

AIR COMMERCE REGULATIONS

(Pursuant to the Air Commerce Act of 1926, as amended)

AERONAUTICS BULLETIN NO. 7-H AIR COMMERCE REGULATIONS ALTERATION AND REPAIR OF AIRCRAFT

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U.S. DEPARTMENT OF COMMERCE BUREAU OF AIR COMMERCE



WASHINGTON, D.C.

AERONAUTICS BULLETIN NO. 7-H

ALTERATION AND REPAIR OF AIRCRAFT

CHAPTER I. GENERAL

SECTION 1. SCOPE OF BULLETIN

(A) The regulations contained herein deal with the alteration and repair of structural components of aircraft rated as airworthy, the alteration and overhaul of approved engines, the alteration, repair, and overhaul of approved propellers, and the repair of instruments used in aircraft rated as airworthy. They are supplemental to the Air Commerce Regulations contained in Aeronautics Bulletins Nos. 7, 7-A, 7-F, and 7-G.

(B) Provision is made herein for the submittal of documentary evidence and information as to repairs, for the submittal of technical data regarding alterations, for the inspection of alterations and major repairs to airplane structures, and for the approval by the Secretary of Commerce of repair stations by specific classifications. Chapter III deals with the required technique and practices in making repairs, alterations or overhauls.

SECTION 2. DEFINITIONS

(A) "Manufacturer" as hereinafter used means the manufacturer holding an approved type certificate for the construction of the airplane, engine or propeller which is being altered, repaired, or overhauled; or the manufacturer of the instrument being repaired or overhauled.

(B) "Approved Repair Station" as hereinafter used means a repair station engaged in altering, repairing or overhauling an airplane, engine, propeller or instrument in accordance

with the classification for which it has been approved.

An airplane manufacturer, upon request, shall be eligible for approval to operate a repair station in the classification covering the same type of structure as employed in the airplane for which he has an approved type certificate. A manufacturer holding an approved type certificate for an engine, upon request, shall be eligible for approval to operate a repair station approved for engine overhaul. A propeller manufacturer, upon request, shall be eligible for approval to operate a repair station in the classification covering the same type of propeller as that for which he has an approved type certificate.

(C) "Other agency" as hereinafter used means a licensed airplane or engine mechanic employed by a manufacturer other than as specified in (A), or by a repair station engaged otherwise than as specified in (B), or any other licensed airplane or engine mechanic making or supervising alterations, repairs or overhauls.

(D) "Alteration" as hereinafter used with reference to aircraft structure means, (a), changes in the structure of an aircraft (except those recommended hereinafter which incorporate the use of a member or portion of a member of greater strength than the original member) or (b) such changes as may affect the balance, stability, permissible gross weight, local strength of supporting structures, or any other aspect of the airworthiness of the aircraft, engine or propeller involved. Examples illustrative of (b) are, the addition, removal, or alteration of baggage compartments; the installation of radio or other fixed equipment weighing more than 25 pounds; and the alteration of the fuel or oil capacity of the aircraft.

(E) "Minor Repair" as hereinafter used means the repair or replacement of any non-

structural members such as failings, cowls and turtlebacks, the repair or replacement of 5 percent or less of the surface of a fabric-covered wing or control surface, the repair of a wing or control surface trailing edge; and the repair or replacement of not more than two adjacent wing ribs.

(F) "Major Repair" as hereinafter used means the repair or replacement of any structural members such as spars, wing and control surface leading edges and tip strips, control surface ribs, more than two adjacent wing ribs, wing and cabin brace struts and wires, wing compression members, fittings, landing gear and tail surface struts and wires, fuselage longerons, cross tubes and diagonals, any control system part, any portion of the wooden or metal cover of a stressed skin wing, control surface or fuselage; and all brackets supporting seats, baggage compartments, fixed equipment, and any control system part. Replacement of a complete airplane component shall be considered a major repair and subject to the same documentary and inspection requirements as hereinafter specified for a major repair.

SECTION 3. APPLICATION OF REQUIREMENTS

(A) The requirements contained herein apply to manufacturers, approved repair stations and other agencies, in accordance with Table V of this bulletin and the following subparagraphs:

(1) Except in the case of manufacturers: (a) the alteration or repair of the structural components of licensed aircraft shall be made by, or closely supervised by, licensed airplane mechanics only, (b), the alteration or overhaul of an approved engine shall be made by, or closely supervised by, licensed engine mechanics only, (c), the alteration, overhaul, or repair of approved propellers shall be made by, or closely supervised by, licensed airplane or engine mechanics only.

(B) An "other agency" shall not engage in the alteration of an approved engine, or the alteration, repair, or overhaul of an approved propeller, or the repair or overhaul of an instrument used in an air line aircraft.

(C) Agencies engaged in the overhaul of an engine must use only structural engine parts which are approved by the Secretary of Commerce.

CHAPTER II. PROCEDURE

SECTION 4. PROCEDURE GOVERNING REPAIRS

(A) Every manufacturer, repair station, or other agency shall execute Repair and Alteration Form #466 in duplicate when the major repair of an airplane structure is involved.

NOTE: A sample copy of Form #466, indicating suggested methods for listing repairs, is appended hereto. Copies of the blank form may be procured from the Bureau of Air Commerce.

(B) A manufacturer or an approved repair station shall execute Repair and Alteration Form #466 when the repair of a propeller is involved. If for any reason such as those set forth in Section 25 and 26 it becomes necessary to reject a propeller or any portion thereof for repair, a copy of the notice of rejection shall be forwarded to the local inspector of the Department of Commerce.

(C) Form #466 need not be executed when the minor repair of an airplane structure, the repair of an instrument, or the overhaul of an engine or propeller is involved.

(D) Most airplane repairs may be described by reference to the figures contained herein. Where exceptions arise, well dimensioned detail sketches shall be made on the blank pages of Form #466. The location and nature of the repairs shall be clearly indicated.

(E) In the event of the major repair of an airplane structure, one copy of the executed Form #466 shall be delivered to the Department of Commerce inspector involved, and one copy delivered to the owner for incorporation in the airplane log book.

(F) In the event of the repair of a propeller, the executed Form #466 shall be delivered to the owner for incorporation in the airplane log book.

(G) In the event of the minor repair of an airplane structure, or the overhaul of an engine or propeller, the repair agency shall enter the facts in the appropriate log book under the signature of the supervising licensed mechanic.

(H) The original parts removed from an airplane in making a major repair or replacement shall be retained for comparison by the Inspector making the inspection. In general, the repair or replacement will be approved when comparison with the retained part indicates conformity with the original, but the Inspector may at his discretion require:

(1) That he be furnished a drawing from the original manufacturer of the part or parts in questions, or

(2) That the agency make a drawing of the repaired part or parts and have the drawing approved, in writing, by the original manufacturer.

(I) The inspector may require that he be furnished with a sample or samples of the material or materials used in making a major repair or replacement. Where it is not possible to compare the materials by a visual inspection the results of material specification tests of the original and replacement samples shall be supplied.

(J) The inspector shall determine whether or not the workmanship and materials are in accordance with the regulations and accepted practice.

SECTION 5. PROCEDURE GOVERNING ALTERATIONS

(A) Every repair agency shall execute Repair and Alteration Form #466 in duplicate when the alteration of an airplane structure, an engine, or a propeller is involved.

(B) The repair agency shall list the nature of the alterations on the blank pages of Form #466. It shall append to the form such technical data as are necessary to substantiate compliance with the requirements of Aeronautics Bulletins Nos. 7-A and 7-G, as the case may be, and shall make reference to such data on the blank pages of the form.

(C) The technical data referred to in (B), together with one copy of the executed Form #466, shall be submitted to the Chief, Manufacturing Inspection Service, Bureau of Air Commerce, Washington, D.C.

(D) On approval of the technical data, the copy of the executed form will be returned to the appropriate inspector together with authorization to proceed with such inspection as may be considered necessary by the Manufacturing Inspection Service.

(E) On final approval of the alteration by the inspector, the duplicate of the executed form shall be delivered to the owner for incorporation in the appropriate log.

(F) Paragraphs (I) and (J) of Section 4 shall also apply in the case of an alteration.

CHAPTER III. TECHNIQUE AND PRACTICES

SECTION 6. MATERIALS

(A) The use of materials of inferior quality or of those which experience has shown to lack

uniformity of quality or strength shall be regarded as sufficient cause for withholding approval of alterations and repairs to licensed aircraft.

(B) The important physical properties of the materials used shall be definitely specified, either by reference to an accepted standard such as Army, Navy or S.A.E. or by reference to reliable test results.

(C) Only the highest quality of casein or animal glue shall be used in making alterations or repairs to wood parts in licensed aircraft.

SECTION 7. ALUMINUM ALLOY STRUCTURES

NOTE: The heat treatment of aluminum alloy structure is adequately covered in Navy Department Bureau of Aeronautics Process Specification SR53a.

(A) All aluminum alloy rivets used by repair agencies shall be properly heat treated, driven within proper time limits, and of proper materials to insure suitable rivet strength, except in approved special cases in secondary parts where the rivets do not transmit stress, in which case no heat treatment is necessary. Special care shall be taken in the heat treatment of rivets are actually rapidly quenched in the quenching medium.

(B) Bolts, screws, and rivets employed in joints of dissimilar metals and wood to aluminum alloy members, in addition to being properly heat treated, shall be specially coated with paint just prior to assembly. (This is particularly important in the case where an aluminum bolt or screw passes through or into wood, or where bolts or rivets pass through tubing. In structures made entirely from Alclad materials, bare bolts may be used).

(C) The following are hereby prohibited:

(1) Quenching of 17S or 24S alloys in hot water or air after heat treatment.

(2) Insufficiently rapid transfer of 17S or 24S alloys from the heat treatment medium to the quench tank. An elapsed time of 10 or 15 seconds will, in many cases, result in noticeably impaired corrosion resistance.

(3) Painting of non-Alclad structures to be subjected to severe corrosive conditions after assembly. (Wherever possible, parts which are not made from Alclad materials shall be anodized and shop primed prior to assembly).

(4) Intimate contact of dissimilar metals or wood with aluminum alloys.

(5) Use of wood which is not thoroughly moisture proof for assembly into aluminum alloy structures.

(6) Re-heating at temperatures above that of boiling water of 17S and 24S alloys after heat treatment. The baking of all primers at temperatures above that of boiling water shall be avoided.

(7) The use of annealed 17S or 24S in parts subject to severe corrosive conditions.

(8) The use of hygroscopic materials improperly moisture proofed in attempting to affect water-tightness of joints and seams.

(9) The use of paint removers which contain strong caustic compounds, and of thin paint removers which may have a tendency to run into joints, rather than those which have a jelly-like consistency.

(10) The leaving of any trace of welding flux immediately after welding. (This is most readily accomplished by washing in a 5% warm solution of sulfuric acid, rinsing in clear warm water, scrubbing accessible welds with a stiff bristled brush, and giving a final rinse).

(D) Gas tanks with inaccessible interior welds should be immersed in a tank containing 5% warm sulfuric acid, carefully rinsed and agitated while rinsing in clear war water, and then dried.

SECTION 8. HEAT TREATMENT

(A) Before replacing damaged members not purchased from the original manufacturer of the aircraft, the repair agency shall in all cases determine the material and heat treatment of the damaged members.

NOTE: In view of the fact that the exact heat treatment of a member is usually very difficult to determine by test, it is recommended that this information be obtained from the manufacturer of the aircraft, or in the event the manufacturer is no longer in operation, this information may be obtained from the Chief of the Manufacturing Inspection Service, Bureau of Air Commerce, Department of Commerce, Washington D.C.

SECTION 9. WIRES AND CABLES

(A) Wires or cables shall be replaced if injured or distorted in any manner.

(B) All control cables shall be spliced and not soldered, using standard Army and Navy tuck splices of at least 5 full tucks, or a Roebbling roll of at least 7 full turns.

(C) Neither wires nor cables shall be subjected to heat.

(D) The substitution of cable for hard or streamline wires is prohibited.

SECTION 10. FABRIC COVERING

(A) All fabric used for re-covering an airplane structure shall be high grade airplane fabric of at least as good quality as that used originally in the airplane. The dope and tape used shall be of as good quality as that used on the original airplane, and the first two coats of dope shall be clear and shall be brushed on. The total number of coats of dope shall not be less than the number applied by the manufacturer. Both surfaces of fabric covering on wings and control surfaces shall be securely fastened to the ribs, by rib-stitching cord or any other method approved by the manufacturer. The spacing of these fasteners shall not exceed that recommended by the manufacturer. When rib stitching cord is used, the cord shall be linen, or equivalent in strength to that used by the manufacturer. When stitching fabric to the ribs, reinforcing tape shall be used on the top of the fabric and over the ribs on both surfaces. This stitching shall be covered with pinked-edge tape, doped to the fabric

NOTE: For more detailed information relative to fabric covering and stitching, reference should be made to Army and Navy specifications on this subject.

SECTION 11. METAL WING RIBS AND SPARS

(A) Repairs to metal ribs and spars shall preferably be made at the factory of origin or by a repair station which is approved for this type of work. If this is not feasible the repair agency shall obtain a recommendation form the original manufacturer and comply with it as to the methods which should be used in making the particular repair.

(B) Damaged stamped metal ribs shall not be repaired, but shall be replaced entirely.

SECTION 12. RIVETED OR BOLTED TRUSS TYPE METAL FUSELAGES

(A) The regulations set forth in Section 11 hereof apply also to this type of structure.

SECTION 13. WOOD OR METAL COVERED (STRESSED-SKIN) WINGS

(A) Repairs to damaged stressed skin or monocoque types of wing structure shall preferably be made at the factory of origin or by a

repair station recommended in writing by the manufacturer for this type of work. An approved repair station shall make such repairs in accordance with specific recommendations from the manufacturer.

(B) Small holes which in the discretion of a Department of Commerce Inspector do not seriously impair the strength of the structure may be repaired by, or the repair may be supervised by, any licensed airplane mechanic, provided the specific recommendations of the manufacturer governing those type of repair are followed. Small holes may be patched by attaching a cover over the hole.

(C) In any case, repairs to damaged skin, if very extensive shall be made by replacing an entire new panel from one structural member to the next. Where holes are large, the seam shall be made to lie along a bulkhead or along a structural member.

SECTION 14. WOOD OR METAL MONOCOQUE FUSELAGES

(A) The regulations set forth in Section 13 hereof apply also to this of structure.

SECTION 15. FITTINGS.

(A) Damaged fittings shall preferably be replaced by factory parts, or by parts made by a repair station approved for fitting repair work.

(B) Worn fittings which were designed without bushings shall not be reamed to oversize or the holes filled with welding rod and reamed, but shall be replaced.

(C) Torn, kinked or cracked fittings shall be replaced.

SECTION 16. WOOD WING RIBS

(A) If a repair agency repairs a damaged rib, it shall be repaired in accordance with Figures 16 and 17 contained herein. Cap strips shall be repaired at the spars or at a joint in the rib, or, preferably, be replaced entirely.

NOTE: In general it is more satisfactory and less expensive to replace broken ribs with ribs built by the original manufacturer.

(B) Damaged web members shall be replaced.

(C) Complete ribs shall be made from a manufacturer's approved drawing or from a drawing made by the repair agency and approved by the manufacturer. The drawing shall be retained by the repair agency for use by the Department of Commerce Inspector in making the inspection.

NOTE: If a complete rib is to be rebuilt, the repair agency may use the original rib as a pattern if it is not seriously damaged.

SECTION 17. WOOD WING SPARS

(A) Wood spars may be spliced at any point, except at a wing fitting, which shall not overlap any part of the splice.

NOTE: In view of the usual poor joint obtained by making scarfs for a spar splice with a saw and plane, it is recommended that a joiner be used.

(B) Approved methods of splicing the various types of spars are shown in Figures 9 and 13 contained herein.

(C) All scarfs shall be made with a 10 to 1 slope and all joints shall be made with the highest quality of casein or animal glue.

NOTE: Casein glue is recommended for soft woods such as spruce, and animal glue for hardwoods such as plywood and ash.

(D) When casein glue is used on soft woods, a pressure of 100 to 150 pounds per square inch shall be applied to the joint during the gluing process. In gluing hard woods a pressure of 200 to 250 pounds per square inch shall be applied.

(E) In cases of elongated bolt holes in a spar, a new section of spar shall be spliced in or the spar replaced entirely.

(F) Except at a fitting, cracked spars in which the cracks are longitudinal and the wood is not splintered may be repaired (except on box spars) by gluing to both sides of the spar, strips of spruce or plywood of sufficient thickness to develop the longitudinal shear strength of the spar, such strips to extend well beyond the termination of the cracks. When this is done a total thickness of spruce equal to the thickness of the spar web, or a total thickness of plywood equal to one half the spar web thickness shall be used as shown in Figure 15 contained herein.

SECTION 18. ENGINE MOUNTS

(A) Due to the ever present vibration in engine mounts it is required that, if damaged, they either be replaced entirely or splices be made in accordance with Figure 1.

SECTION 19. WELDED STEEL TUBE FUSELAGES

(A) Damaged members in steel tube fuselages may be repaired by the methods shown in Figures 1 to 8, if it is possible to have a stub at the splices of the length indicated in the figures.

NOTE: When possible it is recommended that the type of splice shown in Figure 1 be used.

(B) If the member is damaged at the joint so that it is not possible to have such a stub, the member shall be replaced entirely in the case of web members, and in the case of longerons, the splice shall be made in an adjacent bay.

(C) When necessary to remove a member at a joint, or cluster, it shall be carefully and completely removed from the cluster without disturbing the surrounding members to which it is attached.

(D) Replacement tubes shall be at least equal in strength to the original. (It will usually be preferable to make the replacement tube of the same size, gauge, and material as the original, which is shown as tube A in the figures and tables applicable to the various types of splices). When it is more convenient to substitute tubes of other gauge and/or material, such substitutions shall be made in accordance with the tables.

NOTE: The various types of splices shown in Figures 1 to 8 are satisfactory and will be approved by the Department of Commerce if the workmanship and materials are in accordance with accepted aircraft practice.

(E) Where rosette welds are necessary the holes shall be made in the outside tubes only.

SECTION 20. LANDING GEARS

(A) If damaged landing gear struts are made of streamlined tubing they shall not be repaired, but shall be replaced.

NOTE: If damaged landing gear struts are made of round tubing they may be repaired by using splices similar to those shown in figures 1 to 8.

(B) Damaged axles shall be replaced entirely.

(C) The straightening of landing gear struts and the filling of kinks with weld material is prohibited.

SECTION 21. WING BRACE STRUTS

(A) Damaged wing brace struts shall not be repaired, but shall be replaced entirely.

SECTION 22. WING TRAILING AND LEADING EDGES, AND TIP STRIPS

(A) Repairs to wing trailing and leading edges and tip strips shall be made by properly attached and reinforced splices in accordance with the pertinent provisions contained in the preceding sections hereof.

SECTION 23. WOOD COMPRESSION RIBS

(A) Wood compression ribs shall not be repaired but shall be replaced entirely.

SECTION 24. CONTROL SURFACES

(A) Requirements in the preceding sections of this chapter relative to repair procedure shall apply to control surfaces.

NOTE: Repair methods on control surfaces will depend upon the type of construction and the extent of damage.

SECTION 25. METAL PROPELLERS

(A) Damaged hollow steel propeller blades shall not be repaired except by the manufacturer. Welding is not permissible on these blades even for very minor repairs except by the manufacturer due to the special process employed and the heat treatment required. A blade developing a crack of any nature in service shall be returned to the manufacturer for inspection.

NOTE: Minor injuries to the leading and trailing edges only of these blades may be smoothed by hand stoning provided the injury is not deep.

(B) Aluminum alloy propeller blades and steel propeller hubs shall be repaired only by repair agencies approved for this type of work. Such repair agencies shall be governed by the following considerations:

(1) The model numbers of damaged blades which are on the manufacturer's list of blades that cannot be repaired shall be rejected.

NOTE: A damaged metal propeller is one which requires repair because it has been bent, dented, or cracked in such a manner as to render it unsafe for flight.

(2) The extent of a bend in the face alignment of blades shall be carefully checked by means of a protractor similar to the one illustrated in Figure 18 hereof. Only bends not exceeding 20 degrees at .15 inches blade thickness to 0 degrees at 1.1 inches blade thickness may be cold straightened. Blades with bends in excess of this amount require heat treatment and shall be returned to the manufacturer or his authorized agent for repair.

NOTE: In many cases it is possible to eliminate a bend by reducing the diameter of a propeller.

(3) Blades which are bent in edge alignment shall not be repaired by anyone except the manufacturer or his authorized agent.

(4) Damaged blades shall be etched in a 20% caustic soda solution and cleaned in a 20% nitric acid solution or a cleaning solution which will produce equivalent results, care being taken not to etch the shank portion. (The importance of an extremely careful and thorough inspection for nicks, galls, burns, scores, dents, and cracks cannot be too highly emphasized). Scratches and suspected cracks shall be given a local etch and examined with a magnifying glass. The shank fillets and the front half of the under surface of the blades from 6 to 10 inches in from the tip may be considered the most critical portions.

Adjustable pitch blades shall also be etched locally on the clamping portion of the shank at points 1/4 inch in from the hub edge in line with the leading and trailing edges, and examined with a magnifying glass for circumferential cracks.

Any crack is cause for rejection.

(5) Nicks and dents on the leading edge and face of blades shall be blended into the blade contour with smooth curves by the use of a riffle file and crocus cloth. After removal of a nick or dent, the surface shall be etched and examined with a magnifying glass, to insure that the nick or dent is entirely removed and that a crack has not started. The surface shall then be polished locally. Blades requiring removal of more than the following permissible reduction in width and thickness from the drawing dimensions, shall be rejected:

(a)	Inner	2/3	2-1/2%
(b)	Outer	1/3	5%
(c)	Outer	12"	10%
(d)	Outer	6"	May be modified as required.

(6) Hubs shall be minutely inspected for cracks by the wet or dry magnetic dust method. Particular attention shall be paid to the inside in the region of the shear shoulders. Cracks usually start in line with the leading and trailing edges of the blade. Any indication of a crack is cause for rejection.

(7) Hubs and clamp rings shall be cleaned by stripping off the plating in accordance with manufacturer's recommended practice. They shall be dimensionally inspected for conformity to the drawing. Particular care shall be taken to check the 90 degree relation between shaft bore and blade socket centerline and track of the blade sockets, as these are the dimensions which are most likely to be affected by accidents. Any hubs which are sprung shall be rejected.

(8) Splines and cone seats shall be carefully inspected for signs of wear. Splines shall be checked with a single key no-go gauge made to plus .002 of the base drawing dimensions for the spline land width. If the gauge enters more than 20% of the spline area the hub shall be rejected.

(9) Hubs and clamp rings shall be cadmium plated if they pass inspection. This plating shall be done in accordance with manufacturer's recommended practice.

(10) Clevis pins, bolts and nuts shall be replaced if they show any indication of wear or distortion.

(11) The propeller shall be assembled as recommended by the manufacturer, and checked for track and balance. All blades must track within plus or minus 1/16 inch.

(12) Horizontal unbalance may be corrected by adding lead not to exceed 1/4 ounce to the concentric hole in the light blade or removing lead not to exceed 1/4 ounce from the heavy blade. An eccentric hole not over three-eighths inches (3/8") in diameter for any size blade end shall be drilled and filled with lead to procure vertical balance. The outer edge of this hole shall not be nearer than 1/4" to the nearest external surface of the blade. Only one of these eccentric holes per blade will be permitted. The holes may equal the following dimensions, but in no instance shall they be made larger:

Size No. of Shank	Maximum Concentric Hole Diameter	Maximum Concentric Hole Depth	Max. Eccentric 3/8" Hole Depth
00	7/16	2 1/2	2 1/4
0-V2	19/32	3 3/8	3
1/2	5/8	3 5/8	3 1/2
1	3/4	4 1/4	4
1 1/2	13/16	4 7/8	4 1/2
2	7/8	5 1/2	5
3	31/32	6 1/8	6

After securing final horizontal and vertical balance, the holes must be corked to prevent the lead from falling out. If balance cannot be secured within the allowable limits given above, a reinspection is required because this is more than the maximum amount of unbalance that could occur if all parts were within specified tolerances.

(13) Vertical unbalance may be corrected when clamping rings are on the centerline by moving the two rings equally off center in the same direction by an amount which shall not exceed 1/4 inch. When the clamp rings are in the

45 degree position due to engine or cowling interference, vertical balance may be corrected by moving one ring only towards the front centerline for a distance which shall not exceed 1/2". If this will not secure perfect balance, a reinspection is required. An arrow shall be stamped on the hub shell and on the clamp ring showing the final location of the ring.

SECTION 26. WOODEN PROPELLERS

(A) Wooden propellers shall be inspected for cracks, bruises, scars, warp, oversize holes in the hub, evidence of glue failure and separated laminations, sections broken off, defects in the finish, etc. The tipping shall be inspected for looseness or slipping, separation of soldered joints, loose screws, loose rivets, breaks, cracks, eroded sections, corrosion, etc.

(B) A wooden propeller damaged to the following extent shall be scrapped:

- (1) A crack or deep cut across the grain of the wood.
- (2) A comparatively long, wide or deep cut parallel to the grain of the wood.
- (3) A separated lamination.
- (4) An excessive number of screw or rivet holes.
- (5) An oversize hub or bolt hole.
- (6) An appreciable warp.
- (7) An appreciable portion of wood missing.
- (8) Obviously damaged or worn beyond economical repair.

(C) Small cracks parallel to the grain of the wood shall be filled with hot glue thoroughly worked into all portions of the cracks, dried, and then sanded smooth and flush with the surface of the propeller. This also applies to small cuts.

(D) Appreciable dents, scars, etc., which have rough surfaces or shapes that will hold a filler and will not induce failure, shall be filled with a mixture of casein glue and clean, fine sawdust thoroughly worked and packed into the defect, dried, and then sanded smooth and flush with the surface of the propeller. However, in any case, all loose splinters shall be removed.

(E) The finish, where necessary, shall be renewed in accordance with the recommendations of the manufacturer.

(F) Tipping shall be replaced when it cannot be economically and properly repaired. Cracks in the narrow necks of metal between pairs of lobes of the tipping are to be expected and are not

defects. All other cracks are defects that shall be repaired, or eliminated by new tipping.

(G) For balancing, wood propellers shall be mounted on a hardened mandrel on a knife edge balancing stand in a room free from air currents. Each blade shall in turn be placed in a vertical position with the blade extending downward. The propeller shall then remain in either a vertical or horizontal position without showing any tendency to rotate in either direction. If the propeller does not balance, balance may be obtained in the following manner:

(1) Horizontal unbalance may be corrected by the application of clear varnish or solder to the light blade. The light blade may be coated with a high grade of clear priming coat allowing for a finishing coat of clear varnish. After allowing each coat to dry 48 hours, the balance shall be checked. Then, as may be necessary, the required amount of varnish shall be removed by carefully sandpapering or applying an additional coat, allowing for the finishing coat of varnish which shall be a thin coat of high grade clear spar varnish. The balance shall be rechecked and sandpaper or additional varnish applied as may be required to affect final balancing. Only clear finish is permitted.

(2) When necessary to remove the finish at the cambered side of the tipping for inspection, repairs, etc., balance may be effected by applying putty to the tip of the light blade after all grease, oil and other such substances have been removed and the surface dried. The solder to be removed or applied shall be of the approximate weight of the putty. If balancing solder is already present on the wide section of tipping on the back of the heavy blade, the required amount shall be removed by careful filing or scraping. If there is no balancing solder, all of the wide section of tipping on the back of the light blade shall be thoroughly cleaned. With ordinary solder and a soldering iron, all of the cleaned tipping shall be thoroughly tinned. A perfect bond must be made at all points between the tipping and the solder. To prevent burning of the wood under the tipping, more heat than is necessary to flow the solder shall not be applied. The required amount of solder shall be distributed over the entire tinned area. The balance shall be checked and, as may be necessary, solder may be removed or added until final balance is accomplished. The necessary coats of primer and spar varnish shall be allowed for.

(3) Vertical unbalanced may be corrected by applying putty to the light side of the wood hub at a point on the circumference approximately 90 degrees from the longitudinal center line of the blades. The putty shall be weighed and a brass plate weighing slightly more than the putty shall be cut out. The thickness of the plate will be from 1/16 to 1/8 inch depending on the final area, which must be sufficient for the required number of flat head attaching screws. The plate shall be formed to fit the shape of the light side of the wood hub, and the plate drilled and countersunk for the {The original "Aeronautics Bulletin No. 7-H, Air Commerce Regulations Alteration and Repair of Aircraft, dated January 1, 1936, ends in the middle of this paragraph in Chapter III, Technique and Practices. The original begins on the following page with Chapter IV, Approved Repair Stations.}

CHAPTER IV. APPROVED REPAIR STATIONS

SECTION 29. APPROVED REPAIR STATION CERTIFICATES

(A) An individual, partnership, corporation or association engaged in the repair of licensed aircraft or components may file with the Secretary of Commerce an application under oath for an approved repair station certificate on the application form furnished for that purpose, a copy of which is contained herein.

(B) An application for an approved repair station certificate will be examined to determine whether or not the facilities, equipment and licensed personnel listed appear to be adequate for the purpose intended. The repair station may then be inspected as to adequacy and suitability of the facilities, equipment, and as to the competency of the personnel. If, following this inspection, approval is granted, the repair station shall be issued a certificate authorizing it to repair licensed aircraft in accordance with the requirements set forth in these regulations, and in accordance with the letter of transmittal which accompanies and is a part of the approved repair station certificate. This certificate and letter of transmittal shall be displayed in a prominent place in the repair station.

(C) A repair station which has been disapproved for a certificate may reapply at the expiration of 90 days from the date of disapproval.

(D) An approved repair station certificate is valid for as long a period of time as the approved

facilities are continuously maintained. Facilities are understood to include licensed personnel.

SECTION 30. INSPECTION

(A) An inspector or other authorized representative of the Secretary of Commerce shall be permitted by the owner or operating agency to inspect an approved station or one which has applied for approval at any time for the purpose of determining its adequacy and competency. For such purposes the owner or operating agency shall give to such inspector or representative free and uninterrupted access to the repair station and its facilities, and shall furnish such information and data as may be necessary in the premises.

SECTION 31. REFERENCE REQUIREMENTS

(A) Approved repair stations shall keep a copy of the Air Commerce Regulations, including Bulletins Numbers 7, 7-A, 7-F, 7-G, and 7-H available in the station at all times.

SECTION 32. ADVERTISING

(A) A repair station holding an approved repair station certificate shall be privileged to advertise its standing as an approved repair station only for the class or classes of activity for which it is approved.

SECTION 33. GROUNDS FOR REVOCATION OR SUSPENSION

(A) Approved repair station certificates may be suspended or revoked for any of the following reasons:

(1) Violating the Air Commerce Act or any regulations promulgated thereunder.

(2) Making false statements in an application for a certificate or in any report required to be furnished.

(3) Any demonstration of incompetency, carelessness, or negligence, or the use of inferior or improper material.

(4) Failure to maintain sufficient equipment and licensed personnel to make it reasonably certain for airworthy repairs to be made of the type or types for which the approval has been granted.

(5) Using or displaying the certificate for fraudulent or improper purposes.

(6) Refusing to submit to inspection upon proper demand by a representative of the Secretary of Commerce.

(7) Making or permitting any false or misleading statements in advertising pertaining to the repair station.

(8) Performing any act which is contrary to the public safety or interest, or detrimental to the morale of pilots, mechanics, owners, or operators.

(9) Concealing or withholding information on structural defects, damage or faulty workmanship from either the aircraft owner or any authorized representative of the Bureau of Air Commerce.

SECTION 34. CLASSIFICATION ACCORDING TO FACILITIES

(A) The letter of transmittal accompanying each approved repair station certificate shall specify the type of aircraft structure or the specific aircraft component upon which the station may work as an approved repair station. The type of repair work for which approval may be granted shall be dependent upon the equipment, facilities, and personnel of the repair station in question.

(B) The minimum requirements as to facilities and equipment for certain of these classifications are set forth in the following sections of these regulations. (It is realized that these requirements cannot be entirely inflexible because of the variety of circumstances existing in different repair stations. Repair stations, therefore, which do not meet the specific requirements set forth for a particular class of work may be eligible for approval if they possess adequate and suitable substitutes for the items listed).

SECTION 35. GENERAL REQUIREMENTS FOR ALL CLASSES

(A) All approved repair stations shall have the following facilities and equipment:

- (1) A stock room properly set up to insure the proper segregation of materials.
- (2) A proper system of keeping records of all work.
- (3) Facilities and equipment for making small drawings.
- (4) Suitable housing facilities adequately heated and lighted.
- (5) Adequate licensed personnel qualified to perform or supervise the type of work involved.

SECTION 36. WELDED STEEL TUBE STRUCTURE, EXCLUDING FITTINGS

(A) All repair stations approved for repair work on welded steel tube structure, shall have the following facilities, equipment and supplies in addition to those specified in Section 35. These qualifications do not include facilities suitable for the repair of fittings which shall be in accordance with Section 40.

- (1) Acetylene welding equipment with proper assortment of torch tips and supplies.
- (2) Portable buffer.
- (3) Bench and vise.
- (4) Emery wheel (power driven).
- (5) Hand tools, including hack saws, clamps, micrometers suitable for both tubing and flat stock, level, and full set of reamers.
- (6) Adequate supply of all standard sizes of SAE-1025 and SAE-4130 tubing and sheet (in stock or readily available).
- (7) Supplies and equipment for painting and applying protective coatings to the inside as well as to the outside of tubing.
- (8) Portable drill.
- (9) Magnifying glass of at least 10-20 power.
- (10) Long and short trammel rods with adjustable points (for aligning fuselage bays).
- (11) Soldering equipment and supplies.

SECTION 37. WOODEN STRUCTURE, EXCLUDING BOX AND LAMINATED SPARS, WOOD COVERED FUSELAGES, WINGS, AND CONTROL SURFACES

(A) All repair stations approved for repair work on wooden structure, excluding box and laminated spars, wood covered fuselages, wings, and control surfaces, shall have the following facilities, equipment and supplies, in addition to those specified in Section 35:

- (1) Band and rip saws.
- (2) Planer or joiner (unless factory spars used or satisfactory local mill available).
- (3) Hand tools, including clamps.
- (4) Bench, sawhorses, and vise.
- (5) Supply of wood, including aircraft spruce and birch plywood (or satisfactory available source).
- (6) Supply of casein or highest quality animal glue, including proper facilities for mixing.
- (7) Supplies and equipment for varnishing and applying other protective coatings.
- (8) Soldering equipment and other facilities for fabricating drag wires and drag wire lugs.

- (9) Supply of necessary small standard parts.
- (10) Sanding machine.

SECTION 38. FABRIC COVERING

(A) Repair stations which are approved for work on fabric covering shall have the following equipment, facilities and supplies in addition to those specified in Section 35, hereof:

- (1) Sewing machine (double stitching required).
- (2) Suitable separate space for doping, including proper ventilation, temperature and humidity control.
- (3) Hand tools.
- (4) Supply of fabric and tape suitably stored on hand or available source.
- (5) Doping brushes.
- (6) Supply of dope and thinner properly stored.
- (7) Suitable equipment for spray painting, including compressor and spray gun.

SECTION 39. WOOD COVERED WINGS, FUSELAGES AND CONTROL SURFACES, AND BOX AND LAMINATED SPARS

(A) Repair stations which are approved for work on wood covered wings, fuselages and control surfaces, and box and laminated spars, shall have the following equipment, facilities and supplies in addition to those specified in Section 35, hereof:

- (1) An adequate press or sufficient number of clamps.
- (2) All the items prescribed in Section 37 except subparagraph (8).

SECTION 40. STEEL FITTINGS

(A) Repair stations which are approved for work on steel fittings shall have the following equipment, facilities and supplies in addition to those specified in Section 35 hereof:

- (1) Acetylene welding equipment with proper assortment of torch tips and supplies.
- (2) Drill press.
- (3) Portable drilling machine with full set of drills.
- (4) Work bench and vise.
- (5) Hand tools, including micrometers, full set of reamers, and tools for laying out fittings.
- (6) Cutting and forming tools.
- (7) An adequate supply of SAE-1025 and SAE-4130 sheet steel, in stock or readily available.

(8) Supplies and equipment for painting and applying protective coatings.

- (9) A supply of necessary small standard parts.
- (10) Magnifying glass at least 15-20 power.

SECTION 41. ALUMINUM ALLOY STRUCTURE, EXCLUDING FITTINGS

(A) Repair stations which are approved for work on aluminum alloy aircraft structure shall have the following equipment, facilities and supplies in addition to those specified in Section 35 hereof:

- (1) Complete heat-treating equipment for rivets and structural parts, and forming machinery.
- (2) Rivet dies and air hammer or the equivalent.
- (3) Hand tools, clamps, etc.
- (4) Work bench and vise.
- (5) Shear for cutting sheet and brake for bending sheet metal.
- (6) Drill press.
- (7) Portable drill machine with full set of drills.
- (8) A suitable supply or readily available source of aluminum alloy sheets and rivets.
- (9) A supply of necessary small standard parts.
- (10) Pressure indicator and control for air rivet hammer.
- (11) Magnifying glass at least 15-20 power.

SECTION 42. ALUMINUM ALLOY FITTINGS

(A) Repair stations which are approved for work on aluminum alloy fittings shall have the following equipment, facilities and supplies in addition to those specified in Section 35 hereof:

- (1) Drill press.
- (2) Portable drilling machine with full set of drills.
- (3) Work bench and vise.
- (4) Hand tools, including micrometers, full set of reamers, and tools for laying out fittings.
- (5) Cutting and forming tools.
- (6) An adequate supply of aluminum alloy sheets and bar stock, in stock or readily available.
- (7) Supplies and equipment for painting and applying protective coatings.
- (8) Heat treating equipment.
- (9) A supply of necessary small standard parts.
- (10) Magnifying glass at least 15-20 power.

SECTION 43. ASSEMBLY

(A) Assembly operations shall be understood to include the installation of fuel or oil tanks and piping; the installation of control system parts; the installation of seats, instruments, or other such equipment; the joining together of two or more major components of the airplane, etc. Repair stations which are approved for this type of work shall have the following facilities, equipment and supplies in addition to those specified in Section 35 hereof:

- (1) Soldering equipment and supplies.
- (2) Cable splicing equipment.
- (3) A supply of aircraft bolts, nuts, clevis pins, cotter pins, cable, cable shackles, thimbles, and turnbuckles of all the usual sizes, on hand or readily available.
- (4) Level and protractor for rigging.
- (5) A supply of such hand tools and small parts as are necessary for the purpose intended.
- (6) Step ladders of sufficient height and a satisfactory tail stand (for the tail wheel or skid when the airplane is placed in flying position).
- (7) Suitable equipment for annealing and bending fuel and oil lines.
- (8) Work bench and vise.
- (9) Long and short trammel rods.
- (10) Plumb bob.
- (11) Tape at least 50 feet long.
- (12) Hard wire and forming pliers for drag wires.

SECTION 44. ALUMINUM ALLOY PROPELLER BLADES AND/OR STEEL HUBS

(A) Repair stations which are approved for work on aluminum alloy propeller blades and/or steel hubs, shall have the following equipment, facilities and supplies in addition to those specified in Section 35, hereof:

- (1) Balancing stand with knife edge and arbor with suitable mandrels.
- (2) Propeller surface table and mandrels.
- (3) Supply of crocus cloth.
- (4) Riffle files.
- (5) Drilling machine with full set of drills.
- (6) A supply of lead wool, and tools suitable for removing and repacking lead wool.
- (7) A supply of caustic soda and nitric acid.
- (8) Precision calipers.
- (9) Protractor for measuring angle or bend, as illustrated in Figure 18.
- (10) Suitable tanks in which to etch propeller blades.

- (11) Suitable press for straightening propeller blades cold.
- (12) Suitable twisting bars.
- (13) Magnifying glasses for inspecting for cracks, 40-50 power.
- (14) Portable power grinder and buffer with grinding wheel.
- (15) Manufacturer's dimensioned drawings.
- (16) Means of placing manufacturer's identification numbers and date of repair on blades so that disassembly is unnecessary at the time of inspection
- (17) Metal face plate and protractor for measuring pitch angles.
- (18) No-go gauge.
- (19) Spline adapter and stand.
- (20) Cadmium plating equipment installed or readily available.
- (21) Wet or dry magnetic dust equipment for detecting cracks.

SECTION 45. WOODEN PROPELLERS

(A) Repair stations which are approved for work on wooden propellers shall have the following equipment, facilities and supplies in addition to those specified in Section 35 hereof:

- (1) Balancing stand with knife edge and arbor with suitable mandrels.
- (2) Propeller bench with vise or arbor for holding propeller while being repaired.
- (3) Wood files.
- (4) Complete soldering equipment.
- (5) Tin snips or metal shears, and shim stock.
- (6) A supply of high grade animal and casein glue, and facilities for mixing.
- (7) A supply of high grade quick drying varnish.
- (8) A supply of tipping material and wood screws, or available source.
- (9) Adequate glue press.
- (10) Scrapers.
- (11) Means of placing manufacturer's identification numbers and date of repair on the blades.

SECTION 46. ENGINES

(A) Repair stations which are approved for work in connection with engine repairs or overhaul shall have the following equipment, facilities and supplies in addition to those specified in Section 35 hereof:

- (1) Micrometers (inside and outside).
- (2) Engine disassembly stand.

- (3) Complete set of precision measurement tools, including reamers, taps, and valve grinding tools.
- (4) Propeller hub puller.
- (5) Wash tank and air pressure cleaning equipment located in a space separated from the final assembly space so that fog from cleaning may not settle on parts ready for assembly.
- (6) Turning lathe.
- (7) Sand blast equipment, or readily available source.
- (8) Block and tackle equipment.
- (9) A supply of engine service manuals.
- (10) A supply of nuts, bolts, cotter, gaskets, etc., or available source.
- (11) Heating torch.
- (12) Level plate.
- (13) Set of "V" blocks and shim material.
- (14) Height gauge.
- (15) Available test stand for running-in engines.
- (16) Supply of engine enamel.
- (17) Welding torch.
- (18) Brass and copper lock wire.
- (19) Record system for showing total hours, hours since last overhaul, tear down, inspection, parts disposal, parts replacement, and log of test run.
- (20) Assembly stand.
- (21) High power magnifying glass 40-60 power.
- (22) Magnetic dust equipment for detecting minute cracks.
- (23) Equipment suitable for checking alignment of master link, connecting rods, and crankshaft.
- (24) High-pressure spark plug testing machine.
- (25) Carburetor test stand.
- (26) Equipment available for testing electrical accessories such as starters and generators.
- (27) Equipment for testing complete ignition systems (installed or readily available).
- (28) Portable electric drill press and set of drills.
- (29) Power driven emery wheel and buffer.

SECTION 47. INSTRUMENTS

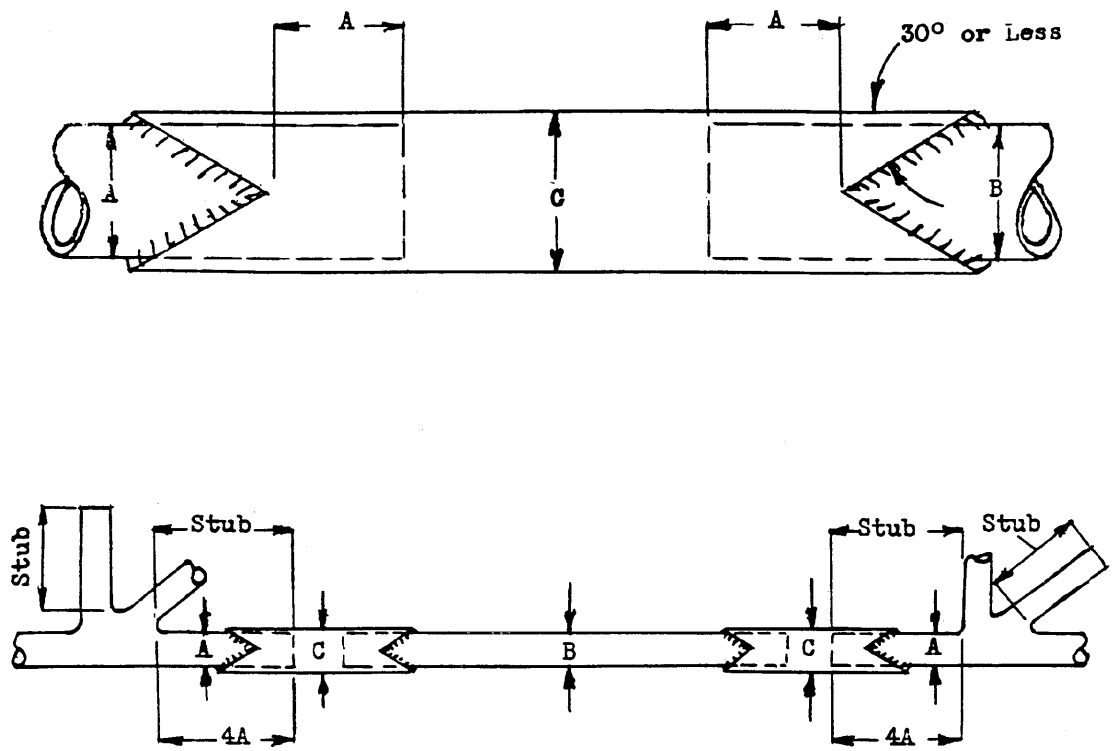
(A) Repair stations which are approved for work in connection with aircraft instrument repairs or overhaul shall have the following equipment, facilities and supplies in addition to those specified in Section 35 hereof:

- (1) Airspeed indicator test apparatus:

- (a) Water manometer graduated in inches.
- (b) Controlled vacuum or pressure line.
- (c) Stand for supporting indicator.
- (2) Altimeter test apparatus:
 - (a) Single tube mercury manometer.
 - (b) Bell jar.
 - (c) Vacuum storage tank.
 - (d) Vacuum pump.
 - (e) Necessary tubing, valves and connections.
- (3) Climb indicator test apparatus:
 - (a) Vacuum pump and pump plate.
 - (b) Bell jar.
 - (c) Mercury-in-glass manometer.
 - (d) Stop watch.
 - (e) Necessary tubing, valves and connections.
- (4) Magnetic compass compensating equipment:
 - (a) Circular concrete platform having a radius at least equal to the length of the largest airplane and situated at one hundred yards away from all steel structure such as hangars or railroads.
 - (b) Special dolly to support tail skid so as to bring the airplane in approximate flying attitude.
 - (c) Single wheel chocks.
 - (d) Several 50 pound sand bags.
 - (5) Card type compass test apparatus:
 - (a) Vacuum pump and pump plate.
 - (b) Barometer.
 - (c) Thermometer.
 - (d) Mercury-in-glass manometer with a m.m. scale.
 - (e) Bell jar.
 - (f) Pressure altitude chart.
 - (g) Suitable length of hose to make connections.
 - (6) Tachometer test stand:
 - (a) Vendor liquid tachometer.
 - (b) Gear box for driving tachometer being tested.
 - (c) Balance wheel to prevent sudden changes in speed.
 - (d) Variable speed electric motor.

SECTION 48.

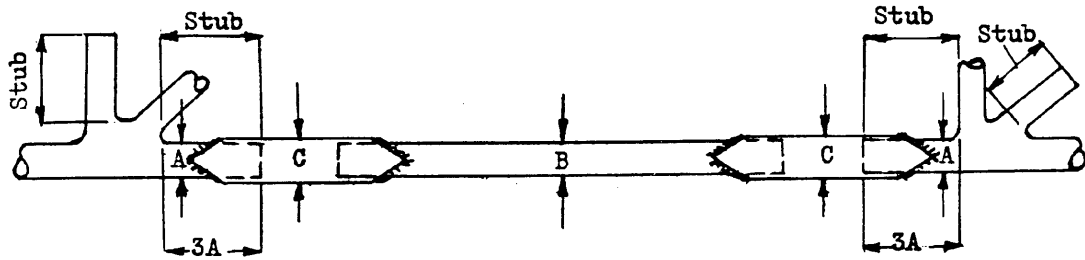
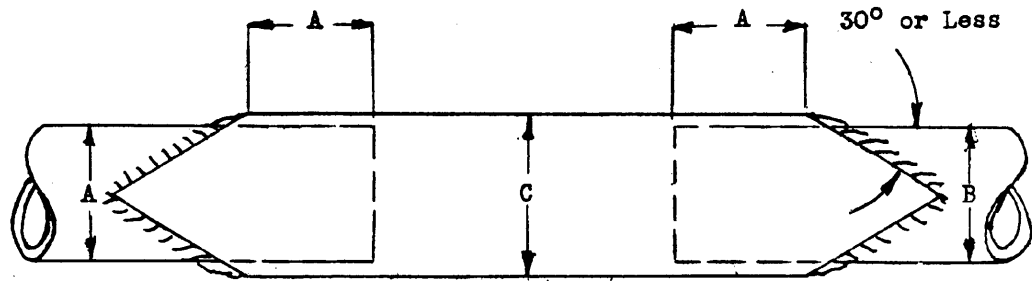
Any regulation heretofore published pursuant to Air Commerce Act of 1926, as amended, which is inconsistent with any of the fore-going regulations, is hereby repealed.



A = Original Tube
B = Replacement Tube
C = Outside Sleeve

See Table I for diameters, wall thicknesses and materials of tubes A, B and C.

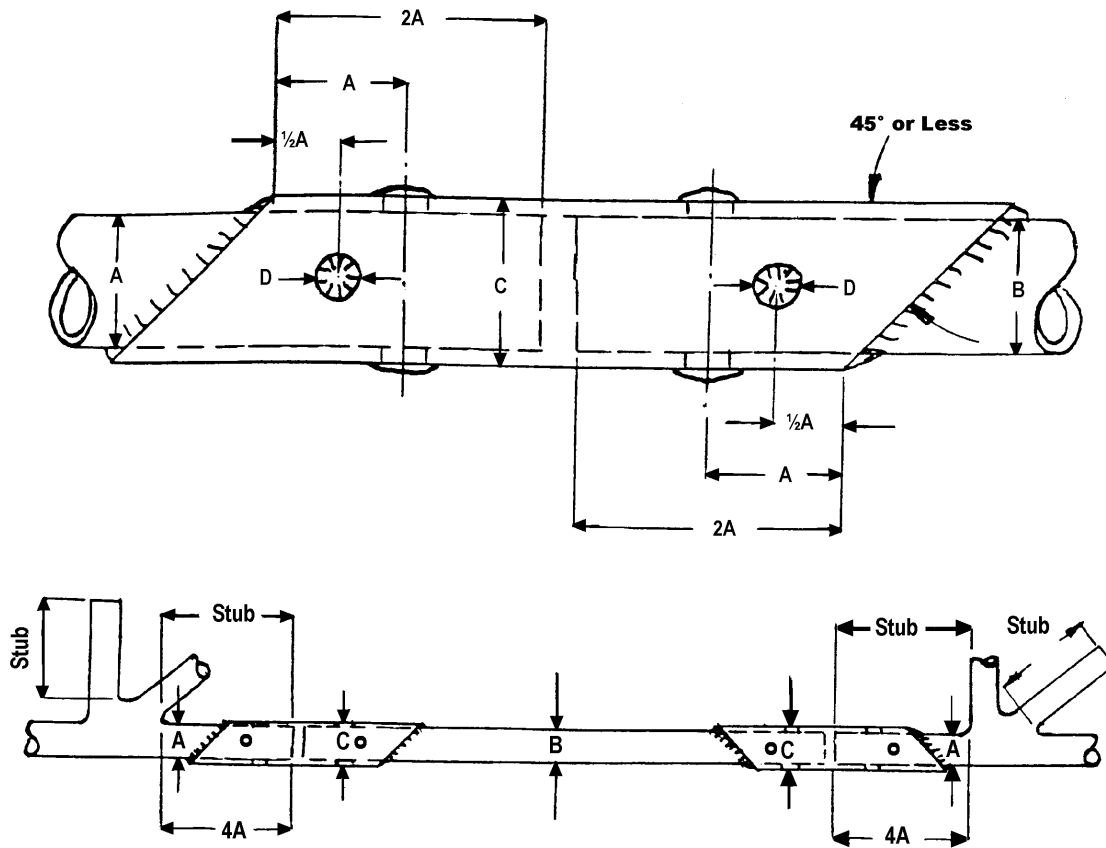
FIGURE 1. TYPE OF SPLICE USING OUTSIDE SLEEVE WITH FISHMOUTHED CUT.



- A = Original Tube**
- B = Replacement Tube**
- C = Outside Sleeve**

See Table I for diameters, wall thicknesses and materials of tubes A, B and C.

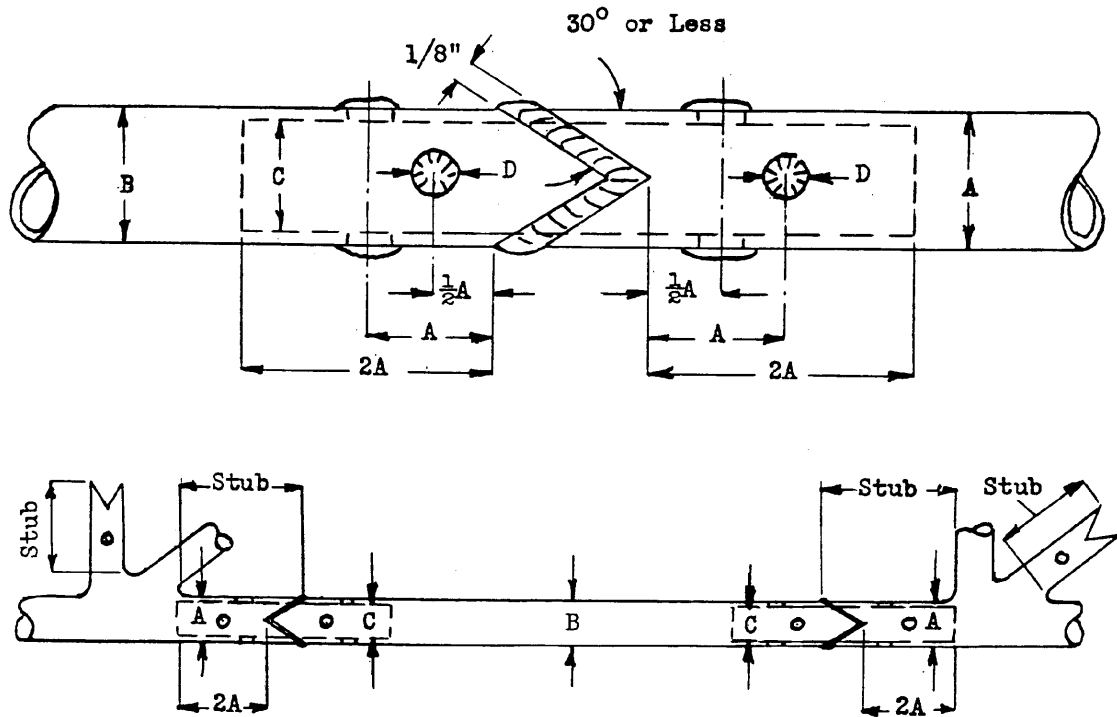
FIGURE 2. TYPE OF SPLICE USING OUTSIDE SLEEVE WITH FISHMOUTHED CUT.



- A = Original Tube**
- B = Replacement Tube**
- C = Outside Sleeve**
- D = $\frac{1}{4}$ Diameter of Tube A, but not less than $\frac{1}{4}$ inch.**
(Four rosette welds used for each splice).
(Drill outside tube only)

See Table I for diameters, wall thicknesses and materials of tubes A, B and C.

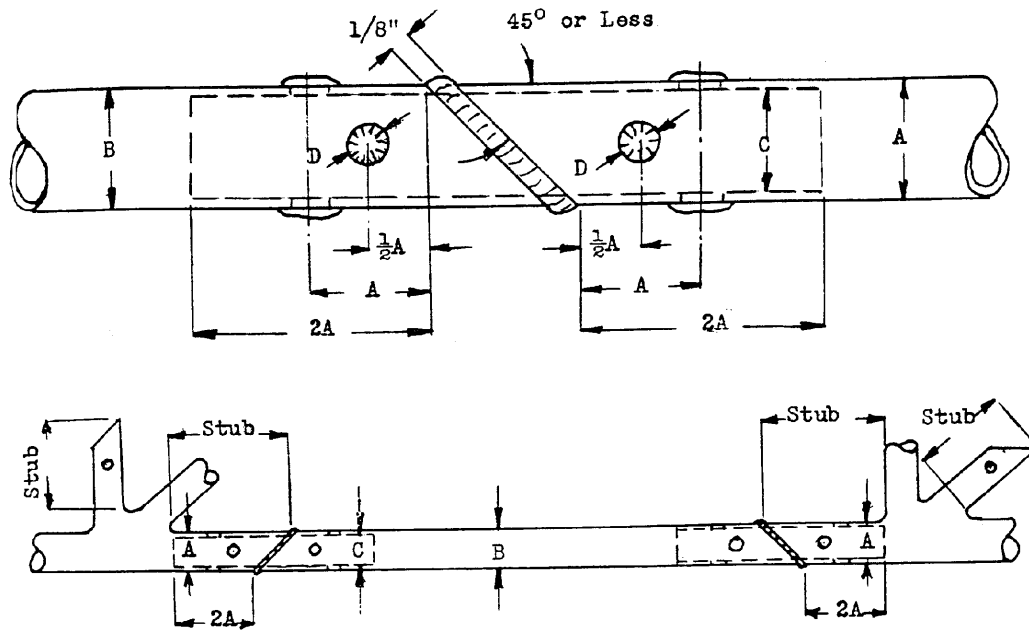
FIGURE 3. TYPE OF SPLICE USING OUTSIDE SLEEVE CUT AT 45 DEGREES.



- A = Original Tube**
- B = Replacement Tube**
- C = Inside Sleeve**
- D = 1/4 Diameter of Tube A, but not less than 1/4 inch**
(Four rosette welds used for each splice).
(Drill outside tube only)

See Table II for diameters, wall thicknesses and materials of tubes A, B and C.

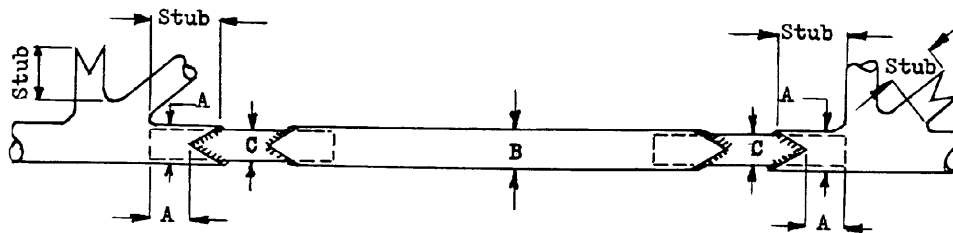
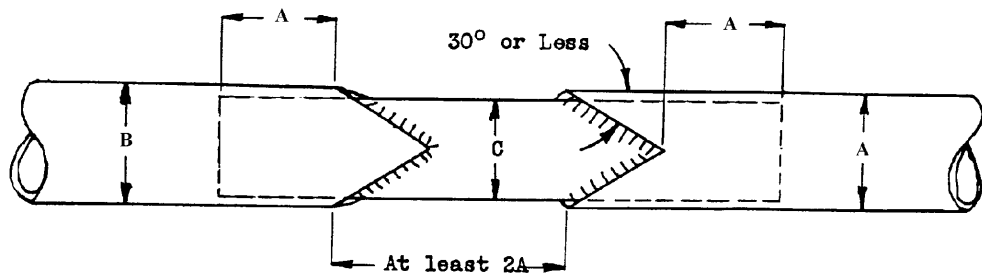
FIGURE 4. TYPE OF SPLICE USING INSIDE SLEEVE, OUTSIDE TUBES FISHMOUTHED AND SINGLE WELDS AT THE SPLICES.



- A = Original Tube
- B = Replacement Tube
- C = Inside Sleeve
- D = 1/4 Diameter of Tube A, but not less than 1/4 inch
(Four rosette welds used for each splice).
(Drill outside tube only)

See Table II for diameters, wall thicknesses and materials of tubes A, B and C.

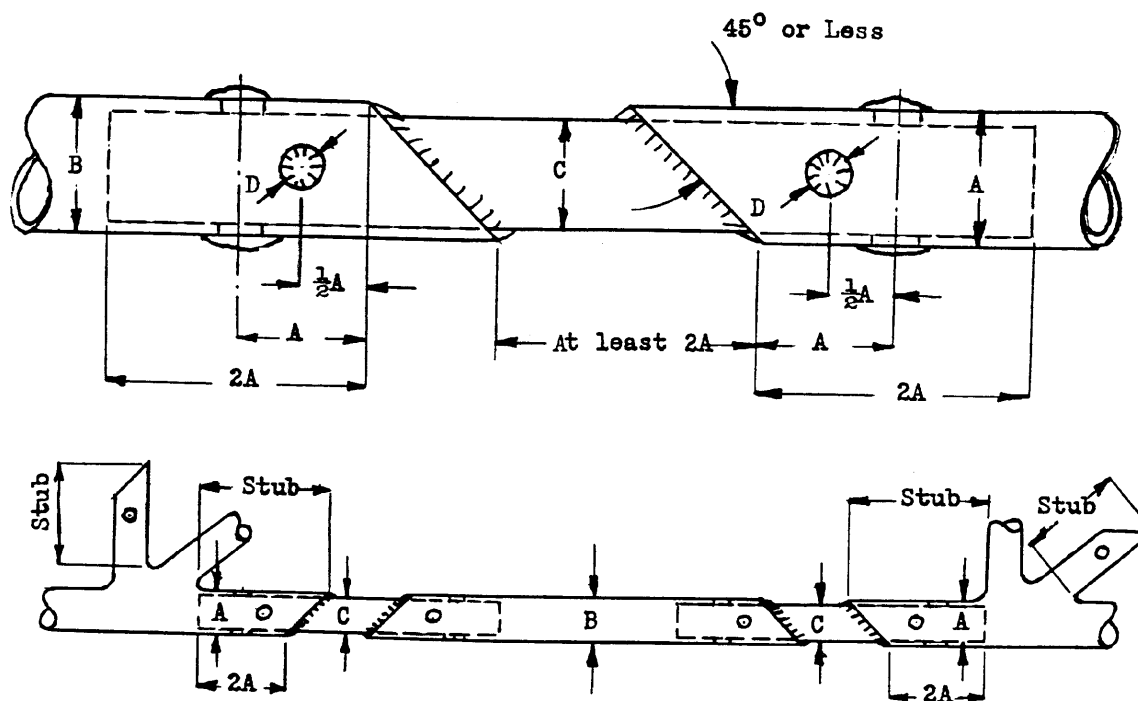
FIGURE 5. TYPE OF SPLICE USING INSIDE SLEEVE, OUTSIDE TUBES CUT AT 45 DEGREES AND WITH SINGLE WELD AT SPLICES.



A = Original Tube
B = Replacement Tube
C = Inside Sleeve

See Table III for diameters, wall thicknesses and materials of tubes A, B and C.

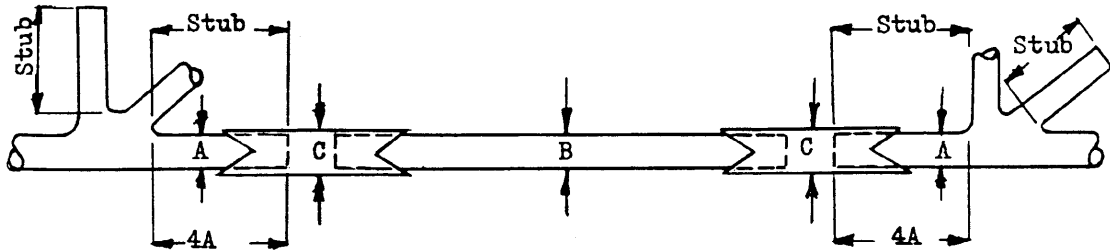
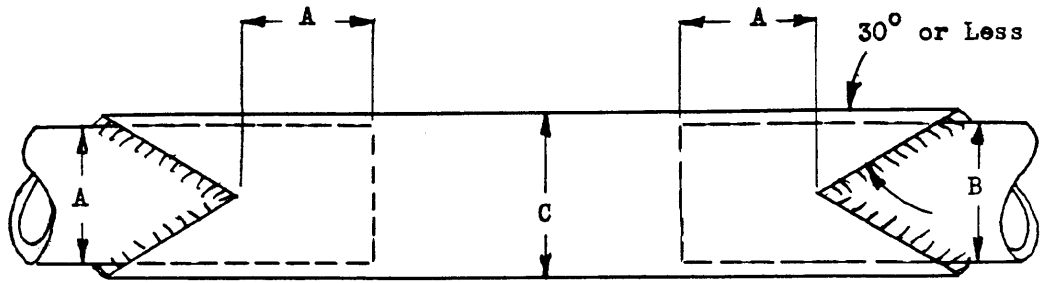
FIGURE 6. TYPE OF SPLICE USING INSIDE SLEEVE, OUTSIDE TUBES FISHMOUTHED, AND WITH SINGLE WELDS AT THE SPLICES.



- A = Original Tube**
- B = Replacement Tube**
- C = Inside Sleeve**
- D = 1/4 Diameter of Tube A, but not less than 1/4 inch**
 (Four rosette welds used for each splice).
 (Drill outside tube only)

See Table III for diameters, wall thicknesses and materials of tubes A, B and C.

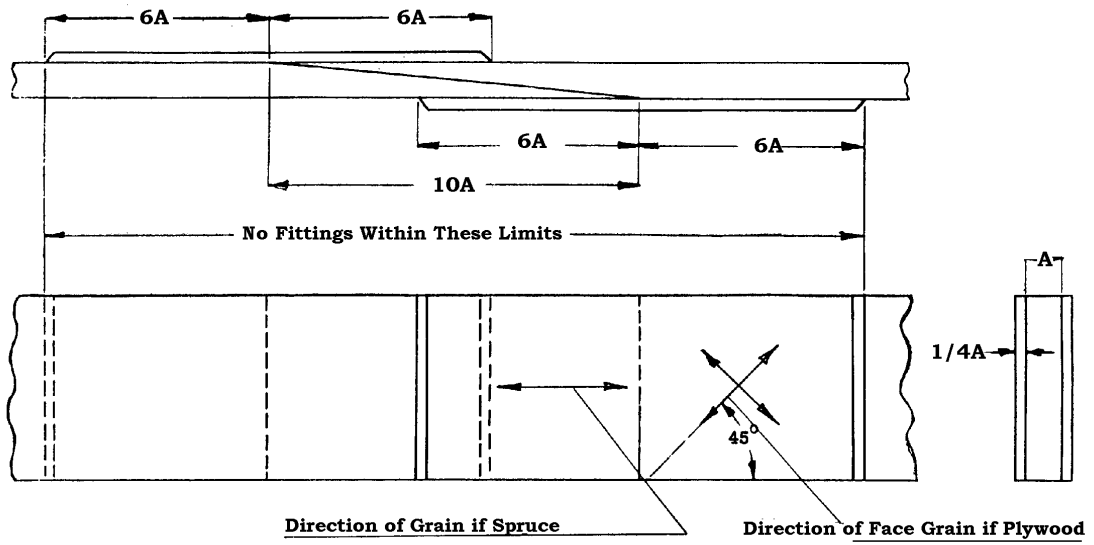
FIGURE 7. TYPE OF SPLICE USING INSIDE SLEEVE, OUTSIDE TUBES CUT AT 45 DEGREES, AND WITH DOUBLE WELDS AT THE SPLICES.



A = Original Tube
 B = Replacement Tube
 C = Outside Sleeve

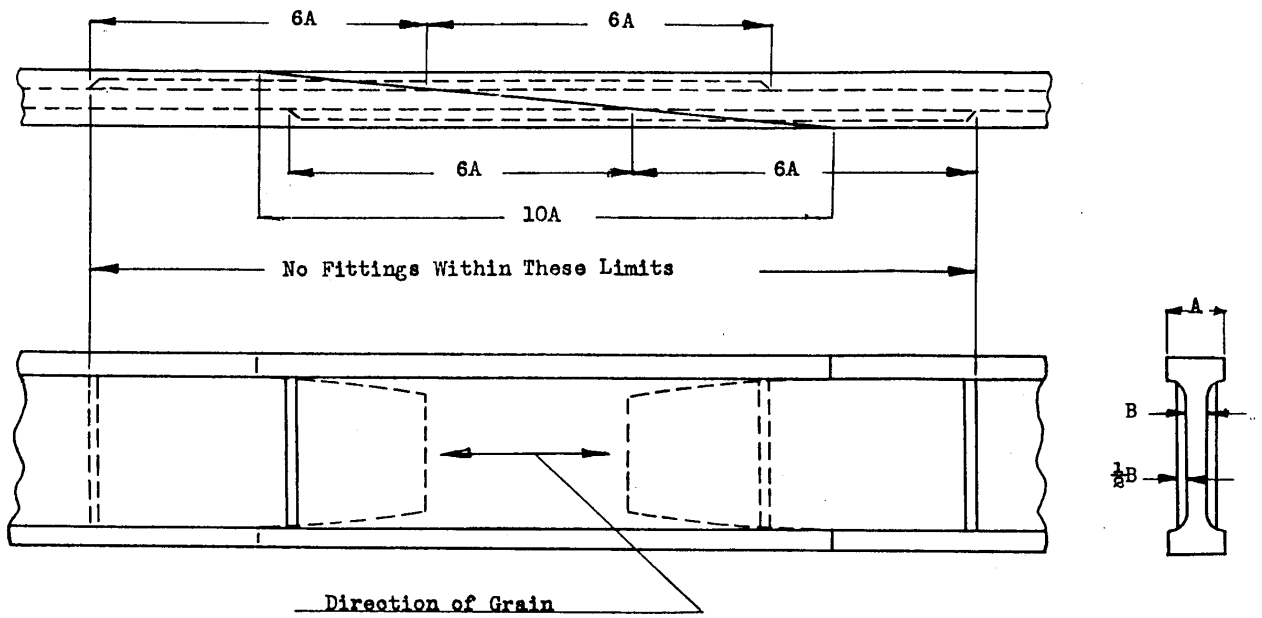
See Table III for diameters, wall thicknesses and materials of tubes A, B and C.

FIGURE 8. TYPE OF SPLICE USING OUTSIDE SLEEVE WITH FISHMOUTHED CUTS FOR CONDITIONS NOT COVERED BY TABLES I, II and III.



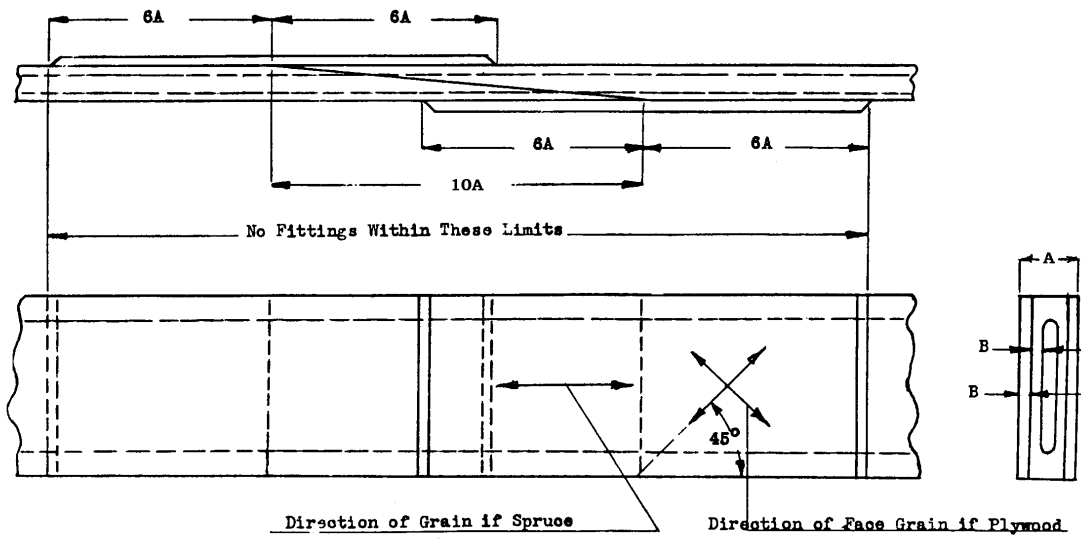
Reinforcing Plates To Be Spruce or Plywood And Shall Be Glued Only.

FIGURE 9. METHOD OF SPLICING SOLID OR LAMINATED RECTANGULAR SPARS.



Reinforcing Plates To Be Spruce And Shall Be Glued Only.

FIGURE 10. METHOD OF SPLICING SOLID "i" SPARS.



Reinforcing Plates To Be Spruce Or Plywood And Shall Be Glued Only.

FIGURE 11. METHOD OF SPLICING INTERNALLY ROUTED SPARS.

See Figure 14 for method of splicing plywood webs.

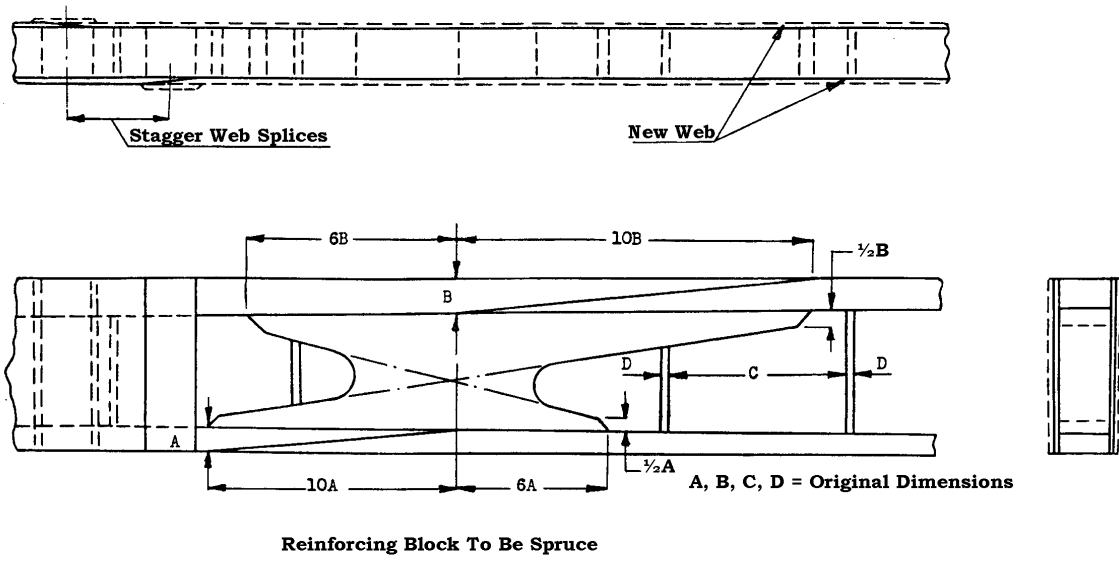
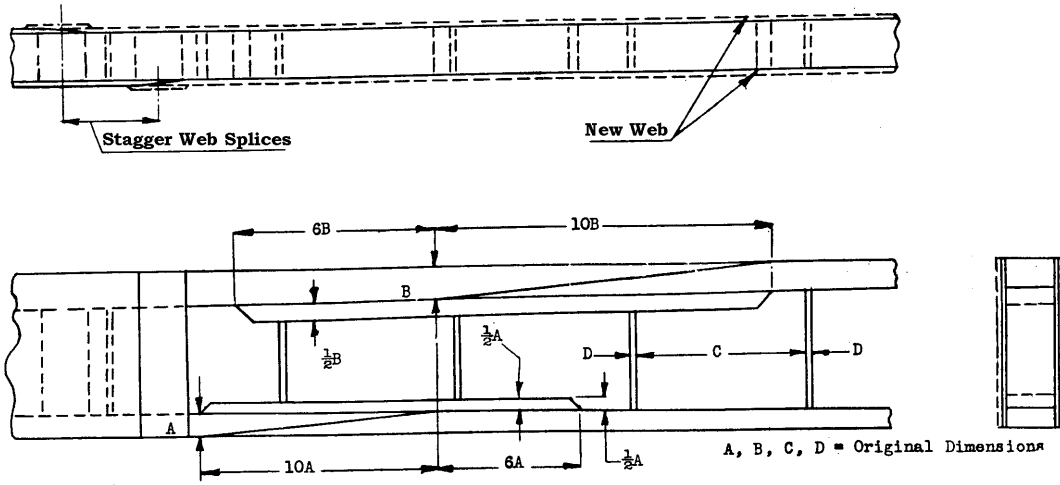


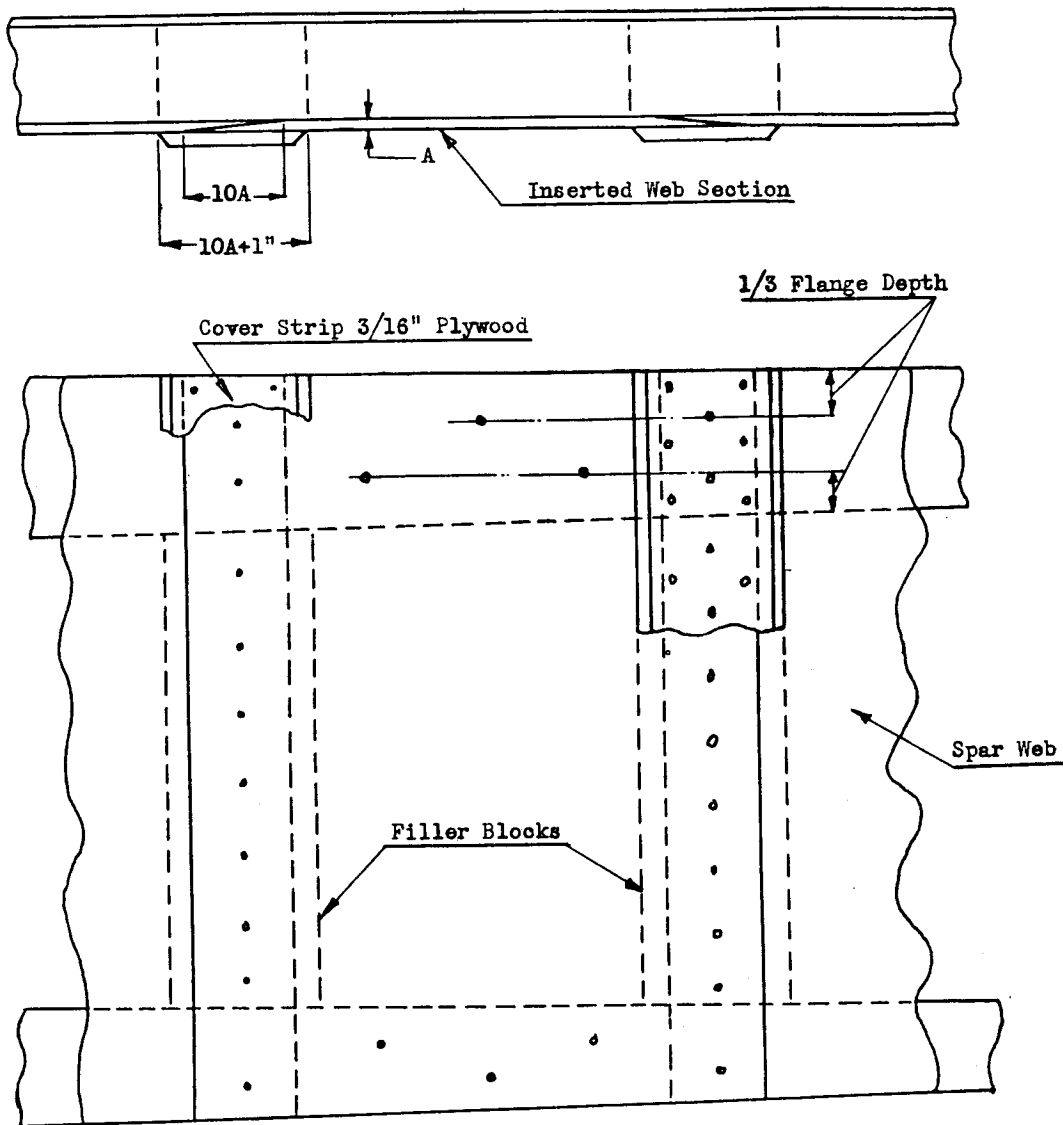
FIGURE 12 - METHOD OF SPLICING BOX SPAR FLANGES.

See Figure 14 for Method of Splicing Plywood Webs.



Reinforcing Plates To Be Spruce

FIGURE 13 - METHOD OF SPLICING BOX SPAR FLANGES.



NOTE:

1. After Inserted Web Has Been Glued And Nailed In Place, Glue Cover Strip Over Entire Length of Splice Joints.
2. Sectional Shape Of Filler Blocks Must Conform Exactly To Taper Of Spar. They Must Not Be Too Tightly Fitted Or Wedging Action Will Loosen Existing Glue Joints Of Webs To Flanges. If Too Loosely Fitted Crushing of Web Will Occur When Clamping.

FIGURE 14 - METHOD OF SPLICING BOX SPAR WEBS.

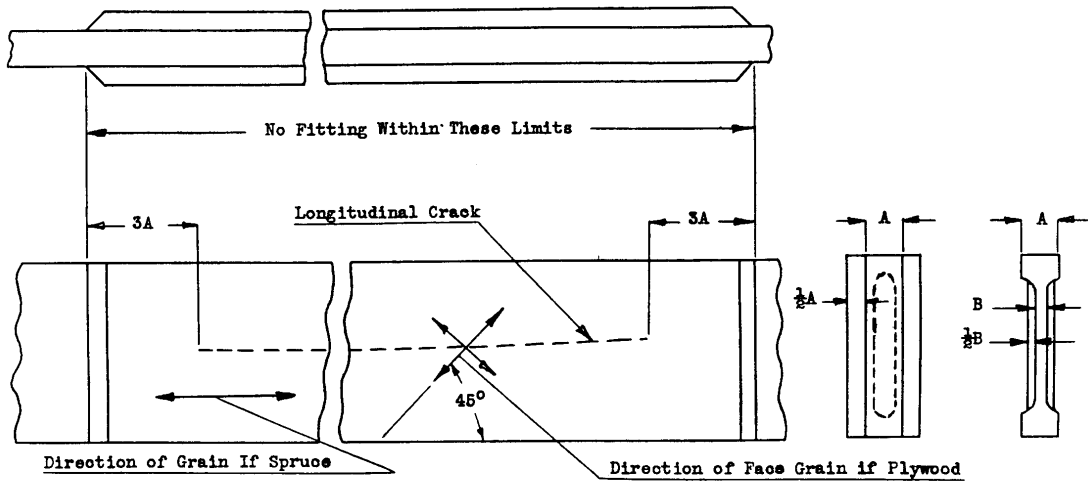
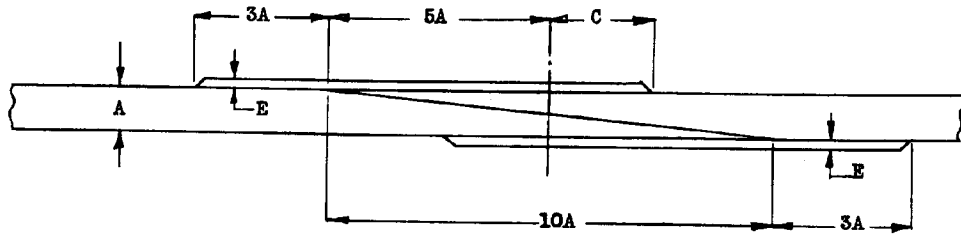
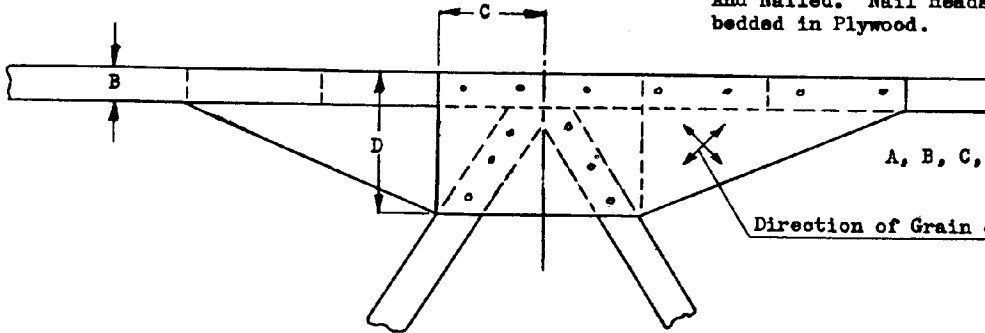


Plate Thicknesses Are For Spruce. If Plywood
Plates Are Used Their Thickness May Be One Half
The Thickness Specified For Spruce.

FIGURE 15 - METHOD OF REINFORCING A LONGITUDINAL CRACK IN A SPAR.



Reinforcing Plates Shall Be Plywood Glued And Nailed. Nail Heads Shall Not Be Imbedded in Plywood.

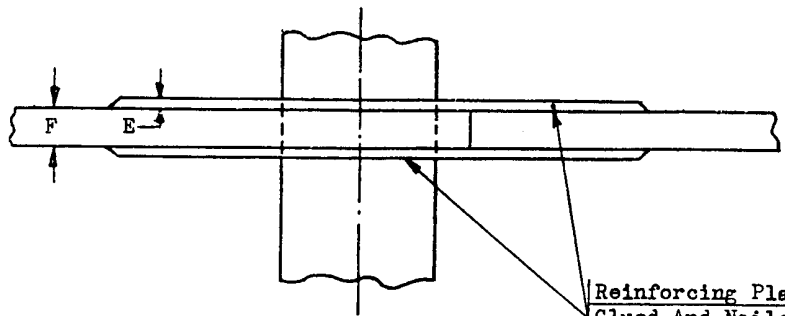


A, B, C, D, E = Original Dimensions

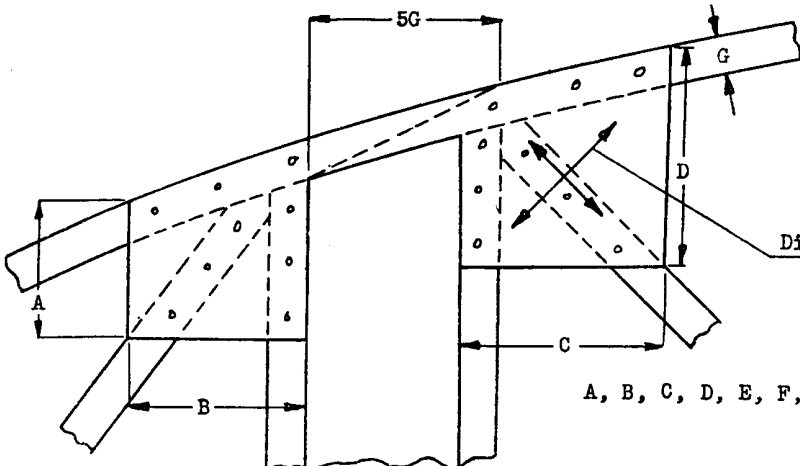
Direction of Grain of Plywood

Damaged Web Members Shall Be Replaced Entirely

FIGURE 16 - TYPICAL RIB SPLICE AT JOINT.



Reinforcing Plates Shall Be Plywood
 Glued And Nailed. Nail Heads Shall
 Not Be Imbedded in Plywood.



A, B, C, D, E, F, G = Original Dimensions

Damaged Web Members Shall Be Replaced Entirely

FIGURE 17 - TYPICAL RIB SPLICE AT A SPAR.

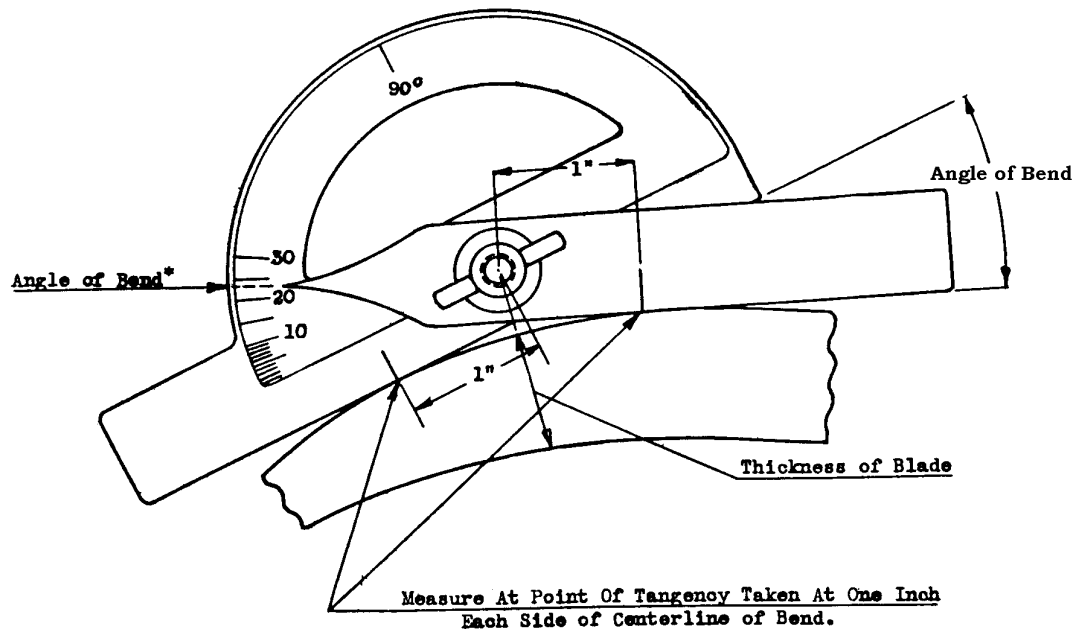


FIGURE 18 - PROTRACTOR AND METHOD OF MEASURING ANGLE OF BEND IN ALUMINUM ALLOY PROPELLERS.

*** See Section 2B (C) (2) for permissible angle of bend before cold straightening.**

Material A	Diameter Inches		Wall Thickness - Inches																			
			A = .028				A = .035				A = .049				A = .058				A = .065			
	1025		4130		1025		4130		1025		4130		1025		4130		1025		4130			
	A,B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
1025	1/2	5/8	.028	.028	.028	.028	.035	.028	.035	.028	.049	.049	.049	.028	.058	.049	.058	.028	.065	.058	.065	.028
4130			.058	.049	.028	.028	.065	.049	.035	.028	.095		.049	.049	.120		.058	.049			.065	.058
1025	5/8	3/4	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.028	.058	.049	.058	.035	.065	.058	.065	.035
4130			.058	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.049			.065	.058
1025	3/4	7/8	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.028	.058	.049	.058	.035	.065	.058	.065	.049
4130			.058	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.049			.065	.058
1025	7/8	1	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.035	.058	.058	.058	.035	.065	.058	.065	.049
4130			.058	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058			.065	.058
1025	1	1 1/8	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.035	.058	.058	.058	.049	.065	.058	.065	.049
4130			.058	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	.058
1025	1 1/8	1 1/4	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.035	.058	.058	.058	.049	.065	.058	.065	.049
4130			.058	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	.058
1025	1 1/4	1 3/8	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.035	.058	.058	.058	.049	.065		.065	.049
4130			.049	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	
1025	1 3/8	1 1/2	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.049	.058	.058	.058	.049	.065		.065	.049
4130			.049	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	
1025	1 1/2	1 5/8	.028	.028	.028	.028	.035	.035	.035	.028	.049	.049	.049	.049	.058	.058	.058	.049	.065		.065	.049
4130			.049	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	
1025	1 5/8	1 3/4	.028	.028	.028	.028	.035	.035		.028	.049	.049	.049	.058	.058	.058	.049	.065			.065	.058
4130			.049	.049	.028	.028	.065	.058	.035	.035	.096		.049	.049	.120		.058	.058	.120		.065	
1025	1 3/4	1 7/8	.028	.028	.028	.028	.035	.035		.028	.049	.049	.049	.058	.058	.058	.049	.065			.065	.058
4130			.049	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	
1025	1 7/8	2	.028	.028	.028	.028	.035	.035		.028	.049	.049	.049	.058	.058	.058	.049	.065			.065	.058
4130			.049	.049	.028	.028	.065	.058	.035	.035	.095		.049	.049	.120		.058	.058	.120		.065	

TABLE I - PROPERTIES OF TUBES FOR SPLICES USING OUTSIDE SLEEVES.
(TO BE USED WITH FIGURES 1,2,3)

Material A	Diameter Inches		Wall Thickness - Inches															
			A = .028				A = .035				A = .049				A = .058			
			1025		4130		1025		4130		1025		4130		1025		4130	
			A,B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
1025	5/8	1/2	.028	.049	.028	.028	.035	.049	.028	.035	.049	.065	.035	.049	.058	.083	.049	.058
4130			.058	.083	.028	.049		.095	.035	.049			.049	.065		.058	.083	
1025	3/4	5/8	.028	.035	.028	.028	.035	.049	.028	.035	.049	.065	.035	.049	.058	.083	.049	.058
4130			.058	.065	.028	.035		.083	.035	.049		.120	.049	.065		.058	.083	
1025	7/8	3/4	.028	.035	.028	.028	.035	.049	.028	.035	.049	.065	.035	.049	.058	.083	.049	.058
4130			.058	.065	.028	.035		.083	.035	.049		.120	.049	.065		.058	.083	
1025	1	7/8	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.083	.049	.053
4130			.058	.058	.028	.035		.083	.035	.049		.120	.049	.058		.058	.083	
1025	1 1/8	1	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.083	.049	.058
4130			.058	.058	.028	.035		.083	.035	.049		.120	.049	.058		.058	.083	
1025	1 1/4	1 1/8	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.083	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.120	.049	.058		.120	.058	
1025	1 3/8	1 1/4	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.065	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.120	.049	.058		.120	.058	
1025	1 1/2	1 3/8	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.065	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.120	.049	.058		.120	.058	
1025	1 5/8	1 1/2	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.065	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.095	.049	.058		.120	.058	
1025	1 3/4	1 5/8	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.065	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.095	.049	.058		.120	.058	
1025	1 7/8	1 3/4	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.065	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.095	.049	.058		.120	.058	
1025	2	1 7/8	.028	.035	.028	.028	.035	.049	.028	.035	.049	.058	.035	.049	.058	.065	.049	.058
4130			.049	.058	.028	.035		.083	.035	.049		.095	.049	.058		.120	.058	

TABLE II - PROPERTIES OF TUBES FOR SPLICES USING INSIDE SLEEVES WITH SINGLE WELDS AT THE SPLICES
(TO BE USED WITH FIGURES 4 AND 5)

Material A	Diameter Inches		Wall Thickness - Inches															
			A = .028				A = .035				A = .049				A = .058			
			1025		4130		1025		4130		1025		4130		1025		4130	
			A,B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
1025	5/8	1/2	.028	.065	.028	.065	.035	.120	.035	.120								
4130			.058	.065	.028	.065		.120	.035	.120								
1025	3/4	5/8	.028	.058	.028	.058	.035	.083	.035	.083								
4130			.058	.065	.028	.058		.095	.035	.083								
1025	7/8	3/4	.028	.049	.028	.049	.035	.065	.035	.065	.049	.095	.049	.095	.058	.120	.058	.120
4130			.058	.065	.028	.049		.083	.035	.065		.120	.049	.095		.058	.058	.120
1025	1	7/8	.028	.049	.028	.049	.035	.058	.035	.058	.049	.083	.049	.083	.058	.120	.058	.120
4130			.058	.058	.028	.049		.083	.035	.058		.120	.049	.083		.058	.058	.120
1025	1 1/8	1	.028	.049	.028	.049	.035	.058	.035	.058	.049	.083	.049	.083	.058	.095	.058	.095
4130			.058	.058	.028	.049		.083	.035	.058		.120	.049	.083		.058	.058	.095
1025	1 1/4	1 1/8	.028	.049	.028	.049	.035	.058	.035	.058	.049	.083	.049	.083	.058	.095	.058	.095
4130			.049	.058	.028	.049		.083	.035	.058		.120	.049	.083		.120	.058	.095
1025	1 3/8	1 1/4	.028	.049	.028	.049	.035	.049	.035	.049	.049	.083	.049	.083	.058	.083	.058	.083
4130			.049	.058	.028	.049		.083	.035	.049		.120	.049	.083		.120	.058	.083
1025	1 1/2	1 3/8	.028	.049	.028	.049	.035	.049	.035	.049	.049	.083	.049	.083	.058	.083	.058	.083
4130			.049	.058	.028	.049		.083	.035	.049		.120	.049	.083		.120	.058	.083
1025	1 5/8	1 1/2	.028	.049	.028	.049	.035	.049	.035	.049	.049	.065	.049	.083	.058	.083	.058	.083
4130			.049	.058	.028	.049		.083	.035	.049		.095	.049	.065		.120	.058	.083
1025	1 3/4	1 5/8	.028	.049	.028	.049	.035	.049	.035	.049	.049	.065	.049	.065	.058	.083	.058	.083
4130			.049	.058	.028	.049		.083	.035	.049		.095	.049	.065		.120	.058	.083
1025	1 7/8	1 3/4	.028	.049	.028	.049	.035	.049	.035	.049	.049	.065	.049	.065	.058	.083	.058	.083
4130			.049	.058	.028	.049		.083	.035	.049		.095	.049	.065		.120	.058	.083
1025	2	1 7/8	.028	.049	.028	.049	.035	.049	.035	.049	.049	.065	.049	.065	.058	.083	.058	.083
4130			.049	.058	.028	.049		.083	.035	.049		.095	.049	.065		.120	.058	.083

TABLE III - PROPERTIES OF TUBES FOR SPLICES USING INSIDE SLEEVES WITH DOUBLE WELDS AT THE SPLICES
(TO BE USED WITH FIGURES 6 AND 7)

TABLE IV - PROPERTIES OF TUBES FOR SPLICES USING OUTSIDE SLEEVES FOR CONDITIONS NOT COVERED BY TABLES I, II AND III.
(To Be Used With Figure 8).

A, B, and C Either 1025 or 4130

Diameter		Wall Thickness	
A and B	C	A and B	C
1-7/8" Or Less	Diameter	.095" or Less	.095"
	A + 1/4"	.120"	.120"
	Diameter	5/32"	5/32"
	A + 3/8"	3/16"	3/16" *
	Diameter	1/4"	1/4" *
2" Or More	Diameter	.095" or Less	.095"
	A + 1/4"	.120"	.120"
	Diameter	5/32"	1/4" *
		3/16"	
		1/4"	

* SLEEVE C MUST BE REAMED TO SLIDING FIT.

REPAIR AND ALTERATION FORM
AIRCRAFT-ENGINES-PROPELLERS

IDENT. NO. _____ NC _____

REPAIR AGENCY
 _____Manufacturer
 _____Approved Repair Station No. _____
 _____Other Agency

ACTIVITY
 _____Airplane Alteration *
 _____Airplane Major Repair *
 _____Engine Alteration
 _____Propeller Alteration
 _____Propeller Repair
 _____Mfg. Serial No. _____
 _____Mfg. Serial No. _____
 _____Mfg. Serial No. _____
 _____Mfg. Serial No. _____
 _____Mfg. Serial No. _____

AIRPLANE MODEL _____
 ENGINE MODEL _____
 PROPELLER MODEL _____
 PROPELLER BLADE MODEL _____
 PROPELLER HUB MODEL _____

OWNER'S NAME _____
 OWNER'S ADDRESS _____

AGENCY'S NAME _____
 AGENCY'S ADDRESS _____

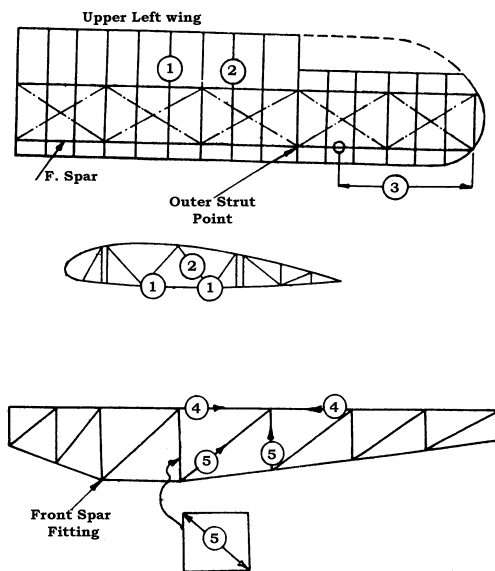
SUPERVISING MECHANIC'S SIGNATURE _____
 SUPERVISING MECHANIC'S LICENSE NO. _____

DATE OF REPAIR OR ALTERATION _____

* APPROVED BY _____ Dept. of Commerce Inspector.
 (Signature of Inspector)

(Check)

- _____The following repairs have been made in accordance with AB 7-H:
 _____The following alterations have been made in accordance with AB 7-H and 7-A _____ 7-G:
 _____Technical data as follows are appended herewith:



Repair		Replacement		Splice	Reinforcement	
No.	Location	Type	Material	Type	Type	Material
1	Wing	Fig. 16	Spruce	Fig. 16	----	3-Plywood
2	“	New	“	-----	----	-----
3	“	Solid	“	Fig. 9	----	Spruce
4	Fuselage	Fig. 1	1025	Fig. 1	----	4130
5	“	Fig. 4	1025	Fig. 4	----	-----
6	“	New	4130	-----	----	-----
7						
8						
9						
10						
11						

CERTIFICATE

_____ certificate that the foregoing
statements are true of his own knowledge.

(Signature of agency)

(Date)

DEPARTMENT OF COMMERCE
Bureau of Air Commerce
WASHINGTON
APPLICATION FOR APPROVED REPAIR
STATION CERTIFICATE

Application No. _____
Certificate No. _____
Inspector's action _____
Inspector _____
Date _____

TO THE SECRETARY OF COMMERCE:

Application is hereby made for an Approved Repair Station Certificate.

1. Name _____
(Print or type)
2. Permanent address _____
(Street) (Post Office)
- _____
- (State) (County) (Telephone)

3. Approval is requested for the following classes of Repair:
(Indicate by check those classes for which approval is desired)
- Welded steel tube structure, excluding fittings.
 - Wood structure (Excluding box and laminated spars, wood covered fuselages, wings and control surfaces)
 - Fabric covering.
 - Wood covered wings, fuselages and control surfaces, and box and laminated wing spars.
 - Steel fittings.
 - Aluminum alloy structure, excluding fittings.
 - Aluminum alloy fittings.
 - Assembly.
 - Aluminum alloy propeller blades and/or steel hubs.
 - Wood propellers.
 - Engines.
 - Instruments.
 - Special classes - (Describe fully).

4. Do you have the minimum required equipment specified in Aeronautics Bulletin 7-H for the classes of repair for which approval is requested? If answer is no, list those items which are lacking:

5. List all equipment and facilities which are available for your use in addition to the minimum required by Regulations 7-H.

6. List all Repair Station personnel with the duties of each, including license number of all mechanics holding licenses.

7. List any additional information which will indicate the adequacy of the Repair Station.

=====

AFFIDAVIT

State _____)

) ss:

Signature of applicant

County of _____)

_____ being first duly sworn, upon his oath deposes and says that the foregoing statements are true of his own knowledge; that he is the _____, of the above-named Repair Station and has the authority to make this application in its behalf.

(Signature)

Subscribed and sworn to before me this _____ day of _____, 19____

My commission expires _____

Notary Public

Note: Execute the application in duplicate and forward to the Bureau of Air Commerce, Department of Commerce, Washington, D.C.

APPLICATION OF REQUIREMENTS

COMPONENT	ACTIVITY	WORK MAY BE DONE BY			REQUIRED		FIELD INSPECTION NECESSARY	ENTRY IN LOG BOOK
		MANUFACTURER	APPR. REP. ¹⁾ STATION	OTHER ¹⁾ AGENCY	FORM #466	TECH. DATA		
AIRPLANE STRUCTURE	ALTERATION REPAIR	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Minor	Yes	Yes	Yes	No	No	No	Yes
	Major	Yes	Yes	Yes	Yes	No	Yes	Yes
ENGINE	ALTERATION OVERHAUL	Yes	Yes	No	Yes	Yes	No	Yes
		Yes	Yes	Yes	No	No	No	Yes
PROPELLER	ALTERATION REPAIR OVERHAUL ⁴⁾	Yes	Yes	No	Yes	Yes	No	Yes ³⁾
		Yes	Yes	No	Yes	No	No	Yes ³⁾
		Yes	Yes	No	No	No	No	Yes ³⁾
INSTRUMENT	REPAIR	Yes	Yes	Yes ²⁾	No	No	No	Yes ³⁾

1. Work must be done by, or supervised by, a licensed mechanic. (See Section 3(a))
2. Except instruments in airline aircraft.
3. Airplane log.
4. Servicing or inspection.

TABLE V

Approved as amended, to take effect January 1, 1936.

/s/ Daniel C. Roper,
Secretary of Commerce
December 23, 1935.