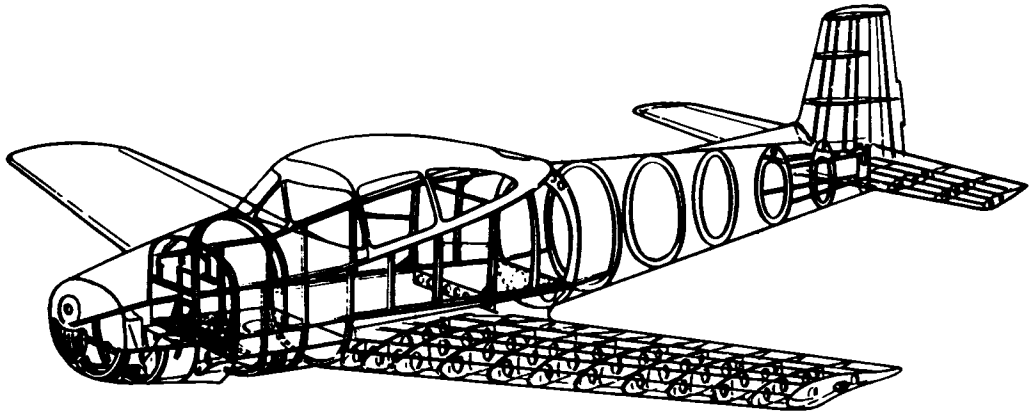
Navion

STRUCTURAL REPAIR



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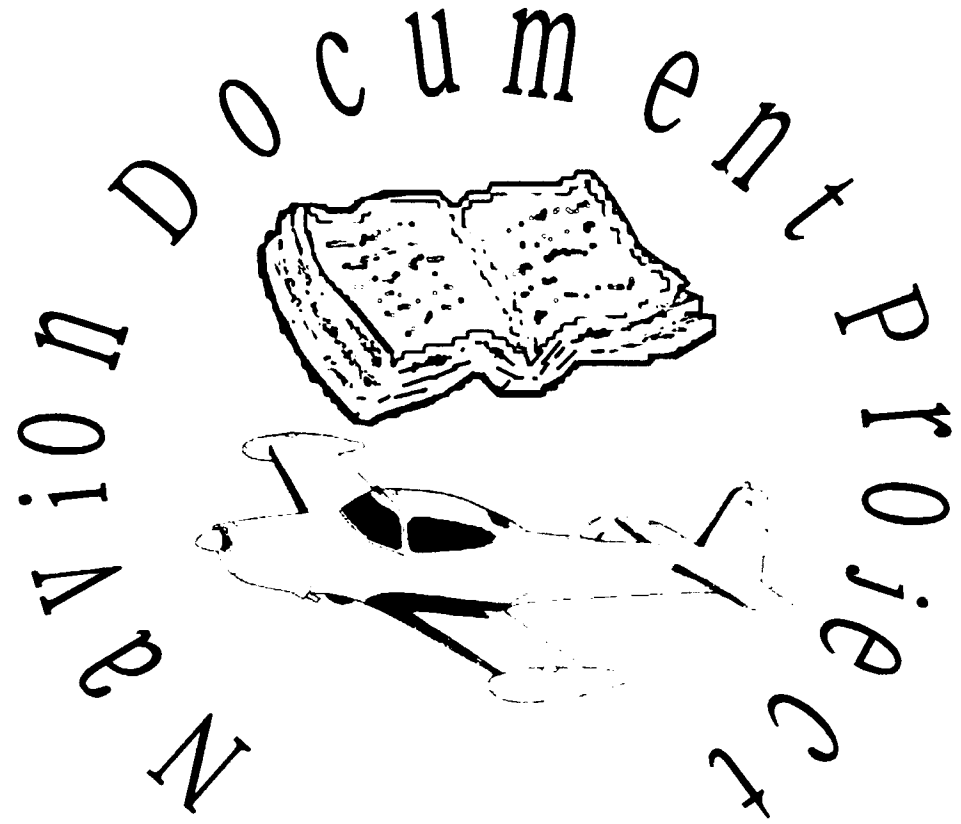

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INTRODUCTION

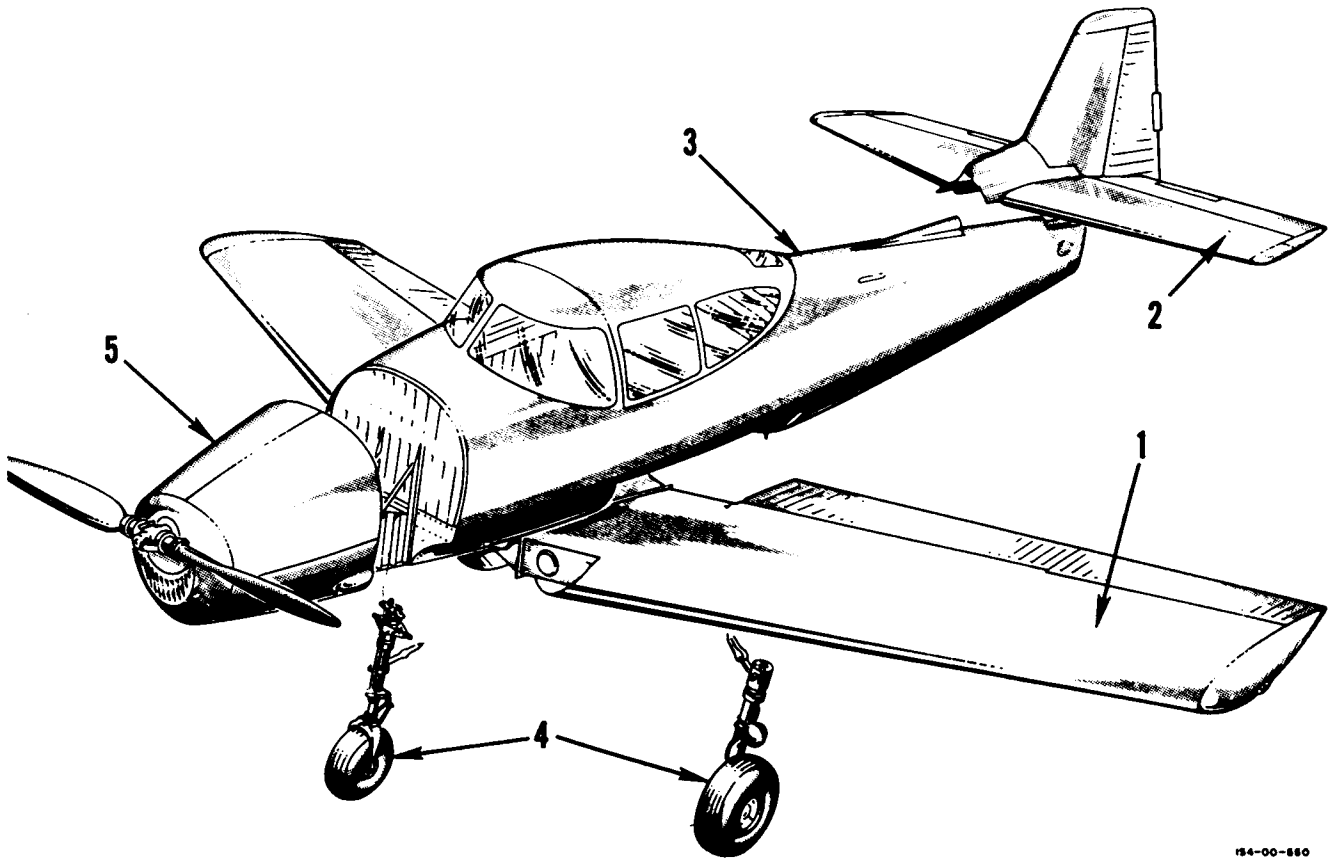
INTRODUCTION. The data included in this repair manual has been developed for personnel faced with the problem of maintaining the airworthiness of damaged Navion airframes. It is intended that this manual will facilitate the restoration of the airplane to a safe airworthy condition with a minimum of elapsed time and a minimum of replacement parts. The manual covers the major structural components of the airplane and includes instructions for determining the extent of damage and methods of repair.

COMPOSITION OF MANUAL. The composition of this repair manual is as follows: Section I - General Instructions other than those found in Civil Aeronautics Manual 18; Section II - Wing Group; Section III - Tail Group; Section Iv - Body Group; Section V - Alighting Gear; Section VI - Engine Section; Section VII - Fabric Repair (Not applicable to the airplane); Section VIII - Extrusion Chart, Equivalents for Extrusions and Formed Sheet Sections; and Section IX - Table of Heat Treated Fittings. Appendix I consists of a list of typical repair materials; Appendix II consists of sketches of typical repairs.

This repair manual is supplemented by Civil Aeronautics Manual 18 which contains information on general working practice; materials and identification; heat treatment of materials; information on rivets, bolts, screws, nuts, and fasteners; cable splicing; structural tubing repairs; repair of transparent plastics, anti-corrosion precaution; replacement of flexible hose, fittings and spotweided structure.

HOW TO USE MANUAL. Identify the damaged structural component of the airplane and from the table shown on Figure 1-1 determine the section of the manual in which the component is covered. The similar structural components are grouped together for convenience; that is, all of the wing stringers repairs are treated together in one group, as are the skin repairs, rib repairs, and spar repairs. The table of contents may be used to find special information.

> The typical repairs shown in Appendix II of this manual are referred to as references to Figure B-1, B-2 (etc).
> Appendix II is the last section of the manual and it will be necessary to refer to this section whenever such references are called out.



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SECTION I

GENERAL

1-1. TYPE OF CONSTRUCTION.

1-2. GENERAL. The Navion airplane carries three passengers and pilot. It is an all metal, single engine, low wing monoplane. The airplane is composed of a cantilever wing, semi-monocoque fuselage, horizontal stabilizer, elevator, vertical fin, rudder and retractable tricycle landing gear. Each wing is a semi-monocoque, cantilever structure consisting of a single wing panel, aileron and flap. The internal structure of the wing consists of front and center stub spars and full span rear spar, ribs, stringers and stiffeners. The aileron and flap consist of spars, ribs and beaded skin. The fuselage is semi-monocoque and consists of bulkheads, longerons, skin and stiffeners. The engine nacelle structure is also semi-monocoque construction and is bolted to the fuselage at the firewall. The tail surfaces, like the aileron and flap, are made up of spars, ribs and skin. Rudder skin is beaded, the elevator's is not. The landing gear is composed of two main gears and a nose gear. The structural details of these various airplane components are described in their respective sections of this manual.

1-3. INVESTIGATING DAMAGE.

1-4. GENERAL. Damage to the airplane structure must be cleaned up so that a thorough inspection may be made of the damaged member or members and the adjacent structure. The adjacent structure should be inspected to determine what secondary damage resulted from the transmission of the load which caused the primary damage. Thoroughly check the adjacent structure for dents, scratches, abrasions, cracks, punctures, loose joints and distortion. Check all riveted or bolted joints and fittings which may have been loosened or damaged. If there is any doubt as to the failure of a rivet or a bolt, remove this rivet or bolt and inspect for possible failure of the hole. Web and skin wrinkles should be thoroughly inspected to determine whether they are permanent stress wrinkles. When such a condition of distortion is ascertained, carefully check, the structures adjacent to this for permanent set or failures.

1-5. AIRPLANE ALIGNMENT. Certain types of damage may result in secondary distortion, not readily apparent, and which can be detected only by checking the alignment of the airplane. Hard landings, flight loads exceeding design requirements or faulty repairs of a major nature may cause such distortion. If this type of damage is suspected, an alignment check should be made. The overall airplane alignment dimensions are shown in Figure 1-2. The horizontal datum point is fuselage station 0. As this station is forward of the airplane, a reference jig point is established at the centerline of the most forward bolt in the wing lower surface splice angle (Fuselage Station 93-1/4) as shown in Figure 1-2.

1-6. SUPPORT OF STRUCTURE DURING REPAIR.

1-7. GENERAL. Before repair, removal, or replacement of any component of the airplane is undertaken, support the component so that proper alignment is maintained and distortion prevented throughout the repair. During extensive repairs, firmly support or remove those airplane parts which produce concentrated loads on the structure. Instructions for the removal of such parts as the engine and landing gear are given in the Navion Service Manual. When special fixtures to support the airplane or any of its components are not available, improvised supports should be fabricated from material available. Basic jig alignment dimensions are given at the end of each corresponding section of this handbook.

1-8. LEVELING.

1-9. GENERAL. The leveling lugs are located on the lower right hand side of the fuselage, forward of the wing. The canopy tracks at the windshield junction are used for lateral leveling. See Figures 1-3 and 1-4.

1-10. OPERATION. Place the airplane on jacks, using the two wing jacks and the tail skid as shown in Figure 1-4. Place a precision spirit level on the fore and aft leveling lugs and raise or lower the tail as necessary to bring the airplane into a longitudinally level position. To level the airplane laterally, place a precision spirit level across the left and right canopy track at the windshield junction and raise or lower either wing as necessary to bring the airplane into a laterally level position. Recheck the longitudinal level. If a correction is needed, recheck the lateral level after this second longitudinal level is determined. Repeat this procedure until the airplane is leveled both longitudinally and laterally.

NOTE

If the spirit level used does not span the leveling lugs or canopy tracks, use a suitable steel bar to span the leveling lugs or canopy tracks. The steel bar must be straight with a smooth surface to insure accurate leveling.

CAUTION

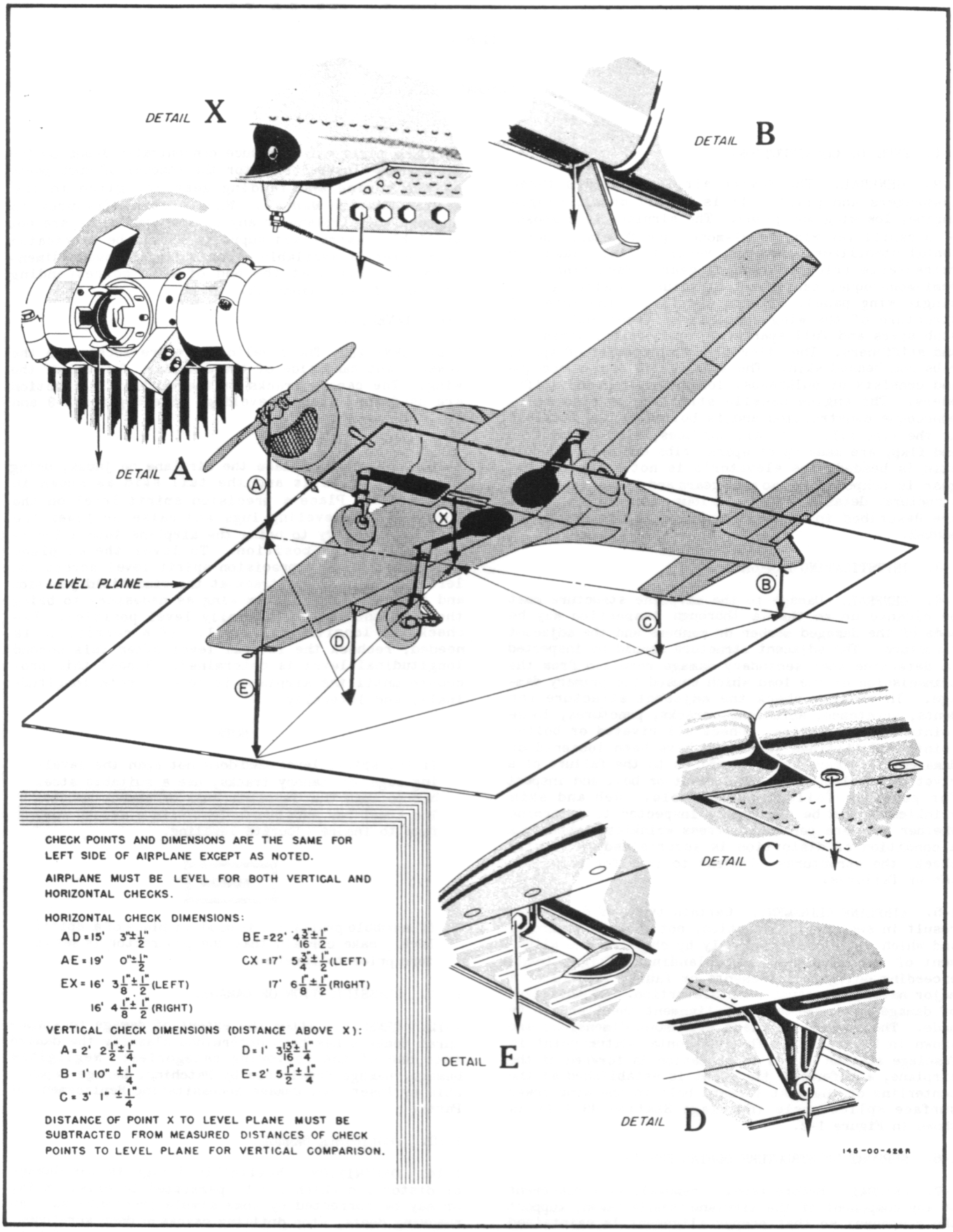
If a bubble protractor is used in place of a spirit level, make certain that the protractor is set at zero prior to leveling.

1-11. CLASSIFICATION OF DAMAGE.

1-12. GENERAL. After the extent of damage to structural members has been determined classify the damage into one of the following categories: Negligible Damage, Damage Repairable by Patching, Damage Repairable by Insertion, Damage Necessitating Replacement of Parts.

1-13. NEGLIGIBLE DAMAGE.

1-14. DEFINITION. Negligible damage is the damage or distortion which may be permitted to exist as is, or may be corrected by some simple procedure such as removing dents, stop drilling cracks or deep scratches, trimming the damage smooth, applying temporary fabric patches etc.; without placing restrictions on flight.



CHECK POINTS AND DIMENSIONS ARE THE SAME FOR LEFT SIDE OF AIRPLANE EXCEPT AS NOTED.

AIRPLANE MUST BE LEVEL FOR BOTH VERTICAL AND HORIZONTAL CHECKS.

HORIZONTAL CHECK DIMENSIONS:

AD = 15' 3" ± 1/2"	BE = 22' 4 3/16" ± 1/2"
AE = 19' 0" ± 1/2"	CX = 17' 5 3/4" ± 1/2" (LEFT)
EX = 16' 3 1/8" ± 1/2" (LEFT)	17' 6 1/8" ± 1/2" (RIGHT)
16' 4 1/8" ± 1/2" (RIGHT)	

VERTICAL CHECK DIMENSIONS (DISTANCE ABOVE X):

A = 2' 2 1/2" ± 1/4"	D = 1' 3 13/16" ± 1/4"
B = 1' 10" ± 1/4"	E = 2' 5 1/2" ± 1/4"
C = 3' 1" ± 1/4"	

DISTANCE OF POINT X TO LEVEL PLANE MUST BE SUBTRACTED FROM MEASURED DISTANCES OF CHECK POINTS TO LEVEL PLANE FOR VERTICAL COMPARISON.

FIGURE 1-2. AIRPLANE ALIGNMENT DIMENSIONS

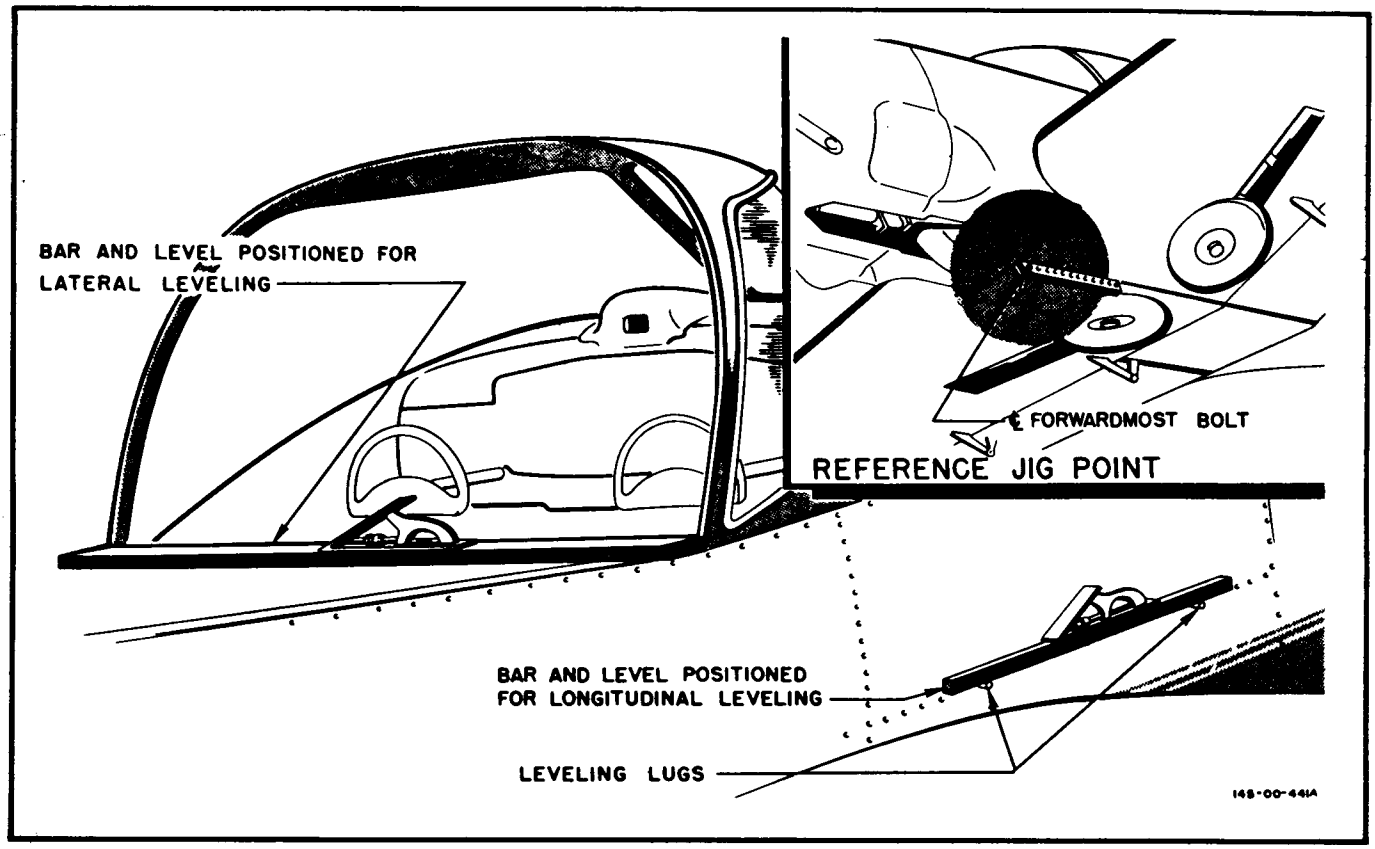


FIGURE 1-3. LEVELING AIRPLANE

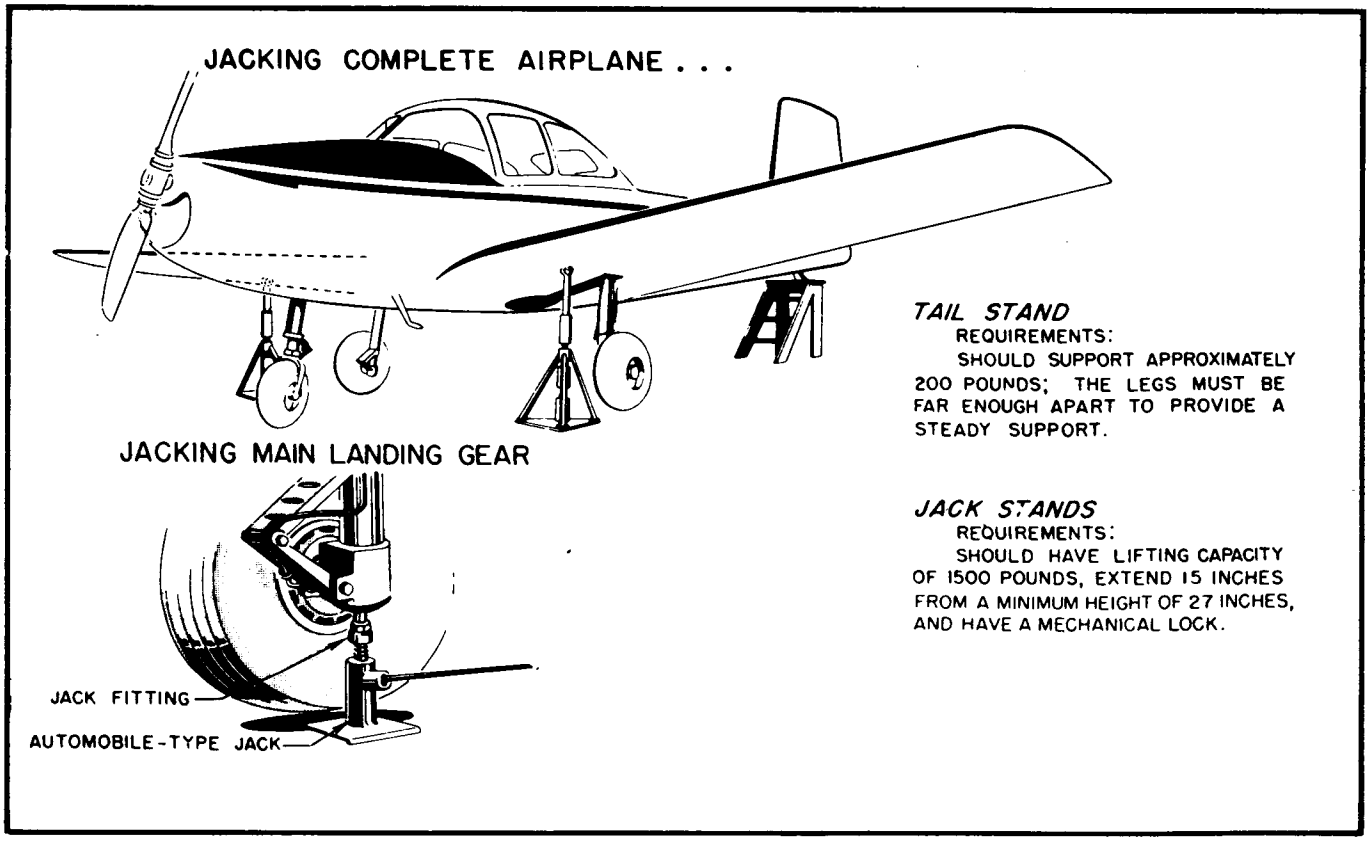


FIGURE 1-4. JACKING AIRPLANE FOR LEVELING

CAUTION

When attempting to classify damage to a structural member as negligible, be sure that the damage complies fully with the specified limits of negligible damage. Failure to do this may result in insufficient structural strength of the damaged member or members for critical conditions of flight.

1-15. SCRATCHES. Scratches in alclad material which do not extend beyond the coating can be classed as negligible. All alclad material furnished under specification AN-A-13 in gages of .064 and above have aluminum coats, which are 2-½ percent of nominal thickness, on each side of the sheet. On gages less than .064, there is a 5 percent coating on each side. Burnish all scratches before classifying them as negligible damage and then paint with zinc chromate primer. This will prevent corrosion of the exposed material and stress concentrations. Treat all scratches which penetrate beyond the clad coating as cracks.

1-16. CRACKS. Cracks and deep scratches must be drilled or trimmed out before attempting to classify them as negligible damage.

1-17. DAMAGE REPAIRABLE BY PATCHING.

1-18. GENERAL. The types of repair shown are divided into typical and specific repairs. Typical repairs shown in Appendix II of the handbook are repairs which are applicable to more than one section of the handbook; that is, access doors and skin patches are used on wings, tails and fuselages. Specific repairs are repairs which are applicable to a member in one section of the handbook only; for instance, a repair to horizontal stabilizer beam will be shown in Section III only. In either typical or specific repairs the repair should be followed as closely as is practicable. Fabric patches should be replaced by permanent metal patches or plugs as soon as practicable.

1-19. REPAIRS OF STRUCTURAL MEMBERS. Damage to structural members which exceeds the specified limits of negligible damage must be repaired using the information included in this handbook. Repairs shown for structural members which have a specified limited length of damage are effective for lengths of damage equal to or less than the specified limit. If this length of damage is exceeded, insertion repairs or replacement must be made. If the repair of a member or members requires cutting back or removal of adjacent structure to make the repair, make certain that this adjacent structure is reattached to maintain the strength of the original structure.

1-20. DAMAGE REPAIRABLE BY INSERTION. Damage repairable by insertion will be in the text only when the repair limitations are such that the specified length of damage for patching the existing repair is exceeded, or when an insertion repair is necessary due to the arrangement of the original structure. For example, if damage occurred to a beam at a hinge bracket and the repair members would interfere with this hinge bracket, it would be necessary to make an insertion repair and to mount and maintain the proper alignment of the hinge bracket. When making an insertion repair, make certain the insertion member is of the same section and material as the original structure unless otherwise specified.

1-21. DAMAGE NECESSITATING REPLACEMENT. This classification of damage will be covered for structural components of the airplane that are damaged beyond repair, and/or can be readily replaced such as castings, forgings, extrusions, etc., and short structural members, such as stiffeners, ribs, hinge brackets, etc.

1-22. AILERON UNBALANCE. The ailerons are statically balanced within a maximum allowable unbalance of four inch-pounds. This balance must be maintained if repairs become necessary or if the surfaces are repainted.

1-23. ELEVATOR UNBALANCE. Partial dynamic and static balance of each elevator is provided, the maximum allowable unbalance being 25 inch-pounds for each elevator.

1-24. RUDDER UNBALANCE. The rudder is not statically balanced; however, in the event of repair, the static unbalance must not exceed 47 inch-pounds.

SECTION II

WING GROUP

2-1. GENERAL.

2-2. DESCRIPTION. (See Figure 2-1.) The wing is a full cantilever type composed of two panels joined at Station 0 (airplane center line). Two stub spars, front and center, extend from Station 0 to Station 50 on each side, enclosing the fuel tanks. The main landing gear wells are just aft of the center spar. Skin panels of the wing lower rear surface are bent up and flanged to form the rear spar. Wing flaps and ailerons are hinged to this beam. Removable wing tips of 52SO aluminum alloy complete the wing.

2-3. ALIGNMENT. Repair jigs for the wing panels, ailerons and flaps may be fabricated from the basic jig dimensions shown at the end of this section, Figures 2-7 through 2-9.

2-4. ACCESS FOR REPAIRS. Access to the interior may be gained through the wheel wells and three access doors, one aft of the landing gear strut, another near the gas tank vent, and the third at Station 130 forward of the aileron hinge. If there is any extensive structural damage, it may be necessary to remove the skin.

NOTE

The close-out strip on the bottom surface is easily removed and replaced and gives access to most parts of the wing interior. This strip lies between stringers number five and six. It is in two parts, from the landing gear well to the aileron control access door and from the access door to the wing tip.

Openings may be made in the skin and repaired as described in paragraphs 2-8 through 2-16.

2-5. WING SKIN.

2-6. DESCRIPTION. (See Figure 2-2.) The skin panels are riveted to stringers and skin attachment flanges of ribs with modified brazier head rivets. All joints are lap joints. All skin is 24ST alclad.

2-7. NEGLIGIBLE DAMAGE. Smooth dents free of cracks or abrasions located anywhere on the wing skin may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1-½ inches in diameter and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits, and subsequently bumped back to contour without cracking or creasing the skin may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

2-8. DAMAGE REPAIRABLE BY PATCHING.

2-9. GENERAL. Any damage in the skin which exceeds that specified in paragraph 2-7 may be repaired by patching. Flush type repairs must be used on the leading edge, aft to the first lap joint. Flush or external patches may be used on the remainder of the wing skin.

2-10. RIVET REQUIREMENTS FOR PATCHING. The wing skin is divided into three groups, depending upon skin stress intensity, and the groups are identified by the Roman Numerals I, II and III on Figure 2-2.

2-11. RIVETS FOR PATCHING, TYPE I, SKIN PANELS. (See Figure 2-2.) Repairs for all Type I wing skin panels must be riveted with AN470AD5 rivets. The spacing is permitted to vary between 3/4 of an inch minimum to one inch maximum, to permit picking up of existing rivet holes. Flush repairs require one row of rivets through the skin panel and doubler and one row through the doubler and flush patch, maintaining a minimum edge distance of 5/16 inch. If an external patch is used, one row of AN470AD5 rivets are required at the above spacing through the patch and skin.

2-12. RIVETS FOR PATCHING, TYPE II, SKIN PANELS. (See Figure 2-2.) Repairs for all Type II wing skin panels must be riveted with AN470AD5 rivets and the spacing is permitted to vary between 3/4 inch minimum to one inch maximum. Flush repairs require two rows of rivets through the skin panel and doubler and two rows through the doubler and flush patch, with 5/8 inch between rivet rows and 5/16 inch minimum edge distance. If an external patch is used, two rows of AN470AD5 rivets are required at the above spacing through the patch and skin.

NOTE

When the central portion of the doubler has not been removed for weight saving, only one row of AN470AD5 rivets is required through the doubler and flush patch at approximately one inch spacing. Two rows of rivets are still required through the skin panel and doubler.

2-13. RIVETS FOR PATCHING, TYPE III, SKIN PANELS. (See Figure 2-2.) Repairs for all Type III wing skin panels must be riveted with AN470AD5 rivets and the spacing is permitted to vary between 3/4 of an inch minimum to one inch maximum. Flush repairs require three rows of rivets through the skin panel and doubler and three rows through the doubler and flush patch, with 5/8 inch between rivet rows and 5/16 inch minimum edge distance. If an external patch is used, three rows of AN470AD5 rivets are required at the above spacing through the patch and skin.

NOTE

When the central portion of the doubler has not been removed for weight saving, only one row of AN470AD5 rivets is required through the doubler and flush patch at approximately one inch spacing. Three rows are still required through the skin panel and doubler.

2-14. ACCESS DOOR CLEAR OF INTERNAL STRUCTURE. Damage to the wing skin of Group No. I clear of internal structure may be repaired by installing a removable access cover plate. Access doors also may be installed to facilitate repairs to the structure. See Figure B-1 for description of access door and paragraph 2-11 for rivet requirements. The cover plate must be a close fit to provide a smooth surface. To install the access door, remove the damaged area by cutting a circular or rectangular hole, leaving sufficient skin to allow for the installation of the doubler. Plate nuts and screws are substituted for rivets in attaching the cover plate to the doubler. The plate nuts on the doubler may be installed prior to its installation. Rivet the doubler to the existing skin and install the cover plate. If desired, an

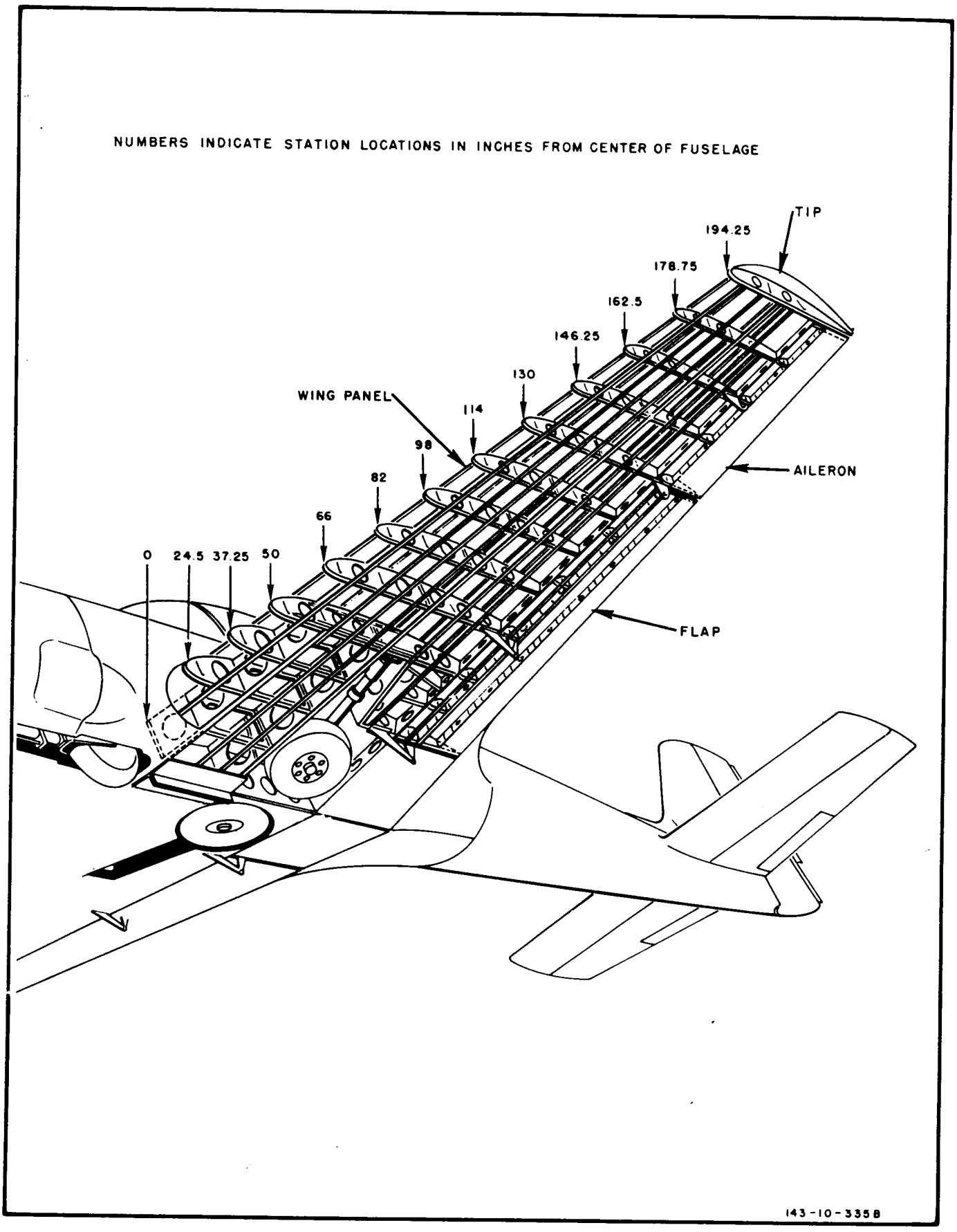
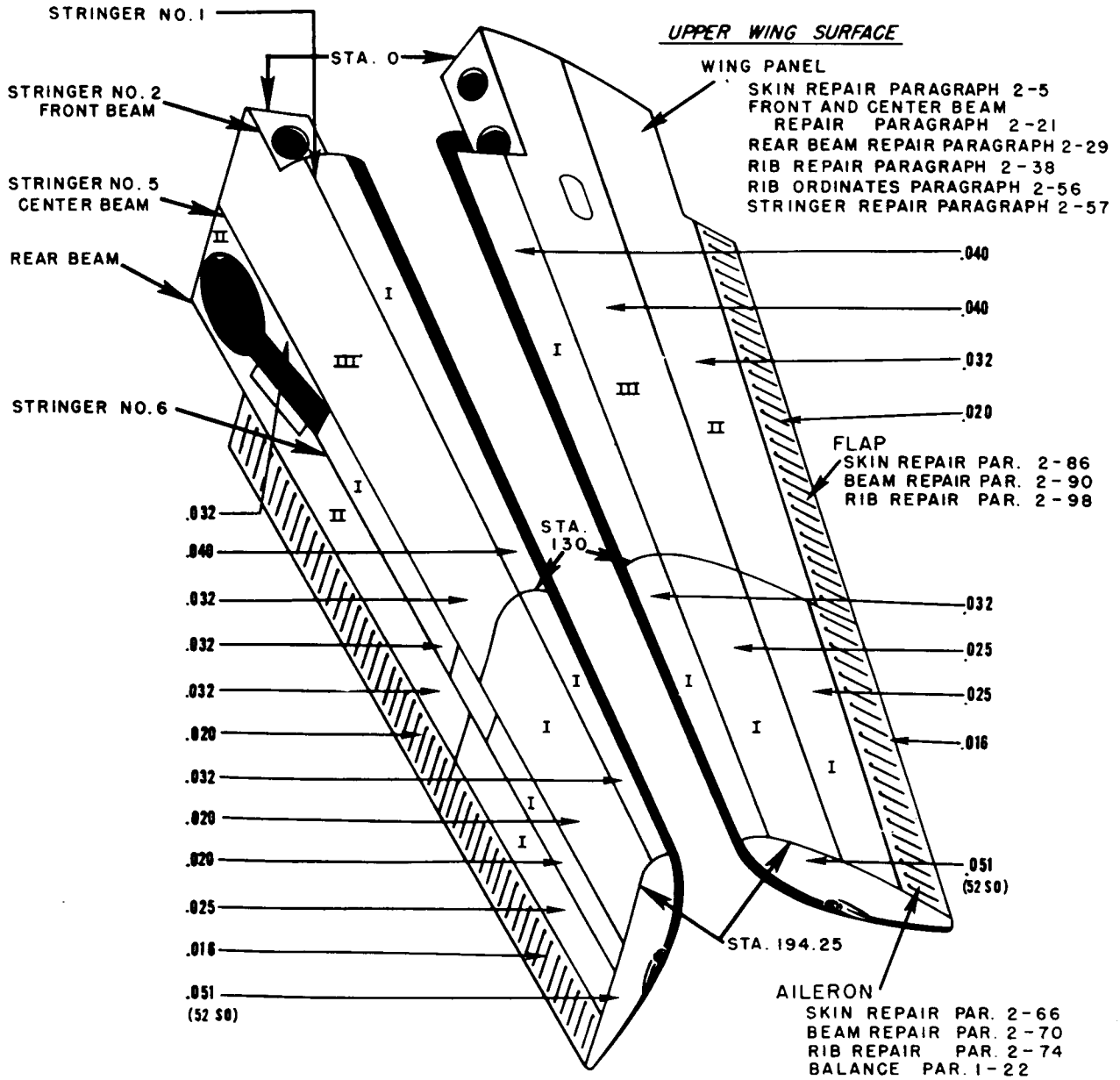


FIGURE 2-1. WING STRUCTURE



NOTE

NUMBERS INDICATE SKIN THICKNESS.
MATERIAL 24 ST. ALCLAD EXCEPT AS NOTED.
ROMAN NUMERALS I, II & III INDICATE SKIN STRESS INTENSITY, SEE PARAGRAPH 2-10 THRU 2-13.

FIGURE 2-2. WING SKIN ARRANGEMENT

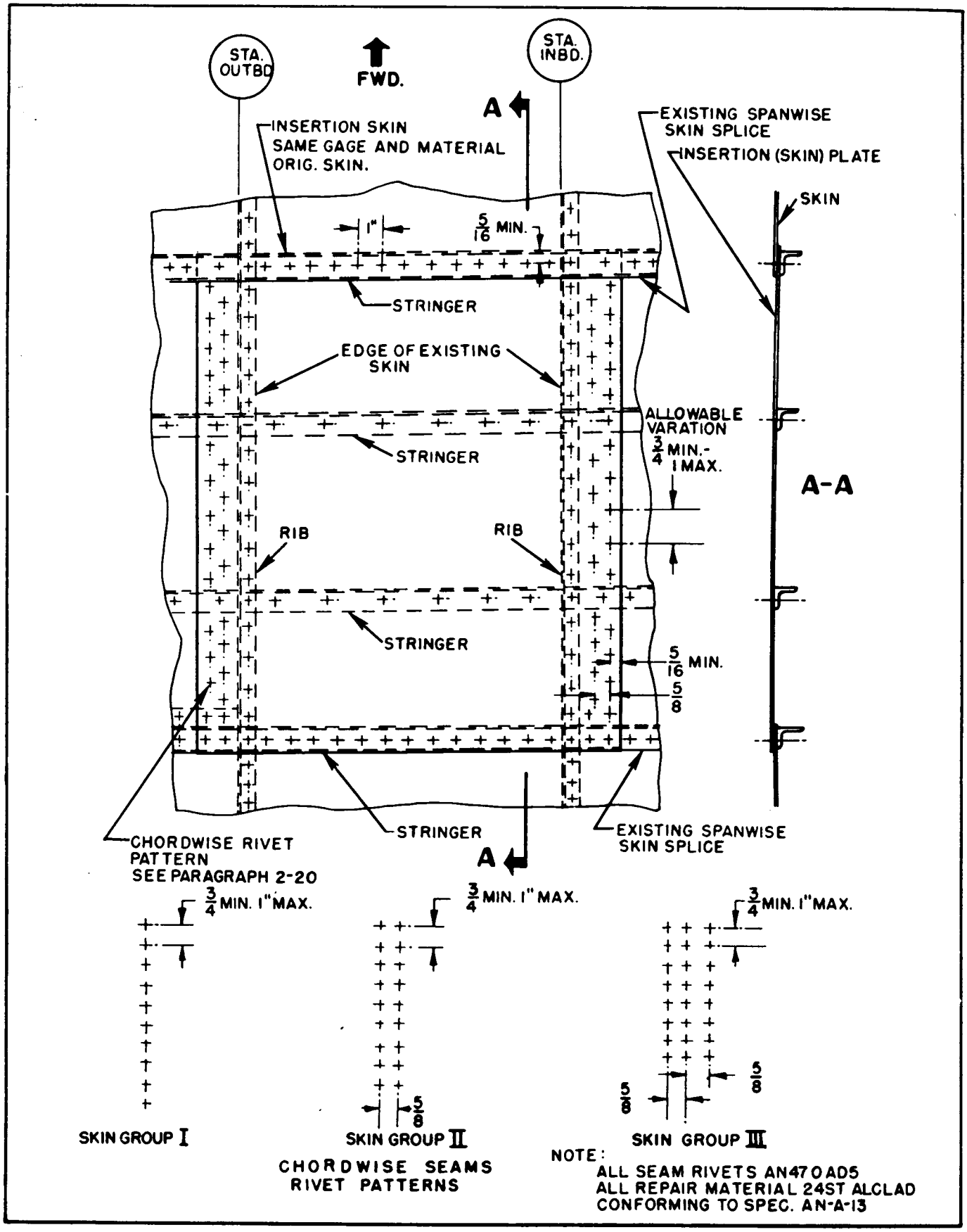


FIGURE 2-3. WING SKIN INSERTION

external access door may be used similar to Figure B-3. Plate nuts and screws are substituted for rivets.

2-15. ACCESS DOOR OVER INTERNAL STRUCTURE. Damage to the wing skin of Group No. I and internal structure, such as a rib or stringer may be repaired by repairing the rib or stringer and then installing the access door. See Figure B-1 for this installation and Paragraph 2-11 for rivet requirements. Trim the skin, leaving sufficient existing skin to allow for the installation of the doubler. Repair the rib or stringer by nesting the repair member on the inside of the damaged member, allowing clearance for installation of the doubler. Install the doubler as shown in Figure B-1. After the doubler is installed, insert a filler between the rib or stringer. Plate nuts and screws are substituted for rivets in attaching the cover plate to the doubler. The plate nuts on the doubler can be installed on the bench. When installing the cover plate, make certain that the screws tying the cover plate to the internal structure are inserted. If desired, an external access door may be used similar to Figure B-3. Plate nuts and screws are substituted for rivets.

2-16. RIVETED SKIN PATCH, CLEAR OF INTERNAL STRUCTURE. Flush skin patches integral with the damaged skin panel may be made by riveting the flush skin patch to the doubler. This type of skin patch may be installed, provided there is an access through which the rivets can be bucked, or cherry rivets (CR-163C) are used. See Figure B-1 and Paragraphs 2-10 thru 2-13. The procedure for making the repair is the same as the installation of an access door as described in Paragraph 2-14, except that rivets are used instead of plate nuts and screws. The external patch shown in Figure B-3 can be used in place of the flush type if desired.

2-17. RIVETED SKIN PATCH OVER INTERNAL STRUCTURE. Flush skin patches integral with the damaged skin panel may be made by riveting the doubler to the existing skin and then riveting the flush skin patch to the doubler and the internal structure. The skin patch is shown in Figure B-1. Rivet requirements are given in Paragraphs 2-10 through 2-13. The procedure is the same as for the installation of an access cover plate as described in Paragraph 2-15, except that rivets are used instead of plate nuts and screws. The external patch shown in Figure B-3 can be used in place of the flush type if desired.

2-18. LEADING EDGE REPAIR, CLEAR OF INTERNAL STRUCTURE. Damage to the leading edge clear of structure should be repaired as shown in Figure B-2 and according to rivet requirements in Paragraph 2-11. The repair can be effected by trimming the skin beyond the damaged area, leaving sufficient skin to allow for the installation of the doubler. If the rivets in the doubler and cover plate are inaccessible for bucking from any other opening, such as the close-out strip noted in Paragraph 2-4, cherry rivets (CR-163C) are used, or the repair may take the form of a flush access door and utilize screws in an access cover plate as called for in Paragraph 2-14.

2-19. LEADING EDGE REPAIR, OVER INTERNAL STRUCTURE. Damage to the leading edge, over internal structure should be repaired as shown in Figure B-2 and according to rivet requirements in Paragraph 2-11. Trim the skin beyond the damaged area, leaving sufficient skin to allow for the installation of the doubler. Trim the rib back beyond the existing skin sufficiently to allow the installation of the doubler. Repair the rib by forming a new rib nose section and making a rib extension splice. The depth of the new nose section must be such that when the existing skin and skin patch are riveted to the doubler, the skin patch will be flush. It will be necessary to put a filler between the existing rib flange and the rib extension splice member. If the rivets in the doubler and cover plate are inaccessible for bucking, from any other opening, such as the close-out strip noted in Paragraph 2-4, cherry rivets (CR-163C) are used, or the repair may take the form of a flush access door and utilize screws in an access cover plate as called for in Paragraph 2-15.

2-20. DAMAGE REPAIRABLE BY INSERTION. (See Figure 2-3.) Skin damage which exceeds approximately 10 by 12 inches should be repaired by inserting a new skin panel section or complete replacement of the skin panel, whichever is more expedient. Either a chordwise or spanwise splice may be used, but since all skin panels are considerably shorter in a chordwise direction, a chordwise splice entails less work and is recommended for general repair. If the damage is in the bay near the end of the sheet, remove and discard the damaged skin and short end. If the damage is located away from the ends of the sheet, cut the skin on both sides and discard damaged skin. Cut a sheet of 24ST alclad larger than the cutout to accommodate rivets with proper edge distance and of the same thickness as the damaged skin panel. Seams should be lap spliced to the undamaged skin. All spanwise seams should occur at existing spanwise seams using AN470AD5 rivets, picking up the existing rivet holes. However, if the new spanwise seams do not occur at an existing seam, use AN470AD5 rivets at one inch spacing. All spanwise seams must have a minimum edge distance of 5/16 inch. Chordwise seams are made with AN470AD5 rivets and the spacing is permitted to vary between 3/4 inch and one inch; the required number of rivet rows vary, between one and three depending upon the skin panel. (See Figures 2-2 and 2-3.) Skin panels of Type I require a single row of rivets, panels of Type II require two rows of rivets, and panels of Type III require three rows of rivets.

2-21. FRONT BEAM AND CENTER BEAM.

2-22. DESCRIPTION. The front and center beams extend from Station 0 to Station 50. They are fabricated from 24ST alclad sheet. The channel web is .040 thickness on the front beam and .051 thickness on the center beam. Spar cap angles are of .091 and .064 thickness respectively. There are angle stiffeners and flanged lightening holes on the web.

2-23. NEGLIGIBLE DAMAGE. Web damage not exceeding the following limits requires no repair or reinforcement. Smooth dents free of cracks and abrasions and clear of lightening hole flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1-½ inches in diameter and adjacent dents are at a distance of 15 inches. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

2-24. DAMAGE TO WEB REPAIRABLE BY PATCHING. Damage to front and center spar webs exceeding negligible damage and 1½ inches clear of lightening holes and spar cap angles may be repaired by a patch plate. Remove damaged area by cutting a circular or rectangular hole; minimum corner radii for rectangular cutout 1/2 inch. Smooth all edges to remove burrs. Cut web patch larger than cutout to accommodate rivets through web with proper edge distance. Front spar web patch is .040 24ST alclad and center spar .051 24ST alclad. Locate position of patch to provide equal overlap at all edges of cutout. Attach web

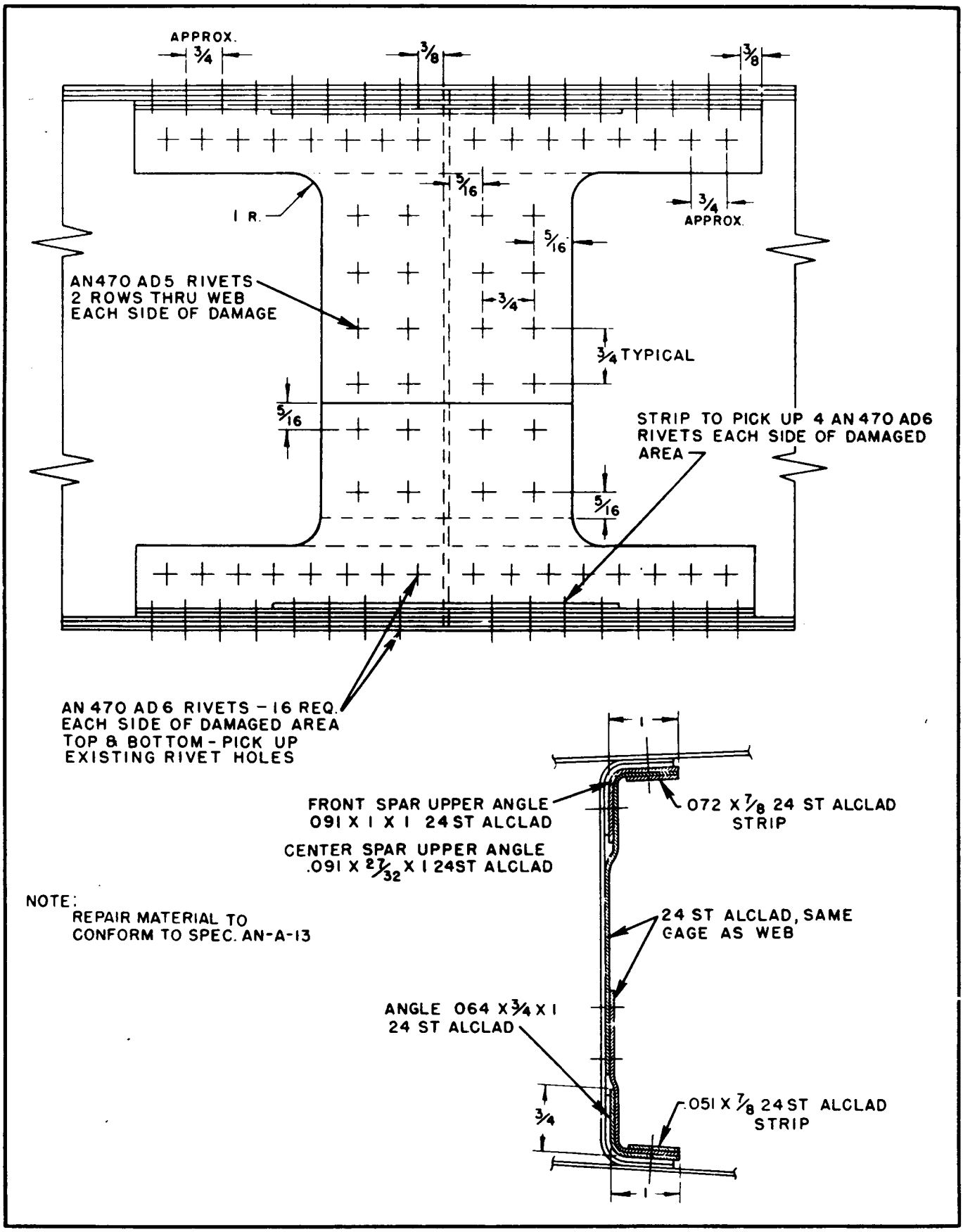


FIGURE 2-4. FRONT BEAM AND CENTER BEAM SPLICE

patch to web with two rows of AN470AD5 rivets around the perifery of the cutout, spaced at 3/4 inch with a distance of 3/4 inch between rivet rows and maintain 5/16 inch minimum edge distance. A similar rivet spacing is shown for the web on Figure 2-4, and the type of patch on Figure B-3.

CAUTION

The above repair does not apply to the front spar inboard of Station 12, or the center spar outboard of Station 40.

2-25. DAMAGE TO WEB LIGHTENING HOLES REPAIRABLE BY PATCHING. (See Figure 2-5.) Clean out damaged area and burr edges. Cut reinforcement from .040 24ST alclad for front spar and .051 24ST alclad for center spar, allowing sufficient material for a 3/4 inch bent-up flange and proper edge distance on all rivets. Attach patch to spar web with AN470AD5 rivets spaced at an average of 3/4 inch with a minimum edge distance of 5/16 inch. There must be two rivet rows around each side of the break in the spar web. Damage or cracks to lightening holes not extending more than 4/3 the flange width may be repaired as shown in Figure B-6.

CAUTION

The above repair does not apply to the front spar inboard of Station 12, or the center spar outboard of Station 40.

2-26. DAMAGE REPAIRABLE BY SPLICING. (See Figure 2-4.) Cut out damaged area of the spar flange and web, removing all jagged edges and corners. Smooth all edges to remove burrs. Install splice repair using material, gages and rivets as shown in Figure 2-4. Install fillerstrips between spar caps and skin as necessary to attach skin to spar. This type of repair may be used for spanwise damage up to nine inches. Only one repair of this type is permitted to a spar on each side of the airplane centerline.

2-27. DAMAGE REPAIRABLE BY INSERTION. Damage to the front or center spars which exceeds approximately nine inches in a spanwise direction should be repaired by an insertion splice. The insertion member must be of the same gage, material and section as the existing structure. The insertion member must be spliced to the existing structure using the repair requirements shown in Figure 2-4. Damage to either extremities of the beams should be repaired by an extension splice. Only one insertion or extension splice is permitted on a spar on each side of the centerline of the airplane.

NOTE

Damage to the front spar inboard of Station 12, and the center spar outboard of Station 40 must be repaired by an extension splice.

2-28. DAMAGE NECESSITATING REPLACEMENT. Damage to the front and center spars which cannot be repaired by insertion requires the replacement of the spar. Any damage to stiffening angles, extrusions, fuselage attachment channels or fittings requires their replacement with identical parts or substitutes as listed in Section VIII.

2-29. REAR SPAR AND LOWER AFT WING SKIN.

2-30. DESCRIPTION. This spar is continuous from the airplane center line, Station 0, to the wing tip, Station 194-$\frac{1}{2}$. It is made by bending up the wing lower surface skin and flanging it to pick up the upper surface skin; .032 24ST alclad sheet is used between Stations 0 and 130, and .025 thickness outboard from Station 130 to 194-$\frac{1}{2}$. Flanged lightening holes and extruded angle stiffeners are introduced on the web between rib attachments.

2-31. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions in the web and lower surface skin, one inch away from bends and lightening hole flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1-$\frac{1}{2}$ inches in diameter and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage. The spar effective flange is considered to be approximately one inch of web and one inch of skin adjacent to bends, and only dents free of cracks and abrasions which are worked back to contour are considered negligible damage.

2-32. DAMAGE TO LOWER SURFACE SKIN REPAIRABLE BY PATCHING, STATIONS 24.5 TO 130.0. Damage exceeding the specified limits of negligible damage to the lower surface skin portion of the rear spar, may be repaired by skin patches as described in Paragraphs 2-16 and 2-17 and shown in Figures B-1 and B-3. All riveting should be identical with Type II skin panels as described in Paragraph 2-12. The edge of the cutout is restricted to 1-$\frac{1}{2}$ inches forward of the bend forming the rear spar.

2-33. DAMAGE TO LOWER SURFACE SKIN REPAIRABLE BY PATCHING, STATION 130.0 TO TIP. Damage exceeding the specified limits of negligible damage may be repaired as described in Paragraph 2-32, except all riveting shall be identical with Type I skin panels as described in Paragraph 2-11.

2-34. DAMAGE TO WEB OF REAR SPAR REPAIRABLE BY PATCHING, STATION 0 TO TIP. Damage to the rear web exceeding negligible damage and 1-$\frac{1}{2}$ inches clear of lightening holes and the bend forming the effective spar flange, may be repaired by a patch plate. Remove damaged area by cutting a circular or rectangular hole; minimum corner radii for rectangular cutout 1/2 inch. Smooth all edges to remove burrs. Cut web patch from .032 24ST alclad and larger than cutout to accommodate rivets to web with proper edge distance. Locate position of patch to provide equal overlap at all edges of cutout. Attach web patch to web with two rows of AN470AD5 rivets around the perifery of the cutout, spaced at 3/4 inch with a distance of 5/8 inch between rivet rows and maintain 5/16 inch minimum edge distance. This type of patch is shown in Figure B-3. Damage to the web at lightening holes may be repaired with a patch shown in Figure B-3. Clean out damaged area and burr edges. Cut patch larger than lightening hole and damaged area to permit riveting around the perifery of the lightening hole and damaged area. Attach patch on rear face of spar using rivet requirements as outlined above. Install an .032 x 3/4 x 3/4 24ST alclad angle stiffener on forward side of web and patch to replace stiffness of lightening hole flange. Attach with AN470AD4 rivets or CR-163C-4 cherry rivet to web and patch at one inch spacing.

2-35. DAMAGE TO REAR SPAR REPAIRABLE BY INSERTION, STATION 0 TO 130.0. Damage extending the width of the

lower surface skin and into the spar web should be repaired by an insertion member using a chordwise splice, as the panel is considerably shorter in this direction. If the damage is in a bay near the ends of the spar panel, remove and discard the short end. If the damage is located away from the ends of the spar panel, cut the spar panel on both sides and discard the damaged portion. Cut a sheet of .032 24ST alclad larger than the cutout, to accommodate rivets in the seams with proper edge distance, and form to the shape of the original section. Seams should be lap-spliced to the undamaged spar panel. Spanwise seams, at the lower surface closure strip and the trailing edge upper surface, should pick up existing rivet holes using AN470AD5 rivets with a minimum edge distance of 5/16 inch. Chordwise seams in the lower skin and web are to be identical with a Type II skin panel chordwise seam (see Paragraph 2-20 and Figure 2-3). Two rows of the AN470AD5 rivets are required chordwise and the spacing is permitted to vary between 3/4 inch and one inch, with 5/8 inch between rivet rows and 5/16 inch minimum edge distance. One by one inch .040 angles of 24ST alclad nesting against the spar web to upper surface and lower surface skin flanges are required, to form the effective spar cap splice. The angles are attached with 10 AN470AD4 rivets each side of a chordwise splice, picking up five rivets thru the spar web and five thru the skin. Four angles are required for a skin insertion away from the spar ends.

NOTE

The web splice must be located outside a lightening hole.

2-36. DAMAGE TO REAR SPAR REPAIRABLE BY INSERTION, STATION 130.0 TO TIP. Damage extending the width of the lower surface skin and into the spar web should be repaired by an insertion member. The method of repair is identical with Paragraph 2-35, except the chordwise seams are to be identical with Type I skin panel chordwise seams (see Paragraph 2-20 and Figure 2-3). A single chordwise row of AN470AD5 rivets are used and the spacing is permitted to vary between 3/4 inch and one inch with a minimum edge distance of 5/16 inch. Thru the spar web a double row of AN470AD5 rivets are required, at the above spacing with 5/8 inch between rows. The insertion is made from a sheet of .025 24ST alclad. The nesting angles are not required for this portion of the spar.

2-37. DAMAGE TO REAR SPAR REQUIRING REPLACEMENT. Replacement should be considered for a spar panel damaged more than 40% of its spanwise length. Only one insertion splice is permitted in each spar panel. Damaged extruded angle stiffener fittings on the rear web should be replaced. Allowable standard section substitutions are listed in Section VIII.

2-38. WING RIBS.

2-39. GENERAL. The wing ribs are formed channel sections of 24ST alclad sheet. There are nose ribs, mid sections and trailing edge portions strengthened with angles, plates and extrusions. Beads and lightening holes are introduced when possible. Ribs between Stations 0 and 50 are interrupted and formers are introduced to support the fuel tanks or to enclose the main landing gear well.

2-40. RIB AT STATION 0.

2-41. DESCRIPTION. This rib, within the fuselage, extends from the front spar to the rear spar. It is built up of 24ST alclad sheet and extrusions. It has an I beam cross section, consisting of an .040 gage web, with flanged lightening holes, stiffening beads and angles, to which are bolted extruded angles to form the flanges.

2-42. NEGLIGIBLE DAMAGE. Rib web damage not exceeding the following limits requires no repair or reinforcement. Smooth dents free of cracks or abrasions and clear of lightening hole flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1-½ inches in diameter and adjacent negligible dents are at a distance of 15 inches. Scratches which do not penetrate beyond the alclad coating may be disregarded. Negligible damage to the rib extruded caps shall not exceed the following limits. Nicks, cracks, and gouges relieved with a minimum of a 1/4 inch radius and faired, occurring in the lipped edges of the outstanding legs and not exceeding 1/8 inch in depth measured from the edge of the flange can be classified negligible damage, provided the damage is at least 1/2 inch from existing rivets and 5/8 inch from bolts.

NOTE

No damage is permitted to the extrusion corner material where the flanges are joined.

2-43. DAMAGE TO RIB WEB REPAIRABLE BY PATCHING. Punctures and holes in the rib web 1-½ inches clear of lightening hole flanges, cap angles, and the front and rear stiffeners may be repaired by a patch plate. Remove damaged area by cutting a circular or rectangular hole; minimum corner radii for rectangular cutout 1/2 inch. Smooth all edges to remove burrs. Cut web patch of .040 24ST alclad larger than the cutout to accommodate rivets to web with proper edge distance (see Figure B-3). Locate position of patch to provide equal overlap at all edges of cutout. Attach web patch to web with two rows of AN470AD5 rivets around the perifery of the cutout, spaced at 3/4 inch with 5/8 inch between rivet rows, maintaining 5/16 inch minimum edge distance. Damage to lightening hole flanges and web may be repaired similar to Figure 2-5. Clean out damaged area using generous radii and burr edges. Cut reinforcement from .040 24ST alclad allowing sufficient material for a 3/4 inch bent up flange and proper edge distance on all rivets. Attach patch to rib web with AN470AD5 rivets spaced at an average of 3/4 inch with a minimum edge distance of 5/16 inch. There must be two rows of rivets around each side of the break in the web. Damage or cracks not extending more than 4/3 the lightening hole flange width may be repaired as shown in Figure B-6.

2-44. DAMAGE TO RIB WEB REPAIRABLE BY INSERTION. Damage to the web which exceeds approximately 1/2 the cross section in a vertical direction may be repaired by inserting a new section or complete replacement of the rib, whichever is more expedient. If the damage is near the end of the rib, remove and discard the damaged end. If the damage is located away from the rib ends, cut the web vertically on both sides and discard the damaged portion. Cut a sheet of .040 24ST alclad the same size as the cutout and butt against existing web. Cut splice plates from .040 24ST alclad, 2-5/8 inches wide and the depth of the web between caps. The splice plates should stop just short of the inner edges of the caps. Locate splice plates with equal overlap, and attach splice plates to existing rib web and insertion web with AN470AD5 rivets at 3/4 inch spacing and 5/8 inch between rows, maintaining a minimum edge distance of 5/16 inch. Two rows of rivets are required on each side of a splice.

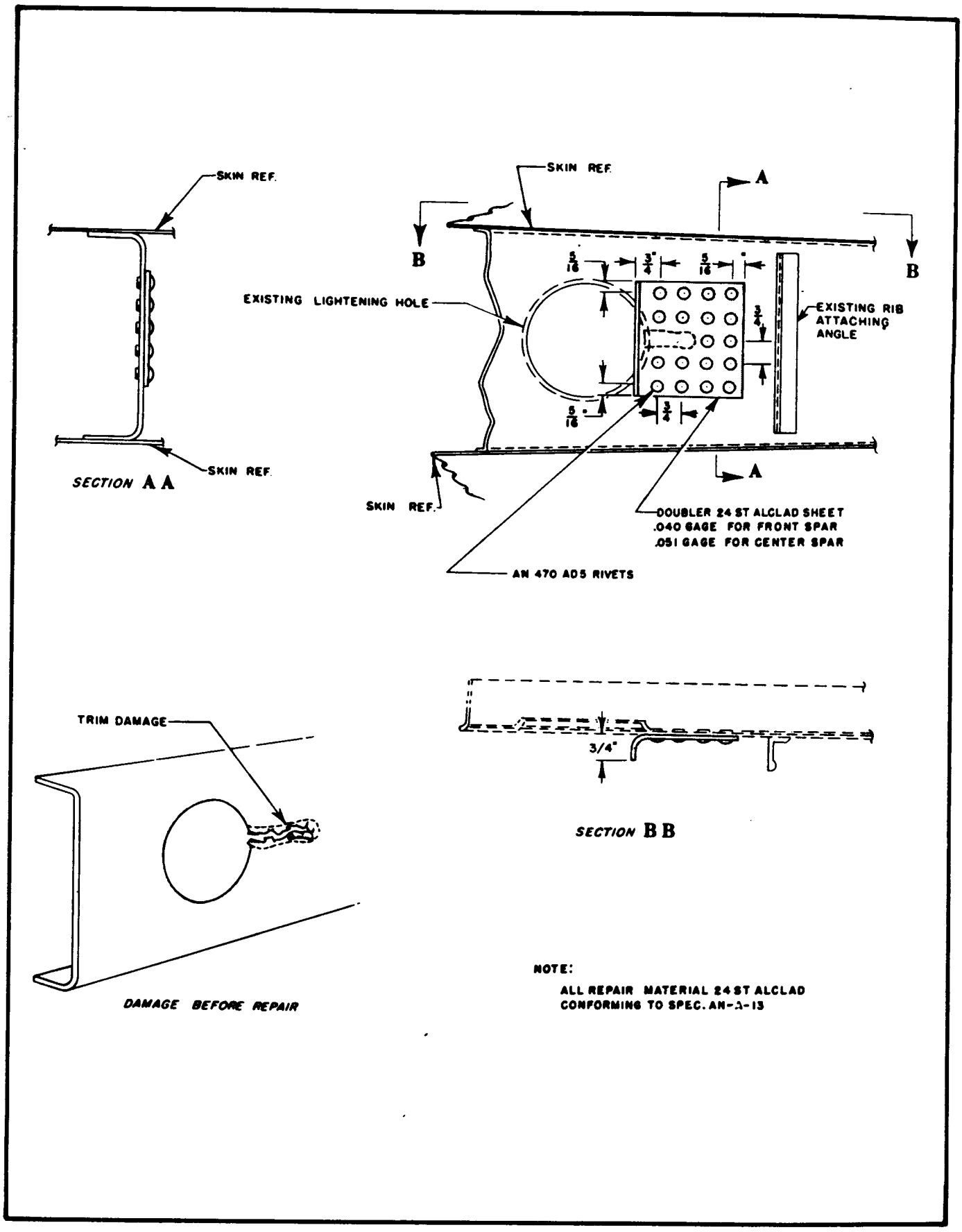


FIGURE 2-5. FRONT BEAM AND CENTER BEAM LIGHTENING HOLE REPAIR

2-45. DAMAGE NECESSITATING REPLACEMENT. Damage to the rib caps exceeding negligible damage requires replacement. The rib web should be replaced for extensive damage and when more than one insertion repair is required.

2-46. RIB AT STATION 50.

2-47. DESCRIPTION. This rib is continuous from the wing leading edge to the rear spar. It is a formed channel of .040 24ST alclad beaded and flanged inboard. There are flanged lightening holes and vertical stiffening angles. An .040 doubler channel extends from the rear spar to the center spar. It is flanged outboard and follows the contours of the top and bottom rib flanges, and is about an inch within them. Extruded angles parallel to the upper and lower rib flanges are riveted to the web about two inches below and above these flanges respectively stiffening the rib longitudinally from leading edge back to the doubler.

2-48. NEGLIGIBLE DAMAGE. Smooth dents in the web free of cracks and abrasions and clear of lightening hole flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1-½ inches in diameter, and adjacent negligible dents are at a distance of 15 inches. Dents exceeding the above limits, and subsequently bumped back to contour without cracking or creasing the web may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage. No damage is permitted to the extruded cap angles.

2-49. DAMAGE REPAIRABLE BY PATCHING. Damage to the lightening hole flanges and adjacent web may be repaired similar to Figure 2-5. Clean out damaged area using generous radii, and burr edges. Cut reinforcement of the same gage and material as rib allowing sufficient material for a 3/4 inch bent-up flange and proper edge distance on all rivets. Attach patch to rib web with AN470AD6 rivets spaced at an average of 3/4 inch with a minimum edge distance of 3/8 inch. There must be two rows of rivets around each side of the break in the web. Damage or cracks not extending more than 4/3 the lightening hole flange width may be repaired as shown in Figure B-6. Punctures and holes in the web between the center spar and landing gear beam may be repaired by a patch plate (see Figure B-3). Remove damaged area by cutting a circular or rectangular cutout; minimum corner radii 1/2 inch for rectangular cutout. Smooth all edges to remove burrs. Cut web patch of .081 24ST alclad larger than the cutout to accommodate bolts to web with proper edge distance. Locate position of patch to provide equal overlap at all edges of cutout. Attach web patch to web with a single row of AN3 bolts and AN365-1032 nuts, spaced at 7/8 inch around the perifery of the cutout.

2-50. DAMAGE NECESSITATING REPLACEMENT. Damage to the rib web not repairable by patching should be replaced. The rib is manufactured in three sections and only the damaged portion need be replaced. Damage to the extruded cap angles requires replacement of the part.

2-51. WING RIBS EXCLUSIVE OF STATIONS 0 AND 50.

2-52. DESCRIPTION. The ribs at Stations 12.25, 24.5 and 37.25 are in two or three separate sections extending either side of the fuel tanks and landing gear well. Ribs at Station 130 and 194.25 are in one piece. All ribs from Station 66 through Station 178.75 inclusive are made up of two parts; nose ribs and trailing edge sections; and are riveted together at stringer number five. All horizontal edges are flanged for skin and stringer attachment.

2-53. NEGLIGIBLE DAMAGE. The same limits as those specified in Paragraph 2-48, apply here.

2-54. DAMAGE REPAIRABLE BY PATCHING. Damage to ribs which may vary in extent and location must be repaired in accordance with the repair data shown on Figure B-5.

2-55. DAMAGE NECESSITATING REPLACEMENT. If any damage extends over half the length of any rib, it is advisable to replace the rib.

2-56. FORMING REPLACEMENT RIBS BY ORDINATES METHOD. Whenever possible, damaged ribs requiring replacement should be replaced by original spare parts. However, where spare parts are not available and immediate repair is necessary, the rib contour is obtained from Table 2-1. The rib upper and lower surface ordinates are charted. This information permits the contour of the rib to be laid out so that a form block can be cut. From 24ST alclad sheet material the same thickness as the original rib, cut material for a new rib by tracing the contour of the form block and adding sufficient width on the top and bottom to permit the forming of the rib flanges. The sheet is clamped to the form block and the rib flanges are formed by pounding with a mallet. Using the damaged rib as a pattern, make the stringer cutouts along the edges of the replacement rib. In place of the flanged lightening holes and stiffening beads of the original rib, bent-up 3/4 x 3/4 angles of the next heavier gage as the rib, are installed on the rib perpendicular to the rib flanges. The replacement rib is installed exactly the same as an original part.

2-57. WING STRINGERS.

2-58. DESCRIPTION. The stringers in the wing are made from 24ST aluminum alloy extrusions and 24ST alclad standard formed sections, varying in thickness from .025 to .125 inches. Detailed dimensions are shown in Section VIII; extrusions 1E128, 1E129 and standard formed angles 1S3, 1S4 and 1S4-3.

2-59. NEGLIGIBLE DAMAGE. Any damage to stringers must be repaired, no negligible damage is permitted.

2-60. DAMAGE REPAIRABLE BY PATCHING. The repairs shown in Figure 2-6 are for partial and complete damage to wing stringers. When damage occurs to any of the skin attachment flanges and skin, and a flush patch skin repair is used, it will be necessary to cut back the stringer's skin flange or the stringer. The skin flange is cut back beyond the skin cutout to allow the installation of the skin doubler as described in Paragraph 2-15. The stringers are reinforced by the repair materials shown in Figure 2-6, which extend beyond the damaged area and doubler sufficiently to permit installation of the rivets called out. When an external skin patch is used for repair, the stringer does not have to be cut back beyond the damaged length of the stringer. The stringer repair is made as shown in Figure 2-6. It will be necessary to insert a filler between the external patch and the stringer.

2-61. DAMAGE REPAIRABLE BY INSERTION. The repairs shown in Figure 2-6 may be used for splicing insertion stringers. The insertion stringer should be identical with the existing part or made from the permissible substitute shown in Section VIII. The insertion stringer must butt against the existing

PERCENT OF CHORD	STATION 24.5			STATION 37.25			STATION 50.00		
	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface
0	0	-2.041		0	-2.069		0	-2.096	
1.25	1.021	+ .063	-3.732	.988	- .050	-3.681	.955	- .165	-3.630
2.50	2.041	.932	-4.317	1.976	+ .787	-4.232	1.911	+ .642	-4.148
5.00	4.082	2.148	-4.992	3.952	1.965	-4.862	3.822	1.781	-4.732
7.50	6.122	3.041	-5.378	5.928	2.832	-5.217	5.733	2.624	-5.056
10	8.163	3.752	-5.620	7.904	3.524	-5.435	7.644	3.296	-5.250
20	16.326	5.509	-5.952	15.808	5.247	-5.705	15.289	4.985	-5.459
30	24.488	6.122	-5.850	23.712	5.864	-5.574	22.935	5.606	-5.298
40	32.651	5.900	-5.695	31.616	5.670	-5.406	30.580	5.440	-5.117
50	40.814	4.906	-5.713	39.520	4.723	-5.420	38.225	4.540	-5.126
60	48.976	3.289	-5.903	47.423	3.170	-5.609	45.870	3.052	-5.315
70	57.139	+1.275	-6.110	55.327	+1.233	-5.821	53.515	+1.190	-5.533
80	65.302	- .884	-6.164	63.231	- .843	-5.885	61.160	- .801	-5.606
90	73.464	-2.957	-5.846	71.135	-2.828	-5.586	68.805	-2.699	-5.327
100	81.627	-4.818		79.038	-4.597		76.450	-4.375	
L. E. Radius	1.319			1.260			1.201		

PERCENT OF CHORD	STATION 66.0			STATION 82.0			STATION 98.0		
	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface
0	0	-2.130		0	-2.164		0	-2.199	
1.25	.916	- .309	-3.566	.874	- .452	-3.502	.834	- .596	-3.438
2.50	1.831	+ .460	-4.042	1.748	+ .278	-3.936	1.668	+ .096	-3.830
5.00	3.661	1.551	-4.569	3.497	1.321	-4.507	3.336	1.090	-4.244
7.50	5.491	2.361	-4.854	5.246	2.099	-4.652	5.003	1.837	-4.450
10	7.321	3.009	-5.018	6.995	2.723	-4.785	6.671	2.436	-4.553
20	14.641	4.657	-5.149	13.990	4.328	-4.840	13.342	4.000	-4.530
30	21.961	5.281	-4.952	20.986	4.957	-4.605	20.012	4.633	-4.259
40	29.281	5.151	-4.754	27.981	4.862	-4.391	26.683	4.573	-4.028
50	36.602	4.310	-4.758	34.977	4.080	-4.390	33.354	3.851	-4.022
60	43.922	2.902	-4.947	41.972	2.753	-4.578	40.024	2.604	-4.210
70	51.242	+1.137	-5.170	48.967	+1.084	-4.808	46.695	+1.030	-4.446
80	58.562	- .749	-5.257	55.963	- .697	-4.907	53.365	- .645	-4.557
90	65.882	-2.537	-5.000	62.958	-2.375	-4.674	60.036	-2.213	-4.348
100	73.202	-4.097		69.954	-3.819		66.706	-3.541	
L. E. Radius	1.127			1.053			.979		

TABLE 2-1. (Sheet 1 of 2 Sheets) WING RIB ORDINATES

PERCENT OF CHORD	STATION 114.0			STATION 130.0			STATION 146.25		
	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface
0	0	-2.233		0	-2.267		0	-2.302	
1.25	.793	- .739	-3.374	.753	- .887	-3.310	.712	-1.028	-3.245
2.50	1.586	- .086	-3.724	1.506	- .268	-3.618	1.423	- .453	-3.510
5.00	3.172	+ .860	-4.081	3.011	+ .630	-3.918	2.846	+ .396	-3.753
7.50	4.759	1.575	-4.248	4.516	1.312	-4.046	4.269	1.046	-3.841
10	6.345	2.150	-4.321	6.021	1.863	-4.088	5.691	1.572	-3.852
20	12.691	3.671	-4.221	12.042	3.342	-3.911	11.382	3.009	-3.597
30	19.037	4.308	-3.912	18.064	3.984	-3.566	17.074	3.655	-3.214
40	25.383	4.284	-3.666	24.085	3.996	-3.303	22.765	3.702	-2.935
50	31.729	3.621	-3.653	30.106	3.391	-3.285	28.456	3.157	-2.911
60	38.074	2.454	-3.841	36.127	2.305	-3.472	34.147	2.153	-3.098
70	44.420	+ .977	-4.084	42.148	+ .923	-3.722	39.838	+ .869	-3.354
80	50.766	- .593	-4.208	48.169	- .541	-3.858	45.529	- .488	-3.503
90	57.112	-2.051	-4.022	54.190	-1.889	-3.695	51.220	-1.724	-3.364
100	63.458	-3.263		60.210	-2.985		56.911	-2.702	
L. E. Radius	.905			.831			.756		

PERCENT OF CHORD	STATION 162.5			STATION 178.75			STATION 194.25		
	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface	Distance from L.E.	Upper Surface	Lower Surface
0	0	-2.337		0	-2.372		0	-2.405	
1.25	.670	-1.174	-3.180	.628	-1.319	-3.115	.590	-1.458	-3.053
2.50	1.340	- .638	-3.402	1.257	- .823	-3.295	1.179	-1.000	-3.192
5.00	2.680	+ .162	-3.588	2.515	- .072	-3.422	2.359	- .295	-3.265
7.50	4.021	.780	-3.636	3.773	+ .513	-3.431	3.538	+ .259	-3.236
10	5.361	1.281	-3.617	5.031	.990	-3.381	4.717	.713	-3.155
20	10.722	2.675	-3.282	10.062	2.341	-2.968	9.434	2.023	-2.668
30	16.084	3.325	-2.862	15.094	2.996	-2.510	14.150	2.682	-2.175
40	21.445	3.409	-2.566	20.125	3.116	-2.198	18.867	2.836	-1.846
50	26.806	2.925	-2.537	25.156	2.691	-2.163	23.584	2.469	-1.806
60	32.167	2.002	-2.724	30.188	1.850	-2.349	28.301	1.706	-1.992
70	37.529	+ .815	-2.987	35.219	+ .761	-2.619	33.017	+ .709	-2.268
80	42.890	- .435	-3.148	40.251	- .382	-2.792	37.734	- .332	-2.454
90	48.251	-1.560	-3.033	45.282	-1.395	-2.701	42.451	-1.238	-2.385
100	53.612	-2.420		50.313	-2.137		47.167	-1.868	
L. E. Radius	.680			.605			.534		

TABLE 2-1. (Sheet 2 of 2 Sheets) WING RIB ORDINATES

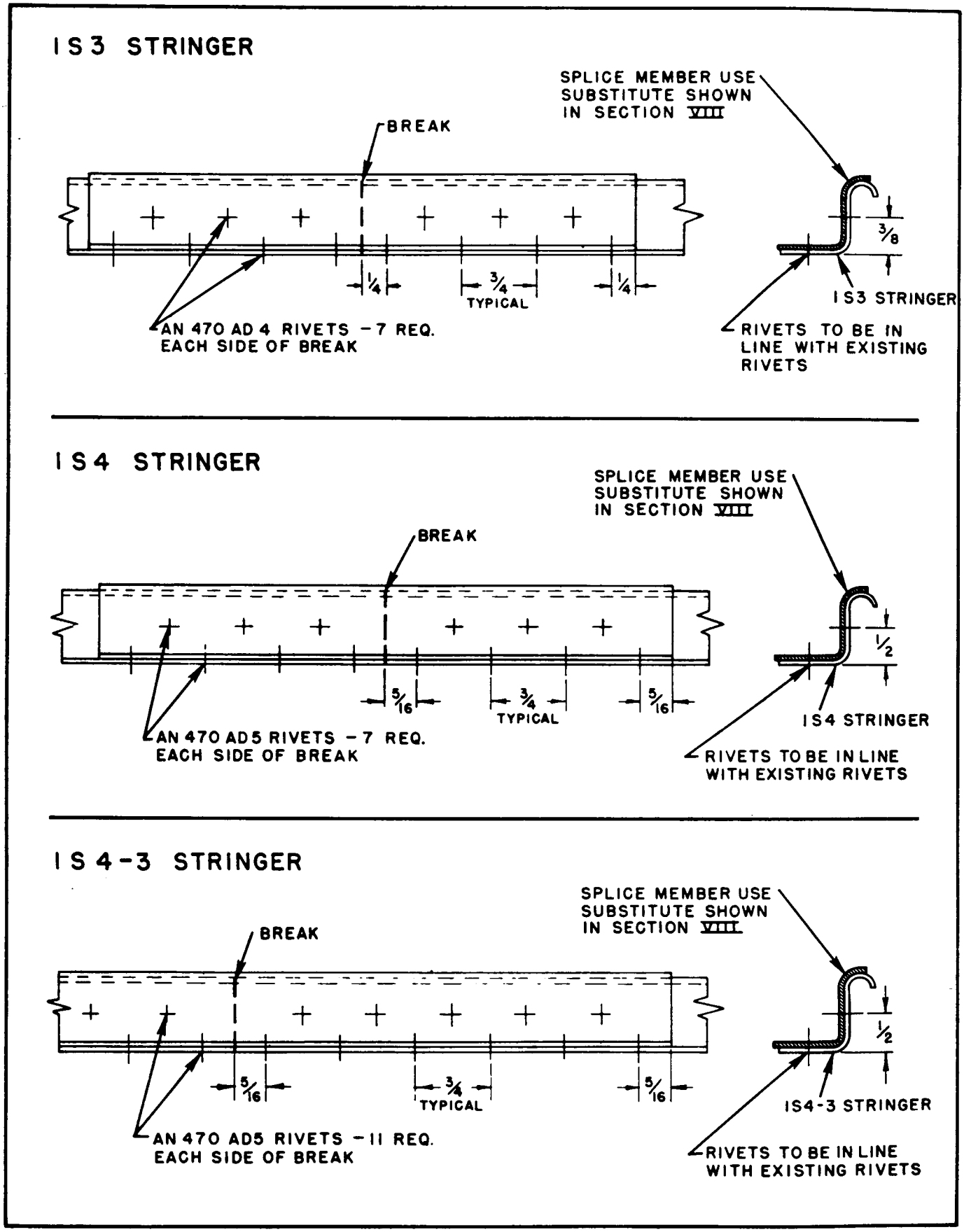
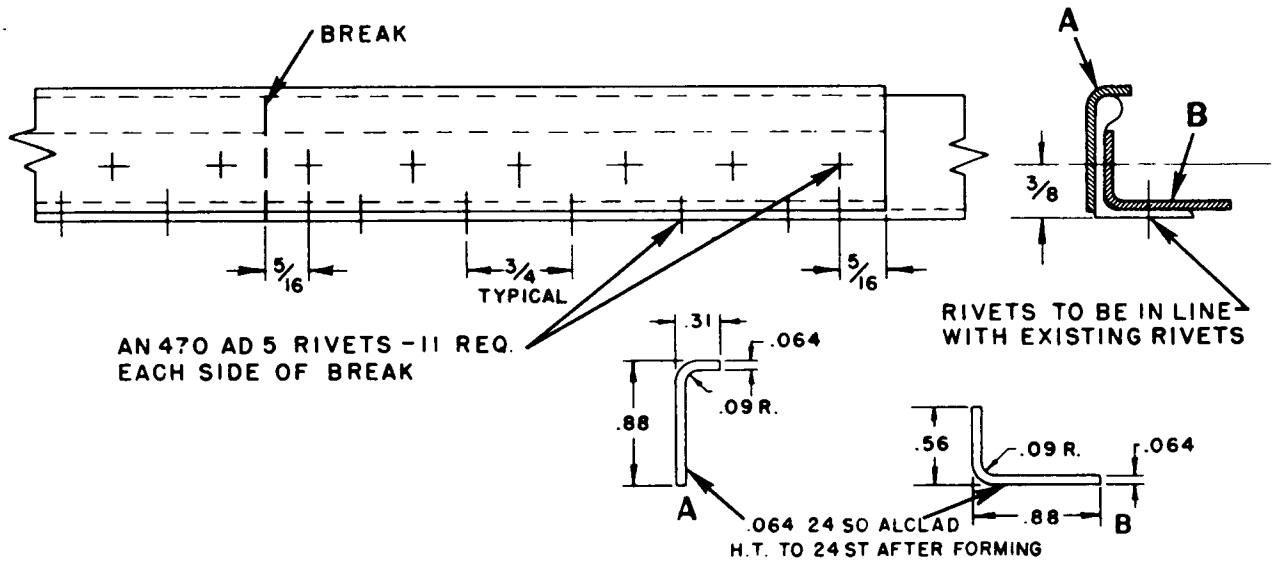


FIGURE 2-6. WING STRINGER REPAIRS

1E128T STRINGER



1E129T STRINGER

SPLICING NOT PERMITTED, REPLACE DAMAGED WING STRINGERS WITH IDENTICAL EXTRUSION OR ALLOWABLE FORMED SHEET SUBSTITUTE SHOWN IN SECTION VIII

COMBINED 1S4 & 1E128T STRINGERS

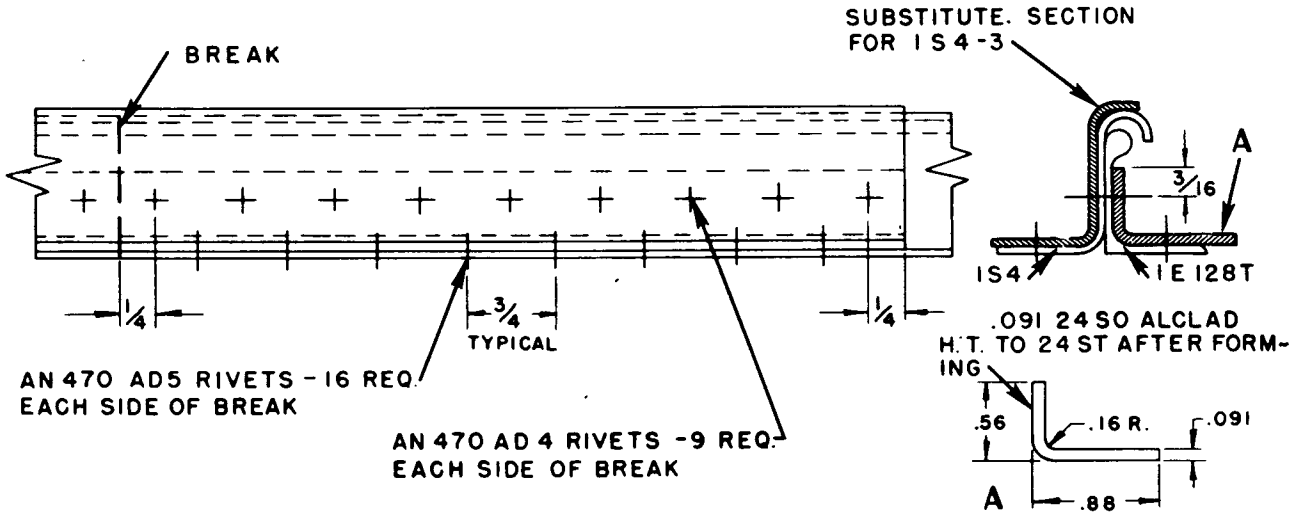


FIGURE 2-6. WING STRINGER REPAIRS

stringer at the splice.

2-62. DAMAGE NECESSITATING REPLACEMENT. Partial and complete damage occuring to the 1E129T type of stringer requires replacement. See Section VIII.

2-63. AILERONS.

2-64. DESCRIPTION. The ailerons are fabricated from 24ST alclad sheet riveted together with modified brazier head type rivets. Each aileron consists of a single spar at 32.4% of the aileron chord, four nose former ribs between two complete ribs at the inboard and outboard ends, and skin wrapped around the ribs. The ailerons are hinged to the wing rear beam, at the inboard end, outboard end, and center of the aileron spar. Ball bearings are staked into each of the hinge brackets. A fixed trim tab is riveted to the inboard trailing edge of the right-hand aileron. An external streamlined static balance weight is attached to the outboard rib of each aileron. Both ailerons are statically balanced within a maximum allowable unbalance of 4 inch-pounds.

2-65. ACCESS FOR REPAIRS. Access to the interior of the ailerons may be gained by removing the skin or installing a cover plate as described in Paragraph 2-14.

2-66. AILERON SKIN.

2-67. DESCRIPTION. The aileron skin consists of three panels of .016 24ST alclad sheet. One sheet is wrapped around and riveted to the nose ribs and spar flanges. Another is used for the lower surface and is bent up and flanged to form the spar. The third is on the upper surface and is riveted to the upper flange of the spar and to the trailing edge of the lower surface skin. The upper and lower surfaces aft of the beam are beaded.

2-68. NEGLIGIBLE DAMAGE. The same limits may be applied to the aileron skin as to that on the wing, see Paragraph 2-7.

2-69. DAMAGE REPAIRABLE BY PATCHING. Damage to the aileron skin panels which exceeds that specified as negligible should be repaired by patching. These patches need not be flush. Use Figures B-1 or B-3.

2-70. AILERON BEAM.

2-71. DESCRIPTION. The aileron beam is the forward portion of the bottom surface skin bent up, flanged, beaded and with lightening holes.

2-72. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions and clear of lightening hole flanges and cap flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1-½ inches in diameter, and adjacent negligible dents are at a distance of 15 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the web may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage. No damage is permitted to the effective spar caps. The effective spar cap is considered to be the flange and approximately 3/4 inch of the adjacent web.

2-73. DAMAGE REPAIRABLE BY PATCHING. Partial or complete damage to a cross section of the aileron beam is repairable by nesting a .020 24ST alclad channel within the beam channel. The channel should be the depth of the beam with 5/8 inch flanges top and bottom. Attach the repair channel flanges to the beam flanges with AN470AD3 rivets, four rivets thru each flange on each side of the damaged area. Web rivet rows should be spaced approximately 5/8 inch apart with four AN470AD3 rivets per row on each side of damage. All rivet rows run spanwise, with the rivets spaced at approximately 5/8 inch. The .020 24ST alclad reinforcing strip at the center hinge should be replaced when damaged.

2-74. AILERON RIBS.

2-75. DESCRIPTION. The aileron ribs are formed of 24ST alclad sheet. There are four nose ribs of .020 and .025 gage, with lightening holes. The ribs at the inboard and outboard ends, extend the length of the aileron chord. All nose ribs are flanged and riveted to the beam and the skin.

2-76. NEGLIGIBLE DAMAGE. Same as that specified in Paragraph 2-48.

2-77. DAMAGE REPAIRABLE BY PATCHING. Any damage not included in that specified as negligible should be repaired by patching or replacement. Repairs may be made as shown for typical formed ribs. See Figures B-5 and B-6.

2-78. DAMAGE NECESSITATING REPLACEMENT. If any damage extends over half the length of a rib, it should be replaced. Any damaged fittings or brackets should be replaced.

2-79. AILERON TRIM TAB.

2-80. DESCRIPTION. The aileron trim tab is 52S0 aluminum alloy sheet, .032 x 2-1/16 x 10-3/8 inches riveted on the inboard trailing edge of the right hand aileron.

2-81. NEGLIGIBLE DAMAGE. Disregard smooth dents free of cracks or abrasions. Two punctures or trimmed holes up to 1/4 inch in diameter may be permitted provided they have a minimum edge distance of 3 inches from each other and are at least a 1/2 inch from all edges of the tab or aileron trailing edge. If the tab is bent or twisted, it may be formed back into shape as long as it is not cracked.

2-82. DAMAGE NECESSITATING REPLACEMENT. Any damage exceeding that classified as negligible requires that the tab be replaced.

2-83. FLAPS.

2-84. DESCRIPTION. The flaps are fabricated from 24ST alclad sheet. Riveted with modified brazier head rivets. Each flap consists of two spars, a stringer, four nose ribs, outboard and inboard end ribs, and beaded skin. The flaps are the slotted type and are mounted on brackets.

2-85. ACCESS FOR REPAIRS. Access to the interior of the flaps may be gained by removing the skin or installing a cover plate, see Paragraph 2-89.

2-86. FLAP SKIN.

2-87. DESCRIPTION. The flap skin consists of three panels of 24ST alclad. A sheet of .016 gage is wrapped around and riveted to the nose ribs and front beam flanges. One of .020 is used for the lower surface, it is riveted to the lower flange of the auxiliary beam, extends forward and is bent up and flanged to form the main beam. The third, also .020 gage, is on the upper surface and is riveted to the upper

flanges of the main and auxiliary beams and to the trailing edge of the lower surface skin. Both upper and lower surface skins are beaded aft of the main beam.

2-88. NEGLIGIBLE DAMAGE. The same limits may be applied to the flap skin as to that on the wing. See Paragraph 2-7.

2-89. DAMAGE REPAIRABLE BY PATCHING. Damage to the flap skin panels which exceeds that specified as negligible should be repaired by patching. These patches need not be flush. Use Figures B-1 or B-3.

2-90. FLAP MAIN BEAM.

2-91. DESCRIPTION. The flap main beam is the forward portion of the bottom surface skin, bent up, flanged, beaded, and with lightening holes.

2-92. NEGLIGIBLE DAMAGE. See Paragraph 2-72.

2-93. DAMAGE REPAIRABLE BY PATCHING. Partial or complete damage to a cross section of the flap main beam is repairable by nesting a .032 24ST alclad channel within the beam channel. The channel should be the depth of the beam with 3/4 inch flanges top and bottom. Attach the repair channel flanges to the beam flanges with AN470AD3 rivet, five rivets each side of the damaged area thru each flange. Web rivet rows should be spaced 5/8 inch apart with five AN470-AD3 rivets per row on each side of damage. Rivet rows run spanwise, with a rivet spacing of approximately 5/8 inch.

2-94. FLAP AUXILIARY BEAM.

2-95. DESCRIPTION. The flap auxiliary beam is an .020 24ST alclad channel with skin attachment flanges, riveted with AD3 modified brazier head rivets, to the upper and lower surface skin between beads. Both ends are flanged and riveted to the webs of the inboard and outboard ribs, at stations 0 and 106.442 respectively.

2-96. NEGLIGIBLE DAMAGE. See Paragraph 2-72.

2-97. DAMAGE REPAIRABLE BY PATCHING. See Paragraph 2-93.

2-98. FLAP RIBS.

2-99. DESCRIPTION. The flap ribs are formed of 24ST alclad sheet. All ribs are .020, .025 or .032 gage. They are all flanged horizontally for skin attachment and vertically to be riveted to the main beam web. The nose ribs are beaded and the lower flanges cut out for the stringer extending parallel and in front of the main beam. Flap support brackets perpendicular to the lower flap surface, just forward of the front beam, are riveted to the nose ribs at Stations 0 and 106.442 and to the skin with bracket supports inside the skin at Station 42.11.

2-100. NEGLIGIBLE DAMAGE. See Paragraph 2-48.

2-101. DAMAGE REPAIRABLE BY PATCHING. See Paragraph 2-77.

2-102. DAMAGE NECESSITATING REPLACEMENT. If any damage extends over half the length of the nose or trailing edge ribs, or if the damage occurs at the stringer cutout, the rib should be replaced. All damaged fittings or brackets should be replaced.

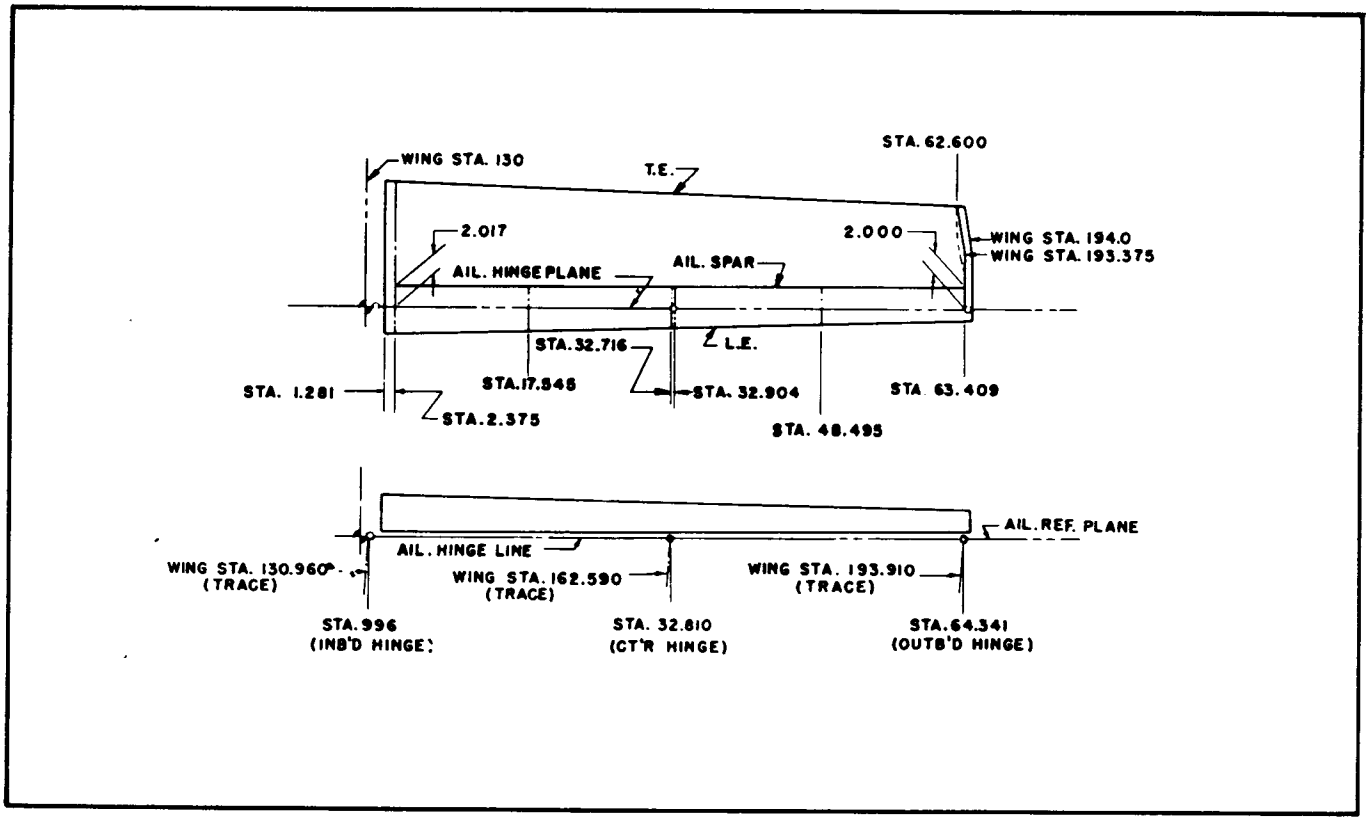


FIGURE 2-7. AILERON JIG DIMENSIONS

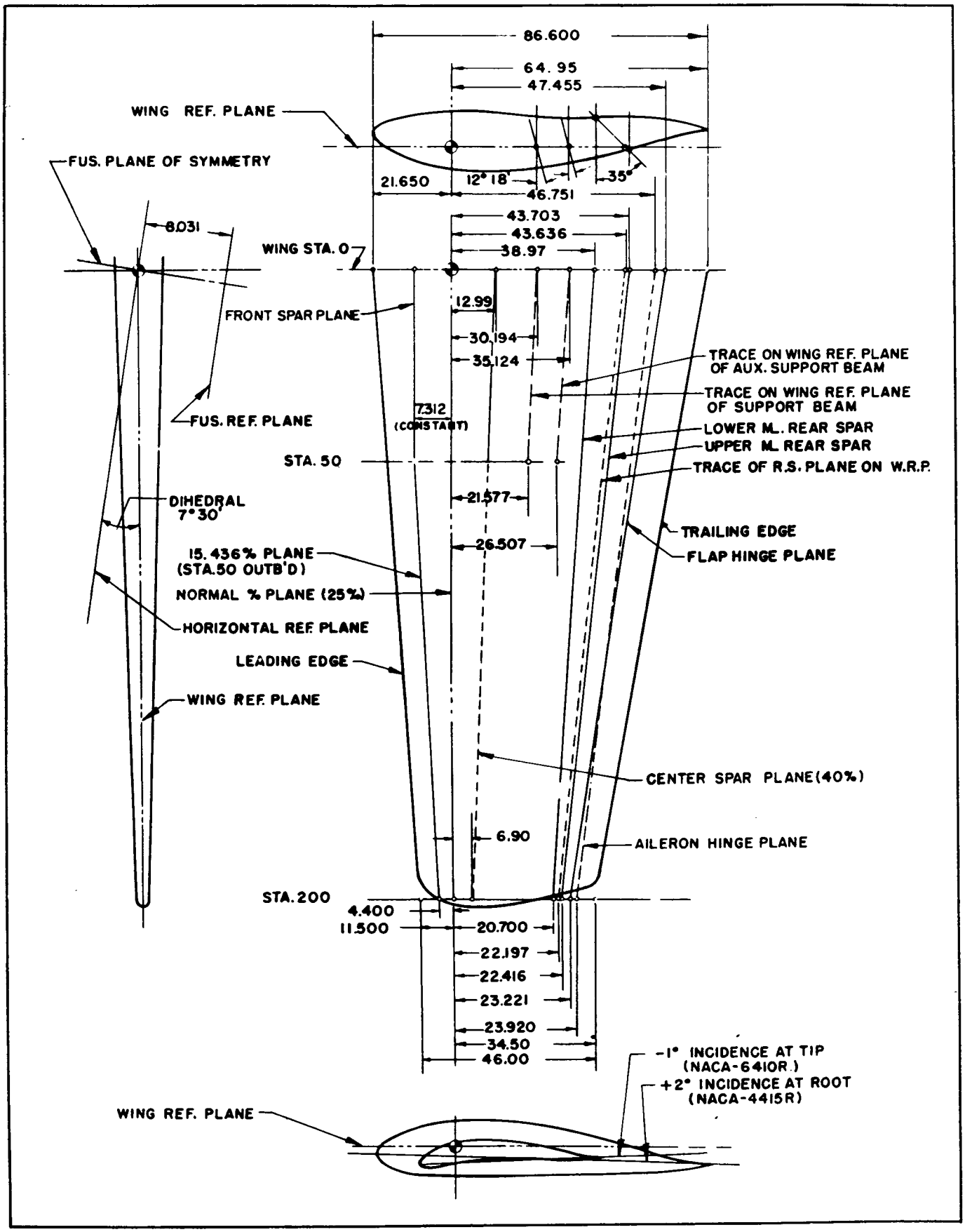


FIGURE 2-8. WING JIG DIMENSIONS

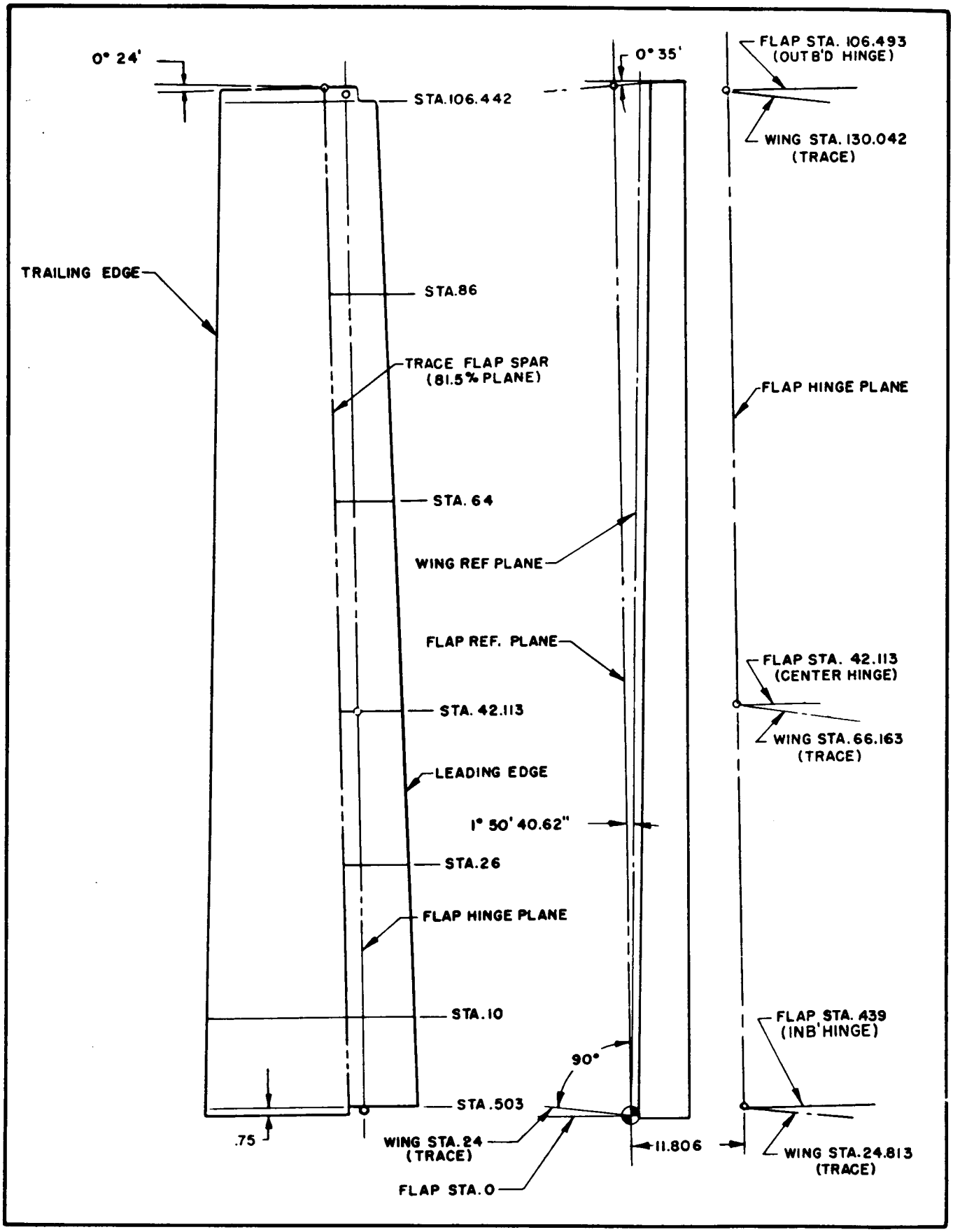


FIGURE 2-9. FLAP JIG DIMENSIONS

SECTION III

TAIL GROUP

3-1. GENERAL.

3-2. DESCRIPTION. (See Figure 3-1.) The tail group is an all-metal structure consisting of a horizontal stabilizer with elevators, and a vertical stabilizer with rudder.

3-3. ALIGNMENT. Repair jigs for the horizontal stabilizer, elevator, vertical stabilizer, and rudder may be fabricated using figures 3-4 and 3-5.

3-4. HORIZONTAL STABILIZER.

3-5. DESCRIPTION. (See figure 3-1.) Each stabilizer assembly consists of a full span beam, 2.8 inches forward of the elevator hinge line, four formed ribs, stringers and skin. Removable tips, made from deep drawn 52 SO are attached with anchor nuts and screws to the most outboard rib. Elevator hinge brackets with staked ball bearings are installed on the spar. All other parts are of 24 ST Alclad sheet.

3-6. ACCESS FOR REPAIRS. Access to a limited portion of the inboard section is afforded through the rib at station 8.5 and to an even smaller portion of the outboard section through the rib at station 75.1 where the tip assembly is readily removable. When damage to the structure is extensive it is necessary to remove the skin, make the necessary repairs to the structure and replace the skin. To repair or replace the skin, it may be necessary to install access holes to permit the bucking of rivets which attach the skin to the internal structure. If damage to the internal structure and skin is not extensive, enlarge the opening in the skin, repair the internal structure and then close the opening by installing an access cover plate. Installation details for access cover plates are described in paragraphs 3-12 and 3-13.

3-7. HORIZONTAL STABILIZER SKIN.

3-8. DESCRIPTION. The skin is .020, 24 ST alclad sheet. The nose panel extends the full semi-span of each stabilizer and laps over the upper and lower surface skin panels on the stringer at station 273.9. Modified Brazier head, 1/8 inch, A17ST aluminum rivets are used for this joint and the skin attachments to the aft stringers and stabilizer beam. The stabilizer tip assembly, formed of .040, 52 SO aluminum sheet, is attached to the rib at station 75.1 by six anchor nuts and screws.

3-9. NEGLIBIBLE DAMAGE. Smooth shallow dents located anywhere on the stabilizer skin, free of cracks and abrasions may be disregarded, provided these dents do not exceed a depth of 1/8 inch and a diameter of 1-1/2 inches, and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating are considered negligible damage.

3-10. DAMAGE REPAIRABLE BY PATCHING.

3-11. GENERAL. Any damage which exceeds the specified limits of negligible damage in Paragraph 3-9 must be repaired by means of patches as shown on Figures B-1 thru B-3. The original smoothness and contour must be retained for leading edge repairs. Skin patches can be either access door type with a removable cover plate, or a completely riveted skin patch integral with the existing skin. Paint all bare surfaces and repair materials with two coats of zinc chromate primer. Stabilizer tips that are cracked or punctured may be repaired by welding. The tip must be thoroughly cleaned before welding. It is important, after repair by welding, to completely remove all welding flux in order to avoid possible corrosion.

3-12. ACCESS DOOR, CLEAR OF INTERNAL STRUCTURE. For damage to the skin clear of internal structure, or for the installation of access doors in the skin, see Figure B-1. Damage to the skin clear of internal structure may be repaired by installing a removable, access cover plate. Access doors also may be installed to facilitate repairs to the structure. The paragraph at the bottom of the figure provides information for the installation of access doors for all skin panels. The cover plate must be a close fit to provide a smooth surface. To install the access door, trim the existing skin panel beyond the damaged area by cutting a circular or rectangular cutout, leaving sufficient skin to allow for the installation of the doubler. Plate nuts and screws are substituted for rivets in attaching the access door to the doubler. The plate nuts attached to the doubler may be installed prior to the installation of the doubler. Rivet the doubler to the existing skin and install the cover plate.

3-13. ACCESS DOOR, OVER INTERNAL STRUCTURE. For damage to the skin over internal structure, or for the installation of access doors in the skin over internal structure, see Figure B-1. Damage to the skin and a rib may be repaired by repairing the rib and then installing the access door. Before attempting the repair, trim the skin beyond the damaged area, leaving sufficient existing skin to allow for the installation of the doubler. Repair the rib by nesting the repair member on the inside of the rib. Install the doubler as shown in the figure. The necessary repair data is provided at the bottom of the Figure. After the doubler is installed, insert a filler between the rib repair member and the cover plate. If the gage of the doubler exceeds the gage of the rib, it may be necessary to insert fillers between the existing rib and the rib repair member. Plate nuts and screws are substituted for rivets in attaching the access door to the doubler and rib. The plate nuts required on the rib repair member can be installed on the bench. When installing the cover plate, be sure that the screws tying the plate to the rib are inserted.

3-14. RIVETED SKIN PATCH, CLEAR OF INTERNAL STRUCTURE. (See Figure B-1.) Flush skin patches integral with the damaged skin panel may be made by riveting the flush skin patch to the doubler. This type of skin patch may be installed, provided there is access through which the rivets can be bucked, or Cherry rivets (CR-163C) are used. In either case, the skin patch repair information is furnished at the bottom of the figure. The typical dimensions shown on the figure are applicable for the repair of all the skin panels. The procedure for making the repair is the same as the installation of an access door as described in paragraph 3-12, except that riv-

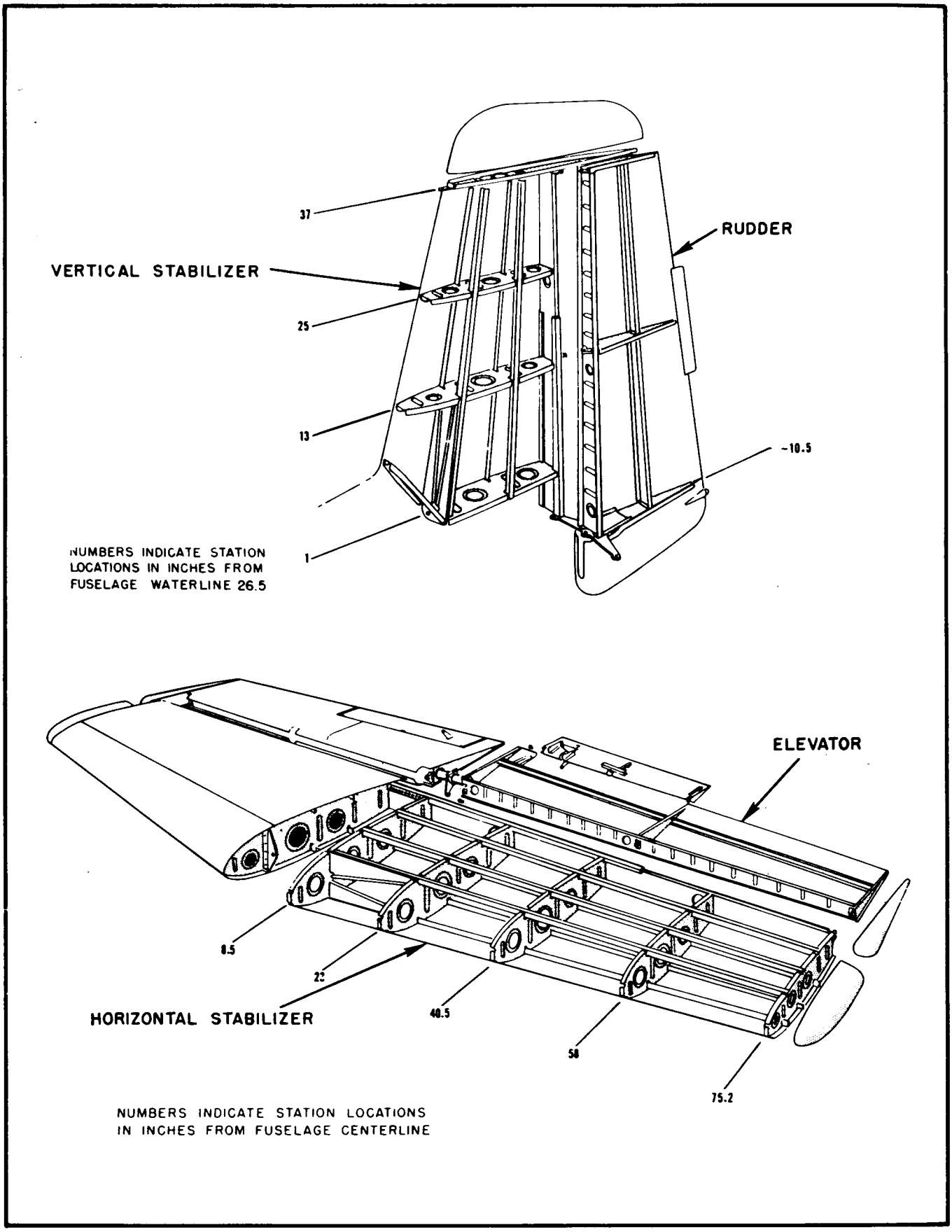


FIGURE 3-1. TAIL STRUCTURE

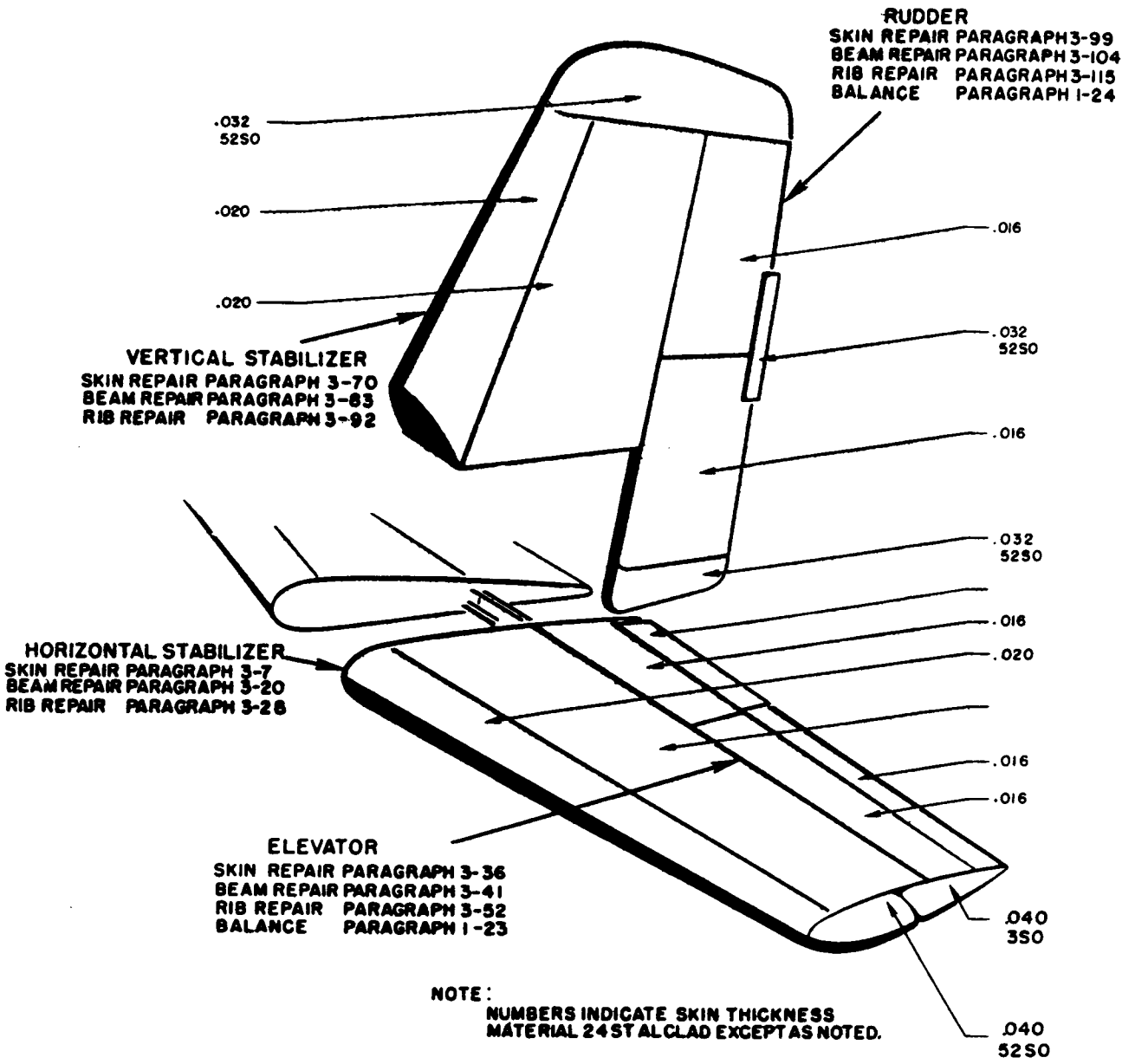


FIGURE 3-2. TAIL SKIN ARRANGEMENT

ets are used instead of plate nuts and screws. If an external patch is desired, use the repair shown in Figure B-3.

3-15. RIVETED SKIN PATCH, OVER INTERNAL STRUCTURE. (See Figure B-1.) Flush skin patches integral with the damaged skin panel may be made by riveting the doubler to the existing skin and riveting the flush skin patch to the doubler and the internal structure. The skin patch repair data is shown at the bottom of the figure. The procedure for making the repair is the same as for the installation of an access cover plate as described in paragraph 3-12, except that rivets are used instead of plate nuts. The rivets tying the skin patch to the repaired internal structure should be the same as the existing rivets or one diameter larger, and should have the same spacing as the rivets in the original structure. If an external patch is desired, use the repair data shown in Figure B-3.

3-16. LEADING EDGE REPAIR, CLEAR OF INTERNAL STRUCTURE. Damage to the leading edge clear of internal structure must be repaired as shown in figure B-2. The skin patch repair information may be obtained at the bottom of the Figure. The repair can be effected by trimming beyond the damaged skin, leaving sufficient skin to allow for the installation of the doubler. This type of skin patch may be installed, provided there is access through which the rivets can be bucked, or Cherry rivets (CR-163C) are used. After the doubler is riveted to the skin, attach the cover plate to the doubler with rivets. A removable cover plate attached with plate nuts and screws may also be used, making the repair the same as the installation of an access door as described in Paragraph 3-12.

3-17. LEADING EDGE REPAIR, OVER INTERNAL STRUCTURE. Damage to the leading edge, over internal structure must be repaired as shown in Figure B-2. The skin patch repair information may be obtained at the bottom of the Figure. Trim the skin beyond the damaged area, leaving sufficient skin to allow for the installation of the doubler. Trim the rib back beyond the existing skin sufficiently to allow for the installation of the doubler. Repair the rib by forming a new rib nose section and making an extension splice. The depth of the new nose section must be such that, when the doubler and flush skin patch are riveted to the doubler, the skin patch will be flush. It will be necessary to put a filler between the existing rib flange and the rib extension splice member. This type of skin patch may be installed, provided there is access through which the rivets can be bucked, or Cherry rivets (CR-163C) are used. After the doubler is installed and the rib repaired, rivet the flush skin patch to the doubler and the new rib section. Use the same spacing as the original spacing to attach the skin patch to the new rib nose section. If a removable access cover is desirable, use plate nuts and screws as described in Paragraph 3-12.

3-18. DAMAGE REPAIRABLE BY INSERTION. Skin that is damaged extensively should be repaired by splicing in a new skin from one structural member to the next. The repair should be made to lie along stiffening members, stringers, ribs or beams, and each seam should be made exactly the same in regard to rivet size, spacing and rivet pattern as the parallel manufactured seams at the edges of the original sheet. If the manufactured seams are different the stronger one must be copied. A similar repair is shown in figure 2-3.

3-19. DAMAGE NECESSITATING REPLACEMENT. Damage to skin which cannot be repaired by insertion must be repaired by replacement of the skin panel.

3-20. HORIZONTAL STABILIZER BEAM.

3-21. DESCRIPTION. This beam is built up of 24ST alclad sheets riveted together with AN470AD4 and AN470AD5 rivets. Bend radii are 3/16". The channel web is .032 gage with spar caps of .125 gage riveted on and continuous between stations 46.5 left and right. A .125 gage reinforcing strip, also riveted to the flanges, extends to station 31-3/4 either side of airplane center. Outboard of station 46½ the beam is a simple .032 channel.

3-22. NEGLIGIBLE DAMAGE. Web damage not exceeding the following limits requires no repair or reinforcement. Smooth dents free of cracks and abrasions and clear of lightening hole flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1½ inches in diameter and adjacent dents are at a distance of 15 inches. Web dents exceeding the above limits and subsequently bumped back to contour without cracking, creasing or oil canning the web may be classified negligible damage. Bent or dented cap angles and flanges free of cracks and abrasions which are reworked to their original shape, free of waviness, and without cracking or creasing may be considered negligible damage. Scratches, located anywhere on the beam which do not penetrate beyond the alclad coating may be classified negligible damage.

3-23. DAMAGE REPAIRABLE BY PATCHING.

3-24. GENERAL. The repair shown is for damage occurring between stations 12.0 and 46.5. If damage is extensive, it will be necessary to remove portions of the skin and any other structure which will interfere with making the repair. These parts of the structure that are removed or cut back must be replaced or repaired and joined as in the original structure, to regain the full strength of the structure. Jigs should be used to maintain the proper alignment of the structure. Trim all damage smooth so that a good fit of repair members is obtained. Paint all base metal with two coats of zinc chromate primer.

3-25. BEAM REPAIRS BETWEEN STATIONS 12.0 aND 46.5. (See Figure 3-3.) Damage to the beam cap flanges must be repaired by replacement of the .125 24ST alclad angle and the .125 24ST alclad strip. The skin attached to the replaced cap flanges must pick up the existing rivet holes. Damaged spar webs should be repaired by a splice plate and angles made of .040 24ST alclad. All rivets used for the repair are AN470AD5.

3-26. BEAM REPAIRS BETWEEN STATION 46.5 AND 76.06. The spar consists of an .032 24ST alclad channel in this region. Damaged web and flanges can be repaired similar to Figure 3-3, using the .040 24ST alclad angles and splice plate and AN470AD5 rivets. The .125 24ST alclad angle and strip are not required for repairs outboard of station 46.5. The double row of rivets thru the splice plate and web, and rivets thru the angles into the beam flanges and web should be identical to Figure 3-3.

3-27. DAMAGE REPAIRABLE BY INSERTION. Damaged beam caps and web, occurring between the airplane centerline and Station 12 must be repaired by the insertion of a .032 24ST alclad beam channel extending 13

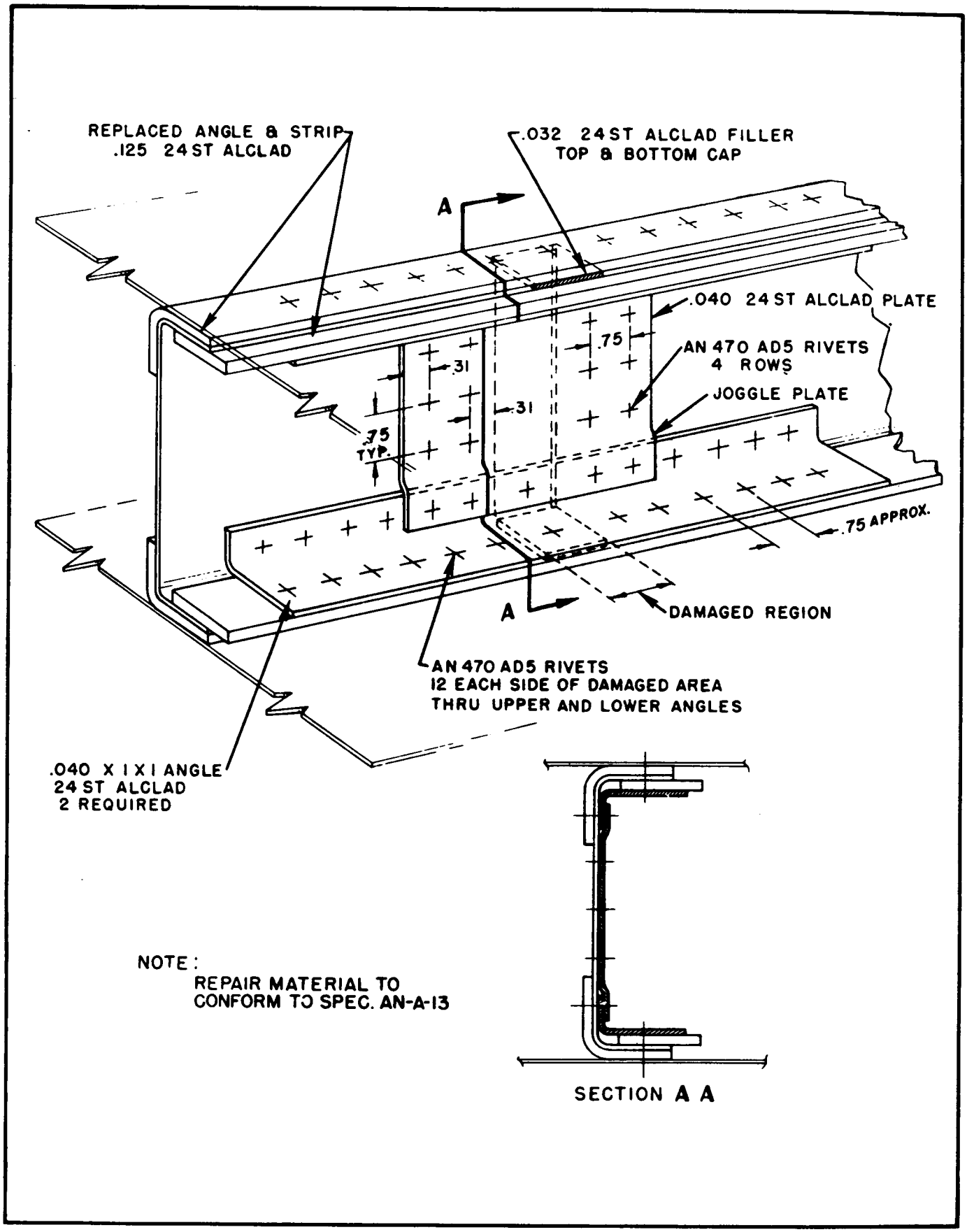


FIGURE 3-3. HORIZONTAL AND VERTICAL STABILIZER BEAM REPAIR

inches each side of the airplane centerline, and the replacement of angle cap strips and plates as described in paragraph 3-25. The ends of the inserted channel must be butted against and lined up with the existing beam channel. The inserted channel must be spliced to the existing structure similar to Figure 3-3. The fittings, plates and angles on the beam web must be installed on the inserted channel identical to the original structure. Damage to any other portion of the stabilizer beam, which exceeds approximately eight inches and requires a splice, should be repaired by an insertion. The insertion member must be spliced to the existing structure using the repair requirements for the portion of the beam being repaired.

3-28. HORIZONTAL STABILIZER RIBS.

3-29, DESCRIPTION. (See Figure 3-1.) The ribs are fabricated of 24ST alclad sheet. All ribs have stiffening beads, flanged lightening holes, upper and lower skin attachment flanges and bent vertical flanges on the aft end, which are riveted to the horizontal stabilizer beam web.

3-30. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions and clear of lightening hole flanges or bends may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1½ inches in diameter and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits, and bent flanges, subsequently bumped back to contour without cracking or creasing the rib may be classified negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

3-31. DAMAGE REPAIRABLE BY PATCHING. Damage to ribs which may vary in extent and location must be repaired in accordance with the repair data shown on Figures B-5 and B-6.

3-32. DAMAGE REPAIRABLE BY INSERTION. Damage to the rib which exceeds 1/3 the length of the rib should be repaired by an insertion repair. The insertion repair should be the same gage, section and material as the existing structure or an equivalent section. Damage to the forward or aft portion of the rib which exceeds 1/3 the length of the rib must be repaired by an extension splice with the same requirements as for the insertion repair. The insertion or extension member must be attached to the structure with the same rivet pattern as the original member.

3-33. ELEVATOR.

3-34. DESCRIPTION. (See Figure 3-1.) The elevators are interchangeable. Each is built around a frame consisting of two spars and three ribs. Between the spars there are angle stiffeners riveted inside the upper and lower surface skin and located approximately every eight inches from the root to tip. Short nose ribs are located forward of the front spar at each hinge bracket. A formed tip is attached to the outermost rib by 12 speed nuts. Adjustable metal trim tabs are installed between the inboard and center ribs. A torque tube riveted to each elevator is connected to an actuating horn at the airplane center-line. All the elevator parts are formed of 24ST alclad sheet, except the tip which is made from 3S0 aluminum alloy, and the torque tube which is steel.

3-35. ACCESS FOR REPAIRS. Access to the interior of each elevator assembly may be gained by removing the skin or by installing a removable access cover plate as described in paragraphs 3-12 and 3-13.

3-36. ELEVATOR SKIN.

3-37. DESCRIPTION. All skin is .016 gage riveted to beams, ribs, and stiffeners by AD3 modified brazier head rivets. A single bent up sheet forms the trailing edge, upper and lower surface, and split leading edge.

3-38. NEGLIGIBLE DAMAGE. Smooth shallow dents located anywhere on the elevator skin and free of cracks and abrasions may be disregarded, provided these dents do not exceed a depth of 1/8 inch and a diameter of 1½ inches, and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating are considered negligible damage.

3-39. DAMAGE REPAIRABLE BY PATCHING. Damage of the elevator skin panels which exceeds the limits of negligible damage should be repaired according to Figures B-1 and B-3.

3-40. DAMAGE REPAIRABLE BY INSERTION. Skin that is damaged extensively should be repaired by splicing in a new skin from one structural member to the next. The repair should be made to lie along stiffening members, ribs or beams, and each seam should be made exactly the same in regard to rivet size, spacing and rivet pattern as the parallel manufactured seams at the edges of the original sheet. If the manufactured seams are different, the stronger one must be copied. A similar repair is shown in Figure 2-3.

3-41. ELEVATOR MAIN BEAM.

3-42. DESCRIPTION. The main beam is a channel formed of .032 24ST alclad, the web is beaded for stiffness.

3-43. NEGLIGIBLE DAMAGE. Web damage not exceeding the following limits requires no repair or reinforcement. Smooth dents free of cracks and abrasions and clear of lightening hole flanges and bends may be disregarded, provided the dents do not exceed a depth of 1/8 inch and 1½ inches in diameter and adjacent dents are at a distance of 15 inches. Web dents exceeding the above limits and subsequently bumped back to contour without cracking, creasing or oil canning the web may be classified as negligible damage. Bent or dented beam flanges free of cracks and abrasions which are reworked to their original shape, free of waviness, and without cracking or creasing may be considered negligible damage. Scratches, located anywhere on the beam, which do not penetrate beyond the alclad coating may be considered negligible damage.

3-44. DAMAGE REPAIRABLE BY PATCHING.

3-45. DAMAGED FLANGE AND ADJACENT WEB. The skin attachment flange and approximately 5/8 inch of the adjacent web are considered the effective flange portion of the beam. Damage to any portion of either the upper or lower effective flange which exceeds the specified limits of negligible damage may be repaired similar to Figure 4-3. One angle may be used to repair damage. Nest the angle inside the damaged flange and adjacent web. Four AN470AD5 rivets are required thru the flange each side of the damaged area. Space the web rivet rows approximately one inch apart, with one row outside the damaged area. Three AN470AD5 rivets are required per web row, each side of the damaged area.

3-46. BEAM SPLICE. Damage affecting more than half of the beam cross-sectional area requires a splice. A repair similar to that shown in Figure 4-3 should be used. Two angles nesting inside the beam are used to span the damaged region. Four AN470AD5 rivets are required thru each skin flange each side of the damaged area. Space web rivet rows approximately one inch apart, the depth of the beam. Three AN470AD5 rivets are required in each row each side of the damaged area.

NOTE

The use of an elevator jig is recommended in order to hold alignment of the structure while the repair is being accomplished.

3-47. DAMAGE REPAIRABLE BY INSERTION. Damage to the main beam which is more than five inches in length horizontally requires a complete splice, to be repaired by an insertion member. The insertion member must be of the same material, section and gage as the existing structure. The ends of the insertion member must be butted and spliced to the existing structure, using the repair data in Figure 4-3 and Paragraph 3-46. Damage to either extremity of the beam must be repaired by means of an extension splice.

3-48. ELEVATOR AUXILIARY BEAM.

3-49. DESCRIPTION. The auxiliary beam is a small channel bent up from .020 24ST alclad sheet inboard of station 40.75, from station 40.75 outboard to the tip it is .016 gage.

3-50. NEGLIGIBLE DAMAGE. Smooth dents free of abrasions or cracks in the flanges or web may be classified as negligible damage, provided the damage does not occur to any rivets or bends. Adjacent negligible damage must be at a distance of 10 inches.

3-51. DAMAGE REPAIRABLE BY PATCHING. Damage to the elevator auxiliary beam which requires a splice is repairable by splicing with an .032 24ST alclad channel installed within the existing channel. Three AN470AD4 rivets in the upper and lower flanges and two AN470AD4 rivets in the web, making a total of eight rivets on each side of the damaged area, are required. Use existing rivet holes in the flanges whenever possible, spacing rivets at approximately 3/4 of an inch. Attach the skin to the flange with repair rivets.

3-52. ELEVATOR RIBS.

3-53. DESCRIPTION. (See figure 3-1.) All three ribs are channels formed of 24ST alclad sheet. The two main inboard ribs at stations 5.603 and 40.75 are stiffened by beads. The end rib has a plain web with neither lightening holes nor beads. It extends 7-3/16 inches forward of the elevator hinge line, and the elevator balance weight is riveted to it. Nose and trailing edge ribs are riveted to main and auxiliary spar webs, respectively.

3-54. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions and clear of lightening hole flanges and bends may be disregarded, provided the dents do not exceed a depth of 1/8 inch and one inch in diameter and adjacent dents are at a distance of 10 inches, dents exceeding the above limits, and bent flanges, subsequently bumped back to contour without cracking or creasing the rib may be classified negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

3-55. DAMAGE REPAIRABLE BY PATCHING. Damage to the ribs which may vary in extent and location must be repaired in accordance with the repair data shown in figure B-5.

3-56. DAMAGE NECESSITATING REPLACEMENT. Replace ribs which have been damaged extensively and which would require considerable repair work.

3-57. ELEVATOR TRIM TAB.

3-58. DESCRIPTION. (See figure 3-1.) The elevator trim tab is composed of a single sheet of 24ST alclad wrapped around five former ribs, giving the tab a hemispherical leading edge, with a sharp trailing edge produced by riveting the two edges of the sheet together. Hinge brackets are located at each end and at the midpoint of the leading edge.

3-59. ELEVATOR TRIM TAB SKIN.

3-60. DESCRIPTION. The tab skin consists of .016 24ST alclad sheet.

3-61. NEGLIGIBLE DAMAGE. Smooth shallow dents located anywhere on the tab skin and free of cracks and abrasions may be disregarded, provided these dents do not exceed a depth of 1/8 inch and a diameter of one inch, and adjacent dents are at distance of 10 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be classified negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

3-62. DAMAGE REPAIRABLE BY PATCHING. Damage to the tab skin which exceeds the limits of negligible damage must be repaired by means of a flush skin patch as in figure B-1 or an outside skin patch as shown in figure B-3. If the patch covers the internal structure, attach the patch to the internal structure, using the same size rivets and spacing as in the original structure.

3-63. ELEVATOR TRIM TAB RIBS.

3-64. DESCRIPTION. All elevator trim tab ribs are bent up out of 24ST alclad sheet.

3-65. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions in the flanges and the web may be classified negligible damage.

3-66. DAMAGE REPAIRABLE BY PATCHING. Damage to ribs which exceeds that specified as negligible may be repaired in accordance with figure B-5.

3-67. VERTICAL STABILIZER.

3-68. DESCRIPTION. (See Figure 3-1.) The structural members are fabricated of 24ST alclad sheet. The tip and a dorsal fin are formed of 52S0 aluminum alloy. The structure consists of four formed ribs, a full span beam, to which the rudder is hinged and stringers riveted inside the skin, about 30% and 60% of the chord aft of the stabilizer leading edge. The tips are removable and are attached to the top rib with plate nuts and screws. The dorsal fin, fairs the vertical and horizontal stabilizer into the fuselage contours. The section between the leading edges of the vertical and horizontal stabilizer is detachable.

3-69. ACCESS FOR REPAIRS. Access to repair internal

structure may be had by removing skin, or installing access holes in the skin. Details for the installation of access holes in the vertical stabilizer skin are described in paragraphs 3-12 and 3-13.

3-70. VERTICAL STABILIZER SKIN.

3-71. DESCRIPTION. The skin is applied in three sections. All are .020 24ST alclad. One sheet is wrapped around the leading edge back to the first stringer, the other two skin panels are lapped under the leading edge skin at the stringer and held by AN470AD3 rivets. These sheets are riveted to the second stringer and flanges of the beams by AN470AD4 rivets.

3-72. NEGLIGIBLE DAMAGE. Smooth shallow dents located anywhere on the vertical stabilizer skin and free of cracks and abrasions may be disregarded, provided these dents do not exceed a depth of 1/8 inch and a diameter of 1-½ inches, and adjacent dents are located at a distance of 15 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating are considered negligible damage.

3-73. DAMAGE REPAIRABLE BY PATCHING.

3-74. GENERAL. Any damage which exceeds that specified in paragraph 3-72 must be repaired. See paragraph 3-11.

3-75. ACCESS DOOR, CLEAR OF INTERNAL STRUCTURE. See paragraph 3-12.

3-76. ACCESS DOOR, OVER INTERNAL STRUCTURE. See paragraph 3-13.

3-77. RIVETED SKIN PATCH, CLEAR OF INTERNAL STRUCTURE. See paragraph 3-14.

3-78. RIVETED SKIN PATCH, OVER INTERNAL STRUCTURE. See paragraph 3-15.

3-79. LEADING EDGE REPAIR, CLEAR OF INTERNAL STRUCTURE. See paragraph 3-16.

3-80. LEADING EDGE REPAIR, OVER INTERNAL STRUCTURE. See paragraph 3-17.

3-81. DAMAGE REPAIRABLE BY INSERTION. See paragraph 3-18.

3-82. DAMAGE NECESSITATING REPLACEMENT. See paragraph 3-19.

3-83. VERTICAL STABILIZER BEAM.

3-84. DESCRIPTION. The vertical stabilizer beam extends the full span of the vertical stabilizer. This beam consists of an .032 24ST alclad channel with flanges reinforced by .072 24ST cap angles whose vertical legs taper from one inch at the stabilizer root to 5/16 inch at the center hinge fitting.

3-85. NEGLIGIBLE DAMAGE. Web damage not exceeding the following limits requires no repair or reinforcement. Smooth dents free of cracks and abrasions and clear of lightening hole flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and a diameter of 1-1/2 inches and adjacent dents are at a distance of 15 inches. Web dents exceeding the above limits and subsequently bumped back to contour without cracking, creasing or oil canning the web may be classified as negligible damage. Bent or dented cap angles and flanges free of cracks and abrasions which are reworked to their original shape, free of waviness, and without cracking or creasing may be considered negligible damage. Scratches, located anywhere on the beam, which do not penetrate beyond the alclad coating may be classified negligible damage.

3-86. DAMAGE REPAIRABLE BY PATCHING. Damage to the beam between station 13.3 and the tip can be repaired similar to figure 3-3. The beam channel is repaired with .040 24ST alclad angles and plate. All rivets used for the repair are AN470AD5. Damage occurring to the .072 24ST alclad beam caps requires replacement of the part (See paragraph 3-89.)

3-87. DAMAGE REPAIRABLE BY INSERTION. Damage between station 13.3 and the tip of the .032 24ST clad beam channel which exceeds eight inches must be repaired by insertion. Insert a .032 24ST alclad channel identical to the beam in the damaged area. The ends of the inserted channel must be butted against and lined up with the existing beam channel. The inserted channel must be spliced to the existing structure similar to figure 3-3.

3-88. DAMAGE REPAIRABLE BY REPLACEMENT.

3-89. BEAM CAP ANGLES. Due to the short length of the .072 24ST cap angles repairing is not practical for damage exceeding negligible damage, and therefore these cap angles should be replaced.

3-90. BEAM-ROOT TO STATION 13.3 Due to the short length repairing is not practical for damaged channels and they should be replaced.

3-91. BEAM-STATION 13.3 TO TIP. Damage requiring more than one insertion or two splice repairs should be repaired by replacement of the part.

3-92. VERTICAL STABILIZER RIBS.

3-93. DESCRIPTION. (See figure 3-1.) The ribs are fabricated from 24ST alclad sheet. All ribs have beads, flanged lightening holes, upper and lower skin attachment flanges, and bent vertical flanges on the aft end of the ribs, which are used to rivet the ribs to the beam. The top most rib is a complete airfoil, extending aft over the rudder. The main beam ends on the lower side of the top rib and the vertical stabilizer tip is fastened to the upper side.

3-94. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions and clear of lightening hole flanges or bends may be disregarded, provided the dents do not exceed a depth of 1/8 inch and a diameter of 1-1/2 inches and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits, and bent flanges, bumped back to contour without cracking or creasing the rib may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

3-95. DAMAGE REPAIRABLE BY PATCHING. Damage to ribs which may vary in extent and location must be repaired in accordance with the repair data shown on figures B-5 and B-6.

3-96. DAMAGE REPAIRABLE BY INSERTION. Damage to the rib which exceeds approximately 1/3 the length of the rib should be repaired by an insertion repair. The insertion repair should be the same gage, section and material as the existing structure or an equivalent section. Damage to the forward or aft portion of the

rib which exceeds approximately 1/3 the length of the rib should be repaired by an extension splice with the same requirements as for the insertion repair. The insertion or extension member must be attached to the structure with the same rivet pattern as the original member.

3-97. RUDDER.

3-98. DESCRIPTION. (See Figure 3-1.) The rudder is made of 24ST alclad sheet, beaded and wrapped around three formed ribs and two spars. There are no other stiffeners. At the bottom of the rudder is a .032 52S0 aluminum alloy removable boot in which the tail light is installed. The rudder hinges are provided with staked in ball bearings. A fixed trim tab is riveted to the trailing edge at the center rib.

3-99. RUDDER SKIN.

3-100. DESCRIPTION. The skin is a single sheet of .016 gage 24ST alclad sheet, beaded and riveted to the front and rear spar flanges with modified brazier head AD4 rivets. It is continuous around the trailing edge ending on the top and bottom of the leading edge.

3-101. NEGLIGIBLE DAMAGE. Smooth dents located anywhere on the rudder skin and free of cracks and abrasions may be disregarded, provided these dents do nct exceed a depth of 1/8 inch and a diameter of 1-1/2 inches and adjacent dents are at a distance of 15 inches. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating are considered negligible damage.

3-102. DAMAGE REPAIRABLE BY PATCHING. Damage to the rudder skin which exceed the limits of negligible damage should be repaired by patching. See Figures B-1 through B-3.

3-103. DAMAGE NECESSITATING REPLACEMENT. Damage to the skin panels which cannot be repaired by patching must be repaired by replacement of the panel rather than attempting an insertion repair.

3-104. RUDDER MAIN BEAM.

3-105. DESCRIPTION. The rudder main beam is a channel formed of .032 24ST alclad with beads and flanged lightening holes.

3-106. NEGLIGIBLE DAMAGE. Web damage not exceeding the following limits requires no repair or reinforcement. Smooth dents free of cracks and abrasions and clear of lightening hole flanges and bends may be disregarded, provided the dents do not exceed a depth of 1/8 inch and a diameter of 1-1/2 inches and adjacent dents are at a distance of 15 inches. Web dents exceeding the above limits and subsequently bumped back to contour without cracking, creasing or oil canning the web may be classified negligible damage. Bent or dented beam flanges free of cracks and abrasions which are reworked to their original shape, free of waviness, and without cracking or creasing may be considered negligible damage. Scratches located anywhere on the beam, which do not penetrate beyond the alclad coating may be considered negligible damage.

3-107. DAMAGE REPAIRABLE BY PATCHING.

3-108. DAMAGED FLANGE AND ADJACENT WEB. The skin attachment flange and approximately 5/8 inch of the adjacent web are considered the effective flange portion of the beam. Damage to any portion of either the upper or lower effective flange which exceeds the specified limits of negligible damage may be repaired similar to figure 4-3. One angle may be used to repair damage. Nest the angle inside the damaged flange and adjacent web. Four AN470AD5 rivets are required through the flange each side of the damaged area. Space the web rivet rows approximately one inch apart, with one row outside the damaged area. Three AN470AD5 rivets are required per web row on each side of the damaged area.

3-109. BEAM SPLICE. Damage affecting more than half of the beam cross-sectional area requires a splice. A repair similar to that shown in figure 4-3 should be used. Two angles nesting inside the beam are used to span the damaged region. Four AN470AD5 rivets are required through each skin flange each side of the damaged area. Space web rivet rows approximately one inch apart the depth of the beam. Three AN470AD5 rivets are required per row on each side of the damaged area.

NOTE

The use of a rudder jig is recommended in order to hold alignment of the structure while the repair is being accomplished.

3-110. DAMAGE REPAIRABLE BY INSERTION. Damage to the main beam which is more than five inches in length vertically requires a complete splice to be repaired by an insertion member. The insertion member must be of the same material, section and gauge as the existing structure. The ends of the insertion member must be butted and spliced to the existing structures, using the repair data shown in figure 4-3 and paragraph 3-109. Damage to either extremity of the beam must be repaired by means of an extension splice.

3-111. RUDDER AUXILIARY BEAM.

3-112. DESCRIPTION. The rudder auxiliary beam is a channel formed of .020 24ST alclad sheet.

3-113. NEGLIGIBLE DAMAGE. Same limits as specified for elevator rear beam, see paragraph 3-50.

3-114. DAMAGE REPAIRABLE BY PATCHING. Damage to the rear rudder beam which exceed that specified in paragraph 3-113 must be repaired. Repairs to be same as that for elevator auxiliary beam. See paragraph 3-51.

3-115. RUDDER RIBS.

3-116. DESCRIPTION. All three ribs are formed of .032 24ST alclad sheet, none have beads or lightening holes.

3-117. NEGLIGIBLE DAMAGE. Smooth dents free of cracks and abrasions and clear of flanges may be disregarded, provided the dents do not exceed a depth of 1/8 inch and a diameter of one inch and adjacent dents are at a distance of 10 inches. Dents exceeding the limits, and bent flanges, subsequently bumped back to contour without cracking or creasing the rib may be classified negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

3-118. DAMAGE REPAIRABLE BY PATCHING. Damage to the ribs which may vary in extent and location must be repaired in accordance with the repair data shown in figure B-5.

3-119. DAMAGE NECESSITATING REPLACEMENT. Replace ribs which have been damaged extensively and which would require considerable repair work.

3-120. RUDDER TRIM TAB.

3-121. DESCRIPTION. This tab is fixed and has a 1-1/16 inch chord, clear of the rudder trailing edge. It is made up of two .032 52S0 aluminum alloy strips, 16 inches long, riveted together with rudder trailing edge between them.

3-122. NEGLIGIBLE DAMAGE. Disregard smooth dents free of cracks, and abrasions, also small punctions up to 1/4 inch in diameter.

3-123. DAMAGE NECESSITATING REPLACEMENT. Any extensive damage not included in that specified by paragraph 3-122 requires that a new tab be installed.

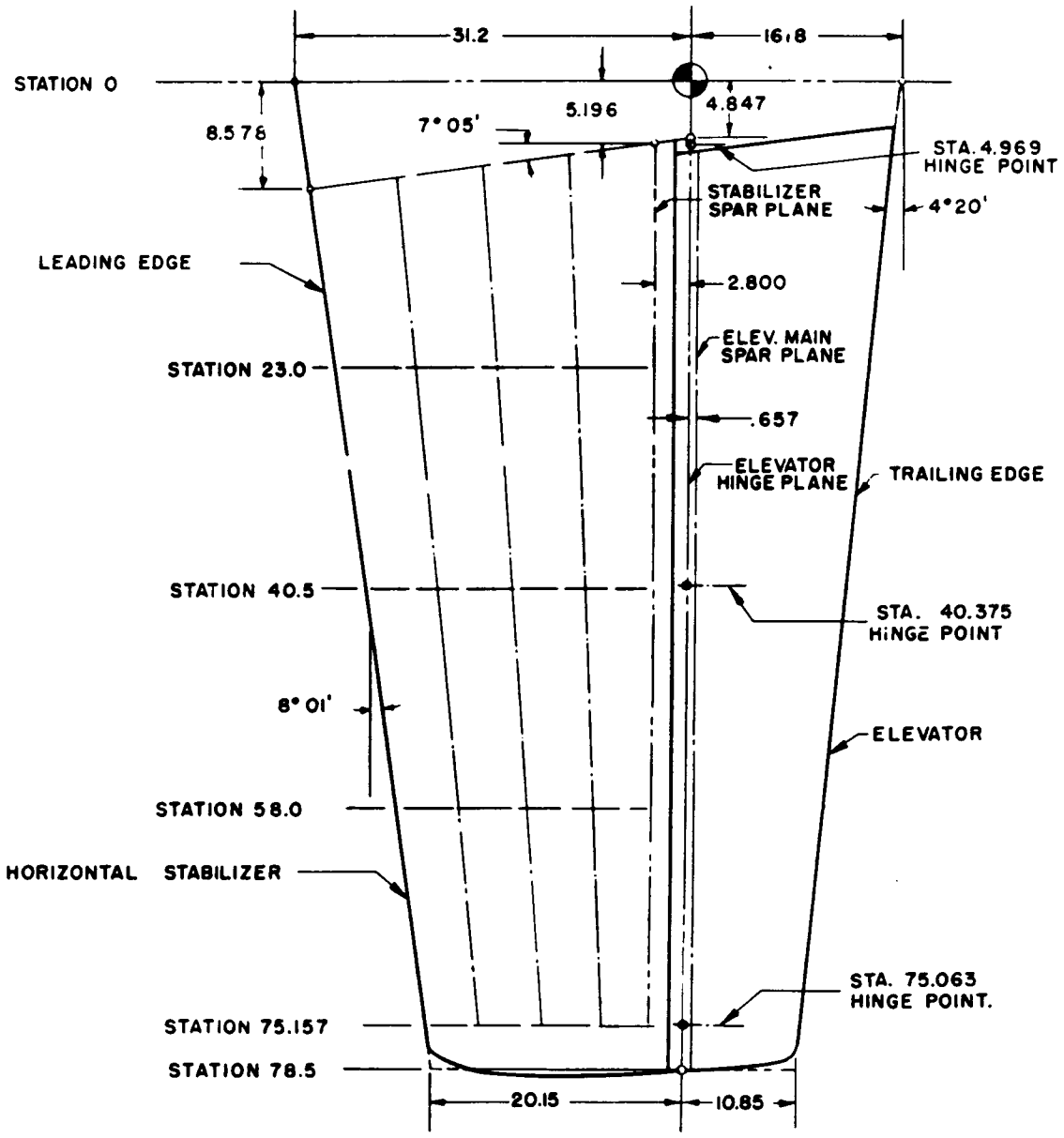


FIGURE 3-4. HORIZONTAL TAIL JIG DIMENSIONS

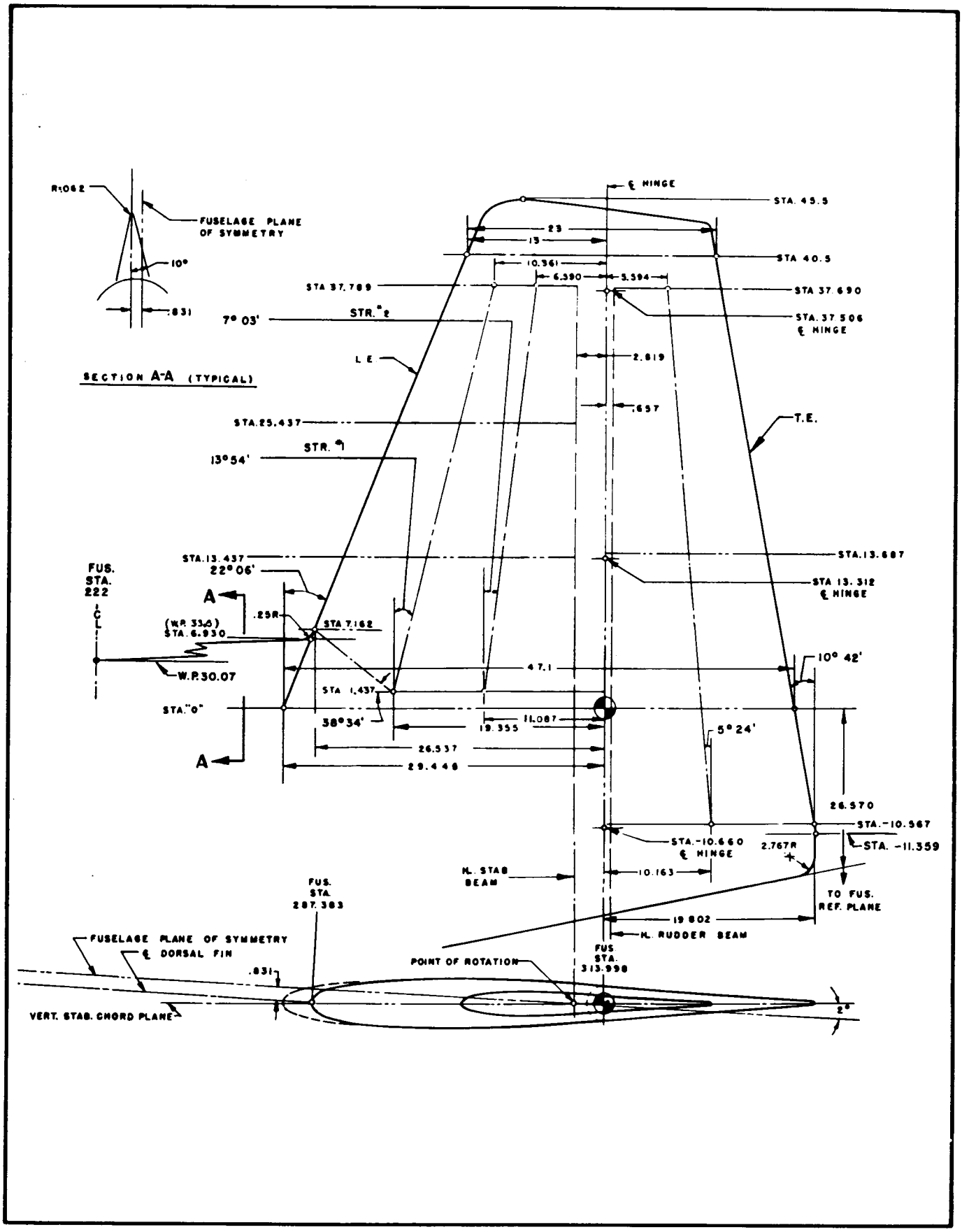


FIGURE 3-5. VERTICAL TAIL JIG DIMENSIONS

SECTION IV

BODY GROUP

4-1. GENERAL.

4-2. DESCRIPTION. (See Figure 4-1.) The forward portion of the fuselage, between stations 54 and 179.75 is a semimonocoque metal structure, enclosing the cockpit. It consists of four longerons, firewall and formers covered by 24ST alclad sheet. Spanning the cockpit and just aft of the rear seat at station 147.125 is a tubular tie rod which is riveted to the upper longerons. Two longitudinal beams supported at the firewall and at the wing forward attachment bulkhead accommodate the nose gear. The pilot's floor covers these two beams, and extends from the firewall to the wing forward attachment bulkhead. The baggage compartment floor is supported fore and aft by fuselage frames at station 142.57 and station 179.75 and on the sides by the lower longerons. The aft part of the fuselage, between stations 179.75 and 313.25, is of monocoque construction, reinforced by frames. The empennage attaches to the fuselage bulkheads at stations 273.118, 294.1 and 311.07.

4-3. ALIGNMENT. In the event of extensive damage to the fuselage the basic alignment dimensions shown shown in Figures 1-2 may be used.

4-4. ACCESS FOR REPAIR. Access to the fuselage interior may be gained through the cockpit, baggage compartment, access doors near the tail, nose wheel well, and removable fairing aft of the wing.

4-5. SKIN.

4-6. DESCRIPTION. The arrangement, material, and gage of the fuselage skin panels are shown in Figure 4-2.

4-7. NEGLIGIBLE DAMAGE. Smooth dents free of cracks or abrasions located anywhere on the fuselage skin may be disregarded, provided they do not exceed a depth of 1/8 inch and 1-½ inches in diameter and adjacent dents are at least 15 inches apart. Dents exceeding the above limits, and subsequently bumped back to contour without cracking or creasing the skin may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

4-8. DAMAGE REPAIRABLE BY PATCHING.

4-9. GENERAL. Any damage that exceeds the specified limits of negligible damage must be repaired to regain the structural strength of the skin. Skin patches may be either the flush type shown in Figure B-1 or the external type shown in Figure B-3. The edges of the patch must be chamfered. Paint all repair materials with at least one coat of zinc chromate primer. The type of skin patch that can be used will be dependent upon time, materials and equipment available and appearance desired. Clean up damaged area with a circular hole or rectangular cutout, with 1/2 inch minimum corner radii for rectangular cutouts. Smooth all edges to remove burrs.

4-10. FLUSH SKIN PATCH CLEAR OF INTERNAL STRUCTURE. (See Figure B-1.) Damage to the skin clear of internal structure may be repaired by a riveted flush skin patch. To install the patch, trim the skin beyond the damaged area, leaving sufficient skin to allow for the installation of the doubler. Rivet the doubler to the existing skin and then rivet the patch to the doubler. Skin patch repair information may be obtained from the Figure. The typical dimensions shown on the Figure are applicable for the repair of all skin panels.

4-11. FLUSH SKIN PATCH OVER INTERNAL STRUCTURE. (See Figure B-1.) Damage to the skin and internal structure may be repaired by repairing the internal structure and then installing the skin patch. Before attempting the repair, trim the skin beyond the damaged area, leaving sufficient existing skin to allow for the installation of the doubler. Repair the internal structure and install the doubler as shown in the Figure. The necessary repair information may be obtained from the Figure. The rivets tying the skin patch to the repaired internal structure should be the same as the existing rivets or one diameter larger, and should have the same spacing as the rivets in the original structure.

4-12. EXTERNAL SKIN PATCHES. (See Figure B-3.) The damaged area must be trimmed before applying the outside skin patch. If the patch is applied over internal structures, a filler the same gage as the existing skin must be placed between the patch and the existing structure. The rivet pattern thru the internal structure must be duplicated.

4-13. BULKHEADS AND FRAMES.

4-14. GENERAL.

4-15 DESCRIPTION. (See Figure 4-1.) The general arrangements and location of the bulkheads and fuselage frames are shown in the figure. All are made of 24ST clad except the firewall which is .019 steel.

4-16. FIREWALL, STATION 54.

4-17. DESCRIPTION. The bulkhead web is .019 SAE 1020 steel; it is divided into an upper and lower section. They are each approximately semicircular in shape. The upper is riveted to a 24ST alclad angle, the lower has an integral flange turned forward. There are cutouts for the nose gear housing and for the engine cooling air. The flat part of both upper and lower sections of the web are stiffened with vertical beads. There are also vertical and horizontal 24ST alclad angles which serve as stiffeners and supports for equipment.

4-18. NEGLIGIBLE DAMAGE. Smooth dents free of cracks or abrasions located anywhere on the firewall may be disregarded, provided they do not exceed a depth of 1/8 inch and 1-½ inches in diameter, and adjacent dents are at least 15 inches apart. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the web may be considered negligible damage. Dented or bent flanges and angles bumped back to contour without cracking, creasing or waviness may be classified negligible damage.

4-19. WEB DAMAGE REPAIRABLE BY PATCHING. Damage to the web which exceeds the limits of negligible damage must be repaired by a SAE 1020 steel patch of the same or next heavier gage. The patch must be riveted to the existing web by AN470AD4 rivets spaced 3/4

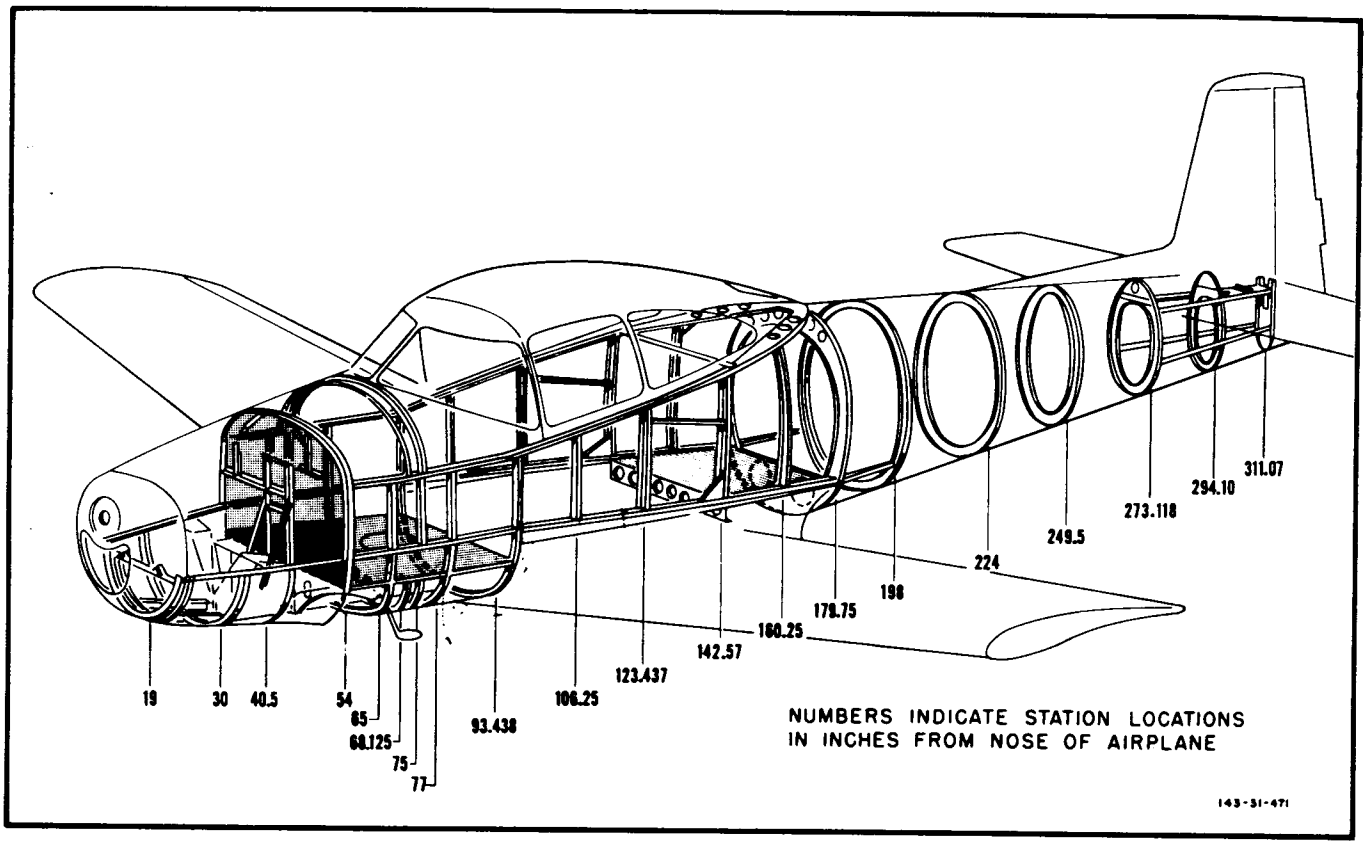


FIGURE 4-1. FUSELAGE STRUCTURE

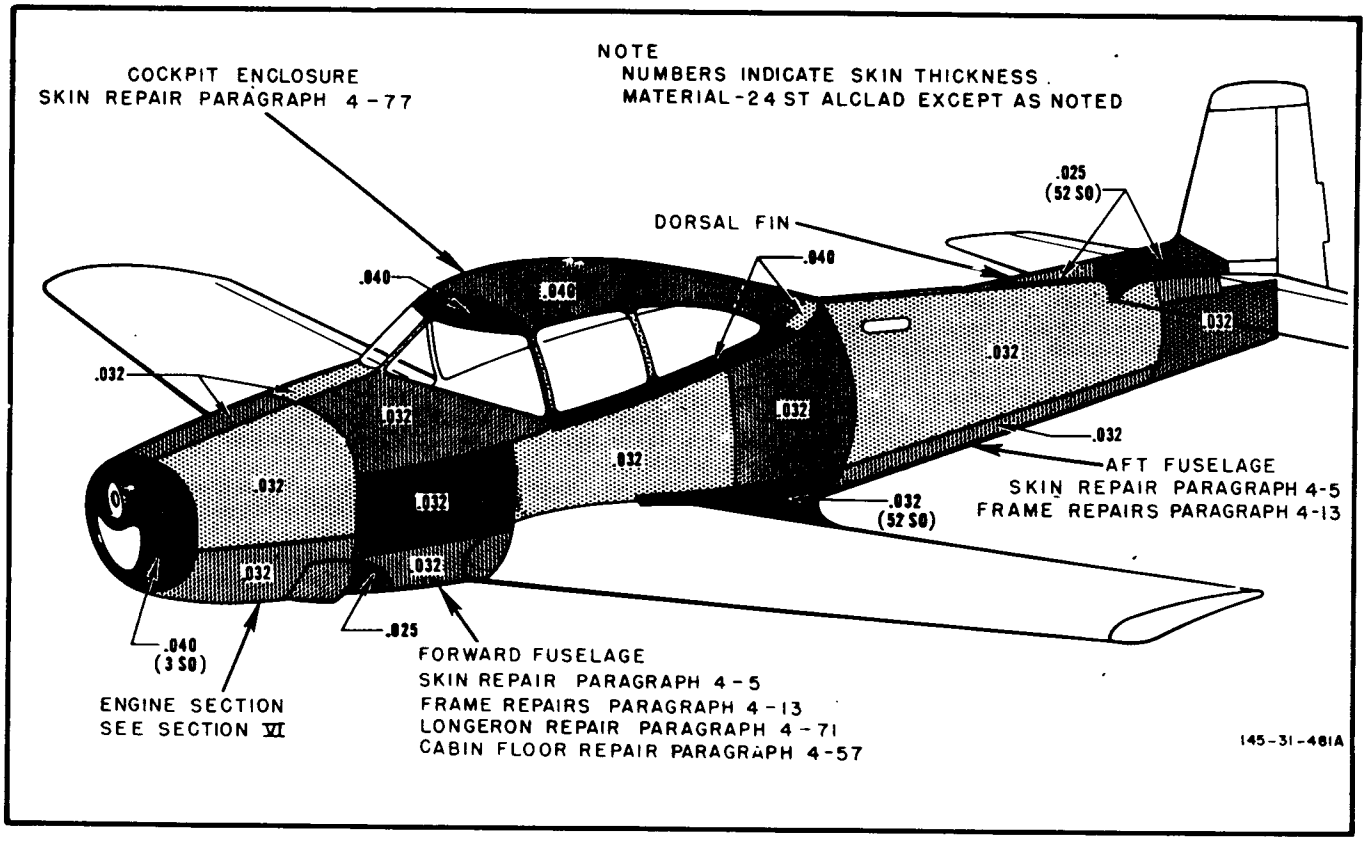


FIGURE 4-2. FUSELAGE SKIN ARRANGEMENT

inch with 1/4 inch minimum edge distance. If the damage occurs over attaching structural members, pick up the existing rivet spacing throughout the damaged area. Trim the damaged area using a circular or rectangular cutout, use 1/2 inch corner radii on rectangular cutouts. Smooth all edges to remove burrs. If any beads occur in the damaged area, they must be replaced by .020 x 3/4 x 3/4 SAE 1020 steel angles, of the same length as the beads, and attached to the patch in locations equivalent to those occupied by the beads in the damaged area. Use AN470AD4 rivets spaced 3/4 inch on centers.

4-20. DAMAGED BULKHEAD FLANGES REPAIRABLE BY PATCHING. Damage of the 24ST flanges at the edges of the web which exceeds negligible damage must be repaired by a splice angle, of .040 24ST clad sheet. It should have equal legs 3/4 inch long and a 1/16 inch bend radius. This splicing angle, nested within the damaged flange, is secured by 16 AN470AD4 rivets, eight on either side of the break, i.e. four in each leg.

4-21. DAMAGED SPLICE ANGLE BETWEEN THE UPPER AND LOWER WEB REPAIRABLE BY PATCHING. Damage to the splice angle between upper and lower webs that exceeds negligible damage shall be repaired by adding a splicing angle of .040 24ST clad sheet, with equal 3/4 inch legs. This angle, nested within the damaged angle, is secured by 20 AN470AD4 rivets; 10 on either side of the break, five in the horizontal flanges of the angles and five in the vertical flanges, spaced approximately 1/2 inch apart.

4-22. DAMAGED VERTICAL CHANNEL SUPPORTING NOSE GEAR HOUSING REPAIRABLE BY PATCHING. Damage to the vertical channels, that support the nose gear housing, that exceeds negligible damage shall be repaired by adding a splicing channel or angle. The damaged area should first be trimmed, using at least a 1/2 inch radius at all corners of the trimmed area. The splicing member should be .064 24ST alclad. The repair member should be a nesting channel where the damaged member is a channel. The channel flanges are to be 3/4 inch wide and the web height 1.898 inches. It should be secured to the existing channel by 48 AN470AD4 rivets; six thru each flange and two rows of six rivets each thru the web on each side of the damaged area. Because of the difficulty in manufacturing a properly nesting channel, it is permissible to use two angles to make up the channel provided they are lapped at one of the two rows of rivets in the web. The splicing member should be an angle when the damaged member has the shape of an angle. The leg of the splicing member adjacent to the bulkhead web should be 3/4 inch long and the other leg shall be as long as the outstanding leg of the damaged angle. The splice angle should be secured to the damaged angle by 24 AN470AD4 rivets; six thru each leg on each side of damaged area. Maintain a 1/4 inch minimum edge distance and a minimum rivet spacing of 5/8 inch. If the damage is in the flange of the channel or angle that is adjacent to the bulkhead web, and is more than 1/2 inch long, place on .051 filler between the web and splice angle. Pick up any existing rivets through splice angle, filler and web.

4-23. FRAMES AT STATIONS 65.0 AND 77.0.

4-24. DESCRIPTION. The frames are made of .040 24ST alclad and their cross sections are channels. The frames are made in three sections and are spliced at the cockpit floor and the lower longeron.

4-25. NEGLIGIBLE DAMAGE. Bent flanges and dents free of cracks and abrasions, which are worked back to their original shape, free of waviness, without cracking or creasing the frame may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating may be disregarded.

4-26. DAMAGE REPAIRABLE BY INSERTION. Damage exceeding a length of approximately six inches may be repaired by an insertion member and spliced as shown in Figure 4-3, or by replacement of the part which ever is more expedient.

4-27. FORWARD WING ATTACHMENT FRAME, STATION 93.438.

4-28. DESCRIPTION. The wing attachment frame is made of .064 24ST alclad material and is horseshoe shaped and of channel cross section. The front spar of the wing is attached to the frame by means of four bolts. The upper and lower fuselage longerons are spliced at this bulkhead.

4-29. NEGLIGIBLE DAMAGE. See Paragraph 4-25.

4-30. DAMAGE REPAIRABLE BY PATCHING. Damage that exceeds the limits of negligible damage must be repaired by patching. As the wing bears against the aft face of this frame, all splices or patches must be on the forward side; also the web rivets must be countersunk on the aft side. To repair the lower half of the frame where the wing is on the aft side, will necessitate removing the wing. Repairs to this frame where the depth of the section is less than 1-3/4 inches shall be accomplished by two angles, making up a channel section and nesting inside the forward face of the frame. The angle flange adjacent to the frame flange is 3/4 inch, the flange adjacent to web should be of a width equal to the inside depth of the section, but trim back the lipped edges to prevent encroaching on the bend radii. The .064 24ST alclad angles are lapped, picking up the two rows of rivets in the web. The angles are attached with a single row of five AN470AD5 rivets thru each frame flange and by two rows of five AN426AD5 rivets thru the web each side of the damage, resulting in 20 rivets each side of the damaged area. Space all rivets at 5/8 inch with approximately 5/8 inch between web rivet rows. Figure 4-3 shows a similar type of repair.

NOTE

Rivets thru the web, for repairs occurring above the wing, may be AN470AD5 rivets.

Where the channel widens and the damage is restricted to the web and is at least 3/4 inch from bend radii after trimming, a .064 24ST alclad plate patch may be used. The patch plate should be of sufficient size to permit a single row of rivets at 5/8 inch spacing on two sides of the damaged area, parallel and adjacent to the flanges. Four rows of rivets spaced at 5/8 inch and with 5/8 inch between rows are required on the two other sides of the damaged area, and these rows are perpendicular to the flanges. All rivets are AN426AD5, countersunk on the aft face of the web and have a minimum edge distance of 5/16 inch. Complete damage to the cross section in the wide portion of the frame is repaired by two angles, making up a channel section and nesting inside the forward face of the frame. The angle flanges adjacent to the frame flanges are 3/4 inch. The flanges adjacent to the web should be of sufficient width to permit overlapping for a distance of two rivet rows. The repair angles are made from .064 24ST alclad. The angles are attached with a single row of five AN470AD5 rivets thru each frame flange, each side of the damage. The web is riveted with AN426AD5 rivets with five

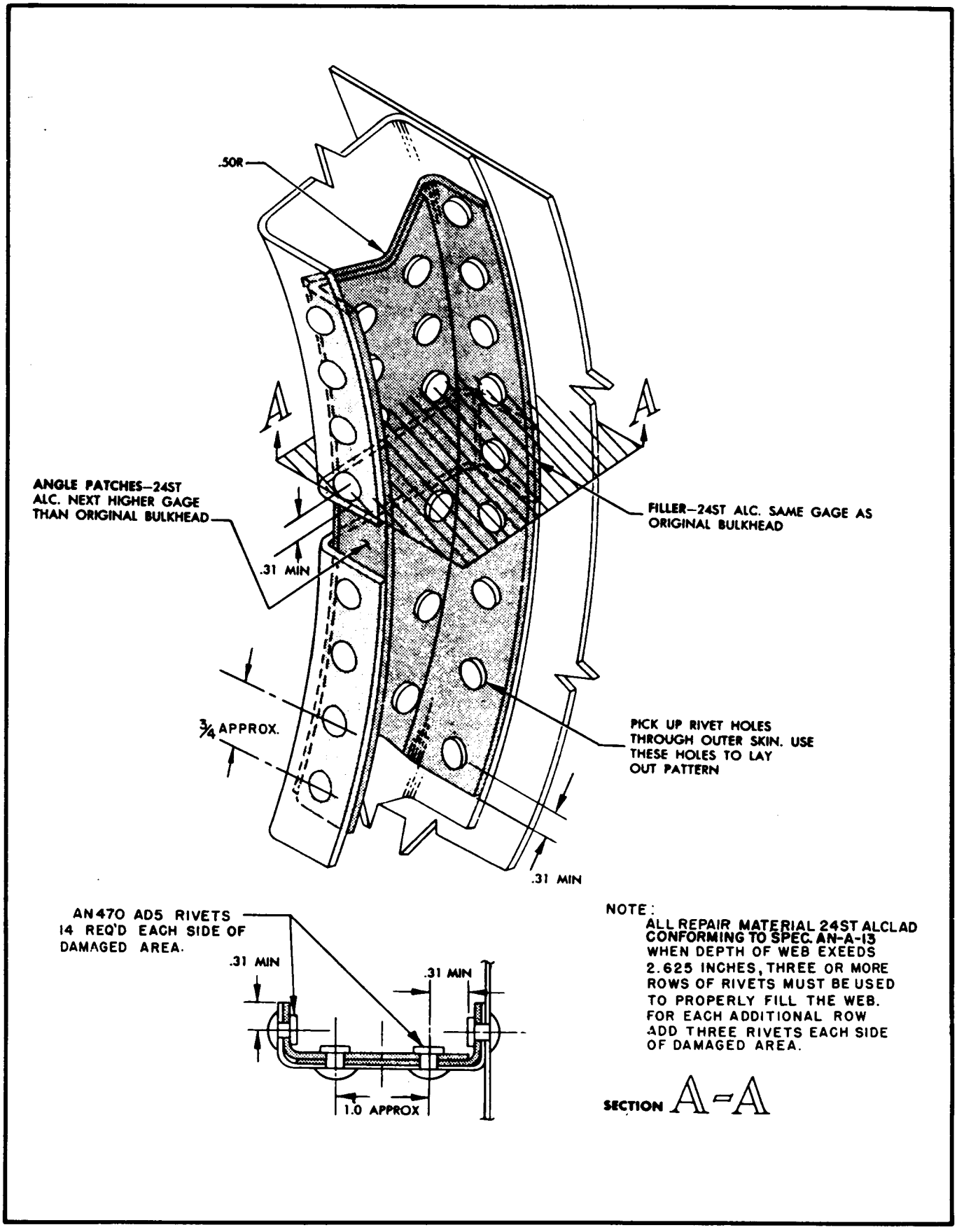


FIGURE 4-3. FUSELAGE FRAME REPAIR

rivets per row. The web rivets should be in rows approximately 5/8 inch apart, with the maximum number of rows which the spacing will permit. All rivets are to be spaced at 5/8 inch on centers.

4-31. FRAMES AT STATION 106.25, 142.57 AND 160.25.

4-32. DESCRIPTION. These frames are made of .040 24ST clad material and are of channel cross section. They extend between the upper and lower longerons and fit inside the longerons at their ends.

4-33. NEGLIGIBLE DAMAGE. See paragraph 4-25.

4-34. DAMAGE REPAIRABLE BY PATCHING. For damage to these frames exceeding negligible damage refer to Figure 4-3. If less than half the cross section is damaged, it is permissible to repair it by using one angle. If one angle is used, two rows of rivets thru the web and one row thru the flange are required.

4-35. DAMAGE REPAIRABLE BY INSERTION. Damage that extends more than six inches should be repaired by insertion. Trim the damaged area and insert a member the same shape, size and gage as the damaged section. Splice each end with a splice as shown in Figure 4-3.

4-36. DAMAGE NECESSITATING REPLACEMENT. Extensive damage should be repaired by the replacement of the part.

4-37. FRAME AT STATION 179.75.

4-38. DESCRIPTION. The baggage compartment ends at this station and the fuselage cross section changes. It is an open section forward and a closed ring at Station 179.75 and aft. The frame consists of an upper and lower part, made of .051 24ST clad and .032 24ST clad respectively. The upper part has the shape of an inverted horseshoe and is of channel cross section. The lower part is essentially a beam with a straight top flange but with the lower flange conforming to the contour of the fuselage skin. Brackets are mounted on the lower frame web, supporting the various control cables that go to the empennage. The fuselage skin is riveted to both parts of this frame by AN470AD4 rivets at approximately 1-$\frac{1}{2}$ inch spacing.

4-39. NEGLIGIBLE DAMAGE. See paragraph 4-25.

4-40. DAMAGE REPAIRABLE BY PATCHING. Damage exceeding negligible damage is repaired similar to that shown in figure 4-3. The only difference is that, where the width at the web will permit, more than two rows of rivets must be used, spaced at approximately six rivet diameters, to properly fill the web. If the damage is less than half the cross section, it is permissible to use only one angle. In such cases the width of splicing angle flange which is next to the web must be wide enough for at least one row of rivets beyond the damaged portion of the web for the entire length of the splice. If the damage is located at a lightening hole and extends into the web, a repair similar to Figure 2-5 may be used. Clean out the damage to a smooth shape and cut a reinforcement from a sheet of .051 24ST alclad for the upper part of the frame and .032 24ST alclad for the lower portion. The doubler is cut larger than the cutout, to accommodate rivets with proper edge distance and permit the bending of a 3/4 inch flange. Attach doubler to frame web with AN470AD5 rivets, spaced at approximately 3/4 inch with 3/4 inch between rivet rows, maintaining a 5/16 inch minimum edge distance. Damage to a lightening hole flange, which does not extend more than 4/3 the width of the flange may be repaired as shown in Figure B-6.

4-41. FRAMES AT STATIONS 198, 224, 249.5, 273.118 AND 294.1.

4-42. DESCRIPTION. These frames are made of 24ST clad material, and have channel cross sections. They are stiffening rings in the fuselage tail cone riveted to the skin by AN470AD4 rivets at two inch spacing at stations 198, 224 and 249.5 and 1-$\frac{1}{2}$ inch spacing at stations 273.118 and 294.1.

4-43. NEGLIGIBLE DAMAGE. See paragraph 4-25.

4-44. DAMAGE REPAIRABLE BY PATCHING. Refer to Figure 4-3 for repair of these frames which exceeds that specified as negligible. If less than half the cross section is damaged it may be repaired by using only one angle. In such cases the width of the splicing angle flange that is next to the web should be wide enough for at least one rivet through the undamaged portion of the web over the entire length of the splice.

4-45. BULKHEAD, STATION 311.07.

4-46. DESCRIPTION. At this station the fuselage has tapered to a semi-elliptical shape, 4-$\frac{1}{2}$ inches across by 18 inches deep, similar to a nose rib with the leading edge at the bottom. It is composed of 24ST alclad sheet. The web is .040 gage flanged aft with an .064 doubler frame, flanged forward, and riveted to the forward face of the web. An elevator control pulley bracket is riveted to the forward face at the top of the web. The rudder hinge brackets are bolted to the aft side of the web at approximately the center of the bulkhead. The steel tail skin plates are bolted to the aft side of the web and doubler, at the bottom of the bulkhead. The vertical stabilizer beam attaches to the upper end of this bulkhead by means of nine AN4 bolts thru the web and doubler. The fuselage skin is riveted to the web and doubler flanges with AN470AD4 rivets.

4-47. NEGLIGIBLE DAMAGE. See paragraph 4-25.

4-48. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding the specified limits of negligible damage should be repaired by replacement of the web or doubler or both.

4-49. WING AFT ATTACHMENT BEAM.

4-50. DESCRIPTION. This beam is a formed channel of .051 24ST clad sheet. It is 5-$\frac{1}{2}$ inches deep with 1-1/16 inch flanges. There are lightening holes every 5-$\frac{1}{2}$ inches across the span. It flanges aft and extends across the fuselage just in front of and below the baggage floor at Station 142.57. Two AN5 bolts pass through both flanges, one at each end of the beam, attaching it to the fuselage lower longeron above and to the wing rear spar below.

4-51. NEGLIGIBLE DAMAGE. See paragraph 4-25.

4-52. DAMAGE REPAIRABLE BY PATCHING. Damage to the flanged lightening holes not extending more than 4/3 the width of the flange may be repaired as shown in Figure B-6.

4-53. CROSS BAR AT STATION 147.125.

4-54. DESCRIPTION. This bar is made of a 24S0 tube .064 x 1-$\frac{1}{2}$ inches, flattened at both ends and heat-treated to 24ST. It extends across the fuselage just aft of the rear seat, and is attached to the upper

longerons by two AN442AD5 rivets and one AN3 steel bolt on each side.

4-55. NEGLIGIBLE DAMAGE. Dents up to 1/16 inch in depth and free of cracks and abrasion may be disregarded. Light Longitudinal scratches may be classified as negligible damage when burnished and painted with zinc chromate primer.

4-56. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding the above limits of negligible damage requires the replacement by another tube of the same material, diameter and thickness; or larger diameter or greater thickness. No repairs should be attempted except straightening of a bowed tube.

4-57. CABIN ENCLOSURE FLOOR.

4-58. DESCRIPTION. The cabin enclosure floor is made up of 24ST clad material. A sheet of .040 gage extends across the fuselage between Stations 54 and 93.438. It is riveted to the fuselage, skin panels and firewall, and is also supported longitudinally by the two nose gear beams. Additional angles and channels are attached to the floor undersurface to provide stiffening and to support various equipment.

4-59. NEGLIGIBLE DAMAGE. Smooth dents free of cracks or abrasions located anywhere on the cabin enclosure floor may be disregarded, provided they do not exceed a depth of 1/8 inch and a diameter of 1-½ inches; and there is at least 15 inches between adjacent dents. Those exceeding the above limits and subsequently bumped back to contour without cracking or creasing the floor may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may also be considered negligible.

4-60. DAMAGE REPAIRABLE BY PATCHING. Damage which exceeds that specified as negligible should be repaired by patching as shown in Figure B-3.

4-61. NOSE GEAR BEAMS.

4-62. DESCRIPTION. These two beams, extending longitudinally six inches either side of the airplane centerline are identical except for minor details. Each is made up of 24ST clad material and consists of an .032 web approximately 9-½ inches deep, upper cap angle of standard section .064 x .759 x .759 (See Section VIII, 1S129), and lower cap angle with equal 3/4 inch flanges .040 inches thick. Vertical stiffening angles are added to the web in between bulkhead stations.

4-63. NEGLIGIBLE DAMAGE. See paragraph 4-25.

4-64. DAMAGE REPAIRABLE BY PATCHING. Holes and punctures in the web and 1-½ inches clear of the cap angles may be repaired as shown in Figure B-3. Rivet the doubler to the web with two rows of AN470AD4 rivets spaced at 3/4 inch and 5/8 inch between rows, maintaining a 1/4 inch edge distance. Damaged stiffening angles should be replaced.

4-65. BAGGAGE COMPARTMENT FLOOR.

4-66. DESCRIPTION. The baggage compartment floor web is .025 24ST alclad, riveted to the lower longerons, the wing aft attachment beam and the fuselage frame at Station 179.75. Stiffening is provided by 7/8 inch deep zee sections, which are riveted to the undersurface of the floor.

4-67. ACCESS FOR REPAIRS. The baggage compartment floor is readily accessible from the inside or the outside. Inside, the rear passengers seats may be moved forward, or removed. Outside, the fuselage fairing under the baggage compartment can be removed.

4-68. NEGLIGIBLE DAMAGE. Smooth dents free of cracks or abrasions located anywhere on the web may be disregarded, provided they do not exceed a depth of 1/8 inch and a diameter of 1-½ inches and there is at least 15 inches between adjacent dents. Dents exceeding the above limits, and subsequently bumped back to contour without cracking or creasing the skin may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may also be considered negligible.

4-69. DAMAGE REPAIRABLE BY PATCHING. Damage to the baggage floor zee stiffeners which requires a complete splice, is repaired by splicing with a zee section of the dimensions and material given for N.A.A. No. 1S41 in Section VIII. Nest the zee section and attach with four AN470AD4 rivets in the upper and lower flanges and four AN470AD4 rivets thru the vertical web, making a total of 12 rivets on each side of the damaged area. Rivet spacing to be approximately 5/8 inch with a minimum edge distance of 3/16 inch. Damage to the floor web may be repaired as shown in Figure B-3. The damage should be trimmed to a circular or rectangular cutout; with 1/2 inch minimum corner radii for rectangular cutouts. The patch should be of sufficient size to permit picking up two rows of AN470AD4 rivets around the perifery of the cutout, 3/4 inch on centers and between rows, maintaining a ¼ inch minimum edge distance.

4-70. DAMAGE REPAIRABLE BY INSERTION. Stringer damage exceeding a length of approximately six inches should be repaired by an insertion. The insertion zee should be of the material and to the dimension of N.A.A. No. 1S41 in Section VIII. The insertion is butted against the existing zee section and spliced as described in paragraph 4-69.

4-71. FUSELAGE LONGERONS.

4-72. DESCRIPTION. The fuselage is reinforced longitudinally between Station 54.0 and Station 179.75 with four longerons; upper left and right, and lower left and right. The longerons are spliced at Station 93.438. Fittings riveted to the forward ends of the lower longerons provide for the attachment of the engine mount. The longerons are all formed sheet metal channals, the upper are made from .051 24ST alclad, and the lower are .102 24ST alclad.

4-73. NEGLIGIBLE DAMAGE. Bends and dents in flanges, free of cracks and abrasions, which are reworked to their original shape, free of waviness and without cracking or creasing the longeron may be classified as negligible damage. Scratches which do not penetrate beyond the alclad coating may be disregarded.

4-74. DAMAGE REPAIRABLE BY PATCHING. (See Figure 4-4.) Damage to the longerons must be repaired in accordance with the repair data shown on the Figure. Complete damage to the longeron cross section is repaired by effecting a complete splice. Use a filler in the damaged area at the skin attachment flange. Attach the skin to the splice and the filler in the damaged area with rivets spaced the same as existing rivets. The lower longerons are repaired as shown in Figure 4-4. Two .102 24ST alclad splice angles span the damaged area, attached with four NAS 178-6 hi-shear rivets thru each flange and four NAS 178-6 hi-shear rivets thru the web, making a total of 12 hi-shear rivets each side of the damaged area. NAS 179-6 hi-shear rivet collars are used with the above hi-shear rivets.

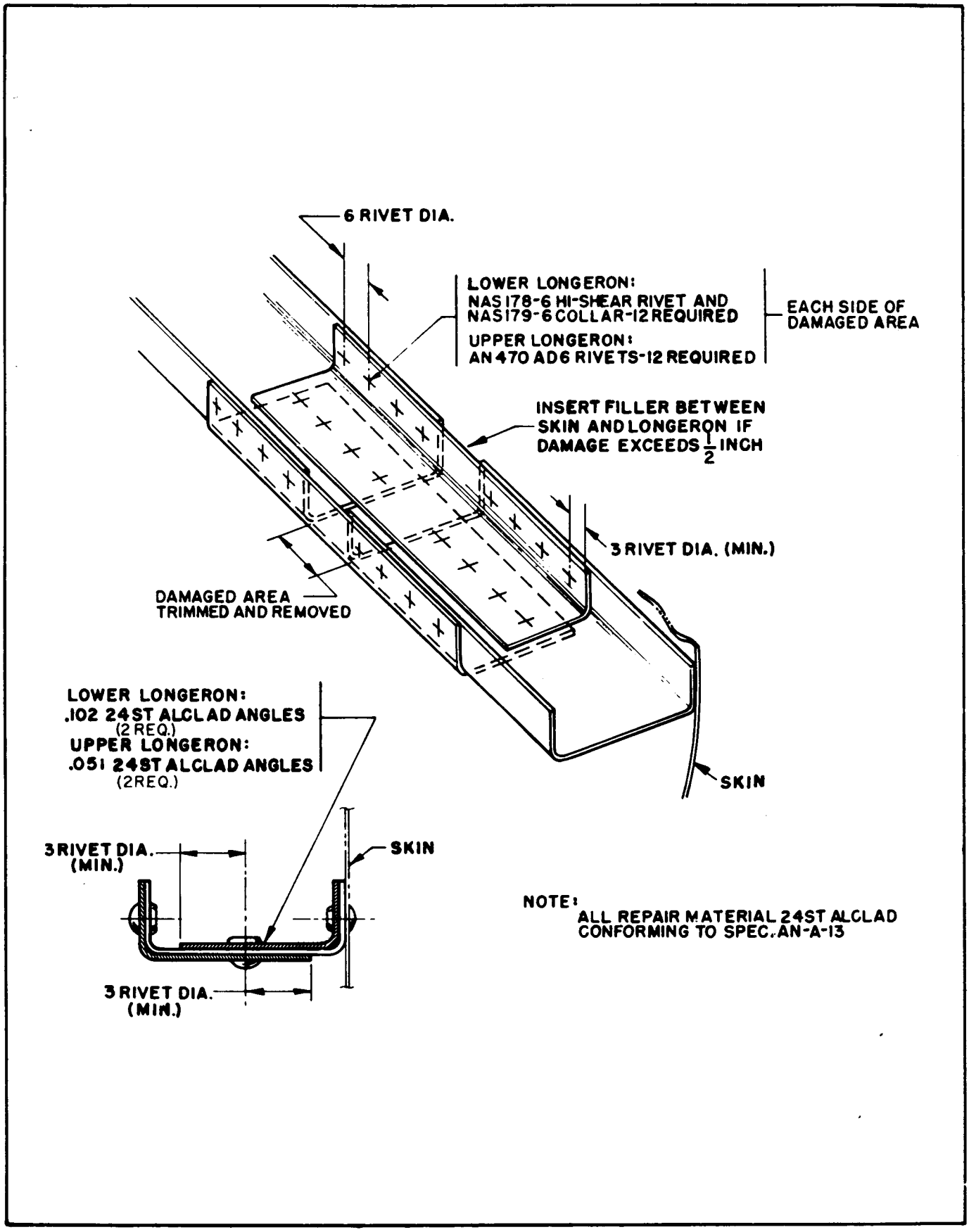


FIGURE 4-4. FUSELAGE LONGERON REPAIR - UPPER AND LOWER

NOTE

Thru the inner flange and web of the lower longeron AN3 bolts and AN365-1032 nuts may be substituted. Thru the flange adjacent to the skin, NAS 221 screws and AN365-1032 nuts should be used.

The upper longerons between station 54 and station 147 are repaired as shown in Figure 4-4. Two .051 24ST alclad splice angles span the damaged area, attached with four AN470AD6 rivets thru each flange and four AN470AD6 rivets thru the web, making a total of 12 rivets each side of the damaged area. Damage to the upper longerons between station 147 and station 179.75 may be repaired similar to Figure 4-4. Two .051 24ST alclad angles are used. The attachment each side of the damaged area, is made with a row of four AN470AD6 rivets thru each longeron flange, and two or more rows, thru the longeron web, spaced at one inch between rows, and using four AN470AD6 rivets per row.

4-75. DAMAGE REPAIRABLE BY INSERTION. All damage to the longerons should be repaired as described in paragraph 4-74. If the damage to the longeron is extensive, an insertion repair should be made. The insertion member must be of the same material, gage, and section as the existing structure. The ends of the insertion member must be butted against the existing longeron. The insertion member must be spliced to the existing longeron, using the repair data in Figure 4-4. Damage occurring at the extremity of the longeron should be repaired by means of an extension splice.

4-76. DAMAGE NECESSITATING REPLACEMENT. Due to the length of the longerons, it will probably always be impractical to replace the longerons. Repair all damage as described in paragraphs 4-75 and 4-76.

4-77. COCKPIT ENCLOSURE.

4-78. DESCRIPTION. The windshield consists of two pieces of formed plastic sheet installed in a 24ST alclad frame. The sliding canopy is constructed of formed 24ST alclad aluminum sheet with plastic window panels. Two channel-shaped longerons extend the full length of the canopy. Attached to the longerons and spot-welded to the top are bowed hat sections which maintain the contour. Two tracks attached to the rear of the canopy engage rollers on the fuselage. The front of the canopy has rollers on each side that engage tracks on the fuselage. A transverse web at the aft end of the canopy covers the baggage compartment, and is strengthened by beading. The windows are held in place by a rubber extrusion. The canopy has a cylinder type lock for use while the airplane is on the ground. A cable, running from the locking handle down the left side to a pin, makes it possible to lock the canopy in several open positions. An opening mechanism makes it possible for the pilot to open the canopy during flight. The inside of the top and sides of the canopy between transparent panels are covered with upholstery, held in place with spring wires along the top, and cemented on the sides

4-79. NEGLIGIBLE DAMAGE. Smooth shallow dents free of cracks or abrasions located anywhere on the canopy skin may be disregarded, provided they do not exceed a depth of 1/8 inch and 1-½ inches in diameter and adjacent dents are at least 15 inches apart. Dents exceeding the above limits and subsequently bumped back to contour without cracking or creasing the skin may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be considered negligible damage.

4-80. DAMAGE REPAIRABLE BY PATCHING. Holes and punctures in the canopy top may be repaired as shown in Figure B-1 or B-3.

SECTION V

ALIGHTENING GEAR

5-1. GENERAL.

5-2. DESCRIPTION. (See figure 5-1.) The alighting gear is of tricycle design, hydraulically retractable, consisting of two main gear assemblies, a nose gear assembly, wheels and tires for each gear and up-locks with normal and emergency control linkage.

5-3. MAIN LANDING GEAR.

5-4. DESCRIPTION. (See figure 5-1.) The main gear assemblies are attached to the wing structure by ball-socket fittings and trunnion pins; pivot on the trunnion pins and retract inboard into the wing panels. Extension of the main gear is accomplished by the movement of the hinged side brace which drops past center and locks in the down position. The gear is held in the up position by an uplock. Shock loads caused during takeoff, landing and taxiing are absorbed by the air-fluid combination of the shock strut.

5-5. NEGLIGIBLE DAMAGE. Small, smooth isolated nicks and scratches up to 1/32 inch in depth may be classified as negligible if free from cracks, sharp corners and abrasions. No damage is permitted to the shock strut inner cylinder, as defects would result in leakage of air and oil.

5-6. REPAIRABLE DAMAGE. Fittings containing worn bushings may be repaired by the replacement of these bushings, reamed to the correct diameter as in the original part.

5-7. AXLE - STRUT HOUSING FORGING CONTAINING CRACKS. Main landing gear housings (axle forging) containing cracks in the upper edge may be reworked. Should visual inspection reveal the presence of a crack, or cracks, the housing should be removed as follows:

5-8. REMOVAL OF HOUSING.

a. Jack up the airplane and relieve all of the air pressure in the strut with cracked housing. Remove the 145-33205 piston and axle assembly.

b. Remove wheel and tire, and disassemble strut until only the shock strut piston and the housing remain.

c. Remove bolt securing cylinder to housing.

d. Measure distance from top of housing to top of cylinder, and note for future reference.

e. Locate short length (six to eight inches) of heavy gage pipe having an inner diameter just slightly larger than the cylinder outer diameter. Slide this pipe over cylinder.

f. Wrap several layers of masking tape around top of cylinder to provide hand-hold.

g. Hold assembly so that housing is immersed in boiling water. Periodically pull assembly from water and shake in an up and down movement so that the pipe on the cylinder acts as a hammer to drive the housing from the cylinder.

5-9. REWORK OF HOUSING. After removing the housing from the cylinder according to paragraph 5-8, preceding, rework the housing as follows:

a. Using file, milling machine, or other convenient method; cut into the forging to remove the crack and adjacent material. Cut a 1/2 inch radius slot to a depth as necessary, but not to exceed 7/16 inch. All surfaces should have a gentle radius when cutting is finished. See Figure 5-2.

b. Clean the cut surfaces and check for continuation of the crack. If it is not possible to clean out cracked material without cutting below housing axle extension (7/16 inch maximum), the housing must be replaced.

WARNING

If crack is not in the area as indicated in Figure 5-2, (forging part line), part must be replaced.

5-10. RE-INSTALLATION OF HOUSING. To install reworked or new housing, proceed as follows:

a. Heat housing in boiling water, dry socket area.

b. If facilities are available, chill cylinder.

c. Paint end of cylinder and housing socket with zinc chromate primer.

d. Before primer dries, place cylinder 90° from old position in housing and press into position. Check cylinder length with dimension taken in step d, of paragraph 5-8 to check that cylinder is full in.

e. Drill cylinder to match housing lock bolt holes, and install lock bolt.

f. Reinstall wheel and tire and install in gear.

g. Make an operational check to ascertain that all adjustments are functioning properly and clearances are adequate.

5-11. MAIN LANDING GEAR STRUT TRUNNION REPAIR. Early model Navions had the trunnion attached to the strut by furnace brazing only. In the event of a failure of these parts, it may be repaired as shown in Figure 5-3. Shape a block of normalized 4130 steel to size, insert into top of strut and arc weld. Drill and ream to .250 + .0015, - .0006 hole and install an AN4-34A Bolt, Nut and Washer.

WARNING

If any copper is evident in the area to be welded, the copper must be removed prior to welding or repair will not be acceptable.

Later model Navions have a 1-1/4 inch arc weld across each side of the trunnion at the strut, which was welded prior to furnace brazing. Any failures occurring on this improved strut may be repaired by the same procedure. The repair does not impair the heat treat value of strut nor will it cause cracks in the weld from copper inclusion, both of which will occur if any other type of repair is attempted.

CAUTION

Pad cylinder with asbestos during welding operation.

NOTE

Each welded part should be magnafluxed after being repaired.

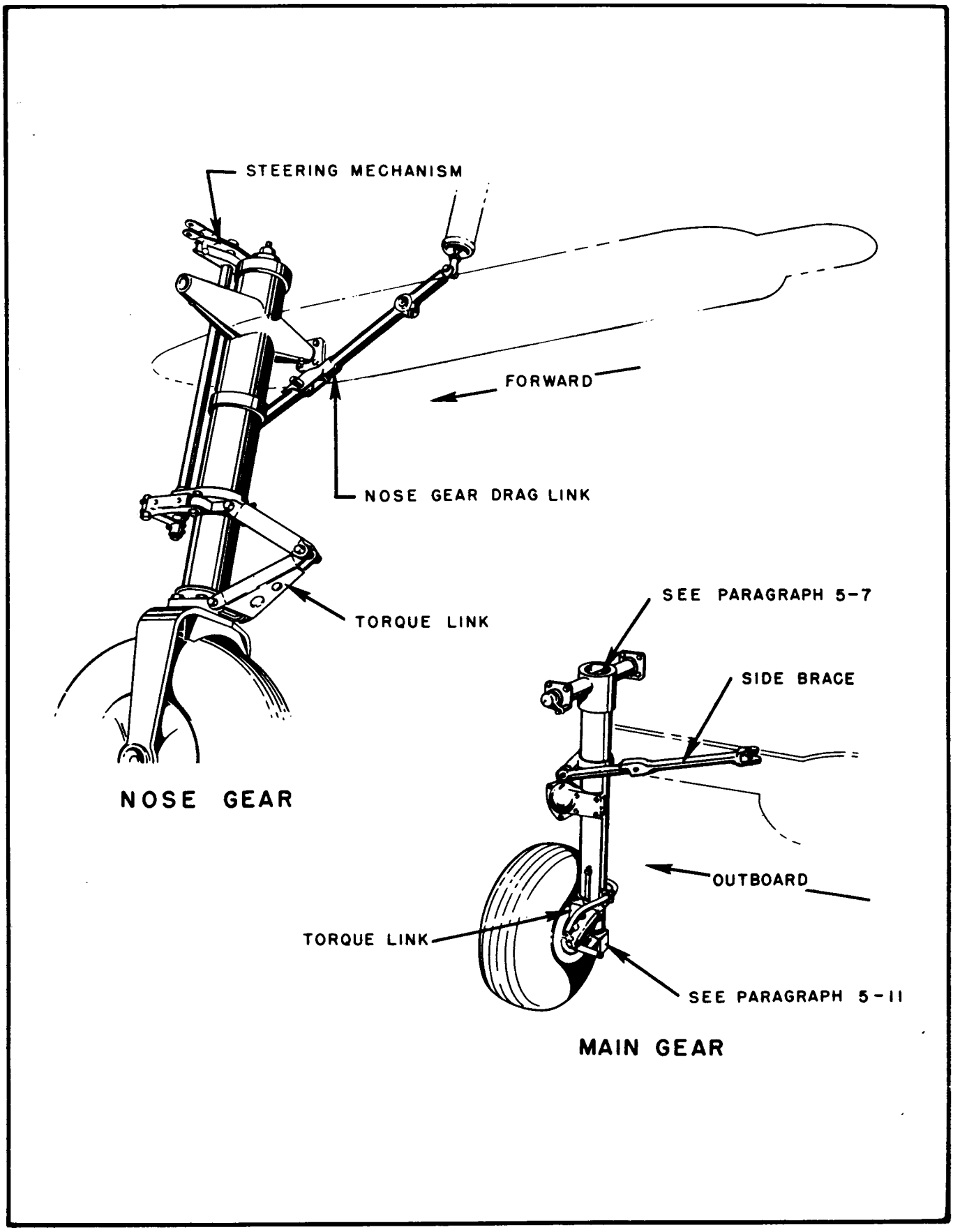
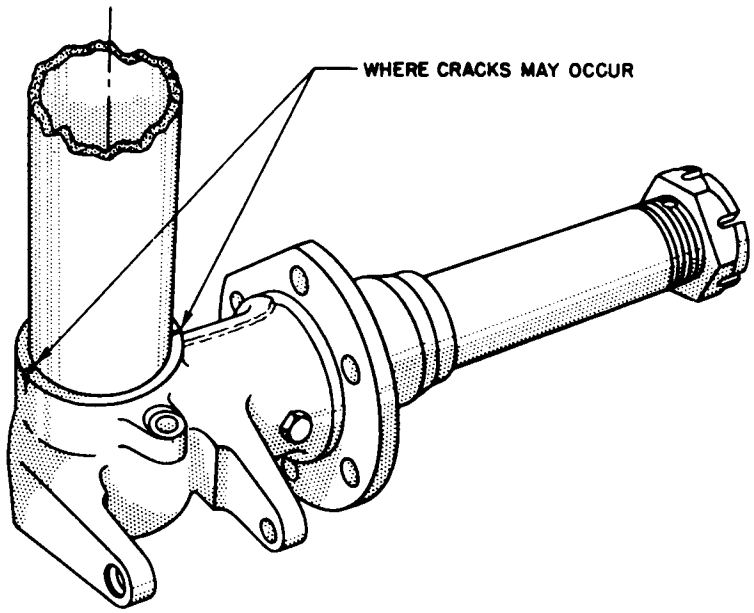


FIGURE 5-1. NOSE AND MAIN LANDING GEAR



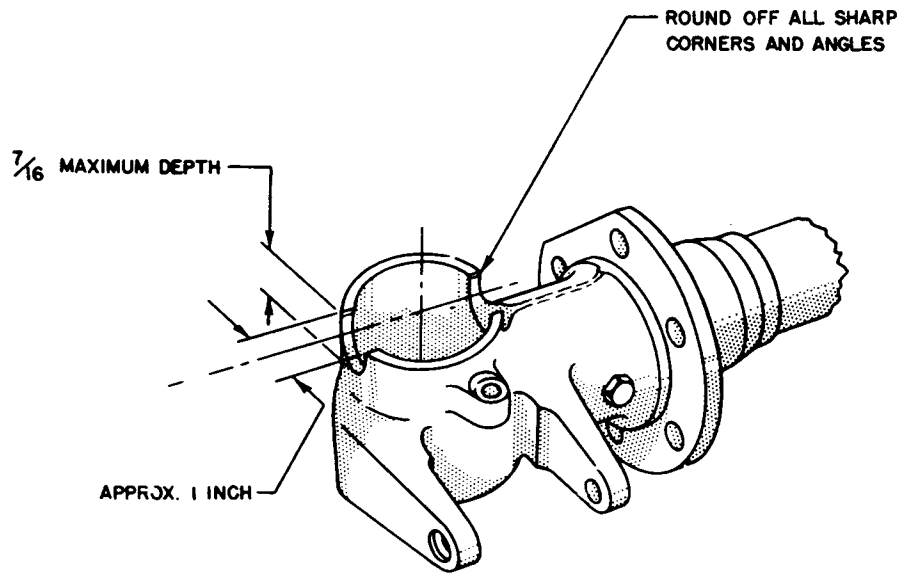


FIGURE 5-2. MAIN LANDING GEAR AXLE HOUSING REPAIR

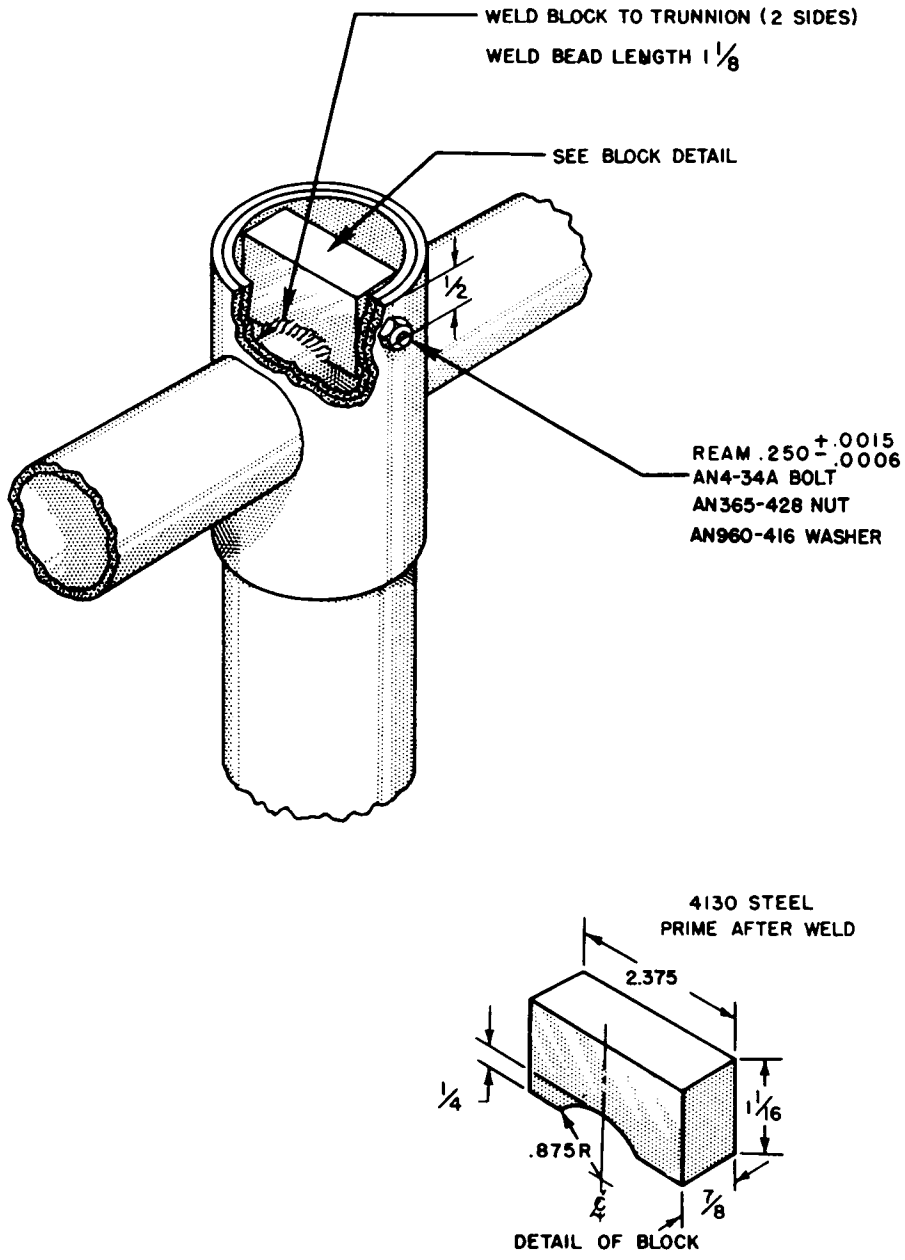


FIGURE 5-3. MAIN LANDING GEAR TRUNNION REPAIR

5-12. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Any part, subjected to damage which is not classified as negligible; section 5-5, or repairable; section 5-6, must be replaced.

5-13. NOSE LANDING GEAR.

5-14. DESCRIPTION. (See Figure 5-1) The nose gear assembly is attached to a support box at the firewall in the nose of the fuselage. It is held in place by ball socket fittings and trunnion pins and pivots aft into a fuselage well. Extension of this gear is accomplished by the movement of a hinged drag brace assembly which drops past center and locks in the down position. The gear is held in the up position by an uplock. Shock loads caused during take-off landing and taxiing are absorbed by the air-fluid, combination in the shock strut. When the nose gear is extended, bell crank rollers contact a steering arm, attached to the shock strut, causing the nose wheel to turn in the direction of the rudder movement. During retraction or extension the nose gear is prevented from turning by a mechanical centering device.

5-15. REPAIRABLE DAMAGE. Fittings containing worn bushings may be repaired by the replacement of these bushings, reamed to the correct diameter as in the original part. No other parts are repairable.

5-16. DAMAGE NECESSITATING REPLACEMENT PARTS. Any part subjected to damage which is not classified as negligible; section 5-5, or repairable; section 5-15, must be replaced.

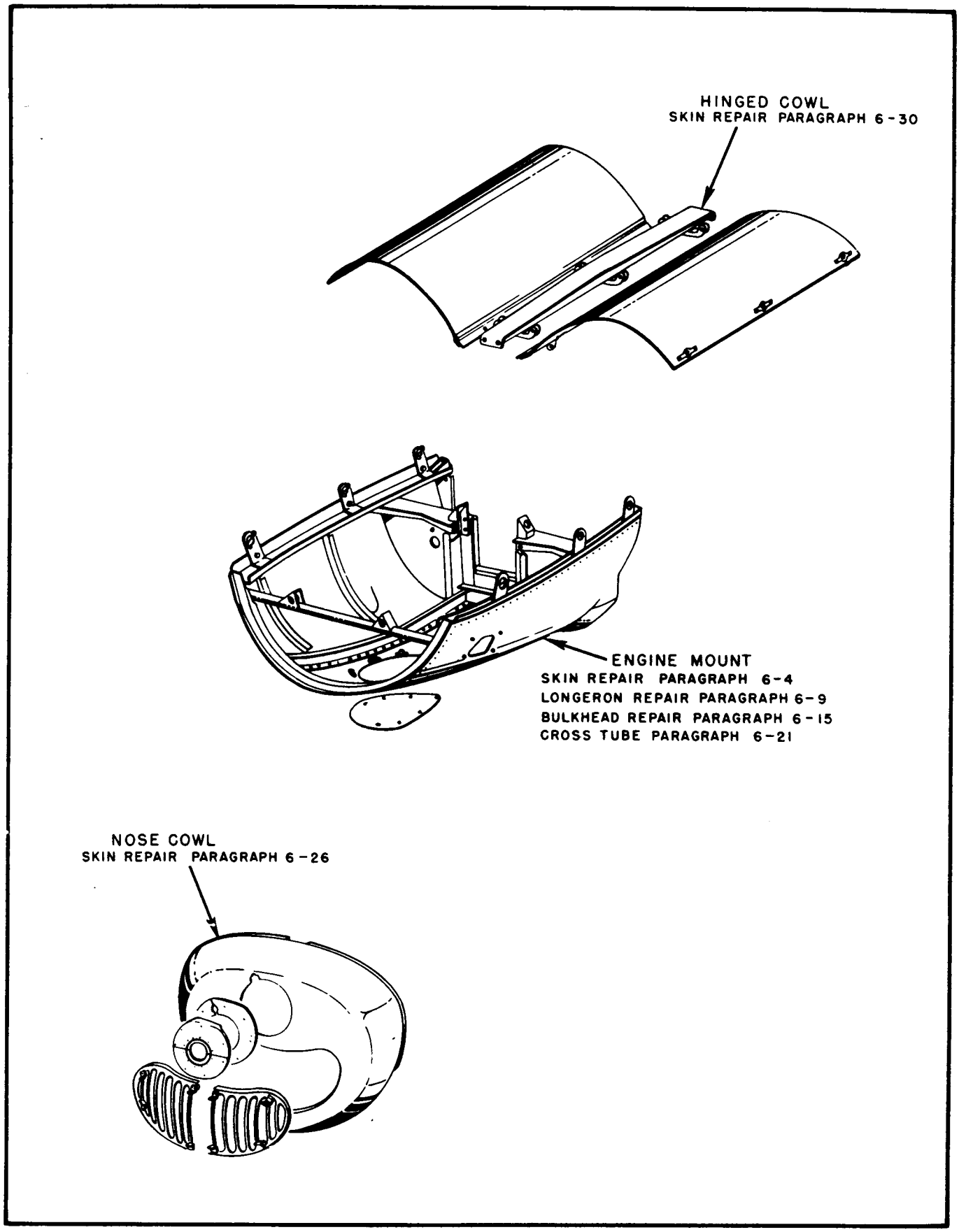


FIGURE 6-1. ENGINE MOUNT AND COWLING STRUCTURE

SECTION VI

ENGINE SECTION

6-1. ENGINE MOUNT.

6-2. DESCRIPTION. (See Figure 6-1.) The engine mount, semimonocoque in construction, is removable from the fuselage and consists of longerons, frames, a bulkhead, a steel cross tube, and alclad sheet covering. The engine is rubber mounted on four fittings, two on the cross tube and two on the bulkhead. The mount is secured to the main fuselage by four attachment fittings, two on the firewall and two on the forward end of the nose wheel beams. The engine nose cowl is bolted to the engine mount and is supported at the top by a channel member extending from the firewall forward. A channel also provides attachment points for the hinged cowling, which is secured by Dzus-Type fasteners at the engine mount upper longerons. The hinged cowl covers the top of the engine. A grill is fitted into the air intake cutout of the nose cowl.

6-3. ACCESS FOR REPAIR. The engine section is accessible through the hinged cowl, and by removing the door in the lower surface under the engine.

6-4. SKIN.

6-5. DESCRIPTION. The arrangement, materials, and gages of the skin panels are shown in Figures 4-2 and 6-1.

6-6. NEGLIGIBLE DAMAGE. Disregard smooth dents and nicks free of cracks and abrasions, and scratches which do not penetrate beyond the alclad coating. Aft of Station 40.5; punctures, deep scratches, cracks, and deep dents which are cleaned up with 1/2 inch diameter holes or smaller and are two inches from adjacent structure are considered negligible damage. The distance of adjacent negligible damage must be at least ten times the diameter of the largest hole. When repairs to negligible damage holes are eventually made, 24ST alclad must be used in accordance with Figure B-4. No holes or punctures are permitted forward of Station 40.5.

WARNING

Doped fabric patches are not permitted for covering of negligible damage holes due to fire hazard.

6-7. DAMAGE REPAIRABLE BY PATCHING. Skin damage which exceeds the specified limits of negligible damage must be repaired. Damage to skin panels may be repaired with the flush patch shown in Figure B-1. Remove damaged area by cutting a circular or rectangular hole; minimum corner radii for rectangular cutouts to be 1/2 inch. Smooth all edges to remove burrs. Flush patch is made from .032 24ST alclad and doubler is .040 24ST alclad. Doubler is fabricated larger than cutout to accommodate rivets to skin with proper edge distance. Fit flush patch to cutout as closely as possible and locate position of doubler to provide equal overlap at all edges of cutout. Attach doubler to skin and flush patch to doubler by riveting with single rows of AN470AD5 rivets. The spacing is permitted to vary between 3/4 inch minimum and one inch maximum, maintaining a minimum edge distance of 5/16 inch.

6-8. DAMAGE REPAIRABLE BY INSERTION. Skin that is damaged extensively should be repaired by splicing in a new skin from one structural member to the next. The repair should be made to lie along stiffening members, frames, longerons, or bulkheads. Lap seams may be made with a single row of AN470AD5 rivets and the spacing permitted to vary between 3/4 inch minimum and one inch maximum. The above limits on rivet spacing permits the picking of existing rivet holes.

6-9. LONGERONS.

6-10. DESCRIPTION. (See Figure 6-1.) The upper and lower longerons are channel sections. The two upper longerons are made from .051 clad 24ST and the two lower longerons are .040 clad 24ST. Fittings riveted to the aft ends of the longerons provide for attachment to the fuselage.

6-11. NEGLIGIBLE DAMAGE. Bent flanges and smooth dents free of cracks and abrasions, which are bumped back to the longeron's original shape, free of waviness and without cracking or creasing the longerons may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be disregarded.

6-12. DAMAGE REPAIRABLE BY PATCHING. Damage to the longerons must be repaired in accordance with the repair data shown in Figures 6-2 and 6-3. Damage to more than 1/2 the cross-sectional area of the longeron is repaired with a complete splice. Trim damaged area smooth, using 1/2 inch corner radii for partial damage. Use a filler in the damaged area at the skin attachment flange. Attach the skin to the splice angle and the filler in the damaged area picking up existing rivet holes. Install repair members with a good fit. Paint all bare metal with at least two coats of zinc chromate primer.

6-13. DAMAGE REPAIRABLE BY INSERTION. Longerons damaged completely for a length exceeding five inches horizontally should be repaired with an insertion, of the same gage, shape and material as the original section and spliced as shown in Figures 6-2 and 6-3. Trim damaged area smooth and burr edges. Prime bare metal with at least two coats of zinc chromate primer.

6-14. DAMAGE NECESSITATING REPLACEMENT. Longerons, which are damaged a large portion of their length should be replaced.

6-15. BULKHEAD AT STATION 40.5. (See Figure 6-1.)

6-16. DESCRIPTION. The bulkhead located at Station 40.5 serves as the engine aft support. It consists of a web which is flanged and riveted to the engine mount skin. The upper edge of the web is riveted to cap members and the caps extend from the upper longerons inboard to the engine support channels. Two engine mount support channels are riveted to the web and extend the depth of the bulkhead, connecting with the fuselage lower attachment fittings.

6-17. WEB NEGLIGIBLE DAMAGE. Disregard smooth dents and nicks free of cracks and abrasions, also scratches which do not penetrate beyond the alclad coating.

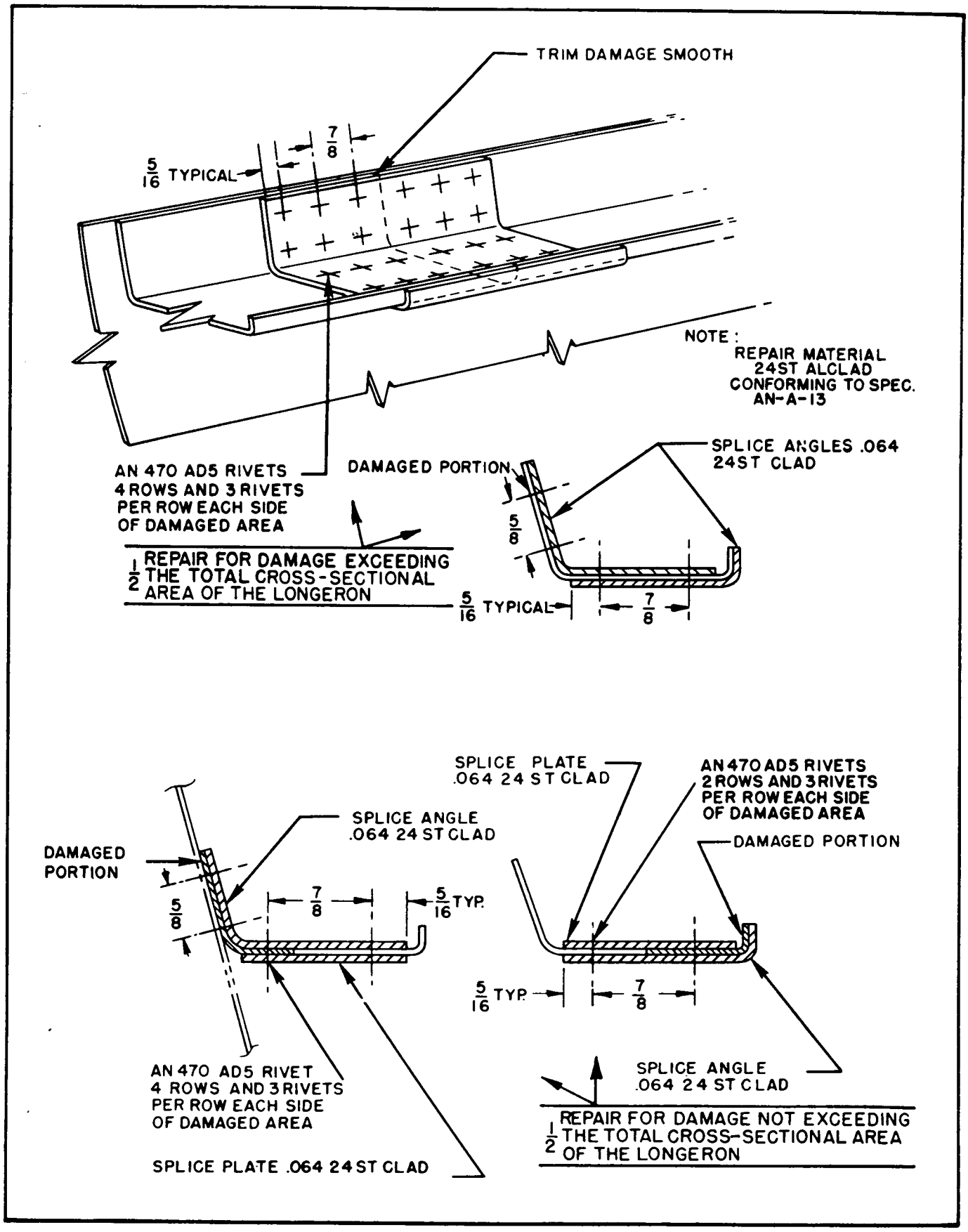


FIGURE 6-2. ENGINE MOUNT UPPER LONGERON REPAIR

CAUTION

Holes and punctures in the bulkhead web cannot be considered negligible damage, as air leakage may cause over heating of engine.

6-18. WEB DAMAGE REPAIRABLE BY PATCHING. Web damage which exceeds the specified limits of negligible damage must be repaired. Remove damaged area by cutting a circular or rectangular hole; minimum corner radii for rectangular cutouts to be 1/2 inch. Smooth all edges to remove burrs. Cut an .051 24 ST alclad patch larger than cutout to accommodate rivets with proper edge distance. Attach patch to bulkhead web with a single row of AN470AD5 rivets at 3/4 inch spacing with a minimum edge distance of 5/16 inch. Repair to be of the type shown in Figure B-3.

6-19. FLANGE NEGLIGIBLE DAMAGE. Bent or dented flanges free of cracks or abrasions, which are bumped back to their original shape, free of waviness, and without cracking or creasing the flanges may be considered negligible damage. Scratches which do not penetrate beyond the alclad coating may be disregarded.

6-20. FLANGE DAMAGE REPAIRABLE BY PATCHING. Flange damage which exceeds the specified limits of negligible damage must be repaired. Trim all damage and smooth all edges to remove burrs. Flange damage adjacent to the engine mount skin, between the upper and lower longerons, may be repaired by nesting a formed .040x3/4x3/4 24ST alclad angle along the flange and web. Attach with AN470AD5 rivets at approximately 3/4 inch spacing with four rivets thru the flange and repair angle and four rivets thru the web and repair angle, making a total of eight rivets each side of the damaged area.

6-21. ENGINE MOUNT CROSS TUBE.

6-22. DESCRIPTION. (See Figure 6-1.) The engine mount cross tube is normalized 4130 chrome-molybdenum steel with engine mount brackets and support bushings welded to the tube. The tube dimensions are .065x1-1/4 outside diameter.

6-23. NEGLIGIBLE DAMAGE. Scratches or nicks, free of cracks, running lengthwise of the tube may be classified as negligible damage if, after smoothing the damage, the damage does not exceed .005 inch in depth and 1-1/2 inches in length. Smooth out sharp nicks and scratches with a fine file, fine emery cloth, or steel wool. Smoothing of damage will remove stress concentrations at the damaged area. Paint all smoothed damage with at least one coat of zinc chromate primer.

NOTE

Deep scratches or nicks running around tube cannot be considered negligible damage.

Any signs of nicks or scratches appearing to have cracked the tube should be checked by magnetic inspection. Magnetic inspection by means of magnetic powder such as magnaflux and black rouge has proven to be a practical and non-destructive method. This process will indicate the presence of minute cracks. The surface to be examined should be thoroughly cleaned as it is otherwise difficult to detect cracks. Magnetically inspected parts must be demagnetized before assembly on airplanes. Another less accurate method of checking for cracks, is to apply a liberal coating of light oil to the affected area, thoroughly wipe the oil off, and then apply a coat of whiting. A crack will usually show by the appearance of oil on the whiting from the crack recess.

NOTE

Cracks can never be considered as negligible damage.

6-24. DAMAGE REPAIRABLE BY PATCHING. Damage which exceeds the specified limits of negligible damage, must be repaired in accordance with instructions in Civil Aeronautics Manual 18.

6-25. DAMAGE NECESSITATING REPLACEMENT. Damage not covered in Civil Aeronautics Manual 18 necessitates replacement of part.

6-26. NOSE COWL.

6-27. DESCRIPTION. (See Figure 6-1.) The engine nose cowl is a stamped part made of .040 52SO aluminum alloy. The cowl covers the forward portion of the engine, and contains an air inlet for cooling the engine. The nose cowl is bolted to the engine mount, and is supported at the top by a channel running aft to the firewall.

6-28. NEGLIGIBLE DAMAGE. Disregard shallow smooth dents or nicks free of cracks or abrasions. Scratches less than .005 inch deep and 1-1/2 inches long are considered negligible damage after burnishing. Deep dents formed back to contour and free of cracks or scratches are considered negligible damage.

6-29. DAMAGE REPAIRABLE BY PATCHING. See Figure B-1. Trim all damaged material to a circular or rectangular cutout; minimum corner radii for rectangular cutouts is 1/2 inch. Smooth all edges to remove burrs. Cut a .051 52SO doubler to fit on inner side of nose cowl; doubler to be formed to contour and larger than cutout to accommodate rivets to cowl with proper edge distance. Cut flush skin patch of .040 52SO to fit as closely to outline of cutout as possible and locate position on doubler to provide equal overlap at all edges of cutout. Attach nose cowl to doubler and doubler to flush patch with a staggered double row of AN470AD5 rivets, maintaining a 3/4 inch rivet spacing with the rows 5/8 of an inch apart with a minimum edge distance of 5/16 of an inch at all sheet edges.

NOTE

When the central portion of the doubler has not been removed, a single row of AN470AD5 rivets thru the doubler and flush patch at a one inch spacing may be used. Two rows of rivets are required thru the cowl skin and doubler.

6-30. HINGED COWL.

6-31. DESCRIPTION. The hinged cowl is made from .032 24 ST alclad, reinforced by three vertical formers on each side. The cowl is secured by three hinge fittings on top and Dzus fasteners at the bottom.

6-32. NEGLIGIBLE DAMAGE. Disregard smooth dents and nicks free of cracks and abrasions, and scratches which do not penetrate beyond the alclad coating. Punctures, deep dents, cracks, and deep scratches which are cleaned up with a 1/2 inch diameter hole or smaller and are two inches from adjacent structure are considered negligible damage. Adjacent negligible damage must be at least ten times the diameter

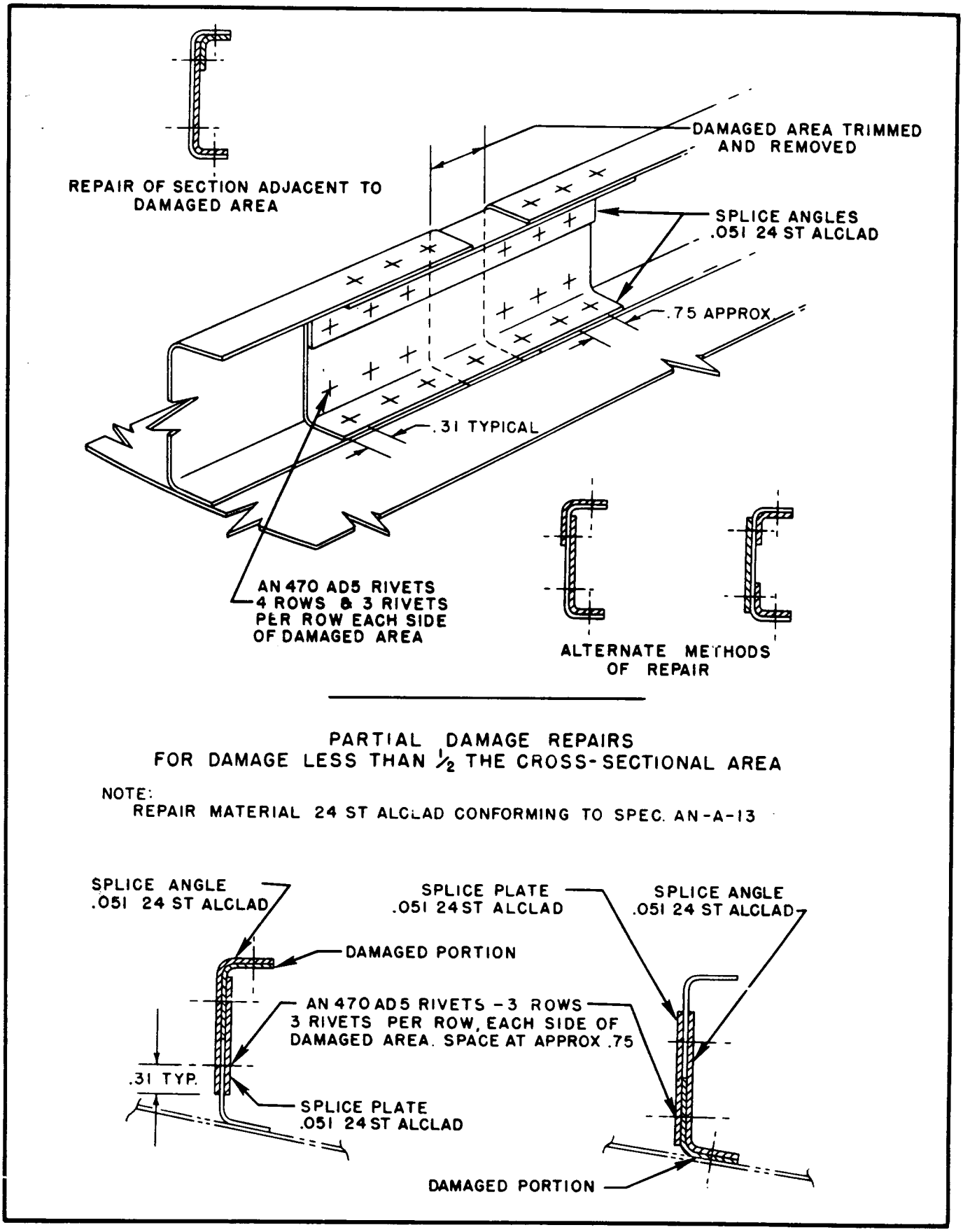


FIGURE 6-3. ENGINE MOUNT LOWER LONGERON REPAIR

of the largest hole. When repairs to negligible damage holes are eventually made, 24ST alclad must be d in accordance with Figure B-4. No holes are per ted below the engine air seal.

CAUTION

Doped fabric patches are not permitted for covering negligible damage holes due to fire hazard.

6-33. DAMAGE REPAIRABLE BY PATCHING. Skin which exceeds the limits of negligible damage must be repaired. Damages to the hinged cowl may be repaired with the flush patch shown in Figure B-1. Remove damaged area by cutting a circular or rectangular hole; minimum corner radii for rectangular cutouts to be 1/2 inch. Smooth all edges to remove burrs. The flush patch is made from .032 24ST alclad and doubler is .040 24ST alclad. Doubler is fabricated larger than cutout to accommodate rivets in skin with proper edge distance. Fit flush patch to cutout as closely as possible to provide equal overlap at all edges of cutout. Attach patch by riveting with single rows of AN470AD4 rivets at 3/4 inch spacing, maintaining a minimum edge distance of 1/4 inch.

6-34. ENGINE AFT MOUNTING FITTINGS.

6-35. DESCRIPTION. The fittings provide the rear support for the engine, transmitting loads into the bulkhead at Station 40.5. The fittings are steel and of channel cross section.

6-36. NEGLIGIBLE DAMAGE. Damage to the lipped edges, which is burnished and relieved with a minimum radius of 1/4 inch and the depth of damage does not exceed 1/8 inch measured from the edge of the flange may be disregarded, provided the damage is at least two rivet diameters clear of existing rivets and one inch away from engine attachment bolt.

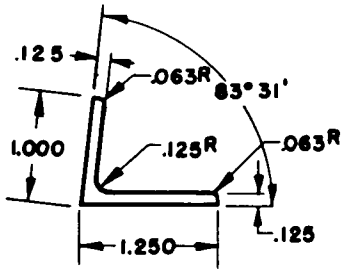
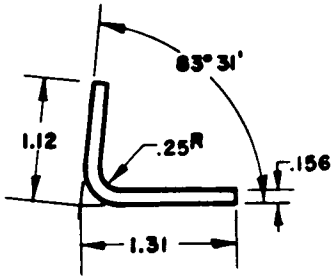
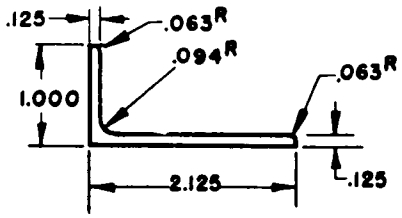
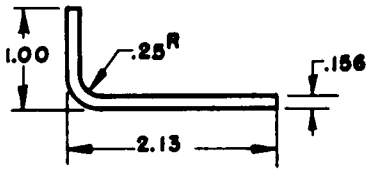
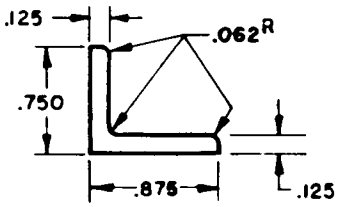
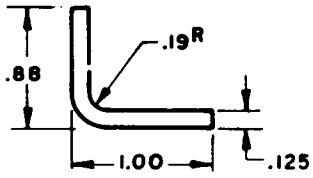
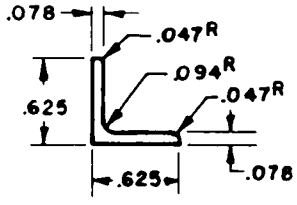
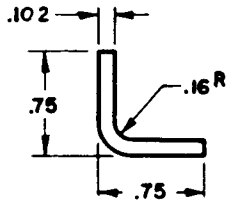
6-37. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding negligible damage requires replacement of fitting.

6-38. ENGINE MOUNT TO FUSELAGE ATTACHMENT FITTINGS.

6-39. DESCRIPTION. The fittings are riveted to the engine mount longerons and provided attachment to the fuselage. The fittings are steel and of channel cross section.

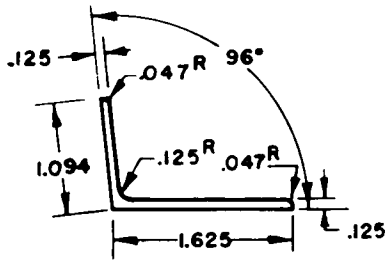
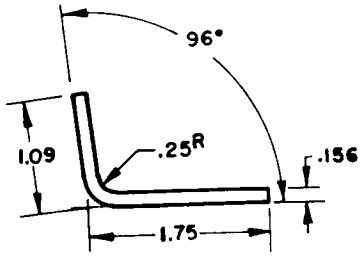
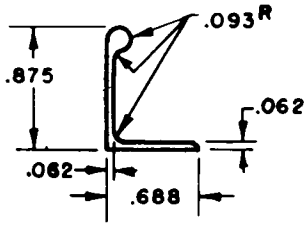
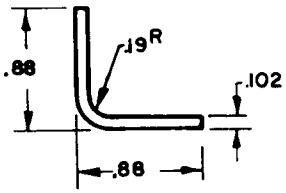
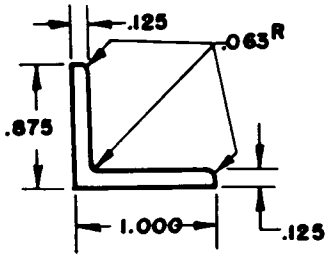
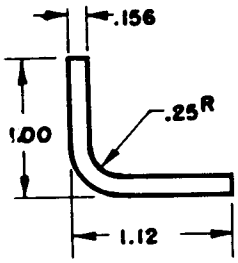
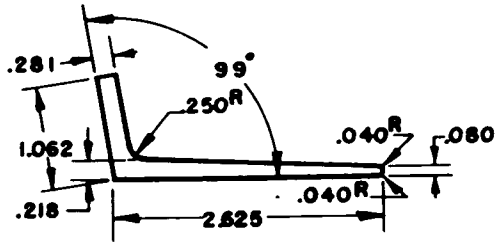
6-40. NEGLIGIBLE DAMAGE. Damage to the lipped edges, which is burnished and relieved with a minimum radius of 1/4 inch and the depth of damage does not exceed 1/8 inch measured from the edge of the flange may be disregarded, provided the damage is at least two rivet diameters clear of existing rivets and one inch away from the attachment bolt.

6-41. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding negligible damage requires replacement of fitting.

NA STANDARD NO.	ALCOA DIE NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTIONS
1E8T	30660	 Area: .266 sq. in.	 Al. Alloy 24S0 clad .156 x 1.88 x L Sheet Area: .321 sq. in.
1E38T	30006	 Area: .375 sq. in.	 Al. Alloy 24S0 clad .156 x 2.82 x L Sheet Area: .440 sq. in.
1E87T	16869	 Area: .187 sq. in.	 Al. Alloy 24S0 clad .125 x 1.637 x L Sheet Area: .204 sq. in.
1E101T	14653	 Area: .092 sq. in.	 Al. Alloy 24S0 clad .102 x 1.301 x L Sheet Area: .133 sq. in.

NOTE: Heat-treat Al. Alloy 24S0 to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-1. EXTRUSION EQUIVALENTS (sheet 1 of 5 sheets)

NA STANDARD NO.	ALCOA DIE NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
1E106T	14284	 Area: .327 sq. in.	 Al. Alloy 24S0 clad .156 x 2.576 x L Sheet Area: .402 sq. in.
1E128T	31153	 Area: .121 sq. in.	 Al. Alloy 24S0 clad .102 x 1.547 x L Sheet Area: .1575 sq. in.
1E129T	31154	 Area: .218 sq. in.	 Al. Alloy 24S0 clad .156 x 1.81 x L Sheet
1E165T	32846	 Area: .663 sq. in.	No substitution permitted

NOTE: Heat-treat Al. Alloy 24S0 to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-1. EXTRUSION EQUIVALENTS (sheet 2 of 5 sheets)

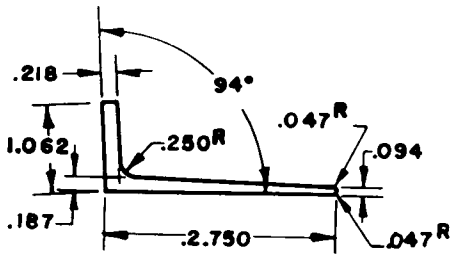
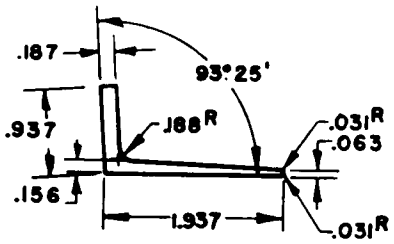
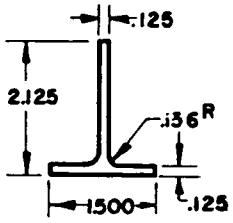
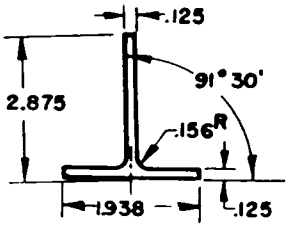
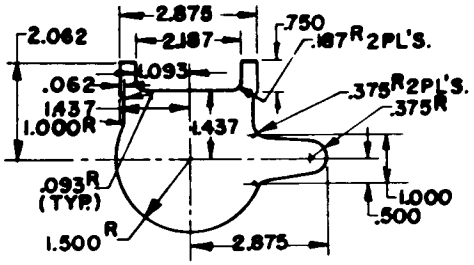
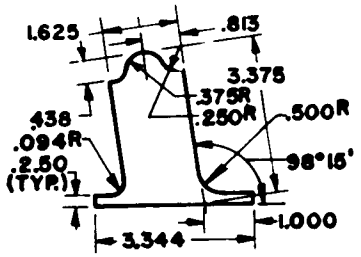
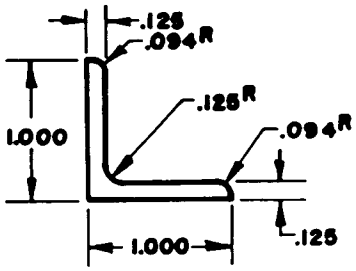
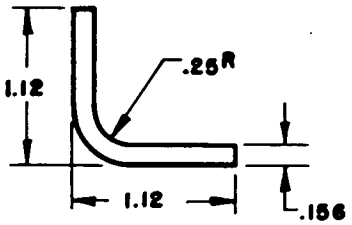
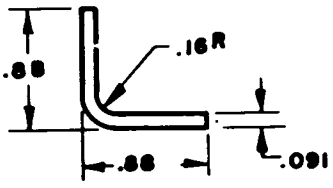
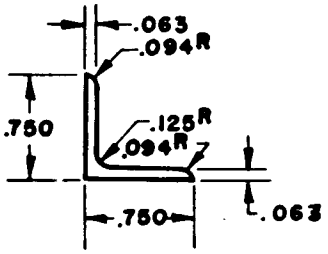
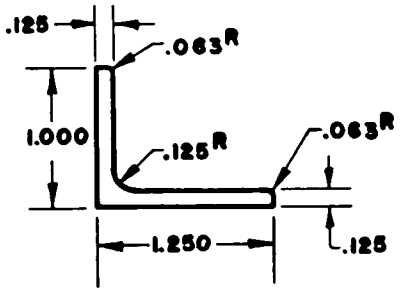
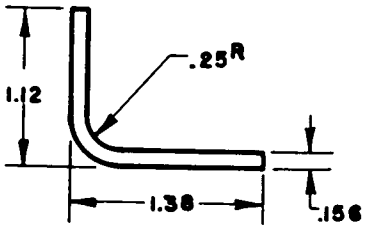
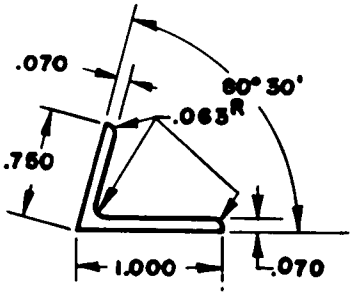
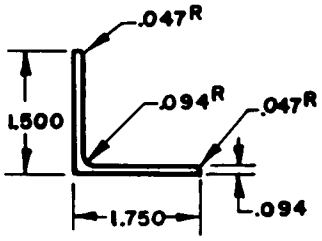
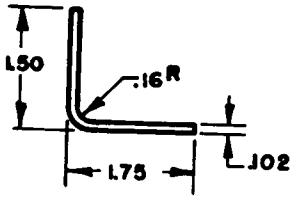
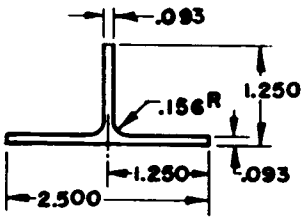
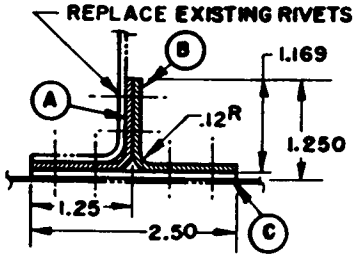
NA STANDARD NO.	ALCOA DIE NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
1E166T	32847	 Area: .600 sq. in.	No substitution permitted
1E167T	32806	 Area: .376 sq. in.	No substitution permitted
4E13T	24750	 Area: .448 sq. in.	No substitution permitted
4E31T	27909	 Area: .596 sq. in.	No substitution permitted

FIGURE 8-1. EXTRUSION EQUIVALENTS (sheet 3 of 5 sheets)

NA STANDARD NO.	ALCOA DIE NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
6E153T	32510	 Area: 9.164 sq. in.	No substitution permitted
6E154T	36745	 Area: 5.331 sq. in	No substitution permitted
	77B	 Area: .233 sq. in.	 Al. Alloy 24S0 clad .156 x 1.93 x L Sheet Area: .301 sq. in.
	78K	 Area: .091 sq. in.	 Al. Alloy 24S0 clad .091 x 1.575 x L Sheet Area: .1433 sq. in.

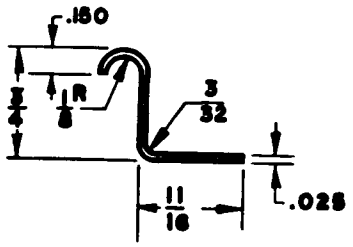
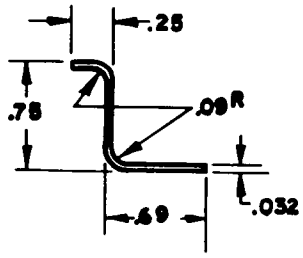
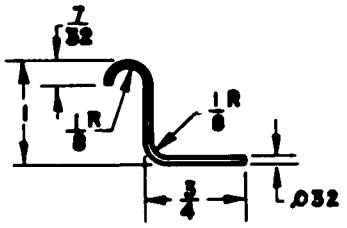
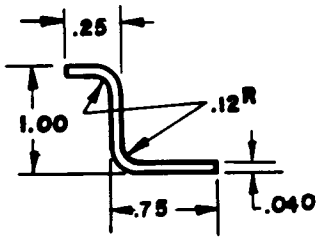
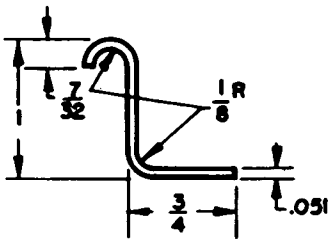
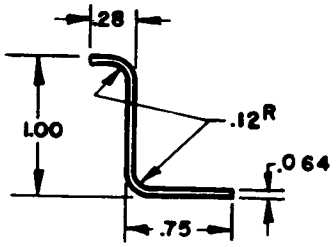
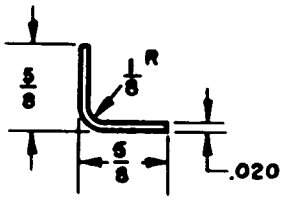
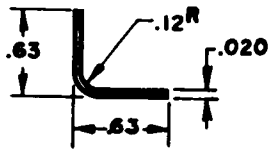
NOTE: Heat-treat Al. Alloy 24S0 to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-1. EXTRUSION EQUIVALENTS (sheet 4 of 5 sheets)

NA STANDARD NO.	ALCOA DIE NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
	734HH	 Area: .260 sq. in.	 Al. Alloy 24S0 clad .156 x 2.19 x L Sheet Area: .342 sq. in
	23993	 Area: .116 sq. in	No substitution permitted
	11638	 Area: .2970 sq. in.	 Al. Alloy 24S0 clad .102 x 3.051 x L Sheet Area: .311 sq. in.
	27740	 Area: .343 sq. in.	 A. Al. Alloy 24S0 clad .081 x 2.260 x L Sheet B. Al. Alloy 24S0 clad .081 x 2.260 x L Sheet C. Al. Alloy 24ST clad .081 x 2.50 x L Sheet Area: .568 sq. in.

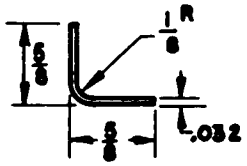
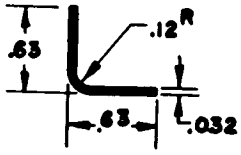
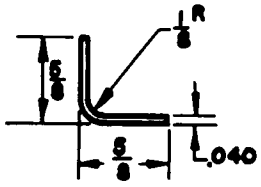
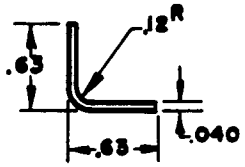
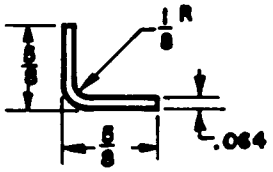
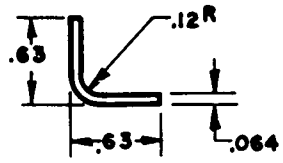
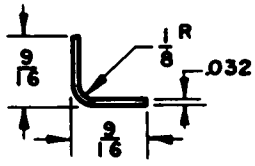
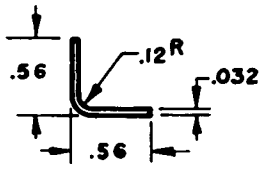
NOTE: Heat-treat Al. Alloy 24S0 to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-1. EXTRUSION EQUIVALENTS (sheet 5 of 5 sheets)

NA STANDARD NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
1S3		
	Area: .041 sq. in.	Al. Alloy 24ST clad .032 x 1.529 x L Sheet Area: .0489 sq. in.
1S4		
	Area: .064 sq. in.	Al. Alloy 24ST clad .040 x 1.788 x L Sheet Area: .0715 sq. in.
1S4-3		
	Area: .102 sq. in.	Al. Alloy 24SO clad .064 x 1.759 x L Sheet Area: .112 sq. in.
1S14-20		
	Area: .023 sq. in.	Al. Alloy 24ST clad .020 x 1.171 x L Sheet Area: .023 sq. in.

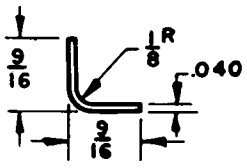
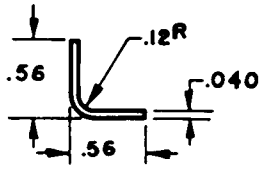
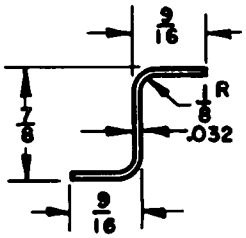
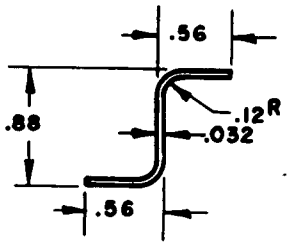
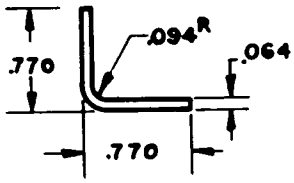
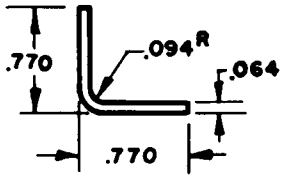
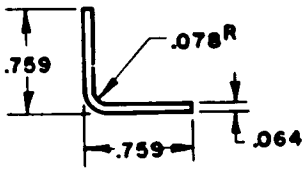
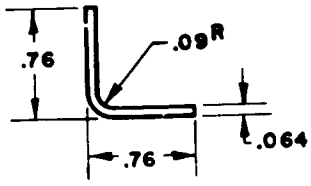
NOTE: Heat-treat Al. Alloy 24SO to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-2. ROLLED SECTION EQUIVALENTS (sheet 1 of 4 sheets)

NA STANDARD NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
1S14-32		
	Area: .037 sq. in.	Al. Alloy 24ST clad .032 x 1.155 x L Sheet Area: .037 sq. in.
1S14-40		
	Area: .046 sq. in.	Al. Alloy 24ST clad .040 x 1.144 x L Sheet Area: .046 sq. in.
1S14-64		
	Area: .072 sq. in.	Al. Alloy 24SO clad .064 x 1.114 x L Sheet Area: .072 sq. in.
1S36-32		
	Area: .033 sq. in.	Al. Alloy 24ST clad .032 x 1.031 x L Sheet Area: .033 sq. in.

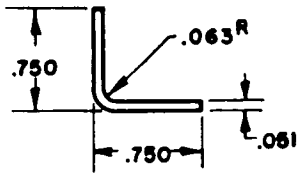
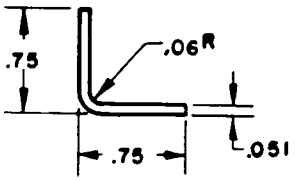
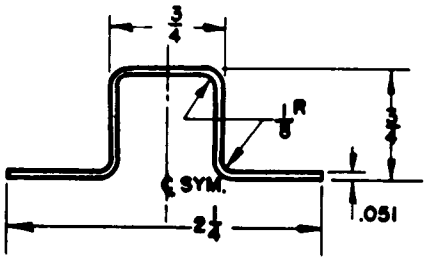
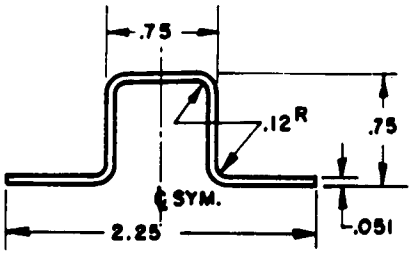
NOTE: Heat-treat Al. Alloy 24SO to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-2. ROLLED SECTION EQUIVALENTS (sheet 2 of 4 sheets)

NA STANDARD NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
1S36-40		
	Area: .041 sq. in.	Al. Alloy 24ST clad .040 x 1.020 x L Sheet Area: .041 sq. in.
1S41		
	Area: .058 sq. in.	Al. Alloy 24ST clad .032 x 1.811 x L Sheet Area: .058 sq. in.
1S91		
	Area: .091 sq. in.	Al. Alloy 24S0 clad .064 x 1.417 x L Sheet Area: .091 sq. in.
1S129		
	Area: .090 sq. in.	Al. Alloy 24S0 clad .064 x 1.397 x L Sheet Area: .090 sq. in.

NOTE: Heat-treat Al. Alloy 24S0 to 24ST after forming. All repair material to conform to specification AN-A-13

FIGURE 8-2. ROLLED SECTION EQUIVALENTS (sheet 3 of 4 sheets)

NA STANDARD NO.	BASIC DIMENSIONS	SUBSTITUTE FORMED SECTION
1S155		
	Area: .072 sq. in.	Al. Alloy 24S0 clad .051 x 1.407 x L Sheet Area: .072 sq. in.
1S203-7		
	Area: .173 sq. in.	Al. Alloy 24ST clad .051 x 3.376 x L Sheet Area: .173 sq. in.

NOTE: Heat-treat Al. Alloy 24S0 to 24ST after forming. All repair material to conform to specification AN-A-13.

FIGURE 8-2. ROLLED SECTION EQUIVALENTS (sheet 4 of 4 sheets)

SECTION IX

HEAT TREATED FITTINGS AND PARTS

Part No.	Part Name	Heat Treat P.S.I.	Com'l Desig'n	Material Specification	Material
143-14051	Fitting - Wing Sta. 50 - Jacking and Mooring	125,000	4130	NAA 5B11 RGH Forg.	C.M. Steel
143-31902-3	Support Assem. - Eng. Mount Front - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
143-31902-4	Support Assem. - Eng. Mount Front - Bracket	90,000	4130	AN-QQ-S-685	C.M. Steel
143-33151-3	Shaft Assem. - Main Ldg. Gr. Trunnion - Shaft	90,000	8735	AMS6283	C.N.M. Steel
143-33153	Shaft - Mn. Ldg. Gr. - Actuating Strut Support	140,000	4130	AN-WW-T-850	C.M. Steel
143-33156	Shaft - Mn. Ldg. Gr. - Side Brace Support - Fitting	180,000	4140	AN-QQ-S-752	C.M. Steel
143-33160-6	Bungee Assem. - Ldg. Gr. Down Lock - Mn. & Ns. - End	90,000	4130	AN-QQ-S-684	C.M. Steel
143-33160-11	Bungee Assem. - Ldg. Gr. Down Lock - Mn. & Ns. - Cap	90,000	4130	AN-QQ-S-684	C.M. Steel
143-33164-5	Link Assem. - Mn. L'dg. Gr. - Side Brace Lower	160,000	4130	AN-QQ-S-684	C.M. Steel
143-33164-4	Link Assem. - Mn. L'dg. Gr. - Side Brace Lower - End	160,000	4130	AN-QQ-S-684	C.M. Steel
143-33165	Brace Assem. - Main Ldg. Gear Upper Side	160,000	4130	(AN-QQ-S-684 (AN-WW-T-850	C.M. Steel
143-33166	Bell Crank Assem. - Main Ldg. Gr., Retracting	125,000	4130	AN-QQ-S-685	C.M. Steel
143-33184	Bolt - Main Ldg. Gr. Side Brace To Torque Shaft - Attaching	140,000	4130	AN-QQ-S-684	C.M. Steel
143-34153	Pin - Nose Gear Trunnion	90,000	4130	AN-WW-T-850	C.M. Steel
143-34155	Fitting - Aux. Ldg. Gr. - Shock Strut Drag Brace	160,000	4130	AN-QQ-S-684	C.M. Steel
143-34156-3	Fitting - Nose Ldg. Gr. - Drag Brace over Center	160,000	4130	AN-QQ-S-684	C.M. Steel
143-34156-5	Fitting - Nose Ldg. Gr. - Drag Brace over Center	160,000	4130	AN-QQ-S-684	C.M. Steel
143-34902-3	Skid - Fuselage Tail	160,000	1070	AMS 5120	Carbon Steel
143-34902-4	Skid - Fuselage Tail	160,000	1070	AMS 5120	Carbon Steel
143-34902-6	Skid - Fuselage Tail	160,000	1070	AMS 5120	Carbon Steel
143-53002-3	Seat Assem. Front - Fitting, Safety Belt	90,000	4130	AN-QQ-S-685	C.M. Steel
143-53002-14	Seat Assem. Front - Clamp Angle	90,000	4130	AN-QQ-S-685	C.M. Steel
143-53003-5	Seat Assem. Rear - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
143-53003-23	Seat Assem. Rear - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
143-53003-42	Seat Assem. Rear - Clip	90,000	4130	AN-QQ-S-685	C.M. Steel
143-53003-420	Seat Assem. Rear - Clip	90,000	4130	AN-QQ-S-685	C.M. Steel
143-53010-9	Track Installation and Assem. Front Seat	150,000	302	AN-QQ-S-772 Class II Comp G 1/2 H S.C.I.	Corr. Res. Steel
145-21404-3	Plate Assem. L.H. Horiz. Stab. to Fus. Attaching	90,000	4130	AN-QQ-S-685	C.M. Steel
145-22003	Hinge - Elevator Trim Tab	90,000	4130	AN-QQ-S-685	C.M. Steel
145-22005-1	Horn - L.H. Elev. Trim Tab Actuating - Upper	90,000	4130	AN-QQ-S-685	C.M. Steel
145-22005-2	Horn - L.H. Elev. Trim Tab Actuating - Lower	90,000	4130	AN-QQ-S-685	C.M. Steel
145-31101-3	Step Assem., Fuselage - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-31103-3	Fitting - Fuselage Joint Large	90,000	8630	AN-S-12	C.N.M. Steel
145-31103-5	Fitting - Fuselage Joint Large	90,000	8630	AN-S-12	C.N.M. Steel
145-31103-7	Fitting - Fuselage Joint Large	90,000	8630	AN-S-12	C.N.M. Steel
145-31103-8	Fitting - Fuselage Joint Large	90,000	8630	AN-S-12	C.N.M. Steel
145-31815-3	Latch Assem. & Install. - Cockpit Enclosure - Tube	75,000	304	AN-WW-T-855	Corr. Res. Steel
145-31815-14	Latch Assem. & Install. - Cockpit Enclosure - Rubbing Strip	75,000	302	AN-QQ-S-772	Corr. Res. Steel
145-31815-16	Latch Assem. & Install. - Cockpit Enclosure - Plate	100,000	347	AN-QQ-S-757	Corr. Res. Steel
145-31815-22	Latch Assem. & Install. - Housing	90,000	4130	AN-QQ-S-684	C.M. Steel

Part No.	Part Name	Heat Treat P.S.I.	Com'l Desig'n	Material Specification	Material
145-31817-3	Hook Assem. - Cockpit Encl. Canopy Latch	140,000	4130	AN-QQ-S-685	C.M. Steel
145-31817-4	Hook Assem. - Cockpit Encl. Canopy Latch	90,000	4130	AN-QQ-S-684	C.M. Steel
145-31817-5	Hook Assem. - Cockpit Encl. Canopy Latch	90,000	4130	AN-QQ-S-684	C.M. Steel
145-31818-6	Housing Assem. - Cockpit Encl. Canopy Latch Pin	90,000	4130	AN-QQ-S-684	C.M. Steel
145-31818-7	Housing Assem. - Cockpit Encl. Canopy Latch Pin	90,000	4130	AN-QQ-S-684	C.M. Steel
145-31830-3	Truck Assem. - Canopy Op. Fwd. - Channel	90,000	4130	AN-QQ-S-685	C.M. Steel
145-31831-3	Truck Assem. - Canopy Op. Fwd. - Channel	90,000	4130	AN-QQ-S-685	C.M. Steel
145-31833-5	Assem. - Mid Position Canopy Lock - Cover Plate	90,000	4130	AN-QQ-S-772	C.N.M. Steel
145-31834	Hinge - Cabin Air Deflector	90,000	4130	AN-QQ-S-771	C.N.M. Steel
145-33103-3	Cyl. Assem. - Main Ldg. Gr. - Shock Strut Outer - Tube	160,000	4130	AN-WW-T-850	C.M. Steel
145-33103-4	Cyl. Assem. - Main Ldg. Gr. - Shock Strut Outer - Sleeve	160,000	8735	AMS6283	C.N.M. Steel
145-33104-3	Cyl. Assem. - Main Ldg. Gr. - Shock Strut Inner	90,000	4130	AN-WW-T-850	C.M. Steel
145-33106	Trunnion - Main Ldg. Gr. - Shock Strut	160,000	4130	AN-WW-T-850	C.M. Steel
145-33107-3	Link Assem. - Main Ldg. Gr. - Torque, Lower Link	90,000	4130	AN-QQ-S-385	C.M. Steel
145-33107-4	Link Assem. - Main Ldg. Gr. - Torque, Lower Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-33107-5	Link Assem. - Main Ldg. Gr.- Torque, Lower Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-33108-3	Link Assem. - Main Ldg. Gr. - Torque, Upper	90,000	4130	AN-QQ-S-685	C.M. Steel
145-33108-4	Link Assem. - Main Ldg. Gr. - Torque, Upper	90,000	4130	AN-QQ-S-685	C.M. Steel
145-33112	Fitting - Main Ldg. Gr. Oleo Side Bracket Attaching	160,000	4130 W.D.	57-105	C.M. Steel
145-33117	Fitting - Main Ldg. Gr. Strut Filler Plug	90,000	4130	AN-WW-T-850	C.M. Steel
145-33118-3	Shaft Assem. - Ldg. Gr. - Lock Release Torque - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-33118-4	Shaft Assem. - Ldg. Gr. - Lock Release Torque - Bellcrank	90,000	4130	AN-QQ-S-685	C.M. Steel
145-33118-5	Shaft Assem. - Ldg. Gr. Lock Release Torque - Bellcrank	90,000	4130	AN-QQ-S-685	C.M. Steel
145-33151-3	Shaft Assem. Main Ldg. Gr. Trunnion - Shaft	90,000	8735	AMS 6283	C.N.M. Steel
145-33154	Fitting - Main Ldg. Gr. Shock Strut Outer Cyl. Torque Link	90,000	4130	AN-QQ-S-684	C.M. Steel
145-33160	Pin - Main Ldg. Gr. - Shock Strut Side Brace	90,000	4130	AN-QQ-S-684	C.M. Steel
145-33161	Axle - Main Ldg. Gr. - Shock Strut	160,000	4130	AN-QQ-S-684	C.M. Steel
145-33169-3	Hook Assem. - Main Ldg. Gr. - Uplock - Hook	125,000	4130	AN-QQ-S-685	C.M. Steel
145-33204	Spacer - Main Ldg. Gr. - Oleo Torque Link, Lower	125,000	4130	AN-QQ-S-684	C.M. Steel
145-34103	Casing Assem. - Aux. Ldg. Gr. Strut Outer Tube	160,000	4130	(AN-QQ-S-685 (AN-WW-T-850	C.M. Steel
145-34104-3	Cyl. Assem. - Aux. Ldg. Gr. Inner Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-34105-10	Fitting - Nose Ldg. Gr. Drag Brace - Retracting Cyl Attaching - Eng.	90,000	4130	AN-QQ-S-684	C.M. Steel
145-34106-3	Link Assem. - Nose Ldg. Gr., Retracting Torque Tube	160,000	4130	AN-WW-T-850	C.M. Steel
145-34106-4	Link Assem. - Nose Ldg. Gr., Re-Tracting Torque Tube	160,00	4130	AN-WW-T-850	C.M. Steel

Part No.	Part Name	Heat Treat P.S.I.	Com'l Desig'n	Material Specification	Material
145-34108-3	Shaft Assem. - Aux. Ldg. Gr. Drag Brace Torque Tube	140,000	4130	AN-WW-T-850	C.M. Steel
145-34118-3	Hook Assem. - Aux. Ldg. Gr. - Uplock - Hook	125,000	4130	AN-QQ-S-685	C.M. Steel
145-34118-4	Hook Assem. - Aux. Ldg. Gr. - Uplock - Tube	125,000	4130	AN-QQ-S-684	C.M. Steel
145-34121	Bolt - Aux. Ldg. Gr. Drag Brace over Center Joint	125,000	4130	AN-QQ-S-684	C.M. Steel
145-34122-4	Crank Assem. Drag Link Torque Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-34123	Bolt - Aux. Ldg. Gr. Drag Brace Upper Attach.	125,000	4130	AN-QQ-S-684	C.M. Steel
145-34126-3	Tube Assem. - Nose Wheel Steering Torque - Arm	90,000	4130	AN-QQ-S-685	C.M. Steel
145-34126-4	Tube Assem. - Nose Wheel Steering Torque - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-34126-5	Tube Assem. - Nose Wheel Steering Torque - Bushing	90,000	4130	AN-WW-T-850	C.M. Steel
145-34127	Axle - Aux. Ldg. Gear	90,000	4130	A.M.S. 6283	C.N.M. Steel
145-34132	Bushing - Aux. Ldg. Gr. Trunnion	90,000	4130	AN-WW-T-850	C.M. Steel
145-34136-3	Link Assem. - Aux. Ldg. Gr. Torque (Fem.) - Bracket	90,000	4130	AN-QQ-S-685	C.M. Steel
145-34136-4	Link Assem. - Aux. Ldg. Gr. Torque (Fem.) - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-34136-5	Link Assem. - Aux. Ldg. Gr. Torque (Fem.) - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-34136-7	Link Assem. - Aux. Ldg. Gr. Torque (Fem.) - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-34137-3	Link Assem. Aux. Ldg. Gr. Steering (Fem.) - Link	90,000	4130	AN-QQ-S-685	C.M. Steel
145-34138-3	Link Assem. Aux. Ldg. Gr. Torque (Male) - Link	90,000	4130	AN-QQ-S-685	C.M. Steel
145-34138-4	Link Assem. Aux. Ldg. Gr. Torque (Male) - Bushing	90,000	4130	AN-WW-T-850	C.M. Steel
145-34139-3	Link Assem. Aux. Ldg. Gr. Torque (Fem.) - Link	90,000	4130	AN-QQ-S-685	C.M. Steel
145-34149-3	Rod Assem. Aux. Ldg. Gr. Steering Mech. Connecting Rod	90,000	4130	AN-WW-T-850	C.M. Steel
145-34154-3	Fitting - Main Ldg. Gr. Shock Strut Outer Cyl. - Torque Link	90,000	4130	AN-QQ-S-684	C.M. Steel
145-34154-4	Fitting - Main Ldg. Gr. Shock Strut Outer Cyl. - Torque Link	90,000	4130	AN-QQ-S-684	C.M. Steel
145-34155-3	Spacer - Aux. Ldg. Gr. - Links Bolt	125,000	4130	AN-WW-T-850	C.M. Steel
145-34155-4	Spacer - Aux. Ldg. Gr. - Links Bolt	125,000	4130	AN-WW-T-850	C.M. Steel
145-34155-5	Spacer - Aux. Ldg. Gr. - Links Bolt	125,000	4130	AN-WW-T-850	C.M. Steel
145-34155-6	Spacer - Aux. Ldg. Gr. - Links Bolt	125,000	4130	AN-WW-T-850	C.M. Steel
145-34155-7	Spacer - Aux. Ldg. Gr. - Links Bolt	125,000	4130	AN-WW-T-850	C.M. Steel
145-34164-4	Link Assem. - Aux. Nose Gr. Drag Brace Lower	160,000	4130	AN-QQ-S-684	C.M. Steel
145-34164-5	Link Assem - Aux. Nose Gr. Drag Brace Lower	160,000	4130	AN-QQ-S-684	C.M. Steel
145-34171	Lever - Nose Gr. Oleo Centering Bungee Attaching	90,000	4130	AN-QQ-S-684	C.M. Steel
145-34175-5	Bellcrank Assem. - Aux. Ldg. Gr. Steering Mechanism	160,000	4130	AN-QQ-S-684 AN-QQ-S-685	C.M. Steel
145-34180	Support Assem. - Aux. Ldg. Gr. - Steering Bellcrank	90,000	4130	AN-QQ-S-685	C.M. Steel
145-34181-4	Bracket Assem. - Aux. Ldg. Gr. - Rubbing Strip - Spring	160,000	4130	AN-QQ-S-685	C.M. Steel
145-34183	Roller - Aux. Ldg. Gr. Drag Link	70,000	410	QQ-S-763	Corr. Res.
145-33188-3	Shaft Assem. - Aux. Ldg. Gr. Drag Brace Torque Tube	140,000	4130	AN-WW-T-850	C.M. Steel

Part No.	Part Name	Heat Treat P.S.I.	Com'l Desig'n	Material Specification	Material
145-34203	Ring - Aux. Ldg. Gr. Bearing Retainer	90,000	8735	AMS 6283	C.N.M. Steel
145-34206	Ring - Aux. Ldg. Gr. Inner Cyl. External Stop	90,000	8735	AMS 6283	C.N.M. Steel
145-34314-3	Crank Assem. - Drag Link Torque Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-37175-5	Bellcrank Assem. - Aux. Ldg. Gr. Steering Mech.	160,000	4130	AN-QQ-S-684	C.M. Steel
145-44014	Bracket Assem. - Hartzell Prop. Control Cycl. Support	90,000	4130	AN-QQ-S-685	C.M. Steel
145-48068-2	Torque Tube - Fuel Shutoff Valve Tube	95,000	4130	AN-T-69	C.M. Steel
145-48068-3	Torque Tube - Fuel Shutoff Valve Tube	95,000	4130	AN-T-69	C.M. Steel
145-48068-4	Torque Tube - Fuel Shutoff Valve Arm	95,000	4130	AN-QQ-S-684	C.M. Steel
145-48075	Adapter - Fuel Shutoff Valve Torque Tube	95,000	4130	AN-QQ-S-684	C.M. Steel
145-48244	Pin - Selector Valve Detent.	180,000	4130	AN-QQ-S-684	C.M. Steel
145-52021-3	Bell Crank Assem. - Wing Flap Strut	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52021-4	Bell Crank Assem. - Wing Flap Strut	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52026-3	Tube Assem. - Wing Flap Operating Torque - Plate	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52026-4	Tube Assem. - Wing Flap Operating Torque - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52026-5	Tube Assem. - Wing Flap Operating Torque - Arm	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52026-6	Tube Assem. - Wing Flap Operating Torque - Arm	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52026-7	Tube Assem. - Wing Flap Operating Torque - Arm	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52027	Support - Wing Flap Torque Tube Center	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52202-3	Column Assem. & Install. - Elev. & Aileron Cont'l - Arm	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52202-5	Column Assem. & Install. - Elev. & Aileron Cont'l - Arm	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52202-15	Column Assem. & Install. - Elev. & Aileron Cont'l - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52202-17	Column Assem. & Install. - Elev. & Aileron Cont'l - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52202-19	Column Assem. & Install. - Elev. & Aileron Cont'l - Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52202-47	Column Assem. & Install. - Elev. & Aileron Cont'l - Spacer	90,000	4130	AN-WW-T-850	C.M. Steel
145-52218-3	Link - Control Cable	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52218-5	Link - Control Cable	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52401-3	Pedal Assem. & Install. - Rudder Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52401-5	Pedal Assem. & Install. - Rudder Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52401-7	Pedal Assem. & Install. - Rudder Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52501-24	Contr. Assem. & Install. - Elev. Trim Tab Operating, Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-52505-7	Contr. Assem. & Install - Fus. Sta. 274 - Elev. Trim Tab, Strap	90,000	4130	AN-QQ-S-685	C.M. Steel
145-52505-14	Cont. Assem. & Install. - Fus. Sta. 274 - Elev. Trim Tab, Spacer	90,000	4130	AN-QQ-S-684	C.M. Steel
145-53005-5	Lock Assem. - Front Seat, Handle	90,000	4130	AN-QQ-S-684	C.M. Steel
145-53005-6	Lock Assem. - Front Seat. Clamp	90,000	4130	AN-QQ-S-685	C.M. Steel
145-53054-1	Fitting - Safety Belt Attachment	90,000	4130	AN-QQ-S-685	C.M. Steel
145-53054-2	Fitting - Safety Belt Attachment	90,000	4130	AN-QQ-S-685	C.M. Steel
145-58237	Spacer - Hyd. Hand Brake Travel Adjusting	90,000	4130	AN-WW-T-850	C.M. Steel

Part No.	Part Name	Heat Treat P.S.I.	Com'l Desig'n	Material Specification	Material
145-58243	Poppet - Hyd. System Relief Valve	90,000	4130	AN-QQ-S-684	C.M. Steel
145-58244-3	Cage - Hyd. System Relief Valve	125,000	4130	AN-QQ-S-684	C.M. Steel
145-58277	Adapter - Hyd. Relief Valve Mech. Lift	90,000	4130	AN-QQ-S-684	C.M. Steel
145-58280	Spacer - Hyd. Relief Valve Mech. Lift	90,000	4130	AN-QQ-S-684	C.M. Steel
145-58302-3	Link Assem. - Hyd. Relief Valve to Bellcrank	90,000	4130	AN-QQ-S-685	C.M. Steel
145-922401-2	Cup Assembly - Torque Tube - Elevator, End	90,000	4130	AN-QQ-S-685	C.M. Steel
145-922401-3	Cup Assembly - Torque Tube . Elevator, Tube	90,000	4130	AN-WW-T-850	C.M. Steel
145-922401-4	Cup Assembly - Torque Tube - Elevator, End	90,000	4130	AN-QQ-S-685	C.M. Steel
154-52026-3	Lock Assem. Surface Control	95,000	8630	AN-T-15	C.N.M. Steel

APPENDIX I

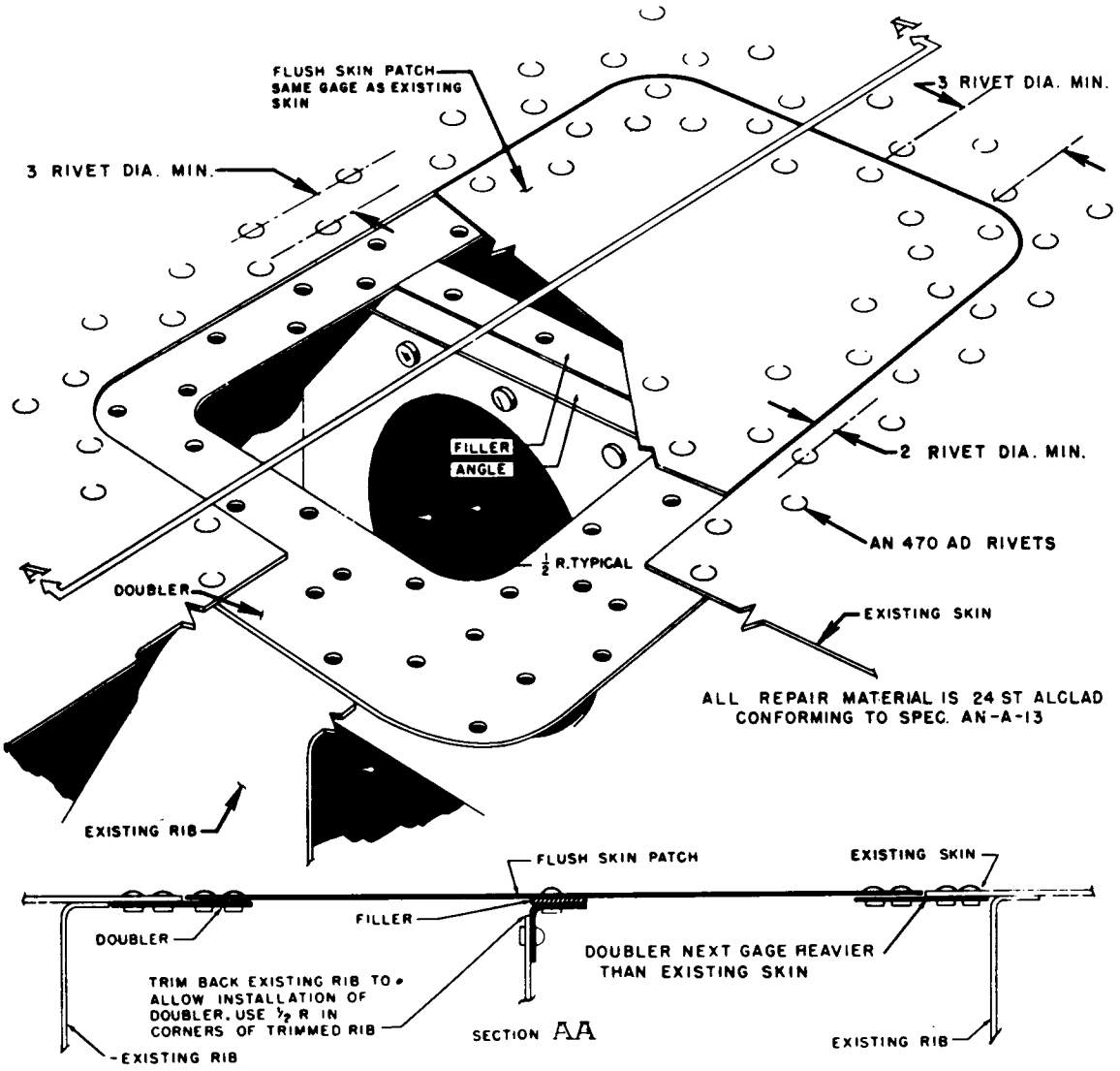
MATERIALS FOR REPAIR

STOCK DESCRIPTION	GAGE	COMMERCIAL DESIGNATION	SPECIFICATION
Sheet	.016	24ST Alclad	AN-A-13 Cond. T
Sheet	.020	24ST Alclad	AN-A-13 Cond. T
Sheet	.025	24ST Alclad	AN-A-13 Cond. T
Sheet	.032	24ST Alclad	AN-A-13 Cond. T
Sheet	.040	24ST Alclad	AN-A-13 Cond. T
Sheet	.051	24ST Alclad	AN-A-13 Cond. T
Sheet	.064	24ST Alclad	AN-A-13 Cond. T
Sheet	.072	24ST Alclad	AN-A-13 Cond. T
Sheet	.081	24ST Alclad	AN-A-13 Cond. T
Sheet	.091	24ST Alclad	AN-A-13 Cond. T
Sheet	.102	24ST Alclad	AN-A-13 Cond. T
Sheet	.125	24ST Alclad	AN-A-13 Cond. T
Sheet	.156	24ST Alclad	AN-A-13 Cond. T
Sheet	.064	24S0 Alclad	AN-A-13 Cond. A
Sheet	.081	24S0 Alclad	AN-A-13 Cond. A
Sheet	.091	24S0 Alclad	AN-A-13 Cond. A
Sheet	.102	24S0 Alclad	AN-A-13 Cond. A
Sheet	.125	24S0 Alclad	AN-A-13 Cond. A
Sheet	.156	24S0 Alclad	AN-A-13 Cond. A
Sheet	.019	SAE 1020 Steel	AN-S-11
Bar	7/8 x 1-1/16	4130 C.M. Steel	AN-S-684
Tube	.065 x 1-$\frac{1}{2}$ O.D.	24ST Al. Alloy	AN-T-80
Tube	.065 x 1-$\frac{1}{2}$ O.D.	4130 C.M. Steel	AN-T-69
AN426 Rivet	AD5	A17ST Al. Alloy	AN-R-19 *
AN470 Rivet	AD3, AD4, AD5, AD6	A17ST Al. Alloy	AN-R-19 *
CR-163C-4 Cherry Rivet	1/8 In. Dia.	A17ST Al. Alloy	USAF 40911 *
CR-163C-5 Cherry Rivet	5/32 In. Dia.	A17ST Al. Alloy	USAF 40911 *
CR-163C-6 Cherry Rivet	3/16 In. Dia.	A17ST Al. Alloy	USAF 40911 *
NAS178-6 Hi-Shear Rivet Pin	3-16 In. Dia.	2330 Steel or Equiv.	AN-B-3 *
NAS179-6 Hi-Shear Rivet Collar	3/16 In. Dia.	A17ST Al. Alloy	AN-QQ-W-298
AN3 Bolt	10-32 NF-3	2330 Steel or Equiv.	AN-B-3 *
NAS220 Screw	8-32 NC-3	2330 Steel or Equiv.	AN-B-3 *
AN365-832 Self-Locking Nut	8-32 NC-3	1112 Steel	AN-N-5 *
AN365-1032 Self-Locking Nut	10-32 NF-3	1112 Steel	AN-N-5 *
AN366-832 Plate Nut	8-32 NC-3	1112 Steel	AN-N-5 *
AN366-1032 Plate Nut	10-32 NF-3	1112 Steel	AN-N-5 *
AN960-8 Washer	.064	1020 Steel	AN-S-11
AN960-10 Washer	.064	1020 Steel	AN-S-11

*Procurement Specification

APPENDIX II

TYPICAL REPAIR ILLUSTRATIONS

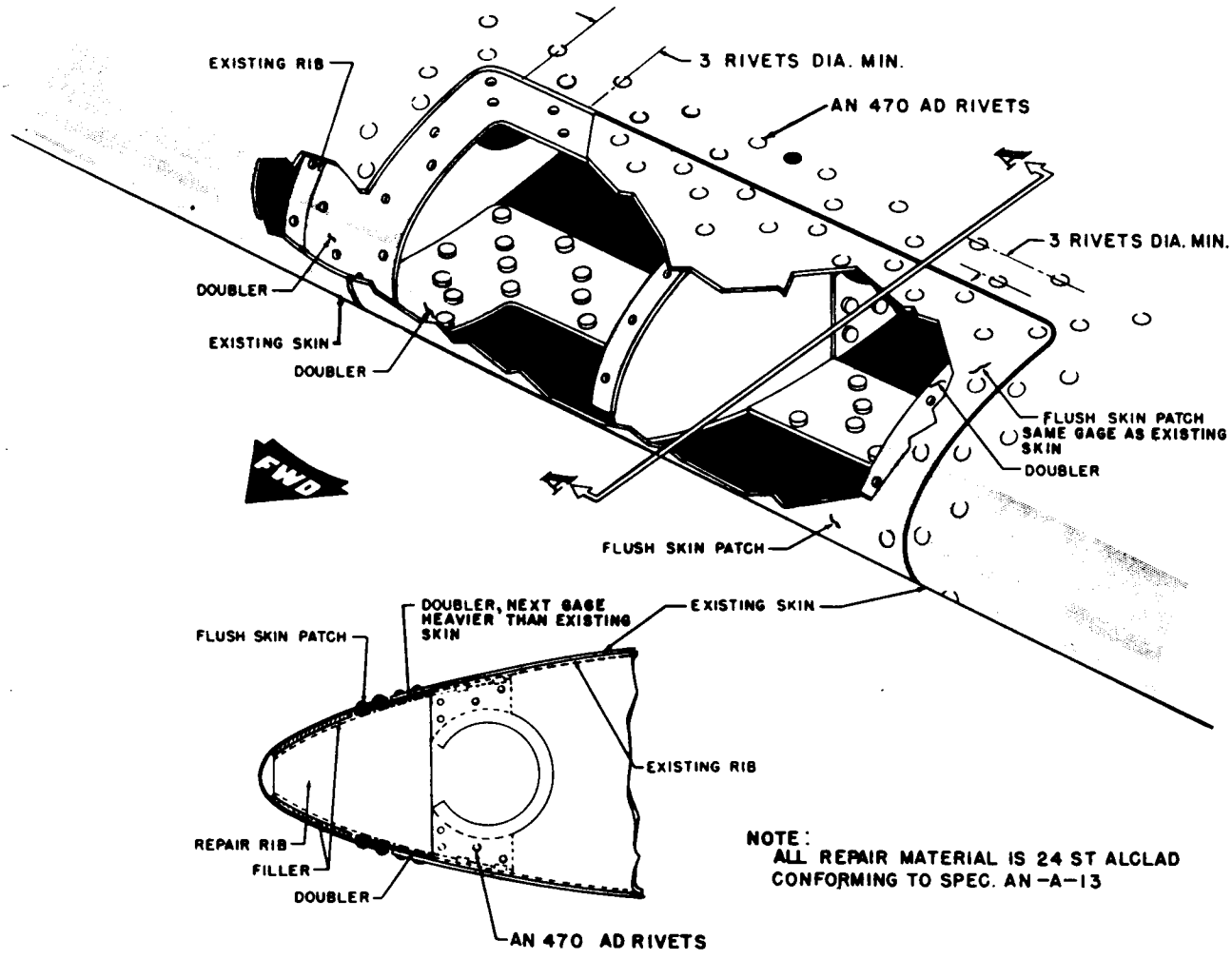


Remove damaged area by cutting a circular or rectangular hole, leaving sufficient skin to allow for the installation of a doubler. If the damage occurred over internal structure, repair the rib, stringer, or frame by nesting the repair member on the inside of damaged member, and allow clearance for the installation of a doubler. Fit the cover plate to the cutout as closely as possible and locate the position of doubler to provide equal overlap at all edges of cutout. Attach doubler to skin, and cover plate to doubler with rivets of the same diameter, spacing, and pattern as the parallel manufactured seams at the edges of the skin panel. If the manufactured seams are different, the stronger one must be copied. Cherry rivets (CR-163C) may be used for attaching the cover plate where it is inaccessible for bucking rivets. Cherry rivets, the next size larger than regular rivets must be used, or add additional cherry rivets in the ratio of 3-2 if the size is not increased. If a removable access door is desired, use plate nuts riveted to the doubler and attach the access door with screws. Plate nuts should also be riveted to the internal structure, if the access door is over internal structure. NAS 220 screws and AN366 plate nuts are substituted for rivets up to and including a diameter of 5/32 inch and NAS 221 screws and AN366 plate nuts are used for 3/16 inch rivets. The spacing and pattern of screws is to be identical with that of rivets in the cover plate.

NOTE

If the rivet size, spacing and pattern is called out in the section applicable to the repair, it must be used.

FIGURE B-1. FLUSH SKIN PATCH



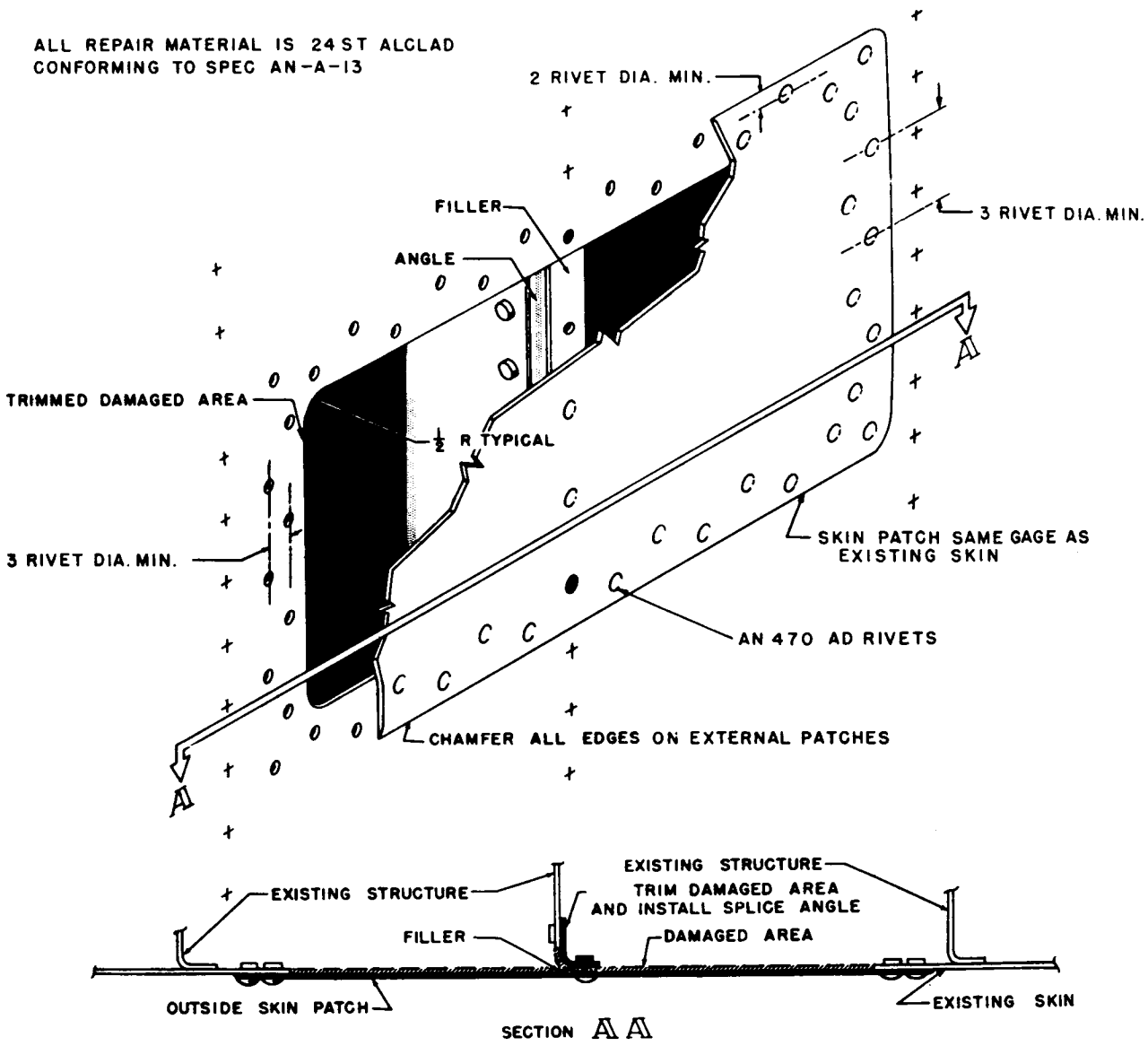
SECTION **AA**

Remove damaged area by cutting a circular or rectangular hole, leaving sufficient skin to allow for the installation of a doubler. If the damage occurred over internal structure, repair the rib, stringer, or frame by nesting the repair member on the inside of damaged member, and allow clearance for the installation of a doubler. Fit the cover plate to the cutout as closely as possible and locate the position of doubler to provide equal overlap at all edges of cutout. Attach doubler to skin, and cover plate to doubler with rivets of the same diameter, spacing, and pattern as the parallel manufactured seams at the edges of the skin panel. If the manufactured seams are different, the stronger one must be copied. Cherry rivets (CR-163C) may be used for attaching the cover plate where it is inaccessible for bucking rivets. Cherry rivets, the next size larger than regular rivets must be used, or add additional cherry rivets in the ratio of 3-2 if the size is not increased. If a removable access door is desired, use plate nuts riveted to the doubler and attach the access door with screws. Plate nuts should also be riveted to the internal structure, if the access door is over internal structure. NAS 220 screws and AN366 plate nuts are substituted for rivets up to and including a diameter of 5/32 inch and NAS 221 screws and AN366 plate nuts are used for 3/16 inch rivets. The spacing and pattern of screws is to be identical with that of rivets in the cover plate.

NOTE

If the rivet size, spacing and pattern is called out in the section applicable to the repair, it must be used.

FIGURE B-2. LEADING EDGE FLUSH SKIN PATCH

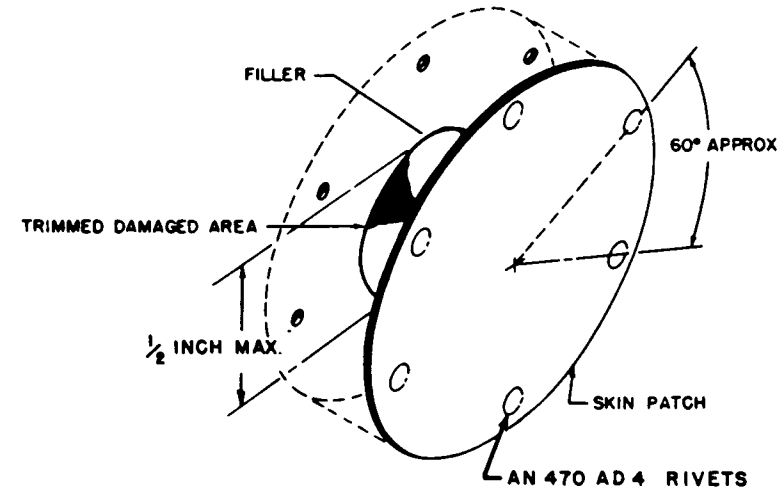


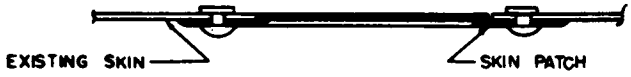
Remove damaged area by cutting a circular or rectangular hole, leaving sufficient skin to allow for the installation of the external patch. If the damage occurred over internal structure, repair the rib, stringer, or frame by nesting the repair member on the inside of damaged member. Cut the external patch larger than the cutout to accommodate the rivets thru the skin with proper edge distance. Attach external patch to the skin with rivets of the same diameter, spacing, and pattern as the parallel manufactured seam at the edges of the skin panel. If the manufactured seams are different, the stronger one must be copied. Cherry rivets (CR-163C) may be used for attaching the external patch where it is inaccessible for bucking rivets. Cherry rivets, the next size larger than regular rivets must be used, or add additional cherry rivets in the ratio of 3-2 if the size is not increased. If a removable access door is desired, use plate nuts riveted to the doubler and attach the access doors with screws. Plate nuts should also be riveted to the internal structure, if the access door is over internal structure. NAS 220 screws and AN366 plate nuts are substituted for rivets up to and including a diameter of 5/32 inch and NAS 221 and AN366 plate nuts are used for 3/16 inch rivets. The spacing and pattern of screws is to be identical with that of rivets in the cover plate.

NOTE

If the rivet size, spacing and pattern is called out in the section applicable to the repair, it must be used.

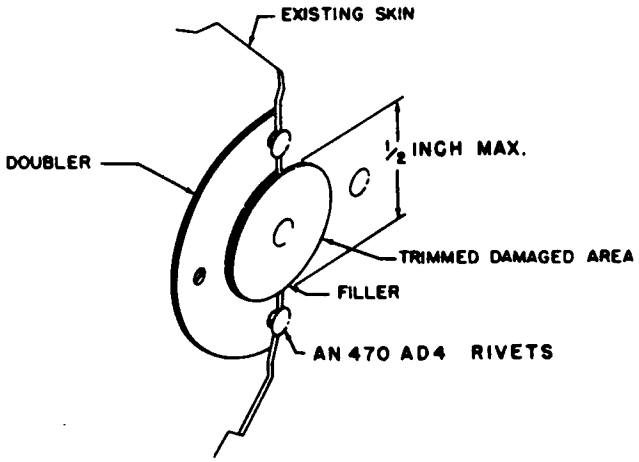
FIGURE B-3. EXTERNAL SKIN PATCH

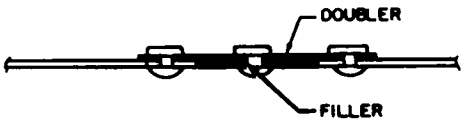




SECTION THROUGH
CENTER OF PATCH

EXTERNAL PATCH





SECTION THROUGH
CENTER OF PATCH

FLUSH PATCH

NOTE

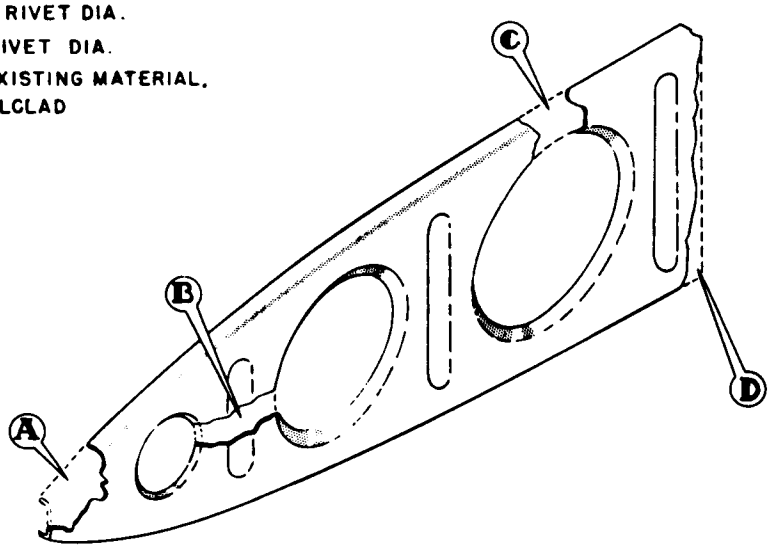
ALL REINFORCEMENT RINGS AND FILLERS SAME GAGE AS EXISTING SKIN.

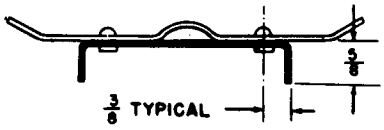
ALL REPAIR MATERIAL 24ST ALCLAD CONFORMING TO SPEC. AN-A-13.
MINIMUM EDGE DISTANCE - TWO RIVET DIA.

FIGURE B-4. NON-STRUCTURAL NEGLIGIBLE DAMAGE PATCH

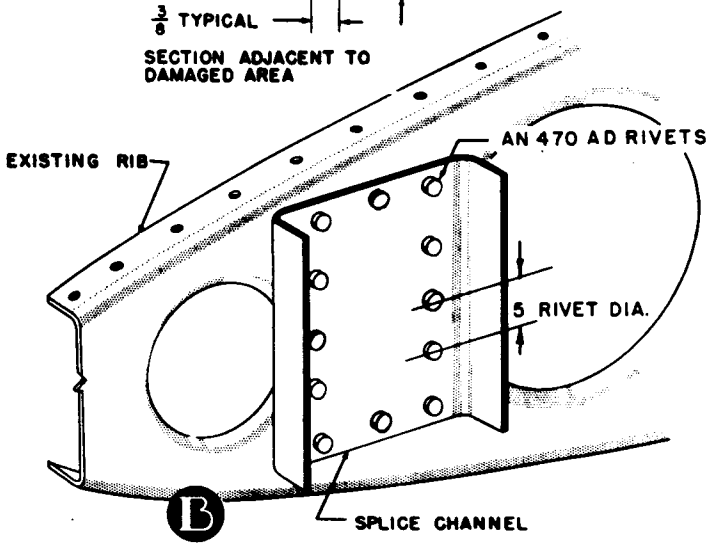
NOTE

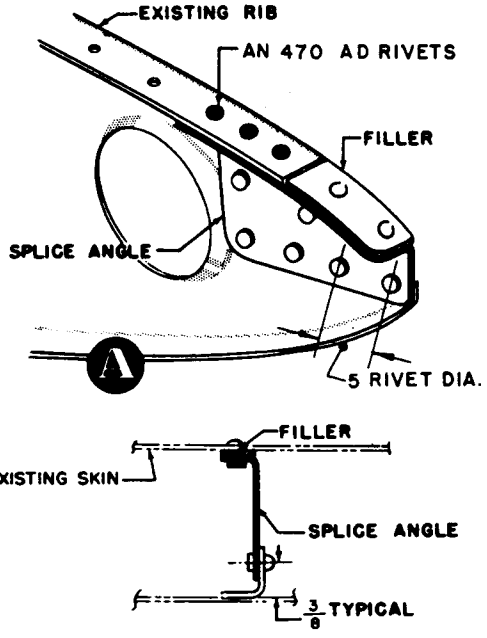
MINIMUM RIVET SPACING - THREE RIVET DIA.
MINIMUM EDGE DISTANCE - TWO RIVET DIA.
REPAIR MEMBER SAME GAGE AS EXISTING MATERIAL.
ALL REPAIR MATERIAL IS 24 ST ALCLAD
CONFORMING TO SPEC. AN-A-13





SECTION ADJACENT TO DAMAGED AREA





SECTION THROUGH DAMAGED AREA

RIVET SIZES FOR LIGHTENING HOLE REPAIRS							
Material Gage (inches)	.016	.020	.025	.032	.040	.051	.064
Rivet Diameter (inches)	3/32	3/32	1/8	5/32	5/32	3/16	3/16
The above values are the preferred AN470AD rivet sizes to be used with various gages of 24ST alclad.							

FIGURE B-5. (Sheet 1 of 2 sheets) TYPICAL RIB REPAIRS

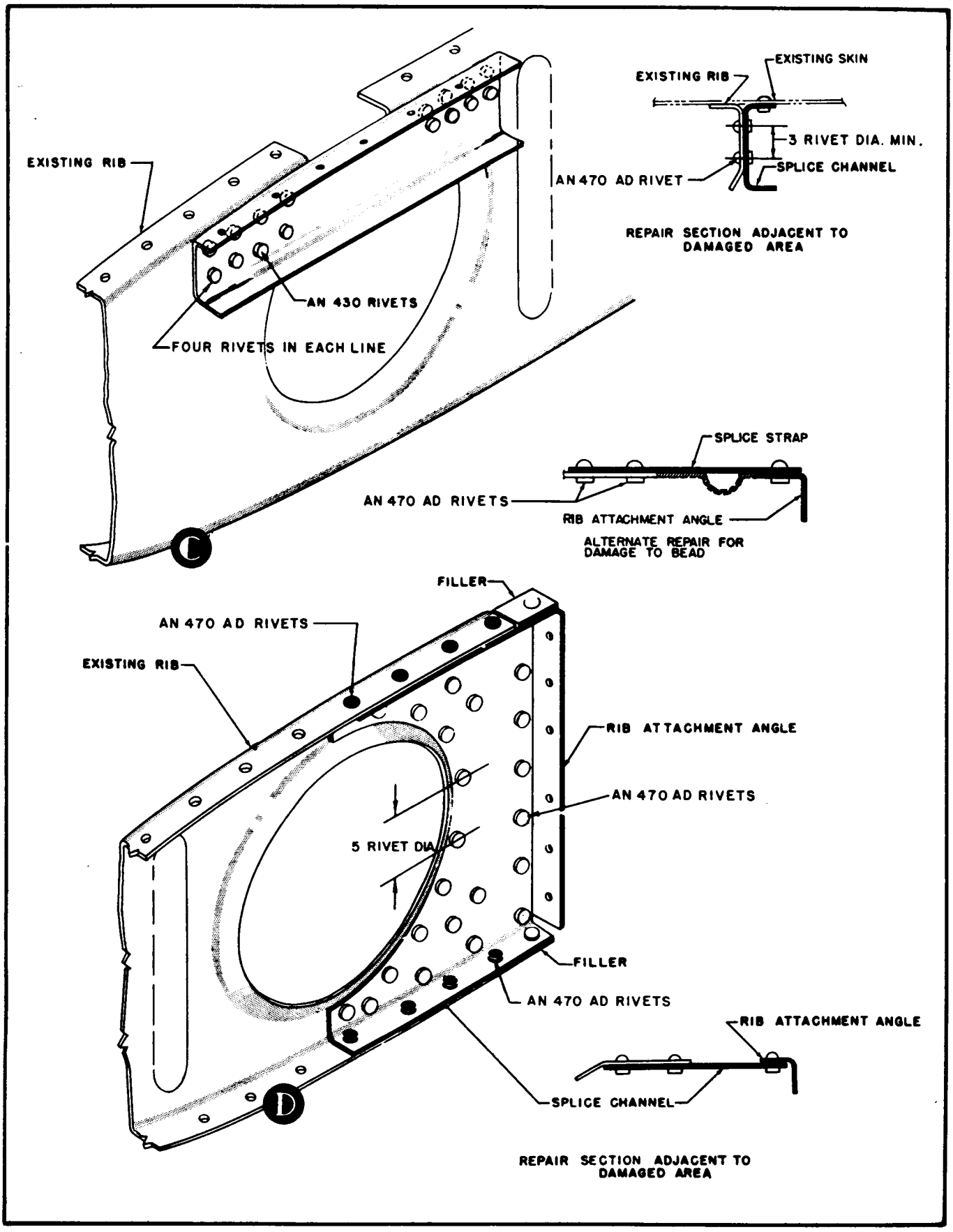
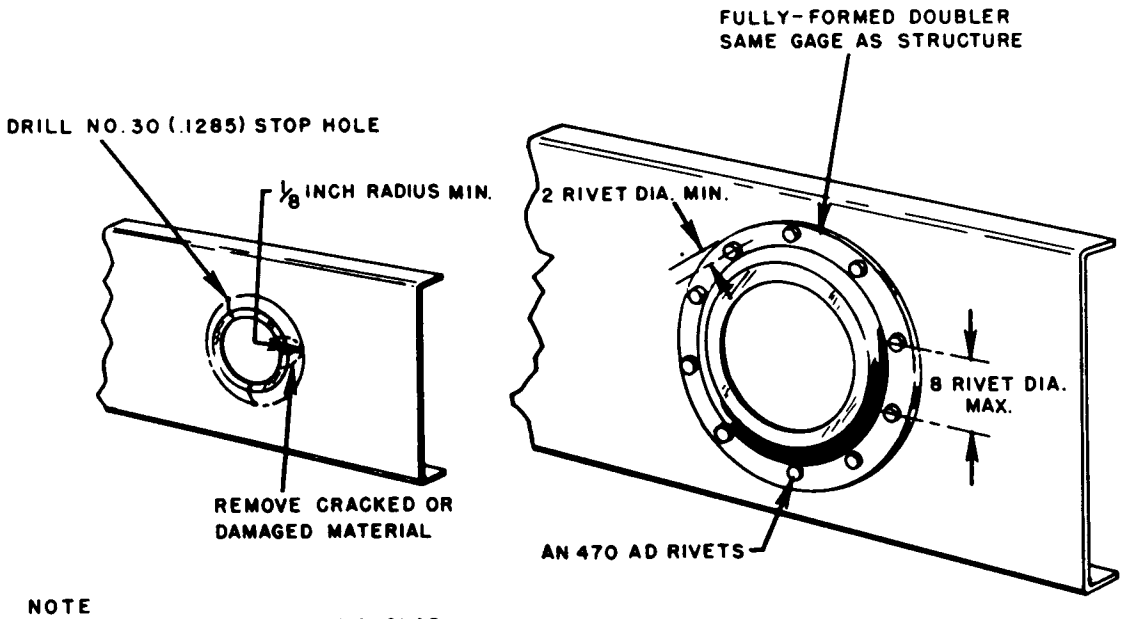


FIGURE B-5. (Sheet 2 of 2 sheets) TYPICAL RIB REPAIRS



NOTE
REPAIR MATERIAL 24 ST ALCLAD CONFORMING TO SPEC. AN-A-13

Cracked or torn lightening hole flanges, where the damage does not extend more than 4/3 the width of the flange, may be repaired as shown in the Figure. Drill No. 30 (.1285) stop hole at the ends of all cracks. Remove the cracked or damaged material by trimming the flange of the lightening hole back to the stop drill hole, with a 1/8 inch minimum radius. If desired, the entire flange may be removed. Smooth all edges to remove burrs. Cut a doubler of the same material and thickness as the existing structure, and form flanges to match the original part. Attach the formed doubler to the existing structure with AN470AD rivets, using the size indicated in the table. Space rivets at approximately 1/4 times the diameter of the lightening hole; but not greater than eight rivet diameters; maintaining a minimum edge distance of two rivet diameters.

RIVET SIZES FOR RIB REPAIRS							
Material Gage (inches)	.016	.020	.025	.032	.040	.051	.064
Rivet Diameter (inches)	3/32	3/32	1/8	5/32	5/32	3/16	3/16
The above values are the preferred AN470AD rivet sizes to be used with various gages of 24ST alclad.							

FIGURE B-6. LIGHTENING HOLE FLANGE REPAIR

NAVION RANGEMASTER AIRCRAFT CORPORATION

WHARTON, TEXAS

STRUCTURAL REPAIR MANUAL

ADDENDUM " A "

PREPARED: Guenther J.H. Rosemann
Guenther J.H. Rosemann

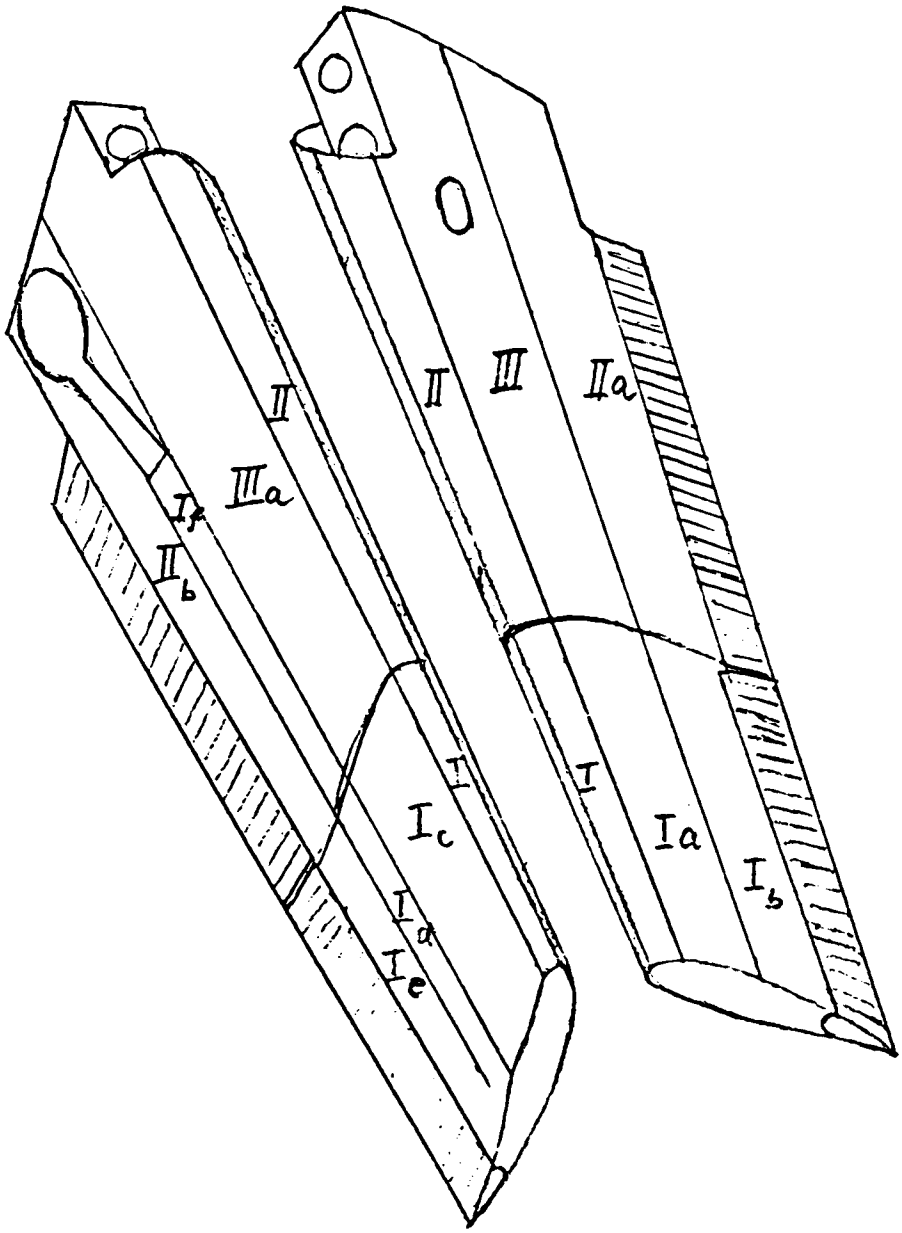
DATE: December 18, 1973

CHECKED: Sillick Steinback
Sillick Steinback

DATE: December 18, 1973

APPROVED BY: Cedric Edwards
Cedric Edwards

FLUSH - RIVETED WING



For wing structure diagrams see
Page 8 Fig.2-1
Page 9 Fig.2-2

Skin Repairs on Flush-Riveted Wing

The wing skin consists of 12 pieces. There is sufficient variation in thickness, loading, and accessability between those that it appears impractical to divide them into only three groups. Therefore, each piece will be treated individually, in order to keep the amount of rework to a minimum, and yet, have an adequate repair, structurally as well as appearancewise. On leading edge and upper skin only flush patches should be used, and flush patches or external patches may be used on the bottom skin. The rivet size and spacing given below were determined using the highest stresses that can occur in that portion of the skin. If, however, a patch is installed in an area which has lower stresses, the rivet spacing may be widened, but only after approval from Engineering has been obtained. The information given below is for flush patches.*

Leading Edge, Panel I: 2-201

For solid Aluminum Rivets, machine countersunk:
One row of rivets in skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing .50" to .80"

For solid Aluminum rivets, dimpled:
One row of rivets in skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing .75 to 1.20 .

For Huck MLS-100-B blind rivets, machine countersunk:
One row in skin and doubler, one row through patch and doubler.
Use MLS 100-B4 (1/8" DIA), Rivet spacing .50" to .56" . (May be staggered)

For Cherrylock CR-2248 blind rivets, machine countersunk:
One row through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" to .625" (May be staggered).

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .75" to 1.00" .

Upper Side:

Panel Ia: 2-202

For solid Aluminum rivets, machine countersunk:
One row through skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing .75" to .94" .

For solid Aluminum rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing 1.00" to 1.50" .

For Huck MLS 100-B blind rivets, machine countersunk:
One row of rivets through skin and doubler, one row through patch and doubler.
Use MLS 100-B4, Rivet spacing .50" to .62" (may be staggered).

For Cherrylock CR-2248 blind rivets, machine countersunk:
One row of rivets through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" to .656" (may be staggered)

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .90" to 1.156" .

*For external patches use values for "..through skin and doubler".

Panel Ib: 2-203

For solid Aluminum rivets, machine countersunk:
One row of rivets through skin and doubler, one through patch and doubler.
Use AN426AD4, Rivet spacing .62" to .75".

For solid Aluminum rivets, dimpled:
One row of rivets through skin and doubler, one through patch and doubler.
Use AN426AD4, Rivet spacing .75" to 1.188".

For Huck MLS 100-B blind rivets, countersunk:
One row through skin and doubler, one staggered row through patch and doubler.
Use MLS 100-B4, Rivet spacing .50" maximum (greader actual spacing can be obtained by staggering).

For Cherrylock CR-2248, machine countersunk:
One row through skin and doubler, one staggered row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" to .55".

For Cherrylock CR-2248, dimpled:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .75" to .94" .

Lower Side

Panel Ic: 2-204

For solid Aluminum rivets, machine countersunk:
One row of rivets in skin and doubler, one staggered row in patch and doubler.
Use AN426AD4, Rivet spacing .50" to .53" .

For solid Aluminum rivets, dimpled:
One row of rivets in skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing 1.0"to 1.28" .

For Huck MLS 100-B blind rivets, machine countersunk:
Two rows of rivets through skin and doubler, two in patch and doubler.
Use MLS 100-B4, Rivet spacing .50" to .62" (min. spacing .50 between any rivets).

For Cherrylock CR-2248 blind rivets, machine countersunk:
Two rows of rivets through skin and doubler, two rows through patch and doubler.
Use 1/8"DIA rivets, Rivet spacing .60" to .72" each row, min. .50" between any rivets.

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .62" to .88" .

Lower Side (cont.)

Panel Id: 2-205

For solid Aluminum rivets, machine countersunk:
One row of rivets through skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing .75" to .90" .

For solid Aluminum rivets, dimpled:
One row of rivets through skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing 1.0" to 1.50" .

For Huck MLS 100-B blind rivets, machine countersunk:
One row of rivets through skin and doubler, one through patch and doubler.
Use MLS 100-B4, Rivet spacing .50" to .62" .

For Cherrylock CR-2248 blind rivets, machine countersunk:
One row through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" to .75" .

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing 1.20" to 1.50" .

Panel Ie: 2-206

For solid Aluminum rivets, machine countersunk:
One row of rivets through skin and doubler, one row through patch and doubler.
Use AN426AD4, Rivet spacing .50" to .687" .

For solid Aluminum rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use AN426 AD4, Rivet spacing .88" to 1.12" .

For Huck MLS 100-B blind rivets, machine countersunk:
One row through skin and doubler, one (staggered) row through patch and doubler.
Use MLS 100-B4, Rivet spacing .50" max. (actual spacing can be widened if staggered)

For Cherrylock CR-2248 blind rivets, machine countersunk:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" max. (actual spacing can be greater widened if staggered)

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .75" to .87" .

Outboard of Sta. 66:

For solid Aluminum rivets, machine countersunk:
One staggered row of rivets through skin and doubler, one through patch and doubler.
Use AN426AD5 rivets, Rivet spacing .62" to .687" .
or AN 426AD4 rivets, Rivet spacing .50" max. (staggered row with .50" min. from one rivet to any other rivet).

For solid Aluminum rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use AN426AD4 rivets, Rivet spacing .62" to .71" .

For Huck MLS 100-B blind rivets, machine countersunk:
Two rows of rivets through skin and doubler, two through patch and doubler.
Use MLS 100-B4 rivets, Rivet spacing .62" to .72" .

For Cherrylock CR-2248 blind rivets, machine countersunk:
Two rows of rivets through skin and doubler, two rows through patch and doubler.
Use CR-2248, 1/8" DIA rivet, Rivet spacing .62" to .73" .

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .62" to .75" .
(may be staggered).

Inboard Sta. 66:

For solid Aluminum rivets, machine countersunk:
Two rows of rivets through skin and doubler, two through patch and doubler.
Use AN426AD5 rivets, Rivet spacing .62" to .81" .

For solid Aluminum rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use AN 426AD5 rivets, Rivet spacing .625"
Min. Spacing .625", variation by staggering possible.

For Huck MLS 100-B blind rivets, machine countersunk:
Two rows of rivets through skin and doubler, two rows through patch and doubler.
Use MLS 100-B5 rivets, Rivet spacing .62" to .70" .

For Cherrylock CR-2248 blind rivets, machine countersunk:
Two rows through skin and doubler, two through patch and doubler.
Use 5/32" DIA rivets, Rivet spacing .62" to .70" .

For Cherrylock CR-2248 blind rivets, dimpled:
Two rows of rivets through skin and doubler, two through patch and doubler.
Use 5/32" DIA rivets, Rivet spacing .75" to 1.00" .

Upper side:

Panel IIa: 2-208

Outboard of Sta.66:

For solid Aluminum rivets; machine countersunk:
Two rows of rivets through skin and doubler, two through patch and doubler:
Use AN426AD4 rivets, Rivet spacing .63" to .79"
or AN426AD5 rivets, Rivet spacing .75" to 1.00" .

For solid Aluminum rivets, dimpled:
One row of rivets through skin and doubler, one (staggered) row through patch and doubler.
Use AN426AD4 Rivet spacing .50" to .60",
or AN426AD5 Rivet spacing .62" to .82".

For Huck MLS 100-B blind rivets, machine countersunk:
Two rows through skin and doubler, two (staggered) through patch and doubler.
Use MLS 100-B4 Rivet spacing .50"

For Cherrylock CR-2243 blind rivets, machine countersunk:
Two rows through skin and doubler, two through patch and doubler.
Use CR-2248, 1/8" DIA, Rivet spacing .50" to .62",
or 5/32" DIA Rivet spacing .63" to .75".

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one row (staggered) through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" (staggered)
or 5/32" DIA rivets Rivet spacing .62" to .635"

Inboard of Sta. 66:

For solid Aluminum rivets, machine countersunk:
Two rows through skin and doubler, two through patch and doubler.
Use AN426AD4 Rivet spacing .50" (staggered).
Or AN426AD5 Rivet spacing .625" (staggered),
Or three rows of rivets through skin and doubler, three through patch and doubler:
Use AN426AD4, Rivet spacing .62" to .75",
or AN426AD5, Rivet spacing .75" to .94".

For solid Aluminum rivets, dimpled:
Two rows through skin and doubler, two through patch and doubler.
Use AN426AD4 Rivet spacing .63" to .75",
or AN426AD5 Rivet spacing .75" to 1.02".

For Huck MLS 100-B blind rivets, machine countersunk:
Three rows of rivets through skin and doubler, three through patch and doubler.
Use MLS 100-B4 rivets, Rivet spacing .50", (staggered),
or MLS 100-B5 rivets, Rivte spacing .625 (staggered).

For Cherrylock CR-2248, machine countersunk:
Three rows through skin and doubler, three rows through patch and doubler.
Use 5/32" DIA rivets, Rivet spacing .62" to .688",
or 1/8" DIA rivets, Rivet spacing .50" to .56" .

For Cherrylock CR-2248, dimpled:
Two rows through skin and doubler, two through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50"to .60",
or 5/32" DIA rivets, Rivet Spacing .63"to .78"

Lower Side:

Panel If: 2-209

Outboard of Sta. 66:

For solid Aluminum rivets, machine countersunk:
One row of rivets through skin and doubler, one through patch and doubler.
Use AN426AD4, Rivet spacing .62" to .72".

For solid Aluminum rivets, dimpled:
One row through skin and doubler, one row through patch and doubler.
Use AN 426AD4, Rivet spacing .75" to 1.09".

For Huck MLS 100-B blind rivets, machine countersunk:
Two rows through skin and doubler, two through patch and doubler.
Use MLS 100-B4, Rivet spacing .625" to .91".
For Cherrylock CR-2248 blind rivets, machine countersunk:
One row through skin and doubler, one row through patch and doubler.
Use 1/8" DIA rivets Rivet spacing .50" to .56".

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .63" to .88".

Inboard of Sta. 66:

For solid Aluminum rivets, machine countersunk:
Two rows of rivets through skin and doubler, two through patch and doubler.
Use AN426AD4, Rivet spacing .60" to .89".

For solid Aluminum rivets, dimpled:
One row through skin and doubler, one through patch and doubler.
Use AN426AD4, Rivet spacing .50" to .68".

For Huck MLS 100-B blind rivets, machine countersunk:
Two rows through skin and doubler, two through patch and doubler.
Use MLS 100-B4 Rivet spacing .50" to .57".

For Cherrylock CR-2248 blind rivets, machine countersunk:
Two rows through skin and doubler, two through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" to .688".

For Cherrylock CR-2248 blind rivets, dimpled:
One row through skin and doubler, one through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .50" to .56",
or two rows through skin, and doubler, two through patch and doubler.
Use 1/8" DIA rivets, Rivet spacing .75" to 1.03",
or combination: One row in skin, two rows in patch.