

MODEL 150 SERIES

1977

SERVICE MANUAL

**FAA APPROVAL HAS BEEN OBTAINED ON TECHNICAL DATA IN
THIS PUBLICATION THAT AFFECTS AIRPLANE DESIGN.**

**CHANGE 1 TO THE BASIC MANUAL IS BEING SUPPLIED TO PROVIDE ADDITIONAL
INFORMATION NECESSARY TO MAINTAIN THE AIRPLANE AND INCORPORATES
TEMPORARY CHANGE 1 AND TEMPORARY REVISION 1.**

1 JULY 1976

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WICHITA, KANSAS, USA**

CHANGE 1

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TEMPORARY REVISION NUMBER 3

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MANUAL TITLE Model 150 Series 1977 Service Manual
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This Temporary Revision consists of the following pages, which affect and replace existing pages in the paper copy manual and supersede aerofiche information.

SECTION	PAGE	AEROFICHE FICHE/FRAME	SECTION	PAGE	AEROFICHE FICHE/FRAME
2	22	1/B11	2	27	Added
2	22A/Deleted	NA	2	28	Added
2	23	1/B12	2	29	Added
2	25	1/B14	15	16A	1/112
2	26	Added	15	16B	Added
2	26A/Deleted	NA			

REASON FOR TEMPORARY REVISION

1. To include the requirement to inspect all fluid carrying lines and hoses in the cabin and wing areas.
2. Revise the Special Inspection Items section, add a Component Time Limits section, and add a fuel quantity indicating system operational test.

FILING INSTRUCTIONS FOR THIS TEMPORARY REVISION

1. For Paper Publications, file this cover sheet behind the publication's title page to identify the inclusion of the Temporary Revision into the manual. Insert the new pages into the publication at the appropriate locations and remove and discard the superseded pages.
2. For Aerofiche Publications, draw a line with permanent red ink marker, through any aerofiche frame (page) affected by the Temporary Revision. This will be a visual identifier that the information on the frame,(page) is no longer valid and the Temporary Revision should be referenced. For "added" pages in a Temporary Revision, draw a vertical line between the applicable frames. Line should be wide enough to show on the edges of the pages. Temporary Revisions should be collected and maintained in a notebook or binder near the aerofiche library for quick reference.

TEMPORARY REVISION NUMBER 2

DATED 7 January 2000

MANUAL TITLE MODEL 150 SERIES 1977 SERVICE MANUAL
MANUAL NUMBER - PAPER COPY D2011-1-13 AEROFICHE D2011-1-13AF
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This Temporary Revision consists of the following pages, which affect existing pages in the paper copy manual and supersede aerofiche information.

SECTION	PAGE	AEROFICHE FICHE/FRAME	SECTION	PAGE	AEROFICHE FICHE/FRAME
2	22A	Added			
2	26A	Added			
18	4A	Added			

REASON FOR TEMPORARY REVISION

To include the inspection requirements of Cessna Service Bulletin SEB99-18.

To provide additional information for the stop drilling of cracks that originate at the trailing edge of control surfaces with corrugated skins.

FILING INSTRUCTIONS FOR THIS TEMPORARY REVISION

For Paper Publications:

File this cover sheet behind the publication's title page to identify the inclusion of the Temporary Revision into the manual. Insert the new pages into the publication at the appropriate locations. Draw a line, with a permanent red ink marker, through any superceded information.

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INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands.

Dates of issue for original and changed pages are:

Original . . . 0 1 July 1976
 Change . . . 1 1 August 1995

* The asterisk indicates pages changed, added, or deleted by the current change.

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 294, CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
* Title	1	* 5-20 thru 5-21	1
* A thru B	1	5-22	0
* C Blank	1	* 5-23	1
i	0	5-24 Blank	0
* ii thru iii	1	6-1 thru 6-5	0
iv Blank	0	* 6-6 thru 6-7	1
1-1	0	6-8 Blank	0
* 1-2	1	* 7-1	1
1-3 thru 1-4	0	7-2 thru 7-7	0
* 2-1	1	* 7-8 thru 7-9	1
2-2	0	7-10	0
* 2-3 thru 2-8	1	8-1 thru 8-6	0
* 2-8A	1	* 9-1	1
* 2-8B Blank	1	9-2 thru 9-4	0
* 2-9	1	* 9-5 thru 9-8	1
2-10	0	10-1 thru 10-7	0
* 2-11 thru 2-14	1	10-8 Blank	0
2-15 thru 2-18	0	* 11-1	1
* 2-19	1	11-2	0
2-20 thru 2-21	0	* 11-3	1
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3-13	0	* 11-14	1
3-14 Blank	0	11-15 thru 11-16	0
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* 5-1	1	11-22 thru 11-26	0
5-2 thru 5-6	0	12-1 thru 12-3	0
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5-16 thru 5-19	0	14-1 thru 14-3	0
		14-4 Blank	0

Upon receipt of the second and subsequent changes to this book, personnel responsible for maintaining this publication in current status should ascertain that all previous changes have been received and incorporated.

LIST OF EFFECTIVE PAGES (Cont).

Page No.	Change No.
* 15-1 thru 15-2	1
15-3 thru 15-8	0
* 15-9 thru 15-10	1
* 15-10A	1
* 15-10B Blank	1
15-11 thru 15-12	0
* 15-13 thru 15-16	1
* 15-16A	1
* 15-16B Blank	1
15-17 thru 15-19	0
15-20 Blank	0
16-1 thru 16-5	0
* 16-6	1
16-7 thru 16-17	0
* 16-18	1
* 16-18A	1
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**CROSS REFERENCE LISTING OF POPULAR
NAME VS. MODEL NUMBERS AND SERIALS**

All aircraft, regardless of manufacturer, are certificated under model number designations. However, popular names are often used for marketing purposes. To provide a consistent method of referring to the various aircraft, model numbers will be used in this publication unless names are required to differentiate between versions of the same basic model. The following table provides a cross reference listing of popular name vs. model numbers.

POPULAR NAME	MODEL YEAR	MODEL	SERIALS BEGINNING	SERIALS ENDING
150 COMMUTER 150 COMMUTER II	1977	150M	15078506	15079405
REIMS/CESSNA F150 REIMS/CESSNA F150 COM- MUTER	1977	F150M	F15001339	F15001428
150 AEROBAT	1977	A150M	A1500685	A1500734
REIMS/CESSNA F150 AEROBAT	1977	FA150M	FA1500312	FA1500336

FOREWORD

This manual contains factory-recommended procedures and instructions for ground handling, servicing, and maintaining Cessna Model 150-Series aircraft. This includes the Models 150, Reims/Cessna F150, 150 Aerobat, and Reims/Cessna F150 Aerobat. The Reims version of the model 150 is identical to the Model 150 except that it is powered by a O-200-A Rolls Royce engine. Besides serving as a reference for the experienced mechanic, this book also covers step-by-step procedures for the less experienced. If properly used, it will better enable the mechanic to maintain Cessna 150-Series aircraft and thereby establish a reputation for reliable service.

The information in this publication is based on data available at the time of publication and is updated, supplemented, and automatically amended by all information issued in Service News Letters, Service Bulletins, Supplier Service Notices, Publication Changes, Revisions, Reissues and Temporary Revisions. All such amendments become part of and are specifically incorporated within this publication. Users are urged to keep abreast of the latest amendments to this publication through the Cessna Product Support subscription services. Cessna Service Stations have also been supplied with a group of supplier publications which provide disassembly, overhaul, and parts breakdowns for some of the various supplier equipment items. Suppliers publications are updated, supplemented, and specifically amended by supplier issued revisions and service information which may be reissued by Cessna; thereby automatically amending this publication and is communicated to the field through Cessna's Authorized Service Stations and/or through Cessna's subscription services.

In addition to the information in this Service Manual, a group of vendor publications is available from Cessna Parts Distribution (CPD 2), which describe complete disassembly, overhaul, and parts breakdown of some of the various vendor equipment items. A listing of the available publications is issued periodically by the Cessna Propeller Product Support Department.

Information for Nav-o-Matic Autopilots, Electronic Communications, and Navigation Equipment are not included in this manual. These manuals are available from Cessna Parts Distribution.

WARNING

INSPECTION INTERVALS, REPLACEMENT TIME LIMITS, OVERHAUL TIME LIMITS, THE METHOD OF INSPECTION, LIFE LIMITS, CYCLE LIMITS, ETC., RECOMMENDED BY CESSNA ARE SOLELY BASED ON THE USE OF NEW, REMANUFACTURED, OR OVERHAULED CESSNA APPROVED PARTS. IF PARTS ARE DESIGNED, MANUFACTURED, REMANUFACTURED, OVERHAULED, PURCHASED, AND/OR APPROVED BY ENTITIES OTHER THAN CESSNA, THEN THE DATA IN CESSNA'S MAINTENANCE/SERVICE MANUALS AND PARTS CATALOGS ARE NO LONGER APPLICABLE AND THE PURCHASER IS WARNED NOT TO RELY ON SUCH DATA FOR NON-CESSNA PARTS. ALL INSPECTION INTERVALS, REPLACEMENT TIME LIMITS, OVERHAUL TIME LIMITS, THE METHOD OF INSPECTION, LIFE LIMITS, CYCLE LIMITS, ETC., FOR SUCH NON-CESSNA PARTS MUST BE OBTAINED FROM THE MANUFACTURER AND/OR SELLER OF SUCH NON-CESSNA PARTS.

SECTION 1
GENERAL DESCRIPTION

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1-1. GENERAL DESCRIPTION.

1-2. MODEL 150 AND F150-SERIES.

1-3. DESCRIPTION. Cessna Model 150 and F150-Series aircraft, described in this manual, are high-wing monoplanes of all-metal, semimonocoque construction. These aircraft are equipped with fixed tubular spring-steel main gear struts and a steerable nose gear. The steerable nose gear is equipped with an air/hydraulic fluid shock strut. Two-place seating is standard, and a double-width, fold-up auxiliary rear seat may be installed as optional equipment. Each Model 150 and F150-Series aircraft is equipped with a four-cylinder, horizontally opposed, air-cooled Continental or Rolls Royce engine, driving an all-metal, fixed-pitch propeller. These aircraft feature a "wrap around" rear window and a swept-back fin and rudder.

1-4. MODEL A150 and FA150-SERIES.

1-5. DESCRIPTION. Aerobatic Model A150 and FA150-Series aircraft are a modification of the currently produced Model 150. Structure has been "beefed-up" in some areas in order to meet require-

ments of the Acrobatic Category, FAR Part 23. In addition to the "beef-up", quick-release cabin doors, two-strap shoulder harnesses, and aerobatic paint design are standard. Removable seat and back cushions are provided to allow occupants to use either a seat-pack or back-pack type parachute during aerobatic maneuvers.

1-6. AIRCRAFT SPECIFICATIONS. Leading particulars of these aircraft, with dimensions based on gross weight, are given in figure 1-1. If these dimensions are used for constructing a hangar or computing clearances, remember that such factors as nose gear strut inflation, tire pressures, tire sizes and load distribution may result in some dimensions that are considerably different from those listed.

1-7. STATIONS. Station diagrams are shown in figures 1-2 and 1-3 to assist in locating equipment when a written description is inadequate or impractical.

1-8. TORQUE VALUES. A chart of recommended nut torque values is shown in figure 1-4. These torque values are recommended for all installation procedures contained in this manual, except where other values are stipulated. They are not to be used for checking tightness of installed parts during service.

GROSS WEIGHT	1600 lb
FUEL CAPACITY	
Standard Wing (Total)	26 gal.
Standard Wing (Usable)	22.5 gal.
Long-Range Wing (Total)	38 gal.
Long-Range Wing (Usable)	35 gal.
OIL CAPACITY	
Without External Filter	6 qt
With External Filter	7 qt
ENGINE MODEL (Refer to Section 11 for Engine Data)	CONTINENTAL O-200 Series
PROPELLER (Fixed Pitch)	69" McCAULEY
MAIN WHEEL TIRES	6.00 x 6, 4-Ply Rating
Pressure	21 psi
NOSE WHEEL TIRE (Standard)	5.00 x 5, 4-Ply Rating
Pressure	30 psi
NOSE WHEEL TIRE (Oversize)	6.00 x 6, 4-Ply Rating
Pressure	35 psi
TIRE (Standard)	
NOSE GEAR STRUT PRESSURE (Strut Extended)	20 psi
WHEEL ALIGNMENT (Tubular Gear)	
Camber	3° to 5°
Toe-In00" to +.16"
AILERON TRAVEL	
Up	20°, +2° -0°
Down	14°, +2° -0°
WING FLAP TRAVEL	
RUDDER TRAVEL (Measured parallel to water line)	0° to 40° ±2°
Right	20° 30', +0° -2°
Left	20° 30', +0° -2°
RUDDER TRAVEL (Measured perpendicular to hinge line)	
Right	23°, +0° -2°
Left	23°, +0° -2°
ELEVATOR TRAVEL	
Up	23°, +1° -0°
Down	15° ±1°
ELEVATOR TRIM TAB TRAVEL	
Up	10° ±1°
Down	20° ±1°
PRINCIPAL DIMENSIONS	
Wing Span	33' 4"
Length	23' 11-1/2"
Fin Height (Maximum with Nose Gear Depressed and Flashing Beacon Installed on Fin)	8' 6"
Track Width	7' 7-1/4"
Tail Span	10' 0"
BATTERY LOCATION	Firewall

Figure 1-1. Aircraft Specifications

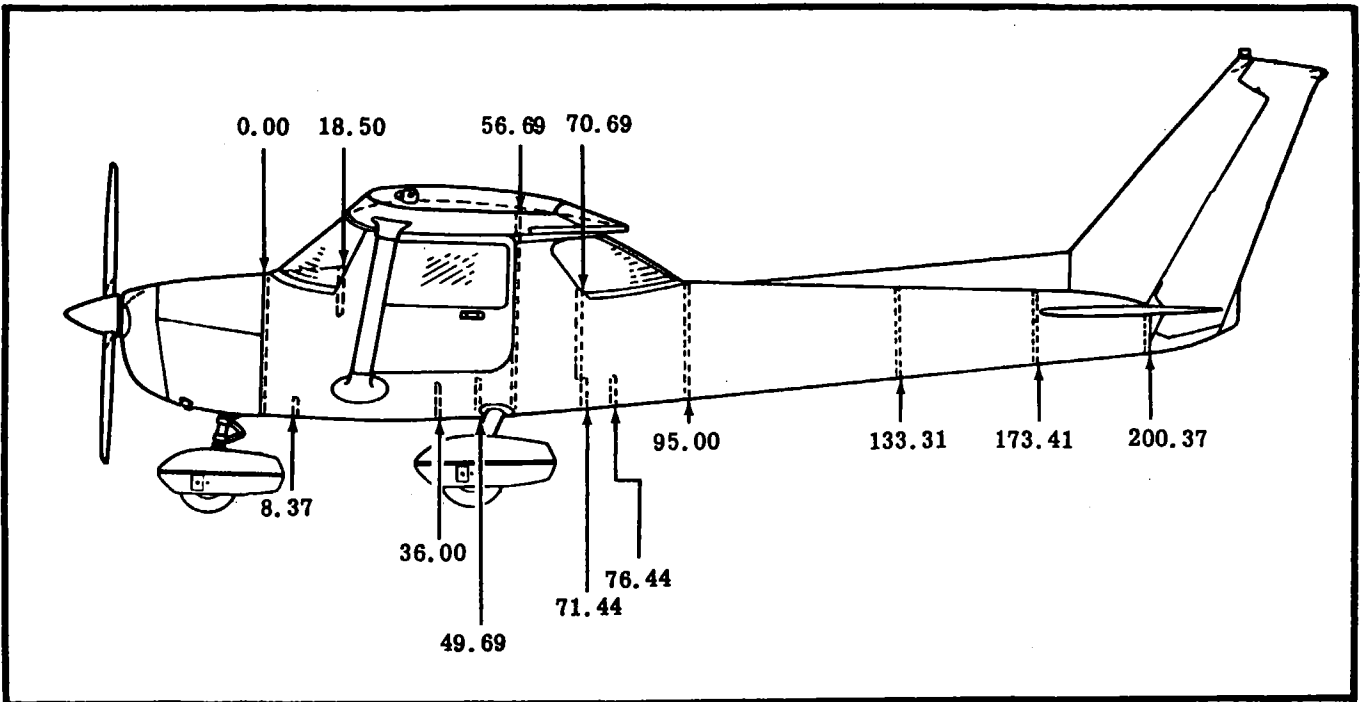


Figure 1-2. Fuselage Stations

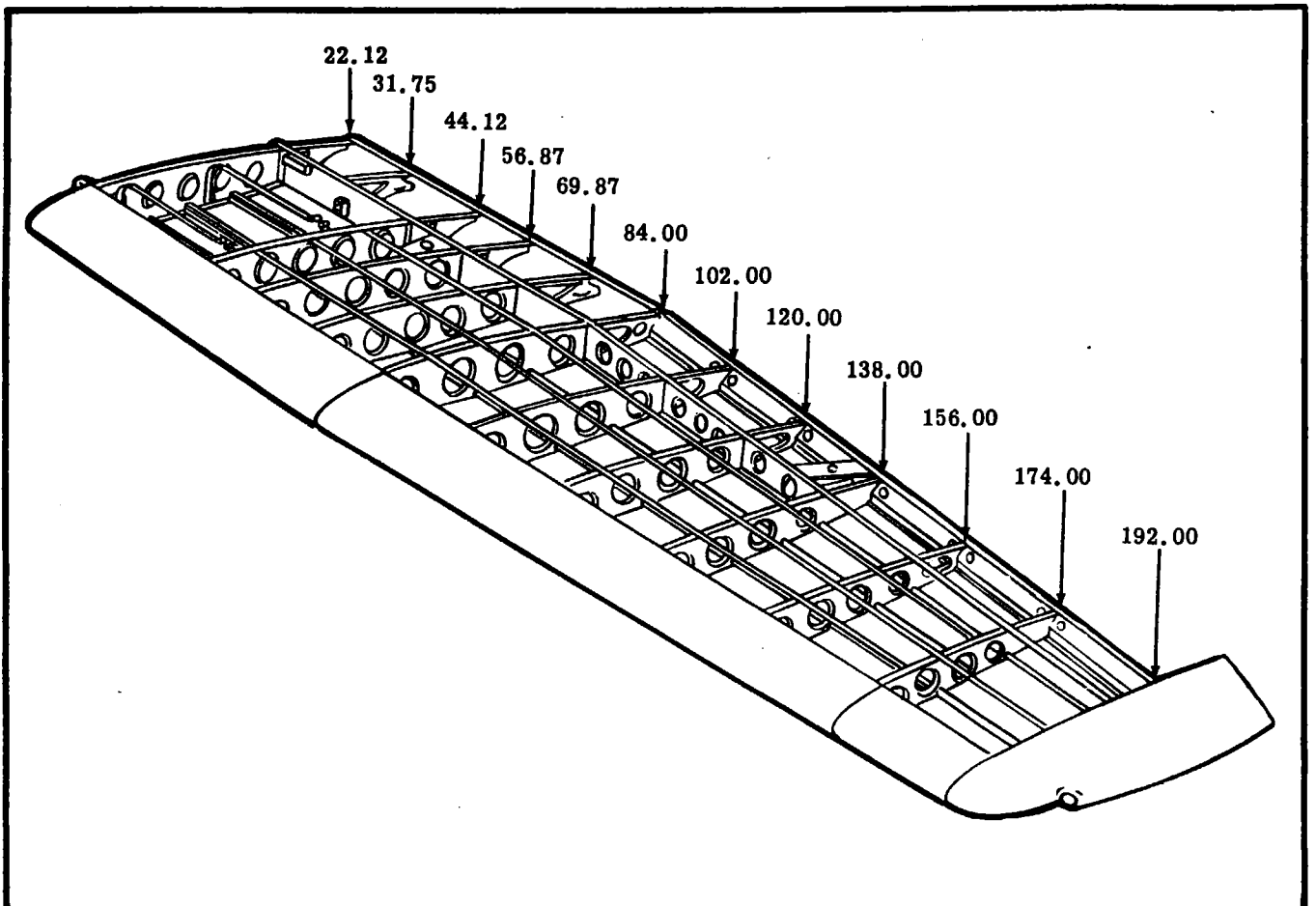


Figure 1-3. Wing Stations

RECOMMENDED NUT TORQUES

THE TORQUE VALUES STATED ARE POUND-INCHES, RELATED ONLY TO STEEL NUTS ON OIL-FREE CADMIUM PLATED THREADS.

FINE THREAD SERIES

TAP SIZE	TENSION		SHEAR	
	TORQUE		TORQUE	
	STD (NOTE 1)	ALT (NOTE 2)	STD (NOTE 3)	ALT (NOTE 2)
8-36	12-15		7-9	
10-32	20-25	20-28	12-15	12-19
1/4-28	50-70	50-75	30-40	30-48
5/16-24	100-140	100-150	60-85	60-106
3/8-24	160-190	160-260	95-110	95-170
7/16-20	450-500	450-560	270-300	270-390
1/2-20	480-690	480-730	290-410	290-500
9/16-18	800-1000	800-1070	480-600	480-750
5/8-18	1100-1300	1100-1600	660-780	660-1060
3/4-16	2300-2500	2300-3350	1300-1500	1300-2200
7/8-14	2500-3000	2500-4650	1500-1800	1500-2900
1-14	3700-5500	3700-6650	2200-3300	2200-4400
1-1/8-12	5000-7000	5000-10000	3000-4200	3000-6300
1-1/4-12	9000-11000	9000-16700	5400-6600	5400-10000

COARSE THREAD SERIES

	(NOTE 4)		(NOTE 5)	
8-32	12-15		7-9	
10-24	20-25		12-15	
1/4-20	40-50		25-30	
5/16-18	80-90		48-55	
3/8-16	160-185		95-100	
7/16-14	235-255		140-155	
1/2-13	400-480		240-290	
9/16-12	500-700		300-420	
5/8-11	700-900		420-540	
3/4-10	1150-1600		700-950	
7/8-9	2200-3000		1300-1800	
1-8	3700-5000		2200-3000	
1-1/8-8	5500-6500		3300-4000	
1-1/4-8	6500-8000		4000-5000	

NOTES

1. Covers AN310, AN315, AN345, AN363, MS20365, MS21042, MS21044, MS21045 and MS21046.
2. When using AN310 or AN320 castellated nuts where alignment between the bolt and cotter pin slots is not reached using normal torque values, use alternate torque values or replace the nut.
3. Covers AN316, AN320, MS20364 and MS21245.
4. Covers AN363, MS20365, MS21042, MS21043, MS21044, MS21045 and MS21046.
5. Covers AN340.

CAUTION

DO NOT REUSE SELF-LOCKING NUTS.

The above values are recommended for all installation procedures contained in this manual, except where other values are stipulated. They are not to be used for checking tightness of installed parts during service.

Figure 1-4. Torque Values

SECTION 2

GROUND HANDLING, SERVICING, CLEANING LUBRICATION AND INSPECTION

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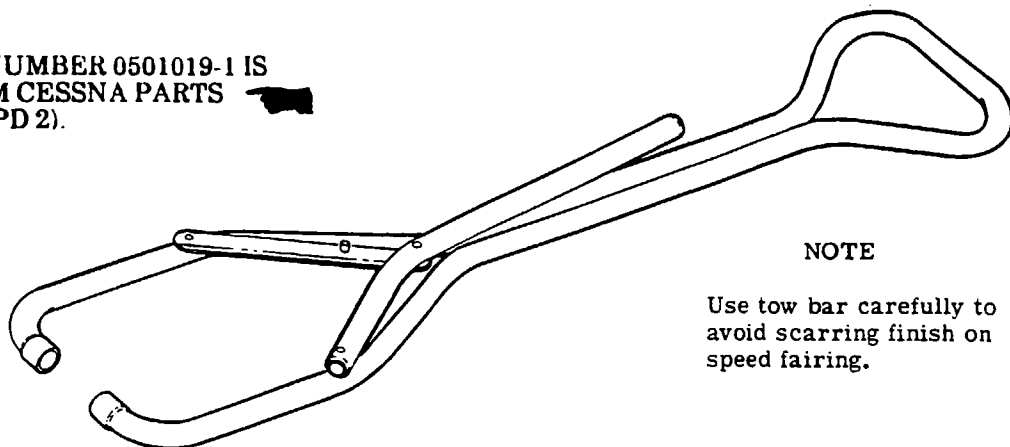
2-1. GROUND HANDLING.

2-2. TOWING. Moving the aircraft by hand is accomplished by using the wing struts and landing gear struts as push points. A tow bar attached to the nose gear should be used for steering and maneuvering the aircraft on the ground. When no tow bar is available, press down at the horizontal stabilizer front spar adjacent to the fuselage to raise the nose wheel off the ground. With the nose wheel clear of the ground, the aircraft can be turned by pivoting it about the main wheels.

CAUTION

When towing the aircraft, never turn the nose wheel more than 30 degrees either side of center or the nose gear will be damaged. Do not push on control surfaces or outboard empennage surfaces. When pushing on the tailcone, always apply pressure at a bulkhead to avoid buckling the skin.

TOW BAR: PART NUMBER 0501019-1 IS AVAILABLE FROM CESSNA PARTS DISTRIBUTION (CPD 2).

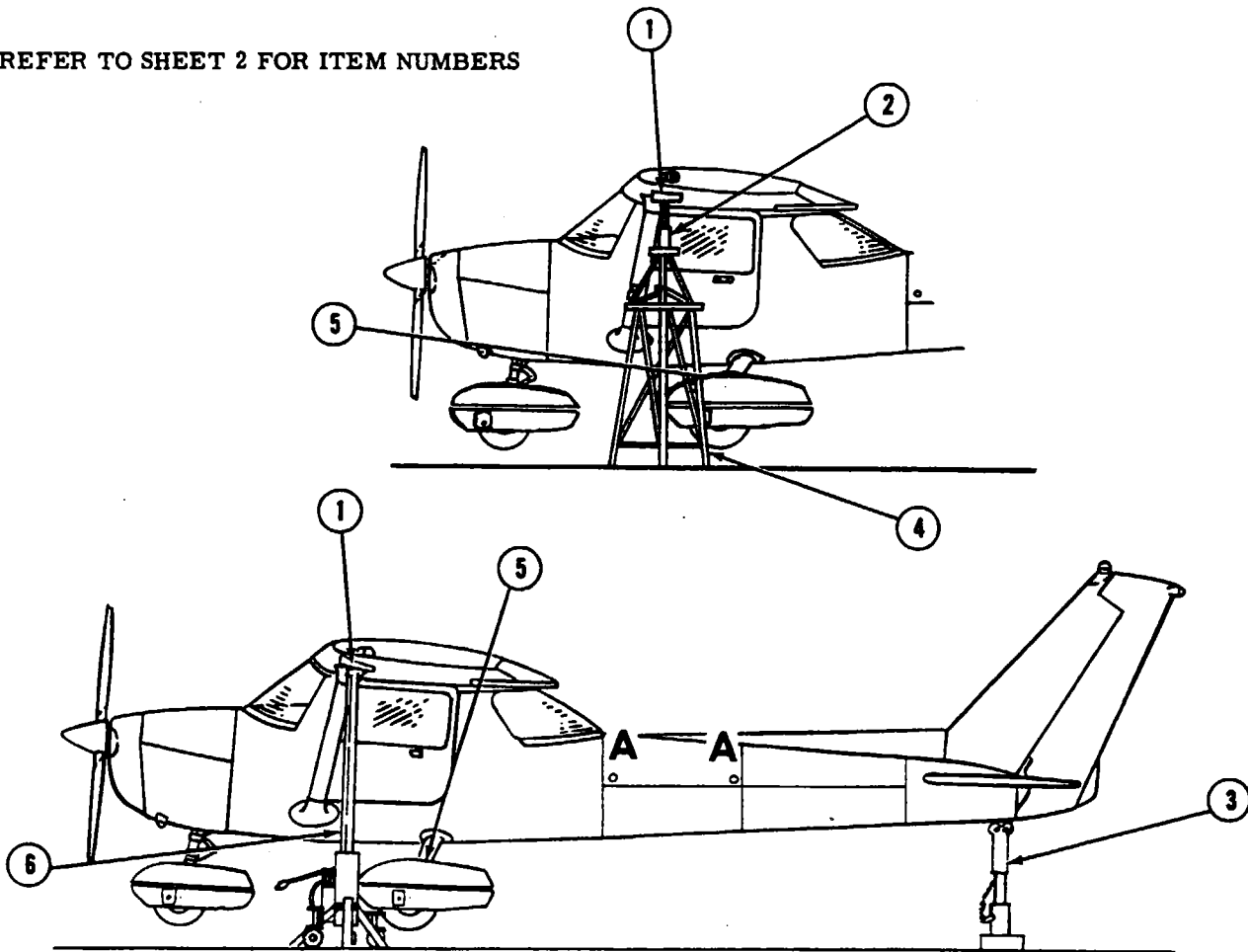


NOTE

Use tow bar carefully to avoid scarring finish on speed fairing.

Figure 2-1. Tow Bar

REFER TO SHEET 2 FOR ITEM NUMBERS



NOTE

Corresponding points on both upper door sills may be used to level the aircraft laterally.

Reference points for longitudinal leveling of aircraft are two screws on left side of tailcone at zero waterline. These are indicated in illustration by **A**.

(Also refer to paragraph 2-5)

Figure 2-2. Jacking and Leveling (Sheet 1 of 2)

JACKING INFORMATION

ITEM NUMBER	TYPE AND NUMBER	REMARKS
①	Block (Jack point not available)	1x4x4 padded with 1/4" rubber
②	Jack	Any short jack of capable capacity
③	Universal tail stand	Any tail stand of capable capacity
④	Cessna #SE-576 (41-1/2" high)	Universal jack stand (FOR USE WITH ITEM 2)
⑤	Built-in jack pad	Part of step bracket (SEE CAUTION)
⑥	#2-170 Basic jack (includes #2-71 Slide tube: Liftstroke 22-1/2") #2-70 Slide tube: Liftstroke 22-1/2" #2-64 Extension cap #2-109 Leg extension	Min. closed height: 34" Max. extension height: 56-1/2" Min. closed height: 57-1/2" Max. extension height: 80" Adds 4" Adds 12"

1. Wing jacks are placed under front spar of wing just outboard of wing strut, and must extend far enough to raise wheels off ground, and must be of adequate strength.
2. Attach a suitable stand to the tie-down ring. Be sure tail stand weighs enough to keep tail down and under all conditions that it is strong enough to support any weight that might be placed on it (place shot bags or sand bags on tail stand. In addition, the base of adjustable tail stand is to be filled with concrete for additional weight as a safety factor.
3. Operate jacks evenly until desired height is reached.

CAUTION

When using built-in jack pad, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must be lowered for a second operation. Jacking both wheels simultaneously at built-in jack pads is not recommended. Jack pad may be used to raise only one main wheel. DO NOT USE brake casting as a jack point.

4. Items (4) and (6) are available from the Cessna Parts Distribution (CPD 2).

2-3. **HOISTING.** The aircraft may be lifted with a hoist of two-ton capacity by using hoisting rings, which are optional equipment, or by means of suitable slings. The front sling should be hooked to each upper engine mount at the firewall, and the aft sling should be positioned around the fuselage at the first bulkhead forward of the leading edge of the stabilizer. If the optional hoisting rings are used, a minimum cable length of 60 inches for each cable is required to prevent bending of the eyebolt-type hoisting rings. If desired, a spreader jig may be fabricated to apply vertical force to the eyebolts.

2-4. **JACKING.** Refer to figure 2-2 for jacking procedures.

2-5. **LEVELING.** Corresponding points on both upper door sills may be used to level the aircraft laterally. The reference points for longitudinal leveling of the aircraft are the two screws on the left side of the tailcone at zero waterline.

2-6. **PARKING.** Parking precautions depend principally on local conditions. As a general precaution, set parking brake or chock the wheels and install the controls lock. In severe weather and high wind conditions, tie down the aircraft as outlined in paragraph 2-7 if a hangar is not available.

2-7. **TIE-DOWN.** When mooring the aircraft in the open, head into the wind if possible. Secure control surfaces with the internal control lock and set brakes.

CAUTION

Do not set parking brakes during cold weather when accumulated moisture may freeze the brakes or when the brakes are overheated.

After completing the preceding, proceed to moor the aircraft as follows:

- a. Tie ropes, cables, or chains to the wing tie-down fittings located at the upper end of each wing strut. Secure the opposite ends of ropes, cables, or chains to ground anchors.
- b. Secure a tie-down rope (no chains or cables) to the exposed portion of the engine mount and secure opposite end of rope to a ground anchor.
- c. Secure the middle of a rope to the tail tie-down ring. Pull each end of rope away at a 45 degree angle and secure to ground anchors at each side of tail.
- d. Secure control lock on pilot control column. If control lock is not available, tie pilot control wheel back with front seat belt.
- e. These aircraft are equipped with a spring-loaded steering system which affords protection against normal wind gusts. However, if extremely high wind gusts are anticipated, additional external locks may be installed.

2-8. **FLYABLE STORAGE.** Flyable storage is defined as a maximum of 30 days non-operational storage. Flyable storage has two programs: Program I (aircraft with engines or cylinders with less than 50 operating hours) and Program II (aircraft with engines or cylinders with 50 or more operating hours).

NOTE

The aircraft is delivered from Cessna with a corrosion-preventive aircraft engine oil (MIL-C-6529, Type II). This engine oil is a blend of aviation grade straight mineral oil and a corrosion preventive compound. This engine oil should be used for the first 25 hours of engine operation. In the event it is necessary to add oil during the first 25 hours of operation, use only aviation grade straight mineral oil of the correct viscosity.

- a. Program I. During the 15 day non-operational storage or the first 50 hours of engine or cylinder operation, every fifth day the propeller shall be rotated through six revolutions, without running the engine, stopping the propeller 45° to 90° from the original position.

WARNING

For maximum safety, always take the following precautions to ensure the engine cannot fire or cause injury when the propeller is moved:

1. Verify magneto switches are OFF.
2. Set throttle CLOSED.
3. Set mixture control "IDLE CUT-OFF".
4. Set brakes and block aircraft wheels.
5. Verify the cabin door latch is open.
6. If the aircraft is stored outside, leave the aircraft tie-downs in place in accordance with paragraph 2-7.
7. Do not stand within the arc of the propeller blades while rotating the propeller.

In addition, the pitot tube static air vents, air vents, openings in the engine cowling, and other similar openings shall have protective covers installed to prevent entry of foreign material. After 15 days, the aircraft should be flown for 30 minutes reaching but not exceeding normal oil and cylinder operating temperatures. If the aircraft cannot be flown, it should be represerved in accordance with paragraph 2-10, Temporary Storage.

CAUTION

Excessive ground operations shall be avoided.

- b. Program II. After engine and cylinders have operated over 50 hours, the aircraft can be non-operationally stored for up to 30 days. Every seventh day the propeller shall be rotated through six revolutions, without running the engine, stopping at 45° to 90° from the original position. The same warnings and cautions apply as with Program I flyable storage above.

Protective covers shall be applied as with Program I flyable storage, but the aircraft need not be flown until 30 days non-operational storage have elapsed. If the aircraft cannot be flown, it should be put into temporary storage in accordance with paragraph 2-10.

2-9. RETURNING AIRCRAFT TO SERVICE. After flyable storage, returning the aircraft to service is accomplished by performing a thorough pre-flight inspection. At the end of the first 25 hours of engine operation, drain engine oil and clean oil pressure screen (or change external oil filter element). Service engine with correct grade and quantity of engine oil. Refer to figure 2-4 and paragraph 2-21 for correct grade of engine oil.

2-10. TEMPORARY STORAGE. Temporary storage is defined as aircraft in a non-operational status for a maximum of 90 days. The aircraft is constructed of corrosion resistant alclad aluminum, which will last indefinitely under normal conditions if kept clean, however, these always are subject to oxidation. The first indication of corrosion on unpainted surfaces is in the form of white deposits or spots. On painted surfaces, the paint is discolored or blistered. Storage in a dry hangar is essential to good preservation and should be procured if possible. Varying conditions will alter the measures of preservation, but under normal conditions a dry hangar, and for storage periods not to exceed 90 days, the following methods of treatment are suggested:

- a. Fill fuel tanks with correct grade of gasoline.
- b. Clean and wax aircraft thoroughly.
- c. Clean any oil or grease from tires and coat tires with a tire preservative. Cover tires to protect against grease and oil.
- d. Either block up fuselage to relieve pressure on tires or rotate wheels every 30 days to change supporting points and prevent flat spotting the tires.
- e. Lubricate all airframe items and seal or cover all openings which could allow moisture and/or dust to enter.

NOTE

The aircraft battery serial number is recorded in the aircraft equipment list. To assure accurate warranty records, the battery should be re-installed in the same aircraft from which it was removed. If the battery is returned to service in a different aircraft, appropriate record changes must be made and notification sent to the Cessna Claims Department.

- f. Remove battery and store in a cool dry place; service the battery periodically and charge as required.

NOTE

An engine treated in accordance with the following may be considered protected against normal atmospheric corrosion for a period not to exceed 90 days.

- g. Disconnect spark plug leads and remove upper and lower spark plugs from each cylinder.

NOTE

The preservative oil must be Lubricating Oil-Contact and Volatile, Corrosion Inhibited,

MIL-L-46002, Grade 1 or equivalent. The following oils are approved for spraying operations by Teledyne Continental Motors: NOX RUST VCI-105 - Daubert Chemical Co., 4700 So. Central Ave., Chicago, Illinois, Petractec VA - Pennsylvania Refining Co., Butler, Pennsylvania.

h. Using a portable pressure sprayer, atomize spray preservative oil through the upper spark plug hole of each cylinder with the piston in approximately the bottom dead center position. A pressure pot or pump-up type garden pressure sprayer may be used. The spray head should have ports around the circumference to allow complete coverage of cylinder walls. Rotate crankshaft as each pair of cylinders is sprayed.

i. After completing step "h," rotate crankshaft so that no piston is at top dead center. If the aircraft is to be stored outside, stop two-bladed propeller so that blades are as near horizontal as possible to provide maximum clearance with passing aircraft.

j. Again spray each cylinder without moving the crankshaft to thoroughly cover all interior surfaces of the cylinder above the piston.

k. Install spark plugs and connect spark plug leads.

l. Apply preservative oil to the engine interior by spraying approximately two ounces of the preservative oil through the oil filler tube.

m. Seal all engine openings exposed to the atmosphere using suitable plugs or non-hygroscopic tape. Attach a red streamer at each point that a plug or tape is installed.

n. If the aircraft is to be stored outside, perform the procedures outlined in paragraph 2-7. In addition, the pitot tube, static source vents, air vents, openings in the engine cowling and other similar openings should have protective covers installed to prevent entry of foreign material.

o. Attach a warning placard to the propeller with the following notation, "DO NOT TURN PROPELLER -- ENGINE PRESERVED - preservation date."

2-11. INSPECTION DURING STORAGE.

- a. Inspect airframe for corrosion at least once a month and remove dust collections as frequently as possible. Clean and wax as required.
- b. Inspect the interior of at least one cylinder through the spark plug hole for corrosion at least once a month.

NOTE

Do not move crankshaft when inspecting interior of cylinder for corrosion.

c. If the engine is not returned to flyable status at end of the 90 day temporary storage period and the aircraft is to be continued in non-operational storage, it must be preserved in accordance with Indefinite Storage, paragraph 2-13.

2-12. RETURNING AIRCRAFT TO SERVICE. After temporary storage, use the following procedures to return the aircraft to service.

- a. Remove aircraft from blocks and check tires for

proper inflation. Check for proper nose gear strut inflation.

- b. Check battery and install.
- c. Check that oil sump has proper grade and quantity of engine oil.
- d. Service induction air filter and remove warning placard from propeller.
- e. Remove materials used to cover openings.
- f. Remove, clean, and gap spark plugs.
- g. While spark plugs are removed, rotate propeller several revolutions to clear excess rust preventative oil from cylinders.
- h. Install spark plugs. Torque spark plugs to value specified in Section 11 and connect spark plug leads.
- i. Check fuel strainer. Remove and clean filter screen if necessary. Check fuel tanks and fuel lines for moisture and sediment, and drain enough fuel to eliminate moisture and sediment.
- j. Perform a thorough pre-flight inspection, then start and warm up engine.
- k. Give the airplane a thorough cleaning and visual inspection. A test flight is recommended.

2-13. INDEFINITE STORAGE Indefinite storage is defined as aircraft in a non-operational status for an indefinite period of time. Engines treated in accordance with the following may be considered protected against normal atmosphere corrosion, provided the procedures outlined in paragraph 2-14 are performed at the intervals specified.

- a. Operate engine until oil temperature reaches normal operating range. Drain engine oil sump and reinstall drain plug.
- b. Fill oil sump to normal operating capacity with MIL-C-6529 Type II corrosion-preventive mixture which has been thoroughly mixed and pre-heated to a minimum of 221° F (105° C) at the time it is added to the engine.

NOTE

MIL-C-6529, Type II corrosion-preventive mixture consists of one part compound MIL-C-6529, Type I (Cosmoline No. 1223, supplied by E. F. Houghton & Co., 305 W. LeHigh Avenue, Philadelphia, PA, or Esso Rus-ban 628, or equivalent) mixed with three parts new lubricating oil of the grade recommended for service. Single grade oil is recommended. During all spraying operations corrosion mixture is pre-heated to 221° to 250° F (105° to 121° C).

NOTE

The corrosion-preventive mixture is harmful to paint and should be wiped from painted surfaces immediately.

- c. Immediately after filling the oil sump with MIL-C-6529, Type II corrosion-preventive mixture, fly the aircraft for a period of time not to exceed a maximum of 30 minutes, reaching but not exceeding normal oil and cylinder temperatures.
- d. Allow engine to cool to ambient temperature.

Accomplish temporary storage steps 2-10.g. thru 2-10.j.

- e. Apply preservative oil to the engine interior by spraying approximately two ounces of MIL-L-46002, Grade 1 oil or equivalent through the oil filler tube.
- f. Do not rotate propeller after completing step "e."
- g. Install lower spark plug or install solid plugs, and install dehydrator plugs in upper spark plug holes. Be sure that dehydrator plugs are blue in color when installed.
- h. Cover spark plug lead terminals with shipping plugs (AN4060-1) or other suitable covers.
- i. With throttle in full open position, place a bag of desiccant in the carburetor intake and seal opening with moisture resistant paper and tape.
- j. Place a bag of desiccant in the exhaust tailpipe(s) and seal openings with moisture resistant tape.
- k. Seal cold air inlet to the heater muff with moisture resistant tape.
- l. Seal engine breather by inserting a dehydrator MS27215-2 plug in the breather hose and clamping in place.
- m. Seal all other engine openings exposed to atmosphere using suitable plugs or non-hygroscopic tape.

NOTE

Attach a red streamer to each place on engine where plugs or bags desiccant are placed or moisture resistant paper or tape is installed. Either attach red streamers outside of the sealed area with tape or to the inside of the sealed area with safety wire to prevent wicking of moisture into the sealed area.

n. If the aircraft is to be stored outside, perform the procedures outlined in paragraph 2-7. In addition, the pitot tube, static source vents, air vents, openings in the engine cowling and other similar openings should have protective covers installed to prevent entry of foreign material.

- o. Attach a warning placard on the throttle control knob, to the effect that the engine contains no lubricating oil. Attach a warning placard to the propeller with the following notation, "DO NOT TURN PROPELLER - ENGINE PRESERVED - preservation date."
- p. Prepare airframe for storage as outlined in paragraph 2-10 thru step "f."

NOTE

As an alternate method of indefinite storage, the aircraft may be serviced in accordance with paragraph 2-10 providing the aircraft is run-up at maximum intervals of 90 days and then reserviced per paragraph 2-10.

2-14. INSPECTION DURING STORAGE. Aircraft in indefinite storage shall be inspected as follows:

- a. Inspect cylinder dehydrator plugs each seven days.
- b. Change dehydrator plugs if their color indicates an unsafe condition.

- c. If the dehydrators plugs have changed color in one-half of the cylinders, all desiccant material in the engine shall be replaced with new material.
- d. Every six months, respray the cylinder interiors with corrosion-preventive mixture.

NOTE

Before spraying, inspect the interior of one cylinder for corrosion through the spark plug hole and remove at least one rocker box cover and inspect the valve mechanism.

2-15. RETURNING AIRCRAFT TO SERVICE. After indefinite storage, use the following procedure to return the aircraft to service:

- a. Remove aircraft from blocks and check tires for correct inflation. Check for correct nose gear strut inflation.
- b. Check battery and install.
- c. Remove all paper, tape, desiccant bags, and streamers used to seal and preserve the engine.
- d. Remove warning placards posted at throttle and propeller.
- e. Remove and clean engine oil screen, then reinstall and safety. On aircraft that are equipped with an external oil filter, install new filter element.
- f. Remove oil sump drain plug and drain sump. Install and safety drain plug.

NOTE

The corrosion-preventive mixture will mix with the engine lubricating oil, so flushing the oil system is not necessary. Draining the oil sump will remove enough of the corrosion-preventive mixture.

NOTE

The corrosion-preventive mixture is harmful to paint and should be wiped from painted surfaces immediately.

- g. Service and install the induction air filter.
- h. Remove dehydrator plugs and spark plugs or plugs installed in spark plug holes and rotate propeller by hand several revolutions to clear corrosion-preventive mixture from cylinders.
- i. Clean, gap, and install spark plugs. Torque plugs to the value listed in Section 11.
- j. Check fuel strainer. Remove and clean filter screen. Check fuel tanks and fuel lines for moisture and sediment, and drain enough fuel to eliminate.
- k. Perform a thorough pre-flight inspection, then start and warm-up engine.
- l. Thoroughly clean and visually inspect aircraft and flight test aircraft.

2-16. SERVICING.

2-17. Servicing requirements are shown in figure 2-4. The following paragraphs supplement this figure by adding details not included in the figure.

2-18. FUEL. Fuel tanks should be filled immediately after flight to lessen moisture condensation. Tank

capacities are listed in Section 1. The recommended fuel grade to be used is given in figure 2-4.

WARNING

Do not fly with contaminated or unapproved fuel.

2-19. FUEL DRAINS. Fuel quick-drains are located in the fuel tanks, fuel line, fuel strainer, carburetor, fuel line forward of the ON-OFF valve and carburetor. A drain plug is installed in the carburetor. The fuel tanks and fuel strainer have drain valves. To activate quick-drain valves for fuel samplings, place cup up to the valve and depress valve with rod protruding from cup. See Section 12 for illustration of fuel tank drain valve. The strainer drain valve is an integral part of the fuel strainer assembly. The strainer drain is equipped with a control which is located adjacent to the oil dipstick. Access to the control is through the oil dipstick access door. Open drains and remove drain plugs at intervals specified in figure 2-4. Also, during daily inspection of the fuel strainer and tanks, if water is found in the system, all fuel drains should be temporarily opened and all water drained from the system. If the aircraft has been serviced with improper fuel grade, defuel completely and refuel with the correct grade. Provided weight and balance considerations will permit, fuel tanks should be kept full between flights.

NOTE

If fuel tank quick-drains are not installed, at least one quart of fuel should be drained from the fuel strainer with the selector valve in a position to assure each tank is draining fuel.

2-20. CARBURETOR DRAIN PLUG INSPECTION. In order to prevent the possibility of thread sealant contamination in the carburetor float chamber, cleaning and inspection of the carburetor should be accomplished at each 100-hour inspection and anytime water in the fuel is suspected.

- a. With the fuel valve OFF, remove carburetor drain plug and clean off any sealant present on the end of the plug or in the threads on the plug.
- b. Inspect drain plug hole in the carburetor and remove any sealant remaining in the hole.
- c. Turn fuel valve to ON to flush float chamber and ascertain that all residue of sealant material is dislodged and washed out of the chamber. Flushing operation should last 15 to 30 seconds.
- d. A second flushing should then be accomplished and the drained fuel retained for inspection to insure that no sealant particles are present.
- e. Install drain plug as follows:
 1. Install drain plug in carburetor 1-1/2 to 2 turns.
 2. Apply sealant to drain plug threads (use NS-40 [RAS-4] or equivalent).
 3. Tighten and safety drain plug.
- f. Turn fuel valve ON and inspect for evidence of fuel leakage.

2-21. ENGINE OIL. Check engine lubricating oil with the oil dipstick five to ten minutes after the

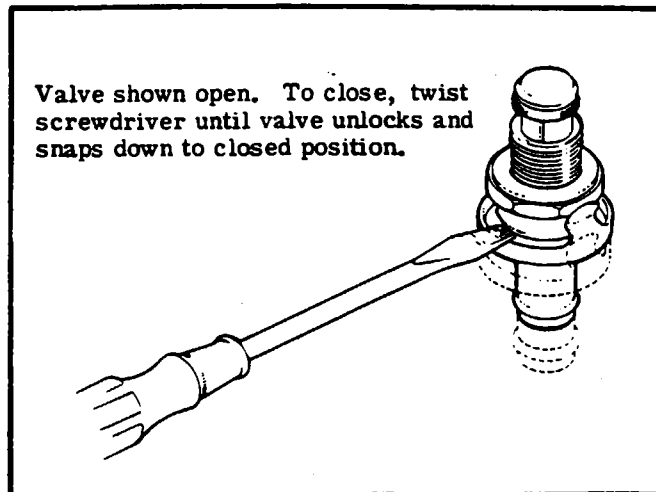
engine has been stopped. Engine oil should be drained while the engine is still hot so that more positive draining is obtained. Refer to the inspection charts for required intervals for oil and filter changes. Change oil every six months even though less than the specified hours have accumulated. Reduce these periods for prolonged operation in dusty areas, in cold climate where sludging conditions exist, or where short flights and long idle periods are encountered, which cause sludging conditions. Always change oil and install a new filter element or clean screen whenever oil on dipstick appears dirty. Oil capacity is six quarts total with a normal operating capacity of five quarts for flights of less than three hours. For extended flight, fill to the six quart level on the dipstick. **DO NOT** operate with less than the minimum for flight quantity of four quarts. If the engine is equipped with an external oil filter, an additional quart of oil is required when the filter element is changed. When adding or changing engine oil, use aviation grade oil in accordance with figure 2-4.

NOTE

The aircraft is delivered from Cessna with a corrosion-preventive aircraft engine oil (MIL-C-6259, Type II). If oil must be added during the first 25 hours of operation, use only aviation grade straight mineral oil conforming to Specification MIL-L-6082 of the correct grade. After the first 25 hours of operation, drain engine oil sump and clean the oil pressure screen. If an optional oil filter is installed, change filter element at this time. Refill sump with correct quantity and grade of aviation grade straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized, then change to ashless dispersant oil conforming to MIL-L-22851, Continental Motors Specification MHS-24, or current Continental Aircraft Engine Service Bulletins. Newly overhauled engines should also be operated on aviation grade straight mineral oil conforming to Specification MIL-L-6082 until a total of 50 hours has accumulated or oil consumption has stabilized. Multi-viscosity oils meeting Continental Motors Specification MHS-24 are approved.

When changing engine oil, remove and clean oil screen, or install a new filter element on aircraft equipped with an external oil filter. An oil quick-drain valve may be installed. This valve provides a quicker and cleaner method of draining engine oil. The valve is installed in the oil drain port of the oil sump and allows oil to be drained by inserting a hose over the fitting end and pushing up to lock the valve open, allowing the oil to drain through the hose into a container. To drain the engine oil, proceed as follows:

- a. Operate engine until oil temperature is at normal operating temperature.
- b. (With Quick-Drain Valve.) Attach a hose to the quick-drain valve in the oil sump. Push up on quick-drain valve until it locks open, and allow oil to drain through hose into container.



Valve shown open. To close, twist screwdriver until valve unlocks and snaps down to closed position.

Figure 2-3. Quick-Drain Valve

- c. (Without Quick-Drain Valve.) Remove oil drain plug from oil sump and allow oil to drain into a container.

NOTE

To ensure complete draining of engine oil sumps, the nose of the aircraft should be raised slightly and the oil drained while hot.

- d. After engine oil has drained, close quick-drain valve as shown in figure 2-3 and remove hose, or install and safety drain plug.
- e. Remove and clean oil screen, or change external oil filter element.
- f. On aircraft equipped with oil cooler, remove drain plug in adapter (using Allen wrench) and drain oil cooler at each oil change. After oil cooler has drained, reinstall plug in adapter.

NOTE

When servicing aircraft equipped with an oil cooler, refer to Continental Aircraft Engine Service Bulletin M76-5 and any revisions or supplements thereto.

- g. Service engine with correct quantity of aviation grade engine oil as specified herein.

NOTE

Check oil with dipstick after the first engine run-up when oil cooler is drained or external filter element is changed. Add oil as required to bring oil in sump to correct level.

2-22. ENGINE INDUCTION AIR FILTER. The induction air filter keeps dust and dirt from entering the induction system. The value of maintaining the air filter in a good clean condition can never be overstressed. More engine wear is caused through the

use of dirty or damaged air filter than is generally believed. The frequency with which the filter should be removed, inspected, and cleaned will be determined primarily by aircraft operating conditions. A good general rule however, is to remove, inspect and clean the filter at least every 50 hours of engine operating time and more frequently if warranted by operating conditions. Some operators prefer to hold a spare induction air filter at their home base of operation so that a clean filter is always readily available for use. Under extremely dusty conditions, daily servicing of the filter is recommended. Two types of filters are used. One is a flock-coated, oiled filter and the other is a dry, paper-media filter.

NOTE

The aircraft is equipped with the flock-coated, oiled filter when it leaves the factory. However, new filters ordered from Cessna Parts Distribution (CPD 2) will be the dry, paper-media filter with an improved element.

To service the flock-coated, oiled filter, proceed as follows:

- a. Remove filter from aircraft.
- b. Wash filter thoroughly in solvent (Federal Specification P-S-661 or equivalent). Wash with soiled face down in solvent.
- c. Drain and dry filter, then dip flock-coated screen filter in the same grade of oil used in the engine and allow excess oil to drain from the filter.
- d. Be sure airbox is cleaned, inspect filter. If filter is damaged, install a new filter.

NOTE

A damaged filter may have broken filtering panels or the flock coating may be missing from

the filtering panels, which will allow unfiltered air to enter the induction system. Any filter that appears doubtful, shall have a new filter installed in its place.

- e. Install filter at entrance to air box with gasket on aft face of filter frame and with air flow arrow on filter pointed in the correct direction.

To service the dry type filter, proceed as follows;

NOTE

Paper induction air filters must be replaced at intervals not exceeding 500 hours time-in-service on the filter.

- a. Remove filter from aircraft.

NOTE

Use care to prevent damage to filter element when cleaning filter with compressed air.

- b. Clean filter by blowing with compressed air (not over 100 psi) from the direction opposite of normal air flow. Arrows on filter case indicate direction of normal air flow.

CAUTION

Do not use solvent or cleaning fluids to wash filter. Use only a water and household detergent solution when washing the filter.

- c. After cleaning as outlined in step "b," the filter may be washed, if necessary, in a solution of warm water and a mild household detergent. A cold water solution may be used.

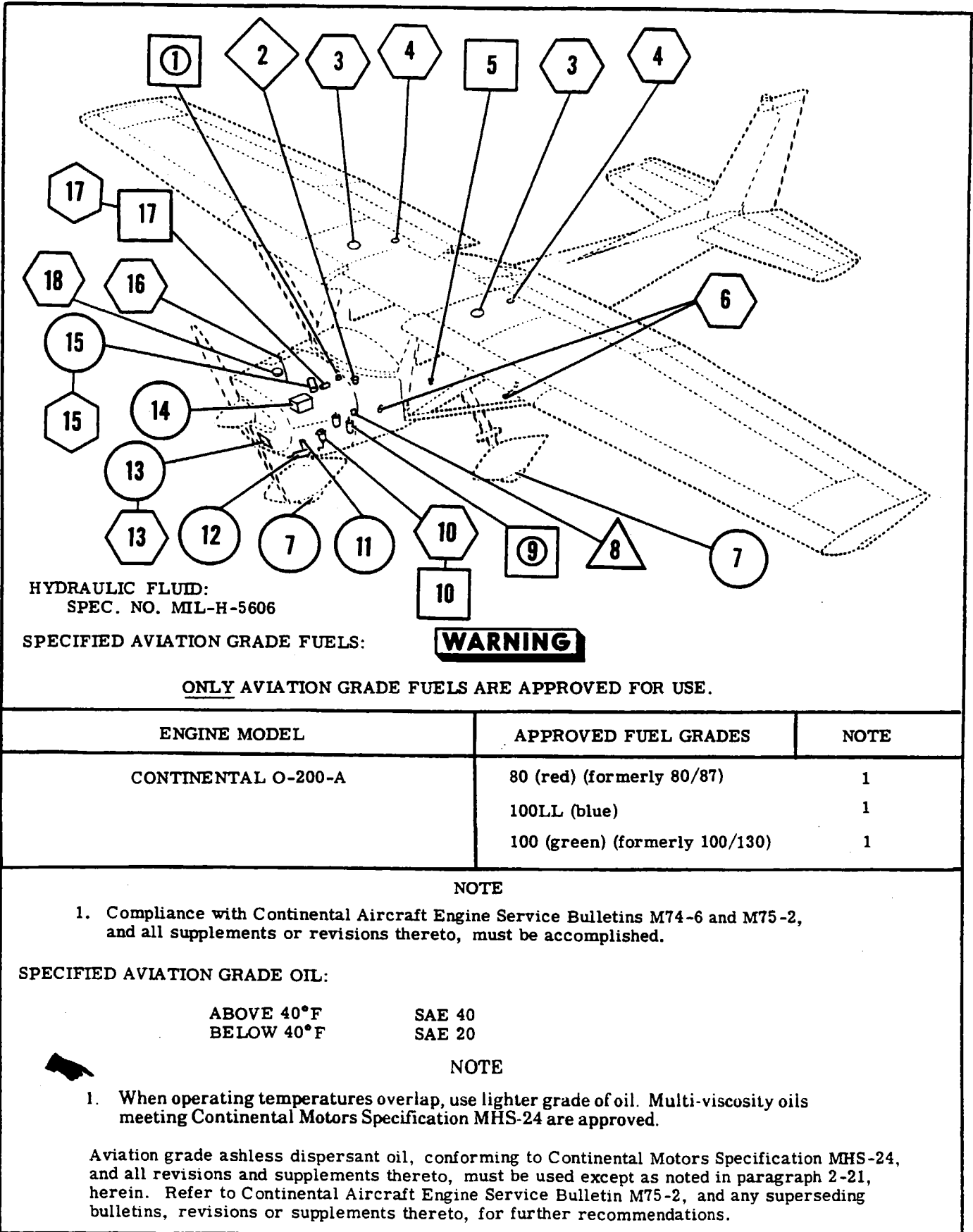


Figure 2-4. Servicing (Sheet 1 of 3)



DAILY

- 3 FUEL TANK FILLER**
Service after each flight. Keep full to retard condensation. Refer to paragraph 2-18 for details.
- 4 FUEL TANK SUMP DRAINS**
Drain off any water and sediment before first flight of the day.
- 6 PITOT AND STATIC PORTS**
Check for obstructions before first flight of the day.
- 10 FUEL STRAINER**
Drain off any water and sediment before the first flight of the day. Refer to paragraph 2-19 for details.
- 13 INDUCTION AIR FILTER**
Inspect and service under dusty conditions. Refer to paragraph 2-22 for details.
- 16 OIL DIPSTICK**
Check oil on preflight. Add oil as necessary. Refer to paragraph 2-21 for details.
- 18 OIL FILLER CAP:**
Whenever oil is added, check that filler cap is tight and oil filler door is secure.



FIRST 25 HOURS


- 15, 17 ENGINE OIL SYSTEM**
Refill with straight mineral oil, non-detergent, and use until a total of 50 hours have accumulated or oil consumption has stabilized, then change to ashless dispersant oil.




50 HOURS

- 13 INDUCTION AIR FILTER**
Clean filter per paragraph 2-22. Replace as required.
- 14 BATTERY**
Check electrolyte level and clean battery compartment each 50 hours or each 30 days.
- 15 ENGINE OIL SYSTEM**
Change oil each 50 hours if engine is NOT equipped with external oil filter; if equipped with external oil filter, change filter element each 50 hours and oil at each 100 hours, or every 6 months.
- 12 SHIMMY DAMPENER**
Check fluid level and refill as required with hydraulic fluid. Refer to paragraph 2-27 for details.
- 7 TIRES**
Maintain correct tire inflation as listed in figure 1-1. Also refer to paragraph 2-25 for details.

Figure 2-4. Servicing (Sheet 2 of 3)


 50 HOURS (Cont)

- 11 NOSE GEAR SHOCK STRUT**
Keep strut filled and inflate to correct pressure. Refer to paragraph 2-26 for details.

 100 HOURS

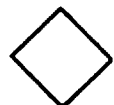
- 5 SHUT-OFF VALVE DRAIN**
Remove plug and drain off any water or sediment. Also refer to paragraph 2-19.
- 10 FUEL STRAINER**
Disassemble and clean strainer bowl and screen.

- 17 ENGINE OIL SYSTEM**
On aircraft equipped with an external full flow oil filter change engine oil, providing the filter element is changed at 50 hour intervals. Change engine oil at least every six months even though less than the recommended hours have accumulated. Reduce these intervals under severe operating conditions.

 200 HOURS

- 1 VACUUM RELIEF FILTER**
Change each 1000 hours, or to coincide with engine overhauls.

- 9 BRAKE MASTER CYLINDERS**
Check fluid level and refill as required with hydraulic fluid. Refer to paragraph 2-28 for details. Landing gear brake master cylinders used prior to 1979 still require overhaul every five years to replace rubber components. Refer to paragraphs 5-57 thru 5-61 for details.

 500 HOURS

- 2 VACUUM SYSTEM CENTRAL AIR FILTER**
Replace every 500 hours.

 AS REQUIRED

- 8 GROUND SERVICE RECEPTACLE**
Connect to 12-volt DC, negative-ground power unit. Refer to Section 11 for details.

Figure 2-4. Servicing (Sheet 3 of 3)

NOTE

The filter assembly may be cleaned with compressed air a maximum of 30 times, or it may be washed a maximum of 20 times. A new filter should be installed after using 500 hours of engine operating time or one year, whichever should occur first. Paper induction air filters must be replaced at intervals not exceeding 500 hours time-in-service on the filter. However, a new filter should be installed anytime it is damaged. A damaged filter may have sharp or broken edges in the filtering panels which would allow unfiltered air to enter the induction system. Any filter that appears doubtful shall have a new filter installed in its place.

d. After washing, rinse filter with clear water until rinse water draining from filter is clear. Allow water to drain from filter and dry with compressed air (not over 100 psi).

NOTE

The filtering panels of the filter may become distorted when wet, but they will return to their original shape when dry.

e. Be sure air box is clean; inspect filter. If filter is damaged, install a new filter.

f. Install filter at entrance to air box with gasket on aft face of filter frame and with air flow arrow on filter frame pointed in the correct direction.

2-23. VACUUM SYSTEM FILTER. The vacuum system central air filter keeps dust and dirt from entering the vacuum operated instruments. Change central air filter element every 500 hours of operating time and whenever suction gage reading drops below 4.8 inches of mercury. Also, do not operate the vacuum system with the filter removed, or a vacuum line disconnected as particles of dust or other foreign matter may enter the system and damage the gyros.

2-24. BATTERY. Battery servicing involves adding distilled water to maintain the electrolyte level even with the horizontal baffle plate or split ring at the bottom of the filler holes, checking cable connections, and neutralizing and cleaning off any spilled electrolyte or corrosion. Use bicarbonate of soda (baking soda) and clean water to neutralize electrolyte or corrosion. Follow with a thorough flushing with clean water. Do not allow bicarbonate of soda to enter battery. Brighten cable and terminal connections with a wire brush, then coat with petroleum jelly before connecting cables. Check the battery every 50 hours (or at least every 30 days), more often in hot weather. Add only distilled water, not acid or "rejuvenators," to maintain electrolyte level in the battery. Inspect the battery box and surrounding area and clean and remove any evidence of corrosion. Refer to Section 16 for detailed battery removal, installation, and testing.

2-25. TIRES. Maintain tire pressure at the air pressure specified in figure 1-1. When checking tire pressure, examine tires for wear, cuts, bruises, and slippage. Remove oil, grease and mud from tires with soap and water.

NOTE

Recommended tire pressures should be maintained. Especially in cold weather, remember that any drop in temperature of the air inside a tire causes a corresponding drop in air pressure.

2-26. NOSE GEAR SHOCK STRUT. The nose gear shock strut requires periodic checking to ascertain that the strut is filled with hydraulic fluid and is inflated to the correct air pressure. To fill the nose gear strut with hydraulic fluid and inflate with air, proceed as follows:

a. Remove filler valve cap and depress valve core to completely deflate nose strut.

b. Remove filler valve from strut.

c. With nose gear strut compressed to its shortest length, fill strut with hydraulic fluid to the bottom of the filler hole.

d. Raise nose of aircraft, extend and compress strut several times to expel any entrapped air, then lower nose of aircraft and repeat step "c".

e. With strut compressed to its shortest length, install filler valve assembly.

f. With nose wheel off ground, inflate strut. Shock strut pressure is listed in figure 1-1.

NOTE

The nose landing gear shock strut will normally require only a minimum amount of service. Maintain the strut extension pressure, as shown in figure 1-1. Lubricate landing gear as shown in figure 2-5. Check the landing gear daily for general cleanliness, security of mounting, and for hydraulic fluid leakage. Keep machined surfaces wiped free of dirt and dust, using a clean lint-free cloth saturated with MIL-H-5606 hydraulic fluid or kerosene. All surfaces should be wiped free of excessive hydraulic fluid.

2-27. NOSE GEAR SHIMMY DAMPENER. The shimmy dampener should be serviced at least every 50 hours. The shimmy dampener must be filled completely with fluid, free of entrapped air, to serve its purpose. To service the shimmy dampener, proceed as follows:

a. Remove shimmy dampener from aircraft.

b. While holding the dampener in a vertical position with fitting end pointed downward, pull fitting end of the dampener shaft to its limit of travel.

c. While holding dampener in this position, fill dampener through open end of cylinder.

d. Push the shaft upward slowly to seal off the filler hole.

e. Clean dampener with solvent. Be sure to keep the shaft protruding through the filler hole until dampener is installed on the aircraft.

f. Install dampener on aircraft.

NOTE

Keep shimmy dampener, especially the exposed portions of the dampener piston shaft,

clean to prevent collection of dust and grit which could cut the seals in the dampener barrel. Keep machined surfaces wiped free of dirt and dust, using a clean lint-free cloth saturated with MIL-H-5606 hydraulic fluid or kerosene. All surfaces should be wiped free of excessive hydraulic fluid.

2-28. **HYDRAULIC BRAKE SYSTEMS.** Check brake master cylinders and refill with hydraulic fluid as specified in the inspection charts. Bleed the brake system of entrapped air whenever there is a spongy response to the brake pedals. Refer to paragraph 5-58 for filling and bleeding the brake system.

2-29. CLEANING.

2-30. Keeping the aircraft clean is important. Besides maintaining the trim appearance of the aircraft, cleaning lessens the possibility of corrosion and makes inspection and maintenance easier.

2-31. **WINDSHIELDS AND WINDOWS.** Windshield and windows should be cleaned carefully with plenty of fresh water and a mild detergent, using the palm of the hand to feel and dislodge any caked dirt or mud. Be sure to frequently refold the cloth to avoid redepositing soil and/or scratching windshield. A sponge, soft cloth, or chamois may be used, but only as a means of carrying water to the plastic. Aliphatic naphtha Type II (conforming to Federal Specification TT-N-95) can be used to remove deposits which cannot be removed using mild soap solution. Rinse thoroughly, then dry with a clean moist chamois. Do not rub the plastic with a dry cloth as this builds up an electrostatic charge which attracts dust.

CAUTION

Do not use methanol, gasoline, denatured alcohol, benzene, xylene, MEK, acetone, carbon tetrachloride, fire extinguisher fluid, de-icer fluid, lacquer thinner, or glass window cleaning spray. These solvents will soften and craze the plastic. When in doubt, do not use it.

After washing, the plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner with soft cloths and rub with moderate pressure. Allow the cleaner to dry, then wipe it off with soft flannel cloths. A thin, even coat of wax, polished out by hand with soft cotton flannel or cotton terry cloths, will fill in minor scratches and help prevent further scratching.

NOTE

Approved and effective acrylic waxes include: Turtle Wax (paste), Great Reflections Paste Wax by Du Pont de Nemours, Slip-stream Wax (paste) by Classic Chemical, and acrylic polish conforming to Federal Specification P-P-560 (such as Permatex plastic cleaner or Mirror Glaze MGH-7 by Mirror Bright Polish Co.).

Do not use a canvas cover on the windshield or windows unless freezing rain or sleet is anticipated.

since the cover may scratch the plastic surface.

CAUTION

Do not use rain repellent on acrylic surfaces such as windshield.

2-32. **PLASTIC TRIM.** The instrument panel, plastic trim, and control knobs need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with Stoddard solvent. Volatile solvents, such as mentioned in paragraph 2-31, must never be used since they soften and craze the plastic.

2-33. **PAINTED SURFACES.** The painted exterior surfaces of the aircraft, under normal conditions, require a minimum of polishing and buffing. Approximately 15 days are required for acrylic or lacquer paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the aircraft. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by an experienced painter. Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or chamois. Harsh or abrasive soaps or detergents which could cause corrosion or make scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent. After the curing period, the aircraft may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wing and tail and on the engine nose cap will help reduce the abrasion encountered in these areas.

2-34. **ALUMINUM SURFACES.** The aluminum surfaces require a minimum of care, but should never be neglected. The aircraft may be washed with non-alkaline grease solvents to remove oil and/or grease. Household type detergent soap powders are effective cleaners, but should be used cautiously since some of them are strongly alkaline. Many good aluminum cleaners, polishes, and waxes are available from commercial suppliers of aircraft products.

2-35. **ENGINE AND ENGINE COMPARTMENT.** The engine should be kept clean since dirty cooling fins and baffle plates can cause overheating of the engine. Also, cleaning is essential to minimize any danger of fire and provide for easier inspection of components. The entire engine cowling may be removed to facilitate engine and interior cowl cleaning. Wash down the engine and components with a suitable solvent, such as Stoddard solvent or equivalent, then dry thoroughly with compressed air.

CAUTION

Particular care should be given to electrical equipment before cleaning. Solvent should not be allowed to enter magnetos, starters, alternators, voltage regulators, and the like. Hence, these components should be protected

before saturating the engine with solvent. Any fuel, soil, and air openings should be covered before washing the engine with solvent. Caustic cleaning solutions should not be used. After cleaning engine, relubricate all control arms and moving parts.

NOTE

During tire or tube change or when wheel is otherwise disassembled, use dye penetrant to inspect wheel hub.

2-36. UPHOLSTERY AND INTERIOR. Keeping the upholstery and interior clean prolongs upholstery fabric and interior trim life. To clean the interior, proceed as follows:

- a. Empty all ash trays and refuse containers.
- b. Brush or vacuum clean the upholstery and carpet to remove dust and dirt.
- c. Wipe leather and plastic trim with a damp cloth.
- d. Soiled upholstery fabrics and carpet may be cleaned with a foam-type detergent used according to the manufacturer's instructions.
- e. Oil spots and stains may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place in the fabric to be cleaned. Never saturate the fabric with volatile solvent; it may damage the padding and backing material.
- f. Scrape sticky material from fabric with a dull knife, then spot clean the area.

2-37. PROPELLER. Wash hub and blades with a soft cloth and Stoddard cleaning solvent or equivalent, then dry thoroughly with compressed air. The propeller should be wiped occasionally with an oily cloth, then wiped with a dry cloth. In salt water areas this will assist in corrosion proofing the propeller.

2-38. WHEELS. The wheels should be washed periodically and examined for corrosion, chipped paint, and cracks or dents in the wheel halves, in the flanges or hubs, and especially around flange mounting screw holes.

NOTE

During 100 hour or annual inspections, check socket head cap screws for proper torque (190 - 200 pound-inches). Loss of torque on socket head is sign of cracks.

NOTE

When repacking wheel bearings, clean wheel assembly, and using magnifying glass, sight through opening to inspect webs around flange mounting screw holes for cracks.

If defects are found remove and repair in accordance with Section 5. Discard cracked wheel halves, flanges or hubs and install new parts.

2-39. LUBRICATION.

2-40. Lubrication requirements are shown if figure 2-5. Before adding grease to grease fittings, wipe dirt from fitting. Lubricate until grease appears around parts being lubricated, and wipe excess grease from parts. The following paragraphs supplement figure 2-5 by adding details.

2-41. TACHOMETER DRIVE SHAFT. Refer to Section 15 for details on lubrication of shaft.

2-42. WHEEL BEARINGS. Clean and repack the wheel bearings at the first 100-hour inspection and at each 500-hour inspection thereafter. If more than the usual number of take-offs and landings are made, extensive taxiing is required, or the aircraft is operated in dusty areas or under seacoast conditions, cleaning and lubrication of the wheel bearings shall be accomplished at each 100-hour inspection.

2-43. NOSE GEAR TORQUE LINKS. Lubricate nose gear torque links every 50 hours. When operating in dusty conditions, more frequent lubrication is required.

2-44. WING FLAP ACTUATOR. Clean and lubricate wing flap actuator jack screw each 100 hours as follows:

- a. Expose jack screw by operating flaps to full-down position.
- b. Clean jack screw threads with solvent rag and dry with compressed air.

NOTE

It is not necessary to remove actuator from aircraft to clean or lubricate threads.

- c. With oil can, apply light coat of No. 10 eight non-detergent oil to threads of jack screw.

SHOP NOTES:

FREQUENCY (HOURS)



METHOD OF APPLICATION



WHERE NO INTERVAL IS SPECIFIED, LUBRICATE AS REQUIRED AND WHEN ASSEMBLED OR INSTALLED.

NOTE

The military specifications listed are not mandatory, but are intended as guides in choosing satisfactory materials. Products of most reputable manufacturers meet or exceed these specifications.

LUBRICANTS

PG — SS-G-659	POWDERED GRAPHITE
GR — MIL-G-81322	GENERAL PURPOSE GREASE
GH — MIL-G-23827	AIRCRAFT AND INSTRUMENT GREASE
GL — MIL-G-21164	MOLYBDENUM DISULFIDE GREASE
OG — MIL-L-7870	GENERAL PURPOSE OIL
PL — VV-P-236	PETROLATUM
GS — MIL-S-8660	DC4 (DOW CORNING)
GP —	NO. 10-WEIGHT, NON-DETERGENT OIL

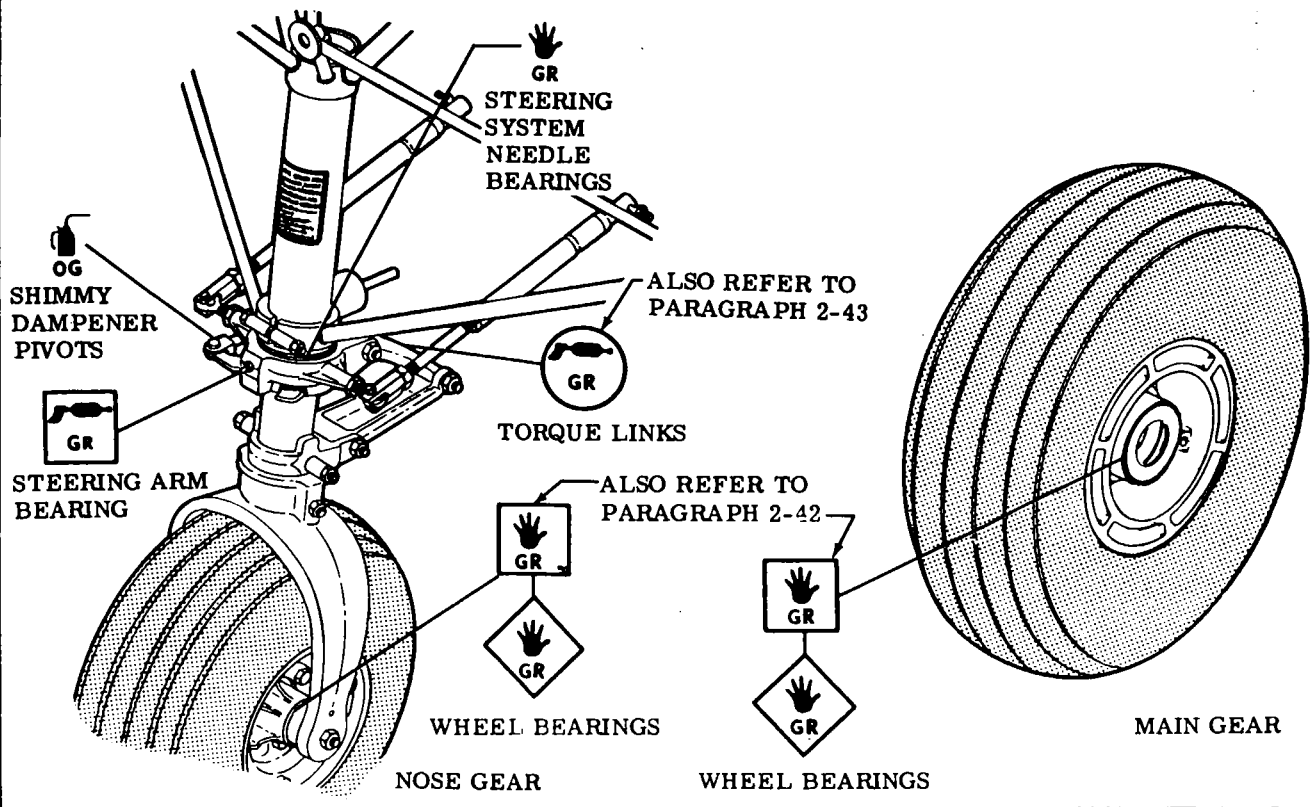


Figure 2-5. Lubrication (Sheet 1 of 3)

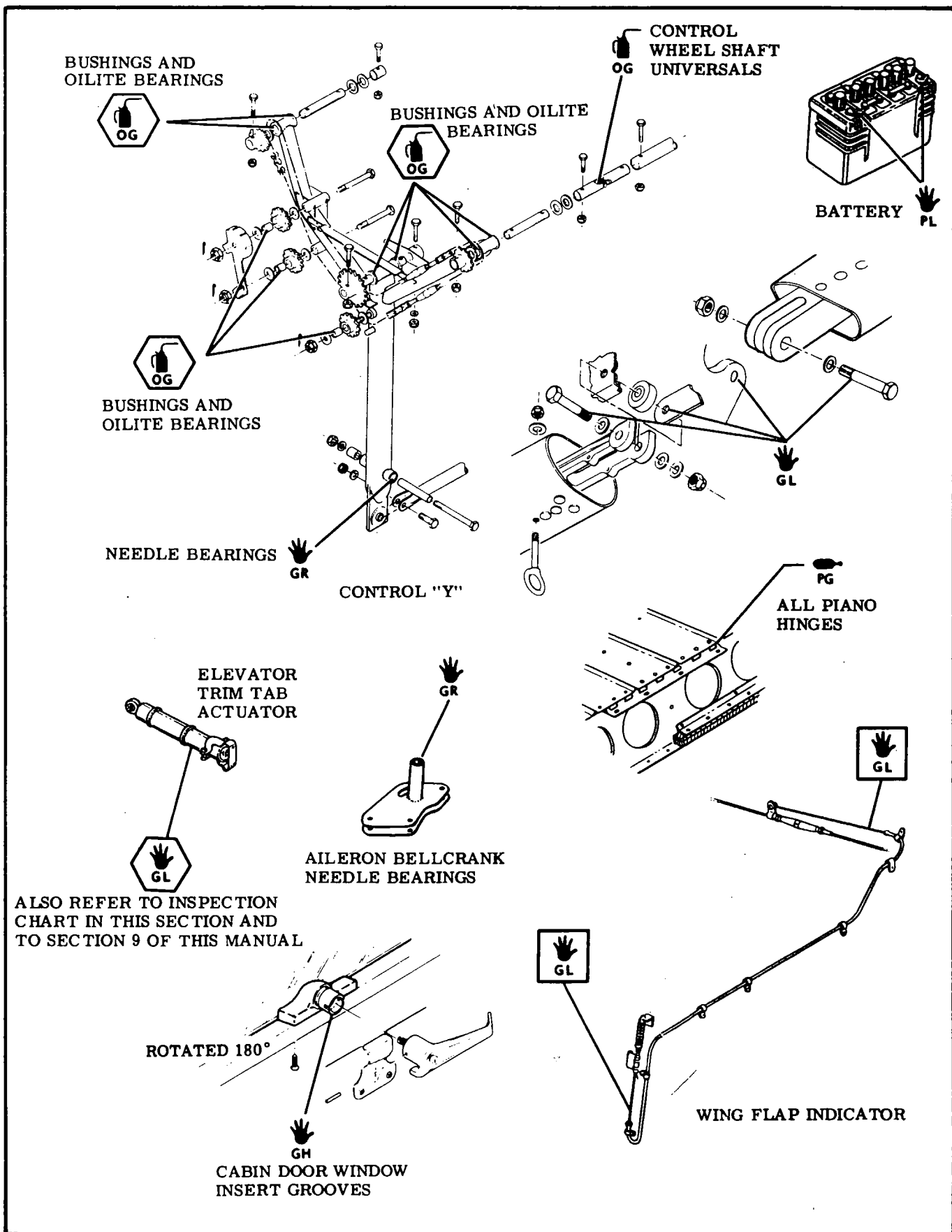
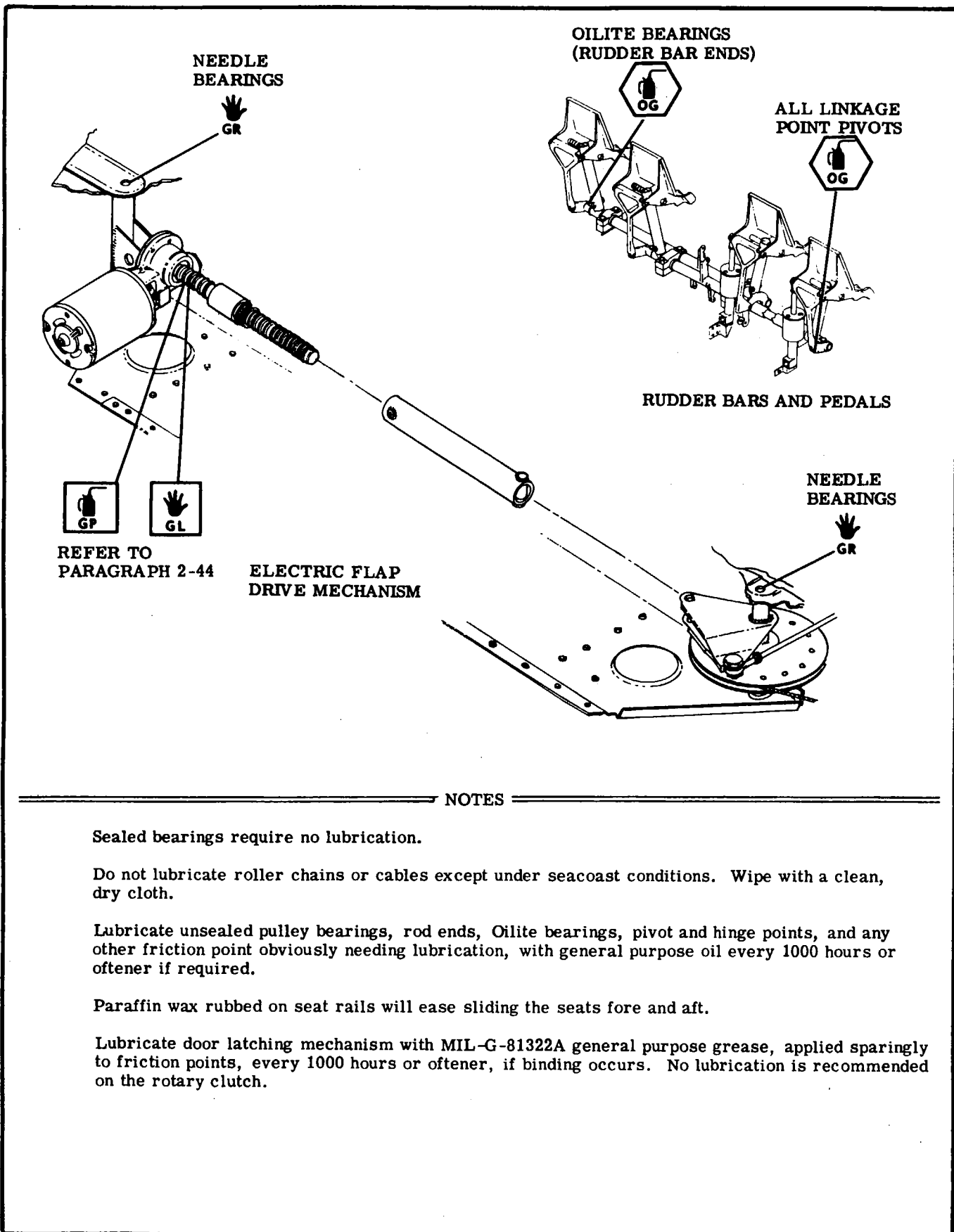


Figure 2-5. Lubrication (Sheet 2 of 3)



NOTES

Sealed bearings require no lubrication.

Do not lubricate roller chains or cables except under seacoast conditions. Wipe with a clean, dry cloth.

Lubricate unsealed pulley bearings, rod ends, Oilite bearings, pivot and hinge points, and any other friction point obviously needing lubrication, with general purpose oil every 1000 hours or oftener if required.

Paraffin wax rubbed on seat rails will ease sliding the seats fore and aft.

Lubricate door latching mechanism with MIL-G-81322A general purpose grease, applied sparingly to friction points, every 1000 hours or oftener, if binding occurs. No lubrication is recommended on the rotary clutch.

Figure 2-5. Lubrication (Sheet 3 of 3)

I INSPECTION REQUIREMENTS.

As required by Federal Aviation Regulations, all civil aircraft of U.S. registry must undergo a **COMPLETE INSPECTION (ANNUAL)** each twelve calendar months. In addition to the required **ANNUAL** inspection, aircraft operated commercially (for hire) must also have a **COMPLETE AIRCRAFT INSPECTION** every 100 hours of operation.

In lieu of the above requirements, an aircraft may be inspected in accordance with a progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.

Therefore, the Cessna Aircraft Company recommends **PROGRESSIVE CARE** for aircraft that are being flown 200 hours or more per year, and the **100 HOUR** inspection for all other aircraft.

II INSPECTION CHARTS.

The following charts show the recommended intervals at which items are to be inspected.

As shown in the charts, there are items to be checked each 50 hours, each 100 hours, each 200 hours, and also Special Inspection items which require servicing or inspection at intervals other than 50, 100 or 200 hours.

- a. When conducting an inspection at 50 hours, all items marked under **EACH 50 HOURS** would be inspected, serviced or otherwise accomplished as necessary to insure continuous airworthiness.
- b. At each 100 hours, the 50 hour items would be accomplished in addition to the items marked under **EACH 100 HOURS** as necessary to insure continuous airworthiness.
- c. An inspection conducted at 200 hour intervals would likewise include the 50 hour items and 100 hour items in addition to those at **EACH 200 HOURS**.
- d. The numbers appearing in the **SPECIAL INSPECTION ITEMS** column refer to data listed at the end of the inspection charts. These items should be checked at each inspection interval to insure that applicable servicing and inspection requirements are accomplished at the specified intervals.
- e. A **COMPLETE AIRCRAFT INSPECTION** includes all 50, 100 and 200 hour items plus those Special Inspection Items which are due at the time of the inspection.

III INSPECTION PROGRAM SELECTION.

AS A GUIDE FOR SELECTING THE INSPECTION PROGRAM THAT BEST SUITS THE OPERATION OF THE AIRCRAFT, THE FOLLOWING IS PROVIDED.

1. IF THE AIRCRAFT IS FLOWN LESS THAN 200 HOURS ANNUALLY.

a. IF FLOWN FOR HIRE

An aircraft operating in this category must have a **COMPLETE AIRCRAFT INSPECTION** each 100 hours and each 12 calendar months of operation. A **COMPLETE AIRCRAFT INSPECTION** consists of all 50, 100, 200 and Special Inspection Items shown in the inspection charts as defined in paragraph II above.

b. IF NOT FLOWN FOR HIRE

An aircraft operating in this category must have a **COMPLETE AIRCRAFT INSPECTION** each 12 calendar months (**ANNUAL**). A **COMPLETE AIRCRAFT INSPECTION** consists of all 50, 100, 200 and Special Inspection Items shown in the inspection charts as defined in paragraph II above. In addition, it is recommended that between annual inspections, all items be inspected at the intervals specified in the inspection charts.

2. IF THE AIRCRAFT IS FLOWN MORE THAN 200 HOURS ANNUALLY.

Whether flown for hire or not, it is recommended that aircraft operating in this category be placed on the CESSNA PROGRESSIVE CARE PROGRAM. However, if not placed on Progressive Care, the inspection requirements for aircraft in this category are the same as those defined under paragraph III 1. (a) and (b).

Cessna Progressive Care may be utilized as a total concept program which insures that the inspection intervals in the inspection charts are not exceeded. Manuals and forms which are required for conducting Progressive Care inspections are available from Cessna Parts Distribution (CPD 2).

IV INSPECTION GUIDE LINES.

- (a) **MOVABLE PARTS** for: lubrication, servicing, security of attachment, binding, excessive wear, safetizing, proper operation, proper adjustment, correct travel, cracked fittings, security of hinges, defective bearings, cleanliness, corrosion, deformation, sealing and tension.

CAUTION

Braided steel covered fluid lines will cause rapid wear of any object they are allowed to chafe against. Check that minimum one-half (1/2) inch clearance be maintained between steel covered lines and any component. If this is not feasible, ensure lines are securely clamped or tied to the component.

- (b) **FLUID LINES AND HOSES** for: leaks, cracks, dents, kinks, chafing, proper radius, security, corrosion, deterioration, obstruction and foreign matter.
- (c) **METAL PARTS** for: security of attachment, cracks, metal distortion, broken spotwelds, corrosion, condition of paint and any other apparent damage.
- (d) **WIRING** for: security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration and corroded terminals.
- (e) **BOLTS IN CRITICAL AREAS** for: correct torque in accordance with torque values given in the chart in Section 1, when installed or when visual inspection indicates the need for a torque check.

NOTE

Torque values listed in Section 1 are derived from oil-free cadmium-plated threads, and are recommended for all installation procedures contained in this book except where other values are stipulated. They are not used for checking tightness of installed parts during service.

- (f) **FILTERS, SCREENS & FLUIDS** for: cleanliness, contamination and/or replacement at specified intervals.
- (g) **AIRCRAFT FILE.**

Miscellaneous data, information and licenses are a part of the aircraft file. Check that the following documents are up-to-date and in accordance with current Federal Aviation Regulations. Most of the items listed are required by the United States Federal Aviation Regulations. Since the regulations of other nations may require other documents and data, owners of exported aircraft should check with their own aviation officials to determine their individual requirements.

To be displayed in the aircraft at all times:

1. Aircraft Airworthiness Certificate (FAA Form 8100-2).
2. Aircraft Registration Certificate (FAA Form 8050-3).
3. Aircraft Radio Station License, if transmitter is installed (FCC Form 556).

To be carried in the aircraft at all times:

1. Weight and Balance, and associated papers (Latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
2. Aircraft Equipment List.

To be made available upon request:

1. Aircraft Log Book and Engine Log Book.

(h) ENGINE RUN-UP.

Before beginning the step-by-step inspection, start, run up and shut down the engine in accordance with instructions in the Owner's Manual. During the run-up, observe the following, making note of any discrepancies or abnormalities:

1. Engine temperatures and pressures.
2. Static RPM. (Also refer to Section 11 of this Manual.)
3. Magneto drop. (Also refer to Section 11 of this Manual.)
4. Engine response to changes in power.
5. Any unusual engine noises.
6. Fuel selector and/or shut-off valve; operate engine(s) on each tank (or cell) position and OFF position long enough to ensure shut-off and/or selector valve functions properly.
7. Idling speed and mixture; proper idle cut-off.
8. Alternator and ammeter.
9. Suction gage.
10. Fuel flow indicator.

After the inspection has been completed, an engine run-up should again be performed to determine that any discrepancies or abnormalities have been corrected.

SHOP NOTES:

IMPORTANT
READ ALL INSPECTION REQUIREMENTS PARAGRAPHS PRIOR TO USING THESE CHARTS.

SPECIAL INSPECTION ITEM

EACH 200 HOURS

EACH 100 HOURS

EACH 50 HOURS

PROPELLER

1. Spinner
2. Spinner bulkhead
3. Blades
4. Bolts and/or nuts
5. Hub

ENGINE COMPARTMENT

Check for evidence of oil and fuel leaks, then clean entire engine and compartment, if needed, prior to inspection.

1. Engine oil, screen, filler cap, dipstick, drain plug and external filter element
2. Oil cooler
3. Induction air filter
4. Induction airbox, air valves, doors and controls
5. Cold and hot air hoses
6. Engine baffles
7. Cylinders, rocker box covers and push rod housings
8. Crankcase, oil sump, accessory section and front crankshaft seal
9. Hoses, metal lines and fittings
10. Intake and exhaust systems
11. Ignition harness
12. Spark plugs
13. Compression check
14. Crankcase and vacuum system breather lines
15. Electrical wiring
16. Vacuum pump and oil separator
17. Vacuum relief valve filter (cabin area)
18. Engine controls and linkage
19. Engine shock mounts, mount structure and ground straps
20. Cabin heat valves, doors and controls
21. Starter, solenoid and electrical connections

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SPECIAL INSPECTION ITEM
EACH 200 HOURS
EACH 100 HOURS
EACH 50 HOURS

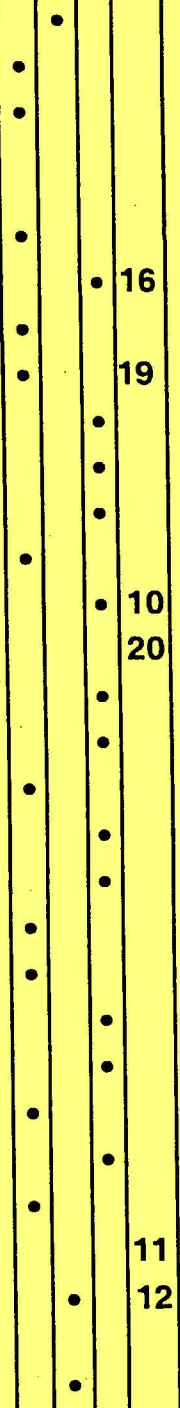
22. Starter brushes, brush leads and commutator	•	
23. Alternator and electrical connections	•	
24. Alternator brushes, brush leads, commutator or slip rings		7
25. Voltage regulator mounting and electrical leads	•	
26. Magnetos (externally) and electrical connections	•	
27. Magnetos (internally)		15
28. Magnetos timing		8
29. Carburetor and drain plug	•	
30. Firewall	•	
31. Engine cowling	•	
FUEL SYSTEM		
1. Fuel strainer, drain valve and control	•	
2. Fuel strainer screen and bowl	•	
3. Fuel tank vents, caps and placards	•	
4. Fuel tanks, sump drains and fuel line drains	•	
5. Drain fuel and check tank interior, attachment and outlet screens		5
6. Fuel vent valves	•	
7. Vent line drain	•	
8. Fuel shut-off valve and placards	•	
9. Fuel valve drain plug	•	
10. Engine primer	•	
11. Perform a fuel quantity indicating system operational test. Refer to Section 15 for detailed accomplishment instructions.		18
LANDING GEAR		
1. Main gear wheels and fairings	•	17
2. Nose gear wheel, torque links, steering tubes, boots and fairing	•	17
3. Wheel bearings		9
4. Nose gear strut and shimmy dampener (service as required)	•	
5. Tires	•	
6. Brake fluid, lines and hoses, linings, discs, brake assemblies and master cylinders	•	
7. Parking brake system	•	
8. Main gear springs	•	

SPECIAL INSPECTION ITEM
EACH 200 HOURS
EACH 100 HOURS
EACH 50 HOURS

- 9. Nose steering arm lubrication
- 10. Torque link lubrication
- 11. parking brake and toe brakes - operational check

AIRFRAME

- 1. Aircraft exterior
- 2. Aircraft structure
- 3. Windows, windshield, doors and seals
- 4. Seat belt and shoulder harness
- 5. Seat stops, seat rails, upholstery, structure and mounting.....
- 6. Control "Y" bearings, sprockets, pulleys, cables, chains and turnbuckles
- 7. Control lock, control wheel and control "Y" mechanism
- 8. Instruments and markings
- 9. Gyros central air filter
- 10. Magnetic compass compensation
- 11. Instrument wiring and plumbing
- 12. Instrument panel, shock mounts, ground straps, cover, decals and labeling
- 13. Defrosting, heating and ventilating systems and controls
- 14. Cabin upholstery, trim, sun visors and ashtrays
- 15. Area beneath floor, lines, hose, wires and control cables
- 16. Lights, switches, circuit breakers, fuses, and spare fuses
- 17. Exterior lights.....
- 18. Pitot and static systems
- 19. Stall warning unit and pitot heater
- 20. Radios, radio controls, avionics and flight instruments.....
- 21. Antennas and cables
- 22. Battery, battery box and battery cables.....
- 23. Battery electrolyte.....
- 24. Emergency locator transmitter
- 25. Inspect all fluid carrying lines and hoses in the cabin and wing areas
for leaks, damage, abrasion, and corrosion.



SPECIAL INSPECTION ITEM

EACH 200 HOURS

EACH 100 HOURS

EACH 50 HOURS

CONTROL SYSTEMS

In addition to the items listed below, always check for correct direction of movement, correct travel and correct cable tension.

1. Cables, terminals, pulleys, pulley brackets, cable guards, turnbuckles and fairleads				
2. Chains, terminals, sprockets and chain guards				
3. Trim control wheels, indicators, actuator and bungee				
4. Travel stops				
5. Decals and labeling				
6. Flap control switch, flap rollers and tracks, flap indicator				
7. Flap motor, transmission, limit switches, structure, linkage, bellcranks, etc.				
8. Elevator and trim tab hinges, tips and control rods				
9. Elevator trim tab system free-play inspection				
10. Elevator trim tab actuator lubrication and tab free-play inspection				13
11. Rudder pedal assemblies and linkage				
12. Skins (external) of control surfaces and tabs				
13. Internal structure of control surfaces				
14. Balance weight attachment				
15. Flap actuator jack screw threads				14

SPECIAL INSPECTION ITEMS

1. First 25 hours: Use mineral oil conforming with MIL-C-6529 Type II for the first 25 hours of operation or until oil consumption has stabilized, or six months, whichever occurs first. If oil consumption has not stabilized in this time, drain and replenish the oil and replace the oil filter. After oil consumption has stabilized, change to an ashless dispersant oil, refer to Teledyne Continental Service Information Letter SIL99-2, or latest revision for a current listing of lubricants authorized by TCM. Change oil each 25 hours if engine is NOT equipped with external oil filter; if equipped with an external oil filter, change oil filter element and oil at each 50 hours of operation or every six months, whichever occurs first. Refer to the latest edition of the TCM engine operator/maintenance manual for the latest oil change intervals and inspection procedures.
2. Clean filter per paragraph 2-22. Replace as required.
3. Replace engine compartment hoses per the following schedule:
 - A. Cessna-Installed Flexible Fluid Carrying Rubber Hoses; replace every 5 years or at engine overhaul, whichever occurs first.
 - B. Cessna Installed Flexible Fluid Carrying Teflon Hoses, replace every 10 years or at engine overhaul, whichever occurs first.
 - C. TCM Installed Engine Compartment Flexible Fluid Carrying Hoses, refer to Teledyne Continental Service Bulletin SB97-6 or latest revision for hose replacement intervals.
4. General inspection every 50 hours. Refer to Section 11 for 100 hour inspection.
5. Each 1000 hours, or at engine overhaul, whichever occurs first.
6. Each 50 hours for general condition and freedom of movement. These controls are not repairable, replace throttle and mixture controls at each engine overhaul.
7. Each 500 hours.
8. Internal Timing:

For airplanes equipped with Slick 4100 series magnetos:

These magnetos cannot be overhauled in the field. The coil, capacitor, and breaker assembly are non-replaceable. These magnetos shall be removed from service upon reaching 800 hours total time in service.

For airplanes equipped with Slick 4300 Series magnetos or TCM/Bendix magnetos:

Refer to the applicable service manual and service bulletins for internal timing procedures and service intervals.

Magneto-To-Engine Timing: First 50 hours, first 100 hours and each 200 hours thereafter.
9. First 100 hours and each 500 hours thereafter. More often if operated under prevailing wet or dusty conditions.
10. Replace each 500 hours.
11. Check electrolyte level and clean battery compartment each 50 hours or 30 days, whichever occurs first.
12. Refer to Section 16 of this manual.

13. Replacement or overhaul of the actuator is required each 1000 hours and/or 3 years, whichever comes first. Refer to figure 2-5 for grease specifications.

NOTE: Refer to Section 9 of this service manual and Cessna Single Engine Service Letter SE73-25, or latest revision, for free-play limits, inspection, replacement and/or repair information.

14. Refer to paragraph 2-44 for detailed instructions for various serial ranges.
15. Each 500 hours. Inspect contact points. Inspect carbon brush, high tension lead, and distributor block. Inspect impulse coupling and pawls. Replace as required. Inspect and lubricate bearings and contact point cam.
16. Vertical stabilizer attachment each 100 hours or annual inspection. However it is recommended that nutplates used to attach the vertical stabilizer be inspected after each 100 hours of operation. Refer to paragraph 4-14A for detailed instructions.
17. Each 100 hours or annual inspection, check socket head cap screws for proper torque. When replacing wheel bearings, check webs around flange mounting screw holes. During tire or tube change, or when the wheel is otherwise disassembled, use dye penetrant to inspect the hubs. Refer to paragraph 2-38.
18. Fuel quantity indicating system operational test is required every 12 months. Refer to Section 15 for detailed accomplishment instructions.
19. Inspect each 50 hours for general condition and security. Replacement is required every 10 years.
20. When the accuracy of the compass is in question, when components are added or removed which have the potential to affect the magnetic accuracy and/or variation of the compass calibration, or after a lightning strike. Refer to Advisory Circular AC43.13-1B, Chapter 12, Section 3 Ground Operational Checks for Avionics Equipment for a detailed listing of conditions requiring the performance of a compass swing and compass swing procedures.

2-45. COMPONENT TIME LIMITS

1. General

- A. Most components listed throughout Section 2 should be inspected as detailed elsewhere in this section and repaired, overhauled or replaced as required. Some components, however, have a time or life limit, and must be overhauled or replaced on or before the specified time limit.

NOTE: The terms overhaul and replacement as used within this section are defined as follows:

Overhaul - Item may be overhauled as defined in FAR 43.2 or it can be replaced.

Replacement - Item must be replaced with a new item or a serviceable item that is within its service life and time limits or has been rebuilt as defined in FAR 43.2.

- B. This section provides a list of items which must be overhauled or replaced at specific time limits. Table 1 lists those items which Cessna has mandated must be overhauled or replaced at specific time limits. Table 2 lists component time limits which have been established by a supplier to Cessna for the supplier's product.
- C. In addition to these time limits, the components listed herein are also inspected at regular time intervals set forth in the Inspection Charts, and may require overhaul/replacement before the time limit is reached based on service usage and inspection results.

2. Cessna-Established Replacement Time Limits

A. The following component time limits have been established by Cessna Aircraft Company.

Table 1: Cessna-Established Replacement Time Limits

COMPONENT	REPLACEMENT TIME	OVERHAUL
Restraint Assembly Pilot, Copilot, and Passenger Seats	10 years	NO
Trim Tab Actuator	1,000 hours or 3 years, whichever occurs first	YES
Vacuum System Filter	500 hours	NO
Vacuum System Hoses	10 years	NO
Pitot and Static System Hoses	10 years	NO
Vacuum Relief/Regulator Valve Filter (If Installed)	500 hours	NO
Engine Compartment Flexible Fluid Carrying Teflon Hoses (Cessna-Installed) Except Drain Hoses (Drain hoses are replaced on condition)	10 years or engine overhaul, whichever occurs first (Note 1)	NO
Engine Compartment Flexible Fluid Carrying Rubber Hoses (Cessna-Installed) Except Drain Hoses (Drain hoses are replaced on condition)	5 years or engine overhaul, whichever occurs first (Note 1)	NO
Engine Air Filter	500 hours or 36 months, whichever occurs first (Note 9)	NO
Engine Mixture, and Throttle, Controls	At engine TBO	NO
Engine Driven Dry Vacuum Pump Drive Coupling (Not lubricated with engine oil)	6 years or at vacuum pump replacement, whichever occurs first	NO
Engine Driven Dry Vacuum Pump (Not lubricated with engine oil)	500 hours (Note 10)	NO
Standby Dry Vacuum Pump	500 hours or 10 years, whichever occurs first (Note 10)	NO

3. Supplier-Established Replacement Time Limits

A. The following component time limits have been established by specific suppliers and are reproduced as follows:

Table 2: Supplier-Established Replacement Time Limits

COMPONENT	REPLACEMENT TIME	OVERHAUL
ELT Battery	Note 3	NO
Vacuum Manifold	Note 4	NO
Magnetos	Note 5	YES
Engine	Note 6	YES
Engine Flexible Hoses (TCM Installed)	Note 2	NO
Auxiliary Electric Fuel Pump	Note 7	YES
Propeller	Note 8	YES

NOTES:

Note 1: This life limit is not intended to allow flexible fluid-carrying Teflon or rubber hoses in a deteriorated or damaged condition to remain in service. Replace engine compartment flexible Teflon (AE3663819BXXXX series hose) fluid-carrying hoses (Cessna installed only) every ten years or at engine overhaul, whichever occurs first. Replace engine compartment flexible rubber fluid-carrying hoses (Cessna installed only) every five years or at engine overhaul, whichever occurs first (this does not include drain hoses). Hoses which are beyond these limits and are in a serviceable condition, must be placed on order immediately and then be replaced within 120 days after receiving the new hose from Cessna.

Note 2: Refer to Teledyne Continental Service Bulletin SB97-6, or latest revision.

Note 3: Refer to FAR 91.207 for battery replacement time limits.

Note 4: Refer to Airborne Air & Fuel Product Reference Memo No. 39, or latest revision, for replacement time limits.

Note 5: For airplanes equipped with Slick magnetos, refer to Slick Service Bulletin SB2-80C, or latest revision, for time limits.

For airplanes equipped with TCM/Bendix magnetos, refer to Teledyne Continental Motors Service Bulletin No. 643, or latest revision, for time limits.

Note 6: Refer to Teledyne Continental Service Information Letter SIL98-9, or latest revision, for time limits.

Note 7: Refer to Cessna Service Bulletin SEB94-7 Revision 1/Dukes Inc. Service Bulletin NO. 0003, or latest revision.

Note 8: Refer to the applicable McCauley Service Bulletins and Overhaul Manual for replacement and overhaul information.

Note 9: The air filter may be cleaned, refer to Section 2 of this service manual for servicing instructions. For airplanes equipped with an air filter manufactured by Donaldson, refer to Donaldson Aircraft Filters Service Instructions P46-9075 for detailed servicing instructions.

The address for Donaldson Aircraft Filters is:

Customer Service
115 E. Steels Corners RD
Stow OH. 44224

Do not overservice the air filter, overservicing increases the risk of damage to the air filter from excessive handling. A damaged/worn air filter may expose the engine to unfiltered air and result in damage/excessive wear to the engine.

Note 10: Replace engine driven dry vacuum pump not equipped with a wear indicator every 500 hours of operation, or replace according to the vacuum pump manufacturer's recommended inspection and replacement interval, whichever occurs first.

Replace standby vacuum pump not equipped with a wear indicator every 500 hours of operation or 10 years, whichever occurs first, or replace according to the vacuum pump manufacturer's recommended inspection and replacement interval, whichever occurs first.

For a vacuum pump equipped with a wear indicator, replace pump according to the vacuum pump manufacturer's recommended inspection and replacement intervals.

SECTION 3

FUSELAGE

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3-1. FUSELAGE.

3-2. WINDSHIELD AND WINDOWS.

3-3. DESCRIPTION. The windshield and windows are single-piece acrylic plastic panels set in sealing strips and held by formed retaining strips secured to the fuselage with screws and rivets. Presstite No. 579.6 sealing compound used in conjunction with a felt seal is applied to all edges of windshield and windows with exception of wing root area. The wing root fairing has a heavy felt strip which completes the windshield sealing.

3-4. CLEANING. (Refer to Section 2.)

3-5. WAXING. Waxing will fill in minor scratches in clear plastic and help protect the surface from further abrasion. Use a good grade of commercial wax applied in a thin, even coat. Bring wax to a high polish by rubbing lightly with a clean, dry flannel cloth.

3-6. REPAIRS. Damaged window panels and windshield may be removed and replaced if damage is extensive. However, certain repairs as prescribed in the following paragraphs can be made successfully without removing damaged part from aircraft. Three types of temporary repairs for cracked plastic are possible. No repairs of any kind are recommended on highly-stressed or compound curves where repair would be likely to affect pilot's field of vision. Curved areas are more difficult to repair than flat areas and any repaired area is both structurally and optically inferior to the original surface.

3-7. SCRATCHES. Scratches on clear plastic surfaces can be removed by hand-sanding operations followed by buffing and polishing, if steps below are followed carefully.

a. Wrap a piece of No. 320 (or finer) sandpaper or abrasive cloth around a rubber pad or wood block. Rub surface around scratch with a circular motion, keeping abrasive constantly wet with clean water to prevent scratching surface further. Use minimum

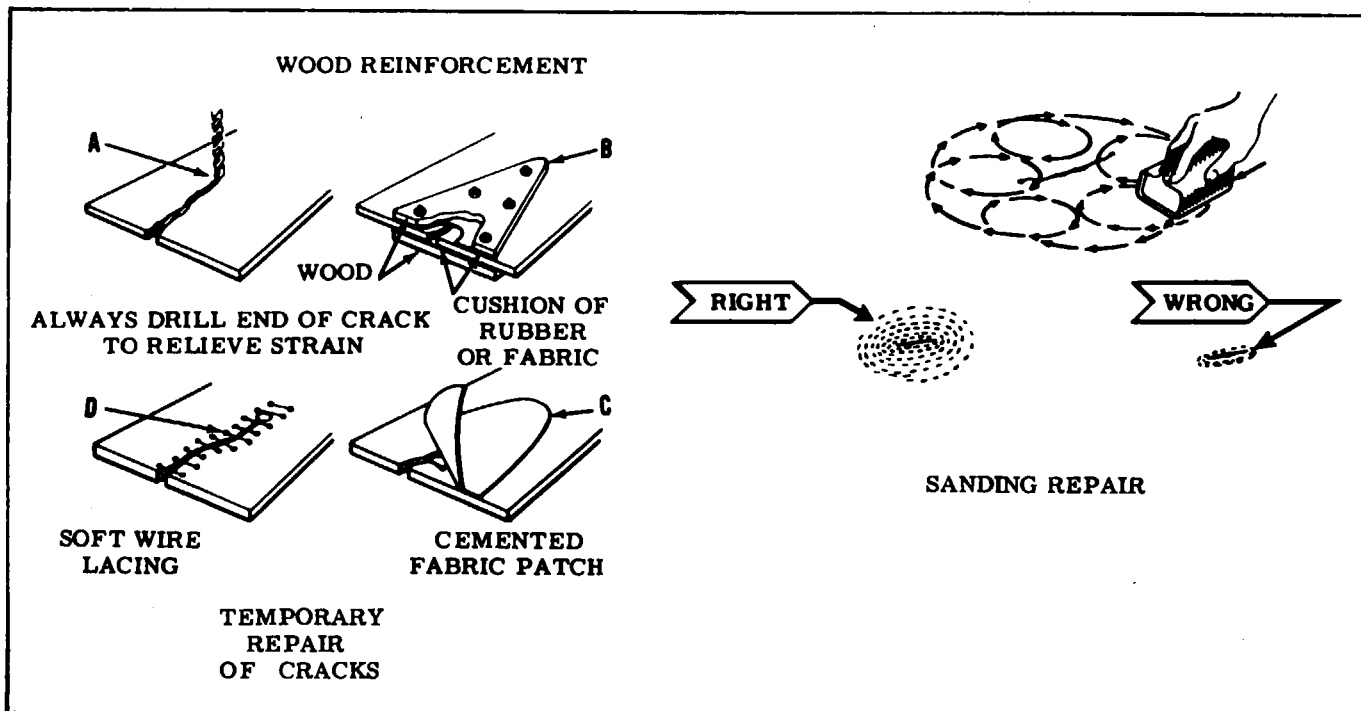


Figure 3-1. Repair of Windows and Windshield

pressure and cover an area large enough to prevent formation of "bull's-eyes" or other optical distortions.

CAUTION

Do not use a coarse grade of abrasive. No. 320 is of maximum coarseness.

b. Continue sanding operation, using progressively finer grade abrasives until scratches disappear.

c. When scratches have been removed, wash area thoroughly with clean water to remove all gritty particles. The entire sanded area will be clouded with minute scratches which must be removed to restore transparency.

d. Apply fresh tallow or buffing compound to a motor-driven buffing wheel. Hold wheel against plastic surface, moving it constantly over damaged area until cloudy appearance disappears. A 2000-foot-per-minute surface speed is recommended to prevent overheating and distortion. (Example: 750 rpm polishing machine with a 10 inch buffing bonnet.)

NOTE

Polishing can be accomplished by hand but will require a considerably longer period of time to attain the same result as produced by a buffing wheel.

e. When buffing is finished, wash area thoroughly and dry with a soft flannel cloth. Allow surface to cool and inspect area to determine if full transparency has been restored. Apply a thin coat of hard wax and polish surface lightly with a clean flannel cloth.

NOTE

Rubbing plastic surface with a dry cloth will build up an electrostatic charge which attracts dirt particles and may eventually cause scratching of surface. After wax has hardened, dissipate this charge by rubbing surface with a slightly damp chamois. This will also remove dust particles which have collected while wax is hardening.

f. Minute hairline scratches can often be removed by rubbing with commercial automobile body cleaner or fine-grade rubbing compound. Apply with a soft, clean, dry cloth or imitation chamois.

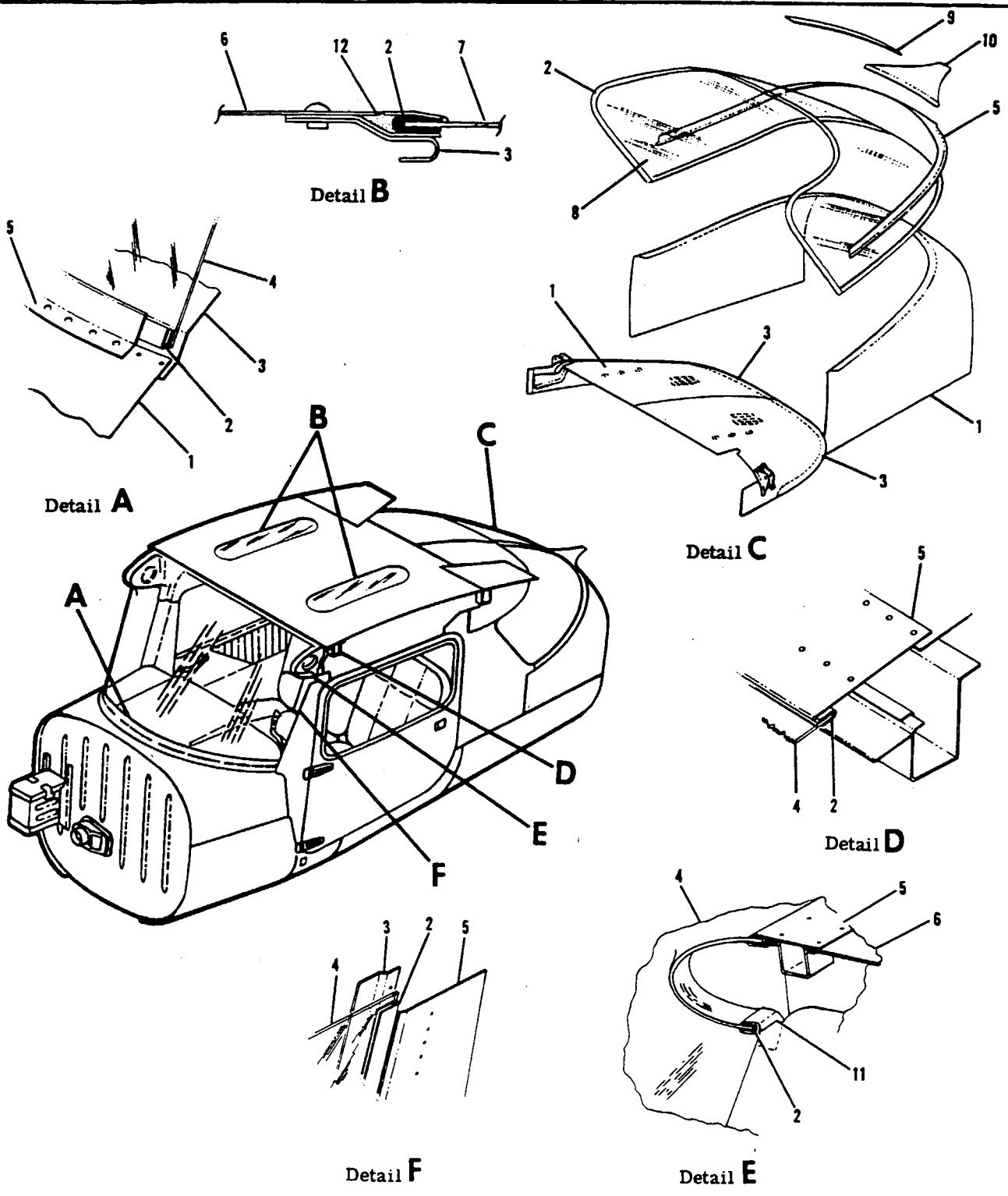
3-8. CRACKS. (Refer to figure 3-1.)

a. When a crack appears, drill a hole at end of crack to prevent further spreading. Hole should be approximately 1/8 inch in diameter, depending on length of crack and thickness of material.

b. Temporary repairs to flat surfaces can be accomplished by placing a thin strip of wood over each side of surface and inserting small bolts through wood and plastic. A cushion of sheet rubber or aircraft fabric should be placed between wood and plastic on both sides.

c. A temporary repair can be made on a curved surface by placing fabric patches over affected areas. Secure patches with aircraft dope, Specification No. MIL-D-5549; or lacquer, Specification No. MIL-L-7178. Lacquer thinner, Specification No. MIL-T-6094 can also be used to secure patch.

d. A temporary repair can be made by drilling small holes along both sides of crack 1/4 to 1/8 inch apart and lacing edges together with soft wire. Small-stranded antenna wire makes a good temporary



- | | |
|-------------------|--------------------------|
| 1. Fuselage Skin | 7. Overhead Cabin Window |
| 2. Felt Seal | 8. Rear Window |
| 3. Inner Retainer | 9. External Centerstrip |
| 4. Windshield | 10. Doubler |
| 5. Outer Retainer | 11. Cover |
| 6. Cabin Top Skin | * 12. Sealer |

*** NOTE**
 Apply Isocryl 5603 sealer to all edges of windshield and windows under outer retainer (5).

lacing material. This type of repair is used as a temporary measure ONLY, and as soon as facilities are available, panel should be replaced.

3-9. WINDSHIELD. (Refer to figure 3-2.)

3-10. REMOVAL.

- a. Drill out rivets securing front retainer strip.
- b. Remove wing fairings over windshield edges.

NOTE

Remove and tape compass clear of work area. Do not disconnect electrical wiring.

- c. Pull windshield straight forward, out of side and top retainers. Remove top retainer if necessary.

3-11. INSTALLATION.

- a. Apply felt strip and sealing compound or sealing tape to all edges of windshield to prevent leaks.
- b. Reverse steps in preceding paragraph for installation.
- c. When installing a new windshield, check fit and carefully file or grind away excess plastic.
- d. Use care not to crack windshield when installing. If not previously removed, top retainer may be removed if necessary. Starting at upper corner and gradually working windshield into position is recommended.

NOTE

Screws and self-locking nuts may be used instead of rivets which fasten front retaining strip to cowl deck. If at least No. 6 screws are used, no loss of strength will result.

3-12. WINDOWS.

3-13. MOVABLE. (Refer to figure 3-3.) Movable windows, hinged at the top are installed in the cabin doors.

3-14. REMOVAL AND INSTALLATION.

- a. Disconnect window stop (4).
- b. Remove pins from window hinges (8).
- c. Reverse preceding steps for installation. To remove frame from plastic panel, drill out blind rivets at frame splice. When replacing plastic panel in frame, ensure sealing strip and an adequate coating of Isocryl 5603 sealer is used around all edges of panel. Refer to Section 19 before painting the inside of the window frame.

3-15. WRAP-AROUND REAR. (Refer to figure 3-2.) The rear window is a one-piece acrylic plastic panel set in sealing strips and held in place by retaining strips.

3-16. REMOVAL AND INSTALLATION.

- a. Remove upholstery as necessary to expose retainer strips inside cabin.
- b. Remove external centerstrip (9).
- c. Drill out rivets to remove outer retainer (5).

- d. Remove window by lifting aft edge and pulling window aft. If difficulty is encountered, rivets securing inner retainers (3) may also be drilled out and retainers loosened or removed as necessary.

- e. Reverse preceding steps for installation. Apply sealing strips and an adequate coating of sealing compound to prevent leaks. When installing a new window, use care not to crack panel and file or grind away excess plastic.

3-17. OVERHEAD. (Refer to figure 3-2.) Overhead cabin windows, located in the cabin top, may be installed. These windows are one-piece acrylic plastic panels set in sealing strips and held in place by retaining strips.

3-18. REMOVAL AND INSTALLATION.

- a. Remove headliner and trim panels.
- b. Drill out rivets as necessary to remove retainer strips.
- c. Reverse preceding steps for installation. Apply sealing strips and an adequate coating of sealing compound to prevent leaks. When installing a new window, use care not to crack panel and file or grind away excess plastic.

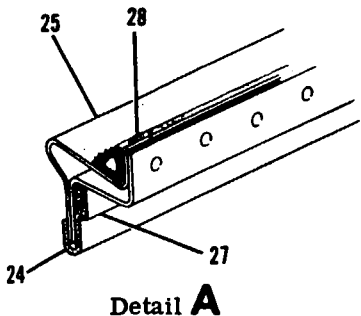
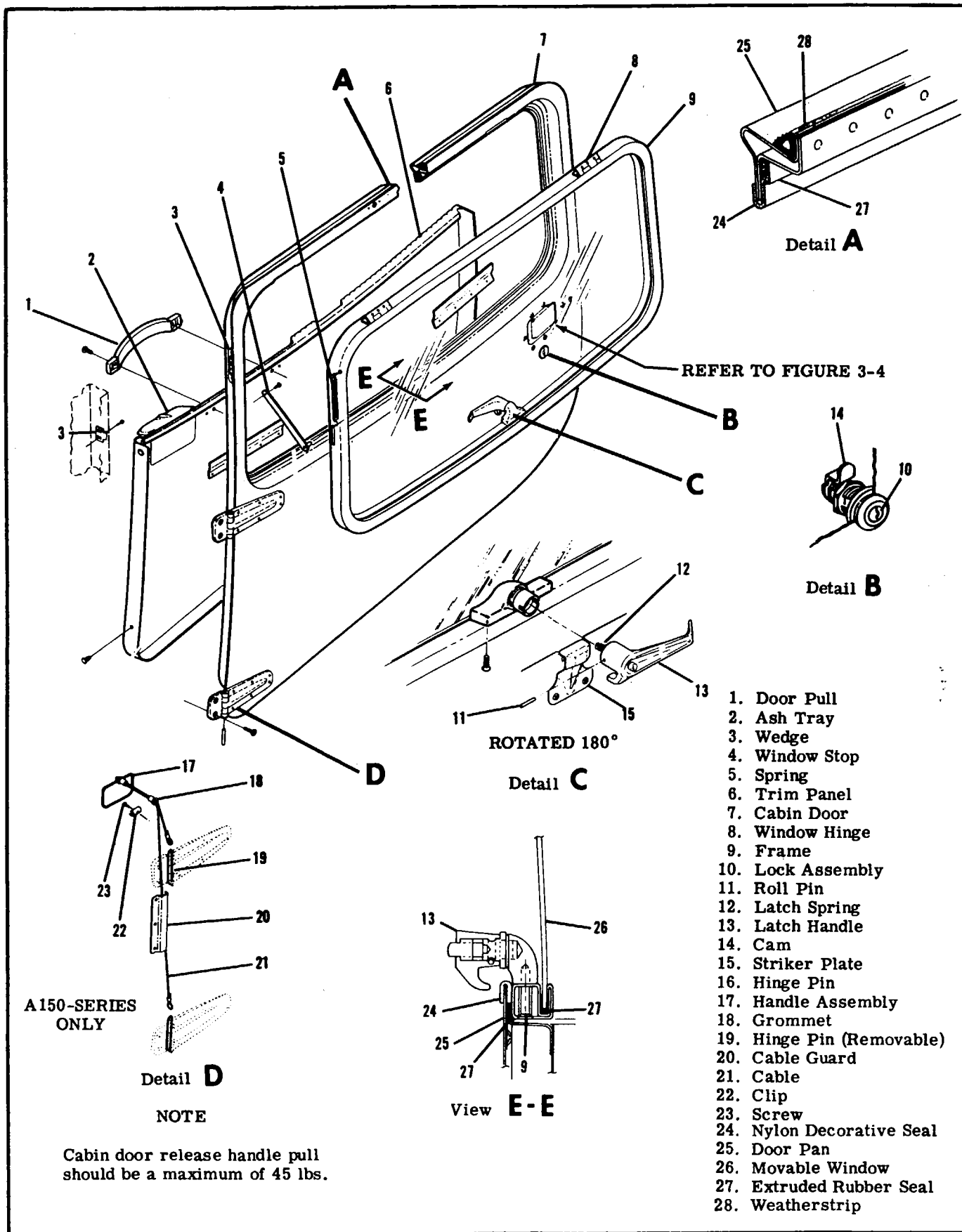
3-19. CABIN DOORS. (Refer to figure 3-3.)

3-20. REMOVAL AND INSTALLATION. On models except A150-Series, removal of cabin doors is accomplished by removing the screws which attach the hinges or by removing the hinge pins. If the permanent hinge pins are removed from door hinges, they may be replaced by clevis pins secured with cotter pins or new pins may be installed and "spin-bradded." On A150-Series, the hinge pins are of the jettisonable type, which may be removed by pulling the emergency door release. On all 150-Series aircraft, when fitting a new door, some trimming and reforming of the door skin and door edges may be necessary to achieve a good fit.

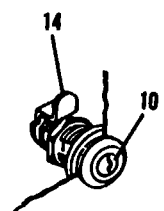
3-21. ADJUSTMENT. Cabin doors should be adjusted so skin fits with fuselage skin. Slots at latch plate permit re-positioning of striker plate. Depth of latch engagement may be changed by adding or removing washers or shims between striker plate and doorpost.

3-22. WEATHERSTRIP. A weatherstrip is cemented around all edges of door. New weatherstrip may be applied after mating surfaces of weatherstrip and door are clean, dry and free from oil or grease. Apply a thin, even coat of adhesive to each surface and allow to dry until tacky before pressing strip in place. Minnesota Mining and Manufacturing Co. No. EC880 cement is recommended. Cut small notch in hollow-type weatherstrip for drainage and position splice at door low point. Be careful not to stretch weatherstrip around door corners.

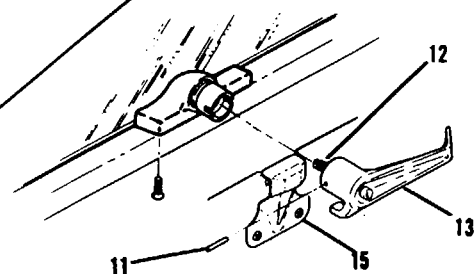
3-23. WEDGE ADJUSTMENT. Wedges at upper forward edge of door aid in preventing air leaks at this point. They engage as door is closed. Several attaching holes are located in wedges and holes which gives best results should be selected.



Detail A

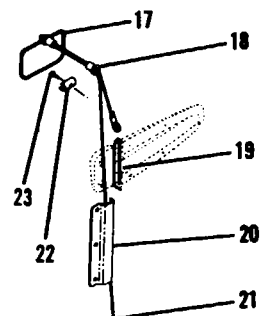


Detail B

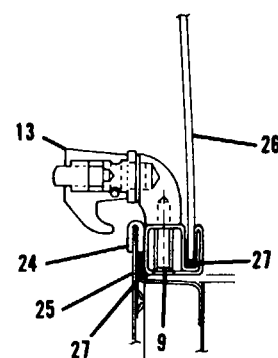


ROTATED 180°

Detail C



Detail D



View E-E

- 1. Door Pull
- 2. Ash Tray
- 3. Wedge
- 4. Window Stop
- 5. Spring
- 6. Trim Panel
- 7. Cabin Door
- 8. Window Hinge
- 9. Frame
- 10. Lock Assembly
- 11. Roll Pin
- 12. Latch Spring
- 13. Latch Handle
- 14. Cam
- 15. Striker Plate
- 16. Hinge Pin
- 17. Handle Assembly
- 18. Grommet
- 19. Hinge Pin (Removable)
- 20. Cable Guard
- 21. Cable
- 22. Clip
- 23. Screw
- 24. Nylon Decorative Seal
- 25. Door Pan
- 26. Movable Window
- 27. Extruded Rubber Seal
- 28. Weatherstrip

A150-SERIES ONLY

NOTE

Cabin door release handle pull should be a maximum of 45 lbs.

Figure 3-3. Cabin Door and Movable Window

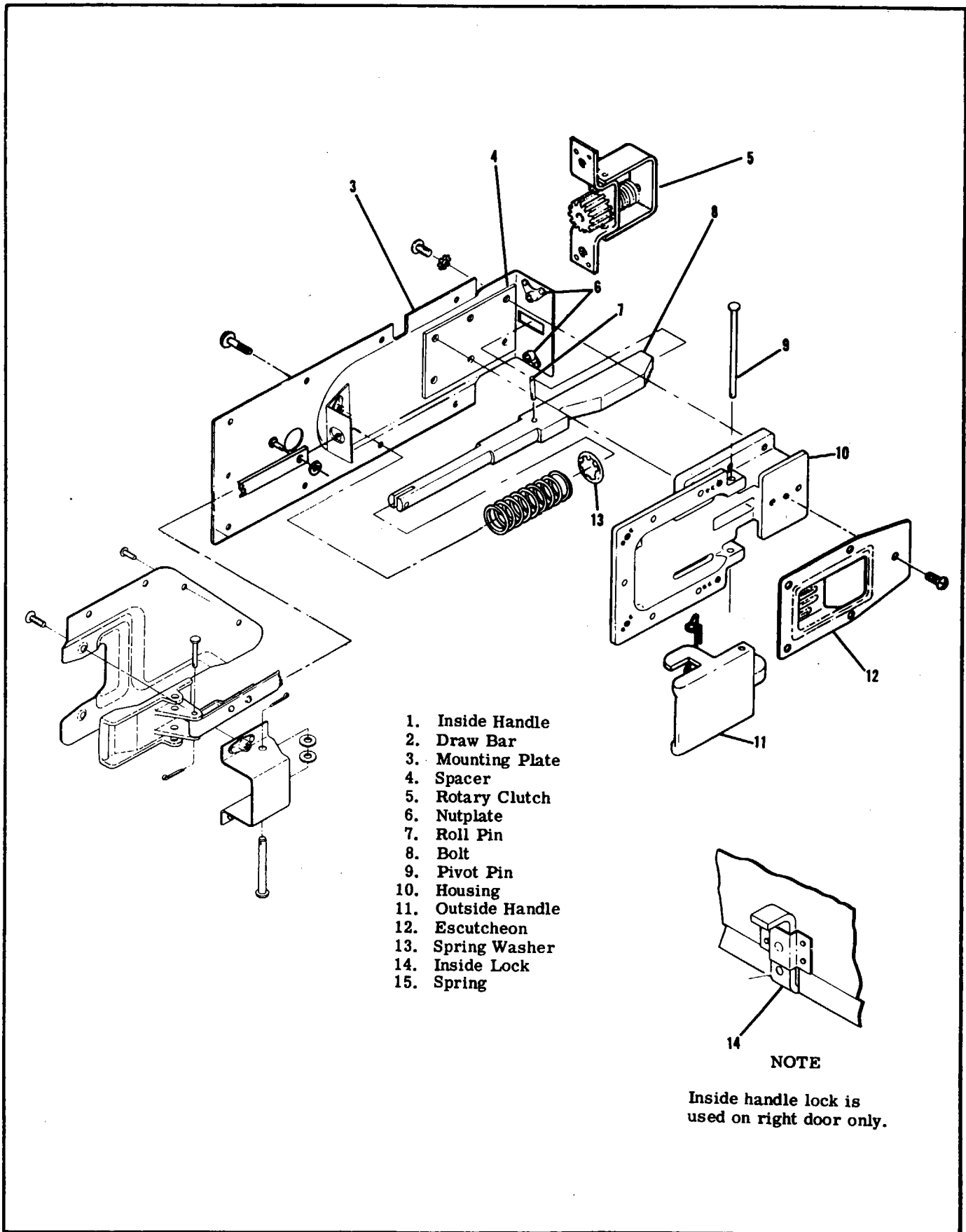


Figure 3-4. Cabin Door Latch

3-24. CABIN DOOR LATCHES. (Refer to figure 3-4.)

3-25. DESCRIPTION. The cabin door latch utilizes a rotary clutch for positive bolt engagement. As the door is closed, teeth on underside of bolt engage gear teeth on clutch. The clutch gear rotates in one direction only and holds door closed. Flush-mounted outside and inside door handles are used to actuate door latches.

3-26. ADJUSTMENT. Adjustment of latch or clutch cover is afforded by oversize and/or slotted holes. This adjustment ensures sufficient gear-to-bolt engagement and proper alignment.

NOTE

Lubricate door latch per Section 2. No lubrication is recommended for rotary clutch.

3-27. LOCK. In addition to an interior lock, a cylinder and key type lock is installed on left door. If lock is to be replaced, the new one may be modified to accept original key. This is desirable, as the same key is used for ignition switch and cabin door lock. After removing old lock from door, proceed as follows:

- a. Remove lock cylinder from new housing.
- b. Insert original key into new cylinder and file off any protruding tumblers flush with cylinder. Without removing key, check that cylinder rotates freely in housing.
- c. Install lock assembly in door and check lock operation with door open.
- d. Destroy new key and disregard code number on cylinder.

3-28. SEATS. (Refer to figure 3-5 and 3-6.)

3-29. PILOT AND COPILOT.

A. RECLINING BACK/FORE-AND-AFT ADJUSTABLE BOTTOM.

B. RECLINING BACK/FORE-AND-AFT AND VERTICALLY ADJUSTABLE BOTTOM.

3-30. DESCRIPTION. The standard seats consist of individual chair units for the pilot and copilot positions with fore-and-aft adjustment on seat rails and two position adjustable backs. Optional pilot and copilot seats feature a fore-and-aft adjustment plus a 3 position vertical adjustment.

NOTE

The vertically adjustable seat is spring loaded to the high position and is adjusted upward with no weight on the seat.

Stops are provided to limit the travel on fore-and-aft adjustable seats.

3-31. REMOVAL AND INSTALLATION.

- a. Remove seat stops from rails.
- b. Slide seat fore-and-aft to disengage seat rollers from rails and lift seat out.
- c. Reverse preceding steps for installation. Ensure all seat stops are reinstalled.

WARNING

It is extremely important that seat stops are installed, since acceleration and deceleration could possibly permit seat to become disengaged from seat rails and create a hazardous situation, especially during takeoff and landing.

3-32. AUXILIARY.

3-33. DESCRIPTION. The double-width auxiliary seat is permanently bolted to the cabin structure and offers no adjustment provisions. The seat structure is mounted on hinge brackets with pivot bolts, thus allowing seat to be pivoted upward for more baggage area.

3-34. REMOVAL AND INSTALLATION.

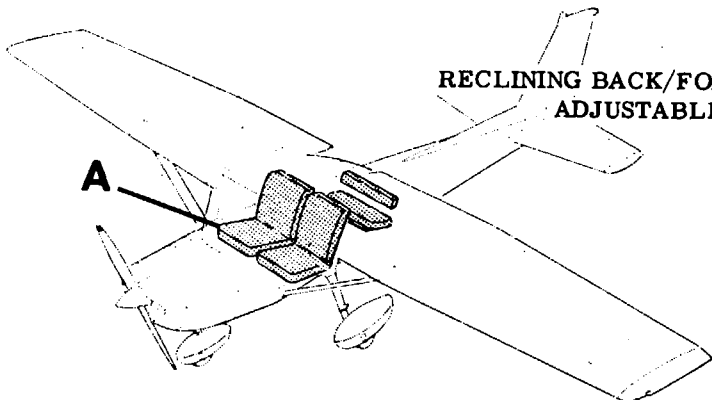
- a. Remove bolts securing seat structure to hinge brackets.
- b. Unsnap seat back from aft cabin wall.
- c. Lift seat out.
- d. Reverse preceding steps for installation.

3-35. REPAIR. Replacement of defective parts is recommended in repair of seats. However, a cracked framework may be welded, provided crack is not in an area of stress concentration (close to a hinge or bearing point). The seat tube-type framework made of 4130 steel may be welded using the heliarc process or equivalent.

3-36. CABIN UPHOLSTERY. Due to the wide selection of fabrics, styles and colors, it is impossible to depict each particular type of upholstery. The following paragraphs describe general procedures which will serve as a guide in removal and replacement of upholstery. Major work, if possible, should be done by an experienced mechanic. If work must be done by a mechanic unfamiliar with upholstery practices, the mechanic should make careful notes during removal of each item to facilitate its replacement later.

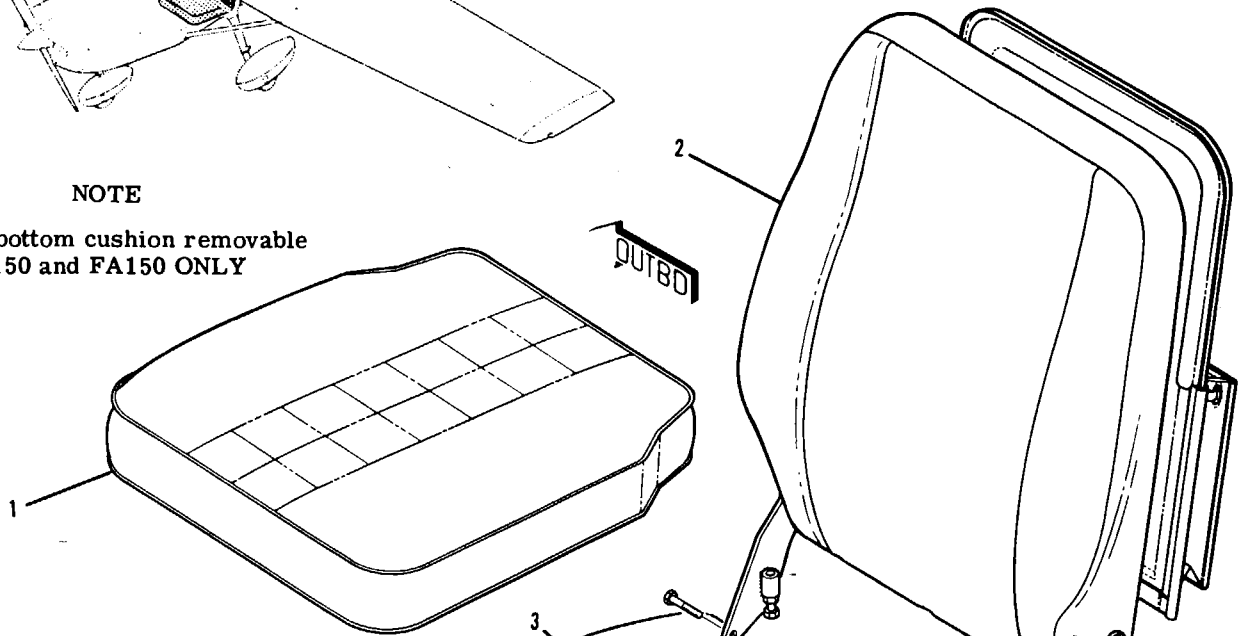
3-37. MATERIALS AND TOOLS. Materials and tools will vary with job. Scissors for trimming upholstery to size and a dull-bladed putty knife for wedging material beneath retainer strips are the only tools required for most trim work. Use industrial rubber cement to hold soundproofing mats and fabric edges in place. Refer to Section 18 for thermo-plastic repairs.

RECLINING BACK/FORE-AND-AFT
ADJUSTABLE SEAT

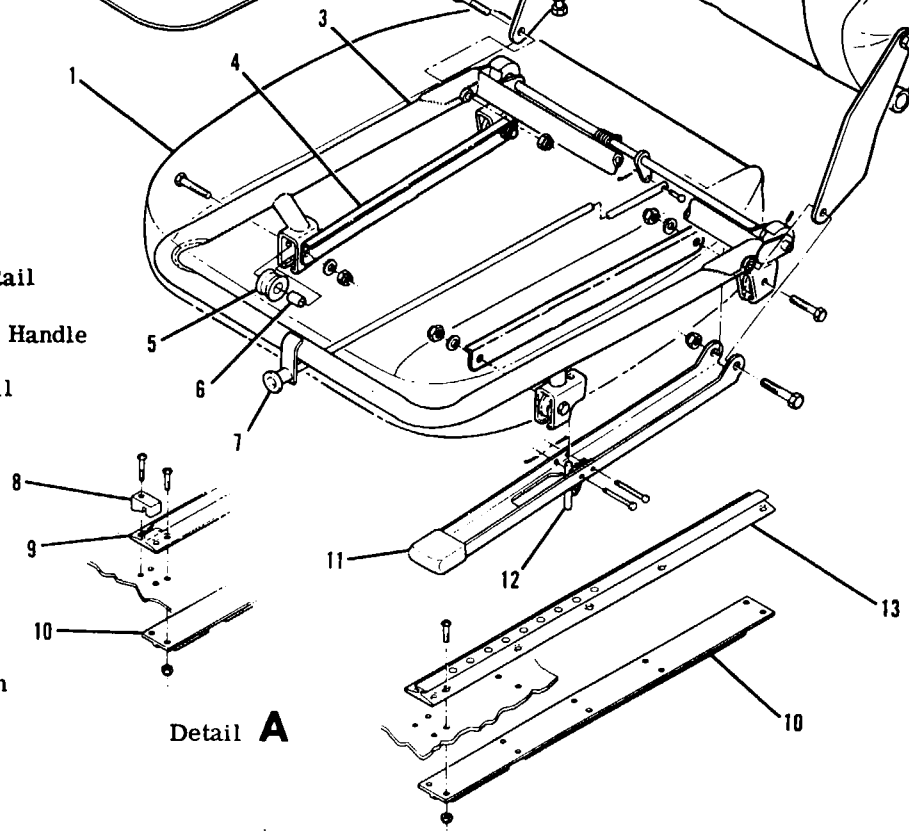


NOTE

Seat bottom cushion removable
on A150 and FA150 ONLY



1. Seat Bottom
2. Seat Back
3. Bottom Frame
4. Brace
5. Roller
6. Bushing
7. Recline Knob
8. Seat Stop
9. Outboard Seat Rail
10. Stiffner
11. Fore/Aft Adjust Handle
12. Latch Pin
13. Inboard Seat Rail



NOTE

Copilot's seat shown

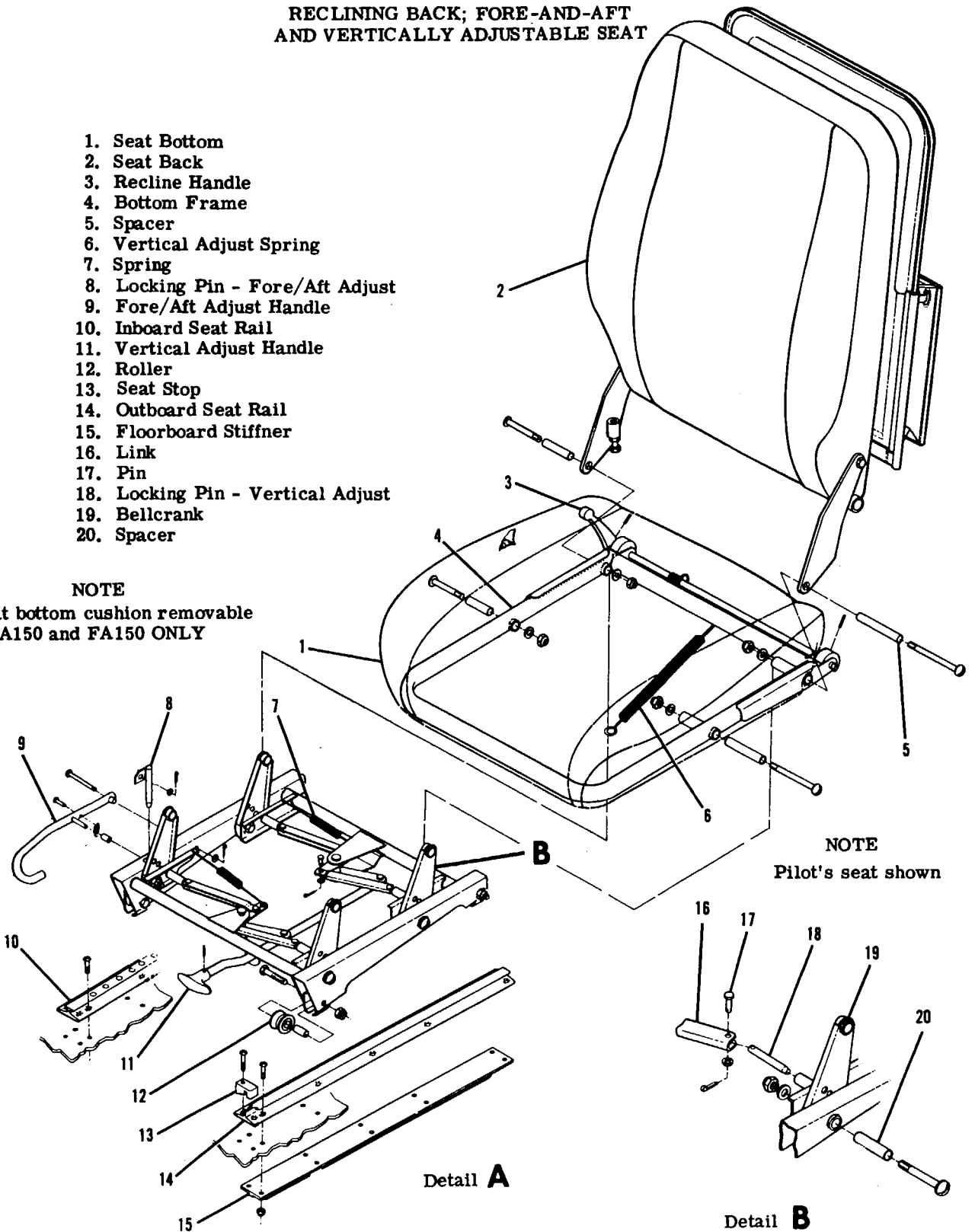
Detail A

Figure 3-5. Pilot and Copilot Seat Installation (Sheet 1 of 2)

RECLINING BACK; FORE-AND-AFT
AND VERTICALLY ADJUSTABLE SEAT

1. Seat Bottom
2. Seat Back
3. Recline Handle
4. Bottom Frame
5. Spacer
6. Vertical Adjust Spring
7. Spring
8. Locking Pin - Fore/Aft Adjust
9. Fore/Aft Adjust Handle
10. Inboard Seat Rail
11. Vertical Adjust Handle
12. Roller
13. Seat Stop
14. Outboard Seat Rail
15. Floorboard Stiffener
16. Link
17. Pin
18. Locking Pin - Vertical Adjust
19. Bellcrank
20. Spacer

NOTE
Seat bottom cushion removable
on A150 and FA150 ONLY



NOTE
Pilot's seat shown

Detail A

Detail B

Figure 3-5. Pilot and Copilot Seat Installation (Sheet 2 of 2)

1. Bottom Frame
2. Seat Bottom
3. Safety Belt
4. Seat Back
5. Seat Back Support
6. Belt Anchor
7. Frame Bracket
8. Spacer

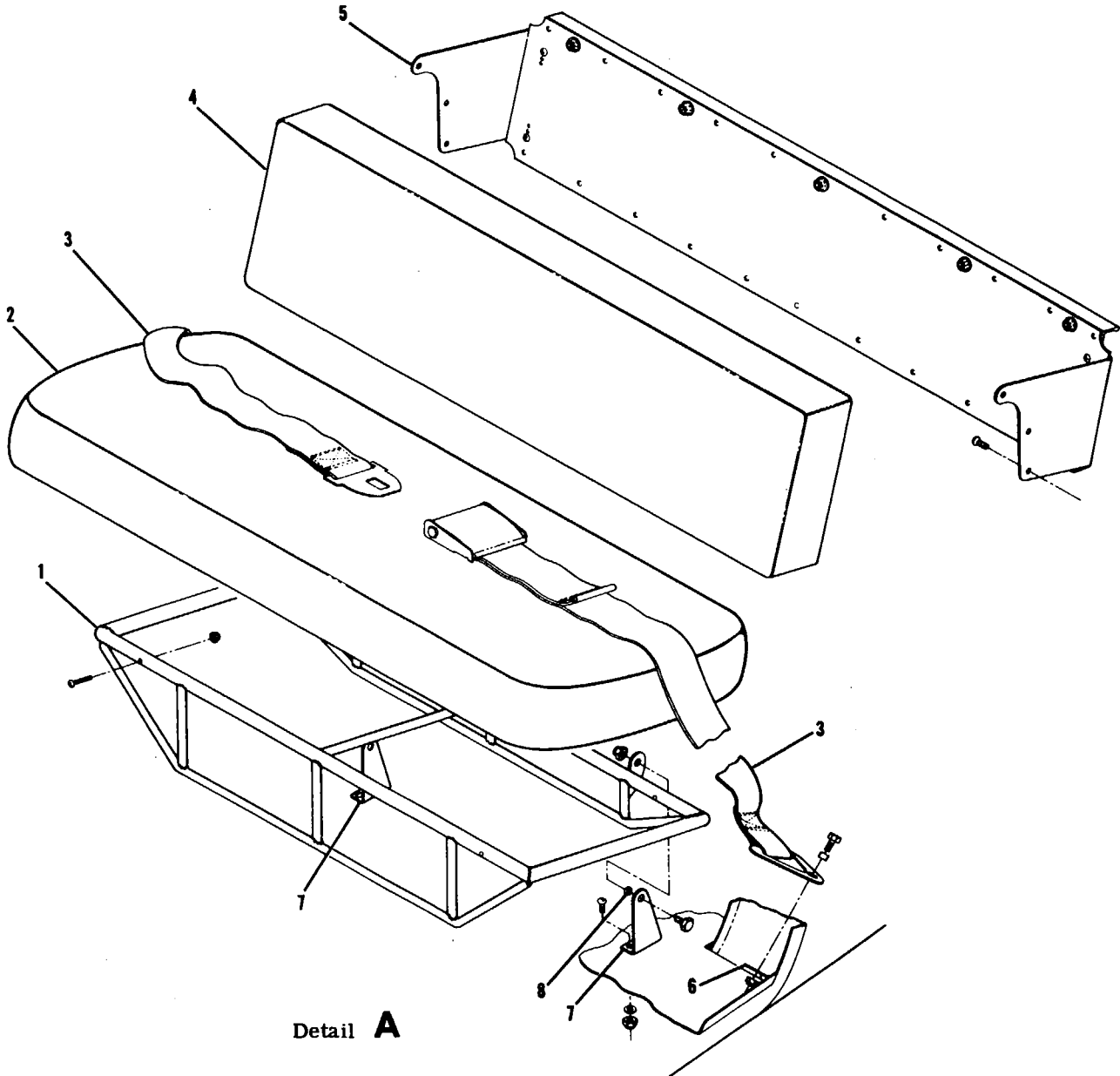
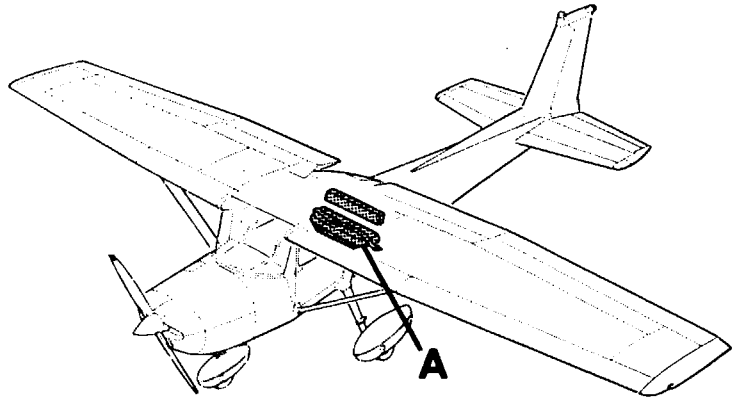


Figure 3-6. Auxiliary Seat Installation

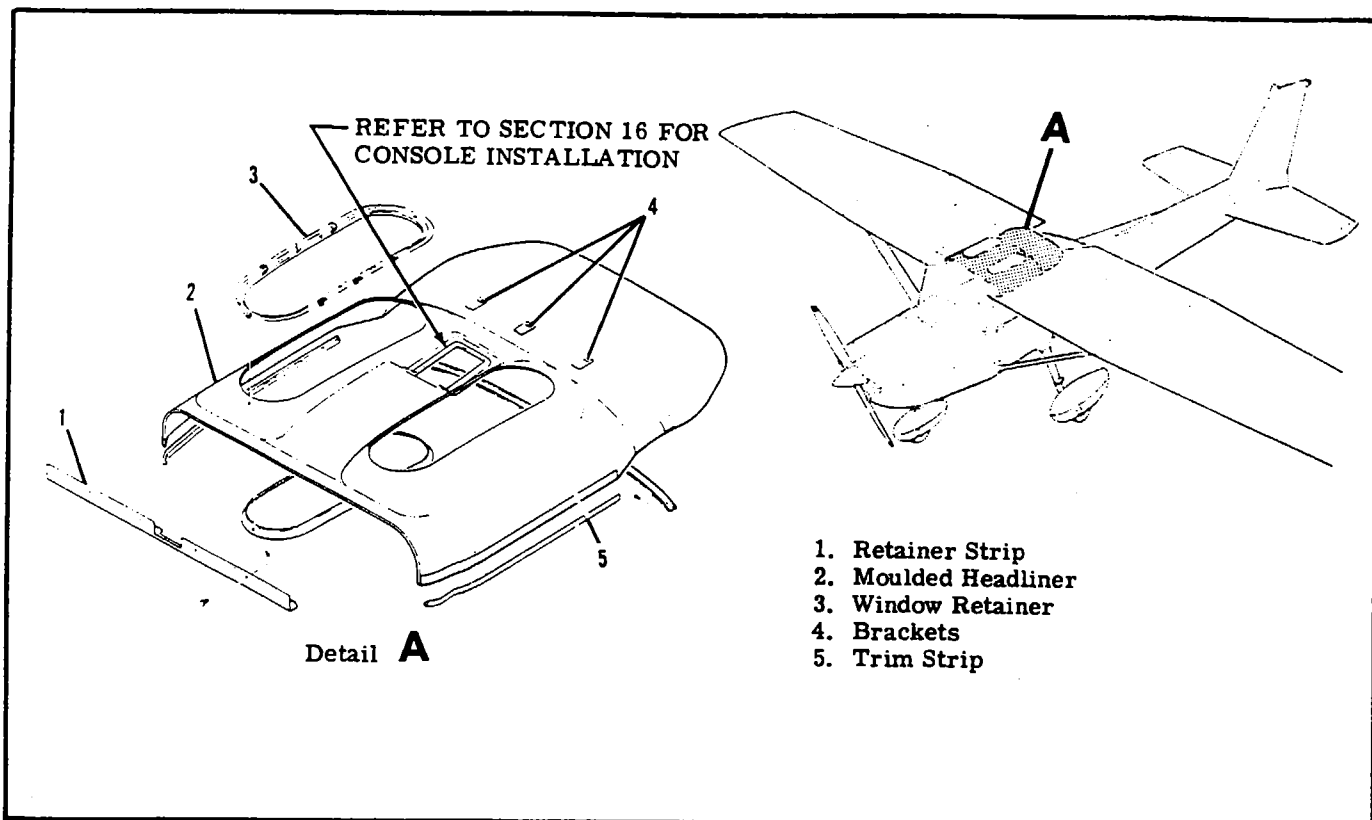


Figure 3-7. Cabin Headliner Installation

3-38. **SOUNDPROOFING.** The aircraft is insulated with spun glass mat-type insulation and a sound deadener compound applied to inner surfaces of skin in most areas of cabin and baggage compartment. All soundproofing material should be replaced in its original position any time it is removed. A soundproofing panel is placed in gap between wing and fuselage and held in place by wing root fairings.

3-39. **CABIN HEADLINER.** (Refer to figure 3-7)

3-40. **REMOVAL AND INSTALLATION.**

1. Remove sun visors, all inside finish strips and plates, overhead console, upper doorpost shields and any other visible retainers securing headliner.
2. Remove molding from fixed windows.
3. Remove screws securing headliner and carefully take down headliner.
4. Remove spun glass soundproofing panels above headliner.

NOTE

The lightweight soundproofing panels are held in place with industrial rubber cement.

5. Reverse preceding steps for installation. Before installation, check all items concealed by headliner for security. Use wide cloth tape to secure loose wires to fuselage and to seal openings in wing roots.

3-41. **UPHOLSTERY SIDE PANELS.** Removal of upholstery side panels is accomplished by removing seats for access, then removing parts attaching panels. Remove screws, retaining strips, arm rests and ashtrays as required to free the various panels. Automotive type spring clips attach most door panels. A dull putty knife makes an excellent tool for prying the clips loose. When installing upholstery side panels, do not over-tighten sheet metal screws. Larger screws may be used in enlarged holes as long as the area behind the hole is checked for electrical wiring, fuel lines and other components which might be damaged by using a longer screw

3-42. **CARPETING.** Cabin area and baggage compartment carpeting is held in place by rubber cement, sheet metal screws or retaining strips. When fitting a new carpet, use old one as a pattern for trimming and marking screw holes.

3-43. **BAGGAGE COMPARTMENT UPHOLSTERY.** A washable plastic held in place by screws and retainers is used in the baggage compartment. Cargo tie-down and/or seat belt brackets must be removed as necessary to facilitate upholstery removal.

3-44. **SAFETY PROVISIONS.**

3-45. **CARGO TIE-DOWNS.** Cargo tie-downs are used to ensure baggage cannot enter seating area

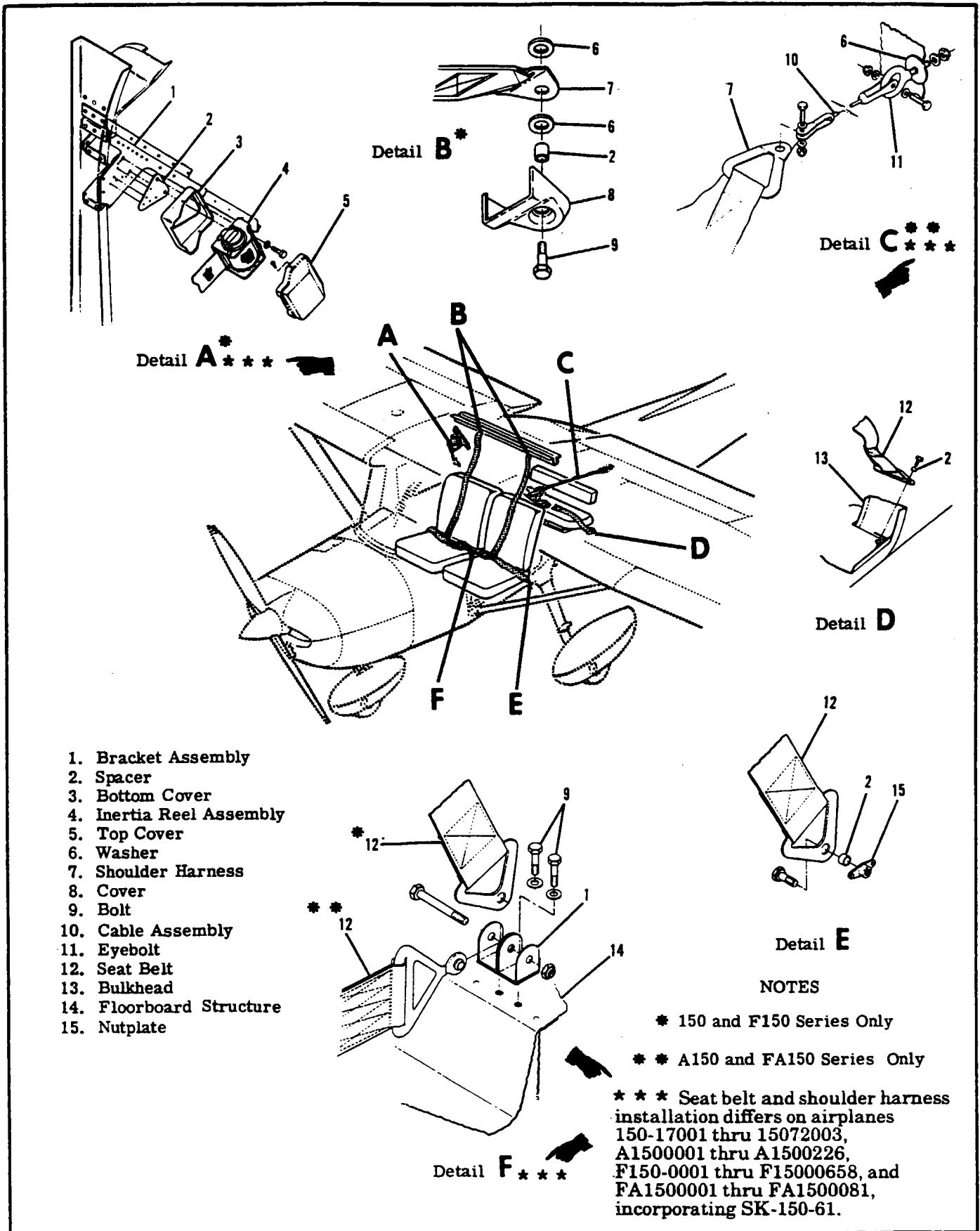


Figure 3-8. Seat Belt and Shoulder Harness Installation

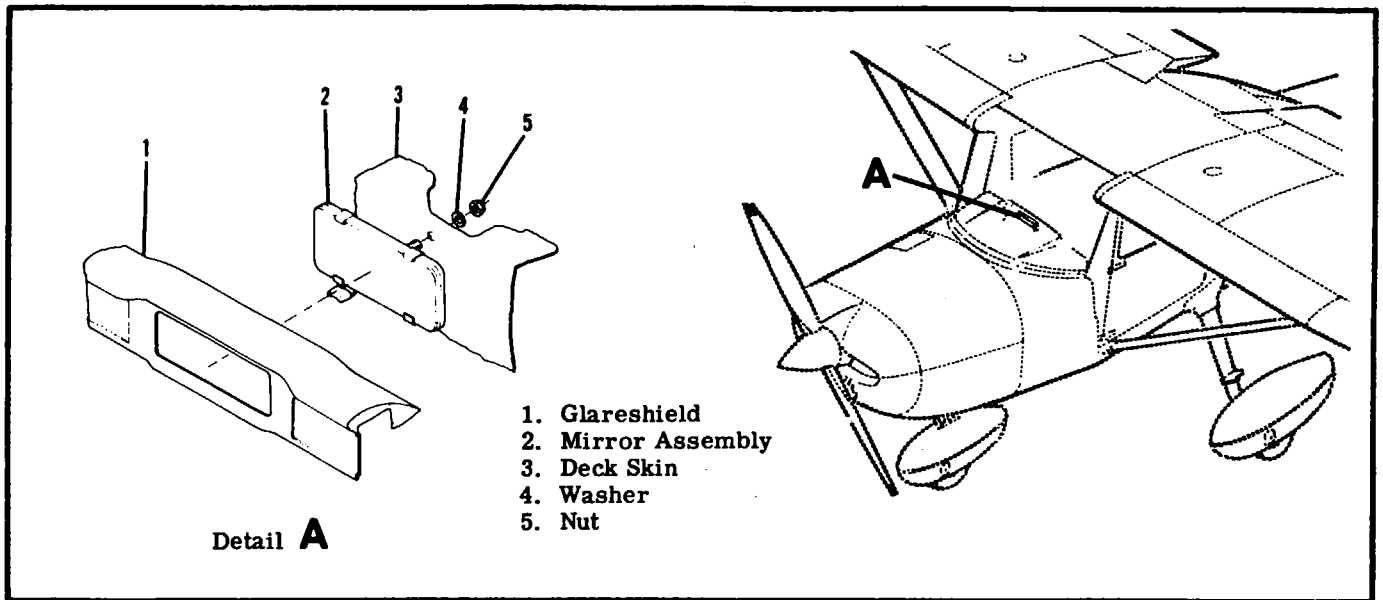


Figure 3-9. Rear View Mirror Installation

during flight. A baggage net can be secured to aft cabin wall and cabin floor for baggage security.

3-46. SAFETY BELTS. Safety belts, bolted to the cabin structure are provided for each seat. Belts should be replaced if frayed or cut, latches are defective or stitching is broken. Attaching parts should be replaced if excessively worn or defective. Refer to figure 3-8.

3-47. SHOULDER HARNESS. Shoulder harnesses may be installed in the aircraft. The latches require no lubrication. Component parts should be replaced as outlined in preceding paragraph. Refer to figure 3-8.

3-48. INERTIA REEL SHOULDER HARNESS. An inertia reel shoulder harness may be installed. The inertia reel allows free movement for the seat occupant but will lock when subjected to a sudden load. Proper operation of the reel can be checked by applying a quick jerk to the belt, inertia reel should lock and hold. Figure 3-8 may be used as a guide for removal and installation.

3-49. REAR VIEW MIRROR. A rear view mirror may be installed on the cowl deck above the instrument panel. Figure 3-9 illustrates details and may be used as a guide for removal and installation.

SHOP NOTES:

SECTION 4

WINGS AND EMPENNAGE

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4-1. WINGS AND EMPENNAGE.

4-2. WINGS. (Refer to figure 4-1.)

4-3. DESCRIPTION. Each all-metal wing is a semi-cantilever, semimonocoque type, with two main spars and suitable ribs for the attachment of the skin. Skin panels are riveted to ribs, spars and stringers to complete the structure. An all-metal, piano-hinged aileron, flaps and a detachable wing tip are mounted on each wing assembly. A single metal fuel tank is mounted between the wing spars at the inboard end of each wing. Colored navigation lights are mounted at each wing tip.

4-4. REMOVAL. Wing removal is most easily accomplished if four men are available to handle the wing. Otherwise, the wing should be supported with a sling or maintenance stand when the fastenings are loosened.

- a. Remove wing root fairings and fairing plates.
- b. Remove all wing inspection plates.
- c. Drain fuel from tank of wing being removed.
- d. Disconnect:
 1. Electrical wires at wing root disconnects.
 2. Fuel lines at wing root. (Refer to precautions outlined in paragraph 12-3.
 3. Pitot line (left wing only) at wing root.
 4. Cabin ventilator hose at wing root.
- e. Slack off tension on aileron cables by loosening turnbuckles, then disconnect cables at aileron bell-cranks. Disconnect flap cables at turnbuckles above headliner, and pull cables into wing root area.

NOTE

To ease rerouting the cables, a guide wire may be attached to each cable before it is pulled free of the wing. Cable may then be disconnected from the wire. Leave the guide wire routed through the wing; it may be attached again to the cable during reinstallation

and used to pull the cable into place.

- f. Remove screws from strut fairings and slide toward center of strut.
- g. Support wing at outboard end and remove strut-to-wing attach bolt.
- h. Lower strut carefully to avoid damage to lower strut-to-fuselage fitting.

NOTE

It is recommended that flap be secured in streamlined position with tape during wing removal to prevent damage, since flap will swing freely.

- i. Mark position of wing attachment eccentric bushings (refer to figure 4-1); these bushings are used to rig out "wing heaviness".
- h. Remove nuts, washers, bushings and bolts attaching wing spars to fuselage.

NOTE

It may be necessary to rock the wing slightly while pulling attaching bolts, or to use a long drift punch to drive out attaching bolts.

- i. Remove wing and lay on padded stand.

4-5. REPAIR. A damaged wing panel may be repaired in accordance with instructions outlined in Section 18. Extensive repairs of wing skin or structure are best accomplished using the wing repair jig, which may be obtained from Cessna. The wing jig serves not only as a holding fixture, making work on the wing easier, but also assures absolute alignment of the repaired wing.

4-6. INSTALLATION.

- a. Hold wing in position and install bolts, bushings, washers and nuts attaching wing spars to fuselage

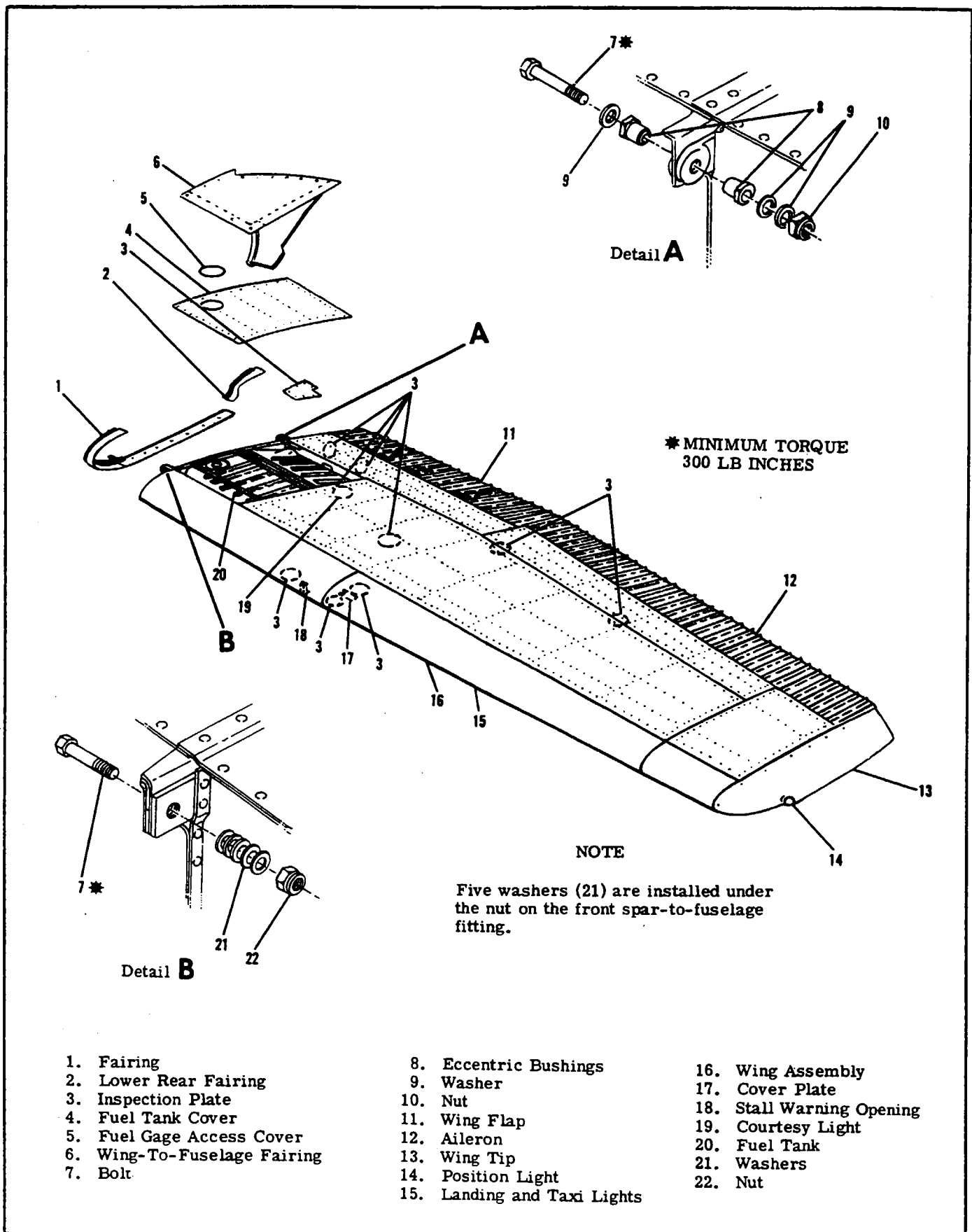


Figure 4-1. Wing Installation

fittings. Be sure eccentric bushings are positioned as marked.

- b. Install bolts, spacers, and nuts to secure upper and lower ends of wing strut to wing and fuselage fittings.
- c. Route flap and aileron cables, using guide wires. (See note in paragraph 4-4.)
- d. Connect:
 1. Electrical wires at wing root disconnects.
 2. Fuel lines at wing root. (Refer to precautions outlined in paragraph 12-3.)
 3. Pitot line (if left wing is being installed).
- e. Rig aileron system. (Section 6.)
- f. Rig flap system. (Section 7.)
- g. Refuel wing tank and check for leaks. (Refer to precautions outlined in paragraph 12-3.)
- h. Check operation of fuel gage.
- i. Install wing root fairings.

NOTE

Apply fillet-type sealant (Permagum 576.1, Presstite Engineering Co.) or equivalent to area between cabin top skin and wing skin and also to area across top of lower strut fitting at skin cutout. Gap between windshield and wing leading edge is sealed with waterproof tape (Polyken 230 or 231, Kendall-Polyken Div.) or equivalent.

NOTE

Be sure to insert soundproofing panel in wing gap, if such a panel was installed originally, before replacing wing root fairings.

- j. Install all wing inspection plates, interior panels and upholstery.

4-7. ADJUSTMENT (CORRECTING "WING-HEAVY" CONDITION. (See figure 4-1.) If considerable control wheel pressure is required to keep the wings level in normal flight, a wing-heavy condition exists.

- a. Remove wing fairing strip on the wing-heavy side of the airplane.
- b. Loosen nut (10) and rotate bushings (8) simultaneously until the bushings are positioned with the thick side of the eccentrics up. This will lower the trailing edge of the wing, and decrease wing-heaviness by increasing angle-of-incidence of the wing.

CAUTION

Be sure to rotate the eccentric bushings simultaneously. Rotating them separately will destroy the alignment between the off-center bolt holes in the bushings, thus exerting a shearing force on the bolt, with possible damage to the hole in the wing spar.

- c. Tighten nut and reinstall fairing strip.
- d. Test-fly the aircraft. If the wing-heavy condition

still exists, remove fairing strip on the "lighter" wing, loosen nut and rotate bushings simultaneously until the bushings are positioned with the thick side of the eccentric down. This will raise the trailing edge of the wing, thus increasing wing-heaviness to balance heaviness in the opposite wing.

- e. Tighten nut, install fairing strip, and repeat test flight.

4-8. WING STRUTS. (See figure 4-2.)

4-9. DESCRIPTION. Each wing has a single lift strut which transmits a part of the wing load to the lower portion of the fuselage. The strut consists of a streamlined tube riveted to two end fittings for attachment at the fuselage and wing.

4-10. REMOVAL AND INSTALLATION.

- a. Remove screws from strut fairings and slide fairings along strut.
- b. Remove fuselage and wing inspection plates at strut junction points.
- c. Support wing securely, then remove nut and bolt securing strut to fuselage.
- d. Remove nut, bolt, and spacer used to attach strut to wing, then remove strut from aircraft.
- e. Reverse preceding steps to install strut.

4-11. REPAIR. Wing strut repair is limited to replacement of tie-downs and attaching parts. A badly dented, cracked, or deformed wing strut should be replaced.

4-12. FIN. (See figure 4-3.)

4-13. DESCRIPTION. The fin is primarily of metal construction, consisting of ribs and spars covered with skin. Fin tips are of ABS or glass fiber construction. Hinge brackets at the fin rear spar attach the rudder.

4-14. REMOVAL AND INSTALLATION. A fin may be removed without first removing the rudder. However, for access and ease of handling, the rudder may be removed by following procedures outlined in Section 10.

- a. Remove fairings on either side of fin.
- b. Disconnect flashing beacon lead, tail navigation light lead, antennas and antenna leads, and rudder cables, if rudder has not been removed.
- c. Remove bolts attaching rear fin brackets to horizontal stabilizer.
- d. Remove bolts attaching front fin brackets to fuselage; remove fin.
- e. Install fin by reversing preceding steps. Be sure to check and reset rudder and elevator travel if any stop bolts were removed or settings disturbed.

4-14A. ATTACHMENT INSPECTION AND NUTPLATE REPLACEMENT. (See figure 4-4A.) FAR rules call for inspection of key and primary structural attachments, including the vertical fin attachment, on either an annual or 100 hour basis. However, it is recommended that the nutplates used to attach the fin be inspected after each 100 hours of operation.

- a. Position rudder to one side as far as possible.

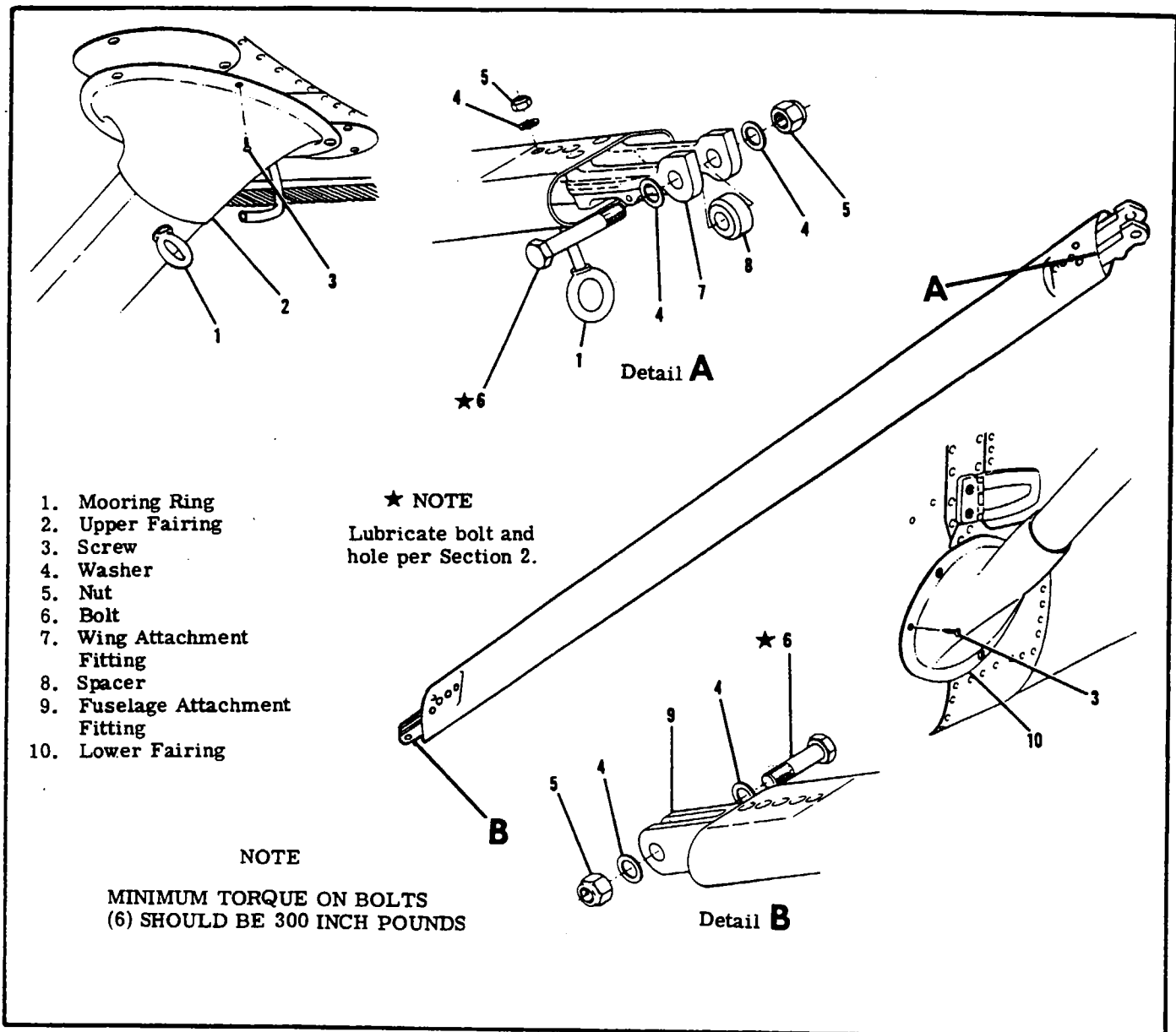


Figure 4-2. Wing Strut Installation

Through access holes in end of vertical fin attach bracket, use an inspection light and small mirror to inspect fin attach bracket and nutplates on upper and lower flange of attach bracket.

b. Position rudder to opposite side, and repeat same inspection for opposite end of attach bracket.

c. If nutplates show no indication of cracking, they are correct.

d. If nutplates are cracked in threaded area, they require replacement.

e. Replace nutplates.

1. Remove rudder, elevators, and vertical fin per sections 10, 8, and paragraph 4-14.

2. Remove bolts securing stabilizer rear spar to fuselage tailcone.

3. Remove bolts securing forward stabilizer attach points. Remove stabilizer.

4. Drill out existing rivets that secure the attach bracket to the stabilizer spar and remove bracket assembly.

5. Remove damaged nutplates by drilling out securing rivets.

6. Using rivets, install replacement nutplates to attach bracket.

7. Remove access cover from top of stabilizer skin for use of bucking bar below skin.

8. Reinstall attach bracket to stabilizer spar.

9. Reinstall stabilizer, vertical fin, rudder, and elevators per paragraph 4-14 and sections 10 and 8.

NOTE

Torque bolts to 70 to 100 pound-inches.

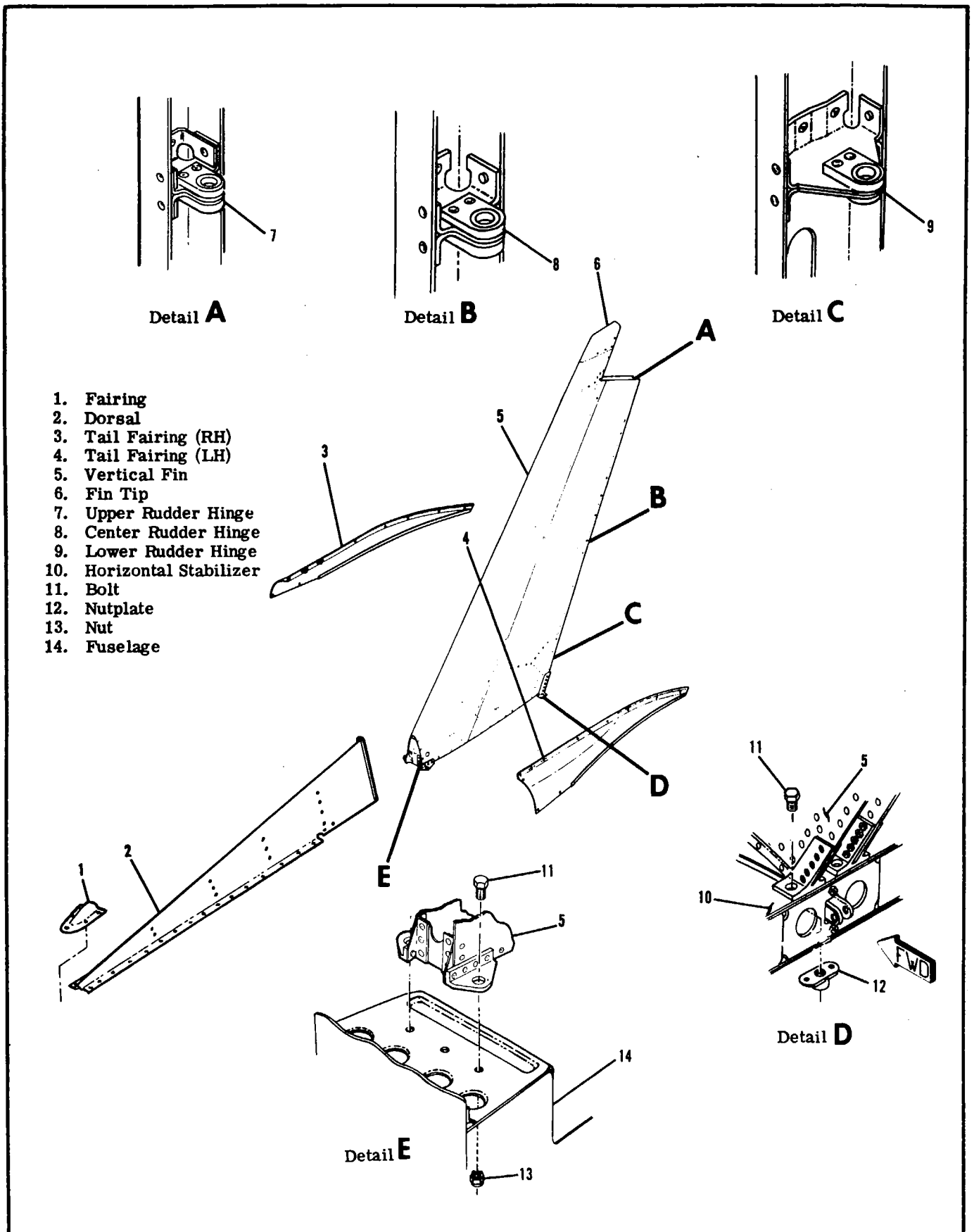


Figure 4-3. Vertical Fin Installation

1. Stabilizer Tip
2. Stabilizer
3. Stop Bolt
4. Fitting
5. Nut
6. Washer
7. Fuselage
8. Screw
9. Bolt
10. Elevator Outboard Hinge
11. Bushing

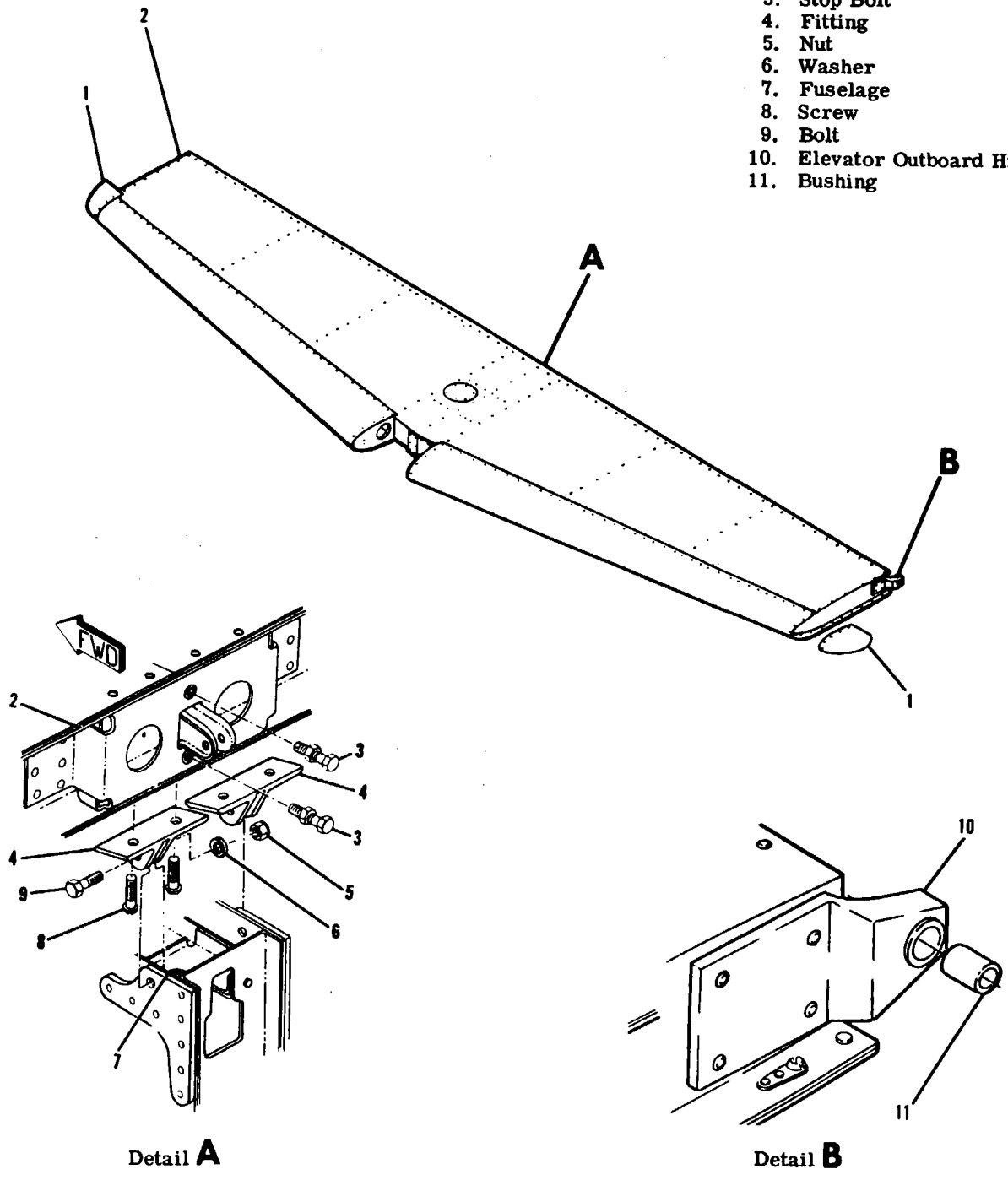


Figure 4-4. Horizontal Stabilizer Installation

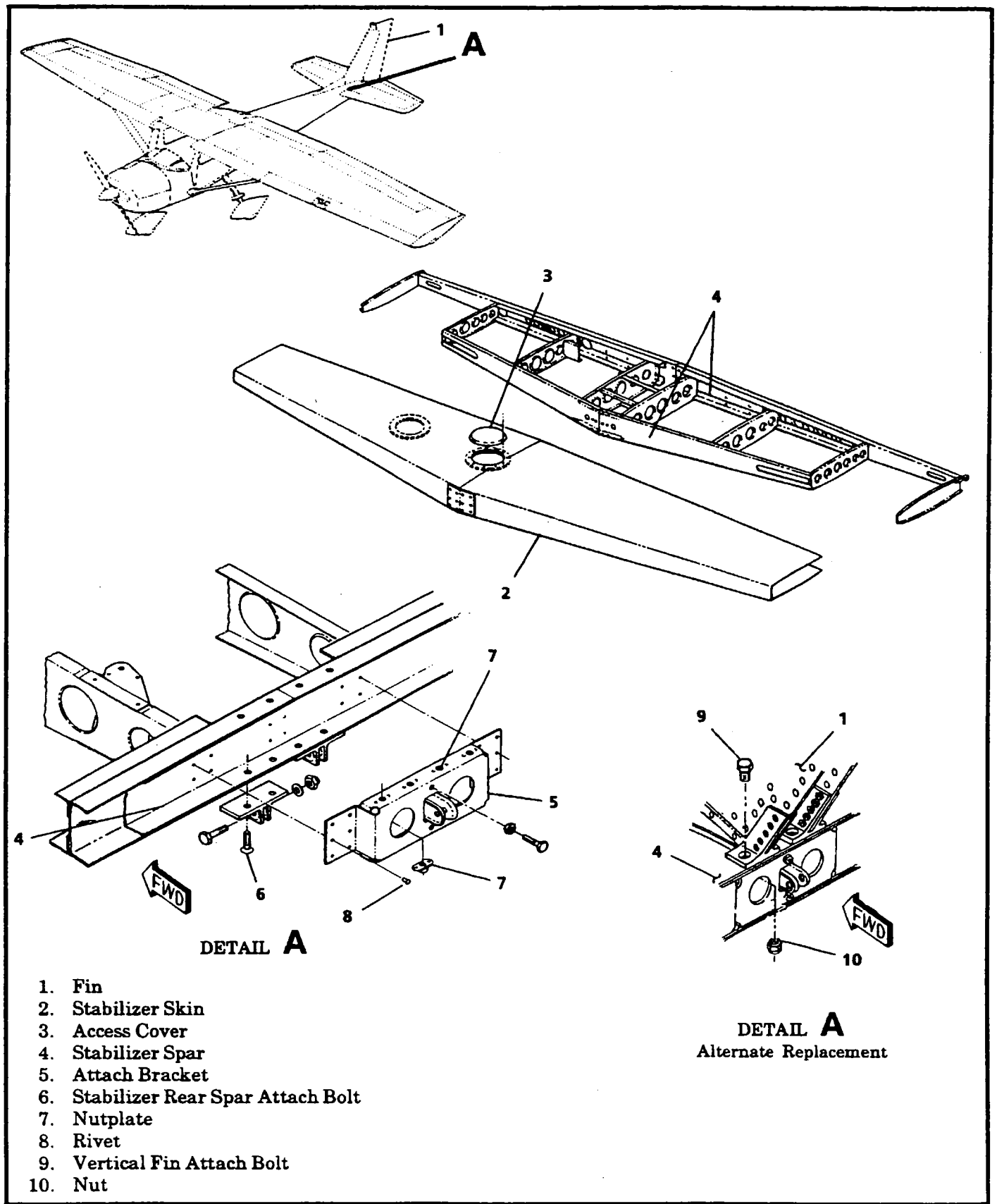


Figure 4-4A. Fin Attachment Inspection and Nutplate Replacement

- f. Use alternate method to replace nutplates:
1. Remove rudder, elevators, and vertical fin per sections 10, 8, and paragraph 4-14.
 2. Remove bolts securing stabilizer rear spar to fuselage tailcone.
 3. Remove bolts securing forward stabilizer attach points. Remove stabilizer.
 4. Remove damaged nutplates by inserting a longer bolt than normally used and lightly tapping the head of the bolt with a hammer to extrude tubular rivets through nutplate ears.

NOTE

Attach bracket is not removed from stabilizer spar with this method.

5. Reinstall stabilizer using bolts at forward and rear spar attach points.

NOTE

Torque bolts to 70 to 100 pound-inches.

6. Using replacement nuts rather than nutplates, reinstall vertical fin per paragraph 4-14.
7. Reinstall rudder and elevator per sections 10 and 8.

4-15. REPAIR. Fin repair should be accomplished in accordance with applicable instructions outlined in Section 18.

4-16. HORIZONTAL STABILIZER. (See figure 4-4.)

4-17. DESCRIPTION. The horizontal stabilizer is primarily of all-metal construction, consisting of ribs and spars covered with skin. Stabilizer tips are ABS. A formed metal leading edge is riveted to the assembly to complete the structure. The elevator trim tab actuator is contained within the horizontal stabilizer. The underside of the stabilizer contains a covered opening which provides access to the actuator. Hinges are located on the rear spar assembly to support the elevators.

4-18. REMOVAL AND INSTALLATION.

- a. Remove elevators and rudder in accordance with procedures outlined in Sections 8 and 10.
- b. Remove vertical fin in accordance with procedures outlined in paragraph 4-14.
- c. Disconnect elevator trim control cables at clevis and turnbuckle inside tailcone, remove pulleys which route the aft cables into horizontal stabilizer, and pull cables out of tailcone.
- d. Remove bolts securing horizontal stabilizer to fuselage.
- e. Remove horizontal stabilizer.
- f. Install horizontal stabilizer by reversing preceding steps. Rig control systems as necessary. Check operation of tail navigation light and flashing beacon.

4-19. REPAIR. Horizontal stabilizer repair should be accomplished in accordance with applicable instructions outlined in Section 18.

SECTION 5
LANDING GEAR AND BRAKES

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5-1. LANDING GEAR.

5-2. DESCRIPTION. The aircraft is equipped with a fixed tricycle landing gear, consisting of tubular springsteel main gear struts, and an air/oil steerable nose gear shock strut. Wheels with disc-type brakes and tube-type tires are installed on the

main landing gear struts and a two-piece, die-cast aluminum wheel is mounted on the nose gear strut. The nose wheel is steerable with the rudder pedals up to a maximum pedal deflection, after which it becomes free-swiveling, up to a maximum of 30 degrees, each side of center. Nose and main wheel speed fairings are available for installation.

5-3. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
AIRCRAFT LEANS TO ONE SIDE.	Incorrect tire inflation.	Inflate to pressure specified in figure 1-1.
	Landing gear attaching parts not tight.	Tighten loose parts; replace defective parts with new parts.
	Landing gear spring excessively sprung.	Remove and install new part(s).
	Bent axles.	Install new part(s).
TIRES WEAR EXCESSIVELY.	Incorrect tire inflation.	Inflate to pressure specified in figure 1-1.
	Main wheels out of alignment.	Remove and install new part(s).
	Landing gear spring excessively sprung.	Remove and install new part(s).
	Bent axles.	Install new part(s).
	Dragging brakes.	Refer to paragraph 5-54.
	Wheel bearings excessively tight.	Adjust properly.
	Wheels out of balance.	Correct in accordance with paragraph 5-21.
	Loose torque links.	Add shims or install new parts as required.
WHEEL BOUNCE EVIDENT ON SMOOTH SURFACE.	Out of balance condition.	Refer to paragraph 5-21.

SHOP NOTES:

5-4. MAIN LANDING GEAR.

5-5. DESCRIPTION. The tubular, spring-steel main landing gear struts are attached to the aircraft at inboard and outboard forgings, located in the belly of the aircraft. A bracket is bonded to each strut for attachment of a step. Hydraulic brake lines are routed down and clamped to each main gear strut. The axles, main wheels and brake assemblies are installed at the lower end of each strut.

5-6. MAIN GEAR STRUT REMOVAL. (Refer to figure 5-1.)

NOTE

The following procedure removes the landing gear as a complete assembly. Refer to applicable paragraphs for removal of individual components.

- a. Remove floorboard access covers over inboard and outboard landing gear forgings (2) and (3).
- b. Hoist or jack aircraft in accordance with procedures outlined in Section 2.
- c. Remove screws attaching fuselage fairing (19), and allow fairing to slide down over spring-strut fairing (18).
- d. Drain hydraulic fluid from brake line (6) on strut being removed.
- e. Disconnect hydraulic brake line (6) at fitting where brake line emerges from fuselage skin. Cap or plug disconnected fittings.
- f. Remove nut, washer and bolt attaching inboard end of tubular strut to the inboard landing gear bulkhead fitting.
- g. Pull tubular strut from fitting and bushing. Use care when removing strut to prevent damage to hydraulic brake line.

NOTE

The tubular strut is a compression fit in the bushing in the outboard landing gear forging (3).

5-7. MAIN GEAR STRUT INSTALLATION. (Refer to figure 5-1.)

NOTE

The following procedure installs the landing gear as a complete assembly. Refer to applicable paragraphs for installation of individual components.

- a. Install all parts removed from strut.
- b. Apply Dow Corning Compound DC7 to approximately 11 inches on upper end of tubular strut.

NOTE

Avoid use of Dow Corning DC7 on surfaces to be painted. DC7 contains silicone which is harmful to painted surfaces.

- c. Slide tubular strut into place through bushing in outboard strut fitting and into inboard strut fitting.
- d. Align tubular strut in inboard fitting and install bolt through fitting and strut. Install washer and nut on bolt and tighten to torque value listed in Section 1.
- e. Connect hydraulic brake line to fitting. Fill and bleed brake system in accordance with applicable paragraph in this Section.
- f. Install fairing.
- g. Lower aircraft and install floorboard access covers.

5-8. STEP BRACKET INSTALLATION.

NOTE

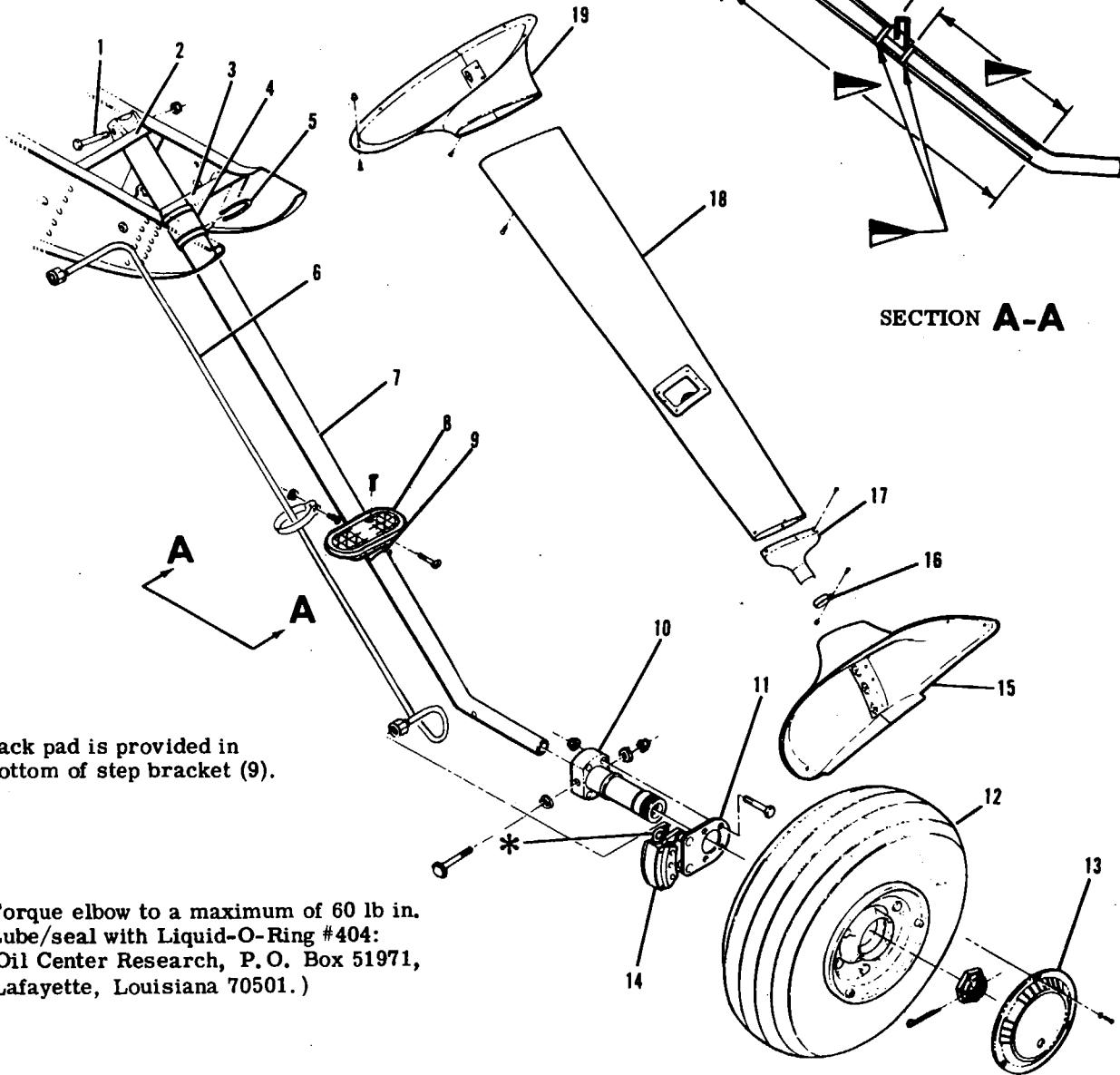
The step bracket is secured to the tubular gear strut with EA9309, EC2216, EC2214, EC3445, or a similar epoxy base adhesive.

- a. Mark position of the bracket so that the new step bracket will be installed in approximately the same position on the strut.
- b. Remove all traces of the original bracket and adhesive as well as any rust, paint or scale with a wire brush and coarse sandpaper.
- c. Leave surfaces slightly roughened or abraded, but deep scratches or nicks should be avoided.
- d. Clean surfaces to be bonded together thoroughly. If a solvent is used, remove all traces of the solvent with a clean, dry cloth. It is important that the bonding surfaces be clean and dry.
- e. Check fit of step bracket on the tubular strut.
- f. Mix adhesive (any of those listed in note preceding step "a") in accordance with manufacturer's directions.
- g. Spread a coat of adhesive on bonding surfaces, and place step bracket in position on the tubular strut. Clamp bracket to strut to ensure a good tight fit.
- h. Form a small fillet of the adhesive at all edges of the bonded surfaces. Remove excess adhesive with lacquer thinner.
- i. Allow adhesive to cure thoroughly according to manufacturer's recommendations before flexing the tubular gear strut or applying loads to the strut.
- j. Paint tubular strut and step bracket after curing is completed.

5-9. MAIN LANDING GEAR FAIRINGS. (Refer to figures 5-1 and 5-2.)

5-10. DESCRIPTION. Some aircraft are equipped with fuselage fairings, attached to the fuselage and the tubular strut fairings with screws. The tubular strut fairings cover the tubular landing gear struts, and attach to the fuselage fairings at the upper end and to fairing caps at the lower end. The fairing caps attach to the tubular strut fairings at the upper end and are clamped to the tubular struts at the lower end. Brake fairings are installed at the lower end of the tubular strut fairings and are attached to the wheel speed fairings by screws around their outer perimeters. The speed fairings are installed over the wheels and are attached to mounting plates, attached to the axles. The wheel fairings are equipped with

Apply Y-8560 (3M Corporation) polyurethane tape (1" wide) to upper and lower surface of spring and above and below step bracket to prevent chafing of spring fairing.



Jack pad is provided in bottom of step bracket (9).

* Torque elbow to a maximum of 60 lb in. Lube/seal with Liquid-O-Ring #404: (Oil Center Research, P. O. Box 51971, Lafayette, Louisiana 70501.)

- | | | |
|---------------------|------------------------|---------------------------|
| 1. Bolt | 7. Tubular Strut | 14. Brake Assembly |
| 2. Inboard Forging | 8. Step | 15. Brake Fairing |
| 3. Outboard Forging | 9. Step Bracket | 16. Clamp |
| 4. Bushing | 10. Axle | 17. Fairing Cap |
| 5. Bushing Retainer | 11. Brake Torque Plate | 18. Tubular Strut Fairing |
| 6. Brake Line | 12. Wheel Assembly | 19. Fuselage Fairing |
| | 13. Hub Cap | |

Figure 5-1. Main Landing Gear Installation

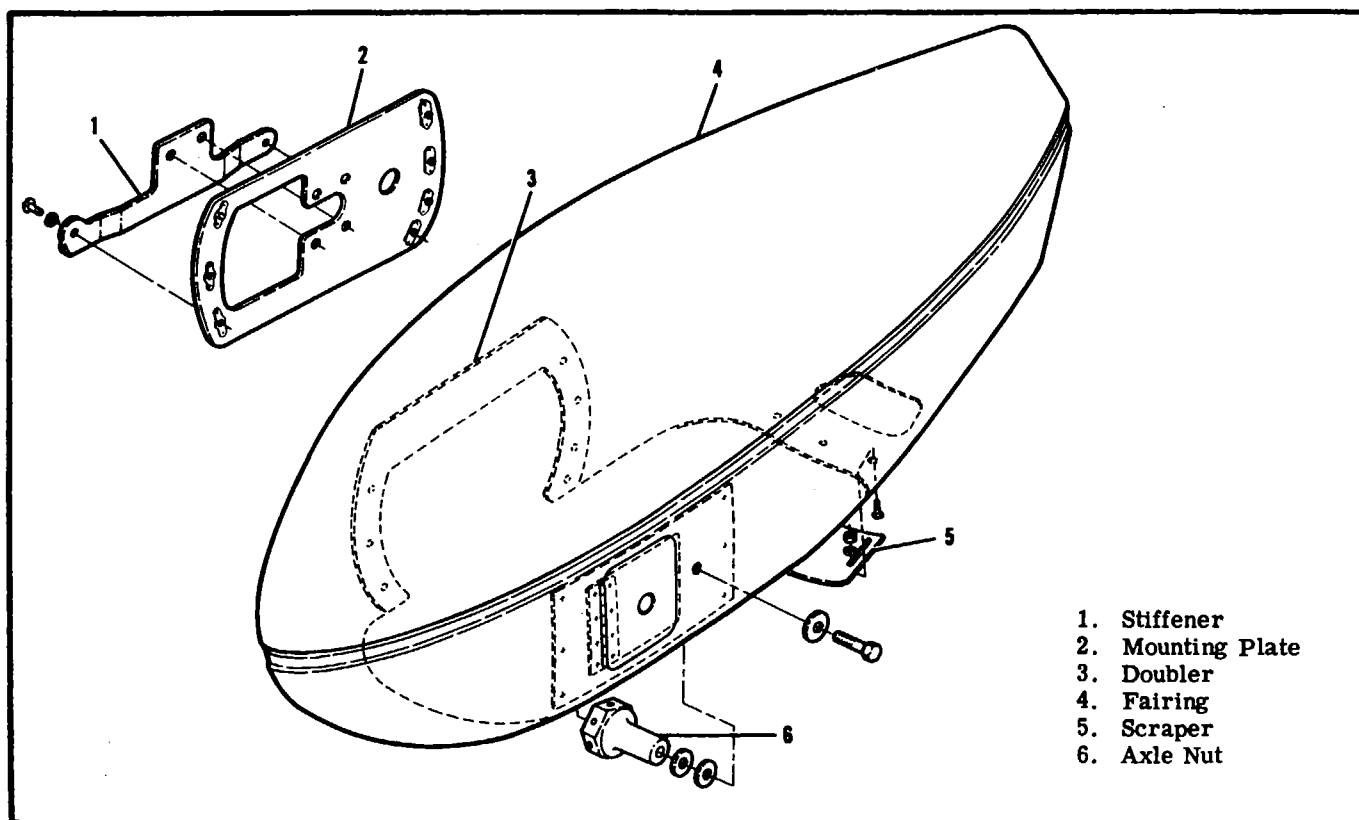


Figure 5-2. Main Wheel Speed Fairing

adjustable scrapers, installed in the lower aft part of the fairings, directly behind the wheels.

5-11. REMOVAL AND INSTALLATION OF MAIN LANDING GEAR FAIRINGS, (Refer to figure 5-1.)

a. To remove brake fairings (15), proceed as follows:

1. Remove screws from perimeter of fairings.
2. Remove screws from nutplates holding fairings together.
3. Spring fairings open to slide over spring strut fairings.
4. Remove brake fairings.
5. Reverse preceding steps to install brake fairings.

b. To remove fairing caps (17), proceed as follows:

1. Remove brake fairings (15), as outlined in step "a".
2. Remove screws attaching fairing caps to spring strut fairings (18).
3. Remove bolt and nut attaching clamps (16) to spring struts (7).
4. Slide clamps (16) down tubular struts (7); remove fairing caps (17).

NOTE

Clamps may be sprung over tubular struts for removal.

5. Reverse preceding steps to install fairing caps.
- c. To remove fuselage fairings (19), proceed as follows:
 1. Remove screws attaching fairings to fuselage.
 2. Slide fairings down tubular strut fairings or re-

move screws from nutplates holding fairings together and spring fairings open to slide over spring strut fairings.

3. Reverse the preceding steps to install fuselage fairings.

d. To remove tubular strut fairings (18), proceed as follows:

1. Remove brake fairings (15) as outlined in step "a".
2. Remove fairing caps (17) as outlined in step "b".
3. Remove fuselage fairings (19) as outlined in step "c".
4. Remove steps (8).
5. Remove screws from nutplates along strut fairings.
6. Spring fairing over tubular struts, using care not to damage brake lines (6).
7. Reverse the preceding steps to install fairings (18).

5-12. MAIN WHEEL SPEED FAIRING REMOVAL. (Refer to figure 5-2.)

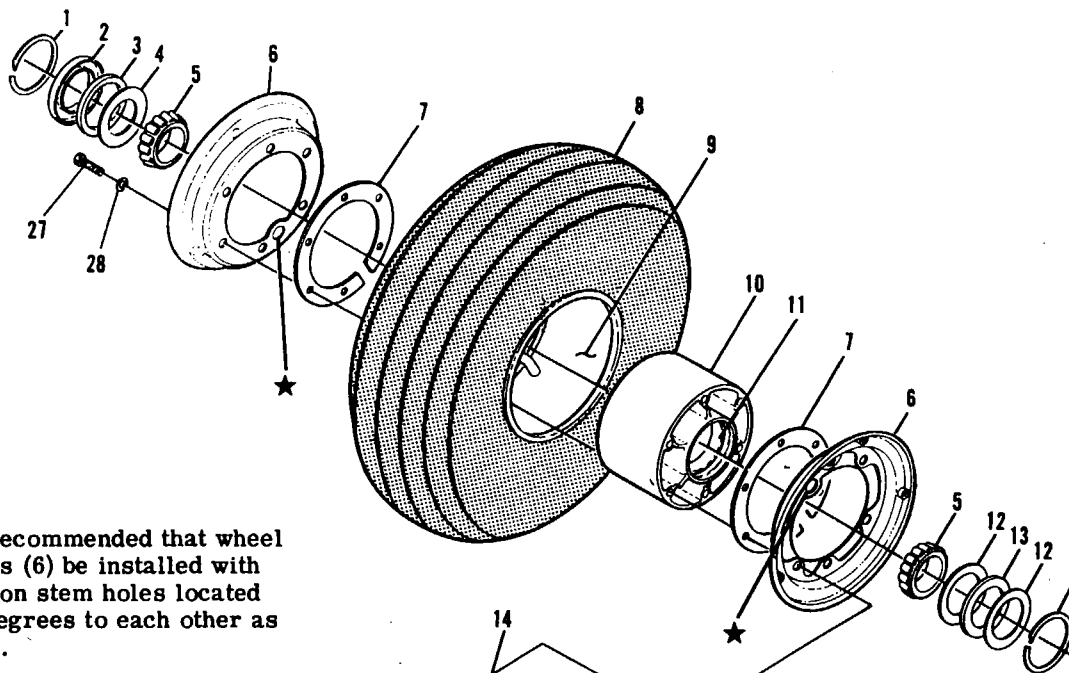
a. Remove brake fairing as outlined in paragraph 5-11, step "a".

b. Remove screws attaching stiffener (1) and in-board side of wheel speed fairing (4) to mounting plate (2), which is attached to the axle.

c. Remove bolt securing outboard side of fairing to axle nut (6).

d. Loosen scraper (5), if necessary, and work speed fairing from wheel.

5-12A. MAIN WHEEL SPEED FAIRING INSTALLATION. (Refer to figure 5-2.)



★ It is recommended that wheel flanges (6) be installed with inflation stem holes located 180-degrees to each other as shown.

1. Snap Ring
2. Grease Seal Retainer (Outboard)
3. Grease Seal Felt (Outboard)
4. Grease Seal Retainer (Outboard)
5. Bearing Cone
6. Wheel Flange
7. Phenolic Spacer
8. Tire
9. Tube
10. Wheel Hub
11. Bearing Cup (Race)
12. Grease Seal Retainer (Inboard)
13. Grease Seal Felt (Inboard)
14. Brake Disc
15. Torque Plate
16. Pressure Plate
17. Anchor Bolt
18. Elbow
19. Brake Cylinder
20. Bolt
21. Bleeder Screw
22. Dust Cap
23. Bleeder Fitting
24. Piston O-Ring
25. Brake Piston
26. Brake Lining
27. Capscrew
28. Washer
29. Back Plate

NOTES

Torque capscrews (27) to 190-200 lb-in.

Torque bolts (20) to 120-130 lb-in.

Torque bleeder screw (21) to 30-40 lb-in.

Torque elbow (18) to a maximum of 60 lb-in. Lube/seal with Liquid-O-Ring #404: (Oil Center Research, P. O. Box 51971, Lafayette, Louisiana 7050.)

Figure 5-3. Main Wheel and Brake

- a. Work speed fairing down over wheel.
- b. Install bolt securing outboard side of speed fairing to axle nut.
- c. Install screws attaching stiffener (1) and inboard side of wheel speed fairing (4) to mounting plate (2), which is bolted to the axle.
- d. Install brake fairing as outlined in step "a" of paragraph 5-11.
- e. After installation, check scraper-to-tire clearance for a minimum of 0.25-inch to a maximum of 0.38-inch. Elongated holes are provided in the scraper for clearance adjustments.

CAUTION

Always check scraper-to-tire clearance after installing speed fairing, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. If the aircraft is flown from surfaces with mud, snow, or ice, the speed fairing should be checked to make sure there is no accumulation which could prevent normal wheel rotation. Wipe fuel and oil from speed fairings to prevent stains and deterioration.

5-13. MAIN WHEEL REMOVAL. (Refer to figure 5-3.)

NOTE

It is not necessary to remove the main wheel to reline brakes or to remove brake parts, other than the brake disc on the torque plate.

- a. Hoist or jack aircraft in accordance with procedures outlined in Section 2.
- b. Remove speed fairing, if installed, as outlined in paragraph 5-12.
- c. Remove hub caps, if installed, cotter pin and axle nut.
- d. Remove bolts and washers attaching brake back plate to brake cylinder, and remove back plate.
- e. Pull wheel from axle.

5-14. MAIN WHEEL DISASSEMBLY.

WARNING

Injury can result from attempting to remove wheel flanges with tire and tube inflated. Avoid damaging wheel flanges when breaking tire beads loose. A scratch, gouge or nick in wheel flange could cause wheel failure.

- a. Remove valve core and deflate tire and tube. Break tire beads loose from wheel flanges.
- b. Remove capscrews and washers from outboard wheel flange.
- c. Remove capscrews and washers from inboard wheel flange.
- d. Remove brake disc.
- e. Separate wheel flanges from wheel hub. Retain spacers on each side of wheel hub.
- f. Remove wheel hub from tire.
- g. Remove retainer rings, grease seal retainers, grease seal felts and bearing cones.

NOTE

Bearing cups (races) are a press fit in the wheel hub and should not be removed unless a new part is to be installed. To remove the bearing cup, heat wheel hub in boiling water for 30 minutes, or in an oven not to exceed 121°C (250°F). Using an arbor press, if available, press out the bearing cup and press in the new bearing cup while the wheel hub is still hot.

5-15. MAIN WHEEL INSPECTION AND REPAIR.

- a. Clean all metal parts, grease seal felts and mylar spacers in cleaning solvent, and dry thoroughly.
- b. Inspect wheel flanges and wheel hub for cracks (refer to paragraph 2-38 for details). Cracked wheel flanges or hub shall be discarded and new parts installed. Sand out smooth nicks, gouges and corroded areas. When the protective coating has been removed, the area should be cleaned thoroughly, primed with zinc chromate and painted with aluminum lacquer.
- c. If excessively warped or scored, or worn to a thickness of 0.190-inch, brake disc should be replaced with a new part. Sand smooth small nicks and scratches.
- d. Carefully inspect bearing cones and cups for damage and discoloration. After cleaning, pack bearing cones with clean aircraft wheel bearing grease. Refer to Section 2 of this manual for grease type.

5-16. MAIN WHEEL REASSEMBLY.

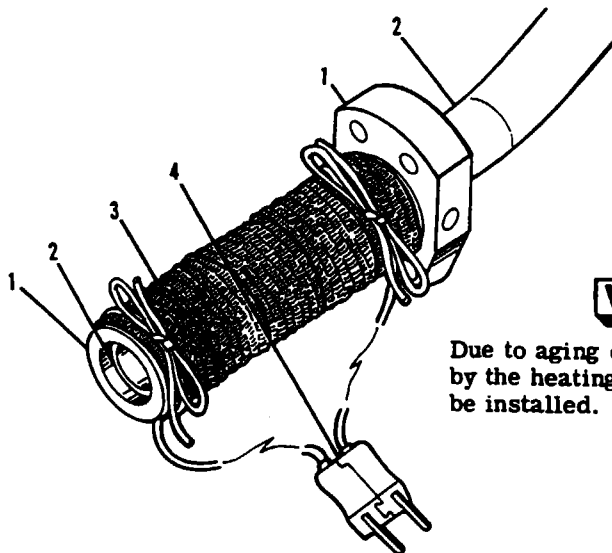
- a. Place wheel hub in tire and tube with tube inflation stem in cutout of wheel hub.
- b. Place spacer and wheel flange on inboard side of wheel hub (opposite of tube inflation stem).
- c. Place washer under head of each capscrew, insert capscrew through brake disc, wheel flange and spacer, and start capscrews into wheel hub threads.

CAUTION

Be sure that spacers, wheel flanges and brake disc are seated on flange of wheel hub. Uneven or improper torque of capscrews can cause failure of capscrews or hub threads with resultant wheel failure.

- d. Tighten capscrews evenly and torque to the value specified in figure 5-3.
- e. Place spacer and wheel flange on outboard side of wheel hub and align valve stem hole in wheel flange.
- f. Place washer under head of each capscrew, insert capscrew through wheel flange and spacer. Start capscrews into wheel hub threads.
- g. Tighten capscrews evenly and torque to the value specified in figure 5-3.
- h. Clean and pack bearing cones with clean aircraft wheel bearing grease. Refer to Section 2 of this manual for grease type.
- i. Assemble bearing cones, grease seal felts and retainer into wheel hub.
- j. Inflate tire to seat tire beads, then adjust to correct pressure. Refer to chart in Section 1 of this manual for correct tire pressure.

Do not place tape in direct contact with tubular gear spring.



WARNING

Due to aging of the aluminum axle, caused by the heating tape, a new axle will have to be installed.

1. Axle
2. Tubular Gear Strut
3. Electrical Heating Tape
4. Plug

Figure 5-4. Main Wheel Axle Removal

5-17. MAIN WHEEL INSTALLATION.

- a. Place wheel assembly on axle.
- b. Install axle nut and tighten axle nut until a slight bearing drag is obvious when the wheel is rotated. Back off nut to nearest castellation and install cotter pin.
- c. Place brake back plate in position and secure with bolts and washers.
- d. Install hub cap. Install speed fairing (if used) as outlined in paragraph 5-12A.

CAUTION

Always check scraper-to-tire clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. If the aircraft is flown from surfaces with mud, snow, or ice, the fairing should be checked to make sure there is no accumulation which could prevent normal wheel rotation. Refer to paragraph 5-12A for correct scraper-to-tire clearance.

5-18. MAIN WHEEL AXLE REMOVAL. Refer to figure 5-4.

- a. Remove speed fairings, if installed, according to procedures outlined in applicable paragraph of this section.
- b. Remove wheels in accordance with procedures outlined in applicable paragraph of this section.
- c. Disconnect, drain and cap or plug hydraulic brake line at the wheel brake cylinder.
- d. Remove cotter pin, nut and bolt attaching axle to spring strut.
- e. Remove brake components and speed fairing plate from axle.

NOTE

Axles are bonded to the struts of tubular gear aircraft with EA9309-25GR adhesive, which is available from Cessna Parts Distribution (CPD 2). The bond is too strong to allow the axle to be removed without first weakening the bond strength. The only methods of weakening the bond are with heat or cryogenic cold; heat being the most practical. A temperature of approximately 500° F is sufficient to weaken the bond so the axle can be removed. This is still a low enough temperature to prevent damage to the tubular strut.

- f. Remove axles as follows:

NOTE

Axles should be removed from strut, using electric heating tape, available from most scientific supply companies. One type can be obtained from Curtin Scientific Co., 6550 East 42nd St., P.O. Box 747, Tulsa, Oklahoma 74101. Tape should conform to the following: 192 watts, 24" long, 1" wide, flexible and heavily insulated.

- g. Wrap heating tape around axle from base head to outer end of axle and tie it on with string provided with the tape, as shown in the figure.

CAUTION

Do not place tape in direct contact with tubular gear spring.

- h. Plug electric tape into 110 volt wall socket and heat for 20 to 30 minutes.
- i. Unplug tape and remove from axle. Remove

axle by striking axle base head with a few sharp blows.

j. Clean any old adhesive off landing gear spring with a wire brush. Brush strokes should run lengthwise along the spring. After old adhesive has been removed, wipe with clean rag saturated with acetone or alcohol. Immediately wipe dry with a clean, lint free cloth.

WARNING

Due to aging of the aluminum axle, caused by the heating tape, a new axle will have to be installed.

5-19. MAIN WHEEL AXLE INSTALLATION.

a. Prior to installing new axle, wipe outer surface of tubular gear and inside of axle with solvent, drying immediately with a clean, lint free cloth.

b. Mix EA9309-25GR adhesive, available from the Cessna Service Parts Center, in accordance with instructions in the package. Spread adhesive thinly and evenly on outer surface of landing gear spring in area that will be covered by axle.

c. Place axle on gear spring and rotate axle to assure even coverage between inner surface of axle and outer surface of spring.

d. Install retaining bolt, washers, nut and cotter pin. Tighten nut securely.

e. Allow 24 hours at 75°F for adhesive to cure, or 30 minutes at 250°F, if heating equipment is available.

f. Install brake components and speed fairing mounting plate to axle.

g. Install wheel on axle in accordance with procedures outlined in applicable paragraph of this section.

h. Connect hydraulic brake line to wheel brake cylinder.

i. Fill and bleed hydraulic brake system in accordance with applicable paragraph in this section.

j. Install speed fairings, if used, in accordance with applicable paragraph in this section.

5-20. MAIN WHEEL ALIGNMENT. Refer to the table in figure 1-1 for information.

5-21. WHEEL BALANCING. Since uneven tire wear is usually the cause of wheel unbalance, replacing the tire will probably correct this condition. Tire and tube manufacturing tolerances permit a specified amount of static unbalance. The light-weight point of the tire is marked with a red dot on the tire sidewall and the heavy-weight point of the tube is marked with a contrasting color line (usually near the inflation valve stem). When installing a new tire, place these marks adjacent to each other. If a wheel shows evidence of unbalance during service, it may be statically balanced. Wheel balancing equipment is available from Cessna Parts Distribution (CPD 2).

5-22. NOSE GEAR.

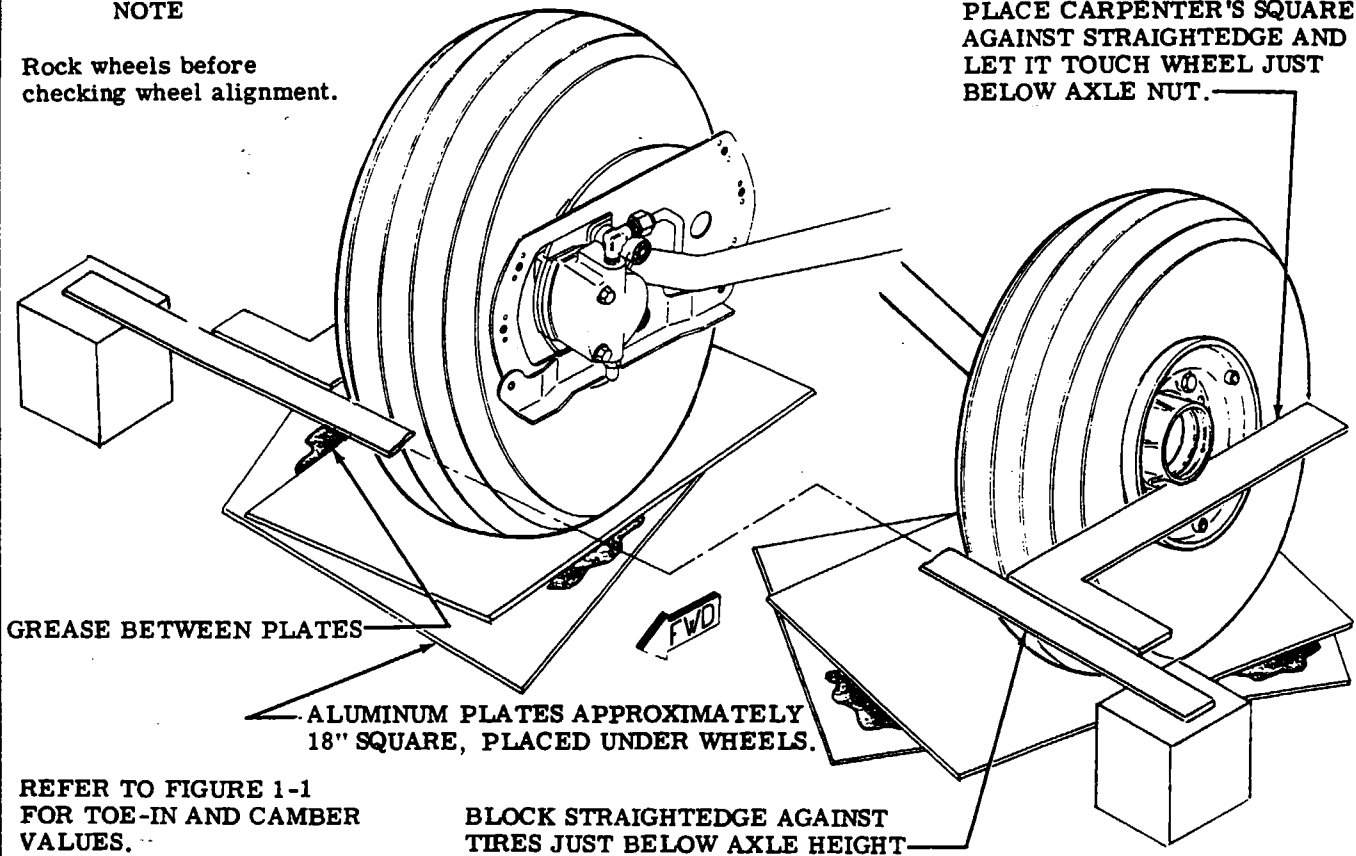
5-23. DESCRIPTION. A steerable nose wheel, mounted in a fork, attached to an air/oil (oleo) shock strut, make up the nose gear. The shock strut is secured to the tubular engine mount. Nose wheel steering is accomplished by two spring-loaded push-pull tubes linking the nose gear steering collar to the rudder pedal bars. A hydraulic fluid-filled shimmy dampener is provided to minimize nose wheel shimmy. A nose wheel speed fairing may be installed on some aircraft.

SHOP NOTES:

NOTE

Rock wheels before checking wheel alignment.

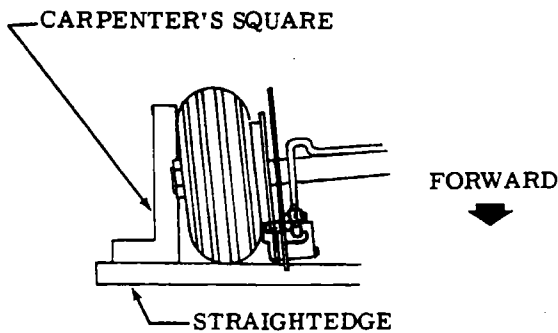
PLACE CARPENTER'S SQUARE AGAINST STRAIGHTEDGE AND LET IT TOUCH WHEEL JUST BELOW AXLE NUT.



REFER TO FIGURE 1-1 FOR TOE-IN AND CAMBER VALUES.

TOP VIEW OF TOE-IN CHECK

Measure toe-in at edges of wheel flange. Difference in measurements is toe-in for one wheel. (half of total toe-in.)



FRONT VIEW OF CAMBER CHECK

Measure camber by reading protractor level held vertically against outboard flanges of wheel.

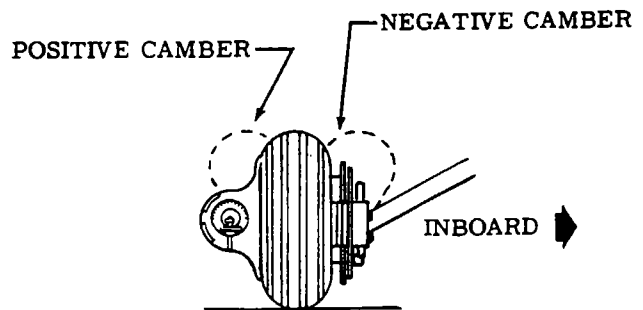


Figure 5-5. Main Wheel Alignment

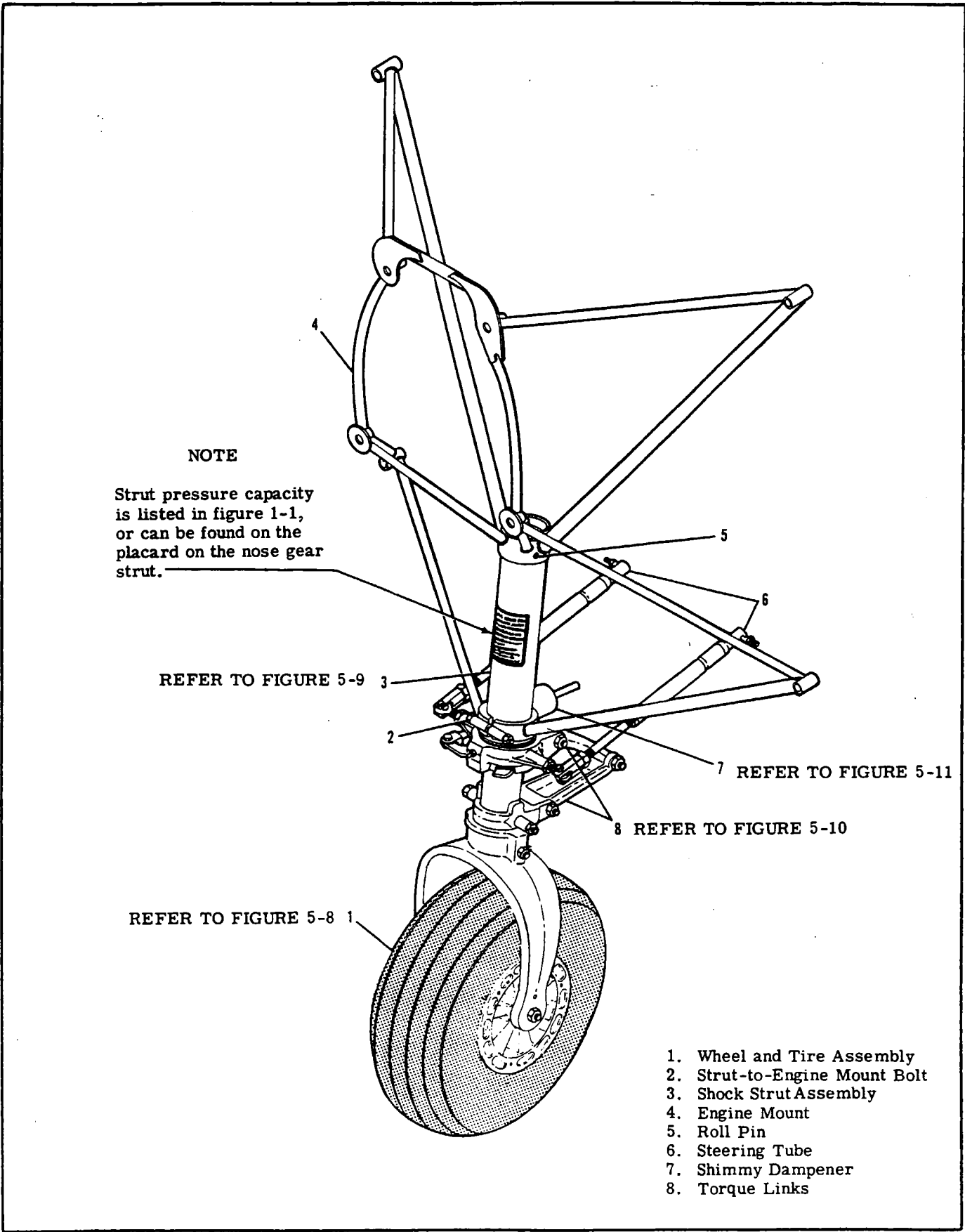


Figure 5-6. Nose Gear Installation

5-24. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
NOSE WHEEL SHIMMY.	Nose strut attaching bolts loose.	Tighten nose strut attaching bolts.
	Loose or worn nose wheel steering linkage.	Tighten. Replace defective parts with new parts.
	Nose wheel out of balance.	Refer to paragraph 5-34.
	Wheel bearings too loose.	Adjust properly.
	Defective shimmy dampener.	Repair, or install new dampener.
	Shimmy dampener fluid low.	Service in accordance with Section 2.
	Loose torque links.	Add shims, or install new parts as required.
	Worn steering arm assembly shims.	Replace or add shims as required.
NOSE STRUT DOES NOT HOLD AIR PRESSURE.	Defective or loose air filler valve.	Check gasket and tighten loose valve. Install new valve if defective.
	Defective strut seals.	Install new seals.
HYDRAULIC FLUID LEAKAGE FROM NOSE STRUT.	Defective strut seals.	Install new seals.

5-25. NOSE GEAR REMOVAL. (Refer to figure 5-6.)

- a. Remove engine cowling for access.
- b. Weight or tie down tail of aircraft to raise nose wheel off the floor.
- c. Disconnect nose wheel steering tubes from nose gear steering collar.
- d. Remove screws attaching hose clamps to strut.
- e. Remove air filler valve core and deflate strut completely, and telescope strut to its shortest length.

WARNING

Be sure strut is deflated completely before removing bolt or roll pin at top of strut.

- f. Remove roll pin at top of strut, and remove bolt which clamps strut to lower part of engine mount.
- g. Pull the strut assembly down out of engine mount fitting.

5-26. NOSE GEAR INSTALLATION. (Refer to figure 5-6.)

- a. Reverse the steps outlined in paragraph 5-25 to install the nose gear.

NOTE

Always install roll pin before clamping strut into lower portion of engine mount to prevent misalignment. Torque clamp bolt in lower portion of engine mount fitting to 120±20 lb-in.

5-27. NOSE WHEEL SPEED FAIRING REMOVAL.

- a. Weight or tie down tail of aircraft to raise nose wheel off floor.
- b. Remove nose wheel axle stud.
- c. Remove bolt securing cover plate and fairing to strut; remove cover plate.

WARNING

Do not remove bolt attaching tow bar spacers, unless strut has been completely deflated.

- d. Slide speed fairing up and remove nose wheel. Loosen scraper if necessary.
- e. Rotate speed fairing 90 degrees and work fairing down over the fork to remove.

5-28. NOSE WHEEL SPEED FAIRING INSTALLATION.

- a. Rotate speed fairing 90° and work fairing up over the fork; rotate fairing to correct position.
- b. Slide fairing up and install nose wheel; install axle stud.
- c. Tighten axle stud until a slight bearing drag is obvious when the wheel is rotated. Back off nut to the nearest castellation, and install cotter pins.
- d. If shock strut was deflated, service after installation has been completed. Refer to servicing instructions in Section 2.
- e. Adjust wheel scraper clearance in accordance with the following caution.

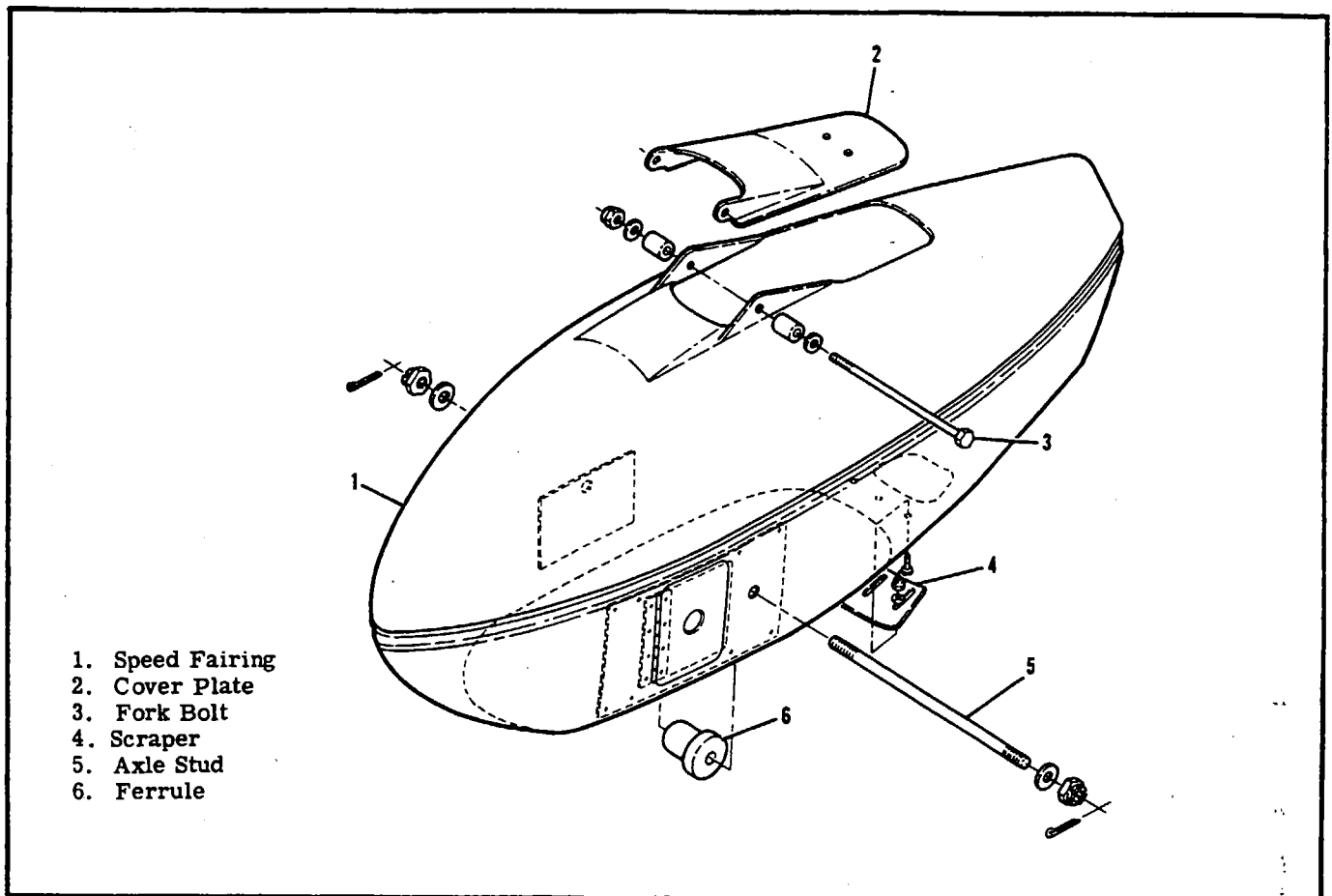


Figure 5-7. Nose Wheel Speed Fairing

CAUTION

Always check scraper clearance after installing speed fairing, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. Set clearance between tire and scraper for a minimum of 0.25-inch to a maximum of 0.38-inch. Elongated holes in the scraper are provided for adjustment. If the aircraft is flown from surfaces with mud, snow, or ice, the speed fairings should be checked to make sure there is no accumulation which could prevent normal wheel rotation. Wipe fuel and oil from speed fairing to prevent staining and deterioration of the fairing.

5-29. NOSE WHEEL REMOVAL.

- a. Weight or tie down tail of aircraft to raise the nose wheel off the floor.
- b. Remove nose wheel axle stud.
- c. Pull nose wheel assembly from fork and remove axle tube from nose wheel. Loosen wheel scraper if necessary, if wheel is equipped with a speed fairing.

5-30. NOSE WHEEL DISASSEMBLY. (Refer to figure 5-8.)

- a. Completely deflate tire and tube and break loose tire beads. Extreme care must be exercised to prevent tire tool damage when removing tire from wheel halves (6).

WARNING

Serious injury can result from attempting to separate wheel halves with tire and tube inflated.

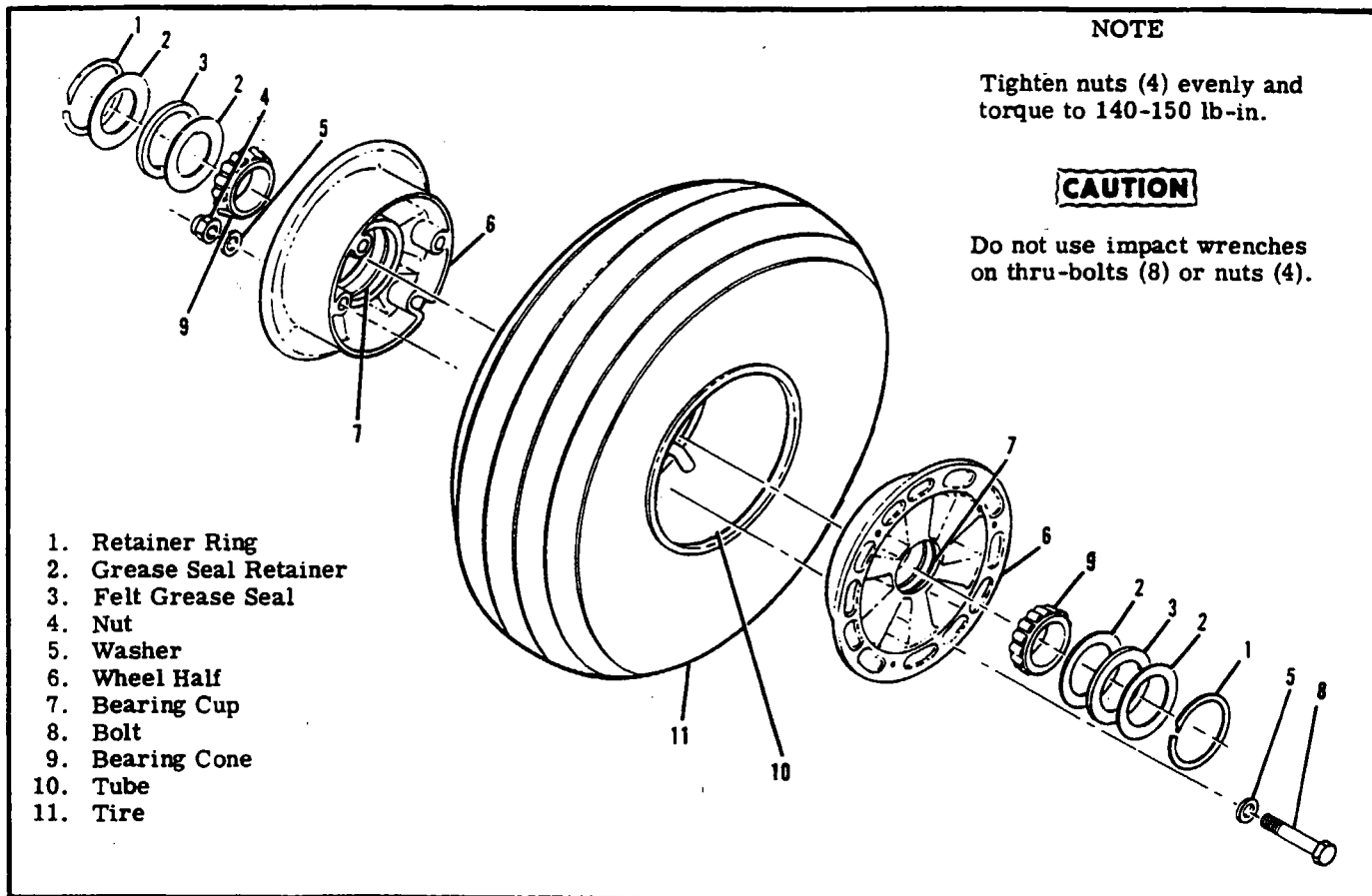
- b. Remove nuts (4) and washers (5).
- c. Remove thru-bolts (8) and washers (5).
- d. Separate and remove wheel halves (6) from tire and tube.
- e. Remove retaining rings (1), grease seal retainer (2), felt grease seal (3), grease retainer (2) and bearing cone (9) from both wheel halves (6).

NOTE

Bearing cups (races) (7) are a press fit in wheel half (6) and should not be removed unless a new part is to be installed. To remove bearing cups, heat wheel half in boiling water for 30 minutes, or in an oven, not to exceed 121°C (250°F). Using an arbor press, if available, press out bearing cup and press in new bearing cup while wheel half is still hot.

5-31. NOSE WHEEL INSPECTION AND REPAIR.

- a. Clean all metal parts and felt grease seals in Stoddard solvent or equivalent, and dry thoroughly.



NOTE

Tighten nuts (4) evenly and torque to 140-150 lb-in.

CAUTION

Do not use impact wrenches on thru-bolts (8) or nuts (4).

- 1. Retainer Ring
- 2. Grease Seal Retainer
- 3. Felt Grease Seal
- 4. Nut
- 5. Washer
- 6. Wheel Half
- 7. Bearing Cup
- 8. Bolt
- 9. Bearing Cone
- 10. Tube
- 11. Tire

Figure 5-8. Nose Wheel and Tire

NOTE

A soft bristle brush may be used to remove hardened grease, dust or dirt.

- b. Inspect wheel halves (6) for cracks or damage. Refer to paragraph 2-38 for details.
- c. Inspect bearing cones (9), cups (7), retaining rings (1) and seals (2) and (3), for wear or damage.
- d. Inspect thru-bolts (8) and nuts (4) for cracks in threads or cracks in radius under bolt head.
- e. Replace cracked or damaged wheel half (6).
- f. Replace damaged retaining rings (1) and seals (2) and (3).
- g. Replace worn or damaged bearing cups (7) and cones (9).
- h. Replace any worn or cracked thru-bolts (8) or nuts (4).
- i. Remove any corrosion or small nicks.
- j. Repair reworked areas of wheel by cleaning thoroughly, then applying one coat of clear lacquer paint.
- k. Pack bearings with grease specified in Section 2.

5-32. NOSE WHEEL REASSEMBLY. (Refer to figure 5-8.)

- a. Assemble bearing cone (9), grease seal retainer (2), felt grease seal (3), grease seal retainer (2) and retaining ring (1) into both wheel halves (6).
- b. Insert tube in tire, aligning index marks on tire and tube.

- c. Place wheel half (6) into tire and tube (side opposite valve stem), aligning base of valve stem in valve slot. With washer (5) under head of thru-bolt (8), insert bolt through wheel half (6).
- d. Place wheel half (6) into other side of tire and tube, aligning valve stem in valve slot.
- e. Install washers (5) and nuts (4) on thru-bolts (8) and pre-torque to 10-50 lb-in.

CAUTION

Uneven or improper torque of the nuts can cause failure of the bolts with resultant wheel failure.

- f. Prior to torquing nuts (4), inflate tube with approximately 10-15 psi air pressure to seat tire.

CAUTION

Do not use impact wrenches on thru-bolts or nuts.

- g. Dry torque all nuts (4) evenly to a torque value of 140-150 lb-in.
- h. Inflate tire to correct pressure specified in figure 1-1.

5-33. NOSE WHEEL INSTALLATION.

- a. Install axle tube in nose wheel.

- b. Install nose wheel assembly in fork and install nose wheel axle stud.
- c. Tighten axle stud until a slight bearing drag is obvious when wheel is rotated. Back the nut off to the nearest castellation and insert cotter pin.

CAUTION

On aircraft equipped with speed fairings, always check scraper-to-tire clearance after installing speed fairing, whenever a tire has been changed or whenever scraper adjustment has been disturbed. Set scraper clearance in accordance with instructions outlined in the Caution following paragraph 5-28.

5-34. WHEEL BALANCING. Refer to paragraph 5-21 for instructions.

5-35. NOSE GEAR SHOCK STRUT DISASSEMBLY. (Refer to figure 5-9.)

NOTE

The following procedures apply to the nose gear shock strut after it has been removed from the aircraft, and the speed fairing and nose wheel have been removed. In many cases, separation of the upper and lower strut will permit inspection and parts installation without removal or complete disassembly of the strut.

WARNING

Be sure strut is completely deflated before removing lock ring in lower end of upper strut, or disconnecting torque links.

- a. Remove shimmy dampener.
- b. Remove torque links. Note position of washers, shims and spacers.
- c. Remove lock ring from groove inside lower end of upper strut. A small hole is provided at the lock ring groove to facilitate removal of the lock ring (refer to view C-C.)

NOTE

Hydraulic fluid will drain from strut halves as lower strut is pulled from upper strut.

- d. Using a straight, sharp pull, separate upper and lower struts. Invert lower strut and drain hydraulic fluid.
- e. Remove lock ring and bearing at upper end of lower strut assembly. Note top side of bearing.
- f. Slide packing support ring, scraper ring, retaining ring and lock ring from lower strut, noting relative position and top side of each ring; wire or tape together, if desired.
- g. Remove O-rings and back-up rings from packing support ring.
- h. Remove bolt securing tow bar spacers.

NOTE

Bolt attaching tow bar spacers also holds base plug in place.

- i. Remove bolt attaching fork to strut barrel, and remove base plug and metering pin from lower strut. Remove O-rings and metering pin from base plug.
- j. Pull orifice piston support from upper strut. Remove O-ring and filler valve.
- k. Remove retaining ring securing steering collar to upper strut. Slide steering collar, shims and washer from upper strut. Note number of shims between washer and steering collar.

5-36. NOSE GEAR SHOCK STRUT INSPECTION AND REPAIR. (Refer to figure 5-9.)

- a. Thoroughly clean all parts in cleaning solvent and inspect them carefully.
- b. All worn or defective parts and all O-rings and back-up rings must be replaced with new parts.
- c. Sharp metal edges should be smoothed with No. 400 emery paper, then cleaned with solvent.

5-37. NOSE GEAR SHOCK STRUT REASSEMBLY. (Refer to figure 5-9.)

NOTE

Used sparingly, Dow Corning Compound DC4 is recommended for O-ring lubrication. All other internal parts should be liberally coated with hydraulic fluid during reassembly.

- a. Install washer (1) and shim/s (2), if installed.
- b. Lubricate needle bearings in steering collar (4) as shown in Section 2, and install collar and retaining ring (5).
- c. Check steering collar for snug fit against washer. Shims of variable thickness are available from Cessna Parts Distribution (CPD 2) to provide a snug fit for collar against washer.

NOTE

If shims are required, remove retaining ring and steering collar and add shims as necessary to provide a snug fit with steering collar retaining ring installed.

Part numbers of shims available and their thicknesses are as follows:

1243030-5	0.006 inch
1243030-6	0.012 inch
1243030-7	0.020 inch

- d. Install rod ends (3) in steering collar (4), and adjust rod ends to dimension specified in Section view A-A in Figure 5-9.
- e. Install O-ring (9) and filler valve (10) in orifice piston support (8) and install orifice piston support in upper strut (7).
- f. Install O-ring (21) and metering pin assembly in lower strut (13); install bolt attaching fork (23) to lower strut.
- g. Align base plug (22) holes with holes in lower strut/fork (13) and (23) assembly; install bolt and tow

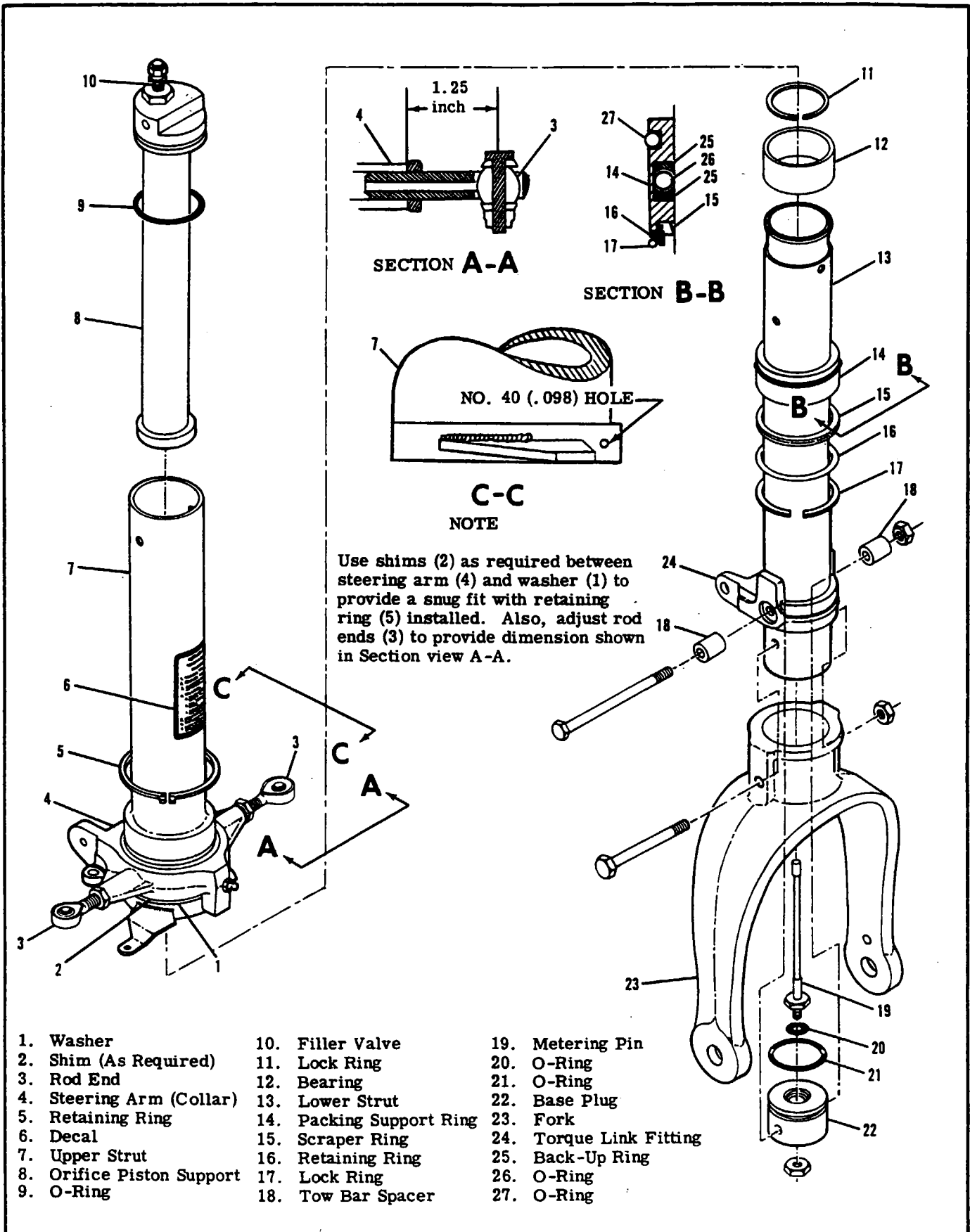


Figure 5-9. Nose Gear Shock Strut

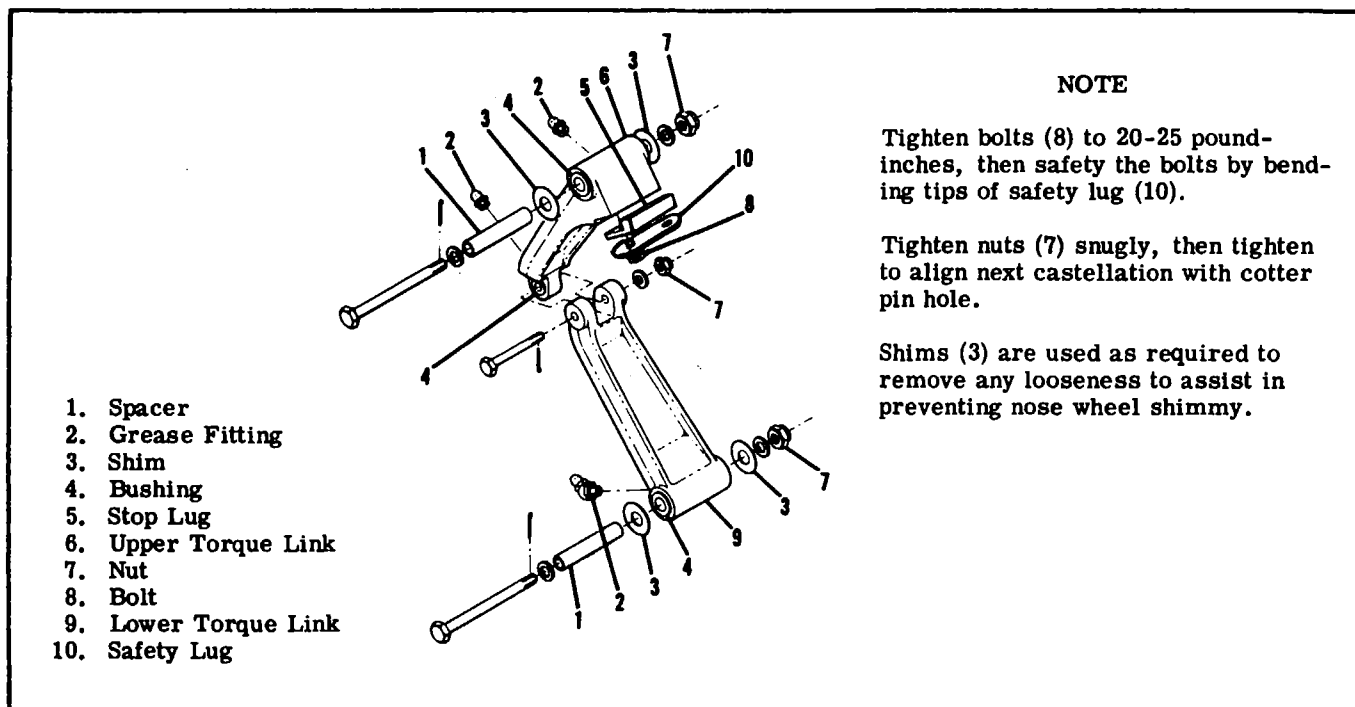


Figure 5-10. Torque Links

bar spacers (18). Install and tighten nut.

NOTE

If base plug (22) is to be replaced, new part will need to be line-drilled to accept AN5 bolt.

h. Install lock ring (17), retaining ring (16) and scraper ring (15) on lower strut, making sure they are installed in same positions as they were removed.

i. Install O-rings (26) and (27) and back-up rings in packing support ring (14); slide packing support ring over lower strut (13).

j. Install bearing (12) and lock ring (11) at upper end of lower strut assembly. Note top side of bearing.

k. Install upper strut assembly over lower strut assembly.

l. Install lock ring (17) in groove in lower end of upper strut. Position lock ring so that one of its ends covers the small access hole in the lock ring groove at the bottom of the upper strut. (Refer to Section C-C in figure 5-9.)

m. Install torque links, positioning washers, shims and spacers exactly as removed.

n. Install shimmy dampener.

o. After shock strut assembly is complete, install strut on aircraft as outlined in paragraph 5-26.

p. After strut is installed in aircraft, fill and inflate shock strut in accordance with procedures outlined in Section 2.

5-38. TORQUE LINKS.

5-39. DESCRIPTION. Torque links keep the lower strut aligned with the nose gear steering system, but permit shock strut action.

5-40. REMOVAL.

WARNING

Completely deflate strut before removing torque links.

- a. Completely deflate shock strut.
- b. Disconnect upper and lower attaching bolts, spacers, shims and nuts, and remove torque links.

5-41. INSPECTION. Torque link bushings should not be removed except for replacement of parts; replace if excessively worn.

5-42. INSTALLATION. (Refer to figure 5-10.)

NOTE

If bolts (8), safety lug (10) and stop lug (5) were removed, upon installation, tighten bolts (8) to 20-25 lb-in, then safety the bolts by bending tips of safety lug (10).

- a. With shock strut completely deflated, install upper and lower torque link assemblies.
- b. Install bolt attaching upper and lower assemblies.
- c. Tighten nuts (7) snugly, then tighten to align next castellation with cotter pin hole in bolt.
- d. Check upper torque link (6) and lower torque link (9) for looseness. If looseness is apparent, remove nuts (7) and bolts and install shims (3) as necessary to take up any looseness. This will assist in preventing nose wheel shimmy.
- e. Retighten nuts (7) snugly, then tighten to align next castellation with cotter pin hole in bolt; install cotter pin.
- f. Fill and inflate shock strut in accordance with

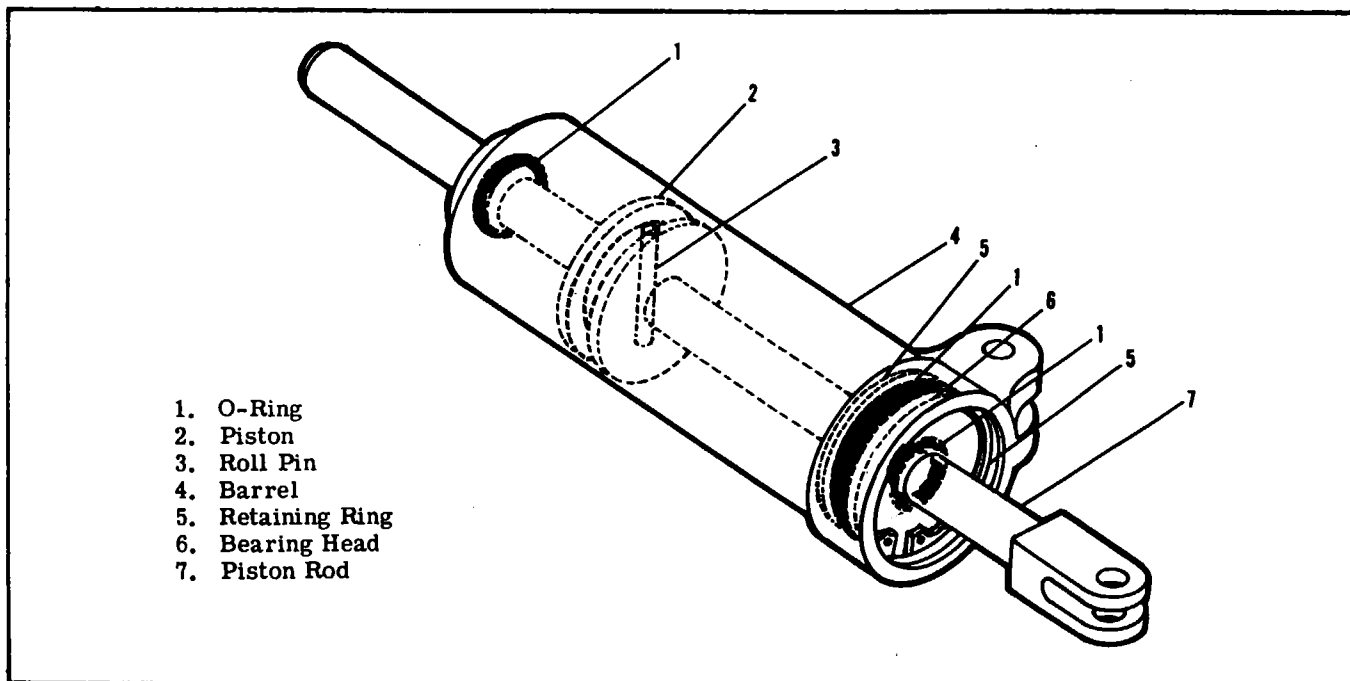


Figure 5-11. Nose Gear Shimmy Dampener

procedures outlined in Section 2.

5-43. SHIMMY DAMPENER.

5-44. DESCRIPTION. The shimmy dampener provided for the nose gear offers resistance to shimmy by forcing hydraulic fluid through small orifices in a piston. The dampener piston shaft is secured to a stationary part and the housing is secured to the nose wheel steering collar which moves as the nose wheel is turned right or left, causing relative motion between the dampener shaft and housing.

5-45. REMOVAL.

- a. Remove cotter pin, nut, washers and bolt attaching piston rod clevis.
- b. Remove cotter pin, nut, spacer and bolt attaching housing to steering collar.

5-46. DISASSEMBLY AND REASSEMBLY. (Refer to figure 5-11.)

- a. Refer to the phantom view of the internal parts of the dampener for disassembly and assembly.
- b. When reassembling dampener, install all new O-rings. Lubricate all parts with clean hydraulic fluid.
- c. When dampener is completely assembled, service in accordance with procedures outlined in Section 2.

5-46A. INSTALLATION.

- a. Attach dampener piston rod clevis to structure with bolt, washers (as required), nut and cotter pin.
- b. Attach body of shimmy dampener to steering collar with bolt, spacer, washers, nut and cotter pin.

5-47. NOSE WHEEL STEERING SYSTEM.

5-48. DESCRIPTION. Nose wheel steering is accomplished through use of the rudder pedals. Spring-loaded steering rod assemblies connect the nose gear steering collar to arms on the rudder bars. Steering is afforded up to approximately 10 degrees each side of neutral, after which brakes may be used to gain a maximum deflection of 30 degrees right or left of center. A flexible boot seals the fuselage entrance of the steering rod assembly.

5-49. NOSE WHEEL STEERING ROD ASSEMBLY.

5-50. DESCRIPTION. The steering rods are connected by a clevis to the rod ends extending from the nose gear steering collar, and to an arm on the rudder pedal crossbars.

5-51. NOSE WHEEL STEERING ADJUSTMENT.

Since the nose wheel steering system and the rudder system are interconnected, adjustment to one system might affect the other system. Refer to Section 10 of this manual for instructions for rigging the nose wheel steering and the rudder system.

5-52. BRAKE SYSTEM.

5-53. DESCRIPTION. The hydraulic brake system is comprised of two master cylinders, located immediately forward of the pilot's rudder pedals, brake lines and hose connecting each master cylinder to its wheel brake cylinder, and the single-disc, floating cylinder-type brake assembly, located at each main landing gear wheel.

5-54. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
DRAGGING BRAKES.	Brake pedal binding.	Check and adjust properly.
	Parking brake linkage holding brake pedal down.	Check and adjust properly.
	Worn or broken piston return spring (in master cylinder.)	Repair, or install new cylinder.
	Insufficient clearance at Lock-O-Seal or incorrect adjustment of cylinder overall length.	Adjust as outlined in paragraph 5-60.
	Restriction in hydraulic lines or restrictions in compensating port in brake master cylinder.	Drain brake line and clear the inside of the brake line with filtered compressed air. If cleaning the lines fails to give satisfactory results, the master cylinder may be faulty and should be repaired.
	Worn, scored or warped brake disc.	Install new disc and brake linings.
BRAKES FAIL TO OPERATE.	Leak in system.	If brake master cylinders or wheel cylinder assemblies are leaking, repair, or install new parts.
	Air in system.	Bleed system.
	Lack of fluid in master cylinders.	Fill and bleed system.
	Defective master cylinder.	Repair, or install new parts.

SHOP NOTES:

5-55. BRAKE MASTER CYLINDERS.

CAUTION

Do not damage Lock-O-Seal.

5-56. DESCRIPTION. The brake master cylinders, located immediately forward of the pilot's rudder pedals, are actuated by applying pressure at the top of the rudder pedals. A small reservoir is incorporated into each master cylinder for the fluid supply. When dual brakes are installed, mechanical linkage permits the copilot pedals to operate the master cylinders.

5-57. BRAKE MASTER CYLINDER REMOVAL.

- a. Remove bleeder screw at wheel brake assembly and drain hydraulic fluid from brake cylinders.
- b. Remove front seats and rudder bar shield for access to the brake master cylinders.
- c. Disconnect parking brake linkage and disconnect brake master cylinders from rudder pedals.
- d. Disconnect brake master cylinders at lower attach points.
- e. Disconnect hydraulic hose from master cylinders and remove cylinders.
- f. Plug or cap hydraulic fittings, hose and lines to prevent entry of foreign matter.

5-58. BRAKE MASTER CYLINDER DISASSEMBLY. (Refer to figure 5-12.)

- a. Unscrew clevis (1) and jamb nut (2).
- b. Remove screw (18), spring (21), lock plate (22), washer (19) and spacer (20).
- c. Remove filler plug (17).
- d. Remove setscrew (5).
- e. Unscrew cover (4) and remove up over piston rod (3).
- f. Remove piston rod (3) and compensating sleeve (16).
- g. Slide sleeve (16) up over rod (3).
- h. Unscrew nut (12) from threads of piston rod (3).
- i. Remove spring (13) and O-ring (9) from piston (14).
- j. Remove Lock-O-Seal (15).

5-59. BRAKE MASTER CYLINDER INSPECTION, REPAIR, AND OVERHAUL. Repair and overhaul is limited to installation of new parts, cleaning, and adjusting. (Refer to reassembly paragraph for adjustment.) Use clean hydraulic fluid (MIL-H-5606) as a lubricant during reassembly of the cylinders. Inspect Lock-O-Seal (Parker Seal Co. p/n 800-001-6) and replace if damaged. Replace all O-rings. Filler plug (17) must be vented so pressure cannot build up in the reservoir during brake operation. Remove plug and drill 1/16-inch hole, 30° from vertical, if plug is not vented.

5-60. BRAKE MASTER CYLINDER REASSEMBLY. (Refer to figure 5-12.)

- a. Install Lock-O-Seal (15) at bottom of piston rod (3).
- b. Install O-ring (9) in groove in piston (14); insert piston spring (13) into piston, and slide assembly up on bottom threaded portion of piston rod (3).
- c. Run nut (12) up threads to spring (13). Tighten nut (12) enough to obtain 0.040±0.005-inch clearance between top of piston and bottom of Lock-O-Seal, as shown in the figure.

- d. Install piston return spring (11) into cylinder (10) portion of body (7).
- e. Install piston rod (3) end through spring (11).
- f. Slide compensating sleeve (16) over rod (3).
- g. Install cover (4), lock plate (22), spacer (20), washer (19), spring (21) and screw (18).
- h. Install jamb nut (2) and clevis (1).
- i. Install filler plug (17), making sure vent hole is open.
- j. Install setscrew (5).

5-61. BRAKE MASTER CYLINDER INSTALLATION.

- a. Connect hydraulic hose to cylinder.
- b. Install cylinder at lower attach point.
- c. Connect master cylinder to rudder pedals.
- d. Connect parking brake linkage.
- e. Install rudder bar shield and install front seats.
- f. Fill and bleed brake system in accordance with applicable paragraph in this Section.

5-62. HYDRAULIC BRAKE LINES.

5-63. DESCRIPTION. The brake lines are rigid tubing, except for flexible hose used at the brake master cylinders. A separate line is used to connect each brake master cylinder to its corresponding wheel brake cylinder.

5-64. WHEEL BRAKE ASSEMBLIES.

5-65. DESCRIPTION. (Refer to figure 5-3.) The wheel brake assemblies use a disc which is attached to the main wheel. The assemblies also employ a floating brake assembly.

5-66. WHEEL BRAKE REMOVAL. (Refer to figure 5-3.) Wheel brake assemblies can be removed by disconnecting the brake line (drain hydraulic brake fluid when disconnecting line) and removing the brake back plate. The brake disc is removed after the wheel is removed and disassembled. To remove the torque plate, remove wheel and axle. Refer to figure 5-3 for brake disassembly.

5-67. WHEEL BRAKE INSPECTION AND REPAIR.

- a. Clean all parts except brake linings and O-rings in dry cleaning solvent and dry thoroughly.
- b. Install all new O-rings. If O-ring reuse is necessary, wipe with a clean cloth saturated in hydraulic fluid and inspect for damage.

NOTE

Thorough cleaning is important. Dirt and chips are the greatest single cause of malfunctions in the hydraulic brake system.

- c. Check brake lining for deterioration and maximum permissible wear. (Refer to applicable paragraph for maximum wear limit.)

d. Inspect brake cylinder bore for scoring. A scored cylinder will leak or cause rapid O-ring wear. Install a new brake cylinder if the bore is scored.

e. If the anchor bolts on the brake assembly are nicked or gouged, they shall be sanded smooth to prevent binding with the pressure plate or torque plate. When new anchor bolts are to be installed, press out old bolts and install new bolts with a soft mallet.

f. Inspect wheel brake disc for a minimum thickness of 0.190-inch. If brake disc is below minimum thickness, install a new part.

5-68. WHEEL BRAKE REASSEMBLY. (Refer to figure 5-3.)

NOTE

Lubricate parts with clean hydraulic fluid during brake reassembly.

a. Refer to figure 5-3 for assembly procedures.

5-69. WHEEL BRAKE INSTALLATION.

a. Place brake assembly in position with pressure plate in place.

b. Install back plate.

NOTE

If torque plate was removed, install as the axle is installed or install on axle. If the brake disc was removed from the wheel, install as wheel is assembled.

5-70. CHECKING BRAKE LINING WEAR. New brake lining should be installed when the existing lining has worn to a minimum thickness of 3/32-inch. A 3/32-inch thick strip of material held adjacent to each lining can be used to determine amount of wear. The shank end of a drill bit of the correct size can also be used to determine wear of brake linings.

5-71. BRAKE LINING INSTALLATION. (Refer to figure 5-3.)

a. Remove bolts securing back plate, and remove back plate.

b. Pull brake cylinder out of torque plate and slide pressure plate off anchor bolts.

c. Place back plate on a table with lining side down flat. Center a 9/64-inch (or slightly smaller) punch in the rolled rivet, and hit the punch sharply with a hammer. Punch out all rivets securing the linings to the back plate and pressure plate in the same manner.

NOTE

A rivet setting kit, Part No. R651, is available from Cessna Parts Distribution (CPD 2). This kit consists of an anvil and punch.

d. Clamp the flat side of the anvil in a vise.

e. Align new lining on back plate and place brake rivet in hole with rivet head in the lining. Place the head against the anvil.

f. Center rivet setting punch on lips of rivet.

While holding back plate down firmly against lining, hit punch with hammer to set rivet. Repeat blows on

punch until lining is firmly against back plate.

g. Realign the lining on the back plate and install and set rivets in the remaining holes.

h. Install a new lining on pressure plate in the same manner.

i. Position pressure plate on anchor bolts and place cylinder in position so that anchor bolts slide into the torque plate.

j. Install back plate with bolts and washers.

k. Complete brake lining conditioning. Refer to paragraph 5-77.

5-72. BRAKE SYSTEM BLEEDING.

NOTE

Bleeding with a clean hydraulic pressure source connected to the wheel cylinder bleeder is recommended.

a. Remove brake master cylinder filler plug and screw flexible hose with appropriate fitting into the filler hole at top of the master cylinder.

b. Immerse opposite end of flexible hose in a container with enough hydraulic fluid to cover the end of the hose.

c. Connect a clean hydraulic pressure source, such as a hydraulic hand pump or Hydro-Fill unit, to the bleeder valve in the wheel cylinder.

d. As fluid is pumped into the system, observe the immersed end of the hose at the master brake cylinder for evidence of air bubbles being forced from the brake system. When bubbling has ceased, remove bleeder source from wheel cylinder, and tighten the bleeder valve.

NOTE

Ensure that the free end of the hose from the master cylinder remains immersed during the entire bleeding process.

5-73. PARKING BRAKE SYSTEM. (Refer to figure 5-13.)

5-74. DESCRIPTION. The parking brake system consists of a control knob on the instrument panel which is connected to linkage at the brake master cylinders. At the brake master cylinders, the control operates locking plates which trap pressure in the system after the master cylinder piston rods have been depressed by toe operation of the rudder pedals. To release the parking brake, depress the pedals and push the control knob full in.

5-75. REMOVAL AND INSTALLATION. (Refer to figure 5-13.) Refer to the figure for relative locations of system components. The illustration may be used as a guide during removal and installation of components.

5-76. INSPECTION AND REPAIR OF SYSTEM COMPONENTS. Inspect lines for leaks, cracks, dents, chafing, proper radius, security, corrosion, deterioration, obstruction and foreign matter. Check brake master cylinders, and repair as outlined in applicable paragraph in this Section. Check parking brake control for operation and release. Replace worn or damaged parts.

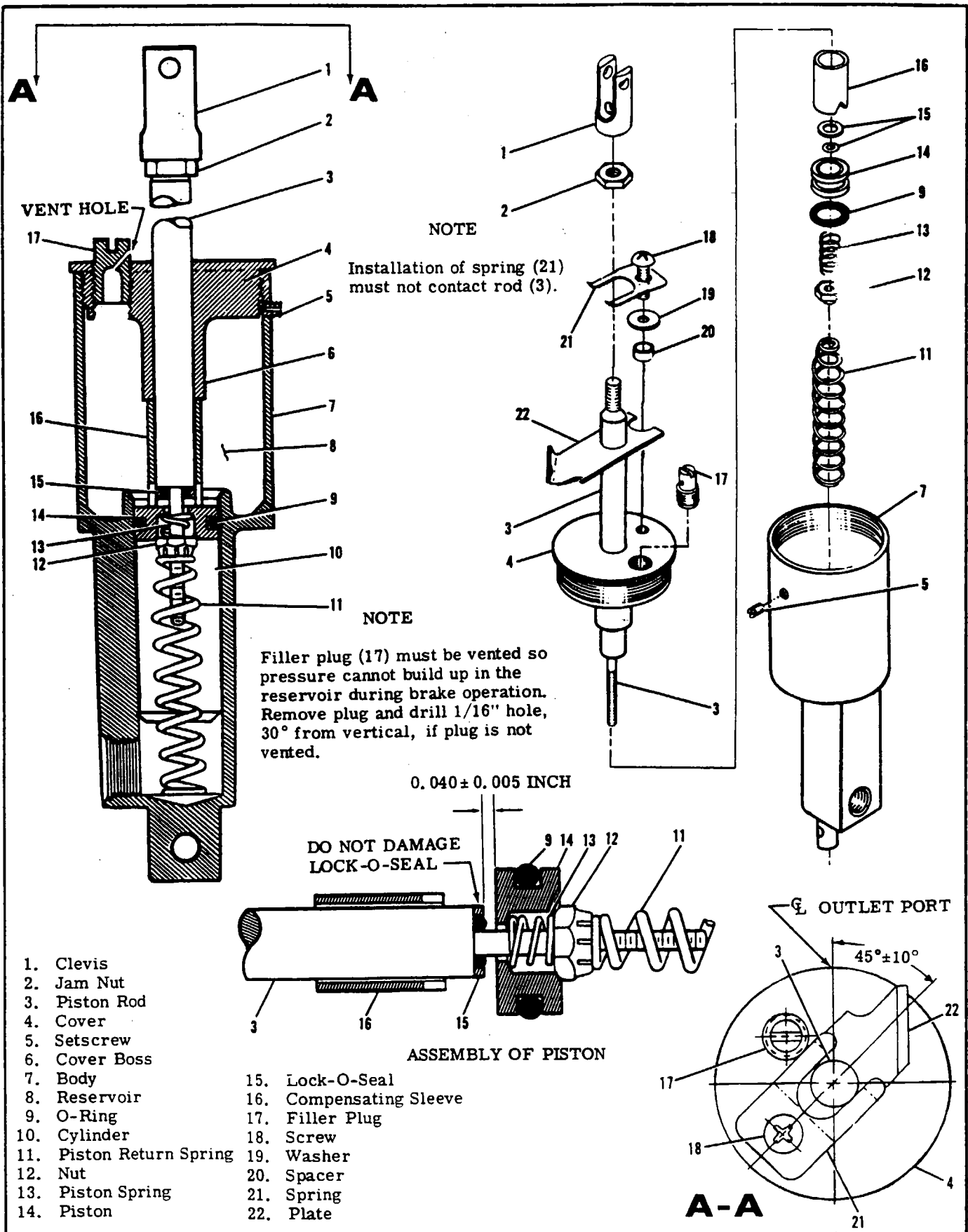


Figure 5-12. Brake Master Cylinder

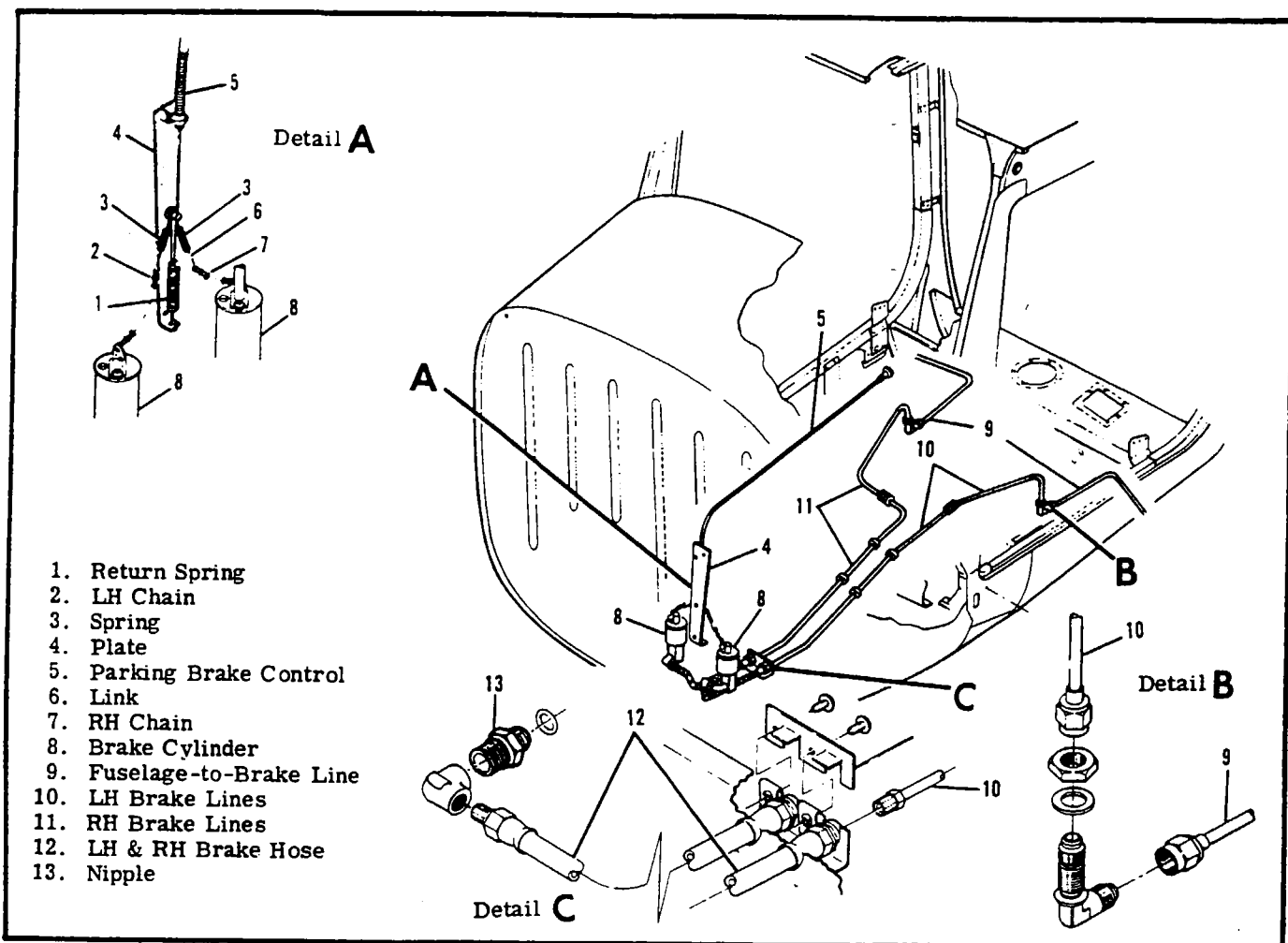


Figure 5-13. Brake Systems

5-77. BRAKE LINING CONDITIONING. The brake lining pads used in this assembly are either non-asbestos organic composition or iron based metallic composition. Brake pads must be properly conditioned (glazed) before use in order to provide optimum service life. This is accomplished by a brake burn-in. Burn-in also wears off brake high spots prior to operational use. If brake use is required before burn-in, use brakes intermittently at LOW taxi speeds.

CAUTION

Brake burn-in must be performed by a qualified person familiar with acceleration and stop distances of the airplane.

- a. Non-asbestos Organic Composition Burn-in.
1. Taxi the airplane for 1500 feet, with engine at 1700 rpm, applying brake pedal force as needed to maintain 5 to 10 M.P.H. (5 to 9 Knots).
 2. Allow brakes to cool for 10 to 15 minutes.
 3. Apply brakes and check to see if a high throttle static engine run-up can be held with

normal pedal force. If so, conditioning burn-in is complete.

4. If static run-up cannot be held, repeat Steps 1 thru 3 as needed.
- b. Metallic Composition Burn-in.
1. Taxi the airplane to 34 to 40 M.P.H (30 to 35 Knots) and perform full stop braking application.
 2. Without allowing brake discs to cool substantially, repeat Step 1 for second full stop braking application.
 3. Apply brakes and check to see if a high throttle static engine run-up can be held with normal pedal force. If so, conditioning burn-in is complete.
 4. If static run-up cannot be held, repeat Steps 1 thru 3 as needed.

NOTE

Normal brake usage should generate enough heat to maintain the glaze throughout the life of the lining. Light brake usage can cause the glaze to wear off, resulting in reduced brake performance. In such cases, the lining may be conditioned again following the instructions set forth above.

SECTION 6

AILERON CONTROL SYSTEM

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6-1. AILERON CONTROL SYSTEM. (Refer to figure 6-1.)

pulleys, sprockets and roller chains, all of which, link the control wheels to the ailerons. A control "Y" interconnects the control wheels to the aileron cables.

6-2. DESCRIPTION. The aileron control system is comprised of push-pull rods, bellcranks, cables,

6-3. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraph 6-15.

TROUBLE	PROBABLE CAUSE	REMEDY
LOST MOTION IN CONTROL WHEELS.	Loose control cables.	Adjust cables to proper tension.
	Broken pulley or bracket, cable off pulley or worn rod end bearings.	Replace worn or broken parts, install cables correctly.
	Sprung bellcrank.	Replace bellcrank.
	Loose chains.	Adjust chain tension.

6-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
RESISTANCE TO CONTROL WHEEL MOVEMENT.	Cables too tight.	Adjust cables to proper tension.
	Pulleys binding or cable off.	Replace defective pulleys. Install cables correctly.
	Bellcrank distorted or damaged.	Replace bellcrank.
	Defective U-joints.	Replace defective U-joints.
	Clevis bolts in system too tight.	Loosen, then tighten properly and safety.
	Rusty chain or chain binding with sprocket.	Replace chain or defective parts.
CONTROL WHEELS NOT LEVEL WITH AILERONS NEUTRAL.	Improper adjustment of chains or cables.	Adjust in accordance with paragraph 6-15.
	Improper adjustment of aileron push-pull rods.	Adjust in accordance with paragraph 6-15.
DUAL CONTROL WHEELS NOT COORDINATED.	Chains improperly adjusted.	Adjust in accordance with paragraph 6-15.
INCORRECT AILERON TRAVEL.	Push-pull rods not adjusted properly.	Adjust in accordance with paragraph 6-15.
	Worn bellcrank stop bushings on bellcrank slots.	Replace worn parts.

6-4. CONTROL "Y". (Refer to figure 6-2.)

6-5. DESCRIPTION. The control "Y" transforms rotation of the control wheels into pulling motion on the aileron cables by means of sprockets and chains. The "Y" is pivoted at the lower end to operate the elevator control system.

6-6. REMOVAL AND INSTALLATION.

a. Remove control cover and carpeting as necessary to gain access to lower end of control "Y".

b. Release cable tension by loosening turnbuckle (index 3, figure 6-1).

c. Remove bolt (17) attaching control link (14).

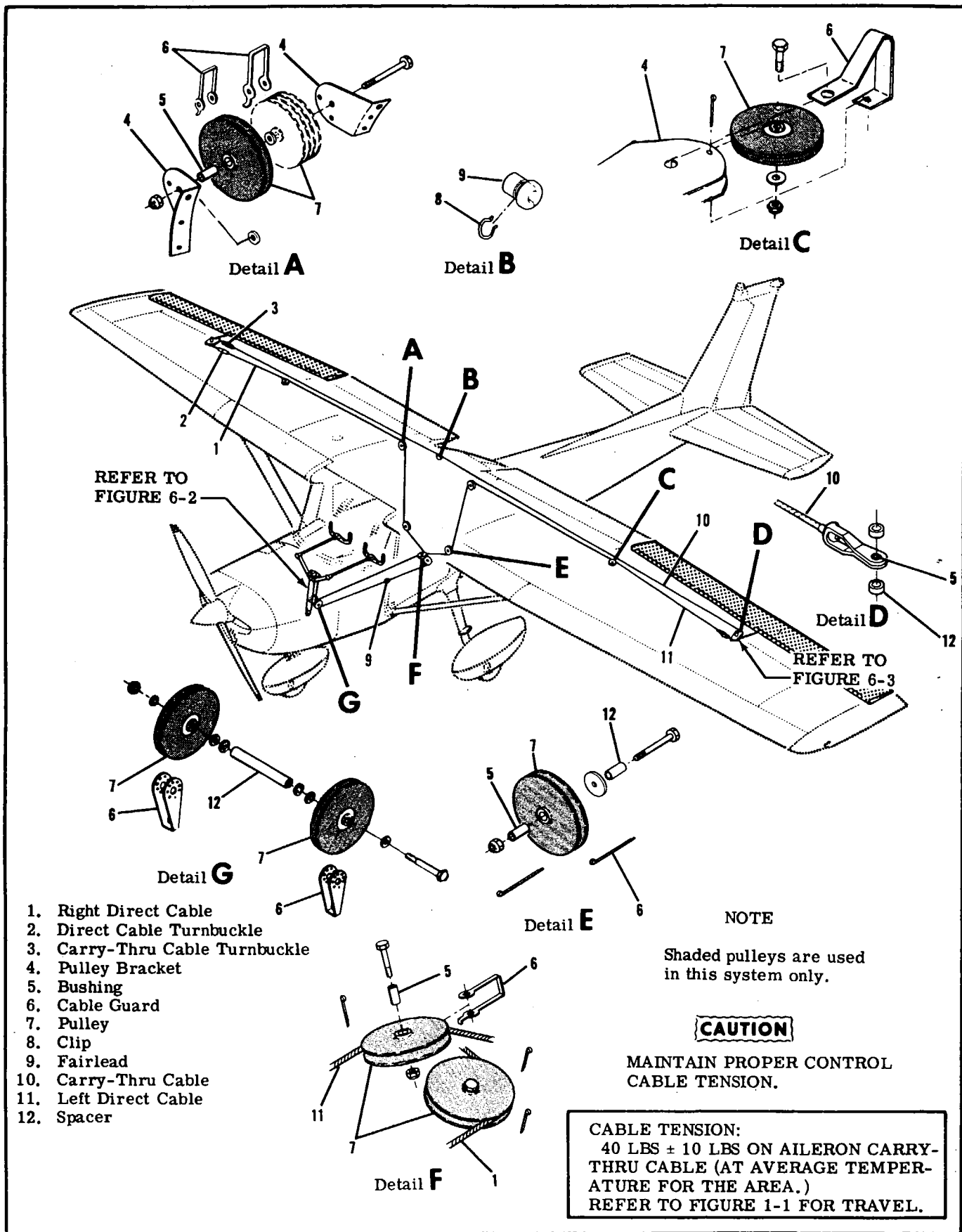
d. Remove bolts (8) securing control wheel tubes (9) to universal joints (7).

e. Remove bolts securing cable ends to control arm (5).

f. Remove pivot bolt (16) and remove control "Y".

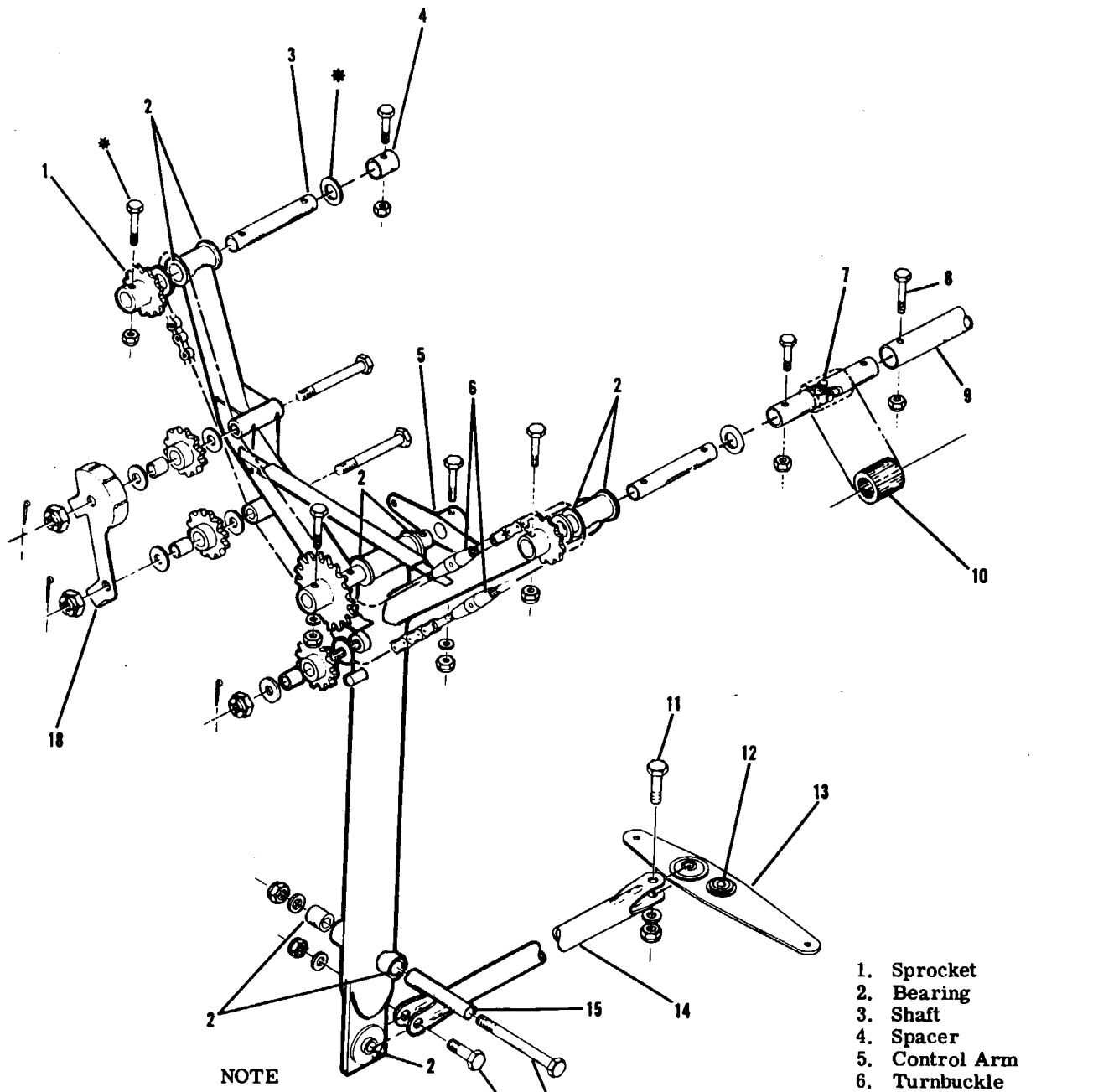
g. Reverse preceding steps for installation.

h. Rig aileron system in accordance with applicable paragraph in this section, safety turnbuckle and re-install all items removed in step "a".



1. Right Direct Cable
2. Direct Cable Turnbuckle
3. Carry-Thru Cable Turnbuckle
4. Pulley Bracket
5. Bushing
6. Cable Guard
7. Pulley
8. Clip
9. Fairlead
10. Carry-Thru Cable
11. Left Direct Cable
12. Spacer

Figure 6-1. Aileron Control System



NOTE

When dual controls are installed, spacer (4) is replaced with a universal joint to which the right control wheel is attached.

Chains are to have minimum amount of tension which will remove slack from chains.

* Use as required for maximum .005 inch end play per side.

* Left and right bolts are to be parallel.

- 1. Sprocket
- 2. Bearing
- 3. Shaft
- 4. Spacer
- 5. Control Arm
- 6. Turnbuckle
- 7. Universal Joint
- 8. Bolt
- 9. Control Wheel Tube
- 10. Cover
- 11. Bolt
- 12. Bearing
- 13. Bellcrank
- 14. Control Link
- 15. Bushing
- 16. Pivot Bolt
- 17. Bolt
- 18. Chain Guard

Figure 6-2. Control "Y" Installation

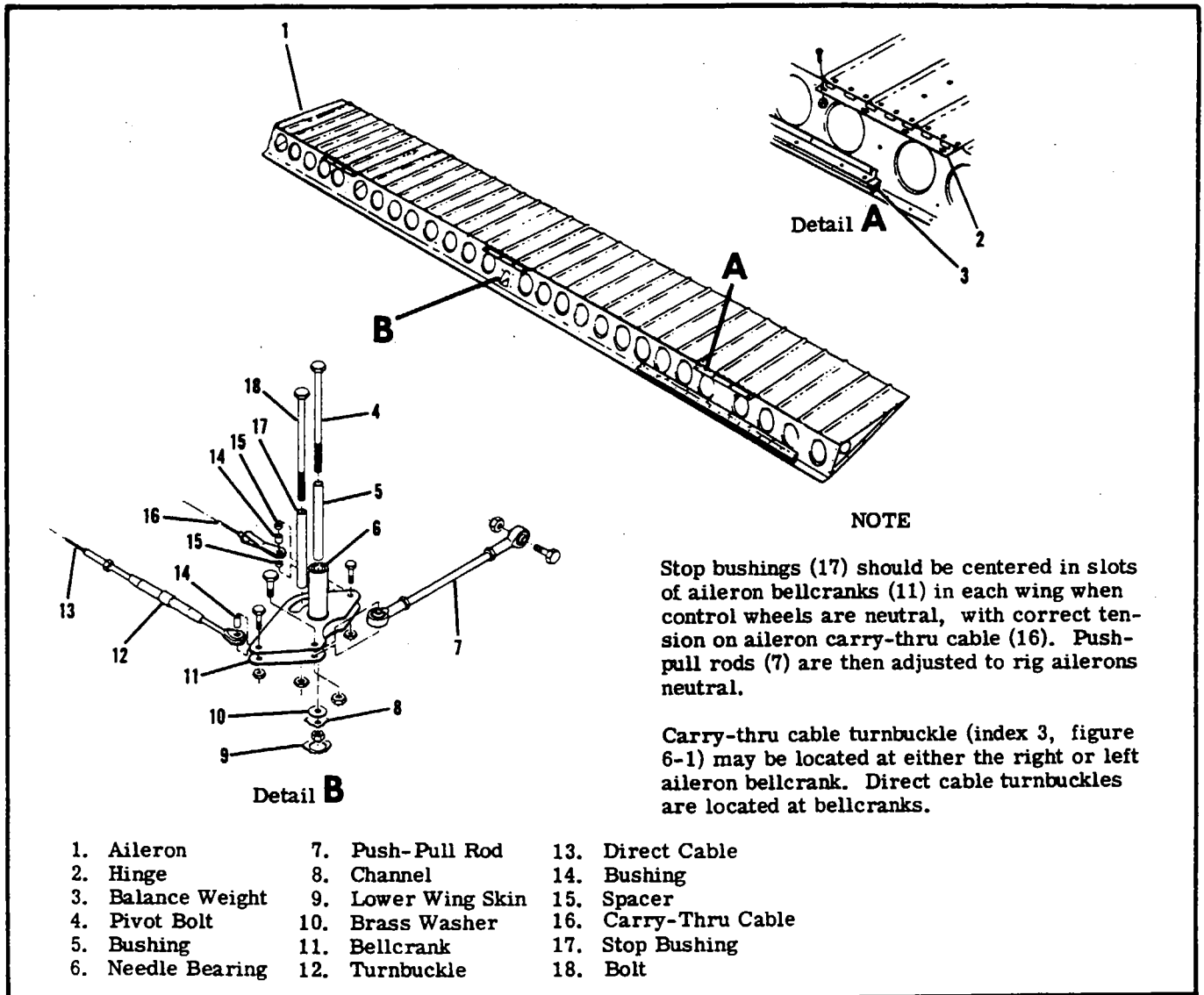


Figure 6-3. Aileron and Bellcrank Installation

i. Check and/or rig elevator control system in accordance with applicable paragraph in Section 8.

6-7. AILERON BELLCRANK. (Refer to figure 6-3.)

6-8. REMOVAL.

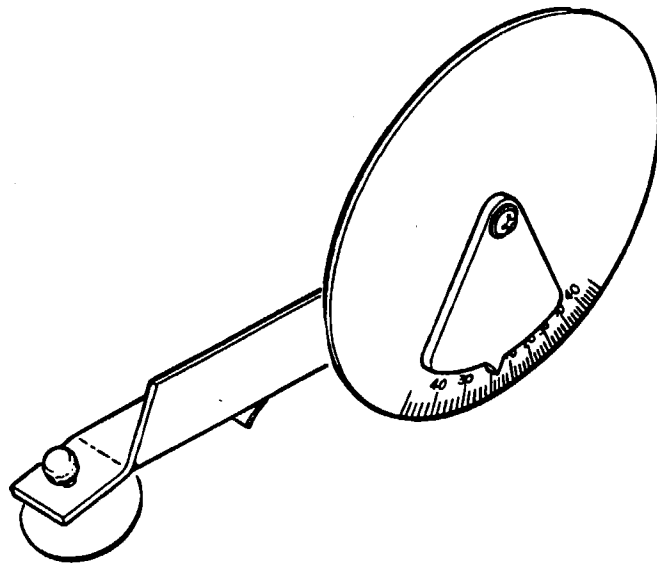
- a. Remove access plate inboard of each bellcrank on underside of wing.
- b. Relieve control cable tension by loosening turnbuckle barrel (index 3, figure 6-1).
- c. Disconnect control cables from bellcrank. Retain all spacers (15).
- d. Disconnect aileron push-pull rod (7) at bellcrank.
- e. Remove nut, washer and bolt securing bellcrank stop bushing (17) and bellcrank (11) to wing structure.
- f. Remove bellcrank through access opening, using care bushing (5) is not dropped from bellcrank.

NOTE

Brass washers (10) may be used as shims between lower end of bellcrank and wing channel (8). Retain these shims. Tape open ends of bellcrank to prevent dust and dirt from entering bellcrank needle bearings (6).

6-9. INSTALLATION.

- a. Place bushing (5) and stop-bushing (17) in bellcrank and position bellcrank in wing.
- b. Install brass washers (10) between lower end of bellcrank and wing channel (8) to shim out excess clearance.
- c. Install bellcrank pivot bolt (4), washers and nut.
- d. Position bellcrank stop-bushing (17) and install attaching bolt (18), washers and nut.



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Figure 6-4. Inclinometer for Measuring Control Surface Travel

- e. Connect aileron cables to bellcrank.
- f. Rig aileron system in accordance with applicable paragraph in this section, safety turnbuckle and install access plates.

6-10. CABLES AND PULLEYS. (Refer to figure 6-1.)

6-11. REMOVAL AND INSTALLATION.

- a. Remove access plates, wing root fairings and upholstery as required.
- b. Disconnect cables from aileron bellcranks and remove cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

To ease routing of cables, a length of wire may be attached to end of cable before being withdrawn from aircraft. Leave wire in place, routed through structure; then attach to cable being installed and use to pull cable into position.

- c. After cable is routed, install pulleys and cable guards. Ensure cable is positioned in pulley groove before installing guard.
- d. Rig aileron system in accordance with applicable paragraph in this section, safety turnbuckles and install access plates, fairings and upholstery removed in step "a."

6-12. AILERONS. (Refer to figure 6-3.)

6-13. REMOVAL.

- a. Disconnect push-pull rod (7) at aileron.

- b. Remove screws and nuts attaching aileron hinges (2) to trailing edge of wing.
- c. Using care, pull aileron out and down to slide hinges from under wing skin and auxiliary spar reinforcements.

6-14. INSTALLATION.

- a. Position aileron hinges between skin and auxiliary spar reinforcements and install screws and nuts attaching hinges to trailing edge of wing.
- b. Attach push-pull rod to aileron.

NOTE

If rigging was correct and push-pull rod adjustment was not disturbed, it should not be necessary to rig system.

- c. Check aileron travel and alignment, rig if necessary, in accordance with applicable paragraph in this section.

6-15. RIGGING.

- a. (Refer to figure 6-2.) Position arm (5) horizontal and install chain with an equal number of links extending from central drive sprocket on arm (5).
- b. Adjust turnbuckles (6) to remove slack from chain and synchronize control wheels (level).

NOTE

Adjust chain turnbuckles (6) to minimum tension required to remove slack.

- c. Tape a bar across both control wheels to hold them in neutral position.

d. (Refer to figure 6-3.) Adjust turnbuckles at bellcranks (11) so stop bushings (17) are centered in bellcrank slots with 40 ± 10 pounds tension on carry-thru cable (16). Disregard tension on direct cables, which will be different than tension on carry-thru cable.

e. Adjust push-pull rod (7) at each aileron until ailerons are neutral with reference to the trailing edge of wing flaps. Be sure wing flaps are fully up when making this adjustment. Tighten push-pull rod jam nuts.

f. Safety all turnbuckles by the single-wrap method using 0.040-inch monel safety wire.

g. Remove bar from control wheels and install all parts removed for access.

h. Check ailerons for correct travel using inclinometer. Refer to figure 1-1 for travel specifications.

WARNING

Be sure ailerons move in correct direction when operated by control wheel.

SHOP NOTES:

SECTION 7

WING FLAP CONTROL SYSTEM

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7-1. WING FLAP CONTROL SYSTEM. (Refer to figure 7-1.)

7-2. DESCRIPTION. The wing flap control system is comprised of an electric motor and transmission assembly, drive pulleys, push-pull rods, cables and a follow-up control. Power from the motor and transmission assembly is transmitted to the flaps by a system of drive pulleys, cables and push-pull rods. Electrical power to the motor is controlled by two microswitches mounted on a floating arm assembly, by a camming lever and a follow-up control. As the flap control lever is moved to the desired flap setting, the attached cam trips one of the microswitches, activating the flap motor. As the flaps move to the position selected, the floating arm is rotated by the follow-up control until the active microswitch clears the cam breaking the circuit and stopping the motor. To reverse flap direction, the control lever is moved in the opposite direction causing the cam to trip the second microswitch which reverses the flap motor. The follow-up control moves the cam until it is clear of the second switch, shutting off the flap motor. Limit switches on flap actuator assembly prevent over-travel of the flaps in the full UP or DOWN positions.

7-3. OPERATIONAL CHECK.

a. Operate flaps through their full range of travel observing for uneven travel or jumpy motion, binding

or lost motion. Ensure flaps are moving together through their full range of travel.

b. Check for positive shut-off of motor at flap travel extremes to prevent damage to actuator assembly.

c. Check flaps for sluggishness in operation. In flight at 100 mph, indicated airspeed, flaps should fully extend in approximately 9 seconds and retract in approximately 5 seconds. On the ground, with engine running, the flaps should extend or retract in approximately 6 seconds.

d. With flaps full UP, mount an inclinometer on one flap and set to 0°. Lower flaps to full DOWN position and check flap angle as specified in figure 1-1. Check approximate mid-range percentage setting against degrees as indicated on inclinometer. Repeat the same procedure for the opposite flap.

NOTE

An inclinometer for measuring control surface travel is available from Cessna Parts Distribution (CPD 2). Refer to figure 6-4.

e. Remove access plates adjacent to flap drive pulleys and attempt to rock pulleys to check for bearing wear.

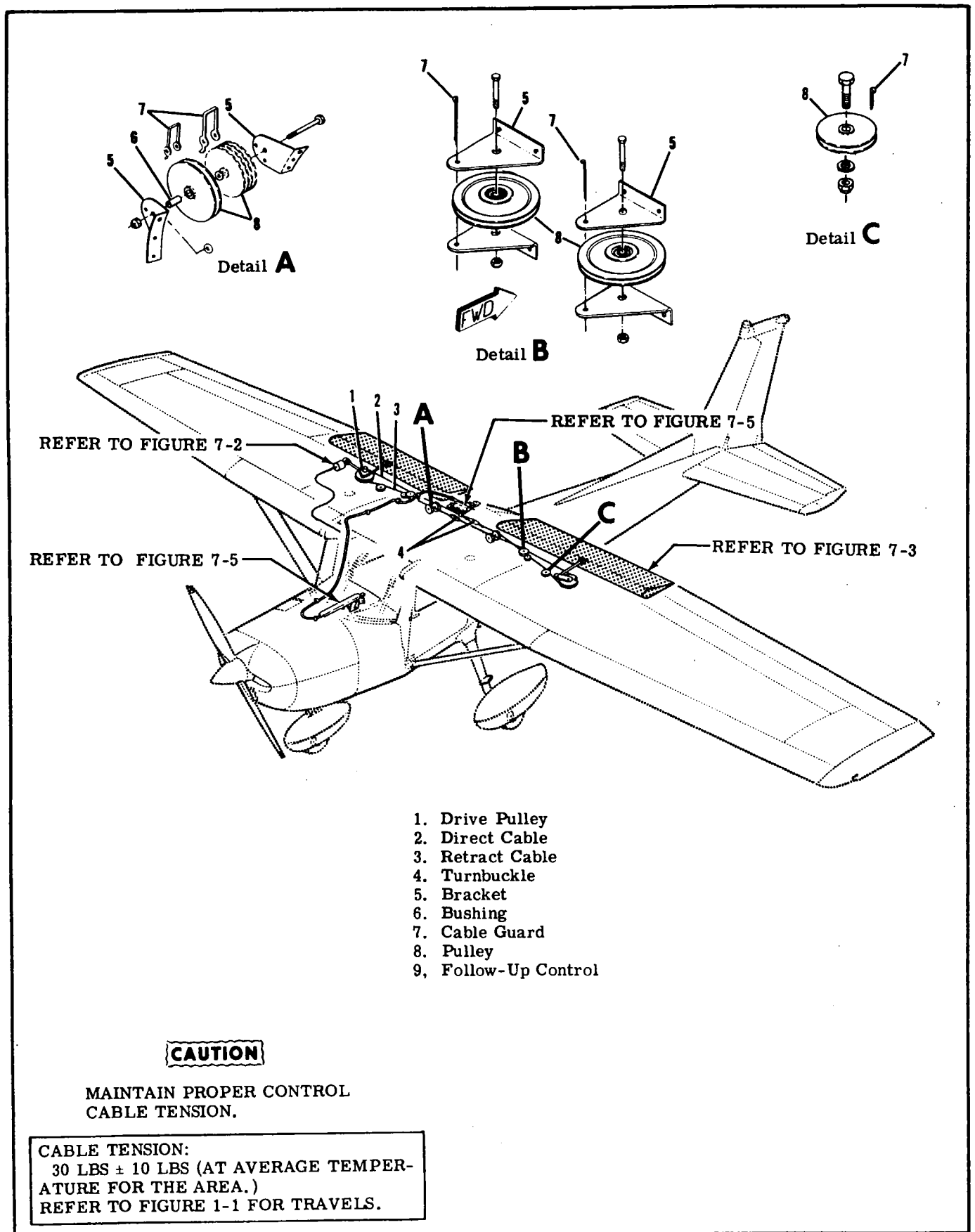
f. Inspect flap rollers and tracks for evidence of binding or defective parts.

7-4. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraphs 7-16 and 7-20.

TROUBLE	PROBABLE CAUSE	REMEDY
BOTH FLAPS FAIL TO MOVE.	Popped circuit breaker.	Reset and check continuity.
	Defective switch.	Place jumper across switch. Replace if defective.
	Defective motor.	Remove and bench test motor. Replace if defective.
	Broken or disconnected wires.	Run a continuity check. Connect or repair wiring.
	Defective or disconnected transmission.	Connect or replace transmission.
	Defective limit switch.	Check continuity of switches. Replace switches found defective.
BINDING IN SYSTEM AS FLAPS ARE RAISED AND LOWERED.	Cables not riding on pulleys.	Check visually. Route cables correctly over pulleys.
	Bind in drive pulleys.	Check drive pulleys in motion. Replace drive pulleys found defective.
	Broken or binding pulleys.	Check pulleys for free rotation or breaks. Replace defective pulleys.
	Frayed cable.	Check visually. Replace defective cable.
	Flaps binding on tracks.	Observe flap tracks and rollers. Replace defective parts.
LEFT FLAP FAILS TO MOVE.	Disconnected or broken cable.	Check cable tension. Connect or replace cable.
	Disconnected push-pull rod.	Check visually. Attach push-pull rod.
INCORRECT FLAP TRAVEL.	Incorrect rigging.	Refer to paragraph 7-16 and 7-20.
	Defective operating switch.	Check continuity of switches. Replace switches found defective.
FLAPS FAIL TO RETRACT.	Defective or disconnected flaps UP operating switch.	Check continuity of switch. Connect or replace limit switch.
FLAPS FAIL TO EXTEND.	Defective or disconnected flaps DOWN operating switch.	Check continuity of switch. Connect or replace limit switch.



REFER TO FIGURE 7-2

REFER TO FIGURE 7-5

REFER TO FIGURE 7-5

REFER TO FIGURE 7-3

- 1. Drive Pulley
- 2. Direct Cable
- 3. Retract Cable
- 4. Turnbuckle
- 5. Bracket
- 6. Bushing
- 7. Cable Guard
- 8. Pulley
- 9. Follow-Up Control

CAUTION

MAINTAIN PROPER CONTROL CABLE TENSION.

CABLE TENSION:
 30 LBS ± 10 LBS (AT AVERAGE TEMPERATURE FOR THE AREA.)
 REFER TO FIGURE 1-1 FOR TRAVELS.

Figure 7-1. Wing Flap Control System

7-5. FLAP MOTOR AND TRANSMISSION ASSEMBLY.

7-6. REMOVAL AND INSTALLATION (Refer to figure 7-2.)

- a. Run flaps to full DOWN position.
- b. Disconnect battery ground cable and insulate terminal as a safety precaution.
- c. Remove access plates beneath flap motor and transmission assembly in right wing.

NOTE

Flap motor (10), transmission (8), hinge assembly (11) and actuating tube (5) are removed from the aircraft as a unit.

- d. Remove bolt (21) securing actuating tube (5) to drive pulley (14).
- e. Screw actuating tube (5) in toward transmission (8) as far as possible by hand.
- f. Remove bolt (1) securing flap motor hinge (11) to wing. Retain brass washer between hinge and wing structure for use on reinstallation.
- g. Disconnect motor electrical leads at quick-disconnects.
- h. Disconnect wiring at limit switches (29 and 32).
- i. Carefully work assembly from wing through access opening.
- j. Reverse preceding steps for reinstallation. If hinge assembly (11) was removed from the transmission (8) for any reason, ensure that short end of hinge is reinstalled toward the top.
- k. Complete operational check as outlined in paragraph 7-3 and rerig system in accordance with paragraph 7-16.

7-7. REPAIR. Repair consists of replacement of motor, transmission, coupling, actuating tube and associated hardware. Bearings in hinge assembly may also be replaced. Lubricate as outlined in Section 2.

7-8. DRIVE PULLEYS. (Refer to figure 7-2.)

7-9. REMOVAL AND INSTALLATION.

- a. Remove access plate adjacent to drive pulley (14) in right wing.
- b. Unzip or remove headliner as necessary for access to turnbuckles (index 4, figure 7-1), remove safety wire and loosen turnbuckles.
- c. Remove bolt (20) securing flap push-pull rod (15) to drive pulley (14) and lower RIGHT flap gently.
- d. Remove bolt (21) securing actuating tube (5) to drive pulley (14) and lower LEFT flap gently. Retain bushing.

e. Remove cable locks (13) securing control cables to drive pulley (14). Tag cables for reference on reinstallation.

f. Remove bolt (12) attaching drive pulley (14) to wing structure.

g. Using care, remove drive pulley through access opening, being careful not to drop bushing. Retain brass washer between drive pulley and wing structure for use on reinstallation. Tape open ends of drive pulley after removal to protect bearings.

h. To remove left wing drive pulley, use this same procedure omitting step "d."

i. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 7-16, safety turnbuckles and reinstall all items removed for access.

7-10. REPAIR. Repair is limited to replacement of bearings. Cracked, bent or excessively worn drive pulleys must be replaced. Lubricate bearings as outlined in Section 2.

7-11. FLAPS. (Refer to figure 7-3.)

7-12. REMOVAL AND INSTALLATION.

- a. Run flaps to full DOWN position.
- b. Remove access plates (1) from top leading edge of flap.
- c. Disconnect push-pull rod (6) at flap bracket (7).
- d. Remove bolts (5) at each flap track. As flap is removed from wing, all washers, rollers and bushings will fall free. Retain these for reinstallation.
- e. Reverse the preceding steps for reinstallation. If push-pull rod (6) adjustment is not disturbed, rerigging of system should not be necessary. Check flap travel and rig in accordance with paragraph 7-16, if necessary.

7-13. REPAIR. Flap repair may be accomplished in accordance with instructions outlined in Section 18.

7-14. CABLES AND PULLEYS. (Refer to figure 7-1.)

7-15. REMOVAL AND INSTALLATION.

- a. Remove access plates, fairings, headliner and upholstery as necessary for access.
- b. If the direct cable (2) is to be removed, disconnect clamp (index 19, figure 7-5) from bellcrank (index 15, figure 7-5).
- c. Remove safety wire, relieve cable tension, disconnect turnbuckles (4) and carefully lower LEFT flap.
- d. Disconnect cables at drive pulleys, remove

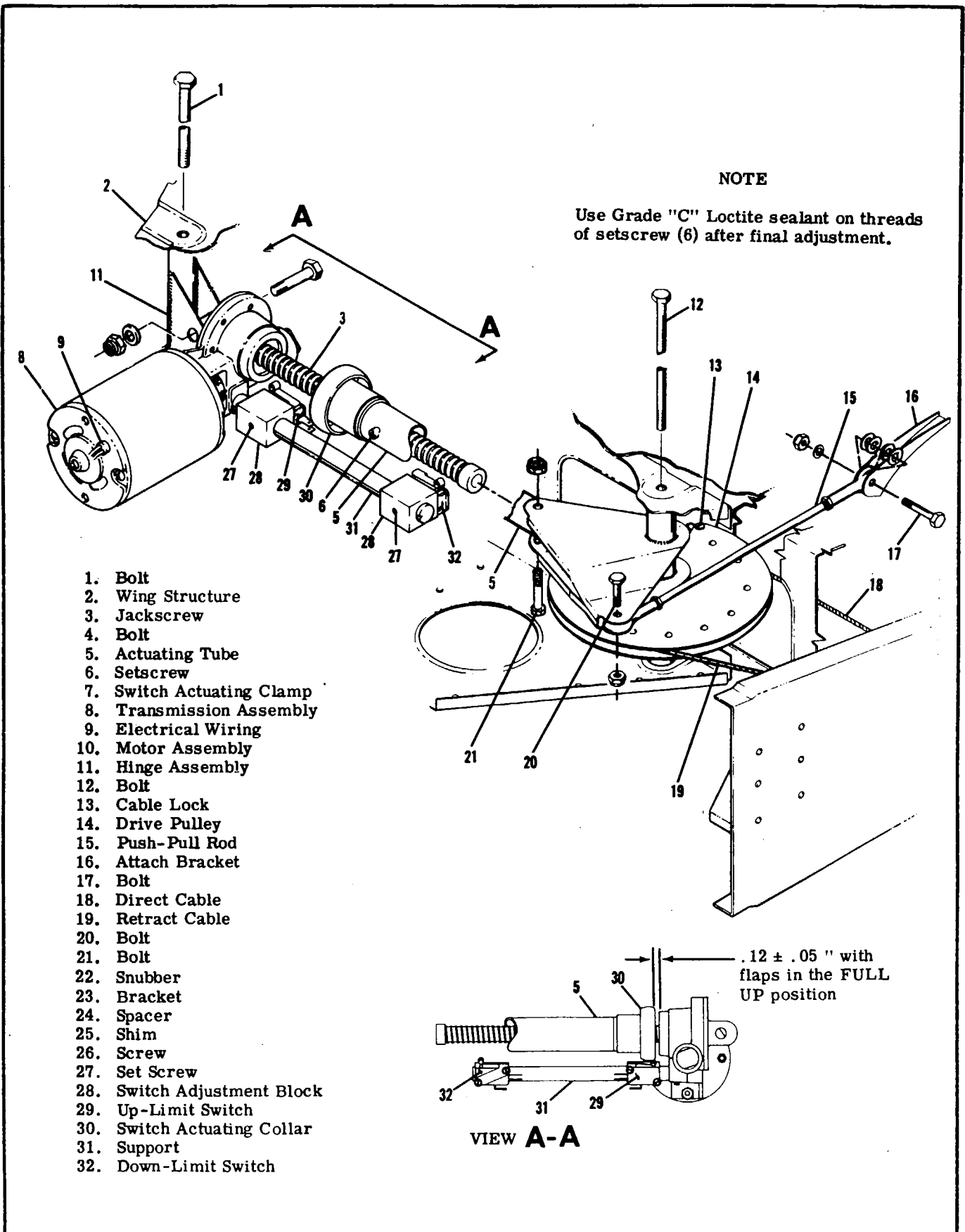
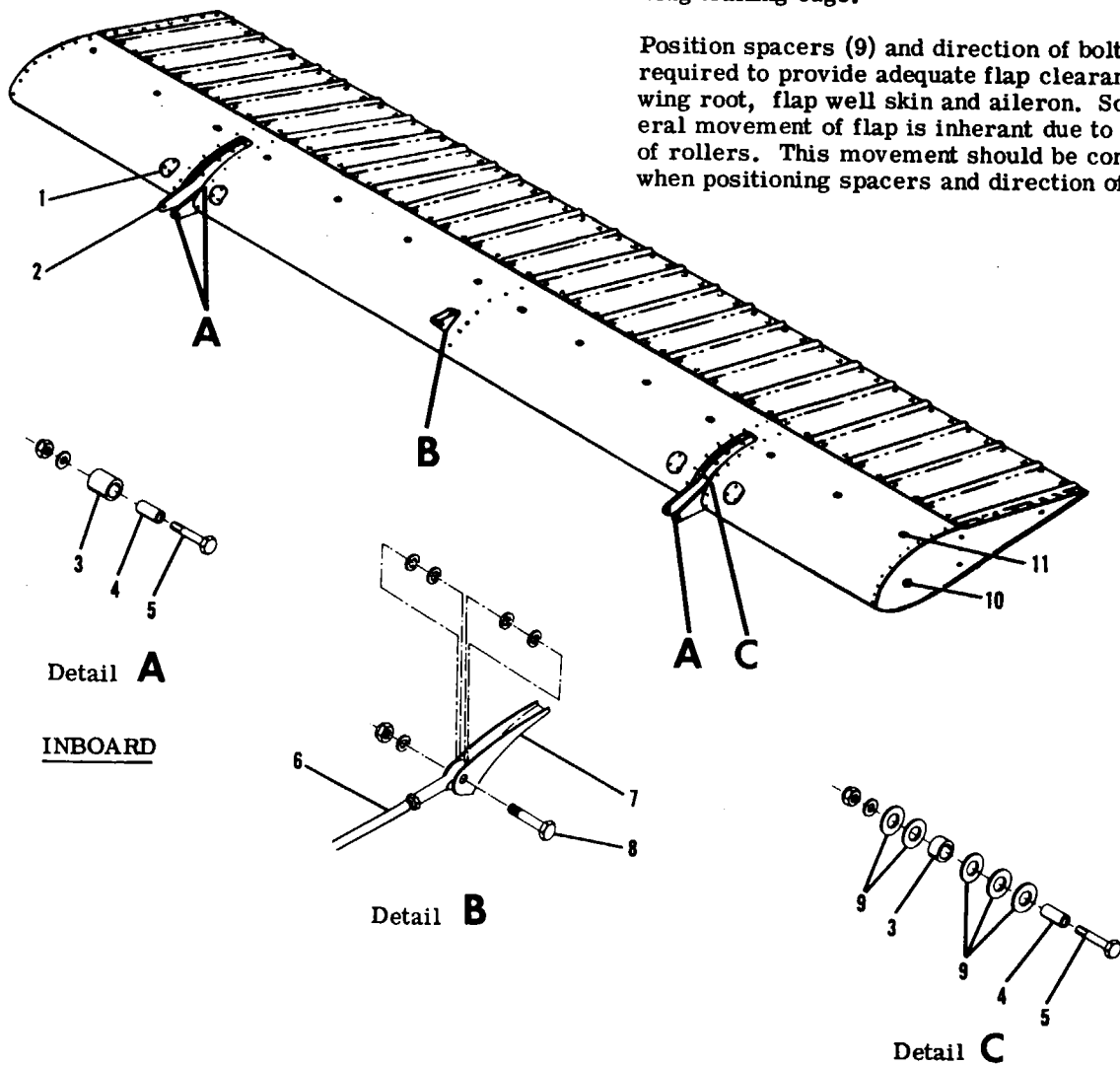


Figure 7-2. Flap Motor and Transmission Installation

NOTE

Bushings (4), rollers (3) and spacers (9) are first positioned through slots in flap tracks, then are secured to the flap roller supports (2) with attaching bolts, washers and nuts. Nylon plug buttons (11) prevent wing flap from chafing wing trailing edge.

Position spacers (9) and direction of bolts (5) as required to provide adequate flap clearance at wing root, flap well skin and aileron. Some lateral movement of flap is inherent due to the width of rollers. This movement should be considered when positioning spacers and direction of bolts.



Detail A

INBOARD

Detail B

Detail C

OUTBOARD

1. Access Plate
2. Flap Support
3. Roller Assembly
4. Bushing
5. Bolt
6. Push-Pull Rod
7. Flap Bracket
8. Bolt
9. Spacer
10. Plug Button
11. Nylon Plug Button

Figure 7-3. Flap Installation

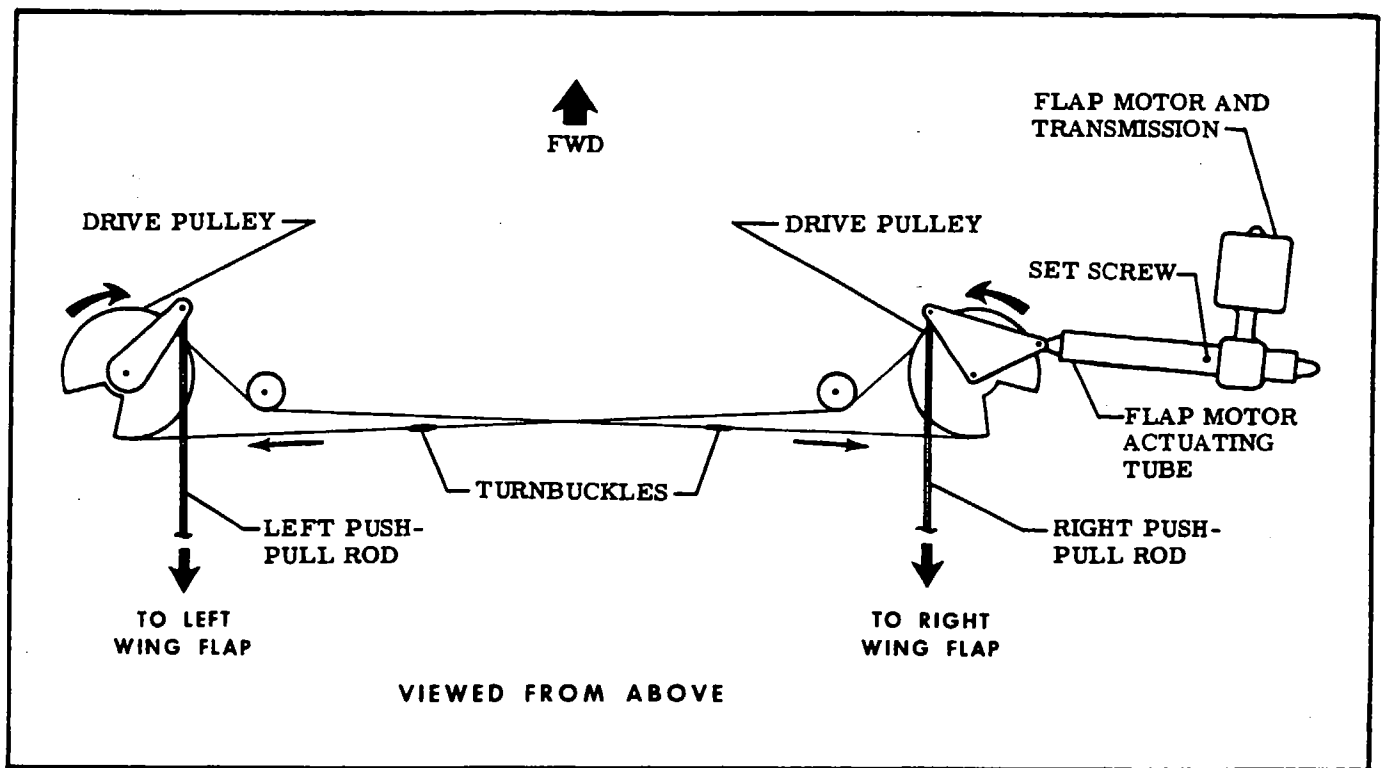


Figure 7-4. Flap System Schematic

cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

To ease routing of cables, a length of wire may be attached to the end of cable being withdrawn from the aircraft. Leave wire in place, routed through structure; then attach the cable being installed and use wire to pull cable into position.

- e. Reverse the preceding steps for reinstallation.
- f. After cables are routed in position, install pulleys and cable guards. Ensure cables are positioned in pulley grooves before installing guards.
- g. Re-rig flap system in accordance with paragraph 7-16 and safety turnbuckles.
- h. Re-rig follow-up system in accordance with paragraph 7-19 and reinstall all items removed in step "a."

7-16. RIGGING.

- a. (Refer to figure 7-1.) Unzip or remove headliner as necessary for access to turnbuckles (4).
- b. With flaps in the full UP position, disconnect follow-up cable (index 1, figure 7-5) by loosening clamp bolt (14).
- c. (Refer to figure 7-1.) Remove safety wire, relieve cable tension, disconnect turnbuckles (4) and carefully lower left flap.

- d. (Refer to figure 7-2.) Disconnect push-pull rods (15) at drive pulleys (14) in both wings and lower RIGHT flap gently.

- e. Disconnect actuating tube (5) from drive pulley (14).

NOTE

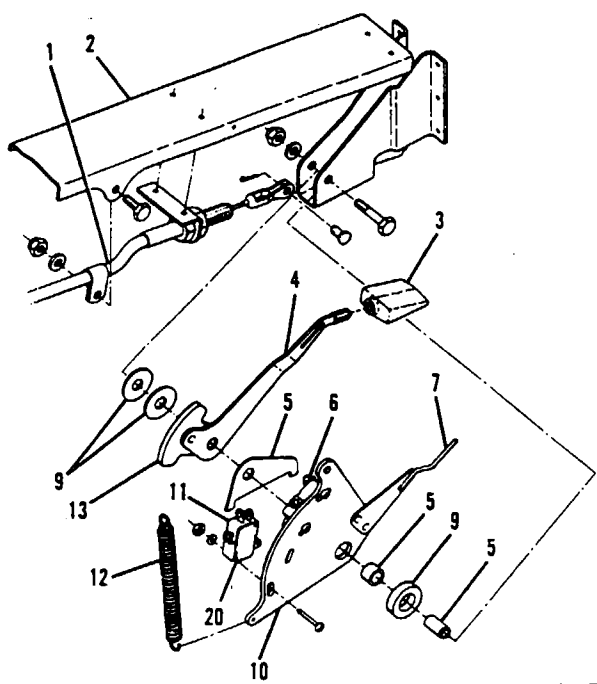
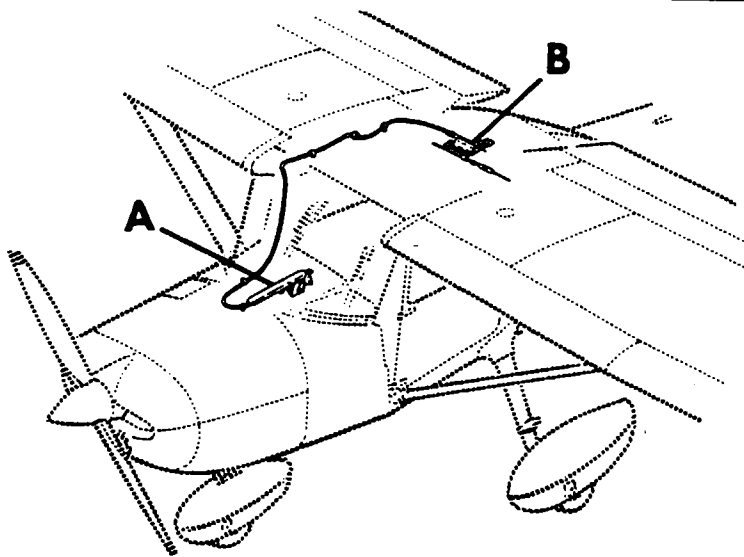
If control cables are not connected to left and right drive pulleys, actuating tube (5) and push-pull rods (15) must be disconnected before installing cables. If drive pulleys (14) are not installed, attach control cables before installing drive pulleys in the wings as illustrated in figure 7-4.

- f. Adjust both push-pull rods (15) to $8.83 \pm .12$ inches between centers of rod end bearings and tighten locknuts on both ends. Connect push-pull rods to flaps and drive pulleys.

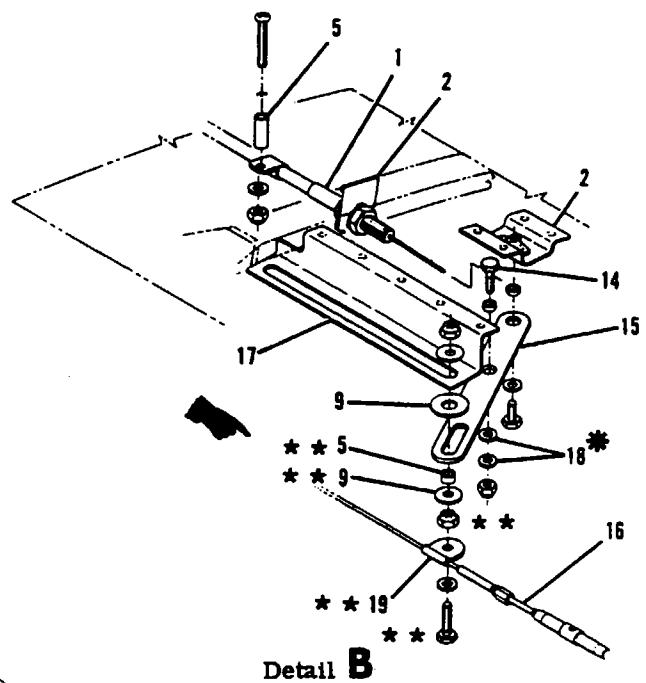
NOTE

Temporarily connect cables at turnbuckles (index 4, figure 7-1) and test flaps by hand to ensure both flaps extend and retract together. If they will not, the cables are incorrectly attached to the drive pulleys. Ensure that the right drive pulley rotates clockwise when viewed from below, as the flaps are extended. Tag cables for reference and disconnect turnbuckles again.

1. Follow-Up Cable
2. Mounting Bracket
3. Knob
4. Flap Lever
5. Spacer
6. Flaps DOWN operating Switch
7. Position Indicator
8. Bushing
9. Washer
10. Switch Mounting Arm
11. Flaps UP Operating Switch
12. Return Spring
13. Cam
14. Clamp Bolt
15. Bellcrank
16. Flap Cable
17. Guide
18. Clamp Bolt Washers
19. Clamp
20. Insulator



Detail A



Detail B

NOTES

* , Position center cable of flap follow-up (1) between washers (18).

** Improved clamp installation on airplanes 15078506 thru 15079405, A1500685 thru A1500734, F15001339 thru F15001428, and FA 1500312 thru FA1500336 incorporating SK172-60A.

Figure 7-5. Flap Follow-Up and Indicating System

g. (Refer to figure 7-2.) Screw actuating tube (5) IN toward transmission (8) by hand to $.12 \pm .05$ inches between switch actuating collar (30) and transmission as illustrated in View A-A.

h. Loosen setscrew (6) securing actuating tube (5) to switch actuating collar (30) and hold collar to maintain $.12 \pm .05$ inch while holding RIGHT flap in the full UP position and adjust actuating tube (5) IN or OUT, as necessary to align with attachment hole in drive pulley (14).

i. Apply Loctite grade CV sealant (or equivalent) to threads of setscrew (6) and torque to 60 pound-inches.

NOTE

If actuating tube (5) is too long to allow attachment to drive pulley after completion of step "h", proceed to step "j".

j. Disconnect push-pull rod (15) at drive pulley (14) to allow connecting actuating tube (5) to drive pulley.

k. Manually hold RIGHT flap in full UP position and readjust push-pull rod (15) to align with attachment hole in drive pulley. Connect push-pull rod and tighten locknuts.

NOTE

The right flap and actuator must be correctly rigged, before cables and left flap can be rigged.

l. With flaps in full UP position, loosen setscrew (27) and slide up limit switch adjustment block (28) on support (31) to just activate switch and shut off electrical power to motor at this position. Tighten setscrew.

m. Manually hold LEFT flap, full UP and connect control cables at turnbuckles (index 4, figure 7-1). Remove reference tags previously installed in step "f".

n. With flaps full UP, adjust turnbuckles to obtain 30 ± 10 pounds tension on cables. Adjust retract cable (19) first.

NOTE

Ensure cables are positioned in pulley grooves and cable ends are positioned correctly at drive pulleys before tightening turnbuckles.

o. Disconnect push-pull rod at left drive pulley. Run motor to extend flaps approximately 20° and check tension on each flap cable. If necessary, readjust turnbuckles to maintain 30 ± 10 pounds tension on each cable and safety turnbuckles.

p. Fully retract right flap. Manually hold left flap in full UP position and readjust push-pull rod to align with attaching hole in drive pulley. Connect push pull rod and tighten locknuts.

NOTE

An inclinometer for measuring control surface travel is available from Cessna Parts Distribution (CPD 2). Refer to figure 6-4.

q. Mount an inclinometer on RIGHT flap and adjust to 0° .

r. Run flaps to full DOWN position and adjust DOWN limit switch (32) to stop motor and flap at the degree of travel specified in figure 1-1. Repeat check on LEFT flap. Recheck limit switch through several flap cycles.

NOTE

All flap rollers may not bottom in the flap tracks at the travel extremes.

s. Reconnect and rerig the flap follow-up system in accordance with paragraph 7-20. Perform an operational check in accordance with paragraph 7-3, recheck all items for proper safetying and replace items removed for access.

7-17. FLAP FOLLOW-UP AND INDICATING SYSTEM. (Refer to figure 7-5.)

7-18. DESCRIPTION. The flap follow-up and indicating system consists of a sheathed cable assembly one end of which is attached to the flap operating switch mounting arm and the other end is clamped to the flap direct cable above the headliner in the rear cabin area. Motion of the flap cable is transmitted through the follow-up control to the pointer attached to the switch mounting arm, moving the pointer along a scale as the flaps are extended or retracted.

7-19. REMOVAL AND INSTALLATION. Figure 7-5 can be used as a guide to removal and installation of the flap follow-up and indicating system.

7-20. RIGGING. (Refer to figure 7-5.)

a. Flap control system must be rigged in accordance with paragraph 7-16 before flap follow-up control can be rigged.

b. Disconnect spring (12) from switch mounting arm (10).

c. With flaps in full UP position, pull center cable of flap follow-up control (1) (detail b, figure 7-5) to remove slack.

d. Ensure flap lever (4) is in full UP position while indicator (7) has a $.03 - .06$ inch clearance with top of instrument panel cut-out. Secure follow-up cable to bellcrank (15) with clamp bolt (14) while observing note in figure 7-5.

e. Connect spring (12) to switch mounting arm (10).

f. Adjust switches (6) and (11) in slotted holes on mounting arm (10) until cam (13) is centered between switch rollers.

g. Mount an inclinometer on one flap and set to 0° (flaps full UP). Turn master switch ON and move flap lever (4) to 10° flap position.

NOTE

An inclinometer for measuring control surface travel is available from Cessna Parts Distribution (CPD 2). Refer to figure 6-4.

h. Observe inclinometer reading when flaps stop. Adjust flaps DOWN operating switch (6) in slotted

holes on mounting arm (10) as required to obtain flap travel of $10^{\circ} \pm 2$.

i. Adjust flaps UP operating switch (11) in slotted holes to obtain positive clearance with cam (13) when flaps DOWN operating switch has just opened in the 10° position.

j. Repeat steps h and i for 20° flap position.

k. Run flaps to full DOWN position ($40^{\circ} \pm 2^{\circ}$) and check that flaps DOWN operating switch (6) remains closed as flap motor limit switch (index 32, figure 7-5) stops flaps at 40° position.

l. Check flaps through several cycles, recheck all items removed for security and replace items removed for access.

SHOP NOTES:

SECTION 8

ELEVATOR CONTROL SYSTEM

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8-1. ELEVATOR CONTROL SYSTEM.

The rear bellcrank serves as an interconnect between the elevators and a bearing point for the travel stop bolts. An elevator trim tab is installed on the right elevator and is described in Section 9.

8-2. DESCRIPTION. The elevators are operated by power transmitted from the control wheels through a series of cables, bellcranks and a push-pull tube.

8-3. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraph 8-14.

TROUBLE	PROBABLE CAUSE	REMEDY
NO RESPONSE TO CONTROL WHEEL FORE-AND-AFT MOVEMENT.	Forward or aft end of push-pull tube disconnected.	Attach push-pull tube correctly.
	Cables disconnected.	Attach cables and rig system in accordance with paragraph 8-14.
BINDING OR JUMPY MOTION FELT IN MOVEMENT OF ELEVATOR SYSTEM.	Defective forward or rear bellcrank pivot bearing.	Replace bellcrank.
	Cables slack.	Adjust to tension specified in figure 8-1.
	Cables not riding correctly on pulleys.	Route cables correctly over pulleys.
	Nylon grommet on instrument panel binding.	Replace grommet.
	Defective control "y" pivot bearing.	Replace bearing.
	Defective elevator hinges or lubrication needed.	Replace defective hinges. Lubricate per Section 2.
	Clevis bolts too tight.	Readjust to eliminate bolt binding.
	Lubrication needed.	Lubricate piano hinges.
Defective pulleys or cable guards.	Replace defective parts and install guards properly.	

8-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
ELEVATORS FAIL TO ATTAIN PRESCRIBED TRAVEL.	Stops incorrectly set.	Rig system in accordance with paragraph 8-14.
	Cables tightened unevenly.	Rig system in accordance with paragraph 8-14.
	Interference at firewall or instrument panel.	Rig system in accordance with paragraph 8-14.

8-4. ELEVATORS. (Refer to figure 8-2.)

8-5. REMOVAL AND INSTALLATION.

NOTE

This procedure is written primarily for the right elevator since the trim tab is attached to this elevator.

- a. Disconnect trim tab push-pull tube (2) at tab actuator.
- b. Remove bolts (8) securing elevators to bellcrank (7).

NOTE

If trim system is not moved and actuator screw is not turned, rigging of trim system should not be necessary after installation of elevator.

- c. Remove bolts (10) from elevator hinges.
- d. Using care, remove elevator.
- e. To remove left elevator use same procedure, omitting step "a".
- f. Reverse preceding steps for installation. Rig system in accordance with applicable paragraph in this section if necessary.

8-6. REPAIR. Repair may be accomplished as outlined in Section 18. Hinge bushings may be replaced as necessary. If repair has affected static balance, check and rebalance as required.

8-7. BELLCRANKS.

8-8. FORWARD. (Refer to figure 8-1.)

8-9. REMOVAL AND INSTALLATION.

- a. Remove seats, upholstery and access plates as necessary.
- b. Relieve cable tension at turnbuckles (10) and disconnect cables from bellcrank (14).
- c. Disconnect push-pull tube (15) from bellcrank.
- d. Remove pivot bolt (13) and remove bellcrank.
- e. Reverse preceding steps for installation. Rig system in accordance with applicable paragraph in

this section, safety turnbuckles and reinstall all items removed in step "a".

8-10. REAR. (Refer to figure 8-2.)

8-11. REMOVAL AND INSTALLATION.

- a. Remove rudder. (Refer to Section 10.)
- b. Remove seats, upholstery and access plates as necessary for access to turnbuckles (index 10, figure 8-1).
- c. Relieve cable tension at turnbuckles and disconnect cables from rear bellcrank (7).
- d. Remove bolts (8) securing elevators to bellcrank.
- e. Remove bellcrank pivot bolt and slide bellcrank from between tube assemblies (6).

NOTE

It may be necessary to remove one of the attaching bolts (10) for clearance when removing the bellcrank pivot bolt.

- f. Reverse preceding steps for installation. Rig system in accordance with applicable paragraph in this section, safety turnbuckles and reinstall all items removed in step "b".

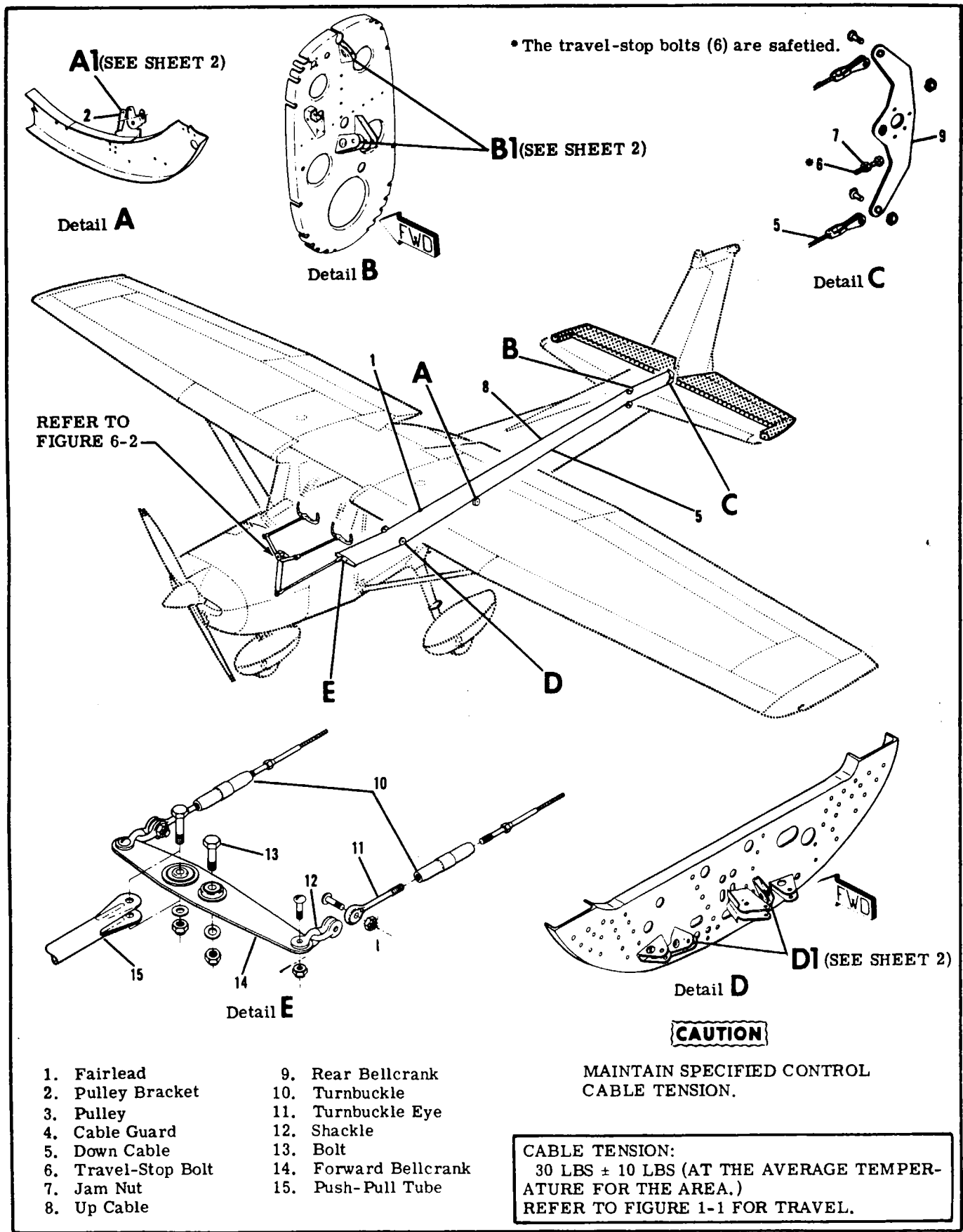
8-12. CABLES AND PULLEYS. (Refer to figure 8-1.)

8-13. REMOVAL AND INSTALLATION.

- a. Remove seats, upholstery and access plates as necessary.
- b. Relieve cable tension at turnbuckles (10).
- c. Disconnect cables at forward bellcrank links (12).
- d. Disconnect cables at rear bellcrank (9).
- e. Remove fairleads, cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

To ease routing of cables, a length of wire may be attached to end of cable before being withdrawn from aircraft. Leave wire in place, routed through structure, attach cable being installed and pull cable into position.



A1(SEE SHEET 2)

Detail **A**

• The travel-stop bolts (6) are safetied.

B1(SEE SHEET 2)

Detail **B**

Detail **C**

REFER TO FIGURE 6-2

Detail **E**

D1(SEE SHEET 2)

Detail **D**

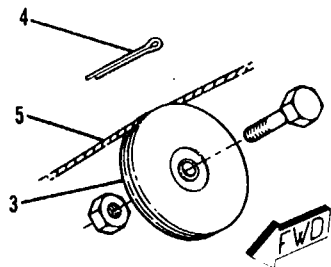
CAUTION

MAINTAIN SPECIFIED CONTROL CABLE TENSION.

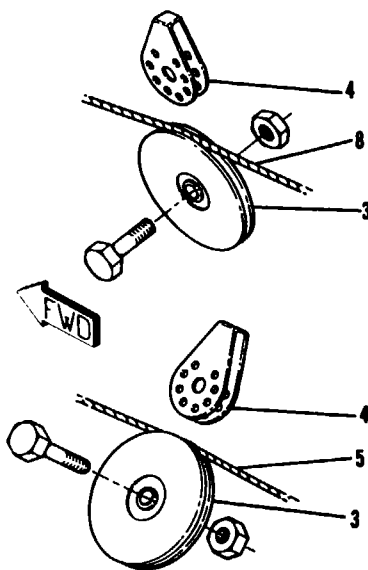
CABLE TENSION:
 30 LBS ± 10 LBS (AT THE AVERAGE TEMPERATURE FOR THE AREA.)
 REFER TO FIGURE 1-1 FOR TRAVEL.

- | | |
|---------------------|-----------------------|
| 1. Fairlead | 9. Rear Bellcrank |
| 2. Pulley Bracket | 10. Turnbuckle |
| 3. Pulley | 11. Turnbuckle Eye |
| 4. Cable Guard | 12. Shackle |
| 5. Down Cable | 13. Bolt |
| 6. Travel-Stop Bolt | 14. Forward Bellcrank |
| 7. Jam Nut | 15. Push-Pull Tube |
| 8. Up Cable | |

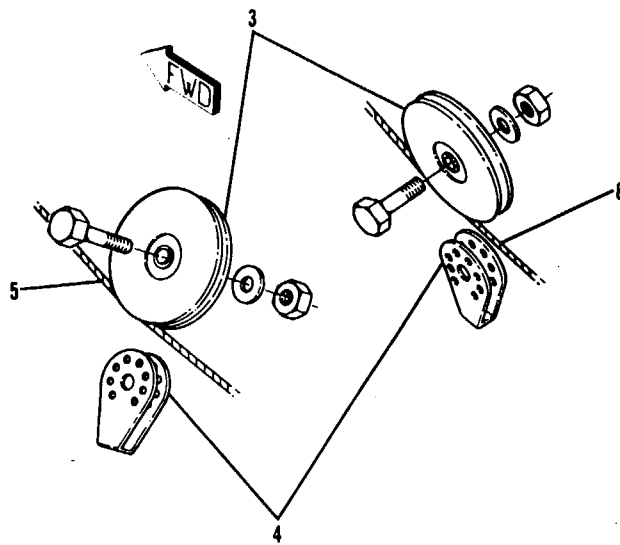
Figure 8-1. Elevator Control System (Sheet 1 of 2)



Detail **A1**

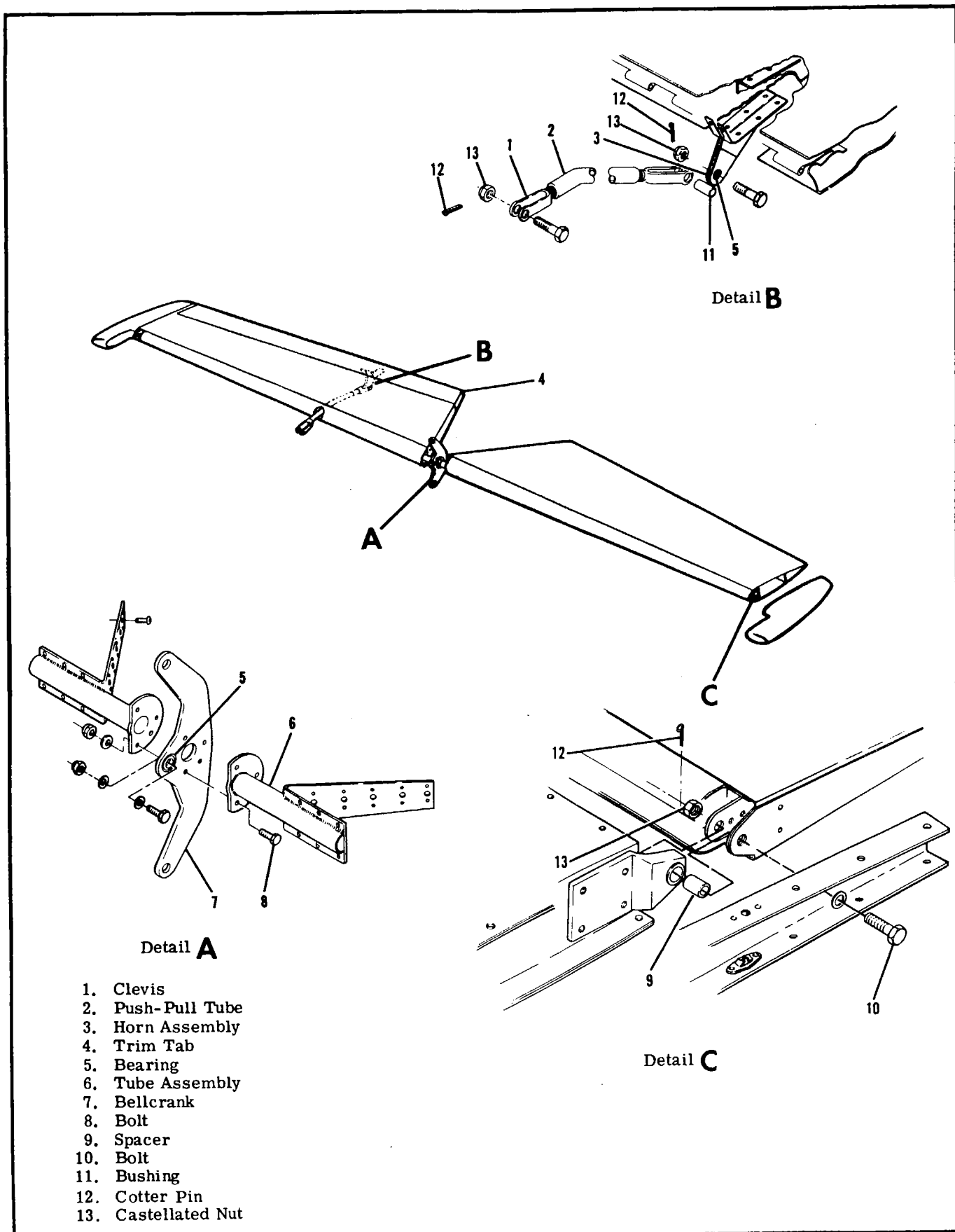


Detail **B1**



Detail **D1**

Figure 8-1. Elevator Control System (Sheet 2 of 2)



- 1. Clevis
- 2. Push-Pull Tube
- 3. Horn Assembly
- 4. Trim Tab
- 5. Bearing
- 6. Tube Assembly
- 7. Bellcrank
- 8. Bolt
- 9. Spacer
- 10. Bolt
- 11. Bushing
- 12. Cotter Pin
- 13. Castellated Nut

Figure 8-2. Elevator Installation

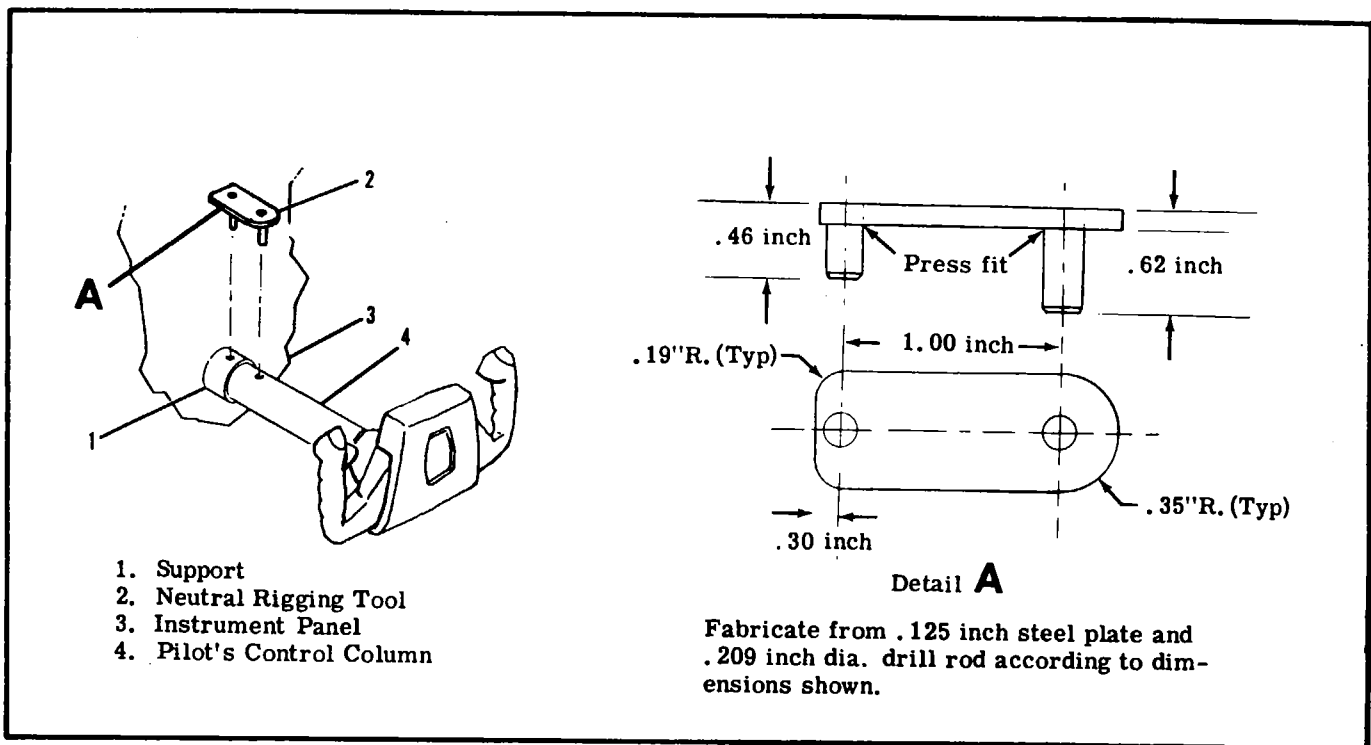


Figure 8-3. Control Column Neutral Position Rigging Tool

f. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley groove before installing guards.

g. Rig system in accordance with applicable paragraph in this section, safety turnbuckles and re-install all items removed in step "a".

8-14. RIGGING. (Refer to figure 8-1.)

a. Remove seats, upholstery and access plates as required to gain access to turnbuckles (10).

b. Lock control column in neutral position by installing neutral position rigging tool (index 2, figure 8-3).

c. Streamline elevators to neutral with horizontal stabilizer.

d. Holding elevators in neutral (streamlined) position, adjust cable tension to 30 ± 10 pounds by tightening turnbuckles.

e. With elevators still in neutral position, mount an inclinometer on one elevator and set to 0° .

NOTE

An inclinometer for measuring control surface travel is available from Cessna Service Parts Center.

f. Remove control column neutral position rigging tool and adjust travel stop bolts (6) so elevators attain degree of travel specified in figure 1-1. Ensure control "Y" does not contact firewall in full DOWN position or instrument panel in full UP position.

g. Check all components for security, safety turnbuckles and reinstall all items removed for access.

WARNING

Make sure elevators move in correct direction when operated by control column.

SHOP NOTES:

SECTION 9
ELEVATOR TRIM CONTROL SYSTEM

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Trim Tab Actuator	9-2	Removal and Installation	9-7
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9-1. ELEVATOR TRIM CONTROL SYSTEM. (Refer to figure 9-1.)

er to operate the tab is transmitted from the trim control wheel by means of chains, cables and an actuator. A mechanical pointer, adjacent to the trim wheel indicates tab position. A "nose-up" setting results in a tab-down position.

9-2. DESCRIPTION. The elevator trim tab, located on the right elevator, is controlled by a trim wheel mounted in the lower instrument panel. Pow-

9-3. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system. Refer to paragraph 9-16.

TROUBLE	PROBABLE CAUSE	REMEDY
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE.	Cable tension too high.	Adjust tension.
	Pulleys binding or rubbing.	Repair or replace as necessary.
	Cables not in place on pulleys.	Install cables correctly.
	Trim tab hinge binding.	Lubricate or replace hinge as necessary.
	Defective trim tab actuator.	Replace actuator.
	Rusty chain.	Replace rusty chain.
	Damaged sprocket.	Replace damaged sprockets.
	Bent sprocket shaft.	Replace bent sprocket shafts.

8-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
LOST MOTION BETWEEN CONTROL WHEEL AND TRIM TAB.	Cable tension too low.	Adjust tension.
	Broken pulley.	Replace defective pulley.
	Cables not in place on pulleys.	Install cables correctly.
	Worn trim tab actuator.	Remove and replace worn actuator.
	Actuator attachment loose.	Tighten.
TRIM INDICATOR FAILS TO INDICATE CORRECT TRIM POSITION.	Indicator incorrectly engaged on wheel track.	Reset indicator.
INCORRECT TRIM TAB TRAVEL.	Stop blocks loose or incorrectly adjusted.	Adjust stop blocks on cables.

9-4. TRIM TAB. (Refer to figure 8-2.)

9-5. REMOVAL AND INSTALLATION.

- a. Disconnect push-pull tube (2) from horn assembly (3).
- b. Drill out rivets attaching hinge to elevator.

NOTE

After tab has been removed and if hinge pin is to be removed, it is necessary to spread the crimped ends of the hinge before driving out pin. When a pin has been installed, crimp ends of hinge to prevent pin from working out.

- c. Reverse preceding steps for installation.

9-6. TRIM TAB ACTUATOR.

9-7. REMOVAL AND INSTALLATION. (Refer to figure 9-1.)

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

- a. Remove baggage compartment aft wall for access.
- b. Remove safety wire and relieve cable tension at turnbuckle (15).

- c. Disconnect push-pull tube (12) from actuator (9).

d. Remove access plate from underside of right hand stabilizer beneath actuator.

e. Remove chain guard (8) and disengage chain (8A) from actuator sprocket.

f. Remove screws (8B) and spacers (10) attaching actuator clamps to stabilizer structure (11) and carefully work actuator out through access opening.

g. Reverse the preceding steps for reinstallation. Rig trim system in accordance with paragraph 9-12, safety turnbuckle (15) and reinstall all items removed for access.

9-8. DISASSEMBLY. (Refer to figure 9-2.)

- a. Remove actuator in accordance with paragraph 9-7.

b. Disassemble actuator assembly (1) as illustrated in Detail A as follows:

1. Remove chain guard (3) if not previously removed in step "e" of paragraph 9-7.

2. Using suitable punch and hammer, remove groov-pins (8) securing sprocket (5) to screw (9) and remove sprocket from screw.

3. Unscrew threaded rod end (15) and remove rod end from actuator.

4. Remove groov-pins (10) securing bearings (6 and 14) at the housing ends.

5. Lightly tap screw (9) toward the sprocket end of housing, remove bearing (6) and collar (7).

6. Lightly tap screw (9) in the opposite direction from sprocket end, remove bearing (14), O-ring (13) and collar (7).

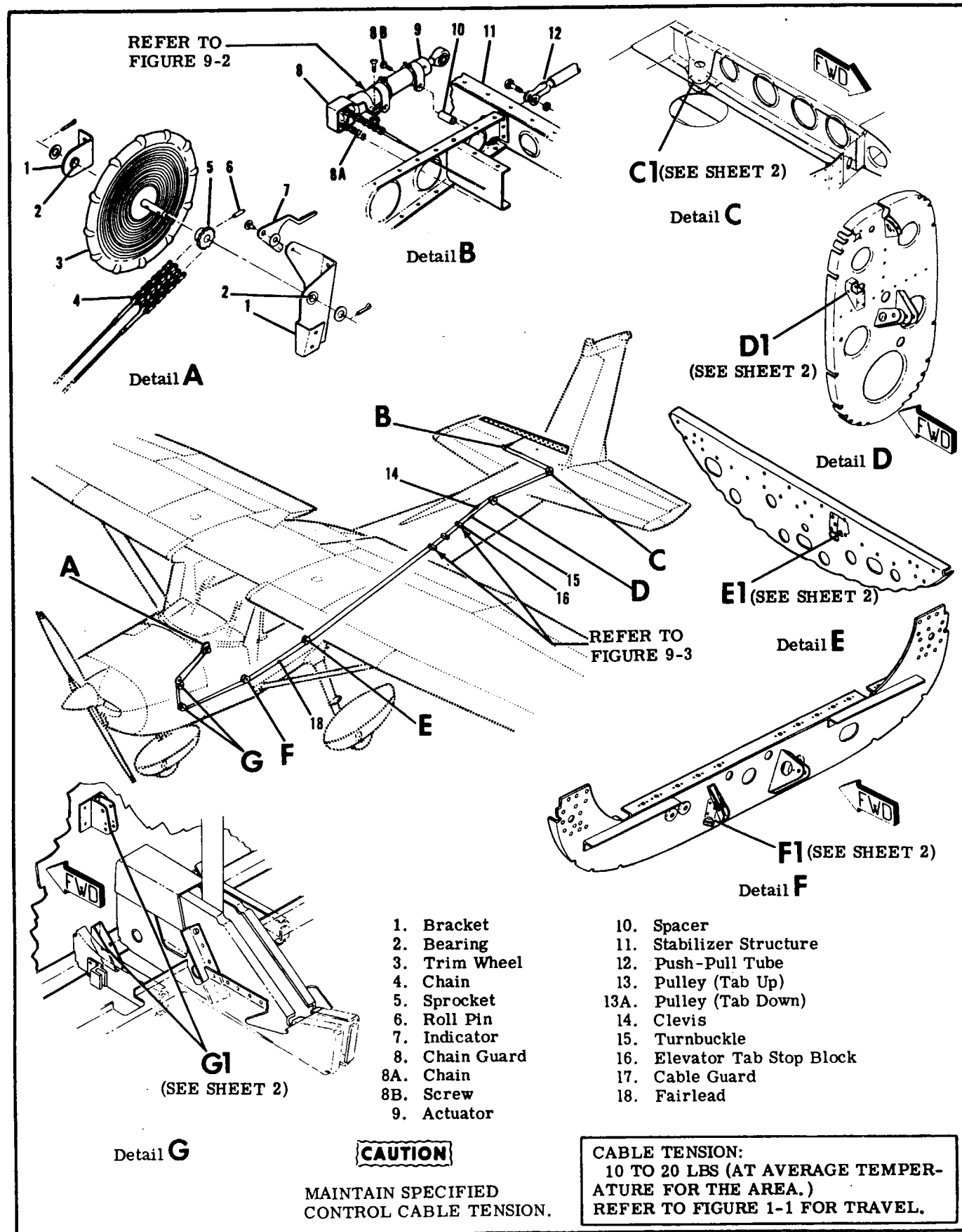


Figure 9-1. Elevator Trim Control System (Sheet 1 of 2)

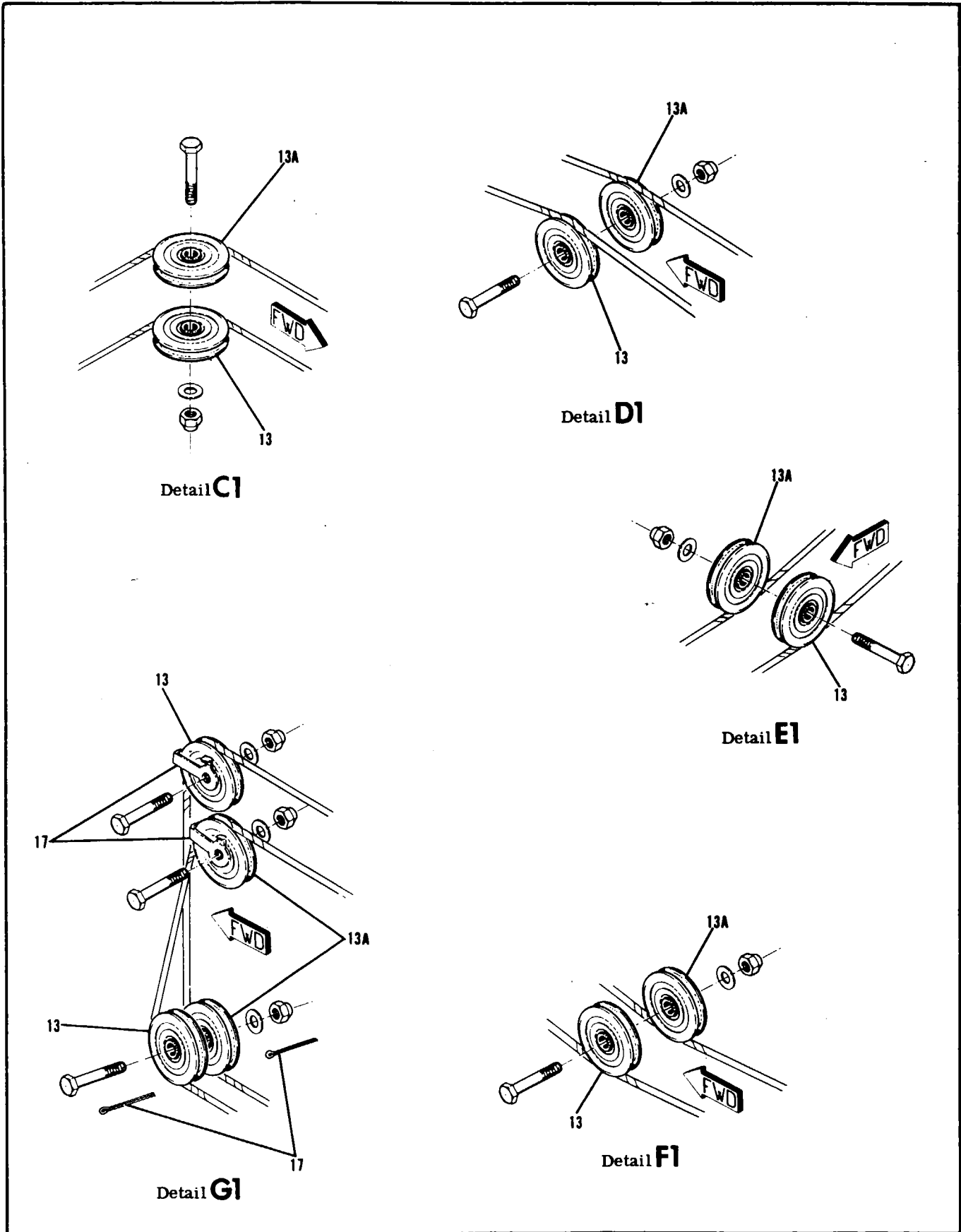


Figure 9-1. Elevator Trim Control System (Sheet 2 of 2)

7. It is not necessary to remove retaining rings (11).

9-9. CLEANING, INSPECTION AND REPAIR. (Refer to figure 9-2.)

- a. DO NOT remove bearing (16) from threaded rod end (15) unless replacement of bearing is necessary.
- b. Clean all component parts, except bearing (16), by washing in Stoddard solvent or equivalent. Do not clean sealed bearing (16).
- c. Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.
- d. Check bearings (6 and 14), screw (9) and threaded rod end (15) for excessive wear and scoring. Dimensions of the parts are as follows:

BEARING (6)	
INSIDE DIAMETER	0.373" MIN.
INSIDE DIAMETER	0.380" MAX.
BEARING (14)	
INSIDE DIAMETER	
SMALL HOLE	0.248" MIN.
SMALL HOLE	0.253" MAX.
LARGE HOLE	0.373" MIN.
LARGE HOLE	0.380" MAX.
THREADED ROD END	
OUTSIDE DIAMETER	
(SHANK)	0.242" MIN.
	0.246" MAX.
SCREW (9)	
OUTSIDE DIAMETER	0.367" MIN.
	0.370" MAX.

NOTE

Relative linear movement between internal threaded screw (9) and bearing (14) should be 0.004 to 0.010 inch at room temperature.

- e. Examine threaded rod end (15) and screw (9) for damaged threads or dirt particles that may impair smooth operation.
- f. Check sprocket (5) for broken, chipped and/or worn teeth.
- g. Check bearing (16) for smoothness of operation.
- h. DO NOT attempt to repair damaged or worn parts of the actuator assembly. Discard all defective items and install new parts during reassembly.

9-10. REASSEMBLY. (Refer to figure 9-2.)

- a. Always discard the following items and install new parts during reassembly:
 1. Groov-Pins (8 and 10).
 2. O-Ring (13).
 3. Nuts (2).
- b. During reassembly, lubricate collars (7), screw (9), and threaded rod end (15) in accordance with Section 2.
- c. Press sprocket (5) into the end of screw (9), align groov-pin holes and install new groov-pins (8).
- d. Slip bearing (6) and collar (7) on screw (9) and slide them down against sprocket (5).
- e. Insert screw (9), with assembled parts, into housing (12) until bearing (6) is flush with the end of housing.

NOTE

When inserting screw (9) into housing (12), locate the sprocket (5) at the end of housing which is farther away from the groove for retaining ring (11).

•The bearings (6 and 14) are not pre-drilled and must be drilled on assembly. The groov-pins (10) are 1/16 inch in diameter, therefore, requiring a 1/16 (0.0625) inch drill.

- f. With bearing (6) flush with end of housing (12), carefully drill bearing so the drill will emerge from the hole on the opposite side of housing (12). DO NOT ENLARGE HOLES IN HOUSING.
- g. Press new groov-pins (10) into pin holes.
- h. Insert collar (7), new O-ring (13) and bearing (14) into opposite end of housing (12).
- i. Complete steps "f" and "g" for bearing (14).
- j. If a new bearing (16) is required, a new bearing may be pressed into the boss. Be sure force bears against the outer race of bearing.
- k. Screw the threaded rod end (15) into screw (9).
- l. Install retaining rings (11), if they were removed.
- m. Test actuator assembly by rotating sprocket (5) with fingers while holding threaded rod end (15). The threaded rod end should travel in and out smoothly with no indication of binding.
- n. Reinstall actuator assembly in accordance with paragraph 9-7.

9-10A. OPERATIONAL CHECKOUT. (Refer to figure 9-2.)

- a. Test actuator assembly by rotating sprocket (5) with fingers while holding threaded rod end (15). The threaded rod end should travel in and out smoothly with no indication of binding.
- b. Reinstall and rig actuator assembly. Refer to paragraphs 9-7 and 9-12.
- c. Recheck trim tab free-play.

9-11. TRIM TAB FREE-PLAY INSPECTION. (Refer to figure 9-3).

- a. Place elevator and trim tab in the neutral position.
- b. Using moderate pressure, move the trim tab trailing edge up and down by hand to check free-play.
- c. A maximum of .112" (total motion up and down) measured at the trim tab trailing edge is permissible.
- d. If the trim tab free-play is less than .112", the system is within prescribed limits.
- e. If the trim tab free-play is more than .112", check the following items for looseness while moving the trim tab up and down.
 1. Check push-pull tube to trim tab horn assembly attachment for looseness while moving trim tab up and down.
 2. Check push-pull tube to actuator assembly threaded rod end attachment for looseness.
 3. Check actuator assembly threaded rod end for looseness in the actuator assembly with push-pull tube disconnected.
- f. If looseness is apparent while checking step e-3, replace actuator assembly. Refer to paragraphs 9-6 through 9-10.

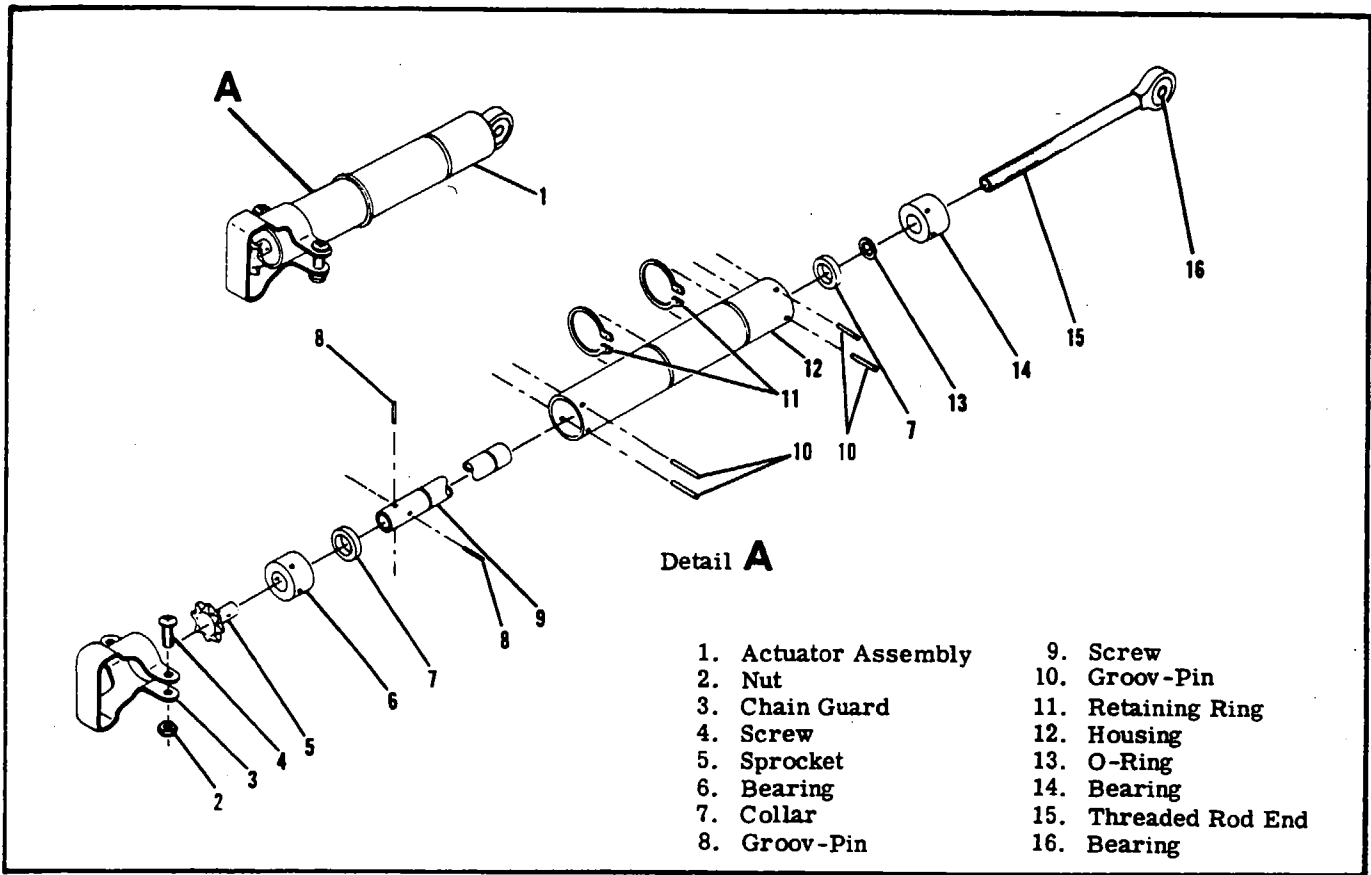


Figure 9-2. Elevator Trim Tab Actuator Assembly

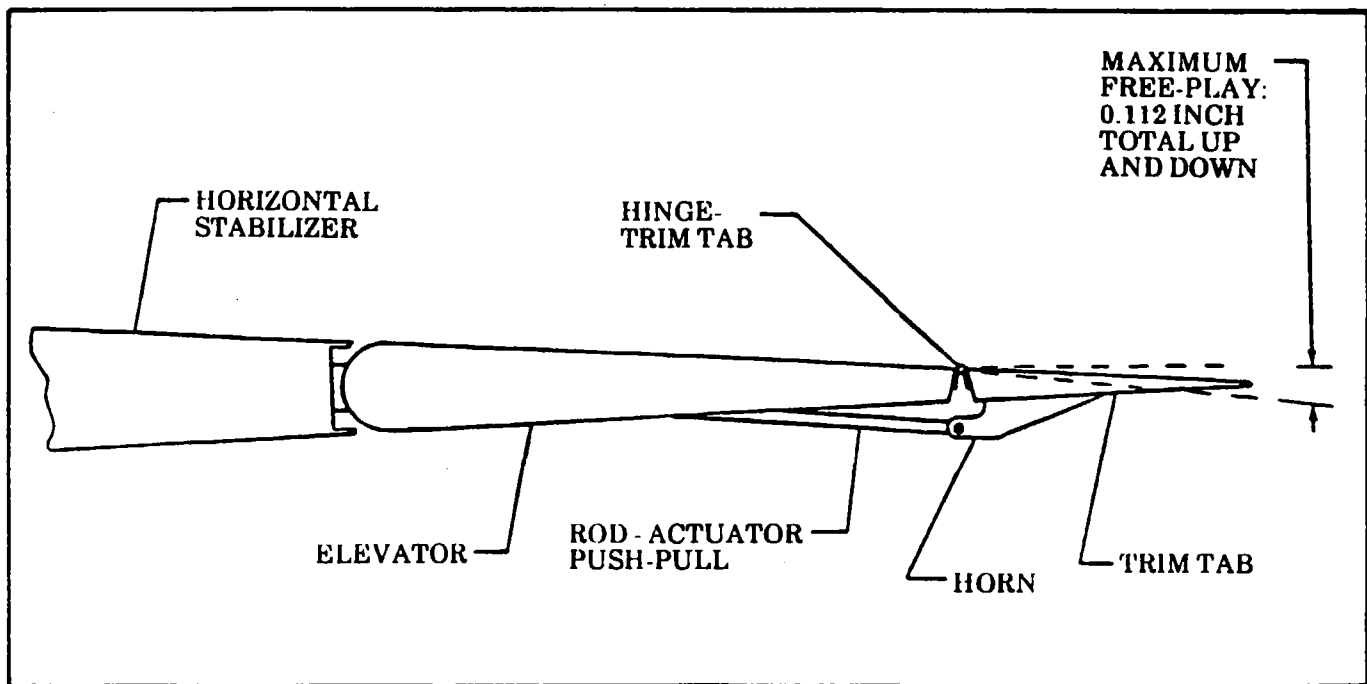


Figure 9-3. Elevator Trim Tab Free-Play Inspection

9-12. TRIM TAB CONTROL WHEEL. (Refer to figure 9-1.)

9-13. REMOVAL AND INSTALLATION.

- a. Relieve cable tension at turnbuckle (15).

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

- b. Disengage chain from sprocket (5).
- c. Remove cotter pin at each end of trim wheel shaft.
- d. Slide shaft assembly into either bearing (2) as far as possible.
- e. Carefully deform brackets (1) and slide shaft assembly free of bearings (2).
- f. Reverse preceding steps for installation. Rig system in accordance with applicable paragraph in this section, safety turnbuckle and reinstall all items removed for access.

9-14. CABLES AND PULLEYS. (Refer to figure 9-1.)

9-15. REMOVAL AND INSTALLATION.

- a. Remove seats, upholstery and access plates as necessary.
- b. Disconnect cables at turnbuckle (15) and clevis (14).
- c. Remove fairlead, cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

To ease routing of cables, a length of wire may be attached to end of cable before being withdrawn from aircraft. Leave wire in place, routed through structure, attach cable being installed and pull cable into position.

- d. After cable is routed in position, install pulleys and cable guards. Make sure cable is positioned in pulley groove before installing guards.
- e. Rig system in accordance with applicable paragraph in this section, safety turnbuckle and reinstall all items removed in step "a."

9-16. RIGGING. (Refer to figure 9-1.)

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

- a. Remove rear baggage compartment panel and access plates as necessary.
- b. Loosen travel stop blocks (16) on cables.
- c. Disconnect actuator (9) from push-pull tube (12).
- d. Check cable tension and readjust turnbuckle (15) if necessary.

NOTE

If chains and/or cables are being installed, permit actuator screw to rotate freely as chains and cables are connected. Set cable tension.

- e. Rotate trim wheel (3) full forward (nose down). Ensure that indicator (7) does not restrict wheel movement. If necessary, reposition indicator using a thin screwdriver to pry trailing leg of indicator out of groove.

NOTE

Full forward (nose down) position of trim wheel is where further movement is prevented by chain or cable ends contacting sprockets or pulleys.

- f. With elevator and trim tab both in neutral (streamlined), place inclinometer on tab and set to zero.

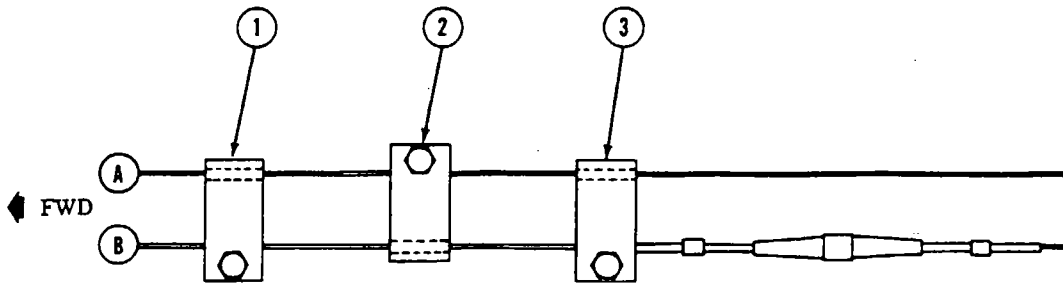
NOTE

An inclinometer for measuring control surface travel is available from Cessna Parts Distribution (CPD 2). Refer to figure 6-4.

- g. Rotate actuator screw in or out as required to place tab up with a maximum of 2° overtravel, with actuator screw connected to push-pull tube (12).
- h. Rotate trim wheel to position tab up and down, readjusting actuator screw as required to obtain overtravel in both directions.
- i. Position stop blocks (16) and adjust as illustrated in figure 9-4 to limit travel to the degree specified in figure 1-1.
- j. Check that trim wheel indicator travels same distance from ends of slot in cover. Reposition trailing leg of indicator if necessary (refer to step "e").
- k. Safety turnbuckle and reinstall all items removed in step "a".

WARNING

Be sure trim tab moves in correct direction when operated by trim wheel. Nose down trim corresponds to tab up position.



1. With elevators in neutral, set trim tab to neutral (streamlined).
2. Position stop block (3) against turnbuckle and secure to cable B.
3. Place inclinometer on trim tab and run tab to DOWN TRAVEL limit listed in Section 1.
4. Position stop block (2) against stop block (3) and secure to cable A.
5. Run trim tab to UP TRAVEL limit listed in Section 1, place stop block (1) against stop block (2) and secure to cable B.

Figure 9-4. Elevator Trim Tab Travel Adjustment

SECTION 10

RUDDER CONTROL SYSTEM

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Rudder	10-5		

10-1. RUDDER CONTROL SYSTEM. (Refer to figure 10-1.)

control nose wheel steering. The system is comprised of rudder pedals, cables and pulleys, all of which link the pedals to the rudder and nose wheel steering.

10-2. DESCRIPTION. Rudder control is maintained through use of conventional rudder pedals which also

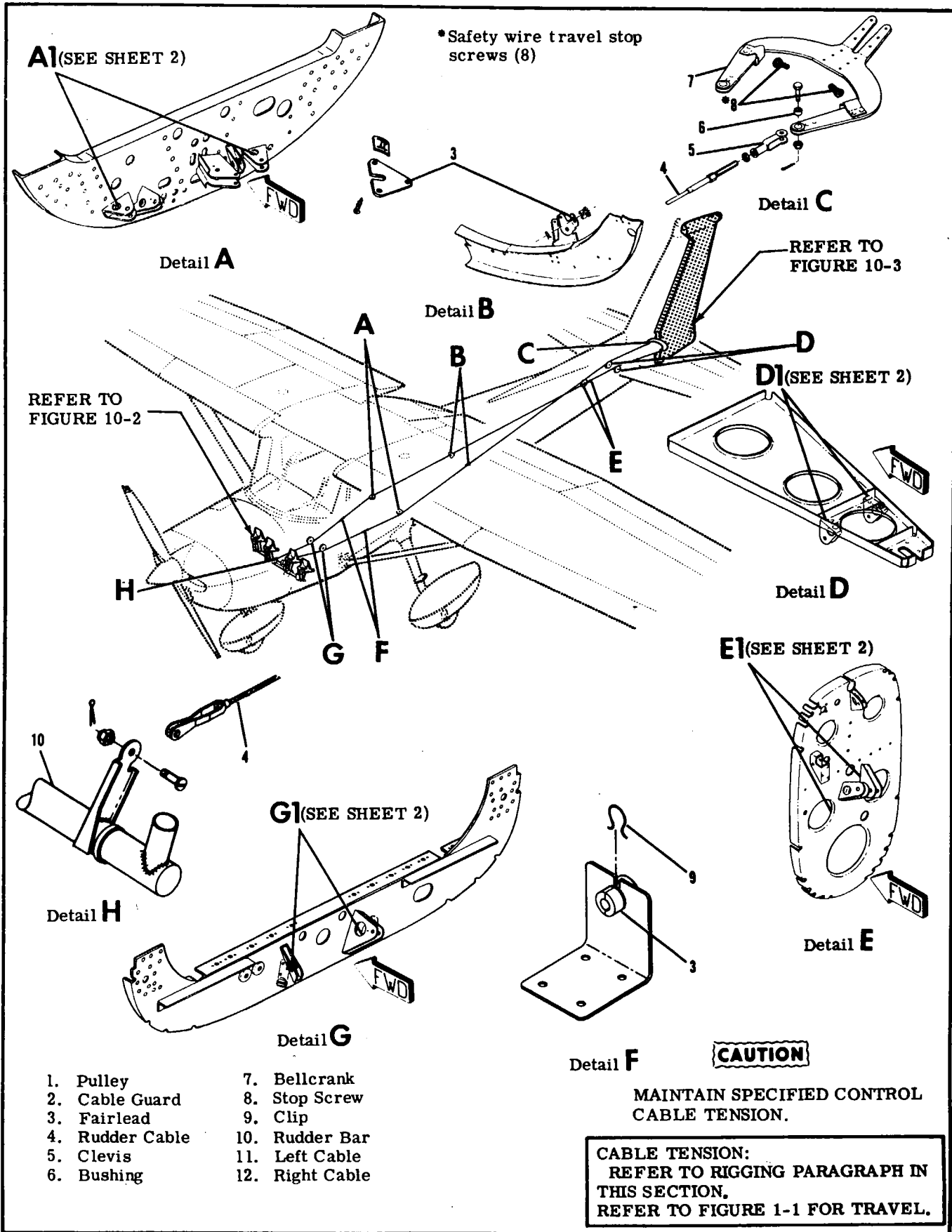
10-3. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraph 10-11.

TROUBLE	PROBABLE CAUSE	REMEDY
RUDDER DOES NOT RESPOND TO PEDAL MOVEMENT.	Broken or disconnected cables.	Connect or replace cables.
BINDING OR JUMPY MOVEMENT OF RUDDER PEDALS.	Cables too tight.	Adjust cable tension in accordance with paragraph 10-11.
	Cables not riding properly on pulleys.	Route cables correctly over pulleys.
	Binding, broken or defective pulleys or cable guards.	Replace defective pulleys and install guards properly.
	Pedal bars need lubrication.	Refer to Section 2.
	Defective rudder bar bearings.	Replace bearing blocks.
	Defective rudder hinge bushings or bellcrank bushings.	Replace defective bushings.
	Clevis bolts too tight.	Readjust to eliminate binding.
	Steering rods not adjusted properly.	Rig system in accordance with paragraph 10-11.
LOST MOTION BETWEEN RUDDER PEDALS AND RUDDER.	Insufficient cable tension.	Adjust cable tension in accordance with paragraph 10-11.
INCORRECT RUDDER TRAVEL.	Incorrect rigging.	Rig system in accordance with paragraph 10-11.

* Safety wire travel stop screws (8)



REFER TO FIGURE 10-2

REFER TO FIGURE 10-3

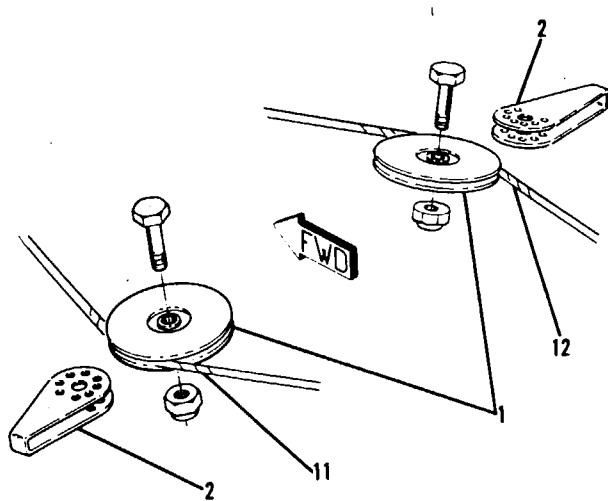
CAUTION

MAINTAIN SPECIFIED CONTROL CABLE TENSION.

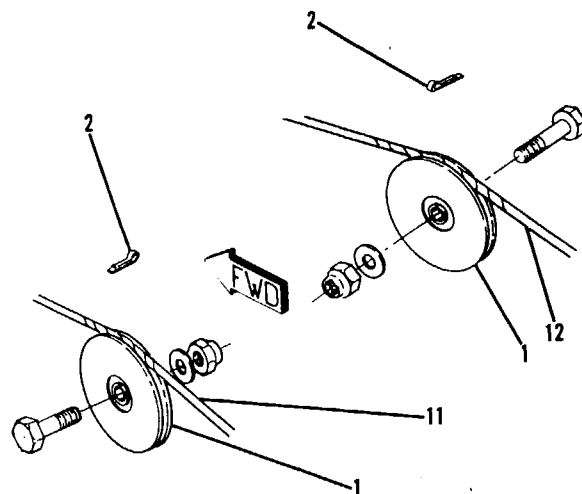
CABLE TENSION:
 REFER TO RIGGING PARAGRAPH IN THIS SECTION.
 REFER TO FIGURE 1-1 FOR TRAVEL.

- | | |
|-----------------|-----------------|
| 1. Pulley | 7. Bellcrank |
| 2. Cable Guard | 8. Stop Screw |
| 3. Fairlead | 9. Clip |
| 4. Rudder Cable | 10. Rudder Bar |
| 5. Clevis | 11. Left Cable |
| 6. Bushing | 12. Right Cable |

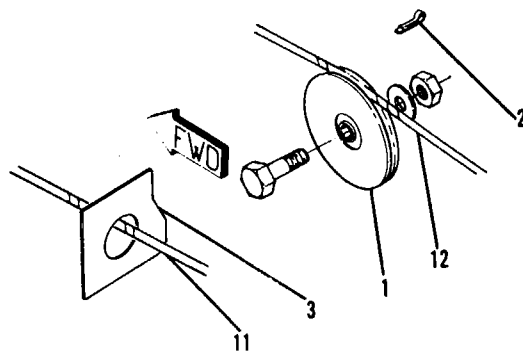
Figure 10-1. Rudder Control System (Sheet 1 of 2)



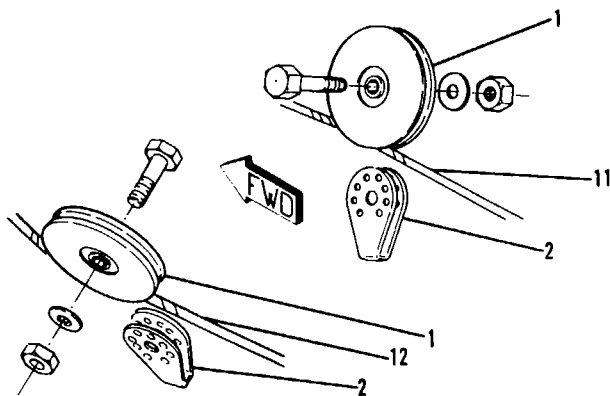
Detail **A1**



Detail **D1**

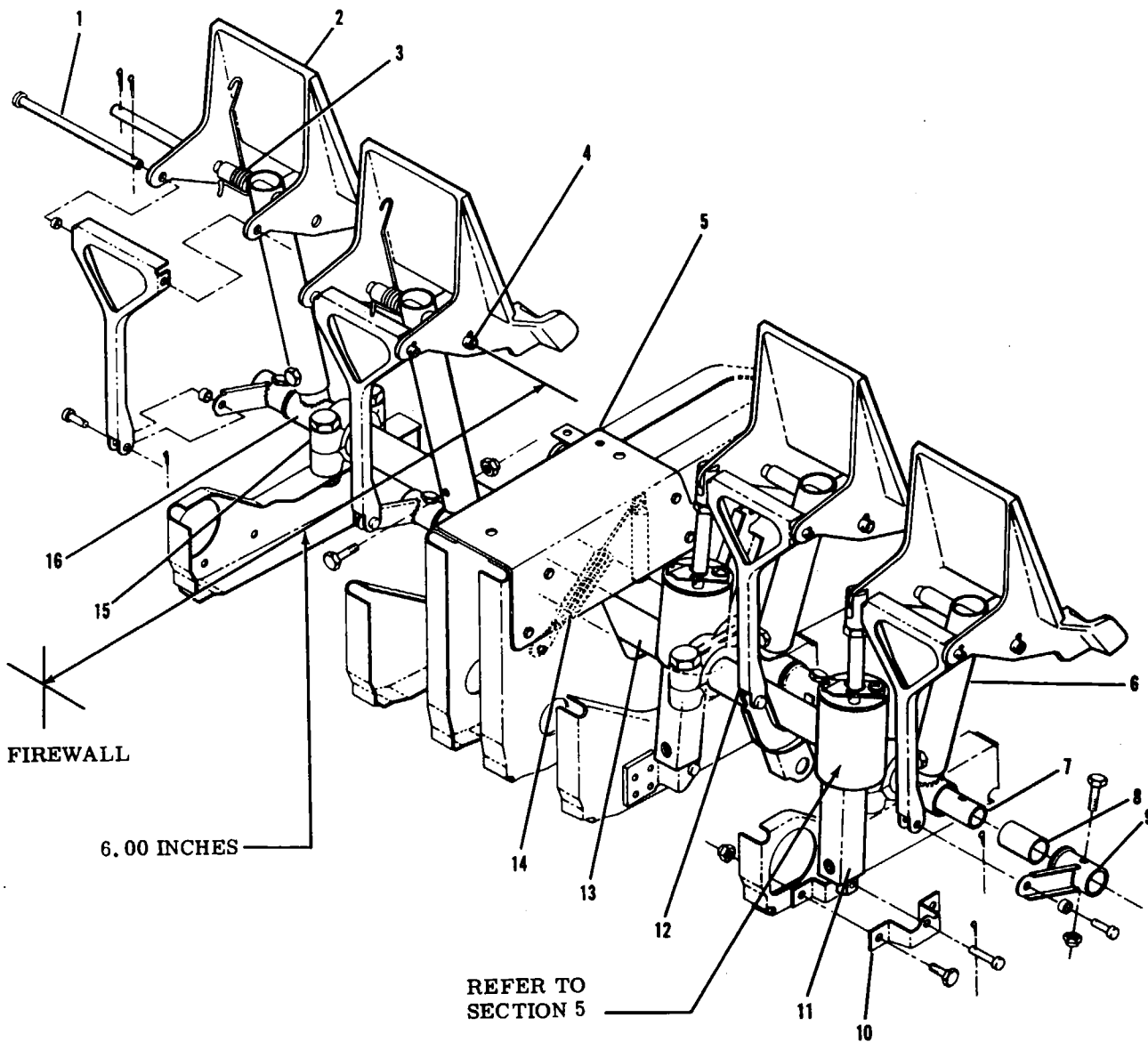


Detail **E1**



Detail **G1**

Figure 10-1. Rudder Control System (Sheet 2 of 2)



- 1. Brake Link Pin
- 2. Pedal
- 3. Anti-Rattle Spring
- 4. Pivot Shaft
- 5. Fuselage Structure

- 6. Pedal Arm
- 7. Brake Torque Tube
- 8. Bearing
- 9. Bellcrank
- 10. Bracket
- 11. Master Cylinder

- 12. Brake Link
- 13. Left Rudder Bar
- 14. Return Spring
- 15. Bearing Block
- 16. Right Rudder Bar

Figure 10-2. Rudder Pedals Installation

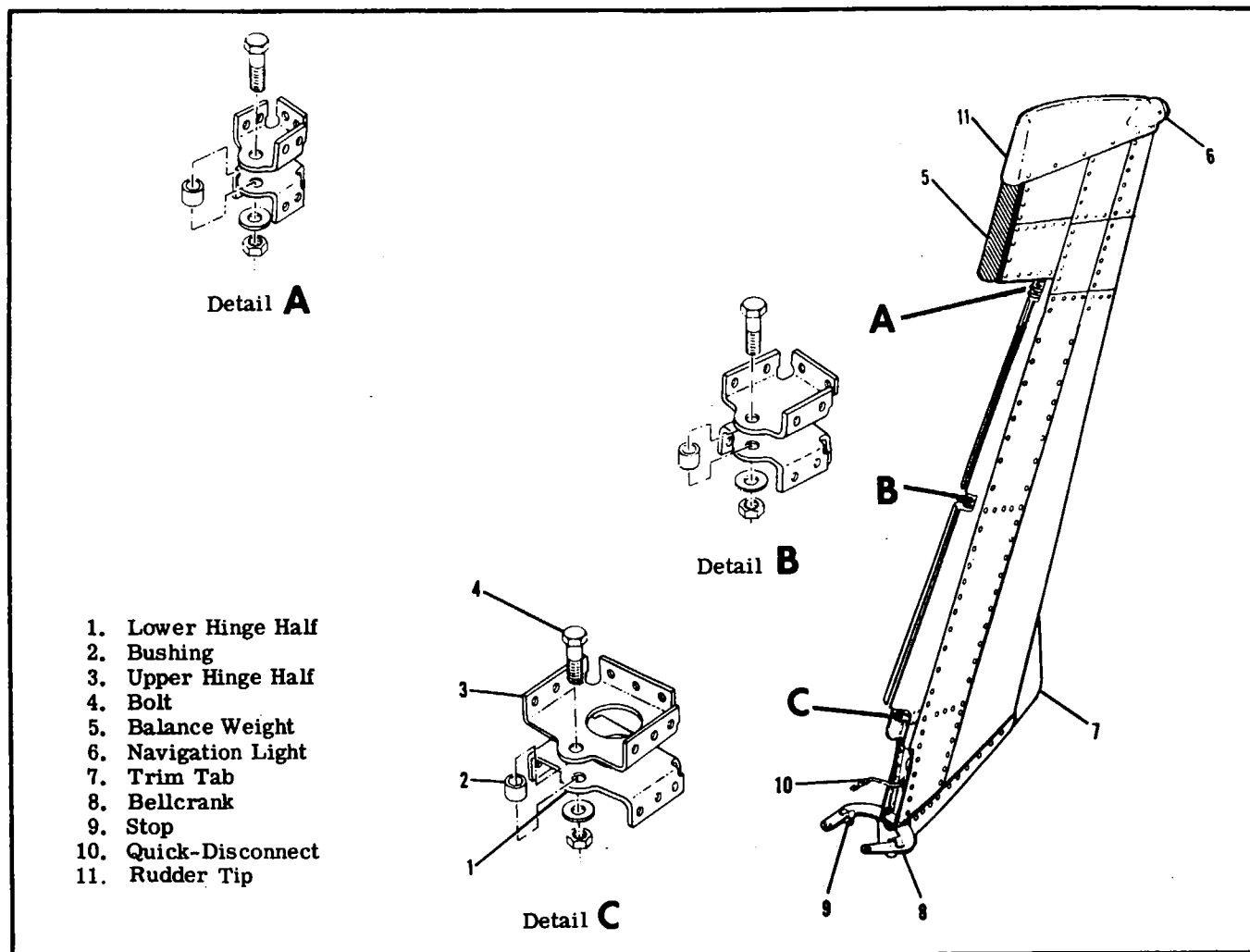


Figure 10-3. Rudder Installation

10-4. RUDDER PEDAL ASSEMBLY. (Refer to figure 10-2.)

10-5. REMOVAL AND INSTALLATION.

- a. Remove carpeting, shields and soundproofing from pedal and tunnel areas as necessary.
- b. Disconnect master cylinders (11) at pilot rudder pedals.
- c. Disconnect parking brake cables at master cylinders.
- d. Remove rudder pedals (2) and brake links (12).
- e. Relieve cable tension at clevises (index 5, figure 10-1).
- f. Disconnect cables, return springs and steering tubes from rudder bars.
- g. Remove bolts securing bearing blocks (15) and work rudder bars out of tunnel area.

NOTE

Rudder bar assemblies should be checked for excessive wear before installation. The bearing blocks are nylon and require no lubrication unless binding occurs. A few

drops of general purpose oil should eliminate such binding.

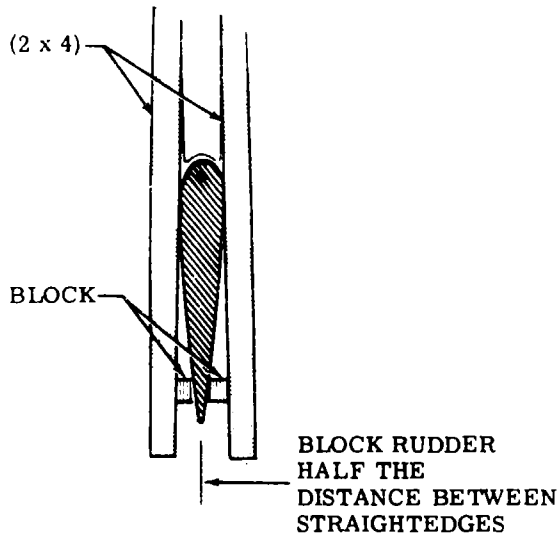
- h. Reverse preceding steps for installation. Rig system in accordance with applicable paragraph in this section, safety clevises and reinstall all items removed in step "a".

10-6. RUDDER. (Refer to figure 10-3.)

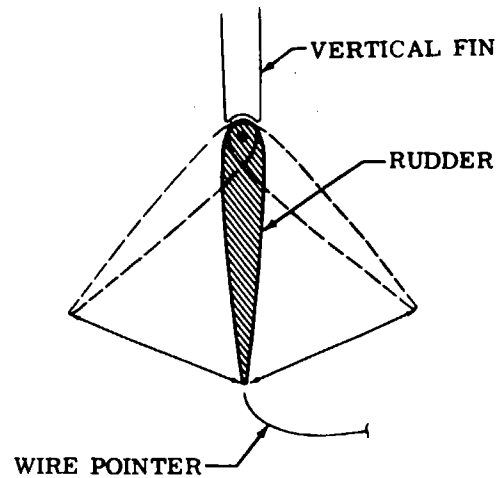
10-7. REMOVAL AND INSTALLATION.

- a. Disconnect tail navigation light quick-disconnect (10).
- b. Relieve cable tension at clevises (index 5, figure 10-1) and disconnect clevises from rudder bellcrank (8).
- c. With rudder supported, remove hinge bolts (4) and lift rudder free of vertical fin.
- d. Reverse preceding steps for installation. Rig system in accordance with applicable paragraph in this section and safety clevises.

10-8. REPAIR. Repair may be accomplished as outlined in Section 18. Hinge bushings may be replaced as necessary.



ESTABLISHING NEUTRAL POSITION OF RUDDER



MEASURING RUDDER TRAVEL

1. Establish neutral position of rudder by clamping straightedge (such as wooden 2 X 4) on each side of fin and rudder and blocking trailing edge of rudder half the distance between straightedges as shown.
2. Tape a length of soft wire to one elevator in such a manner that it can be bent to index with a point on rudder trailing edge just above the lower rudder tip (rudder butt).
3. Using soft lead pencil, mark rudder at point corresponding to soft wire indexing point (neutral).
4. Remove straightedges.
5. Hold rudder against right, then left, rudder stop. Measure distance from pointer to pencil mark on rudder in each direction of travel. Distance should be between 6.04" and 6.60".

Figure 10-4. Checking Rudder Travel

10-9. CABLES AND PULLEYS. (Refer to figure 10-1.)

10-10. REMOVAL AND INSTALLATION.

- a. Remove seats, upholstery and access plates as necessary.
- b. Disconnect cable at rudder bar (10) and bellcrank (7).
- c. Remove cable guards, pulleys and fairleads as necessary to work cables free of aircraft.

NOTE

To ease routing of cables, a length of wire may be attached to end of cable before being withdrawn from aircraft. Leave wire in place, routed through structure, attach cable being installed and pull cable into position.

- d. After cable is routed in position, install pulleys fairleads and cable guards. Ensure cable is positioned in pulley groove before installing guard.
- e. Rig system in accordance with applicable para-

graph in this section, safety clevises and reinstall all items removed in step "a".

10-11. RIGGING. (Refer to figure 10-1.)

- a. Adjust travel stops (8) to attain travel specified in Section 1. Figure 10-4 illustrates correct travel and one method of checking.
- b. Disconnect nose wheel steering tubes (index 6, figure 5-6) from nose strut.
- c. Adjust cables at clevises (5) to align rudder and pedals in neutral position, 6.00 inches from firewall and pedal pivot shafts (index 4, figure 10-2). This step automatically determines cable tension through use of return springs (14).

NOTE

Due to thickness of insulation on firewall, it is recommended that a piece of 1/16 inch welding rod be ground to a sharp point and notched at the 6.00 inch dimension. Pierce insulation on firewall and use notch to measure proper dimension.

SECTION 11

ENGINE

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11-1. ENGINE COWLING.

11-2. DESCRIPTION. The engine cowling is comprised of an upper and lower cowl segment. A large access door on the upper cowl provides access to the fuel strainer drain, oil filler cap, and oil dipstick. Instead of attaching directly to the fuselage, the cowling attaches to shock mounts which are attached to the fuselage. Quick-release fasteners are used at the cowling-to-shock mount attach points to facilitate detachment of the cowling at the firewall. Screws fasten the upper and lower cowl segments together at the nose cap and quick-release fasteners are used along the side parting surfaces to hold cowling segments together.

11-3. REMOVAL AND INSTALLATION. Removal and installation of the engine cowling is accomplished by removing the attaching screws at the nose cap dividing surfaces and releasing the quick-release fasteners at side parting surfaces and at shock mounts of firewall. Disconnect electrical wiring to landing light in nose cap cowling. Disconnect any air duct and control linkage which interferes with removal of the cowling. When installing the cowling, be sure to connect any items disconnected during removal. Make sure that baffle seals are turned in the correct direction to confine and direct airflow around the engine. The vertically installed seals fold forward and the side seals fold upward.

NOTE

When new shock mounts or brackets are being installed, careful measurements should be made to position these parts correctly on the firewall. The service parts are not pre-drilled. Install shock mounts on brackets so that cowling and shock mount is correctly aligned. Sheet aluminum may be used as shims between bracket halves to provide cowling contour.

11-4. CLEANING AND INSPECTION. Wipe the inner surfaces of the cowling segments with a cloth saturated with cleaning solvent (Federal Specification PS-661 or equivalent). If the inside surface of the cowling is coated heavily with oil and dirt, allow solvent to soak until foreign material can be removed. Wash painted surfaces of cowling with a solution of mild soap and water and rinse thoroughly. After washing, a coat of wax applied to painted surfaces is recommended to prolong paint life. After cleaning, inspect cowling for dents, cracks, and loose rivets or spot welds. Repair all defects to prevent spread of damage.

11-5. REPAIR. If cowling skins are extensively damaged, new complete sections of the cowling

should be installed. Standard insert-type patches may be used for repair if repair parts are formed to fit contour of cowling. Small cracks may be stop-drilled and small dents straightened if they are reinforced on the inner surface with a doubler of the same material. Damaged reinforcement angles should be replaced with new parts. Due to their small size, new reinforcement angles are easier to install than to repair the damaged part.

11-6. ENGINE.

11-7. DESCRIPTION. An air-cooled, horizontal-opposed, low-compression, direct-drive, four-cylinder Continental O-200-A series engine driving a fixed-pitch propeller is used to power the aircraft. The cylinders, numbered from rear to front, are staggered to permit a separate throw on the crankshaft for each connecting rod. The right rear cylinder is number 1 and cylinders on the right side are identified by odd numbers 1 and 3. The left rear cylinder is number 2 and the cylinders on the left side are identified as 2 and 4. Refer to paragraph 11-8 for detailed engine data. For repair and overhaul of the engine, refer to the applicable publication issued by the engine manufacturer.

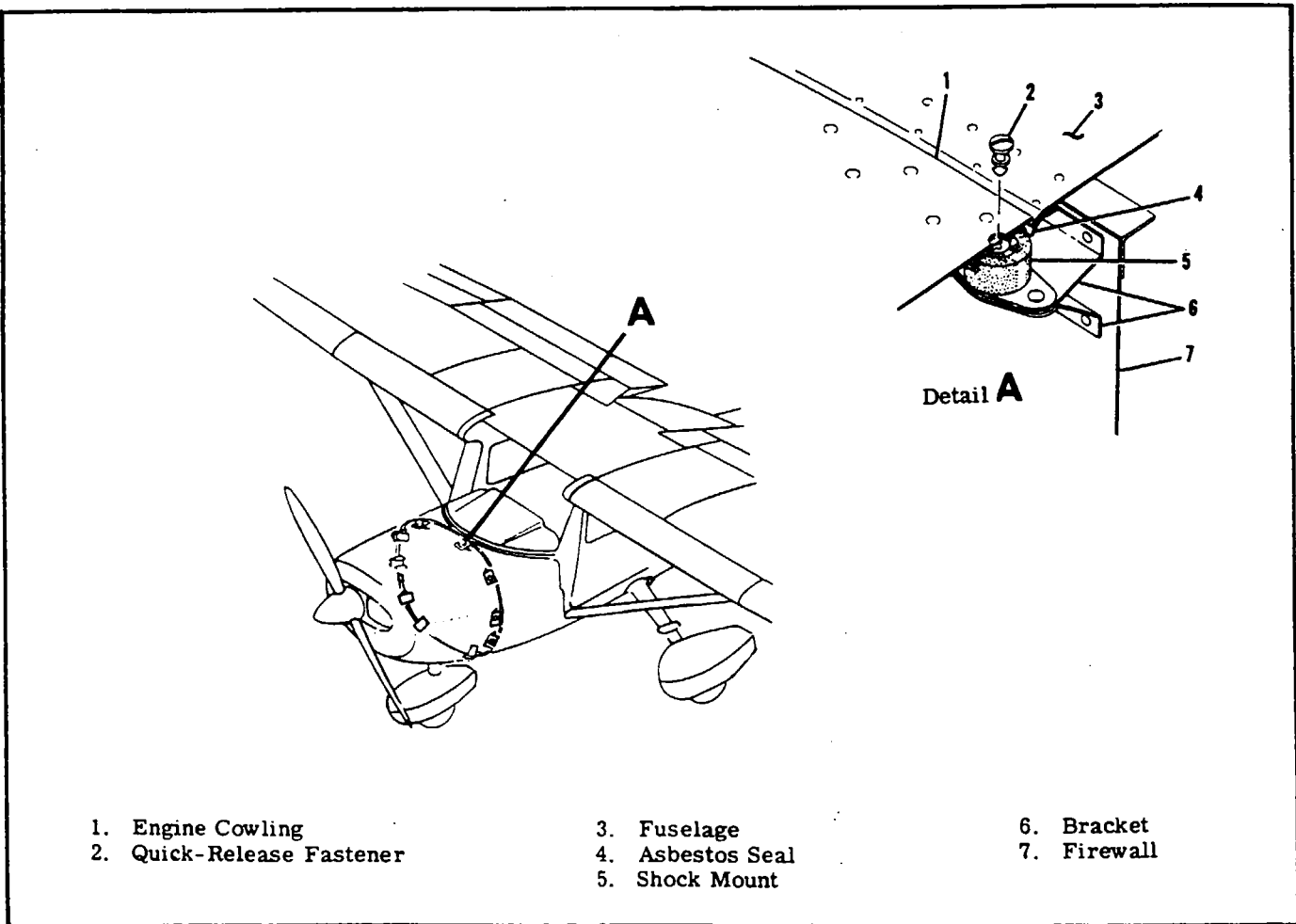


Figure 11-1. Engine Cowling

11-8. ENGINE DATA.

Aircraft Model	150M
MODEL (Continental)	O-200-A
Rated Horsepower at RPM	100 at 2750
Number of Cylinders	4 Horizontally-Opposed
Displacement	200.91 Cubic Inches
Bore	4.0625 Inches
Stroke	3.875 Inches
Compression Ratio	7.00:1
Magnetos	Slick No. 4001
Right Magneto	Fires 24° (+1 -0°) BTC 1-3-2-4 Upper
Left Magneto	Fires 24° (+1 -0°) BTC 1-3-2-4 Lower (Refer to Continental Service Bulletin M77-12 Supplement #1)
Firing Order	1-3-2-4
Spark Plugs	18MM (Refer to current Continental active factory approved spark plug chart)
Torque	330±30 Lb-In.
Carburetor (Marvel-Schebler/Precision)	MA-3-SPA
Alternator	14-Volt, 60-Ampere
Starter (12-Volt)	Automatic Engagement
Tachometer	Mechanical
Oil Sump Capacity	6 U. S. Quarts
With External Filter	7 U. S. Quarts
Oil Pressure (psi)	30-60
Normal	10
Minimum Idling	
Oil Temperature	Within Green Arc
Normal Operating	Red Line (225°F.)
Maximum	
Cylinder Head Temperature	Within Green Arc
Normal Operating	Red Line
Maximum	
Direction of Crankshaft Rotation (viewed from rear)	Clockwise
Dry Weight - with Accessories	200 lb (Weight is approximate and will vary with optional accessories installed)

11-9. TIME BETWEEN OVERHAUL (TBO). Teledyne Continental Motors recommends engine overhaul at 1800 hours for the O-200-A engine. Refer to Continental Aircraft Engine Service Bulletin M74-20, Rev. 1, and to any superseding bulletins, revisions or supplements thereto, for further recommendations. At the time of overhaul, engine accessories should be overhauled.

11-9A. OVERSPEED LIMITATIONS. The engine must not be operated above specified maximum continuous RPM. However, should inadvertent overspeed occur, refer to Continental Aircraft Engine Service Bulletin M75-16, and to any superseding bulletins, revisions or supplements thereto, for further recommendations.

11-10. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE WILL NOT START.	Fuel tank empty.	Fill with proper grade of gasoline.
	Improper use of starting procedures.	Review starting procedure.
	Fuel shut-off valve in OFF position.	Turn shut-off valve ON.
	Carburetor screen or fuel strainer plugged.	Remove and clean thoroughly. Remove moisture.
	Engine flooded.	Refer to paragraph 11-74.
	Defective ignition system.	Refer to paragraph 11-53.
	Excessive induction air leaks.	Correct the cause of leaks.
	Insufficient priming (puffs of white smoke and weak combustion).	Prime more. In cold weather draw plunger slowly back, push hard. Check pump output at priming jet.
	Defective magneto switch or grounded magneto "P" leads.	Check continuity. Repair or replace switch or wiring.
	Defective carburetor.	Repair or replace carburetor.
	Spark plugs fouled or improperly gapped.	Remove and clean: check gaps and insulators. Use new gaskets. Check cables to persistently fouled plugs. Replace defective plugs.
	Magneto impulse coupling failure.	Repair or install new magneto.
	Spark plugs loose.	Using new gaskets, tighten to specified torque.
Water in fuel system.	Drain fuel tank sumps, fuel lines, fuel strainer and carburetor.	
Excessive starter slippage.	Replace starter adapter.	
ENGINE WILL NOT RUN AT IDLING SPEED.	Idle speed or idle mixture incorrectly adjusted.	Refer to paragraph 11-42.
	Carburetor idling jet plugged.	Clean carburetor and fuel strainer.
	Air leak in intake manifold.	Tighten loose connections or replace damaged parts.
	Spark plugs fouled by oil escaping past piston rings.	Top overhaul engine.
ROUGH IDLING.	Idling mixture and/or mixture control improperly adjusted.	Refer to paragraph 11-42 and 11-54.

11-10. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
ROUGH IDLING (cont).	Manual mixture control set for lean mixture.	Use full rich mixture for all ground operation.
	Fouled spark plugs.	Remove and clean. Adjust gaps. Test harness cables. Inspect contact breakers. If persistent, perform top overhaul.
	Priming pump leaking.	Repair or replace.
	Small air leak into induction system.	With mixture control at IDLE CUT-OFF, ignition switch OFF and throttle open, brush soap lather around tube joints and carburetor mount flange, one at a time, and turn propeller backwards to check for bubbles at points of leakage. Tighten connections or replace damaged gasket or seal.
	Leaking accelerating pump.	Repair or install new carburetor.
	Defective engine.	Check compression and listen for unusual engine noises. Engine repair is required.
	Incorrect magneto timing.	Correct timing.
	Worn, faulty, or misset points.	Reset or replace points.
ENGINE RUNS TOO LEAN AT CRUISING POWER.	Manual mixture control in wrong position.	Rig control in accordance with paragraph 11-59.
	Carburetor partially restricted.	Remove and clean.
ENGINE RUNS TOO RICH AT CRUISING POWER.	Manual mixture control in wrong position.	Rig control in accordance with paragraph 11-59.
	Restriction in air scoop or filter partially restricted.	Remove restriction. Clean filter.
	Carburetor air heat valve open.	Rig in accordance with paragraph 11-60.

11-10. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE DOES NOT ACCELERATE PROPERLY.	Cold engine.	Warm up longer.
	Mixture control set for lean mixture.	Set control at full RICH position.
	Restriction in carburetor air intake.	Remove restriction and clean filter.
	Restriction in carburetor jets, low float level, plugged fuel screen.	Clean and repair carburetor.
	Idling setting too lean.	Refer to paragraph 11-42.
ENGINE DOES NOT SHUT OFF WITH MANUAL MIXTURE CONTROL IN IDLE CUTOFF POSITION.	Fuel leakage thru primer.	Repair or install new primer.
	Linkage does not permit idle cutoff lever to reach OFF position.	Rig in accordance with paragraph 11-59.
ENGINE RUNS ROUGH AT HIGH SPEED.	Loose mounting bolts or rubber bushings defective.	Tighten bolts or replace mount bushings.
	Propeller out of balance or track; loose or damaged spinner.	Remove and balance. Repair or replace damaged parts.
	Spark plug gasket leaking, gap too large or insulator damaged.	Replace damaged parts.
	Ignition cable insulation damaged.	Test for leakage at high voltage. Replace damaged ignition lead.
	Excessively lean fuel-air mixture.	Clean fuel strainer, carburetor screen and carburetor main jet.
SLUGGISH OPERATION AND LOW POWER.	Throttle not opening completely.	Rig per paragraph 11-58.
	Spark plugs fouled or improperly gapped.	Remove, clean and regap or install new plugs.
	Carburetor air heat valve open.	Rig in accordance with paragraph 11-60.
	Damaged contact breaker or capacitor.	Overhaul magneto.
	Fuel-air mixture too rich or too lean.	Overhaul and adjust carburetor.

11-10. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
HIGH CYLINDER HEAD TEMPERATURE.	Low grade of fuel.	Drain and fill with correct grade of fuel. Refer to Section 2.
	Lean fuel-air mixture.	Refer to Owner's Manual for correct leaning procedure.
	Excessive carbon deposits in cylinder head and on pistons.	Install new cylinders and piston rings or new engine.
	Cylinder baffles loose or bent.	Check all baffles and correct.
	Dirt between cylinder fins.	Clean thoroughly.
HIGH OIL TEMPERATURE.	Low oil supply.	Replenish.
	Oil viscosity too high.	Refer to Section 2 for seasonal grades.
	Prolonged high speed operation on ground.	Hold ground running above 1500 RPM to a minimum.
LOW OIL PRESSURE.	Low oil supply.	Replenish.
	Oil viscosity too low.	Drain and refill with correct seasonal grade. Refer to Section 2.
	Sludge or foreign material in relief valve.	Remove and clean valve parts.
	Foam in oil due to emulsification of alkaline solids.	Drain and refill with fresh oil. Refer to Section 2 for seasonal grade.
	Defective pressure gage.	Check with known good gage. Replace defective gage.
	Oil pump defective.	Remove and inspect. Examine engine. Metal particles from damaged pump may have entered engine oil passages.
	Oil congealed in gage line.	Disconnect line at engine and gage; flush with kerosene. Pre-fill line with kerosene and install.
	Oil pressure line broken, disconnected or pinched.	Inspect, replace or connect line.
	Internal leak, burned bearings, or damaged gasket.	Major overhaul.

11-10. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
OIL LEAK AT FRONT OF ENGINE.	Damaged crankshaft seal.	Replace.
OIL LEAK AT PUSH ROD HOUSING.	Damaged push rod housing oil seal.	Replace.
LOW COMPRESSION.	Cylinder wall worn out-of-round and choke reduced.	Replace cylinder and rings.
	Intake valves guides worn.	Top overhaul.
	Valves seats and faces worn.	Top overhaul.
	Piston rings excessively worn.	Top overhaul.
	Valves sticking in guides.	Top overhaul.

11-10A. LOCATING OIL LEAKS. Oil leaks, especially those in the engine compartment, can be elusive due to airflow patterns. One method to consider in pin-pointing these leaks is to

- a. Clean suspected leak areas thoroughly with solvent and dry.
- b. Spray the suspected area with dye penetrant developer.
- c. Reinstall the engine cowling and other removed

equipment to normal configuration to ensure air flow for cooling and leak detection.

- d. Accomplish a short run-up, preferably to static RPM, in accordance with Pilot's Operating Handbook.
- e. Dye penetrant developer will enhance the presence of oil leaks. Most leaks are very apparent against the white background.
- f. After locating the leak and effecting repairs, thoroughly clean the area sprayed with the developer. It is highly corrosive.

11-11. REMOVAL. If the engine is to be placed in storage or returned to the manufacturer for overhaul, proper preparatory steps should be taken prior to beginning the removal procedure. Refer to Indefinite Storage in Section 2 for preparation of the engine for storage. The following engine removal procedure is based upon the engine being removed from the aircraft with the engine mount attached to the firewall and all engine hose and lines being disconnected at the firewall. The reason for engine removal will determine where components are to be disconnected.

NOTE

Tag each item disconnected to aid in identifying wires, hose, lines and control linkage when engine is being installed. Protect openings, exposed as a result of removing or disconnecting units, against entry of foreign material by installing covers or sealing with tape.

- a. Place all cabin switches and fuel valves in the OFF position.
- b. Remove engine cowlings. (See paragraph 11-3.)
- c. Open battery circuit by disconnecting battery cable(s) at the battery. Insulate cable terminal(s) as a safety precaution.
- d. Disconnect ignition switch primary ("P") leads at the magnetos.

WARNING

The magneto is in a SWITCH ON condition when the switch wire is disconnected. Ground the magneto points or remove the high tension outlet plate from the magneto or disconnect spark plug lead wires at spark plugs to prevent accidental firing when the propeller is rotated.

- e. Drain engine oil from sump.
- f. Remove propeller and spinner. (See Section 13.)

NOTE

During the following procedures, remove any clamps which secure controls, wires, hose, or lines to the engine, engine mount, or attached brackets, so that they will not interfere with removal of the engine. Omit any of the items which are not present on a particular engine installation.

- g. Disconnect throttle and mixture control at carburetor. Pull these controls free of engine and engine mount, using care not to damage them by bending too sharply. Note position, size and number of attaching washers and spacers.
- h. Disconnect carburetor heat control from arm on carburetor air intake housing assembly. Remove clamps and pull control aft clear of the engine.
- i. Disconnect wires and cables as follows:

CAUTION

When disconnecting starter cable, do not permit starter terminal bolt to rotate. Rotation of the bolt could break the conductor between terminal and field coils causing the starter to be inoperative.

1. Starter electrical cable at starter.
2. Electrical wires and wire shielding ground at alternator.
3. Tachometer drive shaft at adapter on engine.
4. Remove all clamps attaching wires and cables to the engine or engine mount. Pull all wires and cables aft to clear the engine.
- j. Disconnect and cap or plug lines and hose as follows:
 1. Vacuum hose at firewall.

WARNING

Residual fuel and oil draining from disconnected lines and hose is a fire hazard. Use care to prevent accumulation of such fuel and oil when lines or hose are disconnected.

2. Oil pressure hose at firewall.
3. Oil temperature bulb at engine.
4. Primer line to engine at firewall.
5. Fuel hose to engine at fuel strainer on firewall.
6. Remove all clamps attaching lines and hose to engine or engine mount which interferes with engine removal from engine mount.

CAUTION

Attach a tail stand to the tail tie-down fitting before removing the engine. The loss of engine weight will allow the tail to drop. Do not raise engine higher than necessary when removing engine-to-mount bolts. Raising the engine too high places a strain on the attach bolts and hinders their removal.

- k. Attach a hoist to the lifting lug on top of the engine and take up engine weight on hoist.
 1. Remove bolts attaching engine-to-mount. Note direction of bolt installation and position and numbers of washers. Balance the engine by hand as the last of the bolts are removed. Remove ground straps at lower mount legs as bolts are removed.

CAUTION

Hoist engine slowly and ascertain that all items attaching engine and accessories to engine mount and airframe are disconnected.

- m. Carefully guide disconnected components out of engine assembly.

11-12. **CLEANING.** The engine may be cleaned with a suitable solvent, such as Stoddard solvent, or equivalent, then dried thoroughly.

CAUTION

Particular care should be given to electrical equipment before cleaning. Solvent should not be allowed to enter magnetos, starter, alternator, and the like. Hence, protect these components before saturating the engine with solvent. Cover any fuel, oil and air openings on the engine and accessories before washing the engine with solvent. Caustic cleaning solutions should not be used.

11-13. **ACCESSORIES REMOVAL.** Removal of engine accessories for overhaul or for engine replacement involves stripping the engine of parts, accessories, and components to reduce the engine assembly to the bare engine. During removal, carefully examine removed items and tag defective parts for repair or replacement with a new part.

NOTE

Items easily confused with similar items should be tagged to provide a means of identification when being installed on a new engine. All openings exposed by the removal of an item should be closed by installing a suitable cover or cap over the opening. This will prevent entry of foreign particles. If suitable covers are not available, tape may be used to cover the opening.

11-14. **INSPECTION.** For specific items to be inspected refer to engine manufacturer's manual.

- a. Visually inspect the engine for loose nuts, bolts, cracks and fin damage.
- b. Inspect baffles, baffle seals and brackets for cracks, deterioration and breakage.
- c. Inspect all hoses for internal swelling, chafing through protective plys, cuts, breaks, stiffness, damaged threads and loose connections. Excessive heat on hoses will cause them to become brittle and easily broken. Hoses and lines are most likely to crack or break near the end fittings and support points.
- d. Inspect for color bleaching of the end fittings or severe discoloration of the hoses.

NOTE

Avoid excessive flexing and sharp bends when examining hoses for stiffness.

e. Refer to Section 2 for replacement intervals for flexible fluid carrying hoses in the engine compartment.

f. For major engine repairs, refer to the manufacturer's overhaul and repair manual.

11-15. **ENGINE BUILD-UP.** Engine build-up consists of installation of parts, accessories and components to the basic engine to build-up an engine unit ready for installation on the aircraft. All safety wire, lockwashers, elastic stop nuts, gaskets and rubber connections should be new parts.

11-16. **INSTALLATION.** Before installing the engine on the aircraft, install any items that were removed from the engine after it was removed from the aircraft.

NOTE

Remove all protective covers, plugs, caps and identification tags as each item is connected or installed.

- a. Hoist engine assembly to a point near the engine mount.
- b. Route controls, lines and hose in place as the engine is positioned near the engine mount.
- c. Install shock-mounts as shown in figure 11-2 and install engine-to-mount bolts. Be sure ground straps are in place at lower engine mount. Tighten engine-to-mount bolts to torque value shown in figure 11-2.
- d. Remove hoist and stand placed under tail tie-down fitting.
- e. Route throttle and mixture controls to the carburetor and connect, using washers and spacers as noted in step "g" of paragraph 11-11.

NOTE

Throughout the aircraft fuel system, from the fuel tanks to the carburetor, use NS-40 (RAS-4) (Snap-On Tools Corp., Kenosha, Wisconsin), MIL-T-5544 (Thread Compound, Antiseize, Graphite Petrolatum), USP Petrolatum or engine oil as a thread lubricant or to seal a leaking connection. Apply sparingly to male threads only, omitting the first two threads, exercising extreme caution to avoid "stringing" sealer across the end of the fitting. Always ensure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system.

- f. Connect lines and hose as follows:
 1. Fuel hose at fuel strainer on firewall.
 2. Primer line to engine at firewall.
 3. Oil temperature bulb at engine.
 4. Oil pressure hose at firewall.
 5. Install all clamps attaching lines and hose to engine, engine mount, or attached brackets.
- g. Connect wires and cables as follows:
 1. Electrical wires and wire shielding ground at alternator.

CAUTION

When connecting starter cable, do not permit starter terminal bolt to rotate. Rotation of the bolt could break the conductor between terminal and field coils causing the starter to be inoperative.

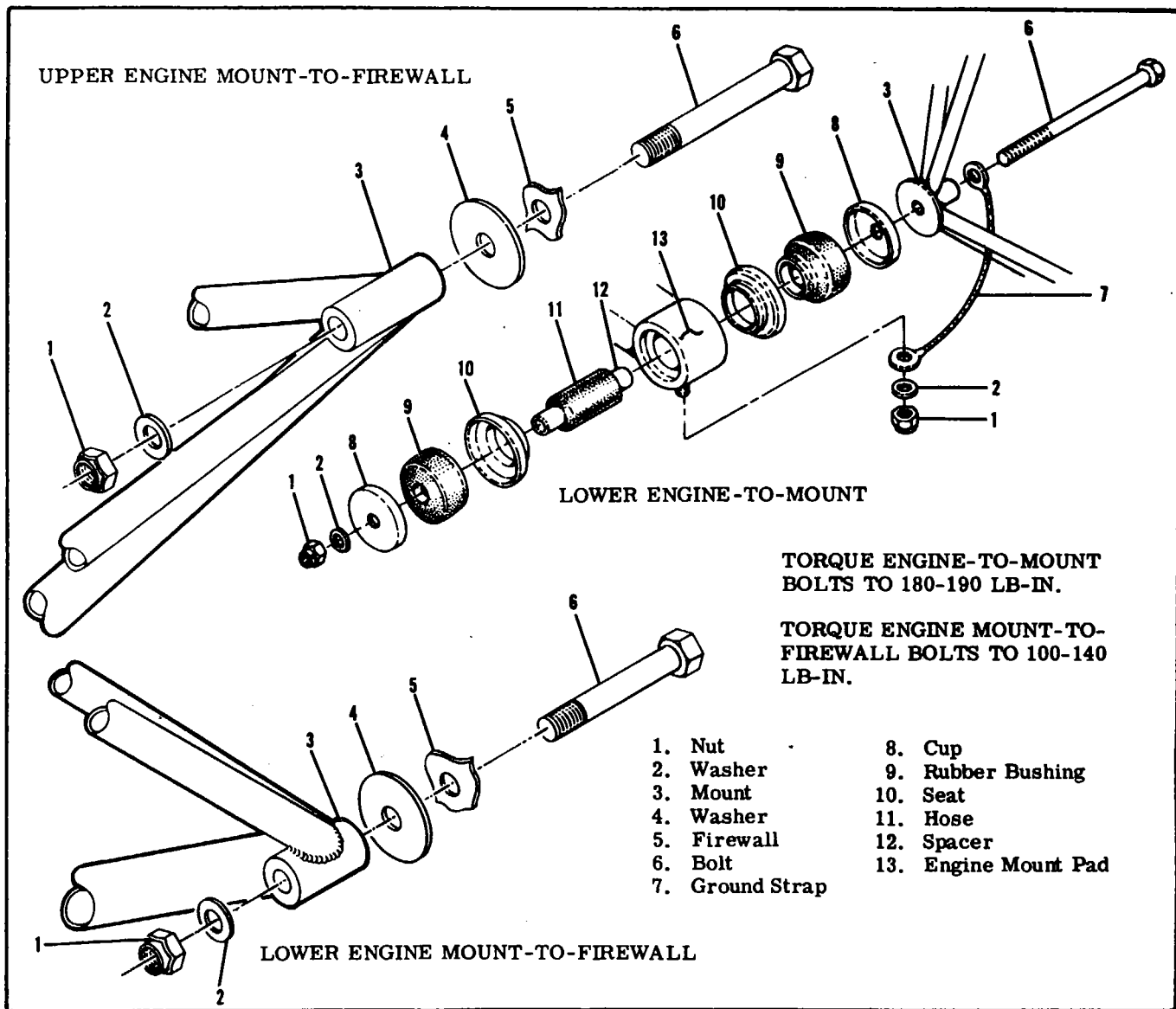


Figure 11-2. Engine Mount Details

- 2. Starter electrical cable at starter.
- 3. Tachometer drive shaft at engine. Be sure drive cable engages drive in adapter on engine. Torque housing attach nut to 100 lb-in.
- 4. Install all clamps attaching wires and cables to engine, engine mount, or attached brackets.
- h. Route carburetor heat control to arm on carburetor air intake housing assembly. Install clamps and rig in accordance with paragraph 11-60.
- i. Install propeller and spinner. (Refer to Section 13 for affected aircraft model.)
- j. Make a magneto switch wire ground-out and continuity check. Connect magneto switch wires to the magnetos.

WARNING

Be sure magneto switch is in OFF position when connecting switch wires to magnetos.

- k. Service engine with proper grade and quantity

- of engine oil. Refer to Section 2 if engine is new, newly overhauled, or has been in storage.
- l. Make sure all switches are in the OFF position, and connect battery cable(s) to battery.
- m. Rig throttle, mixture and carburetor heat controls in accordance with paragraph 11-57 through 11-60.
- n. Check engine installation for security, correct routing of controls, lines, hose and tightness of all components.
- o. Install engine cowling. Clean and install carburetor air filter. Be sure all hot and cold air ducts are installed and connected.
- p. Perform engine run-up and make final adjustments on engine controls.

11-17. FLEXIBLE FLUID HOSES.

11-18. LEAK TEST.

- a. After each 50 hours of engine operation, all flexible fluid hoses in the engine compartment should be

checked for leaks as follows:

1. Examine the exterior of hoses for evidence of leakage or wetness.
2. Hoses found leaking should be replaced.
3. Refer to paragraph 11-14 for detailed inspection procedures for flexible hoses.

11-19. REPLACEMENT.

- a. Hoses should not be twisted on installation. Pressure applied to a twisted hose may cause failure or loosening of the nut.
- b. Provide as large a bend radius as possible.
- c. Hoses should have a minimum of one-half inch clearance from other lines, ducts, hoses or surrounding objects or be butterfly clamped to them.
- d. Rubber hoses will take a permanent set during extended use in service. Straightening a hose with a bend having a permanent set will result in hose cracking. Care should be taken during removal so that hose is not bent excessively, and during reinstallation to assure hose is returned to its original position.
- e. Refer to AC 43.13-1, Chapter 10, for additional installation procedures for flexible fluid hose assemblies.

11-20. **STATIC RUN-UP PROCEDURES.** In a case of suspected low engine power, a static RPM run-up should be conducted as follows:

- a. Run up engine, using takeoff power and mixture settings, with the aircraft facing 90° right and then left to the wind direction.
- b. Record the RPM obtained in each run-up position.

NOTE

Daily changes in atmospheric pressure, temperature and humidity will have a slight effect on static run-up.

- c. Average the results of the RPM obtained. It should be within 50 RPM of 2510 RPM.
- d. If the average results of the RPM obtained are lower than stated above, the following recommended checks may be performed to determine a possible deficiency.
 1. Check carburetor heat control for proper rigging. If partially open it would cause a slight power loss.
 2. Check magneto timing, spark plugs and ignition harness for settings and conditions.
 3. Check condition of induction air filter. Clean if necessary.
 4. Perform an engine compression check. (Refer to engine Manufacturer's Manual).

11-21. BAFFLES.

11-22. **DESCRIPTION.** The sheet metal installed on the engine directs the cooling air flow around the cylinders and other engine components to provide optimum engine cooling. These baffles incorporate rubber-asbestos composition seals at points of contact with the engine cowling to help confine and direct cooling air to the desired area. The baffles, air blast tubes and air scoops are accurately positioned to maintain engine cooling efficiency and their removal

will cause improper air circulation and engine overheating.

11-23. **CLEANING AND INSPECTION.** Engine baffles should be cleaned with a suitable solvent to remove dirt and oil.

NOTE

The rubber-asbestos seals are oil and grease resistant but should not be soaked in solvent for long periods.

Inspect baffles for cracks in the metal and for loose and/or torn seals. Replace defective parts.

11-24. **REMOVAL AND INSTALLATION.** Removal and installation of the various baffle segments is possible with the cowling removed. Be sure that any replacement baffles and seals are installed correctly and that they seal to direct the cooling air in the correct direction.

11-25. **REPAIR.** Baffles ordinarily should be replaced if damaged or cracked. However, small plate reinforcements riveted to the baffle will often prove satisfactory both to the strength and cooling requirements of the unit.

11-26. ENGINE MOUNT.

11-27. **DESCRIPTION.** The engine mount is composed of sections of tubing welded together and reinforced with welded gussets. The purpose of the engine mount is to support the engine and attach the engine to the airframe. The engine is attached to the mount with shock-mount assemblies which absorb engine vibrations. The engine mount also supports the nose gear shock strut.

11-28. **REMOVAL AND INSTALLATION.** Removal of the engine mount necessitates removal of the engine and nose landing gear, followed by removal of the bolts attaching the engine mount to the fuselage structure. When installing an engine mount, tighten mount-to-fuselage bolts to the torque value listed in figure 11-2. Install landing gear as outlined in Section 5. The engine, engine mount and nose gear may be removed from the aircraft and then engine and nose gear removed from the mount.

11-29. INSPECTION AND REPAIR.

- a. Wipe rubber parts of shock-mount pads with a clean dry cloth.
- b. Inspect rubber parts for swelling, cracking or a pronounced set of the part.
- c. Inspect metal parts of shock-mount pads for cracks and excessive wear due to aging and deterioration.
- d. Replace all parts that show evidence of wear or damage with new parts.
- e. Perform engine mount repair as outlined in Section 18.
- f. Paint the engine mount with heat-resistant black paint after welding or whenever original finish has been removed.

11-30. ENGINE OIL SYSTEM. (Refer to figure 11-3.)

11-31. DESCRIPTION. A wet-sump, pressure-lubricating oil system is used in the O-200-A series engines. Oil in the sump passes through a sump pick-up tube, through the suction screen in the tube, to the suction side of the oil pump. From the pressure side of the oil pump, oil is fed through the pressure oil screen, or the external full-flow oil filter, into the left oil gallery. If the optional oil cooler is installed, the oil passes the oil cooler bypass valve, then to the cooler via a flexible hose connection outside the crankcase, thru the cooler and back to the engine via a second flexible hose connection. The oil flows forward through the left gallery, across the crankcase, through the passages connected by the camshaft front journal groove, and into the right gallery. The oil

pressure relief valve closes the rear end of the right gallery. The galleries pressure-feed the main bearings, cam shaft bearings, and hydraulic tappets. Connecting rod bearings are lubricated from the main bearings through drilled passages in the crankshaft. Valve mechanisms are lubricated through hollow push-rods from the tappets. Cylinder walls, piston pins, and connecting rod bushings are spray-lubricated by oil escaping from the connecting rod and main bearings. Gears in the crankcase cover cavity are lubricated by spray from the rear main and rear camshaft bearings. Drilled passages from the crossover oil gallery lubricates the vacuum pump adapter pad mounted at the front lower side of the engine. Throughout the engine, oil is returned to the sump by gravity.

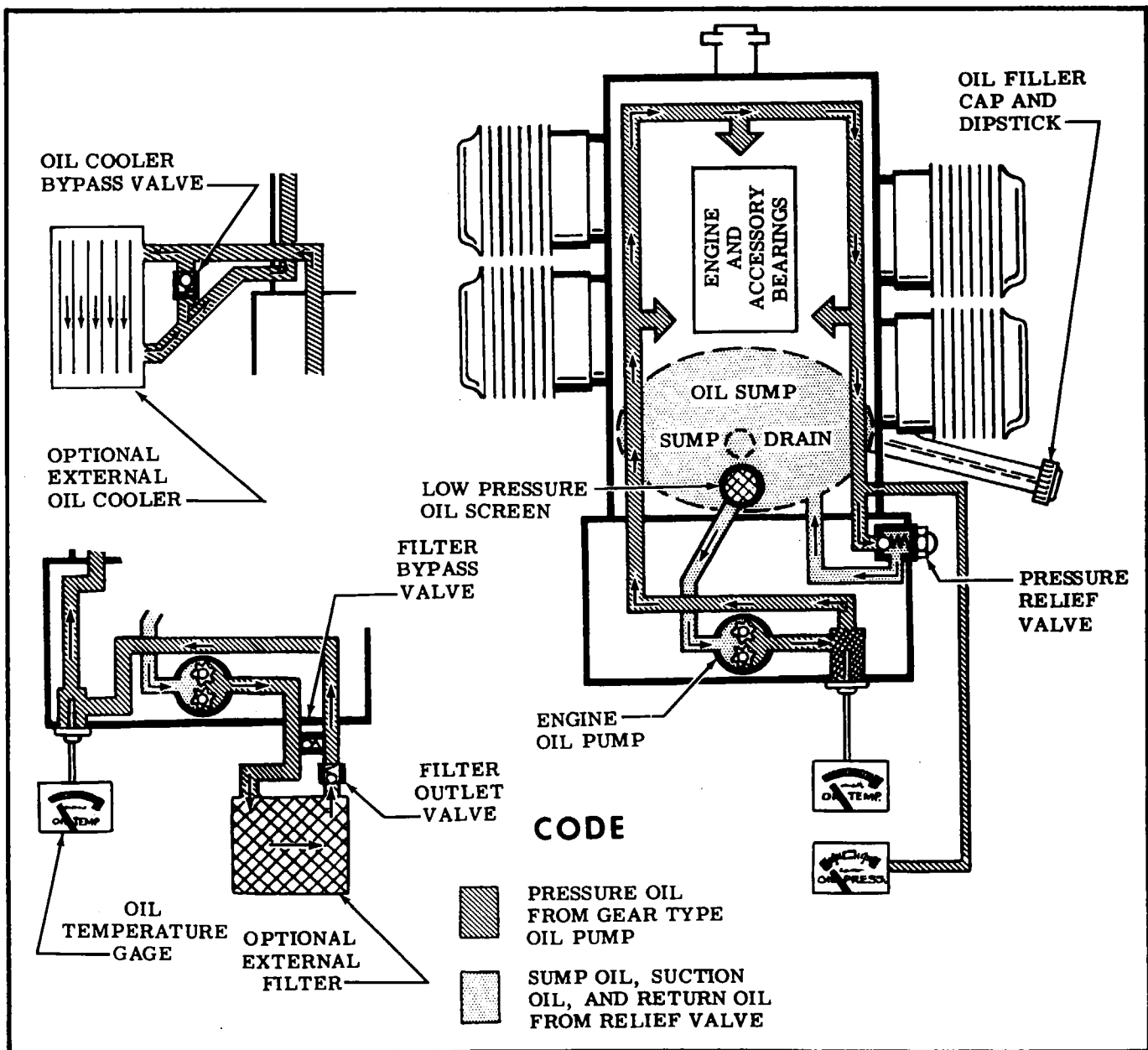


Figure 11-3. Engine Oil Schematic

11-32. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
NO OIL PRESSURE.	No oil in sump.	Fill sump with proper grade and quantity of oil. Refer to Section 2.
	Oil pressure line broken, disconnected or pinched.	Replace or connect.
	Oil pump defective.	Remove and inspect. Examine engine. Metal particles from damaged pump may have entered engine oil passages.
	Defective oil pressure gage.	Check with another gage. Replace if defective.
	Oil congealed in gage line.	Disconnect line at engine and gage; flush with kerosene. Pre-fill with kerosene and install.
	Relief valve defective.	Remove and check for dirty or defective parts. Clean and install; replace defective parts.
LOW OIL PRESSURE.	Low oil supply.	Replenish. Refer to Section 2.
	Low viscosity oil.	Drain sump and refill with proper grade and quantity of oil.
	Oil pressure relief valve spring weak or broken. Dirt on seat.	Replace weak or broken spring. Clean plunger and seat.
	Defective oil pump.	Remove and inspect. Examine engine. Metal particles from damaged pump may have entered engine oil passages.
	Secondary result of high oil temperature.	Observe oil temperature gage for high indication. Determine and correct reason for high oil temperature.
	Plugged oil screen.	Remove and clean screen.
	Oil pressure gage defective.	Check with another gage. Replace if defective.
	Oil pressure relief valve plunger sticking.	Remove and clean plunger.
	Oil pump suction tube screen plugged or internal oil leak.	Engine overhaul required.
HIGH OIL PRESSURE.	High viscosity oil.	Drain sump and refill with proper grade and quantity of oil.
	Defective oil pressure gage.	Check with another gage. Replace if defective.
	Relief valve defective.	Remove and check for dirty or defective parts. Clean and install; replace defective parts.

11-32. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
LOW OIL TEMPERATURE.	Defective oil temperature gage or temperature bulb.	Check with another gage. If reading is normal, aircraft gage is defective. If reading is similar temperature bulb is defective. Replace defective part/or parts.
HIGH OIL TEMPERATURE.	Excessive rate of climb.	Avoid low airspeed.
	Lean fuel-air mixture.	Avoid excessive lean mixture operation.
	Vernatherm control valve damaged or held open by solid matter.	Remove. Clean valve and seat. If still inoperative, replace.
	Low oil supply.	Replenish.
	Oil viscosity too high. Dirty or diluted oil.	Drain and fill sump with proper grade and quantity.
	Prolonged high speed operation on the ground.	Hold ground running above 1500 rpm to a minimum.
	Defective oil temperature gage.	Check with another gage. If second reading is normal, aircraft gage is defective. Replace gage.
	Defective oil temperature bulb.	Check for correct oil pressure, oil level and cylinder head temperature. If they are correct, check oil temperature gage for being defective; if similar reading is observed, bulb is defective. Replace bulb.

11-33. FULL-FLOW OIL FILTER.

11-34. DESCRIPTION. An external oil filter may be installed on the engine. The filter and filter adapter replace the internal oil pressure screen. Provisions are provided in the oil filter adapter cover for the oil temperature bulb. The filter adapter incorporates a bypass valve. If the filter element should become clogged, the bypass valve will open, allowing pressure oil to flow to the engine oil passages.

11-35. FILTER ELEMENT REMOVAL AND INSTALLATION. (See figure 11-4.)

NOTE

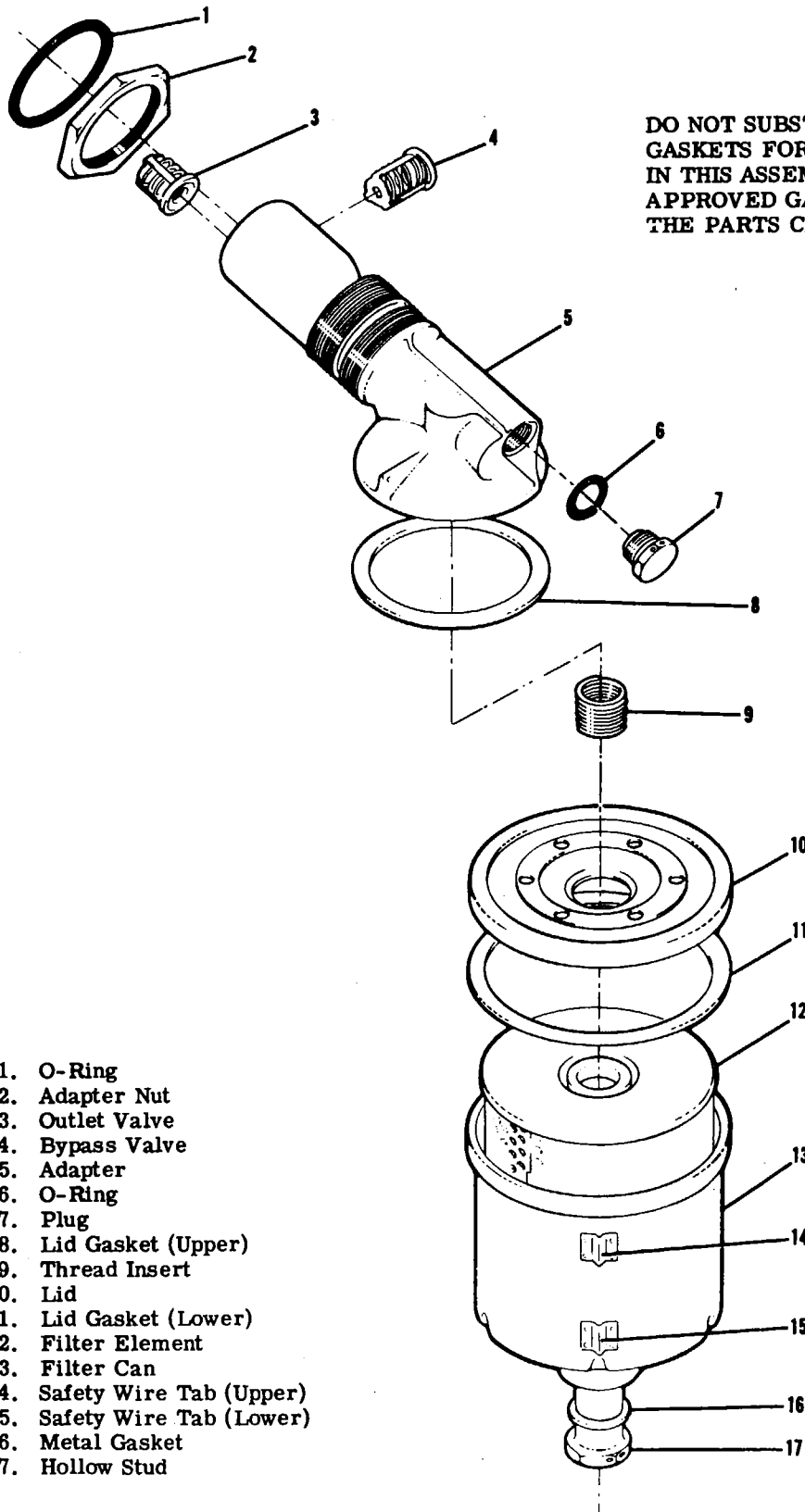
New filter element kits are available from Cessna Parts Distribution (CPI 2).

- a. Remove engine cowling as necessary for access.
- b. Remove both safety wires from filter can and unscrew hollow stud to detach filter assembly from adapter as a unit. Remove from aircraft discarding upper gasket. Oil will drain from filter assembly

- as assembly is removed from adapter.
- c. Press downward on hollow stud to remove from filter element and can. Discard metal gasket.
- d. Lift lid from can, and discard lower gasket.
- e. Pull filter element from can.

NOTE

Before discarding removed filter element, remove the outer perforated paper cover; using a sharp knife, cut through the folds of the filter element at both ends, close to the metal caps. Then carefully unfold the pleated element and examine the material trapped in the filter element for evidence of internal engine damage such as chips or particles from bearings. In new or newly overhauled engines, some small particles or metallic shavings might be found, these are generally of no consequence and should not be confused with particles produced by impacting, abrasion, or pressure. Evidence of internal engine damage found in the oil filter element justifies further examination to determine the cause



NOTE

DO NOT SUBSTITUTE AUTOMOTIVE GASKETS FOR ANY GASKETS USED IN THIS ASSEMBLY. USE ONLY APPROVED GASKETS LISTED IN THE PARTS CATALOG.

- 1. O-Ring
- 2. Adapter Nut
- 3. Outlet Valve
- 4. Bypass Valve
- 5. Adapter
- 6. O-Ring
- 7. Plug
- 8. Lid Gasket (Upper)
- 9. Thread Insert
- 10. Lid
- 11. Lid Gasket (Lower)
- 12. Filter Element
- 13. Filter Can
- 14. Safety Wire Tab (Upper)
- 15. Safety Wire Tab (Lower)
- 16. Metal Gasket
- 17. Hollow Stud

Figure 11-4. Full-Flow Oil Filter

f. Wash lid, hollow stud and can in cleaning solvent and dry with compressed air.

NOTE

When installing a new filter element, it is important that all gaskets are clean, lubricated, and positioned properly, and that the correct amount of torque is applied to the filter hollow stud. If the hollow stud is under-torqued, oil leakage will occur. If the hollow stud is over-torqued, the filter can might possibly be deformed, again causing oil leakage.

Lubricate rubber grommets in each end of new filter element, upper and lower gaskets, and metal gasket with clean engine oil or general purpose grease before installing. Dry gaskets can cause false torque readings, again resulting in oil leakage.

Before assembly, place a straightedge across bottom of filter can. Check for distortion or out-of-flat condition greater than 0.010 inch. Install a new can if either of these conditions exists.

After installing a new upper gasket on the lid, turn lid over. If gasket falls, try a different

gasket and repeat test. If this gasket falls off, install a new lid.

g. Inspect adapter gasket seat for gouges, deep scratches, wrench marks, and mutilation. If any of these conditions are found, install a new adapter.

h. Place a new filter element in can and insert hollow stud with a new metal gasket in place, through the can and filter element.

i. Position a new lower gasket inside flange of lid. Place lid in position on can.

j. Install filter assembly on adapter with a new upper gasket in place. While holding can to prevent it from turning, tighten hollow stud and torque to 20-25 lb-ft (240-300 lb-in), using a torque wrench.

k. Install parts removed for access, and service the engine with proper grade and quantity of engine oil. One additional quart of oil is required each time filter element is changed.

l. Start engine and check for proper oil pressure. Check for oil leaks after warming up engine.

m. Again check for oil leakage after engine has been run at a high power setting (preferably a flight around the field).

n. Check to make sure that the filter has not been in contact with adjacent parts due to engine torque.

o. While engine is still warm, recheck torque on hollow stud, then safety hollow stud to bracket on can, and safety adapter nut to other bracket on filter can.

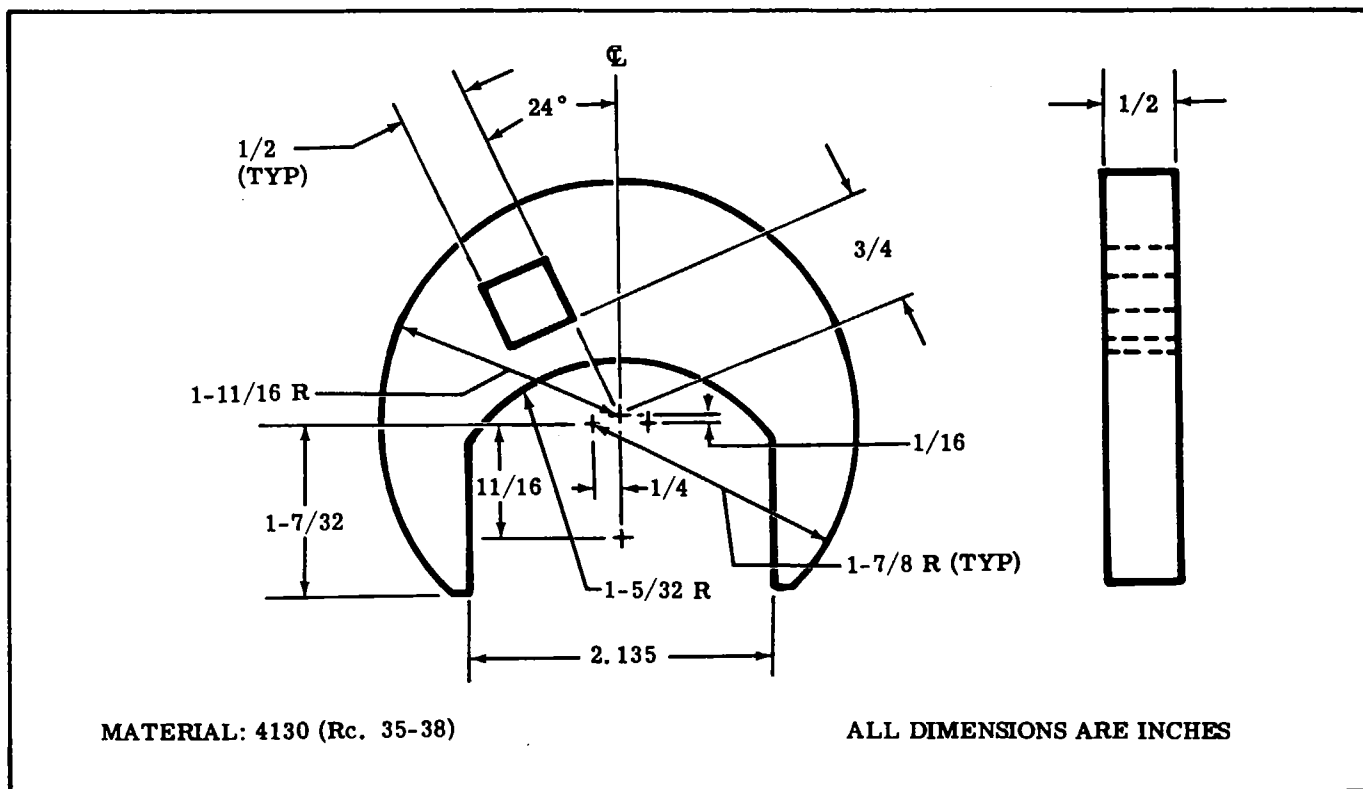


Figure 11-5. Wrench Adapter Fabrication

- 11-36. ADAPTER REMOVAL. (See figure 11-4.)
a. Remove filter can as outlined in paragraph 11-35.

NOTE

A special wrench adapter (Part No. SE709) for the adapter nut is available from Cessna Parts Distribution (CPD 2), or one may be made as shown in figure 11-5.

- b. Note angular position of adapter, then remove safety wire and loosen adapter nut.
c. Unscrew adapter and remove adapter from engine. Discard adapter O-ring.

11-37. DISASSEMBLY, INSPECTION, AND ASSEMBLY. Figure 11-4 shows the relative position of the internal parts of the filter adapter and may be used as a guide during installation of parts. The bypass valve is to be installed as a complete unit, with the valve being staked three places. A new helicoil type thread insert in the adapter may be installed although special tools are required. Follow instructions of the tool manufacturer for their use. Inspect threads on adapter and in engine for damage. Clean adapter in solvent and dry with compressed air. Ascertain that all passages in the adapter are open and free of foreign material. Also, check that bypass valve is seated properly.

11-38. ADAPTER INSTALLATION.

- a. Assemble adapter nut and new O-ring on adapter in sequence illustrated in figure 11-4.
b. Lubricate O-ring on adapter with clean engine oil. Tighten adapter nut until O-ring is centered in its groove on the adapter.
c. Apply an anti-seize compound sparingly to the adapter threads, then simultaneously screw adapter and adapter nut into engine until O-ring seats against engine boss without turning adapter nut. Rotate adapter to approximate angular position noted during removal of adapter. Do not tighten adapter nut at this time.
d. Temporarily install filter assembly on adapter, and position so adequate clearance with adjacent parts is attained. Maintaining this position of the adapter, tighten adapter nut to 50-60 lb-ft (600-700 lb-in) and safety. Use a torque wrench when tightening adapter nut.
e. Using new gaskets, install filter assembly as outlined in paragraph 11-35. Be sure to service engine oil system.

11-39. ENGINE FUEL SYSTEM.

11-40. DESCRIPTION. The engine is equipped with a carburetor mounted at the lower side of the engine. The carburetor is of the plain-tube fixed-jet type, and has such features as an enclosed accelerating pump mechanism, simplified fuel passages to prevent vapor locking, idle cut-off to prevent starting of the engine accidentally, and manual mixture control for leaning. For overhaul and repair of the carburetor refer to the manufacturer's overhaul and repair manual.

11-41. CARBURETOR REMOVAL AND INSTALLATION.

- a. Place fuel shut-off valve in the OFF position.
b. Remove engine cowling and drain fuel strainer.
c. Disconnect flexible ducts from each side of intake airbox.
d. Disconnect carburetor heat control at arm on airbox. Remove clamp securing control to airbox.
e. Remove bolts and screws attaching airbox to carburetor and engine bracket.
f. Disconnect throttle and mixture controls from arms on carburetor. Note EXACT position, size and number of washers and spacers for reference on reinstallation.
g. Disconnect and plug fuel line at carburetor.
h. Remove nuts and washers attaching carburetor to intake manifold. Remove carburetor and mounting gasket.
i. Reverse the preceding steps for reinstallation. Use new gaskets when installing carburetor. Rig controls in accordance with paragraphs 11-58, 11-59 and 11-60. Check carburetor throttle arm to idle stop arm attachment for security and proper safetying at each normal engine inspection in accordance with figure 11-8.

11-42. IDLE SPEED AND MIXTURE ADJUSTMENT should be accomplished after the engine has been warmed up. Since idle RPM may be affected by idle mixture adjustment, it may be necessary to readjust idle RPM after setting the idle mixture correctly.

- a. Set the throttle stop screw to obtain between 575 and 600 RPM, with throttle control pulled full out against idle stop.

NOTE

Engine idle speed may vary among different engines. An engine should idle smoothly, without excessive vibration, and the idle speed should be high enough to maintain idling oil pressure and to preclude any possibility of engine stoppage in flight when the throttle is closed.

- b. Advance throttle to increase engine speed to 1000 RPM.
c. Pull mixture control knob slowly and steadily toward the idle cut-off position, observing tachometer, then return control full in position before engine stops.
d. Adjust mixture adjusting screw at upper end of carburetor intake throat to obtain a slight and momentary gain of 25 RPM maximum at 1000 RPM engine speed as mixture control is moved from full in toward idle cut-off position. Return control to full rich to prevent engine stoppage.
e. If mixture is set too LEAN, engine speed will drop immediately, thus requiring a richer mixture. Turn adjusting screw out (counterclockwise) for a richer mixture.
f. If mixture is set too RICH, engine speed will increase above 25 RPM, thus requiring a leaner mixture. Turn adjusting screw in (clockwise) for a leaner mixture.

NOTE

After each adjustment to the idle mixture, run engine up to approximately 2000 RPM to clear engine of excess fuel to obtain a correct idle speed.

11-43. INDUCTION AIR SYSTEM.

11-44. DESCRIPTION. Ram air to the engine enters the induction airbox through an opening in the forward part of the lower engine cowling nose cap. The air is filtered through a filter which is located at the opening in the nose cap. From the induction airbox the filtered air is directed to the inlet of the carburetor, mounted on the lower side of the engine, and through the carburetor, where fuel is mixed with the air, to the intake manifold. From the intake manifold, the fuel-air mixture is distributed to each cylinder by separate intake pipes. The intake pipes are attached to the intake manifold with hose and clamps and to the cylinder with a two bolt flange which is sealed with a gasket. The induction airbox contains a valve, operated by the carburetor heat control in the cabin, which permits air from an exhaust heated source to be selected in the event carburetor icing or filter icing should be encountered.

11-45. REMOVAL AND INSTALLATION.

a. Remove airbox and carburetor as outlined in paragraph 11-41.

b. Remove intake pipes by disconnecting hose and removing nuts and washers attaching pipes to cylinders.

c. Installation of the system is the reverse of the preceding steps. Use new gaskets at installation.

11-46. IGNITION SYSTEM.

11-47. DESCRIPTION. Sealed, lightweight Slick magnetos are used on the engine. Both magnetos are equipped with impulse couplings. The magnetos **MUST NOT BE DISASSEMBLED**. Internal timing is fixed and the breaker points are not adjustable. Timing marks are provided on the distributor gear and distributor block, visible through the air vent holes, for timing to the engine. A timing hole is provided in the bottom of the magneto adjacent to the magneto flange. A timing pin (or 0.093 inch 6-penny nail) can be inserted through this timing hole into the mating hole in the magneto rotor shaft to lock the magneto approximately in the proper firing position. Slick lightweight ignition harness is used with the lightweight magnetos. For ignition harness repair refer to the manufacturer's Service Manual.

WARNING

During all magneto maintenance, always take proper precautions to make sure the engine can not fire or start when the propeller is moved.

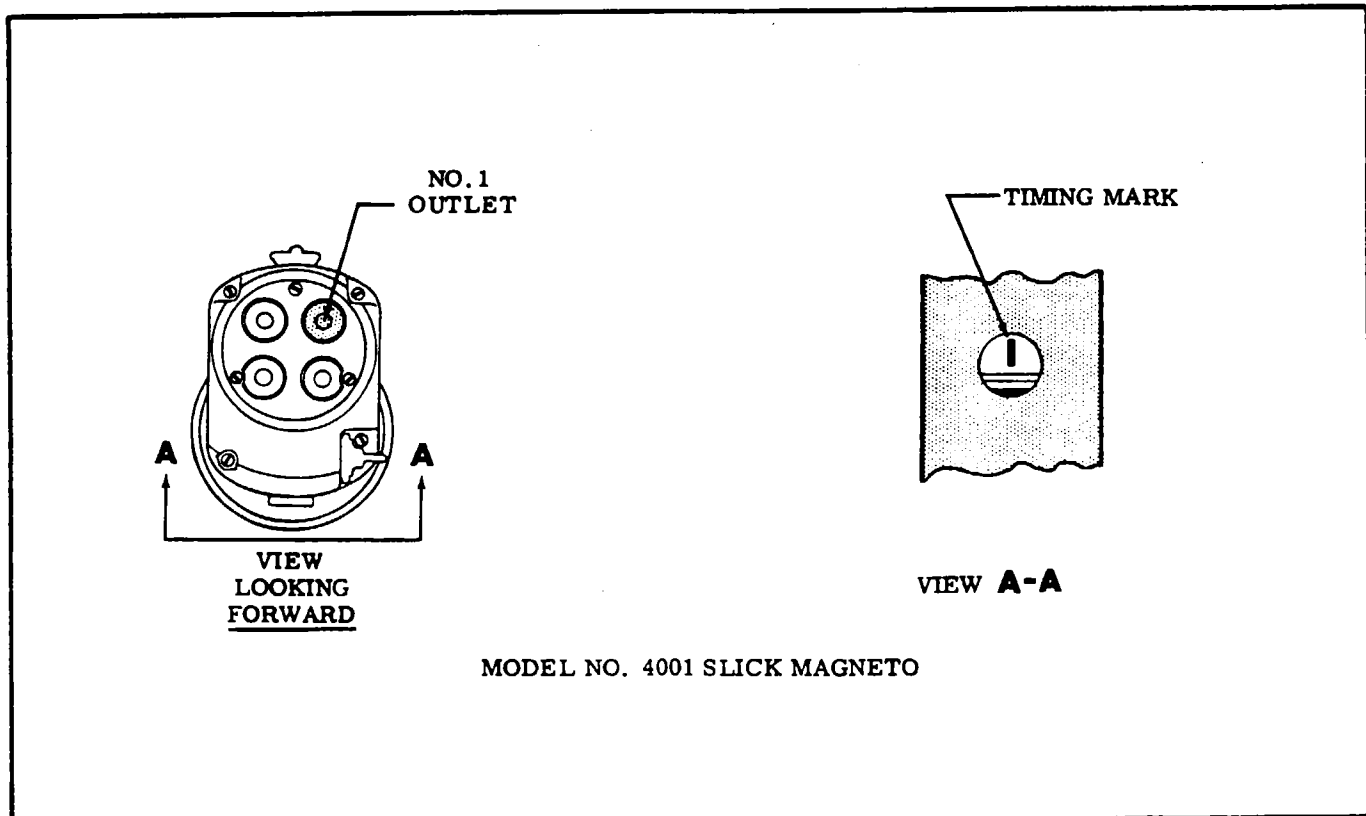


Figure 11-6. No. 1 Magneto Outlet

11-48. **MAGNETO REMOVAL.** Remove high-tension outlet plate, disconnect primary "p" lead, and remove nuts and washers securing magneto to the engine. Note the approximate angular position at which the magneto is installed, then remove magneto.

11-49. **INTERNAL TIMING.** Internal timing is accomplished during manufacture of the magneto. Since these magnetos are NOT TO BE DISASSEMBLED, there is no internal timing involved.

11-50. **REPLACEMENT INTERVAL.** These magnetos cannot be overhauled in the field. The coil, capacitor, and breaker assembly are non-replacable. As a good maintenance practice, and to have the benefit of good ignition at all times, it is recommended that the magnetos be removed at 900 hours of magneto time, and install new exchange magnetos.

11-51. **MAGNETO INSTALLATION AND TIMING TO ENGINE.** The magneto must be installed with its timing marks correctly aligned, with number one cylinder on its compression stroke, and with the number one piston at its advanced firing position. Refer to paragraph 11-8 for the advanced firing position of number one piston. To locate the compression stroke of the number one cylinder, remove the lower spark plug from number two, three, and four cylinder and remove the upper spark plug from number one cylinder. Place the thumb of one hand over the spark plug hole of number one cylinder and rotate crankshaft in the direction of normal rotation until the compression stroke is indicated by positive pressure inside the cylinder lifting the thumb off the spark plug hole. After the compression stroke is obtained, locate number one piston at its advanced firing position. Locating the advanced firing position of number one piston may be obtained by rotating the crankshaft opposite to its normal direction of rotation until it is approximately 30 degrees before top center (BTC) on the compression stroke of number one cylinder. Then, rotate crankshaft in normal direction of rotation to align the correct timing mark on the outer surface of the crankshaft flange, with the parting surface of the crankcase below the crankshaft as the reference point, making sure the final motion of the crankshaft is in the direction of normal rotation.

NOTE

Various other methods and equipment may be used to arrive at the number one piston advanced firing position. One such method is: An accurate top center indicator which screws into a spark plug mounting hole, and a pendulum pointer mounted on a 360-degree timing disc may be used. The timing disc should be adapted to fit over the end of the propeller spinner in such a manner that it may be rotated as necessary.

In all cases, it must be definitely determined that No. 1 cylinder is at the correct firing position, on its compression stroke, when the crankshaft is rotated in its normal direction of rotation.

After the engine has been placed to the correct firing position, install and time magneto to the engine in the following manner.

- a. Remove the timing (vent) plug from the bottom of the magneto. The vent plug in the top of the magneto need not be removed.
- b. Rotate magneto shaft until timing mark on rotor is visible through the vent plug hole. Impulse coupling pawls must be depressed to turn magneto shaft in normal direction of rotation.
- c. Establish that the magneto is at number one firing position. It is possible for the timing mark to be visible while firing position is 180 degrees from number one firing position.

NOTE

It is necessary to "spark" the magneto to establish the correct firing position. The outlet plate with spark plug leads must be installed on the magneto. Hold number one spark plug lead (see figure 11-6) close to magneto case, or ground the magneto and hold the number one spark plug lead close to a good ground. Rotate impulse coupling in normal direction of rotation until a spark occurs at this lead. (Impulse coupling pawls must be depressed to turn magneto shaft in normal direction of rotation.) Turn impulse coupling backward a few degrees, until timing marks on rotor is centered in vent plug hole and install timing pin (or 0.093 inch 6-penny nail) through hole in bottom of magneto next to the flange and into the mating hole in the rotor shaft. This locks the magneto approximately in firing position while installing it on the engine.

- d. Keep timing mark centered in vent plug hole during installation.
- e. Be sure magneto gaskets are in place and that engine is in correct firing position, then install magneto (s) at the angle noted during removal, tighten mounting nuts finger tight.

CAUTION

Remove timing pin from magneto, if installed. Be sure to remove this pin before rotating crankshaft.

- f. Connect one lead of timing light to the capacitor terminal at the rear of the magneto and ground lead of timing light to a good ground.
- g. Rotate propeller opposite to normal direction of rotation a few degrees (approximately 5 degrees) to close magneto contact points.

NOTE

Do not rotate propeller back far enough to engage impulse coupling, or propeller will have to be rotated in normal direction of rotation until impulse coupling releases, then backed up a few degrees before the firing position.

- h. Slowly advance propeller (tap forward with minute movements as firing position is approached)

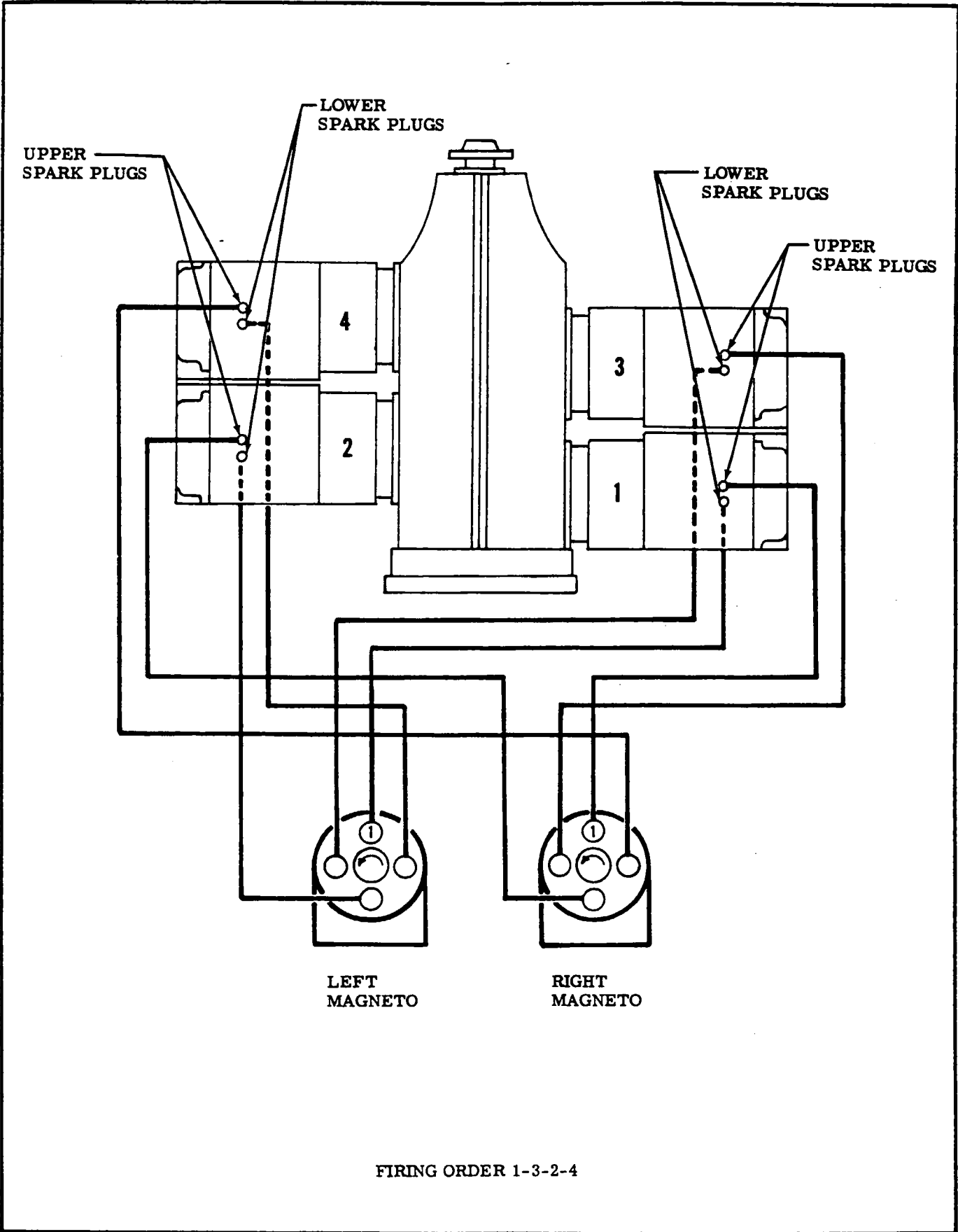


Figure 11-7. Ignition Schematic

in normal direction of rotation until timing light indicates position at which contact points break. The contact points should break at the advanced firing position of number one cylinder. Loosen mounting nuts slightly and rotate magneto case to make contact points break at the correct position. Tighten mounting nuts.

CAUTION

To prevent possible condenser damage, do not exceed 13 - 15 inch-pounds torque when tightening "p" lead nuts during installation of Slick magneto.

i. After tightening magneto mounting nuts, recheck timing. Make sure both magnetos are set to fire at the same time. Remove timing equipment and connect spark plug leads and ignition switch leads.

NOTE

Beginning with the number one outlet, the magneto fires at each successive outlet in a counterclockwise direction, looking at the outlets. Connect number one magneto outlet to number one cylinder spark plug lead, number two outlet to the next cylinder to fire, etc.. Engine firing order is listed in paragraph 11-8.

11-52. **MAGNETO CHECK.** Advanced timing settings in some cases, is the result of the erroneous practice of bumping magnetos up in timing in order to reduce RPM drop on single ignition. NEVER ADVANCE TIMING BEYOND SPECIFICATIONS IN ORDER TO REDUCE RPM DROP. Too much importance is being attached to RPM drop in single ignition. RPM drop on single ignition is a natural characteristic of dual ignition design. The purpose of the following magneto check is to determine that all cylinders are firing. If all cylinders are not firing, the engine will run extremely rough and cause for investigation will be quite apparent. The amount of RPM drop is not necessarily significant and will be influenced by ambient air temperature, humidity, airport altitude, etc. In fact, absence of RPM drop should be cause for suspicion that the magneto timing has been bumped up and is set in advance of the setting specified. Magneto checks should be performed on a comparative basis between individual right and left magneto performance.

a. Start and run engine until the oil and cylinder head temperatures are in the normal operating ranges.

b. Advance engine speed to 1700 RPM.

c. Turn the ignition switch to the "R" position and note the RPM drop, then return the switch to the "BOTH" position to clear the opposite set of plugs.

d. Turn the switch to the "L" position and note the RPM drop, then return the switch to the "BOTH" position.

e. The RPM drop should not exceed 150 RPM on either magneto or show greater than 75 RPM differential between magnetos. A smooth RPM drop-off past normal is usually a sign of a too lean or too rich mixture. A sharp RPM drop-off past normal is usually a sign of a fouled plug, a defective harness lead or out of time. If there is doubt concerning operation of the ignition system, RPM checks at a

leaner mixture setting or at higher engine speeds will usually confirm whether a deficiency exists.

NOTE

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system, a disconnected ground lead at magneto or possibly the magneto timing is set too far in advance.

11-53. **MAINTENANCE.** Magneto-to-engine timing should be checked at the first 50 hours, first 100 hours, and thereafter at each 200 hours. If timing to the engine is not within plus zero degrees and minus two degrees, the magneto should be timed to the engine.

NOTE

If ignition trouble should develop, spark plugs and ignition wiring should be checked first. If the trouble appears definitely to be associated with a magneto, the following may be used to help disclose the source of trouble.

a. Remove high-tension outlet plate and check distributor block for moisture.

b. If any moisture is evident, lightly wipe with a soft, dry, lint-free cloth. Reinstall outlet plate.

NOTE

Since these magnetos MUST NOT BE DISASSEMBLED, new magnetos should be installed if the moisture check does not remedy the trouble.

11-54. **SPARK PLUGS.** Two 18-mm spark plugs are installed in each cylinder and screw into helicoil type thread inserts. The spark plugs are shielded to prevent spark plug noise in the radio and the spark plugs have an internal resistor to provide longer terminal life. Spark plug life will vary with operating conditions. A spark plug that is kept clean and properly gapped will give better and longer service than one that is allowed to collect lead deposits and is improperly gapped. Refer to Continental Aircraft Engine Service Bulletins for correct spark plug and gap.

NOTE

Refer to Section 2 for inspection interval. At each inspection; remove, clean, inspect and regap all plugs. Install lower spark plugs in upper portion of cylinders and install upper spark plugs in lower portion of cylinders. Since deterioration of lower spark plugs is usually more rapid than that of the upper spark plugs, rotating helps prolong spark plug life.

11-55. **ENGINE CONTROLS.**

11-56. **DESCRIPTION.** The throttle, mixture and

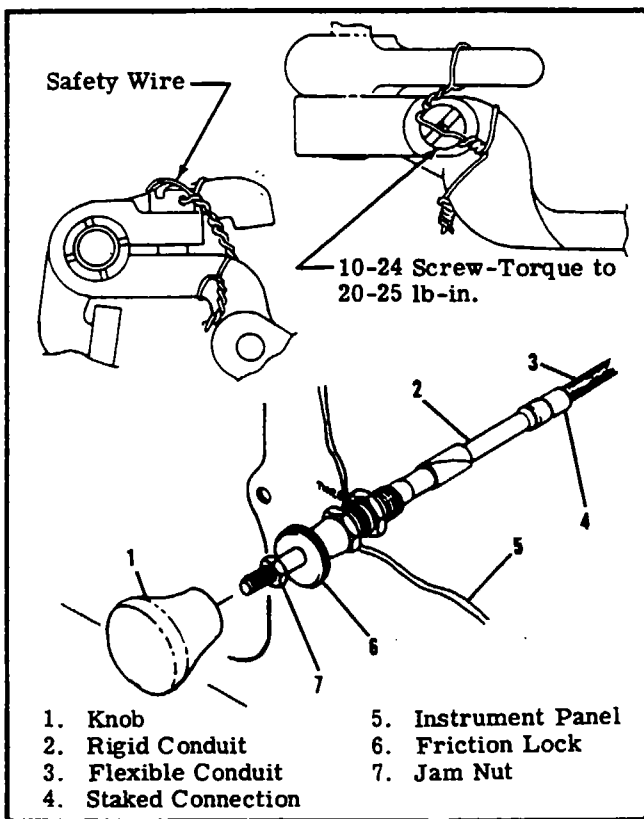


Figure 11-8. Throttle Control

carburetor heat controls are of the push-pull type. The mixture control is equipped to lock in any position desired. To move the control, the spring-loaded button, located in the end of the control knob, must be depressed. When the button is released, the control is locked. The mixture control also has a vernier adjustment. Turning the knob in either direction will change the control setting. The vernier is primarily for precision control setting. The throttle control has neither a locking button nor a vernier adjustment, but contains a knurled friction knob which is rotated for more or less friction as desired. The friction knob prevents vibration induced "creeping" of the control. The carburetor heat control has no locking device.

NOTE

Some controls have intricate parts that will fall out and possibly be lost if the control is pulled from housing while the control is disconnected.

11-57. RIGGING. When adjusting any engine control, it is important to check that the control slides smoothly throughout its full range of travel, that it locks securely if equipped with a locking device, and the arm or lever which it operates moves through its full arc of travel.

CAUTION

Whenever engine controls are being disconnected, pay particular attention to the exact position, size, and number of attaching washers and spacers. Be sure to install attaching parts as noted when connecting controls.

11-58. THROTTLE CONTROL.

NOTE

Before rigging throttle control shown in figure 11-8, check that staked connection between rigid conduit and flexible conduit is secure. If any indication of looseness or breakage is apparent, install new throttle control before continuing rigging procedure.

- a. Pull throttle control out (idle position) and remove throttle control knob.
- b. Screw jam nut all the way down (clockwise) and install throttle knob. Screw knob securely against the jam nut. Do not back jam nut out. This will prevent bottoming and possible damage to the staked connection.
- c. Disconnect throttle control at the carburetor throttle arm, push throttle control in until jam nut contacts friction lock. While the friction lock is loose, then pull control out approximately 1/8 inch for cushion. Note position of larger washer at carburetor end of control. Install washer in same position when connecting control to arm.
- d. Tighten friction lock, being careful not to change position of the throttle.
- e. Move throttle arm on the carburetor to full open, adjust rod end at end of throttle control to fit, and connect to arm on carburetor.
- f. Release friction lock and check full travel of arm on carburetor. If further adjustment is required, make all adjustments at the carburetor end of control. DO NOT change jam nut setting.
- g. Tighten rod end locknuts at carburetor end of control. Be sure to maintain sufficient thread engagement between rod end and control.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the throttle control.

11-59. MIXTURE CONTROL.

- a. Push mixture control full in (RICH), unlock then pull it out approximately 1/8 inch for cushion.
- b. Loosen clamp securing the control housing to the engine.
- c. Shift the control housing in the clamp so that the mixture arm on the carburetor is in full open (RICH). Tighten clamp in this position.

- d. Unlock and pull mixture control full out. Check that mixture arm on carburetor is full closed (IDLE CUT-OFF).
- e. Check that bolt and nut at the mixture arm on the carburetor secures the control wire and that the bolt will swivel in the arm.
- f. Bend control wire tip 90 degrees to prevent it from being withdrawn if the attaching nut should become loose.
- g. When installing a new control assembly, it may be necessary to shorten the wire and/or control housing.
- h. The mixture arm on the carburetor must contact the stops in each direction, and the control should have approximately 1/8 inch cushion when pushed full in (RICH).

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the mixture control.

11-60. CARBURETOR HEAT CONTROL.

- a. Loosen clamp securing the control to the bracket on the airbox.
- b. Push control full in, then pull it out approximately 1/8 inch from panel for cushion.
- c. Shift the control housing in its clamp so that the

valve lever is full forward, with valve seating inside airbox. Tighten clamp in this position.

- d. Pull out on the control and check that the air valve inside the airbox seats in the opposite direction.
- e. Check that bolt and nut on the air throttle lever secures the control wire and that the bolt will swivel in the lever.
- f. Bend the wire tip 90 degrees to prevent it from becoming withdrawn if the attaching nut should become loose.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the carburetor heat control.

11-61. STARTING SYSTEM.

11-62. DESCRIPTION. The automatically engaged starting system employs an electric starter motor mounted at the rear of the accessory housing. A starter solenoid is activated by the ignition key on the instrument panel. When the solenoid is activated, its contacts close and electrical current energizes the starter motor. Initial rotation of the starter motor engages the starter through an overrunning clutch in the starter adapter.

SHOP NOTES:

11-63. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
STARTER WILL NOT OPERATE.	Defective master switch or circuit.	Install new switch or wires.
	Defective starter switch or switch circuit.	Install new switch or wires.
	Defective starter motor.	Remove, repair or install new starter motor.
STARTER MOTOR RUNS, BUT DOES NOT TURN CRANK-SHAFT.	Defective overrunning clutch or drive.	Install new starter adapter.
	Starter motor shaft broken.	Install new starter motor.
STARTER MOTOR DRAGS.	Low battery.	Charge or install new battery.
	Starter switch or relay contacts burned or dirty.	Install serviceable unit.
	Defective starter motor power cable.	Install new cable.
	Loose or dirty connections.	Remove, clean and tighten all terminal connections.
	Defective starter motor.	Check starter motor brushes, brush spring tension, throw solder on brush cover. Repair or install new starter motor.
	Dirty or worn commutator.	Clean and turn commutator.

SHOP NOTES:

11-64. REMOVAL AND INSTALLATION.

- a. Remove cowling as required for access.

CAUTION

When disconnecting or connecting the starter cable, do not permit starter terminal bolt to rotate. Rotation of the terminal bolt could break the conductor between terminal and field coils causing the starter motor to be inoperative.

- b. Disconnect starter power cable at starter. Insulate terminal on power cable to prevent accidental shorting.
- c. Remove nuts attaching starter adapter to crankcase cover studs.
- d. Cut safety wire and remove two bolts threaded through crankcase into starter.
- e. Tap starter gently to loosen gasket and remove starter and adapter with a straight rearward movement.
- f. Clean any gasket which may be stuck to starter, starter adapter, or crankcase cover.
- g. When installing starter, work a non-hardening gasket paste into both sides of a new gasket, and position starter and adapter assembly against crankcase pad.
- h. Install washers and nuts on studs and install bolts through crankcase.

CAUTION

Tighten bolts and nuts evenly to prevent warping adapter cover.

- i. Install lock wire on bolt heads.
- j. Connect starter power cable to starter.

11-65. PRIMARY MAINTENANCE. The starting circuit should be inspected at regular intervals, the frequency of which should be determined by the amount of service and conditions under which the equipment is operated. Inspect the battery and wiring. Check battery for fully charged condition, proper electrolyte level with approved water and terminals for cleanliness. Inspect wiring to be that all connections are clean and tight and that the wiring insulation is sound. Check that the brushes slide freely in their holders and make full contact on the commutator. When brushes are worn to one-half of their original length, install new brushes (compare brushes with new brushes). Check the commutator for uneven wear, excessive glazing or evidence of excessive arcing. If the commutator is only slightly dirty, glazed, or discolored, it may be cleaned with a strip of No. 00 or No. 000 sandpaper. If the commutator is rough or worn, it should be turned in a lathe and the mica undercut. Inspect the armature shaft for rough bearing surfaces. New brushes should be properly seated when installing by wrapping a strip of No. 00 sandpaper around the commutator (with sanding side out) 1-1/4 to 1-1/2 times maximum. Drop brushes on sandpaper covered commutator and turn armature slowly in the direction of normal rotation. Clean sanding dust from motor after sanding operations.

11-66. EXHAUST SYSTEM.

11-67. DESCRIPTION. The exhaust system consists of a muffler for each bank of cylinders with an exhaust pipe from each cylinder to the muffler on that side of the engine. The muffler assemblies are enclosed in shrouds which captures ram air to be heated by the exhaust gases in the muffler. This heated air is used to heat the aircraft cabin and to furnish heated air for carburetor heat at the engine intake system. A tail pipe from each muffler routes exhaust gases overboard through the lower cowling.

11-68. REMOVAL.

- a. Remove engine cowling as required for access.
- b. Disconnect flexible ducts from shrouds on muffler assemblies.
- c. Disconnect braces from muffler and tail pipe assemblies.
- d. Remove nuts and washers securing the exhaust stack assemblies to the cylinders.
- e. Remove exhaust stack assembly.

11-69. INSPECTION. Inspection of the exhaust system shall be thorough because the cabin heating system uses air heated by the heat exchangers of the exhaust system. Since exhaust systems of this type are subject to burning, cracking, and general deterioration from alternate thermal stresses and vibration, inspection is very important and should be accomplished every 100-hours of operation. In addition, an inspection of the exhaust system shall be performed anytime exhaust fumes are detected in the cabin area.

- a. Remove engine cowling, and loosen or remove shrouds so that ALL surfaces of the exhaust system can be visually inspected. Especially check areas adjacent to welds. Look for exhaust gas deposits in surrounding areas, indicating that exhaust gas is escaping through a crack or hole.
- b. For a more thorough inspection, or if fumes have been detected in the cabin, the following inspection is recommended:
 1. Remove exhaust pipe and mufflers.
 2. Use rubber expansion plugs to seal openings.
 - e. Using a manometer or gage, apply approximately 1-1/2 psi (3 inches of mercury) air pressure while the muffler and each exhaust pipe is submerged in water. All leaks will appear as bubbles and can be readily detected.
 4. It is recommended that any exhaust pipe or muffler found defective be replaced with a new part before the next flight.
 - c. Install exhaust system.

11-70. INSTALLATION. Reverse procedure outlined in paragraph 11-68 to install exhaust system. Be sure there is one new copper-ashbestos gasket between each exhaust pipe and its mounting pad on the cylinder. Make sure clamps attaching mufflers to exhaust pipes are tight and all air ducts are installed.

11-71. EXTREME WEATHER MAINTENANCE.

11-72. COLD WEATHER. Cold weather starting is made easier with the installation of the engine primer system and ground service receptacle. The primer

system is a manually operated type. Fuel is supplied by a line from the fuel strainer to the plunger type primer. Operating the primer plunger in the cabin forces fuel to the engine. Fuel is delivered to the intake manifold above the carburetor, therefore, priming the intake manifold. Crushed or broken primer lines should be replaced with new parts. Primer lines should be properly clamped to prevent vibration and chafing. With the ground service receptacle installed, an external power source may be connected to assist in cold weather or low battery starting. Refer to paragraph 11-73 for use of the ground service receptacle.

The following may also be used to assist engine starting in extreme cold weather. After the last flight of the day, drain the engine oil into a clean container so the oil can be preheated. Cover the engine to prevent ice or snow from collecting inside the cowling. When preparing the aircraft for flight or engine run-up after these conditions have been followed, preheat the drained oil.

WARNING

Do not heat oil above 121°C (250°F). A flash fire may result. Before pulling the propeller through, ascertain that magneto switch is in OFF position to prevent the engine from firing.

After preheating the oil, gasoline may be mixed with the heated oil in a ratio of 1 part gasoline to 12 parts oil before pouring into the engine oil sump. If the free air temperature is below -29°C (-20°F), the engine compartment should be preheated with a ground heater. After the engine compartment has been preheated, inspect all engine drain and vent lines for presence of ice. After this procedure has been complied with, pull propeller through several revolutions by hand before starting the engine.

CAUTION

Due to the desludging effect of the diluted oil, engine operation should be observed closely during the initial warm up of the engine. Engines that have accumulated a considerable amount of operational hours since their last dilution period may be seriously affected by the dilution process. This is caused by the diluted oil dislodging sludge and carbon deposits within the engine. This residue will collect in the oil sump and possibly clog the screened inlet to the oil pump. Small deposits may enter the oil pump and be trapped by the pressure oil filter screen. Partial or, in some cases, complete loss of engine lubrication may result from either condition. If these conditions are anticipated after oil dilution, the engine should be operated for several minutes at normal operating temperatures and then stopped and inspected for evidence of sludge and carbon deposits in the oil sump and oil filter screen. Future occurrence of this condition can be prevented by diluting the oil prior to each oil change. This

will prevent the buildup accumulation of the sludge and carbon deposits within the engine.

11-73. **GROUND SERVICE RECEPTACLE.** With the ground service receptacle installed, the use of an external power source is recommended for cold weather and low battery starting and lengthy maintenance work on the aircraft electrical systems. The battery and external power circuits have been designed to completely eliminate the need to "jumper" across the battery contactors to close it. A special fused circuit in the external power system supplies the needed "jumper" across the contacts so that with a "dead" battery and an external power source applied, turning the master switch ON will close the battery contactor.

CAUTION

Be certain that the polarity of an external power source is correct (positive to positive and negative to negative). A polarity reversal will result in immediate damage to the electrical and electronic circuits of the aircraft.

11-74. **HOT WEATHER.** Engine mis-starts characterized by weak, intermittent explosions followed by puffs of black smoke from the exhaust are caused by over-priming or flooding. This situation is more apt to develop in hot weather or when the engine is hot. If it occurs, repeat the starting routine with the throttle approximately one-half OPEN, and the mixture control in IDLE CUT-OFF. As the engine fires, move the mixture control to full RICH and decrease the throttle setting to desired idling speed.

Engine mis-starts characterized by sufficient power to disengage the starter but dying after three to five revolutions are the result of an excessively lean mixture after the start. This can occur either in warm or cold temperatures. Repeat the starting routine with additional priming.

CAUTION

Never operate the starting motor more than 12 seconds at a time. Allow starter motor to cool between cranking periods to avoid overheating. Longer cranking periods will shorten the life of the starter.

11-75. **DUSTY CONDITIONS.** Dust inducted into the intake system of the engine is probably the greatest single cause of early engine wear. When operating under high dust conditions, the induction air filter should be serviced daily as outlined in Section 2.

11-76. **SEACOAST AND HUMID AREAS.** In salt water areas, special care should be taken to keep the engine and accessories clean to prevent oxidation. In humid areas, fuel and oil should be checked frequently and drained of condensed moisture.

11-77. **HAND CRANKING.** A normal hand-cranking procedure may be used to start the engine.

SECTION 12

FUEL SYSTEM

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12-1. FUEL SYSTEM.

12-2. DESCRIPTION. Fuel is gravity-fed from the metal wing tanks, through a shut-off valve and a fuel strainer, to the carburetor. Positive ventilation is provided by a vent line and check valve assembly located in the left wing tank and a crossover line connecting the two tanks together. The vent line from the check valve assembly extends overboard through the lower wing skin adjacent to the left wing strut. A fuel line drain is located between the shut-off valve and the strainer.

12-3. PRECAUTIONS.

NOTE

There are certain general precautions and rules concerning the fuel system which should be observed when performing the operations and procedures in this section. These are as follows:

a. During all fueling, defueling, tank purging, and tank repairing or disassembly, ground the aircraft

to a suitable ground stake.

b. Residual fuel draining from lines and hose constitutes a fire hazard. Use caution to prevent the accumulation of fuel when lines or hose are disconnected.

c. Cap open lines and cover connections to prevent thread damage and the entrance of foreign matter.

NOTE

Throughout the aircraft fuel system, from the tanks to the carburetor, use NS-40 (RAS-4) (Snap-On-Tools Corp., Kenosha, Wisconsin), MIL-T-5544 (Thread Compound Antiseize, Graphite Petrolatum), USP Petrolatum or engine oil as a thread lubricator or to seal a leaking connection. Apply sparingly to male threads only, omitting the first two threads, exercising extreme caution to avoid "stringing" sealer across the end of the fitting. Always ensure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system.

12-4. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
NO FUEL TO CARBURETOR.	Fuel shut-off valve not turned on.	Turn valve on. (Safety in ON position.)
	Fuel tanks empty.	Service with proper grade and amount of fuel.
	Fuel line disconnected or broken.	Connect or repair fuel lines.
	Inlet elbow or inlet screen in carburetor plugged.	Clean and/or replace.
	Fuel tank outlet strainers plugged.	Remove and clean strainers and flush out fuel tanks.
	Defective fuel shut-off valve.	Replace shut-off valve.
	Plugged fuel strainer.	Remove and clean strainer and screen.
	Fuel line plugged.	Clean out or replace fuel line.
FUEL STARVATION AFTER STARTING.	Partial fuel flow from the preceding causes.	Use the preceding remedies.
	Plugged fuel vent.	See paragraph 12-11.
	Water in fuel.	Drain fuel tank sumps, fuel lines and fuel strainer.
NO FUEL QUANTITY INDICATION.	Fuel tanks empty.	Service with proper grade and amount of fuel.
	Blown fuse.	Replace blown fuse.
	Loose connections or open circuit.	Tighten connections; repair or replace wiring. Refer to Section 20.
	Defective fuel quantity indicator or transmitter.	Refer to Section 15.
PRESSURIZED FUEL TANK	Plugged bleed hole in fuel vent.	Check per paragraph 12-11.

SHOP NOTES:

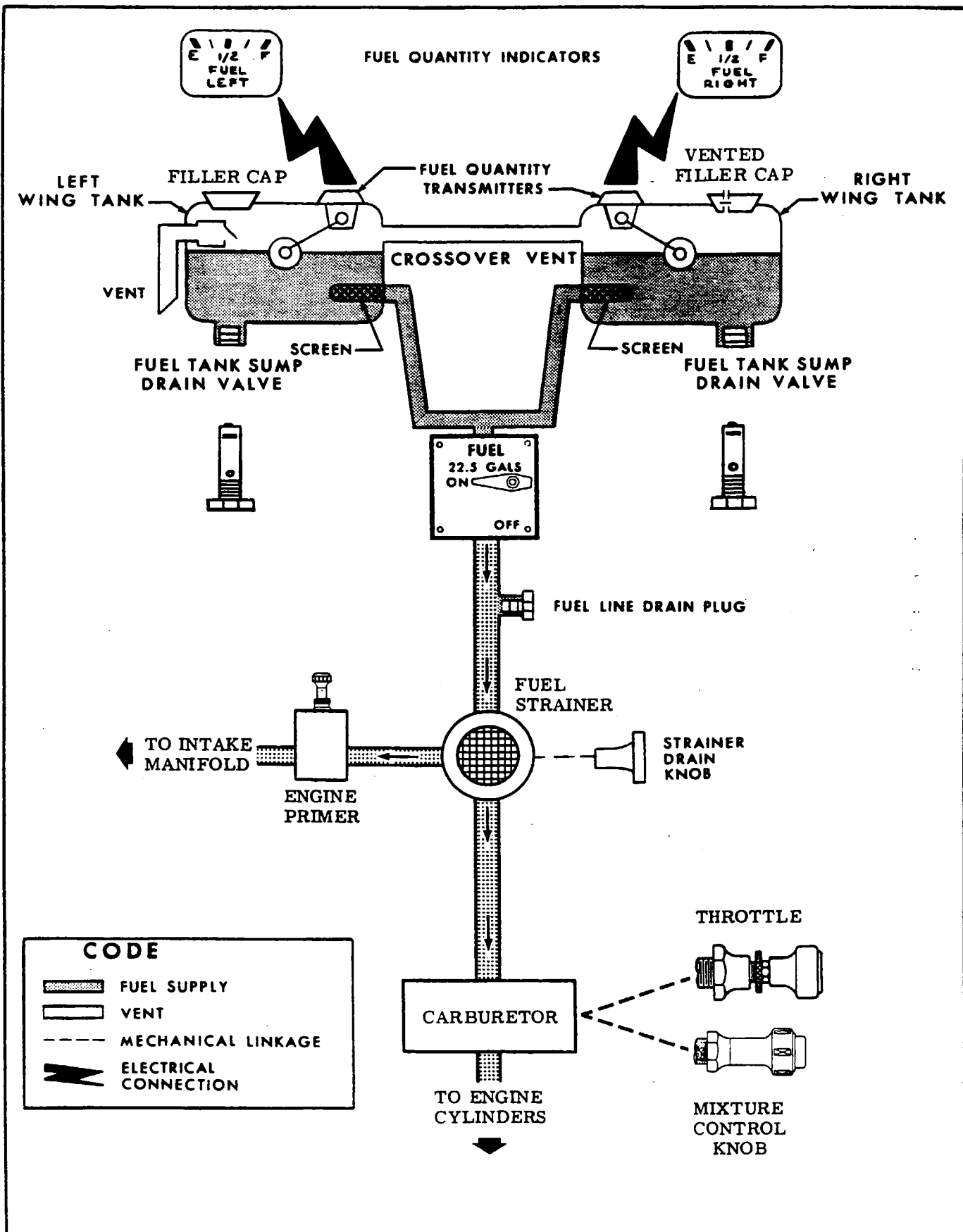


Figure 12-1. Fuel System Schematic

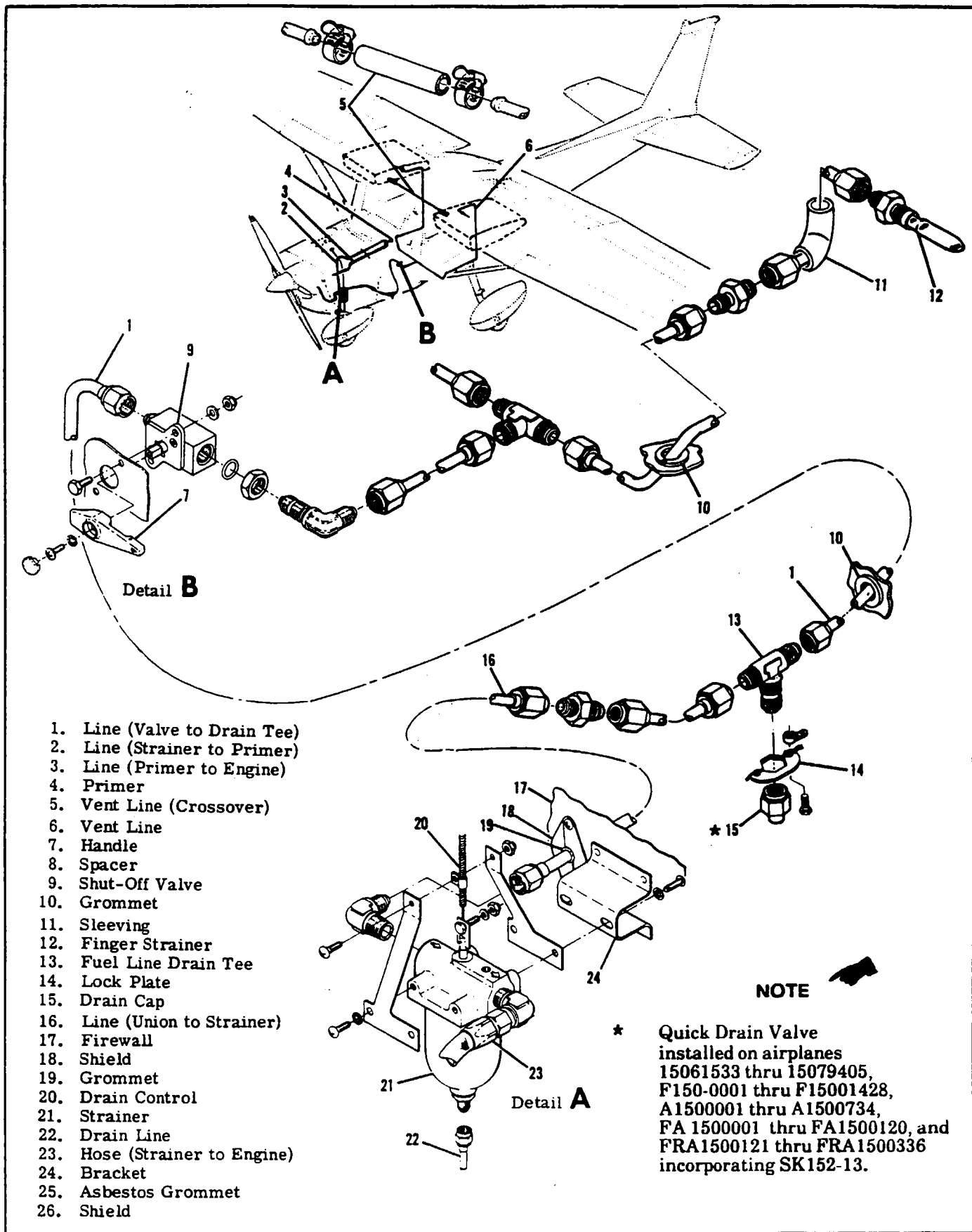
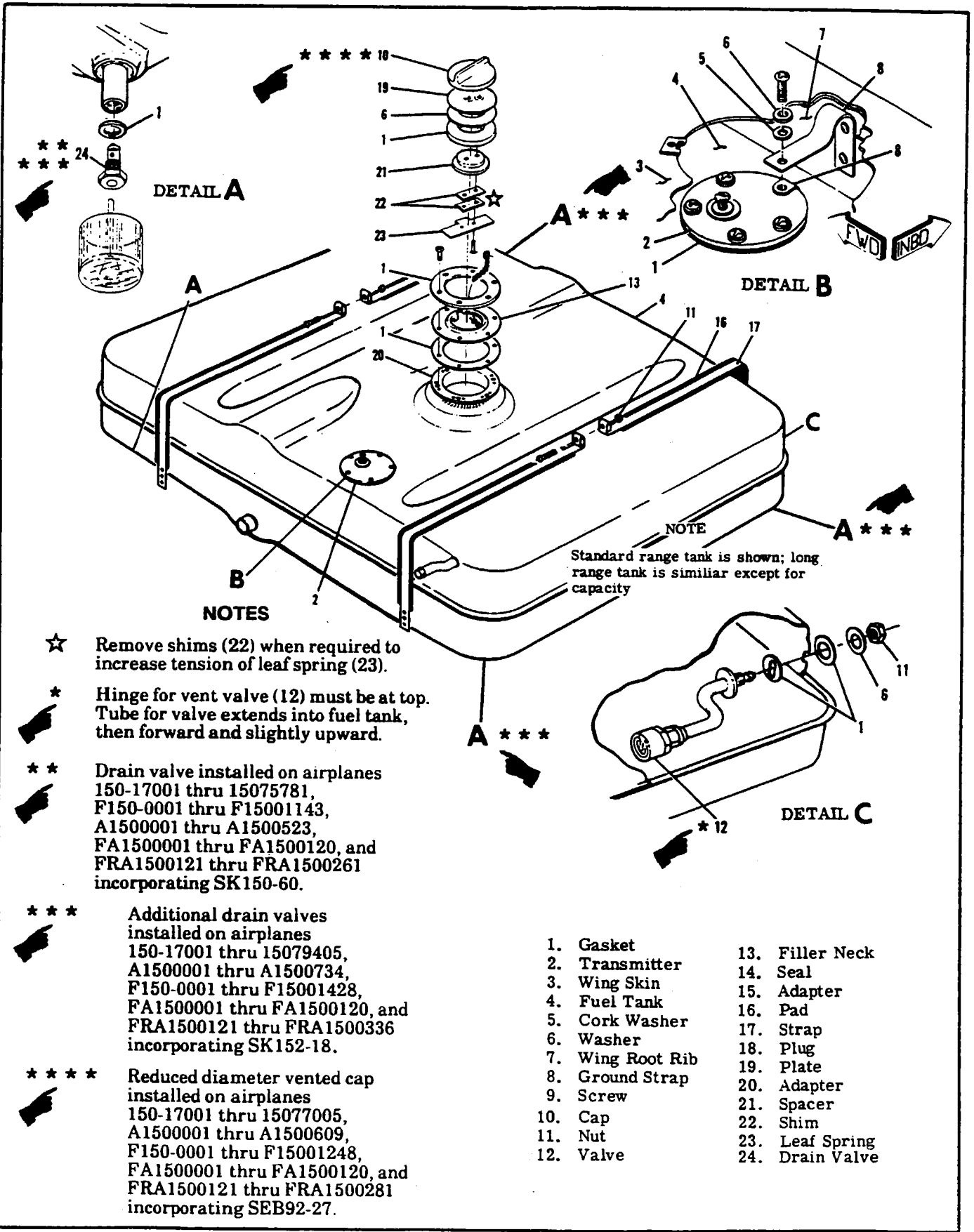


Figure 12-2. Fuel System



DETAIL A

DETAIL B

DETAIL C

NOTES

- ★ Remove shims (22) when required to increase tension of leaf spring (23).
- * Hinge for vent valve (12) must be at top. Tube for valve extends into fuel tank, then forward and slightly upward.
- ** Drain valve installed on airplanes 150-17001 thru 15075781, F150-0001 thru F15001143, A1500001 thru A1500523, FA1500001 thru FA1500120, and FRA1500121 thru FRA1500261 incorporating SK150-60.
- *** Additional drain valves installed on airplanes 150-17001 thru 15079405, A1500001 thru A1500734, F150-0001 thru F15001428, FA1500001 thru FA1500120, and FRA1500121 thru FRA1500336 incorporating SK152-18.
- **** Reduced diameter vented cap installed on airplanes 150-17001 thru 15077005, A1500001 thru A1500609, F150-0001 thru F15001248, FA1500001 thru FA1500120, and FRA1500121 thru FRA1500281 incorporating SEB92-27.

NOTE
Standard range tank is shown; long range tank is similar except for capacity

- | | |
|------------------|-----------------|
| 1. Gasket | 13. Filler Neck |
| 2. Transmitter | 14. Seal |
| 3. Wing Skin | 15. Adapter |
| 4. Fuel Tank | 16. Pad |
| 5. Cork Washer | 17. Strap |
| 6. Washer | 18. Plug |
| 7. Wing Root Rib | 19. Plate |
| 8. Ground Strap | 20. Adapter |
| 9. Screw | 21. Spacer |
| 10. Cap | 22. Shim |
| 11. Nut | 23. Leaf Spring |
| 12. Valve | 24. Drain Valve |

Figure 12-3. Fuel Tank

12-5. FUEL TANKS.

12-6. **DESCRIPTION.** A rigid metal tank is installed in the inboard panel of each wing. Sump drain plugs or valves, one in each tank, are provided for draining trapped water and sediment.

12-7. REMOVAL AND INSTALLATION.

a. Remove sump drain plug or valve and drain fuel from applicable tank. (Observe precautions outlined in paragraph 12-3.)

b. Remove fuel tank cover by removing attaching screws.

c. Remove wing root fairings.

d. Disconnect and plug or cap all fuel and vent lines from tank. Remove fittings as necessary for clearance when removing tank.

e. Disconnect electrical lead and ground strap from fuel quantity transmitter.

f. Disconnect straps securing fuel tank and remove tank. Use care to avoid damage to protruding fittings and hose connections when removing the tank.

g. To install tank, reverse the preceding steps. Be sure grounding is secure in accordance with figure 12-3.

12-8. **FUEL QUANTITY TRANSMITTERS.** Fuel quantity transmitters are installed in the top of fuel tanks. A complete description, along with procedures for removal, installation and adjustment are contained in Section 15.

12-9. FUEL VENTS.

12-10. **DESCRIPTION.** A vent line is installed in the outboard end of the left fuel tank and extends overboard down through the lower wing skin. The inboard end of the vent line extends into the fuel tank, then forward and slightly upward. A vent valve is installed on the inboard end of the vent line inside the fuel tank, and a crossover vent line connects the two tanks for positive ventilation.

12-11. **CHECKING.** Field experience has demonstrated that the fuel vent can become plugged, with possible fuel starvation of the engine or collapse of the fuel tanks. Also, the bleed hole in the vent valve assembly could possibly become plugged, allowing pressure from expanding fuel to pressurize the tanks. The following procedure may be used to check the vent and bleed hole in the valve assembly.

a. Attach a rubber tube to the end of vent line beneath the wing.

b. Blow into tube to slightly pressurize the tanks. If air can be blown into tanks, vent line is open.

c. After tank is slightly pressurized, insert end of rubber tube into a container of water and watch for a continuous stream of bubbles, which indicates the bleed hole in valve assembly is open and relieving pressure.

d. After completion of step "c", blow into tube again to slightly pressurize the tank, and loosen, but do not remove filler cap on opposite wing to check tank crossover line. If pressure escapes from filler cap, crossover line is open.

NOTE

Remember that a plugged vent line or bleed hole can cause either fuel starvation and collapsing of fuel tanks or the pressurization of tanks by fuel expansion.

e. Any fuel vent found plugged or restricted must be corrected prior to returning aircraft to service.

NOTE

The fuel vent line protruding beneath the wing near the wing strut must be correctly aligned to avoid possible icing of the vent tube. Dimensions are shown in figure 12-4.

12-12. **FUEL SHUT-OFF VALVE.** (See figure 12-2.)

12-13. **DESCRIPTION.** The fuel shut-off valve is a two-position ON-OFF valve, located in the floor area between the pilot and copilot positions. Thru 1972 Models, the handle is safetied to the lower mounting bolt. Beginning with 1973 Models, the handle is safetied to a bolt, located in the floorboard. The handle is safetied in the "ON" position with .018" diameter mild steel wire (tag wire), which will break easily if the handle must be turned OFF in an emergency. It is recommended that the valve be replaced and not repaired.

12-14. REMOVAL AND INSTALLATION.

a. Completely drain all fuel from wing tanks, fuel lines, strainer, and shut-off valve. (Observe the precautions in paragraph 12-3.)

b. Remove shut-off valve handle.

c. Remove copilot's seat and access plate under seat.

d. Disconnect and cap all fuel lines at shut-off valve.

e. Remove bolts attaching shut-off valve and remove valve.

f. Reverse the preceding steps for installation. Safety wire valve handle in "ON" position.

12-15. **FUEL STRAINER.** (See figure 12-5.)

12-16. **DESCRIPTION.** The fuel strainer is mounted at the firewall in the lower engine compartment. The strainer is equipped with a quick-drain valve which provides a means of draining trapped water and sediment from the fuel system. The quick-drain control is located adjacent to the oil dipstick and is accessible through the oil dipstick door.

NOTE

The fuel strainer can be disassembled, cleaned and reassembled without removing the assembly from the aircraft. (Refer to paragraph 1&-20.)

12-17. **DISASSEMBLY AND ASSEMBLY.** (See figure 12-5.)

a. Remove drain tube, safety wire, nut and washer at bottom of filter bowl, and remove bowl.

b. Carefully unscrew standpipe and remove.

c. Remove filter screen and gasket. Wash filter screen and bowl with solvent (Federal Specification

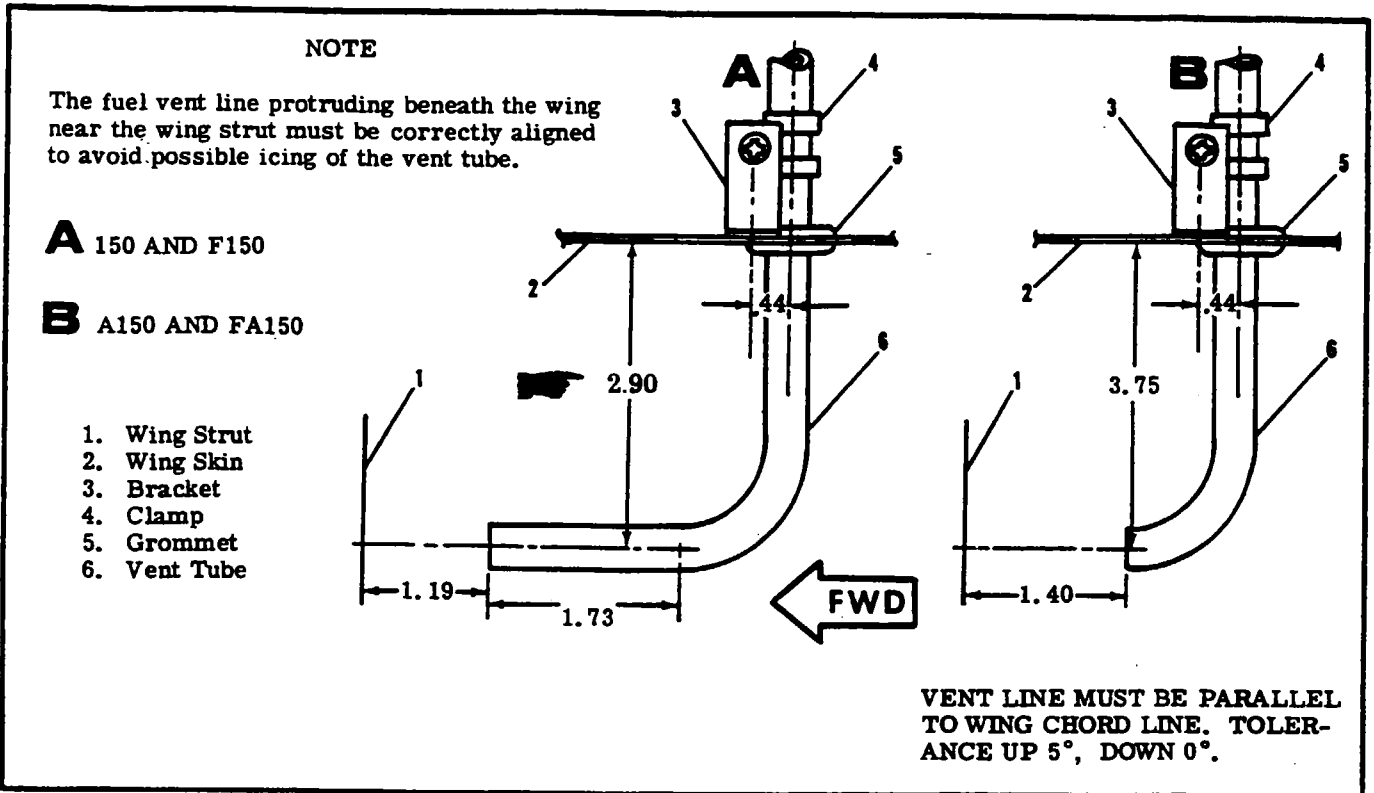


Figure 12-4. Fuel Vent Location

P-S-661, or equivalent) and dry with compressed air.

d. Using a new gasket between filter screen and top assembly, install screen and standpipe. Tighten standpipe only finger tight.

e. Using all new O-rings, install bowl. Note that step-washer at bottom of bowl is installed so that step seats against O-ring.

f. Turn shut-off valve to "ON" position, check for leaks and proper operation.

g. Torque bottom nut (15) to 25-30 lb-in., and safety wire to top assembly of strainer. Wire must have right-hand wrap, at least 45 degrees.

h. Connect drain tube.

12-18. PRIMING SYSTEM. (See figure 12-2.)

12-19. DESCRIPTION. The priming system is comprised of a manually-operated primer located on the instrument panel, and a line from the primer to the

intake manifold. Operation of the plunger forces fuel directly into the engine intake manifold.

12-20. REMOVAL AND INSTALLATION.

a. Disconnect and cap all lines at primer.

b. Unscrew knurled nut and remove plunger from pump body.

c. Remove pump body from instrument panel.

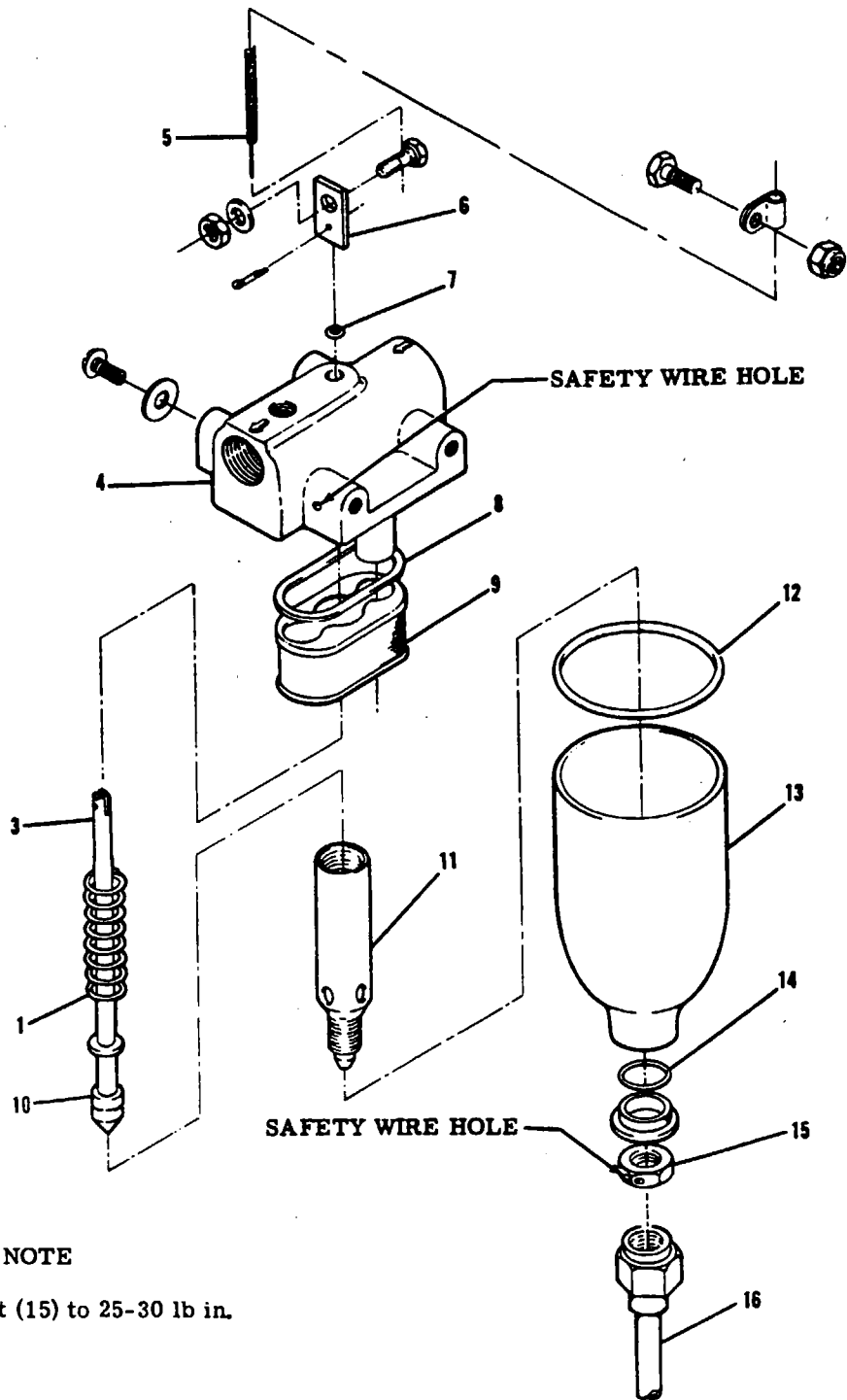
NOTE

Visually inspect primer lines for crushed, kinked, or broken condition. Ensure proper clamping to prevent fatigue due to vibration and chafing.

d. Prior to installing a primer, check for proper pumping action and positive fuel shut-off in the locked position.

e. Reverse preceding steps for installation.

SHOP NOTES:



NOTE

Torque nut (15) to 25-30 lb in.

- 1. Spring
- 2. Washer
- 3. Plunger
- 4. Top
- 5. Drain Control

- 6. Plate
- 7. O-Ring
- 8. Gasket
- 9. Filter
- 10. Collar
- 11. Standpipe

- 12. O-Ring
- 13. Bowl
- 14. O-Ring
- 15. Nut
- 16. Drain Line

Figure 12-5. Fuel Strainer

SECTION 13

PROPELLER

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13-1. PROPELLER.

13-2. DESCRIPTION. An all-metal, fixed-pitch propeller, equipped with a spinner, is used on the aircraft.

13-3. REPAIR. Repair of a metal propeller first involves evaluating the damage and determining whether the repair is to be a major or minor one. Federal Aviation Regulations, Part 43 (FAR 43), and Federal Aviation Agency Advisory Circular No. 43.13 (FAA AC No. 43.13), define major and minor repairs, alterations and who may accomplish them. When making repairs or alterations to a propeller, FAR 43, FAA AC No. 43.13 and the propeller manufacturer's instructions must be observed. The propeller manufacturer's Service Manual may be obtained from Cessna Parts Distribution Center (CPD 2)

13-4. REMOVAL. (Refer to figure 13-1.)

WARNING

Be sure magneto switch is in OFF position before turning propeller.

- a. Remove spinner (1).
- b. Remove safety wire from mounting bolt heads (3).
- c. Remove bolts and washers and remove forward bulkhead (5).

NOTE

The aft spinner bulkhead (7) is installed between propeller (6) and spacer (9), and is removed as the propeller is removed.

d. Using a punch through the holes in forward face of propeller, drive two dowel pins (8) aft to separate propeller and spacer, freeing aft spinner bulkhead.

13-5. INSTALLATION.

a. Clean mating surfaces of propeller, crankshaft flange and spinner bulkheads.

WARNING

Be sure magneto switch is in OFF position before turning crankshaft.

b. Position aft spinner bulkhead between propeller and spacer, and drive dowel pins into position to attach propeller, spacer and spinner bulkhead. Bulkhead must be positioned so that propeller blades emerge with ample clearance.

c. Locate top center of number one piston on its compression stroke. Align the top center mark on the crankshaft flange with parting surface of the crankcase below the crankshaft.

d. With propeller blades in vertical position, rotate blades 30 degrees clockwise (looking aft).

e. Install propeller on crankshaft flange.

f. Install forward spinner bulkhead, tighten bolts evenly and torque to 300-360 lb-in.

g. Safety wire propeller mounting bolts. Safety wire must be installed around bolt heads and not over bolt heads.

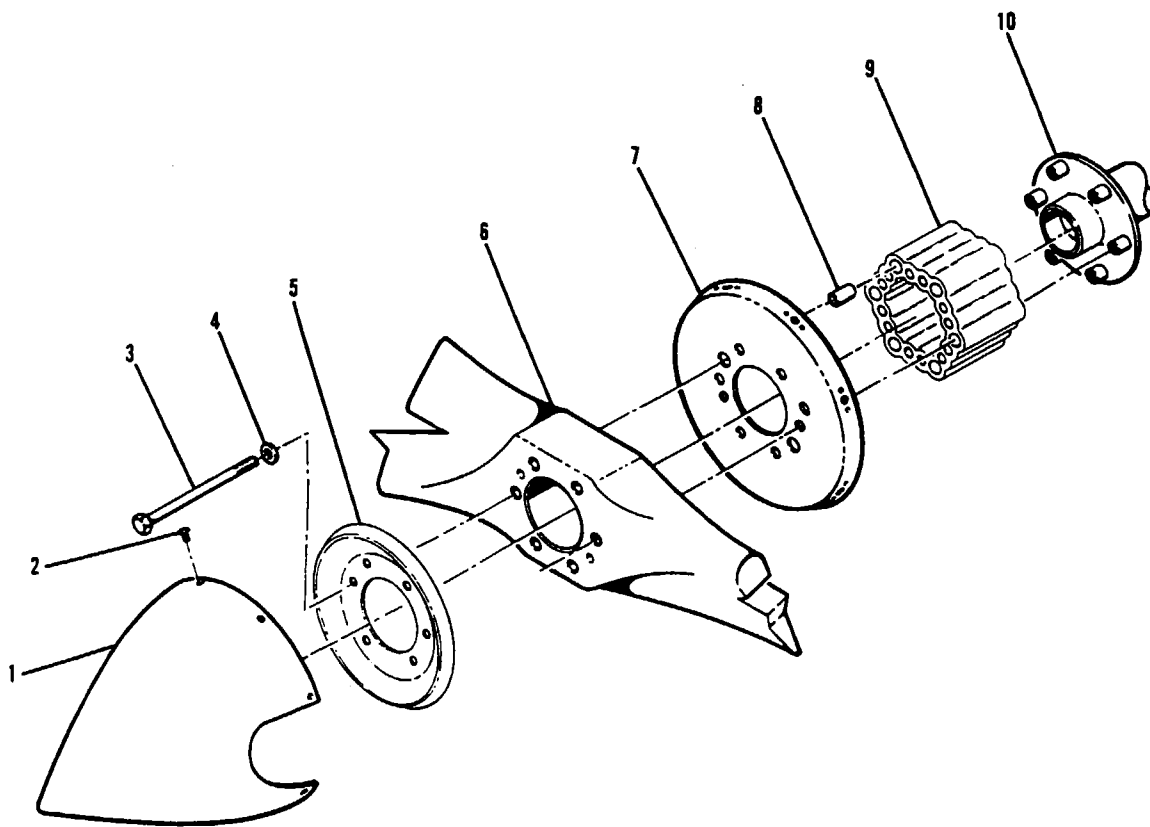
NOTE

Elimination of front bulkhead rotation within spinner will help prevent wearing or cracking of spinners and bulkheads. Apply a single wrap of double stick tape, stretched tightly to prevent wrinkles, around outer flange of front bulkhead before installing spinner to eliminate bulkhead rotation within spinner.

h. Install spinner.

**INSTALL PROPELLER TO TRAIL TOP DEAD
CENTER 30 DEGREES. TORQUE PROPELLER
MOUNTING BOLTS TO 300-360 POUND-INCHES.**

**SAFETY WIRE BOLTS. DO NOT ALLOW WIRE TO
CROSS OVER TOP OF BOLT HEAD. WIRE MUST
BE INSTALLED AROUND BOLT HEAD.**



1. Spinner
2. Screw
3. Bolt
4. Washer
5. Forward Spinner Bulkhead
6. Propeller
7. Rear Spinner Bulkhead
8. Dowel Pin
9. Spacer
10. Crankshaft

Figure 13-1. Propeller and Spinner Installation.

SECTION 14

UTILITY SYSTEMS

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14-1. UTILITY SYSTEMS.

14-2. HEATING SYSTEM.

14-3. DESCRIPTION. The heating system is comprised of the heat exchange section of the exhaust muffler, a shut-off valve, mounted on the right forward side of the firewall, a push-pull control on the instrument panel, outlets and flexible ducting connecting the system.

14-4. OPERATION. Ram air is ducted through an engine baffle inlet and heat exchange section of the exhaust muffler, to the shut-off valve at the firewall. The heated air flows from the shut-off valve into a duct across the aft side of the firewall, where it is distributed into the cabin. The shut-off valve, operated by a push-pull control marked "CABIN HT", located on the instrument panel, regulates the volume of heated air entering the system. Pulling the control full out, supplies maximum flow, and pushing the control in, gradually decreases flow, shutting off flow completely when the control is pushed full in.

14-5. TROUBLE SHOOTING. Most of the operational troubles in the heating, defrosting and ventilating systems are caused by sticking or binding air valves and their controls, damaged air ducting or defects in the exhaust muffler. In most cases, valves or controls

can be freed by proper lubrication. Damaged or broken parts must be repaired or replaced. When checking controls, ensure valves respond freely to control movement, that they move in the correct direction, and that they move through their full range of travel and seal properly. Check that hoses are properly secured, and replace hoses that are burned, frayed or crushed. If fumes are detected in the cabin, a thorough inspection of the exhaust system should be accomplished. Refer to applicable paragraph in Section 11 for this inspection. Since any holes or cracks may permit exhaust fumes to enter the cabin, replacement of defective parts is imperative because fumes constitute an extreme danger. Seal any gaps in shut-off valves at the firewall with Pro-Seal #700 (Coast Pro-Seal Co., Los Angeles, California) compound, or equivalent compound.

14-6. REMOVAL, REPAIR AND INSTALLATION. Figure 14-1 illustrates the heating, defrosting and ventilating systems, and may be used as a guide during removal, repair and installation of system components. Burned, frayed or crushed hose must be replaced with new hose, cut to length and installed in the original routing. Trim hose winding shorter than the hose to allow clamps to be fitted. Defective air valves must be repaired or replaced. Check for proper operation of valves and their controls after repair or replacement.

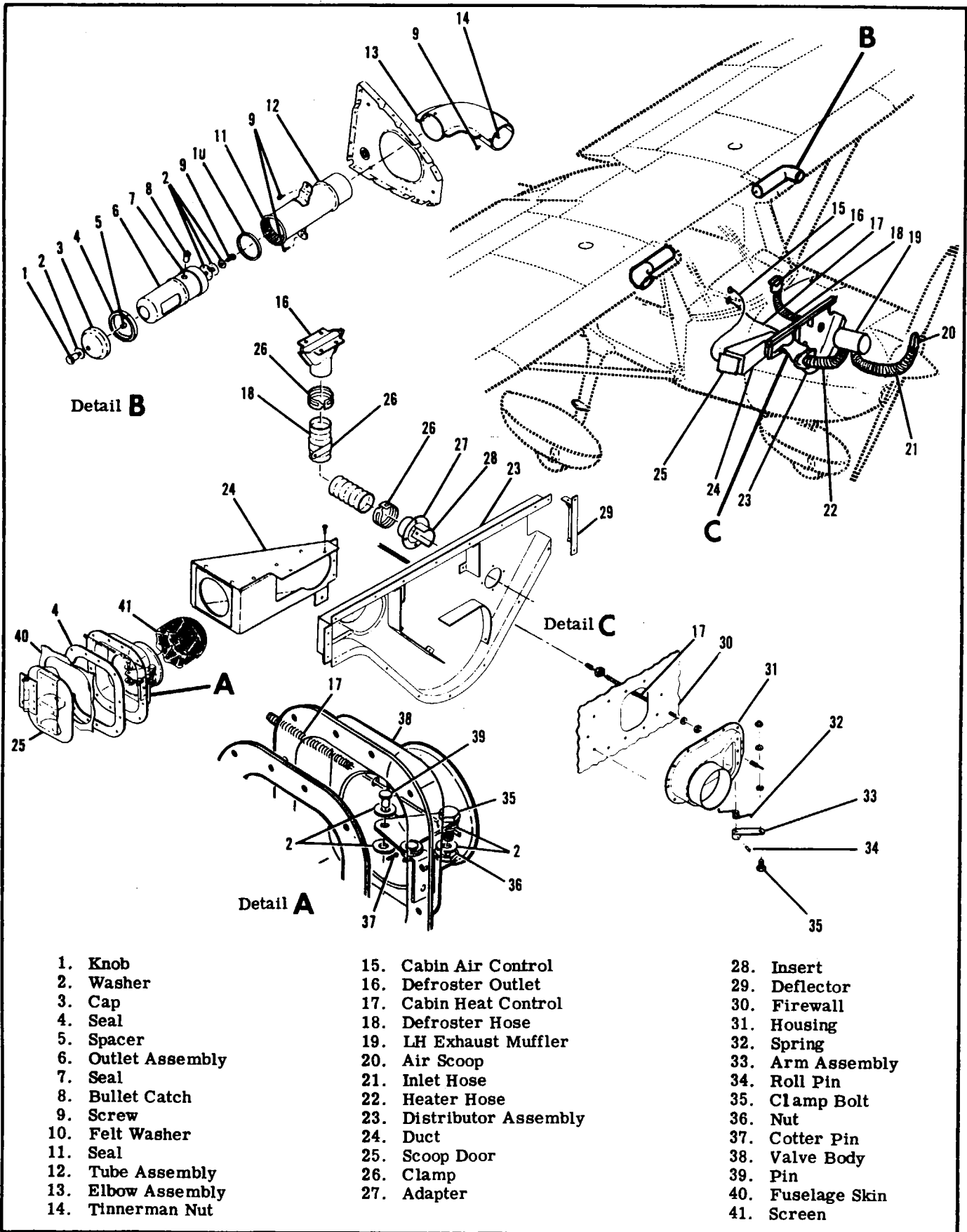


Figure 14-1. Heating, Defrosting, and Ventilating Systems

14-7. DEFROSTER SYSTEM.

14-8. DESCRIPTION. The defrosting system is comprised of the duct across the aft side of the firewall, a defroster outlet, mounted on the left side of the cowl deck, immediately aft of the windshield, and flexible ducting connecting the system.

14-9. OPERATION. Air from the duct across the aft side of the firewall flows through a flexible duct to the defroster outlet. The temperature and volume of this air is controlled by the settings of the heater system control.

14-10. TROUBLE SHOOTING. Since the defrosting system depends on proper operation of the heating system, refer to paragraph 14-5 for trouble shooting the heating and defrosting systems.

14-11. REMOVAL, REPAIR AND INSTALLATION. Figure 14-1 may be used as a guide for removal, repair and installation of defrosting system components. Cut hoses to length and install in the original routing. Trim hose winding shorter than the hose to allow clamps to be fitted. A defective defroster outlet must be repaired or replaced.

14-12. VENTILATING SYSTEM.

14-13. DESCRIPTION. The ventilating system is comprised of an airscoop mounted in the inboard leading edge of each wing, an adjustable ventilator mounted on each side of the cabin near the upper corners of the windshield, a fresh air scoop door mounted on the right side of the fuselage, a control knob on the instrument panel, and flexible ducting connecting the system.

14-14. OPERATION. Air received from scoops

mounted in the inboard leading edges of the wings is ducted to the adjustable ventilators mounted on each side of the cabin near the upper corners of the windshield. Forward cabin ventilation is provided by a fresh air scoop door, mounted on the right side of the fuselage, just forward of the copilot seat. The scoop door is operated by a control in the instrument panel marked "CABIN AIR." Fresh air from the scoop door is routed to the duct across the aft side of the firewall, where it is distributed into the cabin. As long as the "CABIN HT" control is pushed in, no heated air can enter the firewall duct; therefore, when the "CABIN AIR" control is pulled out, only fresh air from the scoop will flow through the duct into the cabin. As the "CABIN HT" control is gradually pulled out, more and more heated air will blend with the fresh air from the scoop and be distributed into the cabin. Either one, or both of the controls may be set at any position from full open to full closed.

14-15. TROUBLE SHOOTING. Most of the operational troubles in the ventilating system are caused by sticking or binding of the inlet scoop door or its control. Check filter element in the inlet scoop door. The element may be removed and cleaned or replaced. Since air passing through the filter is emitted into the cabin, do not use a cleaning solution which would contaminate cabin air. The filter may be removed to increase air flow. However, the removal will cause a slight increase in noise level.

14-16. REMOVAL, REPAIR AND INSTALLATION. Figure 14-1 may be used as a guide for removal, repair and installation of ventilating system components. A defective ventilator or scoop door must be repaired or replaced. Check for proper operation of ventilating controls after installation or repair.

SHOP NOTES:

SECTION 15

INSTRUMENTS AND INSTRUMENT SYSTEMS

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15-1. INSTRUMENTS AND INSTRUMENT SYSTEMS.

15-2. GENERAL. This section describes typical instrument installations and their respective operating systems. Emphasis is placed on trouble shooting and corrective measures only. It does NOT deal with specific instrument repairs since this usually requires special equipment and data and should be handled by instrument specialists. Federal Aviation Regulations require malfunctioning instruments be sent to an approved instrument overhaul and repair station or returned to manufacturer for servicing. Our concern here is with preventive maintenance on various instrument systems and correction of system faults which result in instrument malfunctions. The descriptive material, maintenance and trouble shooting

information in this section is intended to help the mechanic determine malfunctions and correct them, up to the defective instrument itself, at which point an instrument technician should be called in. Some instruments, such as fuel quantity and oil pressure gages, are so simple and inexpensive, repairs usually will be more costly than a new instrument. On the other hand, aneroid and gyro instruments usually are well worth repairing. The words "replace instrument" in the text, therefore, should be taken only in the sense of physical replacement in aircraft. Whether replacement is to be with a new instrument, an exchange one, or original instrument is to be repaired must be decided on basis of individual circumstances.

15-3. INSTRUMENT PANEL.

15-4. DESCRIPTION. The instrument panel assembly consists of a stationary and shock-mounted panel. The stationary panel contains fuel and engine instruments, which are NOT sensitive to vibration. The shock-mounted panel contains major flight instruments such as horizontal and directional gyros which ARE affected by vibration. Most of the instruments are screw-mounted on the panel backs.

15-5. REMOVAL AND INSTALLATION. (Refer to figure 15-1. The stationary panel is secured to engine stringers and a forward fuselage bulkhead and ordinarily is not considered removable. The shock-mounted panel is secured to stationary panel with rubber shock-mounted assemblies. To remove shock-mounted panel proceed as follows:

- a. Unscrew threaded buttons securing decorative cover to panel and remove cover.
- b. Remove nuts from shock-mounts, tag and disconnect instrument wiring and plumbing and pull panel straight back.
- c. Reverse preceding steps for installation. Ensure ground strap is properly installed.

15-6. SHOCK MOUNTS. Service life of instruments is directly related to adequate shock-mounting of panel. If removal of panel is necessary, check mounts for deterioration.

15-7. INSTRUMENTS.

15-8. REMOVAL. (Refer to figure 15-1.) Most instruments are secured to panel with screws inserted through panel face. To remove an instrument, remove decorative cover, disconnect wiring or plumbing to instrument, remove mounting screws and take instruments out from behind, or in some cases, from front of panel. Instrument clusters are installed as units and are secured by a screw at each end. A cluster must be removed from panel to replace an individual gage. In all cases when an instrument is removed, disconnected lines or wires should be protected. Cap open lines and cover pressure connections on instrument to prevent thread damage and entrance of foreign matter. Wire terminals should be insulated or tied up so accidental grounding or short-circuiting will not occur.

15-9. INSTALLATION. Generally, installation procedure is the reverse of removal procedure. Ensure mounting screw nuts are tightened firmly, but do not over-tighten, particularly on instruments having plastic cases. The same rule applies to connecting plumbing and wiring.

NOTE

All instruments (gages and indicators), requiring a thread seal or lubricant, shall be installed using teflon tape on male fittings only. This tape is available through Cessna Parts Distribution (CPD 2).

When replacing an electrical gage in an instrument cluster assembly, avoid bending pointer or dial

or back plate could change calibration of gages.

15-10. PITOT AND STATIC SYSTEMS.

15-11. DESCRIPTION. (Refer to figure 15-2.) The pitot system conveys ram air pressure to the airspeed indicator. The static system vents vertical speed indicator, altimeter and airspeed indicator to atmospheric pressure through plastic tubing connected to a static port. A static line sump is installed at source button to collect condensation in static system. A pitot tube heater may be installed. The heating element is controlled by a switch at instrument panel and powered by the electrical system.

15-12. MAINTENANCE. Proper maintenance of pitot and static system is essential for proper operation of altimeter, vertical speed and airspeed indicators. Leaks, moisture and obstructions in pitot system will result in false airspeed indications, while static system malfunctions will affect readings of all three instruments. Under instrument flight conditions, these instrument errors could be hazardous. Cleanliness and security are the principal rules for system maintenance. The pitot tube and static ports MUST be kept clean and unobstructed.

15-13. STATIC PRESSURE SYSTEM INSPECTION AND LEAKAGE TEST. The following procedure outlines inspection and testing of static pressure system, assuming altimeter has been tested and inspected in accordance with current Federal Aviation Regulations.

- a. Ensure static system is free from entrapped moisture and restrictions.
- b. Ensure no alterations or deformations of airframe surface have been made which would affect the relationship between air pressure in static pressure system and true ambient static air pressure for any flight configuration.
- c. Attach a source of suction to static pressure source opening. Figure 15-3 shows one method of obtaining suction.
- d. Slowly apply suction until altimeter indicates a 1000-foot increase in altitude.

CAUTION

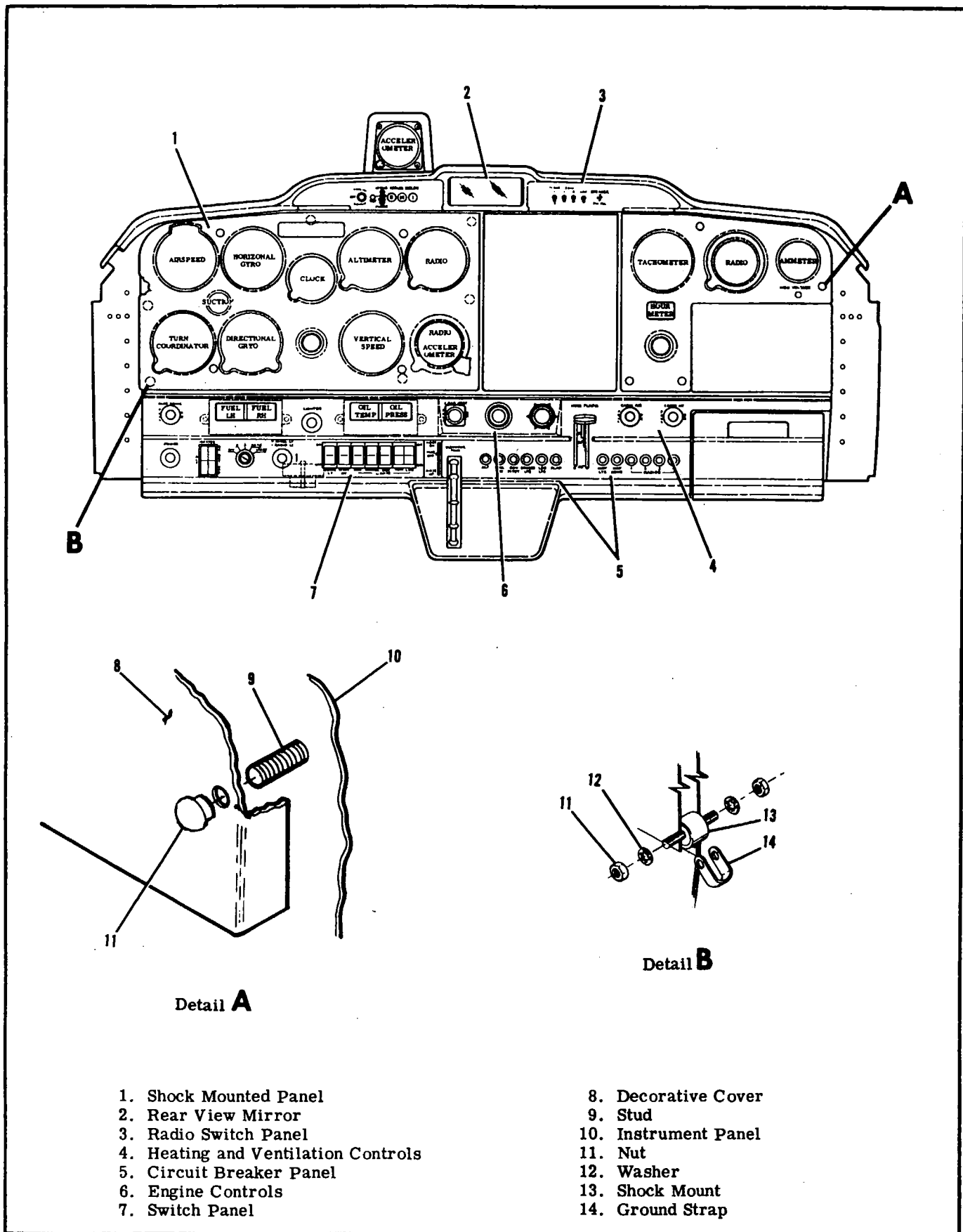
When applying or releasing suction, do not exceed range of vertical speed indicator or airspeed indicator.

- e. Cut off suction source to maintain a "closed" system for one minute. Leakage shall not exceed 100 feet of altitude loss as indicated on altimeter.
- f. If leakage rate is within tolerance, slowly release suction source.

NOTE

If leakage rate exceeds maximum allowable, first tighten all connections, then repeat leakage test. If leakage rate still exceeds maximum allowable, use following procedure.

- g. Disconnect static pressure lines from airspeed indicator and vertical speed indicator. Use suitable



- 1. Shock Mounted Panel
- 2. Rear View Mirror
- 3. Radio Switch Panel
- 4. Heating and Ventilation Controls
- 5. Circuit Breaker Panel
- 6. Engine Controls
- 7. Switch Panel

- 8. Decorative Cover
- 9. Stud
- 10. Instrument Panel
- 11. Nut
- 12. Washer
- 13. Shock Mount
- 14. Ground Strap

Figure 15-1. Typical Instrument Panel

fittings to connect lines together so altimeter is the only instrument still connected into static pressure system.

h. Repeat leakage test to check whether static pressure system or the bypassed instruments are cause of leakage. If instruments are at fault, they must be repaired by an "appropriately rated repair station" or replaced. If static pressure system is at fault, use following procedure to locate leakage.

i. Attach a source of positive pressure to static source opening. Figure 15-3 shows one method of obtaining positive pressure.

CAUTION

Do not apply positive pressure with airspeed indicator or vertical speed indicator connected to static pressure system.

j. Slowly apply positive pressure until altimeter indicates a 500-foot decrease in altitude and maintain this altimeter indication while checking for leaks. Coat line connections and static source flange with solution of mild soap and water, watching for bubbles to locate leaks.

k. Tighten leaking connections. Repair or replace parts found defective.

l. Reconnect airspeed and vertical speed indicators into static pressure system and repeat leakage test per steps "c" thru "f".

15-14. PITOT SYSTEM INSPECTION AND LEAKAGE TEST. To check pitot system for leaks, place a piece of tape over small hole in lower aft end of pitot tube, fasten a piece of rubber or plastic tubing over pitot tube, close opposite end of tubing and slowly roll up tube until airspeed indicator registers in cruise range. Secure tube and after a few minutes recheck airspeed indicator. Any leakage will have reduced the pressure in system, resulting in a lower airspeed indication. Slowly unroll tubing before removing it, so pressure is reduced gradually. Otherwise instrument may be damaged. If test reveals a leak in system, check all connections for tightness.

15-15. BLOWING OUT LINES. Although pitot system is designed to drain down to pitot tube opening, condensation may collect at other points in system and produce a partial obstruction. To clear line, disconnect at airspeed indicator. Using low pressure air, blow from indicator end of line toward pitot tube.

CAUTION

Never blow through pitot or static lines toward instruments.

Like pitot lines, static pressure lines must be kept clear and connections tight. All models have a static source sump which collects moisture and keeps system clear. However, when necessary, disconnect static line at first instrument to which it is connected, then blow line clear with low-pressure air. Check all static pressure line connections for tightness. If hose or hose connections are used, check for general condition and clamps for security. Replace hose which have cracked, hardened or show other signs of deterioration.

15-16. REMOVAL AND INSTALLATION OF COMPONENTS. (Refer to figure 15-2.) To remove pitot mast remove four mounting screws on side of connector (17) and pull mast out of connector far enough to disconnect pitot line (14). Electrical connections to heater assembly (if installed) may be disconnected through wing access opening just in-board of mast. Pitot and static lines are removed in the usual manner, after removing wing access plates, lower wing fairing strip and upholstery as required. Installation of tubing will be simpler if a guide wire is drawn in as tubing is removed from wing. The tubing may be removed intact by drawing it out through cabin and right door. When replacing fittings of pitot and static pressure lines, use anti-seize compound sparingly on male threads of both metal and plastic connections. Avoid excess compound which might enter lines. Tighten connections firmly, but avoid overtightening and distorting fittings. If twisting of plastic tubing is encountered when tightening fittings, VV-P-236 (USP Petrolatum), may be applied sparingly between tubing and fittings.

SHOP NOTES:

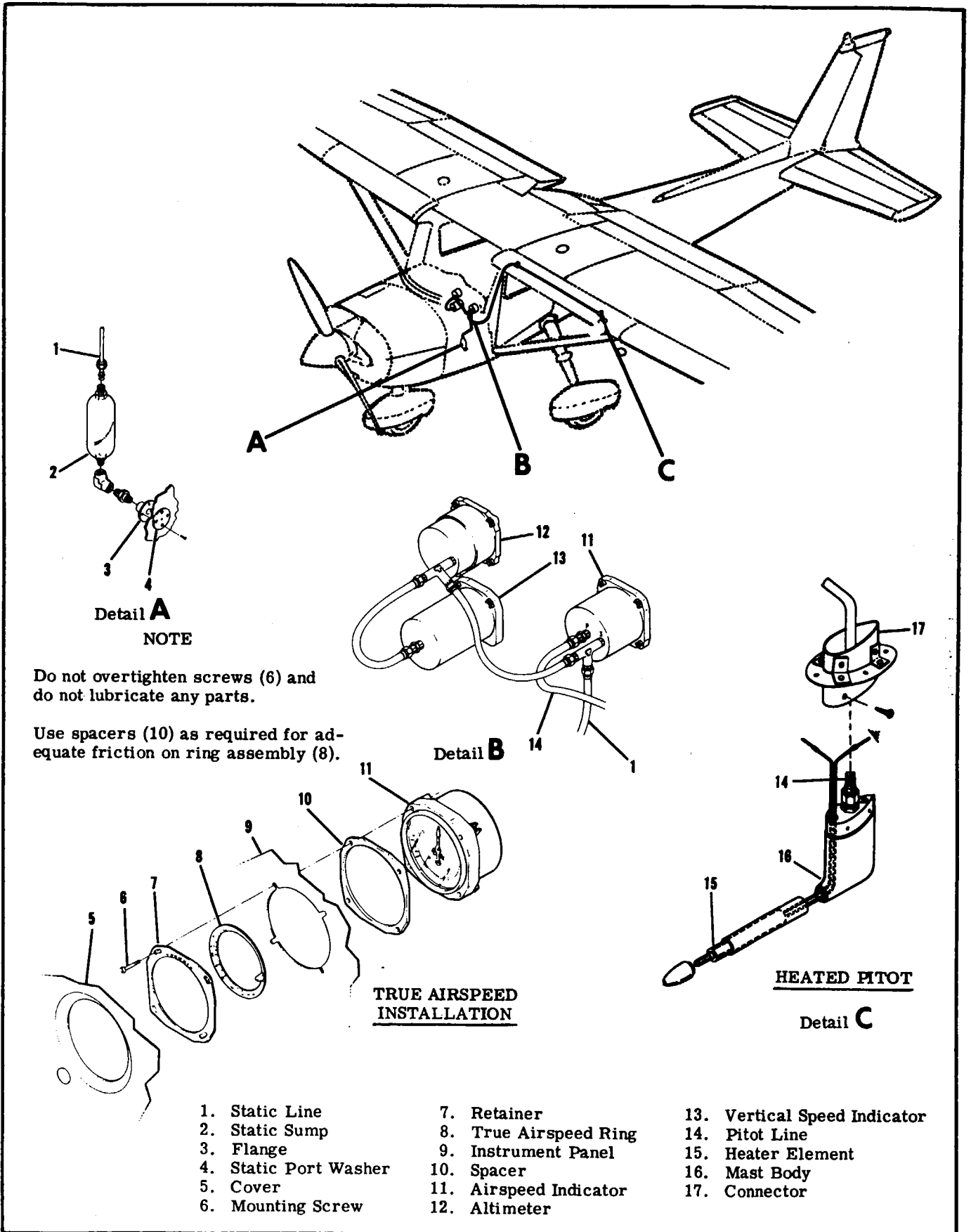


Figure 15-2. Pitot-Static Systems

15-17. TROUBLE SHOOTING--PITOT STATIC SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
LOW OR SLUGGISH AIRSPEED INDICATION. (Normal altimeter and vertical speed.)	Pitot tube obstructed, leak or obstruction in pitot line.	Test pitot tube and line for leaks or obstructions. Blow out tube and line, repair or replace damaged line.
INCORRECT OR SLUGGISH RESPONSE. (all three instruments.)	Leaks or obstruction in static line.	Test line for leaks and obstructions. Repair or replace line, blow out obstructed line.

15-18. TRUE AIRSPEED INDICATOR. A true airspeed indicator may be installed. This indicator, equipped with a conversion ring, may be rotated until pressure altitude is aligned with outside air temperature, then airspeed indicated on the instrument is read as true airspeed on the adjustable ring. Refer to figure 15-2 for removal and installation. Upon installa-

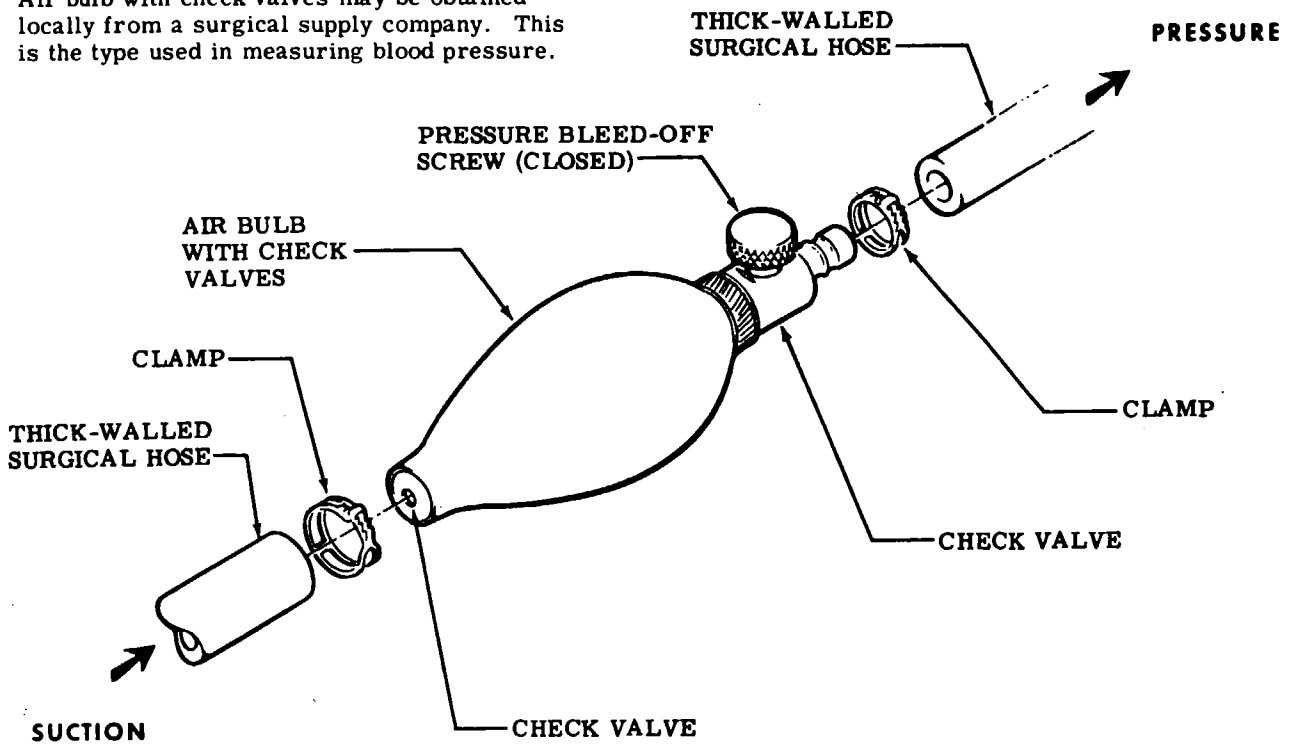
tion, before tightening mounting screws (6), calibrate instrument as follows: Rotate ring (8) until 105K on the adjustable ring aligns with 105K on the indicator. Holding this setting, move retainer (7) until 60°F aligns with zero pressure altitude, then tighten mounting screws (6) and replace decorative cover (5).

15-19. TROUBLE SHOOTING--AIRSPEED INDICATOR.

TROUBLE	PROBABLE CAUSE	REMEDY
HAND FAILS TO RESPOND.	Pitot pressure connection not properly connected to pressure line from pitot tube.	Test line and connection for leaks. Repair or replace damaged line, tighten connections.
	Pitot or static lines clogged.	Check line for obstructions. Blow out lines.
INCORRECT INDICATION OR HAND OSCILLATES.	Leak in pitot or static lines.	Test lines and connections for leaks. Repair or replace damaged lines, tighten connections.
	Defective mechanism or leaking diaphragm.	Substitute known-good indicator and check reading. Replace instrument.
HAND VIBRATES.	Excessive vibration.	Check panel shock mounts. Replace defective shock mounts.
	Excessive tubing vibration.	Check clamps and line connections for security. Tighten clamps and connections, replace tubing with flexible hose.

NOTE

Air bulb with check valves may be obtained locally from a surgical supply company. This is the type used in measuring blood pressure.



TO APPLY SUCTION:

1. Squeeze air bulb to expel as much air as possible.
2. Hold suction hose firmly against static pressure source opening.
3. Slowly release air bulb to obtain desired suction, then pinch hose shut tightly to trap suction in system.
4. After leak test, release suction slowly by intermittently allowing a small amount of air to enter static system. To do this, tilt end of suction hose away from opening, then immediately tilt it back against opening. Wait until vertical speed indicator approaches zero, then repeat. Continue to admit this small amount of air intermittently until all suction is released, then remove test equipment.

TO APPLY PRESSURE:

CAUTION

Do not apply positive pressure with airspeed indicator or vertical speed indicator connected into static system.

1. Hold pressure hose firmly against static pressure source opening.
2. Slowly squeeze air bulb to apply desired pressure to static system. Desired pressure may be maintained by repeatedly squeezing bulb to replace any air escaping through leaks.
3. Release pressure by slowly opening pressure bleed-off screw, then remove test equipment.

Figure 15-3. Static Test Equipment

15-20. TROUBLE SHOOTING--ALTIMETER

TROUBLE	PROBABLE CAUSE	REMEDY
INSTRUMENT FAILS TO OPERATE.	Static line plugged.	Check line for obstructions. Blow out lines.
	Defective mechanism.	Substitute known-good altimeter and check reading. Replace instrument.
INCORRECT INDICATION.	Hands not carefully set.	Reset hands with knob.
	Leaking diaphragm.	Substitute known-good altimeter and check reading. Replace instrument.
	Pointers out of calibration.	Compare reading with known-good altimeter. Replace instrument.
HAND OSCILLATES.	Static pressure irregular.	Check lines for obstruction or leaks. Blow out lines, tighten connections.
	Leak in airspeed or vertical speed indicator installations.	Check other instruments and system plumbing for leaks. Blow out lines, tighten connections.

15-21. TROUBLE SHOOTING--VERTICAL SPEED INDICATOR.

TROUBLE	PROBABLE CAUSE	REMEDY
INSTRUMENT FAILS TO OPERATE.	Static line plugged.	Check line for obstructions. Blow out lines.
	Static line broken.	Check line for damage, connections for security. Repair or replace damaged line, tighten connections.
INCORRECT INDICATION.	Partially plugged static line.	Check line for obstructions. Blow out lines.
	Ruptured diaphragm.	Substitute known-good indicator and check reading. Replace instrument.
	Pointer off zero.	Reset pointer to zero. Reset pointer to zero.
POINTER OSCILLATES.	Partially plugged static line.	Check line for obstructions. Blow out lines.

15-21. TROUBLE SHOOTING--VERTICAL SPEED INDICATOR. (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
POINTER OSCILLATES. (cont).	Leak in static line.	Test lines and connections for leaks. Repair or replace damaged lines, tighten connections.
	Leak in instrument case.	Substitute known-good indicator and check reading. Replace instrument.
HAND VIBRATES.	Excessive vibration.	Check shock mounts. Replace defective shock mounts.
	Defective diaphragm.	Substitute known-good indicator and check for vibration. Replace instrument.

15-22. TROUBLE SHOOTING--PITOT TUBE HEATER.

TROUBLE	PROBABLE CAUSE	REMEDY
TUBE DOES NOT HEAT OR CLEAR ICE.	Switch turned "OFF."	Turn switch "ON."
	Blown fuse.	Check fuse. Replace fuse.
	Break in wiring.	Test for open circuit. Repair wiring.
	Heating element burned out.	Check resistance of heating element. Replace element.

15-23. VACUUM SYSTEM.

15-24. DESCRIPTION. Suction to operate the gyros is provided by a dry-type engine-driven vacuum pump, gear-driven through a spline-type coupling. A suction relief valve, to control system pressure, is connected between the pump inlet and the instruments. In the cabin, the vacuum line is routed from gyro instruments to the relief valve at the firewall. A throw away type central air filter is utilized. The unit is installed with sta-straps for quick change capability. The reading of the suction gage indicates net difference in suction before and after air passes through a gyro. This differential pressure will gradually decrease as the central air filter becomes dirty, causing a lower reading on the suction gage.

15-25. TROUBLE SHOOTING.

NOTE

The Airborne Vacuum System Test Kit, Part No. 343, is available from Cessna Parts Distribution (CPD 2). This kit comes with regulators, ejector, gages, fittings, and instructions to help field maintenance personnel pin-point vacuum system malfunctions.

15-26. TROUBLE SHOOTING--VACUUM SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
NO VACUUM.	Defective pump or suction gage. Stuck relief valve. Plugged hose or line.	Replace pump or suction gage. Adjust or replace relief valve. Locate and remove plugged substance from hose or line.
LOW SUCTION GAGE READINGS.	Leaks or restrictions between instruments and relief valve, relief valve out of adjustment, or defective pump.	Check lines for leaks, disconnect and test pump. Repair or replace lines, adjust or replace relief valve, repair or replace pump.
	Central air filter dirty.	Check filter. Clean or replace filter.
SUCTION GAGE FLUCTUATES.	Defective gage or sticking relief valve. Panel or plumbing vibration.	Check suction with test gage. Replace gage. Clean sticking valve with Stoddard solvent. Blow dry and test. If valve sticks after cleaning, replace valve. Eliminate vibration.
GYRO GAGE FOLLOWS ENGINE RPM.	Blocked relief valve seat area. Defective relief valve.	Remove adjustment screw on relief valve and use clean shop air to blow seat area off. Readjust and/or replace relief valve.
HIGH SUCTION GAGE READINGS.	Gyros function normally, relief valve screen clogged. Relief valve malfunction.	Check screen, then valve. Compare gage readings with new gage. Clean screen, reset valve. Replace gage.
NORMAL SUCTION GAGE READING, SLUGGISH OR ERRATIC GYRO RESPONSE.	Instrument air filters clogged.	Check filter. Clean or replace filter.
ONE OR MORE GYROS WILL NOT OPERATE.	Defective gyro or clogged air filters or hoses.	Replace gyro, air filter, or hose. Clear plugged substances from air filter or hose.
FREQUENT VACUUM PUMP REPLACEMENT.	Incorrect pump for application. Kinked or plugged line, hose, or filter. Vacuum pressure misset. Deice control malfunction. Defective gyro or clogged air filters or hoses.	Replace with correct pump. Remove line, hose, or filter obstruction. Reset vacuum pressure or deice control valve.

15-26. TROUBLE SHOOTING--GYROS.

TROUBLE	PROBABLE CAUSE	REMEDY
HORIZON BAR FAILS TO RESPOND.	Central filter dirty.	Check filter. Clean or replace filter.
	Suction relief valve improperly adjusted.	Adjust or replace relief valve.
	Faulty suction gage.	Substitute known-good suction gage and check gyro response. Replace suction gage.
	Vacuum pump failure.	Check lump. Replace pump.
	Vacuum line kinked or leaking.	Check lines for damage and leaks. Repair or replace damaged lines, tighten connections.
HORIZON BAR DOES NOT SETTLE.	Defective mechanism.	Substitute known-good gyro and check indication. Replace instrument.
	Insufficient vacuum or leaking gyro.	Adjust or replace relief valve. Tape seal horizon gyro case.
	Excessive vibration.	Check panel shock-mounts. Replace defective shock-mounts.

15-26. TROUBLE SHOOTING--GYROS. (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
HORIZON BAR OSCILLATES OR VIBRATES EXCESSIVELY.	Central filter dirty.	Check filter. Clean or replace filter.
	Suction relief valve improperly adjusted.	Adjust or replace relief valve.
	Faulty suction gage.	Substitute known-good suction gage and check gyro indication. Replace suction gage.
	Defective mechanism.	Substitute known-good gyro and check indication. Replace instrument.
	Excessive vibration.	Check panel shock-mounts. Replace defective shock-mounts.
EXCESSIVE DRIFT IN EITHER DIRECTION.	Central air filter dirty.	Check filter. Clean or replace filter.
	Low vacuum, relief valve improperly adjusted.	Adjust or replace relief valve.
	Faulty suction gage.	Substitute known-good suction gage and check gyro indication. Replace suction gage.
	Vacuum pump failure.	Check pump. Replace pump.
	Vacuum line kinked or leaking.	Check lines for damage and leaks. Repair or replace damaged lines, tighten connections.
DIAL SPINS IN ONE DIRECTION CONTINUOUSLY.	Operating limits have been exceeded.	Replace instrument.
	Defective mechanism.	Substitute known-good gyro and check indication. Replace instrument.

SHOP NOTES:

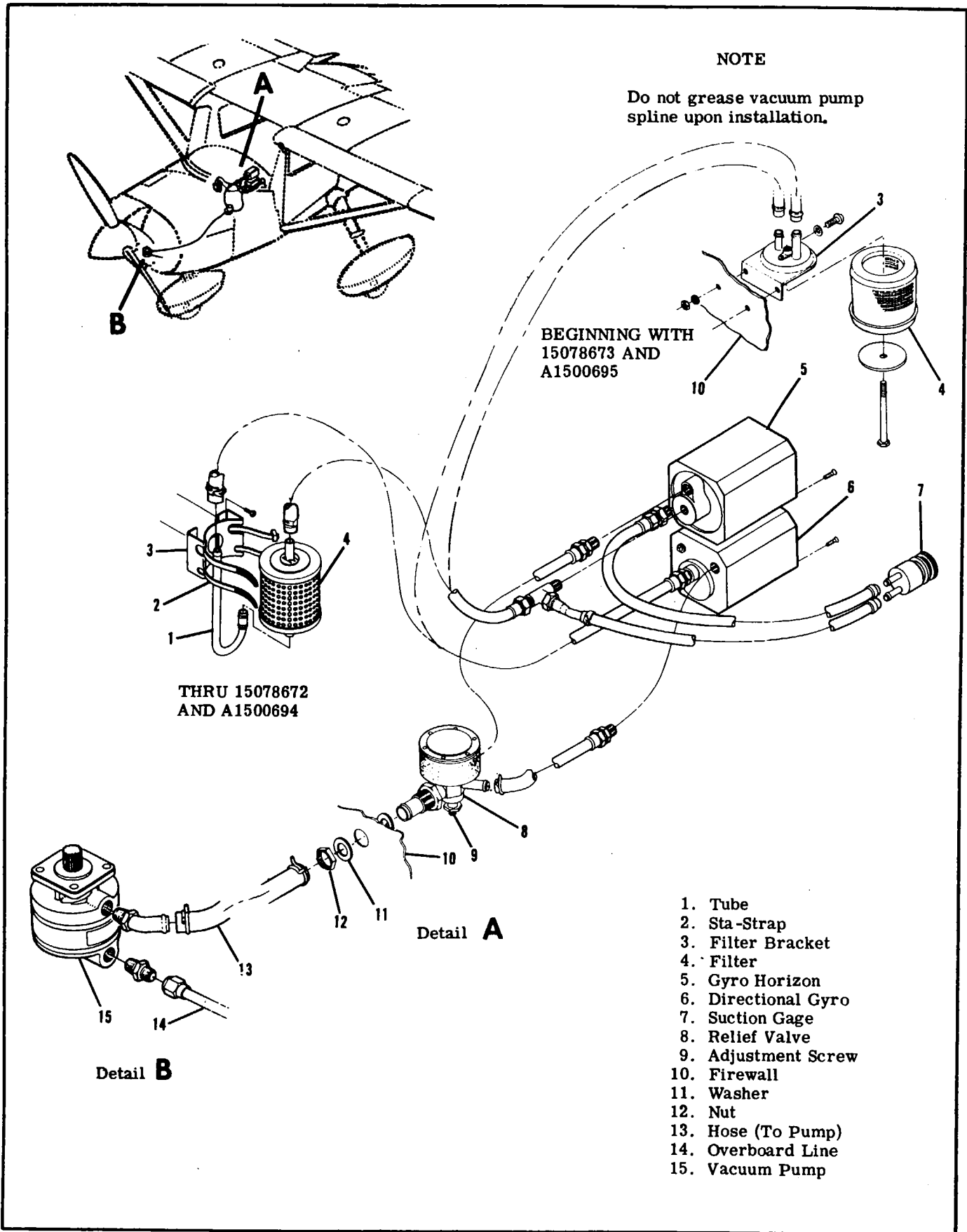


Figure 15-4. Vacuum System

15-27. TROUBLE SHOOTING--VACUUM PUMP.

TROUBLE	PROBABLE CAUSE	REMEDY
OIL IN DISCHARGE.	Damaged engine drive seal.	Replace gasket.
HIGH SUCTION.	Suction relief valve filter clogged.	Check filter for obstructions. Clean or replace filter.
LOW SUCTION.	Relief valve leaking.	Replace relief valve.
	Vacuum pump failure.	Substitute known-good pump and check pump suction. Replace vacuum pump.
LOW PRESSURE.	Safety valve leaking.	Replace safety valve.
	Vacuum pump failure.	Substitute known-good pump and check pump pressure. Replace vacuum pump.

15-28. REMOVAL AND INSTALLATION OF COMPONENTS. The various components of vacuum system are secured by conventional clamps, mounting screws, and nuts. To remove a component, remove mounting screws and disconnect inlet and discharge lines. When replacing a vacuum system component, ensure connections are made correctly. Use no thread-lube on any connections. Teflon tape may be used on male threads. Avoid over-tightening connections. Before re-installing a vacuum pump, place mounting pad gasket over studs. After installing pump, before connecting plumbing, start engine and check for evidence of oil in the discharge which would indicate a leaking engine drive seal.

CAUTION

Never install a pump that has been dropped. Never clamp a pump housing directly in a vise. Such practices can cause internal failure of carbon rotor.

CAUTION

Clogged filters will restrict flow of cooling air. Replace all filters when replacing a vacuum pump.

NOTE

When installing hoses, do not wiggle from side-to-side. This practice can cause particles to be cut from inside hose that could damage pump.

15-29. CLEANING. In general, low-pressure, dry compressed air should be used in cleaning vacuum system components. Suction relief valve, exposed to

engine oil and dirt, should be washed with Stoddard Solvent, then dried with a low-pressure air blast. Check hose for collapsed inner liners as well as external damage..

CAUTION

Never apply compressed air to lines or components installed in aircraft. The excessive pressures will damage gyros. If an obstructed line is to be blown out, disconnect at both ends and blown from instrument panel out.

15-30. VACUUM RELIEF VALVE ADJUSTMENT.

A suction gage reading of 5.3 inches of mercury is desirable for gyro instruments. However, a range of 4.6 to 5.4 inches of mercury is acceptable. To adjust the relief valve, remove control air filter, run engine to 1900 rpm on the ground and adjust relief valve to 5.3 ± 0.1 inches of mercury.

CAUTION

Do not exceed maximum engine temperature.

Be sure filter element is clean before installing. If reading drops noticeably, install new filter element.

15-31. ENGINE INDICATORS.

15-32. TACHOMETER.

15-33. DESCRIPTION. The tachometer is a mechanical indicator driven at half crankshaft speed by a flexible shaft. Most tachometer difficulties will be found in the drive-shaft. To function properly, shaft

housing must be free of kinks, dents and sharp bends. There should be no bend on a radius shorter than six inches and no bend within three inches of either terminal. If a tachometer is noisy or pointer oscillates, check cable housing for kinks, sharp bends and damage. Disconnect cable at tachometer and pull it out of housing. Check cable for worn spots, breaks and kinks.

NOTE

Before replacing a tachometer cable in housing, coat lower two thirds with AC Type ST-640 speedometer cable grease or Lubriplate No. 110. Insert cable in housing as far as possible, then slowly rotate to make sure it is seated in engine

fitting. Insert cable in tachometer, make sure it is seated in drive shaft, then reconnect housing and torque to 50 pound-inches (at instrument).

15-34. OIL PRESSURE GAGE.

15-35. DESCRIPTION. On some airplanes, a Bourbon tube-type oil pressure gage is installed. This is a direct-reading instrument, operated by a pressure pickup line connected to the engine main oil gallery. The oil pressure line from the instrument to the engine should be filled with kerosene, especially during cold weather operation, to obtain immediate oil indication. Electrically actuated gages are installed on some airplanes which utilize a pressure sending bulb.

15-36. TROUBLE SHOOTING -- OIL PRESSURE GAGE (DIRECT READING)

TROUBLE	PROBABLE CAUSE	REMEDY
GAGE DOES NOT REGISTER.	Pressure line clogged.	Check line for obstructions. Clean line.
	Pressure line broken.	Check line for leaks and damage. Repair or replace damaged line.
	Fractured Bourdon tube.	Replace instrument.
	Gage pointer loose on staff.	Replace instrument.
	Damaged gage movement.	Replace instrument.
GAGE POINTER FAILS TO RETURN TO ZERO.	Foreign matter in line.	Check line for obstructions. Clean line.
	Foreign matter in Bourdon tube.	Replace instrument.
	Bourdon tube stretched.	Replace instrument.
GAGE DOES NOT REGISTER PROPERLY.	Faulty mechanism.	Replace instrument.
GAGE HAS ERRATIC OPERATION.	Worn or bent movement.	Replace instrument.
	Foreign matter in Bourdon tube.	Replace instrument.
	Dirty or corroded movement.	Replace instrument.
	Pointer bent and rubbing on dial, dial screw or glass.	Replace instrument.
	Leak in pressure line.	Check line for leaks and damage. Repair or replace damaged line.

15-37. OIL TEMPERATURE GAGE.

15-38. DESCRIPTION. The oil temperature gage is an electrically operated indicator mounted in the instrument cluster with the oil pressure gage. One electrical lead is routed from the indicator to the sending unit, installed in the engine. The other lead supplies power from the bus bar to the indicator. Refer to Table 1 on page 15-16A when trouble shooting oil temperature gage.

15-39. FUEL QUANTITY INDICATING SYSTEM.

15-40. DESCRIPTION. The magnetic type fuel quantity indicators are used in conjunction with a float-operated variable-resistance transmitter in each fuel tank. The full position of float produces a minimum resistance through the transmitter, permitting maximum current flow through the fuel quantity indicator and maximum pointer deflection. As fuel level is lowered, resistance in transmitter is increased, producing a decreased current flow through fuel quantity indicator and a smaller pointer deflection.

15-42. TROUBLE SHOOTING.

15-41. REMOVAL AND INSTALLATION OF FUEL QUANTITY TRANSMITTERS.

- a. Drain fuel from tank. (Observe precautions in Section 12).
- b. Remove access plate above fuel tank for access to transmitter.
- c. Disconnect electrical lead and ground strap from transmitter.
- d. Remove screws attaching transmitter and carefully work transmitter from tank. **DO NOT BEND FLOAT ARM.**
- e. Install transmitter by reversing preceding steps, using new gaskets around opening in fuel tank and under screw heads.
- f. Service fuel tanks. Check for leaks and correct quantity indication.

NOTE

Ensure transmitter is properly grounded in accordance with Section 12.

TROUBLE	PROBABLE CAUSE	REMEDY
FAILURE TO INDICATE.	No power to indicator or transmitter. (Pointer stays below E.)	Check fuse and inspect for open circuit. Replace fuse, repair or replace defective wire.
	Grounded wire. (Pointer stays above F.)	Check for partial ground between transmitter and gage. Repair or replace defective wire.
	Low voltage.	Check voltage at indicator. Correct voltage.
	Defective indicator.	Substitute known-good indicator. Replace indicator.
OFF CALIBRATION.	Defective indicator.	Substitute known-good indicator. Replace indicator.
	Defective transmitter.	Substitute known-good transmitter. Recalibrate or replace.
	Low or high voltage.	Check voltage at indicator. Correct voltage.
STICKY OR SLUGGISH INDICATOR OPERATION.	Defective indicator.	Substitute known-good indicator. Replace indicator.
	Low voltage.	Check voltage at indicator. Correct voltage.

15-42. TROUBLE SHOOTING (cont).

ERRATIC READINGS.	Loose or broken wiring on indicator or transmitter.	Inspect circuit wiring. Repair or replace defective wire.
	Defective indicator or transmitter.	Substitute known-good component. Replace indicator or transmitter.
	Defective master switch.	Replace switch.

15-43. TRANSMITTER CALIBRATION.
(Refer to page 15-16A.)

15-44. HOURMETER.

15-45. DESCRIPTION. The hourmeter is electrically operated and is actuated by a pressure switch in the oil pressure gage line. Electrical power is supplied through a one-amp fuse from the electrical clock circuit and therefore, will operate independently of the master switch.

15-46. MAGNETIC COMPASS. (Refer to figure 15-5.)

15-47. DESCRIPTION. The magnetic compass is liquid-filled, with expansion provisions to compensate for temperature changes. It is equipped with compensating magnets adjustable from front of case. The compass is internally lighted, controlled by the panel lights rheostat. No maintenance is required on compass except for occasional check on a compass rose for adjustment of compensation and replacement of lamp.

NOTE

* Torque compass mount screw
10-15 lb inches to prevent
rotation in flight.

1. Windshield
2. Fuselage Structure
3. Compass Mount
4. Correction Card
5. Compass

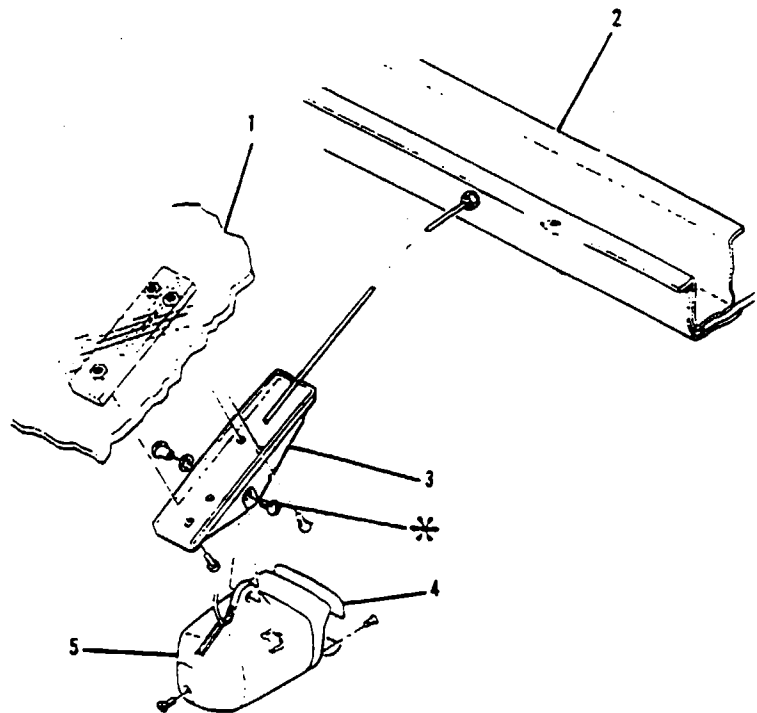


Figure 15-5. Magnetic Compass Installation

15-43. TRANSMITTER ADJUSTMENT.

WARNING: USING THE FOLLOWING FUEL TRANSMITTER CALIBRATION PROCEDURES ON COMPONENTS OTHER THAN THE ORIGINALLY INSTALLED (STEWART WARNER) COMPONENTS WILL RESULT IN A FAULTY FUEL QUANTITY READING.

15-43A. STEWART WARNER GAGE TRANSMITTER CALIBRATION.

Chances of transmitter calibration changing in normal service is remote; however it is possible that the float arm or the float arm stops may become bent if the transmitter is removed from the fuel cell/tank. Transmitter calibration is obtained by adjusting float travel. Float travel is limited by the float arm stops.

WARNING: USE EXTREME CAUTION WHILE WORKING WITH ELECTRICAL COMPONENTS OF THE FUEL SYSTEM. THE POSSIBILITY OF ELECTRICAL SPARKS AROUND AN "EMPTY" FUEL CELL CREATES A HAZARDOUS SITUATION.

Before installing transmitter, attach electrical wires and place the master switch in the "ON" position. Allow float arm to rest against lower float arm stop and read indicator. The pointer should be on E (empty) position. Adjust the float arm against the lower stop so pointer indicator is on E. Raise float until arm is against upper stop and adjust upper stop to permit indicator pointer to be on F (full). Install transmitter in accordance with paragraph 15-41.

15-43B. ROCHESTER FUEL GAGE TRANSMITTER.

Do not attempt to adjust float arm or stop. No adjustment is allowed.

15-43C. FUEL QUANTITY INDICATING SYSTEM OPERATIONAL TEST.

WARNING: REMOVE ALL IGNITION SOURCES FROM THE AIRPLANE AND VAPOR HAZARD AREA. SOME TYPICAL EXAMPLES OF IGNITION SOURCES ARE STATIC ELECTRICITY, ELECTRICALLY POWERED EQUIPMENT (TOOLS OR ELECTRONIC TEST EQUIPMENT - BOTH INSTALLED ON THE AIRPLANE AND GROUND SUPPORT EQUIPMENT), SMOKING AND SPARKS FROM METAL TOOLS.

WARNING: OBSERVE ALL STANDARD FUEL SYSTEM FIRE AND SAFETY PRACTICES.

1. Disconnect all electrical power from the airplane. Attach maintenance warning tags to the battery connector and external power receptacle stating:

DO NOT CONNECT ELECTRICAL POWER, MAINTENANCE IN PROGRESS.

2. Electrically ground the airplane.
3. Level the airplane and drain all fuel from wing fuel tanks.
4. Gain access to each fuel transmitter float arm and actuate the arm through the transmitter's full range of travel.
 - A. Ensure the transmitter float arm moves freely and consistently through this range of travel. Replace any transmitter that does not move freely or consistently.

WARNING: USE EXTREME CAUTION WHILE WORKING WITH ELECTRICAL COMPONENTS OF THE FUEL SYSTEM. THE POSSIBILITY OF ELECTRICAL SPARKS AROUND AN "EMPTY" FUEL CELL CREATES A HAZARDOUS SITUATION.

- B. While the transmitter float arm is being actuated, apply airplane battery electrical power as required to ensure that the fuel quantity indicator follows the movement of the transmitter float arm. If this does not occur, troubleshoot, repair and/or replace components as required until the results are achieved as stated.

NOTE: Stewart Warner fuel quantity indicating systems can be adjusted. Refer to this section for instructions for adjusting Stewart Warner fuel indicating systems. Rochester fuel quantity indicating system components are not adjustable, only component replacement or standard electrical wiring system maintenance practices are permitted.

5. With the fuel selector valve in the "OFF" position, add unusable fuel to each fuel tank.
6. Apply electrical power as required to verify the fuel quantity indicator indicates "EMPTY".
- A. If "EMPTY" is not indicated, adjust, troubleshoot, repair and/or replace fuel indicating components as required until the "EMPTY" indication is achieved.

NOTE: Stewart Warner fuel quantity indicating systems can be adjusted. Refer to this section for instructions for adjusting Stewart Warner fuel indicating systems. Rochester fuel quantity indicating system components are not adjustable, only component replacement or standard electrical wiring system maintenance practices are permitted.

7. Fill tanks to capacity, apply electrical power as required and verify that the fuel quantity indicators indicate "FULL".
- A. If "FULL" is not indicated, adjust, troubleshoot, repair and/or replace fuel indicating components as required until the "FULL" indication is achieved.

NOTE: Stewart Warner fuel quantity indicating systems can be adjusted. Refer to this section for instructions for adjusting Stewart Warner fuel indicating systems. Rochester fuel quantity indicating system components are not adjustable, only component replacement or standard electrical wiring system maintenance practices are permitted.

8. Install any items and/or equipment removed to accomplish this procedure, remove maintenance warning tags and connect the airplane battery.

15-43D. OIL TEMPERATURE INDICATING SYSTEM RESISTANCE TABLE.

The following table is provided to assist in the troubleshooting the oil temperature indicating system components.

Select the oil temperature sending unit part number that is used in your airplane from the left column and the temperature from the column headings. Read the ohms value under the appropriate temperature column.

Part Number	Type	72°F	120°F	165°F	220°F	250°F
S1630-1	Oil Temp				46.4 Ω	
S1630-3	Oil Temp		620.0 Ω			52.4 Ω
S1630-4	Oil Temp		620.0 Ω			52.4 Ω
S1630-5	Oil Temp			192.0 Ω		
S2335-1	Oil Temp	990.0 Ω				34.0 Ω

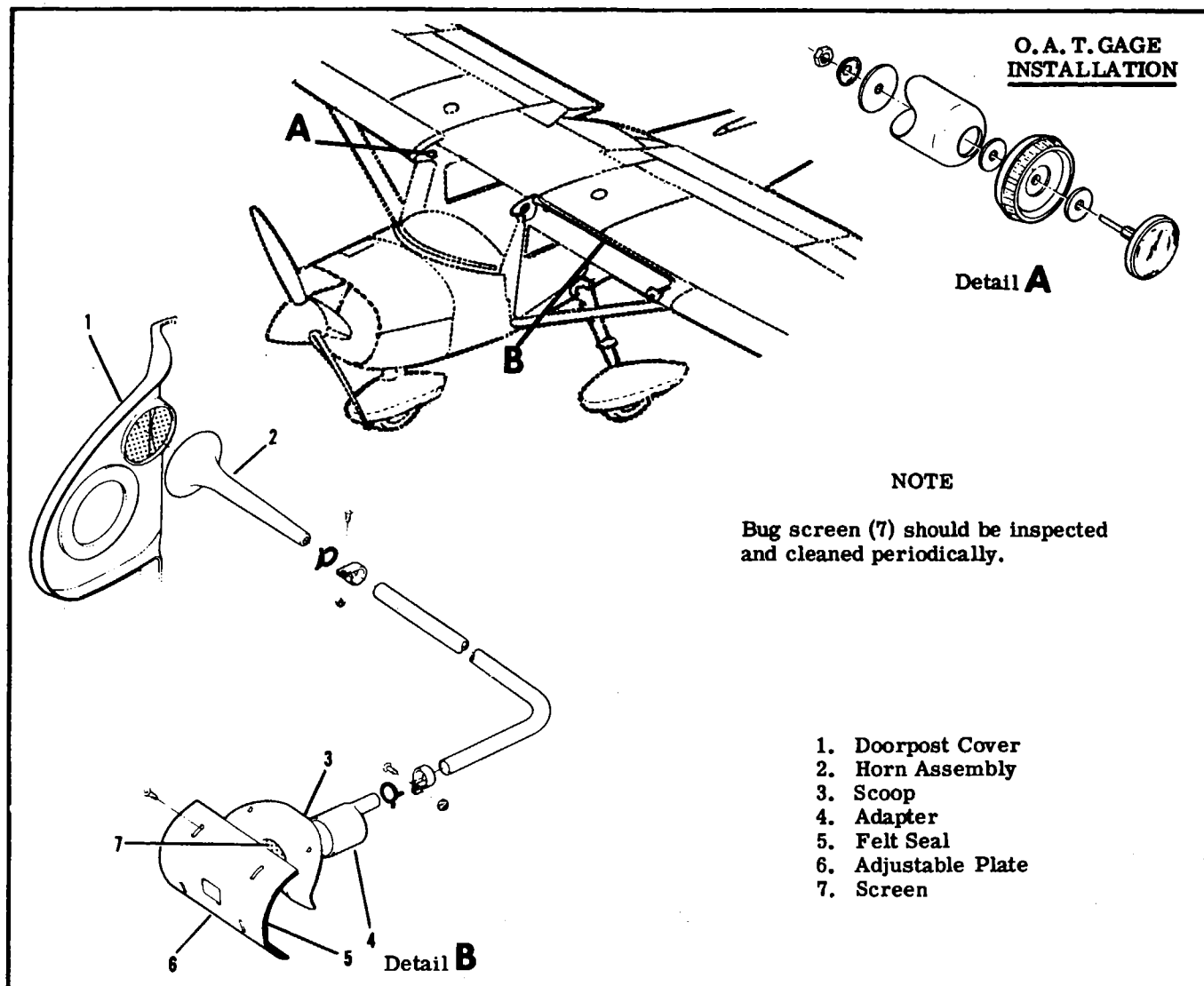


Figure 15-6. Stall Warning System

15-48. ACCELEROMETER.

15-49. DESCRIPTION. The Aerobat offers an accelerometer to assist pilot in performing precision aerobatics. The accelerometer continuously indicates g forces being imposed on aircraft. The dial display utilizes three pointers; one pointer indicates instantaneous acceleration, another records maximum positive acceleration and the third records maximum negative acceleration. Maximum instrument markings range from 10G to 5G. A "PUSH TO SET" knob, located on lower left corner of instrument, is used to reset "Maximum Positive" and "Maximum Negative" pointers. If dual Nav/Coms are installed, the accelerometer is installed in a housing above instrument panel on pilot's side. When aircraft is equipped with single Nav/Com, accelerometer is installed in the vacant Omni indicator instrument space.

15-50. STALL WARNING SYSTEM. (Refer to figure 15-6.)

15-51. DESCRIPTION. The system is composed of an adjustable plate on left wing leading edge, connected to a reed type horn by means of plastic tubing. The horn is actuated approximately 5 to 10 miles per hour above stalling speed as a negative air pressure area at wing leading edge causes a reverse flow of air through horn. By moving adjustable plate (6) up, actuation of horn will occur at a higher speed and moving plate down causes actuation to occur at a slower speed. Center adjustable plate opening in wing leading edge upon installation, then flight test aircraft, observing horn actuation during stall. Re-adjust plate to obtain desired results if necessary. Approximately 3/32 inch adjustment of plate will change speed at which horn actuation occurs by 5 miles per hour. To test horn operation, cover opening in plate (6) with a clean cloth, such as a handkerchief and apply a slight suction by mouth to draw air through horn.

15-52. TURN-AND-SLIP INDICATOR.

is an electrically operated instrument powered by the aircraft electrical system, therefore, operating only when the master switch is ON.

15-53. DESCRIPTION. The turn-and-slip indicator

15-54. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
INDICATOR POINTER FAILS TO RESPOND.	Internal fuse blown.	Check wiring for continuity, check voltage at indicator. Replace fuse, if fuse still blows, replace instrument.
	Master switch "OFF" or switch defective.	Check switch "ON." Replace defective switch.
	Broken or grounded lead to indicator.	Check circuit wiring. Repair or replace defective wiring.
	Indicator not grounded.	Check ground wire. Repair or replace defective wire.
	Defective mechanism.	Replace instrument.
HAND SLUGGISH IN RETURNING TO ZERO.	Defective mechanism.	Replace instrument.
	Low voltage.	Check voltage at indicator. Correct voltage.
POINTER DOES NOT INDICATE PROPER TURN.	Defective mechanism.	Replace instrument.
HAND DOES NOT SIT ON ZERO.	Gimbal and rotor out of balance.	Replace instrument.
	Hand incorrectly sits on rod.	Replace instrument.
	Sensitivity spring adjustment pulls hand off zero.	Replace instrument.
IN COLD TEMPERATURES, HAND FAILS TO RESPOND OR IS SLUGGISH.	Oil in indicator becomes too thick.	Replace instrument.
	Insufficient bearing end play.	Replace instrument.
	Low voltage.	Check voltage at indicator. Correct voltage.
NOISY GYRO.	High voltage.	Check voltage at indicator. Correct voltage.
	Loose or defective rotor bearings.	Replace instrument.

15-55. TURN COORDINATOR.

15-56. DESCRIPTION. The turn coordinator is an electrically operated, gyroscopic, roll-rate turn indicator. Its gyro simultaneously senses rate of

motion roll and yaw axes which is projected on a single indicator. The gyro is a non-tumbling type requiring no caging mechanism and incorporates an a.c. brushless spin motor with a solid state inverter.

15-57. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
INDICATOR DOES NOT RETURN TO CENTER.	Friction caused by contamination in the indicator dampening.	Replace instrument.
	Friction in gimbal assembly.	Replace instrument.
DOES NOT INDICATE A STANDARD RATE TURN (TOO SLOW).	Low voltage.	Correct voltage.
	Inverter frequency changed.	Replace instrument.
NOISY MOTOR.	Faulty bearings.	Replace instrument.
ROTOR DOES NOT START.	Faulty electrical connection.	Correct voltage or replace faulty wire.
	Inverter malfunctioning.	Replace instrument.
	Motor shorted.	Replace instrument.
	Bearings frozen.	Replace instrument.
IN COLD TEMPERATURES, HAND FAILS TO RESPOND OR IS SLUGGISH.	Oil in indicator becomes too thick.	Replace instrument.
	Insufficient bearing end play.	Replace instrument.
	Low voltage.	Correct voltage.
NOISY GYRO.	High voltage	Check voltage to instrument. Correct voltage.
	Loose or defective rotor bearings.	Replace instrument.

15-58. ELECTRIC CLOCK

15-59. DESCRIPTION. The electric clock is connected to the battery through a one-ampere fuse mounted

adjacent to the battery box. The clock electrical circuit is separate from the aircraft electrical system and will operate when the master switch is off.

**SECTION 16
ELECTRICAL SYSTEMS**

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16-1. ELECTRICAL SYSTEMS.

16-2. GENERAL. This section contains service information necessary to maintain the Aircraft Electrical

Power Supply System, Battery and External Power Supply System, Alternator Power System, Aircraft Lighting System, Pitot Heater, Stall Warning, Cigar Lighter and Electrical Load Analysis.

16-3. ELECTRICAL POWER SUPPLY SYSTEM.

16-4. DESCRIPTION. Electrical energy for the aircraft is supplied by a 14-volt, direct-current, single-wire, negative ground electrical system. A 12-volt battery supplies power for starting and furnishes a reserve source of power in the event of alternator failure. An engine-driven alternator is the normal source of power during flight and maintains a battery charge controlled by a voltage regulator. An external power source receptacle is offered as optional equipment to supplement the battery alternator system for starting and ground operation.

16-5. BUS BAR.

16-6. DESCRIPTION. Electrical power for electrical equipment and electronic installations is supplied through the split bus bar. The bus bar is interconnected by a jumper wire and attached to the circuit breakers on the lower, center of the instrument panel.

16-7. REMOVAL AND INSTALLATION. (Refer to figure 16-1).

16-8. MASTER SWITCH.

16-13. TROUBLE SHOOTING THE BATTERY POWER SYSTEM.

16-9. DESCRIPTION. The master switch controls the operation of the battery and alternator systems. The switch is a interlocking split rocker with the battery mode on the right hand side and the alternator mode on the left hand side. This arrangement allows the battery to be on the line without the alternator, however, operation of the alternator without the battery on the line is not possible. The switch is labeled "BAT" and "ALT" on the side of the switch and is located on the left hand side of the switch panel.

16-10. AMMETER.

16-11. DESCRIPTION. The ammeter is connected between the battery contactor and the bus bar. The meter indicates the amount of current flowing either to or from the battery. With a low battery and the engine operating at cruise speed the ammeter will show the fuel alternator output when all electrical equipment is off. When the battery is fully charged and cruise RPM is maintained with all electrical equipment off, the ammeter will show a minimum charging rate. The ammeter is located on the right hand side of the instrument panel.

16-12. BATTERY POWER SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
BATTERY WILL NOT SUPPLY POWER TO BUS OR IS INCAPABLE OF CRANKING ENGINE.	Battery discharged.	1. Measure voltage at "BAT" terminal of battery contactor with master switch and a suitable load such as a taxi light turned on. Normal battery will indicate 11.5 volts or more. If voltage is low, proceed to step 2. If voltage is normal, proceed to step 3.
	Battery faulty.	2. Check fluid level in cells and charge battery at 20 amps for approximately 30 minutes or until the battery voltage rises to 15 volts. Check battery with a load type tester. If tester indicates a good battery, the malfunction may be assumed to be a discharged battery. If the tester indicates a faulty battery, replace the battery.

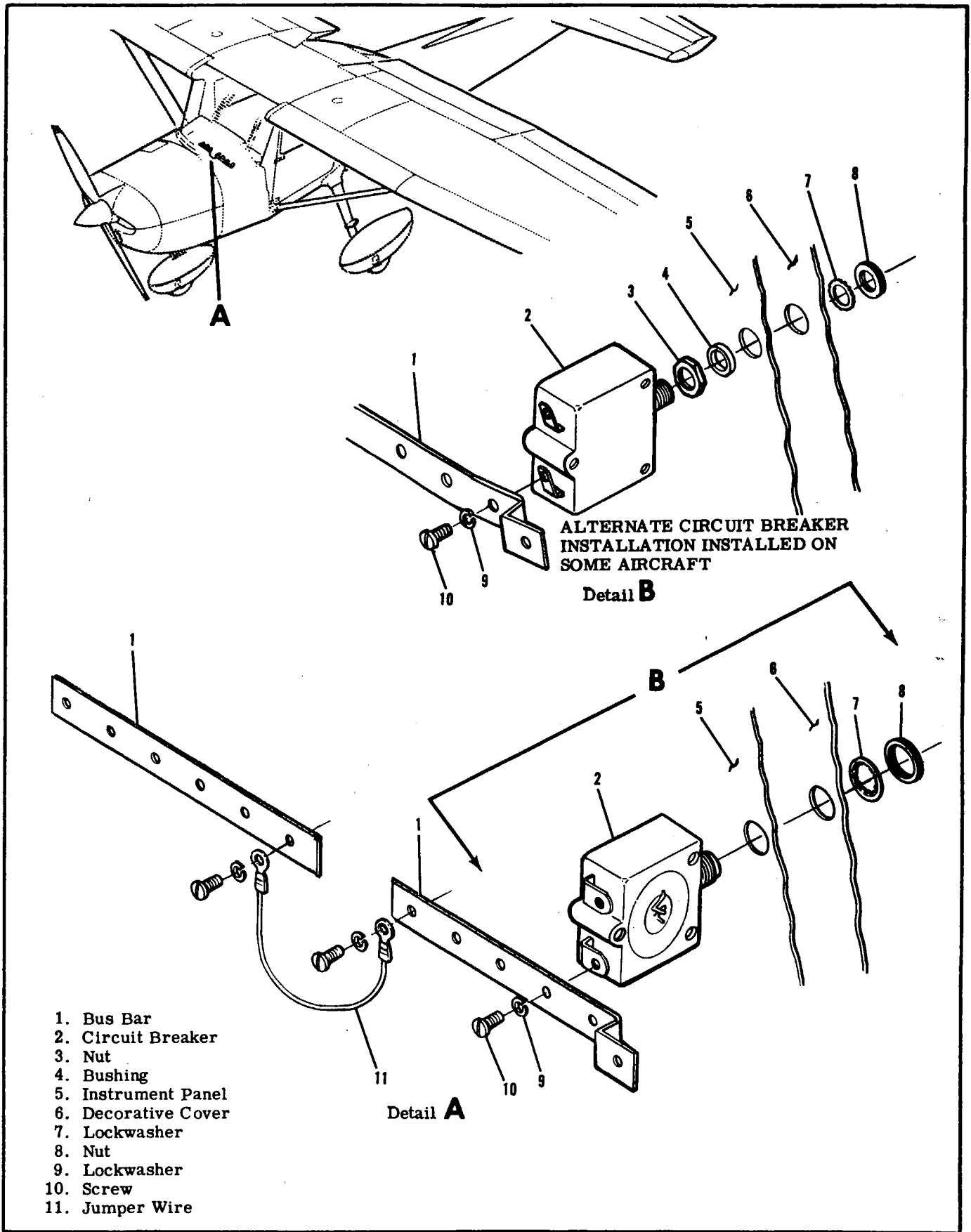


Figure 16-1. Bus Bar Installation

16-13. TROUBLE SHOOTING THE BATTERY POWER SYSTEM. (CONT.)

TROUBLE	PROBABLE CAUSE	REMEDY
BATTERY WILL NOT SUPPLY POWER TO BUS OR IS INCAPABLE OF CRANKING ENGINE. (CONT.)	Faulty contactor or wiring between contactor or master switch.	3. Measure voltage at master switch terminal (smallest) on contactor with master switch closed. Normal indication is zero volts. If voltage reads zero, proceed to step 4. If a voltage reading is obtained check wiring between contactor and master switch. Also check master switch.
	Open coil on contactor.	4. Check continuity between "BAT" terminal and master switch terminal of contactor. Normal indication is 16 to 24 ohms (Master switch open). If ohmmeter indicates an open coil, replace contactor. If ohmmeter indicates a good coil, proceed to step 5.
	Faulty contactor contacts.	5. Check voltage on "BUS" side of contactor with master switch closed. Meter normally indicates battery voltage. If voltage is zero or intermittent, replace contactor. If voltage is normal, proceed to step 6.
	Faulty wiring between contactor and bus.	6. Inspect wiring between contactor and bus. Repair or replace wiring.

16-14. BATTERY.

16-15. DESCRIPTION. The battery is 12 volts and is approximately 25 ampere-hour capacity. The battery is mounted on the forward side of the firewall and is equipped with non-spill filler caps.

16-16. REMOVAL AND INSTALLATION (Refer to figure 16-2.)

- a. Remove top half of cowl.
- b. Remove the battery box cover.
- c. Disconnect the ground cable from the negative battery terminal.

CAUTION

- When installing or removing battery always observe the proper polarity with the aircraft electrical system (negative to ground). Reversing the polarity, even momentarily, may result in failure of semiconductor devices (alternator diodes, radio protection diodes and radio transistors).

- Always remove the battery ground cable first and replace it last to prevent accidental short circuits.

- d. Disconnect the cable from the positive terminal of the battery.
- e. Lift the battery out of the battery box.
- f. To replace the battery, reverse this procedure.

16-17. CLEANING THE BATTERY. For maximum efficiency the battery and connections should be kept clean at all times.

- a. Remove the battery and connections in accordance with the preceding paragraph.
- b. Tighten battery cell filler caps to prevent the cleaning solution from entering the cells.
- c. Wipe the battery cable ends, battery terminals and the entire surface of the battery with a clean cloth moistened with a solution of bicarbonate of soda (baking soda) and water.
- d. Rinse with clear water, wipe off excess water and allow battery to dry.
- e. Brighten up cable ends and battery terminals with emery cloth or a wire brush.
- f. Install the battery according to the preceding paragraphs.
- g. Coat the battery terminals with petroleum jelly or an ignition spray product to reduce corrosion.

16-18. ADDING ELECTROLYTE OR WATER TO THE BATTERY. A battery being charged and discharged

with use will decompose the water from the electrolyte by electrolysis. When the water is decomposed hydrogen and oxygen gases are formed which escape into the atmosphere through the battery vent system. The acid in the solution chemically combines with the plates of the battery during discharge or is suspended in the electrolyte solution during charge. Unless the electrolyte has been spilled from a battery, acid should not be added to the solution. The water, however will decompose into gases and should be replaced regularly. Add distilled water as necessary to maintain the electrolyte level with the horizontal baffle plate or the split ring on the filler neck inside the battery. When "dry charged" batteries are put into service fill as directed with electrolyte. When the electrolyte level falls below normal with use, add only distilled water to maintain the proper level. The battery electrolyte contains approximately 25% sulphuric acid by volume. Any change in this volume will hamper the proper operation of the battery.

CAUTION

Do not add any type of "battery rejuvenator" to the electrolyte. When acid has been spilled from a battery, the acid balance may be adjusted by following instructions published by the Association of American Battery Manufacturers.

16-19. TESTING THE BATTERY. The specific gravity of the battery may be measured with a hydrometer to determine the state of battery charge. If the hydrometer reading is low, slow-charge the battery and retest. Hydrometer readings of the electrolyte must be compensated for the temperature of the electrolyte. Some hydrometers have a built-in thermometer and conversion chart. The following chart shows the battery condition for various hydrometer readings with an electrolyte temperature of 80° Fahrenheit.

SHOP NOTES:

BATTERY HYDROMETER READINGS	
READINGS	BATTERY CONDITION
1.280 Specific Gravity	100% Charged
1.250 Specific Gravity	75% Charged
1.220 Specific Gravity	50% Charged
1.190 Specific Gravity	25% Charged
1.160 Specific Gravity	Practically Dead

NOTE

All readings shown are for an electrolyte temperature of 80° Fahrenheit. For higher temperatures the readings will be slightly lower. For cooler temperatures the readings will be slightly higher. Some hydrometers will have a built-in temperature compensation chart and a thermometer. If this type tester is used, disregard this chart.

If a specific gravity reading indicates that the battery is not fully charged, the battery should be charged at approximately 20 amperes for 30 minutes, or until the battery voltage rises to 15 volts. After charging, a load type tester will give more meaningful results. A specific gravity check can be used after charging but the check cannot spot cells which short under load, broken connectors between plates of a cell, etc.

16-20. CHARGING THE BATTERY. When the battery is to be charged, the level of the electrolyte should be checked and adjusted by adding distilled water to cover the tops of the internal battery plates. Remove the battery from the aircraft and place in a well ventilated area for charging.

WARNING

When a battery is being charged, hydrogen and oxygen gases are generated. Accumulation of these gases can create a hazardous explosive condition. Always keep sparks and open flame away from the battery. Allow unrestricted ventilation of the battery area during charging.

The main points of consideration during a battery charge are excessive battery temperature and violent gassing. Under a reasonable rate of charge (20 amperes or less) the battery temperature should not rise over 125°F, nor should gassing be so violent that acid is blown from the vents.

16-21. BATTERY BOX.

16-22. DESCRIPTION. The battery box is constructed of metal and painted inside and out with acid-proof paint. The box is attached to the right hand side of the firewall. A vent tube is attached to the bottom of the box and extends below the firewall to allow gases and spilled acid to be vented overboard.

16-23. REMOVAL AND INSTALLATION. (Refer to figure 16-2.) The battery box is not considered as a removable item except for replacement purposes. The box is riveted to mounting brackets on the firewall. Should the battery box be removed, on installation of the box or a new box, all rivets and scratches should be painted with acid-proof lacquer, Part No. CES1054-381, available from Cessna Parts Distribution (CPD 2).

16-24. MAINTENANCE. The battery box should be inspected and cleaned periodically. The box and cover should be cleaned with a strong solution of bicarbonate of soda (baking soda) and water. Hard deposits may be removed with a wire brush. When all corrosive deposits have been removed from the box, flush it thoroughly with clean water.

SHOP NOTES:

WARNING

Do not allow acid deposits to come in contact with skin or clothing. Serious acid burns may result unless the affected area is washed immediately with soap and water. Clothing will be ruined upon contact with battery acid.

Inspect the cleaned box and cover for physical damage and for areas lacking proper acid proofing. A badly damaged or corroded box should be replaced. If the box or lid require acid proofing, paint the area with acid proof lacquer, Part No. CES1054-381, available from Cessna Parts Distribution Center (CPD 2).

16-25. BATTERY CONTACTOR.

16-26. DESCRIPTION. The battery contactor is a plunger type and is actuated by turning on the master switch. The contactor is bolted to the inboard side of the battery box. A silicon diode is installed to eliminate spiking of transistorized radio equipment when the contactor is closed. Nylon covers are installed on the terminals to prevent accidental short circuits.

16-27. REMOVAL AND INSTALLATION. (Refer to figure 16-2.)

- a. Place master switch in the OFF position.
- b. Open battery box and disconnect ground cable from negative battery terminal. Pull cable clear of battery box.
- c. Cut sta-straps and remove nylon covers from terminals on contactor.
- d. Remove nuts, lockwashers and plain washers securing the battery cables to the contactor.
- e. Remove nut, lockwasher and plain washers securing master switch wire to contactor.
- f. Remove nuts, washers, and bolts securing the contactor to the battery box and remove contactor.
- g. To install battery contactor reverse the preceding steps.

16-28. BATTERY CONTACTOR CLOSING CIRCUIT. The battery contactor closing circuit consists of a 5 amp fuse, a resistor and a diode installed across the battery contactor. This serves to shunt a small charge around the battery contactor when the battery is too dead to energize the contactor by itself.

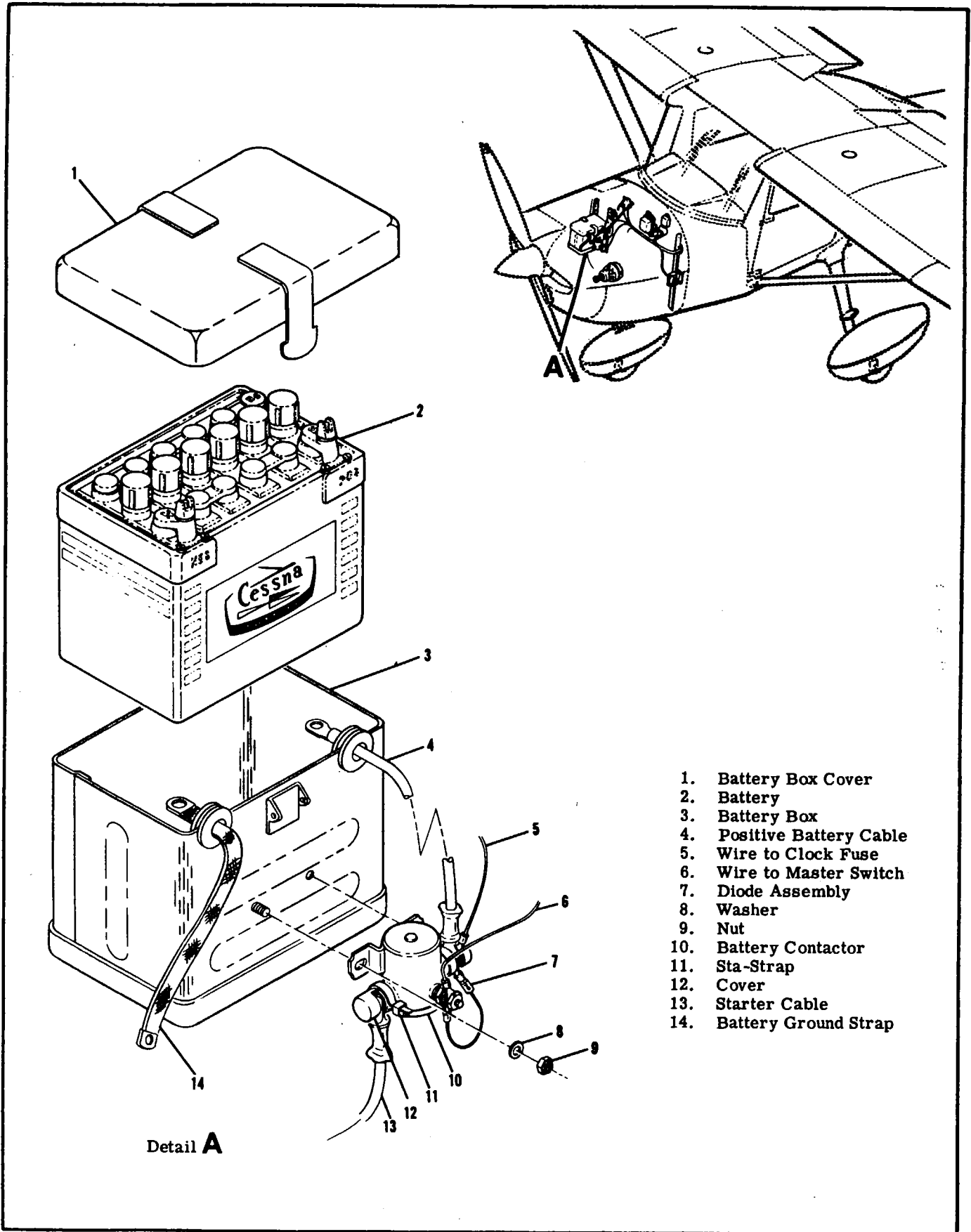


Figure 16-2. Battery, Battery Box and Battery Contactor Installation

16-29. GROUND SERVICE RECEPTACLE.

16-30. DESCRIPTION. A ground service receptacle may be installed to permit the use of external power for cold weather starting or when performing lengthy electrical maintenance. The receptacle is mounted on the left hand side of the firewall with an access door in the engine cowl.

NOTE

Before connecting an external power source, it is important that the master switch be turned "ON". This will close the battery contactor and enable the battery to absorb transient voltages which otherwise might damage the electronic equipment. It will also provide excitation of the alternator field in the event that the battery is completely dead.

16-31. REMOVAL AND INSTALLATION. (Refer to figure 16-3.)

- a. Remove engine cowl in accordance with Section 11.
- b. Open battery box and disconnect the ground cable from the negative terminal of the battery and pull cable from the battery box.
- c. Remove the nuts, washers and ground strap from the terminals of the receptacle and remove the battery cable.
- d. Remove the screws and nuts securing the receptacle to the mounting bracket. Remove receptacle.
- e. To install ground service receptacle, reverse the preceding steps. Be sure to place the ground strap on the negative stud of the receptacle.

16-32. ALTERNATOR POWER SYSTEM.

16-33. DESCRIPTION. The alternator system consists of an engine driven alternator, a voltage regulator mounted on the left hand side of the firewall and a circuit breaker located on the instrument panel. The system is controlled by the left hand portion of the split rocker, master switch labeled "ALT." A over-voltage sensor switch and red warning light labeled "HIGH VOLTAGE" are incorporated to protect the system, (refer to paragraph 16-40). The aircraft battery supplies the source of power for excitation of the alternator.

16-34. ALTERNATOR.

16-35. DESCRIPTION. The alternator is three phase, delta connected with integral silicon diode rectifiers. The alternator is rated at 14 volts at 60 amperes continuous output. The moving center part of the alternator (rotor) consists of an axial winding with radial interlocking poles which surround the winding. With excitation applied to the winding through slip rings the pole pieces assume magnetic polarity. The rotor is mounted in bearings and rotates inside the stator which contains the windings in which ac is generated. The stator windings are three-phase, delta connected and are attached to two diode plates, each of which contains three silicon diodes. The diode plates are

connected to accomplish full-wave, rectification of ac. The resulting dc output is applied to the aircraft bus and sensed by the voltage regulator. The regulator controls the excitation applied to the alternator field thus controlling the output of the alternator.

16-36. REMOVAL AND INSTALLATION. (Refer to figure 16-4.)

- a. Ensure that master switch is off and the negative lead is disconnected from the battery.
- b. Remove wiring from the alternator and label.
- c. Remove screw and nut holding blast tube to support strap clamp, blast tube will then be free for removal.
- d. Remove nuts and washers from alternator mounting bolts.
- e. Remove alternator.
- f. To replace alternator, reverse this procedure.

16-37. ALTERNATOR FIELD PROTECTION.

16-38. DESCRIPTION. A 2-amp automatic resetting circuit breaker located on the left hand, stationary instrument panel stiffener, is provided to protect the alternator field circuit.

16-39. ALTERNATOR REVERSE VOLTAGE DAMAGE. The alternator is very susceptible to reverse polarity current because of the silicon diodes. The diodes, having a very high resistance to reverse current flow, are used without any cutout relay such as used on a generator system. The alternator diodes are arranged with their cathodes connected to the aircraft bus bar which is positive and no back current will flow. If the polarity of the battery is reversed, the diodes will offer no resistance to the current flow. The current rating of the diodes is exceeded and diode failure may result.

16-40. OVER-VOLTAGE WARNING SYSTEM

16-41. DESCRIPTION. The over-voltage system consists of an over-voltage sensor switch and a red warning light labeled "HIGH VOLTAGE". The over-voltage sensor is attached to the wire bundle behind the instrument panel and the light is located on the right hand side of the instrument panel. When an over-voltage tripoff occurs the over-voltage sensor turns off the alternator system and the red warning light comes on. The ammeter will show a discharge. Turn off both sections of the master switch to recycle the over-voltage sensor. If the over-voltage condition was transient, the normal alternator charging will resume and no further action is necessary. If the over-voltage tripoff recurs, then a generating system malfunction has occurred such that the electrical accessories must be operated from the aircraft battery only. Conservation of electrical energy must be practiced until the flight can be terminated. The over-voltage light filament may be tested at any time by turning off the "Alternator" portion of the master switch and leaving the battery portion on. This test does not induce an over-voltage condition on the electrical system.

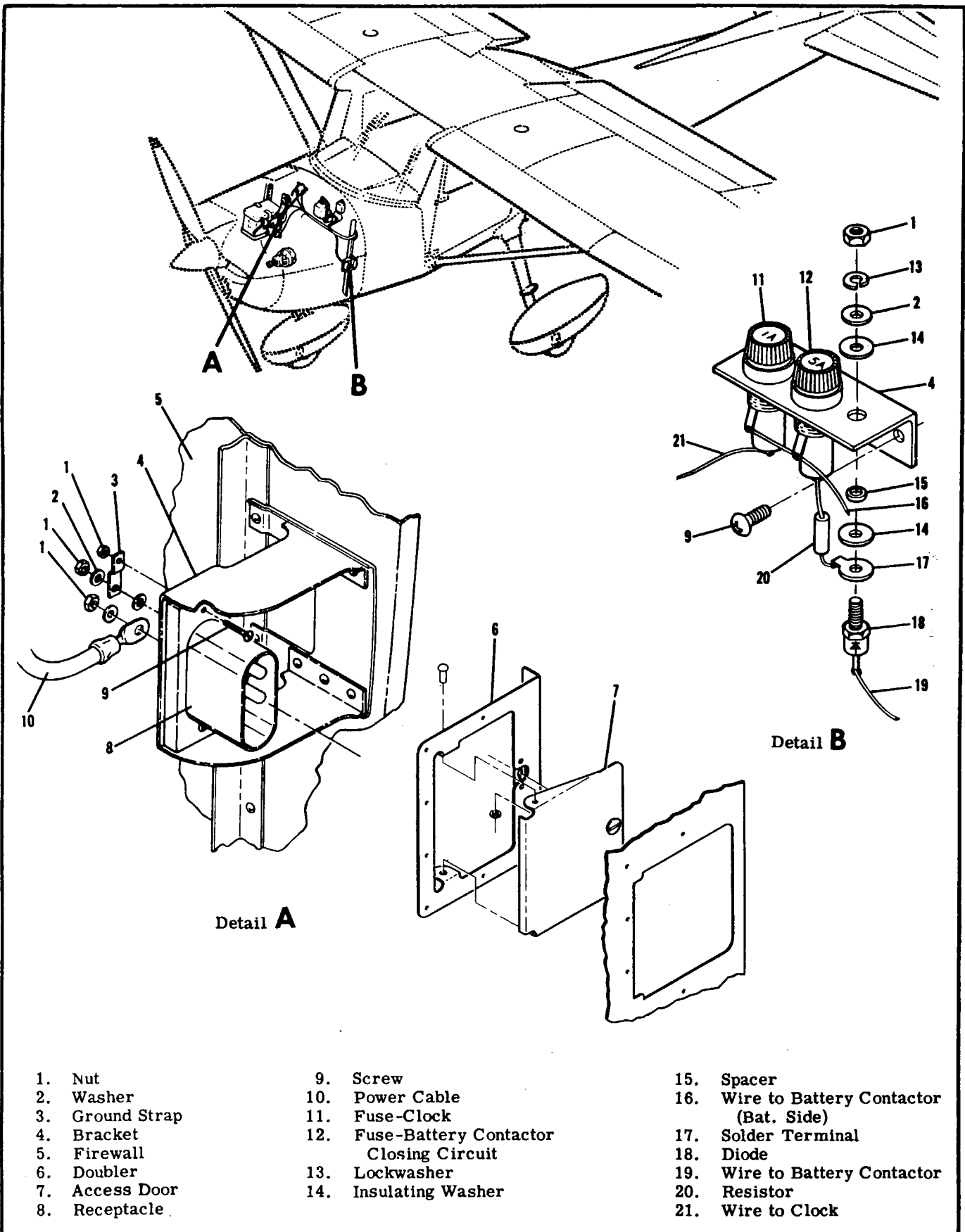


Figure 16-3. Ground Service Receptacle and Battery Contactor Closing Circuit Installation

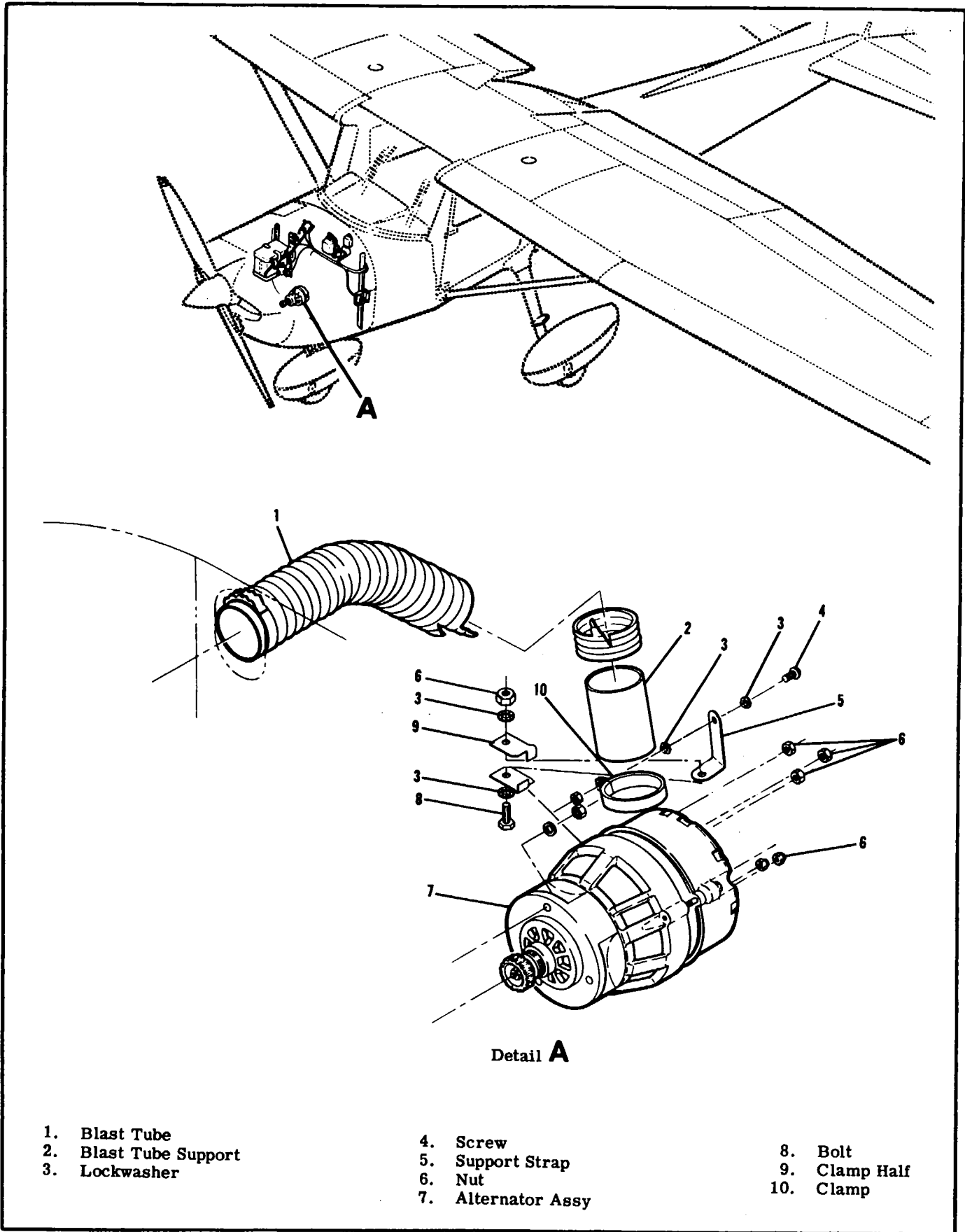


Figure 16-4. Alternator Installation

NOTE

The over-voltage sensor switch contains solid state devices. Observe proper polarity before supplying power. Grounding the orange lead

or interconnecting orange and black leads will destroy the device. When removal is required for replacement, identify (tag) wiring and follow the wiring diagram in Section 20 for rewiring.

16-42. TROUBLE SHOOTING THE ALTERNATOR SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
<p>AMMETER INDICATES HEAVY DISCHARGE WITH ENGINE NOT RUNNING OR ALTERNATOR CIRCUIT BREAKER OPENS WHEN MASTER SWITCH IS TURNED ON.</p>	<p>Shorted radio noise filter or shorted wire.</p>	<p>1. Remove cable from output terminal of alternator. Check resistance from end of cable to ground (MASTER SWITCH MUST BE OFF). If resistance does not indicate a direct short, proceed to step 4. If resistance indicates a direct short, proceed to step 2.</p>
		<p>2. Remove cable connections from radio noise filter. Check resistance from the filter input terminal to ground. Normal indication is infinite resistance. If reading indicates a direct short, replace filter. If no short is evident, proceed to step 3.</p>
		<p>3. Check resistance from ground to the free ends of the wires which were connected to the radio noise filter (or alternator if no noise filter is installed). Normal indication does not show a direct short. If a short exists in wires, repair or replace wiring.</p>
	<p>Shorted diodes in alternator.</p>	<p>4. Check resistance from output terminal of alternator to alternator case. Reverse leads and check again. Resistance reading may show continuity in one direction but should show an infinite reading in the other direction. If an infinite reading is not obtained in at least one direction, repair or replace alternator.</p>

16-42. TROUBLE SHOOTING THE ALTERNATOR SYSTEM (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
<p>ALTERNATOR SYSTEM WILL NOT KEEP BATTERY CHARGED.</p>	<p>Regulator faulty or improperly adjusted.</p>	<p>1. Start engine and adjust for 1500 RPM. Ammeter should indicate a heavy charge rate with all electrical equipment turned off. Rate should taper off in 1-3 minutes. A voltage check at the bus should indicate a reading consistent with the voltage vs temperature chart in the Cessna Alternator Charging Systems Service/Parts Manual. If charge rate tapers off very quickly and voltage is normal, check battery for malfunction. If ammeter shows a low charge rate or any discharge rate, and voltage is low, proceed to step 2.</p>
		<p>2. Stop engine, remove cowl, and remove cover from voltage regulator. Turn master switch ON/OFF several times and observe field relay in regulator. Relay should open and close with master switch and small arc should be seen as contacts open. If relay is inoperative, proceed to step 3. If relay operates, proceed to step 4.</p>
		<p>3. Check voltage at "S" terminal of regulator with master switch closed. Meter should indicate bus voltage. If voltage is present, replace regulator. If voltage is not present check wiring between regulator and bus.</p>
		<p>4. Remove plug from regulator and start engine. Momentarily jumper the "A+" and "F" terminals together on the plug. Ship's ammeter should show heavy rate of charge. If heavy charge rate is observed, replace regulator. If heavy charge rate is not observed, proceed to step 5.</p>
	<p>Faulty wiring between alternator and regulator, or faulty alternator.</p>	<p>5. Check resistance from "F" terminal of regulator to "F" terminal of alternator. Normal indication is a very low resistance. If reading indicates no, or poor continuity, repair or replace wiring from regulator to alternator.</p>

16-42. TROUBLE SHOOTING THE ALTERNATOR SYSTEM (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
ALTERNATOR SYSTEM WILL NOT KEEP BATTERY CHARGED (Cont).	Faulty wiring between alter-	6. Check resistance from "F" terminal of alternator to alternator case. Normal indication is 6-7 ohms. If resistance is high or low, repair or replace alternator.
		7. Check resistance from case of alternator to airframe ground. Normal indication is very low resistance. If reading indicates no, or poor continuity, repair or replace alternator ground wiring.
ALTERNATOR OVERCHARGES BATTERY - BATTERY USES EXCESSIVE WATER.	Regulator faulty or improperly adjusted.	Check bus voltage with engine running. Normal indication agrees with voltage vs temperature chart in the Cessna Alternator Charging Systems Service/Parts Manual. Observe ships ammeter, ammeter should indicate near zero after a few minutes of engine operation. Replace regulator.
OVER-VOLTAGE WARNING LIGHT ON.	Regulator faulty or improperly adjusted. Faulty sensor switch.	1. With engine running turn off and on battery portion of the master switch. If the light stays on shut down engine then turn on the "BAT" and "ALT" portions of the master switch. Check for voltage at the "S" terminal of the voltage regulator. If voltage is present adjust or replace regulator. If voltage is not present check master switch and wiring for short or open condition. If wiring and switch are normal replace sensor.

16-43. VOLTAGE REGULATOR.

16-44. DESCRIPTION. The voltage regulator is a semi-solid state regulator. The field relay in the regulator is a mechanical type and the voltage limiter portion of the regulator is solid state. The regulator is a remove and replace item and not repairable.

16-45. REMOVAL AND INSTALLATION. (Refer to figure 16-5).

a. Make sure the master switch is in the OFF position.

- b. Disconnect the negative lead from the battery and pull lead free of the battery box.
- c. Remove the connector plug from the regulator.
- d. Remove two screws securing the regulator to the firewall.
- e. To install the regulator, reverse the preceding steps. Be sure the connections for grounding the alternator, wiring shields and the base of the regulator are clean and bright before assembly. Otherwise, faulty voltage regulation and/or excessive radio noise may result.

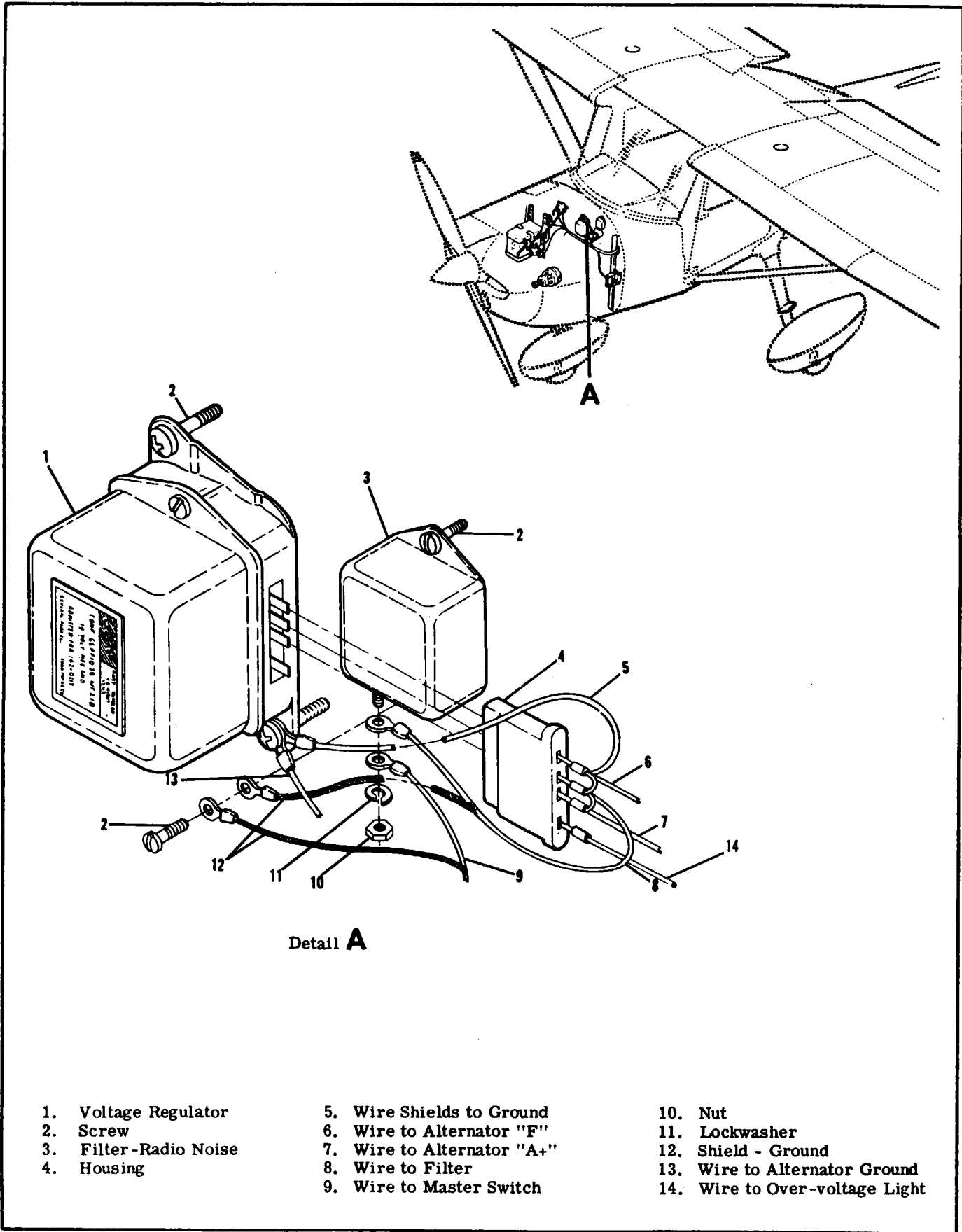


Figure 16-5. Voltage Regulator Installation

16-46. AIRCRAFT LIGHTING SYSTEM.

anti-collision strobe lights, flashing beacon light, dome and instrument flood lights, control wheel map light, compass and radio dial lights.

16-47. DESCRIPTION. The aircraft lighting systems consists of landing and taxi lights, navigation lights,

16-48. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
LANDING AND TAXI LIGHT(s) OUT.	Short circuit in wiring.	1. Inspect circuit breaker. If open, proceed to step 2. If OK, proceed to step 3.
	Defective wiring.	2. Test each circuit separately until short is located. Repair or replace wiring.
	Defective switch.	3. Check voltage at lights with master and landing and taxi light switches ON. Should read battery voltage. Replace switch.
LANDING AND/OR TAXI LIGHT OUT.	Lamp burned out.	1. Test lamp with ohmmeter or new lamp. Replace lamp.
	Open circuit in wiring.	2. Test wiring for continuity. Repair or replace wiring.
FLASHING BEACON DOES NOT LIGHT.	Short circuit in wiring.	1. Inspect circuit breaker. If open, proceed to step 2. If OK, proceed to step 3.
	Defective wiring.	2. Test circuit until short is located. Repair or replace wiring.
	Lamp burned out.	3. Test lamp with ohmmeter or a new lamp. Replace lamp. If lamp is good, proceed to step 4.
	Open circuit in wiring.	4. Test circuit from lamp to flasher for continuity. If no continuity is present, repair or replace wiring. If continuity is present, proceed to step 5.
	Defective switch.	5. Check voltage at flasher with master and beacon switch on. Should read battery voltage. Replace switch. If voltage is present, proceed to step 6.
	Defective flasher.	6. Install new flasher.

16-48. TROUBLE SHOOTING (Cont.)

TROUBLE	PROBABLE CAUSE	REMEDY
FLASHING BEACON CONSTANTLY LIT.	Defective flasher.	1. Install new flasher.
ALL NAV LIGHTS OUT.	Short circuit in wiring.	1. Inspect circuit breaker. If open, proceed to step 2. If OK, proceed to step 3.
	Defective wiring.	2. Isolate and test each nav light circuit until short is located. Repair or replace wiring.
	Defective switch.	3. Check voltage at nav light with master and nav light switches on. Should read battery voltage. Replace switch.
ONE NAV LIGHT OUT.	Lamp burned out.	1. Inspect lamp. Replace lamp.
	Open circuit in wiring.	2. Test wiring for continuity. Repair or replace wiring.

WARNING

The anti-collision system is a high voltage device. Do not remove or touch tube assembly while in operation. Wait at least 5 minutes after turning off power before starting work.

BOTH ANTI-COLLISION STROBE LIGHTS WILL NOT LIGHT.	Open circuit breaker.	1. Check, if open reset. If circuit breaker continues to open proceed to step 2.
		2. Disconnect red wire between aircraft power supply (battery/external power) and strobe power supplies, one at a time. If circuit breaker opens on one strobe power supply. If circuit breaker opens on both strobe power supplies proceed to step 3. If circuit breaker does not open proceed to step 4.
		3. Check aircraft wiring. Repair or replace as necessary.
		4. Inspect strobe power supply ground wire for contact with wing structure.

16-48. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
<p>CAUTION</p> <p>Extreme care should be taken when exchanging flash tube. The tube is fragile and can easily be cracked in a place where it will not be obvious visually. Make sure the tube is seated properly on the base of the nav light assembly and is centered in the dome.</p> <p>NOTE</p> <p>When checking defective power supply and flash tube, units from opposite wing may be used. Be sure power leads are protected properly when unit is removed to prevent short circuit.</p>		
<p>ONE ANTI-COLLISION STROBE LIGHT WILL NOT LIGHT.</p>	<p>Defective Strobe Power Supply, or flash tube.</p>	<p>1. Connect voltmeter to red lead between aircraft power supply (battery/external power) and strobe power supply, connecting negative lead to wing structure. Check for 12 volts. If OK proceed to step 2. If not, check aircraft power supply (battery/external power).</p>
		<p>2. Replace flash tube with known good flash tube. If system still does not work, replace strobe power supply.</p>
<p>DOMELIGHT TROUBLE.</p>	<p>Short circuit in wiring.</p>	<p>1. Inspect circuit breaker. If circuit breaker is open, proceed to step 2. If circuit breaker is OK, proceed to step 3.</p>
	<p>Defective wiring.</p>	<p>2. Test circuit until short is located. Repair or replace wiring.</p>
		<p>3. Test for open circuit. Repair or replace wiring. If no short or open circuit is found, proceed to step 4.</p>
	<p>Lamp burned out.</p>	<p>4. Test lamp with ohmmeter or new lamp. Replace lamp.</p>
<p>Defective switch.</p>	<p>5. Check for voltage at dome light with master and dome light switch on. Should read battery voltage. Replace switch.</p>	

16-48. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
INSTRUMENT LIGHTS WILL NOT LIGHT OR DIM CORRECTLY.	Short circuit in wiring.	1. Inspect circuit breaker. if open, proceed to step 2. If OK, proceed to step 3.
	Defective wiring.	2. Test circuit until short is located. Repair or replace wiring.
		3. Test for open circuit. Repair or replace wiring. If no short or open circuit is found, proceed to step 4.
	Defective rheostat.	4. Check voltage at instrument light with master switch on. Should read battery voltage with rheostat turned full clockwise and voltage should decrease as rheostat is turned counterclockwise. If no voltage is present or voltage has a sudden drop before rheostat has been turned full counterclockwise, replace rheostat..
	Lamp burned out.	5. Test lamp with ohmmeter or new lamp. Replace lamp.
	Defective transistor or open or short circuits between transistor and heat sink.	6. Check for opens or shorts at transistor sockets or between transistor and its heat sink. Heat sink should not ground transistor. If light will not dim, check transistor. Defective or partially shorted transistor can burn out rheostat. Replacement rheostats will continue to burn out until transistor problem is corrected. Replace transistor or insulator as required.

16-48. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
CONTROL WHEEL MAP LIGHT WILL NOT LIGHT.	Nav light switch turned off.	1. Nav light switch has to be ON before map light will light.
	Short circuit in wiring.	2. Check lamp fuse on terminal board located on back of stationary panel with ohmmeter. If fuse is open, proceed to step 3. If fuse is OK, proceed to step 4.
	Defective wiring.	3. Test circuit until short is located. Repair or replace wiring.
		4. Test for open circuit. Repair or replace wiring. If a short or open circuit is not found, proceed to step 5.
	Defective map light	5. Check voltage at map light assembly with master and nav switches on. If battery voltage is present, replace map light assembly.

16-49. LANDING AND TAXI LIGHT.

16-50. DESCRIPTION. The landing and taxi light is mounted in the nose cap of the lower half of the engine cowl. This position facilitates the use of one lamp or both a landing and taxi light. A light cover provides weather protection for the lamp. The landing and taxi light is controlled by a rocker type switch located on the instrument panel. A circuit breaker is used to protect the landing and taxi light circuit.

16-51. REMOVAL AND INSTALLATION. (Refer to figure 16-6).

- a. Remove screws (1) and washers (2) securing cover (3) to nose cap (9) and remove cover.
- b. Remove screws (4) through bracket (5) and remove light assembly from support bracket (8). Note position and number of washer between plate (7) and support bracket (8).
- c. Disconnect electrical leads from lamp (6) and remove lamp assembly.
- d. Remove screws (13) from bracket (5) and remove lamp.
- e. To install landing and taxi light, install new lamp (6) between bracket(s) and plate (7). A minimum of one gasket (12) and a maximum of two may be used to secure lamp.
- f. Connect electrical leads to lamp.
- g. Secure lamp assembly to bracket (8) with screws (4). Be sure washers (10) are installed in the same position as prior to removal.
- h. Secure cover (3) to nose cap (9) with screws (1) and washers (2).

16-52. DUAL LANDING AND TAXI LIGHTS.

16-53. DESCRIPTION. The landing and taxi lights are mounted in the nose cap of the lower half of the engine cowl. The left lamp is used for taxiing and the right for landing. The lamps are controlled by a dual switch assembly with individual operating rocker type switches located on the instrument panel.

16-54. REMOVAL AND INSTALLATION. (Refer to figure 16-6).

- a. Remove screws (11) securing bracket assembly (1) to nose cap (8).
- b. Pull bracket assembly (1) forward from nose cap (8) and disconnect electrical leads from lamps.
- c. Remove screws (7) securing lamp assembly being removed to bracket assembly (1) and remove lamp assembly. Be sure to note position of washers and spacer on taxi light if taxi light is being removed.
- d. Remove screws (2) securing bracket (3) to plate (6) and remove lamp (4).
- e. To install landing or taxi light, install new lamp (4) between bracket (3) and plate (6). A minimum of one gasket (5) and a maximum of two may be used to

secure lamp.

- f. Connect electrical leads to lamps.
- g. Secure lamp assembly or assemblies removed to bracket assembly (1) with screws (7). Be sure washers (9) and spacer (10) are installed in the same position as prior to removal if the taxi light is being installed.
- h. Connect electrical leads to lamps.
- i. Secure bracket assembly (1) to nose cap (8) with screws (11).

16-55. NAVIGATION LIGHTS.

16-56. DESCRIPTION. The navigation lights are attached to the wing tips and the aft end of the vertical fin tip. The lamps are controlled by a rocker type switch located on the instrument panel. A circuit breaker is installed to protect the circuit.

16-57. REMOVAL AND INSTALLATION. For removal and installation of navigation lights refer to figure 16-7.

16-58. ANTI-COLLISION STROBE LIGHTS.

16-59. DESCRIPTION. A white strobe light may be installed on each wing tip with the navigation lights. Strobe lights are vibration resistant and operate on the principle of a capacitor discharge into a xenon tube, producing an extremely high intensity flash. Energy is supplied to the lights from individual power supplies mounted on each wing tip rib.

16-60. REMOVAL AND INSTALLATION. For removal and installation of strobe light and power supply refer to figure 16-7.

WARNING

The anti-collision system is a high voltage device. Do not remove or touch tube assembly while in operation. Wait at least 5 minutes after turning off power before starting work.

16-61. OPERATIONAL REQUIREMENTS.

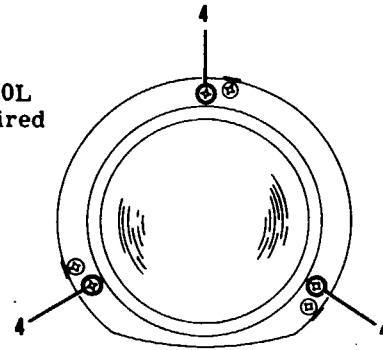
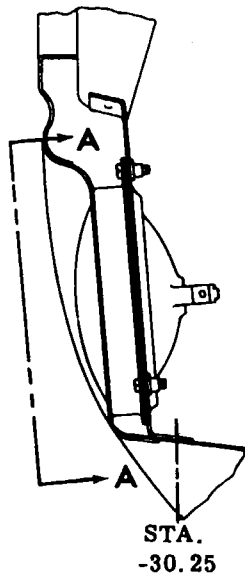
CAUTION

The capacitors in the strobe light power supplies must be reformed if not used for a period of (6) months. The following procedure must be used.

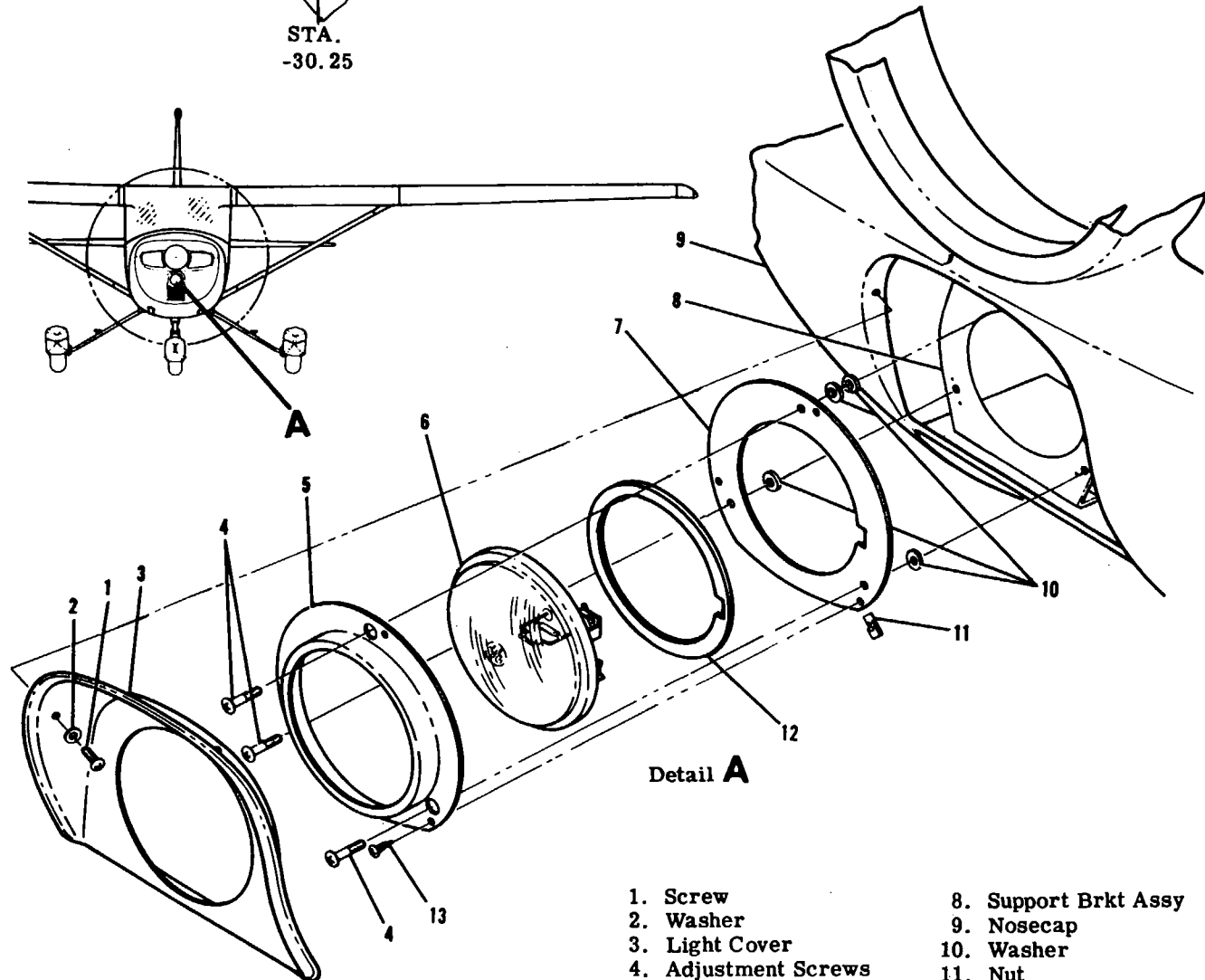
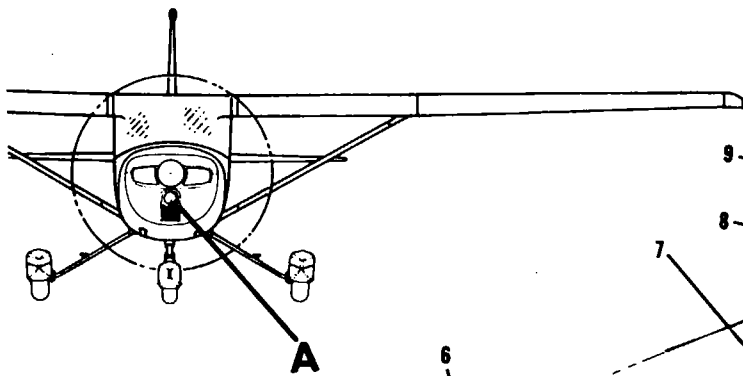
Connect the power supply, red wire to plus, black to ground to 6 volt DC source. Do Not connect strobe tube. Turn on 6 volt supply. Note current draw after one minute. If less than 1 ampere, continue opera-

NOTE

To adjust the landing light, add AN960-10 and/or AN960-10L washers (Ref item 10) as required between plate (7) and support bracket assy (8).



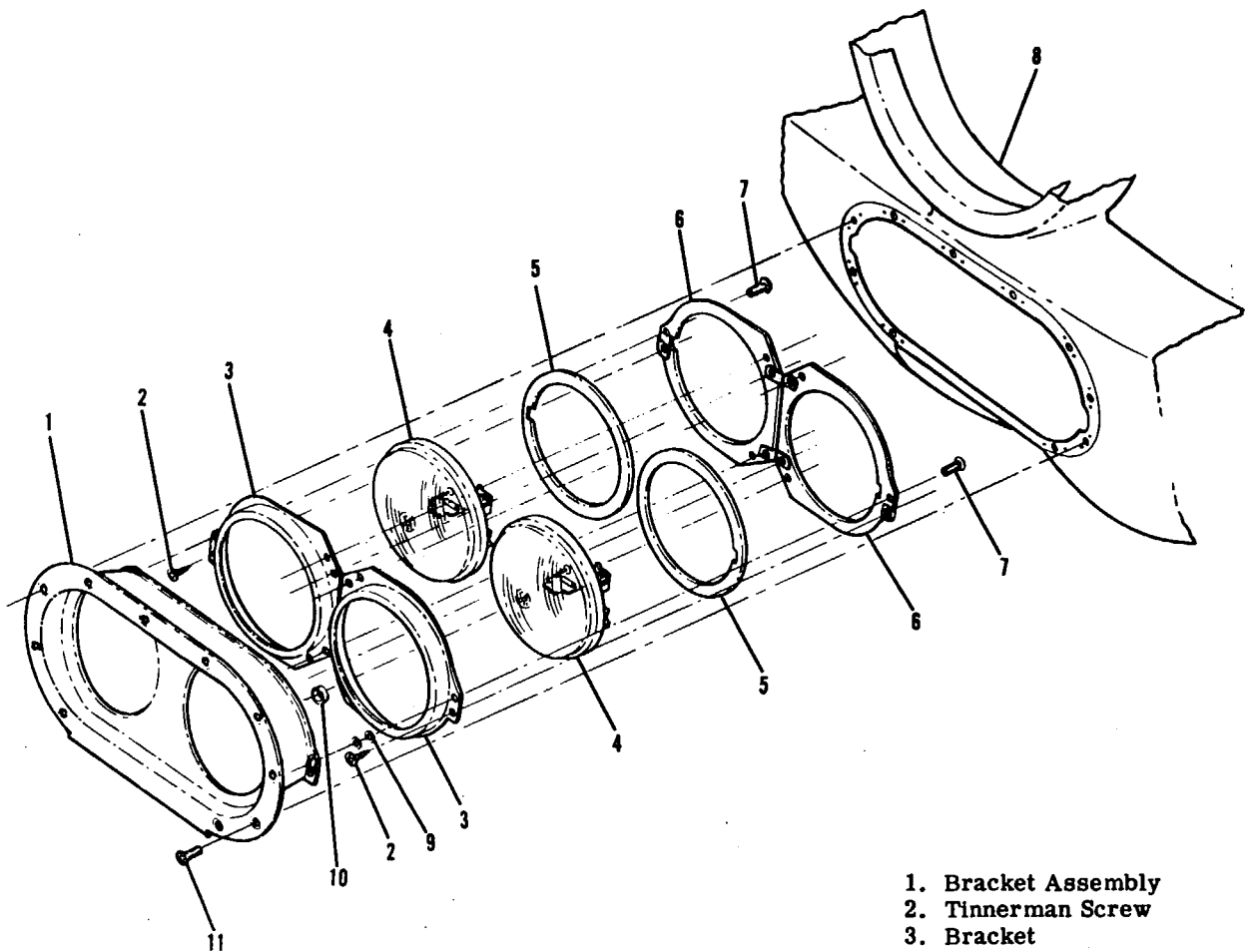
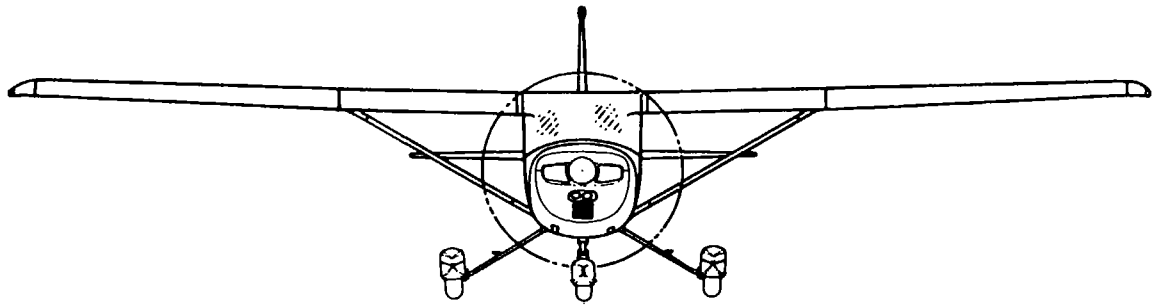
VIEW A-A



Detail A

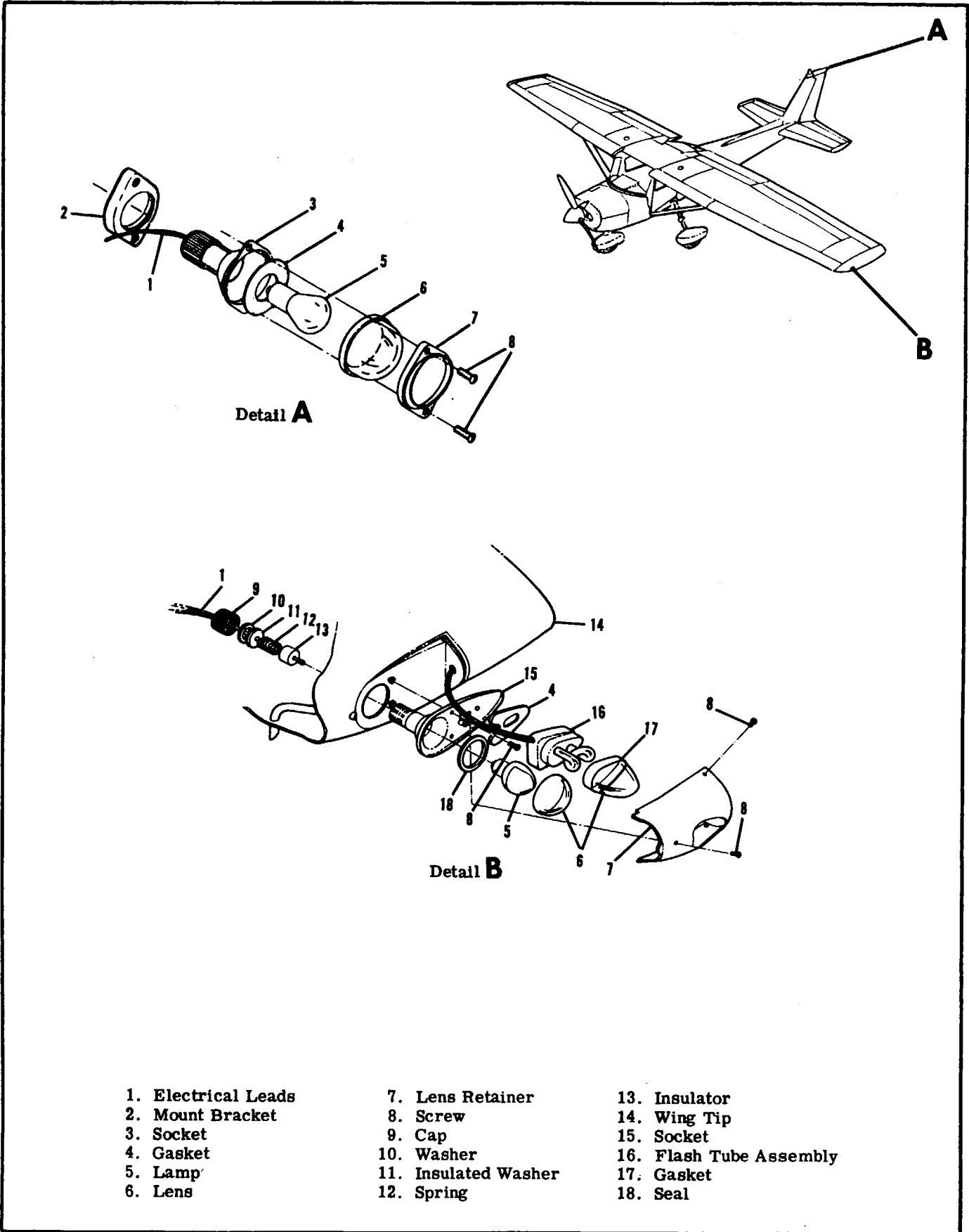
- | | |
|----------------------|----------------------|
| 1. Screw | 8. Support Brkt Assy |
| 2. Washer | 9. Nosecap |
| 3. Light Cover | 10. Washer |
| 4. Adjustment Screws | 11. Nut |
| 5. Bracket | 12. Gasket |
| 6. Lamp | 13. Mounting Screw |
| 7. Plate | |

Figure 16-6. Landing and Taxi Light Installation (Sheet 1 of 2)



1. Bracket Assembly
2. Tinnerman Screw
3. Bracket
4. Lamp
5. Gasket
6. Plate
7. Adjustment Screw
8. Nosecap
9. Washer
10. Spacer
11. Mounting Screw

Figure 16-6. Landing and Taxi Light Installation (Sheet 2 of 2)

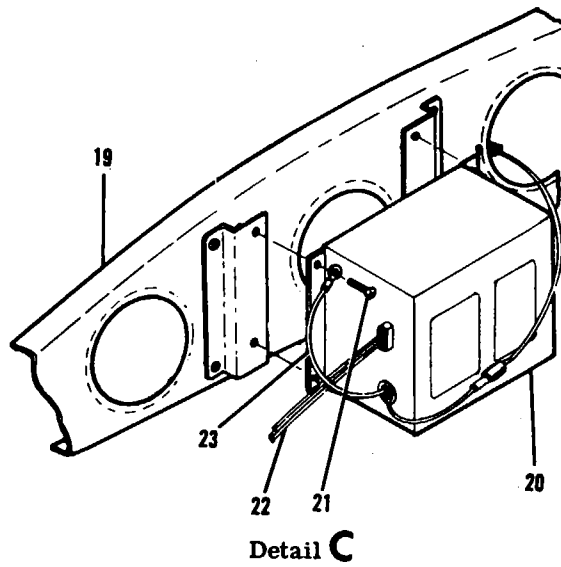
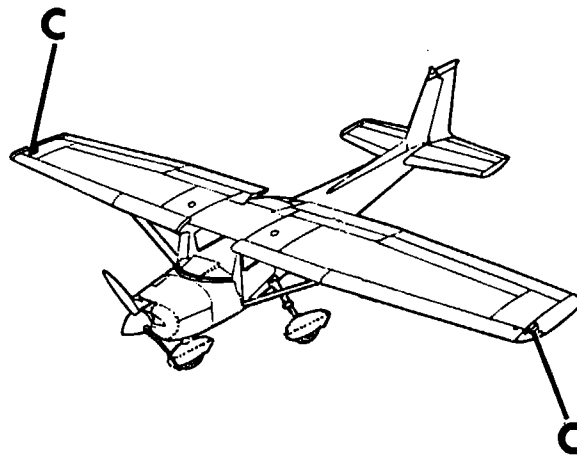


- 1. Electrical Leads
- 2. Mount Bracket
- 3. Socket
- 4. Gasket
- 5. Lamp
- 6. Lens

- 7. Lens Retainer
- 8. Screw
- 10. Washer
- 11. Insulated Washer
- 12. Spring

- 13. Insulator
- 14. Wing Tip
- 15. Socket
- 16. Flash Tube Assembly
- 17. Gasket
- 18. Seal

Figure 16-7. Navigation and Anti-Collision Strobe Lights Installation (Sheet 1 of 2)



- 19. Wing Tip Rib
- 20. Power Supply
- 21. Screw
- 22. Electrical Leads
- 23. Ground Wire

Figure 16-7. Navigation and Anti-Collision Strobe Lights Installation (Sheet 2 of 2)

tion for 24 hours. Turn off DC power source. Then connect to the proper voltage, 12 volt. Connect tube to output of strobe power supply and allow to operate, flashing, for 15 minutes. Remove strobe tube. Operating power supply at 12 volts, note the current drain after one minute. If less than 0.5 amperes, operate for 6 hours. If current draw is greater than 0.5 amperes, reject the unit.

16-62. FLASHING BEACON.

16-63. DESCRIPTION. The flashing beacon light is attached to the vertical fin tip. The lamp is iodine-vapor, electrically switched by a solid-state flasher assembly. The flasher assembly is mounted in the aft section of the tailcone. The switching frequency of the flasher assembly operates the beacon at approximately 45 flasher per minute. A 1.5 ohm, 75 watt resistor is installed to eliminate a pulsing effect on the cabin lighting and ammeter.

16-64. REMOVAL AND INSTALLATION. For removal and installation of flashing beacon refer to figure 16-8.

16-65. INSTRUMENT AND DOME LIGHTS.

16-66. DESCRIPTION. The instrument flood light and dome light are installed in the overhead console. The dome light consists of a frosted lens and a single bulb controlled by a rocker switch on the instrument panel. The instrument flood light consists of a red lens and a single bulb controlled by a rheostat switch located on the instrument panel below the pilots control wheel.

16-67. REMOVAL AND INSTALLATION. For removal and installation of instrument and dome lights refer to figure 16-9.

16-68. TRANSISTORIZED LIGHT DIMMING.

16-69. DESCRIPTION. A remotely located, two-circuit transistorized dimming assembly is installed to control instrument lighting. One circuit controls the compass light, map light and instrument flood lights. The other circuit controls radio lighting. A concentric knob arrangement on a dual rheostat assembly mounted on the instrument panel.

16-70. REMOVAL AND INSTALLATION. For removal and installation of transistorized dimming assembly, refer to figure 16-10.

16-71. COMPASS AND RADIO DIAL LIGHTING.

16-72. DESCRIPTION. The compass and radio dial lighting are contained within the individual units. The lighting is controlled by a concentric knob arrangement on a dual rheostat assembly mounted on the instrument panel.

16-73. CONTROL WHEEL MAP LIGHT.

16-74. DESCRIPTION. The control wheel map light is mounted on the lower side of the control wheel. Light intensity is controlled by a thumb operated rheostat. For dimming the rheostat should be turned clockwise.

16-75. REMOVAL AND INSTALLATION. (Refer to figure 16-11).

- a. For easy access to the map light assembly, rotate the control wheel 90°.
- b. Remove screws (9), spacers (8) and shield (10).
- c. Remove screws (7), inserts (11) and shield (12).
- d. Label the map light wires at the terminal block, then remove screws securing wires to terminal block.
- e. For reassembly reverse the preceding steps.

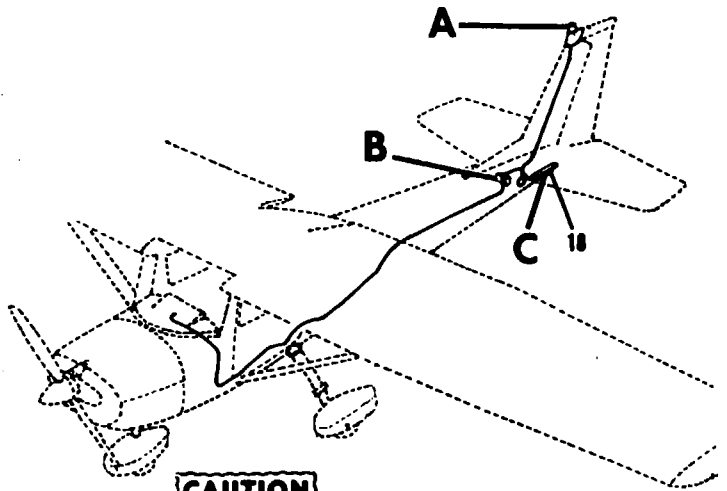
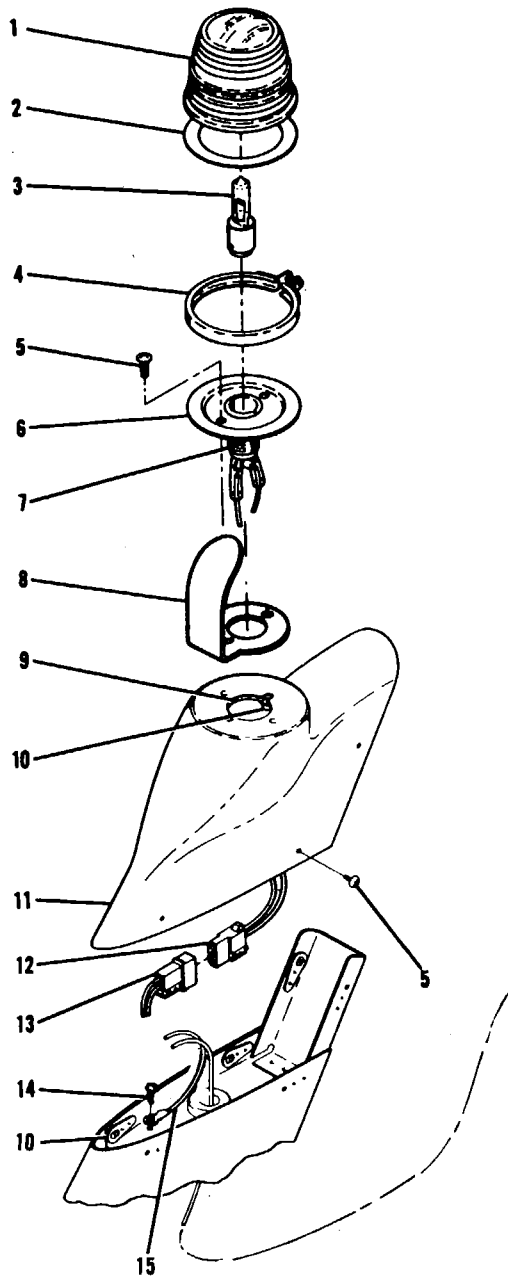
16-76. PITOT HEATER.

16-77. DESCRIPTION. An electrical heater unit may be installed in the pitot tube. The heater offsets the possibility of ice formation on the pitot tube. The heater is integrally mounted in the pitot tube and is operated by a rocker switch on the instrument panel.

16-78. REMOVAL AND INSTALLATION. For removal and installation of pitot heater refer to figure 16-12.

16-79. CIGAR LIGHTER.

16-80. DESCRIPTION. The cigar lighter is mounted on the instrument panel below the pilots control wheel. A 9 amp inline fuse is installed to protect the wire from the cigar lighter to the ammeter.



CAUTION

When inserting lamp into socket always use a handkerchief or a tissue to prevent getting fingerprints on the lamp.

NOTE

Fingerprints on lamp may shorten the life of the lamp.

Detail A

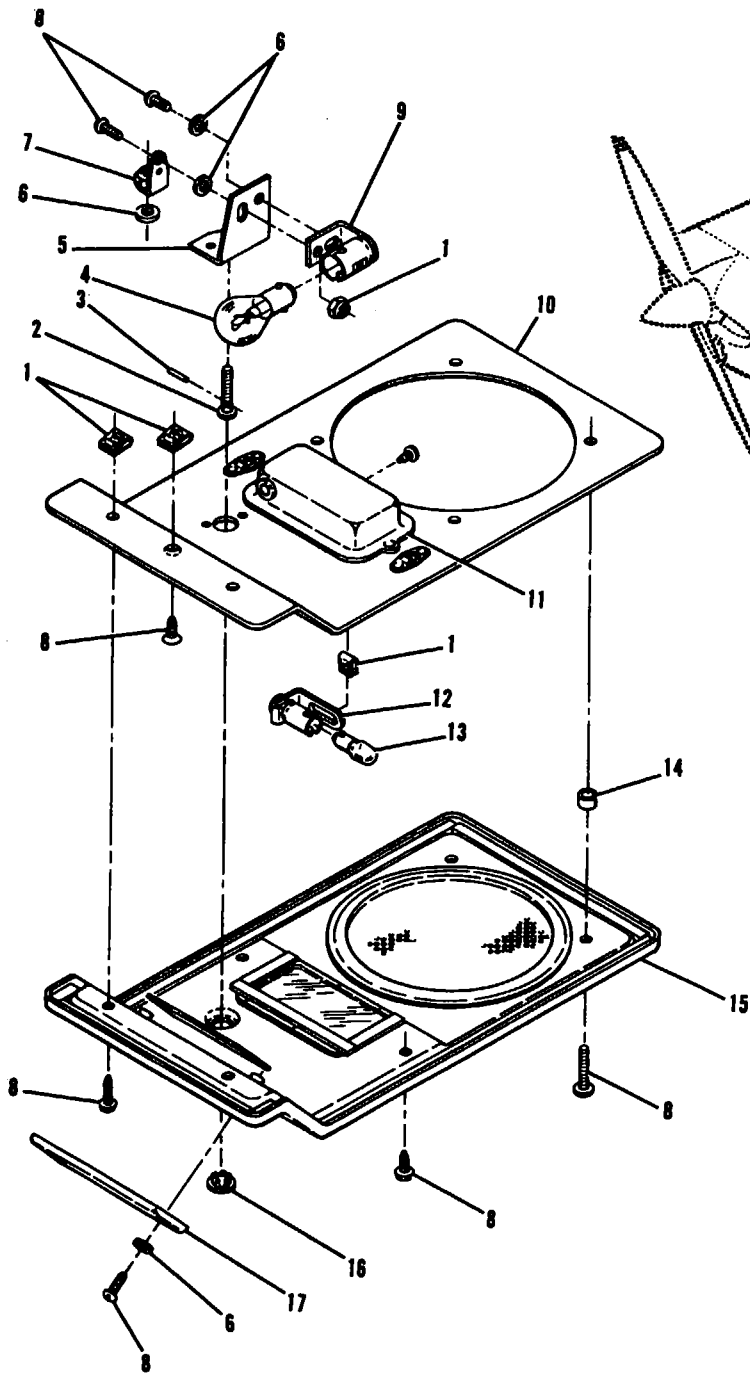
Detail B

Detail C

- 1. Dome
- 2. Gasket
- 3. Lamp
- 4. Clamp Assembly
- 5. Screw
- 6. Plate - Mounting
- 7. Socket Assembly
- 8. Shield
- 9. Plate Assy - Mounting
- 10. Nutplate

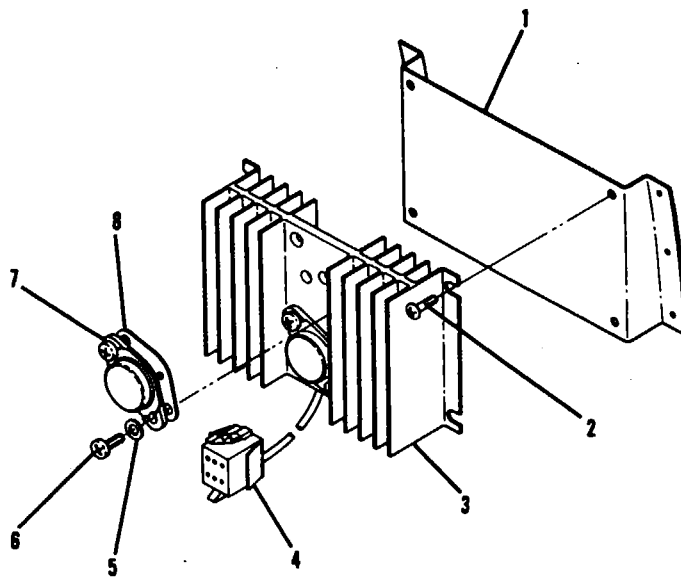
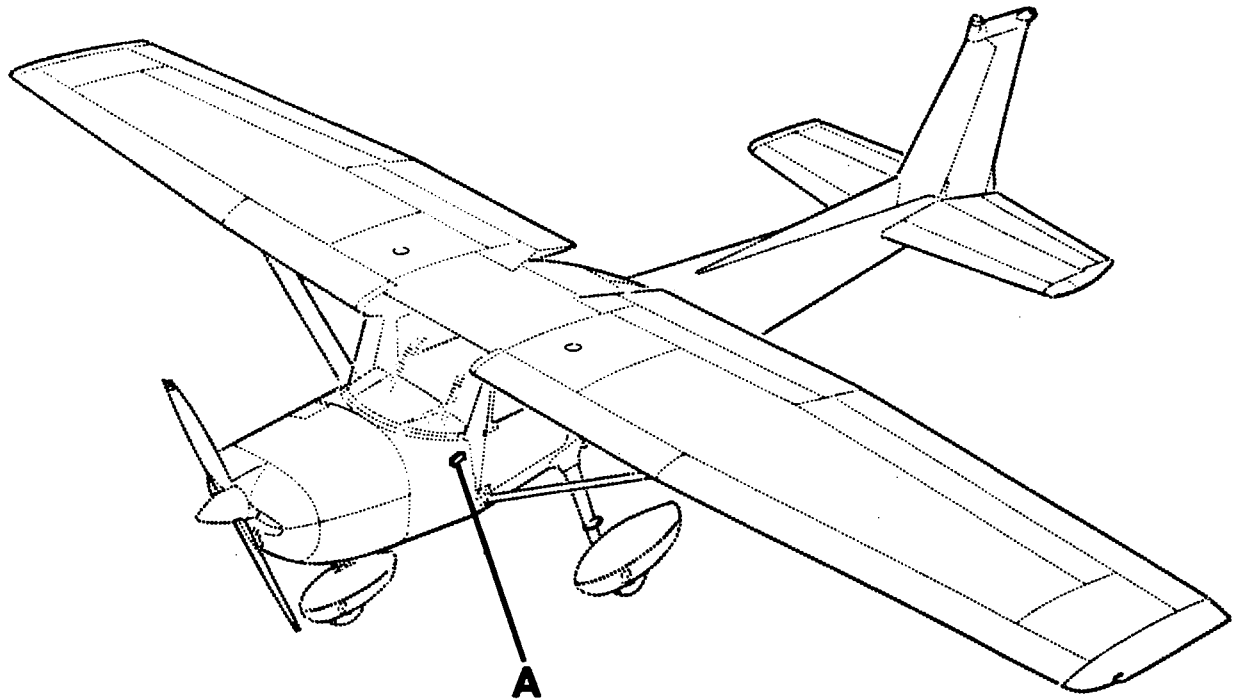
- 11. Tip Assembly - Fin
- 12. Housing - Plug
- 13. Housing - Cap
- 14. Grommet
- 15. Ground Wire
- 16. Bulkhead - Tailcone
- 17. Flasher Assembly
- 18. Nut
- 19. Resistor
- 20. Inspection Plate

Figure 16-8. Flashing Beacon Light Installation



1. Nut
2. Adjustment Screw
3. Pin
4. Lamp (Instrument Light)
5. Bracket
6. Washer
7. Nutplate
8. Screw
9. Socket (Instrument Light)
10. Plate
11. Reflector
12. Socket (Dome Light)
13. Lamp (Dome Light)
14. Spacer
15. Cover
16. Plug Button
17. Adjustment Shield

Figure 16-9. Instrument and Dome Light Console Installation



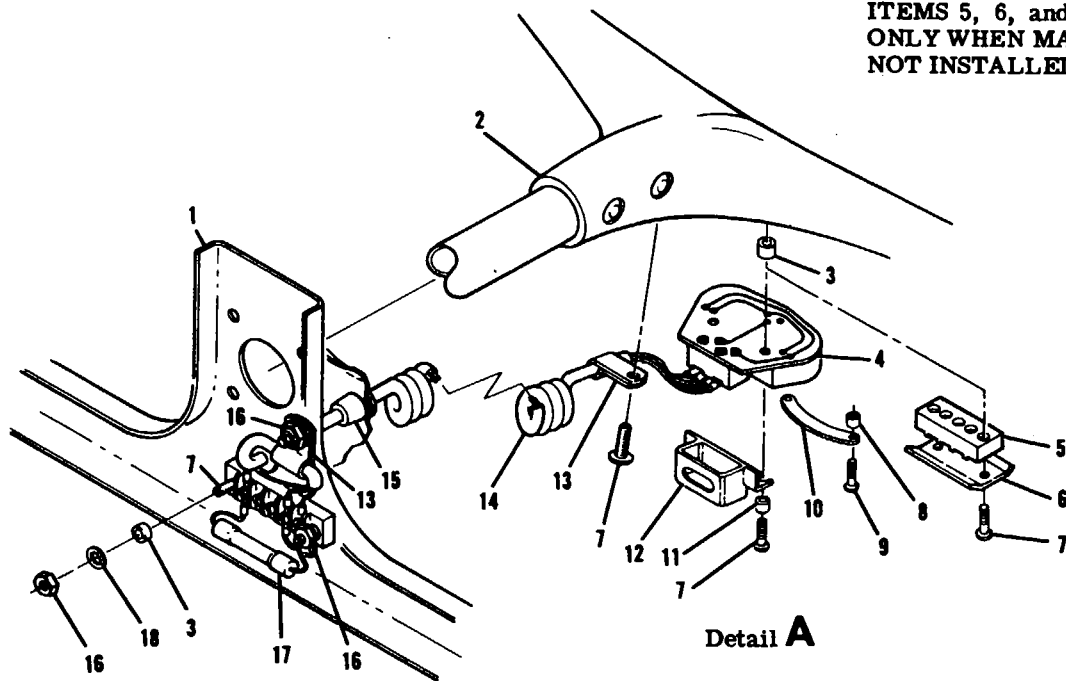
Detail A

- | | |
|---------------------|---------------|
| 1. Mounting Bracket | 5. Washer |
| 2. Mounting Screw | 6. Screw |
| 3. Heat Sink | 7. Transistor |
| 4. Connector | 8. Insulator |

Figure 16-10. Transistorized Light Dimming Installation

NOTE

ITEMS 5, 6, and 7 ARE USED ONLY WHEN MAP LIGHT IS NOT INSTALLED.



- 1. Stationary Panel Assembly
- 2. Control Wheel Assembly
- 3. Spacer
- 4. Map Light Assembly
- 5. Terminal Block
- 6. Cover
- 7. Screw
- 8. Spacer
- 9. Screw
- 10. Shield
- 11. Insert
- 12. Cover
- 13. Clamp
- 14. Cable Assembly
- 15. Grommet
- 16. Nut
- 17. Fuse
- 18. Lock Washer
- 19. Lamp
- 20. Rheostat

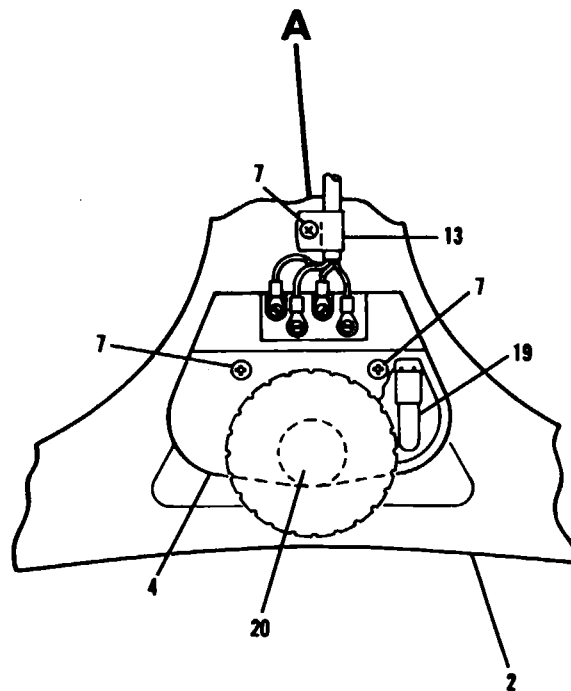


Figure 16-11. Control Wheel Map Light Installation

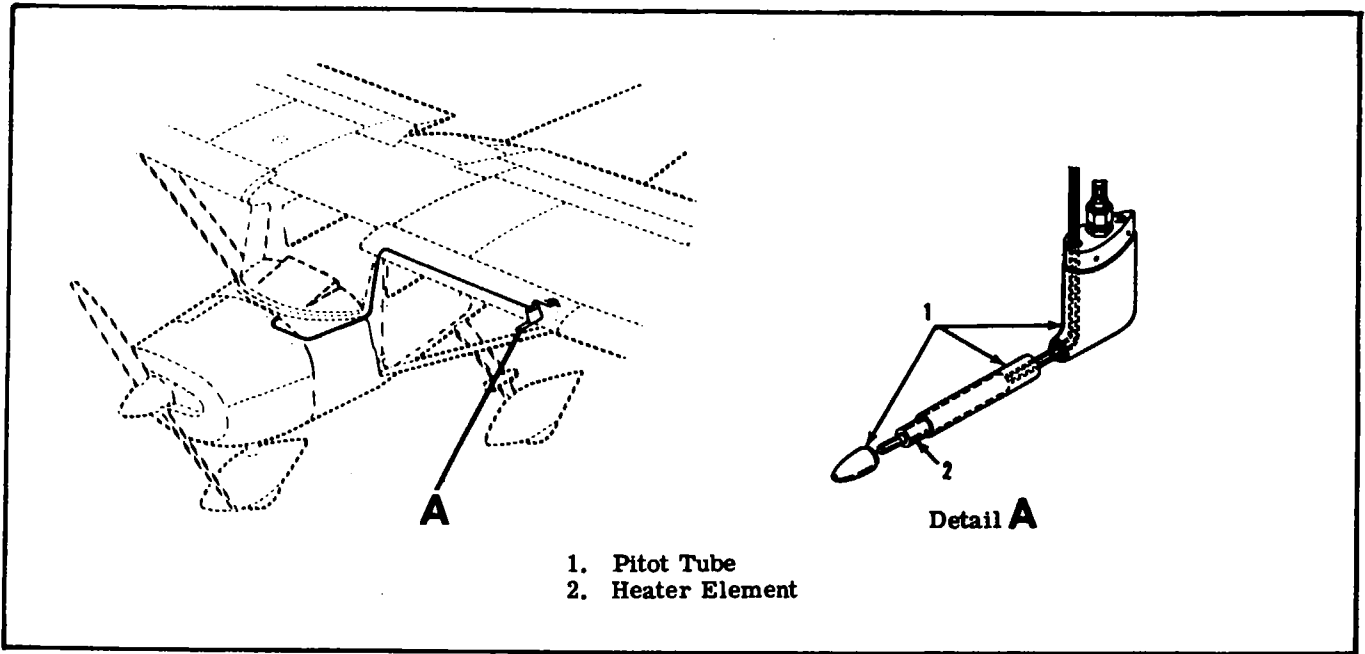


Figure 16-12. Pitot Heater System

SHOP NOTES:

16-81. EMERGENCY LOCATOR TRANSMITTER.

16-82. DESCRIPTION. The ELT is a self-contained, solid state unit, having its own power supply, with an externally mounted antenna. The C589510-0209 transmitter is designed to transmit simultaneously on dual emergency frequencies of 121.5 and 243.0 Megahertz. The C589510-0211 transmitter used for Canadian registry, operates on 121.5 only. The unit is mounted in the tailcone, aft of the baggage curtain on the right hand side. The transmitters are designed to provide a broadcast tone that is audio modulated in a swept manner over the range of 1600 to 300 Hz in a distinct, easily recognizable distress signal for reception by search and rescue personnel and others monitoring the emergency frequencies. Power is supplied to the transmitter by a battery-pack which has the service life of the batteries placarded on the batteries and also on the outside end of the transmitter. ELT's are equipped with a battery-pack containing four lithium "D" size batteries which are stacked in two's (See figure 16-13). The ELT exhibits line of sight transmission characteristics which correspond approximately to 100 miles at a search altitude of 10,000 feet. When battery inspection and replacement schedules are adhered to, the transmitter will broadcast an emergency signal at rated power (75 MW-minimum), for a continuous period of time as listed in the following table.

TRANSMITTER LIFE
TO 75 MILLIWATTS OUTPUT

Temperature	4 Cell Lithium Battery Pack
+130°F	115 hrs
+ 70°F	115 hrs
- 4°F	95 hrs
- 40°F	23 hrs

Battery-packs have a normal shelf life of five to ten (5-10) years and must be replaced at 1/2 of normal shelf life in accordance with TSO-C91. Cessna specifies 5 years replacement of lithium (4-cell) battery packs.

16-83. OPERATION. A three position switch on the forward end of the unit controls operation. Placing the switch in the ON position will energize the unit to start transmitting emergency signals. In the OFF position, the unit is inoperative. Placing the switch in the ARM position will set the unit to start transmitting emergency signals only after the unit has received a 5g (tolerances are +2g and -0g) impact force, for a duration of 11-16 milliseconds.

CAUTION

Do not leave the emergency locator transmitter in the ON position longer than 5 seconds or you may activate downed aircraft procedures by C. A. P., D. O. T. or F. A. A. personnel.

16-84. CHECKOUT INTERVAL:

100 HOURS.

- a. Turn aircraft master switch ON.
- b. Turn aircraft transceiver ON and set frequency on receiver to 121.5 MHz.
- c. Remove the ELT's antenna cable from the ELT unit.
- d. Place the ELT's function selector switch in the ON position for 5 seconds or less. Immediately replace the ELT function selector switch in the ARM position after testing ELT.
- e. Test should be conducted only within the time period made up of the first five minutes after any hour.

CAUTION

Tests with the antenna connected should be approved and confirmed by the nearest control tower.

NOTE

Without its antenna connected, the ELT will produce sufficient signal to reach your receiver, yet it will not disturb other communications or damage output circuitry.

NOTE

After accumulated test or operation time equals 1 hour, battery-pack replacement is required.

- f. Check calendar date for replacement of battery-pack. This date is supplied on a sticker attached to the outside of the ELT case and to each battery.

16-85. REMOVAL AND INSTALLATION OF TRANSMITTER. (Refer to figure 16-13.)

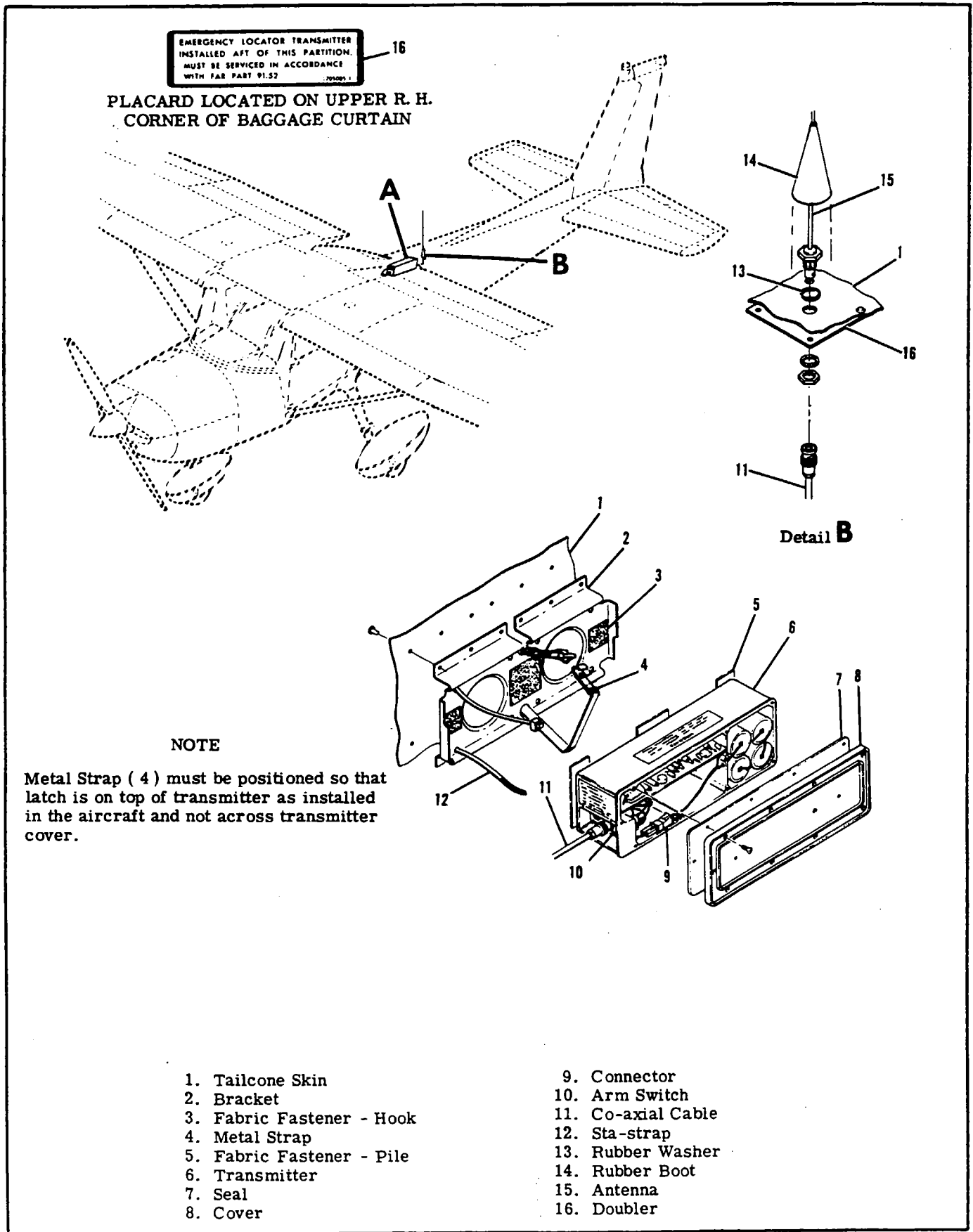
- a. Remove baggage curtain to gain access to the transmitter and antenna.
- b. Disconnect co-axial cable from end of transmitter.
- c. Cut sta-strap securing antenna cable and unlatch metal strap to remove transmitter.

NOTE

Transmitter is also attached to the mounting bracket by velcro strips; pull transmitter to free from mounting bracket and velcro.

NOTE

To replace velcro strips, clean surface thoroughly with clean cloth saturated in one of the following solvents: Trichloric thylene, Aliphatic Napthas, Methyl Ethyl Ketone or Enmar 6094 Lacquer Thinner. Cloth should be folded each time the surface is wiped to present a clean area and avoid redepositing of grease. Wipe surface immediately with clean dry cloth, do not allow solvent to dry on surface. Apply Velcro #40 adhesive to



EMERGENCY LOCATOR TRANSMITTER
 INSTALLED AFT OF THIS PARTITION.
 MUST BE SERVICED IN ACCORDANCE
 WITH FAR PART 91.32

PLACARD LOCATED ON UPPER R. H.
 CORNER OF BAGGAGE CURTAIN

Detail B

NOTE

Metal Strap (4) must be positioned so that latch is on top of transmitter as installed in the aircraft and not across transmitter cover.

- | | |
|---------------------------|--------------------|
| 1. Tailcone Skin | 9. Connector |
| 2. Bracket | 10. Arm Switch |
| 3. Fabric Fastener - Hook | 11. Co-axial Cable |
| 4. Metal Strap | 12. Sta-strap |
| 5. Fabric Fastener - Pile | 13. Rubber Washer |
| 6. Transmitter | 14. Rubber Boot |
| 7. Seal | 15. Antenna |
| 8. Cover | 16. Doubler |

Figure 16-13. Emergency Loactor Transmitter Installation

each surface in a thin even coat and allow to dry until quite tacky, but no longer transfers to the finger when touched (usually between 5 and 30 minutes). Porous surfaces may require two coats. Place the two surfaces in contact and press firmly together to insure intimate contact. Allow 24 hours for complete cure.

- d. To reinstall transmitter, reverse preceding steps.

NOTE

An installation tool is required to properly secure sta-strap. This tool may be purchased locally or ordered from the Pandiut Corporation, Tinley Park, Ill., part number GS-2B (Conforms to MS90387-1).

CAUTION

Ensure that the direction of flight arrows (placarded on the transmitter) are pointing towards the nose of the aircraft.

16-86. REMOVAL AND INSTALLATION OF ANTENNA. (Refer to figure 16-13.)

- a. Disconnect co-axial cable from base of antenna.
- b. Remove the nut and lockwasher attaching the antenna base to the fuselage and the antenna will be free for removal.
- c. To reinstall the antenna, reverse the preceding steps.

NOTE

Upon reinstallation of antenna, cement rubber boot (14) using RTV102, General Electric Co. or equivalent, to antenna whip only; do not apply adhesive to fuselage skin or damage to paint may result.

WARNING

Only Dorne and Margolin (D&M) ELT battery packs should be used as replacements. Use of inferior substitute battery packs could jeopardize crash victim's lives.

16-87. REMOVAL AND INSTALLATION OF LITHIUM FOUR (4) CELL BATTERY-PACK. (Refer to figure 16-14.)

NOTE

Transmitters equipped with the 4 cell battery-pack can only be replaced with another 4 cell battery-pack.

- a. After the transmitter has been removed from aircraft in accordance with para. 16-85, place the transmitter switch in the OFF position.
- b. Remove the nine screws attaching the cover to the case and then remove the cover to gain access to the battery-pack.

NOTE

Retain the rubber gasket and screws for reinstallation.

- c. Disconnect the battery-pack electrical connector and remove battery-pack.
- d. Place new battery-pack in the transmitter with four batteries as shown in the case in figure 16-14.
- e. Connect the electrical connector as shown in figure 16-14.

NOTE

Before installing the new 4 cell battery-pack, check to ensure that its voltage is 11.2 volts or greater.

CAUTION

It is desirable to replace adhesive material on the 4 cell battery-pack, use only 3M Jet Melt Adhesive #3738. Do not use other adhesive materials since other materials may corrode the printed circuit board assembly.

- f. Replace the transmitter cover and gasket.
- g. Remove the old battery-pack placard from the end of transmitter and replace with new battery-pack placard supplied with the new battery-pack.

CAUTION

Be sure to enter the new battery-pack expiration date in the aircraft records. It is also recommended this date be placed in your ELT Owner's Manual for quick reference.

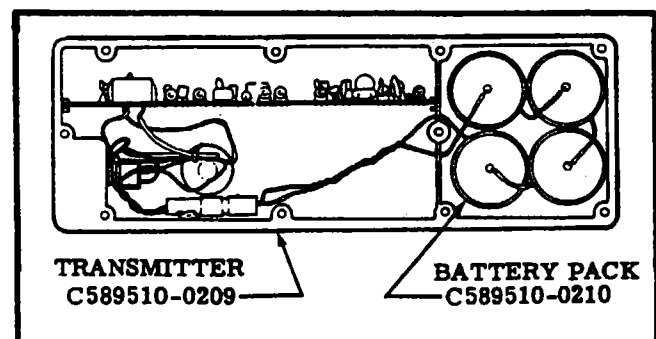


Figure 16-14. Lithium 4 Cell Battery Pack Installations

16-88. TROUBLE SHOOTING. Should your Emergency Locating Transmitter fail the 100 Hours performance checks, it is possible to a limited degree to isolate the fault to a particular area of the equipment. In performing the following trouble shooting procedures to test peak effective radiated power, you will be able to determine if battery replacement is necessary or if your unit should be returned to your dealer for repair.

16-88. TROUBLE SHOOTING (Cont.)

TROUBLE	PROBABLE CAUSE	REMEDY
*POWER LOW	Low battery voltage.	<ol style="list-style-type: none"> 1. Set toggle switch to off. 2. Remove plastic plug from the remote jack and by means of a Switchcraft #750 jackplug, connect a Simpson 260 model voltmeter and measure voltage. If the battery pack transmitters is 11.2 volts or less, the battery pack is below specification.
	Faulty transmitter.	<ol style="list-style-type: none"> 3. If the battery-pack voltage meets the specifications in step 2, the battery-pack is O. K. If the battery is O. K., check the transmitter as follows: <ol style="list-style-type: none"> a. Remove the voltmeter. b. By means of a switchcraft 750 jackplug and 3 inch maximum long leads, connect a Simpson Model 1223 ammeter to the jack. c. Set the toggle switch to ON and observe the ammeter current drain. If the current-drain is in the 85-100 ma range, the transmitter or the co-axial cable is faulty.
	Faulty co-axial antenna cable.	<ol style="list-style-type: none"> 4. Check co-axial antenna cable for high resistance joints. If this is found to be the case, the cable should be replaced.

*This test should be carried out with the co-axial cable provided with your unit.

ELECTRICAL LOAD ANALYSIS CHART

ALL MODELS

STANDARD EQUIPMENT (RUNNING LOAD)	AMPS REQD 1977
Battery Contactor Fuel Indicators Flashing Beacon Light ** Instrument Lights Position Lights Turn Coordinator *	0.6 0.4 7.0 1.1 5.6 0.8
OPTIONAL EQUIPMENT (RUNNING LOAD)	
Strobe Lights Cessna 300 ADF (Type R-546E) Cessna 300 Nav/Com (RT-308C) Cessna 300 Transceiver (Type RT-524A) Cessna 300 Transponder (RT-359A) Cessna 300 N/C (ARC Type RT-328T) Cessna 300 Glideslope (R-443B) (40 Channel) Cessna 400 Marker Beacon (Type R-402A) Cessna 400 Encoding Altimeter (Type EA-401A) 400 XPDR (ARC Type RT-459A) (Export Only) Marker Beacon (Bendix GM-247A) (Export Only)	3.0 1.0 1.5 3.2 1.0 1.5 0.5 0.1 0.2 1.0 0.10
ITEMS NOT CONSIDERED AS PART OF RUNNING LOAD	
Cigar Lighter Clock Dome Light Flap Motor Landing Light (Cowl Mounted) Landing and Taxi Lights (Dual Cowl Mounted)	10.0 † 0.3 15.0 20.0 15.6
† Negligible * Optional on the Standard Model 150 ** Optional on the Standard, Trainer and F150	

SECTION 18

STRUCTURAL REPAIR

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18-1. STRUCTURAL REPAIR.

18-2. REPAIR CRITERIA. Although this section outlines repair permissible on structure of the aircraft, the decision of whether to repair or replace a major unit of structure will be influenced by such

factors as time and labor available, and by a comparison of labor costs with the price of replacement assemblies. Past experience indicates that replacement, in many cases, is less costly than major repair. Certainly, when the aircraft must be restored to its airworthy condition in a limited length of time,

replacement is preferable. Restoration of a damaged aircraft to its original design strength, shape, and alignment involves careful evaluation of the damage, followed by exacting workmanship in performing the repairs. This section suggests the extent of structural repair practicable on the aircraft, and supplements Federal Aviation Regulation, Part 43. Consult the factory when in doubt about a repair not specifically mentioned here.

18-3. EQUIPMENT AND TOOLS.

18-4. SUPPORT STANDS. Padded, reinforced saw-horse or tripod type support stands, sturdy enough to support any assembly placed upon them, must be used to store a removed wing or tailcone. Plans for local fabrication of support stands are contained in figure 18-1. The fuselage assembly, from the tailcone to the firewall, must NOT be supported from the underside, since the skin bulkheads are not designed for this purpose. Adapt support stands to fasten to the wing attach points or landing gear attach points when supporting a fuselage.

18-5. 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.

18-6. 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.

18-7. WING TWIST AND STABILIZER ANGLE - OF-INCIDENCE.

18-8. Wing twist (washout) and horizontal stabilizer angle of incidence are shown below. Stabilizers do not have twist. Wings have no twist from the root to the lift strut station. All twist in the wing panel occurs between this station and the tip rib. Refer to figure 18-2 for wing twist measurement.

WING	
Twist (Washout)	1°
STABILIZER	
Angle of Incidence	-3°

18-9. REPAIR MATERIALS. Thickness of a material on which a repair is to be made can easily be determined by measuring with a micrometer. In general, material used in Cessna aircraft covered in

this manual is made from 2024 aluminum alloy, heat treated to a -T3, -T4, or -T42 condition. If the type of material cannot readily be determined, 2024-T3 may be used in making repairs, since the strength of -T3 is greater than -T4 or -T42 (-T4 and -T42 may be used interchangeably, but they may not be substituted for -T3). When necessary to form a part with a smaller bend radius than the standard cold bending radius for 2024-T4, use 2024-0 and heat treat to 2024-T42 after forming. The repair material used in making a repair must equal the gauge of the material being replaced unless otherwise noted. It is often practical to cut repair pieces from service parts listed in the Parts Catalog. A few components (empennage tips, for example) are fabricated from thermo-formed plastic or glass-fiber constructed material.

18-10. WING.

18-11. DESCRIPTION. The wing assemblies are a semicantilever type employing semimoncoque type of structure. Basically, the internal structure consists of built-up front and rear spar assemblies, a formed auxiliary spar assembly and formed sheet metal nose, intermediate, and trailing edge ribs. Stressed skin, riveted to the rib and spar structures, completes the rigid structure. Access openings (hand holes with removable cover plates) are located in the underside of the wing between the wing root and tip section. These openings afford access to aileron bellcranks, flap bellcranks, electrical wiring, strut attach fittings, control cables and pulleys, and control disconnect points.

18-12. WING SKIN.

18-13. NEGLIGIBLE DAMAGE. Any smooth dents in the wing skin that are free from cracks, abrasions and sharp corners, which are not stress wrinkles and do not interfere with any internal structure or mechanism, may be considered as negligible damage. In areas of low stress intensity, cracks, deep scratches, or deep, sharp dents, which after trimming or stop-drilling can be enclosed by a two-inch circle, can be considered negligible if the damaged area is at least one diameter of the enclosing circle away from all existing rivet lines and material edges. Stop drilling is considered a temporary repair and a permanent repair must be made as soon as practicable.

18-14. REPAIRABLE DAMAGE. Figure 18-4 outlines typical repair to be employed in patching skin. Before installing a patch, trim the damaged area to form a rectangular pattern, leaving at least a one-half inch radius at each corner, and de-burr. The sides of the hole should lie span-wise or chord-wise. A circular patch may also be used. If the patch is in an area where flush rivets are used, make a flush patch type of repair; if in an area where flush rivets

are not used, make an overlapping type of repair. Where optimum appearance and airflow are desired, the flush patch may be used. Careful workmanship will eliminate gaps at butt-joints; however, an epoxy type filler may be used at such joints.

18-15. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If a skin is badly damaged, repair must be made by replacing an entire skin panel, from one structural member to the next. Repair seams must be made to lie along structural members and each seam must be made exactly the same in regard to rivet size, spacing, and pattern as the manufactured seams at the edges of the original sheet. If the manufactured seams are different, the stronger must be copied. If the repair ends at a structural member where no seam is used, enough repair panel must be used to allow an extra row of staggered rivets, with sufficient edge margin, to be installed.

18-16. WING STRINGERS.

18-17. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-18. REPAIRABLE DAMAGE. Figure 18-5 outlines a typical wing stringer repair. Two such repairs may be used to splice a new section of stringer material in position, without the filler material.

18-19. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If a stringer is so badly damaged that more than one section must be spliced, replacement is recommended.

18-20. WING AUXILIARY SPARS.

18-21. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-22. REPAIRABLE DAMAGE. Figure 18-8 illustrates a typical auxiliary spar repair.

18-23. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If damage to an auxiliary spar would require a repair which could not be made between adjacent ribs, the auxiliary spar must be replaced.

18-24. WING RIBS.

18-25. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-26. REPAIRABLE DAMAGE. Figure 18-6 illustrates a typical wing rib repair.

18-27. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Leading and trailing edge ribs that are extensively damaged can be replaced. However, due to the necessity of unfastening an excessive amount of skin in order to replace the rib, they should be repaired if practicable. Center ribs, between the front and rear spar should always be repaired if practicable.

18-28. WING SPARS.

18-29. NEGLIGIBLE DAMAGE. Due to the stress

which wing spars encounter, very little damage can be considered negligible. All cracks, stress wrinkles, deep scratches, and sharp dents must be repaired. Smooth dents, light scratches and abrasions may be considered negligible.

18-30. REPAIRABLE DAMAGE. Figure 18-7 illustrates typical spar repairs. It is often practical to cut repair pieces from service parts listed in the Parts Catalog. Service Kits are available for certain types of spar repairs.

18-31. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Damage so extensive that repair is not practicable requires replacement of a complete wing spar. Also refer to paragraph 18-2.

18-32. AILERONS.

18-33. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-34. REPAIRABLE DAMAGE. The repair shown in figure 18-9 may be used to repair damage to aileron leading edge skins. Figure 18-4 may be used to repair damage to flat surfaces between corrugations, when damage area includes corrugations refer to figure 18-3A. It is recommended that material used for repair be cut from spare parts of the same gauge and corrugation spacing. Following repair the aileron must be balanced. Refer to paragraph 18-36 and figure 18-3 for balancing the aileron. If damage would require a repair which could not be made between adjacent ribs, see the following paragraph.

18-35. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damage would require a repair which could not be made between adjacent ribs, complete skin panels must be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where extensive damage has occurred, replacement of the aileron assembly is recommended. After repair and/or replacement, balance aileron in accordance with paragraph 18-36 and figure 18-3.

18-36. AILERON BALANCING. Following repair, replacement or painting, the aileron must be balanced. Complete instructions for fabricating balancing fixtures and mandrels and their use are given in figure 18-3.

18-37. WING FLAPS.

18-38. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-39. REPAIRABLE DAMAGE. Flap repairs should be similar to aileron repairs discussed in paragraph 18-34. A flap leading edge repair is shown in figure 18-10. If an overlapping patch is to be used, be sure it will not interfere with the wing during flap operation.

18-40. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Flap repairs which require replacement of parts should be similar to aileron repairs discussed in paragraph 18-35. Since the flap is not considered a moveable control surface, no balancing is required.

MODEL 150 SERIES

18-33A. CRACKS IN CORRUGATED AILERON SKINS (Continued from page 18-3)

1. It is permissible to stop drill crack(s) that originate at the trailing edge of the control surface provided the crack is not more than 2 inches in length.
2. Stop drill crack using a #30 (.128 inch) drill.
3. A crack may only be stop drilled once.

NOTE: A crack that passes through a trailing edge rivet and does not extend to the trailing edge of the skin may be stop drilled at both ends of the crack.

4. Any control surface that has a crack that progresses past a stop drilled hole shall be repaired. Refer to paragraphs 18-33, -34, and -35 as applicable for repair information.
5. A control surface that has any of the following conditions shall have a repair made as soon as practicable:
 - A. A crack that is longer than 2 inches.
 - B. A crack that does not originate from the trailing edge or a trailing edge rivet.
 - C. Cracks in more than six trailing edge rivet locations per skin.

Refer to paragraphs 18-33, -34, and -35 as applicable for repair information.

6. Affected control surfaces with corrugated skins and having a stop drilled crack that does not extend past the stop drilled hole, may remain in service without additional repair.

18-38A. CRACKS IN CORRUGATED FLAP SKINS (Continued from page 18-3)

1. It is permissible to stop drill crack(s) that originate at the trailing edge of the control surface provided the crack is not more than 2 inches in length.
2. Stop drill crack using a #30 (.128 inch) drill.
3. A crack may only be stop drilled once.

NOTE: A crack that passes through a trailing edge rivet and does not extend to the trailing edge of the skin may be stop drilled at both ends of the crack.

4. Any control surface that has a crack that progresses past a stop drilled hole shall be repaired. Refer to paragraphs 18-38, -39, and -40 as applicable for repair information.
5. A control surface that has any of the following conditions shall have a repair made as soon as practicable:
 - A. A crack that is longer than 2 inches.
 - B. A crack that does not originate from the trailing edge or a trailing edge rivet.
 - C. Cracks in more than six trailing edge rivet locations per skin.

Refer to paragraphs 18-38, -39, and -40 as applicable for repair information.

6. Affected control surfaces with corrugated skins and having a stop drilled crack that does not extend past the stop drilled hole, may remain in service without additional repair.

18-41. WING LEADING EDGE.

18-42. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-43. REPAIRABLE DAMAGE. A typical leading edge skin repair is shown in figure 18-9. An epoxy-type filler may be used to fill gaps at butt-joints. To facilitate repair, extra access holes may be installed in the locations noted in figure 18-11. If the damage would require a repair which could not be made between adjacent ribs, refer to the following paragraph.

18-44. DAMAGE NECESSITATING REPLACEMENT OF PARTS. For extensive damage, complete leading edge skin panels must be replaced. To facilitate replacement, extra access holes may be installed in the locations noted in figure 18-11.

18-45. ELEVATORS AND RUDDER.

18-46. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13. The exception to negligible damage on the elevator surfaces is the front spar, where a crack appearing in the web at the hinge fittings or in the structure which supports the overhanging balance weight is not considered negligible. Cracks in the overhanging tip rib, in the area at the front spar intersection with the web of the rib, also cannot be considered negligible.

18-47. REPAIRABLE DAMAGE. Skin patches illustrated in figure 18-4 may be used to repair skin damage between corrugations. For skin damage which includes corrugations, refer to figure 18-3A. Following repair the elevator/rudder must be balanced. Refer to figure 18-3 for balancing. If damage would require a repair which could not be made between adjacent ribs, see the following paragraph.

18-48. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damaged area would require a repair which could not be made between adjacent ribs, complete skin panels must be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where extensive damage has occurred, replacement of the entire assembly is recommended. After repair and/or replacement, balance elevators and rudder in accordance with paragraph 18-49 and figure 18-3.

18-49. ELEVATOR AND RUDDER BALANCING. Following repair, replacement or painting, the elevators and rudder must be balanced. Complete instructions for fabricating balancing fixtures and mandrels and their use are given in figure 18-3.

18-50. FIN AND STABILIZER.

18-51. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13.

18-52. REPAIRABLE DAMAGE. Skin patches illustrated in figure 18-4 may be used to repair skin damage. Access to the dorsal area of the fin may be gained by removing the horizontal closing rib at the

bottom of the fin. Access to the internal fin structure is best gained by removing skin attaching rivets on one side of the rear spar and ribs, and springing back the skin. Access to the stabilizer structure may be gained by removing skin attaching rivets on one side of the rear spar and ribs, and springing back the skin. If the damaged area would require a repair which could not be made between adjacent ribs, or a repair would be located in an area with compound curves, see the following paragraph.

18-53. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damaged area would require a repair which could not be made between adjacent ribs, or the repair would be located in an area with compound curves, complete skin panels must be replaced. Ribs and spars may be repaired, but replacement is generally preferable. Where damage is extensive, replacement of the entire assembly is recommended.

18-54. FUSELAGE.

18-55. DESCRIPTION. The fuselage is of semi-monocoque construction, consisting of formed bulkheads, longitudinal stringers, reinforcing channels, and skin panels.

18-56. NEGLIGIBLE DAMAGE. Refer to paragraph 18-13. Mild corrosion appearing upon alclad surfaces does not necessarily indicate incipient failure of the base metal. However, corrosion of all types must be carefully considered, and approved remedial action taken. Small cans appear in the skin structure of all metal aircraft. It is strongly recommended however, that wrinkles which appear to have originated from other sources, or which do not follow the general appearance of the remainder of the skin panels, be thoroughly investigated. Except in the landing gear bulkhead areas, wrinkles occurring over stringers which disappear when the rivet pattern is removed, may be considered negligible. However, the stringer rivet holes may not align perfectly with the skin holes because of a permanent "set" in the stringer. If this is apparent, replacement of the stringer will usually restore the original strength characteristics of the area.

NOTE

Wrinkles occurring in the skin of the main landing gear bulkhead areas must not be considered negligible. The skin panel must be opened sufficiently to permit a thorough examination of the lower portion of the landing gear bulkhead and its tie-in structure.

Wrinkles occurring in open areas which disappear when the rivets at the edge of the sheet are removed, or a wrinkle which is hand removable, may often be repaired by the addition of a 1/2 x 1/2 x .060 inch 2024-T4 extruded angle, riveted over the wrinkle and extended to within 1/16 to 1/8 inch of the nearest structural members. Rivet pattern should be identical to existing manufactured seam at edge of sheet. Negligible damage to stringers, formed skin flanges, bulkhead channels, and like parts is similar to that for the wing skin, given in paragraph 18-13.

18-57. REPAIRABLE DAMAGE. Fuselage skin repairs may be accomplished in the same manner as wing skin repairs outlined in paragraph 18-14. Stringers, formed skin flanges, bulkhead channels and similar parts may be repaired as shown in figure 18-5.

18-58. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Fuselage skin major repairs may be accomplished in the same manner as the wing repairs outlined in paragraph 18-15. Damaged fittings must be replaced. Seat rails serve as structural parts of the fuselage and must be replaced if damaged.

18-58A. BONDED DOORS.

18-58B. REPAIRABLE DAMAGE. Bonded doors may be repaired by the same methods used for riveted structure. Rivets are a satisfactory substitute for bonded seams on these assemblies. The strength of the bonded seams in doors may be replaced by a single 3/32, 2117-AD rivet per running inch of bond seam. The standard repair procedures outlined in AC43.13-1 are also applicable to bonded doors.

18-59. BULKHEADS.

18-60. LANDING GEAR BULKHEADS. Since these bulkheads are highly stressed members, irregularly formed to provide clearance for control cables, fuel lines, etc., the patch-type repairs will be, for the most part, impractical. Minor damage, consisting of small nicks or scratches, may be repaired by dressing out the damaged area, or by replacement of rivets. Any other damage must be repaired by replacing the landing gear support assembly as an aligned unit.

18-61. REPAIR AFTER HARD LANDING. Buckled skin or floorboards, and loose or sheared rivets in the area of the main gear support will give evidence of damage to the structure from an extremely hard landing. When such evidence is present, the entire support structure must be examined, and all support forgings must be checked for cracks, using a dye penetrant and proper magnification. Bulkheads in the damaged area must be checked for alignment, and deformation of the bulkhead webs must be determined with the aid of a straightedge. Damaged support structure, buckled floorboards and skins, and damaged or questionable forgings must be replaced.

18-62. REPLACEMENT OF HI-SHEAR RIVETS. Hi-shear rivet replacement with close tolerance bolts or other commercial fasteners of equivalent strength properties is permissible. Holes must not be elongated, and the Hi-shear substitute must be a smooth push fit. Field replacement of main landing gear forgings on bulkheads may be accomplished by using:

- a. NAS464P* Bolt, MS21042-* Nut and AN960-* washer in place of Hi-Shear Rivets for forgings with machined flat surface around attachment holes.
- b. NAS464P* Bolt, ESNA 2935* (S-1925-1) Mating Base Ring, ESNA LH 2935* (S-1924-1) Nut for forgings (with draft angle of up to a maximum of 8°)

without machined flat surface around attachment holes.

*Dash numbers to be determined according to the size of the holes and the grip lengths required. The bolts grip length should be chosen so that No threads remain in the bearing area.

18-63. FIREWALL DAMAGE. Firewalls may be repaired by removing the damaged material and splicing in a new section. The new portion must be lapped over the old material, sealed with Pro-Seal #700 (Coast Pro-Seal Co., Chemical Division, 2235 Beverly Blvd, Los Angeles, California), compound or equivalent, and secured with stainless steel rivets. Damaged or deformed angles and stiffeners may be repaired as shown in figure 18-12, or they may be replaced. A severely damaged firewall must be replaced as a unit.

18-64. ENGINE MOUNT.

18-65. DESCRIPTION. The mount for the aircraft engine is constructed of 4130 chrome-molybdenum steel tubing. A truss structure, fastened to the firewall at four points, supports a cradle arrangement. This cradle arrangement with its supporting lugs, forms the base for rubber shock mounted engine supports.

18-66. GENERAL CONSIDERATIONS. All welding on the engine mount must be of the highest quality since the tendency of vibration is to accentuate any minor defect present and cause fatigue cracks. Engine mount members are preferably repaired by using a larger diameter replacement tube, telescoped over the stub of the original member using fishmouth and rosette type welds. However, reinforced 30-degree scarf welds in place of the fishmouth welds are considered satisfactory for engine mount repair work.

18-67. ENGINE MOUNT SUPPORT CRADLE DAMAGE. Minor damage such as a crack adjacent to an engine attaching lug may be repaired by rewelding the cradle tube and extending a gusset past the damaged area. Extensively damaged parts must be replaced.

18-68. DAMAGE INVOLVING ENGINE MOUNTING LUGS AND ENGINE MOUNT TO FUSELAGE ATTACHING FITTINGS. Engine mounting lugs and engine mount-to-fuselage attaching fittings should not be repaired but must be replaced.

18-69. BAFFLES. Baffles ordinarily require replacement if damaged for cracked. However, small plate reinforcements riveted to the baffle will often prove satisfactory both to the strength and cooling requirements of the unit.

18-70. ENGINE COWLING.

18-71. REPAIR OF COWLING SKINS. If extensively damaged, complete sections of cowling must be replaced. Standard insert-type skin patches, however, may be used if repair parts are formed to fit. Small

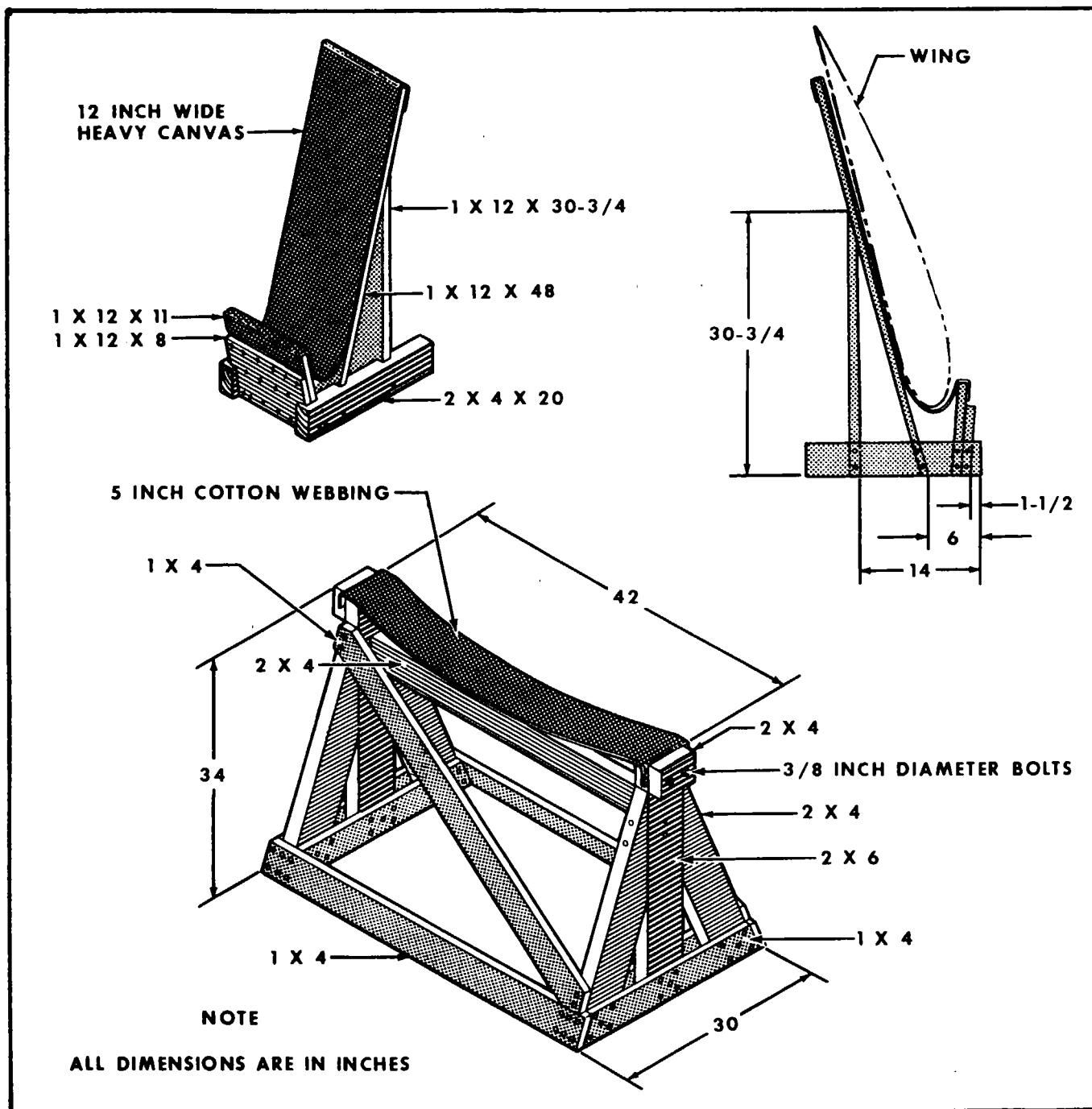


Figure 18-1. Wing and Fuselage Support Stands

cracks may be stop-drilled and dents straightened if they are reinforced on the inner side with a doubler of the same material. Bonded cowling may be repaired by the same methods used for riveted structure. Rivets are a satisfactory substitute for bonded seams on these assemblies. The strength of the bonded seams in cowling may be replaced by a single 3/32, 2117-AD rivet per running inch of bond seam. The standard repair procedures outlined in AC43.13-1 are also applicable to cowling.

18-72. REPAIR OF REINFORCEMENT ANGLES. Cowl reinforcement angles, if damaged, must be replaced. Due to their small size they are easier to replace than to repair.

18-73. REPAIR OF ABS COMPONENTS. Rezolin Repair Kit Number 404 may be obtained from the Cessna Service Parts Center for repair of ABS components.

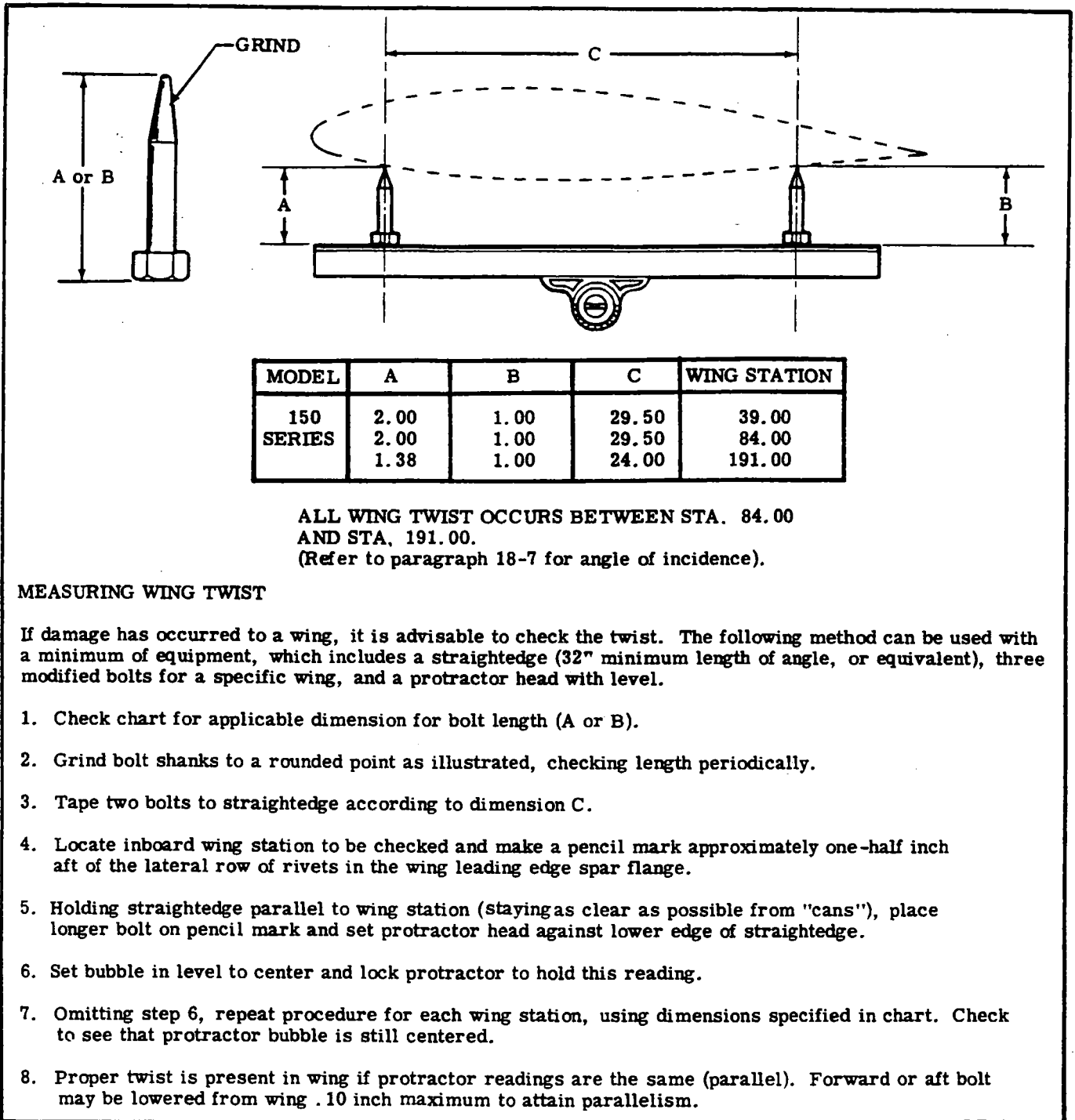


Figure 18-2. Checking Wing Twist

18-74. REPAIR OF GLASS-FIBER CONSTRUCTED COMPONENTS. Glass-fiber constructed components on the aircraft may be repaired as stipulated in instructions furnished in Service Kit 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.

BALANCING PROCEDURES

1. Balance control surfaces in an enclosed draft free area.
2. Control surface to be balanced must be in the final flight configuration, painted (if applicable) trim tabs installed, and all foreign matter removed from inside control surface.
3. If control surface is to be painted, remove all existing paint prior to repainting and rebalancing. Good workmanship and standard repair practices should reduce excessive additional balance weight.
4. Place balancing mandrels (detail B) on a table or other suitable FLAT, LEVELED surface. Mandrels must be placed at 90° to the hinge line of the control surface.

NOTE

Control surface balancing beam and mandrels can be locally fabricated (details A and B) or purchased from Cessna (part no. 5180002-1, Flight Control Surface Balancing Fixture Kit, Detail J).

5. On control surfaces with the piano type hinges, insert inboard and outboard hinges into slotted ends of the balancing mandrels, making sure that balancing mandrels are 90° to the hinge line. On control surfaces with the bearing type hinge point, bolts or pins are inserted through the attaching brackets, then placed on the knife edges of the mandrels as illustrated in (detail H).
6. AILERONS.
 - a. (1) Block up the trailing edge of the aileron until a spirit-level protractor placed on the front face of the aileron spar at W.S. 138.00 (± 6.00), (detail E), indicates 57° 10', (detail D).
 - (2) ALTERNATE METHOD:
Measure the vertical distance from the aileron hinge point to the leveled surface ("d"). Subtract 1.80 inches, then block up trailing edge of the aileron to this measurement.
 - b. With the aileron blocked in position, place the balancing beam (detail A) at W.S. 138.00, (90° to the hinge line), and adjust the trailing edge support on the balancing beam (detail D) until the beam is level. If the aileron has not been disturbed during this operation, the beam is now parallel to the aileron chord line at W.S. 138.00 (detail D).

NOTE

The above procedure must be performed with care. Small angular discrepancies will produce large balancing errors.

NOTE

When positioning balance beam on control surfaces, do not allow balance beam to rest on any rivet heads but on smooth surface.

- c. Remove balancing beam and balance the beam by itself at the knife edges by adding washers as shown (detail C).
- d. Place the balancing beam on the aileron in its original position, then remove the blocks from beneath the trailing edge.
- e. Place the sliding weight (detail D) on the forward end of the balancing beam, moving it along the beam until the beam is again level. A small, lightweight, spirit-level may be used for this purpose provided it is symmetrical about its bubble reference and this reference is placed on the beam directly over the aileron hinge line (detail D).
- f. When aileron is correctly balanced, position of the sliding weight to allow the control surface to be balanced (control surface chord line parallel to horizontal flat surface). Read the number on the beam scale directly below the mark on the sliding weight. This number is the moment of the control surface in pound-inches, about the hinge line, and it must be within the underbalance tolerance listed in the chart on (Sheet 5 of 6).
- g. If modification of the aileron balance weight is necessary to correct an out-of-tolerance condition, the balance weight can be lightened by drilling out part of the weight on the inboard end. The weight can be lightened by drilling out part of the weight on the inboard end. The weight can be increased by a reasonable amount by ordering additional weight and gang channel listed in the applicable Parts Catalog, and installing next to the inboard weight the minimum amount necessary for correct balance. The minimum amount that must be installed, however, must contain at least two attaching rivets. If this minimum amount results in an over-balanced conditions, the new weight and/or old weights can be lightened.

Figure 18-3. Control Surface Balancing (Sheet 1 of 6)

7. RUDDER AND ELEVATORS.

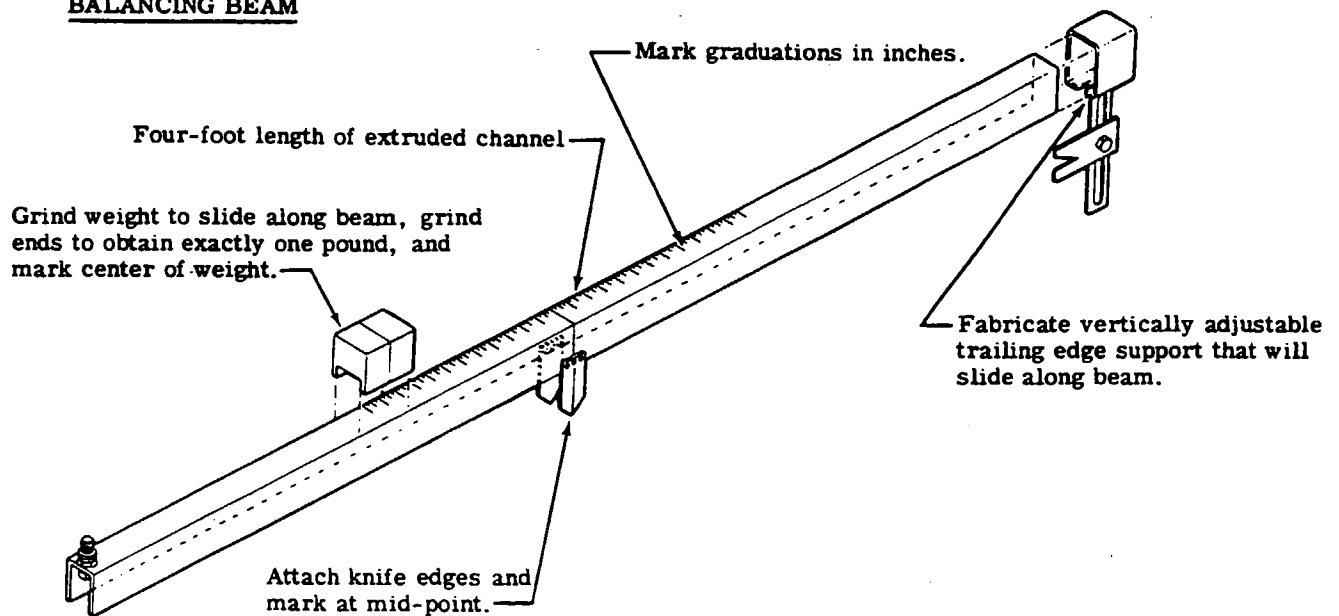
- a. With the rudder/elevator set upon a **FLAT, LEVELED** surface, block up the trailing edge until a center line through the attaching bolt and the trailing edge is equal distance from the leveling surface (detail H).
- b. Place the balancing beam (detail A) on the rudder/elevator near the center attaching bracket, (90° to the hinge line). Adjust the trailing edge support on the balancing beam (detail H) until the beam is level. If the rudder/elevator has not been disturbed during this operation, the beam is now parallel to the chord line of the rudder/elevator.

NOTE

The above procedure must be performed with care. Small angular discrepancies will produce large balancing errors.

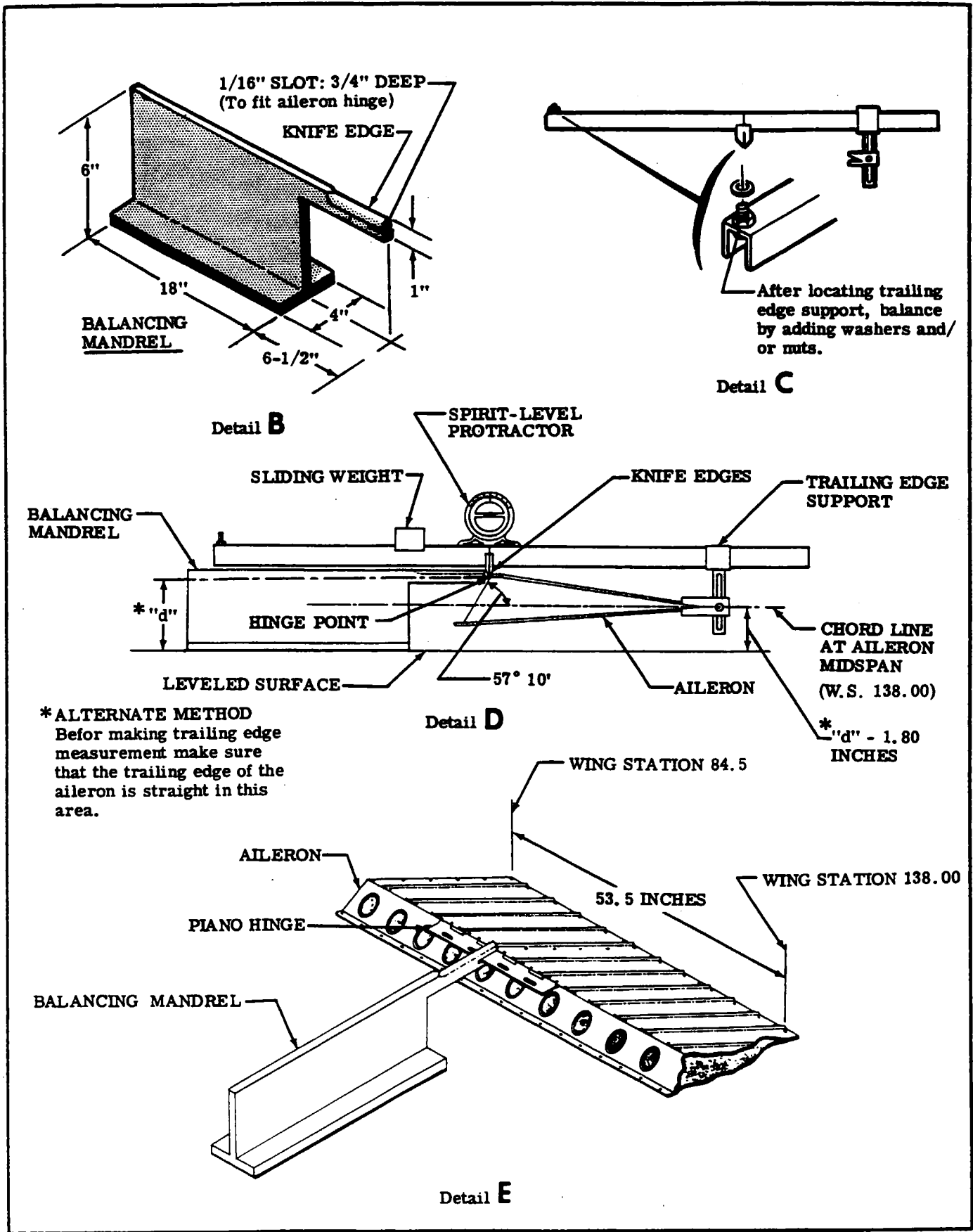
- c. Mark position of the balancing beam, then remove and balance the beam by itself at the knife edges by adding washers as shown in (detail C).
- d. Place the balancing beam on the rudder/elevator in its original position, then remove the block from beneath the trailing edge.
- e. Place the sliding weight (detail H) on the forward end of the balance beam, move it along the beam until the beam is again level. A small, lightweight, spirit-level may be used for this purpose provided it is symmetrical about its bubble reference and this reference is placed on the beam directly over the rudder/elevator hinge line (detail H).
- f. If the rudder/elevator is correctly balanced, the position of the sliding weight with respect to the rudder/elevator hinge line, will produce a moment about the hinge line somewhere within the underbalance tolerance listed in the chart on (Sheet 5 of 5).
- g. If modification of the rudder/elevator balance weight is necessary to correct an out-of-balance condition, the balance weight can be lightened by drilling out part of the weight. The weight can be increased by fusing bar stock solder to the weight after removal from rudder/elevator.

BALANCING BEAM



Detail A

Figure 18-3. Control Surface Balancing (Sheet 2 of 6)



Detail B

Detail C

Detail D

Detail E

*** ALTERNATE METHOD**
 Before making trailing edge measurement make sure that the trailing edge of the aileron is straight in this area.

Figure 18-3. Control Surface Balancing (Sheet 3 of 6)

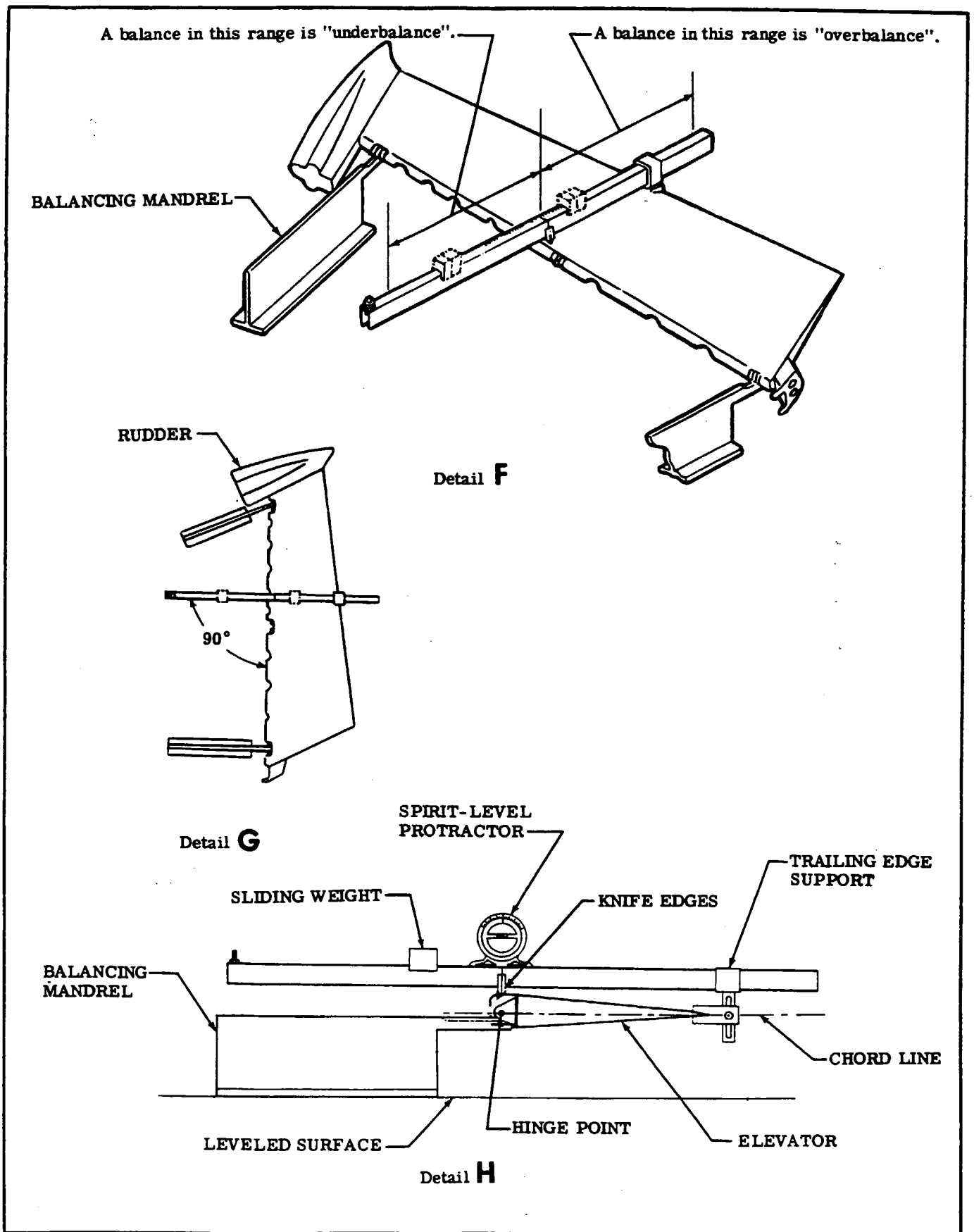


Figure 18-3. Control Surface Balancing (Sheet 4 of 6)

CONTROL SURFACE BALANCE REQUIREMENTS

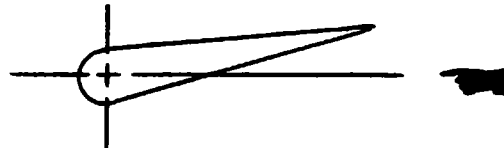
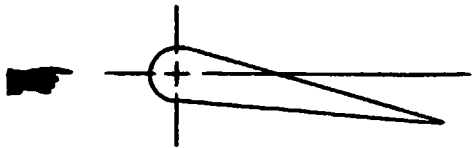
NOTE

Unpainted values are not limits which must be met. They are given as guides, in order that the unbalance of the control surface in the final aircraft configuration may be predicted. If the control surface in the unpainted condition falls within the unpainted limit, the mechanic may feel confident that the control surface will be acceptable after painting. However, if the surface in the unpainted condition exceeds the unpainted limit, the balance must be checked again after final painting to assure that the control surface falls within the painted unbalance limit. Refer to GENERAL NOTES on sheet 3 for specific conditions.

DEFINITIONS:

UNDERBALANCE is defined as the condition that exists when the control surface is trailing edge heavy, and is symbolized by a plus (+).

OVERBALANCE is defined as the condition that exists when the control surface is leading edge heavy, and is symbolized by a minus (-).



CONTROL: AILERON

PAINTED (Inch-Pounds)	UNPAINTED (Inch-Pounds)
BALANCE LIMITS	BALANCE LIMITS
0.0 to + 11.31	0.0 to + 9.23

CONTROL: RUDDER

PAINTED (Inch-Pounds)	UNPAINTED (Inch-Pounds)
BALANCE LIMITS	BALANCE LIMITS
0.0 to + 9.043	0.0 to + 7.00

CONTROL: RIGHT ELEVATOR

PAINTED (Inch-Pounds)	UNPAINTED (Inch-Pounds)
BALANCE LIMITS	BALANCE LIMITS
0.0 to + 14.109	0.0 to + 11.88

CONTROL: LEFT ELEVATOR

PAINTED (Inch-Pounds)	UNPAINTED (Inch-Pounds)
BALANCE LIMITS	BALANCE LIMITS
0.0 to + 14.109	0.0 to + 11.88

Figure 18-3. Control Surface Balancing (Sheet 5 of 6)

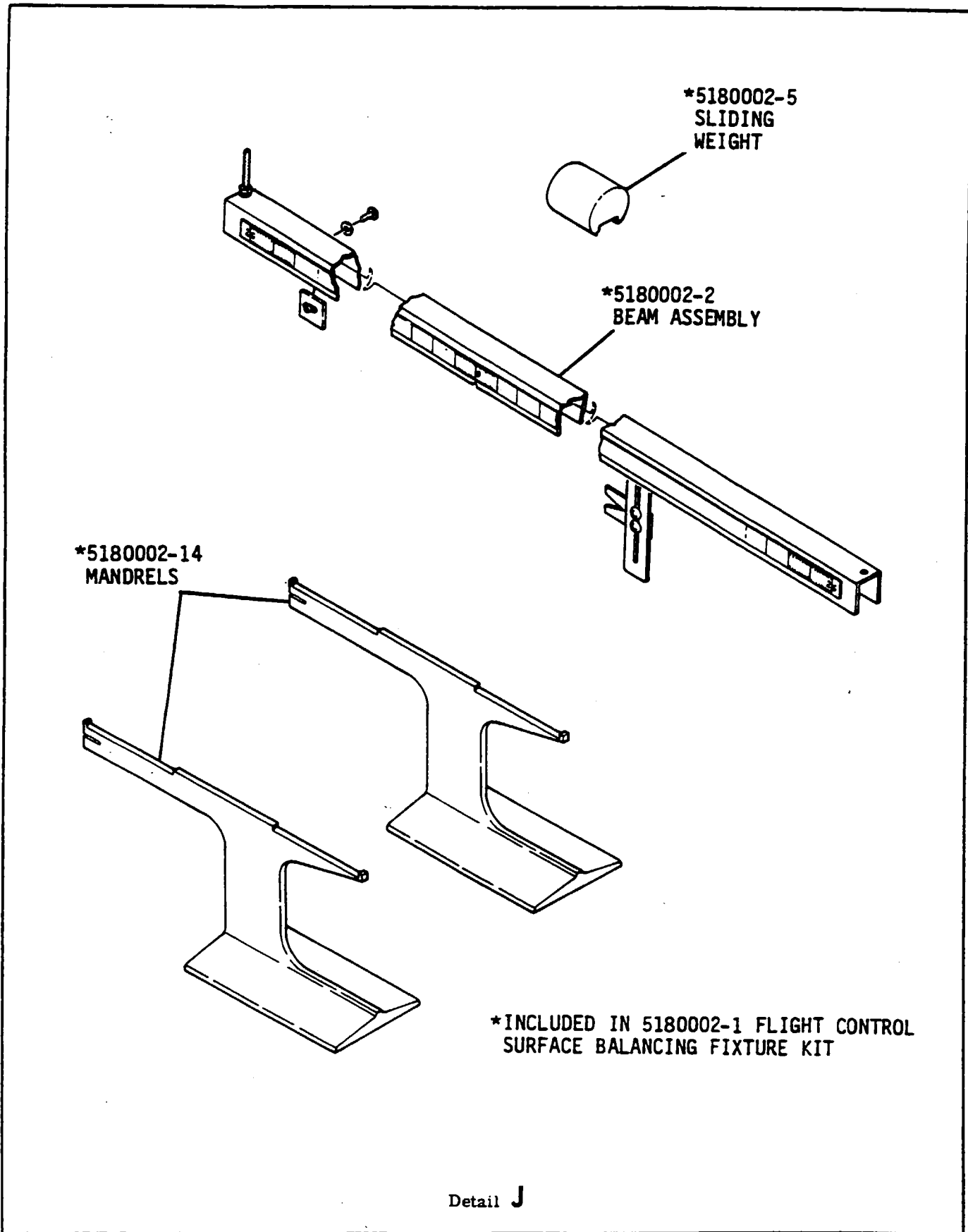


Figure 18-3. Control Surface Balancing (Sheet 6 of 6)

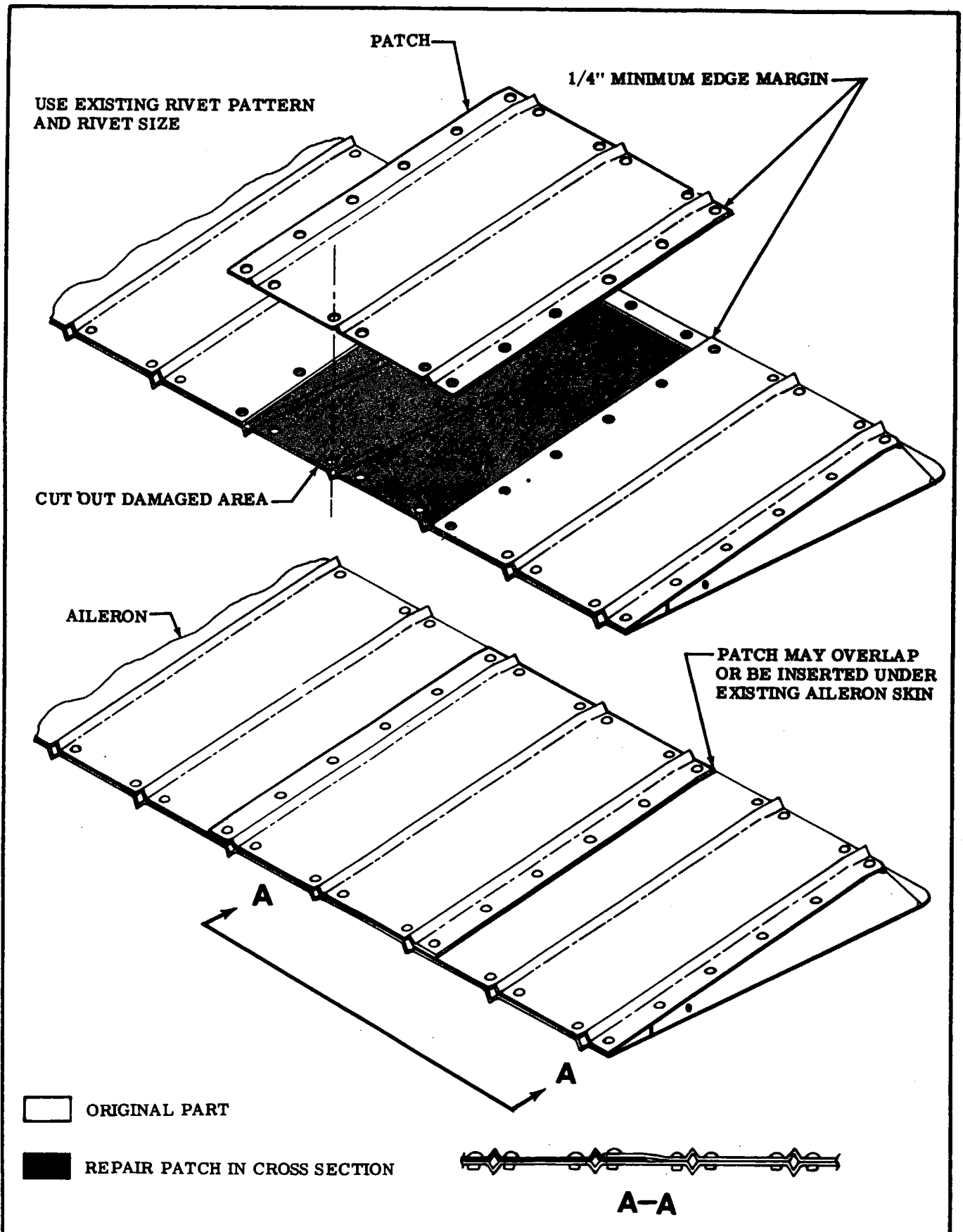
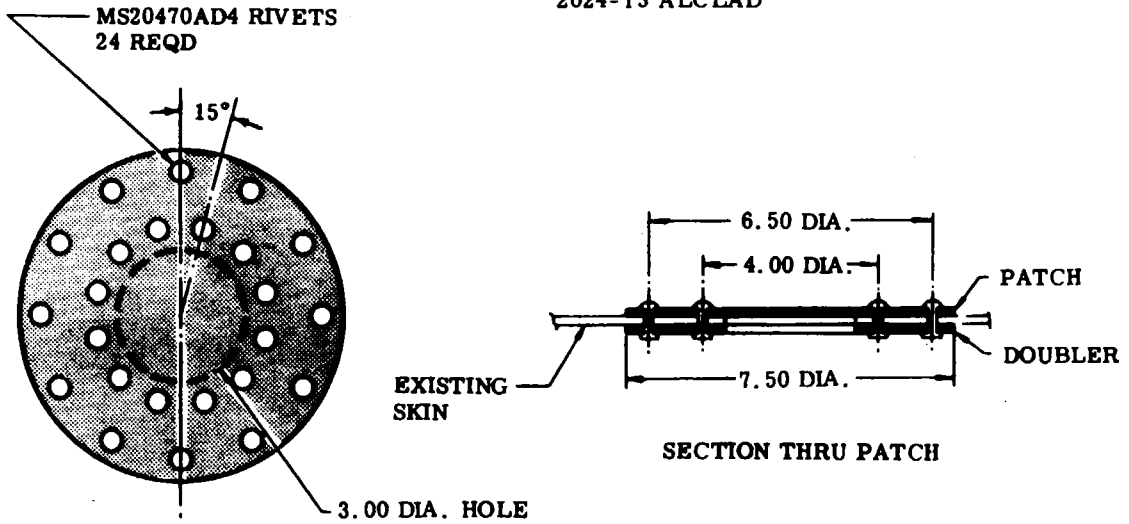
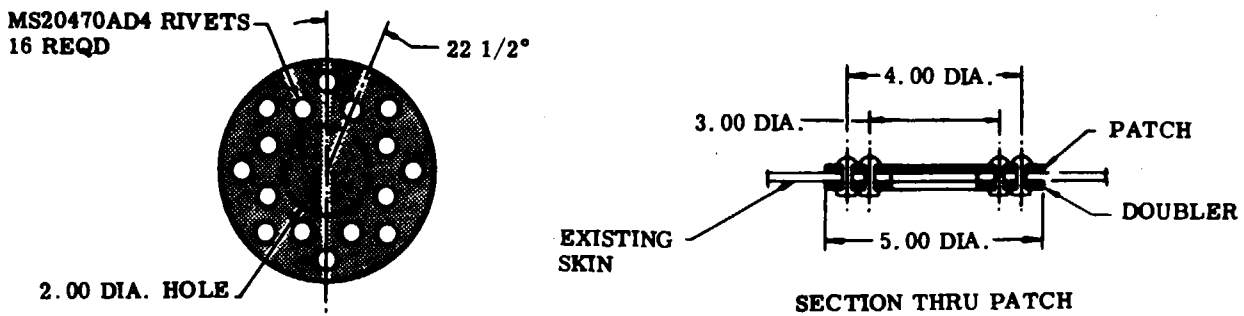


Figure 18-3A. Corrugated Skin Repair

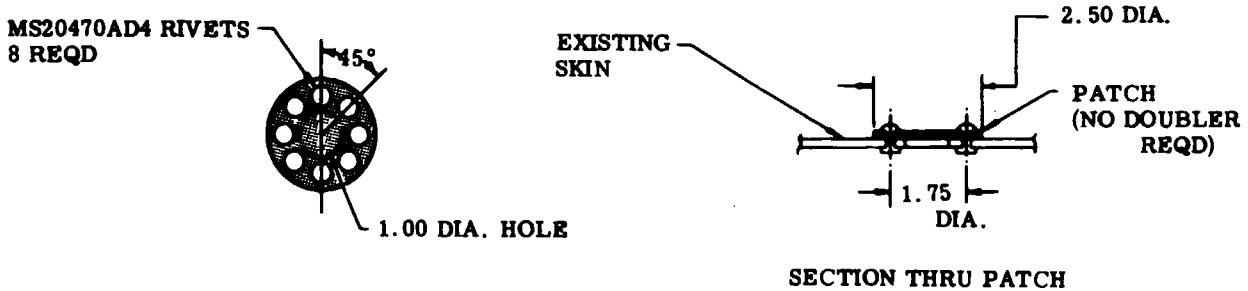
PATCHES AND DOUBLERS —
2024-T3 ALCLAD



PATCH REPAIR FOR 3 INCH DIAMETER HOLE



PATCH REPAIR FOR 2 INCH DIAMETER HOLE



PATCH REPAIR FOR 1 INCH DIAMETER HOLE

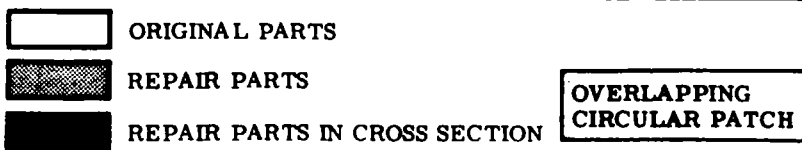
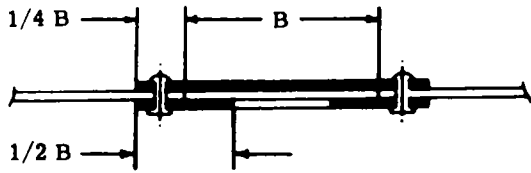
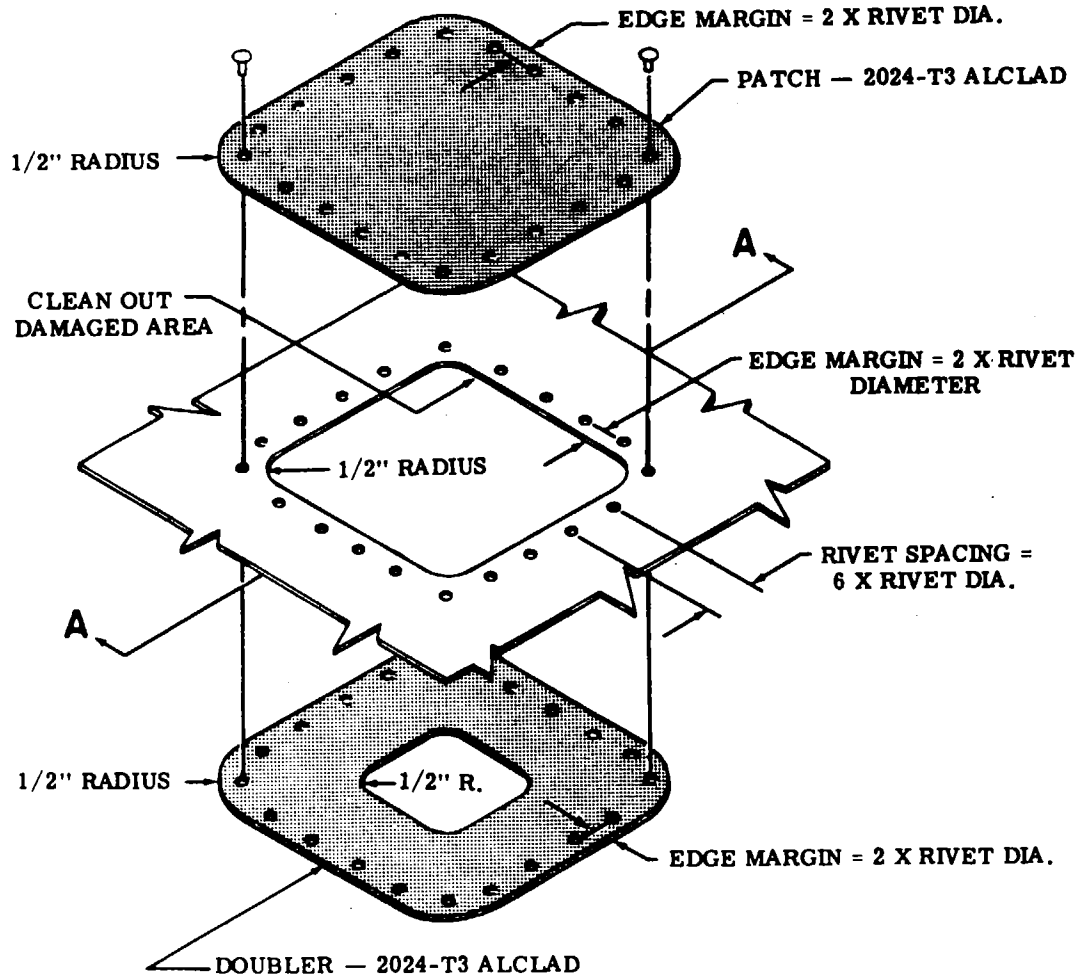


Figure 18-4. Skin Repair (Sheet 1 of 6)



SECTION THRU ASSEMBLED PATCH

A-A

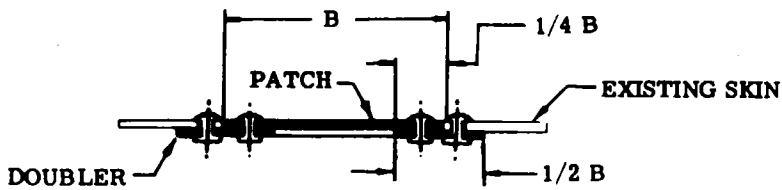


OVERLAPPING REC-TANGULAR PATCH

- ORIGINAL PARTS
- REPAIR PARTS
- REPAIR PARTS IN CROSS SECTION

RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	1/8
.025	1/8
.032	1/8
.040	1/8
.051	5/32

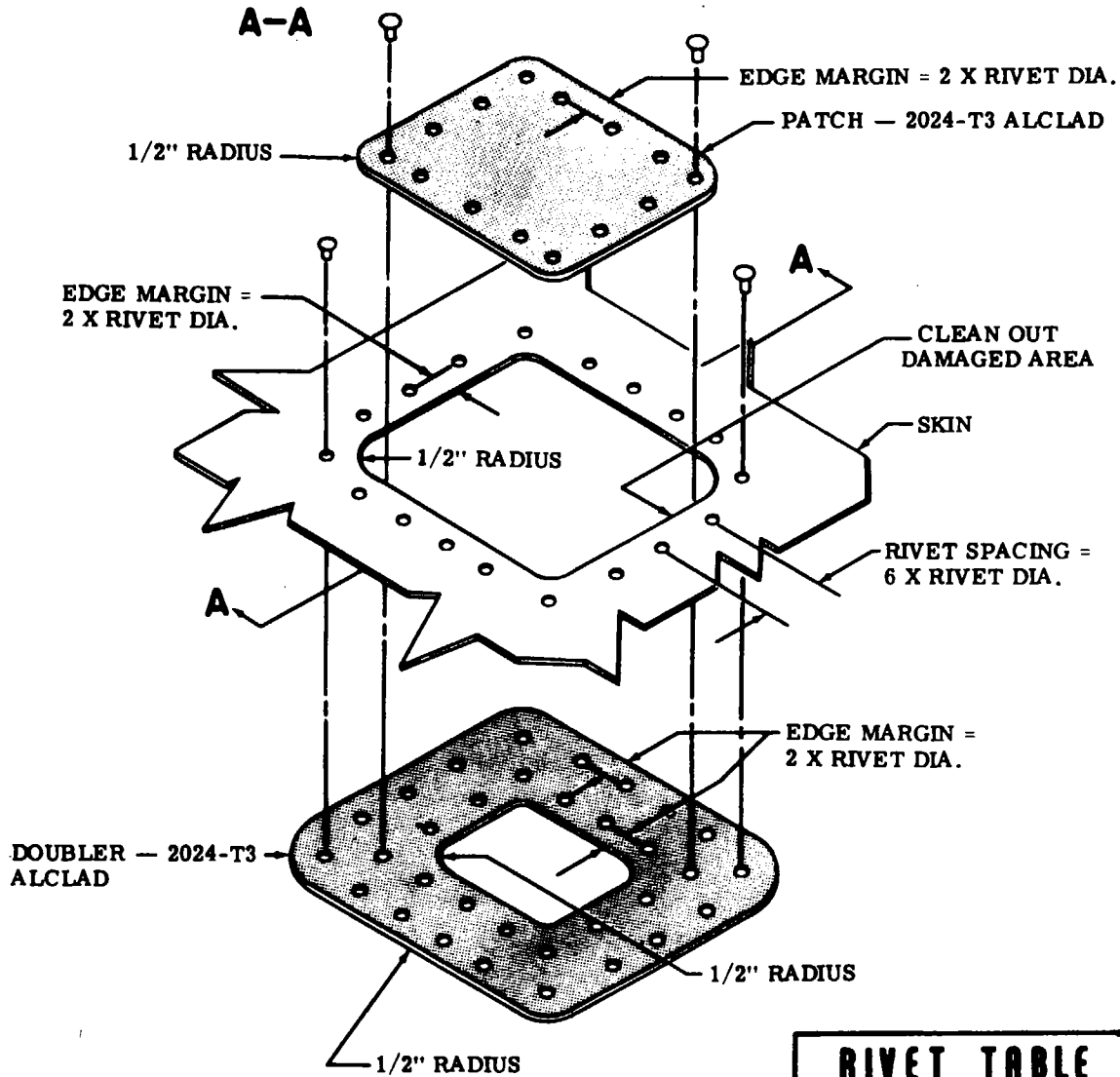
Figure 18-4. Skin Repair (Sheet 2 of 6)



SECTION THRU ASSEMBLED PATCH




NOTE

For optimum appearance and airflow, use flush rivets, dimpled skin and patch, and countersunk doubler.



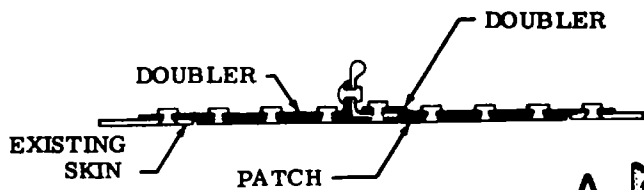
DOUBLER — 2024-T3 ALCLAD

FLUSH RECTANGULAR PATCH (CIRCULAR FLUSH PATCH IS SIMILAR)

-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION

RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	1/8
.025	1/8
.032	1/8
.040	1/8
.051	5/32

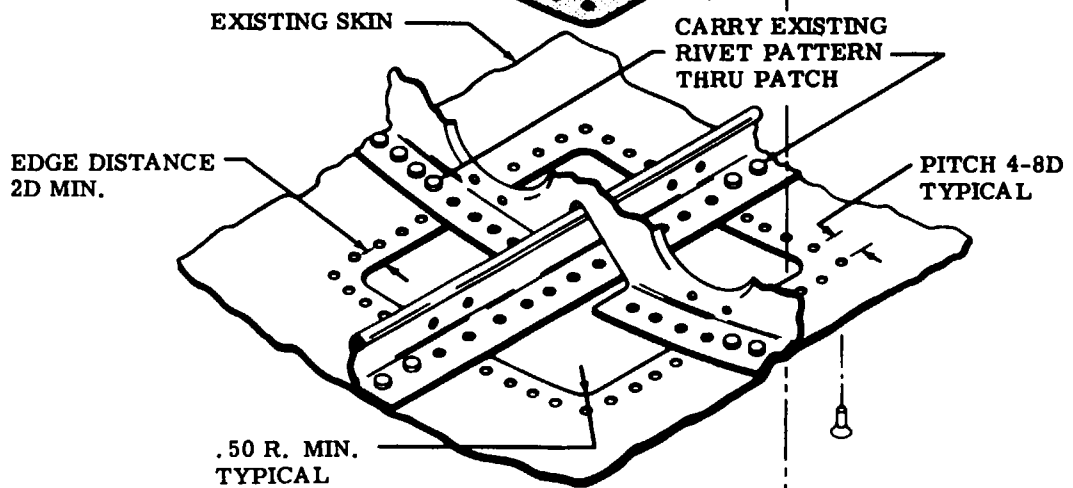
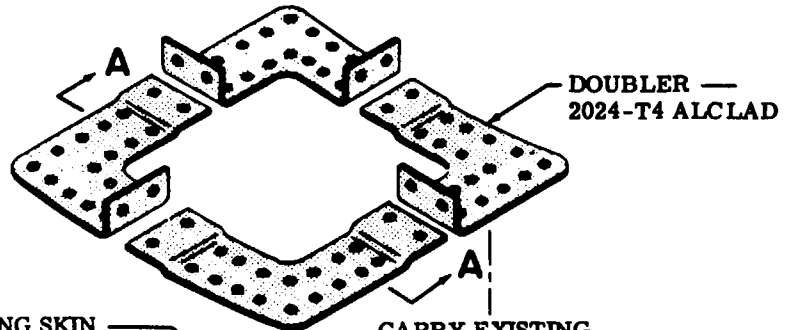
Figure 18-4. Skin Repair (Sheet 3 of 6)



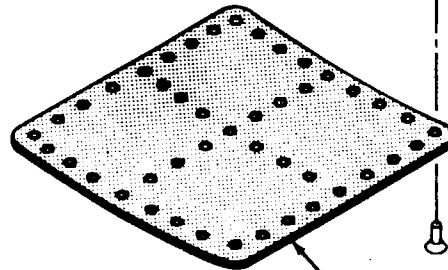
A-A

NOTE

Countersink doublers, and dimple skin and patch.



RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	1/8
.025	1/8
.032	1/8
.040	1/8
.051	5/32



FLUSH PATCH AT STRINGER/BULKHEAD INTERSECTION

- ORIGINAL PARTS
- REPAIR PARTS
- REPAIR PARTS IN CROSS SECTION

NOTE

This procedure is not recommended in areas where stringers are riveted to bulkheads.

Figure 18-4. Skin Repair (Sheet 4 of 6)

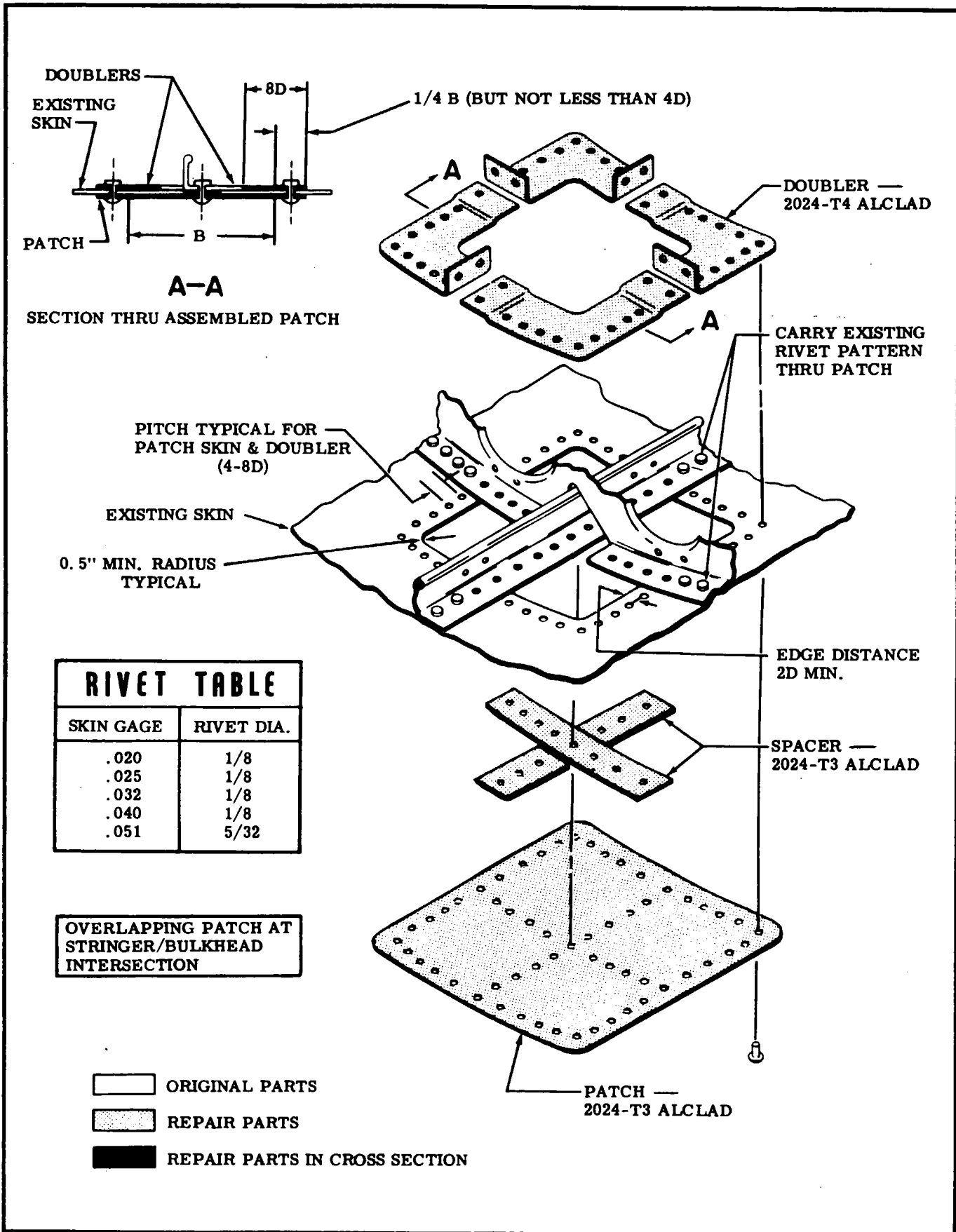


Figure 18-4. Skin Repair (Sheet 5 of 6)

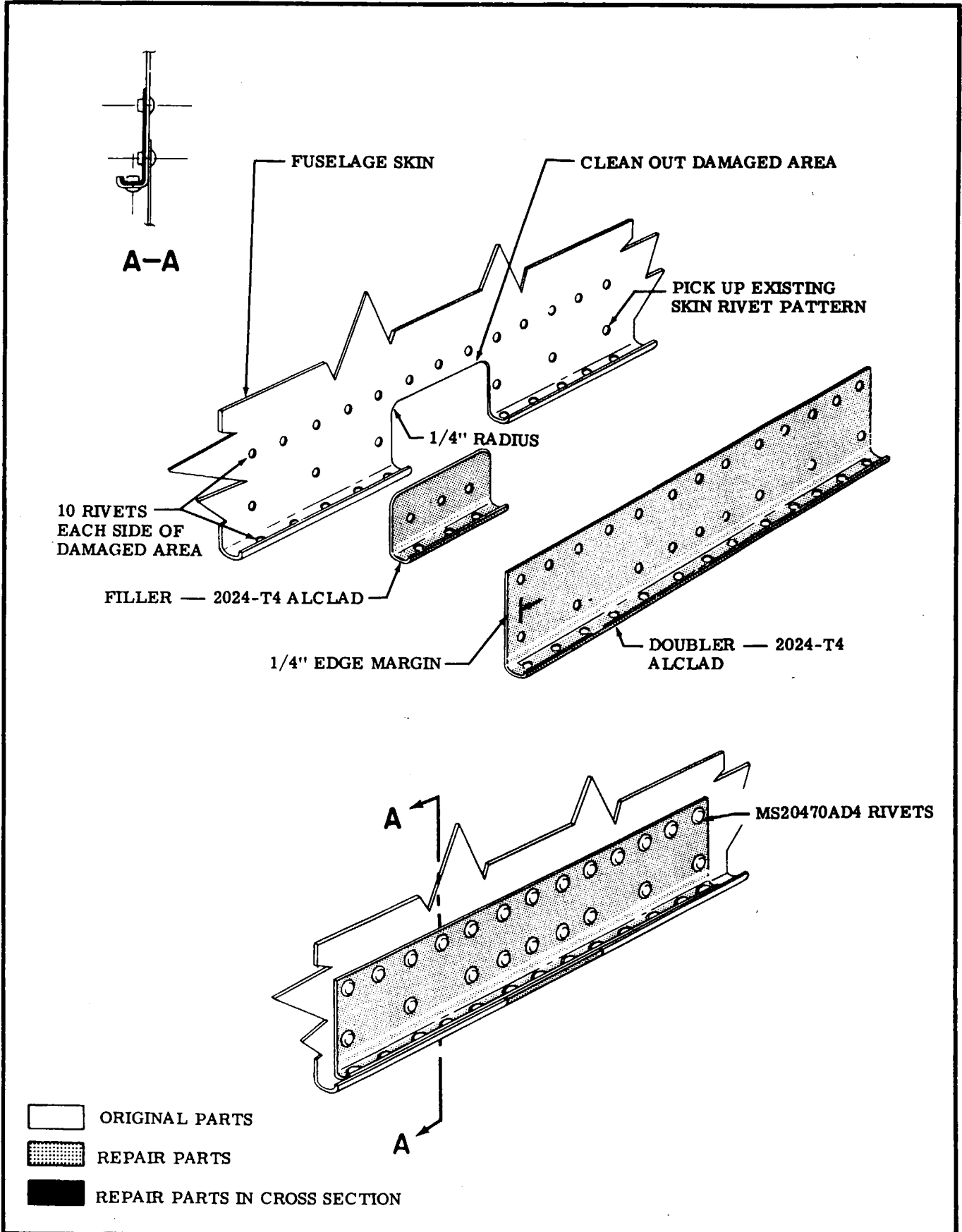


Figure 18-4. Skin Repair (Sheet 6 of 6)

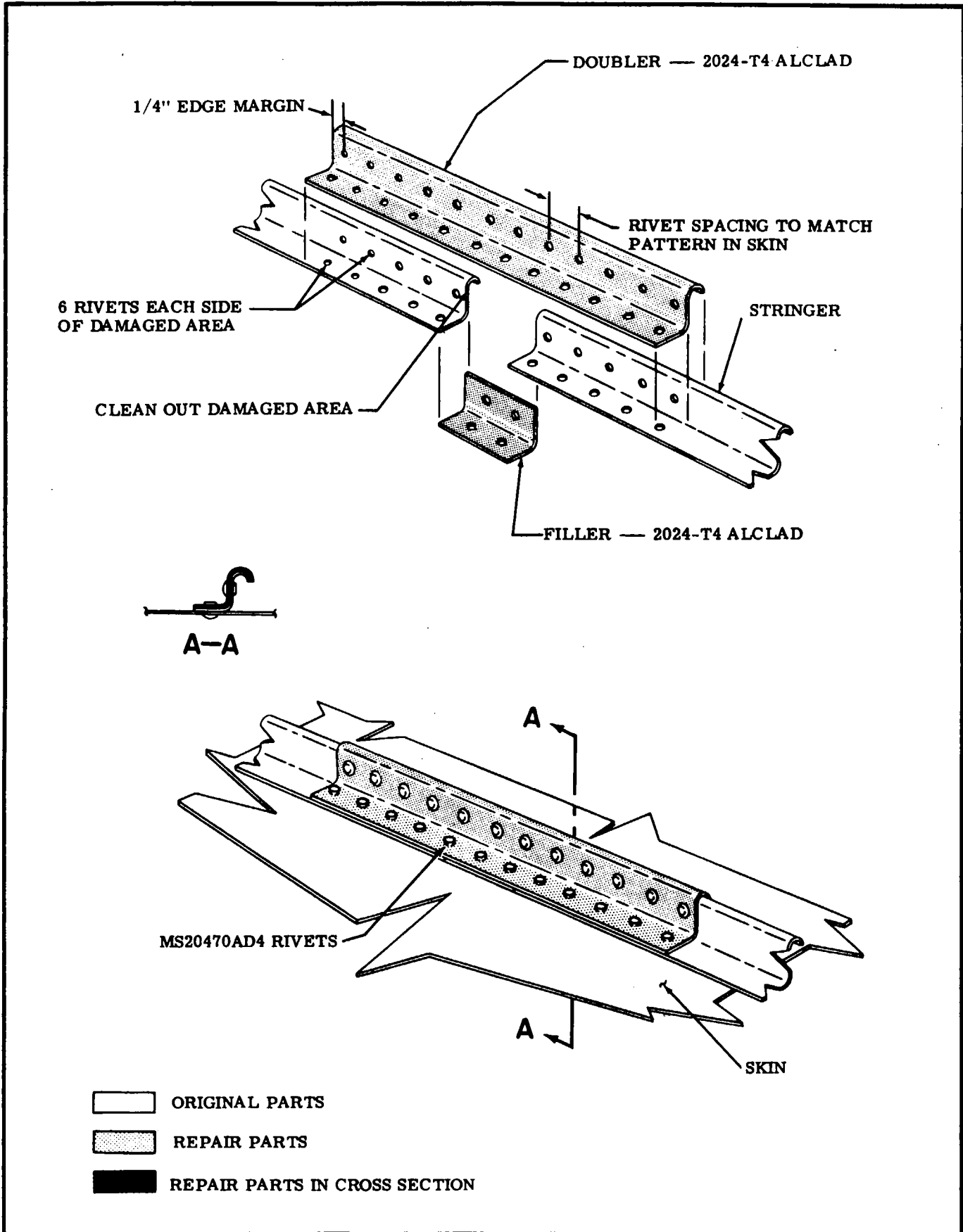


Figure 18-5. Stringer and Channel Repair (Sheet 1 of 4)

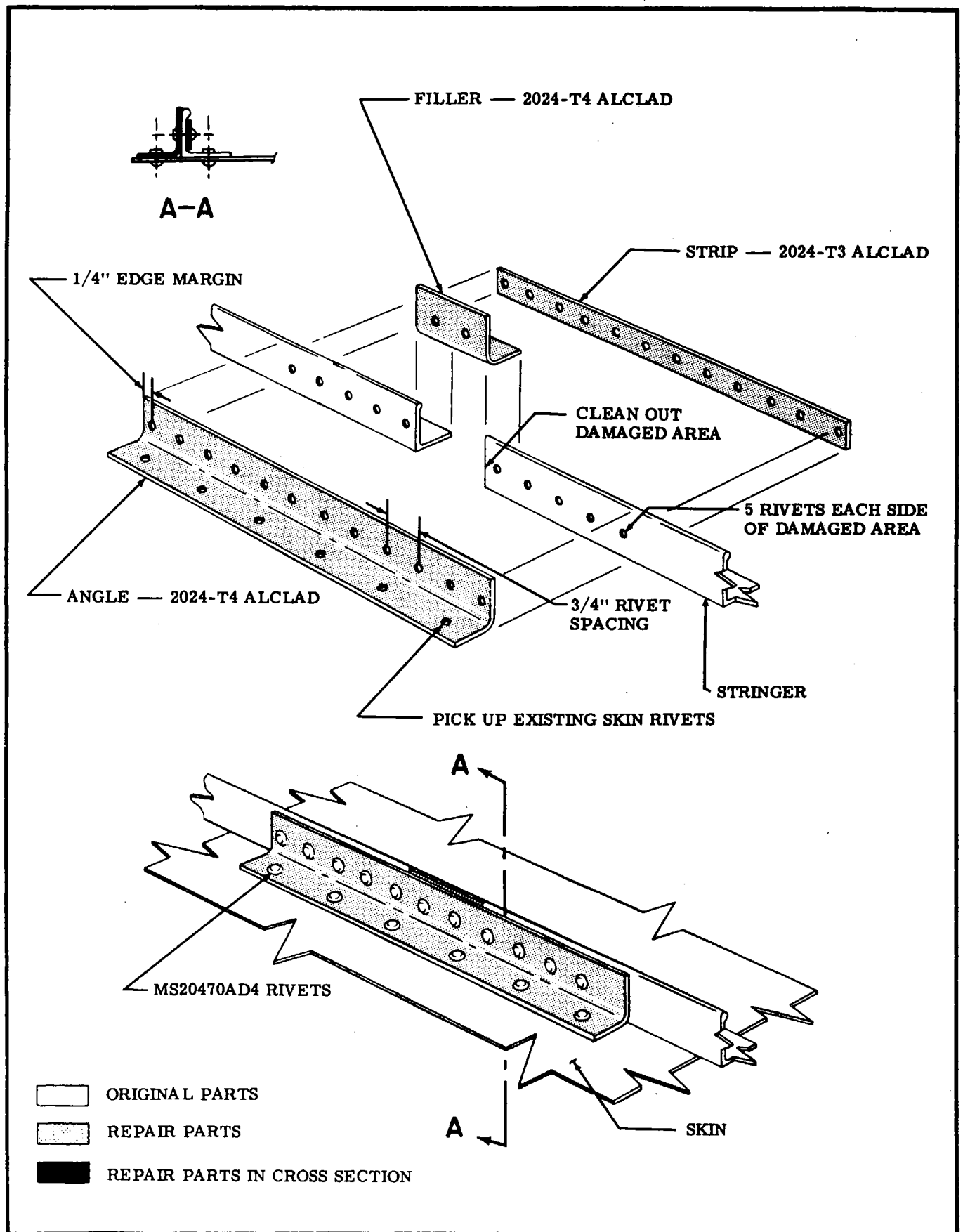
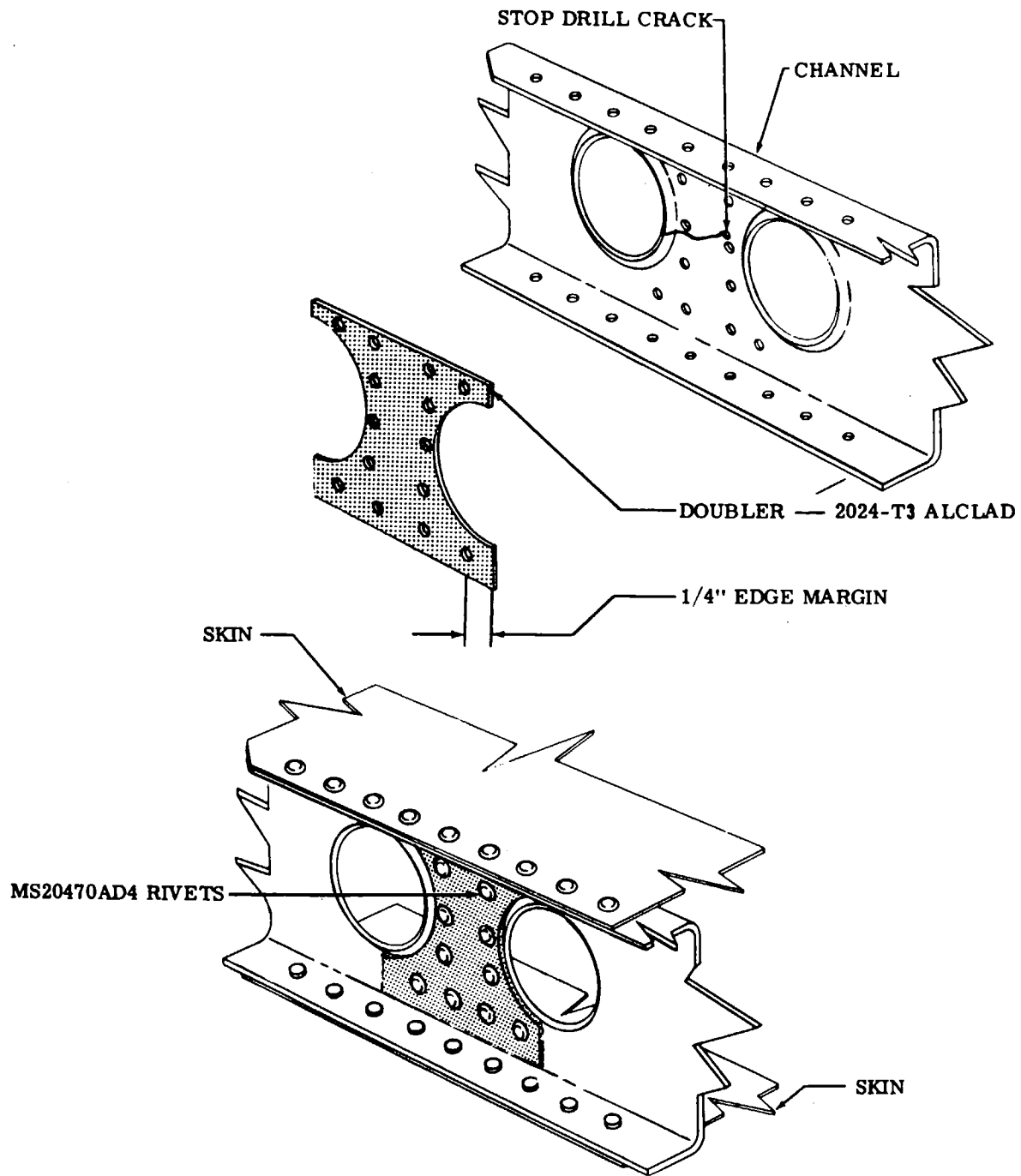


Figure 18-5. Stringer and Channel Repair (Sheet 2 of 4)



- ORIGINAL PARTS
- REPAIR PARTS
- REPAIR PARTS IN CROSS SECTION

Figure 18-5. Stringer and Channel Repair (Sheet 3 of 4)

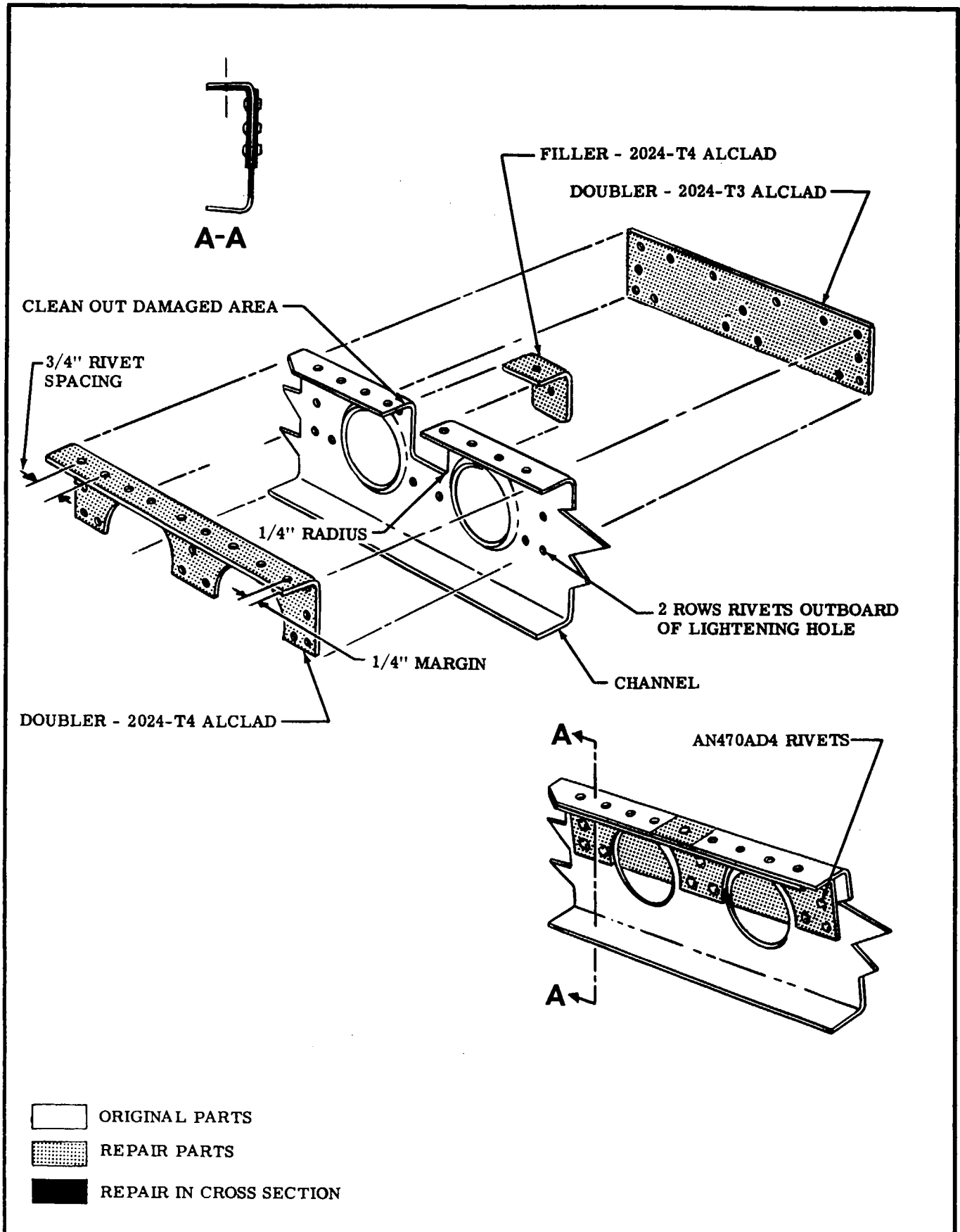


Figure 18-5. Stringer and Channel Repair (Sheet 4 of 4)

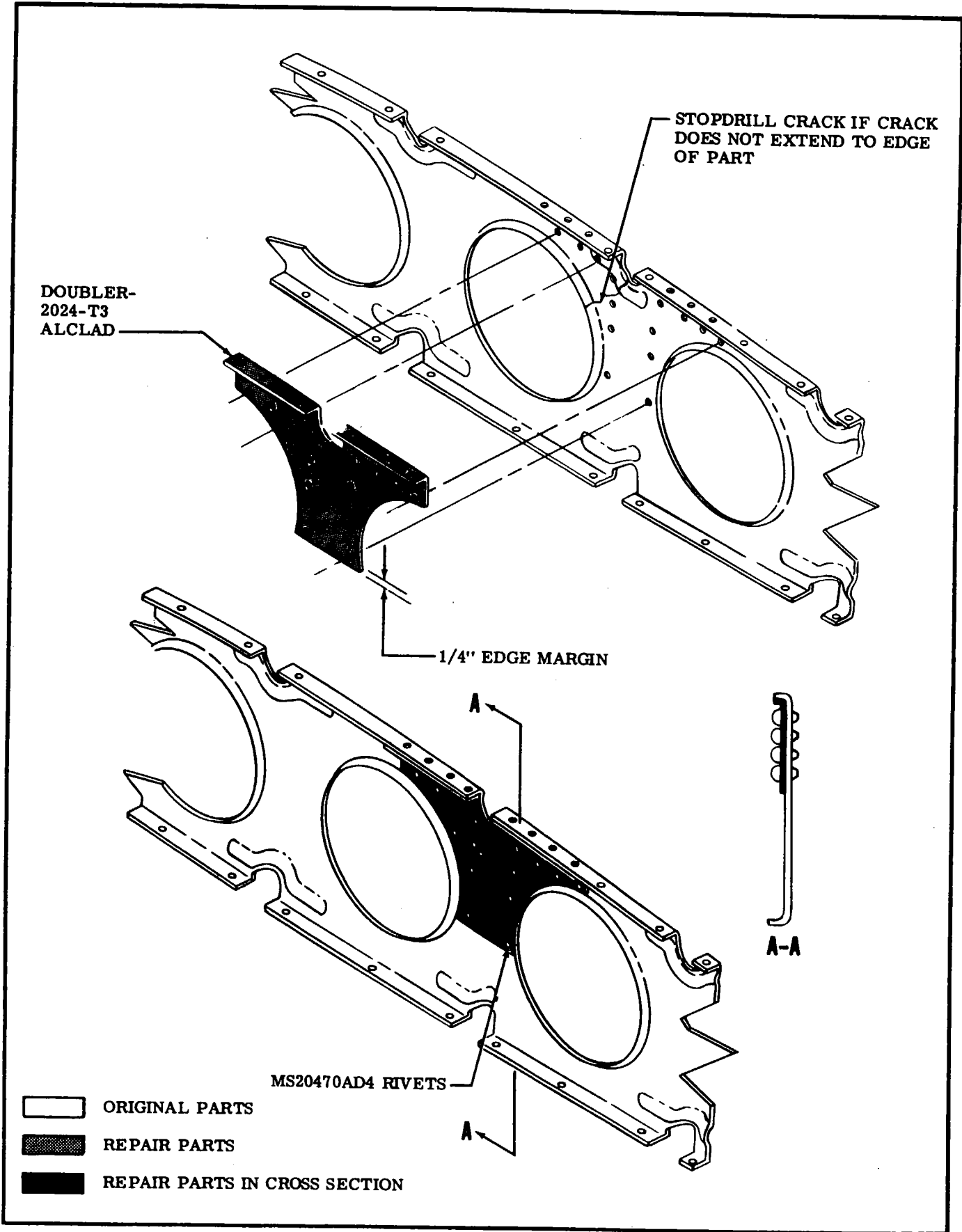


Figure 18-6. Rib Repair (Sheet 1 of 2)

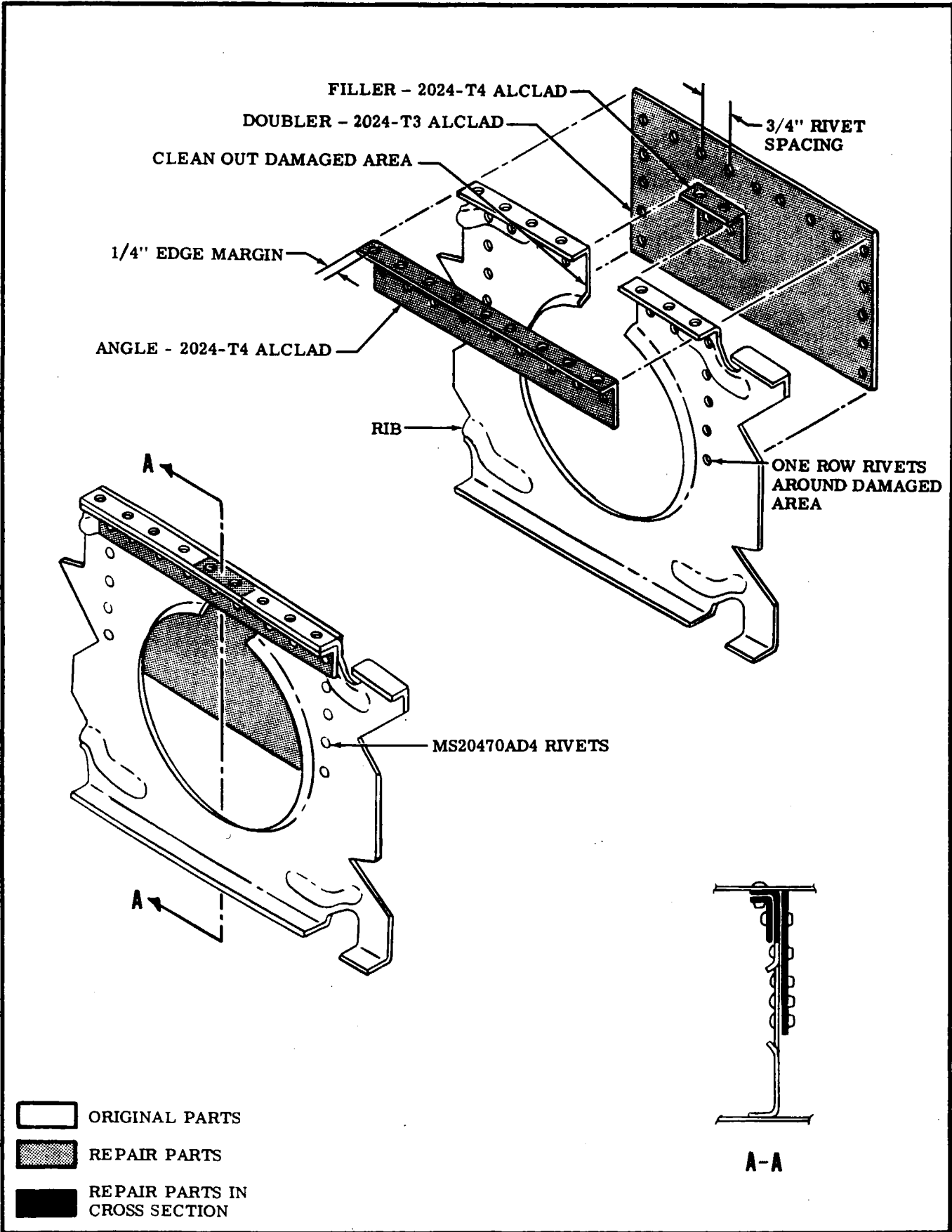


Figure 18-6. Rib Repair (Sheet 2 of 2)

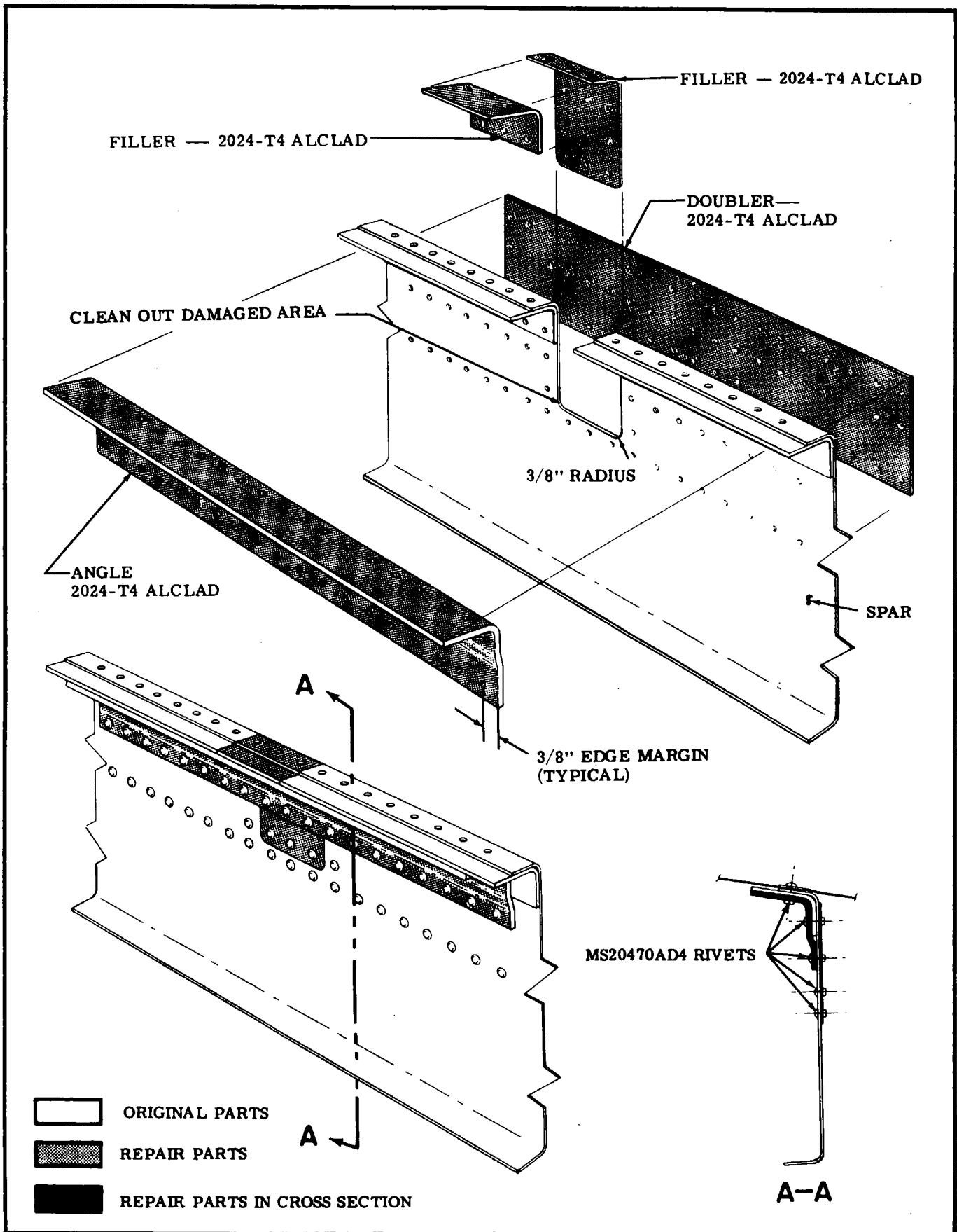


Figure 18-7. Wing Spar Repair (Sheet 1 of 3)

NOTE

This repair applies to either front or rear spar if the spar is a single channel.

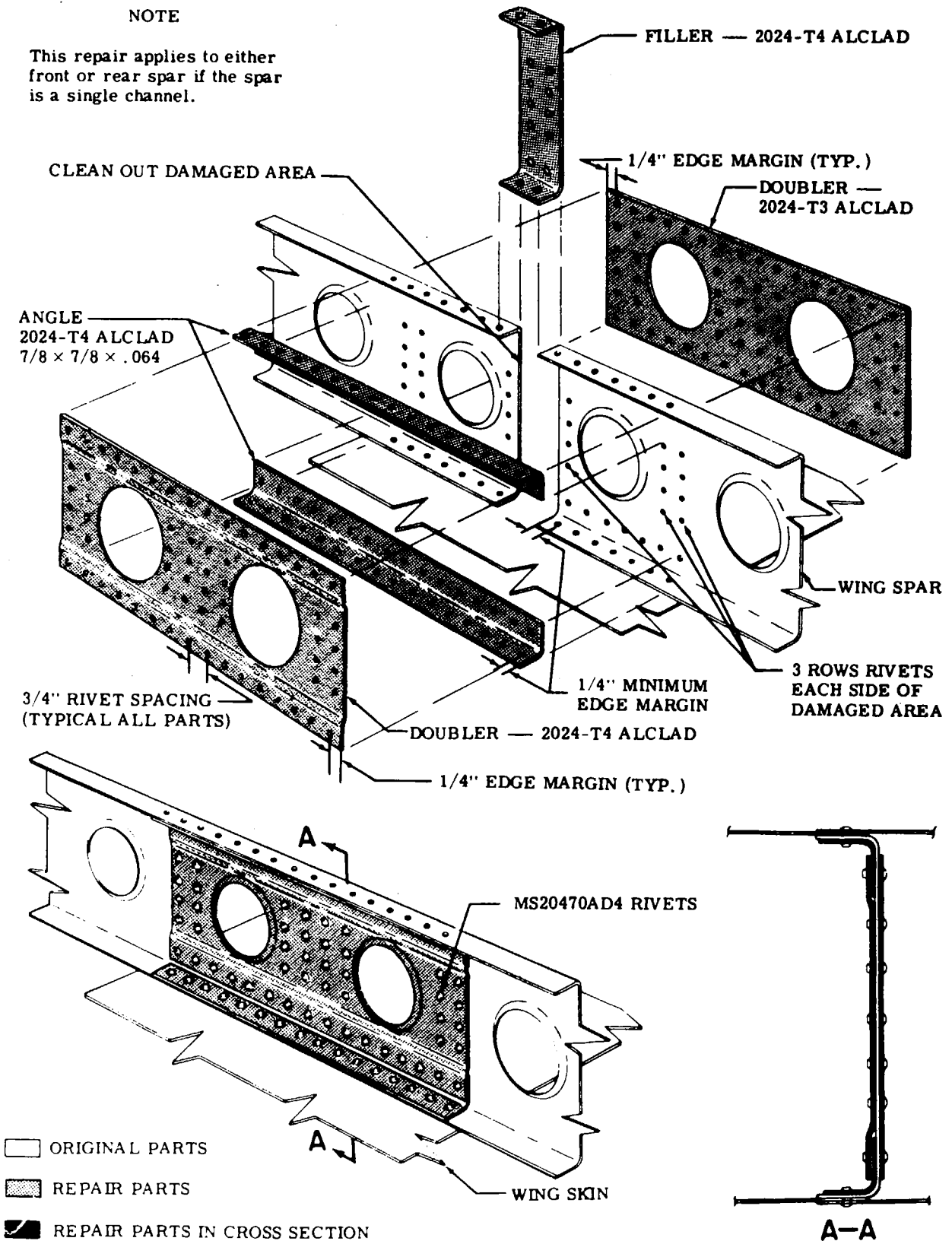


Figure 18-7. Wing Spar Repair (Sheet 2 of 3)

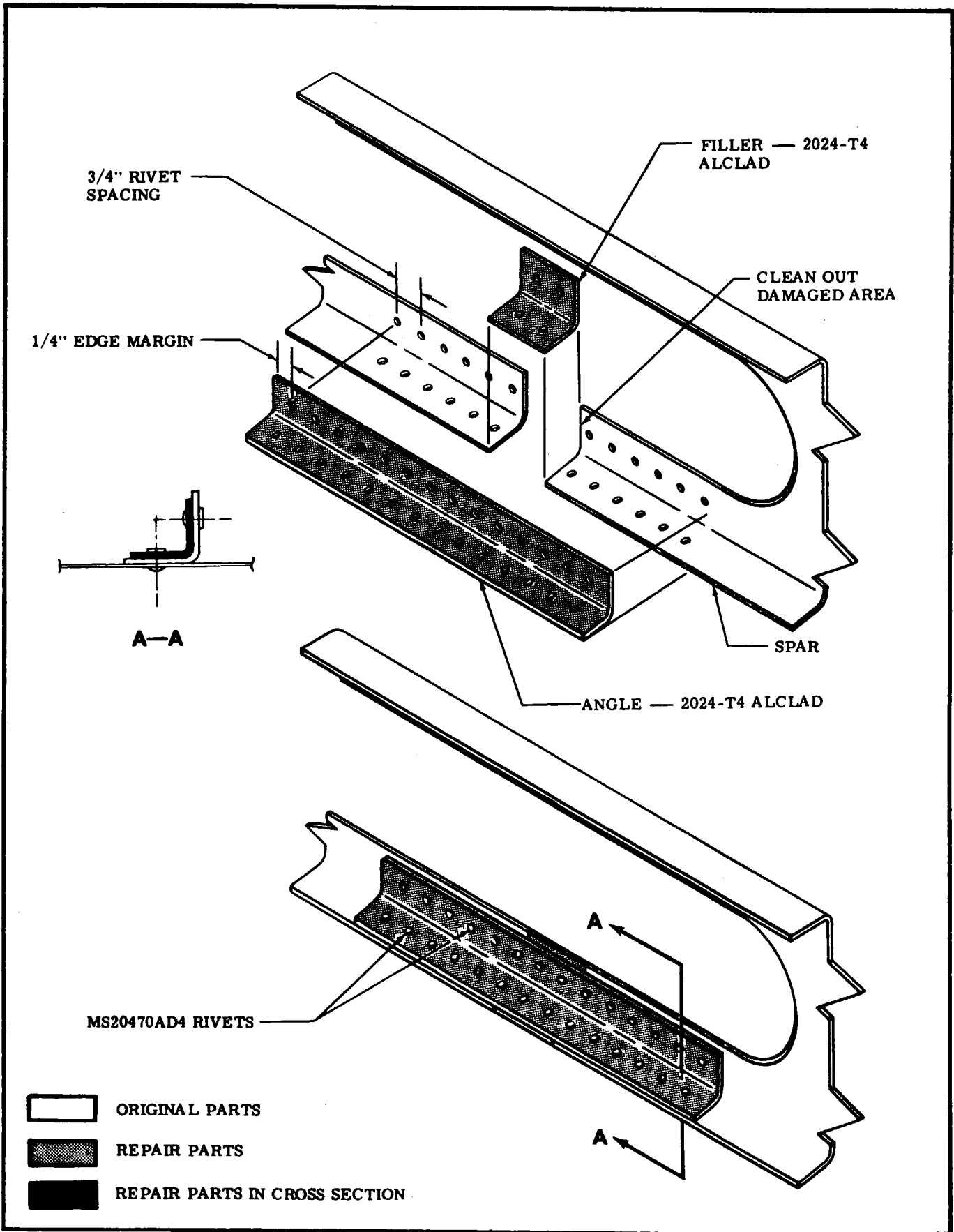


Figure 18-7. Wing Spar Repair (Sheet 3 of 3)

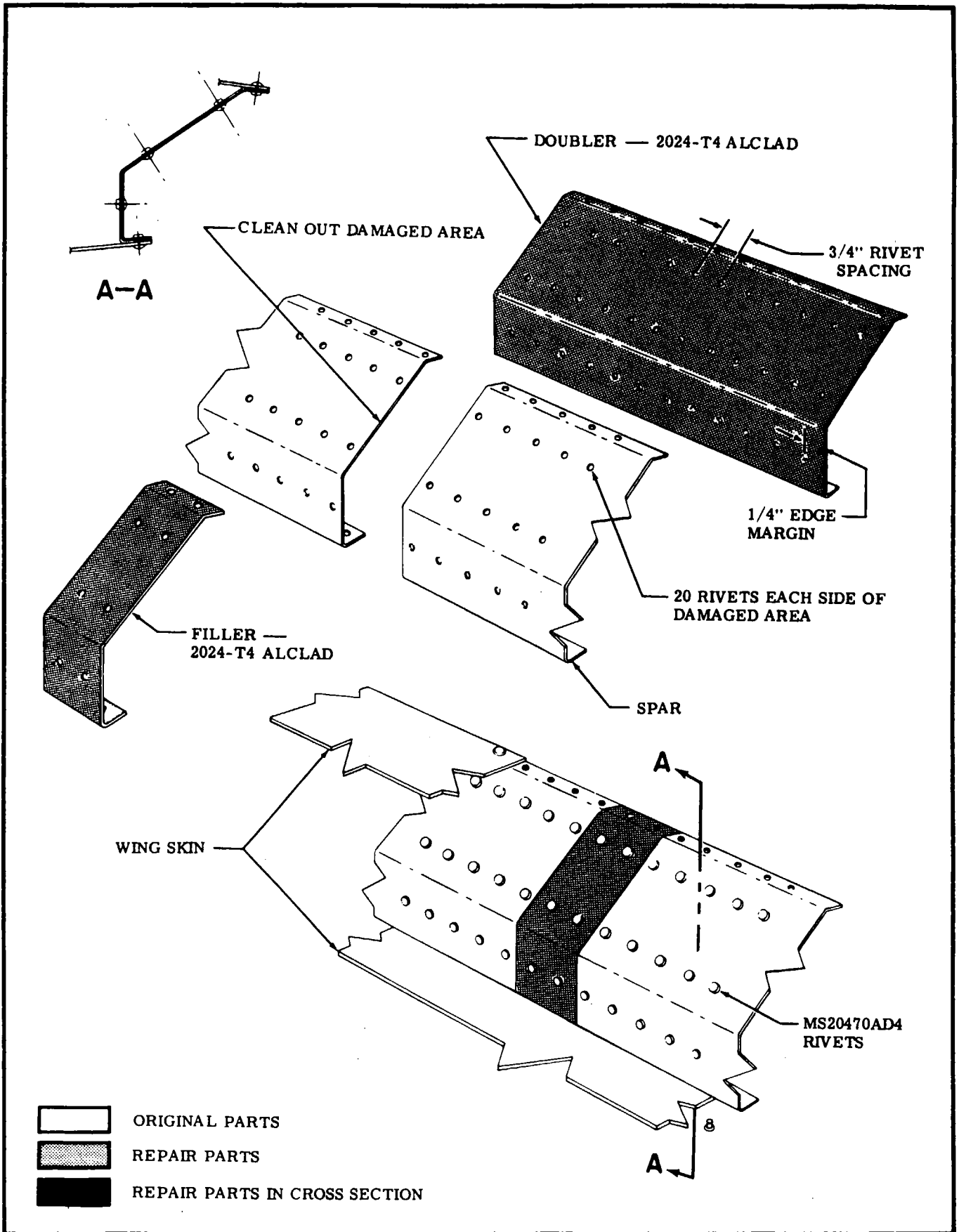


Figure 18-8. Auxiliary Spar Repair

NOTES:

1. Dimple leading edge skin and filler material; countersink the doubler.
2. Use MS20426AD4 rivets to install doubler.
3. Use MS20426AD4 rivets to install filler, except where bucking is impossible. Use CR162-4 Cherry (blind) rivets where regular rivets cannot be bucked.
4. Contour must be maintained; after repair has been completed, use epoxy filler as necessary and sand smooth before painting.
5. Vertical size is limited by ability to install doubler clear of front spar.
6. Lateral size is limited to seven inches across trimmed out area.
7. Number of repairs is limited to one in each bay.

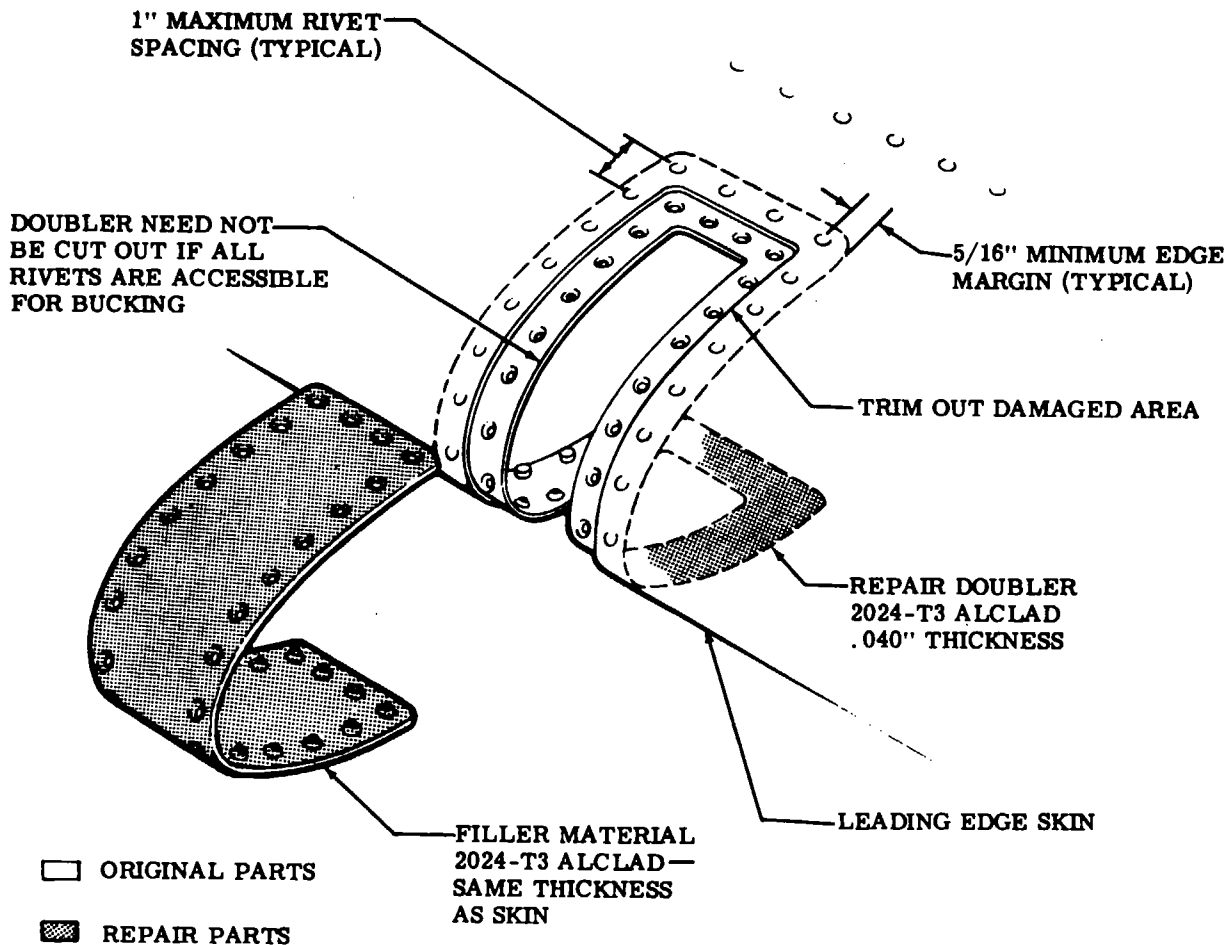


Figure 18-9. Leading Edge Repair

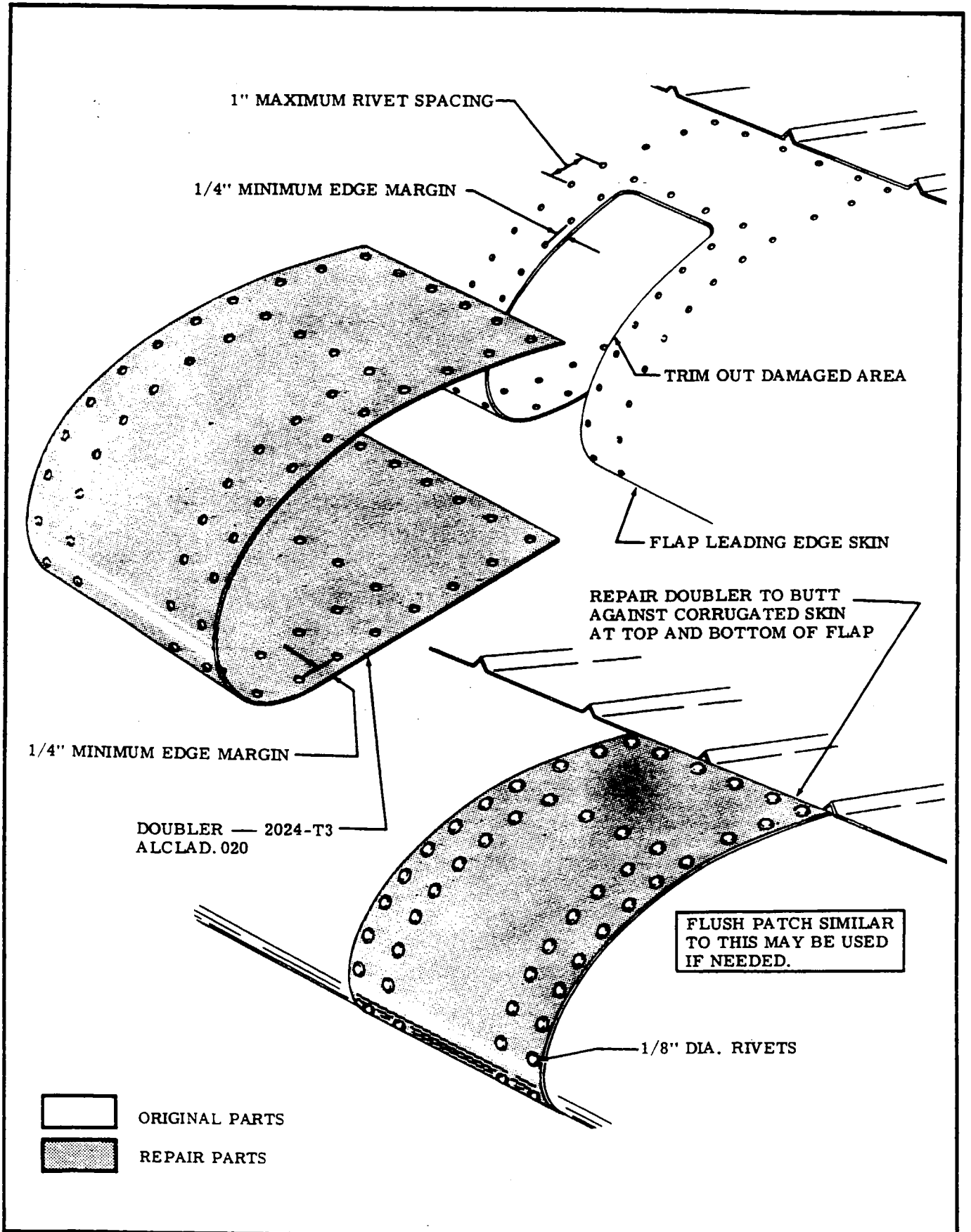
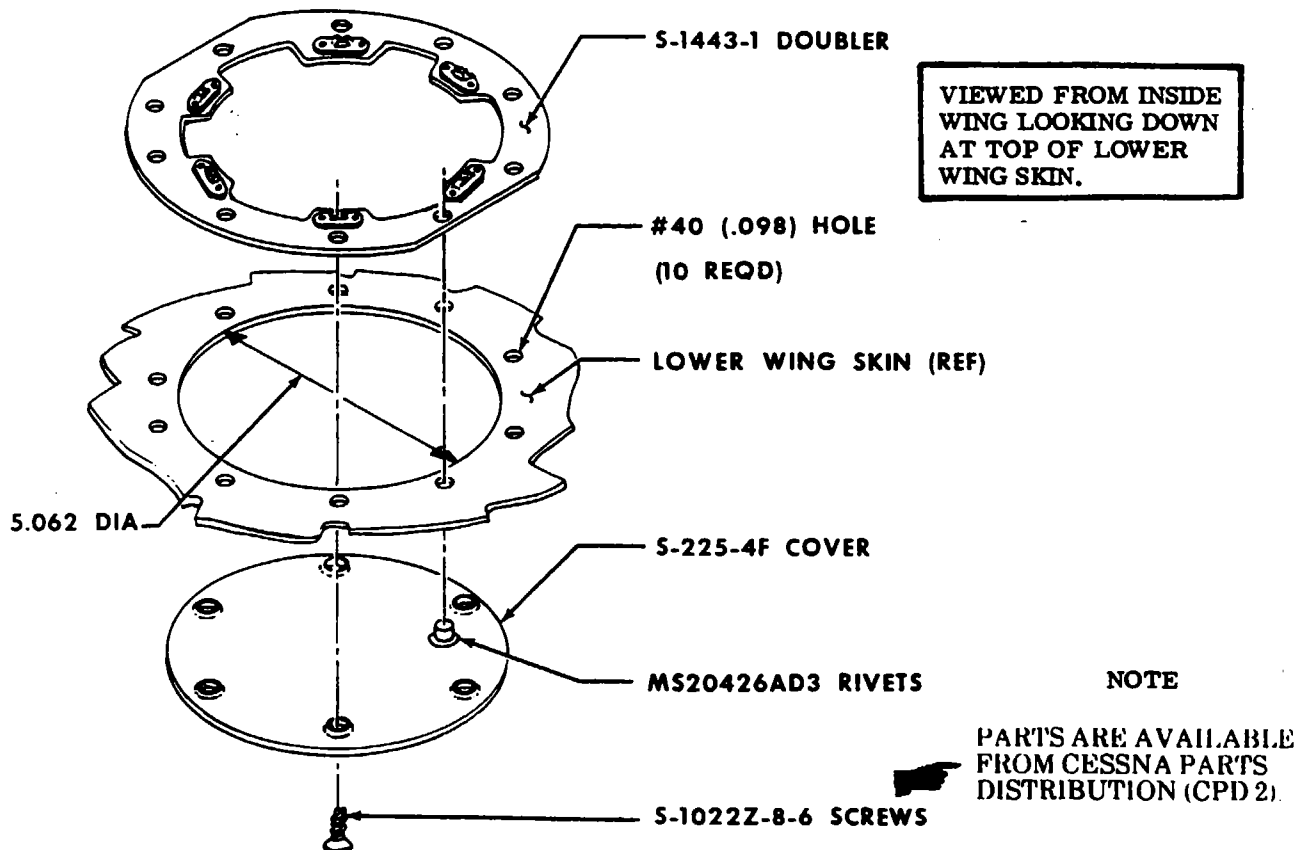


Figure 18-10. Flap Leading Edge Repair



PRECAUTIONS

1. Add the minimum number of access holes necessary.
2. Any circular or rectangular access hole which is used with approved optional equipment installations may be added in lieu of the access hole illustrated.
3. Do not add access holes at outboard end of wing; remove wing tip instead.
4. Do not add an access hole in the same bay where one is already located.
5. Locate new access holes near the center of a bay (spanwise).
6. Locate new access holes forward of the front spars as close to the front spar as practicable.
7. Locate new access holes aft of the front spar between the first and second stringers aft of the spar. When installing the doubler, rotate it so the two straight edges are closest to the stringers.
8. Alternate bays, with new access holes staggered forward and aft of the front spar, are preferable.
9. A maximum of five new access holes in each wing is permissible; if more are required, contact the Cessna Service Department.
10. When a complete leading edge skin is being replaced, the wing should be supported in such a manner so that wing alignment is maintained.

- a. Establish exact location for inspection cover and inscribe centerlines.
- b. Determine position of doubler on wing skin and center over centerlines. Mark the ten rivet hole locations and drill to size shown.
- c. Cutout access hole, using dimension shown.
- d. Flex doubler and insert through access hole, and rivet in place.
- e. Position cover and secure, using screws as shown.

Figure 18-11. Access Hole Installation

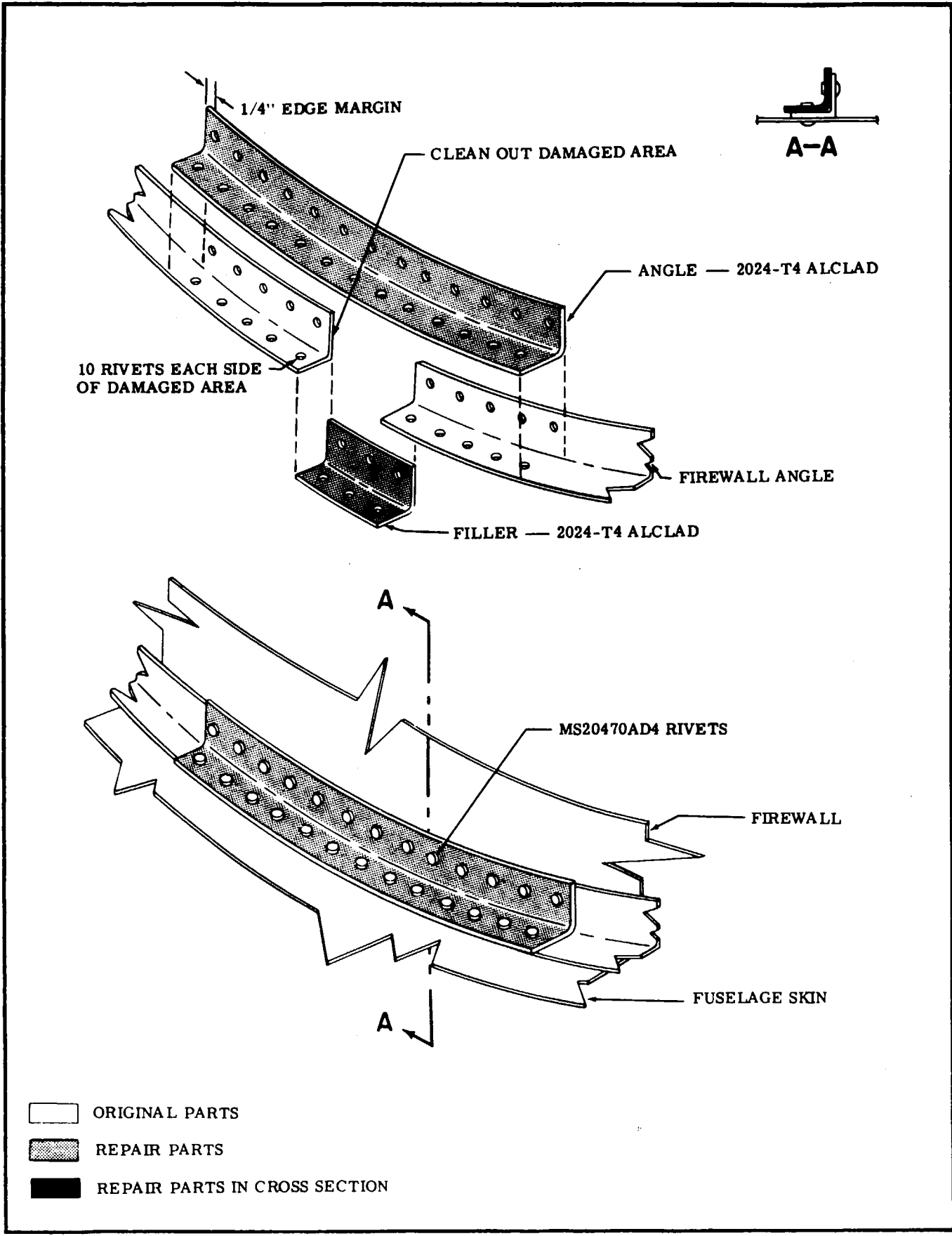


Figure 18-12. Firewall Angle Repair

SECTION 19

PAINTING

NOTE

This Section contains standard factory materials listing and area of application. For paint number and color, refer to Aircraft Trim Plate and Parts Catalog. In all cases determine the types of paint are not compatible. Materials may be obtained from Cessna Parts Distribution (CPD 2).

MATERIAL	NO/TYPE	DOMESTIC	FRENCH	AREA OF APPLICATION
PAINT	ACRYLIC LACQUER	X		NOTE 1
	LACQUER		X	
PRIMER	P60G2 WITH R7K44 REDUCER	X	X	NOTE 2
	EX-ER-7 WITH T-ER-4 REDUCER	X	X	
THINNER	T-8402A	X		NOTE 4
	T-6094A	X	X	NOTE 3
SOLVENT	Methyl Ethyl Keytone (MEK)	X	X	NOTE 5

NOTE

Do not paint Pitot Tube, Gas Caps or Aileron Gap Seals. Also do not paint Antenna Covers which were not painted at the factory.

NOTES

1. Used on aircraft exterior.
2. Used with lacquer or acrylic lacquer on aircraft exterior.
3. Used to thin lacquer and for burndown.
4. Used to thin acrylic lacquer and for burndown.
5. Used to clean aircraft exterior prior to priming.

19-1. PAINTING OF FORMED ABS PLASTIC PARTS. The following procedures outline some basic steps which are useful during touchup or painting of formed ABS plastic parts.

19-2. INTERIOR PARTS (Finish Coat of Lacquer)

a. Painting of Spare Parts.

1. Ensure a clean surface by wiping with Naphtha to remove surface contamination.

CAUTION

Do not use strong solvents such as Xylol, Toluol or Lacquer Thinner since prolonged exposure can soften or embrittle ABS.

2. After the part is thoroughly dry it is ready for the lacquer topcoat. Paint must be thinned with lacquer thinner and applied as a wet coat to ensure adhesion.

b. Touch Up of Previously Painted Parts.

1. Light sanding is acceptable to remove scratches and repair the surface but care must be exercised to maintain the surface texture or grain.

2. Ensure a clean surface by wiping with Naphtha to remove surface contamination.

CAUTION

Do not use strong solvents such as Xylol, Toluol or Lacquer Thinner since prolonged exposure can soften or embrittle ABS.

3. After the part is thoroughly dry it is ready for the lacquer topcoat. Paint must be thinned with lacquer thinner and applied as a wet coat to ensure adhesion.

NOTE

Lacquer paints can be successfully spotted in.

19-3. EXTERIOR PARTS (Acrylic Topcoat)

a. Painting of Spare Parts.

1. Lightly scuff sand to remove scratches and improve adhesion.

2. Ensure a clean surface by wiping with Naphtha to remove surface contamination.

CAUTION

Do not use strong solvents such as Xylol, Toluol or Lacquer Thinner since prolonged exposure can soften or embrittle ABS.

3. After the part is thoroughly dry it is ready

for the topcoat. Paint must be thinned with appropriate acrylic thinner and applied as a wet coat to ensure adhesion.

b. Touch Up of Previously Painted Parts.

1. Lightly scuff sand to remove scratches and improve adhesion.

2. Ensure a clean surface by wiping with Naphtha to remove surface contamination.

CAUTION

Do not use strong solvents such as Xylol, Toluol or Lacquer Thinner since prolonged exposure can soften or embrittle ABS.

3. Apply a compatible primer - surfacer and sealer.

4. After the part is thoroughly dry it is ready for the topcoat. Paint must be thinned and applied as a wet coat to ensure adhesion.

NOTE

Acrylic topcoats can be successfully spotted in.

19-4. EXTERIOR PARTS (Epoxy or Polyurethane Topcoat)

a. Painting of Spare Parts and Touch Up of Painted Parts.

1. Lightly scuff sand to remove scratches and improve adhesion.

2. Ensure a clean surface by wiping with Naphtha to remove surface contamination.

CAUTION

Do not use strong solvents such as Xylol, Toluol or Lacquer Thinner since prolonged exposure can soften or embrittle ABS.

3. Apply a primer compatible with Epoxy or Polyurethane topcoat.

4. After the part is thoroughly dry it is ready for the topcoat.

NOTE

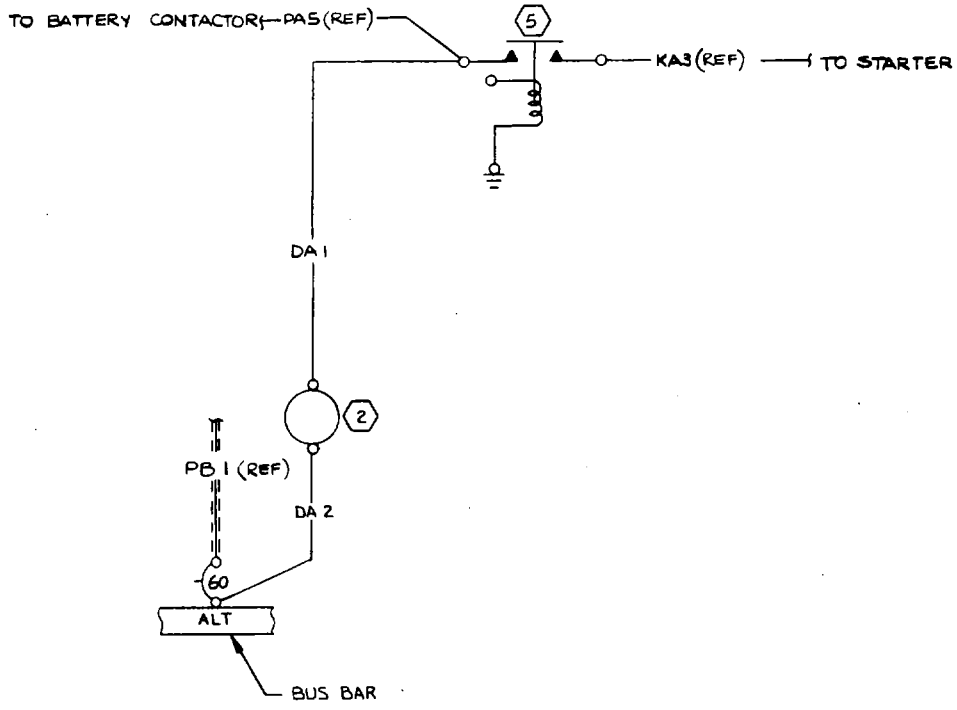
Epoxy or Polyurethane topcoats cannot be successfully spotted in - finish should be applied in areas with natural breaks such as skin laps or stripe lines.

When painting interior and exterior polycarbonate parts, or where the part material is questionable, a "barrier primer" should be applied prior to the Enamel, Lacquer, Epoxy or Polyurethane topcoat.

SECTION 20
WIRING DIAGRAMS

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REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV; DELETE DA 3; CHG TERMINAL LOCATION ON DA 2; DELETE LIGHTER & WIRE LENGTHS (MER E0339)	GS 9-13-74	<i>[Signature]</i>



5060-822-00

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
DA 2	B			S-1367-4-10	S-1367-4-10
DA 1	B			S-1367-4-10	S-1367-4-10

PART NO.	DESCRIPTION
5 S-1991-1	CONTACTOR
2 S-1320-1	AMMETER
1 S-1596-60L	CIRCUIT BREAKER

EQUIPMENT TABLE

CEB-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CEB-XXXX-CESSNA SPEC. NO.
S-XXX OR CMXXXX-CESSNA
STD. NO.

SUPERSEDES:
0410011 PG 4.8

SUPERSEDED BY:

CONTRACT NO:

DESIGN: *J.B. MITCHELL* 8-16-74

GROUP: *(Small)* 8-16-74

DRAWN: *B. FROMAN* 8-15-74

CHECK: *J. YOUEL* 8-15-74

STRESS:

PROJ: *[Signature]* 8-19-74

APPD:

OTHER:

COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

Cessna AIRCRAFT CO.

TITLE
**WIRING DIAGRAM -
AMMETER
60 AMP**

SIZE: C

CODE IDENT. NO.: 71379

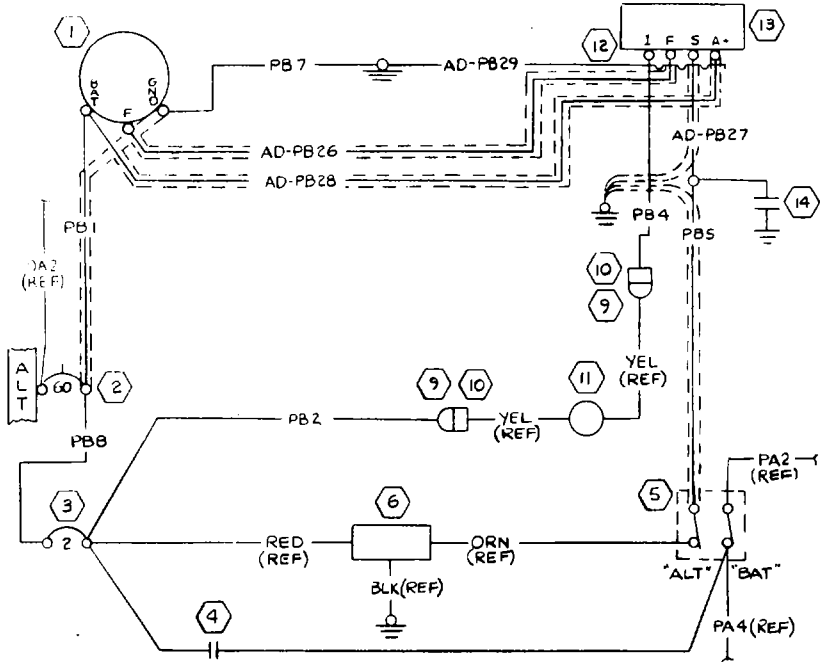
DWG NO.: 0470401

SCALE: NONE

150, A150, FA150

PAGE: 4.1

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV. DELETE PB3 PBC.5 1640 4 S-1641-9; S-1635-2/PB5 WAS S-1636-2 DELETE WIRE LENGTHS MER E0339	9-13-74	GS RF
B	BY REV: F WAS 'A' 'A' WAS 'F' ON CG11001-0201(NOW SHOP PRACTICE)	1-21-76	DLP RF



- NOTES:
- 1. TERMINAL 42281-2(00779) ON CONDUCTOR
TERMINAL 2-323931-2(00779) ON SHIELD&GND.WIRE
 - 2. WIRE MATL PER S-1534-B-9

14	0770038-2	FILTER	
13	C611001-0201	REGULATOR	
12	C6AB-10A730-A	HOUSING	
11	S-2155-1	LIGHT ASSY	
10	S-1637-2	HOUSING-SOCKET	
9	S-1637-1	HOUSING-PIN	
6	C593001-0101	OVERVOLTAGE SENSOR	
5	S-1994-1-1	MASTER SWITCH	
4	TVA-1315	CAPACITOR	
3	CAZ	CIRCUIT BREAKER	
2	S-1596-60L	CIRCUIT BREAKER	
1	C611001-0203	ALTERNATOR ASSY	

PB8	16			S-1367-2-10	S-1367-2-8
AD-PB29	18			S-1947-12	1
AD-PB28	18S			S-1367-1-12	1
AD-PB27	18S			S-1367-1-8	1
AD-PB26	18S			S-1367-1-10	1
PB7	8	S-1562-B-9		S-1943-3	S-1967-4-12
PB5	18S			S-1493-1	S-1587-1-5 S-1367-2-5
PB4	18			S-1636-2	42281-2
PB2	16			S-1635-2	S-1367-2-8
PB1	8S	2		S-1367-4-10	S-1943-3 S-1367-2-10
WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS

ITEM NO.	PART NO.	DESCRIPTION
EQUIPMENT TABLE		
SUPERSEDES: 0410011 PG 4.13.0		
SUPERSEDED BY:		

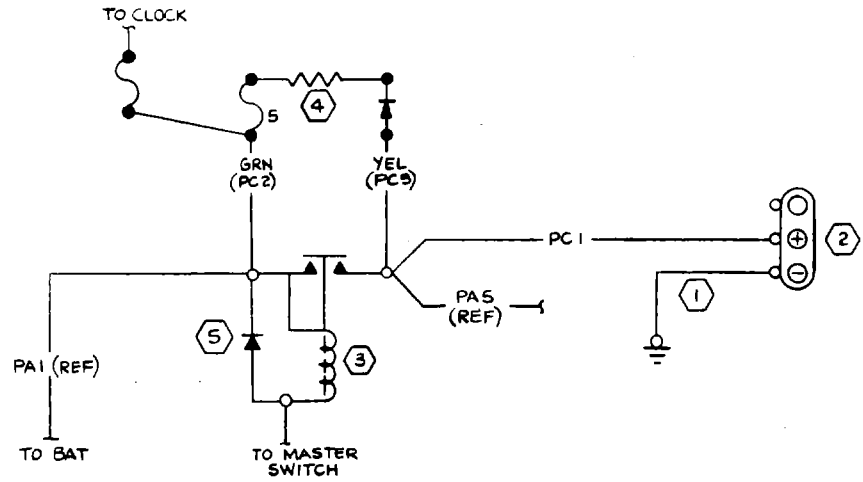
CONTRACT NO:			WIRE TABLE		
DESIGN	NAME	DATE	SIZE	CODE IDENT. NO.	DWG NO
J.B. MITCHELL		8-16-74	C	71379	0470401
GROUP		8-16-74	SCALE: NONE 150,150A,FA150 PAGE: 4.2		
DRAWN	B.FROMAN	8-15-74			
CHECK	J.YOVEL	8-15-74			
STRESS					
PROJ	R.D.Z	8-19-74			
APPD					
OTHER					

(SR7900)(SR7901)(SR7902)
(1507006)(A1500610)(FA1500282)

20-3/(20-4 blank)

500-223-0905

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE WIRE LENGTH (SR 7900)(SR 7901)(SR 7902)	C J H 9-13-74	RF



00-223-0905

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
(GRN)	18	-18-4		5-1367-1-19	SOLDER
(PC2)	18	-18-5		5-1367-1-19	SOLDER
PC1	4			5-1367-6-13	5-1367-6-14

ITEM NO	PART NO.	DESCRIPTION
5	F4	DIODE
4	0712031-3	FUSE & DIODE ASSY
3	S-1579-2	CONTACTOR
2	AN2552-9A	RECEPTACLE
1	CS2155-10	GND STRAP

EQUIPMENT TABLE

CEB-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CEB-XXXX-CESSNA SPEC. NO.
S-XXX OR CMXXXX-CESSNA
STD. NO.

SUPERSEDES:
0410011 PG 4.11

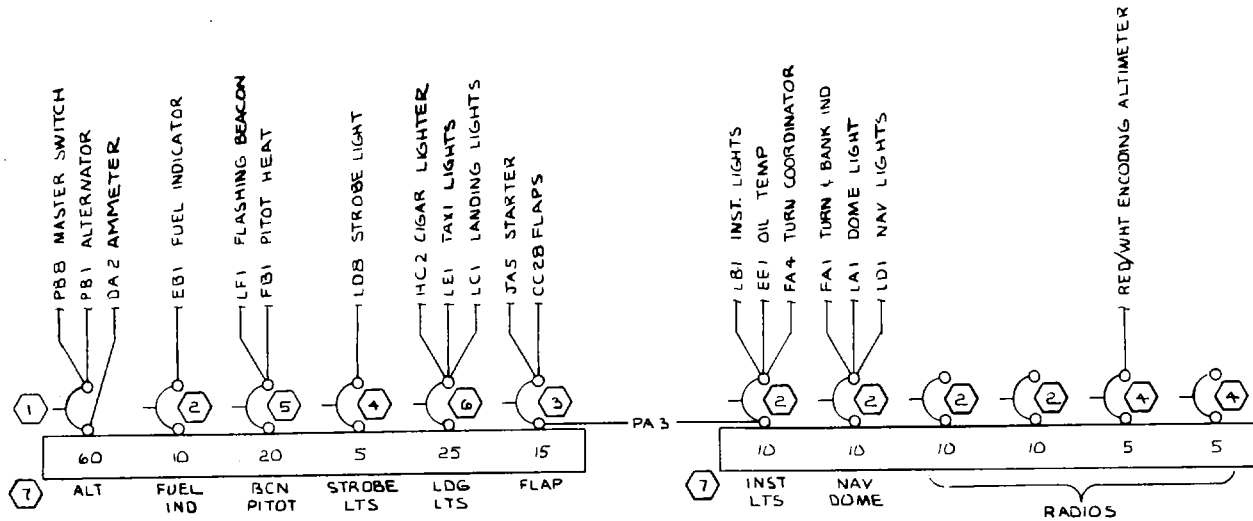
SUPERSEDED BY:

CONTRACT NO:		COMMERCIAL AIRCRAFT DIV. CESSNA AIRCRAFT CO. 5800 E. PAWNEE WICHITA, KANSAS	
DESIGN	J. B. MITCHELL	DATE	8-16-74
GROUP	J. B. MITCHELL	DATE	8-16-74
DRAWN	B. FROMAN	DATE	8-15-74
CHECK	J. YOUDEL	DATE	8-15-74
STRESS			
PROJ	J. B. MITCHELL	DATE	8-17-74
APPD			
OTHER			
SIZE	C	CODE IDENT. NO.	71379
DWG NO			0470401
SCALE: NONE		150, A150, FA150	PAGE: 4, 4

(SR 7900)(SR 7901)(SR 7902)
(15077006)(A1500616)(FA1500282)

20-5

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: HC2 WAS HCI (SRB444)	GDS 4-28-76	[Signature]



32-0905
31-0905
30-0905

NOTES:

- THIS DWG IS FOR REF INFO ONLY. FOR WIRING & WIRE & TERMINAL REQUIREMENTS SEE APPROPRIATE PAGES OF 0470401

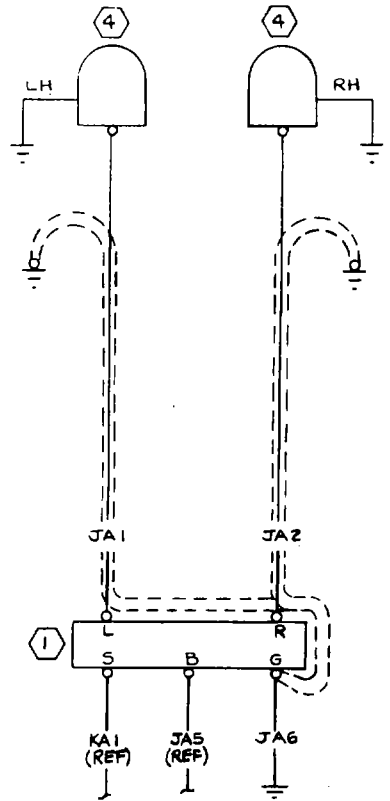
WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
PA 3	B			5-1367-4-10	5-1367-4-10

PART NO.	DESCRIPTION
7	1270 704 BUS BAR
6	S-1360-25L CKT BKR
5	S-1360-20L CKT BKR
4	S-1360-5L CKT BKR
3	S-1360-15L CKT BKR
2	S-1360-10L CKT BKR
1	S-1590-60L CKT BKR

EQUIPMENT TABLE	
CES-1000 IS APPLICABLE	SUPERSEDES:
VENDOR CODES PER S-1400	PAGE 4.3
CES-XXXX-CESSNA SPEC. NO.	SUPERSEDED BY:
S-XXX OR CMXXXX-CESSNA	
STD. NO.	

WIRE TABLE			COMMERCIAL AIRCRAFT DIV.	
CONTRACT NO:			CESSNA AIRCRAFT CO.	
DESIGN	NAME	DATE	8800 E. PAWNEE WICHITA, KANSAS	
GROUP	W. H. L. L. L. L.	2-28-76	TITLE	
DRAWN	SWANSON	2-18-76	WIRING DIAGRAM -	
CHECK	YOUEL	2-20-76	BUS BAR	
STRESS			CIRCUIT BREAKER	
PROJ	FILE	3-1-76	SIZE	CODE IDENT.
APPD			C	71379
OTHER			DWG NO	0470401
			SCALE: NONE	(SRB130)(SRB131) PAGE: 4.5

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9, S-1641-9, JA3+JA4; S-1367-1-10 & S-1367-2-6/ JA1 & JA2 WERE S-1636-1; DELETE WIRE LENGTHS (MER E0339)	65 9-15-74	RF



WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
JA6	18			S-1367-1-6 S-1367-1-8	
JA2	18S			S-1367-1-6 S-1367-1-8	
JA1	18S			S-1367-1-6 S-1367-1-8	

PART NO.	DESCRIPTION
4 447	MAGNETO
1 C292501-0101	IGNITION SWITCH

EQUIPMENT TABLE

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-1000-CESNA SPEC. NO. S-1001 OR CM1000-CESNA STD. NO.

SUPERSEDES: 0410011 PG 5.3
SUPERSEDED BY:

CONTRACT NO: _____

DESIGN NAME DATE: T.B. MITCHELL 8-16-74

GROUP: B. FROMAN 8-16-74

DRAWN: B. FROMAN 8-15-74

CHECK: J. YOUBL 8-15-74

STRESS: _____

PROJ: _____ 8-19-74

APPD: _____

OTHER: _____

COMMERCIAL AIRCRAFT DIV.
CESSNA AIRCRAFT CO.
8800 E. PAWNEE
WICHITA, KANSAS

TITLE: **WIRING DIAGRAM — MAGNETOS**

SIZE: C

CODE IDENT. NO.: 71379

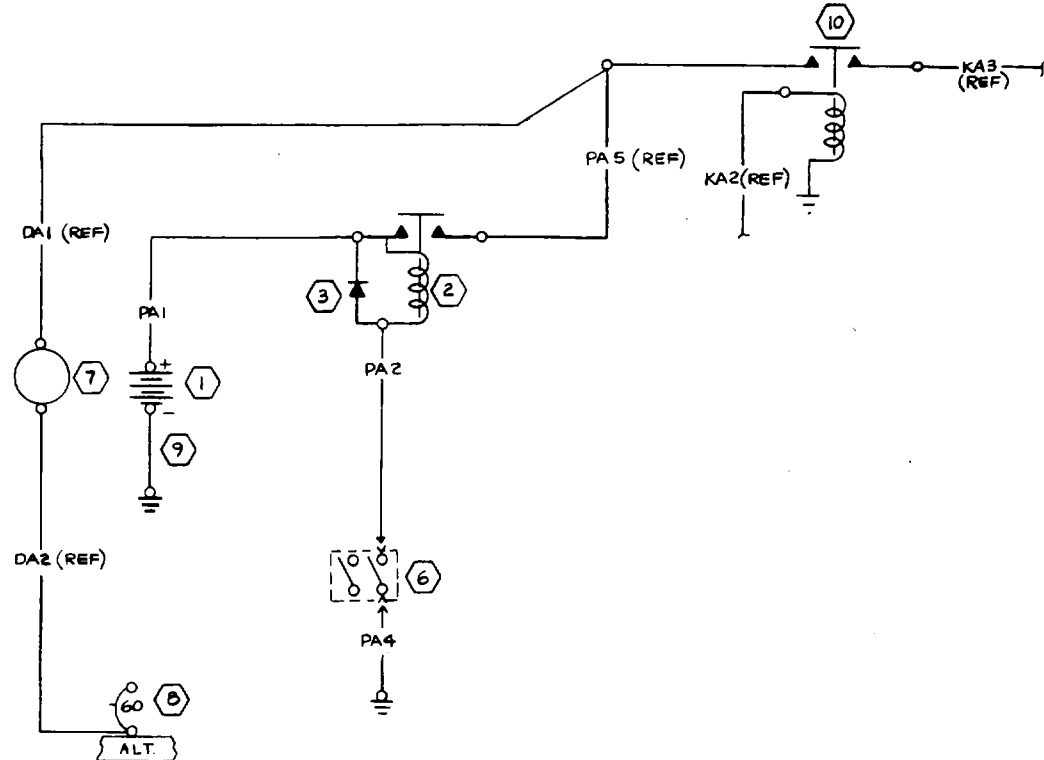
DWG NO.: 0470401

SCALE: NONE

150, A150, PA150

PAGE: 5.1

(SR7900)(SR7901)(SR7902)
(15077006)(A150061Q)(A1500622)



REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9, S-1641-9, PA3, DA3(REF) WIRE LENGTHS; S-1493-1 PB2 WAS S-1636-1 (MER E0339)	GS 9-13-74	<i>[Signature]</i> REF
B	BY REV: S-1320-5 WAS S-1320-1; SER(SR7900)(SR7901)(SR7902)	CJH 11-27-74	<i>[Signature]</i> REF

00-223-0905

ITEM NO.	PART NO.	DESCRIPTION
10	S-1991-1	STARTER CONTACTOR
9	0412007-9	STRAP-BAT GND
8	S-1596-60L	CKT BREAKER
7	S-1320-5	AMMETER
6	S-1994-1-1	SWITCH-MASTER
5	0770728-1	DIODE ASSY
2	S-1579-2	CONTACTOR
1	0511319-1	BATTERY, 12V

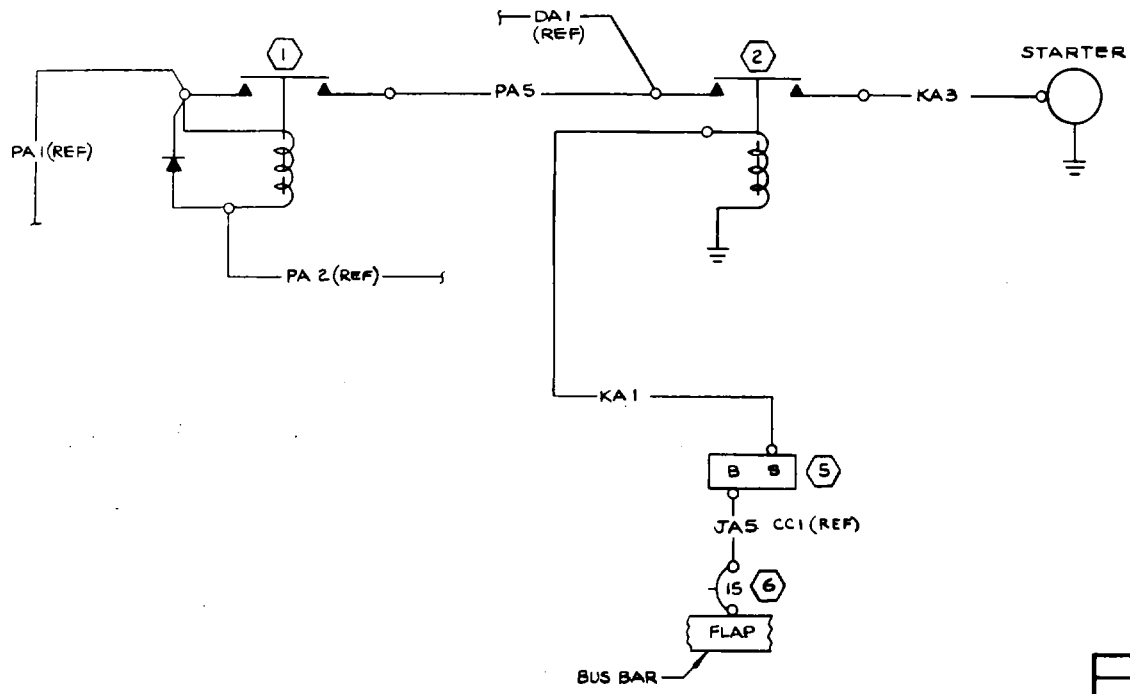
EQUIPMENT TABLE	
CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX-CESNA SPEC. NO. S-XXX OR CMXXXX-CESNA STD. NO.	SUPERSEDES: 0410011 PG 6.3 SUPERSEDED BY:

ITEM NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
PA 4	18			S-1493-1 S-1367-18	
PA 2	18			S-1567-140 S-1493-1	
PA 1	4			S-1367-6-14 S-1367-6-13	

WIRE TABLE		
CONTRACT NO:		COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS
DESIGN	J.B. MITCHELL 8-16-74	Cessna AIRCRAFT CO. WIRING DIAGRAM - BATTERY & STARTER CONTACTORS
GROUP	<i>[Signature]</i> 8-16-74	
DRAWN	B. FROMAN 8-15-74	
CHECK	J. YQUEL 8-15-74	
STRESS		
PROJ	<i>[Signature]</i> 8-19-74	SCALE: NONE
APPD		CODE IDENT. NO. 71379
OTHER		DWG NO. 0470401
		SIZE C
		150, A150, FA150
		PAGE: 6.1

(SR7900)(SR7901)(SR7902)
(15077006)(A1500610)(FA1500282)

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1641-9, S-1640-9, KA2, WIRE LENGTHS; S-1367-1-10/ KA1 WAS S-1635-1 (MER E0339)	GS 9-13-74	<i>[Signature]</i> RF



WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
JAS	18			S-1367-1-10 S-1367-1-6	
PAS	4			S-1367-6-13 S-1367-6-13	
KA3	2			S-1367-7-13 S-1367-7-13	
KA1	18			S-1367-1-10 S-1367-1-10	

PART NO.	DESCRIPTION
6 S-1560-15L	CIRCUIT BREAKER
5 C292501-0101	IGNITION SWITCH
2 S-1991-1	CONTACTOR
1 S-1579-2	CONTACTOR

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-1000-CESNA SPEC. NO.
S-1001 OR CM1000-CESNA
STD. NO.

SUPERSEDES:
0410011 PG 6.4
SUPERSEDED BY:

CONTRACT NO:	
NAME	DATE
DESIGN <i>J.B. MITCHELL</i>	8-16-74
GROUP <i>A Smith</i>	8-16-74
DRAWN <i>B. FROMAN</i>	8-15-74
CHECK <i>J. YOUEL</i>	8-15-74
STRESS	
PROJ <i>2074</i>	8-19-74
APPO	
OTHER	

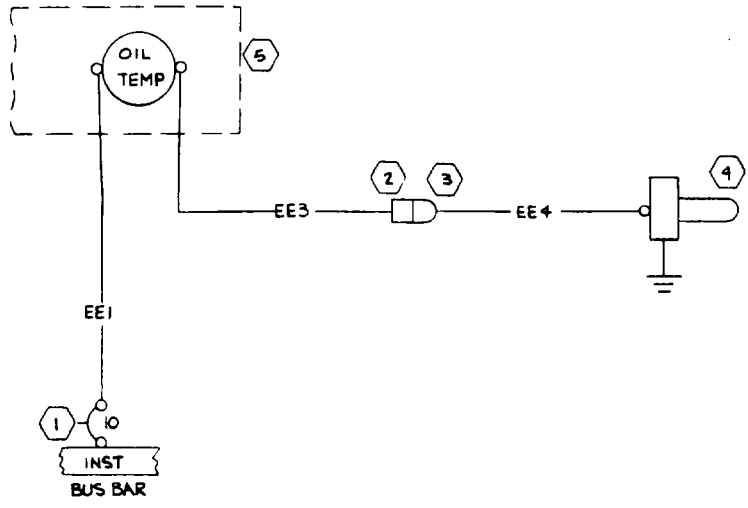
WIRE TABLE
Cessna AIRCRAFT CO.
 COMMERCIAL AIRCRAFT DIV.
 8800 E. PAWNEE
 WICHITA, KANSAS

WIRING DIAGRAM — STARTER

SIZE	CODE IDENT. NO.	DWG NO
C	71379	0470401
SCALE: NONE	150, A160, PA150	PAGE: 6.2

(SR 7900)(SR 7901)(SR 7902)
 (15077006)(A1500610)(FA1500282)

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: C669512-0103 WAS (C669512-0104) (S-1630-3 WAS S-1630-1 (SRB2.94) (REF)	RS 10-13-75	JCY WHS R/S



WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
EE 4	20			S-1635-1 S-1367-1-10	
EE 3	20			S-1367-1-13 S-1636-1	
EE 1	20			S-1367-1-8 S-1367-1-13	

PART NO.	DESCRIPTION
5 C669512-0103	INST. CLUSTER
4 S-1630-3	SENDING UNIT
3 S-1637-1	HOUSING
2 S-1637-2	HOUSING
1 S-1360-10L	CIRCUIT BREAKER

WIRE TABLE

CONTRACT NO: _____

DESIGN: *Anderson* 4-16-75

GROUP: *W.H. Anderson* 4-16-75

DRAWN: *B. HARRISON* 4-14-75

CHECK: *J. YOUDEL* 4-15-75

STRESS: _____

PROJ: *G.A. Fife* 4-17-75

APPD: *JRG*

OTHER: _____

COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

Cessna AIRCRAFT CO.

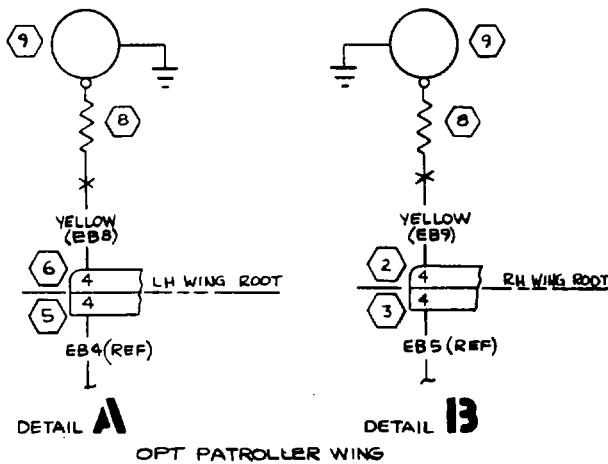
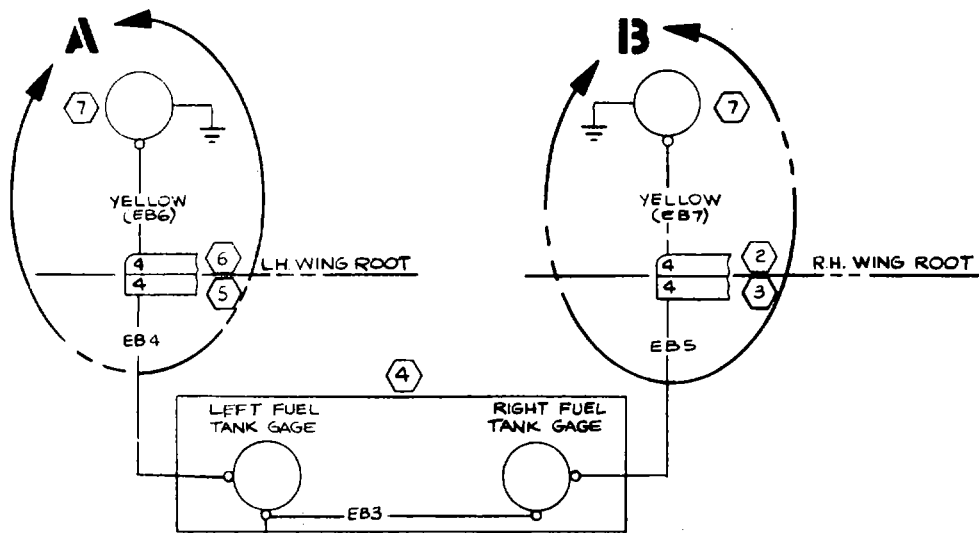
TITLE: **WIRING DIAGRAM -- OIL TEMPERATURE**

SIZE: **C** CODE IDENT. NO: **71379** DWG NO: **0470401**

SCALE: NONE (SR7900)(SR7901) (SR7902) PAGE: 7.1

CO-223-0A05

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9, S-1641-9, EB2, WIRE LENGTHS; FUEL IND WAS INST LTS; S-1367-1-10/EB1 WAS S-1635-1 (MER E0339)	GS 9-13-74	<i>[Signature]</i> RF
B	BY REV: ADD S-1641-9; S-1640-9; IN DETAIL B, PIN 4 WAS PIN 3, ITEM NO.3 WAS NO.7, ITEM NO.2 WAS NO.8 SER (SR7900)(SR7901)(SR7902)	CJH 10-23-74	SEY APP RF



PART NO.	DESCRIPTION
9	0426517-2 XMTR-FUEL LEVEL
8	20Ω SW RESISTOR
7	0426517-1 XMTR-FUEL LEVEL
6	S-1640-6 HOUSING-PIN
5	S-1641-6 HOUSING-SOCKET
4	0413035-1 PANEL ASSY
3	S-1641-9 HOUSING-SOCKET
2	S-1640-9 HOUSING-PIN
1	S-1360-10L CKT BREAKER

EQUIPMENT TABLE	
CEB-1000 IS APPLICABLE	SUPERSEDES: 0410011 PG 8.1.2
VENDOR CODES PER S-1400	SUPERSEDED BY:
CEB-1000-CESSNA SPEC. NO.	
S-100X OR CM1000-CESSNA	
STD. NO.	

WIRE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
18	-18-4			S-1625-1 S-1370-1 (OPT)	
18	-18-4			S-1370-1 (OPT)	
18	-18-4			S-1367-1-10	
18	-18-4			S-1625-1 S-1367-1-10	
EB5	18			S-1367-1-10 S-1625-1	
EB4	18			S-1367-1-10 S-1625-1	
EB3	18			S-1367-1-10 S-1625-1	
EB1	18			S-1367-1-10 S-1367-1-6	

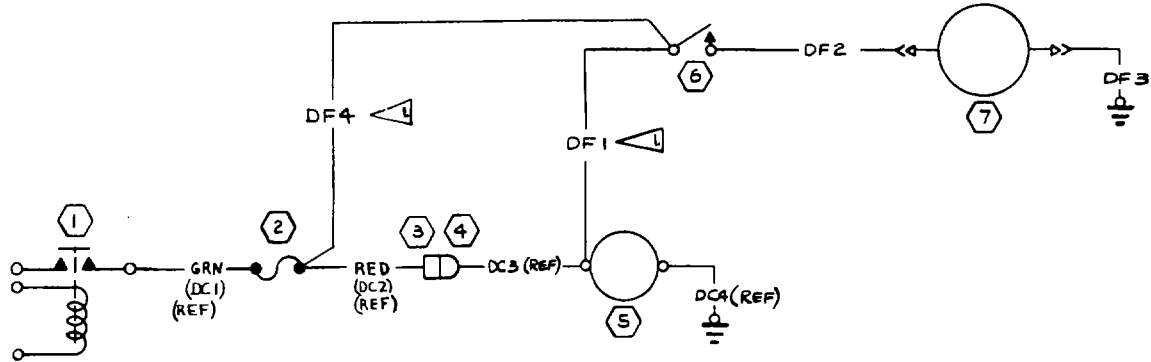
CONTRACT NO:			COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS		
DESIGN	NAME	DATE	Cessna AIRCRAFT CO.		
GROUP	J.P. MITCHELL	8-16-74	TITLE		
DRAWN	B. FROMAN	8-15-74	WIRING DIAGRAM - FUEL INDICATOR & TRANSMITTER		
CHECK	J. YOUNG	8-15-74	SCALE: NONE		
STRESS			SIZE	CODE IDENT.	DWG NO
			C	71379	0470401
			PAGE: 6.1		

(SR 7900)(SR 7901)(SR 7902)
(15077006)(A1500610)(FA1500282)

00-233-0905

20-11

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: ADD GRN TO DC1 & RED TO DC2; DELETE WIRE LENGTHS (MERE0539)	65 9-13-74	<i>[Signature]</i> RF
B	BY REV: C664502-0106 WAS C664501-0103 ADD DF4; REVISE NOTE 1 (SR7900)(SR7901)(SR7902)	81A 10-14-74	<i>[Signature]</i> RF



NOTES:

1. WIRING DIAGRAM SHOWN IS FOR USE WHEN AN OPTIONAL ELECTRIC CLOCK IS INSTALLED. WHEN ELECTRIC CLOCK IS NOT INSTALLED DF4 REPLACES DF1

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
DF4	18			SOLDER S-1367-1-6	
DF3	18			S-1493-1 S-1867-1-8	
DF2	18			S-1493-1 S-1867-1-6	
DF1	18			S-1867-1-6 S-1867-1-6	

PART NO.	DESCRIPTION
7	C664502-0101 HOURMETER
6	S-1711-1 OIL PRESSURE SW
5	S-1317N1 CLOCK
4	S-1637-1 HOUSING
3	S-1637-2 HOUSING
2	6-1091-1 FUSE
1	S-1579-2 CONTACTOR

EQUIPMENT TABLE	
CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX-CESNA SPEC. NO. S-XXX OR CMXXXX-CESNA STD. NO.	SUPERSEDES: 041001 PG B.2 SUPERSEDED BY:

WIRE TABLE		
CONTRACT NO:	NAME	DATE
	J.B. MITCHELL	8-16-74
DESIGN	GROUP	DATE
	B. FROMAN	8-15-74
DRAWN	CHECK	DATE
	J. YOUDEL	8-15-74
STRESS	PROJ	DATE
		8-19-74
APPD	OTHER	

COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

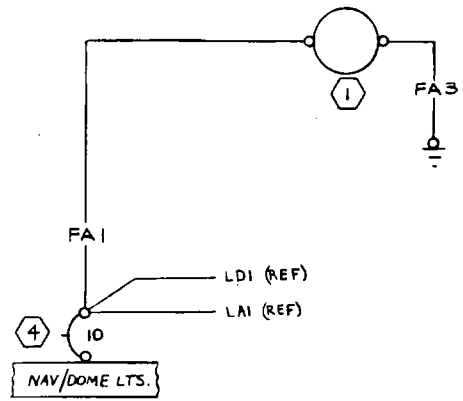
Cessna. AIRCRAFT CO.

TITLE
**WIRING DIAGRAM -
HOURMETER
(OPT)**

SIZE	CODE IDENT. NO.	DWG NO
C	71379	0470401
SCALE: NONE		150, A150, FA150
		PAGE: B. 2

(SR7900)(SR7901)(SR7902)
(15077006)(A1500610)(FA1500282)

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9, S-1641-9, FA2, FA4(REF); NAV/DOME LTS WAS NAV LTS/TIB IND; S-1367-1-8/FA1 WAS S-1635-1; ADD LDI(REF) & LAI(REF); DELETE WIRE LENGTHS (MER E0339)	GS 9-13-74	<i>JAS</i> mty RF



WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
FA3	18			S-1367-1-8 S-1367-1-8	
FA1	18			S-1367-1-8 S-1367-1-8	

PART NO.	DESCRIPTION
4	S-1360-10L CKT BREAKER
1	S-1302N1 T&B INDICATOR

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX-CESNA SPEC. NO.
S-XXXX OR CMXXXX-CESNA
STD. NO.

SUPERSEDES:
0410011 PG 9.2.1
SUPERSEDED BY:

CONTRACT NO:		
DESIGN	J.B. MITCHELL	8-16-74
GROUP	<i>L. Froman</i>	8-16-74
DRAWN	B. FROMAN	8-15-74
CHECK	J. YOUEL	8-15-74
STRESS		
PROJ	<i>F.D. Fife</i>	8-18-74
APPD		
OTHER		

COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

Cessna. AIRCRAFT CO.

TITLE
**WIRING DIAGRAM —
TURN & BANK
(OPT)**

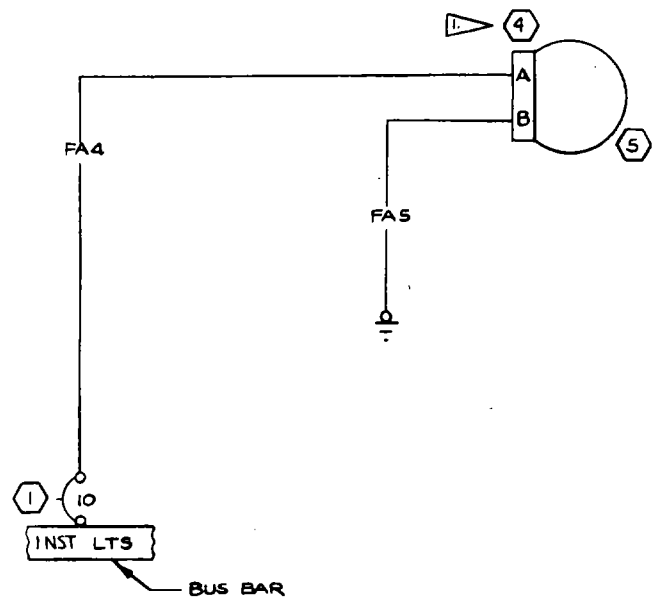
SIZE	CODE IDENT.	DWG NO
C	71379	0470401

SCALE: NONE | ISO, AISO, FAISO | PAGE: 9.1

(GR7900)(GR7901)(GR7902)
(15077006)(A1500610)(FA1500202)

00-225-0905

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9, S-1641-9, FA1(REF), FA2(REF), WIRE LENGTHS; S-1636-1/FA4 WAS "SEE FA2" (MERED339)	GS 9-13-74	<i>[Signature]</i> RF



NOTES:

△ MS3106A10SL35 CONNECTOR IS SUPPLIED BY VENDOR

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
FA 5	18			SOLDER S-1367-1-8	
FA 4	18			SOLDER S-1367-1-8	

WIRE TABLE

PART NO.	DESCRIPTION
5 C661003-0501	TURN COORDINATOR
4 MS3106A10SL35	CONNECTOR △1
1 S-1360-10L	CKT BREAKER

EQUIPMENT TABLE

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX-CESSNA SPEC. NO. S-XXX OR CMXXXX-CESSNA STD. NO.

SUPERSEDES: O410011 PG 9.4
SUPERSEDED BY:

CONTRACT NO.	
DESIGN	J.B. MITCHELL 8-16-74
GROUP	<i>[Signature]</i> 8-16-74
DRAWN	B. FROMAN 8-15-74
CHECK	J. YQUEL 8-15-74
STRESS	
PROJ	<i>[Signature]</i> 8-17-74
APPD	
OTHER	

COMMERCIAL AIRCRAFT DIV.
CESSNA AIRCRAFT CO.
5800 E. PAWNEE
WICHITA, KANSAS

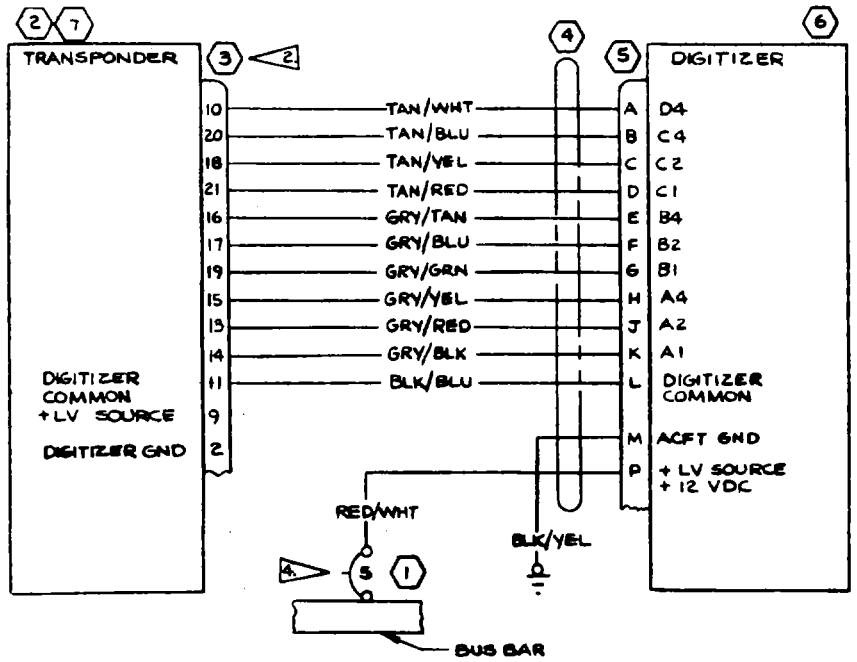
TITLE
**WIRING DIAGRAM -
TURN COORDINATOR**

SIZE: C
CODE IDENT. NO.: 71379
DWG NO.: 0470401

SCALE: NONE
150, A150, FA150
PAGE: 9.2

(SR 790C) (SR 790I) (SR 790Z)
(1507700G) (A1500610) (FA15002B2)

REVISION			
LET	DESCRIPTION	DATE	APPD
A	REV REV: ADD RT-459A (572335)	DLP 12-15-75	2/17/76 R/P



- NOTES:
1. PINS ARE CRIMP TYPE AND ARE FURNISHED BY VENDOR WITH CONNECTOR.
 2. TRANSPODER CONNECTOR HOUSING IS PART OF TRANSPODER CABLE ASSY.
 3. FOR WIRING DIAGRAM OF 300 & 400 TRANSPODER REFER TO 3920143
 4. ATTACH BOTH TRANSPODER AND ENCODING ALTIMETER TO THE NO. 3 CIRCUIT BREAKER
 5. FOR WIRES & TERMINALS SEE 1270625 PG 97

WIRE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS

PART NO.	DESCRIPTION
7	RT-459A TRANSPODER
6	EA-401A ALT DIGITIZER
5	42816 CONNECTOR
4	1570312-2 CABLE ASSY
3	S-2189-1 CONNECTOR
2	RT-359A TRANSPODER
1	S-1360-5L CKT BREAKER

WIRE TABLE

CONTRACT NO.: _____

DESIGNER: J.B. MITCHELL DATE: 8-16-74

GROUP: _____

DRAWN: B. FROMAN DATE: 8-15-74

CHECK: J. YOWEL DATE: 8-15-74

STRESS: _____

PROJ: RT-459A DATE: 8-17-74

APPD: _____

OTHER: _____

COMMERCIAL AIRCRAFT DIV.
5900 E. PAWNEE
WICHITA, KANSAS

TITLE

**WIRING DIAGRAM -
ENCODING ALTIMETER
(OPT)**

SIZE: C CODE IDENT. NO.: 71379 DWG NO.: 0470401

SCALE: NONE 1:50, A1:50, F1:50 PAGE: 9/9

EQUIPMENT TABLE

SEE-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-1000-CESNA SPEC. NO. S-1001 OR C4000-CESNA STD. NO.

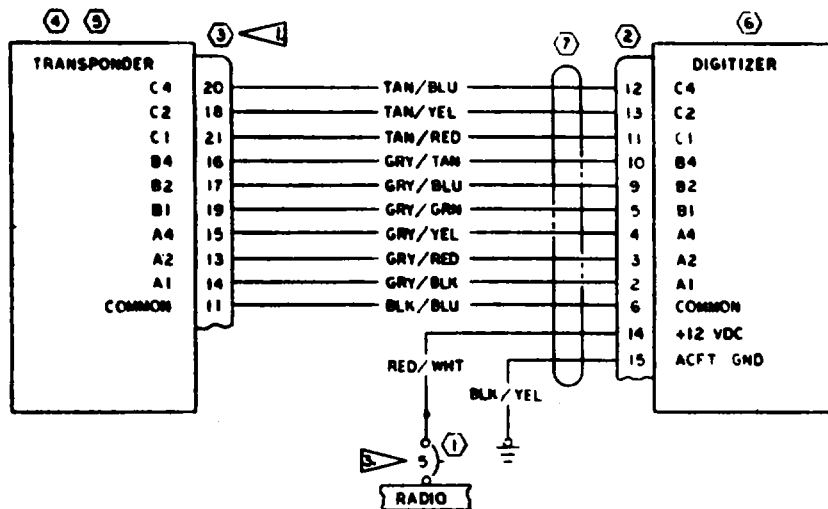
SUPERSEDES: O-410011 PG 9.6

SUPERSEDED BY: _____

5040-B22-00

(SR 700)(SR 710)(SR 7902)

REVISION			
LET	DESCRIPTION	DATE	APPD



NOTES:

- 1. TRANSPODER CONNECTOR HOUSING IS PART OF TRANSPODER CABLE ASSY
- 2. FOR WIRING DIAGRAM OF 300 & 400 TRANSPODER REFER TO 3920168
- 3. ATTACH BOTH TRANSPODER AND ENCODING ALTIMETER TO THE NO. 3 CIRCUIT BREAKER

PART NO.	DESCRIPTION
7	0470404 CABLE ASSY
6	C744001-0101 ALT DIGITIZER
5	RT-459A TRANSPODER
4	RT-399A TRANSPODER
3	S-2189-1 CONNECTOR
2	DA-155 CONNECTOR
1	S-1360-5L CIRCUIT BREAKER

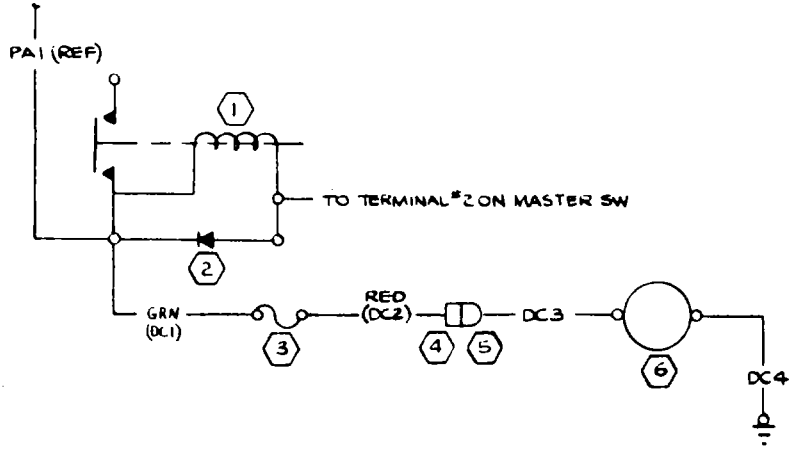
CES-1000 IS APPLICABLE
 VENDOR CODES PER S-1400
 CES-1000-CESNA SPEC. NO.
 S-1000 OR CXXXX-CESNA
 STD. NO.

SUPERSEDED:
 SUPERSEDED BY:

WIRE	GA	MATERIAL	LG	TERMINALS	SERIALS
TAN/BLU	22	22-10-6		S-2190-1	SOLDER
TAN/YEL		22-10-4			
TAN/RED		22-10-2			
GRY/TAN		22-8-10			
GRY/BLU		22-8-6			
GRY/GRN		22-8-5			
GRY/YEL		22-8-4			
GRY/RED		22-8-2			
GRY/BLK		22-8-0			
BLK/BLU		22-0-6		S-2190-1	
BLK/YEL		22-0-4		S-1367-1-8	
RED/WHT	22	22-2-9		S-1367-1-6	SOLDER

CONTRACT NO.			COMMERCIAL AIRCRAFT DIV. 8800 E. FAHNEE WICHITA, KANSAS		
DESIGN	NAME	DATE	TITLE		
0470404	G. STAMM	4-23-76	WIRING DIAGRAM — BLIND ENCODER 150, A150, F150, FA150		
DRAWN	R. KLEIN	4-22-76	SIZE	CODE IDENT NO.	OWG NO
CHECK	Y. OUEL	4-22-76	C	71379	0470401
STRSS			SCALE: NONE	SER (SRB490)	PAGE: 9/4
PROJ	5-4-76				
APPD	5-5-76				
OTHER					

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: C664508-0101 WAS 5-1517-N1 ADD GRN TO DC1. 07-2031-2 WAS 5-1091-1 DELETE WIRE LENGTHS. (MER 80339)(SR7100)(SR7101)(SR7102)	GEC 9-13-74	<i>[Signature]</i> RF



WIRE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
DC 4	18			5-1367-1-B	5-1367-1-B
DC 3	18			5-1637-1	5-1637-1-A
(18-5)	18	-18-5		5-1635-1	SOLDER
(18-5)	18	18-5		5-1367-1-B	SOLDER

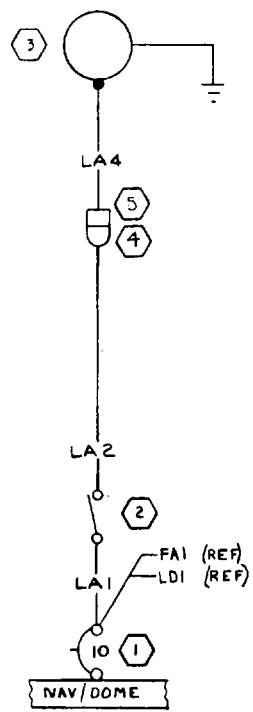
PART NO.	DESCRIPTION
6	C664508-0101 CLOCK ASSY
5	5-1637-1 HOUSING
4	5-1637-2 HOUSING
3	0712031-2 FUSE
2	0770728-1 DIODE ASSY
1	5-1579-2 CONTACTOR

WIRE TABLE			CONTRACT NO:	
DESIGN	J. B. MURPHY	DATE	8-16-74	Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 8808 E. PAWNEE WICHITA, KANSAS
GROUP	1	BY	J. B. MURPHY	
DRAWN	B. F. ROMAN	DATE	8-13-74	
CHECK	J. YOUNG	DATE	8-15-74	
EQUIPMENT TABLE		SUPERSEDED BY:		Cessna AIRCRAFT CO. WIRING DIAGRAM — CLOCK (OPT)
CES-1000 IS APPLICABLE VENDOR CODES PER 8-1400 CES-1000-CESNA SPEC. NO. 8-100X OR CND00P-CESNA STS. NO.		0410011 PG 101 SUPERSEDED BY:		
PROJ	C664508	DATE	4/17/74	SIZE C
APPD		DATE		CODE IDENT. NO. 71379
OTHER		DATE		DWS NO. 0470401
SCALE: NONE		150, A150, PA150		PART NO. 1 (SR7100)(SR7101)(SR7102)

20-16A/(20-16B blank)

CO-223-0905

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV; DELETE S-1640-9, S-1641-9, LA3. WIRE LENGTHS; 0470112-1 WAS S-1641-9; S-1637-1 WAS S-1640-9; S-1635-1/LA2 WAS S-1636-1; NAV/DOME WAS INST LTS; ADD FAI (REF) LDI (REF) (MER E033)	CJH GS 9-13-74	<i>[Signature]</i> RF
B	BY REV: S-1876-1 WAS 0470112-1 (SRB130)(SRB131)(SRB132)	DLP 12-19-75	<i>[Signature]</i> RF



5050-06
5050-15
5050-25
30-00

WIRE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
LA 4	18	SOLDER		S-1636-1	
LA 2	18	S-1493-1		S-1636-1	
LA 1	18	S-1493-1		S-1361-6	

ITEM NO.	PART NO.	DESCRIPTION
5	S-1637-2	HOUSING-SOCKET
4	S-1637-1	HOUSING - PIN
3	S-1876-1	LAMP
2	S-2160-1	SWITCH
1	S-1360-10L	CKT BREAKER

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX-CESSNA SPEC. NO.
S-XXXX OR CXXXX-CESSNA
STD. NO.

SUPERSEDES:
0410011 PG 11.1.3

SUPERSEDED BY:

CONTRACT NO.			WIRE TABLE	
DESIGN	J.B. MITCHELL	8-16-74	TITLE	
GROUP	<i>[Signature]</i>	8-16-74	WIRING DIAGRAM - DOME LIGHT	
DRAWN	B. FROMAN	8-15-74	SIZE	CODE IDENT.
CHECK	J. YOUNG	8-15-74	C	71379
STRESS			DWG NO	0470401
PROJ	<i>[Signature]</i>	8-15-74	SCALE: NONE	150, A150, FA150
APPD			PAGE: 11.1	
OTHER				

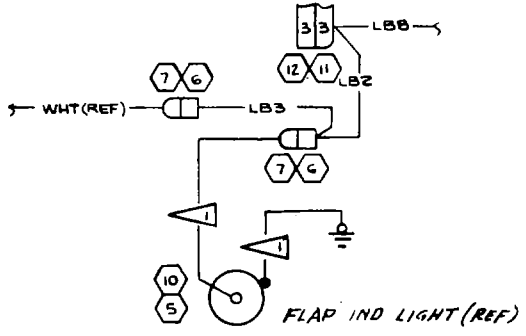
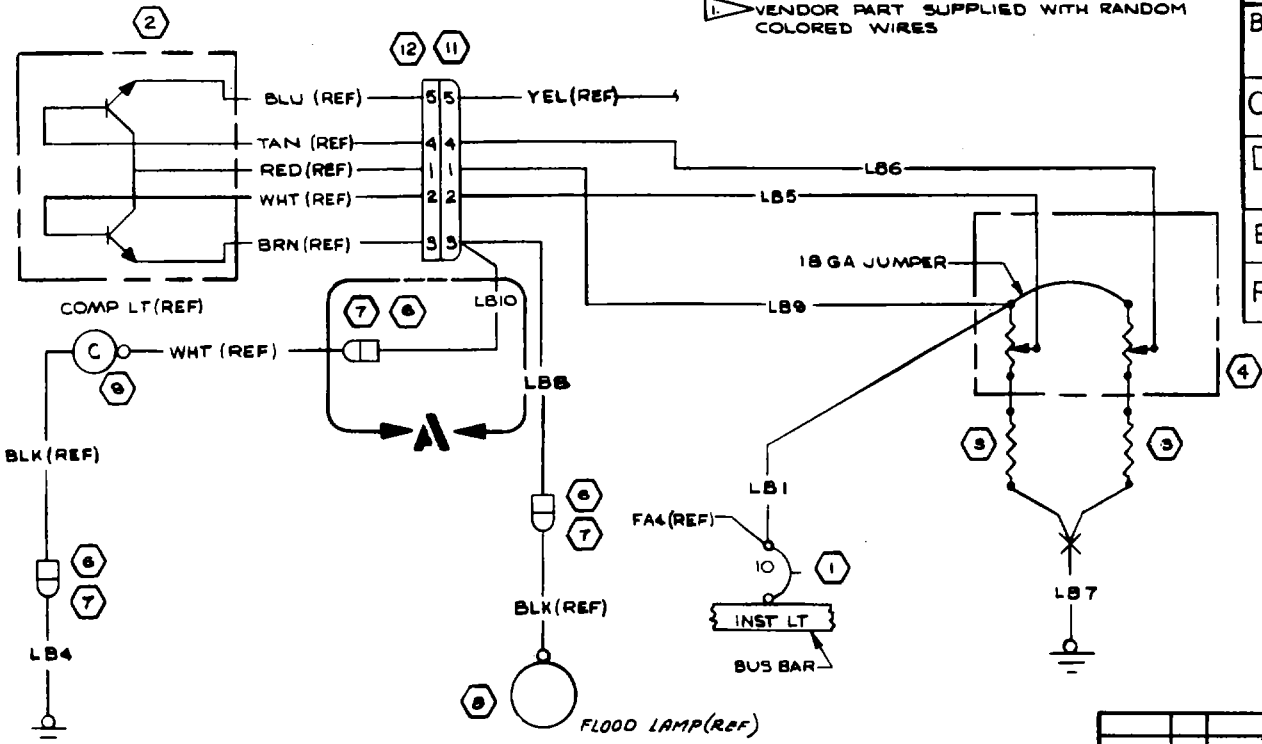
(SR 7900)(SR 7901)(SR 7902)
(1507006)(A1500610)(FA1500282)

20-17

NOTES:

1. VENDOR PART SUPPLIED WITH RANDOM COLORED WIRES

REVISION			
LET	DESCRIPTION	DATE	APPD
B	BY REV: REVISED & REDRAWN (MERO 954) (SR 7900)(SR 7901)(SR 7902)	BLA 10-8-74	JCY REF
C	BY REV: DELETE NOTE, DWG COMPLETE (SR 7900)(SR 7901)(SR 7902)	BLA 1-13-74	JCY REF
D	BY REV: ADD NOTE 1; CHANGE 25-207 TO SHOW CENTER CONDUCTOR (NOW SHOP PRACTICE)	JMS 10-9-75	JCY REF
E	BY REV: BLU(REF) WAS BRN(REF) TAN(REF) WAS WHT(REF) (NOW SHOP PRACTICE)	DLP 11-21-75	JCY REF
F	BY REV: MS15584-2 WAS 0470112-1; ADD DETAIL A, LB10 & SER (SR8130)(SR8131)(SR8132)	DLP 12-19-75	JCY REF



DETAIL A
THRU SER (SR8130)(SR8131)(SR8132)

ITEM NO.	PART NO.	DESCRIPTION
12	5-1641-6	HOUSING SOCKET
11	51640-6	HOUSING PIN
10	25-207	SOCKET
9	C860501-0101	COMPASS ASSY
8	MS15584-2	LAMP
7	5-1637-1	HOUSING SOCKET
6	5-1637-2	HOUSING PLUG
5	5-1894-3	BULB
4	5-2091-3	RESISTOR ASSY
3	520005270J	RESISTOR
2	1570188	DIMMING ASSY
1	5-1360-10L	CKT BREAKER

EQUIPMENT TABLE

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX-CESNA SPEC. NO. S-XXXX OR CHXXXX-CESNA STD. NO.	SUPERSEDES: REV "A"
	SUPERSEDED BY:

ITEM NO.	PART NO.	DESCRIPTION	QTY	UNIT	TERMINALS	SERIALS
	LB10	18			5-1636-2	SEE LB8 SER (SR8130)(SR8131)(SR8132)
	LB9	18			5-1635-1	SOLDER
	LB8	1			5-1635-2	5-1636-2
	LB7	1			5-1370-1	5-1367-16
	LB6	1			5-1636-1	SOLDER
	LB5	1			5-1635-1	SOLDER
	LB4	1			5-1635-1	5-1367-16
	LB3	1			5-1636-2	5-1636-1 THRU SER (SR8130)(SR8131)(SR8132)
	LB2	1			SEE LB3	SEE LB6 THRU SER (SR8130)(SR8131)(SR8132)
	LB1	18			5-1367-14	SOLDER

CONTRACT NO: _____

NAME: _____ DATE: _____

DESIGN: J. B. MITCHELL 8-16-74

GROUP: J. GRANDFIELD 8-16-74

DRAWN: S. FROMAN 8-16-74

CHECK: J. YOUEL 8-15-74

STRESS: _____

PROJ: R. FIFE 8-19-74

APPD: _____

OTHER: _____

COMMERCIAL AIRCRAFT DIV.
5800 E. FAHWEE
WICHITA, KANSAS

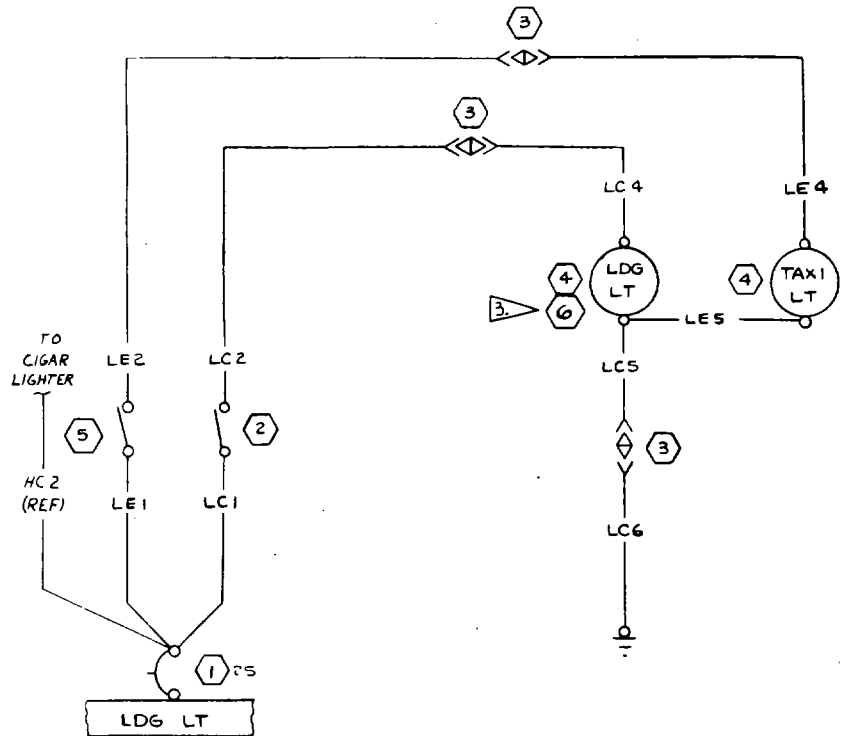
Cessna AIRCRAFT CO.

TITLE: WIRING DIAGRAM — INSTRUMENT LIGHTS

SIZE: C CODE IDENT. NO. 71379 DWG NO. 0470401

SCALE: NONE 150 ALSO FA150 PAGE: 11.2

(SR 7900)(SR 7901)(SR 7902)
(150 77006)(A150 0410)(FA 150 9282)



REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE WIRE LENGTH (SR7900)(SR7901)(SR7902)	C J H 9-13-74	WAS RF
B	BY REV: ADD NOTES 243, 4313, OPT TO TITLE; DELETE OPT FROM WIRE TABLE, LC3, LE3, 57064-1/(LC241E2); SER(SR7900)(SR7901)(SR7902)	C J H 9-24-74	WAS RF
C	BY REV: ADD S-1360-20L (NOW SHOP PRACTICE)	DLP 12-16-75	WAS RF
D	BY REV: ADD HC2(REF); DELETE NOTE 3 & S-1360-20L (SR8444)	GDS 4-20-76	WAS RF

NOTES:

- LANDING LT WIRING IS STANDARD EQUIPMENT FOR DOMESTIC ACFT; LANDING AND TAXI LIGHT WIRING IS STANDARD EQUIPMENT FOR FRENCH ACFT AND OPTIONAL EQUIPMENT FOR DOMESTIC ACFT.
- LE NUMBERED WIRES USED ON DUAL INSTL ONLY

USE ON SINGLE LIGHT INSTL ONLY

ITEM NO.	PART NO.	DESCRIPTION
6	4313	LAMP (250 w)
5	S-2160-5	SWITCH
4	4509	100WATT PAR3 LAMP
3	S-2064-1	CONNECTOR
2	S-2160-4	SWITCH
1	S-1360-25L	CKT BREAKER

CES-1000 IS APPLICABLE
VENDOR CODES PER 8-1400
CES-XXXX-CESNA SPEC. NO.
8-XXXX OR CXXXX-CESNA
STD. NO.

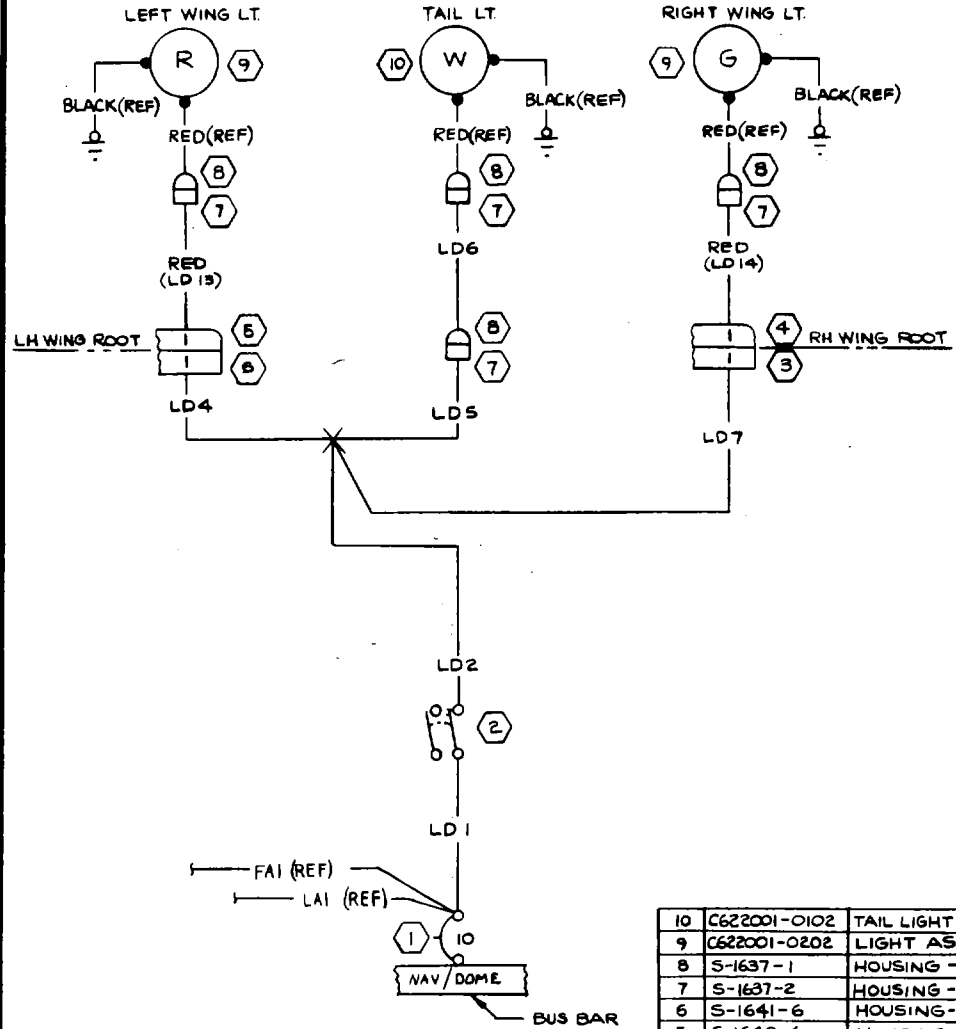
SUPERSEDES:
0410011 PG 11.3.4

SUPERSEDED BY:

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
LE 5	12			S-1367-3-8	S-1367-3-8
LE 4	12			S-1493-3	S-1367-3-8
LE 2	12			S-1493-3	S-1493-3
LE 1				S-1493-3	S-1367-1-6
LC 6				S-1493-3	S-1367-3-6
LC 5				S-1367-3-8	S-1493-3
LC 4	12			S-1493-3	S-1367-3-8
LC 2	12			S-1493-3	S-1493-3
LC 1	12			S-1493-3	S-1367-1-6

WIRE TABLE		
CONTRACT NO:		COMMERCIAL AIRCRAFT DIV. CESSNA AIRCRAFT CO. 5800 E. PAWNEE WICHITA, KANSAS
DESIGN	J.B. MITCHELL	8-16-74
GROUP	B. FROMAN	8-16-74
DRAWN	B. FROMAN	8-15-74
CHECK	J. YOWEL	8-15-74
STRESS		
PROJ	G. D. J.	8-19-74
APPD		
OTHER		
TITLE	WIRING DIAGRAM — LANDING & TAXI LIGHTS (OPTIONAL)	
SIZE	C	CODE IDENT. NO. 71379
DWG NO	0470401	
SCALE:	NONE	150, AISO, FAISO
PAGE:	11.3	

(SR7900)(SR7901)(SR7902)
15077006- A1500610- F15001249 & FA1500282



REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9, S-1641-9, S-1370-2, WIRE LENGTHS; NAV/DOME WAS NAV LTS; S-1635-1/LD2 WAS S-1636-1 (MER ED339)	C J H GS 9-13-74	<i>[Signature]</i> REF
B	BY REV: ADD S-1640-9, S-1641-9 SER(SR7900)(SR7901)(SR7902)	BLA 10-14-74	<i>[Signature]</i> REF

5060-828-0905

ITEM NO	PART NO.	DESCRIPTION
10	C622001-0102	TAIL LIGHT ASSY
9	C622001-0202	LIGHT ASSY
8	S-1637-1	HOUSING - PIN
7	S-1637-2	HOUSING - SOCKET
6	S-1641-6	HOUSING-SOCKET
5	S-1640-6	HOUSING - PIN
4	S-1640-8	HOUSING - PIN
3	S-1641-8	HOUSING - SOCKET
2	S-2160-1	SWITCH
1	S-1360-10L	CKT BREAKER

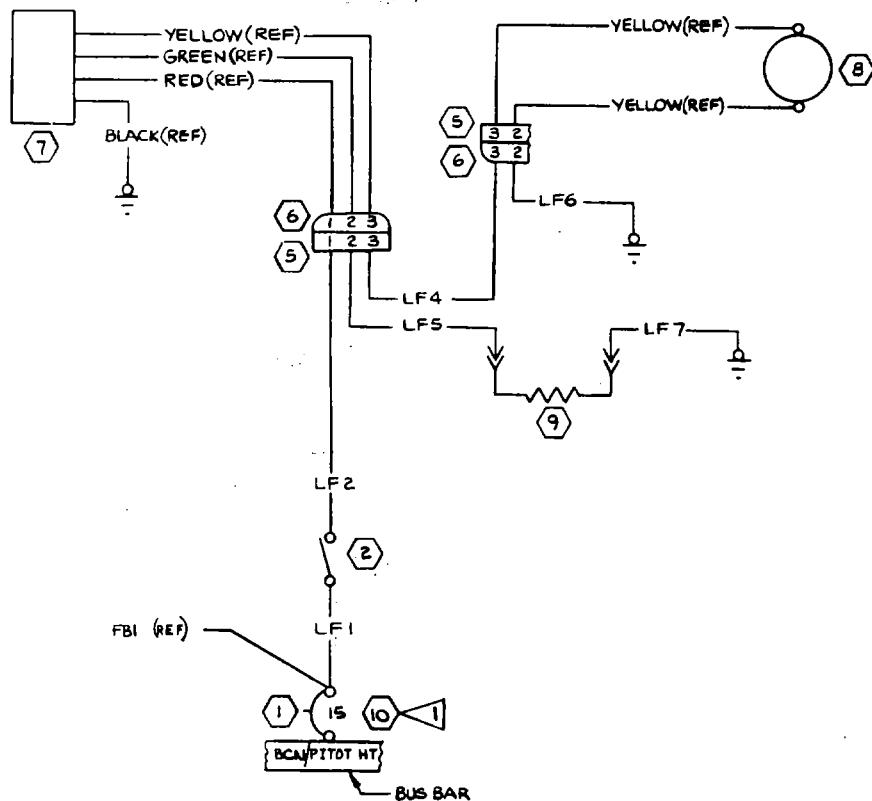
WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
RED (LD14)	18	-18-2	S-1636-1	S-1636-1	
RED (LD19)	18	-18-2	S-1635-1	S-1636-1	
LD7		SEE	S-1636-1		
LD6			S-1635-1	S-1636-1	
LD5			S-1370-1	S-1636-1	
LD4	18	SEE	LD4	S-1636-1	
LD2	18		S-1493-1	SEE	
LD1	18		S-1493-1	S-1367-1-6	

WIRE TABLE		
CONTRACT NO:		
DESIGN	J.B. MITCHELL	8-16-74
GROUP	<i>[Signature]</i>	8-16-74
DRAWN	B. FROMAN	8-15-74
CHECK	J. YOUNG	8-15-74
STRESS		
PROJ	<i>[Signature]</i>	8-19-74
APPD		
OTHER		
SIZE	C	
CODE IDENT. NO.	71379	
DWG NO	0470401	
SCALE:	NONE	
ISO, A150, FA150		
PAGE:	11.4	

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX-CESSNA SPEC. NO. S-XXX OR CMXXXX-CESSNA STD. NO.

SUPERSEDED BY: 0410011 PG 11.4.2

(SR7900)(SR7901)(SR7902)
(1507006)(A1500610)(FA150028E)



REVISION			
LET	DESCRIPTION	DATE	APPO
A	BY REV: DELETE S-1640-9, S-1641-9, LF3, WIRE LENGTH; ADD FBI (REF); BCN PITOT HT WAS BCN (MERED033)	C J H G S 9-13-74	<i>[Signature]</i>
B	BY REV: S-1360-15L WAS S-1360-10L; LF1 & LF2 1/4 GA WIRE WAS 1/8 GA (SR8260)	BAH 5-13-75	<i>[Signature]</i>

(15077006, A1500610, F15D00494, FA1500282)

CO-223-0905

NOTES:

1 THE 20 AMP CIRCUIT BREAKER IS TO BE USED WHEN THE FLASHING BEACON IS INSTALLED WITH PITOT HEAT.

PART NO.	DESCRIPTION
10	S-1360-20L CKT BREAKER
9	OR95-15 RESISTOR
8	C621001-0106 LIGHT ASSY
7	C594502-0101 FLASHER ASSY
6	S-1638-2 HOUSING-CAP
5	S-1638-1 HOUSING-PLUG
2	S-2160-1 SWITCH
1	S-1360-15L CKT BREAKER

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX-CESNA SPEC. NO.
S-XXX OR CMXXXX-CESNA
STD. NO.

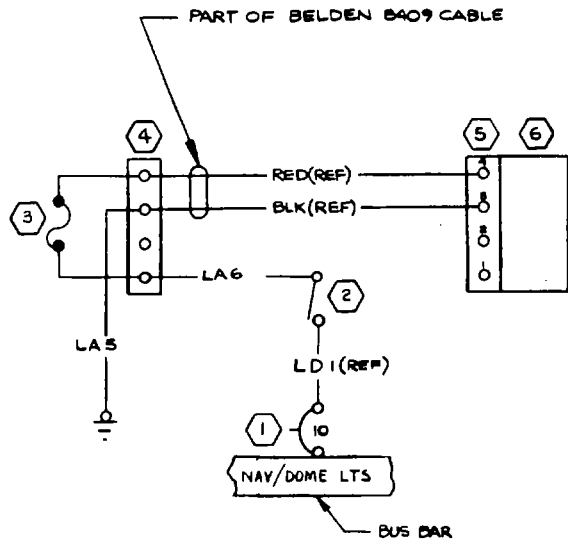
SUPERSEDES:
0410011 PG 11.6.1
SUPERSEDED BY:

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
LF7	16			S-1493-2	S-1367-2-8
LF6	14			S-1635-2	S-1867-2-8
LF5	14			S-1493-2	S-1636-2
LF4	16			S-1605-2	S-1636-2
LF2	14			S-1493-2	S-1636-2
LF1	14			S-1493-2	S-1367-2-8

WIRE TABLE

CONTRACT NO:		COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS	
DESIGN	NAME	DATE	TITLE
GROUP	<i>J. B. MITCHELL</i>	<i>8-16-74</i>	WIRING DIAGRAM — LIGHT-FLASHING BEACON (OPTIONAL)
DRAWN	<i>B. FROMAN</i>	<i>8-15-74</i>	
CHECK	<i>J. YOUNG</i>	<i>8-15-74</i>	
STRESS			
PROJ	<i>D. N. J.</i>	<i>8-15-74</i>	SIZE
APPO			CODE IDENT. NO.
OTHER			DWG NO
			C 71379 - 0470401
SCALE: NONE		18CA150 FA150	PAGE: 11.5

(SR 7900)(SR 7901)(SR 7902)
(15077006)(A1500610)(FA1500282)



REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: NAV/DOME LTS WAS NAV LTS; DELETE WIRE LENGTH (MER E0339)	C J H 63 9-13-74	EF

WIRE CODE NO	GA	MATERIAL	LG	TERMINALS	SERIALS
LA6	20	5-1967-1-832936		(00779)	
LAS	20	5-1493-1-829636		(00779)	

ITEM NO	PART NO.	DESCRIPTION
6	0570088-1	MAPLIGHT ASSY
5	520-4	TERMINAL BLOCK
4	5-171	TERMINAL BLOCK
3	1570141-1	FUSE ASSY
2	S-2160-1	SWITCH
1	S-1960-10L	CKT BREAKER

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER 8-1400
CES-XXXX-CESNA SPEC. NO.
8-XXX OR CMXXXX-CESNA
STD. NO.

SUPERSEDES:
0410011 PG 11.7.1

SUPERSEDED BY:

WIRE TABLE

CONTRACT NO:

DESIGN: J. MITCHELL 8-16-74
GROUP: (S. M.) 8-16-74
DRAWN: B. FROMAN 8-15-74
CHECK: J. YUCEL 8-15-74
STRESS:

COMMERCIAL AIRCRAFT DIV.
8800 E. PAWNEE
WICHITA, KANSAS

Cessna AIRCRAFT CO.

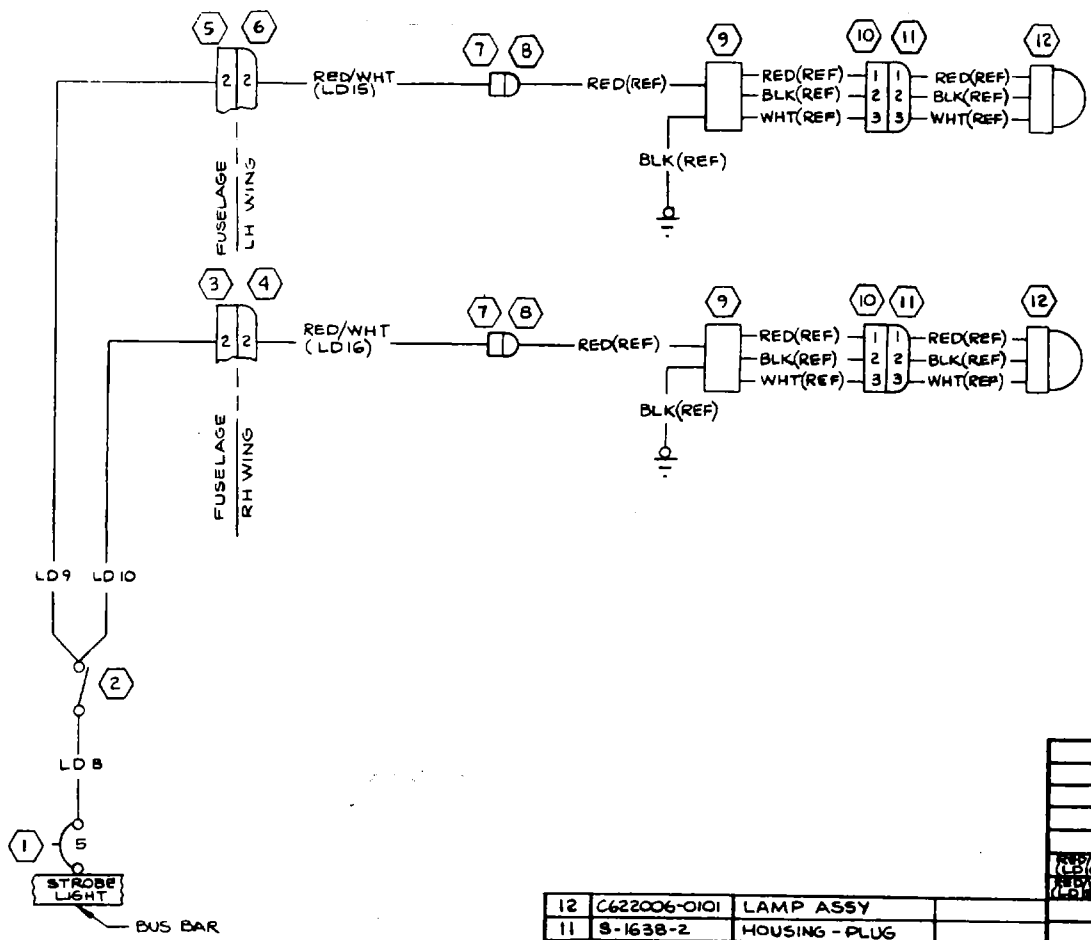
TITLE: **WIRING DIAGRAM - MAPLIGHT- CONTROL WHEEL**

SIZE: C
CODE IDENT. NO.: 71379
DWG NO.: 0470401

SCALE: NONE 150, A150, FA150 PAGE: 11.6

(SR7900)(SR7901)(SR7902)
(15077006)(A1500610)(FA1500282)

00-223-0905



REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1640-9 (1), S-1641-9 (1), LD-11, LD-12, & WIRE LENGTHS (MER E0339)	CTH GS 9-13-74	RF

WIRE CMT NO	GA	MATERIAL	LG	TERMINALS	SERIALS
LD10	18			S-1636-1	(STD)
LD9	18			S-1493-2	S-1636-1
LD8	18			S-1493-1	S-1507-1-6

PART NO.	DESCRIPTION
12	C622006-0101 LAMP ASSY
11	S-1638-2 HOUSING - PLUG
10	S-1638-1 HOUSING - PIN
9	C622007-0101 POWER SUPPLY
8	S-1637-1 HOUSING - PLUG
7	S-1637-2 HOUSING - PLUG
6	S-1640-6 HOUSING - PIN
5	S-1641-6 HOUSING - SOCKET
4	S-1640-9 HOUSING - PIN
3	S-1641-9 HOUSING - SOCKET
2	S-2160-1 SWITCH
1	S-1360-5L CKT BREAKER

PART NO.	DESCRIPTION
EQUIPMENT TABLE	

CES-1000 IS APPLICABLE
 VENDOR CODES PER S-1400
 CES-1000-CESNA SPEC. NO.
 S-1000 OR CN1000-CESNA
 STD. NO.

SUPERSEDES:
 0410011 PG 11.8.1
 SUPERSEDED BY:

CONTRACT NO:		WIRE TABLE	
DESIGN	J.B. MITCHELL	DATE	8-16-74
GROUP	B. FROMAN	DATE	8-16-74
DRAWN	B. FROMAN	DATE	8-15-74
CHECK	J. YOUSEL	DATE	8-15-74
STRESS			
PROJ	X-0376	DATE	8-15-74
APPD			
OTHER			

COMMERCIAL AIRCRAFT DIV.
 5800 E. PAWNEE
 WICHITA, KANSAS

Cessna AIRCRAFT CO.

**WIRING DIAGRAM —
 WING TIP STROBE LIGHT
 (OPT)**

SIZE	CODE IDENT. NO.	DWG NO
C	71379	0470401

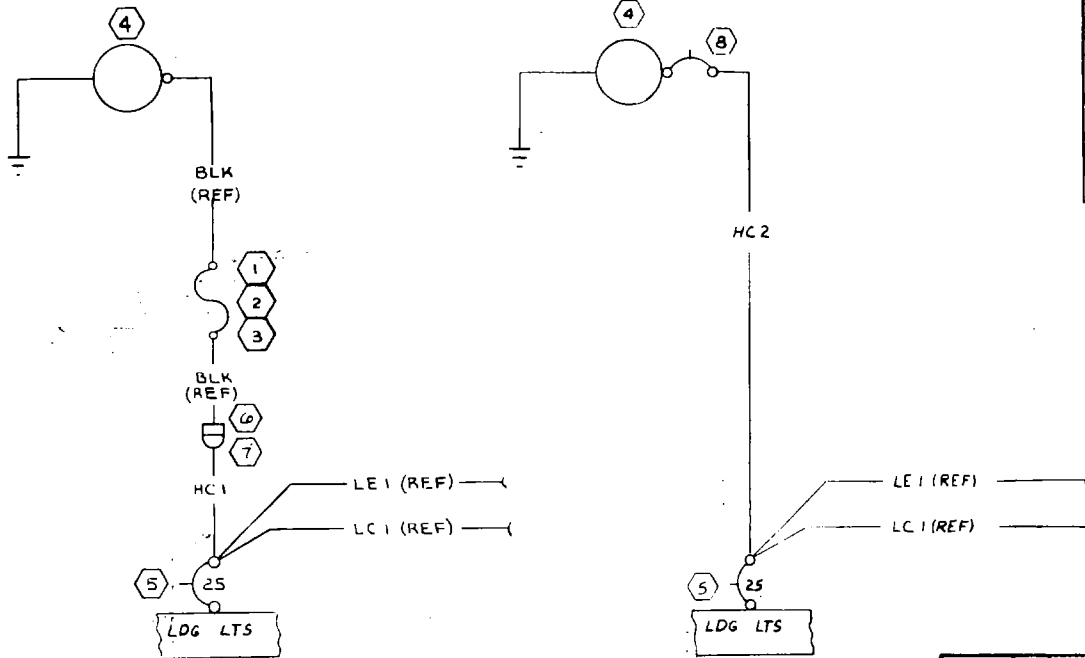
SCALE: NONE 150A150FA150 PAGE: 11.7

(SR 7900)(SR 7901)(SR 7902)
 (150 77006)(A1500610)(FA1506282)

20-23

FORM NO. 80-215B

580-22-0905



THRU SER (SR8444)

SER (SR8444) ON

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE HC2, 05130524-21, SFE 9, 155109A, DA3, WIRE LENGTHS; MOVED ALT BUS BAR TO CIRCUIT BREAKER; S-1367-2 WAS SOLDER (SR7900)(SR7901)(SR7902)(MEK E0339)	CJH 85 9-13-74	J.P.P. M.F. RF
B	BY REV: BLK (REF) WAS HC1, S1360-25L WAS S-1360-10L SER(SR7900)(SR7901)(SR7902)	CJH BLA 10-23-74	J.P.P. M.F. RF
C	BY REV: ADD HC1 S-1637-1 & S-1637-2 (SR8130)(SR8131)(SR8132)	RS 2-18-74	J.P.P. M.F. RF
D	BY REV: ADD HC2; SER OUT 0513052-21 & HC1 (SR8444)	GDS 4-20-76	J.P.P. M.F. RF

5060-00
5060-20

NOTES

1. EFF SRS FOR 91977 ARE SR8130, SR8131 & SR8132

ITEM NO.	PART NO.	DESCRIPTION
8	60232-1	CIRCUIT BREAKER
7	S-1637-1	HOUSING - PIN
6	S-1637-2	HOUSING - SOCKET
5	S-1360-25L	CIRCUIT BREAKER
4	0513052-20	LIGHTER ASSY
3	0513052-21	FUSE ASSY
2	SFE 9	FUSE
1	155109A	FUSEHOLDER

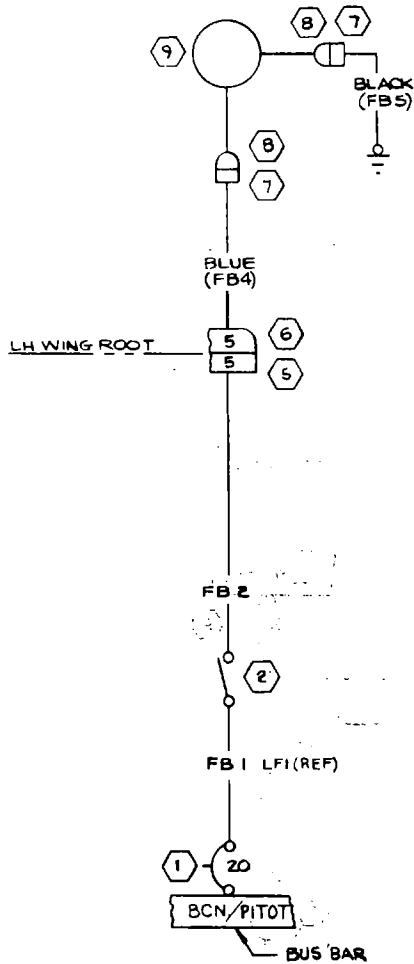
EQUIPMENT TABLE

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX-CESSNA SPEC. NO. S-XXX OR CMXXXX-CESSNA STD. NO.	SUPERSEDES: 0410011 PG 13.11
	SUPERSEDED BY:

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
HC 2	12			S-1367-3-8 S-1367-3-8	SER (SR8444) ON
HC 1	18			S-1367-1-6 S-1636-1	THRU SER (SR8444)

CONTRACT NO:		NAME		DATE	TITLE	
		J.B. MITCHELL		8-16-74	WIRING DIAGRAM - CIGAR LIGHTER (OPT)	
		B. FROMAN		8-15-74		
		J. YUQUÉL		8-15-74		
DESIGN	GROUP	DRAWN	CHECK	STRESS	PROJ	APFD
					J.P.P.	B.K.M.
OTHER	SIZE	CODE IDENT. NO.	DWG NO			
	C	71379	0470401			
SCALE: NONE		150, A150, FA150	PAGE: 13.1			

(SR7900)(SR7901)(SR7902)
15077006 & A:500610 & F15 D01249; FAIS0292



REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: DELETE S-1340-9, S-1341-9, FB3, WIRE LENGTH; BCN/PITOT WAS PITOT HT (MER ED339)	GS 9-13-74	<i>JRB</i> RF
B	BY REV: S-1360-20L WAS S-1360-15L; FB1, FB2 + FB4/14 GA WIRE WAS 16GA (SR0260)	BAH 5-13-75	<i>BAH</i> RF

(15077006, A1500610, F15001049, FA1500282)

CO-223-0905

WIRE CODE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
BLACK (FB5)	18	-18-0		S-1696-1 S-1567-1-8	
BLUE (FB4)	14	-16-6		S-1655-2 S-1696-2 (STD)	
FB2	14			S-1493-2 S-1636-2	
FB1	14			S-1493-2 S-1307-2-6	

PART NO.	DESCRIPTION
9	0721105-5 PITOT HEATER
8	S-1637-1 HOUSING-CAP
7	S-1637-2 HOUSING-PLUG
6	S-1640-6 HOUSING-PIN
5	S-1641-6 HOUSING-SOCKET

PART NO.	DESCRIPTION
2	S-2160-1 SWITCH
1	S-1360-20L CKT BREAKER

EQUIPMENT TABLE

CEB-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX-CESSNA SPEC. NO.
S-XXXX OR CMXXXX-CESSNA
STD. NO.

SUPERSEDES:
0410011 PG 13.3

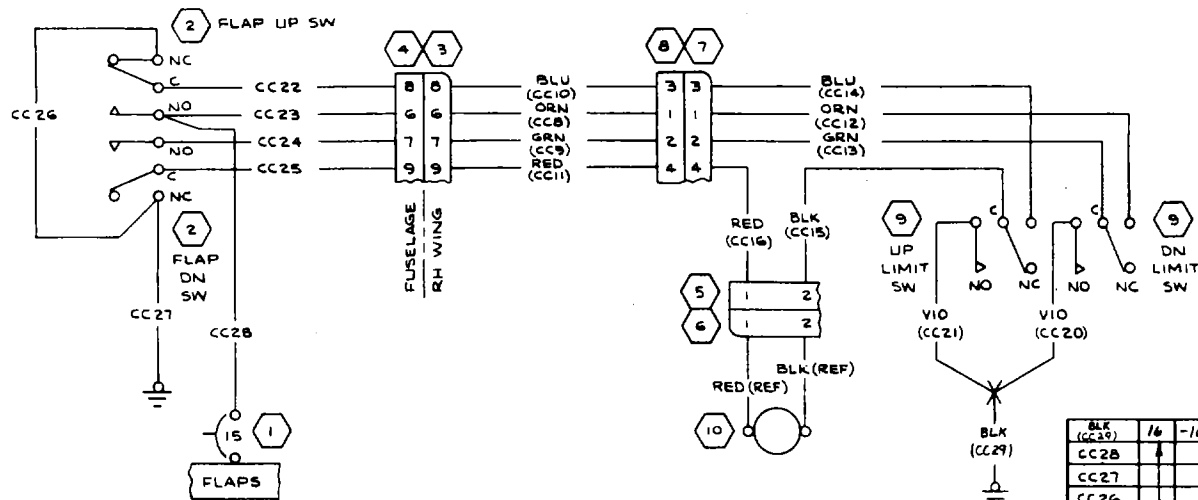
SUPERSEDED BY:

CONTRACT NO:			
DESIGN	J.B. MITCHELL	DATE	8-16-74
GROUP	<i>J. B. MITCHELL</i>	DATE	8-16-74
DRAWN	J.B. FROHMAN	DATE	8-13-74
CHECK			
STRESS			
PROJ	<i>J.B. MITCHELL</i>	DATE	8-13-74
APPD			
OTHER			
SIZE	C	CODE IDENT. NO.	71379
DWG NO.	0470401		
SCALE:	NONE	150, A150, FA150	PAGE: 13.2

(SR7900)(SR7901)(SR7902)
(15077006)(A1500610)(FA1500282)

20-25

REVISION			
LET	DESCRIPTION	DATE	APPD
A	BY REV: ADD BLK CC29 COMMON GND FOR CC20 AND CC21; S-1370-2 WAS S-1367-2-B FOR CC21; SEE CC21 WAS S-1367-2-B FOR CC20. S-1906-1 WAS S-1906-2 (SRB130)(SRB131)(SRB132)	REK 3-20-76	SRB130 SRB131 SRB132



S060-06
S060-1E
S060-2E

WIRE NO.	GA	MATERIAL	LG	TERMINALS	SERIALS
BLK (CC17)	16	-16-0		SEE CC21	S-1367-2-8
CC28				SEE CC22	S-1367-2-6
CC27				SEE CC26	S-1367-2-6
CC26				S-1367-2-4	S-1367-2-4
CC25				S-1367-2-4	S-1636-2
CC24				S-1636-2	S-1367-2-4
CC23				S-1636-2	S-1367-2-4
CC22				S-1636-2	S-1367-2-4
VIO (CC21)		-16-7		S-1370-2	S-1493-2
VIO (CC20)		-16-7		SEE CC21	S-1493-2
RED (CC16)		-16-2		S-1635-2	S-1636-2
BLK (CC15)		-16-0		S-1636-2	S-1493-2
BLU (CC14)		-16-6		S-1635-2	S-1493-2
GRN (CC13)		-16-5		S-1635-2	S-1493-2
GRN (CC12)		-16-3		S-1635-2	S-1493-2
RED (CC11)		-16-2		S-1635-2	S-1636-2
BLU (CC10)		-16-6		S-1635-2	S-1636-2
GRN (CC9)		-16-5		S-1635-2	S-1636-2
ORN (CC8)	16	-16-3		S-1635-2	S-1636-2

PART NO.	DESCRIPTION
10	C301002-0101 ACTUATOR ASSY
9	V3-1-D9 SWITCH
8	S-1641-6 HOUSING
7	S-1640-6 HOUSING
6	S-1636-2 HOUSING
5	S-1636-1 HOUSING
4	S-1641-9 HOUSING
3	S-1640-9 HOUSING
2	S-1906-1 SWITCH
1	S-1360-15L CIRCUIT BKR

EQUIPMENT TABLE	
CES-1000 IS APPLICABLE VENDOR CODES PER 8-400 CES-XXXX-CESSNA SPEC. NO. 8-XXX OR CMXXXX-CESSNA STD. NO.	SUPERSEDES: P 14.1 SUPERSEDED BY:

WIRE TABLE		
CONTRACT NO.:	COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS	
DESIGN	NAME	DATE
GROUP		
DRAWN	PAPE	12-18-75
CHECK	TOWEL	12-19-75
STRESS		
PROJ	DATE	1-5-76
APPD		
OTHER		
SIZE	CODE IDENT. NO.	DWG NO.
C	71379	0470401
SCALE: NONE		ISO/F150, A150, FA150
PAGE: 14.2		

(SRB130)(SRB131)(SRB132)
15078506, A1500685, 15011329