Handbook of Structural Repair
PBY 5
Handbook of Structural Repair

for

NAVY MODELS
PBY-5 • PBY-5A • PBY-6A

ARMY MODEL
OA-10

Airplanes

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ARMY AIR FORCES, AND THE CHIEF OF THE BUREAU OF AERONAUTICS

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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.
SECTIOX 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-6A empennage has been redesigned for the PBY-6A to incorporate overhanging balances on the elevators and rudder 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 watertight compartments. Water loads are taken by the hull bottom to the bulkheads and reacted 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 ensure 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. Q4505 (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:

<table>
<thead>
<tr>
<th>Rivet</th>
<th>Acceptable Substitute</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN425</td>
<td>AN426 (in 100° hole)</td>
</tr>
<tr>
<td>AN426</td>
<td>AN425 (in 78° hole)</td>
</tr>
<tr>
<td>AN430</td>
<td>AN456</td>
</tr>
<tr>
<td>AN442</td>
<td>AN430, AN456</td>
</tr>
<tr>
<td>AN456</td>
<td>AN430</td>
</tr>
</tbody>
</table>

"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 9/32", 5/32" and 3/16" dia. rivets. For rivets less than 9/32" 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 9/4 inch diameter or larger should be of the heat-treatable (17S-T) type.

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 prodding 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 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 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
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 EXTRAUSIONS, 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 PADDLED WITH FELT AT POINTS OF CONTACT WITH THE HULL TO PREVENT SCORING. THE HULL CAN ALSO BE SUP
48. The control surfaces (ailerons, rudder and elevators) should be supported by jigs at the hinge points and trailing edges. (See figures 1-1, 1-2, and 1-3.)

49. LEVELING THE AIRPLANE.

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

51. The leveling lugs for longitudinal leveling are located on the port side of the airplane above the bunk and are attached to belt frame 5.50 and 5.75 on PBY-6 airplanes and belt frames 5.25 and 5.75 on PBY-5A.

52. CLASSIFICATION OF DAMAGE.

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.

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.

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 metal slightly larger than the cleaned up damaged area, riveted to the undamaged skin. (See figure 1-5.) A patch on an extrusion...
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 part. (See figure 1-5.) Patches should be designed to utilize 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 always 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 out of balance and it will be necessary to add a counterweight. After any repair which necessitates removing the surfaces from the airplane, check the static balance.
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 aileron 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.
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 1-56 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

RESTRICTED

13
EXAMPLE

Assume the repair is made to the trailing edge of the 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.

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

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

20.0 - 18.7 = 1.3 lbs. excess of maximum allowable

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

Therefore 1.3 = .15 lbs. weight to be added.

8.5

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 surface is located on figure 1-8. There are certain 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 zipped 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.
Figure 1-10—Main Airplane Components

Index Nomenclature
1. Wing Group
2. Tail Group
3. Body Group
4. Alighting Gear
5. Engine & Nacelle

Section
II
III
IV
V
VI

Figure
2-1
3-1
4-1
5-1
6-1
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 4 1/2.” 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 tank. 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
2-19. FORMULAS FOR DETERMINING NEGLIGIBLE DAMAGE.

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

**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: \( 12A + 7A_1 + 2B + 8C + 9D \leq 60 \)

**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: \( 7A + 2B + B_1 \leq 10 \),

**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.
3. Access to Float Control Gear Box.
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.
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.
11A. Nacelle Fairing Access Doors.
12. Oil Filler Neck.
14B. Starboard Side Only: D-C Generator Junction Box.
15. Access to Junction Box.
17. Access to Oil Tank Attachment Points and Structural Inspection.
18. Fuel Tank Manhole.
20. Structural Inspection Door.
22. Manhole to Wing Splice.
25. Access to Aileron Bell Crank.
27. Access to Aileron Hinges.
30. Port Side Only: Access to Aileron Tab Linkage, Tab Gear Box, and Sprocket.
31. Access to Aileron Tab Chain-to-Cable Bolt Connections.
33. Access to Aileron Controls.
34. Access to Trailing Edge Splicing.
35. Starboard Side Only: Attachment of Aileron Cut-Out to Stubby Trailing Edge.
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.
46. For Structural Inspection.
46A. 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.
64. Access to Bomb Rack MK 51-7.
65. Access to Bomb Nose and Tail Fusing.
69. Sight Gage Inspection Access Doors.
70. 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.
NOTE:

- INTERSPAR LOWER STRINGERS FROM STA. 1 TO STA. 14 ARE K11B24
- INTERSPAR UPPER STRINGERS FROM STA. 1 TO STA. 18 ARE K8669
- ALL OTHER INTERSPAR ZEEs ARE K9047
- THREE LEADING EDGE STRINGERS IMMEDIATELY FWOf FRONT SPAR ARE K9047 (CENTER SECTION)
- ALL OTHER LEADING EDGE STRINGERS ARE K9048

<table>
<thead>
<tr>
<th>ERETRUSION</th>
<th>MATERIAL</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K11B24</td>
<td>24ST AL ALLOY</td>
<td>1 2/3 x 1 3/16 x .062</td>
</tr>
<tr>
<td>K8669</td>
<td>24ST AL ALLOY</td>
<td>1 1/3 x 1 3/16 x .075</td>
</tr>
<tr>
<td>K9047</td>
<td>24ST AL ALLOY</td>
<td>1 x 1 3/16 x .050</td>
</tr>
<tr>
<td>K9048</td>
<td>24ST AL ALLOY</td>
<td>1/8 x 1/4 x .045</td>
</tr>
</tbody>
</table>

Figure 2-4—Wing Stringer Diagram
e. LOCATION: STATION 15-STATION 18
FORMULA: $5A + B + 4C + 8D \leq 42$
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: $10A + 2.5B + 11C \leq 100$
CODE: 
$A = $ Total Spar flange damage
$B = $ Total Skin damage
$C = $ Total number of upper and lower surface stringers completely damaged

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 $5A + B + 4C + 8D \leq 42$. 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 hole is cut the damage must be calculated as $7.25 + 8.531$ 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: $9.75 + 9.6875 = 8.719"$. 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: $8.719 + 7.89 + 5 = 21.609$. 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:
$5A + B + 4C + 8D \leq 42$
$5 \times 3/16 + 21.609 + 4 \times 1 + 8 \times 1 \leq 42$
$34 \leq 42$

Note
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 have to be 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.

---

Note
Figure 2-6—Stringer Nomenclature

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25
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 ensure 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 \( \frac{3}{16} \)" 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,
INSERT PLATE & BUTT SPLICE PLATE TO BE SAME GAGE OR ONE GAGE HEAVIER THAN DAMAGED SKIN

CUT AWAY DAMAGED SKIN HERE

PICK UP EXISTING RIVET HOLES.

NOTE:
IF REPAIR IS IN GAS TIGHT AREA, USE NEOPRENE FOR SEALING MATERIAL BETWEEN REPAIR PLATE & SKIN.

SEE FIG 2-6 FOR RIVET PATTERN AT BUTT SPLICE
ALL MATERIAL 24ST AL ALLOY

SECTION A-A

Figure 2-10—Wing Skin Insertion Repair
### Spar Verticals - Negligible Damage

<table>
<thead>
<tr>
<th>Wing Station</th>
<th>Front Spar</th>
<th>Rear Spar</th>
<th>Wing Station</th>
<th>Front Spar</th>
<th>Rear Spar</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 &amp; 3</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td>7 &amp; 8</td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>$A = \frac{3}{8}'' \text{ MAX} \leq$</td>
<td>$B + C = \frac{3}{4}'' \text{ MAX}$</td>
<td></td>
<td>$A + B = 1'' \text{ MAX}$</td>
<td>$C = \frac{1}{4}'' \text{ MAX}$</td>
</tr>
<tr>
<td>4 &amp; 4$\frac{1}{2}$</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
<td>9 &amp; 10</td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
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<tr>
<td></td>
<td>$A = \frac{1}{4}'' \text{ MAX}$</td>
<td></td>
<td></td>
<td>$A + B = 1'' \text{ MAX}$</td>
<td>$C + D = 1/2'' \text{ MAX}$</td>
</tr>
<tr>
<td>5</td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
<td>11</td>
<td><img src="image11" alt="Diagram" /></td>
<td><img src="image12" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>$A + B = 1'' \text{ MAX}$</td>
<td>$C + D = 1'' \text{ MAX}$</td>
<td></td>
<td>$A + B = \frac{3}{4}'' \text{ MAX}$</td>
<td>$C = \frac{3}{4}'' \text{ MAX}$</td>
</tr>
<tr>
<td>6</td>
<td><img src="image13" alt="Diagram" /></td>
<td><img src="image14" alt="Diagram" /></td>
<td>12</td>
<td><img src="image15" alt="Diagram" /></td>
<td><img src="image16" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>$A + B = \frac{3}{4}'' \text{ MAX}$</td>
<td>$C + D = \frac{3}{4}'' \text{ MAX}$</td>
<td></td>
<td>$A + B = 1'' \text{ MAX}$</td>
<td>$C = \frac{1}{4}'' \text{ MAX}$</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>WING STATION</th>
<th>FRONT SPAR</th>
<th>REAR SPAR</th>
<th>WING STATION</th>
<th>FRONT SPAR</th>
<th>REAR SPAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>13, 14, 15</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td>21</td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
<td></td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
</tr>
<tr>
<td>16, 17, 18</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
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<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
<tr>
<td>19</td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
<td>22 1/2</td>
<td><img src="image11" alt="Diagram" /></td>
<td><img src="image12" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
<td></td>
<td>C + A = 1&quot; MAX. B = 1/4&quot; MAX.</td>
<td>A + B = 1/8&quot; MAX. C = 1/4&quot; MAX.</td>
</tr>
<tr>
<td>20</td>
<td><img src="image13" alt="Diagram" /></td>
<td><img src="image14" alt="Diagram" /></td>
<td>23, 24, 25 1/2</td>
<td><img src="image15" alt="Diagram" /></td>
<td><img src="image16" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Shaded areas indicate negligible damage.

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

**RESTRICTED**
Figure 2-13—Spar Web Repair-Gas Tight Area
Figure 2-14—Typical Spar Web Repair
DAMAGE IN AREA OF FUEL TANK
FOR DAMAGE OF SPAR FLANGE IN GAS TANK IN AREA WHERE SPAR FLANGE IS REINFORCED, EXTEND LENGTH OF SPICE TO SPICE ALL ANGLES AS SHOWN IN SHEETS 3 AND 4 OF THIS FIGURE.

SECTION A-A

SPAR WEB
\frac{1}{2} NEOPRENE
\frac{1}{2} NEOPRENE
\angle NEOPRENE
\angle NEOPRENE
\angle SPICE ANGLE
\angle NEOPRENE
\angle NEOPRENE

REPAIR ANGLE
PLATE
NEOPRENE
NEOPRENE
NEOPRENE
REPAIR PLATE
WING SKIN

NOTES:
REPAIR PARTS TO BE MADE LONG ENOUGH TO PICK UP NUMBER OF RIVETS SHOWN
\(\bullet\) AN442-AD5 - PICK UP EXISTING HOLES
\(\bullet\) AN430-AD5 - PICK UP EXISTING HOLES
\(\square\) AN430-AD9 - PICK UP EXISTING HOLES
\(\bullet\) AN442-AD6 - ADD
\(\bullet\) AN430-AD6 - ADD
\(\bullet\) AN430-AD5 - ADD

EXISTING RIVETS - NOT REMOVED

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

NOTES:
MATERIAL FOR ALL ANGLES 2450 AL ALLOY—HEAT TREAT TO 24ST AFTER FORMING
MATERIAL FOR ALL PLATES & FILLERS 24ST AL ALLOY
BEND RADI FOR ANGLES
NOTES:
+ PICK UP EXISTING AN442AD6 RIVETS
○ ADD AN442AD6 RIVETS
☐ PICK UP EXISTING AN456AD6 RIVETS
○ ADD AN456AD6 RIVETS
★ PICK UP EXISTING AN456AD5 RIVETS
★ ADD AN456AD5 RIVETS
* EXISTING RIVETS
LOCATE ADDITIONAL RIVETS APPROX. AS SHOWN

Figure 2-15 (Sheet 4 of 4 Sheets)—Spar Flange Repair
<table>
<thead>
<tr>
<th>Bulkhead Nos.</th>
<th>Upper Rail</th>
<th>Lower Rail</th>
<th>Zee Members</th>
<th>Angle Members</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Same as for Upper Rail</td>
<td>Nick &amp; Dents less than 1/8&quot; deep allowed in middle half of member-up to 1/4&quot; deep in ends of members</td>
<td></td>
<td>No damage to web can be considered negligible except small shallow dents.</td>
</tr>
<tr>
<td>2</td>
<td>1/2 Max.</td>
<td></td>
<td>Total damage at any one point must be less than 3/8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Maximum of 1/2&quot; nicks to each leg of Z, angle permitted</td>
<td>Same as for Blk'H'd. No. 2</td>
<td>Same as for Blk'H'd. No. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4, 4½</td>
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<td>Same as for Blk'H'd. No. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Same as for upper rail</td>
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</tbody>
</table>

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

RESTRICTED
<table>
<thead>
<tr>
<th>Block Nos.</th>
<th>Upper Rail</th>
<th>Lower Rail</th>
<th>ZCE Members</th>
<th>Angle Members</th>
<th>Remarks</th>
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</thead>
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<tr>
<td>7 &amp; 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WELD: DAMAGE BETWEEN VERTICALS MAY BE CONSIDERED NEGLIGIBLE PROVIDED THE SUM OF THE MAJOR DIAMETERS OF THE CLEANED UP HOLES IN THAT RAY DOES NOT EXCEED 4&quot;</td>
</tr>
<tr>
<td>9 &amp; 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WELD: THE SUM OF THE MAJOR DIAMETERS OF THE CLEANED UP HOLES MUST NOT EXCEED 5&quot;</td>
</tr>
<tr>
<td>11</td>
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</tr>
<tr>
<td>12-13</td>
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<td>14-15</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>A = (\frac{1}{4}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>UPPER WEB: 4&quot; DIA. HOLES BETWEEN VERTICALS MAY BE CONSIDERED NEGLIGIBLE. LOWER WEB: 1&quot; DIA. HOLES BETWEEN STIFFENERS. DOPED FABRIC PATCH OVER HOLES TO KEEP WATER FROM ENTERING WING.</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 &amp; 24</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>WEB: 2&quot; DIA HOLES BETWEEN VERTICALS MAY BE CONSIDERED NEGLIGIBLE.</td>
</tr>
<tr>
<td>25</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>WEB: HOLES BETWEEN VERTICALS WHOSE MAJOR DIAMETERS DO NOT TOTAL MORE THAN 4&quot; MAY BE CONSIDERED NEGLIGIBLE.</td>
</tr>
<tr>
<td>26</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>A = (\frac{1}{8}) MAX.</td>
<td>WEB: HOLES BETWEEN VERTICALS WHOSE MAJOR DIAMETERS DO NOT TOTAL MORE THAN 4&quot; MAY BE CONSIDERED NEGLIGIBLE. ADD FABRIC PATCH OVER ALL HOLES TO PREVENT WATER FROM ENTERING THE WING.</td>
</tr>
</tbody>
</table>

Shaded area represents damage.
Figure 2-17 (Sheet 2 of 2 Sheets)—Bulkhead and Skin Repair in Gas Tight Area
Figure 2-18—Bulkhead Web Patch
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 2EES AS SHOWN, USING THREE (3) AN442AD6 RIVETS ON EACH SIDE OF SPLICE SPACED AT APPROX. 3. ADD FILLERS AS SHOWN & SPLICE CHORD ANGLES WITH EIGHTEEN (18) AN442AD6 RIVETS ON EACH SIDE OF DAMAGED AREA. THE MIN. OVERLAP BEING 4.3. PICK UP STITCH RIVETS THRU VERTICAL LEGS OF CHORD ANGLES & ADD RIVETS BETWEEN TO MAKE PATTERN SHOWN.

O DENOTES AN442AD6 RIVETS.
● DENOTES AN442AD6
GENERAL NOTE:
A series of small holes, the sum of whose diameters do not exceed those given for the maximum hole sizes, may be permitted instead of one large hole.

5" DIA. HOLES BETWEEN RIBS PERMITTED PROVIDED THEY ARE AT LEAST 10" APART—CENTER TO CENTER, TO PRESERVE AIR FLOW OVER NECHELLE PATCH SKIN HOLES WITH .032 24ST ALUMINUM ALLOY PLATE RIVET WITH 2 Christy Rivets SPACED @ 1'O.C.

2.5" DIA. HOLE PERMITTED

NO DAMAGE TO GUSSET ALLOWABLE

NO DAMAGE TO ANY OF THE FOLLOWING MEMBERS MAY BE CONSIDERED NEGligible AB, AC, AD, DC, DE, EF.

1" DAMAGE TO ALL OTHER MEMBERS PERMITTED

Figure 2-20—Nacelle-Negligible Damage
Figure 2-21—Nacelle Skin Patch

RIVET NOTES
1. ALL RIVETS AN 456-AD5
2. MIN. EDGE DISTANCE 1/4
3. NORMAL EDGE DISTANCE 5/10
4. RIVET PITCH APPROX. 1" EXCEPT WHERE NOTED

RESTRIC TED
Figure 2-22—Nacelle Former Repair
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 1/4" of stiffener leg or 1/6" 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 gas tightening 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 Prestite 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.
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**

- **Detail A**
  - Rear struts may be bowed 1/2" max.
  - Front strut no bow permissible.

- **Center of strut**
  - Negligible damage limited to isolated dents
  - Smoothed out nicks not exceeding 1/2" in depth and 1/2" in length, except as shown below.

- **Isolated nicks and dents**
  - Not exceeding 1/8" in depth and 3/8" in length are permitted on both upper and lower fittings.

- **In this area, 40" on each end of strut**, negligible damage limited to dents
  - Smoothed out nicks not exceeding 1/2" in depth and 1/2" in length, except as shown below.

- **Dents not exceeding 1/2" in depth** permitted in 40" areas.

- **Section B-B**

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RESTRICTED

AN 01-5M-3
Figure 2-26—Wing Strut Fittings—Negligible Damage
LEADING EDGE SKIN
WING SKIN
FILLERS
FLAT LEG OF EXTRUSION
EXTRUSION CHANNEL
MICARTA
FRONT SPAR ANGLES
WING SKIN REINFORCEMENT
FRONT SPAR WEB

LEADING EDGE ATTACHMENT
AN 426-AD3 RIVETS & AN 960-A3L WASHERS

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 AN 365-D1032 NUT.

VIEW SHOWING THE ATTACHING STRIP WITH REPAIR SECTION INSTALLED

Figure 2-27—Leading Edge Attaching Strip Repair

RESTRICTED
ANCHOR NUT AC366DF632
RIVET AN426AD3
SUB-ASSEMBLE NUT PLATES TO RING BEFORE INSTALLATION.
FIT NUT PLATES TO SUIT CURVATURE OF SKIN

MAKE CUTOUT IN SKIN TO MATCH PATCH

{(APPROX) SPACING ALL AROUND

REINFORCEMENT PLATE 032 24ST. AL ALLOY

.025 AL. ALLOY PATCH

TRIM AS NECESSARY TO CLEAR STRINGER

NOTES:
- DENOTES AN456-AD4 RIVETS
- DENOTES AN526-D832 SCREWS
WHERE INTERIOR OF LEADING
EDGE IS ACCESSIBLE FOR
RIVETING, USE AN456-AD5
RIVETS INSTEAD OF NUT PLATES & SCREWS

SECTION A-A

Figure 2-28—Leading Edge Skin Repair

RESTRICTED
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 repair. 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 periphery 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 cananlizing 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.

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 ½” 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](image-url)
VIEW OF ASSEMBLED REPAIR

TRIM DAMAGED PORTION AS SHOWN A AN442AD4 RIVETS AT %" SPACING EACH SIDE OF DAMAGE

CHORD LINE

AN515-DD1032 SCREW AN365-D1032 NUT

HARDWOOD BLOCK

IF DIAGONALS ARE DAMAGED, REPLACE WITH CHANNEL OF SAME DIMENSIONS

OF SPAR

.032 24ST AL. ALLOY GUSSET DETAIL B

HARDWOOD BLOCK

CHORD LINE

VIEW SHOWING TYPICAL DAMAGE

HARDWOOD

FORMED 032 DURAL SPLICE CHANNEL

NOTE:

WHEN AN APPRECIABLE AMOUNT OF REPAIR WEIGHT IS ADDED, REBALANCE AILERON IN ACCORDANCE WITH PARAGRAPH 1-58 SECTION I.

REMOVE CRIMPED EDGES FROM RIB IN AREA TO BE REPAIRED.

SECTION A-A

Figure 2-30—Trailing Edge Rib Repair

RESTRICTED
NOTES:
1. DENOTES AN456AD4 RIVETS

REMOVE SUFFICIENT FABRIC FROM AROUND DAMAGED AREA TO BUCK RIVETS. REPLACE FABRIC IN ACCORDANCE WITH SECTION 13 OF THE GENERAL MANUAL FOR STRUCTURAL REPAIR (AN01-1A-1)

Figure 2-31—Formed Trailing Edge Repair
REPAIR PROCEDURE FOR HOLES OVER 3 INCHES WIDE

TRIM AWAY SKIN BETWEEN RIBS.
ATTACH REPAIR PLATE TO RIBS WITH CHERRY RIVETS NAF-1195-5A.
USE ORIGINAL RIVET SPACING.

CUT PATCH PLATE WIDE ENOUGH TO OVERLAP RIBS 3/8 INCH.
PICK UP RIVETS AND PROVIDE STANDARD EDGE DISTANCE. CUT PATCH PLATE FROM .025 24ST AL. ALLOY PLATE TO SUIT-contour of nose section.

DRILL NO. 50 HOLE AT EACH END OF CRACK.

REPAIR PROCEDURE FOR SMALL HOLES OR CRACKS

DRILL NO. 50 STOP HOLES AT EXTREMITIES OF CRACKS.

CUT PATCH PLATE LARGE ENOUGH TO OVERLAP EXTREMITIES OF CRACK OR EDGE OF HOLE A SUFFICIENT DISTANCE TO ADD ONE ROW OF RIVETS ALL AROUND PATCH USING 1/4 INCH EDGE DISTANCE.
ATTACH REPAIR PLATE WITH CHERRY RIVETS NAF1195-4A. USE 3/4 RIVET SPACING.

VIEW OF COMPLETED REPAIR

0.025 24ST AL. ALLOY PATCH PLATE
125 24ST AL. ALLOY SHEET RADIUS PLATE

FOR SPACING OF RIVETS SEE FIGURE 2-6

FILE TO FIT FLUSH WITH \( \frac{3}{32} \) RADIUS.

125 24ST AL. ALLOY SHEET RADIUS PLATE

PICK UP ORIGINAL RIVET & BOLT PATTERN

J13652

FILLER SAME GAUGE AS ORIGINAL SKIN

NOTES & PROCEDURE
FOR TYPE OF DAMAGE AFFECTING BOTH CONTOUR SPlice ANGLES
CUT ANGLE HALFWAY BETWEEN ANY TWO STRINGERS (DEPENDING ON AMOUNT OF DAMAGE)
INSERT NEW PIECE CONTOUR SPlice ANGLE.
ADD SPlice PLATES AS SHOWN PICKING UP ALL RIVETS, THRU
CONTOUR SPlice ANGLE.
ADD 2 RADIUS PLATES LONG ENOUGH TO PICK UP 2
BOLTS OUTSIDE CUT, IF OUTER PANEL IS REMOVED, FLUSH RIVET
RADIUS PLATES TO CONTOUR ANGLE. IF STRINGER IS DAMAGED SEE
FIGURE B-4.
IF DAMAGE IS ON ONE SIDE ONLY
OUTER PANEL MAY BE REMOVED
AND SPlice PLATES NEED BE
INSTALLED ON ONE SIDE ONLY.
THIS TYPE OF REPAIR LIMITED TO
ONE EACH FOR UPPER & LOWER
SURFACE, REPLACE CONTOUR ANGLES
IF DAMAGED AFTER ONCE REPAIRED.

DENOTES AN4 BOLTS (ANS LOWER SURFACE)
DENOTES AN 23 CLEVIS BOLTS.
+ DENOTES REPAIR RIVETS SAME AS ORIGINAL.

SECTION A-A

Figure 2-33—Panel Splice Chord Angle Repair

RESTRICTED
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 zipper 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 ½" deep, and ¼" 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 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 ½" deep and ½" 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 1½" 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 ¾" nor holes more than ¾" 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.
2-90. DAMAGE NECESSITATING REPLACEMENT OF PARTS. The diagonal and vertical aileron bar 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 1/4” 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.
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.

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-monocque 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 passage way 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 pin 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 classified 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 and 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.
SUM OF HOLE DIAMETERS BETWEEN ANY TWO ADJACENT MEMBERS IN SHADED AREA NOT TO EXCEED 1".

SUM OF HOLE DIAMETERS BETWEEN ANY TWO ADJACENT MEMBERS IN SHADED AREA NOT TO EXCEED 1 1/2".

SMOOTHED OUT NICKS NOT EXCEEDING 1/16" IN DEPTH PERMITTED IN EACH LEG OF CHORDWISE MEMBERS OF ALL RIBS. NO DAMAGE PERMITTED TO GUSSETS.

VERTICAL & DIAGONAL MEMBERS—SMOOTHED OUT NICKS NOT EXCEEDING 3/16" IN DEPTH PERMITTED IN EACH LEG.

SPAR FLANGE & GUSSETS—SMOOTHED OUT NICKS NOT EXCEEDING 1/8" IN DEPTH PERMITTED IN EACH LEG.

NOTE: ABOVE DAMAGE IS NEGLIGIBLE PROVIDED RIVET EDGE DISTANCE IS NOT DECREASED TO LESS THAN 1/2 TIMES THE RIVET DIAMETER.

Figure 3-3—Horizontal Stabilizer—Negligible Damage (sheet 1 of 2)
SMOOTHED OUT NICKS NOT EXCEEDING 1/16" IN DEPTH ALLOWED IN THE CORNERS OR DENTS NOT EXCEEDING 1/16" IN DEPTH OR 4" IN LENGTH IN THE WEB.

SMOOTHED OUT NICKS NOT EXCEEDING 1/8" IN DEPTH ALLOWED IN THE FLANGES.

FORMULA METHOD FOR COMPUTING NEGIGIBLE DAMAGE TO SKIN AND STRINGERS

<table>
<thead>
<tr>
<th>STATION</th>
<th>&quot;A&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0 TO 5.0</td>
<td>0.6</td>
</tr>
<tr>
<td>5.0 TO 6.0</td>
<td>1.0</td>
</tr>
<tr>
<td>6.0 TO 7.0</td>
<td>1.3</td>
</tr>
<tr>
<td>7.0 TO 8.0</td>
<td>1.9</td>
</tr>
<tr>
<td>9.0 TO 10.0</td>
<td>1.5</td>
</tr>
<tr>
<td>10.0 TO 12.0</td>
<td>1.1</td>
</tr>
</tbody>
</table>

0.05N_x + 0.10N_x + 0.25L_x + 0.40L_x TO BE LESS THAN "A"

N_x = NUMBER OF DAMAGED LEADING EDGE STRINGERS
N_x = NUMBER OF DAMAGED MAIN STRINGERS
L_x = TOTAL CHORDWISE LENGTH IN INCHES OF DAMAGED UPPER SURFACE SKIN
L_x = 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: BETWEEN STATIONS 6.0 & 7.0.
METHOD: 0.05N_x + 0.10N_x + 0.25L_x + 0.40L_x TO BE LESS THAN 1.3
N_x = 2  N_x = 2  L_x = 2 + 1 + 3  L_x = 1.5
(0.05 x 2) + (0.10 x 2) + (0.25 x 3) + (0.40 x 1.5) = 4.55

SINCE 4.55 IS LESS THAN 1.3 THE DAMAGE IS CONSIDERED NEGIGIBLE, REMOVED.

IF FORMULA SUM HAD EXCEEDED 1.3, REPAIR WOULD BE NECESSARY.

NO DAMAGE TO STRINGER INBOARD OF STATION 4.0 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 NEGIGIBLE IF TWO ADJACENT STRINGERS ARE COMPLETELY DAMAGED.

DAMAGE TO SKIN MAY NOT BE CONSIDERED NEGIGIBLE 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_x = PARTIAL DAMAGE:

FOR MAIN STRINGERS L_x = 2 X PARTIAL DAMAGE.

STABILIZER TO HULL ATTACHING FITTINGS MAY CONTAIN SMOOTHED OUT NICKS PROVIDED THEY ARE AT LEAST 1/2 DIAMETERS FROM THE BOLT HOLES. NO DAMAGE 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, WHICHER ISA SMALLER. FAIRING MAY BE COMPLETELY REMOVED.
NEGLIGIBLE DAMAGE TO SPARS & RIBS IS SHOWN BY SHADEd AREAS. THIS AREA MAY BE COMPLETEly DAMAGED.

IF THE SUM OF DIAMETERS OF ALL HOLES IN ANY PANEL DOES NOT EXCEED 1/3 WIDTH OR HEIGHT OF THE PANEL WHETHER SMALLER, THE DAMAGE TO THE PANEL PLATING IS CONSIDERED NEGLIGIBLE. OUTSIDE LEADING EDGE SKIN MAY BE COMPLETELY DAMAGED IF HEAT ANTI-ICING SYSTEM IS NOT USED.

PBY-5A VERTICAL FIN SHOWN. PBY-6A VERTICAL FIN IS THE SAME EXCEPT THERE ARE NO MEMBERS ABOVE THIS POINT.

NOTE: A PANEL IS A PLATING AREA BOUND BY ADJACENT RIBS OR SPARS.

Figure 3-4—Vertical Stabilizer—Negligible Damage
Figure 3-5 (Sheet 1 of 2 Sheets)—Horizontal Stabilizer-Spar Repair

- 24ST AL ALLOY ANGLE INSERTS
- TYPICAL RIVET SPACING
- REPLACE THIS GUSSET
- REPLACE THESE MEMBERS
- 080 24ST AL ALLOY SHEET
- NEOPRENE ASBESTOS SHEET SEALING STRIP
- REPLACE THIS MEMBER
- REPLACE THIS MEMBER. DO NOT JUGLE.
- HEAT ANTICING RETAINER SKIN PATCH PLATE. IF HEAT ANTI-ICING IS NOT USED IT WILL NOT BE NECESSARY TO PATCH RETAINER SKIN.
- 1/8 RIVET SPACING 2 PLACES
- SECTION A-A

○ INDICATES AN436AD8 RIVETS
● INDICATES AN442A06 RIVETS
○ INDICATES AN442A04 RIVETS

PICK UP NINE RIVETS ON EACH SIDE OF DAMAGE THRU SPICE PLATES.
24ST AL. ALLOY SHEET INSERT ANGLES

0.02 24ST AL. ALLOY SHEET INSERT

REPLACE THESE MEMBERS

0.025 24ST AL. ALLOY SHEET WEB SPICE PLATE. SEE FIGURE 4-6 FOR DETAILS OF RIVET PATTERN, ETC.

0.080 24ST AL. ALLOY SHEET

1/2 RADIUS

TYPICAL RIVET SPACING

5/6 TYP RIVET EDGE DISTANCE

REPLACE THESE MEMBERS

USE FILLERS HERE

SECTION A-A

NOTES:

O INDICATES AN442A04 RIVETS.
O INDICATES AN442A05 RIVETS.
PICK UP EXISTING RIVETS HOLE WHERE POSSIBLE.
Figure 3-6—Vertical Stabilizer Spar Repair

NOTES:
• DENOTES AN442 AD6 RIVETS.
ALL REPAIR MATERIALS 040 24ST AL. ALLOY.
Figure 3.7—Beaded Lightning Hole Repair

RESTRICTED
Figure 3-B—Typical Hydropress Flange Repair

<table>
<thead>
<tr>
<th>SHEET GAUGE</th>
<th>RIVET SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>.020</td>
<td>AN442AD4</td>
</tr>
<tr>
<td>.025</td>
<td>AN442AD4</td>
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<tr>
<td>.032</td>
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<tr>
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<tr>
<td>.064</td>
<td>AN442AD6</td>
</tr>
<tr>
<td>.072</td>
<td>AN442AD6</td>
</tr>
</tbody>
</table>

REPAIR ANGLE SAME GAGE AS DAMAGE MEMBER

DRILL #40 STOP HOLE BOTH ENDS

CRACKED FLANGE

CRACKED FLANGE

DAMAGED FLANGE

RIVETS THROUGH DAMAGE
ALLOWABLE SPAR DAMAGE—95°-131° FROM C:
BAYS WITHOUT LIGHTENING HOLES ARE ALLOWED A 3° DIAM. HOLE IN BAYS WITH LIGHTENING HOLES ONLY NICKS AND DENTS 1/4" LONG ARE ALLOWED. THE SPAR FLANGES MUST NOT CONTAIN NICKS & CUTS EXCEEDING 1/8" IN DEPTH.

DENTS NOT OVER 1/8" DEEP & 2" LONG, CRACKS AND NICKS NOT OVER 1/8" LONG IS NEGLIGIBLE DAMAGE ANY PLACE ON TRAILING EDGE Ribs. CRACKS UP TO 1" LONG IF STOP DRILLED ALLOWED IN ANY TWO MEMBERS OF A TRUSS Framework. ALLOWED IF IT CAN BE STRAIGHTENED WITHOUT EXCEEDING ALLOWABLE CRACKING.

ALLOWABLE FRONT SPAR DAMAGE 29°-71° FROM C:
FRONT SPAR WEB MAY HAVE HOLES EQUAL IN SIZE TO LIGHTENING HOLE IN REAR SPAR AT SAME BAY. THREE SUCH HOLES ALLOWED PROVIDING THEY ARE NOT IN ADJACENT BAYS. IN ADDITION TO ABOVE, SMALL HOLES THE SUM OF WHOSE DIAMETERS DOES NOT EXCEED 1" ARE ALSO PERMITTED AS NEGLIGIBLE DAMAGE IN FRONT SPAR.

IN NOSE SKIN EXCEPTING SHADOWED AREAS DENTS APPROX. 4" IN DIA. AND 1/2" DEEP. 1/2" LONG CRACKS OR 1 1/2" DIA. HOLES NOT CLOSER THAN 10" FROM EACH OTHERS IS CLASSED AS NEGLIGIBLE DAMAGE.

NOTE:
A 1" DIA OR LARGER HOLE IN NOSE SKIN IS NOT NEGLIGIBLE IF IT OCCURS IN SAME BAY WITH A DAMAGE HOLE OR LIGHTENING HOLE IN FRONT SPAR.

IN EACH OF TWO AREAS, ONE 29°-71° AND THE OTHER 95°-31° FROM C. 2 NOSE Ribs, IF NOT ADJACENT, MAY BE COMPLETELY DAMAGED. CUTS, NICKS & HOLES NOT OVER 1/4" LENGTH IS PERMITTED IN ALL NOSE Ribs IN THESE AREAS.

NO DAMAGE PERMITTED TO NOSE SKIN NOSE Ribs, OR SPARS IN SHADOWED AREAS.

ALLOWABLE REAR SPAR DAMAGE 29°-71° FROM C:
1/8" DEEP NICKS & CUTS ALLOWED IN UPPER AND LOWER SPAR ANGLES AND IN STIFFENER ANGLES ONLY.

Figure 3-9—Elevator—Negligible Damage
SECTION C-C

SPAR-DENTS 1/8" IN DEPTH IN WEB AND NICKS OR CUTS 1/4 IN LENGTH ON THE FLANGES, NICKS, AND CUTS 3/16" IN LENGTH ON LIGHTENING HOLE FLANGES.

LEADING EDGE SKIN - HOLES UP TO 1/2" IN DIAM. WITH A TOTAL HOLE DIAM. SUMMATION OF 1/2" PER SKIN PANEL. HOLES NOT TO BE CLOSER THAN 1" TO RIBS.

SECTION A-A

TRAILING EDGE AND LEADING EDGE RIBS - DENTS 1/4" IN DEPTH, 1/4" DIA. HOLES AT 1" SPACING. HOLES AND DENTS TO BE 1" FROM LIGHTENING HOLES, BEADS, AND FLANGES. 1/4" NICKS AND CUTS ON FLANGES.
3/16" NICKS AND CUTS ON LIGHTENING HOLE FLANGES.

SECTION B-B

TRAILING EDGE - DENTS 1/4" IN DEPTH, NICKS OR CUTS 1/4" IN LENGTH, DENTS, CUTS AND NICKS NOT CLOSER THAN 1/2" TO LIGHTENING HOLE. NICKS AND CUTS 3/16" IN LENGTH ON LIGHTENING HOLE FLANGES.

TIP SKIN - HOLE OR SUMMATION OF HOLE DIAMETERS NOT TO EXCEED 1/3 OF THE SMALLEST DIMENSION ON ANY SKIN PANEL.

NOTES:
PBY-6A NEGligible DAMAGE is IDENTICAL TO PBY-5A NEGligible DAMAGE EXCEPT AS SHOWN AT LEFT. DENTS ARE NOT TO EXCEED 4 SQ. INCHES. A SKIN PANEL IS THE AREA OF SKIN BOUNDED BY ADJACENT RIBS OR SPARS.
NEGligible DAMAGE FOR ALL PLATING NOT MENTIONED ABOVE IS AS FOLLOWS: NICKS AND CUTS 1/4" IN LENGTH, DENTS 1/4" IN DEPTH. NICKS AND CUTS 1/4" IN LENGTH ON LIGHTENING HOLE FLANGES. STOP DRILL ENDS OF ALL CRACKS AND FILE SMOOTH ALL ROUGH EDGES.

Figure 3-10 - Rudder-Negligible Damage
Figure 3-12—Elevator Torque Tube Repair

NOTE: THE ABOVE REPAIR IS SATISFACTORY PROVIDED LESS THAN HALF OF THE CROSS SECTION AREA OF THE TORQUE TUBE IS DAMAGED. IF OVER HALF OF THE CROSS SECTION AREA OF THE TORQUE TUBE IS DAMAGED AFTER CLEANING UP IT MUST BE REPLACED.
NOTES:
THIS REPAIR APPLIES TO BOTH OPEN AND CLOSED TUBE RIB MEMBER
O INDICATES AN442AD4 RIVETS
ROUND THESE EDGES

SECTION A-A

CUT OPEN BOTTOM TO PERMIT RIVET BUCKING

.051 24ST AL AL. PLATE

24ST AL AL. CHANNEL INSERT GAGE TO BE SAME AS THAT OF DAMAGED RIB.

ORIGINAL RIB

Figure 3-13—Elevator Rib Repair
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 beltfrares 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 ball 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 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 1/8 inch in the corners. The ends of cracks should be stop drilled with a 1/4" 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 "see" sections made of 24ST aluminum alloy. Cutouts are provided in beltfrares 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 considered as negligible damage.

Note

Cracks in stringers are considered as negligible damage.
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 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 watertightness.

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, 4, 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 1/4 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.
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 1/4 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.

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

NO DAMAGE TO THE HULL BOTTOM STRINGERS IS NEGLIGIBLE EXCEPT 4" DEEP AND 1/2" 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 50% DAMAGED THAT IT IS INEFFECTIVE IN SUPPORTING THE SKIN HALF THE STRINGER MUST BE CONSIDERED LOST.

- TWICE THE PARTIAL DAMAGE TO A STRINGER (OF 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.

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

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

STRINGER SPACING: 5 1/2"

LOCATION: BETWEEN STA 3.33 & 3.66 N = 1 S = 3 5/8 = 8/4

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 1/4 THE SPACING (5/8") BETWEEN ADJACENT (GOOD) STRINGERS MUST BE USED IN THE FORMULA INSTEAD OF THE ACTUAL STRINGER DAMAGE (20")

** Note: All measurements are in inches.

<table>
<thead>
<tr>
<th>STA</th>
<th>FORMULAS</th>
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<tbody>
<tr>
<td>FWD</td>
<td>3.0</td>
</tr>
<tr>
<td>3.0 TO 3.33</td>
<td>3N + S = 45</td>
</tr>
<tr>
<td>3.33 TO 3.66</td>
<td>S = 43</td>
</tr>
<tr>
<td>3.66 TO 4.0</td>
<td>S = 3</td>
</tr>
<tr>
<td>4.0 TO 5.0</td>
<td>S = 10</td>
</tr>
<tr>
<td>5.0 TO 5.2</td>
<td>S = 3</td>
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<td>5.2 TO 5.5</td>
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</tr>
<tr>
<td>5.5 TO 6.0</td>
<td>3N + S = 45</td>
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<td>3N + S = 18</td>
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<td>7.0 TO 8.0</td>
<td>3N + S = 15</td>
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<tr>
<td>8.0 AFT</td>
<td>3N + S = 15</td>
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</table>

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

<table>
<thead>
<tr>
<th>Damaged Skin Gage</th>
<th>Repair Skin Gage</th>
<th>Rivet</th>
<th>E</th>
<th>P</th>
<th>D</th>
<th>No. of Rivet Rows E A S I D E</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.20 0.20</td>
<td>AN442AD4</td>
<td>0.020</td>
<td>3</td>
<td>36</td>
<td>3</td>
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<td>1.02</td>
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<tr>
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<td>AN442AD6</td>
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<td>3</td>
<td>36</td>
<td>3</td>
<td>2</td>
<td>1.25</td>
</tr>
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</table>

### Hull Skin Repair Rivet Table

<table>
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<tr>
<th>Damaged Repair Skin Gage</th>
<th>Rivet</th>
<th>E</th>
<th>P</th>
<th>D</th>
<th>No. of Rivet Rows E A S I D E</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
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<td>0.30 0.32</td>
<td>AN456AD4</td>
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<td>3</td>
<td>2</td>
</tr>
<tr>
<td>0.35 0.40</td>
<td>AN456AD4</td>
<td>0.35</td>
<td>3</td>
<td>36</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>0.40 0.40</td>
<td>AN456AD6</td>
<td>0.40</td>
<td>3</td>
<td>36</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>0.57 0.64</td>
<td>AN456AD8</td>
<td>0.57</td>
<td>3</td>
<td>36</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Notes:**

- As an alternate water seal, marine glue & fabric or 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.
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 figures 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 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.
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 Y38A11T.054 x 7/8
24ST AL. ALLOY SHEET WITH 1/4 FLANGES AND 3/8 LIPS

<table>
<thead>
<tr>
<th>SIZE</th>
<th>MATERIAL</th>
<th>SPECIFICATION</th>
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<tr>
<td>K9047</td>
<td>AL. ALLOY</td>
<td>QQ-A-354 (T)</td>
</tr>
<tr>
<td>K9048</td>
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<td>QQ-A-354 (T)</td>
</tr>
<tr>
<td>Y38A11T</td>
<td>AL. ALLOY</td>
<td>QQ-A-354 (T)</td>
</tr>
</tbody>
</table>

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 integrity or shallow dents without formation of cracks in 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.
NOTES:
0 INDICATES AN442AD4 RIVETS
O INDICATES AN442AD6 RIVETS
REPLACE DAMAGED BULKHEAD FITTING
WITH NEW ONE.
SEE FIGURE 4-6 FOR REPAIR OF DAMAGED
SKIN.
FILE OFF TIPS OF DAMAGED STRINGERS
TO ALLOW ROOM FOR SPlice ANGLES.
USE AN456AD4 IN PLACE OF AN442AD4
RIVETS FOR SPlice THRU SKIN.

TYP. EDGE DISTANCE
EXCEPT AS NOTED

INSERT TO BE SECTION
EQUIVALENT TO
DAMAGED STRINGER

243T AL. ALLOY
REPAIR ANGLES
SEE Fig. B-4

SKIN PATCH PLATE

SECTION A-A

USE SAME QUANTITY AND
TYPE OF RIVETS AS USED
IN ORIGINAL ATTACHMENT

Figure 4-8—Typical Hall Stringer Repair
Figure 4-9—Typical Chine Repair

Section A-A

NOTES

- MARINE GLUE AND FABRIC (OR EQUIVALENT) FOR WATER SEAL
- SKIN:
  - 24ST AL ALLOY SHEET
  - ANGLE GAUGE .054
- BOTTOM SKIN:
  - 24ST AL ALLOY SHEET
  - ANGLE GAUGE .054

- NOTES
  - DENOTES AN455AD6 RIVETS
  - TRIM CUT OUT AREA TO MAINTAIN RIVET SPACING
  - PICK UP ORIGINAL RIVET PATTERN WHERE POSSIBLE
  - SEE FIGURE 4-6 FOR DETAILS OF SKIN PATCH RIVETS AND RIVET SPACING
  - NO INSERT FOR INNER CHINE ANGLE TO BE USED
TRIM OUT DAMAGED AREA APPROX. AS SHOWN

AN 456 AD 6 RIVETS

NOTE:
INSERT FABRIC PACKING IN CORNER FOR WATERSEAL

SECTION A-A

072 24ST AL. ALLOY SHEET

NOTES:
TRIM OUT DAMAGED AREA TO MAINTAIN APPROX. 15/16 RIVET SPACING.
DENOTES AN 456 AD 6 RIVETS.
USE MARINE GLUE & FABRIC TO MAKE SEAMS WATERTIGHT.
TYPICAL EDGE DISTANCE 3/8 INCH.
PICK UP ALL EXISTING RIVETS WHEREVER POSSIBLE.

Figure 4-10—Hull Step Repair Station 5.0

RESTRICTED
3/32 TOTAL DAMAGE ALLOWED ON EDGES OF ALL ANGLES.

1/2 DIAMETER HOLES SPACED NOT CLOSER THAN 1" APART ALLOWED IN INTERCOSTALS.

TYPICAL FOR BELTFRAMES 7.25, 750, 775, 8.0, 8.33, § 8.66

3/32 TOTAL DAMAGE ALLOWED ON EDGES OF ALL ANGLES AND STIFFENERS.

HOLES NOT TO EXCEED 1" IN DIAMETER AND SPACED NO LESS THAN TWO DIAMETERS APART. HOLES SHOULD NOT EXTEND INTO ANGLES MORE THAN 3/32.

TYPICAL FOR BELTFRAMES 0.33, 0.66, § 9.5

Figure 4-11—Negligible Damage—Non-Hydropress Type Beltframes
1/4" HOLES SPACED NOT CLOSER THAN 4" APART, ALLOWED IN INTERCOSTALS.

1/4" TOTAL DAMAGE ALLOWED ON EACH LEG OF ANGLE OF DIAGONAL SIDE BRACES.

IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED "F".

IN THE MIDDLE "G" OF WEB IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED "H".

TOTAL DAMAGE ALLOWED IN THESE AREAS.

IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED "J".

SECTION Z-Z

NOTES:

IN UNSHADED AREAS AND BEADS NEGLECTIBLE DAMAGE IS LIMITED TO ISOLATED NICKS AND DENTS NOT EXCEEDING 1/8" 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 NEGLECTIBLE DAMAGE SIZE SHOWN IN TABLE REPAIRS MUST BE MADE.

<table>
<thead>
<tr>
<th>BELTFRAMES</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
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<td>***</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>

* 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".

Figure 4-12—Negligible Damage—Hydropress Type Beltframes

RESTRICTED
IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED 2".

SECTION B-B

SECTION A-A

NO DAMAGE ALLOWED TO BEADS.

IN EACH OF THESE AREAS THE SUM OF THE DIAMETERS OF ALL HOLES SHOULD NOT EXCEED 3".

IN THE MIDDLE 2" OF WEB THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED 1".

IN UNSHADED AREAS NEGLIGIBLE DAMAGE IS LIMITED TO ISOLATED NICKS AND DENTS NOT EXCEEDING 1/32" DEEP & 1/2" LONG.

Figure 4-13—Beltframe 4.1—Negligible Damage
NOTES:

NEGligible damage to any part of this member is limited to one of the following: see section C-C

Holes not exceeding $\frac{3}{4}$ inch in diameter, spaced at least two diameters apart in both the Cover plate and Top Flange.

Holes not exceeding $\frac{1}{4}$ inch in diameter spaced at least two diameters apart in the Cover plate.

Holes not exceeding $\frac{3}{4}$ inch in diameter, spaced at least two diameters apart through both Web Flanges and Web.

A combination of the above not exceeding $\frac{3}{4}$ inch.

No damage allowed to beads.

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 nég damage size shown in table, repairs must be made.

In this area the sum of the diameters of all holes between any two beads should not exceed 4 inches.

In this area negligible damage is limited to nicks and dents not exceeding $\frac{1}{2}$ inch in depth and $\frac{1}{2}$ inch in length.

$\frac{3}{4}$ inch holes spaced at least 2 inches apart allowed in intercostals.

Figure 4-14—Beltframe 4.2—Negligible Damage
IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED 3 INCHES.

TOTAL DAMAGE ALLOWED IN THESE AREAS. A & B NOT TO EXCEED 1/4 INCH.

IN THESE AREAS THE SUM OF THE DIAMETERS OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED 2 INCHES.

IN THE MIDDLE OF 2 INCHES OF WEB IN THIS AREA. THE SUM OF THE DIAMETER OF ALL HOLES BETWEEN ANY TWO BEADS SHOULD NOT EXCEED 1 INCH.

NOTES:
IN UNSHAD ED AREAS NEGIGIBLE DAMAGES LIMITED TO ISOLATED NICKS AND DENTS NOT EXCEEDING 1/32 INCH IN DEPTH AND 1/2 INCH IN LENGTH.
NO DAMAGE ALLOWED TO BEADS.
ALL CRACKS MUST BE CUT OUT TO GIVE SMOOTH ROUND HOLES OF A DIAMETER SLIGHTLY GREATER THAN THE LENGTH OF THE CRACK. IF THIS CLEANED UP HOLE EXCEEDS NEGIGIBLE DAMAGE SIZE SHOWN IN TABLE, REPAIRS MUST BE MADE.

Figure 4-15—Beltframe 4.3—Negligible Damage
NEGREGIBLE DAMAGE ALLOWED TO THESE ANGLES INCLUDES TOTAL DAMAGE TO ALL SHADED AREAS PLUS \( \frac{3}{8} \) INCH NICKS AND DENTS NOT EXTENDING ACROSS MORE THAN \( \frac{1}{4} \) INCH THE WIDTH OF THE MEMBER.

SECTION A-A

IN THESE WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED \( \frac{1}{4} \) INCHES.

IN THESE AREA NEGREGIBLE DAMAGE TO ANY STIFFENER INCLUDES \( \frac{3}{8} \) INCH TOTAL DAMAGE TO THE EDGE OF EACH LEG AND \( \frac{3}{8} \) INCH NICKS AND DENTS NOT EXTENDING ACROSS MORE THAN \( \frac{1}{4} \) INCH THE WIDTH OF THE MEMBER.

IN THESE WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED \( \frac{1}{4} \) INCHES.

IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES SHOULD NOT EXCEED \( \frac{1}{4} \) INCH.

TOTAL DAMAGE TO ALL SHADED AREAS ALLOWED.

NICKS AND DENTS \( \frac{3}{8} \) DEEP AND \( \frac{1}{4} \) IN LENGTH ALLOWED OVER THIS ENTIRE MEMBER.

TOTAL DAMAGE TO ALL SHADED AREAS ALLOWED.

Figure 4-16—Bulkhead 1-Negligible Damage

RESTRICTED
NEGLIGIBLE DAMAGE ALLOWED TO ALL ANGLES INCLUDES:

⅛ TOTAL DAMAGE TO EDGE OF EACH LEG.
⅛ NICKS AND DENTS NOT EXTENDING ACROSS MORE THAN ¼ THE WIDTH OF THE MEMBER.

IN THESE WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED ⅛ OF THE PANEL WIDTH.

IN THE AREAS BELOW THIS W.L. 41% A WATERTIGHT PATCH MUST BE INSTALLED OVER ALL HOLES.

W.L. 41%

NOTES:

THE WIDTH OF PANELS IS MEASURED BETWEEN THE RIVET LINES OF ADJACENT VERTICAL STIFFENERS.

IN THESE WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED ⅛ OF THE DIMENSION "A."
NEG Igible DAMAGE ALLOWED TO THESE ANGLE MEMBERS INCLUDES 1/8" TOTAL DAMAGE TO EDGE OF EACH LEG AND 1/32 NICKS & DENTS NOT EXTENDING ACROSS MORE THAN 1/4 THE WIDTH OF MEMBER.

DAMAGE TO INTERCOSTAL IS NOT TO EXCEED 1/2 THE WIDTH OF THE INTERCOSTAL WITH NOT MORE THAN 1/3 OF THE SKIN ATTACHING FLANGE DAMAGED.

WEB DAMAGE IN THIS AREA IS NOT TO EXCEED 1/3 THE WIDTH OF THE WEB.

IN THESE WEB AREAS NEGIGIBLE DAMAGE ALLOWED INCLUDES ONLY ONE OF THE FOLLOWING:

- TOTAL DAMAGE TO THE DIAGONAL STIFFENER PLUS HOLES WHOSE SUM OF DIAMETERS DOES NOT EXCEED 1/2".
- SUM OF THE DIAMETERS OF ALL HOLES NOT TO EXCEED 5".
- NO DAMAGE TO DIAGONALS.

IN THESE VERTICAL STIFFENERS TOTAL DAMAGE A & B (SEE SECTION A-A) NOT TO EXCEED 1/4" DAMAGE, C NOT TO EXCEED 1/4" IN ALL OTHER VERTICAL STIFFENERS, DAMAGE TO A & B NOT TO EXCEED 3/4" DAMAGE C NOT TO EXCEED 1/4" IN ALL VERTICAL STIFFENERS. 1/32" NICKS & DENTS NOT EXTENDING MORE THAN 1/4 ACROSS THE MEMBER ARE ALLOWED AS NEGIGIBLE.
UNDAMAGED MATERIAL AROUND, 7⁄8 DIA. HOLE MAY BE A MINIMUM OF 1⁄4" NICKS AND DENTS 1⁄4" DEEP ARE ALLOWED FOR THIS FITTING.

UNDAMAGED MATERIAL AROUND 1⁄4 DIA. HOLE MAY BE A MINIMUM OF 1⁄4" NICKS AND DENTS 1⁄4" DEEP ARE ALLOWED FOR THIS FITTING.

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

NICKS AND DENTS 1⁄4" DEEP AND 1⁄4" IN LENGTH ARE ALLOWED AS NEGLIGIBLE DAMAGE IN ANGLES AND TEE MEMBERS BETWEEN SUPERSTRUCTURE AND WING STRUT FITTING.

Figure 4-19-Bulkhead 4-Negligible Damage (sheet 1 of 2)
SECTION C-C
DAMAGE IN SHAD ED AREAS WHICH
LEAVES MINIMUM EDGE DISTANCE
FOR ALL RIVETS AND BOLTS (1\(\frac{1}{2}\) X
DIAMETER OF THE RIVET OR BOLT)
IS CONSIDERED NEGLIGIBLE.

SECTION D-D

SECTION E-E

SECTION F-F
NOTES:
MEMBERS FOR WHICH DAMAGE IS NOT SHOWN IN THE CROSS
SECTIONS MAY BE DAMAGED \(\frac{1}{8}\) INCH IN EACH LEG.

NEGLIGIBLE DAMAGE SHOWN IN SHAD ED 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 \(T'\) VALUES
GIVEN IN THE TABLE BELOW, THE DAMAGE IS
CONSIDERED NEGLIGIBLE.

<table>
<thead>
<tr>
<th>SECTIONS</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
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<td>see</td>
</tr>
<tr>
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<tr>
<td>CC</td>
<td>see</td>
<td>see</td>
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<td>DD</td>
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<td>1/8</td>
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<tr>
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<td>3/8</td>
</tr>
<tr>
<td>FF</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
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<tr>
<td>JJ</td>
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<td>1/4</td>
</tr>
<tr>
<td>KK</td>
<td>5/16</td>
<td>3/32</td>
</tr>
</tbody>
</table>

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 IN. ALONG THE Member.

SECTION A-A

SECTION B-B

SECTION C-C

FOR TEE SECTION, THE TOTAL SUM OF 'A' DIMENSIONS NOT TO EXCEED 5% PER TEE SECTION.

NICKS & DENTS IN THE ABOVE ZEE MEMBERS NOT TO EXCEED 1/8 INCH DEPTH.

Figure 4-20-Bulkhead E-Negligible Damage (sheet 1 of 2)
SECTION D-D
The total sum of 'A' dimensions
not to exceed $\frac{3}{4}''$ per angle

SECTION E-E
Shaded areas must
not exceed $\frac{1}{2}''$ each

SECTION F-F
Shaded areas must
not exceed $\frac{1}{2}''$ each

SECTION G-G
Shaded area in web must not exceed 1" dia., with holes spaced not closer than 3" apart.

SECTION H-H
$a + b + c + d + e + f + g + h + j = 1\frac{3}{4}''$ max.
Allowable negligible damage.

SECTION J-J
Shaded areas must not exceed $\frac{1}{8}''$ each flange of each angle

SECTION K-K
Shaded areas must not exceed $\frac{1}{8}''$ each

SECTION L-L

SECTION M-M
Nicks & dents not to exceed $\frac{1}{8}''$ in depth & $\frac{3}{8}''$ in length allowed.
IN THIS AREA THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED 3".

NEGLIGIBLE DAMAGE TO ALL ANGLES EXCEPT AS NOTED INCLUDES:

\( \frac{1}{16} \) TOTAL DAMAGE TO EDGE OF EACH LEG.

\( \frac{1}{16} \) NICKS AND DENTS NOT EXTENDING MORE THAN \( \frac{1}{4} \) ACROSS THE MEMBER.

THE SUM OF THE CROSS-SECTION DAMAGE OF EACH ZEE SHOULD NOT EXCEED \( \frac{1}{2} \).

IN THESE WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED \( \frac{1}{4} \) OF THE PANEL WIDTH.

DAMAGE TO THESE MEMBERS IS LIMITED TO NICKS AND DENTS NOT MORE THAN \( \frac{1}{32} \) IN DEPTH AND NOT MORE THAN \( \frac{1}{4} \) ACROSS THE MEMBER.

IN THESE WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL SHOULD NOT EXCEED \( \frac{1}{2} \) THE SPACE BETWEEN TWO VERTICAL STIFFENERS BORDERING THE PANEL.

NOTE:
WIDTH OF PANELS IS MEASURED BETWEEN THE RIVET LINES OF ADJACENT STIFFENERS

Figure 4-21—Bulkheads 6 and 7—Negligible Damage
DAMAGE TO INTERCOSTALS IS NOT TO EXCEED $\frac{1}{2}$ THE WIDTH OF THE INTERCOSTAL WIDTH AND NOT LESS THAN 3 DIAMETERS APART.

NEGLIGIBLE DAMAGE ALLOWED TO ANY ANGLE MEMBER INCLUDES $\frac{3}{32}$ IN. TOTAL DAMAGE TO EDGE OF EACH LEG AND $\frac{1}{8}$ IN. NICKS AND DENTS NOT EXTENDING ACROSS MORE THAN $\frac{1}{4}$ OF THE WIDTH OF THE MEMBER.

IN WEB AREAS THE SUM OF THE DIAMETERS OF ALL HOLES IN ANY PANEL IS NOT TO EXCEED 2 IN.

NOTE: A PANEL IS CONSIDERED TO BE ANY WEB AREA BOUNDED BY TWO ADJACENT ANGLE STIFFENERS.
Figure 4-23—Vertical Stabilizer Frames-Negligible Damage
NOTES:
THIS REPAIR IS DESIGNED TO PICK UP EXISTING RIVET HOLES.

DENOTES AN442AD6 RIVETS.
TRIM DAMAGED AREA TO MAINTAIN 1" RIVET SPACING.

125 24ST AL. ALLOY SHEET INSERT

INSERT ANGLE TO BE EQUIVALENT TO DAMAGED ANGLE
FILE TO FIT RADIUS (SEE SECTION A-A)

091 24ST AL. ALLOY SHEET INSERT

125 24ST AL. ALLOY SHEET

0.07 24ST AL. ALLOY SHEET

SECTION A-A

Figure 4-24 (Sheet 1 of 2 Sheets) - Bulkhead 1 Repairs
LIMIT OF CUTBACK FOR \( \frac{3}{4} \) PLATE

OR ANGLE INSERT SIMILAR TO ORIGINAL ANGLE

EXISTING ZINC CHROMATE TAPE

.064 24ST AL ALLOY SHEET SPlice ANgle

MARINE GLUE & FABRIC OR EQUIVALENT FOR WATER SEAL

.064 24ST AL ALLOY SHEET FILLERS

125 24ST AL ALLOY SHEET SPICE PLATES

TYPICAL EDGE DISTANCE FOR RIVETS

BULKHEAD WEB

HULL BOTTOM SKIN

SECTION A-A

NOTES:
CLEAN UP DAMAGED AREA TO PROVIDE PROPER WIDTH FOR RIVET SPACING
PICK UP ORIGINAL RIVET PATTERN WHERE POSSIBLE
● DENOTES AN442D8 RIVETS
○ DENOTES AN442AD6 RIVETS
FOR REPAIR OF BULKHEAD WEB AND HULL SKIN SEE FIG. 4-6

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
064 x 2\(\frac{3}{4}\) x 2\(\frac{3}{4}\) 245T AL ALLOY ANGLE
PLACE ANGLE APPROXIMATELY AT
LOCATION OF DAMAGED BEAD

CLEAN UP DAMAGED AREA
TO PROVIDE PROPER WIDTH
FOR 3/4 RIVET SPACING

064 245T AL ALLOY SHEET
051 X 1/16 X 1/8 ANGLE
245T AL ALLOY SHEET

1/2 TYPICAL

TYPICAL EDGE DISTANCE
FOR AN442D8 RIVETS.

SECTION A-A

- NOTES:
○ DENOTES AN442AD6 RIVETS
★ DENOTES AN442D8 RIVETS

MAX DISTANCE ALLOWABLE
WITHOUT INSERT

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

RESTRICTED
Figure 4-27 – Repair for Beltframes 3.33 & 3.66
INSERT SECTIONS TO BE SAME AS DAMAGED SECTIONS OR EQUIVALENTS WITH THE EXCEPTION THAT UPS ON TOP FLANGE MAY BE REMOVED. CLEAN UP DAMAGED AREA TO PROVIDE PROPER WIDTH FOR RIVET SPACING.

.091 24ST AL. ALLOY SHEET

072 24ST AL. ALLOY SHEET FILE TO FIT RADIUS

SECTION A-A

NOTES:

<> DENOTES AN442-AD5 RIVETS

O DENOTES AN442-AD6 RIVETS

REPAIR TO DAMAGED MEMBERS ON OPPOSITE SIDE OF BULKHEAD IS SIMILAR TO ABOVE

WEB PATCH SEE FIGURE 4-6

TYPICAL EDGE DISTANCE

TYPICAL RIVET SPACING

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

NOTES:
- $\diamond$ denotes AN442AD6 rivets.
- ○ denotes AN442AD6 rivets.
- All material .072 24st aluminum alloy.
- For patching of hull skin & bulkhead web.
- See Figure 4-6.
Figure 4-29 (Sheet 2 of 2 Sheets)  Beltframe 4.2 Repairs

NOTES:
1. ☐ DENOTES AN442 AD 6 RIVETS
2. TRIM CUT OUT AREA TO MAINTAIN 9/16 RIVET SPACING
EXTRUDED TEE SECTION OR EQUIVALENT INSERT EXCEPT LIPS MAY BE FILED OFF

0.64 x 0.5 x 1.245 ALLOY SHEET ANGLE INSERT

0.051 24ST. ALLOY SHEET INSERT

0.064 24ST. ALLOY SHEET

0.091 24ST. AL. ALLOY SHEET

0.051 24ST. ALLOY SHEET INSERT

125 24ST. AL ALLOY SHEET, FILE TO FIT RADIUS.

WEB INSERT BULKHEAD WEB

WEB PATCH PLATE

SECTION A-A

NOTES:
O DENOTES AN442AD6 RIVETS.
TRIM DAMAGED AREA TO MAINTAIN 3/8 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

RESTRICTED
The sum of hole diameters is not to exceed 1/4" in this area.

Note: All holes in web of keel between STA. 1.0 & 2.0 must be patched with watertight patch.

Twin keel STA. 1.0-2.0

1/2 inch damage allowed on all side angles except as noted.

Damage neg. if not longer than 8 inches.

1/8 inch max. allowable damage in web between stiffeners if non-structural watertight patch is used.

Keel truss STA. 2.0-4.0

Note: Damage to all gussets limited to 1/4" nicks on edge providing rivet edge distance is maintained.

No damage is negligible if it leaves rivets with less than 1/2 rivet diameters edge distance.

Keel truss STA. 4.0-6.0

Notes:
- In this area the sum of hole diameters in any panel is not to exceed 1/3 the distance between vertical stiffeners.

2 inch hole diameter damage allowed in this area
4 inch hole diameter damage allowed in this area
6 inch hole diameter damage allowed in this area
1/2 inch hole diameter damage allowed in this area

A panel is defined as a web area bounded by adjacent vertical stiffeners.

Section IV

Figure 4-31—Keel—Negligible Damage (sheet 1 of 2)
0.064 24ST AL ALLOY SHEET
INSERT, SPLICE TO HULL
SKIN BOTTOM, SEE FIGURE 4-6
FOR DETAILS

CLEAN UP DAMAGED
AREA TO PROVIDE
FOR 3/4 RIVET
SPACING AND
PATCHING OF
HULL SKIN AND
KEEL WEB

0.025 24ST AL ALLOY SHEET
INSERT, SPLICE TO KEEL
WEB, SEE FIGURE 4-6
FOR DETAILS

0.091 x 1 x 1 24ST
AL ALLOY SHEET
ANGLE INSERT

0.102 x 1 x 1 24ST
AL ALLOY SHEET
CHANNEL INSERT

WATER SEAL THIS
AREA WITH MARINE
GLUE AND FABRIC

AN442 AD6 RIVETS
4 EACH SIDE OF DAMAGE

TYPICAL RIVET
SPACING EXCEPT
AS NOTED

TYPICAL EDGE DISTANCE

0.091 24ST AL ALLOY
SHEET CHANNEL

SECTION
A-A

0.102 x 1 x 1
24ST AL ALLOY
SHEET ANGLE

A

PICK UP ORIGINAL RIVET
PATTERN THROUGH HULL
BOTTOM SKIN

* DENOTES AN456 AD5 RIVETS

O DENOTES AN442 AD6 RIVETS
USE MARINE GLUE AND FABRIC BETWEEN
REPAIR CHANNEL AND DAMAGED MEMBERS
FOR A WATER SEAL

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

RESTRICTED

121
3/8 TYPICAL RIVET EDGE DISTANCE

102 24ST AL ALLOY SHEET
081 24ST AL ALLOY SHEET FILLER
032 24ST AL ALLOY SHEET FILLER
WEB PATCH PLATE SEE FIGURE 4-6.

UNDAMAGED WEB

051 24ST AL ALLOY SHEET FILE TO FIT RADIUS
051 24ST AL ALLOY SHEET ANGLE
102 24ST AL ALLOY SHEET FILE TO FIT RADIUS
072 24ST AL ALLOY SHEET FILLER
081 24ST AL ALLOY SHEET FILLER
025 24ST AL ALLOY SHEET WEB FILLER

WEB PATCH PLATE SEE FIGURE 4-6.
UNDAMAGED WEB

SECTION B-B
FILE TO FIT RADIUS
WEB
SECTION A-A
A
B

SEAL THIS AREA WITH A TAPERED ALUMINUM PLUG AT EACH END

○ INDICATES AN442AD6 RIVETS. USE MARINE GLUE AND FABRIC BETWEEN 051 SPICE ANGLE AND DAMAGED ANGLE AND ALSO UNDER WEB PATCHES FOR A WATER SEAL. PICK UP ORIGINAL RIVET HOLES WHERE POSSIBLE.

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

RESTRICTED
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 50 & 70.
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
- 6 INDICATES AN456AD6 RIVETS
- 8 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 4-34—Main Wheel Well Enclosure—Negligible Damage**

**NOTES:**

IN SECTION 76SHAD ED AREAS SHOW ALL NEGLIGIBLE DAMAGE ALLOWED IN ADDITION TO \( \frac{1}{8} \) NICKS AND DENTS NOT EXCEEDING \( \frac{1}{2} " \) LONG AND AT LEAST 1" APART.

ALL NICKS, HOLES AND DAMAGED AREAS MUST BE FILED SMOOTH.
NOTES:

- INDICATES AN4 STEEL BOLTS AND AN365 NUTS FOR REPAIR OF SHEAR WEB, SEE FIGURE 4-6.

- USE MARINE GLUE AND FABRIC TO MAKE WATERTIGHT SHEAR WEB REPAIR.

- BOLT SPACING TO BE STAGGERED

REAM HOLES .2500 ±.0005
DENOTES AN4 STEEL BOLTS, AN365-428 NUTS & AL INSULATING WASHERS.
REAM BOLT HOLES .250 ± .0005

USE MARINE GLUE AND FABRIC TO MAKE REPAIR WATER TIGHT.

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

1. DENOTES AN3 TYPE BOLTS
2. ALL REPAIR MATERIAL TO BE 24ST. AL. ALLOY SHEET.
3. MINIMUM EDGE DISTANCE FOR AN3 BOLTS 1/8
4. PICK UP EXISTING BOLT HOLES WHERE POSSIBLE.
5. TRIM CUTOUT AREA TO MAINTAIN 1/2" BOLT SPACING.
6. REAM BOLT HOLES 1900/10005

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

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AN 01-5M-3

RESTRICTED

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

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AN 01-5M-3
Section IV

- 187 24ST AL. ALLOY SHEET FILE TO FIT RADIUS
- 156 24ST AL. ALLOY SHEET INSERT
- 187 24ST AL. ALLOY SHEET

- 064 24ST AL. ALLOY SHEET FILLER
- 064 24ST AL. ALLOY SHEET FILLER

- 064 24ST AL. ALLOY SHEET SKIN FILLER
- 064 24ST AL. ALLOY SHEET FILLER

- 091 24ST AL. ALLOY SHEET ANGLE
- 3/8 EDGE DISTANCE FOR 1/8 RIVETS

SECTION A-A
- AN 456DB RIVETS 4 REQD EACH SIDE OF DAMAGE INBOARD SIDE OF SHEAR WEB ONLY
- DRIVE TWO AN 456AD6 RIVETS ON BOTH SIDES OF SHEAR WEB THRU CENTER OF SEAMS FOR WATER SEAL

NOTES:
- INDICATES AN 456AD6 RIVETS EXCEPT AS NOTED
- USE MARINE GLUE AND FABRIC OR EQUIVALENT FOR A WATER SEAL
- EDGE DISTANCE FOR AN 456DB RIVETS TO BE
250 24ST. AL. ALLOY SHEET.

INSERT TO BE SAME SECTION OR EQUIVALENT TO DAMAGED SECTION.

0.07 24ST. AL. ALLOY

FOR REPAIR OF SHEAR WEB SEE FIGURE 4-6.

SECTION A-A

NOTES:
- INDICATES AN4 STEEL BOLTS AN365 STEEL LOCK NUTS AND AN960 ALUMINUM INSULATING WASHERS
- ALL REPAIR MATERIAL TO BE 24ST. ALUMINUM. ALLOY.
- REAM BOLT HOLES TO 250 ± 0005

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

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

Index No. | Structure
--- | ---
1 | Actuating Cylinder
2 | 'Oleo' Shock Strut
3 | Fork and Foot Strut Assem
4 | Fork
5 | 'Oleo' Shock Strut
6 | "Ves" Strut
7 | Actuating Cylinder
8 | Main Strut
Figure 5-1 (Sheet 2 of 2 Sheets)—Main Alighting Gear Components

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<tr>
<th>Index No.</th>
<th>Structure</th>
<th>Figure No.</th>
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<tr>
<td>1.</td>
<td>Upper &quot;Vee&quot; Strut</td>
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<tr>
<td>2.</td>
<td>&quot;U&quot; Strut</td>
<td>5-7</td>
</tr>
<tr>
<td>3.</td>
<td>Drag Panel</td>
<td>5-5, 5-6</td>
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<tr>
<td>4.</td>
<td>Float</td>
<td>5-2, 5-3, 5-4</td>
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<tr>
<td>5.</td>
<td>Lower &quot;Vee&quot; Strut</td>
<td>5-8</td>
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</tbody>
</table>
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.

5-5.1. GENERAL. Each main landing gear consists of 17 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.

5-5.2. The strut assembly consists of two pairs of chromemoly "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.

5-5.3. NEGLIGIBLE DAMAGE. Smoothed out nicks and dents not exceeding 1/32 inch in depth and 1/8 inch in length and spaced at least 1 1/2 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.

5-5.4. 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.

5-5.5. 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 assembly.

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.

5-16. Smoothed out nicks and dents not exceeding 1/16 inch in depth and 1/6 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

Notes:
No damage permitted to WEB except for smooth dents free from cracks, scoring or abrasions and not exceeding \( \frac{1}{8} \) in depth. Watertightness must be preserved.

No negligible damage permitted on drag panel fitting except \( \frac{1}{32} \) depth.
NOTE:
WATER SEAL WITH MARINE GLUE AND FABRIC BETWEEN SPLICE PLATE ON OUTSIDE OF KEEL AND BETWEEN SKIN AND PATCH PLATE.

O DENOTES AN442AD5 RIVETS,
• DENOTES AN442AD6 RIVETS

RIVET PLUG FOR WATER TIGHTNESS

SECTION A-A

PLUG ENDS WITH ALUMINUM PLUG

Figure 5-3—Float Keel Repair

RESTRICTED
Figure 5-4—Float Chine Repair

REstricted

040 SPLICE PLATE 24ST AL. ALLOY SHEET.

072 SPLICE ANGLE 24ST AL. ALLOY SHEET.

FINISHED REPAIR LOOKING OUTB'D.

NOTES:

@ DENOTES AN456AD5 RIVETS.

@ DENOTES AN456AD6 RIVETS.

PICK UP EXISTING RIVETS WHEREVER POSSIBLE.

WATERSEAL ALL SEAMS WITH MARINE GLUE AND FABRIC.

5/16 EDGE DISTANCE FOR ALL RIVETS.

SECTION A-A
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 structural parts 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 1/8 inch, 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 1/8 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
TYPICAL NEGLIGIBLE DAMAGE FOR ALL RIBS AND STIFFENERS IN THE DRAG PANEL, EXCEPT THOSE IN THE UNSHADED PORTION.

SECTION A-A

HOLES IN SHAD ED AREAS SPACED NOT CLOSER THAN TWO DIAMETERS ARE CLASSED AS NEGLIGIBLE DAMAGE.

NON-STRUCTURAL 100% DAMAGE ALLOWED.

SEE DETAIL 'C' FOR THIS MEMBER.

NO NEGLIGIBLE DAMAGE PERMITTED IN THIS MEMBER.

UPPER SKIN SPlice-WATER TIGHTNESS NOT REQUIRED ABOVE THIS SPlice.

SKIN DAMAGE IN SHAD ED AREAS MUST BE LIMITED TO HOLES NO LARGER THAN 8 INCHES IN DIAMETER AND NOT LESS THAN 1/2 DIAMETER APART. HOLES IN THE SKIN BELOW THE UPPER SKIN SPlice MUST BE PATCHED WITH A SUITABLE WATER TIGHT SKIN PATCH. THIS PATCH MAY BE IN THE FORM OF A DORED FABRIC PATCH. HOLES ABOVE THE WATER TIGHT AREA NEED NOT BE PATCHED, HOWEVER, IT IS ADVISABLE TO PATCH THE LARGER ONES. SKIN DAMAGE AS SHOWN HERE IS APPLICABLE TO BOTH SIDES OF THE DRAG PANEL.

Figure 5-5—Float Drag Panel—Negligible Damage
Section V

Figure 5-6—Float Drag Panel Repair

NOTES:
1) DENOTES AN442AD3 RIVETS.
2) DENOTES AN442AD5 RIVETS.
EDGE DISTANCE FOR ALL AN442AD3 RIVETS 1/4 INCH.
EDGE DISTANCE FOR ALL AN442AD5 RIVETS 3/16 INCH.
IT IS PERMISSIBLE TO USE CHERRY RIVETS THRU OUTSIDE PATCH PLATE IF NECESSARY EXCEPT THRU CHANNEL.
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, 1/4 inch, member U, 3/8 inch, member M, 1/16 inch, member N, 1/2 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 1/8 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

SECTION A-A

CHROME MOLY STEEL SHEET SPECIFICATION AN-QQ-S-685, AN-S-12, OR AN-S-22, HEAT TREATED TO 100,000 P.S.I MINIMUM SAME GAGE OR NEXT GAGE HEAVIER THAN MATERIAL IN DAMAGED MEMBER. IF ARC WELDING IS USED IT IS NOT NECESSARY TO HEAT TREAT MEMBER AFTER WELDING.
not be less than two inches. Gage of the patch material must be the same as 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 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 cowling 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 turbol 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 1/4 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 1/4 inch. Cracks, nicks or gouges must be stop drilled, routed or smoothed out.

6-11. Damage up to 1/4 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 the 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 6-2 Oil Tank—Negligible Damage
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 legs 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 1/4 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 3/4 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, 1/8 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 1/4 inch diameter drill.

Form a patch to the shape of the member to be repaired. Patch must overlap the damaged area by at least 1 1/2 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 al clad sheet and is assembled in one complete section. The al clad sheet is tack riveted and spot welded to former angles which extend from the bulb angle on the rear of the nose cowl to the head 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 of 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, dents and cracks not exceeding 3/4 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 3/4 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 makes 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 al clad sheets to which formers and stiffeners have been tack riveted and spot welded. 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

Section VI

RESTRICTED
AN 01-5M-3

NOTES:
1. ALL RIVETS WHICH PENETRATE INTO THE INTERIOR OF THE TANKS ARE AN 456 ADS, ALL OTHERS ARE AN 442 ADS.
2. ALL RIVETS LOCATED AT APPROX. 1/2 SPACING MAINTAIN RIVET EDGE DISTANCE OF TWICE THE RIVET DIAMETER WHEN POSSIBLE.
3. USE 1/8" NEOPRENE WASHERS UNDER THE HEAD OF ALL RIVETS WHICH PENETRATE INTO THE INTERIOR OF THE TANK.
4. BEND RADIUS ON ALL PARTS TO BE 1/8".
Figure 6-5—Horizontal Stiffener Repair—Oil Tank

These rivet holes to be for AN442AD5 rivets.

0.064 24ST AL ALLOY FILLER.

Typical edge distance.

0.051 24ST AL ALLOY FILLER.

0.051 24ST AL ALLOY PATCH.

Trim flange of Z-member.

This member is an equivalent replacement of the original member except the flanges are not joggled.

Notes:

Use neoprene washers under the heads of all rivets which penetrate into the tank.

○ Denotes AN 456AD5 rivets

● Denotes AN 442AD5 rivets

Detail of washer made from 1/32 neoprene.
Figure 6-4—Corner Repair—Oil Tank

NOTES:
1. Use \( \frac{1}{32} \) neoprene washers under the heads of the rivets which penetrate into the tank.
2. Indicates AN456AD5 rivets
3. Indicates AN442AD5 rivets
4. Used for two rows only.
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 to fill the gap and secured in place by splice plates or angles. (See figure 6-9.)

6-42. DAMAGE REPAIRABLE BY REPLACEMENT. Damage to short sections of structure or parts such as draw bolts, Dzu fasteners or other standard parts will necessitate their replacement. Refer to the General Manual for Structural Repair (AN 01-1A-1) for repair to Dzu fasteners.
HOLES SMOOTHED OUT AND NOT OVER DIAMETER MAY BE PERMITTED AS NEG. DAMAGE IN THESE MEMBERS PROVIDED THE DAMAGE IS NOT LOCATED IN THE MIDDLE 2/3 OF THE TUBE AND THE HOLES ARE AT LEAST 2 APART. IN ADDITION THE HOLES MUST BE SEALED TO KEEP MOISTURE OUT OF TUBE.

SHAD ED AREA MAY BE COMPLETELY DAMAGED

SEE TABLE FOR MAX PERMITTED BOWING BOWING OF TUBE

BOWING OF MEMBERS

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<th>MEMBER</th>
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<tr>
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NOTES: SMOOTHED OUT NICKS 1/16 IN DEPTH AND 1/4 IN LENGTH AND DENTS NOT OVER 1/32 IN DEPTH ARE PERMISSIBLE AS NEGLIGIBLE DAMAGE PROVIDED THEY ARE NOT LESS THAN 2 APART.
Figure 6-8—Nose Cowl Repair

Bevel edges of patch plate approx 45°

Section A-A

032 24St Alclad Patch
AN456AD4 RIVETS
APPROX 3/4" SPACING
Figure 6-9—Wrap Cowl and Cowl Panel Repair

NOTES:

O DENOTES AN456AD4 RIVETS
ALL REPAIR MATERIAL TO BE
24ST. AL ALLOY SHEET.
TYPICAL EDGE DISTANCE 1/4 INCH.
TRIM DAMAGED AREA TO MAINTAIN
APPROX. 3/4 INCH RIVET SPACING.
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.
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<td>90,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-QQ-S-684</td>
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<td>28D3055</td>
<td>Special Spacer—Engine Cowl Flap</td>
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<td>28F1040</td>
<td>Nut—MK-42 Bomb Rack Attaching—Anchor</td>
<td>70,000 to 95,000</td>
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<td>28F1041-7</td>
<td>Nut—MK-42 Bomb Rack Attaching—Anchor</td>
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<td>Nut—MK-42 Bomb Rack Attaching—Anchor</td>
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<td>28F1070-20</td>
<td>Tube—Furnishings—Pilot's Seat</td>
<td>65,000 to 90,000</td>
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<td>28F1070-21</td>
<td>Rod—Furnishings—Pilot's Seat</td>
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<td>28F1081</td>
<td>Bearing—Furnishings—Pilot's Seat Roller</td>
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<td>Bearing—Furnishings—Pilot's Seat Front Roller</td>
<td>120,000 to 145,000</td>
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<td>Rod—Furnishings—Pilot's Seat Release</td>
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<td>90,000 to 125,000</td>
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<td>C.M. Steel</td>
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<td>PART No.</td>
<td>NAME</td>
<td>HEAT TREAT (psi)</td>
<td>COMM'L DESIGN'N</td>
<td>SPECIFICATION</td>
<td>MATERIAL</td>
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<td>28F1088</td>
<td>Tube—Furnishings—Seat Operatin Mechanism</td>
<td>Normalize</td>
<td>SAE 4130</td>
<td>AN-T-3</td>
<td>C.M. Steel</td>
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<td>28F1099</td>
<td>Lever Assembly—Furnishings—Flare Loading</td>
<td>90,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-WW-T-850</td>
<td>C.M. Steel</td>
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<tr>
<td>28F1119</td>
<td>Channel—Fixed Equipment—Flare Base</td>
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<td>SAE 4130</td>
<td>AN-QQ-S-685</td>
<td>C.M. Steel</td>
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<td>28F1120</td>
<td>Lever Assembly—Fixed Equipment—Flare Base</td>
<td>90,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-WW-T-850</td>
<td>C.M. Steel</td>
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<td>28F1122</td>
<td>Trunnion—Furnishings—Pilot's Seat Exercise Cord</td>
<td>Normalize</td>
<td>SAE 4130</td>
<td>AN-QQ-S-684</td>
<td>C.M. Steel</td>
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<tr>
<td>28F1133</td>
<td>Hook—Fixed Equipment—Flare Fitting</td>
<td>100,000 to 125,000</td>
<td>NE 8630</td>
<td>AN-WW-T-850</td>
<td>C.M. Steel</td>
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<tr>
<td>28F1159</td>
<td>Clip—Fixed Equipment—Flare Cable Spring Screw—MK 15 Bombsight Mount—Brake</td>
<td>Normalize</td>
<td>SAE 4130</td>
<td>AN-QQ-S-685</td>
<td>C.M. Steel</td>
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<td>28F1202</td>
<td>Arm Assembly—Fixed Equipment—Flare Door Release</td>
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<td>28F1344</td>
<td>Washer—Fixed Equipment—Spring Door Flares</td>
<td>90,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-QQ-S-685</td>
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<td>28F1434</td>
<td>Spring—Fixed Equipment—Flare Ejection</td>
<td>100,000 to 125,000</td>
<td>NE 8630</td>
<td>AN-S-12</td>
<td>Alloy Steel</td>
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<td>28F1366</td>
<td>Pin—MK 15 Bombsight Mount Lock</td>
<td>Normalize</td>
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<td>C.M. Steel</td>
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<td>28F1393</td>
<td>Bushing—Anti-Vibration Mounting—Bombsight</td>
<td>90,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-QQ-S-683</td>
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<td>28F1450</td>
<td>Spring—Furnishings—Pilot's Arm Rest</td>
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<td>SAE 4130</td>
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<td>C.M. Steel</td>
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<tr>
<td>28F1525</td>
<td>Bolt Assembly—Armament Torpedo Stop</td>
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<td>SAE 4130</td>
<td>AN-QQ-S-685</td>
<td>C.M. Steel</td>
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<tr>
<td>28F3044</td>
<td>Torque Shaft—Bow Gun Mount</td>
<td>Spring, Temper</td>
<td>SAE 1095</td>
<td>AN-QQ-S-666</td>
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<td>28F4030</td>
<td>Bushing—Torque Shaft—Bow Gun Mount</td>
<td>90,000 to 125,000</td>
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<td>AN-QQ-S-686</td>
<td>Carbon Steel</td>
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<tr>
<td>28F4031-2</td>
<td>Bushing—Torque Shaft—Bow Gun Mount</td>
<td>100,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-QQ-S-684</td>
<td>C.M. Steel</td>
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<td>28F4031-3</td>
<td>Link—Torque Shaft—Bow Gun Mount</td>
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<tr>
<td>28F4032</td>
<td>Pin—Elevator &amp; Aileron Control Lock</td>
<td>90,000 to 125,000</td>
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<td>28F51113</td>
<td>Leg Assembly—Furnishings—Bombers Seat Support</td>
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<td>AN-QQ-S-685</td>
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<tr>
<td>28F5134</td>
<td>Lug—Control—Yoke Lock Tube</td>
<td>90,000 to 125,000</td>
<td>SAE 4130</td>
<td>AN-QQ-S-685</td>
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<td>28F5238</td>
<td>Eccentric Bushing—Bombsight</td>
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<td>28F5252</td>
<td>Bolt—Nose Wheel Door Control Mechanism—Hydraulic System</td>
<td>145,000 to 175,000</td>
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<td>28F6610</td>
<td>Lever Stop—Safety Lock—Landing Gear Selector Valve—Hydraulic System</td>
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<td>AN-QQ-S-685</td>
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<td>28F6640</td>
<td>Eye Pin—Spring Locking Mechanism—Landing Gear Selector Valve—Hydraulic System</td>
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<tr>
<td>PART No.</td>
<td>NAME</td>
<td>HEAT TREAT (psi)</td>
<td>COMM'L DESIGN</td>
<td>SPECIFICATION</td>
<td>MATERIAL</td>
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<td>28F6888-0</td>
<td>Support—Furnishings—Radar Operator’s Seat Post</td>
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<td>AN-WW-T-850</td>
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<tr>
<td>28F6888-2</td>
<td>Support—Furnishings—Radar Operator’s Seat Post</td>
<td>90,000 to 125,000</td>
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<td>AN-WW-T-850</td>
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<td>28F6900</td>
<td>Lever—Furnishings—Radar Operator’s Seat Stop</td>
<td>90,000 to 125,000</td>
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<td>AN-WW-T-850</td>
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<td>28F6901</td>
<td>Collar—Furnishings—Radar Operator’s Seat Stop</td>
<td>90,000 to 125,000</td>
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<td>AN-WW-T-850</td>
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<td>28F12808</td>
<td>Rod—Furnishings—Intake Damper—Empennage Anti-Icing Heater</td>
<td>145,000 to 170,000</td>
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<td>28G1017</td>
<td>Pin—P.P.—Fuel System—Dump Valve Adjusting</td>
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<td>AN-WW-T-850</td>
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<td>28G1018</td>
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<td>Shackle—Clamp Assembly—Mooring Pendant</td>
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<td>Strut Assembly—Float Retracting—Upper</td>
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<td>Strut Assembly—Float Retracting—Lower</td>
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<td>28L071</td>
<td>Journal—Float Retracting Screw—Outboard</td>
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<td>C.M. Steel</td>
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<td>Sleeve—Float—Control Torque Tube Bearing</td>
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<tr>
<td>PART No.</td>
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<td>TREAT TREAT (psi)</td>
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<td>SPECIFICATION</td>
<td>MATERIAL</td>
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<td>Key—Woodruff</td>
<td>200,000</td>
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<td>C.M. Steel</td>
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<td>Tube—Float—Lock &amp; Recoil Mechanism—Drive</td>
<td>150,000</td>
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<td>AN-WW-T-850</td>
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<td>AN-QQ-S-684</td>
<td>C.M. Steel</td>
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<td>Screw—Float—Locking Mechanism; Link</td>
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- SAE 4130
- AN-WW-T-850
- AN-QQ-S-685
- AN-QQ-S-684
- 46S27 Gr. 1
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**APPENDIX II**

**TYPICAL REPAIRS**

**ENDS OF REPAIR ANGLE FLANGES MUST EXTEND AS FAR AS ENDS OF EXTRUDED ANGLE FLANGES**

**SECTION A-A**

**RIVET PATTERN TYPE "A"**

**ENDS OF REPAIR ANGLE FLANGES MUST EXTEND AS FAR AS ENDS OF EXTRUDED ANGLE FLANGES**

**SECTION B-B**

**RIVET PATTERN TYPE "B"**

**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

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<th>EXTRUSION DIE NO.</th>
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**Figure B-1—Typical Repairs—Equal Angles**

**RESTRICTED**
Figure B-2—Typical Repairs—Unequal Angles

RESTRICTED
Appendix II

RESTRICTED
AN 01-5M-3

SECTION X-X

FILE OFF BULB AND EXTEND REPAIR ANGLES TO END OF EXTRUSION FLANGE.

INSERT ANGLE

FILE INNER REPAIR ANGLE TO FIT RADIUS OF BULB AS SHOWN

ENDS OF REPAIR ANGLE FLANGES MUST EXTEND AS FAR AS ENDS OF EXTRUDED ANGLE FLANGES

SECTION A-A

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

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<th>GAGE OF REPAIR ANGLES</th>
<th>REPAIR ANGLE BEND RADIUS</th>
<th>RIVET</th>
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Figure E-3—Typical Repairs-Bulb Angles

RESTRICTED
Figure B-4—Typical Repairs—Extruded Zee Sections

RESTRICTED

Appendix II

`| EXTRUSION DYE NO. | SPlice OVERlap (C) | RIVET PATTERN TYPE | REPAIR ANGLES BEND RADIUS | RIVET | GAGE OF REPAIR ANGLES | NO. OF RIVETS EACH SIDE OF SPICE | D | E | A | P |
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NOTES:
ALL SPICE 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.

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Figure 8-6—Typical Bullet Patch Repair

RESTRICTED