from Table 2, Appendix A of this bulletin, shall be conditioned by Boulton drying, by the steam-vacuum process or by kiln drying. The Boulton drying process and steam vacuum process shall have the following limits:

(a) Boulton Drying:

Boulton Drying		
Species	**Temperature °F**	**Duration (hours)**
Green or partially seasoned Douglas - fir (coast)	220 max.	optional*
Western Larch	220 max.	optional*
* Duration of Boulton drying shall be counted from the time the wood surface is warmed to approximately 150°F.		

(b) Steam-Vacuum Process:

Steam (limits)		
Species	**Temperature °F**	**Total Time(4) Max Hours**
Southern Pine	245 max.	17 (1), 20 (2)
Ponderosa Pine	240 max.	6(3)

Notes:
1. Pole classes nominally less than 37.5 inches in circumference at 6 feet from butt.
2. Pole classes nominally 37.5 inches or larger in circumference at 6 feet from butt.
3. See Appendix A, paragraph 4.2.4 for specific limitations.
4. Initial treatment steaming time plus any re-treatment steaming time, combined, shall not exceed these maximums.

(c) Kiln Drying: See paragraph 4.2.3 of Appendix A for limitations.

b Treatment (Pressure Process): All poles treated by this process shall be treated in a cycle in which the temperatures and pressures shown are not exceeded. These pressures and temperatures shall be recorded on a calibrated recording chart and shall be verified by visual observations of the direct reading gauges throughout the treating cycle by a qualified representative of the treating plant.

Pressure Process				
Species	**Preservative Temperature in °F**			**Impregnation lb/in²**
	Creo. & Oilborne	**ACA/ACZA**	**CCA**	
Western Red Cedar	220	150	120	100
Alaska Yellow Cedar	220	150	120	100
Jack & Red Pine	220	150	120	150
Douglas-fir (coast) & Western Larch	220	150	---	150
Southern Pine	220	150	120	200
Ponderosa (Western) Pine	220	150	120	200

All poles treated with waterborne preservatives shall use the full cell or modified full cell process as described in AWPA Standard U1 except as modified by the provisions of ANSI O5.1.

c Thermal Process – Full-Length and Butt Treatment. Poles species shown in Table 10 may be treated by the Thermal process or Butt treated. AWPA Standards U1, T1, M1 and M4 shall apply.

(1) All poles treated by this process shall be adequately seasoned by natural and artificial methods prior to treatment so that specification requirements for penetration and retention are met.

(2) The temperature of the preservative during the hot oil phase shall not exceed 230°F.

d Results of Treatment

(1) Penetration and retention of preservative shall be tested using borings taken at any point on the pole periphery approximately:

(a) 1 foot below nominal ground line of all butt treated poles.

(b) Six to twelve inches above the nominal ground line of western red cedar, northern white cedar and western larch poles.

(c) Within the zone one foot above to one foot below the brand on all other species of poles.

(2) Retention of preservative shall be no less than that specified in Table 10.

(3) Penetration of preservative, as determined in accordance with AWPA Standard A3, shall not be less than that specified in Table 10 of Appendix A. Chrome Azurol S and Penta-Check shall be used to determine penetration of copper containing preservatives and penta, respectively. Penetration depth shall be measured along a boring from the outer end toward the inner end for a distance throughout which there is continuous preservative penetration, as indicated by evidence of preservative in each annual ring included.

(a) For Group A poles (Those poles with a circumference of less than 37.5 inches at 6 feet from butt):

(1) Bore 20 poles or 20 percent of the poles in the charge, whichever is greater. Accept all poles in the charge for penetration if every boring in the sample conforms. If any sample fails penetration, bore all poles in the charge.

(2) If more than 15% of the poles in the charge are found to be nonconforming, the entire charge shall be retreated. If 15% or less are found to be nonconforming, remove and retreat only those that are nonconforming.

(b) For Group B poles (Those poles with a circumference of more than 37.5 inches at 6 feet from butt):

(1) For Group B poles 45 feet and under, bore each pole in the charge. If more than 15% of these poles are found to be nonconforming, the entire charge shall be retreated. If 15% or less are found to be nonconforming, remove and retreat only those that are nonconforming.

(2) For Group B poles 50 feet and over, bore each pole twice at 90 degrees apart and accept only those poles conforming to penetration in both borings.

(3) Nonconforming poles may be retreated only twice. The letter "R" shall be added to the original charge number in the butts of all poles that are retreated. Poles failing to meet treatment requirements after two retreatments shall be permanently rejected and all brand and butt information removed.

(4) When poles which have been deep incised or radial drilled are bored for penetration and retention testing, the borings shall be taken midway on a diagonal between an incision or hole and an incision or hole in the next vertical row above or below.

e All poles that are cutback after treatment shall be re-treated.

(1) Creosote, Penta, and Copper Naphthenate. Total steaming time, both for initial treatment and re-treatment, is cumulative and shall not exceed the limits for steam found in paragraph 8.a(2)(b). Re-treatment of cutback or reserve treated stock poles shall be by submersion in preservative for not less than 10 minutes under 25 pounds per square inch gauge pressure or not less than 30 minutes at atmospheric pressure.

(2) Waterborne Preservatives: Poles which require re-treatment shall be air dried sufficiently to accept re-treatment. Re-treatment shall be within original treatment limitations. Re-treated poles shall conform fully to all the requirements of this specification; otherwise, they shall be permanently rejected.

(3) Re-treated poles shall have a letter "R" die-stamped, hammer-stamped or burn branded in the sawed butt surface following the charge number to indicate that the poles have been re-treated. (See paragraph 9.e in Appendix A of this bulletin for branding information.)

9 DRAWINGS

The attached drawing W1.1G or M-20 in Appendix A shows in detail the standard framing (gains and bolt holes) for electric distribution poles ordered under this specification. Other distribution pole framings are shown in RUS specifications and drawings: Bulletin 1728F-803, Specifications and Drawings for 24.9/14.4 kV Line Construction and Bulletin 1728F-804, Specifications and Drawings for 12.5/7.2 kV Line Construction. Framing drawings for electric transmission poles are shown in Electric Transmission Specifications and Drawings: Bulletin 1728F-810, "Electric Transmission Specification and Drawings 34.5 through 69 kV" and Bulletin 1728F 811, "Electric Transmission Specifications and drawing 115 kV through 230 kV." Pole stub and anchor log dimensions are shown in the above specifications and drawings or Tables 11, 12 and 13 of Appendix A of this bulletin. The appropriate framing drawings shall be designated and provided by the purchaser.

10. DESTINATION INSPECTION

The RUS borrower shall have the prerogative to inspect materials at destination. All provisions of this specification shall apply to material inspected at destination. If a disagreement arises over conformance of materials received at destination, it shall be the responsibility of the supplier to attempt to resolve this matter with the purchaser.

11. PURCHASE OF RELATED SPECIFICATIONS AND STANDARDS

All ANSI and AWPA standards may be purchased from:
American Wood Protection Association (AWPA)
P.O. Box 361784
Birmingham, Alabama 35236-1784
Telephone: (205)733-4077

Standard Grading Rules for Southern Pine Lumber may be purchased from:
Southern Pine Inspection Bureau
4709 Scenic Highway
Pensacola, Florida 32504-9094
Telephone: (850) 434-2611

Standard Grading Rules for West Coast Lumber may be purchased from:
West Coast Lumber Inspection Bureau
P.O. Box 23145
Portland, Oregon 97281
Telephone: (503) 639-0651

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APPENDIX A MATERIAL REQUIREMENTS

1 INTRODUCTION

The material specifications described in this section are primarily based on the ANSI O5.1 Specification and Dimensions (for Wood Poles). The purpose of this document is to describe the minimum acceptable quality of wood poles, stubs and anchor logs permitted to be purchased by or for RUS borrowers.

2 DEFINITIONS

The following definitions shall apply to the terms used in this standard:

Air Seasoning - Drying by the use of air where the air temperature is not more than 140°F either in the open or under cover.

Boulton Drying - Drying by heating in non-aqueous solution under vacuum.

Check - The lengthwise separation of the wood that usually extends across the rings of annual growth and commonly results from stresses set up in wood during seasoning.

Compression Wood - Abnormal wood formed on the lower side of branches and inclined trunks of softwood trees. Compression wood is identified by its relatively wide annual rings, usually eccentric; relatively large amount of summerwood, sometimes more than 50 percent of the width of the annual rings in which it occurs; and its lack of demarcation between springwood and summerwood in the same annual rings. Compression wood, compared with normal wood, shrinks excessively lengthwise.

Cross Break - A separation of the wood cells across the grain. Such breaks may be due to internal strains resulting from unequal longitudinal shrinkage or to external forces.

Dead Streak - An area, devoid of bark, resulting from progressive destruction of the growth cells of wood and bark at the edges of the streak. On a pole, a dead streak is characterized by a discolored weathered appearance and by lack of evidence of overgrowth along the edges of the deadened surface.

Decay - The decomposition of wood substance by fungi.

Decay, Advanced (or Typical) - The older stage of decay in which the destruction is readily recognized because the wood has become punky, soft and spongy, stringy, ring-shaked, pitted, crumbly, or, in poles not stored or rafted in water, is in a soggy condition. Decided discoloration or bleaching of the rotted wood is often apparent.

Decay, Incipient - The early stage of decay that has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It is usually accompanied by a slight discoloration or bleaching of the wood. Incipient Decay can occur in living trees.

Decayed Knot - A knot containing decay. Two types of decayed knots are recognized.

Type I Knots containing soft or loose fibers (decay) which may extend the full length of the knot into the pole and which are associated with heart rot.

Type II Knots containing soft or loose fibers (decay) which are not associated with heart rot.

Face of Pole - The concave side of greatest curvature in poles with sweep in one plane and one direction, or the side of greatest curvature between groundline and top in poles having reverse or double sweep.

Ground Line Section - That portion of a pole between 1 foot above and 2 feet below the ground line, as defined in the pole dimension tables (see Tables 3 through 9). (For purposes of defining the ground line when incising or radial drilling, see paragraphs 9.7.1 and 9.7.2.)

Hollow Heart - A void in the heartwood caused by decay or insect attack.

Hollow Pith Center - A small hole at the pith center of the trunk or of a knot caused by disintegration of the pith (small soft core occurring in the structural center of a tree or branch).

Insect Damage - Damage resulting from the boring into the pole by insects or insect larvae. Scoring or channeling of the pole surface is not classed as insect damage.

Kiln Drying - Drying by the use of heated air in batch or progressive-type kilns.

Knot Cluster - Two or more knots grouped together as a unit, the fibers of the wood being deflected around the entire unit; distinct from the group of single knots in which each is a unit. A knot cluster shall be considered as a single knot.

Knot Diameter - The diameter of a knot on the surface of the pole measured in a direction at right angles to the lengthwise axis of the pole. The sapwood as well as the heartwood portion of a knot shall be included in the measurement.

NOTE: For a description of means for defining the limits of knots, see American National Standard Definitions of Terms Relating to Timber, ASTM D9-12.

Lot - A quantity of poles of like size, conditioning, and fabrication usually making up one treating charge.

Red Heart - A condition caused by a fungus, Fomes pini, that occurs in the living tree. It is characterized in the early stages of infection by a reddish or brownish color in the heartwood; known as "firm red heart." Later the wood of the living tree disintegrates (decays) in small, usually distinct, areas that develop into white-lined pockets.

Sap Stain - A discoloration of the sapwood, caused by the action of certain molds and fungi, that is not accompanied by softening or other disintegration of the wood.

Scar - A depression in the surface of the pole resulting from a wound where the living tree has not compartmentalized the wound and reestablished the normal cross section of the pole.

Scar, Turpentine Acid Face - An area in the lower portion of a southern pine pole where bark hack removal with acid applied has caused resin to flow. No removal of sapwood has occurred.

Scar, Turpentine Cat Face - A depression in the surface of a southern pine pole resulting from a wood hack into the sapwood, where the tree has not compartmentalized the wound and reestablished the normal cross section of the pole.

Shake - A separation along the grain, the greater part of which occurs between the rings of annual growth.

Shelling - Ring separation extending to the surface of round or sawn timber normally following the growth rings and often associated with limiting defects such as knots, compression wood or shake. Ring separation usually becomes more pronounced as the product dries and may be further aggravated by stress developed during horizontal lifting or loading.

Short Crook - A localized deviation from straightness which, within any section 5 feet or less in length, is more than 1/2 the mean diameter of the crooked section (see Fig. 1, Diagram 3).

Spiral-Grained (Twist-Grained) Wood - Wood in which the fibers take a spiral course about the trunk of a tree instead of a vertical course. The spiral may extend in a right-hand or left-hand direction around the tree trunk. Spiral grain is a form of cross grain.

Split - A lengthwise separation of the wood extending completely through the piece from one surface to another.

Steam Conditioning - Subjecting poles in a closed vessel to steam prior to treatment.

Sweep - Deviation of a pole from straightness (see Fig. 1, Diagrams 1 and 2, Exhibit A).

3 POLE CLASSES

Poles meeting the requirements of this standard are grouped in the classes identified in Tables 5 through 9 of this Appendix, based on their circumference measured 6 feet from the butt. Poles of a given class and length are designed to have approximately the same load carrying capacity regardless of species.

4 MATERIAL REQUIREMENTS: GENERAL

a Species:

(1) Poles. See Table 2, Appendix A.

(2) Pedestal Stubs

(a) All round pedestal stubs shall conform to material requirements for poles. Plywood peeler cores, and similar material where the sapwood has been largely removed, are not acceptable.

(b) All sawn stubs shall conform to the following material requirements:

All sawn stubs furnished under this specification shall be free of brashy wood, cross breaks, decay, insect holes larger than 3/32 of an inch, and dried to a moisture content of not more than 19 percent. The stubs shall be surfaced on four sides, shall meet additional requirements as shown on specification drawings, and shall be made of one of the following:

Coastal origin Douglas-fir conforming to provisions of No. 1 "Structural Joists and Planking," per paragraph 123b, of Standard 17, Grading Rules for West Coast Lumber .

Southern Yellow Pine conforming to the provision of No. 1 "Structural Joist and Planks" as per paragraph 312 of the Southern Pine Inspection Bureau (SPIB) Grading Rules.

b Conditioning, Seasoning, and Treatment Limitations:

(1) Air Seasoning: Air seasoning shall be in conformance with this specification for preservative treatment without developing pretreatment decay. Steaming before or after treatment is permitted for species in Treatment Group A. However, if such steaming is employed, the maximum temperature does not exceed 240°F. The total steaming time from the time steam is introduced into the cylinder, including both initial and final steam, shall not exceed 4 hours duration.

Pedestal stubs which are air-seasoned shall be checked to the heartwood. Their moisture content shall not exceed 25 percent at a depth of 1-1/2 inches or at the sapwood/heartwood line, whichever is less. All sawn pedestal stubs shall be dried to a moisture content of not more than 19 percent prior to treatment.

(2) Boulton Drying Temperature: The temperature employed in Boulton drying poles of species listed under Treatment Group B of Table 2 shall not exceed 220°F. These poles may be steamed up to 240°F for a maximum time of 4 hours, but such steaming shall be limited to steaming after treatment.

(3) Kiln Drying: Where kiln drying is employed on southern pine, ponderosa pine, red pine, jack pine, lodgepole pine, Douglas-fir (coast), and western larch, the maximum dry bulb temperature shall be increased gradually and shall not exceed 170°F (with the exception noted below). Where kiln drying is employed on western red cedar, the maximum dry bulb temperature shall be increased gradually and shall not exceed 160°F. In compartment kilns operating at temperatures up to 170°F, the maximum wet bulb depressions shall not exceed 50°F with the exception that during the first 24 hours there is no limitation on wet bulb depression. In progressive-type kilns operating at temperatures up to 170°F, the maximum wet bulb depression shall not exceed 50°F in the body of the kiln and 90°F at the entrance to the kiln. Exception: Drying over 170°F is permitted for southern pine, lodgepole pine, Douglas-fir (coast), and western larch species. The maximum dry bulb temperature shall not exceed 230°F for these species. For dry bulb temperatures over 200°F, the wet bulb depression shall be not less than 50°F with the exception that during the first 24 hours there is no limitation on wet bulb depression.

Temperature and humidity readings throughout the kiln shall be recorded on a recording chart and verified by observation of direct reading equipment. Gauges and recording equipment shall be calibrated annually.

(4) Steam Conditioning: The steam temperature employed in steam conditioning for poles of species in Treatment Group C of Table 2 shall not exceed 245°F. The time duration for poles with specified circumferences 37.5 inches or less at 6 feet from the butt shall not exceed 17 hours. Poles with specified circumferences larger than 37.5 inches at 6 feet from the butt shall not exceed 20 hours.

c Solvent Recovery. When poles of any species have been treated with a system using an organic solvent-based preservative solution, a solvent recovery cycle of not over 15 hours at a maximum temperature of 225°F is permitted, provided each pole has a moisture content of 25% or below before treatment when measured with a calibrated resistance-type moisture meter at 2 inches from the surface at mid-length.

d Rate of Growth: The average rate of growth measured on the sawed butt surface in the outer 2 inches of poles having a circumference of 37.5 inches or less at 6 feet from the butt, and in the outer 3 inches of poles having a circumference of more than 37.5 inches at 6 feet from the butt, shall not be less than six rings per

inch. Exception: Poles with four and five rings per inch are acceptable if 50 percent or more summerwood is present.

If visual observation of the rate of growth in the butt surface is inconclusive, the referee method for making such a determination is as follows; ring count and summerwood determination is made on an increment core taken 6 feet from the butt directly above the location where the average rate of growth is indicated on the butt surface.

5 MATERIAL REQUIREMENTS: PROHIBITED DEFECTS

a Cross breaks (cracks).

b Decay, except as permitted for firm red heart in paragraph 6.a, defective butts in paragraph 7.d and decayed knots in paragraph 7.f of this Appendix. The presence of fungal fruiting bodies or mycelium on or in a piece of wood shall be considered as evidence of decay and the piece of wood shall be permanently rejected as nonconforming. In the absence of such visual signs of decay, if conditions such as surface softening or discoloration indicate the possibility of decay, a boring should be taken from the affected area and carefully examined by both the quality control supervisor and the third-party inspector to determine if decay is present.

c Dead streaks, except as permitted in paragraph 7.c in this Appendix.

d Holes, other than drilled holes provided for in the specification, open or plugged, except holes for test purposes, which shall be plugged with treated plugs.

e Hollow butts or tops, except as permitted under hollow pith centers and defective butts.

f Marine borer damage.

g Nails, spikes and other metals not specifically authorized by the purchaser.

6 MATERIAL REQUIREMENTS: PERMITTED DEFECTS

a Firm Red Heart: Firm red heart not accompanied by softening or other disintegration (decay) of the wood is permitted.

b Hollow Pith Centers: Hollow pith centers in tops or butts and in knots are permitted in poles that are to be given full-length treatment.

c Sap Stain: Sap stain that is not accompanied by softening or other disintegration (decay) of the wood is permitted.

d Scars: Turpentine acid face scars are permitted anywhere on the pole surface.

7 MATERIAL REQUIREMENTS: LIMITED DEFECTS

a Bark Inclusions: Depressions containing bark inclusions shall not be more than 2 inches in depth, measured from the surface of the pole.

b Compression Wood: The outer 1 inch of all poles shall be free from visible compression wood.

c Dead Streaks: A single, sound dead streak is permitted in cedar, provided the greatest width of the streak is less than 1/4 of the circumference of the pole at the point of measurement.

d Defective Butts: Hollowing in the butt caused by "splinter pulling" in felling the tree is permitted, provided that the area of such a hollow is less than 10 percent of the butt area. Hollow heart or decay, or both, is permitted in cedar poles only, provided the aggregate area of the hollow heart or decay, or both, does not exceed 10 percent of the entire butt area and does not occur closer than 2 inches to the side surface and provided that the depth of the hollow does not exceed 2 feet, measured from the butt surface.

e Insect Damage: Insect damage, consisting of holes 1/16 inch or less in diameter, or surface scoring or channeling is permitted. All other forms of insect damage are prohibited, except those associated with hollow heart in cedar poles.

f Knot: The diameter of any single knot and the sum of knot diameters in any 1-foot section shall not exceed the limits of Table 2. In determining the sum of knot diameters in any 1-foot section, only those knots with diameters over 0.5 inch whose pitch centers fall within the section shall be included in the sum, and the one-foot section shall be located so as to include the maximum number of knots, i.e., the most severe condition. Type II "decayed knots" are permitted.

TABLE 1 LIMITS OF KNOT SIZES			
	Maximum Knot Sizes Permitted		
	Diameter of any single knot		Sum of diameters of all knots greater r than 0.5 inch in any 1-foot section
Length of Pole	**Classes H6 to 3 (Inches)**	**Classes 4 to 10 (Inches)**	**All Classes**
45 Feet and Shorter			
Lower Half of Length	3	2	1/3 of the average circumference of the same 1' section or 8", whichever is greater, but not to exceed 12" (Note 1)
Upper Half of Length	5	4	
50 Feet and Longer			
Lower Half of Length	4	4	1/3 of the average circumference of the same l' section or 10", whichever is greater, but not to exceed l4" (Note 1)
Upper Half of Length	6	6	

Notes:
1. Both upper and lower halves.
2. See section 3 and Tables 5 through 9 of Appendix A for pole classes.

g Scars (Cat Face): No pole shall have a scar or turpentine cat face (southern pine) located within 2 feet of the ground line. Turpentine scars need be trimmed only to the extent necessary for examination for evidence of fungus infection and insect damage. Other sound scars are permitted elsewhere on the pole surface, provided they are smoothly trimmed and do not interfere with the cutting of any gain and provided that:

(1) The circumference at any point on trimmed surfaces located between the butt and 2 feet below the ground line is not less than the minimum circumference specified at 6 feet from the butt for the class and length of the pole; and

(2) The depth of the trimmed scar is not more than 2 inches, if the diameter is 10 inches or less, or 1/5 the pole diameter at the location of the scar if the diameter is more than 10 inches.

h Shakes. Shakes in the butt surface which are not closer than 2 inches to the side surface of the pole are permitted, provided they do not extend to the ground line. Shakes or a combination of connected shakes which are closer than 2 inches to the side surface of the pole are permitted, provided they do not extend further than 2 feet from the butt surface and do not have an opening wider than 1/8 inch. Shakes

in the top surface are permitted in poles that are to be given full-length preservative treatment, provided that the shake is not closer to the surface of the pole than the midpoint of a line extending from the pith to the surface (i.e., the shake is permitted if it is closer to the pith than to the surface of the pole).

i Shape: Poles shall be free from short crooks. A pole may have sweep subject to the following limitations:

(1) Where sweep is in one plane and one direction only: For all poles species, a straight line joining the surface of the pole at the ground line and the edge of the pole at the top shall not be distant from the surface of the pole at any point by more than 1 inch for each 10 feet of length between these points. (See figure 1).

(2) Where sweep is in two planes (double sweep), or in two directions in one plane (reverse sweep), a straight line connecting the midpoint at the ground line with the midpoint at the top shall not at any intermediate point pass through the surface of the pole (See figure 1, diagram 2).

j Shelling. Shelling on the surface of a pole shall be limited to no more than 1 inch in depth nor exceed 1/3 of the pole's circumference at the point of shelling.

k Spiral Grain: Spiral grain (twist grain) is permitted as follows:

Length of Pole (Feet)	Maximum Twist of Grain Permitted
30 and shorter	1 complete twist in any 10 ft.
35-45, inclusive	1 complete twist in any 16 ft.
50 and longer	1 complete twist in any 20 ft.

l Splits and Checks:

(1) In the top: A split or a combination of two single checks (each check terminating at the pith center and separated by not less than 1/6 of the circumference) having one or both portions located in a vertical plane within 30 degrees of the top bolt hole shall not extend downward along the pole more than 6 inches. All other combinations of checks or a split shall not extend downward along the pole more than 12 inches. (Two checks of approximately the same width, each check terminating at the pith center and separated by 1/2 inch or less of wood fiber at any point on the pole circumference, shall be considered as a single continuous check.)

(2) In the butt: A split or a combination of two single checks, as defined in 7.12.1, in its entirety, shall not extend upward along the pole more than 2 feet.

8 DIMENSIONS

For dimensions of particular species of poles, see Tables 3 through 9, Exhibits B to G. For dimensions of stubs and anchor logs, see Tables 11, 12, and 13 respectively, Exhibits I and J.

a Length: Poles less than 50 feet in length shall not be more than 3 inches shorter or 6 inches longer than nominal length. Poles 50 feet or more in length shall not be more than 6 inches shorter or 12 inches longer than nominal length.

Length shall be measured between the extreme ends of the pole.

b Circumference: The minimum circumferences at 6 feet from the butt and at the top, for each length and class of pole, are listed in Tables 3 through 9. The circumference at 6 feet from the butt of a pole shall not be more than 7 inches or 20 percent larger than specified minimum, whichever is greater. The top dimensional requirement shall apply at a point corresponding to the minimum length permitted for the pole. Since poles are classed in the green condition, a reduction of up to 2 percent in circumference anywhere is acceptable after conditioning.

c Classification: The true circumference class shall be determined as follows: Measure the circumference at 6 feet from the butt. This dimension shall determine the true class of the pole, provided that its top (measured at the minimum length point) is large enough. Otherwise, the circumference at the top shall determine the true class, provided that the circumference at 6 feet from the butt does not exceed the specified minimum by more than 7 inches or 20 percent, whichever is greater.

9 MANUFACTURING REQUIREMENTS

a Bark Removal: Outer bark shall be completely removed from all poles.

On all poles, no patch of inner bark more than 1 inch wide shall be left on the pole surface between the butt and 2 feet below the ground line. On poles that are to be given full-length treatment, no patch of inner bark larger than 1 inch wide and 6 inches long shall be left on the pole surface between the top and 2 feet (below the ground line.

NOTE: These provisions are intended to allow an occasional patch of bark and shall not be interpreted to allow numerous patches of bark.

b Sawing: All poles shall be neatly sawed at the top and at the butt along a plane which shall not be out of square with the axis of the pole by more than 2 inches per foot of diameter of the sawed surface. Beveling at the edge of the sawed butt surface not more than 1/12 the butt diameter in width, or an equivalent area unsymmetrically located, is permitted. The sawed surface shall be smooth enough to allow the inspector's mark to be clear and legible after treatment.

c Trimming. Branch stubs and completely or partially overgrown knots rising more than 1 inch above the pole surface shall be closely trimmed. Trimming may be done by shaving machine or by hand.

d Shaving: If shaving is used, the depth of cut shall not be more than necessary to remove inner bark and to trim smoothly and closely all branch stubs and overgrown knots. There shall be no abrupt change in the contour of the pole surface between the ground line and the aboveground sections. The lower 2 feet of poles may be trimmed to remove wood fibers causing butt flare, provided sufficient sapwood remains to obtain customer's minimum penetration requirement.

e Marking and Code Letters: The information in items (1) through (5) below shall be burn branded legibly and permanently on the pole face or included on a metal tag affixed thereto. The metal tag for the face of the pole shall be round, non-corrosive, tight-fitting, recessed 1/4 inch, and of such gauge to remain readable and last for the life of the pole. It shall be fastened with a barbed or serrated non-corrosive nail. The information in items (5) and (6) below shall be placed on the sawed butt surface. If desired by the producer or the purchaser, items (1), (3), and (4) below may also be placed on the sawed butt surface.

(1) The treater's code or trademark*
(2) Independent inspection agency designation or quality assurance mark.
(3) Plant location and month and year of treatment.
(4) Code letters denoting the pole species, preservative, and required retention.
(5) The true circumference-class numeral and numerals showing the length of the pole.
(6) The charge number. (An "R" shall also be die-stamped, hammer-stamped or burn branded in the sawed butt surface of re-treated poles.)

NOTE: Broker or supplier's designation may also appear on pole, but shall be subordinate to the treater's code.

The code letters, not less than 5/8-inch high if burn branded, and not less than 1/8-inch high if on a metal tag, designating the pole species and preservative used, shall be as follows:

Pole Species	Code Letters
Cedar	
Alaska Yellow	**YC**
Western red	**WC**
Douglas-fir (coast)	**DF**
Larch (western)	**WL**
Pine	
Jack	**JP**
Lodgepole	**LP**
Ponderosa	**WP**
Red (Norway)	**NP**
Southern Pine	
Loblolly	
Longleaf	**SP**
Shortleaf	
Slash	

Preservatives	Code Letters
Creosote	**C**
Pentachlorophenol-Petroleum (Heavy Solvent)	**PA**
Ammoniacal Copper Arsenate	**SB**
Ammoniacal Copper Zinc Arsenate	**SZ**
Chromated Copper Arsenate	
Type A	**SC**
Type B	**SJ**
Type C	**SK**
Copper Naphthenate	**N**

For poles, the bottom of the brand or mark shall be placed squarely on the face of the pole and at 10 feet $\pm$ 2 inches from the butt of poles 50 feet or less in length and at 14 feet $\pm$ 2 inches from the butt of poles 55 feet or more in length or as otherwise specified in the purchase order. Anchor logs shall have the brand or mark at the midpoint and the designation for length and diameter (as prescribed in Table 12) on an end. For pedestal stubs the brand shall be placed 5 feet $\pm$ 2 inches from the butt or end.

Example	Interpretation
HRL	Treater's Code or Trademark (e.g., Harry Roberts' Lumber Company)
XYZ	Independent Inspection Agency Designation or Quality Assurance Mark.
S5-08	Plant Location (e.g., Syracuse) Month and Year of Treatment (for example, May 2004)
SPC-9	Species and Preservative (e.g., southern pine, creosote) Retention (actual retention required by this specification)
5-35	Class and length (e.g., Class 5-35 foot pole)

f Framing

(1) All poles and stubs should be bored, gained, and cut to length prior to final treatment. However, should special circumstances arise where additional framing may be required after treatment, all cut surfaces must subsequently be pressure treated or treated with preservative approved for use by AWPA.

(2) All framing shall be in accordance with the attached drawings or with the drawings which accompany the order. Anchor logs shall be bored as required by the order for them.

(3) When gains are required on one side only, they shall be cut on the face of the pole, and the gained surfaces shall be in approximately parallel planes. Transmission poles (e.g., poles 50 feet or longer) may be treated undrilled.

(4) Transmission poles may be bored before treatment for fumigation if designated in the purchase order.

(5) Bolt holes in poles treated with waterborne preservatives shall be drilled to the maximum dimension permitted by the RUS standard drawings (i.e., 1/16 inch over the nominal size).

(6) Anchor logs shall be bored as required by the order for them.

(7) With the approval of the borrower, anti-splitting devices may be added to the pole tops.

g Incising. Incising or radial drilling shall be done in line with the length of the pole and shall be done cleanly to prevent tearing or excessive shattering of fibers.

(1) Distribution Poles: Cedar distribution poles to be treated by the thermal process shall be ground line incised in the area from 2 feet above to 4 feet

below the designated ground line with a pattern and depth sufficient to insure uniform penetration of the total sapwood in the incised area.

(2) Transmission Poles: Cedar transmission poles to be treated by the thermal process shall be ground line incised in the area from 2 feet above to 4 feet below the designated ground line, with a pattern and depth sufficient to insure uniform penetration of the total sapwood in the incised area. All Douglas-fir (coast) transmission poles (poles 50 feet or longer) shall be deep-incised or radial drilled to a minimum depth of 2 1/2 inches in the area from 2 feet above to 4 feet below the designated ground line. Deep incising or radial drilling shall be, as minimum spacing, applied in a 3x6-inch vertical diamond pattern. Radial drilled holes shall not exceed 5/16 inch in diameter.

(3) Pedestal Stubs: The lengthwise surface of sawn Douglas-fir stubs shall be incised to a depth of approximately 0.4 inches in a pattern that insures uniform preservative penetration. Cedar and western larch stubs that are to be treated by the thermal process shall be incised in the groundline section in accordance with AWPA Standards U1 and T1.

(4) Should experience indicate the need for it, the purchaser may specify additional pole incising or radial drilling requirements, including the following:

(a) Through boring may be used as an alternative to deep incising or radial drilling.

Deeper Incising or Boring Suggestions		
Length of Pole	**Deep Radial Drilling Penetration**	**Radial Drilling or Incising**
50 through 65 feet	4.0 inches	2.5 inches
70 through 85 feet	4.5 inches	2.5 inches
90 feet or longer	5.0 inches	2.5 inches

10 STORAGE AND HANDLING

a Storage. When it is necessary to hold poles in storage, they shall be stacked on treated or other nondecaying skids of such dimensions and so arranged as to support the poles without producing noticeable distortion of any of them. The height of the poles shall be limited to avoid damage to poles on the bottom layers.

Poles shall be piled and supported in such a manner that all poles are, at any point, at least 1 foot above the general ground level and any vegetation growing. No decayed wood shall be permitted to remain underneath or adjacent to stored poles. With the exception of short-term piling associated with normal manufacturing procedures, unseasoned poles shall not be dead piled at any time.

b Handling: Poles shall not be dragged along the ground. Cant hooks, pole tongs, or other pointed tools shall not be applied to the ground line section of any pole.

c Mechanical Damage: Poles are not acceptable if they contain indentations attributed to loading or handling slings that are 1/4 inch or more deep over 20 percent or more of the pole circumference, or more than 1/2 inch deep at any point. Other indentations or abrasions, for example, forklift damage, kiln sticker damage, chain-saw damage, etc., shall not be more than 1/10 the pole diameter at the point of damage up to a cumulative cross-sectional maximum of 1 inch. Such damage is permitted in an oversized section, where the excess of wood shall be taken into consideration in evaluating the effects of the damage. In any case, the remaining circumference shall meet or exceed the specification minimum.

TABLE 2 GENERAL REQUIREMENTS

Treatment Group	Genus Species	Fiber Stress (psi)
Treatment Group A (air seasoned)		
Cedar, western red	Thuja plicata	6000
Cedar, Alaska yellow	Chamaecyparis Nootkatensis	7400
Treatment Group B (Boulton drying)		
Douglas-fir, (coast)	Pseudotsuga Menziesii	8000
Larch, western	Larix occidentalis	8400
Treatment Group C (steam conditioned)		
Pine, southern		
Loblolly	Pinus taeda	8000
Longleaf	Pinus palustris	
Shortleaf	Pinus echinata	
Slash	Pinus elliottii	
Treatment Group D (kiln drying)		
Cedar, western red	Thuja plicata	6000
Douglas-fir, (coast)	Pseudotsuga menziesii	8000
Larch, western	Larix occidentalis	8400
Pine, jack	Pinus banksiana	6600
Pine, lodgepole	Pinus contorta	6600
Pine, ponderosa	Pinus ponderosa	6000
Pine, red	Pinus resinosa	6600
Pine, southern		
Loblolly	Pinus taeda	8000
Longleaf	Pinus palustris	
Shortleaf	Pinus echinata	
Slash	Pinus elliottii	

FIGURE 1 MEASUREMENTS OF SWEEP AND SHORT CROOK IN POLES

DIAGRAM 1 – MEASURMENT OF SWEEP IN ONE PLANE AND ONE DIRECTION

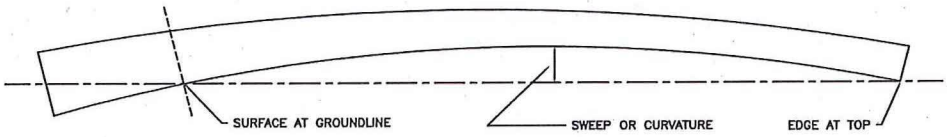


DIAGRAM 2 – MEASURMENT OF SWEEP IN TWO PLANES (DOUBLE SWEEP)
OR IN TWO DIRECTION IN ONE PLANE (REVERSE SWEEP)

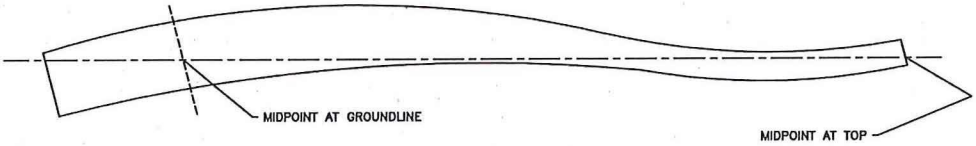
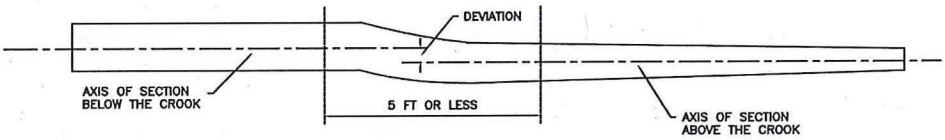
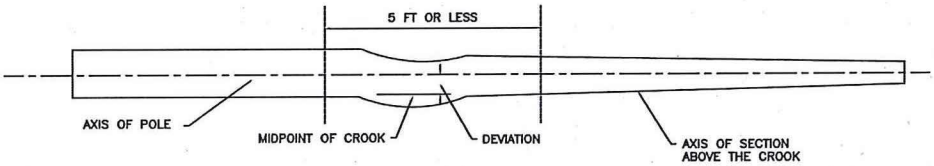


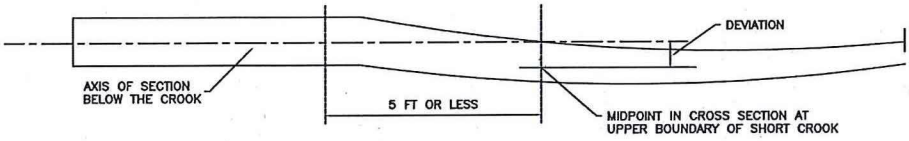
DIAGRAM 3 – MEASURMENT OF SHORT CROOK (THREE CASES SHOWN)



CASE 1: WHERE THE REFERENCE AXES ARE APPROXIMATELY PARALLEL



CASE 2: WHERE AXES OF SECTIONS ABOVE AND BELOW THE CROOK
COINCIDE OR ARE PRACTICALLY COINCIDENT



CASE 3: WHERE AXIS OF SECTION ABOVE SHORT CROOK IS NOT PARALLEL
OR COINCIDENT WITH AXIS BELOW THE CROOK

TABLE 5: DIMENSIONS OF WESTERN RED CEDAR[1] AND PONDEROSA PINE POLES

Class		H-6	H-5	H-4	H-3	H-2	H-1	1	2	3	4	5	6	7	9	10
Minimum Circumference at top (in.)		39	37	35	33	31	29	27	25	23	21	19	17	15	15	12
Length of pole (ft.)	Ground-line[2] distance from butt (ft.)	Minimum circumference at 6 ft from butt (in.)														
20	4	-	-	-	-	-	-	33.5	31.5	29.5	27.0	25.0	**23.0**	**21.5**	**18.5**	**15.0**
25	5	-	-	-	-	-	-	37.0	34.5	32.5	30.0	28.0	**25.5**	**24.0**	**20.5**	**16.5**
30	5.5	-	-	-	-	-	-	40.0	**37.5**	**35.0**	**32.5**	**30.0**	**28.0**	**26.0**	**22.0**	-
35	6	-	-	-	-	**48.0**	**45.5**	**42.5**	**40.0**	**37.5**	**34.5**	**32.0**	**30.0**	**27.5**	-	-
40	6	-	-	**56.5**	**53.5**	**51.0**	**48.0**	**45.0**	**42.5**	**39.5**	**36.5**	**34.0**	**31.5**	-	-	-
45	6.5	**64.5**	**62.0**	**59.0**	**56.0**	**53.5**	**50.5**	**47.5**	**44.5**	**41.5**	**38.5**	**36.0**	33.0	-	-	-
50	7	**67.0**	**64.5**	**61.5**	**58.5**	**55.5**	**52.5**	**49.5**	**46.5**	**43.5**	40.0	37.5	-	-	-	-
55	7.5	**70.0**	**67.0**	**64.0**	**61.0**	**57.5**	**54.5**	**51.5**	**48.5**	**45.0**	42.0	-	-	-	-	-
60	8	**72.0**	**69.0**	**66.0**	**63.0**	**59.5**	**56.5**	**53.5**	**50.0**	**46.5**	43.5	-	-	-	-	-
65	8.5	**74.5**	**71.5**	**68.0**	**65.0**	**61.5**	**58.5**	**55.0**	**51.5**	**48.0**	45.0	-	-	-	-	-
70	9	**76.5**	**73.5**	**70.0**	**67.0**	**63.5**	**60.0**	**56.5**	**53.0**	**49.5**	46.0	-	-	-	-	-
75	9.5	**78.5**	**75.5**	**72.0**	**68.5**	**65.0**	**61.5**	**58.0**	**54.5**	**51.0**	-	-	-	-	-	-
80	10	**80.5**	**77.0**	**74.0**	**70.5**	**67.0**	**63.0**	**59.5**	**56.0**	52.0	-	-	-	-	-	-
85	10.5	**82.5**	**79.0**	**75.5**	**72.0**	**68.5**	**64.5**	**61.0**	**57.0**	53.5	-	-	-	-	-	-
90	11	**84.5**	**81.0**	**77.0**	**73.5**	**70.0**	**66.0**	**62.5**	**58.5**	54.5	-	-	-	-	-	-
95	11	**86.0**	**82.5**	**79.0**	**75.0**	**71.5**	**67.5**	**63.5**	**59.5**	-	-	-	-	-	-	-
100	11	**87.5**	**84.0**	**80.5**	**76.5**	**72.5**	**69.0**	**65.0**	**61.0**	-	-	-	-	-	-	-
105	12	**89.5**	**85.5**	**82.0**	**78.0**	**74.0**	**70.0**	**66.0**	**62.0**	-	-	-	-	-	-	-
110	12	**91.0**	**87.0**	**83.5**	**79.5**	**75.5**	**71.5**	**67.5**	**63.0**	-	-	-	-	-	-	-
115	12	**92.5**	**88.5**	**84.5**	**80.5**	**76.5**	**72.5**	**68.5**	**64.0**	-	-	-	-	-	-	-
120	12	**94.0**	**90.0**	**86.0**	**82.0**	**78.0**	**74.0**	**69.5**	**65.0**	-	-	-	-	-	-	-
125	12	**95.5**	**91.5**	**87.5**	**83.0**	**79.0**	**75.0**	**70.5**	**66.0**	-	-	-	-	-	-	-

NOTES:

1. Dimensions of H Classes are applicable for western red cedar only.
2. The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc
3. Classes and lengths for which circumferences at 6 feet from the butt are listed in bold face type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

TABLE 6
DIMENSIONS OF JACK PINE, LODGEPOLE PINE, RED PINE, REDWOOD, SITKA SPRUCE, WESTERN FIR, AND WHITE SPRUCE POLES

Class		1	2	3	4	5	6	7	9	10
Minimum circumference at top (in.)		27	25	23	21	19	17	15	15	12
Length of Pole (ft.)	Groundline [1] Distance From butt (ft.)	Minimum circumference at 6 ft. from butt (in.)								
20	4	32.5	30.5	28.5	26.5	24.5	**22.5**	**21.0**	**18.0**	**14.5**
25	5	36.0	33.5	31.0	29.0	27.0	**25.0**	**23.0**	**20.0**	**15.5**
30	5.5	39.0	**36.5**	**34.0**	**31.5**	**29.0**	**27.0**	**25.0**	**21.0**	-
35	6	41.5	**38.5**	**36.0**	**33.5**	**31.0**	**28.5**	**26.5**	-	-
40	6	**44.0**	**41.0**	**38.0**	**35.5**	**33.0**	**30.5**	-	-	-
45	6.5	**46.0**	**43.0**	**40.0**	**37.0**	**34.5**	32.0	-	-	-
50	7	**48.0**	**45.0**	**42.0**	39.0	36.0	-	-	-	-
55	7.5	**49.5**	**46.5**	**43.5**	40.5	-	-	-	-	-
60	8.	**51.5**	**48.0**	**45.0**	42.0	-	-	-	-	-
65	8.5	**53.0**	**49.5**	**46.0**	43.0	-	-	-	-	-
70	9	**54.5**	**51.0**	**47.5**	44.5	-	-	-	-	-
75	9.5	**56.0**	**52.5**	**49.0**	-	-	-	-	-	-
80	10	**57.5**	**54.0**	50.5	-	-	-	-	-	-
85	10.5	**58.5**	**55.0**	51.5	-	-	-	-	-	-
90	11	**60.0**	**56.5**	52.5	-	-	-	-	-	-
95	11	**61.5**	**57.5**	-	-	-	-	-	-	-
100	11	**62.5**	**58.5**	-	-	-	-	-	-	-
105	12	**63.5**	**60.0**	-	-	-	-	-	-	-
110	12	**65.0**	**61.0**	-	-	-	-	-	-	-
115	12	**66.0**	**62.0**	-	-	-	-	-	-	-
120	12	**67.0**	**63.0**	-	-	-	-	-	-	-
125	12	**68.0**	**64.0**	-	-	-	-	-	-	-

NOTE - Classes and lengths for which circumferences at 6 feet from the butt are listed in boldface type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

[1]The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc.

TABLE 7: DIMENSIONS OF ALASKA YELLOW CEDAR AND WEST HEMLOCK POLES

Class		H-6	H-5	H-4	H-3	H-2	H-1	1	2	3	4	5	6	7	9	10
Minimum Circumference at top (in.)		39	37	35	33	31	29	27	25	23	21	19	17	15	15	12
Length of pole (ft.)	Ground-line[1] distance from butt	Minimum circumference at 6 ft from butt (in.)														
20	4	-	-	-	-	-	-	31.5	29.5	27.5	25.5	23.5	22.0	20.0	17.5	14.0
25	5	-	-	-	-	-	-	34.5	32.5	30.0	28.0	26.0	24.0	22.0	19.5	15.0
30	5.5	-	-	-	-	-	-	37.5	35.0	32.5	30.0	28.0	26.0	24.0	20.5	-
35	6	-	-	-	-	**45.0**	**42.5**	40.0	37.5	35.0	32.0	30.0	27.5	25.5	-	-
40	6	-	-	**52.5**	**50.0**	**47.5**	**45.0**	42.0	39.5	37.0	34.0	31.5	29.0	25.5	-	-
45	6.5	**60.0**	**57.5**	**55.0**	**52.5**	**49.5**	**47.0**	44.0	41.5	38.5	36.0	33.0	30.5	-	-	-
50	7	**62.5**	**60.0**	**57.0**	**54.5**	**51.5**	**49.0**	46.0	43.0	40.0	37.5	34.5	-	-	-	-
55	7.5	**65.0**	**62.0**	**59.5**	**56.5**	**53.5**	**50.5**	47.5	44.5	41.5	39.0	-	-	-	-	-
60	8	**67.0**	**64.0**	**61.5**	**58.5**	**55.5**	**52.5**	49.5	46.0	43.0	40.0	-	-	-	-	-
65	8.5	**69.0**	**66.0**	**63.0**	**60.0**	**57.5**	**54.0**	51.0	47.5	44.5	41.5	-	-	-	-	-
70	9	**71.0**	**68.0**	**65.0**	**62.0**	**58.5**	**55.5**	52.5	49.0	46.0	42.5	-	-	-	-	-
75	9.5	**73.0**	**69.5**	**66.5**	**63.5**	**60.0**	**57.0**	53.5	50.5	47.0	-	-	-	-	-	-
80	10	**74.5**	**71.5**	**68.0**	**65.0**	**61.5**	**58.5**	55.0	51.5	48.5	-	-	-	-	-	-
85	10.5	**76.0**	**73.0**	**70.0**	**66.5**	**63.0**	**59.5**	56.0	53.0	49.5	-	-	-	-	-	-
90	11	**78.0**	**74.5**	**71.0**	**68.0**	**64.5**	**61.0**	57.5	54.0	50.5	-	-	-	-	-	-
95	11	**79.5**	**76.0**	**72.5**	**69.5**	**66.0**	**62.0**	58.5	55.0	-	-	-	-	-	-	-
100	11	**81.0**	**77.5**	**74.0**	**70.5**	**67.0**	**63.5**	60.0	56.0	-	-	-	-	-	-	-
105	12	**82.5**	**79.0**	**75.5**	**72.0**	**68.5**	**64.5**	61.0	57.0	-	-	-	-	-	-	-
110	12	**84.0**	**80.5**	**77.0**	**73.0**	**69.5**	**65.5**	62.0	58.0	-	-	-	-	-	-	-
115	12	**85.5**	**81.5**	**78.0**	**74.5**	**70.5**	**67.0**	63.0	59.0	-	-	-	-	-	-	-
120	12	**86.5**	**83.0**	**79.5**	**75.5**	**72.0**	**68.0**	64.0	60.0	-	-	-	-	-	-	-
125	12	**88.0**	**84.5**	**80.5**	**76.5**	**73.0**	**69.0**	65.0	61.0	-	-	-	-	-	-	-

NOTE – Classes and lengths for which circumferences at 6 feet from the butt are listed in bold face type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

[1]The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements

TABLE 8: DIMENSIONS OF DOUGLAS FIR (BOTH TYPES) AND SOUTHERN YELLOW PINE POLES

Class		H-6	H-5	H-4	H-3	H-2	H-1	1	2	3	4	5	6	7	9	10
Minimum Circumference		39	37	35	33	31	29	27	25	23	21	19	17	15	15	12
Length of pole (ft.)	Groundline[1] distance from butt (ft.)	Minimum circumference at 6 ft from butt (in.)														
20	4	-	-	-	-	-	-	31.0	29.0	27.0	25.0	23.0	**21.0**	**19.5**	**17.5**	**14.0**
25	5	-	-	-	-	-	-	33.5	31.5	29.5	27.5	25.5	**23.0**	**21.5**	**19.5**	**15.0**
30	5.5	-	-	-	-	-	-	36.5	**34.0**	**32.0**	**29.5**	**27.5**	**25.0**	**23.5**	**20.5**	-
35	6	-	-	-	-	**43.5**	**41.5**	39.0	**36.5**	**34.0**	**31.5**	**29.0**	**27.0**	**25.0**	-	-
40	6	-	-	**51.0**	**48.5**	**46.0**	**43.5**	**41.0**	**38.5**	**36.0**	**33.5**	**31.0**	**28.5**	-	-	-
45	6.5	**58.5**	**56.0**	**53.5**	**51.0**	**48.5**	**45.5**	**43.0**	**40.5**	**37.5**	**35.0**	**32.5**	30.0	-	-	-
50	7	**61.0**	**58.5**	**55.5**	**53.0**	**50.5**	**47.5**	**45.0**	**42.0**	**39.0**	36.5	34.0	-	-	-	-
55	7.5	**63.5**	**60.5**	**58.0**	**55.0**	**52.0**	**49.5**	**46.5**	**43.5**	**40.5**	38.0	-	-	-	-	-
60	8	**65.5**	**62.5**	**59.5**	**57.0**	**54.0**	**51.0**	**48.0**	**45.0**	**42.0**	39.0	-	-	-	-	-
65	8.5	**67.5**	**64.5**	**61.5**	**58.5**	**55.5**	**52.5**	**49.5**	**46.5**	**43.5**	40.5	-	-	-	-	-
70	9	**69.0**	**66.5**	**63.5**	**60.5**	**57.0**	**54.0**	**51.0**	**48.0**	**45.0**	41.5	-	-	-	-	-
75	9.5	**71.0**	**68.0**	**65.0**	**62.0**	**59.0**	**55.5**	**52.5**	**49.0**	**46.0**	-	-	-	-	-	-
80	10	**72.5**	**69.5**	**66.5**	**63.5**	**60.0**	**57.0**	**54.0**	**50.5**	47.0	-	-	-	-	-	-
85	10.5	**74.5**	**71.5**	**68.0**	**65.0**	**61.5**	**58.5**	**55.0**	**51.5**	48.0	-	-	-	-	-	-
90	11	**76.0**	**73.0**	**69.5**	**66.5**	**63.0**	**59.5**	**56.0**	**53.0**	49.0	-	-	-	-	-	-
95	11	**77.5**	**74.5**	**71.0**	**67.5**	**64.5**	**61.0**	**57.0**	**54.0**	-	-	-	-	-	-	-
100	11	**79.0**	**76.0**	**72.5**	**69.0**	**65.5**	**62.0**	**58.5**	**55.0**	-	-	-	-	-	-	-
105	12	**80.5**	**77.0**	**74.0**	**70.5**	**67.0**	**63.0**	**59.5**	**56.0**	-	-	-	-	-	-	-
110	12	**82.0**	**78.5**	**75.0**	**71.5**	**68.0**	**64.5**	**60.5**	**57.0**	-	-	-	-	-	-	-
115	12	**83.5**	**80.0**	**76.5**	**72.5**	**69.0**	**65.5**	**61.5**	**58.0**	-	-	-	-	-	-	-
120	12	**85.0**	**81.0**	**77.5**	**74.0**	**70.0**	**66.5**	**62.5**	**59.0**	-	-	-	-	-	-	-
125	12	**86.0**	**82.5**	**78.5**	**75.0**	**71.0**	**67.5**	**63.5**	**59.5**	-	-	-	-	-	-	-

NOTE – Classes and lengths for which circumferences at 6 feet from the butt are listed in bold face type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

[1] The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc.

TABLE 9: DIMENSIONS OF WESTERN LARCH POLES

Class		H-6	H-5	H-4	H-3	H-2	H-1	1	2	3	4	5	6	7	9	10
Minimum Circumference at top (in.)		39	37	35	33	31	29	27	25	23	21	19	17	15	15	12
Length of pole (ft.)	Groundline[1] distance from butt (ft.)	Minimum circumference at 6 ft from butt (in.)														
20	4	-	-	-	-	-	-	30.0	28.5	26.5	24.5	22.5	**21.0**	**19.0**	**17.0**	**13.5**
25	5	-	-	-	-	-	-	33.0	31.0	29.0	26.5	24.5	**23.0**	**21.0**	**18.5**	**14.5**
30	5.5	-	-	-	-	-	-	35.5	**33.5**	**31.0**	**29.0**	**26.5**	**24.5**	**23.0**	**19.5**	-
35	6	-	-	-	-	**43.0**	**40.5**	38.0	**35.5**	**33.0**	**31.0**	**28.5**	**26.5**	**24.5**	-	-
40	6	-	-	**50.5**	**48.0**	**45.5**	**43.0**	**40.0**	**37.5**	**35.0**	**32.5**	**30.0**	**28.0**	-	-	-
45	6.5	**57.5**	**55.0**	**52.5**	**50.0**	**47.5**	**45.0**	**42.0**	**39.5**	**37.0**	**34.0**	**31.5**	**29.0**	-	-	-
50	7	**60.0**	**57.5**	**55.0**	**52.0**	**49.5**	**47.0**	**44.0**	**41.0**	**38.5**	35.5	33.0	-	-	-	-
55	7.5	**62.0**	**59.5**	**57.0**	**54.0**	**51.5**	**48.5**	**45.5**	**42.5**	**40.0**	37.0	-	-	-	-	-
60	8	**64.5**	**61.5**	**59.0**	**56.0**	**53.0**	**50.0**	**47.0**	**44.0**	**41.0**	38.5	-	-	-	-	-
65	8.5	**66.0**	**63.5**	**60.5**	**57.5**	**55.0**	**52.0**	**48.5**	**46.0**	**42.5**	39.5	-	-	-	-	-
70	9	**68.0**	**65.0**	**62.5**	**59.5**	**56.5**	**53.5**	**50.0**	**47.0**	**44.0**	41.0	-	-	-	-	-
75	9.5	**70.0**	**67.0**	**64.0**	**61.0**	**58.0**	**54.5**	**51.5**	**48.0**	**45.0**	-	-	-	-	-	-
80	10	**71.5**	**68.5**	**65.5**	**62.5**	**59.0**	**56.0**	**52.5**	**49.5**	46.0	-	-	-	-	-	-
85	10.5	**73.0**	**70.0**	**67.0**	**64.0**	**60.5**	**57.5**	**54.0**	**50.5**	47.0	-	-	-	-	-	-
90	11	**74.5**	**71.5**	**68.5**	**65.0**	**62.0**	**58.5**	**55.0**	**51.5**	48.5	-	-	-	-	-	-
95	11	**76.5**	**73.0**	**70.0**	**66.5**	**63.0**	**60.0**	**56.5**	**53.0**	-	-	-	-	-	-	-
100	11	**78.0**	**74.5**	**71.0**	**68.0**	**64.5**	**61.0**	**57.5**	**54.0**	-	-	-	-	-	-	-
105	12	**79.0**	**76.0**	**72.5**	**69.0**	**65.5**	**62.0**	**58.5**	**55.0**	-	-	-	-	-	-	-
110	12	**80.5**	**77.0**	**73.5**	**70.0**	**66.5**	**63.0**	**59.5**	**56.0**	-	-	-	-	-	-	-
115	12	**82.0**	**78.5**	**75.0**	**71.5**	**68.0**	**64.0**	**60.5**	**57.0**	-	-	-	-	-	-	-
120	12	**83.0**	**79.5**	**76.0**	**72.5**	**69.0**	**65.0**	**61.5**	**58.0**	-	-	-	-	-	-	-
125	12	**84.5**	**81.0**	**77.5**	**73.5**	**70.0**	**66.0**	**62.5**	**58.5**	-	-	-	-	-	-	-

NOTE – Classes and lengths for which circumferences at 6 feet from the butt are listed in bold face type are the preferred standard sizes. Those shown in light type are included for engineering purposes only.

[1]The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to

TABLE 10
TREATMENT AND RESULTS OF TREATMENT

		Preservative Treatments Minimum Retentions[H] (Pounds per Cubic Foot)				Assay Zone	Penetration		
Species	Area Use[A]	Creo-sote[B]	Penta[C]	Water-borne[D]	CuN[E]	Inches from Surface	Inches from Surface		Percent of Sapwood
PRESSURE PROCESS - FULL LENGTH TREATMENT									
Southern Pine	1	9.0	0.45	0.60	0.080	0.50 to 2.0	3.50	or	90
Southern Pine	2	7.5	0.38	---	0.060	0.50 to 2.0	3.00	or	90
Douglas-fir[G,I]	1	12.0	0.60	0.60	0.095	0.25 to 1.0	0.75	and	85
Douglas-fir[G,I]	2	9.0	0.45	---	0.075	0.25 to 1.0	0.75	and	85
Ponderosa Pine[G]	1	9.0	0.45	0.60	---	0.50 to 2.0	3.50	or	90
Ponderosa Pine[G]	2	7.5	0.38	---	---	0.50 to 2.0	3.00[J]	or	90
Red Pine	1	12.0	0.60	0.60	---	0.10 to 1.60	3.00	or	90
Red Pine	2	10.0	0.50	0.60	---	0.10 to 1.60	2.50	or	85
Jack Pine	2	12.0	0.60	0.60	---	0.10 to 0.75	1.50	or	85[K]
Western Larch	2	18.0	0.80	0.60	---	0.10 to 0.60	0.50	and	100[L]
Western Red Cedar	2	20.0	1.0	0.60	0.12	0.0 to 0.50	0.50	or	100
Lodgepole Pine	2	12.0	0.60	0.60	---	0.10 to 0.75	0.75	and	85
PRESSURE AND THERMAL PROCESS - FULL LENGTH TREATMENT									
Western Larch	2	20.0	0.80	---	---	0.0 to 0.50	0.50	and	85
Western Red Cedar	2	20.0	1.0	---	0.15	0.0 to 0.50	0.50	or	100
Alaska Yellow Cedar	2	20.0	1.0	---	0.15	0.0 to 0.50	0.50	or	100
THERMAL PROCESS- BUTT TREATMENT									
Alaska Yellow Cedar	2[F]	20.0	1.0	---	---	0.0 to 0.50	0.50	or	100
Western Red Cedar	2[F]	20.0	1.0	---	---	0.0 to 0.50	0.50	or	100

Notes:

A. Use Area 1- South of the 40th parallel of north latitude and east of the 95th meridian of west longitude, including the Gulf Coast of Texas.
Use Area 2- Elsewhere than as defined for Use Area 1.

B. Test By Toluene Extraction

C. This retention for lime ignition or x-ray spectroscopy method. Copper pyridine method, which equals 90% of lime ignition results, is required when poles may have been in contact with salt water, and for all species native to the Pacific Region, unless it specifically states on the raw material invoice that the material has not been in contact with salt water or shown by analysis that there are no additional chlorides present in the wood before treating.

D. Pressure Treatment Only

E. In Decay Zone 5, shown in RUS Bulletin 1730B-121, minimum retentions are 0.130 PCF for Southern Pine and 0.150 PCF for Douglas-fir, for all poles within 50 miles of coastal waters.

F. Allowed for use in low to moderate decay zones.

G. Species native to the Pacific Coast region as per Agriculture Handbook 541 (1979).

H. A reduction of 10 percent from the values shown above in any of the test zones is acceptable at destination within 6 months from the date of delivery.

I. Coast type

J. 3.5 inches of penetration for waterborne preservatives.

K. 3.0 inches or 90% sapwood penetration for waterborne preservatives.

L. Up to a maximum of 0.75 inches.

M. A second (inner) assay zone is required for Douglas-fir transmission poles. The inner assay zone consists of the next one-half inch beyond the standard assay zone listed in Table 10. The preservative retention in this inner zone must be at least 50% of the required retention for the standard assay zone.

TABLE 11
DIMENSION OF ELECTRIC STUBS

Lodge pole Pine, Red Pine, Jack Pine

Length of Stub (Feet)	Minimum Top Circumference * (Inches) Class of Stub						
	1	2	3	4	5	6	7
10.5	37.0	34.5	32.0	29.5	27.0	25.0	22.5
11	39.5	37.5	34.0	31.5	29.5	26.5	24.0
11.5	42.0	39.0	36.0	33.5	31.0	28.5	26.0
12.5	43.5	40.5	37.5	34.5	32.0	29.5	27.0
13	45.5	42.5	39.5	36.5	33.5	31.0	28.5

*Maximum circumference not more than these figures plus 4 inches

Southern Pine, Douglas fir (coast) and Western Larch

Length of Stub (Feet)	Minimum Top Circumference * (Inches) Class of Stub						
	1	2	3	4	5	6	7
10.5	36.0	33.5	31.0	28.5	26.0	24.5	22.5
11	38.0	35.5	33.0	30.0	28.0	25.5	23.5
11.5	40.0	37.5	35.0	32.0	29.5	27.0	25.0
12.5	42.0	39.5	36.5	34.0	31.0	28.5	26.5
13	43.5	40.5	37.5	35.0	32.0	29.5	27.0

*Maximum circumference not more than these figures plus 4 inches

TABLE 12
DIMENSIONS OF ANCHOR LOGS

Southern Pine, Lodgepole Pine, Red Pine, Jack Pine, Douglas fir and Western Larch

	Log Designation					
	F2-1	F2-2	F2-3	F2-4	TA-2L	TA-4L
Log Length (Feet)	4.0	4.5	5.0	5.0	5.0	8.0
Minimum Diameter (Inches)	8.0	9.0	10.0	12.0	8.0	8.0

TABLE 13
TELEPHONE STUBS FOR MOUNTING BURIED PLANT TERMINAL HOUSINGS

Telephone Round Type Stubs

Dimensions: Top Diameter shall be 4 1/2" minimum. Butt Diameter shall be 5" minimum.

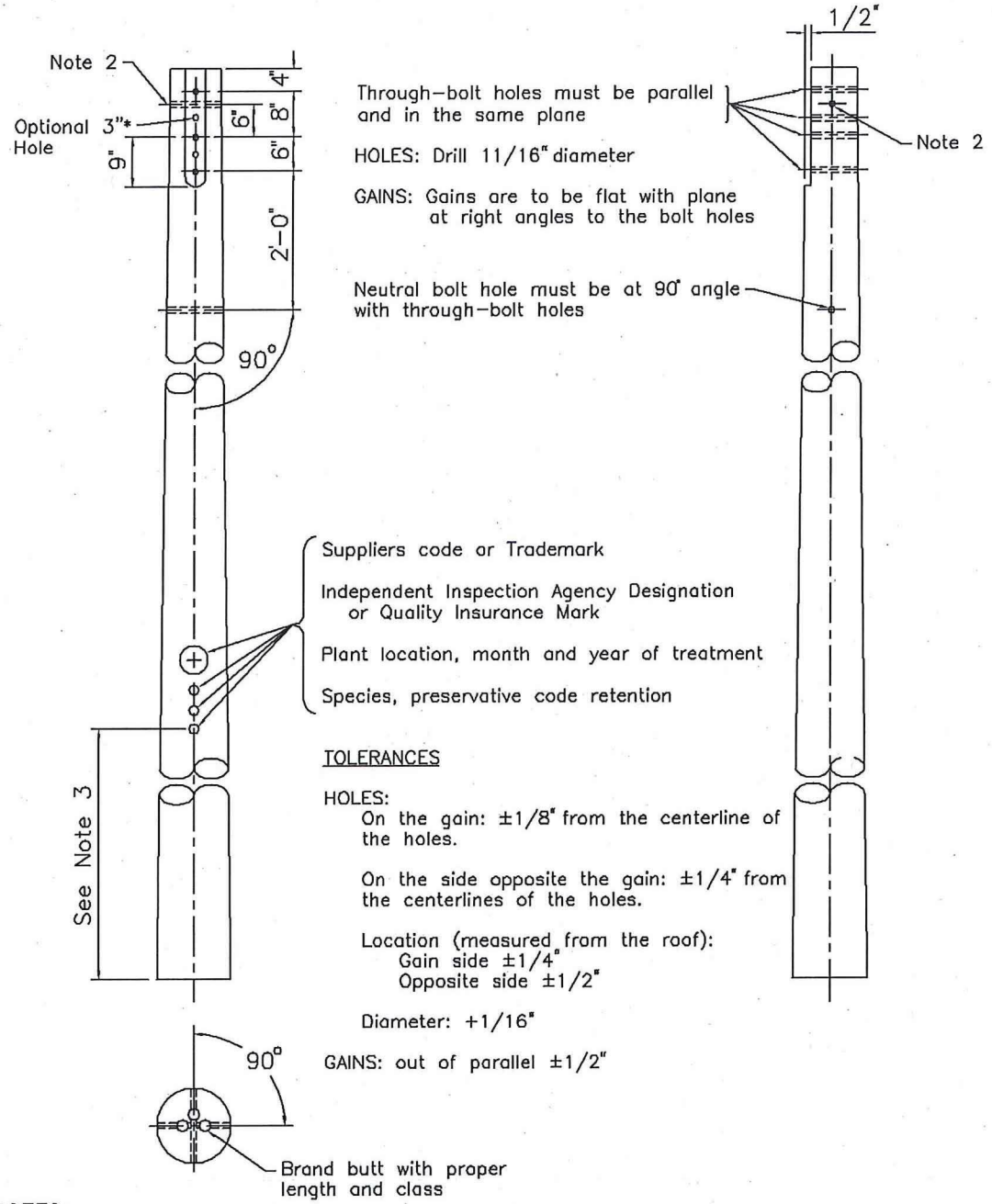
Bid Limit Designation	Length
BA-2	6'-6"
BA-3	8'-0"
BA-4	10'-0"
BA-5	13'-6"

Telephone Sawn Pedestal Stubs

Dimensions: Finished Minimum Cross-section of 3 1/2" x 4 1/2".

Bid Limit Designation	Length
BA-21	6'-6"
BA-22	8'-0"
BA-23	10'-0"

FIGURE 2 ELECTRIC POLE FRAMING DRAWINGS



NOTES:

1. All poles shorter than 50 feet must be bored, roofed and gained before treatment, except that Class 7 and smaller poles need not be gained unless requested by purchaser. Roofs may be flat or at a 15° angle at the producer's option.
2. Anti-split bolt hole is optional and is to be drilled only when so specified by the purchaser.
3. Bottom of brand or center of metal disk shall be 10' ±2" from the pole butt for poles less than 55' in length; 14' ±2" for poles 55' and longer.

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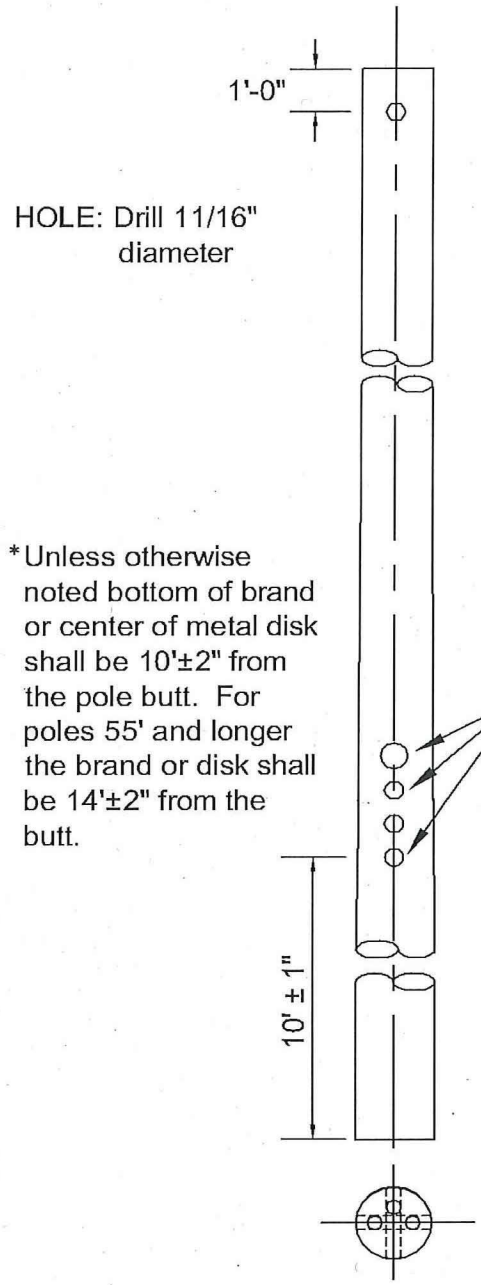
FIGURE 3 TELECOMMUNICATIONS POLE FRAMING DRAWING



HOLE: Drill 11/16" diameter

*Unless otherwise noted bottom of brand or center of metal disk shall be 10'±2" from the pole butt. For poles 55' and longer the brand or disk shall be 14'±2" from the butt.

TOLERANCES

HOLES:
Holes on the brand side: ±1/8" from the centerline of the holes.

On the side opposite the brand: ±1/4" from the centerline of the holes.

Location-measured from the roof:
Brand side: ±1/4"
Opposite side: ±1/2"

Diameter of hole: +1/16"

Suppliers code or Trademark
Independent Inspection Agency Designation or Quality Assurance Mark
Plant location, month and year of treatment
Species, preservative code retention

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METRIC CONVERSION FACTORS

TO CONVERT FROM	TO	MULTIPLY BY
Foot (ft)	meter (m)	0.3048
Inch (in)	centimeter	2.54
Pound per cubic foot (pcf) (lb/ft^3)	kilogram per cubic meter (kg/m^3)	16.01846
Pound per square inch (psi) (lb/in^2)	kilogram per square meter (kg/m^2)	703.0696
Degrees Fahrenheit (°F)	degrees Celsius (°C)	5/9(°F-32)