SECTION 16

STRUCTURAL REPAIR

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16-1. GENERAL.

NOTE

The following information in addition to Part 43, of the Federal Aviation Regulations may be used as a guide to accomplish repair of the aircraft. After any repair/replacement or painting of the ailerons, elevator, or rudders the surface must be rebalanced.

16-2. Repair of damaged structural members and skins first requires a careful, thorough examination to determine the extent of the damage. The decision of whether to repair or replace damaged parts will be influenced by such factors as time and labor available, comparative costs involved, and equipment necessary to accomplish the repair.

16-3. Repair of damage must restore at least the original strength of the damaged part. Care must be taken that repairs do not strengthen parts too much, especially where a certain amount of flexibility was in the original design. Forces may be transmitted by repairs that are too rigid into members not designed for such forces. When in doubt about a specific repair, consult the factory.

16-4. Alignment and shape of repairs in areas where a smooth surface is required for airflow characteristics should be made by replacing a complete skin panel or, if the damaged area is small, a reinforced flush patch may be made. A complete skin panel should also be replaced in any area where the damage to the skin panel is extensive.

16-5. Spars, ribs, bulkheads, and the various types of stiffeners may be repaired by removing the damaged area, inserting a filler of like material, and reinforcing with appropriate repair doublers. It is often practical to cut repair pieces from parts listed in the Parts Catalog. Usually, it is better to replace major assemblies if damage is extensive. Major assembly jigs, available from the factory, are recommended for such damage.

16-6. SUPPORT STANDS shown in figure 16-5 are used to hold a fuselage or wing when it is removed. The stands may be manufactured locally of any suitable wood.

16-7. FUSELAGE REPAIR JIGS. Whenever a repair is to be made which could affect structural alignment, suitable jigs must be used to assure correct alignment of major attach points, such as fuselage, firewall, wing and landing gear. These fuselage repair jigs are obtainable from the factory.

16-8. WING JIGS. These jigs serve as a holding fixture during extensive repair of a damaged wing, and locates the root rib, leading edge and tip rib of the wing. These jigs are also obtainable from the factory.

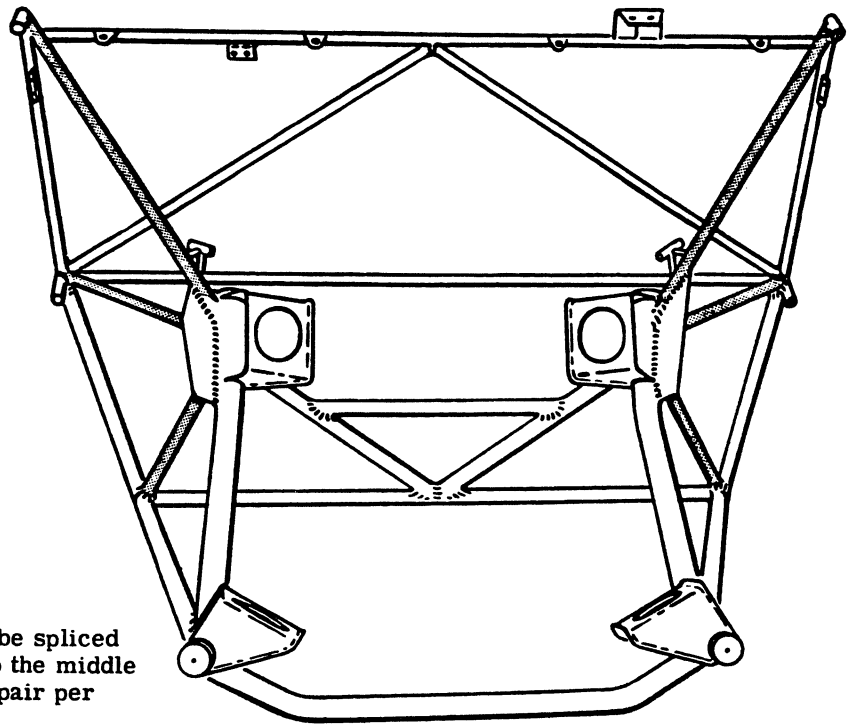
16-9. CONTROL SURFACE BALANCING.

16-10. ELEVATOR AND RUDDER control surfaces are 100% statically balanced. This means that when an elevator or rudder control surface is supported horizontally along its hinge centerline, it must balance (trailing edge level with hinge centerline). A tolerance of 0.75 lb-in. is permitted. This means that the trailing edge may swing upward or downward, but only far enough that a one-pound weight placed .75 inch fore or aft from the hinge centerline will cause the trailing edge to return to level or beyond in the opposite direction. Refer to figure 16-4.

16-11. AILERON control surfaces on the Model 337 are also 100% statically balanced while trailing edge is 0.15 inch below hinge centerline at inboard end of aileron (aileron inverted). This means that when an aileron control surface is supported horizontally along its hinge centerline, it must balance at this specified position. A tolerance of +0.00 to -0.50 lb-in. over-balance is permitted. This means that the trailing edge may swing upward, but only far enough that a one-pound weight placed 0.50 inch aft of hinge centerline will cause the trailing edge to return to the balancing position (trailing edge 0.15 inch below hinge centerline at inboard end of aileron while it is inverted). Before balancing an aileron with a manually adjustable trim tab installed, the trim tab must be streamlined with trailing edge of aileron. Refer to figure 16-4.

16-12. REAR ENGINE MOUNT REPAIR.

16-13. The rear engine mount is constructed of 4130 chrome-molybdenum steel. Since it is not heat-treated damaged parts may be repaired. Welding should be of the highest quality, since the tendency of engien vibration is to accentuate any minor defects and cause fatigue cracks. In general, it is preferable to replace damaged tubes in their entirety, although standard tubing splices may be made, except



NOTE

Shaded engine mount tubes may be spliced provided no repairs are made to the middle third of the tube and only one repair per tube is made.

Figure 16-1. Rear Engine Mount Repair (Typical)

for certain members of the engine mount. These members, shown in figure 16-1, may be repaired, providing no repairs are made to the middle third of the tube and only one repair per tube is made. If they were made stronger than the original members, the safety feature designed to make them fail first (so the engine would fall below the cabin in a forward-impact crash) would be lost. No additional gussets are to be installed, but the original gussets may be replaced. An extensively damaged engine mount should be replaced.

16-14. REPAIR OF THERMO-FORMED PLASTIC COMPONENTS.

16-15. Repair of puncture or holes in thermo-formed plastics can be made by trimming out the damaged area, removing any paint in the area, and installing an overlapping, beveled, or flush patch of identical material. Doublers may be installed behind the patch where additional strength is desired. MEK, or any commercially available solvent that will soften and dissolve the plastic, may be used as the bonding agent. Dissolving some of the plastic shavings in the solvent will furnish additional working time. Moderate pressure is recommended for best results. Curing time will vary with the agent used, but repairs should not be strained until fully cured. Cracks can be repaired by saturating the crack itself with the solvent, then filling with an epoxy filler or a paste made of the plastic shavings and the solvent. Again, the crack may be reinforced with a doubler on the back side for additional strength. After the repair has been made, the area may be sanded smooth and painted. Parts that are extensively damaged should be replaced instead of repaired.

16-16. REPAIR OF GLASS RIBER CONSTRUCTED COMPONENTS.

16-17. Glass fiber constructed components on the aircraft may be repaired as stipulated in instructions furnished in SK182-12. Observe the resin manufacturer's recommendations concerning mixing and application of the resin. Epoxy resins are preferable for making repairs, since epoxy compounds are usually more stable and predictable than polyester and, in addition, give better adhesion.

16-18. STRUCTURAL ALIGNMENT.

16-19. The dimensions and angles shown in figures 16-2 and 16-3 will establish structural alignment in accordance with the following chart:

Wing root angle of incidence	4°30'
Wing tip angle of incidence	2°30'
Wing twist (washout)	2°
Stabilizer angle of incidence (on ground, unsupported)	-3°45'
Stabilizer angle of incidence (in flight)	-4°15'

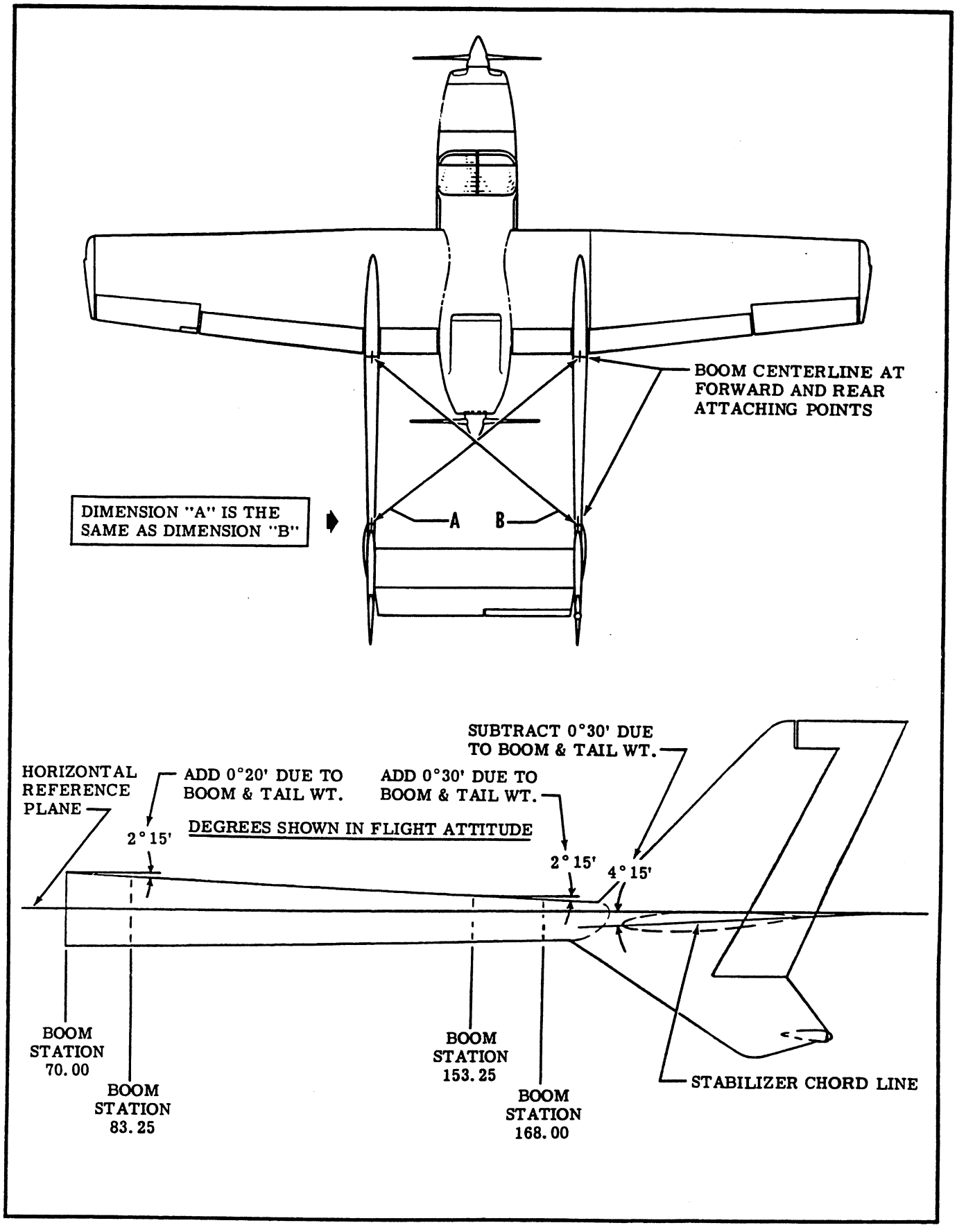
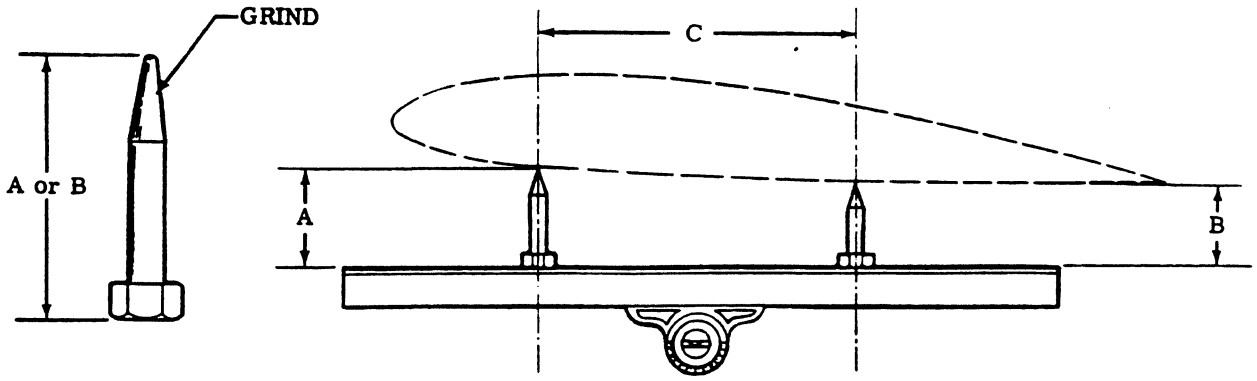


Figure 16-2. Structural Alignment



A	B	C	WING STATION
2.00	1.00	26.00	39.00
1.20	1.00	17.50	221.00

MEASURING WING TWIST

If damage has occurred to a wing, it is advisable to check the twist. The following method can be used with a minimum of equipment, which includes a straightedge (32" minimum length of angle, or equivalent), three modified bolts, and a protractor head with level.

1. Check chart for applicable dimension for bolt length (A or B).
2. Grind bolt shanks to a rounded point as illustrated, checking length periodically.
3. Tape two bolts to straightedge according to dimension C.
4. Locate inboard wing station to be checked and make a pencil mark approximately one-half inch aft of leading edge skin.
5. Holding straightedge parallel to wing station, (staying as clear as possible from "cans"), place longer bolt on pencil mark and set protractor head against lower edge of straightedge.
6. Set bubble in level to center and lock protractor to hold this reading.
7. Omitting step 6, repeat procedure for outboard wing station, using dimensions specified in chart. Check to see that protractor bubble is still centered.
8. Proper twist is present in wing if protractor readings are the same (parallel). Forward or aft bolt may be lowered from wing .10 inch maximum to attain parallelism.

Figure 16-3. Checking Wing Twist

GENERAL NOTES

1. Balance control surfaces in a draft-free area.
2. Place hinge bolts through control surface hinges, and position on knife edge balancing mandrels.
3. Make sure all control surfaces are in their final flight configuration: painted, trim tabs installed, all foreign matter removed from inside of control surface, elevator trim tab push-pull rod installed, and all tips installed.
4. Place balancing mandrels on a table or other suitable flat surface.
5. Adjust trailing edge support to fit control surface being balanced while center of balancing beam is directly over hinge line. Remove balancing beam and balance the beam itself by adding washers or nuts as required at end opposite the trailing edge support.
6. When positioning balancing beam on control surface, avoid rivets to provide a smooth surface for the beam, and keep the beam 90° to the hinge line of the control surface.
7. Paint is a considerable weight factor. In order to keep balance weight to a minimum, it is recommended that existing paint be removed before adding paint to a control surface. Increase in balance weight will also be limited by the amount of space available and clearance with adjacent parts. Good workmanship and standard repair practices should not result in unreasonable balance weight.
8. The approximate amount of weight needed may be determined by taping loose weight at the balance weight area.
9. Lighten balance weight by drilling off part of weight.
10. Make balance weight heavier by fusing bar stock solder to weight. The ailerons should have balance weight increased by ordering additional weight and gang channel listed in the Parts Catalog, and installing next to existing inboard weight the minimum length necessary for correct balance, except that a length which contains at least two attaching screws must be used. If necessary, lighten new weight and/or existing weights for correct balance.

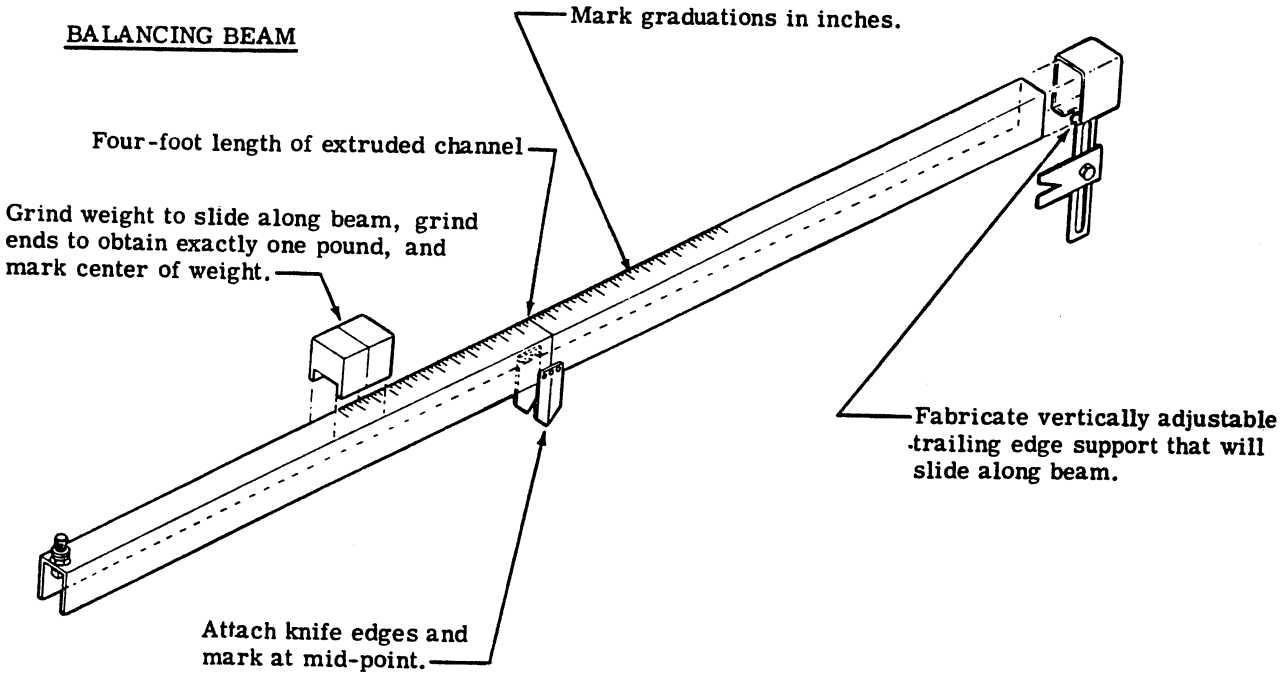


Figure 16-4. Control Surface Balancing (Sheet 1 of 3)

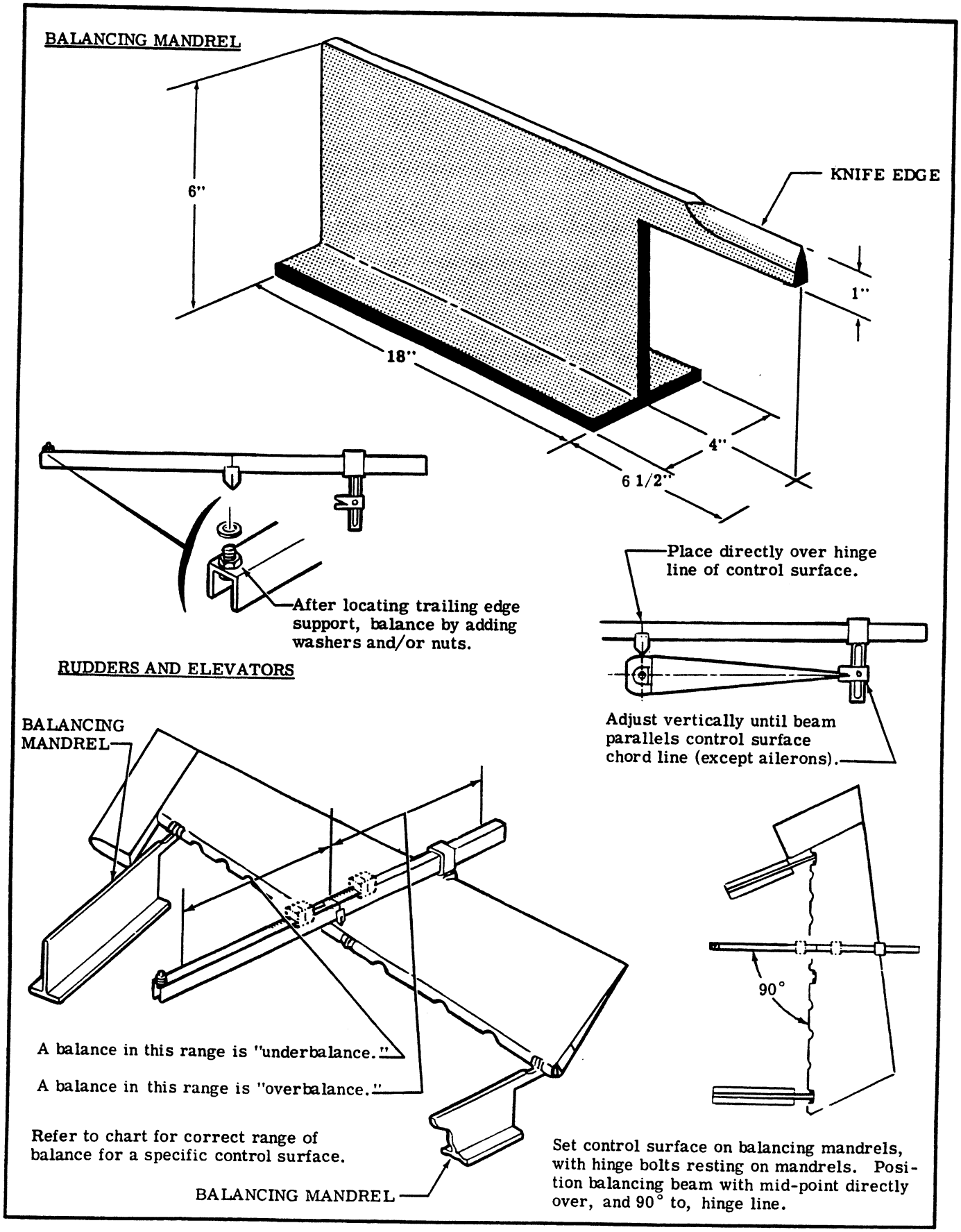
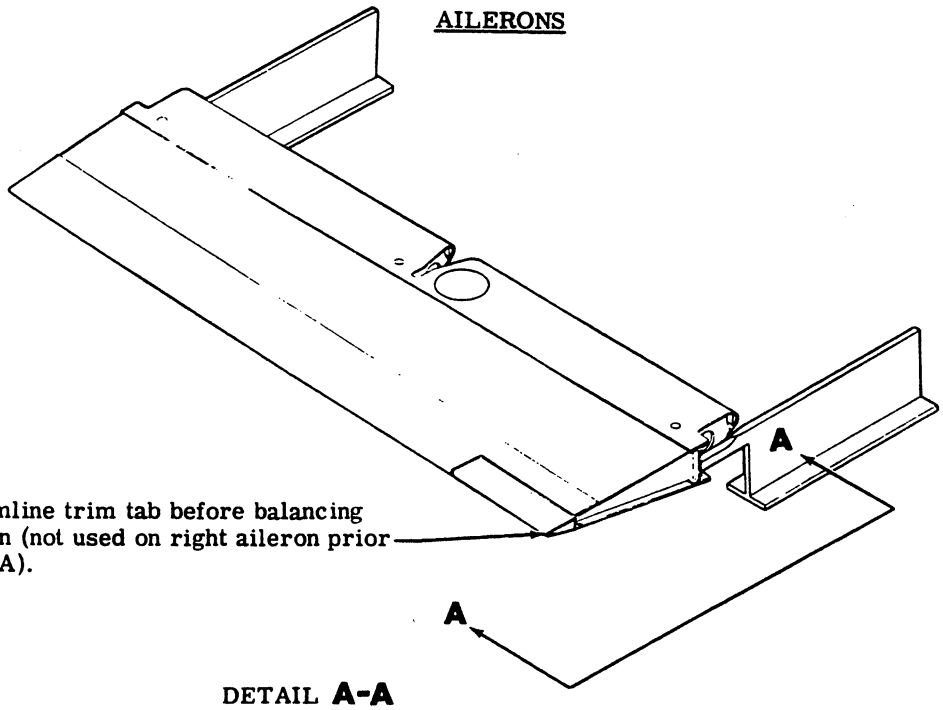


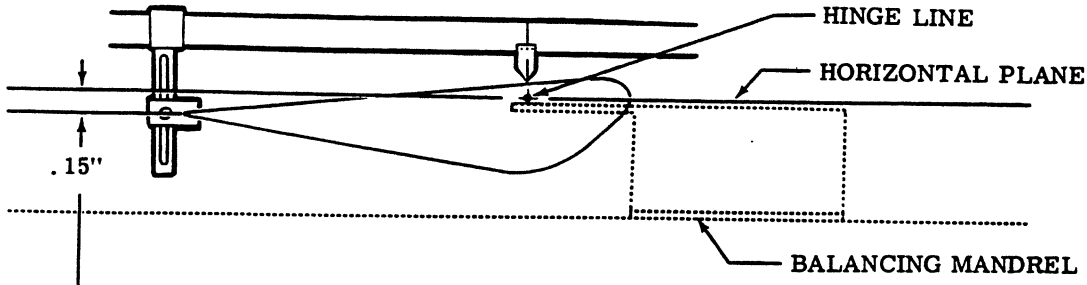
Figure 16-4. Control Surface Balancing (Sheet 2 of 3)

AILERONS



Streamline trim tab before balancing aileron (not used on right aileron prior to 337A).

DETAIL **A-A**



Balance aileron inverted, with inboard corner of trailing edge .15" below hinge line horizontal plane.

Refer to chart for correct range of balance.

AILERONS Balance Range	RIGHT RUDDER Balance Range	LEFT RUDDER Balance Range	ELEVATOR Balance Range
+ .00 to - .50 Inch - Pounds (Overbalance)	+ .75 to - .75 Inch - Pounds	+ .75 to - .75 Inch - Pounds	+ .75 to - .75 Inch - Pounds

NOTE

The "Balance Range" columns list the moment tolerances within which the control surface must balance. These tolerances must never be exceeded in the final flight configuration.

Figure 16-4. Control Surface Balancing (Sheet 3 of 3)

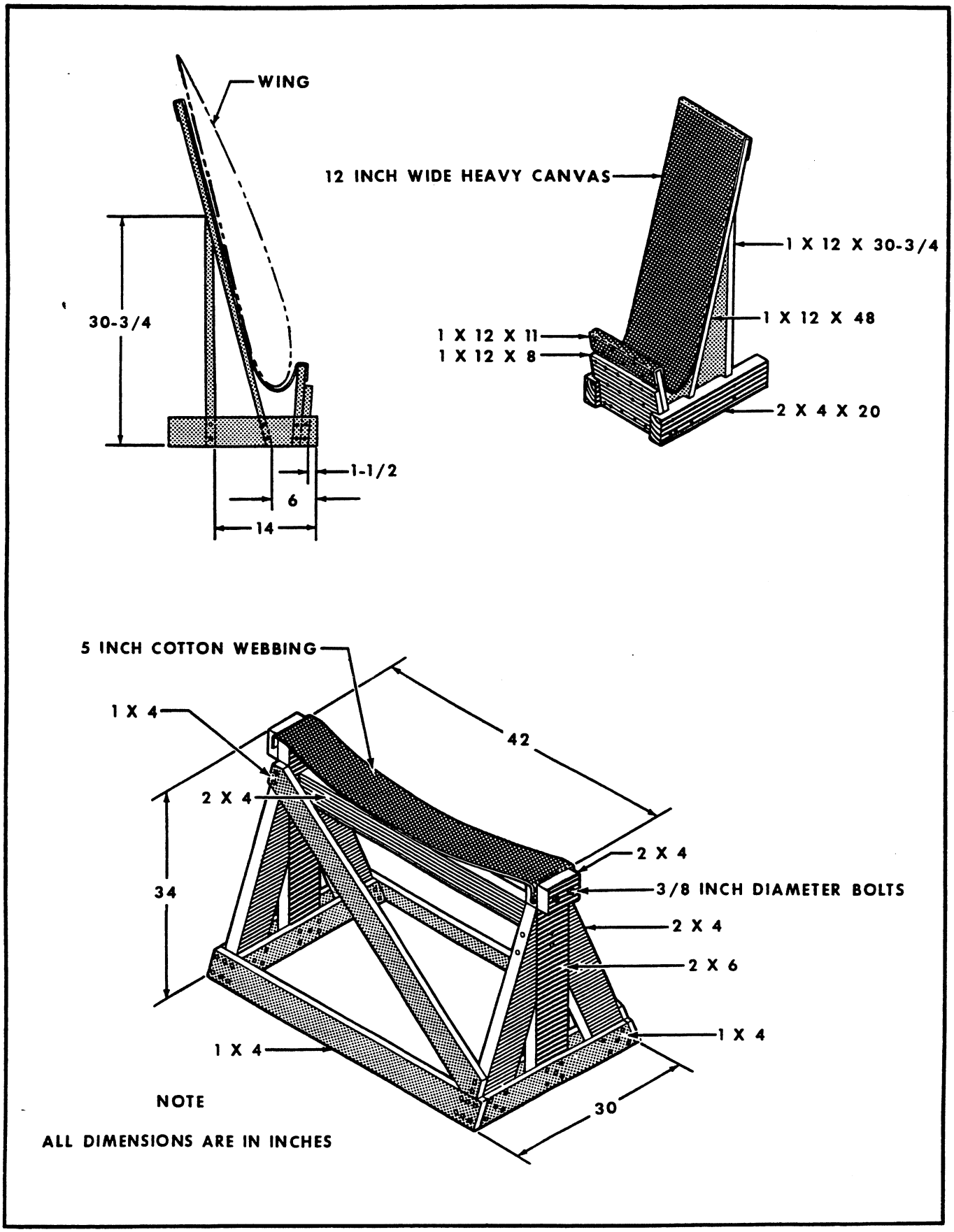


Figure 16-5. Wing and Fuselage Support Stands