Chapter VII
Aircraft Repairs

All major repairs must conform to the guidelines of the original certification of an aircraft, and they must meet with the approval of the FAA and the manufacturer. Before making any major structural repair or alteration, the technician should review acceptable FAA data, FAA-approved technical data, and manufacturer’s recommendations.

A. Acceptable And Approved FAA Repair Data

FAA-approved technical data, the technical data which must be used in making an FAA-approved repair, includes the following: Aircraft Type Certificate (ATC) data sheets, aircraft specifications, Supplemental Type Certificates (STC), Airworthiness Directives (ADs), and manufacturers’ FAA-approved data (DOA). Approved data can also be obtained from a designated engineering representative (DER) and a designated alteration station (DAS) with an FAA field approval.

When FAA-approved technical data is not available, the following technical information may be used in making major repairs or alterations: FAA Advisory Circulars (AC) 43.13-1A and 2A, manufacturers’ technical information such as manuals, bulletins, kits etc., and military technical orders.

Major repairs can be made using the AC43.13-1A as approved data when the mechanic determines that it is directly applicable to the repair, and if the information is not opposed to the manufacturer’s data. The AC 43.13-1A contains a series of sheet metal structural repairs which serve as general guidelines. Many of these repairs are similar to the repairs shown in the manufacturers’ maintenance manuals. A good suggestion is to use the examples shown in AC 43.13-1A as a minimum standard for performing an FAA-approved repair.

B. Ordering Parts

Although parts for older aircraft may have to be made, it is more economical to buy new aircraft parts. When ordering new parts, the serial number of the aircraft must be known because later models may be slightly different in design.

In the parts book, later-model aircraft have a “usable on” code to indicate the manufacturer’s changes.

An example of the code is shown in Figure 7-1. Note three different styles of wing tips: B, C, and D. Each letter represents the serial number range of the aircraft on which the wing tips are used.

C. Analyzing The Repair Area

The use of the manufacturer’s maintenance and parts manual is important in determining the extent of the damaged area. List the new or rebuilt parts needed. Determine if the damage is serious enough for complete replacement of a wing or control surface. For example, it may be more economical to replace a whole wing rather than pay for replacement parts and labor.

When planning repairs, consideration must be given to the speed of the aircraft. For example, a low-speed aircraft uses surface patches or common lap joints with universal head rivets, while high-speed aircraft use flush patches and countersunk rivets.

The cost of labor and parts must be estimated and the owner so informed. Do not begin any repair work on an aircraft without the consent of the aircraft owner.

Damages that often appear on aircraft structures are oil canning, ruptures, cracking and attrition. Oil canning is caused by the loosening of skins between two ribs or stringers. The metal pops back and forth until it becomes excessively coldworked and cracks. Ruptures are caused by the exertion of force on the structural skins of light, pressurized aircraft.

Many aircraft will develop cracks near joints or seams. These cracks are usually caused by over coldworking the metal. Attrition is the failure of aircraft structures due to age and use. As an aircraft gets older, its ability to withstand the constant expansions and contractions caused by flying or landing is impaired.

In their earlier stages, many structural problems can be prevented by the addition of a stiffener in the area where the coldworking action is taking
### Aircraft Serial Number is FA15000085 (Code-D)

**Note Usable On Code:**

- **Aircraft Serial Number is FA15000085 (Code-D)**

**Fig. 7-1 Page from illustrated parts catalog.**

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place. Excessive coldworking faults are commonly associated with light, thin-gauge aircraft skins. Larger aircraft are also affected over a longer period of time.

**D. Removal Of The Damaged Parts**

Cleaning out the damaged area involves the removal of all bent or broken parts. Disassemble the aircraft carefully because many of the parts may be re-usable or repairable. As the parts are removed, they should be identified by part and re-installation number with a permanent felt marker. The permanent felt markings can later be washed away with alcohol.

**Warning: When removing rivets, never oversize the holes.**

The recommended procedure for rivet removal is to use a drill, one size smaller than the rivet being removed. Drill only the depth of the manufactured head. Use a pin punch the same size as the rivet, and snap the drilled heads off. Back up the shop head side of the rivet shank and tap out the remaining stem.

**E. Installation Of New Or Rebuilt Parts And Patches**

Repair parts must be as strong as the original. The metal used to make the parts must be the same alloy content and thickness as the original. The parts must be re-installed using the same size and kind of rivets as the original design.

A hole finder will be needed to locate the centers of new rivet holes when new skins are being prepared for installation (Figure 7-2). When re-assembly begins, do not rivet anything in place until all parts are fitted together and the holes line up. Hold the work in place with Clecos placed two or three inches apart. Be sure that all pilot holes are brought up to specifications before riveting begins.

A patch on the leading edge of a light aircraft wing flap serves to restore its original strength and shape. An example of a repair to a flap leading edge

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**Fig. 7-2** New skin being prepared for installation.

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Fig. 7-3 Flap leading edge repair.
A balance in this range is "underbalance".

A balance in this range is "overbalance".

Balancing mandrel

Spirit-level protractor

Sliding weight

Knife edges

Trailing edge support

Chord line

Elevator

Leveled surface

Hinge point

Four-foot length of extruded channel

Grind weight to slide along beam, grind ends to obtain exactly one pound, and mark center of weight.

Fabricate vertically adjustable trailing edge support that will slide along beam.

Attach knife edges and mark at mid-point.

Fig. 7-4 Balancing mandrel and beam for re-balancing control surfaces.