M2-07 AMERICAN WOOD PROTECTION ASSOCIATION **STANDARD**

STANDARD FOR INSPECTION OF WOOD PRODUCTS TREATED WITH PRESERVATIVES

Jurisdiction: AWPA Subcommittee T-7

Amended in 2000 and 2001; reaffirmed in 2007.

This AWPA Standard is promulgated according to an open, consensus procedure.

Scope: This Standard provides detailed inspection procedures for products at wood preserving plants. This Standard also contains detailed procedures and test methods for determining the conformance of treated wood products with specified standards or other written product quality specifications. There may be instances where the procedures and tests are not entirely suitable for a given situation. In these cases determination of treatment conformance is in part dependent on the judgment and experience of the inspector.

PART A
POLES, PILING, TIES, TIMBERS AND OTHER COMMERCIAL/INDUSTRIAL PRODUCTS NORMALLY SUBJECT TO WRITTEN SPECIFICATIONS BY THE PURCHASER

1. General:

1.1 The purchaser is responsible for stipulating size, grade, length, retention level and other requirements of the products to be purchased. This may be done by reference to existing formal standards and specifications.

1.2 The primary responsibility of the inspector is to determine by inspection and verification that the timber products, preservative and treatment conform to the specification. The inspector also determines if the methods and facilities of production conform with applicable AWPA Standards of recommended practice and/or other standards if specified by the purchaser.

1.3 The treating company shall allow access by the inspector to the parts of the plant necessary for inspection purposes. Ample space, safe working conditions and needed assistance shall be provided for turning, moving or spreading products for inspection and tests.

1.4 The inspector shall have available for reference a copy of the purchaser's specification, AWPA Standards, other standards, specifications or grading rules and any special drawings or instructions applicable to the material to be inspected which is necessary to determine compliance with the purchaser's specifications.

1.5 The inspector shall have knowledge of storage practices, manufacturing and treating equipment, laboratory facilities, quality control practices, and other details necessary to meet the responsibilities of inspection.

1.6 In the event of a contested rejection, the inspector shall make a careful re-examination of the material, or re-run any test. Unresolved differences and any matter not clearly understood in the specification shall be referred to the purchaser for clarification.

2. Inspection of Material Before Treatment:

2.1 Inspection prior to treatment shall be made after the products are completely manufactured and ready for treatment. In the event the material is not treated within 10 days after inspection, it shall be re-examined by the inspector immediately before treatment.

2.2 Product quality. The inspector shall reject any piece immediately upon finding it does not conform to the specification under which it was purchased. Rejected pieces, made to conform by additional work, shall be re-inspected. If required in the written specification, the purchaser shall be informed of the additional work for conformance.

2.2.1 The surfaces of the material to be inspected shall be free of ice, snow or mud that would hinder inspection.

2.2.2 Whenever it becomes evident during inspection of any lot of round material that non-conforming pieces exceed three percent for any one defect or five percent for all defects, the inspector shall withhold further inspection and reject the balance of the lot. Such a rejected balance may be inspected as a new lot after the supplier has taken action to eliminate all defective pieces. Sorting, however, shall not be permitted when a lot has been rejected for decay. (Note: A "lot" is defined as the number of pieces of a given item submitted for inspection at one time).

2.2.3 The inspector shall be alert for evidence of decay.

2.3 Moisture content. The inspector shall test representative pieces when a maximum moisture content is specified. The minimum number of pieces tested in a lot or charge shall be:

2.3.1 20 poles or piles

2.3.2 5 percent or 50 pieces (whichever is less) of a charge of crossarms or similar sawn material.

The test shall be made with a moisture meter, by the toluene extraction method, or by the oven-drying method as specified by the purchaser. A wood sample removed for moisture content determination shall be to the same depth as that required for preservative penetration. Borer cores, taken for laboratory tests by the toluene extraction or oven-drying method, shall be placed, immediately after the core is taken, in a tared, glass-stoppered weighing bottle, and the stopper replaced after each boring is put into the bottle.

2.3.1 The moisture content of a composite sample tested by the oven-drying method shall be determined by the following formula:

$$M = \frac{W - w}{w} \times 100$$

Where M is the percent moisture content, W is the original

weight of the wood and w is the weight of the wood after oven-drying at 215° F to a constant weight.

2.3.2 The moisture content of a composite sample tested by the toluene extraction method shall be determined by the formula:

$$M = \frac{\text{cc Water extracted}}{\text{W - Water extracted}} \times 100$$

Where M is the percent moisture content, cc is cubic centimeters and W is the original weight of the sample in grams.

2.3.3 When moisture content is determined by moisture meter, the lot shall be considered acceptable when the average moisture content does not exceed that specified. However, any individual pieces exceeding the maximum specified moisture content by more than a relative 20 percent shall be rejected and removed from the lot but shall be used in calculating the average moisture content. If a digital moisture meter indicates the moisture content is too high to be displayed, substitute a reading of 60 percent. When tests are made by the toluene extraction or oven-drying method, the lot shall be rejected when the moisture content of the composite sample exceeds the maximum specified.

2.3.4 The moisture meter shall be of the electrical resistance type, with insulated needles of proper length for the material being tested. The readings shall be corrected for wood species and temperature and the manufacturer's instructions shall be followed. Moisture meter readings over 25 percent are not accurate and the moisture content can be much higher than shown.

2.4 Manufacture. Details of manufacture (such as boring, framing, incising, shaving, bark removal, sawing, surfacing and branding) shall be checked on at least 10 percent of the pieces in a lot for good workmanship and conformance with the applicable specification or drawing. When a piece is found non-conforming in any detail, that detail shall be checked on all pieces.

2.4.1 Bored holes, gains and daps shall be checked for conformance to the drawing. Attention shall be given to the side where bits emerged to see that deviation of hole does not exceed the limits allowed in the purchaser's drawing or framing detail.

2.4.2 Dimensions of all pieces shall be checked for accuracy, except when size and length is obvious from visual comparison with a measured piece. Conformance with minimum dimensions applies at time of inspection. Allowance should not be made for any reduction in size due to subsequent drying, unless allowed by the purchase specification.

3. Inspection During Treatment:

3.1 Preservative system. The inspector shall determine if the preservative conforms with the requirement for the preservative system being used. A treatment shall be rejected when a test or analysis shows the preservative system to be non-conforming in any detail, unless there is provision in the preservative standard for correction of the nonconformance and acceptance of the charge based on analyzed results. The decision of acceptance, rejection or retreatment shall be made by the purchaser, or the inspector as instructed by the purchaser, when the preservative system is non-conforming.

3.1.1 The minimum frequency of preservative solution analyses by the inspector shall be:

3.1.1.1 for each occasional single charge inspected.

3.1.1.2 for the first charge of consecutive treatments in a series.

3.1.1.3 for at least one of every five charges, selected at random, in the case of consecutive treatments from the same working tank.

The water content for each charge shall be determined at plants when steaming is used and retention by gauge is specified. For creosote the xylene insolubles shall be checked on each charge when previous tests indicate it is approaching the maximum specified limit.

3.1.2 The minimum extent of the inspector's analysis of preservative solutions should be as follows:

3.1.2.1 For creosote solutions: Complete analysis for conformance with AWPA Standard P1/P13 or P2, whichever is applicable.

3.1.2.2 For creosote/petroleum oil solutions under AWPA Standard P3: complete analysis of the coal tar creosote and the petroleum oil, used to form the solution, for conformance with AWPA Standards P1/P13 and P4 respectively. Alternatively, the inspector can determine conformance by review of plant records concerning specifications of materials received.

3.1.2.3 Chemical analysis for water-borne preservatives shall be made in accordance with AWPA Standard A2, A9, A11 and A17 for conformance to AWPA Standard P5.

3.1.2.4 Analysis for organic compounds used as preservatives in petroleum solution shall be in accordance with AWPA Standard A5 for conformance to AWPA Standard P8. Petroleum solutions shall also be tested for organic preservative compound content by AWPA Standard A5.

3.1.2.5 Pentachlorophenol-petroleum solution. Samples from a solution of pentachlorophenol-petroleum which have already been mixed shall be tested for pentachlorophenol content, solubility, specific gravity, water and sediment. The specific gravity determined on the solution shall be lowered by 0.03 to compensate for the presence of 5 percent additive. The flash point and viscosity shall also be tested if these values are not available from the certification of the original analysis report on the solvent furnished by the supplier of the solution. All tests shall be made for conformance with Standard P9.

3.1.2.6 Copper Naphthenate solution. Samples of the working treating solution shall be analyzed for copper content using AWPA Standard A5, A9, and/or A11. Other physical property tests may be conducted to help characterize the solvent. These tests are referred to in AWPA Standard P9.

3.1.3 Preservative samples should be taken directly from the treating cylinder. A valve for sampling should be located near mid-height and mid-length of the cylinder. The sample from the treating cylinder shall be taken immediately after filling. Alternatively, a sample may be taken from the work tank immediately after the solution is returned at the end of the pressure period, or after thorough agitation, from the work tank immediately prior to filling of the cylinder. Adequate

preservative shall be allowed to flow through the valve before the sample is taken to ensure a representative sample of the tank solution.

3.1.4 Preservative samples shall be taken by the inspector or according to his direction.

3.2 Treatment. The inspector shall verify that vacuum, pressure and temperature, where applicable, meet the requirements of the appropriate AWPA Use Category System Standard by either direct observation or by review of instrument records.

3.2.1 Recording instruments shall be checked with indicating gauges and thermometers. Inaccuracies shall be referred to the treating company for prompt correction. In the event of an inaccuracy in excess of the tolerances in Standard M3 indicating possible damage to the material, the inspector shall reject the charge and the matter shall be referred to the purchaser for decision as to conditional acceptance.

3.2.2 When net retention of preservative by gauge is specified, the inspector shall assure that the tank gauges are in proper working condition, check the volume and composition of the charge (species, class, dimensions, etc.), and obtain tank gauge and temperature readings.

4. Inspection After Treatment:

4.1 Physical inspection. Following treatment the inspector shall first examine the charge for cleanliness, mechanical damage to individual pieces, treatment damage such as severe checking, splitting or honeycombing, and for untreated areas resulting from air pockets, floating material, or insufficient height of preservative.

4.2 Boring Instructions

4.2.1 Boring shall be done with a sharp increment borer which extracts a core approximately 0.20 inch in diameter. A bit of smaller diameter may be used to avoid damage to small dimension material. When smaller bits are used, additional cores may be taken to make up the required sample volume. The bit shall be kept free of rust, pitch or preservative. When the diameter of the core is critical for assay purposes, the bit or core diameter shall be accurately determined as shown in Section 4.2.2 to the nearest 0.001 inch. Borings for penetration and/or assay shall be taken by the inspector or in his presence.The minimum number of borings shall be as specified in the AWPA Use Category System Standards for the commodity, species and type of treatment, or as required by the customer's specification. Borings shall be taken at the following locations on each piece of bored wood unless otherwise specified by the purchaser or the applicable AWPA Standard.

4.2.1.1 Pressure treated material, approximately midway between ends, except Red Oak over 9 feet in length.

4.2.1.2 Red Oak over 9 feet in length -- 4 feet from either end.

4.2.1.3 Butt and Thermal treated poles -- in accordance with the applicable standard.

Borings shall be taken from pieces which represent, as nearly as practical, an equal proportion of the different sizes, seasoning and location of pieces in the charge. In sawn material when large variations in size, especially in thickness, exist within a charge, the charge should be divided as nearly as possible into lots of related sizes and sampled as separate lots. Differences of grain configuration and density are often found in lots of sawn material. Sampling should be on a random basis so that all pieces available for sampling within a lot have an equal chance of being included in the sample. Knots, grain deviation around knots, pitch pockets, shakes, splits, irregular slope of grain and reaction wood (compression or tension) shall be avoided in selecting the exact location for the boring. For incised material, borings shall be taken at a point midway on a line diagonally between adjacent incisions. When it is apparent from visual inspection that the depth and density of incisions is not uniform on all faces of sawn material, borings shall be taken from the face that has less dense or shallower incising. The core shall be discarded if a borer passes through an internal defect, or if the core is crushed, broken or smeared with treating solution so the penetration cannot be determined. For sawn material which require both minimum heartwood penetration and percent of sapwood, borings shall be taken from heartwood faces and sapwood faces in the approximate proportion of heartwood and sapwood faces in a charge. Penetration into heartwood is not required for charges of material which require a minimum sapwood penetration in inches of wood or percent of the sapwood. In round material (poles, piling, and posts), boring shall be toward the center of the piece. In sawn material, borings shall be taken perpendicular to the face being sampled.

4.2.2 Core handling. The following procedure shall be used in processing increment borer cores. Steps required for assay by extraction (identified in the list) may be ignored when the procedure is not used.

a) Tare the weighing bottle and screen thimble (extraction assay).

b) As the increment borer penetrates the material, ensure that it is perpendicular to the surface being bored or is directed toward the center as required by the type of material.

c) Remove the core from the increment borer carefully to avoid breaking or damaging the core.

d) When applicable, apply heartwood indicator (Sections 4.3.1.1 and 4.3.1.2) and measure the depth of sapwood or cut away the heartwood portion.

e) Measure the depth of preservative penetration. For light colored, clear or waterborne treatments apply an appropriate preservative penetration indicator (AWPA Standard A3).

f) Record the data.

g) After sectioning the core in a jig, remove the separated section and:

i) place in a weighing bottle with other sections and immediately replace stopper (extraction assay) **or**

ii) combine with other core sections for later analysis.

h) After sampling, reweigh the bottle, thimble and core sections (extraction assay).

i) Analyze as directed in AWPA Standards A2, A6, A9, A11, A16, A18, A20, A21, A23, or A24.

For sectioning cores, a jig shall be used consisting of a grooved block with slits to accommodate a razor blade. The length of the core section shall be within a tolerance of plus or minus

0.05 inch. The jig shall not be allowed to lie unprotected in the sun.When sampling for assays which require a known volume of wood the borer shall be calibrated at least once a month, and after each sharpening. Either of the two following methods shall be used:

Method 1: Calibrating the increment borer bit. This method shall be used on new or unworn bits. A Starrett Taper Gage (Cat. No. 269A), or equivalent, shall be used, reading to the nearest 0.001 inch. The bit diameter shall be considered as the average of two readings made at the maximum and minimum diameter.

Method 2: Calibrating by increment borer cores. At least 20 borings shall be measured. Preferably this shall be done immediately after extracting each core from wood at normal temperatures. If measurements cannot be made immediately, the cores shall be placed in a small, clean, tightly stoppered bottle, and they shall be measured immediately on return to the laboratory. Only well-cut cores shall be used and care should be taken to measure at a point within the assay sampling zone, free from knots and resin accumulations. The diameter of each core shall be measured once across the grain and once along the grain using either a machinist's micrometer or a Starrett dial test indicator or equivalent, reading to the nearest 0.001 inch. The two diameters shall be averaged, and the calibrated diameter of the borer shall be considered as the total of these average diameters divided by the number of cores.

4.2.3 Plugging test holes. All increment borer holes should be promptly plugged with treated, tight fitting wooden plugs or other material not susceptible to insect attack and decay. Wooden plugs shall be treated with a preservative similar in performance to that of the product treatment. It may not be practical to use wooden plugs for sawn material of a thickness less than two inches nominal or in plywood due to the risk of damage. Care should be used in selecting the proper diameter plugs, and in driving to avoid breaking the plug or splitting the piece.

4.3 Measurement of penetration. Except as modified below, the depth of penetration shall be the distance from the outer end of the core to the first untreated annual ring and shall include only the portion of the innermost ring plainly showing preservative. An annual ring shall be considered penetrated if any portion of that ring is penetrated. In sawn material, where a core is at an angle of less than 45 degrees to the annual ring(s), the first definite break in penetration shall be the measured depth of penetration. Unless specified otherwise in a Use Category System Standard for an individual species, measurement of penetration shall be to the nearest one-tenth inch. If penetration is clearly obvious from examination of an individual unsmudged core, then the penetration may be measured on the round core; otherwise, cores shall be split lengthwise through the center and penetration measured on the cut face. Ray cells passing through an annual ring are not considered part of an annual ring and shall not be considered in evaluating penetration except as skips, as defined in 4.3.5.Penetration measurement shall be made at the time of sampling. In all cases, time shall be allowed for penetration indicators to adequately react with the treated wood. The depth of penetration in material treated with colorless and waterborne solutions shall be determined in accordance with AWPA Standard A3.

4.3.1 Percent sapwood penetration. The depth of the sapwood shall be measured on all cores when there is a percent of sapwood penetration requirement. Sapwood measurement shall be to the nearest one-tenth inch. Where heartwood is clearly obvious, it may be identified visually. With species or individual pieces not showing a clear demarcation in color between heartwood and sapwood, the sapwood thickness shall be checked with indicators described in the following paragraphs.

4.3.1.1 Pines. The sapwood heartwood indicator for the pines shall be made by mixing together equal volumes of the following two solutions:

Solution A -- O-anisidine Hydrochloride

1. Weigh out 8.5g concentrated hydrochloric acid (37%)

2. Dilute with water to make 495 g of solution

3. Add 5g O-anisidine and stir until completely dissolved.

Solution B -- 10 percent Sodium Nitrite.

Dissolve 50 g sodium nitrite in 450 g water

For maximum shelf life, both Solutions A and B should be stored in a refrigerator or other cool, dark location. Under such conditions the storage life exceeds one month. The mix of the two solutions can be used over a period of several days, but filtering before use is necessary. The mix of the indicator may be applied by spraying, dropper or brushing. Generally after several minutes heartwood will usually develop a red or reddish orange color or a yellow red color. In some instances the color development may take longer than several minutes. The color is often bright but the intensity and brightness and the color itself may vary over the length of the heartwood in a core. When the indicator is applied to sapwood the sapwood usually remains a uniform pale yellow orange color and the indicator will be absorbed by the wood. Smooth surfaces give better results than rough surfaces. (Wettability of the indicator can be improved by adding a wetting agent such as a few drops of Kodak Photo-Flo to each 100 ml. of indicator mix). Several applications of the indicator may assist in color development. Heat may also be used to accelerate the reaction of the indicator with the wood. Excessive heat, however, may cause deterioration of the indicator and must be avoided. Signs of deterioration of the indicator is the formation of a uniform dull reddish-brown color. The reading of color shall be made in good light. In some instances wood that appears to be heartwood in pines reacts poorly with the indicator. In addition to the obvious appearance of the heartwood, other physical characteristics may be used to aid in judging whether wood in a core is heartwood or wood that acts similar to heartwood relative to treatment, e.g. the failure of the wood in question to absorb the indicator or water when placed on its surface, the non-compressibility of the wood longitudinally when compared to obvious sapwood in the same core and the location of the wood in the core is typically where heartwood is located. Using physical characteristics as an aid must be done cautiously and be supported by treating cycle data showing treatment to be, what is by experience, generally considered

adequate for acceptable treatment of the species and commodity treated. The absorption may be checked as follows: If wood readily absorbs a solution when placed on its surface, it is probably treatable. A simple test for absorption can be performed by immersing the core(s) in water for 30 minutes or by wrapping the core(s) in a wet paper towel for the same length of time. Dry the surface of the core(s) with a paper towel and compress the core(s) longitudinally. Observe if any solution appears on the surface of the core(s). If so, the wood has absorbed solution and is not heartwood. The application of Chrome Azurol S penetration indicator solution prior to the application of the heartwood/sapwood indicator to the same surface will interfere with the color development and may give a false indication of heartwood. The Chrome Azurol S indicator is accurate if it is used after the heartwood/sapwood indicator.

4.3.1.2 Test for Douglas-fir. The heartwood and sapwood of Douglas-fir can usually be differentiated with a 0.1 percent solution of methyl orange in water or a 0.7 percent solution of alizarine-sulfonate in water. The alizarine-sulfonate stains the heartwood and one or two adjacent annual rings in the sapwood yellow and the sapwood pink, or some other shade of red. The methyl orange stains the heartwood a reddish color and the sapwood yellowish. The indicator works on both dry and green wood, and the colors are comparatively permanent. The test works best on a freshly exposed surface. A little alcohol added to the solution will make wet wood dry more rapidly . The ammonia present in material freshly treated with an ammoniacal preservative may interfere with the color reaction of the methyl orange indicator.

4.3.2 In red oak lumber and ties, the number of annual growth rings in a 3 inch core and the number of rings containing preservative shall be counted. The latter divided by the former multiplied by 100 will give the percentage of rings penetrated, and preservative in any pore or vessel of an annual ring shall class that ring as penetrated. In case of doubt, the core shall be split or cut cross-wise through the springwood. The percentage of rings penetrated in any charge of red oak shall be determined by totaling the individual percentages and dividing their sum by the number of measurements.

4.3.3 In gum lumber and ties, the depth of penetration shall be the sum of all treated sections appearing on the core.

4.3.4 For determination of longitudinal heartwood penetration in crossarms, borings shall be taken in the center-line of the side or bottom of the crossarm and the specified distance from one of the holes at least six inches from the end but within the limits of AWPA Standards U1 and T1. For determining radial penetration in the sapwood of crossarms, bore the bottom or side with the most sapwood and as far as practical from any hole, thus avoiding longitudinal penetration.

4.3.5 Penetration in sawn material. The measurement of the depth of penetration may not always be exact. Certain grain configurations may make it difficult to determine the actual depth of penetration in a core. A core of this type may be disregarded and an additional core taken from another location on the piece or from another piece in the lot. When cores are taken from additional pieces, the same random sampling pattern used in obtaining the other cores shall be followed.

A skip or series of skips not caused by obvious excess moisture content is permitted in a core not to exceed 15% of the required depth of penetration in sapwood. If a skip occurs in the assay zone, the penetration shall be recorded and an additional core may be taken to complete the assay sample.

Pitch is generally not treatable and in a core shall be considered the same as heartwood.

4.4 Retention. The method of determining the net retention of preservative in kg/m^3 (pcf) of wood shall be as specified by the purchaser.

4.4.1 Retention by gauge or scales.

4.4.1.1 Retention by tank gauge. Determine the amount of preservative solution retained by the total wood volume in the charge according to readings of the working tank gauge before and after treatment, with corrections for temperature and conversion of gallons to pounds. The number of pounds of preservative used divided by the total volume of the charge gives the net retention in pounds per cubic foot of wood.

Correction factors. In computing retentions by tank gauge, the temperature of creosote and creosote solutions shall be corrected, from the observed temperature at each tank reading, to 100°F by using the tables in AWPA Standard F1. Volumes of creosote-petroleum solutions shall be corrected to 100°F by using AWPA Standard F4. Volumes of penta-petroleum solution and copper naphthenate-petroleum solution shall be corrected to 60°F by using AWPA Standard F2.

(a) Gallons of creosote and creosote solutions shall be converted to pounds per US gallon by using Table 2 of AWPA Standard F6 "Conversion of Specific Gravity to Pounds per Gallon". Gallons of penta-petroleum solution and copper naphthenate-petroleum solution shall be converted to pounds per US gallon by multiplying the specific gravity at 15.5°C (60/60°F) by 8.32828.

(b) For penta-petroleum solutions or other oilborne solutions, the retention of active preservative in pcf may be obtained by multiplying the pounds of solution retained by the strength of the solution expressed as a decimal, and dividing by the number of cubic feet in the charge.

(c) Waterborne Preservatives -- The retention of waterborne preservatives shall be calculated as pounds of the preservative as defined in AWPA Standard P5. Concentration of preservative in solution shall be determined by analysis in accordance with the appropriate "A" Standard.

4.4.1.2 Retention by tank scale. Determine retention of preservative solutions by actual weighing of the amount of preservative retained from a scale tank and dividing by total volume in the charge.

4.4.2 Retention by chemical or extraction assay -- samples for assay shall meet the following requirements:

Poles. Borings shall be taken from poles having a sapwood depth at least equal to the maximum depth of the zone specified for assay.

Group A. A boring shall be included in the assay sample regardless of penetration, provided the charge is sampled for penetration in accordance with Standard T1. Otherwise, the requirement for Group B poles will apply.

Group B. A boring shall be composited in the assay sample only if the requirement for penetration is met.

Piles. Marine and Land -- There is no requirement for minimum sapwood depth in borings taken for assay. A boring taken for assay shall meet the penetration requirement of AWPA Standard T1.

Posts. Borings taken for assay shall contain a minimum sapwood depth of one inch. A boring shall be included in the assay sample regardless of penetration.

Sawn. Borings are to be taken from sapwood of Southern pine, Ponderosa pine, Radiata pine, Caribbean pine, red pine, Western red cedar, Alaskan yellow cedar, incense cedar, and unincised redwood. Borings from other softwood species shall be taken from heartwood faces and sapwood faces in the approximate proportion of heartwood and sapwood faces in a charge. The treated wood surface should be lightly scraped prior to taking a sample in order to remove surface deposits of preservative. A boring shall be included in the assay sample regardless of penetration.

4.4.2.1 Retention by chemical assay. Determine the quantity of preservative (disregarding the solvent) retained in a boring sample by assaying for quantity of the solid chemical retained, and computing the retention on the basis of pounds of solid chemical per cubic foot in the assay zone. When standard wood densities are needed, AWPA Standard A12 should be used. The retention of the waterborne preservatives shall not be less than indicated in Section 3 of AWPA Standard T1 for any individual component and shall not be less than the retention specified in the applicable AWPA commodity specification for the intended use.

4.4.2.2 Retention by extraction assay. Determine the amount of creosote or other oil-type preservative solution retained in representative pieces by extracting the cores with boiling toluene and calculating the retention.

4.4.2.3 The basis of pounds of chemical per cubic foot of wood. (For laboratory procedure, refer to AWPA Standard A6).

4.4.2.4 When material is retreated in a charge with untreated material, borings from the retreated material shall not be included in the assay samples. The number of representative borings to comprise the sample and the section of the core (zone) to be used for the analysis shall meet the AWPA Standard for the applicable commodity, species and type of treatment. When there is an insufficient quantity of material in the charge to obtain, with one boring from each piece, the required size sample for the assay, an equal number of additional borings shall be taken from each of the pieces already bored.

4.5 Reduction of Chromium (VI). When required by the applicable AWPA commodity specification or by the purchaser, CCA treated material will be tested for completion of the chemical reduction of soluble Chromium (VI) using Method A3, Section 11. A borer core shall be taken at a point in a plane approximately 300 - 600 mm (1 – 2 ft) below the brand of 5 poles in each charge. The corer bit should be thoroughly rinsed in cool water between borings to minimize contamination and reduce the possible influence of elevated bit temperatures on the indicated presence of hexavalent chromium. The outer 13 mm (0.5 inch) of each core shall be evaluated for the presence of hexavalent chromium. Only cores that are fully penetrated in the outer 13 mm (0.5 inch) and meet the pole penetration requirements shall be evaluated. The jig used for sectioning and splitting the cores shall not be allowed to lie unprotected in the sun. If one (1) or fewer of the cores tests positive for the presence of hexavalent chromium, the charge shall be considered conforming. If three (3) or more cores test positive for the presence of hexavalent chromium, the charge shall be considered non-conforming. A minimum waiting period, dependent on the temperature of the air or water surrounding the poles, is required before a failed charge shall be re-evaluated (Table 1). If two (2) of the five (5) poles test positive for hexavalent chromium, the charge shall be deemed non-conforming, but the inspector may immediately remove cores from one additional set of (5) poles. The charge may be deemed conforming if none of the second set of poles test positive for hexavalent chromium; otherwise the charge shall be deemed non-conforming and shall not be sampled again until the minimum waiting period has elapsed. During each subsequent inspection of a failed charge, five (5) poles will again be sampled; these five poles shall include any poles that failed during prior evaluations.

Table 1. Minimum waiting period between inspections for the presence of hexavalent chromium.

Fixation Temperatures	Minimum Hours Between Tests
Below 20 C (68 F)	24
20 – 35 C (68 – 95 F)	12
35 – 50 C (95 – 122 F)	6
50 – 65 C (122 – 149 F)	3
Above 65 C (149 F)	1.5

4.6 If drying after treatment is specified or required, the inspector shall check moisture content as stated in section 2.3 for verification of the represented moisture content.

5. Evidence of inspection: Inspector's identification. When size permits, each piece of accepted material shall be legibly identified by the inspector or someone under his/her immediate supervision. The identifying mark shall be obliterated or removed from products found non-conforming at any stage.

6. Reporting:

6.1 Step-by-step work sheets are recommended for use in recording preservative analyses and retention assays. Copies of the work sheets may be used in reporting the results of such tests.

6.2 Each inspection shall be covered by an inspector's report which includes the minimum applicable information from the following list, plus any other information requested by the inspector's supervisor or by the specifier:

Name of treating company
Location of treating plant
Applicable product specification or standard
Charge number
Date of treatment
Contents of charge
- Type of material
- Number of pieces by size
- Species
- Degree of seasoning
- Manufacturing (incised, unincised, rough surfaces, etc.)
- Number of cubic feet
- Preservative

Process used in treatment
- Steam conditioning
- Time required to reach maximum temperature
- Time steamed at maximum temperature
- Maximum temperature
- Initial vacuum period
- Maximum vacuum

Heating in oil
- Heating period
- Maximum vacuum
- Maximum temperature
- Total condensation
- Total absorption of preservative

Treatment
- Initial air pressure
- Initial air period
- Pressure period
- Maximum pressure
- Maximum temperature
- Average temperature
- Maximum final vacuum

Final vacuum period
- Time and temperature of final steam bath (if any)
- Time and temperature of expansion bath (if any)
- Working tank readings with temperature
- Injection under pressure (determined after kickback after final vacuum)
- Final retention (determined after kickback after final vacuum)
- Total time of treatment

Penetration
- Number of borings taken
- Percent conforming

PART B
CONSUMER/COMMODITY SAWN PRODUCTS NOT NORMALLY SUBJECT TO WRITTEN SPECIFICATIONS BY THE PURCHASER

1. General:

1.1 The primary responsibility of the inspector is to determine by inspection and verification that the preservative and treatment of timber products conform to the applicable AWPA Standards for the anticipated end use of the product as stated by the management of the treating facility. The inspector also determines if the methods and facilities of production conform with applicable AWPA Standards of recommended practice.

1.2 The treating company shall allow access by the inspector to the parts of the plant necessary for inspection purposes. Ample space, safe working conditions and needed assistance shall be provided for moving products for inspection and tests.

1.3 The inspector shall have available for reference a copy of the AWPA Standards.

1.4 The inspector shall have knowledge of storage practices, manufacturing and treating equipment, laboratory facilities, quality control practices, and other details necessary to meet the responsibilities of inspection.

2. Inspection of Material Before Treatment:

2.1 When specified, inspection prior to treatment shall be made after the products are completely manufactured and ready for treatment.

2.2 Product quality. The plant quality control personnel shall reject products which do not conform to specifications in AWPA standards applicable to the intended end use. Rejected products, made to conform by additional work, shall be re-inspected.

2.2.1 The surfaces of the material to be inspected shall be free of ice, snow or mud that would hinder inspection.

2.2.2 The plant quality control personnel shall be alert for evidence of decay.

2.3 Moisture content. The plant quality control personnel shall test representative pieces when a maximum moisture content is specified in applicable AWPA Standards. The minimum number of pieces tested in a lot or charge shall be 50 or 5 percent (whichever is less). The test shall be made with a moisture meter or by the oven-drying method. A wood sample removed for moisture content determination shall be to the same depth as that required for preservative penetration. Borer cores, taken for determination of moisture content by the oven-drying method, shall be placed, immediately after the core is taken, in a tared, glass-stoppered weighing bottle, and the stopper replaced after each boring is put into the bottle.

2.3.1 The moisture content of a composite sample tested by the oven-drying method shall be determined by the following formula:

$$M = \frac{W - w}{w} \times 100$$

Where:

M is the percent moisture content
W is the original weight of the wood and
w is the weight of the wood after oven-drying at 101°C (215°F) to a constant weight.

2.3.2 When moisture content is determined by moisture meter,

the lot shall be considered acceptable when the average moisture content does not exceed that which is in the applicable treating standard. If a digital moisture meter indicates the moisture content is too high to be displayed substitute a reading of 60 percent. When tests are made by the oven-drying method, the lot shall be rejected when the moisture content of the composite sample exceeds the maximum allowed in the applicable treating standard.

2.3.3 The moisture meter shall be of the electrical resistance type, with insulated needles of proper length for the material being tested. The readings shall be corrected for wood species and temperature and the manufacturer's instructions shall be followed. Moisture meter readings over 25 percent are not accurate and the moisture content can be much higher than shown.

3. Inspecion During Treatment:

3.1 Preservative system. The plant quality control personnel shall determine if the preservative conforms with the requirement for the preservative system being used. A treatment shall be rejected when a test or analysis shows the preservative system to be non-conforming in any detail, unless there is provision in the preservative standard for correction of the nonconformance and acceptance of the charge based on analyzed results. The decision of acceptance, rejection or retreatment shall be made by the plant quality control personnel when the preservative system is non-conforming.

3.1.1 The preservative shall be analyzed in accordance with an applicable AWPA "A" Standard for conformance to the applicable "P" Standard.

3.1.2 Preservative samples should be taken directly from the treating cylinder. A valve for sampling should be located near mid-height and mid-length of the cylinder. The sample from the treating cylinder shall be taken immediately after filling. Alternatively, a sample may be taken from the work tank immediately after the solution is returned at the end of the pressure period, or after thorough agitation, from the work tank immediately prior to filling of the cylinder. Adequate preservative shall be allowed to flow through the valve before the sample is taken to ensure a representative sample of the tank solution.

3.1.3 Preservative samples shall be taken by the plant quality control personnel.

3.2 Treatment. The plant quality control personnel shall verify that, vacuum, pressure and temperature, where applicable, meet the requirements of the appropriate Use Category System Standard by either direct observation or by review of instrument records.

3.2.1 Recording instruments shall be checked with indicating gauges and thermometers. Inaccuracies shall be referred to the management of the treating company for prompt correction. In the event of an inaccuracy in excess of the tolerances in Standard M3 indicating possible damage to the material, the plant quality control personnel shall initially reject the charge and the matter shall be reviewed to reach a decision concerning acceptance, rejection or remedial action.

4. Inspection After Treatment:

4.1 Physical inspection. The inspector shall examine the products for cleanliness, mechanical damage to individual pieces, treatment damage such as severe checking, splitting or honeycombing, and for untreated areas resulting from air pockets, floating material, or insufficient height of preservative.

4.2 Boring Instructions

4.2.1 Boring shall be done with a sharp increment borer which extracts a core approximately 0.20 inch in diameter. A bit of smaller diameter may be used to avoid damage to material. When smaller bits are used, additional cores may be taken to make up the required sample volume. The bit shall be kept free of rust, pitch or preservative. When the diameter of the core is critical for assay purposes, the bit or core diameter shall be accurately determined to the nearest 0.001 inch using the methods in Section 4.2.2 of Section A of this Standard. Borings for penetration and/or assay shall be taken by the inspector or in his presence. The minimum number of borings shall be as specified in the AWPA Use Category System Standards for the commodity, species and type of treatment. When lumber is checked for penetration with a 20-core sample and fails to meet the penetration requirement and has no more than 7 failing cores, a second set of 20 cores may be taken from the same material. If the average of the two 20-core sets meets the penetration requirement the charge shall be accepted. The sampling pattern used for the first 20-core set shall be used for the second set. Borings shall be taken approximately midway between ends and at the approximate midpoint of the face being sampled. When large variations in size exist within a charge, the charge should be divided as nearly as possible into lots of related sizes and sampled as separate lots. Sampling should be on a random basis so that all pieces available for sampling within a lot have an equal chance of being included in the sample. True random sampling within a lot will likely result in borings being taken from pieces which represent, as nearly as practical, an equal proportion of the different sizes, seasoning and location of pieces in the charge. Knots, grain deviation around knots, pitch pockets, shakes, splits, irregular slope of grain and reaction wood shall be avoided in selecting the exact location for the boring. For incised material, borings shall be taken at a point midway on a line diagonally between adjacent incisions. When it is apparent from visual inspection that the depth and density of incisions is not uniform on all faces of sawn material, borings shall be taken from the face that has less dense or shallower incising. The core shall be discarded if a borer passes through an internal defect, or if the core is crushed, broken or smeared with treating solution so the penetration cannot be determined. For material which requires both minimum heartwood penetration and percent of sapwood, borings shall be taken from heartwood faces and sapwood faces in the approximate proportion of heartwood and sapwood faces in a charge. Penetration into heartwood is not required for charges of material which require a minimum sapwood penetration in inches of wood or percent of the sapwood. Borings shall be taken perpendicular to the face being sampled.

4.2.2 Core handling. The following procedure shall be used

in processing increment borer cores:

1 As the increment borer penetrates the material, ensure that it is perpendicular to the surface being bored.
2 Remove the core from the increment borer carefully to avoid breaking or damaging the core.
3 When applicable, apply heartwood indicator (Sections 4.3.1.1 and 4.3.1.2) and measure the depth of sapwood or cut away the heartwood portion.
4 Measure the depth of preservative penetration. For light colored, clear or waterborne treatments apply an appropriate preservative penetration indicator (AWPA Standard A3).
5 Record the data.
6 After sectioning the core in a jig, remove the separated section and combine with other core sections for later analysis.
7 Analyze as directed in AWPA Standards A2, A6, A9, A11, A16, A18, A20, A21, A23, or A24.

For sectioning cores, a jig shall be used consisting of a grooved block with slits to accommodate a razor blade. The length of the core section shall be within a tolerance of plus or minus 0.05 inch. The jig shall not be allowed to lie unprotected in the sun.When sampling for assays which require a known volume of wood the borer shall be calibrated at least once a month, and after each sharpening. Either of the two methods in 4.2.2 of Section A, shall be used.

4.2.3 Plugging test holes. All increment borer holes should be promptly plugged with treated, tight fitting wooden plugs or other material not susceptible to insect attack and decay. Wooden plugs shall be treated with a preservative similar in performance to that of the product treatment. It may not be practical to use wooden plugs for sawn material of a thickness less than two inches nominal or in plywood due to the risk of damage. Care should be used in selecting the proper diameter plugs, and in driving to avoid breaking the plug or splitting the piece.

4.3 Measurement of penetration. Except as modified below, the depth of penetration shall be the distance from the outer end of the core to the first untreated annual ring and shall include only the portion of the innermost ring plainly showing preservative. An annual ring shall be considered penetrated if any portion of that ring is penetrated. In sawn material, where a core is at an angle of less than 45 degrees to the annual ring(s), the first definite break in penetration shall be the measured depth of penetration. Unless specified otherwise in the appropriate Use Category System Standard for an individual species column, measurement of penetration shall be to the nearest one-tenth inch. If penetration is clearly obvious from examination of an individual unsmudged core, then the penetration may be measured on the round core; otherwise, cores shall be split lengthwise through the center and penetration measured on the cut face. Ray cells passing through an annual ring are not considered part of an annual ring and shall not be considered in evaluating penetration except as skips, as defined in 4.3.2. Penetration measurement shall be made at the time of sampling. In all cases, time shall be allowed for penetration indicators to adequately react with the treated wood. The depth of penetration in material treated with colorless and waterborne solutions shall be determined in accordance with AWPA Standard A3.

4.3.1 Percent sapwood penetration. The depth of the sapwood shall be measured on all cores when there is a percent of sapwood penetration requirement. Sapwood measurement shall be to the nearest one-tenth inch. Where heartwood is clearly obvious, it may be identified visually. With species or individual pieces not showing a clear demarcation in color between heartwood and sapwood, the sapwood thickness shall be checked with indicators described in the following paragraphs.

4.3.1.1 Pines. The sapwood heartwood indicator for the pines shall be made by mixing together equal volumes of the following two solutions:

Solution A. O-anisidine Hydrochloride

1. Weigh out 8.5 g concentrated hydrochloric acid (37%)
2. Dilute with water to make 495 g of solution
3. Add 5 g O-anisidine and stir until completely dissolved.

Solution B. 10 percent Sodium Nitrite.

1. Dissolve 50 g sodium nitrite in 450 g water

For maximum shelf life, both Solutions A and B should be stored in a refrigerator or other cool, dark location. Under such conditions the storage life exceeds one month. The mix of the two solutions can be used over a period of several days, but filtering before use is necessary.The mix of the indicator may be applied by spraying, dropper or brushing. Generally after several minutes heartwood will usually develop a red or reddish orange color or a yellow red color. In some instances the color development may take longer than several minutes. The color is often bright but the intensity and brightness and the color itself may vary over the length of the heartwood in a core. When the indicator is applied to sapwood the sapwood usually remains a uniform pale yellow orange color and the indicator will be absorbed by the wood. Smooth surfaces give better results than rough surfaces. (Wettability of the indicator can be improved by adding a wetting agent such as a few drops of Kodak Photo-Flo to each 100 ml. of indicator mix). Several applications of the indicator may assist in color development. Heat may also be used to accelerate the reaction of the indicator with the wood. Excessive heat however, may cause deterioration of the indicator and must be avoided. A sign of deterioration of the indicator is the formation of a uniform dull reddish-brown color. The reading of color shall be made in good light. In some instances wood that appears to be heartwood in pines reacts poorly with the indicator. In addition to the obvious appearance of the heartwood, other physical characteristics may be used to aid in judging whether wood in a core is heartwood or wood that acts similar to heartwood relative to treatment, e.g. the failure of the wood in question to absorb the indicator or water when placed on its surface, the non-compressibility of the wood longitudinally when compared to obvious sapwood in the same core and the location of the wood in the core is typically where heartwood is located. Using physical characteristics as an aid must be done cautiously and be supported by treating cycle data showing treatment to be, what is by experience, generally considered

adequate for acceptable treatment of the species and commodity treated. The absorption may be checked as follows: If wood readily absorbs a solution when placed on its surface, it is probably treatable. A simple test for absorption can be performed by immersing the core(s) in water for 30 minutes or by wrapping the core(s) in a wet paper towel for the same length of time. Dry the surface of the core(s) with a paper towel and compress the core(s) longitudinally. Observe if any solution appears on the surface of the core(s). If so, the wood has absorbed solution and is not heartwood. The application of Chrome Azurol S penetration indicator solution prior to the application of the heartwood/sapwood indicator to the same surface will interfere with the color development and may give a false indication of heartwood. The Chrome Azurol S indicator is accurate if it is used after the heartwood/sapwood indicator.

4.3.1.2 Test for Douglas-fir. The heartwood and sapwood of Douglas-fir can usually be differentiated with a 0.1 percent solution of methyl orange in water or a 0.7 percent solution of alizarine-sulfonate in water. The alizarine-sulfonate stains the heartwood and one or two adjacent annual rings in the sapwood yellow and the sapwood pink, or some other shade of red. The methyl orange stains the heartwood a reddish color and the sapwood yellowish. The indicator works on both dry and green wood, and the colors are comparatively permanent. The test works best on a freshly exposed surface. A little alcohol added to the solution will make wet wood dry more rapidly . The ammonia present in material freshly treated with an ammoniacal preservative may interfere with the color reaction of the methyl orange indicator.

4.3.2 Variability of penetration. The measurement of the depth of penetration may not always be exact. Certain grain configurations may make it difficult to determine the actual depth of penetration in a core. A core of this type may be disregarded and an additional core taken from another location on the piece or from another piece in the lot. When cores are taken from additional pieces, the same random sampling pattern used in obtaining the other cores shall be followed.A skip or series of skips not caused by obvious excess moisture content is permitted in a core not to exceed 15% of the required depth of penetration in sapwood. If a skip occurs in the assay zone, the penetration shall be recorded and an additional core may be taken to complete the assay sample. Pitch is generally not treatable and in a core shall be considered the same as heartwood.

4.4 Retention. The method of determining the net retention of preservative per cubic foot of wood shall be in accordance with the Standards of the AWPA.

4.4.1 Sample for chemical assay. Samples for assay shall meet the following requirements

Sawn: Borings are to be taken from sapwood of Southern pine, Ponderosa pine, Radiata pine, Caribbean pine, red pine, Western red cedar, Alaskan yellow cedar, incense cedar, and unincised redwood. Borings from other softwood species shall be taken from heartwood faces and sapwood faces in the approximate proportion of heartwood and sapwood faces in a charge. The treated wood surface should be lightly scraped prior to taking a sample in order to remove any surface deposits of preservative. A boring shall be included in the assay regardless of penetration.

Shakes and shingles: When shakes and shingles are sawn and the sawdust collected for analysis, note that the particle size must meet the appropriate criteria. Where usable pieces of shakes or shingles remain, they must be retreated on another charge or cut surfaces must be treated with a topically applied preservative in accordance with AWPA Standard M4.

Southern Pine:

Method 1: Shakes or shingles shall be cut across their width at a point where the thickness is approximately 10 mm (0.6 in.) and the sawdust collected for analysis. The assay sample shall be entirely sapwood.

Method 2: Borings for assay shall be taken from sapwood, through the narrow edge and across the width at a point where the thickness is approximately 10 mm (0.6 in).

Western Red Cedar:

Shakes or shingles shall be rip sawn from tip to butt, not closer than 25 mm (1 in.) from an edge and the sawdust collected for analysis.

4.4.1.1 Retention by chemical assay. Determine the quantity of preservative (disregarding the solvent) retained in a boring sample by assaying for quantity of the solid chemical retained, and computing the retention on the basis of pounds of solid chemical per cubic foot in the assay zone. When standard wood densities are needed, AWPA Standard A12 should be used. The retention of the waterborne preservatives shall not be less than indicated in Section 3 of AWPA Standard T1 for any individual component and shall not be less than the retention specified in the applicable AWPA commodity specification for the intended use.

4.4.1.2 When material is retreated in a charge with untreated material, borings from the retreated material shall not be included in the assay samples. The number of representative borings to comprise the sample and the section of the core (zone) to be used for the analysis shall meet the AWPA Standard for the applicable commodity, species and type of treatment. When there is an insufficient quantity of material in the charge to obtain, with one boring from each piece, the required size sample for the assay, an equal number of additional borings shall be taken from each of the pieces already bored.

4.5 Reduction of Chromium (VI). When required by the applicable AWPA commodity specification, CCA treated material will be tested for completion of the chemical reduction of soluble Chromium (VI) using Method A3, Section 11.

4.6 If drying after treatment is specified or required, the inspector shall check moisture content as stated in section 2.3 for verification of the represented moisture content.

5. Evidence of inspection: Inspector's identification. When required and if size permits, each piece of accepted material shall be legibly identified by the inspector or someone under his/her immediate supervision. The identifying mark shall be obliterated or removed from products found nonconforming unless retreated and verified as conforming.

6. Reporting:

6.1 Each inspection shall be covered by an inspector's report which includes the minimum applicable information according to the following two lists.

Mandatory Information on the Report

Name of treating company
Location of treating plant
Applicable product specification or standard
Charge number
Type of material
Species
Preservative
Number of borings taken for penetration
Percent of borings conforming for penetration

Applicable or Optional Information

Heartwood content
Date of treatment
Moisture content after treatment
Number of pieces by size
Degree of seasoning
Manufacturing
Number of cubic feet
Process parameters used in treatment
Incising

6.2 Results of retention assays or preservative analyses shall be recorded.