

MIL-P-19550B(SH)  
23 May 1984  
SUPERSEDING  
MIL-P-19550A(SHIPS)  
23 April 1965  
(See 6.8)

## MILITARY SPECIFICATION

### PRESERVATIVE TREATMENT, PLYWOOD (SHIP AND BOAT USE)

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers the pressure preservative treatment of plywood with water-borne preservatives and the drying of the plywood after treatment. Plywood is suitable for ship and boat use under moderate decay hazard conditions.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specification. Unless otherwise specified, the following specification of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

#### SPECIFICATION

##### MILITARY

MIL-P-18066 - Plywood, Ship and Boat Construction.

(Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5530

## MIL-P-19550B(SH)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the document which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

## AMERICAN WOOD PRESERVERS ASSOCIATION (AWPA) STANDARDS

- A2 - Analysis of Waterborne Preservatives and Fire-Retardant Formulations.
- C1 - All Timber Products - Preservative Treatment (General Requirements).
- C9 - Plywood-Pressure Treatment.
- M6 - Brands used on Forest Products.
- P5 - Water-Borne Preservatives.

(Application for copies should be addressed to the American Wood Preservers Association, P.O. Box 849, Stevensville, MD 21666.)

## ASTM

- D 1325 - Ammoniacal Copper Arsenate, Spec. for.
- D 1625 - Chromated Copper Arsenate, Spec. for. (DoD adopted)
- D 2016 - Moisture Content of Wood. (DoD adopted)

(Application of copies should be addressed to the ASTM, 1916 Race Street, Philadelphia, PA 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

## 3. REQUIREMENTS

3.1 Material.

3.1.2 Species or types. The plywood furnished under this specification shall be of those species or types which are receptive to and can withstand pressure impregnation (see 6.2 and 6.3).

3.2 Pressure treatment. Full cell pressure treatment shall be employed using any of the water-borne preservatives specified in table I. Treatment shall be in accordance with the general procedures of AWPA C1 and C9 under conditions specified in 3.2.1.

## MIL-P-19550B(SH)

TABLE I. Treatment of plywood with water-borne preservatives.

Water-borne preservatives	Minimum net retention of solid preservative	Applicable standards	
	lb/ft <sup>3</sup> of plywood	ASTM	AWPA
Ammoniacal copper arsenate Chromated copper arsenate	0.40 (oxide basis)	D 1325 or	STD-P5
Types A, B or C	0.40 (oxide basis)	D 1625 or	STD-P5

3.2.1 Treating conditions. Plywood shall not be subjected to steaming. Treating temperatures shall not exceed 120 degrees Fahrenheit (°F). The maximum pressure used shall be not greater than 150 pounds per square inch (lb/in<sup>2</sup>). Whenever the quantity to be treated is sufficient, plywood panels of different thickness shall be treated in separate charges.

3.3 Retention. The minimum net retention of preservative by panel assay shall be not less than specified in table I. For extreme decay hazard conditions see 6.4. The average retention of preservative solution shall be not less than 25 pounds per cubic foot (lb/ft<sup>3</sup>) of plywood when determined on full size panels in each charge as specified in 4.3.2.

3.4 Penetration. Penetration will be considered sufficient only if the retention has been met and 90 percent of borings from each treating charge show each veneer is penetrated (see 4.3.2).

3.5 Kiln drying and conditioning. Air seasoning of treated plywood is not permitted. The treated plywood shall be kiln dried to a moisture content of 13 ± 3 percent. Drying temperature shall not exceed 160°F during drying and reconditioning to restore surface moisture. Relative humidity during reconditioning shall not exceed 76 percent (see 6.7.2).

3.6 Handling and stacking. Handling, stacking and stickering of plywood for treating, kiln drying, storage prior to final loading and final loading shall be accomplished in such a manner as to prevent mechanical damage and warpage (see figure 1 for suggested method). It is extremely important to avoid sticker misalignment during treatment, when stickers may tend to float out of position and during drying, where any distortions become set into the panels.

3.7 Storage and delivery. Plywood shall be stored under weatherproof shelter during all phases of treating and drying prior to shipment, and shall be preserved in accordance with 5.1 during storage and shipment.

## MIL-P-19550B(SH)

3.8 Marking. Unless otherwise specified (see 6.2), each panel shall be legibly marked on end, edge or back, adjacent to existing markings, with the following information coded in accordance with the symbols of AWPA M6:

- (a) Treater's symbol or mark, denoting company and plant.
- (b) Chemical designation.

3.9 Workmanship. Treated plywood panels shall be free of wrinkles, warp  $\frac{1}{16}$  inch in excess of that described herein, surface checks in excess of  $\frac{1}{32}$  of an inch in width, mechanically damaged ends or sides and any other degrade in excess of that permitted by the grade of plywood specified to be treated. In panels thicker than  $\frac{1}{2}$ -inch, bow  $\frac{2}{16}$  or cup  $\frac{3}{16}$  shall not exceed  $\frac{1}{8}$  inch per foot of bow or cup chord length. In panels  $\frac{1}{2}$  inch or less in thickness, bow or cup shall not exceed  $\frac{1}{4}$  inch per foot of chord. In panels  $\frac{1}{2}$ -inch or less in thickness, bow shall be not greater than 1 inch; and cup shall not exceed 1 inch.

3.9.1 Sharp kinks, usually caused by sticker misalignment are not permitted. Sharp kinks are those occurring abruptly over a very short distance, such that it could not be reasonably expected that the plywood panel could be drawn up tight against a stiffener or frame and result in a flat surface or smooth curve when held in place by fasteners.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

#### 4.2 Quality conformance sampling.

4.2.1 Lot. For the purpose of sampling, a lot shall consist of the treated plywood kiln dried in a single kiln charge.

4.2.2 Sampling for surface examination. For the examination specified in 4.3.1.2, random samples shall be selected from each lot, with lot acceptance based on table II.

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$\frac{1}{16}$  Warp is any variation from a true or plane surface. Warp includes bow, and cup, or any combination thereof.

$\frac{2}{16}$  Bow is a deviation flatwise from a straight line drawn from end to end of a panel and is measured at the point of greatest distance from the straight line.

$\frac{3}{16}$  Cup is the curve across the grain or width of a panel.

MIL-P-19550B(SH)

TABLE II. Sampling procedures for examination.

Number of panels in charge	Number of panels in sample	Acceptance number (defectives)	Rejection number (defectives)
2 to 8	All	0	1
9 to 15	5	0	1
16 to 25	8	1	2
26 to 90	13	1	2
91 to 150	20	2	3
151 to 280	32	3	4
281 to 500	50	5	6
501 to 1200	80	7	8
1201 to 3200	125	10	11
3201 to 10000	200	15	16

#### 4.3 Tests.

##### 4.3.1 Examination.

4.3.1.1 Process examination. Treating and kiln drying charts which show that the procedures are in accordance with this specification shall be maintained. When specified (see 6.2), a quart sample of the preservative used, shall be drawn under the surveillance of an inspector, and submitted to a laboratory satisfactory to Naval Sea Systems Command (NAVSEA) to determine conformance with the applicable specification or standard requirements specified in table I.

4.3.1.1.1 Treating conditions. Conditions during pressure treatment shall be as specified in 3.2.

4.3.1.2 Surface examination. Each of the sample panels selected as specified in 4.2.2 shall be examined to determine conformance with 3.9. If any panel does not conform to all requirements it shall be considered defective and shall be rejected. If the number of such nonconforming panels in any sample exceeds the acceptance number for that sample, the lot represented by the sample shall be rejected.

4.3.1.2.1 Warp measurement. Warp measurement shall be made by taut wire or string or straight edge, connecting adjacent corners of a panel. Maximum deviation from the straight line formed (chord) shall be measured on each edge and the deviation per foot calculated over the chord distance from where the panel edge departs from the straight line to where it returns to or crosses the line (that is, if the bow or cup continues on the opposite side of the straight line). Warp may be measured with the panel lying on a horizontal, plane surface, to allow some straightening due to the panel's weight.

## MIL-P-19550B(SH)

4.3.2 Preservative retention and penetration.

4.3.2.1 Sample panel assay. Preservative retention shall be determined by assay of borings of sample panels randomly placed in each charge. Four sample panels, 2 feet by 4 feet shall be cut from a sheet of the thickest plywood to be treated. Alternatively, samples may be cut from lesser quality plywood of the same species, thickness and veneer thickness and expected to have the same treating and drying characteristics. At least two borings shall be taken from each panel, one at the center of the face, and others scattered but not less than approximately 12 inches from the edges or ends. Enough borings shall be taken to permit assay in accordance with AWPA A2. Retention and penetration shall be not less than specified in table I and 3.4, respectively.

4.3.2.2 Panel retention by weight gain. The average retention of solution shall be determined on randomly selected and distributed full sized panels; at least three each, representing the thickest full sized panel and the panel having the thinnest veneer (if other than the thickest panel) shall be placed in each treating charge. Sample panels shall be weighed before and after treatment. Retention shall be not less than specified in 3.3.

4.3.3 Moisture content. At least four samples shall be placed at random in each charge of plywood to be kiln dried to determine moisture content by the method specified in 4.3.4. Samples upon which moisture determinations are made shall be well distributed within the kiln. Test specimens may, at the option of the contractor, be obtained from small panels of the same species, thickness, and veneer thickness at least 2 feet by 2 feet in size which the contractor has furnished for this purpose. The assay sample panels of 4.3.2.1 may be used prior to taking assay borings. Such sample panels shall have been subjected to the treating and drying phases in such a manner that the test sample will be representative of the condition of the panels in the lot being tested.

4.3.4 Moisture content determination of treated plywood after kiln drying. The oven drying test method specified in ASTM D 2016 shall be used. Specimens for moisture content determinations shall be taken at least 10 inches back from the panel end and edge on the panels selected in accordance with 4.3.3. Moisture content specimens shall be at least 2 inches by 4 inches by panel thickness. (Note: It is possible that with some species, preservative, glue type and moisture content range combinations, electronic type moisture meters may provide an accurate measure of the moisture content. Their use is permitted in lieu of oven drying if it can be conclusively shown that the readings are accurate for the material in question in the moisture range of  $13 \pm 3$  percent, with or without a correction factor, as specified in ASTM D 2016.)

4.4 Inspection of packaging. Packaging, packing, and marking shall be examined to determine compliance with section 5 of this specification.

## 5. PACKAGING

5.1 Preservation. Kiln dried treated material shall be protected from the elements (rain, snow, sun, etc.) by weatherproof shelters or vehicles or weatherproof, reinforced wrapping at all times during storage and shipment.

## MIL-P-19550B(SH)

5.2 Packing. Unless otherwise specified (see 6.2), treated material shall be packed in accordance with the requirements imposed for the plywood order (which is to be treated). In the absence of a specific definitive requirement, the appropriate level of packaging specified in MIL-P-18066 shall apply.

5.3 Marking for identification. In addition to any special marking required (see 6.2), each unit package or unitized load shall be marked with the following:

Chemical treatment designation.  
 Species, sizes, grade and type of plywood.  
 Specification number.  
 Gross weight.  
 Contractor's name and plant address which treated the plywood.  
 Date of treatment.

## 6. NOTES

6.1 Intended use. Material tested with water-borne preservatives is intended for use where protection against decay and wood-destroying organisms is desired under moderate leaching conditions (occasional exposure to rain water or constant exposure to the ground). It is intended to provide a treated product where cleanliness, paintability and freedom from odor are of importance. Material treated to the required retentions specified herein is not intended for use where marine borers are present.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Species, grade or class, sizes and quantity of plywood to which treatment applies (see 3.1.2 and 6.3).
- (c) Marking requirements for individual pieces (optional, see 3.8).
- (d) Whether a sample of the preservative used should be submitted to a laboratory (see 4.3).
- (e) Instructions for packaging and reloading plywood after treatment (optional, see 5.2 and 6.5).
- (f) Special marking required for unit packages (see 5.3).

6.3 Acquisition. It is essential that only plywood made with waterproof adhesives be subjected to treatment. In general, softwood plywood of an exterior type or exterior glue type and hardwood plywood of technical type in current U.S. commercial standards are suitable.

6.4 Extreme decay hazard. For extreme conditions of decay hazard, where exceptionally long service life is required or where repair would be extremely costly, preservative retention of 0.60 lb/ft<sup>3</sup> may be specified in lieu of the retentions of table I. Plywood so treated may show some reduction in strength and impact resistance and possibly increased corrosivity.

6.5 Ordinarily specific packaging requirements will be covered by the materials specification under which the plywood is ordered. If no requirement is specified, 5.2 applies.

## MIL-P-19550B(SH)

6.6 Physical damage in treatment. Unless care is taken, objectionable physical damage can occur to plywood due to inadequate stacking and tramming. The following are suitable suggested methods:

6.6.1 Tramming of plywood. Plywood can be stacked on edge without stickers inside a suitable framework built from dressed 3 inch lumber. The frame should extend above the plywood at least 3 inches so that the plywood can be free floating in the cylinder. A total of at least 3 inches free space should be left across the base of the tram to allow for expansion of the plywood during treatment. Cross members, 2 inches thick, should extend across the frame above the plywood. They should be secured to the frame by 3/4-inch steel bands. Each band should pass along the top of the cross member and be secured to the tram. Care should be taken to prevent cutting of the band by the cylinder guard rail.

6.6.2 Preventing damage to plywood panels. Regardless of the method of tramming used, over-hang should be limited to a maximum of 2 feet. Long sheets should be supported to two or more trams. Where over-hang occurs on trams, the ends of the load should be protected from damage. A used rubber tire should be suspended between tram loads from a 2 by 4 spanning adjacent trams. A hole should be cut in the bottom of the tire to permit solution to drain. Rubber tires should be suspended similarly from the front and rear trams in the charge. A 2 by 8, at least 4 feet long, should be wired to these tires across the load. The height of the forward tire should be adjusted so that the 2 by 8 will absorb the force of the engine pushing the load. Such precautions will prevent damage to plywood ends.

6.7 Drying of preservative treated plywood. The following suggestions may be helpful in drying treated plywood to avoid surface checking, warping and other forms of degrade.

6.7.1 Stacking. Warping can be controlled by proper stickering, adequate support, and holding down of the loads. A level base should be used under each pile, with supports under each tier of stickers which should be well aligned vertically preferably by the use of sticker guides. Stickers should be uniform in thickness. A thickness of 3/4-inch has been found generally satisfactory. Sticker spacing should not exceed 12 inches. Piles should be held down by spring take-up devices or weighting (see figure 1). Accurate sticker alignment is extremely important.

6.7.2 Kiln drying. Kiln drying schedules should be exceptionally mild if quality is to be obtained. The time at which changes in kiln conditions can be made will depend upon thickness and composition of the plywood. The following kiln schedule is derived from a schedule used commercially to dry treated Douglas-fir plywood:

<u>Portion of total drying time</u>	<u>Dry-bulb temperature</u>	<u>Wet-bulb temperature</u>	<u>Relative humidity</u>	<u>Equilibrium moisture content</u>
	°F	°F	Percent	Percent
First 1/6	130	121	76	12.7
Second 1/6	140	123	60	9.0
Third 1/6	150	123	45	6.4
Last 1/2	160	123	34	4.8

MIL-P-19550B(SH)

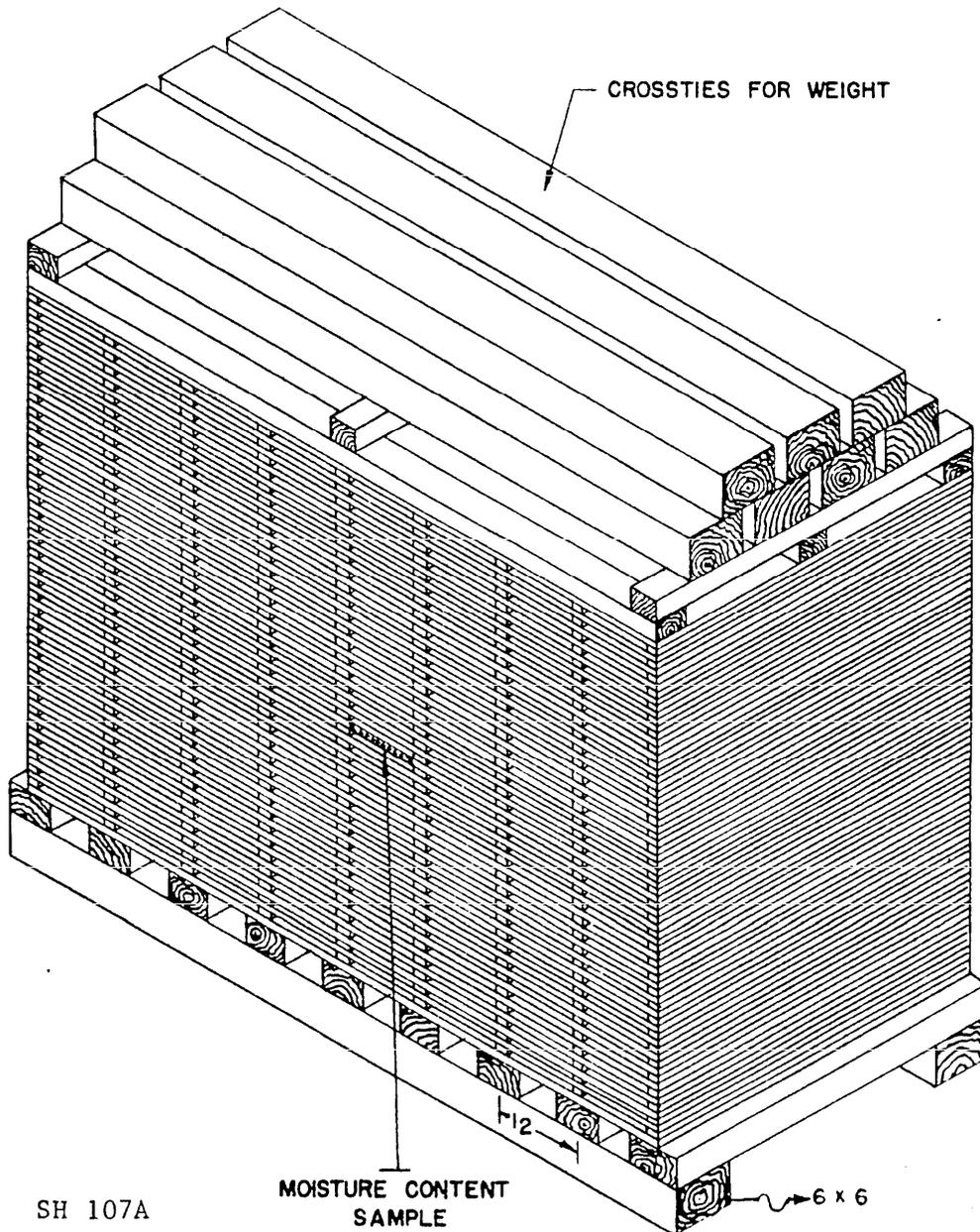
An equalization treatment is a controlled temperature and relative humidity condition used at the end of drying to stop the drying of the driest panels while allowing the wettest panels to continue drying, thus reducing the moisture range between the panels. An equalization treatment at 45 percent relative humidity can be used when the driest material in the kiln charge gets down to 7 percent moisture content. When a surface reconditioning treatment is used, a relative humidity of 70 percent should be used if the average moisture content sought is 11 percent or below and 75 percent if an average of 12 percent or higher is desired.

6.8 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Preparing activity:  
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## MIL-P-19550B(SH)

Stickers: Uniformly dressed to 3/4 inch dimension and preferably of 1-inch width. Although not shown by the drawing, all stickers should be 2 or 3 inches longer than the width of the pile to permit vertical alinement of displaced stickers. Sticker spacing should be not more than 12 inches. There should be no unsupported ends; that is, stickers should be placed at the extreme ends of the pile. Vertical alinement of stickers and supporting timbers should always be maintained.



(Omit bottom bolsters for kiln drying.)

FIGURE 1. Method of stacking plywood for storing.

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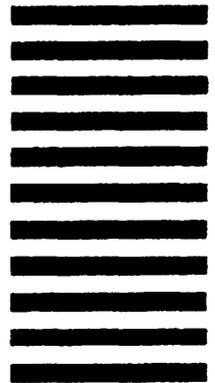
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**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL***(See Instructions - Reverse Side)***1. DOCUMENT NUMBER**

MIL-P-19550B(SH)

**2. DOCUMENT TITLE**

PRESERVATIVE TREATMENT, PLYWOOD (SHIP AND BOAT USE)

**3a. NAME OF SUBMITTING ORGANIZATION****4. TYPE OF ORGANIZATION (Mark one)** VENDOR USER MANUFACTURER OTHER (Specify): \_\_\_\_\_**b. ADDRESS (Street, City, State, ZIP Code)****5. PROBLEM AREAS****a. Paragraph Number and Wording:****b. Recommended Wording:****c. Reason/Rationale for Recommendation:****6. REMARKS****7a. NAME OF SUBMITTER (Last, First, MI) - Optional****b. WORK TELEPHONE NUMBER (Include Area Code) - Optional****c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional****8. DATE OF SUBMISSION (YYMMDD)****DD FORM 1426**  
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