

MIL-P-5451

14 December 1949

MILITARY SPECIFICATION

PROPELLERS AND TEST CLUBS; FIXED PITCH WOOD

This specification was approved on the above date by joint action of the Air Force and Navy Departments for use in the procurement of aeronautical supplies, and supersedes the following specification:

AN-P-15b
22 March 1946

This specification consists of this cover sheet and Specification AN-P-15b, 22 March 1946, with amendment -1, dated 30 December 1948, modified as follows:

Paragraph G-2: Delete "Specification AN-P-15b" and substitute "Specification MIL-P-5451."

Copies of this specification may be obtained upon application to the Command General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; or the Commanding Officer, U. S. Naval Air Station, Johnsville, Pennsylvania.

When a request for this specification is received by a supplying activity it be necessary to attach this cover sheet to the pertinent specification before iss

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AN-P-15b AMENDMENT-1 30 December 1948

AIR FORCE-NAVY AERONAUTICAL SPECIFICATION PROPELLERS AND TEST CLUBS; FIXED-PITCH WOOD

This amendment approved on the above date by joint action of the Air Force and Navy Departments, forms a part of and should be attached to AN Aeronautical Specification AN-P-15b, dated 22 March 1946. It shall become effective immediately upon issue.

Paragraph A-1a. Air Force-Navy Aeronautical Specifications: Amended by changing the following:

"A-1a. Specification AN-QQ-S-757 to AN-S-757."

Paragraph A-1d: Add new paragraph as follows:

"A-1d. JAN Specification.-

JAN-A-397 Adhesives, Thermosetting-Resin, Room Temperature and Intermediate-Temperature Setting, Waterproof (Phenolic, Resorcinol and Melamine Base) (For Wood)."

Paragraph D-4: Amended by addition of following sentence and Table II:

"Test clubs shall conform to the dimensions shown on the drawing within the tolerances specified in Table II, unless otherwise specified by the Procuring Agency.

TABLE II
Test Club Dimensional Tolerances in the White

Thickness of Boss.	$\pm 1/16$ inch
Blade Length.	$\pm 1/8$ inch
Track.	$1/8$ inch
Edge Alignment.	$\pm 1/8$ inch
Hub Bolt Holes.	$\pm .005$ inch
Width of Blade (Center of Hub to 24" Station).	$\pm 1/8$ inch
Width of Blade (30" Station to Tip Blades with Chords of 10" or More).	$\pm 1/8$ inch
Width of Blade (30" Station to Tip with Chords Less than 10").	$\pm 1/16$ inch
Boss Diameter.	$\pm 3/16$ inch
Thickness of Blade (6" Station to 24" Station).	$\pm 3/16$ inch
Thickness of Blade (30" Station to Tip).	$\pm 3/32$ inch
Template Fit (6" Station to 24" Station) (Gap between Halves).	$5/16$ inch
Template Fit (30" Station to Tip) (Gap between Halves).	$3/32$ inch
Template Fit Airfoil Contour.	$1/32$ inch
Hub Bore.	$\pm .015$ inch
Blade Angle (6" Station to and Including 18" Sta.)	± 1.0 degree
Blade Angle (24" Station to Tip).	± 0.5 degree

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AN-P-15b
Amendment -1
(December 1948)

Paragraph H-1a(2): Amended by deleting the paragraph and substituting the following:

"H-1a(2). JAN-A-397 Adhesives, Thermosetting-Resin Room-Temperature and Intermediate-Temperature Setting Waterproof, Phenolic, Resorcinol, and Melamine Base for Wood."

Paragraph I-4a. Amended to read as follows:

"I-4a. Sources.- Copies of Air Force-Navy Aeronautical Specifications, Drawings and Joint Army-Navy Specifications required for Government procurement, and ANA Bulletins and the Index of ANA Standards, may be obtained upon application to the Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; or to the Commanding Officer, U. S. Naval Air Development Station, Johnsville, Pennsylvania. ANA Specifications and Drawings are available for purchase from the above agencies, acting as agents for the Superintendent of Documents. The price may be obtained from the Index of ANA Standards or upon application to either of the above agencies, and payment shall be made by check or money order, payable to the Superintendent of Documents or the Treasurer of the United States."

Paragraph I-4b. Amended to read as follows:

"I-4b. Federal Specifications.- Copies of Federal Specifications and the Federal Specifications Index may be obtained upon application, accompanied by money order, coupon, or cash, to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The price of Federal Specifications may be obtained from the Federal Specifications Index or the Superintendent of Documents."

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AN-P-15b

22 March 1946

Superseding

AN-P-15a

12 April 1943

**ARMY-NAVY AERONAUTICAL SPECIFICATION
PROPELLERS AND TEST CLUBS; FIXED-PITCH WOOD**

This specification was approved on the above date by joint action of the War and Navy Departments, for use in the procurement of aeronautical supplies and shall become effective immediately upon issue.

A. APPLICABLE SPECIFICATIONS.

A-1. The following specifications of the issue in effect on date of invitation for bids shall form a part of this specification:

A-1a. AN Aeronautical Specifications.-

AN-P-23	Propellers; Installation Model Specification (Instructions for Preparation)
AN-W-2	Wood; Method for Kiln Drying
AN-L-18	Lumber; Aircraft Propeller
AN-C-121	Cloth; Mercerized Cotton Airplane
AN-P-30	Packaging and Packing; Aircraft Propellers (For Domestic and Overseas Shipment)
AN-P-24	Propellers; Type Test
AN-V-27	Varnish; Wood Propeller
AN-E-7	Enamel; Camouflage, Quick Drying
AN-TT-D-554	Dope; Cellulose Nitrate, Pigmented
AN-QQ-S-757	Steel; Corrosion and Heat Resisting (18 Cr, 8 Ni) Plate, Sheet and Strip

A-1b. Federal Specifications.-

QQ-N-281	Nickel-Copper Alloy; Forgings, Plates, Rods, Shapes, Sheets, Strips, and Wire
QQ-B-611	Bars, Plates; Rods, Shapes, Sheets and Strips; Brass, Commercial.

A-1c. ANC Bulletins.-

ANC-18	Wood Aircraft Structures, Design of
ANC-19	Wood Aircraft Inspection and Fabrication

B. TYPE AND MODEL.

B-1. The type and model shall be in accordance with Specification AN-P-23.

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(March, 1946)

C. MATERIAL AND WORKMANSHIP.

C-1. **Materials.**- Materials used in the manufacture of aircraft wood propellers shall be of high quality, suitable for the purpose, and shall conform to applicable Government specifications. Material conforming to contractors' specifications may be used provided the specifications are acceptable to the Government and contain provisions for adequate tests. The use of contractors' specifications will not constitute waiver of Government inspection.

C-2. **Workmanship and Finish.**- The workmanship and finish on all propellers shall be in accordance with high grade propeller practice and to the satisfaction of the Procuring Agency. The propellers shall be finished smooth, free from defects, scratches, excess glue, excess solder, overlap ridges and tool marks.

C-3. The materials and processes used in the fabrication of the propellers and test clubs shall be further subject to inspection in accordance with Bulletins ANC-18 and ANC-19. In case of any discrepancy between the Bulletins and the specification, the requirements of the specification shall govern.

D. GENERAL REQUIREMENTS.

D-1. **Model Specification.**- A propeller installation specification shall be furnished by the contractor for approval and release in accordance with Specification AN-P-23.

D-2. **Design.**- When the propellers are designed by the contractor, the contractor shall, when required by contract, submit three complete sets of blueprints of drawings, made in accordance with the Army and Navy practices and standards, to the Procuring Agency for approval. If satisfactory, one of these sets will be approved and returned to the contractor.

D-2a. **Design Data and Drawings.**- Propellers shall be made strictly according to drawings which are acceptable to the Procuring Agency. Drawings shall not be scaled. In cases of discrepancies, the contractor shall communicate with the Procuring Agency or its duly authorized representative.

D-2a(1). In addition to the dimensions and tolerances normally included on the drawings, the contractor's drawings or specifications shall carry the following information when applicable: (When the following information is specified in the specification, the drawing shall reference the applicable specification).

Material:

- Kind of Wood Used
- Weight of Propeller or Test Club
- at 5 to 7 Percent Moisture Content
- Finish (smooth, sandpapered, etc.)
- Protective Treatment
- Part Number and Marking Locations
- Gage Fits

(Omission of any of the above data from contractor's drawings or specifications shall be explained, unless self-evident, to the satisfaction of the Procuring Agency).

D-3. **Type Test.**- The acceptance of any propeller or test club as a service model shall be predicated on the satisfactory completion of a type test in accordance with Specification AN-P-24 or portions thereof as specified by the Procuring Agency.

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(March, 1946)

D-4. **Dimensions and Tolerances.**— The propellers shall conform to the dimensions shown on drawings within the tolerances specified in Table I, unless otherwise specified by the Procuring Agency.

TABLE I
Blade Dimensional Tolerances in the White

Thickness of Boss.....	±1/32 inch
Blade Length.....	±1/16 inch
Track.....	1/16 inch
Edge Alignment.....	±1/16 inch
Hub Bolt Holes.....	+ .005 inch
	— .000 inch
Thickness of Individual Laminations.....	± .002 inch
Width of Blade (Center of Hub to 24" Station).....	±3/32 inch
Width of Blade (30" Station to Tip).....	±1/16 inch
Hub Diameter.....	±3/32 inch
Thickness of Blade (6" Station to 24" Station).....	+1/8 inch
	—1/16 inch
Thickness of Blade (30" Station to Tip).....	+3/64 inch
Template Fit (Center of Hub to 24" Station).....	3/32 inch
Template Fit (30" Station to Tip).....	+1/32 inch
Hub Bore.....	+ .015 inch
	— .000 inch
Blade Angle (6" Station to and Including 18" Station).....	±1.0 degree
Blade Angle (24" and 30" Stations).....	±0.5 degree
Blade Angle (36" Stations to Tip).....	±0.4 degree

D-4a. Blades of the same propeller shall be identical within the limits as given, disregarding the plus or minus sign.

D-5. **Wood.**— Propellers and test clubs shall be made from lumber conforming to Specification AN-L-18. Flight propellers shall be made only of sugar maple, sweet or yellow birch, black cherry, or black walnut. Test clubs may be made of any of the species listed in Specification AN-L-18.

D-6. **Kiln Drying Lumber.**— The species of woods used for propeller lumber shall be kiln dried in accordance with Specification AN-W-2.

D-7. **Moisture Content.**— The moisture content of propeller lumber shall be between 5 to 7 percent at the time of gluing. The variation of moisture content in the same board shall not exceed one percent.

D-8. **Laying Out Laminæ.**— The full length laminæ shall be so laid out that the grain of the wood does not have a combined grain slope steeper than 1:15 with reference to the centerline of the blade. The short laminæ (those not reaching beyond the 30 inch station) shall be so laid out that the long axis is approximately parallel to the grain of the wood.

D-9. **Spliced Laminæ and Hub Wideners.**— Boards may be glued edge to edge to produce laminæ or hub sections of the necessary width providing that the edges to be joined are approximately parallel to the direction of the grain as indicated on the face of the board. In no case shall the slope of the grain with respect to the edge to be glued be steeper than 1 in 15.

D-9a. **Edge joints** may be plain or serrated. The edges shall be smoothly and accurately joined not more than eight hours before gluing. If serrated, the pitch shall be less than 1/8 inch and not greater than 1/4 inch.

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(March, 1946)

D-9b. Edge joints shall remain in the clamps at least 4 hours after gluing. After removal from the clamps, the edge joints shall be conditioned for a period of not less than 72 hours at temperatures of not less than 21°C (70°F) before the final surfacing operation.

D-10. Laminæ Thickness.- Each lamination, after being completely shaped, spliced, or fitted with hub wideners shall be planed to thickness. The manufacturer will not be required to adhere to the thickness specified on the drawing, but may use wood which varies in finished thickness from 1/2 inch to 1 inch, in order to best utilize the lumber at his disposal. Laminæ of one thickness, held within the allowable tolerance, shall be used in a single propeller, except on outside laminations.

D-11. Before assembling the laminæ for gluing, they shall be separated by weight into three classes; light, medium, and heavy. Only laminæ of one class shall be assembled in a single propeller. The laminæ shall be assembled in propeller groups and carefully balanced both vertically and horizontally. By placing the heavy end of adjacent laminæ at opposite ends of the propeller groups, the propeller group can be brought approximately into balance. This will greatly aid in obtaining the balance of the finished propeller.

D-12. Preparation of the Laminæ for Gluing.- Laminæ shall be prepared for gluing by smoothly and accurately planing all surfaces to be glued not more than four hours before gluing. At the time of gluing, all surfaces shall be free from dirt, grease, and any other material that may interfere with the adhesion of the glue.

D-13. Glue.- The glue used in the manufacture of fixed pitch aircraft wood propellers shall be as specified in section H. Glue shall be prepared in accordance with the manufacturer's instructions. Containers used for the mixing of the glue must be thoroughly cleaned immediately after using. Containers of copper, brass or aluminum shall not be used.

D-14. Gluing Laminæ.-

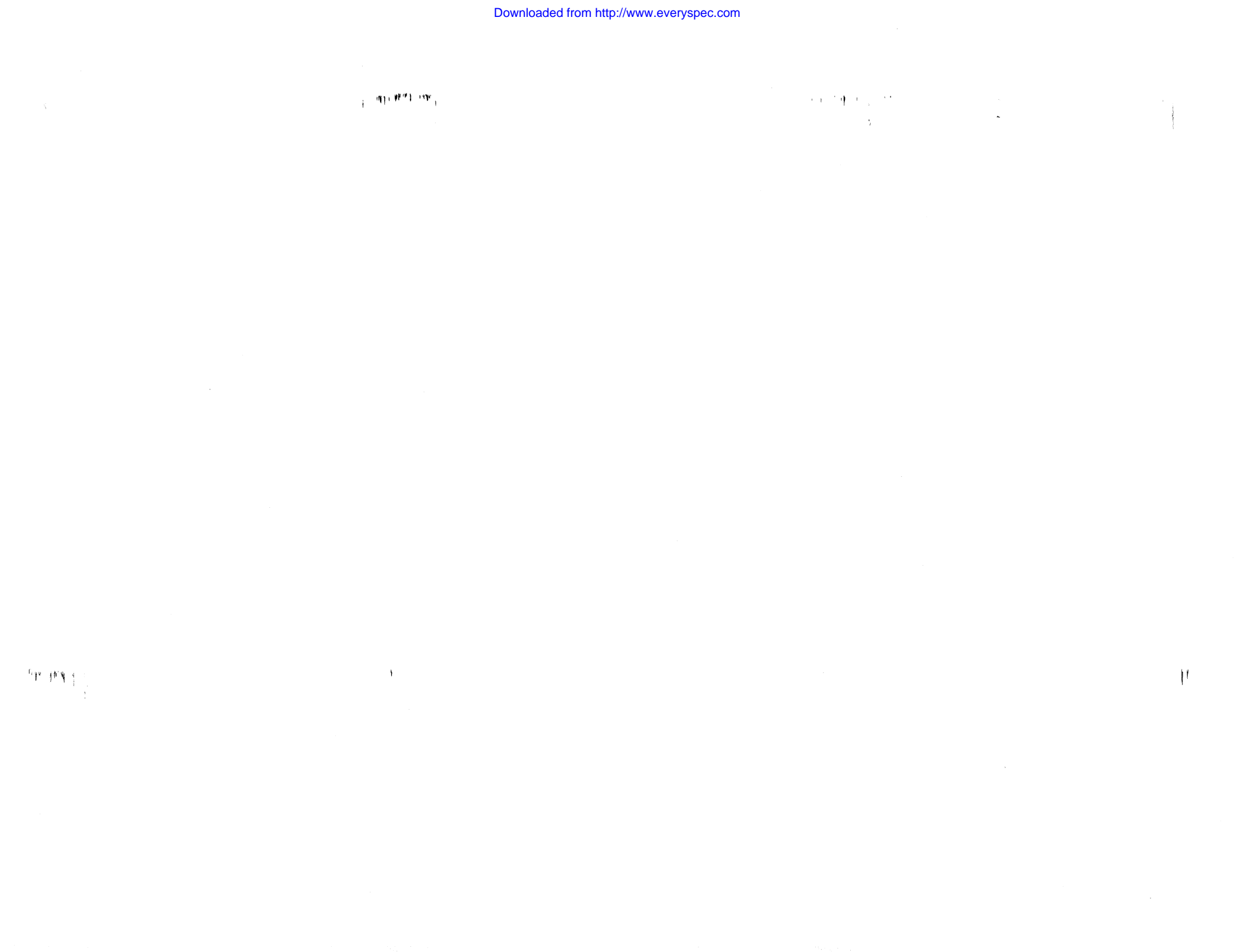
D-14a. The propeller manufacturer shall so control the temperature of the gluing room, the amount of glue spread, the time that elapses between the time the glue is spread and the pressure applied, and the pressure so that glue joints of maximum strength will be obtained.

D-14b. Assembly periods and pressures shall conform to those recommended for cold-setting, urea-resin glues in Table 5-12, page 207, ANC-19.

D-14c. Application of Glue.- Glue shall be applied in accordance with the manufacturers instructions. The gluing shall be done in a room which shall be enclosed, light, clean, and free from draughts and dust. No gluing shall be done when the temperature of the gluing room or wood is below 24°C (75°F). Particular care should be taken to spread the glue evenly and to correct thickness. The use of a glue spreader is recommended.

D-15. Rough Shaping and Conditioning of Blocks.- The blocks shall be roughed out (not closer than 1/8 inch of the finished surface removed). They shall then be placed in a closed conditioning room wherein the relative humidity shall be controlled to maintain an equilibrium moisture content within the range from 5 to 7 percent. They shall be conditioned therein for not less than 7 days at 24°C (75°F) or not less than 3 days at 49°C (120°F). The propellers shall be supported horizontally on pins through the hub holes in such a manner that the air has free access to all surfaces. The temperature and humidity shall be recorded periodically in various parts of the room and if the conditions vary, the air shall be circulated by means of fans, properly located.

D-15a. Final Shaping.- The blocks shall be carved, worked to a final size, and shaped and smoothly sandpapered. It is desirable that this work be done under shop conditions which closely approximate those under which the propellers are stored in the rough but it is not mandatory that the shop be air conditioned. The change in pitch angle from



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station to station shall be smooth and true throughout the length of the blade. Irregularities in contour will not be allowed.

D-16. Stations.- The stations used in carving and checking the cross sections are located by planes perpendicular to the center line to the propeller and tangent to arcs, whose radii are shown on the drawings. Stations shall be designated according to their radial distance in inches from the center of the hub. The first station shall be located 12 inches from the center of the hub, the remaining stations thereafter located in successive increments of six inches. A cross section profile for an intermediate station will be established at the tip portion of the blade and shall be located $1/2$ the total distance between the standard station and the extreme tip when in excess of six-inch increment spacings.

D-17. Drilling.-

D-17a. The large hub hole shall be bored by a cutter having a peripheral speed sufficient to get a smooth accurate hole. All holes in propellers shall be bored with extreme accuracy in order to insure their being straight through the propeller and perpendicular to the hub faces. Immediately after boring, the hub hole and bolt holes shall be sealed with a varnish conforming to Specification AN-V-27 by plugging one end of the hole, filling with varnish and allowing to stand for not less than 15 minutes before draining.

D-17b. All hub and bolt holes shall be bored to dimensions specified on the propeller drawing. The tolerance limits shall be as shown in Table I.

D-17c. Hub and bolt holes shall be drilled from a hub or jig approved by the Procuring Agency. In order to secure alignment of the bolt holes, they shall be drilled half way through the hub and then the propeller reversed and the holes completed from the other side. A reamer should be used for correction of existing variations at point of misalignment when necessary.

D-18. Template Fit.- The blades shall be inspected for template fit as specified in section F.

D-19. Balancing.-

D-19a. Propellers and test clubs shall be tested for vertical and horizontal balance after shaping and after each consecutive process which might affect their balance.

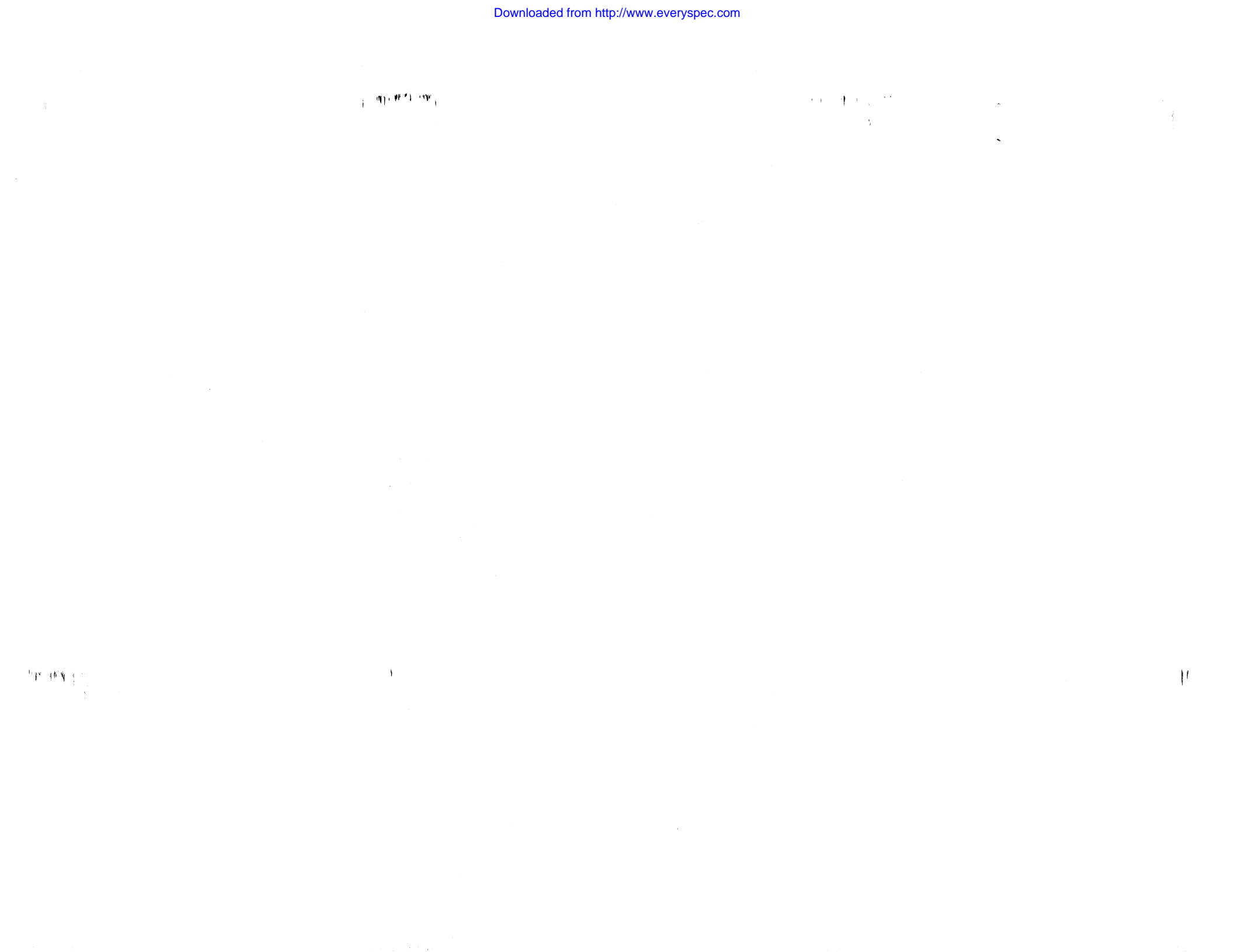
D-19b. Final Balance.- Horizontal balance shall be attained to within the sensitivity of the balancing equipment (0.04 pound-inch maximum). Vertical balance shall be obtained within 0.2 pound-inch.

D-19c. Balance with Hub Installed.- A hub shall be bolted securely into the propeller or test club. Balance may be secured by the application of liquid finish to the lighter blades for horizontal balance, or by securing a brass plate to the wood portion of the hub, for vertical balance. This plate shall be not thicker than $3/32$ inch nor weigh more than 0.12 pound. It shall be secured to the hub by No. 4 brass or plated steel flat head wood screws, $1/2$ inch long. The finished propeller or club shall stand at any angle on the balancing apparatus without showing persistent motion in any direction.

D-19d. The boring of holes in propellers or test clubs and the insertion of lead or other material to assist in balancing will not be permitted.

D-20. Serial Number.- Unless otherwise specified by the Procuring Agency, the serial numbers shall be assigned by the manufacturer.

D-21. Identifying Model Designation.- The manufacturer's model designation, whether design number, part number, or drawing number, shall be the same.



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D-22. Identification Marking.-

D-22a. Propellers with integral spinners shall be marked on the up-stream or front face, in a location that is visible from the front of the propeller when installed on the airplane; marking to be confined to an area not exceeding one inch from the spinner. Two blade propellers, without spinner, shall be marked on the side of the boss. Blade No. 1 shall be identified by the stamp "1" just outside of the hub. Four blade propellers and test clubs shall be marked in the location as indicated on the drawing.

D-22b. All propellers shall be marked before final finish is applied, using 3/8-inch cut steel stencils with the following information:

Model designation
Serial number
Manufacturer's name or trademark

D-23. Finish.-

D-23a. Unless otherwise specified by the Procuring Agency, all wood propellers and test clubs shall be finished in the following manner:

D-23a(1). Dipping.- Three dip coats of varnish shall be applied. The varnish shall be reduced to not less than 18 percent non-volatile for dipping. The first dip coat shall be applied by complete immersion until rapid bubbling, indicating displacement of air has ceased. Succeeding coats shall be applied by immersion for not less than ten seconds.

D-23a(1)a. Drainage.- Following the application of each coat, the propeller or test club shall be held in a horizontal position to permit drainage toward the trailing edges. The accumulated material shall be wiped off with rags wet with suitable solvent to prevent formation of fatty edges.

D-23a(2). After each coat of varnish has dried, the surface shall be sanded lightly to remove nibs or other irregularities.

D-23a(3). After the third coat of varnish has dried and has been sanded, the metal tipping shall be applied.

D-23a(4). Two additional coats of varnish, as previously used for dipping, shall be applied by spraying or brushing. For these coats the varnish shall be used essentially at package consistency.

D-23a(5). If camouflage finish is specified, one coat of infrared reflecting camouflage enamel shall be applied by spraying in addition to the above finish.

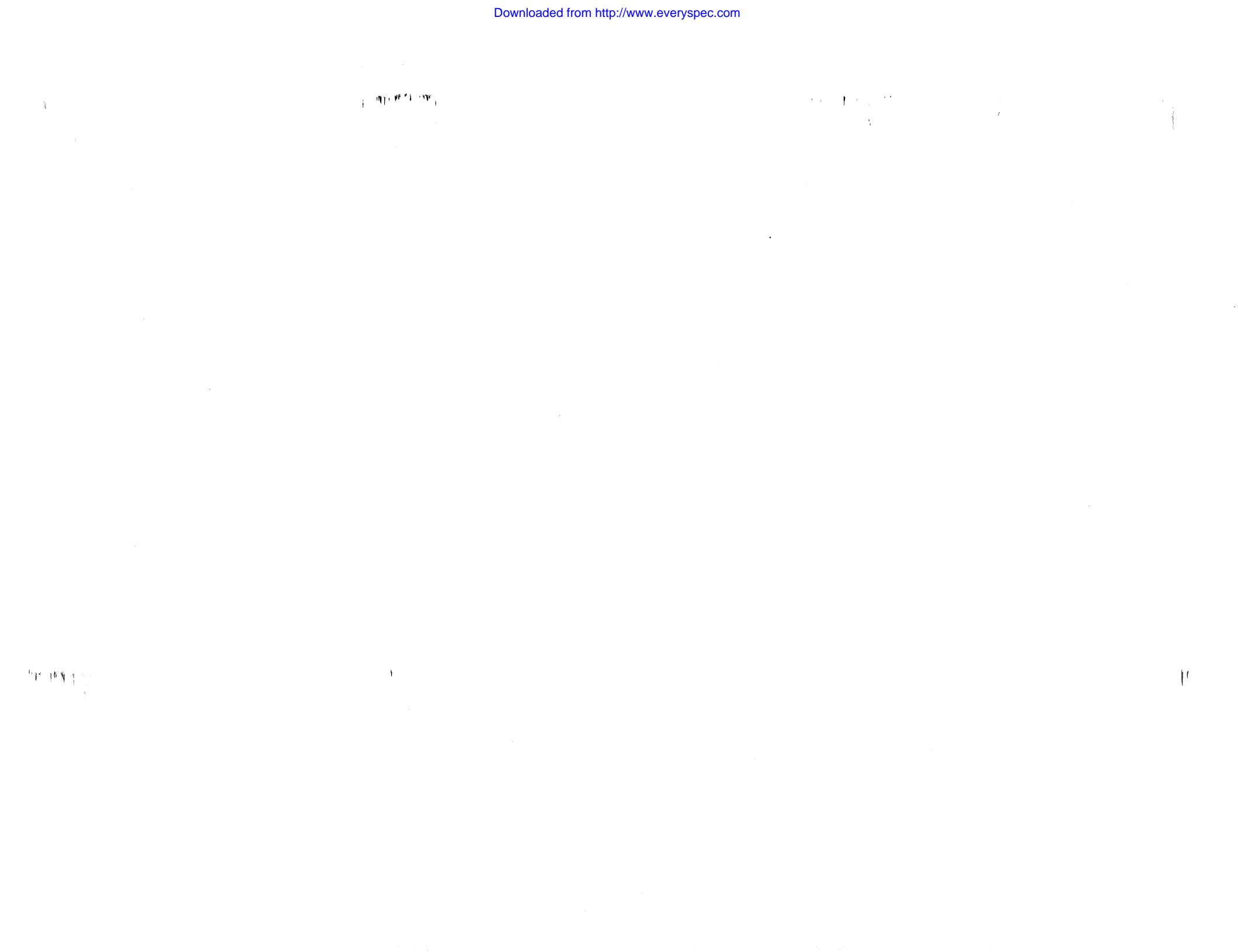
D-23a(6). In cases where dipping is impractical, such as large diameter test clubs, the hub and bolt holes shall be plugged on one side and poured full of varnish. This shall be allowed to stand for 5 minutes and then drained. Following this operation the test club shall be given 5 brush or spray coats of varnish with suitable drying intervals in between.

D-23a(7). After the last coat of finish has been applied, coat the tip of each blade for an inboard distance of 4 inches with enamel, Specification AN-E-7, color No. 614 Orange-Yellow.

E. DETAIL REQUIREMENTS.

E-1. The requirements of drawings and detail specifications specified or approved by the Procuring Agency are applicable as detail requirements of this specification.

E-2. Propellers (or Test Clubs when required).-



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E-2a. Sheathing and Tipping of Propellers.- Blades of all propellers shall be sheathed with cotton fabric, unless otherwise specified on the drawing. Mercerized cotton airplane fabric, conforming to Specification AN-C-121, shall be used. The tips of all propellers, 80 inches or over, shall be sheathed for an inboard distance of not less than 15 inches measured from the tip and all propellers under 80 inches shall be sheathed for not less than 12 inches.

E-2a(1). Application of Fabric.- The fabric shall be cemented to the wood with glue as specified in section H. The fabric shall be applied before any finishing operation.

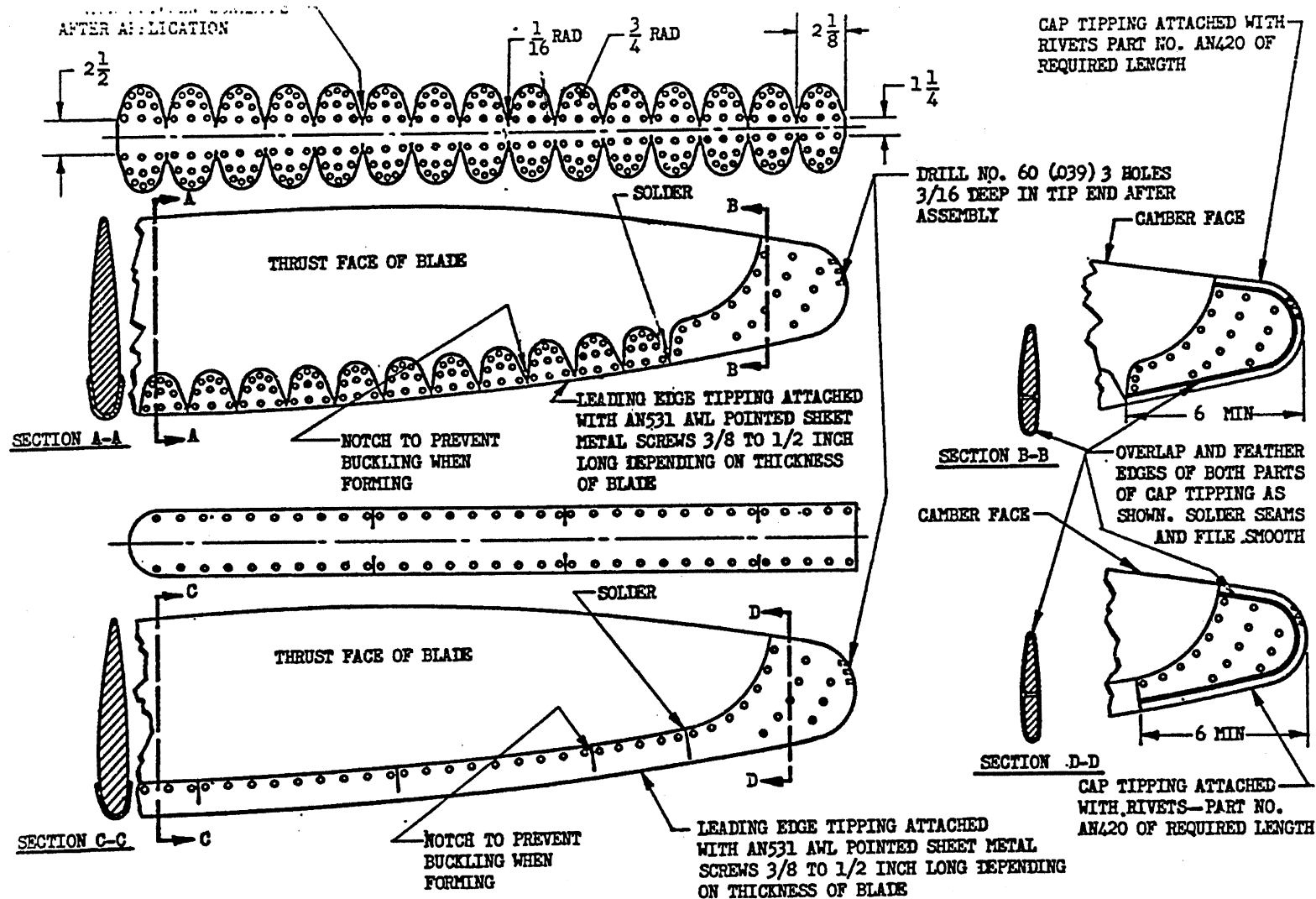
E 2a(2). Apply fabric to the propeller as follows: After the application of an even coat of adhesive on the camber face of one blade, the fabric is laid on, starting at the leading edge and trimming the cloth to exactly follow its contour. It is then smoothed down, working from the leading edge and pressing out the glue toward the trailing edge. As soon as the backs of the blades are covered, the propeller is turned over. The pitch faces are then covered in a similar manner and the fabric is finally carried around the leading edge to the camber face and finished with about 7/8-inch overlap only when no metal tipping is to be applied; otherwise no overlap is necessary. The tip shall be allowed to dry under shop conditions for at least 24 hours before working further. The fabric shall be laid free from wrinkles and air pockets and shall adhere tightly throughout. No laps or seams shall appear on the exposed surfaces after the application of the metal tipping.

E-2a(3). Prior to further finishing operations, the fabric shall be given one brush coat of pigmented nitrate dope (color to be acceptable to the Procuring Agency) conforming to Specification AN-TT-D-554. Further finishing shall be in accordance with the requirements previously described.

E-2b. Tipping Propellers with Metal.- Blades of all propellers shall be tipped with brass, stainless steel, or nickel-copper alloy, 0.020 inch, plus or minus .002 inch thick, conforming to Specification QQ-B-611, AN-QQ-S-757, or QQ-N-281 respectively. The tip shall be serrated, scalloped or plain type acceptable to the Procuring Agency. The metal shall be so cut as to be easily formed to the contour of the leading edge of the blade, and burrs shall be removed from all metal edges before application to the blade. The edges of the metal shall be filed to a knife edge at the tip section where overlapping occurs to prevent a ridge being formed by the overlap. The method of applying tipping is illustrated in Figure 1.

E-2c. Application of Metal Tip.- The metal tip shall be applied over the third coat of finish. The metal cap may be formed over a die and brazed or soldered together prior to application. Otherwise the small piece of metal shall be applied to the camber side first. The ends of the large piece (on the thrust face) shall then be lapped over the small piece as to effect a continuous piece of metal along the leading edge. The metal shall be secured by No. 4awl pointed plated sheet metal screws, 1/2 and 3/8 inch long except in the thin section near the blade tip where 1/8-inch diameter copper rivets shall be used. The blade shall be bored for the screws and countersunk for the screw heads. The countersunk holes shall be coated with a protective finish. The metal shall not be countersunk to take the screw heads, but shall be dimpled into the countersunk holes in the wood by a method that avoids splitting or compressing the wood.

E-2d. Rivet Holes.- The holes for the rivets shall be drilled through the metal and wood with the tip in place. Countersinking of the metal tipping will not be permitted, but the metal shall be removed and the holes in the wood countersunk and a protective coating applied as in the case of the screws. The metal shall then be replaced and be carefully dimpled into the countersunk holes before heading. Rivet holes shall be drilled to the exact size of rivet, so that the rivets may be pressed in by hand. Rivets shall not be driven in. When completed, the metal tip shall fit snugly against the wood. Buckling or lifting of the metal shall be cause for rejection. Solder shall be filled in over the heads of these rivets and screws, and filed down to the smooth surface of the metal tip. Care shall be exercised in soldering screws and rivets to avoid undue heating or charring of the wood.



PLAIN TIPPING NOT RECOMMENDED FOR PROPELLERS ON ENGINES OF OVER 250 H P.

FIGURE 1. Application of Metal Tipping.

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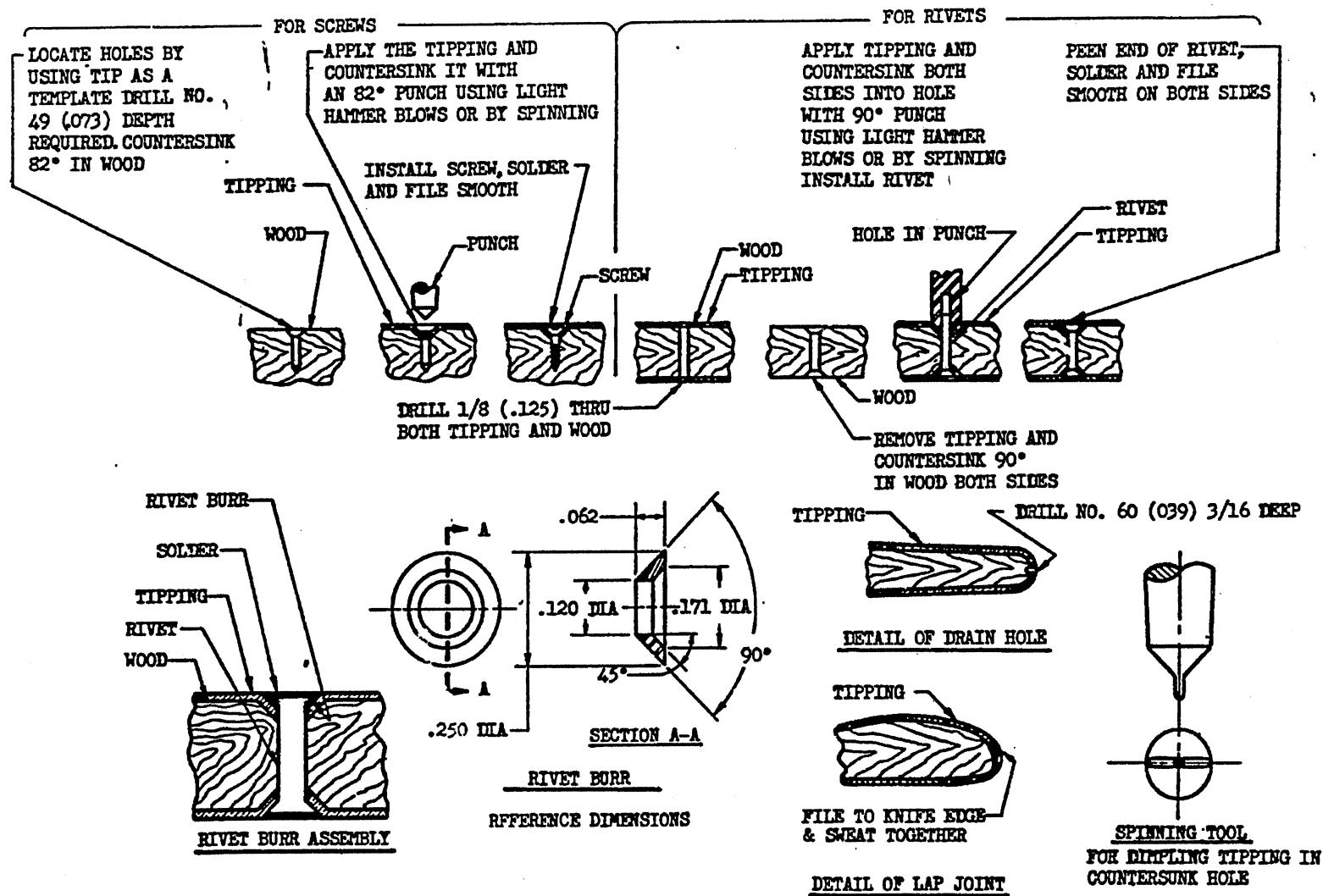


FIGURE 1. (Continued) Application of Metal Tipping

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F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-1. General.- When inspection is conducted at the contractor's plant, all tests specified herein under Testing shall be accomplished by the contractor under the supervision of the Government Inspector.

F-1a. Facilities.- Contractors not having laboratory facilities satisfactory to the Inspector shall engage the services of a commercial testing laboratory acceptable to the Inspector.

F-1b. Previous Approval.- Acceptance or approval of material or release of any design by the Procuring Agency shall in no case be construed as a guaranty of the acceptance of the finished product.

F-1c. All equipment used for the final inspection for acceptance of propellers shall be acceptable to the Government. This equipment shall be subject to checking by the Inspector at any time and shall be checked periodically as deemed advisable to assure consistency of required accuracy.

F-1d. After final acceptance of the product, the Inspector shall stamp upon the leading edge of the hub, beyond the hub face plate, the official stamp of acceptance. This shall be plainly visible where the propeller is mounted on the airplane.

F-2. Inspection of Laminæ.-

F-2a. General.- The propeller manufacturer may assemble the laminæ into propeller groups either before or after inspection. Each lamination, after being planed to thickness, shall be subjected to rigid inspection.

F-2b. Defects in Laminæ.- Laminæ containing checks, shakes, rot, dots, pronounced burls or curls, worm holes, discoloration streaks, and other similar defects shall be considered cause for rejection.

F-2b(1). Knots.- Round knots over 1/2 inch in diameter, or small knots that are not as sound as the surrounding wood and which are present in large numbers, and knots in parts of the finished blade less than 1/2 inch thick or within 18 inches of the tip of either blade, shall be cause for rejection.

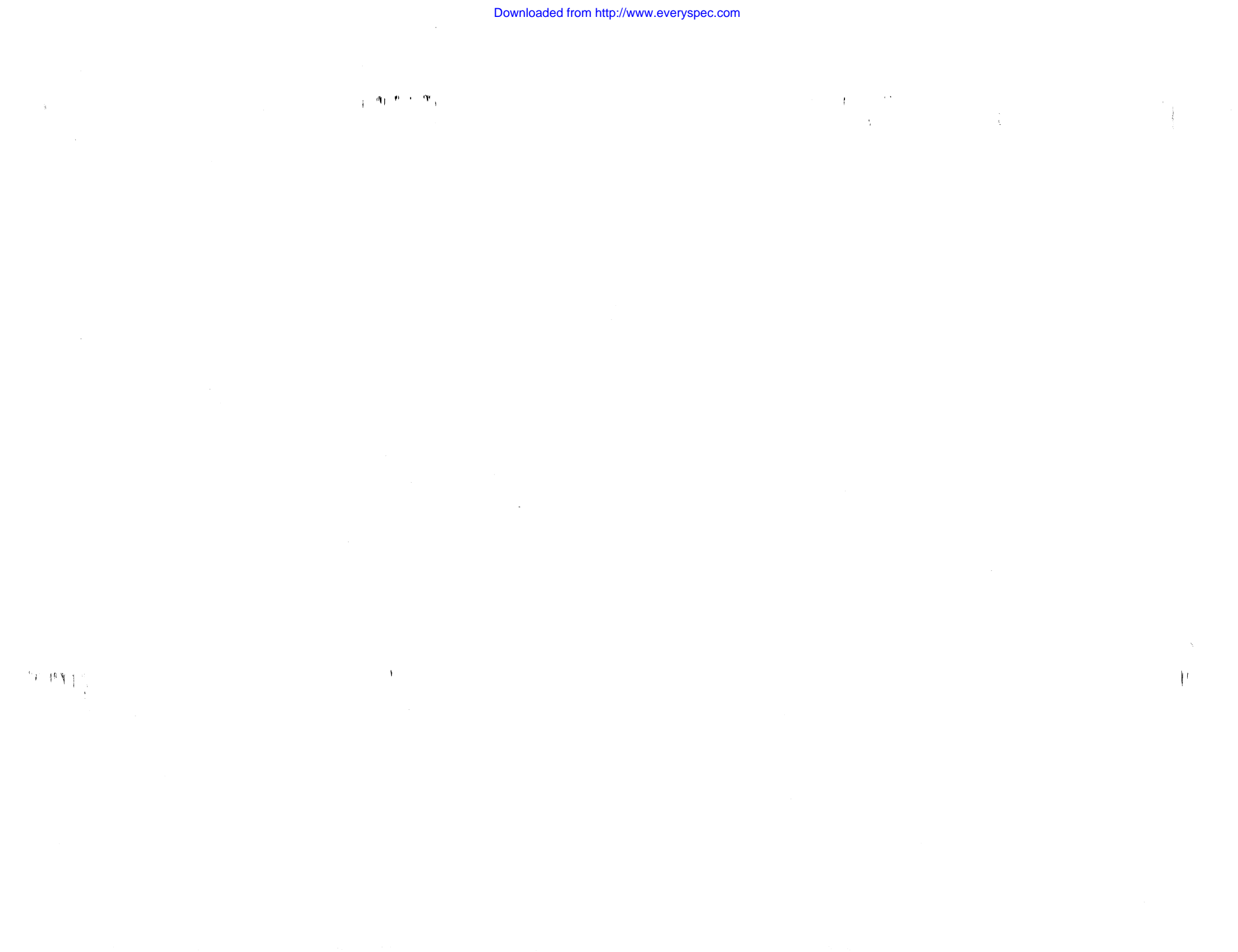
F-3. Hub Holes.- The diameter of hub holes shall be inspected in the white by "Go" and "No Go" gages, or other means acceptable to the Procuring Agency. The "Go" gage shall be made to the exact size given on the drawing. It shall fit into the hub hole with a light hand press fit. The "No Go" gage shall be .015 inch oversize and bore of the hub hole shall be such that it is impossible to press in the "No Go" gage by hand.

F-3a. Hub holes shall be inspected to determine whether they are round and perpendicular to hub form. Tolerance or roundness of hub hole shall be plus 0.020 inch, minus 0.000. Tolerance on perpendicularity of hub hole shall be 0.020 inch in length of hub hole.

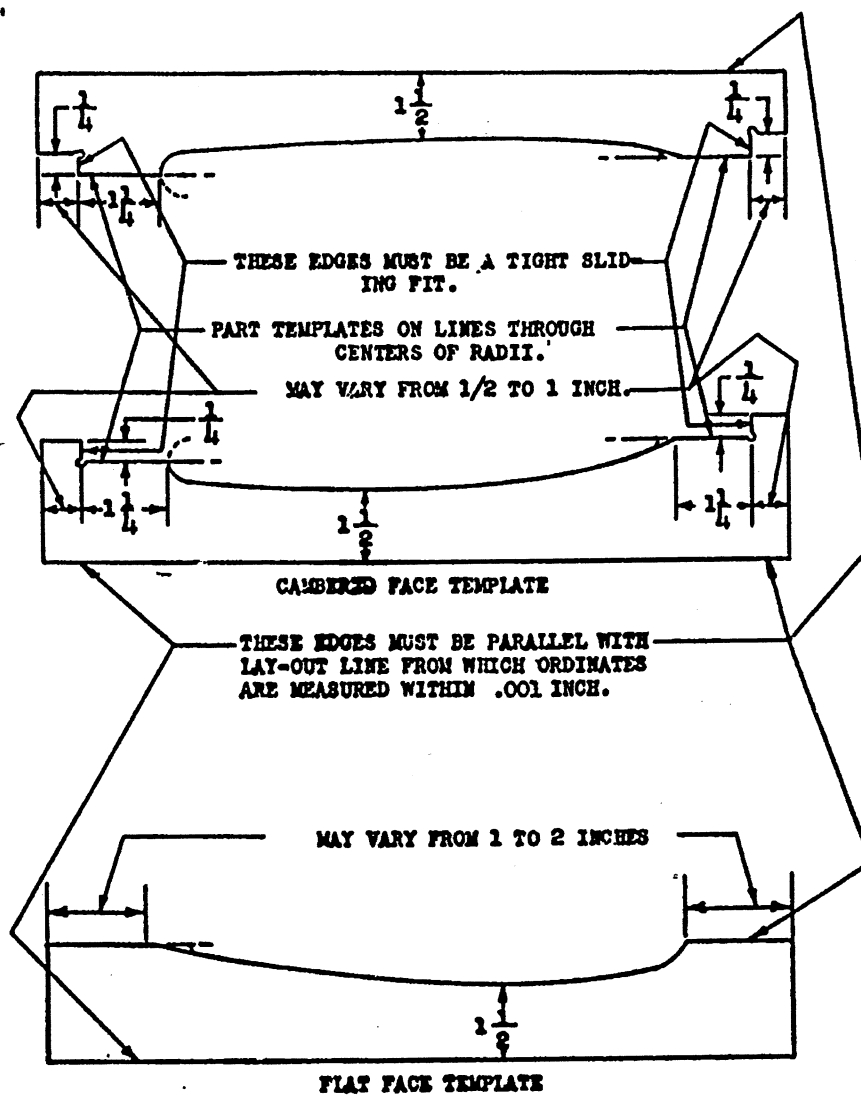
F-4. Template Fit.-

F-4a. Steel templates constructed as shown on Figure 2 and within plus or minus 0.005 inch of drawing dimensions, shall be used to determine the template, the template fit and the final inspection for acceptance.

F-4b. The templates shall be applied in such a manner that the plane of the template will coincide with the plane of the cross section as indicated on the drawing. The parting edges of the two halves of the template shall be kept parallel, the opening or gap being the same at the leading and trailing edges of the section, and the orientation of the template shall be maintained within the angle tolerances of the corresponding station while the gaps between the template and the surface of the blade are checked with the narrow feeler gages to determine whether the irregularities are within the tolerances. All checking with templates shall be accomplished with the propeller in the "white".

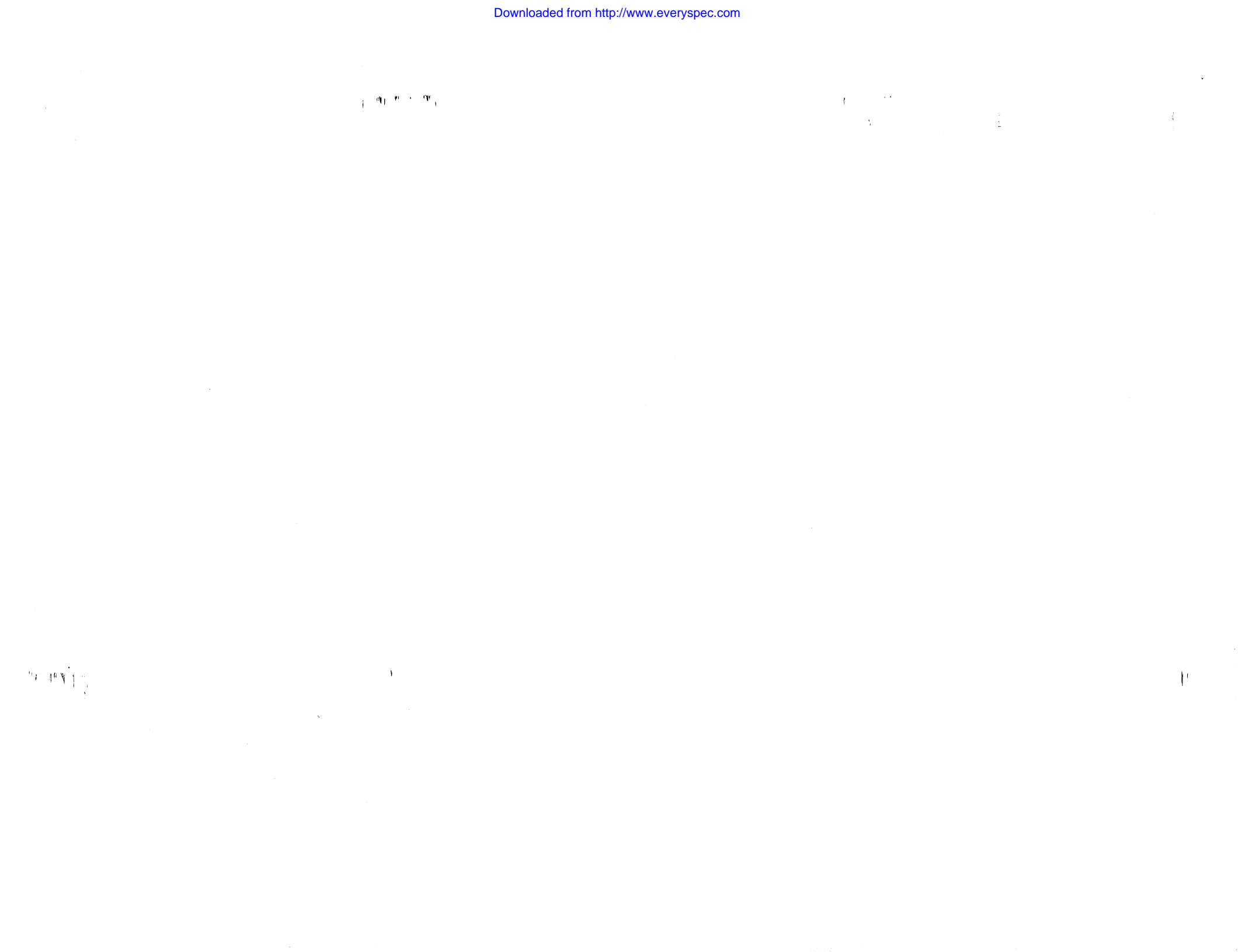


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TEMPLATE MUST BE FLAT
ITS ENTIRE LENGTH WITHIN .010
ORDINATE TOLERANCES $\pm .005$
GAGE THICKNESS .095.

FIGURE 2. Blade Templates



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When the use of a straight edge is acceptable for this purpose, it is considered as half of a template. The manufacturer may substitute variations in the above procedure for template design and checking, provided the variations are acceptable to the Procuring Agency.

F-5. Reports of Tests.- The contractor shall furnish in duplicate such test reports as are required by the Inspector or Procuring Agency, showing quantitative results for any material tests and analyses required by this specification. The test reports shall be signed by the director, or his authorized assistant, of the laboratory in which the tests were conducted. When inspection is conducted at the contractor's plant, these reports shall be furnished to the Inspector.

F-6. Examination of Product.- Each propeller shall be examined for conformance to the requirements of this specification with respect to Workmanship, Defects, and Finish.

F-7. Testing.- Testing of materials shall be in accordance with this specification or other methods acceptable to the Procuring Agency.

F-7a. All propellers or test specimens destroyed in conducting tests required by this or detailed specifications, or to determine conformance with this specification shall be in addition to the quantity specified in the contract or order, and shall be furnished without additional charge to the Procuring Agency.

F-7b. Balancing.- Balancing shall be in accordance with section D.

F-7b(1). The propellers shall be inspected for balance by the use of stands, bushings, mandrels, and other necessary equipment which will be acceptable in every detail to a duly authorized Government representative. The conditions and adjustments of the balancing equipment shall be checked for accuracy and correctness at frequent intervals, and the contractor shall immediately correct any error discovered, or replace any defective equipment.

G. PACKING AND MARKING FOR SHIPMENT.

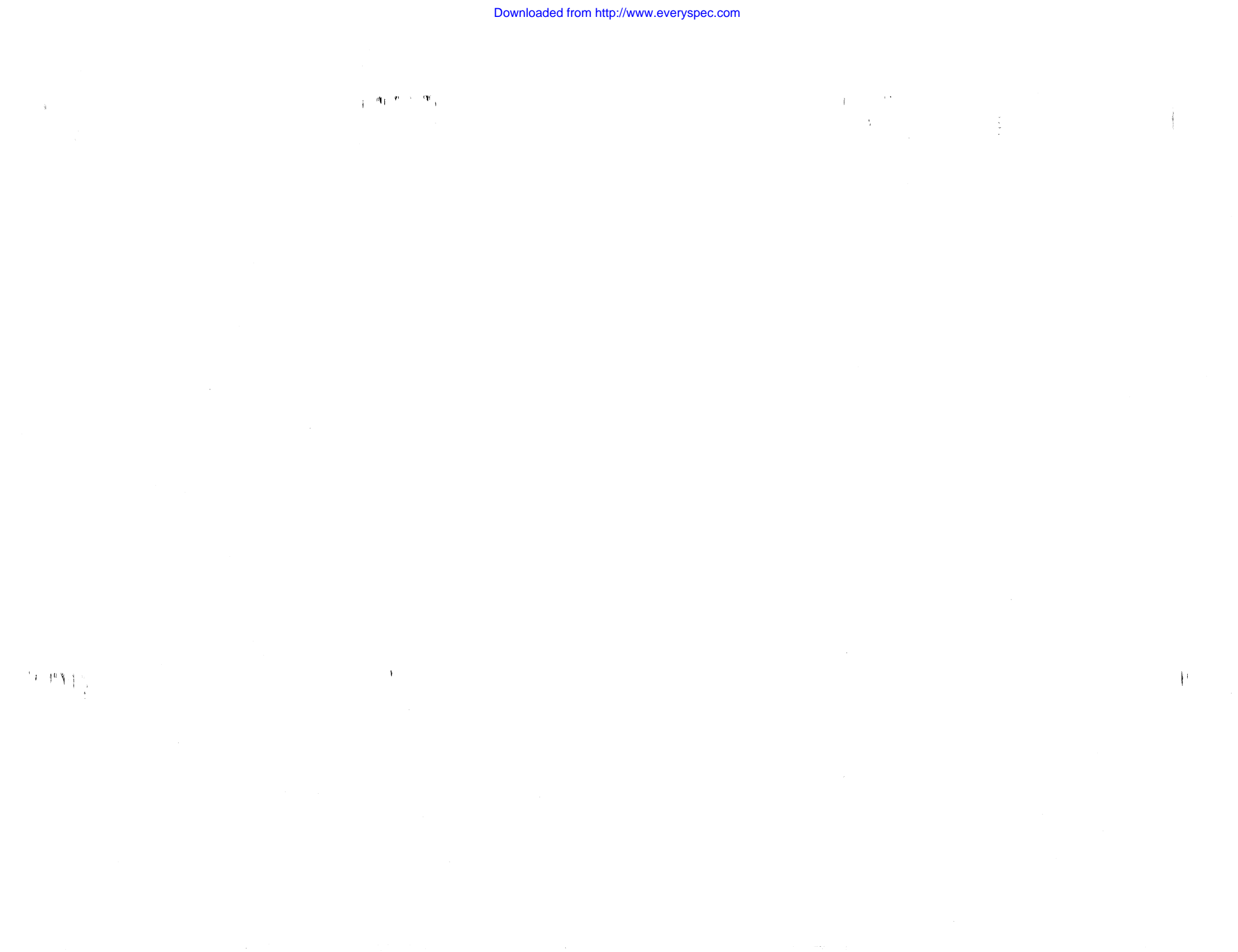
G-1. Packing.- All aircraft wood propellers and test clubs shall be prepared for shipment in accordance with Specification AN-P-30.

G-2. Marking.- The boxes shall be marked to give the following information:

PROPELLERS; FIXED PITCH AIRCRAFT WOOD (or TEST CLUBS;
FIXED PITCH AIRCRAFT WOOD, as applicable)
Specification AN-P-15b
Design number
Serial number
Government order number (or contract number if order
number is not assigned)
Name of contractor (and name of propeller manufacturer
if not the same)

H. REQUIREMENTS APPLICABLE TO INDIVIDUAL DEPARTMENTS.

H-1. The following departmental specifications of the issue in effect on date of invitation for bids shall form a part of this specification, applicable to purchases by the agency indicated.



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H-1a. Army.-

H-1a(1) U. S. Army Specification 94-40645, Marking; Shipment (Domestic and Export).

H-1a(2). AAF Specification No. 14124, Glue; Low-Temperature-Setting Resin (Phenol, Melamine and Resorcinol Base).

Copies of these specifications may be obtained upon application to the Army Air Forces activity listed in section I.

H-1b. Navy.-

H-1b(1). Navy Shipment Marking Handbook.

H-1b(2). Navy Glue Specification G-33 Glue; Phenol Aldehyde Resin (Type I)

Copies of this handbook and specification may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C.

I. NOTES.

I-1. Use.- The propeller and test clubs covered by this specification are intended for use on aircraft and in the testing of aircraft engines.

I-2. Superseding Data.- Specification AN-P-15b supersedes all previous issues of Specification AN-P-15, which supersedes U. S. Army Specification 29536 for aeronautical use.

I-3. Definitions.-

I-3a. Track.- Track is defined as the corresponding points on two or more blades of a propeller lying in the same plane perpendicular to the axis of rotation within the required track tolerances.

I-3b. Edge Alignment.- Edge alignment is defined as the distance parallel to the respective chords of the sections from the centerline of the blade to the leading edge of the cross-sections as designated on the drawing. Optional use of projected edge alignment is permitted when specified on the drawing.

I-4. Publications.- When requesting publications, refer to both title and number.

I-4a. Sources.- Copies of Army-Navy Aeronautical Specifications, drawings and bulletins may be obtained upon application to the Commanding General, Air Materiel Command, Wright Field, Dayton, Ohio; or to the Bureau of Aeronautics, Navy Department, Washington 25, D. C. Naval activities should make application to the Commanding Officer, Naval Aircraft Modification Unit, Johnsville, Pennsylvania.

I-4b. Copies of Federal Specifications may be obtained upon application, accompanied by money order or coupon, or cash, to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

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NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

