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AN 01-70AC-3

STRUCTURAL REPAIR INSTRUCTIONS

FOR

ARMY MODEL **PT-13D**

NAVY MODEL **N2S-5**

AIRPLANES

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15 MARCH 1945

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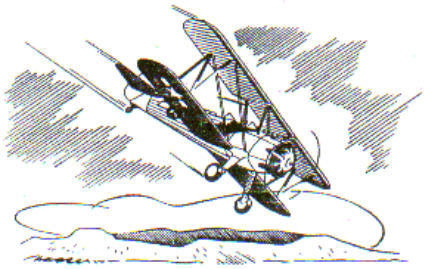
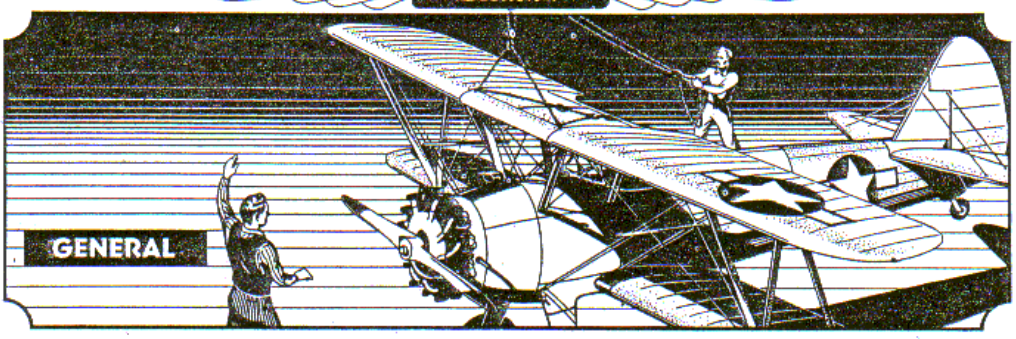
TABLE OF CONTENTS

LIST OF ILLUSTRATIONS



Section I



1. TYPE OF CONSTRUCTION.

The PT-13D/N2S-5 primary trainer airplane is a single engine, two-place, open cockpit biplane. Each wing panel is of wooden spar and rib construction, reinforced with aluminum alloy drag struts and tie-rod type bracing. Ailerons constructed of aluminum alloy are fitted into the trailing edge of each lower wing panel, and all wing panels and ailerons are fabric covered. The wings are fitted to the fuselage through the use of aluminum alloy interplane struts and drawn steel streamlined wires.

Tail surfaces are fabricated of welded chrome-molybdenum steel tubing with leading edges faired with aluminum alloy sheet. All surfaces are fabric covered.

The fuselage frame is a truss type structure of welded chrome-molybdenum steel tubing. Aluminum alloy stringers and arched formers are riveted together to form the fairing which is attached to the fuselage frame by tube clamps and over which the fabric covering is applied. All cowling is non-stressed aluminum alloy sheet.

The wheel-type, full cantilever alighting gear is equipped with spring-oil shock struts and 24-inch streamlined wheels incorporating hydraulic brakes. The tailwheel is a full-swiveling, steerable unit equipped with an air-oil type shock strut.

2. INVESTIGATING DAMAGE.

When investigating damage, great care must be taken to determine the complete extent of the damage to the airplane. Shocks will often travel through the structure in such a manner as to cause damage or failure of some part remote from the original and apparent damaged area. If such a condition occurs, it is possible to overlook damage which would present a structural hazard in service unless a very thorough inspection is made of the complete airplane.

a. REPAIR VERSUS REPLACEMENT.

(1) It will be necessary first to determine whether damaged parts should be repaired or replaced. Such decision is determined by the nature, location, and accessibility of the part and its function in the airplane, as well as by the extent of the damage. To prevent grounding an airplane for a prolonged period of time caused by difficulties encountered in making a replacement, it may be preferable to repair a part rather than replace it even though the damage is comparatively great.

(2) Before beginning replacement it should be determined that the member definitely is not repairable. This may save needless replacement work which at first glance seems necessary. Nevertheless, even though a part could be repaired, it may be necessary to make a replacement because of the conditions set forth below.

(a) The damage may be such that the function for which the part was intended can not be restored by repairs. This may be true for highly stressed parts which require a high degree of heat treatment, or which have peculiarities such as special tolerance.

(b) Due to characteristics of the damage involved field repairs normally cannot restore a damaged part to its original quality, making replacement with a new part more desirable.

(3) Unavailability of replacement parts, however, may necessitate repair which should be done in accordance with the recommended procedure.

3. SUPPORT OF STRUCTURE DURING REPAIR.

Careful handling of the airplane and its parts is essential. Very often more damage than originally existed is done to the airplane by carelessness in handling and improper supporting of the structure during repairs.

a. Hoisting lugs are provided on top of the upper wing center section near each forward corner of the fuel tank. Care must be exercised to provide a correct cable arrangement when using these hoisting lugs. A hoist sling conforming to the specifications in *figure 2* will provide a suitable tool for hoisting the airplane as shown in *figure 1*.

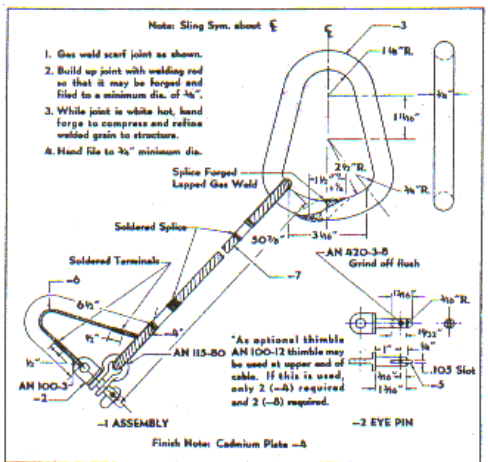
b. Provisions are made for supporting the airplane on jacks under either the lower wing or main alighting gear and at the jack point just forward of the tail wheel. *(See figure 1.)*

c. Lift handles are located on the lower longerons at station 6.

CAUTION

These lift handles should not be used for hoisting the airplane by cables due to the danger of damaging the fuselage fairing.

d. When repairing major components of the airplane requiring the insertion or replacement of parts, the respective sections should be supported in light repair jigs illustrated in *figures 34, 35, 36, 41, 42, 43, 44, 57, and 64.*



PARTS LIST

PART	NO. REQ.	NAME	MATERIAL	SPEC.	REMARKS
AN100-3	4	Thimble			
AN420-3-8	1	Rivet, CSK Head	3/8" Diameter		
AN115-80	2	Shackle			
–8	2	Thimble	AN100-12		
–7	2	Cable	1/4" Dia. 7"×19" Flex. Cable	22-C-2	
–6	2	Cable	1/4" Dia. 7"×7" Flex. Cable	22-C-2	
–5	2	Lock	.109/1/4"×5/8" Steel	AN-S-11	
–4*	4	Thimble	5/16" O.D.×.035" Steel Tubing	AN-WW-T-850	H.T. 280,000 #/in.²
–3	1	Ring	3/4" Dia. ×20 3/4" Steel Rod	AN-QQ-S-646	Proof Load to 10,000 #
–2	2	Eye Pin	Make from AN46-17	AN-QQ-S-685	
–1	1	Assembly			

Figure 2—Hoist Sling

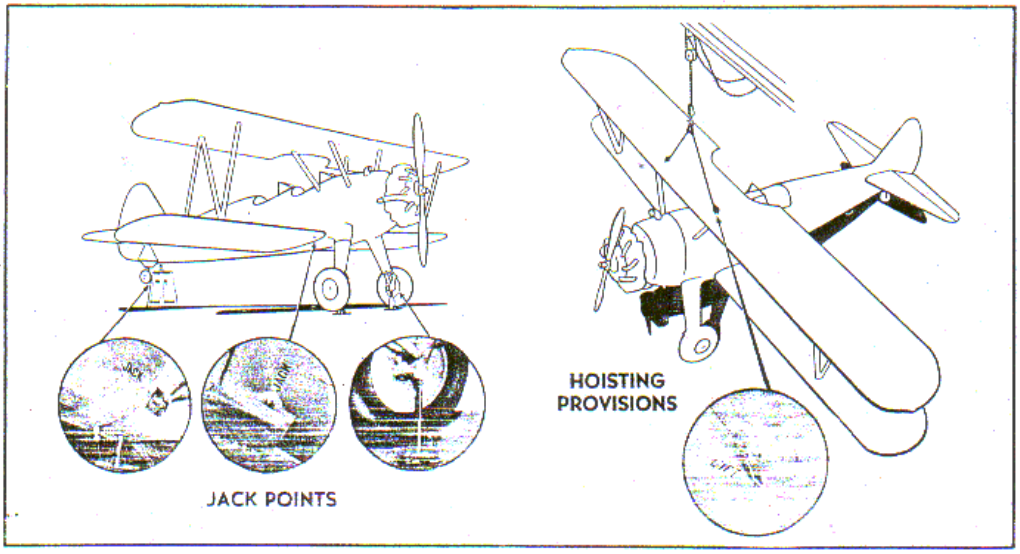


Figure 1—Hoisting and Jacking Provisions

4. LOCATION OF LEVELING POINTS.

a. Transverse leveling points are located on the lower longerons just aft of station 1. *(See figure 3.)* Access to these points may be gained by removing the bottom fuselage cowling.

b. The longitudinal leveling points are located on the fuselage cross tubes between stations 1 and 2. *(See figure 4.)* Access to these points is gained by raising the fuselage side cowl doors.

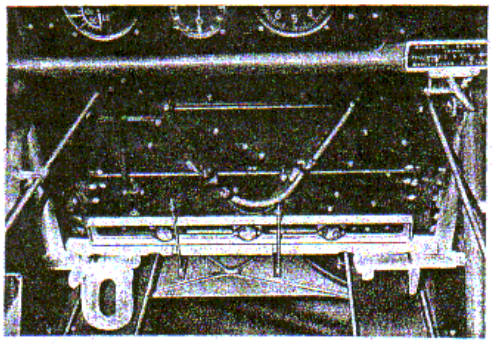


Figure 3—Transverse Leveling

5. TYPES OF REPAIR.

All repairs outlined in this manual are intended to be permanent.

a. Repairs to the fuselage, stabilizer, rudder, elevators, and fin frames will consist largely of repairs to welded steel tube structures and the regular methods outlined in section X of the general manual for structural repair, technical order AN 01-1A-1, should be followed.

b. The wings and center section are of wooden spar and rib construction and standard aircraft woodworking practices will be followed when making repairs. See section XII of technical order AN 01-1A-1.

c. The forward part of the fuselage is covered with aluminum alloy sheet and riveted repairs outlined in section IV of this manual should be used.

Note

When a new repair involves an area immediately adjacent to or within several inches of an already existing repair, it is advisable to remove the old repair and include the entire area in the new repair.

6. FIELD REPAIRS OF SPOT-WELDED STRUCTURES.

Spot-welds in the engine cowl may be repaired by the insertion of AN455AD4 or AN456AD4 rivets for each spot-weld which is broken loose. Rivets should not be spaced closer than one-half inch. Additional information on rivets and rivet spacing will be found in section VI of technical order AN 01-1A-1.

7. RIGGING PROCEDURES.

a. WING RIGGING.—Wing stagger, wing dihedral angle, and wing incidence angle determine the flying characteristics of the PT-13D/N2S-5 airplanes. The correctness of these factors depends entirely upon the method of rigging. For this reason it is suggested that special attention be given to the rigging procedure. With the center section and the wing panels installed, the following rigging instructions should be adhered to:

Note

Both sides of the airplane should be rigged at the same time.

(1) A close fitting wooden block must be placed in the torque links of the main gear shock struts after which adjustable jacks should be placed beneath each axle jack point and the rear jack point. *(See figure 1.)*

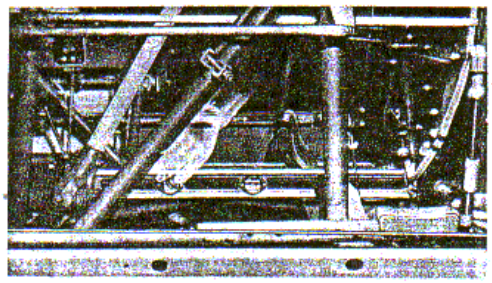


Figure 4—Longitudinal Leveling

(2) A leveling bar and spirit level should be placed on the leveling lugs provided on the lower longerons just aft of station number 1. *(See figure 3.)* The jacks under the main alighting gear should be adjusted to level the airplane transversely.

(3) A spirit level should be placed on the leveling lugs provided on the lower fuselage cross tubes between stations 1 and 2 as shown in *figure 4* and the airplane leveled longitudinally by adjusting the jack beneath the rear jack point.

(4) The center section should be centered by hanging a plumb bob over the outboard side of each upper wing front attachment bolt fitting and the distance measured from the fuselage box tube to the plumb bob line. *(See figure 5.)* This distance, 23 ± 1/32 inches, must be equal (± 1/16 inch) on each side of the fuselage. Location of the center section is controlled by two sets of roll wires having two wires each (see 1, *figure 9*), both of which must have equal tensions (± 150 pounds). Correct roll wire tensions are 1100 minimum, 1250 nominal, and 1400 maximum pounds.

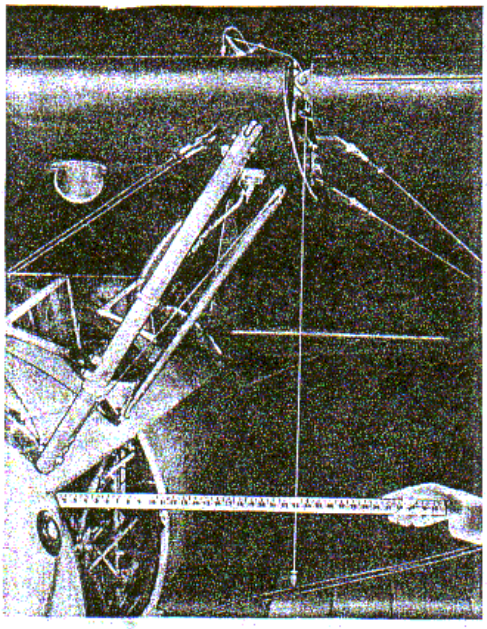


Figure 5—Center Section Centering

Note

To obtain equal roll wire tensions within the specified tolerances it is often necessary to quarter a roll wire by removing the clevis pin from an attaching clevis and running the clevis up one-half turn.

(5) The correct dihedral angle of 1½ degrees on the lower wing is set by placing the dihedral board atop the lower wing with the small end toward the wing tip. A spirit level should be placed on top of this board and the rear landing wire adjusted until the correct dihedral angle is obtained. *(See figure 6.)*

Note

The rear landing wire (see 5, *figure 9*) will now be supporting the weight of the lower wing and all other wing wires should be completely slack.

(6) Squareness of the lower wing panels should be checked by scaling the distance from the center line of the propeller shaft at the front of the engine to the center of the bolt at the right- and left-hand lower front strut points. These distances should be equal within ⅜ inch. Alignment of the lower wing panels should be checked if this tolerance is exceeded.

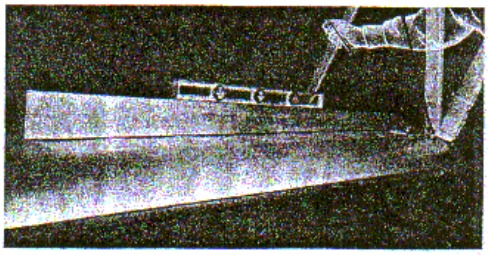


Figure 6—Wing Dihedral Check

If a wing panel is "out-of-square" it will be necessary to re-rig the panel by adjusting the internal brace wires. Squaring of the wing panels should be accomplished in the following manner:

(a) The frame should be placed in an inverted position on a checking table similar to *figure 34* for the upper and lower wing panels and *figure 36* for the center section with the wing root fittings secured to hold them in alignment.

(b) Reference points should be established on both the front and rear spars at the intersection of the spar and compression strut center lines. The diagonal distances between these reference points in each wing bay must be equal.

(c) Any misalignment in the wing panels should be corrected by adjusting the internal brace wires until the diagonal distances between reference points in each bay are equal. Wire tensions should be checked with a tensiometer to the readings given in *figure 9*.

(7) The wing stagger is determined by hanging a plumb bob over the leading edge of the upper wing directly in line with the strut point and measuring the distance from the spoiler strip on the leading edge of the lower wing to the plumb bob line. *(See figure 7.)* This distance should be 26-13/16 ± ⅛ inches.

Note

With the upper spoiler strip removed, the stagger should be 26-9/16 (± ⅛) inches.

If the wing stagger is too great, the anti-drag wire (2) should be tightened and the drag wire (3) loosened the same number of turns until the measurement is within the specified tolerance. *(See figure 9.)* If the stagger is too small, the procedure should be reversed; that is, tighten the drag wire and loosen the anti-drag wire. After the strut point stagger has been set, the drag wires should be checked for 1200 minimum, 1650 nominal, and 2100 maximum pounds tension. If the drag wires are in tolerance, the anti-drag wires should automatically be in correct tension.

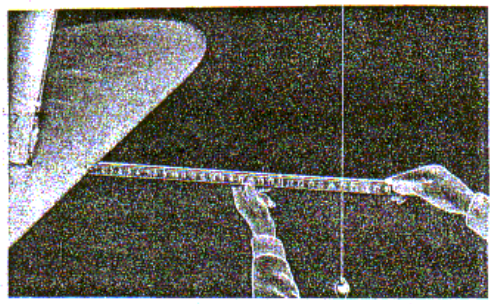


Figure 7—Wing Tip Stagger Check

CAUTION

After their correct tensions have been established, the drag and anti-drag wires must not be moved during the remainder of the rigging procedure.

(8) The rear landing wire and the rear flying wires form the rear bay and pull against each other. If either the landing wire or the flying wires are tightened, the remaining wire or wires will increase in tension. The strut arrangement between the upper and lower wings is stationary and any movement of either wing by necessity moves the other wing. With these facts in mind, the rear landing wire (see 5, *figure 9*) should be tightened six or seven half turns. Obviously this will pull the lower wing up, consequently pulling the dihedral angle out of its correct position. This is compensated for by tightening the rear flying wires (see 7, *figure 9*) which are attached to the fuselage, to their correct tensions of 1000 minimum, 1200 nominal, or 1400 maximum pounds. The lower wing should assume its correct dihedral angle and the rear landing wire should be within its tension tolerance of 1500 minimum, 1850 nominal, or 2200 maximum pounds.

(9) All wires in the front bay should be tightened "hand-snug" and then the front flying wires (see 4, *figure 9*) rigged to a tension of 750 minimum, 850 nominal, or 950 maximum pounds.

(10) Step (9) should automatically set the front landing wire (see 6, *figure 9*) to within its specified tension of 1500 minimum, 1750 nominal, or 2000 maximum pounds. If these tolerances are exceeded, the front flying and landing wires must be adjusted until all wires in the front bay are within tension tolerance.

(11) The strut point stagger should be rechecked as outlined in step (7), and if the stagger is not within the specified tolerance, it should be corrected by adjusting the landing and flying wires in the front bay. The upper wing may be moved forward by tightening the front flying wires and may be pulled aft by tightening the front landing wire. In either case, the corresponding wire or wires should be loosened the same number of half turns to maintain the proper tension on all wires in the front bay.

(12) The upper wing incidence angle of four degrees should be checked by placing the incidence board, with a spirit level on its under side, directly under the first rib outboard of the strut fittings. *(See figure 8.)*

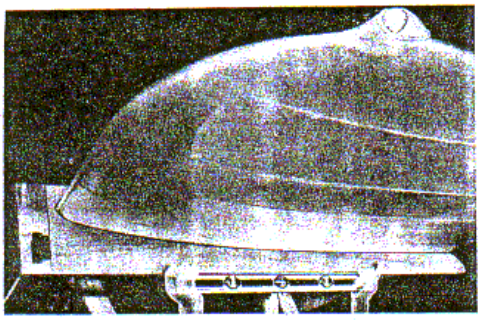


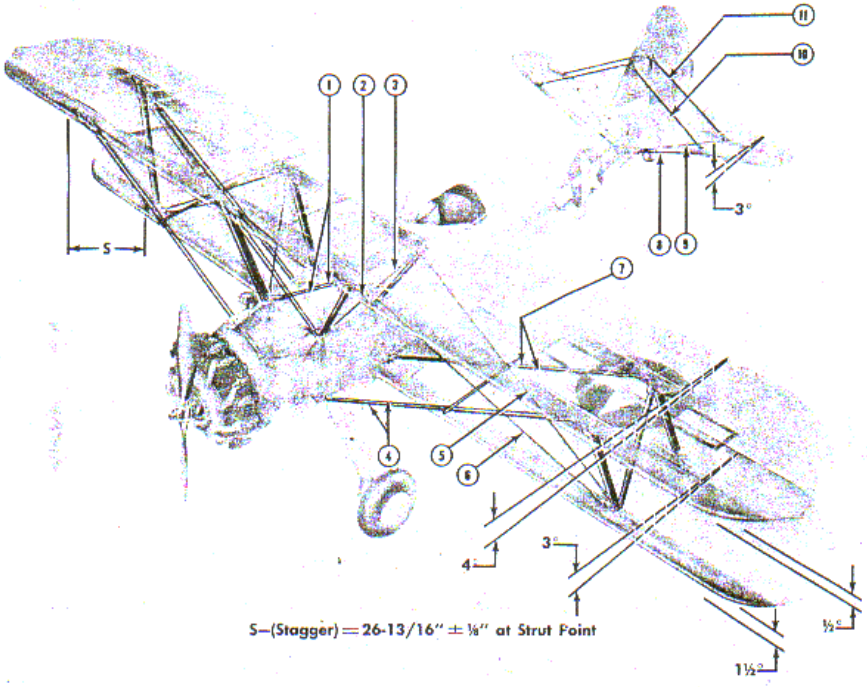
Figure 8—Upper Wing Incidence Check

If the incidence angle is too great, the rear flying wires must be loosened; if the angle is too small, the rear flying wires should be tightened.

CAUTION

When it is necessary to correct the incidence angle, the tension must be rechecked after adjusting the flying wires.

(13) The lower wing incidence angle of three degrees should be checked by placing the lower wing incidence board with a spirit level on its under side, directly under the first rib outboard of the strut fitting. This angle can be corrected by adjusting the rear strut length at its lower fitting. *(See figure 10.)*



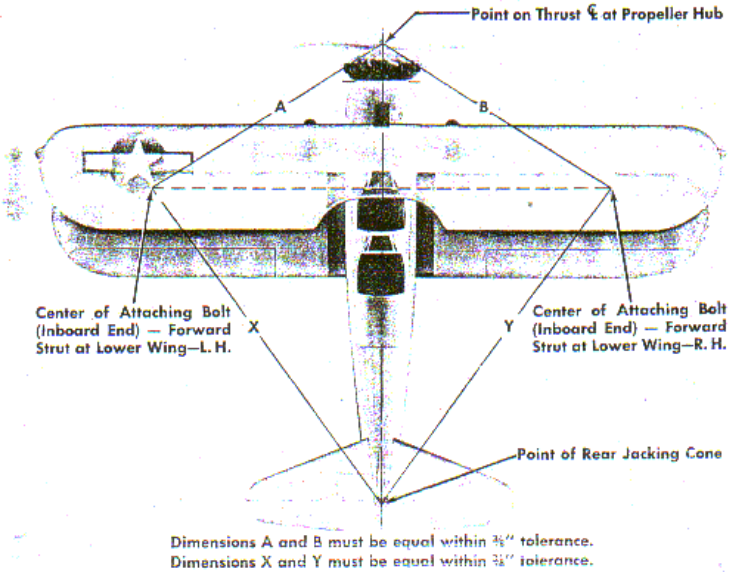
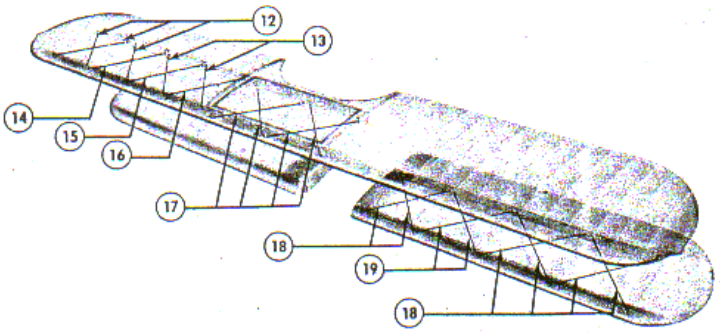


Figure 9 (Sheet 1 of 2 Sheets)—Rigging Diagram



INDEX NO.	TIE ROD NO.	NOMENCLATURE	SIZE	TENSIOMETER READING		
				MINIMUM	NOMINAL	MAXIMUM
1	75-1001-1	Tie Rod—Center Section Roll	5/16-24-6100	1100	1250	1400
2	AN676AC-3575	Tie Rod—Anti-drag Cabane	3/8-24-8000	No Reqd. Load	No Reqd. Load	No Reqd. Load
3	AN675AC-3925	Tie Rod—Drag Cabane	5/16-24-6100	1200	1650	2100
4	AN675AC-12025	Tie Rod—Front Flying Wire	5/16-24-6100	750	850	950
5	AN675AC-8900	Tie Rod—Rear Landing Wire	5/16-24-6100	1500	1850	2200
6	AN675AC-9300	Tie Rod—Front Landing Wire	5/16-24-6100	1500	1750	2000
7	AN676AC-11925	Tie Rod—Rear Flying Wire	3/8-24-8000	1000	1200	1400
8	AN674A-3900	Tie Rod—Lower Front	1/4-28-3400	215	315	415
9	AN674A-3850	Tie Rod—Lower Rear	1/4-28-3400	235	335	435
10	AN673A-4425	Tie Rod—Upper Front	10-32-2100	200	300	400
11	AN673A-4675	Tie Rod—Upper Rear	10-32-2100	200	300	400
12	AN703A-3825	Tie Rod—Upper Wing	10-32-2100	325	350	375
13	AN703A-3900	Tie Rod—Upper Wing	10-32-2100	325	350	375
14	AN704A-3750	Tie Rod—Upper Wing	1/4-28-3400	375	400	425
15	AN704A-3900	Tie Rod—Upper Wing	1/4-28-3400	375	400	425
16	AN704A-3825	Tie Rod—Upper Wing	1/4-28-3400	375	400	425
17	AN704A-4000	Tie Rod—Center Section	1/4-28-3400	650	700	750
18	AN703A-4200	Tie Rod—Lower Wing	10-32-2100	325	350	375
19	AN703A-4325	Tie Rod—Lower Wing	10-32-2100	325	350	375

Figure 9 (Sheet 2 of 2 Sheets)—Rigging Diagram

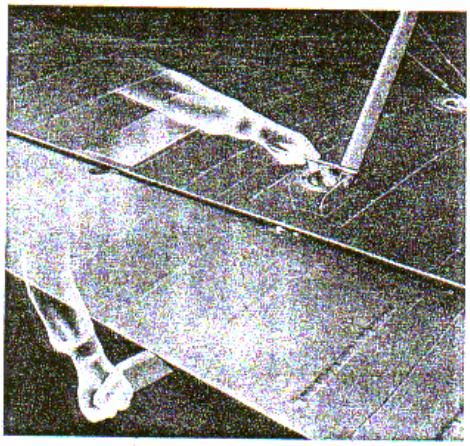


Figure 10—Lower Wing Incidence Check

Note

After the wing incidence angle is set, the locknut must be secured.

b. EMPENNAGE RIGGING.—With the airplane leveled as described in paragraph *a*, preceding, the fin and stabilizer should be rigged as follows:

(1) The upper and lower brace wires should be tightened "hand-snug" only.

(2) As shown in *figure 11*, a spirit level should be placed on the two elevator bearing fittings and the stabilizer leveled by adjusting and upper and lower rear brace wires until level readings are obtained on each side of the airplane.

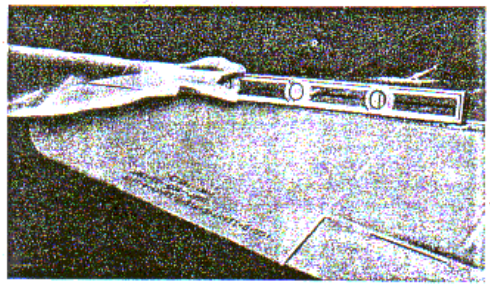


Figure 11—Stabilizer Leveling

(3) A spirit level should then be placed on the side of the fin approximately three inches forward of the rudder hinge center line. *(See figure 12.)* The upper rear brace wires should then be adjusted until the fin is vertical.

(4) The fin and rudder should be clamped together and visually aligned with the center section spar stiffener by adjusting the front brace wires.

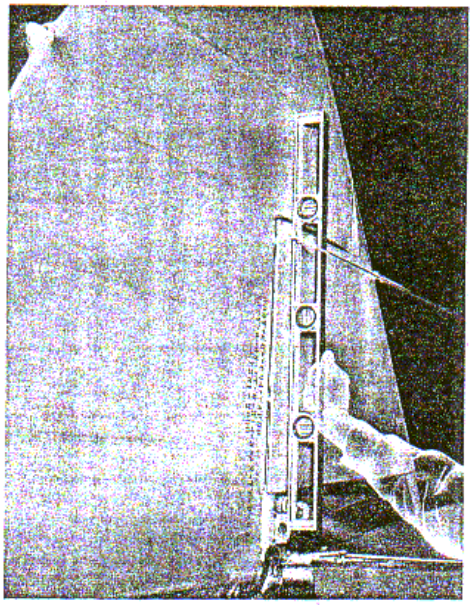


Figure 12—Fin Leveling

(5) Tensions of the empennage brace wires should be checked with a tensiometer to the following readings:

(a) Upper front and rear brace wires—200 to 400 pounds.

(b) Lower front brace wires—215 to 415 pounds.

(c) Lower rear brace wires—235 to 435 pounds.

c. CONTROL SURFACES RIGGING.

(1) AILERON ADJUSTMENT.

(a) The control stick should be placed in an absolutely neutral position laterally. This is accomplished with the use of the control stick collar and the adjustable link illustrated in *figure 24*, and a level protractor set at ½ degree to compensate for the slight taper of the wooden control stick. See *figure 13* for the correct placement of these tools. When the neutral position is established, the control stick should be clamped in place.

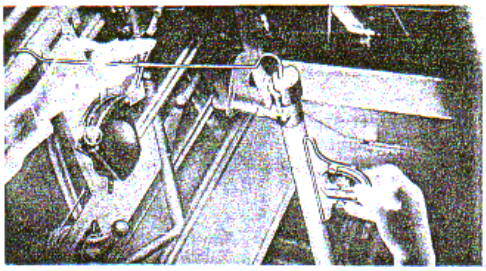


Figure 13—Control Stick Neutralizing—Lateral

(b) The eye-bolt on the inboard end of the aileron push-pull tubes should be adjusted to obtain visual alignment of the aileron trailing edge with the wing trailing edge. The locknut should then be tightened. *(See figure 14.)*

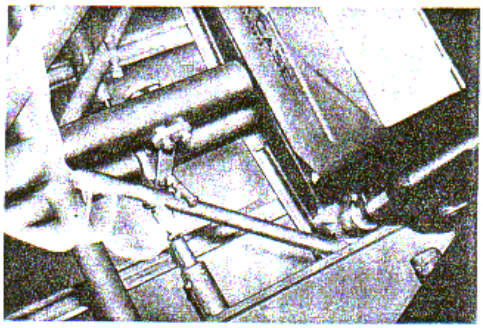


Figure 14—Aileron Alignment and Travel Adjustment

(c) The swinging protractor illustrated in *figure 25* should be attached to the aileron trailing edge and the stop bolts which bear against the horn on the interstick torque tube adjusted to give the ailerons 23 degrees "up" travel. This should automatically set the ailerons to 18 degrees "down" travel.

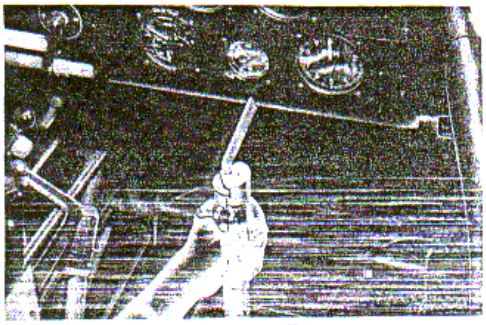


Figure 15—Control Stick Neutralizing—Longitudinal

(2) ELEVATOR ADJUSTMENT.

(a) The control stick should be neutralized longitudinally using the short link and collar illustrated in *figure 24*. Correct application of these tools is shown in *figure 15*.

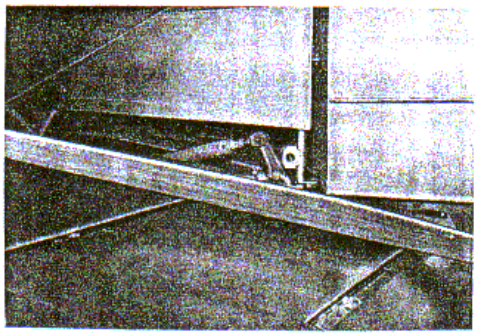


Figure 16—Elevator Trimming

(b) With the control stick clamped in neutral position, the elevator is trimmed with the stabilizer by placing a straightedge on top of the elevator and stabilizer parallel to the fin and adjusting the clevis at the rear of the elevator push-pull tube until the surfaces are aligned. *(See figure 16.)* The locknut should then be tightened.

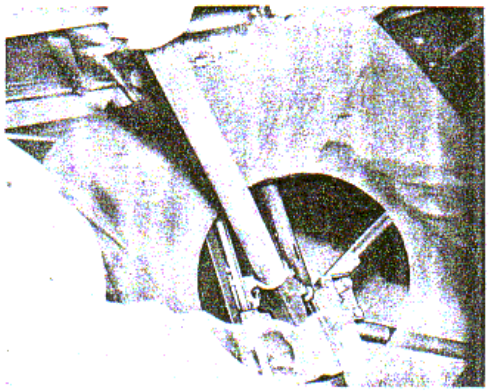


Figure 17—Elevator Travel Adjustment

(c) Elevator travel is adjusted by clamping the swinging protractor to the elevator trailing edge *(see figure 13)*, then adjusting the stop bolt located on the front of the forward cockpit control stick socket *(see figure 17)* to allow 22 degrees downward

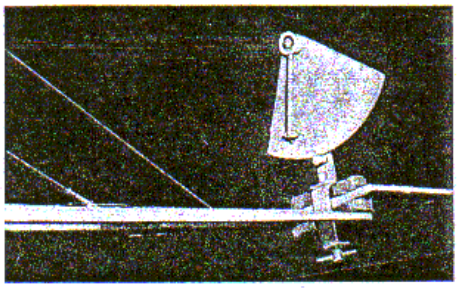


Figure 18—Elevator Travel Check

travel. The stop bolt on the rear of the rear cockpit control stick socket must be adjusted to permit 28 degrees upward travel. The locknuts should then be tightened.

(3) RUDDER ADJUSTMENT.

(a) A wooden block 3-11/16 inches in length should be placed between the front of each rudder pedal rack and the phenolic stop block located on the bus cable pulley brackets. The rudder bus cable should then be tightened to hold the racks against the wood blocks.

Note

After rigging, all cables in the system shall not have more than three threads out or 12 threads in at either end of the turnbuckle barrels.

(b) The turnbuckles at the rudder control horns *(see figure 19)* should be adjusted to obtain visual alignment of rudder with fin and with the

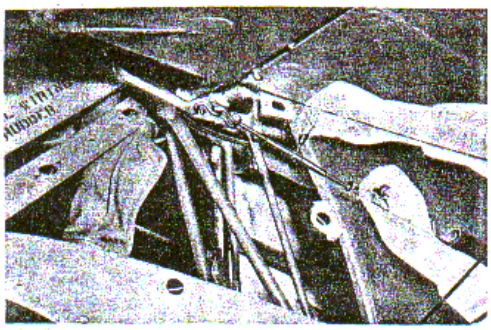


Figure 19—Rudder Adjustment

stiffener over the fuel tank. The rudder should be checked for 30 degrees right travel and 30 degrees left travel.

(c) The tail wheel control cables should be tightened to within three threads of each turnbuckle, and the rudder control and tail wheel control cables checked for 60 to 80 and 35 to 45 pounds tension, respectively.

(4) ELEVATOR TRIM TAB ADJUSTMENT.

(a) Both cockpit trim tab control handles should be set at zero and the turnbuckles located aft of the tab control non-reversing mechanism adjusted to obtain visual alignment of the trailing edges of the tabs and elevators.

(b) Trim tab travel of 15 degrees in each direction may be adjusted by filing the tab control horns as necessary to obtain proper travel.

(c) The trim tab control cables should be checked for 10 to 15 pounds tension.

d. SPECIAL RIGGING TOOLS.

(1) WIRE WRENCH.—To eliminate the possibility of scratching or nicking the steel brace wires, a wire wrench similar to the one shown in *figure 20* should be used when adjusting the flying and landing wires.

Such a wrench can be fabricated by wedging a piece of wood approximately six inches long inside a piece of 1-inch pipe of equal length. A slot twice the thickness of the rear flying wire should be cut in each end of the pipe.

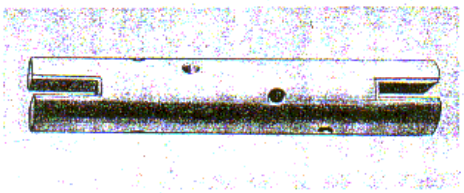
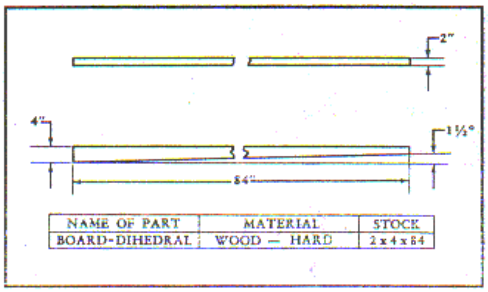


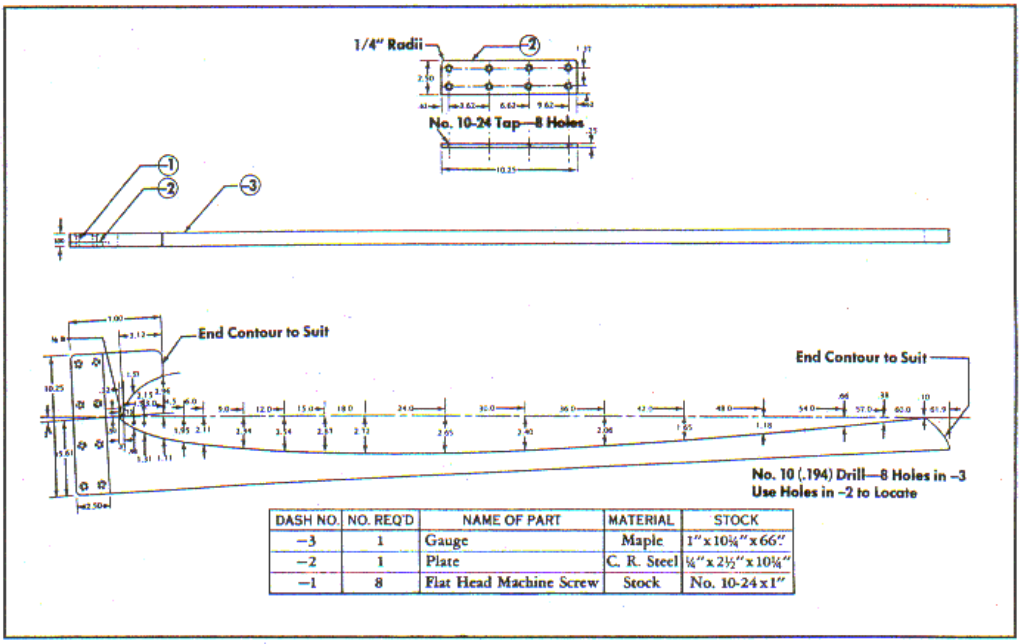
Figure 20—Wire Wrench

(2) WING DIHEDRAL BOARD.—A dihedral board can be fabricated of 2 x 4-inch stock, seven feet long tapered at a 1½ degree angle. *(See figure 21.)* The board should be of hard wood to minimize the possible wear through extensive use.



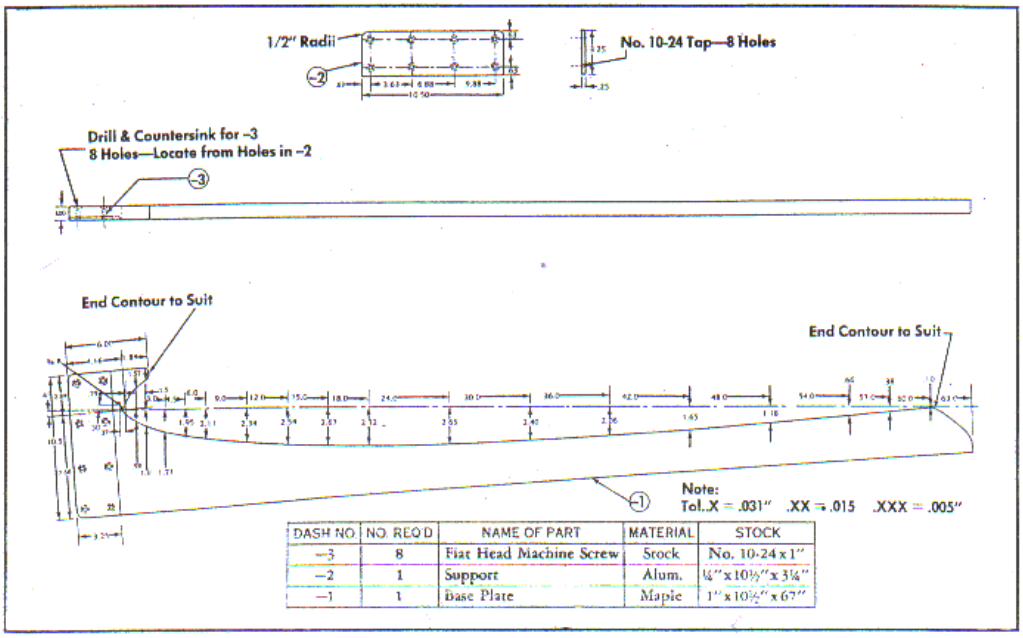
NAME OF PART	MATERIAL	STOCK
BOARD-DIHEDRAL	WOOD — HARD	2 x 4 x 84

Figure 21—Wing Dihedral Board



DASH NO.	NO. REQ'D	NAME OF PART	MATERIAL	STOCK
–3	1	Gauge	Maple	1" x 10¾" x 66"
–2	1	Plate	C. R. Steel	¼" x 2½" x 10¾"
–1	8	Flat Head Machine Screw	Stock	No. 10-24 x 1"

Figure 22—Lower Wing Incidence Board



DASH NO.	NO. REQ'D	NAME OF PART	MATERIAL	STOCK
–3	8	Flat Head Machine Screw	Stock	No. 10-24 x 1"
–2	1	Support	Alum.	¼" x 10½" x 3¼"
–1	1	Base Plate	Maple	1" x 10½" x 67"

Figure 23—Upper Wing Incidence Board

(3) WING INCIDENCE BOARDS.—Separate incidence boards for the upper and lower wing panels should be fabricated from 2 x 8 stock to the dimensions given in *figures 22 and 23*.

(4) AILERON AND ELEVATOR NEUTRALIZING TOOLS.

(a) CONTROL STICK COLLAR.—A metal collar suitable to clamp over the end of the control stick should be fabricated with a small hole drilled in its exact center. *(See figure 24.)*

(b) ADJUSTABLE LINK.—An adjustable link for aileron neutralizing should be constructed so that one of its ends will fit into the hole of the above mentioned collar while the other end hooks over either top longeron. *(See figure 24.)*

(c) SHORT LINK.—For elevator neutralizing, a short metal link should be formed with one end curved to fit the cross tube directly below the front cockpit instrument panel and the other end fitted with a point which will fit the hole in the control stick collar. *(See figure 24.)*

(5) SWINGING PROTRACTOR.—A swinging protractor similar to the one illustrated in *figure 25* should be used when checking aileron and elevator travel.

(6) LEVEL BAR.—A level bar should be made from metal suitable to maintain a squareness within close tolerance. This bar should be notched in four places to allow clearance of the floorboard edges and the storage battery bracket rods when used on the lateral leveling lugs. *(See figure 3.)*

(7) MISCELLANEOUS EQUIPMENT.—A tensiometer conforming to the AAF drawing No. 32A 2148 should be used to check tensions on the wing and interplane wires. Adjustable jacks, plumb bob lines, a 36-inch scale, and a conventional spirit level are the additional necessary equipment required to rig the wing bays of this airplane properly.

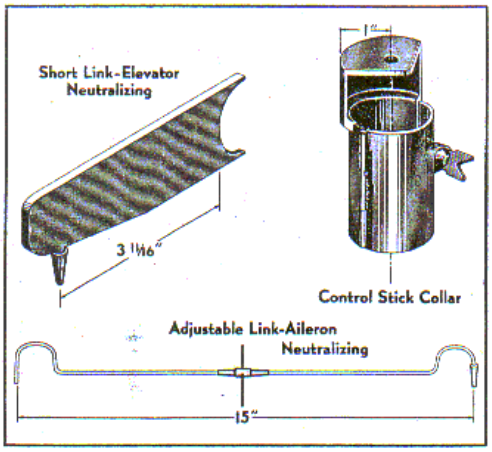


Figure 24—Control Surfaces Neutralizing Tools

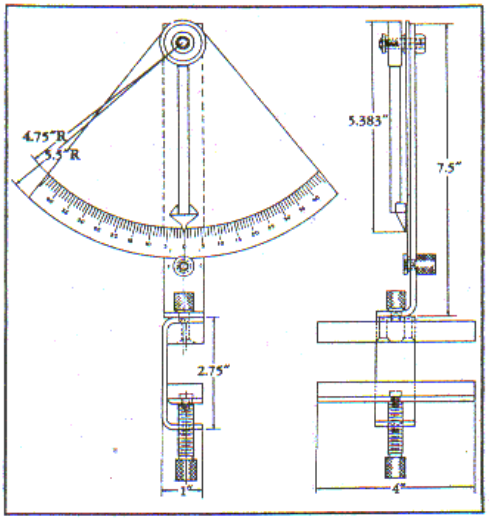
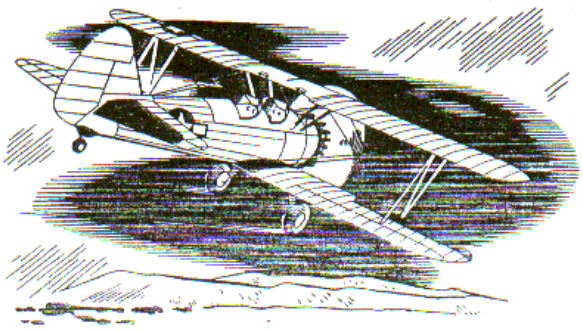


Figure 25—Swinging Protractor



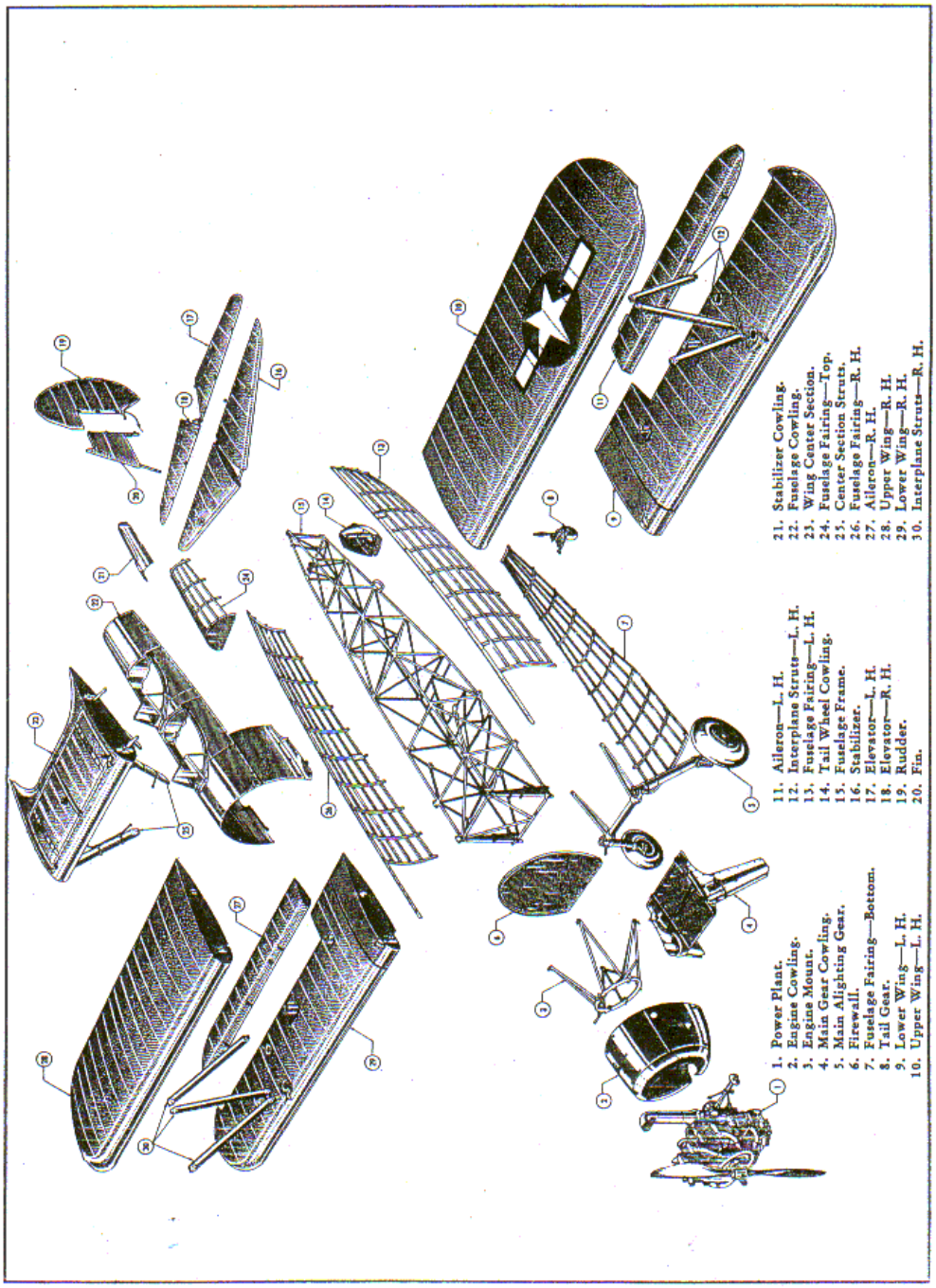


Figure 26—Major Component Assemblies

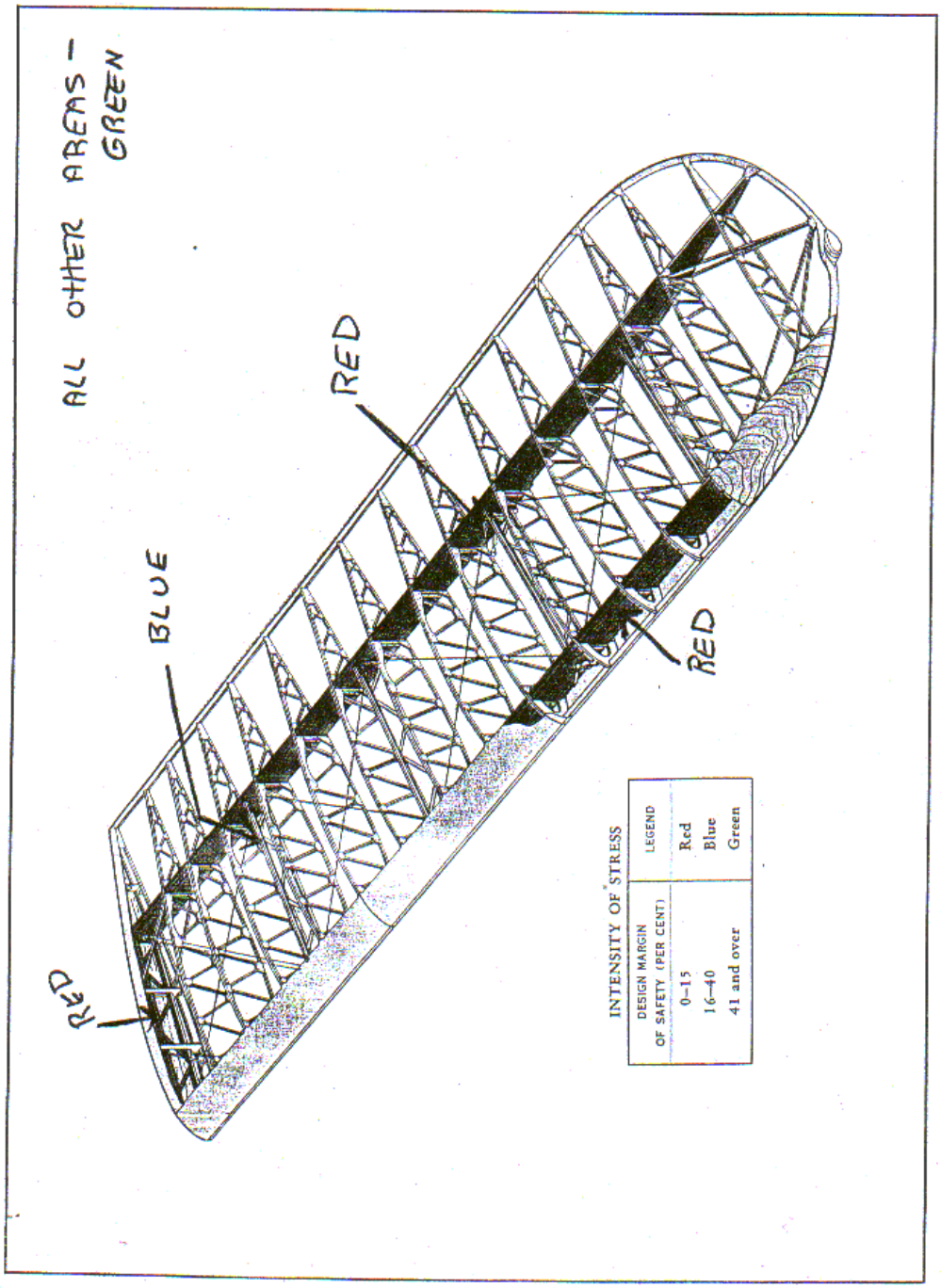
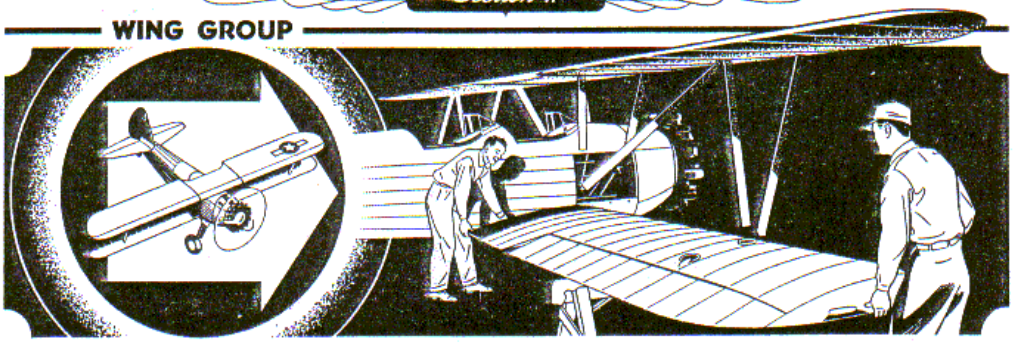


Figure 27—Upper Wing Assembly and Stress Diagram

Section II

WING GROUP



1. DESCRIPTION.

a. GENERAL.—The wing sections of this biplane are fitted to the fuselage to form a positive stagger and are externally braced by interplane struts and streamlined flying and landing wires. The lower wing panels are attached to the fuselage by means of fittings on the lower longerons. The upper wing center section is fitted to the fuselage by four cabane struts. The outer wing panels are in turn attached to the center section at the wing root fittings and are braced to the lower wing panels by three struts on each side of the airplane.

b. WING PANELS.—The structure of the wing panels consists of two rectangular wooden spars, either solid or laminated, wooden ribs, and truss-type compression struts. *(See figures 27 and 29.)* Drag and anti-drag stresses are carried by heavy steel wires which are attached diagonally from front to rear spars between the compression struts. The wing leading edges are covered with aluminum alloy sheet out to the interplane strut attachment points and beyond this are covered with plywood. The trailing edge is an extruded aluminum alloy channel. The entire surface of the wing panels is covered with doped fabric.

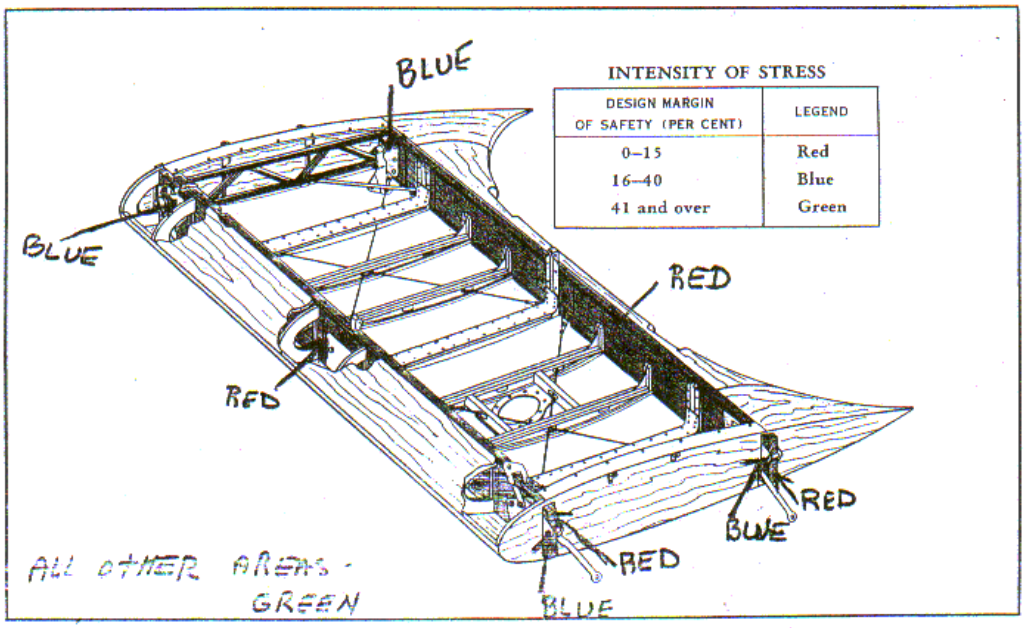


Figure 28—Center Section Assembly and Stress Diagram

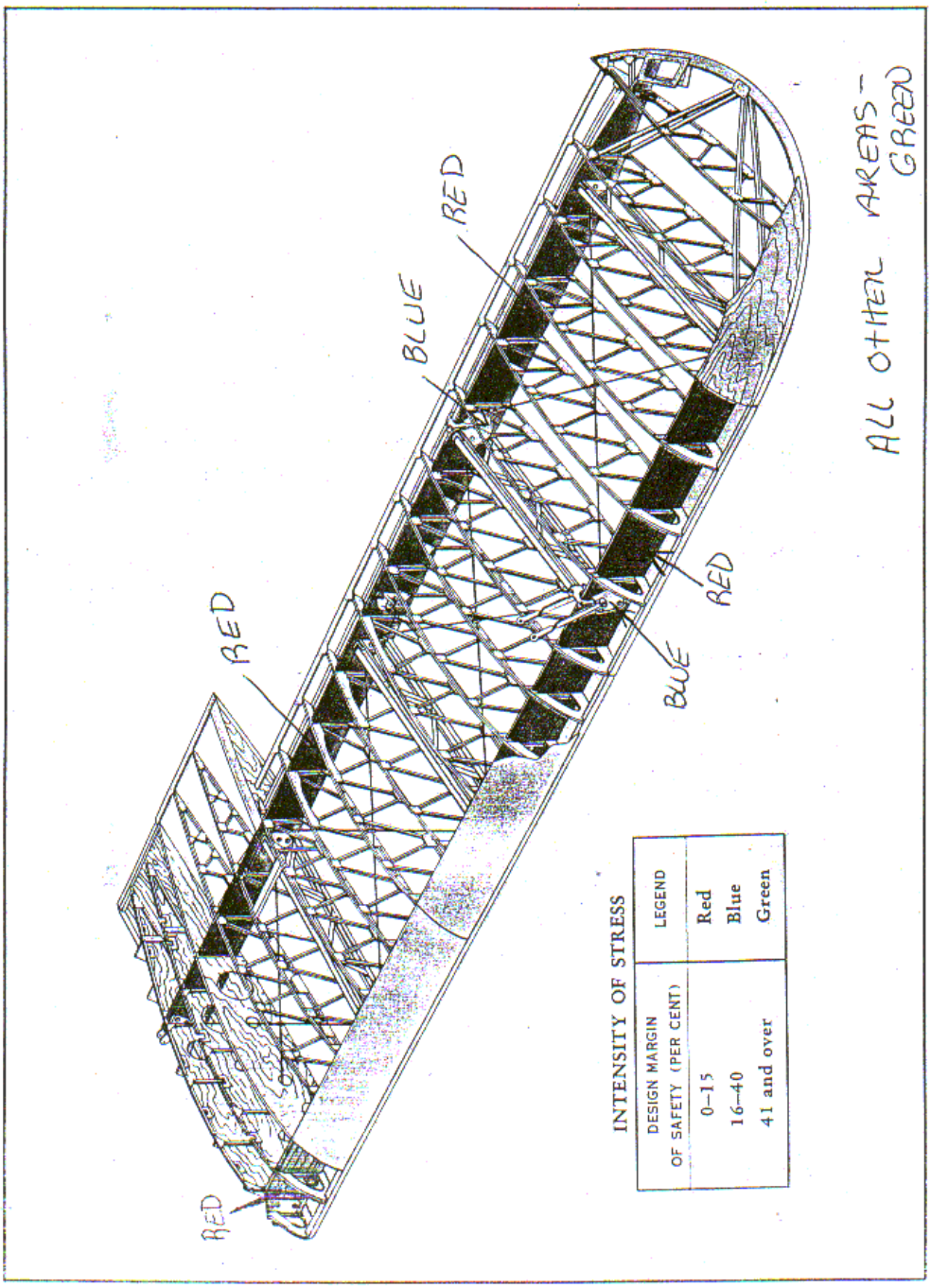


Figure 29—Lower Wing Assembly and Stress Diagram

c. CENTER SECTION.—The wing center section is similar in construction to the wing panels with the exception that the ribs and compression struts are of cradle type to accommodate the fuel tank. The leading edge is covered with plywood while the trailing edge is formed by a wooden bow attached to the two outboard ribs and covered with plywood. *(See figure 28.)* The lower surface and the leading and trailing edges are covered with doped fabric.

d. AILERONS.—The ailerons are constructed of riveted aluminum alloy spar and ribs with the leading edge also formed of aluminum alloy sheet. The surface is covered with doped fabric. *(See figure 30.)*

e. INTERPLANE AND CENTER SECTION STRUTS AND BRACE WIRES.—The interplane struts are aluminum alloy tube assemblies with forged fittings riveted in each end. Flying and landing loads are transmitted to the fuselage by streamlined steel brace wires. *(See figure 31.)*

2. DEFINITION OF DAMAGE CLASSIFICATION.

a. NEGLIGIBLE DAMAGE shall be considered damage that will not affect the airworthiness of the wing assembly and does not require attention.

b. DAMAGE REPAIRABLE BY PATCHING shall be considered damage that may be repaired by reinforcing a portion of the wing structure or patching of the doped fabric.

c. DAMAGE REPAIRABLE BY INSERTION shall be considered that damage which will require the removal and replacement of a portion of the wing structure or fabric skin.

d. DAMAGE NECESSITATING REPLACEMENT OF PARTS shall be considered that damage which is unrepairable by patching or insertion but which may be repaired by installing a new part. Damage requiring replacement, but which cannot be replaced because of structural design, will necessitate the replacement of the entire assembly.

3. NEGLIGIBLE DAMAGE.

a. FABRIC SKIN.—Scuffed paint and small holes in the fabric may be considered as negligible, to be repaired at the convenience of maintenance personnel.

b. LEADING EDGE.—Small dents in the metal leading edge strip will be considered negligible if the fabric is not torn and no ribs are broken. Small holes and cracks in the leading edge will also be considered negligible provided the holes are rounded out or the cracks stop-drilled with a 1/16-inch drill.

c. TRAILING EDGE.—Small bends in the trailing edge of the outboard panels may be considered negligible. However, close inspection should be made to any damage to the center section trailing edge to determine that the bow and plywood structure are not fractured.

d. AILERONS.—Due to the force exerted on these surfaces during flight, slight bends in the structure will be the only damage considered as negligible and any further damage should be repaired before the airplane is flown.

e. WING TIPS.—Minor damage to the bow or outboard rib capstrip will be considered negligible if the plywood fairing has not been fractured.

f. RIBS.—*Any* damage to a rib will *not* be considered negligible and will require repair. However, in case of an emergency such as the necessity of ferrying the airplane to a repair depot, it will be possible to fly the airplane with slightly damaged ribs provided the

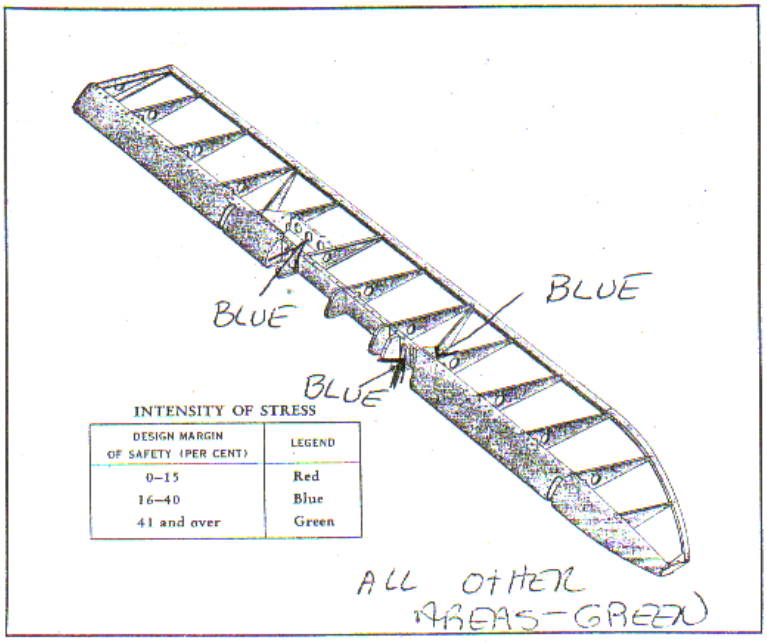


Figure 30—Aileron Assembly and Stress Diagram

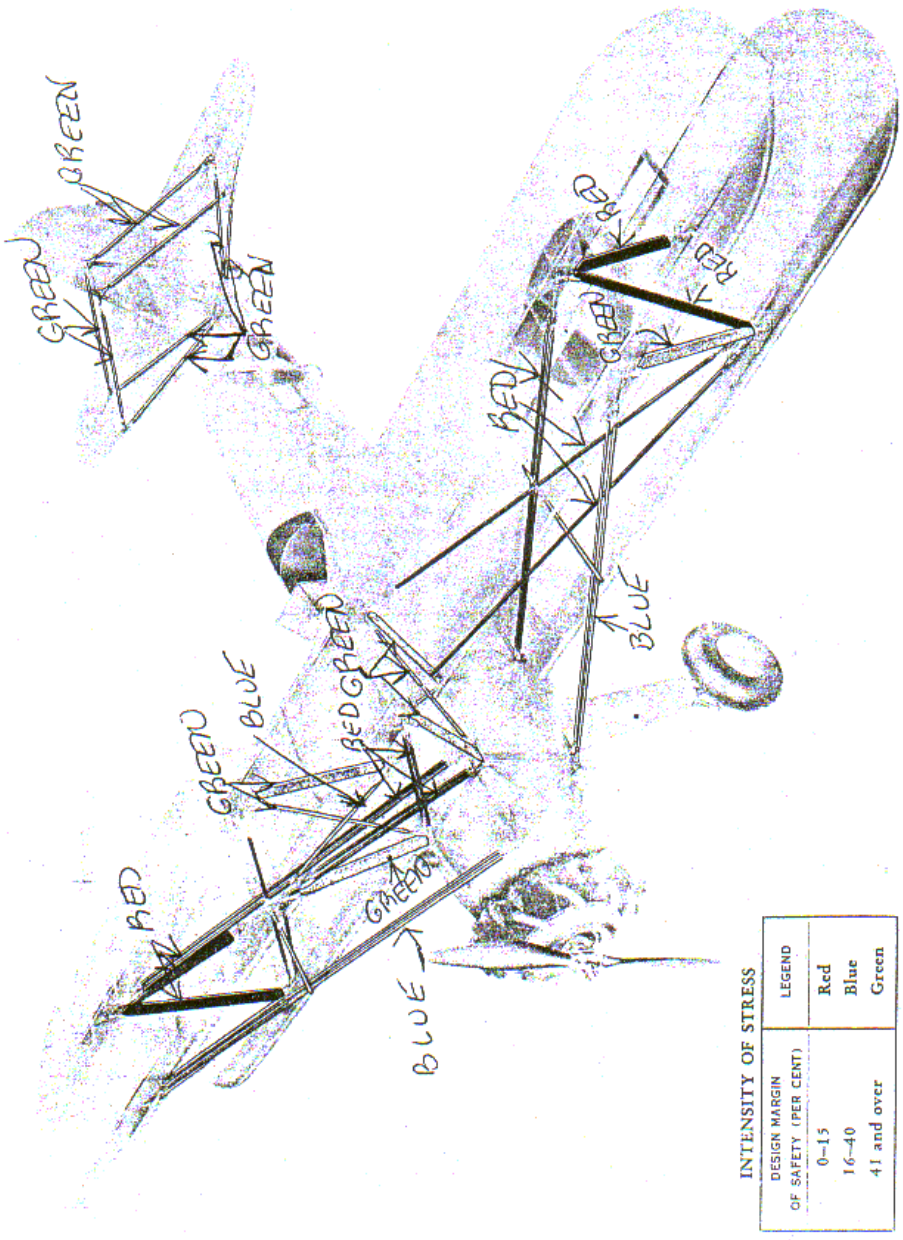


Figure 31—Interplane Struts and Brace Wires Stress Diagram

damage does not extend over a large area and no other part of the wing structure is damaged.

g. SPARS.—Due to the fact that the spars are the main structural members of the wing panels, the only damage to be considered as negligible will be small nicks and scratches.

h. FUEL TANK.—Small dens and scratches in the tank surface may be repaired at the convenience of service personnel.

4. DAMAGE REPAIRABLE BY PATCHING.

a. FABRIC SKIN.—Patching of the doped fabric skin shall be accomplished according to the standard methods outlined in section XIII of the general manual for structural repair, technical order AN 01-1A-1.

b. LEADING EDGE.

(1) PLYWOOD.—Patching repairs to the plywood leading edge of the center section and of the wing panels outboard of the strut point shall be made according to section XII of technical order AN 01-1A-1.

(2) ALUMINUM ALLOY SHEET.—No attempt should be made to patch the metal leading edge of the wing panels and any damage not considered as negligible should be repaired by replacement of the section.

c. TRAILING EDGE.

(1) CENTER SECTION.—Repairs to the trailing edge of the center section should be made according to section XII of technical order AN 01-1A-1.

(2) WING PANELS AND AILERONS.—Cracked or broken trailing edge extrusions may be repaired by adding an insert of hard wood (ash) or a spacer of 24ST aluminum bar shaped to conform to the trailing edge strip. (See section VIII.) An alternate method is to splice in a crimped insert of the same aluminum alloy as the trailing edge strip.

d. WING TIPS AND RIBS.—Wing tip bows and rib capstrips may be reinforced according to the practices set forth in section XII of technical order AN 01-1A-1.

CAUTION

No attempt should be made to reinforce the outboard rib of the lower wing panel due to the fact that a reinforced rib may result in a broken spar in the event of a ground loop.

e. FUEL TANK.—Loose tank baffles may be detected by buffeting along the rivet welds with a soft rubber mallet or the heel of the hand. A tank with only two loose baffles may be returned to service, whereas, *all baffles* in a tank with three or more loose baffles should be repaired with the application of rosette welds to connect the outer tank skin to the baffles at alternate spaces between the original welds on the rivets in the tank. *(See figure 32.)*

(1) PREPARATION OF TANK.

(a) The tank should be drained and removed from the wing center section.

(b) It is recommended that the paint be removed from the tank with a paint remover conforming to AAF Specification No. 14119, after which the anodize finish should be removed with sandpaper from an area approximately one inch square around the areas to be welded.

(c) Before welding, the fuel tank should be steamed for a period of six hours to remove any gasoline or fumes remaining in the tank. Steaming facilities must allow steam to reach all internal parts of the tank continuously. The tank should be placed in an attitude to permit immediate drainage of all water during the steaming operation. After steaming the tank should be aired for 12 hours either in a well ventilated room or out of doors. Immediately before welding, the tank should be rinsed thoroughly with one pint of carbon tetrachloride.

WARNING

Failure to adhere to these instructions may result in serious injury to personnel.

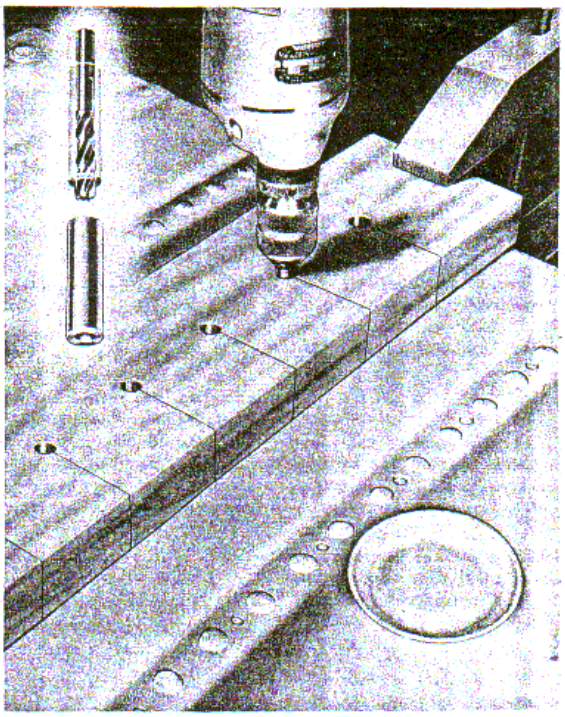
(2) TANK REPAIR.

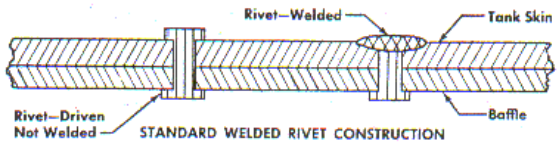
(a) Using a straight shank, four-fluted, single end mill in a slow speed drill with a stop adjusted to a depth of .064 inch, a ⅜-inch hole should be drilled through the skin of the tank at alternate spaces between the original rivet welds. The baffle should not be drilled. A guide or template made of a suitable hardwood such as is shown in *figure 32* should be used to locate the holes along the centerline of the baffle.

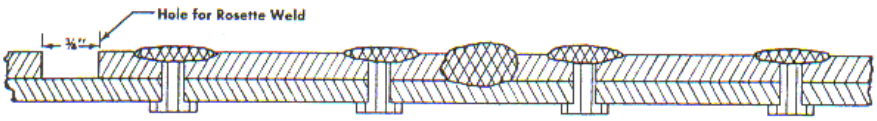
(b) Using a rosette weld, the baffle and tank skin should be welded together, with extreme care taken to locate the weld along the centerline of the baffle. Off-center welds may cause cracking of the baffle.

(c) When repair welds are made, local heating will cause the tank skin to buckle. Most of the buckling and any other dents in the skin may be removed by buffeting lightly around the perimeter of the dents with a soft rubber mallet when the tank is inflated to approximately three to five pounds per square inch. While the tank is under pressure it should be tested for leaks after the dents have been removed.

(d) The tank should be cleaned and painted with one coat of zinc chromate primer, AN Specification No. AN-TT-P-656, and two coats of aluminized lacquer.







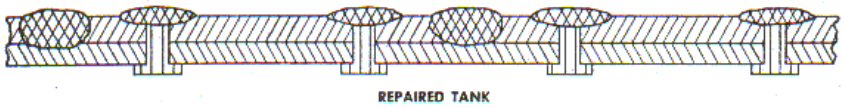


Figure 32—Fuel Tank Repair

5. DAMAGE REPAIRABLE BY INSERTION.

a. SKIN.—When damage to the fabric skin of a wing panel is too extensive to be repaired by a patch, that section of the fabric envelope sustaining the damage may be removed back to the first seam on either side of the damage and a new section inserted according to the regular practices described in section XIII of technical order AN 01-1A-1.

b. SPARS.—Damage to the wing spars, including elongated bolt holes, may be repaired by splicing in a new section. Splices are permissible anywhere on the spar except at a wing fitting and no part of a splice should overlap this point. Procedure for splicing a wing spar will be found in section XII of technical order AN 01-1A-1.

WARNING

No more than two splices will be allowed for each spar, exclusive of any splices the manufacturer may have incorporated in the original fabrication of the airplane.

c. RIBS.—Damaged or broken web members in the wing ribs must be repaired by inserting a new member. Ribs damaged at their trailing edge may be repaired by the addition of a filler block and gussets.

d. AILERON.—Cracked or broken aileron spars may be repaired by inserting a splice as illustrated in *figure 33*.

6. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS.

a. SPARS.—Wing spars must be replaced if three or more splices are necessary to make repair. Even without exceeding this limitation is may be advisable to replace spars if the equipment is available to make a satisfactory replacement.

b. WING FITTINGS AND HINGE CASTINGS.—Damaged wing root and spar fittings and aileron hinge castings should be replaced. No welding or straightening will be permitted on these parts.

c. INTERPLANE AND CENTER SECTION STRUTS.—These struts are highly heat treated assemblies and no attempt should be made to repair damaged members.

d. BRACE WIRES.—Internal wing brace wires are made of corrosion resistant steel and derive their strength from cold forming. Damaged wires should be replaced with new parts.

REPAIR MATERIALS

Repair	*Material*	*Specification*
Spars—Wing and Center Section	Douglas Fir	AN-F-7 Class N
Spar Reinforcements	Mahogany Mahogany-Poplar Plywood	15068 AN-NN-P-511
Rib Cap Strips and Braces	Spruce	AN-S-6
Rib Webs, Gussets and Reinforcements	Mahogany-Poplar Plywood	AN-NN-P-511
Wing Tip Former	Spruce	AN-S-6
Leading Edge—Wings	24ST Alclad Sheet	AN-A-13, Cond. T
Trailing Edge—Wings	24ST Alclad Extrusion—Alcoa Die No. K-1508	AN-A-13, Cond. T
Aileron Gap Former—Lower Wings	24ST Alclad Sheet	AN-A-13, Cond. T
Leading and Trailing Edges—Center Section	Mahogany-Poplar Plywood	AN-NN-P-511
Wingwalk and Wing Tip Cover	Mahogany-Poplar Plywood	AN-NN-P-511
Fabric Skin	Predoped Fabric	AN-C-113, Type I
Leading Edge Spoiler	Ash	82-3
Leading Edge, Ribs and Spar—Aileron	24ST Alclad Sheet	AN-A-13, Cond. T
Tip Trailing Edge and Tip Spar—Aileron	24SO Alclad Sheet (Heat treat after forming)	AN-A-13, Cond. A

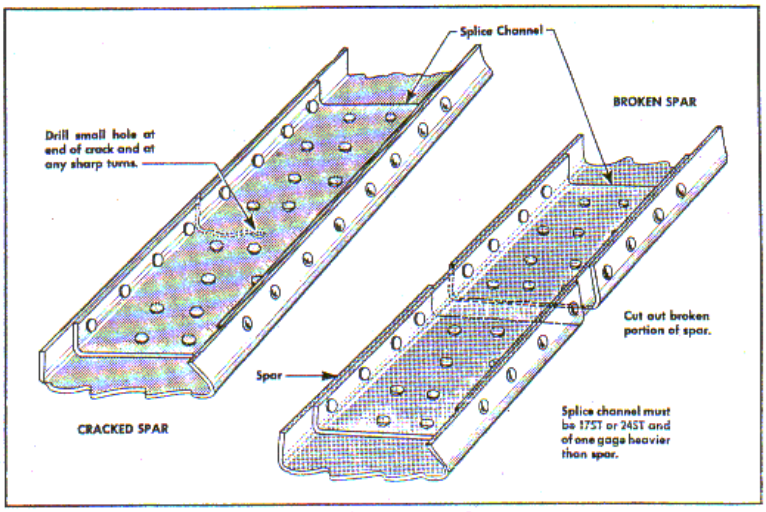


Figure 33—Aileron Spar Splice

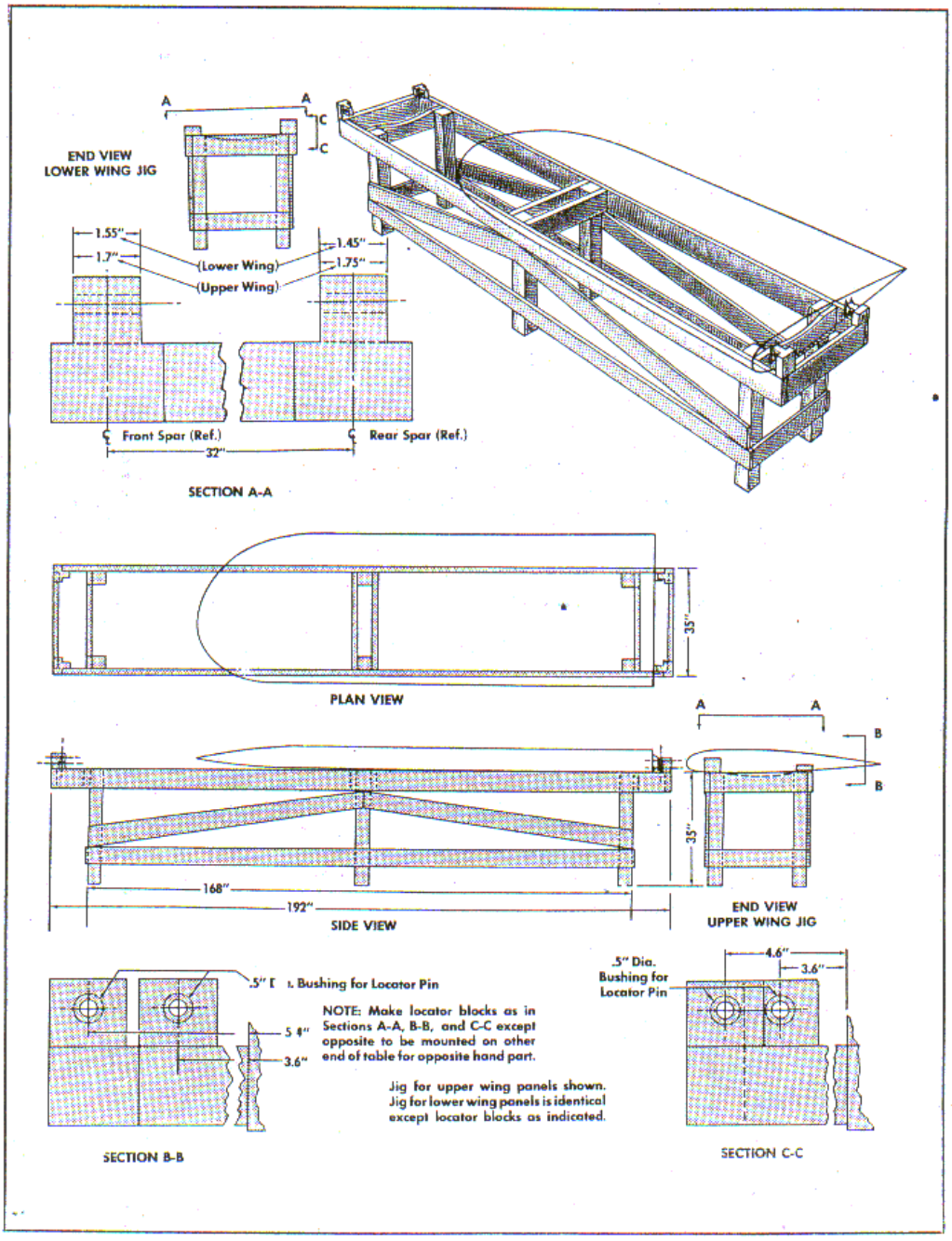


Figure 34—Upper and Lower Wing Repair Jig

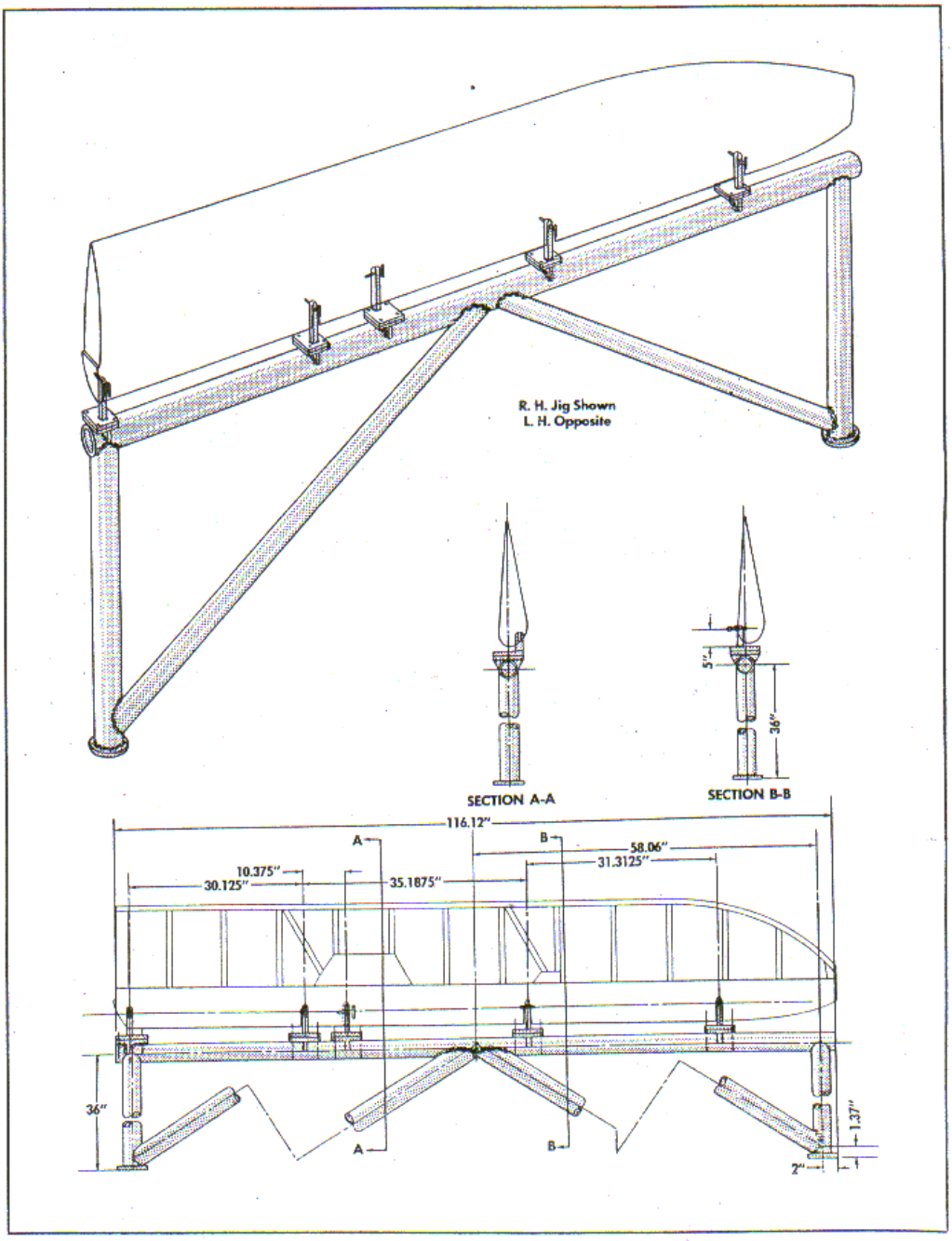


Figure 35—Aileron Repair Jig

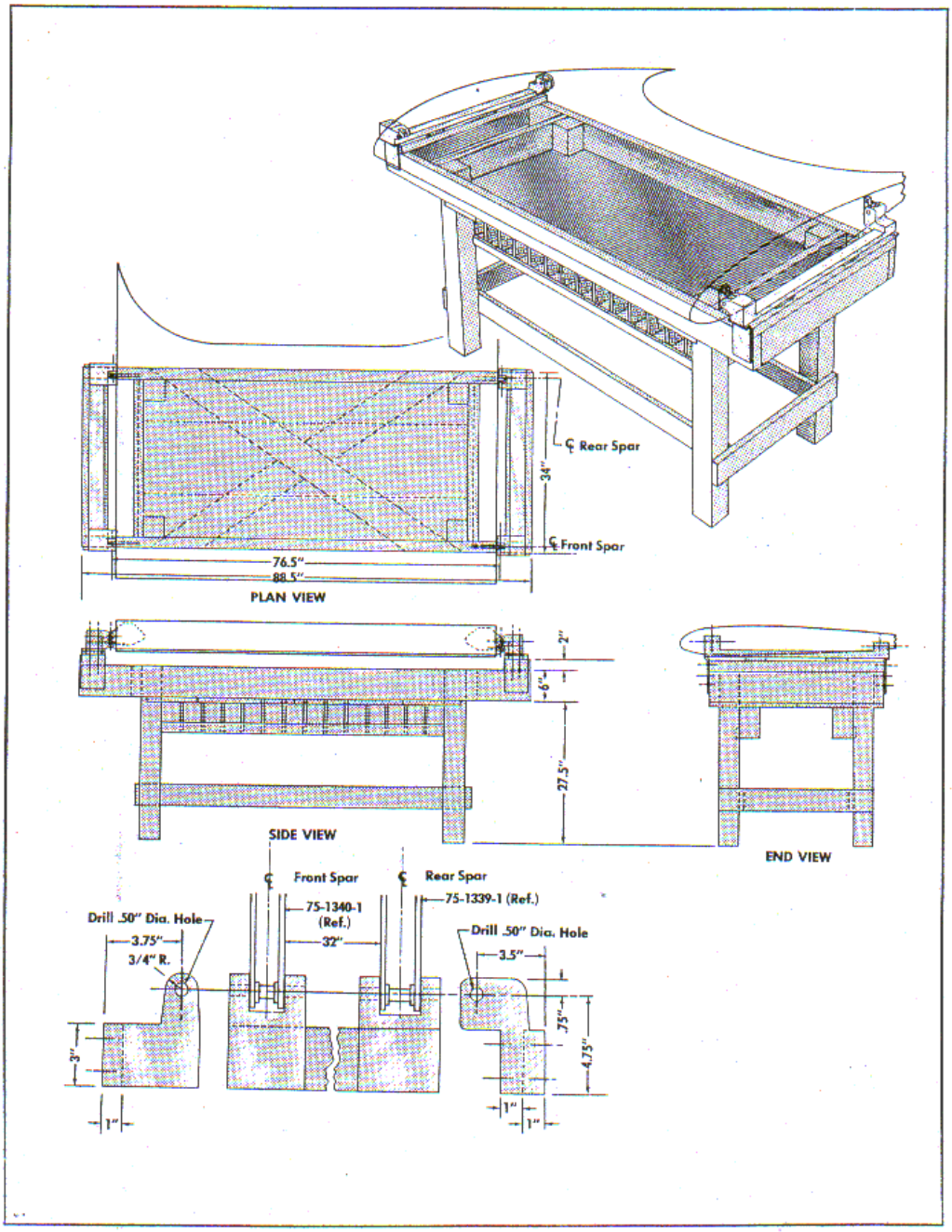
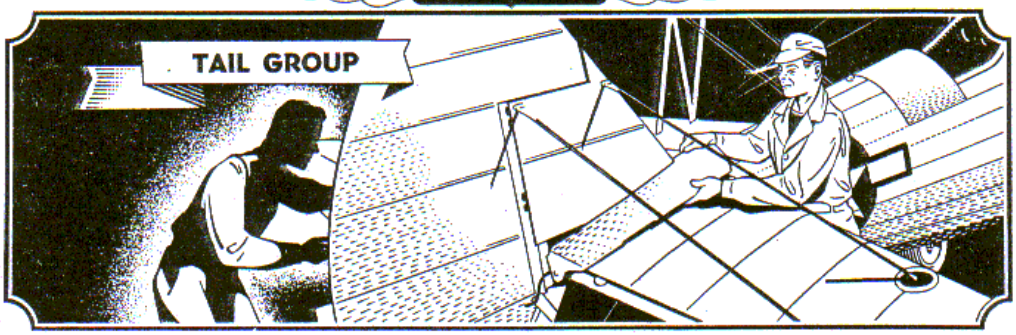


Figure 36—Center Section Repair Jig

Section III



1. DESCRIPTION.

a. GENERAL.—The entire empennage is constructed of chrome-molybdenum steel tubing with fabric covering. Leading edges, trailing edges, and the root ribs of the elevators, stabilizer, and fin are fabricated of 24ST aluminum alloy sheet. The tail surfaces are braced by AN standard, type 1, carbon steel streamlined wires.

b. STABILIZER.—The complete stabilizer is constructed as a unit and is attached to the fuselage with four AN standard bolts passing through four forged chrome-molybdenum steel lugs. *(See figure 37.)*

c. FIN.—The fin is similar in construction to the stabilizer and is bolted to the upper fuselage truss and supported by brace wires. *(See figure 38.)*

d. RUDDER.—The rudder and its mast are welded into an integral unit with a small metal trim tab attached to the trailing edge to afford ground adjustment to overcome "yaw". *(See figure 39.)*

e. ELEVATOR.—The left and right elevators are symmetrical with a control horn installed at their joining point and are of a similar type of construction as the rudder. Controllable wooden trim tabs are inset in the inboard trailing edge of each elevator. *(See figure 40.)*

2. DEFINITION OF DAMAGE CLASSIFICATION.

a. NEGLIGIBLE DAMAGE shall be considered damage that will not affect the airworthiness of the tail sections, and does not require attention.

b. DAMAGE REPAIRABLE BY PATCHING shall be considered damage that may be repaired by reinforcing a portion of the tail group structure or by patching the doped fabric.

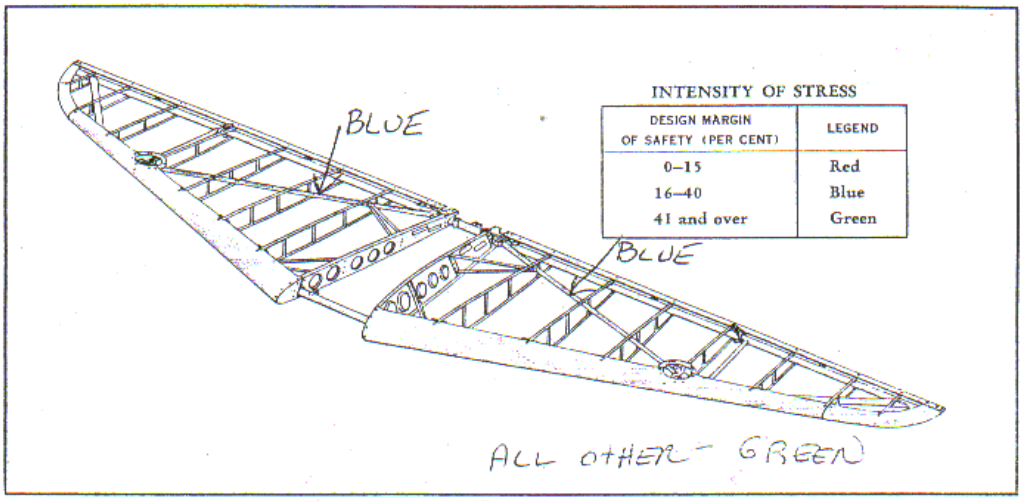


Figure 37—Stabilizer Assembly and Stress Diagram

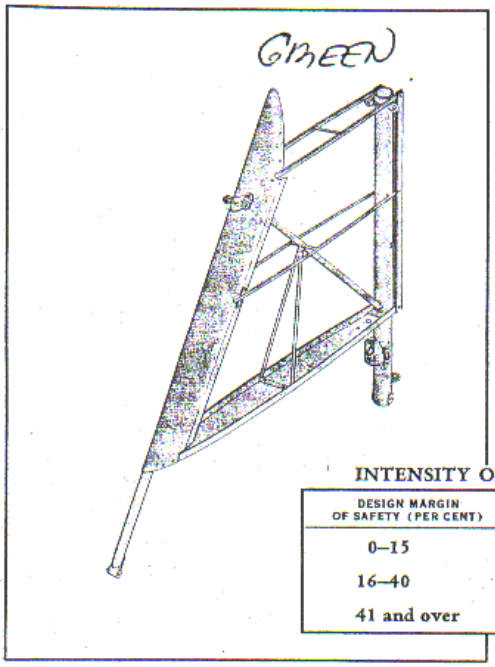


Figure 38—Fin Assembly and Stress Diagram

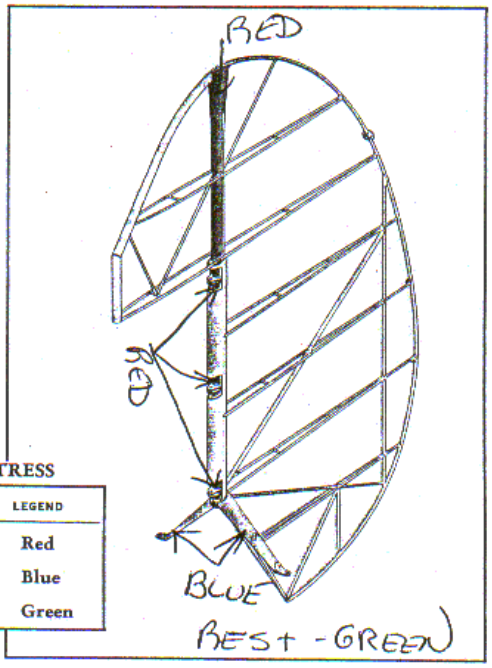


Figure 39—Rudder Assembly and Stress Diagram

c. DAMAGE REPAIRABLE BY INSERTION.—Due to the welded type of construction of the tail sections, any damage not affecting the entire frame of a section and which may be repaired by cutting out a portion of the frame and welding in a new piece will be considered repairable by insertion.

d. DAMAGE NECESSITATING REPLACEMENT OF PARTS shall be considered that damage which is unrepairable by patching or insertion and which will require the installation of a new part to the section.

3. NEGLIGIBLE DAMAGE.

Small scratches and nicks in the empennage framework and slight bends in the structure may be considered negligible providing the tube is not crushed and there are no breaks in the framework. Small holes or cracks in the leading edges of the stabilizer and fin should be stop-drilled, and small holes in the fabric skin may be repaired at the discretion of maintenance personnel. Small nicks and scratches in the elevator trim tabs should be sanded down and refinished.

4. DAMAGE REPAIRABLE BY PATCHING.

a. EMPENNAGE FRAMEWORK.—Standard structural tubing repair practices detailed in section X of technical order AN 01-1A-1 should be followed when making repairs to the empennage framework.

b. FABRIC SKIN.—Patching of the doped fabric skin shall be accomplished according to the standard methods outlined in section XIII of the general manual for structural repair, technical order AN 01-1A-1.

5. DAMAGE REPAIRABLE BY INSERTION.

a. Due to the welded type of construction, most minor damage to the tail surfaces can be repaired by insertion. The standard practices for structural tubing repair outlined in section X of technical order AN 01-1A-1 will be followed when making repairs to these assemblies, with additional information included below.

b. For repairs to the spar tubes, an inner sleeve splice is recommended due to the close clearance between framework and the surface covering.

c. The service repair jigs illustrated in *figures 41, 42, 43, and 44* are typical of the jigs recommended for use when making repairs to the tail surfaces requiring the splicing of a tube or the insertion of a new part.

6. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS.

a. STABILIZER.—Excessively bent or broken ribs, hinge fittings, attachment fittings and leading and trailing edges should always be replaced with a new part rather than repaired.

b. ELEVATOR.

(1) An elevator control horn which is damaged in any way should never be repaired but should always be replaced with a new part; however, a worn bearing may be replaced without discarding the entire horn.

(2) Damage to the elevator trim tab or hinges will require the replacement of the entire assembly, while the control horns may be replaced separately.

(3) From a standpoint of airworthiness, repairs may be made to the elevator frame to cover most any damage and replacement will be at the discretion of service personnel.

c. FIN.

(1) A cracked or broken leading edge or trailing edge strip should be replaced. No attempt should be made to repair or straighten a hinge fitting; a new part should be substituted.

(2) While most damage to any single member of the fin frame can be repaired by cutting out the damaged part and replacing it with a new one, replacement of the entire assembly will be made at the discretion of service personnel.

d. RUDDER.

(1) While most damage to any single member of the rudder frame can be repaired by cutting out the damaged part and replacing it with a new one, replacement of the entire assembly will be at the discretion of service personnel.

(2) A damaged fitting or control horn should never be repaired but should always be replaced.

REPAIR MATERIALS

Repair	*Material*	*Specification*
Skin	Predoped Fabric	AN-C-113, Type I
Fabric Strip	24ST Alclad	AN-A-13, Cond. T
Stab. Root Rib	24SO Alclad Sheet*	AN-A-13, Cond. A
Frame	X4130 or NE8630	AN-WW-T-850 or AN-T-15
Elev. Trailing Edge	24ST Alum. Alloy Extrusion	AN-A-13, Cond. T
Stab. Leading Edge Tip	3SO Alclad Sheet	QQ-A-359 Temp. A
Leading Edge—Fin Stab. and Elev.	24ST Alclad Sheet	AN-A-13, Cond. T
Elev. Spar—Rear	NE8630 Steel Sheet	AN-S-12 Cond. N
Elev. Root Rib	24SO Alclad Sheet*	AN-A-13, Cond. A
Leading Edge—Rudder	NE8630 Steel Sheet	AN-S-12 Cond. N
Fin Root Rib	24SO Alclad Sheet*	AN-A-13 Cond. A

* *Heat treat after forming.*

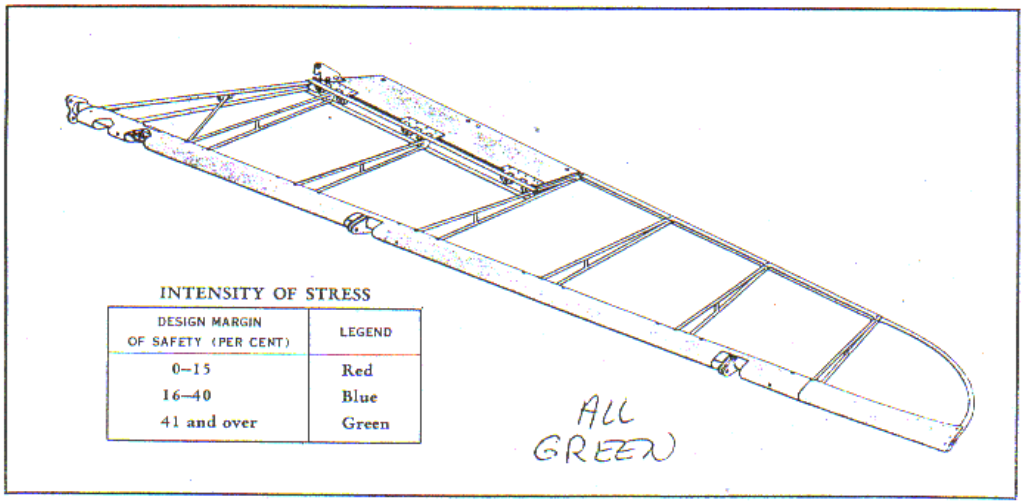


Figure 40—Elevator Assembly and Stress Diagram

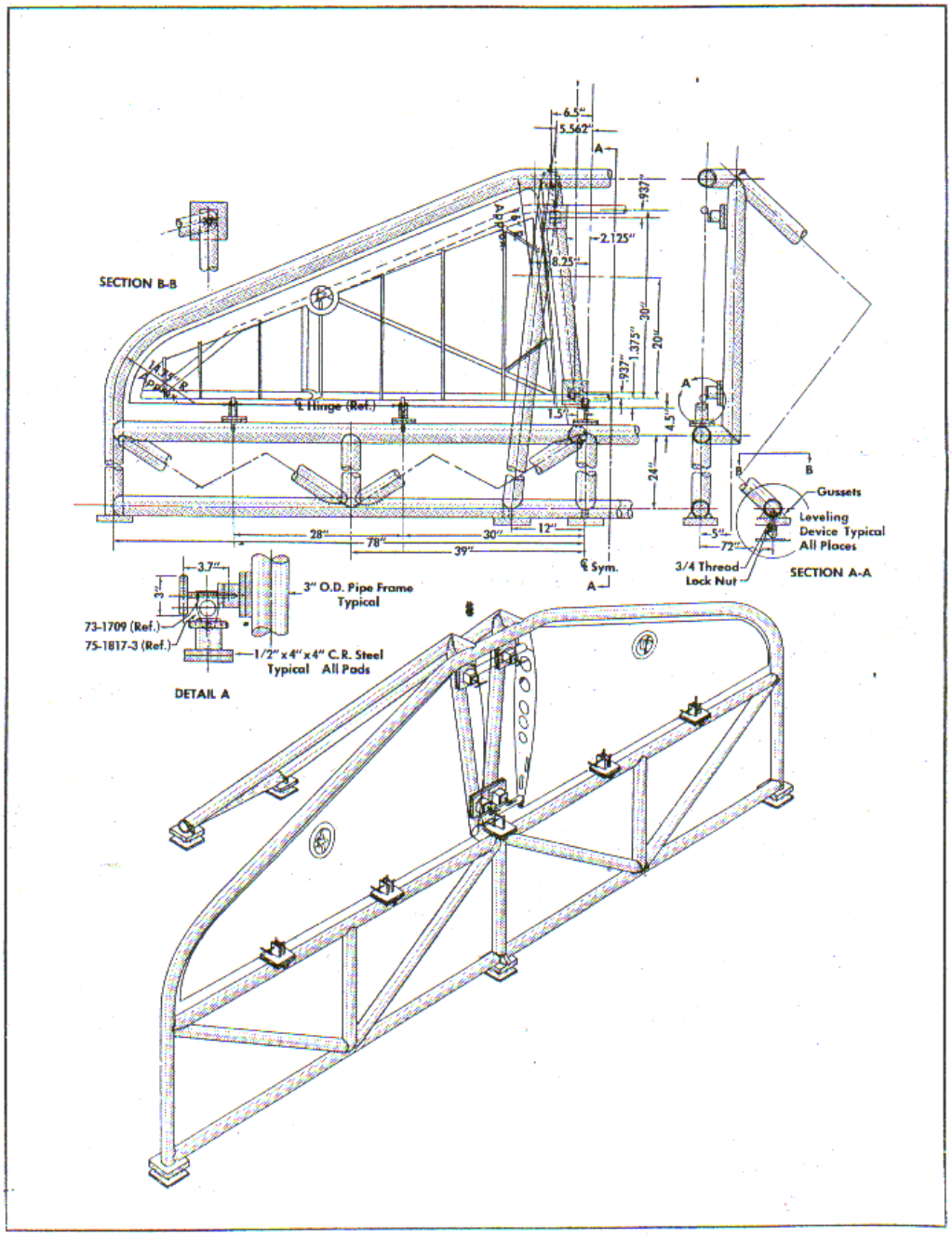


Figure 41—Stabilizer Repair Jig

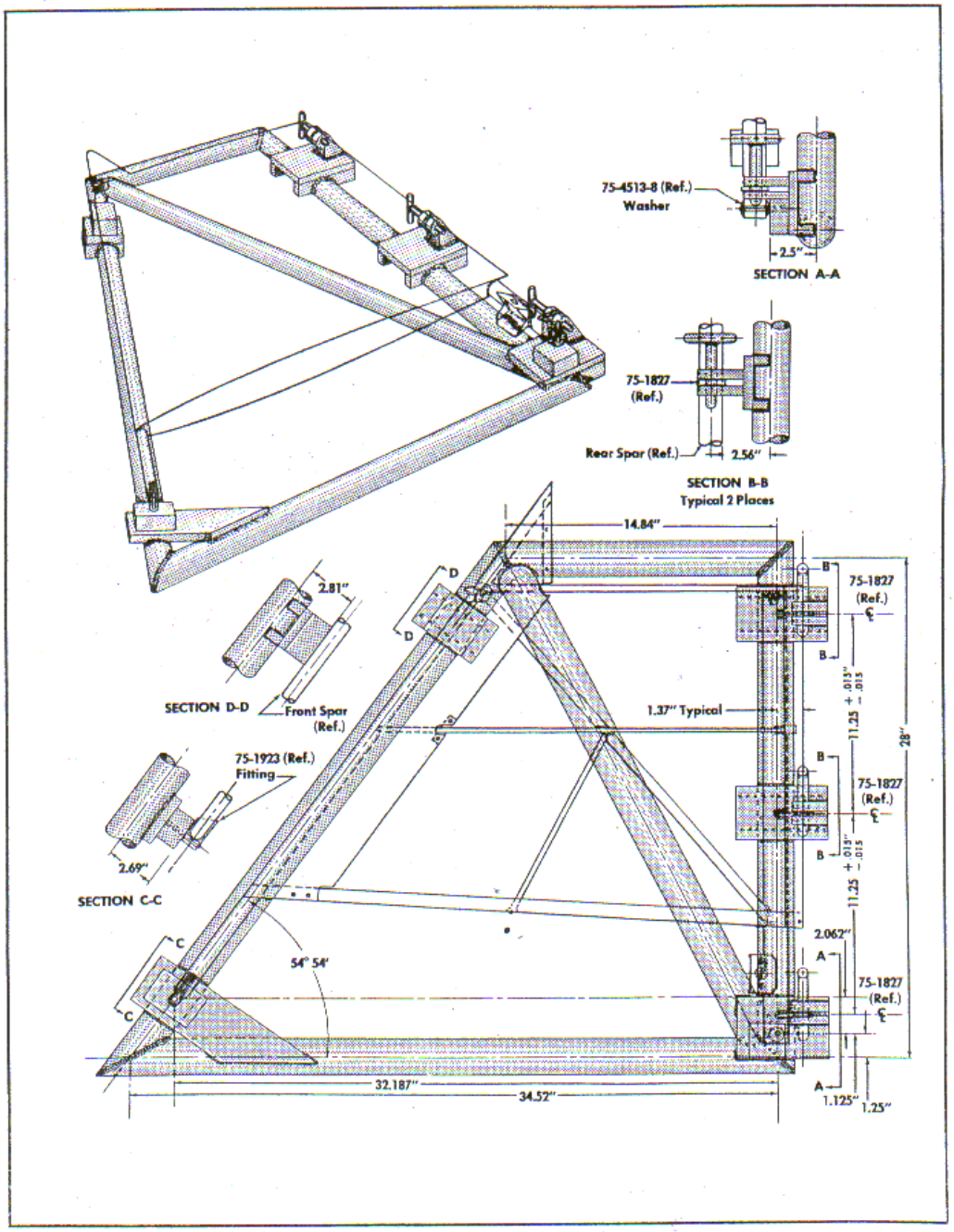


Figure 42—Fin Repair Jig

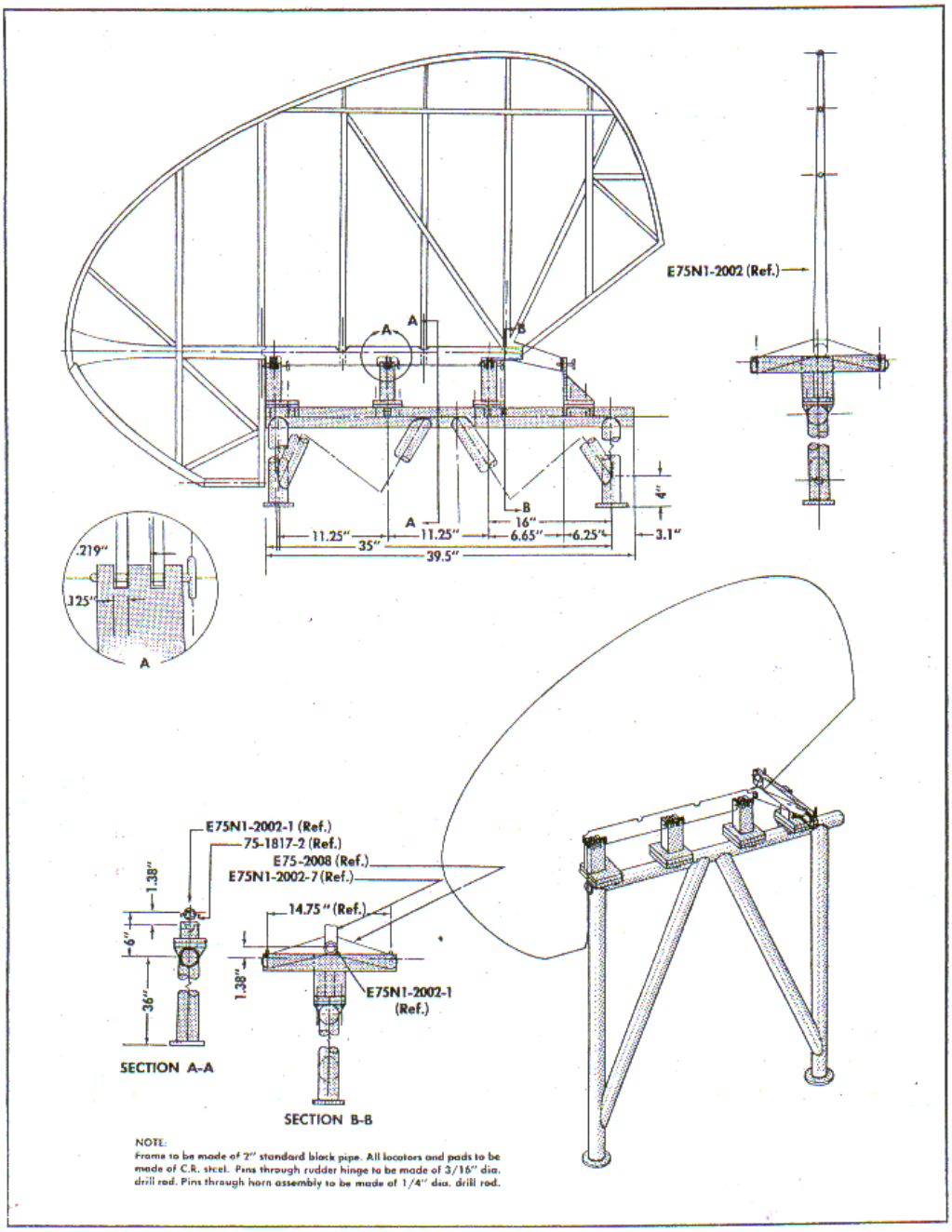


Figure 43—Rudder Repair Jig

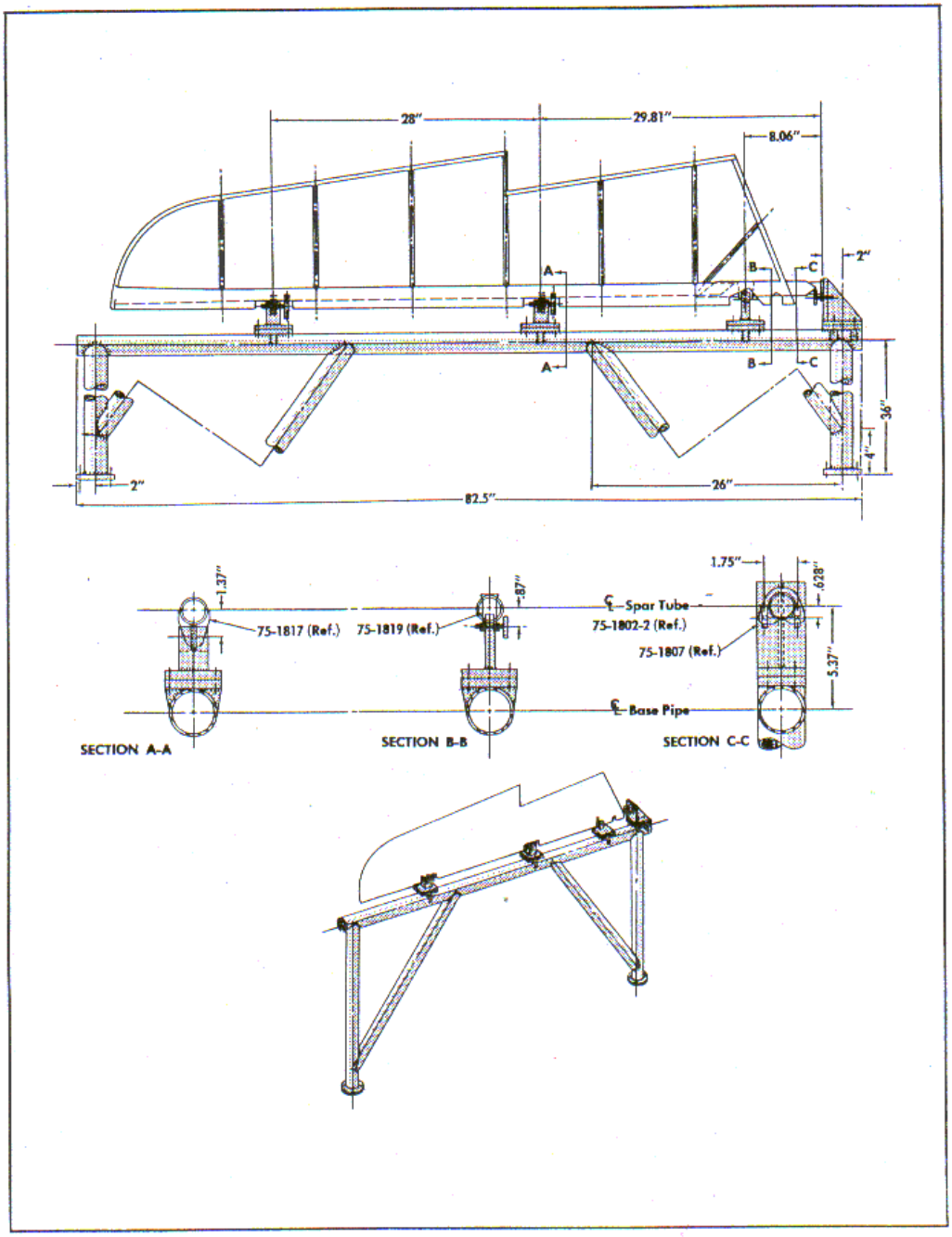


Figure 44—Elevator Repair Jig

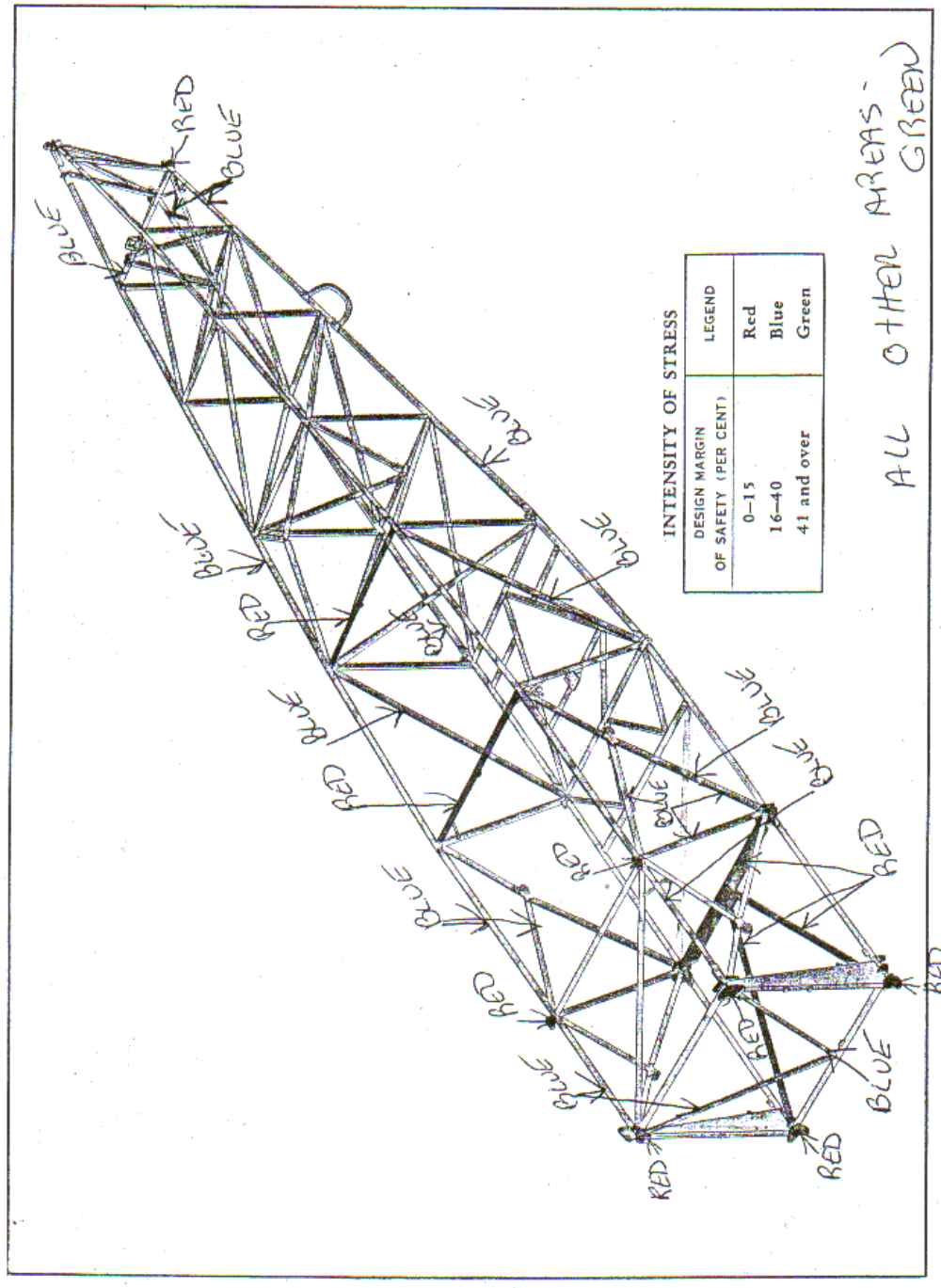
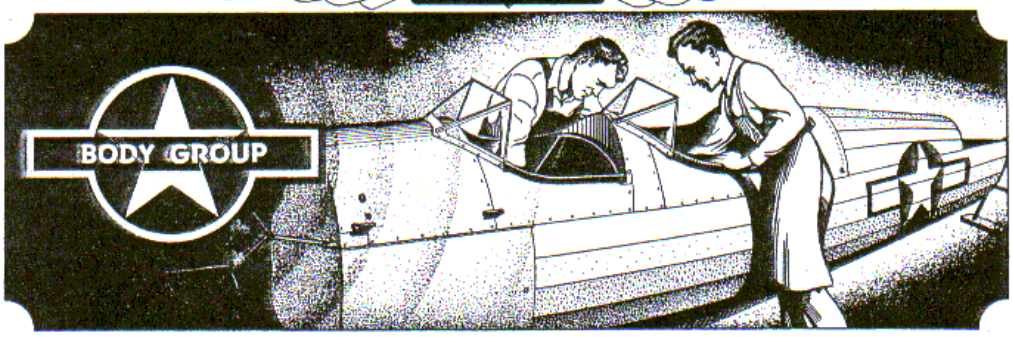


Figure 45—Fuselage Frame Assembly and Stress Diagram

Section IV



1. DESCRIPTION.

a. The fuselage frame is a welded structure constructed of X4130 or NE8630 chrome-molybdenum steel tubing with fittings for attachment of the alighting gear, lower wing, cabane struts, and flying wires provided as integral parts of the structure.

b. The cowling and fairing is formed of stamped and drawn aluminum alloy sheet. Aluminum alloy stringers and arches are riveted together and bolted to clamps attached to the fuselage structure to form the fuselage fairing over which fabric covering is applied. The cowling is suitably reinforced and provided with Dzus fasteners or screws for attachment.

2. DEFINITION OF DAMAGE CLASSIFICATION.

a. NEGLIGIBLE DAMAGE shall be considered damage that will not affect the airworthiness of the body assembly and does not require attention.

b. DAMAGE REPAIRABLE BY PATCHING shall be considered damage to the fuselage cowl or fairing that may be repaired by reinforcing a portion of the structure with a riveted patch, or damage to the fabric skin which may be repaired by sewing and patching the doped fabric.

c. DAMAGE REPAIRABLE BY INSERTION shall be considered that damage to the fuselage frame which may be repaired by the removal of a portion of the steel tubing and the splicing in of a new section.

d. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS shall be considered that damage to the body frame, fairing, or cowling which is unrepairable by patching or insertion but which may be repaired by installing a new part.

3. NEGLIGIBLE DAMAGE.

a. FUSELAGE FRAME.—Small nicks and scratches in the steel tubes and bows in the tubing which do not exceed 1/32 inch in any 12-inch section may be considered as negligible and may be repaired at the convenience of service personnel. Bent tubes should be straightened according to the methods described in section X of technical order AN 01-1A-1.

b. FUSELAGE COVERING.—The metal cowl covering the forward section of the fuselage is not highly stressed and for this reason small holes having no sharp corners, small dents, and minor cracks may be considered negligible from a structural standpoint. However, all cracks should be stop-drilled to prevent the crack from spreading.

c. FUSELAGE FAIRING.—The fuselage fairing strips are not considered structural members and slight bows and bends to these strips which do not loosen or damage the fabric skin may be considered negligible.

4. DAMAGE REPAIRABLE BY PATCHING.

a. FABRIC SKIN.—Patching of the doped fabric skin shall be accomplished according to the standard methods outlined in section XIII of technical order AN 01-1A-1.

b. METAL COWLING.—Breaks or punches in the metal cowling may be repaired by riveting on small patches where the damaged area is not large enough to merit replacement. *Figure 46* is included to identify the type and gage of aluminum alloy used in the various places. Following are the three recommended types of patches, which may be used when making these repairs.

(1) EXTERNAL PATCHES. *(See figure 48.)*

(a) Any ragged edges of the hole should first be cut away so that no sharp corners remain.

(b) A patch should be cut from material of the same gage as the skin panel or of one gage heavier. It is preferable to use 24ST or 17ST Alclad but, if this is not available, 52SH may be used provided it is one gage heavier than the original skin. The size and shape of the hole will determine the size and shape of the patch.

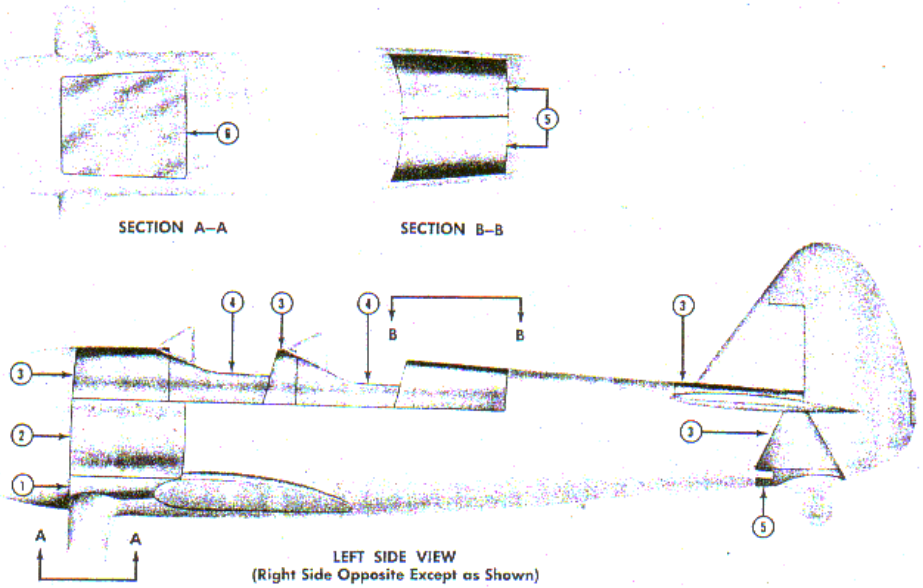
(c) The patch is to be riveted to the skin using AN430AD4 rivets and, as the skin is not stressed, no specific number of rivets is specified; however, care should be taken that enough rivets are used to hold the patch securely in place.

(2) FLUSH PATCHING FOR SMALL HOLES. *(See figure 49.)*

(a) The break or hole should be cut out to a definite symmetrical shape with all corners rounded.

(b) A reinforcement plate or doubler should be cut from either 24ST or 17ST Alclad of the same gage or one gage heavier than the panel to be patched. All corners of the doubler are to be rounded.

(c) The doubler should be riveted in place with AN430AD4 rivets.



INDEX	MATERIAL
1.	.051 24SO Al. Alloy Alclad* Alt. Mat. 051 17SO Al. Alloy Alclad**
2.	.051 24ST Al. Alloy Alclad Alt. Mat. 051 17ST Al. Alloy Alclad
3.	.025 24ST Al. Alloy Alclad Alt. Mat. .025 17ST Al. Alloy Alclad
4.	.032 24ST Al. Alloy Alclad
5.	.032 24ST Al. Alloy Alclad Alt. Mat. .032 17ST Al. Alloy Alclad
6.	.040 24ST Al. Alloy Alclad Alt. Mat. .040 17ST Al. Alloy Alclad

* Heat treat to 24ST after forming.
** Heat treat to 17ST after forming.

Figure 46—Fuselage Cowl Plating Diagram

(d) A patch the same size and shape as the cutout in the skin should be cut from the same material as the doubler. This patch should be placed in the hole and riveted to the doubler using AN430AD4 rivets.

(e) No specific number of rivets are recommended but care should be taken to fix the doubler and patch securely in place.

(3) REPAIR OF SMALL CRACKS.
(See figure 50.)

(a) Before patching small cracks in the metal skin, enough 3/32-inch holes should be drilled at the end of any crack to relieve the tear stress.

(b) A patch large enough to clear all parts of the crack by ⅞ inch should be cut from 24ST or 17ST Alclad of the same gage as the original skin or of one gage heavier.

(c) This patch should be riveted to the skin with AN430AD4 rivets. No specific number of rivets need be used but care should be taken to use enough to prevent the crack from spreading.

(4) RIVETING.—Standard riveting practices should be followed as described in section VI of technical order AN 01-1A-1.

c. STRINGERS.

(1) Cracks or breaks in the fuselage fairing stringers may be repaired by reinforcing the damaged member with an extruded section or hand formed splice.

(2) An extrusion of the same cross section as the original stringer may be used as a patch material. The reinforcement must fit smoothly into the stringer even if it is necessary to file the bulb angle and corner radius of the patch extrusion.

(3) Refer to *figure 51* for details of the patch.

5. DAMAGE REPAIRABLE BY INSERTION.

a. FUSELAGE FRAME.—The standard methods of repair detailed in section X of technical order AN 01-1A-1 for the splicing and insertion of sections of steel tubing shall be followed when making repairs to the fuselage framework. Specific repair procedures applicable to this airplane are detailed below. Specifications for a suitable repair jig are included in *figure 57*.

(1) STEEL TUBING.—Damage to a section of steel tubing in which the wall of the tube is crushed or broken may be repaired by splicing a new section of tubing with the exception of the upper seat attachment tubes which, due to their high degree of heat treatment, should never be spliced.

CAUTION

The minimum distance between a tubular splice and a tube cluster shall be 1½ times the diameter of the damaged tube.

(2) ATTACHMENT FITTINGS.

(a) Should the threads on the engine mount attachment fitting become damaged, the strength of the fitting is sufficient to permit *two* oversize stud replacements. These studs are made from 7/16 AN bolts and may be replaced by ½-inch or 9/16-inch studs. The fuselage fitting must be tapped out to the size stud being used and the engine mount end of the stud turned off to 7/16-inch diameter and threaded 7/16-20.

(b) When the maximum of two oversize studs has been used, the fuselage fitting may be repaired by inserting a replacement nut as shown in *figure 47*.

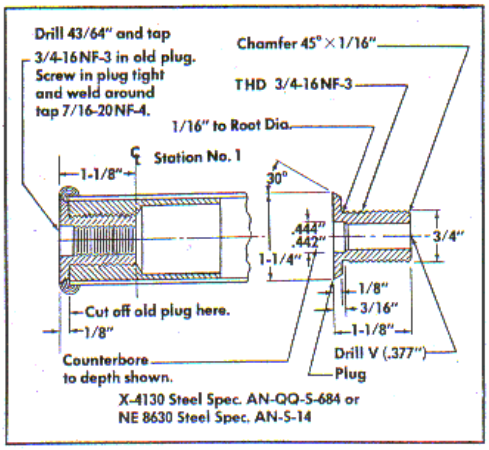


Figure 47—Engine Mount Nut Stud Replacement Bushing

(b) Worn or elongated bushings in the wing and cabane strut attachment fittings may be repaired by inserting a new bushing *(see figure 53)* and, in the instance of a cracked or broken lower wing rear attachment fitting, repair should follow the procedure shown in *figure 52*.

(c) Worn stabilizer attachment fittings may be repaired by inserting a new bushing as shown in *figure 54* and the stabilizer brace wire lug may be repaired as described in *figure 55*.

b. FUSELAGE FAIRING.—Fairing stringers which are damaged too severely to be repaired by the methods described in *figure 51* should be cut out between the arches and a new section inserted by riveting.

6. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS.

a. FUSELAGE FRAME.

(1) No repair other than replacement should be made on the cross tube behind each cockpit seat due to the high degree of heat treatment of these parts.

(2) Damage to wing and cabane strut attachment fittings, the repair to which has not been covered in paragraph 5, preceding, will require the replacement of the tube cluster.

(3) In the event the damage to a section of the frame is too great or extends over such an area not to merit repair by the methods described previously in this section, special repair assemblies illustrated in *figure* 56 are available or may be salvaged to be inserted to replace the damaged section.

b. FUSELAGE FAIRING.—Damage to the fairing arches or stringers which will cause whipping and flutter of the fabric skin and may result in tearing of the skin during flight will necessitate the replacement of the fairing assembly. Although such damage merits replacement, it still may be repaired with assembly off the airplane.

c. FUSELAGE COWLING.—Any damage to the cowling which cannot be repaired by the methods described in paragraph 4, preceding, will require replacement of that section of cowling.

REPAIR MATERIALS

Repair	*Material*	*Specification*
Fuselage Frame	X4130 or NE8630 Seamless Steel Tubing	AN-WW-T-850 or AN-T-15
Fabric Skin	Predoped Fabric	AN-C-113, Type I
Cowling	24ST or 17ST Al. Alloy Alclad Sheet	AN-A-13, Cond. T or QQ-A-351, Cond. T
Fairing	24ST or 17ST Al. Alloy Alclad Extrusion	AN-A-13, Cond. T or QQ-A-351, Cond. T
Engine Nut-Stud Bushing	X4130 or NE8630 Steel Rod	AN-QQ-S-684 or AN-S-14

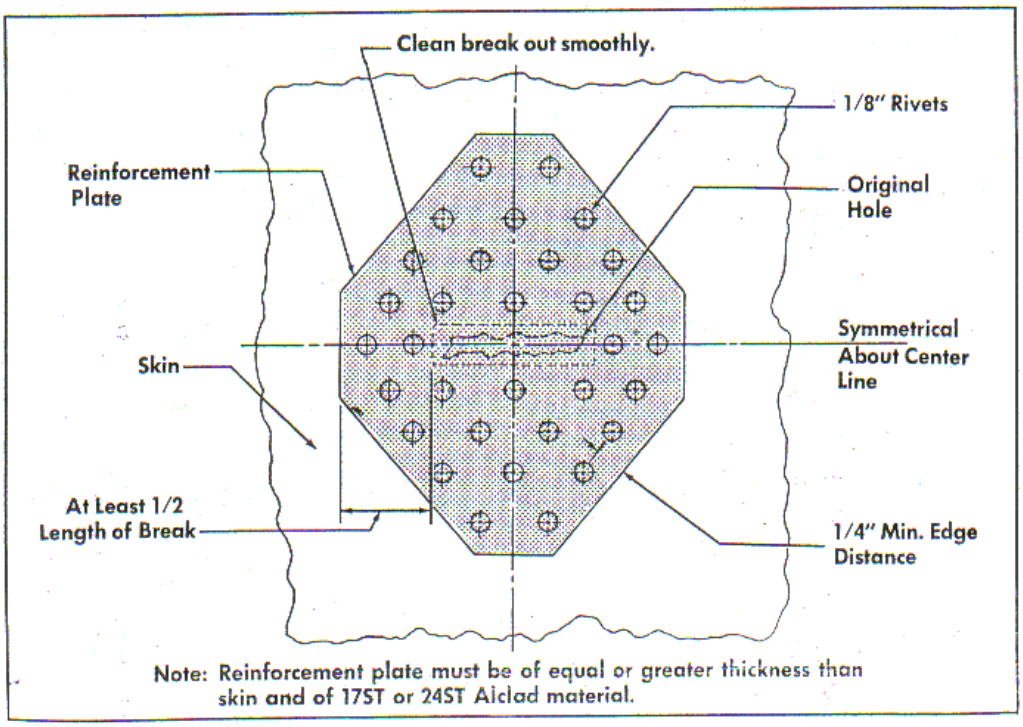


Figure 48—Typical External Skin Patch

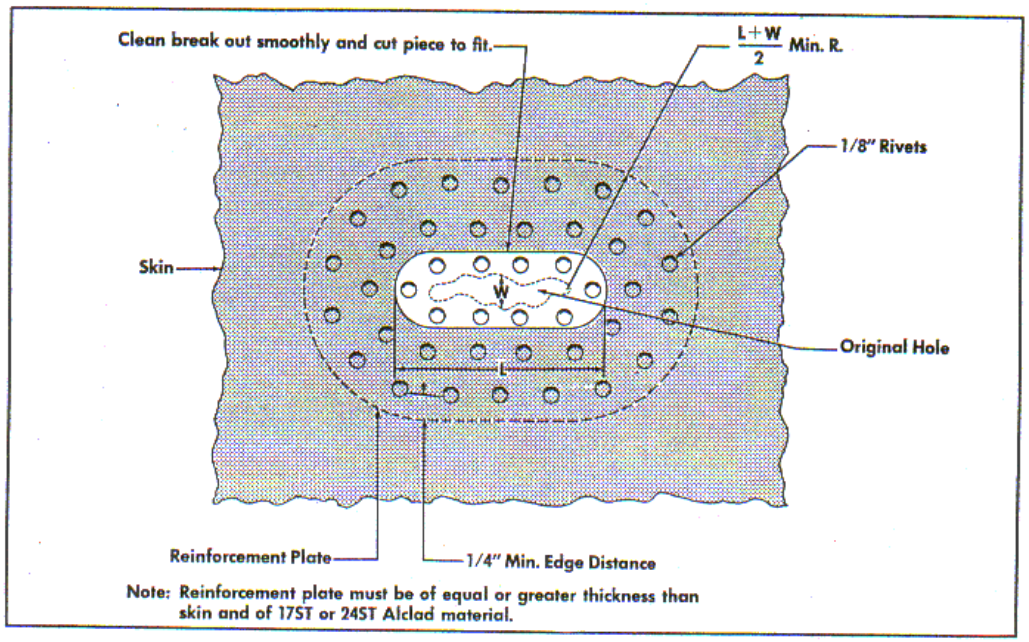


Figure 49—Typical Skin Flush Patch

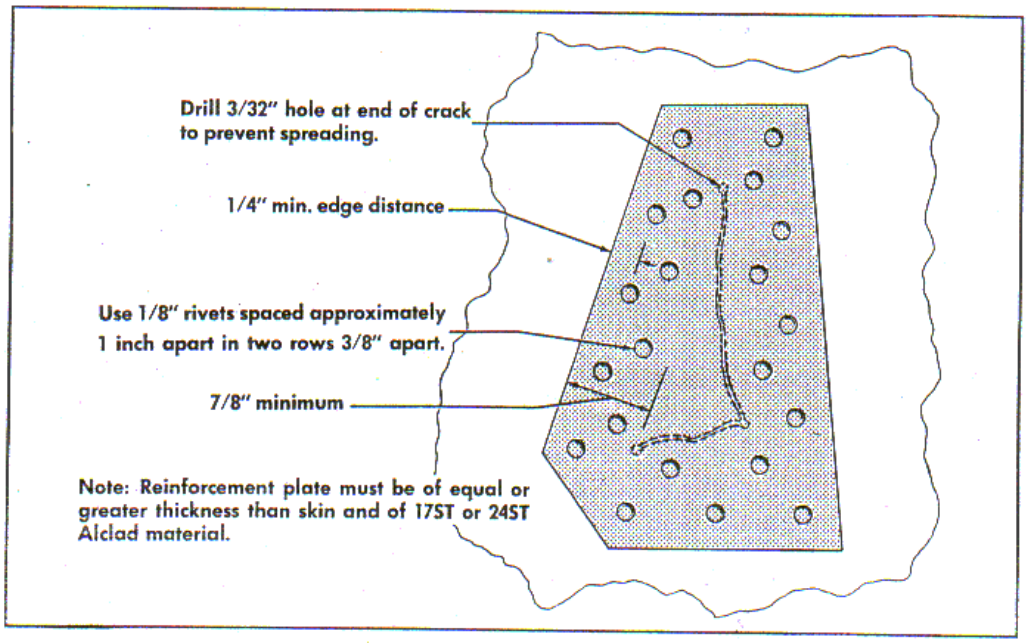


Figure 50—Typical Small Crack Repair

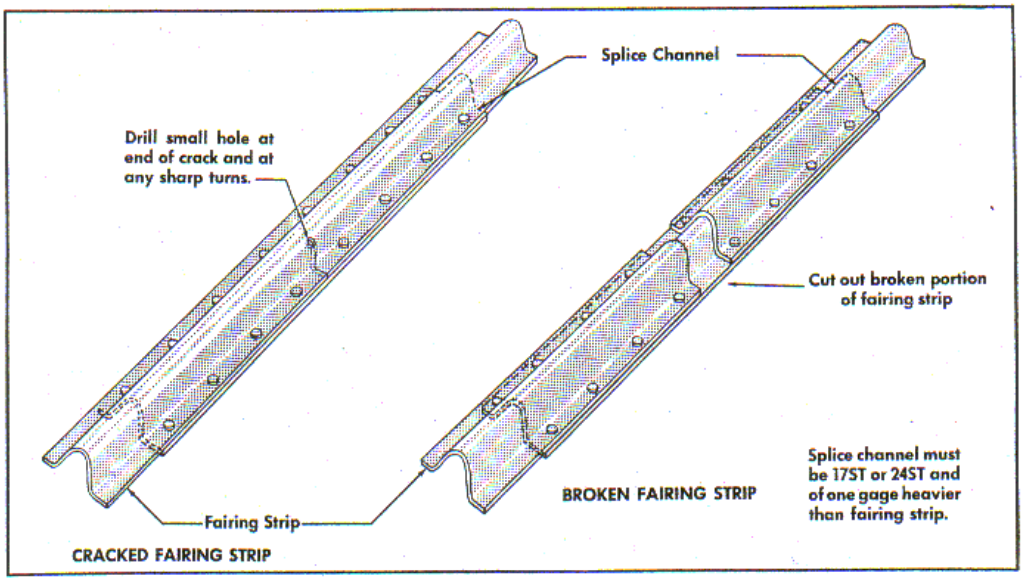


Figure 51—Fuselage Fairing Strip Repair

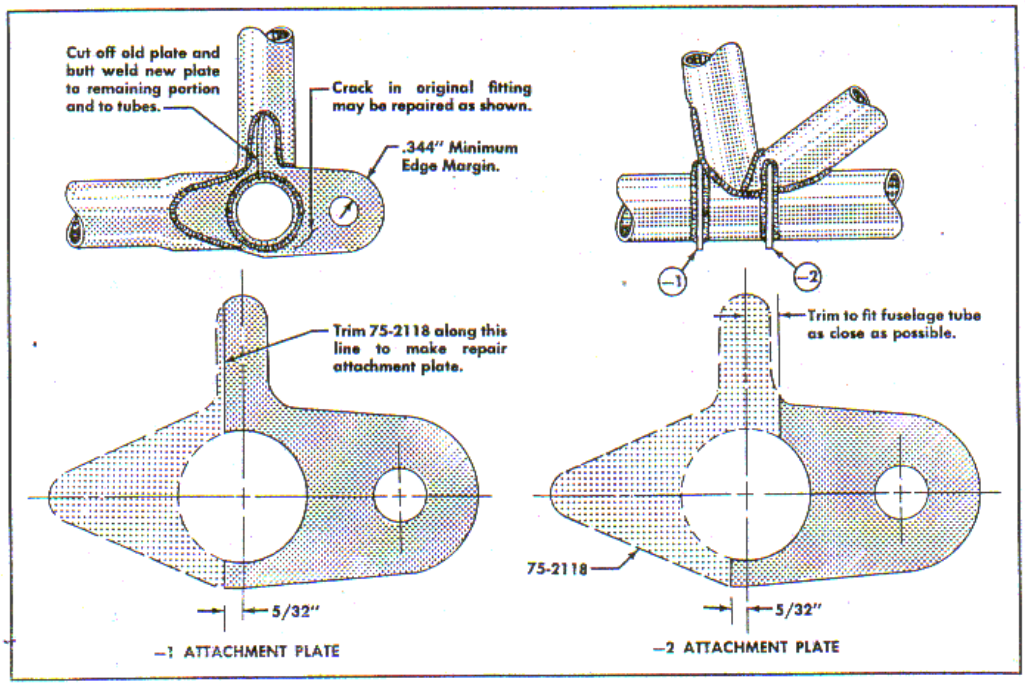


Figure 52—Lower Wing Rear Attachment Plate Repair

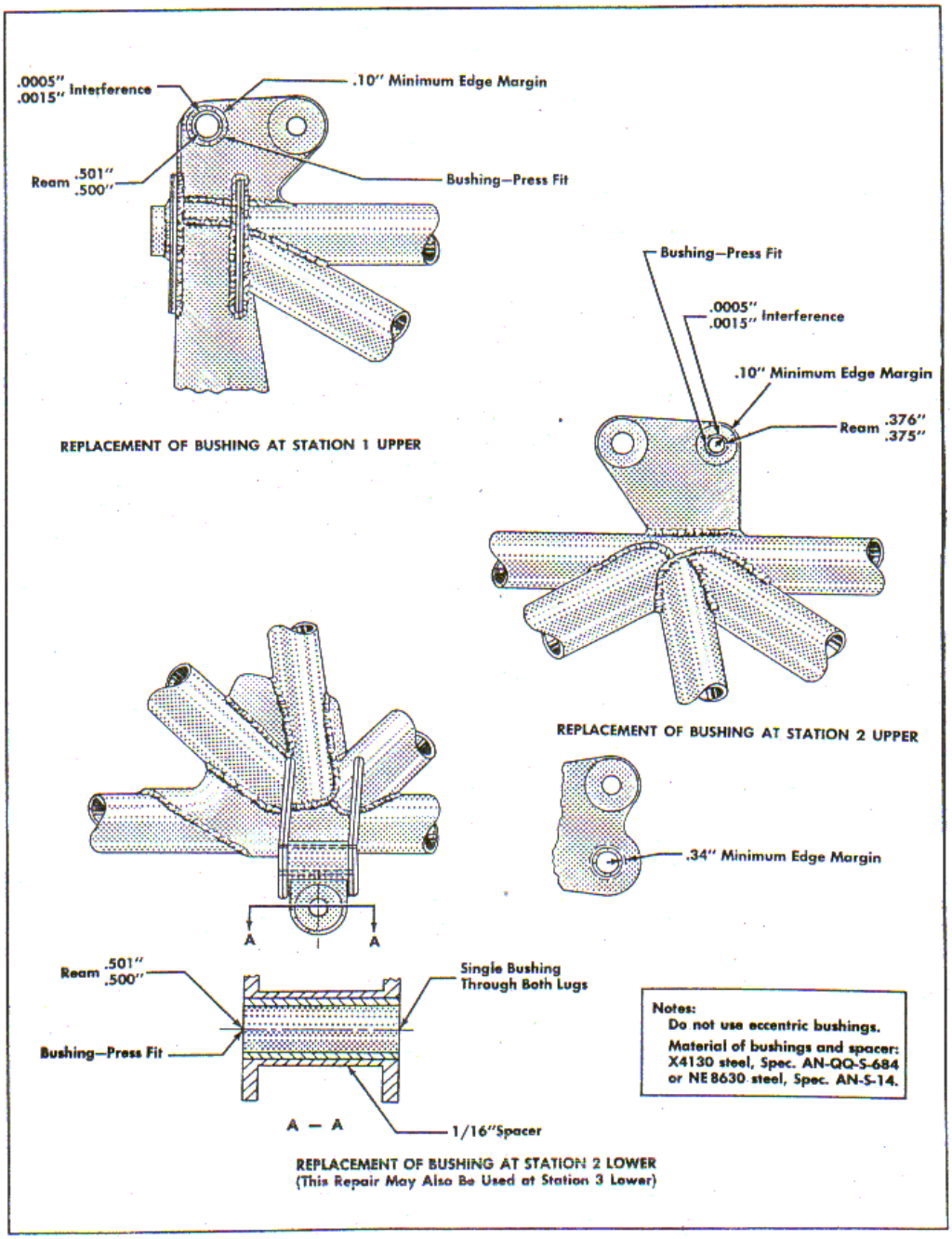


Figure 53—Wing and Strut Attachment Fitting Repair

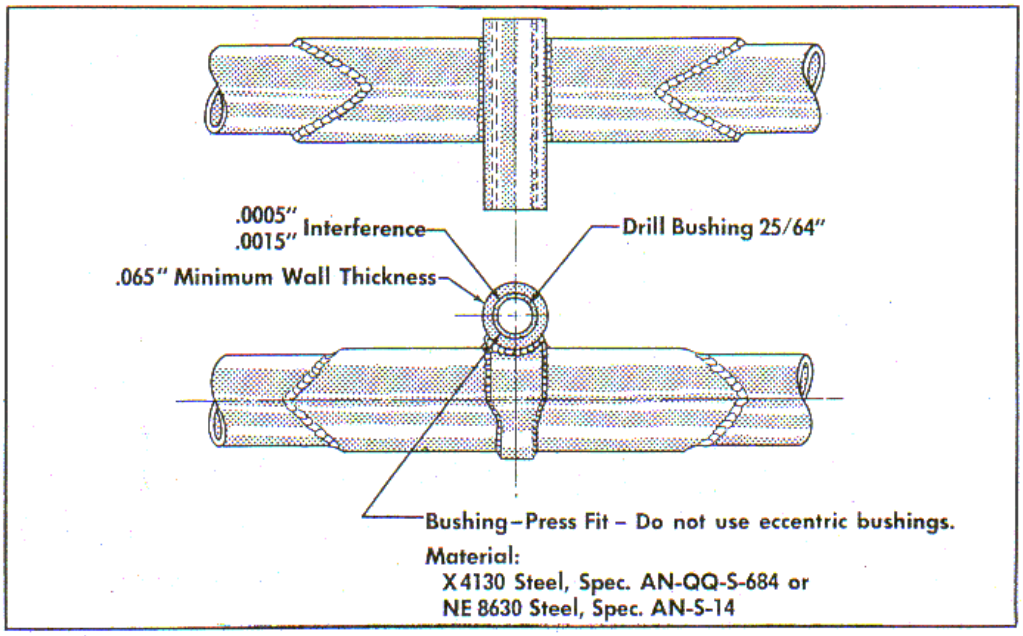


Figure 54—Stabilizer Attachment Fitting Repair

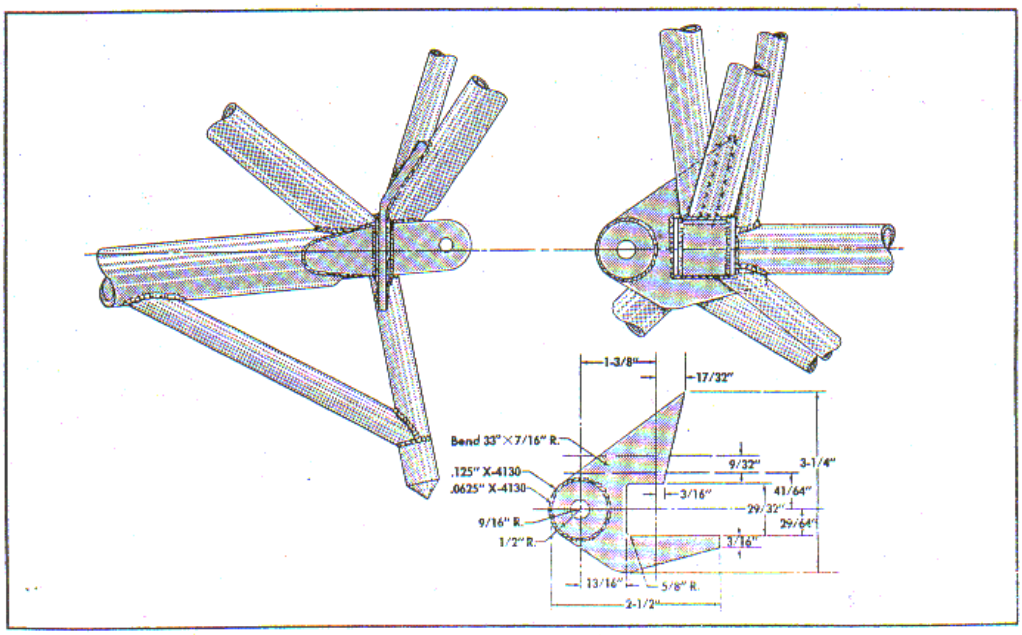


Figure 55—Stabilizer Wire Lug Fitting Repair

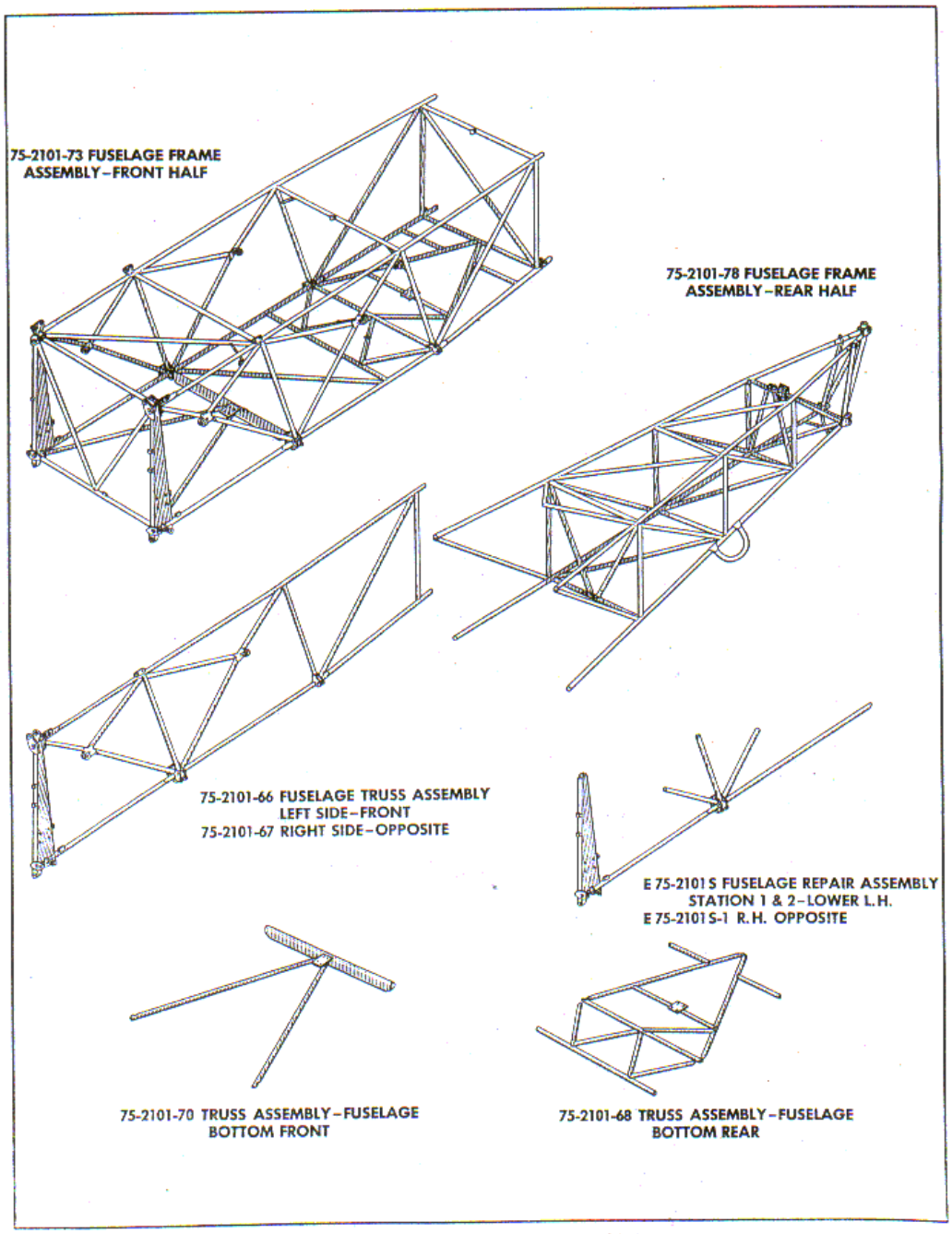


Figure 56—Fuselage Repair Assemblies

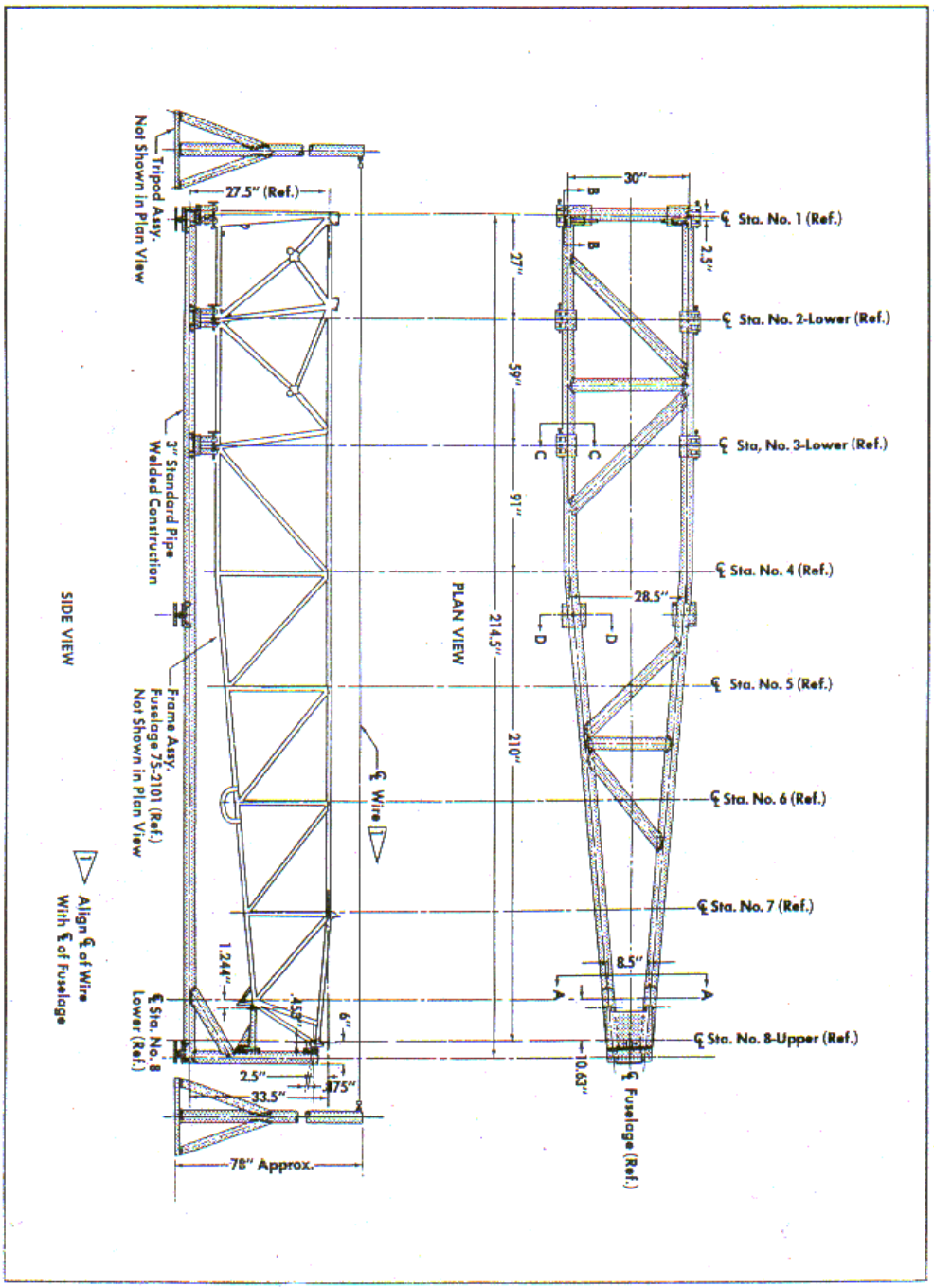


Figure 57 (Sheet 1 of 2 Sheets)—Fuselage Repair Jig

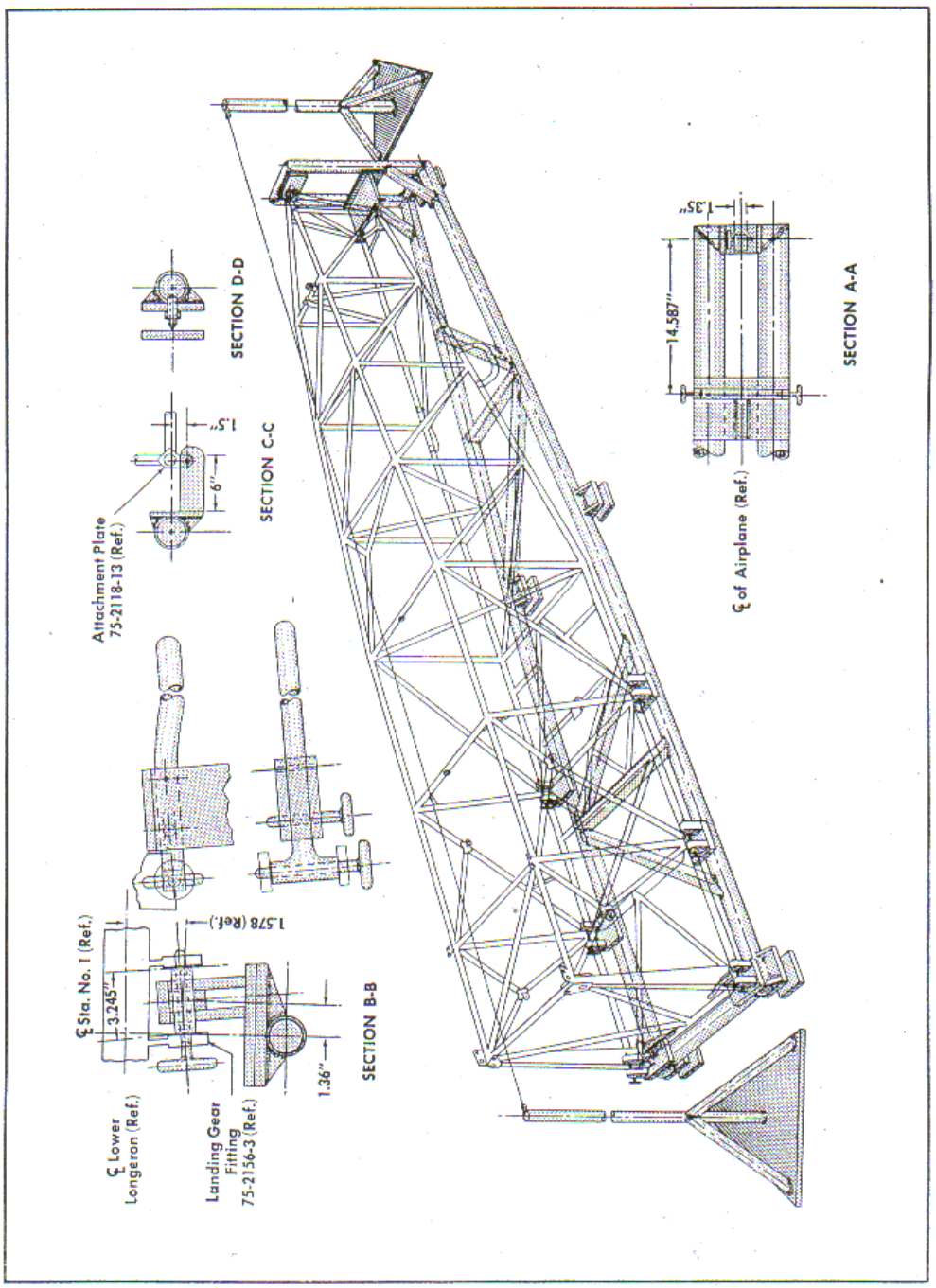


Figure 57 (Sheet 2 of 2 Sheets)—Fuselage Repair Jig

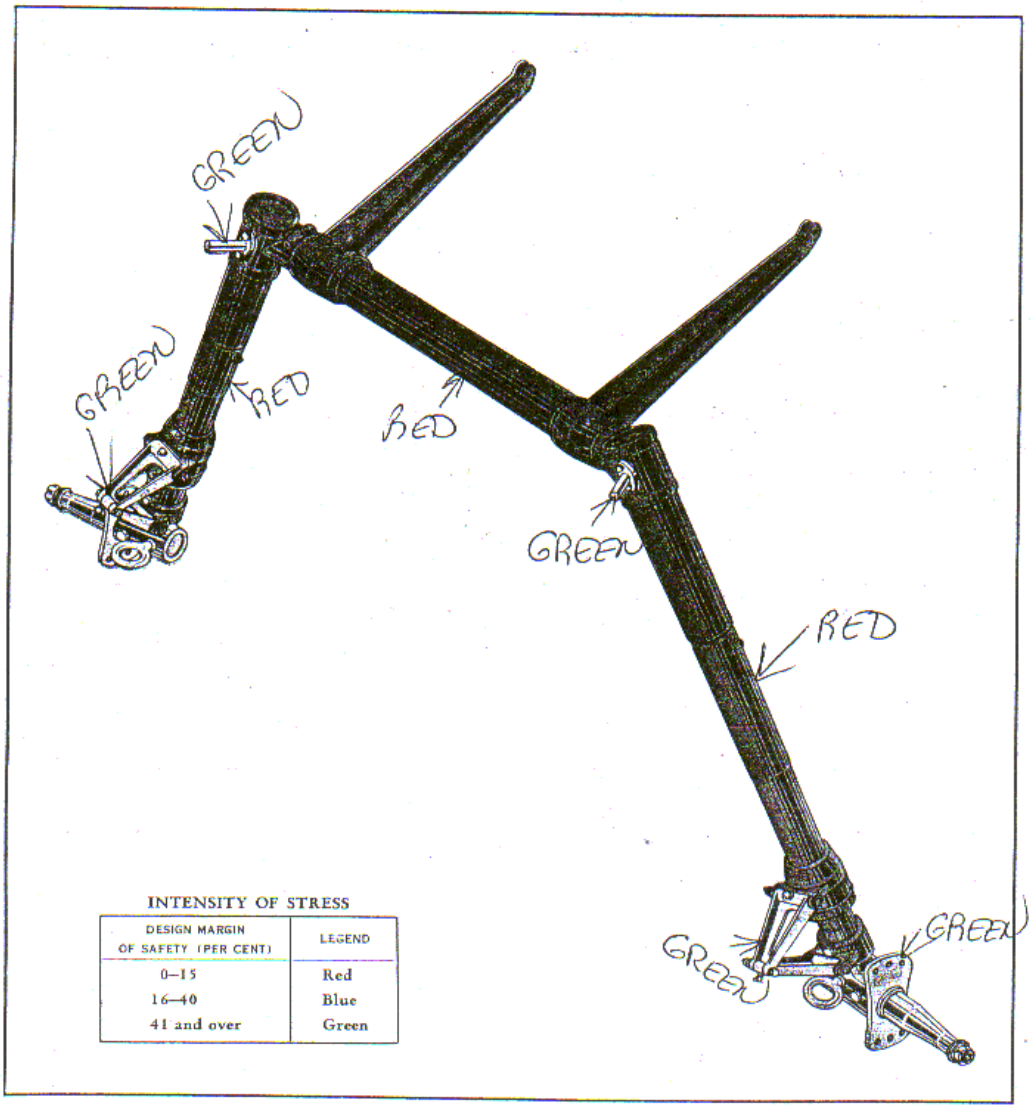
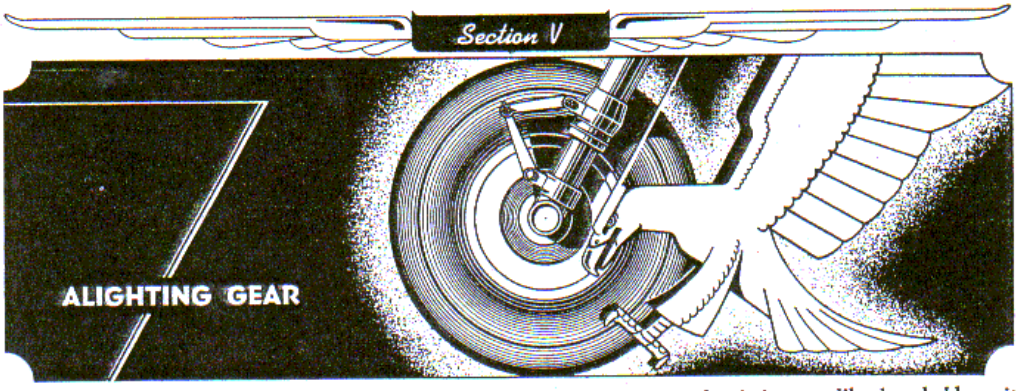
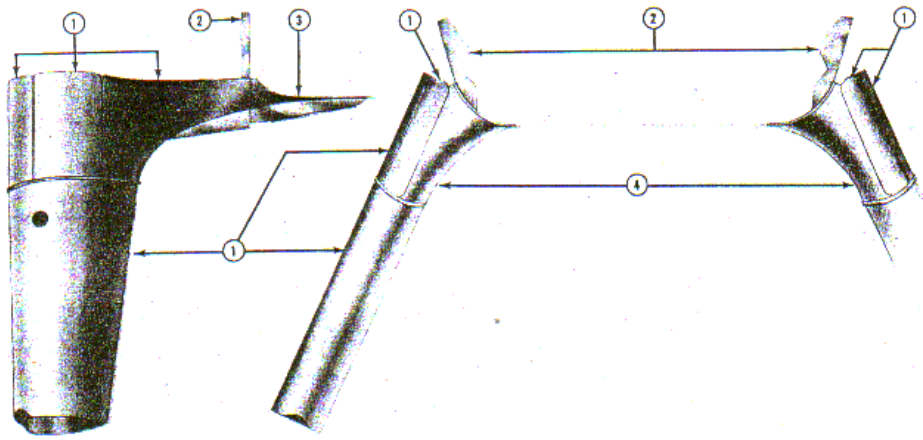


Figure 58—Main Gear Assembly and Stress Diagram



1. DESCRIPTION.

a. MAIN GEAR.—The main gear is a wheel type, full cantilever gear, incorporating 24-inch streamlined wheels, hydraulic brakes and spring-oil shock absorber struts with scissor-type torque resisting links. The main chassis is a readily detachable unit in which the shock absorber struts serve as the main members supported from the cross tube by two forged sponson knuckles. A forged axle knuckle fitted to the lower end of each shock strut contains a standard AAF type axle supporting the brake assem-



INDEX	MATERIAL
1.	.032 24ST Al. Alloy Alclad Alt. Mat. .032 17ST Al. Alloy Alclad
2.	.040 24SO Al. Alloy Alclad* Alt. Mat. .040 17SO Al. Alloy Alclad**
3.	.032 24SO Al. Alloy Alclad* Alt. Mat. .032 17SO Al. Alloy Alclad**
4.	.040 3S½H Aluminum Alloy

* Heat treat to 24ST after forming.

** Heat treat to 17ST after forming.

Figure 59—Alighting Gear Cowl Plating Diagram

bly and wheel. Two forged chrome-molybdenum heat-treated arms extend to the rear from the cross tube and the entire unit is supported at four points by suitable fittings on the lower longerons. All parts of the main landing gear are shrink or press fitted and then bolted.

b. TAIL GEAR.—The tail wheel is a full swiveling, steerable type gear incorporating an air-oil shock strut, a cantilever fork-and-post assembly, and mounting a 10-inch smooth contour tire. The tail wheel assembly is attached to the fuselage frame by a welded steel-tube trunnion.

2. DEFINITION OF DAMAGE CLASSIFICATION.

a. NEGLIGIBLE DAMAGE shall be considered damage that will not affect the airworthiness of the alighting gear and does not require immediate attention.

b. DAMAGE REPAIRABLE BY PATCHING will apply only to the alighting gear cowling and will be considered damage that may be repaired by covering or reinforcing sections of the metal cowl.

c. DAMAGE REPAIRABLE BY INSERTION.—Due to the high degree of heat treatment of the alighting gear structure, insertions will be permitted only on the tail wheel trunnion assembly.

d. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS shall be considered damage unrepairable by patching or insertion, but that which may be repaired by installing a new part.

3. NEGLIGIBLE DAMAGE.

a. Negligible damage to the alighting gear structure and to the outer cylinders of the shock struts may be identified and treated as described in technical order AN 01-1A-1, section X, paragraph 1.*b.*

b. Negligible damage to the sheet metal fairing should be treated in the same manner prescribed for the fuselage cowling in section IV, paragraph 3.*b.* of this manual; however, it should be made certain that such damage does not affect the movable parts of the gear.

4. DAMAGE REPAIRABLE BY PATCHING.

The only patching repairs allowed on the alighting gear may be made on the sheet metal fairing. The types of repair will be the same as those described for the fuselage cowling in section IV, paragraph 4.*b.*, and in *figures 48, 49, and 50*. Such repairs should not obstruct any movable parts of the alighting gear.

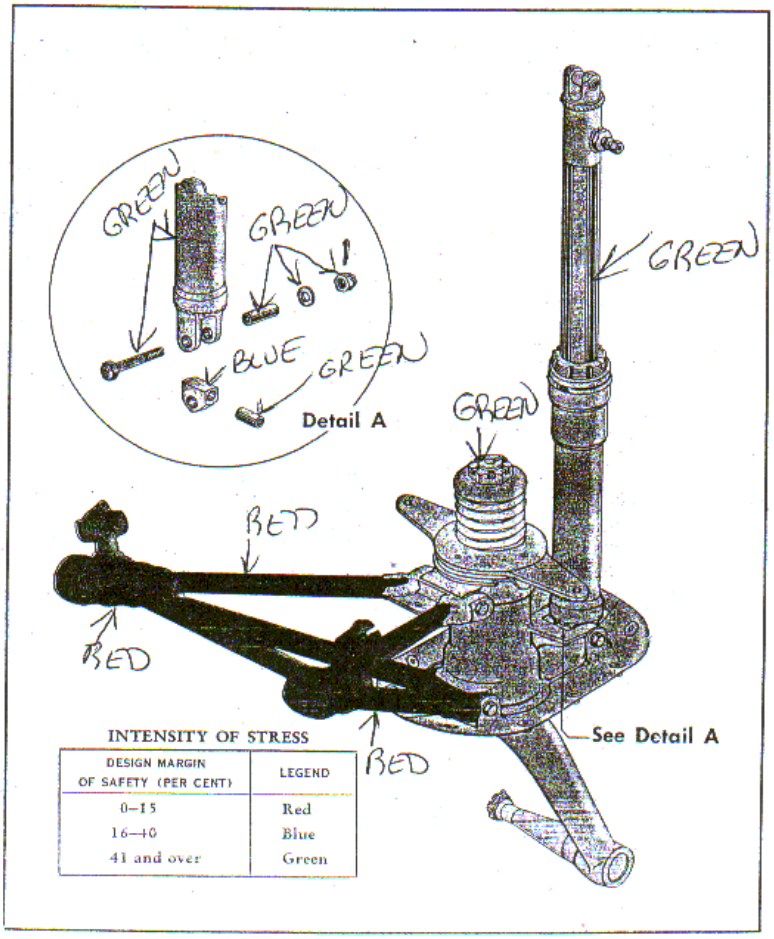


Figure 60—Tail Gear Assembly and Stress Diagram

5. DAMAGE REPAIRABLE BY INSERTION.

a. MAIN GEAR.—Due to the high degree of heat treatment and the close tolerances of the main gear structure components, any damage in excess of that listed as negligible will require the replacement of the damaged part. No repairs by insertion are recommended.

b. TAIL GEAR.—With the exception of the tail wheel trunnion, no repairs by insertion are recommended for the tail gear. The trunnion assembly may be repaired by splicing or partial replacement of the tubular structure as outlined in section X of technical order AN 01-1A-1.

6. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS.

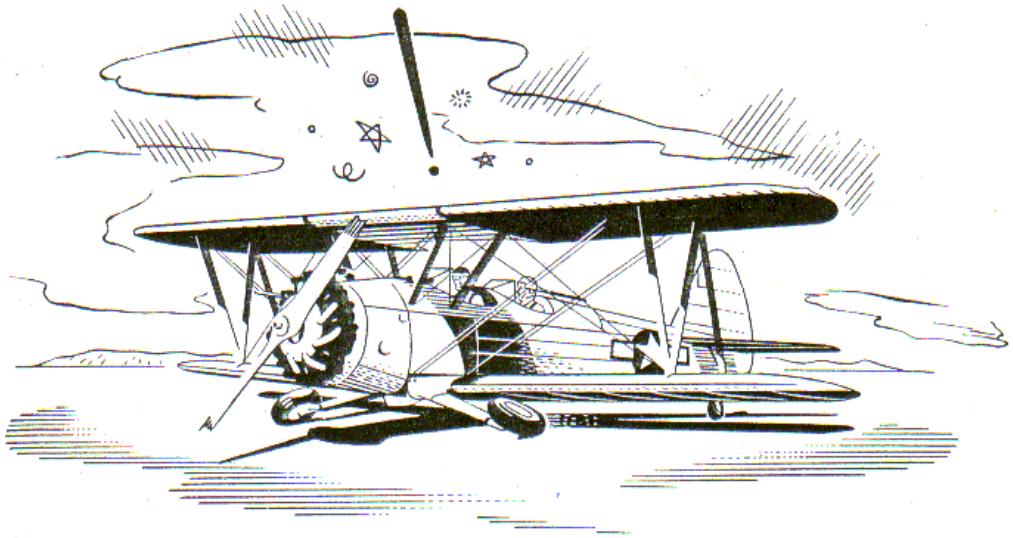
a. With the exception of the tail wheel trunnion, any damage sustained by the alighting gear in excess of that listed as negligible will necessitate the replacement of the damaged part due to the fact that the major components are highly heat treated members whose strength would be so reduced by welding as to make them unsafe.

b. The tail wheel trunnion assembly is a normalized structure, therefore the repairs described in paragraph 5.*b.*, preceding, are recommended only as temporary and the damaged assembly should be replaced as soon as possible.

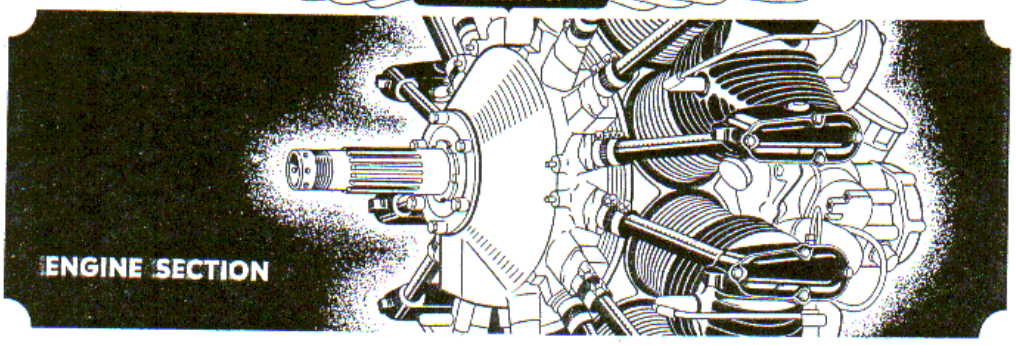
REPAIR MATERIALS

Repair	*Material*	*Specification*
Tail Wheel Trunnion	X4130 or NE8630 Seamless Steel Tubing	AN-WW-T-850 or AN-T-15
Cowling and Fairing	24ST Alclad Sheet	AN-A-13, Cond. T
	17ST Alclad Sheet	QQ-A-351, Cond. T
	24SO Alclad Sheet*	AN-A-13, Cond. A
	17SO Alclad Sheet**	QQ-A-351, Cond. A
	3S½H Alclad Sheet	QQ-A-359

* Heat treat to 24ST after forming.
** Heat treat to 17ST after forming.
See figure 59 for cowling and fairing identification.



Section VI



1. DESCRIPTION.

a. The engine section, located forward of the firewall, consists of the engine mount, power plant and accessories, oil tank, and the sheet metal cowling.

b. The engine mount is a welded structure constructed of chrome-molybdenum steel tubing with reinforcing gussets of sheet steel. Lord type shock mounts are employed in the engine attaching lugs which are welded to the ring of the structure.

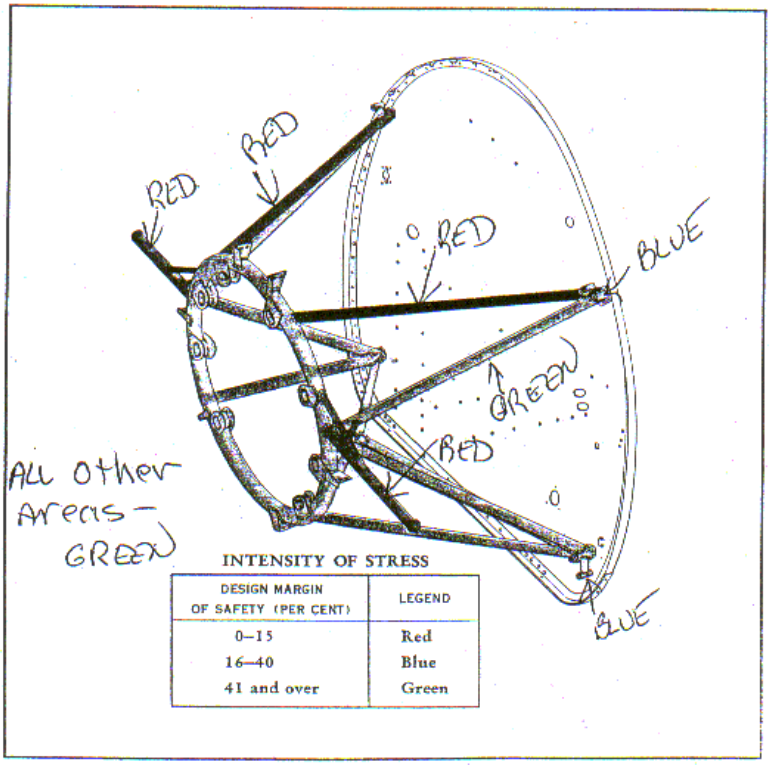
c. The engine cowling is made from stamped aluminum alloy sheet suitably reinforced and provided with quick-locking fasteners or provisions for attachment with screws. The side panels are hinged to provide easy access to the accessories compartment.

2. DEFINITION OF DAMAGE CLASSIFICATION.

a. NEGLIGIBLE DAMAGE shall be considered damage that will not affect the airworthiness of the engine section and does not require attention other than thorough inspection.

b. DAMAGE REPAIRABLE BY PATCHING shall be considered that damage which may be repaired by reinforcing the damaged structure or patching the cowling or firewall.

c. DAMAGE REPAIRABLE BY INSERTION shall be considered that damage which will require the removal and replacement of a portion of the engine mount.



INTENSITY OF STRESS

DESIGN MARGIN OF SAFETY (PER CENT)	LEGEND
0–15	Red
16–40	Blue
41 and over	Green

Figure 61—Engine Mount Assembly and Stress Diagram

d. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS shall be considered that damage which would be impractical to repair or which would render the assembly unsafe even if repaired.

3. NEGLIGIBLE DAMAGE.

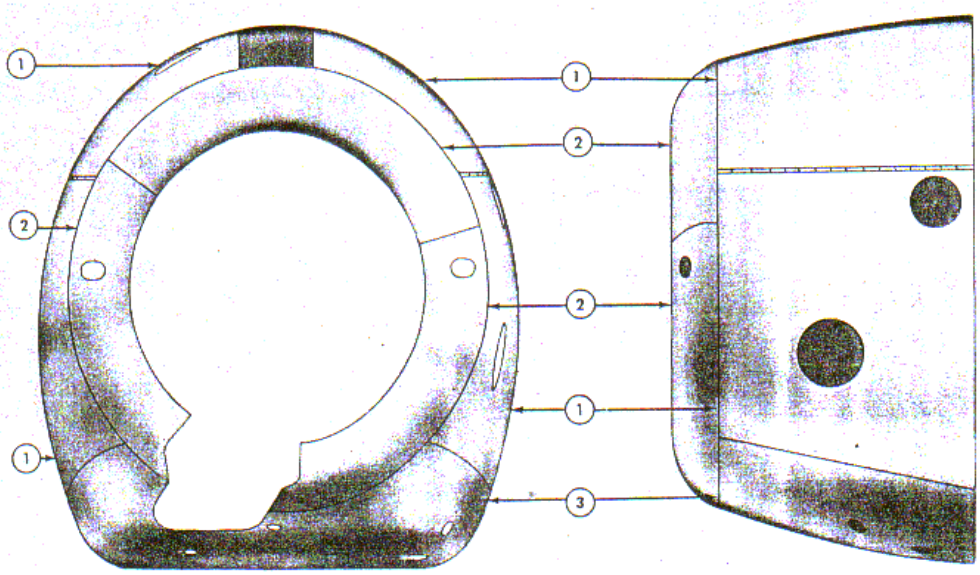
a. ENGINE MOUNT.—Since this structure is subjected to severe stress at all times, any damage will require careful inspection and due consideration. Small dents and scratches may be considered negligible if, after thorough examination, they are found not to exceed 1/32 inch and show no cracks or abrasions. All sharp nicks and scratches should be smoothed down with a fine file.

b. COWLING AND AIR INTAKE DUCT.—Dents and scratches may be considered negligible and small cracks may be stop-drilled as a temporary measure and should be patched as soon as possible.

4. DAMAGE REPAIRABLE BY PATCHING.

a. ENGINE MOUNT.—Dents, sharp scratches, and cracks exceeding the "negligible" classification described in paragraph 3, preceding, shall be repaired according to the methods outlined in section X of technical order AN 01-1A-1.

b. COWLING AND AIR INTAKE DUCT.—Small holes, breaks, or cracks in the sheet metal cowling should be repaired by the same methods outlined for the fuselage cowling in section IV, paragraph 4, of this manual. The same will apply to the carburetor air intake duct within practical limits.



FRONT VIEW LEFT SIDE VIEW

INDEX	MATERIAL
1.	.051—24SO Aluminum Alloy Alclad* Alternate Material—.051—17SO Al. Alloy Alclad**
2.	.040—24SO Aluminum Alloy Alclad*
3.	.051—24SO Aluminum Alloy Alclad*

* Heat treat to 24ST after forming.
** Heat treat to 17ST after forming.

Figure 62—Engine Cowl Plating Diagram

c. FIREWALL.—Holes or cracks in the firewall may be repaired similarly to the cowl patches illustrated in *figures 48, 49, and 50*. Cracks often occur at the point of attachment of the engine mount to the fuselage. *Figure 63* is included to give the minimum requirements and size of a patch for the lower left hand corner. This illustration is intended to be typical only and the shape of patches for the other attaching points shall be adjusted accordingly.

5. DAMAGE REPAIRABLE BY INSERTION.

Standard structural steel tubing repair methods outlined in section X of technical order AN 01-1A-1 will be followed when repairing the engine mount; however, repairs by insertion of a splice shall not be made on the engine mount ring or in a welded supporting member within three inches of the ring.

6. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS.

a. ENGINE MOUNT.—Damage to the engine mount members in excess of that defined in preceding paragraphs 3, 4, and 5 will require the replacement of that member. It should be noted that all joints of the engine mount are torch-normalized after welding and repairs should follow the same practice. Replacement of the entire assembly will be made at the discretion of service personnel.

b. COWLING, FIREWALL AND AIR INTAKE DUCT.—Damage in excess of that which would be practical to patch will require the replacement of the firewall or sections of the engine cowl or air intake duct.

REPAIR MATERIALS

Repair	*Material*	*Specification*
Cowling	24SO Alclad-Heat Treat after Forming	AN-A-13, Cond. A
Engine Mount	X4130 or NE8630 Seamless Steel Tubing	AN-WW-T-850 or AN-T-15
Firewall	24ST Alclad	AN-A-13, Cond. T

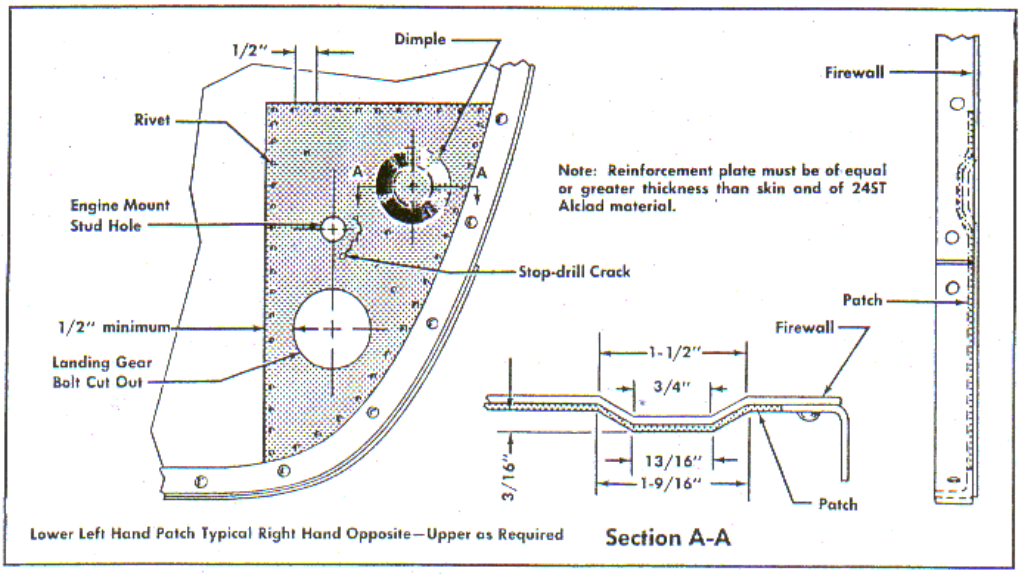


Figure 63—Typical Firewall Patch at Mounting Lugs

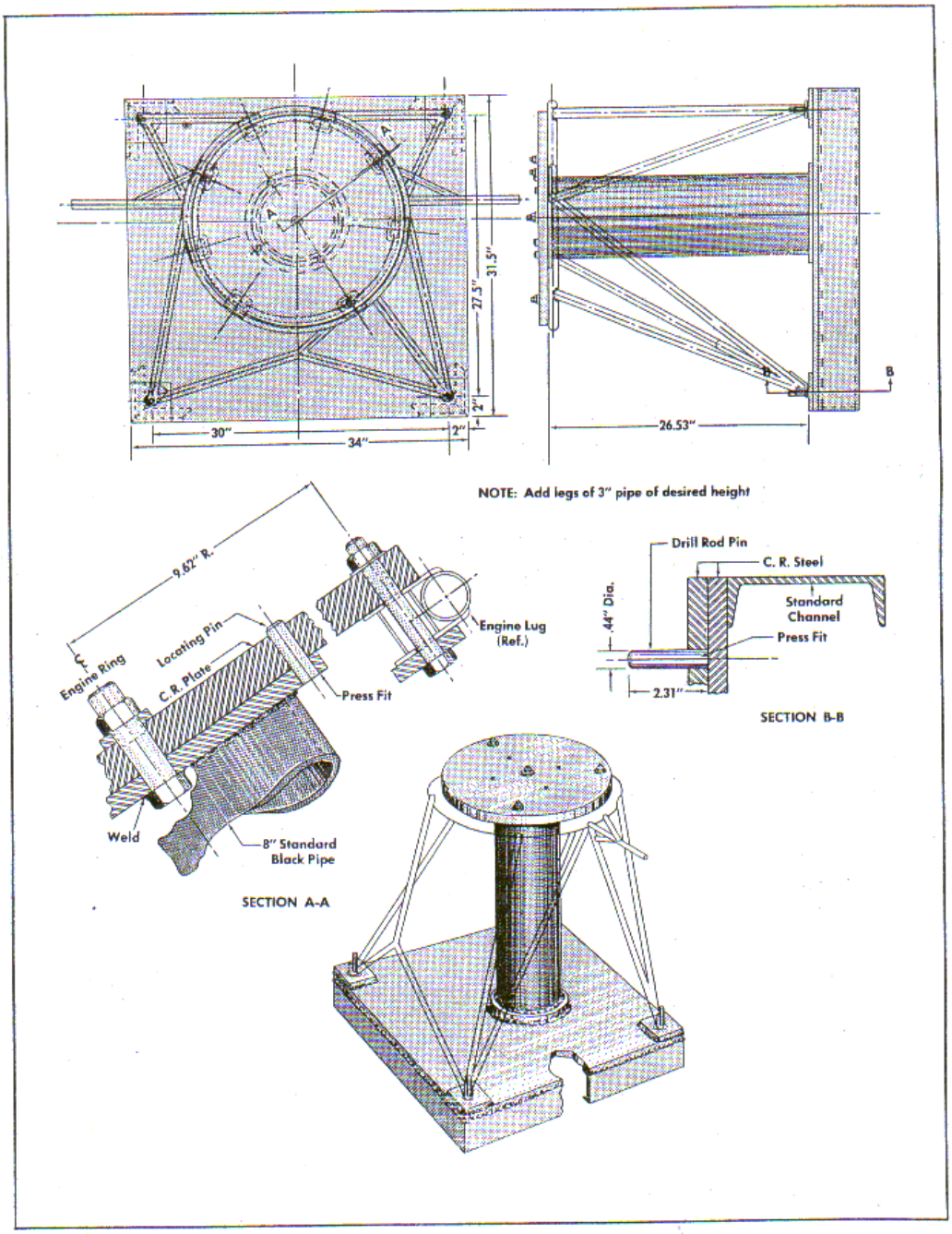


Figure 64—Engine Mount Repair Jig

Section VII

FABRIC REPAIR AND ATTACHMENT

1. GENERAL.

a. All surfaces of the PT-13D/N2S-5 airplane, except those which are enclosed in sheet metal cowling, are covered with fabric skin. The envelope method of covering is used on all surfaces except the upper wing center section, where the blanket method is employed. Application of the fabric shall conform to U. S. Army Specification 98-24108.

b. The envelope for each section shall be so designed and sewed that when it is applied to the airplane, all fore-to-aft seams shall be parallel to the line of flight and so arranged that lacing will not be through or over a seam.

c. All seams shall be plain-lap or folded-fell. The seams shall be hand-sewed at recesses, hinges, handles, or other obstructions which make it impractical to fit a machine-sewed envelope over the frame.

d. Inspection doors and windows are provided at various places on the airplane. At these openings metal frames are set in the covering, over which the door or window is attached by screws. The fabric over these openings is cut in such a manner that is best suited to the nature of the opening, and a reinforcing patch is applied with dope to the outer surface.

e. The materials required for repair or complete recovering of the airplane are listed at the end of this section.

2. FABRIC REPAIR.

All repairs to the fabric skin of this airplane should be made according to the information contained in section XIII of technical order AN 01-1A-1.

3. FABRIC ATTACHMENT.

The information on fabric attachment procedures contained below is intended to be supplementary to U. S. Army Specification 98-24108, according to which this airplane is covered, and to the general manual for structural repair, AN 01-1A-1, section XIII. Only those practices peculiar to this airplane have been included, other information being contained in the above mentioned documents. Doping procedure is to follow U. S. Army Specification 98-24100.

a. WINGS.

(1) UPPER AND LOWER PANELS.

(a) The envelopes for the upper and lower wings should be laid out to fit the wing contour with all seams, except around the wing tip, running parallel to the ribs. The rear seam is to coincide with the wing tip seam at the inboard edge of the wing tip.

(b) The upper wing tip should not be sewed at the landing light position, and the lower wing should not be trimmed or sewed at the aileron cut-out.

(c) All plywood covering should be sanded to remove rough varnish, after which the envelope may be slipped over the wing beginning at the wing-tip end and working inboard.

(d) The wing tip should be stay-tacked in just enough places to hold and it should be made certain that all seams are in correct alignment.

(e) The lower side of the upper wing envelope and the upper side of the lower wing envelope should be stretched toward the root rib and stay-tacked on the root side. All seams should be inspected to see that they are in place after which the fabric should be

tacked permanently. This operation should then be repeated on the opposite side.

(f) On the lower wing the cover should be stretched aft and over the aileron cut-out former strips and stay-tacked, leaving two or three inches of the fabric for later trimming.

(g) The cover should be laced to the wing ribs using reinforcing tape ⅜ inch wide over the top of the ribs between the fabric and the stitching. The tape and stitching shall not extend over the leading or trailing edges and the rib stitch spacing shall conform to section XIII of AN 01-1A-1.

(h) Two-inch surface tape should be doped on at all rib locations and seams. Celluloid drainage grommets must be doped on at each side of each rib along the lower side of the trailing edge and at the openings provided at the root rib. Surface tape 3¾ inches wide shall be doped along the leading and trailing edges and around the wing tip.

(i) Heavy-duty patches with their metallic frames should be doped on at the inspection openings. The first coat of clear dope is then applied by brush.

(j) After this coat of dope has dried, a one-inch strip of canvas tape should be doped over the leading edge of the root rib and a one-inch canvas strip, pre-doped before pinking, doped completely around the wing root.

(k) On the lower wing, the fabric around the aileron cut-out should be trimmed to a ½-inch minimum edge and permanently tacked to the wood strip under the upper former strip. Surface tape 2¼ inches wide should be applied over the upper and lower former strips and over the fabric edge.

(l) The fabric at the lower wing tip hand holes should be slit and doped to the wood frame after which a patch is doped to the wing surfaces around the hand holes.

(m) The remaining two coats of clear dope and three coats of aluminized dope shall then be applied with an absolute minimum drying time between coats of 30 minutes, temperature and humidity conditions being favorable.

(2) CENTER SECTION.

(a) The blanket method of covering is used in fitting the fabric skin to the center section due to the large fuel tank cut-out on the upper side. The blanket should be of sufficient size to cover the leading and trailing edges from spar to spar and the side of each root ribs.

(b) The end which is to be the trailing edge of the blanket should be folded over, inside out, and machine sewed to fit the curved contour of the trailing edge former. It is then trimmed to a one-half inch minimum edge and this edge is folded over and machine-stitched again.

(c) The cover should then be turned right side out, slipped over the trailing edge, and tacked along the seam in just enough places to hold. It should then be stretched and tacked to the lower side of the root ribs, working progressively from rear to front until the front edge can be tacked permanently to the wood strip along the upper side of the front spar. The fabric should then be tacked to the rear spar tacking strip.

Note

It is advisable to slit the fabric at the points where the strut and brace wire fittings protrude *after* the fabric has been permanently tacked to all places.

(d) With the fabric cut around the wing root fittings, it should be trimmed to the contour of the root ribs with sufficient margin left to be turned under and tacked around the rib outside edge.

(e) Reinforcing tape is to be laced over the ribs and patches are to be applied with dope at the fuel line and sump fitting positions, fuel gage and rear-view mirror positions, and around the strut and brace wire fittings. The hand holes should be cut out and the loose fabric doped to the wood formers around the holes. Two and one-fourth inch surface tape is then doped over the ribs from leading edge to trailing edge and completely around the root ribs. Surface tape 3¾ inches wide is applied to the leading and trailing edges. Surface tape is also applied along the tacked fabric edge at the tank cut-out.

(f) Drainage grommets are to be doped on at each side of the ribs forward of the rear spar and along the lower surface of the trailing edge at the places that water is most likely to collect. The first coat of clear dope may then be applied.

(g) A reinforcing patch of canvas 1 inch wide is to be doped around the outside of the root ribs to serve as a chafing strip.

(b) The remaining two coats of clear dope and three coats of aluminized dope shall then be applied with an absolute minimum drying time of 30 minutes between coats, temperature and humidity conditions being favorable.

(3) AILERONS.

(a) The aileron envelope is to be machine sewed along the trailing edge and around the outboard tip curve up to the outboard rib. The envelope is then slipped over the aileron frame, starting at the tip end, and with all seams aligned, it should be stretched inboard and hand stitched to the root rib. The fabric will have to be trimmed and folded under at the leading edge of the root rib. A patch should be cut to fit this area.

(b) One-half inch reinforcing tape should be laced over the ribs up to the leading and trailing edges.

(c) The outboard edge should be trimmed and hand stitched after which a patch is applied with dope.

(d) Surface tape, 2¼ inches wide around the ribs and 3¾ inches wide along the leading and trailing edges, should be applied with dope.

(e) The fabric at the hinge points and at the control horn location should be slit and doped back into the recesses and a patch applied around the opening.

(f) Drainage grommets should be doped on at all necessary locations after which the remaining coats of clear dope and aluminized dope are applied.

b. TAIL SURFACES.

(1) STABILIZER.

(a) The fabric covering for the stabilizer consists of two opposite envelopes, machine sewed along the trailing edge and around the contour of the leading edge. Each envelope is drawn tightly over the root rib and hand sewed with a baseball stitch along the lower edge of the rib.

(b) Fabric attachment strips are attached with screws along the trailing edge of the stabilizer.

(c) Heavy duty canvas patches are used at each inspection window, brace wire attaching points, and at the trailing edge hinge points. Fabric patches are applied to the covering over the screw heads along the leading edge, on the inboard side of the root rib around the nose, and at the rear over the tab control cable cut-outs.

(d) Covering and doping practices common to all sections of the empennage are described in paragraph (5), following.

(2) ELEVATORS.

(a) The envelope for the elevators is formed to fit the curved contour of the trailing edge, outboard tip, and the trim tab cut-out. It is machine sewed along the trailing edge and along the leading edge to approximately 30 inches inboard of the elevator tip. The balance of the leading edge seam is hand sewed with a baseball stitch after the envelope is pulled over the frame.

Note

A heavy duty canvas strip should be doped to the leading edge of the elevator before the envelope is installed over the frame.

(b) The envelope is to be stretched toward the root rib and hand stitched over the root rib and the outboard edge of the trim tab cut-out.

(c) Fabric patches are to be applied with dope over the leading edge hinge points and tab control cut-outs before the fabric is cut out around these points. A patch should also be doped on at the point where the tab control cable extends through the upper and lower skin surfaces.

(d) Covering and doping practices common to all sections of the empennage are described in paragraph (5), following.

(3) FIN.

(a) The fin envelope is formed of two equal fabric panels cut to the contour of the fin frame and machine stitched along the leading and trailing edges and along the upper rib. Another fabric panel should be cut to fit the rear of the leading edge upper extension and machine stitched down one side only.

(b) The envelope is then slipped over the frame and hand sewed with a baseball stitch along the other side of the leading edge rear panel and along the lower rib.

(c) The covering is cut out around the hinge and brace wire fittings after which the fabric attach-

ment strips are attached with screws along the trailing edge of the fin between the former strips.

(d) Fabric patches are doped around the brace wire fittings and a heavy duty canvas chafing strip is doped around the outer edge of the lower rib. These are applied over all surface tape.

(e) Covering and doping practices common to all sections of the empennage are described in paragraph (5), following.

(4) RUDDER.

(a) The rudder envelope consists of two fabric panels machine sewed together around the curved outside contour of the rudder frame. The envelope is then pulled over the top of the frame, stretched around the lower edge and the seams aligned.

(b) The leading edge seam is hand sewed between the hinge points and control horn using a baseball stitch. Fabric patches are doped over the finishing tape at these points and a heavy canvas reinforcing patch is applied around the tail light position.

(c) A Fabricoid reinforcement one inch square is applied beneath a fabric patch 2½ inches square at the point on the left side of the rudder where the tail light conduit extends through the fabric.

(d) Covering and doping practices common to all sections of the empennage are described in paragraph (5), following.

(5) GENERAL.

(a) Reinforcing tape is laced over all ribs outside the fabric envelope. It should not run over the leading or trailing edges.

(b) Surface tape should be doped over all seams, ribs, and the leading and trailing edges of each section.

(c) The patches described in the preceding paragraphs (1), (2), (3), and (4) are to be applied with dope *after* all surface tape has been doped on.

(d) Drainage grommets should be doped to the fabric at all points where moisture is most likely to collect.

(e) The remaining coats of clear dope and aluminized dope are to be applied according to U. S. Army Specification 98-24100.

c. FUSELAGE.

(1) PREPARATION OF ENVELOPE.

(a) The fuselage envelope should be formed of five panels similar in shape to the fuselage fairing assemblies. These panels will be a bottom panel, two side panels, and two top panels joined to fit the top fuselage fairing.

(b) Seams must run parallel to the fairing stringers and the upper edges of the side panels are to be hemmed to receive the fabric attachment strips.

(c) The bottom panel should not be sewed to the side panels at the lower wing recesses or at the lift handle points and enough fabric should be left at these edges to cover the recesses and allow hand stitching at the lift handles.

(2) ATTACHMENT OF ENVELOPE.

(a) The envelope should be pulled over the fuselage working from the rear forward. All seams should be aligned as the envelope is being pulled onto the frame.

(b) Fabric attachment strips are to be inserted into the hem of the envelope along the upper longeron, forward and aft of the top fairing. These strips are then attached to the frame with screws.

(c) The fabric around the forward and aft ends of the fuselage fairing is attached in the following manner:

1. The fabric should be stretched around the edge of the fairing while fabric attachment strips are installed with screws over the cover.

2. The edge of the fabric is then pulled back over the attaching strips and doped down.

Note

The frame for the clean-out door at the lower rear end of the fuselage should be slipped under the envelope before the fabric attachment strip is secured.

(d) Metal former strips are used to attach the fabric at the lower wing recesses. The fabric should be slit with a knife at the wing fitting.

(e) The seam at the lift handles is to be hand-sewed using a baseball stitch.

(f) Surface tape 2¼ inches wide should be doped over all fairing stringers, seams, and over all fabric ends where attaching strips have been used to secure the envelope.

(g) The fabric over the inspection doors and clean-out door should be slit and doped back over their frames after which heavy duty canvas patches are applied over the openings. These patches should not be cut out until the final coat of dope has been applied and the doors are ready to be installed.

(h) Heavy duty canvas tape one inch wide should be doped around the front and rear fairing edges and around the fuselage top edge which will be covered by the baggage compartment door.

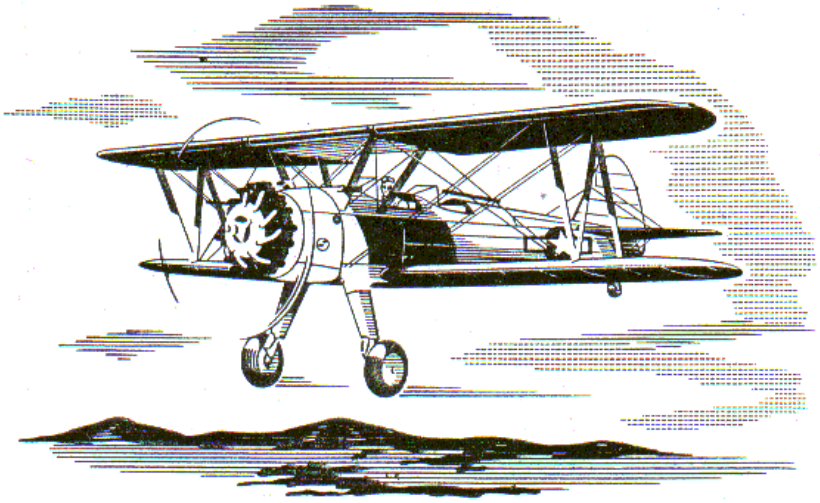
(i) Canvas patches should be applied to the fuselage envelope along the area of contact with the lower wing panels, around the aileron control rod opening, and between the two prongs of the wing attachment fittings.

(j) Two canvas tunnels, closed at their forward ends, should be formed and doped to the fabric at the point where the rudder control cables extend through the fabric covering.

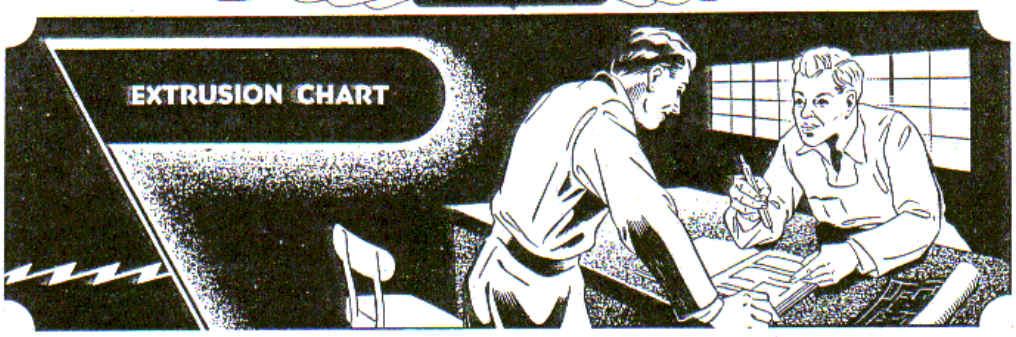
(k) The remaining coats of clear dope and aluminized dope should be applied with a minimum drying time between coats of 30 minutes, temperature and humidity conditions being favorable.

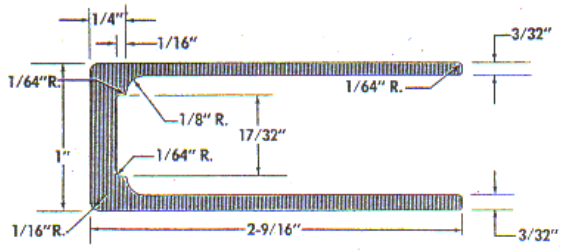
MATERIALS AND PROCESS SPECIFICATIONS

U. S. Army	98-24108	Surfaces Aircraft; Application of Fabric to.
U. S. Army	98-24100	Doping Aircraft Surfaces.
Army-Navy Aeronautical	AN-C-113	Cloth; Cellulose Nitrate Predoped Airplane, Type I.
Army-Navy Aeronautical	AN-DD-T-91	Tape, Cotton Reinforcing.
U. S. Army	6-62	Tape, Surface.
Federal	CCC-D-771	Duck, Cotton, Type II.
Federal	V-T-291	Thread, Linen; Type B, 9 ply.
Federal	C-B-191	Beeswax, Technical Grade.
Army-Navy Aeronautical	AN-TT-D-514	Dope; Cellulose Nitrate Clear.
Army-Navy Aeronautical	AN-TT-D-551	Dope; Cellulose Nitrate Clear (For Alumium Dope).
Army-Navy Aeronautical	AN-TT-A-461	Aluminum Pigment Paste, Aircraft.
Army-Navy Aeronautical	AN-TT-D-554	Dope; Cellulose Nitrate Pigmented.
Army-Navy Aeronautical	AN-TT-T-256	Thinner; Cellulose-Nitrate Dope-and-Lacquer.
Army-Navy Aeronautical	AN-TT-T-258	Thinner; Cellulose-Nitrate Dope-and-Lacquer; Blush Retarding.



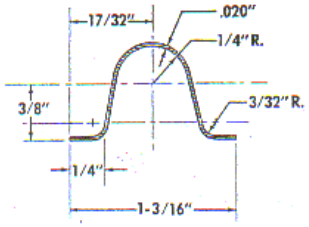
Section VIII





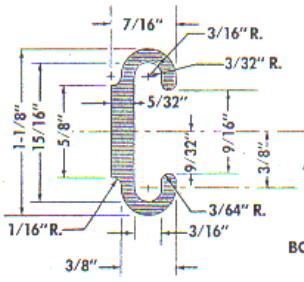
17ST ALUM. ALLOY
SPEC. QQ-A-351
ALCOA DIE NO. K-12406

BOEING DWG. NO. 75-1138



24ST ALUM. ALCLAD
SPEC. AN-A-13

BOEING DWG. NO. 75-2321



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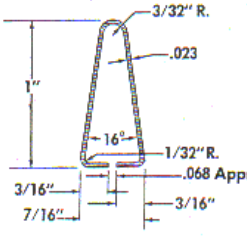
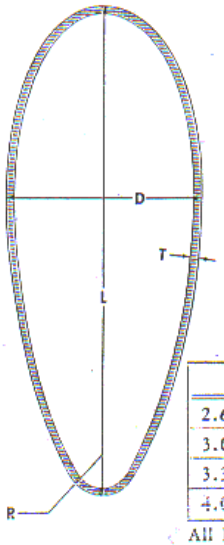
SPEC. QQ-A-351
ALCOA DIE NO. K-11174

BOEING DWG. NO. 73-3402



24ST ALUM. ALLOY
SPEC. AN-A-13
ALCOA DIE NO. K-1508

BOEING DWG. NO. 75-1153

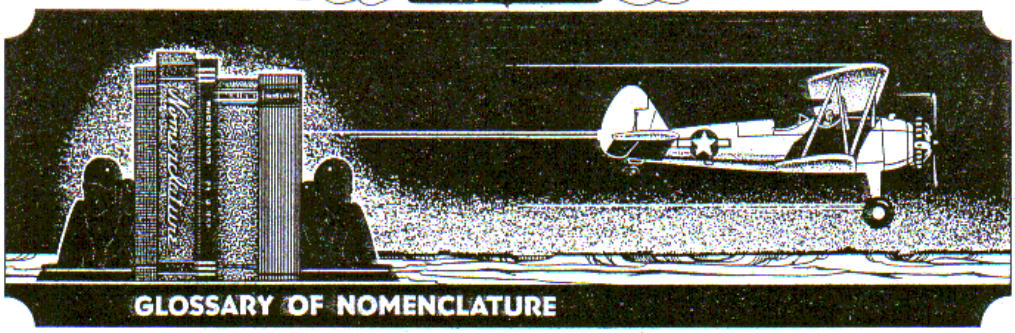


17ST ALUM. ALLOY
SPEC. 57-187-2B

L	D	R	T
2.697	1.143	.217	.058
3.035	1.286	.244	.058
3.372	1.429	.272	.065
4.045	1.714	.326	.083

All Dimensions Are in Inches

Appendix I



GLOSSARY OF NOMENCLATURE

U. S. A.	BRITISH	U. S. A.	BRITISH
Air controls	Flying controls	Hydraulic strut	Jack (hydraulic)
Airplane, without engine	Airframe	Land	Alight
Angle of incidence	Angle of wing setting	Landing gear	Alighting gear
Baggage	Luggage	Left	Port
Battery, storage	Accumulator	Longeron or stringer	Stringer
Carburetor	Carburetter or carburettor	Oleo strut	Compression leg
Center section	Centre section plane	Panel, center wing	Centre section plane
Chord	Chord line	Panel, outboard	Outer plane
Clevis	Fork joint	Propeller	Airscrew
Duct, air	Interconnecting sleeve	Right	Starboard
Empennage	Tail unit	Shock strut	Compression leg
Engine or power plant	Aero-engine	Stabilizer:	
Filter, air	Air cleaner	Horizontal	Tail plane
Firewall	Fire proof bulkhead	Vertical	Fin
Gage, fuel	Fuel contents gage or fuel level indicator	Trim tab	Trimming tab
		Wing	Main plane
Gasoline, "gas", or fuel	Petrol	Wire, landing	Anti-lift wire