Handbook of Structural Repair PBY 5

RESTRICTED

AN 01-5M-3

Handbook of Structural Repair

for

NAVY MODELS

PBY-5 • PBY-5A • PBY-6A

ARMY MODEL

OA-10

Airplanes

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INTRODUCTION

This manual has been prepared to provide instructions to service personnel in the structural repair of the PBY-6A airplane. The information contained is also applicable to PBY-5 and PBY-5A airplanes unless otherwise stated.

The book is arranged to cover repairs to each major component of the airplane separately. Typical repairs applicable to any part of the airplane are given in Appendix II. The organization of the book is shown by the Table of Contents.

Since this book is intended primarily for the repair of a specific type of airplane, neither fundamental repair procedure nor general aircraft repair will be covered by this book. For such material the General Manual for Structural Repair (AN 01-1A-1) should be consulted.

Because of the lack of a standard terminology in the aircraft industry, certain terms used throughout this manual are illustrated below for clarification.

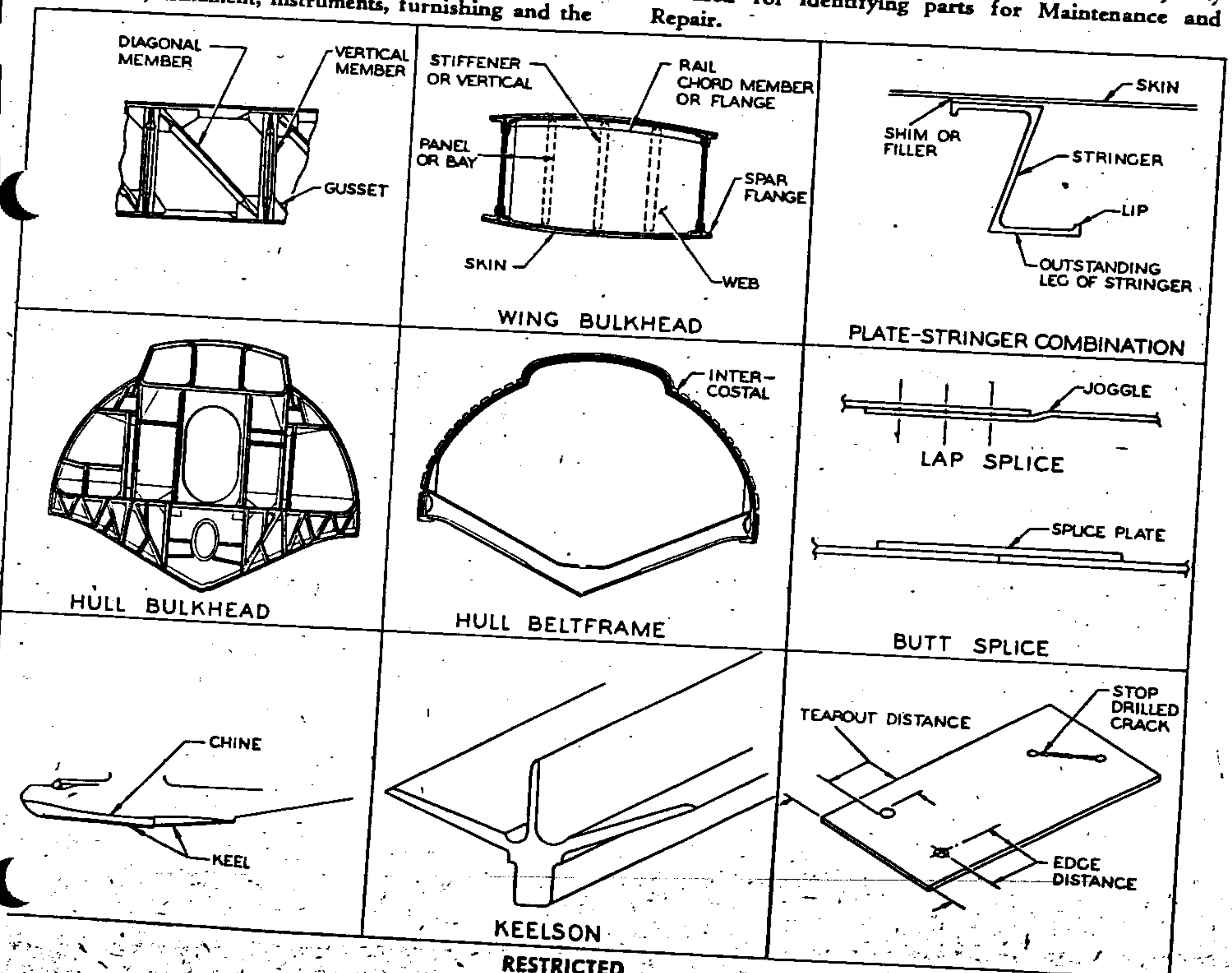
Controls, armament, instruments, furnishing and the associated angles, brackets, clips and supporting structure have been omitted from the illustrations and descriptions. These items are not considered primary structure (i.e. not contributing to the strength of the airplane).

Since the type, extent and location of damage cannot always be foreseen, it is impossible to include a repair for every damage. Designs for the repair of only the most likely damage, therefore, are included in this manual. It will usually be possible to combine some of the repairs outlined to effect a satisfactory repair for any combination of damage.

Instructions for the maintenance of equipment as well as the installation and removal of the various structural components of the airplane are given in the Handbook of Erection and Maintenance Instructions:

AN 01-5MA-2 (PBY-5 and PBY-5A Airplanes)
AN 01-5MC-2 (PBY-6A Airplanes)

The Illustrated Parts Catalogue (AN 01-5M-4) may be used for identifying parts for Maintenance and Repair.



SECTION I

General

SECTION I
GENERAL

1-1. TYPE OF CONSTRUCTION.

1-2. The PBY-6A is an amphibious flying boat designed for both land and water operations. The hull and retractable wing tip floats provide a means of landing on water while the retractable tricycle type landing gear enables the airplane to land on the ground.

1-3. WING. The wing is a semicantilever beam of conventional two-spar skin stringer design braced by two wing-hull struts on each side of the airplane. The wing assembly is composed of a center section and two removable outer panels which include the ailerons. Attachment of the wing to the hull is accomplished by means of the struts and two bolted joints at the center of the airplane (at hull bulkheads 4 and 5).

1-4. EMPENNAGE. The PBY-5A empennage has been redesigned for the PBY-6A to incorporate overhanging balances on the elevators and rudder and to decrease the rudder chord and increase the rudder height. The two tails are structurally similar. This manual will discuss the structure of the PBY-6A tail. Where dissimilarity exists the detail design of both will be covered.

1-5. The empennage group consists of a vertical stabilizer (the lower half of which is an integral part of the hull), a horizontal stabilizer, a rudder and two elevators.

1-6. The horizontal stabilizer is a two spar construction from the center line to station 8 and a D-section outboard of this point. Bulkheads are truss type. The whole assembly is covered with 24S-T aluminum alloy sheet on extruded stringers. The stabilizer is attached to the lower fin by four large fittings and six smaller intermediate fittings.

1-7. The lower portion of the rudder structure is a closed box formed by the curved leading edge skin and a single spar; in the vicinity of the upper hinge two spars are employed. The vertical load of the rudder taken thru the lower bearing plate into the hull tail cone. The rudder ties to the vertical fin by means of three hinge arms.

1-8. The elevators are two panels joined rigidly together by an aluminum alloy torque tube to which a control arm is attached. They are essentially a D-Section to which the trailing edge ribs are attached. Five hinges support the two elevators, the centerline hinge being common to both.

1-9. HULL. The hull is a semi-monocoque structure. Eight bulkheads comprise the main supporting structure. Four of these are water-tight dividing the hull into five water-tight compartments. Water loads are taken by the hull bottom to the bulkheads and reacted the keel and sides of the hull. Landing loads imposed by the landing gear are transferred primarily through steel fittings into hull bulkheads 4 and 5 which are the main structural members of the hull.

1-10. ALIGHTING GEAR. The landing gear consists of two main wheels attached by shock struts and retracting mechanism between hull bulkheads 4 and 5, and a nose-wheel attached to a shock strut and retracting mechanism located in the bow of the hull.

1-11. ENGINE AND NACELLE. Two R-1830-92 engines are mounted to the center section of the wing by means of welded steel tube engine mounts.

1-12. The engines are faired by the nacelle fairings which converge to the contour of the top and bottom wing surfaces.

1-13. For a more comprehensive description of the various structural components refer to the section of the handbook covering the specific item.

1-14. INSPECTION FOR DAMAGE.

1-15. GENERAL. The airplane should be inspected periodically for damaged structure. A thorough examination will permit the preparation of a detailed repair plan which will insure the availability of the necessary materials and tools and will prevent loss of valuable time. Remove all grease, dirt, etc., at and in the vicinity of the damage, so that the extent of cracks, condition of rivets, welds, etc., may be accurately determined.

1-16. Structural parts should be inspected for dents, cracks, holes, scratches, breaks, sharp corners and abrasions, loose, sheared or otherwise damaged rivets, elongated rivet holes, bowing, distortion, worn spots and corrosion. Dents and wrinkling in skin sheets should be inspected to insure that they are not stress wrinkles caused by failure of vital structure. Bent or twisted structures may be straightened and used unless cracks appear in the straightening process. All cracks should be stop drilled. Large cracks will necessitate the use of a new part.

1-17. Test watertight joints for leaks. Check hinges, fasteners and locking mechanism to determine whether their operation has been impaired. If damage is to fabric-covered surfaces, the internal structure of the component should be inspected through access holes provided. If damage is in locations where inspection is impossible because of inaccessibility, access holes should be made in accordance with figure 2-28, or the section of fabric should be removed if access holes do not facilitate complete inspection.

1-18. Experience has shown that when a bullet strikes sheet material, it heat-treats the metal in the vicinity of the bullet hole. This metal is thus embrittled and minute cracks are created by the impact of the bullet. It is a good practice therefore to trim a liberal amount of metal away from bullet and shell holes when cleaning up the damaged area.

1-19. Inspection should determine the relative amount of work involved in effecting a repair, as compared to that of replacing damaged members with new parts if available.

1-20. Included in each section is a separate paragraph containing information pertinent to inspection of damaged structure, together with a list of the types of damage that may be encountered. Necessary special inspection procedures are also provided in the applicable repair instruction paragraphs.

1-21. Whenever damage to a structure is discovered, the adjacent structure should be carefully inspected for secondary damage. Such secondary damage frequently occurs as a result of overloading caused by the original damage. Since heavy shock loads may be transmitted through several structures, rivets and bolts may be loosened and sheet metal buckled quite a distance away from the area of primary damage. Rivets should be checked in order to determine if they have sheared; a .005" feeler gage can be used for this purpose.

1-22. Also check for any skin wrinkles, elongated rivet or bolt holes, fine hairline cracks, damaged control cables or damaged fuel or hydraulic lines.

1-23. If the airplane is damaged by shell fire, the route of the projectile should be followed and the above steps taken.

1-24. RIVETS. It is particularly important to check rivets closely. A rivet may be strained or even sheared off and yet appear normal by casual inspection; rivets may stretch or fail, leaving the head intact. For instance, after straightening a bent member all of the structure adjacent to it should be inspected for loose rivets. Always use a feeler gage when inspecting for damaged rivets, checking for tipping or rising of heads and for separation of the riveted members at the rivet shanks. Also inspect carefully for elongated rivet holes which may often be detected by a close examination of the sheet surface near the head. The slight impression made in the sheet by the rivet head when driven will be exposed if the rivet has moved in elongating the hole.

1-25. RIVET TYPES. When making repairs the same type of rivet should be used as in the surrounding structure unless otherwise specified. Rivets vary in head type and material. Flat head rivets are used on internal structure while brazier head rivets are generally used on surfaces exposed to the slipstream.

1-26. Countersunk rivets are used for a specific purpose; either for clearance or to obtain a smooth, low drag external surface for aerodynamic reasons.

1-27. The types of aluminum alloy rivets used in the original construction of the airplane are:

a. AN-425 (78° Countersunk). AN-426 (100° Countersunk) rivets are used on later airplanes replacing AN-425.

b. AN-426 (100° Countersunk).

c. Q4303 (115° Countersunk)—This is a CVAC standard rivet. It has been replaced by AN-426 rivets on current production airplanes.

d. AN-442 (Flat head).

e. AN-456 (Brazier head).

f. Q4305 (Brazier head).—This is a CVAC standard rivet which has been replaced in current production airplanes by AN-456 rivets.

g. 22Q013 (Mushroom head).—This is a CVAC standard rivet formerly used in the fuel tank area. It has been replaced on current airplanes by AN-430 rivets.

h. AN-430 (Round head).—These rivets are used in the fuel tank area. A better clamping action and therefore better fuel tightening is obtained with these rivets than with the brazier head type.

1-28. All of the above rivets may be obtained in two materials 17S (type D rivet) and A-17S (type AD rivet). Only the type D rivet is used in the original construction of the airplane.

1-29. For information on identification of the rivet material and for illustrations of the head shapes refer to General Manual for Structural Repair, AN 01-1A-1.

1-30. RIVET SUBSTITUTES. Rivets most generally available in the field are AN425, AN426, AN442 and AN456. The following substitutions are permissible:

Rivet	Acceptable Substitut
AN425	AN426 (in 100° ho[illegible] [illegible]y)
AN426	AN425 (in 78° hole [illegible])
AN430	AN456
AN442	AN430, AN456
AN456	AN430
"Q" Standards	See c, f, and g above

1-31. A17S-T rivets (AD) which can be driven as purchased without heat treatment may be substituted for 17S-T rivets (D), which require heat-treatment before driving, for all repair rivets of 3/16 inch diameter or less if: (a) at least half of the rivets substituted are increased to the next larger size, the added rivets being distributed evenly throughout the pattern, or (b) in accordance with the following rule: if 8 or fewer A17S-T rivets are to be substituted for 17S-T rivets of the same size, add one additional rivet to the pattern. If from 9 to 16 rivets are involved, add 2 additional A17S-T rivets; from 17 to 24, 3 additional rivets must be added to the pattern. This rule applies for ⅛", 5/32" and 3/16" dia. rivets. For rivets less than ⅛" dia. the A17S-T type may be substituted without the addition of any rivets to the pattern or an increase in the diameter of any of the rivets. All repair rivets of ¼ inch diameter or larger should be of the heat-treatable (17S-T) type.

1-32. Heat-treatment of 17S-T aluminum alloy rivets shall be in accordance with standard practice. (See General Manual for Structural Repair, AN 01-1A-1). A17S-T rivets are driven without heat-treatment.

1-33. Steel or aluminum alloy bolts may be substituted for 17S-T (D) rivets if it is necessary to eliminate heat-treatment of rivets in making repairs. Note that if bolts are substituted for rivets so that a mixed bolt-rivet pattern results, (this condition should be avoided whenever possible) the bolts *must fit their holes with a maximum clearance of .002"*. If all of the rivets in the pattern are replaced with bolts, the bolts must fit within .005".

1-34. The use of blind rivets for making repairs in critical structure is not recommended. If the damaged part is not readily accessible, either sufficient areas of skin should be removed to permit access, or a removable access door should be made. (See figure 2-28.)

1-35. CORROSION. The entire structure should be inspected at regular intervals for damage from corrosion. Aluminum corrosion is especially prevalent wherever moisture tends to collect. Dissimilar metals, adjacent or in contact, provide a source of corrosion and should therefore be closely inspected. Equipment which is badly corroded contains deep pits, holes, or cracks. However, corrosion cannot always be detected by visual examination alone, but may sometimes be found under blistered or flaking paint. When corrosion appears on materials having an iron base, it appears in the form of a red rust; on materials having a copper base, as green formations; and on materials having an aluminum or magnesium base, as white formations. The extent of ordinary corrosion can be determined by probing for pits with a fine needle. The degree of corrosion will vary with the type of corrosive medium which contacts the metal, the period of exposure, the age of the protective paint or oil fillers, and the time which has elapsed between removal of the airplane from the corrosive medium and the inception of salvage. Parts which are simply stained or etched with very shallow pitting are generally serviceable unless this condition occurs in a highly stressed part of the primary structure. Normally, destructive corrosion does not take place within a short period of time; however, the effect of any corrosion can be minimized by expediting salvage. For information pertaining to the protection of the structure from damage by corrosion, refer to the General Manual for Structural Repair (AN 01-1A-1).

1-36. All the aluminum alloys, clad and unclad, in the airplane have been anodized. This treatment provides excellent protection against corrosion of the surface of the metal and results in improved adherence of paint subsequently applied. When facilities are available repair parts should be anodized, otherwise the parts should be covered with two coats of green primer with thorough drying time allowed between coats.

1-37. SHEET. Because of the type of construction used most of the metal sheets used for the fabrication of the primary structural members of the airplane are stressed, that is, they carry load. If the continuity of any of this skin is interrupted, the load must pass around the hole. In some cases this will overload the surrounding structure and result in a failure. It is important therefore that damage to skin be repaired in accordance with the instructions given in the manual. Particular attention shall be given to the rivet pattern used in repairs.

1-38. The 24S-T aluminum alloy used in the construction of the airplane is in a definite physical condition and its strength will be adversely affected by the improper application of heat in making repairs. All aluminum alloy parts are installed in the heat-treated (hard) condition. However, in order to fabricate certain parts with small bend radii 24S-O (soft) material must be used. Before such a part may be installed in the airplane it is essential that it be HEAT-TREATED to the 24S-T (hard) condition. If 24S-O material is not available, 24S-T material may be annealed, the part formed and then re-heat-treated to 24S-T.

1-39. The repairs outlined in this manual are designed to call for repair parts to be made from 24S-T whenever possible to avoid the heat-treat operation. When, because of severity of the bend, 24S-O material is called, THESE PARTS MUST BE HEAT-TREATED TO 24S-T BEFORE INSTALLATION IN THE AIRPLANE. The parts should be heat-treated in detail, that is before assembly to other repair parts. (Refer to Section V of the General Manual for Structural Repair, AN 01-1A-1.)

1-40. Repair illustrations in this manual indicate the bend radius to be used for each repair part. For fabricating repair parts not covered by the illustrations, consult the General Manual for Structural Repair, AN 01-1A-1, for the proper radius.

1-41. Alclad sheet stock (aluminum alloy coated with pure aluminum) is used in the fuel tank area of the wing as well as in a few isolated regions throughout the airplane. For purposes of repair, this material may be treated like aluminum alloy. However, for equal gauges, alclad is weaker than aluminum alloy and therefore the following two points are important from a strength standpoint:

a. Aluminum alloy may always be substituted for alclad sheet of equal thickness.

b. Alclad sheet may never be substituted for aluminum alloy unless the loss of strength is compensated by an appropriate increase of one gauge in sheet thickness.

1-42. Most steel parts in the airplane are heat-treated. Usually the component parts of a steel assembly are welded and then the assembly is heat-treated. There is an exception to this procedure, however; provided electric arc welding is used, it is not necessary to normalize an assembly after welding if the components have been normalized in detail. Specific repair procedures for steel assemblies are given in the applicable sections of the manual.

1-43. INSPECTION AFTER REPAIR. Inspection should be made during each stage of a repair before it becomes inaccessible. The repair should be checked against the removed damaged section or duplicate

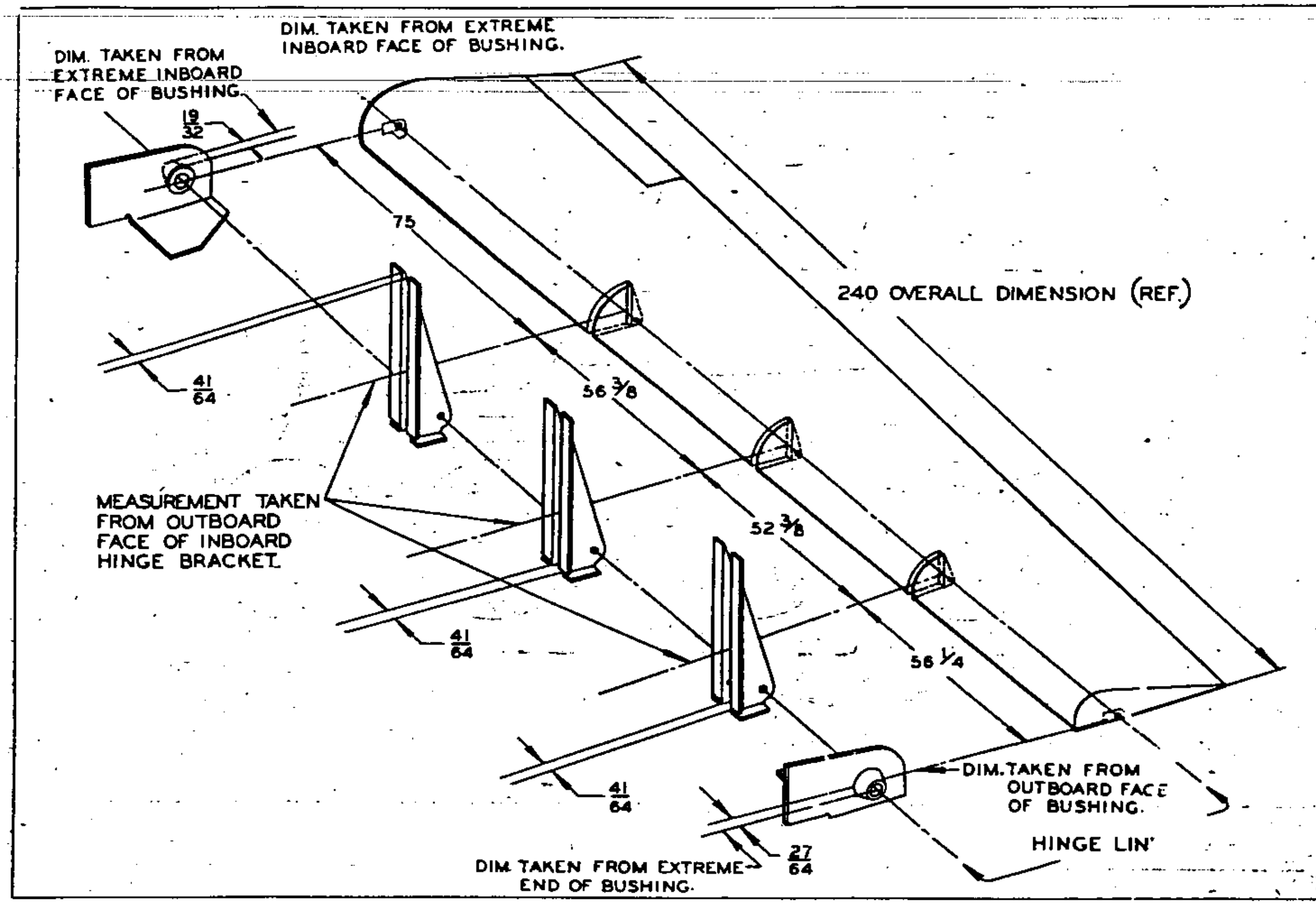


Figure 1-1—Aileron Jig Points

structure to determine that proper repair was undertaken. Repair inspection should provide positive assurance that required heat-treatment exists in all repair parts, that required bolt hole tolerances have been obtained, that sizes of plates or members and number size, type and location of repair rivets or bolts specified for repair have been used. It is also important to inspect the anti-corrosion precautions such as chromate tape or paste application, anodizing and use of proper coats of primer and final finish.

1-44. After repair, the structure should be examined for damage which may have resulted from repair operations. Occasionally it will be found that the vibration caused by riveting has loosened older rivets or that rivets have been formed poorly or that plating has been dimpled severely. Frequently errors in drilling weaken the structure by damaging legs of extrusions, flanges of frame channels, or webs of bulkheads. Also, in cleaning up damage, accidents may occur which will necessitate independent repairs or a removal resulting in a repetition of repair. If preliminary measurements between reference points are taken, recheck these measurements and thereby make certain that distortion has not occurred. In final inspection determine that all tools, scraps, chips, and miscellaneous parts have been removed, leaving the area clean and the finish intact.

1-45. SUPPORT OF STRUCTURE DURING REPAIR.

Before any repair or replacement of a member of basic structure is undertaken, it is essential that the structure be suitably and firmly supported to prevent distortion. Concentrated loads, such as the engines, fuel, or landing gear, should be removed or independently supported. If special cradles and jigs are not available, temporary supports such as wooden cradles or jigs, should be made for the purpose.

1-46. The wing should be supported by auxiliary struts, or should be removed from the airplane and supported by cradles. These supports should be placed at the wing bulkheads. For removal of the wing refer to "Handbook of Erection and Maintenance Instructions—PBY-6A Airplane (AN 01-5MC-2)".

1-47. The hull should be supported by cradles placed at bulkheads and beltframes. Cradles may be made of wood to fit the contour of the hull bottom. The cradle should be padded with felt at points of contact with the hull to prevent scoring. The hull can also be sup-

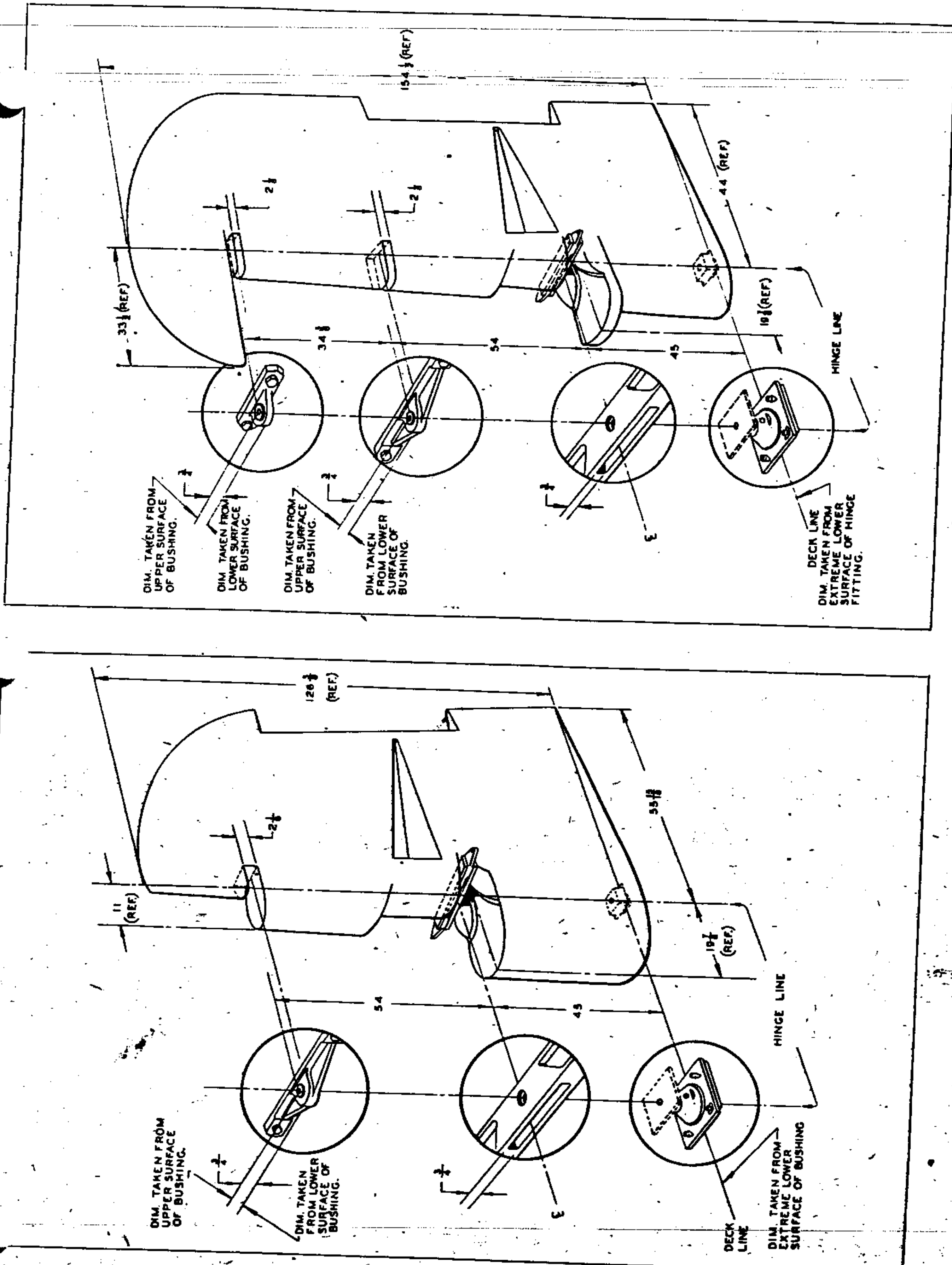


Figure 1-2—Rudder Jig Points

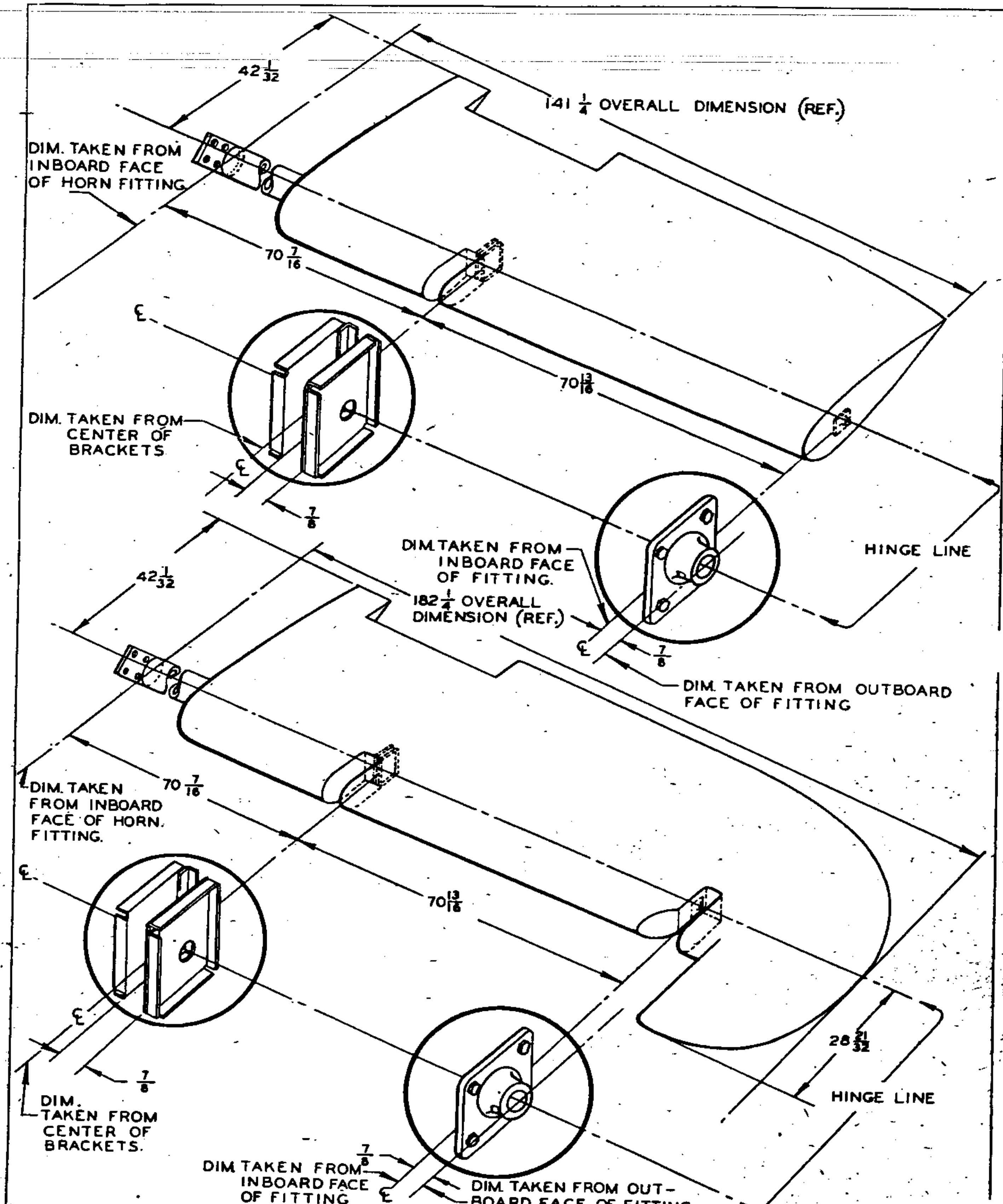


Figure 1-3—Elevator Jig Points

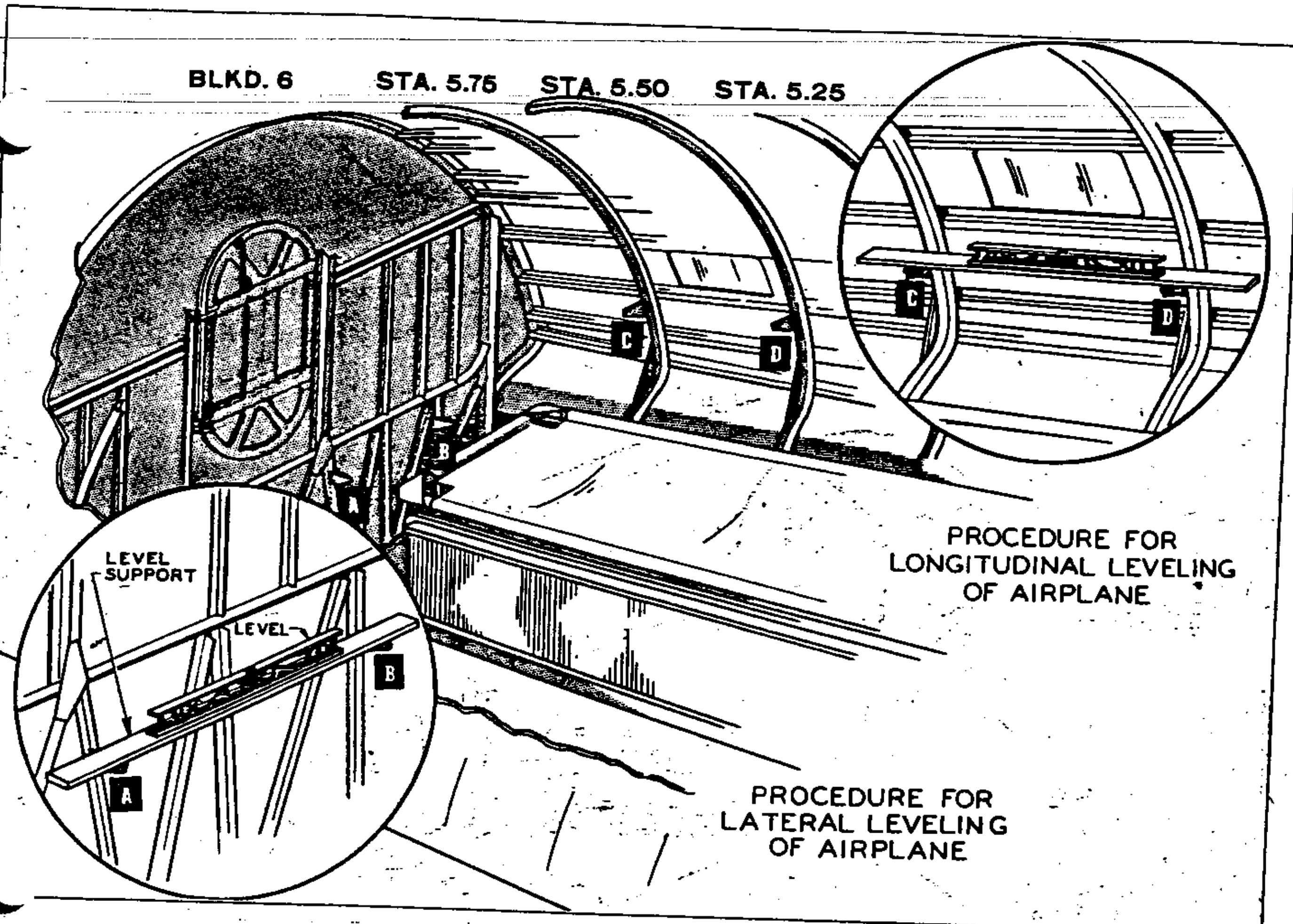


Figure 1-4—Airplane Leveling Lugs

ported by installing the main beaching gear on the airplane and rolling the airplane on two elevated platforms. This permits easy access to the lower portion of he hull.

1-48. The control surfaces (aileron, rudder and elevator) should be supported by jigs at the hinge points nd trailing edges. (See figures 1-1, 1-2, and 1-3.)

-49. LEVELING THE AIRPLANE.

50. The two leveling lugs for lateral leveling are lo-ted on the port forward face of bulkhead 6, below ne level of the door. (See figure 1-4.) Lay any straight r and a spirit level across the leveling lugs and jack one side of the airplane a few inches off the ground. hen jack up the other side of the airplane until the irit level indicates level position. This is done while e airplane is on either the beaching gear or landing ar.

51. The leveling lugs for longitudinal leveling are ated on the port side of the airplane above the bunk d are attached to beltframe 5.50 and 5.75, on PBY- airplanes and beltframes 5.25 and 5.75 on PBY-5A . (See figure 1-4.) Lay a leveling bar and spirit oss the lugs. To level the airplane while on the landing gear, inflate or deflate the nose wheel oleo strut until the spirit level indicates level position. To level the airplane while on the beaching gear, raise the tail with a special hoist at the aft fitting until level position is indicated on spirit level.

1-52. CLASSIFICATION OF DAMAGE.

1-53. Generally speaking there are four classifications of repair. Quite often a damage will require a combination of two or more of these types of repair. A description and typical examples of each class are given below.

1-54. NEGLIGIBLE DAMAGE. Negligible damage is that damage or distortion which can be permitted to exist as is or corrected by a simple procedure (removing dents, stop drilling cracks, temporary fabric patching, etc.), without placing restrictions on flight.

1-55. DAMAGE REPAIRABLE BY PATCHING. Patching in general refers to that type of damage which will permit the addition of a repair piece laid over the damaged area. For example a patch on the skin would consist merely of a piece of sheet cut slightly larger than the cleaned up damaged area, riveted to the undamaged skin. (See figure 1-5.) A patch on an extrusion

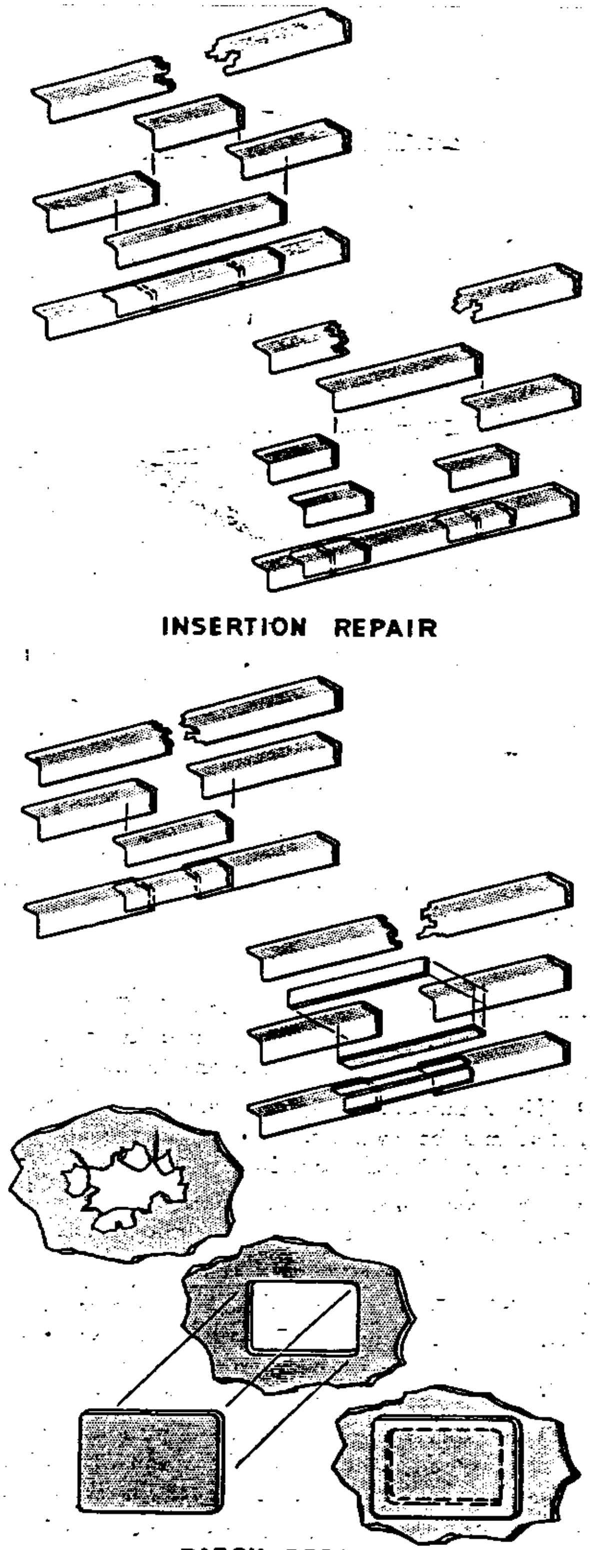


Figure 1-5—Types of Repair by Patching and Insertion

or other formed part would consist possibly of a reinforcing strip laid over the damaged area or another formed part nested in and riveted to the damaged pa (See figure 1-5.) Patches should be designed to utili existing rivet patterns when possible. Repairs to watertight bulkheads, hull, and floors are made water-tight by the use of zinc chromate tape, or equivalent seals inserted between the overlapping edges of the patches. Repairs in the fuel tank are made gas tight by the use of neoprene as a gasket material and by using gas tight rivet spacing.

1-56. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion may be defined as a repair which by reason of the extent of damage does not lend itself to patching because of the excess weight which would necessarily be added. For example if a stringer were damaged over a long length the damaged portion would be removed and a new stringer length inserted. The new piece would be spliced into the untouched structure at each end. (See figure 1-5.)

1-57. DAMAGE NECESSITATING REPLACEMENT. Replacement repair is employed wherever the damage is too serious to employ any of the foregoing methods of repair. It consists of removing the part damaged and replacing it with an identical part or the fabricated structural equivalent. When this repair is employed, the method of attachment, unless further damage to adjacent members makes deviation necessary, should be the same as that used in the attachment the original part. Parts damaged by fire must alwa be replaced.

1-58. BALANCING CONTROL SURFACES.

1-59. GENERAL. The possibility that the major control surfaces of an airplane might develop destructive oscillation (flutter) in flight is eliminated by controlling the distribution of weight so that the balance of the surfaces about their hinge lines is maintained between established safe limits. Most critical is the degree of trailing edge heaviness about the hinge line. Due to their design, control surfaces are usually trailing edge heavy, and counterweights are added to the leading edge to offset some of this unbalance. The addition of weight to the surfaces in the form of repairs may disturb the initial unbalance sufficiently to exceed safe limits and could therefore become a possible cause of destructive oscillation of the surface in flight. Minor patching of fabric surfaces, which adds negligible weight to the control surface, need not be considered cause for checking the balance. The nearer the patch is to the hinge line of the surface, the less will be its effect on the balance. Large, heavy, or numerous patches, especially those on or near the trailing edge, should therefore be avoided by making a section replacement or by partial recovering. In most cases, the addition of weight during repair will tend to make the surface u balanced and it will be necessary to add a count weight. After any repair which necessitates removing the surfaces from the airplane, check the static balance

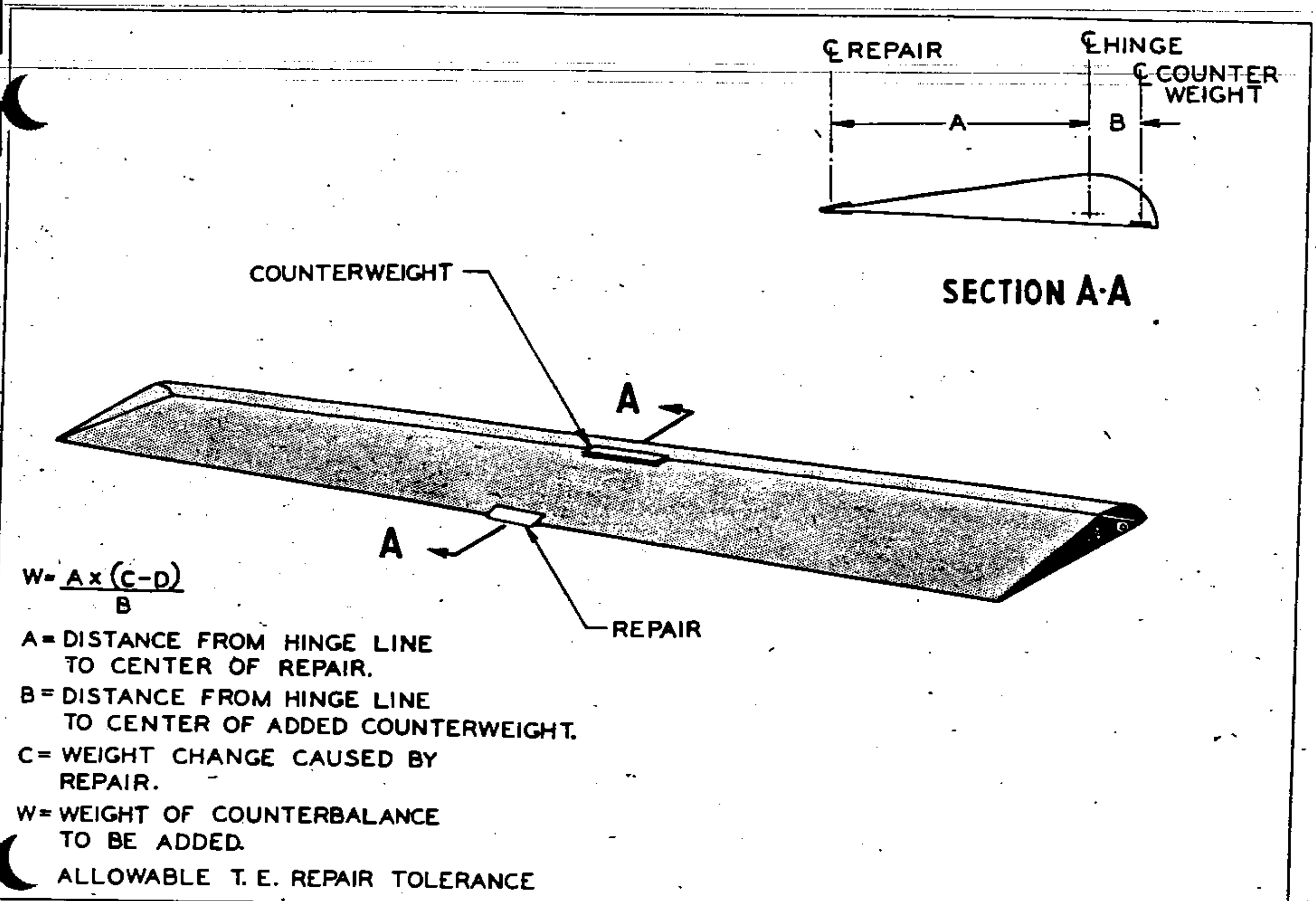


Figure 1-6—Determination of Unbalance Caused by Repair

before remounting the surfaces. Prior to making a balance check, the surface must be completely assembled and finished with balance weights, hinge fittings and trim tab operating rods all in place.

1-60. The leading edge of a control surface is that portion of the control surface which lies forward of the hinge and trailing edge is that portion which lies aft of the hinge line.

1-61. In the following text limits are placed upon the amount of tail heaviness that a surface can possess. There is no limit placed upon the amount of nose or leading edge heaviness other than the actual amount of weight added in the form of repairs and counterweights. The addition of too much weight to the leading edge of the surface may cause failure of the hinge bearings or in the case of a heavy counterweight, it may cause local failure of the skin and structure at the point where the counterweight is secured to the leading edge.

1-62. ALLOWABLE REPAIR WEIGHT.

AILERON. As it leaves the factory, the port has two counterweights in its leading edge, one located at the extreme outboard end between ribs 1 and 2 and the other between ribs 10 and 11. The starboard aileron has one counterweight located in the leading edge at the inboard end between ribs 13 and 14.

1-64. The maximum allowable repair, without rebalancing, that may be added to the port aileron aft of the hinge line is 18.7 inch pounds.

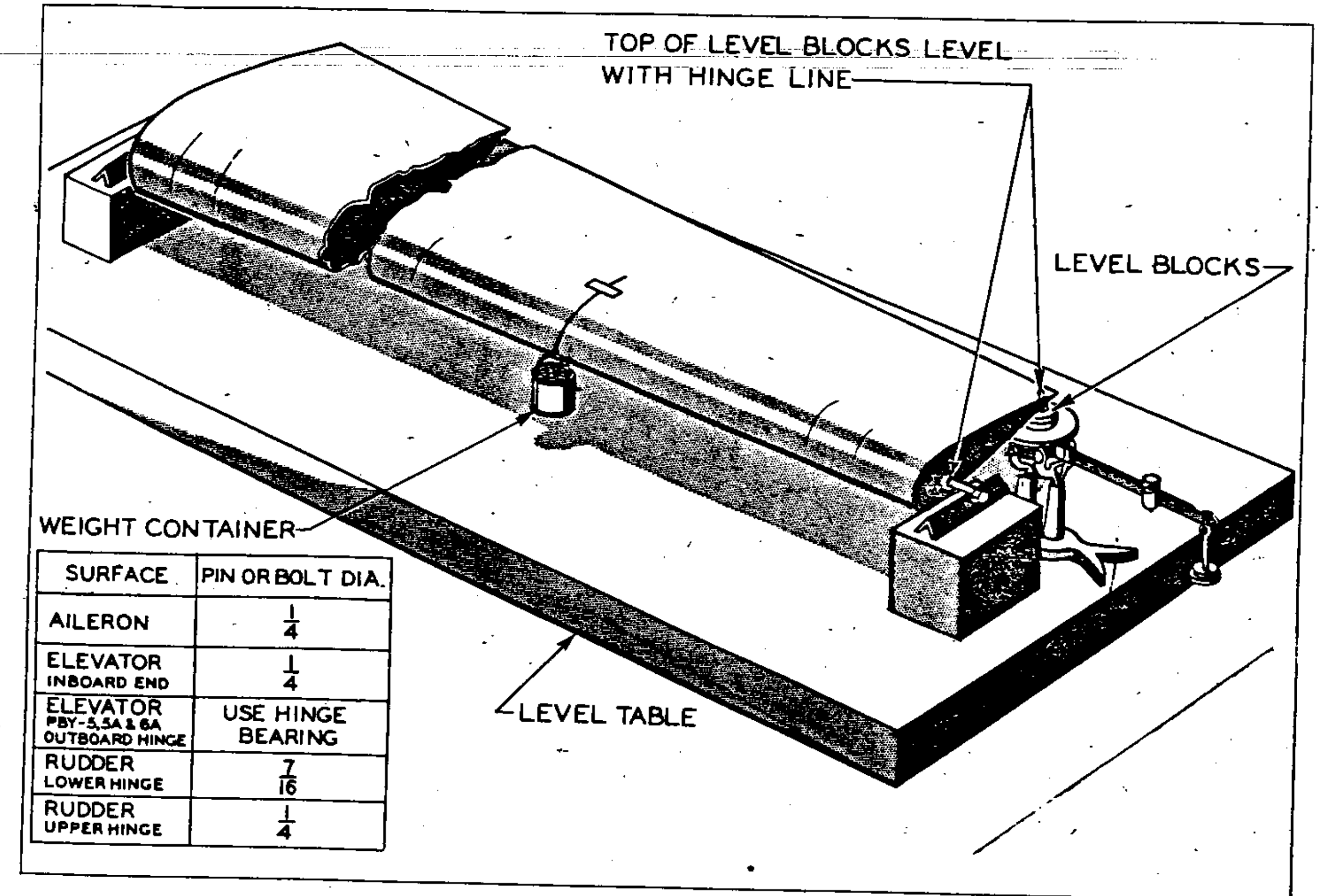
1-65. The maximum allowable repair, without rebalancing, that may be added to the starboard aileron aft of the hinge line is 2.6 inch pounds.

1-66. ELEVATOR. A three pound counterweight is riveted to the leading edge of each PBY-6A elevator just inboard of the outboard hinge. The PBY-5 and PBY-5A elevators do not have counterweights.

1-67. The maximum allowable repair without rebalancing that may be added to the PBY-5 and PBY-5A airplane elevators aft of the hinge line is 22.6 inch pounds.

1-68. For PBY-6A airplane elevators, 104.7 inch pounds may be added aft of the hinge line.

1-69. RUDDER. A 17½ pound counterweight is secured to the leading edge of the PBY-5 and PBY-5A airplane rudder just below the upper hinge. The PBY-6A airplane rudder has no counterweight attached to it



SURFACE	PIN OR BOLT DIA.
AILERON	$\frac{1}{4}$
ELEVATOR INBOARD END	$\frac{1}{4}$
ELEVATOR PBY-5,5A & 6A OUTBOARD HINGE	USE HINGE BEARING
RUDDER LOWER HINGE	$\frac{7}{16}$
RUDDER UPPER HINGE	$\frac{1}{4}$

Figure 1-7—Determining Static Balance

since its design brings it within the allowable limits of tail heaviness.

1-70. The maximum allowable repair, without rebalancing that may be added to the PBY-5 and PBY-5A airplane rudders aft of the hinge line is 5.0 inch pounds.

1-71. For the PBY-6A airplane rudder, 78.0 inch pounds may be added aft of the hinge line.

1-72. DETERMINING AMOUNT OF UNBALANCE CAUSED BY REPAIR. (See figure 1-6.)

1-73. The repair patches, together with all rivets and fastenings should be weighed and the weight recorded. If any parts are removed, their weight should be recorded and then the net weight change calculated. The net weight change is the difference between the weight of the patches plus their attaching parts and the weight of the parts removed.

1-74. Locate the hinge line and measure the distance from the hinge line to the center of the patch.

1-75. Multiply the distance from the hinge line to the center of the repair by the net weight change as determined in paragraph 1-56 above. This will give the inch pounds added by the repair.

1-76. If this figure is more than the maximum allowable, a weight must be added on the opposite side of the hinge line from the repair.

1-77. To determine the amount of weight to be added proceed as follows:

a. Subtract the maximum allowable repair in inch pounds, which can be obtained from paragraph 1-51, from the repair weight determined in paragraph 1-58 above. This is the amount of unbalance in excess of the maximum allowable.

b. Decide on the approximate location of the counterweight to be added and measure the distance from the hinge line to the center of the weight. The counterweight should be added as nearly opposite the repair as possible.

c. Divide the amount of repair in excess of the maximum allowable as obtained in paragraph 1-62 above by the distance from the hinge line to the center of the counterweight. This is the weight of the counterbalance to be added.

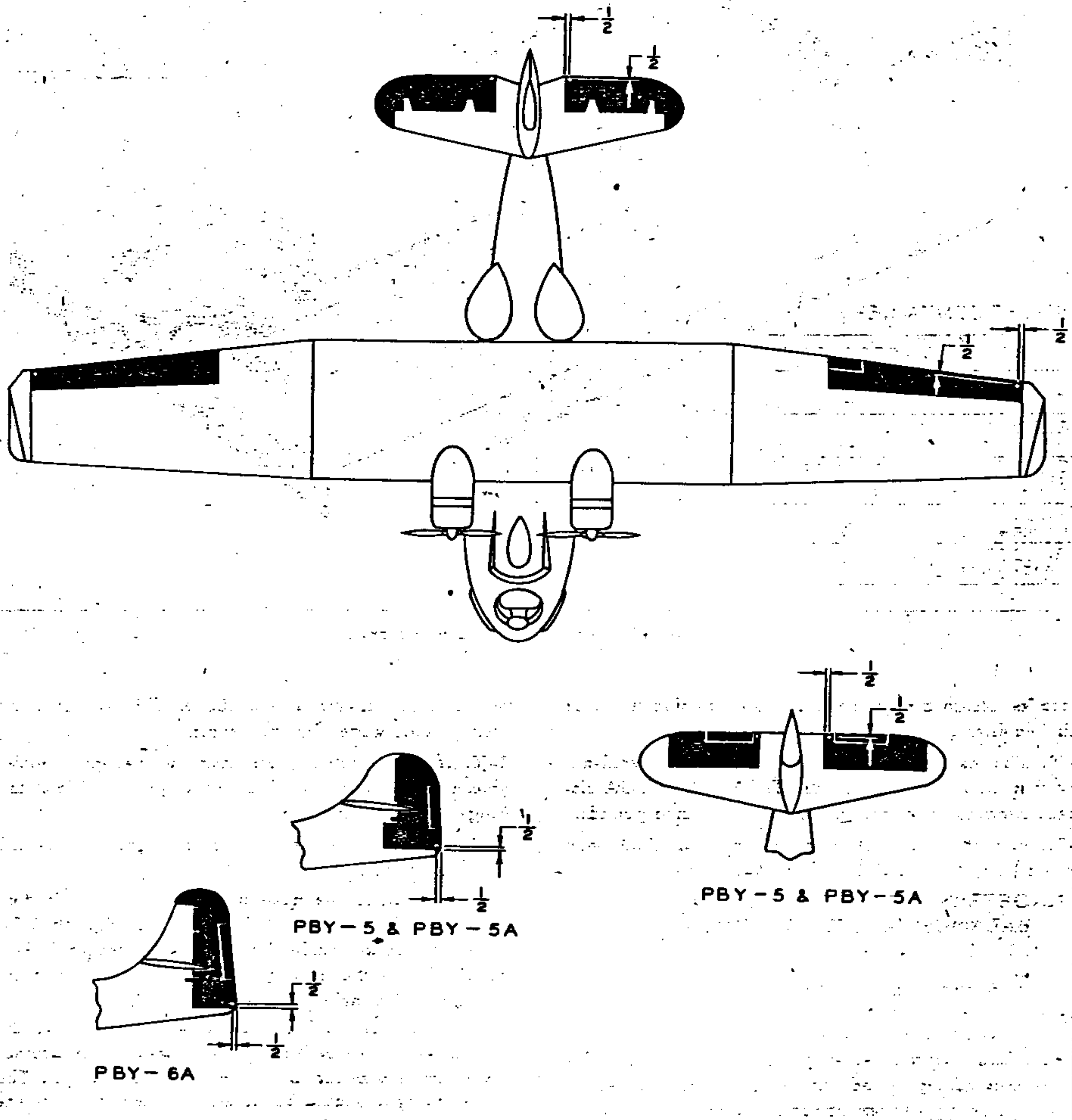


Figure 1-8—Static Balance Points

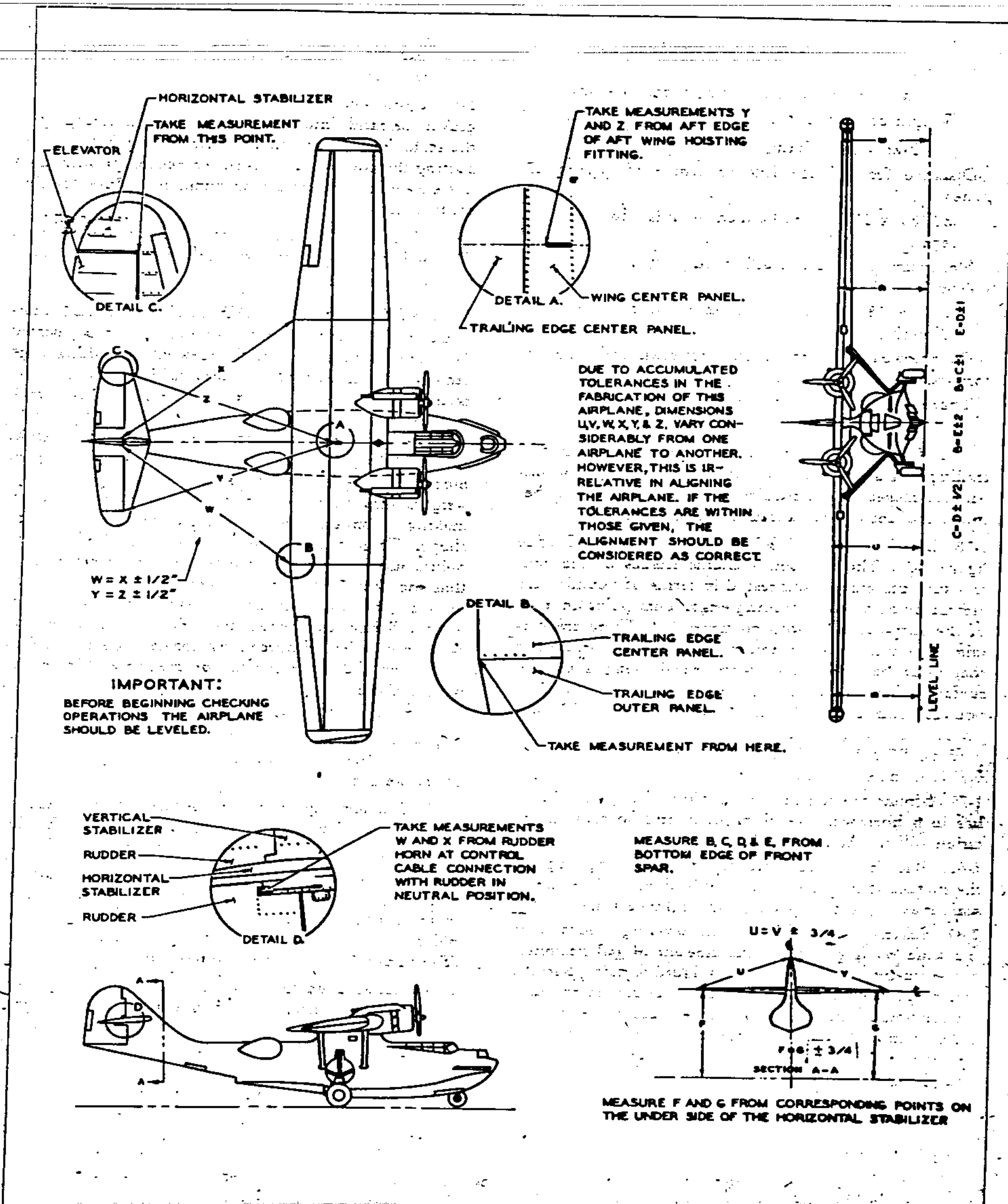


Figure 1-9—Rigging Diagram

EXAMPLE

Assume a repair is made to the trailing edge of the t aileron.

Weight or repair and attaching parts	0.90 lbs.
Weight of parts removed	0.10 lbs.
Net weight change	+0.80 lbs.

Distance from hinge line to center of repair: 25 inches.

.80 lbs. x 25 in. = 20.0 inch pounds added by repair

Maximum allowable trailing edge heavy for port aileron is 18.7 in. lbs.

20.0 − 18.7 = 1.3 in. lbs. excess of maximum allowable

Counterweight to be located approximately 8.5 in. forward of the hinge line.

Therefore $\frac{1.3}{8.5}$ = .15 lbs. weight to be added.

d. If repairs are made on both the leading and trailing edges of a control surface, the amount of unbalance caused by the repairs will be the differences between the unbalance caused by each repair.

1-78. DETERMINING STATIC UNBALANCE. (See figure 1-7.) The tail heavy characteristics of the control surfaces may be expressed in terms of pounds at a certain point on their trailing edge. This point on each the surfaces is located on figure 1-8. There are cer- n minimum and maximum values of tail heaviness that must be adhered to when rebalancing a control surface. These values are as follows: port aileron, 10.35 pounds; starboard aileron, 8.46 pounds; PBY-5 and PBY-5A elevators, 8.0 pounds; PBY-6A elevators, 11.18 pounds; PBY-5 and PBY-5A rudder, 9.72 pounds; and PBY-6A rudders, 11.21 pounds.

1-79. Mount the surface on its hinge fittings so that it lies in a horizontal, level position and so that its rotation will not be restricted.

1-80. Place a balance scale under the trailing edge of the surface at the point indicated in figure 1-8. A spring scale may be used in place of the balance scale.

1-81. Subtract the weight of the leveling blocks from the scale reading. This is the amount of tail heaviness possessed by the surface. If this figure is more than the maximum specified for the surface being balanced, a counterweight must be added to the leading edge. If it is less than the minimum specified a counterweight must be added aft of the hinge line or one removed from the leading edge.

1-82. To determine the amount of counterweight needed, hang a lightweight container from the approximate center of the location at which the counterweight is to be added.

1-83. Drop small weights, such as screws, nuts, nails, gravel, or sand, into the container until the reading of the scale (minus the weight of the leveling blocks) supporting the control surfaces in the neutral position does not exceed the maximum or minimum values for that control surface.

1-84. Remove and weigh the container and its contents. This weight is the minimum amount of counterbalance required.

1-85. SECURING ADDITIONAL COUNTERWEIGHTS. Counterweights should always be located as nearly as possible directly forward of trailing edge repairs and directly aft of nose section repairs. Nose section weights may be in the form of sheet stock formed to suit the contour of the inner skin of the nose section, or may be cut from bar stock (lead, wrought iron, or cast iron). In the use of bar stock, wooden blocks may be cut to fit the inner contour. The bar weights may then be bolted to these wooden blocks, making it unnecessary to machine the metal bars to shape. Weights should not be concentrated at any one point, but should be distributed over a sizable area so that the skin supporting the weight will not be unduly loaded (this will prevent the skin from buckling inward). When an appreciable weight is required, the skin should be reinforced by formed sheet material, riveted to the inner surface of the nose skin in the weighted area.

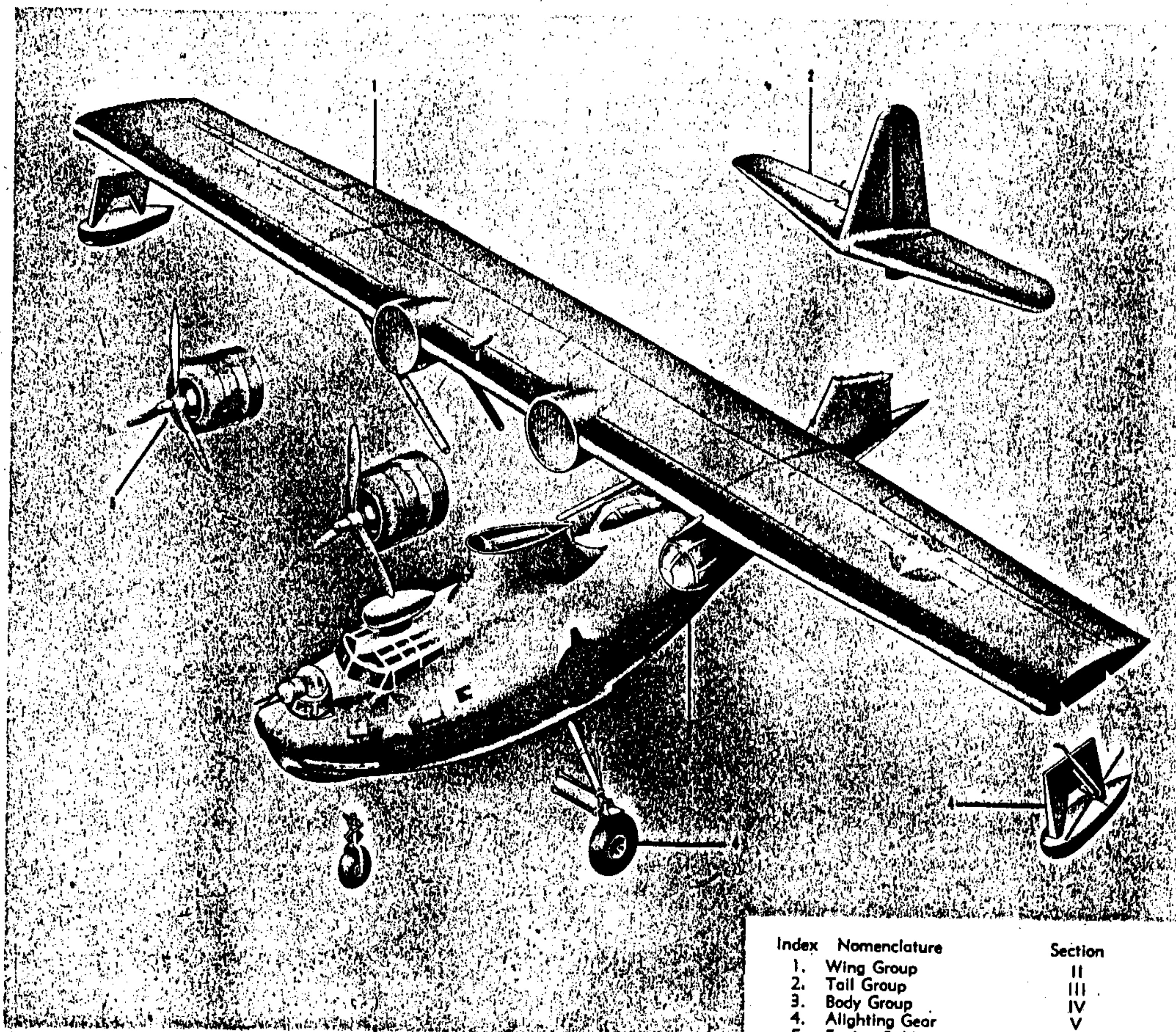
1-86. When it is necessary to add weight to trailing edges, the counterweight should consist of sheet material attached to several ribs, for an even distribution of the weight.

1-87. Counterweights may be secured to the leading edge of the aileron by inserting them through the zippered access doors on the upper surfaces of the aileron.

1-88. When inserting counterweights in the leading edges of the elevators and rudders, cut an access door in the leading edge near the place where the counterweight is to be added and work through this opening. (See figure 2-32 for typical access door.)

1-89. Access openings must be cut in the trailing edge of the control surface when attaching counterweights to the trailing edge. Refer to the General Manual for Structural Repair, AN 01-1A-1, for fabric patching and repair.

★ ★ ★



Index	Nomenclature	Section	Figure
1.	Wing Group	II	2-1
2.	Tail Group	III	3-1
3.	Body Group	IV	4-1
4.	Alighting Gear	V	5-1
5.	Engine & Nacelle	VI	6-1

Figure 1-10—Main Airplane Components

SECTION

Wing Group

II

SECTION II
WING GROUP

2-1. GENERAL.
(See figure 2-1.)

2-2. The wing of the PBY type airplane is a semi-cantilever beam divided into three main assemblies, a center section and two outer panels. The outer panels may be removed from the center section and the center section from the hull if desired, for repair. It is attached to the hull by two bolted wing-hull fittings at the center of the airplane and by four struts bolted at one end to the wing and at the other end to the hull.

2-3. The main structural units of the wing are the front spar, the rear spar, the upper and lower skin-stringer combinations and the bulkheads, all fabricated from aluminum alloy sheet or extruded stock.

2-4. Virtually the entire load of the wing is carried by the inter-spar structure, a small part of the load being carried by the leading edge stringers. The wing is divided into 28 stations, on each side of the center line. The center line of the wing is designated as Station 1. Each station occurs at a bulkhead point, and the bulkhead is often designated by the station number, as "bulkhead 1," or "bulkhead 4½." Most of the bulkheads in the wing are of the truss type fabricated from either extruded angles or zee sections.

2-5. Damage to either spars or plating is usually critical and therefore particular attention should be paid to the repairs outlined and the instructions given in the text for these items.

2-6. The fuel for the PBY is carried in the center section in tanks, termed "integral tanks," which are formed by the spars, upper and lower surfaces, center line bulkheads and one gas tight bulkhead on either side of the wing at Station 5. Repairs to this area require special treatment to insure gas tightness. Neoprene is used as gasket material on all faying surfaces and is shown on most of the repair illustrations. For repairs outside the gas tank area these same repairs may be used simply by omitting the gasket material and changing the gauge of any fillers affected by deletion of the gaskets.

2-7. Location of wing access doors is shown in figure 2-2.

2-8. In making major repairs, the wing should be supported as outlined in Paragraph 1-45.

2-9. If joggling equipment is available many of the repairs given may be greatly simplified by eliminating fillers. Since such equipment is not generally available all repairs have been designed to use fillers. No fillers have been used where the step-offs are less than .030.

2-10. NEGLIGIBLE DAMAGE to the wing structure is discussed under the repair of each component. This type of damage is defined as that damage or distortion which can be permitted to exist as is, or corrected by a simple procedure (removing dents, stop drilling cracks, temporary fabric patching, etc.) without placing restrictions on flight.

2-11. The wing is divided into three classes of structure according to structural function:

a. Skin-stringer, spar flanges; carrying wing bending loads.

b. Front and rear spar webs and stiffeners, carrying shear load.

c. Bulkheads; carrying air loads from the surfaces to the spars.

2-12. Negligible damage has been computed on the assumption that each class is structurally independent of the others in performing its function. Maximum negligible damage in one class may therefore exist simultaneously with maximum negligible damage in the other classes.

2-13. PLATING.
(See figure 2-3.)

2-14. GENERAL. The wing plating consists of 24ST aluminum alloy and alclad skin mounted on 24ST extruded zee stringers. (See figure 2-4.) The upper and lower plating from the center line of the airplane to station 5 on each side form part of the integral fuel tanks. The skin in this area is 24ST Alclad. A large fuel cell access door in the upper surface plating forms an integral part of the structure.

WARNING

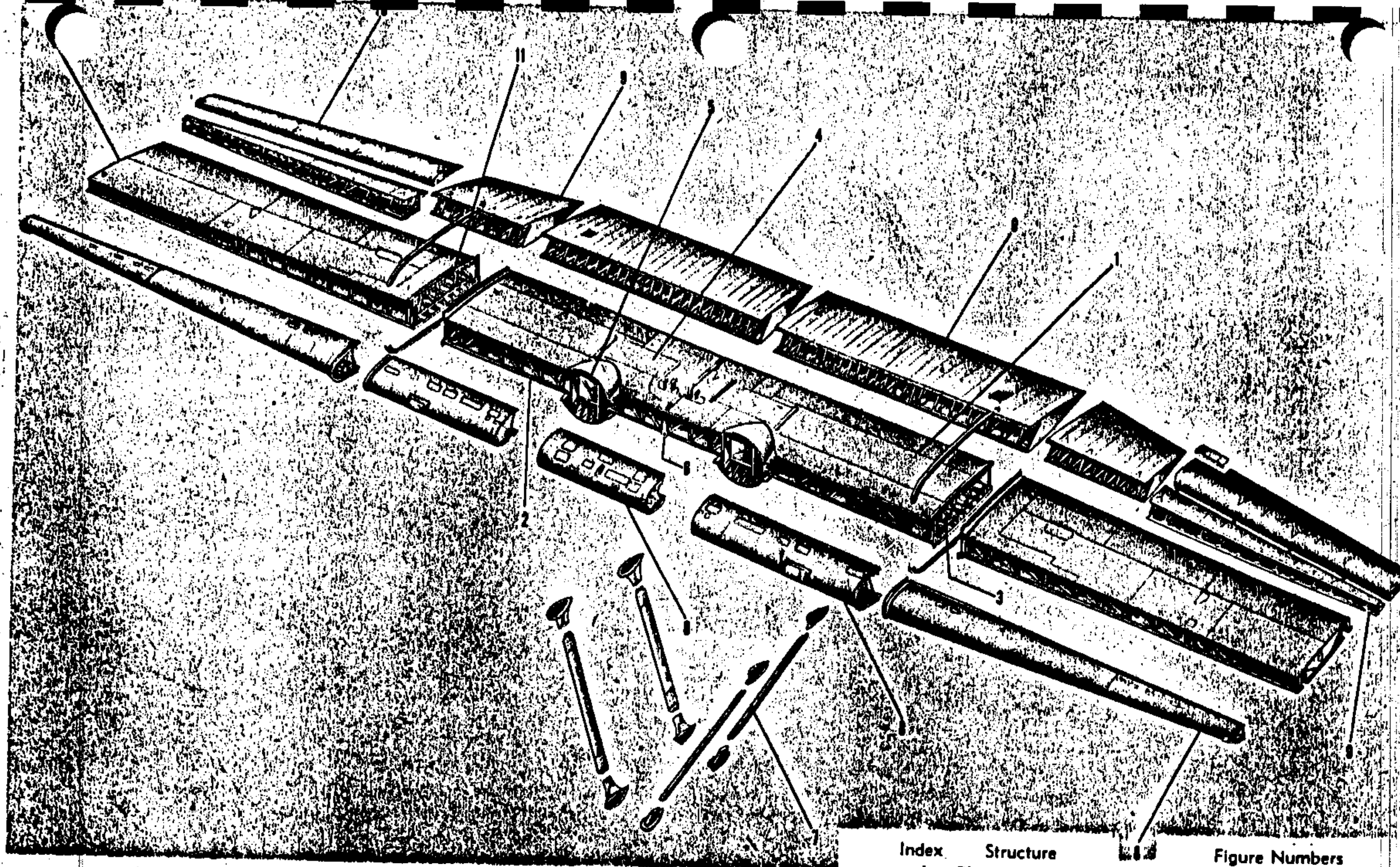
The fuel cell access door and the fuel cell manifold access doors on the lower surface (See figure 2-2, index Nos. 66, 67, 68, 70, 71, 72, 23.) carry load and must be repaired like any other area of plating.

2-15. NEGLIGIBLE DAMAGE. (See figure 2-5.)

2-16. The wing skin-stringer combinations and the spar flanges are structurally interdependent in that damage to one member may cause failure of another member some distance away. The combination of small individual damages in different parts of the wing may also cause failure even though the individual damage would be considered negligible if it existed alone. A method for determining whether the damage is negligible is outlined in the following paragraphs and illustrated in figure 2-5.

2-17. In considering negligible damage in the wing center section, the following points must be borne in mind:

a. No damage resulting in a crack or break in the plating in the fuel tank area can be considered negligible if gas leaks would develop therefrom. If fuel cells are used this same damage might be considered



Index	Structure	Figure Numbers
1.	Plating	2- 2 to 2-10 incl. and 2-35
2.	Spars	2-11 to 2-15 incl.
3.	Bulkheads	2-16 to 2-19 incl.
4.	Integral Fuel Tank	2-13, 2-17
5.	Nacelle	2-20 to 2-22 incl.
6.	Wing-Hull Attachment	2-23, 2-24
7.	Struts & Strut Attachment	2-25, 2-26
8.	Leading Edges	2-27, 2-28
9.	Trailing Edges	2-29 to 2-32 incl.
10.	Ailerons	2-29, 2-30, 2-31, 2-33
11.	Panel Splice	2-34, 2-35

Figure 2-1—Main Wing Components

negligible—however, it must be repaired if the area is subsequently used as an integral tank.

b. Damage may not be considered negligible if two adjacent stringers or the spar flange and the adjacent stringer are damaged.

c. Damage to skin cannot be considered negligible if it extends over two adjacent stringers, over the spar flange and adjacent stringer or over a distance exceeding the stringer spacing in the damaged area.

d. Damage may not be considered negligible if its extent spanwise exceeds the stringer spacing in that area.

e. Isolated nicks in stringers which affect less than ½ of the outstanding leg may be considered negligible provided they are smoothed out (See figure 2-6.)

2-18. METHOD OF DETERMINING NEGLIGIBLE DAMAGE. Before the following formulas for determining negligible damage can be used, steps a, b, c, and d above must be reviewed. If any of these conditions exist repairs must be made to eliminate them.

Note

All damage is measured in inches in the chordwise direction.

a. (See figure 2-5.) In using the formulas consider all damage within a 24" spanwise bay.

b. Check the spar flange damage. If any of the damage, measured in inches in the chordwise direction, exceeds the figures given in the chart on figure 2-5, such damage must be repaired before using the formulas.

Note

Figures for the extent of damage must be based on "cleaned up" damage.

c. Determine the total measurement of all damage to the spar flanges.

d. Determine the total measurement of all damage to the skin (upper and lower surface).

e. Count the number of completely damaged stringers.

Note

When a stringer is completely damaged, the skin damage over that stringer must be taken as the sum of the distances from the damaged stringer to each adjacent stringer (or spar flange) divided by two, regardless of whether the skin is actually damaged to that extent or not.

f. Multiply each of the totals, c, d and e by their respective factors given in the equation for the region in which the damage occurs, and add the results.

g. If the sum is equal to or less than the number on the right side of the equation, damage is negligible.

h. If the sum exceeds the figure given on the right side of the equation, the damaged areas will have to be repaired one by one until the condition of step g is obtained.

2-19. FORMULAS FOR DETERMINING NEGLIGIBLE DAMAGE.

a. LOCATION: STATION 1 to STATION 3
FORMULA: $8A + 2B + 8C + 9D \leqq$ (equal to or less than) 60

CODE: A = Total Spar flange damage
B = Total Skin damage
C = Total number of damaged lower surface stringers
D = Total number of damaged upper surface stringers

Note

Damage in the area of the spar flanges that affects two layers of skin must be figured as double the normal damage in the above equation.

Damage to the skin, stringers and tapping strip of the leading edge, or the tapping strip of the trailing edge may be considered negligible between stations 1-4.

Holes through the leading edge skin must be temporarily patched with either fabric or metal.

b. LOCATION: STATION 3 to STATION 4
FORMULA: $12A + 7A_1 + 2B + 8C + 9D \leqq 60$

CODE: A = Total Front Spar Damage
A_1 = Total Rear Spar Damage
B = Total Skin damage
C = Total Number of damaged lower surface stringers
D = Total Number of damaged upper surface stringers

Note

Damage in the area of the spar flanges that affects two layers of skin should be figured as double the normal damage in the above equation.

c. LOCATION: STATION 4 to STATION 12
FORMULA: No negligible damage permitted other than that defined under paragraph 2-10.

d. LOCATION: STATION 12-STATION 15
FORMULA: $7A + 2B + B_1 \leqq 10$,

CODE: A = Total Spar flange damage
B = Total damage in .040 and .064 skin
B_1 = Total damage in .025 and .030 skin

WARNING

No damage to stringers can be considered negligible in this area.

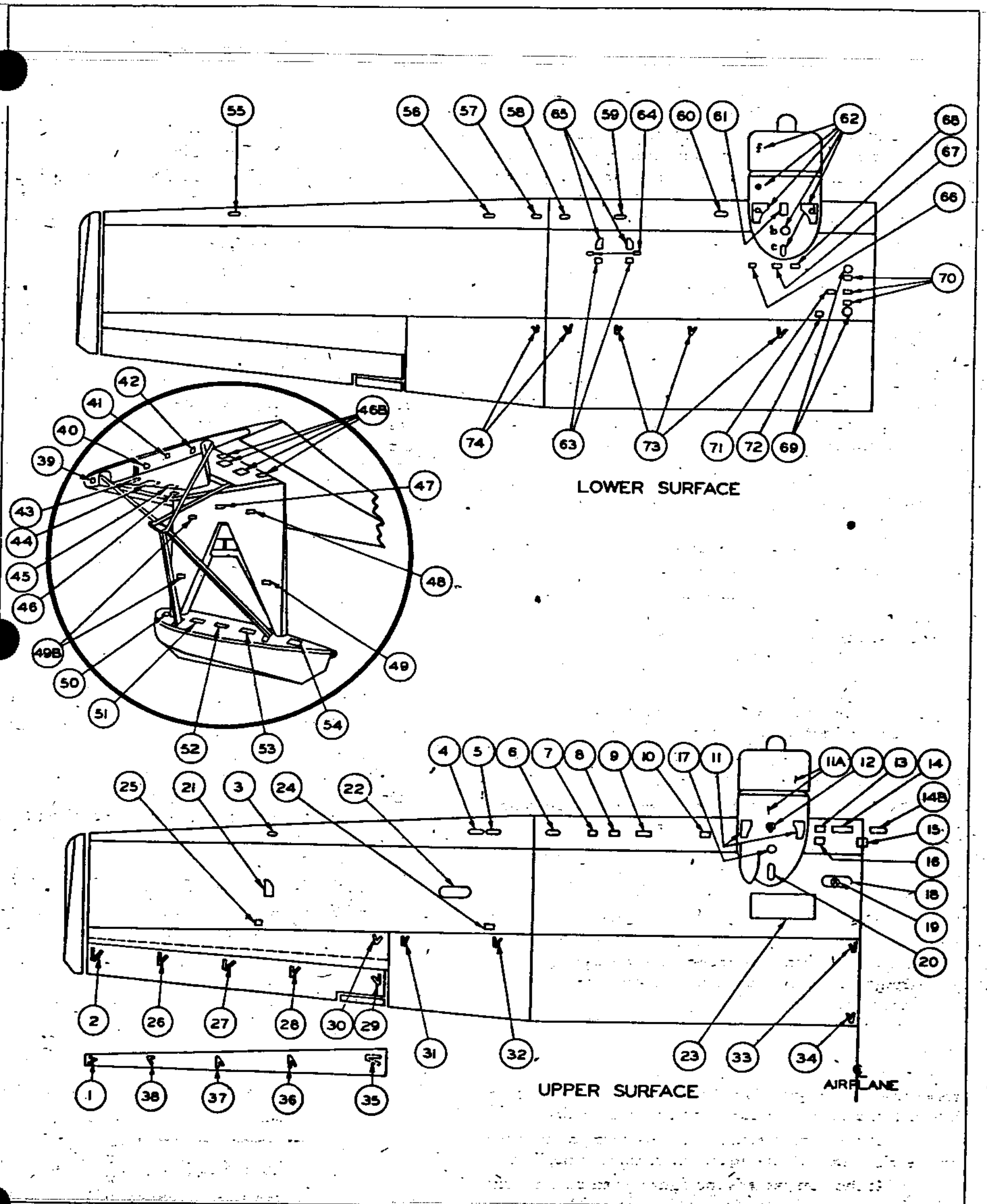


Figure 2-2 (Sheet 1 of 2 Sheets)—Wing Access Doors

1. Access to Attachments of Aileron Cut-Out.
2. Access to Aileron Hinge.
3. Access to Float Control Gear Box.
4. Access to Leading Edge.
5. Access to Leading Edge.
6. Access to Anti-Icing Splice, Wing Splice, Float Torque Tube Linkage, Pitot Static Tube Wire Attachment, and Bomb Rack Cable Pulley.
7. Access to Landing Light Wire Attachment and to Bomb Release Cable Pulleys.
8. Access to Cable Splice Plate, to Anti-Icing Duct, and to Bomb and Torpedo Control Cables.
9. Access to Cable Attachment Plate, Pulley and Fair-Leads, and to Bomb and Torpedo Controls.
10. Access to Anti-Icing Duct Connections and to Bomb and Torpedo Rack Cable Attachments.
11. Access to Engine Emergency Starter Handle, Anti-Icing Door Actuating Motor, and Anti-Icing Duct Connection.

11A. Nacelle Fairing Access Doors.

12. Oil Filler Neck.
13. Access to Battery.
14. Port Side Only: Access to Fuel Hose, Pipe Lines and Attachments, Cables, Fair-Leads, and Pulley Brackets at Superstructure Intersection.

14B. Starboard Side Only: D-C Generator Junction Box.

15. Access to Junction Box.
16. Access to Landing Light Relay Engine Terminal.
17. Access to Oil Tank Attachment Points and Structural Inspection.
18. Fuel Tank Manhole.
19. Fuel Filler Neck.
20. Structural Inspection Door.
21. Access to Float Control Gear Box, Float Lock, and Recoil Mechanism.
22. Manhole to Wing Splice.
23. Access to Fuel Tank.
24. Access to Aileron Idler and Turnbuckle.
25. Access to Aileron Bell Crank.
26. Access to Aileron Hinges.
27. Access to Aileron Hinges.
28. Access to Aileron Hinges.
29. Access to Aileron Tab Linkage, Tab Actuating Arm, and Aileron Pivot Bearing.
30. Port Side Only: Access to Aileron Tab Linkage, Tab Gear Box, and Sprocket.
31. Access to Aileron Tab Chain-to-Cable Bolt Connections.
32. Access to Connection of Aileron Push-Pull Tube to Idler.
33. Access to Aileron Controls.
34. Access to Trailing Edge Splicing.
35. Starboard Side Only: Attachment of Aileron Cut-Out to Stubby Trailing Edge.
36. Access to Attachments of Aileron Cut-Out.
37. Access to Aileron Cut-Out and Aileron Actuating Arm Attachments.
38. Access to Attachments of Aileron Cut-Out.
39. Running Light Flex Coupling and Leading Edge Inspection.
40. Port Side Only: Float Micro Switch Installation.
41. Access to Float UP Lock and Cable; on Starboard Side Only: Access to Recognition Lights Flex Couplings and Junction Box.
42. Antenna Mast Attachment.
43. Port and Starboard Sides: Junction Box for Running Light, Anchor Light, Formation Light; Starboard Side: To Recognition Lights and two Micro Switches.
44. For Conduit and Structural Inspection.
45. Port Side Only: Access to Float "Down" Micro Switch Mounts.
46. For Structural Inspection.

46B. Access Doors Opposite 43, 44, 45, and 46.

47. Structural Inspection Openings.
48. Structural Inspection Openings.
49. Structural Inspection Openings.
50. Structural Inspection Openings.
51. Structural Inspection Openings.
52. Structural Inspection Openings.
53. "Vee" Strut Attachment and Access to Drain Hole Pipe and Structural Inspection.
54. "Vee" Strut Attachment and Structural Inspection of Watertight Compartment.
55. Access to Float Control Gear Box.
56. Access Door to Wing Line Fitting.
57. Access to Float Torque Tube.
58. Access to Float Torque Tube.
59. Access Door to Landing Light Wires.
60. Port Side Only: Access to Pitot Tube Lines and Brackets. Port and Starboard Sides: Leading Edge and Lower Anti-Icing Duct Inspection.
61. Access to Engine Heater.
62. Nacelle Fairing.
63. Access to Bomb Release.
64. Access to Bomb Rack MK 51-7.
65. Access to Bomb Nose and Tail Fusing.
66. Fuel Cell Manifold Access Doors.
67. Fuel Cell Manifold Access Doors.
68. Fuel Cell Manifold Access Doors.
69. Sight Gage Inspection Access Doors.
70. Fuel Cell Manifold Access Doors.
71. Fuel Cell Manifold Access Doors.
72. Fuel Cell Manifold Access Doors.
73. Access to Aileron Controls. (The first from left also gives access to anti-icer exhaust duct connection.)
74. Access to Wing Splice.

Figure 2-2 (Sheet 2 of 2 Sheets)—Wing Access Doors

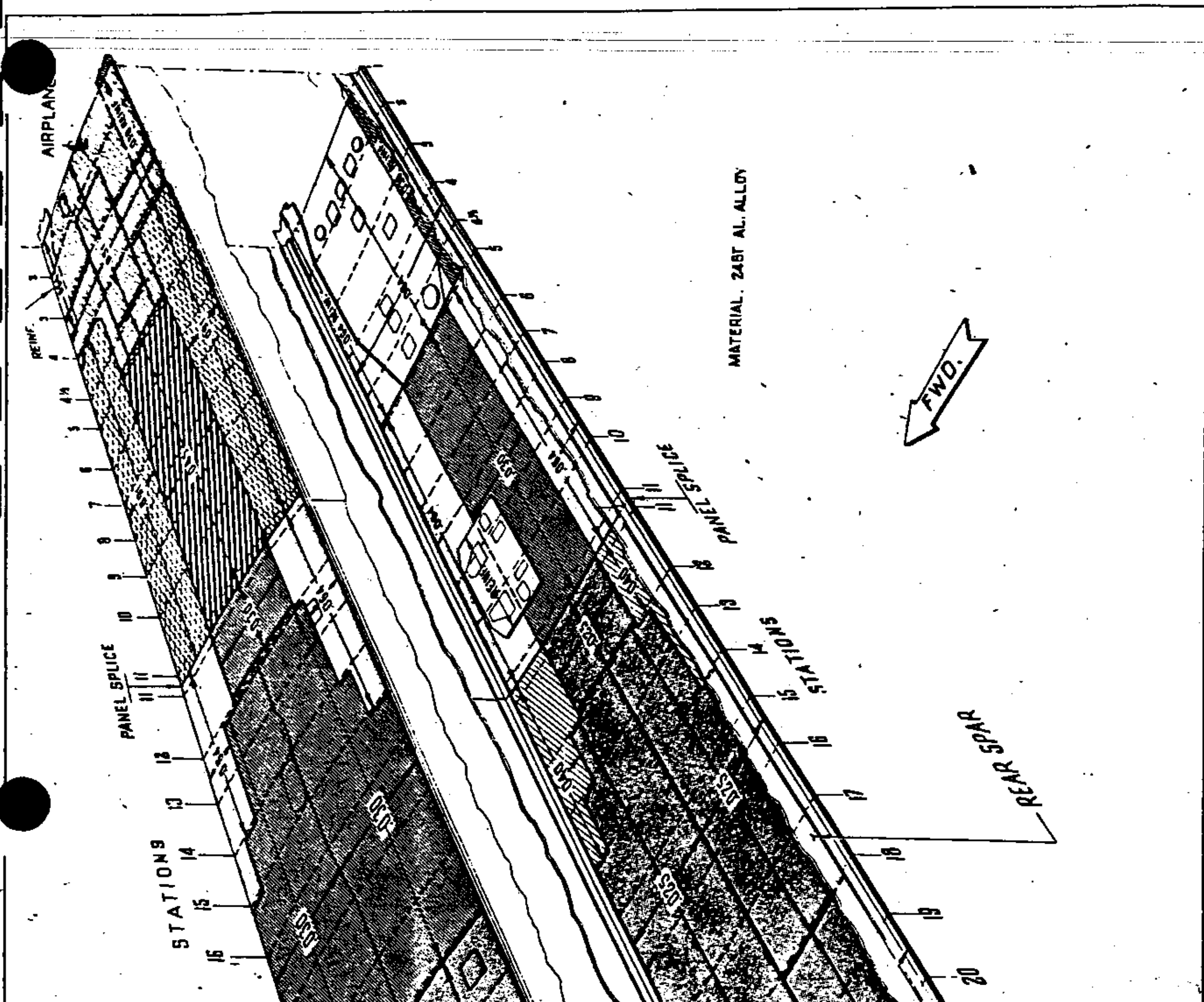
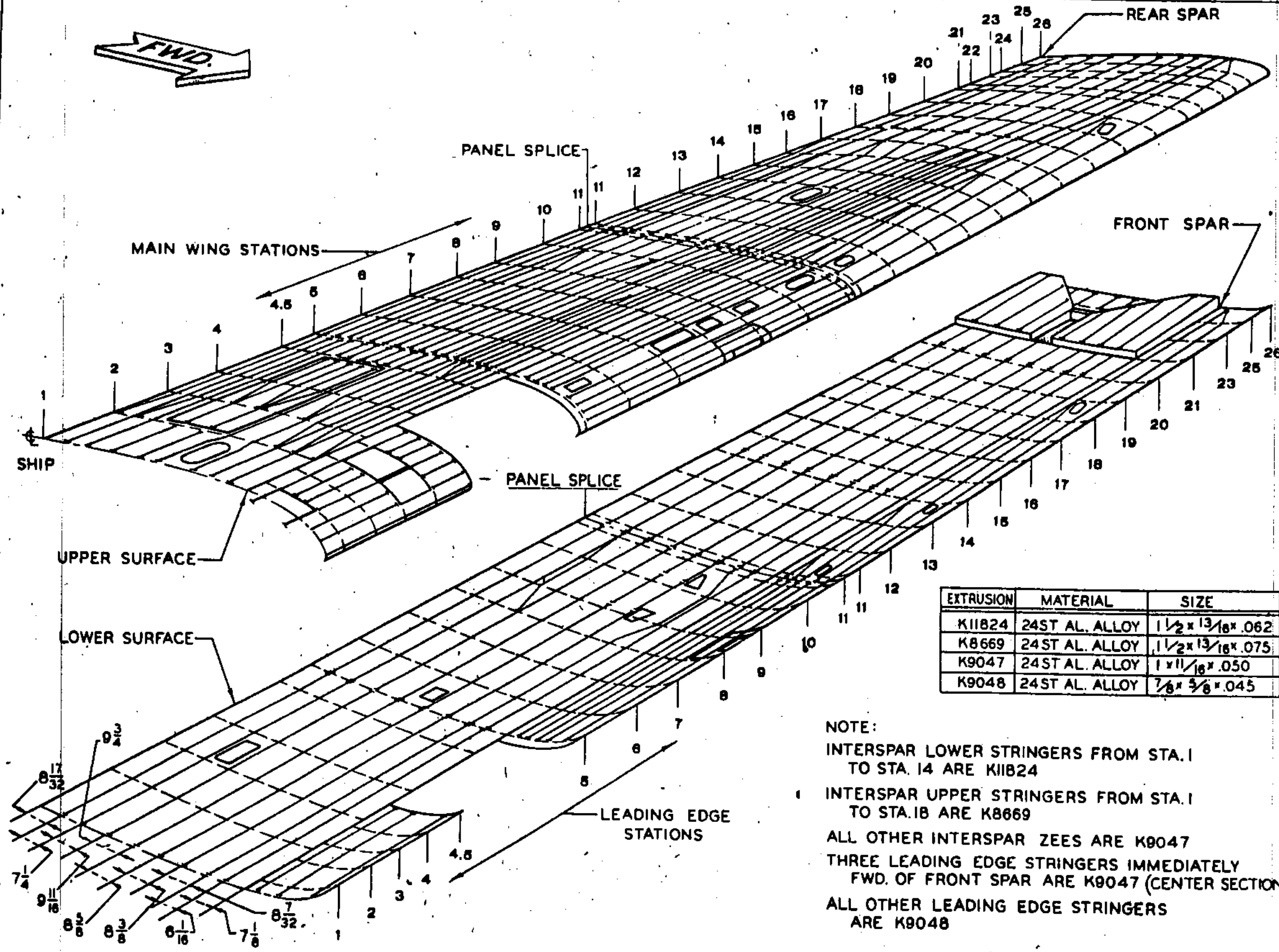


Figure 2-3—Wing Plating Diagram



EXTRUSION	MATERIAL	SIZE
K11824	24ST AL. ALLOY	$1\frac{1}{2} \times \frac{13}{16} \times .062$
K8669	24ST AL. ALLOY	$1\frac{1}{2} \times \frac{13}{16} \times .075$
K9047	24ST AL. ALLOY	$1 \times \frac{11}{16} \times .050$
K9048	24ST AL. ALLOY	$\frac{7}{8} \times \frac{5}{8} \times .045$

NOTE:

INTERSPAR LOWER STRINGERS FROM STA. I TO STA. 14 ARE K11824

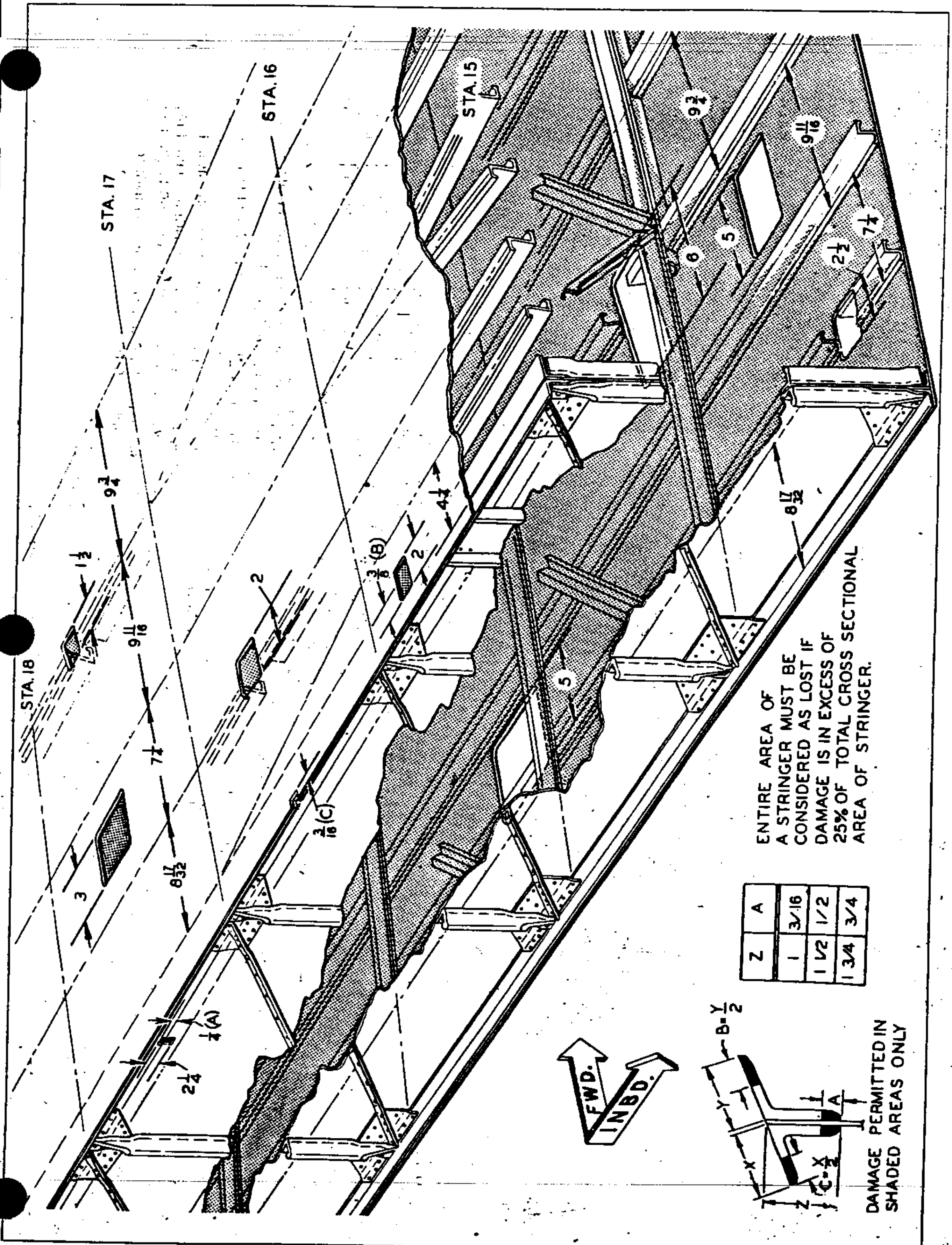
INTERSPAR UPPER STRINGERS FROM STA. I TO STA. 18 ARE K8669

ALL OTHER INTERSPAR ZEES ARE K9047

THREE LEADING EDGE STRINGERS IMMEDIATELY FWD. OF FRONT SPAR ARE K9047 (CENTER SECTION)

ALL OTHER LEADING EDGE STRINGERS ARE K9048

Figure 2-4—Wing Stringer, Diagram



Z	A
1	3/16
1 1/2	1/2
1 3/4	3/4

Figure 2-5—Wing Plating-Negligible Damage

e. LOCATION: STATION 15-STATION 18
FORMULA: $5A + B + 4C + 8D \leqq 42$
CODE: A = Total Spar flange damage
B = Total Skin damage
C = Total number of damaged lower surface stringers
D = Total number of damaged upper surface stringers

f. LOCATION: STATION 18-STATION 21
FORMULA: $10A + 2.5B + 11C \leqq 100$
CODE: A = Total Spar flange damage
B = Total Skin damage
C = Total number of upper and lower surface stringers completely damaged

g. STATION 21-STATION 26—No negligible damage permitted other than that defined under paragraph 2-10.

2-20. HOW TO USE THE FORMULAS. Refer to figure 2-5 which shows damage to the wing between station 15 and station 18. To determine if the damage in this area is negligible the formula in paragraph e above will be used.

a. Since the formula covers all damage in a 24" spanwise bay consider the damage between station 16 and 17. The damage consists of a damaged stringer and a 6" hole in the lower surface, a two inch hole and a damaged stringer in the upper surface skin, a 3/16 inch notch in the upper surface spar flange, and a 5" hole in the lower surface skin.

b. Check the spar flange damage with the table on figure 2-5. From station 14-18 the allowable C dimension for the upper spar flanges is 1⅜". The damage is 3/16" and therefore within the allowable.

Note

If the spar flange damage exceeds the allowable damage, such damage would have to be repaired, and then not considered in the formula.

c. A check reveals that no two adjacent stringers are damaged.

Note

If two adjacent stringers are damaged one stringer must be repaired. Only one damaged stringer would then be considered in the formula.

d. Further checking shows that none of the skin damage extends over two adjacent stringers.

Note

Skin damage extending over 2 adjacent stringers is not negligible and must be repaired. When repaired it is of course not considered in the formula.

e. Check to see that the spanwise extent of the damage does not exceed twice the stringer spacing in that area.

Note

Spanwise damage exceeding the stringer spacing in that area must be repaired.

f. The formula for figuring negligible damage between stations 15 and 18 is $5A + B + 4C + 8D \leqq 42$. A, the total spar flange damage, is, from inspection of the illustration, 3/16. B, the total skin damage is found as follows: The chordwise extent of the hole in the upper surface is 2" but since the stringer below this skin hole is cut the damage must be calculated as $\frac{7.250}{2} + \frac{8.531}{2}$ or 7.89". (See paragraph 2-18e.) The hole in the lower surface skin at Station 16 also cuts out a stringer so the same procedure is used for calculating the skin damage: $\frac{9.75}{2} + \frac{9.6875}{2} = 8.719"$. The damage to the lower surface skin immediately outboard of Station 17 does not damage any stringer, therefore the extent of this damage may be taken as 5". The total skin damage then, is found by adding these three figures: 8.719 + 7.89 + 5 or 21.609.

The total number of damaged lower surface stringers is 1, therefore C = 1.

The total number of damaged upper surface stringers is also 1, therefore D = 1.

Substitute these values in the formula:

$$5A + B + 4C + 8D \leqq 42$$
$$5 \times 3/16 + 21.609 + 4 \times 1 + 8 \times 1 \leqq 42$$
$$34 < 42$$

2-21. It may be assumed therefore that the damage which occurred in the 24" bay under consideration is negligible. If the left hand side of the equation had totaled more than 42 some of the damage would had to have been repaired to bring the total to less than 42. From the result of the above calculations it appears that the quickest way to bring down the total would have been to repair some skin damage which accounted for most of the total.

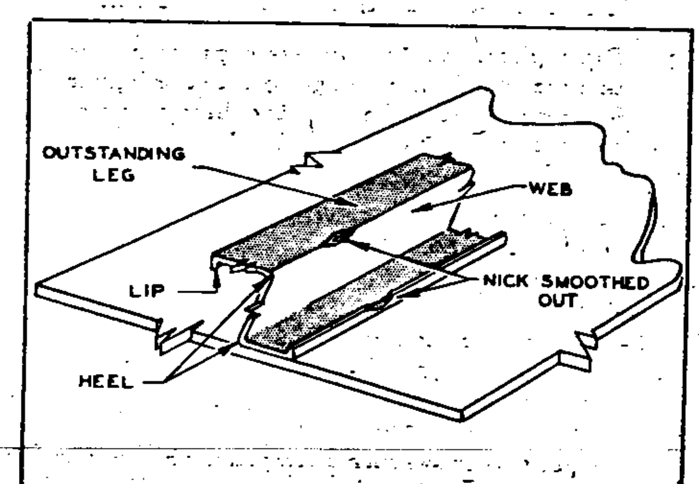
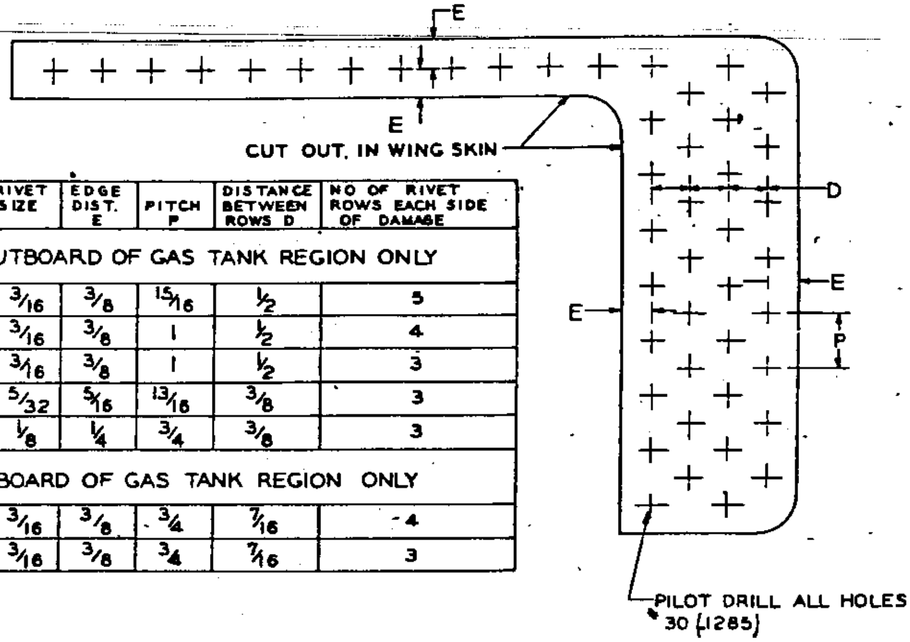


Figure 2-6—Stringer Nomenclature



CHORDWISE

SKIN GAGE	RIVET SIZE	EDGE DIST. E	PITCH P	DISTANCE BETWEEN ROWS D	NO OF RIVET ROWS EACH SIDE OF DAMAGE
OUTBOARD OF GAS TANK REGION ONLY					
.091	3/16	3/8	15/16	1/2	5
.064	3/16	3/8	1	1/2	4
.051	3/16	3/8	1	1/2	3
.045 .040	5/32	5/16	13/16	3/8	3
.030 .025	1/8	1/4	3/4	3/8	3
INBOARD OF GAS TANK REGION ONLY					
.091	3/16	3/8	3/4	7/16	4
.064 .051	3/16	3/8	3/4	7/16	3

NOTES:
1-TO FACILITATE LAYOUT OF RIVET PATTERNS FOR PATCHING WING SKINS FABRICATE A TEMPLATE AS SHOWN FOR EACH SKIN GAGE SHOWN TO CORRESPOND TO THE INFORMATION GIVEN IN TABLE ABOVE.
2-SPOT RIVETS ON TWO SIDES OF DAMAGED AREA THRU PILOT HOLES AND THEN ROTATE TEMPLATE 180° AND LOCATE HOLES ON REMAINING TWO SIDES.
3-THE EDGES OF THE SKIN CUT SHOULD CORRESPOND TO THE INSIDE EDGE OF THE TEMPLATE. THE PATCH PLATE OVERLAP IS DETERMINED FROM THE OUTSIDE EDGES OF THE TEMPLATE.
4-DETERMINE THE NUMBER OF ROWS OF RIVETS NEEDED FOR SKIN GAGE:
a-CUT PATCH PLATE TO SIZE.
b-DRILL WING SKIN & PATCH PLATE.
c-RIVETS IN ACCORDANCE WITH TABLE.

Figure 2-7—Template for Determining Rivet Patterns

2-22. DAMAGE REPAIRABLE BY PATCHING. Damage to wing plating is usually repaired by patching. The presence of external patches on the wing will not materially affect the performance of the airplane and such a repair presents the simplest method of repairing damage.

Note

Patch plates may be the same gauge as the skin they patch except in gauges .032 or lighter it is recommended that the next heavier gauge be used to facilitate riveting.

2-23. Since most of the load carried by the skin is in a spanwise direction all patches will have a multiple row rivet pattern through the chordwise edges of the patch plate and a single row of rivets along the length of the patch.

2-24. In order to simplify patching the wing skin, a template can be designed which by varying the number of rivet rows and the diameter of the rivets, can be used for any given locale.

2-25. Figure 2-7 shows such a template. The code on the drawing indicates what rivet pattern is to be used in any given area. The single row of rivets along the sides of the template must always run in a spanwise direction i.e. parallel to the stringers. Patches in the fuel tank area should be used with a neoprene gasket to insure gas tightness. Patches outside the fuel tank area need not be used with a gasket. Typical patch repairs to the wing plating are shown in figures 2-8 and 2-9.

2-26. The template may be used on large holes merely by spotting as many rivet pilot holes as the template carries and then lining up the template with the holes just spotted and repeating the process.

CAUTION

When using the template in the fuel tank area on large holes, the rivet pattern on the end of the template may have to be varied to insure gas tight spacing i.e. a spacing of not more than 5/8" between the end and side rivets.

2-27. DAMAGE REPAIRABLE BY INSERTION. When a large section of plating is repaired by cutting away the damaged area and replacing it with a new piece of sheet using one or more of the original splices,

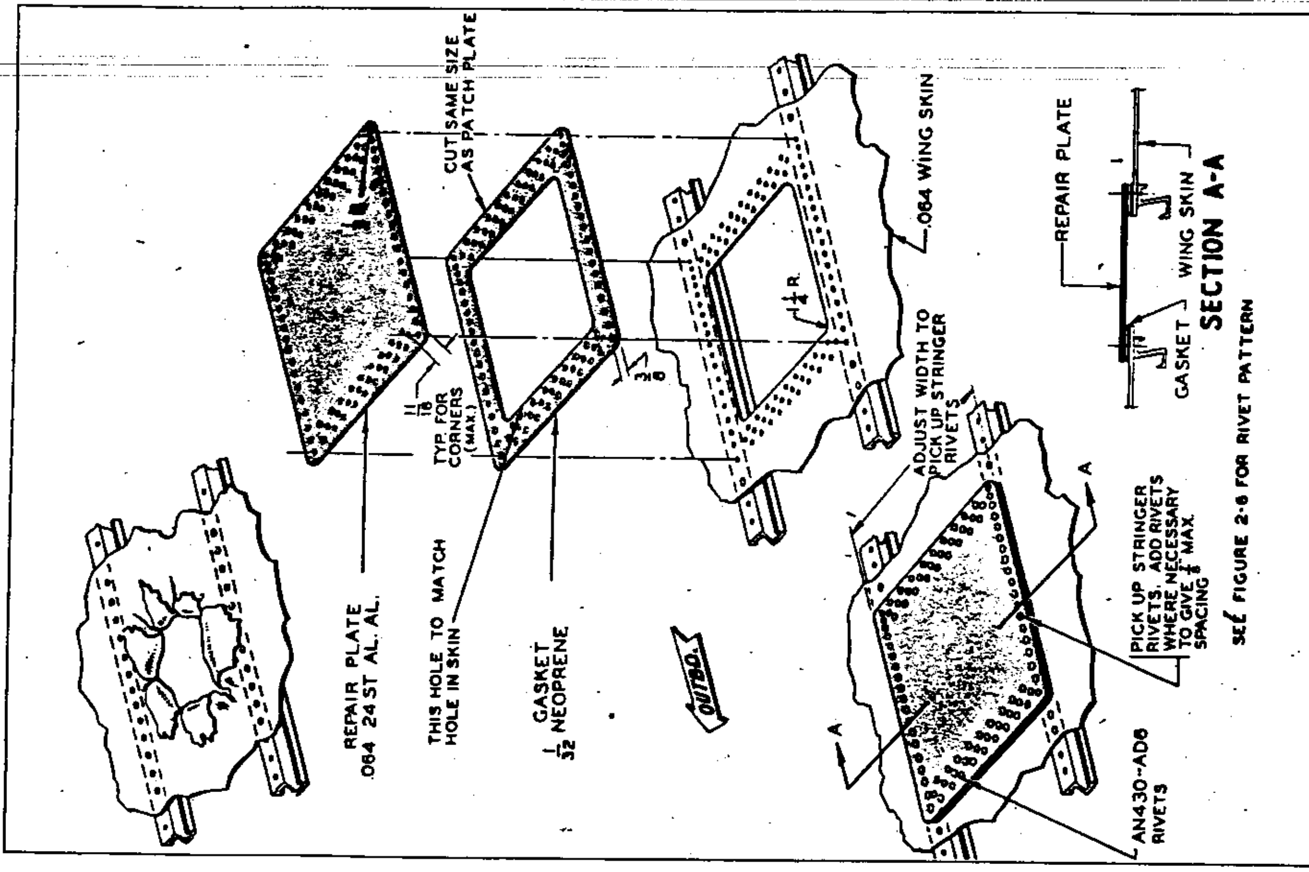


Figure 2-9—Typical Wing Skin Patch

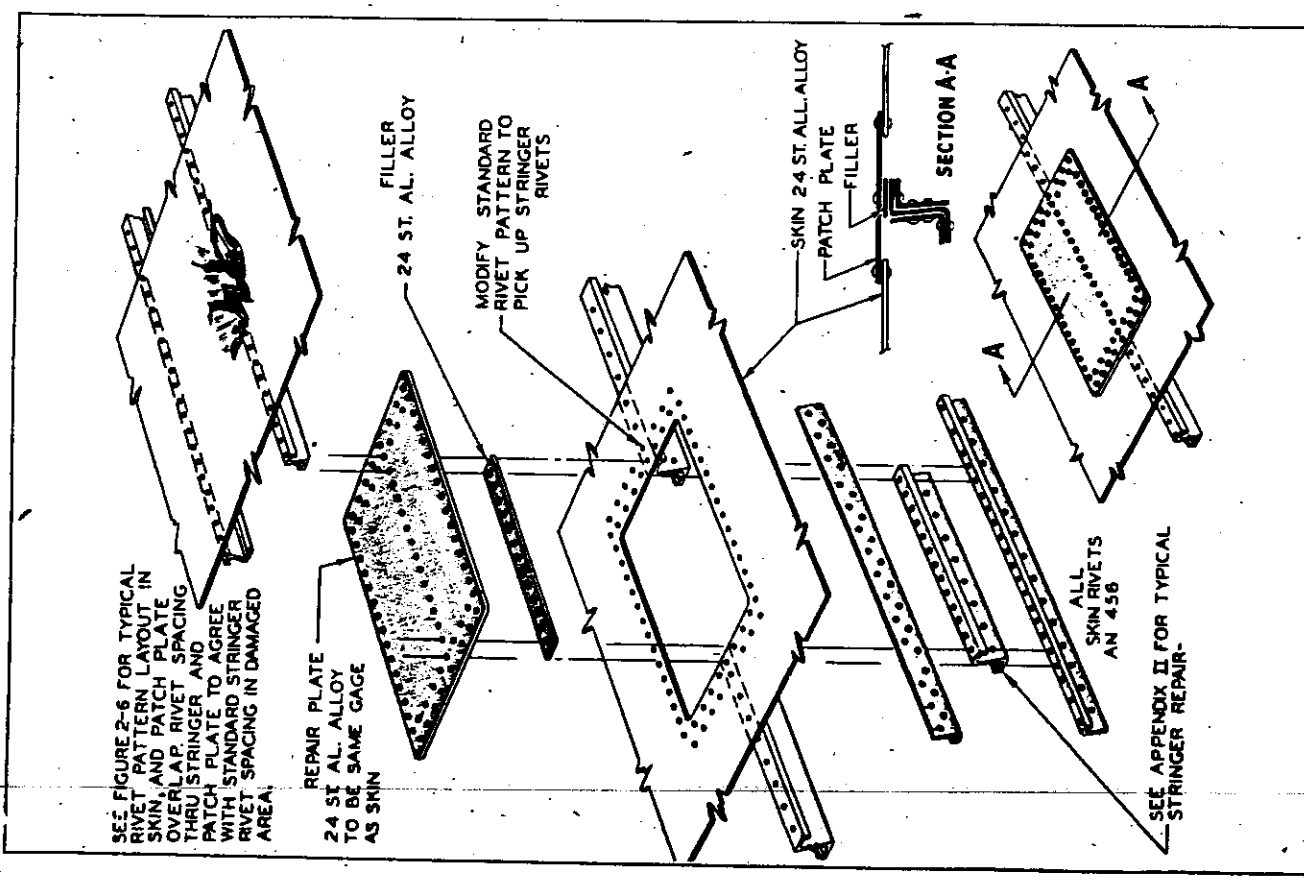


Figure 2-8—Wing Skin Patch-Stringer Damaged

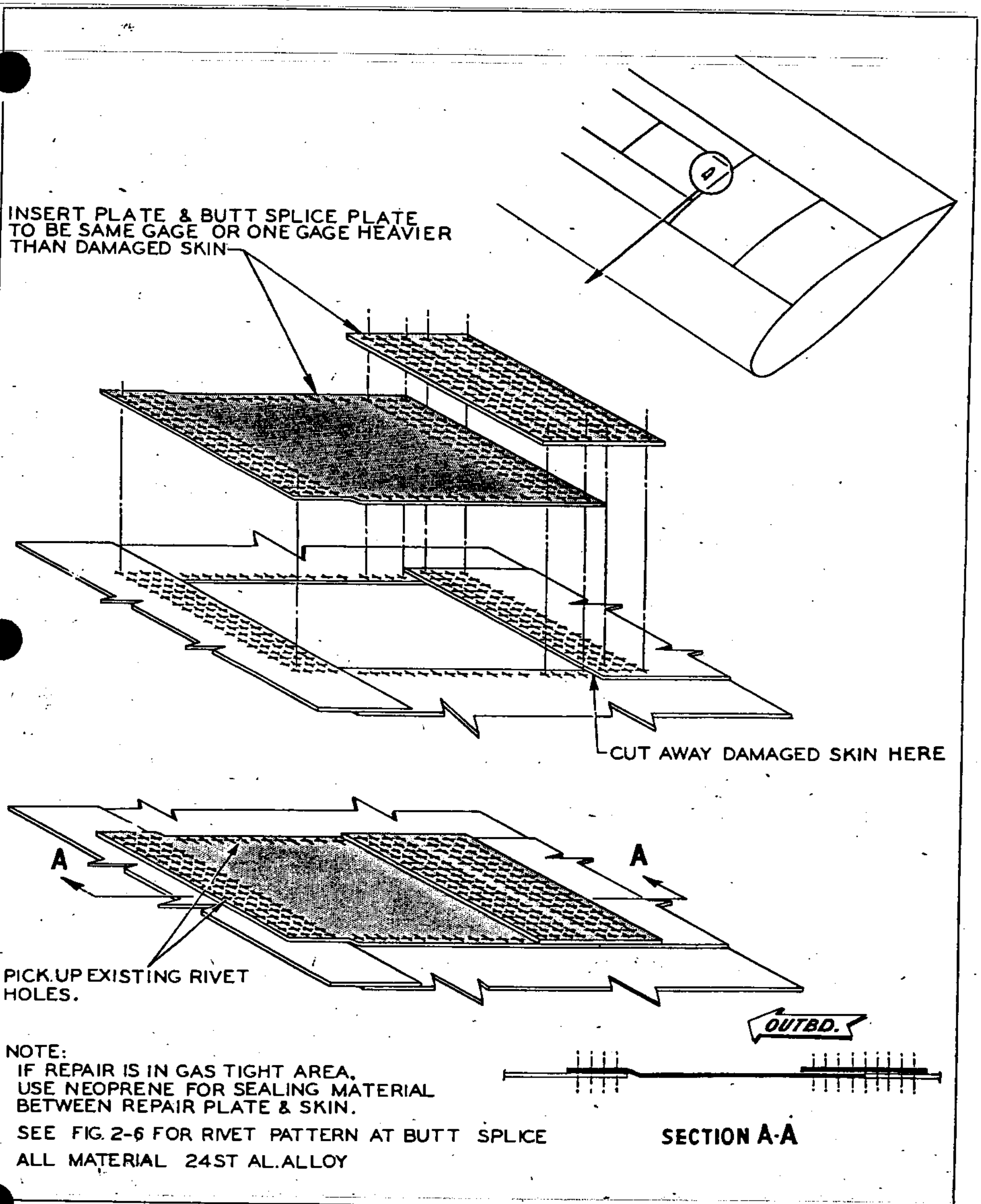


Figure 2-10—Wing Skin Insertion Repair

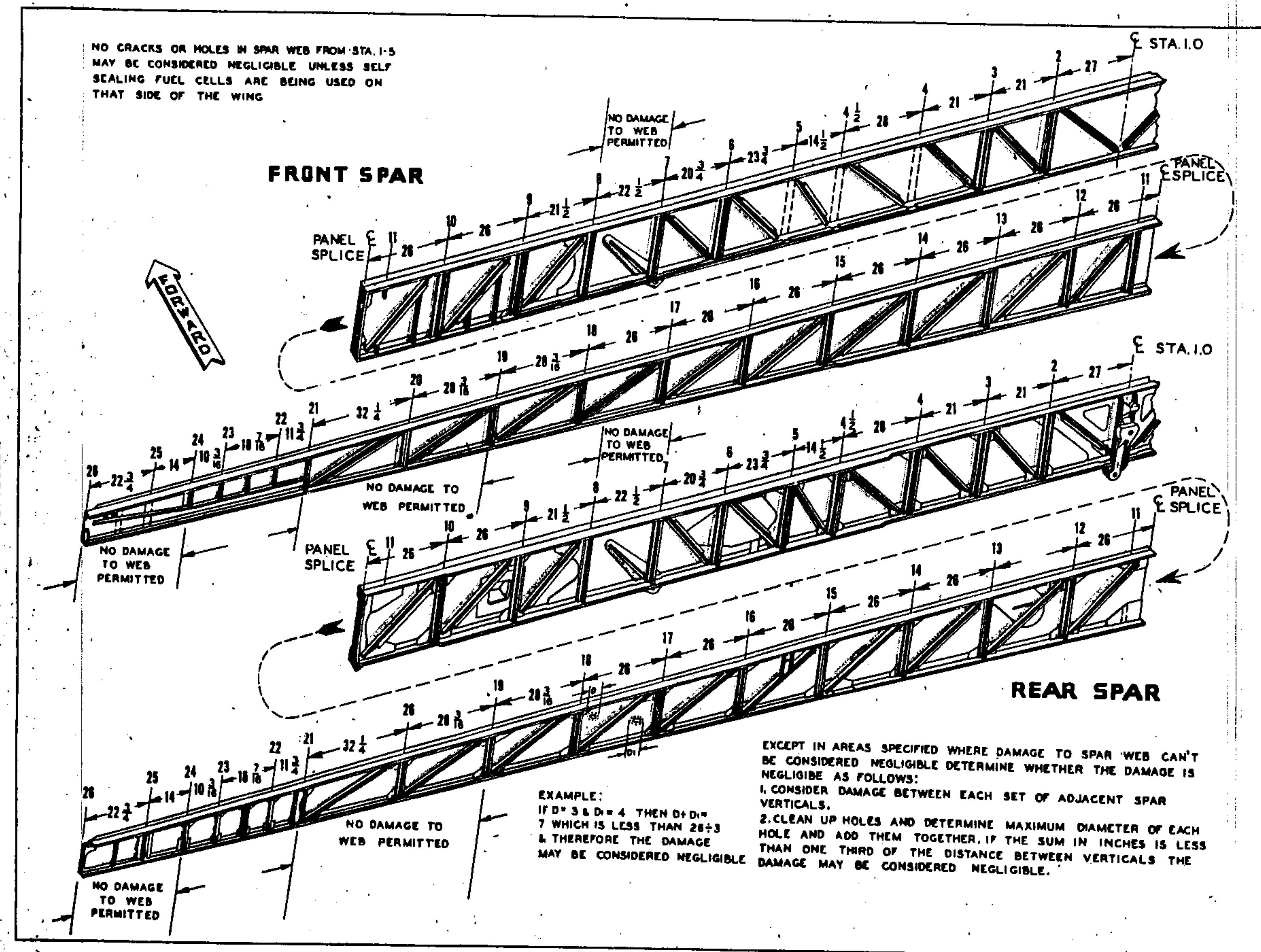


Figure 2-11—Spars-Negligible Damage

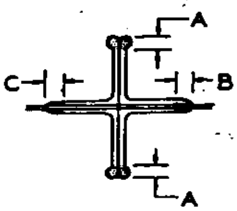
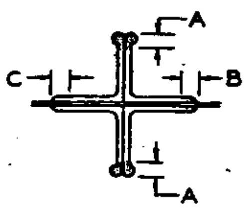
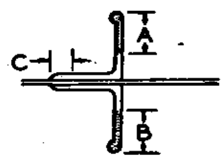
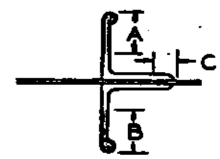
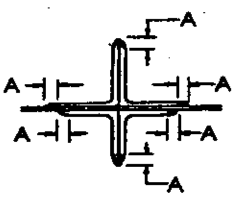
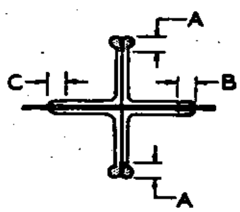
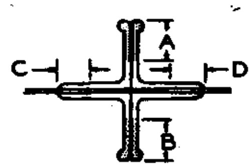
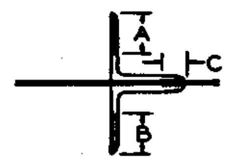
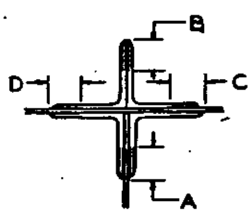
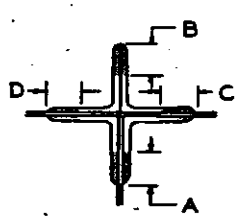
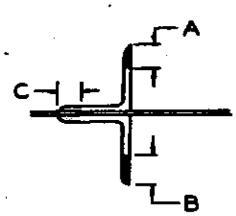
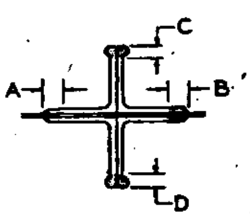
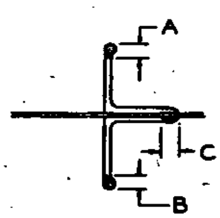
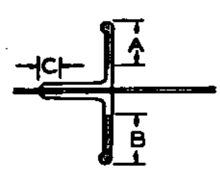
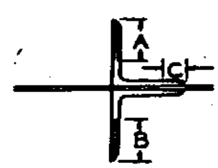
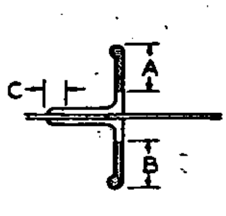
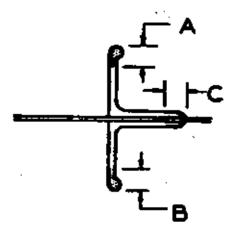
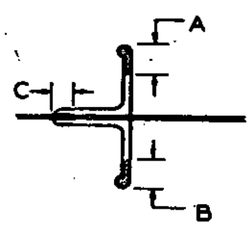
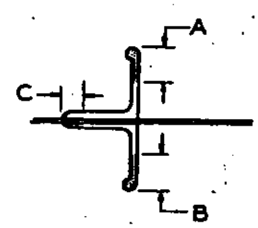
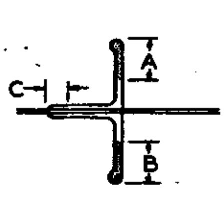
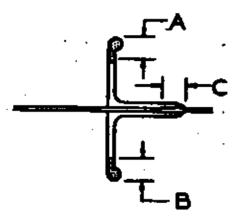
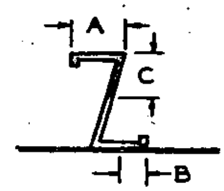
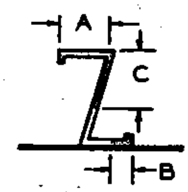
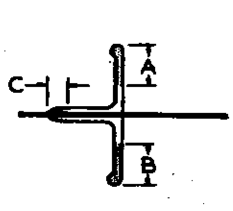
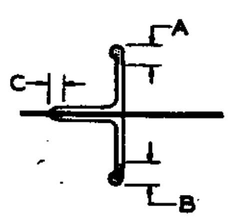
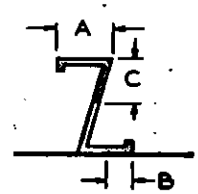
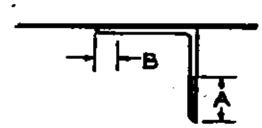
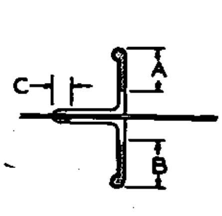
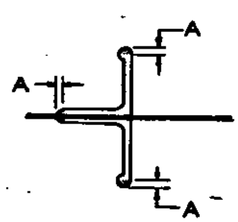
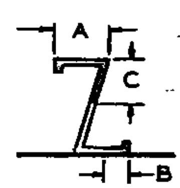
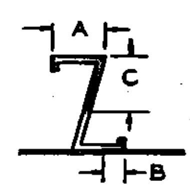
SPAR VERTICALS – NEGLIGIBLE DAMAGE					
WING STATION	FRONT SPAR	REAR SPAR	WING STATION	FRONT SPAR	REAR SPAR
2 & 3	 A = 3/16" MAX. or B+C = 3/8" MAX.	 A = 3/16" MAX. or B+C = 3/8" MAX.	7 & 8	 A+B = 1" MAX. C = 1/4" MAX.	 A+B = 1" MAX. C = 1/4" MAX.
4 & 4½	 A = 1/8" MAX.	 A = 3/16" MAX. or B+C = 3/8" MAX.	9 & 10	 A+B = 1" MAX. C+D = 3/4" MAX.	 A+B = 1" MAX. C = 1/4" MAX.
5	 A+B = 1" MAX. C+D = 1" MAX.	 A+B = 1" MAX. C+D = 1" MAX.	11	 A+B = 3/4" MAX. C = 1/4" MAX.	
6	 A+B = 3/4" MAX. C+D = 3/4" MAX.	 A+B = 3/4" MAX. C = 1/4" MAX.	12	 A+B = 1 1/4" MAX. C = 1/4" MAX.	 A+B = 1" MAX. C = 1/4" MAX.

Figure 2-12 (Sheet 1 of 2 Sheets)—Spar Verticals-Negligible Damage

SPAR VERTICALS — NEGLIGIBLE DAMAGE

WING STATION	FRONT SPAR	REAR SPAR	WING STATION	FRONT SPAR	REAR SPAR
13, 14 & 15	 A+B = 1¼" MAX. C = ¼" MAX.	 A+B = ½" MAX. C = ¼" MAX.	21	 A+B = ¾" MAX. C = ¼" MAX.	 A+B = 1" MAX. C = ¼" MAX.
16, 17 &, 18	 A+B = 1⅛" MAX. C = ¼" MAX.	 A+B = ½" MAX. C = ¼" MAX.	22	 C + A = 1" MAX. B = ¼" MAX.	 C + A = 1¼" MAX. B = ¼" MAX.
19	 A+B = 1⅛" MAX. C = ¼" MAX.	 A+B = ½" MAX. C = 3/16" MAX.	22½	 C + A = 1" MAX. B = ¼" MAX.	 A = ½" MAX. B = ¼" MAX.
20	 A+B = 1¼" MAX. C = ¼" MAX.	 A = 1/16" MAX.	23, 24 25, 25½	 C + A = 1" MAX. B = ½" MAX.	 C + A = 1¼" MAX. B = ¼" MAX.

SHADED AREAS INDICATE NEGLIGIBLE DAMAGE

Figure 2-12 (Sheet 2 of 2 Sheets)—Spar Verticals-Negligible Damage

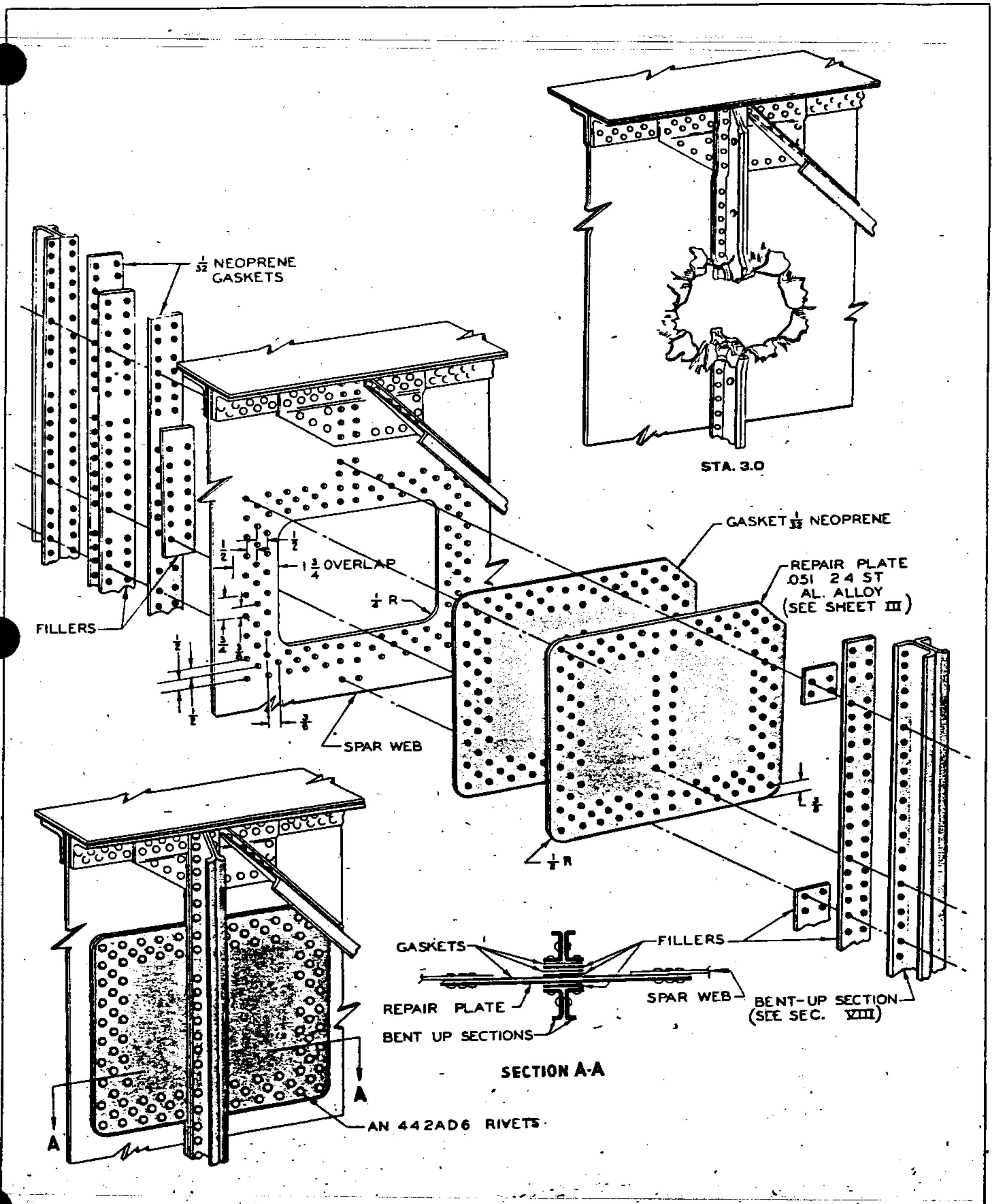


Figure 2-13—Spar Web Repair-Gas Tight Area

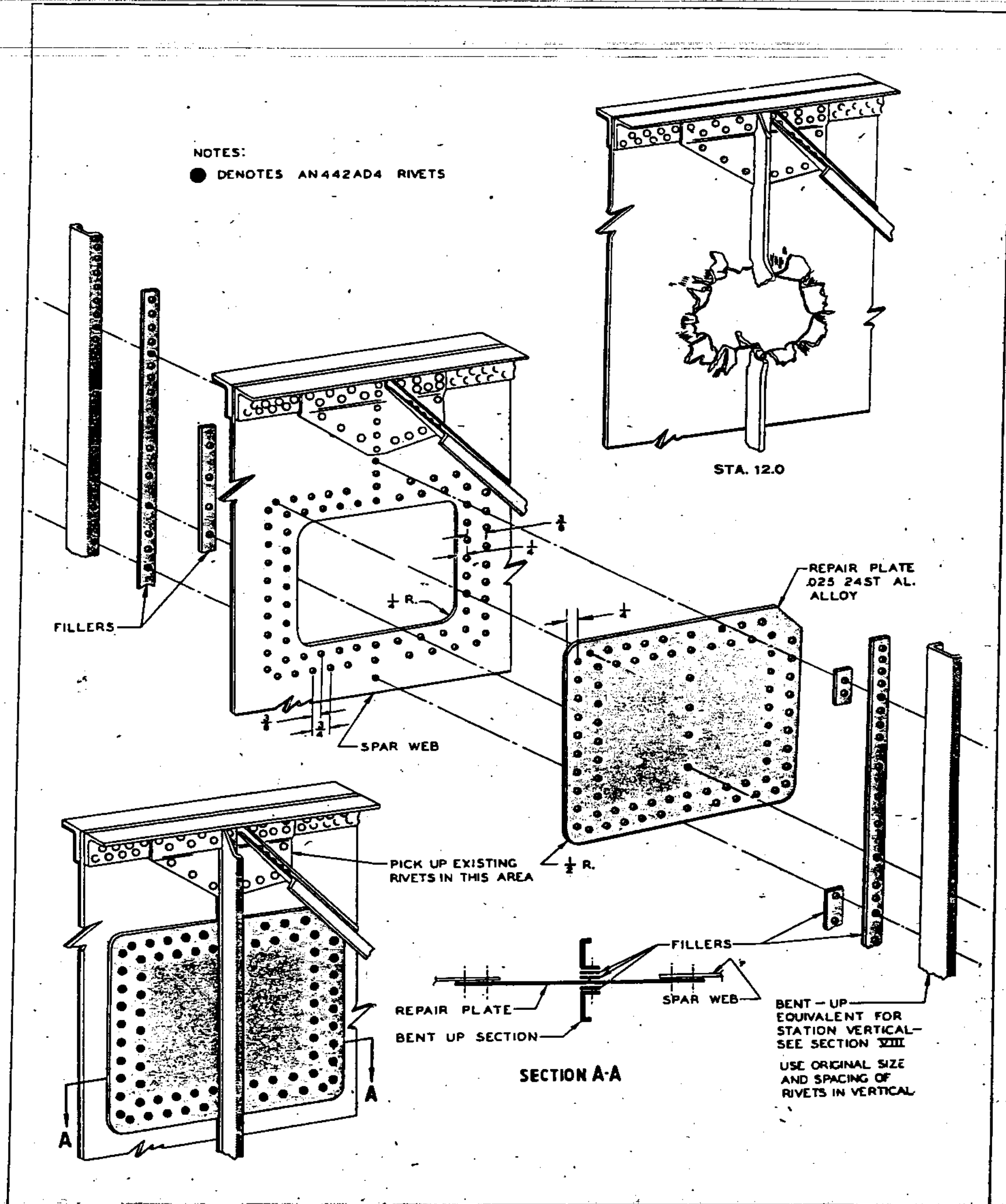


Figure 2-14—Typical Spar Web Repair

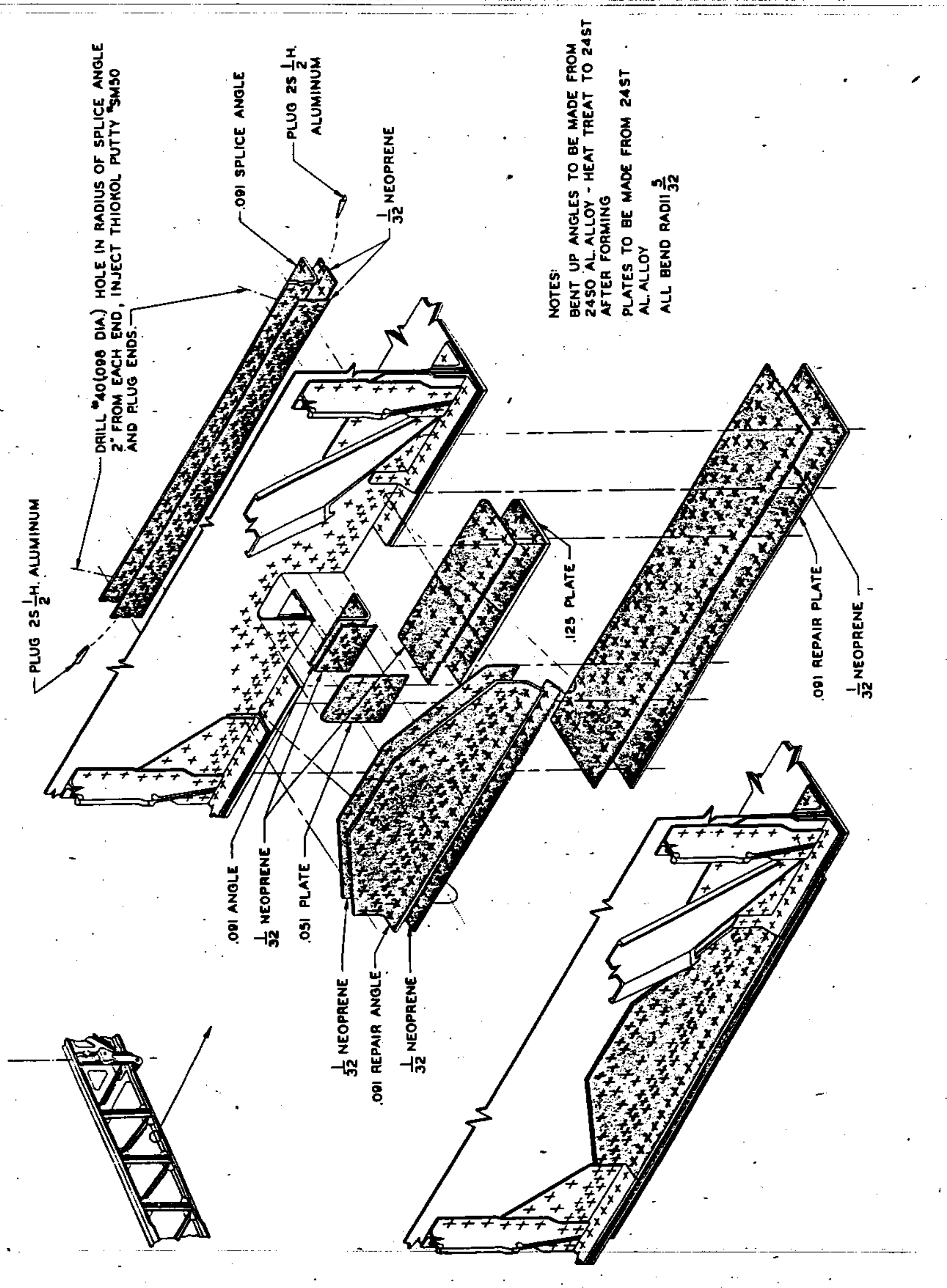


Figure 2-15 (Sheet 1 of 4 Sheets)—Spar Flange Repair-Gas Tight Area

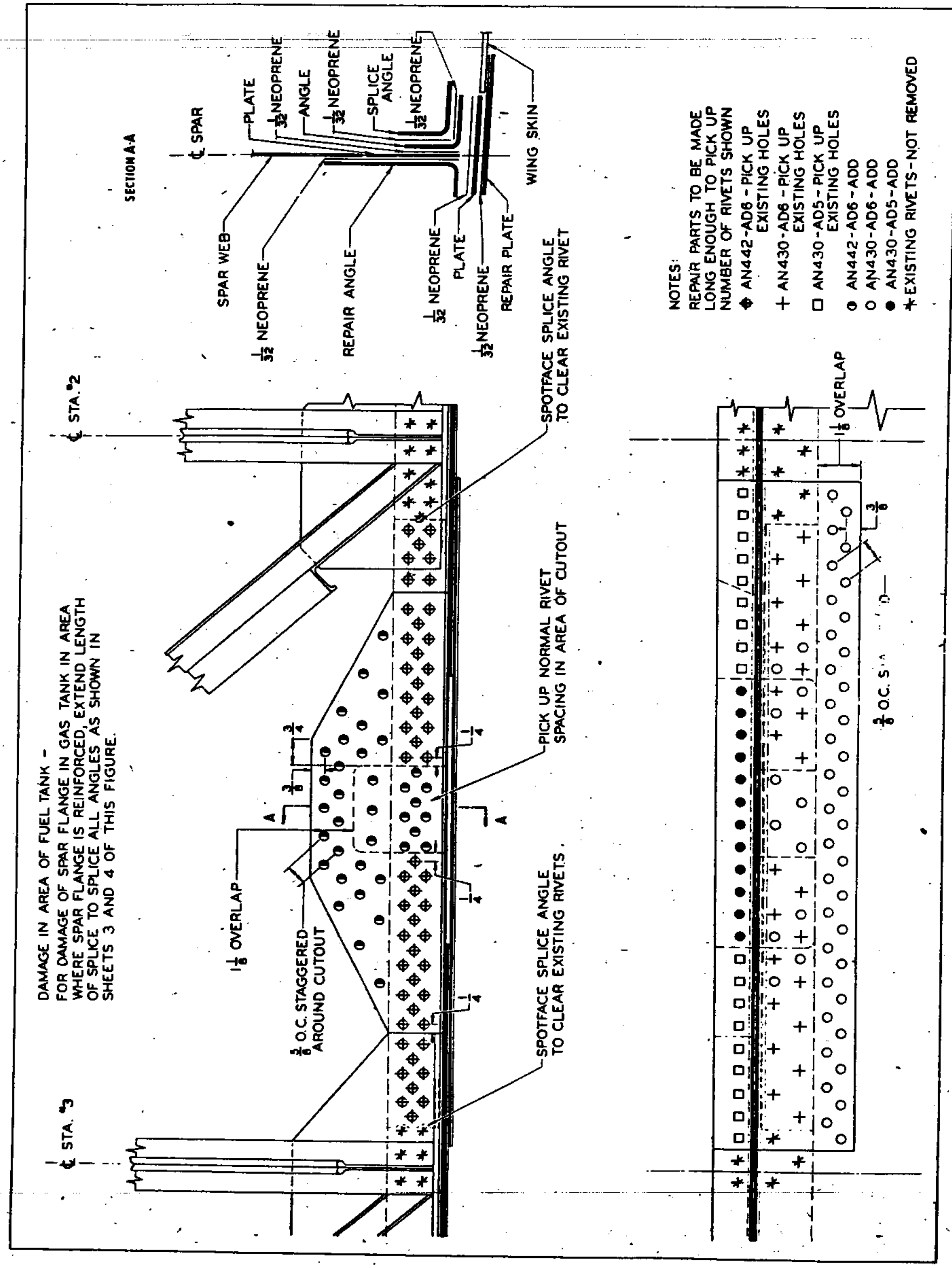


Figure 2-15 (Sheet 2 of 4 Sheets)—Spar Flange Repair-Gas Tight Area

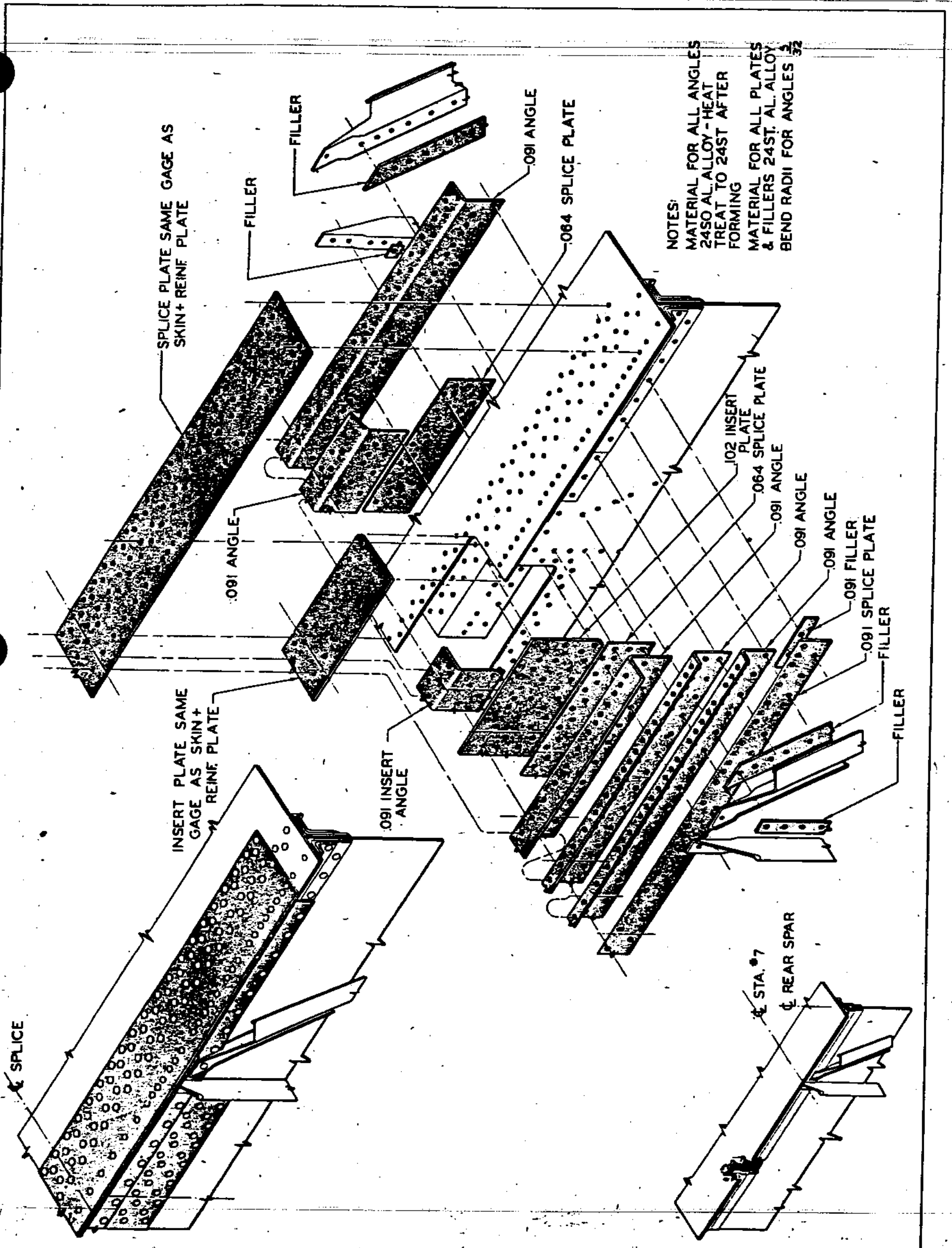


Figure 2-15 (Sheet 3 of 4 Sheets)—Spar Flange Repair

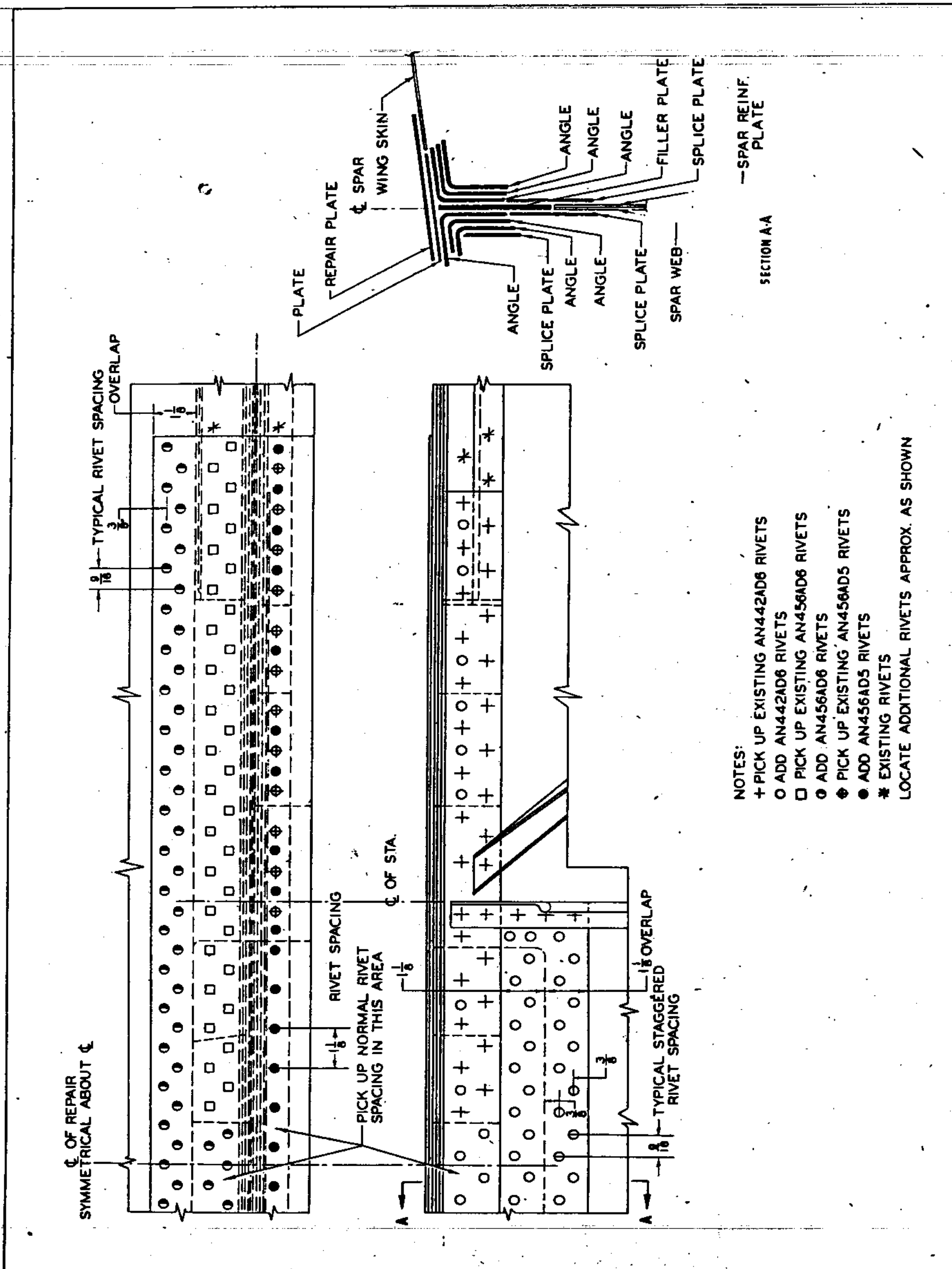


Figure 2-15 (Sheet 4 of 4 Sheets)—Spar Flange Repair

BULK-HEAD NOS.	BULKHEAD MEMBERS — NEGLIGIBLE DAMAGE				
	WING MEMBERS				
	UPPER RAIL	LOWER RAIL	ZEE MEMBERS	ANGLE MEMBERS	REMARKS
1.	A, B, W — SUM OF A&B DAMAGES AT ANY ONE POINT MUST BE LESS THAN 3/4	SAME AS FOR UPPER RAIL	NICKS & DENTS LESS THAN 1/64" DEEP ALLOWED IN MIDDLE HALF OF MEMBER—UP TO 1/4" DEEP IN ENDS OF MEMBERS		NO DAMAGE TO WEB CAN BE CONSIDERED NEGLIGIBLE EXCEPT SMALL SHALLOW DENTS.
2	1/8 MAX. — 1/8 MAX.	1/8 MAX. — 1/4 MAX.	TOTAL DAMAGE AT ANY ONE POINT MUST BE LESS THAN 5/8" — $A = \frac{5}{8}$ MAX. OR $A+B+C = \frac{5}{8}$ MAX.	1/4 MIN. — 7/8 MIN.	
3.	MAXIMUM OF 1/8" NICKS TO EACH LEG OF EACH ANGLE PERMITTED	SAME AS FOR BLK'H'D NO.2	SAME AS FOR BLK'H'D NO 2		
4 & 4½	$A = \frac{1}{4}$" MAX	SAME AS FOR BLK'H'D NO.2	$A+B+C = \frac{3}{4}$" MAX. — $A+C = \frac{3}{4}$ MAX. — $B+D = \frac{3}{4}$ MAX. — $A+B+C = \frac{3}{4}$ MAX	$A = \frac{1}{4}$" MAX. — $A+B+C = 1\frac{1}{4}$ MAX	WEB: A HOLE UP TO 3" DIA. MAY BE CONSIDERED NEGLIGIBLE
5.	$A+B+C = \frac{3}{4}$" MAX.	SAME AS FOR UPPER RAIL	$A+B+C = \frac{1}{2}$" MAX.		WEB-DAMAGE TO WEB CAN BE CONSIDERED NEGLIGIBLE ONLY IF FUEL CELLS ARE BEING USED ON THAT SIDE OF WING. THE TOTAL DIAMETERS OF ALL CLEANED UP HOLES BETWEEN STIFFENERS MUST NOT EXCEED 6".
6.	1/4" MAX. — $\frac{1}{4}$" MAX.	1/4" MAX. — $\frac{1}{4}$" MAX.	$A+B+C = \frac{3}{4}$" MAX.		

Figure 2-16 (Sheet 1 of 2 Sheets)—Wing Bulkhead Members-Negligible Damage

B'K'H'D NOS.	UPPER RAIL	LOWER RAIL	ZEE MEMBERS	ANGLE MEMBERS	REMARKS
7 & 8	1/16" MAX. 1/16" MAX.	1/8" MAX. 1/8" MAX.	A+B+C = 3/4 MAX. D+E+F = 3/4 MAX.	A = 1/16 MAX B = 1/8 MAX UPPER SURFACE	WEB: DAMAGE BETWEEN VERTICALS MAY BE CONSIDERED NEGLIGIBLE PROVIDED THE SUM OF THE MAJOR DIAMETERS OF THE CLEANED UP HOLES IN THAT BAY DOES NOT EXCEED 4".
9 & 10	A+B+C = 1/2" MAX.	SAME AS UPPER RAIL	A+B+C = 1/2" MAX. A+B+C = 1/2 MAX.	MAXIMUM DIA. HOLE = B÷3 NO DAMAGE ALLOWABLE LESS THAN 1/2" FROM RADIUS 1/4" MAX.	WEB: THE SUM OF THE MAJOR DIAMETERS OF THE CLEANED UP HOLES MUST NOT EXCEED 5".
11 CENTER PANEL & OUTER PANEL	1/8" MAX. 1/8" MAX.	A+B+C = 1/2" MAX.	A+B+C = 3/4" MAX.		
12-13 14-15 16-17 18-19 & 20	SAME AS BULKHEAD # 11	SAME AS BULKHEAD # 11	A+B+C = 5/8" MAX.		
21	A = 1/8" MAX.	A = 1/8" MAX.	A+B+C = 1/2" MAX.	A = 1/8" MAX.	UPPER WEB: 4" DIA. HOLES BETWEEN VERTICAL STIFFENERS MAY BE CONSIDERED NEGLIGIBLE. LOWER WEB: 1" DIA. HOLES BETWEEN STIFFENERS. DOPE FABRIC PATCH OVER HOLES TO KEEP WATER FROM ENTERING WING.
22 FRONT & REAR	1/8" MAX. 1/8" MAX.	1/8" MAX. 1/8" MAX.		1/8" MAX. 1/8" MAX.	
23 & 24	A = 1/8" MAX.	A = 1/8" MAX.		A = 1/8" MAX.	WEB: 2" DIA. HOLES BETWEEN VERTICALS MAY BE CONSIDERED NEGLIGIBLE.
25	A = 1/8" MAX.	A = 1/8" MAX.	A+B+C = 1/2" MAX.	A = 1/8" MAX.	WEB: HOLES BETWEEN VERTICALS WHOSE MAJOR DIAMETERS DO NOT TOTAL MORE THAN 2" MAY BE CONSIDERED NEGLIGIBLE.
26	A = 1/8" MAX.	A = 1/8" MAX.		A = 1/8" MAX.	WEB: HOLES BETWEEN VERTICALS WHOSE MAJOR DIAMETERS DO NOT TOTAL MORE THAN 4" MAY BE CONSIDERED NEGLIGIBLE. ADD FABRIC PATCH OVER ALL HOLES TO PREVENT WATER FROM ENTERING THE WING.

SHADED AREA REPRESENTS DAMAGE

Figure 2-16 (Sheet 2 of 2 Sheets)—Wing Bulkhead Members-Negligible Damage

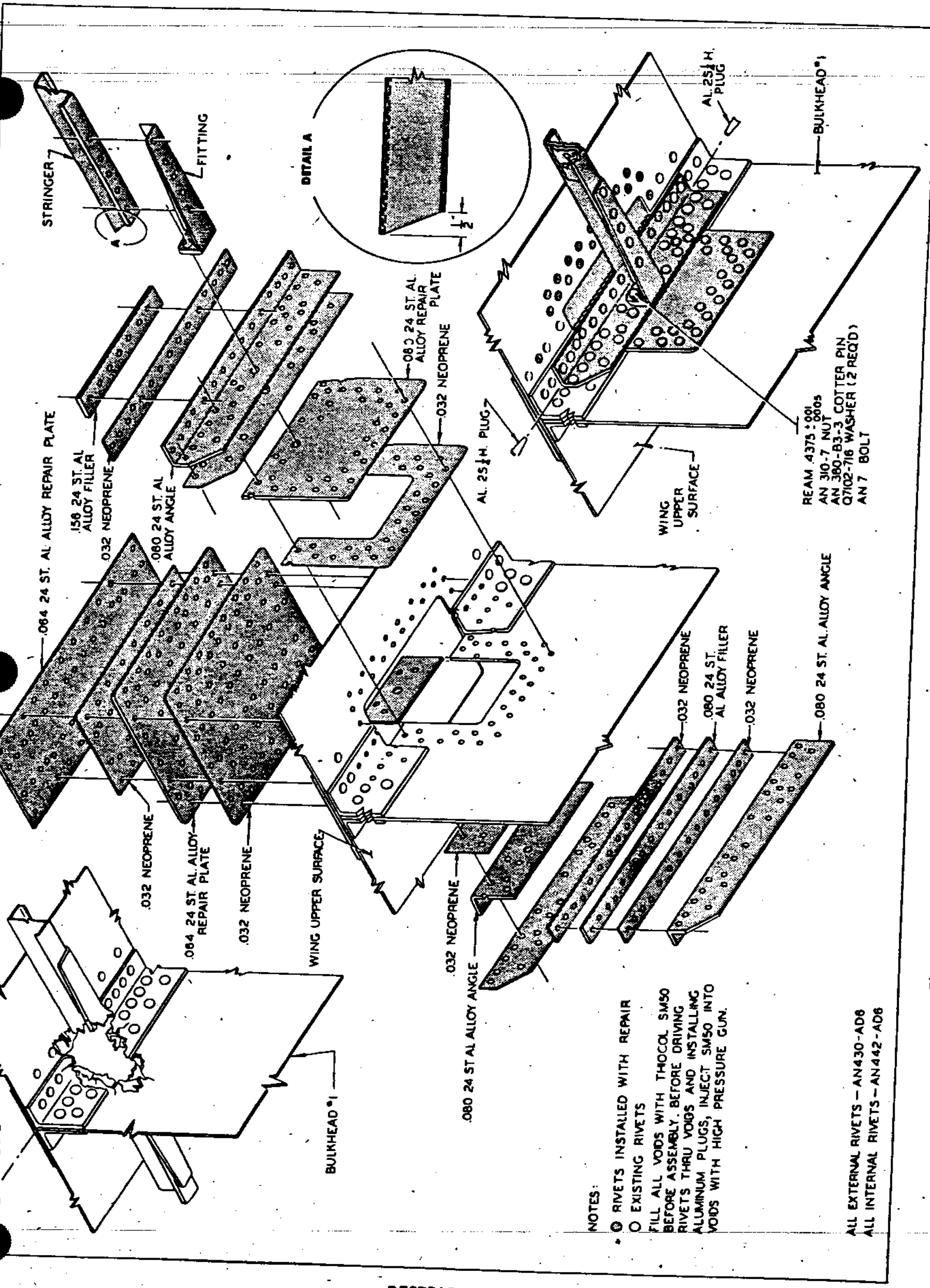
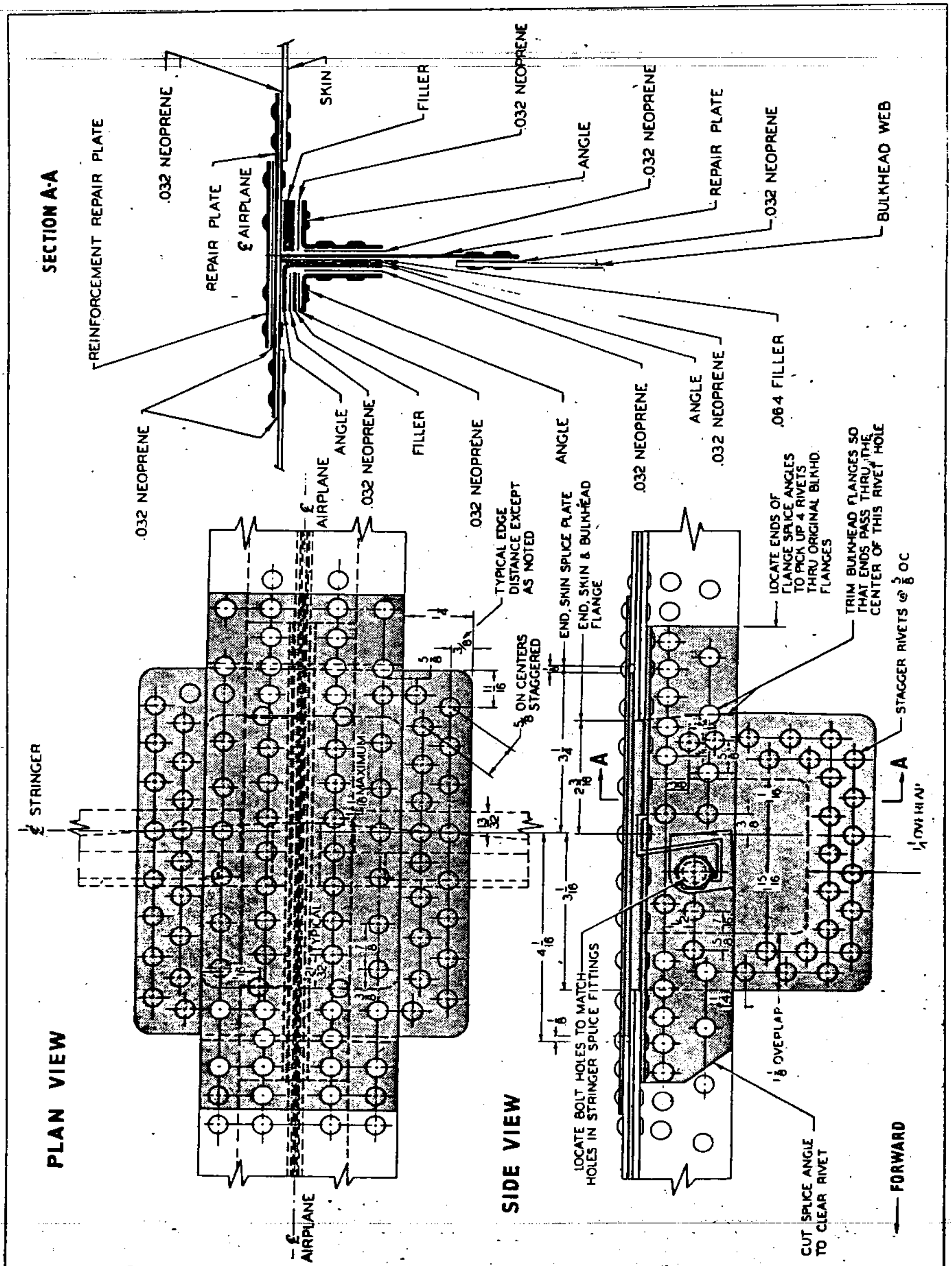


Figure 2-17 (Sheet 1 of 2 Sheets)—Bulkhead and Skin Repair in Gas Tight Area



(Figure 2-17 (Sheet 2 of 2 Sheets)—Bulkhead and Skin Repair in Gas Tight Area

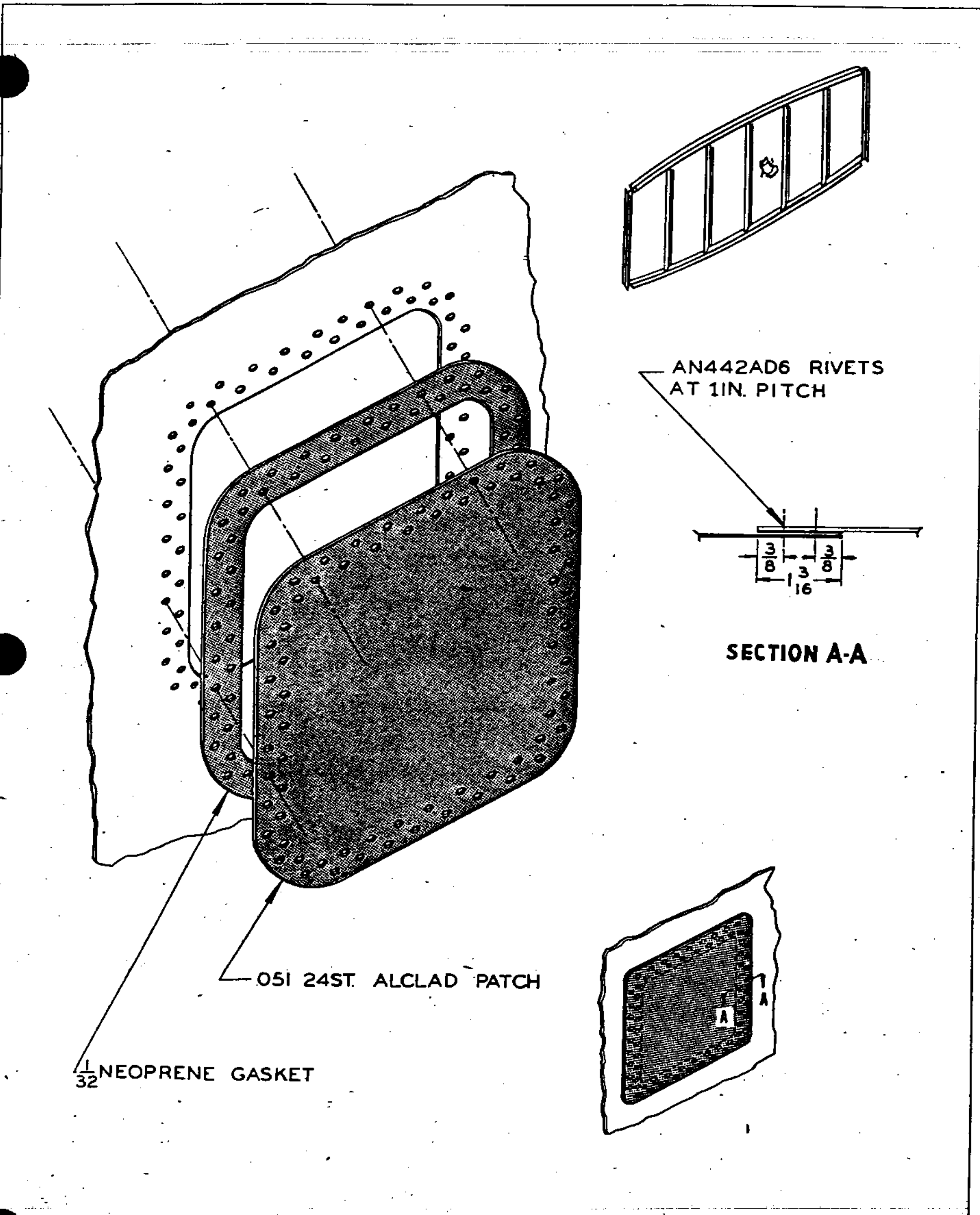
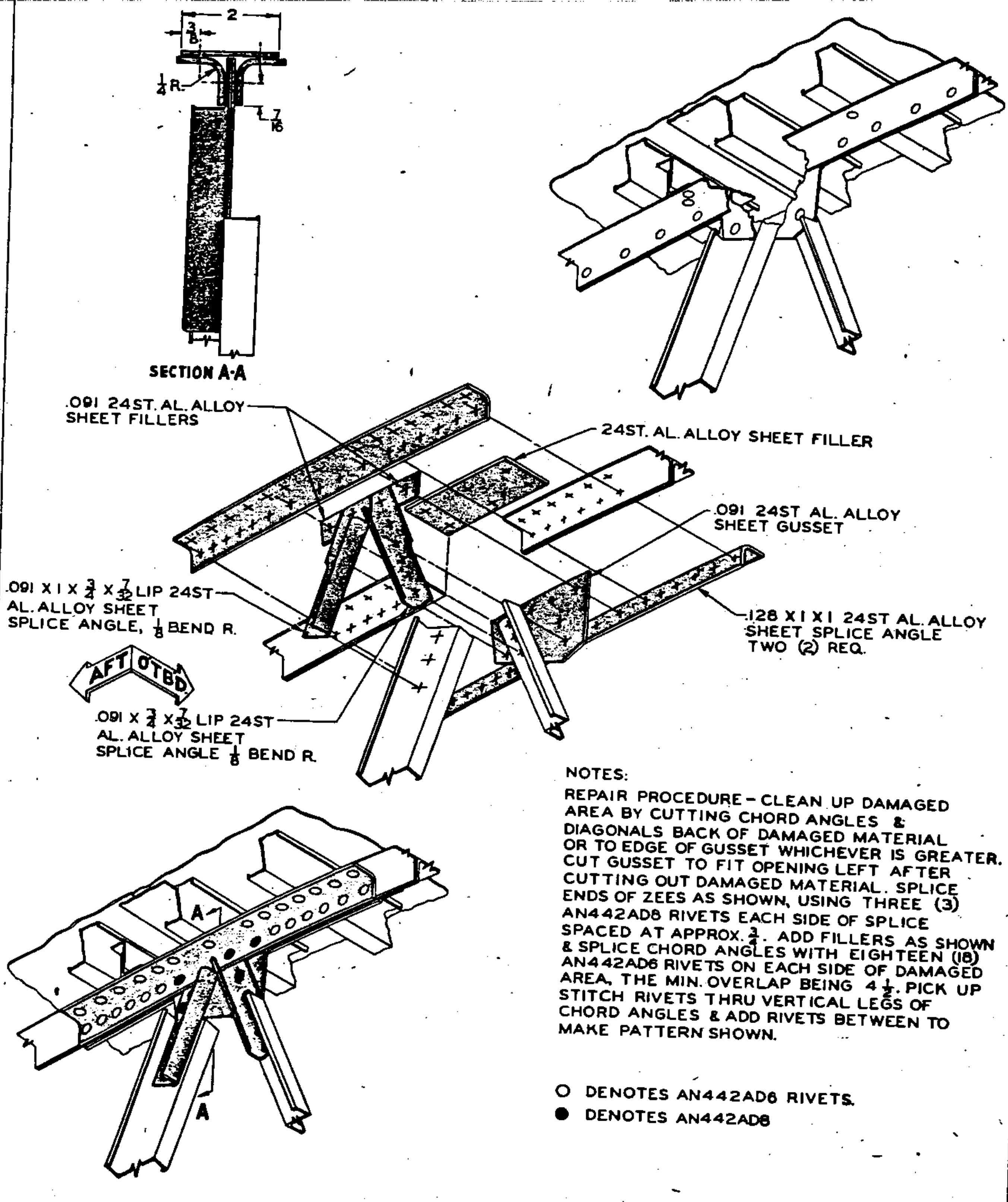


Figure 2-18—Bulkhead Web Patch



NOTES:

REPAIR PROCEDURE – CLEAN UP DAMAGED AREA BY CUTTING CHORD ANGLES & DIAGONALS BACK OF DAMAGED MATERIAL OR TO EDGE OF GUSSET WHICHEVER IS GREATER. CUT GUSSET TO FIT OPENING LEFT AFTER CUTTING OUT DAMAGED MATERIAL. SPLICE ENDS OF ZEES AS SHOWN, USING THREE (3) AN442AD8 RIVETS EACH SIDE OF SPLICE SPACED AT APPROX. 3/4. ADD FILLERS AS SHOWN & SPLICE CHORD ANGLES WITH EIGHTEEN (18) AN442AD6 RIVETS ON EACH SIDE OF DAMAGED AREA, THE MIN. OVERLAP BEING 4 1/2. PICK UP STITCH RIVETS THRU VERTICAL LEGS OF CHORD ANGLES & ADD RIVETS BETWEEN TO MAKE PATTERN SHOWN.

○ DENOTES AN442AD6 RIVETS.
● DENOTES AN442AD8

Figure 2-19—Bulkhead Rail Repair

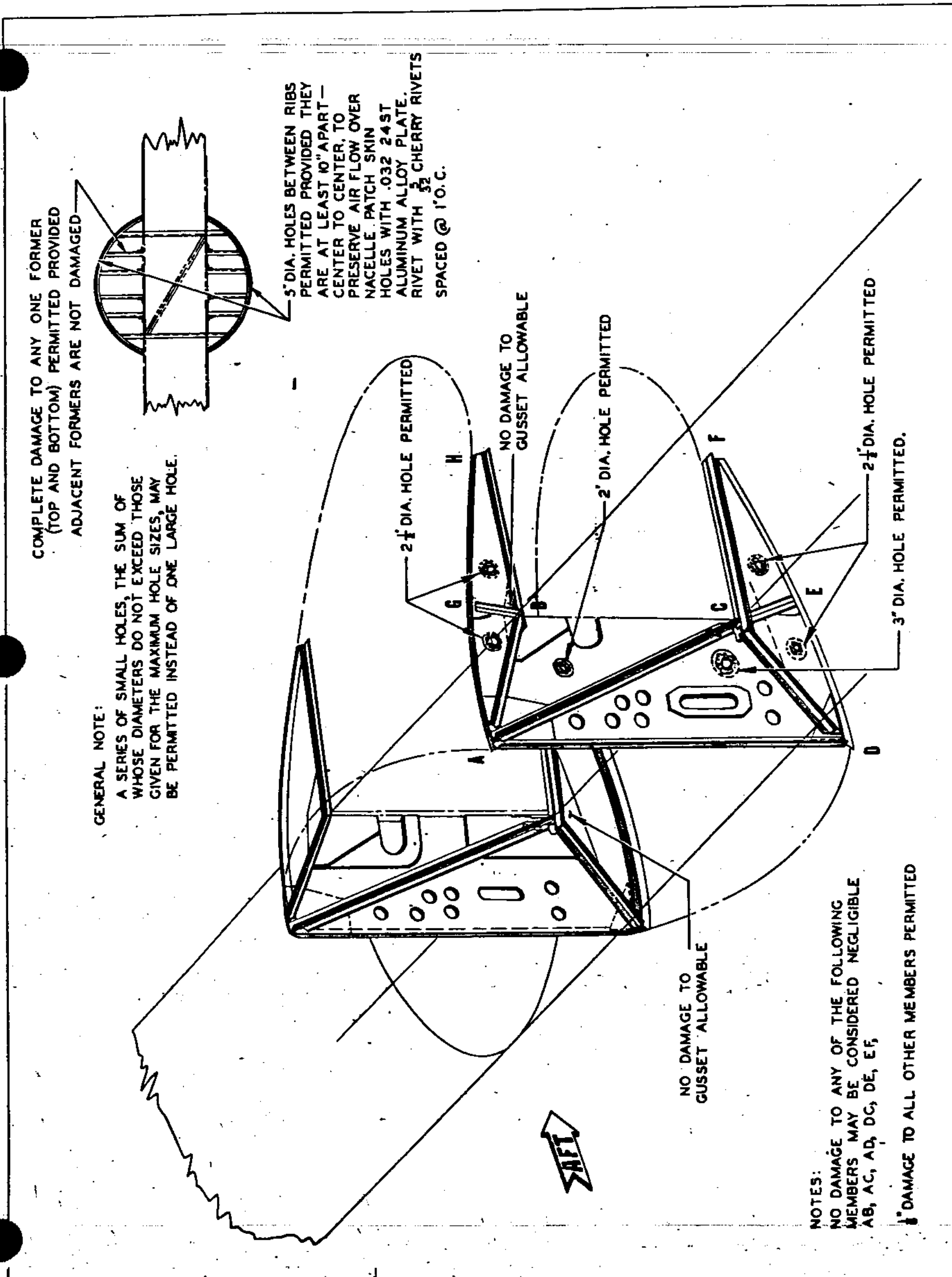


Figure 2-20—Nacelle-Negligible Damage

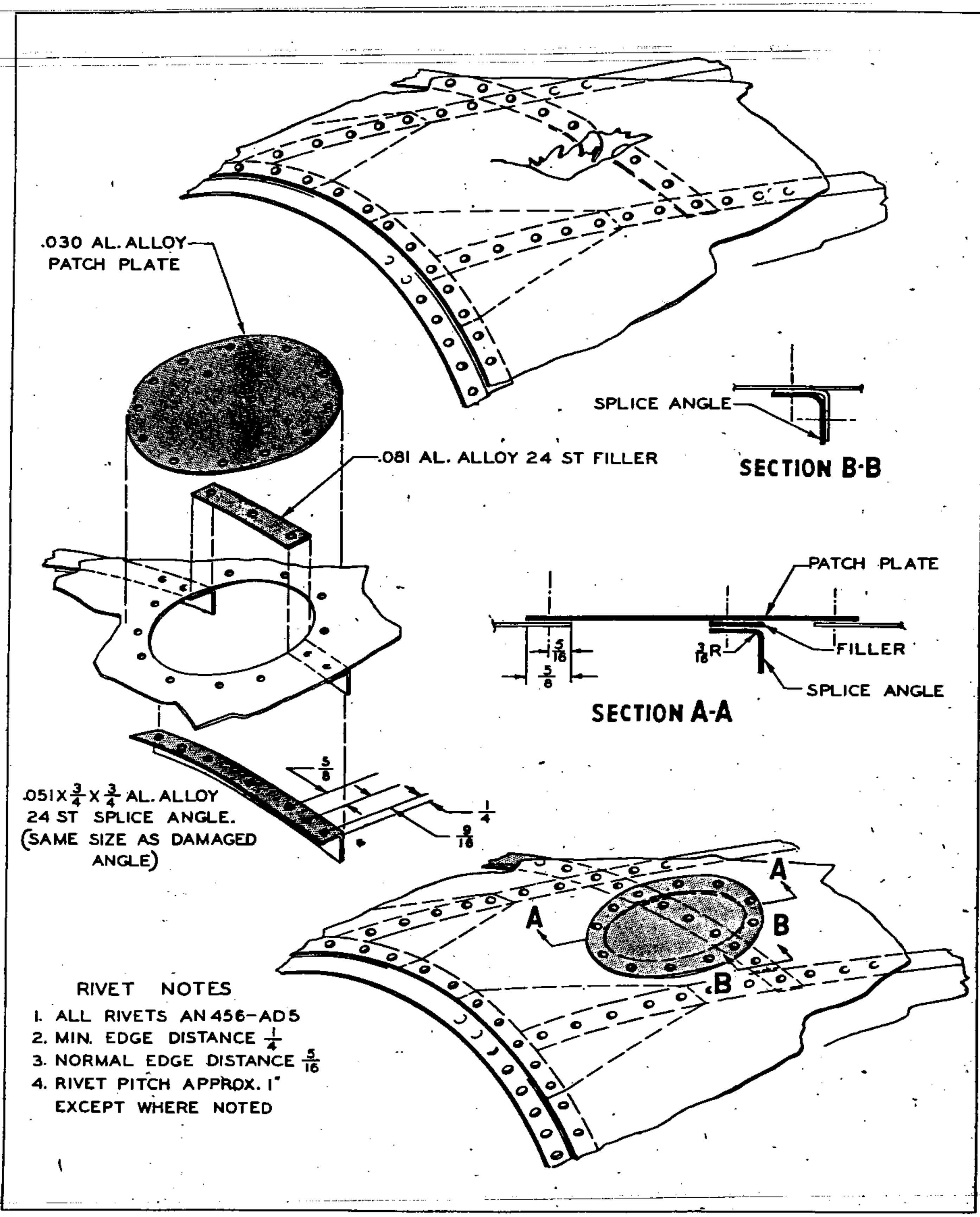


Figure 2-21—Nacelle Skin Patch

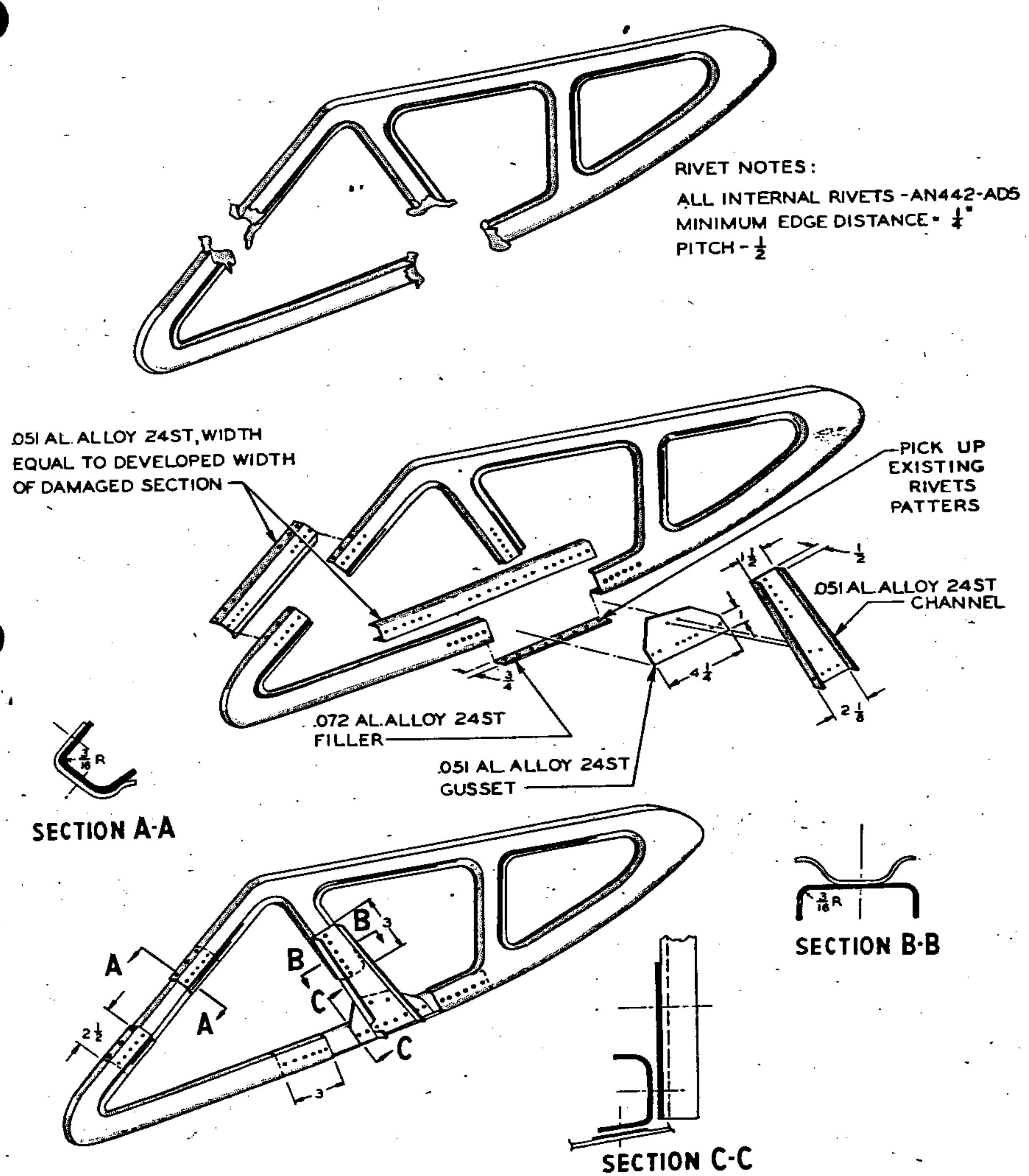


Figure 2-22—Nacelle Former Repair

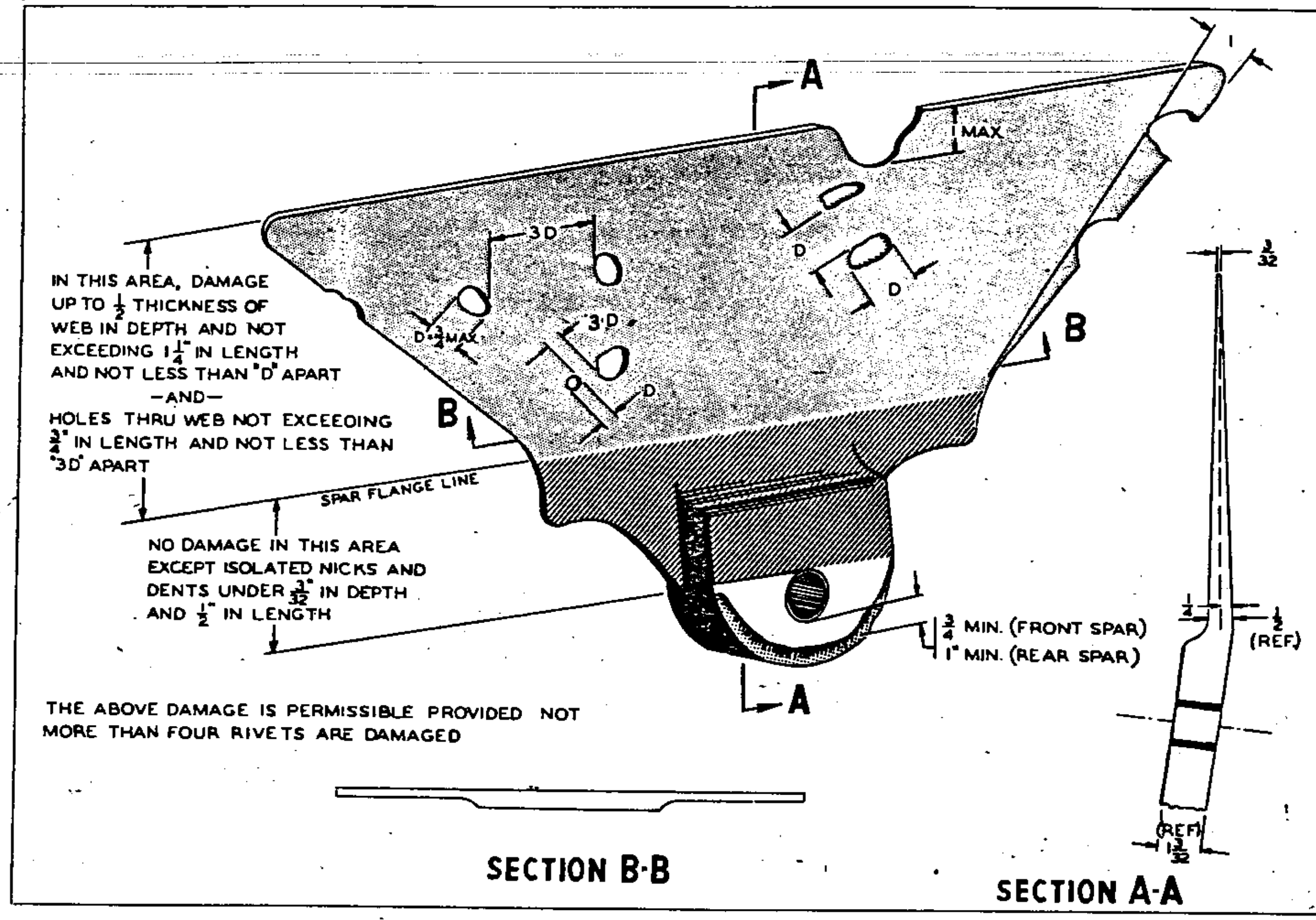


Figure 2-23—Wing-Hull Fitting-Negligible Damage

such a repair may be defined as an insertion. A typical insertion repair is exemplified by figure 2-10. The original splices utilized should pick up the old rivet pattern while the new splices should duplicate corresponding existing splices.

2-28. DAMAGE REPAIRABLE BY REPLACEMENT. When more than 50 per cent of a sheet of skin is damaged the entire sheet should be replaced. All existing rivet holes must be picked up through the new sheet.

2-29. SPARS.

2-30. GENERAL. The wing spars are of the web-truss type design, fabricated from alclad sheet and extruded stiffeners. They are riveted to the skin at the spar flanges and to the bulkheads at the station verticals. The spar is divided into stations which correspond to the main wing stations. A spar vertical is located at each station. The main wing fittings are riveted to and form an integral part of the spar. Since the spars form part of the integral fuel tank, the area between stations 1-5 must be gas tight.

2-31. NEGLIGIBLE DAMAGE. The maximum negligible damage permitted for any spar diagonal consists only of dents or nicks not more than ¼" of stiffener leg or ⅛" of heel has been removed and provided the dents or nicks have been filed out smooth.

2-32. The maximum negligible damage permitted in the spar web between adjacent verticals is shown in figure 2-11. Negligible damage to spar verticals is tabulated in figure 2-12.

2-33. For negligible damage to the spar flanges see paragraphs 2-15 to 2-21 inclusive.

2-34. DAMAGE REPAIRABLE BY PATCHING. Patches for the spar web must be made gas tight in the fuel tank area by means of a neoprene gasket and gas tight rivet spacing. A typical gas tight spar repair is shown in figure 2-13. Substitute sheet metal equivalents for extruded verticals, are shown tabulated in Section VIII. Substitute sheet metal equivalents for extruded spar diagonals may be found in Section VIII, Extrusion Chart. A typical outer panel spar web repair is shown in figure 2-14.

2-35. DAMAGE REPAIRABLE BY INSERTION—SPAR FLANGES. Repair design for spar flange splices are based on one flange splicing the other thereby necessitating the addition of only one splice plate.

In order to accomplish this repair it will be necessary to trim one spar flange away from the adjacent flange. This may be done with a rotary file, a router, or by using a hammer and chisel. In any case, extreme caution should be exercised that the adjacent member is not nicked or otherwise damaged. A typical spar flange repair is shown in figure 2-15.

2-36. DAMAGE REPAIRABLE BY REPLACEMENT—SPAR STIFFENERS. Where facilities for joggling are available, it will be easier to replace spar verticals and diagonals (with either the proper extrusion or its equivalent bent up section see Section VIII) rather than to repair them. If joggling cannot be accomplished, the member may be repaired or a new member may be used with fillers instead of joggles.

2-37. WING BULKHEADS.

2-38. GENERAL. The wing is composed of a center line bulkhead and 28 bulkheads on either side. Each bulkhead is located at a wing station point. All of the bulkheads are of truss type construction except bulkhead 5 and the center wing bulkhead which are gas tight web bulkheads and form the ends of the integral fuel tank. All of the truss type bulkheads and the stiffeners of the webbed bulkheads, are fabricated from aluminum alloy extruded sections.

2-39. NEGLIGIBLE DAMAGE. The maximum damage to bulkhead rails, diagonals and verticals which may be permitted to exist (other than that damage defined under paragraph 2-10) without repairing is listed on the chart, figure 2-16.

2-40. No damage to the center line bulkhead web, bulkhead 1, may be allowed to exist except shallow bumps. No damage except shallow bumps can be allowed to exist on the web of bulkhead 5 unless fuel cells are being used on that side of the wing. In this case the allowable web damage is defined in figure 2-16.

2-41. DAMAGE REPAIRABLE BY PATCHING. The principles of gastighting as defined under paragraph 2-45 must be observed when making any repairs to either bulkhead 1 or bulkhead 5. Typical bulkhead web patches are shown in figures 2-17 and 2-18.

2-42. It is recommended that all damaged bulkhead diagonals be replaced rather than repaired since this can usually be done by removing and replacing a very few rivets.

2-43. DAMAGE REPAIRABLE BY INSERTION. Bulkhead rails are most easily repaired by insertion. For these repairs see Appendix II, Typical Repairs. Figure 2-19 shows a typical bulkhead rail repair.

2-44. DAMAGE REPAIRABLE BY REPLACEMENT. Repair of damage to bulkhead diagonals may be more easily accomplished by replacing the damaged member rather than by trying to repair it.

2-45. INTEGRAL FUEL TANK.

2-46. The integral fuel tanks are formed by the upper and lower surfaces of the wing, the wing spars and three gas tight bulkheads and have a capacity of 875 U. S. Gallons each. When delivered from the factory, self-sealing fuel cells are installed in the port wing only on ships having even serial numbers, and in the starboard wing only on ships having odd serial numbers. The amount of damage allowable in the integral tank depends to a large extent upon whether that particular tank is equipped with, or can be equipped with self-sealing cells. For example, a shot thru the integral tank may not be critical structurally, but may be critical because of the fuel leak which would result if no cells were being used in that tank. If a large number of small flak holes were present, the installation of fuel cells in that tank would be the quickest way to repair such damage providing the damage could be classified as negligible structurally.

2-47. The fuel tank is made gas tight by using a neoprene gasket between all faying surfaces, thru the use of gas tight corners, and thru the use of a calking compound in all voids.

2-48. The neoprene used must be resistant to aromatic fuels and low temperatures. It should have a Shore Durometer hardness of 40-55. No gauge of neoprene other than .032 should be used. The calking compound used by the factory is known as SM-50, manufactured by the Presstite Engineering Corp., St. Louis, Missouri. This material is in pretty general use throughout the fleet, but if not available a heavy grade of zinc chromate paste may be used.

2-49. Gas tightening in the corners of the tank is accomplished by means of "gas tight corners." These corner fittings are installed with neoprene gaskets between all faying surfaces. The voids formed between the corners and surrounding structure are filled with SM-50 before the corners are installed.

2-50. If leaks develop at the gas tight corners they may be stopped by injecting SM-50 into the voids. The standard "Injection Method" of repairing fuel tanks is to be used on this airplane.

2-51. To prevent the sealant material in the voids from drying or being washed out by the action of the gasoline small aluminum plugs are used at the ends of these voids. These plugs are tapered and wedged into the voids then peened or staked in place with a small diameter wire.

2-52. Another method of retaining the sealant material in the voids is to drive a rivet directly through the void. (See figure 2-17.) This latter method of course, can only be used where the two sides of the void are flat and parallel.

2-53. Stringer carry-thru at the three gas tight bulkheads is accomplished by means of a neoprene washer installed in a counter sunk recess in each of the two stringer splice fittings. Whenever one of these fittings is replaced see that a new washer is installed with the new fitting. (See figure 2-17.) After repairs to the fuel tank have been completed, pressure test the tank to 3 psi. air pressure.

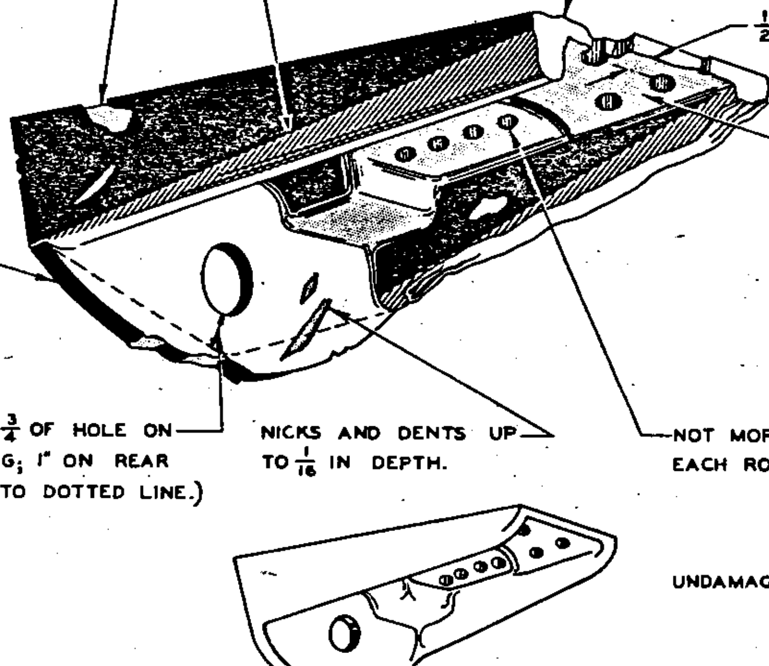


Figure 2-24—Wing-Hull Fitting Sugar Scoop-Negligible Damage

2-54. NACELLE.

2-55. GENERAL. The nacelle structure on the PBY type airplane is of the semi-monocoque type. The engine loads are transmitted through the engine mount and into the oil tank by means of four bolts. The oil tank in turn is supported by and bolted to the nacelle structure. Only damage to the nacelle structure will be considered in this section. For repairs to the oil tank and engine mount structure see Section VI.

2-56. The load from the oil tank is transmitted to the nacelle through the upper and lower attaching screws and thru the bolts on the sides of the nacelle. Since the nacelle loads are fed into the wing thru the nacelle side bulkhead truss work, particular attention should be paid to the repair of these members. Before making major repairs to the nacelle the engine must be removed.

2-57. NEGLIGIBLE DAMAGE. Because of low margins of safety on the nacelle structure little damage other than that defined in Paragraph 2-10 can be classified as negligible.

2-58. Figure 2-20 shows the main structural members of the nacelle and describes what damage may be allowed to exist without repairing.

2-59. DAMAGE REPAIRABLE BY PATCHING. Figure 2-21 shows a typical patching repair to the upper nacelle skin. This same type of repair may be used on the lower nacelle skin or to repair any of the nacelle bulkhead webs.

2-60. Figure 2-22 shows how a drop hammered nacelle former may be repaired. A similar repair may be applied to any of the upper or lower surface formers.

2-61. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Any of the structural members shown on figure 2-20 must be replaced when they are damaged. No repairs should be attempted on these members. The new parts should be the equivalent extrusion when available or the equivalent bent up sheet substitute shown in Section VIII.

2-62. WING-HULL ATTACHMENT.

2-63. GENERAL. Attached to each spar at the center of the wing are fittings which tie the wing to the hull. The fittings are 14S-T aluminum alloy forgings. The two special bolts which tie the wing fittings to the hull fittings may be replaced with equivalent AN Standard bolts by increasing the heat-treat to 145-170,000 pounds per square inch.

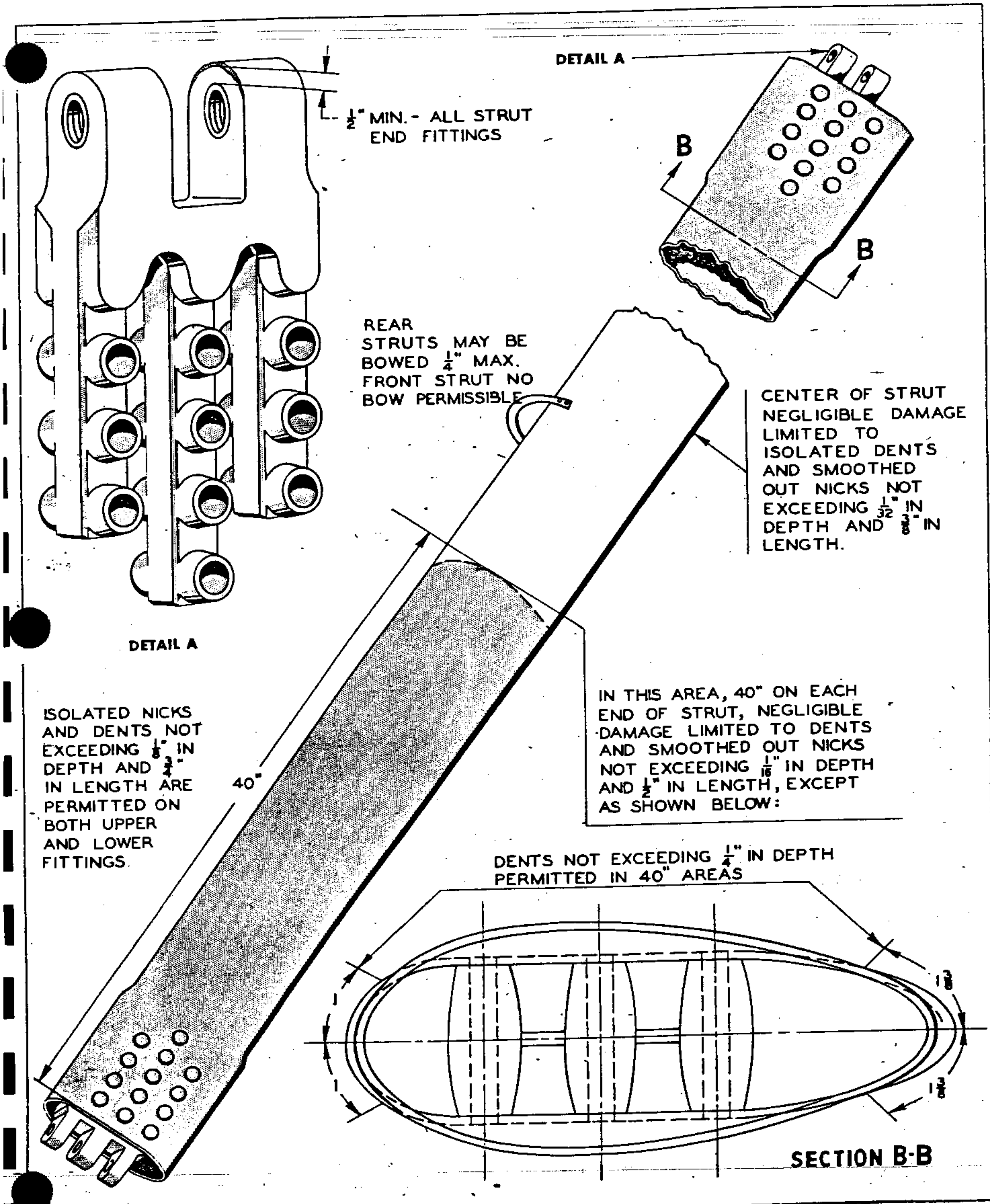


Figure 2-25—Wing Struts-Negligible Damage

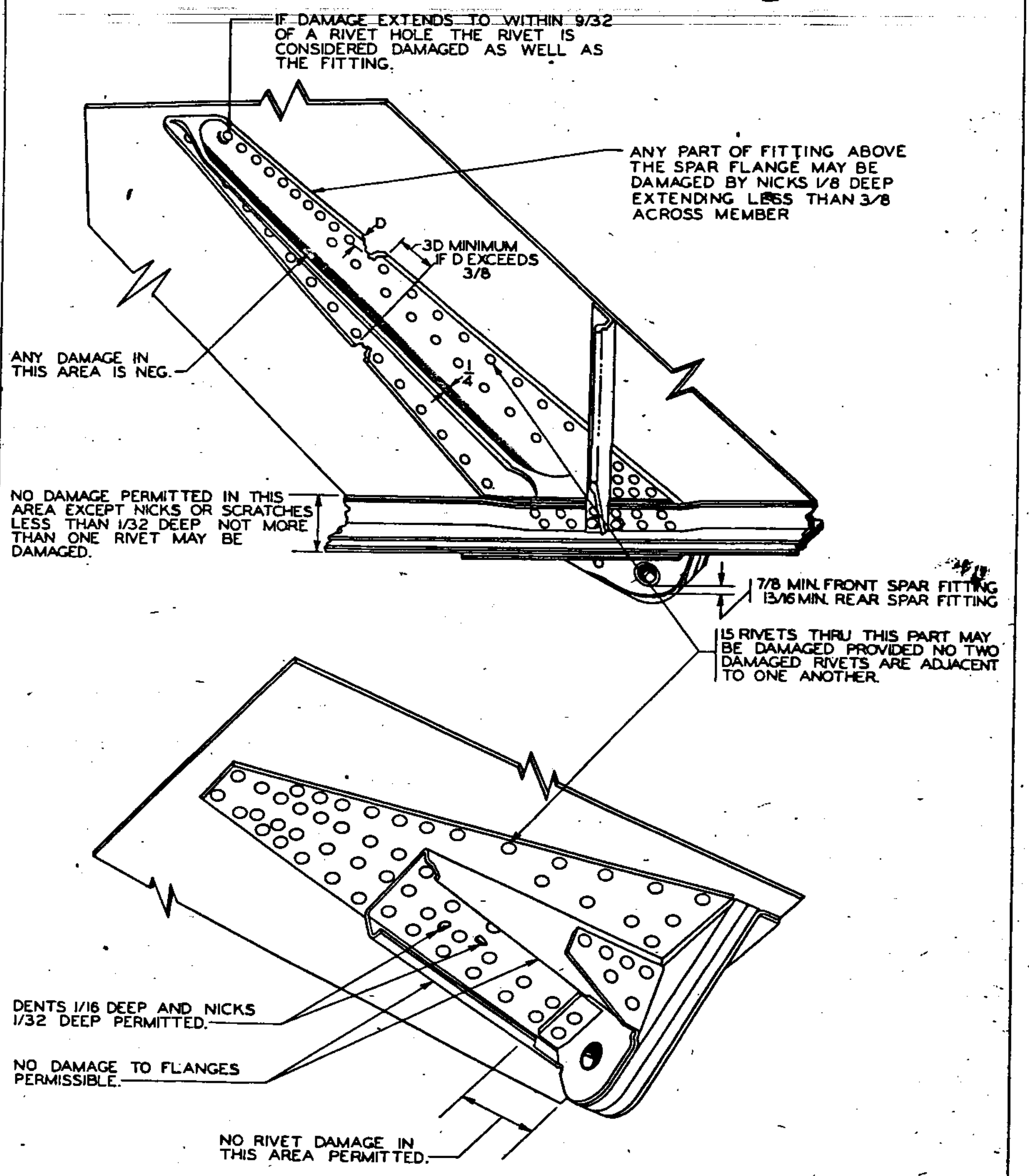
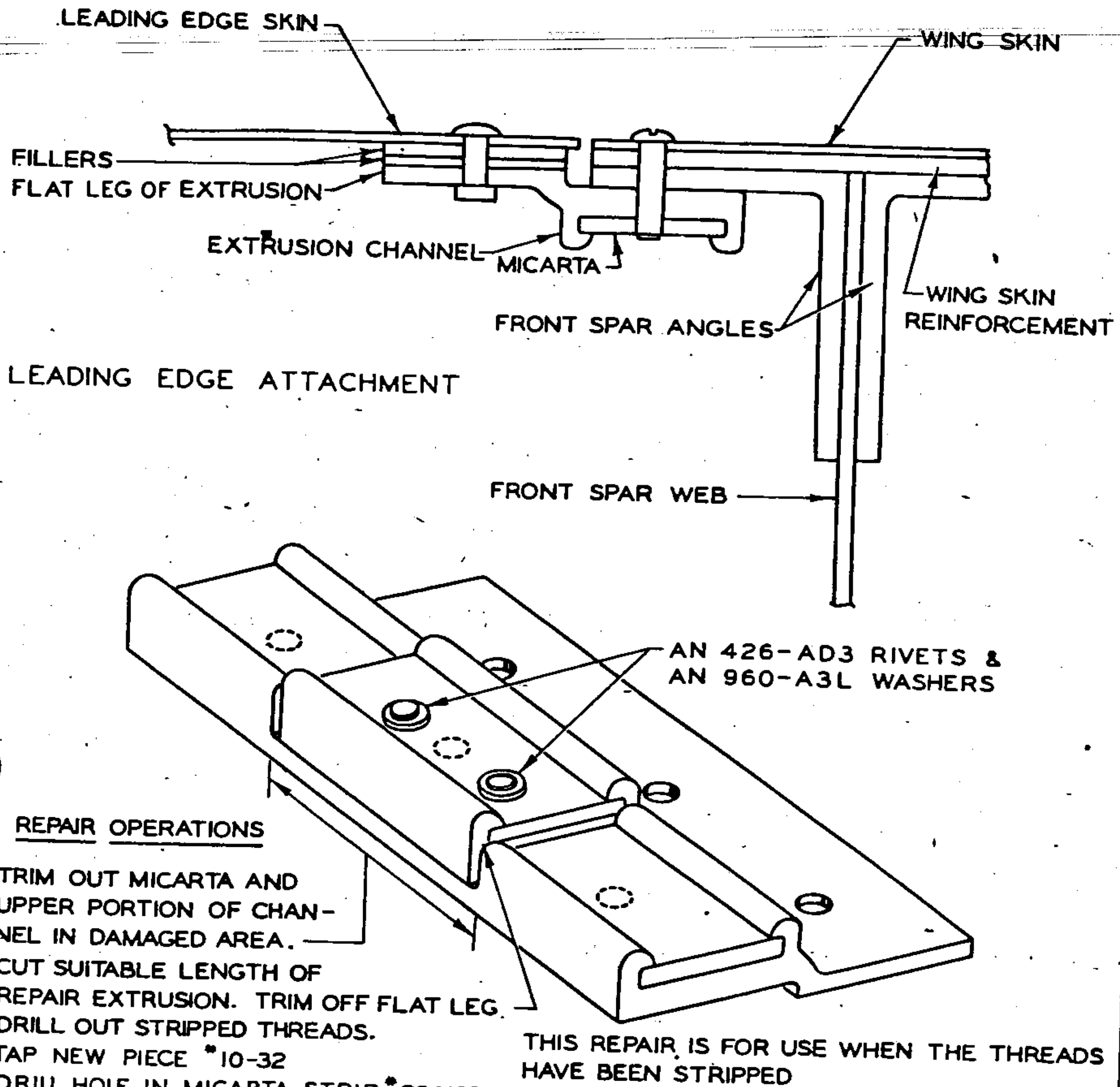


Figure 2-26—Wing Strut Fittings-Negligible Damage



REPAIR OPERATIONS

1. TRIM OUT MICARTA AND UPPER PORTION OF CHANNEL IN DAMAGED AREA.
2. CUT SUITABLE LENGTH OF REPAIR EXTRUSION. TRIM OFF FLAT LEG.
3. DRILL OUT STRIPPED THREADS.
4. TAP NEW PIECE #10-32
5. DRILL HOLE IN MICARTA STRIP #22(.157) AND INSERT IN EXTRUSION.
6. RIVET REPAIR EXTRUSION IN PLACE.

NOTE:

WHEN DAMAGED AREA IS ACCESSIBLE THROUGH HAND HOLES DRILL OUT STRIPPED THREADS AND INSTALL SCREW AND AN365-D1032 NUT

VIEW SHOWING THE ATTACHING STRIP
WITH REPAIR SECTION INSTALLED

Figure 2-27—Leading Edge Attaching Strip Repair

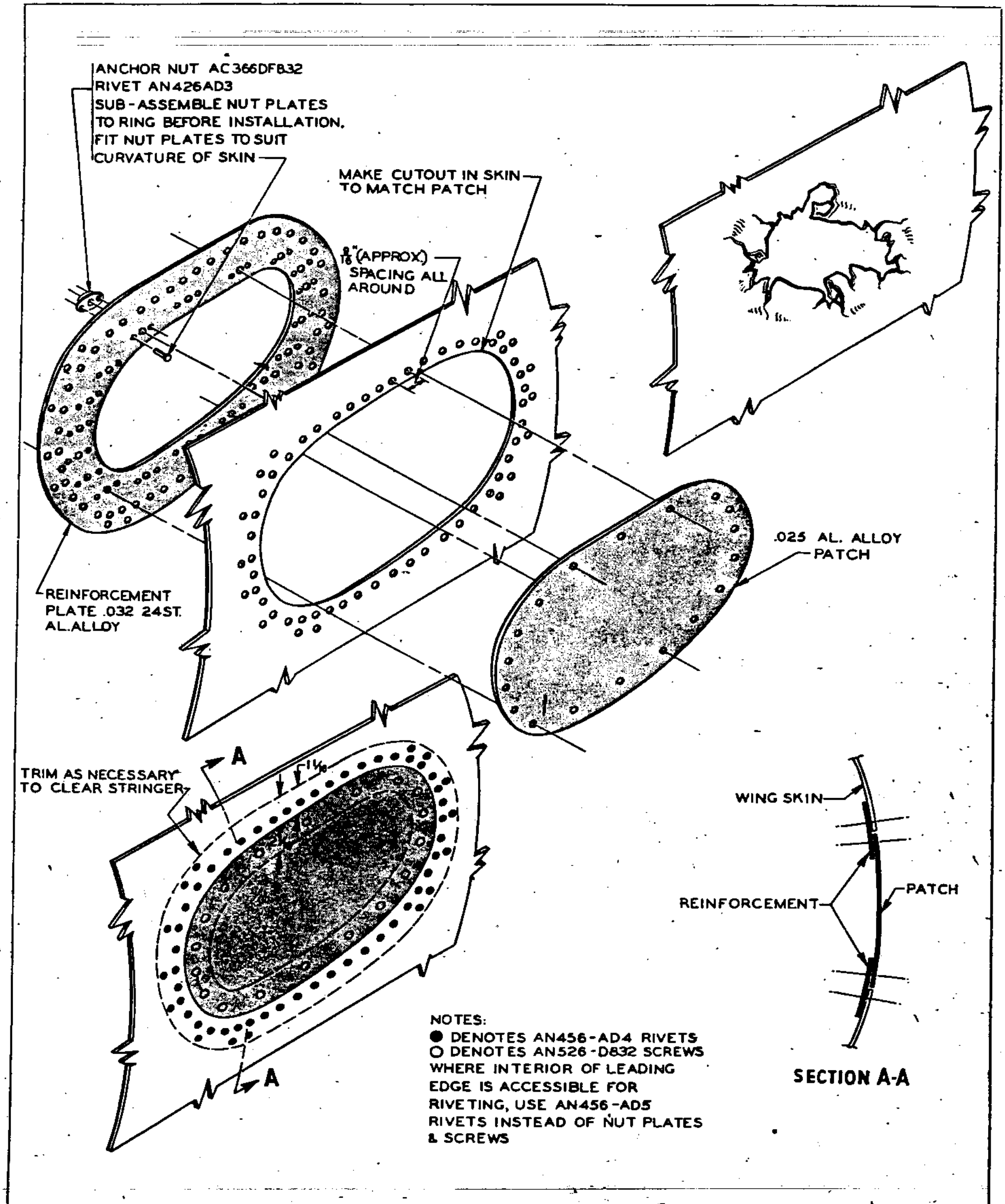


Figure 2-28—Leading Edge Skin Repair

2-64. NEGLIGIBLE DAMAGE. Figures 2-23 and 2-24 show what damage in addition to that outlined in Paragraph 2-10 may be allowed to exist without repairing. Negligible damage to both the front and rear fittings is the same with the exception of the amount of damage which may be sustained around the main bolt hole. The minimum bolt hole edge distances given on the illustration must be maintained. Either damage to perifery of the fitting or an increase in the bolt hole size to accommodate an oversize bushing will reduce the edge distance.

2-65. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Any damage to the wing-hull fittings greater than negligible will necessitate replacing the part. If replacement parts are not available new parts must be machined from 14S-T forging stock.

2-66. STRUTS AND STRUT ATTACHMENTS.

2-67. GENERAL. The four wing struts are attached to the sides of the hull at hull stations 4 and 5 and to the wing spars at wing station 7. The wing loads are transmitted to the struts by means of fittings riveted to the spars.

2-68. NEGLIGIBLE DAMAGE. Negligible damage to the wing struts is outlined in Figure 2-25. Negligible damage to the wing strut attaching fittings is shown in figure 2-26.

2-69. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Any damage to the struts or the strut attaching fittings greater than negligible will necessitate replacing the part. If replacement fittings are not available, new parts may be machined from 14S-T forging stock. If new struts are not available, the possibility of canabilizing replacement parts from other aircraft should be investigated.

2-70. LEADING EDGES.

2-71. GENERAL. There are five leading edge assemblies on the airplane: a left and right hand outer panel leading edge; a center section center leading edge (between nacelles); and a left and right hand center section outer leading edge (from the nacelle outboard to the panel splice). The leading edge design incorporates aluminum alloy skin and extruded stringers, and ribs built up from extruded sections.

2-72. NEGLIGIBLE DAMAGE. It is important that a normal air flow be maintained over the leading edge. For this reason large dents should be smoothed out. Other than the negligible damage described under paragraph 2-10 the following additional damage may be allowed to exist without repair:

a. Three inch diameter holes in the skin not closer than three inches measured from the edges of the holes.

Note

Dope a fabric patch over leading edge skin holes classed as negligible damage.

b. Damage to either upper or lower surface leading edge stringers forward of the first 2 stringers from the front spar may be considered negligible.

c. The first two stringers from the front spar on both the upper and lower surface of the leading edge are considered structurally as part of the interspar structure. Therefore, to determine if damage to these stringers may be considered negligible, consult paragraph 2-15 to 2-21 inclusive.

Note

The skin near these leading edge stringers is not considered part of the interspar structure.

d. Negligible damage to the leading edge ribs is considered to consist of nicks not more than 1/8" deep in the extruded sections, and cracks not exceeding one inch in length in the intercostals or nose gusset piece.

2-73. DAMAGE REPAIRABLE BY PATCHING. The leading edge skin in any area should be patched in accordance with figure 2-28. Figure 2-27 outlines the method of repairing an attaching strip in which the threads have been stripped. Leading edge stringers are to be patched in accordance with the typical repairs outlined in Appendix II.

2-74. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Damage to leading edge ribs in excess of negligible should be repaired by replacing the damaged members.

2-75. TRAILING EDGES.

2-76. GENERAL. The trailing edges of the airplane are built in six sections; a left and right center section trailing edge, a left and right hand outer panel "stubby"

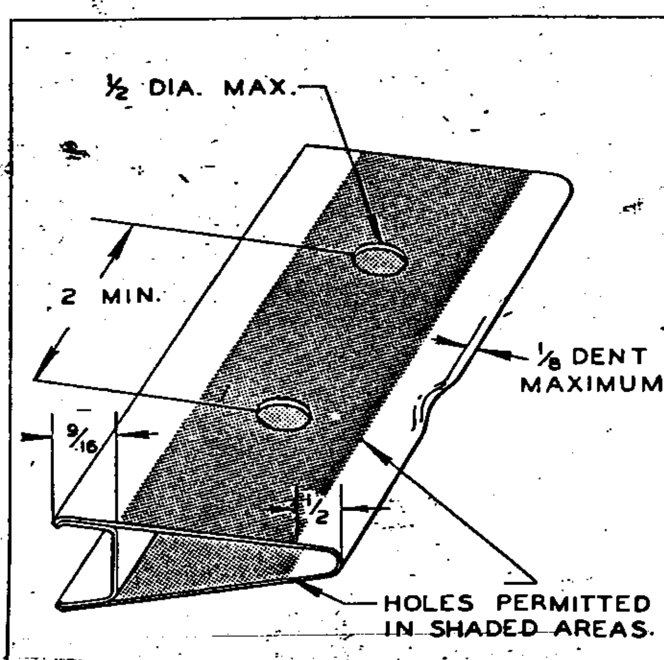


Figure 2-29—Trailing Edge-Negligible Damage

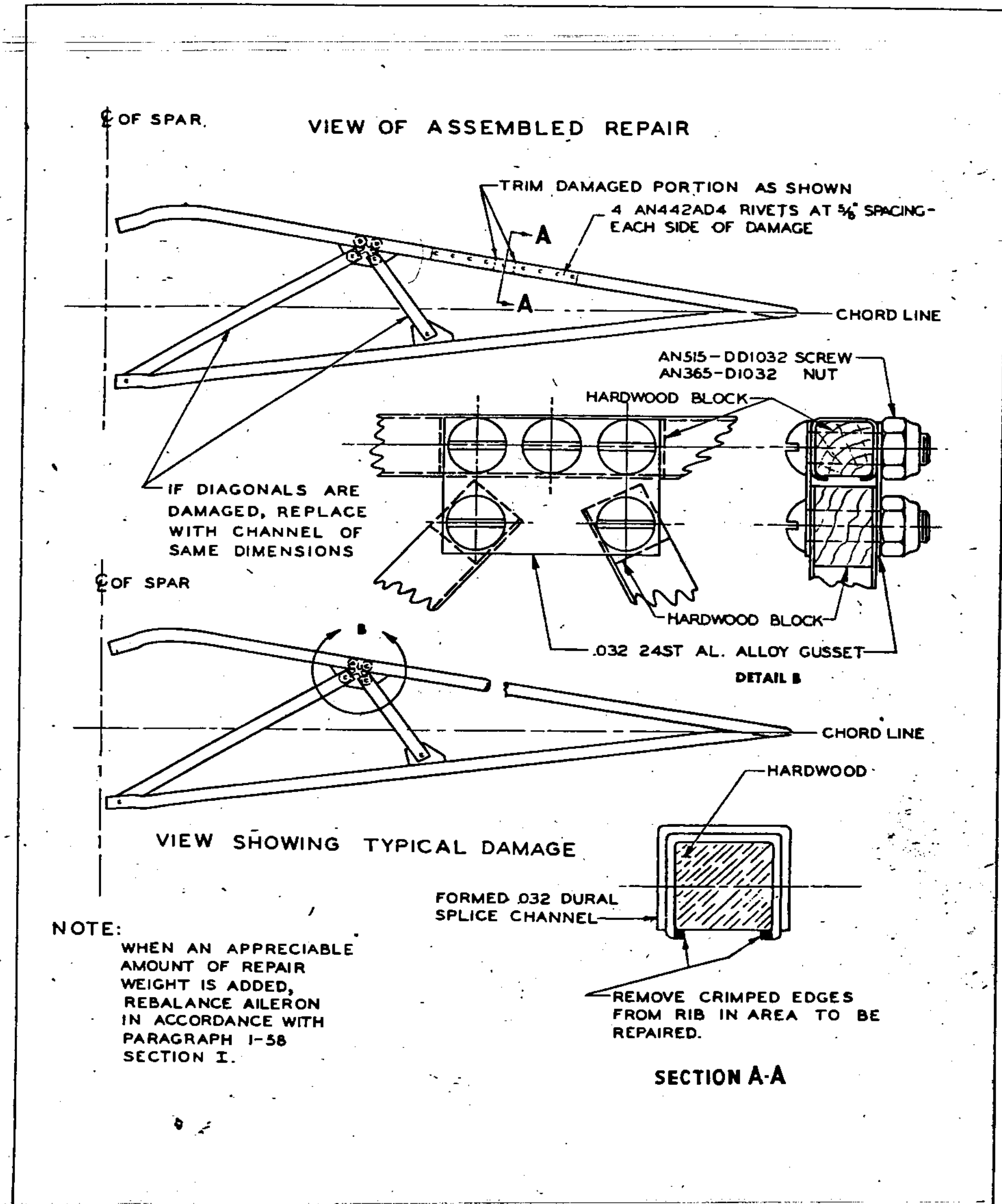


Figure 2-30—Trailing Edge Rib Repair

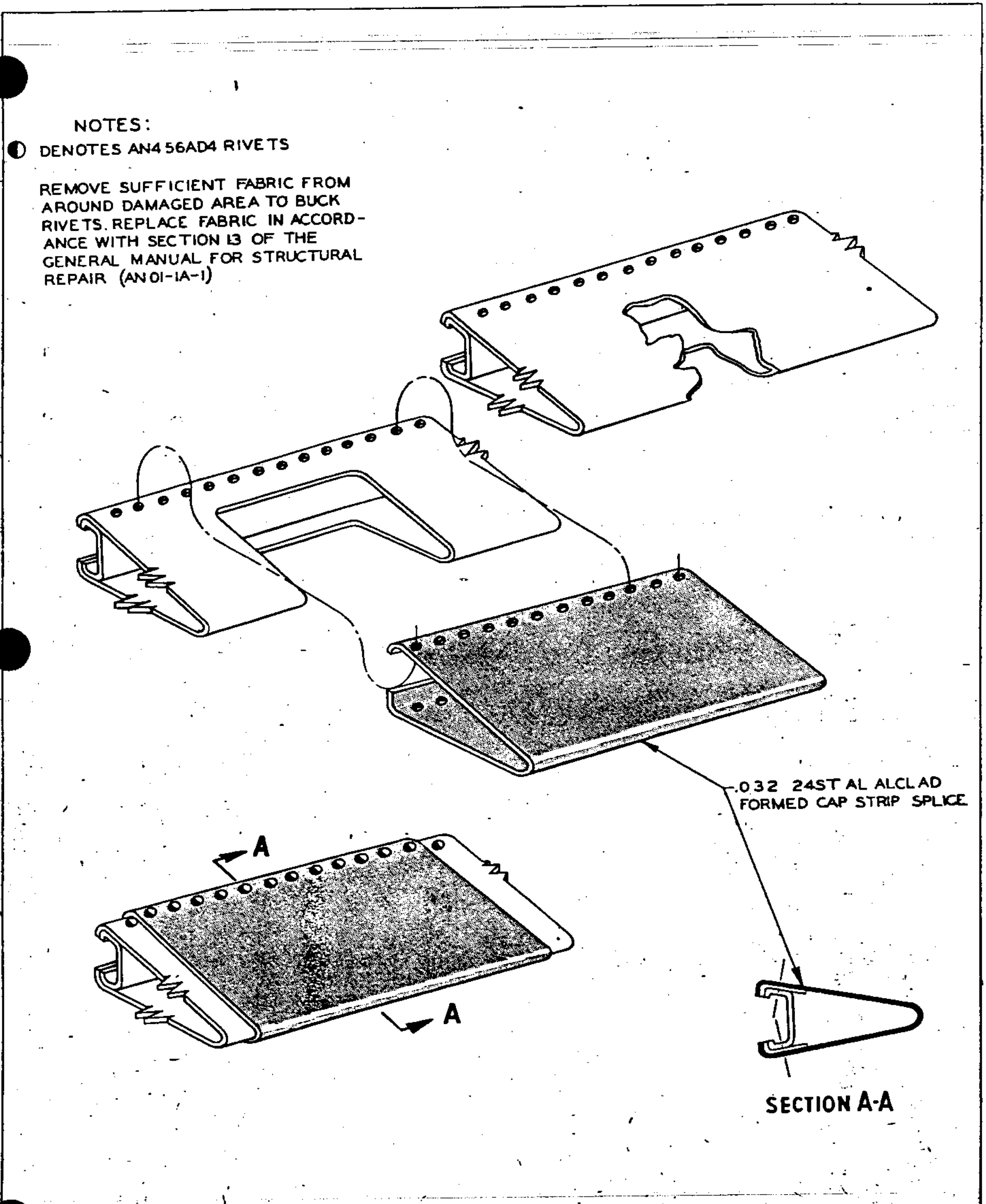


Figure 2-31—Formed Trailing Edge Repair

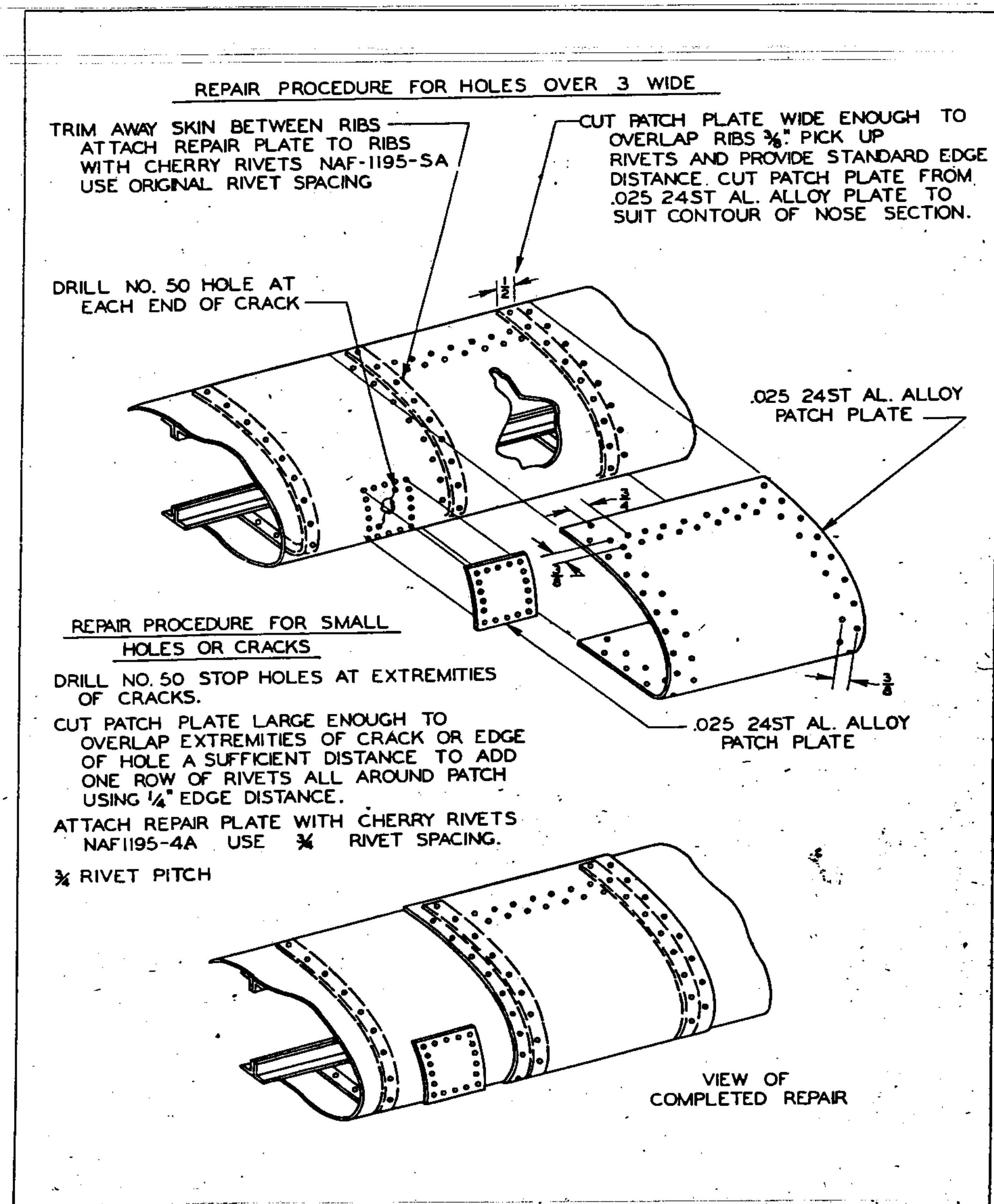


Figure 2-32—Aileron Leading Edge Repair

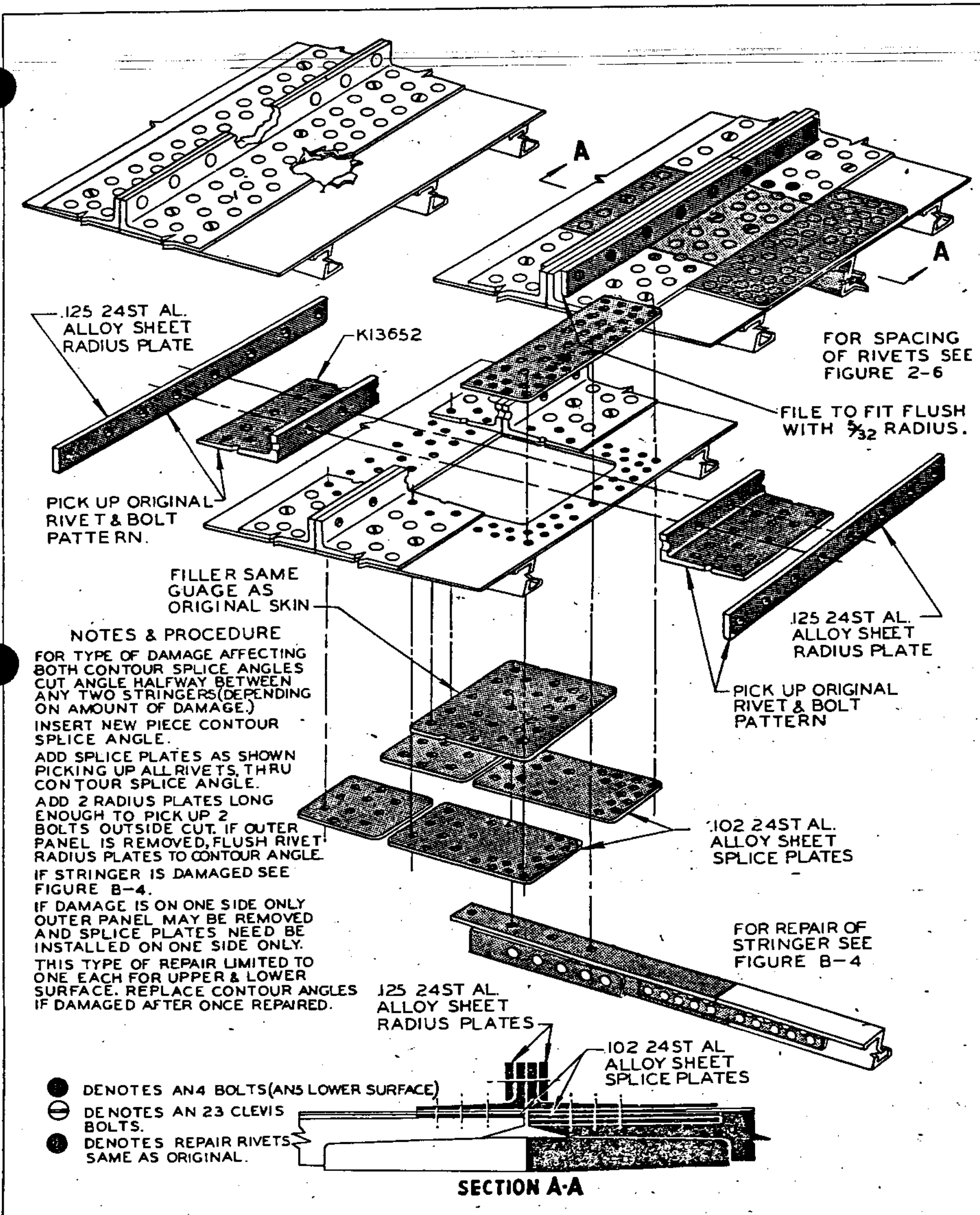


Figure 2-33—Panel Splice Chord Angle Repair

trailing edge, and a left and right hand aileron cut-out trailing edge. Each assembly is a fabric-covered framework of aluminum alloy truss ribs, formed trailing edge sections, and extruded aluminum alloy tapping strips for attachment to the rear spar flanges. Access to the interior is gained through zippered access flaps in the fabric. (See figure 2-2.)

2-77. NEGLIGIBLE DAMAGE. Because of the small size of the trailing edge rib members, it is unlikely that any damage to the ribs can be classed as negligible. Further, no tears or holes in the fabric covering can be classed as negligible. Nicks 1/8" deep and 1/2" wide in the outstanding leg of the trailing edge attaching strip may be considered negligible provided they are smoothed out. Negligible damage to the trailing edge cap strips and formed trailing edge section is defined in figure 2-29.

2-78. DAMAGE REPAIRABLE BY PATCHING. Damage to the fabric covering of the trailing edges should be repaired in accordance with the procedure outlined in Section VIII of the General Manual for Structural Repair (AN 01-1A-1).

2-79. Damage to rib members may be repaired in accordance with figure 2-30.

2-80. Damage to the formed trailing edge may be repaired in accordance with figure 2-31.

2-81. When the trailing edge tapping strip has been cut through and the trailing edge must be removed to effect the repair, caution should be exercised since with the tapping strip severed, the tension of the fabric will spring the edges of the tapping strip and cause further damage. Therefore, brace the ends of the tapping strip before removing the trailing edge.

2-82. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If damage to the trailing edges is extensive, the entire assembly should be replaced. If some of the special attaching screws are lost during replacement, any No. 10-32 AN screw may be substituted. The Erection and Maintenance Manual (AN 01-5MC-2) should be consulted for the proper length of screw.

2-83. AILERON.

2-84. GENERAL. The aileron structure consists of a truss type spar (fabricated from 24S-T aluminum alloy extrusions) and ribs and a sheet metal formed leading edge section. The entire assembly is fabric covered. The trailing edge of the aileron (the portion of the surface aft of the spar) is very similar to the regular trailing edge surfaces of the airplane. For any repairs in this area consult paragraph 2-75 to 2-82 inclusive and figures 2-29, 2-30 and 2-31. Repairs to the fabric covering of the aileron should be made in accordance with Section VIII of the General Manual for Structural Repair (AN 01-1A-1).

2-85. When any repairs are made on the aileron including extensive fabric repairs, paragraph 1-58 of this manual should be consulted. Rebalancing of the aileron may become necessary if the repairs involve the addition or redistribution of weight.

WARNING

Checking the balance of the ailerons after repair is vital. An unbalanced aileron may set up "aileron flutter" which can result in loss of the ailerons and the airplane.

2-86. The internal structure of the aileron particularly in the nose area, is not very accessible for repair. It is therefore permissible to use "cherry" blind rivets for repairing any of the structure except the spar. When blind rivets are used they must be one size larger than the rivet previously used in that area.

2-87. NEGLIGIBLE DAMAGE. See paragraph 2-77 for definition of negligible damage to the trailing edge of the aileron. Nicks up to 1/8" deep and 3/8" in length in any of the aileron spar members may be classed as negligible damage provided the nicks are filed out smooth. Damage to the aileron leading edge which may be classed as negligible is: stop drilled cracks not exceeding 1" in length and holes not exceeding 1 1/2" in diameter and not closer than 3" between the edges of the holes. In the area within 1" of the extreme forward point of the nose, and thru the reinforcing plates around the hinge cutouts and horn, neither cracks longer than 3/8" nor holes more than 3/8" in diameter can be classed as negligible damage. Not more than two holes may occur in the same bay. All holes must be covered with a fabric patch.

2-88. DAMAGE REPAIRABLE BY PATCHING. A typical patch repair to the aileron leading edge is shown in figure 2-32.

2-89. DAMAGE REPAIRABLE BY INSERTION. Damage to the aileron spar flanges may be repaired by insertion. Refer to the typical repair of extruded section K-78-F in Appendix II.

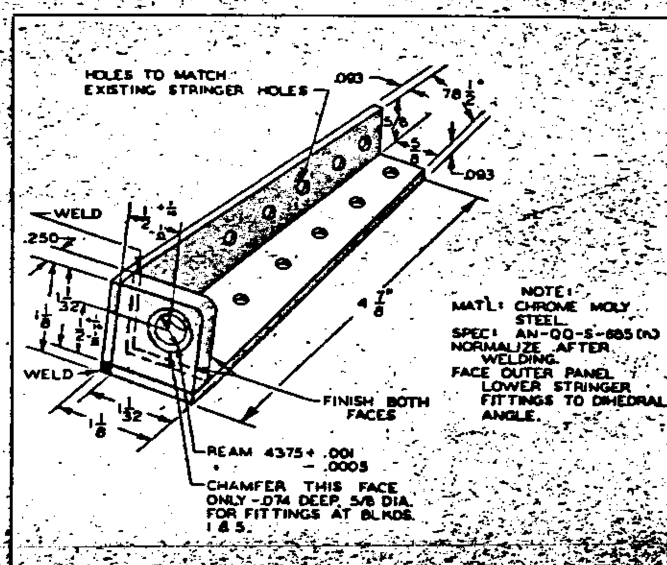


Figure 2-34—Substitute Stringer Splice Fitting

2-90. DAMAGE NECESSITATING REPLACEMENT OF PARTS. The diagonal and vertical aileron spar extrusions should be replaced when the damage exceeds that which is classified as negligible. See the table of extrusion equivalents given in Section VIII. Care should be exercised that when members are replaced, that they be riveted with the same size rivets as were previously installed.

2-91. PANEL SPLICE.

2-92. GENERAL. The outer wing panels are joined to the center panel by means of a bolted joint called the panel splice. Loads imposed by the outer panel are transmitted to the center section thru a series of bolted fittings and splice angles. Standard AN bolts and nuts are used throughout the splice. Paragraph 1 of Section IV of the Erection and Maintenance Manual (AN 01-5MC-2) should be consulted for a diagram of the panel splice bolt plan.

2-93. NEGLIGIBLE DAMAGE. The only negligible damage permitted at the panel splice consists of nicks 1/8" deep and not longer than 1/2" in the extruded splice angles.

2-94. DAMAGE REPAIRABLE BY PATCHING. Because of space limitations the only parts of the panel splice which can be repaired by patching are the external extruded contour angles. A typical repair for these members is shown in figure 2-33.

2-95. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Damage to any panel splice members with the exception of the external chord angles will necessitate replacing the part. There is no acceptable substitute for the extruded angle sections at the panel splice. Unless new parts can be machined from bar stock, the necessary parts must be salvaged from other aircraft. Damaged stringer fittings may be replaced with a substitute steel fitting manufactured in accordance with figure 2-34.

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SECTION III

Tail Group

SECTION III

TAIL GROUP

3-1. GENERAL.

(See figure 3-1.)

3-2. The tail group consists of a horizontal stabilizer which provides a hinge support for the elevator and a vertical stabilizer which provides a hinge support for the rudder.

3-3. When making repairs to any damaged portion of the tail group, especially the leading edges, the repair should be made as neat and trim as possible in order to prevent any changes in air flow that might affect the stalling characteristics of the tail or cause flutter to develop.

3-4. Although a number of access doors are located in the tail surfaces, many damages will be difficult to repair due to lack of accessibility for riveting, etc. In such cases it will be necessary to remove a portion of the skin (aluminum alloy or fabric) adjacent to the repair, complete the repair, and then patch the access hole, using Cherry blind rivets in the case of aluminum alloy skin and stitched doped fabric in the case of fabric skin. See General Manual for Structural Repair, AN 01-1A-1 for details.

3-5. HORIZONTAL AND VERTICAL STABILIZERS.

3-6. GENERAL. (See figure 3-1.) The vertical and horizontal stabilizers are both of similar construction, each being a semi-monocoque full cantilever structure. The principal structural members of the vertical and horizontal stabilizers are a front and rear spar. Ribs (constructed of standard extruded sections in the case of the horizontal stabilizer and of hydropress construction in the case of the vertical stabilizer) are attached to the spars and run chordwise, serving to hold the skin to contour. On the horizontal stabilizer the ribs are located at each station. (See figure 3-2.)

3-7. Both stabilizers are covered with 24S-T aluminum alloy skin stiffened by the ribs and in the case of the horizontal stabilizer also by stringers. The leading edges of both the vertical and horizontal stabilizers are covered with an outer skin in addition to the inner leading edge skin. The outer and inner skins provide a passageway for the circulation of heated air for anti-icing.

3-8. NEGLIGIBLE DAMAGE. All permissible negligible damage to the horizontal and vertical stabilizers is shown in figures 3-3 and 3-4, respectively. In airplanes that are not equipped with heat anti-icing, complete destruction of the outer leading edge skin is considered as negligible, requiring no repair.

3-9. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Most damage which is too extensive to be considered as negligible should be repaired by patching.

3-10. In the case of holes in the stabilizer skin, the patch should be made flush. Figure 2-28 illustrates a skin damage repair on the leading edge of the wing which should also be used for skin repairs to the horizontal or vertical stabilizers.

3-11. Since stringers used in the horizontal stabilizer are similar to those used in the hull, the repair procedure outlined in figure 4-9 should also be followed in repairing stabilizer stringers.

3-12. Spar repairs are shown in figures 3-5 and 3-6. All short length spar stiffening angles, braces, gussets, etc., are best repaired by replacing the member rather than by patching it. For repairs to any of the standard extruded stiffening members refer to Appendix II.

3-13. Most of the ribs are of hydropress construction, containing lightening holes and beads. Repairs for these hydropress members are shown in figures 3-7 and 3-8.

3-14. ELEVATOR AND RUDDER.

(See figure 3-1.)

3-15. The elevator and rudder are similar structures, each being of aluminum alloy frame construction with fabric covering. The principal structural member in each is a spar to which is attached a series of ribs which provide rigidity and maintain the contour of the surface. The ribs in the elevator are of truss construction (composed of angles and channels); those in the rudder are of hydropress construction, containing many beaded lightening holes.

3-16. NEGLIGIBLE DAMAGE. All damage to the elevator and rudder that is classed as negligible damage is shown in figures 3-9 and 3-10 respectively.

3-17. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Most damage to the elevator or rudder should be repaired by patching.

3-18. The metal leading edge skin of both the elevator and rudder should be patched in the same manner as the leading edge of the wing. This repair is shown in figure 2-28.

3-19. Typical repairs to rudder hydropress spar and rib members are shown in figures 3-7 and 3-8. Typical repairs to the elevator spar and channel or box section ribs are shown in figures 3-11 and 3-13 respectively.

3-20. Damage to short length members or to hinge fittings should be repaired by replacing the member. However, damage to the elevator torque tube if not over half the cross sectional area of the tube should be repaired by patching as shown in figure 3-12. If the damage exceeds one-half the cross sectional area of the tube, the torque tube should be completely replaced.

Index	Structure	Figure No.
1.	Horizontal Stabilizer	3-3
2.	Elevator	3-9
3.	Front Spar - Vertical Stabilizer	3-6
4.	Vertical Stabilizer	3-4
5.	Rudder	3-10
6.	Rudder Rib	3-7
7.	Elevator Rib	3-13
8.	Elevator Spar	3-11
9.	Horizontal Stabilizer Spar	3-5
10.	Elevator Torque Tube	3-12
11.	Vertical Stabilizer Rib	3-7
12.	Rear Spar - Vertical Stabilizer	3-6
13.	Rudder Leading Edge Rib	3-8

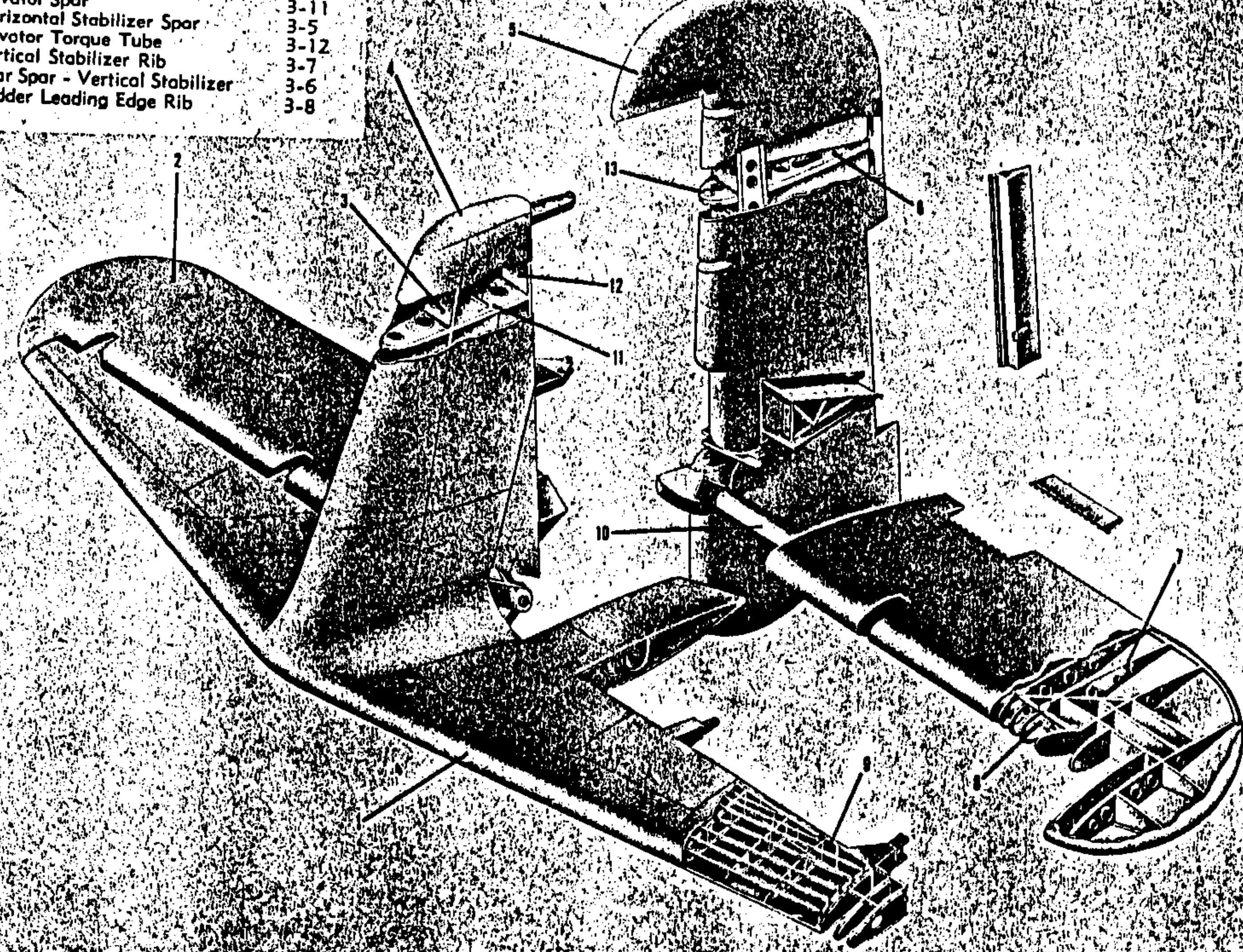


Figure 3-1—Main Tail Components

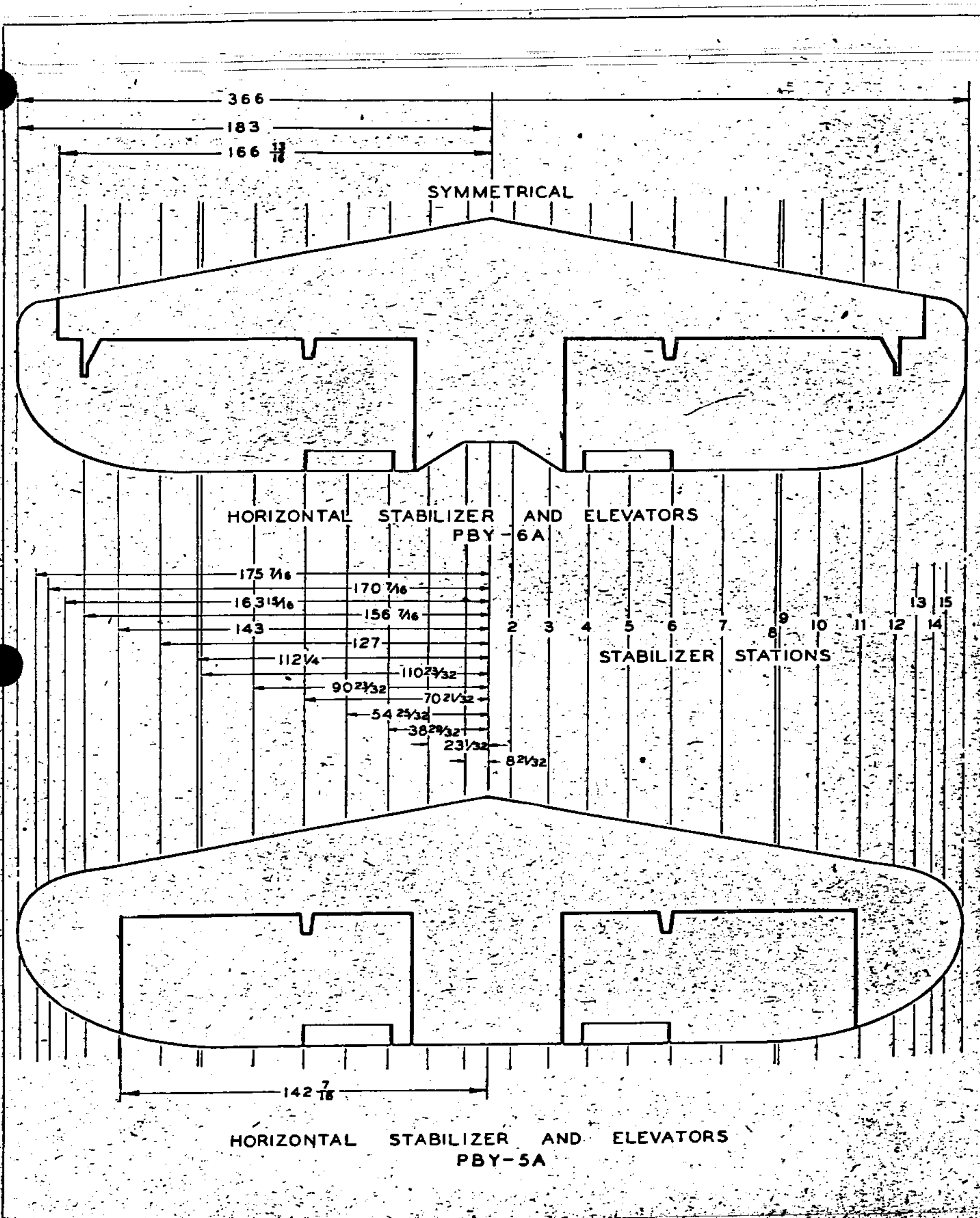


Figure 3-2—Tail Station Diagram

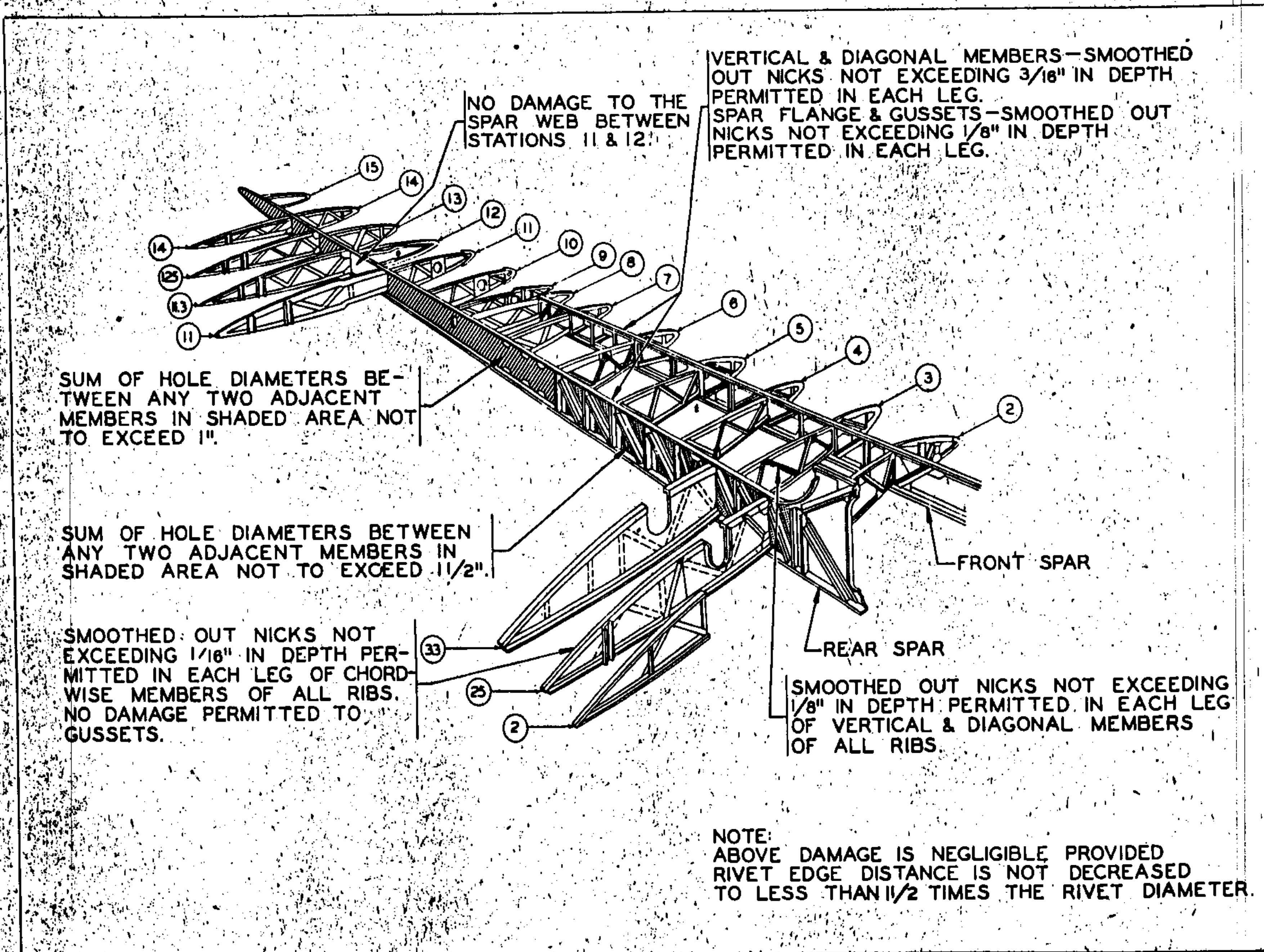
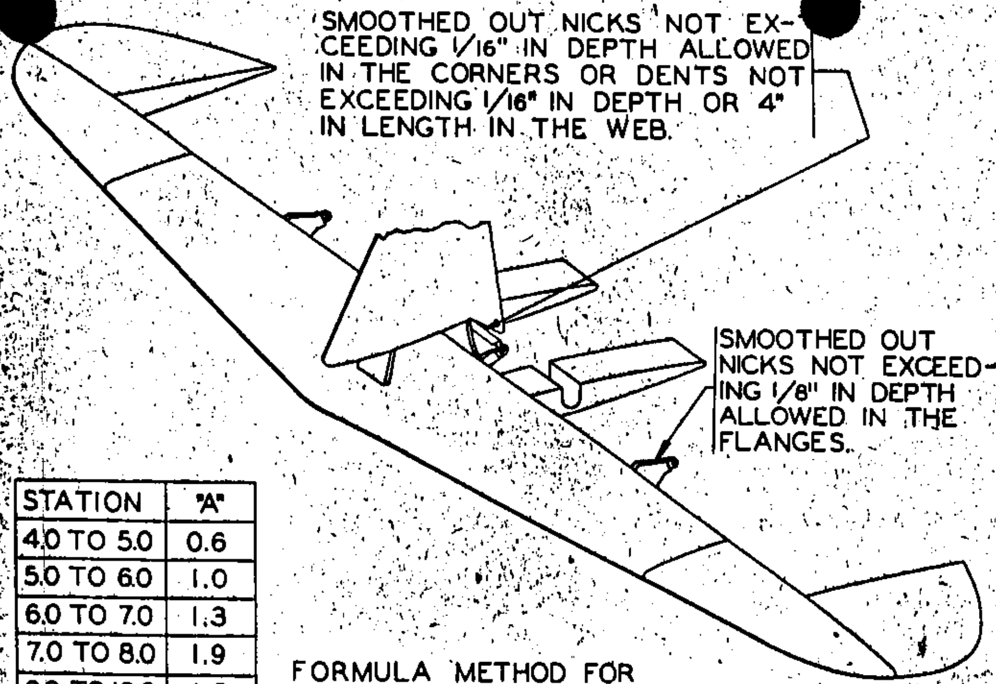


Figure 3-3—Horizontal Stabilizer-Negligible Damage (sheet 1 of 2)



STATION	"A"
4.0 TO 5.0	0.6
5.0 TO 6.0	1.0
6.0 TO 7.0	1.3
7.0 TO 8.0	1.9
9.0 TO 10.0	1.5
10.0 TO 12.0	1.1

FORMULA METHOD FOR COMPUTING NEGLIGIBLE DAMAGE TO SKIN AND STRINGERS

$.059N_1 + .101N_2 + .025L_1 + .040L_2$ TO BE LESS THAN "A"

N_1 = NUMBER OF DAMAGED LEADING EDGE STRINGERS.
N_2 = NUMBER OF DAMAGED MAIN STRINGERS
L_1 = TOTAL CHORDWISE LENGTH, IN INCHES, OF DAMAGED UPPER SURFACE SKIN.
L_2 = TOTAL CHORDWISE LENGTH IN INCHES OF DAMAGED LOWER SURFACE SKIN.

EXAMPLE:
DAMAGE: UPPER SURFACE SKIN 2" CHORDWISE x 3" SPANWISE.
LOWER SURFACE SKIN 1.5" CHORDWISE x 3.5" SPANWISE.
LEADING EDGE SKIN 1" CHORDWISE x 2" SPANWISE.
TWO NON-ADJACENT LEADING EDGE STRINGERS.
ONE UPPER & ONE LOWER SURFACE MAIN STRINGER.
LOCATION: BETEEN STATIONS 6.0 & 7.0.
METHOD: $.059N_1 + .101N_2 + .025L_1 + .040L_2$ TO BE LESS THAN 1.3.
$N_1 = 2$ $N_2 = 2$ $L_1 = 2 + 1 = 3$ $L_2 = 1.5$
$(.059 \times 2) + (.101 \times 2) + (.025 \times 3) + (.040 \times 1.5) = .455$
SINCE .455 IS LESS THAN 1.3 THE DAMAGE IS CONSIDERED NEGLIGIBLE. IF FORMULA SUM HAD EXCEEDED 1.3, REPAIR WOULD BE NECESSARY.

NO DAMAGE TO SKIN OR STRINGERS INBOARD OF STATION 40 IS ALLOWED.

SKIN BETWEEN STATIONS, FROM STATION 12.0 TO TIP, MAY HAVE HOLES 1/3 THE DISTANCE BETWEEN STATIONS IN DIAMETER.

DAMAGE MAY NOT BE CONSIDERED NEGLIGIBLE IF TWO ADJACENT STRINGERS ARE COMPLETELY DAMAGED.

DAMAGE TO SKIN MAY NOT BE CONSIDERED NEGLIGIBLE IF IT EXTENDS OVER TWO ADJACENT STRINGERS OR IN A CHORDWISE OR SPANWISE DIRECTION EXCEEDING THE STRINGER SPACING IN THE DAMAGED AREA.

ENTIRE AREA OF STRINGER MUST BE CONSIDERED LOST IF DAMAGE IS IN EXCESS OF 25% OF TOTAL CROSS-SECTIONAL AREA OF THE STRINGER.

IF STRINGER IS SO DAMAGED THAT IT IS INEFFECTIVE IN SUPPORTING THE SKIN, HALF THE SKIN AREA BETWEEN ADJACENT (GOOD) STRINGERS MUST BE CONSIDERED LOST.

IF LESS THAN 25% OF THE CROSS-SECTIONAL AREA OF A STRINGER IS DAMAGED, THIS PARTIAL DAMAGE MAY BE USED IN THE FORMULA AS LOWER SURFACE SKIN DAMAGE IN THE FOLLOWING MANNER
FOR LEADING EDGE STRINGERS L_2 = PARTIAL DAMAGE.
FOR MAIN STRINGERS L_2 = 2 x PARTIAL DAMAGE.

STABILIZER TO HULL ATTACHING FITTINGS MAY CONTAIN SMOOTHED OUT NICKS PROVIDED THEY ARE AT LEAST 1 1/2 DIAMETERS FROM THE BOLT HOLES. NO DAMAGE IS ALLOWED IN THE WEB OF THE FITTINGS.

PBY-6A OUTBOARD HINGE BRACKET—BEAM FLANGES & VERTICAL STIFFENERS MAY HAVE 3/16" OF OUTSTANDING LEG REMOVED. WEB OF BEAM MAY HAVE HOLES TOTALING 1/4 THE HEIGHT OR WIDTH BETWEEN VERTICAL STIFFENERS, WHICHEVER IS SMALLER. FAIRING MAY BE COMPLETELY REMOVED.

Figure 3-3—Horizontal Stabilizer-Negligible Damage (sheet 2 of 2)

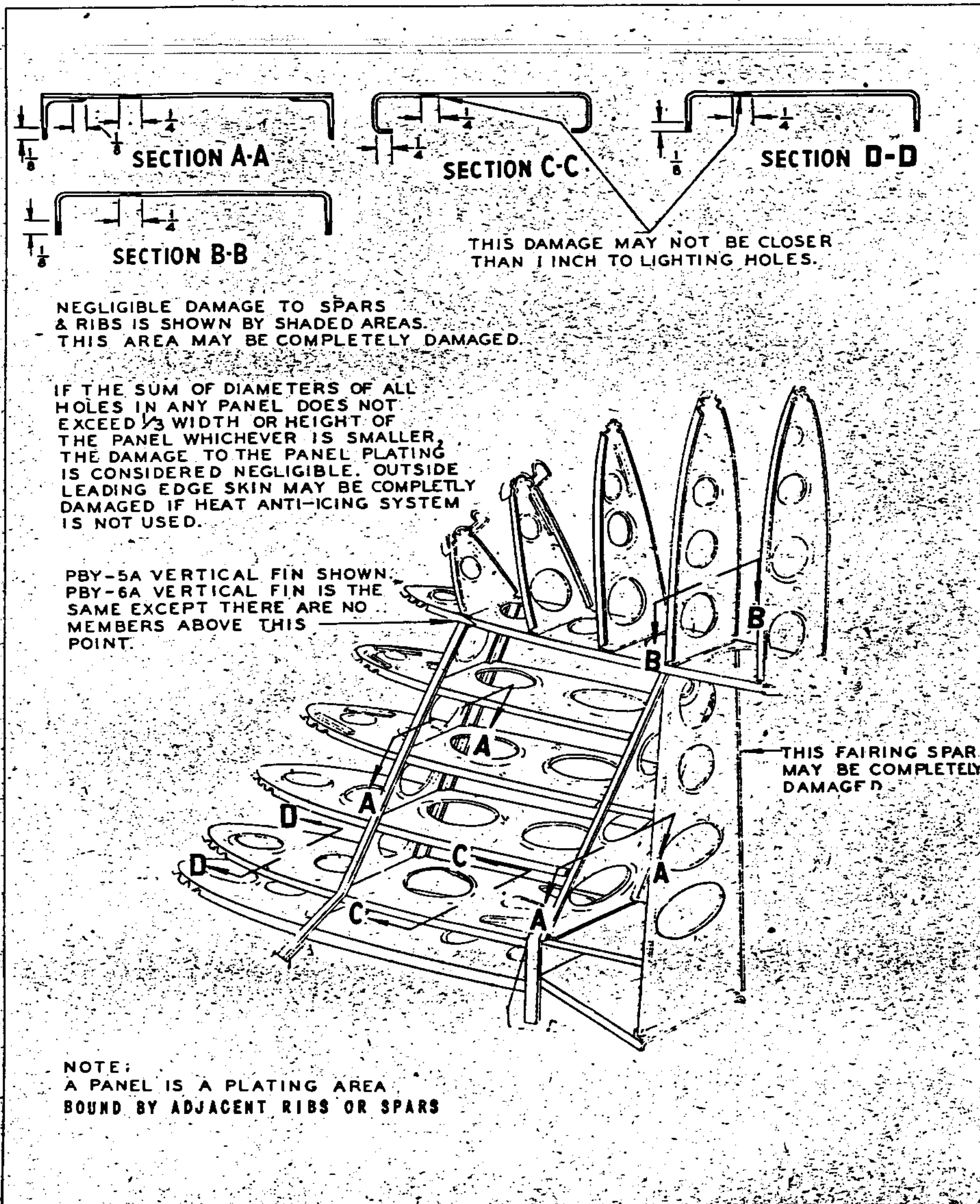


Figure 3-4—Vertical Stabilizer-Negligible Damage

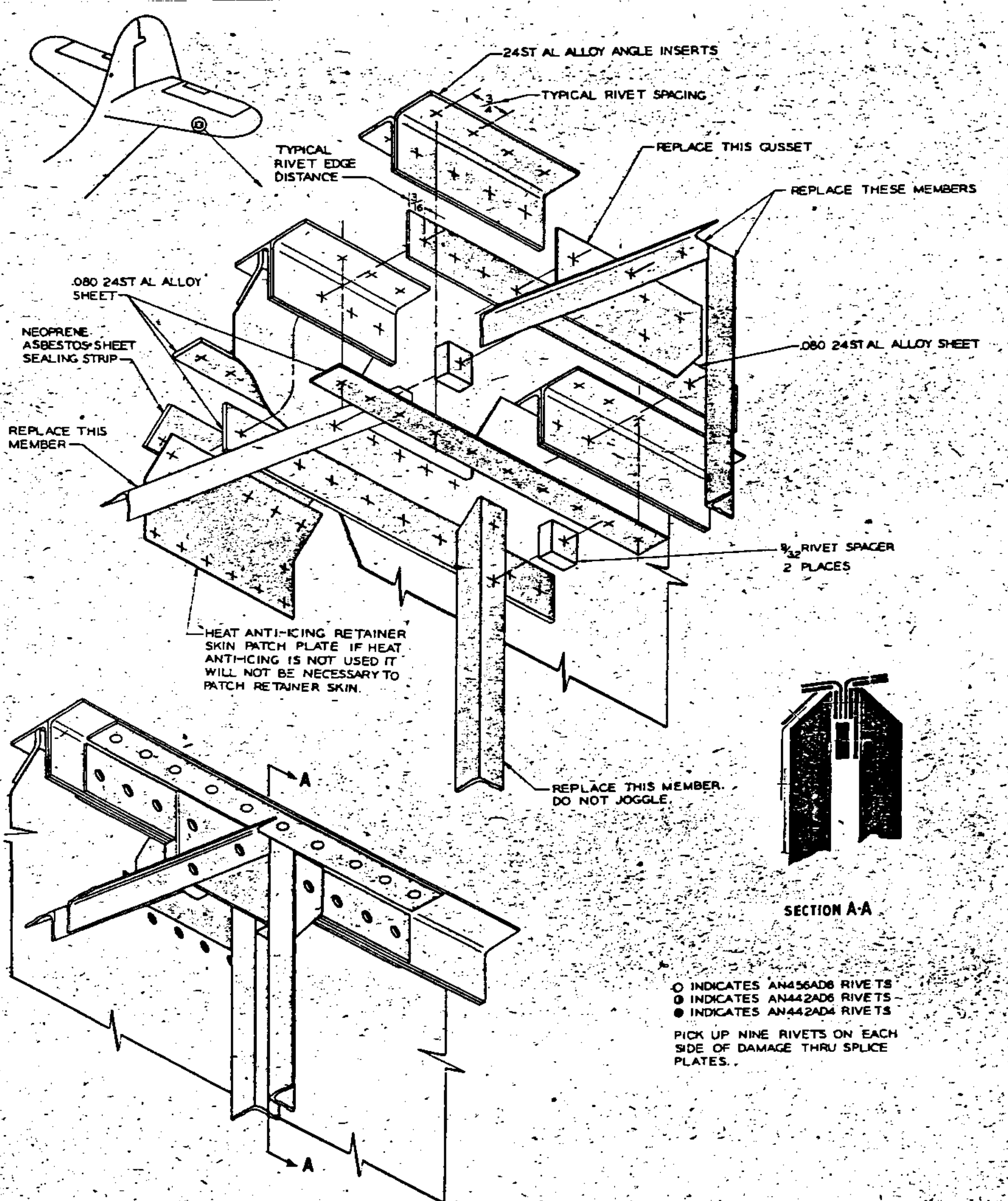


Figure 3-5 (Sheet 1 of 2 Sheets)—Horizontal Stabilizer-Spar Repair

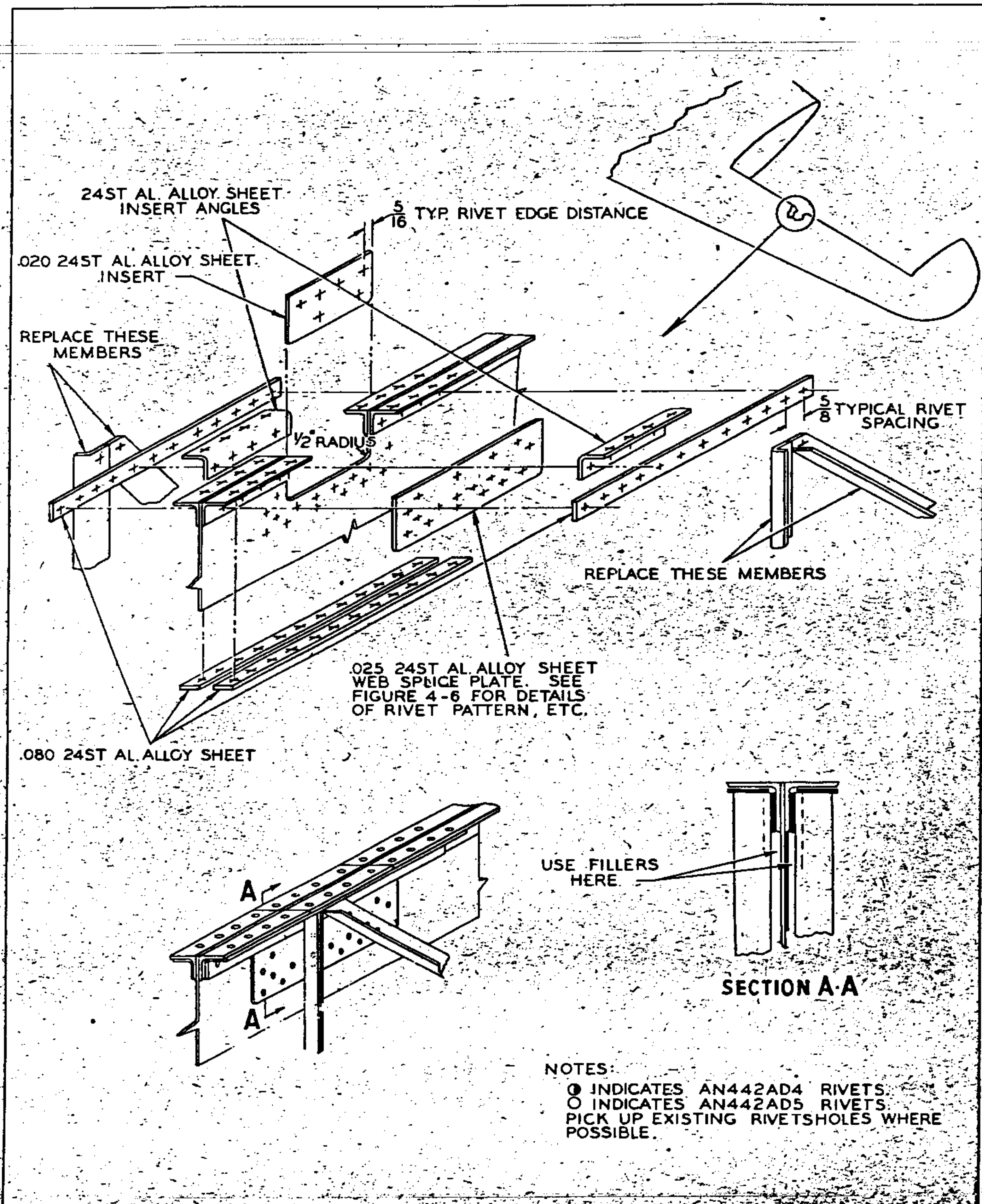


Figure 3-5 (Sheet 2 of 2 Sheets)—Horizontal Stabilizer-Spar Repair

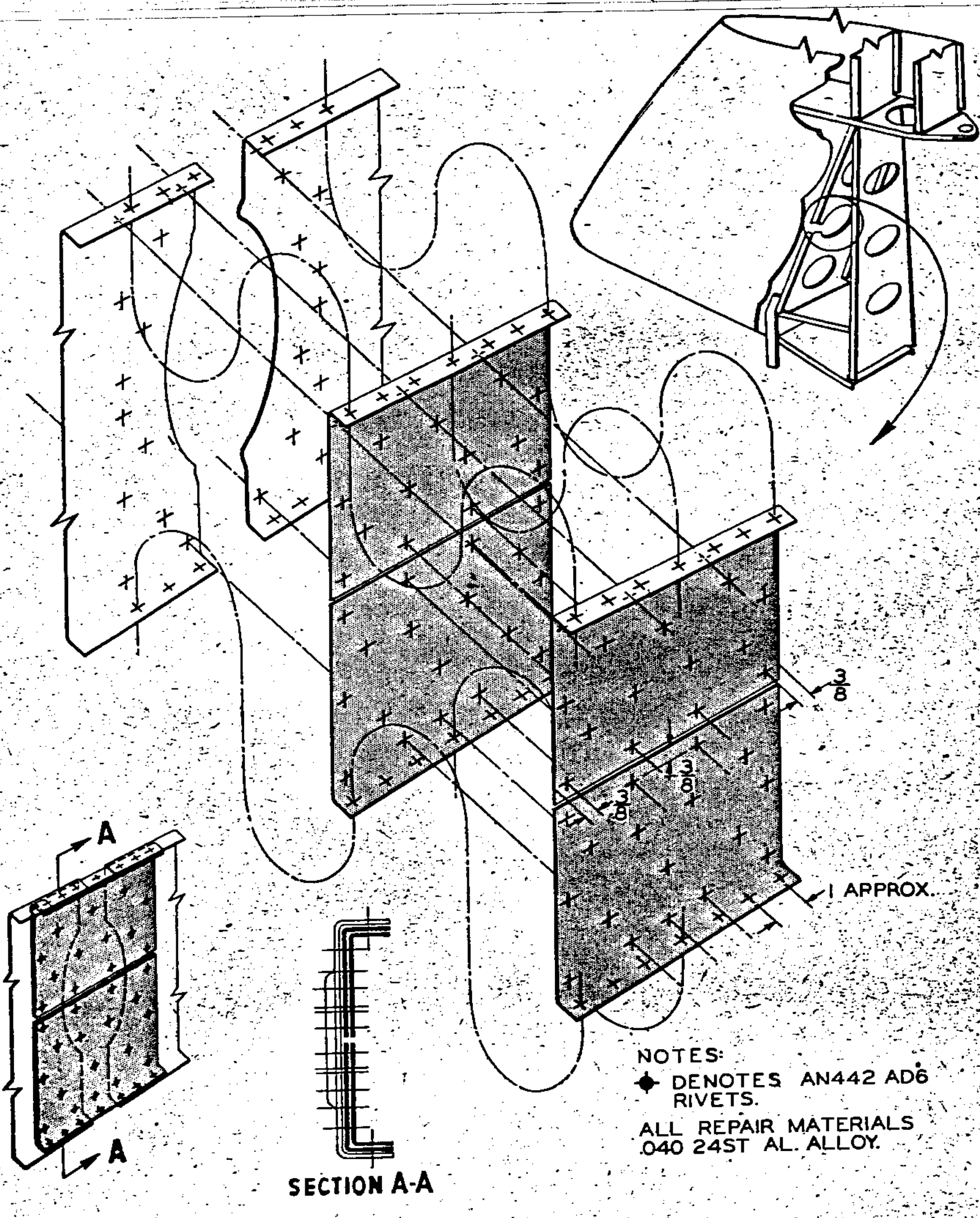
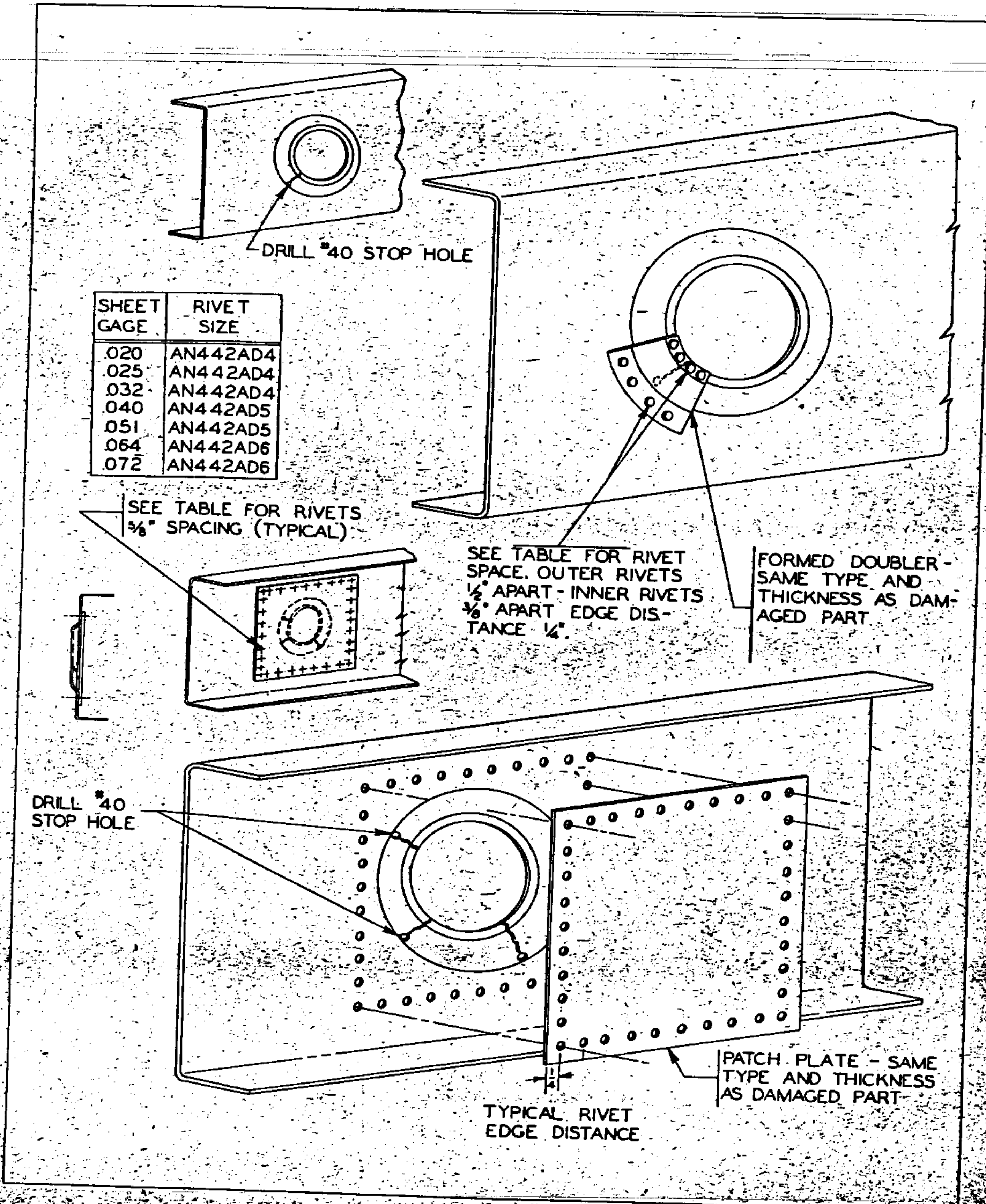
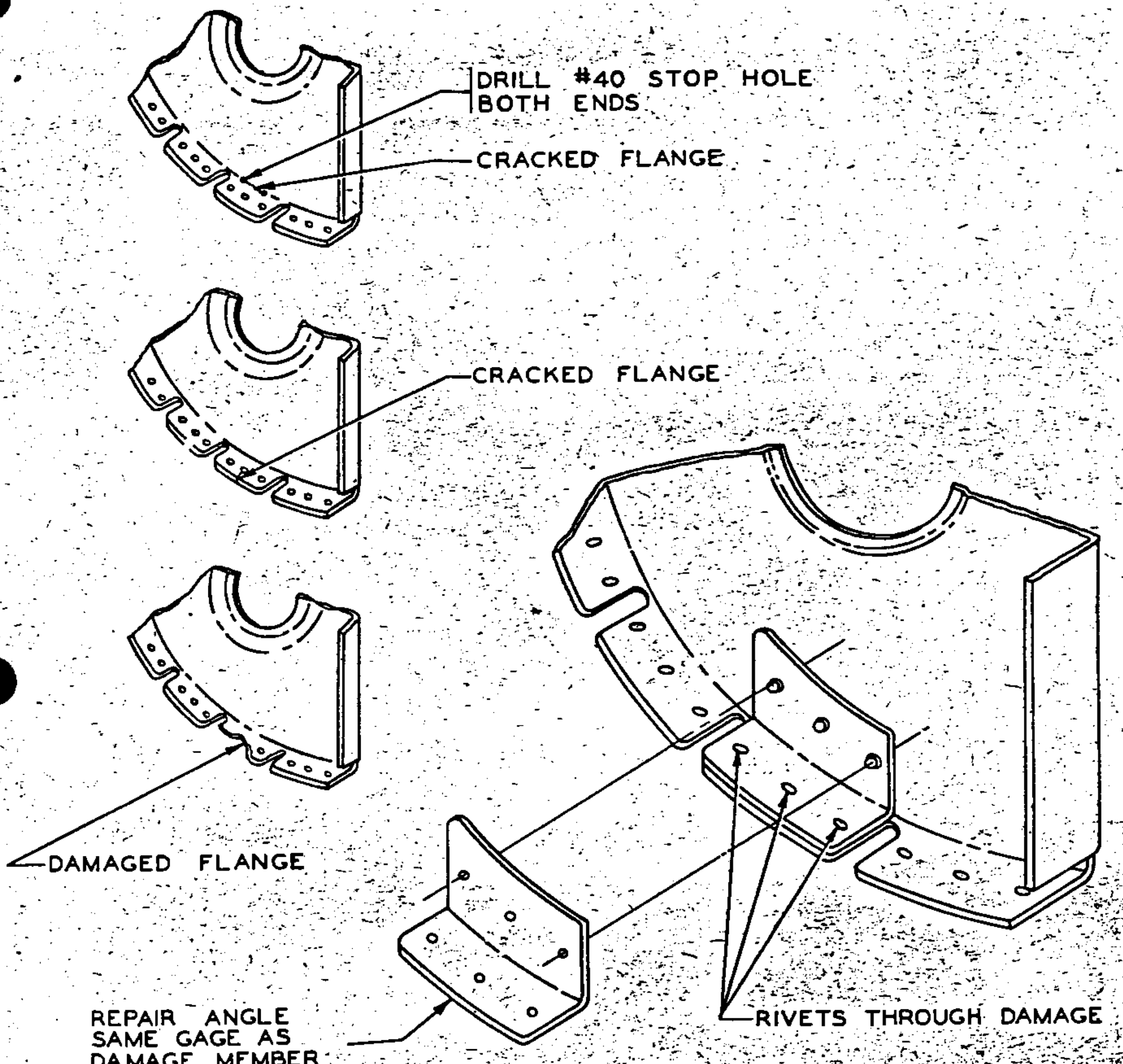


Figure 3-6—Vertical Stabilizer Spar Repair



SHEET GAGE	RIVET SIZE
.020	AN442AD4
.025	AN442AD4
.032	AN442AD4
.040	AN442AD5
.051	AN442AD5
.064	AN442AD6
.072	AN442AD6

Figure 3-7—Beaded Lightning Hole Repair



SHEET GAUGE	RIVET SIZE
.020	AN442AD4
.025	AN442AD4
.032	AN442AD4
.040	AN442AD5
.051	AN442AD5
.064	AN442AD6
.072	AN442AD6

Figure 3-8—Typical Hydropress Flange Repair

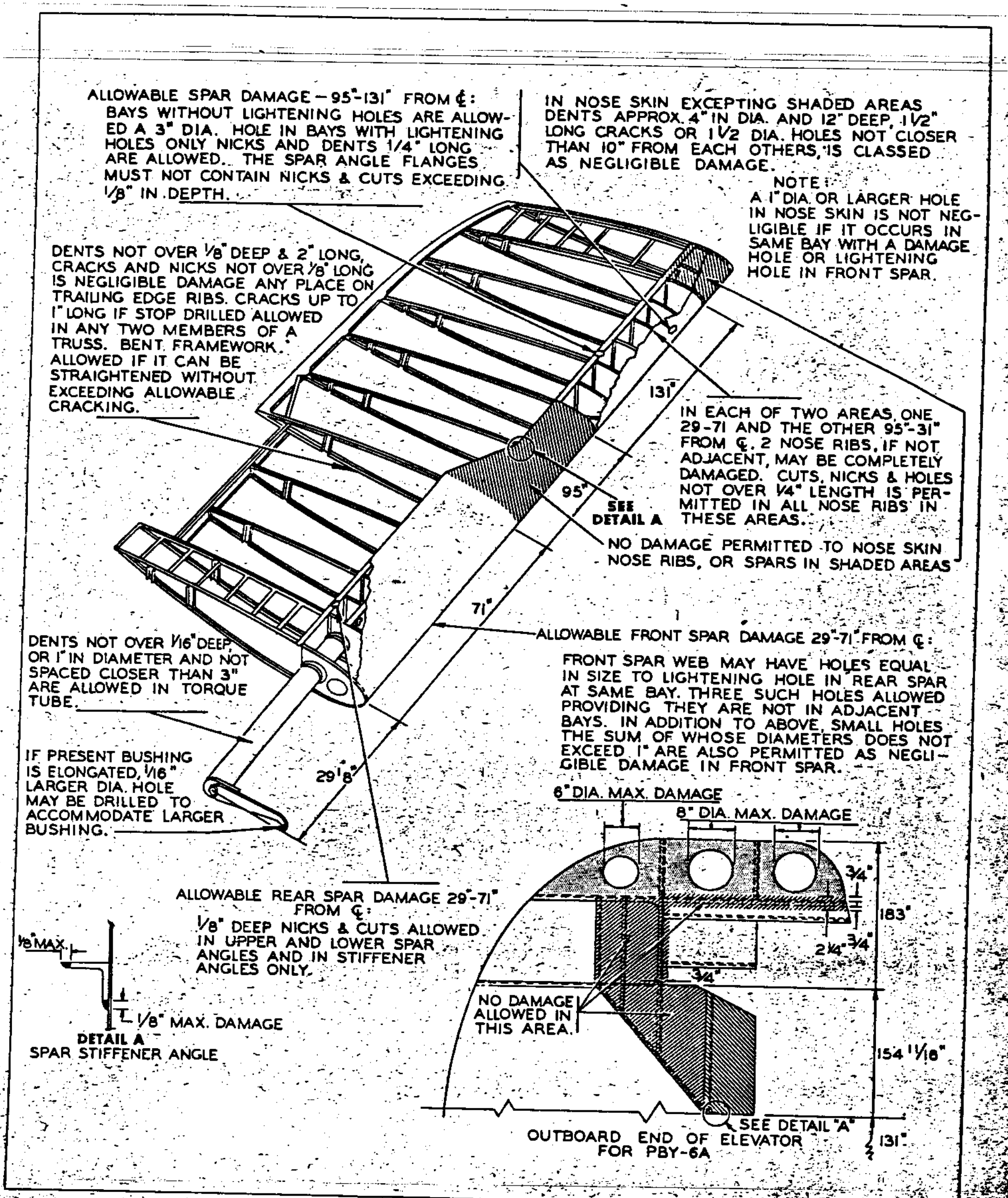


Figure 3-9—Elevator-Negligible Damage

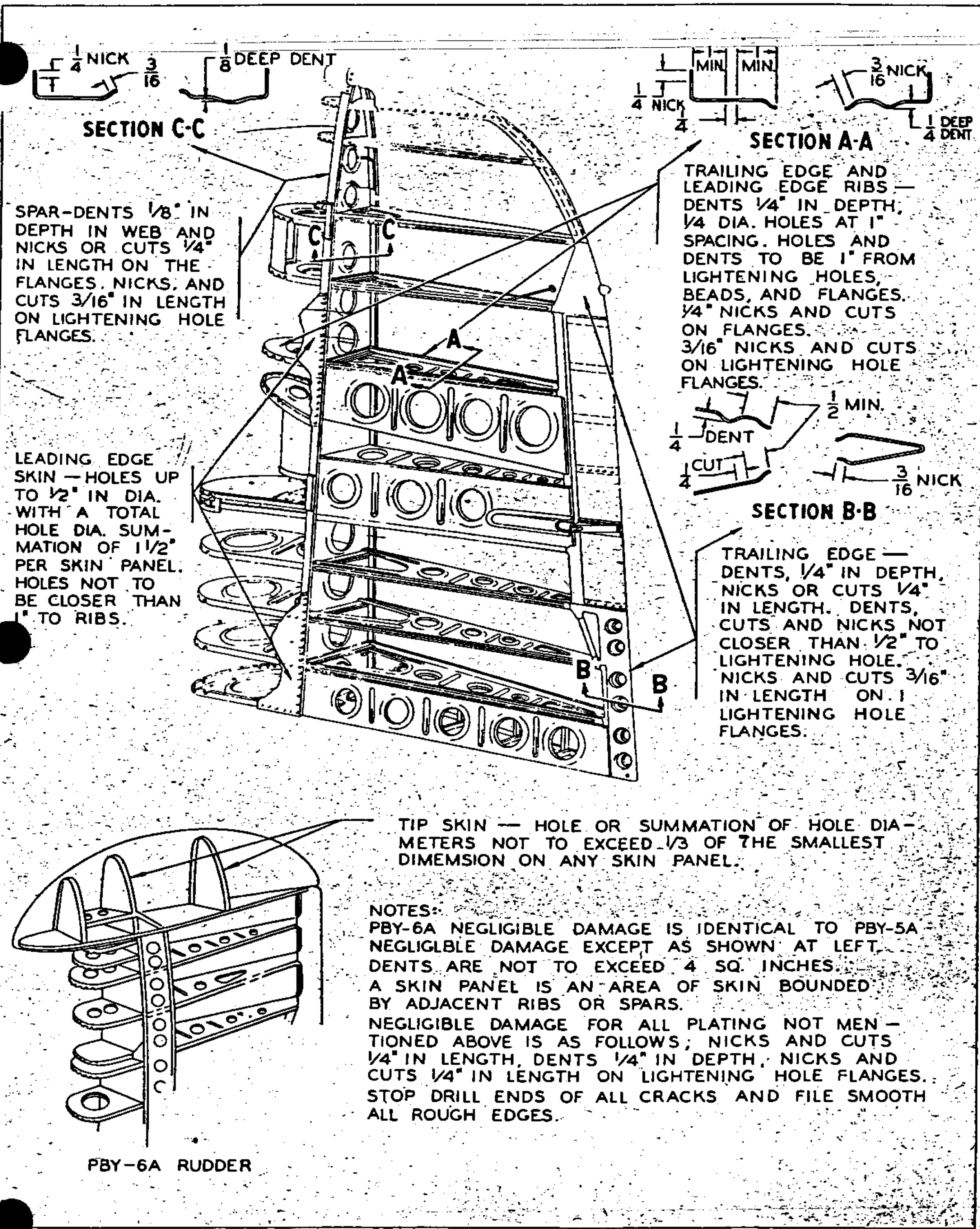


Figure 3-10—Rudder-Negligible Damage

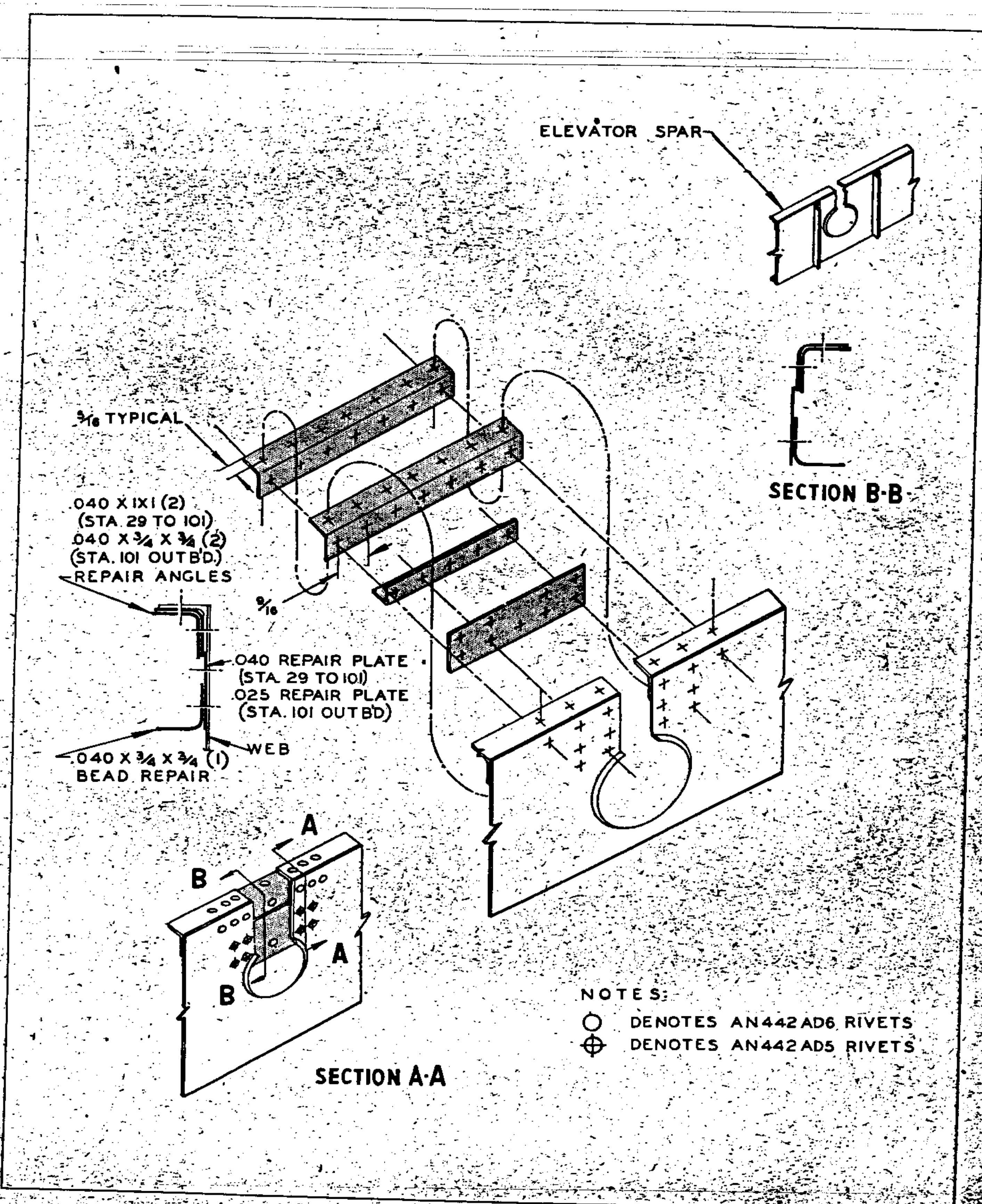


Figure 3-11—Elevator Spar Repair

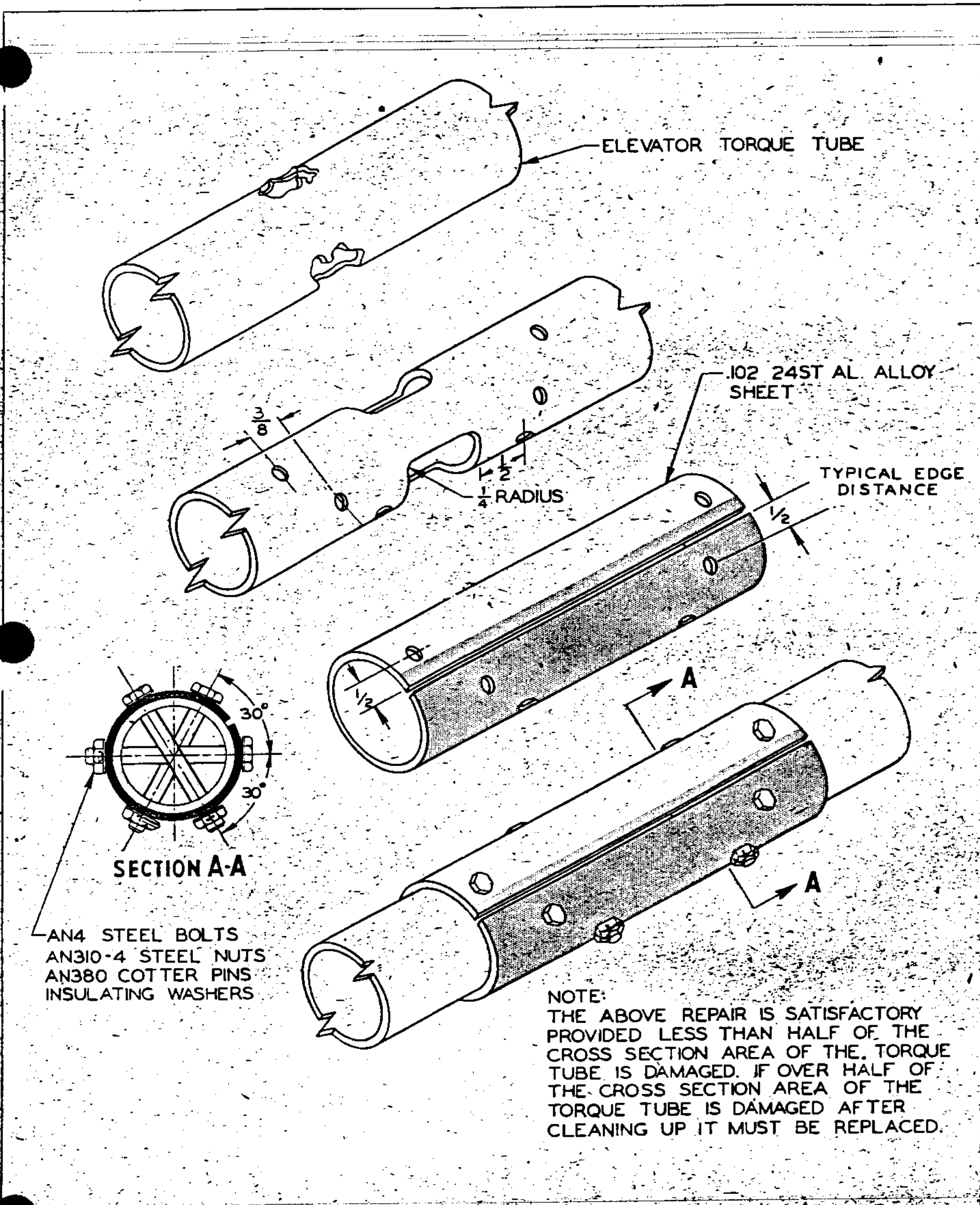


Figure 3-12—Elevator Torque Tube Repair

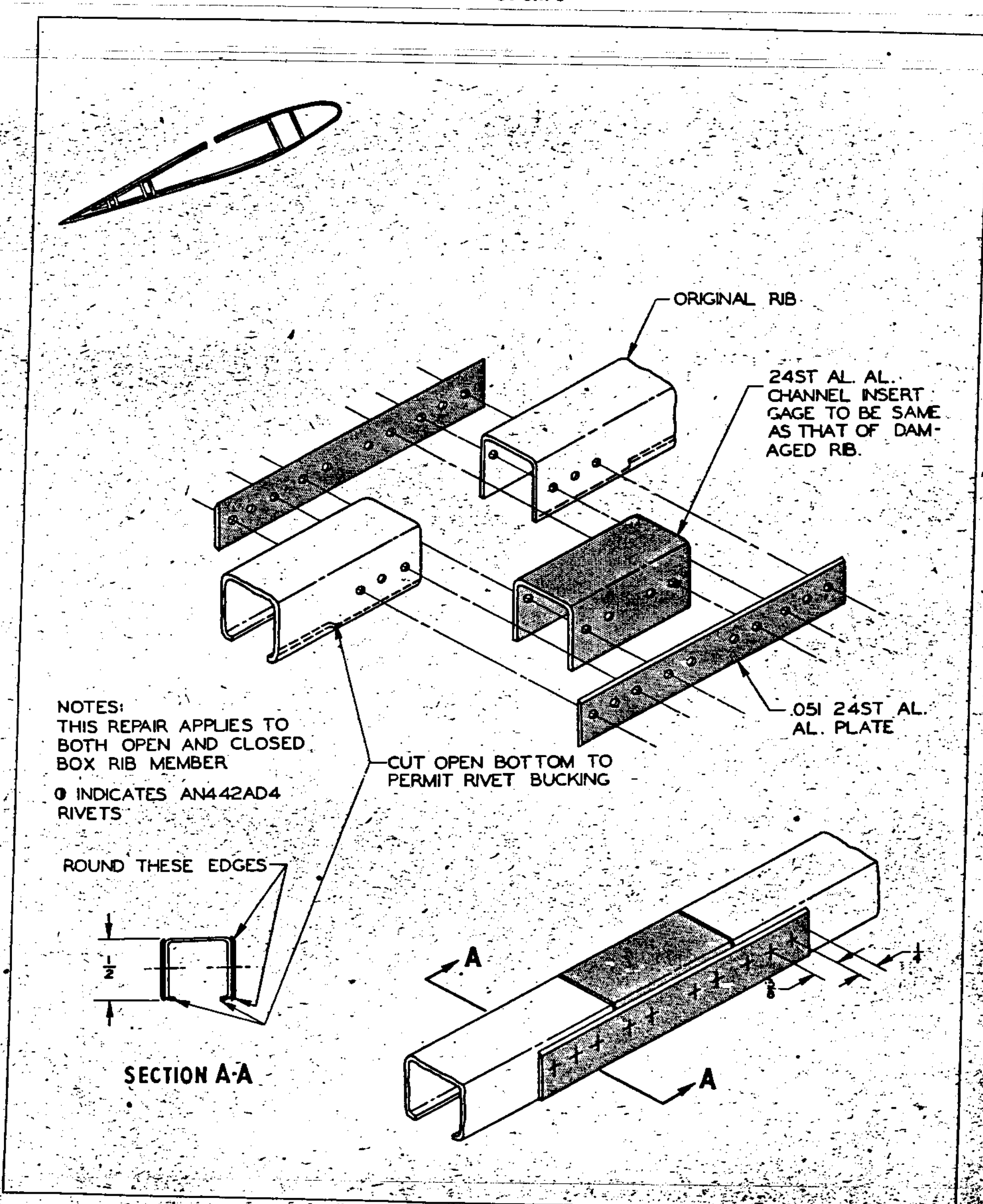


Figure 3-13—Elevator Rib Repair

SECTION

Body Group

IV

SECTION IV

HULL

4-1. GENERAL.

4-2. The hull is an all metal skin stressed structure built around a keel and reinforced longitudinally by stringers and two chines and laterally by beltframes and bulkheads. (See figure 4-1.)

4-3. It consists of a superstructure and a main structure which is divided into the following five watertight compartments: The bombardier's and pilot's compartment forward of bulkhead 2; the navigator's and radio operator's compartment between bulkheads 2 and 4; the crew compartment between bulkheads 4 and 6; the waist gunner's compartment between bulkheads 6 and 7; and the tail compartment aft of bulkhead 7. Any one of these watertight compartments may be sealed off from the rest of the hull by closing watertight doors installed at bulkheads 2, 4, 6 and 7. (See figure 4-2 for the location of all stations.) In addition the lower portion of the nose of the airplane contains an enclosure covered by two doors for housing the nose landing gear. Watertight recesses in both sides of the hull between stations 4 and 5 provide space for housing the main landing gear.

4-4. The hull is attached to the wing by means of two fittings located in the superstructure, one at station 4 and the other at station 5. Lateral bracing of the hull to wing is provided by four wing-to-hull struts.

4-5. PLATING.

4-6. GENERAL. Anodized 24ST aluminum alloy plating is used to cover the entire hull and the superstructure. (See figure 4-4.) All hull plating sheets overlap at their joints which are made watertight by means of zinc chromate tape. The plating is highly stressed and therefore proper repair procedure for it is necessary.

4-7. NEGLIGIBLE DAMAGE. Smooth dents in the plating if free from cracks or abrasions and having an area not exceeding six square inches and a depth not greater than one-sixteenth of an inch may be neglected at any location on the hull.

Note

All structure in the vicinity of dents should be carefully inspected for cracks and warping.

4-8. Holes and cracks existing in the skin above the flood water line of the airplane (See figure 4-3.) will be considered as negligible damage provided the number of holes and cracks and their size and location does not exceed the conditions shown in figure 4-5.

4-9. All holes should be cleaned up to give radii of at least ½ inch in the corners. The ends of cracks should be stop drilled with a ⅛" drill. After they are cleaned up, all holes and cracks should be covered temporarily with a fabric patch or a Tinnerman standard hole patch. (See Appendix II.)

4-10. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. If the skin is damaged in excess of that defined as negligible damage, it should be repaired by patching. The repair (See figure 4-6.) consists of a patch plate (of at least the same gauge as the damaged skin) which is placed over the cleaned up hole or stop drilled crack and then riveted in place. In patching damaged hull skin below the flood water line it is necessary to use a water seal material such as marine glue and fabric, zinc chromate tape, or 1/64th inch thick synthetic rubber sheet to make the repair water tight.

4-11. In cases where the damaged plating occurs over stringers, bulkhead members, or keelson, it is necessary to insert a filler of same gauge as the damaged skin before patching. Insertion of a filler plate when the damage occurs over a wide area is also desirable before patching.

4-12. In rare cases where a large portion of a hull plating panel is damaged it will be advisable to replace the complete plating panel with a new one of same material and gauge. In such cases remove the old skin panel by carefully drilling out all rivets holding the panel; clamp the new panel in place; drill rivet holes in panel to match existing rivet holes in surrounding skin; and then attach new panel in place by means of rivets of same size and type as those that were removed.

4-13. STRINGERS.

4-14. GENERAL. (See figure 4-7.) The stringers, which provide longitudinal stiffening for the skin, are extruded "zee" sections made of 24ST aluminum alloy. Cutouts are provided in beltframes to pass the stringers through. However, at bulkheads the stringers are cut and attached to the bulkhead by means of extruded aluminum alloy stringer clips.

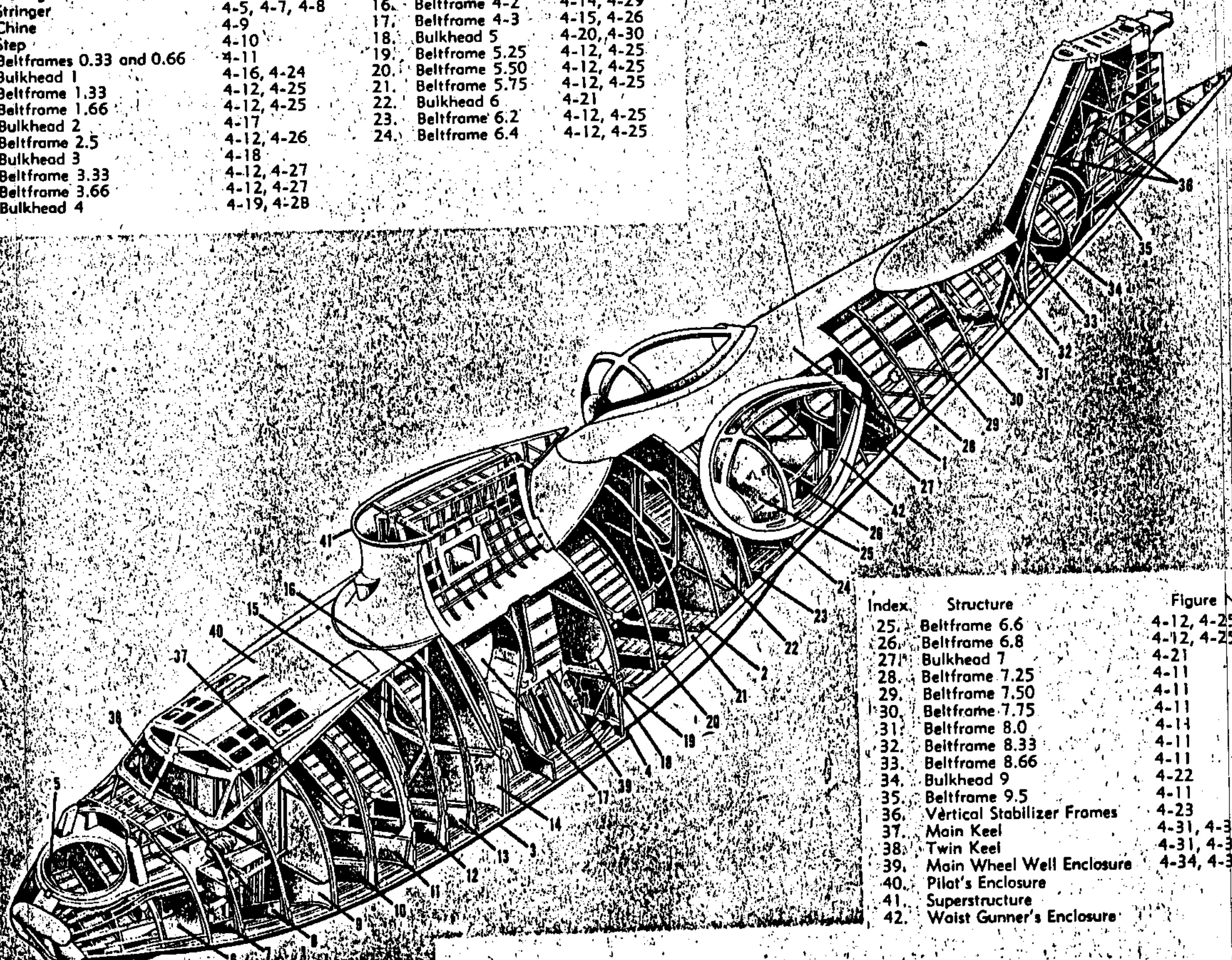
4-15. NEGLIGIBLE DAMAGE. (See figure 4-5.) Small, smooth isolated dents free from cracks, sharp corners or abrasions and less than 1/16 inch in depth may be considered as negligible damage if they can be removed without excessive hammering. The presence of small isolated nicks in the edges of the free flange may also be considered as negligible damage provided the depth of the nick after being cleaned out smoothly does not exceed 1/16 inch. All nicks classed as negligible damage should be filed to a tapering contour, the depth not exceeding 1/16 inch.

Note

Cracks in stringers are not considered as negligible damage.

Index	Structure	Figure No.
1.	Plating	4-4 thru 4-6
2.	Stringer	4-5, 4-7, 4-8
3.	Chine	4-9
4.	Step	4-10
5.	Beltframes 0.33 and 0.66	4-11
6.	Bulkhead 1	4-16, 4-24
7.	Beltframe 1.33	4-12, 4-25
8.	Beltframe 1.66	4-12, 4-25
9.	Bulkhead 2	4-17
10.	Beltframe 2.5	4-12, 4-26
11.	Bulkhead 3	4-18
12.	Beltframe 3.33	4-12, 4-27
13.	Beltframe 3.66	4-12, 4-27
14.	Bulkhead 4	4-19, 4-28

Index	Structure	Figure No.
15.	Beltframe 4-1	4-15, 4-26
16.	Beltframe 4-2	4-14, 4-29
17.	Beltframe 4-3	4-15, 4-26
18.	Bulkhead 5	4-20, 4-30
19.	Beltframe 5.25	4-12, 4-25
20.	Beltframe 5.50	4-12, 4-25
21.	Beltframe 5.75	4-12, 4-25
22.	Bulkhead 6	4-21
23.	Beltframe 6.2	4-12, 4-25
24.	Beltframe 6.4	4-12, 4-25



Index	Structure	Figure No.
25.	Beltframe 6.6	4-12, 4-25
26.	Beltframe 6.8	4-12, 4-25
27.	Bulkhead 7	4-21
28.	Beltframe 7.25	4-11
29.	Beltframe 7.50	4-11
30.	Beltframe 7.75	4-11
31.	Beltframe 8.0	4-11
32.	Beltframe 8.33	4-11
33.	Beltframe 8.66	4-11
34.	Bulkhead 9	4-22
35.	Beltframe 9.5	4-11
36.	Vertical Stabilizer Frames	4-23
37.	Main Keel	4-31, 4-33
38.	Twin Keel	4-31, 4-32
39.	Main Wheel Well Enclosure	4-34, 4-35
40.	Pilot's Enclosure	
41.	Superstructure	
42.	Waist Gunner's Enclosure	

Figure 4-1—Main Hull Components

4-16. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Stringers which have been damaged in excess of that permitted for negligible damage may be repaired by patching. (See figure 4-8.) In this repair it is necessary to insert a filler section cut from an identical extruded section or bent up from sheet of same gauge. Since in many cases the hull plating is also damaged along with the stringer, the stringer and plating repair should be planned to maintain the rivet patterns through both members as detailed in figures 4-6 and 4-8. In cases where the damaged area occurs over a great length, the insert stringer is spliced to the undamaged stringer ends with two angles at each butt joint rather than by two angles covering the entire length of the damaged area. This type of repair will save weight. Ordinarily most stringer repair is done by patching and insertion. However, occasionally a section of a stringer is damaged over such a great length that repair by splicing and insertion is not feasible. This type of damage may be repaired by replacement which consists of drilling out the rivets securing the entire stringer to the skin and the bulkhead stringer fittings, and then replacing it with an undamaged stringer of same cross section and material. The new stringer should be riveted in place by rivets (equivalent to those removed) placed in the existing rivet holes in the skin.

4-17. CHINE AND STEPS.

4-18. GENERAL. (See figure 4-1.) The chine is a longitudinal stiffener assembly located at the intersection of the hull bottom and each side of the hull. It consists of an inner and outer angle with the skin intersection between. The step (one at station 5.0 and the other at station 7.0) is a heavy plating which covers the hull along the area where it is stepped up to a higher level.

4-19. NEGLIGIBLE DAMAGE. Smooth dents if free from cracks or abrasions and having an area not exceeding six square inches and a depth not greater than 1/16 inch may be considered as negligible damage and therefore requiring no repair.

Note

All structure in the vicinity of the dents should be carefully inspected for cracks and warping.

4-20. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. A typical patching repair for the chine and step is shown in figures 4-9 and 4-10, respectively. In the chine repair it is necessary to provide an insert section equivalent to the outer chine angle. It should be noted that no insert is needed for the inner chine angle. Since damage to the chine invariably involves damage to the hull skin, the repair should be planned to provide the proper rivet pattern as detailed in both figures 4-6 and 4-9. Since the chine is located below the flood water line, water seal material such as marine glue and fabric, zinc chromate tape or 1/64 inch thick synthetic rubber sheet must be used to insure water tightness.

4-21. In cases where the damage occurs over a considerable area, splicing should be done at each of the two butt joints rather than over the entire length of the damage in order to save weight.

4-22. In certain cases where the damage to the chine area occurs over a great length, an entire length of outer and inner chine angles may be removed and replaced with new chine angles of same size and material.

Note

When using this type of repair it may also be advisable to replace the hull side and bottom skin panels in the damaged area.

4-23. BULKHEADS AND BELTFRAMES.

4-24. GENERAL. The beltframes and bulkheads serve to maintain the rigidity of the hull. They are located at all stations in the hull, the bulkheads being located at most of the main stations while the beltframes are located at the intermediate stations. (See figure 4-1.) Four of the bulkheads (those at stations 2.0, 4.0, 6.0 and 7.0) are watertight, consisting of a partition of sheet webbing reinforced by angle framework. In the center of these bulkheads is a reinforced opening closed by a watertight door. The remaining bulkheads contain larger open areas with heavy angle framework for stiffening.

4-25. Beltframes consist of formed bulb angles supporting the upper hull skin and either a beaded hydropressed floor frame or a built up web frame (reinforced by stiffener angles) which serves as a former and reinforcement for the hull bottom. Beltframes distribute shear loads to the hull plating and also maintain the contour of the hull plating between bulkheads.

4-26. NEGLIGIBLE DAMAGE. Cracks after stop drilling and nicks after filing out and also dents not exceeding a certain area and depth are considered as negligible damage in beltframes and bulkheads. (See figures 4-11 through 4-23.)

4-27. Also considered as negligible damage in bulkheads and beltframes are holes of certain size and location. (See figures 4-11 through 4-23.)

CAUTION

A hole in no case may extend more than halfway through the bead.

4-28. Scratches except as noted in figures 4-11 through 4-23 may be classed as negligible damage provided they are less than 1/32 inch deep and ¾ inch long.

4-29. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Holes exceeding negligible damage size in beltframes and bulkhead webs should be repaired by patching as shown in figure 4-6.

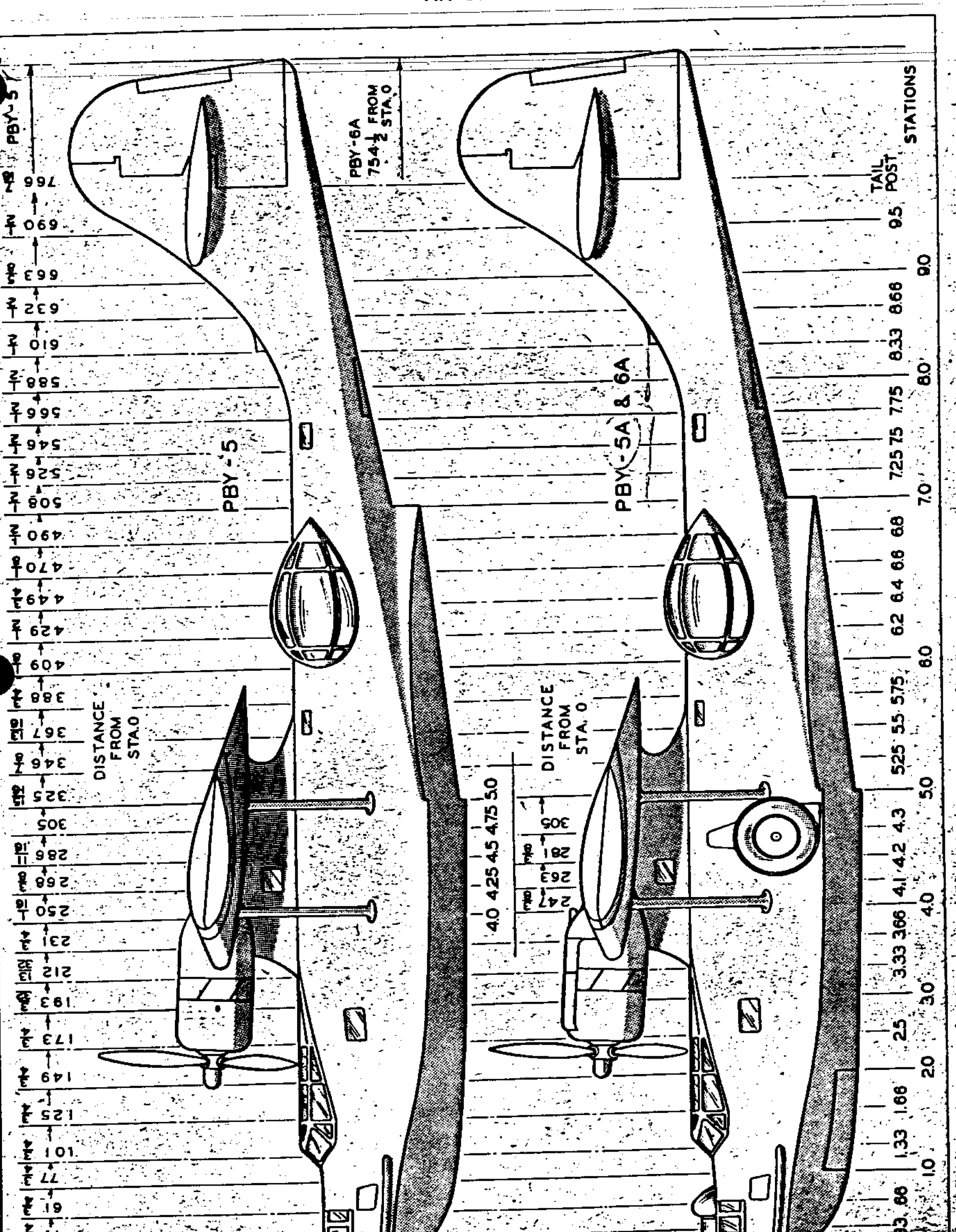


Figure 4-2—Hull Station Diagram

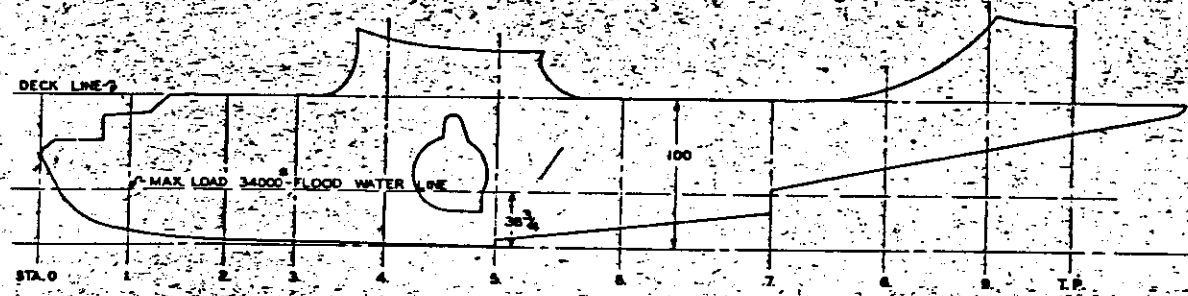


Figure 4-3—Hull Flood Water Line

CAUTION

All web repairs made on watertight areas of bulkheads must be sealed with marine glue and fabric, zinc chromate tape, or 1/64 inch thick synthetic rubber sheet.

4-30. All damaged webbing should be cut out well beyond the ends of cracks with the corners of holes rounded with a radius of not less than ½ inch. Beaded areas (such as those on a floor frame section of a beltframe) that are damaged should be repaired by patching or repaired by an angle as shown in figure 4-26.

4-31. Figures 4-24 through 4-30 give complete details of typical beltframe and bulkhead repairs. These repairs involve insertion as well as patching. The repairs for the large number of standard extruded sections used on bulkheads and beltframes are shown in Appendix II.

4-32. Most stiffening angles on bulkheads and beltframes are of relatively short length and consequently when damaged they are most easily and quickly repaired by being replaced with a new member of similar section. Extruded sections when damaged can be replaced by similar rolled sections of equivalent strength. (See Section VIII.) Special attaching fittings such as stringer fittings, hull to wing fittings, and wing strut fittings should be replaced if damaged.

4-33. In general most bulkhead repairs are designed to pick up the original rivet holes. In order to do this it is not necessary to maintain rigidly the rivet pattern outlined in the various repair illustrations.

CAUTION

In all cases the number and size of rivets specified in the repair illustrations must be rigidly adhered to in making repairs.

4-34. KEEL.

4-35. GENERAL. The keel is the principal structural member of the hull, being the foundation upon which the hull is built. The keel extends along the bottom of the hull from the nose of the airplane to the second step at station 7.0. (See figure 4-1.) Between stations 1.0 and 2.0 the keel is cut out to allow room for the nose wheel enclosure. However, continuity between the forward and rear keel sections is maintained by the side sections of the nose wheel enclosure which act as auxiliary keels.

4-36. The keel is a truss frame type of structure with vertical and diagonal angles reinforced by sheet webbing. Special extrusions are provided along the bottom of the keel for attachment of the hull bottom plating. Additional auxiliary keels are provided between stations 4.0 and 5.0, one on each side of the main keel. These auxiliary keels form the lower part of the shear web and transmit the main landing gear loads to bulkheads 4 and 5.

4-37. NEGLIGIBLE DAMAGE. Smooth dents having an area less than six square inches and a depth of less than 1/16 inch or less in the keel webbing will be classed as negligible damage and thus permitted to exist without repair.

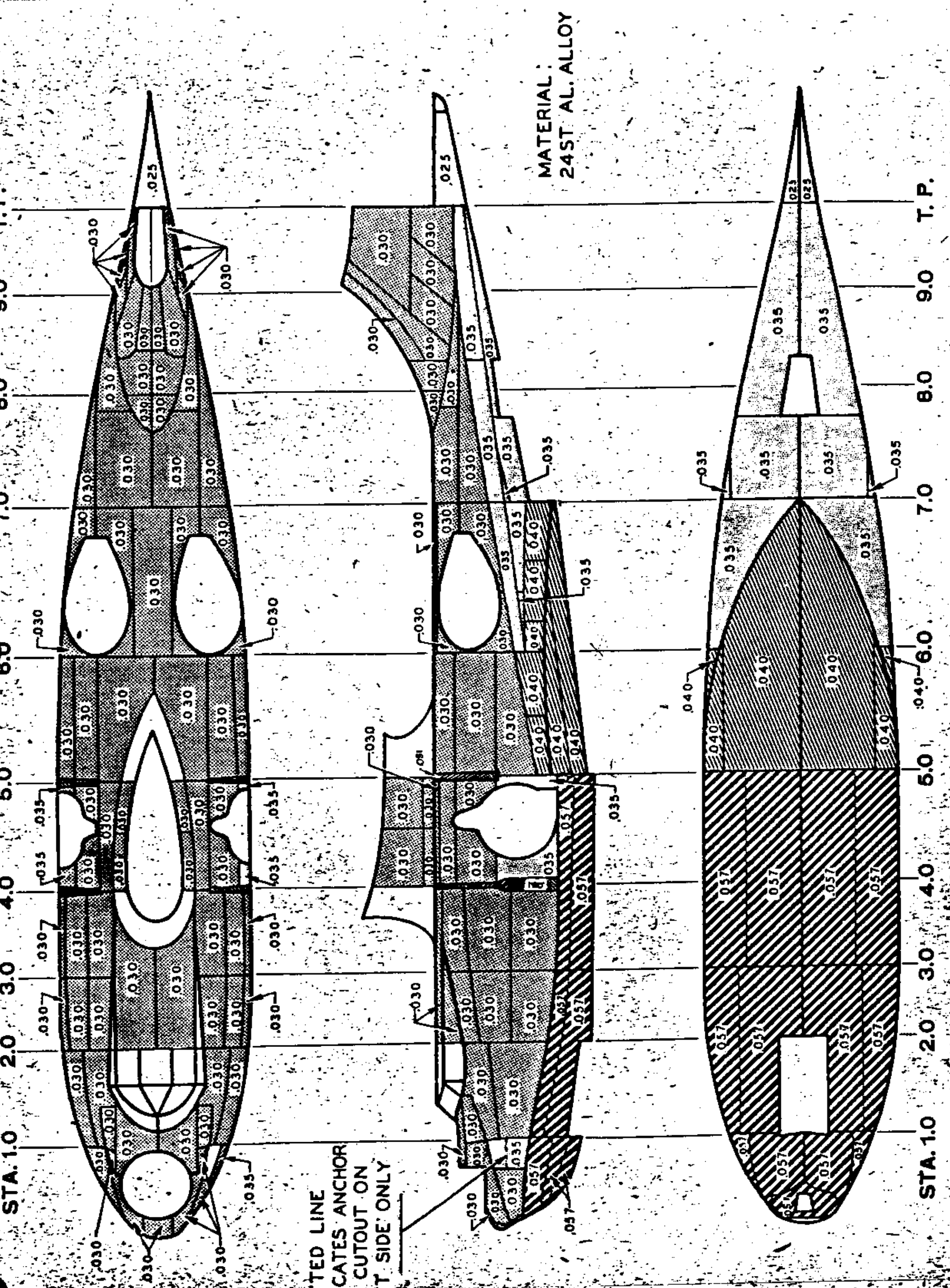


Figure 4-4—Hull Plating Diagram

NO DAMAGE THROUGH THE HULL SKIN BELOW THE FLOOD WATERLINE CAN BE CONSIDERED NEGLIGIBLE.

NO DAMAGE TO THE HULL BOTTOM STRINGERS IS NEGLIGIBLE EXCEPT 1/64" DEEP AND 1/4" LONG NICKS AND DENTS.

DAMAGE MAY NOT BE CONSIDERED NEGLIGIBLE IF TWO ADJACENT STRINGERS ARE COMPLETELY DAMAGED.

DAMAGE TO THE SKIN MAY NOT BE CONSIDERED NEGLIGIBLE IF IT EXTENDS OVER TWO ADJACENT STRINGERS OR IN A TRANSVERSE DIRECTION EXCEEDING THE STRINGER SPACING IN THE DAMAGED AREA OR IN A LONGITUDINAL DIRECTION EXCEEDING TWICE THE STRINGER SPACING IN THE DAMAGED AREA.

ALL DAMAGE WITHIN A 48" LONGITUDINAL DIMENSION MUST BE CONSIDERED AS EXISTING AT ONE SECTION.

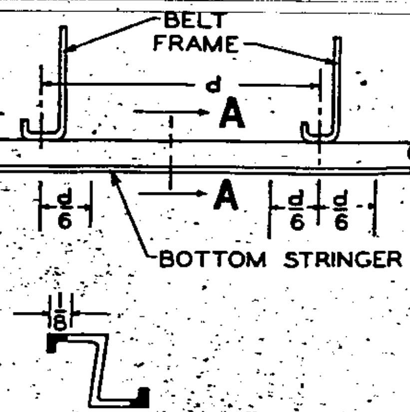
IN COMPUTING AREA REMOVED BY DAMAGE, THE FOLLOWING RULES SHOULD BE FOLLOWED:

ENTIRE AREA OF STRINGER MUST BE CONSIDERED AS LOST IF DAMAGE IS IN EXCESS OF 25% OF TOTAL CROSS SECTIONAL AREA OF THE STRINGER.

IF STRINGER IS SO DAMAGED THAT IT IS INEFFECTIVE IN SUPPORTING THE SKIN HALF THE SKIN AREA BETWEEN ADJACENT (GOOD) STRINGERS MUST BE CONSIDERED LOST.

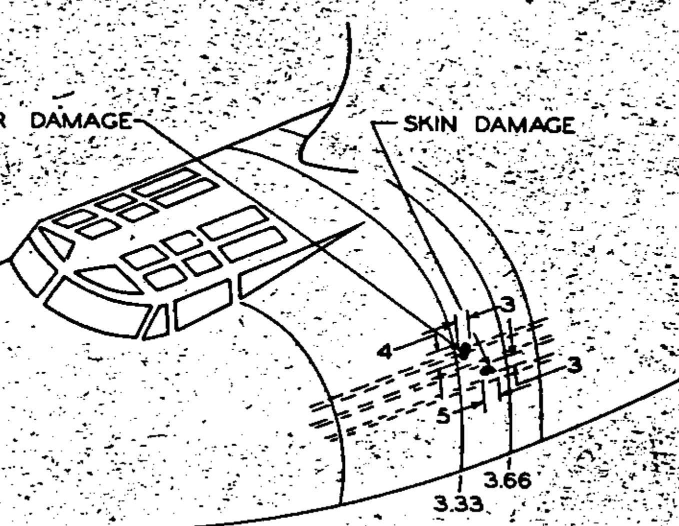
TWICE THE PARTIAL DAMAGE TO A STRINGER (IF LESS THAN 25% OF THE CROSS SECTIONAL AREA) MAY BE USED IN THE FORMULA AS SKIN DAMAGE.

DAMAGE BETWEEN STATIONS 3.66 & 4.0 MUST BE LIMITED TO THE TOP STRINGER ONLY AND TO SKIN WITHIN 10" OF CENTER LINE TO BE CONSIDERED NEGLIGIBLE.



SECTION A-A

NO DAMAGE ALLOWED FOR A DISTANCE OF 1/4 FROM BELT FRAME OR BULKHEAD FOR BOTTOM STRINGERS. SEE SEC. AA FOR DAMAGE TO BOTTOM STRINGERS IN OTHER AREA.



USE OF FORMULA FOR DETERMINING DAMAGE TO SKIN AND STRINGERS PERMISSIBLE AS NEGLIGIBLE DAMAGE.

DAMAGE: ONE SKIN DAMAGE 5" LONG X 3" WIDE.
ONE SKIN STRINGER DAMAGE 3" LONG X 4" WIDE.

STRINGER SPACING: 5 1/2"

LOCATION: BETWEEN STA. 3.33 & 3.66 N=1 S=3+*5½=8½
USE FORMULA FROM TABLE 3X1+8.5=11.5

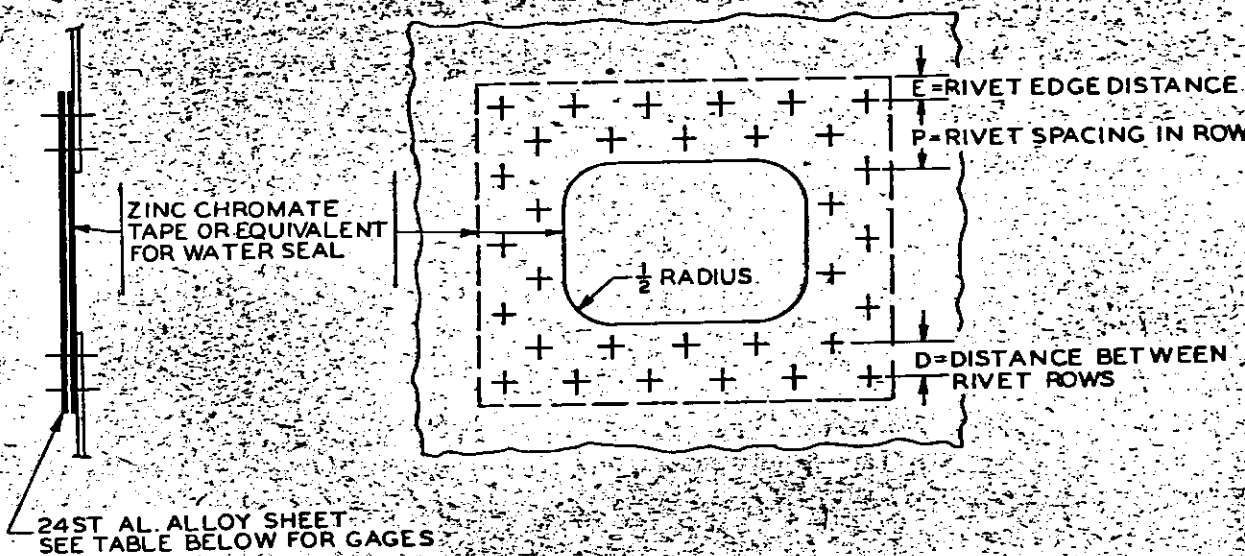
SINCE THE FORMULA SUM SHOULD EQUAL OR BE LESS THAN 30 THIS DAMAGE IS CONSIDERED NEGLIGIBLE.
• IF THE FORMULA SUM EXCEEDED 30 REPAIRS WOULD HAVE BEEN NECESSARY.

*SINCE STRINGER IS COMPLETELY DAMAGED ½ THE SPACING (5½") BETWEEN ADJACENT (GOOD) STRINGERS MUST BE USED IN THE FORMULA INSTEAD OF THE ACTUAL SKIN DAMAGE (4")

STA	FORMULAS
FWD 3.0	3N + S ≤ 60
3.0 TO 3.33	3N + S ≤ 45
3.33 TO 3.66	3N + S ≤ 30
3.66 TO 4.0	SEE NOTE 9
4.0 TO 5.0	5N + S ≤ 10
5.0 TO 5.2	S ≤ 3
5.2 TO 5.5	3N + S ≤ 20
5.5 TO 6.0	3N + S ≤ 45
6.0 TO 7.0	3N + S ≤ 45
7.0 TO 8.0	3N + S ≤ 18
8.0 AFT	3N + S ≤ 15

N = NUMBER OF DAMAGED STRINGERS.
S = TOTAL TRANSVERSE LENGTH IN INCHES OF DAMAGED SKIN.

Figure 4-5—Hull Plating and Stringer-Negligible Damage



BULKHEAD, BELTFRAME & MISCELLANEOUS WEBBING REPAIRS RIVET TABLE

DAMAGED SKIN GAGE	REPAIR SHT GAGE	RIVET	E	P	D	NO. OF RIVET ROWS EA SIDE DAMAGE
.020	.020	AN442AD4	1/4	5/8	5/16	2
.025	.025	AN442AD4	1/4	5/8	5/16	2
.032	.032	AN442AD4	1/4	5/8	5/16	2
.040	.040	AN442AD6	5/16	25/32	3/8	2
.051	.051	AN442AD6	3/8	15/16	15/32	3
.064	.064	AN442AD6	3/8	15/16	15/32	4
		AN442D8	1/2	1 1/4	5/8	3
.072	.072	AN442AD6	3/8	15/16	15/32	4
		AN442D8	1/2	1 1/4	5/8	3
.081	.081	AN442AD6	3/8	15/16	15/32	5
		AN442D8	1/2	1 1/4	5/8	3
.091	.091	AN442AD6	3/8	15/16	15/32	5
		AN442D8	1/2	1 1/4	5/8	4
.102	.102	AN442AD6	3/8	15/16	15/32	6
		AN442D8	1/2	1 1/4	5/8	4
.125	.125	AN442AD6	3/8	15/16	15/32	7
		AN442D8	1/2	1 1/4	5/8	5

HULL SKIN REPAIR RIVET TABLE

DAMAGED SKIN GAGE	REPAIR SHT. GAGE	RIVET	E	P	D	NO. OF RIVET ROWS EA. SIDE DAMAGE
.030	.032	AN456AD4	1/4	5/8	5/16	2
.035	.040	AN456AD4	1/4	5/8	5/16	2
.040	.040	AN456AD6	5/16	25/32	3/8	2
.057	.064	AN456AD8	3/8	15/16	15/32	3

NOTES:

AS AN ALTERNATE WATER SEAL, MARINE GLUE & FABRIC OR $\frac{1}{64}$ SYNTHETIC RUBBER SHEET MAY BE USED.

FOR WATERTIGHT BULKHEAD REPAIRS, WATERSEAL MATERIAL WILL ONLY BE NECESSARY FOR THOSE REPAIRS WHICH OCCUR BELOW THE WATER LINE.

FOR REPAIRS TO WEBS OTHER THAN THE HULL SKIN USE AN442 RATHER THAN AN456 TYPE RIVETS.

IN THE RIVET TABLES, ALTERNATE RIVET SIZES AND SPACING ARE SHOWN FOR THE LARGER SKIN SIZES.

Figure 4-6—Typical Hull Plating or Web Repair

4-38. Holes, cracks and nicks are also permitted to exist in keel webbing angle members or keelson extruded members. The size and location of holes, cracks and nicks permissible as negligible damage is shown in figure 4-31.

4-39. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Damaged areas of the keel webbing should be repaired by patching as shown in figure 4-6.

4-40. Repairs to keelson sections between stations 2.0 and 5.0 and between stations 5.0 and 7.0 are shown in figure 4-33, sheets 1 and 2 respectively. Repairs to the keelson forward of station 2.0 are similar to those on the keelson between stations 5.0 and 7.0.

4-41. Repairs to the twin keel sections between stations 1.0 and 2.0 and between stations 4.0 and 5.0 are shown in figures 4-32 and 4-35 respectively.

4-42. Stiffening angles on the keel structure are most easily and quickly repaired by replacing the damaged member with an equivalent member.

4-43. The repair of standard extruded sections of the keel structure is shown in Appendix II.

CAUTION

All repairs to the keelson at the bottom of the keel structure must be made watertight by the use of marine glue and fabric, zinc chromate tape, or 1/64 inch thick synthetic rubber sheet as a water seal.

4-44. NOSE WHEEL ENCLOSURE.

4-45. GENERAL. This enclosure is important structurally due to landing and take-off conditions. The nose wheel doors should fit snugly over the enclosure which itself must be watertight.

4-46. NEGLIGIBLE DAMAGE. Shallow scratches not exceeding 1/64 inches in depth and dents not exceeding ten square inches and 1/16 inches in depth are permitted as negligible damage in the nose wheel enclosure and door structure. (See figure 4-31 for details.)

4-47. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. All holes exceeding negligible damage size in the nose wheel well or nose wheel door webbing may be repaired as shown in figure 4-6.

CAUTION

Repairs to webbing must be made watertight by the use of marine glue and fabric, zinc chromate tape, or 1/64 inch thick synthetic rubber sheet as a water seal.

4-48. Typical repairs to the nose wheel well enclosure (whose sides comprise the twin keel) are shown in figure 4-32.

4-49. For repairs to the many standard extruded sections which act as stiffeners to the door and enclosure structure, see Appendix II. As a rule a damage to short length sections may be more easily and quickly repaired by replacing the damaged member with an equivalent rolled section rather than by patching.

4-50. MAIN WHEEL WELL ENCLOSURE.

4-51. GENERAL. This is a watertight enclosure on each side of the hull that houses and supports the main landing gear. It is important structurally because it transmits to bulkheads 4 and 5 the main landing gear loads by means of a shear web, an auxiliary keel, and the various landing gear fittings.

4-52. NEGLIGIBLE DAMAGE. Shallow scratches not exceeding 1/64 inches in depth and dents not exceeding ten square inches and 1/16 inches in depth are permitted as negligible damage in all webbing of the main wheel enclosure.

4-53. Nicks, cracks and holes in structural members which are classed as negligible damage are shown in figure 4-34.

4-54. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. A typical repair for holes in webbing exceeding negligible damage size is shown in figure 4-6.

CAUTION

All web repairs to the main wheel well enclosure must be made watertight by the use of marine glue and fabric, zinc chromate tape, or 1/64 inch thick synthetic rubber sheet as a water seal.

4-55. Typical repairs to heavy structural members in the main wheel well enclosure are shown in figure 4-35.

4-56. Damage to main landing gear fittings should be repaired by replacing the fitting with a new one.

4-57. Repairs to all standard extruded sections will be found in Appendix II.

4-58. PILOT'S AND WAIST GUNNER'S ENCLOSURES.

4-59. GENERAL. The pilot's and the waist gunner's enclosures are made of Plexiglas supported by framework made of aluminum alloy. Both enclosures, of somewhat similar construction, are designed to be watertight and to carry only small stresses.

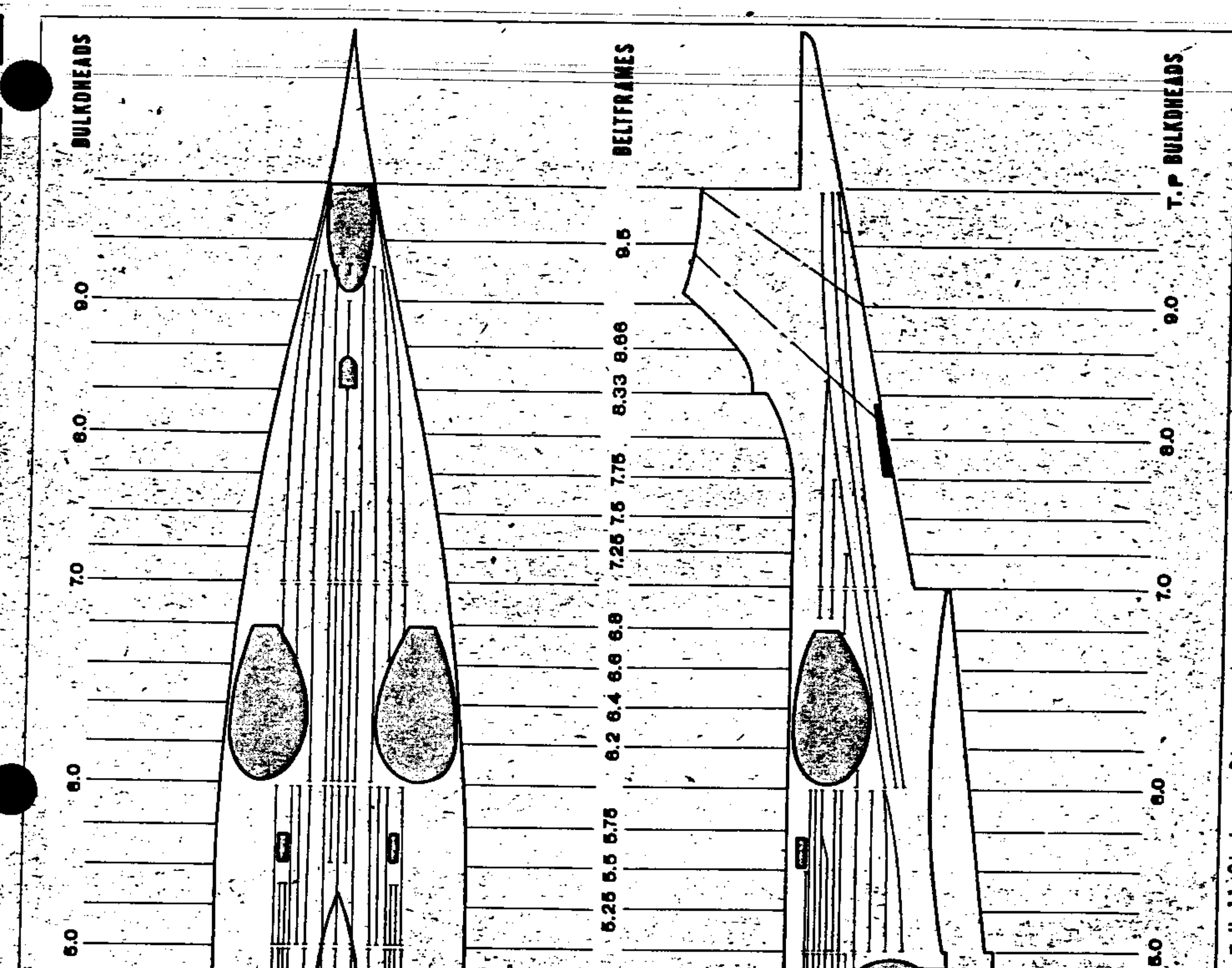
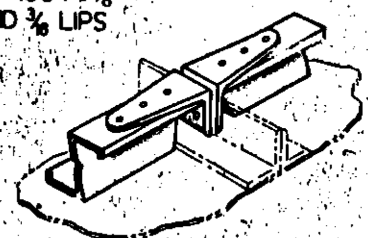


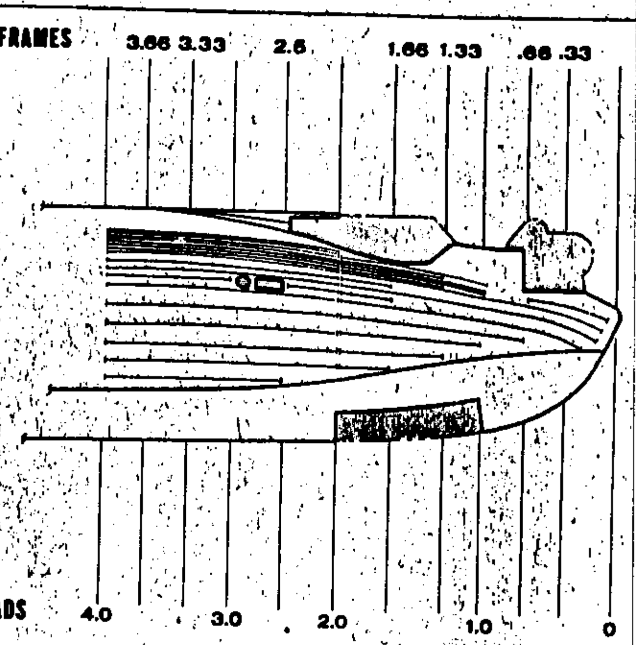
Figure 4-7—Hull Stringer Diagram (sheet 1 of 2)

NOTE:
ALL LONGITUDINAL BOTTOM STRINGERS FROM STA. 0 TO STEP AT STA. 7.0 ARE K9047
ALL LONGITUDINAL BOTTOM STRINGERS FROM STEP AT STA. 7.0 AFT ARE K9048
ALL LONGITUDINAL DECK STRINGERS ARE K9048 EXCEPT THOSE BETWEEN STA. 4.0 AND STA. 5.0, FROM CENTER LINE TO WHEEL WELL INCLUSIVE. THE LATTER ARE Y36A11T .064 x 7/8 24ST AL. ALLOY SHEET WITH 11/16 FLANGES AND 3/16 LIPS

SIZE	MATERIAL	SPECIFICATION
K9047	AL. ALLOY	QQ-A-354 (T)
K9048	AL. ALLOY	QQ-A-354 (T)
Y36A11T	AL. ALLOY	QQ-A-354 (T)



TYPICAL BOTTOM STRINGER ATTACHMENT EXCEPT AT STATION 1.0



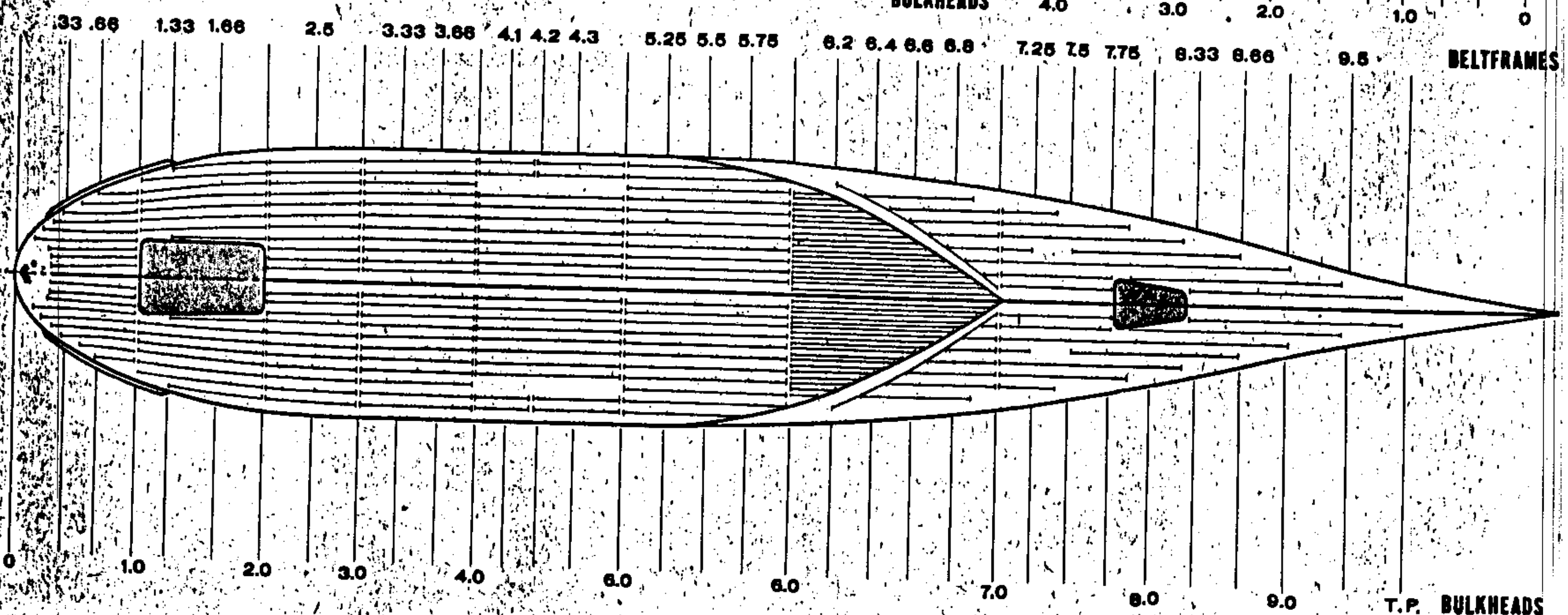


Figure 4-7—Hull Stringer Diagram (sheet 2 of 2)

4-60. NEGLIGIBLE DAMAGE. Small pits and surface scratches that are not numerous enough to impair visibility or shallow dents without formation of cracks in the Plexiglas are classed as negligible damage. Also classed as negligible damage are shallow scratches not exceeding 1/64" in depth and dents in the framework that do not distort enclosure structure to the extent that it is no longer waterproof.

4-61. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Damage to the aluminum alloy framework may be repaired by patching with sheet. In cases where a considerable length of framework is damaged it is desirable to replace with new framework.

4-62. For repairs to damaged Plexiglas refer to the "General Manual for Structural Repair," AN 01-1A-1.

★ ★ ★

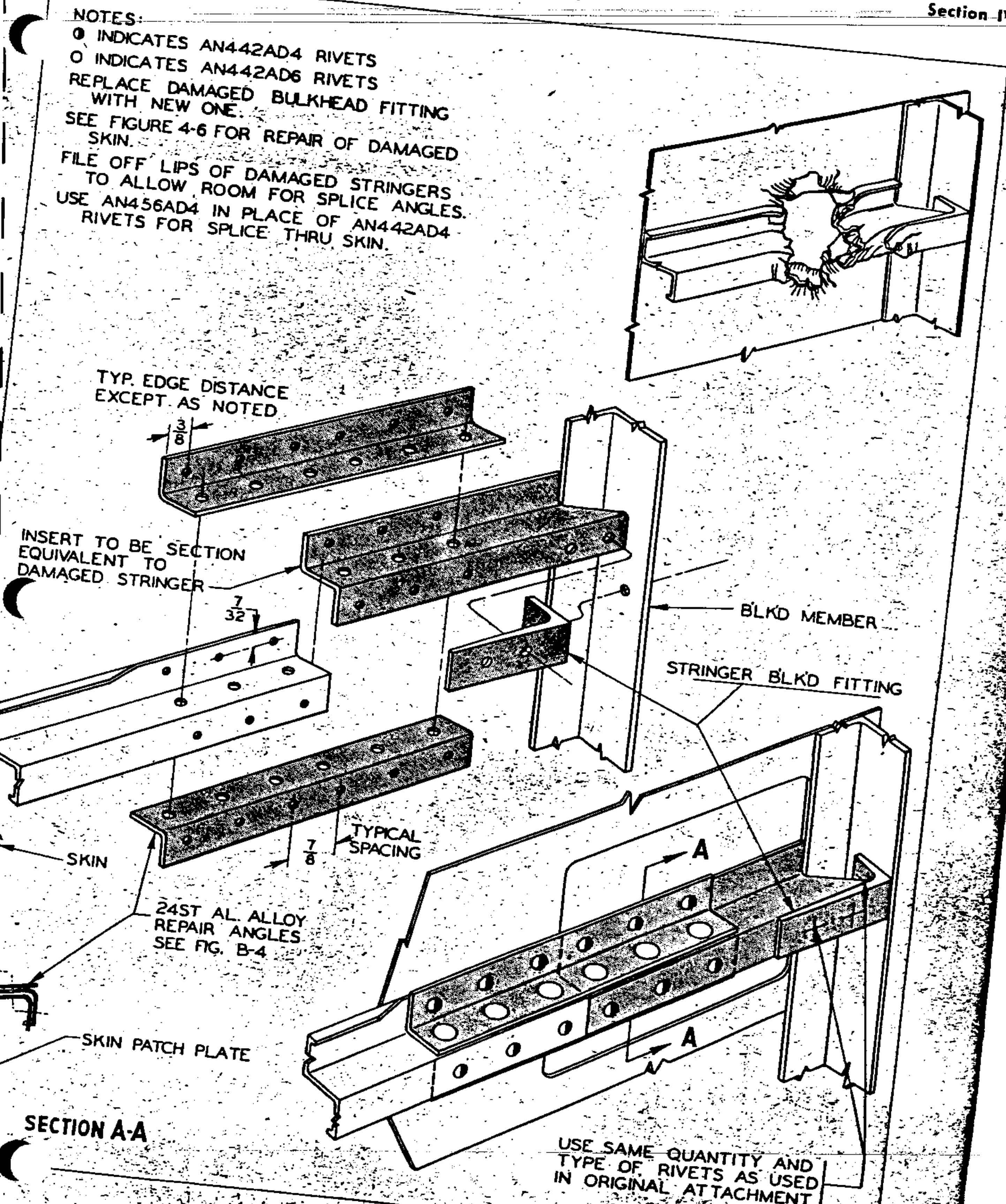


Figure 4-8—Typical Hull Stringer Repair

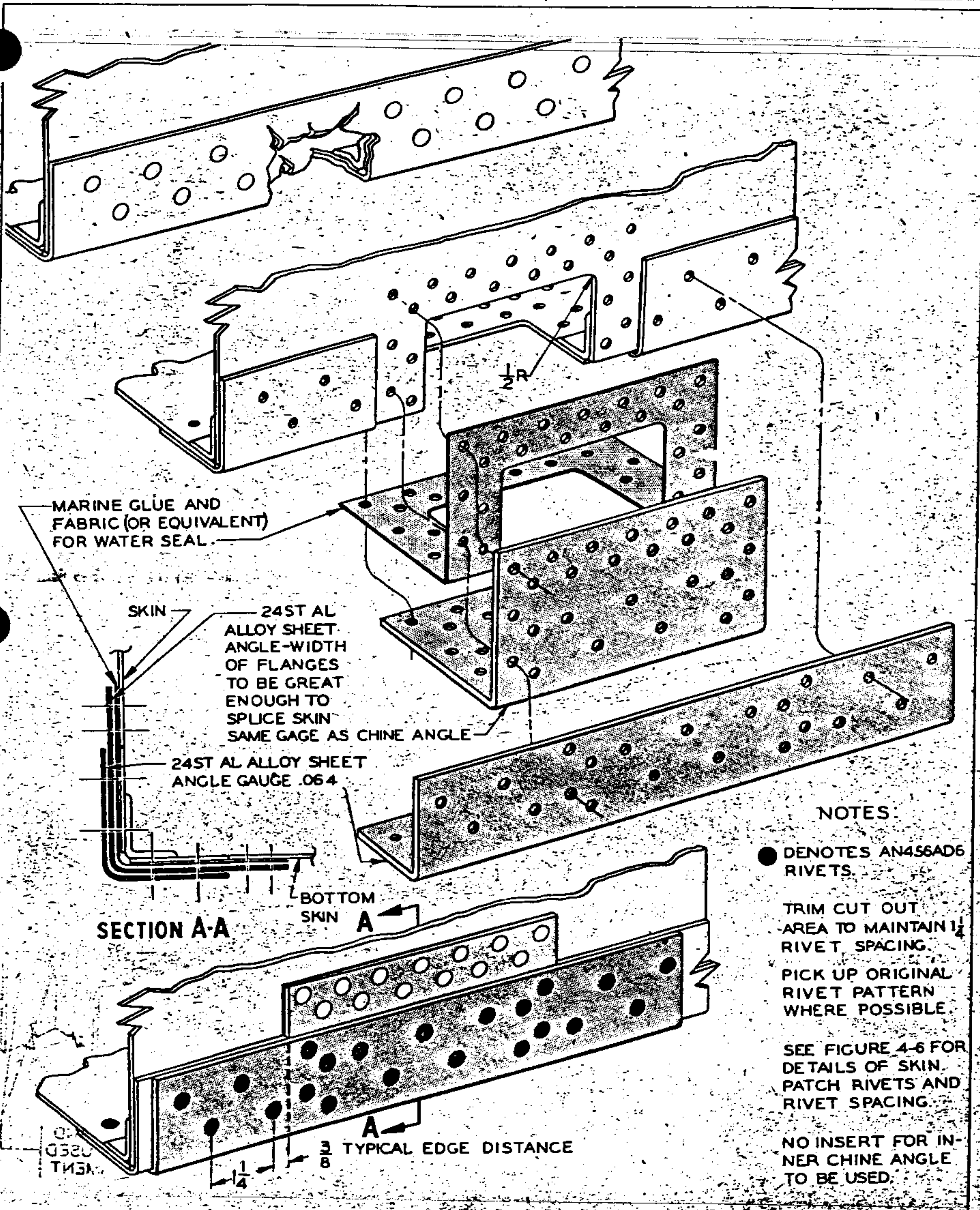


Figure 4-9—Typical Chine Repair

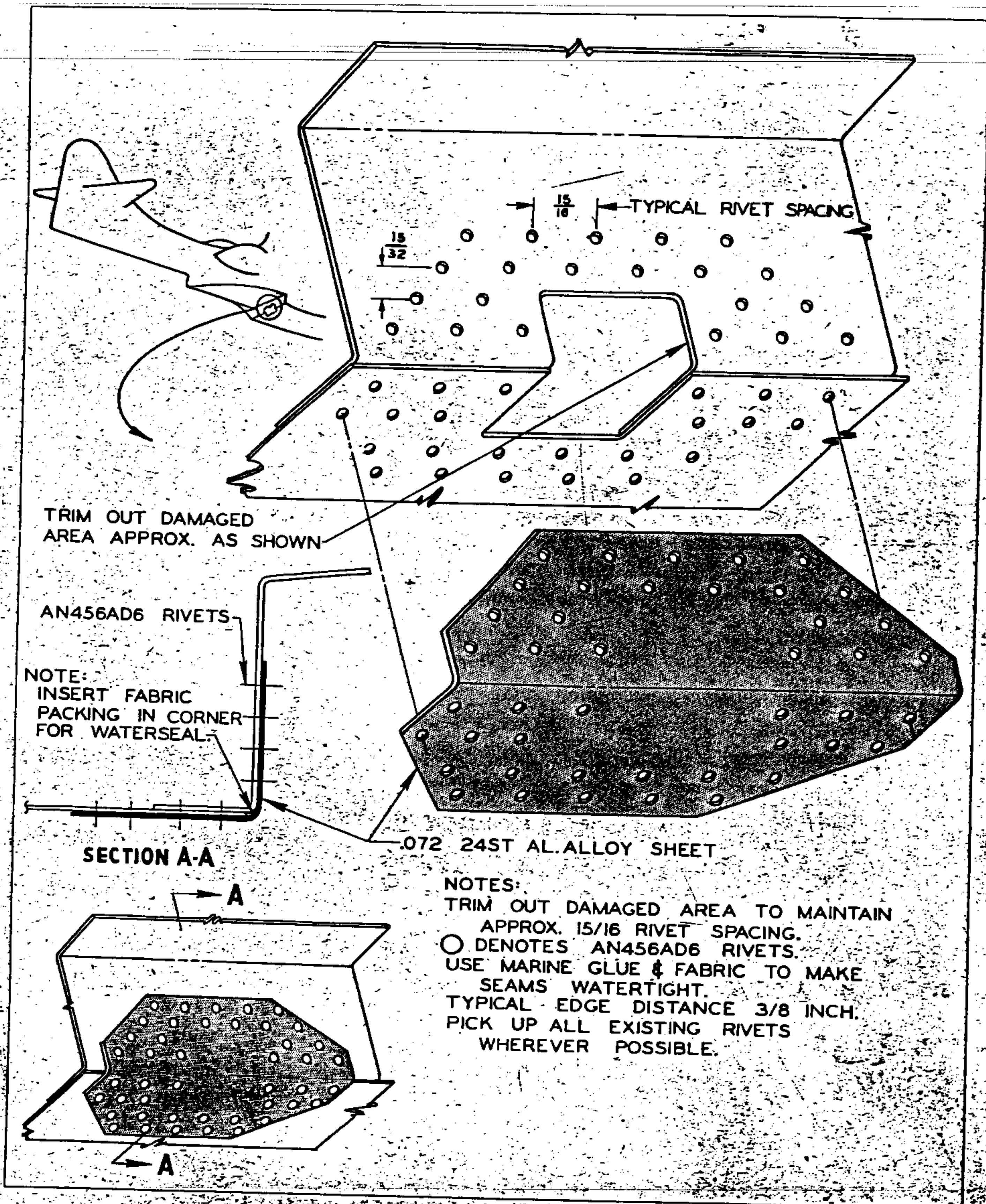


Figure 4-10—Hull Step Repair-Station 5.0

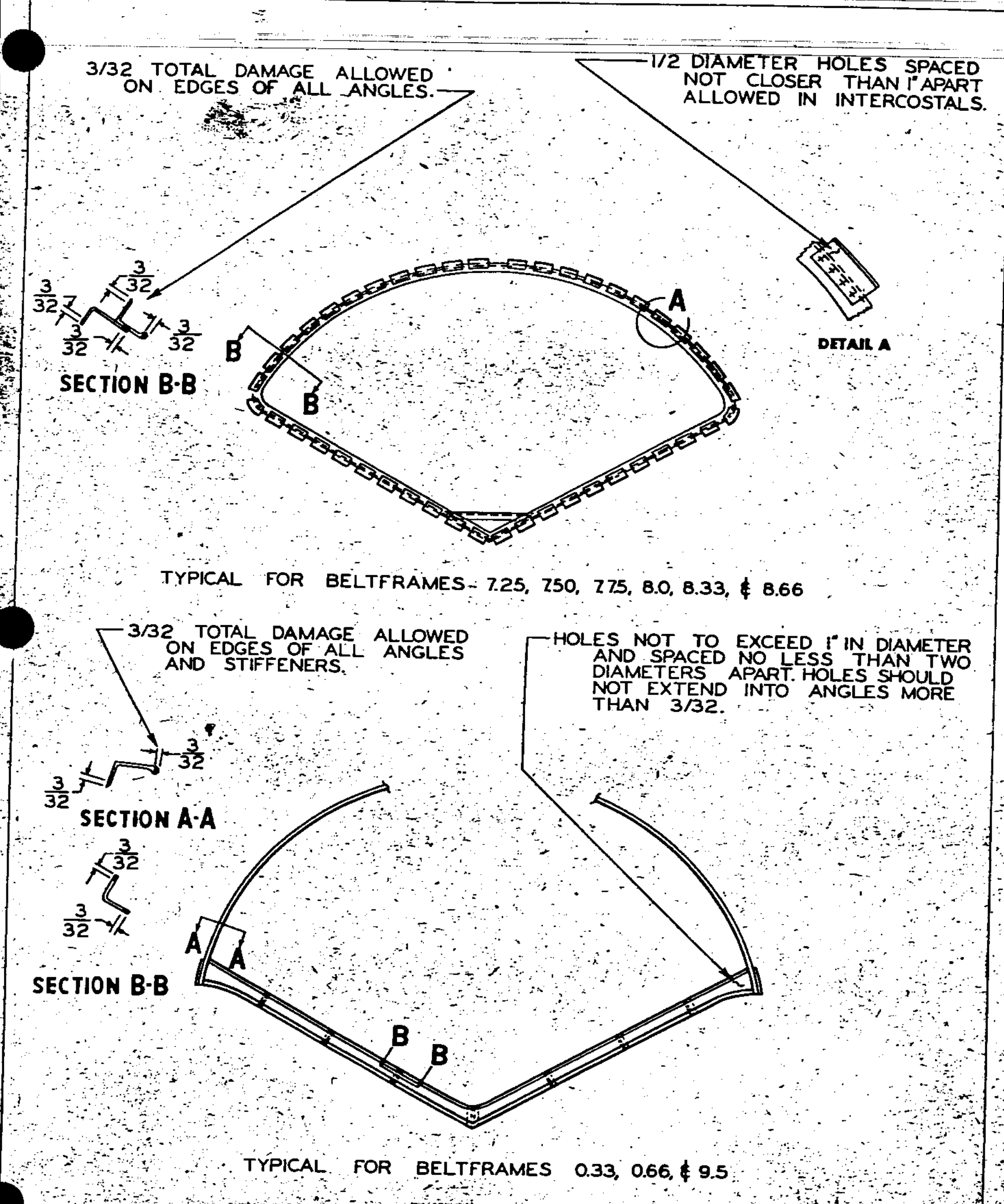
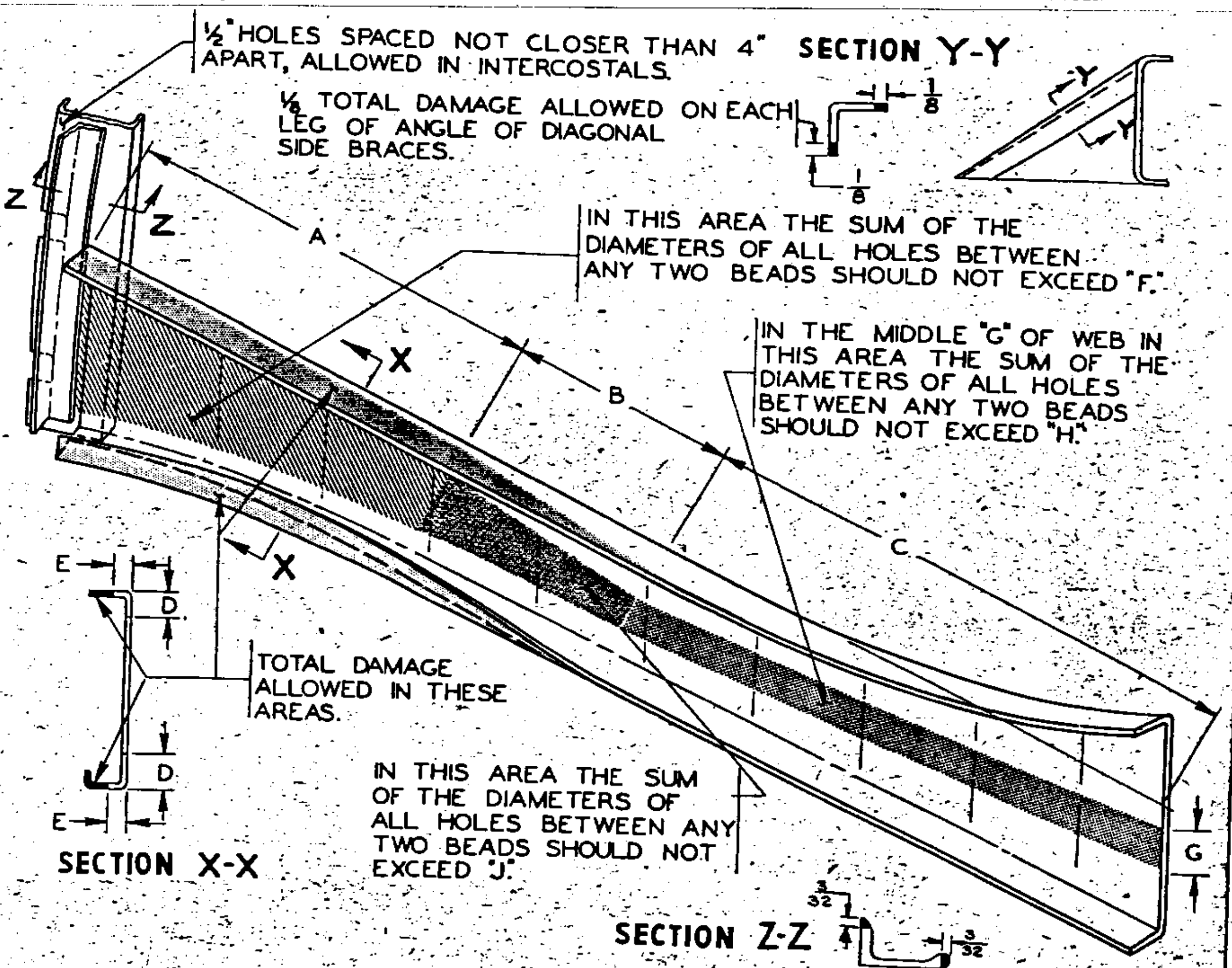


Figure 4-11—Negligible Damage—Non-Hydropress Type Beltframes



BELTFRAMES	A	B	C	D	E	F	G	H	J
1.33	42½	0	0	1	⅝	3			
1.66	47	0	0	1	⅝	3	4½	3	3
2.5	36	10	18½	¾	½	3	2	1	2
3.33	34	6	23½	¾	½	2¼	2	1	1⅝
3.66	34	6	23½	¾	½	2¼	2	1	1⅝
5.25	30	23¾	10	1	½	3	3	1	2
5.50	30	23	10	1	½	3	3	1	2
5.75	30	20	10	1	½	3	3	1	2
6.20	23	8	18½	¾	½	1¾	2	1	1⅜
6.40	19	11¾	10	¾	½	1	**	1	1
6.60	27½	0	0	1	⅝	*	***		
6.80	15½	0	0	1	½	3	***		

* DEPTH OF FRAMES DIVIDED BY 3. MAX. NOT TO EXCEED 3."
** DEPTH OF FRAMES AT POINT OF HOLE MINUS 4."
*** DEPTH OF FRAMES AT POINT OF HOLE MINUS 2."

NOTES:

IN UNSHADED AREAS AND BEADS NEGLIGIBLE DAMAGE IS LIMITED TO ISOLATED NICKS AND DENTS NOT EXCEEDING 1/32" IN DEPTH AND SPACED AT LEAST 1" APART.

ALL CRACKS MUST BE CUT OUT TO SMOOTH ROUND HOLES OF A DIAMETER SLIGHTLY GREATER THAN THE LENGTH OF THE CRACK. IF THE CLEANED UP HOLE EXCEEDS NEG. DAMAGE SIZE SHOWN IN TABLE REPAIRS MUST BE MADE.

Figure 4-12—Negligible Damage—Hydropress Type Beltframes

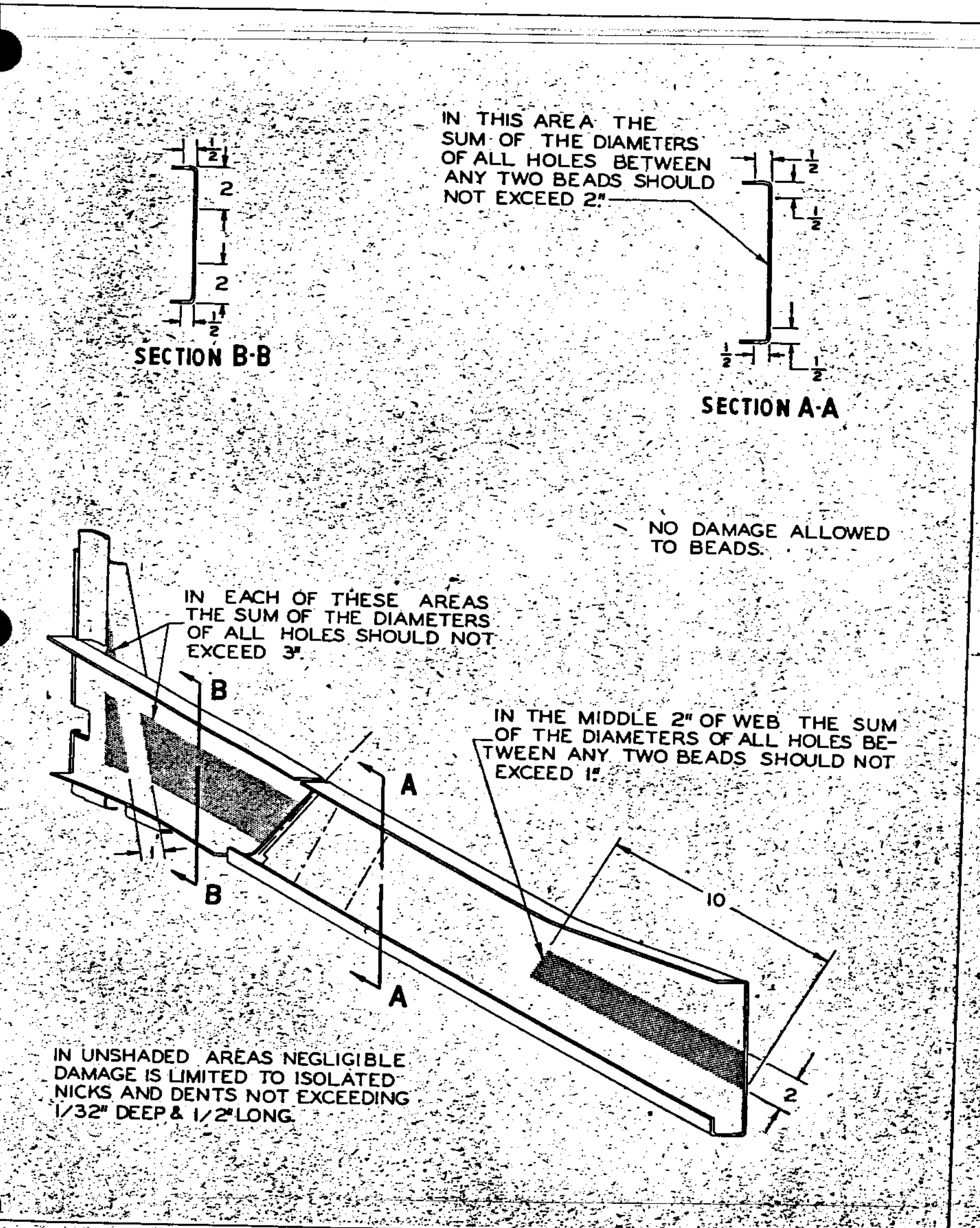


Figure 4-13—Beltframe 4.1-Negligible Damage

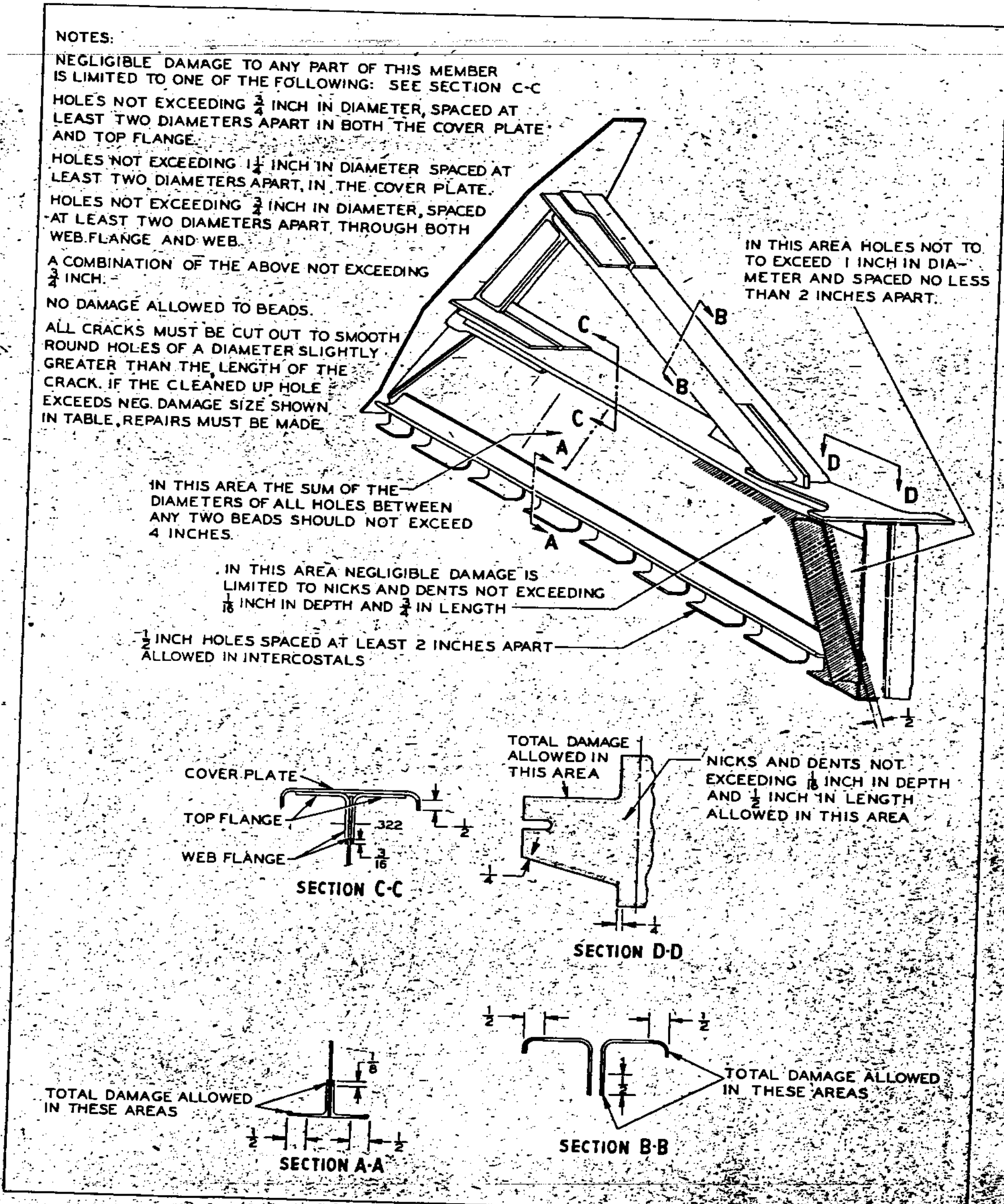


Figure 4-14—Beltframe 4.2-Negligible Damage

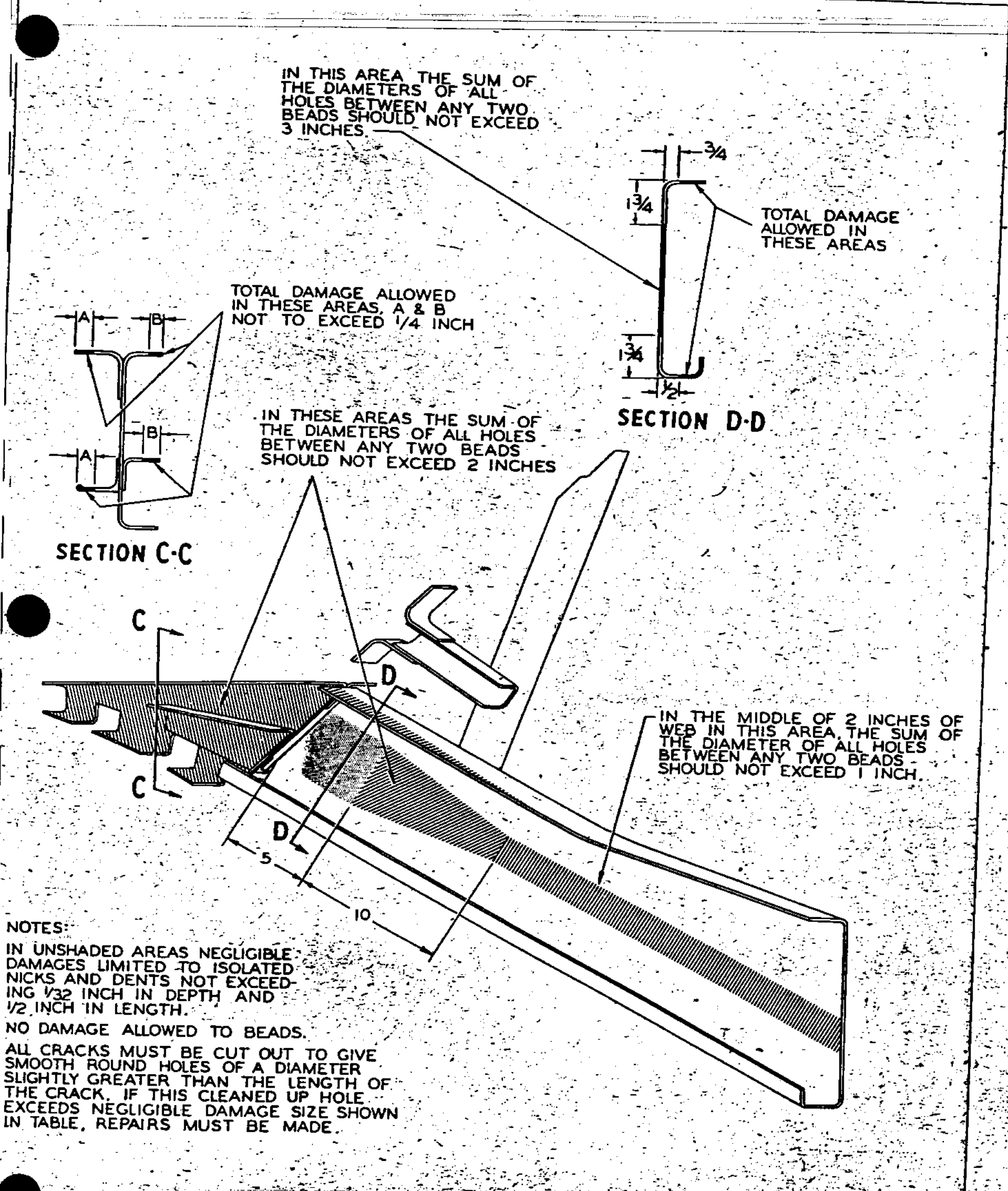


Figure 4-15—Beltframe 4.3-Negligible Damage

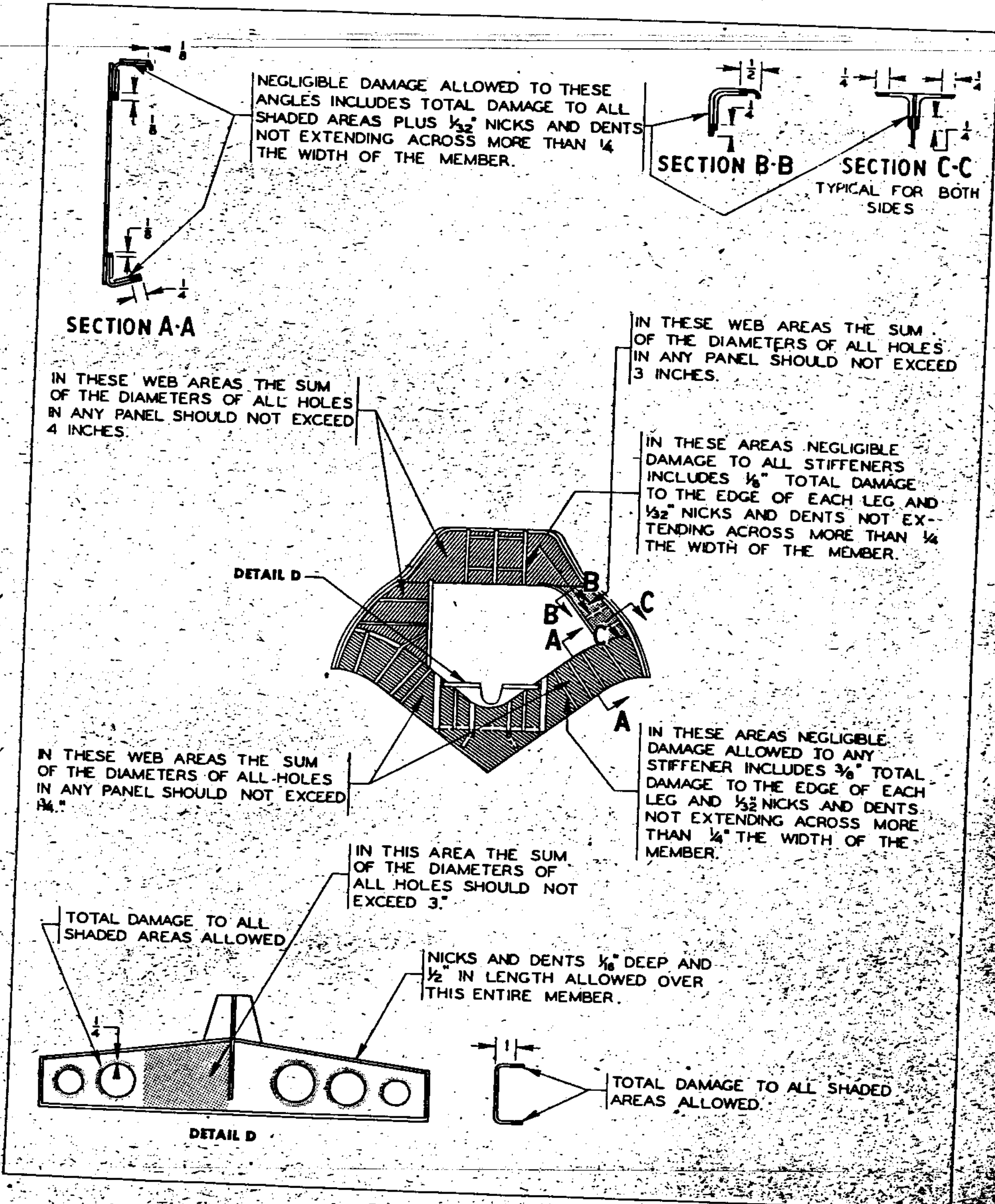


Figure 4-16—Bulkhead 1-Negligible Damage

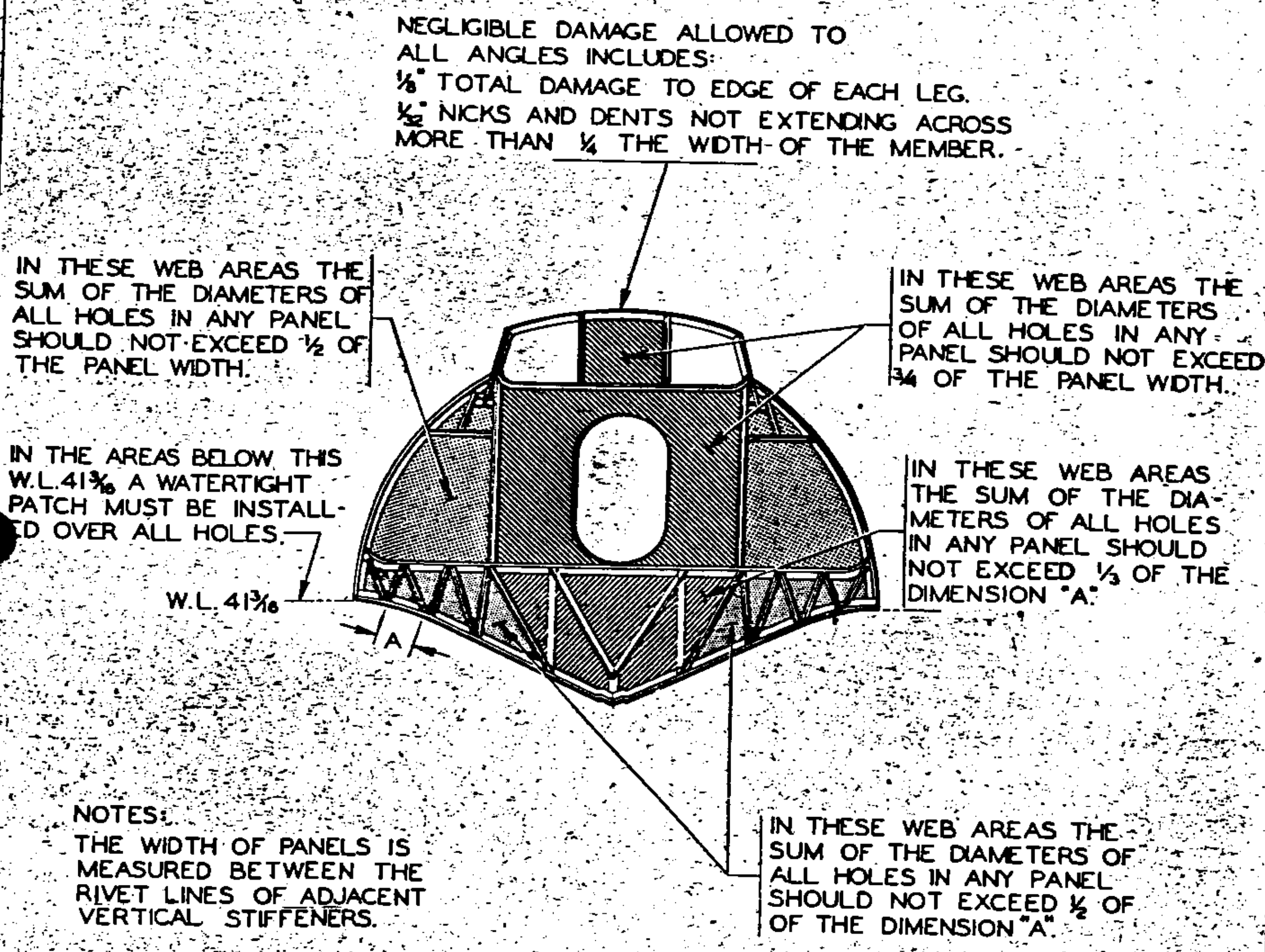


Figure 4-17—Bulkhead 2-Negligible Damage

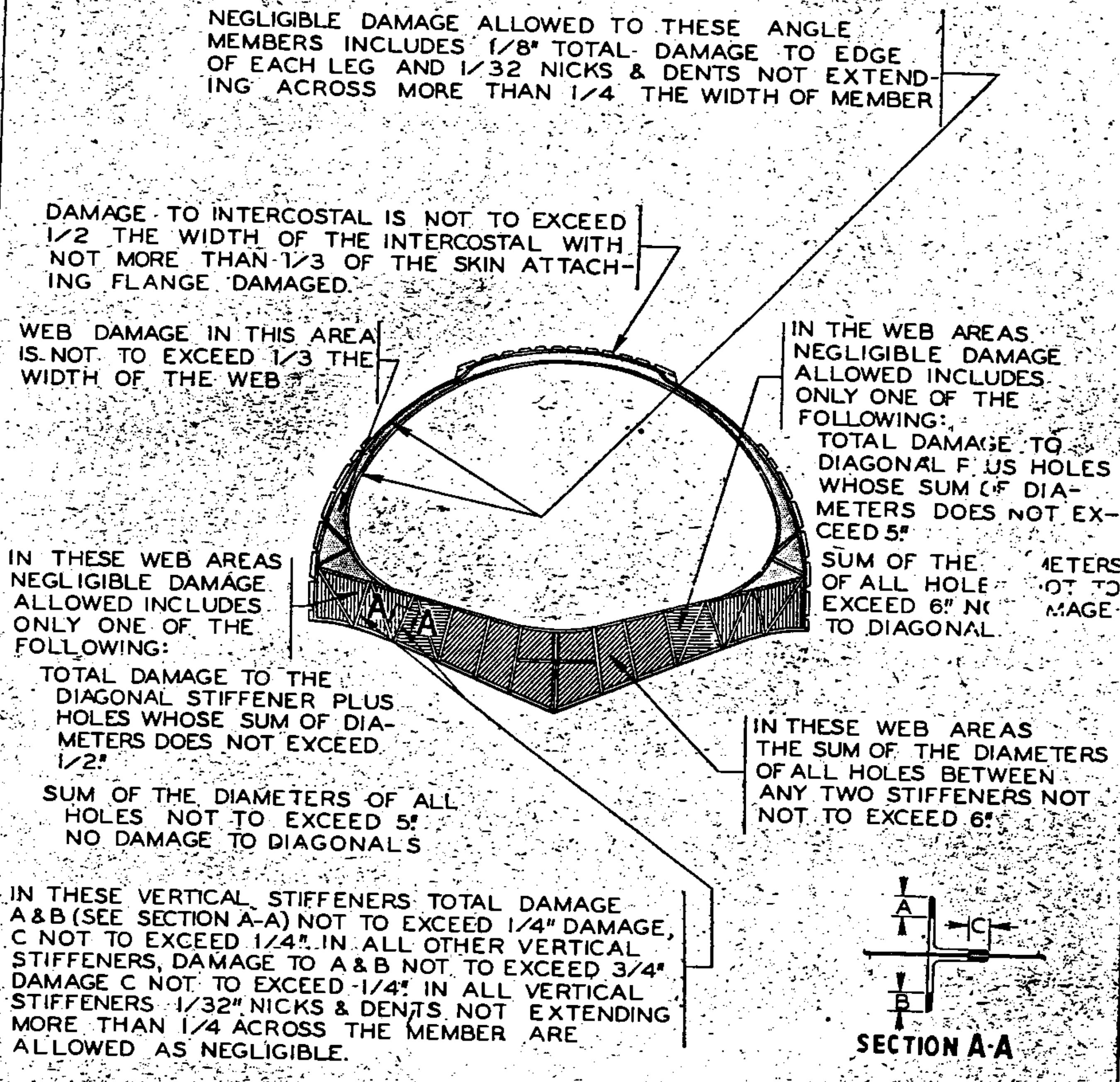


Figure 4-18—Bulkhead 3-Negligible Damage

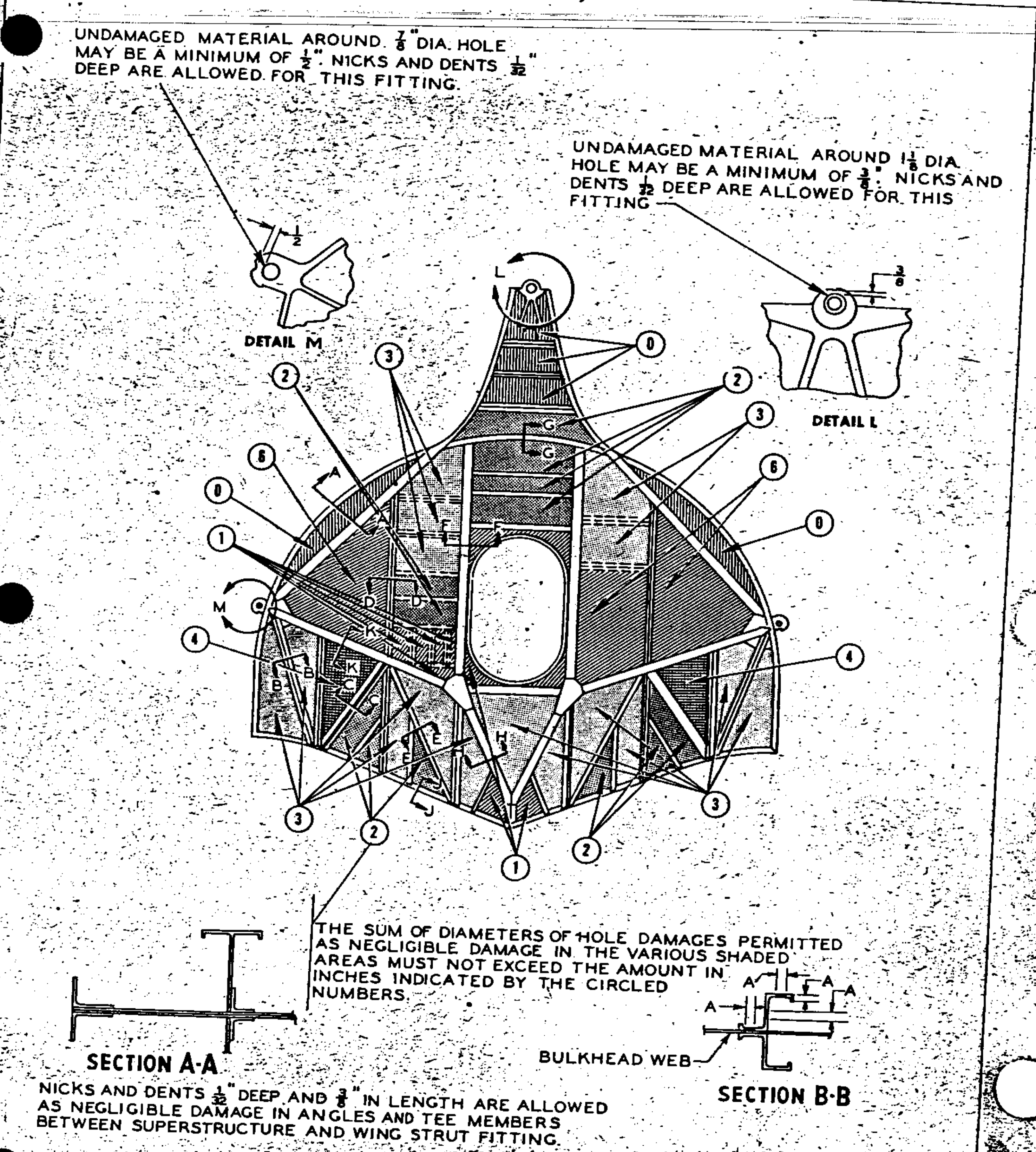
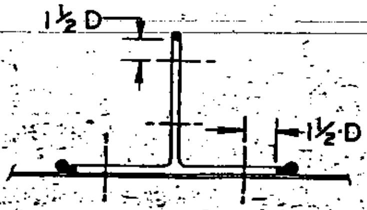
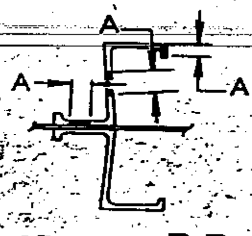


Figure 4-19—Bulkhead 4—Negligible Damage (sheet 1 of 2)

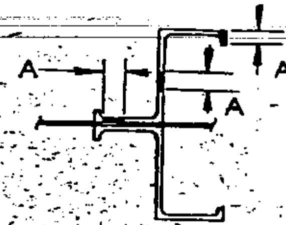


SECTION C-C

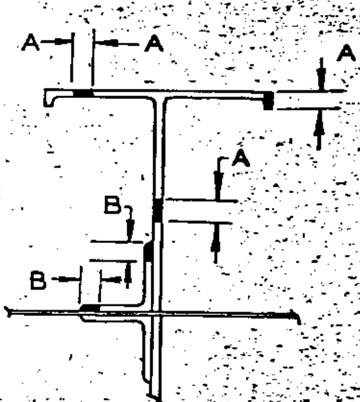
DAMAGE IN SHADED AREAS WHICH LEAVES MINIMUM EDGE DISTANCE FOR ALL RIVETS AND BOLTS (1½ X DIAMETER OF THE RIVET OR BOLT) IS CONSIDERED NEGLIGIBLE.



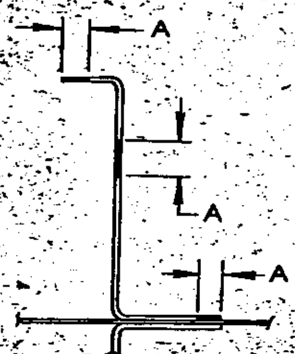
SECTION D-D



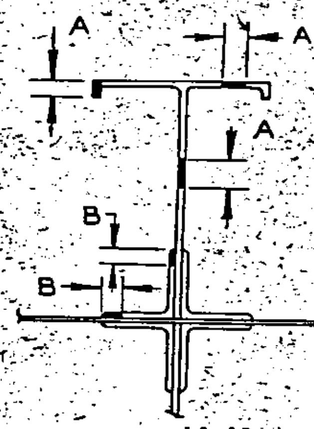
SECTION E-E



SECTION F-F



SECTION G-G



SECTION H-H

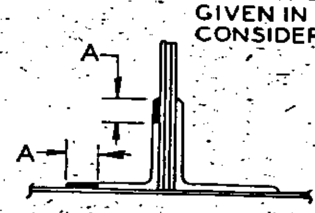
NOTES:

MEMBERS FOR WHICH DAMAGE IS NOT SHOWN IN THE CROSS SECTIONS MAY BE DAMAGED 3/32 INCH IN EACH LEG.

NEGLIGIBLE DAMAGE, SHOWN IN SHADED AREAS OF THE CROSS SECTIONS, IS LISTED IN THE TABLE.

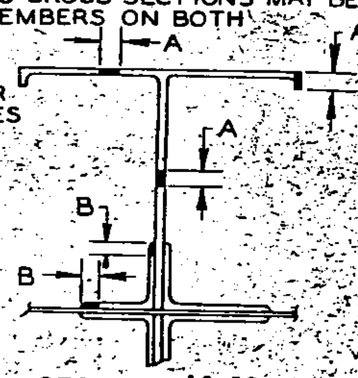
NEGLIGIBLE DAMAGE SHOWN IN THE VARIOUS CROSS SECTIONS MAY BE PERMITTED SIMULTANEOUSLY IN SIMILAR MEMBERS ON BOTH SIDES OF THE BULKHEAD.

IF THE SUM OF THE A DIMENSIONS AND THE SUM OF THE B DIMENSIONS FOR EACH MEMBER IN EACH SECTION, DO NOT EXCEED THE VALUES GIVEN IN THE TABLE BELOW, THE DAMAGE IS CONSIDERED NEGLIGIBLE.



SECTION J-J

SECTIONS	A	B
A A	SEE SECTION NOTE	
B B	1/2	
C C	SEE SECTION NOTE	
D D	1/8	
E E	3/4	
F F	1/2	1/8
G G	1 1/2	
H H	3/4	3/8
J J	1/4	
K K	5/16	3/32



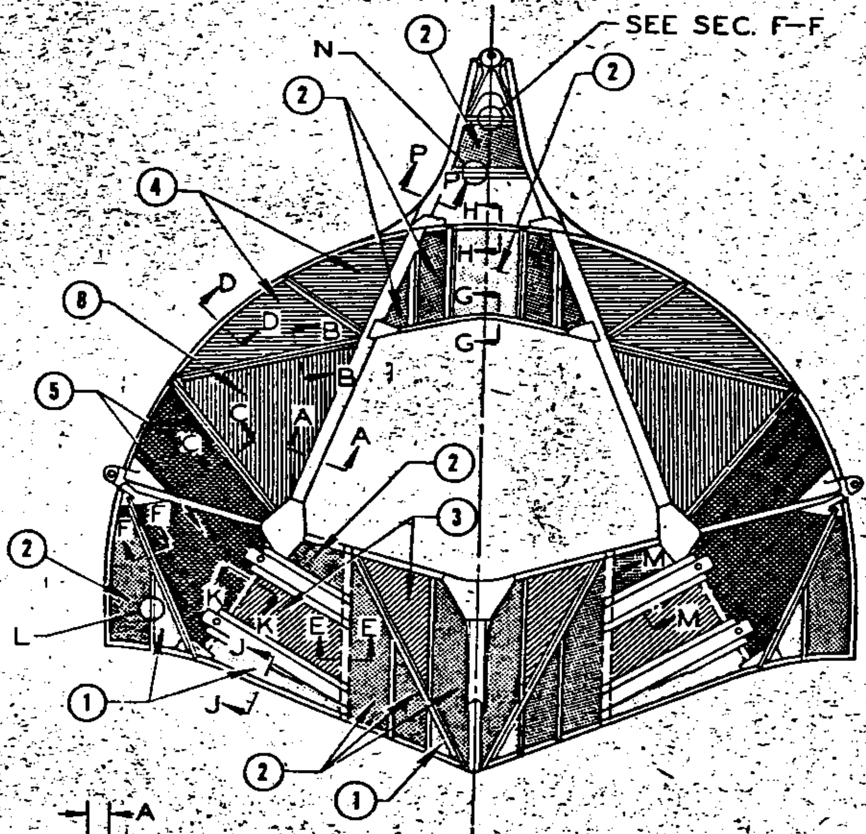
SECTION K-K

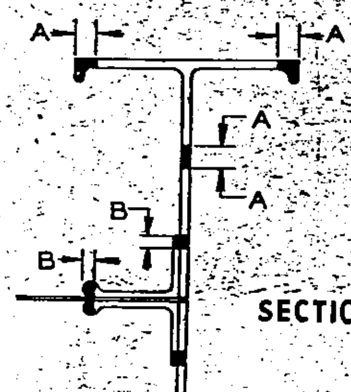
Figure 4-19—Bulkhead 4-Negligible Damage (sheet 2 of 2)

NOTES:

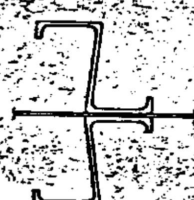
THE SUM OF HOLE DIAMETERS PERMITTED AS NEGLIGIBLE DAMAGE IN THE VARIOUS SHADED REGIONS MUST NOT EXCEED THE AMOUNT IN INCHES INDICATED BY THE CIRCLED NUMBER.

THE DAMAGE TO MEMBERS AS SHOWN IN THE VARIOUS SECTIONS IS NOT TO EXIST OVER A TOTAL LENGTH OF 2" ALONG THE MEMBER.





SECTION A-A



SECTION B-B

SECTION C-C

FOR TEE SECTION, THE TOTAL SUM OF 'A' DIMENSIONS NOT TO EXCEED ⅝ PER TEE SECTION.

NICKS & DENTS IN THE ABOVE ZEE MEMBERS NOT TO EXCEED 1/32 INCH DEPTH.

Figure 4-20—Bulkhead 5—Negligible Damage (sheet 1 of 2)

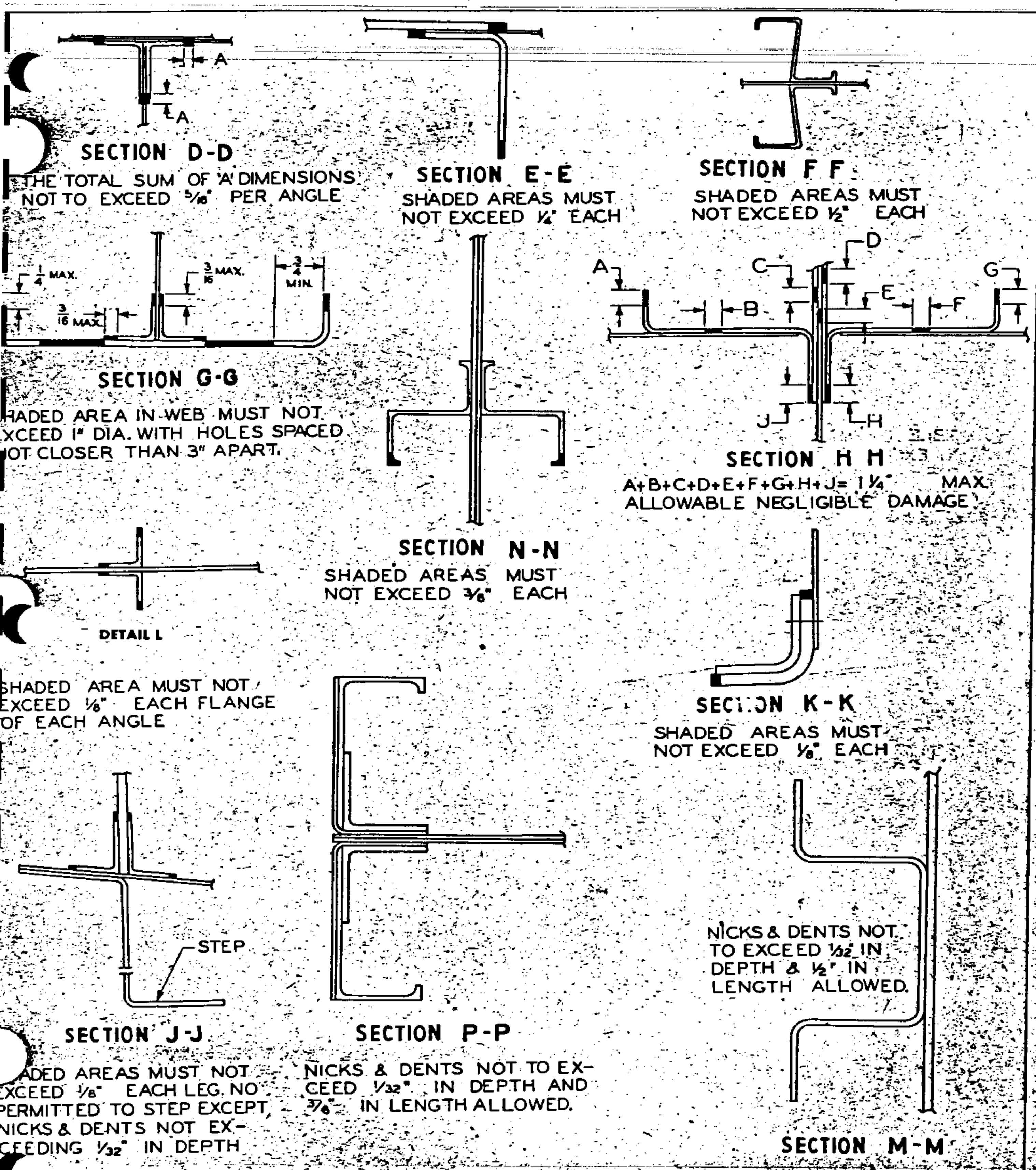


Figure 4-20—Bulkhead 5-Negligible Damage (sheet 2 of 2)

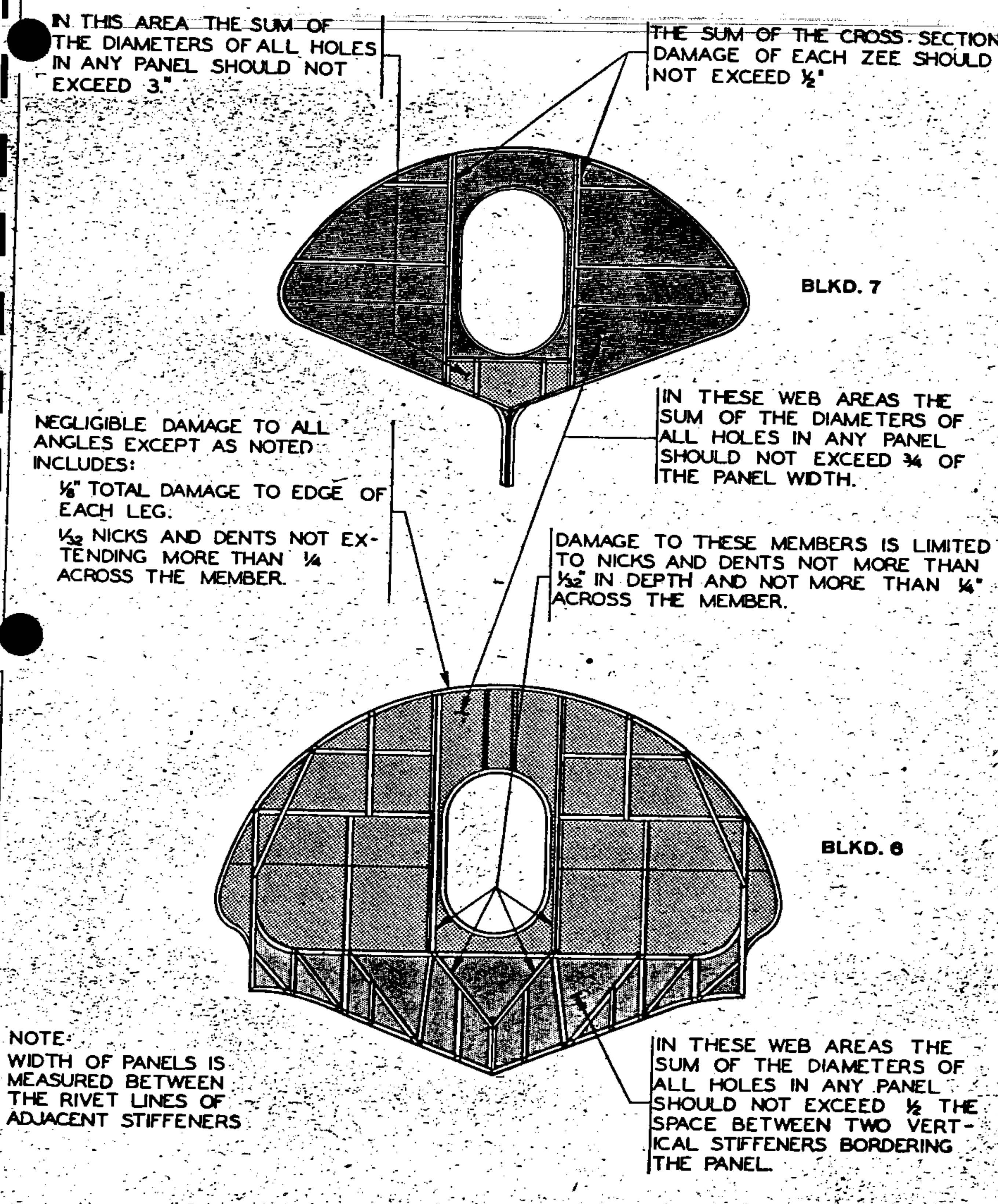


Figure 4-21—Bulkheads 6 and 7-Negligible Damage

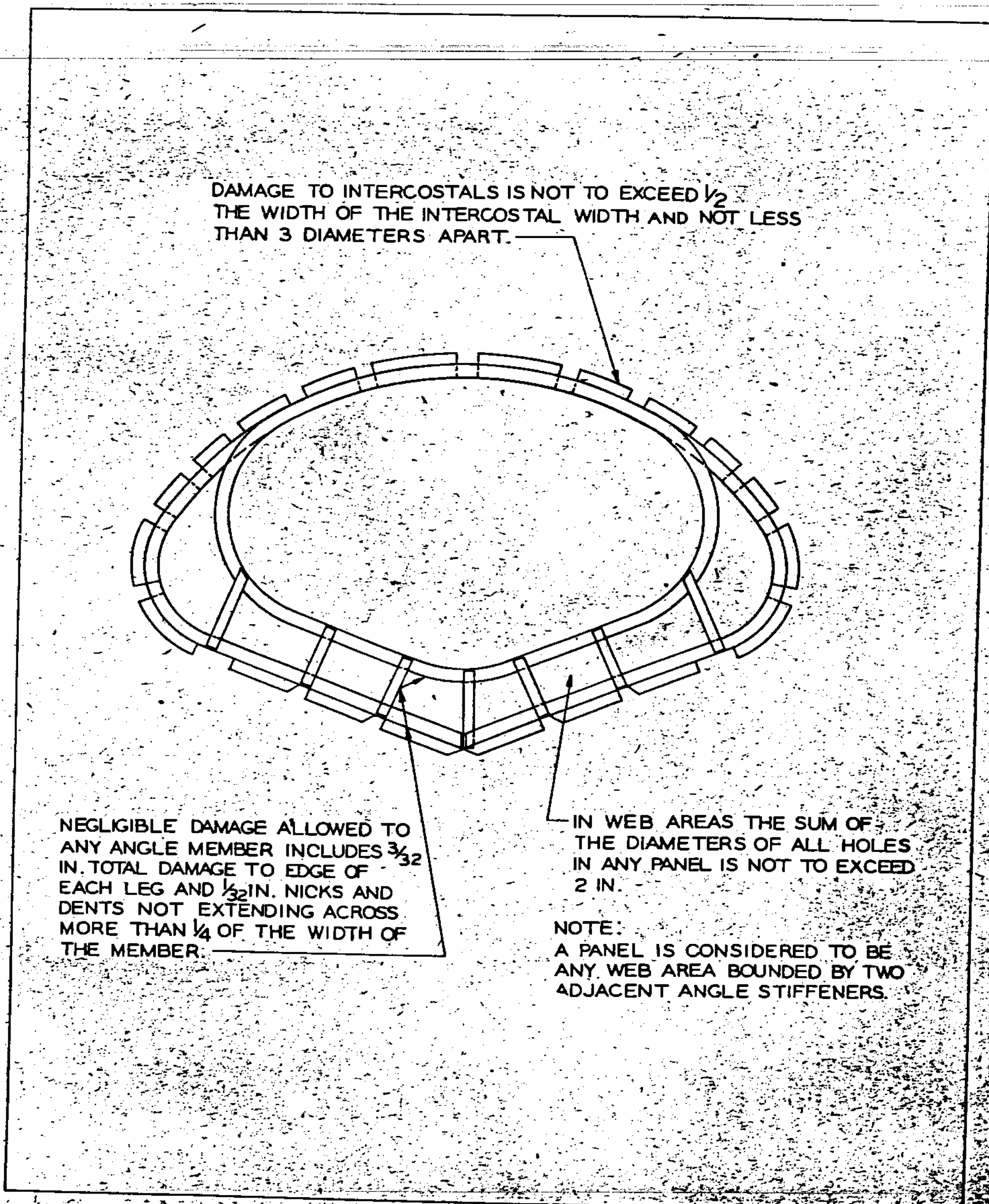


Figure 4-22—Bulkhead 9-Negligible Damage

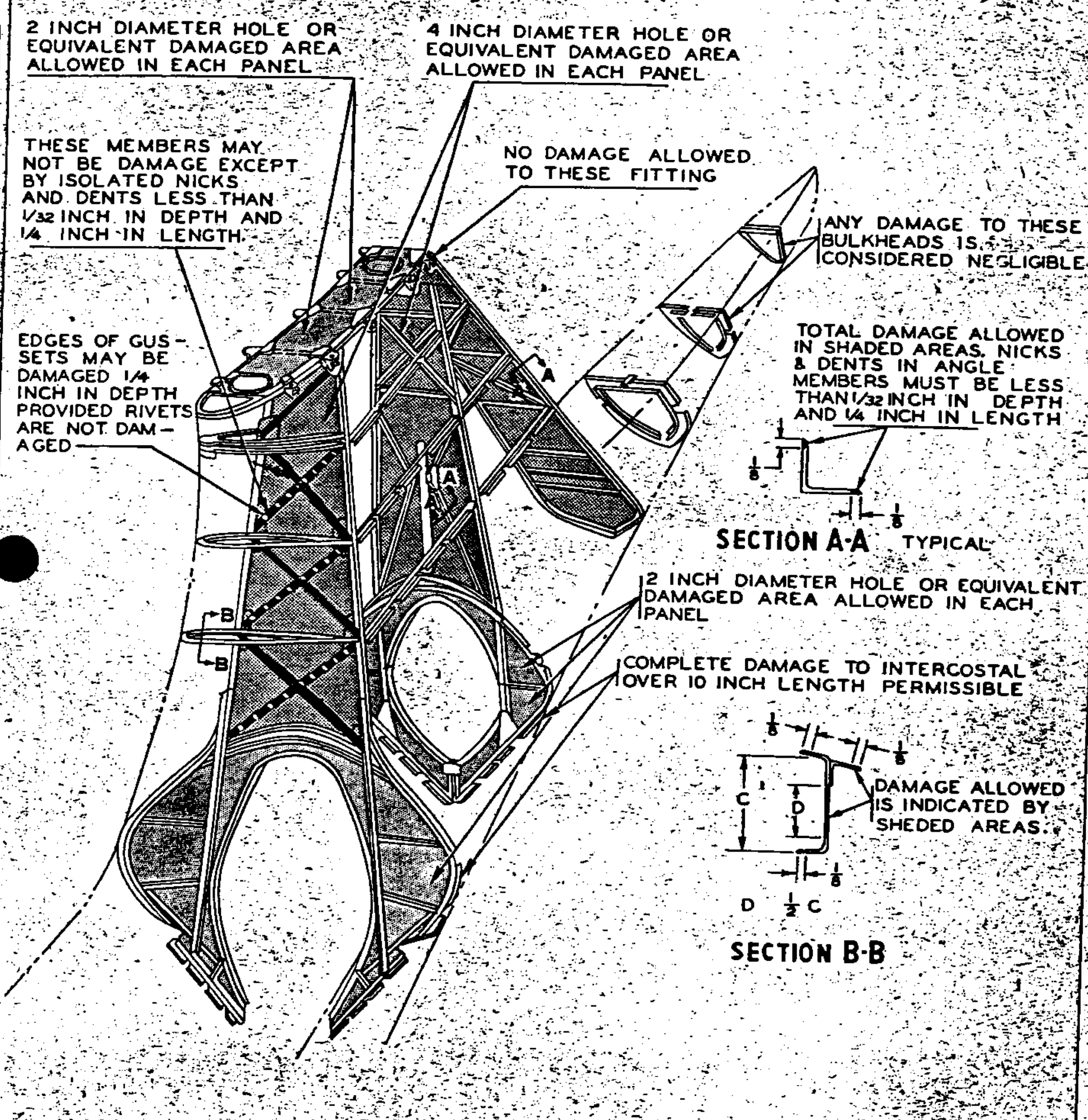


Figure 4-23—Vertical Stabilizer Frames-Negligible Damage

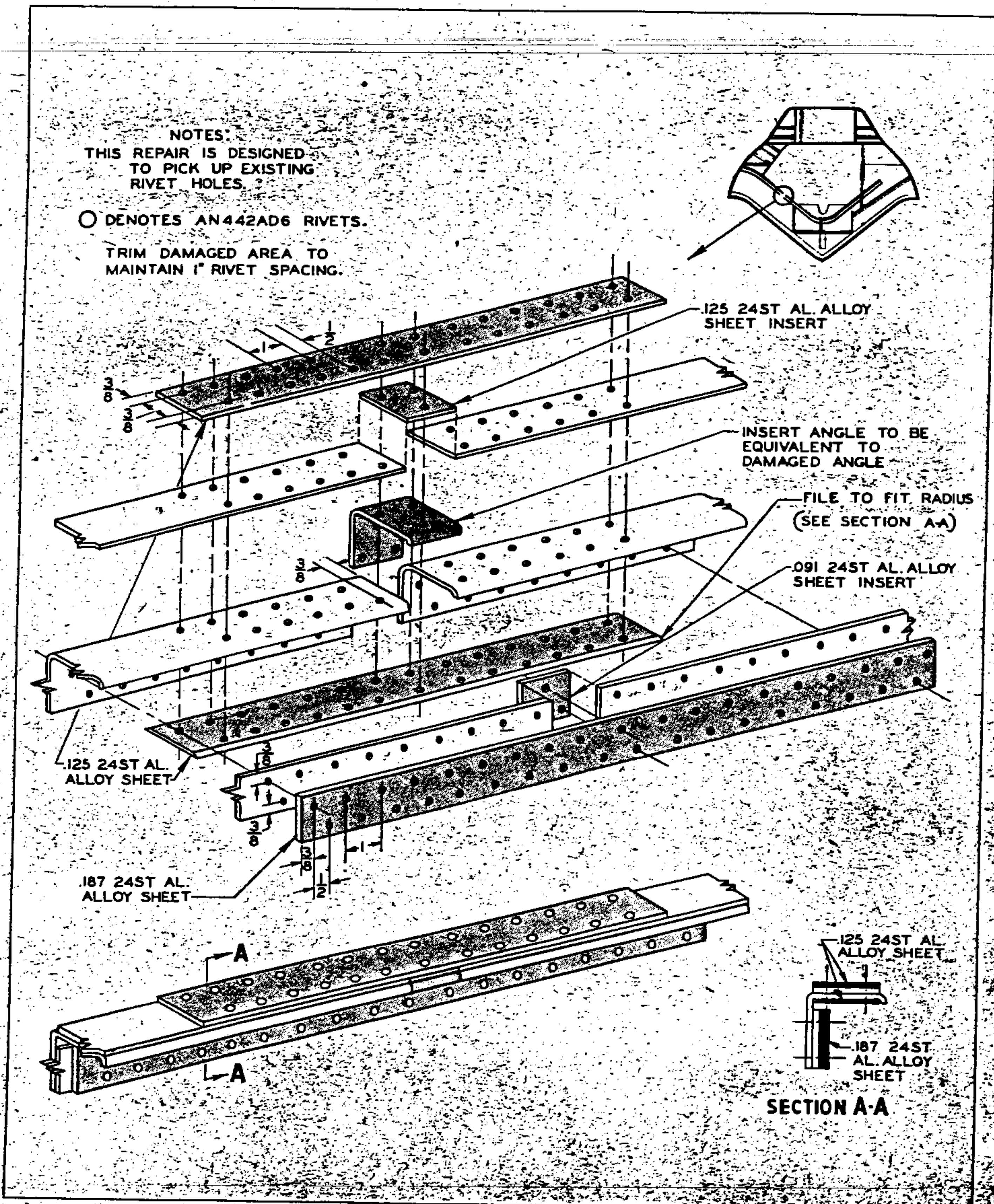


Figure 4-24 (Sheet 1 of 2 Sheets)—Bulkhead 1 Repairs

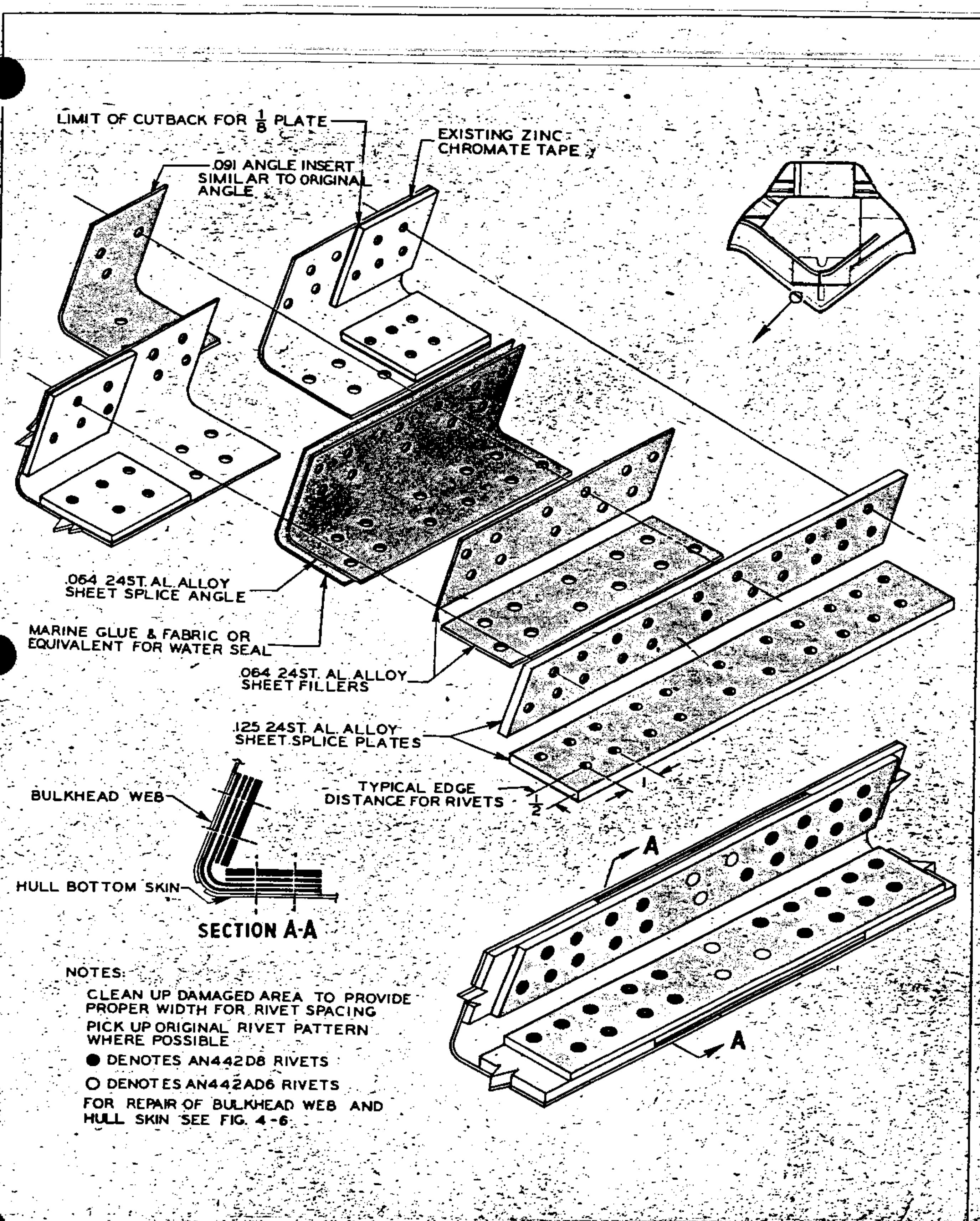


Figure 4-24 (Sheet 2 of 2 Sheets)—Bulkhead 1 Repairs

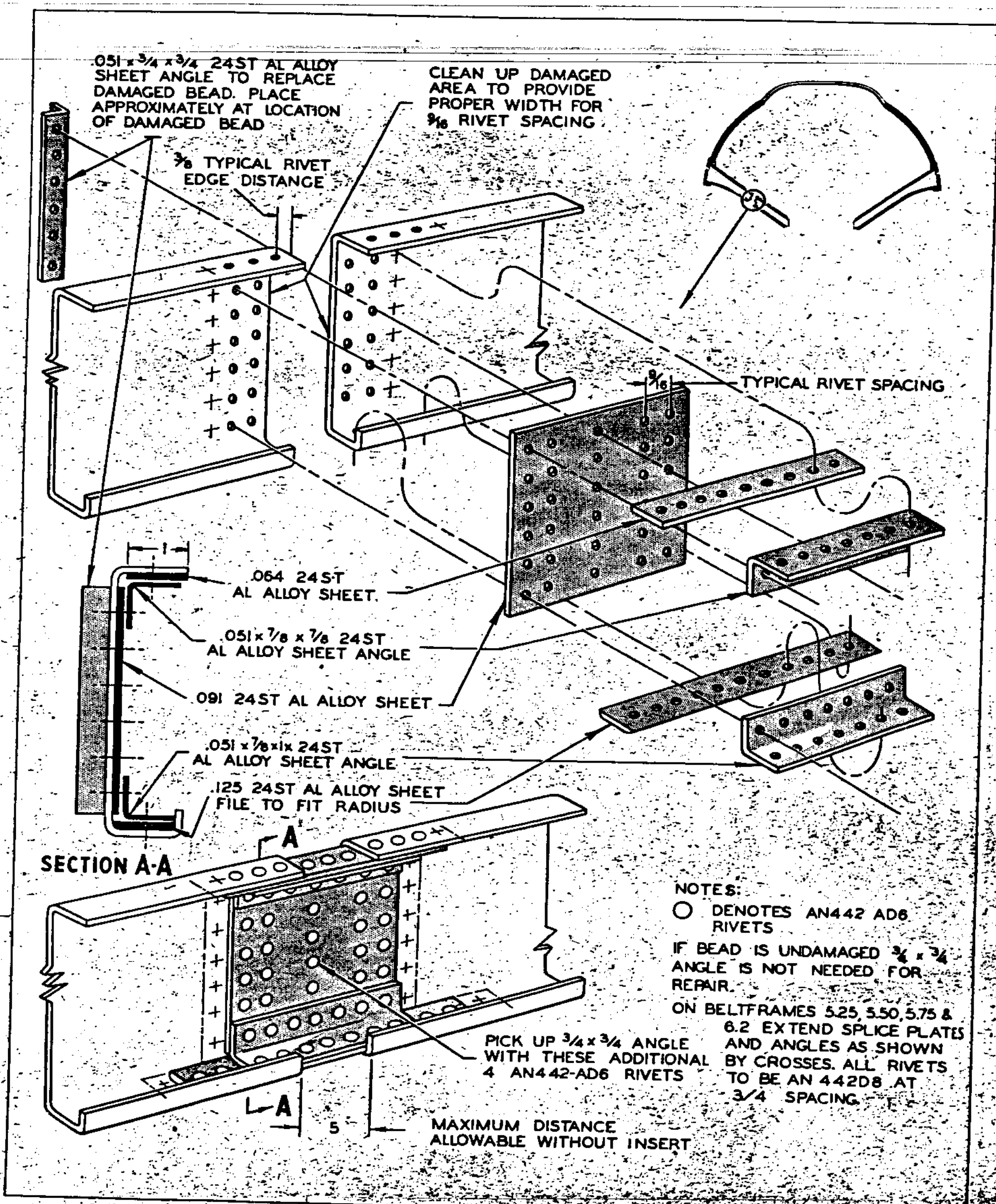


Figure 4-25—Repair for Beltframes 1.33, 1.66, 5.25, 5.50, 5.75, 6.2, 6.4, 6.6, 6.8

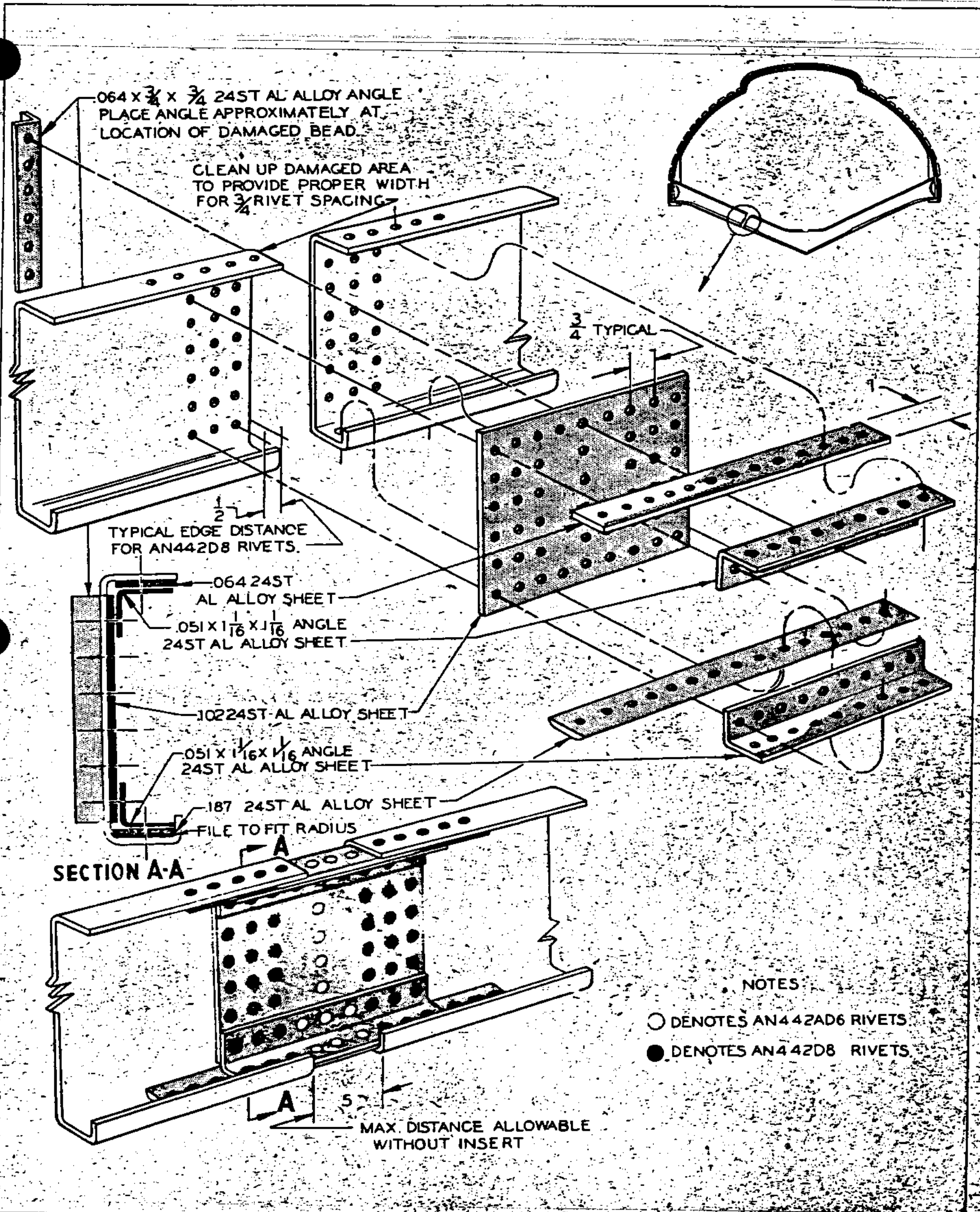


Figure 4-26—Repair for Beltframes 2.5, 4.1 & 4.3

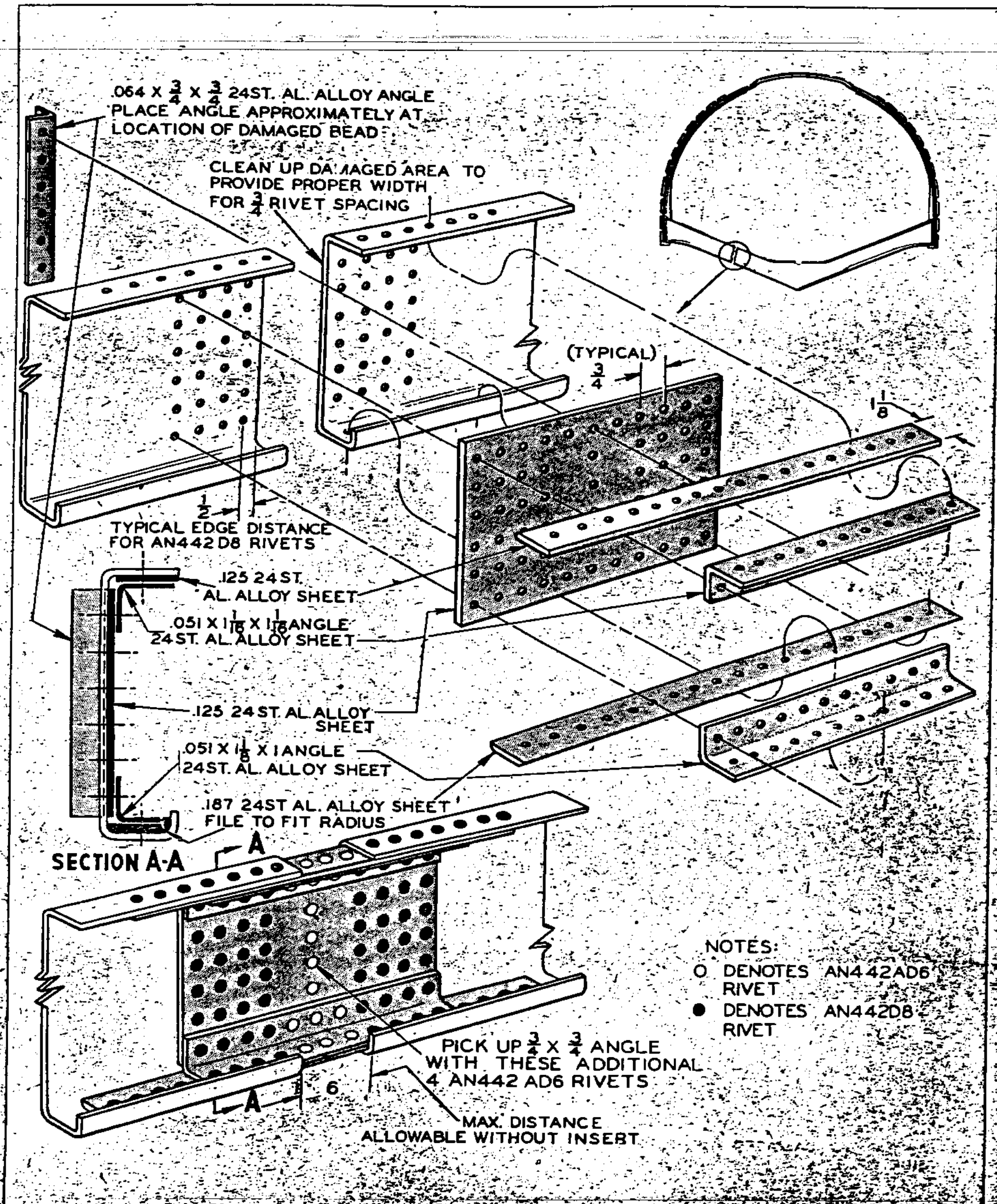


Figure 4-27—Repair for Beltframes 3.33 & 3.66

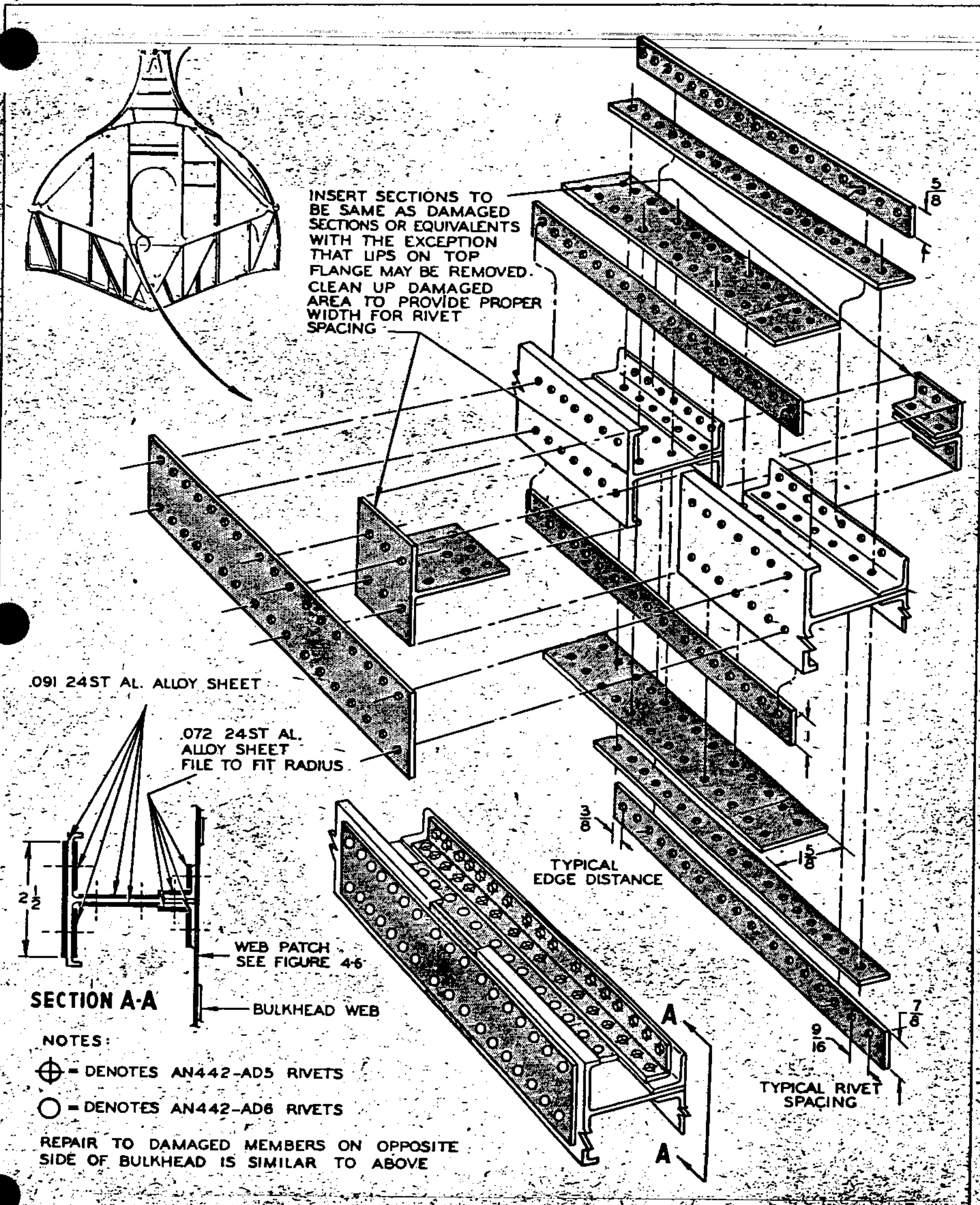


Figure 4-28 (Sheet 1 of 2 Sheets)—Bulkhead 4 Repairs

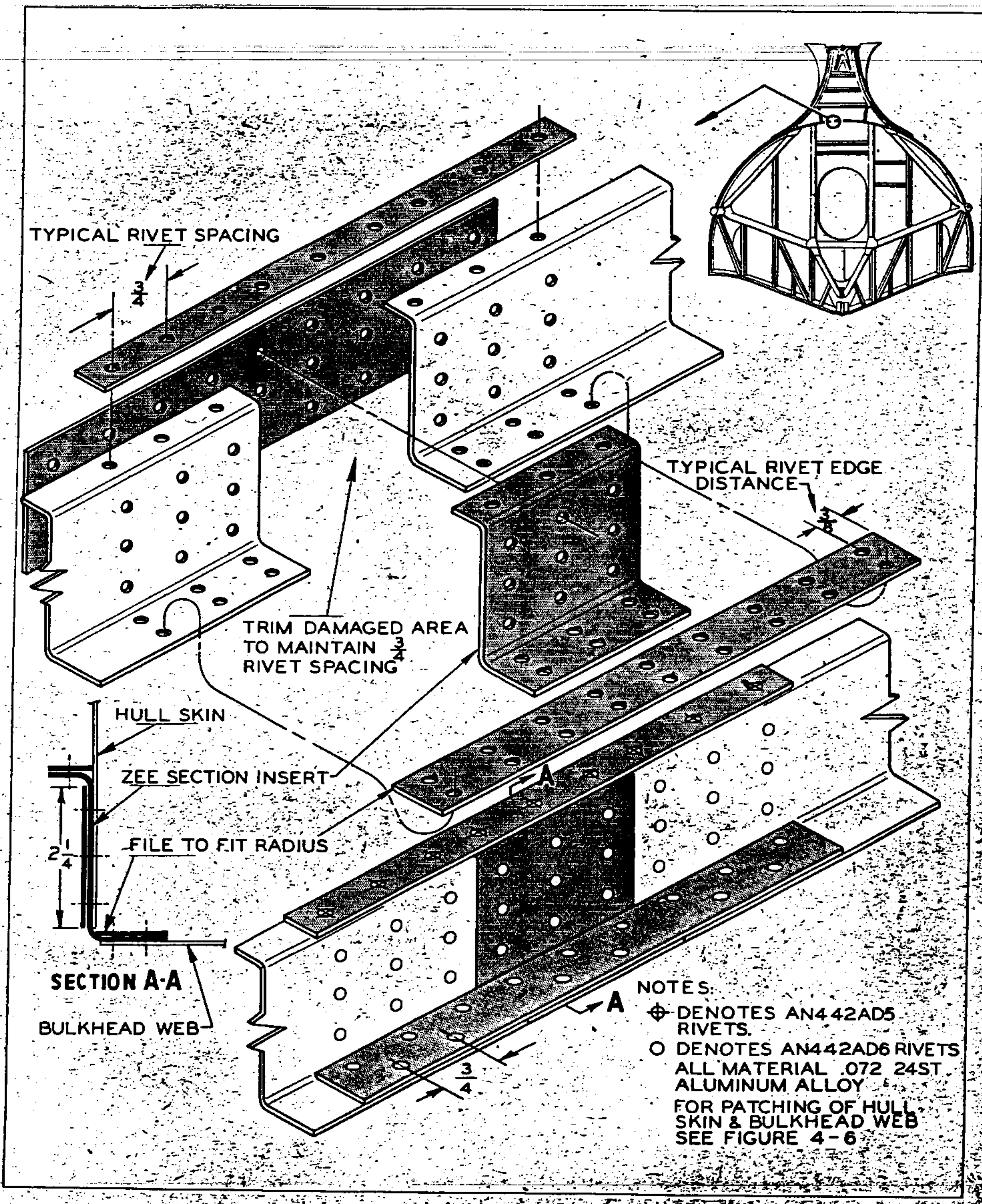


Figure 4-28 (Sheet 2 of 2 Sheets)—Bulkhead 4 Repairs

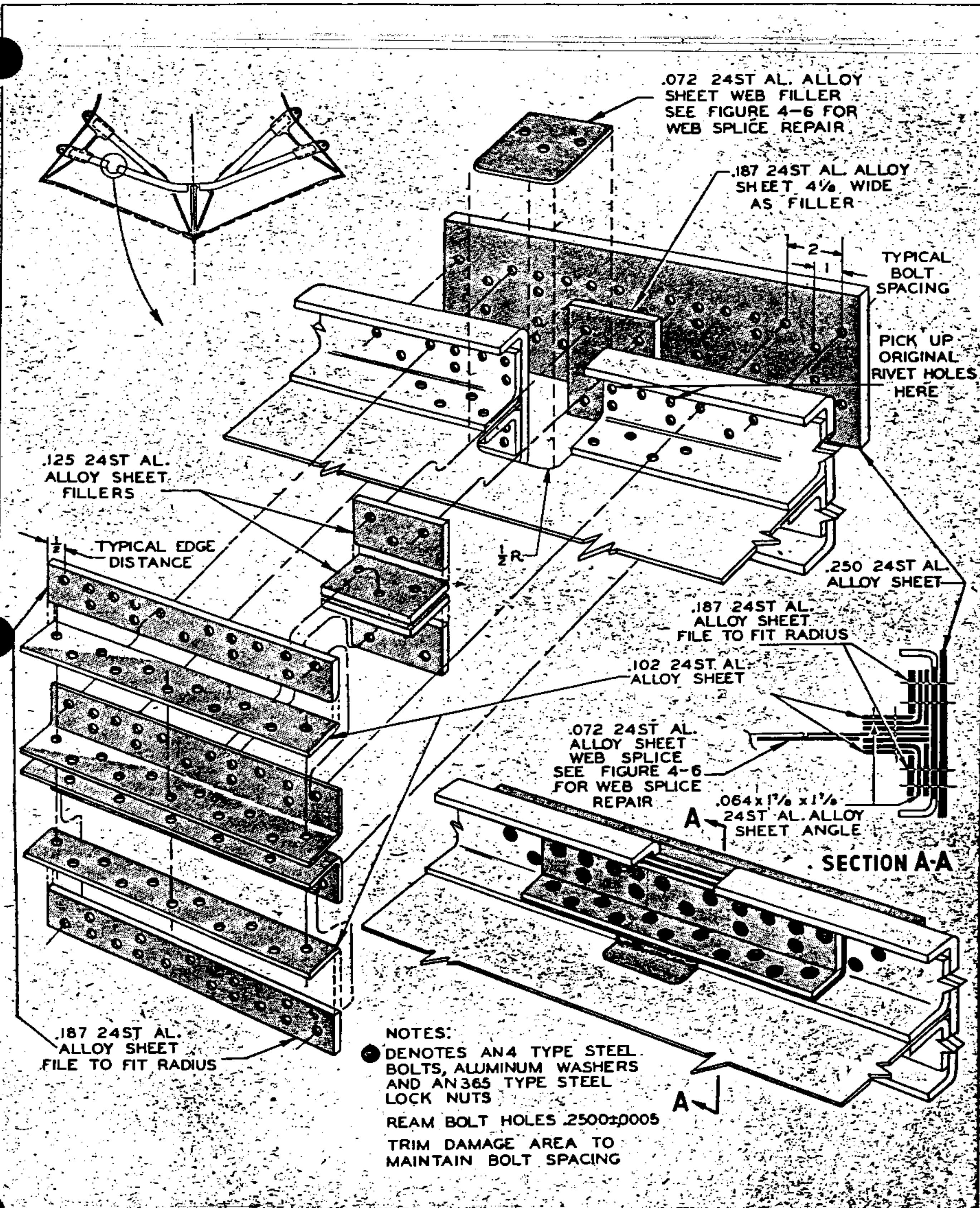


Figure 4-29 (Sheet 1 of 2 Sheets)—Beltframe 4.2 Repairs

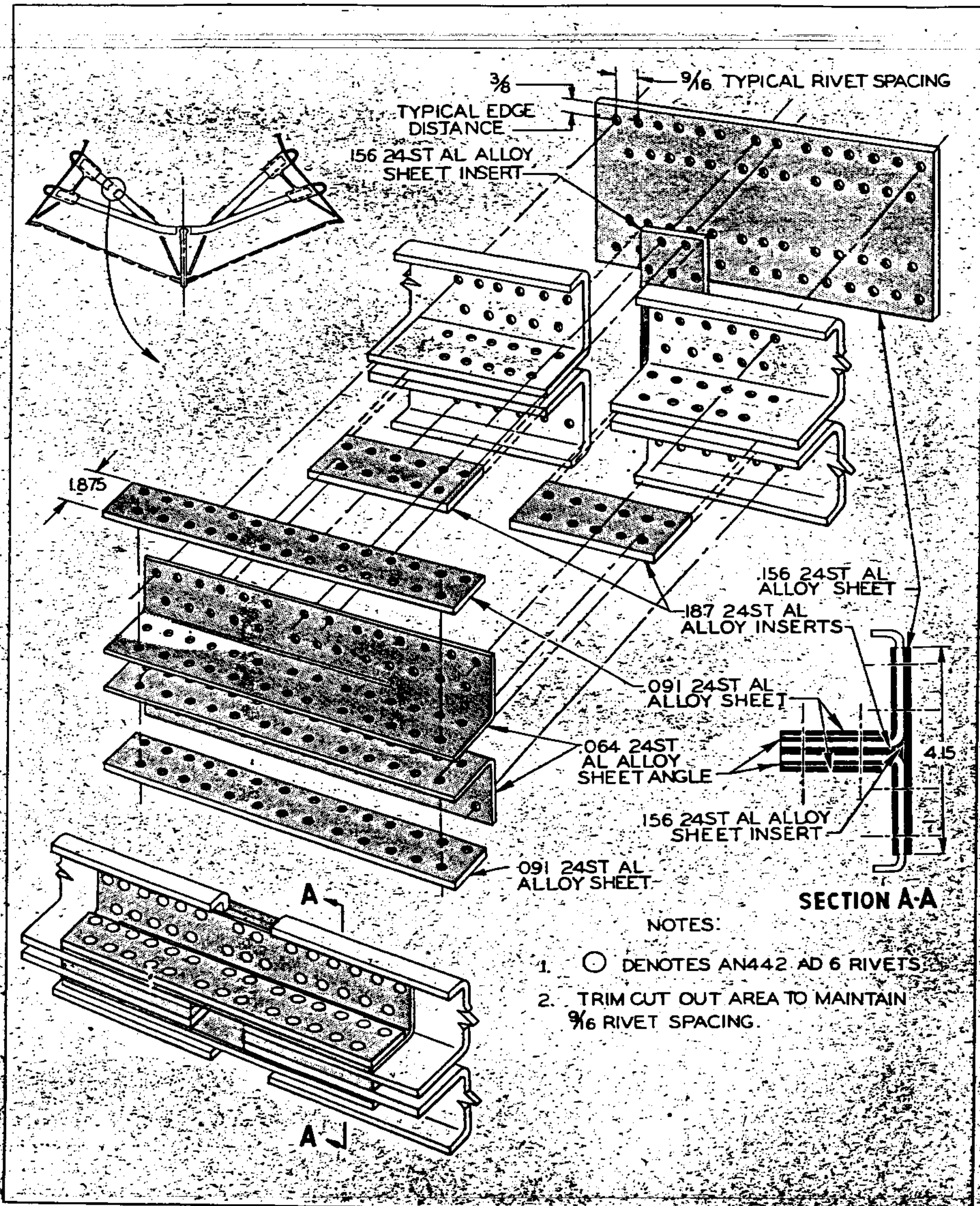
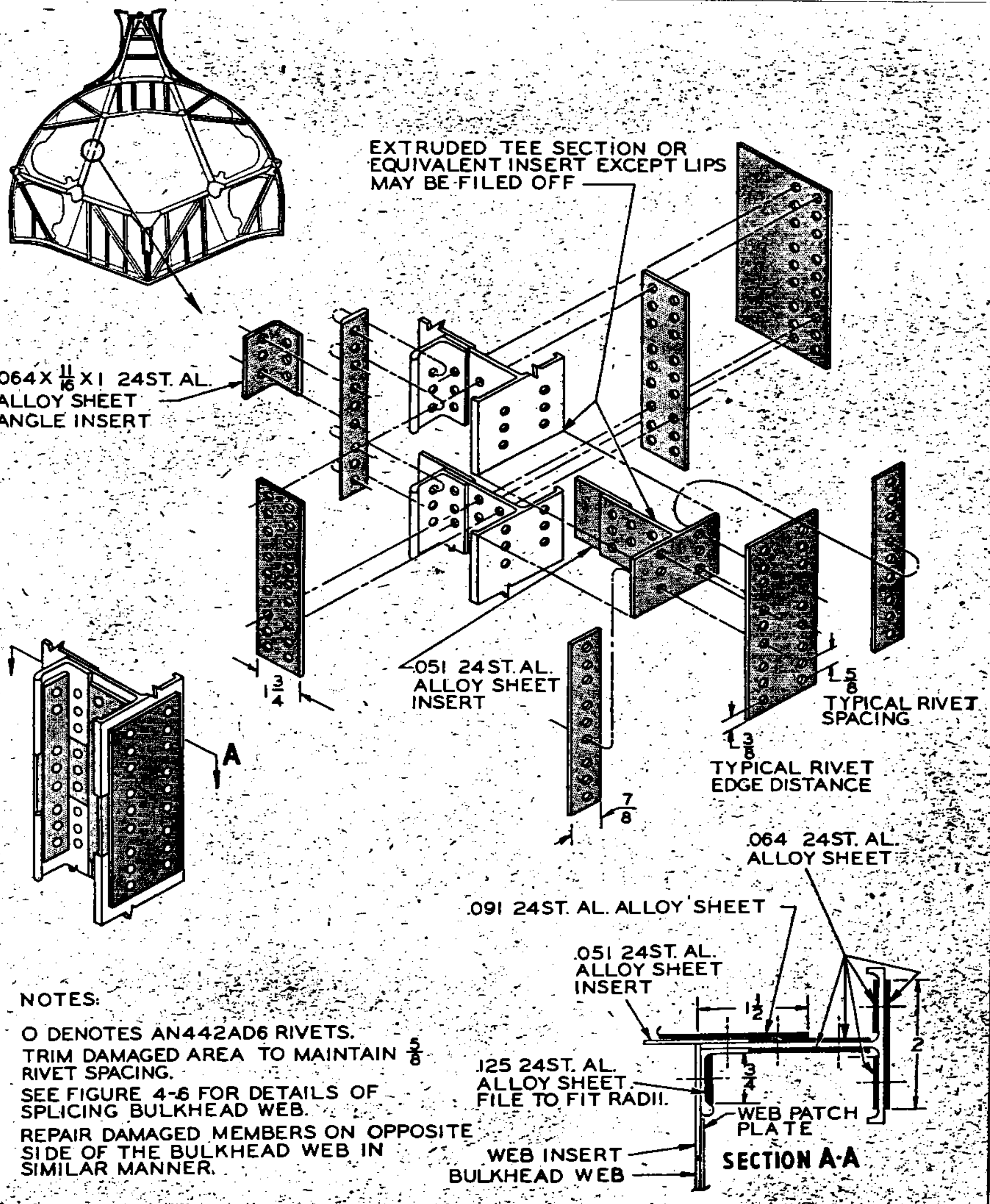


Figure 4-29 (Sheet 2 of 2 Sheets)—Beltframe 4.2 Repairs



NOTES:

O DENOTES AN442AD6 RIVETS.

TRIM DAMAGED AREA TO MAINTAIN 5/8 RIVET SPACING.

SEE FIGURE 4-6 FOR DETAILS OF SPLICING BULKHEAD WEB.

REPAIR DAMAGED MEMBERS ON OPPOSITE SIDE OF THE BULKHEAD WEB IN SIMILAR MANNER.

Figure 4-30—Bulkhead 5 Repairs

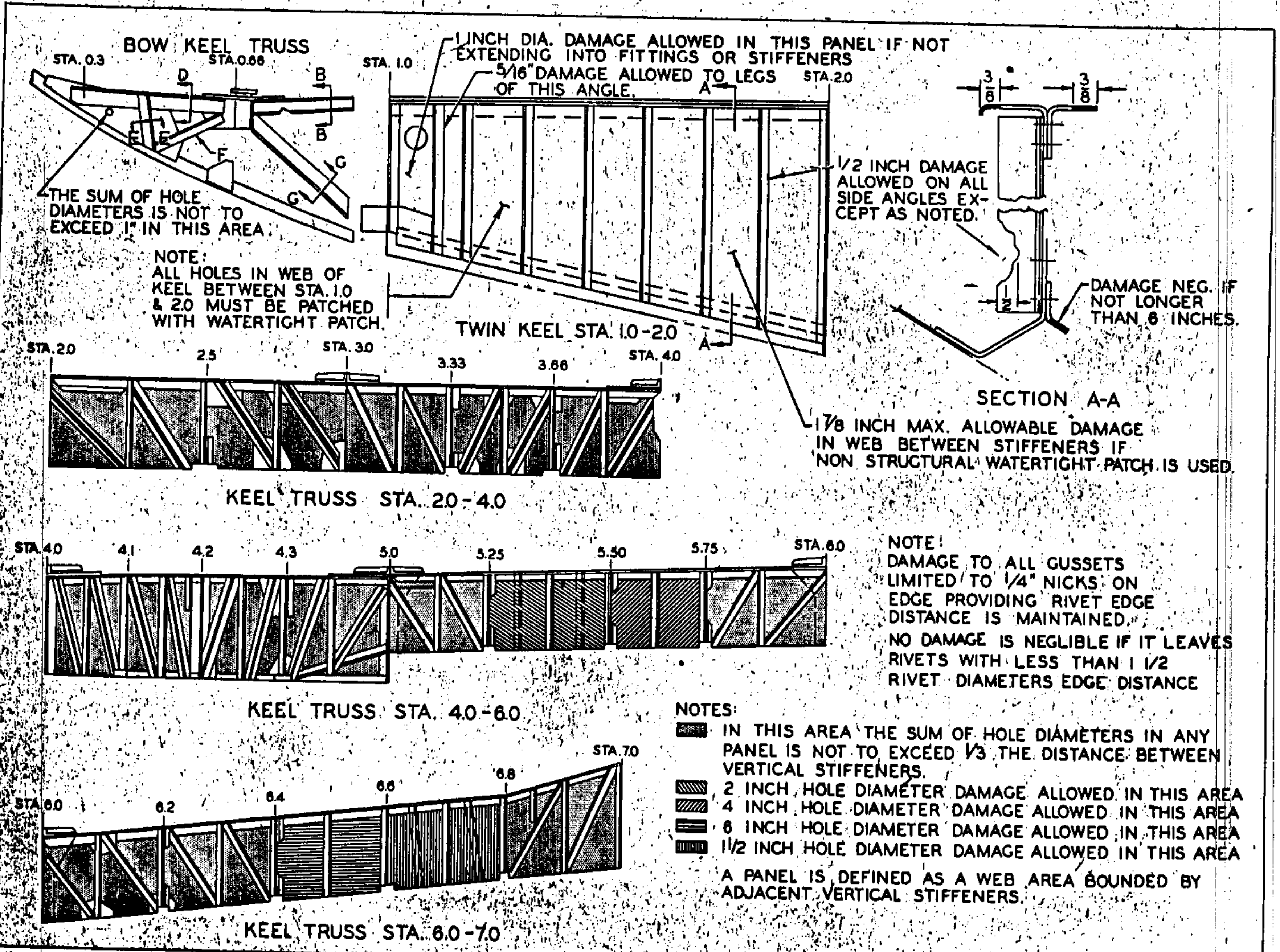


Figure 4-31—Keel-Negligible Damage (sheet 1 of 2)

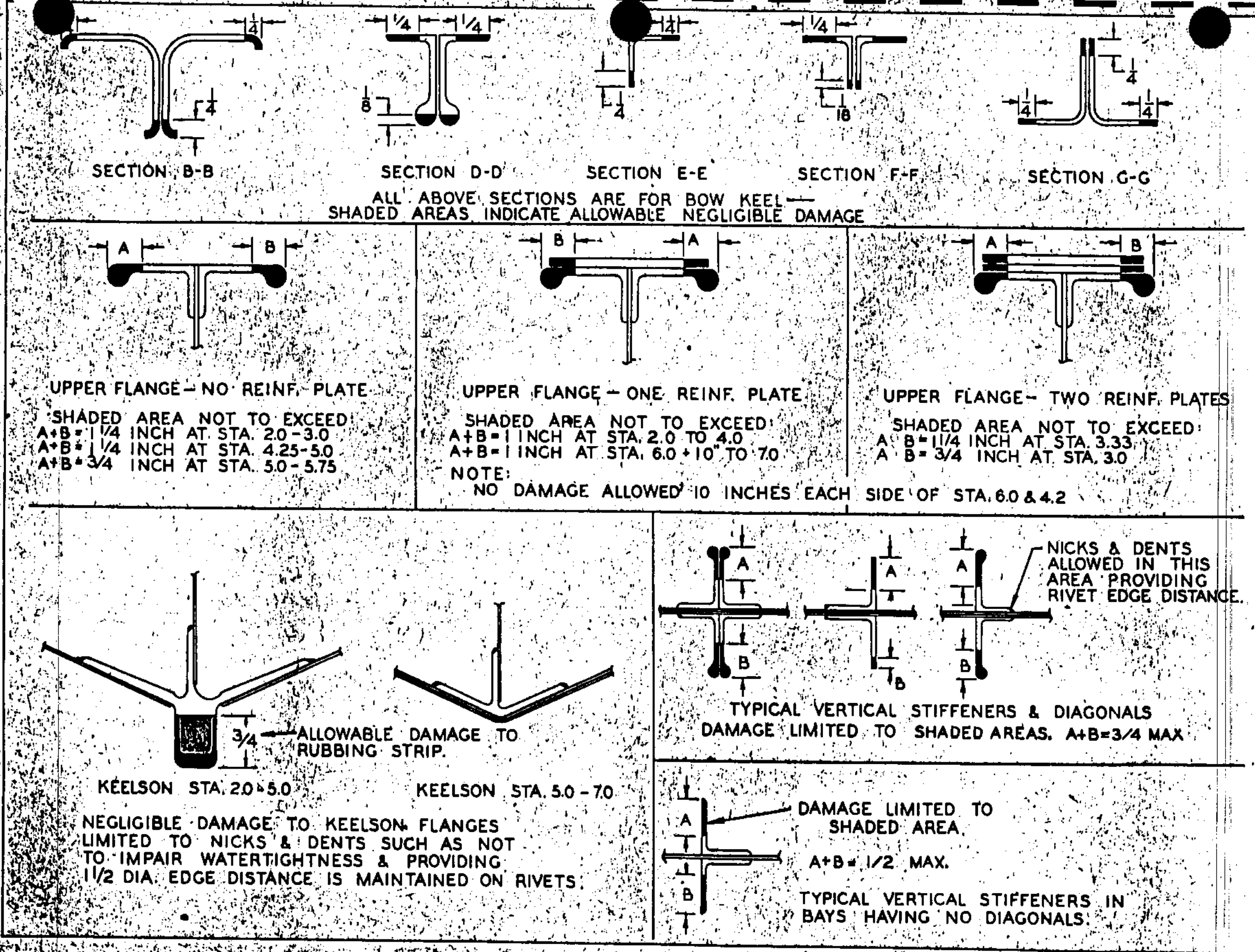


Figure 4-31—Keel-Negligible Damage (sheet 2 of 2)

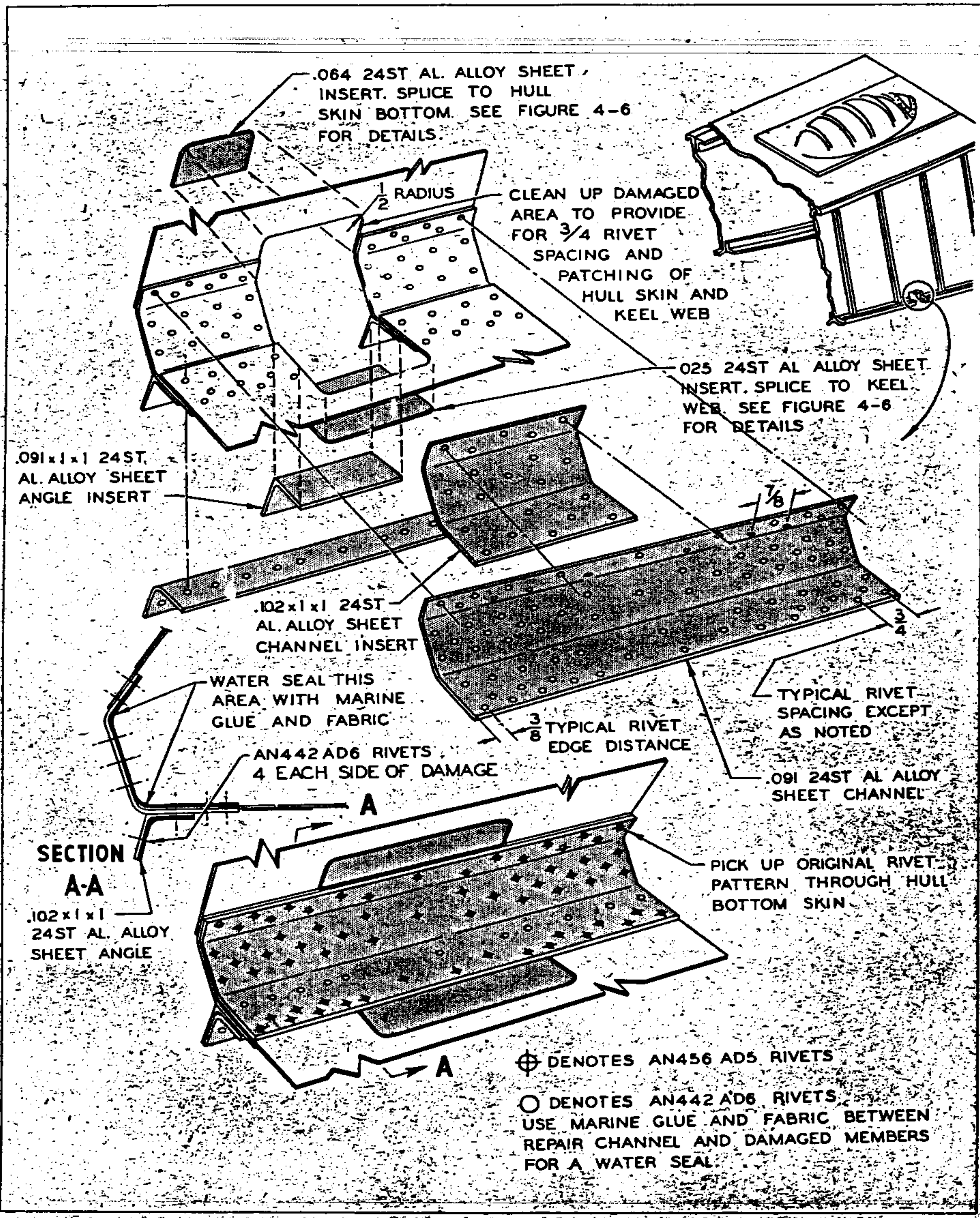


Figure 4-32 (Sheet 1 of 2 Sheets)—Twin Keel Repair

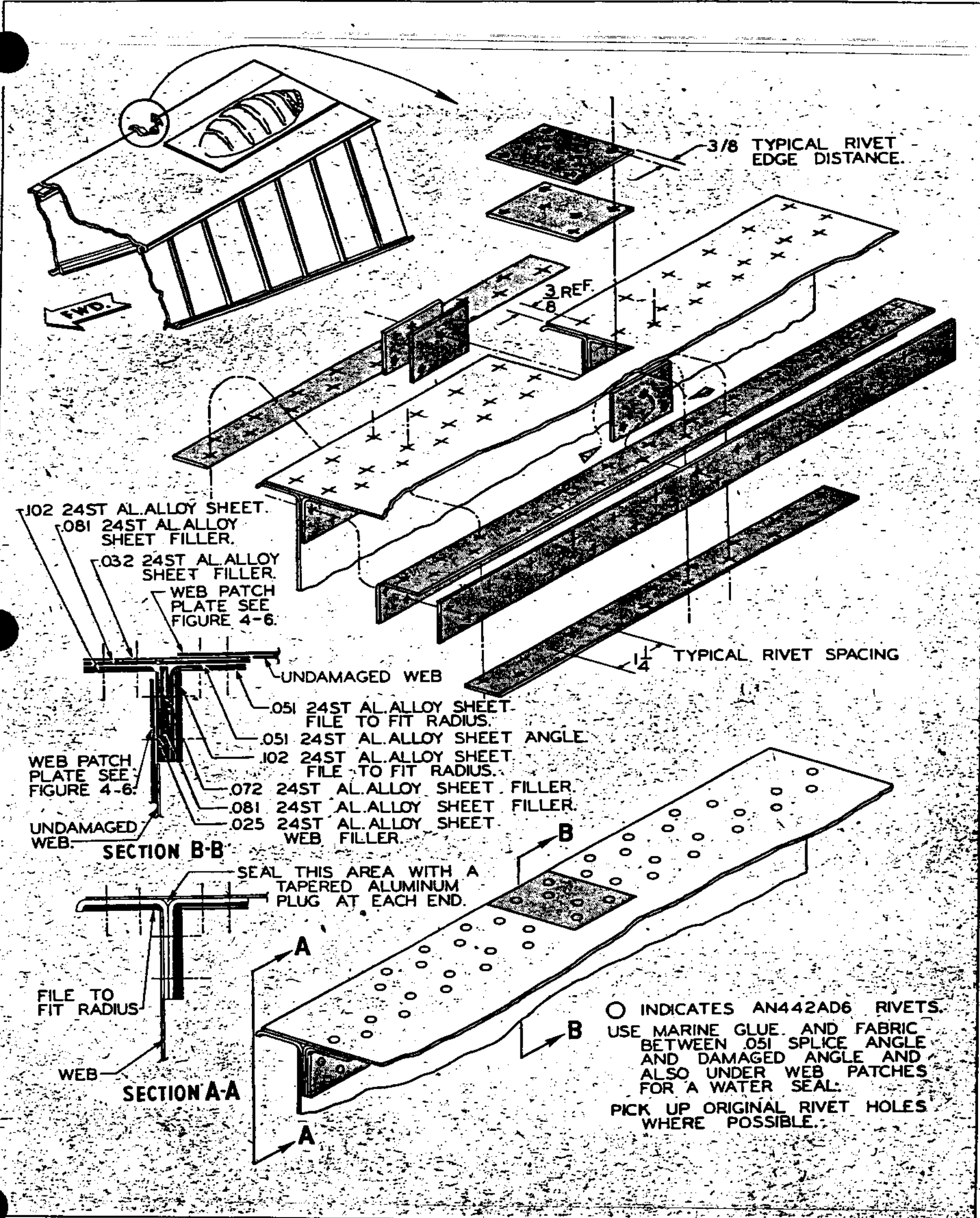
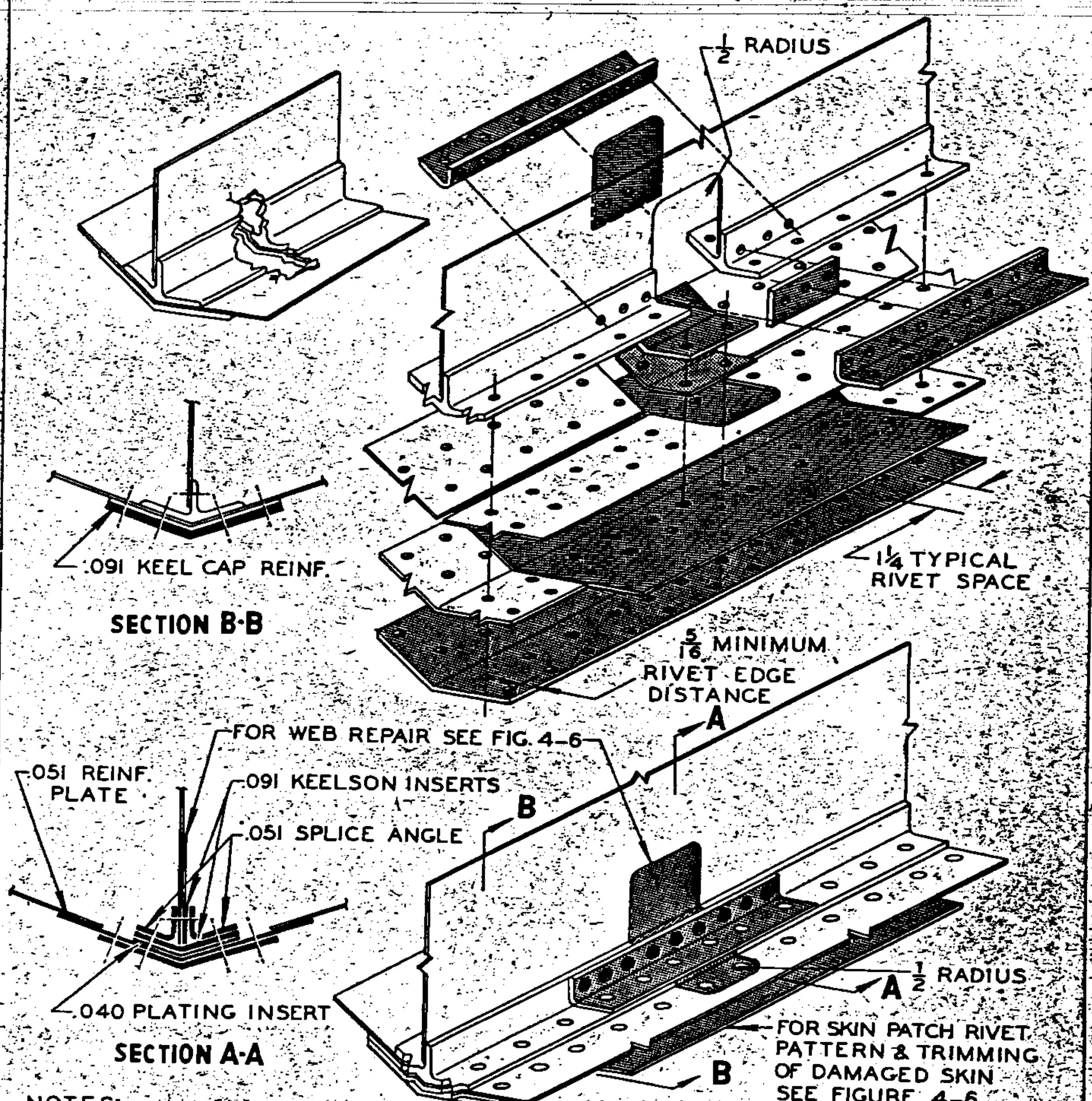


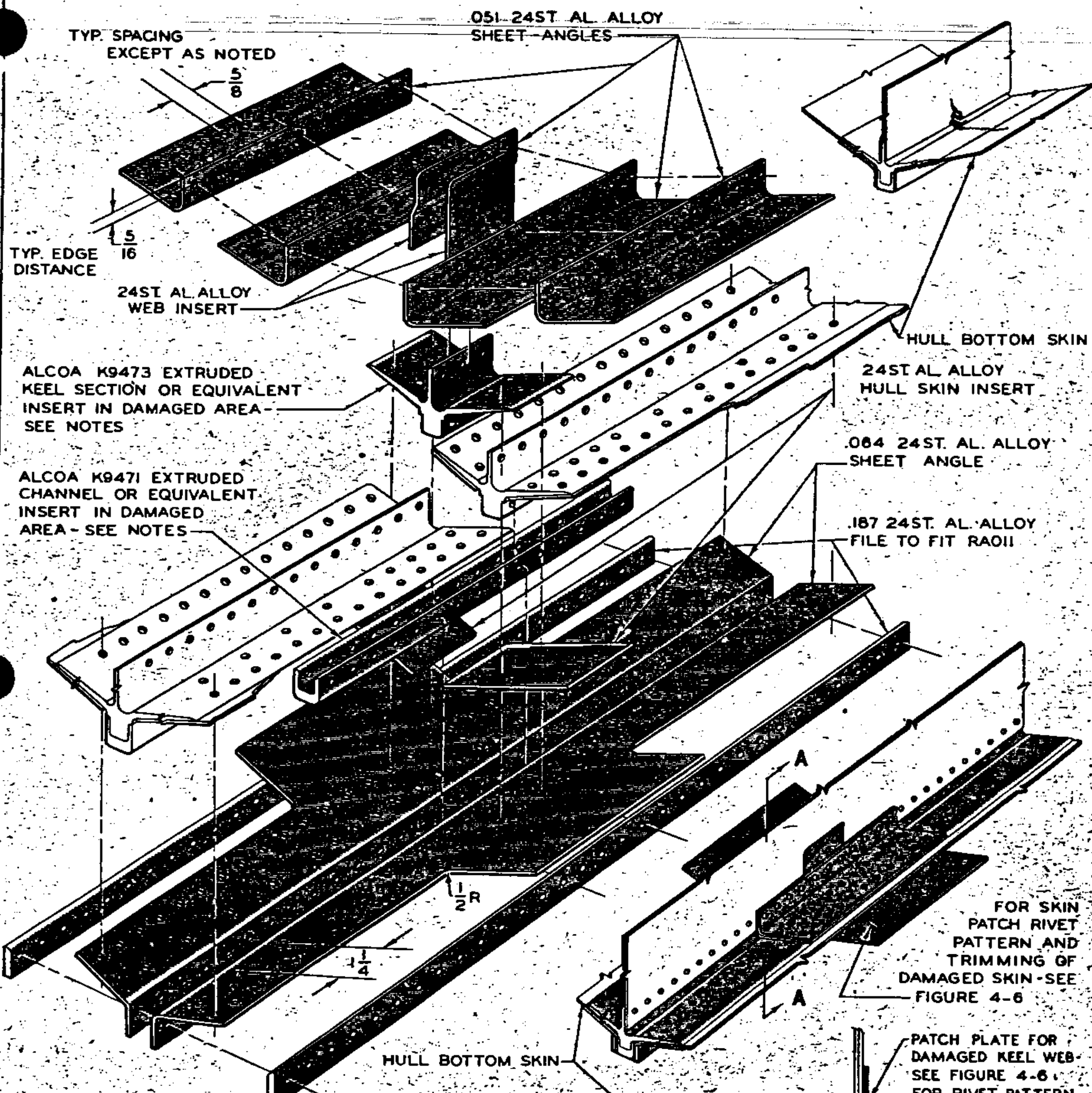
Figure 4-32 (Sheet 2 of 2 Sheets)—Twin Keel Repair



NOTES:
- O DENOTES AN456AD6 RIVETS EXCEPT AS NOTED.
- ● DENOTES AN442AD6 RIVETS.

USE MARINE GLUE & FABRIC OR EQUIVALENT TO MAKE SKIN REPAIRS WATER TIGHT.
PICK UP EXISTING RIVET HOLES WHERE POSSIBLE.
THIS REPAIR IS DESIGNED FOR THE KEELSON BETWEEN STA. 5.0 & 7.0.
ALL REPAIR MATERIAL IS 24ST AL ALLOY

Figure 4-33 (Sheet 1 of 2 Sheets)—Main Keel Repair



NOTES:

CUT OUT ALCOA K9471 SECTION OVER LENGTH 9" GREATER THAN CUT OUT LENGTH OF ALCOA K9473 SECTION

⊕ INDICATES AN456AD6 RIVETS

◑ INDICATES AN442AD6 RIVETS

SEE FIGURE 4-6 FOR REPAIR OF SKIN OR WEB

USE MARINE GLUE AND FABRIC BETWEEN KEEL SECTION AND REPAIR PARTS FOR A WATER SEAL

PICK UP EXISTING RIVET HOLES WHERE POSSIBLE

Figure 4-33 (Sheet 2 of 2 Sheets)—Main Keel Repair

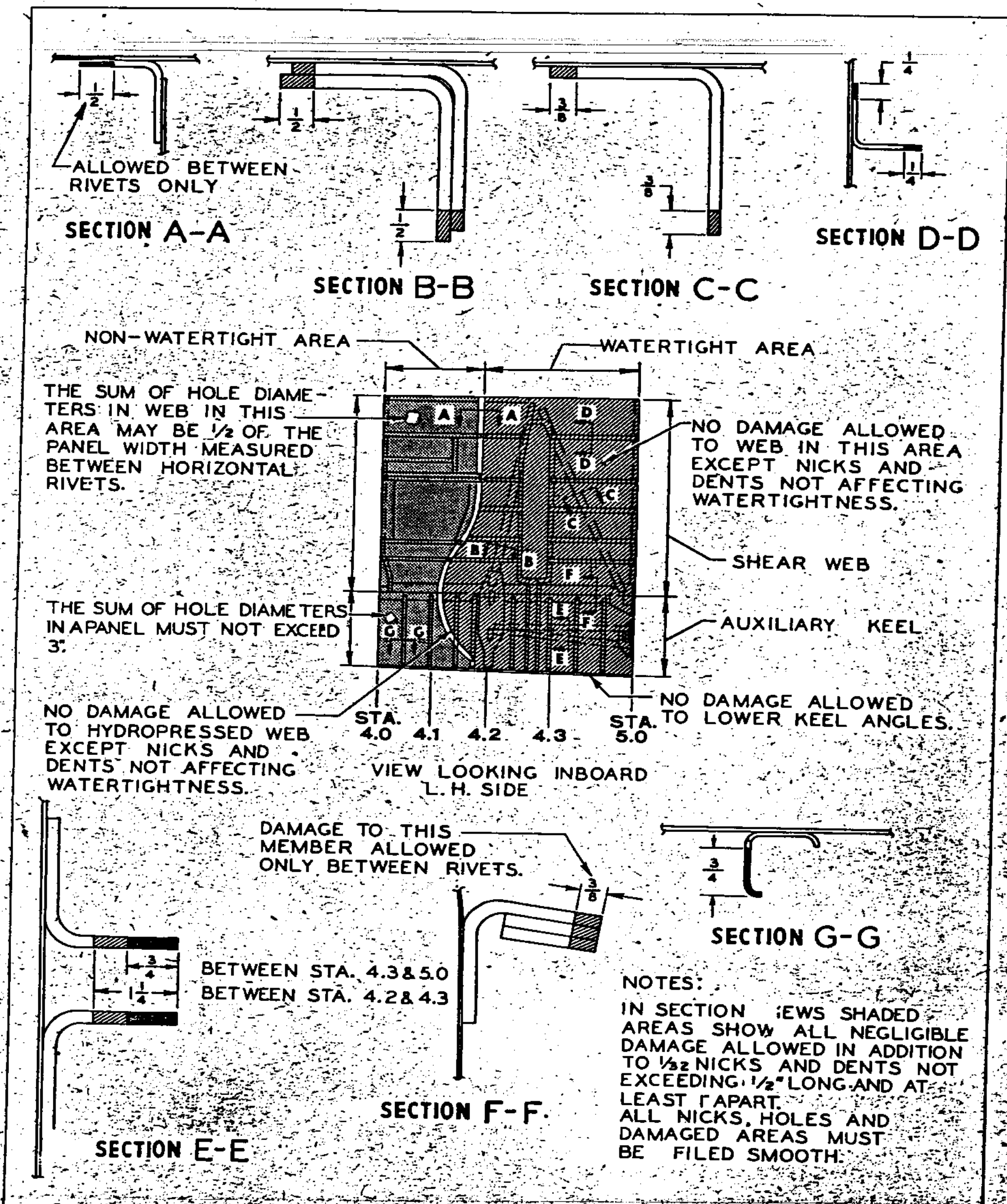


Figure 4-34—Main Wheel Well Enclosure-Negligible Damage

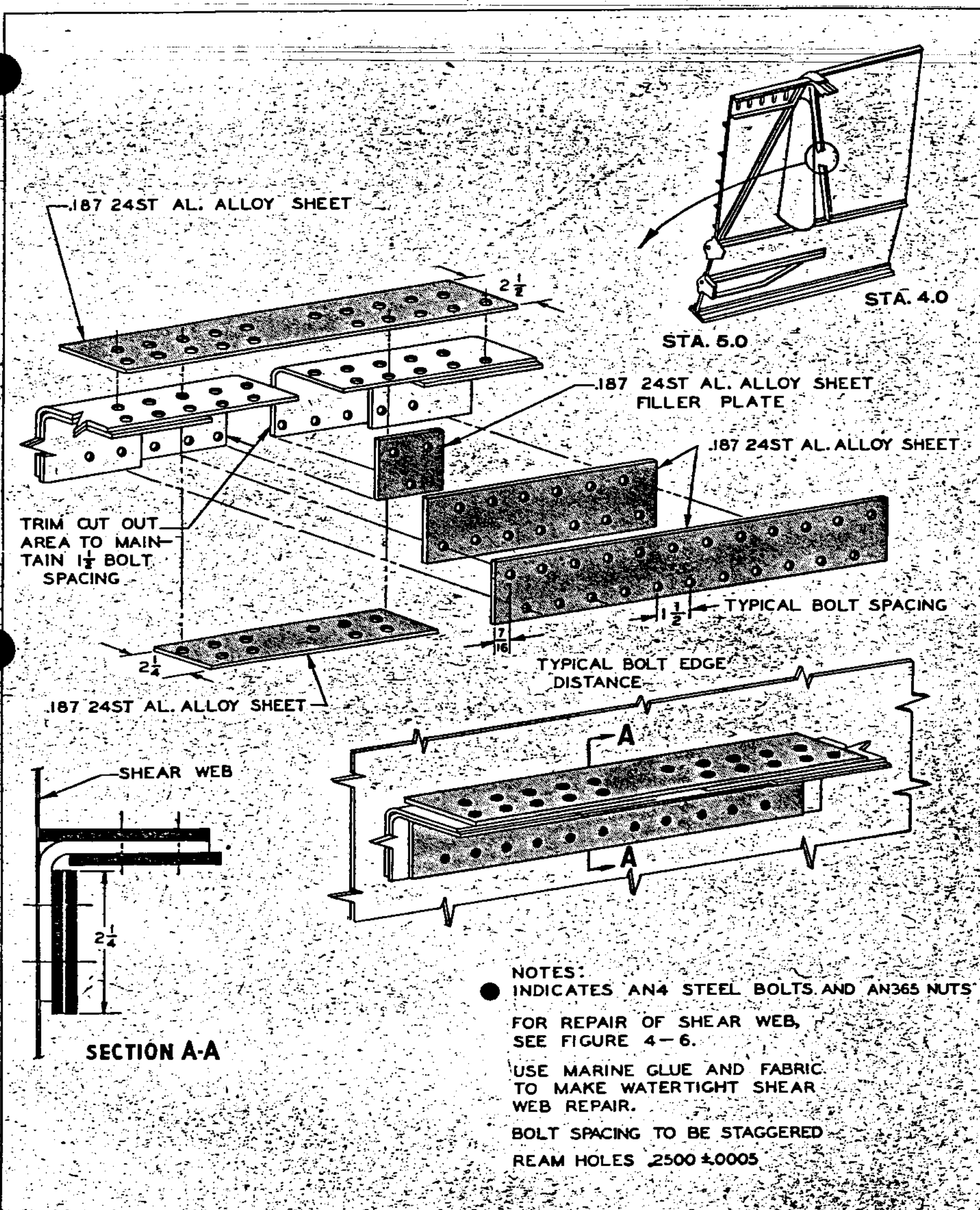


Figure 4-35 (Sheet 1 of 5 Sheets)—Main Wheel Well Enclosure Repair

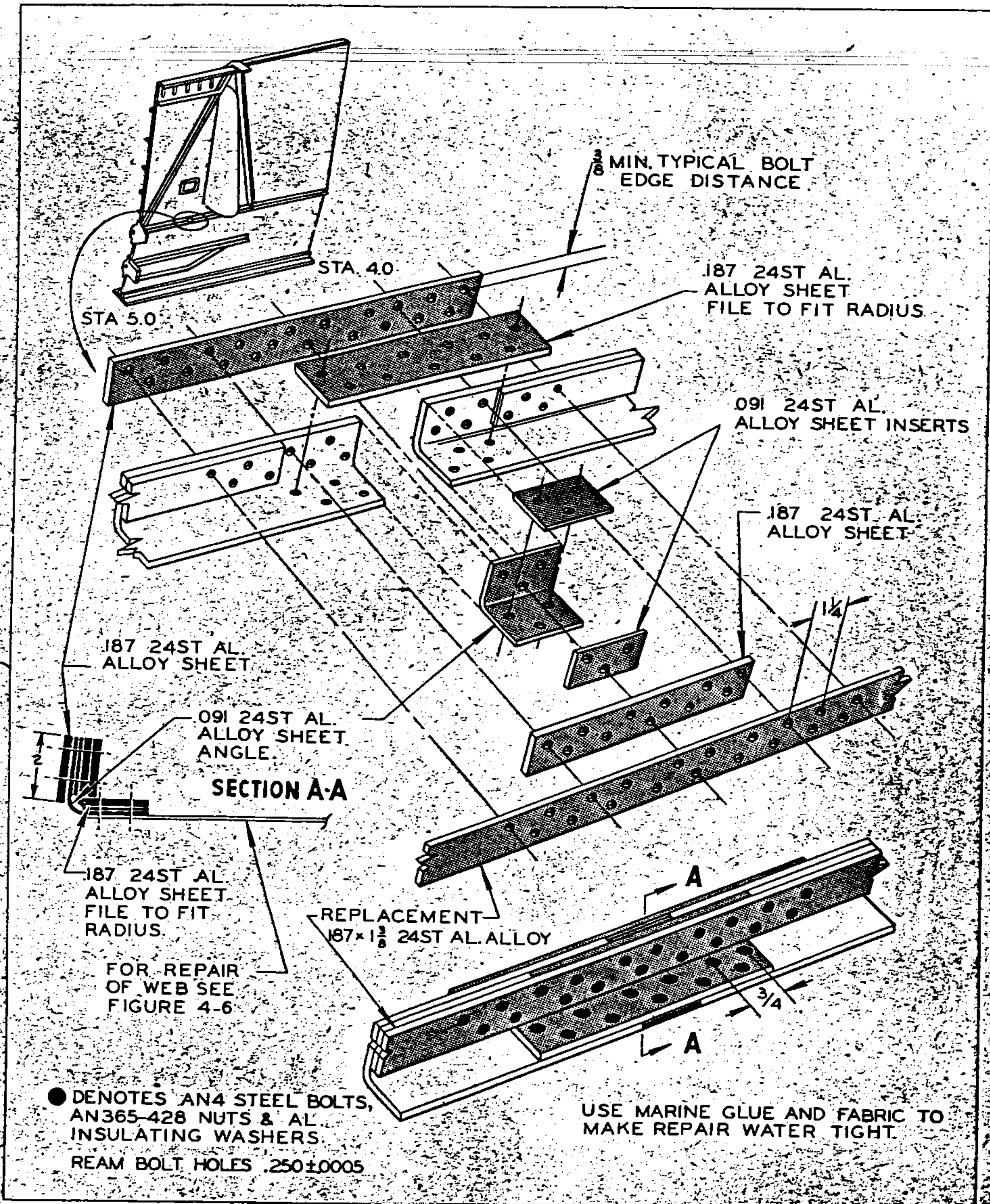
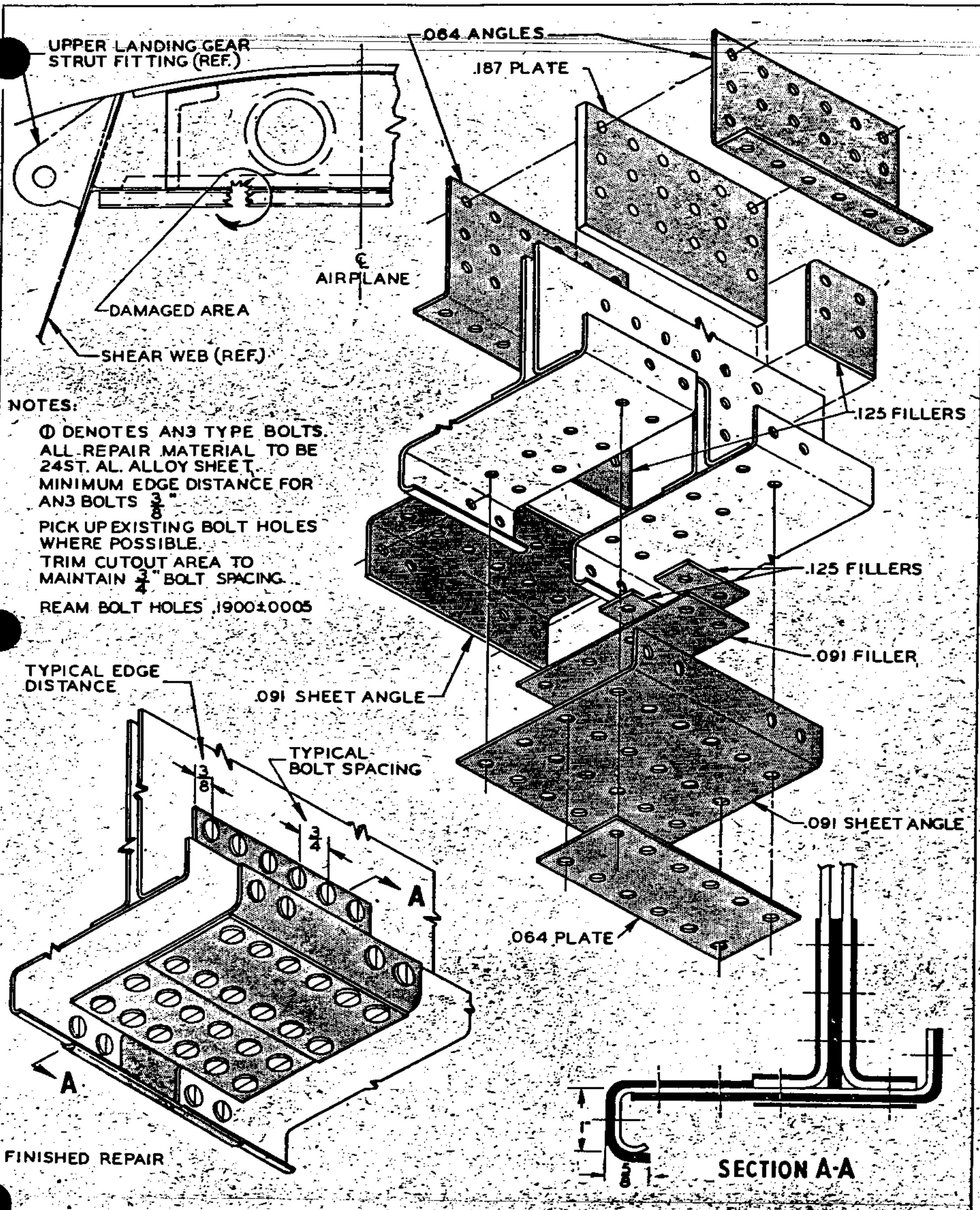


Figure 4-35 (Sheet 2 of 5 Sheets)—Main Wheel Well Enclosure Repair



NOTES:

① DENOTES AN3 TYPE BOLTS.
ALL REPAIR MATERIAL TO BE 24ST. AL. ALLOY SHEET.
MINIMUM EDGE DISTANCE FOR AN3 BOLTS 3/8"
PICK UP EXISTING BOLT HOLES WHERE POSSIBLE.
TRIM CUTOUT AREA TO MAINTAIN 3/4" BOLT SPACING.
REAM BOLT HOLES .1900±.0005

Figure 4-35 (Sheet 3 of 5 Sheets)—Main Wheel Well Enclosure Repair

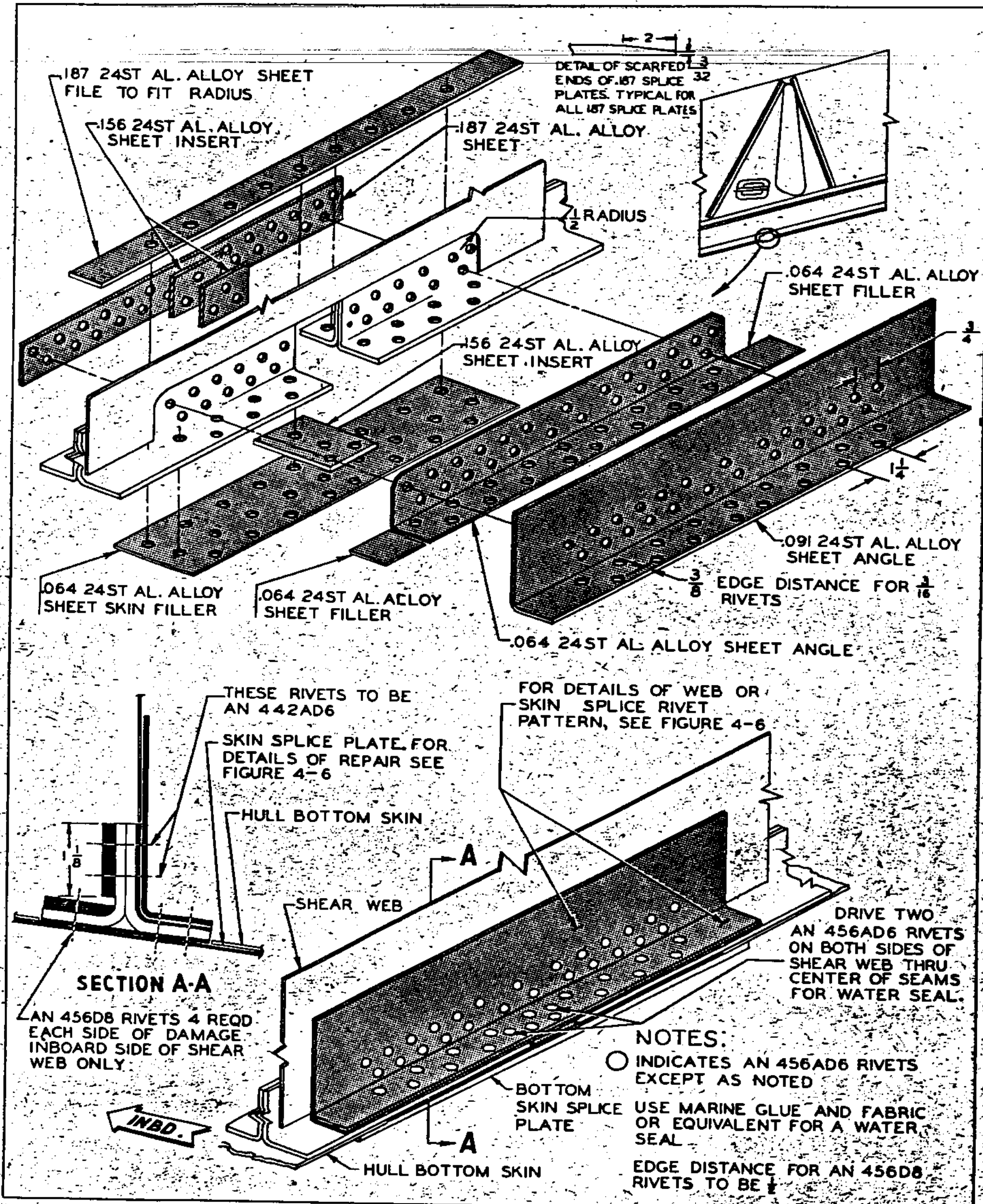


Figure 4-35 (Sheet 4 of 5 Sheets)—Main Wheel Well Enclosure Repair

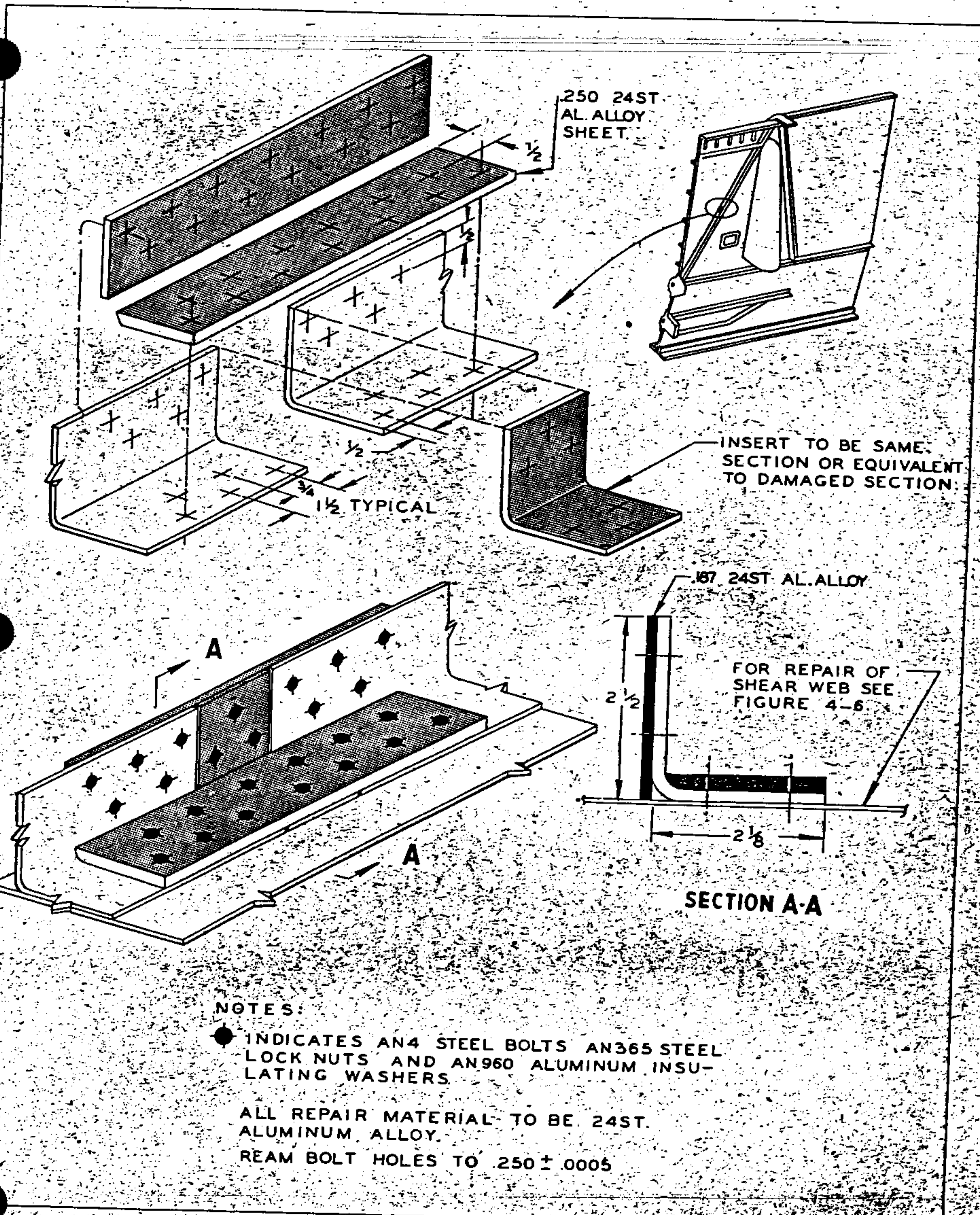
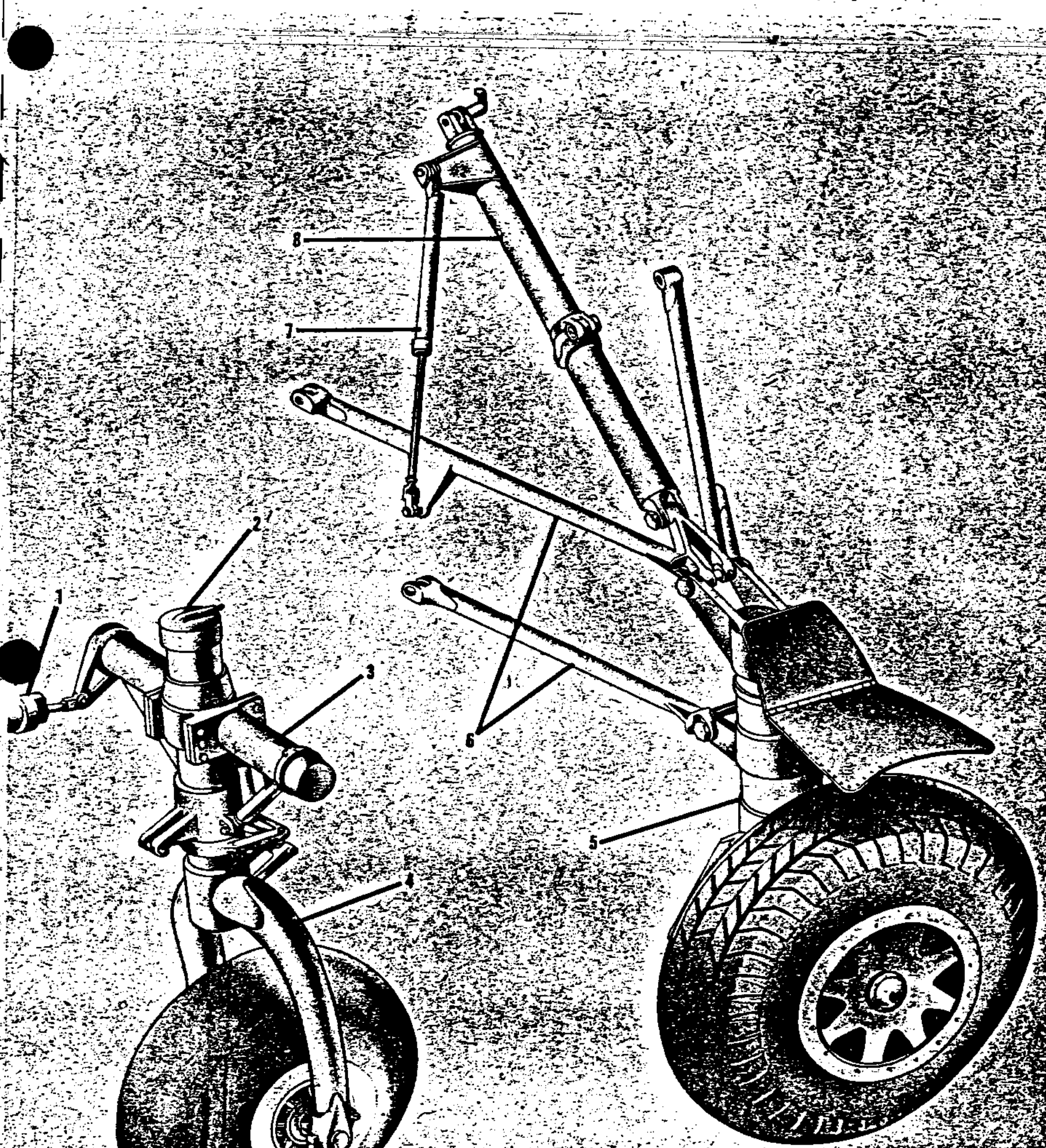


Figure 4-35 (Sheet 5 of 5 Sheets)—Main Wheel Well Enclosure Repair

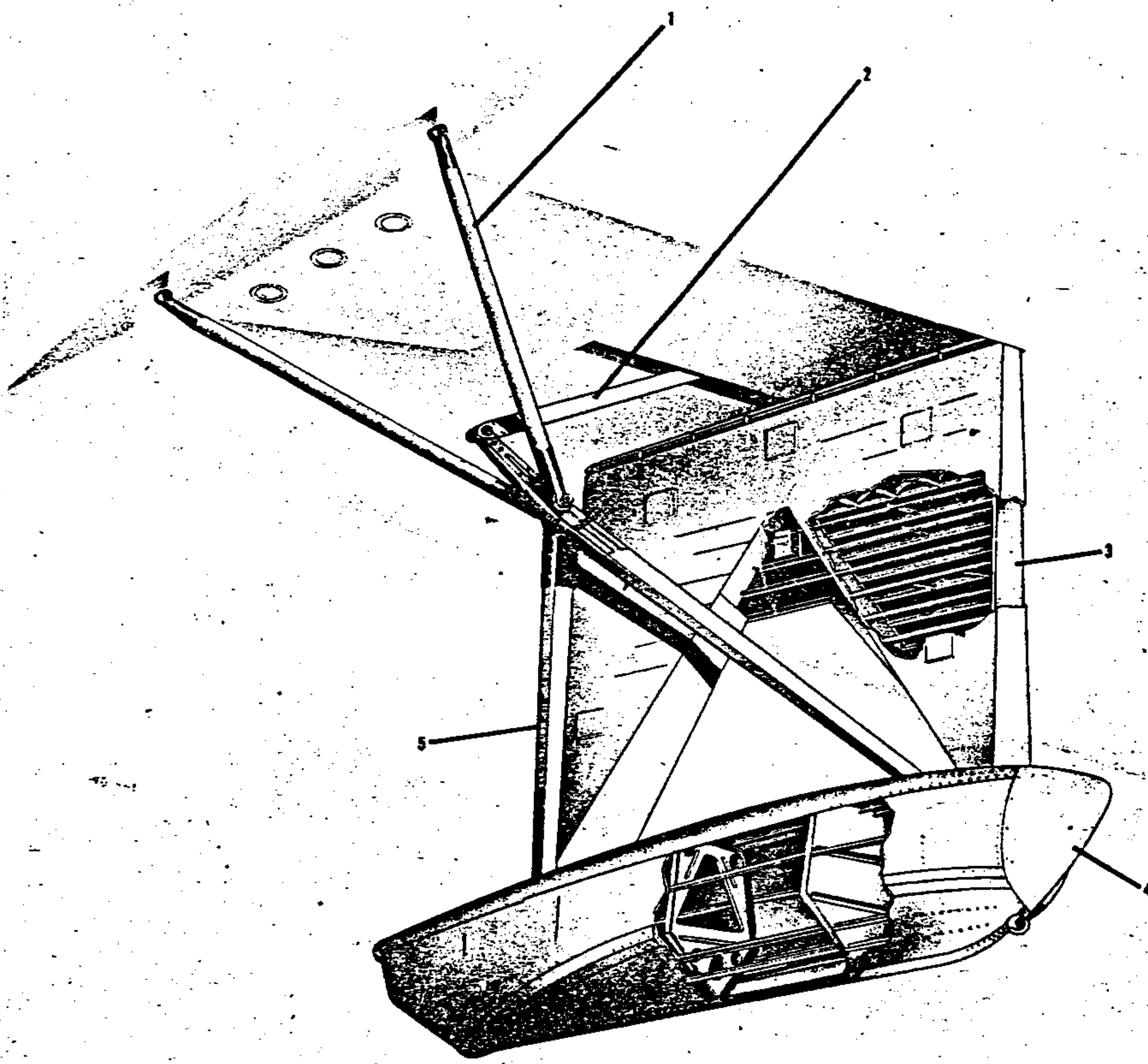
SECTION V

Alighting Gear



Index No.	Structure
1.	Actuating Cylinder
2.	Oleo Shock Strut
3.	Torque Tube & Strut Assem.
4.	Fork
5.	Oleo Shock Strut
6.	"Vee" Struts
7.	Actuating Cylinder
8.	Main Strut

Figure 5-1 (Sheet 1 of 2 Sheets)—Main Alighting Gear Components



Index No.	Structure	Figure No.
1.	Upper "Vee" Strut	5-7
2.	"U" Strut	5-7
3.	Drag Panel	5-5, 5-6
4.	Float	5-2, 5-3, 5-4
5.	Lower "Vee" Strut	5-8

Figure 5-1 (Sheet 2 of 2 Sheets)—Main Alighting Gear Components

SECTION V
ALIGHTING GEAR

5-1. GENERAL.

(See figure 5-1.)

5-2. The PBY-5A and PBY-6A airplanes are equipped with dual alighting gears. The stepped hull bottom and retractable wing tip floats provide a means for alighting on water, while the retractable tricycle type landing gear provides a means for making ground landings. The PBY-5 airplanes are not equipped for ground landings.

5-3. The wing tip floats are supported by the float drag panels and are extended and retracted by the float struts and their retracting mechanism. The float braces and drag panels retract into recesses in the under side of the ends of the wing, and the floats, when retracted, form the wing tips.

5-4. The main wheels and their retracting mechanisms are retracted into recesses in the hull's sides when the airplane is in flight, and during all water operations. The nose wheel and its retracting mechanism are retracted into the nose wheel enclosure when the airplane is in flight, and during all water operations.

5-5. MAIN LANDING GEAR.

5-6. GENERAL. Each main landing gear consists of a 47 inch 10-ply smooth contour tire, a Goodyear wheel and watertight brake assembly, a shock strut including oleo, scissors and axle, a hydraulic retracting mechanism, and a strut assembly.

5-7. The strut assembly consists of two pairs of chrome-moly "vee" struts forming a parallelogram linkage from the oleo to the hull fittings and a chrome-moly main strut from the oleo to the upper inner portion of the wheel well. The main strut is broken near its center so that it may fold inward during retraction.

5-8. NEGLIGIBLE DAMAGE. Smoothed out nicks and dents not exceeding 1/32 inch in depth and 3/8 inch in length and spaced at least 1¾ inches apart may be considered negligible in all members of the main landing gear. All nicks and dents must be smoothed out to eliminate sharp corners so that stress concentrations will not be built up.

5-9. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Because of the high loads imposed on the landing gear assemblies during take-off and landing, and the consequent necessity of keeping all units in perfect working order, no repairs can safely be made anywhere in the landing gear system. Instead, all damaged parts, with the exception of those whose injuries are defined as negligible, shall be replaced.

5-10. Damage to the primary structure of the landing gear necessitates close inspection of the supporting structure for secondary damage. Periodic inspection shall be made also for slight defects in struts, fittings, bolts and especially welded joints. Any small weakness may easily become aggravated to the point of endangering the operation of the system. To avoid this hazard, all faulty parts must be replaced as soon as it has been determined that the damage cannot be classed as negligible.

5-11. Scratches of any kind on the machined strut are not negligible and should be carefully polished, first with a fine emery cloth and then with crocus cloth. If there are deep scratches with burrs, the burrs should be removed with a fine mill file and the scratches should be polished.

5-12. NOSE LANDING GEAR.

5-13. GENERAL. The nose landing gear consists of a single 30 inch, 8-ply smooth contour tail wheel type tire, wheel and axle, a shock strut, a fork extending from the axle to the shock strut, a shimmy damper, a hydraulic retracting mechanism, and a strut asembly.

5-14. The strut assembly consists of a pair of chrome-moly cross tubes bolted to the top of the oleo strut. The outer ends of the cross tube fit into pivot bearings installed on the double keels. The lower end of the oleo strut is braced by two diagonal chrome-moly struts whose upper ends attach to the outer ends of the cross tubes. The cross tubes serve as the axis of rotation when the nose wheel is retracted or extended.

5-15. NEGLIGIBLE DAMAGE. The only negligible damage that may be allowed to the members of the nose landing gear are as follows:

The torque tube may have smoothed out nicks and dents not exceeding 1/16 inch in depth provided damage is at least three inches from oleo strut attaching fitting. There is no restriction on the number or length of these nicks and dents but no other type of damage permitted.

The diagonal struts may have smoothed out nicks and dents not exceeding 1/32 inch in depth with no restriction on their length.

5-16. Smoothed out nicks and dents not exceeding 1/16 inch in depth and 3/8 inch in length and spaced at least one inch apart may be considered negligible in the nose wheel fork. No other damage is considered negligible.

5-17. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Refer to paragraph 5-9 above.

5-18. FLOATS.

5-19. GENERAL. Each float structure is of a stressed skin, all metal aluminum alloy construction, consisting of six transverse frames and bulkheads, and longitudinal stringers. Each float contains three watertight

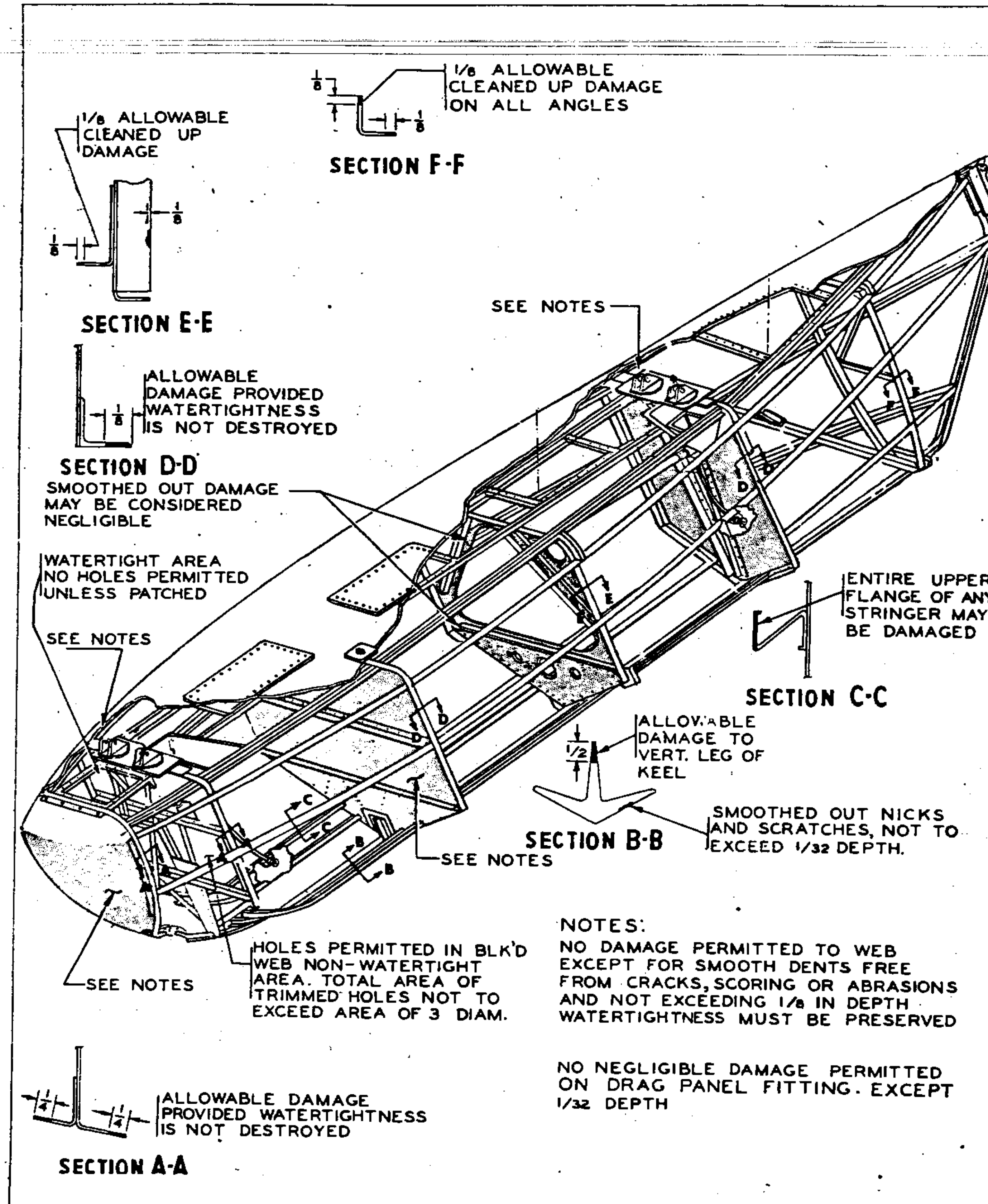


Figure 5-2—Float-Negligible Damage

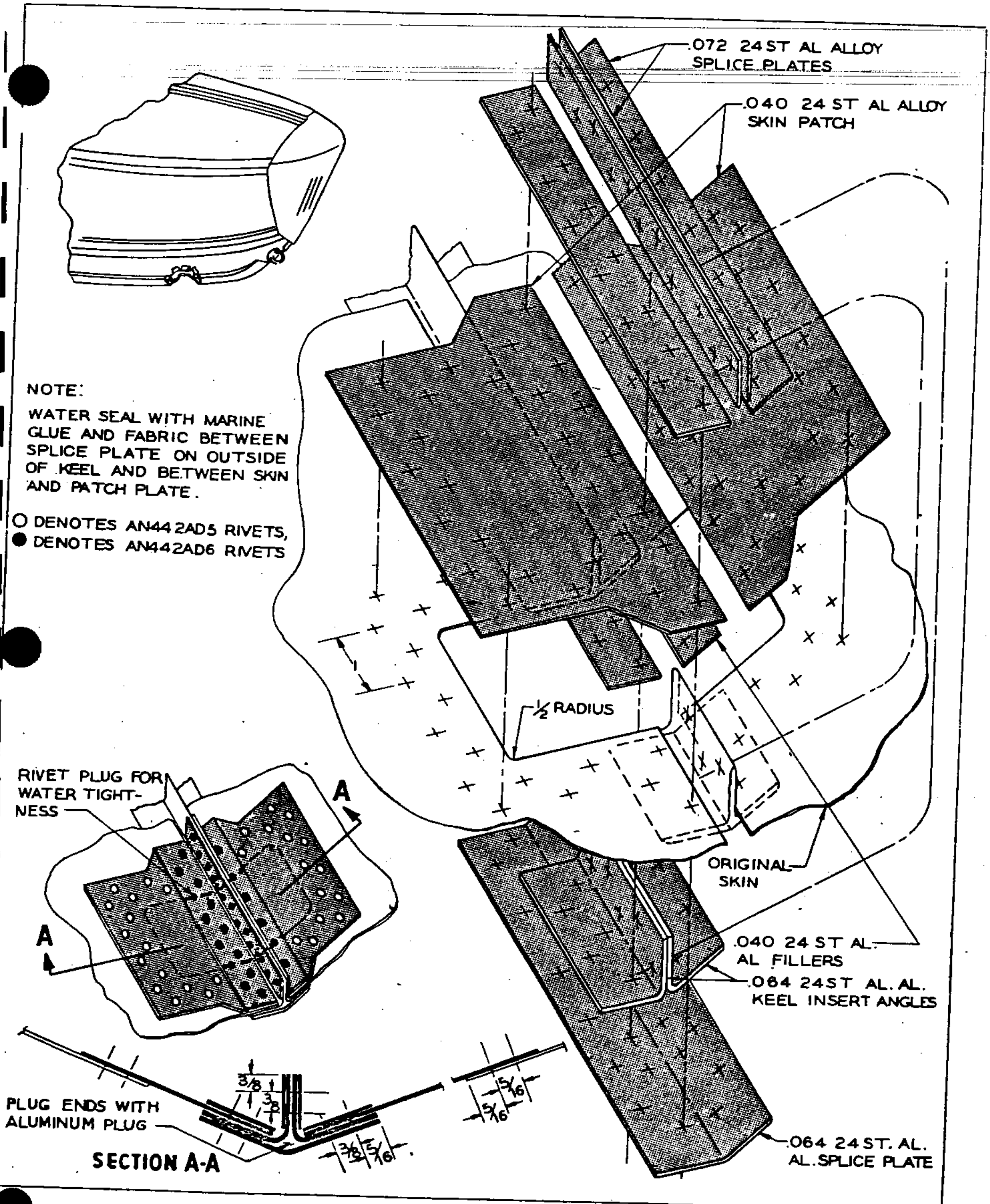


Figure 5-3—Float Keel Repair

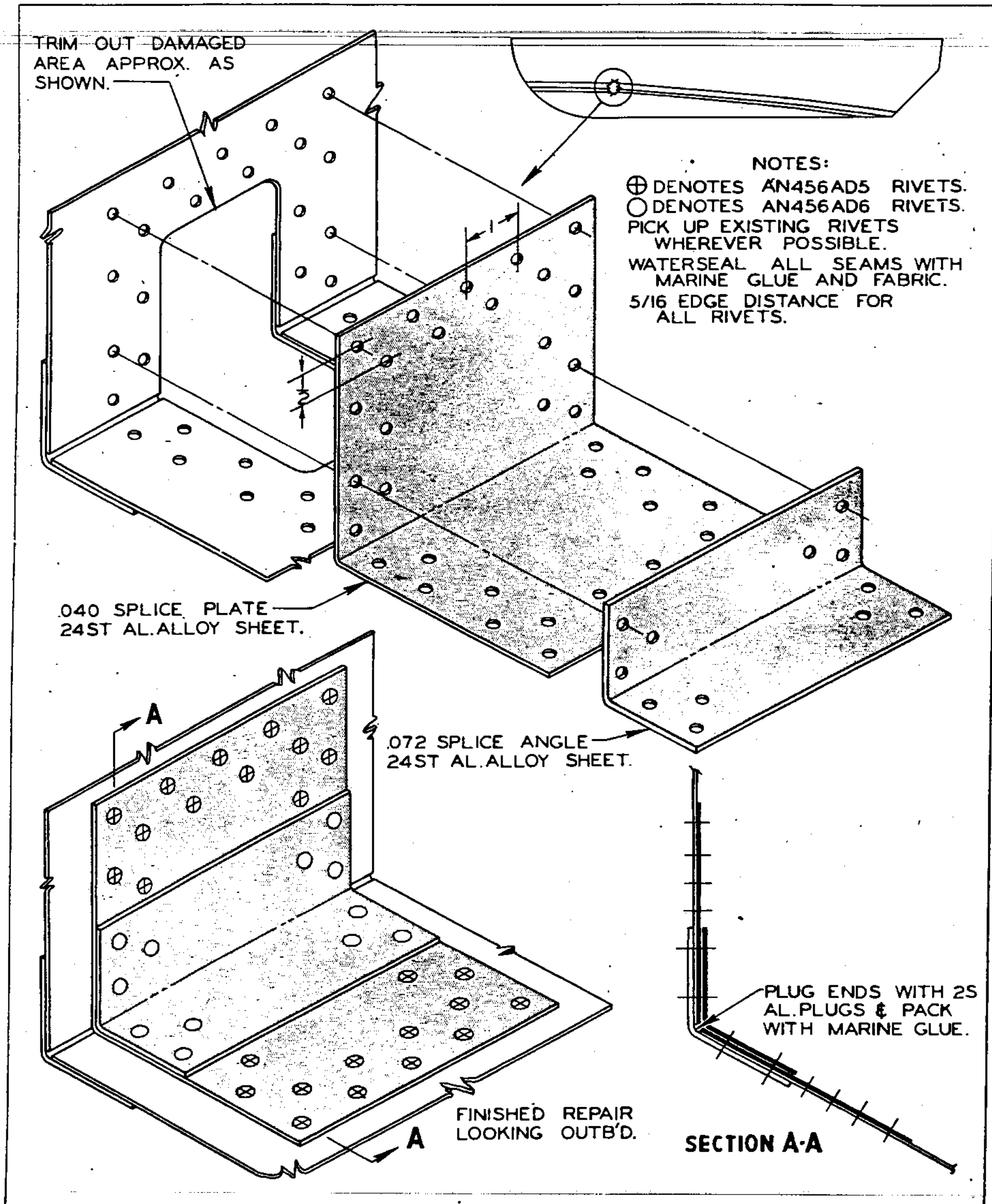


Figure 5-4—Float Chine Repair

compartments, which are vented by tubing into the drag panel. The vent lines should be kept unobstructed at all times to prevent possible rupturing of the float skin due to difference of pressure within the float and the atmosphere at high altitude.

5-20. To give access to the interior of the float for periodic inspection or repair, five doors are provided on the upper surfaces of the float. These doors are a structural part of the float and must be securely fastened to the deck with screws to prevent possible buckling of the float skin and leakage of water into the watertight compartments of the float.

5-21. NEGLIGIBLE DAMAGE. Dents in the float plating, located at least two inches from structural members such as stringers, frames or bulkheads, need not be repaired if they are free from sharply defined edges, scoring or abrasions. A smooth dent not exceeding a depth of ⅜ inches, and extending over an area not including a structural member would be regarded as negligible. Under no circumstances can plating damage which results in injury to stringers, be considered negligible. For negligible damage to bulkheads, beltframes, stringers and other structural members refer to figure 5-2.

5-22. DAMAGE REPAIRABLE BY PATCHING AND INSERTION. Repairs accomplished by patching restore strength or water tightness or both to a member when the damage is not extensive enough to warrant inserting a filler or replacing with a new member. An insertion repair is necessary when the original member has been cut through to remove the damage and consists of a matching section, inserted to fill the gap and secured in place by splice plates or angles.

5-23. Cracks, scores and dents in the float plating may be repaired by patching, provided the damaged area can be restored to shape or cut away and effectively repaired. The distorted plating must first be restored to shape using a mallet and wooden backing block. It is imperative that after this operation the structure in the vicinity be examined since straightening may have caused cracks to develop or rivets to be strained.

5-24. Cracks should have a ⅛ inch diameter hole drilled at each extremity to prevent further extension. The patch plate must be prepared from material of the same gage, or the next heavier gage, and specification as the plate being repaired. Where possible, the repair patch plate should be fitted on the outside of the hull, especially when the plating is badly cracked, since this will minimize possible corrosion. To insure water tightness use marine glue and fabric, zinc chromate tape, or 1/64 synthetic rubber sheet between the patch plate and float plating before riveting. See figure 4-6 for typical repair. For typical stringer repair refer to figure 4-9.

5-25. A damaged keel can be repaired by cutting out the damaged portion and inserting a new piece of the same size, gage and specification as the damaged part. If a keel extrusion is not available for insertion an equivalent bent up section as shown in Section VIII may be substituted. Refer to figure 5-3 for typical keel repair.

5-26. A damaged chine angle or plate can be repaired by cutting out the damaged portion and splicing across with a piece of the same size, gage and specification as the chine angle. The next heavier gage may be used but under no circumstances should a lighter gage be used. The adjacent shell plating should be restored to shape and any damage to stringers, frames and bulkheads must be repaired. The existing rivet holes in the plates can be used; distorted rivet holes may be drilled out for the next larger size rivet. In order to insure water tightness, insertion pieces, butt-straps and plating must be separated by marine glue and fabric, zinc chromate tape, or 1/64 synthetic rubber sheet before riveting. A typical chine repair is shown in figure 5-4.

5-27. DAMAGE REPAIRABLE BY REPLACEMENT. Damage to certain short sections of structure or parts such as drag panel attaching fittings or strut fittings whose shape makes them difficult to repair will necessitate their replacement. It is more economical to replace members in cases where the total amount of time and material used to repair the member is equal or greater than the amount used to replace the member.

5-28. DRAG PANEL.

5-29. GENERAL. The drag panel is the main load carrying structural member of the float bracing structure. It is of aluminum alloy construction and is designed to carry the drag and vertical loads imposed upon it by the float. The two vertical and four diagonal channel shaped beams are the main load carrying members and are stiffened and tied together by means of transverse and vertical ribs and the panel skin. The lower 2/3 of the drag panel must be kept water tight at all times as it is constantly submitted to water spray during all water operations of the airplane.

5-30. NEGLIGIBLE DAMAGE. (See figure 5-5.) Holes in the skin or in the main structural channels of the drag panel which are classified as negligible must fall between ribs and stiffeners. If the damage extends across the internal structure it must be repaired.

5-31. Cracks in the shaded portion of the drag panel skin which do not exceed eight inches in length and have been stop drilled and which fall between ribs and stiffeners may be considered negligible.

5-32. All cracks and holes in the watertight portion of the drag panel which may be considered negligible should be temporarily patched with a doped fabric patch in order to prevent corrosion when subjected to water spray. The portion of the drag panel which lies below the upper skin splice is watertight.

5-33. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. (See figure 5-6.) Repair to the main structural beams of the float drag panel may be made by inserting a channel shaped splice across the damaged area, over-lapping the damaged

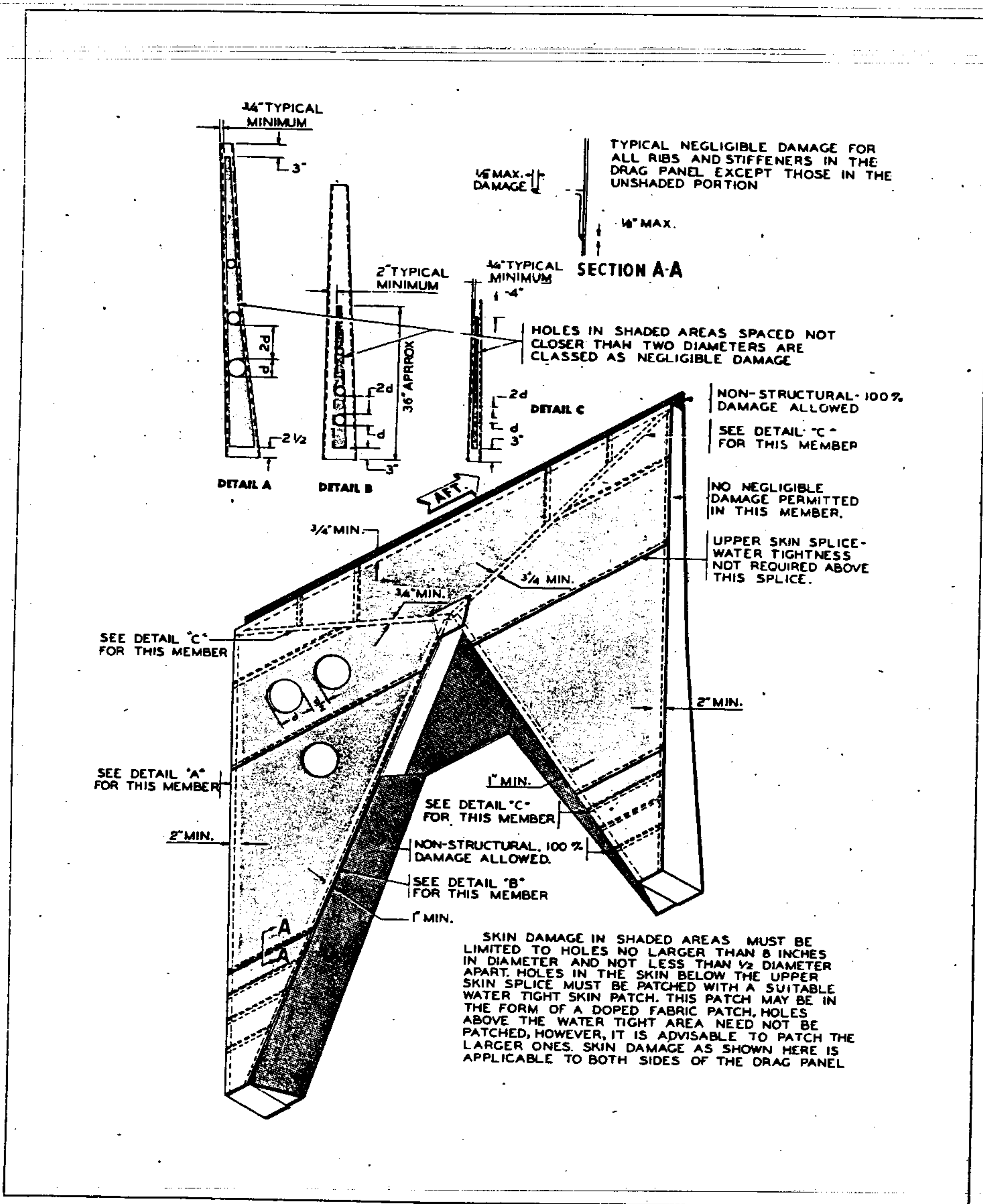


Figure 5-5—Float Drag Panel-Negligible Damage

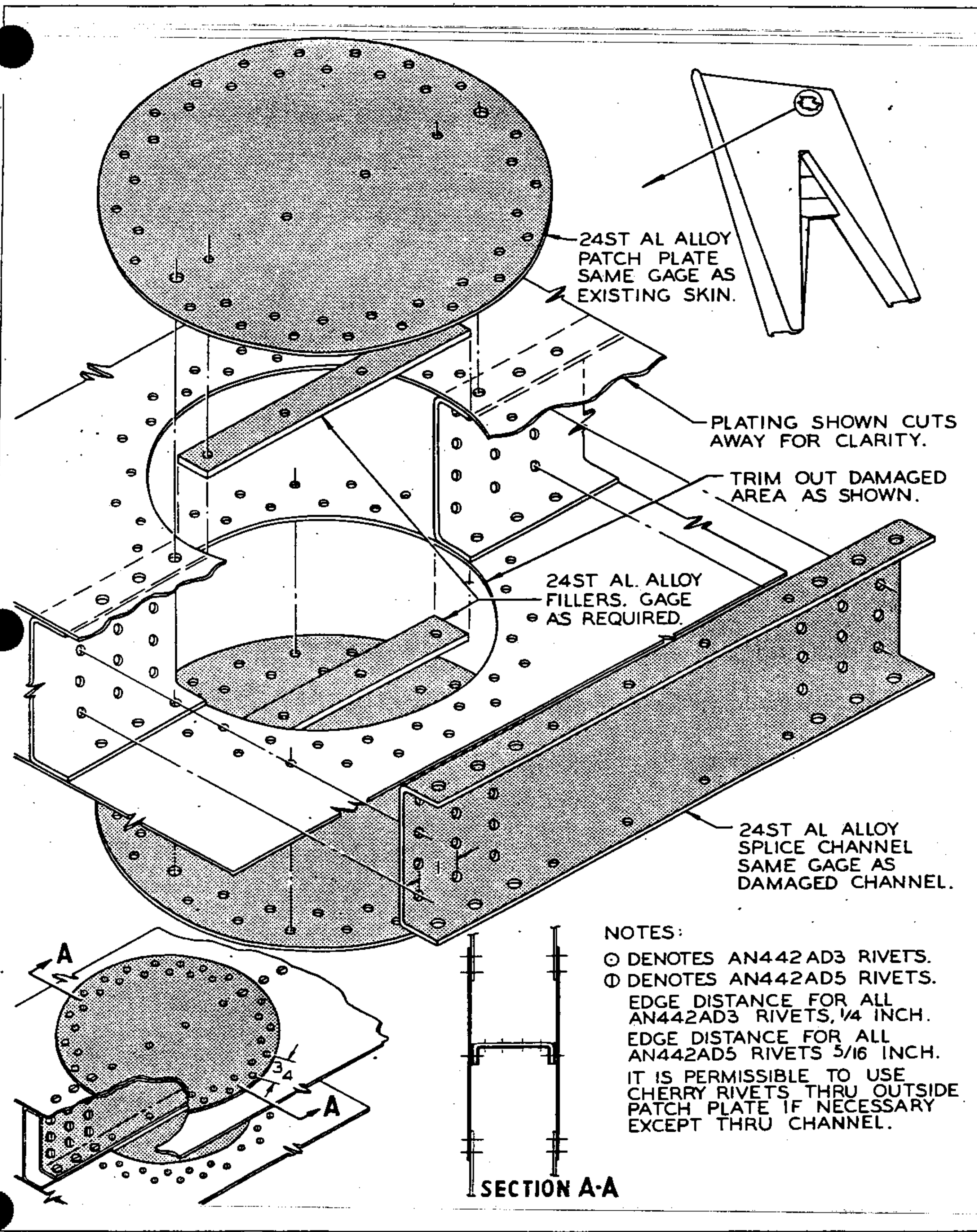
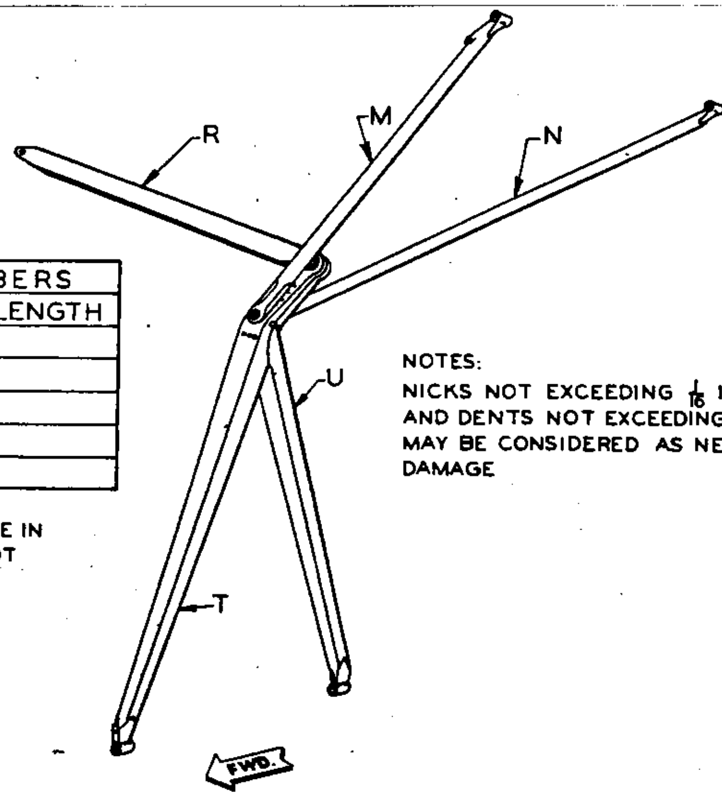


Figure 5-6—Float Drag Panel Repair



ALLOWABLE BOWING OF MEMBERS	
MEMBER	MAX. BOW IN TOTAL LENGTH
T	3/4"
U	3/8"
M	1/16"
N	1/2"
R	0"

THE BOWING OF THESE MEMBERS MAY BE IN ANY DIRECTION AS LONG AS IT DOES NOT INTERFERE WITH THE LOWERING AND RAISING OF THE FLOATS

NOTES:
NICKS NOT EXCEEDING 1/16 IN DEPTH AND DENTS NOT EXCEEDING 1/16 IN DEPTH MAY BE CONSIDERED AS NEGLIGIBLE DAMAGE

Figure 5-7—Float Struts-Negligible Damage

beam far enough to pick up a minimum of three rivets. The splice channel may be bent up from the next heavier gage aluminum alloy sheet.

5-34. The skin patch over the damaged area may be made from the same gage sheet as the original skin. In the watertight area of the drag panel (that portion below the upper skin splice) place marine glue and fabric, zinc chromate tape, or 1/64 synthetic rubber sheet between the original skin and the patch in order to preserve the watertightness.

5-35. Damage to certain short members such as the rib angles and parts such as the wing fittings and the float fittings whose shape makes them difficult to repair will necessitate their replacement.

5-36. STRUTS.

5-37. GENERAL. The float retraction and extension mechanism linkage consists of the upper and lower "vee" struts and the "U" strut. The upper and lower "vee" struts are of welded chrome-moly steel construction and the "U" strut is an aluminum alloy extrusion with fittings attached at its ends. The struts not only serve as the mechanical linkage but also carry some of the drag and vertical float loads.

5-38. NEGLIGIBLE DAMAGE. (See figure 5-7.) Negligible damage to the float struts may take the form of nicks a maximum of 1/32 inch deep and dents a maximum of 1/16 inch in depth.

5-39. Minor bowing of the struts may be considered negligible if it falls within the following limits: member T, ¾ inch, member U, ⅜ inch, member M, 1/16 inch, member N, ½ inch, and member R, no bowing permitted. The bowing in these members may be in any direction as long as it does not interfere with the retraction and extension of the floats. No other damage to the float struts may be considered negligible other than that listed above.

5-40. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. (See figure 5-8.) Damage to the upper and lower "vee" struts may be repaired in the following manner provided the damaged area is not closer than five inches to a fitting:

Clean up damaged area and stop drill the extremities of any cracks with a ⅛ inch diameter drill.

Form a patch to the shape of the member to be repaired. Patch must be scarfed on a 30 degree angle and the closest edge of the scarf to the damaged area must

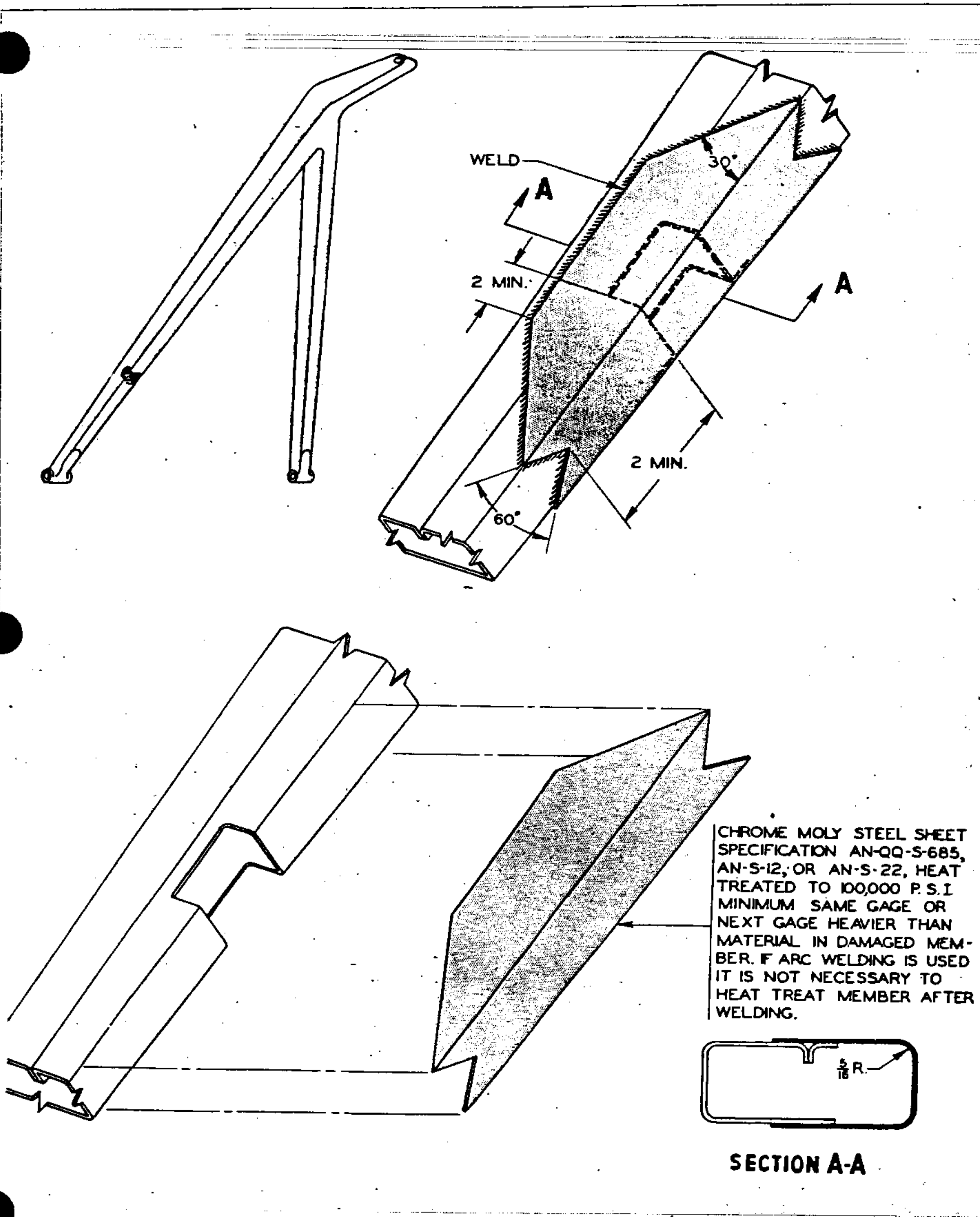


Figure 5-8—"Vee" Strut Repair-Float

not be less than two inches. Gage of the patch material must be the same gage at the damaged member or the next heavier gage.

Pack wet asbestos around the tube as close to the patch as possible in order to keep the member from warping during the welding process.

Arc weld the patch in place.

5-41. Using the above method of repairing the struts eliminates the necessity of heat treating the struts after welding.

5-42. Since the "U" strut is the main member of the float retracting and extending mechanism and because of its shape it is advisable to replace it whenever it has been damaged.

★ ★ ★

SECTION VI

Engine Group

SECTION VI
ENGINE SECTION

6-1. GENERAL.

(See figure 6-1.)

6-2. Each nacelle consists of four sections: an engine cowling section, a nacelle cowling section, oil tank section, and an oil tank support section. The engine cowling section is made up of the nose cowl, the wrap cowl, the cowl flaps and the engine cowl former ring which supports the cowl flaps. The nacelle cowl section is made up of a short wrap cowl and two cowl panels, and forms the fairing for the engine accessory bay which contains the engine mount. The oil tank section consists of the oil tank and four cowl panels which complete the fairing between the top of the tank and the wing and the bottom of the tank and the wing. The oil tank support structure forms the aft part of the nacelle and carries the engine loads to the wing. This portion of the nacelle is discussed under Section II, Wing.

6-3. OIL TANK.

6-4. GENERAL. The oil tank assembly is a structural part of the nacelle to which the tubular engine mount is attached. The top and bottom of the tank is formed to the contour of the nacelle proper. The forward face of the tank and the side cowl formers constitute the firewall.

6-5. The tank structure consists of pressed sheet baffles supported by extruded angle stiffeners to which the flat sheet side walls are attached. Fittings are provided at each corner of the forward face for the attachment of the engine mount. Extruded angles are riveted to the aft sides of the tank for attachment of the tank to the wing nacelle structure. Flanges are also provided at the top and bottom contoured portions of the tank for attachment to the wing nacelle fairing.

Note

The power plant must be removed from the oil tank before any repairs are made to the tank.

6-6. NEGLIGIBLE DAMAGE. (See figure 6-2.) No damage is permitted the rear side flanges which fasten the oil tank to the nacelle structure on the wing. No damage is permitted to the oil tank sheet except smooth dents not more than 1/16 inch deep provided there is no indication of cracking.

6-7. The outer legs of the longerons (triangular shaped members at the outer corners of the tank which extend from the front to the rear of the tank and enclose the engine mount fittings at their forward end) may be damaged as much as two inches deep providing there is no damage to the engine mount fitting or reinforcing plate. The depth of the damage is measured after trimming the damaged area to smooth the edges.

6-8. Cracks, nicks or gouges up to 1/4 inch in length are permitted around the beaded lightening holes and in the lower flange of the bottom beams. Cracks must be stop drilled and nicks and gouges must be smoothed out. No damage is permitted to the upper flange of the beam.

6-9. Holes up to two inches in diameter may be permitted to exist in the web of the internal stiffeners provided there is at least 1/2 inch of metal between the holes and the edge of the stiffener and the holes are at least one diameter apart. Cracks, nicks or gouges 1/4 inch long are permitted in the flanges of the stiffeners and in the legs of the angle and zee stiffeners. All cracks must be stop drilled and nicks and gouges must be smoothed out.

6-10. The front flange of the oil tank proper may be damaged not to exceed a depth of 3/4 inch. Cracks, nicks or gouges must be stop drilled, routed or smoothed out.

6-11. Damage up to 3/4 inch deep is permitted in the top and bottom rear flanges provided not more than half the screw holes are damaged and there are no more than two adjacent screw holes in any one group damaged. Cracks must be stop drilled and nicks and gouges must be smoothed out.

Note

All holes in the fire wall must be repaired, regardless of size, to retain the fireproofing function of the part.

6-12. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Repairs accomplished by patching restore strength to a member when the damage is not extensive enough to warrant inserting a filler or replacing with a new member. An insertion repair is necessary when the original member has been cut through to remove the damage and consists of a matching section, inserted to fill the gap, secured in place by splice plates or angles. Repairs to the oil tank accomplished by patching or insertion are described by means of figures 6-3, 6-4, 6-5 and 6-6.

6-13. Since access to the inner structure of the oil tank is rather limited, a careful investigation of the damage should be made in order to ascertain whether or not the damage may be classified as negligible. Refer to the preceding paragraph for types of negligible damage.

6-14. The fire wall webbing, which is attached to the forward edges of the oil tank, may be patched as shown in figure 4-6 except that no water seal is necessary.

6-15. DAMAGE REPAIRABLE BY REPLACEMENT. Damage to certain short sections of structure or parts such as engine mount fittings, wing to tank attaching angles or any of the tank castings whose shape make them difficult to repair will necessitate their replace-

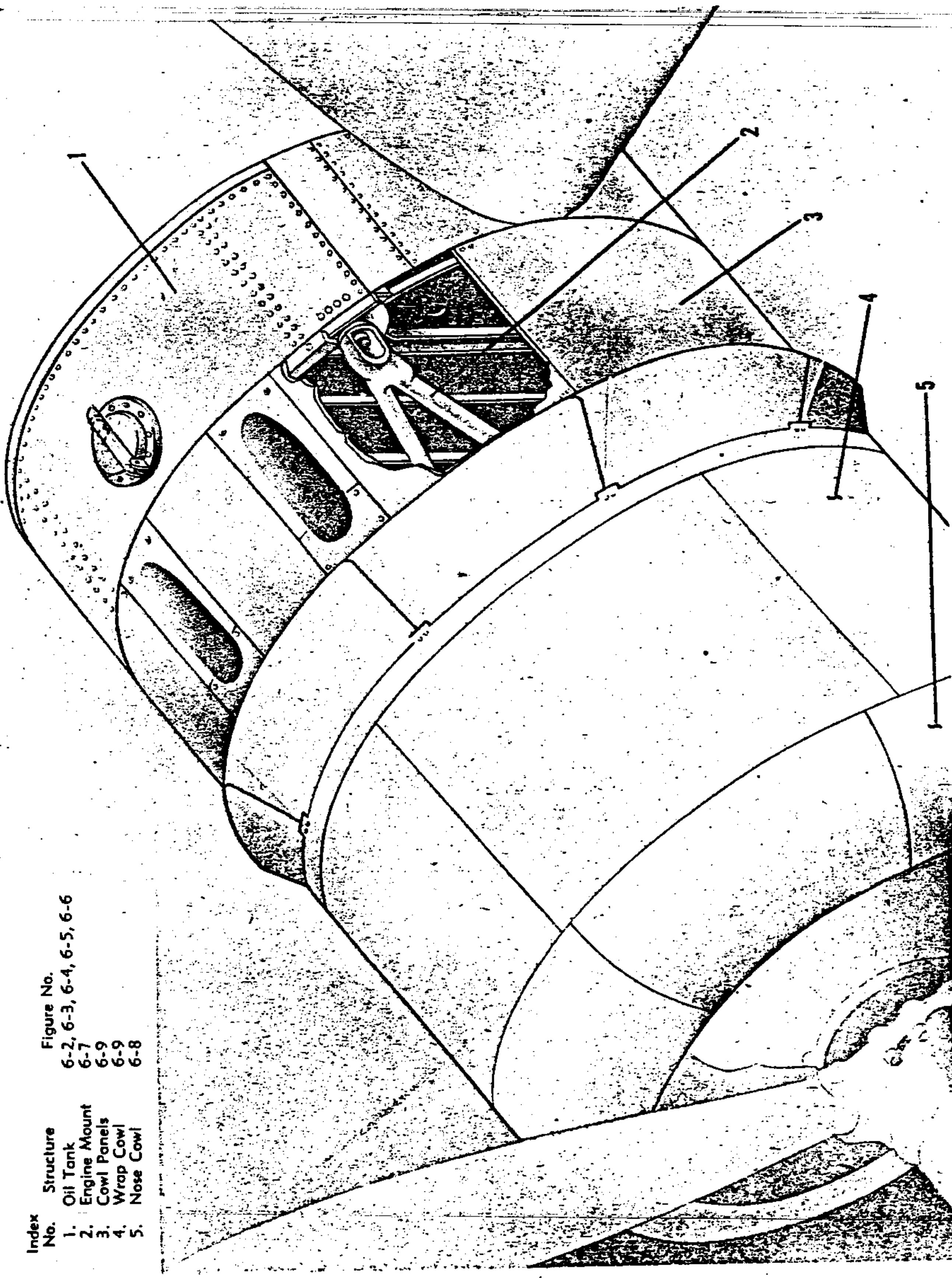


Figure 6-1—Engine Section Components

Index No.	Structure	Figure No.
1.	Oil Tank	6-2, 6-3, 6-4, 6-5, 6-6
2.	Engine Mount	6-7
3.	Cowl Panels	6-9
4.	Wrap Cowl	6-9
5.	Nose Cowl	6-8

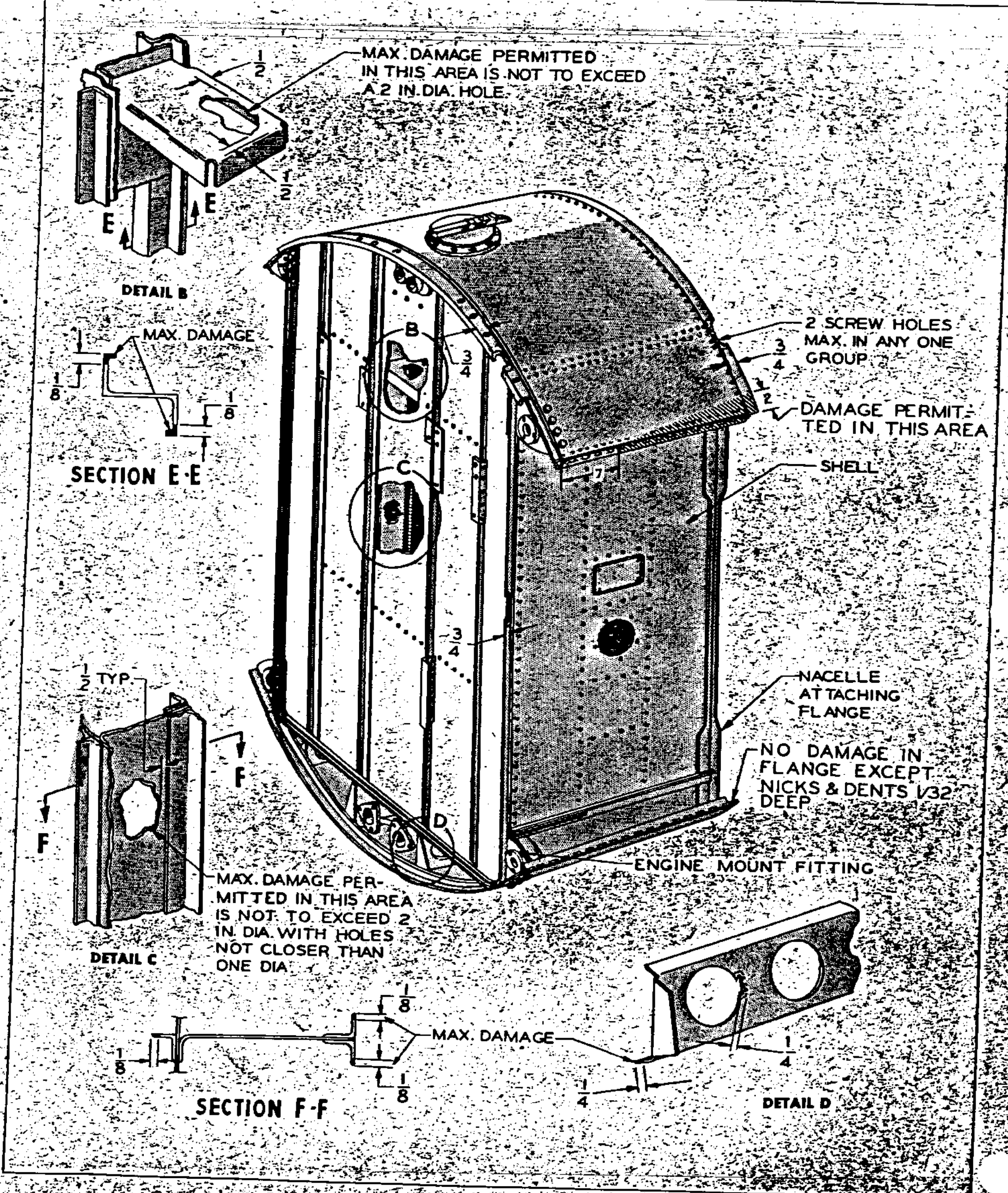


Figure 6-2—Oil Tank-Negligible Damage

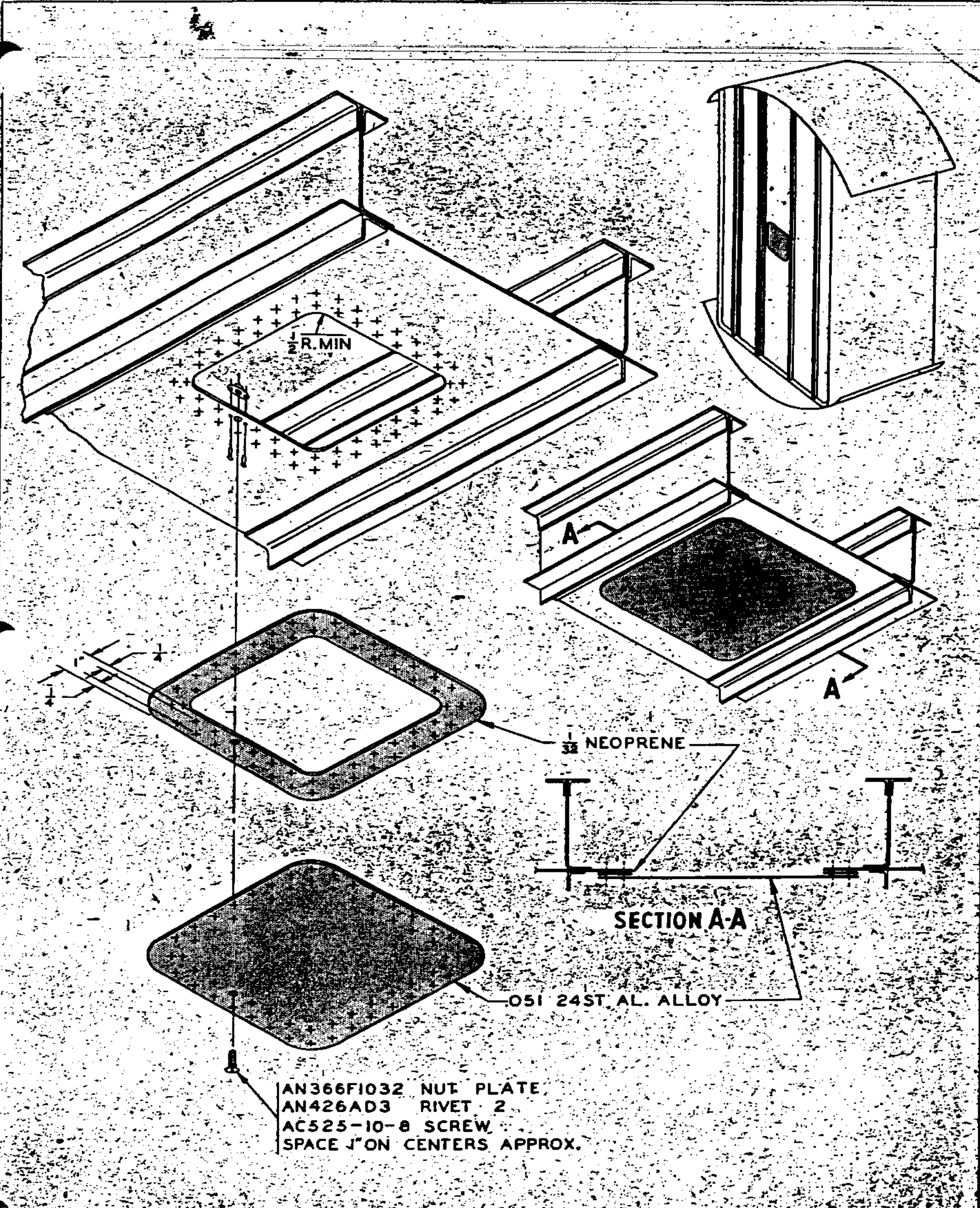


Figure 6-3—Typical Access Door-Oil Tank

ment. It is more economical to replace members in cases where the total amount of time and material used to repair the member is equal to or greater than the amount used to replace the member.

6-16. ENGINE MOUNT.

6-17. GENERAL. The engine mount is a welded chrome-moly tubular steel structure made of triangular elements which provide four points of support at the firewall end and carry the engine support ring at the forward end. There are eight lugs welded to the engine mounting ring which hold the engine mounting bolts. The junction of the tubes are reinforced with welded steel gussets.

6-18. NEGLIGIBLE DAMAGE. Some forms of damage to the engine mount may be considered negligible. Such damage may take the form of slight indentations, scratches, or minor bowing. In the following discussion, refer to figure 6-7 for identification of the various engine mount members and the amount of damage allowed each.

6-19. Smoothed out nicks 1/32 inch in depth and ¼ inch in length and dents not over 1/16 inch in depth are permissible in all members of the engine mount provided they are not less than two inches apart.

6-20. Smoothed out damage through the side of tubes FB and AB up to ¼ inch in diameter is permissible provided the damage is not located in the middle 1/3 of the tube and the holes are not less than two inches apart. The holes must be sealed to prevent entry of moisture to the inside of the tube.

6-21. The maximum amount of bow each member of the engine mount may possess in 18 inches of length is as follows: Member AB, ⅛ inch; member FB, 3/16 inch; member AC, 1/16 inch; member EC, 1/16 inch.

6-22. The amount and types of negligible damage permitted the nacelle fittings and the engine fittings is shown on figure 6-7.

6-23. No damage other than that listed above is permitted the engine mount. Welded seams must be inspected closely whenever a tube has been bent.

6-24. DAMAGE REPAIRABLE BY PATCHING, INSERTION OR REPLACEMENT. Most types of repairable damage to the engine mount tubes may be patched in the following manner:

Clean up damaged area and stop drill the extremities of cracks with a ⅛ inch diameter drill.

Form a patch to the shape of the member to be repaired. Patch must overlap the damaged area by at least 1½ diameters of the tube being repaired.

Pack wet asbestos around the tube as close to the patch as possible in order to keep the tube from warping during the welding process.

Arc weld the patch in place.

6-25. Using the above method of repairing engine mount tubes eliminates the necessity of heat treating the engine mount after welding. Refer to the General Manual for Structural Repair (AN 01-1A-1), Section 10 for other methods of repairing the engine mount.

6-26. NOSE COWL.

6-27. GENERAL. The nose cowl is made of 24ST alclad sheet and is assembled in one complete section. The alclad sheet is tack riveted and spotwelded to former angles which extend from the bulb angle on the rear of the nose cowl to the bead on the front.

6-28. The nose cowl is held in place by 14 shock mounts which are attached by means of brackets to the rocker boxes on the forward row of cylinders of the engine. The shock mounts are riveted to the fore and aft former angles on the nose cowl. The forward section of the carburetor air intake duct is riveted to the top of the nose cowl.

6-29. NEGLIGIBLE DAMAGE. Cleaned up holes, not exceeding one inch in diameter, may be considered negligible except in the area of the carburetor air intake duct. Any holes in this area must be patched.

6-30. Shallow scratches or small isolated dents free from cracks, abrasions and sharp corners, may be considered negligible.

6-31. Cracks not exceeding one inch in length that have been stop drilled with a No. 40 (.098) drill at each end may be considered negligible.

6-32. Cleaned up nicks, gouges and cracks not exceeding ⅛ inch in depth may be permitted to exist in the fore and aft former angles.

6-33. Smoothed out isolated nicks and cracks not exceeding ⅛ inch in depth in the circular bulb tee former may be considered negligible.

6-34. DAMAGE REPAIRABLE BY PATCHING, OR INSERTION. Damage repairable by patching is usually used in the skin area where there are no formers or stiffeners or where the damage is not extensive enough to warrant inserting a filler or replacing with a new member. An insertion repair is usually necessary where the original member has been cut through to remove the damage and consists of a matching section, inserted to fill the gap, and secured in place by splice plates or angles. (See figure 6-8.)

6-35. DAMAGE REPAIRABLE BY REPLACEMENT. Damage to certain short sections of structure or members, such as the nose cowl support lugs whose shape make them difficult to repair will necessitate their replacement.

6-36. WRAP COWL AND COWL PANELS.

6-37. GENERAL. The wrap cowl and cowl panels are made of 24ST alclad sheets to which formers and stiffeners have been tack riveted and spotwelded. The upper panel of the forward wrap cowl forms the second portion of the carburetor air intake duct.

6-38. NEGLIGIBLE DAMAGE. Cleaned up holes, not exceeding one inch in diameter, may be considered negligible except in the panel containing the carburetor air intake duct. Any hole in this panel must be patched.

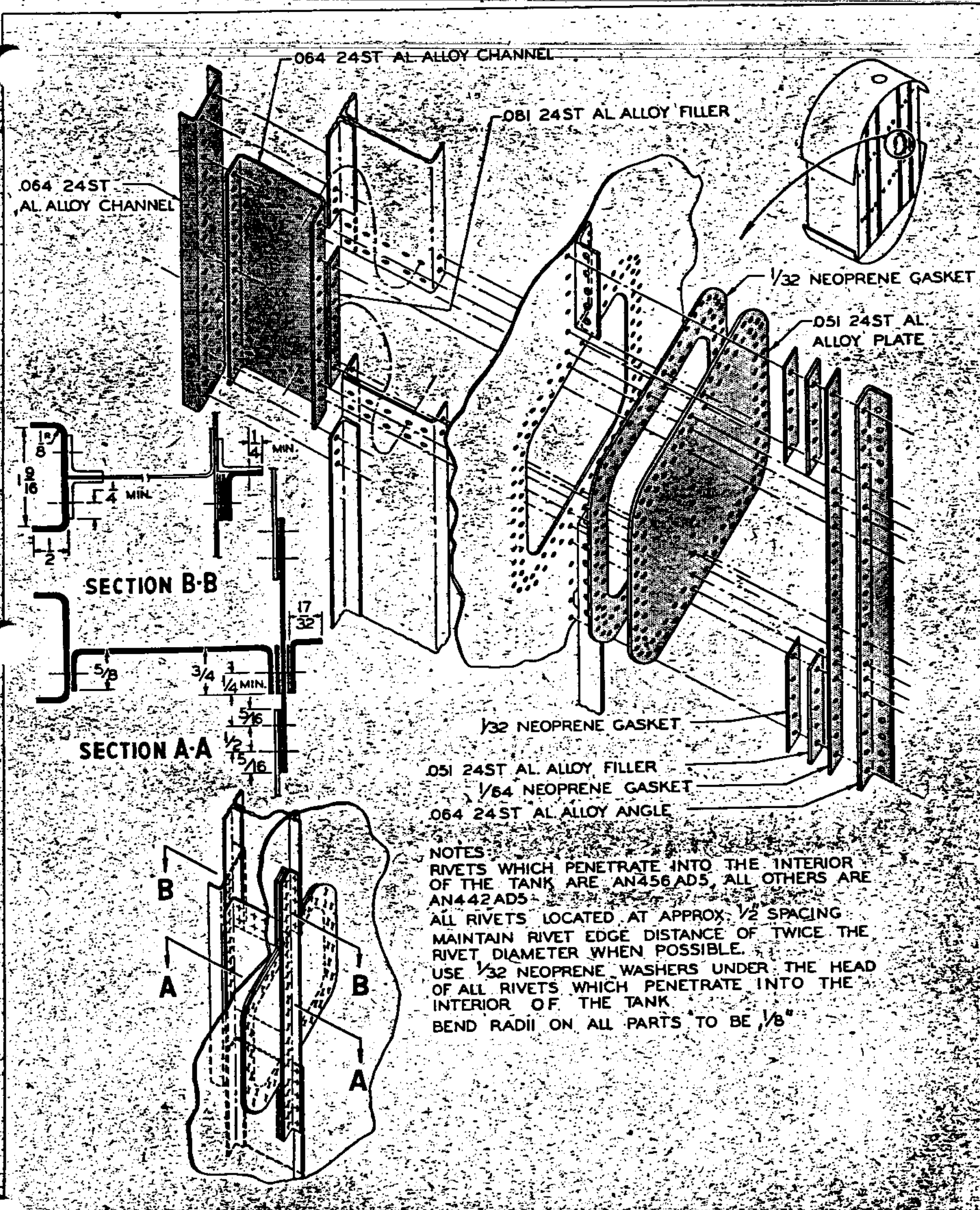


Figure 6-4—Vertical Stiffener Repair-Oil Tank

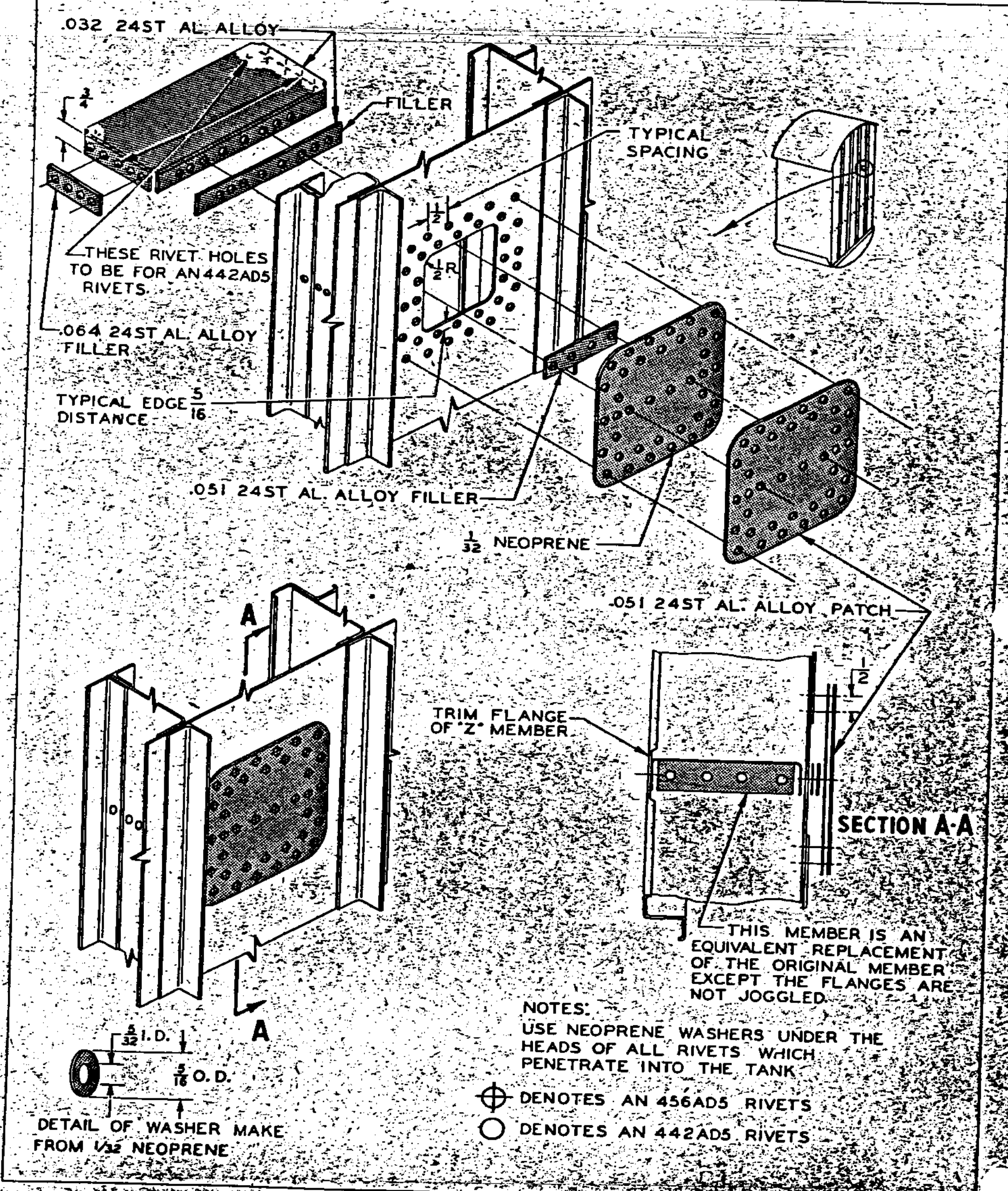


Figure 6-5—Horizontal Stiffener Repair-Oil Tank

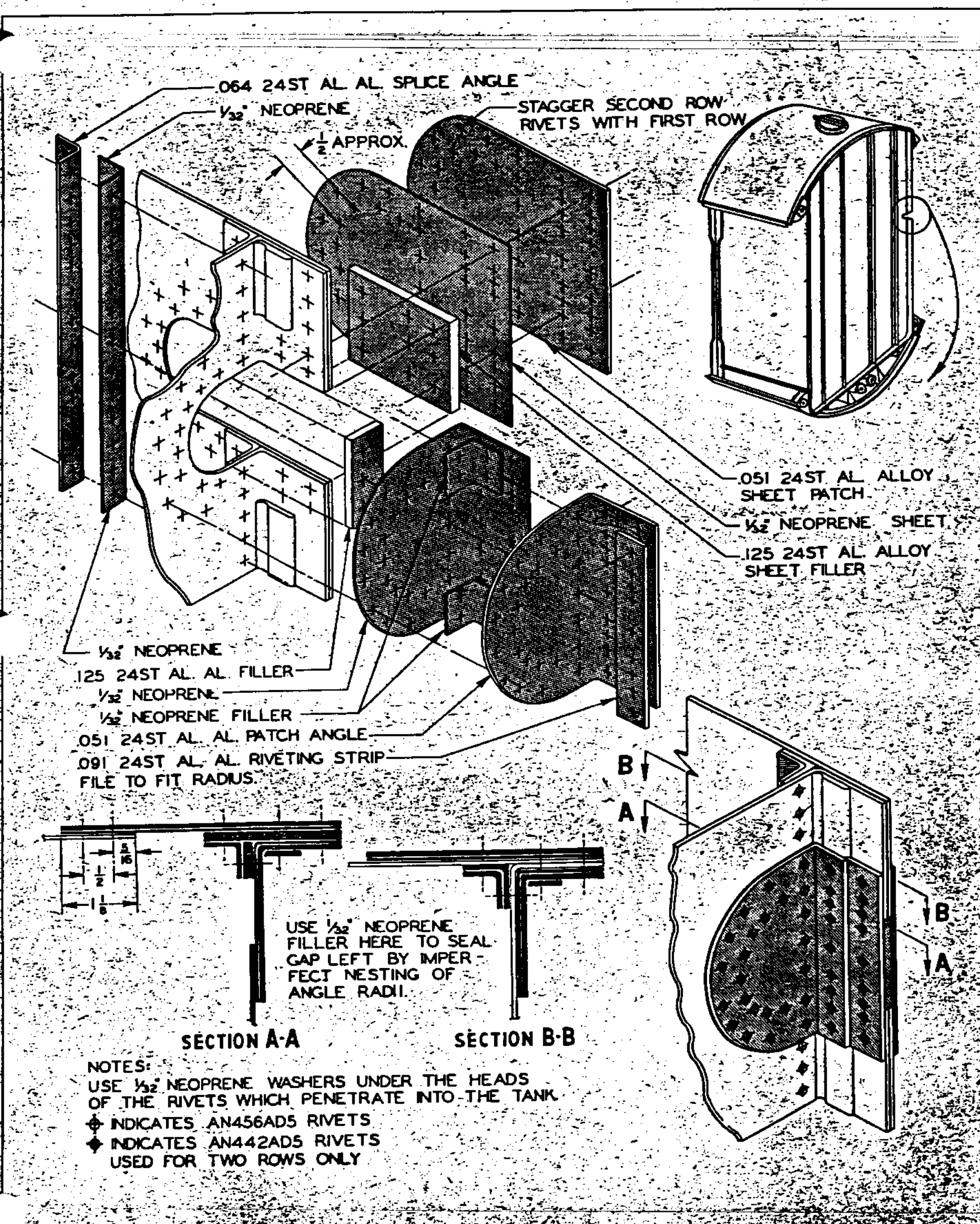


Figure 6-6—Corner Repair-Oil Tank

6-39. Shallow scratches or small isolated dents, free from cracks, abrasions and sharp corners, may be considered negligible.

6-40. Cracks not exceeding one inch in length that have been stop drilled with a No. 40 (.098) drill at each end may be considered negligible.

6-41. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Repairs accomplished by patching are used in the skin area where there are no formers or stiffeners or where the damage is not extensive enough to warrant inserting a filler or replacing with a new member. An insertion repair is necessary where the original member has been cut through to remove the damage and consists of a matching section, inserted t fill the gap and secured in place by splice plates o angles. (See figure 6-9.)

6-42. DAMAGE REPAIRABLE BY REPLACEMENT. Damage to short sections of structure or parts such as draw bolts, Dzus fasteners or other standard parts will necessitate their replacement. Refer to the General Manual for Structural Repair (AN 01-1A-1) for repair to Dzus fasteners.

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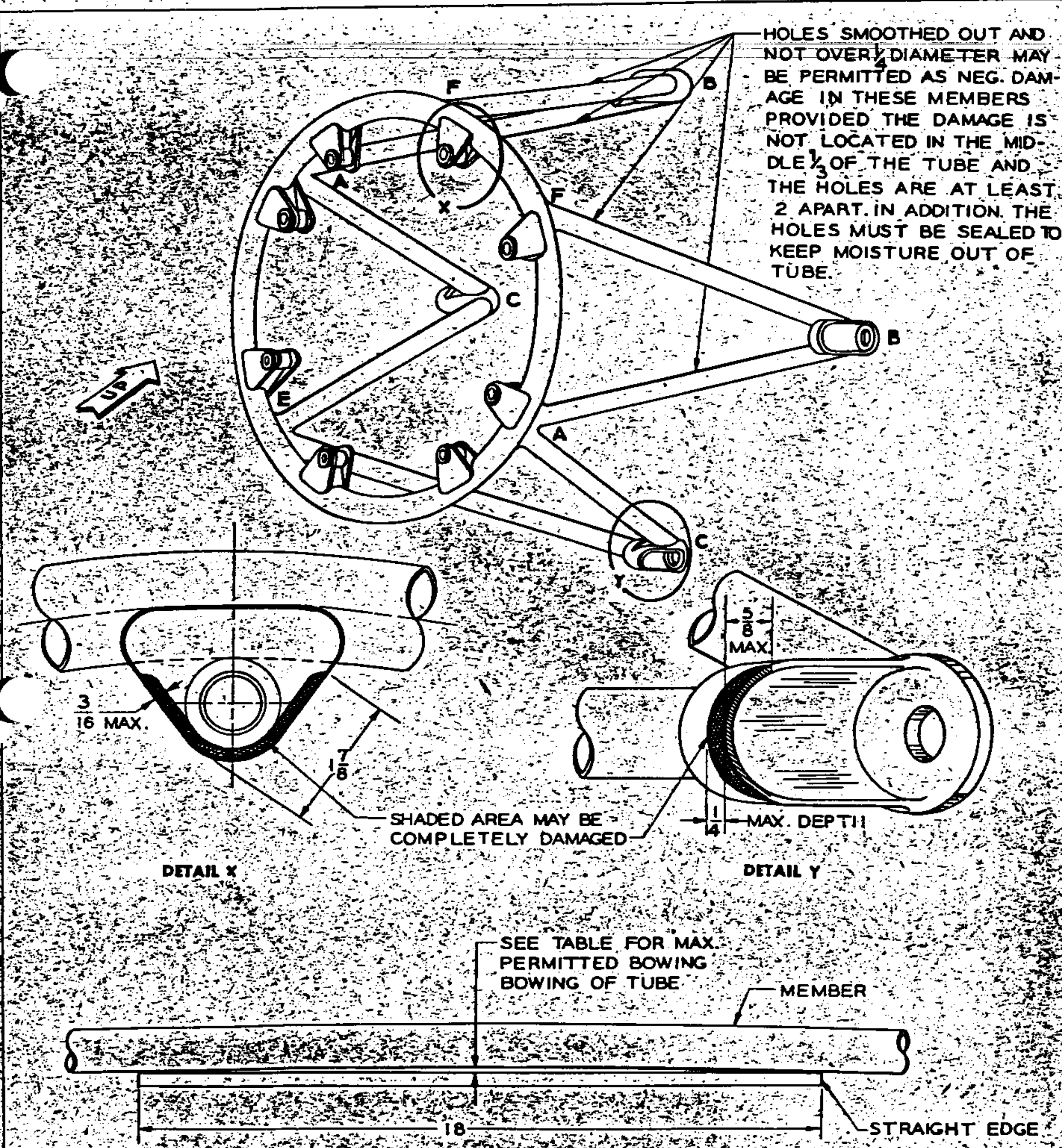

BOWING OF MEMBERS

MEMBER	MAX. BOW IN 18
AB	1/8
FB	3/16
AC	1/32
EC	1/16

NOTES:
SMOOTHED OUT NICKS 1/8 IN DEPTH AND 1/4 IN LENGTH AND DENTS NOT OVER 1/16 IN DEPTH ARE PERMISSIBLE AS NEGLIGIBLE DAMAGE PROVIDED THEY ARE NOT LESS THAN 2 APART.

Figure 6-7—Engine Mount-Negligible Damage

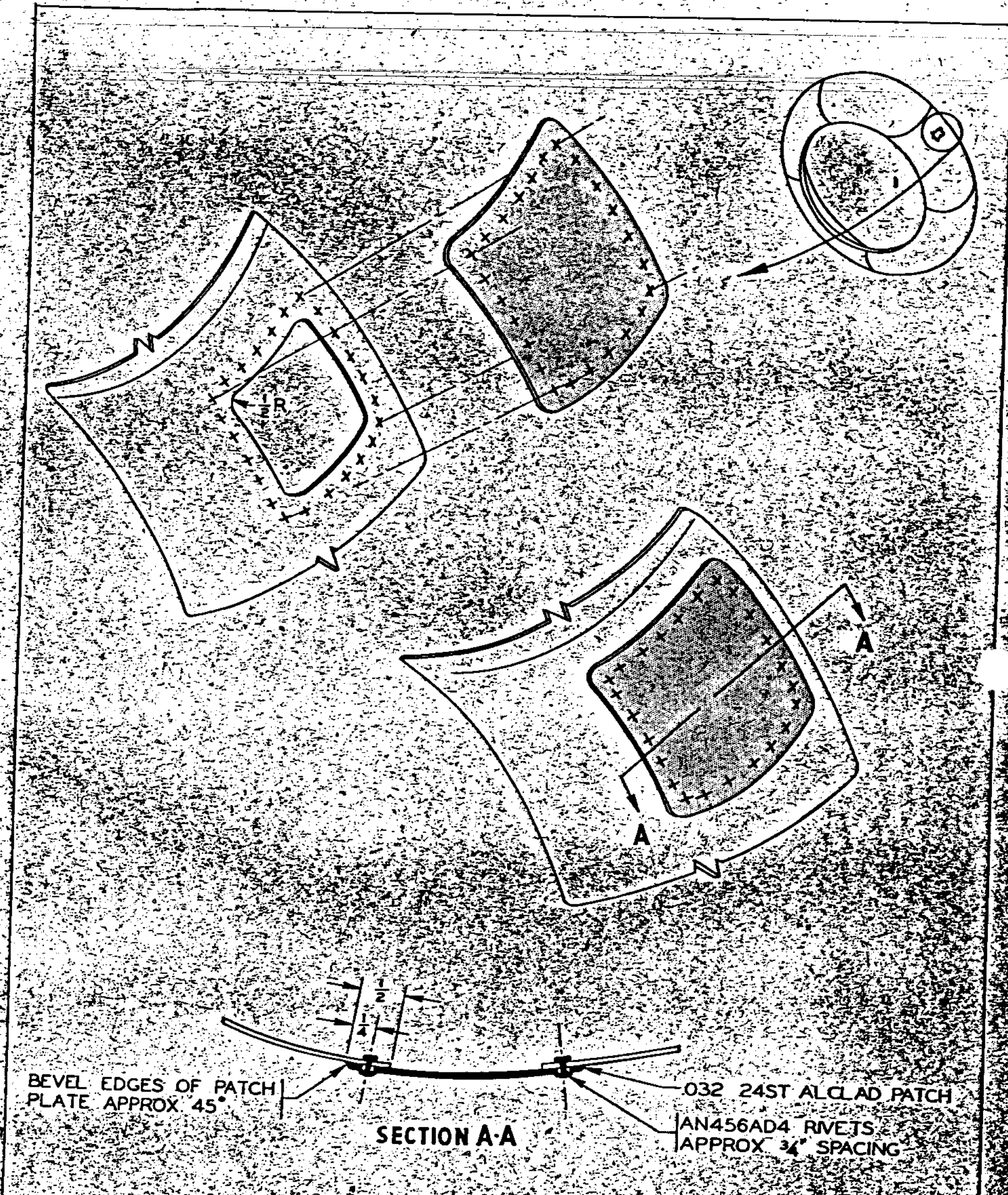

Figure 6-8—Nose Cowl Repair

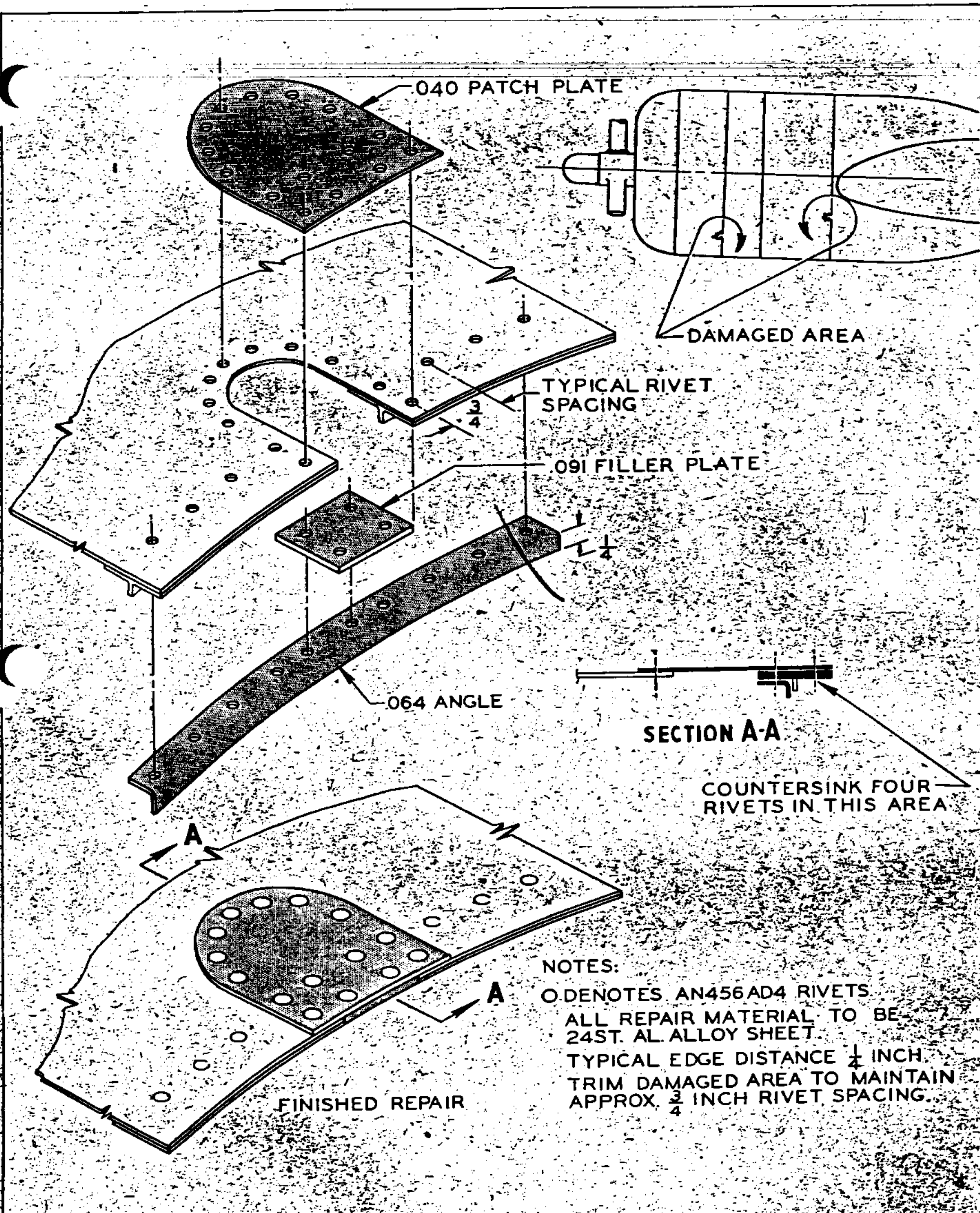

Figure 6-9—Wrap Cowl and Cowl Panel Repair

SECTION VII
FABRIC REPAIRS

Repairs to the fabric covered surfaces of the airplane should be made in accordance with Section 13 of the General Manual for Structural Repair, AN 01-1A-1.

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28B10037	Plate—Hull—Rear Towing Ring	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28B10081	Reinforcing Channel—Pilot's and Copilot's Seat Tracks	145,000 to 170,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28C1092	Pin—Flap Control Sprocket—Taper	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28C1134	Eye Bolt—Servo Unit—Follow-up Cable Attachment	90,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28C2062	Bushing—Controls—Rudder Pedal Lock Pin	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28C2064	Pin—Controls—Rudder Pedal Lock	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28C5522	Pin—Furnishings—Brake Pedal Lock	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28C5569	Tube—Controls—Aileron & Elevator Yoke Lock	90,000 to 125,000	SAE 4130	AN-T-3	C.M. Steel
28C5724	Sleeve—Controls—Brake Lever Bearing	120,000 to 145,000	SAE 4130	AN-WW-T-850	C.M. Steel
28C6027	Link—Controls—3/16 Cable—Adjustment	170,000 to 190,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28C10062	Shaft Assembly—Control—Aileron Tab Indicator	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28C10091	Hollow Shaft—Controls—Control Wheel	140,000	"K" Monel	QQ-N-286	K-Monel Metal
28C10092	Nut—Controls—Wheel—Hollow Shaft	70,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28D2010	Plunger—Engine Cowl Flap	100,000 to 115,000	Type 410	46S26	Corr. Resis. Steel
28D3013	Bolt—Engine Cowl Flap—Special	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28D3015	Nut—Engine Cowl—Check	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28D5052	Rod—Engine Cowl Flaps	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28D5055	Special Spacer—Engine Cowl Flap	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1040	Nut—MK 42 Bomb Rack Attaching—Anchor	70,000 to 95,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1041-7	Nut—MK 42 Bomb Rack Attaching	70,000 to 95,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1041-8	Nut—MK 42 Bomb Rack Attaching	70,000 to 95,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1070-20	Tube—Furnishings—Pilot's Seat	65,000 to 90,000	SAE 4130	AN-WW-T-850	C.M. Steel
28F1070-21	Rod—Furnishings—Pilot's Seat	65,000 to 90,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1081	Bearing—Furnishings—Pilot's Seat Roller	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1082	Bearing—Furnishings—Pilot's Seat—Front Roller	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-2	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-3	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-6	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-7	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-10	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-12	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-14	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1085-15	Rod—Furnishings—Pilot's Seat Release	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28F1088	Tube—Furnishings—Seat Operating Mechanism	Normalize	SAE 4130	AN-T-3	C.M. Steel
28F1099	Lever Assembly—Furnishings—Flare Loading	90,000 to 125,000	SAE 4130	AN-WW-T-850	C.M. Steel
			SAE 4130	AN-QQ-S-685	
			SAE 4130	AN-QQ-S-684	
28F1119	Channel—Fixed Equipment—Flare Base	Normalize	SAE 4130	AN-WW-T-850	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28F1120	Lever Assembly—Fixed Equipment Flare Base	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
			SAE 4130	AN-QQ-S-685	
			SAE 4130	AN-WW-T-850	
28F1122	Trunnion—Furnishings—Pilot's Seat Exercise Cord	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28F1153	Hook—Fixed Equipment—Flare Firing	100,000 to 125,000	NE 8630	AN-S-12	Alloy Steel
28F1157	Clip—Fixed Equipment—Flare Cable Spring	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28F1202	Screw—MK 15 Bombsight Mount—Brake	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1344	Arm Assembly—Fixed Equipment—Flare Door Release	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-QQ-S-684	
28F1349	Washer—Fixed Equipment—Spring Door Flares	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28F1366	Spring—Fixed Equipment—Flare Ejection	Spring Temper	SAE 1095	AN-QQ-S-666	Carbon Steel
28F1393	Pin—MK 15 Bombsight Mount Lock	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1450	Bushing—Anti-Vibration Mounting—Bombsight	100,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F1525	Spring—Furnishings—Pilot's Arm Rest	Spring Temper	SAE 1095	AN-QQ-S-666	Carbon Steel
28F3044	Bolt Assembly—Armament Torpedo Stop	150,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-QQ-S-684	
28F4030	Torque Shaft—Bow Gun Mount	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F4031-2	Bushing—Torque Shaft—Bow Gun Mount	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F4031-3	Bushing—Torque Shaft—Bow Gun Mount	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F4032	Link—Torque Shaft—Bow Gun Mount	Normalize	SAE 4130	AN-QQ-S-684	C.M. Steel
28F5113	Pin—Elevator & Aileron Control Lock	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28F5134	Leg Assembly—Furnishings—Bombers Seat Support	Normalize	SAE 4130	AN-QQ-S-684	C.M. Steel
			SAE 4130	AN-WW-T-850	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28F5238	Lug—Controls—Yoke Lock Tube	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F5252	Eccentric Bushing—Bombsight	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F6610	Bolt—Nose Wheel Door Control Mechanism—Hydraulic System	145,000 to 175,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28F6640	Lever Stop—Safety Lock—Landing Gear Selector Valve—Hydraulic System	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-QQ-S-684	
28F6646	Eye Pin—Spring Locking Mechanism—Landing Gear Selector Valve—Hydraulic System	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28F6888-0	Support—Furnishings—Radar Operator's Seat Post	90,000 to 125,000	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685	C.M. Steel
28F6888-2	Support—Furnishings—Radar Operator's Seat Post	90,000 to 125,000	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685	C.M. Steel
28F6900	Lever—Furnishings—Radar Operator's Seat—Stop	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28F6901	Collar—Furnishings—Radar Operator's Seat—Stop	90,000 to 125,000	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685	C.M. Steel
28F12808	Rod—Furnishings—Intake Damper—Empennage Anti-Icing Heater	145,000 to 170,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28G1017	Pin—P.P.—Fuel System—Dump Valve—Adjusting	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28G1018	Fork—P.P.—Fuel System—Dump Valve	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28G1020	Stud—P.P.—Fuel System—Dump Valve	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28H1031	Shackle—Clamp Assembly—Mooring Pendant	115,000 to 145,000	Type 410	46S26	St. Steel
28L028	Strut Assembly—Float Retracting—Upper	90,000 to 125,000	SAE 4130 SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685 AN-QQ-S-684	C.M. Steel
28L029	Strut Assembly—Float Retracting Lower	100,000 Min.	SAE 4130 SAE 4130 SAE 4130	AN-QQ-S-685 AN-WW-T-850 AN-QQ-S-684	C.M. Steel
28L071	Journal—Float Retracting Screw—Outboard	125,000	SAE 4140	AN-QQ-S-752	C.M. Steel
28L073	Journal—Float Retracting Screw—Inboard	150,000	SAE 4140	AN-QQ-S-752	C.M. Steel
28L075	Screw—Float Retracting Mechanism—Trunion	90,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L077	Collar—Float Retracting Screw	Normalize	SAE 4130	AN-QQ-S-684	C.M. Steel
28L079	Fitting Assembly—Float Retracting Mechanism—Link—Outer	125,000	SAE 4130 SAE 4130	AN-QQ-S-685 AN-WW-T-850	C.M. Steel
28L080 L/R	Fitting Assembly—Float Retracting Mechanism—Link—Inner	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28L082	Bolt—Float—Control Torque Tube Shaft—Taper	125,000	SAE 4140	AN-QQ-S-752	C.M. Steel
28L088-6	Coupling—Float Retracting Mechanism Control Motor	125,000	SAE 4140	AN-QQ-S-752	C.M. Steel
28L090	Coupling—Float—Control Torque Tube	150,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L091-2	Tube—Float—Control Torque	145,000 to 170,000	SAE 4130	AN-T-3	C.M. Steel
28L091-6	Coupling—Float—Control Torque Tube	145,000 to 170,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L092	Coupling—Float—Control Torque Tube	150,000	SAE 4140	AN-QQ-S-752	C.M. Steel
28L098	Coupling—Float—Control Torque Tube	150,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L102	Sleeve—Float—Control Torque Tube Bearing	125,000	SAE 4130	AN-WW-T-850	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N	SPECIFICATION	MATERIAL
28L112 L/R	Fitting Assembly—Float—Brace—Upper Front	125,000	SAE 4130	AN-WW-T-850	C.M. Steel
			SAE 4130	AN-QQ-S-685	
			SAE 4130	AN-QQ-S-684	
28L113 L/R	Fitting Assembly—Float—Brace—Upper Rear	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-WW-T-850	
			SAE 4130	AN-QQ-S-684	
28L118 L/R	Stop—Float—Retracting Screw—Adjusting Screw	150,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1005	Socket Assembly—Float Gear—Automatic Lock	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-WW-T-850	
28L1009 L/R	Nut—Float—Recoil Mechanism Special	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1012-2	Key—Woodruff	200,000	SAE 4140	AN-QQ-S-752	C.M. Steel
28L1017	Retainer—Float—Locking Mechanism Bearing	90,000	SAE 4130	AN-WW-T-850	C.M. Steel
28L1021	Spacer—Float—Locking Mechanism Bearing	90,000	SAE 4130	AN-WW-T-850	C.M. Steel
28L1022 L/R	Nut—Float—Locking & Recoil Mechanism—End	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1023	Tube—Float—Lock & Recoil Mechanism—Drive	150,000	SAE 4130	AN-WW-T-850	C.M. Steel
28L1024	Spacer—Float—Lock & Recoil Mechanism—Support Bearing	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1025	Coupling—Float—Lock & Recoil Mechanism—Driven	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1031-2	Screw—Float—Locking Mechanism Link	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1032	Coupling Assembly—Float Lock & Recoil Mechanism—Adapter	120,000 to 145,000	SAE 4130	AN-WW-T-850	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28L1034	Latch—Float Lock Mechanism	100,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1035	Terminal—Float—Lock Mechanism—Latch	100,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L1052	Pin (Special)—Float—Lock & Recoil Mechanism	80,000 Min.	SAE 4130	AN-QQ-S-684	C.M. Steel
28L2018	Lug—Float—Front Handling	70,000		46S27 Gr. 1	Steel—Corr. Resis.
28L2035	Lug—Float—Removable—Rear Handling	70,000		46S27 Gr. 1	Corr. Resis. Steel
28L4055-6	Bolt—Landing Gear—Main Wheel Oleo Strut Attaching—Short	170,000 to 190,000	Type 431	AN-QQ-S-770	St. Steel
28L4055-7	Bolt—Landing Gear—Main Wheel Oleo Strut Attaching—Long	170,000 to 190,000	Type 431	AN-QQ-S-770	St. Steel
28L4056-7	Bolt—Landing Gear—Main Wheel Oleo Strut Attaching	170,000 to 190,000	Type 431	AN-QQ-S-770	St. Steel
28L4057	Nut—Landing Gear—Main Wheel—Oleo Strut Attaching	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28L4067-7	Bolt—Main Landing Gear—Lower Vee Strut—Front	170,000 to 190,000	Type 431	AN-QQ-S-770	St. Steel
28L4078	Spring—Main Landing Gear—Bumper	Spring Temper	SAE 6150	46S31	CR. Van. Spring Steel
28L4085	Nut—Main Landing Gear—Lower Vee Strut Attaching	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5015	Strut Assembly—Main Landing Gear—Lower Vee	175,000	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-684	C.M. Steel
28L5019	Hinge Pin—Main Landing Gear—Main Upper and Lower Struts	175,000	Type 431	AN-QQ-S-770	St. Steel
28L5023 L/R	Strut Assembly—Main Landing Gear—Lower Vee	175,000	SAE 4130 SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-684 AN-QQ-S-685	C.M. Steel
28L5026 L/R	Strut Assembly—Main Landing Gear—Upper Half—Main	175,000	SAE 4130 SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685 AN-QQ-S-684	C.M. Steel
28L5027	Strut Assembly—Main Landing Gear—Lower Half—Main	175,000	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-684	C.M. Steel
28L5029	Latch—Nose Landing Gear—Down Lock	175,000	Type 431	AN-QQ-S-770	St. Steel
28L5041 L/R	Pin—Main Landing Gear—Upper Main Strut—Operating	175,000	Type 431	AN-QQ-S-770	St. Steel
28L5043	Latch—Main Landing Gear—Main Strut—Locking	170,000 to 190,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5044-2	Universal—Main Landing Gear—Main Strut—Operating	170,000 to 190,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5044-3	Universal—Main Landing Gear—Main Strut—Operating	170,000 to 190,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5045	Pin—Nose Landing Gear—Down Lock Latch	175,000	Type 431	AN-QQ-S-770	St. Steel
28L5047	Lever—NLG—Down Lock Latch	Anneal	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5058	Bolt—Main Landing Gear Upper Vee Strut—Rear	170,000 to 190,000	Type 431	AN-QQ-S-770	St. Steel
28L5066	Nut—Main Landing Gear—Latch Spring Retainer	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5067 L/R	Bell Crank—Main Landing Gear—Main Strut Latch Release	100,000	SAE 4130	49-S-1	C.M. Steel
28L5068	Bolt—Main Landing Gear—Upper Half Main Strut—Attaching	175,000	Type 431	AN-QQ-S-770	St. Steel
28L5069	Rod Assembly—Main Landing Gear—Main Strut Latch Release	Normalize	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-684	C.M. Steel
28L5071	Screw—MLG—Latch Release Rod—Adjusting	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28L5072	Clamp—Main Landing Gear—Main Strut—Latch Release Rod	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28L5076	Latch Assembly—Nose Landing Gear Up Lock	175,000	SAE 4130 SAE 4130	AN-QQ-S-684 AN-QQ-S-685	C.M. Steel
28L5081	Cylinder Assembly—Main Landing Gear Bumper	90,000 to 125,000	SAE 4130 SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685 AN-QQ-S-684	C.M. Steel
28L5083	End Cap—Main Landing Gear—Bumper Cylinder	100,000	SAE 4130	49-S-1	C.M. Steel
28L5086	Arm—Main Landing Gear—Bumper	90,000 to 125,000	SAE 4130 SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685 AN-QQ-S-684	C.M. Steel
28L5099	Fitting—MLG—Oleo Bumper	100,000	SAE 4130	49-S-1	C.M. Steel
28L5102	Screw—Main Landing Gear—Uplatch Release—Adjusting	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5103	Cylinder Assembly—Main Landing Gear—Uplatch Release	Normalize	SAE 4130 SAE 4130	AN-WW-T-850 AN-QQ-S-685	C.M. Steel
28L5104	Cap—Main Landing Gear Uplatch Release—Cylinder	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5106	Plunger—Main Landing Gear—Uplatch Release	120,000 to 145,000	SAE 4130	AN-QQ-684	C.M. Steel
28L5108	Handle Assembly—Main Landing Gear—Uplatch Emergency Release	Normalize	SAE 4130	AN-WW-T-850	C.M. Steel
28L5110-6	Fork—Main Landing Gear—Uplatch—Emergency Release Yoke	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5114	Arm—Main Landing Gear—Wheel Well Door—Operating Mechanism	150,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28L5115-8	Link Subassembly—MLG—Wheel Well Door—Operating Mechanism	145,000 to 170,000	SAE 4130	AN-WW-T-850	C.M. Steel
28L5117-6	Clamp Subassembly—NLG—Wheel Well—Upper Door	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28L5117-7	Clamp Subassembly—MLG—Wheel Well—Upper Door	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28L5119-2	Uplatch Assembly—Main Landing Gear	80,000	Type 321 Type 410	AN-QQ-S-757 46S26	St. Steel
28L5122	Spring—NLG—Down Lock—Latch	Spring Temper		AN-W-17	Spring Steel
28L5124	Pin—MLG—Upper Vee Strut—Operating	170,000 to 190,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28L5136	Support—NLG—Lubricator Fitting	90,000 to 125,000	SAE 4130	AN-QQ-685	C.M. Steel
28L5139	Adapter—NLG—Thrust Bearing—Lubricator	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28-O-2017-2	Stud—Oil Tank	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28-O-2017-3	Stud—Oil Tank	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28-O-2025	Eye Bolt—Oil Tank Filler	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28-O-2042	Clip—Tank Filler	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28-O-3009-3	Flange Assembly—Oil Check Valve	90,000 to 125,000	SAE 4130	AN-WW-T-850	C.M. Steel
28-O-3035-6	Bushing—Oil Tank—Motor Mount	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28-O-5025	Elbow Assembly	90,000 to 125,000	SAE 4130	AN-WW-T-850	C.M. Steel
28-O-5032-6	Support Subassembly—Vacuum Pump Relief Valve	90,000 to 115,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28-O-5032-9	Strap—Vacuum Pump Relief Valve Support	90,000 to 115,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28-O-5032-10	Strap—Vacuum Pump Relief Valve Support	90,000 to 115,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28-O-5049	Spring—Latch Clip—Oil Filler Cap	Spring Temper		AN-W-17	Spring Steel
28-O-10036	Flange Assembly—Engine Oil Outlet	90,000 to 125,000	SAE 4130	AN-WW-T-850	C.M. Steel
28P1015-6	Pin—Engine Control—Cowl Flap Operating—Crank	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28P1049	Shaft—Engine Controls—Control Unit	Normalize	SAE 4130	AN-T-3	C.M. Steel
28P1070	Shaft End—Engine Controls—Control Unit	125,000	NE 8735	AN-S-15	Alloy Steel
28P1170	Nut—Propeller Hoist—Engine Attaching	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28P1231	Hub—Engine Controls—Mixture Control Unit	Normalize	SAE 4130	AN-WW-T-850	C.M. Steel
28P1232-2	Stud—Engine Controls—Mixture Control Unit	90,000 to 125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28P1289-2	Fitting—Cowl Flap Return Spring	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28P1289-4	Fitting—Cowl Flap Return Spring	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28P1298 L/R	Rack Assembly—Mixture Control Lever—Locking	175,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-QQ-S-752	
28P5014	Bell Crank Assembly—Carburetor—Hot Air—Intake	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28P5016	Link Assembly—Carburetor Hot Air Intake	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28P5114	Shaft—P.P.—Cowl Flap Control	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28P5137	Sleeve Assembly—Carburetor Air Control	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-WW-T-850	
28P5169	Bracket—Power Plant—Generator	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28P5170-10	Bracket Assembly—Power Plant—Starter—Generator	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28P5170-11	Strap Assembly—Power Plant—Starter Generator	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28P5526	Bell Crank Assembly—Carburetor Air Control	120,000 to 145,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-QQ-S-684	
28P5529-6	Support Assembly—Power Plant—Starter—Generator	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
28P10038	Strap Assembly—Power Plant—Starter Generator Bracket	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28P10091-6	Bracket—Power Plant—Generator	90,000 to 125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28T1036	Stud—Shaft—Tail—Hinge Bearing	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel

PART No.	NAME	HEAT TREAT (psi)	COMM'L. DESIG'N.	SPECIFICATION	MATERIAL
28T2024	Shaft—Tail—Hinge Bearing	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28T5082	Nut—Rudder Tab Control—Thrust Bearing Retaining	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W068-1	Eye Bolt—Hoisting Terminal—Wing Outer Panel	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W068-2	Fork—Hoisting Terminal—Wing Outer Panel	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W072 L/R	Bracket—Wing—Aileron Hinge—Outer	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28W073 L/R	Bracket—Wing—Aileron Hinge—Inner	120,000 to 145,000	SAE 4130	AN-QQ-S-684	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28W129 L/R	Fitting—Wing—Float Retracting Mechanism—Screw—Outer	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W133 L/R	Fitting—Assembly—Wing—Float Strut Attachment—Front	150,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W134 L/R	Fitting Assembly—Wing—Float Strut Attachment—Rear	150,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-WW-T-850	
28W142 L/R	Plate—Wing—Float Brace Attachment—Rear	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W143 L/R	Plate—Wing—Float Brace Attachment—Front	125,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W181	Bolt—Wing—Center Attaching—Rear	145,000 to 170,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W182	Bolt—Wing—Center Attaching—Front	145,000 to 170,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W188	Bearing—Wing Station No. 14—Leading Edge	120,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W104114	Filler Plate—Fitting—Wing Rear Spar—Hoisting Sling	170,000 to 190,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W1045 L/R	Fitting—Wing—Rear Spar—Hoisting Sling	170,000 to 190,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W1046 L/R	Fitting—Wing—Front Spar—Hoisting Sling	170,000 to 190,000	SAE 4130	AN-QQ-S-685	C.M. Steel
28W1135 L/R	Fitting Assembly—Wing—Float Brace Attachment—Rear	150,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-WW-T-850	
28W1136 L/R	Fitting Assembly—Wing—Float Brace Attachment—Front	150,000	SAE 4130	AN-QQ-S-685	C.M. Steel
			SAE 4130	AN-WW-T-850	
28W2188	Bearing—Wing Station No. 14—Leading Edge	150,000	SAE 4130	AN-QQ-S-684	C.M. Steel
			SAE 4130	AN-QQ-S-685	
28W5042	Screw—Wing—Outer Panel Attaching Joint—Fairing	125,000	SAE 4130	AN-QQ-S-684	C.M. Steel
28W5192	Screw—Fuel Cell Access Door—Special	65,000 to 90,000	SAE 4130	AN-QQ-S-684	C.M. Steel
29A017-2	Eye—Turnbuckle—Torpedo Sling	Normalize	SAE 2330	AN-QQ-S-689	Nickel Steel
29A017-3	Barrel—Turnbuckle—Torpedo Sling	Normalize	SAE 2330	AN-QQ-S-689	Nickel Steel
29A017-4	Fork—Turnbuckle—Torpedo Sling	Normalize	SAE 2330	AN-QQ-S-689	Nickel Steel
320-046	Flange Assembly—Engine Oil Outlet	90,000 to 125,000	SAE 4130	AN-WW-T-850	C.M. Steel
32P271	Bracket Assembly—Cooling Tube—Front	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel
32P270-0	Bracket Assembly—Cooling Tube—Rear	Normalize	SAE 4130	AN-QQ-S-685	C.M. Steel

Stock Description	Gage	Commercial Designation	Specification
Tubing	1¼ O.D. x .049	4130 Ch. Moly Steel	AN-WW-T-850(N)
~~Tubing~~	~~1½ O.D. x .072~~	~~4130 Ch. Moly Steel~~	~~AN-WW-T-850(N)~~
Tubing	1¼ O.D. x .049	4130 Ch. Moly Steel	AN-T-3(N)
Tubing	1½ O.D. x .072	4130 Ch. Moly Steel	AN-T-3(N)
Extrusion	Alcoa K 77B	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 77F	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 78C	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 78F	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 78J	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 78P	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 78Y	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa 734FF	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa 734TT	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 778	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa 919	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 1172	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa 1288	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 1297	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 1298	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 1557	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 1559	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 1908	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa 2499	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 5009	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 5010	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 5090	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 5401	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 5600	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 6235	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 6240	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa 6494	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 7604	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 8669	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9047	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9048	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9471	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9472	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9473	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9695	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9823	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9831	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 9876	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11015	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11270	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11271	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11272	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11407	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11630	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11631	24ST Aluminum Alloy	QQ-A-354(T)

Stock Description	Gage	Commercial Designation	Specification
Extrusion	Alcoa K 11632	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11633	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11634	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11635	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11636	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11637	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11638	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11818	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11819	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11820	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11824	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11871	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 11886	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 12023	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 12024	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 12027	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 12028	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 12468	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13428	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13604	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13624	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13639	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13651	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13686	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 13689	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 14033	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 14034	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 14035	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 14040	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 14049	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 14221	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 30787	24ST Aluminum Alloy	QQ-A-354(T)
Extrusion	Alcoa K 31150	24ST Aluminum Alloy	QQ-A-354(T)

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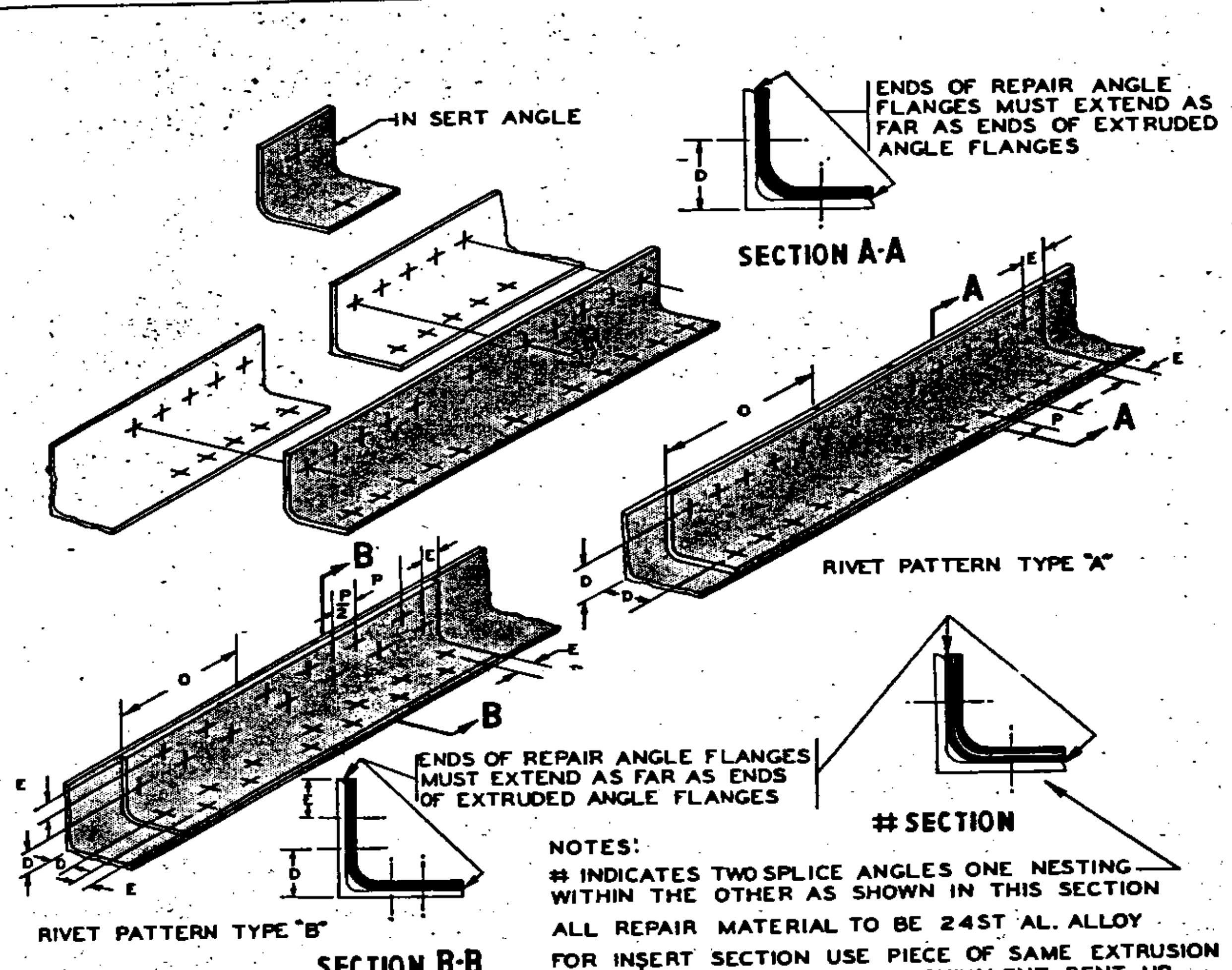
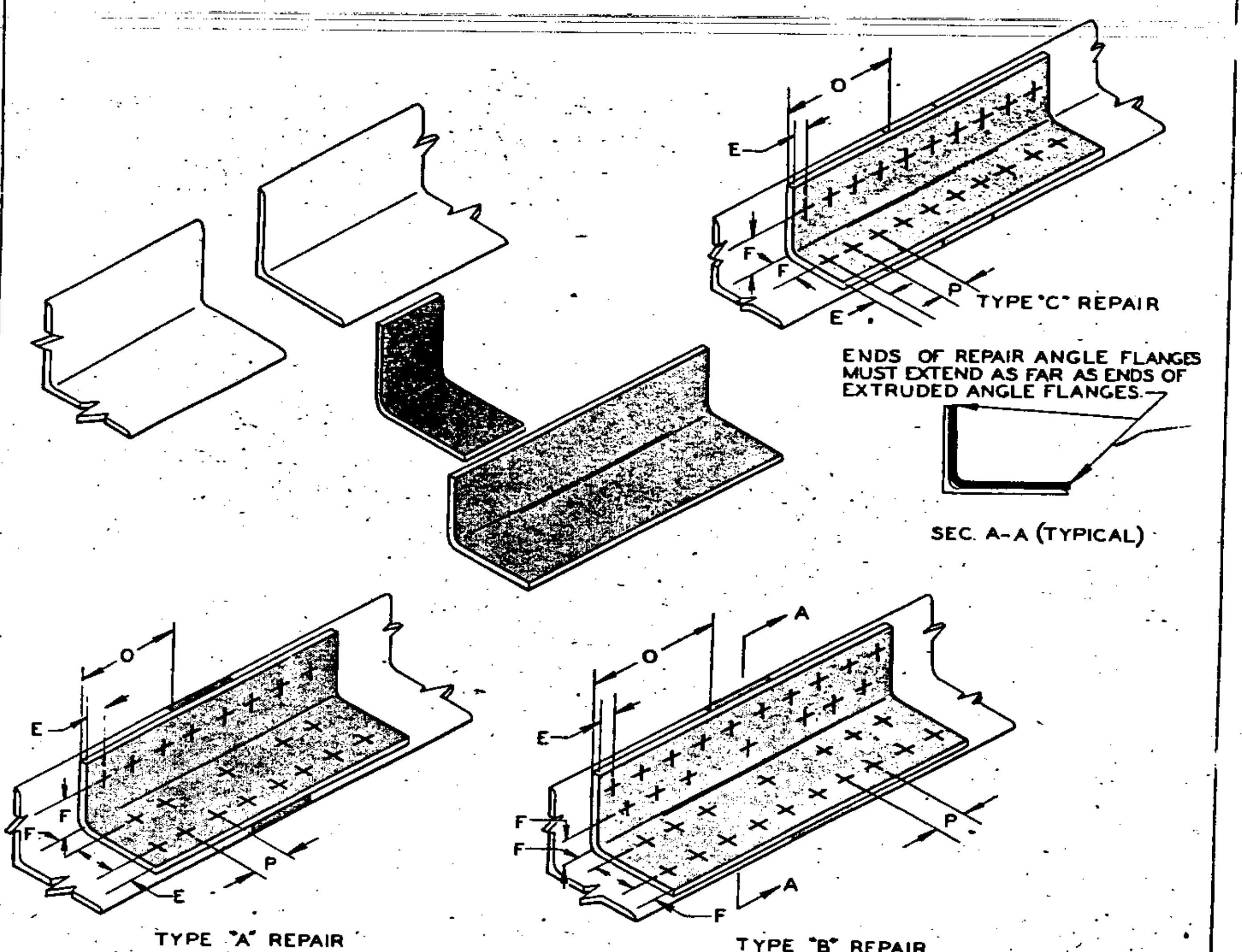
APPENDIX II
TYPICAL REPAIRS



NOTES:
# INDICATES TWO SPLICE ANGLES ONE NESTING WITHIN THE OTHER AS SHOWN IN THIS SECTION
ALL REPAIR MATERIAL TO BE 24ST AL. ALLOY
FOR INSERT SECTION USE PIECE OF SAME EXTRUSION AS THAT DAMAGED OR THE EQUIVALENT BENT-UP SECTION SHOWN IN SECTION VIII

EXTRUSION DIE NO.	SPLICE OVERLAP (O)	GAGE OF REPAIR ANGLES	REPAIR ANGLE BEND RADIUS	PATTERN TYPE	RIVET	RIVET PER SPLICE	P"	E"	D"
K 78 P	2	# .040	3/32	A	AN442AD4	10	3/8	1/4	5/16
K 6240	1 5/8	# .051	3/16	A	AN442AD4	8	3/8	1/4	11/32
K 13624	2 3/8	# .040	1/8	A	AN442AD4	12	3/8	1/4	3/8
K 5401	2 1/2	# .072	1/4	A	AN442AD5	10	15/32	5/16	7/16
K 78 C	3 7/16	# .064	3/16	A	AN442AD5	14	15/32	5/16	1/2
K 78 J	3 7/16	# .072	1/4	A	AN442AD5	14	15/32	5/16	9/16
K 78 F	4 1/8	# .064	1/4	A	AN442AD6	14	9/16	3/8	5/8
K 77 B	5 1/4	# .072	1/4	A	AN442AD6	18	9/16	3/8	5/8
K 78 Y	4	# .060	1/4	A	AN442D8	10	3/4	1/2	3/4
K 77 F	4 3/4	# .081	9/32	A	AN442D8	12	3/4	1/2	3/4
K 11637	3 1/2	# .051	3/16	B	AN442D8	10	1/4	1/2	5/8

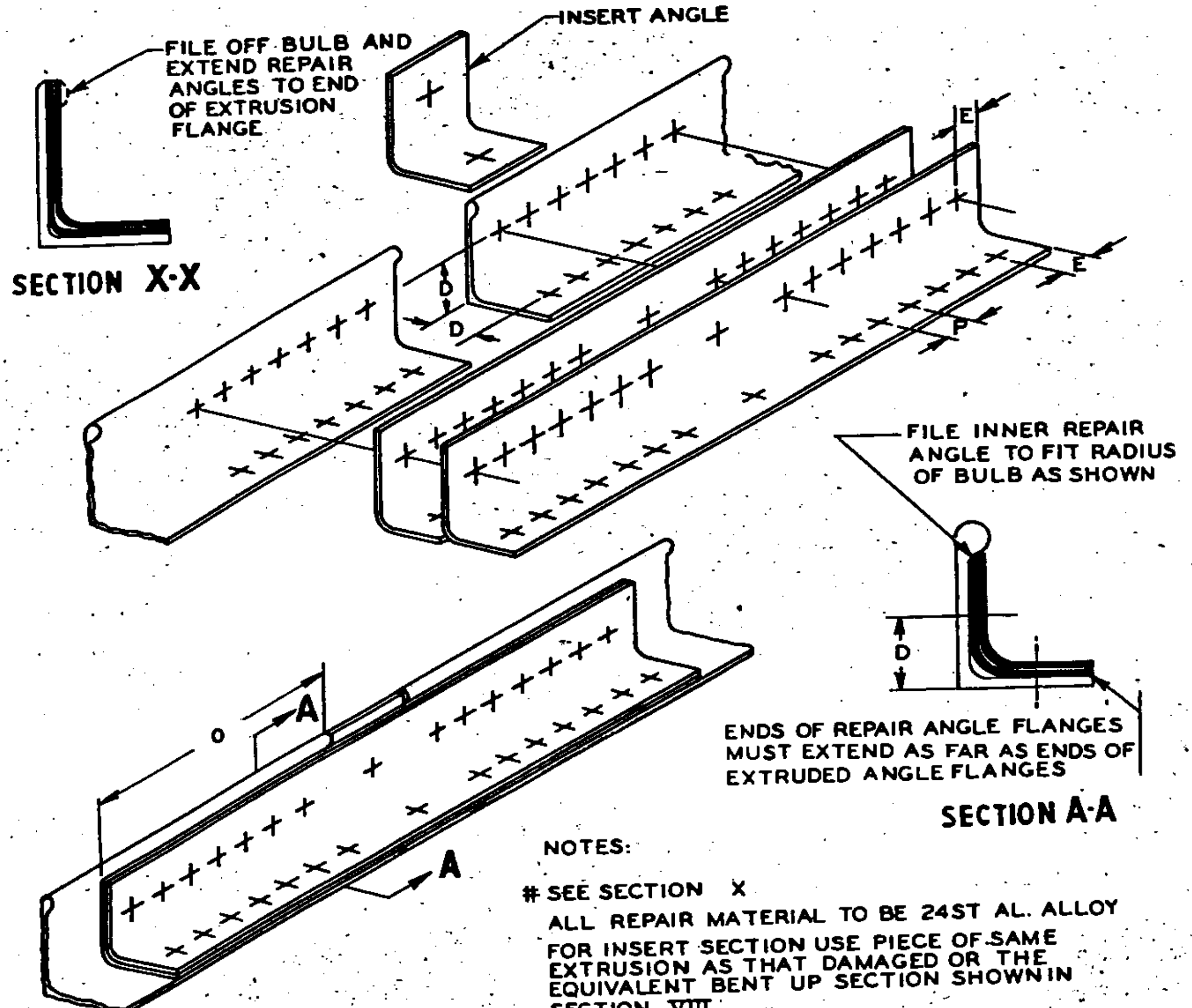
Figure B-1—Typical Repairs-Equal Angles



NOTES:
ALL SPLICE MATERIAL TO BE 24ST ALUMINUM ALLOY.
FOR INSERT USE PIECE OF SAME EXTRUSION AS THAT DAMAGED OR THE EQUIVALENT BENT-UP SECTION GIVEN IN SECTION VIII.
# INDICATES TWO REPAIR ANGLES, ONE NESTED WITHIN THE OTHER.

EXTRUSION DIE NO.	REPAIR TYPE	OVERLAP (O) EACH SIDE OF DAMAGE	GAGE OF SPLICE ANGLE	BEND RADIUS	RIVET TYPE	NO. RIVETS EACH SIDE OF SPLICE	E	F	P
K14033	C	2 1/2	.064	3/16	AN442 AD5	10	5/16	3/8	15/32
K13689	A	3	# .040	5/32	AN442 AD6	11	3/8	7/16	3/4
K13689	C	3 9/16	# .064	1/8	AN442 AD6	12	3/8	15/32	9/16
K734FF	A	4 1/4	# .064	1/8	AN442 AD6	14	3/8	15/32	7/8
K734TT	B	4 3/4	# .072	3/16	AN442 D8	14	1/2	5/8	1 1/4
K1288	C	3	# .040	5/32	AN442 AD6	10	3/8	7/16	9/16
K6494	A	3	.072	1/4	AN442 AD6	14	3/8	5/8	9/16
K9876	C	2 3/8	# .040	3/32	AN442 AD4	12	1/4	5/16	3/8
K11636	A	3 9/16	# .064	1/4	AN442 AD6	17	3/8	5/8	9/16
K11638	B	3 9/16	# .064	1/4	AN442 AD6	22	3/8	5/8	9/16
K11820	A	3 9/16	.091	5/16	AN442 AD6	17	3/8	5/8	9/16

Figure B-2—Typical Repairs-Unequal Angles



NOTES:

\# SEE SECTION X

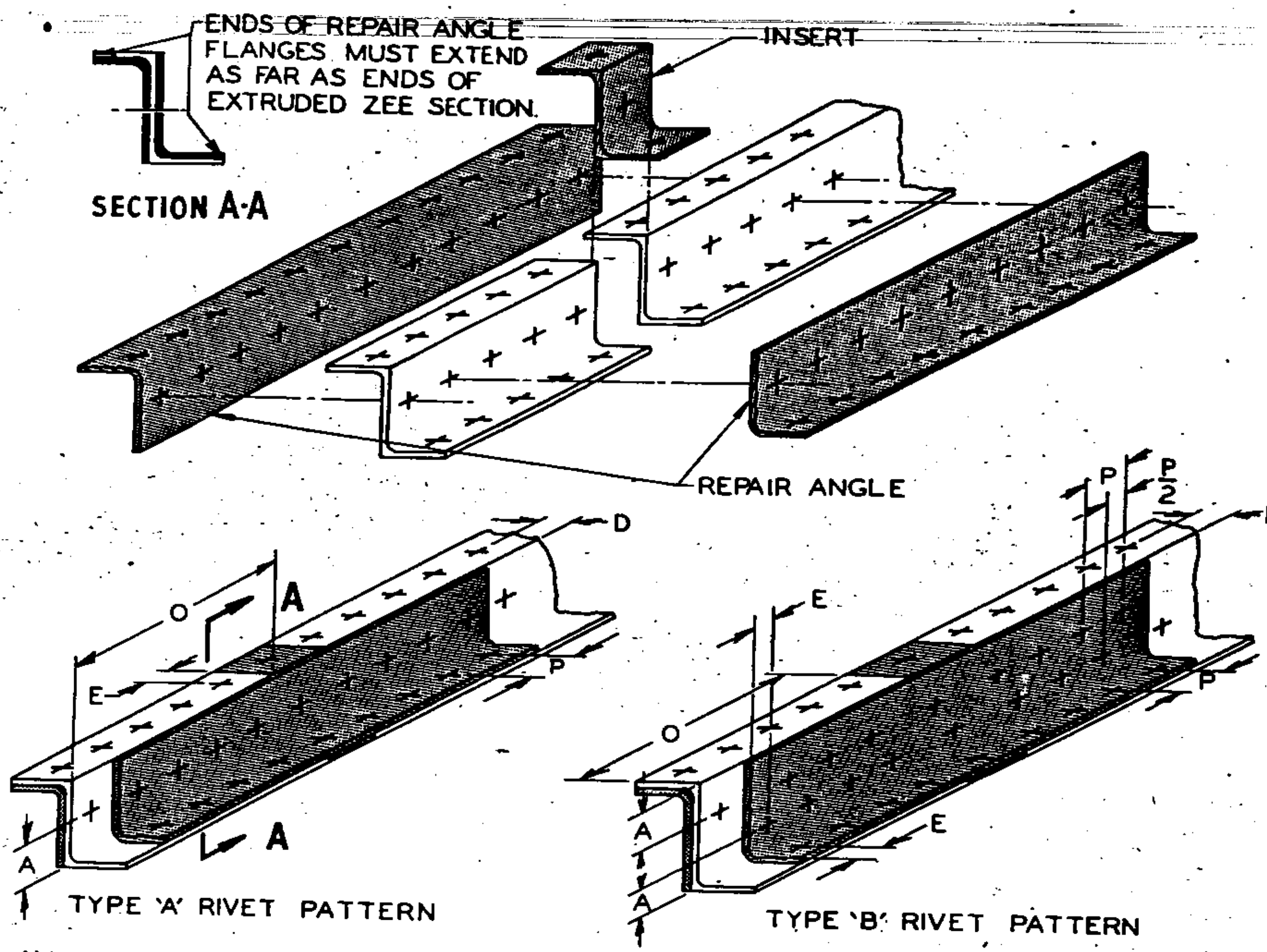
ALL REPAIR MATERIAL TO BE 24ST AL. ALLOY

FOR INSERT SECTION USE PIECE OF SAME EXTRUSION AS THAT DAMAGED OR THE EQUIVALENT BENT UP SECTION SHOWN IN SECTION VIII

SEE TABLE BELOW FOR ALL REPAIR INFORMATION

EXTRUSION DIE NO.	SPLICE OVERLAP (O)	GAGE OF REPAIR ANGLES	REPAIR ANGLE BEND RADIUS	RIVET	RIVETS PER SPLICE	"P"	"E"	"D"
K1559	3 1/2	.051	1/8	AN442AD4	18	3/8	1/4	11/32
K1298	3 7/16	.051	3/16	AN442AD5	14	15/32	5/16	7/16
K5009	4 3/8	.064	3/16	AN442AD5	18	15/32	5/16	15/32
#K7781	5 1/4	.064	1/8	AN442AD6	18	9/16	3/8	15/32

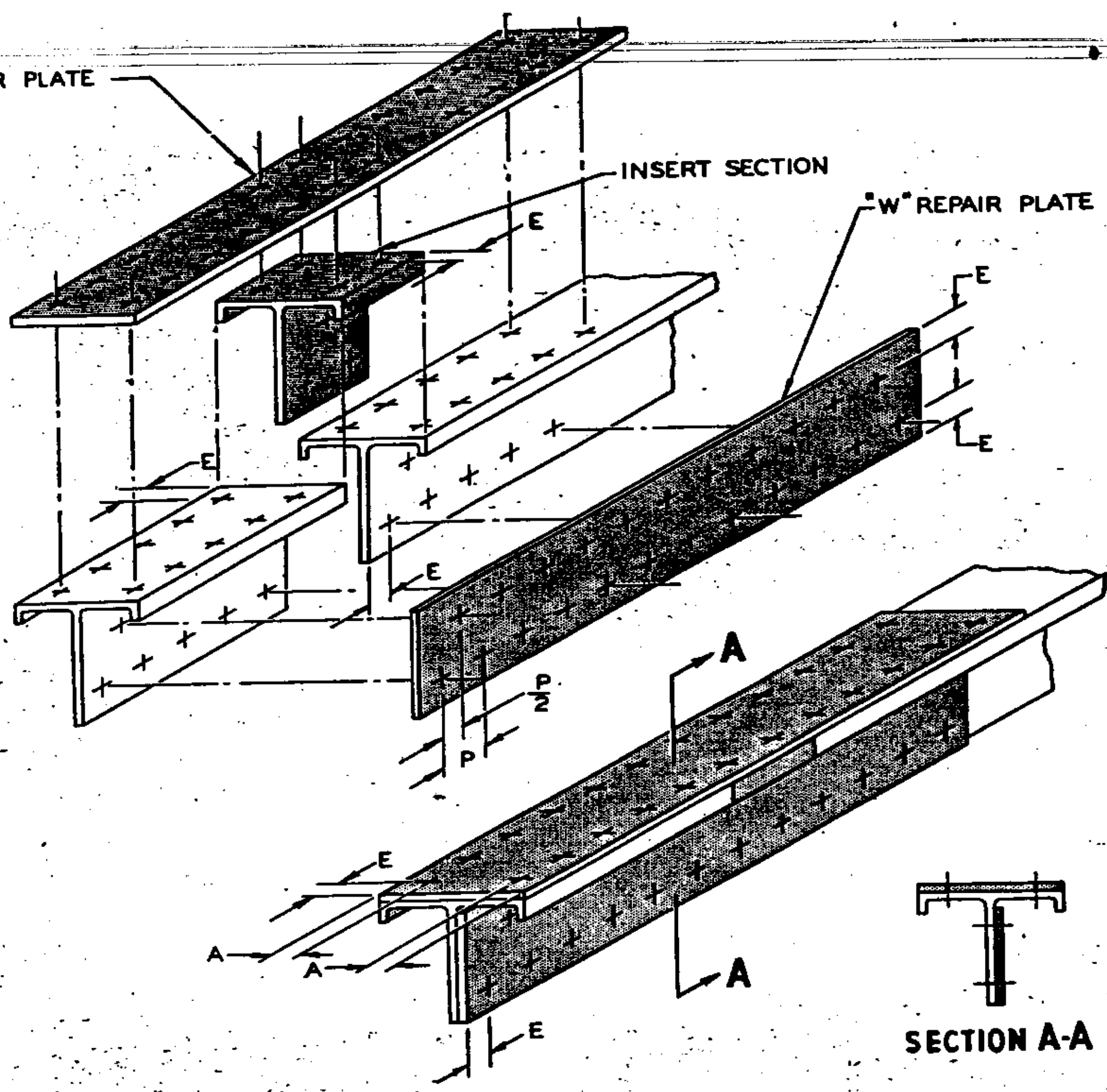
Figure B-3—Typical Repairs-Bulb Angles



ALL SPLICE MATERIAL TO BE 24ST AL. ALLOY.
FOR INSERT USE PIECE OF SAME EXTRUSION OR THE EQUIVALENT BENT UP SECTION GIVEN IN SECTION VIII.
FILE OFF LIPS OF EXTRUSION TO ALLOW FOR SPLICING.

EXTRUSION DIE NO.	SPLICE OVERLAP (O)	RIVET PATTERN TYPE	REPAIR ANGLES BEND RADIUS	RIVET	GAGE OF REPAIR ANGLES	NO. OF RIVETS EACH SIDE OF SPLICE	D	E	A	P
K 8669	3	B	1/4	AN442AD6	.064 x 7/8 x 1 7/16	FLANGES 9 WEB 7	1/2	3/8	1/2	9/16
K 9047	2 31/32	A	3/16	AN442AD5	.051 x 11/16 x 15/16	FLANGES 11 WEB 6	13/32	5/16	1/2	15/32
K 9048	2 1/2	A	3/16	AN442AD5	.051 x 9/16 x 13/16	FLANGES 9 WEB 5	3/8	5/16	7/16	15/32
K11824	3	B	1/4	AN442AD6	.064 x 7/8 x 1 7/16	FLANGES 9 WEB 7	1/2	3/8	1/2	9/16
K11270	3	A	3/16	AN442AD6	.064 x 13/16 x 1	FLANGES 9 WEB 5	1/2	3/8	9/16	9/16
K11886	1 5/8	A	1/8	AN442AD4	.040 x 1/2 x 1/2	FLANGES 7 WEB 4	5/16	1/4	5/16	3/8
K13686	2 1/2	A	5/32	AN442AD5	.051 x 11/16 x 15/16	FLANGES 9 WEB 5	3/8	5/16	1/2	15/32
K14040	2 1/2	A	3/16	AN442AD5	.051 x 9/16 x 13/16	FLANGES 9 WEB 5	3/8	5/16	7/16	15/32

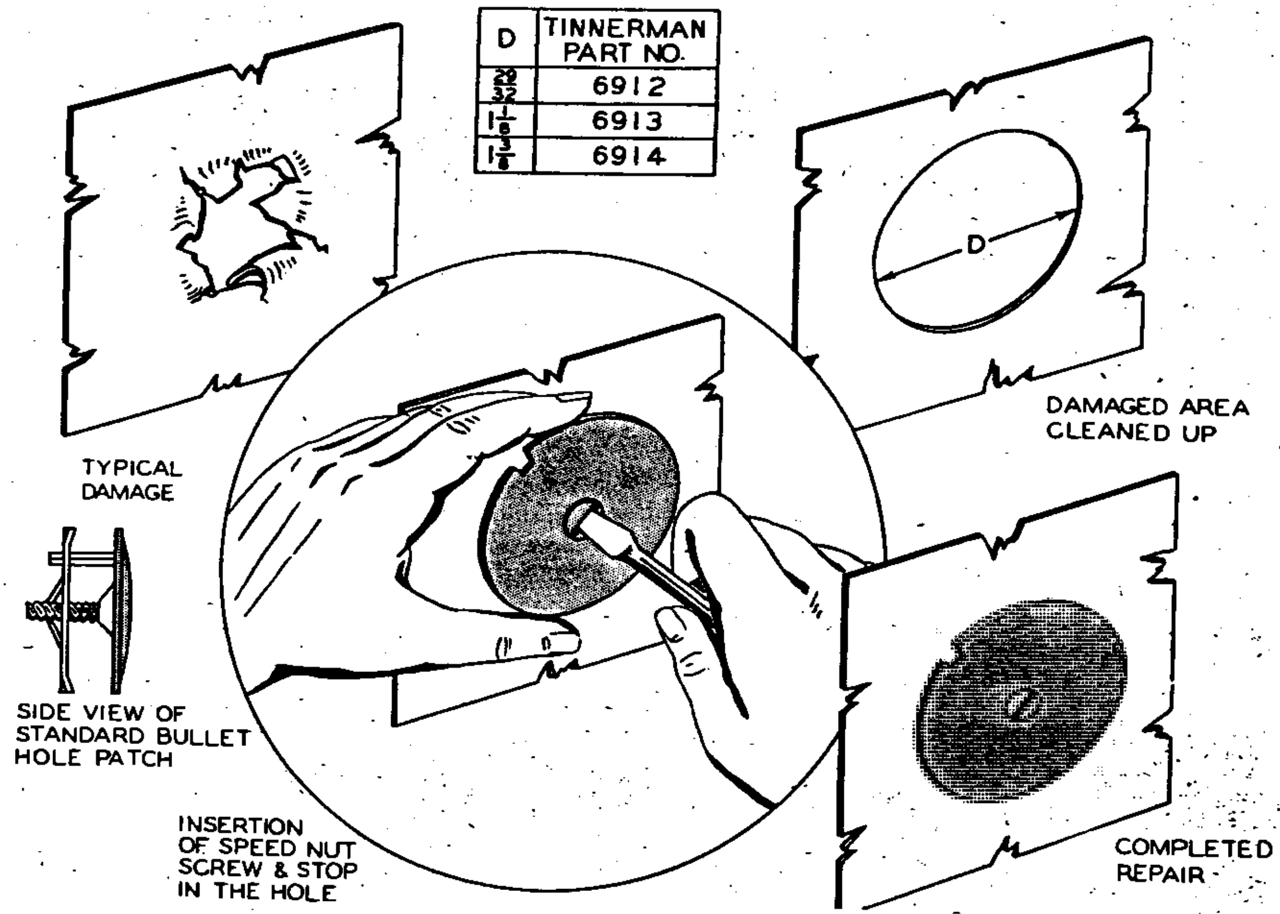
Figure B-4—Typical Repairs-Extruded Zee Sections



NOTES:
ALL SPLICE MATERIAL TO BE 24ST AL. ALLOY.
FOR INSERT USE PIECE OF SAME EXTRUSION AS THAT DAMAGED OR THE EQUIVALENT BENT UP SECTION GIVEN IN SECTION VIII

EXTRUSION DIE NUMBER	MINIMUM OVERLAP FOR "W" PLATE	MINIMUM OVERLAP FOR "F" PLATE	SIZE OF SPLICE PLATES "W" PLATE	SIZE OF SPLICE PLATES "F" PLATE	NUMBER RIVETS EACH SIDE OF SPLICE "W" PLATE	NUMBER RIVETS EACH SIDE OF SPLICE "F" PLATE	TYPE RIVETS	E	A	P
K12023	4 11/16	4 1/8	.091×2 3/8	.102×1 13/16	15	14	AN442AD6	3/8	1/2	9/16
K12024	4 11/16	4 11/16	.091×2 3/8	.102×2 3/8	15	16	AN442AD6	3/8	1/2	9/16
K11272	4 11/16	6 15/16	.091×2 3/8	.125×2 3/8	15	24	AN442AD6	3/8	1/2	9/16
K11407	4 11/16	8 5/8	.091×2 3/8	.156×2 7/8	15	30	AN442AD6	3/8	1/2	9/16
K2499	1 7/8	2 7/16	.072×1	.064×1 1/2	5	8	AN442AD6	3/8	3/8	9/16
K1172	4 1/8	6 15/16	.156×1 1/4	.156×2 1/4	13	24	AN442AD6	3/8	1/2	9/16

Figure B-5—Typical Repairs-Extruded Tee Sections



D	TINNERMAN PART NO.
$\frac{29}{32}$	6912
$1\frac{1}{8}$	6913
$1\frac{3}{8}$	6914

Figure B-6—Typical Bullet Patch Repair