# REPRINT

## CARDINAL RG SERIES
## 1971 THRU 1975
## SERVICE MANUAL

# D991-3-13

**THIS REPRINT**
**CONSISTS OF THE BASIC MANUAL, DATED 1 SEPTEMBER 1972, AND INCORPORATES CHANGE 1, DATED 1 SEPTEMBER 1973, CHANGE 2, DATED 15 JANUARY 1974; CHANGE 3, DATED 1 SEPTEMBER 1974; AND TEMPORARY CHANGE NO. 1, DATED 18 NOVEMBER 1977.**

SERVICE MANUAL

# 1971 thru 1975

# CARDINAL RG SERIES

Member of GAMA

*THIS REPRINT CONSISTS OF THE BASIC MANUAL, DATED 1 SEPTEMBER 1973; CHANGE 2, DATED 15 JANUARY 1974; CHANGE 3, DATED 1 SEPTEMBER 1974; AND TEMPORARY CHANGE NO. 1, DATED 18 NOVEMBER 1977.*



D991-3-13
(RGI-50-3/00)

1 SEPTEMBER 1972

CHANGED 1 SEPTEMBER 1974

Cessna
A Textron Company

# TEMPORARY REVISION NUMBER 4

DATE 7 October 2002

**MANUAL TITLE** Cardinal RG Series 1971 Thru 1975 Service Manual

**MANUAL NUMBER - PAPER COPY** D991-3-13

**MANUAL NUMBER - AEROFICHE** D991-3-13AF

**TEMPORARY REVISION NUMBER** D991-3TR4

**MANUAL DATE** 1 September 1972 **REVISION NUMBER** 3 **DATE** 1 September 1974

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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 | 25 | 1/B13 | | | |
| 2 | 26A/Deleted | NA | | | |
| 2 | 30 | 1/B18 | | | |
| 2 | 30A/Deleted | NA | | | |
| 2 | 31 | Added | | | |
| 2 | 32 | Added | | | |
| 2 | 33 | Added | | | |
| 15 | 20B1 | Added | | | |
| 15 | 20B2 | Added | | | |

## REASON FOR TEMPORARY REVISION

1. To Add A Component Time Limits Section And 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 Insert the new pages into the publication at the appropriate locations and remove and discard the superseded pages.

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# TEMPORARY REVISION NUMBER 3

**DATED** 7 January 2000

**MANUAL TITLE** CARDINAL RG SERIES 1971 THRU 1975 SERVICE MANUAL

**MANUAL NUMBER - PAPER COPY** D991-3-13 **AEROFICHE** D991-3-13AF

**TEMPORARY REVISION NUMBER PAPER COPY** D991-3TR3 **AEROFICHE** N/A

**MANUAL DATE** 1 SEPTEMBER 1972 **REVISION NUMBER** 3 **DATE** 1 September 1974

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| SECTION | PAGE | AEROFICHE FICHE/FRAME | SECTION | PAGE | AEROFICHE FICHE/FRAME |
|---|---|---|---|---|---|
| 2 | 26A | Added | | | |
| 2 | 30A | Added | | | |

## REASON FOR TEMPORARY REVISION

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

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**DATED** 3 October 1994

**MANUAL TITLE** CARDINAL RG SERIES 1971 THRU 1975 SERVICE MANUAL

**MANUAL NUMBER - PAPER COPY** D991-3-13 **AEROFICHE** D991-3-13AF

**TEMPORARY REVISION NUMBER - PAPER COPY** D991-3TR2-13 **AEROFICHE** N/A

**MANUAL DATE** 1 SEPTEMBER 1972 **REVISION NUMBER** 3 **DATE** 1 SEPTEMBER 1974

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 |
|---|---|---|---|---|---|
| 15 | 16 | 2 B02 | | | |
| 15 | 17 | 2 B03 | | | |
| 15 | 19 | 2 B05 | | | |
| 15 | 20A | 2 B07 | | | |
| 15 | 20B | added | | | |
| 15 | 20C/D | added | | | |

## REASON FOR TEMPORARY REVISION

1. To revise procedure to incorporate both Stewart Warner and Rochester fuel gage transmitter calibration.
2. To revise procedures to incorporate both electrically and pressure controlled oil temperature and oil pressure gages.
3. To revise procedure to incorporate both Stewart Warner and Rochester cylinder head temperature gages.

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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.

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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 September 1972
Change . . . 1 . . . 1 September 1973
Change . . . 2 . . . 15 January 1974
Change . . . 3 . . . 1 September 1974

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 404, CONSISTING OF THE FOLLOWING:

| Page No. | Change No. |
|---|---|
| *Title | 3 |
| *A | 3 |
| i | 0 |
| *ii | 3 |
| iii | 0 |
| iv Blank | 0 |
| 1-1 | 0 |
| *1-2 | 3 |
| 1-3 | 1 |
| *1-4 | 3 |
| 2-1 | 1 |
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| 2-4 thru 2-6 | 1 |
| *2-7 | 3 |
| 2-8 thru 2-17 | 1 |
| *2-18 | 3 |
| 2-19 thru 2-26 | 1 |
| *2-27 | 3 |
| 2-28 | 1 |
| *2-29 thru 2-30 | 3 |
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| *3-9 | 3 |
| 3-10 thru 3-12A | 1 |
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| 3-13 | 1 |
| *3-14 thru 3-18 | 3 |
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| *5-1A | 3 |
| 5-1B | 2 |
| 5-2 | 2 |
| 5-3 thru 5-5 | 2 |
| 5-6 thru 5-7 | 2 |
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| 5-8 thru 5-9 | 2 |
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| 19-23 thru 19-24 | 1 |
| *19-25 | 3 |
| 19-26 | 1 |
| *19-27 thru 19-30 | 3 |
| *19-30A thru 19-30E | 3 |
| *19-30F Blank | 3 |
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| 19-33 | 1 |
| *19-34 thru 19-35 | 3 |
| 19-36 thru 19-40 | 1 |
| *19-41 thru 19-42 | 3 |
| 19-43 thru 19-44 | 1 |

**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.**

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

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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 these aircraft, the model number will be used in this publication unless the popular name is necessary to differentiate between versions of the same basic model. The following table provides a listing of popular name, model number and serial number.

| POPULAR NAME | MODEL YEAR | MODEL | SERIALS BEGINNING | SERIALS ENDING |
|---|---|---|---|---|
| CARDINAL RG | 1971 | 177RG | 177RG0001 | 177RG0212 |
| | 1972 | 177RG | 177RG0213 | 177RG0282 |
| | 1973 | 177RG | 177RG0283 | 177RG0432 |
| | 1974 | 177RG | 177RG0433 | 177RG0592 |
| CARDINAL RG<br>CARDINAL RG II | 1975 | 177RG | 177RG0593 | |
| REIMS/CESSNA CARDINAL RG | 1971 | F177RG | F177RG0001 | F177RG0042 |
| | 1972 | F177RG | F177RG0043 | F177RG0062 |
| | 1973 | F177RG | F177RG0063 | F177RG0092 |
| | 1974 | F177RG | F177RG0093 | F177RG0122 |
| | 1975 | F177RG | F177RG0123 | |

## FOREWORD

This Service Manual contains factory-recommended procedures and instructions for ground handling, servicing and maintaining Cessna Cardinal RG-Series aircraft. Besides serving as a reference for the experienced mechanic, this Service Manual also covers step-by-step procedures for the less experienced man. This Service Manual should be kept in a handy place for ready reference. If properly used, it will better enable the mechanic to maintain these aircraft and thereby establish a reputation for reliable service.

The information in this Service Manual is based on data available at the time of publication, and is supplemented and kept current by service letters and service news letters published by Cessna Aircraft Company. These are sent to all Cessna Dealers so that they have the latest authoritative recommendations for servicing Cessna aircraft. Therefore, it is recommended that Cessna owners utilize the knowledge and experience of the factory-trained Dealer Service Organization.

In addition to the information in this Service Manual, a group of vendor publications are available from the Cessna Service Parts Center 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 in service letters.

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

# SECTION 1

# GENERAL DESCRIPTION

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## 1-1. GENERAL DESCRIPTION.

## 1-2. CARDINAL RG-SERIES.

1-3. DESCRIPTION. The Cessna Cardinal RG-Series aircraft, described in this manual, are single-engine, high-wing monoplanes of all-metal, semimonocoque construction. Wings are full cantilever, with a sealed section which forms an integral fuel bay area in each wing. The fully-retractable tricycle landing gear consists of tubular spring-steel main gear struts and a steerable nose gear with an air/hydraulic fluid shock strut. Standard four-place seating consists of two individual front seats and one two/place rear seat. These aircraft feature a horizontal stabilator, swept-back fin and rudder, large entry doors, and rear and side windows. The aircraft are powered by four-cylinder, horizontally opposed, air-cooled, "Blue Streak" (Lycoming) engines, driving all-metal, constant speed propellers.

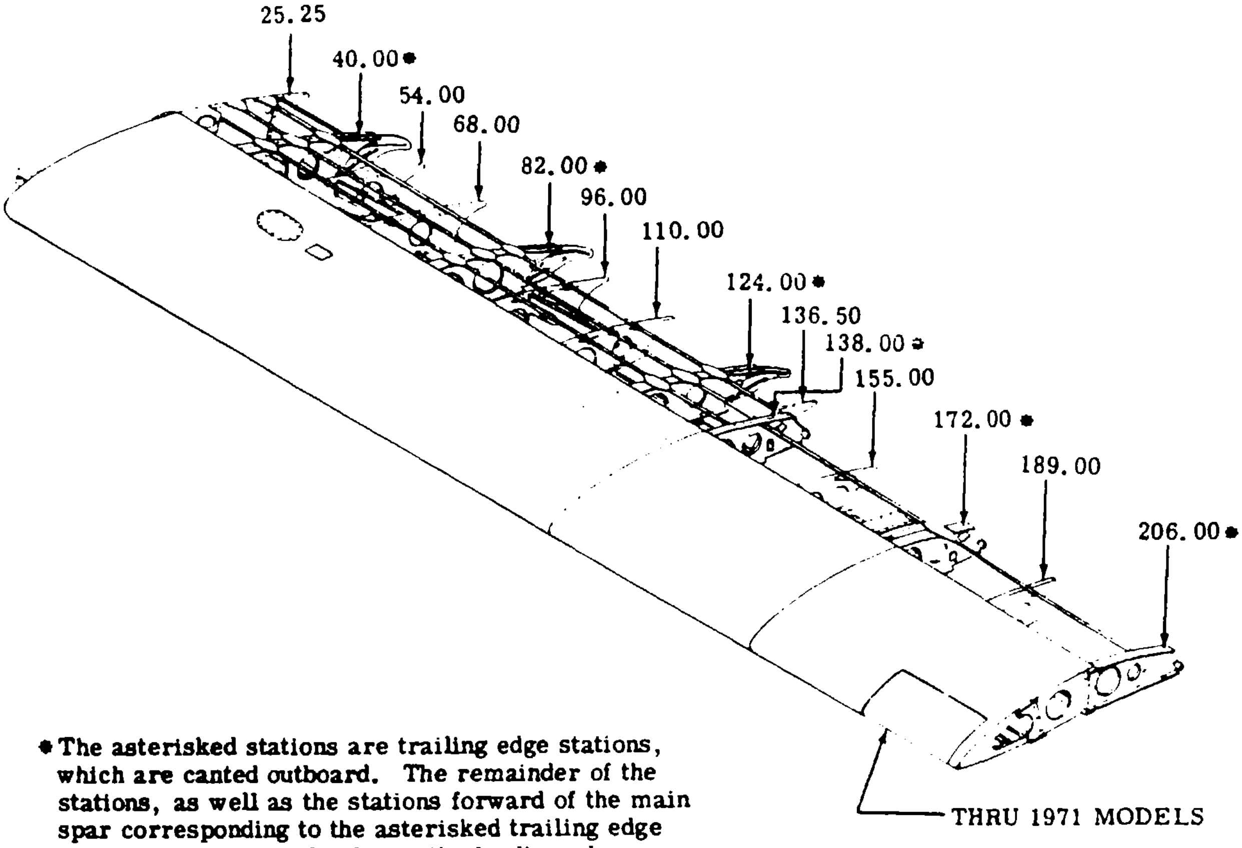
1-4. AIRCRAFT SPECIFICATIONS. Leading particulars of these aircraft, with dimensions based on gross weight, are given in figure 1-1. If these dimensions are used for constructing a hangar or computing clearances, remember that such factors as nose gear strut inflation, tire pressures, tire sizes, and load distribution may result in some dimensions that are considerably different from those listed.

1-5. STATIONS. A station diagram is shown in figure 1-2 to assist in locating equipment when a written description is inadequate or impractical.

1-6. TORQUE VALUES. A chart of recommended nut torque values is shown in figure 1-3. 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 | 2800 lb |
| FUEL CAPACITY | |
| (Total) | 61 gal |
| (Usable) | 60 gal |
| OIL CAPACITY | |
| (Without External Filter) | 8 qt |
| (With External Filter) | 9 qt |
| ENGINE MODEL (Refer to Section II for Engine Data) | LYCOMING IO-360 SERIES |
| PROPELLER (Constant Speed) | 78" McCAULEY |
| MAIN WHEEL TIRES | 15x6.00-6, 6-Ply Rating |
| Pressure | 68 psi |
| NOSE WHEEL TIRE | 5.00-5, 4-Ply Rating |
| Pressure | 31 psi |
| NOSE GEAR STRUT PRESSURE (Strut Extended) | 38 psi |
| WHEEL ALIGNMENT | |
| Camber | 3° to 5° |
| Toe-In | 0" to .06" |
| AILERON TRAVEL | |
| Up | 20° ± 2° |
| Down | 15° ± 2° |
| WING FLAP TRAVEL | 0° to 30°, +2° -0° |
| RUDDER TRAVEL (Measured parallel to water line) | |
| Right | 21° 45' ± 1° |
| Left | 21° 45' ± 1° |
| RUDDER TRAVEL (Measured perpendicular to hinge line) | |
| Right | 24° ± 1° |
| Left | 24° ± 1° |
| STABILATOR TRAVEL | |
| Up | 20° ± 1° |
| Down | 5° ± 1° |
| STABILATOR TRIM TAB TRAVEL | |
| Up | 5° ± 1° |
| Down | 13° ± 1° |
| PRINCIPAL DIMENSIONS | |
| Wing Span (With Strobe Lights) | 35' 6" |
| Tail Span | 11'10" |
| Length. | 27'3" |
| Fin Height (Maximum with Nose Gear Depressed and Flashing Beacon Mounted on Fin) | 8'7" |
| Track Width | 7'10" |
| BATTERY LOCATION | Aft of Baggage Area |

Figure 1-1. Aircraft Specifications




* The asterisked stations are trailing edge stations, which are canted outboard. The remainder of the stations, as well as the stations forward of the main spar corresponding to the asterisked trailing edge stations, are perpendicular to the leading edge.

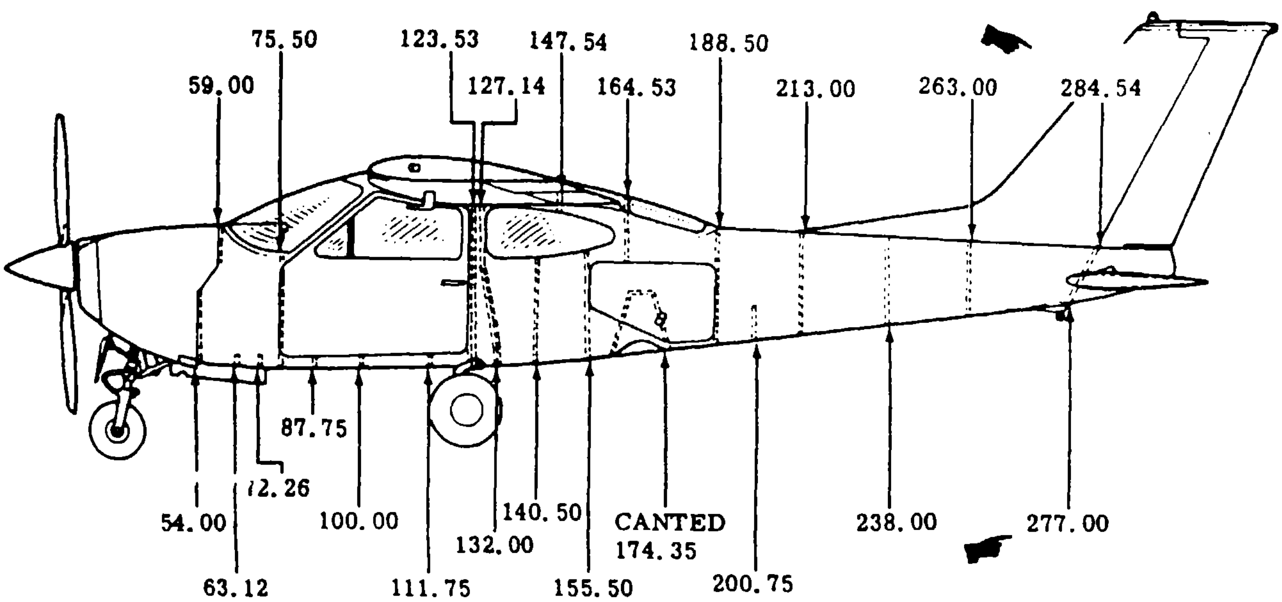



Figure 1-2. Reference Stations

## 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 TORQUE STD (NOTE 1) | TENSION TORQUE ALT (NOTE 2) | SHEAR TORQUE STD (NOTE 3) | SHEAR TORQUE 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

| TAP SIZE | (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 1-3. Torque Values

SECTION 2

# GROUND HANDLING, SERVICING, CLEANING, LUBRICATION, AND INSPECTION

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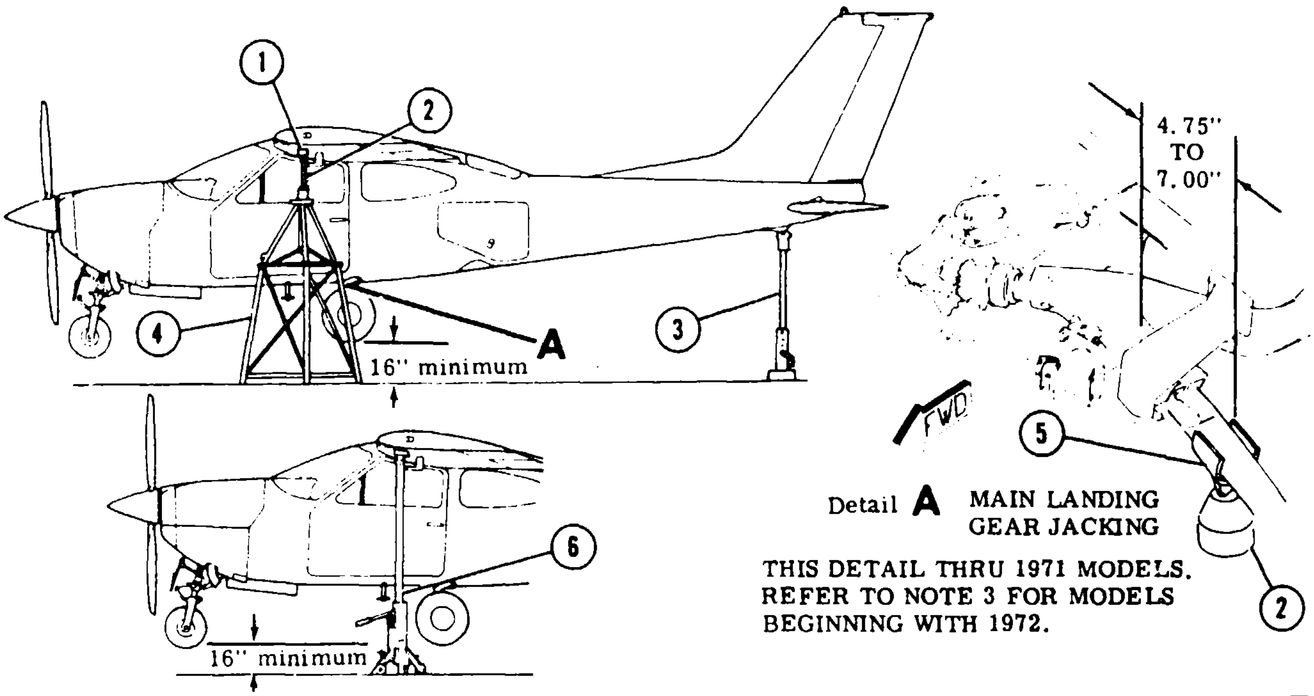
## 2-1. GROUND HANDLING.

2-2. TOWING. Moving the aircraft by hand is accomplished by using the landing gear struts as push points. A tow bar attached to the nose gear should be used for steering the aircraft when pulling or pushing the aircraft by hand. When no tow-bar is available, press down at a tailcone bulkhead, just forward of the stabilator, to raise the nose wheel off the ground. With the nose wheel clear of the ground, the aircraft can be pivoted about either main wheel.

**CAUTION**

When power towing the aircraft, never turn the nose wheel more than 39 degrees either side of center or the nose gear and structure could 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.




| ITEM NUMBER | TYPE AND PART-NUMBER | REMARKS |
|---|---|---|
| 1 | Block (Jack point not available)<br>Cessna #1200028-1 | 1 x 4 x 4 padded with 1/4" rubber<br>Jack point (SEE NOTE 1) |
| 2 | Jack | Any short jack of capable capacity<br>(SEE NOTE 1) |
| 3 | Cessna #SE-767 | Universal tail stand (SEE NOTE 2) |
| 4 | Cessna #SE-576 (41-1/2" high) | Universal jack stand (FOR USE WITH ITEM 2) |
| 5 | Cessna #0541208-1 | Jack pad (Thru 1971 Models) (SEE NOTE 3) |
| 6 | #2-170 Basic jack<br>#2-64 Extension cap (4" high)<br>#2-70 Slide tube extension | Minimum closed 57.5"; maximum extended 80.0"<br>(Insert slide tube extension into basic jack) |

1. Provisions are furnished on the bottom of each wing for installation of optional 1200028-1 jack points.
2. Weighted adjustable stand attaches to tie-down ring.

   Wing jack points are aft of the aircraft center-of-gravity. This causes the aircraft to be nose heavy when on jacks. Place additional weights (shot bags or sand bags) on the weighted tail stand to hold the tail down. In addition, the base of adjustable tail stand (SE767) is to be filled with concrete for additional weight as a safety factor.

3. Refer to detail A for location of placement of optional 0541208-1 jack pad assemblies. The jack pad may be used to raise only one main wheel. Do not use brake casting as a jack point. Beginning with 1972 Models, use jack point on bottom of step.
4. Items (1), (3), (4), (5) and (6) are available from the Cessna Service Parts Center.

Figure 2-1. Jacking Details (Sheet 1 of 2)

## JACKING AIRCRAFT

1. Lower the aircraft tail so that wing jack and stands can be placed at wing points.
2. Raise aircraft tail and attach tail stand to tail tie-down ring. BE SURE the tail stand weighs enough to keep the tail down under all conditions and that it is strong enough to support any weight that may be placed upon it.
3. Raise jacks evenly until desired height is reached. When jacking the aircraft, the main landing gear wheels must be a minimum of 16" above shop floor for landing gear retraction.
4. The jack pad assembly may be used to raise only one main wheel. Do not use brake casting as a jack point.
5. The nose may be raised by weighting down the tail. Place weight on each side of stabilator, next to fuselage.
6. Whenever the landing gear is to be operated in the shop, use the wing jack and tail jack points to raise the aircraft.
7. The aircraft may be hoisted as outlined in paragraph 2-3.

## REMOVING AIRCRAFT FROM JACKS

1. Place landing gear control handle in gear down position.
2. Operate power source or aircraft emergency hydraulic hand pump until landing gear is down and locked, the green (DOWN) light is illuminated.
3. Disconnect power source and/or stow emergency hydraulic hand pump handle.
4. Ascertain that green (DOWN) light is illuminated; then place master switch in OFF position.
5. Lower jacks evenly until aircraft rests on the landing gear and remove wing jacks and tail stand.
6. Compress nose landing gear shock strut to static position.

**SHOP NOTES:**

Figure 2-1. Jacking Details (Sheet 2 of 2)

2-3. HOISTING. The aircraft may be lifted with a hoist of two-ton capacity by using hoisting rings, (optional equipment) or by means of suitable slings. The front sling should be hooked to the engine mount at the upper firewall attach points on each side, and the aft sling should be positioned around the fuselage at the first bulkhead forward of the leading edge of the stabilator. 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 cause vertical force to be applied to the eyebolt hoisting rings, thus allowing a shorter cable length.

2-4. JACKING. Refer to figure 2-1 for jacking procedures.

**CAUTION**

When using the individual gear strut 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 then be lowered for a second jacking operation. Do not jack both main wheels simultaneously with individual jack pads.

2-5. LEVELING. Longitudinal leveling of the aircraft is accomplished by removing the plug buttons at stations 213.0 and 238.0 on the left side of the tailcone and installing screws in the jig located nutplates, the placing a level across the screws. Raise or lower the nose strut to properly center the bubble in the level. A level placed across the front seat rails at corresponding points is used to level the aircraft laterally.

2-6. PARKING. When parking the aircraft, head into the wind and set parking brakes.

**CAUTION**

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

Close cowl flaps, install internal control lock and place chocks under all wheels. In severe weather and high wind conditions, tie aircraft down as outlined in paragraph 2-7 if a hangar is not available.

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

**CAUTION**

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

Moor the aircraft as follows:

a. Tie ropes, cables or chains to the wing tie-down fitting located under each wing. Secure the opposite end to ground anchors.

b. Secure the middle of a rope (do not use chain or cable) to the nose gear trunion. Pull each end away at a 45 degree angle and secure to ground anchors.

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.

d. Secure control lock on pilot control column. If control lock is not available, tie control wheel back with front seat belt.

e. These aircraft are equipped with a spring-loaded steering bungee 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 and/or the first 25 hours of intermittent engine operation.

NOTE

The aircraft is delivered from Cessna with a corrosion preventive aircraft engine oil (MIL-C-6529, Type II RUST BAN). This engine oil is a blend of aviation grade straight mineral oil and a corrosion preventive compound. This oil should be used for the first 50 hours of engine operation. Refer to paragraph 2-20 for oil change information during the first 50 hours of engine operation.

During the 30 day non-operational storage or the first 25 hours of intermittent engine operation, every seventh day, the propeller shall be rotated through five revolutions, without running the engine. If the aircraft is stored outside, tie down in accordance with paragraph 2-7. 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 30 days, aircraft should be flown for 30 minutes or ground run-up until oil has reached operating temperature.

2-9. RETURNING AIRCRAFT TO SERVICE. After flyable storage, returning the aircraft to service is accomplished by performing a thorough preflight inspection. At the end of the first 25 hours of engine operation, drain engine oil, clean oil screens and change external oil filter element, if installed. Service engine with correct grade and quantity of engine oil. Refer to figure 2-2 and paragraph 2-20 for correct grade of 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 alloys 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 in a dry hangar, and for storage periods not to exceed 90 days, the following methods of treatment are suggested.

a. Fill fuel bays 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 prevent flat spotting of 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 reinstalled 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 Lycoming: Socony Averex 901, or Esso Rust-Ban 626, or equivalent.

h. Using a portable pressure sprayer, spray preservative oil through the upper spark plug hole of each cylinder with the piston in a down position. Rotate crankshaft as each pair of cylinders is sprayed.

i. After completing step "h," rotate crankshaft so that no piston is at a top position. 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 similar openings should have protective covers installed to prevent entry of foreign material.

o. Attach a warning placard to the propeller to the effect that the propeller shall not be moved while the engine is in storage.

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 at the end of the 90 day period, the aircraft is to be continued in non-operational storage, repeat the procedural steps "g" thru "o" of paragraph 2-9.

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. (Refer to figure 1-1 for pressures.)

b. Check and install battery.

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. (Refer to paragraph 11-3.)

g. While spark plugs are removed, rotate propeller several revolutions to clear excess rust preventive oil from cylinders.

h. Install spark plugs. Torque spark plugs to 390±30 lb-in and connect spark plug leads.

i. Check fuel strainer. Remove and clean filter screen if necessary. Check fuel bays and fuel lines for moisture and sediment. Drain enough fuel to eliminate moisture and sediment.

j. Perform a thorough preflight inspection, then start and warm-up engine.

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 install drain plug.

b. Fill oil sump to normal operating capacity with corrosion preventive mixture which has been thoroughly mixed and pre-heated to a minimum of 221°F at the time it is added to the engine oil sump.

NOTE

Corrosion preventive mixture consists of one part compound MIL-C-6529, Type I, mixed with three parts new lubricating oil of the grade recommended for service. Avco Lycoming recommends Esso Rust-Ban 628 or equivalent. During all spraying operations, corrosion preventive mixture is pre-heated to 221° to 250°F.

c. Immediately after filling the oil sump with corrosion preventive mixture, fly the aircraft for a period of time not to exceed a maximum of 30 minutes.

CAUTION

Injecting corrosion preventive mixture too fast can cause a hydrostatic lock. Use caution when spraying mixture into air induction system to prevent oil from entering the air section of the injector. Fluid can easily enter the air section of the injector through the impact tubes or the annular groove around the venturi. For this reason, ascertain that spraying nozzle is inserted into the venturi beyond the impact tubes.

d. With engine operating at 1200 to 1500 rpm and induction air filter removed, spray corrosion preventive into the injector throat, at the rate of one-half gallon per minute until heavy smoke comes from the exhaust stacks, then increase spray until engine is stopped.
e. Do not rotate propeller after completing step "d."
f. Remove all spark plugs and spray corrosion preventive mixture, which has been pre-heated to 221° to 250°F, into all spark plug holes to thoroughly cover entire surface of the interior of each cylinder above the piston.
g. Install lower spark plugs or install solid plug in lower spark plug holes, and install protex plugs in each of the top spark plug holes. Be sure that each protex plug is blue in color when installed.
h. Protect and support the spark plug leads with AN-4060-1 protectors or other suitable protector.
i. Flush injector with a preservative grade oil Specification MIL-O-6081, Grade 1010, (Standard Oil Co., Esso Turbo-Oil 1010 or the equivalent) as follows:

1. Remove plugs and drain all fuel from the injector. If available, apply 10 to 15 psi air pressure to the fuel inlet, until all fuel is discharged from the injector.
2. Replace the plugs and apply preservative grade oil filtered through a 10-micron filter at 13-15 psi to the injector fuel inlet until clear oil is discharged from the servo fitting and fuel outlet.

CAUTION

Do not exceed the above air pressure as internal damage to the injector may result.

j. With throttle in full open position, place a bag of desicant in the injector intake and seal opening with moisture resistant paper and tape.
k. Place a bag of desicant in the exhaust tailpipes and seal openings with moisture resistant tape.
l. Seal cold air inlet to the heater muff with moisture resistant tape.
m. Seal engine breather by inserting a protex plug in the breather hose and clamp in place.
n. Seal all other engine openings exposed to atmosphere using suitable plugs or non-hygroscopic tape.

NOTE

Attach a red streamer to each place plugs or tape is installed. Either attach red streamer outside 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.

o. Drain corrosion preventive mixture from engine sump and re-install drain plug or close drain valve.

NOTE

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

p. Attach a warning placard to the throttle control knob to the effect that the engine contains no lubricating oil. Also, placard the propeller to the effect that it should not be moved. While the engine is in storage.
g. Prepare the 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 60 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 protex plugs each 7 days.
b. Change protex plugs if their color indicates an unsafe condition.
c. If the protex plugs have changed color in one-half of the cylinders, all desicant material in the engine shall be replaced with new material.
d. Every six months re-spray 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. Check hydraulic level in Power Pack.
d. Remove all materials used to seal and cover openings.
e. Remove warning placards posted at throttle knob and on the propeller.
f. Remove and clean engine oil screen, then reinstall and safety. On aircraft that are equipped with an external oil filter, install a new filter element.
g. Remove oil drain plug or open drain valve and drain sump. Install and safety drain plugs or close drain valve.

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.

h. Clean and install the induction air filter.
i. Remove protex plugs and spark plug or solid plugs installed in spark plug holes. Rotate propeller by hand several revolutions to clear corrosion preventive mixture from cylinders.
j. Clean, gap, and install spark plugs. Tighten spark plugs to the torque value shown in paragraph 11-3.
k. Check fuel strainer. Remove and clean filter screen. Check fuel tank drains and fuel lines for moisture and sediment, and drain enough fuel to eliminate.
l. Drain preservative oil from injector unit as follows:
1. Remove drain plugs and drain all oil from the injector.
2. Install drain plugs and place mixture control to full Rich position.
3. Apply service type gasoline into the fuel inlet at a pressure of 13-15 psi until all of the oil is flushed from the injector at the servo fitting and fuel outlet.
4. Connect fuel inlet and servo fitting lines or hose.
m. Perform a thorough pre-flight inspection, then start and warm-up engine.
n. Thoroughly clean aircraft and flight test aircraft.

2-16. SERVICING.

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

2-18. FUEL. The fuel system should be serviced immediately after flight to reduce condensation in the system. Fuel capacity is listed in figure 1-1. The recommended fuel grade to be used is given in figure 2-3.

2-19. FUEL DRAINS are located at various places in the fuel system. Refer to Section 12 for locations of fuel drains. Remove plugs and open valves at the intervals specified in figure 2-2. Also, during daily inspection of the fuel drains, if any water is found, there is a possibility that the wing sumps or fuel lines contain water. Remove all drain plugs and drain all water from system. To activate valve for fuel sampling, place cup up to valve and depress valve with rod protruding from cup. (Refer to figure 12-2.)

2-20. ENGINE OIL. Check engine lubricating oil with the dipstick five to ten minutes after the engine has been stopped. The aircraft should be in as near a level position as possible when checking the engine oil, so that a true reading is obtained. Engine oil should be drained while the engine is still hot, and the nose of the aircraft should be raised slightly for more positive draining of any sludge which may have collected in the engine oil sump. Engine oil should be changed every six months, even though less than the specified hours have accumulated. Reduce these intervals for prolonged operations in dusty areas, in cold climates where sludging conditions exist, or where short flights and long idle periods are encountered, which cause sludging conditions. Always change oil, clean oil screens, and clean and/or change external filter element whenever oil on the dipstick appears dirty. Detergent or ashless dispersant oil, conforming to Specification No. MIL-L-22851, for the "Blue Streak" (Lycoming) engine, shall be used. Multi-viscosity oil may be used to extend the operating temperature range, improve cold engine starting and lubrication of the engine during the critical warm-up period, thus permitting flight through wider ranges of climate change without the necessity of changing oil. The multi-viscosity grades are recommended for aircraft engines subjected to wide variations in ambient air temperatures when cold starting of the engine must be accomplished at temperatures below 30°F.

NOTE

New or newly-overhauled engines should be operated on aviation grade straight mineral oil until the first oil change. If a detergent or ashless dispersant oil is used in a new or newly-overhauled engine, high oil consumption might possibly be experienced. The anti-friction additives in detergent and dispersant oils will retard "break-in" of the piston, rings and cylinder walls. This condition can be avoided by the use of straight mineral oil. The aircraft is delivered from Cessna with straight mineral oil (MIL-C-6529, Type II, RUST BAN). If oil must be added during the first 25 hours, use only aviation grade straight mineral oil (non-detergent) conforming to Specification No. MIL-L-6082. After the first 25 hours of operation, drain engine oil sump and clean both the oil suction strainer and oil pressure screen. If an optional oil filter is installed, change filter element at this time. Refill sump with a straight mineral oil (non-detergent) and use until a total of 50 hours have accumulated or oil consumption has stabilized, then change to detergent oil.

When changing engine oil, remove and clean oil screens, 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 quick and cleaner method of draining the engine oil. This valve is installed in the oil drain port of the oil sump, and allows oil to be drained by attaching a hose over the fitting end and pushing up, causing 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 oil sump. Push up on quick-drain valve until it locks open, and allow oil to drain through hose into a container.

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

d. After engine oil has drained, close quick-drain valve and remove hose. Install and safety drain plug.

e. Remove and clean oil screen, or change external oil filter element.

f. Service engine with correct quantity and grade of engine oil.

NOTE

Refer to inspection charts for intervals for changing oil and filter elements.

NOTE

To minimize loss of oil through the breather, fill to specified oil level on dipstick for normal operation (flight of less than three hours duration). For extended flight, fill to FULL mark on dipstick. Do not operate with less than MINIMUM-FOR-FLIGHT quantities listed. If an external oil filter is installed, one additional quart of oil is required when filter element is changed.

2-21. ENGINE AIR INDUCTION FILTER. The induction air filter keeps dust and dirt from entering the induction system. More engine wear is caused through the use of a dirty or damaged filter than is generally believed. Therefore, maintaining the air filter in a good clean condition can never be over stressed. The frequency with which the filter should be removed and cleaned will be determined primarily by the aircraft operating conditions. A good general rule however, is to remove 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 spare induction air filters at their home base of operation so that a clean filter is always readily available for use. When operating in extremely dusty conditions, daily servicing of the filter is recommended. To service the filter, proceed as follows:

a. Remove filter from aircraft.

NOTE

Use care to prevent damage to filtering media panels when cleaning filter with compressed air.

b. Clean filter with compressed air (not over 100 psi), direct air through filter in the direction opposite of normal air flow. Arrows on filter frame 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 unit.

c. After cleaning with compressed air, 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.

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. The filter should be replaced with a new filter after 500 hours of engine operating time or one year whichever should occur first. However, a new filter should be installed at any time the existing filter is damaged. A damaged filter may have sharp or broken edges in the filtering panels which would allow unfiltered air to enter the engine 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 the filter is clear. Allow water to drain from the filter and then dry filter 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 they are dry.

e. Be sure air box and ducts are clean and filter is not damaged. Install a new filter if the existing filter is damaged.

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

2-22. VACUUM SYSTEM AIR FILTER. The vacuum system central air filter keeps dust and dirt from entering the vacuum operated instruments. Inspect the filter element every 200-hour inspection for damage and cleanliness. Change the central air filter element every 500 hours of operating time and whenever the suction gage reading drops below 4.6 inches of mercury. Also, do not operate the vacuum system with the filter element removed or a vacuum line disconnected as particles of dust or other foreign matter may enter the system and damage the vacuum operated instruments.

2-23. BATTERY. Battery servicing involves adding distilled water to maintain the electrolyte level even with the horizontal baffle plate at the bottom of the cell filler holes, checking the battery cable connections, and neutralizing and cleaning off any spilled electrolyte or corrosion. Use bicarbonate of soda (baking soda) and water to neutralize electrolyte or corrosion. Follow with a thorough flushing with clean water. Brighten cables and terminals with a wire brush, then coat with petroleum jelly before connecting. The battery box also should be checked and cleaned if any corrosion is noted. Distilled water, not acid or "rejuvenators," should be used to maintain electrolyte level. Check the battery every 50

**SHOP NOTES:**

hours (or at least every 30 days) more often in hot weather. Refer to Section 16 for detailed battery removal, installation and testing.

2-24. TIRES. The tire should be maintained at the air pressure specified in figure 1-1. When checking tire pressure, examine tire for wear, cuts, bruises, and slippage. Remove oil, grease, and mud from tires with soap and water.

NOTE

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

2-25. 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. When servicing the nose gear shock strut, proceed as follows:

a. Weight or tie-down the aircraft tail to raise nose wheel off floor.

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

c. Remove filler valve from strut.

d. Extend strut one inch, and fill to overflow with hydraulic fluid. Replace fluid filler plug while strut is extended.

e. Compress strut. If strut compresses fully, repeat steps "c and d" until strut will not compress fully.

f. After strut can not be fully compressed. Remove fluid filler plug and compress strut fully allowing fluid to overflow from filler.

g. With strut fully compressed, install and tighten fluid filler plug and install valve core.

h. With nose wheel off the floor, inflate strut to the air pressure specified in figure 1-1. Install valve cap and lower aircraft. Inner strut barrel should show below outer barrel 1.25-3.00 inches.

NOTE

The nose landing gear shock strut will normally require only a minimum amount of service. Maintain the strut extension air pressure shown in figure 1-1. Lubricate landing gear as shown in figure 2-3. Check landing gear daily for general cleanliness, security of mounting, and for hydraulic fluid leakage. Keep machined surface of strut barrel wiped free of dirt and dust, using a clean, lint-free cloth moistened with hydraulic fluid or kerosene. All surfaces should be wiped free of excess hydraulic fluid or kerosene. Leave a light film of fluid on the machine surface of the strut barrel.

2-26. SHIMMY DAMPENER. The shimmy dampener contains a compensating mechanism within the hollow piston rod for thermal expansion and contraction of the hydraulic fluid. The shimmy dampener must be filled completely with fluid, free of entrapped air, to serve its purpose. In addition, the piston rod must also be partially full of fluid before the temperature compensating mechanism will function properly. It should be noted that the fluid is under pressure exerted against the floating piston by a spring, and that loosening or removing the filler plug will cause loss of fluid and necessitate removal and refilling of the shimmy dampener and piston rod.

NOTE

The shimmy dampener should be checked at each 50-hour inspection to see if it should be serviced.

To check whether the shimmy dampener needs filling, measure the location of the floating piston as follows:

a. Insert a length of music wire into the upper end of the piston rod until it touches the floating piston. The music wire should be ground to a blunt point.

b. Mark the music wire at the end of the piston rod, and measure the music wire for depth of insertion.

c. If the floating piston is 3.10 inches from end of piston rod, the shimmy dampener needs filling.

To fill the shimmy dampener, proceed as follows:

a. Remove shimmy dampener from aircraft.

b. Cut safety wire and remove roll pin from piston rod. Use caution since the roll pin is under a spring load,

c. Remove retaining rings and remove bearing head and piston assembly from cylinder barrel.

d. Remove O-ring from piston, and using a blast of compressed air at roll pin in piston, remove floating piston from piston rod.

e. Using new O-rings install piston and rod assembly in cylinder. Move piston rod to place piston bottomed out against end of dampener barrel opposite open end of barrel.

f. Fill barrel through open end and install bearing head and retainer ring - then invert unit to place open end of piston rod up. Fill open piston rod with fluid, then slowly work piston up and down, drawing fluid through orifice and expelling air until area behind piston is solidly filled with fluid, free of entrapped air. Keep piston rod filled with fluid.

g. After all air has been worked out, "top off" piston rod with fluid. Insert floating piston into piston rod and push down until floating piston is 2.50-inches from open end of piston rod. Loosen filler plug slightly to permit floating piston to be moved to proper position, but tighten as the correct dimension is reached.

NOTE

Be sure that the shimmy dampener and hydraulic fluid are at room temperature while filling to the dimension noted.

h. Install spring, roll pin, and safety wire.

i. Wash shimmy dampener with solvent and dry thoroughly.

j. Reinstall dampener on aircraft.

NOTE

Keep the shimmy dampener, especially the exposed portions of the machined surfaces of the piston rod clean to prevent collections of dirt and grit which could cut the seals in the dampener barrel. Keep the machined surfaces wiped free of dirt and grit, using a clean lint-free cloth moistened with hydraulic fluid or kerosene. All surfaces should be wiped free of excess hydraulic fluid or kerosene. Leave a light film of fluid on the machined surfaces of the piston rod to prevent corrosion.

2-27. HYDRAULIC BRAKE SYSTEM. The hydraulic brake systems should be checked for correct amount of hydraulic fluid at least every 200 hours. Add fluid at the brake master cylinders. Bleed brake system of entrapped air when there is a spongy response to the brake pedals. Refer to Section 5 for the brake bleeding procedure.

2-28. HYDRAULIC RESERVOIR. The hydraulic reservoir should be checked at each 50-hour inspection and whenever fluid level is suspected to be low. Fill reservoir as necessary. Remove filler plug and fill to bottom of casting in filler holes. When checking fluid level, insert a wire through the vent hole to ascertain that the vent has not become plugged. Use only clean MIL-H-5606 hydraulic fluid when filling the reservoir.

2-29. HYDRAULIC FLUID CONTAMINATION CHECK. At the first 50-hour and first 100-hour inspection, thereafter at each 500-hour inspection or one year, whichever should occur first, a sample of hydraulic fluid should be taken and examined for sediment and discoloration. This may be done as follows:

a. Place aircraft master switch in OFF position.

b. In the nose wheel well on the right side, disconnect the forward hydraulic line at bulkhead fitting and drain a small sample of hydraulic fluid into a non-metallic container.

c. Connect hydraulic line to bulkhead fitting and tighten.

d. Analyze drained hydraulic fluid.

e. If the drained fluid is clear and is not appreciably darker in color than new fluid, continue to use the present fluid.

f. If the fluid color is doubtful, place fluid sample in a non-metallic container and insert a strip of polished copper in the fluid sample.

g. Keep copper strip in the sample fluid for six hours at a temperature of 70°F or more. A slight darkening of the copper strip is permissible, but there should be no pitting or etching visible up to 20X magnification.

2-30. CLEANING.

2-31. GENERAL DESCRIPTION. 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.

2-32. UPHOLSTERY AND INTERIOR. Keeping the upholstery and interior clean prolongs upholstery fabrics 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 fabric and carpet may be cleaned with a foam-type detergent cleaner used accordingly to the manufacturer's instructions.

e. Oil and grease spots and stains may be cleaned with household spot removers, used sparingly. Before using any solvent spot remover, 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.

2-33. INTERIOR TRIM. The instrument panel covers, plastic trim, and control knobs need only to be wiped with a damp cloth. Oil and grease on the control knobs can be removed with a cloth moistened with Stoddard solvent or equivalent. Volatile solvents, such as gasoline, alcohol, benzene, acetone, carbon tetrachloride, fire extinguisher fluid, de-icer fluid, lacquer thinner, or glass window cleaning spray should never be used to clean plastic trim. These solvents will soften and craze the plastic trim.

2-34. WINDSHIELD AND WINDOWS. The windshield and windows should be cleaned carefully with plenty of clean water and a mild detergent, using the palm of the hand to feel and dislodge any caked mud or dirt. A sponge, soft cloth, or chamois may be used, but only as a means of carrying water to the plastic. Rinse thoroughly, then dry with a clean moist chamois. Do not rub plastic panels with a dry cloth as this will build up an electrostatic charge which attracts dust. Oil and grease may be removed by lightly wiping with a soft cloth moistened with Stoddard solvent.

**CAUTION**

Do not use gasoline, alcohol, benzene, acetone, carbon tetrachloride, fire extinguisher fluid, de-icer fluid, lacquer thinner, or glass window cleaning spray to clean the windshield or windows. These solvents will soften and craze the plastic.

After washing, the 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 the windshield and windows with soft flannel cloths. A thin, even coat of wax, polished out by hand with soft flannel cloths, will fill in minor scratches and help prevent further scratching. 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.

2-35. ALUMINUM SURFACES. The aluminum surfaces require a minimum of care, but should never be neglected. The aircraft may be washed with clean water to remove dirt, and with carbon tetrachloride or other 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.

2-36. 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 clear water and drying with soft cloths or damp 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 soft 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 wings, tail and the engine nose cap will help reduce the abrasion encountered in these areas.

2-37. ENGINE COMPARTMENT. The engine section 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 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, oil, and air openings should be covered before washing the engine with solvent. Caustic cleaning solutions should be used cautiously and should always be properly neutralized after their use.

2-38. PROPELLER. The propeller should be wiped occasionally with an oily cloth, then wiped with a dry cloth, to remove grass and bug stains. In salt water areas this will assist in corrosion proofing the propeller.

2-39. WHEELS. The wheels should be washed periodically and examined for corrosion, chipped paint, and cracks or dents in the wheel castings. Sand smooth, prime, and repaint or repair minor defect. Cracked wheel halves shall have new parts installed.

2-40. LUBRICATION.

2-41. GENERAL DESCRIPTION. Lubrication requirements for the aircraft are shown in figure 2-3. Before adding lubricant to a lubricator fitting, wipe dirt from fitting. Lubricate until lubricant appears around parts being lubricated, and wipe excess lubricant from parts. The following paragraphs supplement figure 2-3 by adding detailed information.

2-42. NOSE GEAR TORQUE LINKS. Lubricate nose gear torque links at every 50-hour inspection. When operating in dusty areas, more frequent lubrication is required.

2-43. WHEEL BEARINGS. Clean and repack the main and nose 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 in areas of high humidity, cleaning and lubrication of the wheel bearings shall be accomplished at each 100-hour inspection.

2-44. WING FLAP ACTUATOR.

a. On aircraft prior to Serial 177RG0213 & F177RG-0043 which have not been modified by Service Kits SK177-17 or SK177-18B, proceed as follows:

1. At each 100 hour inspection, inspect wing flap actuator jack screw and ball retainer assembly for lubrication, and lubricate if required. Also, remove, clean and lubricate jack screw whenever actuator slippage is experienced. If lubrication is required, proceed as follows:

a. Gain access to actuator by removing appropriate inspection plates on lower surface of wing.

b. Expose jack screw by operating flaps to full-down position.

c. Wipe a small amount of lubricant from jack screw with a rag and examine for condition. Lubricant should not be dirty, sticky, gummy or frothy in appearance.

d. Inspect wiped area on jack screw for presence of hard scale deposit. Previous wiping action will have exposed bare metal if no deposit is present.

e. If any of the preceding conditions exist, clean and relubricate jack screw as outlined in steps "f" thru "r".

f. Remove actuator from aircraft in accordance with procedures outlined in Section 7.

g. Remove all existing lubricant from jack screw and torque tube by running the nut assembly to the end of the jack screw away from the gearbox, and soaking the nut assembly and jack screw in Stoddard solvent.

NOTE

Care must be taken to prevent solvent from entering gearbox. The gearbox lubricant is not affected and should not be disturbed.

h. After soaking, clean entire length of jack screw with compressed air.

NOTE

Do not disassemble nut and ball retainer assembly.

i. Relubricate jack screw with MIL-G-21164 (Molybdenum Disulfide Grease) as outlined in steps "j" thru "m".

j. Rotate nut down screw toward the motor.

k. Coat screw and thread end of nut with grease and run nut to full extension.

l. Repeat the process and pack lubricant in the cavity between the nut and ball retainer at the threaded end of the nut.

m. Repeat the process and work nut back and forth several times.

n. Remove excess grease.

o. Reinstall actuator in aircraft in accordance with instructions outlined in Section 7.

b. On aircraft prior to Serial 177RG0213 & F177RG-0043 which have been modified by Service Kits SK177-17B or SK177-18B, proceed as follows:

a. Clean jack screw with solvent rag, if necessary, and dry with compressed air.

b. Relubricate jack screw with MIL-G-21164 (Molybdenum Disulfide Grease) as required.

c. On aircraft beginning with Serial 177RG0213 & F177RG0043, clean and lubricate wing flap actuator jack screw each 100 hours as follows:

1. Expose jack screw by operating flaps to full-down position.

2. 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.

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

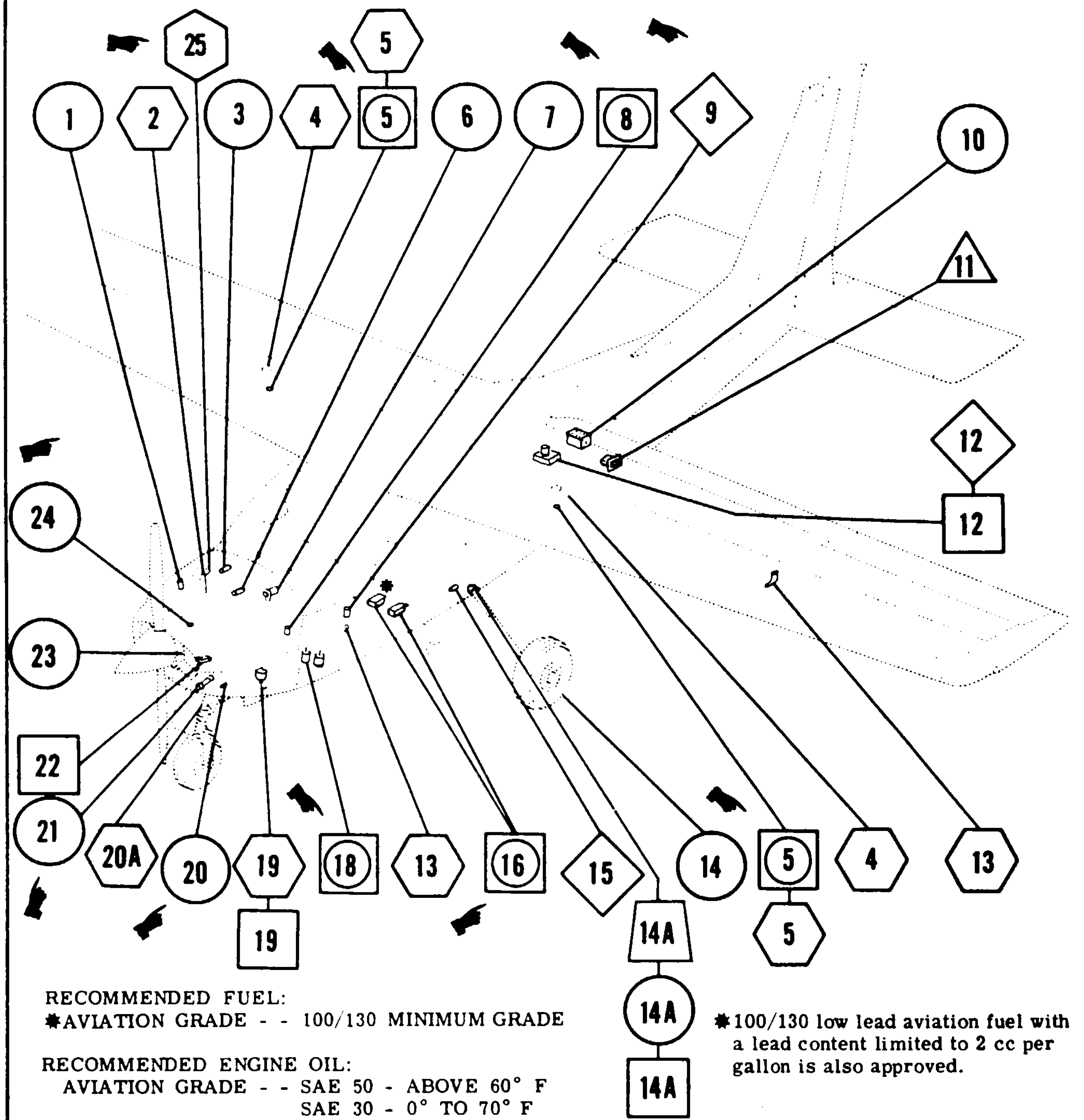
2-45. TACHOMETER DRIVE SHAFT. Refer to Section 15 for details of lubrication of the tachometer drive shaft.

2-46. NOSE GEAR STEERING COLLAR. Lubricate nose gear steering collar spindle links at each 100-hour inspection.

2-47. NOSE GEAR PIVOTS. Lubricate all nose gear pivot points at each 100-hour inspection, including the drag link pivot points. More frequent lubrication may be required when operating in dusty areas.

2-48. MAIN GEAR PIVOT POINTS. Lubricate main landing gear pivot assembly at each 500-hour inspection. If more than the usual number of take-offs and landings are m ade, lubrication of the pivot assembly should be accomplished at each 100-hour inspection.

**SHOP NOTES:**




RECOMMENDED FUEL:
✱AVIATION GRADE - - 100/130 MINIMUM GRADE

✱100/130 low lead aviation fuel with a lead content limited to 2 cc per gallon is also approved.

RECOMMENDED ENGINE OIL:
AVIATION GRADE - - SAE 50 - ABOVE 60° F
SAE 30 - 0° TO 70° F
SAE 20 - BELOW 10° F

✱ BEGINNING WITH 177RG0283 AND F177RG0063

HYDRAULIC FLUID:
SPEC. NO. MIL-H-5606

MULTI-VISCOSITY OIL WITH A RANGE OF SAE 10W30 IS RECOMMENDED FOR IMPROVED COLD ENGINE STARTING AND LUBRICATION OF THE ENGINE DURING THE CRITICAL WARM-UP PERIOD. DETERGENT OR ASHLESS DISPERSANT OIL, CONFORMING TO LYCOMING SPECIFICATION NO. 301E, MUST BE USED.

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

DAILY

**4** FUEL BAYS:
Service after each flight. Keep full to retard condensation. Refer to paragraph 2-18 for details.

**5** FUEL BAY SUMP DRAINS:
Drain off any water and sediment before first flight of the day.

**19** FUEL STRAINER:
Drain off any water and sediment before first flight of the day.

**2** OIL DIPSTICK:
Check on preflight. Add oil as necessary. Refer to paragraph 2-20 for details. Check that filler cap is tight and oil filler is secure.

**13** PITOT AND STATIC PORTS:
Check for obstructions before first flight of the day.

**23** INDUCTION AIR FILTER:
Inspect and service under dusty conditions. Refer to paragraph 2-21 for details.

**20A** NOSE GEAR SHOCK STRUT:
Check on preflight. Check inner barrel showing below outer barrel to be 1.25-3.00 inches. Deviation from these dimensions is cause to check and service strut per paragraph 2-25.

FIRST 25 HOURS

**25** 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 detergent oil. Refer to paragraph 2-20.

25 HOURS

**14A** MAIN LANDING GEAR SUPPORT ASSEMBLY SILENCER. (Thru 177RG0212)
Check for condition, uneven wear and peeling.

50 HOURS

**23** INDUCTION AIR FILTER:
Clean filter per paragraph 2-21. Replace as required.

**10** BATTERY:
Check electrolyte level and clean battery compartment each 50 hours or each 30 days.

**7** 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 least at each 100 hours, or every 6 months.

**21** SHIMMY DAMPENER:
Check fluid level and refill as required in accordance with paragraph 2-26.

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

50 HOURS

14 TIRES:
Maintain correct tire inflation as listed in figure 1-1. Refer to paragraph 2-24 for details.

14A MAIN LANDING GEAR SUPPORT ASSEMBLY SILENCER. (Thru 177RG0212):
Check for condition, uneven wear and peeling.

24 FUEL SELECTOR VALVE DRAIN:
Remove plug and drain water or sediment.

20 NOSE GEAR SHOCK STRUT:
Keep strut filled and inflated to correct pressure. Refer to paragraph 2-25 for details.

6 SUCTION OIL SCREEN:
Remove and clean in solvent at each oil change.

3 OIL PRESSURE SCREEN:
Remove and clean in solvent at each oil change.

1 SPARK PLUGS:
Remove, clean and re-gap all spark plugs. Refer to paragraph 11-58 for details.

100 HOURS

19 FUEL STRAINER:
Disassembly and clean strainer bowl and screen.

12 HYDRAULIC RESERVOIR FILLER:
Remove, clean screen and fill as required.

22 OVERCENTER LOCK ASSEMBLY BOLT:
Check and lubricate as required.

14A MAIN LANDING GEAR SUPPORT ASSEMBLY SILENCER (Thru 177RG0212).
Check for condition, uneven wear and peeling.

200 HOURS

8 VACUUM RELIEF VALVE FILTER:
Change each 1000 hours or to coincide with engine overhauls.

5 FUEL BAY SUMP DRAINS:
Drain off any water or sediment.

16 FUEL RESERVOIR TANK(S): (Refer to * on sheet 1)
Drain off any water or sediment.

18 BRAKE MASTER CYLINDERS:
Check fluid level and fill as required with hydraulic fluid. Refer to paragraph 2-27.

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

500 HOURS

9 VACUUM SYSTEM CENTRAL AIR FILTER:
Replace every 500 hours.

15 RESTRICTOR VALVE AND INSERT SCREENS:
Clean every 500 hours.

12 HYDRAULIC RESERVOIR:
At first 50, first 100, and thereafter at each 500 hours or one year, a sample of fluid should be examined. Refer to paragraph 2-29 for details.

AS REQUIRED

11 GROUND SERVICE RECEPTACLE:
Refer to Section 16 for details.

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

FREQUENCY (HOURS)

25 50 100 500 1000

METHOD OF APPLICATION

SPRAY CAN | HAND | GREASE GUN | OIL CAN | SYRINGE (FOR POWDERED GRAPHITE)

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

NOTE

The military specifications listed are not manatory, 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-81322B . . . . . . . . . . GENERAL PURPOSE GREASE
GH— MIL-G-23827A . . . . . . . . . . AIRCRAFT AND INSTRUMENT GREASE
GL— MIL-G-21164C . . . . . . . . . . HIGH AND LOW TEMPERATURE GREASE
OG— MIL-L-7870A . . . . . . . . . . . GENERAL PURPOSE OIL
PL— VV-P-236 . . . . . . . . . . . . . PETROLATUM
GS— MIL-S-8660B . . . . . . . . . . . SILICONE COMPOUND
EA— MIL-L-23398B . . . . . . . . . . . ELECTROFILM LUBRI-BOND "A"★
GT— . . . . . . . . . . . . . . . . . . . . NO. 10 WT. NON-DETERGENT OIL

★ Electrofilm Inc., 7116 Laurel Canyon Blvd., North Hollywood, Calif.

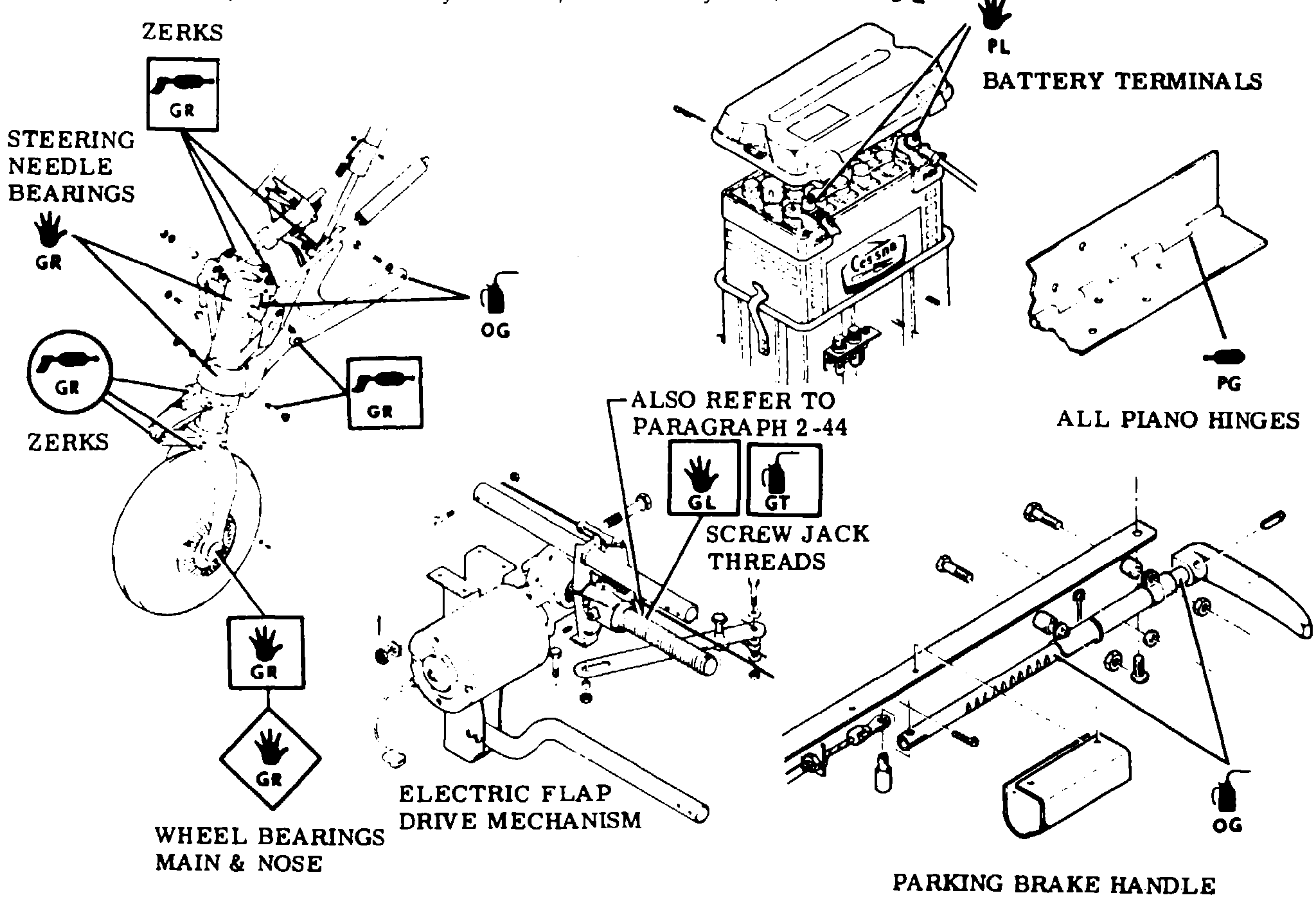



Figure 2-3. Lubrication (Sheet 1 of 3)

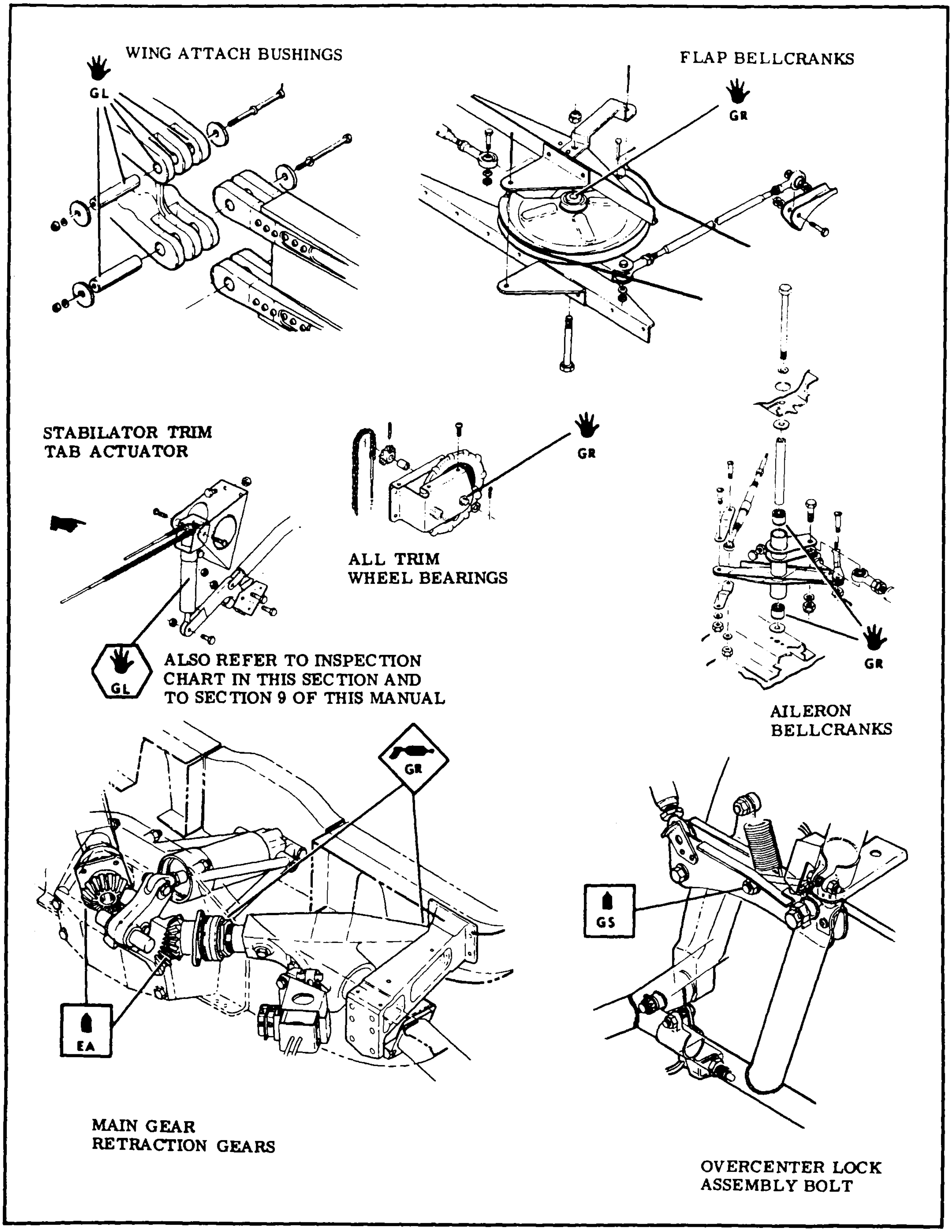
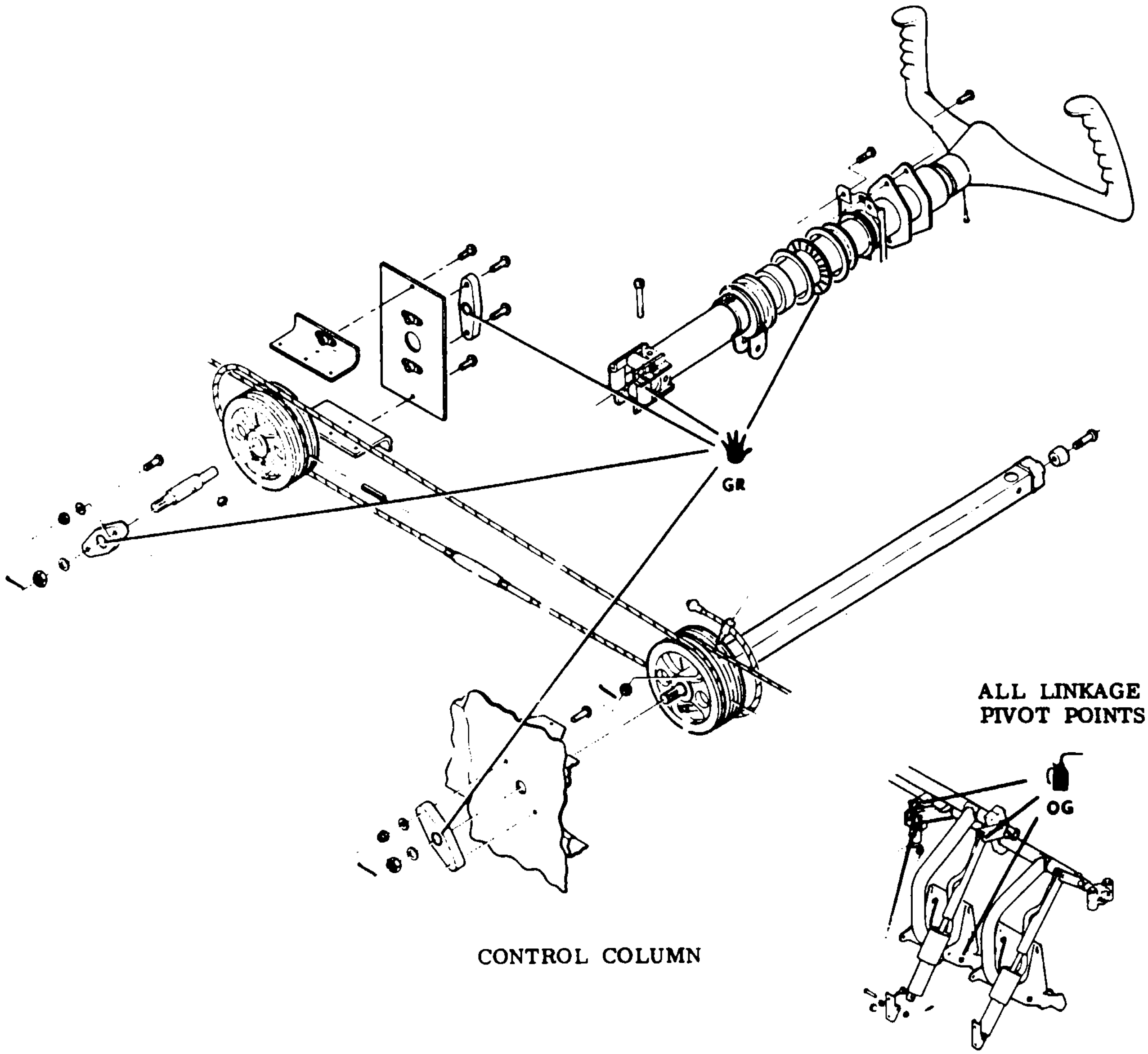



Figure 2-3. Lubrication (Sheet 2 of 3)




CONTROL COLUMN

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 all sliding surfaces, pin joints and hinges of the cabin door latching mechanism with MIL-S-8660 SILICONE COMPOUND at assembly and every 1000 hours or oftener if binding occurs. No lubrication is recommended on the rotary clutch.

Figure 2-3. 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 the Cessna Service Parts Center.

## IV INSPECTION GUIDE LINES.

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

(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 to be 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.

| Item | EACH 50 HOURS | EACH 100 HOURS | EACH 200 HOURS | SPECIAL INSPECTION ITEM |
|---|---|---|---|---|
| **PROPELLER** | | | | |
| 1. Spinner | ● | | | |
| 2. Spinner bulkhead | | | ● | |
| 3. Blades | ● | | | |
| 4. Mounting bolts | | | ● | |
| 5. Hub | | | ● | |
| 6. Governor and control | | | ● | |
| **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 | ● | | | 1 |
| 2. Oil cooler | | ● | | |
| 3. Induction air filter | ● | | | 2 |
| 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 | ● | | | 3 |
| 10. Intake and exhaust systems | ● | | | 4 |
| 11. Ignition harness | | ● | | |
| 12. Spark plugs | | ● | | |
| 13. Compression check | | | ● | |
| 14. Crankcase and vacuum system breather lines | | | ● | |
| 15. Electrical wiring | | ● | | |
| 16. Vacuum pump | | ● | | |
| 17. Vacuum relief valve filter | | | ● | 5 |
| 18. Engine controls and linkage | ● | | | 6 |
| 19. Engine shockmounts, mount structure and ground straps | | | ● | |

| Item | EACH 50 HOURS | EACH 100 HOURS | EACH 200 HOURS | SPECIAL INSPECTION ITEM |
|---|---|---|---|---|
| 20. Cabin heat valves, doors and controls | | | • | |
| 21. Starter, solenoid and electrical connections | | • | | |
| 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. Magneto timing | | | | 8 |
| 28. Firewall | | | • | |
| 29. Fuel/air (metering) control unit | | • | | |
| 30. Fuel injection system | • | | | |
| 31. Engine cowl flaps and controls | • | | | |
| 32. Engine cowling | | • | | |
| 33. Engine-driven fuel pump attach bolts (Torque to 225-250 lb-in) | | • | | |
| **FUEL SYSTEM** | | | | |
| 1. Fuel strainer, drain valve and control, bay vents, caps and placards | • | | | |
| 2. Fuel strainer screen and bowl | | • | | |
| 3. Fuel injector screen | • | | | |
| 4. Fuel reservoir | | | • | |
| 5. Drain fuel and check bay interior, attachment and outlet screens | | | | 5 |
| 6. Fuel bays and sump drains | | | • | |
| 7. Fuel vent line drain | | | • | |
| 8. Fuel selector valve and placards | • | | | |
| 9. Fuel shut-off valve and placards | • | | | |
| 10 Auxiliary fuel pump | | • | | |
| 11. Engine-driven fuel pump | | • | | |
| 12. Fuel quantity indicators and transmitter units | • | | | |
| 13. Fuel vent line drain plug | | | • | |
| 14. Engine primer | | • | | |
| 15. Perform a fuel quantity indicating system operational test. Refer to Section 15 for detailed accomplishment instructions. | | | | 20 |

## LANDING GEAR

| Item | Each 50 Hours | Each 100 Hours | Each 200 Hours | Special Inspection Item |
|---|---|---|---|---|
| 1. Brake fluid, lines and hose, linings, disc, brake assemblies and master cylinders | | | ● | |
| 2. Main gear wheels | ● | | | |
| 3. Wheel bearings | | | | 9 |
| 4. Main gear springs | | | ● | |
| 5. Tires | ● | | | |
| 6. Torque link lubrication | ● | | | |
| 7. Parking brake system | | | ● | |
| 8. Nose gear strut and shimmy dampener (service as required) | ● | | | |
| 9. Nose gear steering collar lubrication | | ● | | |
| 10. Nose gear wheel | ● | | | |
| 11. Park brake and toe brakes-operational test | ● | | | |

## LANDING GEAR RETRACTION SYSTEM

NOTE

When performing an inspection of the landing gear retraction system, the aircraft must be placed on jacks and an external electrical power source of at least 60A should be used to prevent drain on the aircraft battery when operating the system.

| Item | Each 50 Hours | Each 100 Hours | Each 200 Hours | Special Inspection Item |
|---|---|---|---|---|
| 1. Operate the landing gear through five fault-free cycles, noting cycling time. (Approximate travel time of landing gear is 11-13 seconds in each direction) | | | ● | |
| 2. Check nose landing gear doors for at least 1/2-inch clearance with any part of landing gear during operation, and for proper fit when closed | ● | | | |
| 3. Check down position of main gear struts | | ● | | |
| 4. Check main gear downlock engagement | | | ● | |
| 5. Check adjustment and operation of main gear up and down indicator switches, nose gear up and down indicator switches and nose gear squat switch. Also check indicator lights for proper operation | | | ● | |
| 6. Check nose gear downlock adjustments | | | ● | |
| 7. Check all hydraulic system components for security, hydraulic leaks and any apparent damage to components or mounting structure | | | ● | |
| 8. Check nose gear door linkage for security, wear of pivot points and bearings, and for distortion or other damage | | | ● | |
| 9. Check main gear strut-to-pivot attachment | | ● | | |

| Item | Each 50 Hours | Each 100 Hours | Each 200 Hours | Special Inspection Item |
|---|---|---|---|---|
| 10. Check condition of all springs | | ● | | |
| 11. Hydraulic fluid contamination check | | ● | | |
| 12. Check operation of emergency hand pump and relief valve | | | ● | |
| 13. Clean hydraulic fluid filler screen | | ● | | |
| 14. Check and clean insert screens and restrictor valve | | | | 10 |
| 15. Check power pack motor brushes | | | | 11 |
| 16. Check main gear bevel gear for wear and lubrication | | ● | | 12 |
| 17. Main landing gear pivot assembly lubrication | | ● | | |
| 18. Check bumper pads on main gear strut collar adapter (Thru 177RG0212) | | | | 13 |

**CAUTION**

Before installing access plates, inspect area beneath floorboard for loose screws, washers, shavings and other foreign material which could enter landing gear bevel gears and cause damage.

AIRFRAME

| Item | Each 50 Hours | Each 100 Hours | Each 200 Hours | Special Inspection Item |
|---|---|---|---|---|
| 1. Aircraft exterior | ● | | | |
| 2. Aircraft structure | | | ● | 19 |
| 3. Windows, windshield, doors and seals | ● | | | |
| 4. Seat stops, seat rails, upholstery, structure and mounting | | | ● | |
| 5. Seat belts and shoulder harnesses | ● | | | |
| 6. Control column bearings, pulleys, cables, chains and turnbuckles | | | ● | |
| 7. Control lock, control wheel and control column mechanism | | | ● | |
| 8. Instruments and markings | ● | | | |
| 9. Gyros central air filter | | | ● | 14 |
| 10. Magnetic compass compensation | | | | 5 |
| 11. Instrument wiring and plumbing | | | ● | |
| 12. Instrument panel, shockmounts, ground straps, cover, decals and labeling | | | ● | |
| 13. Defrosting, heating and ventilating systems and controls | ● | | | |
| 14. Cabin upholstery, trim, sunvisors and ash trays | | | ● | |
| 15. Area beneath floor, lines, hoses, wires and control cables | | | ● | |
| 16. Lights, switches, circuit breakers, fuses and spare fuses | ● | | | |

| Item | Each 50 Hours | Each 100 Hours | Each 200 Hours | Special Inspection Item |
|---|---|---|---|---|
| 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 | | | | 15 |
| 24. Emergency locator transmitter | | ● | | 16 |

CONTROL SYSTEMS

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

| Item | Each 50 Hours | Each 100 Hours | Each 200 Hours | Special Inspection Item |
|---|---|---|---|---|
| 1. Cable, 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 flap position indicator | ● | | | |
| 7. Flap motor, transmission, limit switches, structure, linkage, bellcranks, etc. | | | ● | |
| 8. Stabilator, trim tab, hinges and push-pull tube | ● | | | |
| 9. Ru der pedal assemblies and linkage | | | ● | |
| 10. Skins (external) of control surfaces and tabs | ● | | | |
| 11. Internal structure of control surfaces | | | ● | |
| 12. Balance weight attachment | | | ● | |
| 13. Flap actuator jack screw threads | | | | 17 |
| 14. Stabilator trim tab actuator lubrication and tab free-play inspection | | | | 18 |

1. First 25 hours: (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 detergent oil. Change oil each 50 hours if the 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.

2. Clean filters per paragraph 2-21. Replace as required.

3. Replace hoses at engine overhaul or after 5 years, whichever comes first.

4. General inspection every 50 hours. Refer to Section 11 for 100 hour inspection.

5. Each 1000 hours, or to coincide with engine overhaul.

6. Each 50 hours for general condition and freedom of movement. These controls are not repairable. Replace as required at each engine overhaul.

7. Each 500 hours.

8. BENDIX S-1200 and D-2000 INTERNAL TIMING AND MAGNETO-TO-ENGINE TIMING: At the first 25 hours, first 50 hours, first 100 hours and thereafter at each 100 hours, the contact breaker point compartment and magneto-to-engine timing should be inspected and checked. If magneto-to-engine timing is correct within plus zero degrees and minus two degrees, internal timing need not be checked. If timing is out of tolerance, remove magneto and set internal timing, then install and time to the engine.

9. First 100 hours and each 500 hours thereafter. More often if operated under prevailing wet or dusty conditions.

10. Clean insert screens and restrictor valve at each 500 hours and whenever improper fluid circulation is suspected.

11. Each 500 hours and whenever improper operation is suspected.

12. Each 200 hours for wear and lubricate gear faces with Electro film Lubri-Bond "A" or equivalent.

13. Check for condition, uneven wear and peeling each 25, 50 and 100 hours. (Thru 177RG0212)

14. Replace each 500 hours.

15. Check electrolyte level and clean battery compartment each 50 hours or each 30 days.

16. Refer to Section 16 of this Manual.

17. Refer to paragraph 2-44 for detailed instructions for various serial ranges.

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

NOTE

Refer to Section 9 of this Manual for free-play limits, inspection, replacement and/or repair.

A high-time inspection is merely a 100-hour inspection with the addition of an engine overhaul. Avco Lycoming recommends overhaul of the engine at 1600 hours. Propeller overhaul should coincide with engine overhaul, but intervals between overhauls of the propeller shall not exceed 1200 hours. At the time of engine overhaul, engine accessories shall be overhauled.

19. On aircraft 177RG0001 thru 177RG0350 and F177RG0001 thru F177RG0083 and F177RG0091, each 100 hours, inspect vertical fin forward attachment bulkhead at station 263.0 for cracks around vertical fin attachment bolt holes in accordance with Single Engine Service Letter SE73-40. Cracking around vertical fin attachment bolt holes will require that bulkhead assembly be replaced with improved configuration bulkhead by installing the following service kits for the applicable serials listed: Service Kit SK177-28 for aircraft serials 177RG0001 thru 177RG0282 and F177RG0001 thru F177RG0062; Service Kit SK1777-29 for aircraft serials 177RG0283 thru 177RG0350 and F177RG0063 thru F177RG0083 and F177RG0091.

20. Fuel quantity indicating system operational test is required every 12 months. Refer to Section 15 for detailed accomplishment instructions.

## 2-49. 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 |

| COMPONENT | REPLACEMENT TIME | OVERHAUL |
|---|---|---|
| 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, Throttle, and Propeller 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 (Lycoming-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: For Textron Lycoming engines, refer to latest Textron Lycoming Engine Service Bulletins.

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: For Textron Lycoming engines, Refer to Textron/Lycoming Service Instruction S.I. 1009AJ, 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 the windshield and windows with exception of the 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 the 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 the damaged part from the 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 the repair would be likely to affect the 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 the 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 the surface around scratch with a circular motion, keeping abrasive constantly wet with clean water to prevent scratching the surface further. Use minimum pressure and cover an area large enough to prevent the formation of "bull's-eyes" or other optical distortions.

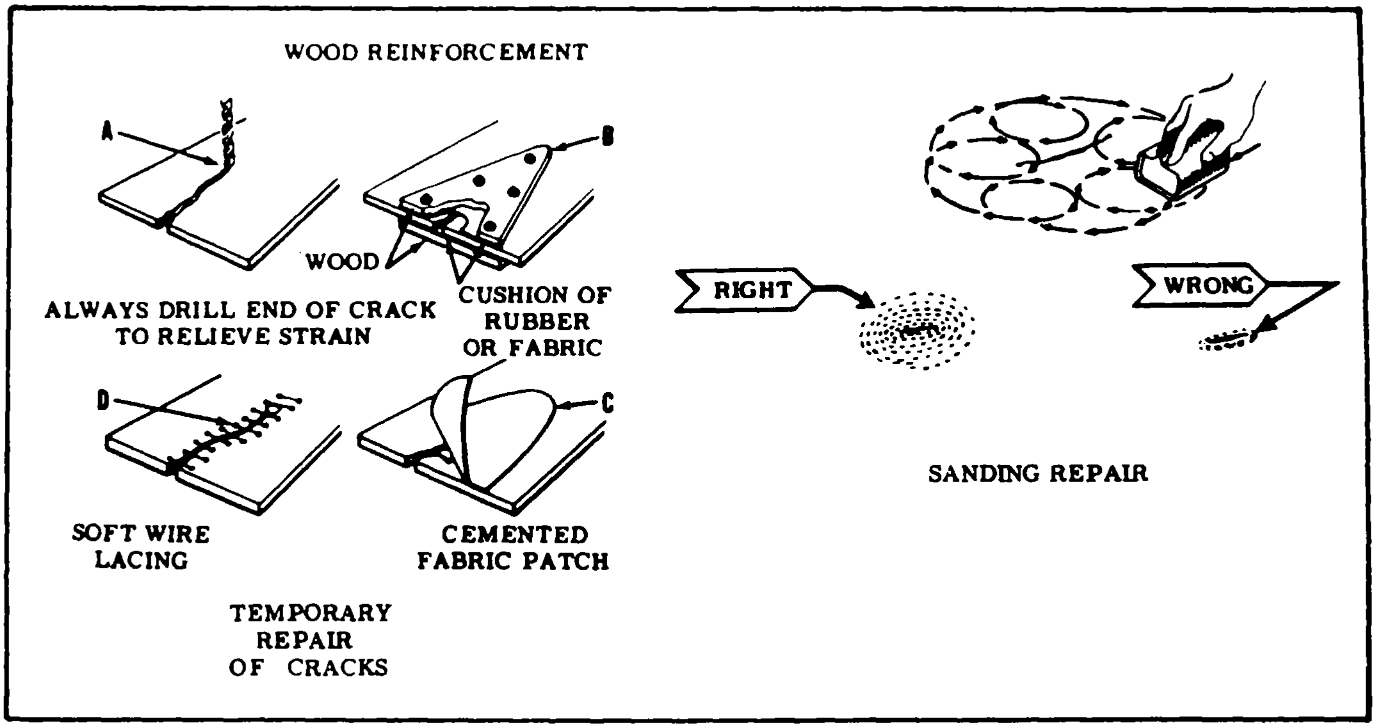



Figure 3-1. Repair of Windshield and Windows

**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 the scratches disappear.

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

d. Apply fresh tallow or buffing compound to a motor-driven buffing wheel. Hold the wheel against plastic surface, moving it constantly over the damaged area until the 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 the buffing is finished, wash the area thoroughly and dry with a soft flannel cloth. Allow surface to cool and inspect the area to determine if full transparency has been restored. Apply a thin coat of hard wax and polish the surface lightly with a clean flannel cloth.

NOTE

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

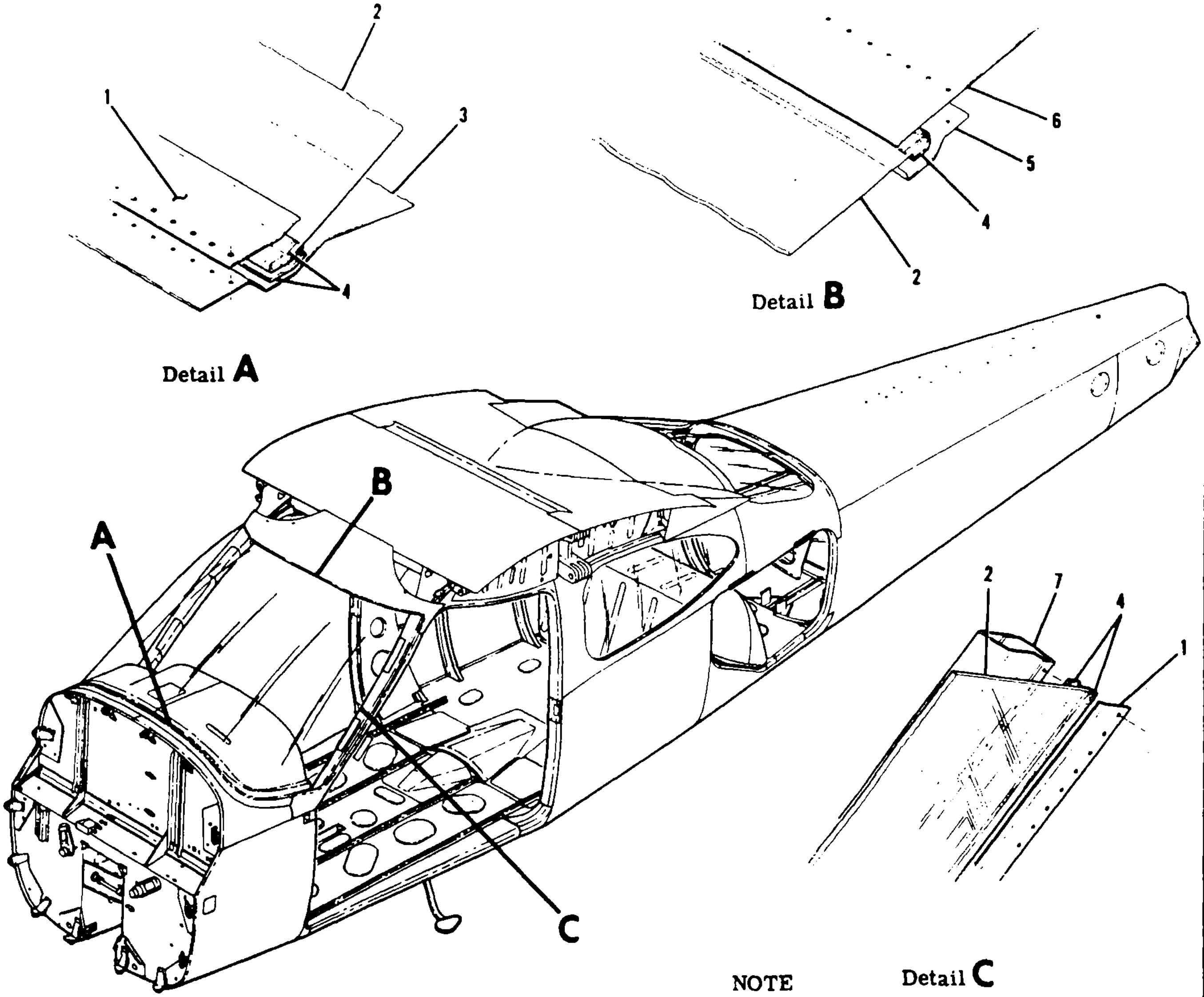
f. Minute hairline scratches can often be removed by rubbing with commercial automobile body cleaner or fine-grade rubbing compound. Apply with a soft, clean, dry cloth or imitation chamois.

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

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

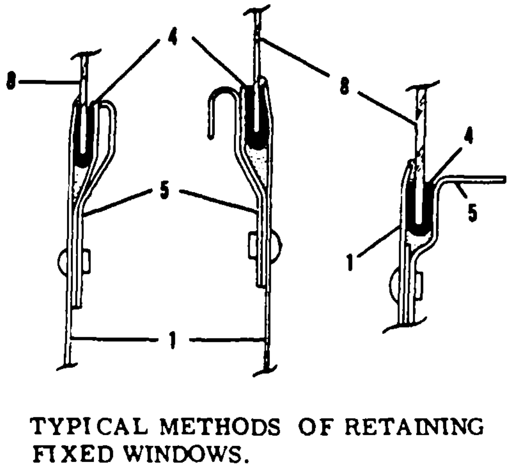
b. Temporary repairs of flat surfaces can be accomplished by placing a thin strip of wood over each side of the surface and inserting small bolts through the wood and plastic. A cushion of sheet rubber or aircraft fabric should be placed between the wood and plastic on both sides.

c. A temporary repair can be made on a curved surface by placing fabric patches over the affected areas. Secure the 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 the patch.




NOTE

- Presstite No. 579.6 sealer should be applied to all edges of windshield and windows when felt sealing strip (4) is used.
- Seal openings at intersection of bulkheads with, (576.1 Permagum, Presstite Engineering Company, St Louis, Missouri) or equivalent.
- For further cabin sealing refer to Cessna Single-engine Service Letters SE71-38 Dated November 19, 1971 and SE71-12 Dated April 21, 1971.




TYPICAL METHODS OF RETAINING FIXED WINDOWS.

1. Outer Retainer
2. Windshield
3. Cowl Deck
4. Felt Seal
5. Inner Retainer
6. Cabin Top Skin
7. Door Post
8. Window

Figure 3-2. Windshield and Fixed Window Installation

d. A temporary repair can be made by drilling small holes along both sides of the crack 1/4 to 1/8 inch apart and lacing the edges together with soft wire. Small-stranded antenna wire makes a good temporary lacing material. This type of repair is used as a temporary measure ONLY, and as soon as facilities are available, the 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.
c. Remove outside air temperature gage.

NOTE

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

d. 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 reinstallation.
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.) A movable window, hinged at the aft edge, is installed in the forward part of each cabin door. The window is operated by a crank on the inside of the door. A rubber seal is attached to the window frame. This seal should be sprayed periodically with MS-122 (18598) or equivulent to prevent adhering to the window. Confine the spray to seal do not overspray.

3-14. REMOVAL AND INSTALLATION.
a. Disconnect bellcrank link (10).
b. Drill out rivets attaching window hinge to door.

NOTE

Since the hinge and retainers are sealed to the clear plastic, the complete window assembly must be replaced.

c. Reverse preceding steps for reinstallation.

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. Drill out rivets as necessary to remove the retainers on both sides and the lower edge of window.
c. Remove window by starting at aft edge and pulling window into the cabin area.
d. Reverse preceding steps for reinstallation. Apply sealing strips and an adequate coating of sealing compound to prevent leaks. When installing a new window, check fit and carefully file or grind away excess plastic.
e. Use care not to crack the window when installing.

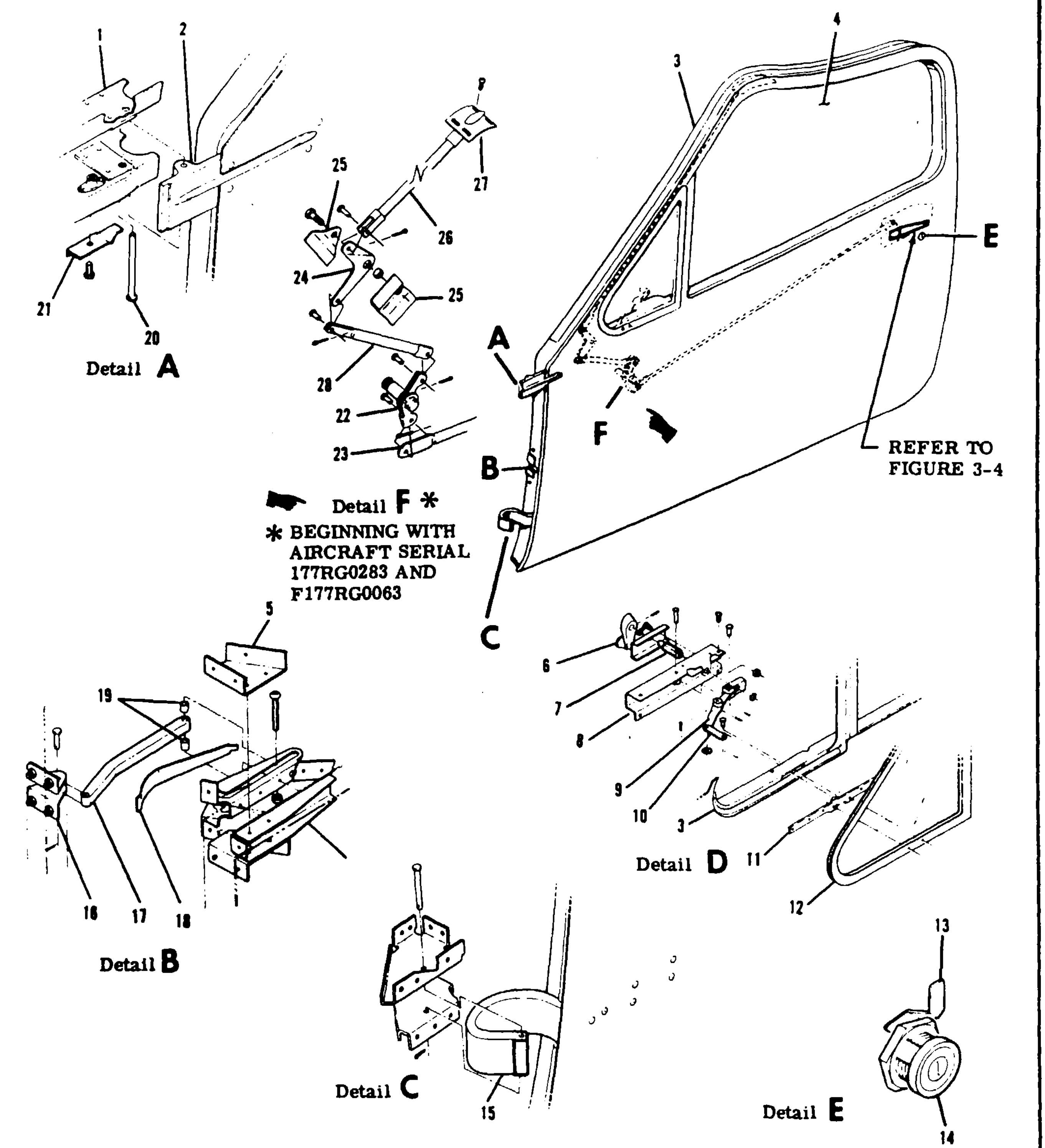
3-17. FIXED. The fixed windows are one-piece acrylic plastic panels set in sealing strips and sealing compound and held in place by formed retainer strips.

3-18. REMOVAL AND INSTALLATION.
a. SIDE WINDOWS. (Refer to figure 3-2.)
1. Remove upholstery and trim panels as necessary.
2. Drill out rivets as necessary to remove retainer strips and remove window.
3. Reverse preceding steps for reinstallation. Apply sealing strips and an adequate coating of sealing compound to all edges of window to prevent leaks. When installing a new window, check fit and carefully file or grind away excess plastic. Use care not to crack the window when installing.
b. DOOR WINDOWS. (Refer to figure 3-3.)
1. Remove weatherstripping as necessary.
2. Drill out rivets around edge of door in the area of window.
3. Pull window out through top of door.
4. Reverse preceding steps for reinstallation. Apply sealing strips and an adequate coating of sealing compound to all edges of window to prevent leaks. When installing a new window, check fit and carefully file or grind away excess plastic. Use care not to crack the window when installing.

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

3-20. REMOVAL AND INSTALLATION.
a. Disconnect door stop arm (17) at bracket (16).
b. Remove upholstery panels as necessary to gain access to hinge pins.
c. Remove upper hinge pin stop (21) and remove pin. Upper pin is installed with head down.
d. Remove pin from hinge (15).
e. Using care, remove door.
f. Reverse preceding steps for reinstallation.

3-21. ADJUSTMENT. Cabin doors should be adjusted so the skin fairs with the fuselage skin. When fitting a new door, some trimming of the door skin at edges and some reforming with a soft mallet may be necessary to achieve a good fit. Beginning with Aircraft Serial 177RG0213 and F177RG0043 bonded doors are installed and forming the door edge is not permissable as it could cause material separation.




1. Fuselage Structure
2. Upper Hinge
3. Door Assembly
4. Fixed Window
5. Stiffener
6. Crank
7. Actuating Screw
8. Actuator Assembly
9. Bellcrank Assembly
10. Link
11. Stiffener
12. Vent Window
13. Cam
14. Lock Assembly
15. Lower Hinge
16. Bracket
17. Stop Arm
18. Stop Spring
19. Spacer
20. Pin
21. Pin Stop
22. Shaft Assembly
23. Push rod, Door Latch
24. Bell Crank
25. Bracket
26. Rod Assembly, Upper Latch
27. Sleeve Assembly
28. Rod Assembly

Figure 3-3. Cabin Door Installation

3-22. WEATHERSTRIP. A weatherstrip is cemented around 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 the strip in place. Minnesota Mining and Manufacturing Co. No. EC-880 cement or equivalent is recommended. Trim the seal at the two drain holes in the bottom of the door to allow drainage. The cabin fixed window installation is changed from a felt seal around the window edge to a extruded rubber channel beginning with 177RG0283 and F177RG0063. When installing a new window moisture seal the edge of the metal retainer with No. 579.6 Sealer, Prestite Engineering Co. St. Louis, Missouri, or equivalent.

3-23. LATCHES. (Refer to figure 3-3 and 3-4.)

3-24. DESCRIPTION. The cabin door latch is a push-pull bolt type, utilizing a rotary clutch for positive bolt engagement. As the door is closed, teeth on the underside of bolt engage gear teeth on the clutch. The clutch gear rotates in one direction only and holds the door until the handle is moved to LOCK position, driving bolt into the slot. Beginning with Aircraft Serial 177RG0283 and F177RG0063 a latching bolt has been added to the forward upper corner of the door. (Refer to figure 3-3.) Linkage connected to the inside door handle moves the bolt to engage a hole location in the door jamb, when the door handle is moved to the locked position.

NOTE

Do not close door with door handle in the locked position, as it could result in damage to the bolt or door jamb.

3-25. ADJUSTMENT. Vertical adjustment of the rotary clutch is afforded by slotted holes which ensures sufficient gear-to-bolt engagement and proper alignment. There is no adjustment involved with the forward latch except positioning the sleeve bracket on upper edge of door for aligning the bolt.

NOTE

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

3-26. LOCK. In addition to interior locks, a cylinder and key type lock is installed on the left door. If the lock is to be replaced, the new one may be modified to accept the original key. This is desirable, as the same key is used for the ignition switch and the cabin door lock. After removing the old lock from the door, proceed as follows:

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

3-27. INDEXING INSIDE HANDLE. (Refer to figure 3-4.) When the inside door handle is removed, reinstall in relation to position of bolt (4) which is spring-loaded to CLOSE position. The following procedure may be used:

a. Temporarily install handle (10) on shaft assembly (18) approximately vertical.
b. Move handle (10) back and forth until handle centers in spring-loaded position.
c. Without rotating shaft assembly (18), remove handle and install spring (14), then install placard (13) with CLOSE index at top and press placard to seat prongs.
d. Install nylon washer (12).
e. Install handle (10) to align with CLOSE index on placard (13) and install clip (11).
f. Ensure bolt (4) clears doorpost and teeth engage clutch gear when handle (10) is in CLOSE position.

3-28. BAGGAGE DOOR. (Refer to figure 3-5.)

3-29. REMOVAL AND INSTALLATION.

a. Disconnect door stop (8) at bracket (2).
b. Remove hinge pins (1).
c. Reverse preceding steps for reinstallation. When fitting a new door, some trimming of the door skin at the edges may be necessary. The door is a bonded assembly therefore forming the door edge is not permissable as it could cause material separation.

3-30. SEATS. (Refer to figure 3-6.)

3-31. PILOT AND COPILOT.

a. RECLINING BACK.
b. ARTICULATING RECLINE/VERTICAL ADJUST.

3-32. DESCRIPTION. These seats are manually-operated throughout their full range of operation. Seat stops are provided to limit fore-and-aft travel.

3-33. REMOVAL AND INSTALLATION.

a. Remove seat stops from seat rails.
b. Disengage the seat adjustment pin.
c. Slide seat fore-and-aft to disengage seat rollers from rails.
d. Lift seat out.
e. Reverse preceding steps for reinstallation. Ensure all seat stops are reinstalled on the outboard seat rail at extreme end of travel locations on rail.

**CAUTION**

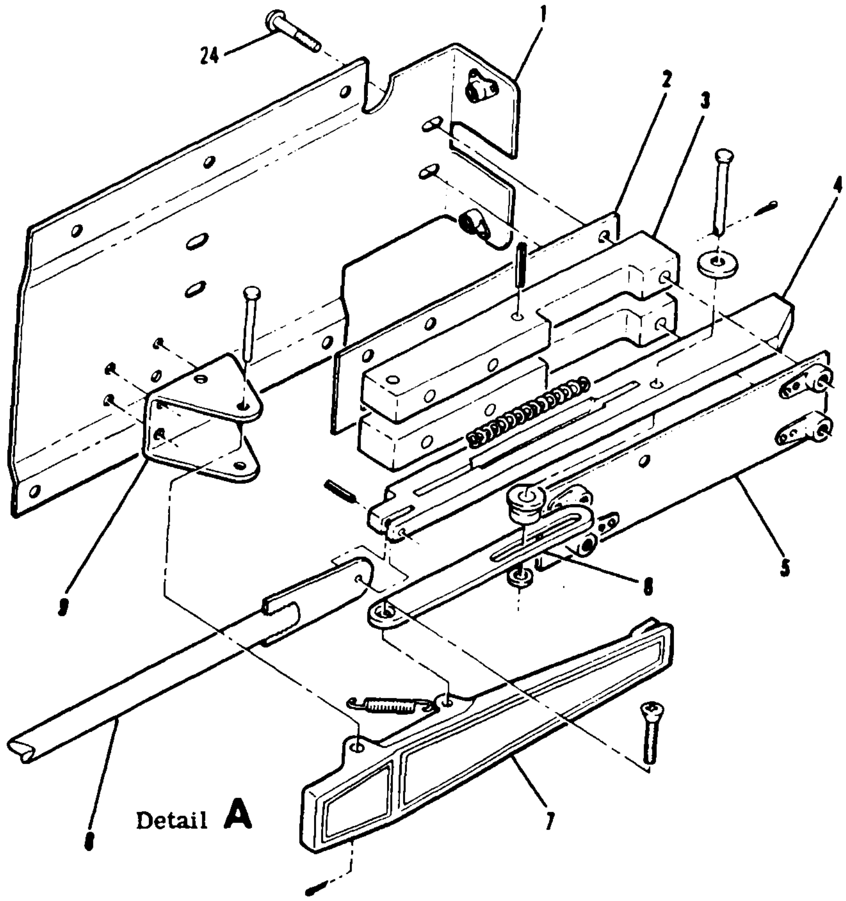
It is extremely important that the pilot's seat stops are installed. Acceleration and deceleration could possibly permit seat to become disengaged from the seat rails and create a hazardous situation, especially during take-off and landing.

3-34. REAR.

a. DOUBLE-WIDTH BOTTOM AND BACK/SINGLE RECLINING BACK.
b. DOUBLE-WIDTH BOTTOM/INDIVIDUAL RECLINING BACKS.

1. Latch Base Plate
2. Base Bolt Guide
3. Side Base Plate
4. Bolt
5. Top Bolt Guide
6. Pull Bar
7. Outside Handle
8. Push-Pull Bar
9. Bracket
10. Inside Handle
11. Clip
12. Nylon Washer
13. Placard
14. Spring
15. Retainer
16. Plate
17. Bearing Plate
18. Shaft Assembly
19. Cover
20. Guide
21. Clutch Assembly
22. Doubler
23. Door Post
24. Bolt
25. Striker Plate

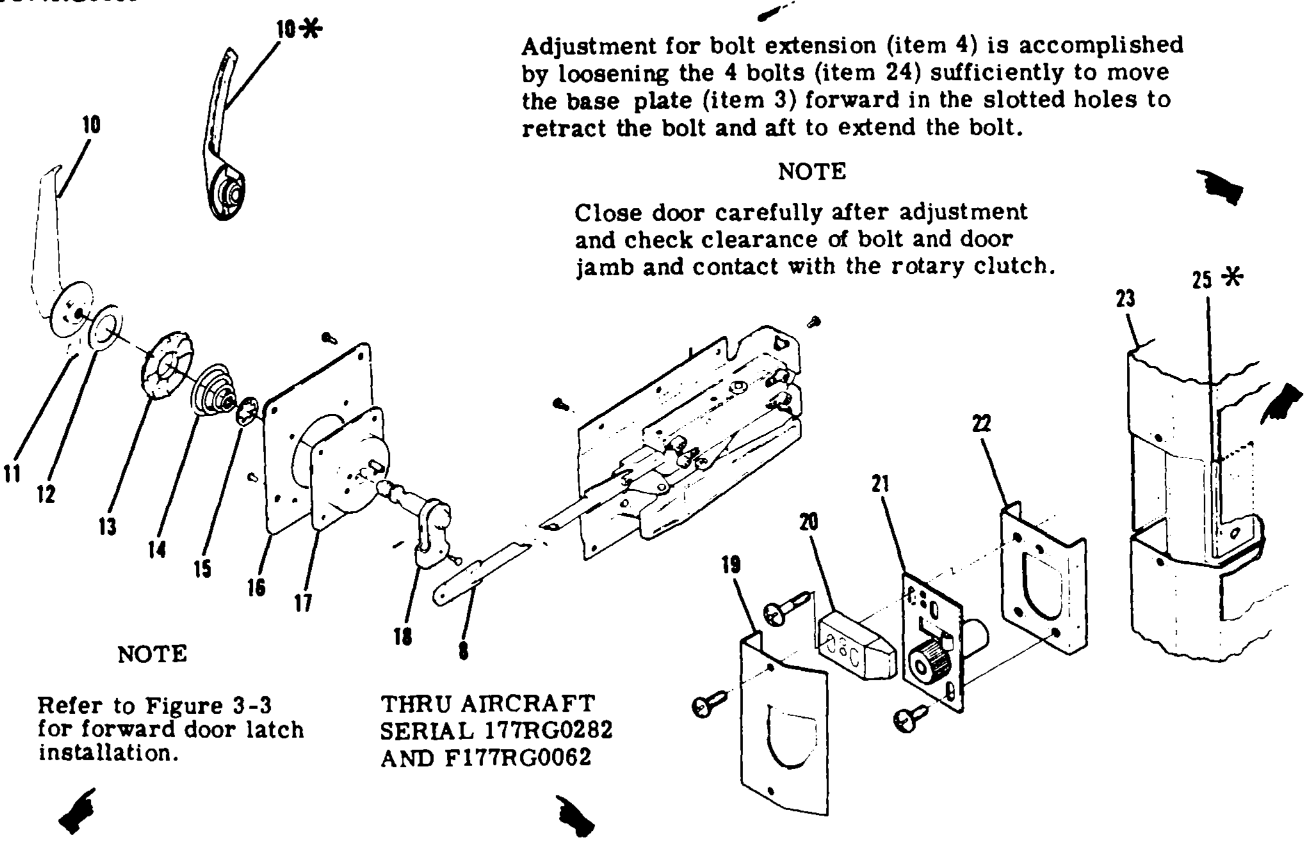
*BEGINNING WITH AIRCRAFT SERIAL 177RG0283 AND F177RG0063




Adjustment for bolt extension (item 4) is accomplished by loosening the 4 bolts (item 24) sufficiently to move the base plate (item 3) forward in the slotted holes to retract the bolt and aft to extend the bolt.

NOTE

Close door carefully after adjustment and check clearance of bolt and door jamb and contact with the rotary clutch.

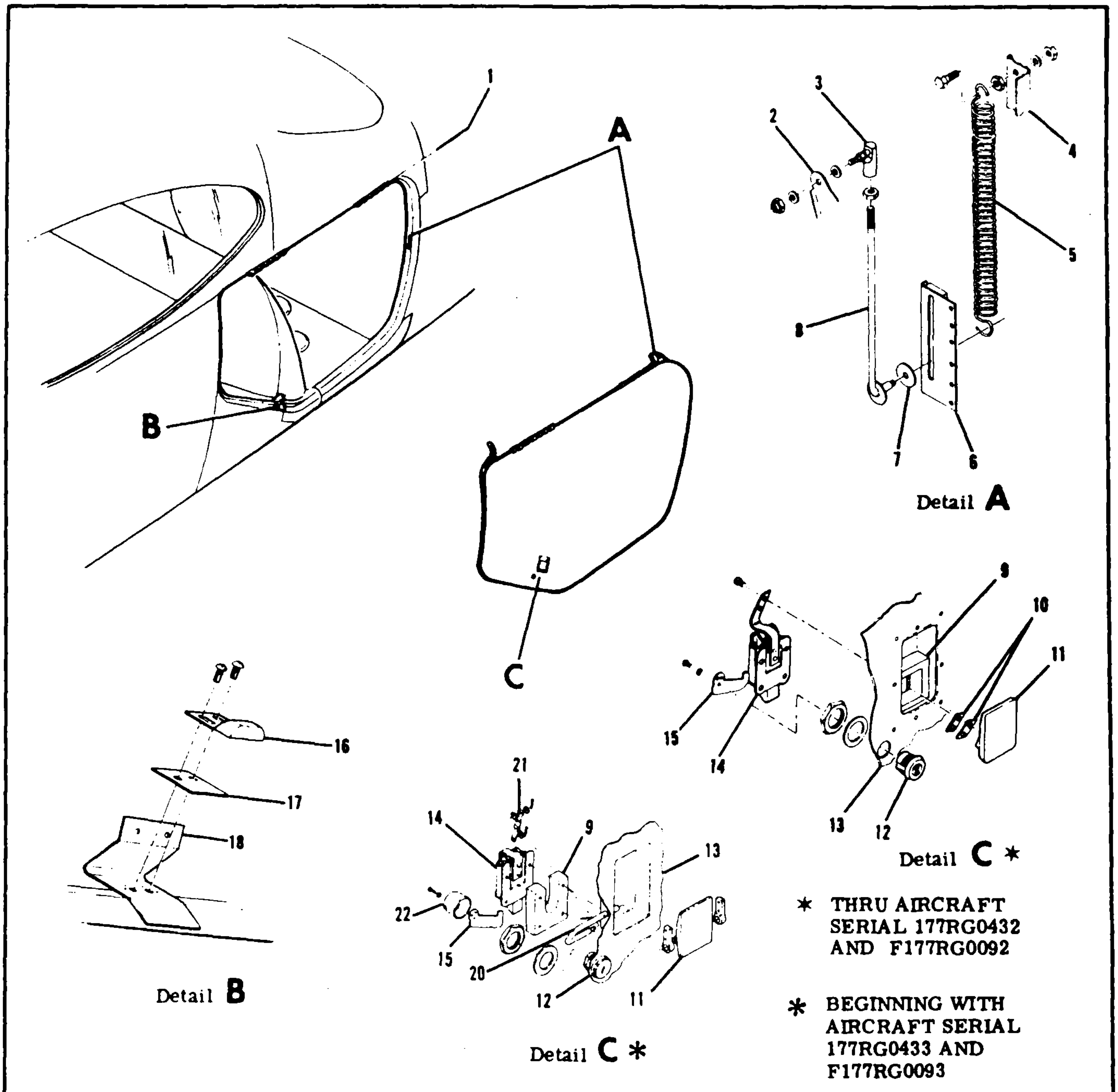



NOTE

Refer to Figure 3-3 for forward door latch installation.

THRU AIRCRAFT SERIAL 177RG0282 AND F177RG0062

Figure 3-4. Door Latch Assembly




1. Hinge Pin
2. Bracket
3. Ball Joint
4. Bulkhead
5. Balance Spring
6. Rod Support Bracket
7. Nylon Washer
8. Door Stop
9. Seal
10. Spacer
11. Handle
12. Lock Assembly
13. Outer Skin
14. Latch Assembly
15. Cam
16. Bracket
17. Shim
18. Striker
19. Bearing Assembly
20. Handle Shaft
21. Linkage Assembly
22. Lock Cover

NOTE

*● Use spacers (10) as required to align handle (11) flush with outside skin.

● Bond seal (9) around baggage door and handle (11) with EC-880, Minnesota Mining and Manufacturing Co.

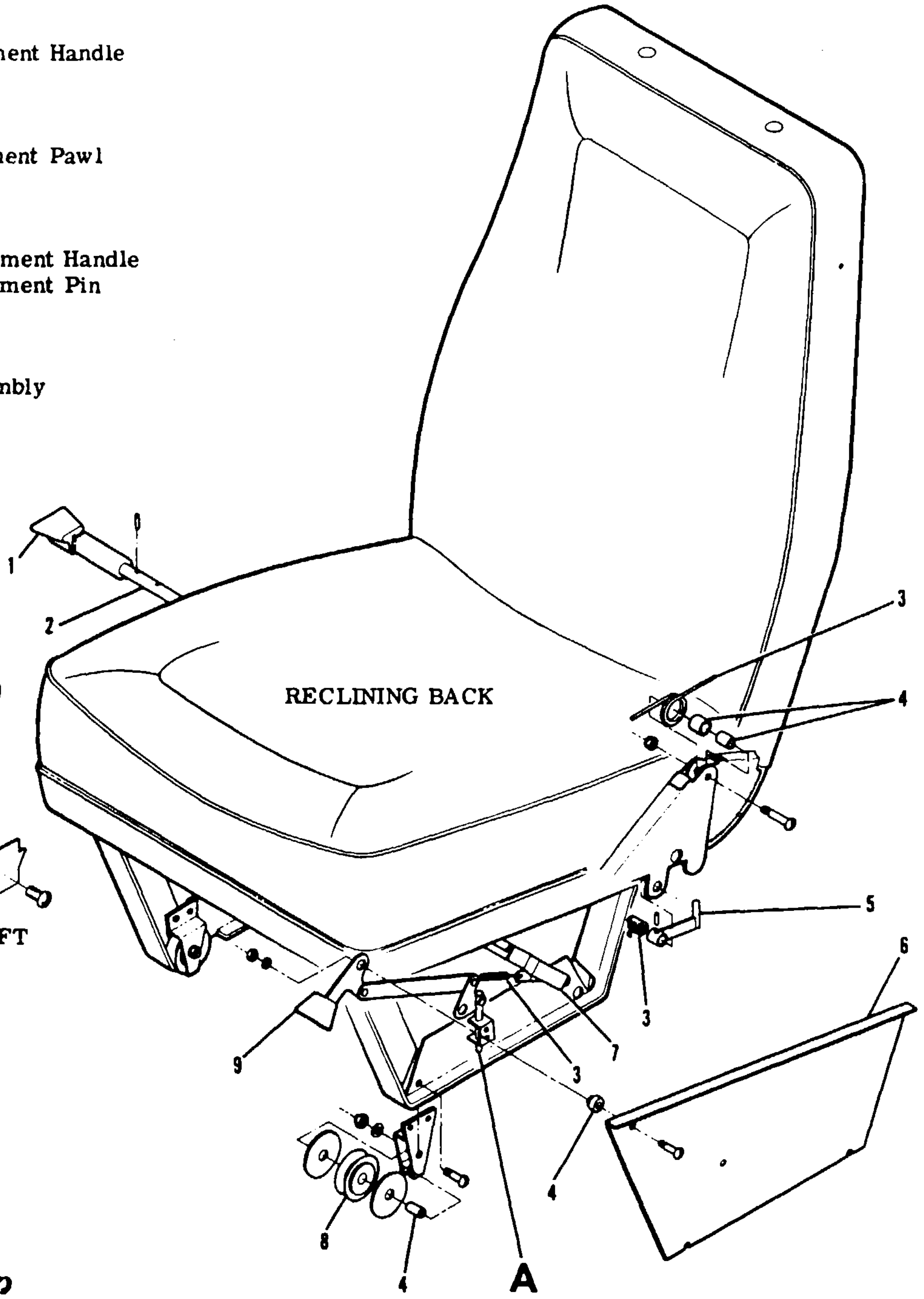
● Forming of the flange to flush door with fuselage is not permissible as forming of the flange could cause damage to the bonded area.

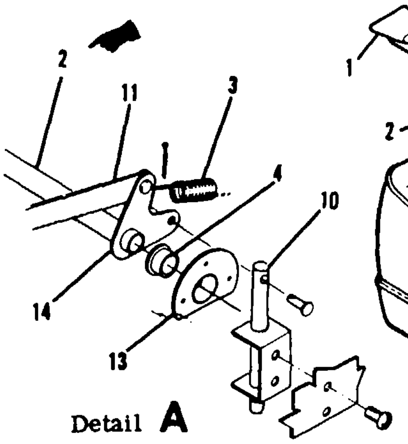
Figure 3-5. Baggage Door Installation

## PILOT AND COPILOT SEAT

(STANDARD)

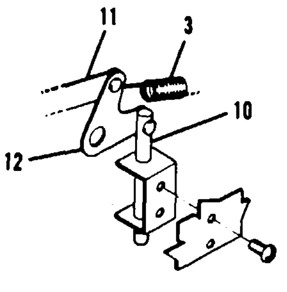
1. Recline Adjustment Handle
2. Torque Tube
3. Spring
4. Bushing
5. Recline Adjustment Pawl
6. Web
7. Footrest
8. Roller
9. Fore/Aft Adjustment Handle
10. Fore/Aft Adjustment Pin
11. Link
12. Bellcrank
13. Housing
14. Bellcrank Assembly



Detail **A**

BEGINNING WITH AIRCRAFT SERIALS 177RG0283 AND F177RG0063



Detail **A**

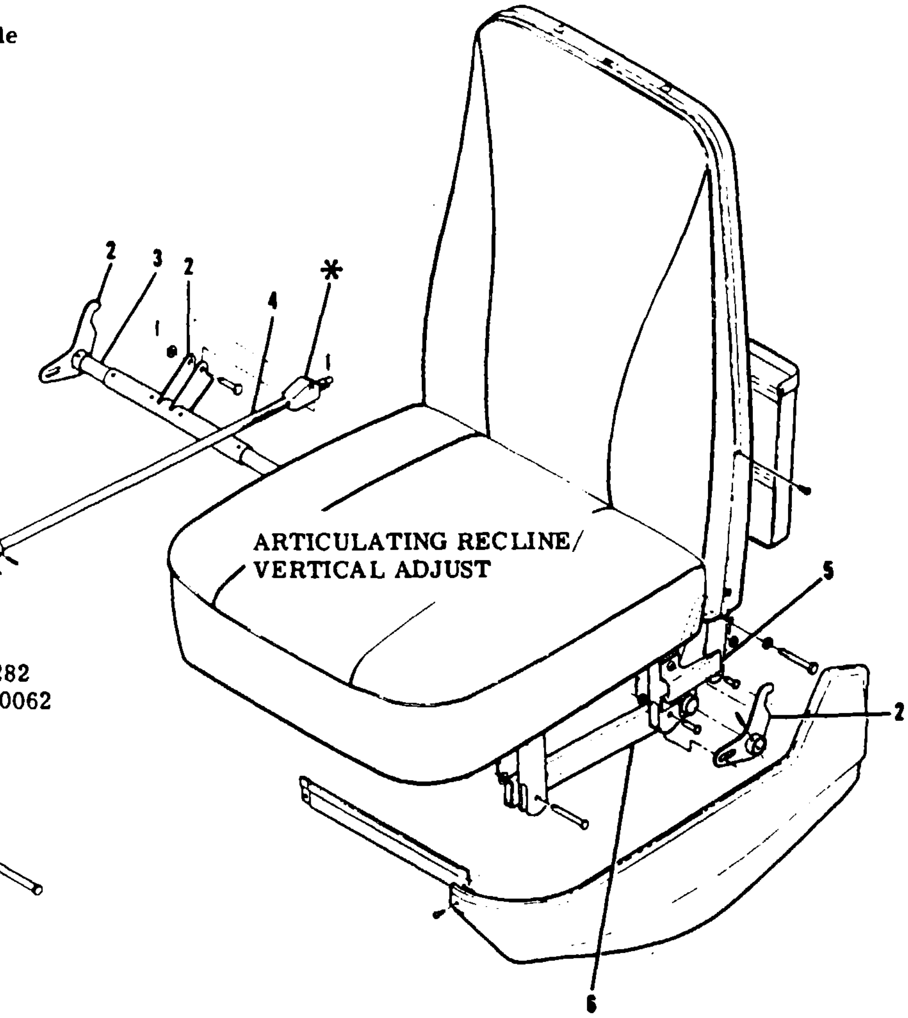
AIRCRAFT SERIALS THRU 177RG0282 AND F177RG0062

Figure 3-6. Seat Installation (Sheet 1 of 5)

## PILOT AND COPILOT SEAT

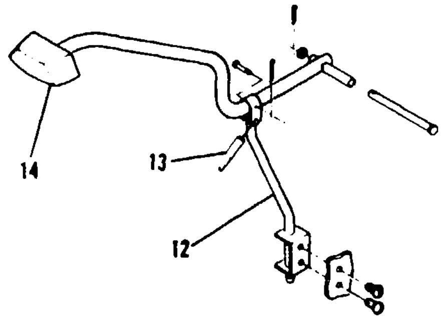
(OPTIONAL)

1. Articulating Adjustment Handle
2. Bellcrank
3. Torque Tube
4. Adjustment Screw
5. Trim Bracket
6. Bracket Assembly
7. Channel
8. Seat Structure
9. Bushing
10. Roller
11. Vertical Adjustment Handle
12. Fore/Aft Adjustment Pin
13. Spring
14. Fore/Aft Adjustment Handle

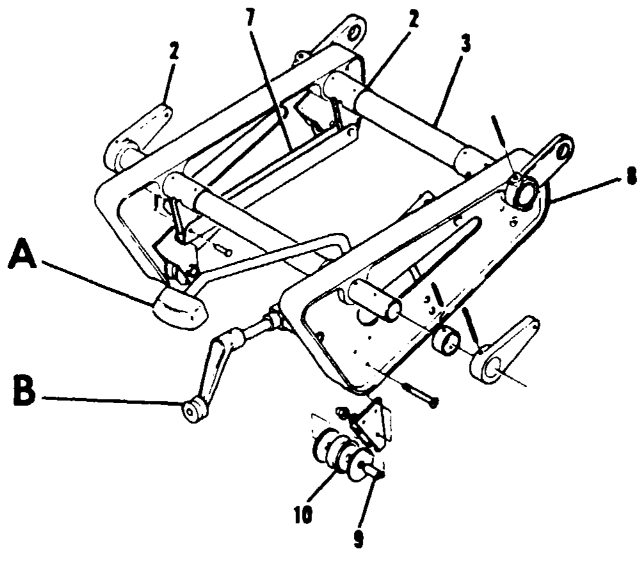


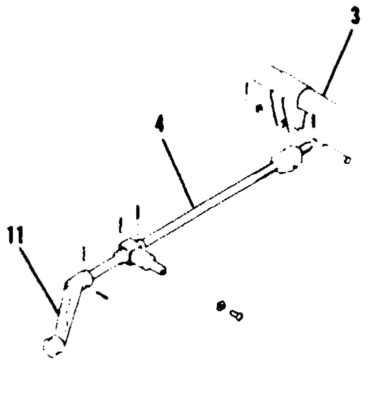

NOTE

* The nut on adjustment screw (4) is rotated 180° BEGINNING WITH 177RG0213 THRU 177RG0282 AND F177RG0043 THRU F177RG0062



Detail **A**

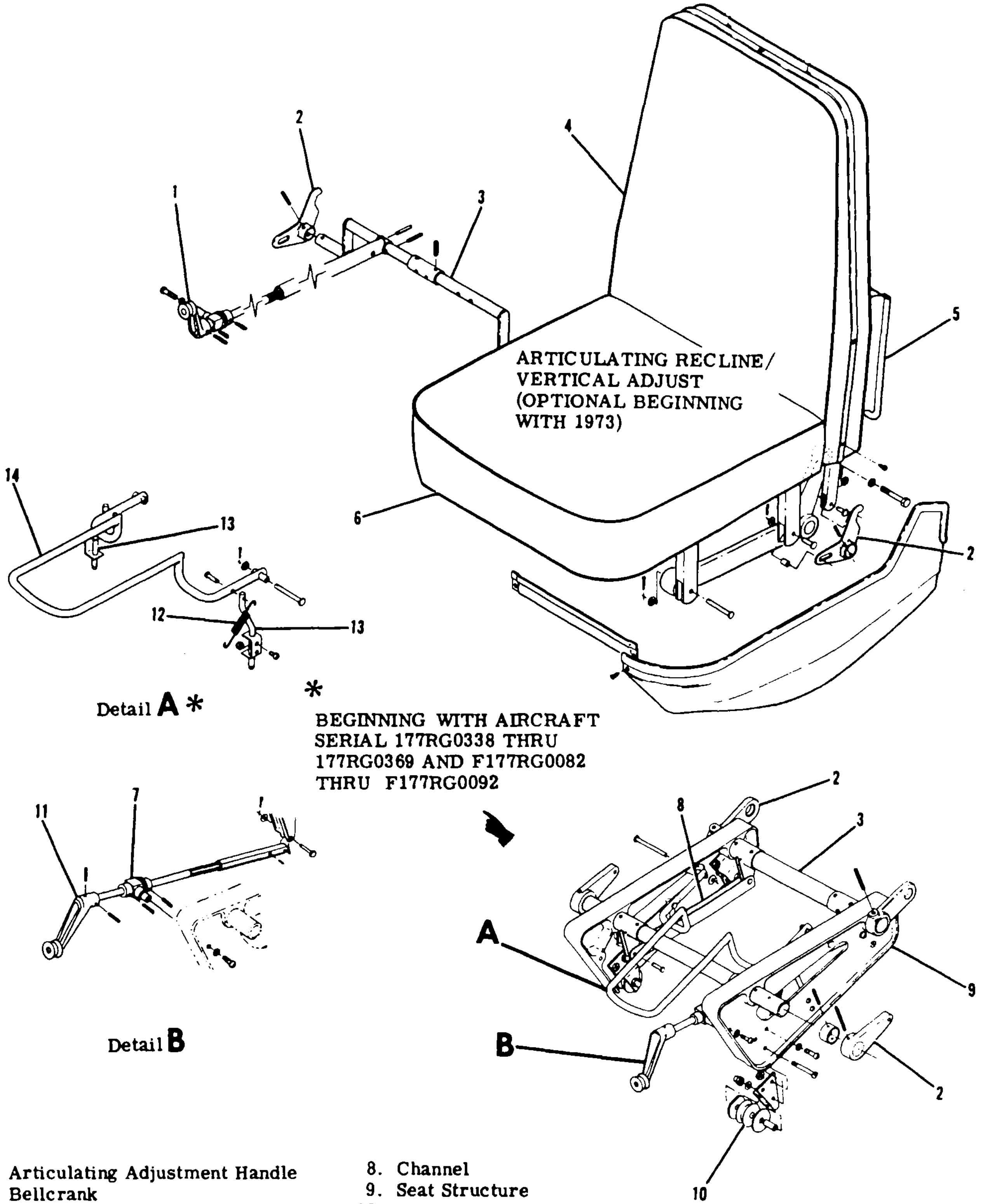


Detail **B**

Figure 3-6. Seat Installation (Sheet 2 of 5)

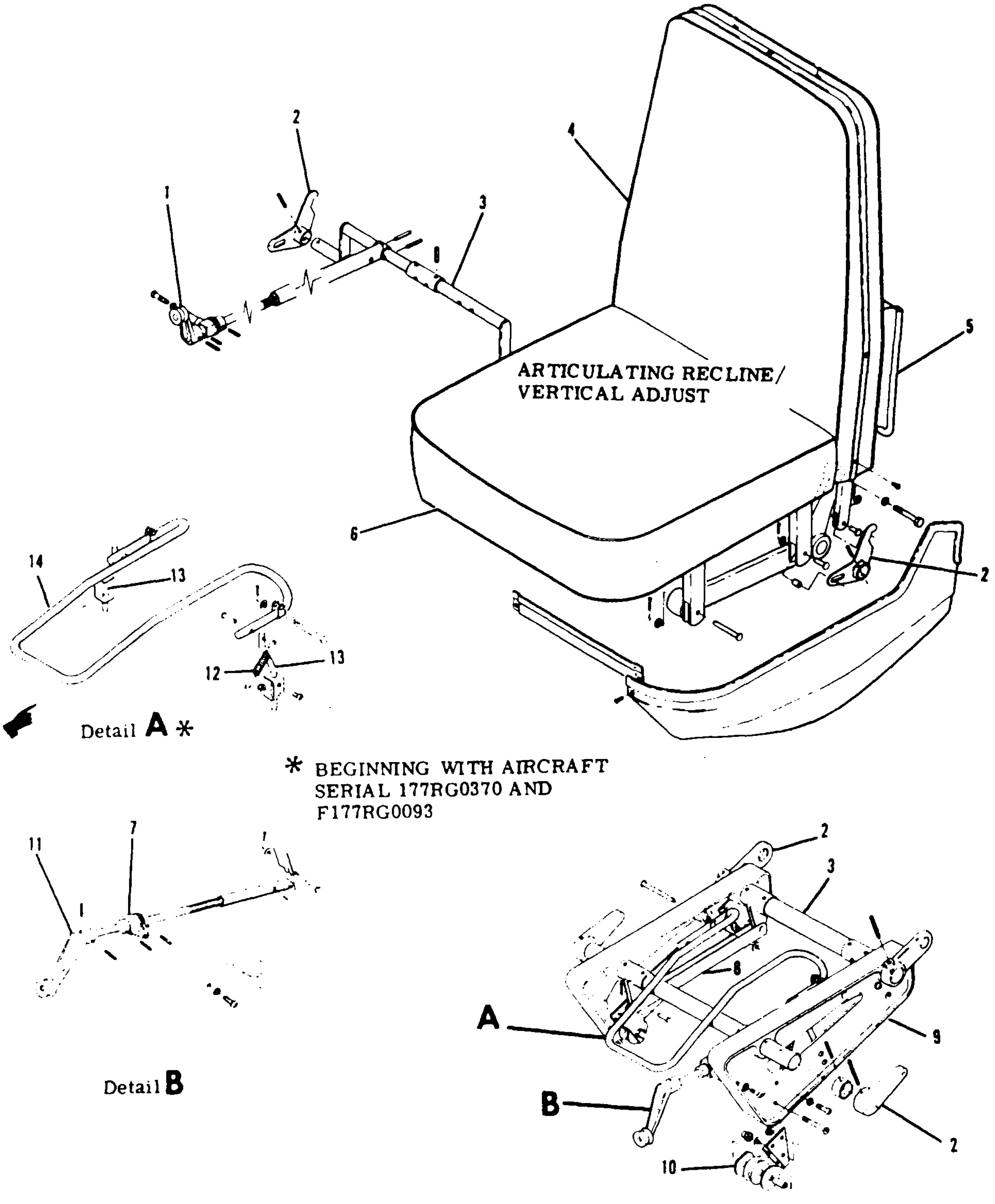
PILOT AND COPILOT SEATS




1. Articulating Adjustment Handle
2. Bellcrank
3. Torque Tube
4. Seat Back
5. Magazine Pocket
6. Seat Bottom
7. Bearing Block
8. Channel
9. Seat Structure
10. Roller
11. Vertical Adjustment Handle
12. Spring
13. Adjustment Pin
14. Fore/Aft Adjustment Handle

Figure 3-6. Seat Installation (Sheet 3 of 5)

PILOT AND COPILOT SEATS




1. Articulating Adjustment Handle
2. Bellcrank
3. Torque Tube
4. Seat Back
5. Magazine Pocket
6. Seat Bottom
7. Bearing Block
8. Channel
9. Seat Structure
10. Roller
11. Vertical Adjustment Handle
12. Spring
13. Adjustment Pin
14. Fore/Aft Adjustment Handle

Figure 3-6. Seat Installation (Sheet 4 of 5)

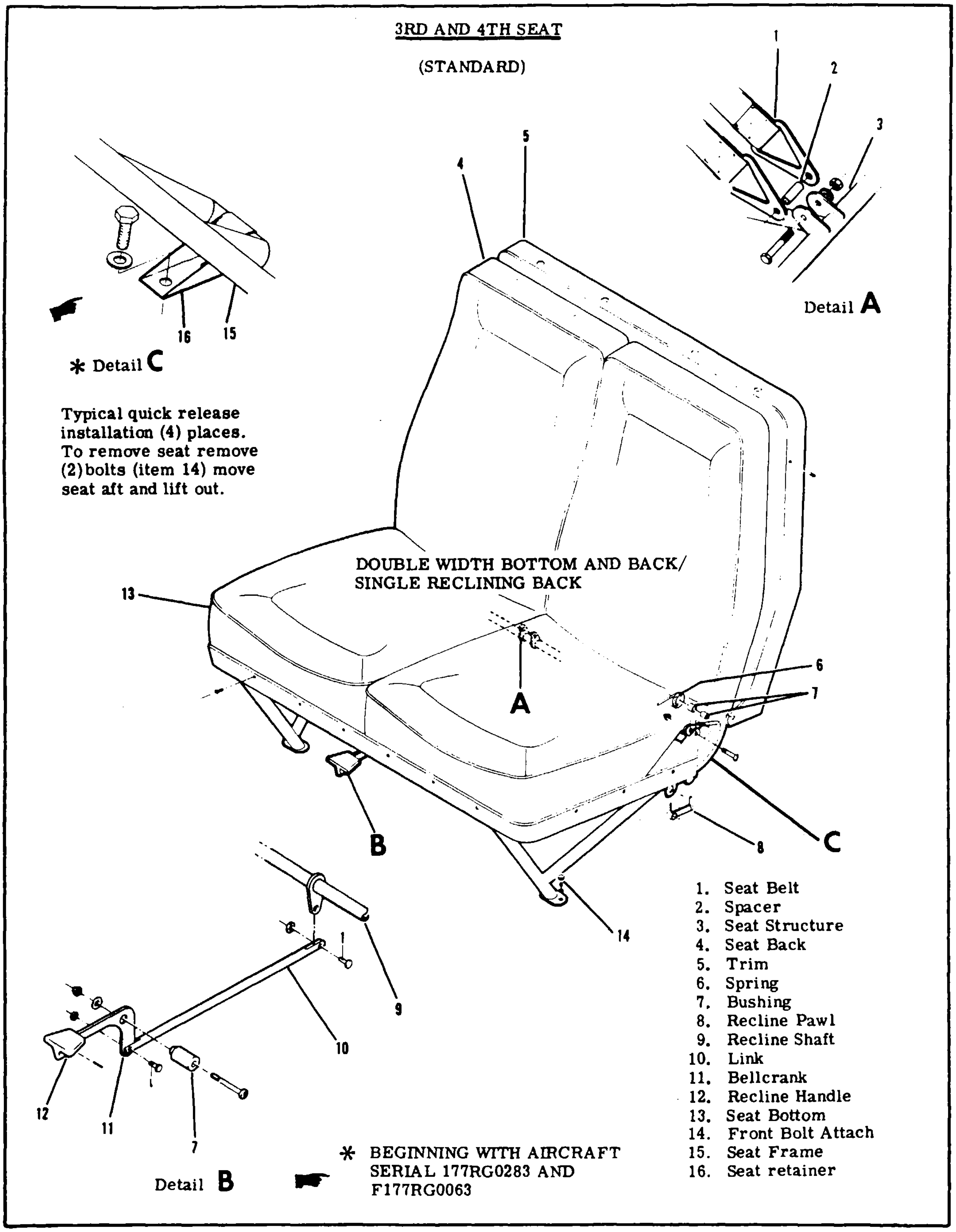



Figure 3-6. Seat Installation (Sheet 4 of 5)

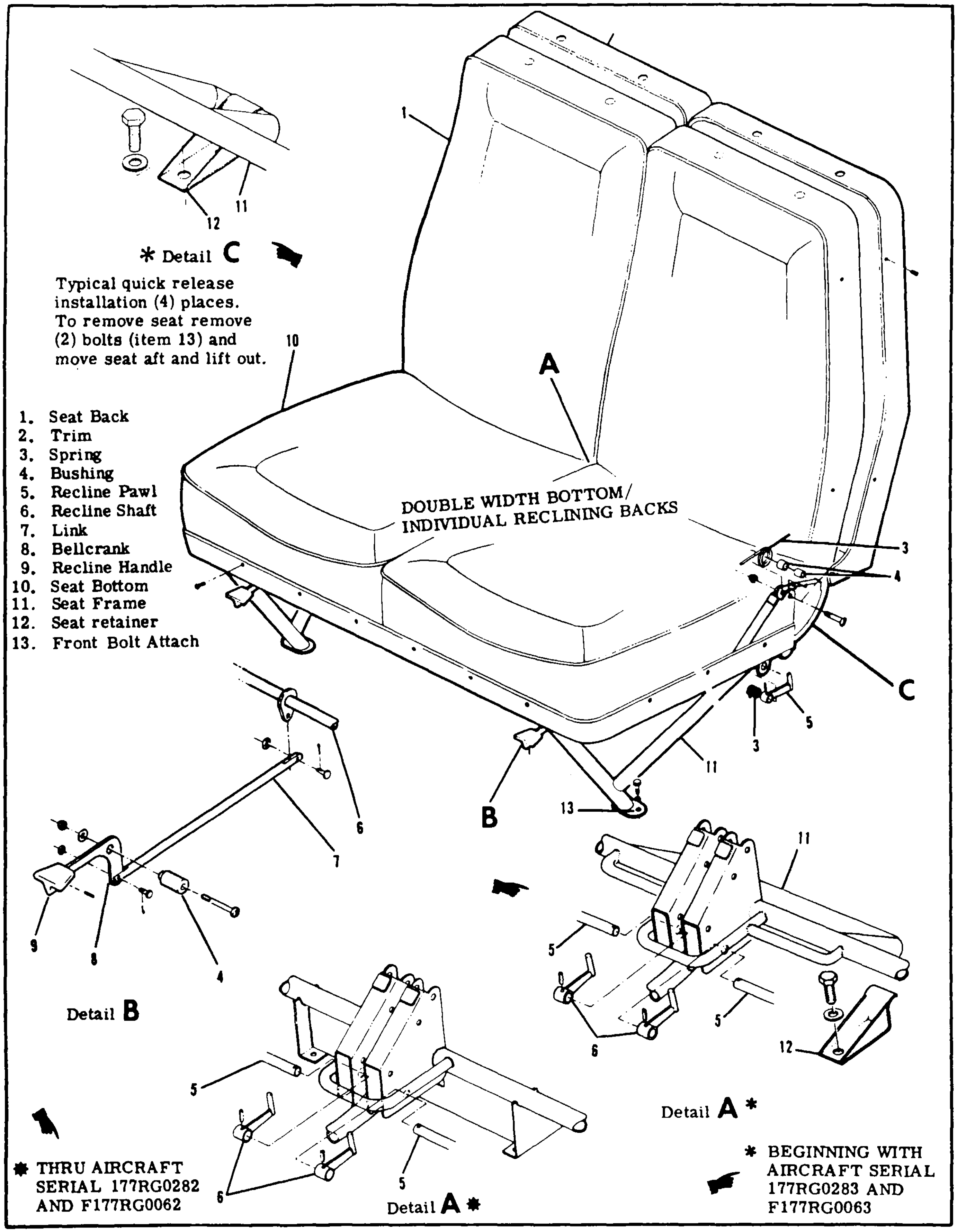
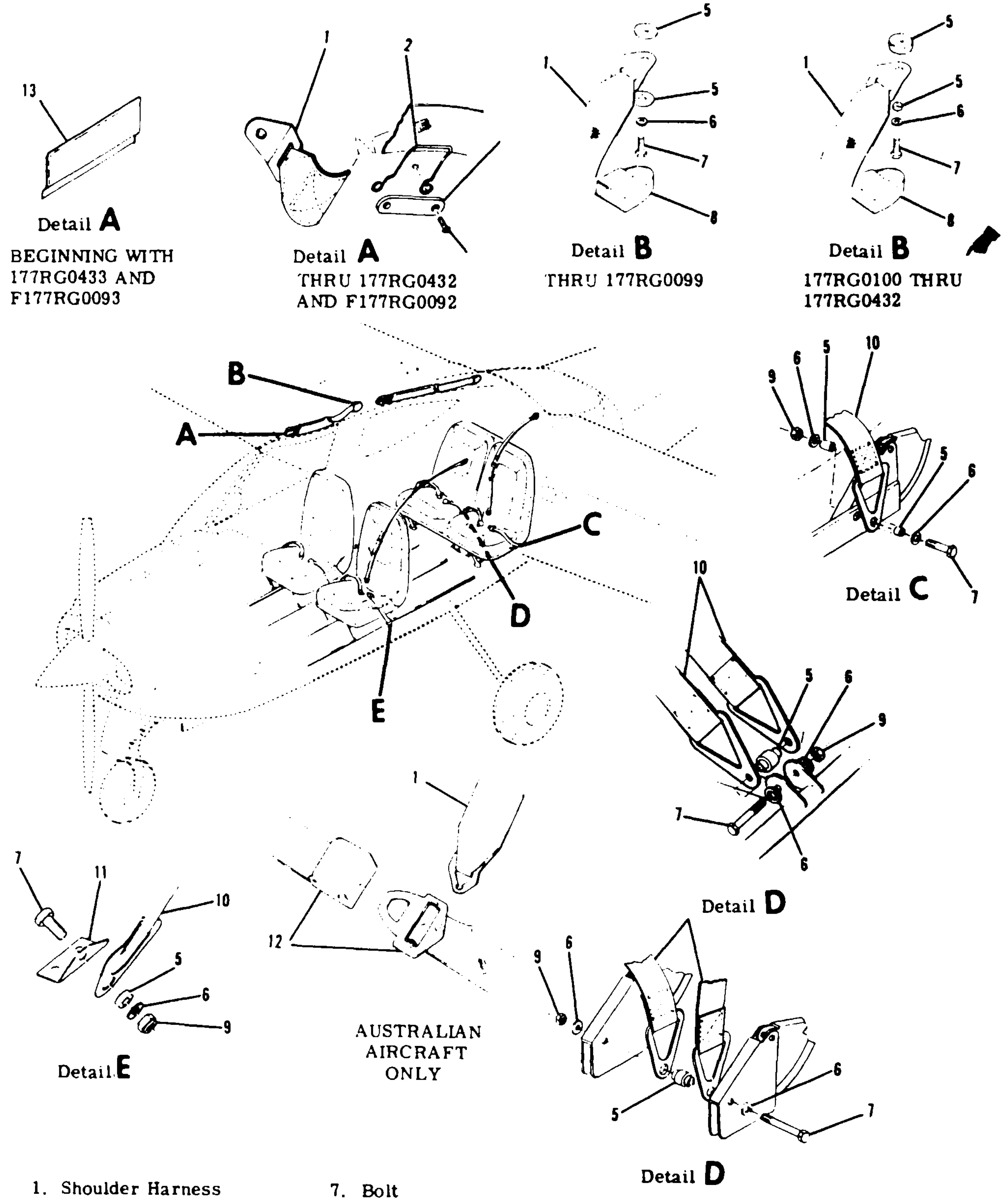



Figure 3-6. Seat Installation (Sheet 5 of 5)




1. Shoulder Harness
2. Clip
3. Cover
4. Screw
5. Spacer
6. Washer
7. Bolt
8. Cover
9. Nut
10. Seat Belt
11. Bracket
12. Quick-Disconnect
13. Storage Tray

NOTE

When installing seat belts be sure that the belt half with the buckle is installed on the inboard side of the seat.

Figure 3-7. Seat Belt and Shoulder Harness Installation (Sheet 1 of 2)

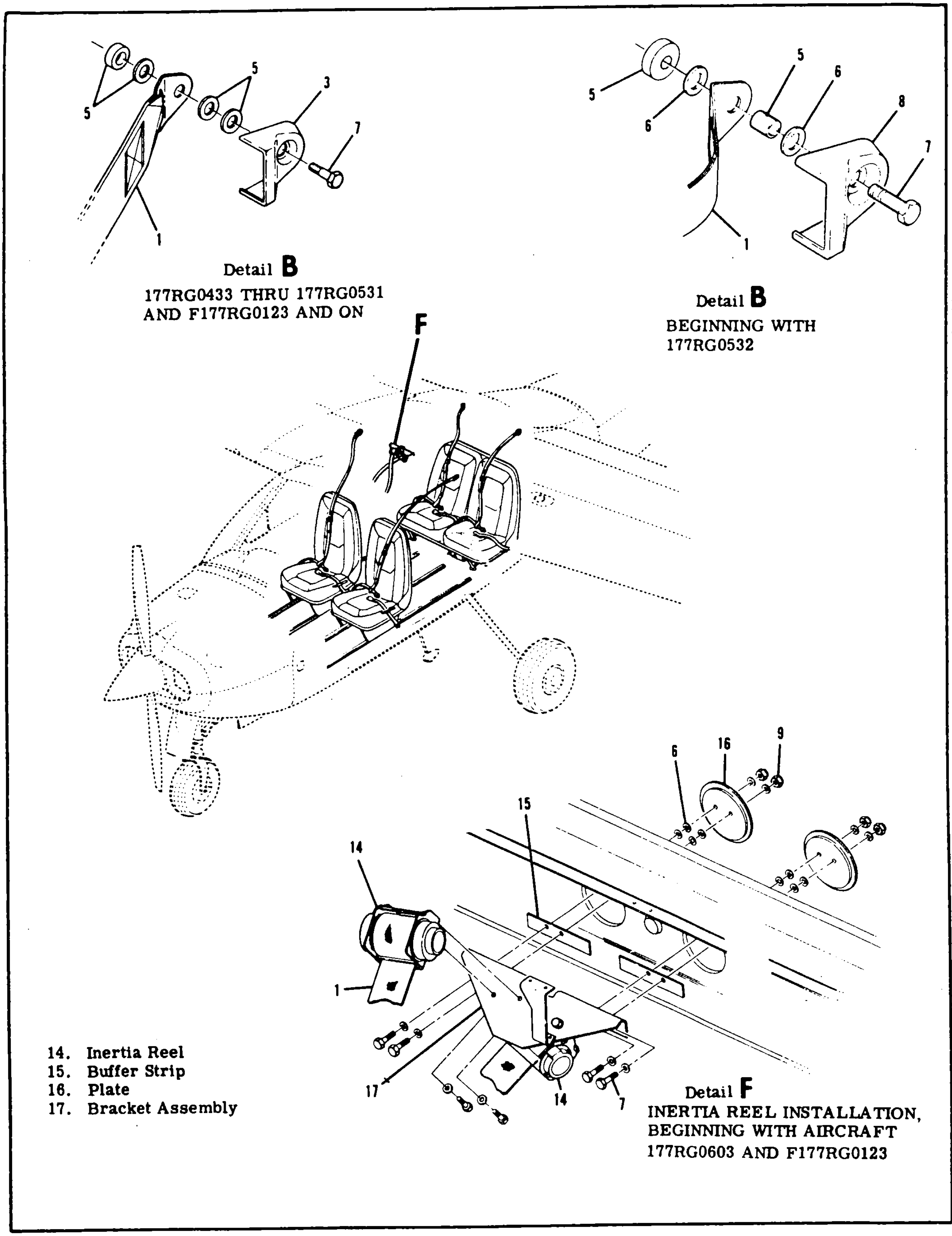
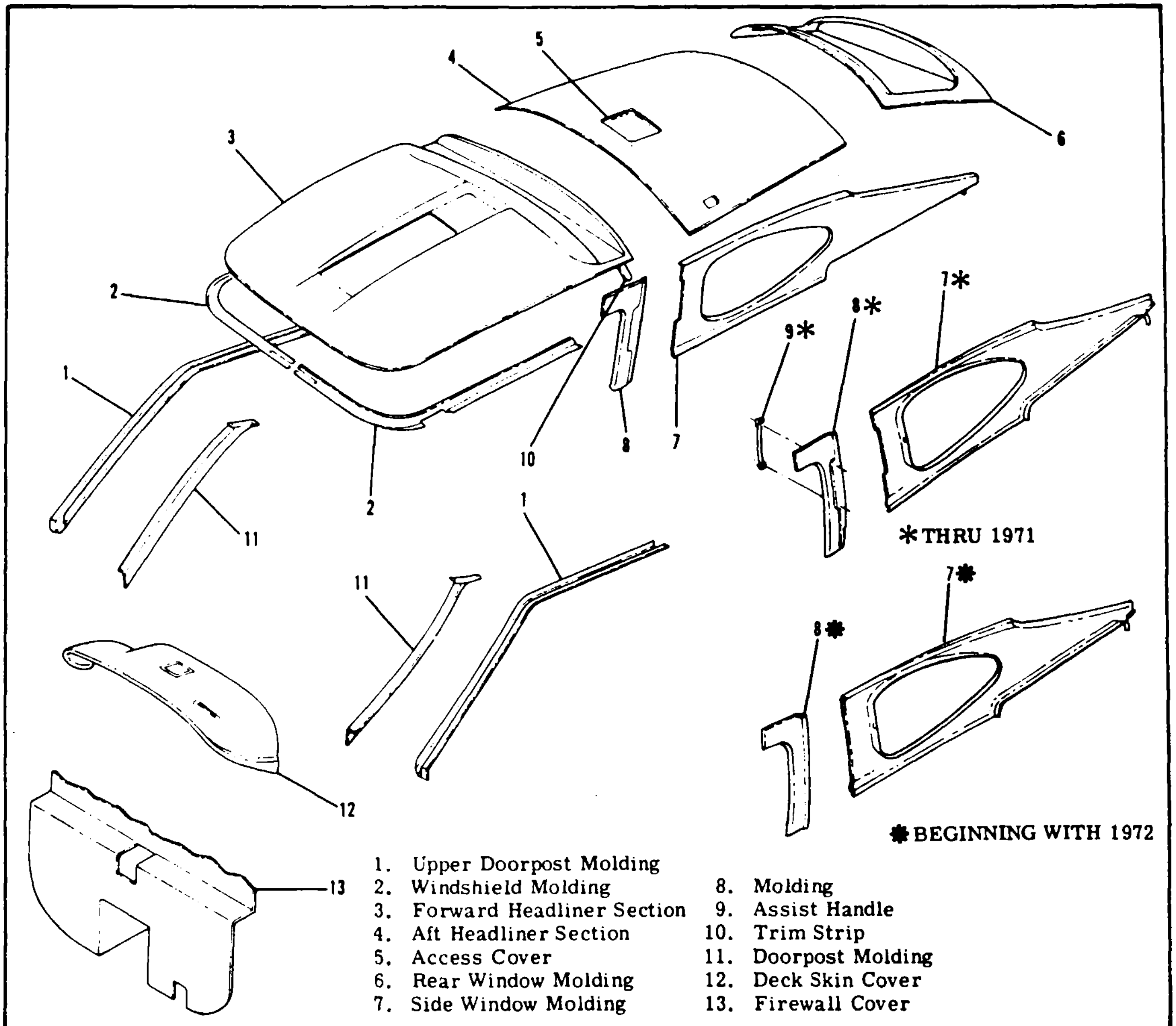



Figure 3-7. Seat Belt and Shoulder Harness Installation (Sheet 2 of 2)




1. Upper Doorpost Molding
2. Windshield Molding
3. Forward Headliner Section
4. Aft Headliner Section
5. Access Cover
6. Rear Window Molding
7. Side Window Molding
8. Molding
9. Assist Handle
10. Trim Strip
11. Doorpost Molding
12. Deck Skin Cover
13. Firewall Cover

Figure 3-8. Headliner Installation

3-35. DESCRIPTION. These seats are permanently bolted to the cabin structure and incorporate no adjustment provisions other than manually-adjustable three position backs.

3-36. REMOVAL AND INSTALLATION.

a. Remove bolts securing seat to cabin structure thru Aircraft Serial 177RG0282 and F177RG0062. Beginning with Aircraft Serial 177RG0283 and F177RG0063 remove the (2) two forward attach bolts and slide seat aft. (See figure 3-6.)

b. Lift seat out.

c. Reverse preceding steps for reinstallation.

3-37. REPAIR. Replacement of defective parts is recommended in repair of seats. However, a cracked framework may be welded, provided the crack is not in an area of stress concentration (close to a hinge or bearing point). The square-tube framework is 6061 aluminum, heat-treated to a T-6 condition. Use a heliarc weld on these seats, as torch welds will destroy heat-treatment of frame structure.

3-38. 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 the work must be done by a mechanic unfamiliar with upholstery practices, the mechanic should make careful notes during removal of each item to facilitate replacement later.

3-39. MATERIALS AND TOOLS. Materials and tools will vary with the 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

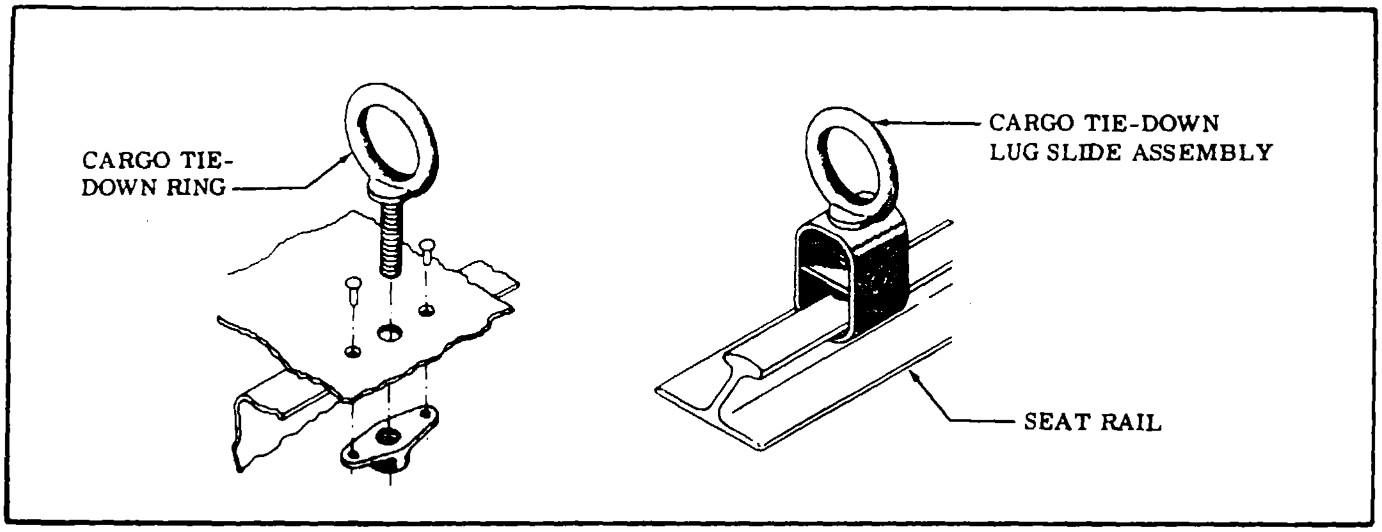



Figure 3-9. Cargo Tie-Downs

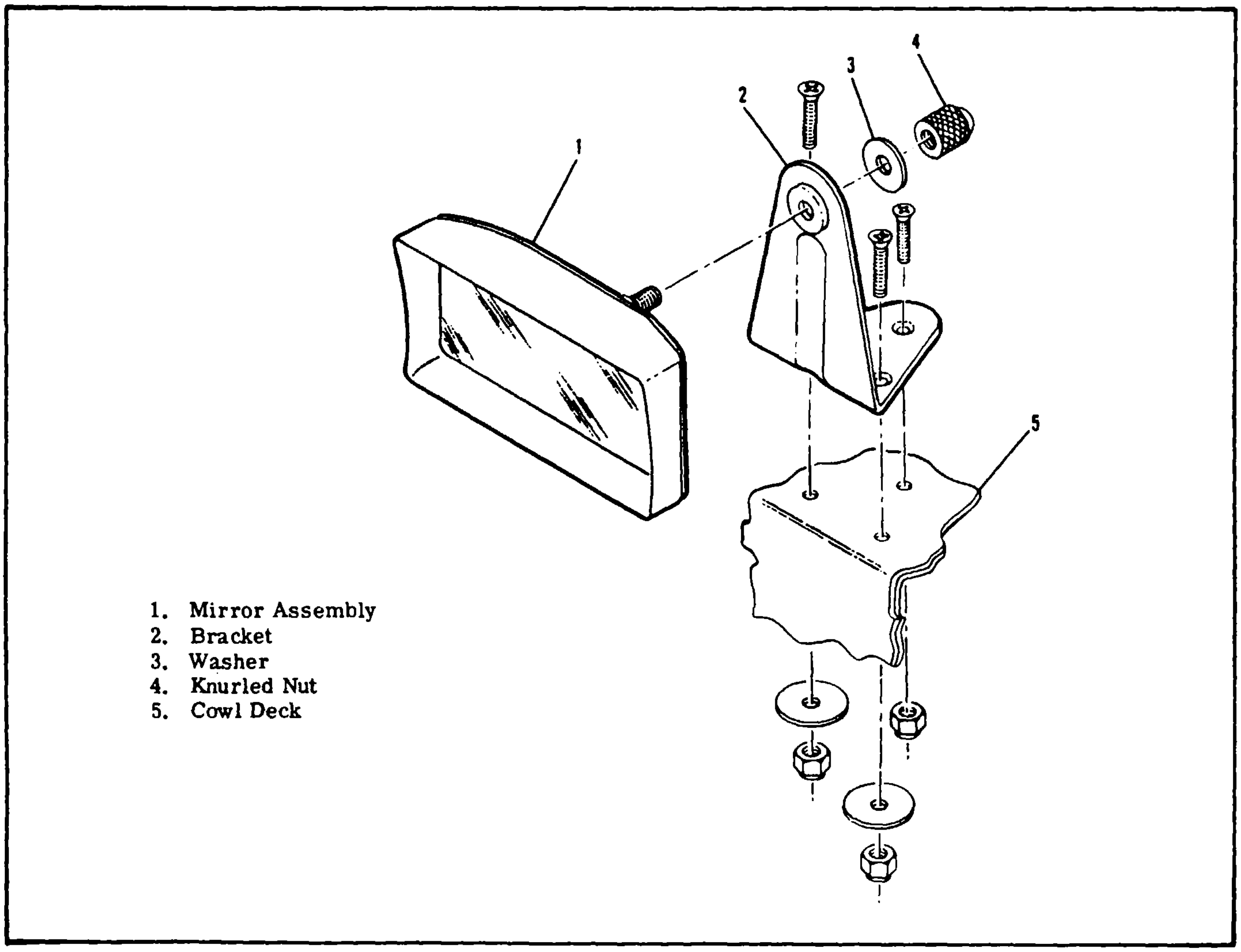



Figure 3-10. Rear View Mirror Installation

fabric edges in place. Refer to Section 17 for thermoplastic repairs.

3-40. SOUNDPROOFING. The aircraft is insulated with spun glass mat-type insulation and a sound deadener compound applied to inner surfaces of the skin in most areas of the 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 the gap between wing and fuselage and held in place by the wing root fairings.

3-41. CABIN HEADLINER. (Refer to figure 3-8.)

3-42. DESCRIPTION. The cabin headliner is constructed of closed-cell thermoformed plastic, installed in two sections. One section extends from aft of the main spar forward and the other section from the main spar aft. The headliner is held in place with sheet metal screws.

3-43. REMOVAL AND INSTALLATION.

a. Remove forward air inlet controls and overhead console.
b. Remove rear air inlet controls and escutcheons.
c. Remove access cover aft of main spar.
d. Remove molding from fixed windows and trim strip above windshield and doors.
e. Remove screws from the aft headliner section and carefully remove section.
f. Remove screws from the forward headliner section and carefully remove section.
g. Remove spun glass soundproofing panels.

NOTE

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

h. Reverse preceding steps for reinstallation. Before installation, check all items concealed by the headliner for security. Use wide cloth tape to secure loose wires to the fuselage and to seal the openings in the wing roots. Straighten any supports bent during removal of the headliner.

3-44. UPHOLSTERY SIDE PANELS. Removal of the upholstery side panels is accomplished by removing the seats for access, then removing the parts attaching panels. Remove screws, retaining strips, arm rests and ash trays as required to free the panels. Automotive type spring clips attach most door panels. A dull putty knife makes an excellent tool for prying the clips loose. When installing side panels, do not over-tighten 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.

3-45. DOOR MOLDING. To furnish an ornamental edging for the door opening and to provide additional sealing, windlaces are installed on the lower half of the door openings and a plastic molding is installed on the upper half.

3-46. CARPETING. Cabin area and baggage compartment carpeting is held in place by rubber cement, small sheet metal screws and retaining strips. Velcro hook, pile fasteners are used in the area under the front seats for access to inspection access covers. When fitting a new carpet, use the old one as a pattern for trimming and marking screw holes. Cargo tie-downs and/or safety belt brackets may be removed as necessary to aid in removal of carpeting.

3-47. SAFETY PROVISIONS.

3-48. CARGO TIE-DOWNS. Cargo tie-downs are used to ensure baggage cannot enter seating area during flight. Methods of attaching tie-downs are illustrated in figure 3-8. The eyebolt and nutplate can be located at various points. The sliding tie-down lug also utilizes the eyebolt and attaches to a seat rail. A baggage net may be installed using the cargo tie-downs.

3-49. SAFETY BELTS. (Refer to figure 3-7 for installation). Safety 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. The front seat safety belts are attached to clips bolted to the cabin floor and the center seat safety belts are attached to the seats themselves.

NOTE

The belt half with the buckle should be installed on the outboard side of the seat to ensure proper operation of the shoulder harness.

3-50. SHOULDER HARNESS. (Refer to figure 3-7 for installation). Individual shoulder harnesses may be installed for each seat. Each harness is connected to the upper fuselage structure and to the seat safety belt buckle. Component parts should be replaced as outlined in the preceding paragraph. Beginning with aircraft 177RG0603 and F177RG0123 an inertia reel installation may be installed as optional equipment. Refer to figure 3-7, sheet 2, for installation.

3-51. REAR VIEW MIRROR. A rear view mirror may be installed on the cowldeck above the instrument panel. Figure 3-9 shows details for the rear view mirror installation.

# SECTION 4

# WINGS AND EMPENNAGE

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## 4-1. WINGS AND EMPENNAGE.

### 4-2. WINGS (See figure 4-1.)

4-3. DESCRIPTION. Each wing is of all-metal construction with a single main spar, two fuel spars, formed ribs and stringers. The front fuel spar also serves as an auxiliary spar and provides the forward attachment point for the wing. An inboard section of the wing, forward of the main spar, is sealed to form an integral fuel bay area. Stressed skin is riveted to the spars, ribs and stringers to complete the structure. An all-metal, balanced aileron, flap, and a detachable wing tip are mounted on each wing assembly. The leading edge of the left wing is equipped with landing and taxi lights. 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 gap fairings and fillets.

b. Drain fuel from wing being removed.

c. Disconnect:

1. Electric wires at wing root disconnects.
2. Fuel lines at wing root.
3. Pitot line (left wing only) at wing root.
4. Cabin ventilator hoses at wing root.
5. Aileron carry-thru cable at turnbuckle in cabin area. Remove cable guards and/or pulleys as necessary to pull aileron cables into wing root area. Refer to figure 6-1 for aileron cable routing and turnbuckle location.

d. If right wing is being removed, disconnect flap cables at turnbuckles, and remove cable guards and/ or pulleys as necessary to pull flap cables into right 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. Then disconnect cable from wire and 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.

e. If left wing is being removed, disconnect flap cables at turnbuckles, and remove cable guards and/ or pulleys as necessary to pull flap cables into left wing root area. Disconnect flap follow-up control from follow-up control arm and pull control out of wing area. Disconnect electrical lead at flap motor quick-disconnect. Refer to figure 7-1 for flap cable routing, turnbuckle location, and details of flap system.

NOTE

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

f. Remove nut, washer and bolt attaching front fuel spar to fuselage.
g. Remove bolts, washers, and retainers that hold main spar dowel pins in position.
h. Support wing at inboard and outboard end, and remove dowel pins that attach main wing spar to fuselage. It is best to remove the top dowel pin first, then lower outboard end of wing before removing the bottom dowel pin.

NOTE

It may be necessary to use a long punch to drive out main wing spar attaching dowel pins, or to rock the wings slightly while removing the pins. Care must be used not to damage dowel pins, spar fittings, or spar carry-thru fittings as these are reamed holes and close tolerance dowel pins.

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 with wing tip low.
b. Install:
1. Dowel pins attaching main spar to fuselage. (Install bottom pin first, then rotate wing up and install top pin.)

NOTE

Refer to figure 4-1 for lubrication of dowel pins prior to installation.

2. Bolts, retainers, washers, and nuts that hold main spar attach dowel pins in position.
3. Front fuel spar attach bolt, washer and nut.
c. Route flap and aileron cables and make proper connections.
d. Connect.
1. Electrical wires at wing root disconnects.
2. Fuel lines at wing root.
3. Pitot line (if left wing is being installed).
4. Cabin ventilator hoses at wing root.
e. Rig aileron system (Section 6).
f. Rig flap system (Section 7).
g. Refuel wing tank and check all connections for leaks.
h. Check operation of navigation, courtesy and landing lights. (1972 Models landing lights are cowl mounted).
i. Check operation of fuel gage.
j. Install wing gap fairings and fillets.

NOTE

Be sure to install soundproofing panel in wing gap before replacing fairings.

k. Install all inspection plates, interior panels and upholstery.
l. Test operate flap and aileron systems.

4-7. ADJUSTMENT (CORRECTING "WING-HEAVY" CONDITION). If considerable control wheel pressure is required to keep the wings level in normal flight, a wing-heavy condition exists. Refer to Section 6 for adjustment of aileron tabs.

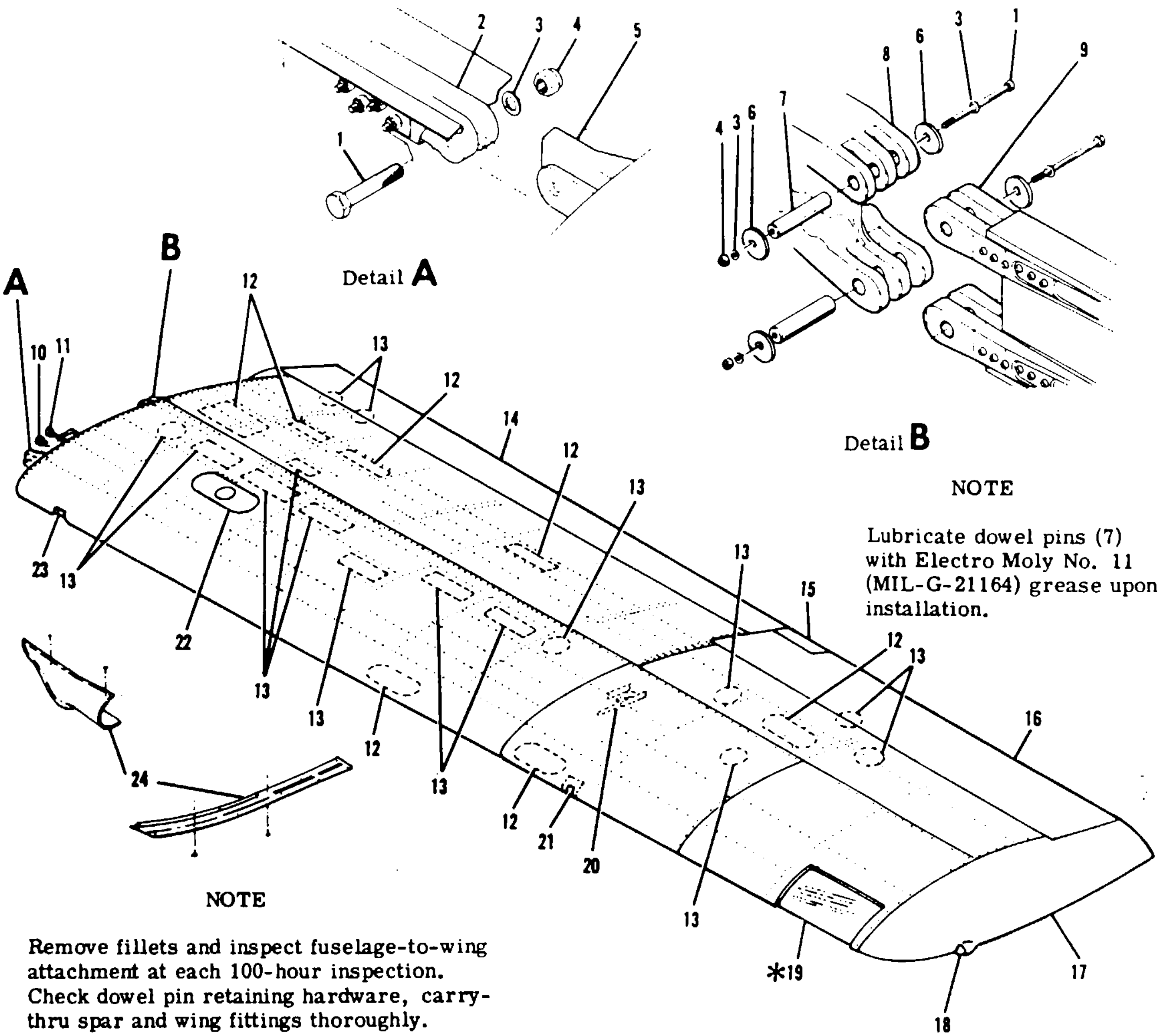
4-8. FIN. (See figure 4-2.)

4-9. DESCRIPTION. The fin is primarily of metal construction, consisting of ribs and spars, covered with skin. Fin tips are of glass fiber/ABS construction. Hinge brackets at the rear spar attach the rudder. Brackets containing rudder stop bolts are attached at the rear spar.

4-10. REMOVAL. The fin may be removed without first removing the rudder. However, for access and ease of handling, the rudder may be removed, following procedures outlined in Section 10.
a. Remove stabilator tab actuator arm and remove stinger.
b. Remove stabilator trim tab bellcrank.
c. Disconnect flashing beacon lead, tail navigation light lead, antennas and antenna leads, and rudder cables if rudder has not been removed.
d. Remove screws attaching dorsal to fuselage and fin and remove dorsal and dorsal fairing.
e. Remove bolts attaching fin rear spar to bulkhead, and remove bolts attaching bracket at fin front spar to fuselage.
f. Remove the fin.

4-11. REPAIR. Fin repair should be accomplished in accordance with applicable instructions outlined in Section 18.

4-12. INSTALLATION. Reverse the steps outlined in paragraph 4-10 to install the fin. Check and reset rudder and stabilator travel if any stop bolts were removed or settings disturbed.




NOTE

Lubricate dowel pins (7) with Electro Moly No. 11 (MIL-G-21164) grease upon installation.

NOTE

Remove fillets and inspect fuselage-to-wing attachment at each 100-hour inspection. Check dowel pin retaining hardware, carry-thru spar and wing fittings thoroughly.

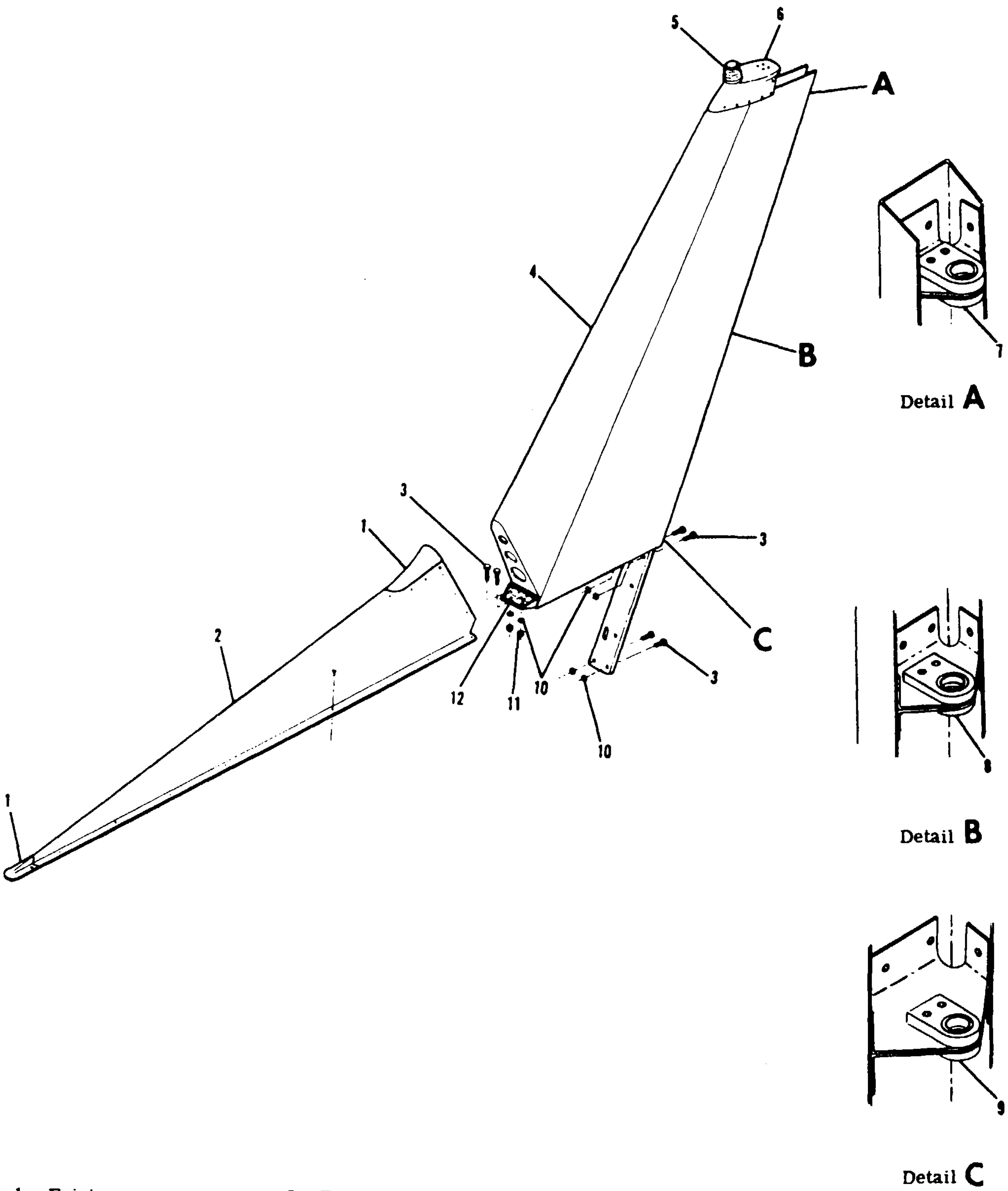
If there is damage to bushings in fittings (2) and (8), notify factory before anticipating replacement, as these are critical areas.

NOTE

* On 1972 Models landing and taxi lights are cowl mounted.

1. Bolt
2. Fwd Fuselage Fitting
3. Washer
4. Nut
5. Fwd Wing Fitting
6. Retainer
7. Dowel Pin
8. Aft Fuselage Fitting
9. Aft Wing Fitting
10. Fuel Vent Line
11. Fuel Line
12. Door
13. Plate
14. Flap
15. Aileron Tab
16. Aileron
17. Wing Tip
18. Position Light
19. Landing and Taxi Lights
20. Pitot Tube
21. Stall Warning Unit
22. Fuel Filler Door
23. Ram Air Inlet
24. Fairing

Figure 4-1. Wing Installation




1. Fairing
2. Dorsal
3. Bolt
4. Fin Assembly
5. Flashing Beacon
6. Fin Tip
7. Upper Rudder Hinge
8. Center Rudder Hinge
9. Lower Rudder Hinge
10. Washer
11. Nut
12. Attach Bracket

Figure 4-2. Vertical Fin

# SECTION 5

## LANDING GEAR, BRAKES AND HYDRAULIC SYSTEM

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## SHOP NOTES:

## 5-1. LANDING GEAR RETRACTION SYSTEM.

5-2. GENERAL DESCRIPTION. Retraction and extension of the landing gear is accomplished by a hydraulically-powered system, integrated with electrical circuits which help control and indicate the position of the gear. Retraction and extension of the gear utilizes a nose gear actuator and one main gear actuator which operates both main gears through a central sector gear arrangement. The nose gear doors are mechanically-operated. The doors are closed with the gear retracted and are open with the landing gear extended. The main gears have no doors. Hydraulic fluid is supplied to the landing gear actuating cylinders by an electrically-powered, reversible pump, located in the tailcone, just aft of the baggage compartment close out curtain. The hydraulic reservoir is an integral part of the pump. Thru aircraft serials 177RG0432 and F177RG0092, the pump is controlled by the gear control handle, mounted to the left of the engine controls, on the instrument panel. As the gear control handle is selected to either the up or down position, the pump directs fluid through the power pack control valve assembly, to the individual actuating cylinders. As the fluid pressure increases at one side of the actuating cylinder, fluid at the other side of the cylinder is directed back through the control valve assembly to the pump. The gear up or gear down lines serve either as pressure return lines, depending on rotation of the pump and position of the gear control handle to retract or extend the landing gear. Mechanical overcenter locks provide up and down locks for the nose gear. The main gear utilizes hydraulic pressure for positive uplock and electro-mechanical downlocks. On the control valve, through which pressure fluid passes during gear retraction, is a pressure switch. This switch opens the electrical circuit to the pump solenoid when the main gear fully retracts, and pressure in the system increases to approximately 1500 psi. The pressure switch will continue to hold the electrical curcuit open until pressure in the system drops to approximately 1100 psi, at which time the pump will again operate to build up pressure to approximately 1500 psi as long as the gear control handle is in the up position. With gear control handle in the down position, the pressure switch has no effect on the system. To prevent excessive pressure in the hydraulic system due to fluid expansion, a thermal relief valve will allow fluid to return to the reservoir. Other valves in the pump system, channel fluid to the proper outlets during gear retraction or extension. In the base of the pump is a shuttle valve that allows fluid displaced by the cylinder piston rods to return to the reservoir without back-pressure. An emergency hand pump, located between the pilot and copilot seats, is used to manually extend the gear in the event of normal hydraulic pump failure. When the hand pump is used to manually extend the landing gear, it activates valves within the normal hydraulic system to isolate and direct manual pressure for extension only. This creates a difference in pressure between the emergency and normal systems. A relief valve, located forward of the hand pump, must be pulled up for approximately five seconds to equalize pressure in the system after manual gear extension before the landing gear can be retracted with the normal hydraulic system. Beginning with aircraft serials 177RG0433 and F177RG0093, gear selection is accomplished manually, eliminating the need for the shuttle valve in the power pack. The relief valve is deleted. A check valve is included in the power pack. The check valve retains pressure in the gear UP position. The pilot shuttles the selector valve manually by changing the gear handle position. The selector valve is mounted in the pedestal below the instrument panel. The selector valve has operational pressure only during a cycle. At all other times, it has reservoir pressure. For emergency extension of the gear, the selector handle must be in the down position before the hand pump will energize the system. Between the selector valve and the main gear downlock actuator in the system, a lock valve and a pressure switch are installed. The lock valve is used in conjunction with the pressure switch to prevent gear recycling. The pressure switch opens the electrical circuit to the pump solenoid when the gear fully retracts, and pressure in the system increases to approximately 1500 psi. The pressure switch will continue to hold the electrical circuit open until pressure in the system drops to approximately 1100 psi, at which time the pump will again operate to build up pressure to approximately 1500 psi as long as the gear control handle is in the up position. With gear control handle in the down position, the pressure switch has no effect on the system. During a normal cycle, the gear locks up or down and the position indicator light illuminates to indicate completion of the cycle. Landing gear extended and locked can be detected by illumination of the gear DOWN indicator light, (green), and/or absence of a gear warning horn with the throttle retarded below 12-inches manifold pressure. Indication of gear retracted is provided by illumination of the gear UP (amber) light. The nose gear squat switch, actuated by the nose gear, electrically prevents inadvertent retraction whenever the nose gear strut is compressed by the weight of the aircraft.

## 5-3. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| LANDING GEAR FAILS TO RETRACT. | System pressure not equalized. | Pull pressure relief valve up for approximately ten seconds. |
| | Motor circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| | Indicator circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| | Motor circuit wires disconnected or broken. | Repair or replace wiring. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| LANDING GEAR FAILS TO RETRACT (Cont). | Indicator circuit wires disconnected or broken. | Repair or replace wiring. |
| | Nose gear squat switch inoperative. | Install new switch. |
| | Pressure switch defective. | Install new switch. |
| | Pump motor retract solenoid defective (upper solenoid). | Install new solenoid. |
| | Incomplete gear selector switch ground. | Check ground. |
| | Gear selector switch defective. | Install new switch. |
| | Incomplete pump motor ground. | Check ground. |
| | Pump motor defective. | Overhaul or install new pump motor. |
| | Reservoir fluid level below operating level. | Fill reservoir with hydraulic fluid. |
| | Battery low or dead. | Check battery condition. Install new battery. |
| GEAR RETRACTION OR EXTENSION EXTREMELY SLOW. | Reservoir fluid level below operating level. | Fill reservoir with hydraulic fluid. |
| | Restrictor valve or insert screens restricted. | Remove and clean restrictor valve and insert screens. |
| | Shuttle valve sticking in control valve assembly. | Remove and clean control valve assembly. |
| | Restriction in hydraulic lines. | Isolate and remove restrictions. |
| PUMP MOTOR STOPS BEFORE GEAR IS RETRACTED. | Motor circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| | Indicator circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| | Pressure switch out of adjustment. | Remove, adjust, or install new switch. |
| | Shuttle valve sticking in control valve assembly. | Remove and clean control valve assembly. |
| | Restriction in hydraulic system allowing pressure to build up and shut off pump motor before gear is retracted. | Isolate and determine cause. Remove restriction. |
| PUMP MOTOR STOPS BEFORE GEAR IS EXTENDED. | Motor circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |

TROUBLE SHOOTING (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
| --- | --- | --- |
| PUMP MOTOR STOPS BEFORE GEAR IS EXTENDED (Cont). | Indicator circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| PUMP MOTOR CONTINUES TO RUN AFTER GEAR IS FULLY RETRACTED. | Pressure switch defective. | Install new switch. |
| | Pressure switch out of adjustment. | Remove, adjust, or install new switch. |
| | Pump motor retract solenoid sticking (upper solenoid). | Install new solenoid. |
| | Internal leakage in system. | Check gear actuators for internal leakage. Repair or install new actuators. |
| | | Check for internal damage in Power Pack and control valve assembly. |
| | External system leakage. | Check all lines and hose for leakage. Repair or install new parts. |
| | Power Pack relief valve out of adjustment. | Replace Power Pack. |
| PUMP MOTOR CONTINUES TO RUN AFTER GEAR IS FULLY EXTENDED. | Pump motor extend solenoid sticking (lower solenoid). | Install new solenoid. |
| | Down-shutoff solenoid sticking. | Install new solenoid. |
| | Nose or main gear downlock switch out of adjustment. | Adjust switches. |
| | Nose or main gear downlock switch defective. | Install new switches. |
| PUMP MOTOR CYCLES EXCESSIVELY AFTER GEAR IS RETRACTED. | Pressure switch out of adjustment. | Remove, adjust, or install new switch. |
| | Gear up check valve leakage. | Remove Power Pack, install new valve or install new Power Pack. |
| | Internal leakage in system. | Check gear actuator for internal leakage. Repair or install new actuator.<br><br>Check for internal damage in Power Pack and control valve assembly. Install new units. |
| | External system leakage. | Check all lines and hose for leakage. Repair or install new parts. |

TROUBLE SHOOTING (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| GEAR DOES NOT FULLY RETRACT, BUT PUMP MOTOR CONTINUES TO RUN. | Pump high pressure relief valve out of adjustment. | Remove Power Pack, disassemble, and adjust relief valve, or install new Power Pack. |
| | Internal leakage in system. | Check gear actuator for internal leakage. Repair or install new actuators. |
| | | Check for internal damage in Power Pack and control valve assembly. Install new units. |
| | Reservoir fluid level below operating level. | Fill reservoir with hydraulic fluid. |
| LANDING GEAR FAILS TO EXTEND. | Motor circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| | Indicator circuit breaker open. | Reset circuit breaker. Determine cause of blown circuit breaker. |
| | Motor circuit wires disconnected or broken. | Repair or replace wiring. |
| | Pump motor extend solenoid defective (lower solenoid). | Install new solenoid. |
| | Incomplete gear selector switch ground. | Check ground. |
| | Gear selector switch defective. | Install new switch. |
| | Incomplete pump motor ground. | Check ground. |
| | Pump motor defective. | Overhaul or install new pump motor. |
| | Reservoir fluid level below operating level. | Fill reservoir with hydraulic fluid. |
| | Battery low or dead. | Check battery condition. Install new battery. |
| | Pressure in hand pump lines. | Pull hand pump relief valve. |

If it is found that the Power Pack is at fault and requires disassembly, it is recommended that it be overhauled by a recommended overhaul shop. However, if this cannot be achieved, minor repairs of the pump, such as replacement of gaskets and pump motor components, and pressure checks with adjustments, may be accomplished in accordance with procedures outlined in paragraphs 5-5 thru 5-11.

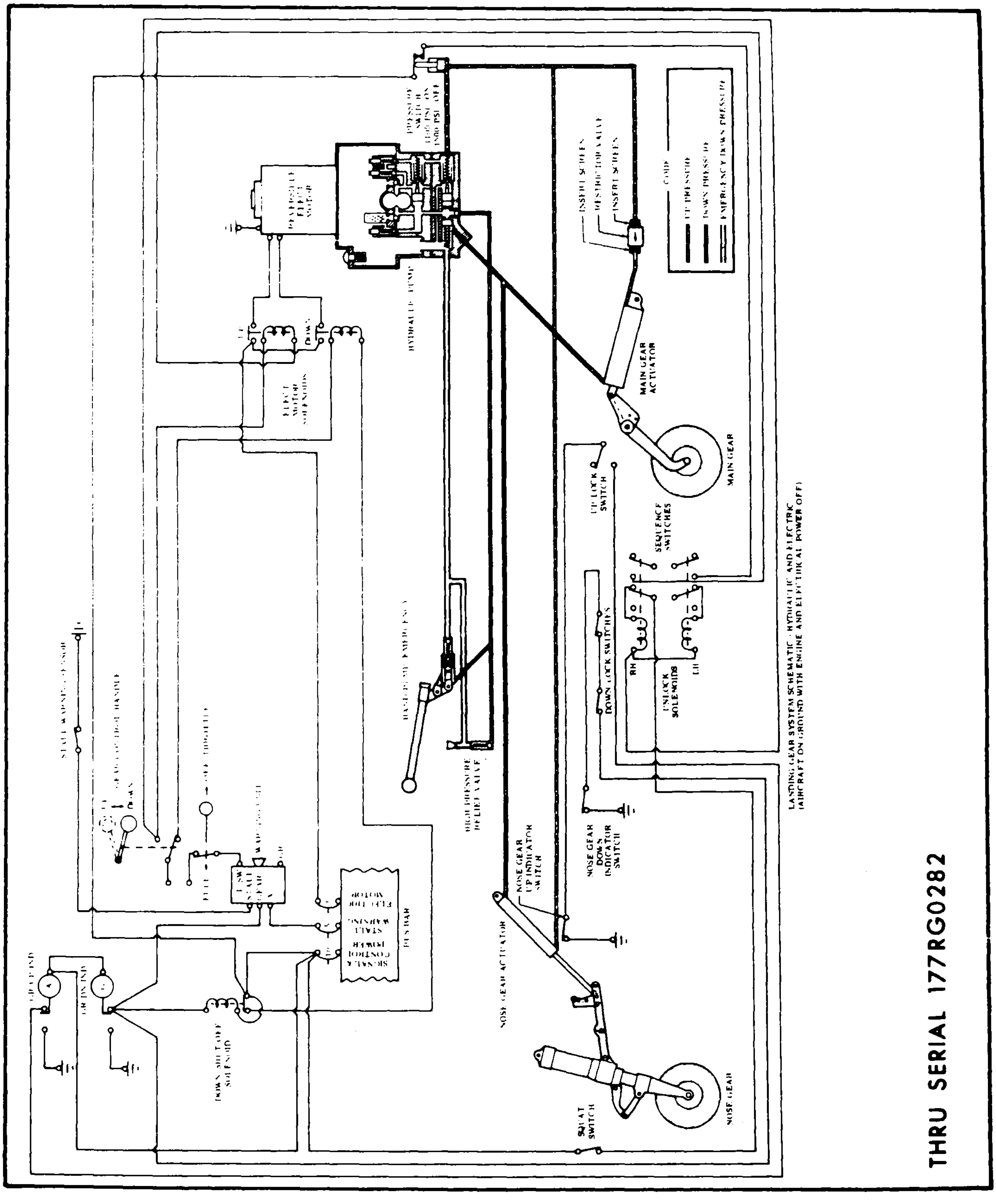
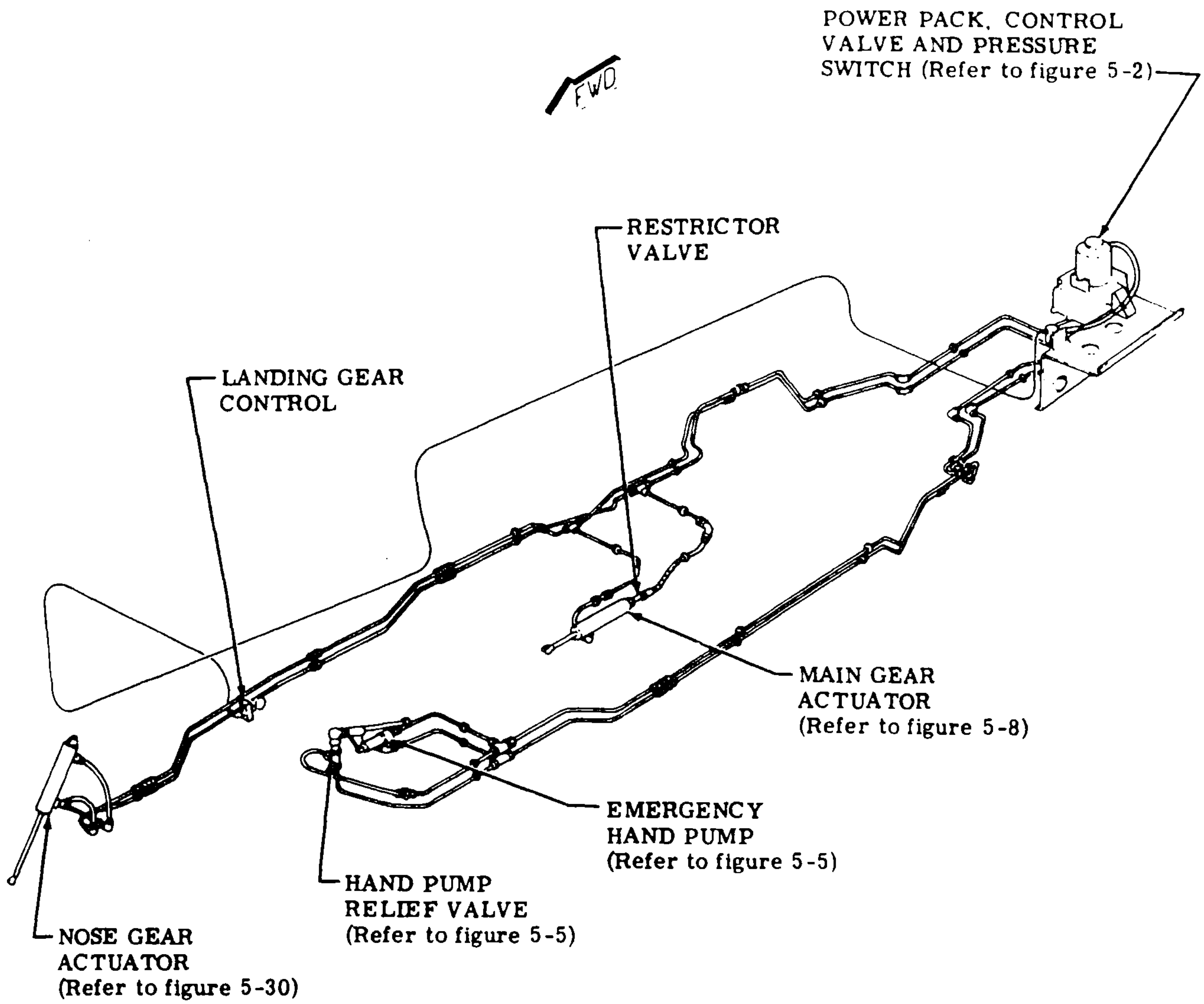



Figure 5-1. Hydraulic System (Sheet 1 of 7)

5-4. POWER PACK. The power pack, located in the tailcone, aft of the baggage compartment curtain, is a multi-purpose unit. It contains a hydraulic reservoir, valves which control flow of pressurized fluid to actuators, and the electrically-driven reversible motor and pump. An emergency hand pump, located between the pilot and copilot seats, uses reservoir fluid to permit extension of the landing gear if the hydraulic pump should fail.

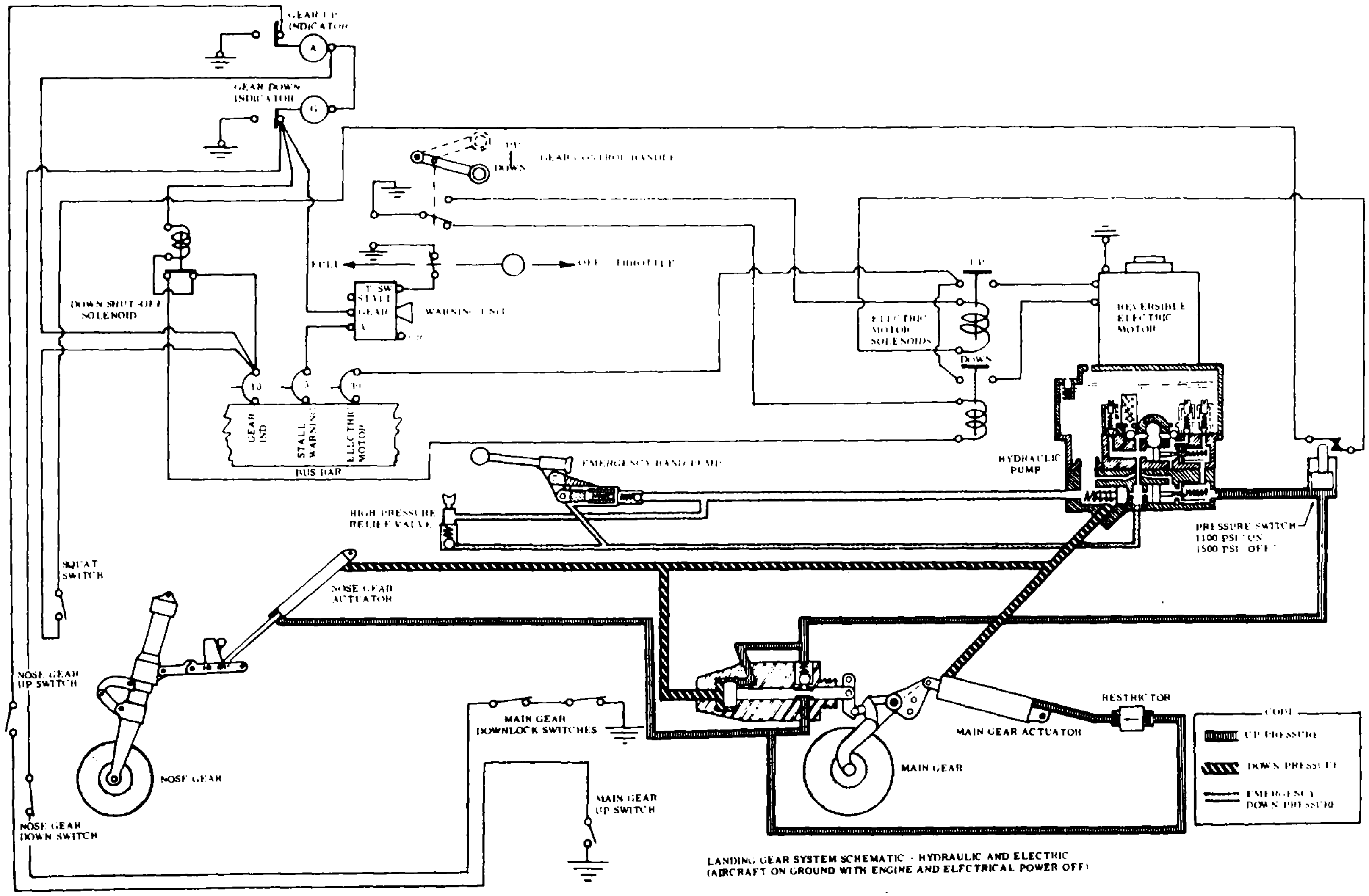



NOTE

Refer to sheet 1 for related hydraulic system schematic.

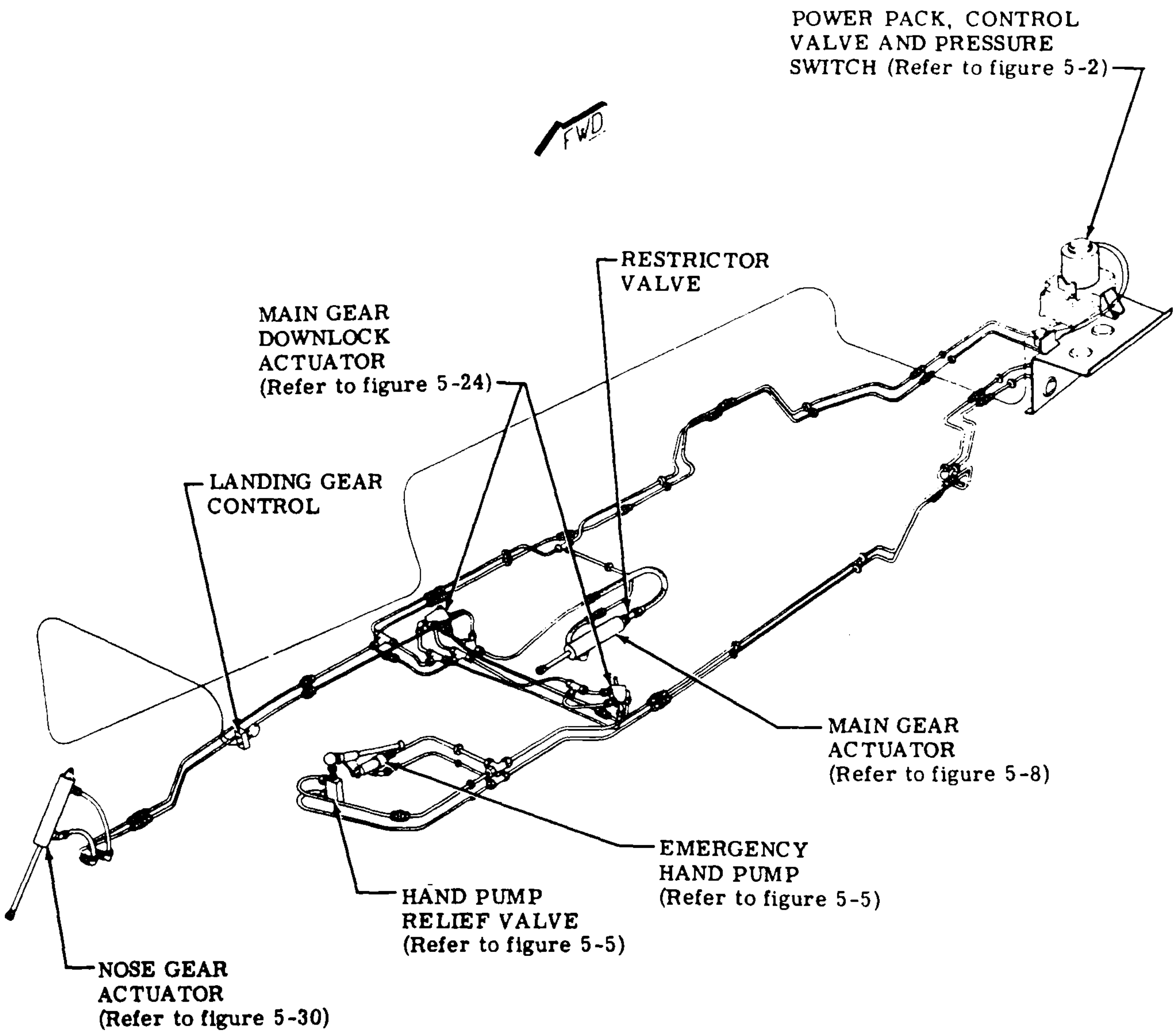
THRU SERIAL 177RG0282

Figure 5-1. Hydraulic System (Sheet 2 of 7)




SERIAL 177RG0283 THRU SERIAL 177RG0432

Figure 5-1. Hydraulic System (Sheet 3 of 7)

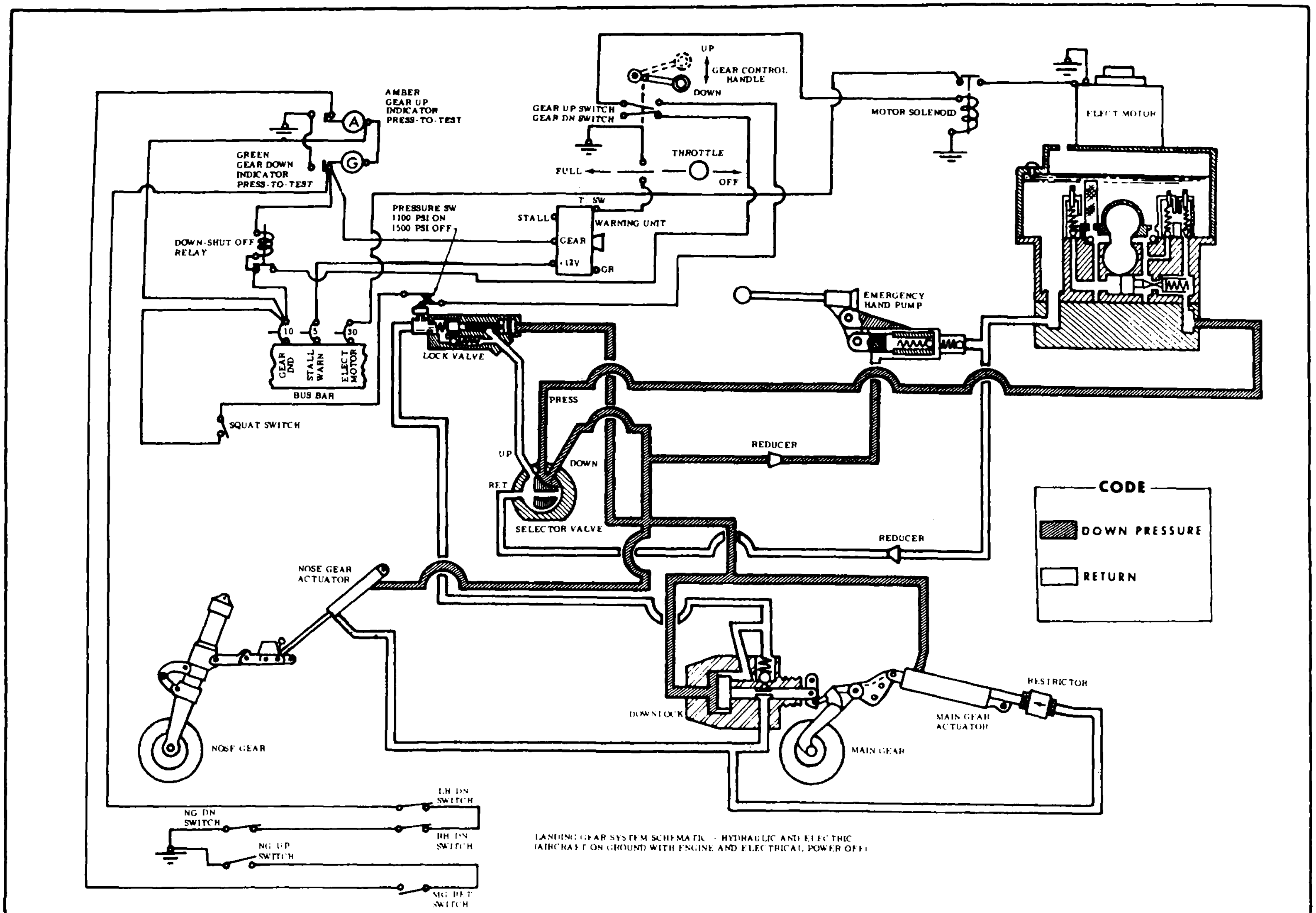



NOTE

Refer to sheet 3 for related hydraulic system schematic.

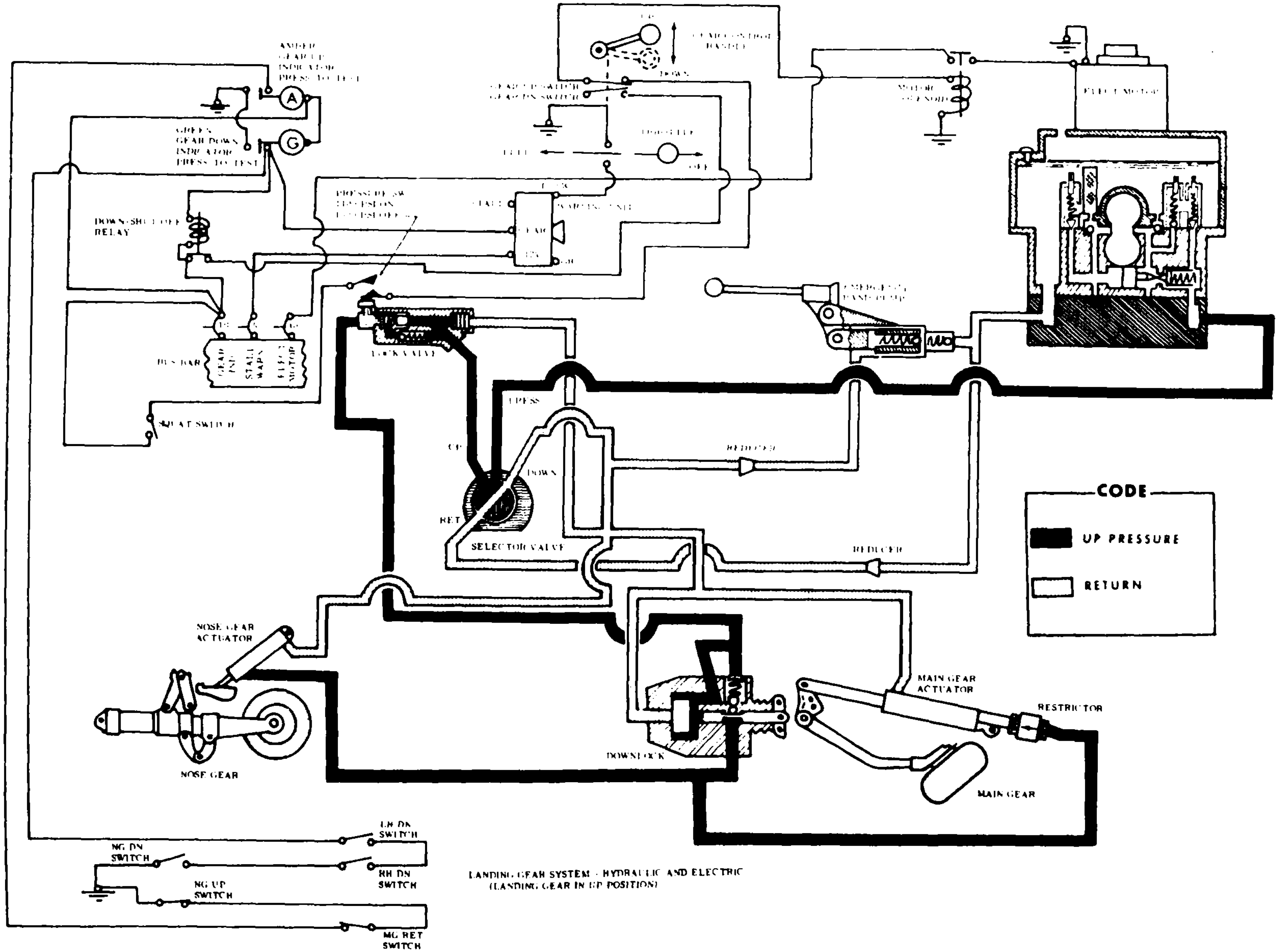
SERIAL 177RG0283 THRU SERIAL 177RG0432

Figure 5-1. Hydraulic System (Sheet 4 of 7)



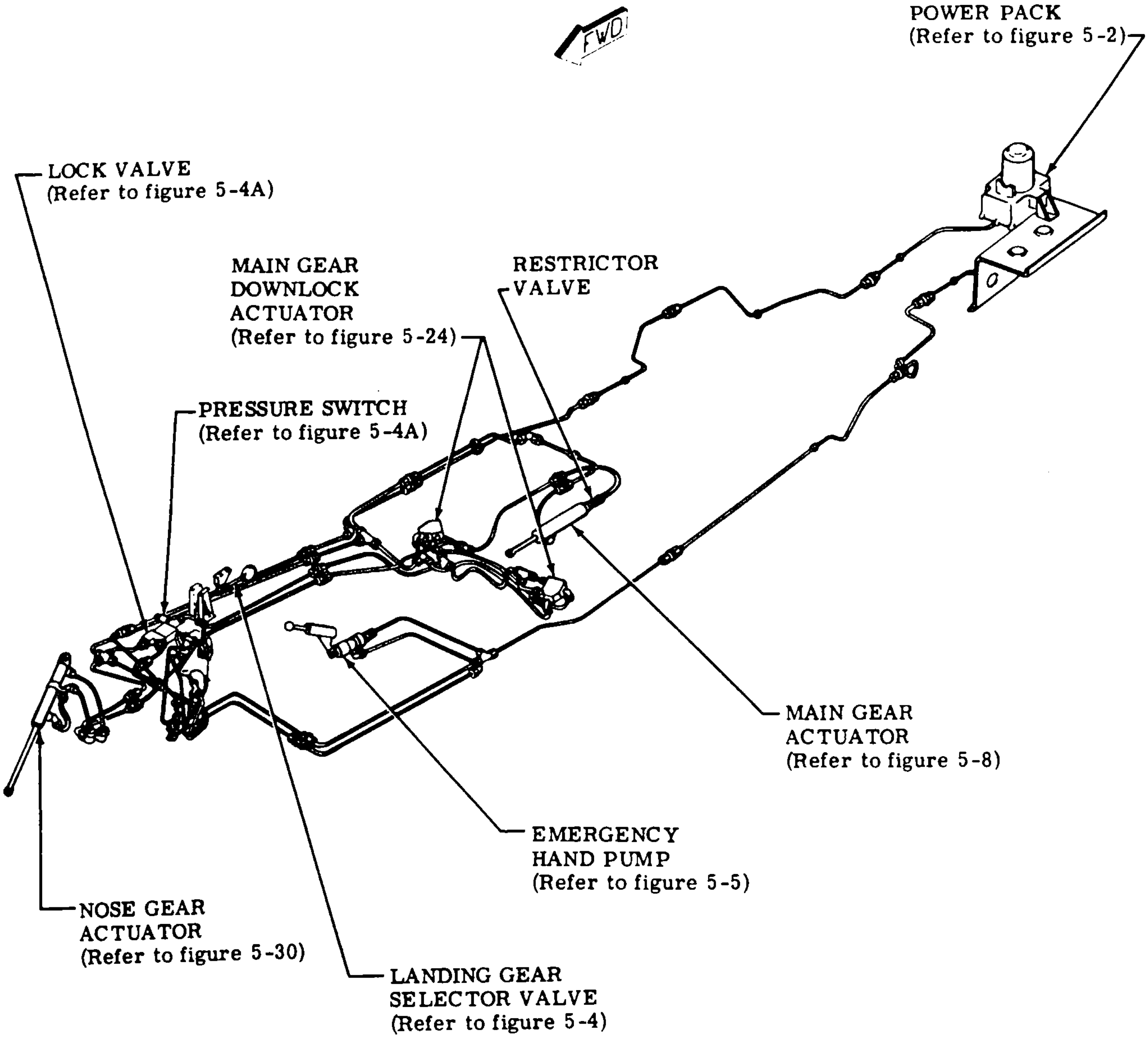

BEGINNING WITH SERIAL 177RG0433

Figure 5-1. Hydraulic System (Sheet 5 of 7)




BEGINNING WITH SERIAL 177RG0433

Figure 5-1. Hydraulic System (Sheet 6 of 7)

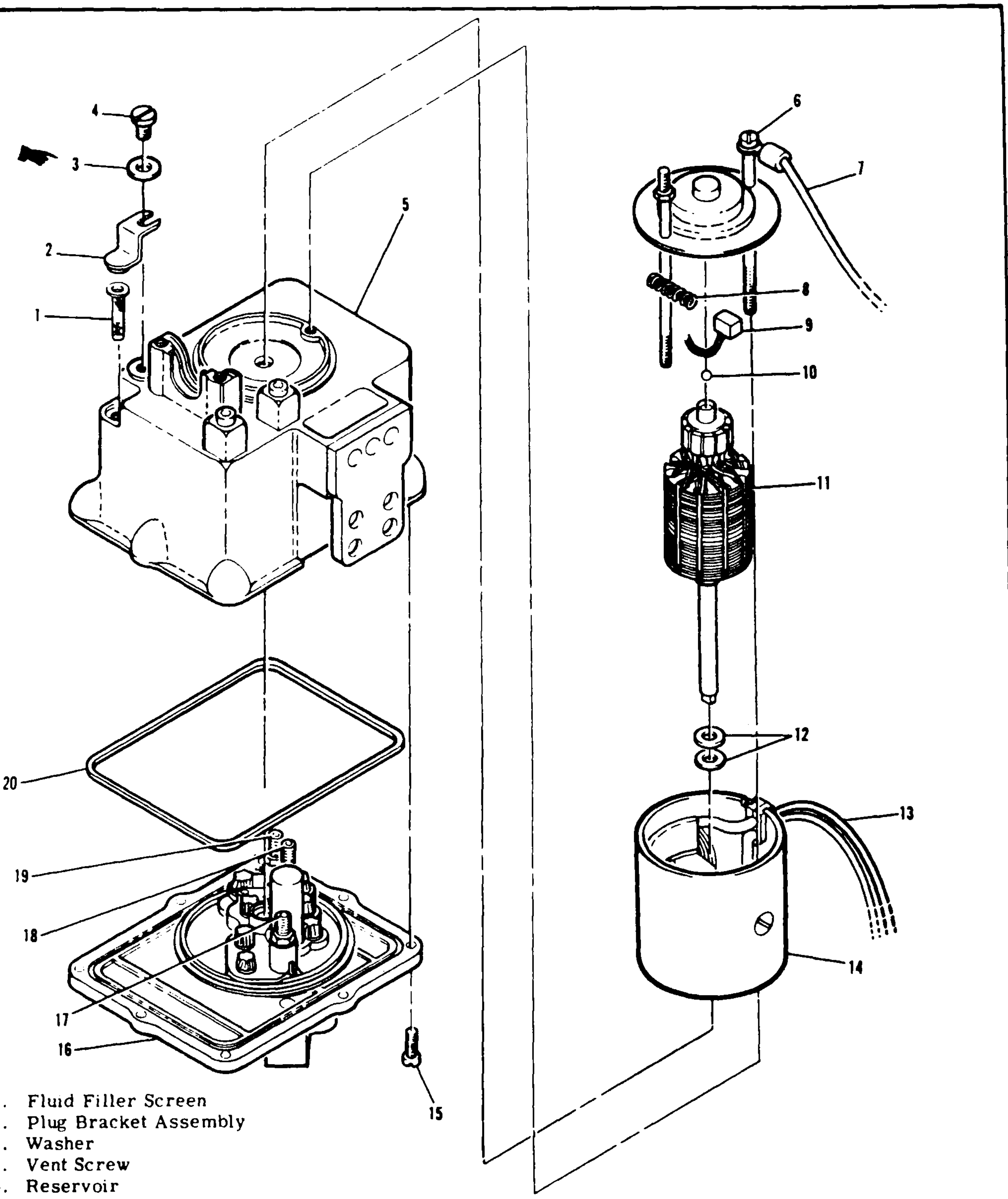



NOTE

Refer to sheets 5 and 6 for related hydraulic system schematic.

BEGINNING WITH SERIAL 177RG0433

Figure 5-1. Hydraulic System (Sheet 7 of 7)




1. Fluid Filler Screen
2. Plug Bracket Assembly
3. Washer
4. Vent Screw
5. Reservoir
6. Motor Thru-Screw
7. Motor Ground Lead
8. Brush Spring
9. Brush Assembly
10. Thrust Ball
11. Armature
12. Thrust Washers
13. Electrical Leads
14. Field and Frame Assembly
15. Screw
16. Valve Body and Gear Case
17. Pressure Relief Valve Adjustment (Gear Down)
18. Pressure Relief Valve Adjustment (Gear Up)
19. Pressure Relief Valve Adjustment (Thermal Relief)
20. Seal

Figure 5-2. Power Pack Disassembly (Sheet 1 of 2)

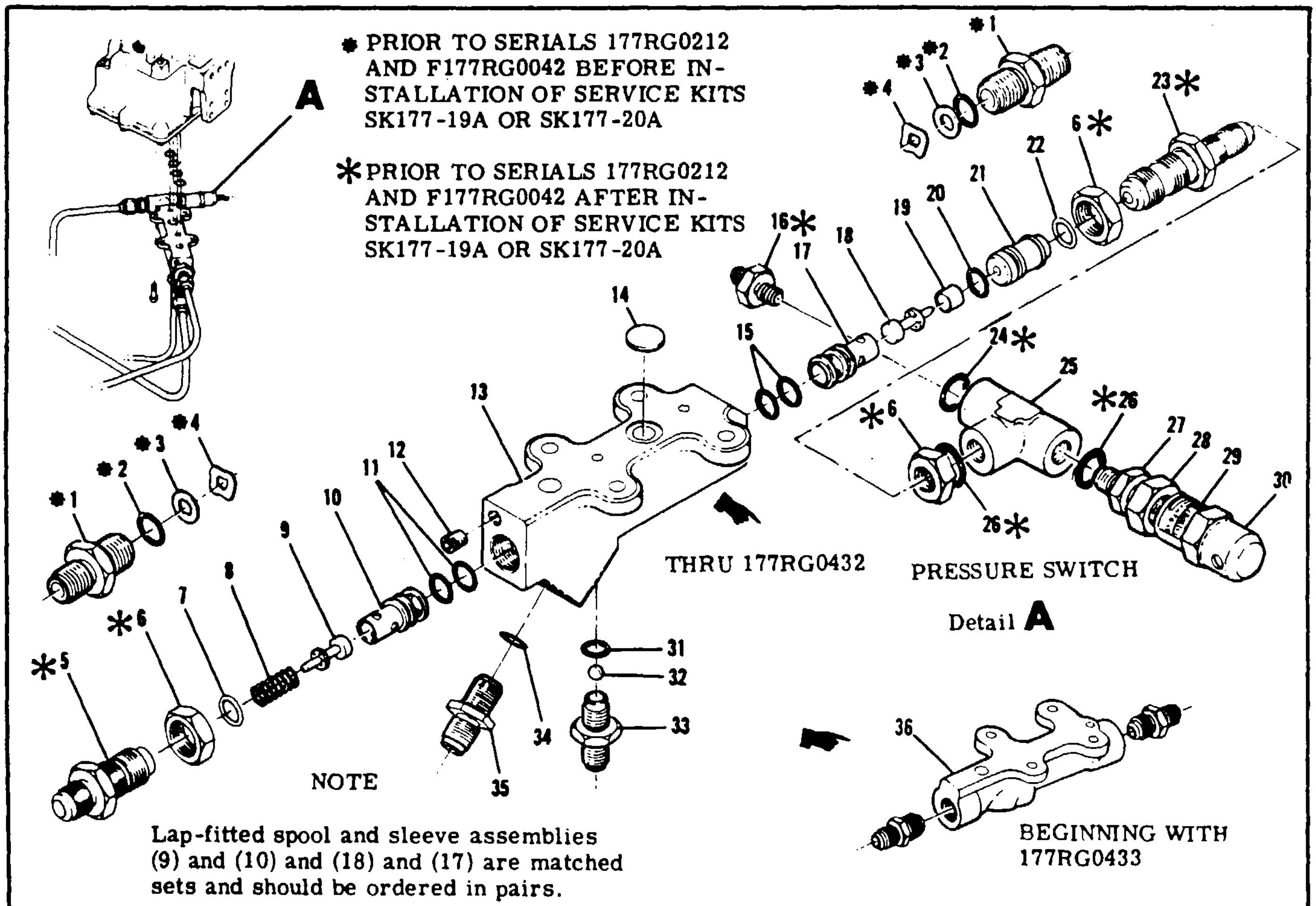
5-5. POWER PACK REMOVAL.

NOTE

As hydraulic lines are disconnected or removed, plug or cap all openings to prevent entry of foreign material into the lines or fittings.

a. Working through baggage door, lower close out curtain at aft end of baggage compartment.
b. Disconnect ground strap from battery. Insulate ground strap terminal as a safety precaution.
c. Disconnect pump motor electrical wires at gear up and gear down solenoids. Also, disconnect pump motor ground wire at fuselage structure. Tag wires so they may be installed in the same locations.
d. Spread drip cloth beneath power pack, and disconnect, cap or plug four (prior to 177RG0433 and F177RG0093); two (beginning with 177RG0433 and F177RG0093) hydraulic lines from control valve assembly or adapter beneath power pack.
e. Remove four bolts, washers and nuts attaching power pack to support structure. Support power pack as last of bolts are removed.
f. Remove power pack from aircraft.

5-6. POWER PACK DISASSEMBLY. (See figure 5-2.) After the Power Pack has been removed from the aircraft and all ports are capped or plugged, spray with cleaning solvent (Federal Specification P-S-661, or equivalent) to remove all accumulated dust and dirt. Do not allow cleaning solvent to enter pump motor. Dry with filtered compressed air. To disassemble the unit, proceed as follows:
a. Cut safety wire and remove four bolts and washers attaching control valve assembly to bottom of Power Pack. Note direction of fittings.




1. Reducer Fitting
2. O-Ring
3. Washer
4. Spring-Lock Washer
5. Fitting
6. Nut
7. Packing
8. Return Spring Spool
9. Spool
10. Sleeve
11. O-Ring
12. Plug
13. Control Valve Body
14. Seal Disc
15. O-Ring
16. Union
17. Sleeve
18. Spool
19. Spacer
20. O-Ring
21. Lock Valve Assembly
22. Packing
23. Fitting
24. O-Ring
25. Tee
26. O-Ring
27. Fitting
28. Jam Nut
29. Housing
30. Cap
31. O-Ring
32. Ball
33. Special Fitting
34. O-Ring
35. Fitting
36. Adapter

Figure 5-2. Power Pack Disassembly (Sheet 2 of 2)

b. Discard O-rings between control valve assembly and Power Pack.
c. Disassemble control valve assembly by removing fittings. Keep parts for each side separated.

NOTE

The spool and sleeve in each end of the control valve are matched parts and should be replaced as an assembly only. Other parts in the control valve may be replaced individually.

d. Remove thru-bolts from pump motor head.

NOTE

Before removing head assembly, make an alignment mark from the head assembly to frame and field assembly. Also, make an alignment mark from frame and field assembly to the reservoir. Use paint to make alignment marks.

e. Remove head assembly. Note the thrust ball located between the armature and head assembly. Retain thrust ball.
f. Lift armature from frame and field assembly. Note number of thrust washers on drive end of armature shaft. Retain thrust washers.
g. Invert reservoir assembly and remove eight screws attaching valve body and gear case assembly to reservoir.

NOTE

Pump gears and valves should be removed only for cleaning purposes. Valve springs should be positively identified with their individual valve cavities. Otherwise it will be necessary to adjust each valve for proper operating pressure.

h. Remove gear cap by removing bolts attaching cap.

5-7. HYDRAULIC PUMP CLEANING, INSPECTION, AND REPAIRS. Repairs to the hydraulic pump are limited to replacement of parts, O-rings and seals only.
a. Discard all removed O-rings. Assemble unit with new O-rings.
b. Remove caps or plugs and clean all parts with cleaning solvent (Federal Specification P-S-661, or equivalent) and dry thoroughly.

NOTE

Thorough cleaning is important. Dirt and chips are the greatest single cause of malfunctions in the hydraulic systems. Carefulness and proper handling of parts to prevent entrance of foreign material or prevent damage must be observed at all times.

c. Inspect all Power Pack parts for scratches, scores, chips, cracks, and indication of wear.
d. Inspect all components of the motor for worn brushes, excess commutator wear and excess bearing wear.
e. All damaged parts shall be replaced with new parts.

5-8. POWER PACK ASSEMBLY. (See figure 5-2.) Use new O-rings and gaskets during reassembly. Lubricate O-rings and parts with clean hydraulic fluid during reassembly.
a. Install new O-rings where removed in paragraphs 5-6 and 5-7.
b. Position frame and field assembly on reservoir. Note alignment marks on frame and field assembly and reservoir.
c. Place thrust washers on drive end of armature. Use same number of thrust washers removed in paragraph 5-6.
d. Lubricate armature drive shaft with light grease to protect O-ring seal from damage.
e. Insert armature in frame and field assembly and through O-ring in reservoir.
f. Apply light film of SAE 20 oil to bushing in head assembly.
g. Insert thrust ball in cavity in armature shaft at the commutator end of armature. To hold ball in position apply a small amount of light grease over ball.
h. Place head assembly over armature and on frame and field assembly. Note alignment marks.
i. Secure head assembly with thru-bolts.

NOTE

Check freedom of armature rotation and end play (thrust) within frame and field assembly. A minimum of 0.005-inch end play is allowable. Should end play be incorrect, adjust by adding or removing thrust washers on drive end of armature as required.

j. If removed, place pump gears in the gear case and install cap. Secure with attaching bolts.
k. Lubricate reservoir seal with hydraulic fluid and place seal in the recess in the base assembly.
l. Position valve body and gear case assembly with reservoir.

**CAUTION**

Use care when aligning armature drive with the pump gear. Motor should not be used to make this alignment.

m. Be sure that reservoir seal is properly positioned and install attaching screws. Do not overtighten attaching screws and cause binding in motor.
n. Assembly of the control valve is the reverse of disassembly.

NOTE

Spool and sleeve are matched parts. If necessary to replace, replace as an assembly only.

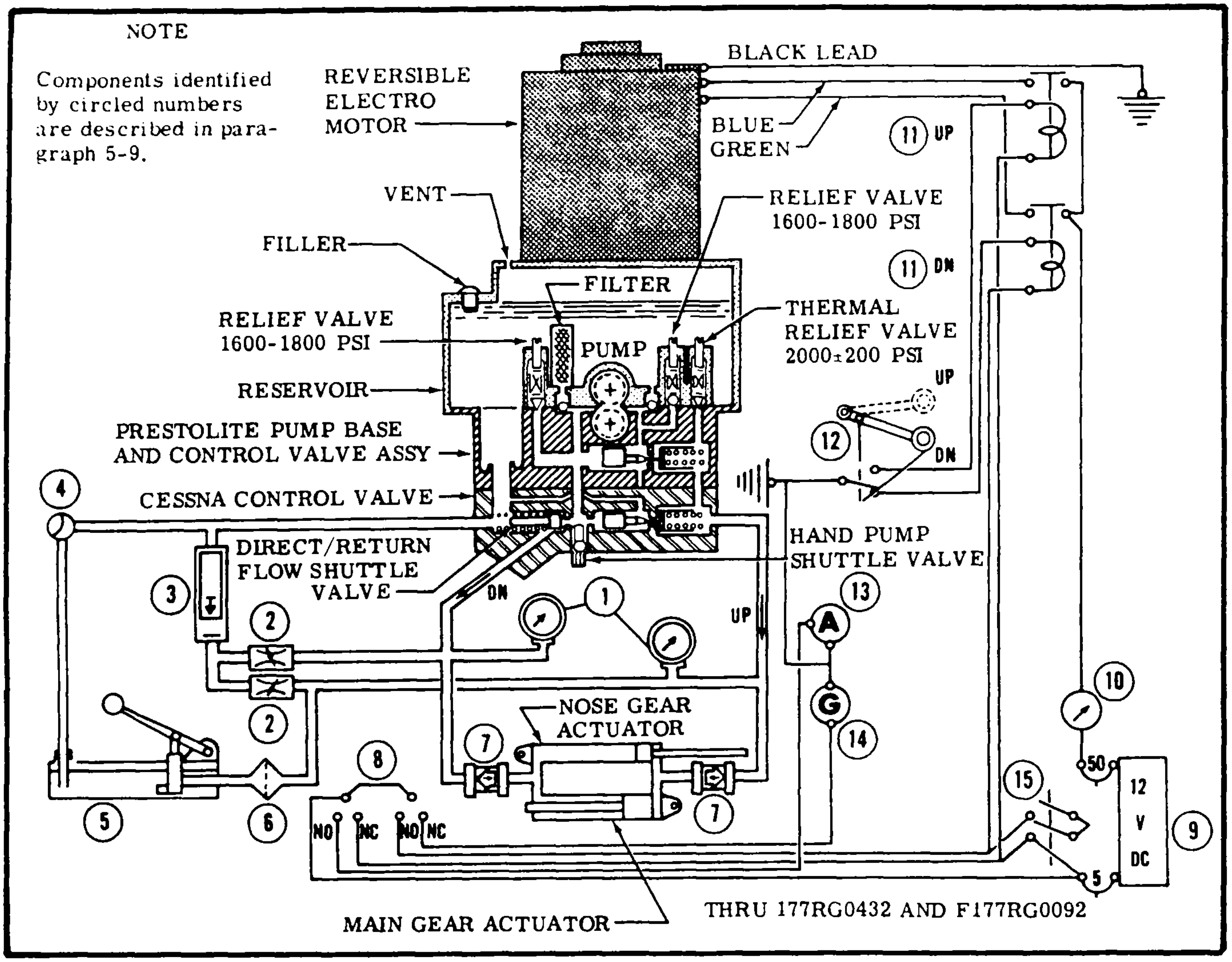



Figure 5-3. Power Pack Functional Test Schematic

o. With Power Pack inverted, lubricate O-rings and install.

p. Position control valve assembly and install attaching bolts and washers. Tighten bolts evenly to 70 lb-in. Safety wire the bolts together.

q. Conduct motor operational test not to exceed 10 seconds running time.

5-9. POWER PACK FUNCTIONAL TEST PROCEDURES. THRU 177RG0432 AND F177RG0092 (Refer to figure 5-3.)

a. TEST EQUIPMENT. A hydraulic test unit may be assembled locally, if desired. Equipment required for a test unit is listed in the following chart.

| | |
|---|---|
| (1) HYDRAULIC PRESSURE GAGE | Hydraulic pressure gages, graduated from 0 to 2500 psi, shall indicate pressure in the "DOWN" and "UP" line respectively. Graduation shall be 20 psi maximum. Adequate protection shall be provided to avoid damage caused by quick pressure discharge. |
| (2) FLOW CONTROL VALVE | Needle-type valves shall be used to control access to the flow meter from either "DOWN" or "UP" pressure port of the Cessna control valve assembly. The flow control valves shall be capable of accepting .50 gpm flow, and controlling output from 0 to 100 cubic inches per minute. |

(3) FLOW METER

A device shall be provided on return line to the hydraulic unit to determine flow/pressure relations of the pump. The flow meter shall read in cubic inches per minute or percentage of a constant flow value affixed to its nameplate. The meter shall be calibrated for MIL-H-5606 fluid, and the maximum nominal reading shall be .50 gpm.

(4) DRAIN VALVE

A manual ON/OFF valve shall be used to drain hydraulic units reservoir at the end of the test.

(5) AUXILIARY HAND PUMP

A hand pump with integral reservoir shall be used to perform thermal relief valve check, and to fill up the reservoir of the hydraulic unit being tested. The hydraulic fluid (MIL-H-5606) shall be periodically checked for contamination and replaced as required.

(6) FILTER

A fine mesh filter shall be used at the pressure port of the hand pump to keep system clean of particles greater than 40 microns.

(7) ONE-WAY RESTRICTOR VALVE

Restrictors shall be used on both "DOWN" and "UP" pressure lines to simulate the load of the landing gear actuating system. Restrictors shall be located just ahead of tees dividing the flow to nose and main gear cylinders. Restrictor assembly shall be composed of the following items which are available from the Cessna Service Parts Center.

a. 1580012-2 Restrictor (.014 dia. orifice)
b. AC105H4609E-4 Screen insert (2)
c. 1580015-1 Adapter
d. MS28778-4 Gasket (2)
e. AN815-4D Union

NOTE

Install restrictors with free-flow arrow pointing from cylinders.

(8) LIMIT SWITCHES

Switches shall be of single-pole, double-throw type, provided with convenient actuating system, arranged as shown in figure 5-3. Purpose is to cut off power supply to electric motor (solenoid switches) at the end of the working cycle, and to turn on corresponding indicator light.

(9) ELECTRO POWER SOURCE

Power source shall provide DC voltage of 14 volts nominal, with an output of 50 amp minimum. A voltmeter shall be provided with an accuracy within 3%. The power source shall be protected with fuses or circuit breakers, as shown.

(10) AMMETER

An ammeter (0 to 50 amp) shall be installed in the main power (to the motor) for input readings.

(11) SOLENOID SWITCH

Identical solenoid switches, or corresponding manual single-pole, double-throw switches shall be used.

(12) CONTROL SWITCH

Any convenient-single-pole, double-throw switch shall be used.

(13) INDICATOR LIGHT

VM011M-4A gear up indicator light (amber).

(14) INDICATOR LIGHT

VM911M-3A gear down indicator light (green).

| | |
|---|---|
| (15) BYPASS SWITCH | A "momentary on" double-pole, double-throw switch shall be used to bypass limit switches, when pressure relief valves are to be checked. (MS35059-30 toggle switch, S-1890-1 push button switch, or equivalent, may be used.) |

Use standard hydraulic tubing, hose and fittings as required. Wire to be 20 gage, except motor power lines, which are to be 10 gage wire. All hydraulic components to be rated for operating at 1500 psi, except flow meter and drain line. All leakage checks to be made after one minute settling period. Note leakage of test stand itself before performing leakage tests and take into account.

NOTE

Auxiliary hand pump shall be located at a level below the manifold to allow fluid drainage.

b. PREPARATION.

1. Using MS28778-4 gaskets (4) and NAS144-DH-12 bolts (4), with AN 960-916 washers, install Prestolite Power Pack on top of Cessna-built control valve assembly, and connect electrical lines as specified in figure 5-3.

2. With drain valve (Item 4) closed, and flow control valve (Item 2) open, pump fluid from auxiliary hand pump (Item 5), until fluid level in Power Pack reservoir reaches bottom of filler hole.

NOTE

Washers covering vent hole shall be removed during operation.

3. Turn on electric power source and adjust to 14 volts DC.

4. With flow control valves (Items 2) closed, operate unit through five complete cycles to purge air from system.

5. Adjust flow control valves (Items 2) to obtain fluid pressure 750±50 in both "DOWN" and "UP" lines subsequently. Stop operation when "DOWN" cycle is completed.

6. Tests are to be performed at normal room temperature. (Fluid temperature 70° to 110°F.)

NOTE

Before starting any series of tests, or after a long non-operating interval, perform leakage test of the test stand and note amount of leaked fluid (drops per minute) or pressure drop rate (psi per minute).

c. OPERATION.

1. With drain valve (Item 4) closed, and flow control valves (Items 2) adjusted to obtain 750±50 in both "DOWN" and "UP" lines, place control handle (Item 12) in "DOWN" position. Unit should operate smoothly and come to a stop when green indicator light comes on. Pressure should drop to zero thereafter.

2. Close flow control valve (Item 2) in "DOWN" line and turn momentary switch (Item 15) on. "DOWN" line pressure gage shall indicate 1600 to 1800 psi, and ammeter reading shall be 35 to 50 amps (maximum).

NOTE

Do not operate unit in excess of 10 seconds under high load conditions.

3. Place control handle (Item 12) in "UP" position and observe for a smooth operation, coming to an end, when the amber indicating light comes on. Pressure in "UP" line may drop slightly.

4. Close flow control valve (Item 2) in "UP" line and turn momentary switch (Item 15) on. Pressure in "UP" line shall rise up to 1600 to 1800 psi and ammeter reading shall show 35 to 50 amps (maximum).

NOTE

Do not operate unit in excess of 10 seconds.

5. After a five minute stabilizing period, pressure drop, due to internal or external leakage, shall not exceed 150 psi in any five minute period.

d. THERMAL RELIEF VALVE CHECK.

1. With conditions as under step "c", substep "4", slowly increase pressure in "UP" line, using auxiliary hand pump, and observe for cracking pressure of thermal relief valve. Pressure gage shall indicate 1950 to 2250 psi, and the reseat pressure drop shall be in the range of 100 to 300 psi.

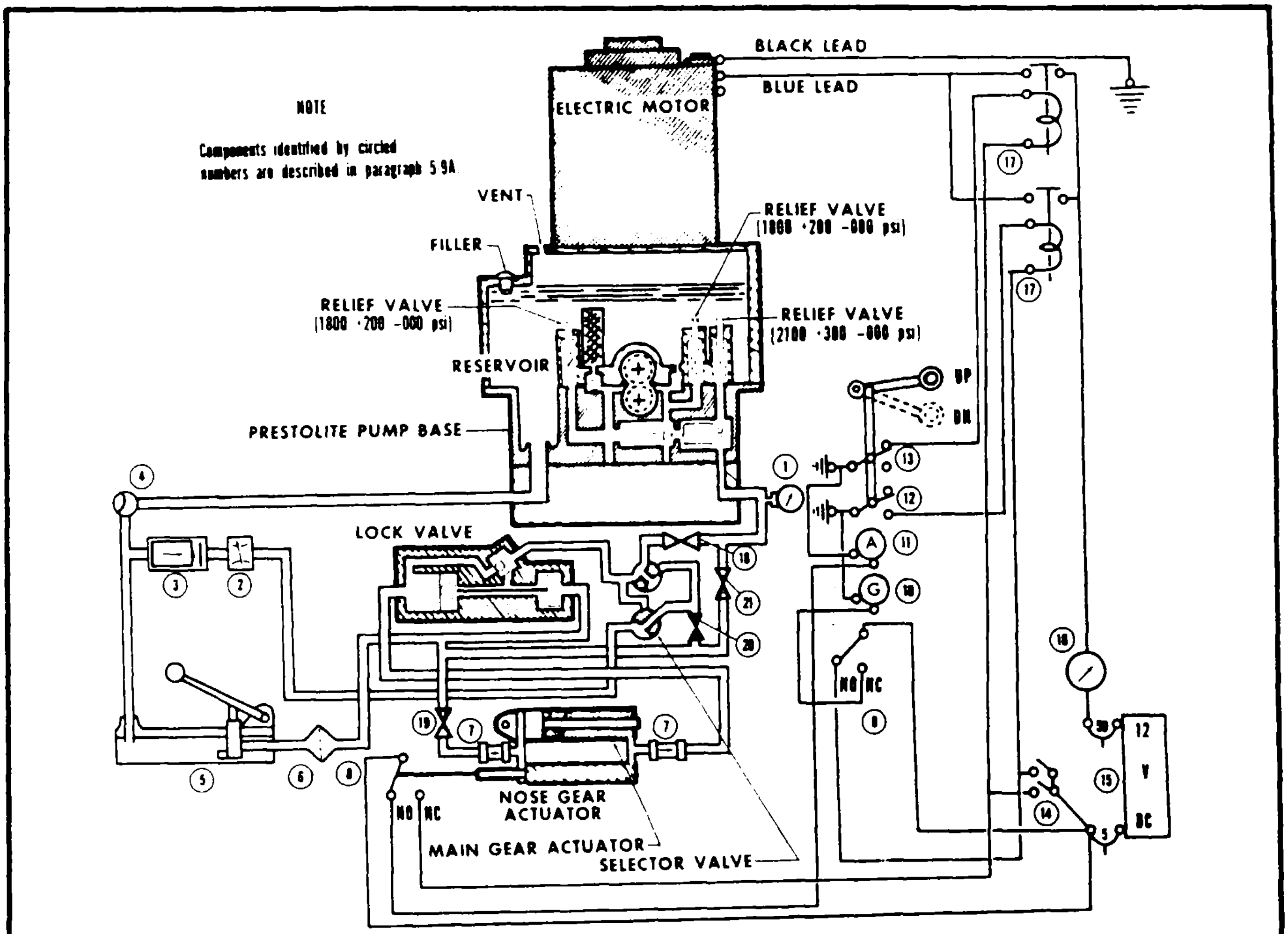
2. Operate control handle in "DOWN" position to unload the system.

e. FLUID FLOW TEST.

1. With control handle in "DOWN" position, and green indicator light on, turn on momentary switch, adjust "DOWN" line pressure to 1000±50 psi, using flow control valve, and note fluid flow. Flow meter shall indicate 45 cubic inches flow (minimum).

2. Place control valve in "UP" position, and when amber indicator light comes on, turn on the momentary switch, adjust "UP" pressure to 1000±50 psi, using the second flow control valve, and note flow. Flow meter shall indicate 45 cubic inches flow (minimum).

5-9A. POWER PACK FUNCTIONAL TEST PROCEDURES. BEGINNING WITH 177RG0433 AND F177RG0093 (Refer to figure 5-3A.)




BEGINNING WITH 177RG0433 AND F177RG0093

Figure 5-3A. Power Pack Functional Test Schematic

a. TEST EQUIPMENT. A hydraulic test unit may be assembled locally, if desired. Equipment required for a test unit is listed in the following chart.

| | | |
|---|---|---|
| 1 | HYDRAULIC PRESSURE GAGE | A hydraulic pressure gage shall indicate pressure in the pressure line. Graduation shall be 20 psi maximum. Adequate protection shall be provided to avoid damage caused by pressure discharge. |
| 2 | FLOW CONTROL VALVE | A needle-type valve shall be used to control access to the flow meter from the pressure port. The valve shall be capable of accepting .50 gpm flow, and controlling output from 0 to 100 cubic inches per minute. |
| 3 | FLOW METER | A device shall be provided on return line to the hydraulic unit to determine flow/pressure relations of the pump. The flow meter shall read in cubic inches per minute or percentage of a constant flow valve affixed to its name-plate. The meter shall be calibrated for MIL-H-5606 fluid, and the maximum nominal reading shall be .50 gpm. |
| 4 | DRAIN VALVE | A manual ON/OFF valve shall be used to drain hydraulic unit reservoir at the end of the test. |

| | | |
|---|---|---|
| 5 | AUXILIARY HAND PUMP | A hand pump with integral reservoir shall be used to perform relief valve check, and to fill up the reservoir of the hydraulic unit being tested. The hydraulic fluid (MIL-H-5606) shall be periodically checked for contamination and replaced as required. |
| 6 | FILTER | A fine mesh filter shall be used at the pressure port of the hand pump to keep system clean of particles greater than 40 microns. |
| 7 | ONE-WAY RESTRICTOR VALVE | Restrictors shall be used on both "DOWN" and "UP" pressure lines to simulate the load of the landing gear actuating system. Restrictors shall be located just ahead of tees dividing the flow to nose and main gear cylinder. Restrictor assembly shall be composed of the following items which are available from the Cessna Service Parts Center.<br>a. 1580012-2 Restrictor (.014 dia. orifice)<br>b. AC105H4609E-4 Screen insert (2)<br>c. 1580015-1 Adapter<br>d. MS28778-4 Gasket (2)<br>e. AN815-4D Union<br><br>NOTE<br><br>Install restrictors with free-flow arrow pointing from cylinders. |
| 8<br>9 | LIMIT SWITCHES | Switches shall be of single-pole, single-throw type provided with convenient actuating system and arranged as shown in figure 5-3A. Purpose is to cut off power supply to electric motor (solenoid switches) at the end of the working cycle, and to turn on corresponding indicator light. |
| 10 | INDICATOR LIGHT | VM911M-3A gear down indicator light (green). |
| 11 | INDICATOR LIGHT | VM011M-4A gear up indicator light (amber). |
| 12<br>13 | CONTROL SWITCH | Switches shall be single-pole, single-throw type with a convenient handle system which controls the selector valve. |
| 14 | BYPASS SWITCH | A "momentary ON" single-pole, single-throw switch shall be used to bypass limit switches where pressure relief valves are to be checked. |
| 15 | ELECTRIC POWER SOURCE | Power source shall provide DC voltage of 14 volts nominal, with an output of 50 amp minimum. A voltmeter shall be provided with an accuracy within 3%. The power source shall be protected with fuses or circuit breakers as shown. |
| 16 | AMMETER | An ammeter (0 to 50 amp) shall be installed in the main power line (to the motor) for input readings. |
| 17 | SOLENOID SWITCH | Identical solenoid switches, or corresponding manual single-pole, double-throw switches shall be used. |
| 18 19 20 | MANUAL SHUT-OFF VALVE | During cycling tests, the shut-off valves (18), (19) and (20) are to be in the "ON" position. |
| 21 | ANNUAL SHUT-OFF VALVE | During cycling tests, this shut-off valve (21) is to be in the "OFF" position. |

Use standard hydraulic tubing, hose and fittings as required. Wire to be 20 gage except motor power lines, which are to be 10 gage wire. All hydraulic components to be rated for operating at 1500 psi except flow meter and drain line. All leakage checks to be made after one minute settling period. Note leakage of test stand itself before performing leakage tests and take into account.

NOTE

Auxiliary hand pump shall be located at a level below the manifold to allow fluid drainage.

b. PREPARATION.

1. Using MS28778-4 gaskets (4) and NAS144DH-12 bolts (4), with AN960-916 washers, install Prestolite Power Pack on top of Cessna built manifold, and connect electric lines as specified.

2. With drain valve (item 4) closed, and flow control valve (item 2) open, pump fluid from auxiliary hand pump (item 5) until fluid level in Power Pack reservoir reaches bottom of filler hole.

NOTE

Washers covering vent hole shall be removed during operation.

3. Turn on electric power source (item 15) and adjust to 14 volts D. C.

4. Operate through 5 complete cycles to purge air from system.

5. Adjust flow control valve (item 2) to obtain fluid pressure 750 ± 50 psi. Stop operation when "DOWN" cycle is completed.

6. Tests are to be performed at normal room temperature. (Fluid temperature 70° to 110°F.)

NOTE

Before starting any series of tests, or after a long non-operating interval, perform leakage test of the test stand and note amount of leaked fluid (drops per minute) or pressure drop rate (psi per minute).

c. OPERATION.

1. With drain valve (item 4) closed, and flow valve (item 2) adjusted to obtain fluid pressure of 750 ± 50 psi, place control handle in "DOWN" position. The unit shall operate smoothly and come to a stop when the green indicator light (item 10) comes on. Pressure shall drop to zero.

2. Close flow control valve (item 2) and turn bypass switch (item 14) "ON". Pressure gage shall indicate 1800 to 2000 psi, and ammeter reading shall be 35 to 50 amps (maximum).

NOTE

Do not operate unit in excess of 10 seconds under high load conditions.

3. Place control handle in "UP" position and observe for a smooth operation coming to an end when the amber indicator light (item 11) comes on. Pressure in "UP" position may drop slightly.

4. Close flow control valve (item 2) in "UP" position and turn bypass switch (item 14) on. Pressure in "UP" position shall rise to 1600 to 1800 psi and ammeter reading shall show 35 to 50 amps (maximum).

NOTE

Do not operate unit in excess of 10 seconds.

5. After a five minute stabilizing period, pressure drop due to internal or external leakage shall not exceed 150 psi in any 5 minute period.

d. FLUID FLOW CHECK

1. With control handle in "DOWN" position, and green indicator light "ON", turn on bypass switch (item 14), adjust "DOWN" line pressure to 1000 ± 50 psi using flow control valve (item 2) and note fluid flow. Flow meter (item 3) shall indicate 45 cubic inches flow minimum.

e. FINAL INSPECTION.

Drain hydraulic power pack with drain valve (item 4) and remove from test fixture. Inspect for workmanship, finish, security of assembly and cap or cover all openings.

5-10. POWER PACK INSTALLATION.

a. Position Power Pack to mounting support structure and install bolts, washers, and nuts.

b. Remove caps or plugs and connect hydraulic lines to fittings in control valve assembly below Power Pack.

c. Connect Power Pack electrical leads. White lead to lower solenoid. Blue lead to upper solenoid. Black ground lead to aircraft structure.

d. Fill reservoir with hydraulic fluid (MIL-H-5606).

e. With aircraft on jacks, cycle landing gear to purge hydraulic system of air and to check for leakage. Refill reservoir with hydraulic fluid.

5-11. PRESSURE SWITCH ADJUSTMENT. (Refer to figure 5-2.)

a. Jack aircraft in accordance with procedures outlined in Section 2.

b. Attach external power source and install pressure gage in landing gear UP line.

c. Install pressure switch in aircraft, loosen jam nut (28) and back off switch housing (29).

d. Retract landing gear and apply pressure to 1500 ±50 PSI.

e. Tighten switch housing until snap action switch actuates, then tighten jam nut against housing.

f. Recheck operating point of 1500±50 PSI, and reset, if required.

g. Lower landing gear, remove external power source and remove aircraft from jacks.

5-12. PANEL MOUNTED GEAR SELECTOR VALVE. (Beginning with 177RG0433 and F177RG0093.) (Refer to figure 5-4.)

5-13. DESCRIPTION. A mechanical gear selector valve is located in the pedestal. Gear selection is accomplished manually, eliminating the shuttle valves in the power pack as utilized in previous models. The relief valve is also deleted. The pilot shuttles the valve manually when he changes the gear handle position. A check valve is installed in the system which retains pressure in the gear-up position. The selector valve only has operation pressure during a cycle. At all other times it retains reservoir pressure. For emergency extension of the gear, the selector handle must be in the down position before the hand pump will energize the system.

5-14. REMOVAL.

a. Remove the pedestal cover as follows:

1. Remove cowl flap control knob and gear selector knob.

2. Remove microphone mounting bracket and nut from microphone jack (if installed).

3. Remove ashtray and ashtray retainer.

4. Disconnect electrical wiring to pedestal cover.

5. Remove cigar lighter (if installed).

6. Remove courtesy light.

7. Remove screws securing pedestal cover to structure and carefully remove cover.

b. Remove screws from around perimeter of plate on aft side of pedestal; remove plate.

**CAUTION**

As hydraulic lines are disconnected, fluid will leak. Precautions must be taken to prevent excessive leakage, such as spreading drip cloths and plugging lines.

c. Disconnect hydraulic lines at elbows, observing the preceding precautions.

d. Remove cotter pin, washer and pin from clevis on rod assembly.

e. Using figure 5-4 as a guide, remove bolts, washers and nuts attaching LH bracket (12) and RH bracket (17) to top of tunnel; remove selector and brackets as an assembly.

5-15. DISASSEMBLY. (Refer to figure 5-4.)

a. Cut safety wire attached to lever (6) and bolt.

b. Unscrew bolt attaching lever (6) to spool (14); remove lever.

c. Remove screws, washers and nuts attaching switch mounting bracket (9) to LH bracket (12); remove switch bracket.

d. Remove washers and nuts from 3 bolts; remove bolts, and separate brackets (12) and (17) from cover (5), body (1) and cover (16).

5-16. INSPECTION OF PARTS.

NOTE

Spool assembly (14) and valve body (1) are sold only as a matched set. If either unit is damaged, both should be replaced.

a. Replace packings (2) and check washers (13) for wear.

b. Check passages in body (1) for obstructions while rotating spool assembly (14).

5-17. ASSEMBLY. (Refer to figure 5-4.)

a. Install new packing (2) over spool assembly (14) and in grooves in valve body (1).

b. Assemble covers (5) and (16) and brackets (12) and (17) to valve body (1); install 3 bolts, washers and nuts.

c. Install switch mounting bracket (9) to LH bracket (12).

d. Install lever (6) on end of spool assembly (14).

e. Safety wire lever to attaching bolt.

5-18. INSTALLATION.

NOTE

Before installing selector valve, pin lever (6) in the down position. Adjust down switch (8) to be actuated by lever (6). With lever pinned and switch adjusted, install selector valve assembly as follows:

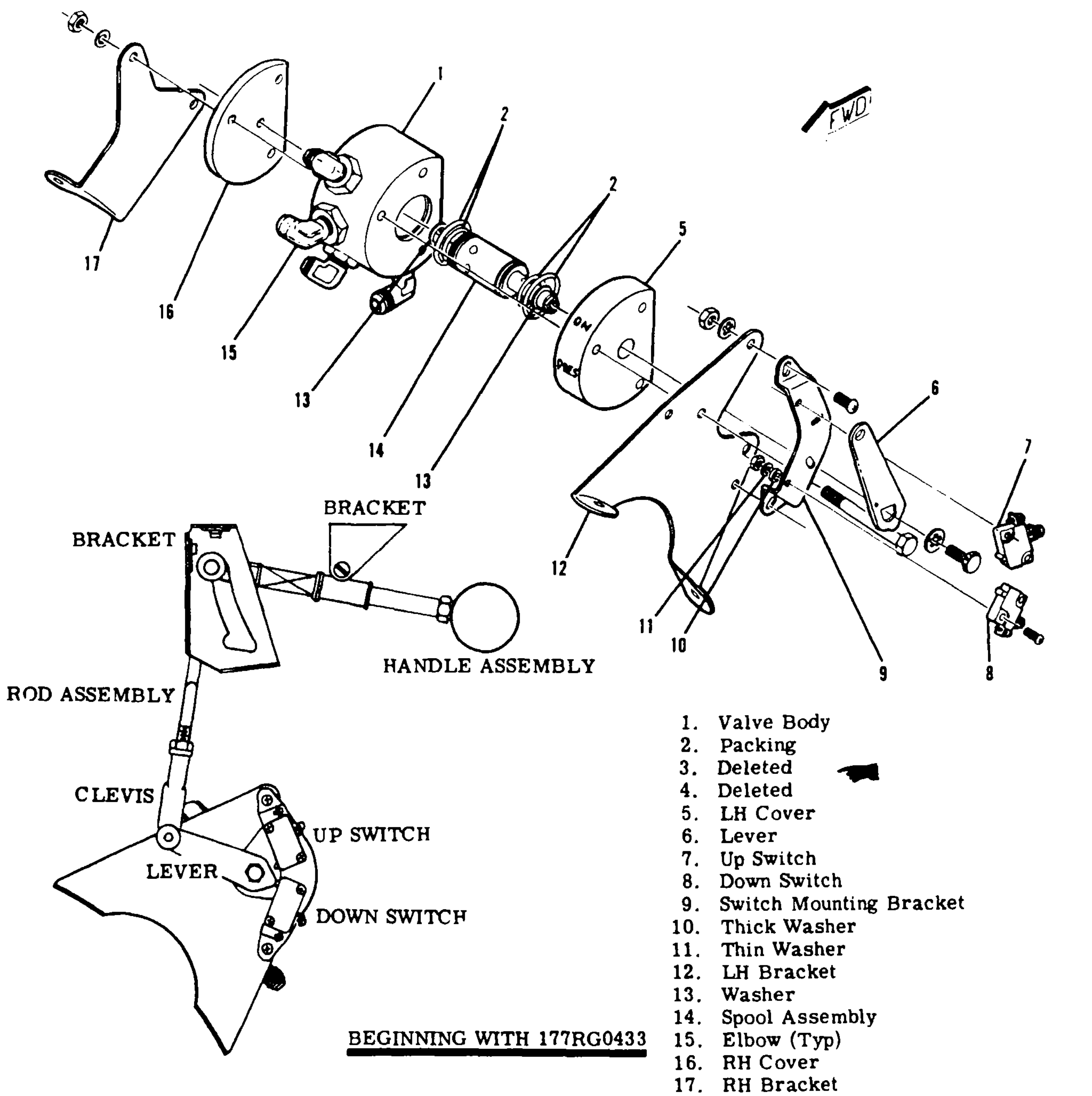
a. Install unit on tunnel top inside pedestal with bolts, washers and nuts.

b. Attach hydraulic lines at elbows on selector valve.

c. Attach clevis on rod assembly to lever (6) with pin washer and cotter pin.

NOTE

Prior to installing pedestal cover, rig gear selector valve in accordance with procedures outlined in the following paragraph. Then jack the aircraft in accordance with procedures outlined in Section 2, attach an external power source and check operation of gear selector valve and for leakage by cycling gear several times.




1. Valve Body
2. Packing
3. Deleted
4. Deleted
5. LH Cover
6. Lever
7. Up Switch
8. Down Switch
9. Switch Mounting Bracket
10. Thick Washer
11. Thin Washer
12. LH Bracket
13. Washer
14. Spool Assembly
15. Elbow (Typ)
16. RH Cover
17. RH Bracket

Figure 5-4. Landing Gear Selector Assembly

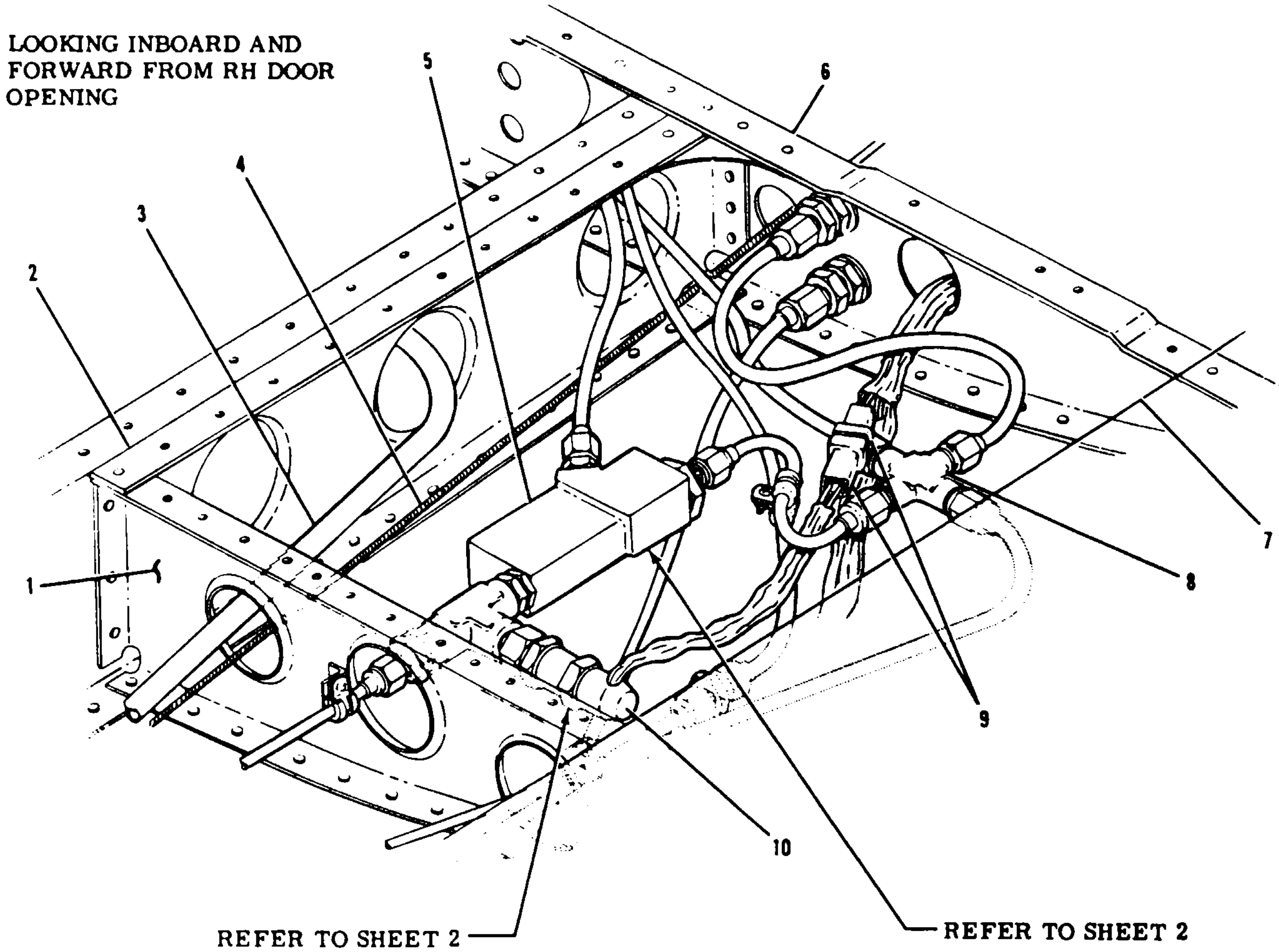
d. Install plate on aft side of pedestal by installing attaching screws.
e. Carefully install pedestal cover with attaching screws.
f. Install courtesy light.
g. Install cigar lighter (if applicable).
h. Connect electrical wiring to pedestal cover.
i. Install ashtray and ashtray retainer.
j. Install microphone mounting bracket and nut from microphone jack (if applicable).
k. Install cowl flap control knob and gear selector knob.

5-19. RIGGING. (Refer to figure 5-4.)
a. Place valve actuating lever (6) in down position, and adjust rod assembly to the selector valve lever.

NOTE

In the down position, the selector valve lever will point down.

b. Attach rod assembly to selector valve assembly.
c. Place lever in the up position.
d. Adjust upper switch to be actuated by the handle when in the up position.




1. Bhd. Sta. 87.75
2. Left Body Line 5.50
3. Fuel Pump Line
4. Rudder Cable
5. Lock Valve
6. Bhd. Sta. 75.50
7. Left Body Line 15.50
8. Tee
9. Inline Plug
10. Pressure Switch
11. Fitting
12. Packing
13. Piston
14. Housing
15. Packing
16. Check Valve
17. Packing
18. Fitting
19. Seat
20. Back-Up Ring
21. Packing
22. Ball
23. Guide
24. Spring
25. Back-Up Ring
26. Packing
27. Cap
28. Switch
29. Housing
30. Nut
31. Retainer
32. Spacer
33. Spring
34. Guide
35. Spring
36. Piston
37. Packing
38. Fitting

BEGINNING WITH 177RG0433

Figure 5-4A. Lock Valve and Pressure Switch Installation (Sheet 1 of 2)

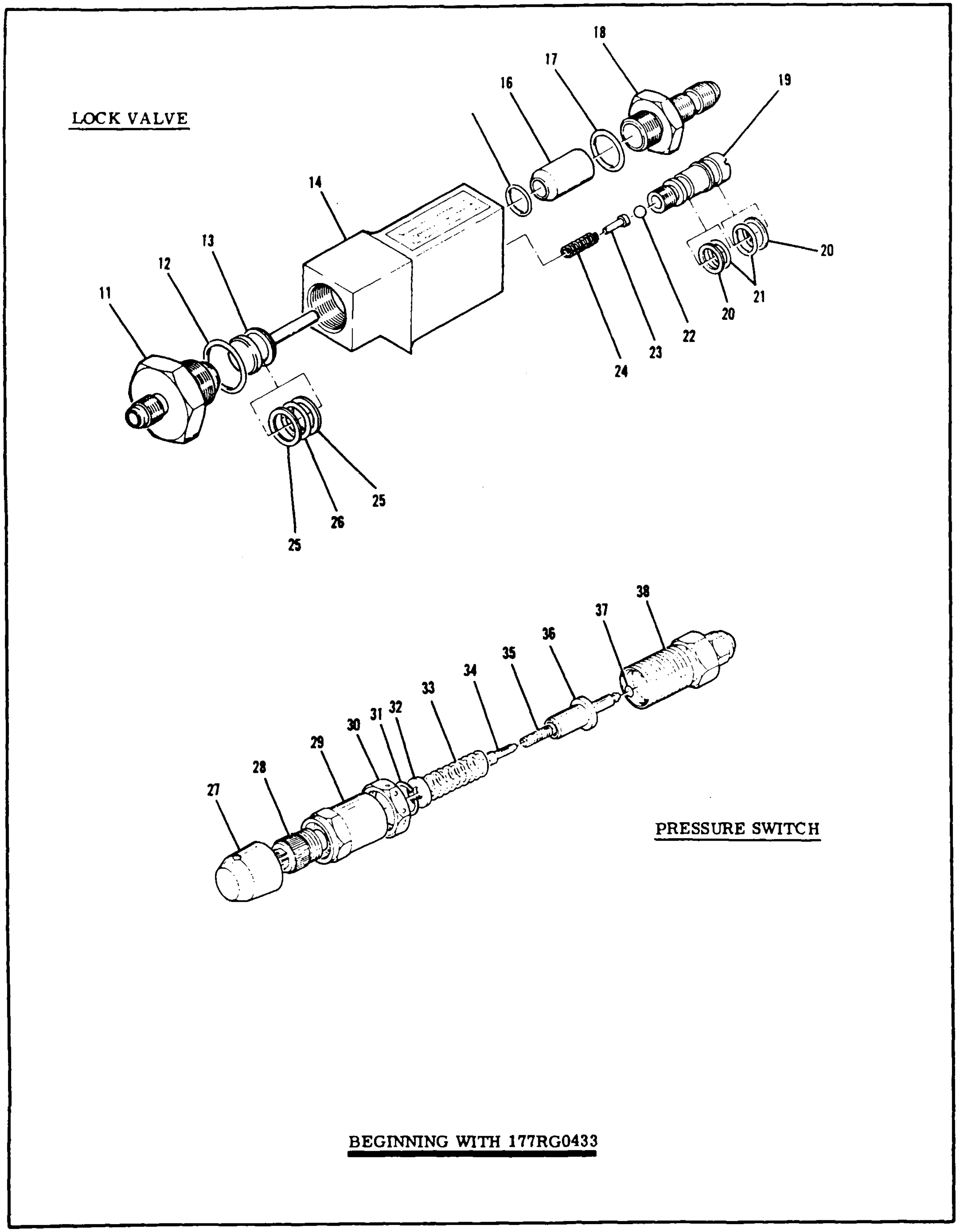



Figure 5-4A. Lock Valve and Pressure Switch Installation (Sheet 2 of 2)

e. Check wiring attachment per wiring diagrams in Section 19.

5-19A. LOCK VALVE. (Beginning with 177RG0433 and F177RG0093.) (Refer to figure 5-4A.)

5-19B. DESCRIPTION. The lock valve is installed between the selector valve and the main gear downlock actuator, and is used in conjunction with the pressure switch to prevent recycling of the gear.

5-19C. REMOVAL AND INSTALLATION.

a. Push copilot seat aft as far as it will go and peel back carpet on RH side to expose access plate above lock valve.

b. Remove access plate.

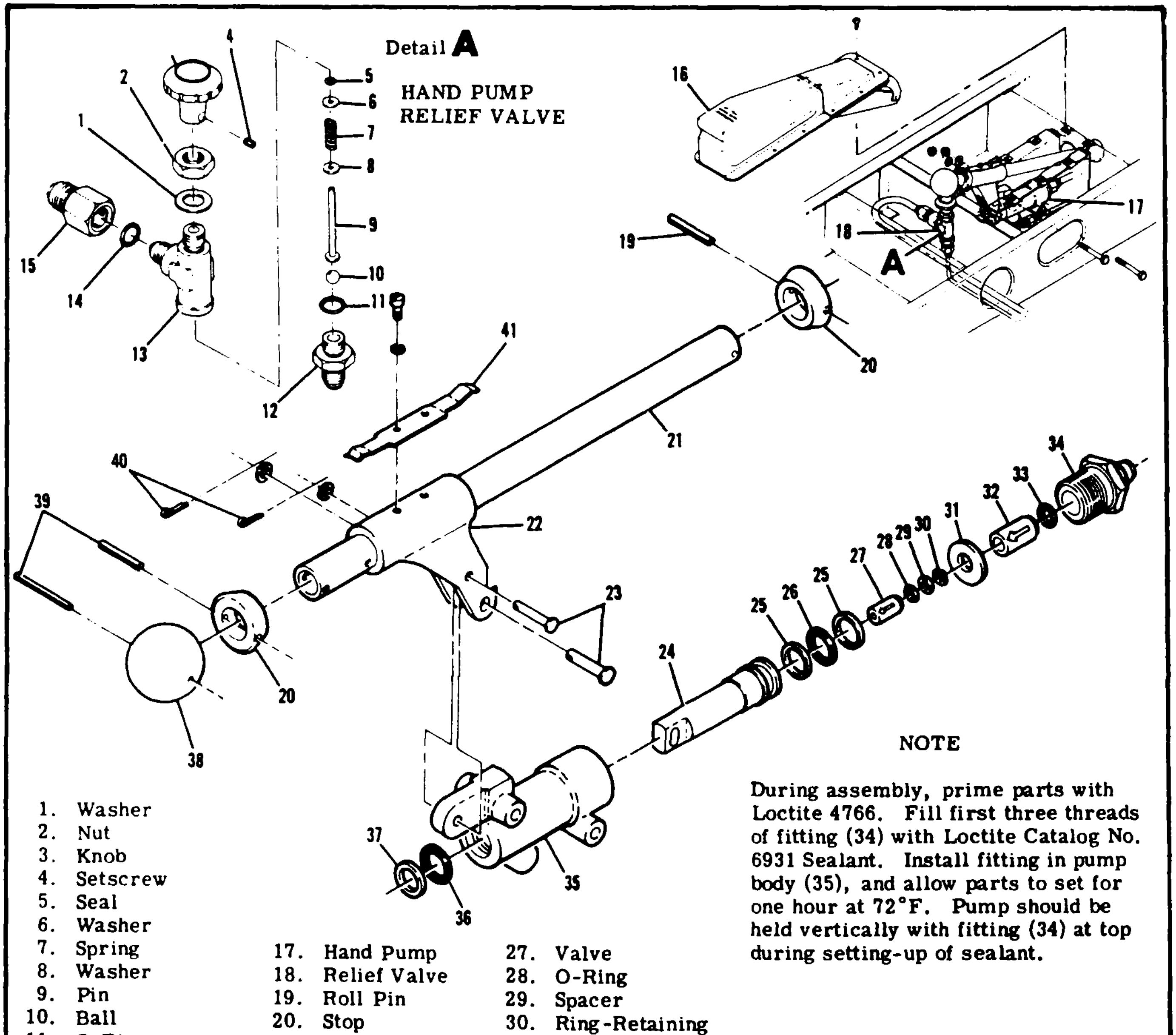
c. Disconnect and cap or plug three lines attached to valve; remove valve.

d. Reverse procedures outlined in preceding steps to install valve.

5-19D. DISASSEMBLY. (Refer to figure 5-4A.)

a. Remove end fitting (11), packing (12), piston (13) and back-up rings (25) from housing (14).

b. Remove end fitting (18), packings (17) and check valve (16) from housing (14).




1. Washer
2. Nut
3. Knob
4. Setscrew
5. Seal
6. Washer
7. Spring
8. Washer
9. Pin
10. Ball
11. O-Ring
12. Fitting-Special
13. Valve Body
14. O-Ring
15. Fitting-Reducer
16. Cover
17. Hand Pump
18. Relief Valve
19. Roll Pin
20. Stop
21. Handle
22. Fork
23. Pin
24. Piston
25. Back-Up Ring
26. O-Ring
27. Valve
28. O-Ring
29. Spacer
30. Ring-Retaining
31. Washer
32. Valve
33. O-Ring
34. Fitting-Special
35. Pump Body
36. O-Ring
37. Back-Up Ring
38. Knob
39. Roll Pin
40. Cotter Pin
41. Spring-Lock

NOTE

During assembly, prime parts with Loctite 4766. Fill first three threads of fitting (34) with Loctite Catalog No. 6931 Sealant. Install fitting in pump body (35), and allow parts to set for one hour at 72°F. Pump should be held vertically with fitting (34) at top during setting-up of sealant.

Figure 5-5. Hand Pump and Relief Valve

c. Remove seat (19) along with packings (21) and back-up rings (20).
d. Remove ball (22), guide (23) and spring (24).

5-19E. INSPECTION. Perform the following inspections to ascertain that all parts are in a serviceable condition.
a. Inspect threaded surfaces for cleanliness and freedom of cracks and excessive wear or damage.
b. Inspect seat (19) for sharp seating edge with ball (22). Lap as necessary to obtain a sharp seating edge.
c. Inspect piston (13) and guide (23) for cracks, scoring, wear or surface irregularities which may affect their function or the overall function of the lock valve.

NOTE

Repair of most parts of the lock valve assembly is impractical. Replace defective parts with serviceable parts. Minor scratches may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect the operation of the unit. Install all new packing and back-up rings during reassembly.

5-19F. ASSEMBLY.

NOTE

Lubricate all packing and back-up rings with Petrolatum or MIL-H-5606 hydraulic fluid during reassembly.

a. Install new packing (12) and (26) and back-up rings (25) on piston (13); install in housing (14) with end fitting (11). Use care to prevent damage to packing and back-up rings.
b. Install packings and check valve into housing (14) with end fitting (18).

NOTE

Install check valve with flow arrow pointing toward end fitting.

c. Install ball (22), guide (23), spring (24), packing (21) and seat (19).

5-19G. PRESSURE SWITCH. (Beginning with 177RG0433 and F177RG0093.) (Refer to figure 5-4A.)

5-19H. DESCRIPTION. A pressure switch is located between the selector valve and the main gear downlock actuator. The switch is installed immediately adjacent to and downstream from the lock valve which is located immediately in front of the copilot seat under the floorboard. The pressure switch opens the electrical circuit to the pump solenoid when the gear fully retracts, and pressure in the system increases to approximately 1500 psi. The pressure switch will continue to hold the electrical circuit open until pressure in the system drops to approximately 1100 psi, at which time the pump will again operate to build up pressure to approximately 1500 psi as long as the gear control handle is in the UP position. With gear control handle in the DOWN position, the pressure switch has no effect on the system.

5-19I. REMOVAL AND INSTALLATION. (Refer to figure 5-4A.)
a. Push copilot seat aft as far as it will go and peel back carpet on RH side to expose access plate above pressure switch.
b. Remove access plate.
c. Remove pressure switch from tee and plug tee.
d. Reverse procedures outlined in preceding steps to install pressure switch.

5-19J. SWITCH ADJUSTMENT. (Refer to figure 5-4A.)
a. Jack aircraft in accordance with procedures outlined in Section 2.
b. Attach external power source and install pressure gage in gear UP line. (Refer to figure 5-1, sheet 4.)
c. Loosen jam nut on switch and back off switch housing (29).
d. Retract landing gear and apply pressure to 1500 ±50 psi.
e. Tighten switch housing until snap action switch actuates, then tighten jam nut against housing.
f. Recheck operating point of 1500 ±50 psi, and reset, if required.
g. Lower landing gear, remove external power source and remove aircraft from jacks.

5-20. EMERGENCY HAND PUMP. The emergency hand pump is mounted below the floor between the pilot and copilot seats. The pump handle extends

**SHOP NOTES:**

into the cabin and is enclosed by a hinged cover. The pump supplies a flow of pressurized hydraulic fluid to extend the landing gear in the event of normal hydraulic pump failure.

5-21. EMERGENCY HAND PUMP REMOVAL AND INSTALLATION.
a. Remove seats as required for access.
b. Remove screws attaching cover over hand pump and remove cover.
c. Peel back carpet as required for access to pump mounting bolts.
d. Wedge cloth under hydraulic fittings to absorb fluid, then disconnect the two hydraulic lines and plug or cap open fittings to prevent entry of foreign material.
e. Remove two bolts, washers, and nuts securing pump to mounting bracket.
f. Work pump from aircraft.
g. Install hand pump by reversing the preceding steps, bleeding lines and pump as lines are connected. Fill reservoir as required.

5-22. EMERGENCY HAND PUMP DISASSEMBLY. After the emergency hand pump has been removed from the aircraft and the ports are capped or plugged, spray with cleaning solvent (Federal Specification P-S-661, or equivalent) to remove all accumulated dust or dirt. Dry with filtered compressed air.
a. Remove hand pump handle by removing pivot and linkage pins after removing cotter pins.
b. Remove end fitting from body assembly.
c. Push piston from body assembly.
d. Remove retaining ring from end fitting to remove valve assemblies.
e. Remove and discard all O-rings and back-up rings.

5-23. INSPECTION OF PARTS.
a. Inspect seating surfaces of valves.
b. Inspect piston for scores, burrs, or scratches which could cut O-rings. This is a major cause of external and internal leakage. The piston may be polished with extremely fine emery paper. Never use paper coarser than No. 600 to remove scratches or burrs. If defects do not polish out, replace piston.

5-24. REASSEMBLY. (Refer to figure 5-5.) Assemble the emergency hand pump, using the figure as a guide. Also, for detailed instructions, reverse the procedures outlined in paragraph 5-22. Lubricate all parts with hydraulic fluid during reassembly.

5-25. MAIN LANDING GEAR.

5-26. GENERAL DESCRIPTION. The tubular main gear struts rotate aft and inboard to stow the main wheels beneath the baggage compartment. The main gear utilizes hydraulic pressure for positive uplock and electro-mechanical downlocks. Main gear uplock pressure is maintained automatically by the Power Pack assembly. Rotation of the gear to extend or retract the struts is achieved through pivot assemblies which are in turn bolted to pinion gears and driven by the sector gear attached to the main gear actuator.

5-27. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| AIRCRAFT LEANS TO ONE SIDE. | Incorrect tire inflation. | Inflate to correct pressure. |
| | Incorrect adjustment of main gear strut collar. | Correct in accordance to main gear rigging. |
| | Bent axle. | Install new axle. |
| UNEVEN OR EXCESSIVE TIRE WEAR. | Incorrect tire inflation. | Inflate to correct pressure. |
| | Wheels out of alignment. | Align wheels. |
| | Wheels out of balance. | Balance wheels. |
| | Sprung main gear strut. | Replace strut. |
| | Bent axle. | Replace axle. |
| | Dragging brake. | Jack wheel and check brake. |
| | Wheel bearings not adjusted properly. | Tighten axle nut properly. |
| | Loose torque links. | Add shim washers and replace as required. |

5-28. MAIN WHEEL REMOVAL.

NOTE

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

a. Using an individual jack pad, jack the wheel as outlined in Section 2.
b. Remove hub cap.
c. Remove cotter pin and axle nut.
d. Remove bolts and washers attaching back plate to brake assembly and remove back plate.
e. Pull wheel assembly from axle.

5-29. MAIN WHEEL DISASSEMBLY.
a. Deflate tire and tube and break tire beads loose at wheel flanges.

CAUTION

Avoid damaging wheel flanges when breaking tire beads loose. A scratch, gouge, or nick may cause wheel failure.

b. Remove thru-bolts and separate wheel halves, removing tire, tube, and brake disc.
c. Remove the grease seal rings, felts, and bearing cones from the wheel halves.

NOTE

The bearing cups are a press fit in the wheel halves and should not be removed unless new bearing cups are to be installed. To remove the bearing cup, heat wheel half in boiling water for 15 minutes. Using an arbor press, if available, press out the bearing cup and press in new cup while wheel is still hot.

5-30. MAIN WHEEL INSPECTION AND REPAIR.
a. Clean all metal parts and the grease seal felts in cleaning solvent and dry thoroughly.
b. Inspect wheel halves for cracks. Cracked wheel halves must be rejected and new parts installed. Sand out nicks, gouges, and corroded areas. When the protective coating has been removed, the area should be thoroughly cleaned, primed with zinc chromate and painted with aluminum lacquer.
c. Inspect brake disc. If excessively warped or scored, or worn to a thickness of 0.190-inch, the disc should be replaced with a new part. Sand smooth small nicks and scratches.
d. Bearing cups and cones must be inspected carefully for damage and discoloration. After cleaning, pack bearing cone with clean aircraft wheel bearing grease before installation in the wheel half.

5-31. MAIN WHEEL REASSEMBLY.
a. Insert thru-bolts through brake disc and position brake disc in the inner wheel half, using the thru-bolts to guide the disc. Assure that the brake disc is seated in wheel half.
b. Insert tube in tire, aligning index marks on tire and tube.
c. Position tire and tube with the inflation valve through hole in outboard wheel half. Place the inner wheel half in position with thru-bolts in outboard wheel half. Apply light force to bring wheel halves together and assemble a washer and nut on thru-bolts. Tighten thru-bolt nuts evenly to the torque value stipulated in figure 5-6A.

CAUTION

Uneven or improper torque of the thru-bolt nuts may cause failure of bolts with resultant wheel failure.

d. Clean and repack wheel bearing cones with clean aircraft wheel bearing grease.
e. Assemble the bearing cones, grease seal felts, and rings into wheel halves.
f. Inflate tire to seat tire beads, then adjust pressure to specified pressure listed in figure 1-1.

5-31A. MAIN AND NOSE WHEEL THRU-BOLT NUT TORQUE VALUES. (Refer to figure 5-6A.) During assembly of main or nose wheels, the thru-bolt nuts should be tightened evenly and torqued to the values stipulated in figure 5-6A. To facilitate identification of wheel manufacturers, solid wheels are manufactured by Cleveland Aircraft Products Co., and webbed wheels are manufactured by McCauley Industrial Corp. Cleveland wheels are also identified by having two wheel halves as shown in figure 5-6 and figure 5-27. McCauley wheels are identified by having two wheel flanges and a hub as shown in figure 5-27. The difference between McCauley steel-flange wheels and Mc Cauley aluminum-flange wheels is illustrated in figure 5-27.

5-32. MAIN WHEEL INSTALLATION.
a. Position wheel wheel assembly on axle.
b. Install axle nut and tighten until a slight bearing drag is obvious when wheel is rotated. Back off nut to nearest castellation and install cotter pin.
c. Place brake back plate in position and secure with washers and bolts.
d. Install hub cap.
e. Remove jack and jack pad.

5-33. MAIN WHEEL AND AXLE REMOVAL.
a. Using an individual jack pad, jack the wheel as outlined in Section 2.
b. Remove wheel assembly in accordance with paragraph 5-28.
c. Disconnect and drain brake hose at brake assembly. Cap or plug open fittings and lines to prevent entry of foreign material.
d. Disconnect brake line from fitting in brake line attach bracket.

| LANDING GEAR WHEEL THRU-BOLT/NUT TORQUE VALUES | | | | | | |
|---|---|---|---|---|---|---|
| MAIN GEAR | NOSE GEAR | WHEEL NUMBER | SIZE | MANUFACTURER | THRU-BOLT/ NUT TORQUE | RIM |
| X | | C163001-0104 | 6.00 X 6 | CLEVELAND | 90 lb-in | ALUMINUM |
| | X | 1241156-12 | 5.00 X 5 | CLEVELAND | 120-130 lb-in | ALUMINUM |
| | X | C163002-0201 | 5.00 X 5 | MC CAULEY | 120-130 lb-in | ALUMINUM |
| | X | C163003-0201 | 5.00 X 5 | MC CAULEY | 90-100 lb-in | STEEL |

Figure 5-6A. Main and Nose Wheel Thru-Bolt Nut Torque Values

## SHOP NOTES:

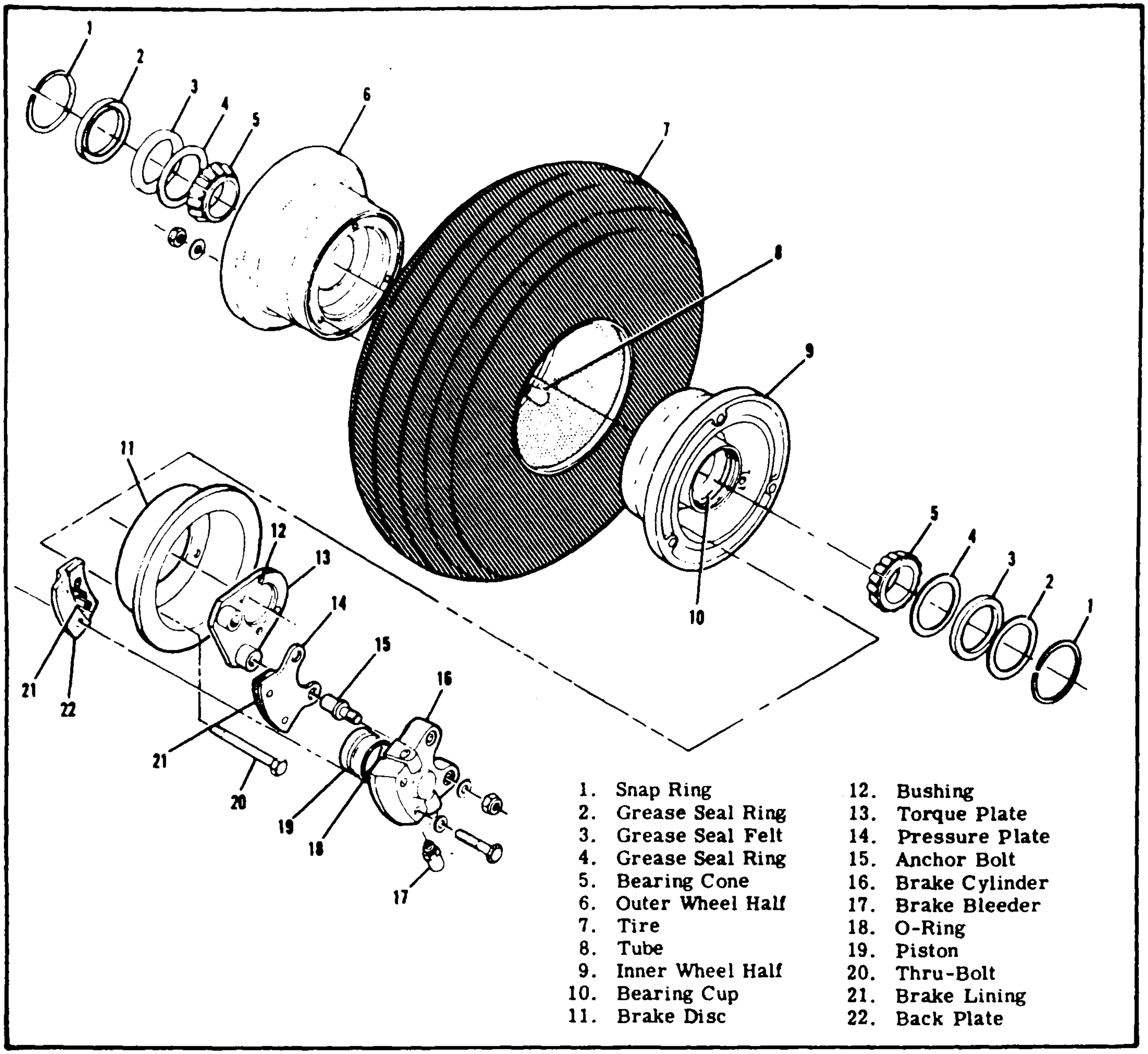



Figure 5-6. Main Wheel and Brake Assembly

e. Remove four nuts, washers, and bolts securing axle, brake torque plate, brake line bracket, and wheel alignment shims.

NOTE

When removing axle from strut fitting, note number and position of the wheel alignment shims. Mark these shims or tape them together carefully so they can be reinstalled in exactly the same position to ensure that wheel alignment is not disturbed.

5-34. MAIN WHEEL AND AXLE INSTALLATION.

a. Place axle, alignment shims, brake line bracket, and brake torque plate in position. Make sure wheel alignment shims and brake line bracket are in their original position. Insert bushings in brake torque plate and install bolts washers and nuts securing components to strut fitting.

b. Connect hydraulic brake line to fitting at brake line bracket.

c. Install wheel assembly in accordance with paragraph 5-32.

d. Connect hydraulic brake hose to brake cylinder.

e. Fill and bleed affected brake brake system.

f. Lower aircraft and check main wheel alignment.

5-35. MAIN GEAR STRUT AND WHEEL REMOVAL.

a. Jack aircraft in accordance with Section 2.

b. Remove seats and carpet as required for access to access plates above main landing gear and remove access plate.

c. Place master switch to ON and place landing gear control handle to UP position to unlock main gear downlocks and return master switch to OFF.

d. Remove grommet at end of strut attach bolt.
e. Remove internal retainer ring from pivot assembly around strut attach bolt.
f. Using main landing gear strut-attach bolt remover tool, remove attach-bolt. The tool is illustrated in figure 5-7. Access to bolts is gained through access holes in the belly stringers adjacent to the main landing gear actuator.
g. Work gear strut and wheel from pivot assembly.
h. Remove O-ring from pivot assembly. This is in gear attach bolt hole.

5-36. STEP INSTALLATION. (Beginning with 1972 Models.)

NOTE

The step is bonded to the landing gear spring strut with EC2216 (3M Co.).

a. Mark position of removed step so that the new step will be installed in approximately the same position on the strut.
b. Remove all traces of the original step and adhesive as well as any rust, paint or scale with a wire brush and coarse sandpaper.
c. Leave surfaces of strut slightly roughened or abraded, but deep scratches or nicks should be avoided. Also, roughen bonding surface of new step.
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 thoroughly dry.
e. Jack or hoist aircraft in accordance with instructions outlined in Section 2.
f. Disconnect brake line and remove wheel, axle and strut fitting. (Refer to figure 5-7.)
g. Mix adhesive (EC2216, or equivalent) in accordance with manufacturer's directions.
h. Spread a coat of mixed adhesive on bonding surfaces of strut and step fitting, and slide step fitting up on strut to marked position. Make sure step is straight on strut.
i. Form a small fillet of adhesive at all edges of the bonding surfaces. Remove excessive adhesive with lacquer thinner.
j. Install wheel, axle and strut fitting. Connect brake line and bleed brakes in accordance with paragraph 5-107.
k. Remove aircraft from jacks.
l. Allow adhesive to thoroughly cure according to manufacturer's recommendations before flexing the gear spring strut or applying loads to the step.
m. Paint gear spring strut and step after curing is completed.

5-37. REPLACEMENT OF MAIN GEAR SILENCER PAD (Thru 177RG0212.)
a. Remove existing pad and thoroughly clean surface of adapter, using #400 wet-or-dry sandpaper.
b. Wipe surface of adapter with solvent(MEK or alcohol.
c. Roughen one side of the new silencer pad with sandpaper and wipe with rag saturated with alcohol or MEK.
d. Apply Loctite 5381 adhesive, evenly to pad and adapter.
e. Place pad on adapter and apply slight even pressure with suitable block and clamp to hold in position.

5-38. MAIN GEAR STRUT AND WHEEL INSTALLATION.

NOTE

Petrolatum (VV-P-236) or hydraulic fluid (MIL-H-5606) shall be applied to O-rings and attach bolt before installation.

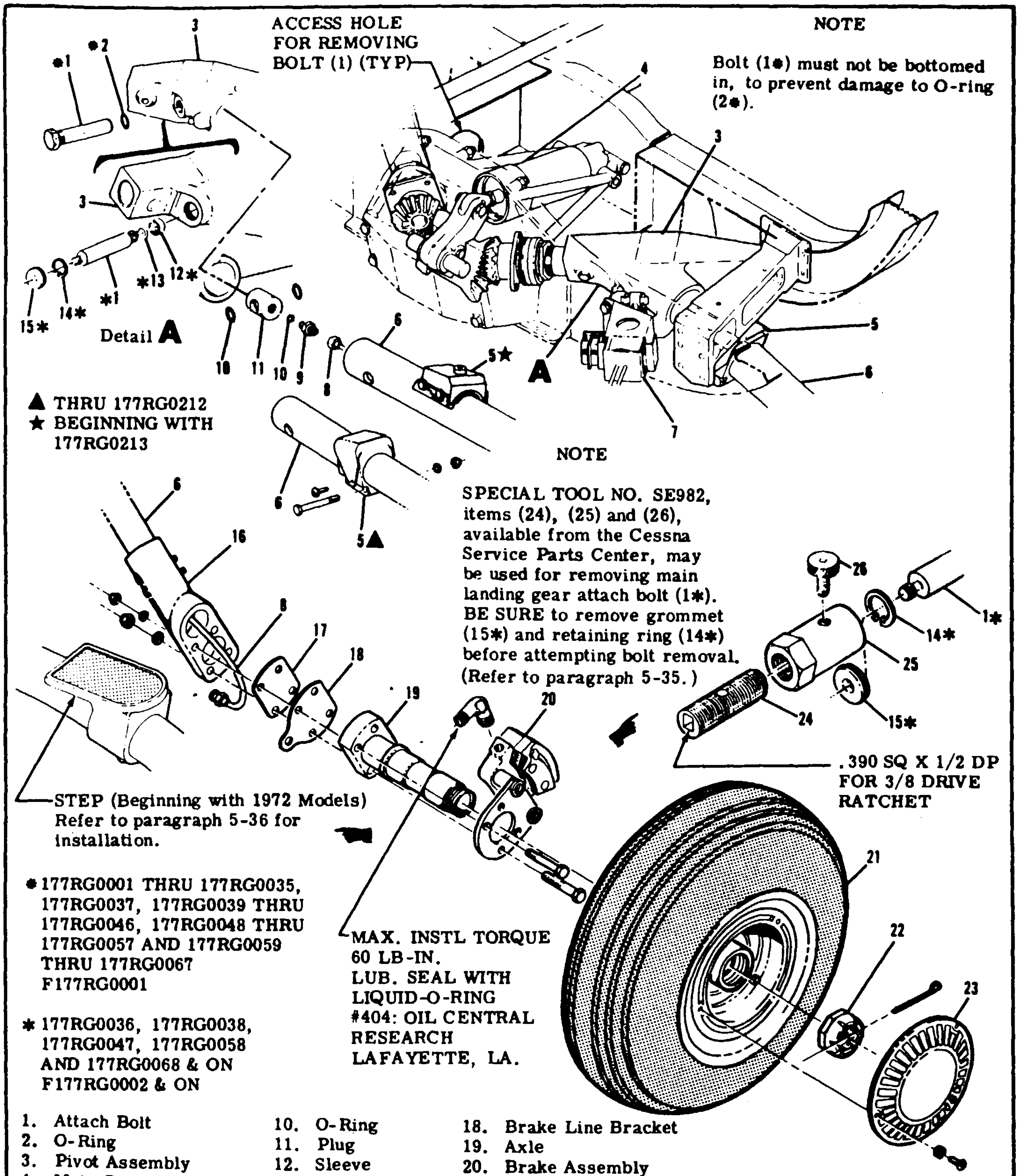
a. If brake line plug was removed from gear strut, install new O-rings in plug and install plug in gear strut aligning gear strut attach bolt hole.
b. Install new O-ring in pivot assembly at inboard end of gear strut attach bolt hole.
c. If strut support assembly was removed from strut, install support assembly approximately 6-inches from upper end of strut.
d. Apply general purpose grease (MIL-G-7711) to approximately 4 inches on upper end of strut.
e. Work strut into pivot assembly aligning strut attach bolt holes.
f. Install attach bolt and retainer ring.
g. Fill cavity at end of attach bolt with general purpose grease (MIL-G-7711) and install grommet over end of attach bolt.
h. Refer to paragraph 5-48 for rigging of main gear.

5-39. MAIN GEAR ACTUATOR.

5-40. REMOVAL. (Refer to Figure 5-9.)
a. Jack aircraft in accordance with Section 2.
b. Remove seats and carpet as required for access to access plate above main landing gear actuator and remove access plate.
c. Disconnect two hydraulic hoses from actuator. Cap or plug hose and open fittings to prevent loss of fluid and entry of foreign material.
d. Remove three bolts, washers and nuts to remove either the right or left actuator support assembly.
e. Remove bolt attaching actuator rod end to sector arm.
f. Work actuator pin from support and work actuator from aircraft.

5-41. DISASSEMBLY. (Refer to figure 5-8.)
a. Remove retainer ring at gland end of cylinder.
b. Pull piston rod, gland and piston from cylinder.
c. Loosen lock nut and remove rod end from piston rod.
d. Remove gland from piston rod.
e. Remove O-rings and back-up rings from gland and piston.

5-42. INSPECTION AND REPAIR.
Make the following inspection to ascertain that all parts are in a serviceable condition.
a. Inspect all threaded surfaces for cleanliness and for freedom of cracks and excessive wear.
b. Inspect piston, cylinder, piston rod, end gland, and bearings for cracks, chips, scratches, scoring, wear, or surface irregularities which may affect their function or the overall function of the main landing gear actuator.
c. Inspect actuator attach pin for excessive wear.




1. Attach Bolt
2. O-Ring
3. Pivot Assembly
4. Main Gear Actuator
5. Strut Support Assembly
6. Main Gear Strut
7. Downlock Assembly
8. Brake Line
9. Fitting
10. O-Ring
11. Plug
12. Sleeve
13. Packing
14. Retaining Ring
15. Grommet
16. Strut Fitting
17. Alignment Shim
18. Brake Line Bracket
19. Axle
20. Brake Assembly
21. Wheel Assembly
22. Axle Nut
23. Hub Cap
24. Threaded Rod
25. Body
26. Pin Stopper

Figure 5-7. Main Gear Strut Removal

## 5-43. INSPECTION TOLERANCES.

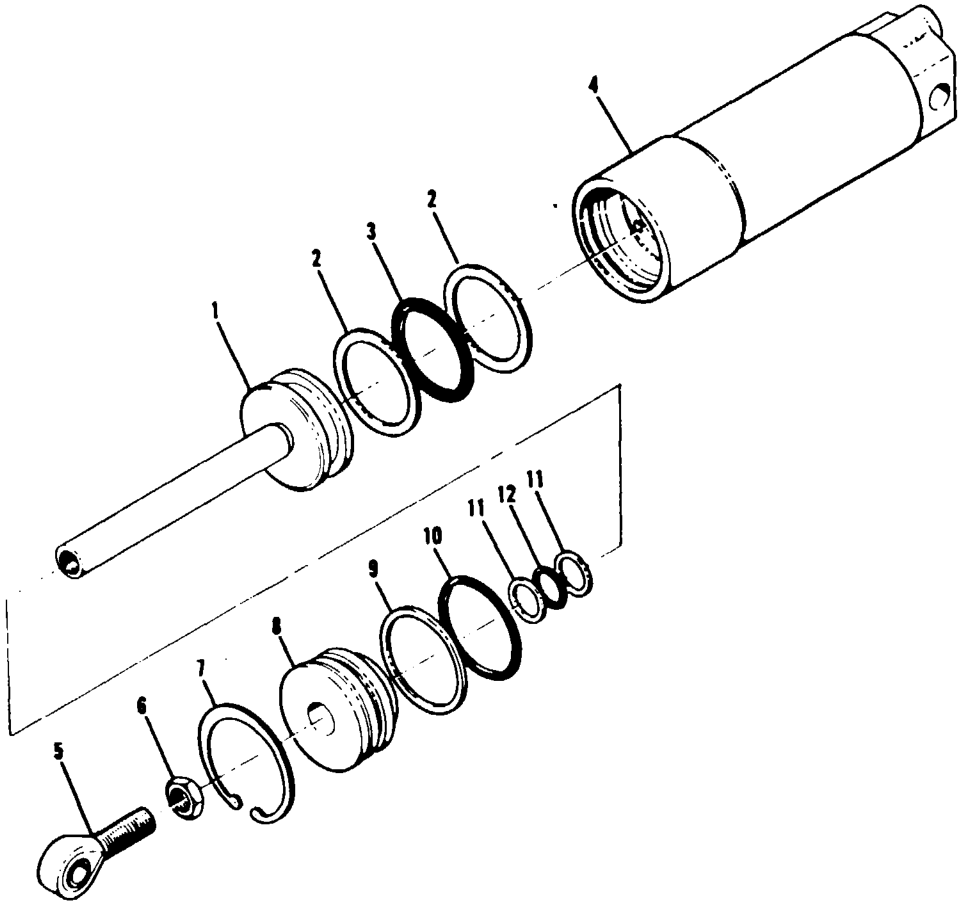
| | |
|---|---|
| Cylinder Bore Diameter (Below Gland) | 2.000 + 0.002, -0.000 in |
| Piston Rod Diameter | 0.624 + 0.000, -0.002 in |
| Piston Diameter | 1.997 + 0.000, -0.001 in |
| Stroke | 3.90 in |
| Length Installation | 8.00 in |
| Rod End Adjustment | ±0.15 in |

5-44. REASSEMBLY. (Refer to figure 5-8.) Repair of most parts of the main gear actuator assembly is impractical. Replace defective parts with serviceable parts. Minor scratches and scores may be removed by polishing with a fine abrasive crocus cloth (Federal Specification P-C-458) providing their removal does not affect operation of the main landing gear actuator. Install all new O-rings and back-up rings during reassembly of the actuator. Lubricate all internal parts, O-rings, and back-up rings with hydraulic fluid (MIL-H-5606).

a. Install back-up rings and O-ring in groove of piston. Install O-ring between back-up rings with contour on back-up ring next to the O-ring.

b. Install back-up ring and O-ring in groove on gland. Back-up ring to be toward inboard end of gland.

c. Install back-up rings and O-ring in internal groove of gland. Install O-ring between back-up rings with contour on back-up ring next to the O-ring.




1. Piston
2. Back-Up Ring
3. O-Ring
4. Cylinder
5. Rod End
6. Lock Nut
7. Retainer Ring
8. Gland
9. Back-Up Ring
10. O-Ring
11. Back-Up Ring
12. O-Ring

Figure 5-8. Main Gear Actuator

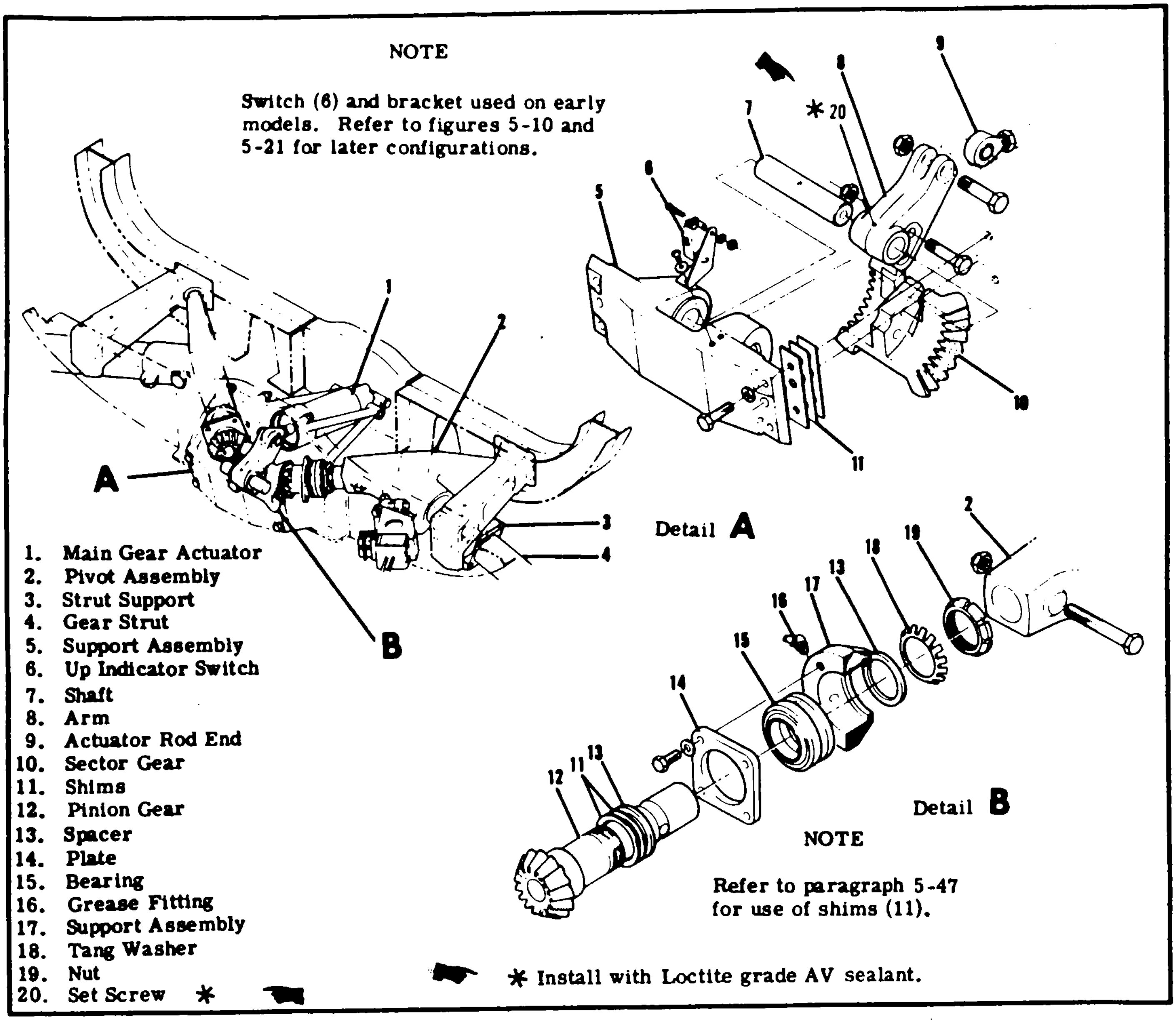



Figure 5-9. Sector Gear, Pinion Gear and Main Gear Actuator Removal and Installation

d. Install gland on piston rod. Use care and prevent damage to O-ring and back-up rings.
e. Install piston and gland into cylinder and install retainer ring at end of gland.
f. Install rod end and lock nut on piston rod.
g. Install actuator mounting pin in actuator.

5-45. INSTALLATION. (Refer to Figure 5-9.)
a. Place actuator into position and insert mounting pin in support.
b. Install removed support and attaching bolts, washers and nuts; install cotter pin.
c. Adjust rod end and attach to sector gear arm.
d. Connect hydraulic hose.
e. Using an external power source, cycle landing gear to bleed hydraulic system. Keep reservoir full of fluid.
f. Install access plate, carpet and seats removed for access.
g. Lower aircraft to ground.

5-45A. SECTOR GEAR ASSEMBLY.

5-45B. REMOVAL.
a. Jack aircraft in accordance with procedures outlined in Section 2.
b. Remove main gear strut as outlined in applicable paragraph.
c. Disconnect main gear actuator rod end from sector gear arm.
d. Remove four bolts and washers securing sector gear and shaft assembly to landing gear inboard support forging.
e. Pull sector gear from pinion gears. Retain shims between support forgings, in their respective positions. These shims are used to align sector gear with pinion gears. Use care and do not damage landing gear UP switch.

5-45C. DISASSEMBLY AND INSPECTION. ( Refer to figure 5-9. )

a. Remove set screw (20) and using a punch made of soft metal, drive shaft (7) from forging (5) and arm (8).

b. Remove bolts securing sector gear(10) to arm (8) and remove arm from sector gear. Clean all parts with cleaning solvent.

c. Inspect all threaded parts for freedom of cracks and general servicability.

d. Inspect all parts for cracks, nicks and signs of excessive wear.

e. Discard dammaged or worn parts with new parts.

5-45D. REASSEMBLY AND INSTALLATION. ( Refer to figure 5-9. )

a. Reverse procedures outlined in paragraphs 5-45B and 5-45C to reassemble and install sector gear assembly. Prime threads of set screw (20) with grade AV Loctite before installing.

5-46. PIVOT AND PINION GEAR ASSEMBLY.

5-46A. REMOVAL. (Refer to figure 5-9. )

a. Jack aircraft in accordance with Section 2.

b. Remove main landing gear strut as outlined in paragraph 5-35.

c. Disconnect main gear actuator rod end from sector gear arm.

d. Remove four bolts and washers securing sector gear and shaft assembly to the landing gear inboard support forging.

e. Pull sector gear from pinion gears. Retain shims, between support forgings, in their respective positions. These shims are used to align sector gear with pinion gears. Use care and do not damage landing gear up switch.

f. Disconnect brake line and remove swivel fitting at outboard end of pivot assembly.

g. Form locking tang away from nut attaching pinion shaft to forging and loosen nut.

h. Remove nut, washer and bolt securing pinion shaft to pivot assembly.

i. Remove four bolts and washers attaching pinion and bushing to landing gear forging.

j. Pull pinion from pivot assembly and forging noting position, and number of shims and spacers. Retain shims, spacers, tang washer, and nut.

k. Remove pivot assembly. It may be necessary to remove downlock mechanism to remove pivot assembly.

5-47. INSTALLATION. (Refer to figure 5-9. )

a. Paint mark the outboard faces of the two pinion teeth, located next to the centerline of symmetry and facing key groove on pinion shaft.

b. Slide greased pivot shaft end into the outboard support forging bushing.

c. With plate, thick aluminum spacer (PIN 2041015-4) on pinion slide pinion through bushing and into the pivot assembly. Do not fix pinion at this time.

d. Place sector gear and shaft assembly to the landing gear up position inboard support forging and engage first lower sector teeth between the marked teeth on both pinions with struts in up position; push bevel gear subassembly (sector gear and shaft assembly) toward the support forging acting simultaneously at the actuating arm to accomplish rotation of the gears until full engagement is realized.

e. Pulling bevel gear subassembly forward and pinions toward center of aircraft, adjust gear engagement as required, that is teeth faces of the sector and the pinion to be flush within 0.015-inch T.I.R., and backlash of gears 0.004 to 0.006 inch.

NOTE

With gears engaged, measure resulting gap between pinion shoulder and spacer next to the inboard bushing inner race, and between bevel gear support and inboard support forging.

The following shims are used as required to shim the pinion shaft as required for correct gear engagement.

2041015-2 . . . . . . . . . . . . . . . . 0.025-in
2041015-1 . . . . . . . . . . . . . . . . 0.012-in
2041015-3 . . . . . . . . . . . . . . . . 0.050-in
2041015-5 . . . . . . . . . . . . . . . . 0.005-in

The following shims are used as required between the bevel gear support forging and inboard support forging to shim bevel gear engagement.

2041018-1 . . . . . . . . . . . . . . . . 0.050-in
2041018-2 . . . . . . . . . . . . . . . . 0.025-in
2041018-3 . . . . . . . . . . . . . . . . 0.012-in

f. With shims as needed, slide pinion shaft through the inboard forging bushing, add spacer, key washer, and nut, and push pinion shaft into pivot assembly. Tighten pinion shaft nut and safety by bending washer tang across nut flat.

g. Install bevel gear assembly as in step "d" with required shims. Install bolts and washers securing assembly to inboard forging.

h. Attach main gear actuator rod end (9) to arm (8). If set screw (20) was removed or loosened, reinstall with Loctite grade AV sealant.

i. Install bolt securing pinion to pivot assembly.

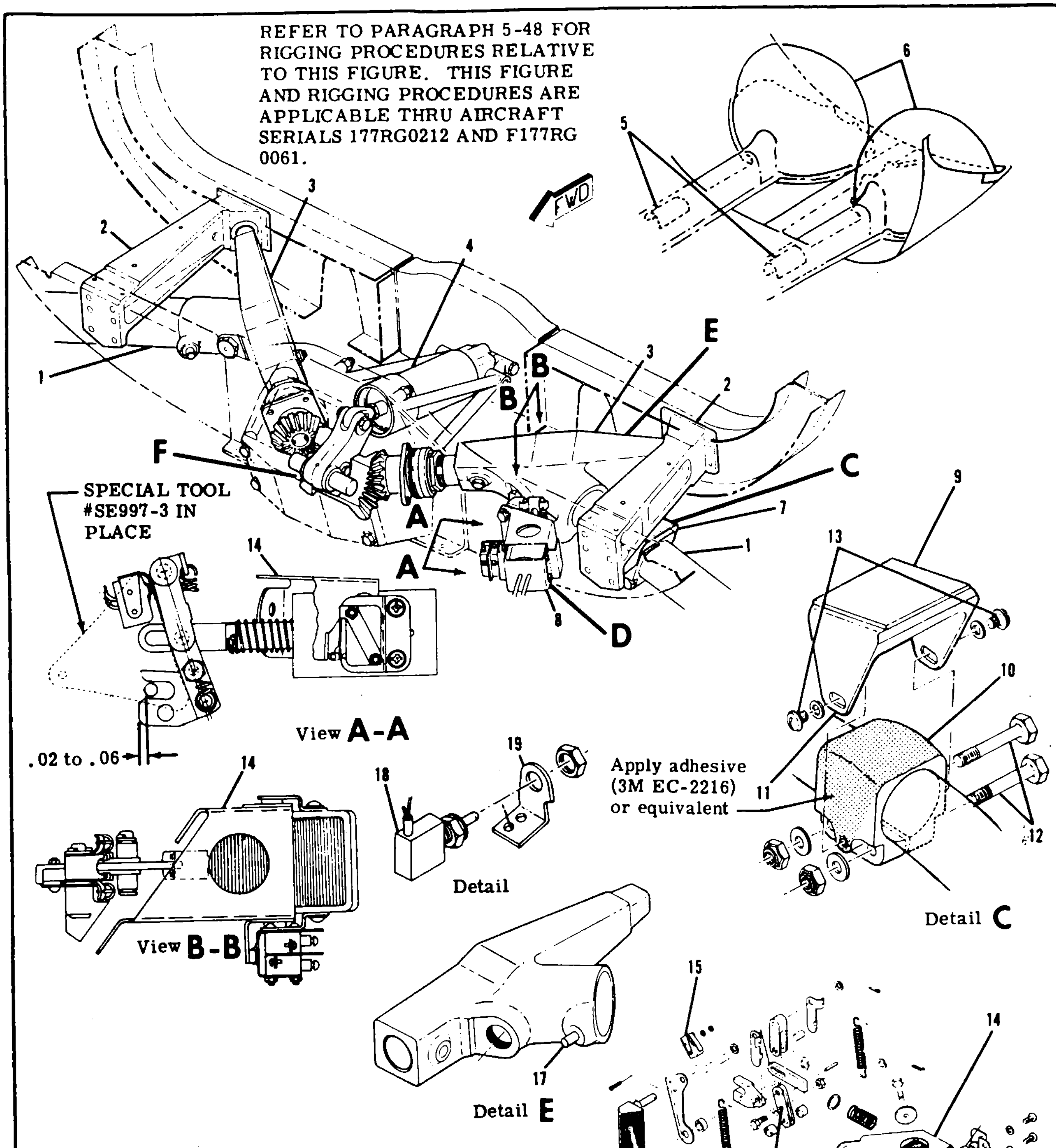
j. Install landing gear strut and rig landing gear as outlined in paragraph 5-48.

5-48. MAIN LANDING GEAR RIGGING - THRU 177RG0212. (Refer to figure 5-10. )

NOTE

Steps 5-48b thru 5-48k pertain to bonding of the main gear strut support assemblies (7) to the main gear strut (1), and positioning to support assemblies for proper contact with main landing gear support (2). These steps need not be performed unless:

1. New strut support assemblies are being installed.
2. Existing bonding has loosened and rebonding is required.
3. Landing gear rigging inspection or malfunction indicates the need to break existing bond and reposition support assemblies.
4. It is determined that strut support assemblies were not bonded during a previous installation.

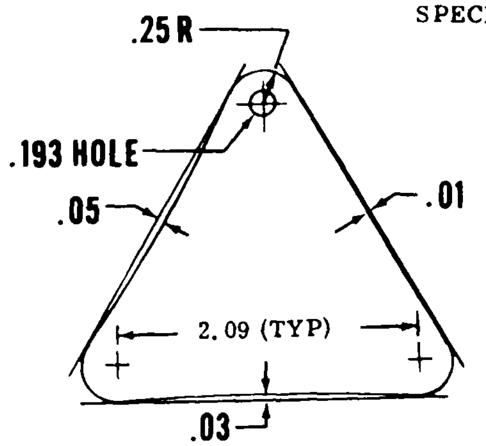


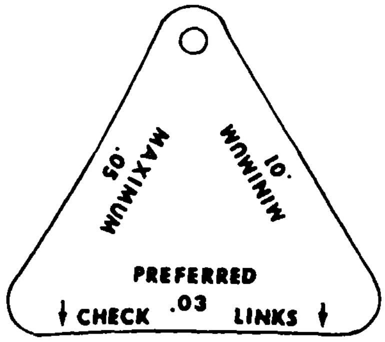

1. Main Landing Gear Strut
2. Main Landing Gear Support
3. Pivot Assembly
4. Main Landing Gear Actuator
5. Rubber Bumper
6. Main Landing Gear Wheel Well
7. Main Landing Gear Strut Support Assembly
8. Main Landing Gear Downlock
9. Silencer
10. Collar
11. Adapter
12. Bolts
13. Screws
14. Solenoid Mount Bracket
15. Downlock Switch
16. Eccentric Spacer
17. Pin
18. Switch Bracket
19. Up Indicator Switch

Figure 5-10. Main Landing Gear Rigging Procedures (Sheet 1 of 2)

DOWNLOCK CHECK GAGE

SPECIAL TOOL #SE997-3



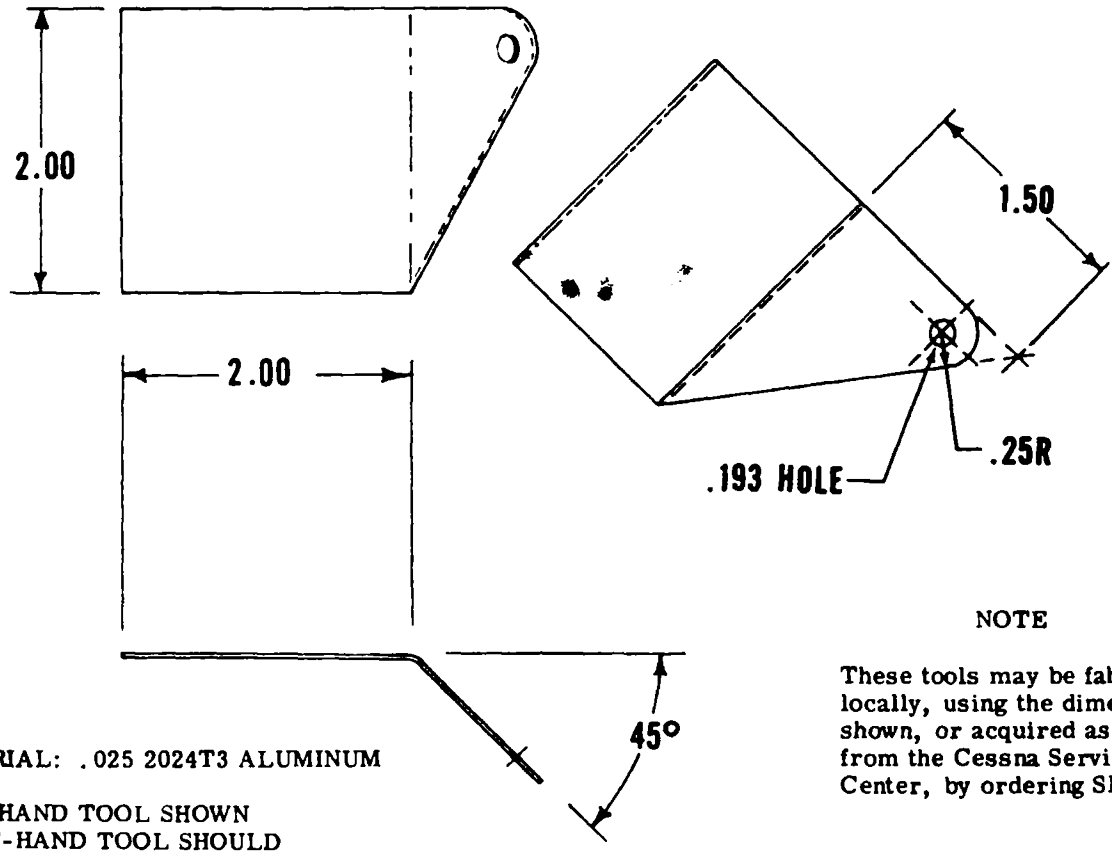

MATERIAL: .040 2024T3 ALUMINUM

Refer to paragraph 5-37 for tool use.

SILKSCREEN OR PRINT
AS SHOWN------------
DO NOT STEEL-STAMP

SHIM

SPECIAL TOOLS #SE997-1 (LH) and #SE997-2 (RH)




MATERIAL: .025 2024T3 ALUMINUM

LEFT-HAND TOOL SHOWN
(RIGHT-HAND TOOL SHOULD
BE BENT OPPOSITE)

Refer to paragraph 5-37 for tool use.

NOTE

These tools may be fabricated locally, using the dimensions shown, or acquired as a kit from the Cessna Service Parts Center, by ordering SE997.

SPECIAL TOOLS #SE997-1 AND #SE997-2
ARE EFFECTIVE THRU 177RG0212

Figure 5-10. Main Landing Gear Rigging Procedures (Sheet 2 of 2)

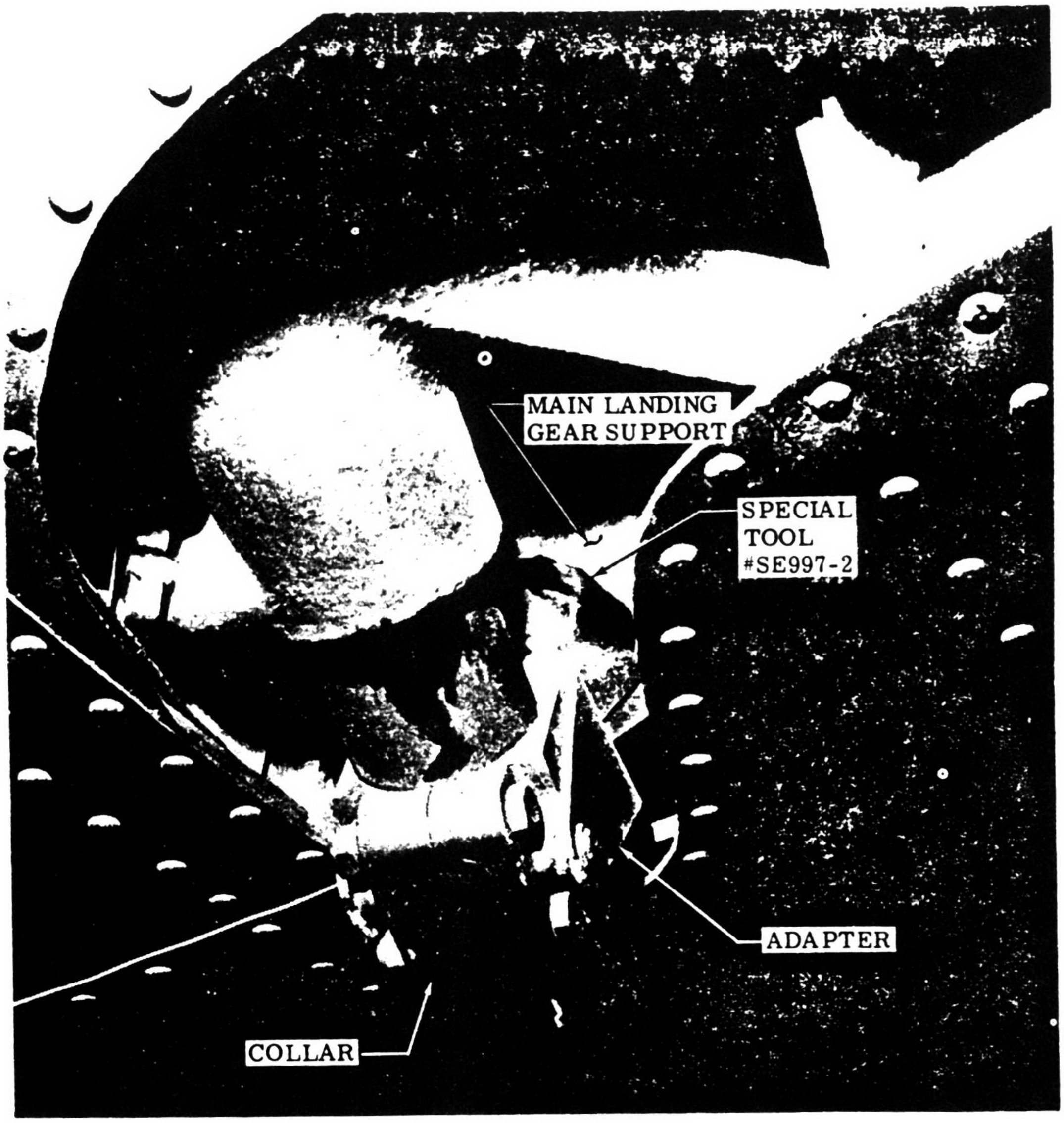



Figure 5-11. Checking for Simultaneous Contact (Sheet 1 of 2)

This figure illustrates special tool #SE997-2 (RH) in place between silencer pad and main landing gear support. Left-hand tool, #SE997-1, should be used in the same manner.

Prior to performing any bonding operation on the strut or strut support assemblies, all existing bonding must be completely removed. If the parts are new or have not been previously bonded, use #400 wet-or-dry sandpaper, or remove iridite finish from inner surface of adapter (11) and mating surface of collar (10). Using paint remover, remove paint from main gear strut in the area covered by the collar.

NOTE

It is recommended that during rigging procedures, an external power source be connected to the aircraft. Maintain 13.8 volts during the rigging procedures.

a. Roll back carpet between front and rear seats. Remove access plates above lock assemblies.

b. Jack the aircraft in accordance with procedures outlined in Section 2.

c. With main landing gear rotating freely, adjust strut support assemblies to a nominal distance of 1.8-inches from pivot assemblies (3).

d. Loosen 3 bolts (2 forward and 1 aft), attaching solenoid mount bracket (14) to bulkhead station 123.5. LOOSEN AFT BOLT FIRST to allow bracket to self-align.

e. Mark area covered by strut support assemblies (7). Back off strut support assemblies and apply MIL-S-22473 Grade AV or Loctite Catalog No. 87 to areas marked, and replace strut support assemblies.

f. Using hand pump, bring landing gear to nearly full-down position. As the landing gear approaches full-down, check top surface of strut support assemblies (7) for squareness and simultaneous contact with bottom surface of landing gear support (2).

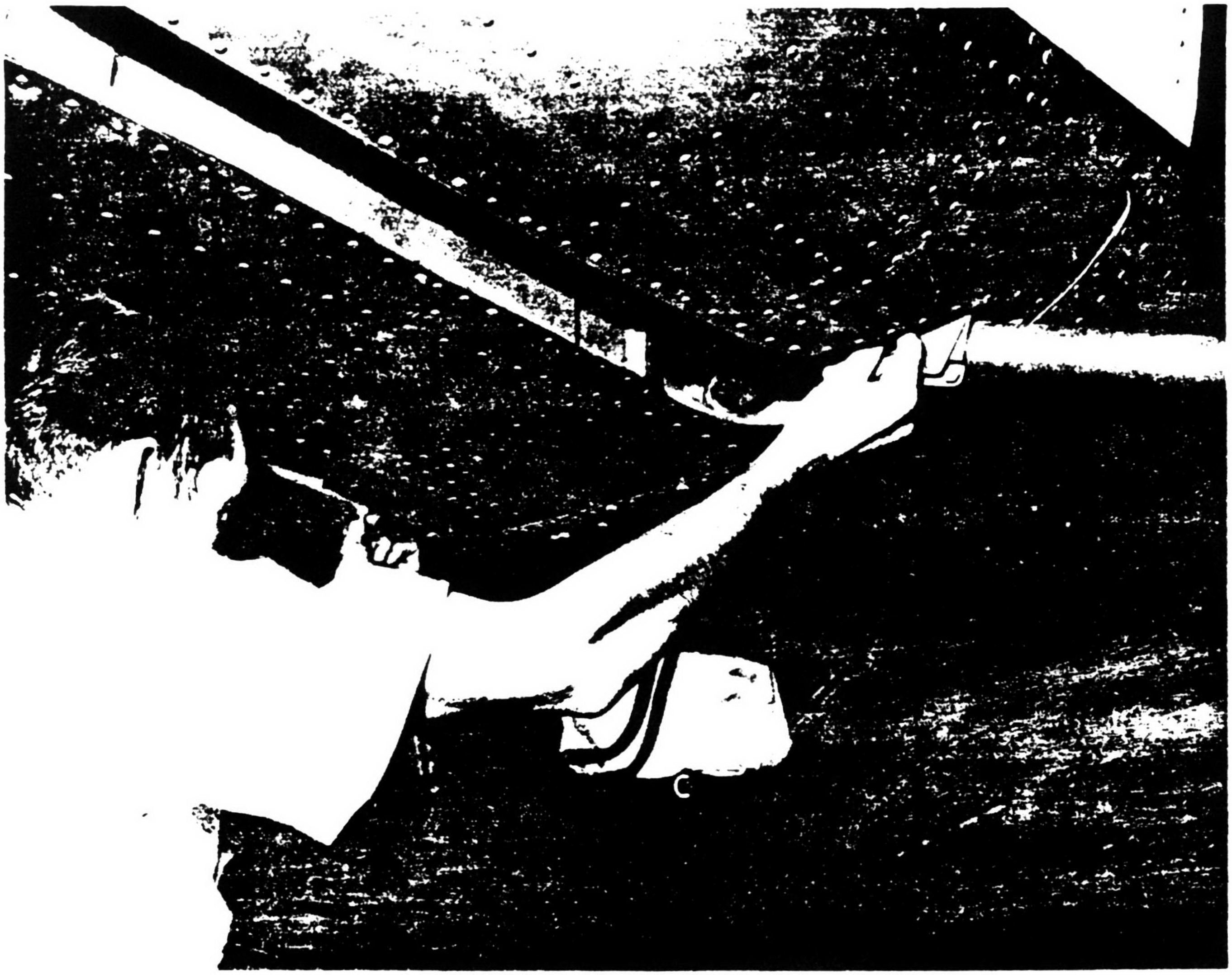



Figure 5-11. Checking for Simultaneous Contact (Sheet 2 of 2)

This figure illustrates the correct method of using special tools, #SE997-1 and -2, for checking simultaneous contact of silencer pads against main landing gear supports.

NOTE

Check squareness of contact by using .004-inch feeler gage. Gage should not fit between support and support assembly. Check simultaneous contact by inserting special tool #SE997-1 (LH) and #SE997-2 (RH) between support and support assembly prior to gear reaching full-down. Side that contacts first will unlock easiest. Refer to sheet 2 for tool fabrication. (Refer to figure 5-11 for tool usage).

NOTE

Suitable supports may be placed under tires to hold gear hard against shims or tools without additional use of hand pump.

g. Assure that right and left support assemblies (7) make contact with landing gear supports (2) simultaneously and completely square. Adjust collars (10) in or out and position adapters (11) as required, to obtain simultaneous contact.

NOTE

If one support assembly makes contact before the other, move support assembly NOT making contact, inboard until the space between support assembly (7) and support (2) is one-half (1/2) what it was when the first support assembly made contact. Move opposite support assembly outboard exactly the same amount the first was moved inboard. One support assembly should now be positioned outboard from the 1.8-inch point (refer to step "c") exactly the same amount the opposite support assembly is positioned outboard of the 1.8-inch point.

h. Recheck for simultaneous contact and squareness.

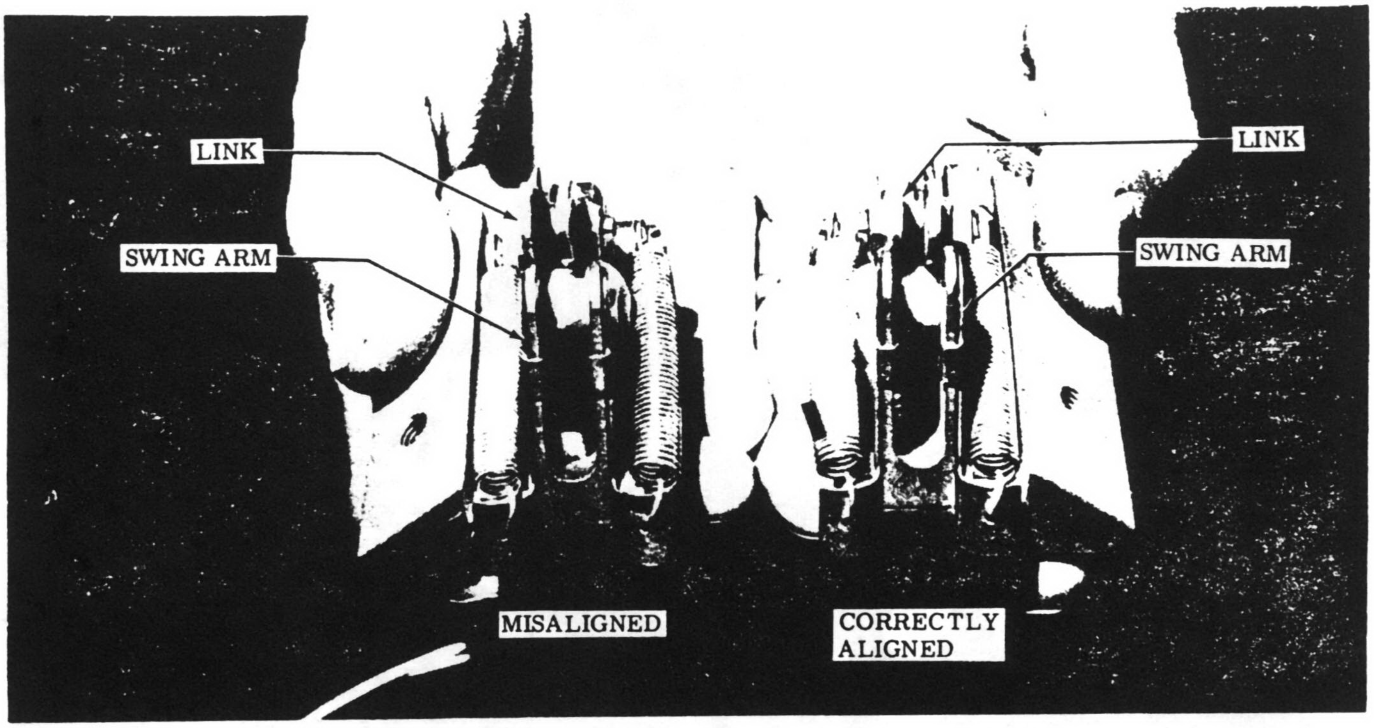



Figure 5-12. Misalignment of Lock Mechanism Components

This figure compares lock mechanisms. The assembly at left is misaligned. Ends of link are misaligned with ends of swing arm. This condition can be caused by a bent upper pin on downlock support assembly. Rigging the lock assemblies too low will bend the upper pin on lock assembly and cause binding of linkage. The assembly at right in this figure is desired, as the link works freely inside the swing arm, resulting in proper operation.

NOTE

With gear in full-down position, light tapping with fiber or plastic mallet on bottom side of support assembly (7) should position support assembly to required squareness of contact with main landing gear support (2).

i. After final adjustment, tighten bolts (12) snugly, taking care not to move collars (10) or adapters (11).
j. Pull relief valve to relieve pressure. Release locks and remove wheel supports to allow landing gear to fall to "trail" position.
k. Mark position of adapters (11) on collars (10) and remove adapters.
l. Tighten bolts (12) to 60-90 lb-in.
m. Apply adhesive (3MEC-2216 or equivalent) to collar (10) as shown in detail "C". Bond adapter (11) to collar in the previously marked position and tighten screws (13).

NOTE

It is recommended that cure time and temperature recommendation for adhesive be followed closely to assure maximum effectiveness of the bond.

n. After cure time has elapsed, to prevent rust, prime unpainted portion of strut (1) with Red Oxide Primer (Enmar Synthetic Primer or equivalent). Apply top coat of aircraft exterior paint.

CAUTION

Mask off all surfaces and edges of silencer (9) prior to painting, as paint will craze material and loosen bond.

1. Adjust downlocks (8) as follows: Manually trip locks to "locked" position. If binding occurs, check for misalignment of components as illustrated in figure 5-12. Using tool #SE997-3, check for overcenter linkage to be .02-inch overcenter (refer to view A-A). When using tool #SE997-3, clearance should be more than .01-inch, but less than .03-inch. After adjustment has been made, apply Loctite Catalog No. 87 to eccentric spacer (16 - Detail D).

NOTE

Tool #SE997-3 may be fabricated locally in accordance with instructions outlined on sheet 2, or may be ordered from the Cessna Service Parts Center.

2. Manually unlock downlocks.
3. Using hand pump, lower landing gear to a nearly full-down position and insert .025-inch shim or tools #SE997-1 (LH) and #SE997-2 (RH) between top faces of strut support assemblies (7) and bottom faces of supports (2). Refer to figure 5-11 for tool usage. Suitable supports may be placed under tires to hold gear hard against shims or tools without additional use of hand pump.

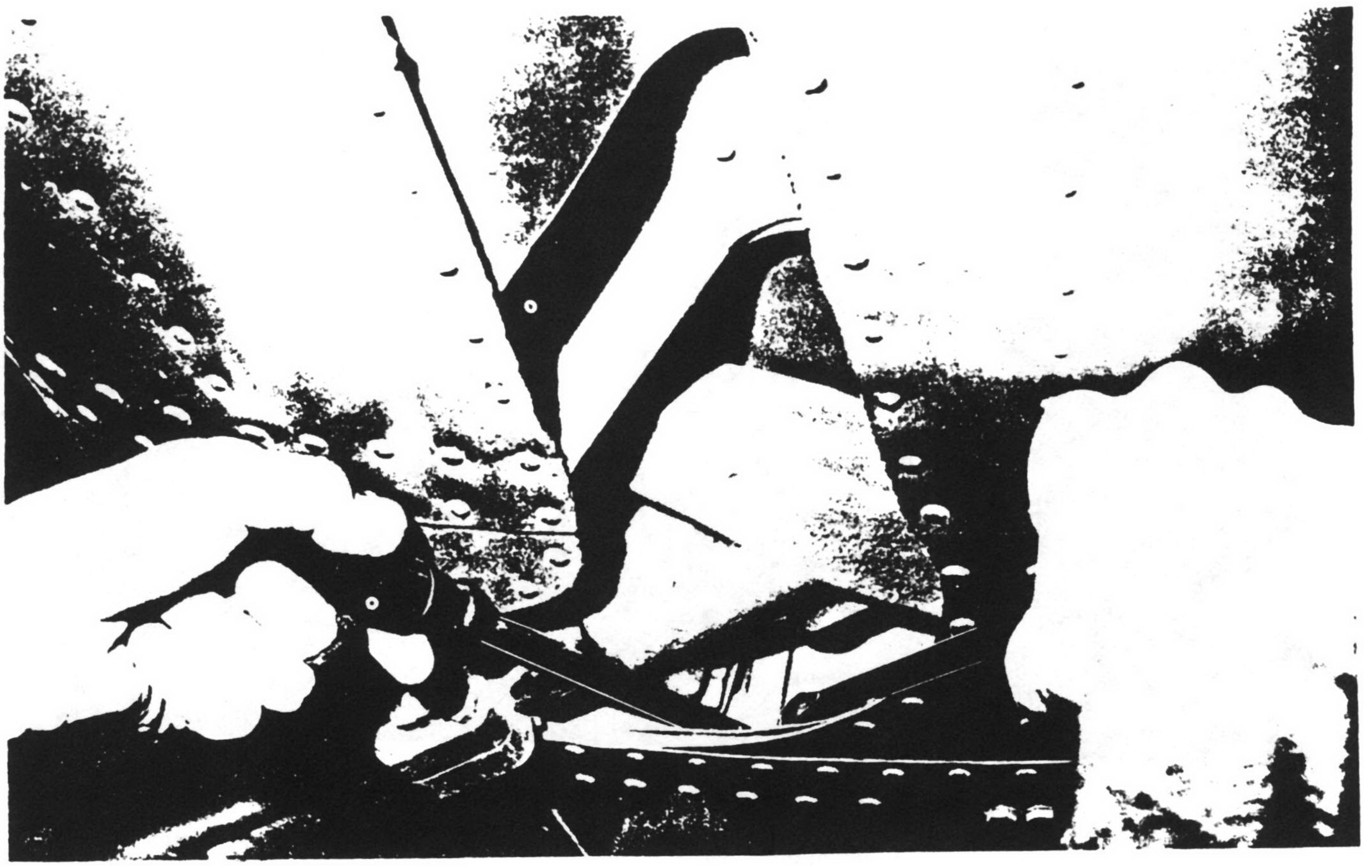


Figure 5-13. Adjusting Downlocks Vertically and Outboard

This figure illustrates the correct method of moving the downlocks vertically and outboard. This should be accomplished with the aid of a helper to tighten the bolts. TIGHTEN (2) FORWARD BOLTS FIRST. TIGHTEN AFT BOLT LAST.

NOTE

Tools #SE997-1 and SE997-2 may be fabricated locally in accordance with instructions outlined on sheet 2 or may be ordered from the Cessna Service Parts Center.

4. Pins in pivot assemblies (3) should be engaged in downlock latches and locks tripped to "locked" position.
5. Move downlock (8) vertically to position lower leg of downlock latch solid against bottom of pin (17) and outboard (horizontally) to obtain .02 to .06 dimension shown in view A-A. This will approximately center latch horizontally on exposed portion of pin (17). Refer to figure 5-13 for correct method of adjustment.

NOTE

If the preceding condition cannot be obtained: pin on bottom leg of fork, it may be necessary to move both support assemblies (7) inboard equally, the minimum amount required to prevent weight of the aircraft from riding on lock mechanism rather than silencer (9). If it is necessary to move support assemblies inboard, recheck silencer pad adjustment per step "f".

6. Using a suitable gage, check for .02 to .06-inch depth of pin (15) in throat of latch. Depth of engagement may be increased by moving lock assembly (8) inboard or adding plate against flange of solenoid mount bracket. Reverse procedures to decrease engagement. Tighten attaching bolts.

NOTE

TIGHTEN 2 FORWARD BOLTS FIRST. TIGHTEN 1 AFT BOLT LAST. Refer to figure 5-13. If assembly does not tighten firmly against bulkhead and maintain position, check downlock support assemblies as shown in figure 5-14.

7. Remove tire supports; pull relief valve to relieve pressure, if required.
8. Remove .025-inch shims.
9. Check unlock force on downlock as follows:

**WARNING**

Check unlock force on one gear and re-engage lock before checking opposite side.

10. Manually unlock locks by pushing on overcenter point on linkage. Using push-pull fish scales, and

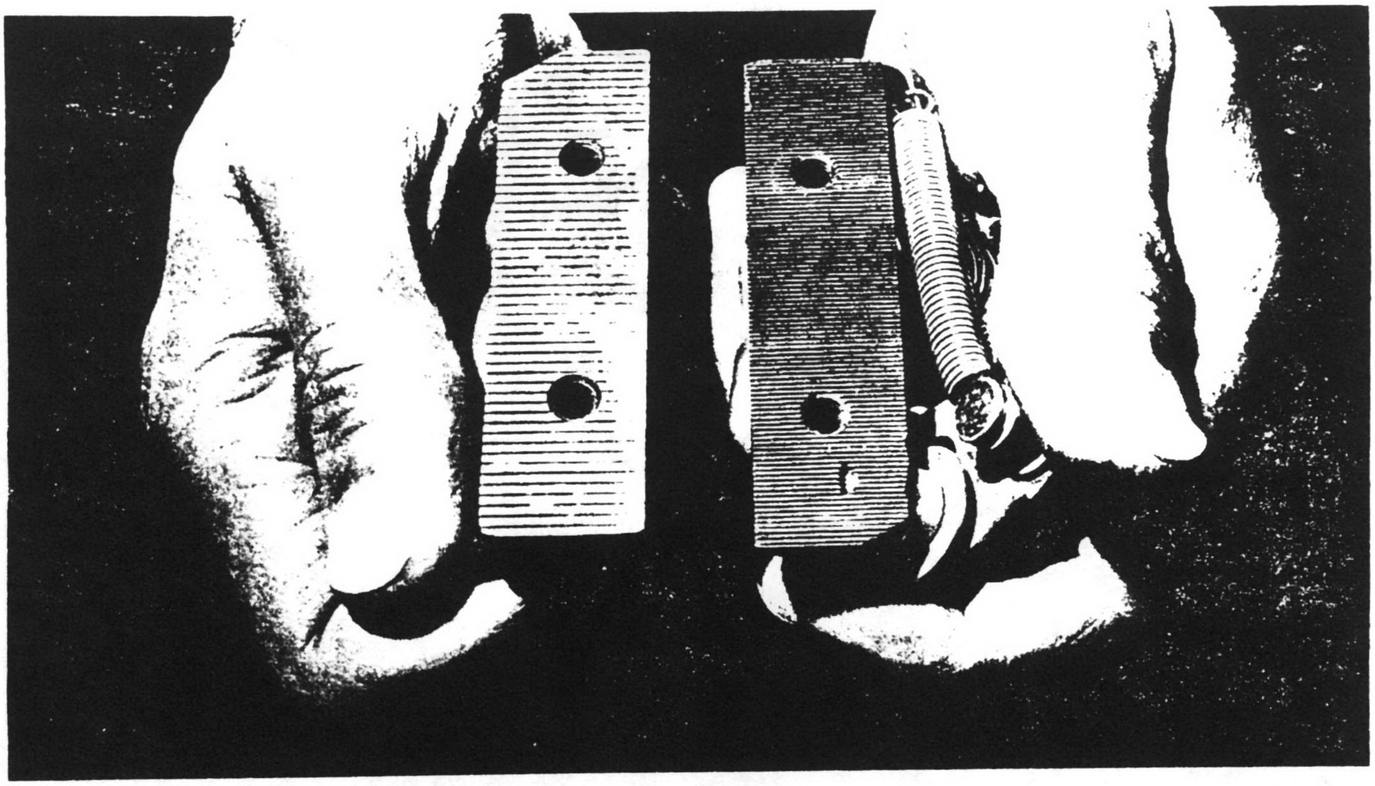


Figure 5-14. Downlock Support Assemblies

This figure compares downlock support assemblies. The serrations on the assembly at left are not sharp and defined, while those on the assembly at right are sharp to the touch and should "bite" into the bulkhead.

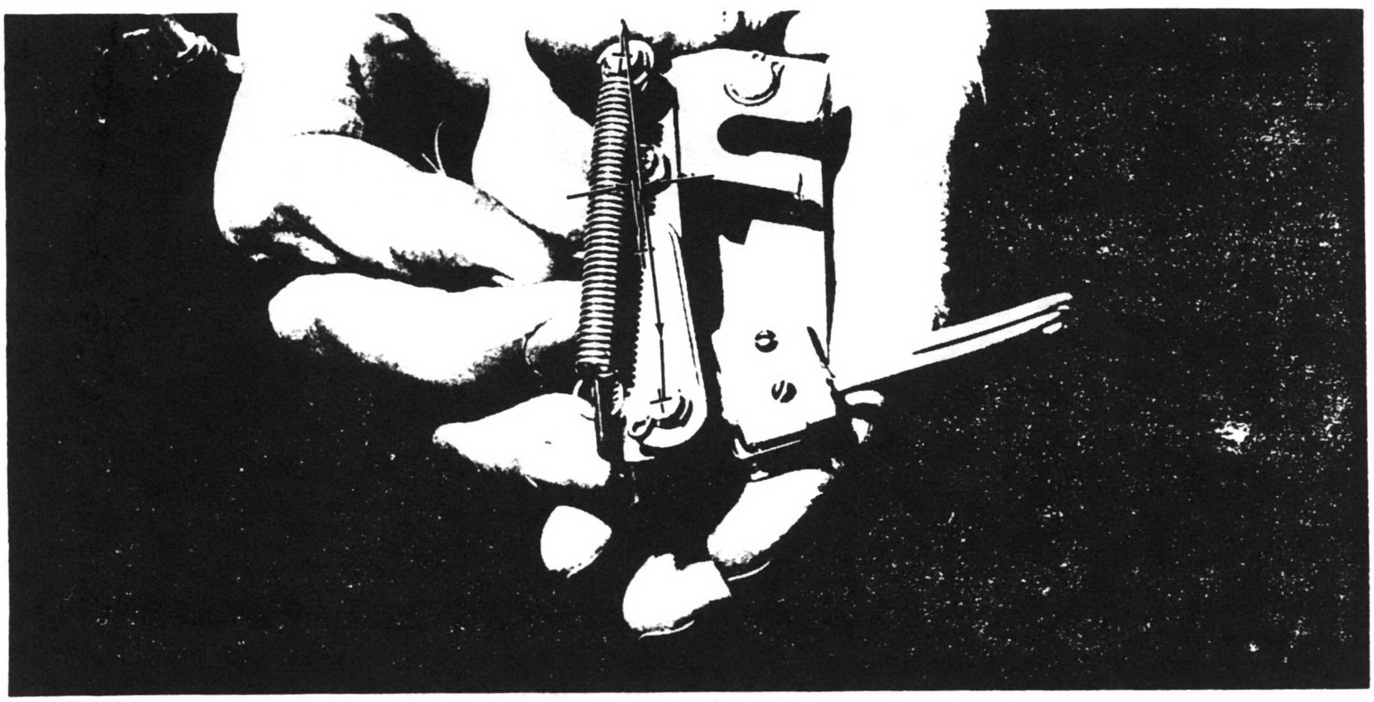


Figure 5-15. Downlock Indicator Switch Adjustment

This figure illustrates the downlock linkage position at the time of downlock indicator switch operation.

Figure 5-16. Sequence Switch Adjustment

This figure illustrates the approximate lock position when the sequence switches operate.

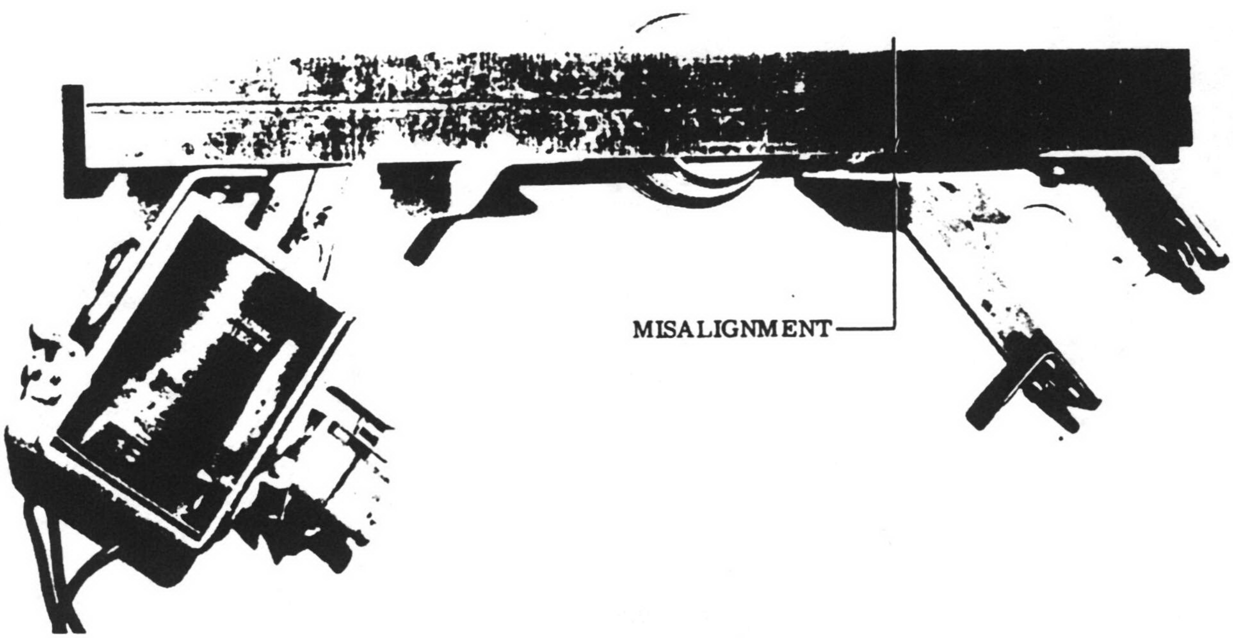



Figure 5-17. Checking Alignment of Solenoid Bracket Flanges

This figure illustrates the check for alignment of flanges on solenoid mount bracket. The bracket flanges at left are in alignment, while the amount of misalignment is shown at right. Misaligned flanges on this bracket will distort bracket, causing solenoid plunger to bind, either in the solenoid or in lock mechanism.

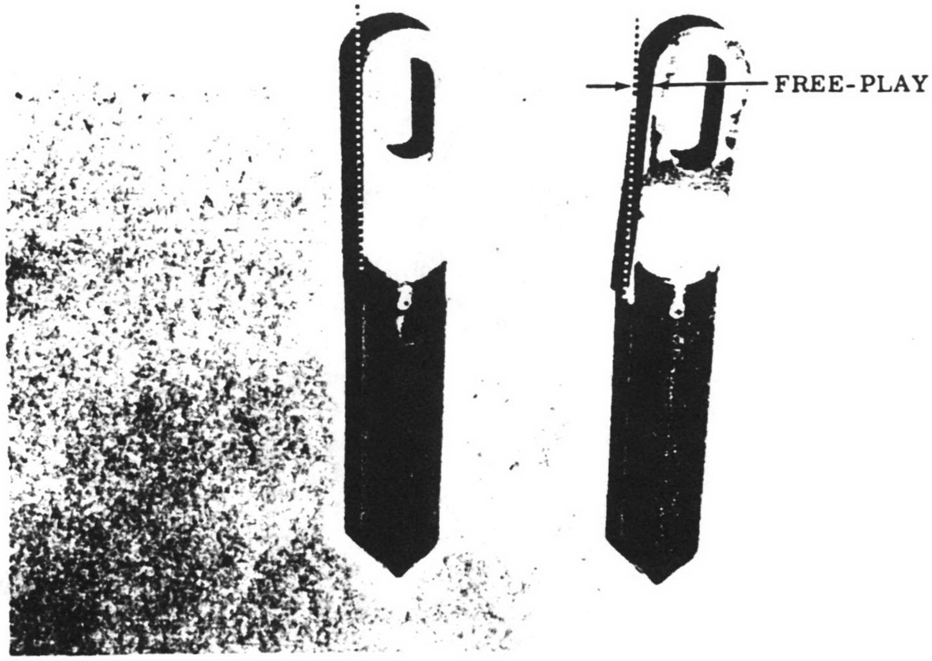



Figure 5-18. Comparing Solenoid Plungers

**This figure compares solenoid plungers. The plunger at left is desired because the plunger extension is straight and rigid, while the extension on the right is loose, and will use up the rocking motion of the solenoid.**

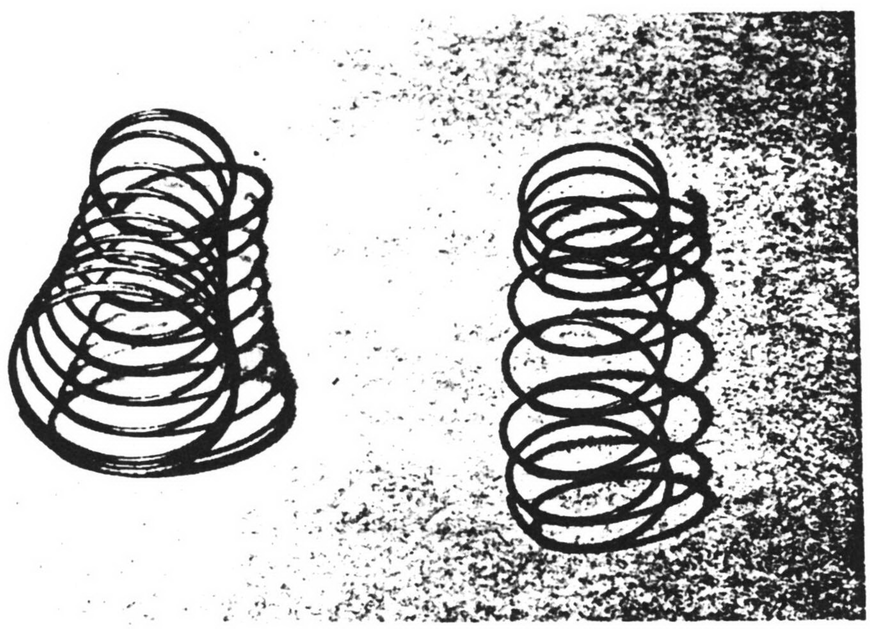


Figure 5-19. Comparing Solenoid Return Springs

This figure compares a close-wound end spring (left) with an open-wound end spring (right). Close-wound end spring (left) should be used in lieu of open-wound end spring (right) to prevent spring from winding over spacer. Spring on the left is conical. This is the type of spring installed on later aircraft. Spring can be cylindrical so long as it has close-wound ends.

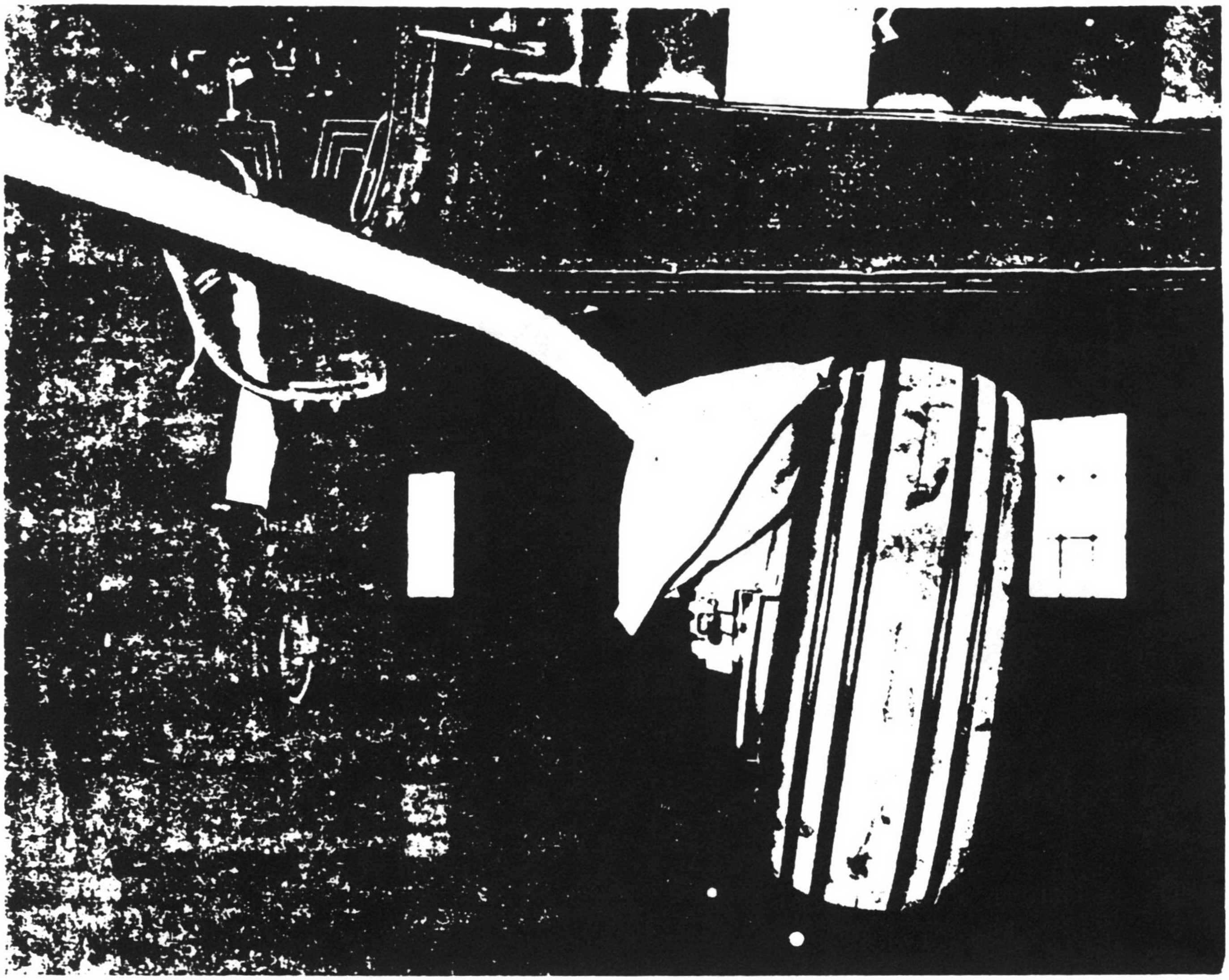


Figure 5-20. Installation of 25 lb Shot Bags

This figure illustrates the correct method of installing 25 lb shot bags on each wheel and brake assembly during cycle test. Do not retract gear into wells with shot bags on wheels.

pushing on overcenter linkage, measure unlock force. Unlock force should be approximately 3 to 4 pounds. After checking unlock force on both sides with the aid of a helper manually support gear legs and trip locks to allow gear to fall to "trail" position.

o. Extend landing gear using aircraft battery power. Check for simultaneous locking action and assure that no interference exists between locking mechanism and aircraft structure.

NOTE

Particular care should be taken to check solenoid plunger clearance.

p. Adjust downlock limit switches (15) to make contact just before overcenter linkage passes center in the locking direction. Refer to figure 5-14.

q. Select normal gear retraction. Check for simultaneous operation of both downlocks unlocking.

r. Adjust sequence switches shown in figure 5-15, and fasten attaching screws.

s. Check downlock assemblies (8) for drag-free operation. If drag is evident, check alignment of components as shown in figures 5-17, 5-18 and 5-19. Plunger should work freely.

t. Adjust main gear actuating cylinder rod to bottom the piston out when the landing gear is fully retracted and the rubber bumpers (5) are half-way deflected.

u. Adjust main gear actuator switch for .03 to .06-inch overtravel when the gear is in the retracted position and the main gear actuator piston is bottomed out.

v. Check wheel and tire clearance in wheel wells (6).

NOTE

Some early aircraft may have excessive shim build-up for wheel alignment, causing tire to drag aft side of wheel well. This condition can be remedied by installing single wheel alignment shims (P/N2041033-1), used on later aircraft. These shims are available from the Cessna Service Parts Center.

w. Attach external power source and cycle gear several times to assure proper operation, checking light indications. Approximate travel time of landing gear is 11-13 seconds in each direction.

NOTE

Lay a 25 lb. shot bag on each main wheel and brake assembly as shown in figure 5-20, during cycle test. This will preload the downlock assemblies and simulate the approximate loads on the main landing gear while airborne. Gear should lock and unlock satisfactorily with shot bags in position on wheels. Do not retract gear into wells with shot bags in place on wheels.

x. After cycle test, disconnect external power source and remove aircraft from jacks.

5-49. MAIN LANDING GEAR RIGGING. (177RG0213 THRU 177RG0282). (Refer to figure 5-21.)

a. Jack aircraft in accordance with instructions outlined in Section 2.

b. With main gear rotating freely, loosen 4 bolts attaching shell assembly to saddle (items 11 and 10).

NOTE

Three bolts can be easily removed. The fourth can be removed with a 90° offset open-end wrench.

c. Loosen, but do not remove bolts; remove shell assembly (11).

d. Remove bolt attaching eccentric bushing (13), allowing saddle (10) to be removed from aircraft.

e. Reinstall shell on saddle and temporarily hold the assembly in approximate position on the aircraft.

f. Using hand pump, rotate main gear to full-down position. Strut support assembly (7) will self-align into correct position fore and aft.

g. With soft pencil or suitable marker, mark main landing gear support forging (2) on rear edge of strut support assembly (7).

h. Allow main gear to rotate freely, allowing strut support assembly to be removed.

i. Remove shell assembly (11) from saddle (10). Install support assembly (7), eccentric bushing (13), washer and bolt in approximate position on aircraft.

j. Rotate eccentric bushing (13) until aft edge of support assembly (7) matches line marked on main landing gear support forging.

NOTE

Correct position of eccentric bushing is in outboard quadrant position.

k. Reinstall shell assembly (11) on saddle (10) and tighten 4 bolts.

l. Using hand pump, rotate main gear to full-down position. Observe that both gear springs contact shell assemblies simultaneously.

m. Add or remove shims (9) as required to obtain simultaneous contact.

NOTE

Nominal condition is one .032-inch thick shim. Allowable range is from no shims to two .032-inch shims or any combination between.

n. After shims are installed, tighten bolt attaching eccentric bushing.

o. Temporarily install shells (11) and rotate main gear to full-down position, checking for correct alignment and simultaneous contact of strut support assemblies (7).

p. Allow main gear to rotate freely. Insert .025-inch lock adjustment shim (14) between shell (11) and saddle (10). Shell must be loosened and slid down to facilitate insertions of .025-inch lock adjustment shim (14).

q. Using hand pump, rotate main gear to full-down position. Suitable supports may be placed under tires to hold gear hard against .025-inch lock adjustment shims without additional use of hand pump while adjusting downlocks.

1. Adjust downlock assemblies (8) as follows: Manually trip locks to "locked" position. Using tool #SE997-3, check for overcenter linkage to be .01-inch to .05-inch overcenter. The desired amount is .03-inches. (Refer to view B-B.) Rotate eccentric bushing, if required, to adjust. Check linkage and solenoid action for completely free motion.

NOTE

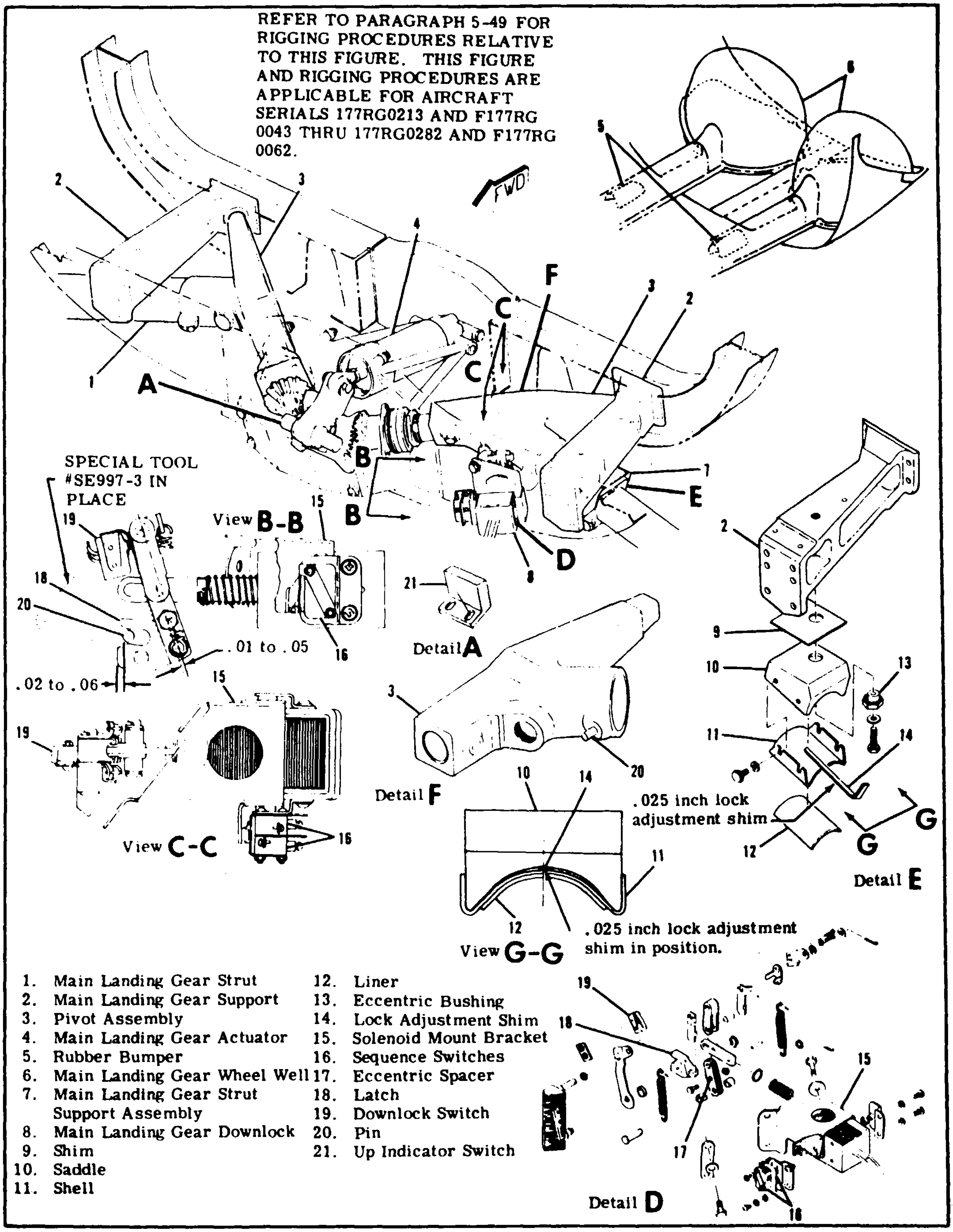
Tool #SE997-3 may be fabricated locally in accordance with instructions outlined in figure 5-10, sheet 2, or may be acquired from the Cessna Service Parts Center.

2. Manually unlock downlocks.
3. Pins (20) in pivot assemblies (3) should be engaged in downlock latches and locks tripped to "locked" position.
4. Move downlocks (8) as required to vertically center pin (20) in latch (18). Using a suitable gage, check for .02-inch to .06-inch depth of pin (20) in the throat of latch (18). Depth of engagement may be increased by moving lock assembly (8) inboard or by adding plate against flange of solenoid mount bracket (15). Reverse procedures to decrease engagement. Tighten attaching bolts.
5. Remove tire supports, pull relief valve to relieve pressure, if required.
6. Remove .025-inch lock adjustment shim (14).
7. Check unlock force on downlocks as follows:

**WARNING**

Check unlock force on one gear and reengage lock before checking opposite side.

8. Manually unlock locks by pushing on over-center




1. Main Landing Gear Strut
2. Main Landing Gear Support
3. Pivot Assembly
4. Main Landing Gear Actuator
5. Rubber Bumper
6. Main Landing Gear Wheel Well
7. Main Landing Gear Strut Support Assembly
8. Main Landing Gear Downlock
9. Shim
10. Saddle
11. Shell
12. Liner
13. Eccentric Bushing
14. Lock Adjustment Shim
15. Solenoid Mount Bracket
16. Sequence Switches
17. Eccentric Spacer
18. Latch
19. Downlock Switch
20. Pin
21. Up Indicator Switch

Figure 5-21. Main Landing Gear Rigging Procedures

point on linkage. Unlock force should be approximately 3 to 4 pounds. After checking unlock force on both sides with the aid of a helper manually support gear legs and trip locks to allow gear to fall to "trail" position.

r. Extend landing gear using aircraft battery power. Check for simultaneous locking action and assure that no interference exists between locking mechanism and aircraft structure.

s. Adjust downlock limit switches (19) to make contact when downlocks are locked.

t. Select normal gear retraction. Check for simultaneous operation of both downlocks unlocking.

u. Adjust sequence switches (16) to be actuated when solenoid trips, then fasten attaching screws.

v. Check downlock assemblies (8) for drag-free operation of solenoid plunger. Tilt mounting bracket, if necessary, to correct solenoid adjustment.

w. Adjust main gear actuating cylinder rod to bottom the piston out when the landing gear is fully-retracted and the rubber bumpers (5) are half-way deflected.

x. Adjust main gear actuator switch (21) for .03-inch to .06-inch overtravel when the gear is in the retracted position and the main gear actuator piston is bottomed out.

y. Check wheel and tire for positive clearance in wheel wells.

z. Attach external power source and cycle gear several times to assure proper operations, checking light indications. Approximate travel time of landing gear is 11-13 seconds in each direction.

NOTE

Lay a 25 lb shot bag on each wheel and brake assembly during cycle test. This will simulate the approximate air loads on the main landing gear while airborne. Gear should lock and unlock satisfactorily with shot bags in position on wheels. Do not retract gear into wells with shot bags on wheels. After cycle test, disconnect external power source and remove aircraft from jacks.

5-50. MAIN LANDING GEAR RIGGING. (177RG0283 AND F177RG0063 THRU 177RG0432 and F177RG0092.) (Refer to figure 5-22.)

NOTE

It is recommended that during rigging procedures, an external power source be connected to the aircraft. Maintain 13.8 volts during the rigging procedures.

a. Roll back carpet between front and rear seats. Remove access plates above lock assemblies.

b. Jack aircraft in accordance with procedures outlined in Section 2.

c. With main landing gear rotating freely, assemble a left-hand saddle (10) and a .032-inch shim (9) in place beneath left-hand outboard forging (2) with the cam portion of the bushing outboard. Temporarily tighten bolts and install right-hand saddle and shim in the same manner.

d. Position a shell assembly (12) on each saddle (10) and temporarily tighten retainer bolts.

e. Install main landing gear downlocks (8), actuator mounting brackets (16) and actuators (14) (if removed). Adjust jam nuts (15) to position actuators at approximately mid-position of the fore and aft adjustment. Adjust eccentric bushing (17) supporting the latches (23) so that the cam portion of the bushing is aft; temporarily tighten bolts.

f. Connect all hydraulic lines and fill system with hydraulic fluid.

g. Using either the emergency hand pump or Hydro-Test unit, bring landing gear to a nearly full-down position. As the landing gear approaches full-down, check shells (12) for alignment. Rotate saddle assemblies (10) on bushings (11) for alignment with gear legs. If assembly is too far forward or too far aft, drop landing gear out, remove shell (12) and turn bushings (11) as required to move assemblies forward or aft as required; replace shell.

h. When alignment is obtained, check for simultaneous contact of gear legs to shells (12). When proper alignment and simultaneous contact of gear legs to shells is achieved, remove the landing gear shells and tighten the bolts installed vertically which attaches the eccentric bushings and saddles to the outboard landing gear forgings. Reinstall the landing gear shells and tighten the four bolts on each saddle which attach the shells to the saddles. Safety wire the subject shell attachment bolts.

NOTE

If contact is not simultaneous, shims (9) may be added or removed to obtain simultaneous contact. Any shim or combination of shims that will allow the downlocks to be adjusted is permissible, as long as the total is no more than .064-inch thick (2 thick shims). Nominal is .032-inch (1 thick shim) on each side. Minimum is no shims.

i. Bring landing gear into full-down position.

j. Observe relationship of latch (23) to pin (24) in forging (3). Jaw of latch (23) must be parallel to pin (24) to avoid eccentric loading and provide smooth operation. Bottom of latch support block (21) may be moved inboard or outboard to provide latch-pin alignment.

k. When alignment is obtained, tap top of support lightly with a fiber mallet to be sure upper support-attach bolts are at bottom of holes. This will prevent shifting of the locks (8) downward when a lead is applied. Torque up two support mounting bolts and one actuator bracket bolt on each side.

l. With gear legs held hard against saddles (10) by hydraulic pressure or supports under wheels, adjust latch eccentric bushings (17) to obtain .002-inch to .003-inch clearance between the tip of the latch (23) and the pin (24) as the latch is operated. This adjust- is to be made on new parts or after parts replacement. In service, when adjustment reaches .025-inch, reset to .010-inch. Tighten self-locking nuts to hold bushings in place.

m. With latches (23) in place against pins (24), adjust jam nuts holding actuators (14) to take up all slack in the linkage, but not tight enough to start

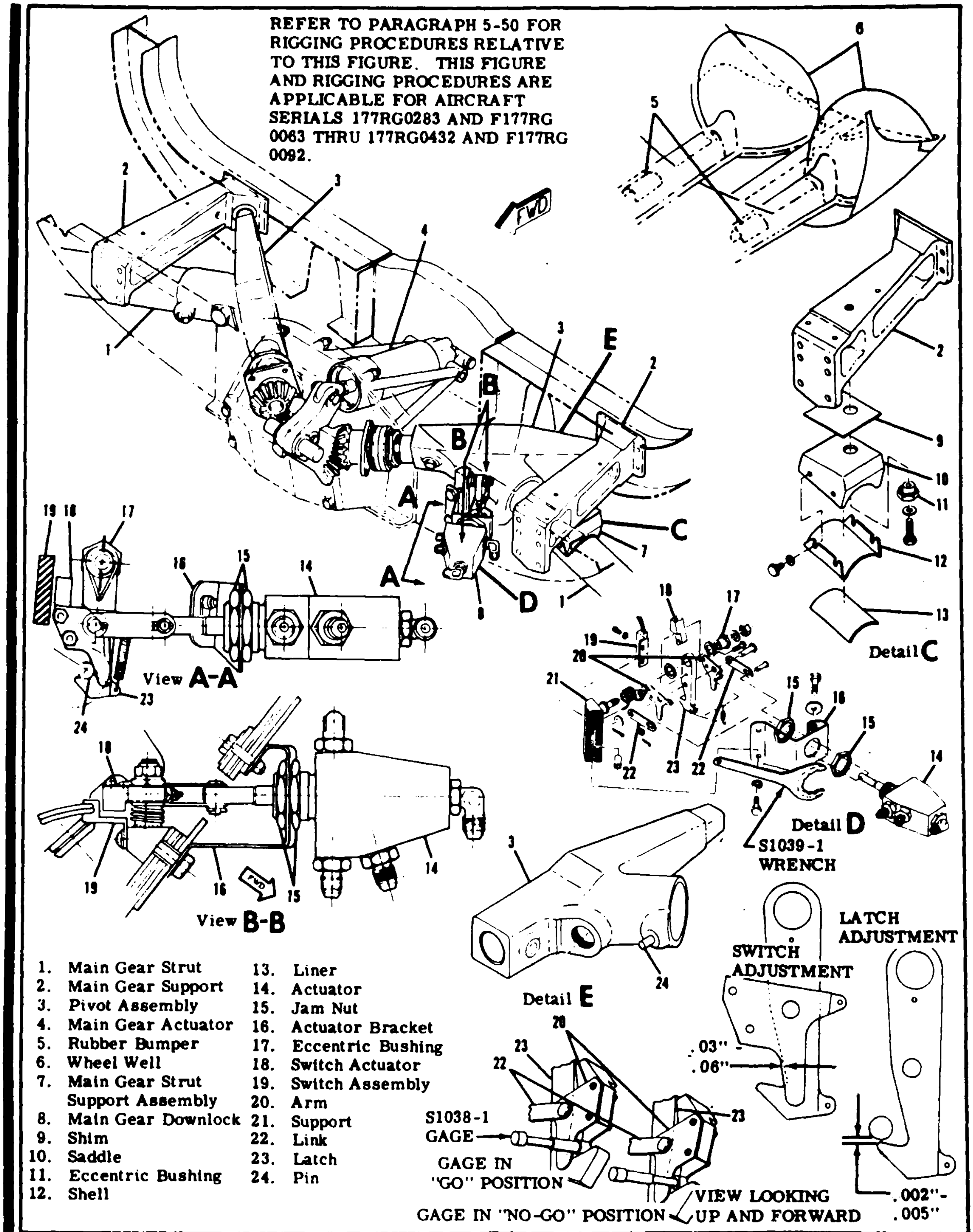



Figure 5-22. Main Landing Gear Rigging Procedures

pulling latch; tighten forward jam nut with special tool #SE1039-1, which can be acquired from the Cessna Service Parts Center.

NOTE

With tool #SE1039-1, turn front jam nut against bracket and recheck links. If links are tight, readjust so that links are free but not loose. Back up front nut approximately 1/4 turn. Tighten aft nut approximately 1/4 turn by hand, then tighten front jam nut with tool #SE1039-1. Recheck and readjust as necessary.

n. Release latches and allow landing gear to rotate freely.

o. With power on and pump circuit breaker (35 amp) pulled out and using hand pump, pump just enough strokes to position downlock actuators (14) to lock position. Loosen two screws holding magnetic switch (19) to support block (21).

p. Slide switch up as far as possible. With a helper holding opposite switch actuated, insert "GO" end of special tool #SE1038-1, available from the Cessna Service Parts Center, into downlock latch (23), depressing vanes which hold the magnet.

g. While holding gage, carefully slide switch downward until switch actuation is indicated by an audible "click" of the relay and illumination of the green gear-down light. Tighten screws holding switch.

r. Remove and reinsert "GO" gage to check operation. Remove gage and insert "NO-GO" end of gage. No response should be encountered.

NOTE

If switch cannot be adjusted from UP position, move switch to full-down position and adjust in an upward direction.

s. An alternate method of checking switches is as follows: Release latches and allow main landing gear to rotate freely. Using hand pump, pump just enough strokes to position downlock actuators (14) to "lock" position. Loosen two screws holding magnetic switch (19) to support block (21).

1. Slide switch up as far as possible.
2. Connect ohmmeter or continuity light to the switch leads.
3. Depress vanes across throat of latch until from .03-inch to .06-inch of the vanes is extended past the throat of the latch.
4. Holding this vane position, slide the switch down until contact is indicated.
5. Tighten two screws holding switch.

t. Adjust opposite landing gear in the same manner.

NOTE

If aircraft is non-operational, position downlock actuators in full-aft or "locked" position. Disconnect switch from aircraft system and connect to ohmmeter or continuity light. Disregarding opposite switch, adjust switch in same manner as in steps "o" thru "r", except that indication will occur on ohmmeter.

NOTE

The preceding procedures for checking magnetic switches are necessary because magnetic switches do not produce an audible "click" as is characteristic of other type switches.

u. Adjust main gear actuator cylinder rod to bottom the piston out when the landing gear is fully retracted and the rubber bumpers (5) in strut wells are half-way deflected.

v. Adjust main gear actuator magnetic limit switch for .03-inch to .06-inch overtravel when the gear is in the retracted position and the main gear actuator piston is bottomed out.

w. Check wheel and tire for positive clearance in wheel wells.

x. Attach external power source and cycle gear several times to assure proper operation, checking light indications. Approximate travel time of landing gear is 11-13 seconds in each direction.

NOTE

Lay a 25 lb shot bag on each wheel and brake assembly during the cycle test. This will simulate the approximate air loads on the main landing gear while airborne. Gear should lock and unlock satisfactorily with shot bags in position on wheels. Do not retract gear into wells with shot bags on wheels. After cycle test, disconnect external power source and remove aircraft from jacks.

5-51. MAIN LANDING GEAR RIGGING. (BEGINNING WITH 177RG0433 AND F177RG0093). (Refer to figure 5-23.)

NOTE

It is recommended that during rigging procedures, an external power source be connected to the aircraft. Maintain 13.8 volts during the rigging procedures.

a. Roll back carpet between front and rear seats. Remove access plates above lock assemblies.

b. Jack aircraft in accordance with procedures outlined in Section 2.

c. Allow main gear to rotate freely. Assemble a left-hand saddle (10) and a .032-inch shim (9) in place beneath left-hand outboard forging (2) with the cam portion of the bushing outboard. Temporarily tighten bolt. Install right-hand saddle and shim in the same manner.

d. Position a shell assembly (12) on each saddle (10) and temporarily tighten bolts.

e. Install main landing gear downlocks (8), actuator mounting brackets (16) and actuators (14) (if removed). Adjust jam nuts (15) to position actuators at approximately mid-position of the fore and aft adjustment. Adjust the bushings (17) supporting the latches (23) such that the cam portion of the bushing is aft; and temporarily tighten.

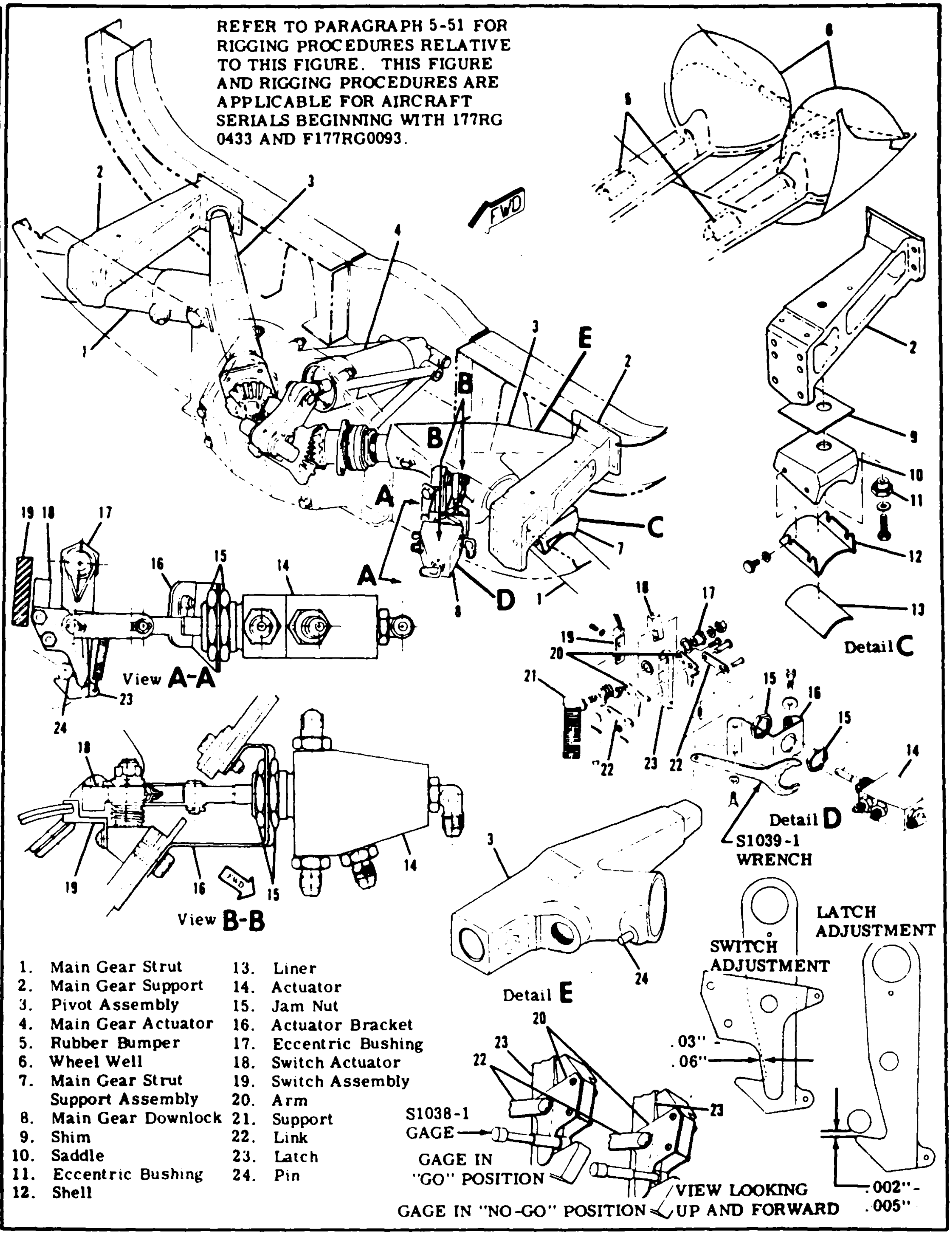



Figure 5-23. Main Landing Gear Rigging Procedures

f. Connect all hydraulic lines and fill system with hydraulic fluid.

g. Using either the emergency hand pump or Hydro-Test unit, bring landing gear to a nearly full-down position. As the landing gear approaches full-down, check shells (12) for alignment. Rotate saddle assemblies (10) on bushings (11) for alignment with gear legs. If assembly is too far forward or too far aft, drop landing gear out, remove shell (12) and turn bushing (11) as required to move assemblies forward or aft as required; replace shell (12).

h. The .015-inch maximum dimension (see figure 5-22) between the neoprene shell (12) and the strut (1) is in reference to the aircraft positioned in a stand for rigging. This will provide approximately 90±10% contact area with the aircraft on the ground.

i. When alignment is obtained, check for simultaneous contact of gear legs to shells (12). When proper alignment and simultaneous contact of gear legs to shells is achieved, remove the landing gear shells and tighten the bolts installed vertically which attaches the eccentric bushings and saddles to the outboard landing gear forgings. Reinstall the landing gear shells and tighten the four bolts on each saddle which attach the shells to the saddles. Safety wire the subject shell attachment bolts.

NOTE

If contact is not simultaneous, shims (9) may be added or removed to obtain simultaneous contact. Any shim or combination of shims that will allow the downlocks to be adjusted is permissible, as long as the total is no more than the .064-inch thick (2 thick shims). Nominal is .032-inch (1 thick shim) on each side. Minimum is no shims.

j. Bring landing gear into full-down position.

k. Observe relationship of latch (23) to pin (24) in forging (3). Jaw of latch (23) must be parallel to pin (24) to avoid eccentric loading and provide smooth operation. The bottom of latch support block (21) may be moved inboard or outboard to provide latch-pin alignment.

l. When alignment is obtained, tap top of support lightly with a fiber mallet to be sure upper support-attach bolts are at bottom of holes. This will prevent shifting of the locks (8) downward when a load is applied. Torque up two support mounting bolts and one actuator bracket bolt on each side.

m. With gear legs held hard against saddles (10) by hydraulic pressure or supports under wheels, adjust latch eccentric bushings (17) to obtain .002-inch to .003-inch clearance between the tip of the latch (23) and the pin (24) as the latch is operated. This adjustment is to be made on new parts or after parts replacement. In service, when adjustment reaches .025-inch, reset to .010-inch. Tighten self-locking nuts to hold bushings in place.

n. With latches (23) in place against pins (24), adjust jam nuts holding actuators (14) to take up all slack in the linkage, but not tight enough to start pulling latch; tighten forward jam nut with special tool #SE1039-1, which can be acquired from the Cessna Service Parts Center.

o. Release latches and allow landing gear to rotate freely.

p. With power on and pump circuit breaker (35 amp) pulled out and using hand pump, pump just enough strokes to position downlock actuators (14) to lock position. Loosen two screws holding magnetic switch (19) to support block (21).

NOTE

With tool #SE1039-1, turn front jam nut against bracket and recheck links. If links are tight, readjust so that links are free but not loose. Back up front nut approximately 1/4 turn. Tighten aft nut approximately 1/4 turn by hand, then tighten front jam nut with tool #SE1039-1. Recheck and readjust as necessary.

q. Slide switch up as far as possible. With a helper holding opposite switch actuated, insert "GO" end of special tool #SE1038-1, available from the Cessna Service Parts Center, into downlock latch (23), depressing vanes which hold the magnet.

r. While holding gage, carefully slide switch downward until switch actuation is indicated by an audible "click" of the relay and illumination of the green gear-down light. Tighten screws holding switch.

s. Remove and reinsert "GO" gage to check operation. Remove gage and insert "NO-GO" end of gage. No response should be encountered.

NOTE

If switch cannot be adjusted from UP position, move switch to full-down position and adjust in an upward direction.

t. An alternate method of checking switches is as follows: Release latches and allow main landing gear to rotate freely. Using hand pump, pump just enough strokes to position downlock actuators (14) to "lock" position. Loosen two screws holding magnetic switch (19) to support block (21).

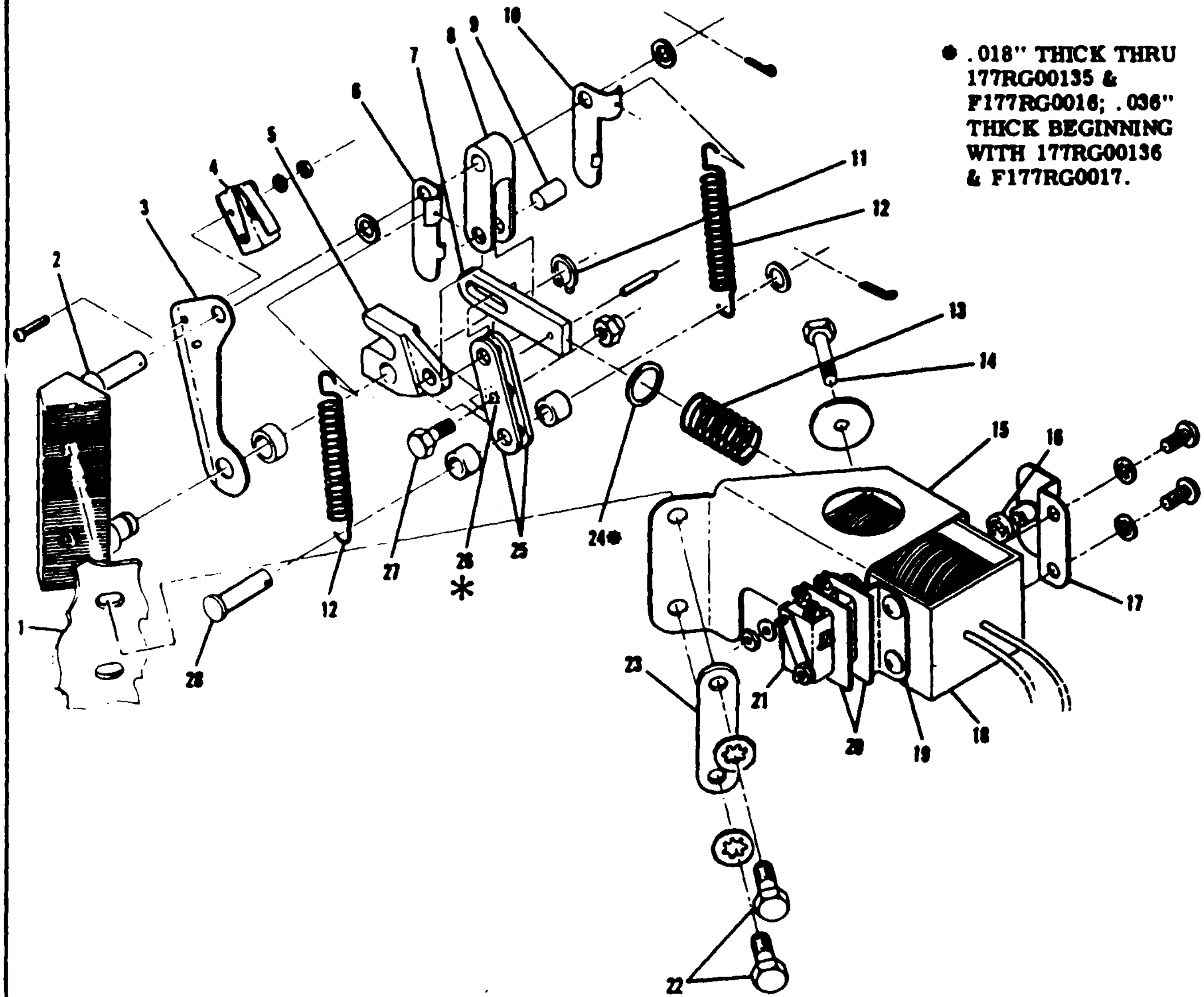
1. Slide switch up as far as possible.
2. Connect ohmmeter or continuity light to the switch leads.
3. Depress vanes across throat of latch until from .03-inch to .06-inch of the vane is extended past the throat of the latch.
4. Holding this vane position, slide the switch down until contact is indicated.
5. Tighten two screws holding switch.

u. Adjust opposite landing gear in the same manner.

NOTE

If aircraft is non-operational, position downlock actuators in full-aft or "locked" position. Disconnect switch from aircraft system and connect to ohmmeter or continuity light. Disregarding opposite switch, adjust switch in same manner as in steps "p" thru "s", except that indication will occur on ohmmeter.

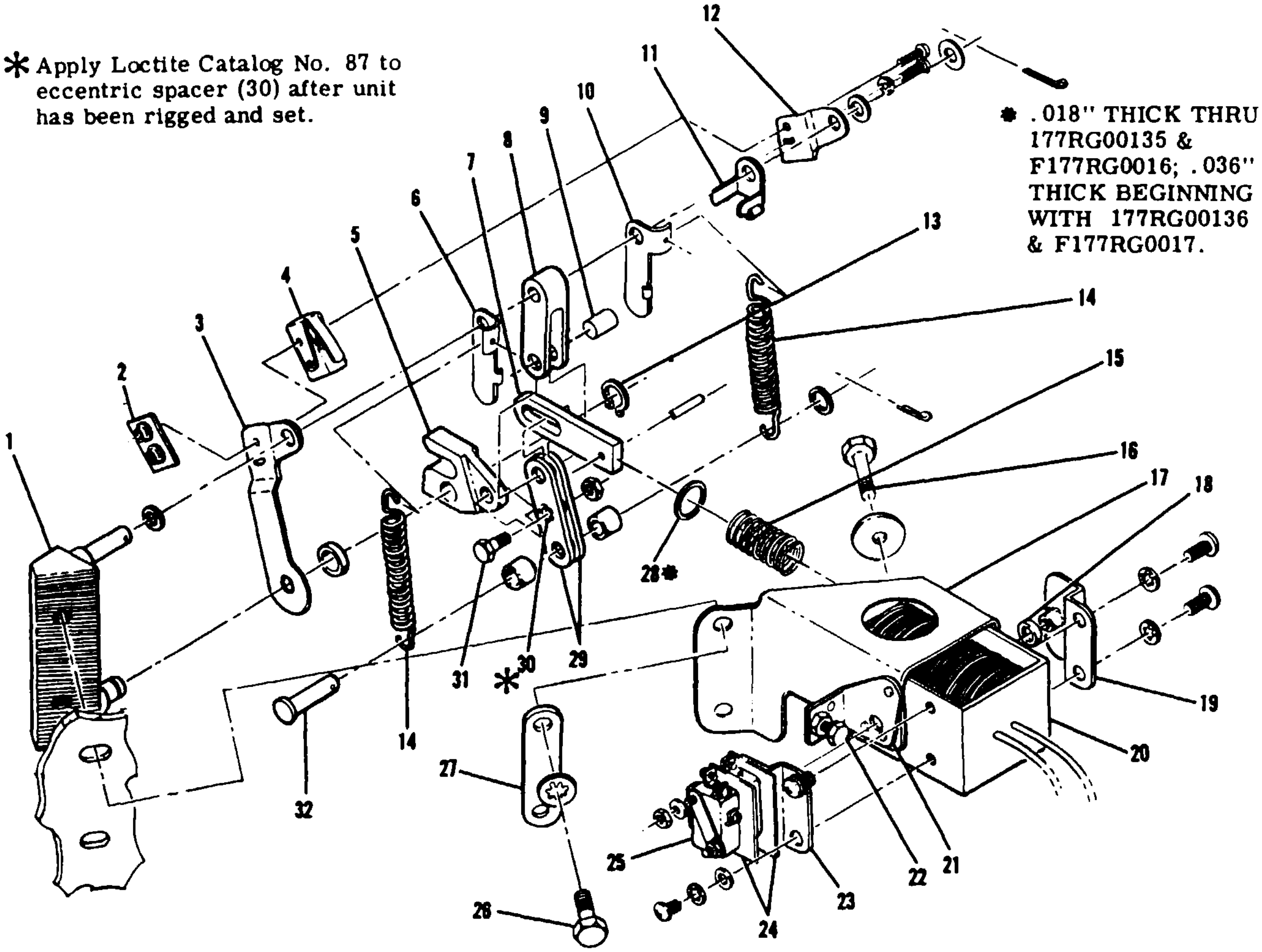
AIRCRAFT SERIALS 177RG0001 THRU 177RG0282 AND F177RG0001 THRU F177RG0062
PRIOR TO BEING MODIFIED PER SERVICE KITS SK177-21A OR SK177-22A




| | |
|---|---|
| 1. Bulkhead | 15. Solenoid Mount Bracket |
| 2. Downlock Support Assembly | 16. Spacer |
| 3. Switch Mount Plate | 17. Solenoid Attach Bracket |
| 4. Downlock Switch | 18. Solenoid |
| 5. Downlock Latch | 19. Switch Attach Bracket |
| 6. Spring Bracket | 20. Insulator |
| 7. Solenoid Plunger Extension | 21. Sequence Switch |
| 8. Swing Arm | 22. Forward Bolt |
| 9. Pin | 23. Plate |
| 10. Spring Bracket | 24. Spacer |
| 11. Retainer Ring | 25. Link |
| 12. Overcenter Spring | 26. Eccentric Spacer |
| 13. Solenoid Return Spring | 27. Bolt |
| 14. Aft Bolt | 28. Pin |

* Apply Loctite Catalog No. 87 to eccentric spacer (26) after unit has been rigged and set.

Figure 5-24. Main Landing Gear Downlock Assembly (Sheet 1 of 3)

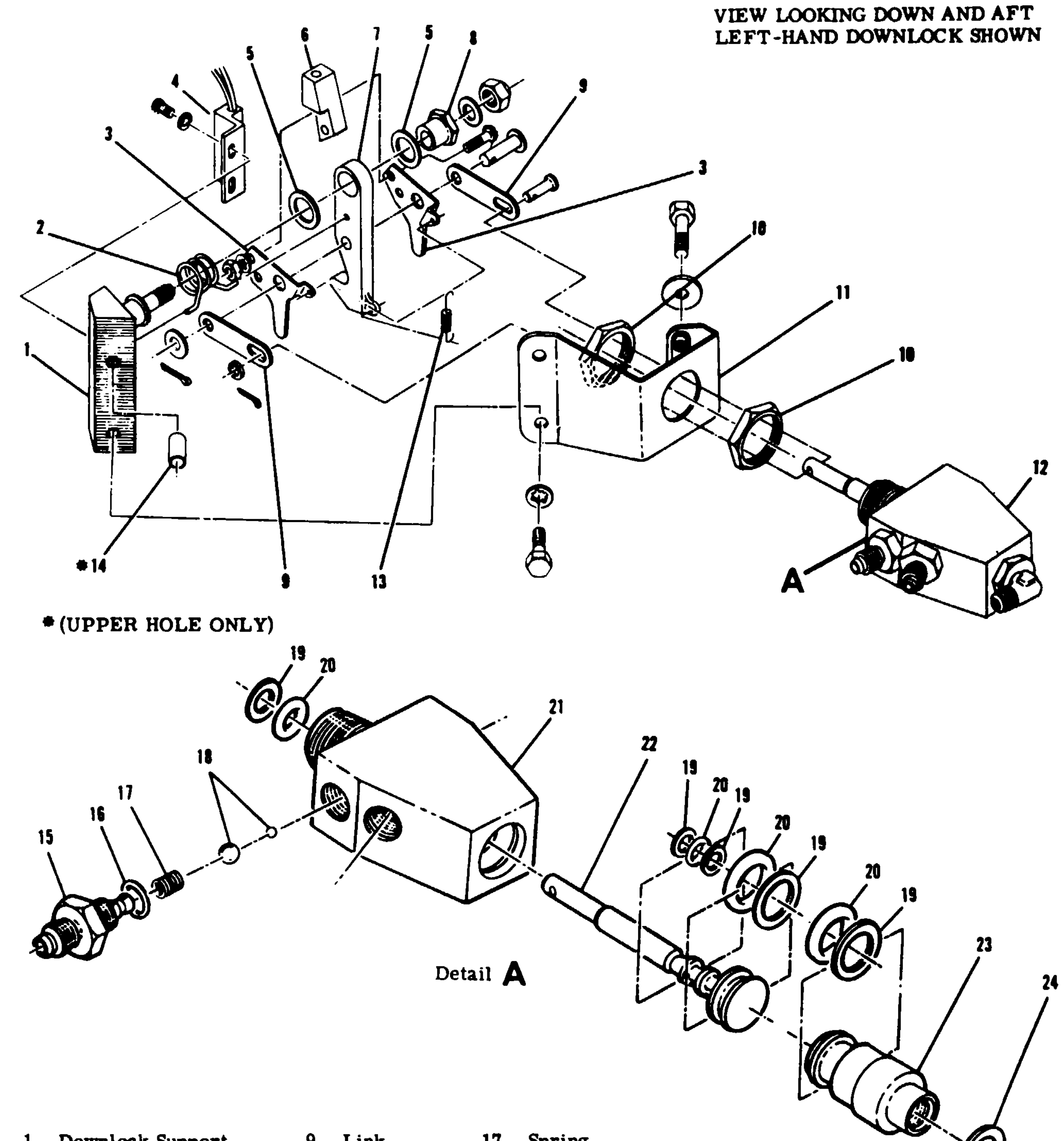



AIRCRAFT SERIALS 177RG0001 THRU 177RG0212 AND F177RG0001 THRU F177RG0042 WHEN MODIFIED PER SERVICE KIT SK177-21A

AIRCRAFT SERIALS 177RG0213 THRU 177RG0282 AND F177RG0043 THRU F177RG0062 WHEN MODIFIED PER SERVICE KIT SK177-22A

1. Downlock Support Assembly
2. Nutplate
3. Switch Mount Plate
4. Downlock Switch
5. Downlock Latch
6. Spring Bracket
7. Solenoid Plunger Extension
8. Swing Arm
9. Pin
10. Spring Bracket
11. Actuator
12. Plate
13. Retainer Ring
14. Overcenter Spring
15. Solenoid Return Spring
16. Aft Bolt
17. Solenoid Mount Bracket
18. Spacer
19. Solenoid Attach Bracket
20. Solenoid
21. Actuator Plate
22. Adjusting Bolt and Jam Nut
23. Switch Attach Bracket
24. Insulator
25. Sequence Switch
26. Forward Bolt
27. Plate
28. Spacer
29. Link
30. Eccentric Spacer
31. Bolt
32. Pin

Figure 5-24. Main Landing Gear Downlock Assembly (Sheet 2 of 3)




| | | |
|---|---|---|
| 1. Downlock Support | 9. Link | 17. Spring |
| 2. Torsion Spring | 10. Jam Nut | 18. Ball |
| 3. Arm | 11. Bracket | 19. Back-Up Ring |
| 4. Down Switch Holder | 12. Actuator | 20. Packing |
| 5. Spacer | 13. Spring | 21. Valve Body |
| 6. Down Magnet | * 14. Spacer | 22. Piston & Rod |
| 7. Latch | 15. Fitting | 23. Plug |
| 8. Bushing | 16. Gasket | 24. Retainer Ring |

BEGINNING WITH AIRCRAFT SERIALS 177RG0283 AND F177RG0063

Figure 5-24. Main Landing Gear Downlock Assembly (Sheet 3 of 3)

NOTE

The preceding procedures for checking magnetic switches are necessary because magnetic switches do not produce an audible "click" as in characteristic of other type switches.

v. Adjust main gear actuator cylinder rod to bottom the piston out when the landing gear is fully retracted and the rubber bumpers (5) in strut wells are halfway deflected.
w. Adjust main gear actuator magnetic limit switch for .03-inch to .06-inch overtravel when the gear is in the retracted position and the main gear actuator piston is bottomed out.
x. Check wheel and tire for positive clearance in wheel wells.
y. Attach external power source and cycle gear several times to assure proper operation, checking light indications. Approximate travel time of landing gear is 11-13 seconds in each direction.

NOTE

Lay a 25 lb shot bag on each wheel and brake assembly during the cycle test. This will simulate the approximate air loads on the main landing gear while airborne. Gear should lock and unlock satisfactorily with shot bags in position on wheels. Do not retract gear into wells with shot bags on wheels. After cycle test, disconnect external power source and remove aircraft from jacks.

5-52. MAIN GEAR DOWNLOCK ACTUATOR. (Refer to figure 5-24, sheet 3.)

5-53. DESCRIPTION. Beginning with 177RG0283 and F177RG0063, hydraulic downlock actuators are employed in the main gear downlock system. A hook-type lock is adjustable by the aid of an eccentric. Rigging procedures are outlined in paragraph 5-50.

5-54. REMOVAL.
a. Jack aircraft as outlined in Section 2.
b. Remove seats and carpet as required for access to access plate above actuator to be removed; remove access plate.
c. Spread drip cloth beneath actuator, and disconnect, cap or plug the hydraulic lines from the actuator.
d. Referring to sheet 3 of figure 5-24, remove cotter pin, washer and pin from end of piston rod on aft side of bulkhead.
e. Loosen jam nuts (10) from threaded portion of actuator; pull actuator forward out of bracket (11).

5-55. DISASSEMBLY. (Refer to figure 5-24.)
a. Remove retainer ring (10).
b. Remove plug (19); discard back-up ring and packing.
c. Remove fitting (1), spring (3) and balls (4). Remove gasket (2).
d. Remove piston and rod (8); discard back-up rings and packings.

5-56. PARTS INSPECTION AND REPAIR. Make the following inspection to ascertain that all parts are in a serviceable condition.
a. Inspect all threaded surfaces for cleanliness and for freedom of cracks and excessive wear.
b. Inspect plug (9), piston (8) and body (7) for cracks, chips, scratches, scoring, wear or surface irregularities which may affect their function or the overall function of the downlock actuator.
c. Repair of actuator parts is impractical. Replace damaged parts with serviceable parts. Minor scratches and scores may be removed by polishing with a fine abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect the operation of the actuator.

5-57. REASSEMBLY.
a. Lubricate all internal parts, back-up rings and packings with hydraulic fluid (MIL-H-5606).
b. Install back-up rings and packings in grooves of piston (8) and plug (9); install back-up ring and packing in valve body (7).
c. Install piston (8) in valve body (7). Use care to prevent damage to back-up rings and packings.
d. Install plug (9) in valve body (7).
e. Install retaining ring (10).
f. Install gasket (2) on fitting (1).
g. Install balls (4), spring (3) and fitting (1) into valve body (7).

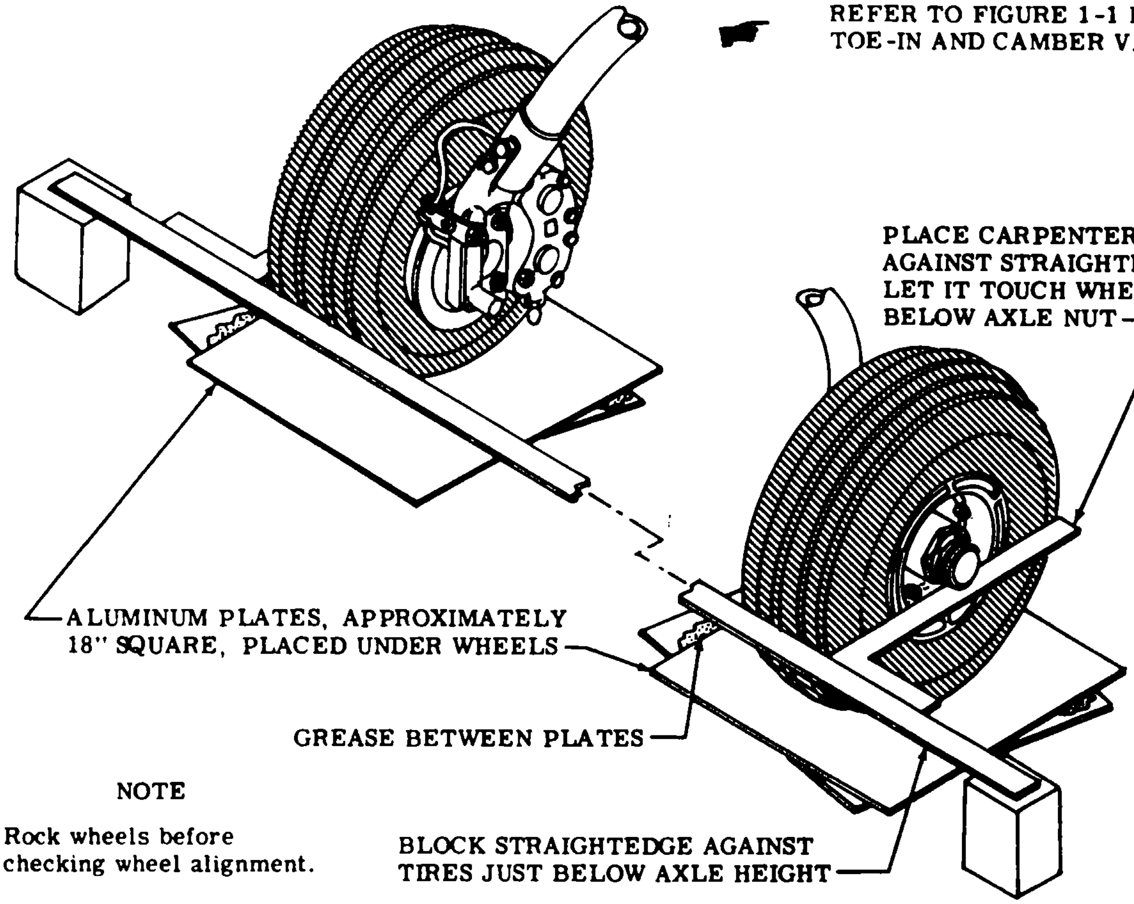
5-58. MAIN WHEEL ALIGNMENT. Correct main wheel alignment is obtained through the use of tapered shims between the gear strut fitting and the flange of the axle. Refer to figure 5-25 for procedures to be used in checking wheel alignment. Wheel shims and the correction imposed on the wheel by the various shims, are listed in the illustration. Some early aircraft may have excessive shim build-up for wheel alignment, causing main gear tires to drag aft sides of wheel wells. This condition can be remedied by installing single, special shims (P/N 2041033-1, available from the Cessna Service Parts Center) used on later aircraft.

NOTE

Failure to obtain acceptable wheel alignment through the use of the shims indicates a deformed main gear strut or a bent axle.

5-59. NOSE GEAR.

5-60. DESCRIPTION. The retractable nose gear shock strut is pivoted at the lower front portion of the engine mount, and retracts aft into the nose wheel well. Retraction and extension of the nose gear is accomplished by a double-acting hydraulic cylinder attached to the lock assembly. Initial action of the cylinder disengages the overcenter downlock and overcenter uplock before retraction or extension begins. Nose wheel steering is afforded by a spring-loaded steering rod assembly (bungee), linking the nose gear steering collar to the rudder pedal bars. A fluid filled shimmy dampener is provided to minimize nose wheel shimmy. Nose gear

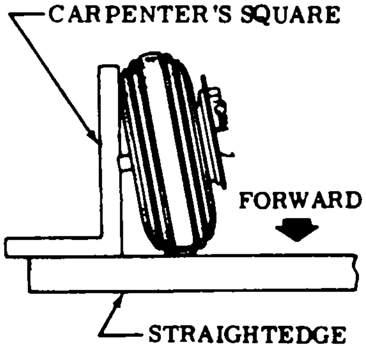



NOTE

Rock wheels before checking wheel alignment.

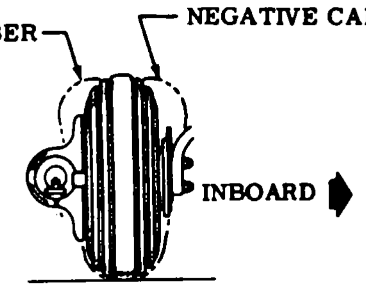
## TOP VIEW OF TOE-IN CHECK

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




## FRONT VIEW OF CAMBER CHECK

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




NOTE

Setting toe-in and camber within these tolerances while the cabin and fuel tanks are empty will give approximately zero toe-in and zero camber at gross weight. Ideal setting is zero toe-in and zero camber at normal operating weight. Therefore, if normally operated at less than gross weight and abnormal tire wear occurs, realign the wheels to attain the ideal setting for the load conditions under which the aircraft normally operates. Refer to the preceding page for shims available and their usage. Always use the least number of shims possible to obtain the desired result.

Figure 5-25. Main Wheel Alignment (Sheet 1 of 2)

| SHIM PART NO. | POSITION OF THICKEST CORNER OR EDGE OF SHIM | CORRECTION IMPOSED ON WHEEL | | | |
|---|---|---|---|---|---|
| | | TOE-IN | TOE-OUT | POS. CAMBER | NEG CAMBER |
| 0541157-1 | AFT<br>FWD | .06"<br>---- | ----<br>.06" | ----<br>0°3' | 0°3'<br>---- |
| 0541157-2 | UP<br>DOWN | .006"<br>---- | ----<br>.006" | 0°30'<br>---- | ----<br>0°30' |
| 0541157-3 | AFT<br>FWD | .12"<br>---- | ----<br>.12" | ----<br>0°7' | 0°7'<br>---- |
| 0441139-5 | UP & FWD<br>UP & AFT<br>DOWN & FWD<br>DOWN & AFT | ----<br>.12"<br>----<br>.11" | .11"<br>----<br>.12"<br>---- | 0°25'<br>0°11'<br>----<br>---- | ----<br>----<br>0°11'<br>0°25' |
| 0441139-6 | UP & FWD<br>UP & AFT<br>DOWN & FWD<br>DOWN & AFT | ----<br>.24"<br>----<br>.22" | .22"<br>----<br>.24"<br>---- | 0°50'<br>0°22'<br>----<br>---- | ----<br>----<br>0°22'<br>0°50' |
| 1241061-1 | UP & FWD<br>UP & AFT<br>DOWN & FWD<br>DOWN & AFT | .03"<br>.06"<br>----<br>---- | ----<br>----<br>.06"<br>.03" | 2°50'<br>2°49'<br>----<br>---- | ----<br>----<br>2°49'<br>2°50' |

Figure 5-25. Main Wheel Alignment (Sheet 2 of 2)

doors are mechanically closed as the nose gear retracts. As the nose gear extends, the doors are mechanically opened.

## 5-61. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| HYDRAULIC FLUID LEAKAGE FROM NOSE STRUT. | Defective strut seals. | Install new seals. |
| NOSE STRUT DOES NOT HOLD AIR PRESSURE. | Defective air filler valve, or valve not tight. | Check gasket and tighten loose valve. Replace, if defective. |
| | Defective strut seals. | Replace defective seals. |

## 5-62. REMOVAL.

a. Jack aircraft or weight down or tie-down tail to raise nose wheel from floor.
b. Remove lower engine cowling.
c. Disconnect electrical wire from squat switch and remove clamps attaching electrical wiring to nose gear strut.
d. Remove bolt attaching forward drag link to nose gear strut.
e. Disconnect steering bungee and shimmy dampener at steering collar at top of strut.
f. Remove nuts and washers from bolts attaching strut trunnion to engine mount. Rotate lower end of strut aft to remove strut attaching bolts.
g. Work strut from engine mount.

**WARNING**

Be sure strut is deflated completely before removing bolt attaching steering collar to strut or disconnecting torque links.

## 5-63. INSTALLATION.

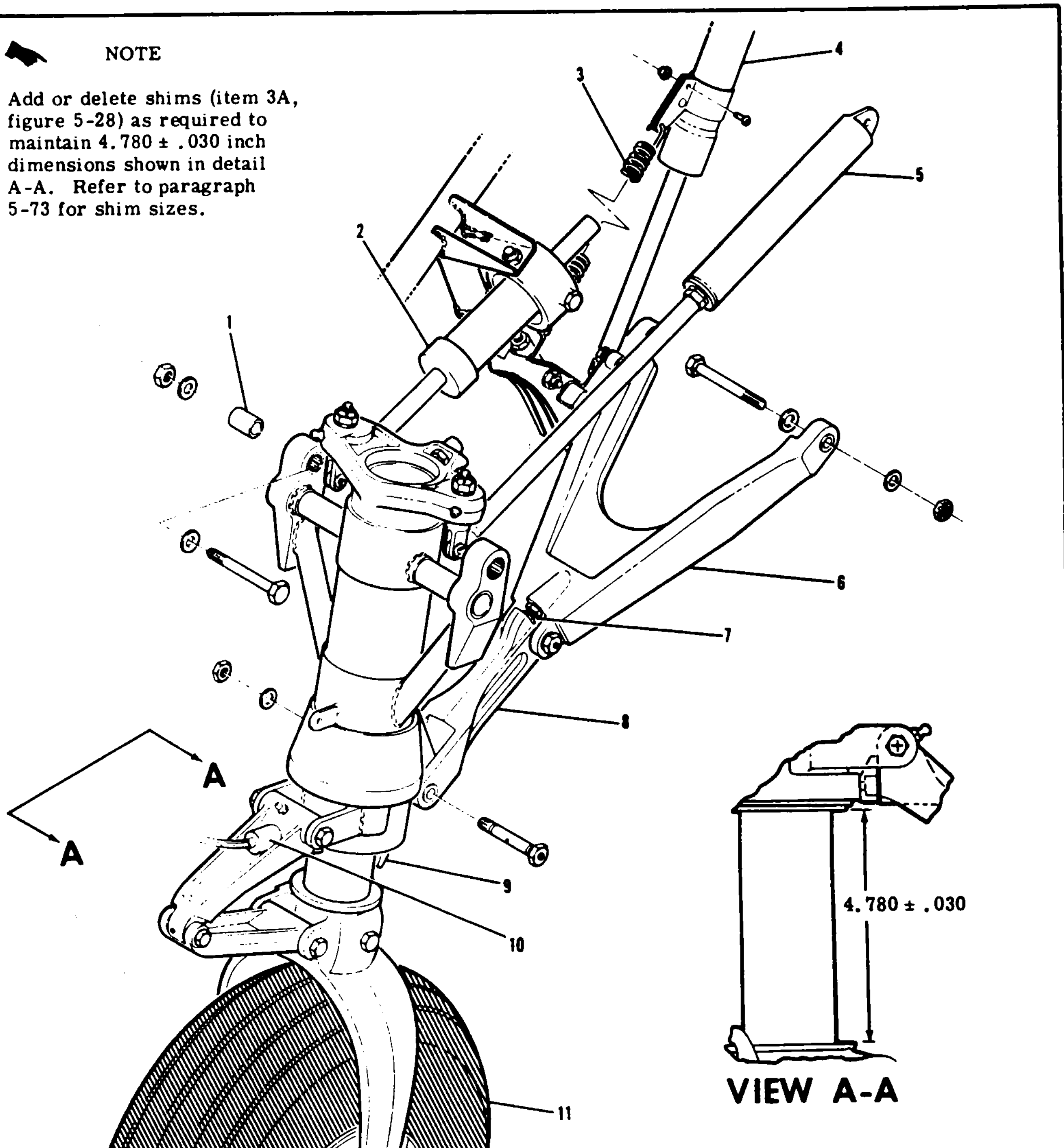
NOTE

The nose gear strut should be serviced with hydraulic fluid and compressed air before installation.

a. Install bearing inner race in bearings in strut trunnion and position attaching bolts in inner race

NOTE

Add or delete shims (item 3A, figure 5-28) as required to maintain 4.780 ± .030 inch dimensions shown in detail A-A. Refer to paragraph 5-73 for shim sizes.




1. Bearing Inner Race
2. Shimmy Dampener
3. Overcenter Spring
4. Nose Gear Actuator
5. Steering Bungee
6. Aft Drag Link Assembly
7. Overcenter Stop Adjustment
8. Forward Drag Link Assembly
9. Uplock Hook
10. Squat Switch
11. Tire
12. Hub Cap

Figure 5-26. Nose Gear Installation

of bearings with large washer under head of bolt.

b. Position strut in engine mount and install attaching bolts, washers, and nuts.

c. Connect steering bungee and shimmy dampener at steering collar.

d. Install bolt attaching forward drag link to nose gear strut.

e. Connect squat switch electrical wiring and install clamps securing electrical wiring to strut.

f. Check nose gear rigging in accordance with paragraph 5-92.

g. Install engine cowling and check rigging of forward nose gear door.

h. Lower aircraft.

5-64. NOSE WHEEL REMOVAL AND INSTALLATION.

a. Weight or tie-down tail of aircraft to raise the nose wheel off the floor.

b. Remove nose wheel axle bolt.

c. Use a rod or long punch inserted through one axle bolt ferrule to tap the opposite ferrule out of the fork. Remove both ferrules and pull the nose wheel from the fork.

d. Remove spacers and axle tube from the nose wheel.

e. Reverse the preceding steps to install the nose wheel. Tighten axle bolt until a slight bearing drag is obvious when the wheel is turned. Back the nut off to the nearest castellation and install cotter pin.

5-65. NOSE WHEEL DISASSEMBLY (Cleveland Wheel).

a. Remove hub cap, completely deflate tire and break tire beads loose from wheel rims.

**WARNING**

Injury can result from attempting to separate wheel halves with the tire inflated. Avoid damaging wheel flanges when breaking tire beads loose.

b. Remove thru-bolts and separate wheel halves.

c. Remove tire and tube from wheel halves.

d. Remove bearing retaining rings, grease seals, and bearing cones.

NOTE

The bearing cups are a press fit in the wheel halves and should not be removed unless installation of new cups is necessary. To remove, heat wheel half in boiling water for 15 minutes. Using an arbor press, if available, press out the bearing cup and press in the new one while the wheel is still hot.

5-66. NOSE WHEEL INSPECTION AND REPAIR (Cleveland Wheel).

a. Clean all metal parts and the grease seal felts in cleaning solvent and dry thoroughly.

b. Inspect wheel halves for cracks. Cracked wheel halves must be rejected and new parts installed. Sand out 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. Bearing cups and cones must be inspected carefully for damage and discoloration. After cleaning, repack cones with clean aircraft wheel bearing grease before installation in the wheel half.

5-67. NOSE WHEEL REASSEMBLY (Cleveland Wheel).

a. Insert tube in tire, aligning index marks on tire and tube.

b. Place tire and tube on wheel half and position valve stem through hole in wheel half.

c. Insert thru-bolts, position other wheel half, and secure with washers and nuts. Take care and avoid pinching tube between wheel halves. Torque thru-bolts evenly to torques stipulated in figure 5-6A.

**CAUTION**

Uneven or improper torque on thru-bolt nuts may cause bolt failure with resultant wheel failure.

d. Clean and repack bearing cones with clean aircraft wheel bearing grease.

e. Assemble bearing cones, seals, and retainers into wheel halves.

f. Inflate tire to seat tire beads, then adjust to correct pressure.

g. Install hub caps and install wheel in accordance with paragraph 5-64.

5-68. NOSE WHEEL DISASSEMBLY (McCauley Wheel).

a. Remove hub caps, completely deflate tire and break tire beads loose at wheel flanges.

**WARNING**

Injury can result from attempting to remove wheel flanges with tire and tube inflated. Avoid damaging wheel flanges when breaking tire beads loose.

b. Remove thru-bolts, nuts and washers.

c. Remove thru-bolts and separate wheel flanges from wheel hub. Retain spacers between wheel flanges and wheel hub.

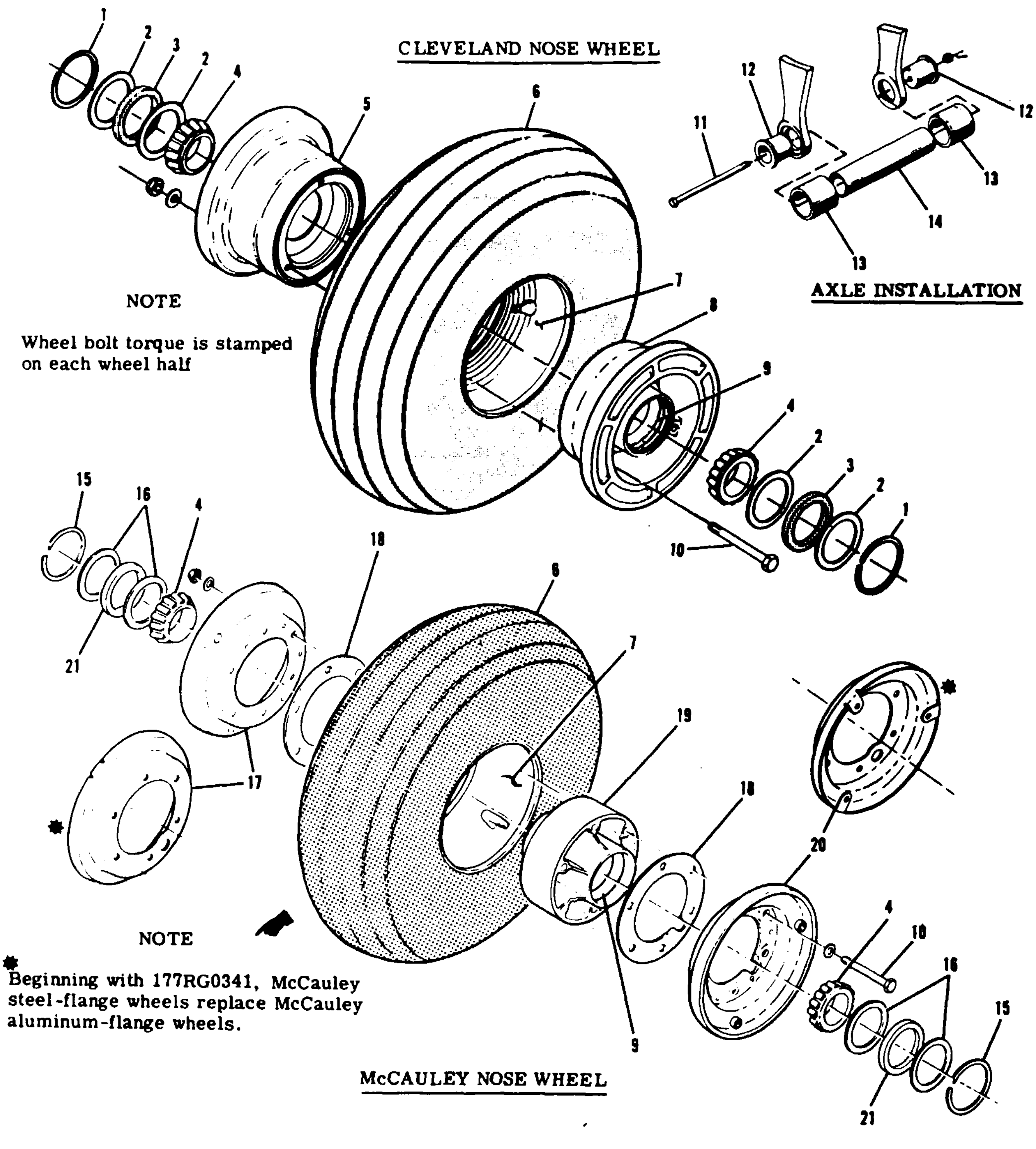
d. Remove wheel hub from tire and tube.

e. Remove retainer rings and remove grease seal retainers, grease seal felts, and bearing cones from wheel hub.

NOTE

The 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 is still hot.

5-69. NOSE WHEEL INSPECTION AND REPAIR (McCauley Wheel).




| | | |
|---|---|---|
| 1. Snap Ring | 8. Female Wheel Half | 15. Retainer Ring |
| 2. Grease Seal Ring | 9. Bearing Cup | 16. Grease Felt Retainer |
| 3. Grease Seal Felt | 10. Thru-Bolt | 17. Wheel Flange |
| 4. Bearing Cone | 11. Axle Bolt | 18. Spacer |
| 5. Male Wheel Half | 12. Axle Bolt Bucket | 19. Wheel Hub |
| 6. Tire | 13. Axle Spacer | 20. Wheel Flange |
| 7. Tube | 14. Axle Tube | 21. Grease Felt |

Figure 5-27. Nose Wheel

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. 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. Carefully inspect bearing cones and cups for damage and discoloration. After cleaning, pack bearing cones with clean aircraft wheel bearing grease (Section 2) before installing in wheel hub.

5-70. NOSE WHEEL REASSEMBLY (McCauley Wheel).
a. Insert tire in tube, aligning index marks on tire and tube.
b. Place wheel hub in tire with valve stem in cutout of wheel hub.
c. Place spacer and wheel flange on one side of wheel hub and, with washer under head of thru-bolt, insert bolt through wheel flange and wheel hub.
d. Place spacer and wheel flange on other side and align valve stem in cutout in wheel flange.
e. Install washers and nuts on thru-bolts.

**CAUTION**

Be sure that spacers and wheel flanges are seated on flange of wheel hub. Uneven or improper torque of the thru-bolt nuts can cause failure of the bolts, with resultant wheel failure.

f. Tighten thru-bolts evenly and torque to values stipulated in figure 5-6A.
g. Clean and pack bearing cones with clean aircraft wheel bearing grease (Section 2).
h. Assemble bearing cones, grease seal felts and retainers into wheel hub.
i. Inflate tire to seat tire beads, then adjust to correct tire pressure. See figure 1-1 for correct tire pressure.

5-71. WHEEL BALANCING. Since uneven tire wear is usually the cause of wheel unbalance, installing a new tire probably will 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 valve stem). When installing a new tire, place these marks adjacent to each other. If a wheel becomes unbalanced during service, it may be statically rebalanced. Wheel balancing equipment is available from the Cessna Service Parts Center.

5-72. NOSE GEAR STRUT DISASSEMBLY. (See figure 5-28. The following procedure applies to the nose gear shock strut after it has been removed from the aircraft, and the nose wheel has been removed.

NOTE

The following procedure may be used to separate the upper and lower struts, leaving the upper strut and trunnion installed in the aircraft. Most shock strut seals and parts subject to wear may be replaced without nose gear removal and complete disassembly.

a. Jack nose wheel a sufficient distance to permit lower strut to be pulled from upper strut. Refer to paragraph 2-4 for jacking procedure.
b. Deflate the strut completely and remove valve core.
c. Disconnect upper torque link from lower torque link, noting positions of washers and spacers.
d. Remove external retaining ring from lower end of upper strut and allow collar assembly to slide down on to lower strut.
e. Remove lock ring from inside lower end of upper strut. A small access hole is provided at the lock ring groove to facilitate removal of the lock ring.

NOTE

Hydraulic fluid will drain as lower strut is separated from upper strut. Also retain bearing races and bearing as struts are separated.

f. Use a straight sharp pull to separate the upper and lower struts. Invert the lower strut and drain remaining fluid.
g. Remove lock ring and bearing at upper end of lower strut. Note that chamfered edge of bearing is up next to lock ring.
h. 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.
i. Remove collar and external retaining ring from lower strut.
j. Remove O-ring from outer groove of packing support ring.
k. Remove back-up rings and O-ring from inside groove in packing support ring.

NOTE

Nose gear fork and lower strut are a press fit, drilled on assembly. Separation of the strut and fork is not recommended, except for installation of a new part.

l. Remove bolt, washer, and nut attaching fork and cam to lower strut, and pull hose plug and assembled parts out of lower strut. Remove O-rings and metering pin from base plug.

NOTE

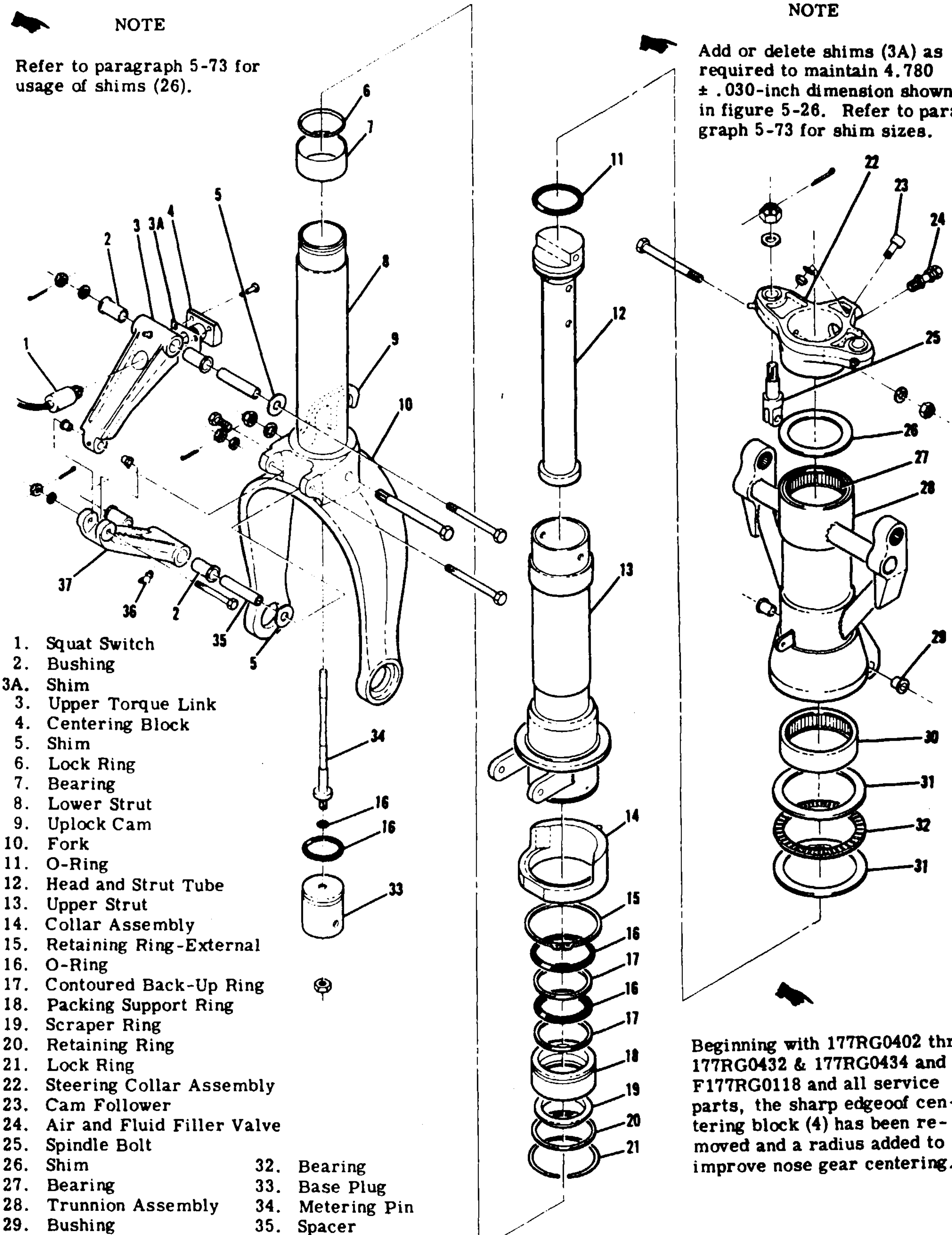
If necessary to remove upper strut or head and strut tube assembly, remove filler valve and bolt attaching steering collar to upper strut and push upper strut, head and strut tube assembly from trunnion.

NOTE

Refer to paragraph 5-73 for usage of shims (26).

NOTE

Add or delete shims (3A) as required to maintain 4.780 ± .030-inch dimension shown in figure 5-26. Refer to paragraph 5-73 for shim sizes.




1. Squat Switch
2. Bushing
3A. Shim
3. Upper Torque Link
4. Centering Block
5. Shim
6. Lock Ring
7. Bearing
8. Lower Strut
9. Uplock Cam
10. Fork
11. O-Ring
12. Head and Strut Tube
13. Upper Strut
14. Collar Assembly
15. Retaining Ring-External
16. O-Ring
17. Contoured Back-Up Ring
18. Packing Support Ring
19. Scraper Ring
20. Retaining Ring
21. Lock Ring
22. Steering Collar Assembly
23. Cam Follower
24. Air and Fluid Filler Valve
25. Spindle Bolt
26. Shim
27. Bearing
28. Trunnion Assembly
29. Bushing
30. Bearing
31. Bearing Race
32. Bearing
33. Base Plug
34. Metering Pin
35. Spacer
36. Lubricator
37. Lower Torque Link

Beginning with 177RG0402 thru 177RG0432 & 177RG0434 and F177RG0118 and all service parts, the sharp edgeoof centering block (4) has been removed and a radius added to improve nose gear centering.

Figure 5-28. Nose Gear Strut

5-73. NOSE GEAR STRUT ASSEMBLY.

a. Thoroughly clean all parts in cleaning solvent and examine them carefully. Install all new O-rings and back-up rings.

b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5-72, with the exception that special attention must be paid to the following.

c. Sharp metal edges should be smoothed with No. 400 emery paper, then thoroughly cleaned with solvent.

d. Lubricate all O-rings and back-up rings, and all other internal parts with a film of petralatum (VV-P-236) or hydraulic fluid (MIL-H-5606) during reassembly.

e. Check strut extension dimension to be 4.780± .030 inch as shown in figure 5-26. Add or delete shims (item 3A, figure 5-28, as required to maintain the dimension indicated. The following shims are available from the Cessna Service Parts Center.

| | |
|---|---|
| 2043038-1 . . . . . . . . . . . . . | 0.012 inch |
| 2043038-2 . . . . . . . . . . . . . | 0.020 inch |
| 2043038-3 . . . . . . . . . . . . . | 0.032 inch |
| 2043038-4 . . . . . . . . . . . . . | 0.040 inch |

NOTE

Cleanliness and proper lubrication, along with careful workmanship are important during assembly of the shock strut.

f. If the upper strut was removed from the trunnion, lubricate needle bearings with general purpose grease (MIL-G-7711) before assembly. Be sure that filler valve port is installed so that the filler valve can be installed to the aft side of the strut.

g. When installing the steering collar at top of strut, use shims as required to provide a maximum gap of 0.016-inch between bottom of steering collar and trunnion. The following shims are available from the Cessna Service Parts Center.

| | |
|---|---|
| 1542009-2 . . . . . . . . . . . . . . . | 0.032-inch |
| 1542009-3 . . . . . . . . . . . . . . . | 0.016-inch |

h. Install external retaining ring and collar on lower strut before installing packing support ring and its retaining parts.

i. Slide lock ring retaining ring, scraper ring, and packing support ring on lower strut.

j. When installing bearing at top of lower strut, be sure that beveled edge of bearing is installed up next to the lock ring.

k. Tighten torque link center bolt snug and then tighten to next castellation and install cotter pin.

l. After shock strut is assembled, service shock strut with hydraulic fluid and compressed air as outlined in Section 2.

5-74. TORQUE LINKS. The torque links are illustrated in figure 5-28. Torque link removal and installation procedures are discussed in the following paragraph, along with removal and installation of the nose gear squat switch. Lubricator fittings and bushings should not be removed except for replacement of parts. Excessively worn parts should be replaced with new parts. ALWAYS deflate nose gear shock strut completely before disconnecting torque links.

5-74A. SQUAT SWITCH. (Refer to figure 5-28A.) The squat (or safety) switch interrupts the landing gear circuit, preventing landing gear retraction while the aircraft is resting on the ground. Also, while airborne, the switch prevents the nose gear from retracting into the well, except when the nose wheel is in alignment. The squat switch is installed through a hole in the upper torque link and is threaded into a centering block, attached to the aft side of the torque link. A portion of the squat switch plunger protrudes from the aft side of the centering block .055 ± .005-inch. The threaded portion of the switch is sealed in the threads of the centering block with Grade AV Loctite sealant. Removal and installation of squat switches may be accomplished as outlined in the following steps.

a. Disconnect nose gear strut door turnbuckle and cowl flap linkage; remove upper and lower engine cowling.

b. Mark positions of sta-straps along routing of wires from squat switch at upper torque link to splices approximately 10-inches from firewall in upper right-hand engine compartment. Mark wires to facilitate correct installation of replacement leads; cut sta-straps.

c. Cut wires at splices in upper right-hand engine compartment and remove wires from routing along engine mount tubes down to squat switch at upper torque link.

d. Deflate shock strut completely.

e. Disconnect upper torque link from lower torque link, noting positions of washers and spacers.

f. Disconnect upper torque link from upper strut lugs; remove upper torque link.

g. Remove (2) screws attaching centering block to torque lint.

h. Retain any shims removed from between centering block and torque link for reinstallation.

i. Break loose sealant in threads and remove switch from centering block.

j. Remove all sealant from threads in centering block.

k. Feed 72" leads from replacement squat switch through hole in centering block.

l. Apply Loctite Grade AV sealant to threads in centering block.

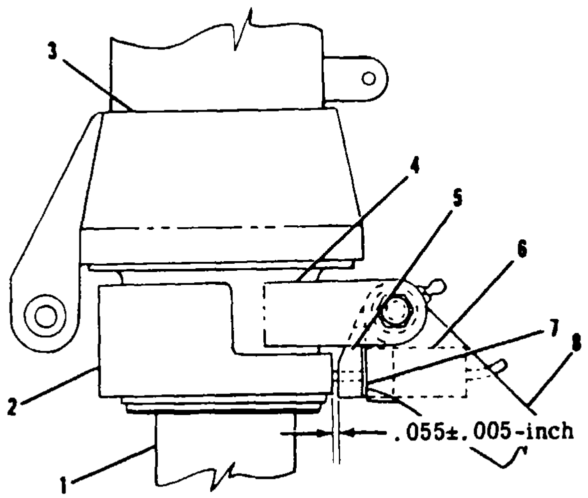
NOTE

Cure time of Grade AV sealant is 2 to 6 hours (umprimed) or 5 to 20 minutes (primed). Excessive sealant may be wiped off with a rag moistened with trichloroethylene.

m. Screw new squat switch into centering block, ensuring that leads remain untwisted.

n. Adjust squat switch by screwing or unscrewing in centering block to allow switch plunger to protrude .055 ± .005-inch as shown in the figure.

o. After sealant has cured (refer to note following step "1"), attach centering block to upper torque link with (2) screws, and insert leads and squat switch through hole in torque link.




NOTE

Threaded portion of squat switch (6) is sealed in the threads of centering block (5) with Loctite Grade AV sealant.

1. Inner Barrel
2. Collar
3. Trunnion
4. Upper Strut
5. Centering Block
6. Squat Switch
7. Shim
8. Upper Torque Link

Figure 5-28A. Squat Switch Installation

p. Attach upper torque link to upper strut lugs, installing washers and spacers in positions from which they were removed.
q. Attach upper torque link to lower torque link.

NOTE

Tighten bolt snug, then tighten one more castellation and install cotter pin.

r. Inflate shock strut as outlined in Section 2.
s. Route squat switch leads along engine mount tubes and down truunion to match routing of removed wires.
t. Install sta-straps in locations marked during removal.
u. Splice squat switch leads to existing wires, which were tagged during removal of old leads.
v. Replace upper and lower engine cowling. Attach cowl flap linkage and strut door turnbuckle; safety wire turnbuckle.

5-75. SHIMMY DAMPENER. The shimmy dampener is illustrated in figur 5-29, which may be used as a guide for disassembly, replacement of parts and re-assembly. Replace parts found defective. Use new O-rings and lubricate parts with clean hydraulic fluid during assembly. Refer to paragraph 2-27 for shimmy dampener servicing procedures.

5-76. NOSE GEAR STEERING SYSTEM. Nose wheel steering is accomplished through the use of the rudder pedals. A spring-loaded steering rod assembly connects the nose gear steering collar to an arm assembly on the rudder bars. Steering is afforded up to approximately 35 degrees each side of neutral, after which brakes may be used to gain maximum deflection of 39 degrees right or left of center.

5-77. STEERING BUNGEE ASSEMBLY. The steering bungee assembly is spring-loaded and should not be disassembled internally. The bungee is connected to the steering collar by a clevis pin and a bellcrank which in turn is connected through linkage to the arm on the rudder pedal bars.

5-78. NOSE WHEEL STEERING ADJUSTMENT. Since the nose wheel steering and rudder system are interconnected, adjustments to one system may affect the other system. Section 10 contains rigging instructions for the nose wheel steering system as well as the rudder system.

5-79. NOSE GEAR ACTUATOR. The double-acting nose gear actuator extends and retracts the nose gear. The actuator is attached to the nose gear through the overcenter lock assembly.

5-80. NOSE GEAR ACTUATOR REMOVAL.
a. Jack aircraft in accordance with procedures outlined in Section 2.
b. Disconnect lock spring at clamp on actuator; cap or plug hose and fitting openings to prevent entry of foreign material. Tag hydraulic hose to identify where they connect at actuator.
c. Remove clamps attaching hose to actuator.
d. Push up at joint of forward and aft drag links to obtain access to bolt attaching actuator to overcenter lock assembly; unsafety and remove bolt.
e. Remove cotter pin and washers at upper end of actuator. Work actuator from aircraft.

5-81. DISASSEMBLY AND REPAIR OF ACTUATOR.

LEADING PARTICULARS.

| | |
|---|---|
| Cylinder Bore Diameter (Below Gland Installation) . . . . . . . . . . . . | 1.000 + 0.002, -0.000 in |
| Piston Rod Diameter . . . . . . . . . . . . . . . . . . . . . . . . . . | 0.436 + 0.000, -0.002 in |
| Piston Diameter . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0.997 + 0.000, -0.001 in |
| Work Stroke . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 6.33 in |
| Length (Extended) (Nominal) . . . . . . . . . . . . . . . . . . . . . | 17.55 in |
| Length (Retracted) (Installation) . . . . . . . . . . . . . . . . . . | 11.35 in |
| Length (Collapsed) . . . . . . . . . . . . . . . . . . . . . . . . . | 11.03 in |

5-82. DISASSEMBLY.

NOTE

Measure length of actuator in fully-extended position. Measurement should be from centerline-to-centerline of attaching holes.

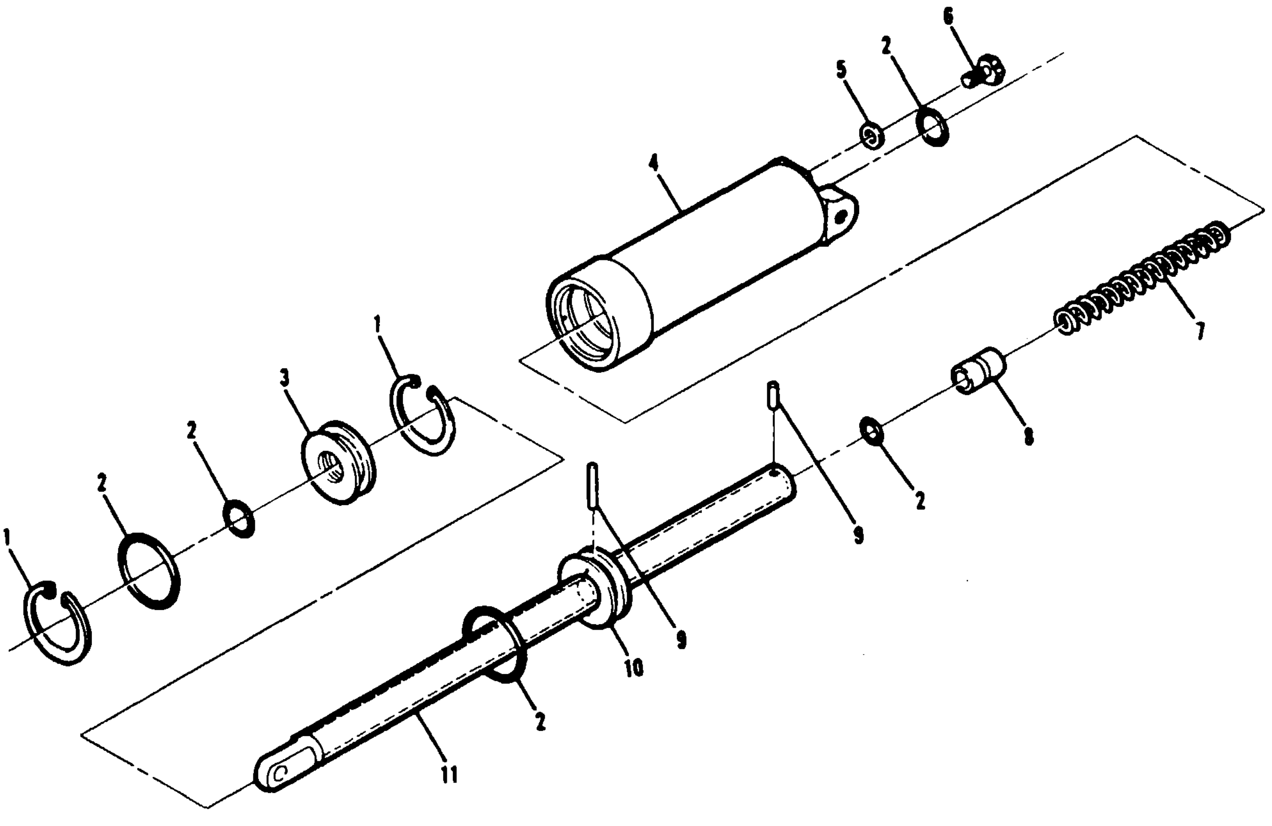
a. Remove retainer ring at gland end of cylinder.
b. Pull piston, piston rod, and gland from cylinder.
c. Loosen lock nut and remove rod end from piston rod.
d. Remove gland from piston.
e. Remove and discard O-rings and back-up rings from gland and piston.

NOTE

Do not remove bearing from cylinder body unless installation of new part is necessary.

5-83. INSPECTION OF PARTS. Make the following inspections to ascertain that all parts are in a serviceable condition.

a. Inspect all threaded surfaces for cleanliness and




1. Snap Ring
2. O-Ring
3. Bearing Head
4. Barrel
5. Gasket
6. Filler Plug
7. Spring
8. Floating Piston
9. Roll Pin
10. Piston
11. Piston Rod

Figure 5-29. Shimmy Dampener

for freedom of cracks and excessive wear.

b. Inspect piston, cylinder, piston rod, end gland, and bearings for cracks, chips, scratches, scoring, wear, or surface irregularities which may affect their function or the overall function of the nose landing gear actuator.

5-84. REASSEMBLY. Repair of most parts of the nose gear actuator assembly is impractical. Replace defective parts with serviceable parts. Minor scratches and scores may be removed by polishing with a fine abrasive crocus cloth (Federal Specification P-C-458) providing their removal does not affect the operation of the unit. Install all new O-rings and back-up rings during reassembly of the actuator. Lubricate all parts except bearings with hydraulic fluid (MIL-H-5606).

a. Install back-up rings and O-ring on cylinder piston. Install O-ring between back-up rings with contour of back-up ring next to O-ring.

b. Install O-ring in exterior groove of gland.

c. Install O-ring and back-up ring in internal groove of gland. Back-up ring is installed outboard of O-ring in internal groove.

d. Install gland on piston rod. Use care and prevent damage to O-ring and back-up ring.

e. Install piston and gland into cylinder and install retainer ring at end of gland.

f. Install lock nut and rod end.

g. If bearing in cylinder is being replaced, stake three equal spaces each side.

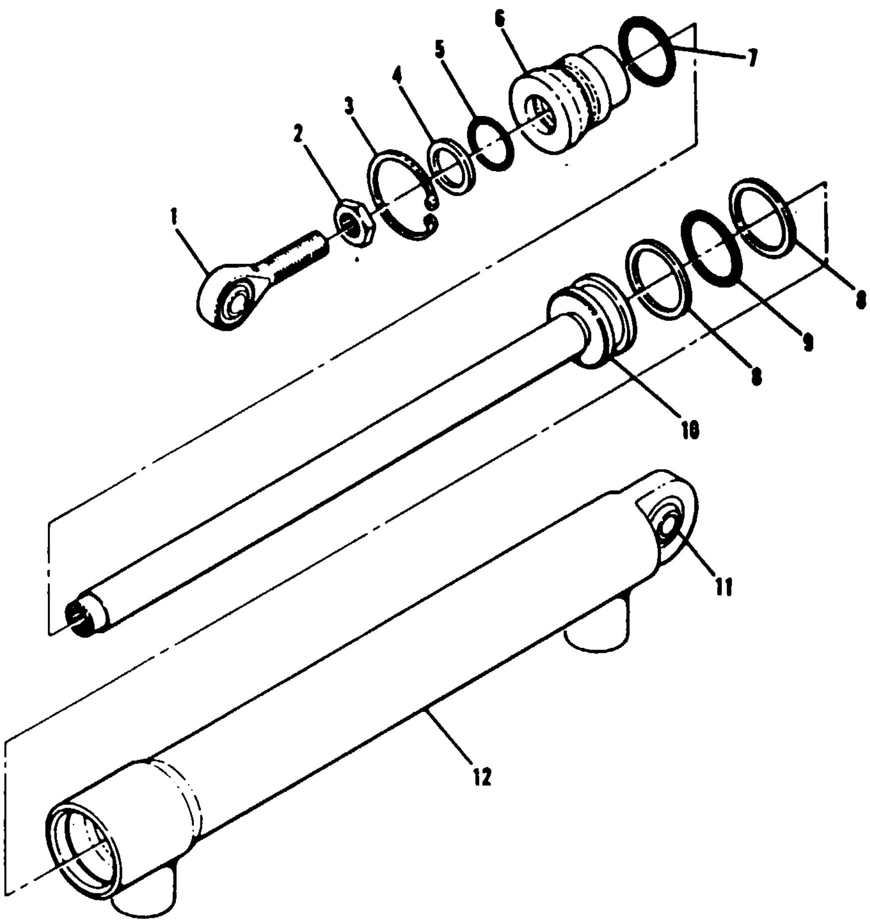
h. Adjust length of actuator to length measured in paragraph 5-82 by adjusting rod end.

5-85. INSTALLATION OF NOSE GEAR ACTUATOR.

a. Attach upper end of actuator with washers and cotter pins.

NOTE

Be sure to install actuator with hydraulic hose fittings on aft side.




1. Rod End
2. Lock Nut
3. Retainer Ring
4. Back-Up Ring
5. O-Ring
6. Gland
7. O-Ring
8. Back-Up Ring
9. O-Ring
10. Piston
11. Bearing
12. Cylinder

Figure 5-30. Nose Gear Actuator

b. Adjust piston rod in accordance with paragraph 5-92 (all) when nose gear is extended and locked.
c. Attach lower end of actuator to aft end of over-center lock assembly with bolt, safety bolt.
d. Pull drag links down at center pivot points and attach spring to clamp on actuator.
e. Attach hydraulic hose to actuator according to tags on hose.
f. Clamp hose to actuator.
g. With external power source connected to aircraft, cycle landing gear to bleed any air from system.
h. Check hydraulic fluid reservoir for proper amount of fluid.
i. Check nose gear rigging as outlined in paragraph 5-92.

5-86. NOSE GEAR UPLOCK MECHANISM. Details of the nose gear uplock mechanism are shown in figure 5-32, which may be used as a guide for removal and installation.

5-87. RIGGING NOSE GEAR UPLOCK MECHANISM. Refer to paragraph 5-92 for rigging of the nose landing gear.

5-88. NOSE GEAR DOWNLOCK MECHANISM. Details of the nose gear downlock mechanism are shown in figure 5-32 which may be used as a guide during removal and installation.

5-89. RIGGING NOSE GEAR DOWNLOCK MECHANISM. Refer to paragraph 5-92 and figure 5-32 for procedures for rigging the nose gear downlock mechanism.

5-90. NOSE LANDING GEAR DOORS. Mechanically-actuated wheel well doors are provided for the nose landing gear. The doors are open when the nose gear is down and closed when the nose gear is retracted. The forward door is attached to the nose gear through linkage and the door is hinged to the lower engine cowling. The wheel well doors are hinged at lower side of the wheel well. Figure 5-31 shows the opening and closing mechanism for the doors and may be used as a guide during removal and installation.

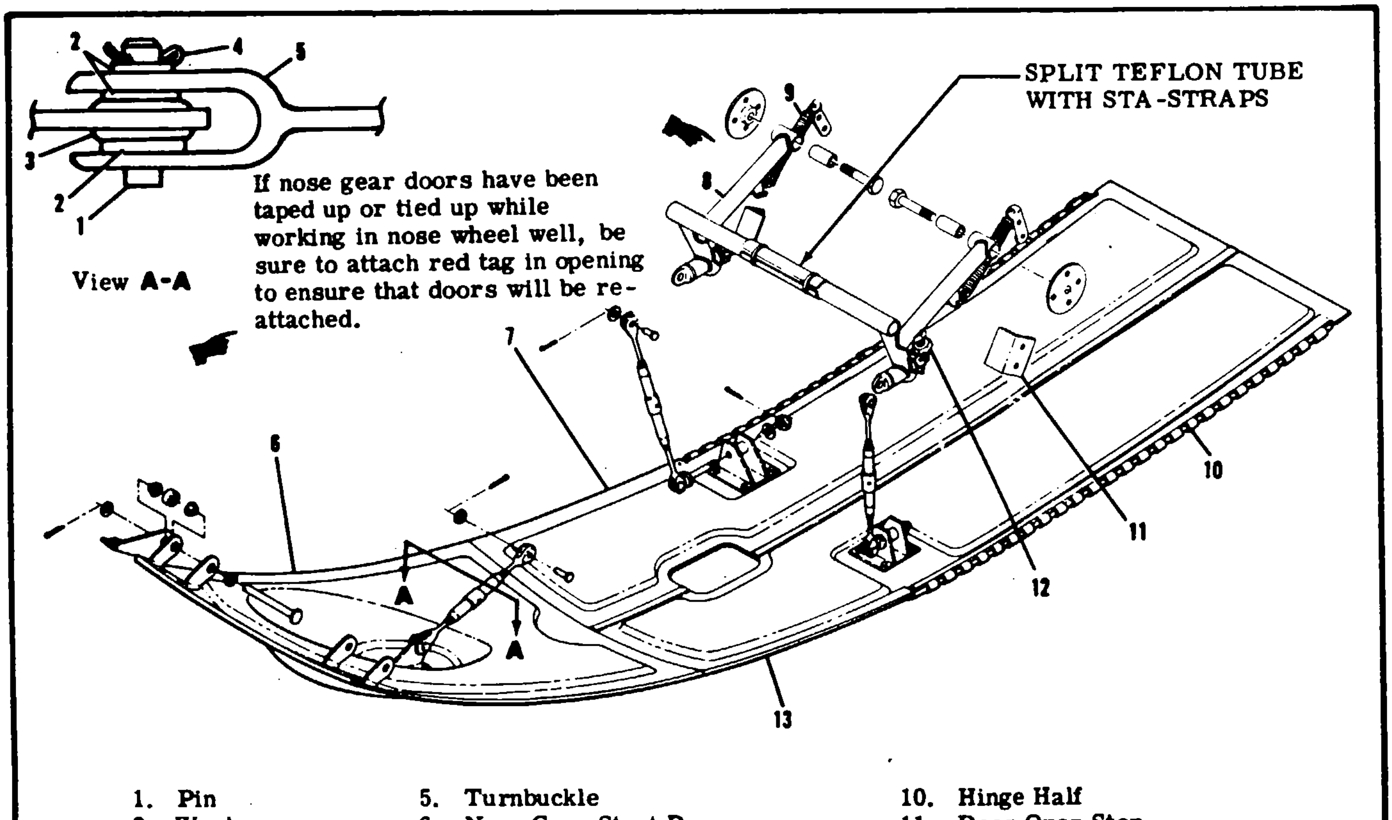
5-91. RIGGING NOSE GEAR DOORS. Refer to paragraph 5-92 for rigging the nose landing gear doors,

5-92. RIGGING NOSE LANDING GEAR. (Refer to figure 5-32.)

NOTE

A simplified method for checking unlock forces, gear up position, up and down indicator switches, hook-to-actuator assembly clearance and minor lubrication is to proceed as follows:

a. Jack aircraft in accordance with pro-




1. Pin
2. Washer
3. Grommet
4. Cotter Pin
5. Turnbuckle
6. Nose Gear Strut Door
7. Right Nose Wheel Door
8. Actuator Arm
9. Spring
10. Hinge Half
11. Door Open Stop
12. Door Open Stop Adjustment
13. Left Nose Wheel Door

Figure 5-31. Nose Gear Doors

cedures outlined in Section 2.

b. Pull landing gear circuit breaker and disconnect turnbuckle (item 32, sheet 4) from nose gear strut, disconnect cowl flap linkage and remove upper and lower engine cowling.

c. Push in landing gear circuit breaker and electrically extend gear to DOWN AND LOCKED position.

d. Pull out landing gear circuit breaker.

e. Select GEAR UP with selector handle in cabin.

f. Manually unlock main gear.

g. The preceding procedures will free the nose gear and allow it to swing freely, enabling the mechanic to perform the checks described at the beginning of the note.

For an initial installation, or to completely rig the nose landing gear, proceed as follows:

a. Jack aircraft in accordance with procedures outlined in Section 2 and rig nose gear as follows:

1. With nose gear extended, pull landing gear circuit breaker and disconnect turnbuckle (item 32, sheet 4) from nose gear strut, disconnect cowl flap linkage and remove upper and lower engine cowling.

NOTE

Do not disturb cowl flap linkage adjustment, or cowl flaps will have to be rigged in accordance with procedures outlined in Section 11.

2. Disconnect turnbuckles (item 33, sheet 4) at top ends. Tape or tie doors open.

NOTE

Attach red tag or streamer at the opening to ensure that doors will be re-attached.

3. Push landing gear circuit breaker in and partially retract gear. Pull landing gear circuit breaker and disconnect lock spring (item 10, sheet 2) at upper end (clamp on nose gear actuator). Disconnect lower end of lock spring from hole in center of lock link stud (item 15A, sheet 5).

4. Referring to sheet 2, break safety wire from bolt (2A) to roller bracket on lock assembly (1); remove bolt (2A).

5. Push landing gear circuit breaker in and select gear-up at instrument panel to draw nose gear actuator rod up into actuator to move it out of work area; pull landing gear circuit breaker.

6. Disconnect fork (item 25, detail B, sheet 3) from arm of bellcrank assembly (26).

NOTE

Lower end of fork/rod assembly (24) could be disconnected from bellcrank assembly (23) and rod set aside to remove it from work area.

7. Referring to view A1-A1 on sheet 5, loosen bolt (7) attaching rod end (15) to engine mount (6); back-out bolt (7) only enough to remove nut (13), washers (14 and 43) and rod end (15).

8. On an initial installation, with landing gear extended, and doors (items 38 and 39, sheet 4) open, adjust bolts (36) on bottom aft sides of door actuator weld assemblies (35), so that the points where door turnbuckles (33) attach to weld assemblies (35) are approximately 1/16-inch overcenter forward (as shown in view D1-D1 on sheet 5).

NOTE

Turnbuckle adjustment is not important at this time.

9. Tap nose gear forward to straighten drag links (18 and 45) as shown in view E-E on sheet 7; check drag link overcenter bolt (44) for .004 to .008-inch clearance (as shown in figure) with drag links straight.

10. If adjustment is necessary, break safety wire from bolt (44) to rear drag link (18) and adjust bolt (44) to obtain .004 to .008-inch clearance with drag links straight.

NOTE

This adjustment will give .03 to .06-inch overcenter measurement with drag links pushed down (refer to view E-E on sheet 7).

11. Push drag links down and check for .03 to .06-inch overcenter measurement. Tap nose wheel hard in the aft direction to be sure drag links will stay down and not kick back up. Safety wire bolt (44) to hole in aft drag link (18).

12. On an initial installation, adjust eccentric bushing (9) to the two-o'clock position, as shown in view G-G on sheet 5. Adjust lock link stud rod end (15) to match position of eccentric bushing (9) hole and with shock pad (1A) on forward end of lock assembly (1), just contacting rod end (15).

NOTE

Shock pad (1A) is a neoprene, 70 duromater sheet, 1/2" x 2-1/4" x .062", and is bonded to lock assembly (1) with EC-1300L or EC-880 (3M Company, St. Paul, Minnesota 55101). If excessively worn or cut, pad should be replaced, as difficulty in obtaining proper clearances will be encountered. Toluol should be used to soften the "cement line" as tension is applied to peel back the damaged pad. Clean off excessive adhesive or solvent before applying new pad. To apply new pad, stir EC-1300L or EC880 cement thoroughly before using. Apply one even brush coat to metal and to the pad. Allow cement to air dry for a minimum of 30 minutes, and then apply a second coat to each of the surfaces. Install shock pad (1A) on lock assembly (1) and allow at least 30 minutes, preferably one hour, for drying.

13. With landing gear down, adjust lock link stud rod end (15) to obtain 15 to 20 pounds unlocking force, using fish scale, as shown in view A2-A2 on

sheet 5.

14. Swing gear by hand to retracted position, and check unlocking force, with fish scale, to be 15 to 20 pounds. If unlocking force is more than or less than the 15 to 20 pound range, adjust eccentric bushing (9) either clockwise or counterclockwise to obtain desired unlocking force.

NOTE

If adjustment of eccentric bushing fails to obtain desired unlocking force, further adjustment of lock link stud rod end (15) will be necessary.

15. Swing gear by hand into retracted position, if gear is extended, and adjust tire to have .8-inch minimum to 1.0-inch maximum clearance of the fuselage skin contour. Make this adjustment with lock link stud rod end (15).

NOTE

A combination of eccentric and rod end adjustments are usually required to obtain up position and up and down lock force.

16. Swing gear by hand and check long finger of uplock hook (41) going past actuator assembly (37).

17. Adjust hook (oversize holes provided) as required to obtain 1/16-inch to 1/8-inch clearance past tube (view D2-D-2, sheet 5).

18. Adjust rod (24) to bellcrank arm (23) for as much engagement as possible and still have hook (41) clear roller (29) during retraction and extension of the gear; attach fork (item 25, sheet 3).

19. With gear up and locked, attach spring (21), if disconnected.

NOTE

When rigging the nose gear, all parts must be free and in good alignment to ensure proper operation.

20. Adjust magnetic indicator switch (item 12, sheet 2) to have .03-inch to .06-inch overtravel with gear up and locked.

21. Manually extend landing gear and check position of doors. If doors open outward from vertical, remove washer from under eyebolt (item 34, sheet 4) that upper end of turnbuckle (33) attaches to, and readjust turnbuckle with gear up. If doors open inward from vertical, add washer under eyebolt and readjust turnbuckle with gear in up position; safety wire turnbuckles.

22. With gear pushed up and locked, adjust uplock bushing (30) on uplock roller (29) vertically to match uplock hook (41).

23. Install .025-inch to .050-inch shim between rod end (15) and shock pad (1A) as shown on sheet 4. With shim in place, adjust down light switch (4) until it actuates, tighten switch and remove shim.

NOTE

Refer to paragraph 5-92A for procedures in testing the reed-type magnetic switches.

24. Attach and adjust strut door turnbuckle (item 32, sheet 4) when cowling is installed; safety wire turnbuckle.

25. Check to see that nose gear squat switch makes contact when nose gear strut is .25-inch minimum from its fully extended position (4.780 ± .030").

NOTE

If squat switch does not make contact or is defective or damaged, it should be replaced in accordance with applicable paragraph in this Section.

26. Extend gear, using hand pump, to full extension.

CAUTION

Guide rod end travel to avoid damage to either actuator rod end or structure. If no help is available, assure that rod end (20) will line up with channel in lock assembly (1). If resistance to pumping is encountered, stop and recheck alignment.

27. Check aligning of nose gear actuator rod end bolt hole and bolt hole in lock assembly. If rod end extends approximately 1/32-inch further in alignment with overcenter lock hole, no further adjustment is necessary. (Refer to view F-F, sheet 5).

28. Partially retract landing gear and connect nose gear actuator rod end (20) to lock assembly (1); resafety wire bolt (2A) to roller bracket on lock assembly. If bolt (2) was removed or loosened, reinstall with Loctite grade CV sealant.

29. Reset landing gear circuit breaker and cycle gear twenty-five times and check all lights, switches and normal gear operation.

30. Operate gear through at least five lock and unlock cycles with a 25 pound shot bag on each wheel and brake assembly, as shown in figure 5-20, during cycle test. This will simulate approximate air loads on the main landing gear while airborne. Gear should lock and unlock satisfactorily with shot bags in position on wheels.

CAUTION

Do not retract gear into wells with shot bags on wheels.

5-92A. TESTING REED SWITCHES INSTALLED IN AIRCRAFT.

a. Turn off master switch and remove lamp from gear down indicator.

b. Attach one probe of an ohmmeter to a good airframe ground.

c. Attach the other ohmmeter probe to terminal 2 on the gear down indicator light socket.

NOTE

If ohmmeter indicates continuity, all of the gear down indicator switches and their attendant circuit parts are satisfactory.

d. If ohmmeter does not indicate continuity, use a sharp pointed probe and pierce the insulation of wire GE8 (reference drawing 2070001, page 15.2.7) in Section 19 of this Manual. A showing of continuity on the ohmmeter indicates that the right main gear and nose gear down switches are satisfactory and also indicates that the portion of the circuit from the ohmmeter probe back to pin 2 on the gear down indicator light has a malfunction.

e. If the ohmmeter does not indicate continuity at this point, insert the sharp probe into wire GE7. An indication of continuity at this point shows that the nose gear down switch and its attendant circuit is working as required.

NOTE

An indication of continuity at this point, along with no continuity indicated with the probe in wire GE8, shows a malfunction of the right main gear downlock switch or its associated circuit parts. A lack of continuity shown with the probe in wire GE7 indicates a problem in the nose gear down switch or its attendant circuit parts.

f. On aircraft serials prior to 177RG00065, no continuity indication with the probe in wire GE7 could indicate an open nose gear sense switch as well as an open nose gear down switch.

NOTE

To isolate the nose gear down switch, insert the sharp probe into wire GE11. (reference 2070001, page 15.2.1) in Section 19 of this Manual. A lack of continuity here indicates a problem in the nose gear down switch or its circuit. An indication of continuity at this point proves that the nose gear down switch is closed.

g. The nose gear up and the main gear up switches may be checked in a similar manner, starting at pin 2 of the gear up indicator light socket.

NOTE

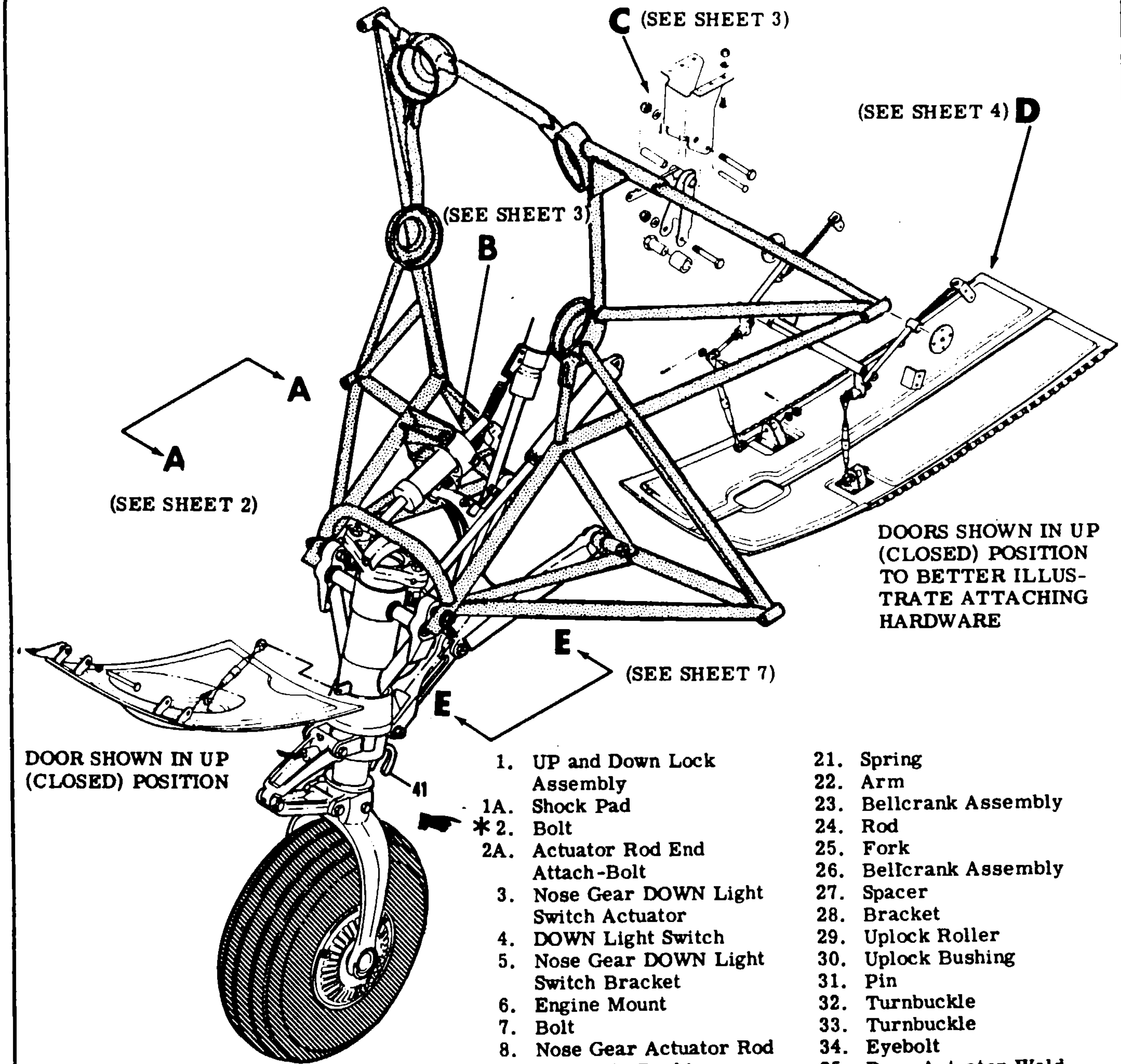
Be sure to remove the indicator lamp first.

h. If a lack of continuity in any of the preceding steps indicates a switch is not functioning, an attempt should be made to activate the switch by adjusting the position of either the magnet or switch until the reed closes.

NOTE

If it is necessary to adjust the magnet-switch combination to a gap of less than .050-inch to make the switch operate, it indicates that either the switch or the magnet is inoperative and one or the other should be replaced.

**SHOP NOTES:**




1. UP and Down Lock Assembly
1A. Shock Pad
*2. Bolt
2A. Actuator Rod End Attach-Bolt
3. Nose Gear DOWN Light Switch Actuator
4. DOWN Light Switch
5. Nose Gear DOWN Light Switch Bracket
6. Engine Mount
7. Bolt
8. Nose Gear Actuator Rod
9. Eccentric Bushing
10. Lock Spring
11. Nose Gear UP Light Switch Bracket
12. UP Light Switch
13. Nut
14. Washer
15. Lock Link Stud Rod End
15A. Lock Link Stud
16. Nose Gear UP Light Switch Actuator
17. Bolt
18. Aft Drag Link
19. Roller
20. Actuator Rod End
21. Spring
22. Arm
23. Bellcrank Assembly
24. Rod
25. Fork
26. Bellcrank Assembly
27. Spacer
28. Bracket
29. Uplock Roller
30. Uplock Bushing
31. Pin
32. Turnbuckle
33. Turnbuckle
34. Eyebolt
35. Door Actuator Weld Assembly
36. Bolt
37. Door Actuator Assembly
38. LH Aft Nose Gear Door
39. RH Aft Nose Gear Door
40. Strut Door
41. Uplock Hook
42. Spacer
43. Washer
44. Drag Link Overcenter Bolt
45. Forward Drag Link

NOTE

Refer to paragraph 5-92 for nose gear rigging procedures.

* Install with Loctite grade CV sealant.

Figure 5-32. Nose Gear Rigging (Sheet 1 of 7)

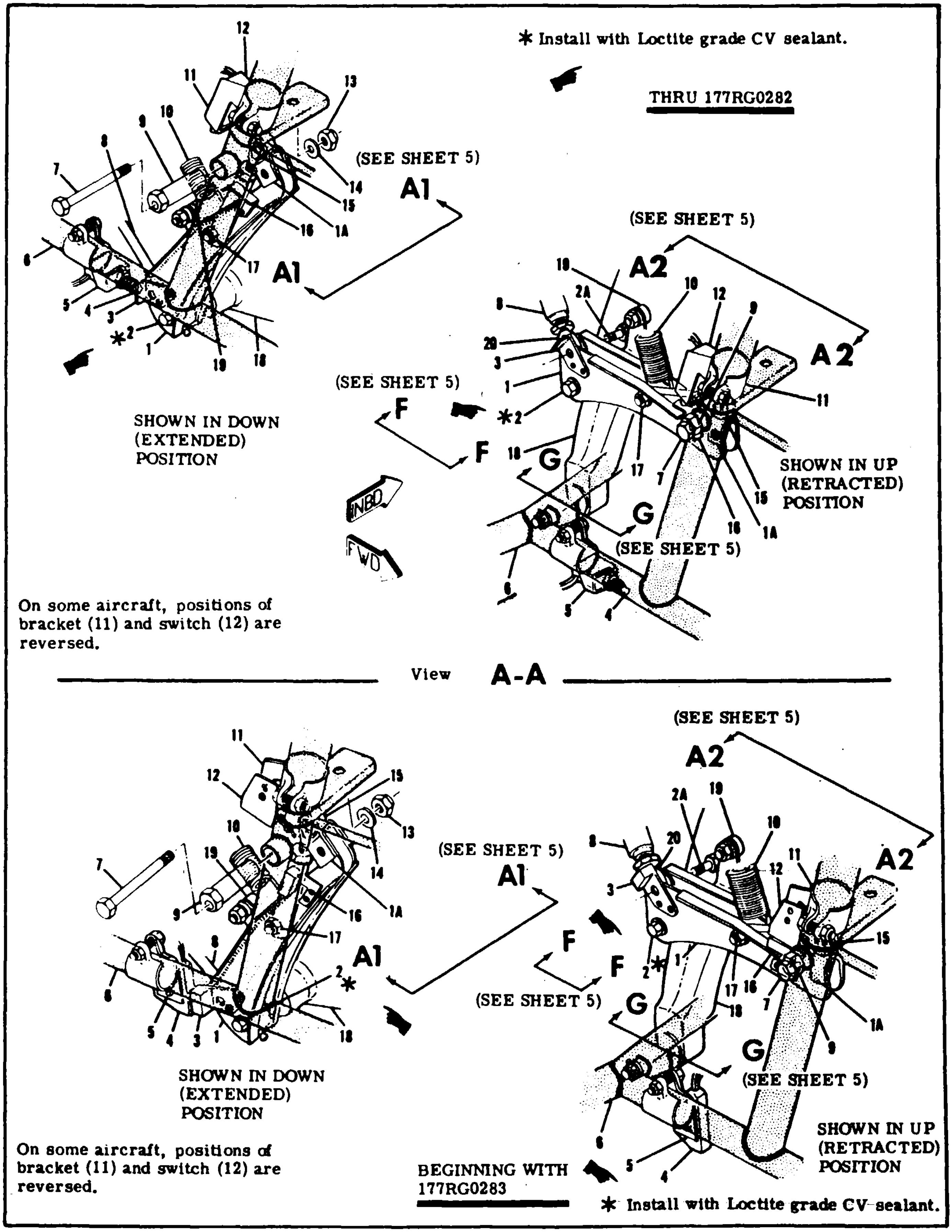



Figure 5-32. Nose Gear Rigging (Sheet 2 of 7)

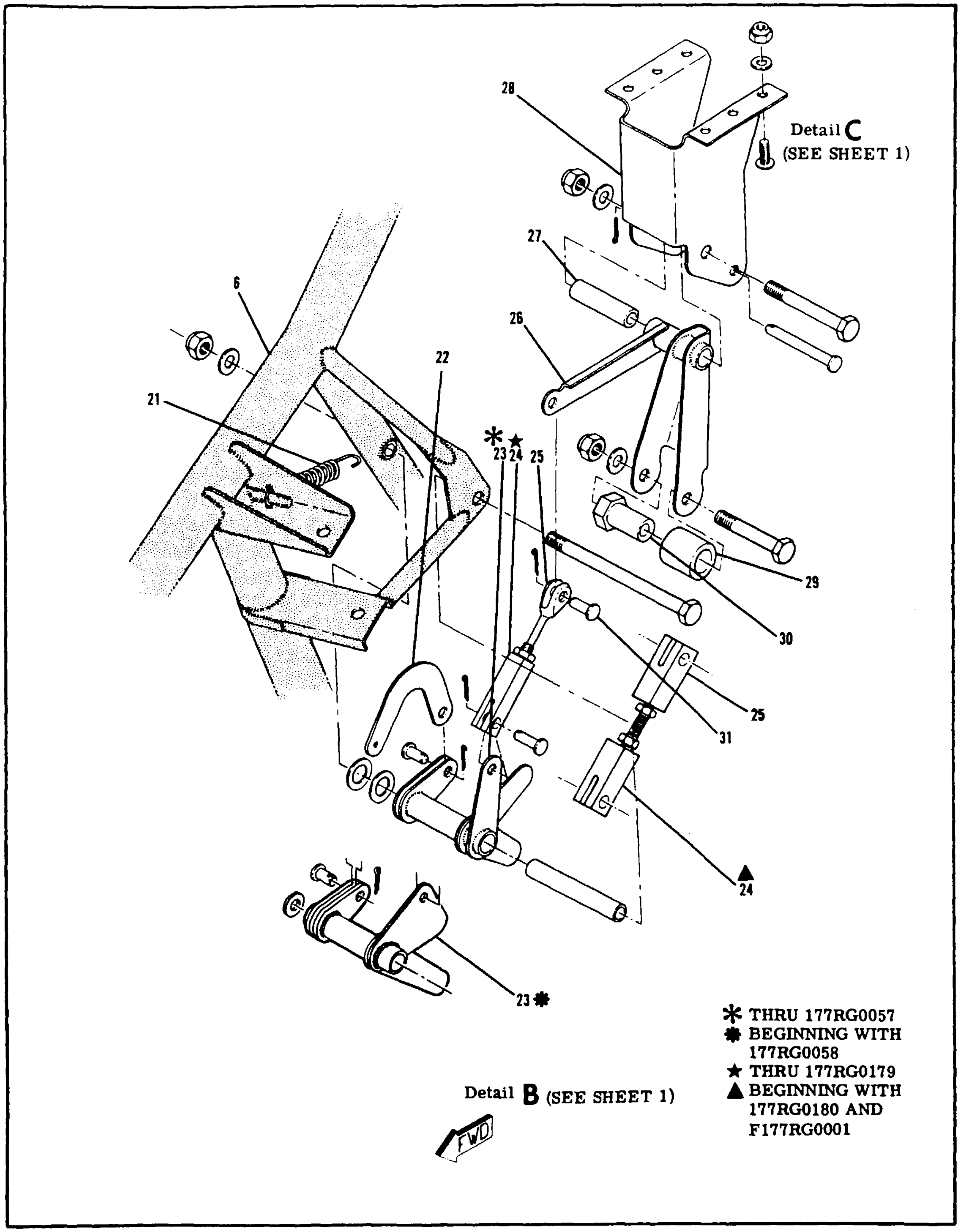
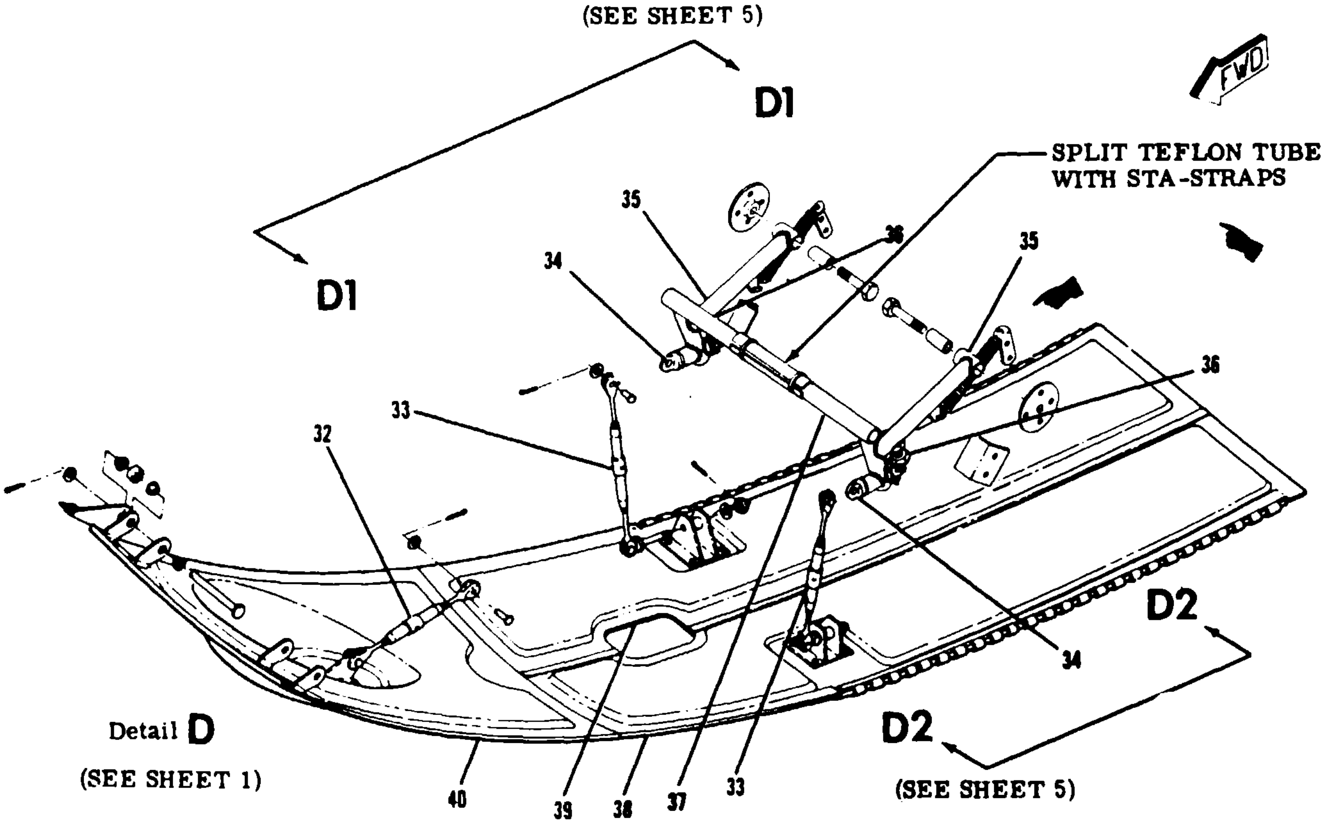



Figure 5-32. Nose Gear Rigging (Sheet 3 of 7)



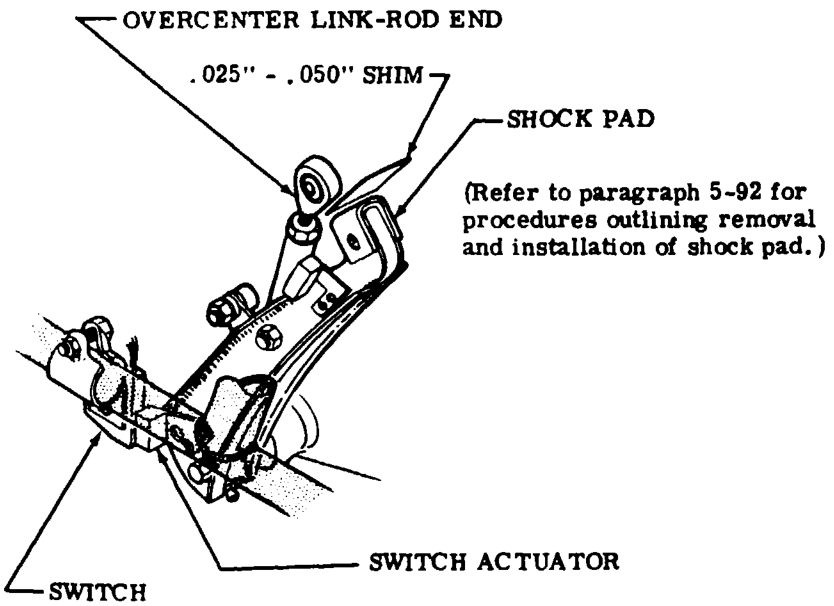




Figure 5-32. Nose Gear Rigging (Sheet 4 of 7)

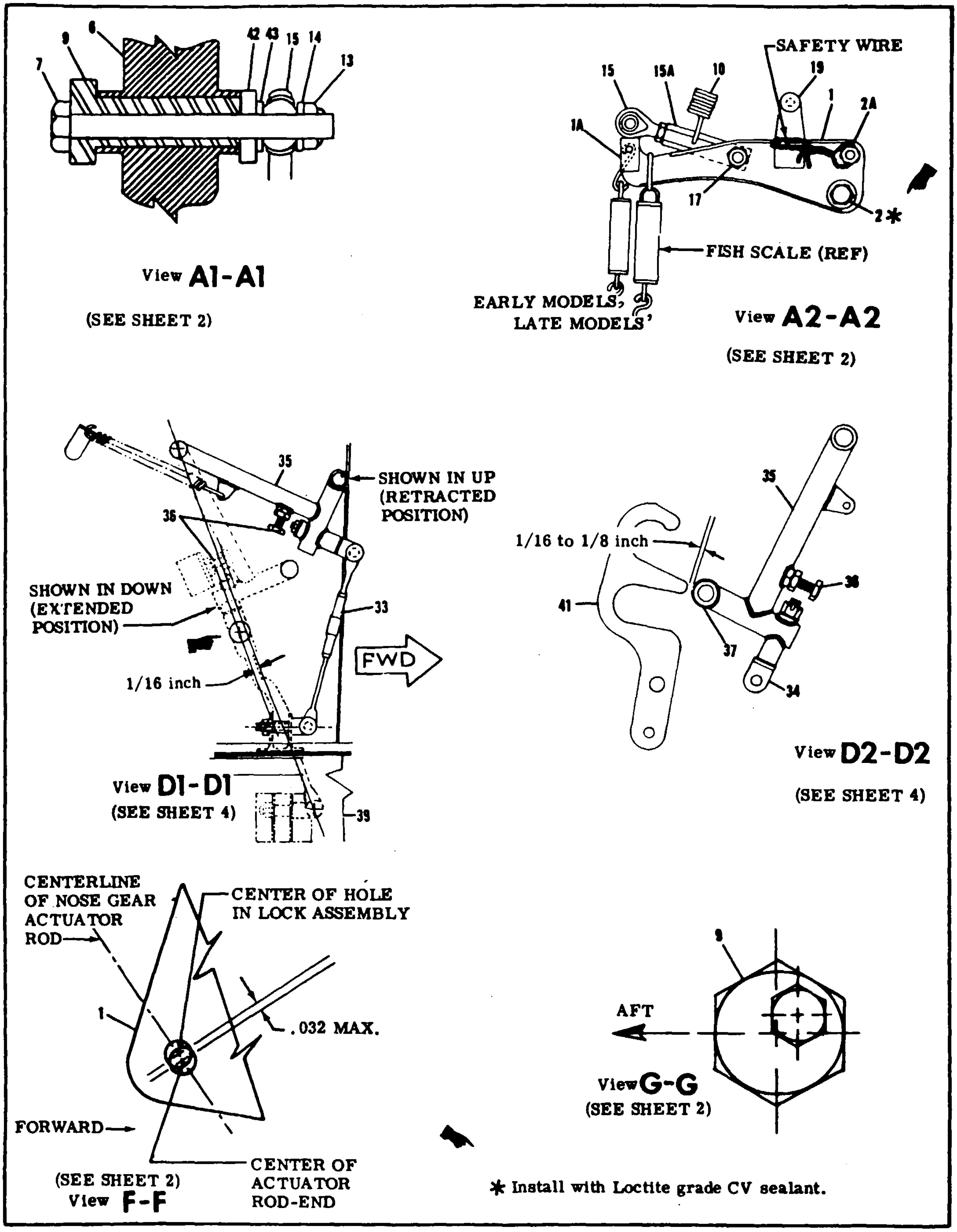



Figure 5-32. Nose Gear Rigging (Sheet 5 of 7)

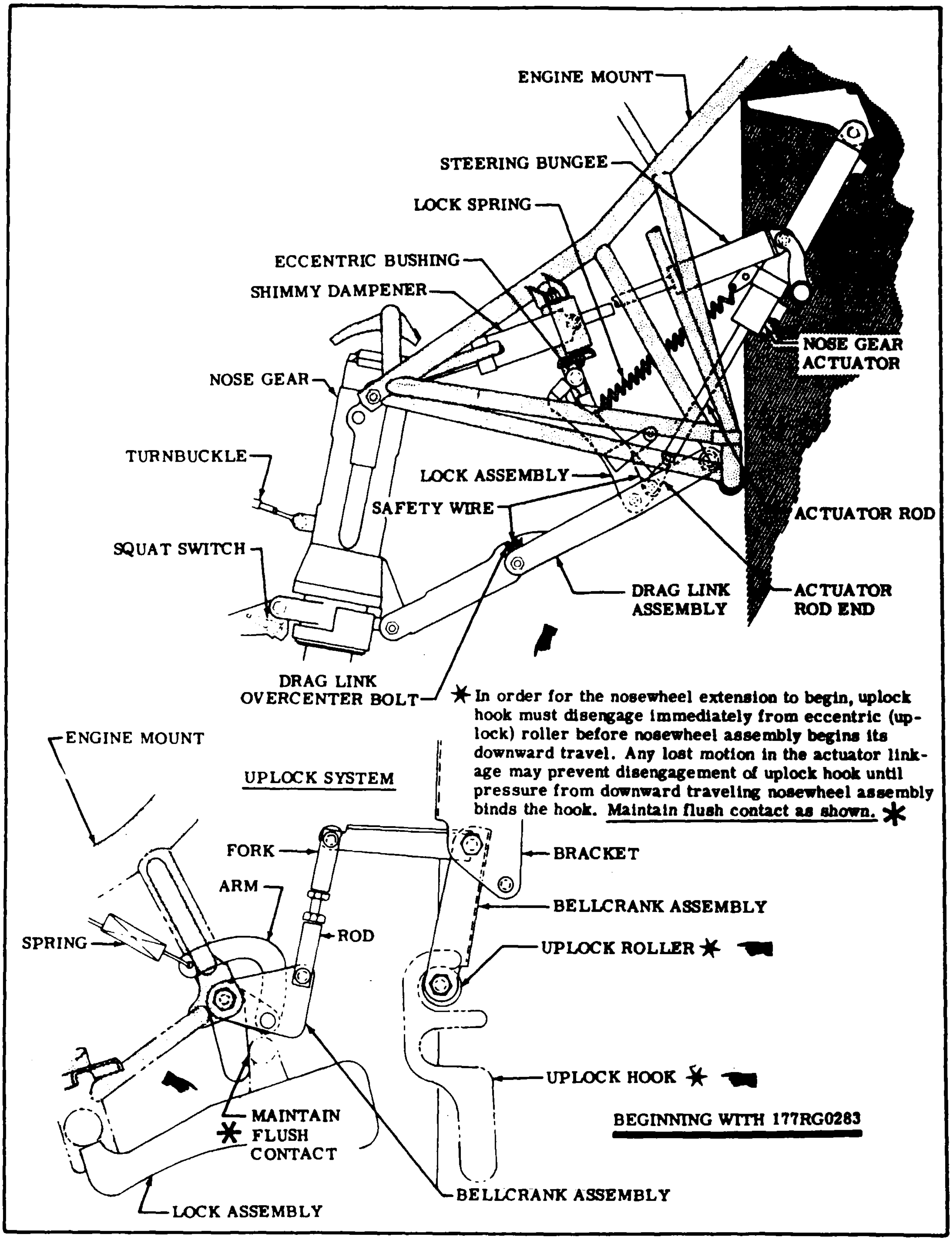
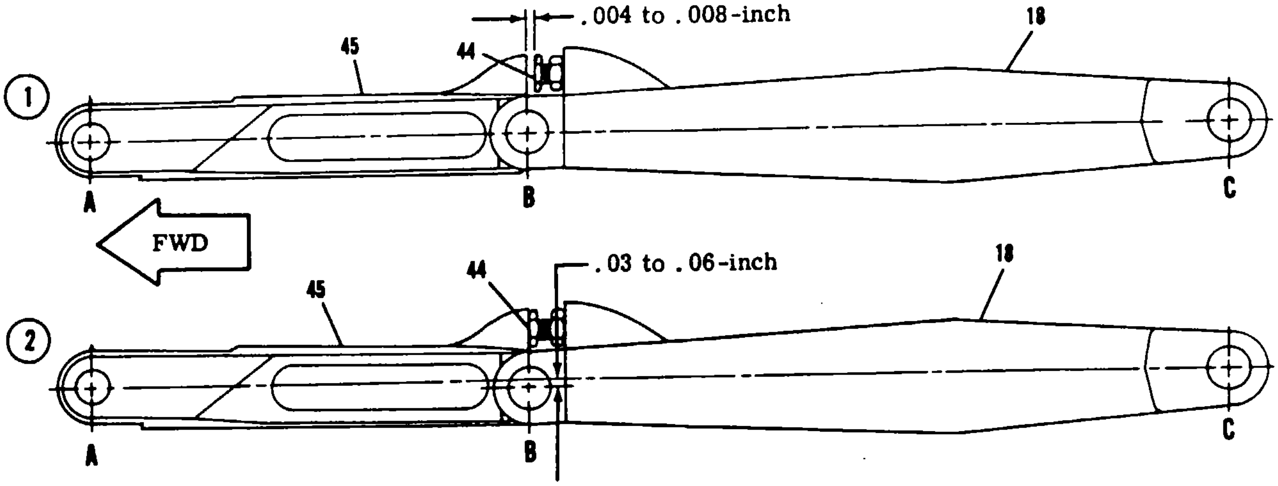



Figure 5-32. Nose Gear Rigging (Sheet 6 of 7)

Adjust overcenter bolt (44) to .004 to .008-inch with points A, B and C in alignment.




With drag links (45) and (18) pushed down and adjustment made as shown in detail 1, overcenter measurement will be .03 to .06-inch as shown in detail 2.

NOTE

Safety wire bolt (44) after adjustment.

View **E-E**

(SEE SHEET 1)

Figure 5-32. Nose Gear Rigging (Sheet 7 of 7)

## SHOP NOTES:

5-93. BRAKE SYSTEM.

5-94. GENERAL DESCRIPTION. The hydraulic brake system consists of two master cylinders, brake lines connecting each master cylinder to its wheel brake cylinder, and the single-disc type brake assembly, located at each main landing gear wheel.

5-95. 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 replace master cylinder. |
| | Insufficient clearance of Lock-O-Seal in master cylinder. | Adjust as shown in figure 5-33. |
| | Restriction in hydraulic lines or restriction in compensating port in master brake cylinder. | Drain brake lines and clear the inside of brake line with filtered compressed air. Fill and bleed brakes. If clearing the lines fail to give satisfactory results, the master cylinder may be faulty and should be repaired. |
| | Worn, scored, or warped brake discs. | Replace brake disc and linings. |
| | Damaged or accumulated dirt restricting free movement of wheel brake parts. | Clean and repair or replace parts as necessary. |
| BRAKES FAIL TO OPERATE. | Leak in system. | Check entire system for leaks. If brake master cylinders or wheel assemblies are leaking, they should be repaired or replaced. |
| | Air in system. | Bleed system. |
| | Lack of fluid in master cylinders. | Fill and bleed systems. |
| | Master cylinder defective. | Repair or replace master cylinder. |

5-96. BRAKE MASTER CYLINDERS. The brake master cylinders, located just forward of the pilot rudder pedals, are actuated by applying toe pressure at the top of the rudder pedals. A small reservoir is incorporated into each master cylinder to supply the fluid required for operation. Where dual brakes are installed, mechanical linkage permits the copilot pedals to operate the master cylinder.

5-97. BRAKE MASTER CYLINDER REMOVAL AND INSTALLATION.

a. Remove bleeder screw at wheel brake assembly and drain hydraulic fluid from brake system.

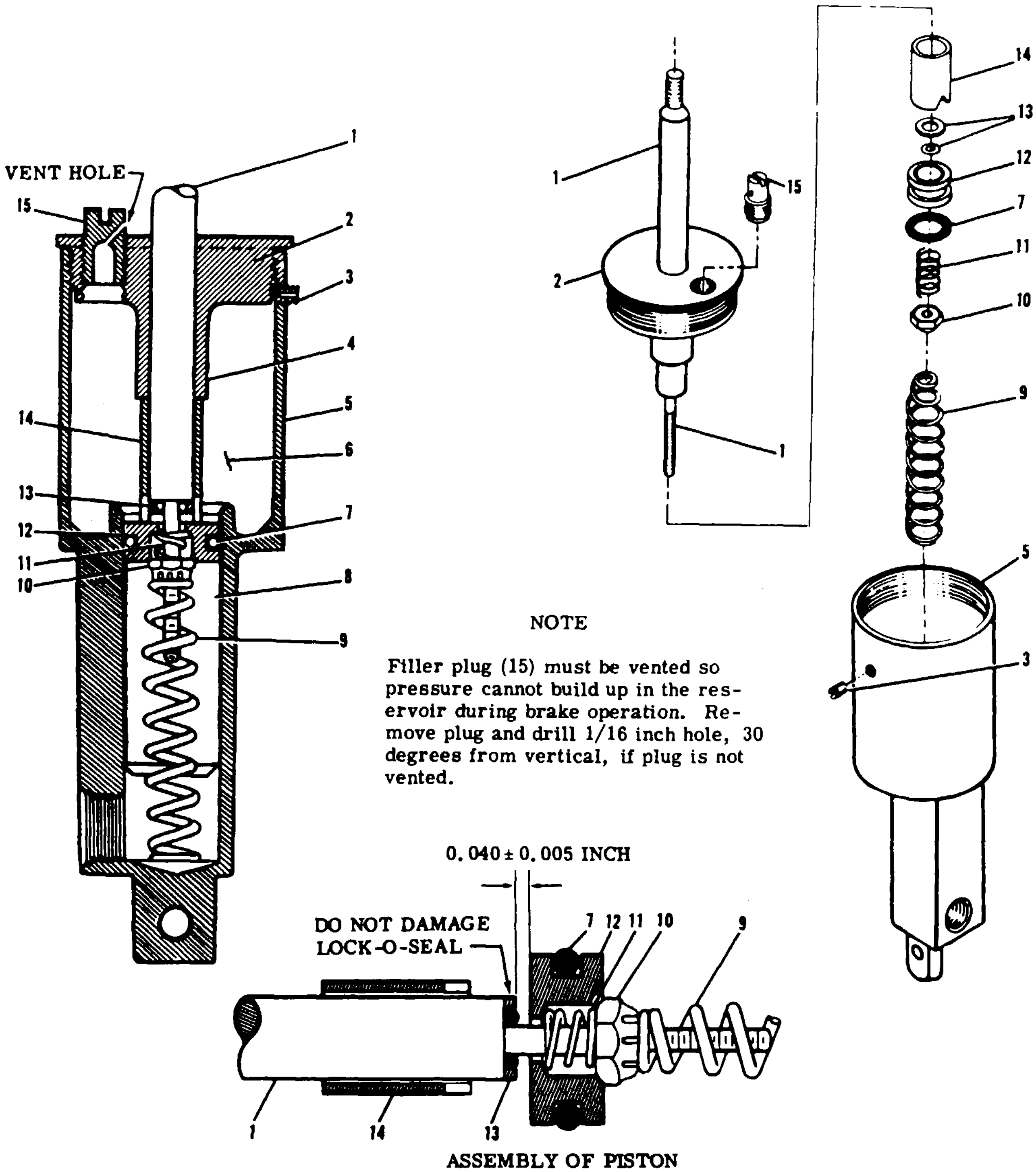
b. Disconnect parking brake cables from master cylinder extensions.

c. Disconnect master cylinder extension at rudder bars.

d. Disconnect hydraulic hose at master cylinders. Plug or cap hydraulic fittings and hose to prevent entry of foreign materials.

e. Remove pins attaching master cylinders at brackets and remove cylinders from aircraft.

f. Reverse the preceding steps to install brake master cylinders, then fill and bleed brake system in accordance with paragraph




1. Piston Rod
2. Cover
3. Setscrew
4. Cover Boss
5. Body
6. Reservoir
7. O-Ring
8. Cylinder
9. Piston Return Spring
10. Nut
11. Piston Spring
12. Piston
13. Lock-O-Seal
14. Compensating Sleeve
15. Filler Plug

Figure 5-33. Brake Master Cylinder

5-98. BRAKE MASTER CYLINDER DISASSEMBLY AND REPAIR. Figure 5-33 may be used as a guide during disassembly and assembly of the brake master cylinders. Repair is limited to replacement of parts, cleaning, and adjustment. Use clean hydraulic fluid (MIL-H-5606) as a lubricant during assembly of the cylinders.

5-99. HYDRAULIC BRAKE LINES. Brake lines are of rigid tubing, except for flexible hose, used at the brake master cyclinders, and at the wheel cylinders. A separate line is used to connect each brake master cylinder to its corresponding wheel brake cylinder.

5-100. WHEEL BRAKE ASSEMBLIES. The wheel brake assemblies use a disc which is attached to the main wheel with the wheel thru-bolts, and a floating brake assembly. See figure 5-6.

5-101. WHEEL BRAKE REMOVAL. Wheel brake assemblies are the floating type and can be removed after disconnecting the brake hose and removing the back plate and then pulling assembly from the torque plate.

NOTE

The brake disc can be removed after wheel removal and disassembly. To remove the torque plate, remove wheel and axle as outlined in paragraph 5-33.

5-102. WHEEL BRAKE INSPECTION AND REPAIR.

a. Clean all parts except brake linings and O-rings in dry cleaning solvent and dry thoroughly.

b. New O-rings are usually installed at each overhaul. If reuse of old O-rings is necessary, they should be wiped with a clean cloth saturated with hydraulic fluid and inspected 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 linings for deterioration and maximum permissible wear. See paragraph 5-105.

d. Inspect brake cylinder bore for scoring. A scored cylinder may leak or cause rapid O-ring wear. A scored brake cylinder should be replaced.

e. If the anchor bolts on the brake assemblies are nicked or gouged, they should be sanded smooth to prevent binding with the pressure plate or torque plate. When anchor bolts are replaced they should be pressed out after removing nuts. New bolts can be installed by tapping with a soft mallet.

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

5-103. WHEEL BRAKE ASSEMBLY. Lubricate parts with clean hydraulic fluid and assemble components with care to prevent damage to O-rings. Refer to figure 5-6 during assembly of wheel brakes.

5-104. WHEEL BRAKE INSTALLATION. Place brake assembly in position with pressure plate in place, then install back plate. If the torque plate was removed, install as the wheel and axle are installed. If the brake disc was removed from the wheel, install as the wheel is assembled. Connect brake line to brake cylinder. Fill and bleed brake system.

5-105. BRAKE LINING WEAR. The brake linings should be replaced when they are worn to a minimum thickness of 3/32-inch. Visually compare a 3/32 inch strip of material held adjacent to each lining to measure the thickness of the lining. The shank end of correct size drill bits make excellent tools for checking minimum thickness of the brake linings.

5-106. BRAKE LINING REPLACEMENT. (Refer to figure 5-6.)

a. Remove bolts and washers 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. Center a 9/64-inch diameter (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.

NOTE

A rivet setting kit, (P/N R561) is available from the Cessna Service Parts Center. 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 linign. Place rivet head against the anvil.

f. Center the rivet setting punch on the lips of the rivet. While holding the back plate down firmly against the lining, hit the punch with a hammer to set the rivet. Repeat blows on the punch until lining is firmly against the back plate.

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

h. Install a new lining on the 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 and secure with bolts and washers.

k. Bleed brake system.

5-107. BRAKE BLEEDING. Standard bleeding with a a clean hydraulic pressure source connected to the wheel cylinder bleeder is recommended.

a. Remove brake master cylinder filler plug and screw a flexible hose with a suitable fitting into the filler hole. Immerse the free end of the hose in a container with enough hydraulic fluid to cover the end of the hose.

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

c. As fluid is pumped into the system, observe the immersed end of the hose at the brake master cylinder for evidence of air bubbles being forced from the brake system.

d. When bubbling has ceased, tighten bleeder valve and remove bleeder source from wheel cylinder.

NOTE

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

e. Remove hose and install filler plug at master cylinder.

5-108. PARKING BRAKES. The parking brake system uses a handle and ratchet mechanism connected by cable and pulley arrangement to the extension rods at the top of the master cylinders. Pulling out the handle depresses both cylinder piston rods and the ratchet locks the handle in this position until the handle is turned and released.

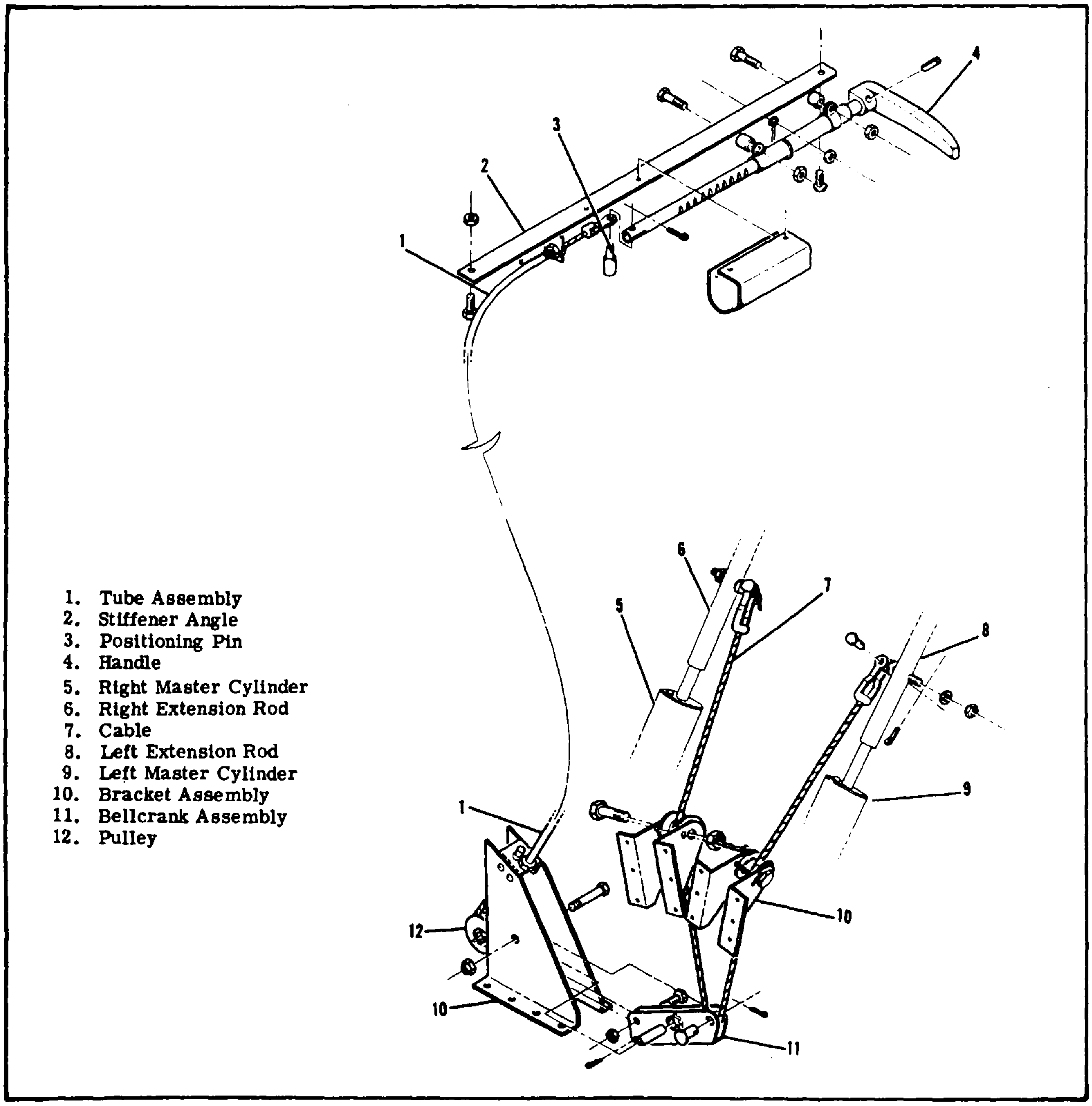



Figure 5-34. Parking Brake System

SECTION 6

# AILERON CONTROL SYSTEM

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

6-2. DESCRIPTION. The aileron control system is comprised of push-pull rods, bellcranks, cables, pulleys, quadrants and components forward of the instrument panel, all of which, link the control wheels to the ailerons.

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 6-20.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| LOST MOTION IN CONTROL WHEEL. | 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. |
| 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 bearing binding. | Replace bellcrank. |
| | Defective quadrant assembly. | Replace quadrant assembly. |
| | Clevis bolts in system too tight. | Loosen, then tighten properly and safety. |
| | Defective bearing in control column sleeve. | Replace defective bearing. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| CONTROL WHEELS NOT LEVEL WITH AILERONS NEUTRAL. | Improper adjustment of cables. | Adjust in accordance with paragraph 6-20. |
| | Improper adjustment of aileron push-pull rods. | Adjustment push-pull rods to obtain proper alignment. |
| DUAL CONTROL WHEELS NOT COORDINATED. | Interconnect cables improperly adjusted. | Adjust in accordance with paragraph 6-20. |
| INCORRECT AILERON TRAVEL. | Push-pull rods not adjusted properly. | Adjust in accordance with paragraph 6-20. |
| | Incorrect adjustment of travel stop bolts. | Adjust in accordance with paragraph 6-20. |

6-4. CONTROL COLUMN. (Refer to figure 6-2.)

6-5. DESCRIPTION. Rotation of the control wheel (1) rotates four bearing roller assemblies on the end of the tube and bearing assembly (14), which in turn, rotates a square control tube assembly (36) inside and extending from the tube and bearing assembly (14). Attached to this square tube (36) is a quadrant (31) which operates the aileron system. This same arrangement is provided for both control wheels and synchronization of the control wheels is obtained by the transition cable (34), turnbuckle (33) and adjustment terminals (30). The forward end of the square control tube (36) is mounted in a bearing block (24) on the firewall (35) and does not move fore-and-aft, but rotates with the control wheel. The four bearing roller assemblies on the end of the tube and bearing assembly (14) reduce friction as the control wheel is moved fore-and-aft for stabilator system operation. A sleeve weld assembly (11), containing bearings which permit the tube and bearing assembly (14) to rotate within it, is secured to the tube by a sleeve and retaining ring in such a manner that it moves fore-and-aft with the tube and bearing assembly. This movement allows the link (15) attached to the sleeve weld assembly (11) to operate a lever arm (19) which transmits force to a quadrant (21). The stabilator control cables (22 and 23) are attached to these quadrants. When dual controls are installed, the copilot control wheel is linked to the aileron and stabilator control systems in the same manner as the pilot control wheel.

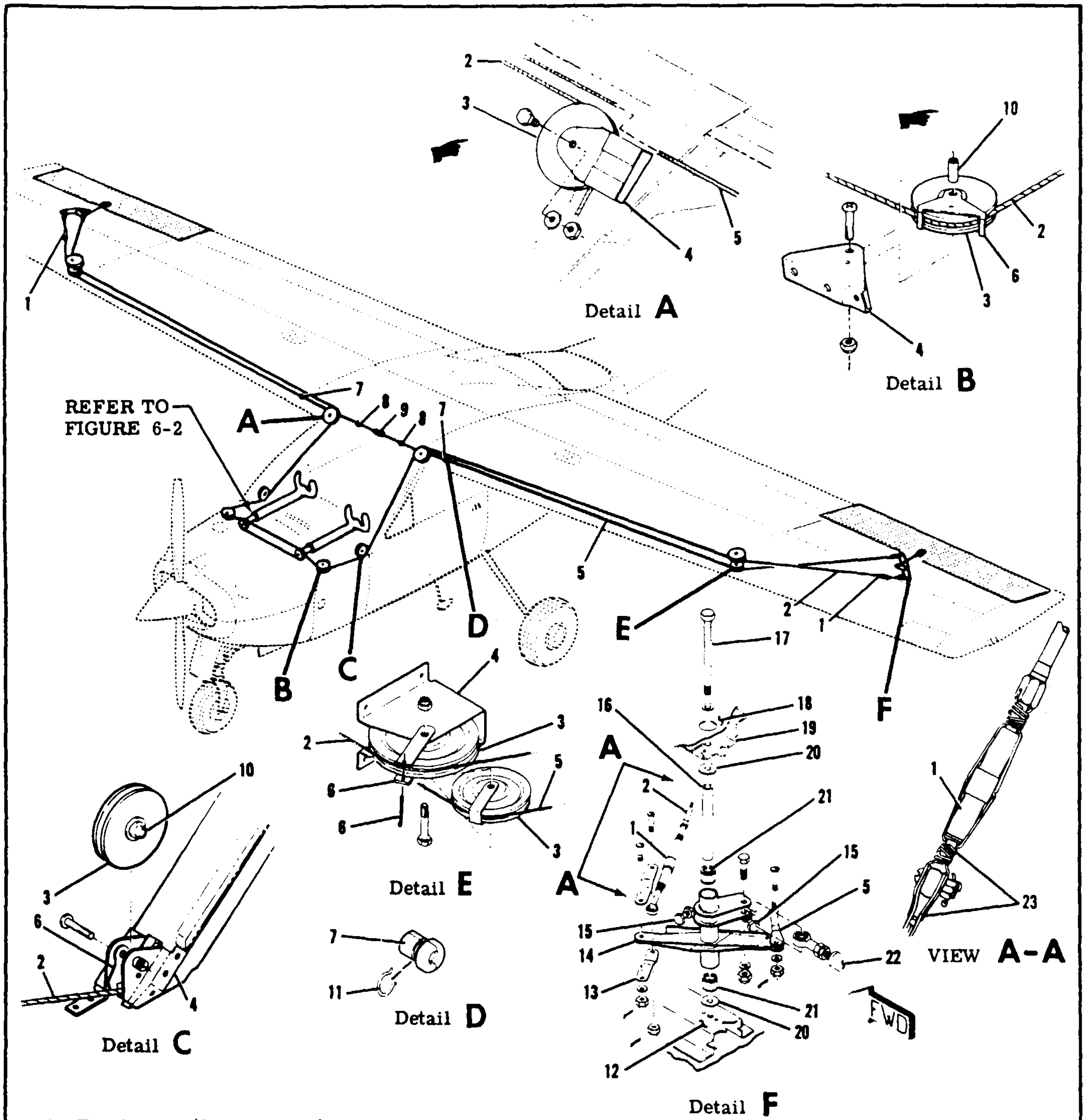
6-6. REMOVAL AND INSTALLATION.

NOTE

To remove the control tube and bearing assembly (14), complete steps "a through g", to remove control tube assembly (36), complete steps "a through l", to remove quadrant (31), complete steps "a through m".

a. Remove screw securing decorative collar (2) and slide collar forward to expose control wheel mounting screws.
b. Remove screws securing control wheel (1) to tube and bearing assembly (14) and remove control wheel. Disconnect electrical wiring to control wheel, if installed.
c. Remove lower decorative cover from instrument panel.
d. Remove screws securing collar (3), spacer (4) and bracket (5) to instrument panel.
e. Disconnect link assembly (15) from sleeve weld assembly (11).
f. Loosen screw securing adjustable glide plug (38).
g. Pull control tube and bearing assembly (14) aft through instrument panel to remove.
h. Relieve aileron direct cable (27) tension by loosening turnbuckles (index 1, figure 6-1).
i. Relieve transition cable (34) tension by loosening turnbuckle (33).
j. Remove aileron rudder interconnect cable clamps (index 5, sheet 2), if installed.
k. Remove roll pin (32) securing tube assembly (36) to quadrant (31).
l. Remove nut (28) and washer from tube assembly (36) protruding through bearing block (24) on forward side of firewall (35) and remove tube assembly.
m. Disconnect cables from quadrant (31).
n. Reverse the preceding steps for reinstallation. Rig aileron and aileron-rudder interconnect systems in accordance with paragraph 6-20, safety turnbuckles and all other items previously safetied. Tighten nut (28) securing tube assembly (36) to firewall snugly, then loosen nut to 0.030 " maximum clearance between nut and washer, align cotter pin hole and install pin.

6-7. REPAIR. Worn, damaged or defective shafts, bearings, quadrants, cables or other components should be replaced. Refer to Section 2 for lubrication requirements.




1. Turnbuckle (Direct Cable)
2. Direct Cable
3. Pulley
4. Bracket
5. Carry-thru Cable
6. Cable Guard
7. Fairlead
8. Grommet
9. Turnbuckle (Carry-Thru Cable)
10. Bushing
11. Clip
12. Lower Support
13. Link
14. Bellcrank
15. Travel Stop Bolt
16. Bushing
17. Pivot Bolt
18. Upper Wing Skin
19. Upper Support
20. Brass Washer
21. Needle Bearing
22. Push-Pull Rod
23. Safety Wire

**CAUTION**

MAINTAIN PROPER CONTROL CABLE TENSION.

| |
|---|
| CABLE TENSION:<br>30 LBS ± 10 LBS ON CARRY-THRU CABLE (AT AVERAGE TEMPERATURE FOR THE AREA.)<br>REFER TO FIGURE 1-1 FOR TRAVEL. |

Figure 6-1. Aileron Control System

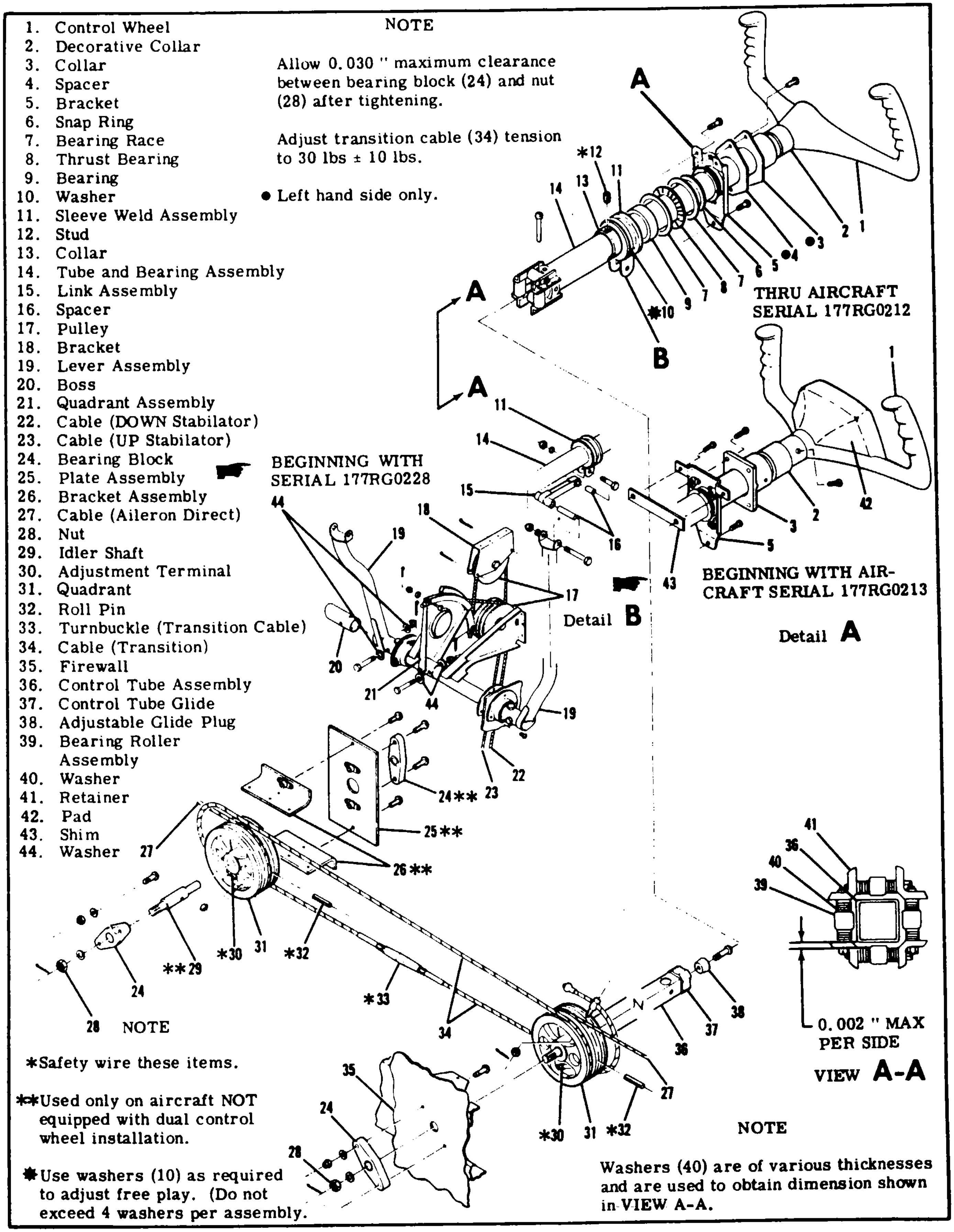
1. Control Wheel
2. Decorative Collar
3. Collar
4. Spacer
5. Bracket
6. Snap Ring
7. Bearing Race
8. Thrust Bearing
9. Bearing
10. Washer
11. Sleeve Weld Assembly
12. Stud
13. Collar
14. Tube and Bearing Assembly
15. Link Assembly
16. Spacer
17. Pulley
18. Bracket
19. Lever Assembly
20. Boss
21. Quadrant Assembly
22. Cable (DOWN Stabilator)
23. Cable (UP Stabilator)
24. Bearing Block
25. Plate Assembly
26. Bracket Assembly
27. Cable (Aileron Direct)
28. Nut
29. Idler Shaft
30. Adjustment Terminal
31. Quadrant
32. Roll Pin
33. Turnbuckle (Transition Cable)
34. Cable (Transition)
35. Firewall
36. Control Tube Assembly
37. Control Tube Glide
38. Adjustable Glide Plug
39. Bearing Roller Assembly
40. Washer
41. Retainer
42. Pad
43. Shim
44. Washer

NOTE

Allow 0.030 " maximum clearance between bearing block (24) and nut (28) after tightening.

Adjust transition cable (34) tension to 30 lbs ± 10 lbs.

● Left hand side only.




NOTE

*Safety wire these items.

**Used only on aircraft NOT equipped with dual control wheel installation.

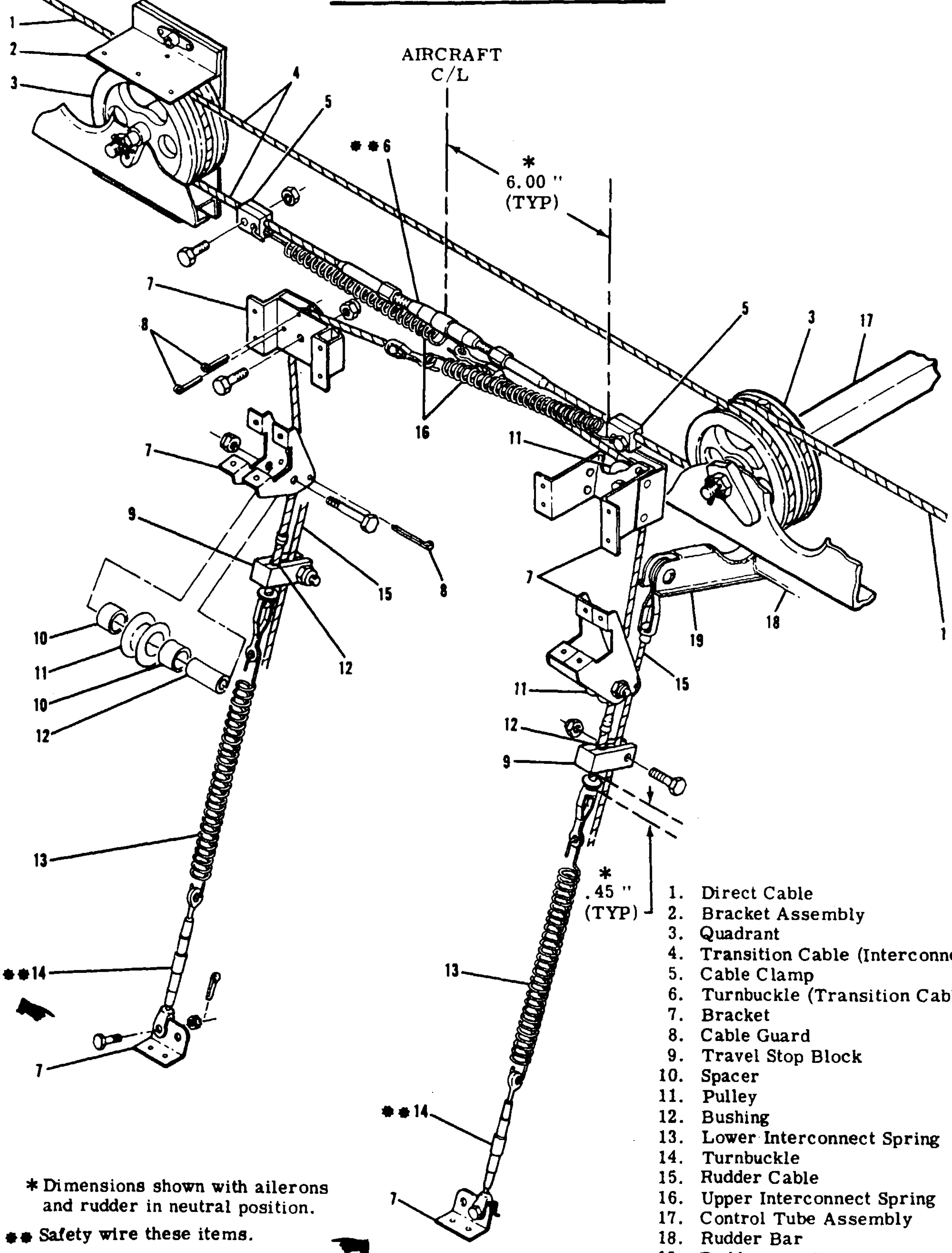
✱Use washers (10) as required to adjust free play. (Do not exceed 4 washers per assembly.

NOTE

Washers (40) are of various thicknesses and are used to obtain dimension shown in VIEW A-A.

Figure 6-2. Control Column (Sheet 1 of 2)

AILERON-RUDDER INTERCONNECT




1. Direct Cable
2. Bracket Assembly
3. Quadrant
4. Transition Cable (Interconnect)
5. Cable Clamp
6. Turnbuckle (Transition Cable)
7. Bracket
8. Cable Guard
9. Travel Stop Block
10. Spacer
11. Pulley
12. Bushing
13. Lower Interconnect Spring
14. Turnbuckle
15. Rudder Cable
16. Upper Interconnect Spring
17. Control Tube Assembly
18. Rudder Bar
19. Rudder Bar Arm

* Dimensions shown with ailerons and rudder in neutral position.

** Safety wire these items.

Figure 6-2. Control Column (Sheet 2 of 2)

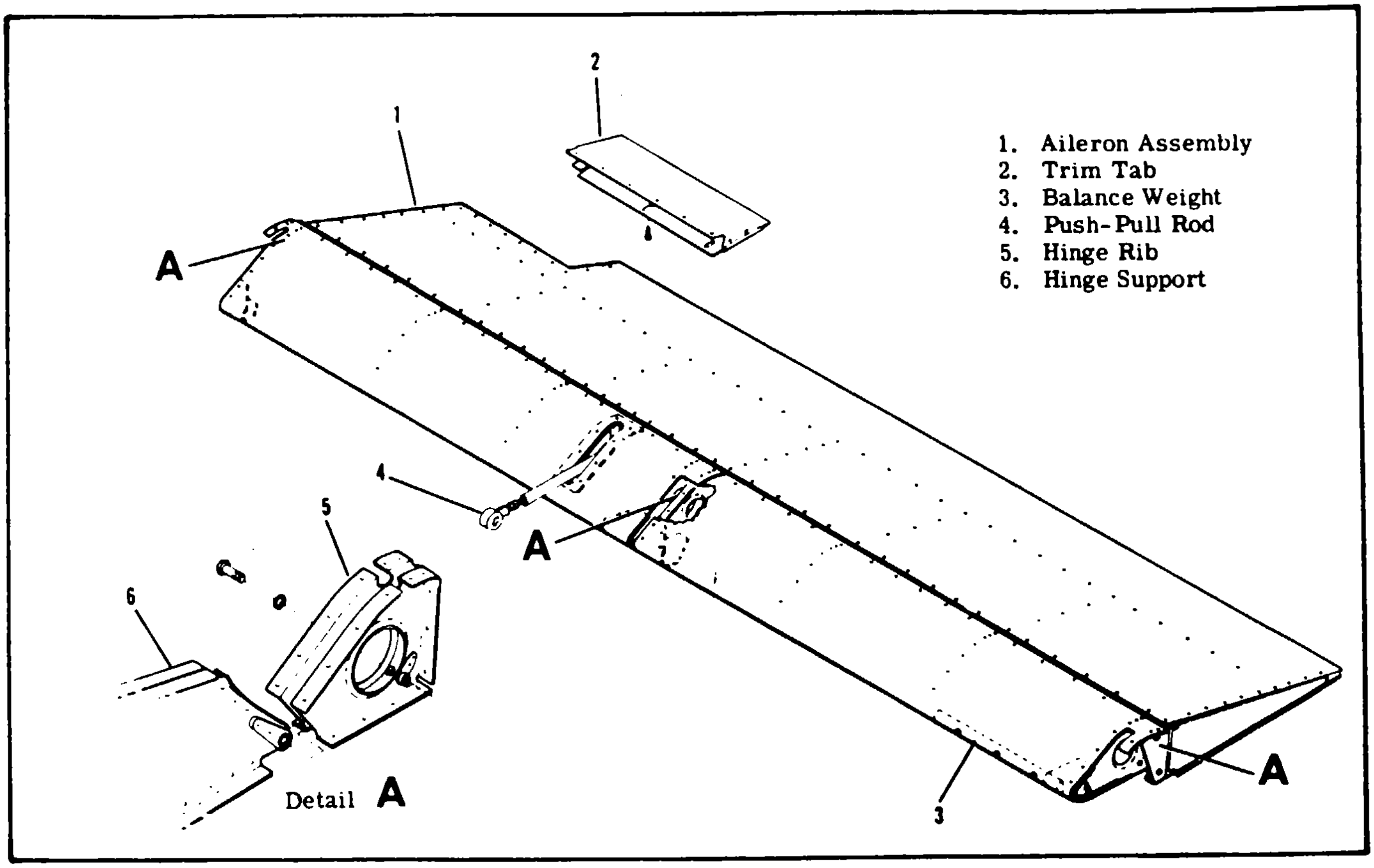



Figure 6-3. Aileron Installation

6-8. AILERON BELLCRANK. (Refer to figure 6-1.)

6-9. REMOVAL.
a. Remove access plate inboard of each bellcrank on underside of wing.
b. Relieve control cable tension by loosening turnbuckles (1).
c. Disconnect direct cable link (13) at bellcrank (14).
d. Disconnect carry-thru cable (5) at bellcrank.
e. Disconnect aileron push-pull rod (22) at bellcrank.
f. Remove bolt (17) securing bellcrank to wing structure.
g. Remove bellcrank through access opening, using care that bushing (16) is not dropped from bellcrank.

NOTE

Brass washers (20) may be used as shims between bellcrank and wing supports (12 and 19). Retain these shims. Tape open ends of bellcrank to prevent dust and dirt from entering bellcrank needle bearings (21).

6-10. INSTALLATION.
a. Connect control cables (2 and 5) to bellcrank (14) prior to positioning bellcrank in wing.
b. Place bushing (16) in bellcrank and position bellcrank in wing.
c. Install brass washers (20) as required between upper and lower end of bellcrank and wing supports to shim out excess clearance.
d. Install bellcrank pivot bolt (17).
e. Connect push-pull rod (22) to bellcrank.
f. Rig aileron system in accordance with paragraph 6-20, safety turnbuckles and reinstall all items removed for access.

6-11. REPAIR. Repair of bellcranks consists of replacement of defective parts. If needle bearings are dirty or in need of lubrication, clean thoroughly and lubricate as outlined in Section 2.

6-12. CABLES AND PULLEYS. (Refer to figure 6-1.)

6-13. REMOVAL AND INSTALLATION.
a. Remove access plates, wing root fairings and upholstery as required.
b. Disconnect cables from turnbuckles and bellcranks or quadrants depending on which cable is to be removed.
c. Remove cable guards, fairleads and pulleys as necessary to work cables free of aircraft.

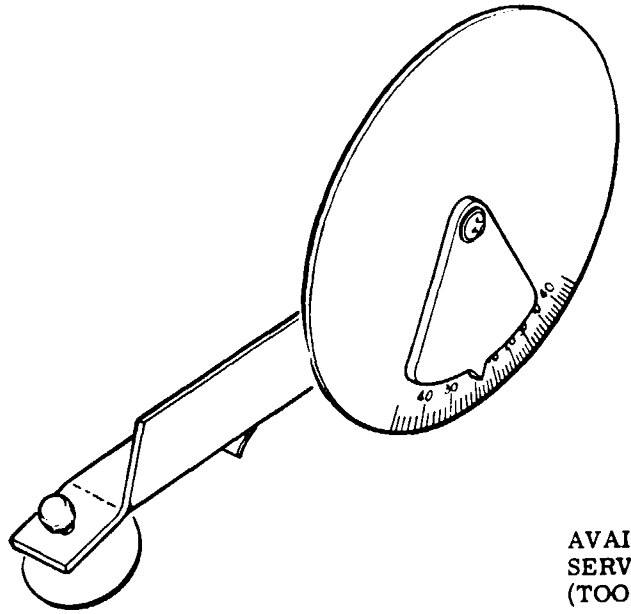



Figure 6-4. Inclinometer for Measuring Control Surface Travels

NOTE

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

d. After cable is routed, install pulleys, fairleads and cable guards. Ensure cable is positioned in pulley groove before installing guard. Check grommets (8) for proper installation.
e. Re-rig aileron system in accordance with paragraph 6-20, safety turnbuckles, install access plates, fairings and upholstery removed in step "a."

6-14. AILERONS. (Refer to figure 6-3.)

6-15. REMOVAL AND INSTALLATION.
a. Remove access plate and disconnect push-pull rod (4) at aileron.
b. Remove wing tip for access to outboard hinge bolt.
c. Run flaps to full down position for access to inboard hinge bolt.
d. Remove hinge bolts securing aileron and carefully remove aileron from wing.
e. Reverse preceding steps for reinstallation. Rig system if necessary in accordance with paragraph 6-20 and reinstall all items removed for access.

NOTE

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

6-16. REPAIR. Aileron repair and static balance may be accomplished in accordance with instructions outlined in Section 17. Before installation, ensure balance weights and hinges are securely attached.

6-17. AILERON TRIM TAB. (Refer to figure 6-3.)

6-18. REMOVAL AND INSTALLATION.
a. Remove screws on lower side of tab.
b. Drill out rivets on upper side of tab and remove tab.
c. Reverse preceding steps for reinstallation.

6-19. ADJUSTMENT. Adjustment is accomplished by loosening the screws, shifting tab trailing edge up to correct for a wing-heavy condition or down to correct for a wing-light condition. Divide correction equally on both tabs. When installing a new wing or aileron, set tab in neutral and adjust as necessary after flight test.

6-20. RIGGING. (Refer to figure 6-1.)
a. Relieve all tension on aileron control system by loosening turnbuckles (1 and 9).
b. Disconnect push-pull rods (22) at bellcranks (14).

c. Adjust interconnect cable turnbuckle (index 33, figure 6-2) and adjustment terminals (index 30, figure 6-2) to remove cable slack, acquire proper tension (30 ± 10 pounds) and position control wheels level (synchronized).
d. Tape a bar across both control wheels to hold them in neutral position.
e. Adjust push-pull rods (22) at each aileron to 10.80" between centerlines of rod-end bolt holes and connect push-pull rods to bellcranks (14).
f. Adjust direct cable turnbuckles (1) and carry-thru cable turnbuckle (9) equally to obtain 30 ± 10 pounds tension on carry-thru cable while maintaining ailerons in neutral with reference to trailing edge of wing flaps. Be sure wing flaps are full UP and disregard aileron trim tabs when making this adjustment.
g. With ailerons in neutral position (streamlined), mount an inclinometer on trailing edge of one aileron and set to 0°.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

h. Remove bar from control wheels and adjust travel stops (15) to degree specified in figure 1-1.
i. Ensure all turnbuckles are safetied, cables, fairleads and cable guards are properly installed, jam nuts are tight and replace all items removed for access.

**WARNING**

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

6-21. AILERON-RUDDER INTERCONNECT SYSTEM. (Refer to figure 6-2, sheet 2.)

6-22. RIGGING.
a. With interconnect cable clamps (5) installed as illustrated, the centering force exerted on the control wheel due to the interconnect springs (13 and 16) should be 2.5 + 1-0 pounds. This force may be checked with a spring scale attached to the hand grip of the control wheel with the controls fully crossed (full left rudder and full right aileron or full right rudder and full left aileron). If not within tolerance, do not move clamps (5), replace the springs (13 and 16).

**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 consists of an electric motor and transmission assembly, drive pulleys, snychronizing push-pull tubes, bellcranks, push-pull rods, pulleys and a follow-up control. Power from the motor and transmission assembly is transmitted to the flaps by a system of drive pulleys and cables. Electrical power to the motor is controlled by two microswitches mounted on a "floating" arm. a control lever and a follow-up control. As the control lever is moved to the desired flap setting, it trips a switch actuating the flap motor. As the flaps move, the floating arm is rotated by the follow-up control until the active switch clears the control lever, breaking the circuit. To reverse direction of travel, the control lever is moved in the opposite direction. When its cam contacts the second switch it reverses the flap motor. Likewise the follow-up control moves the floating arm until the second switch is clear of the control lever. Limit switches at the actuator assembly are connected in series with the switches on the floating arm to prevent over-travel of the flaps in the full UP or DOWN position.

7-3. OPERATIONAL CHECK.

a. Operate flaps through their full range of travel, observing for uneven or jumpy motion, binding and lost motion in system. Make sure flaps are moving together through their full range of travel.

NOTE

Due to the cable tension differential, the right flap will "lead" the opposite flap during extension when checked on the ground. In flight, the flaps will equalize due to the air pressure and cable stretch.

b. THRU AIRCRAFT SERIAL 177RG0212 AND F177RG0042 WHEN NOT MODIFIED IN ACCORDANCE WITH SK177-18. Check for positive shut-off of motor at the flap travel extremes, motor should NOT continuously freewheel at travel extremes.

c. BEGINNING WITH AIRCRAFT SERIAL 177RG-0213, F177RG0043 AND ALL AIRCRAFT MODIFIED IN ACCORDANCE WITH SK177-18. Check for positive shut-off of motor at the flap travel extremes, FLAP MOTOR MUST STOP OR DAMAGE WILL RESULT.

d. Check flaps for sluggishness in operation. On the ground with engine running, the flaps should extend in approximately 5.5 seconds and retract in approximately 6.5 seconds.

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

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

f. Remove access plates and attempt to rock drive pulleys and bellcranks to check for bearing wear.

g. 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 paragraph 7-21.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| BOTH FLAPS FAIL TO MOVE. | Defective circuit breaker. | Replace breaker. |
| | Popped circuit breaker. | Reset breaker. |
| | Defective microswitch. | Replace microswitch. |
| | Defective flap motor. | Replace flap motor. |
| | Broken or disconnected wires. | Connect or repair wiring. |
| | Defective or disconnected transmission and actuator assembly. | Connect or replace transmission and actuator assembly. |
| | Disconnected cables. | Connect cables. |
| | Follow-up control disconnected or slipping. | Secure control or replace if defective. |
| BINDING IN SYSTEM AS FLAPS ARE RAISED AND LOWERED. | Cables not riding on pulleys. | Route cables correctly over pulleys. |
| | Bind in drive pulleys. | Replace drive pulley. |
| | Broken or binding pulleys. | Replace defective pulleys. |
| | Frayed cable. | Replace defective cable. |
| | Flaps binding on tracks. | Replace defective parts. |
| ONE FLAP FAILS TO MOVE. | Broken attachment to actuator. | Replace defective parts. |
| | Disconnected or broken cable. | Connect or replace cable. |
| | Disconnected push-pull rod. | Attach push-pull rod. |
| INCORRECT FLAP TRAVEL. | Incorrect rigging. | Refer to paragraph 7-21. |
| | Defective microswitch. | Replace microswitch. |
| | Follow-up control disconnected or slipping. | Secure control or replace if defective. |
| FLAPS FAIL TO EXTEND. | Defective, loose, or improperly adjusted forward operating switch. | Adjust and secure switch. Replace if defective. |
| | Follow-up control slipping, broken or disconnected. | Connect and secure control. Replace if defective. |
| | Defective down limit switch. | Replace defective switch. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| FLAPS FAIL TO RETRACT. | Defective, loose or improperly adjusted aft operating switch. | Adjust and secure switch. Replace if defective. |
| FLAP MOTOR CONTINUOUSLY FREEWHEELS. | Microswitches improperly adjusted. | Refer to paragraph 7-21. |
| FLAP POSITION INDICATOR FAILS TO RESPOND OR READINGS ERRONEOUS. | Follow-up control slipping, broken or disconnected. | Connect and secure control. Replace if defective. |
| | Pointer bent or broken. | Replace defective parts. |

7-5. FLAP MOTOR, TRANSMISSION AND ACTUATOR ASSEMBLY.

7-6. REMOVAL AND INSTALLATION.

a. Place master switch in the ON position, run flaps to the full DOWN position then place master switch in the OFF position.
b. Remove aft baggage compartment wall, disconnect battery cables from battery and insulate terminals as a safety precaution.
c. Remove access plates from below actuator assembly.
d. (Refer to figure 7-1.) Remove headliner access cover, remove safety wire and relieve cable tension at turnbuckles (12 and 12A).
e. (Refer to figure 7-2.) Disconnect direct cables (3) from actuator guide assembly (7).
f. Remove bolt (14) securing follow-up control lever (11) to actuator guide assembly (7).
g. Remove screws securing lower support (22) to brackets (16 and 21).
h. Remove bolt (6) securing motor and transmission assembly to bracket (21). Move lower support (22) and motor and transmission assembly outboard to allow access to upper support screws.
i. Remove screws securing upper support (2) to brackets (16 and 21). Place switches (17 and 18) and all attaching hardware out of the working area.
j. Slide the lower support (22) out of grommet in the actuator guide assembly (7) and remove support from the wing.
k. Disconnect electrical quick-disconnect (15).
l. Using care, remove motor (1), transmission (4), actuator guide assembly (7) and upper support (2) from wing through access opening as a unit.
m. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 7-21, safety turnbuckles and reinstall all items removed for access.

7-7. REPAIR. Repair consists of replacement of motor, transmission or coupling. For lubrication requirements refer to Section 2.

7-8. FLAP CONTROL LEVER.

7-9. REMOVAL AND INSTALLATION. (Refer to figure 7-1.)

a. Disconnect battery cables and insulate terminals as a safety precaution.
b. Remove follow-up control (19) from switch mounting arm (24).
c. Remove flap operating switches (28 and 30) from switch mounting arm (24). It is not necessary to disconnect electrical wiring at switches.
d. Remove knob (27) from control lever (21).
e. Remove remaining items by removing attaching bolt. Use care not to drop parts into tunnel area.
f. Reverse the preceding steps for reinstallation. Do not overtighten attaching bolt causing lever (21) to bind. Rig system in accordance with paragraph 7-21.

7-10. DRIVE PULLEYS.

7-11. REMOVAL AND INSTALLATION. (Refer to figure 7-1.)

a. Run flaps to full DOWN position.
b. Remove headliner access cover, remove safety wire and relieve cable tension at turnbuckles (12 and 12A).
c. Remove access plates adjacent to drive pulley (2).
d. Remove bolt securing flap push-pull rod (9) to drive pulley (2).
e. Remove bolt securing synchronizing push-pull tube (1) to drive pulley (2).
f. Remove cable guards (6).
g. Remove cable lock pins (7) and disconnect cables (8 and 10) from drive pulley. Tag cables for reference on reinstallation.
h. Remove pivot bolt (5) attaching drive pulley to wing structure.
i. Remove drive pulley (2) through access opening, using care not to drop bushing (4). Retain brass washer between drive pulley and support bracket. Tape open ends of pulley to protect bearings (3).

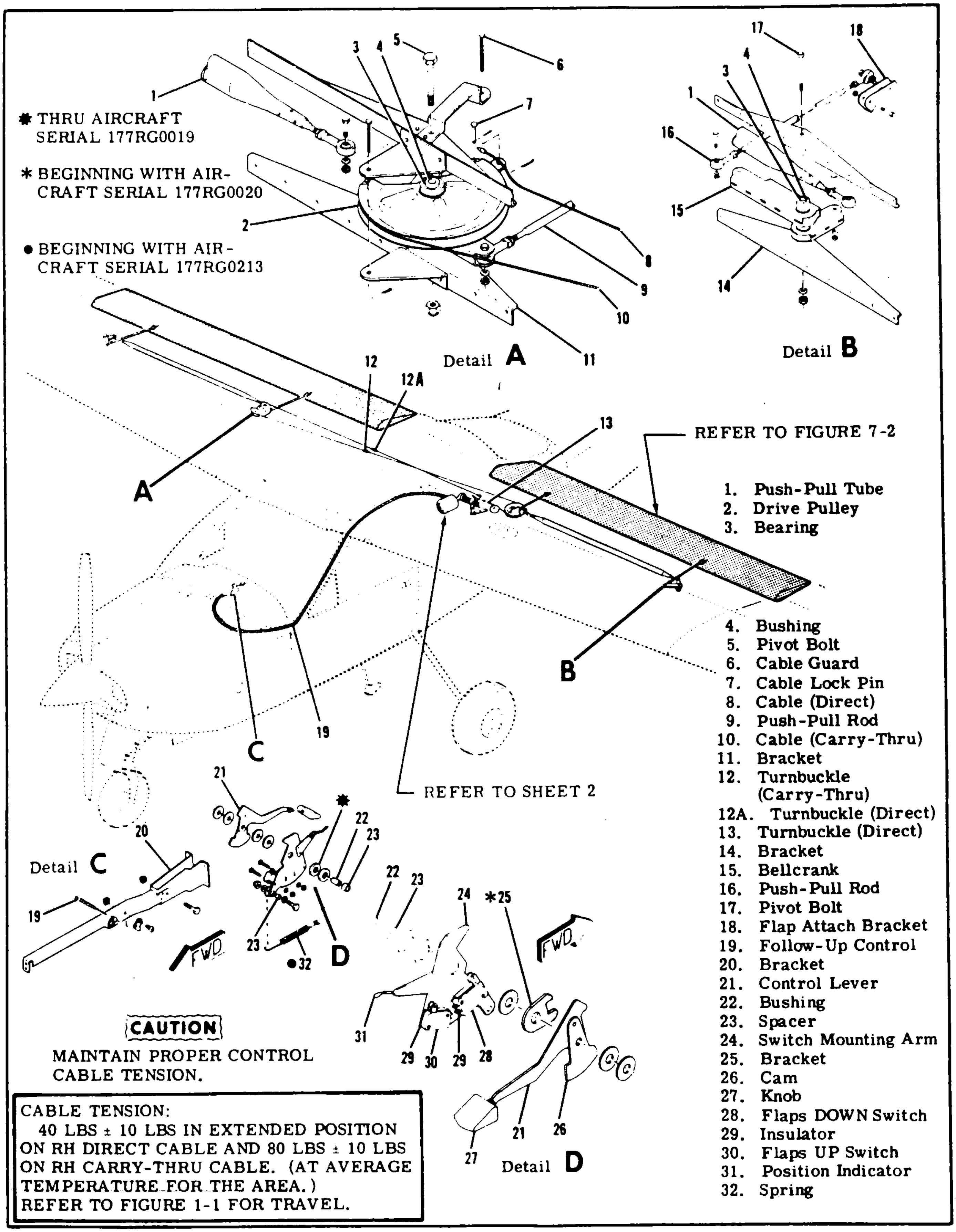


Figure 7-1. Flap Control System

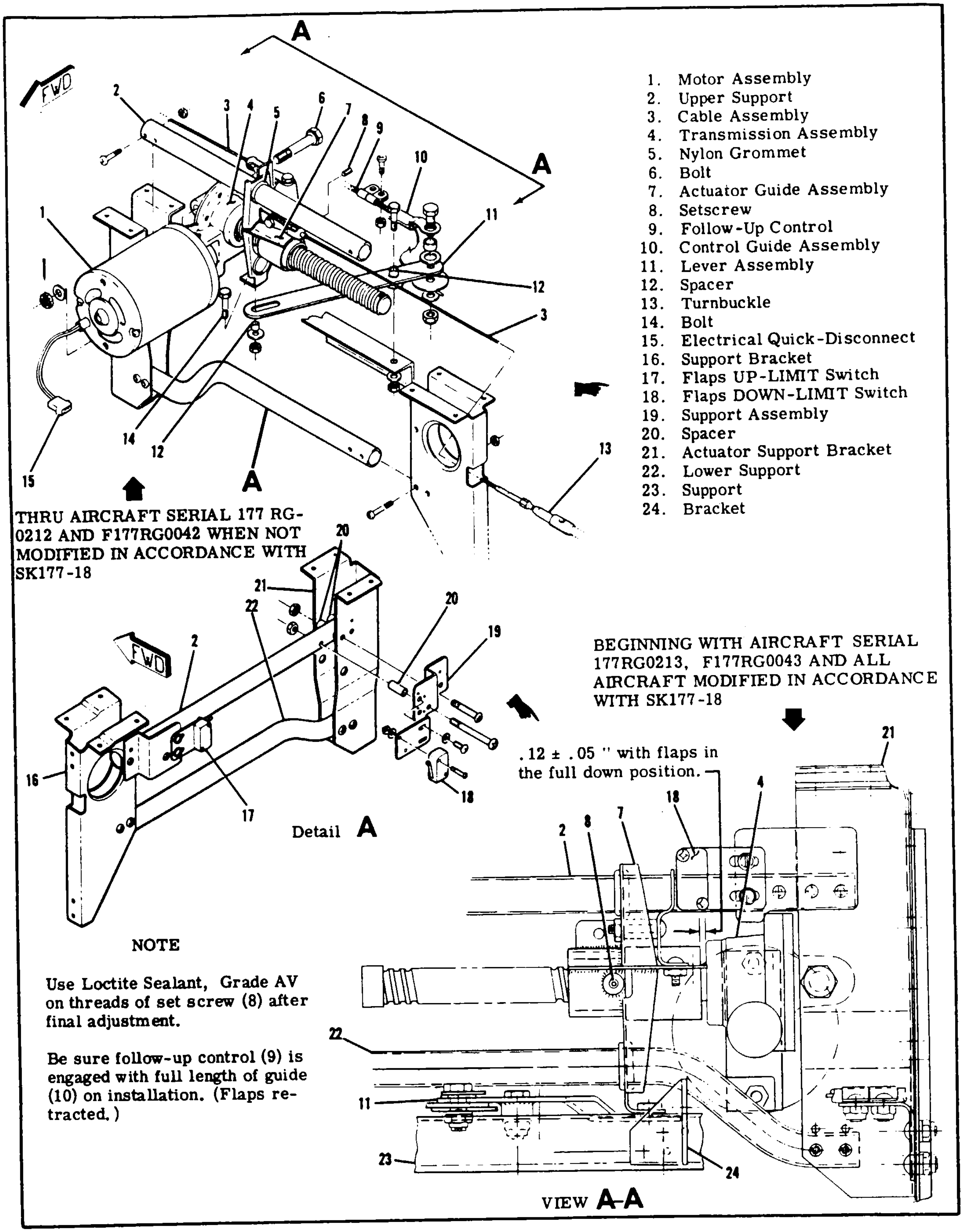


Figure 7-2. Flap Motor, Transmission and Actuator Installation

j. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 7-21, safety turnbuckles and reinstall all items removed for access.

7-12. REPAIR. Repair is limited to replacement of bearings. Cracked, bent or excessively worn drive pulleys must be replaced. Lubricate drive pulley bearings as outlined in Section 2.

7-13. BELLCRANKS.

7-14. REMOVAL AND INSTALLATION. (Refer to figure 7-1.)
a. Run flaps to full DOWN position.
b. Remove access plates adjacent to bellcrank (15).
c. Remove bolt securing push-pull rod (16) to bellcrank (15).
d. Remove bellcrank pivot bolt (17) and position bellcrank as necessary to expose synchronizing push-pull tube (1) attach point.
e. Remove bolt securing synchronizing push-pull tube (1) to bellcrank (15) and work bellcrank out through access opening using care not to drop bushing (4). Tape open ends of bellcrank to protect needle bearings (3).

NOTE

To remove synchronizing push-pull tube (1), disconnect tube at bellcrank (15) and drive pulley (2). Position tube through lightening holes until removal is possible through access opening.

f. Reverse the preceding steps for reinstallation. Brass washers may be used as required to shim out excess clearance between bellcrank and support brackets. If the push-pull rod and synchronizing tube adjustments are not disturbed, re-rigging of the system should not be necessary. Check flap travel and rig in accordance with paragraph 7-21, if necessary, and reinstall all items removed for access.

7-15. REPAIR. Repair is limited to replacement of bearings. Cracked, bent or excessively worn bellcranks must be replaced.

7-16. FLAPS.

7-17. REMOVAL AND INSTALLATION. (Refer to figure 7-3.)
a. Run flaps to full DOWN position.
b. Remove access plate (5) outboard of the inboard flap track.
c. Disconnect push-pull rod at both flap attach points (2).
d. Remove bolt (9) at each aft flap track, pull flap aft and remove remaining bolts. 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.
f. If the push-pull rod adjustment is not disturbed, re-rigging of the system should not be necessary. Check flap travel and rig in accordance with paragraph 7-21, if necessary.

7-18. REPAIR. Flap repair may be accomplished in accordance with instructions outlined in Section 17.

7-19. CABLES AND PULLEYS.

7-20. REMOVAL AND INSTALLATION. (Refer to figure 7-1.)
a. Remove access plates, fairings and upholstery as required for access.
b. Relieve cable tension at turnbuckles (12 and 12A).
c. Disconnect cables at drive pulleys (2).
d. Disconnect cables at actuator assembly (index 7, figure 7-2).
e. 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 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.

f. Reverse the preceding steps for reinstallation. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley groove before installing guard.
g. Re-rig flap system in accordance with paragraph 7-21, safety turnbuckles and reinstall all items removed in step "a".

7-21. RIGGING.

NOTE

The following procedure outlines COMPLETE flap system rigging. All steps of this procedure should be noted, although individual circumstances may not require that all steps be completed.

a. THRU AIRCRAFT SERIAL 177RG0212 AND F177RG0042 WHEN NOT MODIFIED IN ACCORDANCE WITH SK177-18.
1. (Refer to figure 7-2.) Run flaps to the FULL DOWN position.

NOTE

Loosen screws securing limit switches (17 and 18) and slide switches in their adjustment slots until they cannot be actuated by the guide assembly (7). This will ensure that the flaps are reaching their full travel before being stopped by the limit switches.

2. (Refer to figure 7-1.) Remove headliner access cover, remove safety wire, relieve cable tension and disconnect turnbuckles (12 and 12A).
3. Disconnect push-pull rods (9) at both drive pulleys (2).
4. Disconnect push-pull rods (16) at both bellcranks (15).

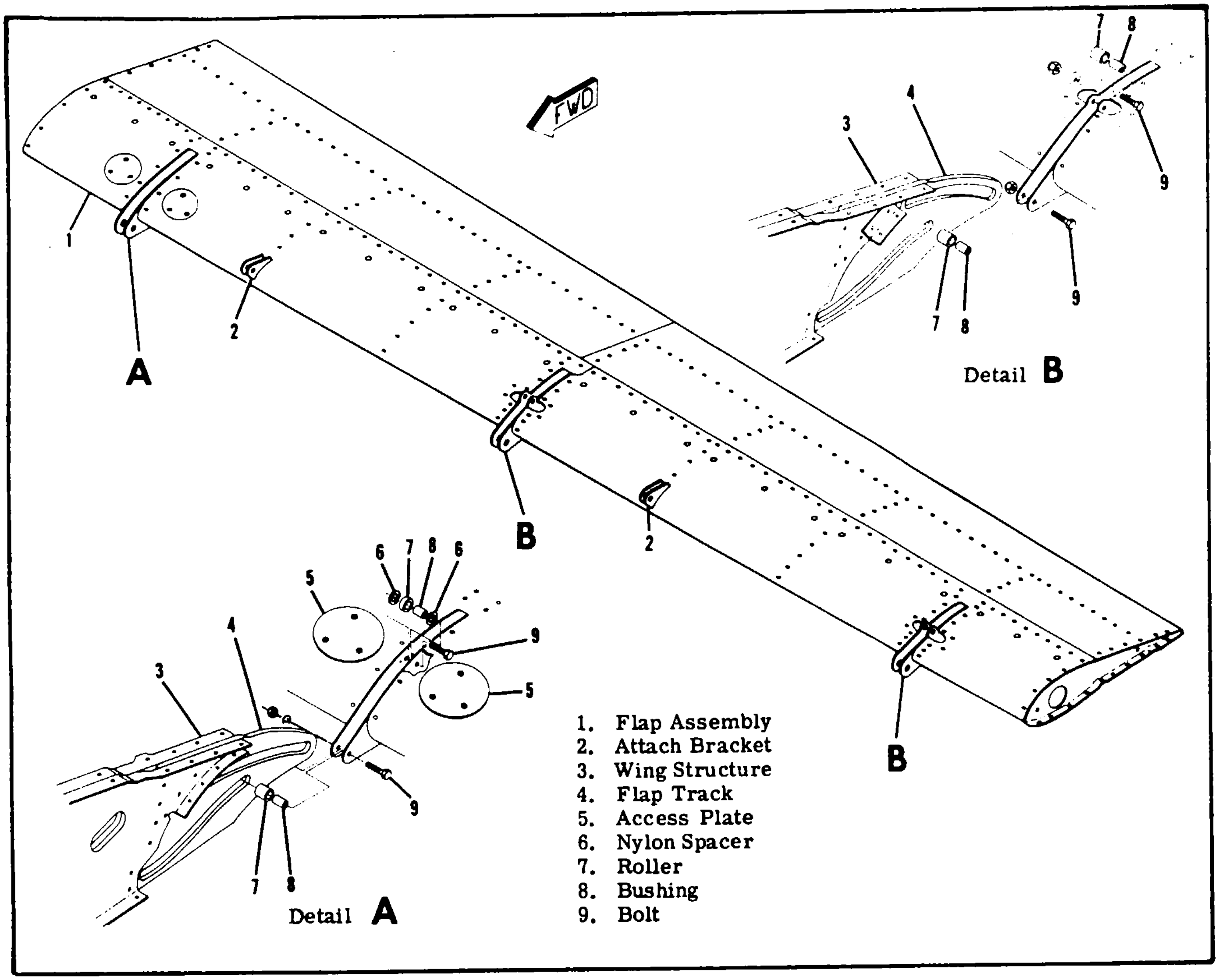


Figure 7-3. Flap Installation

5. Disconnect both synchronizing push-pull tubes (1) at the drive pulleys (2) and bellcranks (15).

6. If the cables are to be replaced, and the drive pulleys (2) ARE installed in the wings, rotate the drive pulleys beyond their normal range of travel to permit cable attachment. If the drive pulleys ARE NOT installed in the wings, it may be easier to attach the cables prior to installing the drive pulleys in the wings.

7. Attach the direct and carry-thru cables in accordance with schematic in figure 7-4.

8. Adjust the synchronizing push-pull tubes (1) to 41.94" between centers of rod end holes, tighten jam nuts and install push-pull tubes.

9. Adjust inboard push-pull rods (9) to 12.12" and outboard push-pull rods (16) to 11.57" between centers of rod end holes, tighten jam nuts and install push-pull rods.

10. Ensure all cables are properly routed and in their pulley grooves, then adjust turnbuckles (12 and 12A) to obtain specified cable tension with flaps in the FULL DOWN position.

11. (Refer to figure 7-2.) Run flaps FULL UP AND FORWARD and adjust UP-LIMIT switch (17) to operate and shut-off motor at this position.

12. Mount an inclinometer on one flap and adjust to 0°.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

13. Run flaps DOWN and adjust DOWN-LIMIT switch (18) to operate and shut-off motor at the $30°+2°-0°$ position.

14. (Refer to figure 7-1.) Operate control lever (21) and run flaps to the full UP position.

15. Disconnect follow-up control (19) at switch mounting arm (24).

16. Without moving the control lever (21), move arm (24) until cam (26) is centered between switches (28 and 30). Ensure switches are centered in their

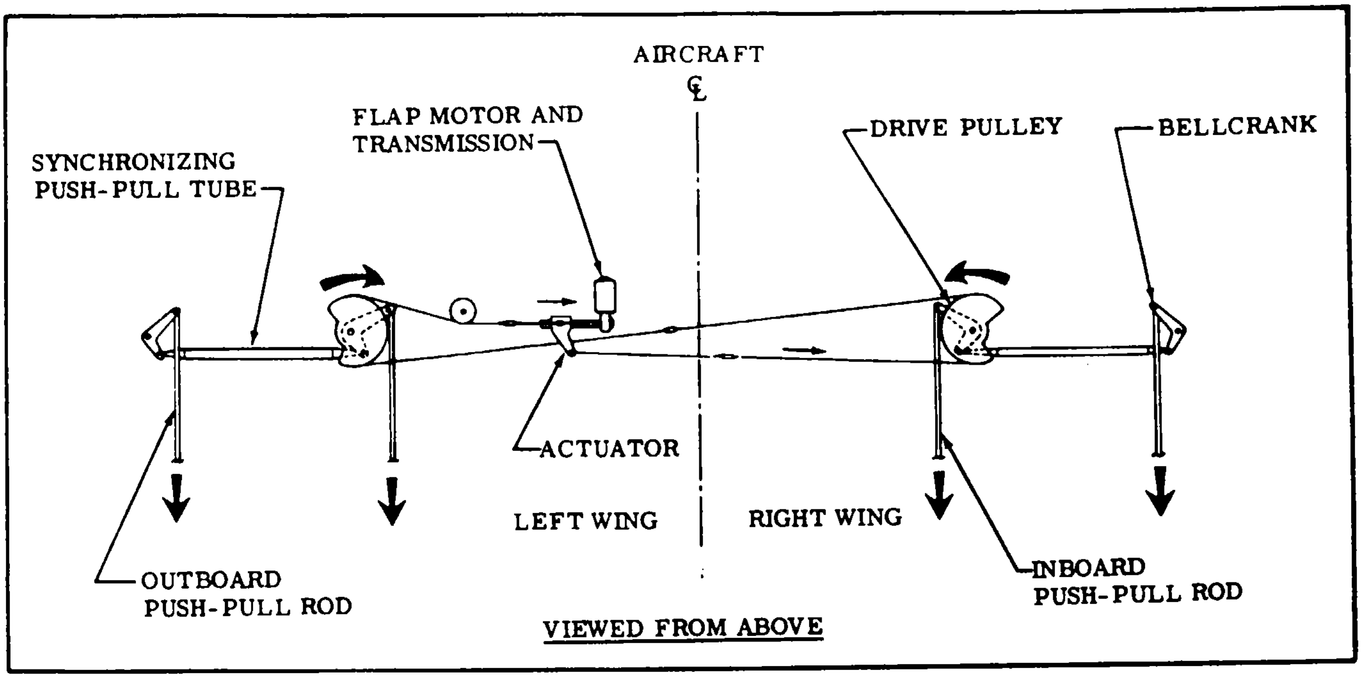


Figure 7-4. Flap System Schematic

respective adjustment slots prior to centering cam (26).

17. Adjust flaps DOWN operating switch (28) in the slotted holes until the roller just clears cam (26) and secure switch. This adjustment should provide flaps down operation to 10°±2° and 20°±2°. If not, readjust switch (28) as necessary.

NOTE

The flaps must NEVER exceed 10° when the control lever (21) is moved from the 0° to 10° position.

18. Adjust flaps UP operating switch (30) in the slotted holes to 0.062" clearance between switch roller and cam (26) when the DOWN operating switch has just opened in the 10° and 20° position.

NOTE

Flap travel on UP cycle may deviate a maximum of 4° from indicated position.

19. Complete an operational check as outlined in paragraph 7-3.

20. Check all rod ends and clevis ends for sufficient thread engagement, all jam nuts are tight, safety turnbuckles and reinstall all items removed for access.

21. Flight test aircraft and check that follow-up control does not cause automatic cycling of flaps. If cycling occurs, readjust operating switches as necessary per steps 17 and 18.

b. BEGINNING WITH AIRCRAFT SERIAL 177RG-0213, F177RG0043 AND ALL AIRCRAFT MODIFIED IN ACCORDANCE WITH SK177-18. (Refer to figure 7-2.)

**CAUTION**

Do not use aircraft power to operate the flap motor until the limit-switches (17 and 18) have been adjusted or damage may occur due to overtravel. Separate the electrical quick-disconnect (15) at the flap motor and connect jumper wires from a 12-volt power source to operate the flap motor. The leads may be reversed to change motor direction or a 3-position switch (spring-loaded to center OFF position) may be used. Use caution when approaching travel extremes as there is no provision for freewheeling in the transmission.

1. Complete steps 2 thru 5 of subparagraph "a."

2. (Refer to figure 7-2.) Using the external power source and jumpers, run the actuator guide assembly (7) to .12±.05" between guide assembly (7) and transmission (4) as illustrated in VIEW A-A. Adjust the DOWN-LIMIT switch (18) to operate and shut-off motor at this position. DO NOT ALLOW GUIDE ASSEMBLY TO SEAT AGAINST TRANSMISSION.

3. Complete steps 6 thru 10 of subparagraph "a."

4. Mount an inclinometer on one flap and adjust to 30°+2°-0°.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

5. Using the external power supply and jumpers, run the flaps FULL UP AND FORWARD (0°) and adjust the UP-LIMIT switch (17) to operate and shut-off motor at this position. DO NOT ALLOW GUIDE ASSEMBLY TO REACH THE END OF THE SCREW ASSEMBLY.

6. Connect the electrical quick-disconnect (15) at the flap motor.

7. Complete steps 14 thru 21 of subparagraph "a."

## SHOP NOTES:

# SECTION 8

# STABILATOR CONTROL SYSTEM

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8-1. STABILATOR CONTROL SYSTEM. (Refer to figure 8-1.)

8-2. DESCRIPTION. The stabilator is operated by power transmitted through fore-and-aft movement of the pilot or copilot control wheels. The system is comprised of control columns, pulleys and cables which attach to the stabilator balance arm. As the stabilator moves through its range of travel, the trim tab changes angle in the opposite direction effecting control wheel forces and giving the pilot a positive "feel" at the control wheel. The trim tab is described in Section 9.

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 8-10.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| NO RESPONSE TO CONTROL WHEEL FORE-AND-AFT MOVEMENT. | Link disconnected at control column. | Attach link and rig system per paragraph 8-10. |
| | Cables disconnected. | Attach cables and rig system per paragraph 8-10. |

8-3. TROUBLE SHOOTING (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| BINDING OR JUMPY MOTION FELT IN MOVEMENT OF STABILATOR SYSTEM. | Defective stabilator quadrant pivot bearings. | Replace bearings. |
| | Defective stabilator pivot bearings. | Replace bearings. |
| | Cables slack. | Adjust to tension specified in figure 8-1. |
| | Cables not riding correctly on pulleys. | Route cables correctly over pulleys. |
| | Defective trim tab bellcrank bearings. | Replace bellcrank. |
| | Defective control column bearing rollers. | Replace defective rollers. |
| | Defective control column torque tube bearings. | Replace bearings. |
| | Control guide on aft end of control tube assembly adjusted too tight. | Loosen screw and tapered plug in end of control tube enough to eliminate binding. |
| | Defective pulleys or cable guards. | Replace defective parts and install guards properly. |
| STABILATOR FAILS TO ATTAIN PRESCRIBED TRAVEL. | Stops incorrectly set. | Rig per paragraph 8-10. |
| | Cables tightened unevenly. | Rig per paragraph 8-10. |
| | Interference at instrument panel. | Rig per paragraph 8-10. |

8-4. CONTROL COLUMN. (Refer to figure 6-2.) Section 6 outlines removal, installation and repair of control column.

8-5. STABILATOR. (Refer to figure 8-2.)

8-6. REMOVAL AND INSTALLATION.

a. Remove stinger.

b. Remove stabilator trim tab push-pull tube (3) at tab (2).

c. Remove bolts (12) securing balance weight arm (16) to stabilator (1).

NOTE

Rigging of stabilator and trim systems should not be affected by removal of stabilator. Cable tension need not be relieved if the balance weight arm is not to be removed from aircraft.

d. Remove stabilator pivot bolts (11) and remove stabilator (1) and trim tab (2) as a unit.

e. Reverse preceding steps for reinstallation. Check stabilator and trim tab travels and rig if necessary.

8-7. REPAIR. Repair may be accomplished as outlined in Section 17. Pivot bearing may be replaced as necessary. If repair has affected static balance, check and rebalance as required.

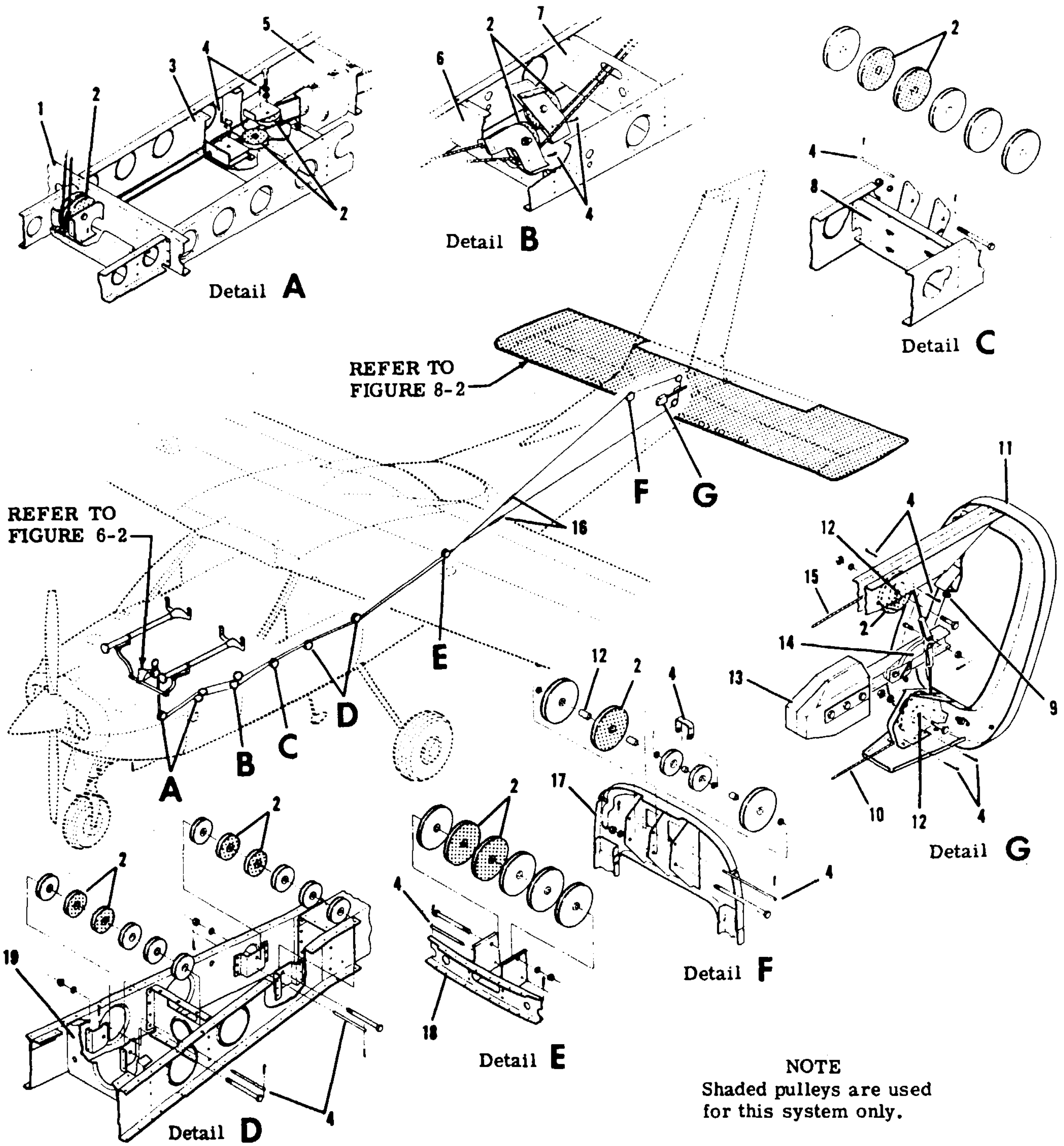
8-8. CABLES AND PULLEYS. (Refer to figure 8-1.)

8-9. REMOVAL AND INSTALLATION.

a. Remove seats, upholstery and access plates as necessary.

b. Relieve cable tension at turnbuckles (16).

c. Disconnect cables at control column. (Refer to figure 6-2.)




NOTE
Shaded pulleys are used for this system only.

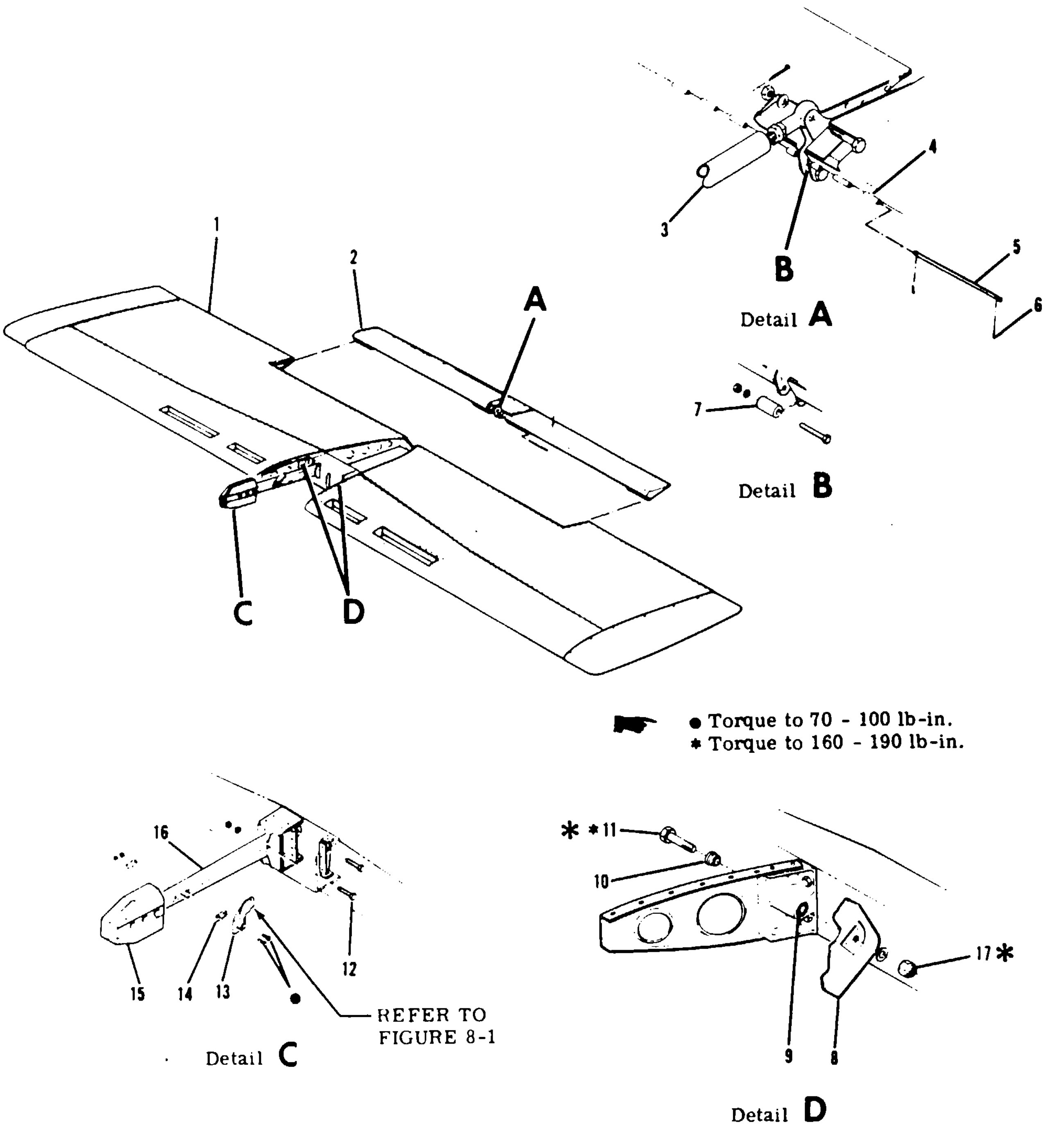
1. Bulkhead (Station 75.50)
2. Pulley
3. Bulkhead (Station 87.75)
4. Cable Guards
5. Bulkhead (Station 92.55)
6. Bulkhead (Station 100.00)
7. Bulkhead (Station 111.75)
8. Bulkhead (Station 116.40)
9. Travel Stop Bolt
10. Stabilator UP Cable
11. Bulkhead (Station 277.00/284.54 )
12. Spacer
13. Balance Weight
14. Control Arm
15. Stabilator DOWN Cable
16. Turnbuckle
17. Bulkhead (Station 263.00)
18. Bulkhead (Station 188.50)
19. Bulkhead (Station 132.00)

**CAUTION**

MAINTAIN PROPER CONTROL CABLE TENSION.

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

Figure 8-1. Stabilator Control System

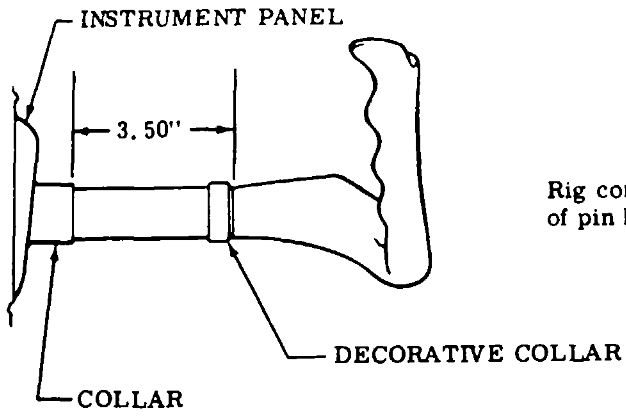



1. Stabilator Assembly
2. Trim Tab Assembly
3. Push-Pull Tube
4. Hinge Assembly
5. Hinge Pin
6. Cotter Pin
7. Spacer
8. Fuselage Structure
9. Bearing
10. Retainer
11. Bolt
12. Bolt
13. Control Arm Assembly
14. Spacer
15. Balance Weight
16. Balance Weight Arm
17. Nut

NOTE

* Beginning with 177RG 0401 and on, and on aircraft F177RG 0075, F117RG 0081, F177RG 0084 and F177RG 0087 and on, a drilled bolt, a castellated nut and a cotterpin are installed on the stabilator hinge point.

Figure 8-2. Stabilator Installation




NOTE

Rig control column to dimension shown regardless of pin hole location.

Figure 8-3. Control Column Neutral Position

d. Disconnect cables at control arm (14).
e. 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 the end of cable before being withdrawn from the aircraft. Leave wire in place, routed through structure; then attach the cable being installed and pull cable into position.

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 paragraph 8-10, safety turnbuckles and reinstall all items removed in step "a".

8-10. RIGGING. (Refer to figure 8-1.)
a. Relieve cable tension at turnbuckles (16).
b. Block control wheel in neutral position illustrated in figure 8-3.
c. Adjust turnbuckles (16) as necessary to set stabilator to neutral while maintaining proper cable tension.

NOTE

Stabilator neutral position is determined by aligning the rivet in the inboard leading edge of stabilator with an adjacent No. 40 pilot hole in the left side of fuselage.

d. With stabilator in neutral, mount an inclinometer on trailing edge of stabilator and set to 0°.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

e. Unblock control wheel and adjust travel stop bolts (10) to travel specified in figure 1-1.
f. Safety turnbuckles and reinstall all items removed for access.
g. After completion of steps "a" thru "f", the normal force required to operate the stabilator should be 12 lbs maximum measured at the center of the control wheel.

**WARNING**

Be sure stabilator moves in correct direction when operated by the control column.

## SECTION 9

## STABILATOR TRIM CONTROL SYSTEM

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9-1. STABILATOR TRIM CONTROL SYSTEM. (Refer to figure 9-1.)

9-2. DESCRIPTION. The stabilator trim tab serves a dual purpose. As a conventional trim tab, it is controlled by the trim wheel. Force to operate the tab is transmitted by cables and chains through a screw jack actuator, to a bellcrank and push-pull tube and finally to the trim tab. The trim tab also serves as an anti-servo tab. As the stabilator moves through its range of travel, the tab automatically trims opposite to afford a positive "feel" to the control wheel.

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 9-14.

| 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. | Remove and replace. |
| | Damaged sprocket. | Remove and replace. |
| | Bent sprocket shaft. | Remove and replace. |
| | Actuator pivot binding. | Replace defective parts. |

9-3. 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 INDICATION INCORRECT. | Indicator incorrectly engaged on wheel track. | Reset indicator. |
| INCORRECT TRIM TAB TRAVEL. | Stop blocks loose or incorrectly adjusted. | Adjust stop blocks on cables. |
| | Incorrect rigging. | Rig system per paragraph 9-14. |

9-4. TRIM TAB. (Refer to figure 9-1.)

9-5. REMOVAL AND INSTALLATION.

a. Remove push-pull tube attach point cover and disconnect push-pull tube (29) at tab.

NOTE

If trim system is not moved and actuator screw is not turned, re-rigging of system should not be necessary after reinstallation of tab.

b. Remove hinge pins from hinges and carefully remove tab.

c. Reverse preceding steps for reinstallation. Rig system if necessary in accordance with paragraph 9-14.

9-6. TRIM TAB ACTUATOR.

9-7. REMOVAL AND INSTALLATION. (Refer to figure 9-1.)

a. Remove rear baggage compartment wall and tailcone access plates.

b. Remove safety wire and relieve cable tension at turnbuckles (13).

**CAUTION**

Position a support stand under tailskid assembly to prevent tailcone from dropping while working inside.

c. Remove screws (22) securing actuator bracket (25) to support bracket.

d. Remove chain guard (24) and disengage chain (20) from actuator sprocket (21).

e. Disconnect actuator (26) from bellcrank (28) and remove actuator from aircraft.

f. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 9-14, safety turnbuckles and reinstall all items removed for access. For lubrication requirements refer to Section 2.

9-7A. DISASSEMBLY. (Refer to figure 9-3.)

a. Remove actuator in accordance with paragraph 9-7.

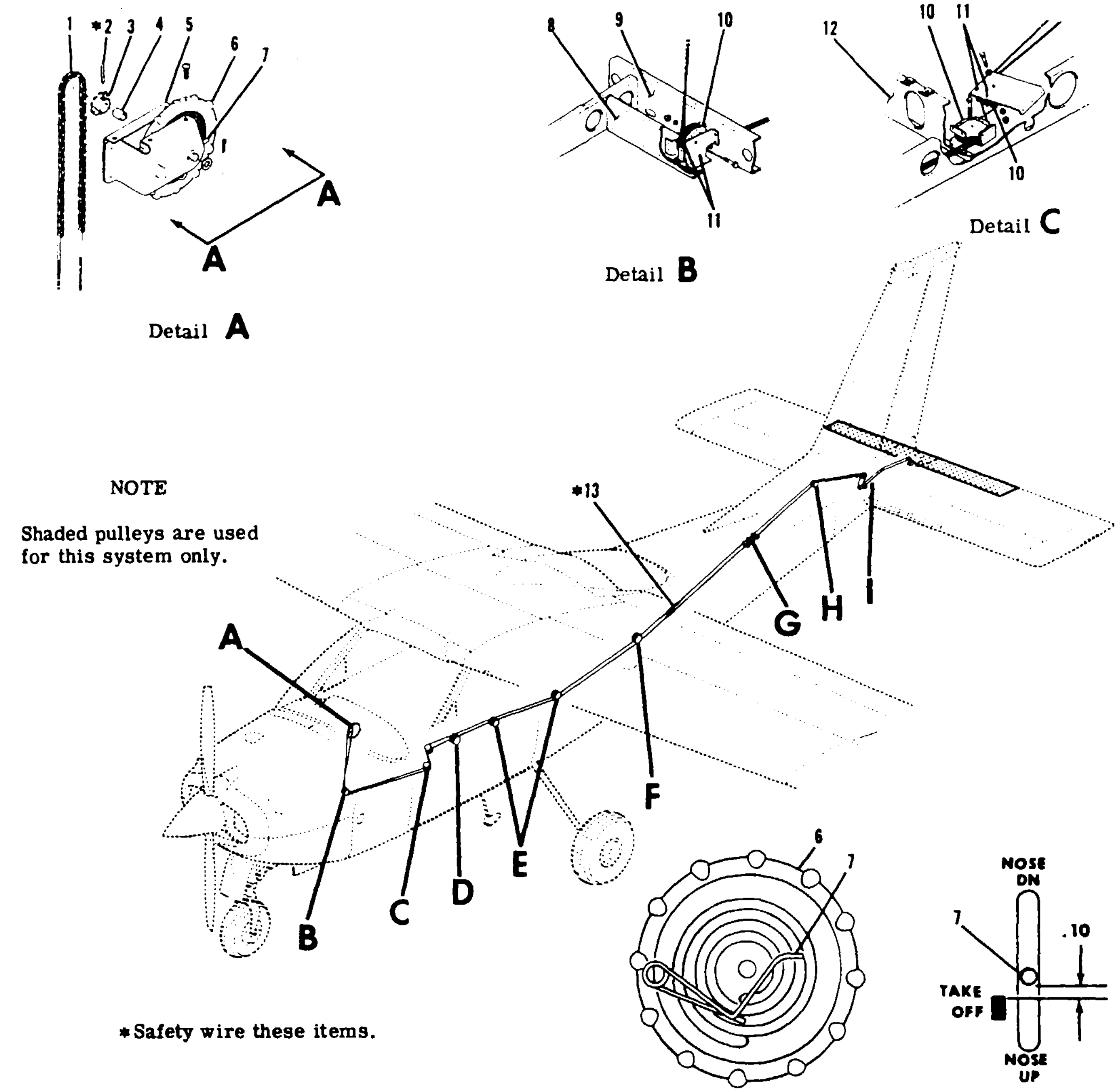
b. Disassembly actuator assembly as illustrated in figure 9-3 as follows:

1. Remove retaining rings (12) from actuator assembly and slide actuator bracket (index 25, figure 9-1) from housing (7).
2. Using suitable punch and hammer, remove groove pins (4) securing sprocket (1) to screw (5) and remove sprocket from screw.
3. Unscrew threaded rod end (10) and remove rod end from actuator.
4. Remove groove pins (6) securing bearings (2 and 9) at the housing ends.
5. Lightly tap screw (5) in the opposite direction from sprocket end, remove bearing (9), O-ring (8) and collar (3).
6. Lightly tap screw (5) toward the sprocket end of housing, remove bearing (2) and collar (3).

9-7B. CLEANING, INSPECTION AND REPAIR. (Refer to figure 9-3.)

a. DO NOT remove bearing (11) from threaded rod end (10) unless replacement of bearing is necessary.

b. Clean all component parts, except bearing (11), by washing in Stoddard solvent or equivalent. Do not clean sealed bearing (11).




1. Roller Chain
2. Roll Pin
3. Sprocket
4. Spacer
5. Bracket
6. Trim Control Wheel
7. Indicator
8. Bulkhead (Station 72.26)
9. Bulkhead (Station 75.50)
10. Pulley
11. Cable Guard
12. Bulkhead (Station 100.00)
13. Turnbuckle
14. Bulkhead (Station 116.40)
15. Bulkhead (Station 132.00)
16. Bulkhead (Station 188.50)
17. Travel Stop Block
18. Bushing
19. Bulkhead (Station 263.00)
20. Roller Chain
21. Sprocket
22. Pivot Screw
23. Support Bracket
24. Chain Guard
25. Actuator Bracket
26. Actuator Assembly
27. Bolt
28. Bellcrank
29. Push-Pull Tube
30. Trim Tab

**CAUTION**

MAINTAIN PROPER CONTROL CABLE TENSION.

CABLE TENSION:
15 LBS + 5 - 0 LBS (AT AVERAGE TEMPERATURE FOR THE AREA.)
REFER TO FIGURE 1-1 FOR TRAVEL.

Figure 9-1. Stabilator Trim Control System (Sheet 1 of 2)

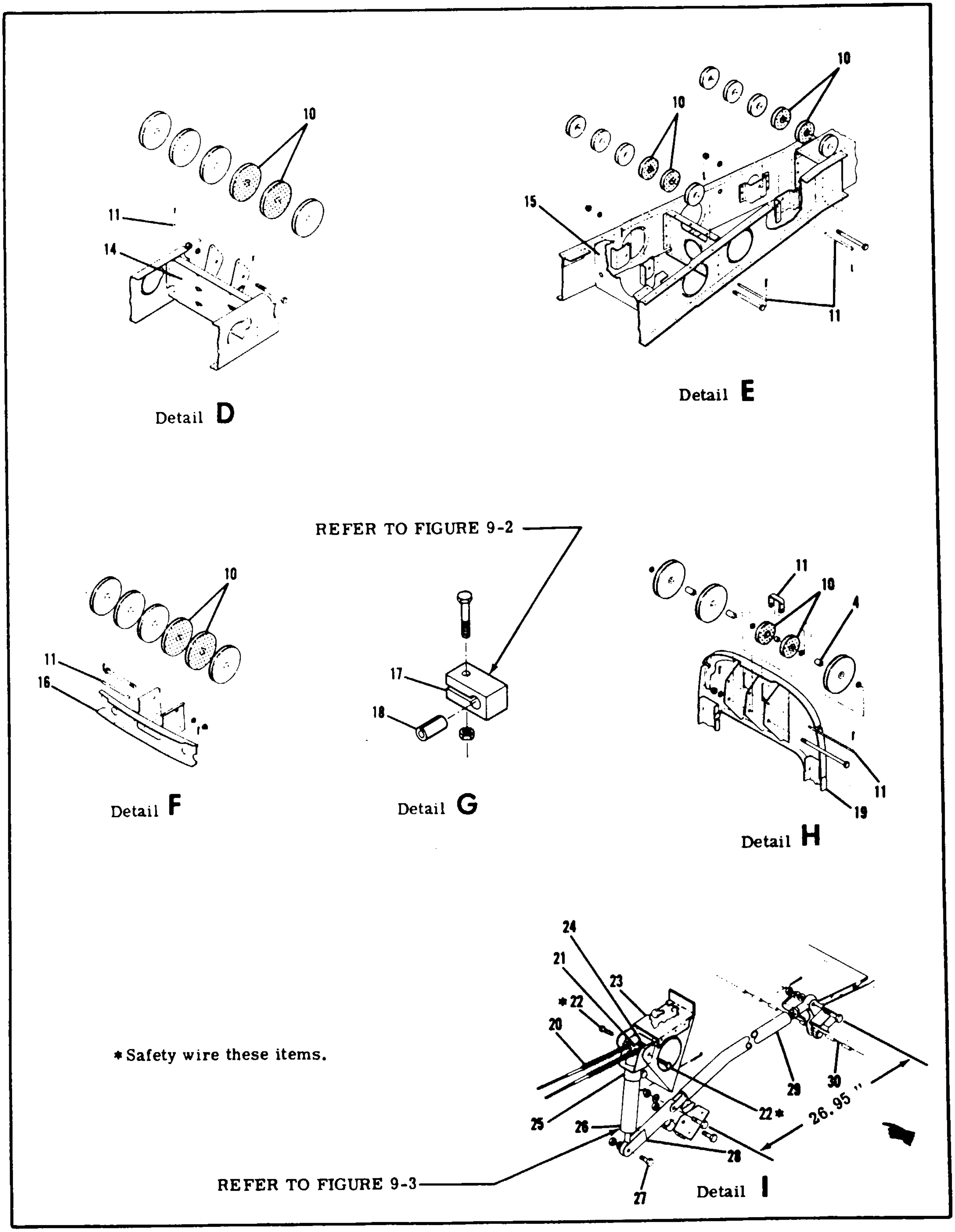
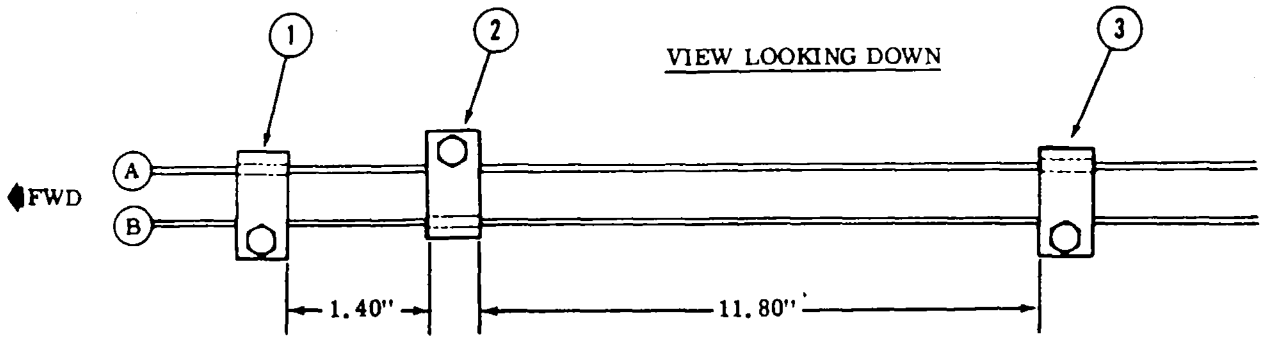
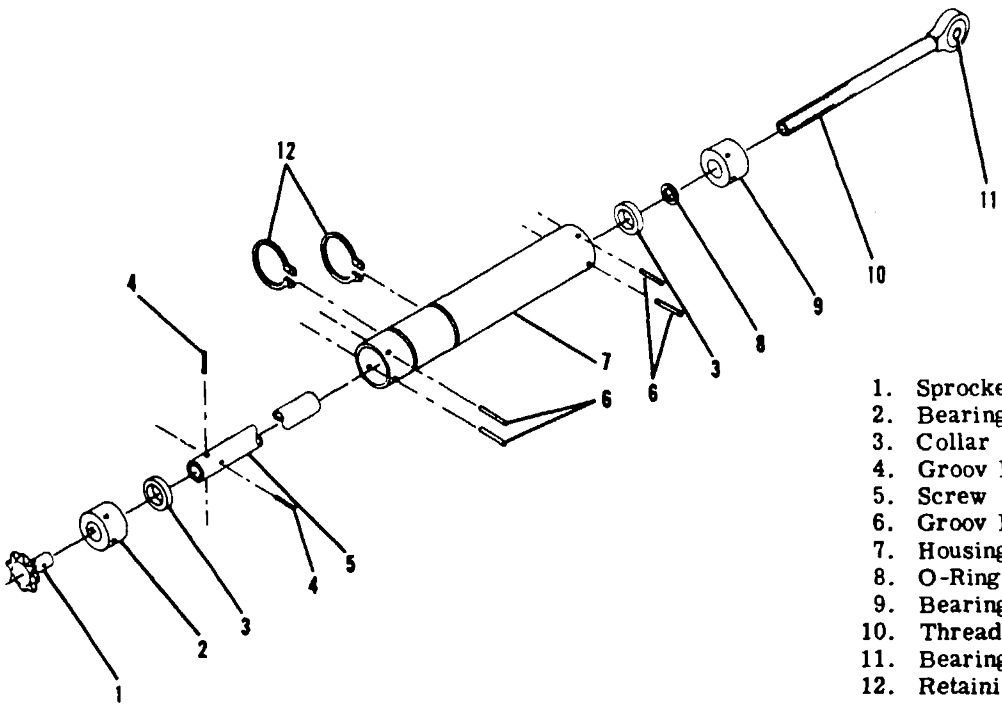



Figure 9-1. Stabilator Trim Control System (Sheet 2 of 2)




1. Set stabilator in neutral position. (Refer to paragraph 8-9.)
2. Set trim tab in neutral position (streamlined).
3. Position stop block (1) on cable B in tailcone and secure.
4. Position stop block (2) on cable A approximately 1.40" from stop block (1) and secure.
5. Position stop block (3) on cable B approximately 11.80" from stop block (2) and secure.
6. Place inclinometer on trim tab and check for degree of travel specified in figure 1-1.
7. Re-adjust stop blocks (2) and (3) as necessary.

Figure 9-2. Stabilizer Trim Travel Adjustment




1. Sprocket
2. Bearing
3. Collar
4. Groov Pin
5. Screw
6. Groov Pin
7. Housing
8. O-Ring
9. Bearing
10. Threaded Rod End
11. Bearing
12. Retaining Ring

Figure 9-3. Stabilizer Trim Tab Actuator Assembly

c. Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.

d. Check bearings (2 and 9), screw (5) and threaded rod end (10) for excessive wear and scoring. Dimensions of the parts are as follows:

| | | |
|---|---|---|
| BEARING (2) | | |
| INSIDE DIAMETER | | 0.373" MIN. |
| INSIDE DIAMETER | | 0.380" MAX. |
| BEARING (9) | | |
| 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 (10) | | |
| OUTSIDE DIAMETER (SHANK) | | 0.242" MIN. |
| | | 0.246" MAX. |
| SCREW (5) | | |
| OUTSIDE DIAMETER | | 0.367" MIN. |
| | | 0.370" MAX. |

NOTE

Relative linear movement between internal threaded screw (5) and bearing (9) should be 0.004 to 0.010 inch at room temperature.

e. Examine threaded rod end (10) and screw (5) for damaged threads or dirt particles that may impair smooth operation.

f. Check sprocket (1) for broken, chipped and/or worn teeth.

g. Check bearing (11) 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.

9-7C. REASSEMBLY. (Refer to figure 9-3.)

a. Always discard the following items and install new parts during reassembly.

1. Groove Pins (4 and 6)
2. O-Ring (8)

b. During reassembly, lubricate collars (3), screw (5) and threaded rod end (10) in accordance with Section 2.

c. Slip collar (3) and bearings (2) on screw (5).

d. Press sprocket (1) into the end of screw (5), align groove holes and install new groove pins (4).

e. Insert screw (5), with assembled parts, into housing (7) until bearing (2) is flush with the end of housing.

NOTE

When inserting screw (5) into housing (7), locate the sprocket (1) at the end of housing which is closer to the grooves for retaining rings (12).

- New bearings (2 and 9) are not pre-drilled and must be drilled on assembly. The groov pins (6) are 1/16 inch in diameter, therefore, requiring a 1/16 (0.0625) inch drill.

f. With bearing (2) flush with end of housing (7), carefully drill bearing so the drill will emerge from the hole on the opposite side of housing (7). DO NOT ENLARGE HOLES IN HOUSING.

g. Press new groove pins (6) into pin holes.

h. Insert collar (3), new O-ring (8) and bearing (9) into opposite end of housing (7).

i. Complete steps "f" and "g" for bearing (9).

j. If a new bearing (11) 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 (10) into screw (5).

l. Slide actuator bracket (index 25, figure 9-1) onto housing (7) and install retaining rings (12).

m. Test actuator assembly by rotating sprocket (1) with fingers while holding threaded rod end (10). 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.

9-7D. TRIM TAB FREE-PLAY INSPECTION. (Refer to figure 9-1.)

a. Place stabilator 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 .137" (total motion up and down) measured at the trim tab trailing edge is permissible.

d. If the trim tab free-play is less than .137", the system is within prescribed limits.

e. If the trim tab free-play is more than .137", check the following items for looseness while moving the trim tab up and down.

1. Check push-pull tube (29) to trim tab horn assembly attachment for looseness.
2. Check push-pull tube (29) to bellcrank assembly (28) attachment for looseness.
3. Check bellcrank assembly (28) to actuator assembly (26) attachment for looseness.
4. Check actuator assembly threaded rod end for looseness in the actuator assembly (26).

f. If looseness is apparent while checking steps e-1 thru e-3, repair by installing new parts.

g. If looseness is apparent while checking step e-4, refer to paragraphs 9-6 through 9-7C.

9-8. TRIM TAB CONTROL WHEEL. (Refer to figure 9-1.)

9-9. REMOVAL AND INSTALLATION.

a. Relieve cable tension at turnbuckles (13).

CAUTION

Position a support stand under tailskid assembly to prevent tailcone from dropping while working inside.

b. Remove pedestal cover as outlined in paragraph 9-13.
c. Remove screws securing trim wheel brackets (5) to pedestal structure. Lower trim wheel (6) and brackets (5) to remove chain (1).

NOTE

Trim wheel (6) may be removed from brackets (5) by driving out roll pin (2) in sprocket (3) and removing cotter pin on opposite end of shaft. This procedure is recommended for parts replacement only.

d. Reverse preceding steps for reinstallation. Rig system in accordance with paragraph 9-14, safety turnbuckles and reinstall all items removed for access.

9-10. CABLES AND PULLEYS.

9-11. REMOVAL AND INSTALLATION.
a. FORWARD CABLE. (Refer to figure 9-1.)
1. Peel back carpeting as necessary to expose access plates in cabin and baggage areas and remove plates.
2. Remove safety wire, relieve cable tension and disconnect forward cable ends from turnbuckles (13).

CAUTION

Position a support stand under tailskid assembly to prevent tailcone from dropping while working inside.

3. Remove pedestal cover as outlined in paragraph 9-13.
4. Disengage roller chain (1) from trim control wheel sprocket (3).
5. Remove cable guards and pulleys as necessary to work cable free of aircraft.

NOTE

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

6. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley groove before installing guards. Ensure roller chain (1) is positioned correctly over sprocket (3).
7. Re-rig system in accordance with paragraph 9-14, safety turnbuckles and reinstall all items removed for access.
b. AFT CABLE. (Refer to figure 9-1.)
1. Remove rear baggage compartment wall.
2. Remove safety wire, relieve cable tension and disconnect aft cable ends from turnbuckles (13).

CAUTION

Position a support stand under tailskid assembly to prevent tailcone from dropping while working inside.

3. Remove travel stop blocks (17).
4. Disengage roller chain (20) from actuator sprocket (21).
5. Remove cable guards and pulleys as necessary to work cable free of aircraft.

NOTE

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

6. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley groove before installing guards. Ensure roller chain (20) is positioned correctly over actuator sprocket (21).
7. Re-rig system in accordance with paragraph 9-14, safety turnbuckles (13) and reinstall all items removed for access.

9-12. PEDESTAL COVER.

9-13. REMOVAL AND INSTALLATION.
a. Remove cowl flap control knob.
b. Remove microphone mounting bracket and nut from microphone jack (if installed).
c. Remove ashtray and ashtray retainer.
d. Disconnect electrical wiring to pedestal cover.
e. Remove cigar lighter (if installed).
f. Remove courtesy light.
g. Remove screws securing pedestal cover to structure and carefully remove cover.
h. Reverse preceding steps for reinstallation.

9-14. RIGGING. (Refer to figure 9-1).
a. Remove rear baggage compartment wall and access plates as necessary.

CAUTION

Position a support stand under tailskid assembly to prevent tailcone from dropping while working inside.

b. Loosen travel stop blocks (17) on trim tab cables and disconnect actuator (26) from bellcrank (28).
c. Equalize roller chains ( 1 and 20) on sprockets (3 and 21) as illustrated in DETAIL "A" and DETAIL "I".
d. Check cable tension and readjust turnbuckles (13), if necessary.

NOTE

If new cables and chains are being installed, permit actuator screw to rotate freely as cables and roller chains are connected, equalize roller chains (1 and 20) on sprockets (3 and 21), adjust cable tension and safety turnbuckles (13).

e. Set stabilizer in neutral position. (Refer to figure 8-3 and paragraph 8-10.)

f. Position indicator (7), should be approximately 0.10 inch above "TAKE-OFF" mark as illustrated in VIEW "A-A" to assure that control wheel (6) has approximate equal amounts of travel in both directions of rotation (center groove of control wheel). If indication is correct, proceed to step "g". If indication is incorrect, proceed as follows:

1. Remove pedestal cover as outlined in paragraph 9-13.
2. Pry trailing leg of indicator (7) out of groove in trim wheel (6) using a thin screwdriver, reposition leg to groove illustrated in VIEW "A-A" and bend indicator (7) to 0.10 inch above "TAKE-OFF" mark, if necessary.

g. With stabilizer in neutral and trim tab streamlined, place an inclinometer on trim tab and set to 0°.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

h. Manually move trim tab (30) to full UP position, then rotate actuator screw in or out until rod end aligns with bellcrank attaching hole. Secure actuator (26) to bellcrank (28).

i. Position stop blocks (17) on cables and adjust blocks as illustrated in figure 9-2 to degree of tab travel specified in figure 1-1. It is not necessary for indicator (7) to use all of the allowable slot.

j. Assure that tab travel is 5°±1° nose up (tab down) with indicator (7) at top of "TAKE-OFF" mark and that tab travel is 8°±1° nose up (tab down) with indicator (7) at bottom of "TAKE-OFF" mark.

k. Safety turnbuckles (13) and reinstall all items removed for access.

l. After completion of steps "a" thru "k", the normal force required to operate the trim tab should be 3 lbs maximum, measured at the rim of the trim control wheel.

**WARNING**

**Be sure trim tab moves in correct direction when operated by the trim control wheel. Nose down trim corresponds to tab up position.**

# SECTION 10

## RUDDER AND RUDDER TRIM CONTROL SYSTEMS

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NOTE

This section is divided into two parts. The first part consists of paragraphs 10-1 through 10-11 and covers the rudder control system. The second part consists of paragraphs 10-12 through 10-19 and covers the rudder trim control and nosewheel steering systems.

10-1. RUDDER CONTROL SYSTEM. (Refer to figure 10-1.)

10-2. DESCRIPTION. Rudder control is maintained through use of conventional rudder pedals which also control nose wheel steering. The system is comprised of the rudder pedals installation, cables and pulleys, all of which link the pedals to the rudder and nose wheel steering.

NOTE

The rudder control system, rudder trim control system and nosewheel steering system are interconnected and adjustments to any one system will affect the others.

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. |
| | 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. | Replace defective bushings. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| LOST MOTION BETWEEN RUDDER PEDALS AND RUDDER. | Insufficient cable tension. | Adjust cable tension. |
| INCORRECT RUDDER TRAVEL. | Incorrect rigging. | Rig in accordance with paragraph 10-11. |

10-4. RUDDER PEDAL ASSEMBLY. (Refer to figure 10-2.)

10-5. REMOVAL AND INSTALLATION.

a. Disconnect master cylinder clevis rods (11) from lever assemblies (10).

b. Disconnect all brake links (19) from rudder bars.

c. Disconnect and remove the pilot rudder pedals (13).

d. Disconnect and remove the copilot pedal support assemblies (20).

e. Relieve rudder cable tension at turnbuckles (index 15, figure 10-1).

f. Disconnect cables (17 and 18) from rudder bar arms (6 and 8).

g. Remove bolt securing rudder trim control assembly (index 11, figure 10-5) to rudder bar arm (7).

h. Disconnect and remove engine controls from aircraft (Refer to Section 11).

i. Remove instrument panel-to-firewall stiffener adjacent to the mixture control.

j. Remove radios and radio cooling hose as required.

k. Disconnect and remove the left hand stabilator lever assembly (index 19, figure 6-2).

l. Remove bolts securing bearing blocks (3) and carefully work rudder bars (5 and 9) out of aircraft from the left side of pedestal.

NOTE

The two inboard bearing blocks contain clearance holes for the rudder bars at one end and a bearing hole at the other. Tag these bearing blocks for reference on reinstallation.

m. Reverse preceding steps for reinstallation. Lubricate rudder bar assemblies as outlined in Section 2. Rig system in accordance with paragraph 10-11, safety turnbuckles and install all items removed for access.

10-6. RUDDER. (Refer to figure 10-3.)

10-7. REMOVAL AND INSTALLATION.

a. Remove stinger.

b. Disconnect tail navigation light quick-disconnect (10).

c. Relieve cable tension at turnbuckles (index 15, figure 10-1).

d. Disconnect cables from rudder horn assembly (9).

e. With rudder supported, remove hinge bolts and lift rudder free of vertical fin.

f. Reverse preceding steps for reinstallation. Rig system in accordance with paragraph 10-11, safety turnbuckles and reinstall all items removed for access.

10-8. REPAIR. Repair and balance may be accomplished as outlined in Section 17.

10-9. CABLES AND PULLEYS. (Refer to figure 10-1.)

10-10. REMOVAL AND INSTALLATION.

a. FORWARD CABLES

1. Remove carpeting, upholstery and access plates as necessary.
2. Relieve cable tension at turnbuckles (15) and disconnect cables.
3. Disconnect cables (1 and 5) from rudder bar arms and rudder horn assembly.
4. Remove cable guards, pulleys and grommets as necessary to work cables free of aircraft.

NOTE

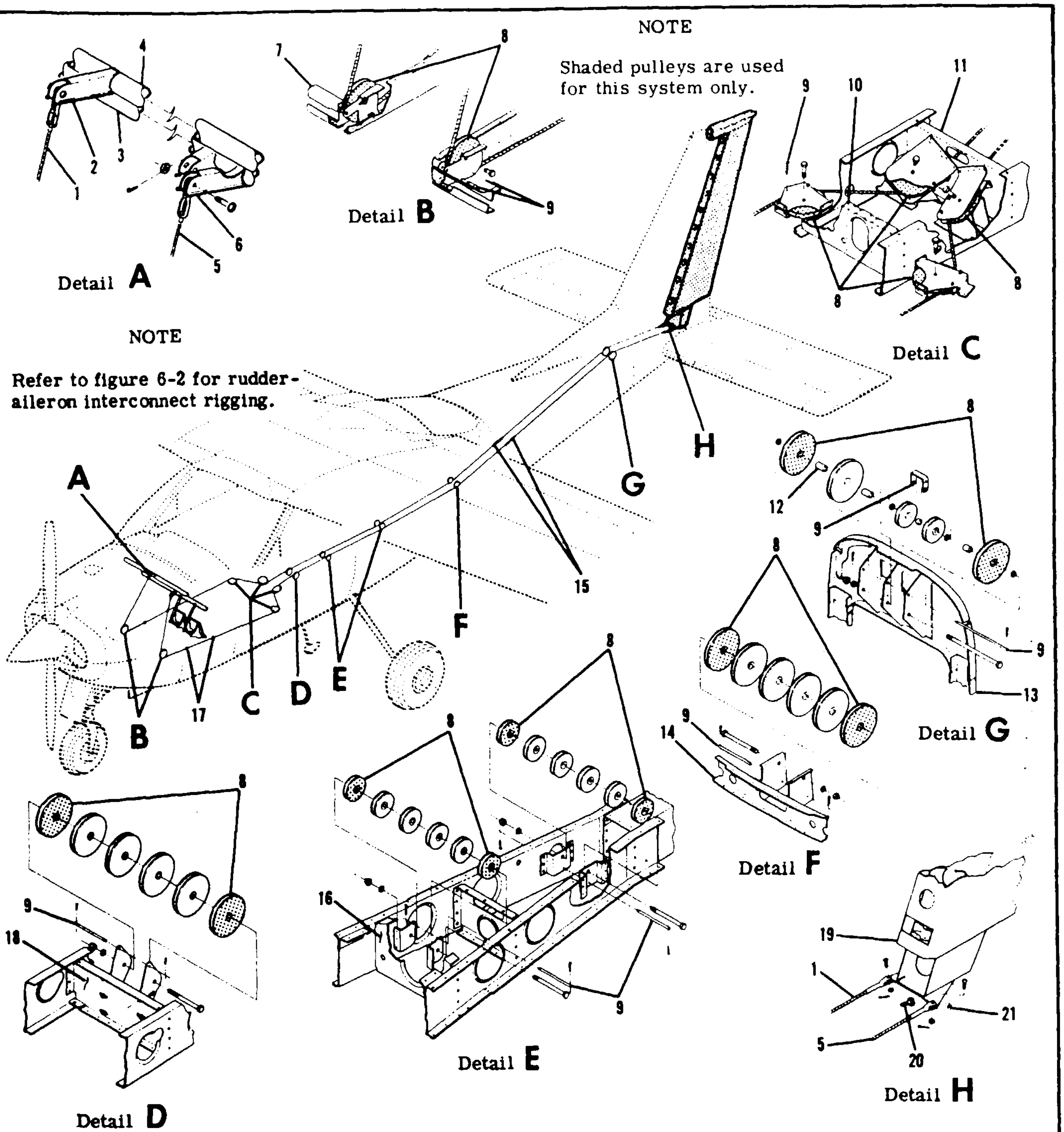
To ease routing of cables, a length of wire may be attached to the end of cable before being withdrawn from aircraft. Leave wire in place, routed through structure, then attach the cable being installed and pull cable into position.

5. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley groove before installing guard and ensure grommets (17) are properly installed.

b. AFT CABLES.

1. Remove screws securing stinger, disconnect tail light wire and remove stinger from aircraft.
2. Remove access plate from tailcone.
3. Remove safety wire and relieve cable tension at turnbuckles (15).
4. Disconnect cables (1 and 5) at bellcrank (19).
5. Complete "NOTE."
6. Reverse the preceding steps for reinstallation.

c. Re-rig system in accordance with paragraph 10-11, safety turnbuckles and reinstall all items removed in step "a".



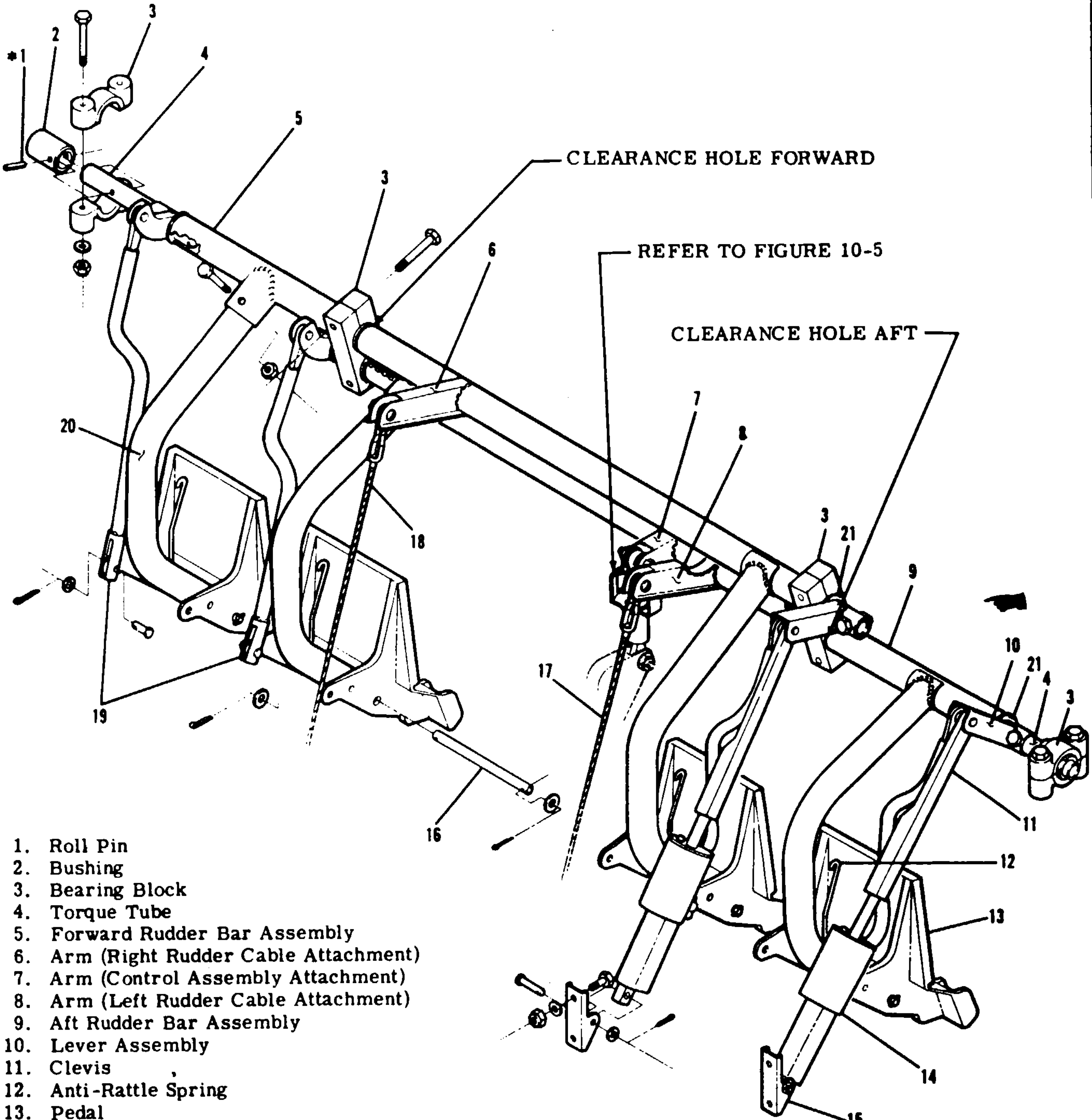

1. Right Rudder Cable
2. Arm (Right Rudder Cable)
3. Aft Rudder Bar
4. Forward Rudder Bar
5. Left Rudder Cable
6. Arm (Left Rudder Cable)
7. Bulkhead (Station 54.00)
8. Pulley
9. Cable Guard
10. Bulkhead (Station 100.00)
11. Bulkhead (Station 111.75)
12. Spacer
13. Bulkhead (Station 363.00)
14. Bulkhead (Station 188.50)
15. Turnbuckle
16. Bulkhead (Station 132.00)
17. Grommet
18. Bulkhead (Station 116.50)
19. Rudder
20. Stop Bolt
21. Bushing

**CAUTION**

MAINTAIN PROPER CONTROL CABLE TENSION.

CABLE TENSION:
30 LBS + 10 - 00 LBS (AT AVERAGE TEMPERATURE FOR THE AREA.)
REFER TO FIGURE 1-1 FOR TRAVEL.

Figure 10-1. Rudder Control System




1. Roll Pin
2. Bushing
3. Bearing Block
4. Torque Tube
5. Forward Rudder Bar Assembly
6. Arm (Right Rudder Cable Attachment)
7. Arm (Control Assembly Attachment)
8. Arm (Left Rudder Cable Attachment)
9. Aft Rudder Bar Assembly
10. Lever Assembly
11. Clevis
12. Anti-Rattle Spring
13. Pedal
14. Master Cylinder
15. Support
16. Pivot Shaft
17. Left Rudder Cable
18. Right Rudder Cable
19. Brake Link
20. Pedal Support Assembly
21. Washer

* Safety wire these items.

Figure 10-2. Rudder Pedals Installation

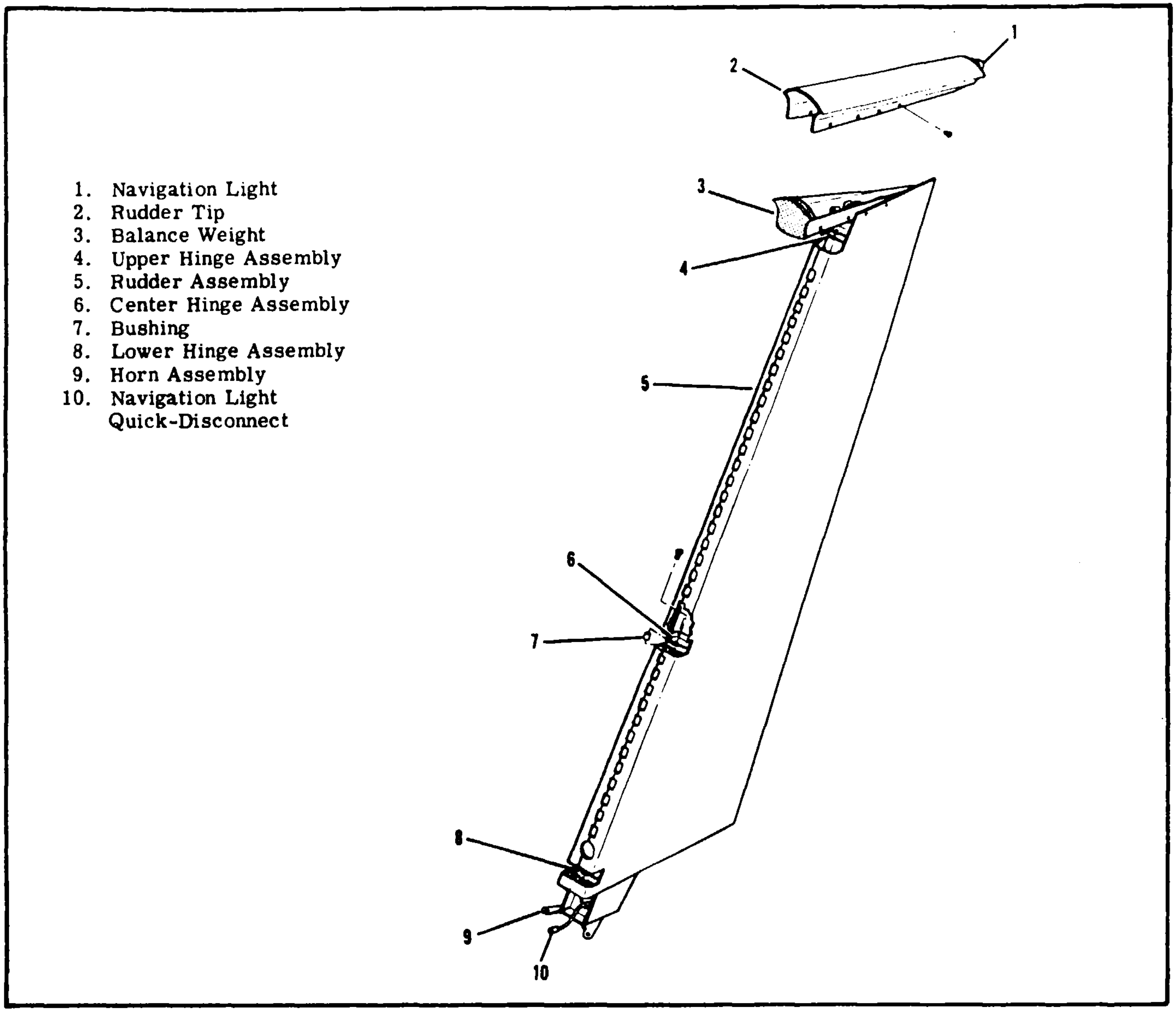



Figure 10-3. Rudder Assembly

10-11. RIGGING. (Refer to figure 10-1.)

NOTE

The rudder control system MUST be rigged correctly prior to rigging the rudder trim control system or the nosewheel steering system.

a. Adjust the travel stop bolts (20) to degree of travel specified in figure 1-1. Figure 10-4 illustrates the correct travel and one method of checking.
b. Relieve the cable tension at turnbuckles (15).
c. Remove pin (index 1, figure 10-5) securing steering bungee rod to steering collar spindle.
d. Clamp rudder pedals in neutral position.
e. Adjust turnbuckles (15) evenly to streamline rudder and obtain proper cable tension. Safety turnbuckles (15).

NOTE

After completing the preceding steps, the rudder control system is rigged. The rudder trim control system must now be rigged prior to rigging the nosewheel steering. Refer to paragraph 10-19.

10-12. RUDDER TRIM CONTROL AND NOSE WHEEL STEERING SYSTEM. (Refer to figure 10-5.)

10-13. DESCRIPTION. The rudder trim control system is comprised of a trim control wheel, mounted in the pedestal, which is connected to a screwjack control assembly attached to the aft rudder bar. The nosewheel steering system is comprised of a steering bungee linked to the screwjack control assembly and nose gear steering collar.

10-14. TROUBLE SHOOTING.

NOTE

This trouble shooting chart should be used in conjunction with the trouble shooting chart in paragraph 10-3.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraph 10-11 and 10-19.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| FALSE READING ON TRIM POSITION INDICATOR. | Improper rigging. | Rig in accordance with paragraphs 10-11 and 10-19. |
| | Worn, bent or disconnected linkage. | Repair or replace as necessary. |
| HARD OR SLUGGISH OPERATION OF TRIM WHEEL. | Worn, bent or binding linkage. | Repair or replace as necessary. |
| | Incorrect rudder cable tension. | Adjust rudder cable tension. |
| FULL TRIM TRAVEL NOT OBTAINED. | Rudder trim system improperly rigged. | Rig in accordance with paragraphs 10-11 and 10-19. |

10-15. STEERING BUNGEE. (Refer to figure 10-5.)

10-16. REMOVAL AND INSTALLATION.
a. Remove bolt securing steering bungee (3) to arm (4).
b. Remove pin (1) securing bungee rod to steering spindle.
c. Reverse preceding steps for reinstallation. Rig in accordance with paragraphs 10-11 and 10-19.

10-17. TRIM CONTROL WHEEL. (Refer to figure 10-5.)

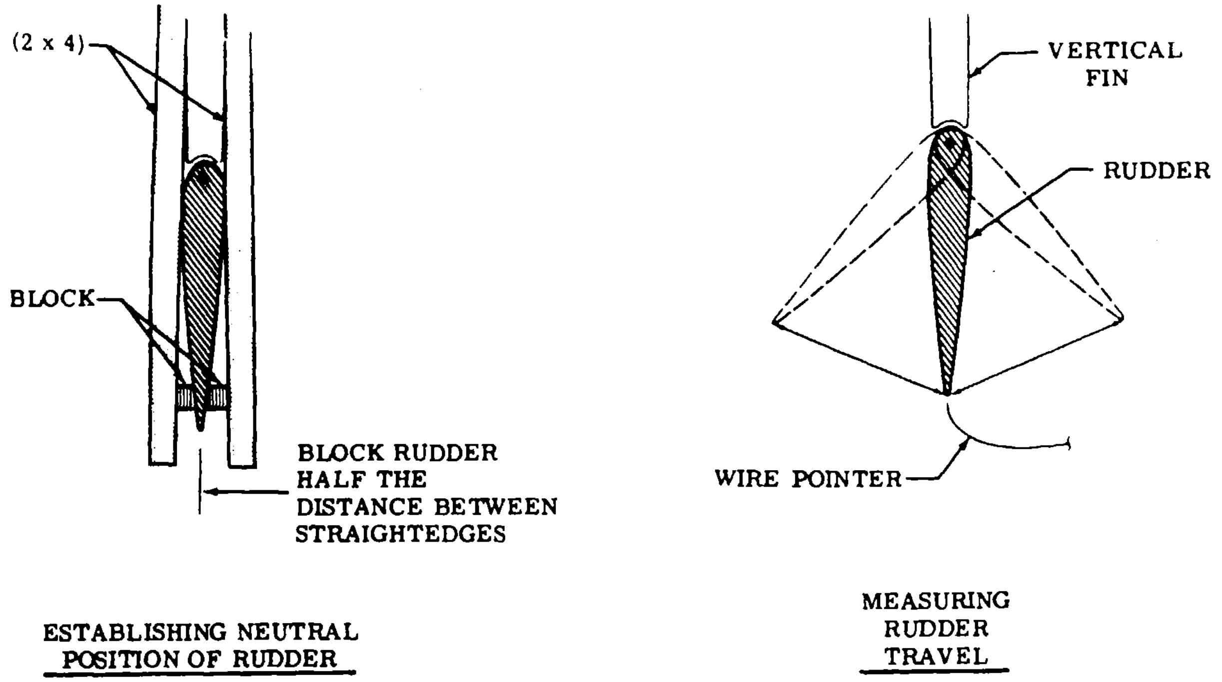
10-18. REMOVAL AND INSTALLATION.
a. Remove pedestal cover in accordance with paragraph 9-13.
b. Remove bolts securing control assembly (11) to rudder bar (12) and bellcrank (7).
c. Remove screws securing trim wheel brackets (20) to pedestal structure.
d. Carefully remove trim wheel (22), brackets (20), chain (18), control assembly (11) and attaching parts out of aircraft as a unit.
e. The assembly may now be disassembled and parts replaced as necessary by removing roll pin (25) and sprocket (26).
f. Reverse preceding steps for reinstallation. Rig system in accordance with paragraph 10-19.

10-19. RIGGING. (Refer to figure 10-5.)

NOTE

The rudder control system MUST be rigged correctly prior to rigging the rudder trim control system or the nosewheel steering system.

a. Check and/or complete rigging procedures outlined in paragraph 10-11.
b. Remove pedestal cover in accordance with paragraph 9-13.
c. Position control wheel (22) with the grooves in position illustrated in DETAIL A and position indicator trailing leg in the center groove of control wheel.
d. Disconnect control assembly (11) at rudder bar (12) and bellcrank (7).
e. Without moving control wheel (22) position roller chain (18) on sprockets (10, 16 and 26) so the chain travel stop (17) is centered between sprockets (10 and 26).
f. Adjust the lower eyebolt on the control assembly (11) completely IN, then OUT two complete turns.
g. Adjust the upper eyebolt on the control assembly (11) as required to obtain an overall length of 3.73" between centers of eyebolts. Make sure the control wheel (22) and roller chain (18) are not moved while making this adjustment.




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 the stinger in such a manner that it can be bent to index at the lower corner of the rudder trailing edge.
3. Using soft lead pencil, mark rudder at point corresponding to soft wire indexing point (neutral).
4. Remove straightedges and blocks.
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 6.25 and 6.78 inches.

Figure 10-4. Checking Rudder Travel

h. Carefully attach the control assembly (11) to rudder bar (12) and bellcrank (7) so adjustment is not disturbed. Arm assembly (5) should now be in vertical position.

i. Tie down or weight tail to raise nosewheel free of ground and ensure the nose gear is centered against external stop.

j. Maintaining the rudder pedals clamped in the neutral position (step "d", paragraph 10-11), extend steering bungee rod until the free play is removed.

NOTE

Ensure the steering bungee rod (1B) is seated against the internal springs but DO NOT attempt to preload these springs by shorting the rod after alignment with the steering collar spindle (1A). Preload is built into bungee.

k. Loosen jam nut (2) and adjust steering bungee rod (1B) in or out as required to align with the steering collar spindle (1A), tighten jam nut and install pin (1).

l. Remove clamps from rudder pedals, remove weights from tail and lower nosewheel to ground.

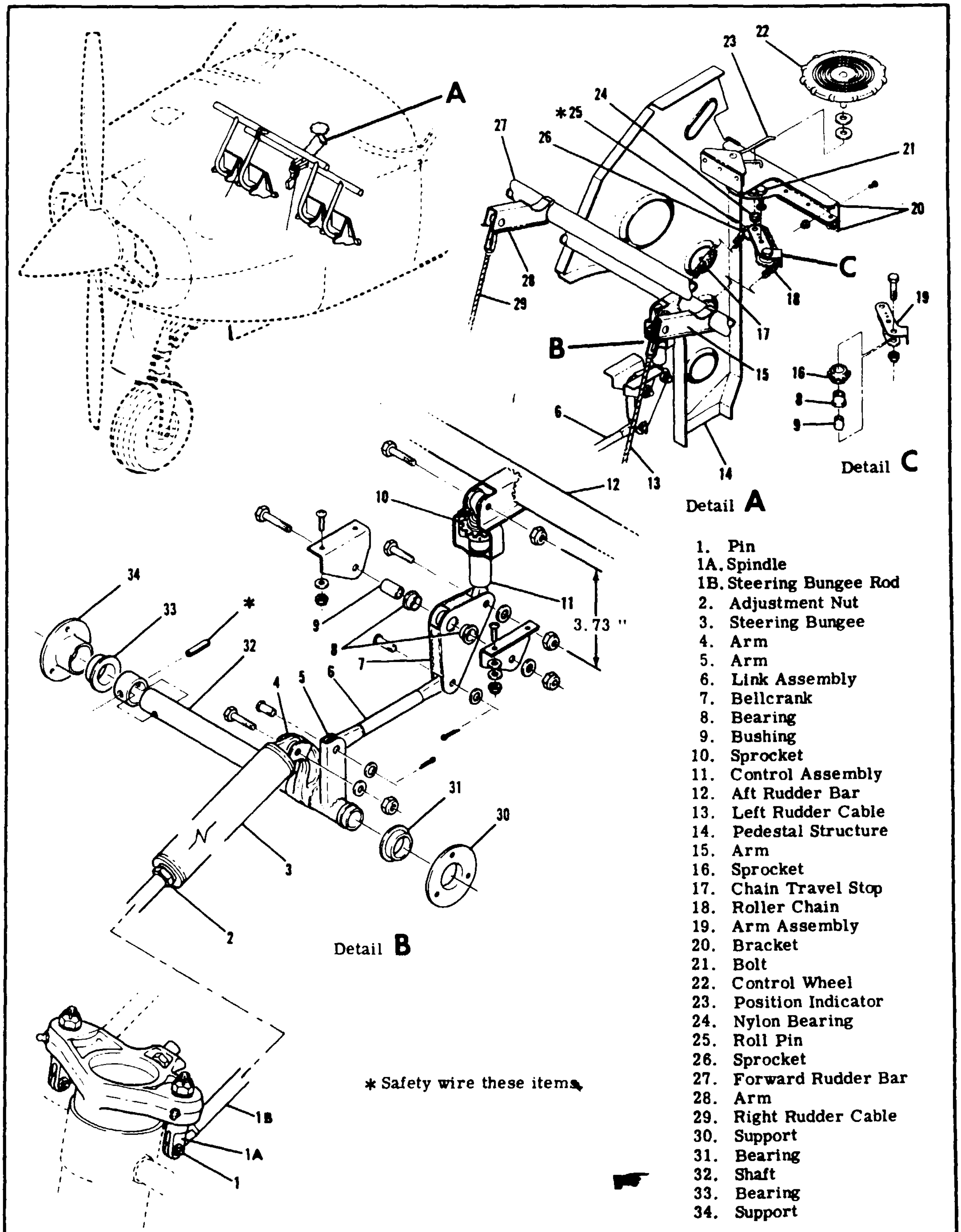
NOTE

Check aileron-rudder interconnect rigging as illustrated in figure 6-2.

m. Ensure turnbuckles are safetied and reinstall all items removed for access.

**WARNING**

Ensure rudder moves in the correct direction when operated by the pedals and trim control wheel.




1. Pin
1A. Spindle
1B. Steering Bungee Rod
2. Adjustment Nut
3. Steering Bungee
4. Arm
5. Arm
6. Link Assembly
7. Bellcrank
8. Bearing
9. Bushing
10. Sprocket
11. Control Assembly
12. Aft Rudder Bar
13. Left Rudder Cable
14. Pedestal Structure
15. Arm
16. Sprocket
17. Chain Travel Stop
18. Roller Chain
19. Arm Assembly
20. Bracket
21. Bolt
22. Control Wheel
23. Position Indicator
24. Nylon Bearing
25. Roll Pin
26. Sprocket
27. Forward Rudder Bar
28. Arm
29. Right Rudder Cable
30. Support
31. Bearing
32. Shaft
33. Bearing
34. Support

Figure 10-5. Rudder Trim Control System

SECTION 11

ENGINE

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11-1. ENGINE.

11-2. GENERAL DESCRIPTION. A direct-drive, four-cylinder, fuel injected, horizontally-opposed, air-cooled, wet-sump "Blue-Streak" (Lycoming) engine is used to power the aircraft. The cylinders, numbered from front to rear, are staggered to permit a separate throw on the crankshaft for each connecting rod. The right front cylinder is number 1 and cylinders on the right side of the engine are identified by odd numbers 1 and 3. The left front cylinder is number 2 and the cylinders on the left side are identified as 2 and 4. Refer to paragraph 11-3 for engine data. For repair and overhaul of the engine, engine accessories, propeller and propeller governor, refer to the applicable publication issued by their manufacturers. These publications may be obtained from the Cessna Service Parts Center.

11-3. ENGINE DATA.

| | | |
|---|---|---|
| Aircraft Model | Cardinal RG (THRU 1972) | Cardinal RG (1973 AND ON) |
| Model (Lycoming "Blue Streak") | IO-360-A1B6 | IO-360-A1B6D |
| Rated Horsepower at RPM | 200 at 2700 | Same |
| Number of cylinders | 4 Horizontally-Opposed | Same |
| Displacement | 361.0 Cubic Inches | Same |
| Bore | 5.125 Inches | Same |
| Stroke | 4.375 Inches | Same |
| Compression Ratio | 8.7:1 | Same |
| Magnetos | | |
| Right Magneto | Bendix Model No. S4LH-1209<br>Fires 25° BTC<br>1-3 Upper and 2-4 Lower | |
| Left Magneto | Bendix Model No. S4LH-1227<br>Fires 25° BTC<br>2-4 Upper and 1-3 Lower | |
| Dual Magneto (Impulse) | | Bendix No. D4LN-2021 |
| Right Side | | Fires 25° BTC<br>1-3 Upper and 2-4 Lower |
| Left Side | | Fires 25° BTC<br>2-4 Upper and 1-3 Lower |
| Firing Order | 1-3-2-4 | Same |
| Spark Plugs | 18mm (Refer to latest revision of Service Instruction No. 1042) | Same |
| Torque | 390±30 Lb-In | Same |
| Fuel Injector (Bendix) | RSA-5AD1 | Same |
| Tachometer | Mechanical Drive | Same |
| Oil Sump Capacity | 8 U.S. Quarts | |
| With External Filter | 9 U.S. Quarts | Same |
| Oil Pressure | | |
| Minimum Idling | 25 PSI | Same |
| Normal | 60 to 90 PSI | Same |
| Maximum (Cold Oil Starting) | 100 PSI | Same |
| Oil Temperature | | |
| Normal Operating | Within Green Arc | Same |
| Maximum Allowable | Red Line (245°F) | Same |
| Cylinder Head Temperature | | |
| Normal Operating | Within Green Arc | Same |
| Maximum Allowable | Red Line (475°F) | Same |
| Probe Location | Lower side of No. 3 Cylinder | Same |
| Dry Weight-With Accessories | 325 Lbs (Weight is approximate and will vary with optional accessories installed). | 316 Lbs (Weight is approximate and will vary with optional accessories installed). |

11-4. TROUBLE SHOOTING ENGINE.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| ENGINE WILL NOT START (NO PRESSURE INDICATED ON FUEL GAGE). | No fuel to engine. | Check mixture control for proper position, fuel boost pump on and operating, fuel valves open, fuel filters clean and unblocked, fuel level in cells. |
| ENGINE WILL NOT START (SUFFICIENT FUEL PRESSURE INDICATED ON FUEL GAGE). | Engine flooded. | Reset throttle, clear engine of excess fuel and attempt re-start. |
| | No fuel to engine. | Loosen line at fuel injector nozzle. If there is no fuel flow with fuel pressure showing on gage, replace the flow divider valve. |
| | Grounded ignition-switch wires. | Check for grounded switch wires. |
| | Magneto improperly timed to engine. | Refer to paragraph 11-55. |
| | Magneto internal timing incorrect, weak capacitor, or improperly adjusted breaker points. | Refer to paragraph 11-56. |
| | Fouled spark plugs. | Remove and clean, check gaps and insulators. Reinstall with new gaskets. Check ignition harness. |
| | Weak spark, magneto coils burned out, moisture in distributor. | Remove and bench test magnetos, ignition harness and spark plugs. |
| | Leak in intake manifold. | Check hose connections, gaskets and tighten hose clamps and flange attaching bolts. |
| ENGINE WILL NOT RUN AT IDLING SPEED. | Idle stop screw or idle mixture lever incorrectly adjusted. | Refer to paragraph 11-39. |
| | Propeller control set in high pitch (low rpm) position. | Use low pitch (high rpm) position for all ground operations. |
| | Air leak in intake manifold. | Tighten loose connections or replace damaged parts. |
| | Weak magneto capacitor. | Install new capacitor. |
| | Spark plugs fouled by oil escaping past piston rings. | Top overhaul engine. |
| ROUGH IDLING. | Improper idle mixture adjustment. | Refer to paragraph 11-39. |
| | Manual mixture control set for lean mixture. | Use full rich mixture for all ground operation. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| ROUGH IDLING (Cont). | Fouled spark plugs. | Remove and clean, adjust gaps, test ignition harness, inspect magneto breaker points. If presistent, top overhaul engine. |
| | Loose or deteriorated engine mounts. | Check tighten or install new parts. |
| | Burned or warped exhaust valves and/or seats. Scored valve stems. | Top overhaul engine. |
| | Hydraulic tappet sticking or worn. | Listen for tappet noise. Refer to engine manufacturer's overhaul manual. |
| ENGINE DOES NOT ACCELERATE PROPERLY. | Idle mixture to lean. | Refer to paragraph 11-39. |
| | Worn throttle or mixture linkage. | Install new parts as required. |
| | Propeller control set for high pitch (low rpm). | Set for low pitch (high rpm) for all ground operations. |
| ENGINE RUNS ROUGH AT HIGH SPEED. | Loose or deteriorated engine mount pads. | Check tighten or install new parts. |
| | Propeller out of balance or track. | Remove and repair. |
| | Spark plug gasket leaking, improper gap, or damaged insulator. | Install new parts. |
| | Ignition cable insulator deteriorated. | Test cables for leakage and install new parts as necessary. |
| | Improper mixture. | Check mixture control setting. |
| CONSISTENT MISFIRING AT HIGH RPM. | Valve spring broken. | Install new spring. |
| | Valve warped or burned. | Top overhaul engine. |
| | Hydraulic tappet worn or dirty. | Remove, clean or install new parts. |
| ENGINE POWER TOO LOW ( CONSTANT SPEED ) | Improper propeller governor adjustments. | Perform static RPM check. Refer to paragraph 11-4 A for details. |
| ( FIXED PITCH ) | Refer to paragraph 11-4 A. | Refer to paragraph 11-4 A for applicable details. |

TROUBLE SHOOTING ENGINE (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| SLUGGISH OPERATION AND LOW POWER (Cont). | Worn valve seats. | Top overhaul engine. |
| | Worn or stuck piston rings. | Top overhaul engine. |
| LOW PRESSURE ON FUEL GAGE. | Restricted flow to flow divider valve. | Check mixture control for full travel. Check for clogged fuel filters. |
| | Inadequate flow from pump. | Worn pump or pump plunger shaft. Install new parts. |
| | Interference with mixture control. | Check clear of surrounding accessories. |
| HIGH PRESSURE ON FUEL GAGE. | Restricted flow beyond flow divider valve. | Check for restricted nozzles or flow divider valve. Clean nozzles or install new valve. |
| FLUCTUATING PRESSURE ON FUEL GAGE. | Vapor in system. Excessive fuel temperature. | If not cleared with boost pump, drain fuel pressure line. |
| | Fuel leak in gage line. Leak at gage connection. | Drain gage line. Repair fuel leak. |
| ENGINE DOES NOT STOP SATISFACTORY WITH MIXTURE CONTROL IN IDLE CUTOFF. | Mixture control valve leaking in idle cutoff position. | Check mixture control, should be in full idle cutoff. Check fuel boost pump off. |
| HIGH CYLINDER HEAD TEMPERATURE. | Low grade fuel. | 100/130 grade (minimum). |
| | Excessive carbon deposits in cylinder head and on piston. | Top overhaul engine. |
| | Clogged cylinder fins. | Clean thoroughly. |
| | Leaking exhaust valves. | Top overhaul engine. |
| | Improperly rigged cowl flaps. | Refer to paragraph 11-16. |
| HIGH OIL TEMPERATURE. | Oil cooler fins clogged. | Clean thoroughly. |
| | Oil cooler oil passages restricted. | Remove and flush cooler. |
| | Oil cooler bypass valve damaged or held open. | Remove, clean valve and seat. If still inoperative, install new valve. |
| | Low oil supply. | Replenish. |
| | Oil viscosity too high. | Refer to Section 2. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| HIGH OIL TEMPERATURE (Cont). | Prolonged high speed operation on ground. | Avoid prolonged ground operation above 1500 rpm. |
| | Dirty oil screens. | Remove and clean screens. |
| LOW OIL PRESSURE. | Low oil supply. | Replenish. |
| | Oil viscosity too low. | Refer to Section 2. |
| | Sludge or foreign material in relief valve. | Remove and clean valve. |
| | Defective pressure gage. | Install new gage. |
| | Internal leak, damaged gasket or bearing. | Major overhaul engine. |
| OIL LEAK AT FRONT OF ENGINE. | Crankshaft oil seal leaking. | Install new oil seal. |
| | Propeller O-ring leaking. | Install new O-ring. |
| OIL LEAK AT PUSH ROD HOUSING. | Damaged housing seal. | Install new seals. |
| LOW COMPRESSION. | Worn cylinder and/or rings. | Top overhaul engine or replace defective cylinder. |
| | Valves not properly seating. | Top overhaul engine or replace defective cylinder. |
| EXCESSIVE OIL CONSUMPTION. | Low grade of oil. | Fill sump with oil conforming to specification. Refer to Section 2. |
| | Failed or failing bearing. | Check oil screens for metal particles and if found, overhaul engine. |
| | Worn piston rings. | Install new rings. |
| | Incorrect ring installation. | Install new rings. |

11-4A. 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 take-off 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 2660 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 governor control for proper rigging. It should be determined that the governor control arm travels to the high RPM stop on the governor and that the high RPM stop screw is adjusted properly. (Refer to Section 13 for procedures).

NOTE

If verification of governor operation is necessary the governor may be removed from the engine and a flat plate installed over the engine pad. Run-up engine to determine that governor was adjusted properly.

2. Check carburetor heat control (carburetor equipped engines) for proper rigging. If partially open it would cause a slight power loss. On fuel injected engines check operation of alternate air door spring or magnetic lock to make sure door will remain closed in normal operation.

3. Check magneto timing, spark plugs and ignition harness for settings and condition.

4. On fuel injection engines, check fuel injection nozzles for restriction and check for correct unmetered fuel flow.

5. Check condition of induction air filter. Clean if required.

6. Perform an engine compression check (Refer to engine Manufacturer's Manual).

11-5. ENGINE REMOVAL. If the engine is to be placed in storage or returned to the manufacturer for overhaul, proper preparatory steps should be taken for corrosion prevention prior to beginning the removal procedure. Refer to Section 2 for preparation of the engine for storage. The following removal procedure is based on the engine being removed from the aircraft with the engine mount attached to the firewall and all engine connections being disconnected at the firewall.

NOTE

Tag each item disconnected to aid in identifying wires, hoses and control linkage when the engine is being installed. Protect openings, exposed as a result of removing or disconnecting units, against entry of foreign matter by installing covers or sealing openings with tape.

## SHOP NOTES:

a. Place all cabin switches and fuel valve in the OFF position.

b. Remove engine cowling. (Refer to paragraph 11-12.)

c. Open battery circuit by disconnecting battery cables. Insulate cable terminals as a safety precaution.

**WARNING**

The magneto is in a SWITCH ON condition when the switch wire is disconnected. Ground the magneto points or remove the high tension wires from the magneto or spark plugs to prevent accidental firing when the propeller is rotated.

d. Disconnect switch wires at magnetos.

e. Drain engine oil sump and oil cooler.

f. Remove propeller and spinner. (Refer to Section 13.)

g. Disconnect throttle and mixture controls at servo regulator unit. Pull these controls free of engine and engine mount, using care not to damage them by bending too sharply. Note position, sizes and number of attaching washers and spacers.

h. Disconnect propeller governor control at governor.

i. Loosen clamps and remove flexible duct from engine baffle and oil cooler shroud.

j. Loosen clamps and remove flexible duct from muffler shroud and heater valve and duct from baffle and heater valve.

k. Disconnect wires and cables as follows:

1. Tachometer drive shaft at adapter on engine.

**CAUTION**

When disconnecting starter cable do not permit starter terminal bolt to rotate. Rotation of the terminal bolt could break the conductor between terminal bolt and field coils causing the starter to be inoperative.

2. Starter electrical cable at starter.
3. Electrical wires and wire shielding ground at alternator.
4. Cylinder head temperature probe at cylinder.
5. Exhaust gas temperature probe.
6. Remove all clamps attaching wires or cables to engine, engine mount and attached brackets. Pull all wires clear of the engine.

l. Disconnect lines and hoses as follows:

**WARNING**

Residual fuel and oil draining from disconnected lines and hoses constitutes a fire hazard. Use caution to prevent accumulation of such fuel and oil when lines or hoses are disconnected.

1. Vacuum pump hose at firewall.
2. Engine breather line.
3. Oil temperature bulb at adapter on engine.
4. Fuel flow indicator hose at firewall.
5. Fuel supply hose at engine-driven fuel pump.
6. Engine-driven fuel pump drain line.
7. Oil pressure hose at firewall.
8. Oil cooler hose at oil cooler on firewall.
9. Remove all clamps attaching lines and hoses to engine, engine mount or attached brackets.

m. Attach a hoist to the lifting strap on top of the engine and take up engine weight on hoist.

**CAUTION**

Place a stand under 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 attach bolts. Raising the engine too high places a strain on the attach bolts and hinders their removal.

n. Remove bolts attaching engine-to-mounts. Balance the engine by hand as the last of these bolts are removed.

**CAUTION**

Hoist engine slowly and ascertain that all items attaching engine and accessories to airframe are disconnected.

o. Carefully guide disconnected components out of engine assembly.

11-6. CLEANING. The engine may be cleaned with Stoddard solvent or equivalent, then dried thoroughly.

**CAUTION**

Particular care should be given to electrical equipment before cleaning. Cleaning fluids should not be allowed to enter magnetos, starter, alternator and the like. Protect these components before saturating the engine with solvents. All other openings should also be covered before cleaning the engine assembly. Caustic cleaning solutions should be used cautiously and should always be properly neutralized after their use.

11-7. ACCESSORIES REMOVAL. Removal of engine accessories for overhaul or for engine replacement involves stripping the engine of parts, accessories and components to reduce it to the bare engine. During the removal process, removed items should be examined carefully, and defective parts should be tagged for repair or replacement with new components.

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 openings.

11-8. 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. All flexible fluid carrying hoses in the engine compartment should be replaced at engine overhaul or every five years, whichever occurs first.

f. For major engine repairs, refer to the manufacturer's overhaul and repair manual.

11-9. BUILD-UP. Engine build-up consists of installing 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, stop nuts, gasket and rubber connections should be new parts.

11-10. INSTALLATION. Before installing the engine on the aircraft, install any items that were removed after the engine was removed from the aircraft or airframe.

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 hoses in place as the engine is positioned near the firewall and mount.

c. Install engine mount bolts. Install shock-mounts as shown in figure 11-1. Tighten engine mount bolts to the torque values shown in figure 11-1.

d. Remove hoist and tail stand placed under tail tie-down fitting.

e. Route throttle, mixture and propeller governor controls to their respective units and connect. Secure controls in position with clamps.

NOTE

Throughout the aircraft fuel system, from the bays to the engine-driven pump, use RAS-4 (Snap-On Tools Corporation, Kenosha, Wisconsin) or MIL-T-5544 thread compound as a thread lubricant or to seal a leaking connection. Apply sparingly to male fitting only, omitting the first two threads. Always be sure that the compound, the residue from a previously used compound or any other foreign material cannot enter the system. Throughout the fuel injector system, from the engine-driven fuel pump through the air bleed nozzles, use only a fuel soluble lubricant, such as engine lubricating oil, on the fitting threads. Do not use any other form of thread compound on the injector system fittings.

f. Connect lines and hoses as follows:

1. Oil cooler hose at oil cooler on firewall.
2. Oil pressure hose at firewall.
3. Engine-driven fuel pump drain line.
4. Fuel supply hose at engine-driven fuel pump.
5. Fuel flow indicator hose at firewall.
6. Oil temperature bulb at adapter on engine.
7. Engine breather lines.
8. Vacuum pump hose at firewall.
9. Install all clamps attaching lines and hoses to engine, engine mount or brackets.

g. Connect wires and cables as follows:

1. Exhaust gas temperature wires at quick-disconnects.
2. Cylinder head temperature probe at lower side of cylinder.
3. Electrical wires and wire shielding ground at alternator.
4. Tachometer drive shaft at adapter on engine. Tighten drive shaft attaching nut to 100 lb-in.

**CAUTION**

When connecting starter cable, do not permit starter terminal bolt to rotate. Rotation of the starter terminal bolt could break the conductor between terminal bolt and field coils. causing the starter to be inoperative.

5. Starter electrical cable at starter.
6. Install all clamps attaching wires and cables to engine, engine mount or brackets.

h. Install flexible duct to heater valve and baffle and duct to heater valve and muffler shrouds. Tighten clamps.

i. Install flexible duct to baffle and oil cooler shroud. Tighten clamps.

j. Install propeller and spinner. (Refer to Section 13.)

k. Make a magneto switch ground-out and continuity check. Connect magneto switch wires.

**WARNING**

Be sure magneto switch is in OFF position when connecting switch wires to magnetos.

l. 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.
m. Make sure all switches are in the OFF position and connect battery cables.
n. Rig engine controls in accordance with paragraph 11-61 through 11-64.
o. Check engine installation for security, correct routing of controls, lines, hoses and electrical wiring, proper safetying and tightness of all components.
p. Install engine cowling and rig cowl flaps.
q. Perform an engine run-up and make final adjustments on engine controls.

11-10A. FLEXIBLE FLUID HOSES.

11-10B. PRESSURE TEST.
a. After each 50 hours of engine operation, all flexible fluid hoses in the engine compartment should be pressure tested as follows:
1. Place mixture control in the idle cut-off position.
2. Place the auxiliary fuel pump in the ON position.
3. Examine the exterior of hoses for evidence of leakage or wetness.
4. Hoses found leaking should be replaced.
5. After pressure testing fuel hoses, allow sufficient time for excess fuel to drain overboard from the engine manifold before attempting an engine start.
6. Refer to paragraph 11-8 for detailed inspection procedures for flexible hoses.

11-10C. 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.

11-11. ENGINE COWLING. The engine cowling is shock-mounted. Instead of attaching directly to the fuselage, the cowling attaches to shock-mounts, which in turn, are fastened to the fuselage. Quick-release fasteners are used at the cowling-to-shock-mount attach points to facilitate removal of the cowling. The trailing edge of the lower cowl section has cut-outs to which controllable cowl flaps are attached. These cowl flaps are used to control engine temperatures. Beginning with the 1972 model year, the landing light is installed in the lower cowling nose cap.

11-12. REMOVAL AND INSTALLATION. Removal of the engine cowling is accomplished by removing attaching screws and releasing quick-release fasteners. Disconnect cowl flap controls at the cowl flap. On the 1972 Models, disconnect landing light electrical wires. When installing cowling, be sure to connect any items disconnected during removal. Also, be sure that the baffle seals are turned in the correct direction to confine and direct air flow around the engine. The vertical seals must fold forward and the side seals must fold upwards.

NOTE

When new shock-mounts or brackets are being installed, careful measurements should be made to position these parts correctly on the firewall. These service parts are not pre-drilled. Install shock-mounts on brackets so that cowling and shock-mounts are correctly aligned. Sheet aluminum may be used as shims between bracket halves to provide proper cowling contour.

11-13. CLEANING AND INSPECTION. Wipe the inner surfaces of the cowl with a cloth saturated with cleaning solvent. If the inside of the cowl is coated heavily with grease and dirt, allow the solvent to soak until the foreign material can be removed. Painted surfaces should be cleaned by washing with water and a mild soap. Waxing after cleaning is recommended to prolong paint life. After cleaning, inspect cowling for dents, cracks, loose spot welds and loose or missing rivets. Repair all defects to prevent spread of damage.

11-14. REPAIR. If the cowling skins are extensively damaged, install complete new section. Standard insert-type patches may be used if repair parts are formed to fit. 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 quick-release fasteners and shock-mounts should be replaced with new parts.

11-15. COWL FLAPS. Cowl flaps are provided as a means of controlling engine temperature. Two cowl flaps, operated by a single control in the cabin, are located at the aft edge of the lower cowl section.

11-16. RIGGING. (Refer to figure 11-3.)
a. Disconnect control clevises (18) from cowl flaps (15).
b. Check to make sure that the flexible controls reach their internal stops in each direction. Mark controls so that full travel can be readily checked and maintained during the remaining rigging procedures.
c. Place cowl flap control lever (4) in the CLOSED position, which is the bottom hole in the bracket (7). If control lever cannot be placed in the correct hole in bracket, loosen clamp (10) at upper end of controls (11) and slip housings in clamp or adjust controls at upper clevis (9) to position control lever in correct hole in the bracket (7).
d. With control lever in the CLOSED position, hold

one cowl flap closed, streamlined with trailing edge of lower cowl and adjust clevis (18) on control to hold cowl flap in this position. Repeat for the other cowl flap. If either control needs to be lengthened or shortened, the lower clamp may be loosened and the housing slipped in the clamp or lower end clevis may be adjusted. Maintain sufficient thread engagement of clevis.

11-17. ENGINE BAFFLES. The sheet metal baffles installed on the engine directs the flow of air around the cylinders and other engine components to provide optimum cooling. These baffles incorporate rubber-asbestos composition seals at points of contact with the engine cowling and other engine components to help confine and direct the airflow to the desired area. It is very important to engine cooling that the baffles and seals are in good condition and installed correctly. Removal and installation of the various baffle segments is possible with the cowling removed. Be sure that any new baffle seals properly.

11-18. CLEANING AND INSPECTION. The engine baffles should be cleaned with a suitable solvent to remove oil and dirt.

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. Repair or replace any defective parts.

11-19. 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.

11-20. ENGINE MOUNT. The engine mount is comprised of sections of tubing welded together and reinforced with welded gussets. The purpose of the mount is to support the engine and attach it to the airframe. Also the engine mount supports the retractable nose landing gear. The engine is attached to the mount with shock-mount assemblies which absorb engine vibrations.

11-21. REMOVAL AND INSTALLATION. (Refer to figure 11-1.)

a. Remove engine in accordance with paragraph 11-5.

b. Remove nose landing gear in accordance with Section 5.

c. Remove bolts (1) and carefully remove engine mount.

d. Reverse the preceding steps for installation.

11-22. REPAIR. Repair of the engine mount shall be performed carefully as outlined in Section 17. The mount shall be painted with heat-resistant black enamel after welding or whenever the original finish has been removed. This will prevent corrosion.

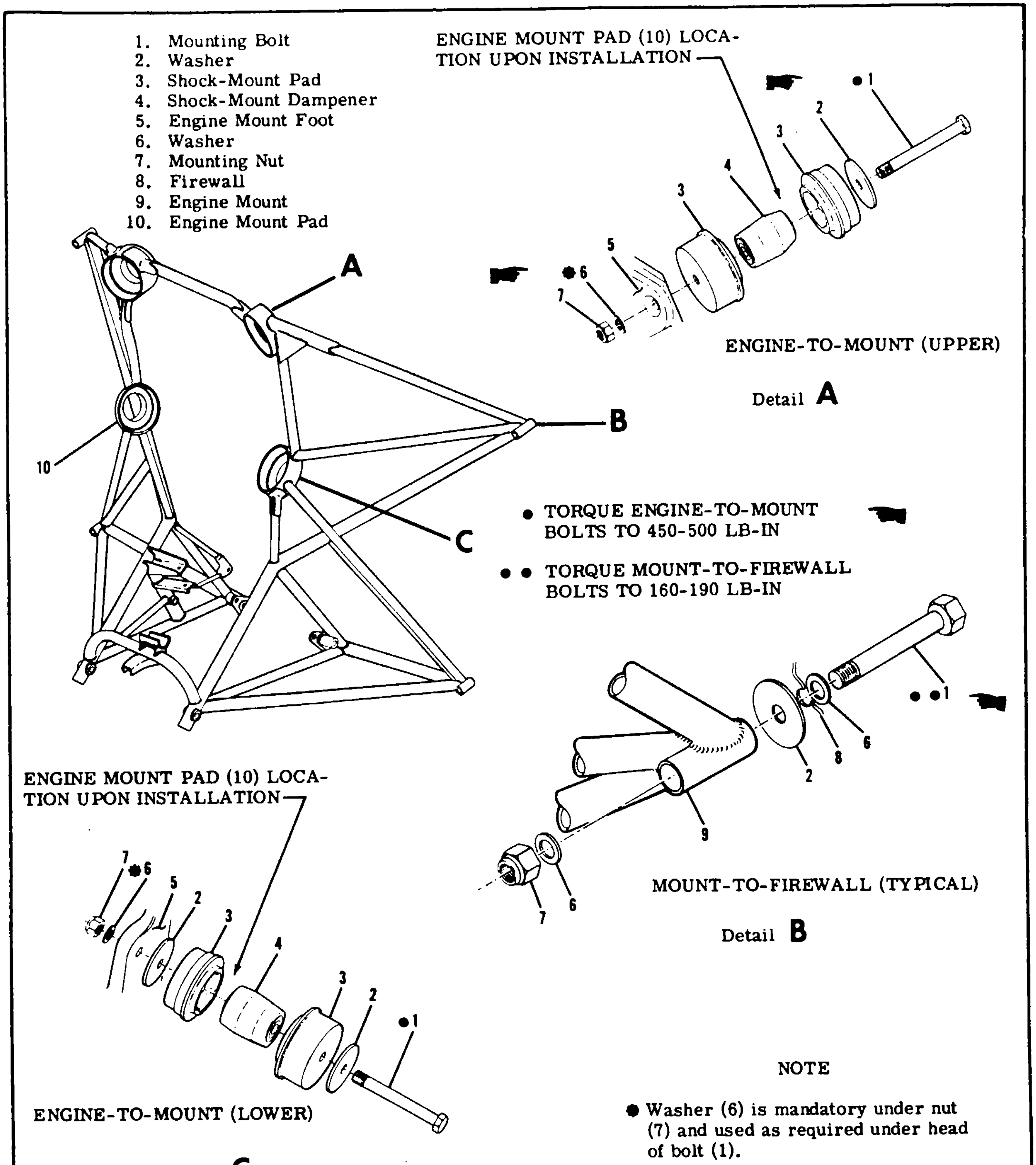
11-23. ENGINE SHOCK-MOUNT PADS. (Refer to figure 11-1.) The bonded rubber and metal shock-mounts are designed to reduce transmission of engine vibrations to the airframe. The rubber pads should be wiped clean with a clean dry cloth.

NOTE

Do not clean the rubber pads (3) and dampener assembly (4) with any type of cleaning solvent.

Inspect the metal parts for cracks and excessive wear due to aging and deterioration. Inspect the rubber pads (3) for separation between the pad and metal backing, swelling, cracking or a pronounced set of the pad. Install new parts for all parts that show evidence of wear or damage.

11-24. ENGINE OIL SYSTEM. The lubricating system is of the full pressure, wet sump type. The main bearings, connecting rod bearing, camshaft bearings, valve tappets and push rods, are lubricated by positive pressure. The pistons, piston pins, cams, cylinder walls, valve rockers, valve stems and other internal moving parts are lubricated by oil collectors and oil spray. The pump, which is located in the accessory housing, draws oil through a drilled passage leading from the suction screen located in the sump. From the pump, the oil enters a drilled passage to a threaded connection and through a flexible hose to the cooler. Pressure oil from the cooler returns through a flexible hose to a threaded connection on the accessory housing. From there the oil flows through a drilled passage to the pressure screen which is contained in a cast chamber mounted on the accessory housing. If cold oil or obstruction should restrict the flow through the cooler, a cooler bypass valve is provided to pass the pressure oil directly from the pump to the pressure screen. The oil is then filtered through the pressure screen chamber and fed through a drilled passage to the pressure relief valve which is located in the upper right side of the crankcase forward of the accessory housing. This relief valve regulates the engine oil pressure by allowing excessive oil to return to the pump, while the balance of the pressure oil is fed to the main oil gallery in the right half of the crankcase. The oil is distributed from the main gallery by means of a separate drilled passage to each main bearing of the crankshaft. The drilled passages to the bearings are located in such a manner as to form an inertia type filter, thus ensuring that only the cleanest oil will reach the bearings. Drilled passages from the rear main bearing supply pressure oil to the crankshaft idler gears. Angular holes are drilled through the main bearings to the rod journals where sludge removal tubes are located. Oil from the main gallery also flows to the cam and valve gear passages and then is conducted through branch passages to the hydraulic tappets and cam shaft bearings. Oil travels out through the hollow push rods to the valve rocker bearings and valve stems. Residual oil from the bearings, accessory drives and rocker boxes flows by gravity to the sump where it passes through the suction screen and is recirculated through the engine. The constant-speed propeller receives oil from the propeller governor




NOTE

● Washer (6) is mandatory under nut (7) and used as required under head of bolt (1).

When installing shock-mounts, install shock-mount pads (3) as shown for the upper and lower mounts. Also note on lower mount, washer (2) is installed between engine mount foot and shock-mount pad (3).

Figure 11-1. Engine Mount Details

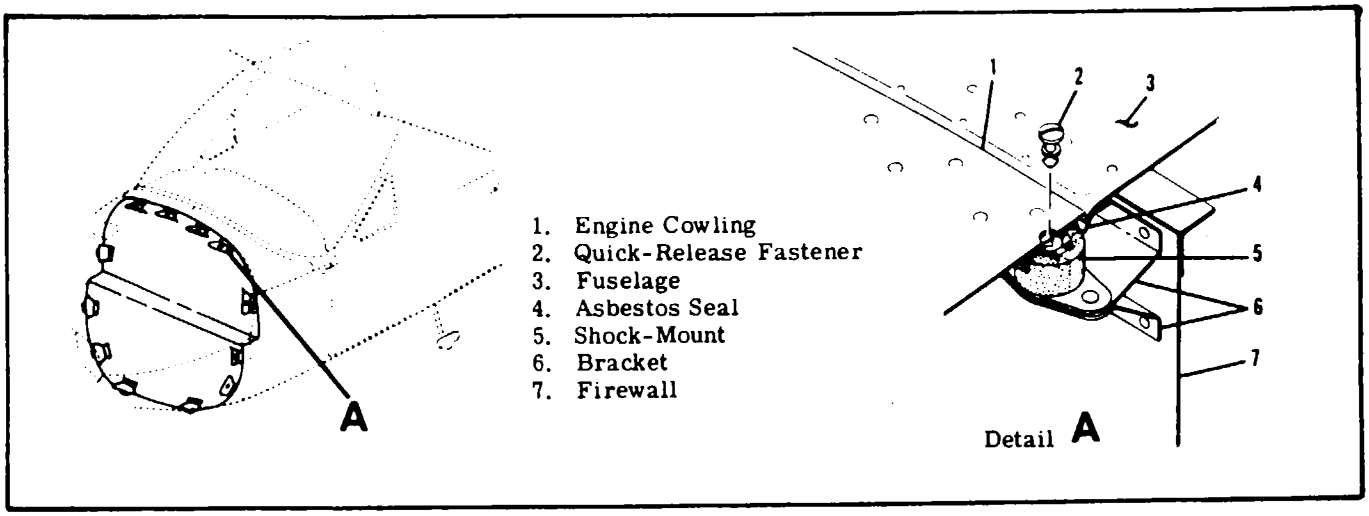



Figure 11-2. Engine Cowling Shock-Mounts

located on the accessory housing through an external line to the front main bearing. An external, replaceable element full-flow oil filter may be installed.

11-25. TROUBLE SHOOTING. Refer to paragraph 11-4 for trouble shooting the engine oil system.

11-26. FULL-FLOW OIL FILTER.

NOTE

THRU AIRCRAFT SERIAL 177RG0282, the full-flow oil filter is optional equipment. Follow installation and servicing instructions provided in this manual. BEGINNING WITH AIRCRAFT SERIAL 177RG0283, the filter is a standard Lycoming engine component. Follow installation and servicing instructions provided in Lycoming Service Letter No. L157B, dtd 6-22-73.

An external oil filter may be installed on the engine. The filter and filter adapter replace the regular engine oil pressure screen and cast chamber on the accessory housing. The filter adapter incorporates mounting provisions for the thermostatic oil cooler bypass valve and the oil temperature sensing bulb. If the filter element should become clogged, the bypass valve allows engine oil to flow to the engine oil passages.

11-27. REMOVAL AND INSTALLATION. (Refer to figure 11-4.)

NOTE

Filter element replacement kits are available from the Cessna Service Parts Center.

a. Remove engine cowling as necessary for access to filter.
b. Remove both safety wires from filter can and unscrew hollow stud (10) to detach filter assembly from adapter (2) as a unit. Remove assembly from aircraft and discard gasket (5).
c. Remove nylon nut from hollow stud (10) at top of lid (6) and press downward on stud to remove.
d. Lift lid (6) off filter can (9) and discard gasket (7).
e. Pull filter element (8) out of filter can (9).

NOTE

Before discarding removed filter element (8), remove the outer perforated paper cover; using a sharp knife, cut through the folds of the filter element at both ends. Then, carefully unfold the pleated element and examine the material trapped in the 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 damage found in the oil filter element justifies further examination to determine the cause.

f. Wash lid (6), hollow stud (10) and filter can (9) in solvent and dry with compressed air.

NOTES

When installing a new filter element (8), it is important that all gaskets are clean, lubricated and positioned properly, and that the correct amount of torque is applied to the hollow stud (10). If the stud is under-torqued, oil leakage will occur. If the stud is over-torqued, the filter can might possibly be deformed, again causing oil leakage.

- Lubricate all rubber grommets in the new filter element, lid gaskets and metal gasket with clean engine oil or general purpose grease before installation. Dry gaskets may cause false torque readings, again resulting in oil leakage.

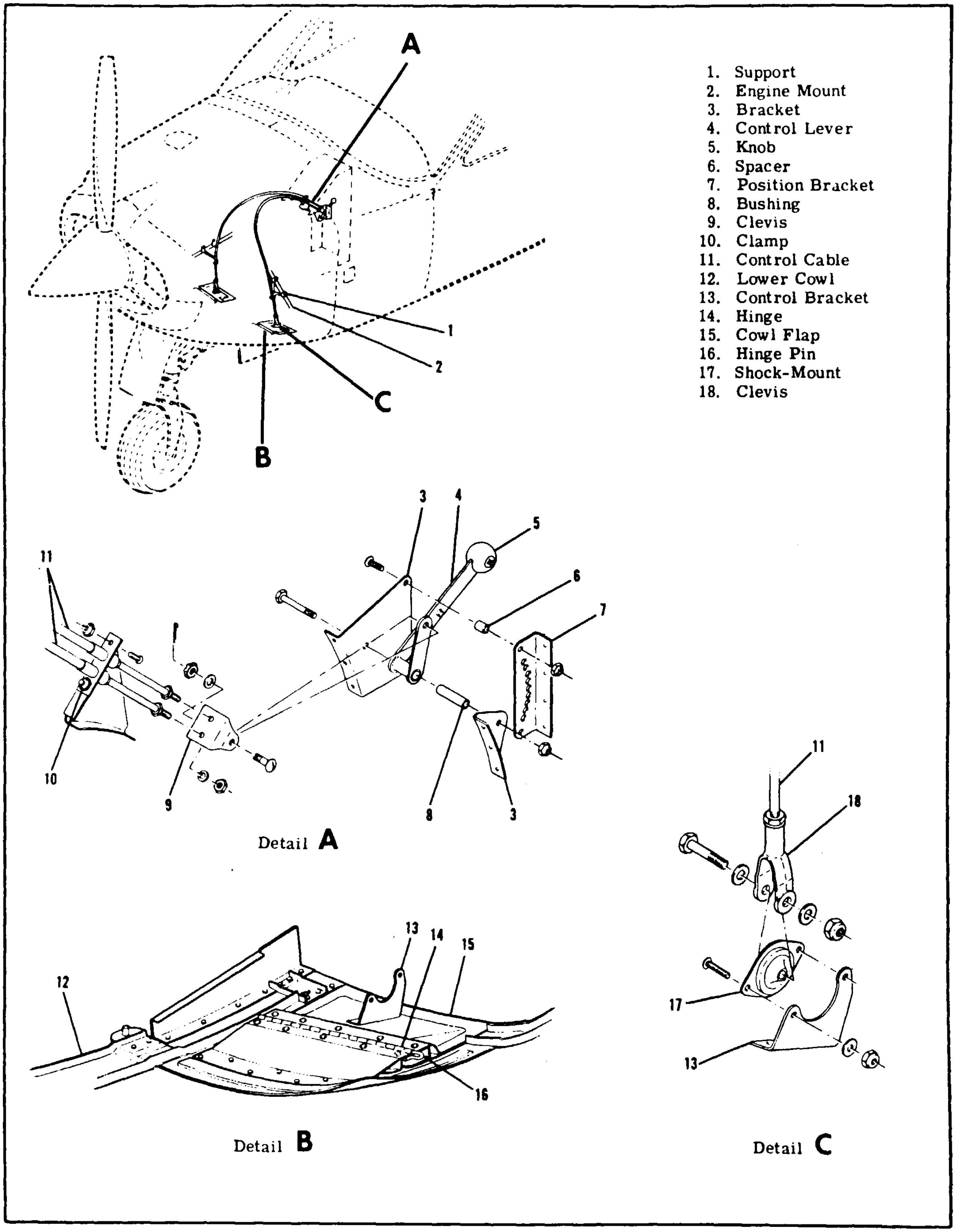
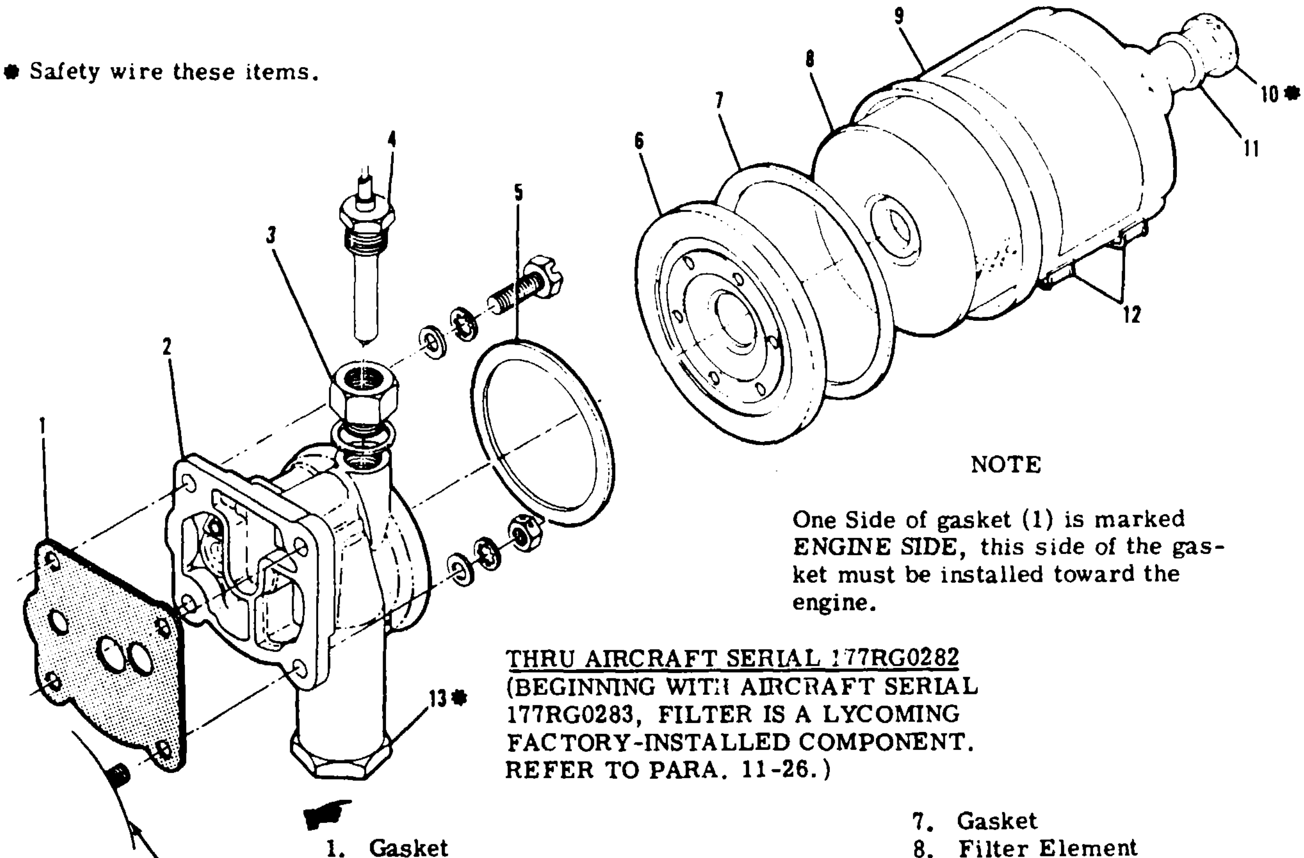



Figure 11-3. Cowl Flaps

* Safety wire these items.




NOTE

One Side of gasket (1) is marked ENGINE SIDE, this side of the gasket must be installed toward the engine.

THRU AIRCRAFT SERIAL 177RG0282 (BEGINNING WITH AIRCRAFT SERIAL 177RG0283, FILTER IS A LYCOMING FACTORY-INSTALLED COMPONENT. REFER TO PARA. 11-26.)

1. Gasket
2. Adapter
3. Oil Temperature Bulb Adapter
4. Oil Temperature Bulb
5. Gasket
6. Lid
7. Gasket
8. Filter Element
9. Filter Can
10. Hollow Stud
11. Copper Gasket
12. Safety Wire Tab
13. Thermostatic Valve

Figure 11-4. Full-Flow Oil Filter

- 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 filter can if either of these conditions exists.

- After installing a new gasket on 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 the 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 (8) in can (9) and insert the hollow stud (10) with a new metal gasket (11) in place, through the filter can and element.
i. Position a new gasket (7) inside flange of lid (6). Place lid in position on filter can and install the nylon nut. The nut should be snugly seated against lid by finger-tightening and must not protrude above the metal surface of the lid.
j. With new gasket (5) on face of lid, install filter can assembly on adapter (2) with safety wire tabs (12) on filter can down. While holding filter can to prevent turning, tighten hollow stud (10) and torque to 20-25 lb-ft (240-300 lb-in), using a torque wrench.
k. Install all parts removed for access and service the engine with the proper grade and quantity of engine oil. One additional quart of oil is required each time the filter element is changed.
l. Start engine and check for proper oil pressure. Check for oil leakage after warming up the engine.
m. Again check for oil leakage after engine has been run at high power setting (preferably a flight around the field).
n. Check to make sure filter can has not been making contact with any adjacent parts due to engine torque.
o. While engine is still warm, recheck torque on hollow stud (10) then safety stud to tab (12) on filter can and safety thermostatic valve (13) to tab on filter can.

11-28. FILTER ADAPTER REMOVAL. (Refer to figure 11-4.)
a. Remove filter assembly in accordance with paragraph 11-27.
b. Remove oil temperature bulb (4) from adapter (2).
c. Remove the three bolts and washers attaching

adapter to accessory housing.

d. Remove nut and washers attaching the lower left corner of adapter to accessory housing and remove adapter.

e. Remove gasket (1) from adapter mounting pad and discard.

11-29. DISASSEMBLY, INSPECTION AND REASSEMBLY.
After removal of the adapter (2), remove thermostatic bypass valve (13) for cleaning. Do not disassemble the valve. Clean adapter valve in solvent and dry with compressed air. Ascertain that all passages in adapter are open. Remove any gasket material that may have adhered to the adapter. Inspect adapter for cracks, damaged threads, scratches or gouges to gasket seats. If any of these are found, install a new adapter. Using a new gasket install thermostatic bypass valve in adapter.

11-30. INSTALLATION.

a. Using a good grade of gasket sealant, install a new gasket on accessory housing adapter mount pad. Note that one side of the gasket is marked ENGINE SIDE; this side of the gasket must be installed toward the engine.

b. Install adapter on mounting pad and install bolts, washers and nut. Use lockwashers next to bolt heads and nut.

c. Tighten bolts and nut to 75 lb-in.

d. Install oil temperature bulb in adapter.

e. Install filter assembly in accordance with paragraph 11-27.

f. Install any components removed for access.

11-31. ENGINE OIL COOLER. The external oil cooler is mounted on the firewall. Flexible hoses carry the oil to and from the cooler. Cooling air for the cooler is ducted from the upper right engine baffle to the shroud covered oil cooler. Exhaust air from the cooler is discharged into the engine compartment. A thermostatically operated cooler bypass valve, installed in the oil pressure screen mounting pad, causes oil to bypass the cooler in the event of congealed oil or an obstruction in the cooler. The bypass valve passes the oil directly to the pressure screen until a predetermined oil temperature is reached, then oil is routed through the cooler. At each engine oil change, drain the oil cooler.

11-32. FUEL INJECTION SYSTEM. The fuel injection system installed on the aircraft is a low pressure, multi-nozzle, continuous flow system, which injects raw fuel into the engine cylinders to match engine air intake. The system components consist of the airflow sensing system, regulator section, fuel metering section, flow divider valve and air bleed nozzle. The relationship of the airflow sensing system, regulator section and fuel metering section is such that the three units are embodied within the throttle body casting. The grouping of these items is referred to hereafter as the SERVO REGULATOR.

11-33. SERVO REGULATOR. The servo regulator occupies the position ordinarily used by the carburetor at the engine intake manifold inlet. The servo regulator consists of the airflow sensing system, servo valve and fuel control system. Operation of the fuel injection system is based on the principle of measuring airflow and using the airflow signal to operate a servo valve. The accurately regulated fuel pressures established by the servo valve, when applied across the fuel control system makes fuel flow proportional to airflow.

11-34. AIRFLOW SENSING SYSTEM. The airflow sensing system consists of a throttle body which houses the air throttle valve, the venturi, servo valve and fuel control unit. The differential pressure between impact air and the venturi throat pressure is a measurement of the velocity of the air entering the engine. These pressures are vented through drilled channels in the throttle body to both sides of an air diaphragm and create a force across the diaphragm. A change in air throttle position or a change in engine speed will change the air velocity which in turn changes the force across the air diaphragm.

11-35. REGULATOR SECTION. The regulator contains the diaphragm referred to in paragraph 11-34 and a fuel diaphragm. Fuel inlet pressure is applied to one side of the fuel diaphragm. The other side of the fuel diaphragm is exposed to fuel that has passed through the metering jet (metered fuel pressures). The differential pressure across the fuel diaphragm is referred to as the fuel metering force. The air metering force applied to the air diaphragm is transmitted through the regulator stem and tends to move the ball valve in the opening direction. The fuel metering force across the fuel diaphragm acts to oppose the air metering force and tends to close the ball valve. Because the air forces are very low in the idle range, a constant head idle spring is provided to maintain an adequate fuel metering force at low rpm. As the air metering force increases, the spring compresses until the spring retainer touches the air diaphragm and acts as a solid member. The constant effort spring produces a force which provides a smooth transfer from idle to low power cruise operation. Whenever the air metering, fuel metering and spring forces are balanced, the ball valve maintains a fixed position.

11-36. FUEL METERING SECTION. The fuel control system is contained within the throttle body casting and consists of an inlet fuel screen, a rotary idle valve and a rotary mixture valve. The idle valve is connected to the throttle valve by means of an external adjustable link. The idle valve controls fuel flow through the low speed range of operation and is adjustable to obtain good idling characteristics without affecting fuel metering in the high power range. The mixture control valve gives full rich mixture on one stop and a progressively leaner mixture as it is moved toward idle cutoff. The full rich stop defines sea level requirements and the mixture control provides for altitude leaning. Both idle speed (closed throttle position) and idle mixture (relationship between throttle position and idle valve position) may be readily adjusted externally to meet individual engine requirements.

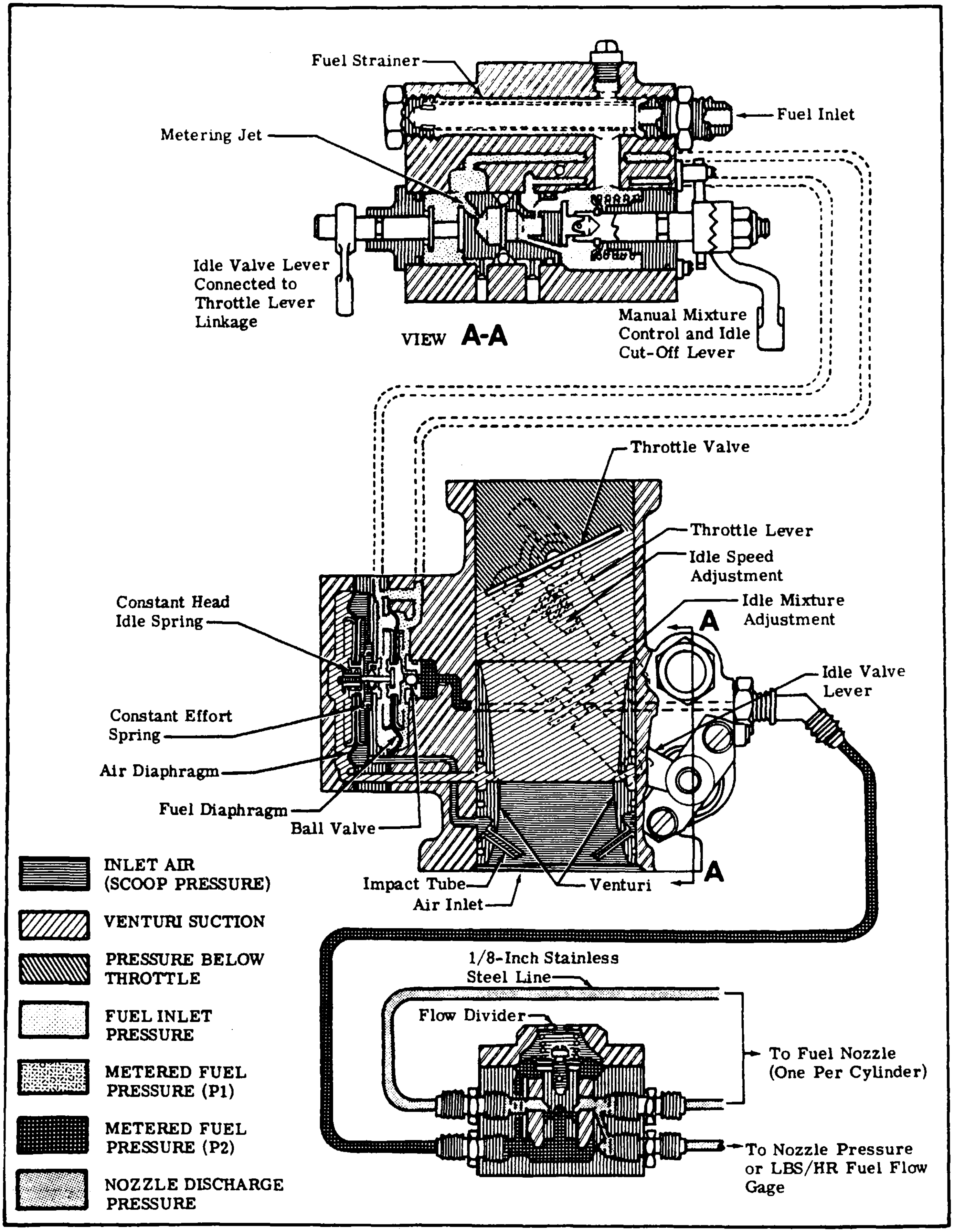



Figure 11-5. Fuel Injection System Schematic

11-37. REMOVAL AND INSTALLATION.

a. Remove engine cowling as required for access.

b. Release clamp and disconnect flexible duct from airbox.

c. Cut safety wire and remove four bolts attaching airbox to servo regulator. Remove airbox.

d. Disconnect throttle and mixture controls from regulator. Note position and size of washers and spacers at regulator end of control so that these parts may be installed in the same position when connecting the controls.

e. Place fuel valve in OFF position.

f. Disconnect and cap or plug fuel lines at regulator.

g. Remove four sets of Palnuts, nuts and washers attaching regulator to intake manifold and remove regulator.

h. Reverse the preceding steps for reinstallation. Use new gaskets between regulator and intake manifold and between airbox and regulator.

i. Rig mixture and throttle controls.

11-38. INSPECTION AND CLEANING. The servo regulator should be inspected and the fuel inlet screen should be cleaned at each 50-hour inspection period.

a. Remove and clean the fuel injector inlet screen in unleaded gasoline or Stoddard solvent.

b. Using new O-rings, install fuel injector screen and safety.

c. Inspect servo regulator and all fuel injector fuel lines for tightness and evidence of fuel leakage.

NOTE

Slight fuel stains adjacent to the air bleed nozzles is not cause for concern.

d. Check tightness and safety wire all nuts and screws which fasten the injector to the engine.

e. Check throttle and mixture controls and levers for evidence of wear and looseness.

f. Clean induction air filter (Refer to Section 2.)

g. Add a drop of engine oil to the ends of the air throttle shaft, so that the oil can work into the throttle shaft bushings.

h. Lightly lubricate the rod ends of the throttle and mixture controls.

i. Check controls for freeness of operation.

11-39. ADJUSTMENT. (Refer to figure 11-5.) Adjustments to the servo regulator must be confined to idle speed and mixture only.

a. Start and run engine until the oil and cylinder head temperatures are in the normal operating range.

b. Check the magnetos for proper operation in accordance with paragraph 11-57.

c. Clear the engine by advancing the rpm to approximately 1800, then retard the throttle to the idle position. The engine rpm should stabilize at 600±25. If not, adjust the idle speed screw IN to increase and OUT to decrease rpm.

NOTE

The idle speed and idle mixture must be adjusted with the propeller control in the full low pitch (high-rpm) position.

d. After the idle speed has stabilized (600±25 rpm), move the mixture control slowly toward the IDLE CUT-OFF position and observe the tachometer for any minute change during this manual leaning procedure.

e. Quickly return the mixture control to the FULL RICH position before the engine stops.

f. A momentary increase of approximately 25 rpm while slowly manually leaning the mixture is most desirable, an increase of more than 25 rpm indicates a rich idle mixture and an immediate decrease in rpm (if not preceded by a momentary increase) indicates a lean idle mixture.

g. If the idle mixture is too rich, turn the idle mixture adjustment center screw one or two notches in a clockwise direction as viewed from the aft end of the unit, then repeat steps "d" through "f."

h. If the idle mixture is too lean, turn the idle mixture adjustment center screw one or two notches in a counterclockwise direction as viewed from the aft end of the unit, then repeat steps "d" thru "f."

i. This method of adjustment will give the desired idle rpm and the lowest manifold pressure reading. If the adjustments do not remain stable, check the throttle and mixture linkage for evidence of wear and improper rigging. Any looseness of the throttle and mixture linkage will cause erratic idling. In all cases, allowance should be made for the effect of weather condition upon idling adjustment. The relation of the aircraft to the prevailing wind direction will have an effect on the propeller load and engine rpm. It is advisable to make idle adjustments with the aircraft crosswind.

11-40. FLOW DIVIDER VALVE. The flow divider valve is mounted on the top side of the engine and is supplied with fuel through an external hose. Spring pressure in conjunction with ambient air pressure closes the flow divider valve when fuel pressure from the servo regulator falls below approximately 2 psi. As the valve opens, the fuel is channeled from the central chamber into individual passages; each passage leads to an air bleed nozzle supply line for each cylinder to assure an even distribution of fuel at idle. As power demand is increased above idle requirements, the flow divider valve fully opens and fuel to the engine becomes a function of fuel pressure at the air bleed nozzles. Under idle cut off conditions, the loss of supply pressure permits the valve to close and immediately stop flow of fuel to all cylinders resulting in smooth shut down.

11-41. REMOVAL AND INSTALLATION.

a. Remove cowling as required for access.

b. Disconnect and cap or plug all fuel lines at flow divider valve.

c. Remove the three bolts attaching valve bracket to the engine. Remove valve and bracket.

d. Valve may be removed from bracket by removing screws attaching valve to bracket.

e. Reverse preceding steps for reinstallation. Torque engine backbone bolts to 75 pound-inches and inspect all lines and hoses for crimps.

11-42. AIR BLEED NOZZLES. From the flow divider valve, individual fuel lines convey the metered fuel to the air bleed nozzles, one of which is located in each cylinder. Each nozzle outlet is directed into the cylinder intake port. An air bleed, incorporated into each nozzle, aids in breaking up and atomizing the fuel during idle and part throttle conditions. In addition, ambient air pressure equalizes the pressure at all nozzles to eliminate the adverse effect of low manifold pressure at idle so that the lines can be maintained full of fuel to provide good distribution and acceleration characteristics.

11-43. REMOVAL. The air bleed nozzle must be removed from the engine before it can be cleaned. To remove the nozzles from the engine, proceed as follows:

a. Remove engine cowling as required for access.
b. Disconnect fuel injection lines from nozzles.

NOTE

Plug or cap all disconnected lines and fittings.

c. Using a one-half inch, deep socket, remove the air bleed nozzle from the cylinder.

11-44. CLEANING AND INSPECTION. Inspect air bleed nozzles at 50-hour inspections, paying particular attention to the condition of the screens and orifices. All nozzles having contaminated screens must be removed and cleaned. To clean air bleed nozzles, proceed as follows:

a. Remove nozzles from cylinder ports. (Refer to paragraph 11-43.)
b. Wash nozzle in clean unleaded gasoline or Stoddard solvent.
c. Using compressed air of 100 psi, blow through nozzle in direction opposite of flow of fuel.

CAUTION

Do not use wire to clean nozzle orifices and do not remove shield to clean air screens in nozzle.

d. Reinstall nozzles in cylinder ports in accordance with paragraph 11-45.

11-45. INSTALLATION. Ascertain that all nozzles for a particular engine are stamped for the same calibrated range. To install nozzles, proceed as follows:

a. Using a one-half inch, deep socket install nozzles in cylinder intake ports. Torque nozzles to 60 lb-in.

CAUTION

When installing fuel lines and fittings, use only a fuel soluble lubricant such as engine oil on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

b. Connect fuel injection lines to nozzles.
c. Inspect installation for evidence of crimped fuel lines.
d. Install cowling.

11-46. INDUCTION AIR SYSTEM. Ram air enters the induction airbox through the air filter located in the left forward baffle. The induction airbox has an opening for unfiltered air from the engine compartment with a door spring-loaded to closed position which is opened by engine suction in the event the air filter should become clogged by foreign material. In the event of engine backfire, this spring-loaded door will close to prevent the backfire from being discharged into the engine compartment. From the induction airbox, air passes through the fuel servo regulator unit and is supplied to the cylinders through the intake manifold piping.

11-47. REMOVAL AND INSTALLATION.

a. Remove cowling as required for access.
b. Remove airbox and servo regulator as outlined in paragraph 11-37.
c. Mark the intake pipes as they are removed from the engine so they may be reassembled in the same location from which they were removed.
d. Loosen hose clamps and slide hose connection from sump. Remove any clamps attaching wires and lines to the intake pipe.
e. Remove two nuts, washers and lockwashers attaching intake pipe flange to cylinder.
f. Remove intake pipe and clean gasket from cylinder mounting pad and intake pipe flange.
g. Reverse preceding steps for reinstallation. Use new gaskets and install pipes in the same location from which they were removed.

11-48. IGNITION SYSTEM.

11-49. DESCRIPTION. The ignition system is comprised of two magnetos, two spark plugs in each cylinder, an ignition wiring harness, an ignition switch mounted on the instrument panel and required wiring between the ignition switch and magnetos.

11-50. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| ENGINE FAILS TO START. | Defective ignition switch. | Check switch continuity. Replace if defective. |
| | Spark plugs defective, improperly gapped or fouled by moisture or deposits. | Clean, regap and test plugs. Replace if defective. |
| | Defective ignition harness. | If no defects are found by a visual inspection, check with a harness tester. Replace defective parts. |
| | Magneto "P" lead grounded. | Check continuity. "P" lead should not be grounded in the ON position, but should be grounded in OFF position. Repair or replace "P" lead. |
| | Failure of impulse coupling. | Impulse coupling pawls should engage at cranking speeds. Listen for loud clicks as impulse couplings operate. Remove magnetos and determine cause. Replace defective magneto. |
| | Defective magneto. | Refer to paragraph 11-56. |
| | Broken drive gear. | Remove magneto and check magneto and engine gears. Replace defective parts. Make sure no pieces of damaged parts remain in engine or engine disassembly will be required. |
| ENGINE WILL NOT IDLE OR RUN PROPERLY. | Spark plugs defective, improperly gapped or fouled by moisture or deposits. | Clean, regap and test plugs. Replace if defective. |
| | Defective ignition harness. | If no defects are found by a visual inspection, check with a harness tester. Replace defective parts. |
| | Defective magneto. | Refer to paragraph 11-56. |
| | Impulse coupling pawls remain engaged. | Listen for loud clicks as impulse coupling operates. Remove magneto and determine cause. Replace defective magneto. |
| | Spark plugs loose. | Check and install properly. |

## 11-51. MAGNETOS.

### 11-52. DESCRIPTION.

a. BENDIX S-1200 SERIES. The Bendix S-1200 series magneto is a completely self-contained unit. A two-pole rotating magnet provides the magnetic energy for the circuit. Suppression of breaker contact point arcing is accomplished by a feed-thru type capacitor mounted in the contact breaker point assembly cover. The left magneto incorporates an impulse coupling to rotate the magnet between impulse trips faster than engine cranking speed thus generating a better spark for starting, automatically retard the spark when starting the engine and act as a drive coupling for the magneto. The right magneto incorporates the standard drive.

b. BENDIX D-2000 SERIES. The Bendix D-2000 series magneto consists of two electrically independent ignition circuits in one housing. A single four pole rotor provides the magnetic energy for both circuits. The magneto uses an impulse coupling to provide reliable ignition at engine cranking speed. Suppression of breaker contact point arcing is accomplished by feed-thru type capacitors mounted in the magneto cover which forms a part of the magneto harness assembly.

### 11-53. REMOVAL AND INSTALLATION.

a. BENDIX S-1200 SERIES.

**WARNING**

The magneto is in a SWITCH ON condition when the switch wire is disconnected. Therefore, ground the breaker contact points or disconnect the high-tension wires from magneto or spark plugs.

1. Remove engine cowling in accordance with paragraph 11-12.
2. Disconnect magneto "P" lead at the capacitor.
3. Remove nuts and washers attaching high-tension outlet plate to the magneto and remove plate.

NOTE

It is a good practice to position No. 1 cylinder at its approximate advanced firing position before removing the magneto.

4. Remove nuts, washers and clamps attaching magneto to the engine accessory housing.
5. Note the approximate angular position at which the magneto is installed, then remove the magneto.
6. Reverse the preceding steps for reinstallation and time magneto-to-engine in accordance with paragraph 11-55.

b. BENDIX D-2000 SERIES.

1. Remove engine cowling in accordance with paragraph 11-12.
2. Remove the eight screws securing the high-tension outlet cover to the magneto. The "P" leads may be disconnected for additional clearance if necessary.

NOTE

It is a good practice to position No. 1 cylinder at its approximate advanced firing position before removing the magneto.

3. Remove nuts, washers and clamps attaching the magneto to the engine accessory housing. Note the approximate angular position at which the magneto is installed, then remove the magneto.
4. Reverse the preceding steps for reinstallation and time magneto-to-engine in accordance with paragraph 11-55.

### 11-54. INTERNAL TIMING.

a. BENDIX S-1200 SERIES. (MAGNETO REMOVED FROM ENGINE.) The following procedures outline adjustment of the breaker contact points to open at the proper position. It is assumed that the magneto has not been disassembled and that the distributor gear and rotor shaft gear have been assembled for correct meshing of gears and direction of rotation. Magneto overhaul, including separation of the major sections, is not covered in this manual. Refer to the applicable Bendix publications for disassembly and overhaul.

1. Remove breaker contact point assembly cover.
2. Remove timing inspection plug from top of magneto and ventilator plug from bottom of magneto.
3. Turn rotating magnet in normal direction of rotation until the L ("E" gap) mark on distributor gear is approximately aligned with mark on block. Then turn rotating magnet in the opposite direction of rotation until the magnet locates in the neutral position.
4. Turn rotating magnet in normal direction of rotation until the first timing mark on the magnet is aligned with the divided casting line of the magneto housing. There are four timing marks cast on the rotating magnet, two on each pole piece. When the rotating magnet is in its neutral position and then rotated in normal direction of rotation, the first timing mark on rotating magnet to appear in ventilator hole is the "E" gap mark for magnetos of this rotation. The other mark on magnet is the "E" gap for magnetos of opposite rotation.
5. While holding rotating magnet in this EXACT location, adjust the breaker contact points to just begin to open. Point opening shall be determined by the use of a timing light. (Bendix Part No. 11-9110 or equivalent.)
6. Turn rotating magnet in normal direction of rotation until cam follower of contact assembly is on the high point of cam lobe. Contact point clearance should be 0.016±0.003 inch. If dimension does not fall within limits, readjust contact points and recheck to be sure the points just begin to open when the applicable timing mark (refer to step 4) on magnet is aligned with divided casting line on housing ("E" gap).

NOTES

Wire feeler gages are recommended when checking contact point clearance.

- No attempt should be made to stone or dress contact points.

- If the above conditions are met and within tolerance, the magneto is timed internally and ready for installation. If the above conditions are not within tolerance, proceed to step 7.

7. Using a pair of padded jaw pliers or a vise, grip the drive member on the drive end of rotating magnet. While holding the rotating magnet, loosen the screw securing breaker contact cam to rotating magnet shaft and back screw out approximately half way. Place the end of a broad bladed screw driver between the bottom of the cam and housing. Strike the screw driver handle with a sharp downward blow to "pop" the cam loose from taper of shaft.

8. Rotate cam until breaker contact cam follower is on high point of cam lobe. Adjust breaker points to obtain a clearance of 0.016±0.003 inch. Tighten breaker contact securing screws to 20-25 lb-in.

9. Repeat steps 3 and 4.

10. While holding rotating magnet in this EXACT location, rotate the breaker contact cam in the opposite direction of rotation a few degrees BEYOND where the breaker contacts close, then rotate cam in the normal direction of rotation until the breaker contacts just begin to open. Point opening shall be determined by the use of a timing light. (Bendix Part No. 11-9110 or equivalent.)

11. While holding cam in this EXACT position, push cam on magnet shaft as far as possible with the fingers. Tighten cam securing screw thereby drawing the cam down evenly and tightly. Torque cam securing screw to 16-20 lb-in.

NOTE

Extreme care must be exercised in this operation. If cam adjustment is changed in the slightest degree, the timing of the magneto will be thrown off. Do not drive cam on shaft with a mallet or other instrument.

12. Repeat steps 3, 4, 5 and 6.

b. BENDIX D-2000 (DUAL) SERIES. (MAGNETO REMOVED FROM ENGINE.)

NOTE

A magneto, correctly timed internally, will have the red painted tooth of the large distributor gears approximately centered in the timing windows, the L ("E" gap) mark on the rotor shaft in alignment with the pointer and both sets of breaker contacts opening, all at the same time.

1. Remove breaker contact point assembly cover, if installed, by removing the cover screws, pulling cover directly aft away from housing and disconnecting both capacitor leads from breaker contact assemblies.

2. Remove timing inspection hole plugs from magneto.

3. Slowly turn the rotor shaft until the red painted tooth of the large distributor gear for each side is approximately centered in the inspection windows and the L ("E" gap) mark on the rotor is aligned with the pointer. Lock the rotor in this EXACT position using Bendix Rotor Holding Tool, Part No. 11-8465 or equivalent.

NOTE

Position the 11-8465 Rotor Holding Tool on drive end of rotor shaft in the 4 o'clock position so any shaft deflection caused by clamping action will be in a plane parallel to the breaker contacts.

4. Connect the timing light (Bendix Part No. 11-9110 or equivalent) black lead to any unpainted surface of the magneto. Connect the red light lead to the left breaker contact terminal and the green light lead to the right breaker contact terminal.

5. Carefully adjust the LEFT breaker contacts to just begin to open (light will go out) with the timing pointer within the width of the L ("E" gap) mark.

6. Repeat step 5 for the RIGHT breaker contacts.

7. Loosen the rotor holding tool and turn rotor shaft in normal direction of rotation until cam followers of contact assemblies are on the high point of cam lobes. Contact point clearance should be 0.016±0.002 inch and 0.016±0.004 inch on LEFT and RIGHT contacts respectively. If dimensions do not fall within limits, readjust contact points and recheck to be sure the points just begin to open when the timing pointer is within the width of the L ("E" gap) mark.

NOTES

Wire feeler gages are recommended when checking contact point clearance.

- No attempt should be made to stone or dress contact points.

- If the above conditions are met and within tolerance, the magneto is timed internally and ready for installation. If the above conditions are not within tolerance, proceed to step 8.

8. While holding the rotor shaft, loosen the screw securing breaker contact cam to rotor shaft and back screw out approximately half way. Place the end of a broad bladed screw driver between the bottom of the cam and housing. Strike the screw driver handle with a sharp downward blow to "pop" the cam loose from taper of shaft.

9. Rotate cam until breaker contact cam followers are on the high point of cam lobes. Adjust breaker points to obtain a clearance of 0.016±0.002 inch and 0.016±0.004 inch on LEFT and RIGHT contacts respectively. Tighten breaker contact securing screws to 20-25 lb-in.

10. Repeat step 3.

11. While holding rotor shaft in this EXACT position, rotate the breaker contact cam in the opposite direction of rotation a few degrees BEYOND where the breaker contacts close, then rotate cam in the normal direction of rotation until the breaker contacts just begin to open. Point opening should be determined by the use of a timing light. (Bendix Part No. 11-9110 or equivalent.)

12. While holding cam in this EXACT position, push cam on rotor shaft as far as possible with the fingers. Tighten cam securing screw thereby drawing the cam down evenly and tightly. Torque cam securing screw to 16-20 lb-in.

NOTE

Extreme care must be exercised in this operation. If cam adjustment is changed in the slightest degree, the timing of the magneto will be thrown off. Do not drive cam on rotor shaft with a mallet or other instrument.

13. Recheck timing to make sure both sets of breaker contacts begin to open within the width of the L ("E" gap) mark and that the contact point clearance is in accordance with dimensions in step 7.

NOTE

When reinstalling the inspection hole plugs, make sure the ventilated plugs are installed in the ends of the magneto. Torque plugs to 12-15 lb-in.

11-55. MAGNETO-TO-ENGINE TIMING.

a. BENDIX S-1200 SERIES. 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 11-3 for the advanced firing position of number one piston. To locate the compression stroke of number one cylinder, remove the lower spark plug from number 2, 3 and 4 cylinders. 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 attained, locate number one piston at its advance 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 the piston is approximately 30 degrees before top dead center (BTC) on the compression stroke of number one cylinder. Then rotate crankshaft slowly in normal direction of rotation to align the timing mark on the FORWARD face of the starter ring gear with the drilled hole in the forward end of the starter, making sure the final movement of the ring gear is in the direction of normal rotation.

NOTE

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 also be used to locate the advanced firing position. 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 the number one cylinder is at the correct firing position and on the compression stroke, when the engine is turned in its normal direction of rotation.

After the engine has been placed in the correct firing position, install and time the magneto to the engine in the following manner:

1. Remove timing inspection plug from top of magneto. Turn magneto drive shaft in direction of operating rotation until the applicable timing mark on the distributor gear is approximately aligned with the mark on the distributor block. Depress impulse coupling pawls on left magneto to rotate magneto shaft.

NOTE

The timing marks are for reference only. They should not be used to adjust contact breaker point opening or to determine proper timing of the magneto. (Refer to paragraph 11-54 for internal timing.)

2. Be sure magneto gasket (right magneto), magneto adapter and gaskets (left magneto) are in place and that engine is in the correct firing position, then install magneto approximately at the angle noted during removal, tighten mounting nuts finger tight.

NOTE

Be sure to keep timing marks in the magneto aligned as close as possible when installing on the engine.

3. Connect positive lead of the timing light (Bendix Part No. 11-9110 or equivalent) to the switch terminal (capacitor stud) of the magneto. Secure the common lead of timing light to a good ground.

4. Rotate propeller opposite to normal direction of rotation a few degrees (approximately 5 degrees) to close the magneto breaker contact points.

NOTE

Do not rotate propeller backward enough to engage impulse coupling, or the propeller will have to be rotated in the normal direction of rotation until impulse coupling releases on the left magneto, then again backed-up to a few degrees before the firing position.

5. Slowly advance propeller (tap forward with minute movements as advanced firing position is approached) in normal direction of rotation until timing light indicates position at which contacts break. The contacts should break at the advanced firing position of number one cylinder. Loosen mounting nuts slightly and rotate magneto case as required to cause the contacts to break at the correct position. Tighten mounting nuts.

6. After tightening magneto mounting nuts, recheck timing. Make sure that both magnetos are set to fire at the same time. Remove timing equipment, install spark plugs and connect spark plug leads and ignition switch leads.

b. BENDIX D-2000 (DUAL) SERIES. The magneto must be installed with its timing marks carefully aligned, with number one cylinder on its compression stroke and with the number one piston at its advanced firing position. Refer to paragraph 11-3 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 2, 3 and 4 cylinders. Remove the upper spark plug from number 1 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 attained, 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 dead center (BTC) on the compression stroke of number one cylinder. Rotate crankshaft in a normal direction to align the timing mark on the front face of the starter ring gear support with the drilled hole in the starter, making sure the final motion of the ring gear is in the direction of normal rotation.

NOTE

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 also be used to locate the advanced firing position. 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 the number one cylinder is at the correct firing position and on the compression stroke, when the engine is turned in its normal direction of rotation.

After the engine has been placed in the correct firing position, install the magneto to the engine in the following manner:

1. Remove the timing window plug from the most convenient side of the magneto housing.

2. Remove the rotor viewing location plug from the top center of the housing.

3. Turn the rotating magnet drive shaft in the normal direction of magneto rotation until the red painted tooth of the large distributor gear is centered in the timing hole (hole at each side of magneto).

4. Also observe at this time that the built in pointer just ahead of the rotor viewing window aligns with the L ("E" gap) mark on the rotor.

5. Install the magneto-to-engine gasket on the magneto flange.

**WARNING**

Do not attach harness spark plug leads to the spark plugs until all magneto-to-engine timing procedures are completed and the switch leads ("P" leads) are connected.

6. Remove the engine-to-magneto drive gear train backlash by turning magneto drive opposite to normal rotation as far as possible.

7. With the no. 1 cylinder at its correct firing position and on the compression stroke, hold the magneto as close to its no. 1 firing position as possible (red tooth in center of window and pointer over L ("E" gap) mark on rotor) and install magneto to the engine. Loosely tighten magneto in position.

NOTE

To facilitate connection of a timing light to the switch lead ("P" lead) terminals, short adapter leads may be fabricated. These can be made by using two switch lead terminals and two short pieces of insulated wire. Install the fabricated adapter leads in the switch lead outlet terminals of the cover.

8. Attach the red lead of the timing light (Bendix Part No. 11-9110 or equivalent) to the left switch lead adapter, the green lead of the timing light to the right switch lead adapter and the black lead of the timing light to the magneto housing (common ground).

NOTE

An internal timing tolerance is allowed when adjusting the two main breakers. Therefore, one of the main breakers may open slightly before the other. Magneto-to-engine timing should be accomplished using the first main breaker to open as the reference point when the engine is in the firing position for No. 1 cylinder. This will insure that ignition created by either spark plug will not occur prior to the desired engine firing point.

9. Turn the entire magneto in direction of rotor rotation until the timing lights are on.

10. Turn magneto in direction of rotor rotation, right-hand rotation to right and left-hand rotation to left, until one of the timing lights first goes off. Then tighten the magneto mounting clamps evenly in this position.

11. Back the engine up approximately 10° and then carefully "bump" the engine forward while observing the timing lights.

12. At the No. 1 cylinder firing position, one of the timing lights should go off. Continue turning the engine in its normal direction of rotation until the other timing light goes off. This should be not more than 3 engine degrees later than the first light. If not, repeat steps 9 thru 11 until these conditons are obtained.

13. Make sure the magneto clamps are tightened securely, recheck timing once more and remove timing equipment.

14. Reinstall inspection plugs and torque plugs to 12-15 lb-in.

11-56. MAINTENANCE.

a. BENDIX S-1200 AND D-2000 SERIES. At the first 25-hour inspection, first 50-hour inspection, each 100-hour inspection and thereafter at each 100-hour inspection, the contact breaker point compartment and magneto-to-engine timing should be inspected and checked. If magneto-to-engine timing is correct within plus zero and minus two degrees, internal timing need not be checked. If timing is out of tolerance, remove magneto and set internal timing (paragraph 11-54), then install and time to the engine.

NOTE

If engine operating troubles develop which appear to be caused by the ignition system, it is advisable to check the spark plugs and ignition harness first before working on the magnetos. If the trouble appears definitely associated with a magneto, the following may be used to help disclose the source of trouble without overhauling the magneto.

1. Moisture check.

a. Remove contact breaker point assembly cover and inspect cover, cables and capacitor for moisture in the area.

b. Inspect distributor block high tension outlets for moisture.

c. If any moisture is evident, lightly wipe with a soft, dry, clean, lint-free cloth.

CAUTION

Do not use gasoline or any other solvent, as these will remove the wax coating on some parts and cause an electrical leak.

2. Breaker contact compartment check.

a. Check all parts of the contact breaker assembly for security. Check distributor block high-tension outlet springs for evidence of spark erosion and proper height. The end of spring should not be more than 0.422 inch from top of tower.

b. Check breaker contact assembly points for excessive wear, burning, deep pits and carbon deposits. Breaker points may be cleaned with a hard finish paper. If breaker points are found defective, install a new assembly. Make no attempts to stone or dress breaker points. Clean new breaker points with clean unleaded gasoline and hard finish paper before installing.

c. Check condition of the cam follower felt. Squeeze felt between thumb and finger. If fingers are not moistened with oil, re-oil using 2 or 3 drops of lubricant (Bendix Part No. 10-86527 or equivalent). Allow approximately 30 minutes for felt to absorb the lubricant. Blot off excess lubricant with a clean, lint-free cloth. Too much lubricant could foul breaker points and cause excessive burning.

d. BENDIX S-1200 SERIES. Check capacitor mounting bracket for cracks or loosening. If equipment is available, check the capacitor for leadage, series resistance and capacitance. The capacitance should be at least 0.30 microfarads.

e. BENDIX D-2000 (DUAL) SERIES. Check capacitors for looseness in the magneto cover of the harness assembly and for any physical damage. If equipment is available, check the capacitors for leakage, series resistance and capacitance. The capacitance should be 0.34 to 0.41 microfarads.

NOTE

Spring in capacitor outlet may cause an indication of a short to ground if an adapter lead is not used.

f. If the trouble has not been corrected after accomplishing the moisture and breaker contact compartment check, check magneto-to-engine timing in accordance with paragraph 11-55. If timing is incorrect, remove magneto and adjust internal timing in accordance with paragraph 11-54.

g. Reinstall magneto and time to engine in accordance with paragraph 11-55.

h. If the trouble has not been corrected, magneto overhaul or replacement is indicated.

11-57. MAGNETO CHECK.

a. Start and run engine until the oil and cylinder head temperatures are in the normal operating ranges.

b. Advance engine speed to 1800 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 50 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 a magneto 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.

11-58. 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 radios and 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.

NOTE

At each 100-hour inspection, remove, clean, inspect and regap all spark 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 plugs, rotating helps prolong spark plug life.

11-59. ENGINE CONTROLS.

11-60. DESCRIPTION. The throttle, mixture and propeller controls are of the push-pull type. The propeller and mixture controls are 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 propeller and mixture controls also have a vernier adjustment. Turning the control 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.

NOTE

Some controls have intricate parts that will fall out and possibly be lost if the control is pulled from the housing while it is disconnected.

11-61. RIGGING. When adjusting any engine control, it is important to check that the control slides smoothly throughout its full 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**

Some engine controls have a small retaining ring brazed (or attached with epoxy resin) near the threaded end (engine end) of the control. The purpose of these retaining rings is to prevent inadvertent withdrawal of and possible damage to the knob end of the controls while jam nuts and rod ends are removed.

11-62. THROTTLE CONTROL.

NOTE

Before rigging throttle control, check that staked connection between rigid conduit and flexible conduit is secure. If any indication of looseness or breakage is apparent, replace the throttle control before continuing with the rigging.

a. Pull throttle control out (idle position) and remove throttle control knob.
b. Screw jam nut all the way down (clockwise) and reinstall the throttle knob. Do not back the jam nut out. This will prevent bottoming and possible damage to the staked connection.
c. Disconnect the throttle control at the servo regulator arm, push throttle control in until jam nut hits friction lock while the friction lock is loose, then pull control out approximately 1/8 inch for cushion. Note position, size and number of washers and spacers at the servo regulator end of the control. When connecting control to arm, install washers and spacers in same position.
d. Tighten friction lock being careful not to change position of the throttle control.
e. Move the throttle arm on the servo regulator to full open, adjust rod end on control to fit, and connect to the arm on servo regulator.
f. Release friction lock and check for full travel of arm on servo regulator. If further adjustment is required, make all adjustments at the servo regulator end of control. Do NOT change jam nut setting.
g. Tighten rod end jam nuts at servo regulator end of control. Be sure to maintain sufficient thread engagement of rod end on control.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the throttle control.

11-63. MIXTURE CONTROL.
a. Remove bolt attaching control rod end to mixture arm on the servo regulator.
b. Push mixture control full in (FULL RICH) at the instrument panel, then pull control knob out approximately 1/8-inch for cushion.
c. Place mixture control arm on servo regulator in the full rich position. Loosen lock nut on control and screw rod end in or out until attaching bolt slides in easily with control arm against full rich stop.
d. With rod end bolt in place, pull mixture control to idle cut-off position, and remove bolt from rod end, and check that mixture control arm on servo regulator is in idle cut-off position. Reinstall bolt.
e. The mixture arm on the servo regulator must reach mechanical stops in both positions and control should have approximately 1/8-inch cushion at the instrument panel.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the mixture control.

11-64. PROPELLER GOVERNOR CONTROL. Refer to Section 13 for rigging of the propeller governor control.

11-65. STARTING SYSTEM.

11-66. DESCRIPTION. The starting system employs an electrical starter motor mounted at the front (propeller end) lower left side of the engine. 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 armature shaft, engaged with the reduction gear, drives the Bendix shaft and pinion. When the armature turns the reduction gear, the Bendix drive pinion meshes with the crankshaft ring gear assembly by inertia and action of the screw threads within the Bendix sleeve. A detent pin engages in a notch in the screw threads which prevents demeshing if the engine fails to start when the starting circuit is de-energized. When the engine reaches a predetermined speed, centrifugal action forces the detent pin out of the notch in the screw shaft and allows the pinion to demesh from the ring gear.

**CAUTION**

Never operate the starter motor more than 12 seconds at a time. Allow starter motor to cool between cranking periods to avoid overheating. Longer cranking periods without cooling time will shorten the life of the starter motor.

11-67. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| STARTER WILL NOT OPERATE. | Defective master switch or circuit. | Check continuity of master switch and circuit. Install new switch or wires. |
| | Defective starter switch or switch circuit. | Check continuity of switch and circuit. Install new switch or wires. |
| | Defective starter motor. | Check voltage to starter. If voltage is present. Remove, repair or install new starter motor. |
| STARTER MOTOR RUNS, BUT DOES NOT TURN CRANKSHAFT. | Defective Bendix drive. | Remove starter and inspect Bendix drive. Replace defective parts. |
| | Damaged starter pinion gear or ring gear. | Inspect starter pinion gear and ring gear. Replace defective parts. |
| STARTER MOTOR DRAGS. | Low battery. | Check battery. Charge or install new battery. |
| | Starter switch or relay contacts burned or dirty. | Install serviceable unit. |
| | Defective starter motor power cable. | Inspect cable. Install new cable. |
| | Loose or dirty connections. | Inspect connections. Remove, clean and tighten all terminal connections. |
| | Defective starter motor. | Check starter motor brushes, brush spring tension, thrown solder on brush cover. Repair or install new starter motor. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| STARTER MOTOR DRAGS (Cont). | Dirty or worn commutator. | Inspect commutator. Clean and turn commutator. |
| STARTER EXCESSIVELY NOISY. | Worn starter pinion gear or broken teeth on ring gear. | Inspect starter pinion gear and ring gear. Replace defective parts. |

11-68. PRIMARY MAINTENANCE. The starting circuit should be inspected at regular intervals, the frequency of which should be determined by the 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 sure 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 ones). 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.

11-69. STARTER MOTOR.

11-70. REMOVAL AND INSTALLATION.

a. Remove engine cowling in accordance with paragraph 11-12.

**CAUTION**

When disconnecting or connecting the 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.

b. Disconnect electrical cable at starter motor. Insulate the disconnected cable terminal as a safety precaution.

c. Remove three nuts and washers and one bolt securing starter to crankcase. Work starter from engine.

d. To install starter, position starter on mounting pad, aligning dowel pins in starter mounting pad with holes in mounting pad on engine.

e. Secure starter with washer, lockwasher and nut in three places and install bolt and washers.

f. Tighten nuts and bolt evenly to a torque value of 150 lb-in.

g. Connect electrical cable to starter terminal and install engine cowling.

11-71. EXHAUST SYSTEM.

11-72. DESCRIPTION. The exhaust system consists of two mufflers, one for the left and one for the right bank of cylinders. Each cylinder has an exhaust pipe from the cylinder mount pad to its respective muffler. A crossover pipe from the left muffler to the tailpipe on the right muffler is used to route the left bank of cylinders exhaust overboard. A heat shield is installed between the crossover pipe and engine oil sump. Each muffler is enclosed in a shroud which captures exhaust heat from the muffler which is used to heat the aircraft cabin. Flexible ducts route outside air to the muffler shrouds. This air, after being heated by the mufflers is routed to the cabin heat valves on the firewall.

11-73. REMOVAL.

a. Remove engine cowling in accordance with paragraph 11-12.

b. Disconnect flexible ducts from shrouds on muffler assemblies.

c. Remove nuts, washers, bolts and clamps attaching exhaust pipes to the mufflers. Also, remove clamps attaching crossover pipe to right muffler tailpipe.

d. Remove nuts and washers attaching exhaust pipes to cylinder mount pads.

e. Remove bolts, washers and nuts attaching mufflers to braces.

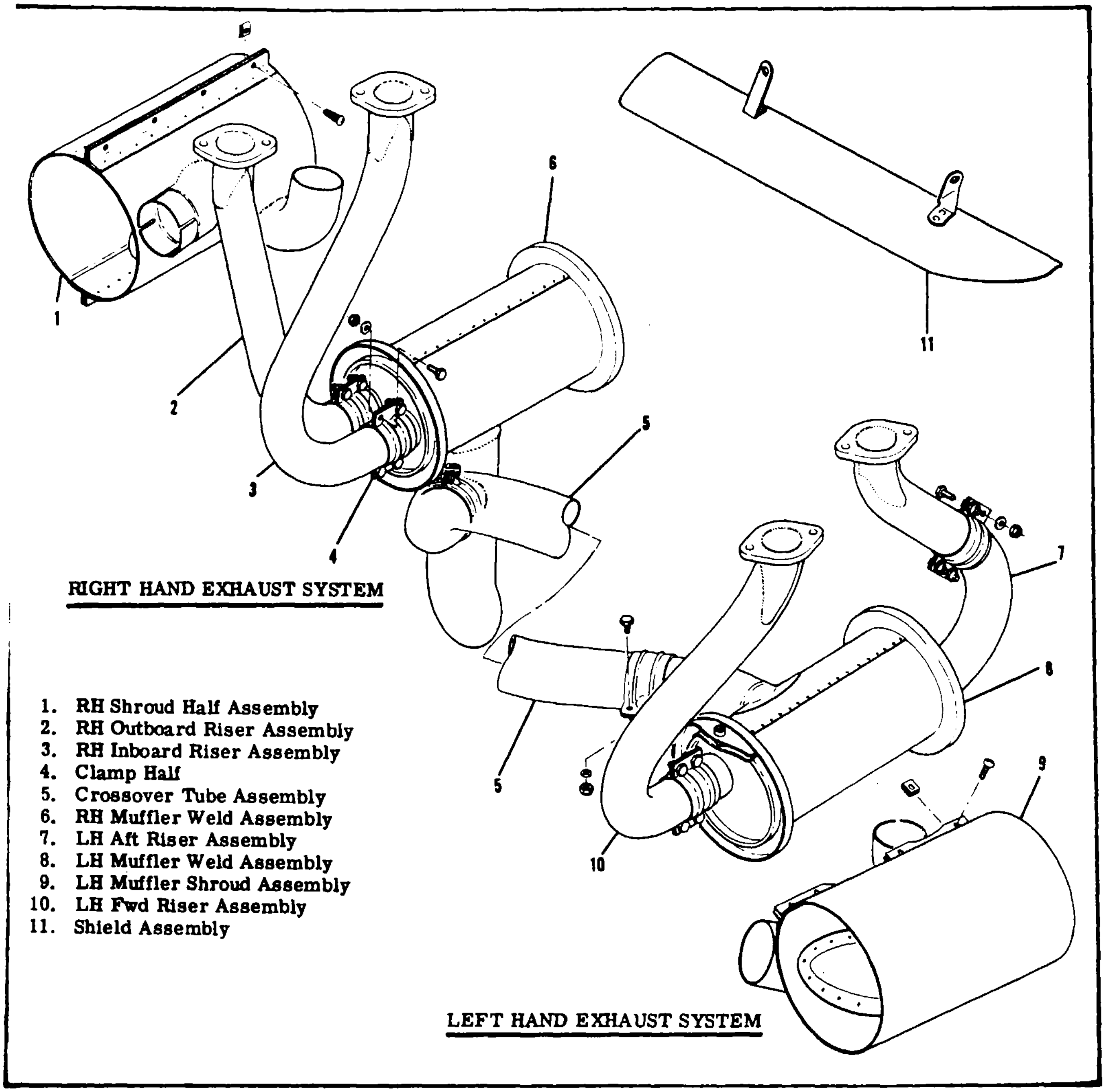
f. Remove mufflers, exhaust pipes and crossover pipe from aircraft. It may be necessary to remove heat shield to remove crossover pipe.

11-74 INSPECTION. Since exhaust systems of this type are subject to burning, cracking and general deterioration from alternate thermal stresses and vibrations, inspection is important and should be accomplished every 100 hours of operation. Also, a thorough inspection of the engine exhaust system should be made to detect cracks causing leaks which could result in loss of engine power. To inspect the engine exhaust system, proceed as follows:

a. Remove engine cowling as requred so that all surfaces of the exhaust assemblies can be visually inspected. Inaccordance with paragraph 11-12.

NOTE

Especially check the areas adjacent to welds and slip joint. Look for gas deposits in sur-




1. RH Shroud Half Assembly
2. RH Outboard Riser Assembly
3. RH Inboard Riser Assembly
4. Clamp Half
5. Crossover Tube Assembly
6. RH Muffler Weld Assembly
7. LH Aft Riser Assembly
8. LH Muffler Weld Assembly
9. LH Muffler Shroud Assembly
10. LH Fwd Riser Assembly
11. Shield Assembly

Figure 11-6. Exhaust System

rounding areas, indicating that exhaust gases are escaping through a crack or hole or around the slip joints.

b. After visual inspection, an air leak check should be made on the exhaust system as follows:

1. Attach the pressure side of an industrial vacuum cleaner to the tailpipe opening, using a rubber plug to effect a seal as required.

NOTE

The inside of the vacuum cleaner hose should be free of any contamination that might be blown into the engine exhaust system.

2. With vacuum cleaner operating, all joints in the exhaust system may be checked manually by feel, or by using a soap and water solution and watching for bubbles. All joints should be free of air leaks.

c. Where a surface is not accessible for a visual inspection, or for a more positive test, the following procedure is recommended.

1. Remove exhaust stack assemblies.
2. Use rubber expansion plugs to seal opening.

3. Using a manometer or gage, apply approximately 5- 1/2 psi (10 inches of mercury) air pressure while each stack assembly is submerged in water. Any leaks will appear as bubbles and can be readily detected.

4. It is recommended that exhaust stacks found defective be replaced before the next flight.

d. After installation of exhaust system components perform the inspection in step "b" of this paragraph to ascertain there are no leaks at the joints of the system.

5. If no defects are found, remove plugs and dry components with compressed air.

e. Install the exhaust system and engine cowling.

11-75. INSTALLATION.

NOTE

Use new gaskets, regardless of apparent condition of those removed.

a. Place all sections of the assembly in position and join together loosely with attaching clamps and braces. Tighten nuts securing exhaust pipe to cylders first; then tighten all clamps joining sections. Tighten bolts attaching mufflers to braces.

b. Torque exhaust stack nuts at cylinders to 160-180 lb-in.

c. Install engine cowling.

11-76. EXTREME WEATHER MAINTENANCE.

11-77. COLD WEATHER. Cold weather starting is made easier by the installation of the manually-operated engine primer system. Fuel is supplied by a line from the fuel strainer to the plunger type primer. Operating the primer forces fuel to the intake valve port of the cylinder. Primer lines should be replaced when crushed or broken and should be properly clamped to prevent vibration and chafing. With an external power receptacle installed, an external power source may be connected to assist in cold weather or low battery starting. Refer to paragraph 11-81 for use of the external power 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 the oil above 121°C (250°F). A flash fire may result. Before pulling the propeller through, ascertain that the magneto switch is in the OFF position to prevent accidental firing of the engine.

After preheating the oil, gasoline may be mixed with the heated oil in a ratio of 1 part fuel 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 by 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 the propeller through several revolutions by hand before starting 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 considerable amount of operational hours accumulated since their last dilution period may be seriously affected by the dilution process. This will be 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 actually enter the oil pump and be trapped by the main oil filter screen. Partial or complete loss of engine lubrication may result from either condition. If these conditions are anticipated after oil dilution, the engine should be run 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 accumulation of the sludge and carbon deposits.

11-78. HOT WEATHER. Engine starting in hot weather or with a hot engine is sometimes hampered by vapor formation at certain points in the fuel system. To purge the vapor, move the throttle to the FULL OPEN position, move the mixture control to the IDLE CUT-OFF position, turn fuel boost pump ON and advance the mixture control to the full RICH position until a pressure indication is noted on the fuel flow gage or about two seconds. Return the mixture control to the IDLE CUT-OFF position and bring the throttle back to approximately 1/4 open. Engage starter, as the mixture becomes progressively leaner, reaching a combustible mixture, the engine will start. When the engine fires, gently move the mixture control to FULL RICH. If the engine tends to die, turn boost pump switch momentarily to ON at appropriate intervals until vapor is fully cleared and the engine runs smoothly.

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 procedure with the throttle approximately one-half OPEN and the mixture control in IDLE CUT-OFF. As the engine fires, move 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 in either warm or cold temperatures. Repeat the starting procedure 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 motor.

11-79. DUSTY CONDITIONS. Dust induced into the intake system of the engine is probably the greatest single cause of early engine wear. When operating under high dust conditions, service the induction air filter daily as outlined in Section 2. Also, change engine oil and lubricate the airframe more often than specified.

11-80. 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.

11-81. GROUND SERVICE RECEPTACLE. With the ground service receptacle installed, the use of an external power source is recommended for cold weather starting and lengthy maintenance of the aircraft electrical system with the exception of electronic equipment.

NOTE

Electrical power is supplied through a split bus bar, one side containing electronic system circuits and the other side having general electrical system circuits. In the split bus system, both sides of the bus are on at all times except when either an external power source is connected or the starter switch is turned on; then a power contactor is automatically activated to open the circuit to the electronic bus. Isolating the electronic circuits in this manner prevents harmful transient voltages from damaging the semiconductors in the electronic equipment. Therefore, the external power source cannot be used as a source of power when checking electronic components. Just before connecting an external power source (generator type or battery type cart), the master switch should be turned ON.

The ground service plug receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is correctly connected to the aircraft. If the plug is accidentally connected backwards, no power will flow to the aircraft electrical system, thereby preventing any damage to electrical equipment.

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.

11-89. HAND CRANKING. A normal hand cranking procedure may be used to start the engine, if the starter is not engaged with the ring gear.

**SHOP NOTES:**

SECTION 12

# FUEL SYSTEM

TABLE OF CONTENTS



## 12-1. FUEL SYSTEM.

NOTE

The fuel system as described in this section does not include the fuel injection system. Refer to Section 11 for that part of the fuel system.

## 12-2. DESCRIPTION.

a. (Thru 177RG0282 and F177RG0062). Fuel from the wing fuel bay areas is routed through a reservoir tank and an electrical auxiliary fuel pump with bypass valve to an ON-OFF valve. From the valve, fuel flows through a fuel strainer to the engine-driven fuel pump. The fuel bays are individually vented overboard through vent lines extending to opposite wing tips. A drain plug for each vent line is located in the wing gap area of each wing. The reservoir tank is vented to the left fuel bay vent line, and is "teed" into the line immediately outboard of the left wing fuel bay. A reservoir drain valve is installed in the aft inboard side of the reservoir. Drainage is accomplished by pulling the drain control knob, located in the floor area to the left of the pilot's seat.

b. (Beginning with 177RG0283 and F177RG0063). Fuel from the wing fuel bay areas is routed through two reservoir tanks to a fuel selector valve. The valve has four positions: LEFT, BOTH, RIGHT and OFF. From the selector valve, fuel flows through an electrical auxiliary fuel pump with bypass valve, through a fuel strainer, to the engine-driven fuel pump. The fuel bays are individually vented overboard through vent lines extending to opposite wing tips. A drain plug for each vent line is located in the wing gap area of each wing. The reservoir tanks are vented to their respective fuel bay vent lines, and are "teed" into the lines immediately outboard of the fuel bays. A reservoir drain valve is installed in each reservoir tank. Drainage of both reservoir tanks simultaneously is accomplished by pulling a single control knob, located in the floor area directly beneath the pilot's seat.

## 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, purging, 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 fuel bays to the engine-driven fuel pump, use NS-40 (RAS-4) (Snap-On Tool Corp., Kenosha, Wisconsin), MIL-T-5544 (Thread Compound, Antiseize, Graphite-Petrolatum) or equivalent, as a thread lubricant or to seal a leaking connection. Apply sparingly to male threads only, omitting the first two threads. Always ensure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system. Throughout the fuel injection system, from the engine-driven fuel pump through the discharge nozzles, use only a fuel soluble lubricant, such as engine lubricating oil, on fitting threads. Do not use any other form of thread compound on the injection system.

## 12-4. TROUBLE SHOOTING.

NOTE

This trouble shooting chart should be used in conjunction with the trouble shooting chart in Section 11.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| NO FUEL FLOW TO ENGINE-DRIVEN PUMP | Selector valve not turned on. | Turn valve on. |
| | Fuel bays empty. | Service with proper grade and amount of fuel. |
| | Fuel line disconnected or broken. | Connect or repair fuel lines. |
| | Fuel bay outlet screens plugged. | Remove and clean screens and flush out fuel bays. |
| | Defective selector valve or reservoir tank drain valve. | Remove and repair or replace valve. |
| | Plugged fuel strainer. | Remove and clean strainer. |
| | Fuel line plugged. | Clean out or replace fuel line. |
| FUEL STARVATION AFTER STARTING | Partial fuel flow from the preceding causes. | Use the preceding remedies. |
| | Malfunction of engine-driven fuel pump. | Refer to Section 11. |
| | Fuel vents plugged. | See paragraph 12-18. |
| | Water in fuel. | Drain fuel bay sumps, fuel lines and reservoir tank. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| NO FUEL QUANTITY INDICATION | Fuel bays empty. | Service with proper grade and amount of fuel. |
| | Circuit breaker open or defective. | Reset. Replace if defective. |
| | Defective fuel quantity indicator or transmitter. | See Section 15. |
| | Loose connections or open circuit. | Tighten connections; repair or replace wiring. |
| NO FUEL FLOW WHEN ELECTRIC PUMP IS TURNED ON | Defective fuel pump switch. | Replace defective switch. |
| | Open or defective circuit breaker. | Reset. Replace if defective. |
| | Loose connections or open circuit. | Tighten connections; repair or replace wiring. |
| | Defective electric fuel pump. | Repair or replace pump. |
| | Defective engine-driven fuel pump bypass or defective fuel injection system. | Refer to Section 11. |

**SHOP NOTES:**

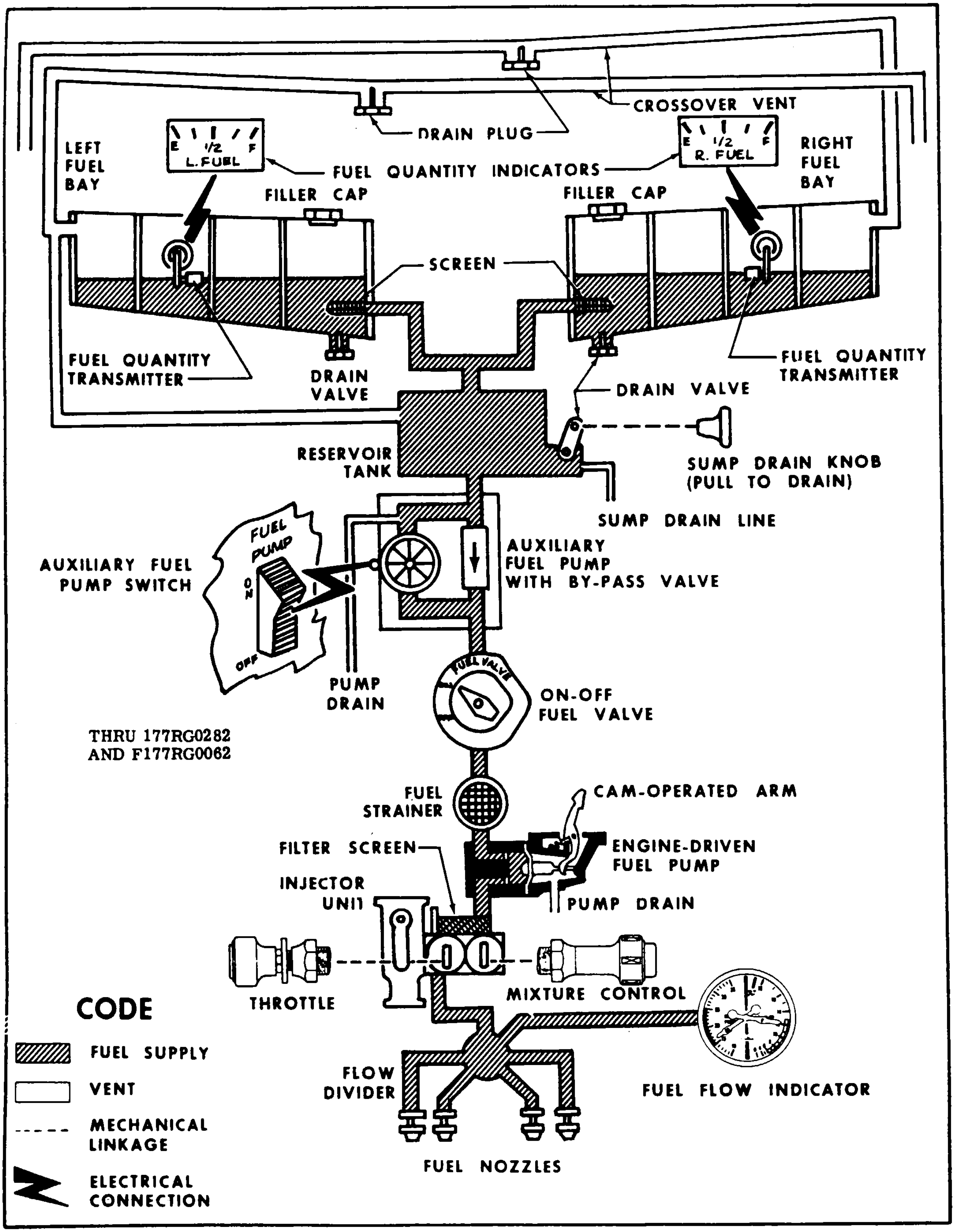
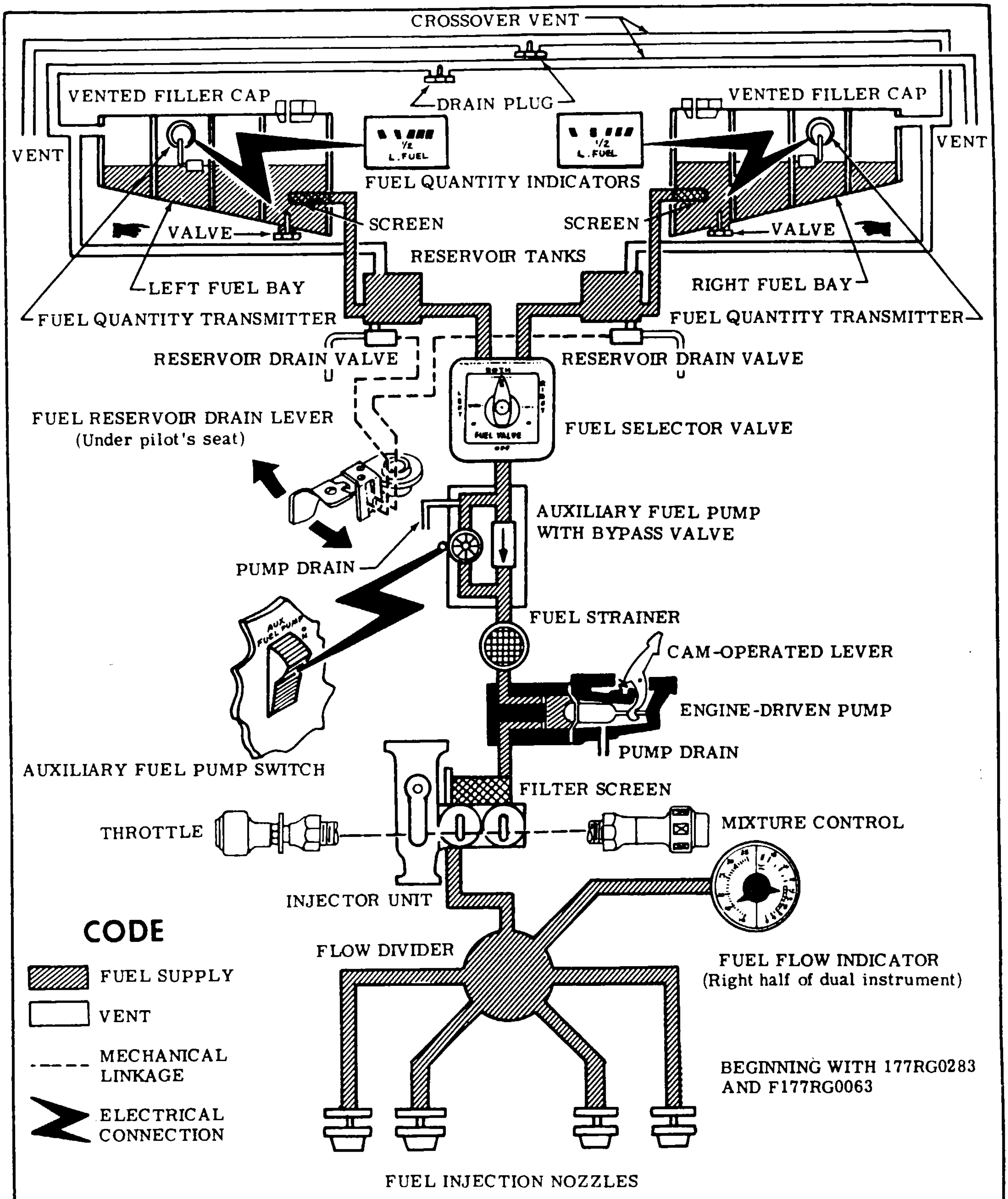
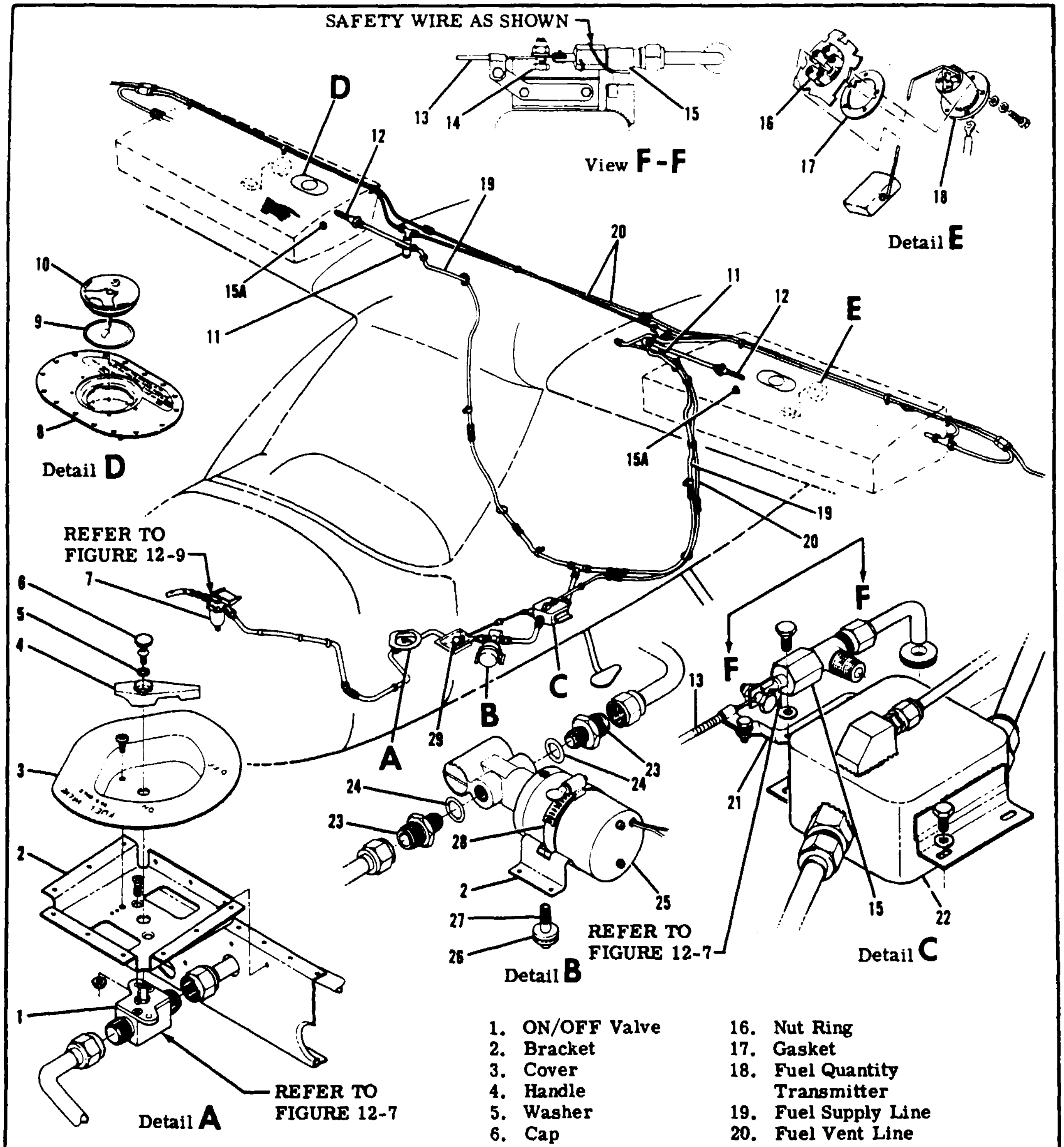



Figure 12-1. Fuel System Schematic (Sheet 1 of 2)




TO ENSURE DESIRED FUEL CAPACITY WHEN REFUELING, PLACE THE FUEL SELECTOR VALVE IN EITHER LEFT OR RIGHT POSITION TO PREVENT CROSS-FEEDING.

Figure 12-1. Fuel System Schematic (Sheet 2 of 2)



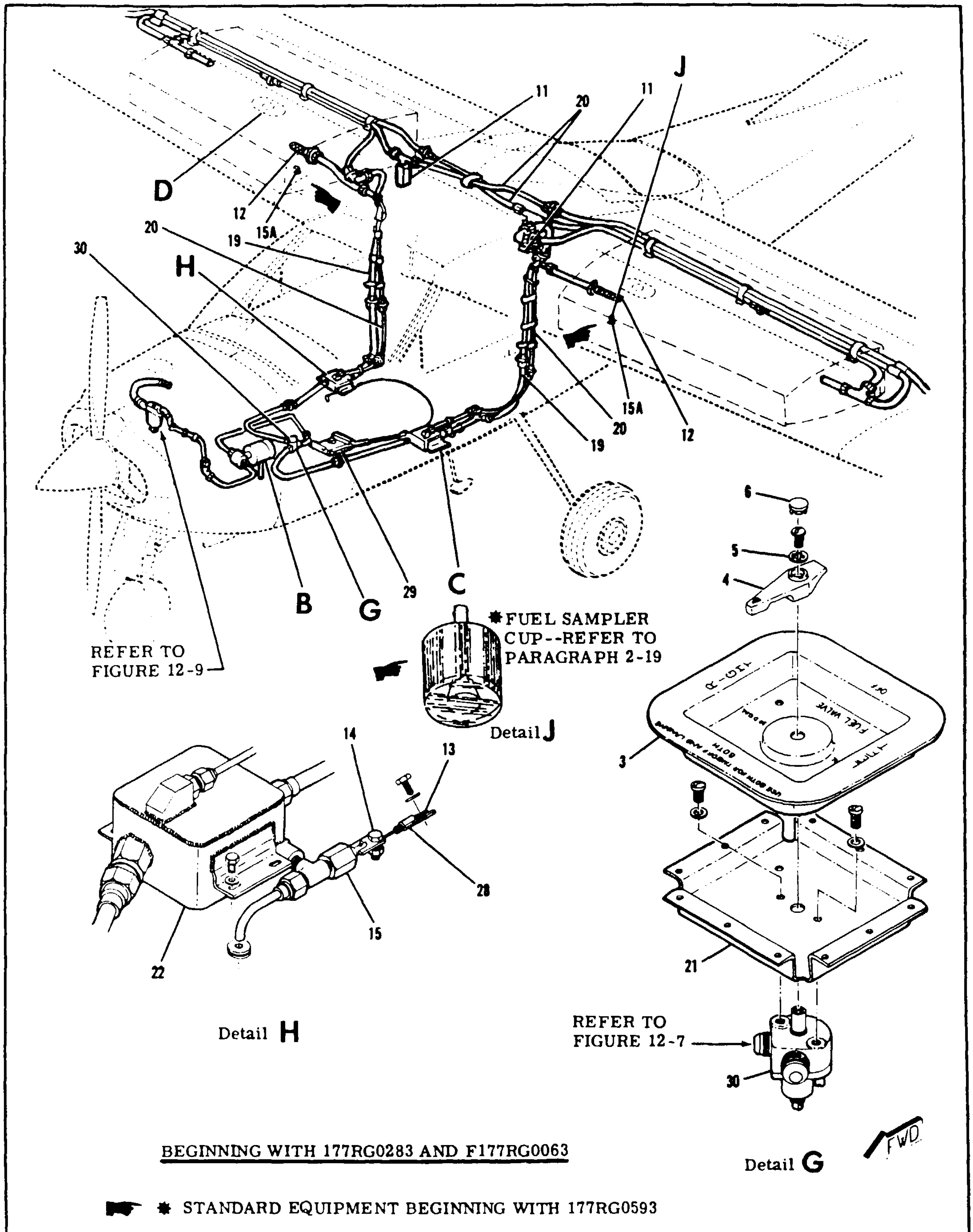

1. ON/OFF Valve
2. Bracket
3. Cover
4. Handle
5. Washer
6. Cap
7. Fuel Strainer
8. Door Assembly
9. O-Ring
10. Cap
11. Drain Fitting
12. Strainer
13. Drain Control
14. Clamp Bolt
15. Drain Valve
15A Sump Drain Valve
16. Nut Ring
17. Gasket
18. Fuel Quantity Transmitter
19. Fuel Supply Line
20. Fuel Vent Line
21. Bracket
22. Reservoir Tank
23. Reducer
24. Packing
25. Auxiliary Fuel Pump
26. Grommet
27. Vent Tube
28. Clamp
29. Drain Control Knob
30. Selector Valve

NOTE

Refer to figure 12-5 for details of the fuel vent system.

THRU 177RG0282 AND F177RG0062

Figure 12-2. Fuel System (Sheet 1 of 2)




BEGINNING WITH 177RG0283 AND F177RG0063

* STANDARD EQUIPMENT BEGINNING WITH 177RG0593

Figure 12-2. Fuel System (Sheet 2 of 2)

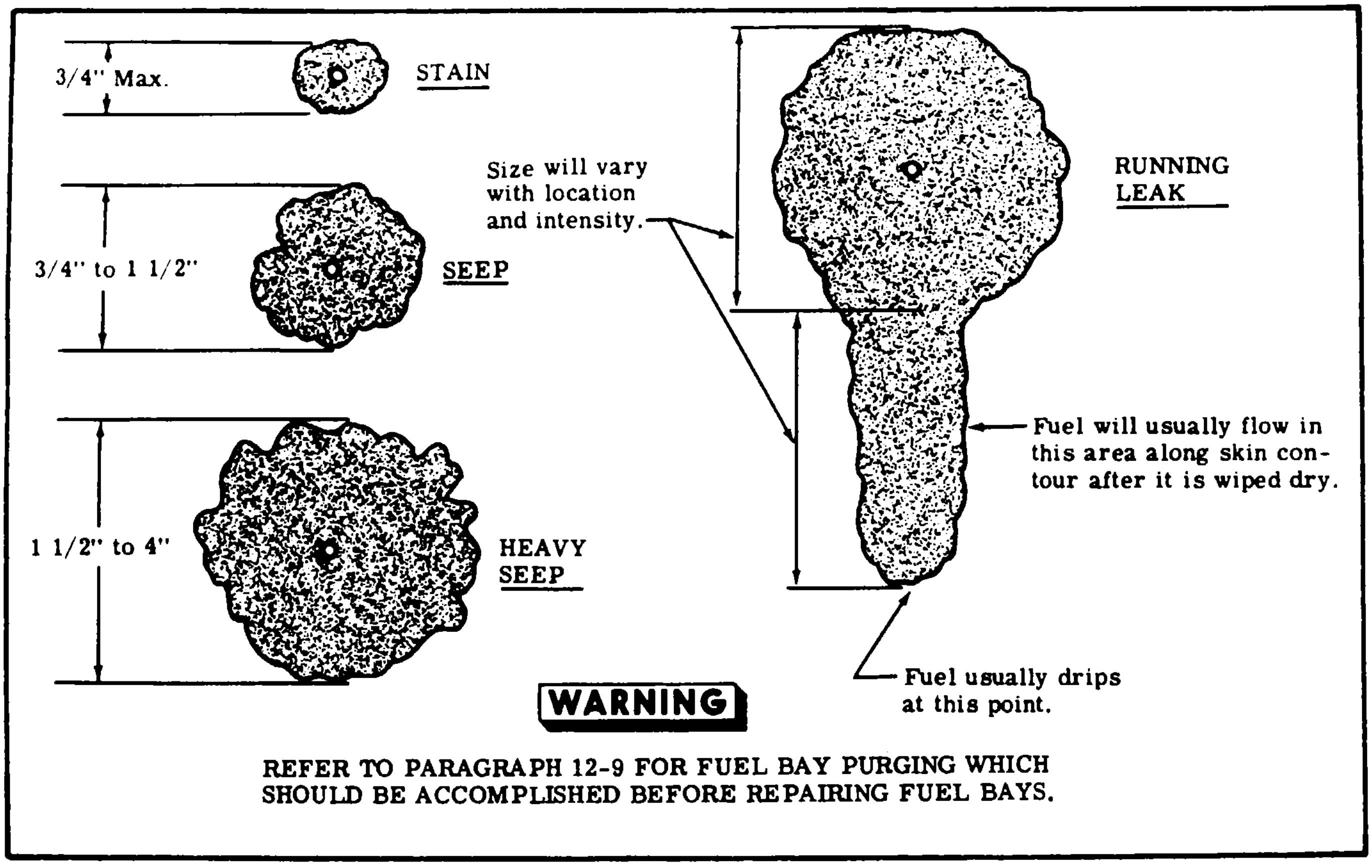



Figure 12-3. Classification of Fuel Leaks

12-5. FUEL BAYS.

12-6. DESCRIPTION. Aircraft with cantilever wings have an inboard section of each wing, forward of the main spar, sealed to form an integral fuel bay area. The bay consists of a front and rear fuel spar, inboard, outboard and intermediate ribs and stringers. Thru serials 177RG0282 and F177RG0062, usable fuel in each bay is 25.0 gallons when completely filled. Beginning with Serials 177RG0283 and F177RG0063, usable fuel in each bay is 30.0 gallons when completely filled. A 22 gallon marker, in the form of a series of small holes just inside the filler neck, is provided to facilitate fueling to reduced fuel loads.

12-7. FUEL BAY LEAKS.

12-8. CLASSIFICATION OF FUEL LEAKS. Fuel leaks which do not constitute a flight hazard are stains, seeps and heavy seeps NOT in an enclosed area. However, they should be repaired when the aircraft is grounded for other maintenance. Fuel leaks which constitute a flight hazard are running leaks in any area, seeps, heavy seeps or stains in an enclosed area, such as the wing leading edge, the sections of wing inboard and outboard of the fuel bay and the area between the rear fuel spar and the main spar. These leaks must be repaired before that bay is used for another flight. The wet or stained spot on the wing in the area of the bay is an indication of the intensity of the leak. Fuel leak classifications are shown in figure 12-3.

NOTE

Stains and seeps that are not considered a flight hazard must be inspected after each flight to ensure that they have not grown in intensity to the point of causing a flight hazard.

12-9. FUEL BAY PURGING.

**WARNING**

To reduce the possibility of an explosion while repairing integral fuel bays which have been fueled, the bay may be purged with an inert gas.

The following procedure may be used to purge the bay with argon or carbon dioxide.

a. Ground aircraft to a suitable ground stake.
b. Turn selector valve to OFF position.
c. Drain all fuel from bay being repaired. Observe precautions outlined in paragraph 12-3.
d. Disconnect fuel and vent lines from bay.
e. Remove access doors and insert hose to each end of bay simultaneously.
f. Allow inert gas to flow into bay for several minutes (time dependent upon hose size, rate of flow, etc.) to remove all fuel vapors.

Since argon or carbon dioxide are heavier than air, these gasses will remain in the bay during the repair. The repair should be made using non-sparking tools (air motors, plastic scrapers, etc.)

NOTE

Portable vapor detectors are available to determine pressure of explosive mixtures and are calibrated for leaded fuel. These detectors can be used to determine when it is safe to make repairs.

12-10. INTEGRAL FUEL BAY SEALANT. Two kinds of sealants are used, one to seal the fuel bay area, and the other to seal the access doors. The access door sealant is more pliable and will not adhere to metal as firmly as the bay sealant does. This permits the access doors to be removed without damage to them. Service Kit SK210-56, available from the Cessna Service Parts Center, contains these sealants with the proper quantity of accelerator for each sealant. The sealants and accelerators can be identified by the color of the material.

**WARNING**

Keep sealants away from heat and flame. Use only in a well ventilated area. Avoid skin and eye contact. WEAR EYE SHIELDS. In case of eye contact, flush with copious amounts of water and get prompt medical attention.

12-11. MIXING SEALANT. Mix sealant in accordance with instructions supplied with Service Kit SK210-56.

12-12. SEALING DURING AND AFTER STRUCTURAL REPAIR.

**CAUTION**

Protect drain holes and fuel outlet screens when applying sealants.

Any repair that breaks the fuel bay seal will necessitate resealing of that area of the bay. Repair parts that need sealing must be installed and riveted during the sealing operation. All joints within the boundary of the bay, but which do not provide a direct fuel path out of the bay, such as stringers and rib flanges within the bay, must be fay surface sealed only. Joints which provide a direct fuel path out of the bay area, such as fuel spar flanges and outboard rib flanges, must be fay surface sealed and fillet sealed on the fuel side. Fay surface sealing is applying sealant to one mating part before assembly. Enough sealant must be applied so it will squeeze out completely around the joint when the parts are riveted or fastened together. The fillet seal is applied after the joint is fay surface sealed and riveted or fastened together. Fillet sealing is applying sealant to the edge of all riveted joints, joggles, bend reliefs, voids, rivets or fasteners through the boundary of the bay and any place that could produce a fuel leak. The fay sealant need not be cured before the fillet seal is applied, but the squeezed-out sealant, to which the fillet sealant is applied, must be free of dirt and contamination. Fillets laid on intersecting joints shall be joined together to produce a continuous fillet. Filler sealant must be pressed into the joint, working out all entrapped air. The best method of applying sealant is with an extrusion gun. Then work the sealant into the joint with a small paddle, being careful to eliminate all air bubbles.

NOTE

During structural repair, parts must be predrilled, countersunk or dimpled and cleaned before being sealed and positioned for final installation.

a. Remove all existing sealant from area to be sealed, leaving a taper on the remaining sealant. The taper will allow a scarf bond and a continuous seal when the new sealant is applied.

NOTE

The best method of removing sealant is with a chisel-like tool made of hard fiber. Remaining sealant may then be removed with aluminum wool. Steel wool or sand paper must not be used.

b. Vacuum thoroughly to remove all chips, filings, dirt, etc., from the bay area.
c. All surfaces and areas to be sealed shall be thoroughly cleaned by wiping with a clean cloth dampened with Methyl Ethyl Ketone (MEK), acetone or similar solvent and dried with a clean cloth before the solvent evaporates. Always pour the solvent on the cloth. Never use a contaminated solvent. The cloth shall not be so saturated that dripping occurs.

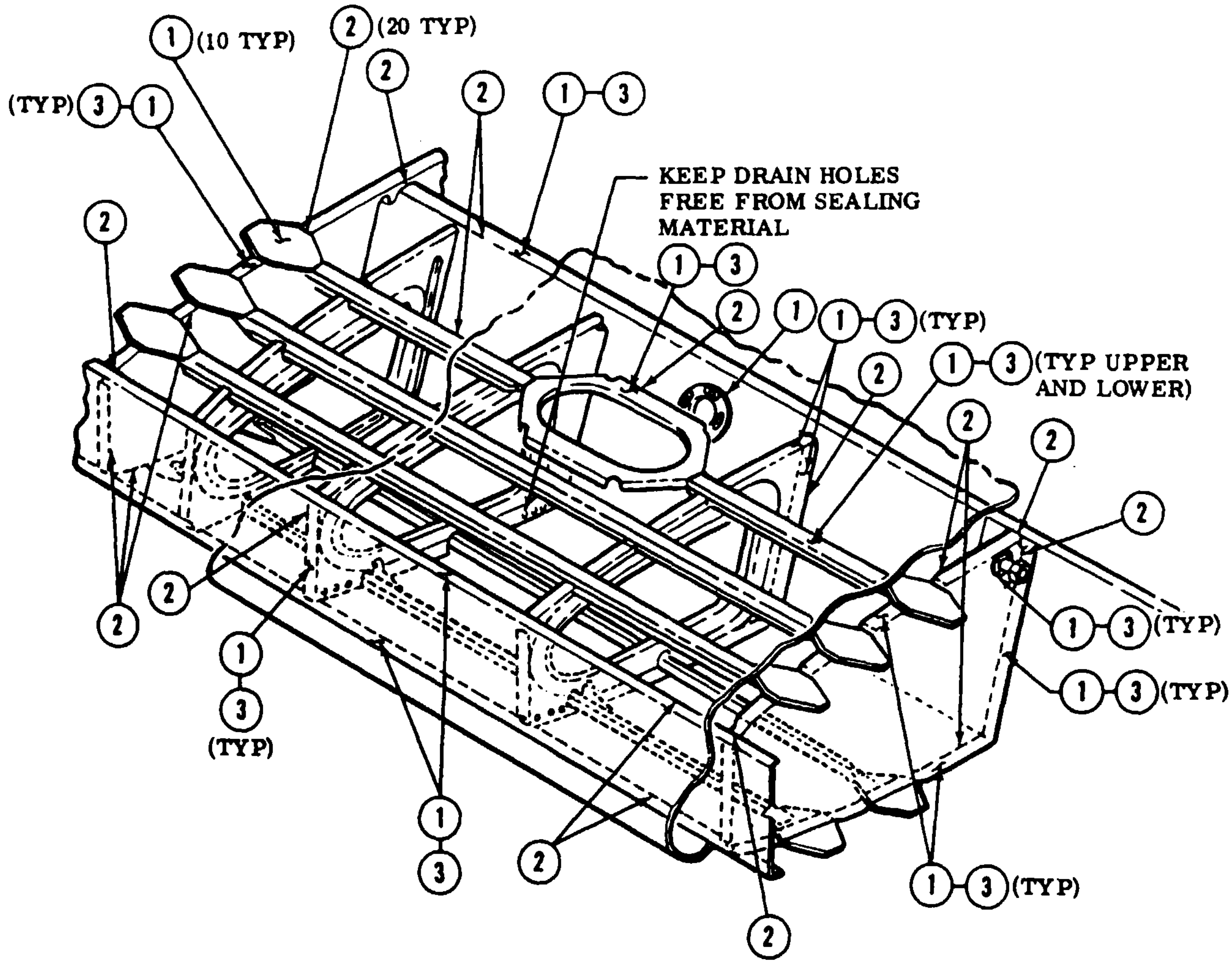
NOTE

Allowable work life of Tank Area Sealant is two hours from the starting time of mixing. Allowable work life of Access Cover Sealant is two hours. These apply to standard conditions of 77° Fahrenheit and 50% relative humidity. An increase in temperature or a decrease in humidity will shorten the work life of the sealant.

d. Apply fay surface sealant to one mating part and install rivets or fasteners while sealant is still within its allowable work life.

NOTE

During the sealing operation, sealant must be checked at various times to determine that it has not exceeded its allowable work life. Use a small wood paddle, such as a tongue depressor, to gather some sealant. Touch the sealant to a piece of clean sheet metal. If the sealant adheres to the sheet metal, it is still within its allowable work life. If the sealant does not adhere to the




NOTE

Types of sealing shown in this figure are used during manufacture of the fuel area. The same types should be used when making a structural repair to the fuel bay area, and when reinstalling the access doors or the fuel quantity transmitter plate.

CODE

1 FAYING SURFACE SEAL

2 FILLET SEAL

3 RIVET AND FASTENER SEAL

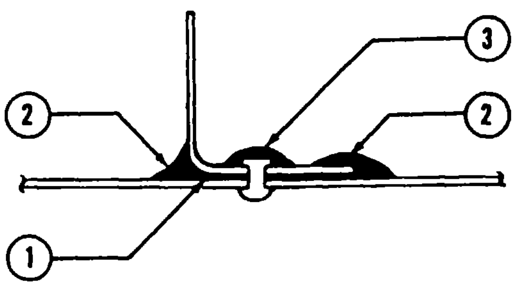
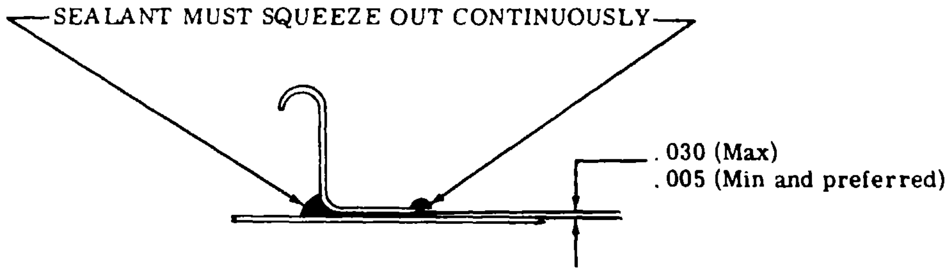
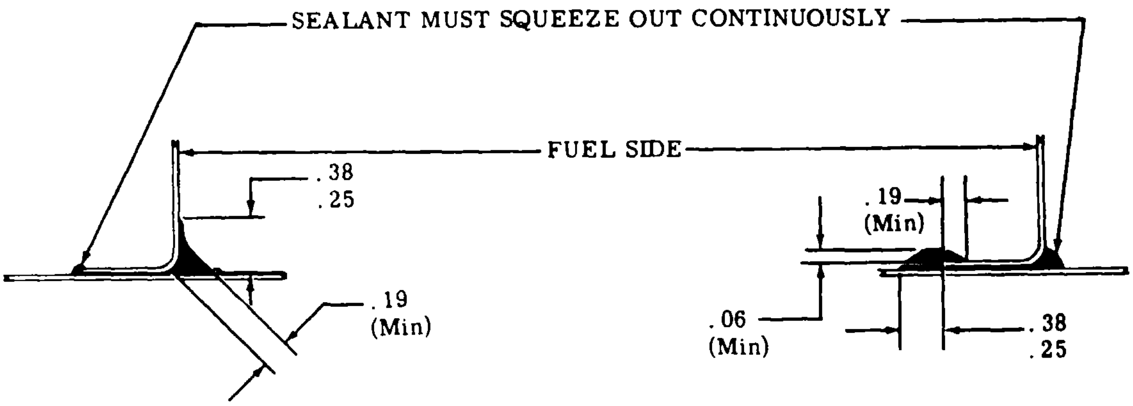



Figure 12-4. Fuel Bay Sealing (Sheet 1 of 2)




FAY SURFACE SEALING




FILLET SEALING (With fay surfaces sealed)


FASTENER SEALING

Figure 12-4. Fuel Bay Sealing (Sheet 2 of 2) sheet metal, it is beyond its allowable work life and must not be used.

e. Apply a fillet seal to the repaired area on the inside of the bay.
f. Apply fay surface door sealant to access doors and fuel quantity transmitter adapter plate, if removed, and install the doors and adapter.
g. Allow the sealant to cure. Refer to paragraph 12-14 for curing time.
h. Clean stains from outside of bay area.
i. Test fuel bay for leaks as described in paragraph 12-15.

12-13. SEALING FUEL LEAKS. First determine the source of the fuel leaks. Fuel can flow along a seam or the structure of the wing for several inches, making the leak source difficult to find. A stained area is an indication of the leak source. Fuel leaks can be found by testing the complete bay as described in paragraph 12-15. Another method of detecting the source of a fuel leak is to remove access doors and blow with an air nozzle from inside of the bay in the area of the leak while a soap bubble solution is applied to the outside of the bay. After the leak source has been found, proceed as follows:
a. Remove existing sealant in the area of the leak as described in paragraph 12-12 step "a."
b. Clean the area and apply a fillet seal. Press sealant into leaking area with a small paddle, being sure to work out all entrapped air.
c. If a leak occurs around a rivet or bolt, restrike the rivet or torque the bolt to the maximum allowable torque and repair any damaged sealant.
d. Apply fay surface door sealant to access doors or fuel quantity transmitter adapter plate, if removed, and install the doors and adapter plate.
e. Test fuel bay for leaks as described in paragraph 12-15.

12-14. CURING TIME. Service Kit 210-56 contains Fuel Bay Area Sealant and Access Door Sealant. Normal curing time for fuel bay area sealant is 72 hours. Normal curing time for access door sealant is 24 hours. These values are based on a standard condition of 77° Fahrenheit and 50% humidity. Curing time may be accelerated as shown in the following chart.

NOTE

Fuel bay must be vented to relieve pressure during accelerated curing.

| Temperature of Sealant °F. | Time in Hours |
|---|---|
| 160 | 3 |
| 140 | 4 |
| 120 | 7 |

**WARNING**

Access door sealant must not be heated above 90° until sealant is cured for 24 hours based on a standard condition of 77° Fahrenheit and 50% relative humidity. Harmful vapors are released if sealant is heated above 90°F.

12-15. TESTING INTEGRAL FUEL BAY.
a. Remove vent line from vent fitting and cap the fitting.
b. Remove forward and aft fuel lines from bay.
c. An air or inert gas source, regulated at 0.8 psig (max.), should be attached to the bay with a suitable water manometer or other pressure measuring device. All other openings shall be closed off and a positive pressure of .5 psig applied to the fuel bay. The system shall then be closed so that no further pressure is applied. After 5 minutes, no pressure drop shall be observed.

NOTE

Thermal instability will result in variation in the pressure readings. Time should be allowed as required to permit stabilization of the system prior to testing.

d. Make sure filler cap is installed and sealed.

**CAUTION**

Do not attempt to apply pressure to the bay without a good regulator and a positive shut-off in the supply line. Do not pressurize the fuel bay to more than .5 psig, or damage may occur.

e. Reseal and retest if any leaks are found.

12-16. FUEL VENTS.

12-17. DESCRIPTION.
a. (Thru 177RG0282 and F177RG0062). A fuel bay vent line extends from the upper aft corner of each fuel bay to the opposite wing tip. These vent lines each contain a drain plug, located just outside of each cabin door. A reservoir tank vent line is routed from the reservoir tank to the left fuel bay vent line, and is "teed" into that line, just outboard of the left fuel bay.
b. (Beginning with 177RG0283 and F177RG0063). A fuel bay vent line extends from the upper aft corner of each fuel bay to the opposite wing tip. These vent lines each contain a drain plug, located just outside of each cabin door. A reservoir tank vent line is routed from each reservoir tank to each fuel bay vent line, and is "teed" into their respective line, just outboard of each fuel bay.

12-18. CHECKING FUEL VENTS. Field experience has demonstrated that fuel vents can become plugged, causing possible fuel starvation of the engine. Also, the bleed hole in the vent valve assembly could possibly become plugged, allowing pressure from expanding fuel to pressurize the bay areas. The following procedure may be used to check the vent and bleed hole in the valve assembly.
a. Cover drilled holes approximately 6 inches from end of vent lines at trailing edges of wing tips.
b. Attach a rubber tube to end of vent line at trailing edge of one wing tip.

NOTE

Removal and installation procedures are written for each area identified by the letters shown in this figure. Refer to paragraphs 12-19 thru 12-27 for procedures.

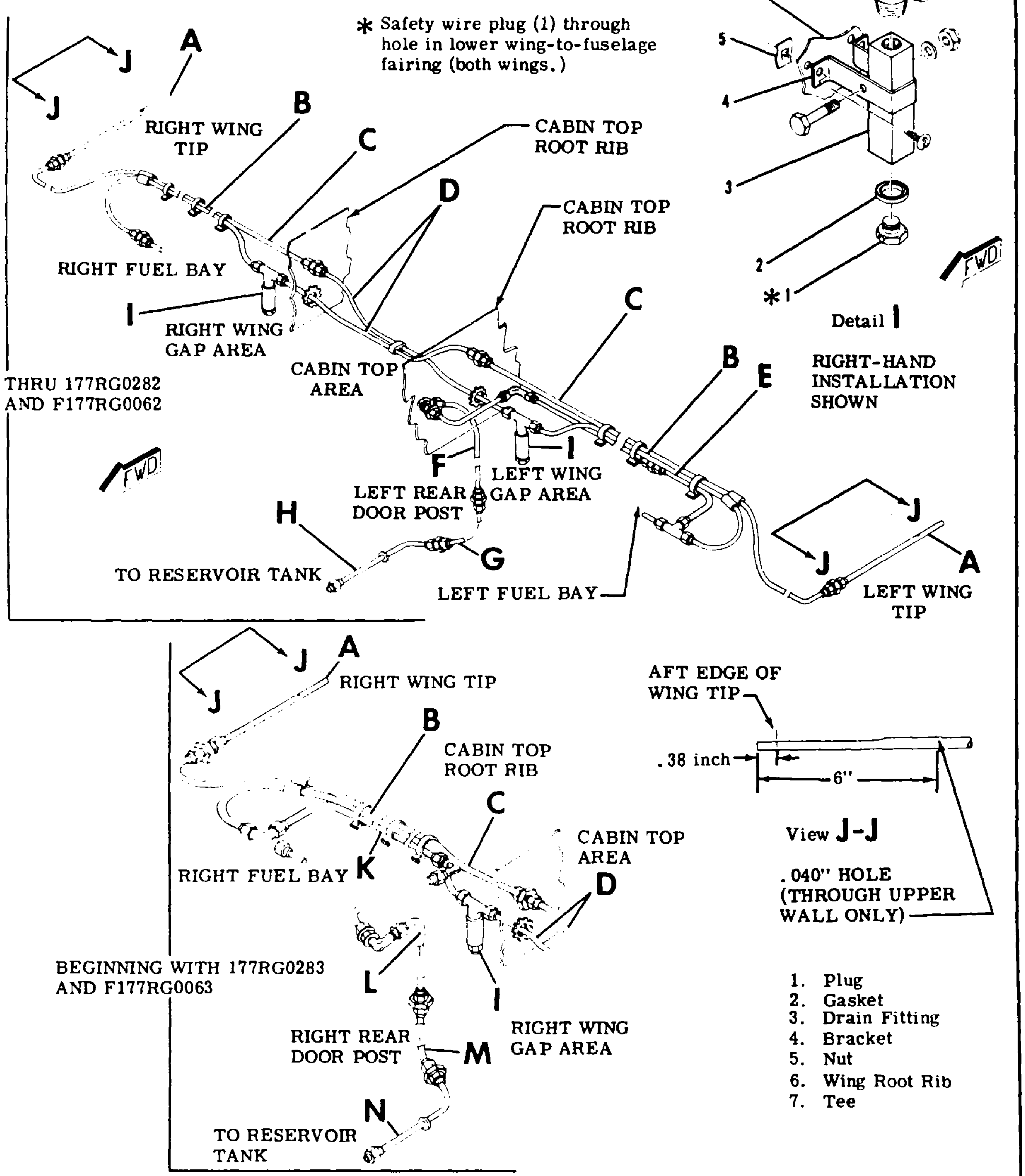



Figure 12-5. Fuel Vent System

c. Turn selector valve to ON position and check that filler cap on bay being tested is securely installed.

d. Blow into tube at opposite wing tip to slightly pressurize the fuel bay. If air can be blown into bay, the vent line is open.

e. After fuel bay 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.

f. Repeat this procedure for fuel vent at opposite wing tip.

NOTE

Remember that a plugged vent line or bleed hole can cause either fuel starvation or the pressurizing of the bay by fuel expansion. Therefore, any fuel vent found plugged or restricted must be corrected before returning aircraft to service.

CAUTION

Be sure to uncover drilled holes in vent lines at wing tips after completion of check.

NOTE

Removal and installation procedures are written for each area identified by the letters shown in figure 12-5.

12-19. REMOVAL AND INSTALLATION. (Area "A", figure 12-5.)

a. Remove clamp from vent line inside wing tip.
b. Remove wing tip.
c. Disconnect vent line at union; remove vent line.
d. Reverse preceding steps for installation.

CAUTION

Ensure vent line is installed as shown in view J-J.

12-20. REMOVAL AND INSTALLATION. (Area "B", figure 12-5.)

a. Break safety wire at drain fitting in lower wing-to-fuselage fairing.
b. Remove fairing and drain fuel from fitting. (Observe precautions outlined in paragraph 12-3.)
c. Remove cover plates in lower wing skin as necessary for access.
d. Remove clamping along tube routing.
e. Disconnect vent line at outboard end of fuel bay in right wing, or at outboard end of tee in left wing.
f. Disconnect vent line at hose fitting, and remove outboard tube through access hole in wing skin.
g. Disconnect inboard tube at drain fitting in wing gap area, and remove through wing root rib.
h. Reverse preceding steps for installation.

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-21. REMOVAL AND INSTALLATION. (Area "C", figure 12-5.)

a. Break safety wire at drain fitting in lower wing-to-fuselage fairing and remove fairing.
b. Remove cover plates in lower wing skin as necessary for access.
c. Remove clamp from vent line inside wing tip and remove tip.
d. Remove clamping along tube routing.
e. Disconnect inboard end of tube at cabin top root rib inside wing gap area.
f. Remove vent tube by pulling out through wing tip.
g. Reverse preceding steps for installation.

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-22. REMOVAL AND INSTALLATION. (Area "D", figure 12-5.)

a. Break safety wire at drain fitting in lower wing-to-fuselage fairing.
b. Remove fairing and drain fuel from fitting. (Observe precautions outlined in paragraph 12-3.)
c. Remove overhead console and forward headliner as outlined in Section 3.
d. Remove clamping in cabin top.
e. Disconnect line at fitting in cabin top root rib.
f. Disconnect opposite end of line at drain fitting in wing gap area.
g. Remove vent line by pulling into cabin area.
h. Reverse preceding steps for installation.

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-23. REMOVAL AND INSTALLATION. (Area "E", figure 12-5.)

a. Break safety wire at drain fitting in left lower wing-to-fuselage fairing and remove fairing.
b. Remove cover plates in lower wing skin as necessary for access.
c. Remove clamping along tube routing.
d. Disconnect inboard end of inner vent tube at cabin top root rib in wing gap area.
e. Disconnect outboard end of inner vent tube at union inside wing.
f. Remove inner vent tube by pulling into wing gap area.
g. Disconnect inboard end of outer vent tube at union inside wing.
h. Disconnect opposite end of outer tube at aft end of tee at outboard end of fuel bay and remove tube through access hole in wing skin.
i. Reverse preceding steps for installation.

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-24. REMOVAL AND INSTALLATION. (Area "F", figure 12-5.)

a. Break safety wire at drain fitting in lower wing-to-fuselage fairing and remove fairing.

b. Drain fuel cells through drain valves. Drain reservoir tank and fuel lines by pulling drain control knob to left of pilot seat. (Observe precautions outlined in paragraph 12-3.)

c. Disconnect vent line fitting at cabin top root rib in wing gap.

d. Remove upholstery along left rear door post as necessary to gain access.

e. Disconnect vent tube at union along door post.

f. Remove vent line by pulling down along door post.

g. Reverse preceding steps for installation.

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-25. REMOVAL AND INSTALLATION. (Area "G", figure 12-5.)

a. Drain fuel cells through drain valves. Drain reservoir tank and fuel lines by pulling drain control knob to left of pilot seat. (Observe precautions outlined in paragraph 12-3.)

b. Remove upholstery along left rear door post as necessary to gain access to union.

c. Disconnect vent tube at union along door post.

d. Remove rear seat, carpeting and access plates as necessary for access to union.

e. Disconnect tube at union and remove tube by pulling up toward door post.

f. Reverse preceding steps for installation.

12-26. REMOVAL AND INSTALLATION. (Area "H", figure 12-5.)

a. Drain fuel cells through drain valves. Drain reservoir tank and fuel lines by pulling drain control knob to left of pilot seat. (Observe precautions outlined in paragraph 12-3.)

b. Remove rear seat, carpeting and access plates as necessary for access to union and reservoir tank.

c. Disconnect tube at union and reservoir tank, and remove tube.

d. Reverse preceding steps for installation.

12-27. REMOVAL AND INSTALLATION OF DRAIN FITTING. (Detail "I", figure 12-5.)

a. Break safety wire at drain fitting in lower wing-to-fuselage fairing.

b. Remove fairing and drain fuel from fitting. (Observe precautions outlined in paragraph 12-3.)

c. Disconnect vent lines from tee (7).

d. Remove bolt, nut and washer from bracket (4).

e. Remove drain fitting.

f. Reverse preceding steps for installation.

12-28. REMOVAL AND INSTALLATION. (Area "K", figure 12-5.)

a. Break safety wire at drain fitting in right lower wing-to-fuselage fairing and remove fairing.

b. Remove cover plates in lower wing skin as necessary for access.

c. Remove clamping along tube routing.

d. Disconnect inboard end of inner vent tube at cabin top root rib in wing gap area.

e. Disconnect outboard end of inner vent tube at union inside wing.

f. Remove inner vent tube by pulling into wing gap area.

g. Disconnect inboard end of outer vent tube at union inside wing.

h. Disconnect opposite end of outer tube at aft end of tee at outboard end of fuel bay and remove tube through access hole in wing skin.

i. Reverse preceding steps for installation.

**SHOP NOTES:**

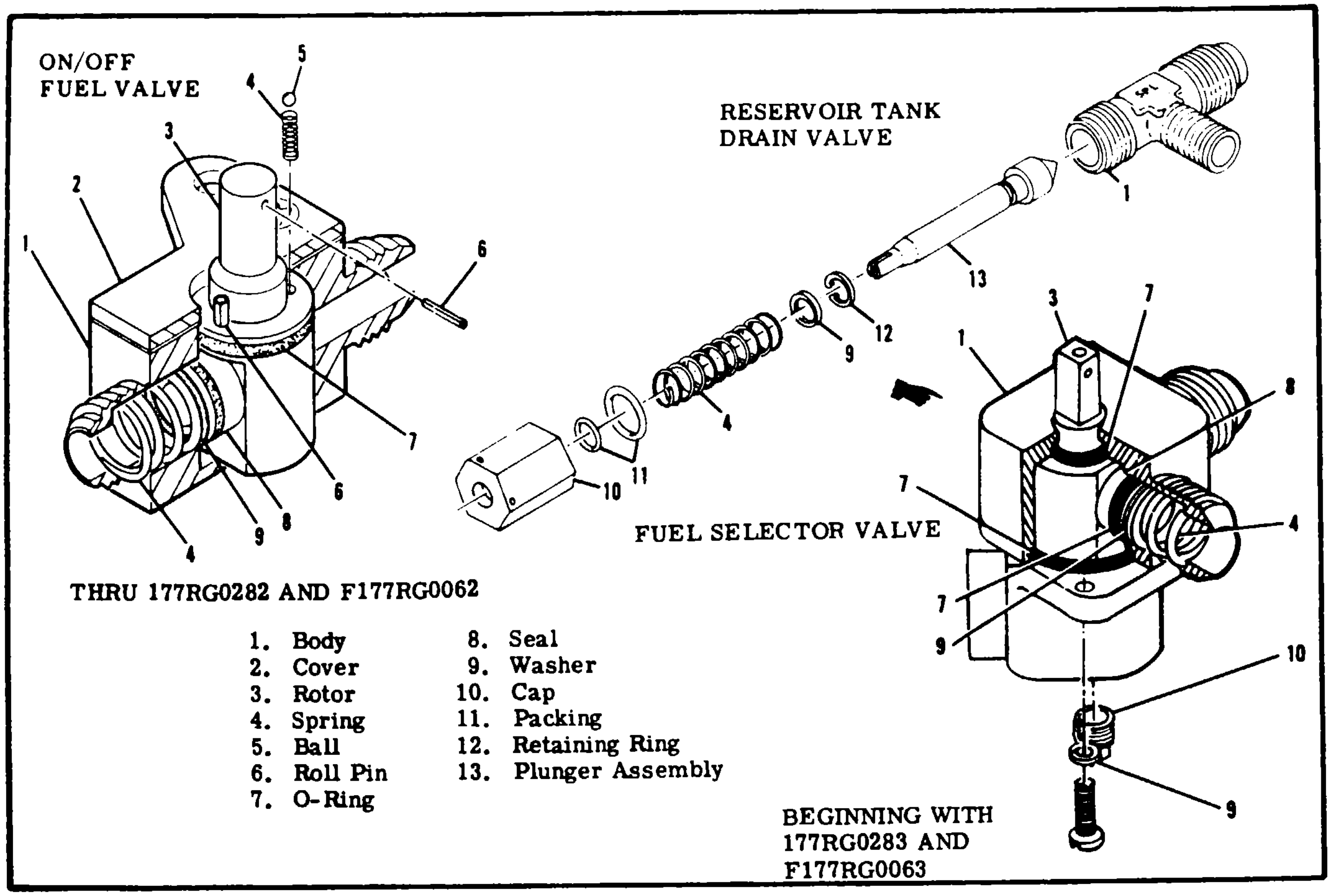



Figure 12-6. Selector Valves and Reservoir Tank Drain Valve

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-29. REMOVAL AND INSTALLATION (Area "L", figure 12-5.)

a. Break safety wire at drain fitting in lower wing-to-fuselage fairing and remove fairing.
b. Drain fuel cells through drain valves. Drain reservoir tanks and fuel lines by pulling drain control under pilot seat. (Observe precaution outlined in paragraph 12-3.)
c. Disconnect vent line fitting at cabin top root rib in wing gap area.
d. Remove upholstery along right rear door post as necessary to gain access.
e. Disconnect vent tube at union along door post.
f. Remove vent line by pulling down along door post.
g. Reverse preceding steps for installation.

NOTE

Be sure to safety wire drain fitting in lower wing-to-fuselage fairing.

12-30. REMOVAL AND INSTALLATION. (Area "M", figure 12-5.)

a. Drain fuel cells through drain valves. Drain reservoir tanks and fuel lines by pulling drain control under pilot seat. (Observe precautions outlined in paragraph 12-3.)
b. Remove upholstery along right rear door post as necessary to gain access to union.
c. Disconnect vent tube at union along door post.
d. Remove rear seat, carpeting and access plates as necessary for access to union.
e. Disconnect tube at union and remove tube by pulling up toward door post.
f. Reverse preceding steps for installation.

12-31. REMOVAL AND INSTALLATION. (Area "N", figure 12-5.)

a. Drain fuel cells through drain valves. Drain reservoir tanks and fuel lines by pulling drain control under pilot seat. (Observe precautions outlined in paragraph 12-3.)
b. Remove rear seat, carpeting and access plates as necessary for access to union and reservoir tank.
c. Disconnect tube at union and reservoir tank, and remove tube.
d. Reverse preceding steps for installation.

12-32. FUEL QUANTITY TRANSMITTERS.

12-33. DESCRIPTION. Two fuel quantity indicators, located on the instrument panel, are actuated individually by an electric fuel quantity transmitter installed on each aft fuel spar. The transmitters consist of a float attached to a pivoted rod, one end of which is a rheostat wiper. The vertical motion of the fuel causes angular travel of the float which increases and/or decreases the amount of electrical resistance in the circuit. The resistance regulates the amount of needle deflection which indicates fuel level.

12-34. REMOVAL AND INSTALLATION. Refer to Section 15 of this manual for removal and installation procedures and calibration instructions.

12-35. FUEL RESERVOIR TANK. (Thru 177RG0282 and F177RG0062). (Refer to figure 12-2, sheet 1.)

12-36. DESCRIPTION. A fuel reservoir tank is installed in the floorboard area under the pilot's seat. The tank has three fuel line connections; one from a tee in the supply lines from the fuel bays, one to the auxiliary electric fuel pump, and one teed into the left fuel bay vent line. A sump drain valve is installed in the aft inboard side of the tank. Drainage is accomplished by pulling the sump drain control located in the floor area to the left of the pilot's seat.

12-37. REMOVAL AND INSTALLATION.
a. Completely drain all fuel from wing bays, lines and reservoir tank. (Observe precautions in paragraph 12-3.)
b. Remove pilot's seat, carpeting, and access cover above reservoir tank.
c. Disconnect and cap or plug all fuel lines at reservoir.
d. Disconnect drain control at clamp and valve on tank.
e. Remove bolts attaching tank to aircraft structure, and lift out the tank.
f. Reverse preceding steps to install reservoir tank.

12-38. FUEL RESERVOIR TANKS. (Beginning with 177RG0283 and F177RG0063.) (Refer to figure 12-2, sheets 1 and 2.)

12-39. DESCRIPTION. A fuel reservoir tank is located in the floorboard area on each side of the aircraft, immediately aft of the pilot and copilot seats. Draining of both tanks simultaneously is accomplished by pulling the reservoir tank drain control located in the floor area directly beneath the pilot's seat.

12-40. REMOVAL AND INSTALLATION.
a. Completely drain all fuel from wing bays, lines and reservoir tanks. (Observe precautions in paragraph 12-3.)
b. Remove seat, carpeting and access cover above tank to be removed.
c. Disconnect and cap or plug all fuel lines at reservoir tank.
d. Disconnect drain control at clamp and valve at tank.
e. Remove bolts attaching tank to aircraft structure, and lift out tank.
f. Reverse preceding steps to install reservoir tank.

12-41. FUEL RESERVOIR TANK DRAIN VALVES.

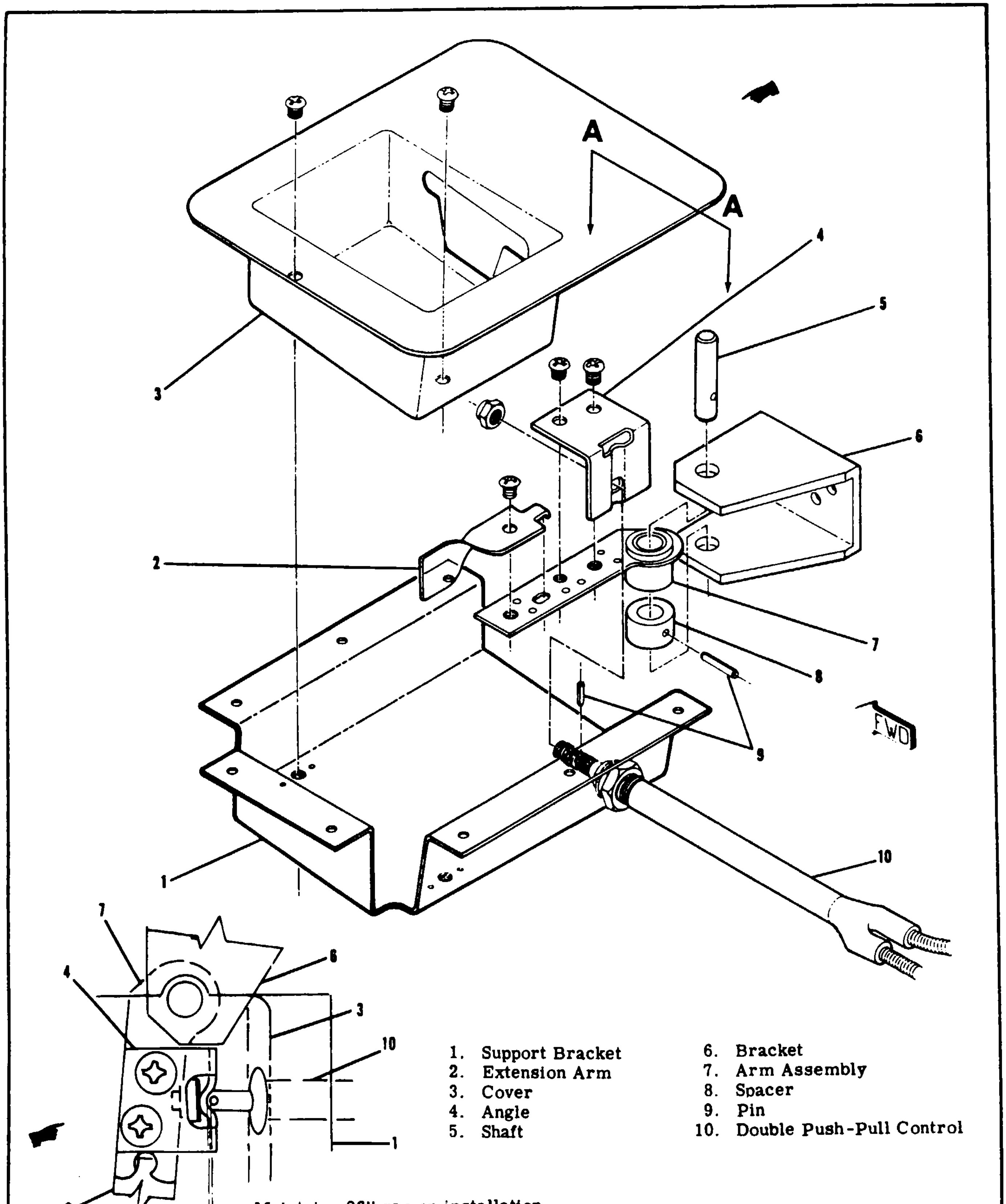
12-42. DESCRIPTION. A reservoir tank drain valve is attached to a boss on the side of each fuel reservoir tank, located in the floorboard area of the aircraft. Thru 177RG0282 and F177RG0062, a single reservoir tank and valve assembly is installed under the pilot's seat. Beginning with 177RG0283 and F177RG0063, a tank and valve assembly is located on each side of the aircraft, immediately aft of the pilot and copilot seats. Drainage is accomplished by pulling the reservoir tank control located in the floor area to the left of the pilot's seat on earlier serial aircraft, and directly beneath the pilot's seat on later serial aircraft.

12-43. REMOVAL AND INSTALLATION. (Refer to figure 12-2.) Remove applicable reservoir tank in accordance with paragraph 12-37 or 12-40. After reservoir tank has been removed, drain valve must be unscrewed from boss in tank. Figure 12-7 illustrates the reservoir tank drain valve. The figure may be used as a guide for replacement of parts. Reverse steps in paragraph 12-37 or 12-40 for installation of reservoir tank after drain valve is screwed into boss of valve. Prior to installation of access plates, service fuel bays and check reservoir tanks for leaks.

12-44. FUEL RESERVOIR TANK DRAIN CONTROL.

12-45. DESCRIPTION.
a. (Thru 177RG0282 and F177RG0062). The reservoir tank drain valve control is located in the floorboard area to the left of the pilot's seat. The control is a push-pull type which actuates the plunger on the reservoir tank drain valve located at the reservoir tank.
b. (Beginning with 177RG0283 and F177RG0063). The reservoir tank drain valve control is located in the floorboard area directly beneath the pilot's seat. The control is illustrated in figure 12-8.

12-46. REMOVAL AND INSTALLATION.
a. (Thru 177RG0282 and F177RG0062).
1. Remove pilot's seat, peel back carpeting and remove access plates above reservoir tank and control routing.
2. Disconnect control from clamp bolt at reservoir tank drain valve.
3. Loosen clamp securing control housing at bracket on reservoir tank.
4. Remove lock nut from control at knob end of




1. Support Bracket
2. Extension Arm
3. Cover
4. Angle
5. Shaft
6. Bracket
7. Arm Assembly
8. Spacer
9. Pin
10. Double Push-Pull Control

Detail **A-A** BEGINNING WITH 177RG0283 AND F177RG0063

Figure -2-7. Fuel Reservoir Drain Valve Control

control.

5. Pull control forward out of grommet, support and cover.

6. Install control by reserving the preceding steps.

7. Prior to attaching control at valve end, assure that valve plunger is pushed in as far as it will go. Shift control housing in clamp as necessary to attach control to clamp bolt. Bend control wire at clamp bolt to prevent wire from working loose.

b. (Beginning with 177RG0283 and F177RG0063).

1. Remove pilot's seat, peel back carpeting and remove access plates above reservoir tanks and control routing.

2. Referring to figure 12-8, remove screws attaching extension arm (2) to arm assembly (7).

3. Remove screws attaching cover (3); remove cover.

4. Remove screws attaching angle (4) to arm assembly (7).

5. Remove nut from forward end of control (10) at angle (4).

6. Remove pin (9) from control (10) inside bracket (1).

7. Remove nut from threaded end of control (10) inside bracket (1).

8. Disconnect controls from clamp bolts at reservoir tank drain valves.

9. Loosen clamps securing control housing at brackets.

10. Pull controls from clamp bolts and clamps.

11. Pull single control (10) aft out of bracket (1).

12. Install control by reversing the preceding steps.

13. Prior to attaching controls at valve ends, assure that valve plungers are pushed in as far as they will go. Shift control housings in clamps as necessary to attach controls to clamp bolts. Bend control wires at clamp bolts to prevent wires from working loose.

12-47. FUEL SELECTOR VALVES.

12-48. DESCRIPTION.

a. (Thru 177RG0282 and F177RG0062). An ON/OFF fuel valve is located in the floor area between the pilot and copilot positions. The positions on the valve are labeled "ON" and "OFF". Valve repair consists of replacement of seals, springs, balls and other detail parts. Figure 12-7 illustrates the proper relationship of parts and may be used as a guide during disassembly and assembly of these valves.

b. (Beginning with 177RG0283 and F177RG0063). A four-position fuel selector valve is located in the floor area between the pilot and copilot positions. The positions on the valve are labeled "LEFT", "BOTH", "RIGHT" and "OFF". Valve repair consists of replacement of seals, O-rings, springs and other detail parts. Figure 12-7 illustrates the proper relationship of parts and may be used as a guide during disassembly and assembly of these valves.

12-49. REMOVAL AND INSTALLATION.

a. (Thru 177RG0282 and F177RG0062).

1. Completely drain all fuel from wing bays, lines and reservoir tank. (Observe precautions in paragraph 12-3.)

2. Remove cap, screw, washer and handle from valve.

3. Pull back carpet immediately forward of valve and remove access plate.

4. Remove cover from valve.

5. Working through slots in bracket, disconnect and cap or plug fuel lines at valve.

6. Remove valve through access hole.

7. Reverse preceding steps to install valve. Prior to reinstallation of access plate and carpeting, service fuel bays and check valve for leaks.

b. (Beginning with 177RG0283 and F177RG0063).

1. Completely drain all fuel from wing bays, lines and reservoir tanks. (Observe precautions in paragraph 12-3.)

2. Remove cap, screw, washer, handle and cover from valve.

3. Remove two screws attaching selector valve to bracket.

4. Peel back carpet and remove large access plate above selector valve.

5. Disconnect and cap or plug three fuel lines at selector valve; remove selector valve.

6. Reverse preceding steps to install selector valve. Immediately after installing fuel lines, service fuel bays and check valve for leaks.

12-50. FUEL STRAINER.

12-51. DESCRIPTION. The fuel strainer is mounted on the firewall step in the engine compartment. The strainer filters fuel flowing to the engine-driven fuel pump.

12-52. REMOVAL AND INSTALLATION. (Refer to figure 12-9.)

a. Turn selector valve to OFF position.

b. Remove upper engine cowling for access.

c. Disconnect and cap or plug fuel lines at strainer. (Observe precautions in paragraph 12-3.)

d. Break safety wire at mounting bolts and remove bolts, and remove strainer.

e. Reverse preceding steps for installation. Safety wire attaching bolts. Observe note in paragraph 12-3

12-53. DISASSEMBLY AND ASSEMBLY. (Refer to figure 12-9.)

a. Remove cap (1) and drain fuel from strainer.

b. Remove safety wire, nut (2) and step-washer (3) and remove bowl (5).

c. Carefully unscrew standpipe (6) and remove.

d. Remove filter screen (7) and gasket (8). Wash filter screen and bowl with solvent (Federal Specification P-S-661, or equivalent) and dry with compressed air.

e. Using a new gasket (8) between filter screen (7) and top assembly (9), install filter screen (7) and standpipe (6). Tighten standpipe only finger tight.

f. Using all new O-rings, install bowl (5). Note that step-washer (3) is installed so that step seats against O-ring (4). Install cap (1).

g. Install strainer on aircraft and attach fuel lines. (Observe note in paragraph 12-3.)

h. Turn ON/OFF fuel valve to ON position, start engine and check for leaks.

i. Safety wire bottom nut (2) to top assembly (9).

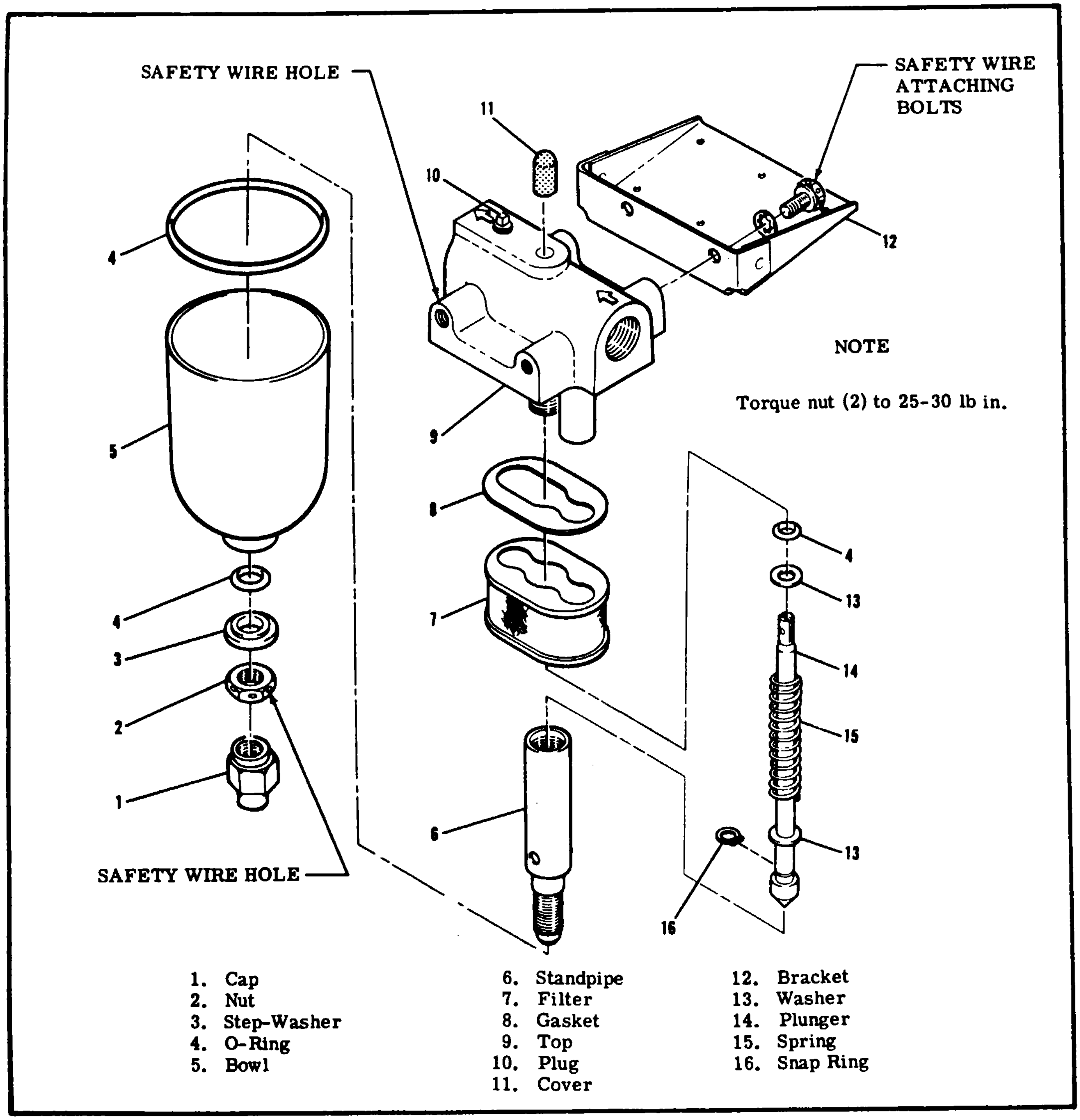



Figure 12-8. Fuel Strainer

Wire must have right-hand wrap, at least 45 degrees.

j. Safety wire attaching bolts and install cowling.

12-54. ELECTRICAL AUXILIARY FUEL PUMP

12-55. DESCRIPTION. Prior to 177RG0283 and F177RG0063, the auxiliary fuel pump is located in the floorboard area, under the sump drain control. Beginning with 177RG-0283 and F177RG0063, the pump is located in the floorboard area immediately forward of the fuel selector valve. An integral by-pass and check valve permits fuel flow through the pump even when the pump is inoperative, but prevents reverse flow. A separate overboard drain line from the pump prevents entry of fuel into the electric motor, in the event of pump internal leakage.

12-56. REMOVAL AND INSTALLATION.

a. (Thru 177RG0282 and F177RG0062).

1. Completely drain all fuel from wing bays, lines and reservoir tank. (Observe precaution in paragraph 12-3.)

2. Remove carpeting and access plate above pump.

3. Disconnect and cap or plug fuel lines from pump and remove electrical connections from pump.

4. Loosen clamp securing pump to bracket and lift pump out.

5. Reverse preceding steps for pump installation. Prior to installation of access plate, service fuel bays, start up engine and check pump for operation and leakage.

b. (Beginning with 177RG0283 and F177RG0063).

1. Turn fuel selector handle to "OFF" position.

2. Remove cap, screw, washer, handle and cover from above fuel selector handle.

3. Remove two screws attaching selector valve to bracket.

4. Peel back carpet and remove large access plate above selector valve and auxiliary fuel pump.

5. Disconnect and cap or plug fuel lines at auxiliary fuel pump. Remove electrical connections at pump.

6. Reverse preceding steps for pump installation. Prior to installation of access plate, service fuel bays, start up engine and check pump for operation and leakage.

## SHOP NOTES:

# SECTION 13

# PROPELLER AND GOVERNOR

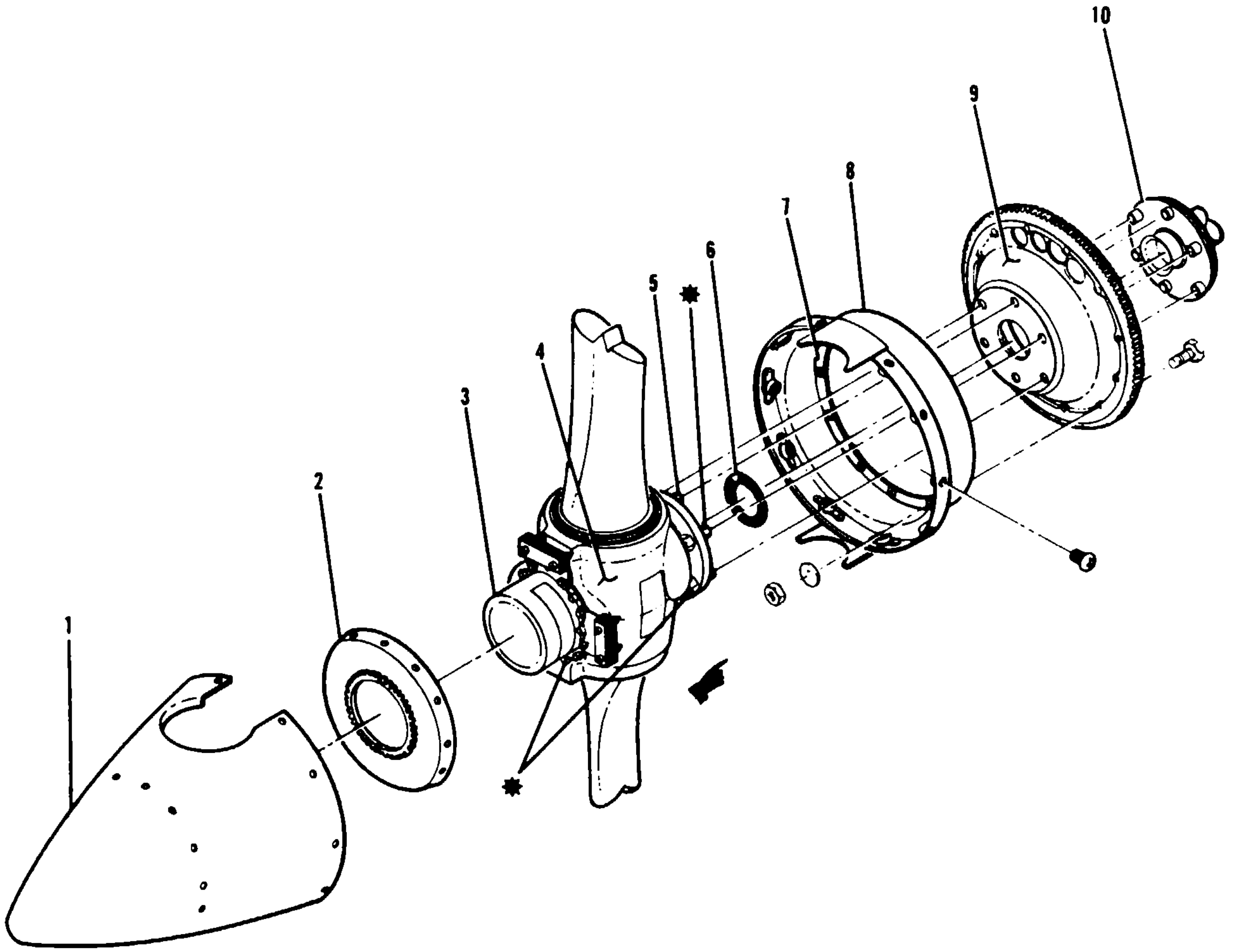
TABLE OF CONTENTS Page



## 13-1. PROPELLER.

13-2. DESCRIPTION. The propeller, of the constant-speed type, is a single-acting unit in which governor-regulated oil pressure opposes the natural centrifugal twisting moment of the rotating blades, and the force of a spring, to obtain the correct pitch for the engine load. Engine lubricating oil is supplied to the power piston in the propeller hub through the engine crankshaft. The amount and pressure of the engine oil supplied is controlled by the engine-driven governor. Increasing engine speed will cause oil to be admitted to the piston, thereby increasing the pitch. Conversely, decreasing engine speed will result in oil leaving the piston, thus decreasing the pitch.

13-3. REPAIR. Metal propeller repair first involves evaluating the damage and determining whether the repair will be major or minor. Federal Aviation Regulations, Part 43 (FAR 43) and Federal Aviation Agency Advisory Circular No. 43.13 (FAA AC 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.




NOTE

Torque studs (5) evenly to 55 - 65 lb-ft (660 - 780 lb-in) and safety in pairs.

Bulkhead (2) is riveted to spinner dome (1). Be sure that grommet is installed in bulkhead (2).

Install shims (7) with bevel next to aft spinner bulkhead.

Index propeller blades on TC mark, viewed from the front of the engine.

✱ Safety wire these items.

1. Spinner Dome
2. Spinner Bulkhead
3. Propeller Cylinder
4. Propeller
5. Stud
6. O-Ring
7. Shim
8. Aft Spinner Bulkhead
9. Starter Ring Gear Support
10. Engine Crankshaft

Figure 13-1. Propeller Installation

13-4. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| FAILURE TO CHANGE PITCH. | Control disconnected or broken. | Connect or install new control and rig control properly. |
| | Governor not correct for propeller. "Sensing Wrong." | Install correct governor. Refer to paragraph 13-8. |
| | Defective governor. | Install new governor. Refer to paragraph 13-9. |
| | Defective pitch changing mechanism inside propeller or excessive blade friction. | Repair or install new propeller. |
| FAILURE TO CHANGE PITCH FULLY. | Improper rigging of governor control. | Check travel of governor arm and rig properly. |
| | Defective governor. | Install new governor. Refer to paragraph 13-9. |
| SLUGGISH RESPONSE TO PROPELLER CONTROL. | Excessive friction in pitch changing mechanism inside propeller or excessive blade friction. | Repair or install new propeller. |
| STATIC RPM TOO HIGH OR TOO LOW | Improper propeller governor adjustments. | Perform static RPM check Refer to section 11 for procedures. |
| ENGINE SPEED WILL NOT STABILIZE. | Sludge in propeller governor. | Remove and clean governor. Refer to paragraph 13-9. |
| | Air trapped in propeller actuating cylinder. | Purge air by exercising the propeller several times before take-off. |
| | Excessive friction in pitch changing mechanism inside propeller or excessive blade friction. | Repair or install new propeller. |

**SHOP NOTES:**

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| ENGINE SPEED WILL NOT STABILIZE (Cont). | Defective governor. | Install new governor. Refer to paragraph 13-9. |
| OIL LEAKAGE AT MOUNTING FLANGE. | Damaged O-ring between engine and propeller. | Install new O-ring. |
| | Foreign material between engine and propeller mating surfaces or mounting nuts not tight. | Remove propeller, clean mating surfaces, install propeller and torque mounting nuts. |
| OIL LEAKAGE AT ANY OTHER PLACE. | Defective seals, gaskets, threads, etc., or incorrect assembly. | Propeller repair or replacement is required. |

13-5. REMOVAL. (See figure 13-1.)

a. Remove spinner dome (1).

b. Remove safety wire and loosen bolts, attaching propeller to engine crankshaft, about 1/4-inch and pull propeller forward.

NOTE

Bolts will have to be backed out evenly so that propeller may be pulled forward (approximately 1/4-inch at a time) until all bolts are disengaged from the engine crankshaft flange. As the propeller is separated from the engine crankshaft, oil will drain from the propeller and engine crankshaft cavities.

c. Pull propeller from engine crankshaft.

d. If necessary to remove the aft spinner bulkhead, remove bolts, washers and nuts attaching bulkheads. to the starter ring gear support. Retain shims.

NOTE

After removal of the propeller, the starter ring gear support assembly may be removed from the engine crankshaft to allow easier access of the aft spinner bulkhead attaching bolts. Loosen alternator adjusting arm and disengage alternator drive pulley belt from pulley on aft face of starter ring gear support assembly.

13-6. INSTALLATION. (Refer to figure 13-1.)

a. If aft spinner bulkhead was removed, reinstall on ring gear support, using bolts, nuts and shims as shown in figure 13-1.

b. If starter ring gear support and aft spinner bulkhead were removed, clean mating surfaces of support assembly and engine crankshaft flange.

c. Place alternator drive belt in the pulley groove of the starter ring gear support. Fit starter ring gear over propeller flange bushings on crankshaft.

NOTE

Make sure the bushing hole in the ring gear support, that bears the identification "O", is assembled at the "O" identified crankshaft flange bushing. This bushing is marked "O" by an etching on the crankshaft flange next to the bushing. The starter ring gear must be located correctly to assure proper alignment of the timing marks on the ring gear.

d. Clean propeller hub cavity and mating surfaces of propeller hub and ring gear support.

e. Lightly lubricate a new O-ring and the crankshaft pilot with clean engine oil and install O-ring in the propeller hub.

f. Align propeller mounting bolts with proper holes in engine crankshaft flange and slide propeller carefully over crankshaft pilot until bolts can be started in crankshaft flange bushing. Position propeller blades to extend by aft spinner bulkhead with ample clearance.

g. Tighten bolts evenly and work propeller aft on crankshaft flange. Tighten bolts to the torque value shown in figure 13-1.

h. Install safety wire through roll pins saftying bolts in pairs.

i. Adjust alternator drive belt tension as outlined in Section 16.

j. Install spinner dome.

13-7. PROPELLER GOVERNOR.

13-8. DESCRIPTION. The base mounted, engine-driven, centrifugal, single-acting governor is mounted on the lower right side of the engine accessory drive housing. The term single-acting refers to the manner in which engine oil is directed to the propeller to effect changes in propeller blade pitch. This governor produces oil pressure to increase blade pitch. Decreased blade pitch is produced by centrifugal twisting moment of the rotating propeller blades and the force of an internal spring in the propeller, when governor oil pressure is relieved. Oil relieved by the governor is permitted to return from the propeller to the engine. Basically the governor consists of an engine-driven gear pump with a pressure relief valve, a pair of rotating flyweights pivoted on a flyweight head, a spring-loaded pilot valve operated by the flyweights under the influence of centrifugal force and a control lever which varies the spring load on the pilot valve.

NOTE

Outward physical appearance of specific governors is the same, but internal parts determine whether it uses oil pressure to increase or decrease propeller blade pitch. Always be sure the correct governor is used with the propeller.

13-9. TROUBLE SHOOTING. Since governor action is directly related to the propeller pitch changing mechanism, there are very few governor troubles that can be isolated with the governor installed and operating. Failure of the propeller to change pitch correctly might be caused either by the governor or propeller. Except for locating obvious troubles, it is best to install a governor known to be in good condition to check whether the propeller or the governor is at fault when trouble occurs in the propeller pitch-changing mechanism. If the trouble disappears, the governor was at fault; if the trouble persists, the propeller may be at fault. Removal and installation, rigging of control, high-speed stop adjustment, desludging, and installation of the governor mounting gasket are not major repairs and may be accomplished in the field. Repairs to propeller governors are classed as propeller major repairs in Federal Aviation Regulations, which also define who may accomplish such repairs.

13-10. REMOVAL.

a. Remove engine cowling as required for access.
b. Disconnect heater ducts and oil cooler duct as required for access to governor.
c. Disconnect control from arm on governor and disconnect control from bracket.
d. Remove nuts and washers securing governor to adapter on engine accessory housing and work governor from mounting studs.
e. Remove mounting gasket.
f. Remove control bracket from governor.

13-11. INSTALLATION.

a. Install control bracket on governor, safety attaching screws.
b. Wipe governor and adapter mounting pad clean.
c. Install a new mounting gasket on the mounting studs. Install gasket with raised surface of the gasket screen toward the governor.
d. Position governor on mounting studs, aligning governor drive splines with drive splines in the engine, and install mounting washers and nuts. Do not force spline engagement. Rotate engine crankshaft slightly and splines will engage smoothly when properly aligned.
e. Tighten mounting nuts to 100-150 pound-inches.
f. Connect control to bracket and control arm on the governor. Rig control as required for full travel. Refer to paragraph 13-13.
g. Install all parts removed for access.

13-12. HIGH RPM STOP ADJUSTMENT.

a. Remove engine cowling as required for access.
b. Loosen the high-speed stop screw lock nut.
c. Turn the stop screw IN to decrease maximum rpm and OUT to increase maximum rpm. One full revolution of the stop screw causes a change of approximately 25 rpm. Refer to paragraph 11-3 for maximum rpm.
d. Tighten stop screw lock nut and make control linkage adjustment as necessary to maintain full travel of the control so that governor arm contacts stop screw.
e. Install cowling and test operate propeller and governor combination.

NOTE

It is possible for either the propeller low pitch (high rpm) stop or the governor high rpm stop to be the high rpm limiting factor. It is desirable for the governor stop to limit the high rpm at the maximum rated rpm for a particular aircraft. Due to climatic conditions, field elevation, low pitch propeller blade angle and other considerations, an engine may not reach rated rpm on the ground. It may be necessary to readjust the governor stop after test flying to obtain maximum rated rpm when airborne.

13-13. RIGGING.

NOTE

The result of rigging of the governor control is full travel of the governor control arm (bottomed out against both high and low pitch stops) with some "cushion" at both ends of the control travel.

a. Disconnect control from governor arm.
b. Place control in the cabin full forward then pull control knob back approximately 1/8-inch and lock in this position. This will allow "cushion" to assure full contact with governor high rpm stop screw.
c. Place governor control arm against high rpm stop screw.
d. Loosen jam nuts and adjust control rod end until attaching holes align while governor control arm is a against high rpm stop screw. Be sure to maintain sufficient thread engagement of the control and rod end. If necessary, shift control in its clamps to achieve this.
e. Attach control rod end to governor control arm, tighten control rod end jam nuts and install all safties
f. Operate the propeller control to see that the governor arm attains full travel in both directions.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the propeller control.

## SECTION 14

## UTILITY SYSTEMS

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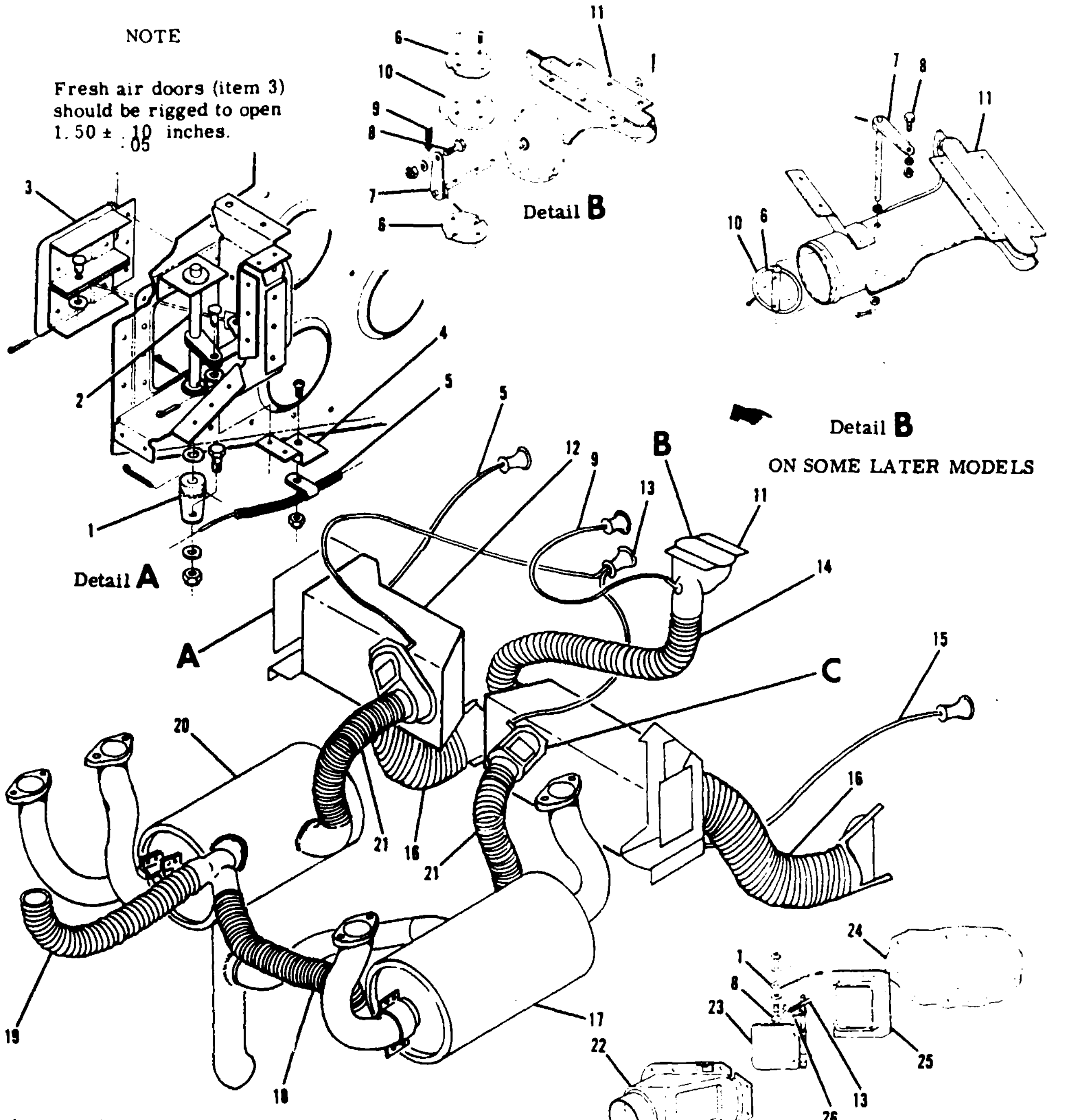
14-1. UTILITY SYSTEMS.

14-2. HEATING SYSTEM. (Refer to figure 14-1.)

14-3. DESCRIPTION. The heating system is comprised of the heat exchange sections of the exhaust mufflers, two plenum chambers with shut-off valves, on the 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 the heat exchange section of the right hand exhaust muffler, and through a cross-over hose to the left hand exhaust muffler, to two plenum chambers, or mixing airboxes, located on the aft side of firewall right and left of the centerline. The "Cabin Heat" control, a position locking control, located on the forward instrument panel, controls both of the mixing valves on the firewall. Pulling the control through initial travel to the detent on control shaft, delivers varying amounts of cold air to the maximum cold air mixing at the detent position. As the control is extended from detent position lesser amounts of cold air is introduced until in the fully extended position cold air is shut off and maximum heated air is delivered to the outlets. Individual "Cabin Air" controls, located at either side of instrument panel, control a fresh air door, adjacent to the airbox, that opens into the airstream and delivers fresh air for ventilation or additional cold air for mixing, to the outlets. A vent outlet is located at the pilot & co-pilots rudder pedals and at the fwd edge of door thru aircraft Serial 177RG0432 and F172RG0092. Beginning with 177RG0433 and F177RG-0093 ducts and a vent outlet is added to the door to increase delivery of air to rear seat. Outlet has a baffle control for directing airflow.

14-5. TROUBLE SHOOTING. Most of the operational troubles encountered in the heating and defrosting systems are caused by sticking or binding valves or 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 seat properly. Check that hose are properly secured and replace hose 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 heater ducts across the firewall with Pro-Seal #700 (Coast Pro-Seal Co., Chemical Division, Los Angeles, California) compound or equivalent compound.

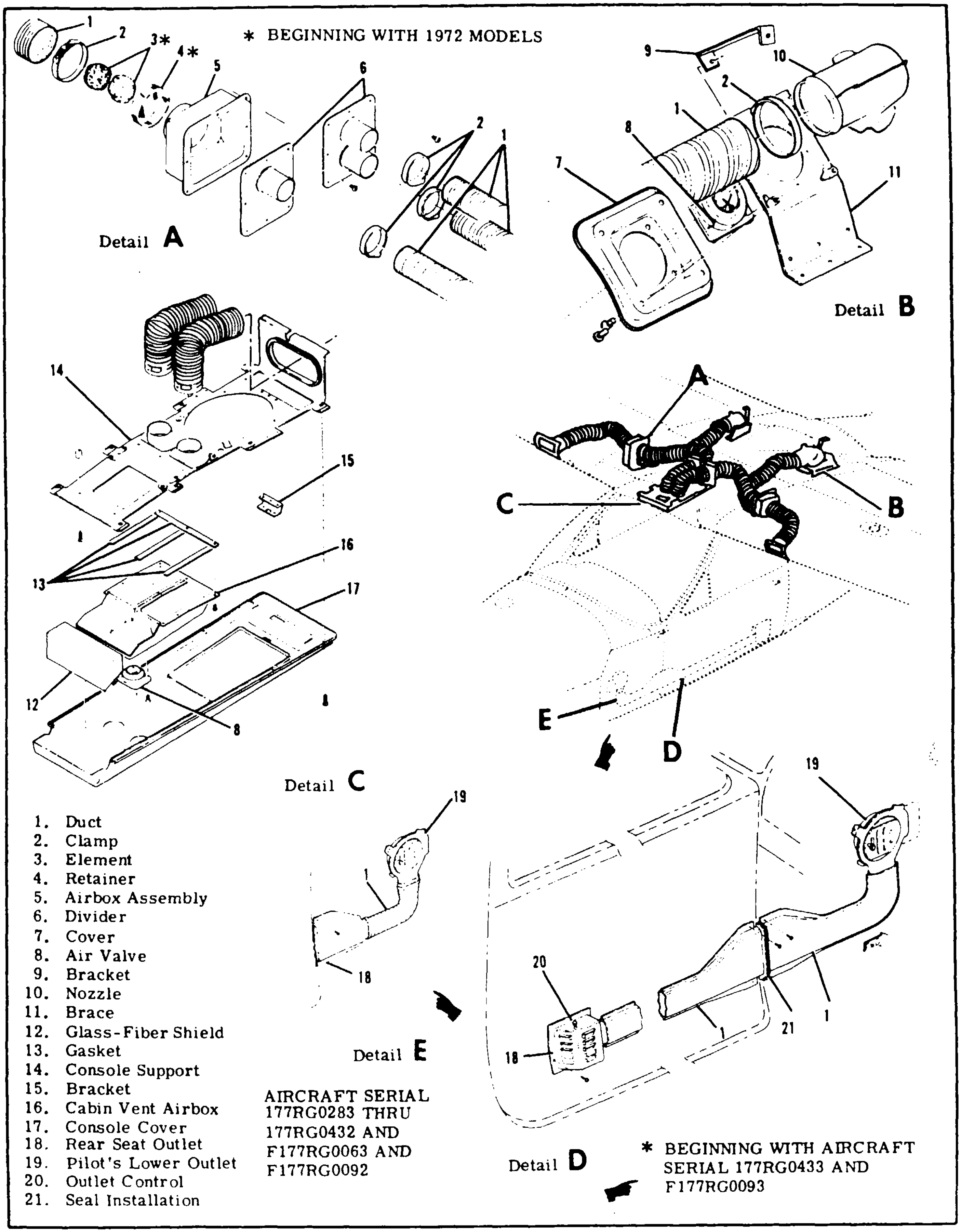



1. Arm Assembly
2. Shaft Assembly
3. Door Assembly
4. Bracket
5. RH Cabin Air Control
6. Stiffener
7. Lever Assembly
8. Clamp Bolt
9. Defroster Control
10. Seal
11. Nozzle
12. RH Firewall Duct
13. Cabin Heat Control
14. Defroster Hose
15. LH Cabin Air Control
16. Ducting
17. LH Exhaust Muffler
18. Crossover Hose
19. Inlet Hose
20. RH Exhaust Muffler
21. Heater Hose
22. Plenum Chamber
23. Door Assembly
24. Firewall
25. Valve Seat
26. Spring

NOTE

Seal valve seat (24) with Pro-Seal #700. Apply parting agent (Silicone Grease, or equivalent) to surface of seat (25) where door (23) makes contact. Apply sealer to door (23) .10" thick and .20" wide in position to mate with seat on valve seat (25). Form seal to fit by closing door (23) against seat (25) and hold open until sealer sets up.

Figure 14-1. Heater, Defroster and Ventilating systems. (Sheet 1 of 2)




1. Duct
2. Clamp
3. Element
4. Retainer
5. Airbox Assembly
6. Divider
7. Cover
8. Air Valve
9. Bracket
10. Nozzle
11. Brace
12. Glass-Fiber Shield
13. Gasket
14. Console Support
15. Bracket
16. Cabin Vent Airbox
17. Console Cover
18. Rear Seat Outlet
19. Pilot's Lower Outlet
20. Outlet Control
21. Seal Installation

Figure 14-1. Heater, Defroster and Ventilating Systems. (Sheet 2 of 2)

14-6. REMOVAL, INSTALLATION AND REPAIR. Figure 14-1 illustrates the heating and defrosting systems, and may be used as a guide during removal, installation and repair of heating system components. Burned, frayed or crushed hose should 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.

14-7. DEFROSTER SYSTEM. (Refer to figure 14-1.)

14-8. DESCRIPTION. The defrosting system is comprised of a duct across the left aft side of the firewall, a defroster outlet, mounted in the left side of the cowl deck, immediately aft of the windshield, a control knob on the instrument panel, and flexible ducting connecting the system.

14-9. OPERATION. Air from the duct across the left aft side of the firewall flows through a flexible duct to the defroster outlet. The defroster control operates a damper in the defroster nozzle to regulate the amount of air deflected across the inside surface of the windshield. The temperature and volume of this air is controlled by the settings of the cabin heating 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, INSTALLATION AND REPAIR. Figure 14-1 illustrates the defrosting system and may be used as a guide for removal, installation and repair of defroster system components. Burned, frayed or crushed hose should 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. A defective defroster outlet must be repaired or replaced.

14-12. VENTILATING SYSTEM. Refer to figure 14-1 (Sheet 2 of 2)

14-13. DESCRIPTION. The ventilating system is comprised of an airscoop mounted in the inboard leading edge of each wing, a small plenum chamber mounted at each wing root rib, two adjustable ventilators mounted in the overhead console, two adjustable ventilators mounted in the aft wing root areas and flexible ducting connecting the system.

14-14. OPERATION. Ram air received from scoops mounted in the inboard leading edges of the wings is ducted to small plenum chambers, located at each wing root rib. From the plenum chambers, the air is routed to the pilot and copilot overhead console outlets and to the rear seat outlets. The quantity of air is controlled by means of a 360 degree, manually-operated swiveling valve which can be turned to increase, decrease and direct the flow of air whenever desired.

14-15. TROUBLE SHOOTING. Most of the operational troubles encountered in the ventilating system are caused by sticking or binding air valves or their controls or damaged air ducting. In most cases air valves or controls can be freed by proper lubrication. Damaged or broken parts should be repaired or replaced. When checking rigging of 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.

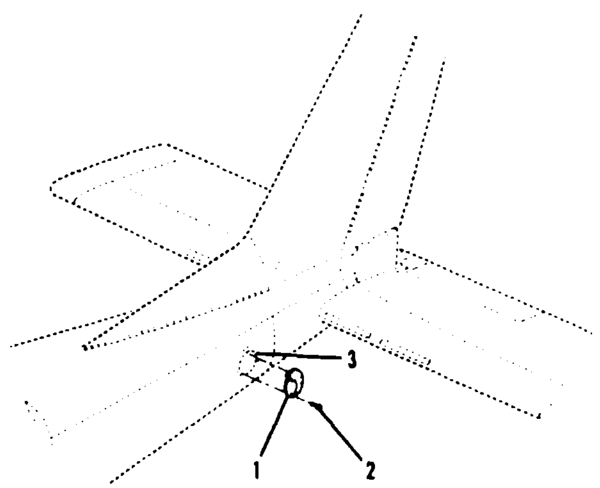
14-16. REMOVAL, INSTALLATION AND REPAIR. Figure 14-1 illustrates the ventilating system, and may be used as a guide for removal, installation of ventilating system components. Frayed or crushed hose should be replaced with new hose, cut to length and installed in the original routing. Trim hose winding 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 controls after repair or replacement.

14-17. TAILCONE PRESSURIZATION. BEGINNING WITH AIRCRAFT 177RG0433 and F177RG0093.

14-18. DESCRIPTION. To avoid a buildup of exhaust gases in the aircraft tailcone, air scoops have been installed on both sides of the tailcone. Air entering these air scoops pressurize the tailcone preventing exhaust gases from entering or accumulating in the tailcone.

**WARNING**

The air scoops may be removed for inspection of the tailcone area but they must be reinstalled with the scoops facing forward to provide proper operation.




1. Air Scoop
2. Screw
3. Inspection Hole

Figure 14-2. Tailcone Pressurization.

SECTION 15

INSTRUMENTS AND INSTRUMENT SYSTEMS

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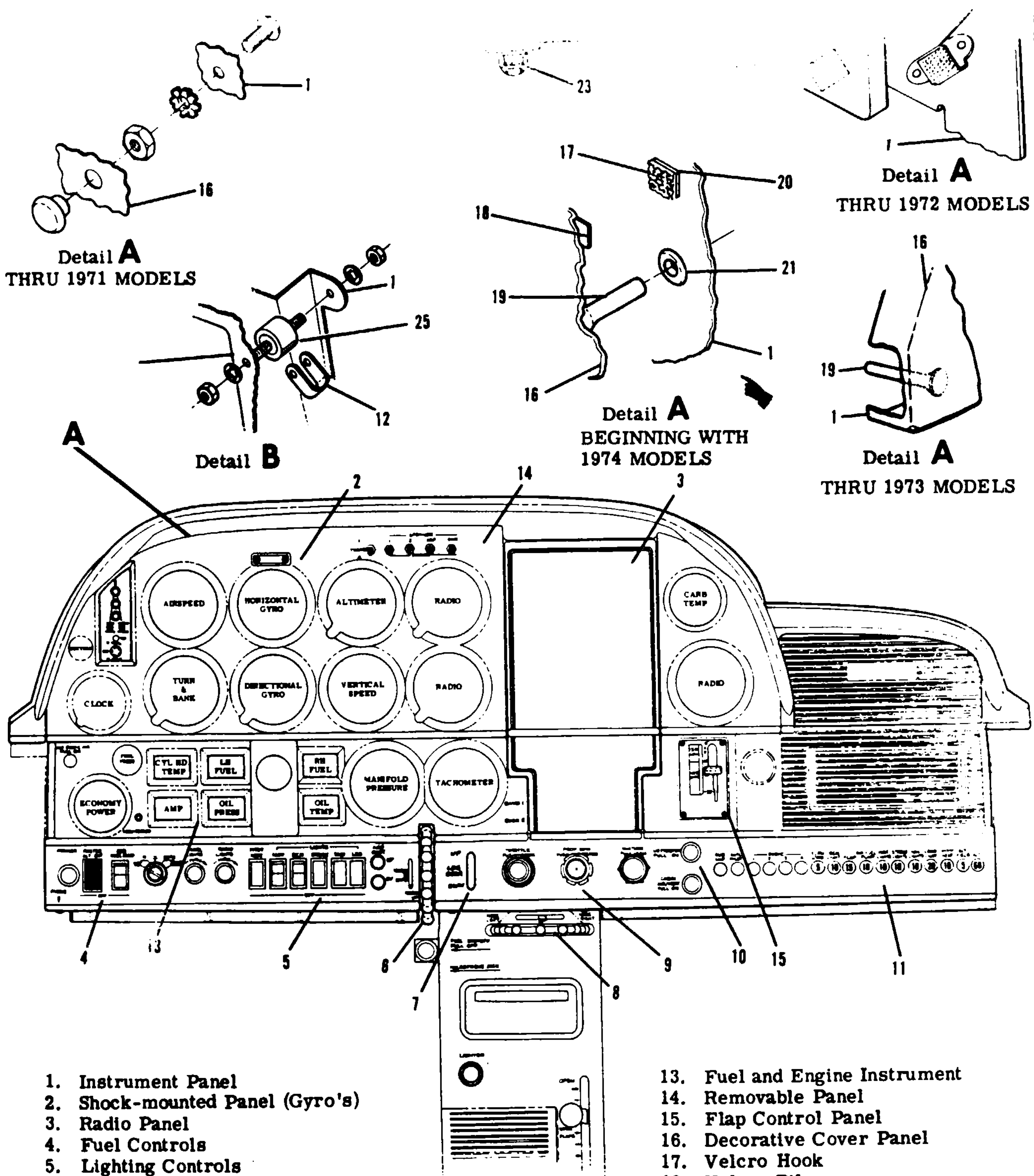
15-1. INSTRUMENTS AND INSTRUMENT SYSTEMS.

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 the aircraft. Whether replacement is to be with a new instrument, an exchange one, or the original instrument is to be repaired must be decided on basis of individual circumstances.




1. Instrument Panel
2. Shock-mounted Panel (Gyro's)
3. Radio Panel
4. Fuel Controls
5. Lighting Controls
6. Stabilator Trim Control
7. Landing Gear Controls
8. Engine Controls
9. Rudder Trim
10. Heating and Ventilation Controls
11. Circuit Breaker Panel
12. Ground Strap (upper location only)
13. Fuel and Engine Instrument
14. Removable Panel
15. Flap Control Panel
16. Decorative Cover Panel
17. Velcro Hook
18. Velcro Pile
19. Guide Pin
20. Shim
21. Grommet
22. Outside Temperature Gage
23. Correction Card
24. Magnetic Compass
25. Shock-mount

Figure 15-1. Instrument Panel (Typical)

15-3. INSTRUMENT PANEL. (Refer to figure 15-1.)

15-4. DESCRIPTION. The instrument panel assembly consists of a stationary panel, a removable flight instrument panel and a shock-mounted panel. The stationary panel, containing fuel and engine instruments is secured to the engine mount stringers and a forward fuselage bulkhead. The removable panel, containing flight instruments such as airspeed, vertical speed and altimeter is secured to the stationary panel with screws. The shock-mounted panel, containing major flight instruments such as the horizontal and directional gyros is secured to the removable panel with rubber shock-mounted assemblies. Most of the instruments are screw mounted on the panel backs. Decorative panels are installed by threaded buttons on early models and by velcro fasteners and guide pins on others. Beginning with 1974 models a combination of guide pin and grommet and velcro fasteners are used.

15-5. REMOVAL AND INSTALLATION.

a. FLIGHT INSTRUMENT PANEL.

1. On early models unscrew threaded buttons. on other models the covers can be removed by gently pulling in a straight line until guide pins are released.
2. Remove switch mounting nuts and switches as necessary and remove decorative cover.
3. Tag and disconnect plumbing and wiring.
4. Remove screws securing flight instrument panel to stationary panel and pull panel straight back.
5. Reverse preceding steps for reinstallation.

b. SHOCK-MOUNTED PANEL.

1. Complete steps 1 and 2 above.
2. Tag and disconnect gyro plumbing.
3. Remove shock-mount nuts securing shock-mounted panel to flight instrument panel and pull panel straight back.
4. Reverse preceding steps for reinstallation. Ensure ground strap is properly installed.

15-6. SHOCK-MOUNTS. Service life of shock-mounted instruments is directly related to adequate shock-mounting of the panel. If removal of shock-mounted panel is necessary, check mounts for deterioration and replace as necessary.

15-7. INSTRUMENTS. (Refer to figure 15-1.)

15-8. REMOVAL. Most instruments are secured to the panel with screws inserted through the panel face, under the decorative cover. To remove an instrument, remove decorative cover, disconnect wiring or plumbing to instrument, remove mounting screws and take instrument 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 the forward side of the stationary 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 to prevent accidental grounding or short-circuiting.

15-9. INSTALLATION. Generally, installation procedure is the reverse of removal procedure. Ensure nounting 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 the Cessna Service Parts Center.

When replacing an electrical gage in an instrument cluster assembly, avoid bending pointer or dial plate. Distortion of dial or back plate could change the calibration of gages.

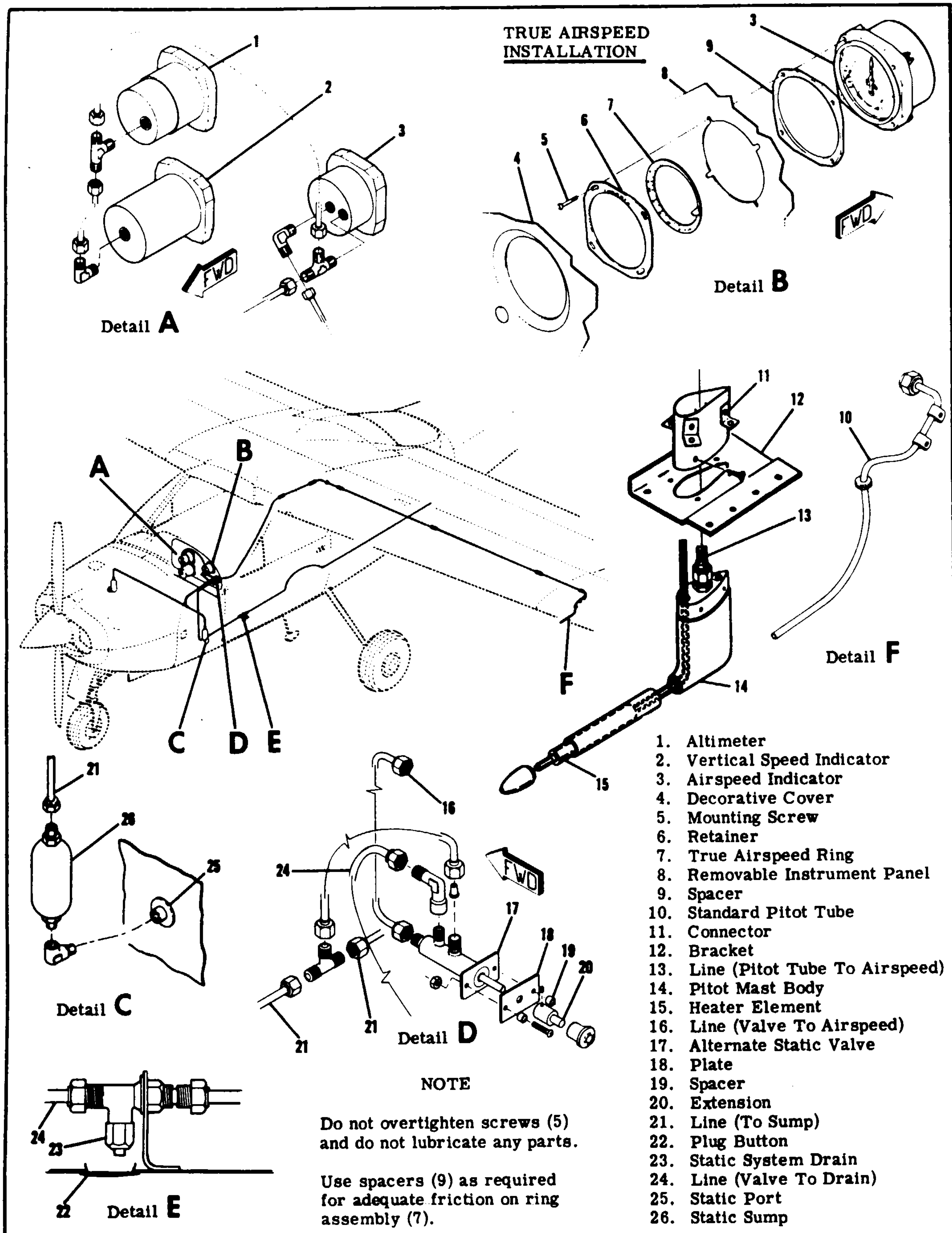
15-10. PITOT AND STATIC SYSTEMS. (Refer to figure 15-2.)

15-11. DESCRIPTION. 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 the static ports. A static line sump is installed at each source button to collect condensation in the static system. A pitot tube heater and stall warning heater may be installed. The heating elements are controlled by a switch at the instrument panel and powered by the electrical system. A static pressure alternate source valve may be installed in the static system for use when the external static source is malfunctioning. This source is to be used only in emergencies. This valve also permits draining condensate from the static lines. Refer to Owner's Manual for flight operation using alternate static source pressure. Beginning with 177RG 0552, an encoding altimeter and a standby altimeter may be installed. The encoding altimeter supplies an altitude reading to the optional 300 or 400 transponder for signal transmission. The standby altimeter is connected to the static system by a tube to the vertical speed indicator.

15-12. MAINTENANCE. Proper maintenance of the pitot and static system is essential for proper operation of altimeter, vertical speed and airspeed indicators. Leaks, moisture and obstructions in the pitot system will result in false airspeed indications, while static system malfunctions will affect the readings of all three instruments. Under instrument flight conditions, these instruments 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 the static pressure system, assuming the altimeter has been tested and inspected in accordance with current Federal Aviation Regulations.

a. Ensure that the static system is free from entrapped moisture and restrictions.




1. Altimeter
2. Vertical Speed Indicator
3. Airspeed Indicator
4. Decorative Cover
5. Mounting Screw
6. Retainer
7. True Airspeed Ring
8. Removable Instrument Panel
9. Spacer
10. Standard Pitot Tube
11. Connector
12. Bracket
13. Line (Pitot Tube To Airspeed)
14. Pitot Mast Body
15. Heater Element
16. Line (Valve To Airspeed)
17. Alternate Static Valve
18. Plate
19. Spacer
20. Extension
21. Line (To Sump)
22. Plug Button
23. Static System Drain
24. Line (Valve To Drain)
25. Static Port
26. Static Sump

NOTE

Do not overtighten screws (5) and do not lubricate any parts.

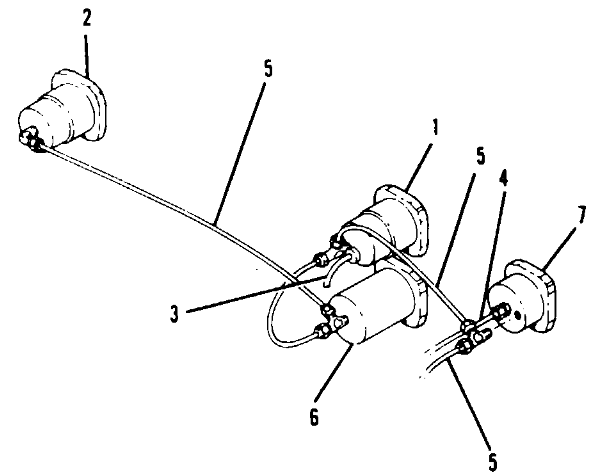
Use spacers (9) as required for adequate friction on ring assembly (7).

Figure 15-2. Pitot-Static Systems

NOTE

WHEN AN ENCODING ALTIMETER AND A STANDBY ALTIMETER ARE INSTALLED, STATIC LINE ROUTING WILL BE SHOWN.

VIEW LOOKING AFT




1. Encoding Altimeter
2. Standby Altimeter
3. Line (To Transponder)
4. Pitot Line
5. Static Line
6. Vertical Speed Indicator
7. Airspeed Indicator

OPTIONAL ENCODING ALTIMETER
BEGINNING WITH 177RG 0552

Figure 15-2A. Encoding Altimeter Installation

b. Ensure that no alterations or deformations of the airframe surface have been made which would affect the relationship between air pressure in the static pressure system and true ambient static air pressure for any flight configuration.
c. Seal one static source port with pressure sensitive tape. This seal must be air tight.
d. Close the static pressure alternate source valve, if installed.
e. Attach a source of suction to the remaining static pressure source opening. Figure 15-3 shows one method of obtaining suction.
f. Slowly apply suction until the altimeter indicates a 1000-foot increase in altitude.

**CAUTION**

When applying or releasing suction, do not exceed the range of vertical speed indicator or airspeed indicator.

g. Cut off the suction source to maintain a "closed" system for one minute. Leakage shall not exceed 100 feet of altitude loss as indicated on the altimeter.
h. If leakage rate is within tolerance, slowly release the suction source and remove the tape from static port.

NOTE

If leakage rate exceeds the maximum allowable, first tighten all connections, then repeat leakage test. If leakage rate still exceeds the maximum allowable, use the following procedure.

i. Disconnect the static pressure lines from airspeed indicator and vertical speed indicator. Use suitable fittings to connect the lines together so the altimeter is the only instrument still connected into the static pressure system.
j. Repeat the leakage test to check whether the static pressure system or the bypassed instruments are the cause of leakage. If the instruments are at fault, they must be repaired by an "appropriately rated repair station" or replaced. If the static pressure system is at fault, use the following procedure to locate leakage.
k. Attach a source of positive pressure to the static source opening. Figure 15-3 shows one method of obtaining positive pressure.

**CAUTION**

Do not apply positive pressure with the airspeed indicator or vertical speed indicator connected to the static pressure system.

l. Slowly apply positive pressure until the 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 LEAK-TEC or a solution of mild soap and water, watching for bubbles to locate leaks.
m. Tighten leaking connections. Repair or replace parts found defective.
n. Reconnect the airspeed and vertical speed indicators into the static pressure system and repeat leakage test per steps "c" thru "h".

15-14. PITOT SYSTEM INSPECTION AND LEAKAGE TEST. To check the pitot system for leaks, place a piece of tape over the small hole in the 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 the pitot system is designed to drain down to the pitot tube opening, condensation may collect at other points in the system and produce a partial obstruction. To clear the line, disconnect it at the airspeed indicator. Using low pressure air, blow from the indicator end of line toward the pitot tube.

**CAUTION**

Never blow through pitot or static lines toward the instruments.

Like the pitot lines, static pressure lines must be kept clear and connections tight. Static source sumps collect moisture and keeps system clear. However, when necessary, disconnect static line at first instrument to which it is connected, then blow the line clear with low pressure air.

NOTE

On aircraft equipped with an alternate static source, use the same procedure, opening the alternate static source valve momentarily to clear line, then close valve and clear the remainder of system.

Check all static pressure line connections for tightness. If hose or hose connections are used, check them 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 the pitot mast, remove the four mounting screws on the side of connector (11) and pull mast out of connector far enough to disconnect pitot line (13). Electrical connections to the heater assembly (if installed) may be disconnected through the wing access opening just inboard of the 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 the cabin and right door. When replac-

15-17. TROUBLE SHOOTING -- PITOT-STATIC SYSTEM.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| LOW OR SLUGGISH AIRSPEED INDICATION. (Normal altimeter and vertical speed.) | Pitot tube deformed, leak or obstruction in pitot line. | Straighten tube, repair or replace damaged line. |
| INCORRECT OR SLUGGISH RESPONSE. (All three instruments.) | Leaks or obstruction in static line. | Repair or replace line. |
| | Alternate static source valve open. | Close for normal operation. |

ing components of the pitot and static pressure systems, use anti-seize compound sparingly on male threads on 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.

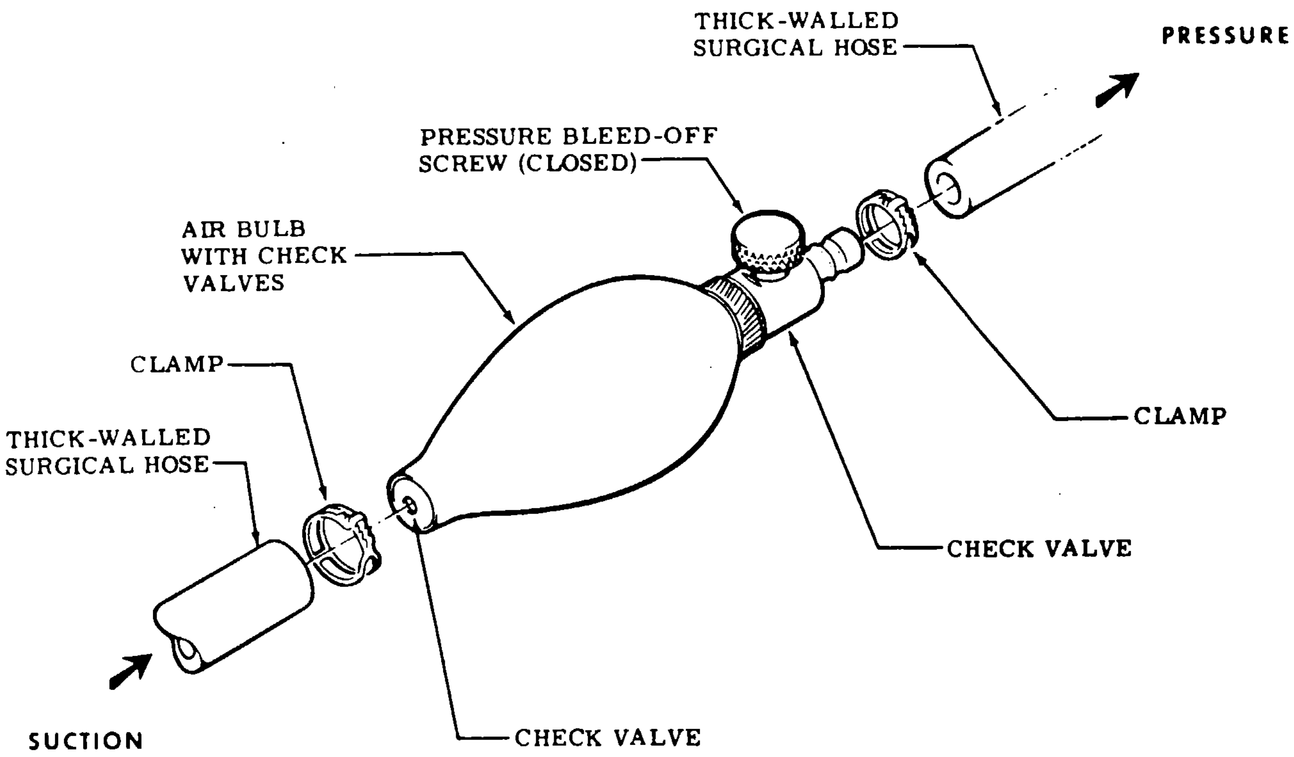
15-18. TRUE AIRSPEED INDICATOR. A true airspeed indicator may be installed. This indicator, equipped with a conversion ring, may be rotated until pressure altitude is aligned with outside air temperature, then airspeed indicated on the instrument is read as true airspeed on the adjustable ring. Refer to figure 15-2 for removal and installation. Upon installation, before tightening mounting screws (5), calibrate the instrument as follows: Rotate ring (7) until 120 mph on adjustable ring aligns with 120 mph on indicator. Holding this setting, move retainer (6) until 60°F aligns with zero pressure altitude, then tighten mounting screws (5) and replace decorative cover (4).

15-19. TROUBLE SHOOTING.

NOTE

Refer to paragraph 15-15 before blowing out pitot or static lines.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| HAND FAILS TO RESPOND. | Pitot pressure connection not properly connected to pressure line from pitot tube. | Repair or replace damaged line, tighten connections. |
| | Pitot or static lines clogged. | Blow out lines. |
| INCORRECT INDICATION OR HAND OSCILLATES. | Leak in pitot or static lines. | Repair or replace damaged lines, tighten connections. |
| | Defective mechanism. | Replace instrument. |
| | Leaking diaphragm. | Replace instrument. |
| | Alternate static source valve open. | Close for normal operation. |
| HAND VIBRATES. | Excessive vibration caused by loose mounting screws. | Tighten mounting screws. |
| | Excessive tubing vibration. | Tighten clamps and connections, replace tubing with flexible hose. |




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 System Test Equipment

15-20. TROUBLE SHOOTING -- ALTIMETER.

NOTE

Refer to paragraph 15-15 before blowing out pitot or static lines.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| INSTRUMENT FAILS TO OPERATE. | Static line plugged. | Blow out lines. Clean static ports. |
| | Defective mechanism. | Replace instrument. |
| INCORRECT INDICATION. | Hands not carefully set. | Reset hands with knob. |
| | Leaking diaphragm. | Replace instrument. |
| | Pointers out of calibration. | Replace instrument. |
| HAND OSCILLATES. | Static pressure irregular. | Blow out lines, tighten connections, Clean static ports. |
| | Leak in airspeed or vertical speed indicator installations. | Blow out lines, tighten connections. |

15-21. TROUBLE SHOOTING -- VERTICAL SPEED INDICATOR.

NOTE

Refer to paragraph 15-15 before blowing out pitot or static lines.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| INSTRUMENT FAILS TO OPERATE. | Static line plugged. | Blow out lines. Clean static ports. |
| | Static line broken. | Repair or replace damaged line, tighten connection. |
| INCORRECT INDICATION. | Partially plugged static line. | Blow out lines. Clean static ports. |
| | Ruptured diaphragm. | Replace instrument. |
| | Pointer off zero. | Reset pointer to zero. |

15-21. TROUBLE SHOOTING (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| POINTER OSCILLATES. | Partially plugged static line. | Blow out lines. Clean static ports. |
| | Leak in static line. | Repair or replace damaged lines, tighten connections. |
| | Leak in instrument case. | Replace instrument. |
| HAND VIBRATES. | Excessive vibration caused by loose mounting screws. | Tighten mounting screws. |
| | Defective diaphragm. | Replace instrument. |

15-22. TROUBLE SHOOTING -- PITOT TUBE HEATER.

NOTE

Refer to paragraph 15-15 before blowing out pitot or static lines.

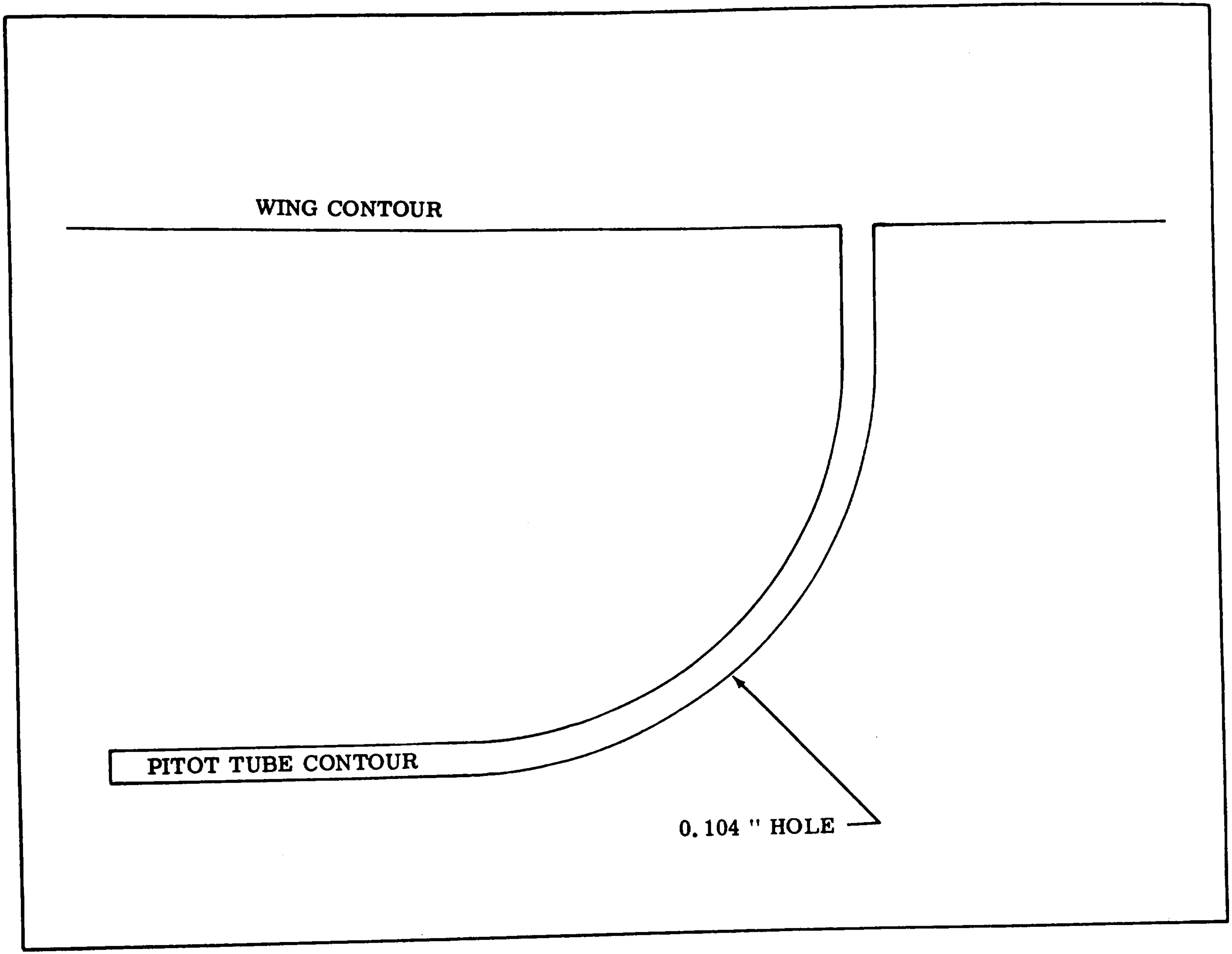
| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| TUBE DOES NOT HEAT OR CLEAR ICE. | Switch turned "OFF." | Turn switch "ON." |
| | Popped circuit breaker. | Reset breaker. |
| | Break in wiring. | Repair wiring. |
| | Heating element burned out. | Replace element. |

15-23. PITOT TUBE ALIGNMENT. (Refer to figure 15-2.) For correct airspeed indication the pitot tube (10) must be properly aligned. The open end of tube must be perpendicular to the longitudinal axis of aircraft. A template like the one shown in figure 15-4 will prove the most convenient means of checking the alignment. Prior to using the template, check that pitot tube parallels the row of rivets just outboard of tube. A straightedge may be placed along the row of rivets to check alignment. The template fits the wing contour and should conform to the illustration. The illustration has been drawn carefully to actual size and may be traced directly on a sheet of stiff plastic, plywood or metal. Place a piece of carbon paper between the printed page and template material, then trace contours.

15-24. VACUUM SYSTEM. (Refer to figure 15-5.)

15-25. 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. A central air filtering system is utilized. The reading of the suction gage indicates net difference in suction before and after air passes through a gyro. This pressure differential will gradually decrease as the central air filter becomes dirty, causing a lower reading on the suction gage.

Figure 15-4. Pitot Tube Alignment Template



15-26. TROUBLE SHOOTING - VACUUM SYSTEM.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| 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 operation with filters removed. Replace filters. |
| LOW SUCTION GAGE READINGS. | Leaks or restriction between instruments and relief valve, relief valve out of adjustment, 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 operation with filter removed. Clean or replace filter. |
| SUCTION GAGE FLUCTUATES. | Defective gage or sticking relief valve. | Check suction with test gage. Replace gage. Clean sticking valve with Stoddard solvent. Blow dry and test. If valve sticks after cleaning, replace valve. |

15-27. TROUBLE SHOOTING -- GYROS.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| HORIZON BAR FAILS TO RESPOND. | Central air filter dirty. | Clean or replace filter. |
| | Suction relief valve improperly adjusted. | Adjust or replace relief valve. |
| | Faulty suction gage. | Replace suction gage. |
| | Vacuum pump failure. | Replace pump. |
| | Vacuum line kinked or leaking. | Repair or replace damaged lines, tighten connections. |
| HORIZON BAR DOES NOT SETTLE. | Defective mechanism. | Replace instrument. |
| | Insufficient vacuum. | Adjust or replace relief valve. |
| | Excessive vibration. | Replace defective shock-mounts. |

15-27. TROUBLE SHOOTING -- GYROS (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| HORIZON BAR OSCILLATES OR VIBRATES EXCESSIVELY. | Central air filter dirty. | Clean or replace filter. |
| | Suction relief valve improperly adjusted. | Adjust or replace relief valve. |
| | Faulty suction gage. | Replace suction gage. |
| | Defective mechanism. | Replace instrument. |
| | Excessive vibration. | Replace defective shock-mounts. |
| EXCESSIVE DRIFT IN EITHER DIRECTION. | Central air filter dirty. | Clean or replace filter. |
| | Low vacuum, relief valve improperly adjusted. | Adjust or replace relief valve. |
| | Faulty suction gage. | Replace suction gage. |
| | Vacuum pump failure. | Replace pump. |
| | Vacuum line kinked or leaking. | Repair or replace damaged lines, tighten connections. |
| DIAL SPINS IN ONE DIRECTION CONTINUOUSLY. | Operating limits have been exceeded. | Replace instrument. |
| | Defective mechanism. | Replace instrument. |

15-28. TROUBLE SHOOTING -- VACUUM PUMP.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| OIL IN DISCHARGE. | Damaged engine drive seal. | Replace gasket. |
| HIGH SUCTION. | Suction relief valve screen clogged. | Clean or replace screen. |
| LOW SUCTION. | Relief valve leaking. | Replace relief valve. |
| | Vacuum pump failure. | Replace vacuum pump. |

15-29. REMOVAL AND INSTALLATION. The various components of the vacuum system are secured by conventional clamps, mounting screws and nuts. To remove a component, remove mounting screws and disconnect inlet and discharge lines. Cap open lines and fitting to prevent dirt from entering the system. When replacing a vacuum system component, ensure connections are made correctly. Use thread lubricant sparingly and only on male threads. Avoid over-tightening connections. Before installing the vacuum pump, place mounting pad gasket in position over studs. Be sure all lines and fittings are open and caps are removed.

15-30. CLEANING. Low pressure, dry compressed air should be used in cleaning vacuum system components. The suction relief valve should be washed with Stoddard solvent then dried with low-pressure air. Refer to Section 2 for central air filter. Check hose for collapsed inner liners as well as external damage.

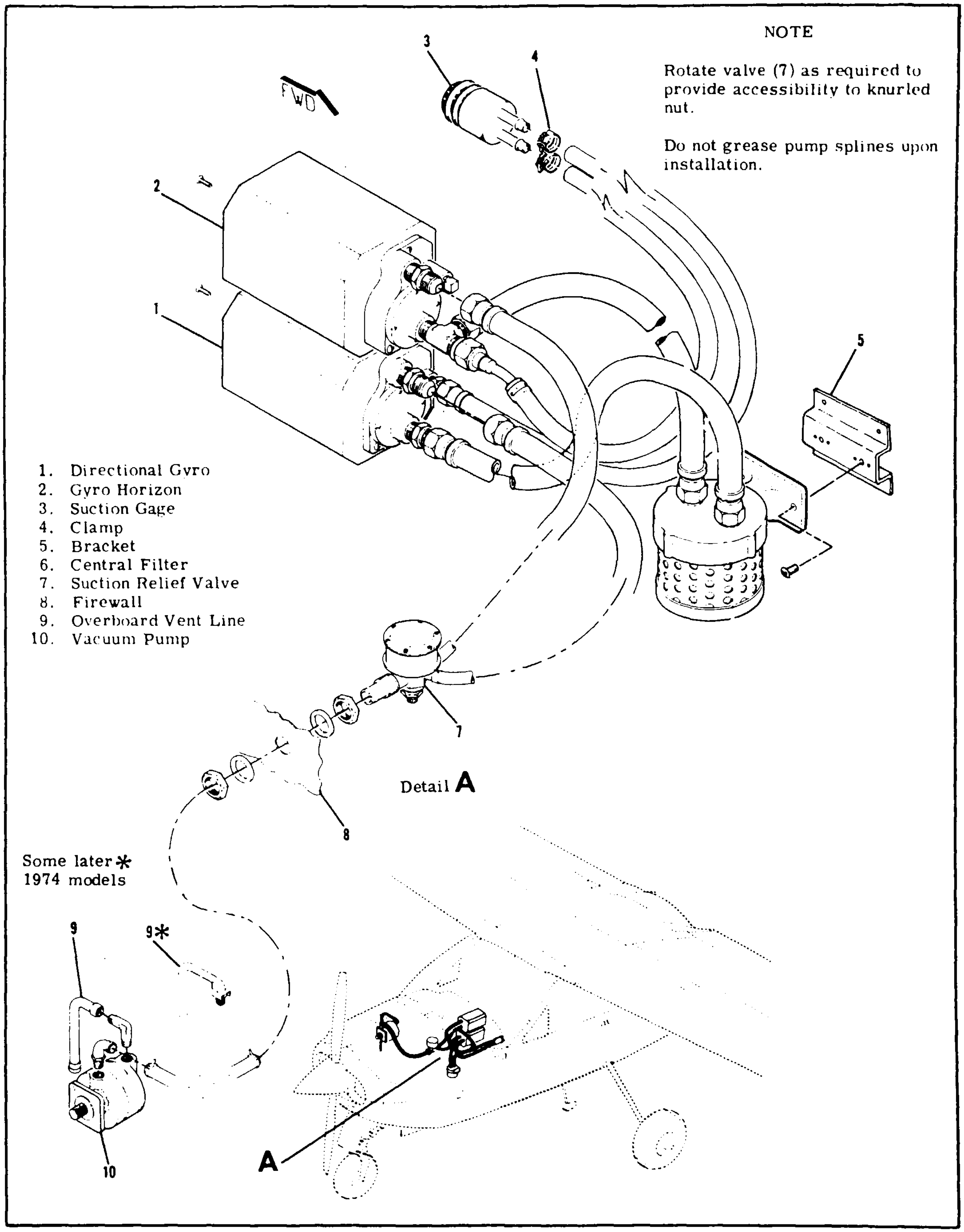



Figure 15-5. Vacuum System

**CAUTION**

Never apply compressed air to lines or components installed in the aircraft. The excessive pressures will damage gyros. If an obstructed line is to be blown out, disconnect the line at both ends and blow from the instrument panel out.

15-31. VACUUM RELIEF VALVE ADJUSTMENT. A suction gage reading of 5.3 inches of mercury is desirable for the gyro instruments. However, a range of 4.6 to 5.4 inches of mercury is acceptable. To adjust the relief valve, remove the central air filter, run the engine to 2200 rpm on the ground and adjust relief valve to 5.3 ± .1 inches of mercury.

**CAUTION**

Do not exceed maximum engine temperature.

Be sure the filter element is clean before installing. If reading drops noticeably, install a new filter element.

15-32. ENGINE INDICATORS.

15-33. TACHOMETER.

15-34. 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, the 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 the pointer oscillates, check the 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 the housing, coat the lower two thirds with AC Type ST-640 speedometer cable grease or Lubriplate No. 110. Insert the cable in housing as far as possible, then slowly rotate cable to make sure it is seated in the engine fitting. Insert cable in tachometer, making sure it is seated in drive shaft, then reconnect housing and torque to 50 pound-inches (at instrument).

15-35. MANIFOLD PRESSURE/FUEL INDICATOR.

15-36. DESCRIPTION. The manifold pressure and fuel flow indicators are in one instrument case, however, each instrument operates independently. The manifold pressure gage is a barometric instrument which indicates absolute pressure in the intake manifold in inches of mercury. The fuel flow indicator is a pressure instrument calibrated in gallons per hour, indicating approximate gallons of fuel metered per hour to the engine. Pressure for operating the indicator is obtained through a hose from the fuel flow divider valve.

NOTE

For manifold pressure gage pick-up re-location on some early model aircraft refer to Cessna Single-engine Service Letter No. SE72-4 dated Feb. 25, 1972.

15-37. TROUBLE SHOOTING -- MANIFOLD PRESSURE INDICATOR.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| EXCESSIVE ERROR AT EXISTING BAROMETRIC PRESSURE. | Pointer shifted. | Replace instrument. |
| | Leak in vacuum bellows. | Replace instrument. |
| | Loose pointer. | Replace instrument. |
| | Leak in pressure line. | Repair or replace damaged line, tighten connections. |
| | Condensate or fuel in line. | Blow out line. |
| JERKY MOVEMENT OF POINTER. | Excessive internal friction. | Replace instrument. |
| | Rocker shaft screws tight. | Replace instrument. |
| | Link springs too tight. | Replace instrument. |
| | Dirty pivot bearings. | Replace instrument. |

15-37. TROUBLE SHOOTING--MANIFOLD PRESSURE INDICATOR(Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| JERKY MOVEMENT OF POINTER (Cont). | Defective mechanism. | Replace instrument. |
| | Leak in pressure line. | Repair or replace damaged line, tighten connections. |
| SLUGGISH OPERATION OF POINTER. | Foreign matter in line. | Blow out line. |
| | Damping needle dirty. | Replace instrument. |
| | Leak in pressure line. | Repair or replace damaged line, tighten connections. |
| EXCESSIVE POINTER VIBRATION. | Tight rocker pivot bearings. | Replace instrument. |
| | Excessive vibration. | Tighten mounting screws. |
| IMPROPER CALIBRATION. | Faulty mechanism. | Replace instrument. |
| NO POINTER MOVEMENT. | Faulty mechanism. | Replace instrument. |
| | Broken pressure line. | Repair or replace damaged line. |

15-38. TROUBLE SHOOTING -- FUEL FLOW INDICATOR.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| DOES NOT REGISTER. | Pressure line clogged. | Blow out line. |
| | Pressure line broken. | Repair or replace damaged line. |
| | Fractured bellows or damaged mechanism. | Replace instrument. |
| | Clogged snubber orifice. | Replace instrument. |
| | Pointer loose on staff. | Replace instrument. |
| POINTER FAILS TO RETURN TO ZERO. | Foreign matter in line. | Blow out line. |
| | Clogged snubber orifice. | Replace instrument. |
| | Damaged bellows or mechanism. | Replace instrument. |
| INCORRECT OR ERRATIC READING. | Damaged or dirty mechanism. | Replace instrument. |
| | Pointer bent, rubbing on dial or glass. | Replace instrument. |
| | Leak or partial obstruction in pressure or vent line. | Blow out dirty line, repair or tighten loose connections. |

## 15-39. CYLINDER HEAD TEMPERATURE GAGE.

15-40. DESCRIPTION. The temperature bulb regulates electrical power through the cylinder head temperature gage. The gage and bulb require little or no maintenance other than cleaning, making sure lead is properly supported and all connections are clean, tight and properly insulated. Stewart Warner gages are equipped with a potentiometer for calibration purposes. Rochester gages cannot be calibrated. Refer to Table 1, page 15-20A, when trouble shooting the cylinder head temperature gage.

NOTE

A Cylinder Head Temperature Gage Calibration Unit (SK182-43) is available and may be ordered through the Cessna Service Parts Center.

## 15-41. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| GAGE INOPERATIVE. | No current to circuit. | Repair electrical circuit. |
| | Defective gage, bulb or circuit. | Repair or replace defective items. |
| GAGE FLUCTUATES RAPIDLY. | Loose or broken wire permitting alternate make and break of gage circuit. | Repair or replace defective wire. |
| GAGE READS TOO HIGH ON SCALE. | High voltage. | Check "A" terminal. |
| | Gage off calibration. | Recalibrate or replace gage. |
| GAGE READS TOO LOW ON SCALE. | Low voltage. | Check voltage supply and "D" terminal. |
| | Gage off calibration. | Recalibrate or replace gage. |
| GAGE READS OFF SCALE AT HIGH END. | Break in bulb. | Replace bulb. |
| | Break in bulb lead. | Replace bulb. |
| | Internal break in gage. | Replace gage. |
| OBVIOUSLY INCORRECT READING. | Defective gage mechanism. | Replace gage. |
| | Incorrect calibration. | Recalibrate. |

## 15-42. OIL PRESSURE GAGE

15-43. DESCRIPTION. On some airplanes, a Bourdon 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 which utilize a pressure sending bulb are installed on some airplanes.

## 15-44. TROUBLE SHOOTING -- OIL PRESSURE GAGE (DIRECT READING).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| GAGE DOES NOT REGISTER. | Pressure line clogged. | Clean line. |
| | Pressure line broken. | 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. | 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. | Repair or replace damaged line. |

## 15-45. OIL TEMPERATURE GAGE.

15-46. DESCRIPTION. On some airplanes, the oil temperature gage is a Bourdon tube type pressure instrument connected by armored capillary tubing to a temperature bulb in the engine. The temperature bulb, capillary tube and gage are filled with fluid and sealed. Expansion and contraction of fluid in the bulb with temperature changes operates the gage. Checking capillary tube for damage and fittings for security is the only maintenance required. Since the tubes inside diameter is quite small, small dents and kinks, which would be quite acceptable in larger tubing, may partially or completely close off the capillary, making the gage inoperative. Some airplanes are equipped with electric Rochester gages that are not adjustable. Refer to Table 2, page 15-20B, when trouble shooting the oil temperature gage.

## 15-47. FUEL QUANTITY INDICATING SYSTEM.

15-48. DESCRIPTION. The magnetic-type fuel quantity indicators are used in conjunction with a float operated, variable-resistance transmitter in each fuel bay. The full position of the 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 the transmitter is increased, producing a descresed current flow through the fuel quantity indicator and a amaller pointer deflection. the resistance regulates the amount of needle deflection, which indicates fuel level.

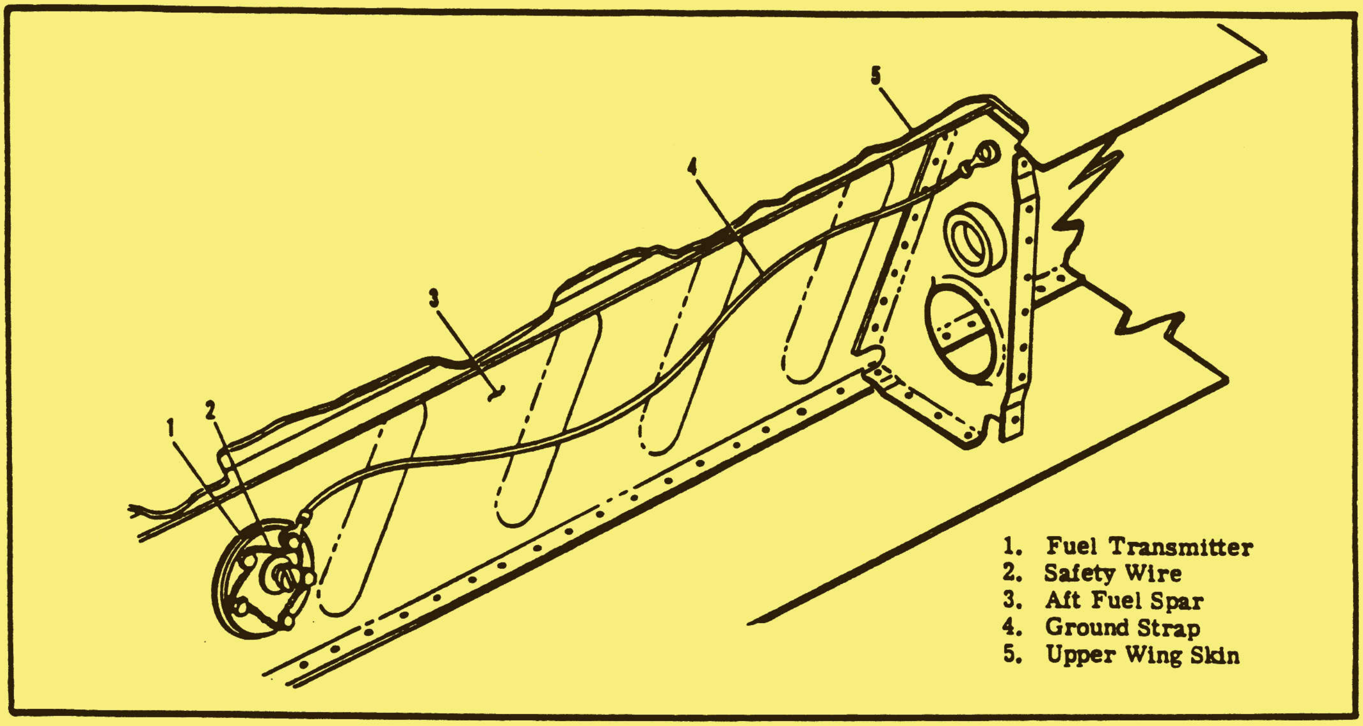



Figure 15-6. Fuel Quantity Transmitter Grounding

## SHOP NOTES:

15-48A. TRANSMITTER REMOVAL & INSTALLATION.

a. Remove access plates on underside of wing, forward of flap bellcrank.

b. Drain enough fuel from bay to lower fuel level below transmitter adapter. (Observe precautions in Section 12, Paragraph 12-3.)

c. Disconnect electrical lead and ground strap from transmitter.

d. Remove safety wire from transmitter attaching bolts, remove bolts and carefully remove transmitter from fuel spar. DO NOT BEND FLOAT ARM.

e. To install transmitter, reverse preceding steps, using a new gasket around opening in fuel bay and new sealing washers.

f. Service fuel bay. Check for leaks and correct fuel quantity indication.

NOTE

Be sure grounding is secure and in accordance with figure 15-6.

15-49. TRANSMITTER ADJUSTMENT.
(Refer to page 15-20A/B)

15-50. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| FAILURE TO INDICATE. | No power to indicator or transmitter. (Pointer stays below E.) | Check and reset breaker, repair or replace defective wiring. |
| | Grounded wire. (Pointer stays above F.) | Repair or replace defective wire. |
| | Low voltage. | Correct voltage. |
| | Defective indicator. | Replace indicator. |
| SYSTEM OFF CALIBRATION. | Defective indicator. | Replace indicator. |
| | Defective transmitter. | Recalibrate or replace. |
| | Low or high voltage. | Correct voltage. |
| STICKY OR SLUGGISH INDICATOR OPERATION. | Defective indicator. | Replace indicator. |
| | Low voltage. | Correct voltage. |
| ERRATIC READINGS. | Loose or broken wiring on indicator or transmitter. | Repair or replace defective wire. |
| | Defective indicator or transmitter. | Replace indicator or transmitter. |
| | Defective master switch. | Replace switch. |

15-51. HOURMETER.

15-52. DESCRIPTION. The hourmeter is an electrically operated instrument, 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 independent of the master switch.

## 15-53. ECONOMY MIXTURE INDICATOR.

15-54. DESCRIPTION. The economy mixture indicator is an exhaust gas temperature (EGT) sensing device which is used to aid the pilot in selecting the most desirable fuel-air-mixture for cruising flight at less than 75% power. Exhaust gas temperature (EGT) varies with ratio of fuel-to-air mixture entering the engine cylinders. Refer to the Owner's Manual for operating procedure of the system. Beginning with AIRCRAFT SERIALS 177RG0257 AND F177RG0063 a 100 inch lead is utilized, coil or fold excess lead and tie in convenient out of the way location.

15-55. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| GAGE INOPERATIVE. | Defective gage, probe or circuit. | Repair or replace defective part. |
| INCORRECT READING. | Indicator needs calibrating. | Calibrate indicator in accordance with paragraph 15-56. |
| FLUCTUATING READING. | Loose, frayed or broken lead, permitting alternate make and break of circuit. | Tighten connections and repair or replace defective leads. |

15-56. CALIBRATION. A potentiometer adjustment screw is provided behind the plastic cap at the back of the instrument for calibration. This adjustment screw is used to position the pointer over the reference increment line (4/5 of scale) at peak EGT. Establish 75% power in level flight, then carefully lean the mixture to peak EGT. After the pointer has peaked, using the adjustment screw, position pointer over reference increment line (4/5 of scale).

NOTE

This setting will provide relative temperature indications for normal cruise power settings within range of the instrument.

Turning the screw clockwise increases the meter reading and counterclockwise decreases the meter reading. There is a stop in each direction and damage can occur if too much torque is applied against stops. Approximately 600°F total adjustment is provided. The adjustable yellow pointer on the face of the instrument is a reference pointer only.

15-57. REMOVAL AND INSTALLATION. Removal of the indicator is accomplished by removing the mounting screws and disconnecting the leads. Tag leads to facilitate installation. The thermocouple probe is secured to the exhaust stack with a clamp. When installing probe, tighten clamp to 45 pound-inches and safety as required.

15-58. MAGNETIC COMPASS AND OUTSIDE AIR TEMPERATURE GAGE. Refer to Figure 15-6.

15-59. DESCRIPTION. The magnetic compass is liquid-filled, with expansion provisions to compensate for temperature changes. It is equipped with compensating magnets adjustable from the front of the case. Beginning with aircraft serial 177RG0313 and F177RG0088, a slot is provided in the bezel for adjustment without removing the bezel, remove the card correction decal only and make the adjustment. The compass has an internal replaceable lamp, controlled by the panel lights rheostat. No maintenance is required on the compass except an occasional check on a compass rose and replacement of the lamp. The compass mount is attached by three screws to a base plate which is bonded to the windshield with methylene chloride. A tube containing the compass light wires is attached to the metal strip at the top of the windshield. The Outside Air Temperature gage is installed in the same mount and senses air temperature through an extended probe on the outside of the windshield. The gage should periodically be checked for accuracy with a certified temperature gage.

15-59A. REMOVAL AND INSTALLATION.

a. To remove the compass from the mounting cup remove (2) screws from the bezel and remove the screw from the front of mount, remove wire splices at the window retainer, pull in a follow wire as wire is pulled out for reinstallation in the tubing.

b. To remove mount remove screws from mount, nuts are retained in the base plate, bonded to the windshield.

c. To remove the Outside Air Temperature Gage remove sealer around probe on outside of winshield and screw the indicator out of the rubber insert.

d. Install components by reversing the procedure, seal around outside temperature gage probe on the outside of the windshield with sealer (General Electric RTV102 or equivalent).

## 15-49. TRANSMITTER ADJUSTMENT.

**WARNING**

**Using the following fuel transmitter calibration procedure on components other than the originally installed (Stewart Warner) components will result in a faulty fuel quantity reading.**

15-49A. STEWART WARNER GAGE TRANSMITTER CALIBRATION. Chances of transmitter calibration changing in normal service is remote; however, it is possible that float arm or float arm stops may become bent if transmitter is removed from cell. Transmitter calibration is obtained by adjusting float travel. Float travel is limited by 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 master switch in "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 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 15-48A.

15-49B. ROCHESTER GAGE TRANSMITTER. Do not attempt to adjust float arm or stop. No adjustment is allowed.

Table 1

NOTE

Select the cylinder head temperature sending unit part number that is used in your aircraft from the left column and the temperature from the column headings. Read the ohms value under the appropriate temperature column.

| Part Number | Type | 200°F | 220°F | 450°F | 475°F |
|---|---|---|---|---|---|
| S1372-1 | CHT | | 310.0 | 34.8 | |
| S1372-2 | CHT | | 310.0 | 34.8 | |
| S1372-3 | CHT | | | 113.0 | |
| S1372-4 | CHT | | | 113.0 | |
| S2334-3 | CHT | 745.0 | | | 38.0 |
| S2334-4 | CHT | 745.0 | | | 38.0 |

Table 2

NOTE

Select the oil temperature sending unit part number that is used in your aircraft 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 | |
| S1630-3 | Oil Temp | | 620.0 | | | 52.4 |
| S1630-4 | Oil Temp | | 620.0 | | | 52.4 |
| S1630-5 | Oil Temp | | | 192.0 | | |
| S2335-1 | Oil Temp | 990.0 | | | | 34.0 |

## 15-49C. 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.

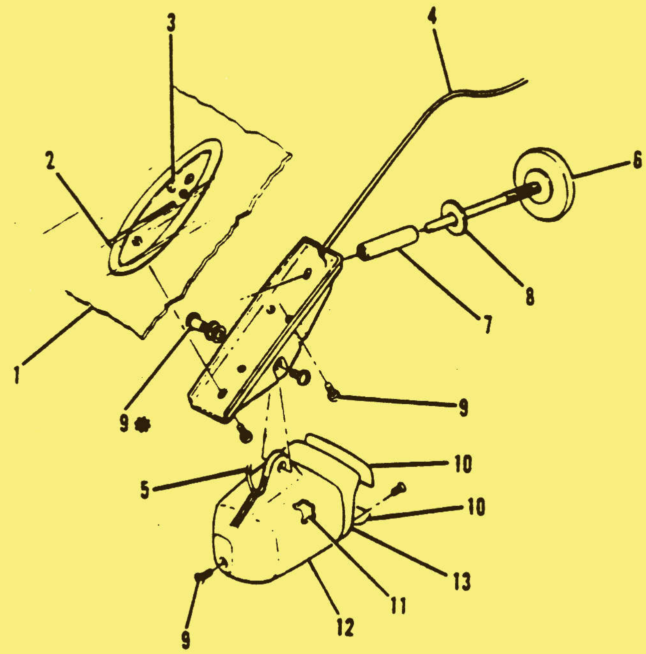
   **NOTE:** Stewart Warner fuel quantity indicating systems can be adjusted. Refer to this section for instructions for adjusting Stewart Warner fuel indicating systems.
   Rochester fuel quantity indicating system components are not adjustable, only component replacement or standard electrical wiring 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.




NOTE

✱ Torque to 10-15 lb inches to prevent compass rotation in flight.

1. Windshield
2. Base Plate
3. Insert
4. Tube
5. Wire
6. Outside Air Temperature Gage
7. Rubber Insert
8. Rubber Washer
9. Screw
10. Compass Correction Card
11. Compass
12. Compass Mount
13. Bezel

Figure 15-6. Magnetic Compass and Outside Air Temperature Gage Installation.

15-60. STALL WARNING HORN AND TRANSMITTER.

15-61. DESCRIPTION. The stall warning horn is contained in the dual warning unit mounted on the right side of the firewall behind the glove box. It is electrically operated and controlled by a stall warning transmitter mounted on the leading edge of the left wing. For further information on the warning horn and transmitter, refer to Section 16.

15-62. TURN COORDINATOR.

15-63. DESCRIPTION. The turn coordinator is an electrically operated, gyroscopic, roll-turn rate indicator. Its gyro simultaneously senses rate of motion roll and yaw axis which is projected on a single indicator. The gyro is a non-tumbling type requiring no caging mechanism and incorporates an ac brushless spin motor with a solid-state inverter. The unit incorporates a ON-OFF Flag. denoting a loss of power. The OFF signal is a divided red & black window and the normal ON signal is a solid black window.

15-64. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| INDICATOR DOES NOT RE-TURN TO CENTER. | Friction caused by contamination in the indicator damping. | Replace instrument, inverter and restrictor valve. |
| | Friction in gimbal assembly. | Replace instrument, inverter and restrictor valve. |
| DOES NOT INDICATE A STANDARD RATE TURN (TOO SLOW). | Low voltage. | Correct voltage. |
| | Inverter frequency changed. | Replace inverter, instrument and restrictor valve. |
| NOISY MOTOR. | Faulty bearings. | Replace instrument, inverter and restrictor valve. |
| ROTOR DOES NOT START. | Faulty electrical connection. | Correct voltage or replace faulty wire. |
| | Inverter malfunctioning. | Replace inverter, instrument and restrictor valve. |
| | Motor shorted. | Replace instrument, inverter and restrictor valve. |
| | Bearings frozen. | Replace instrument, inverter and restrictor valve. |
| IN COLD TEMPERATURES, HAND FAILS TO RESPOND | Oil in indicator becomes too thick. | Replace instrument, inverter and restrictor valve. |
| | Insufficient bearing end play. | Replace instrument, inverter and restrictor valve. |
| | Low voltage. | Correct voltage. |

15-65. TURN-AND-SLIP INDICATOR.

15-66. DESCRIPTION. The turn-and-slip indicator is operated by the aircraft electrical system and operates ONLY when the master switch is on. Its circuit is protected by an automatically-resetting circuit breaker.

15-67. TROUBLE SHOOTING.

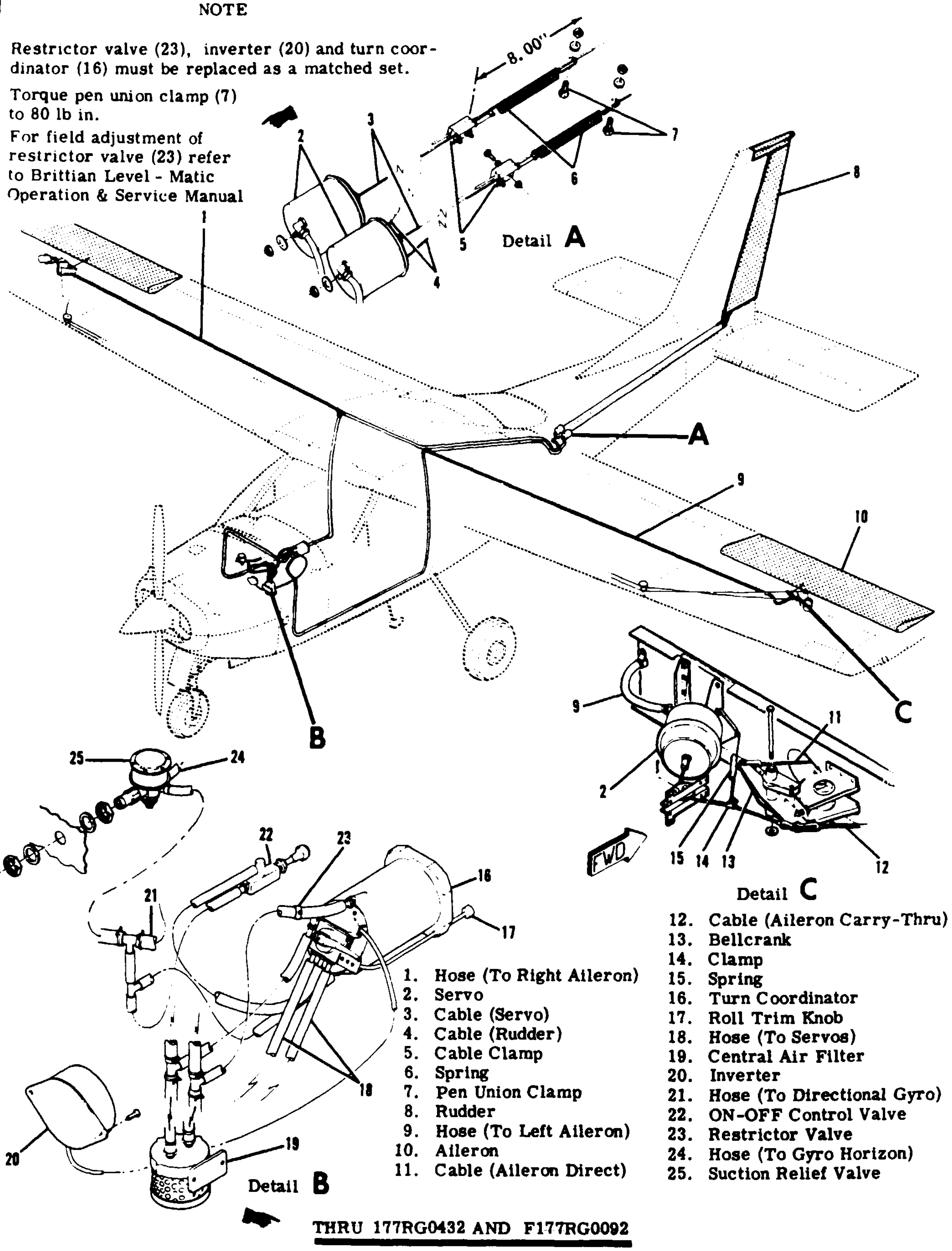
| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| HAND SLUGGISH IN RE-TURNING TO ZERO. | Defective mechanism. | Replace instrument. |
| | Low voltage. | Correct voltage. |
| POINTER DOES NOT INDI-CATE PROPER TURN. | Defective mechanism. | Replace instrument. |

NOTE

Restrictor valve (23), inverter (20) and turn coordinator (16) must be replaced as a matched set.

Torque pen union clamp (7) to 80 lb in.

For field adjustment of restrictor valve (23) refer to Brittian Level - Matic Operation & Service Manual




1. Hose (To Right Aileron)
2. Servo
3. Cable (Servo)
4. Cable (Rudder)
5. Cable Clamp
6. Spring
7. Pen Union Clamp
8. Rudder
9. Hose (To Left Aileron)
10. Aileron
11. Cable (Aileron Direct)
12. Cable (Aileron Carry-Thru)
13. Bellcrank
14. Clamp
15. Spring
16. Turn Coordinator
17. Roll Trim Knob
18. Hose (To Servos)
19. Central Air Filter
20. Inverter
21. Hose (To Directional Gyro)
22. ON-OFF Control Valve
23. Restrictor Valve
24. Hose (To Gyro Horizon)
25. Suction Relief Valve

THRU 177RG0432 AND F177RG0092

Figure 15-6. Wing Leveler Control System

15-67. TROUBLE SHOOTING (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| INDICATOR POINTER FAILS TO RESPOND. | Automatic resetting circuit breaker defective. | Replace breaker. |
| | Master switch "OFF" or switch defective. | Replace defective switch. |
| | Broken or grounded lead to indicator. | Repair or replace defective wiring. |
| | Indicator not grounded. | Repair or replace defective wire. |
| | 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. | Correct voltage. |
| NOISY GYRO. | High voltage. | Correct voltage. |
| | Loose or defective rotor bearings. | Replace instrument. |

15-68. ELECTRIC CLOCK.

15-69. DESCRIPTION. The electric clock is connected to the battery through a one-ampere fuse mounted adjacent to the battery box. The electrical circuit is separate from the aircraft electrical system and will operate when the master switch is "OFF."

15-70. WING LEVELER. THRU AIRCRAFT 177RG0433 AND F177RG0093. (Refer to figure 15-6)

15-71. DESCRIPTION. The wing leveler control system, consisting of a turn coordinator, pneumatic servos, connecting cables and hose may be installed. The turn coordinator gyro senses changes in roll attitude, then electrically meters vacuum power from the engine-driven vacuum pump to the cylinder-piston servos, operating ailerons for lateral stability. In addition to aileron servos, two servos are connected to the rudder cables and provide yaw stability that prevents excessive changes in heading in turbulent air. Manual control of the system is afforded by the roll trim knob. Roll trim should not be used to correct faulty rigging or "wing heaviness." Manual override of the system may be accomplished without damage to the aircraft or system. The ON-OFF valve controls the vacuum supply to distributor valve, but does not affect the electrically operated turn coordinator gyro. Installation of the wing leveler does not change the vacuum relief valve settings. Refer to the appropriate publication issued by the manufacturer for trouble shooting procedures.

15-72. RIGGING.

a. Rudder controls and rudder must be in neutral position before clamps (5) are secured to cables (4).
b. While maintaining servos (2) in their neutral position, remove slack from servo cables (3) by moving clamps (5) aft on rudder cables (4) until servo cables become taut, then secure clamps (5) to cables.
c. Connect springs (6) to cable ends, then pull cables through clamps (5) until servos (2) are fully extended but not stretched.
d. Position pen union clamps (7) on rudder cables (4) 8.00 inches aft of clamps (5) and secure. Torque clamps (7) to 80 pound-inches.
e. Aileron servos require no rigging if components are installed as illustrated in figure 15-6.

TABLE OF CONTENTS Page

16-1. ELECTRICAL SYSTEMS.

16-2. GENERAL. This section contains information necessary to maintain the Aircraft Electrical Power Supply System, Battery and External Power Supply System, Alternator Power Supply System, Aircraft Lighting System, Pitot Heater, Stall and Gear Warning System, Electric Clock, Cigar Lighter, and Electrical Load Analysis Chart.

16-3. ELECTRICAL POWER SUPPLY SYSTEM.

16-4. DESCRIPTION. Electrical energy for the aircraft is supplied by a 12-volt, direct-current, single-wire, negative ground electrical system. A single 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 receptacle is offered as optional equipment to supplement the battery system for starting and ground operation.

16-5. SPLIT BUS BAR.

16-6. DESCRIPTION. Electrical power is supplied through a split bus bar. One side of the bus bar supplies power to the electrical equipment while the other side supplies the electronic installations. When the master switch is closed the battery contactor engages and the battery power is supplied to the electrical side of the split bus bar. The electrical bus feeds power to the electronic bus through a normally-closed relay; this relay opens when the starter switch is engaged or when an external power source is used, preventing transient voltages from damaging the semiconductor circuitry in the electronics installations.

16-7. SPLIT BUS POWER RELAY.

16-8. DESCRIPTION. A power relay is installed behind the instrument panel on all aircraft utilizing a split bus bar. The relay is a normally closed type, opening when external power is connected or when the starter is engaged, thus removing battery power from the electronic side of the split bus bar and preventing transient voltages from damaging the electronic installations. (See figure 16-1.)

16-9. MASTER SWITCH.

16-10. DESCRIPTION. The operation of the battery and alternator system is controlled by a master switch. The switch, when operated, connects the battery contactor coil to ground and the alternator field circuit to the battery, activating the power systems. The switch is a inter-locking, split rocker with 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 above the switch and is located on the left hand side of the switch panel.

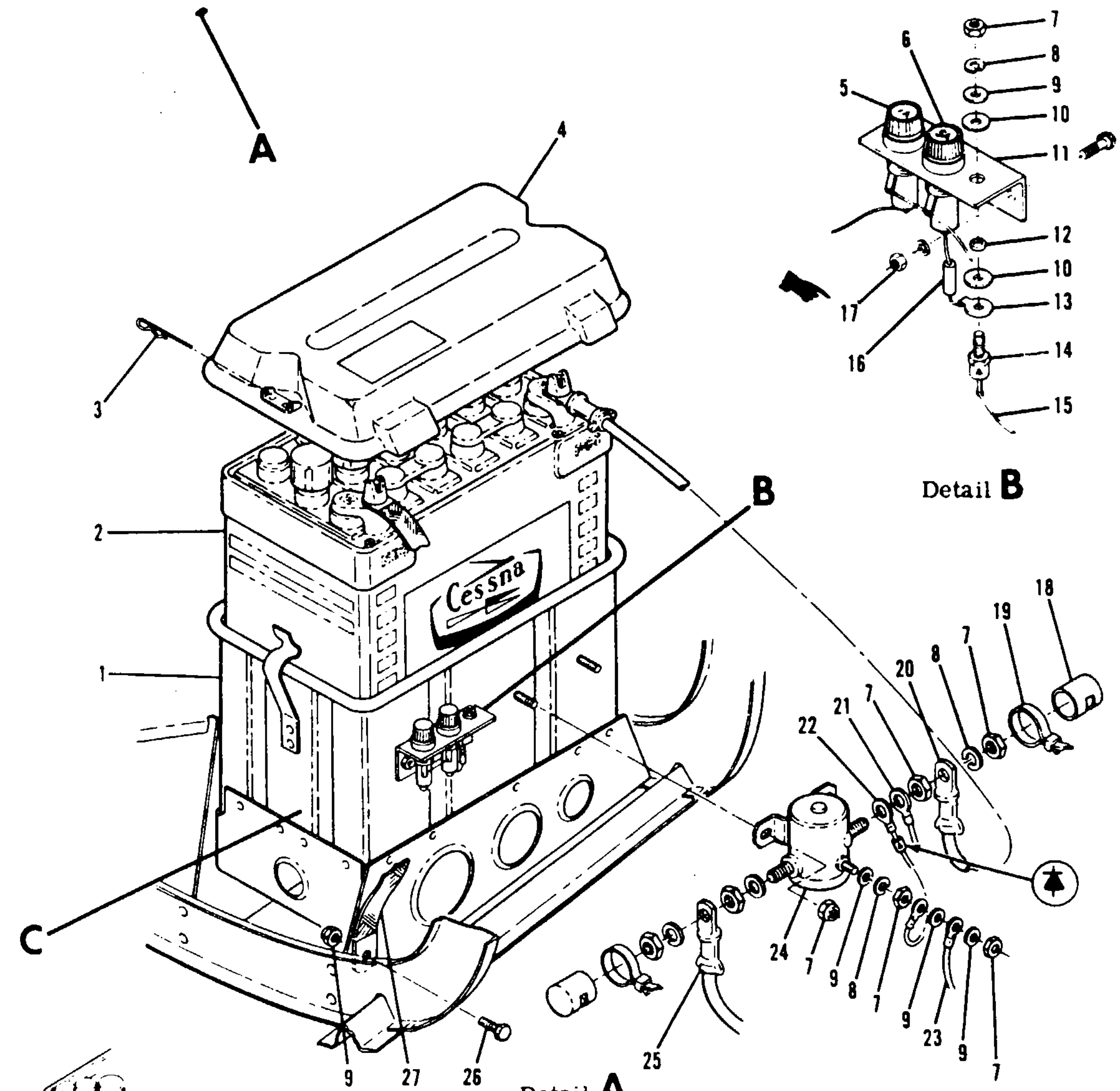
16-11. AMMETER.

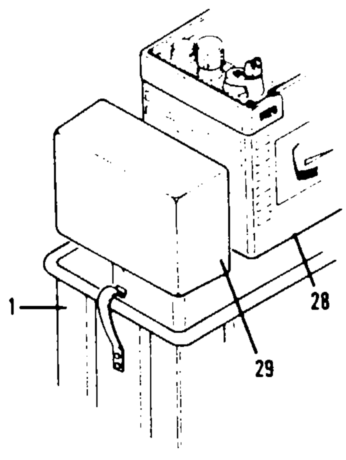
16-12. DESCRIPTION. The ammeter is connected between the battery and the aircraft bus. The meter indicates the amount of current flowing either to or from the battery. With a low battery and the engine operating at cruise speed, the ammeter will show the full alternator output. When the battery is fully charged and cruise is maintained with all electrical equipment off, the ammeter will show a minimum charging rate.


Detail B
1971 MODELS & ON

1. Locknut
2. Lockwasher
3. Split Bus Power Relay
4. Washer
5. Bolt

Figure 16-1. Split Bus Power Relay Installation




1. Battery Box
2. Battery - 33 Amp Hr. (Opt)
3. Locking Clip
4. Battery Box Lid
5. Fuse - Clock
6. Fuse - Battery Contactor Closing Circuit
7. Nut
8. Lockwasher
9. Washer
10. Insulating Washer
11. Bracket - Fuse Mounting
12. Spacer
13. Solder Terminal
14. Diode
15. Wire to Battery Contactor
16. Resistor
17. Nut
18. Insulator Cover
19. Sta - Strap
20. Positive Battery Cable
21. Battery Contactor Closing Circuit Wire
22. Diode Wire
23. Master Switch Wire
24. Contactor
25. External Power Cable
26. Bolt
27. Negative Ground Strap
28. Battery - 25 Amp Hr.
29. Spacer

Figure 16-2. Battery and Electrical Equipment Installation

16-13. BATTERY POWER SYSTEM.

16-14. BATTERY.

16-15. DESCRIPTION. The battery, furnished as standard equipment, is 12-volts and is approximately 25 ampere-hour capacity. A larger heavy duty battery is offered as optional equipment. The heavy duty battery is also 12-volts but is approximately 33 ampere hour capacity. The battery is mounted in the tailcone and is equipped with non-spill filler caps. Since the same battery box is used for both batteries, a spacer is utilized to fill the unused portion of the battery box when the smaller standard battery is installed. (See figure 16-2.)

16-16. TROUBLE SHOOTING

| 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. |
| | 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 intermittant, replace contactor. If voltage is normal, proceed to step 6. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| BATTERY WILL NOT SUPPLY POWER TO BUS OR IS INCAPABLE OF CRANKING ENGINE (cont). | Faulty wiring between contactor and bus. | 6. Inspect wiring between contactor and bus. Repair or replace wiring. |

16-17. REMOVAL AND INSTALLATION (Refer to figure 16-2.)

a. Remove aft baggage wall.
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.

16-18. 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 paragraph.
g. Coat the battery terminals with petroleum jelly or an ignition spray product to reduce corrosion.

16-19. 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.

16-20. 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.

16-21. 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. Test the battery with a hydrometer to determine the amount of charge. Decrease the charging rate or stop charging temporarily if the battery temperature exceeds 125°F.

16-22. BATTERY BOX.

16-23. DESCRIPTION. The battery is completely enclosed in an acid resistant plastic box which is riveted to mounting brackets in the tailcone. The box has a vent tube which protrudes through the bottom of the aircraft allowing battery gases and spilled electrolyte to escape.

16-24. REMOVAL AND INSTALLATION. (Refer to figure 16-2.) The battery box is riveted to the mounting brackets in the tailcone. The rivets must be drilled out to remove the box.

16-25. MAINTENANCE OF BATTERY BOX. 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.

**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 paint Part No. CES 1054-529, available from the Cessna Service Parts Center.

16-26. BATTERY CONTACTOR.

16-27. DESCRIPTION. The battery contactor is bolted to the side of the battery box. The contactor is a plunger type contactor which is actuated by turning the master switch on. When the master switch is off, the battery is disconnected from the electrical system. A silicon diode is used to eliminate spiking of transistorized radio equipment. The large terminal of the diode connects to the battery terminal of the battery contactor. The small terminal of the diode and the master switch wire connect to the coil terminal of the battery contactor. Nylon covers are installed on the contactor terminals to prevent accidental shorts. (See figure 16-2.)

16-28. REMOVAL AND INSTALLATION. (Refer to figure 16-2.)

a. Remove the battery box cover and disconnect the ground cable from the negative battery terminal and pull cable clear of battery box.
b. Remove the nut, lockwasher and the two plain washers securing the battery cables to the battery contactor.
c. Remove the nut, lockwasher and the two plain washers securing the wire which is routed to the master switch.
d. Remove the silicon diode which is connected to the battery terminal and the coil terminal.
e. Remove the bolt, washer and nut securing each side of the battery contactor to the battery box. The contactor will now be free for removal.
f. To replace the contactor, reverse this procedure.

16-29. BATTERY CONTACTOR CLOSING CIRCUIT.

16-30. DESCRIPTION. This circuit consists of a 5-amp fuse, a resistor and a diode mounted on a bracket on the side of the battery box. This serves to shunt a small charge around the battery contactor so that ground power may be used to close the contactor when the battery is too dead to energize the contactor by itself.

16-31. GROUND SERVICE RECEPTACLE.

16-32. DESCRIPTION. A ground service receptacle is offered as optional equipment to permit use of external power for cold weather starting or when performing lengthy electrical maintenance. A reverse polarity protection system is utilized whereby ground power must pass through an external power contactor to be connected to the bus. A silicon junction diode is connected in series with the coil on the external power contactor so that if the ground power source is inadvertently connected with a reverse polarity, the external power contactor will not close. This feature protects the diodes in the alternator, and other semiconductor devices, used in the aircraft from possible reverse polarity damage.

NOTE

Maintenance of the electronic installation cannot be performed when using external power. Application of external power opens the relay supplying voltage to the electronic bus. For lengthy ground testing of electronic systems, connect a well regulated and filtered power supply directly to the battery side of the battery contactor. Adjust the supply for 14-volts and close the master switch.

NOTE

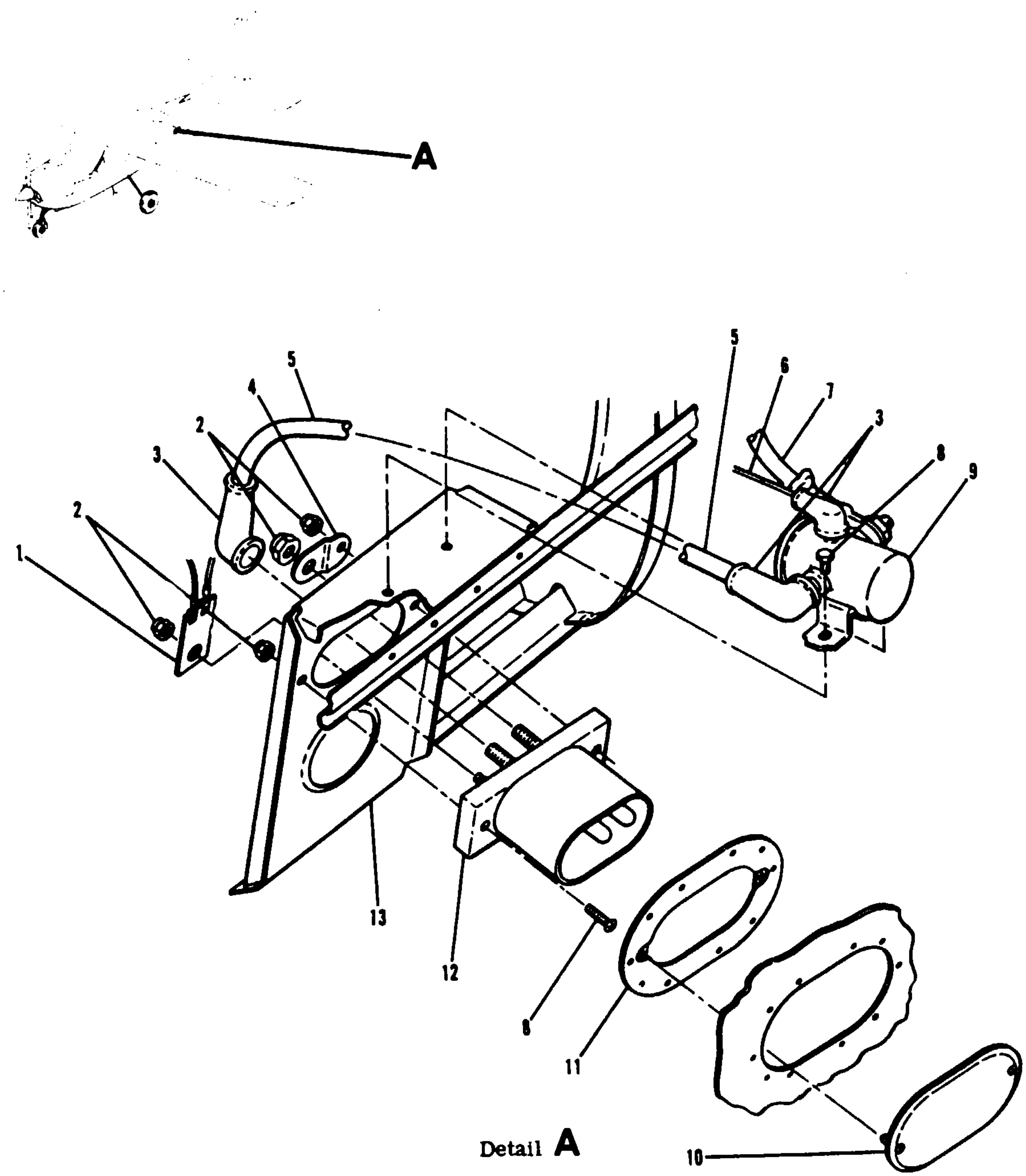
When using ground power to start the aircraft, close the master switch before removing the ground power plug. This will ensure closure of the battery contactor and excitation of the alternator field in the event that the battery is completely dead.

CAUTION

Failure to observe polarity when connecting an external power source directly to the battery or directly to the battery side of the battery contactor, will damage the diodes in the alternator and other semiconductor devices in the aircraft.

16-33. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| STARTER ENGAGES WHEN GROUND POWER IS CONNECTED. | Shorted or reversed diode in split bus-bar system. | Check wiring to, and condition of diode mounted on the split bus relay bracket adjacent to the magneto switch. Correct wiring. Replace diode board assembly. |
| GROUND POWER WILL NOT CRANK ENGINE. | Ground service connector wired incorrectly. | 1. Check for voltage at all three terminals of external power contactor with ground power connected and master switch off. If voltage is present on input and coil terminals but not on the output terminal, proceed to step 4. If voltage is present on the input terminal but not on the coil terminal, proceed to step 2. If voltage is present on all three terminals, check wiring between contactor and bus. |
| | | 2. Check for voltage at small terminal of ground service receptacle. If voltage is not present, check ground service plug wiring. If voltage is present, proceed to step 3. |




1. Diode Assembly
2. Nut
3. Nipple
4. Ground-Strap
5. Cable - Ext Pwr Contactor to Receptacle
6. Wire - Ext Pwr Contactor to Diode Assembly
7. Cable - Contactor to Gnd
8. Screw
9. External Power Contactor
10. Door Assembly
11. Doubler Assembly
12. Receptacle - Ext Power
13. Bracket Assembly

Figure 16-3. Ground Service Receptacle Installation

16-33. TROUBLE SHOOTING. (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| GROUND POWER WILL NOT CRANK ENGINE. (Cont). | Open or mis-wired diode on ground service diode board assembly. | 3. Check polarity and continuity of diode on diode board at rear of ground service receptacle. If diode is open or improperly wired, replace diode board assembly. |
| | Faulty external power contactor. | 4. Check resistance from small (coil) terminal of external power contactor to ground (master switch off and ground power unplugged). Normal indication is 16-24 ohms. If resistance indicates an open coil, replace contactor. If resistance is normal, proceed to step 5. |
| | Faulty contacts in external power contactor. | 5. With master switch off and ground power applied, check for voltage drop between two large terminals of external power (turn on taxi light for a load). Normal indication is zero volts. If voltage is intermittently present or present all the time, replace contactor. |

16-34. REMOVAL AND INSTALLATION. (Refer to figure 16-3.)

a. Open the battery box and diconnect the ground cable from the negative terminal of the battery and pull the cable from the battery box.

b. Remove the nuts, washers, ground strap and diode board from the studs of the receptacle and remove the battery cable.

c. Remove the screws and nuts holding the receptacle. The receptacle will then be free from the bracket.

d. To install a ground service receptacle, reverse this procedure. Be sure to place the ground strap on the negative stud of the receptacle.

16-35. ALTERNATOR POWER SYSTEM.

16-36. 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. Beginning with 1972 models an over-voltage sensor switch and red warning light labeled HIGH VOLTAGE are incorporated to protect the system, (refer to paragraph 16-46). The aircraft battery supplies the source of power for excitation of the alternator.

16-37. ALTERNATOR.

16-38. DESCRIPTION. The 60-ampere alternators used on the 177RG model are 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 the ac is generated. The stator windings are three-phase, delta connected, and are attached to two diode plates, each of which contain three silicon diodes.

The diode plates are connected to accomplish full-wave, rectification of the ac. The resulting dc output is applied to the aircraft bus and sensed by the voltage regulator. The regulator contorls the excitation applied to the alternator field, thus controlling the output voltage of the alternator.

16-39. TROUBLE SHOOTING THE ALTERNATOR SYSTEM.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| AMMETER INDICATES HEAVY DISCHARGE WITH ENGINE NOT RUNNING OR ALTERNATOR CIRCUIT BREAKER OPENS WHEN MASTER SWITCH IS TURNED ON. | Shorted radio noise filter or shorted wire. | 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. |
| | | 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. |
| | | 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. |
| | Shorted diodes in alternator. | 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. |
| ALTERNATOR SYSTEM WILL NOT KEEP BATTERY CHARGED. | Regulator faulty or improperly adjusted. | 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 consistant with the voltage vs temperature chart on page 16-10. 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. |

16-39. TROUBLE SHOOTING THE ALTERNATOR SYSTEM (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| ALTERNATOR SYSTEM WILL NOT KEEP BATTERY CHARGED (Cont). | Regulator faulty or improperly adjusted. (Cont.) | 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. |
| | | 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. |
| | | 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. |
| | Faulty wiring between alternator and regulator, or faulty alternator. | 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. |
| | | 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. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| 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 on page 16-13. Observe ship's 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. |

16-40. 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 safety wire from the upper adjusting bolt and loosen bolt.
d. Remove safety wire from lower adjusting bolt and remove bolt.
e. Remove the locknut from the alternator mounting bolt.
f. Remove the alternator drive belt and the alternator mounting bolt, the alternator will then be free for removal.
g. To replace the alternator, reverse this procedure.
h. Apply a torque wrench to the nut on alternator pulley and adjust the belt tension so the belt slips when the following torque value is applied.

**TORQUE VALUES FOR CHECKING ALTERNATOR BELT TENSION**

| Used Belt | New Belt |
|---|---|
| Slips At<br>7 to 9 Ft. Lbs. | Slips At<br>11 to 13 Ft. Lbs |

—NOTE—

Whenever a new belt is installed, belt tension should be checked within 10 to 25 hours of operation.

i. Tighten and safety wire upper and lower adjusting bolts.
j. Tighten alternator mounting bolt.

16-41. ALTERNATOR FIELD CIRCUIT PROTECTION. On models prior to 1970, a 2-amp automatic resetting circuit breaker located on the back of the instrument panel is provided to protect the alternator field circuit. On 1970 models and on, a manually-resettable circuit breaker located on the switch panel is provided to protect the alternator field circuit.

16-42. ALTERNATOR VOLTAGE REGULATOR.

16-43. DESCRIPTION. The alternator voltage regulator contains two relays. One relay is actuated by the aircraft master switch and connects the regulator to the battery. The second relay is a two-stage, voltage sensitive device, which is used to control the current applied to the field winding of the alternator. When the upper set of contacts on the voltage regulator relay are closed, full bus voltage is applied to the field. This condition will exist when the battery is being heavily charged or when a very heavy load is applied to the system. When the upper contacts open, as the voltage begins to rise toward normal bus voltage to the alternator field is reduced through a resistor network in the base of the regulator, thus reducing the output from the alternator. As the voltage continues to rise, assuming a very light load on the system, the lower contacts will close and ground the alternator field and shut the alternator completely off. Under lightly loaded conditions the voltage relay will vibrate between the intermediate charge rate and the lower (completely off) contacts. Under a moderate load, the relay will vibrate between the intermediate charge rate and the upper (full output) contacts.

The voltage relay is temperature compensated so that the battery is supplied with the proper charging voltage for all operating temperatures. With the battery fully charged (ship's ammeter indicating at or near zero) and a moderate load applied to the system (a taxi light turned on), the voltage at the bus bar should be within the range shown according to the air temperature on the following chart:

| TEMPERATURE | BUS VOLTAGE |
|---|---|
| 60 - 74°F. | 13.8 - 14.1 |
| 75 - 90°F. | 13.7 - 14.0 |
| 91 - 100°F | 13.6 - 13.9 |

The voltage regulator is adjustable but adjustment on the airplane is not recommended. A bench adjustment procedure is outlined in the Cessna Alternator Charging Systems Service/Parts Manual.

The voltage regulator is adjustable, but adjustment on the aircraft is not recommended. A bench adjustment procedure is outlined in the Cessna Alternator Charging Systems Service/Parts Manual.

16-44. TROUBLE SHOOTING. For trouble shooting the voltage regulator, refer to paragraph 16-39.

16-45. REMOVAL AND INSTALLATION. (Refer to figure 16-5.)

a. Make sure that the master switch is off, or disconnect the negative lead from the battery.

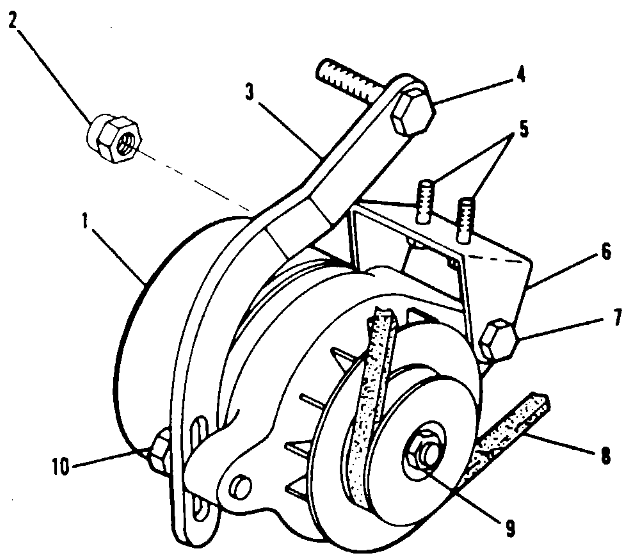
b. Remove the connector plug from the regulator.

c. Remove two screws holding the regulator on the firewall.

d. To replace the regulator, reverse the procedure. Be sure that the connections for grounding the alternator, wiring shields and the base of the regulator are clean and bright before assembly. Otherwise, poor voltage regulation and/or excessive radio noise may result.

16-46. OVER-VOLTAGE WARNING SYSTEM.

16-47. DESCRIPTION. Beginning with 1972 Models, an over-voltage warning system is incorporated in the aircraft. The over-voltage warning system consists of an over-voltage sensor switch and a red warning light labeled, "HIGH VOLTAGE", on 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 Mas- 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 tripout 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 red warning light filament can be tested by turning off the Alternator portion of the Master Switch and leaving the Battery portion turned on. This test does not induce an over-voltage condition on the electrical system. On models prior to aircraft serials 177RG0243 and F177RG0046, should nuisance trip-outs occur caused by voltage spiks or transient voltage, Cessna Single-engine Service Letter SE72-15 dated April 21, 1972 should be complied with.

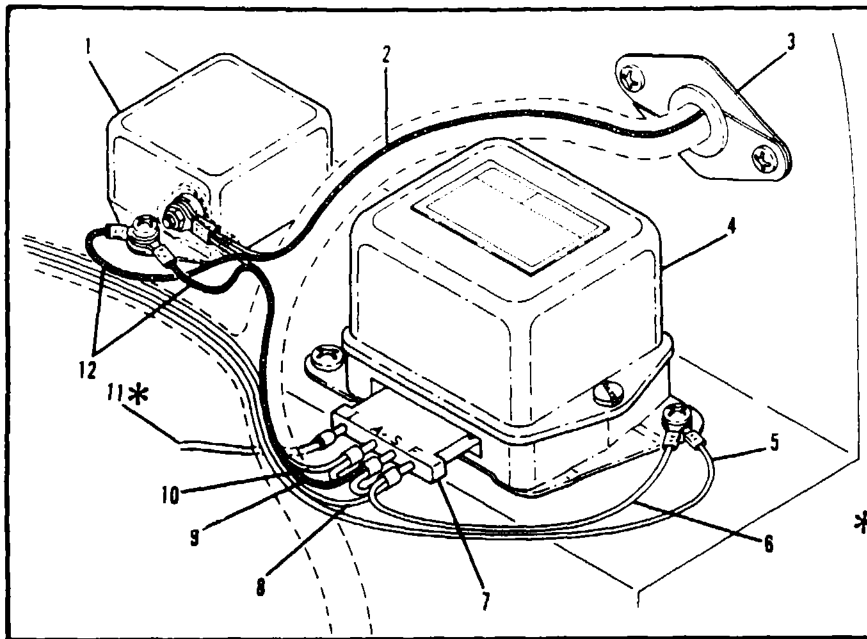



**WARNING**

On models manufactured prior to mid 1971 should alternator thru-bolt loosening or breaking occur, Cessna Service Letter SE71-40 dated November 24, 1971 should be complied with. On models manufactured after mid 1971 a new high strength thru-bolt and a K shaped retainer are installed. Torque bolts 45 to 55 pound-inches.

1. Alternator
2. Locknut
3. Adjusting Bracket
4. Upper Adjusting Bolt
5. Mounting Bracket Bolt
6. Mounting Bracket
7. Alternator Mounting Bolt
8. Drive Belt
9. Alternator Pulley Nut
10. Lower Adjusting Bolt

Figure 16-4. Alternator Installation




* BEGINNING WITH 177RG0213

1. Filter - Radio Noise
2. Wire to Master Switch
3. Firewall Shield
4. Voltage Regulator
5. Alternator Ground Wire
6. Regulator Ground Wire
7. Housing - Plug
8. Wire to Alternator "F"
9. Wire to Regulator
10. Wire to Alternator "A+"
*11. Wire to High Voltage Light
12. Shields - Ground

Figure 16-5. Voltage Regulator Installation

## 16-48. AIRCRAFT LIGHTING SYSTEM.

16-49. DESCRIPTION. The aircraft lighting system consists of instrument lighting (overhead console light, eyebrow lights and compass light), flashing beacon light, anti-collision strobe lights, control wheel map light and courtesy lighting consisting of left and right wing courtesy lights and a pedestal light for cabin floor lighting.

## 16-50. TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| LANDING AND TAXI LIGHTS OUT. | Short circuit in wiring. | 1. Inspect circuit breaker. If circuit breaker is open, proceed to step 2. If circuit breaker is 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 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 circuit breaker is open, proceed to step 2. If circuit breaker is OK, proceed to step 3. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| FLASHING BEACON DOES NOT LIGHT (Cont). | 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. |
| FLASHING BEACON CONSTANTLY LIT. | Defective flasher. | 1. Install new flasher. |
| ALL NAV LIGHTS OUT. | Short circuit in wiring. | 1. Inspect circuit breaker. If circuit breaker is open, proceed to step 2. If circuit breaker is 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. |
| ONE ANTI-COLLISION STROBE LIGHT DOES NOT LIGHT. THRU 1972 MODELS. | Flash tube burned out. | Test with new flash tube. Replace flash tube. |
| | Faulty wiring. | Test for continuity. Repair or replace. |
| | Faulty trigger head. | Test with new trigger head. Replace trigger head. |
| BOTH ANTI-COLLISION STROBE LIGHTS WILL NOT LIGHT. THRU 1972 MODELS. | Circuit breaker open. | Inspect. Reset. |

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| BOTH ANTI-COLLISION STROBE LIGHTS WILL NOT LIGHT. THRU 1972 MODELS. (Cont). | Faulty power supply. | Listen for whine in power supply to determine if power is operating. |
| | Faulty switch. | Test for continuity. Repair or replace. |
| | Faulty wiring. | Test for continuity. Repair or replace. |
| ONE ANTI-COLLISION STROBE LIGHT DOES NOT LIGHT. BEGINNING WITH 1973 MODELS. | Flash tube burned out. | Test with new flash tube. Replace flash tube. |
| | Faulty power supply. | Listen for whine in power supply to determine if power is operating. |
| | Faulty wiring. | Test continuity. Repair or replace. |
| BOTH ANTI-COLLISION STROBE LIGHTS WILL NOT LIGHT. BEGINNING WITH 1973 MODELS. | Circuit breaker open. | Inspect. Reset. |
| | Faulty switch. | Test for continuity. Repair or replace. |
| | Faulty switch. | Test for continuity. Repair or replace. |
| DOME LIGHT TROUBLE. | Short circuit in wiring. | 1. Inspect circuit breaker. If circuit breaker is open, proceed to step 2. If circuit breaker is 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. |
| | Lamp burned out. | 4. Test lamp with ohmmeter or new lamp. Replace lamp. |
| | Defective switch. | 5. Check for voltage at dome light with master and dome light switch on. Should read battery voltage. Replace switch. |

16-50. TROUBLE SHOOTING (Cont).

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| INSTRUMENT LIGHTS WILL NOT LIGHT (THRU 1974 MODELS). | Short circuit in wiring. | 1. Inspect circuit breaker. If circuit breaker is open, proceed to step 2. If circuit breaker is OK, proceed to step 3. |
| | Defective wiring. | 2. Test circuit until short is located. Repair or replace wiring.<br><br>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. |
| INSTRUMENT LIGHTS WILL NOT LIGHT (1975 MODELS & ON). | Short circuit wiring. | 1. Inspect circuit breaker. If circuit breaker is open, proceed to step 2. If circuit breaker is 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. |
| | Faulty section in dimming potentiometer. | 4. Lights will work when control is placed in brighter position. Replace potentiometer. |
| | Faulty light dimming transistor. | 5. Test both transistors with new transistor. Replace faulty transistor. |
| | Faulty selector switch. | 6. Inspect. Replace switch. |
| INSTRUMENT LIGHTS WILL NOT DIM (1975 MODELS & ON). | Open resistor or wiring in minimum intensity end of potentiometer. | 1. Test for continuity. Replace resistor or repair wiring. |
| | Shorted transistor. | 2. Test transistor by substitution. Replace defective transistor. |

| 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.<br>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 assembly. | 5. Check voltage at map light assembly with master and nav switches on. If battery voltage is present, replace map light assembly. |

16-51. LANDING AND TAXI LIGHTS. (THRU 1971 MODELS.)

16-52. DESCRIPTION. The landing and taxi light are mounted in the leading edge of the left wing. A clear plastic cover provides weather protection for the lamps. The outboard lamp is the taxi light and the inboard is the landing light. The landing light is adjusted to throw its beam further forward than the taxi light.

16-53. REMOVAL AND INSTALLATION. (Refer to figure 16-6.)

a. Remove screws holding wing tip to wing, disconnect navigation light wire and remove wing tip.
b. Remove screws holding seal on rib to gain access to lights through lightening hole in rib.
c. Using a short screwdriver, reach in through the lightening hole and remove the four attaching screws (8) from the bracket assembly and remove the bracket.

NOTE

Do not reposition the landing and taxi light adjustment screws (7). If readjustment is required, refer to figure 16-6.

d. Remove the two screws securing the wiring to the lamp contacts and remove the lamp.
e. Install new lamp and reassembly.
f. To replace plastic window, remove screws holding leading edge of rib to wing and remove leading edge of rib.
g. Slide the plastic window out of the retainers, install new window and reassemble.

16-54. LANDING AND TAXI LIGHTS. (BEGINNING WITH 1972 MODELS).

16-55. DESCRIPTION. The landing and taxi lights are located on the lower engine cowl. The taxi light is on the left hand side and both lights are used for landing. Lights are controlled by a inter-locking, split rocker switch mounted on the instrument panel. The right hand side of the switch for taxi and the left for landing.

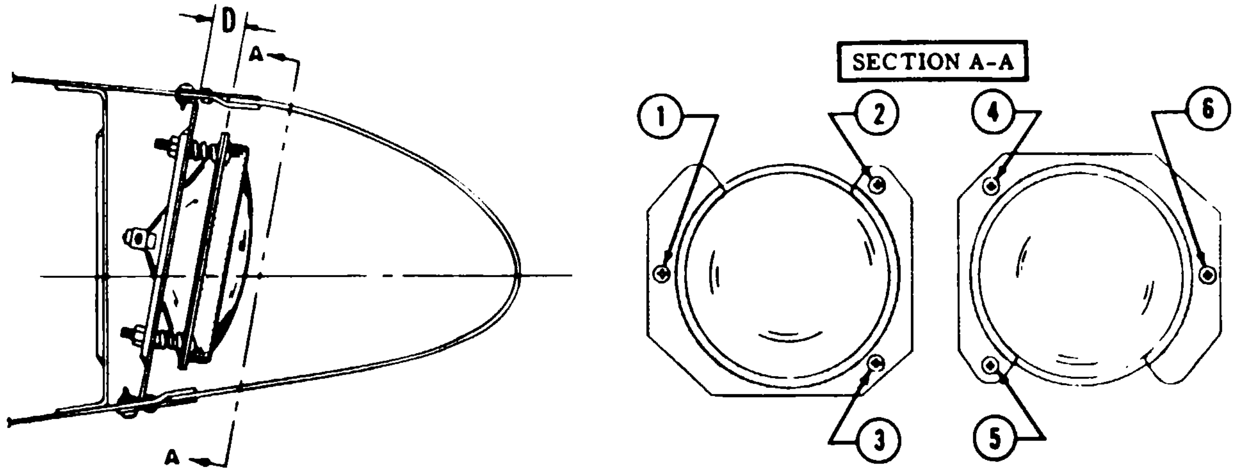
16-56. REMOVAL AND INSTALLATION. (Refer to figure 16-6.)

a. Remove lower half of the engine cowl and disconnect landing and taxi lights leads.
b. Remove the three tinnerman screws holding plate (6) and remove the lamp.
c. Install new lamp and reassemble.
d. Connect leads to lamps and install cowl.

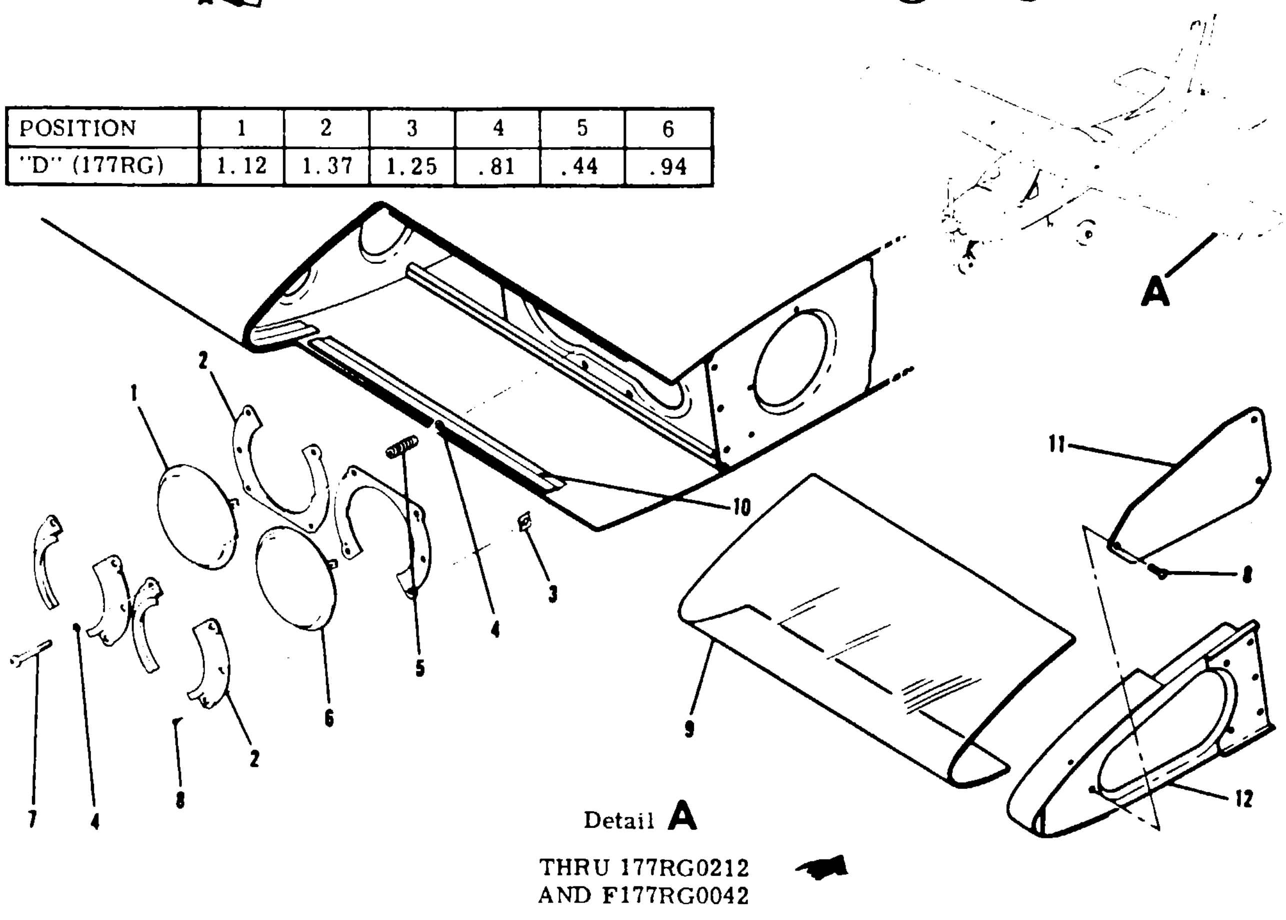
16-57. ADJUSTMENT OF LANDING AND TAXI LIGHT (THRU 1971 MODELS). Refer to figure 16-6, sheet 1 of 2. Adjustment of the landing and taxi light is pre-set at the factory with the adjustment screws bottomed out against the bracket. Should further adjustment be desired, turn adjustment screws until desired setting is obtained.

16-58. ADJUSTMENT OF LANDING AND TAXI LIGHT (BEGINNING WITH 1972 MODELS). Refer to figure 16-6, sheet 2 of 2. Adjustment of the landing and taxi lights is pre-set at the factory. Should further adjustment be desired proceed as follows;

a. Remove cowling as outlined in Section 11.
b. Install washers between bracket (2) and

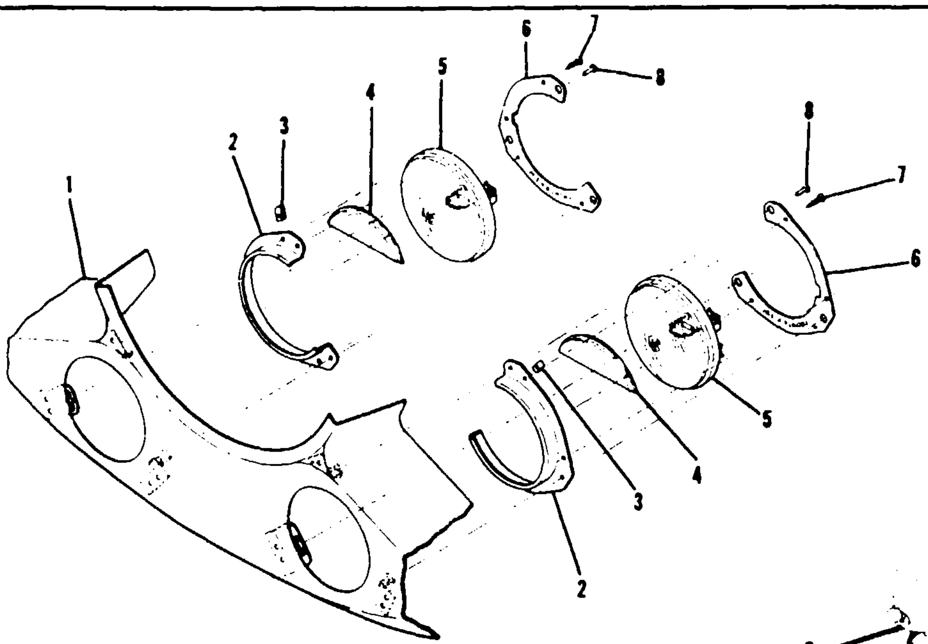



| POSITION | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| "D" (177RG) | 1.12 | 1.37 | 1.25 | .81 | .44 | .94 |



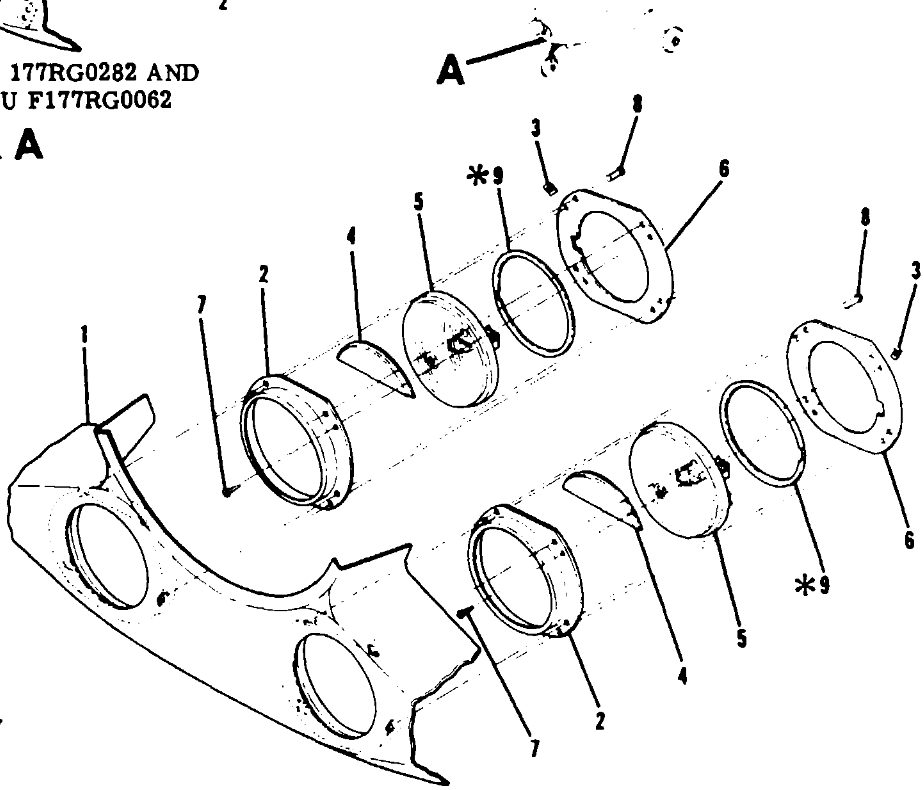

1. Landing Lamp
2. Bracket
3. Tinnerman Nut
4. Washer
5. Spring
6. Taxi Lamp
7. Adjusting Screw
8. Screw
9. Window
10. Retainer
11. Seal
12. Rib

Figure 16-6. Landing Light Installation and Adjustment (Sheet 1 of 2)




177RG0213 THRU 177RG0282 AND
F177RG0043 THRU F177RG0062

Detail **A**




*NOTE

A minimum of one gasket and a maximum of two gaskets may be used to secure lamp.

BEGINNING WITH 177RG0283
AND F177RG0063

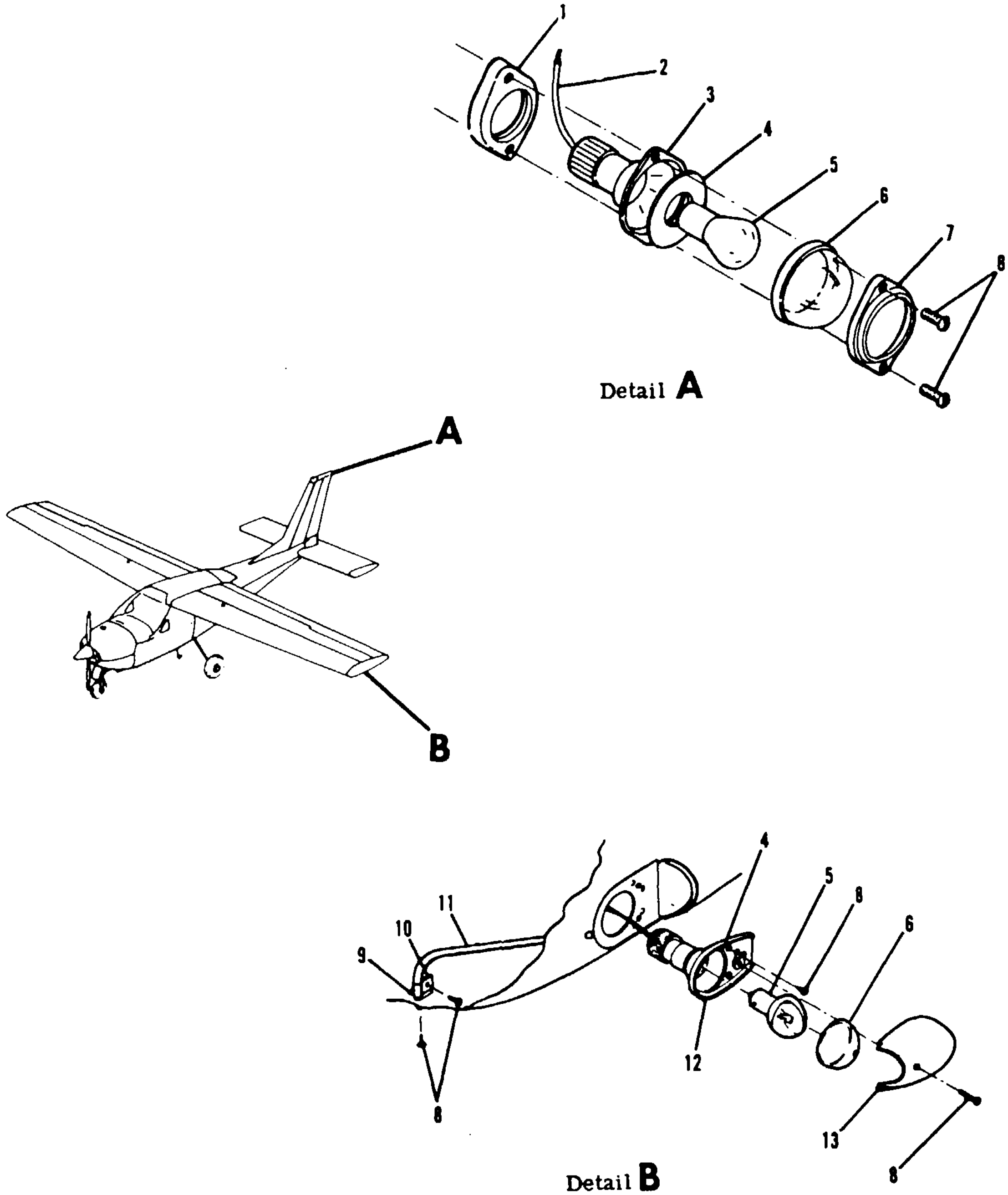
Detail **A**

1. Nose Cap
2. Bracket
3. Tinnerman Nut
4. Deflector
5. Lamp
6. Plate
7. Tinnerman Screw
8. Screw
9. Gasket

NOTE

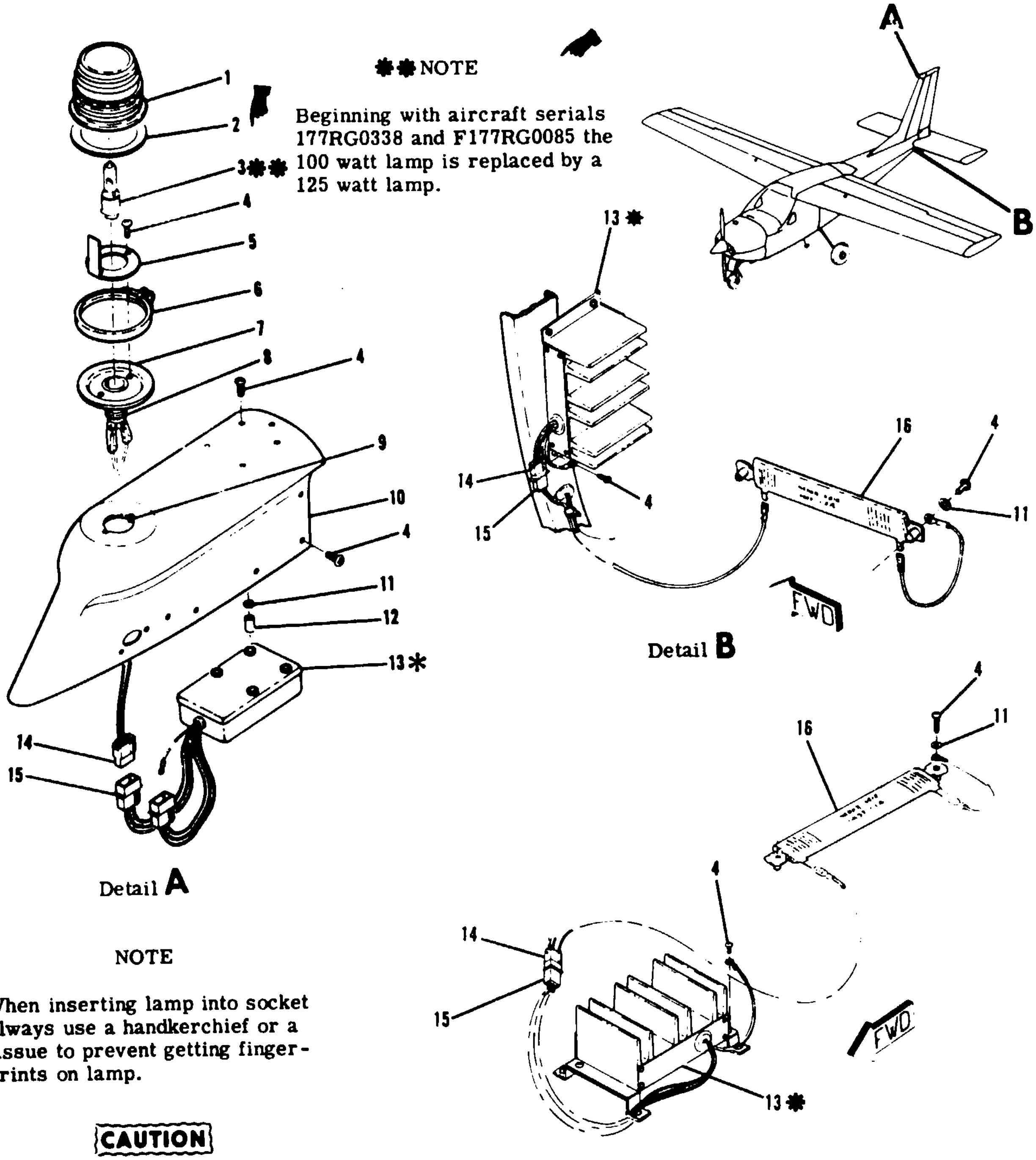
Should further adjustment be desired, washers may be added between bracket (2) and nose cap (1). A Maximum of two washers may be used.

Figure 16-6. Landing Light Installation and Adjustment (Sheet 2 of 2)




1. Mount
2. Electrical Leads
3. Tail Navigation Light
4. Gasket
5. Bulb
6. Lens
7. Lens Retainer
8. Screw
9. Bracket
10. Clamp
11. Detector - Light
12. Base - Lamp
13. Shield

Figure 16-7. Navigation Lights Installation




** NOTE

Beginning with aircraft serials 177RG0338 and F177RG0085 the 100 watt lamp is replaced by a 125 watt lamp.

NOTE

When inserting lamp into socket always use a handkerchief or a tissue to prevent getting finger-prints on lamp.

**CAUTION**

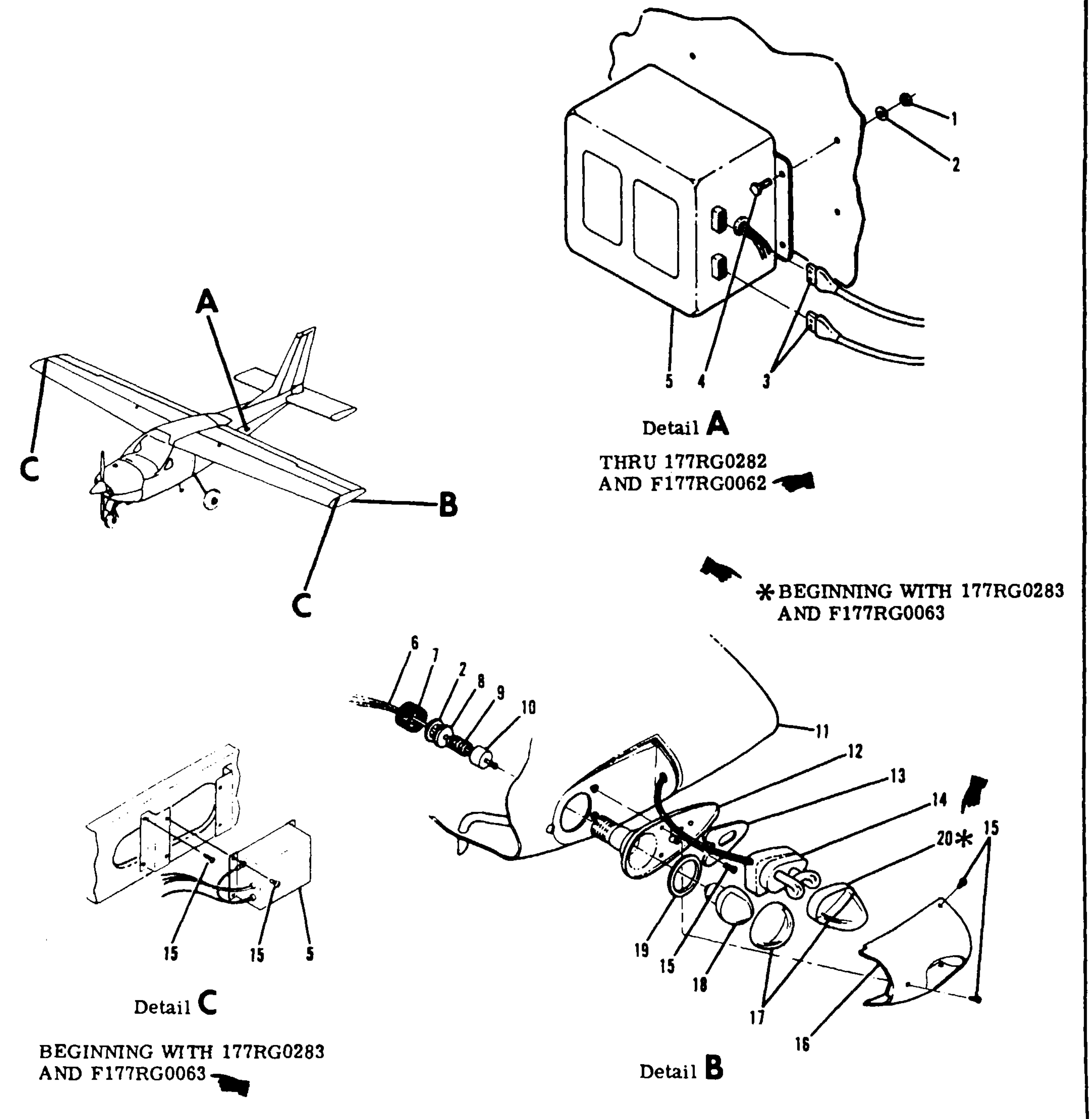
Fingerprints on lamp may shorten the life of the lamp.

* THRU 177RG0282 AND F177RG0062

* 177RG0283 THRU 177RG0301

* BEGINNING WITH 177RG0302 AND F177RG0063

Figure 16-8. Flashing Beacon Light Installation




1. Nut
2. Washer
3. Housing - Plug
4. Bolt
5. Power Supply
6. Electrical Leads
7. Cap
8. Insulated Washer
9. Spring
10. Insulator
11. Wing Tip
12. Wing Navigation Light
13. Spacer
14. Flash Tube Assembly
15. Screw
16. Lens Retainer
17. Lens
18. Bulb
19. Seal
20. Gasket

Figure 16-9. Anti-Collision Strobe Lights Installation nose cap (1). A maximum of two washers may be used.

c. Reinstall cowling.

16-59. NAVIGATION LIGHTS.

16-60. DESCRIPTION. The navigation lights are located on each wing tip and the top edge of the vertical fin. The lights are controlled by a single switch located on the instrument panel.

16-61. REMOVAL AND INSTALLATION. For removal and installation of navigation lights, refer to figure 16-7.

16-62. FLASHING BEACON LIGHT.

16-63. DESCRIPTION. The flashing beacon light is attached to a (ABS) plastic mounting on the vertical fin tip. The flashing beacon is an iodine-vapor lamp electrically switched by a solid-state flasher assembly. Thru aircraft serials 177RG0282 and F177RG0062 the flasher assembly is located under the fin tip, aircraft serial 177RG0283 thru 177RG0301 the flasher assembly is located on the left hand side of the tailcone at station 263.00, beginning with serials 177RG0302 and F177RG0063 the flasher assembly is the bottom of the tailcone aft of station 263.00. The switching frequency of the flasher assembly operates the beacon at approximately 45 flashes per minute.

16-64. REMOVAL AND INSTALLATION. For removal and installation of the flashing beacon light, refer to figure 16-8.

16-65. ANTI-COLLISION STROBE LIGHTS.

16-66. DESCRIPTION. A white strobe light is installed on each tip and lights are vibration resistant and operate on the principle of a capacitor discharge into a xenon tube, producing an extermely high intensity flash. Energy is supplied from a power supply, mounted aft of the baggage cutain, on the left side of the aircraft thru 1972 Models, and on each wing tip rib beginning with 1973 Models.

16-67. REMOVAL AND INSTALLATION. Refer to figure 16-9 as a guide for removal and installation of the anti-collision strobe light components.

**WARNING**

This 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.

16-67A. TRANSISTORIZED LIGHT DIMMING.

16-67B. DESCRIPTION. Beginning with aircraft serial 177RG0603 a remotely located two circuit transistorized dimming assembly is installed to control instrument panel lighting, radio lighting and electroluminescent panel lighting, if installed. Panel light dimming controls are increased from two to three. This is accomplished by a concentric knob arrangement on one of the existing control knobs. The right hand knob controls the radio lighting, the center portion of the left hand knob controls electroluminescent panel lighting and the other knob controls post lighting instrument cluster, flood and compass lighting. The dimming assembly is located on the inboard side of the glove box.

16-67C. REMOVAL AND INSTALLATION. For removal and installation of transistorized dimming assembly refer to figure 16-9A.

16-67D. ELECTROLUMINESCENT PANEL LIGHTING.

16-67E. DESCRIPTION. The electroluminescent lighting consists of four "EL" panels; the left hand switch panel, the center panel, the right hand circuit breaker panel and the flap panel. The ac voltage required to drive the panels is supplied by a small inverta-pack (power supply) located on the inside, upper portion of the firewall, on the left hand side. The intensity of the "EL" panel lighting is controlled by the center portion of the panel lighting rheostat knob.

16-67F. REMOVAL AND INSTALLATION. For removal and installation refer to figure 16-9B.

16-68. INSTRUMENT LIGHTING.

16-69. DESCRIPTION. The instrument panel lighting is fabricated in two separate sections. The lower two-thirds of the instrument panel is illuminated by an overhead light console mounted immediately forward of the cabin ventilation system. The lighting for the upper one-third of the instrument panel is provided by four small lights located in the instrument panel glare shield. The intensity of the instrument panel lighting is controlled by a dimming rheostat located on the left side of the instrument panel.

16-70. REMOVAL AND INSTALLATION. For removal and installation of instrument panel lights, refer to figuer 16-10, 16-11.

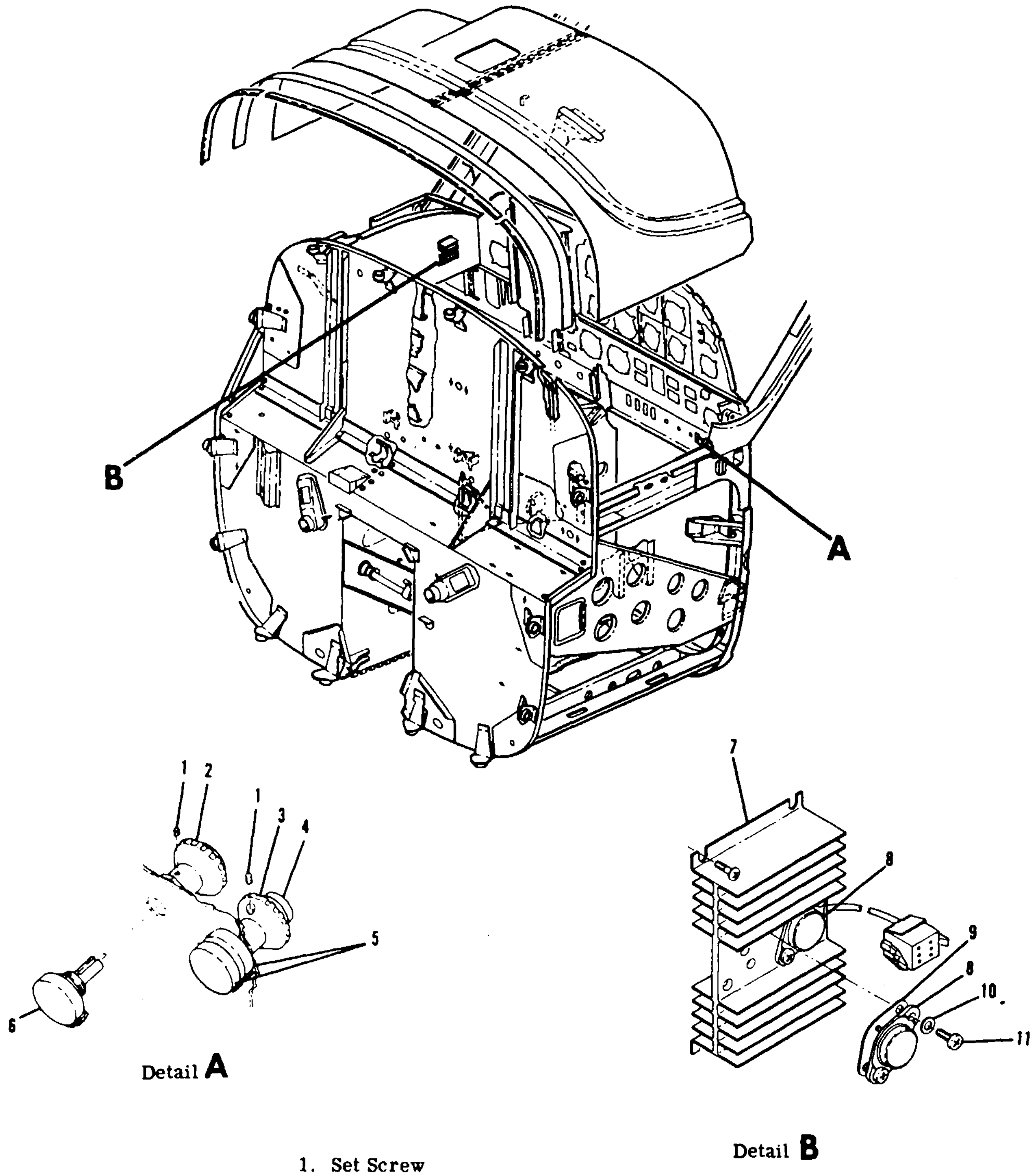
16-71. DOME LIGHT.

16-72. DESCRIPTION. The dome light is located in the aft end of the overhead console and provides for cabin lighting. The dome light consists of a frosted lens and a single bulb controlled by a switch located in the center of the overhead console.

16-73. REMOVAL AND INSTALLATION. For removal and installation of dome light, refer to figure 16-11.

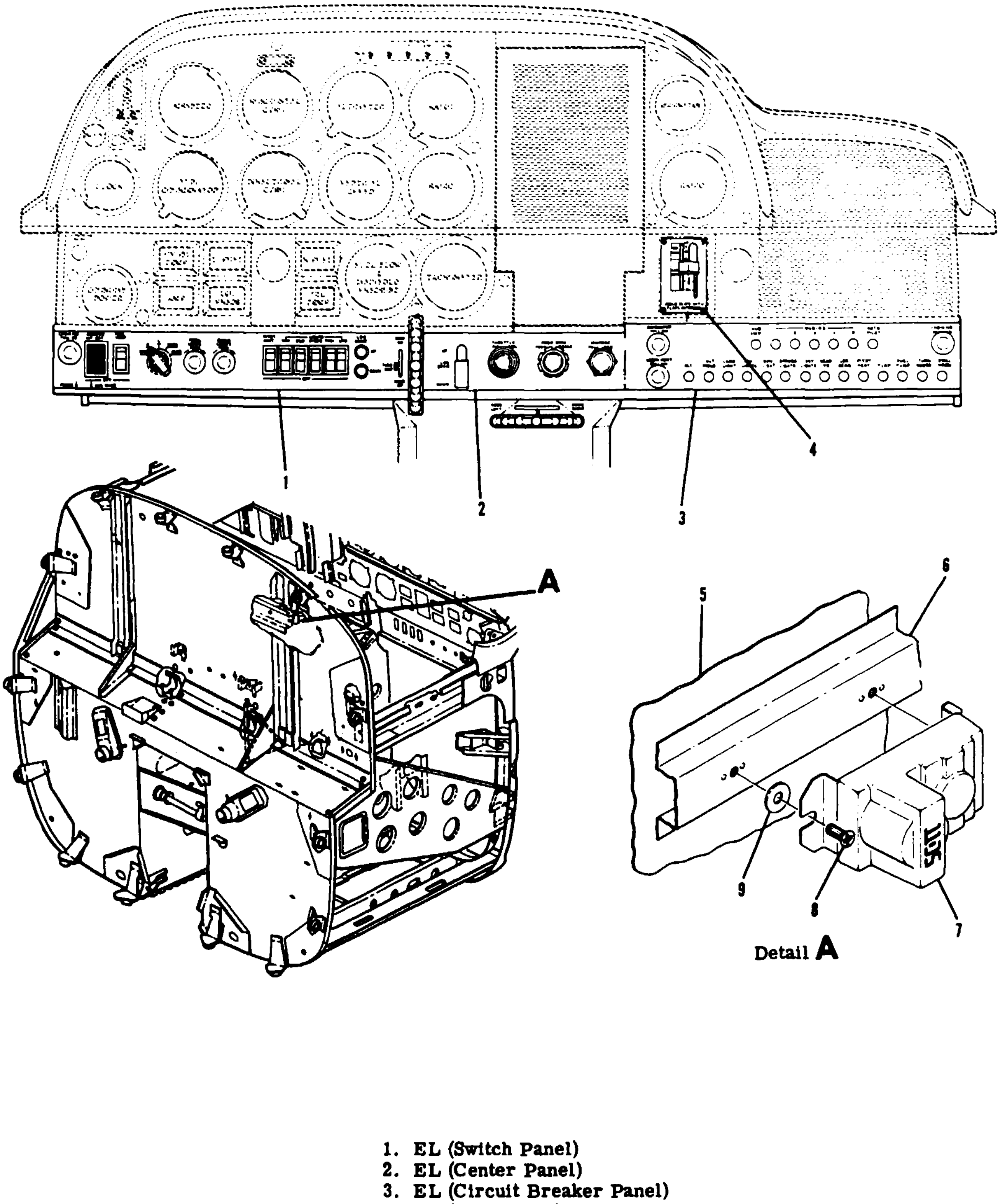
16-74. COMPASS AND RADIO DIAL LIGHTING.

16-75. DESCRIPTION. The compass and radio dial lights are contained within the individual units. The compass light is controlled by the instrument light dimming rheostat and the radio lights are controlled by the radio light dimming rheostat. Both rheostats are located on the left side of the panel.




1. Set Screw
2. Knob (Radio Lights)
3. Knob (Panel Lights)
4. Knob (EL Panel Lights)
5. Rheostat (Panel and EL Panel Lighting)
6. Rheostat (Radio Lights)
7. Heat Sink
8. Transistor
9. Insultaor
10. Washer
11. Screw

Figure 16-9A. Transistorized Light Dimming Installation



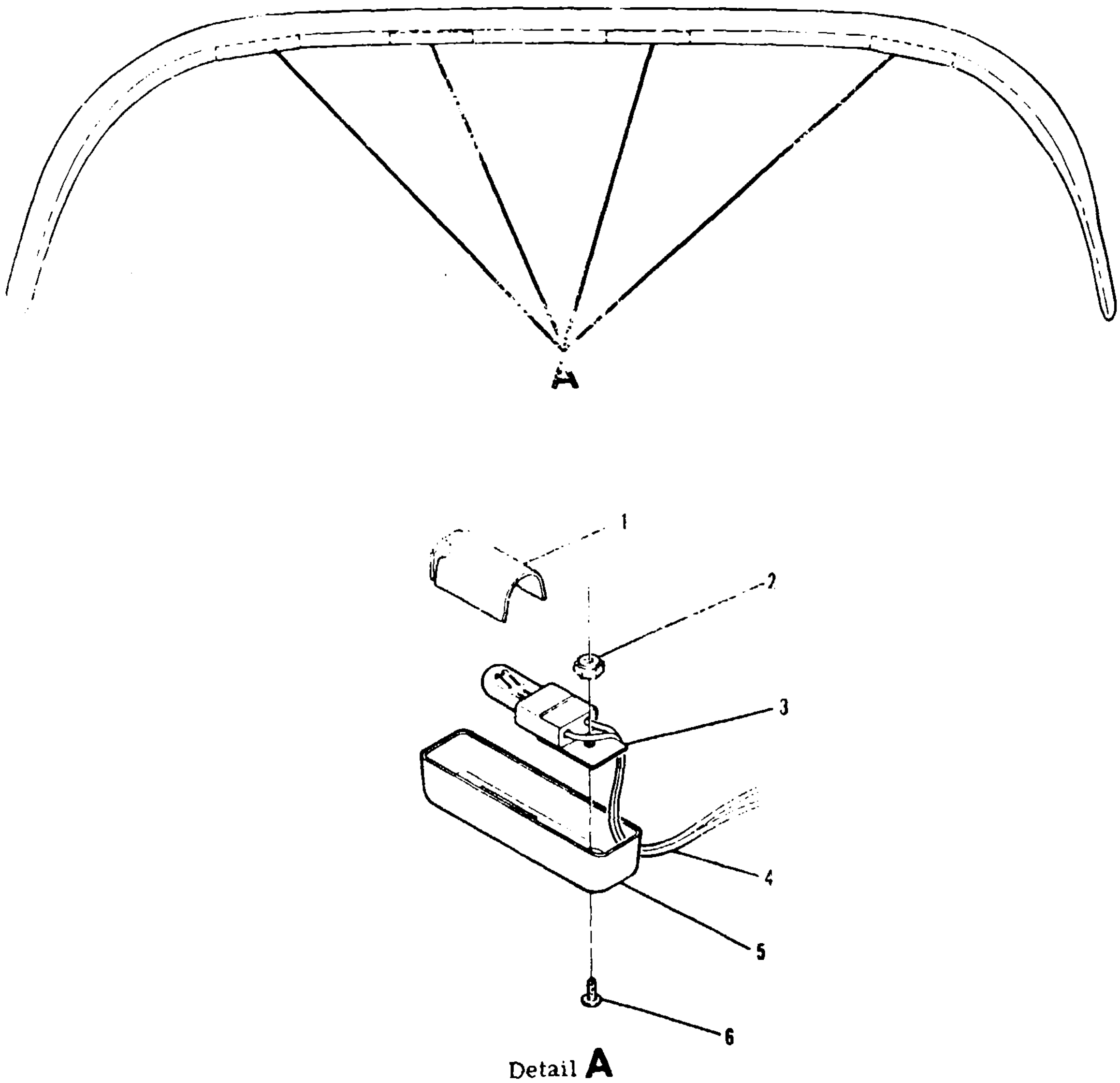

1. EL (Switch Panel)
2. EL (Center Panel)
3. EL (Circuit Breaker Panel)
4. EL (Flap Panel)
5. Firewall
6. Stiffener
7. Power Supply
8. Screw
9. Washer

Figure 16-9B. Electroluminescent Panel Lighting Installation

16-76. COURTESY LIGHTING.

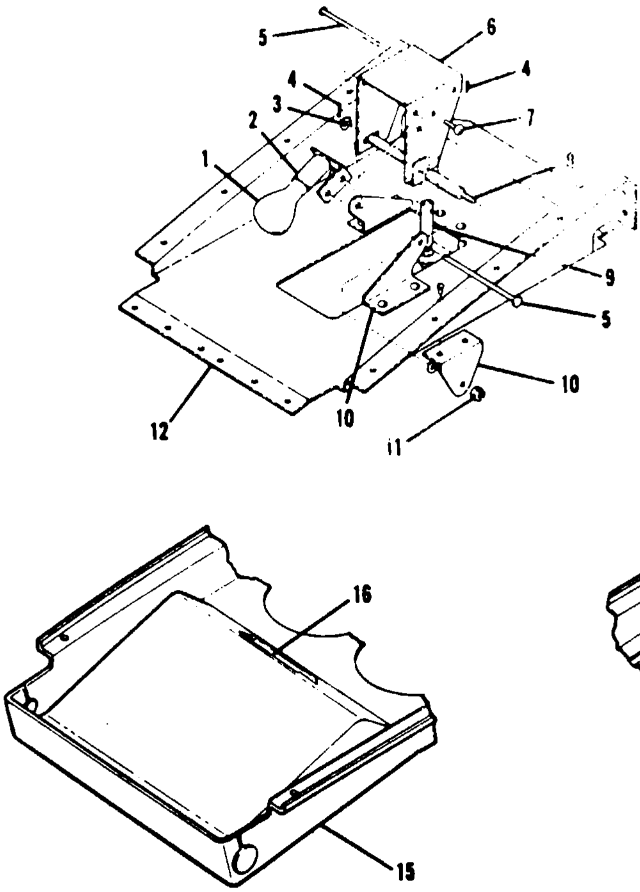
16-77. DESCRIPTION. A courtesy light is located on the underside of each wing and in the lower portion of the pedestal. The switch operating all three courtesy lights is located on the left hand doorpost.

16-78. REMOVAL AND INSTALLATION. For removal and installation of courtesy lights, refer to figure 16-12.

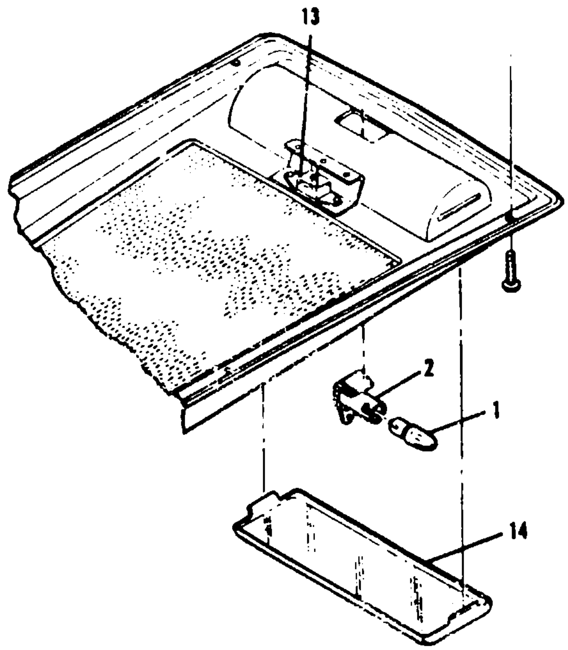



1. Shield
2. Nut
3. Lamp Assembly
4. Electrical Leads
5. Housing
6. Screw

Figure 16-10. Instrument Brow Light Installation




INSTRUMENT FLOOD LIGHT INSTALLATION




[illegible]LATION

1. Lamp
2. Socket
3. Washer
4. Cotter pin
5. Pin
6. Bracket
7. Screw
8. Horizontal Adjustment
9. Vertical Adjustment
10. Angle
11. Nut
12. Instrument Light Bracket
13. Dome Light Switch
14. Dome Light Window
15. Overhead Console
16. Instrument Light Lens

Figure 16-11. Dome and Instrument Lights Installation

16-79. CONTROL WHEEL MAP LIGHT.

16-80. DESCRIPTION. An optional control wheel map light is available on the 177RG. The map light is mounted on the underside of the control wheel and the light intensity is controlled by a thumb operated rheostat. For dimming, the rheostat should be turned clockwise. The NAV LIGHTS switch must be turned on to operate the map light.

16-81. REMOVAL AND INSTALLATION. (Refer to figure 16-14.)
a. For easy access to the map light assembly rotate the control wheel 90°.
b. On 1972 Models, remove terminal block cover.
c. Label the wires connecting the map light assembly (termianl block) and remove screws securing the wires to the terminal block.
d. Remove screws securing map light to the control wheel and remove map light assembly.
e. For reassembly reverse this procedure.

16-82. STALL AND GEAR WARNING UNIT.

16-83. DESCRIPTION. The stall and gear warning unit is mounted on the inboard side of the map compartment. The unit contains two independently operated horns. One horn is a stall warning horn designed to emit a high-pitched, steady sound when actuated by the stall warning switch mounted in the leading edge of the left wing. The other horn is a gear warning horn designed to emit a interrupted lower-pitched gear warning signal. The gear warning horn will sound whenever the throttle is retarded below 12 inches manifold pressure (master switch on) with the gear up.

16-84. REMOVAL AND INSTALLATION. For removal and installation of the stall and gear warning unit, refer to figure 16-13.

16-85. STALL WARNING SWITCH.

16-86. DESCRIPTION. The stall warning switch is installed in the leading edge of the left wing and is actuated by airflow over the surface of the wing. The switch will close as a stall condition is approached, actuating the stall warning horn. The horn should sound at approximately five to ten miles per hour above the actual stall speed. Initial installation of the switch should be with the lip of the warning switch approximately one sixteenth of an inch below the center line of the wing skin cutout. Test fly the aircraft to determine if the horn sounds at the desired speed. If the horn sounds too soon, move the unit down slightly; if too late, move the unit up slightly.

16-87. REMOVAL AND INSTALLATION. For removal and installation of the stall warning switch refer to figure 16-16.

16-88. PITOT AND STALL WARNING HEATER CIRCUITS.

16-89. DESCRIPTION. Electrical heater units are incorporated in some pitot tubes and stall warning switch units. The heaters offset the possibility of ice formation on the pitot tube and stall warning actuator switch. The heaters are integrally mounted in the pitot tube and stall warning actuator switch. Both heaters are controlled by the pitot heat switch.

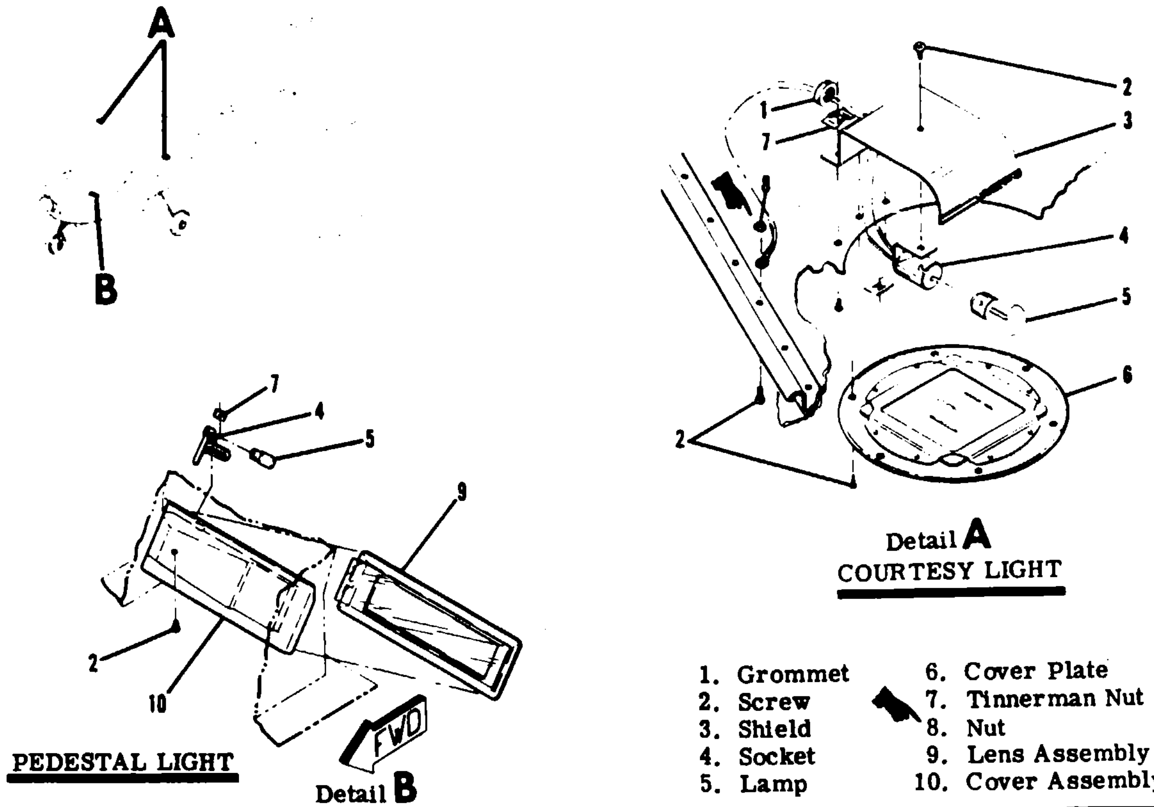
16-90. REMOVEL AND INSTALLATION. For removal and installation refer to figure 16-15 and 16-16.

16-91. LANDING GEAR INDICATOR LIGHTS.

16-92. DESCRIPTION. The position of the landing gear on the Model 177RG is indicated by two press-to-test lamp assemblies mounted on the left side of the switch panel. The green light is on when all the wheels are down and locked; the amber is on when all the wheels are up and locked. If any wheel assumes an intermediate position of neither up and locked or down and locked, both lights will be dark. The hood of each light is removable for bulb replacement, and has a dimming shutter.

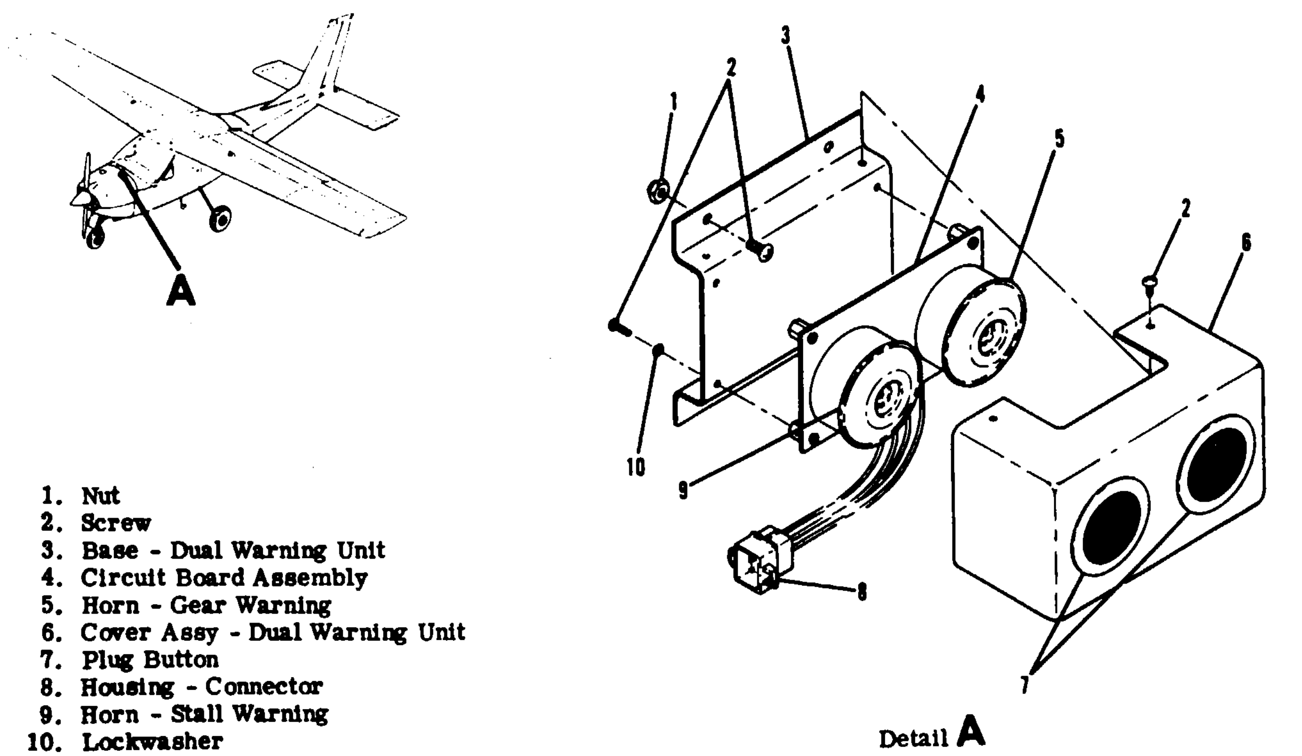
16-93. REMOVAL AND INSTALLATION.
a. Remove the hood on either light by unscrewing counterclockwise. The lamp bulb is in the hood and may be replaced by pulling it out and inserting a new lamp.
b. To remove the lamp socket assembly, remove the nut from the assembly on the front side of the panel.
c. Tag and unsolder the wires from the socket assembly.
d. To replace a lamp socket assembly, reverse the above procedure.

**SHOP NOTES:**




1. Grommet
2. Screw
3. Shield
4. Socket
5. Lamp
6. Cover Plate
7. Tinnerman Nut
8. Nut
9. Lens Assembly
10. Cover Assembly

Figure 16-12. Courtesy Lights Installation

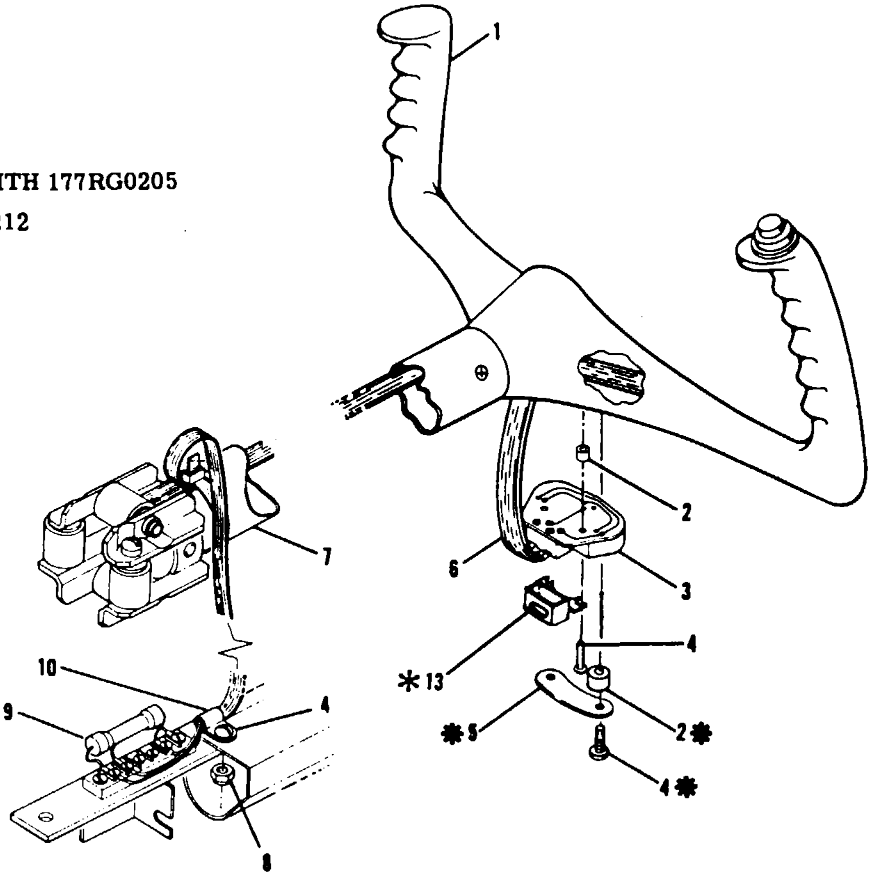



1. Nut
2. Screw
3. Base - Dual Warning Unit
4. Circuit Board Assembly
5. Horn - Gear Warning
6. Cover Assy - Dual Warning Unit
7. Plug Button
8. Housing - Connector
9. Horn - Stall Warning
10. Lockwasher

Figure 16-13. Stall and Gear Warning Unit

*BEGINNING WITH 177RG0205

✱THRU 177RG0212




1. Control Wheel Assembly
2. Spacer
3. Map Light Assembly
4. Screw
5. Plate
6. Cable Assembly
7. Control Column
8. Nut
9. Fuse
10. Clamp
11. Lamp
12. Rheostat
13. Cover

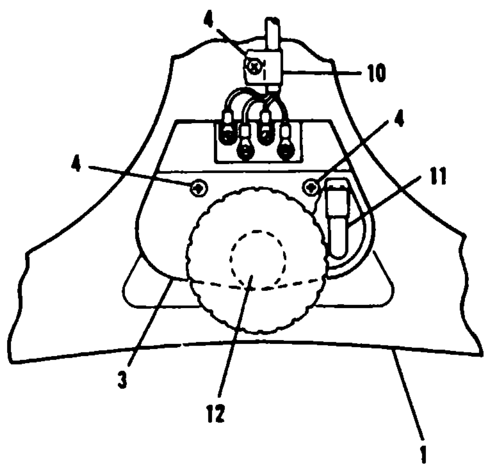
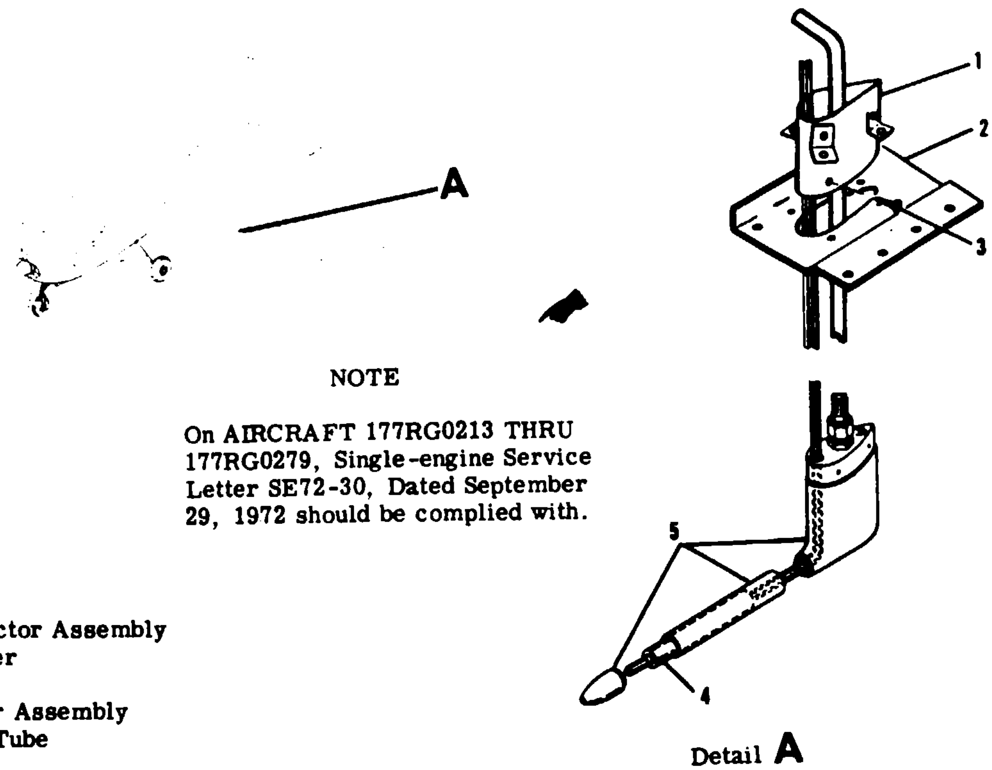



Figure 16-14. Control Wheel Map Light Installation

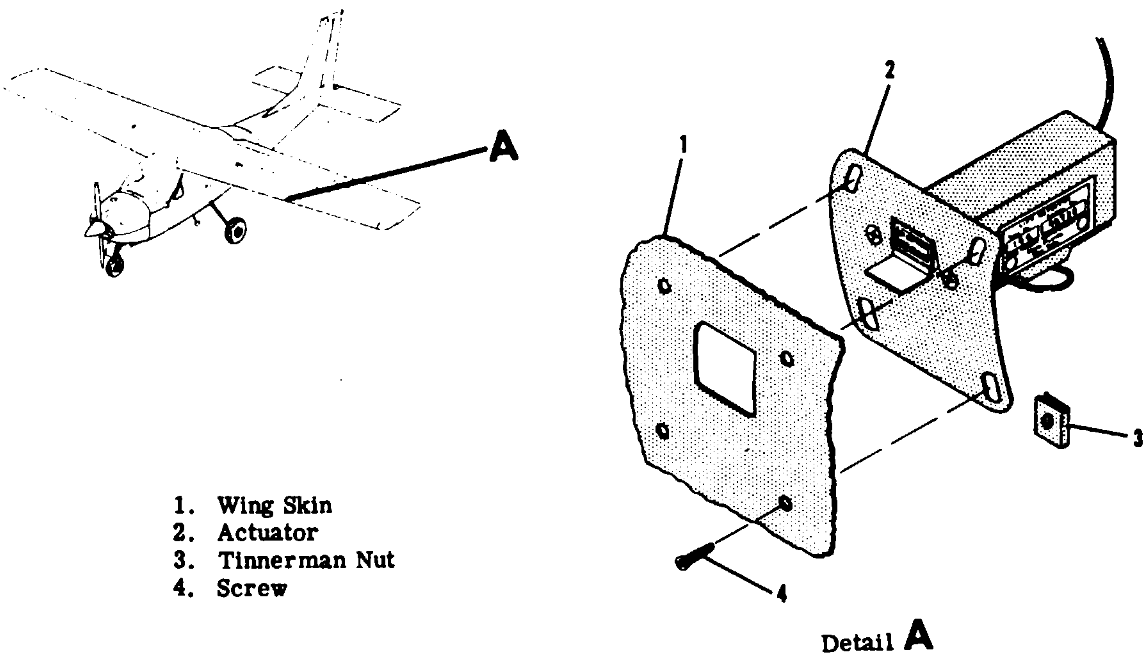



NOTE

On AIRCRAFT 177RG0213 THRU 177RG0279, Single-engine Service Letter SE72-30, Dated September 29, 1972 should be complied with.

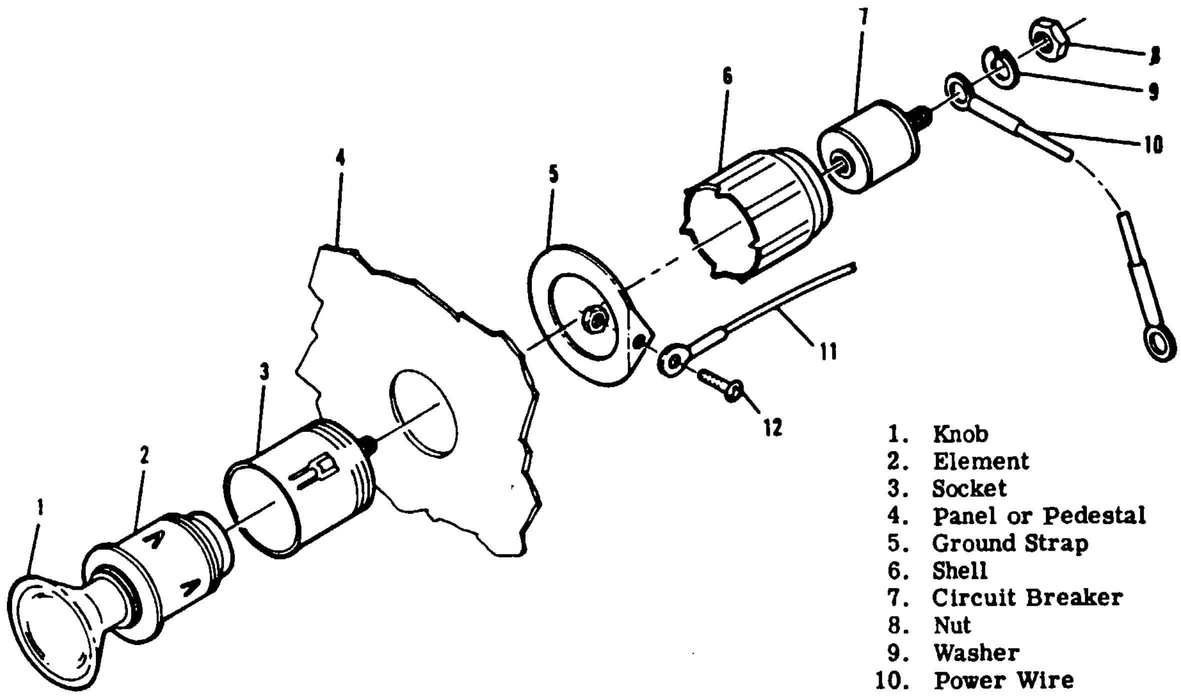
1. Connector Assembly
2. Doubler
3. Screw
4. Heater Assembly
5. Pitot Tube

Figure 16-15. Heated Pitot Installation




1. Wing Skin
2. Actuator
3. Tinnerman Nut
4. Screw

Figure 16-16. Stall Warning Switch




1. Knob
2. Element
3. Socket
4. Panel or Pedestal
5. Ground Strap
6. Shell
7. Circuit Breaker
8. Nut
9. Washer
10. Power Wire
11. Ground Wire
12. Screw

Figure 16-17. Cigar Lighter Installation

16-94. CIGAR LIGHTER.

16-95. DESCRIPTION. The cigar lighter is mounted on the front of the instrument panel pedestal and is equipped with a thermal-actuated circuit breaker which is attached to the rear of the cigar lighter. The circuit breaker will open if the lighter becomes jammed in the socket or held in position too long. The circuit breaker may be reset by inserting a small probe into the .078 diameter hole in the back of the circuit breaker and pushing lightly until a click is heard.

**CAUTION**

Make sure the master switch is "OFF" before inserting probe into the circuit breaker on cigar lighter to reset.

16-96. REMOVAL AND INSTALLATION. Refer to figure 16-17.)

a. Ensure that the master switch is "OFF."
b. Remove cigar lighter element.
c. Disconnect wire on back of lighter.
d. Remove shell that screws on socket back of panel.
e. Remove cigar lighter ground strap.

NOTE

The cigar lighter is mounted in a royalite panel. In order for the lighter to be grounded and to operate, a ground strap must be installed.

f. The socket will then be free for removal.
g. To install a cigar lighter, reverse this procedure.

16-97. EMERGENCY LOCATOR TRANSMITTER.

16-98. DESCRIPTION. Two types of Emergency Locator Transmitters (ELT) have been installed in Cessna aircraft. Each of the ELT's is a self-contained, solid state unit, having its own power supply, with an external mounted antenna. The transmitters are designed to transmit simultaneously on dual emergency frequencies of 121.5 and 243.0 Megahertz. All units were mounted in the tailcone, aft of the baggage curtain on the right hand side. The transmitters were both 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 thru early 1974 models, were equipped with a battery-pack containing six, magnesium "D" size dry cell batteries wired in series. Mid 1974 and on, ELT's are equipped with a battery-pack containing four lithium "D" size batteries wired in series.

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 | 6 Cell Magnesium Battery Pack | 4 Cell Lithium Battery Pack |
|---|---|---|
| +130°F | 89 hrs | 115 hrs |
| + 70°F | 95 hrs | 115 hrs |
| - 4°F | 49 hrs | 95 hrs |
| - 40°F | 23 hrs | 70 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 3 years replacement of magnesium (6-cell) battery-packs and 5 years replacement of lithium (4-cell) battery packs.

16-99. 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.

**WARNING**

Magnesium (6-cell) battery-packs (excluding 4 cell lithium battery-packs) after prolonged continuous use (1 hour) in a sealed environment give off explosive gas. If your ELT has operated for this time period or longer, as a precautionary measure, loosen the ELT cover screws, lift the cover to break air tight seal and let stand for 15 minutes before tightening screws. Keep sparks, flames and lighted cigarettes away from battery-pack.

NOTE

After relatively short periods of inactivation, the magnesium (6-cell) battery-pack develops a coating over its anode which drastically reduces self discharge and thereby gives the cell an extremely long storage life. This coating will exhibit a high resistance to the flow of electric current when the battery is first switched on. After a short while (less than 15 seconds), the battery current will completely dissolve this coating and enable the battery to operate normally. If this coating is present when your ELT is activated, there may be a few seconds delay before the transmitter reaches full power.

16-100. CHECKOUT INTERVAL:

100 HOURS.

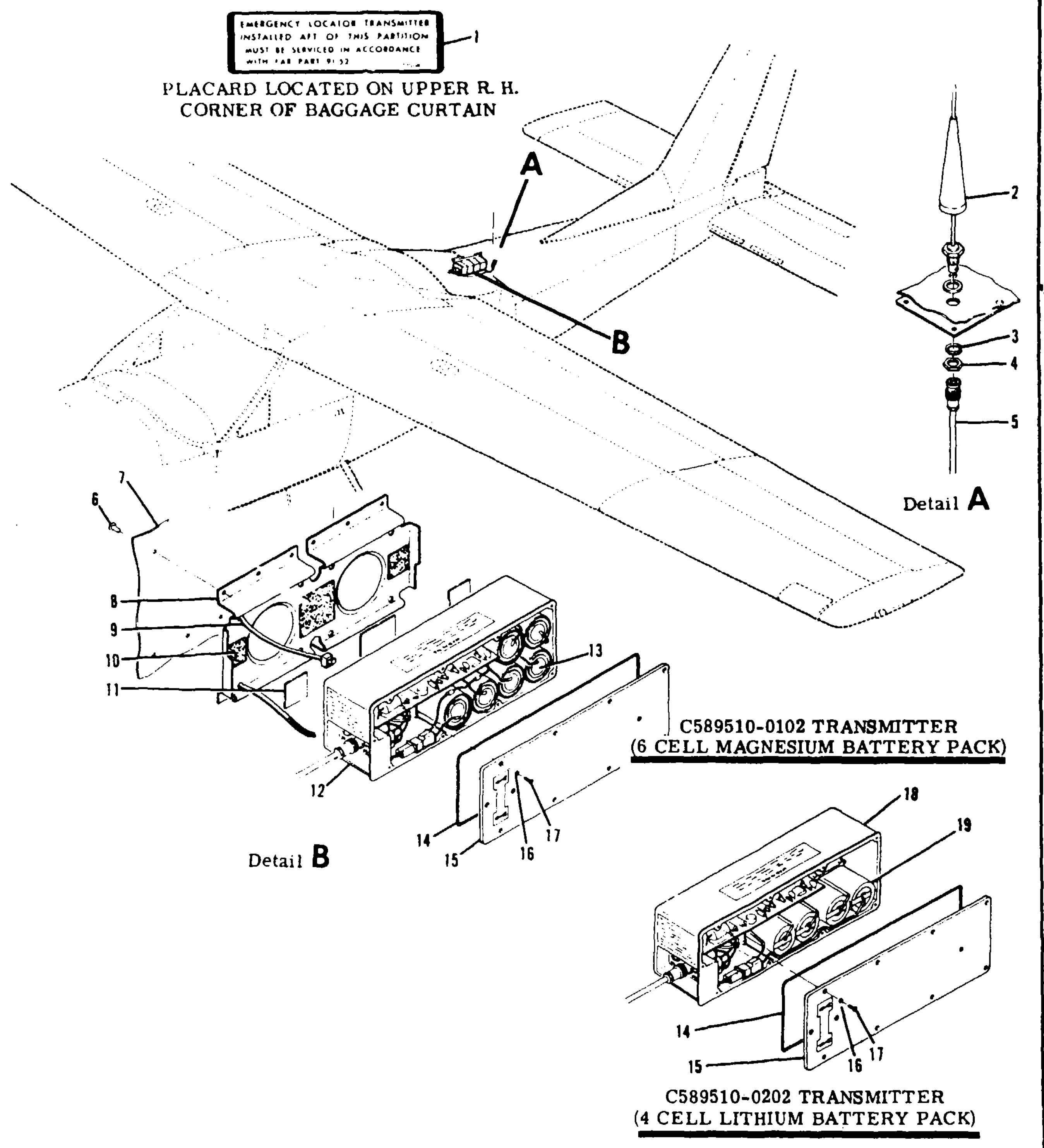
a. Turn aircraft master switch ON.
b. Turn aircraft transceiver ON and set frequency on receiver to 121.5 MHz.
c. Remove the ELT's antenna cable from the ELT unit.
d. Place the ELT's function selector switch in the ON position for 5 seconds or less. Immediately replace the ELT function selector switch 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.




1. Placard
2. Antenna
3. Washer
4. Nut
5. Antenna Cable
6. Rivet
7. Tailcone Skin
8. Mounting Bracket
9. Sta-Strap
10. Fabric Fastener - Hook
11. Fabric Fastener - Pile
12. Transmitter - 6 Cell Bat. -Pack
13. Battery Pack - 6 Cell Bat. -Pack
14. "O" Ring Gasket
15. Cover
16. Washer - Rubber
17. Screw
18. Transmitter - 4 Cell Bat. -Pack
19. Battery Pack - 4 Cell Bat. -Pack
20. Collapsible Antenna

Figure 16-18. Emergency Locator Transmitter Installation

NOTE

After accumulated test or operation time equals 1 hour, battery-pack replacement is required.

e. 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.

16-101. REMOVAL AND INSTALLATION OF TRANSMITTER. (Refer to figure 16-18.)

a. Remove baggage curtain to gain access to the transmitter and antenna.
b. Disconnect co-axial cable from end of transmitter.
c. Cut four sta-straps and 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 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.

16-102. REMOVAL AND INSTALLATION OF MAGNESIUM SIX (6) CELL BATTERY-PACK. (Refer to figure 16-19.)

NOTE

Transmitters equipped with the 6 cell battery-pack can only use the 4 cell lithium battery-pack as a replacement battery-pack. Refer to paragraph 16-103 for replacement details.

b. Remove the nine screws and rubber washers attaching the cover to the case and then remove the cover to gain access to the battery-pack.

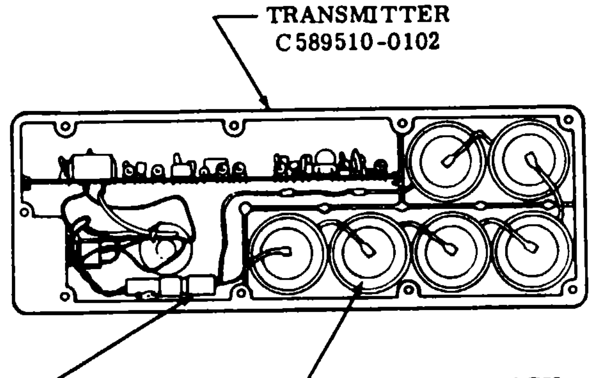



Figure 16-19. Magnesium 6 Cell Battery-Pack Installation

NOTE

Retain the rubber "O" ring gasket, screws and rubber washers for reinstallation.

c. When replacing the battery-pack with another 6 cell battery-pack which has a plastic connector attached to the battery leads, merely disconnect the old battery-pack and replace with a new battery-pack, making sure the plastic connectors are completely mated. (Refer to figure 16-18.)

CAUTION

Some early transmitters equipped with the 6 cell battery-pack were delivered with transmitter leads soldered directly to the battery-pack. Failure to observe proper polarity in connecting a new battery-pack in the transmitter may result in immediate failure of transistorized components attached to the printed circuit board in the transmitter.

NOTE

Before installing the new 6 cell battery-pack, check to ensure that its voltage is 10.8 volts or greater.

d. When replacing a 6 cell magnesium battery-pack with a 4 cell lithium battery-pack, merely disconnect the old battery-pack and replace with a 4 cell battery-pack, as shown in figure 16-20.

NOTE

Before installing the new 4 cell battery-pack, check to ensure that its voltage is 11.2 volts or greater.

CAUTION

If 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.

e. Replace the transmitter cover by positioning the rubber "O" ring gasket on the cover and pressing the cover and case togehter, attach with nine rubber washers and screws.

NOTE

Care should be taken to avoid trapping the rubber "O" ring gasket and over-tightening screws.

f. 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.

16-103. REMOVAL AND INSTALLATION OF LITHIUM FOUR (4) CELL BATTERY-PACK. (Refer to figure 16-20.)

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 the aircraft in accordance with para. 16-101, 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 "O" ring gasket, rubber washers 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 16-20.
e. Connect the electrical connector as shown in figure 16-20.

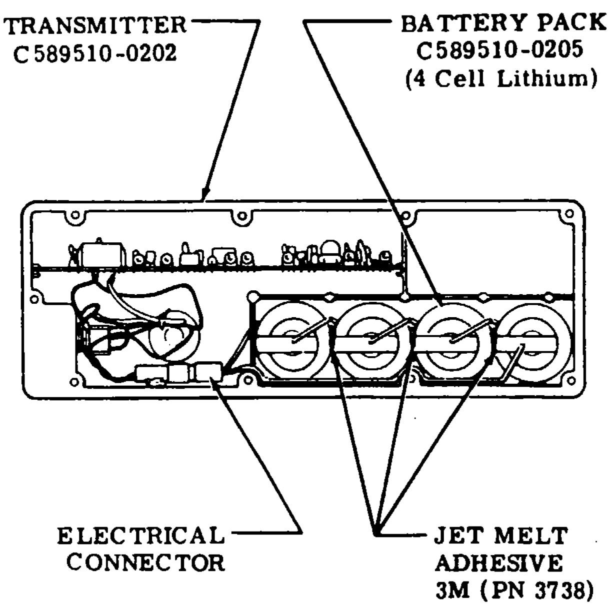



Figure 16-20. Lithium 4 Cell Battery-Pack Installation

NOTE

Before installing the new 4 cell battery-pack, check to ensure that its voltage is 11.2 volts or greater.

CAUTION

If 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 by positioning the rubber "O" ring gasket on the cover and pressing the cover and case together. Attach cover with nine screws and rubber washers.

16-104. TROUBLE SHOOTING. Should your Emergency Locating Transmitter fail the 100 Hour 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.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| *POWER LOW | Low battery voltage. | 1. Set toggle switch to off.<br>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 voltage on C589510-0102 Transmitter is 10. 8-volts or less, the battery-pack is below specification. If the battery-pack voltage on the C589510-0202 transmitter is 11. 2-volts or less, the battery-pack is below specification. |
| | Faulty transmitter. | 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:<br>a. Remove the voltmeter.<br>b. By means of a switchcraft 750 jackplug and 3 inch maximum long leads, connect a Simpson Model 1223 ammeter to the jack.<br>c. Set the toggle switch to ON and observe the ammeter current drain. If the C589510-0102 or C589510-0202 transmitter has a current drain in the 85-100 ma range, the transmitter or the coaxial cable is faulty. |
| | Faulty co-axial antenna cable. | 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.

## SHOP NOTES:

# ELECTRICAL LOAD ANALYSIS CHART

## ALL MODELS

| STANDARD EQUIPMENT (Running Load) | AMPS REQD 1971 | 1972 | 1973 | 1974 | 1975 |
|---|---|---|---|---|---|
| Battery Contactor | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| Clock | * | * | * | * | * |
| Cylinder Head Temperature Indicator | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Fuel Quantity Indicator | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Instrument Lights | | 1.84 | 1.84 | 1.84 | 1.84 |
| a. Instrument Panel Eye Brow Lights | .75 | .75 | .75 | .75 | .75 |
| b. Instrument Light Mounted in Console | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| c. Compass | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Lamp - Gear Up or Gear Down | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Position Lights | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 |
| Turn Coordinator | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| **OPTIONAL EQUIPMENT (Running Load)** | | | | | |
| Brittain Wing Leveler | .28 | .28 | .28 | — | — |
| Cessna 300 ADF (Type R-521B) | 1.6 | — | — | — | — |
| Cessna 300 ADF (Type R-546A) | — | 1.0 | 1.0 | 1.0 | — |
| Cessna 300 ADF (Type R-546E) | — | 1.0 | 1.0 | 1.0 | — |
| Cessna 300 DME (KN-60B) | 5.0 | — | — | — | — |
| Cessna 300 DME (KN-60C) | | 3.0 | 3.0 | 3.0 | — |
| Cessna 300 HF Transceiver | 6.5 | 6.5 | 6.5 | 6.5 | — |
| Cessna 300 Transceiver (Type RT-524A) | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |
| Cessna 300 Marker Beacon (Type R-502B) | 0.02 | 0.02 | 0.02 | 0.02 | — |
| Cessna 300 Nav/Com (Type RT-517R or RT-540A) | 4.5 | — | — | — | — |
| Cessna 300 Nav/Com (Type RT-528A) | 1.9 | 1.9 | 1.9 | — | — |
| Cessna 300 Nav/Com (Type RT-528E) | — | — | — | 1.9 | 1.9 |
| Cessna 300 Nav/Com (Type RT-508A) | 1.9 | 1.9 | 1.9 | — | — |
| Cessna 300 Nav/Com (Type RT-308C) | — | — | — | 1.5 | 1.5 |
| Cessna 300 Nav/Com (Type RT-328A) | — | — | 1.9 | — | — |
| Cessna 300 Nav/Com (Type RT-328C) | — | — | — | 1.5 | — |
| Cessna 300 Nav/Com (Type RT-328D) | — | — | — | — | 1.5 |
| Cessna 300 Navomatic Autopilot (Type AF-394A) | 2.0 | 2.0 | 2.0 | 2.0 | — |
| Cessna 300A Navomatic Autopilot (Type AF-395A) | — | — | — | — | 2.0 |
| Cessna 200A Navomatic Autopilot (Type AF-295A) | — | — | — | 2.0 | — |
| Cessna 200A Navomatic Autopilot (Type AF-295B) | — | — | — | — | 2.0 |
| Cessna 300 Transponder (Type KT-75R) | — | 1.5 | — | — | — |
| Cessna 300 Transponder (Type KT-76 & KT-78) | — | — | 1.3 | — | — |
| Cessna 300 Transponder (Type RT-359A) | — | — | — | 1.0 | 1.0 |
| Cessna 400 ADF (Type R-324A) | 2.0 | — | — | — | — |
| Cessna 400 ADF (Type R-346A) | — | 1.0 | 1.0 | 1.0 | — |
| Cessna 400 ADF (Type R-446A) | — | — | — | — | 1.3 |
| Cessna 400 Glideslope (Type R-543B) | 0.5 | 0.5 | — | — | — |
| Cessna 400 Glideslope (Type R-443A) | — | — | 0.4 | 0.4 | — |
| Cessna 400 Glideslope (Type R-443B) | — | — | — | 0.4 | 0.4 |
| Cessna 400 Marker Beacon (Type R-402A) | — | — | — | — | .14 |
| Cessna 400 Nav/Com (Type RT-422A) | — | — | 2.5 | 2.5 | — |
| Cessna 400 Nav/Com (Type RT-522A) | 3.0 | 3.0 | — | 3.0 | 3.0 |
| Cessna 400 Nav/Com (Type RT-428A) | — | — | — | — | 1.5 |
| Cessna 400 Transceiver (Type RT-432A) | — | — | 1.4 | 1.4 | — |
| Cessna 400 Transceiver (Type RT-532A) | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Cessna 400 Transponder (Type RT-506A) | 3.0 | 3.0 | 3.0 | — | — |
| Cessna 400 Transponder (Type RT-459A) | — | — | — | 1.0 | 1.0 |
| Cessna EA-401A Encoding Altimeter | — | — | — | — | .065 |
| Narco Mark 12 Nav/Com (Type VOA40 and VOA50) | 4.6 | — | — | — | — |
| Narco UGR-2 Glideslope Receiver | .23 | — | — | — | — |
| King KA-25C Isolation Amplifier | .5 | .5 | .5 | .5 | — |

# ELECTRICAL LOAD ANALYSIS CHART

## ALL MODELS

| OPTIONAL EQUIPMENT (Running Load) - (CONT) | AMPS REQD 1971 | 1972 | 1973 | 1974 | 1975 |
|---|---|---|---|---|---|
| King KN-60C DME | — | — | — | — | 3.0 |
| Single-Sideband HF Transceiver | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Control Wheel Map Light | .16 | .16 | .16 | .16 | .16 |
| Flashing Beacon Light | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Heaters, Stall Warning and Pitot | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Hourmeter | * | * | * | * | * |
| Strobe Lights | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Turn & Bank Indicator | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Pantronics PT10-A HF Transceiver | — | — | — | — | 6.5 |
| **ITEMS NOT CONSIDERED AS PART OF RUNNING LOAD** | | | | | |
| Auxiliary Fuel Pump | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Cigarette Lighter | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Console Dome Light | .3 | 2.5 | 2.5 | 2.5 | 2.5 |
| Flap Motor | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Landing Lights | 15.6 | 20.0 | 20.0 | 20.0 | 20.0 |
| Oil Dilution System | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Stall and Gear Warning Horn | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Wing Courtesy Lights and Pedestal Light | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Gear Pump Motor | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 |

*Negligible

# SECTION 17

# STRUCTURAL REPAIR

TABLE OF CONTENTS

17-1. STRUCTURAL REPAIR.

17-2. 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.

17-3. EQUIPMENT AND TOOLS.

17-4. SUPPORT STANDS. Padded, reinforced sawhorse 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 17-1. 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.

17-5. 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.

17-6. 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.

17-7. 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 repaired 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.

17-8. WING ANGLE-OF-INCIDENCE. Angle-of-incidence and wing twist (washout) are listed in the following chart. The cantilever wing has a uniform twist from the root rib to the tip rib. The amount of twist between these two ribs is the difference between the angle-of-incidence at the root and the angle-of-incidence at the tip. (Refer to figure 17-2.)

WING

| | |
|---|---|
| Angle-of-incidence, Root . . . | +4.12° |
| Angle-of-incidence, Tip . . . | + .72° |
| Twist (Washout) . . . . . . . | +3.40° |

17-9. WING.

17-10. DESCRIPTION. The wing is sheet-metal constructed, with a single main spar, two fuel spars, formed ribs and stringers. The front fuel spar also serves as an auxiliary spar and is the forward wing attaching point. An inboard section forward of the main spar is sealed to form an integral fuel bay area. The main spar consists of milled spar caps and attaching fittings joined by a web section. The aft fuel spar is a formed channel. The front fuel spar is a built-up assembly consisting of a formed channel, doubler, attach strap and support angle. Stressed skin, riveted to the ribs, spars and stringers, completes the wing 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 the flap and aileron bellcranks, flap drive pulleys, flap actuator in left wing, flap and aileron control cable disconnect points, fuel adapter plate, air scoop connectors and electrical wiring.

17-11. WING SKIN.

17-12. 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 any area of the wing. Outboard of wing station 40.00 in areas of low stress intensity, cracks, deep scratches or 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. The area on the lower surface of the wing between the two stringers adjacent to the main spar is not considered low stress intensity. Stop drilling is considered a temporary repair and a permanent repair should be made as soon as practicable.

17-13. REPAIRABLE DAMAGE. Repairs must not be made to the upper or lower wing skin inboard of station 40.00 without factory approval. However, an entire skin may be replaced without factory approval. Refer to Section 1 for wing station locations. Figure 17-4 outlines typical repairs 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 deburr. 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.

17-14. 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 existing 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.

17-15. WING STRINGERS.

17-16. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-17. REPAIRABLE DAMAGE. Figure 17-5 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.

17-18. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If a stringer is so badly damaged that more than one section must be spliced, replacement is recommended.

17-19. WING RIBS.

17-20. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-21. REPAIRABLE DAMAGE. Figure 17-6 illustrates typical wing rib repairs.

17-22. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Any wing rib damaged extensively should be replaced. However, due to the necessity of disassembling so much of the wing in order to replace a rib, especially in the fuel bay area which involves sealing, wing ribs should be repaired if practicable.

17-23. WING SPAR.

17-24. NEGLIGIBLE DAMAGE. Due to the stresses which the wing spar encounters, very little damage can be considered negligible. Smooth dents, light scratches and abrasions may be considered negligible.

17-25. REPAIRABLE DAMAGE. All cracks, stress wrinkles, deep scratches and sharp dents must be repaired. However, repairs must not be made to the main wing spar inboard of wing station 146.00 without factory approval. Refer to Section 1 for wing station locations. Figure 17-7 outlines a typical main wing spar repair.

17-26. DAMAGE NECESSITATING REPLACEMENT OF PARTS. An entire wing spar may be replaced without factory approval.

17-27. WING FUEL BAY SPARS AND RIBS.

17-28. NEGLIGIBLE DAMAGE. Any smooth dents in the fuel spars 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 any area of the spar.

17-29. REPAIRABLE DAMAGE. The type of repair outlined in figure 17-7 also applies to fuel bay spars outboard of wing station 84.0. Inboard of station 84.0, factory approval of proposed repairs is required. Refer to Section 12 for sealing procedures when working in fuel bay areas.

17-30. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Due to the amount of fuel bay sealant which must be removed from fuel bay components to facilitate repair, individual parts are not available to replace fuel bay spars or ribs. The entire fuel bay area must be replaced as a unit.

17-31. AILERONS.

17-32. NEGLIGIBLE DAMAGE. See paragraph 17-12

17-33. REPAIRABLE DAMAGE. The repair shown in figure 17-8 may be used to repair damage to aileron leading edge skins. The flush-type skin patches shown in figure 17-4 may be used to repair damage to the remaining skins. Following repair, the aileron must be balanced. Refer to paragraph 17-35 and figure 17-3 for balancing the aileron.

17-34. 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 or replacement, balance aileron in accordance with paragraph 17-35 and figure 17-3.

17-35. 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 17-3.

17-36. WING FLAPS.

17-37. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-38. REPAIRABLE DAMAGE. Flap repairs should be similar to aileron repairs discussed in paragraph 17-33. A flap leading edge repair is shown in figure 17-9.

17-39. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Flap repairs which require replacement of parts should be similar to aileron repairs discussed in paragraph 17-34. Since the flap is not considered a movable control surface, no balancing is required.

17-40. WING LEADING EDGE.

17-41. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-42. REPAIRABLE DAMAGE. A typical leading edge skin repair is shown in figure 17-8. Also, wing skin repairs, outlined in paragraph 17-13, may be used to repair leading edge skins, although the flush-type patches should be used. Extra access holes, described in figure 17-10, must not be installed in the wing without factory approval. Where extreme damage has occurred, replace complete skin panels.

17-43. DAMAGE NECESSITATING REPLACEMENT OF PARTS. An entire leading edge skin may be replaced without factory approval.

17-44. STABILATOR.

17-45. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-46. REPAIRABLE DAMAGE. Should damage occur to the skin in the area between the two outboard ribs, the entire skin in that area may be replaced, or the skin in any bay may be replaced, depending on the extent of damage. Replacement skin must be the same gage as the original skin. Repair seams must be made to lie along existing structural members, and each seam must use the same rivet size and pattern as the original seam. Should damage occur to the stabilator tip, replacement of the tip is recommended.

17-47. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Repairs must not be made to the stabilator inboard of the area between the two outboard ribs without factory approval. However, an entire skin, spar or rib may be replaced without factory approval.

17-48. STABILATOR BALANCING. Following repair, replacement or painting, the stabilator must be balanced. Complete instructions for fabricating balancing fixtures and mandrels and their use, are given in figure 17-3.

17-49. STABILATOR TRIM TAB. Repairs must not be made to the stabilator trim tab without factory approval.

17-50. RUDDER.

17-51. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-52. REPAIRABLE DAMAGE. Skin patches illustrated in figure 17-4 may be used to repair skin damage. If the damaged area would require a repair which could not be made between adjacent ribs, see the following paragraph.

17-53. 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 or replacement, balance rudder in accordance with paragraph 17-54 and figure 17-3.

17-54. RUDDER BALANCING. Following repair, replacement or painting, the rudder must be balanced. Complete instructions for fabricating balancing fixtures and mandrels and their use, are given in figure 17-3.

17-55. FIN.

17-56. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12.

17-57. REPAIRABLE DAMAGE. Skin patches, illustrated in figure 17-4, may be used to repair skin damage. Access to the dorsal fin may be gained by removing the fin from the aircraft. (Refer to Section 4.) Access to the fin is best gained by removing skin attaching rivets on one side of the rear spar and ribs, then springing back the skin. If the damaged area would require a repair which could not be made between adjacent ribs, or if a repair would be located in an area with compound curves, see the following paragraph.

17-58. DAMAGE NECESSITATING REPLACEMENT OF PARTS. If the damaged area would require a repair which could not be made between adjacent ribs, or if 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.

17-59. FUSELAGE.

**CAUTION**

Repairs must not be made to the main wing spar carry-thru section of the cantilever wing without factory approval.

17-60. DESCRIPTION. The fuselage is of semi-monocoque construction consisting of formed bulkheads, longitudinal stringers, reinforcing channels and skin platings.

17-61. NEGLIGIBLE DAMAGE. Refer to paragraph 17-12. 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 area, 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 on 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 must be identical to the existing manufactured seam at the edge of the sheet.

17-62. REPAIRABLE DAMAGE. Fuselage skin repairs may be accomplished in the same manner as wing skin repairs outlined in paragraph 17-13. Stringers, formed skin flanges, bulkhead channels and similar parts may be repaired as shown in figure 17-5.

17-63. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Fuselage skin major repairs may be accomplished in the same manner as wing skin repairs outlined in paragraph 17-14. Damaged fittings must be replaced. Seat rails serve as structural parts of the fuselage and must be replaced if damaged.

17-63A. BONDED DOORS.

17-63B. 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 AC 43.13-1 are also applicable to bonded doors.

17-64. BULKHEADS.

17-65. LANDING GEAR BULKHEADS. Since these bulkheads are highly stressed members irregularly formed to provide clearance for control lines, actuators, fuel lines, etc., 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 such damage must be repaired by replacing the landing gear support assembly as an aligned unit.

17-66. 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 carefully examined and all support forgings must be checked for cracks, using a dye penetrant and proper magnification. Bulkheads in the area of possible damage must be checked for alignment and a straightedge must be used to determine deformation of the bulkhead webs. Damaged support structure, buckled floorboards and skins and damaged or questionable forgings must be replaced.

17-67. 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. NAS 464P* Bolt, ESNA 2935* Mating Base Ring, ESNA LH 2935* 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.

17-68. 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 17-11, or they may be replaced. A severely damaged firewall must be replaced as a unit.

17-69. ENGINE MOUNT.

17-70. 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.

17-71. 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 large 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.

17-72. 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.

17-73. 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.

17-74. BAFFLES. Baffles ordinarily require replacement 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.

17-75. ENGINE COWLING.

17-76. REPAIR OF COWLING SKINS. If extensively damaged, complete sections of cowling must be replaced. Standard insert-type patches, however, may be used if repair parts are formed to fit. Small 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 AC 43.13-1 are also applicable to cowling.

17-77. REPAIR OF REINFORCEMENT ANGLES. Cowl reinforcement angles, if damaged, must be replaced. Due to thier small size they are easier to replace than to repair.

17-78. REPAIR OF ABS COMPONENTS. Rezolin Repair Kit, Number 404 may be obtained from the Cessna Service Parts Center for repair of ABS components.

17-79. REPAIR OF GLASS-FIBER CONSTRUCTED COMPONENTS. Glass-fiber constructed components on the aircraft may be repaired as stipulated in instructions furnished in SK182-12. Observe the resin manufacturer's recommendations concerning mixing and application of the resin. Epoxy resins are preferable for making repairs, since epoxy compounds are usually more stable and predictable than polyester and give better adhesion.

## SHOP NOTES:

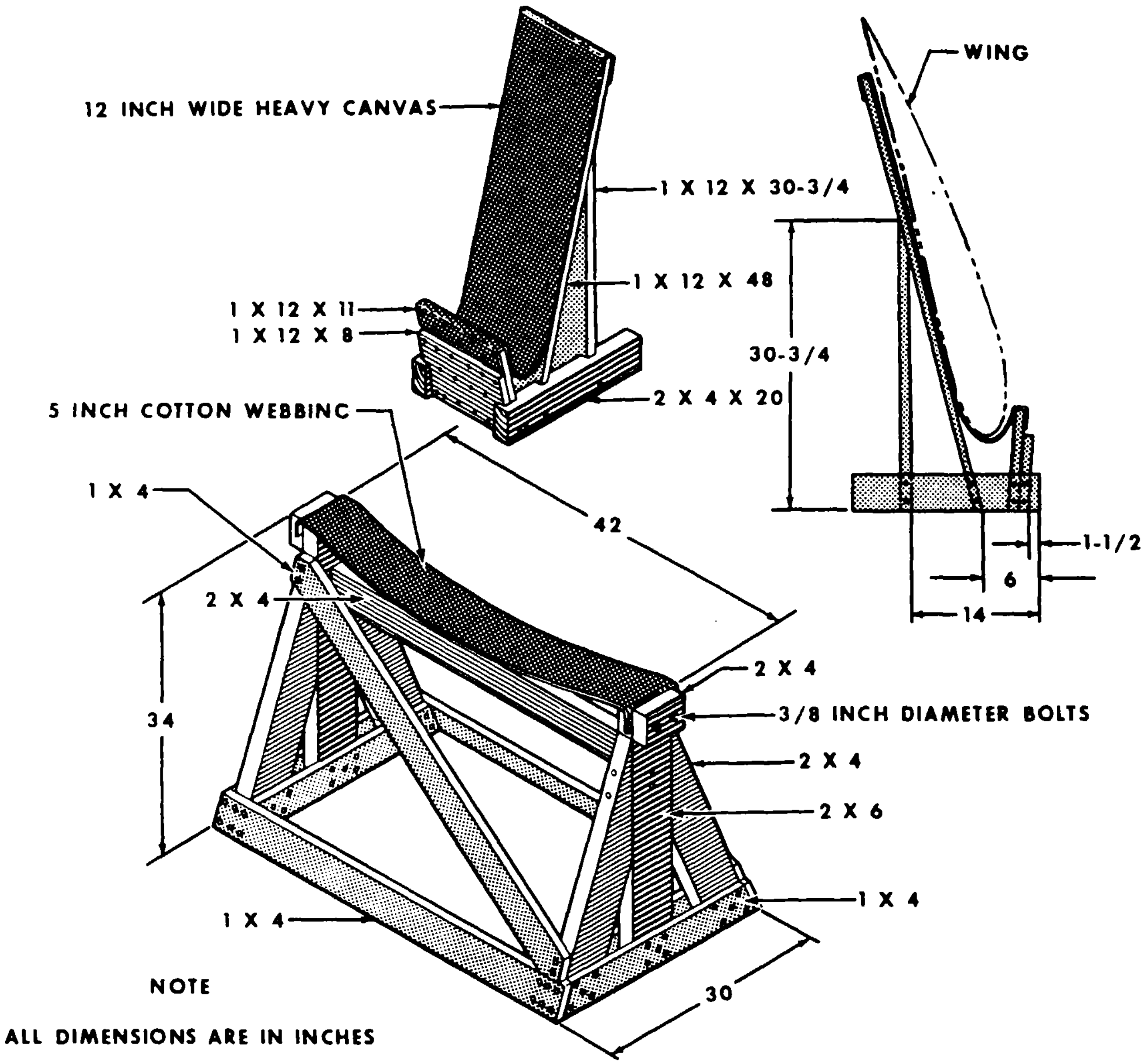
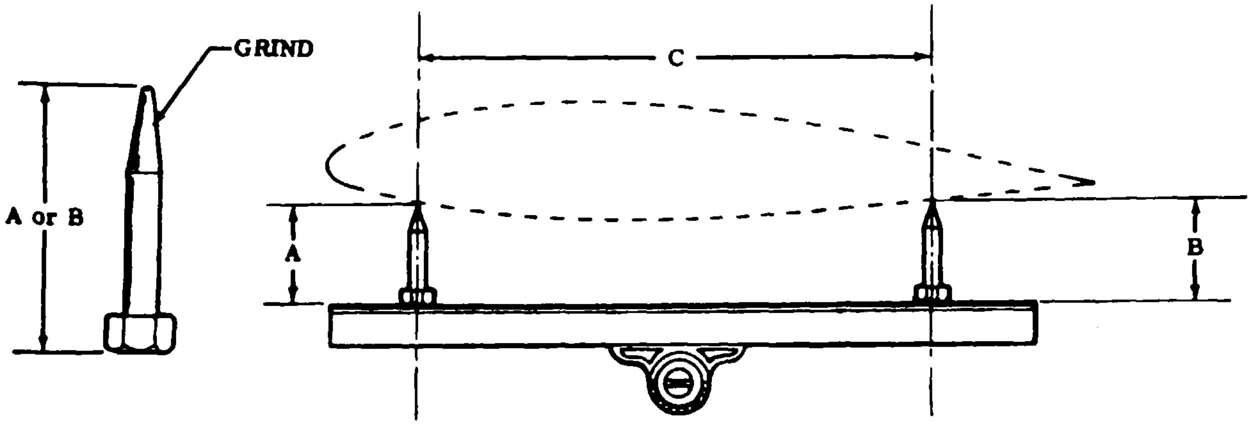
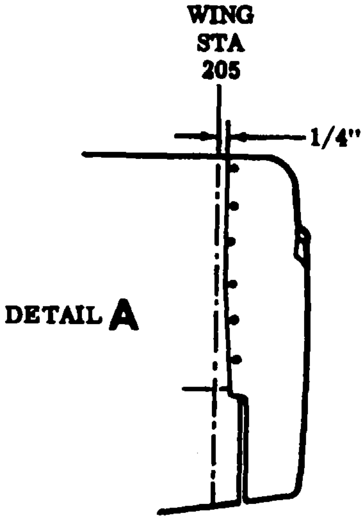



Figure 17-1. Wing and Fuselage Support Stands




| MODEL | A | B | C | WING STATION |
|---|---|---|---|---|
| CARDINAL | 2.00 | 2.00 | 40.50 | 26.50 |
| RG-SERIES | .25 | 2.00 | 25.50 | 205.00 |

**CHECKING WING TWIST**

If damage has occurred to a wing, it is advisable to check the twist. The following method can be used with a minimum of equipment, which includes a straightedge (42" minimum length of angle, or equivalent), two modified bolts and a protractor head with level.

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

Figure 17-2. Checking Wing Twist

GENERAL NOTES

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

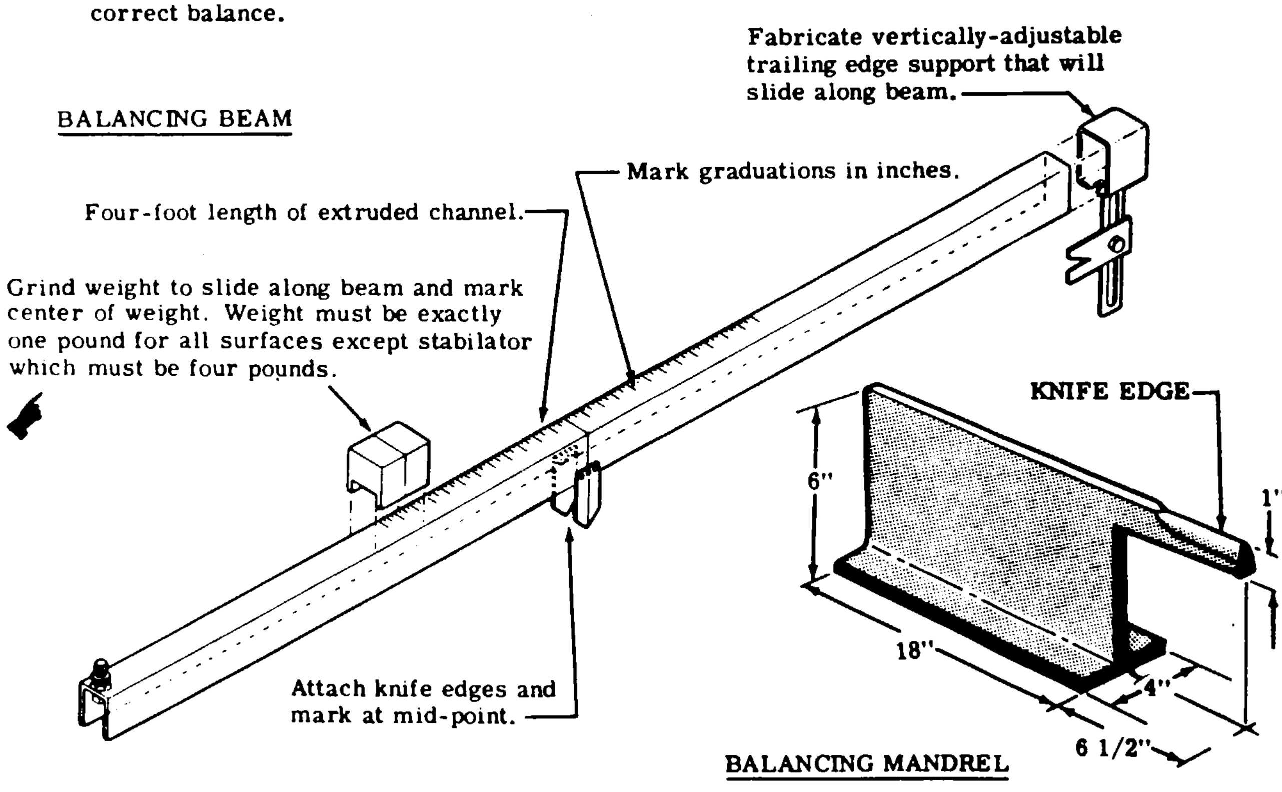



Figure 17-3. Control Surface Balancing (Sheet 1 of 4)

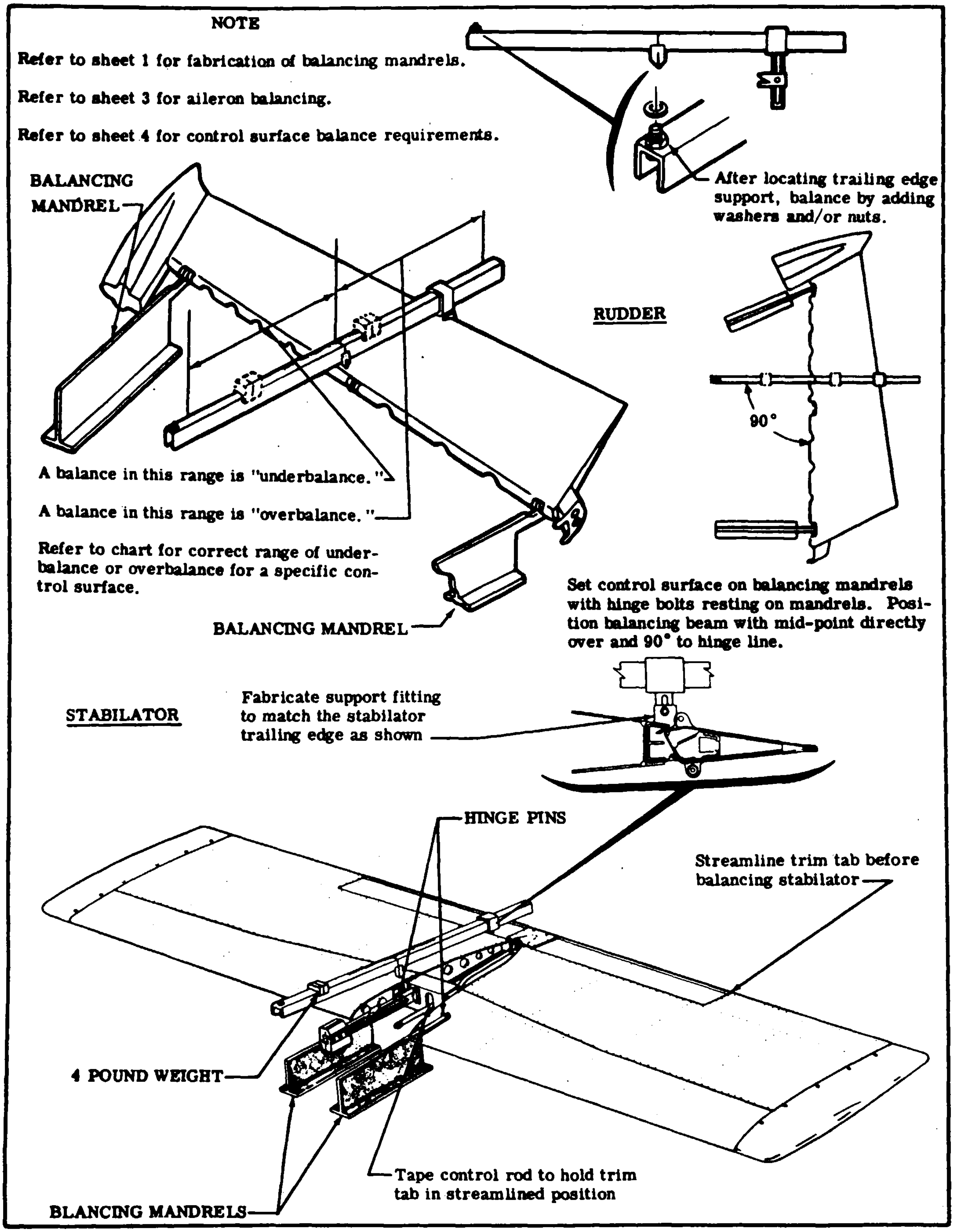
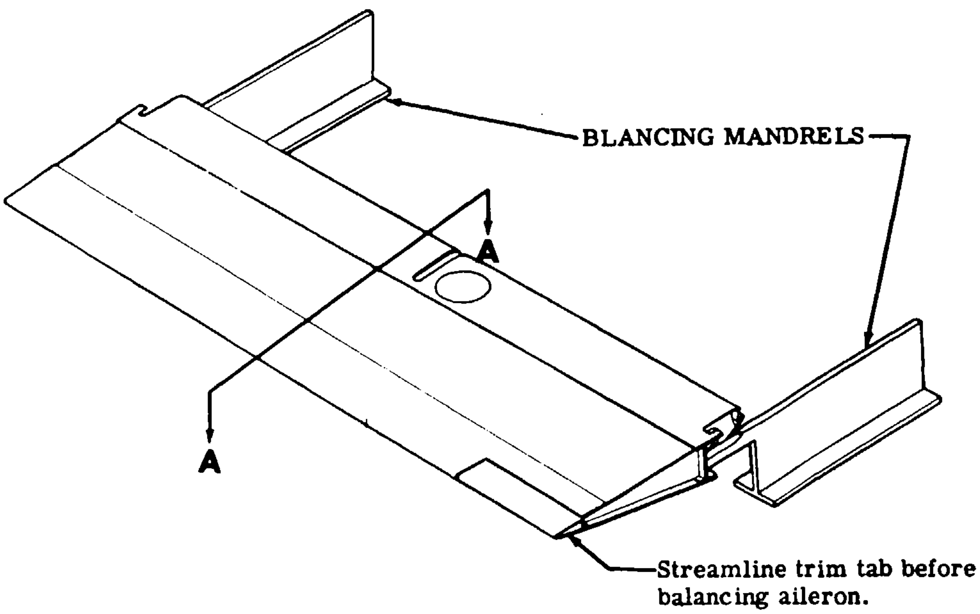
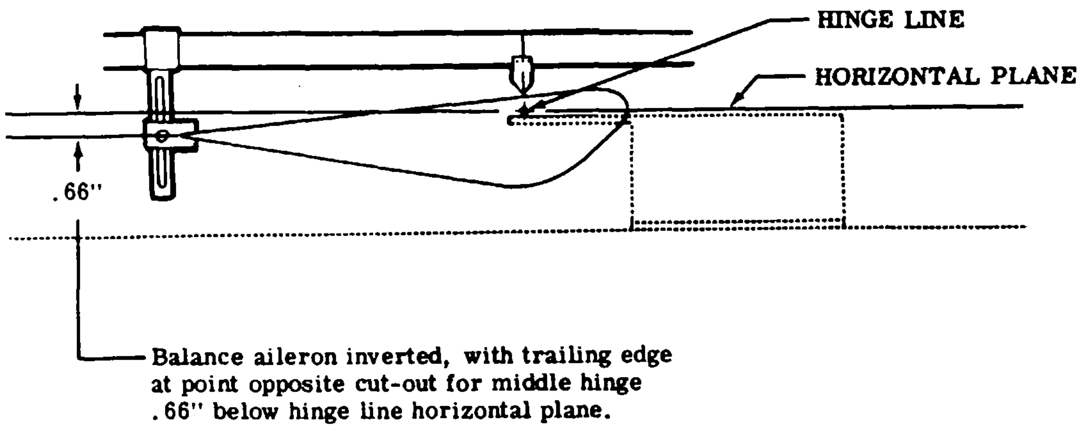



Figure 17-3. Control Surface Balancing (Sheet 2 of 4)

## AILERONS




DETAIL A-A




Refer to chart for correct
range of underbalance.

Figure 17-3. Control Surface Balancing (Sheet 3 of 4)

## CONTROL SURFACE BALANCE REQUIREMENTS

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 1 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 |
| +13.00 to +19.5 | +10.00 to +16.5 |

| UNPAINTED (CORROSION-PROOFING ONLY) (Inch-Pounds) |
|---|
| BALANCE LIMITS |
| +11.5 to +18.00 |

CONTROL: STABILATOR

| PAINTED (Inch-Pounds) | UNPAINTED (Inch-Pounds) |
|---|---|
| BALANCE LIMITS | BALANCE LIMITS |
| 0.00 to +18.10 | -5.00 to +1.23 |

| UNPAINTED (CORROSION-PROOFING ONLY) (Inch-Pounds) |
|---|
| BALANCE LIMITS |
| -5.00 to + 6.40 |

CONTROL: RUDDER

| PAINTED (Inch-Pounds) | UNPAINTED (Inch-Pounds) |
|---|---|
| BALANCE LIMITS | BALANCE LIMITS |
| +12.00 to +15.00 | +10.00 to +13.00 |

| UNPAINTED (CORROSION-PROOFING ONLY) (Inch-Pounds) |
|---|
| BALANCE LIMITS |
| +11.00 to +14.00 |

Figure 17-3. Control Surface Balancing (Sheet 4 of 4)

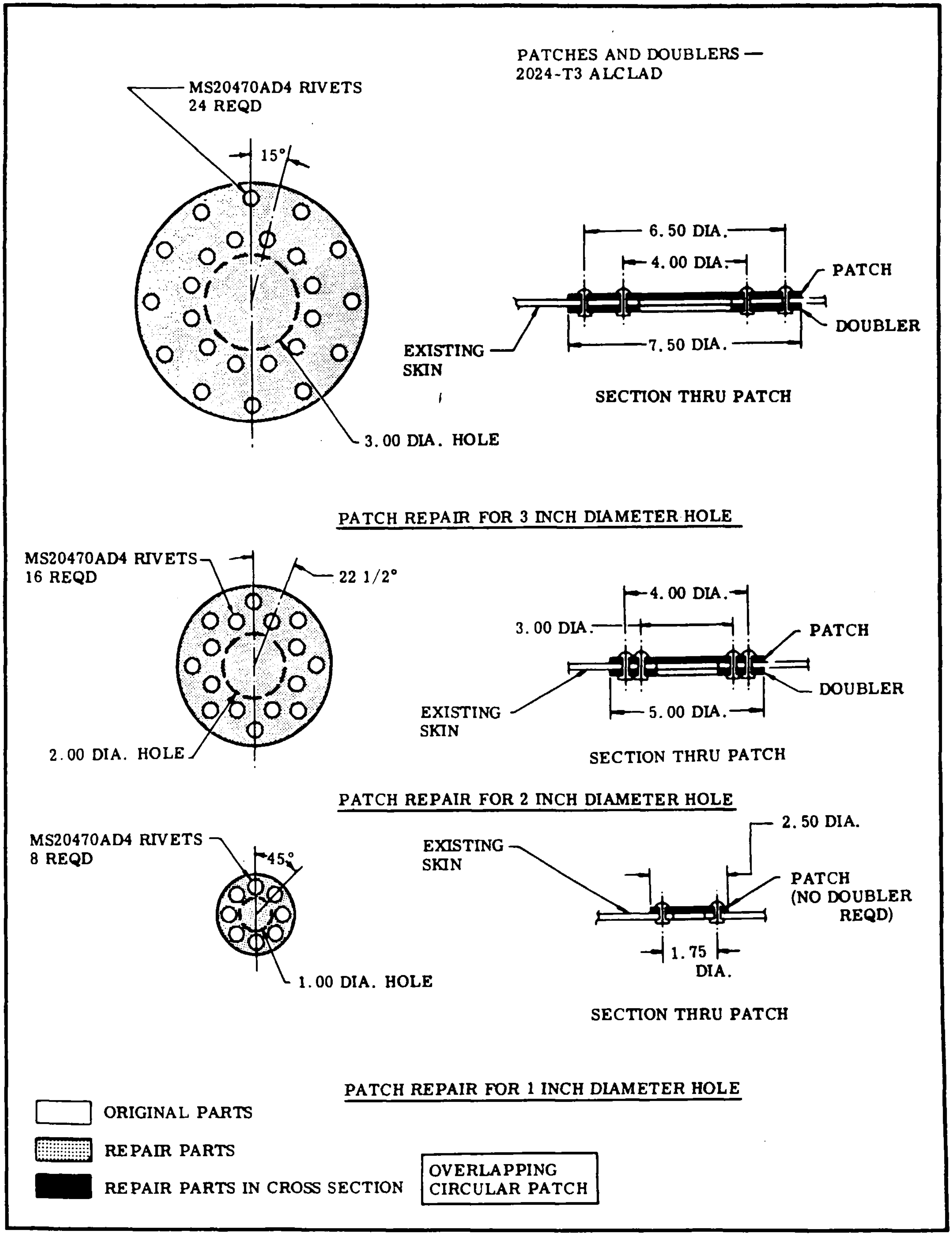
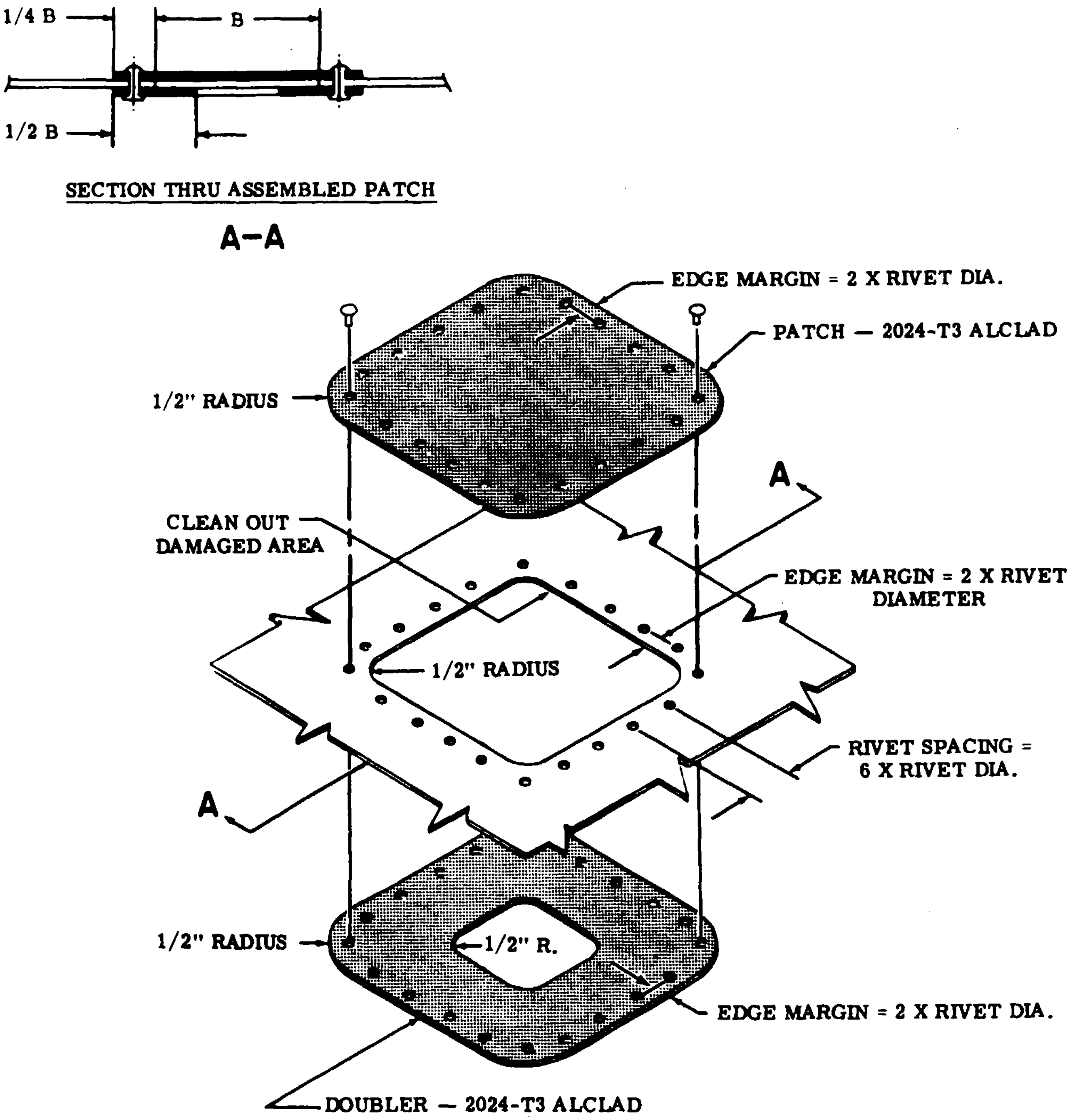



Figure 17-4. Skin Repair (Sheet 1 of 6)




ORIGINAL PARTS

REPAIR PARTS

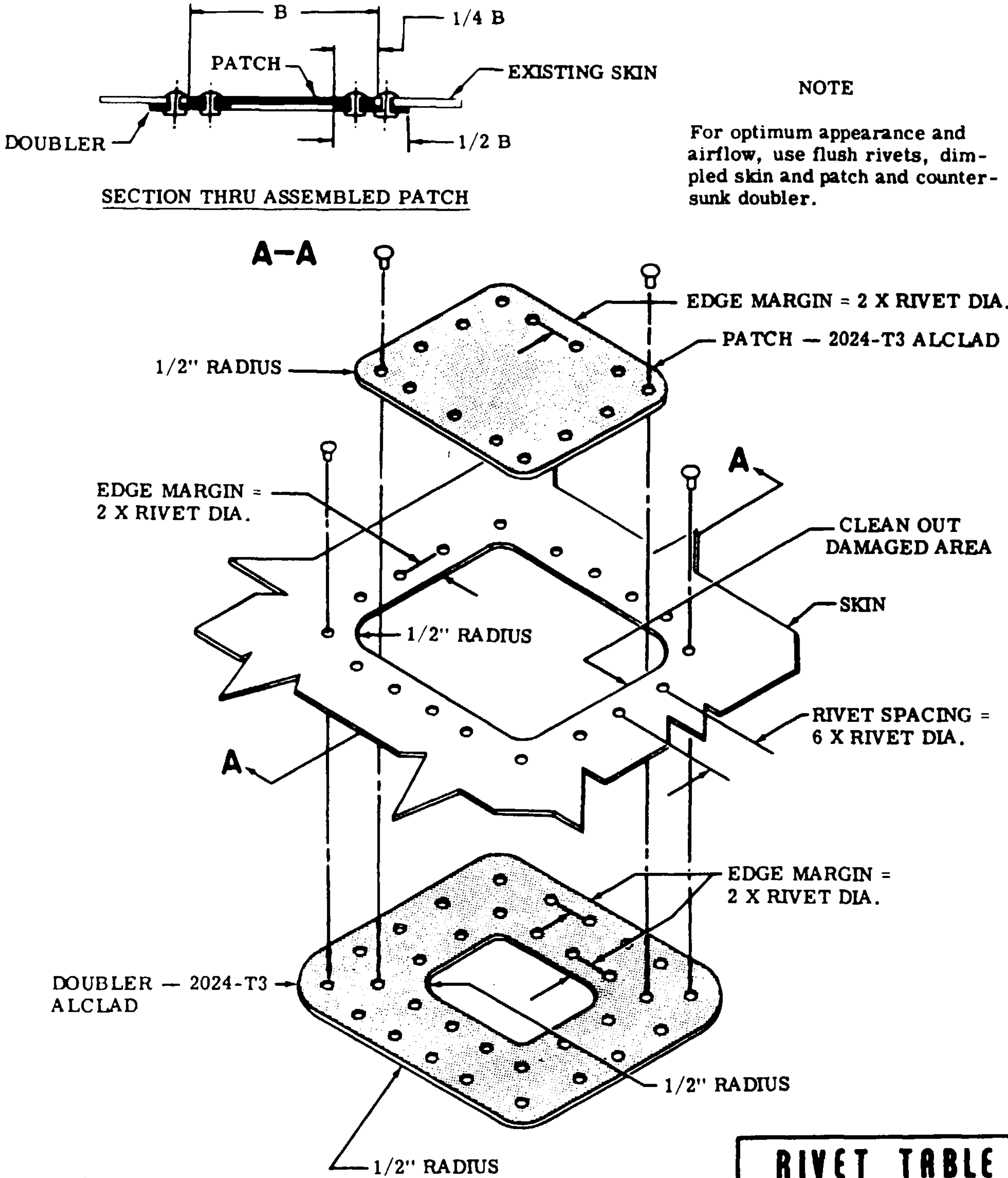
REPAIR PARTS IN CROSS SECTION

OVERLAPPING RECTANGULAR PATCH

**RIVET TABLE**

| SKIN GAGE | RIVET DIA. |
|---|---|
| .020 | 1/8 |
| .025 | 1/8 |
| .032 | 1/8 |
| .040 | 1/8 |
| .051 | 5/32 |

Figure 17-4. Skin Repair (Sheet 2 of 6)




NOTE

For optimum appearance and airflow, use flush rivets, dimpled skin and patch and countersunk doubler.

ORIGINAL PARTS

REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

FLUSH RECTANGULAR PATCH (CIRCULAR FLUSH PATCH IS SIMILAR)

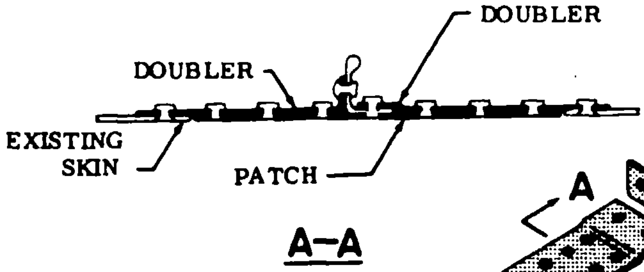
**RIVET TABLE**

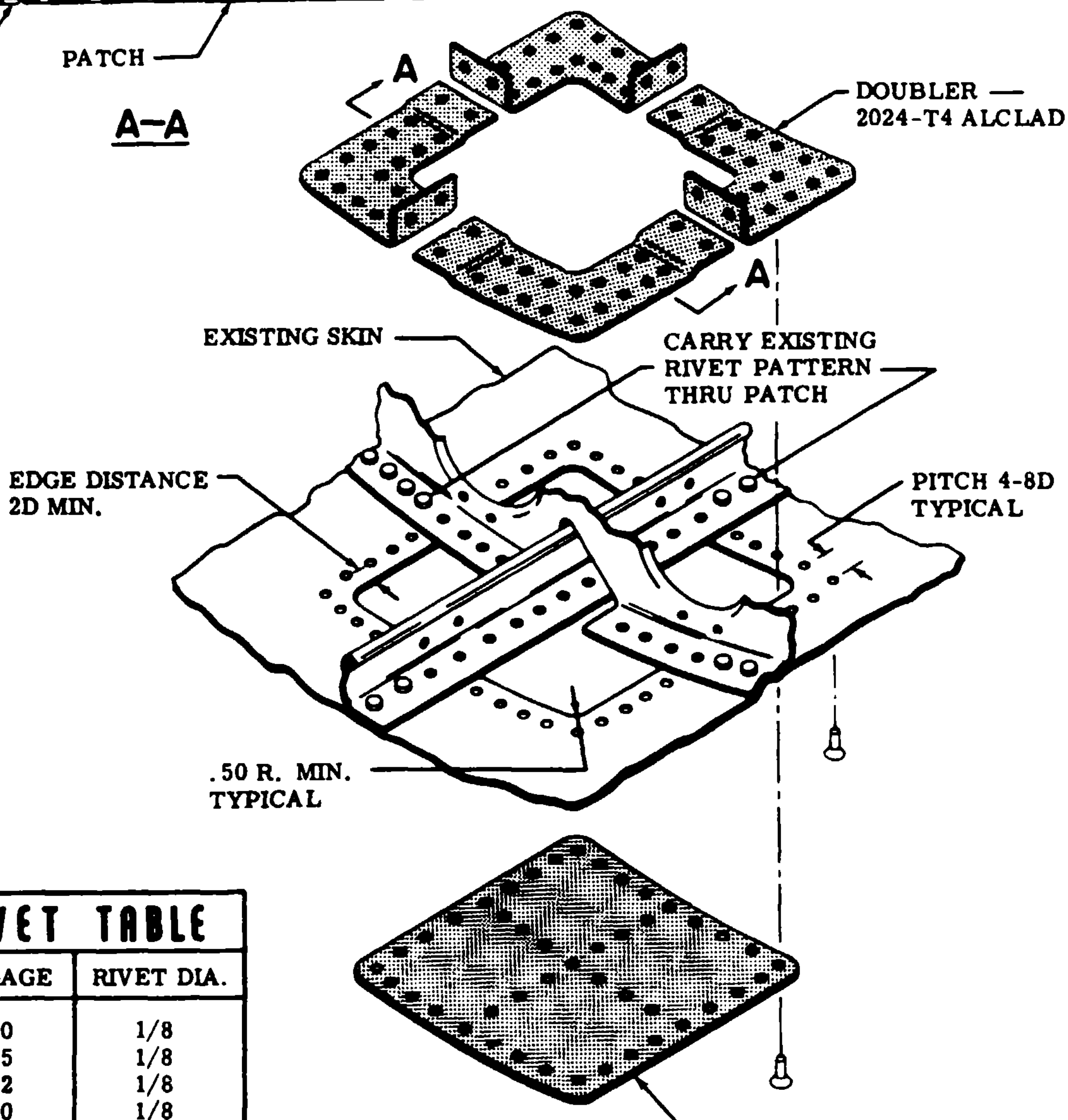
| SKIN GAGE | RIVET DIA. |
|---|---|
| .020 | 1/8 |
| .025 | 1/8 |
| .032 | 1/8 |
| .040 | 1/8 |
| .051 | 5/32 |

Figure 17-4. Skin Repair (Sheet 3 of 6)

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

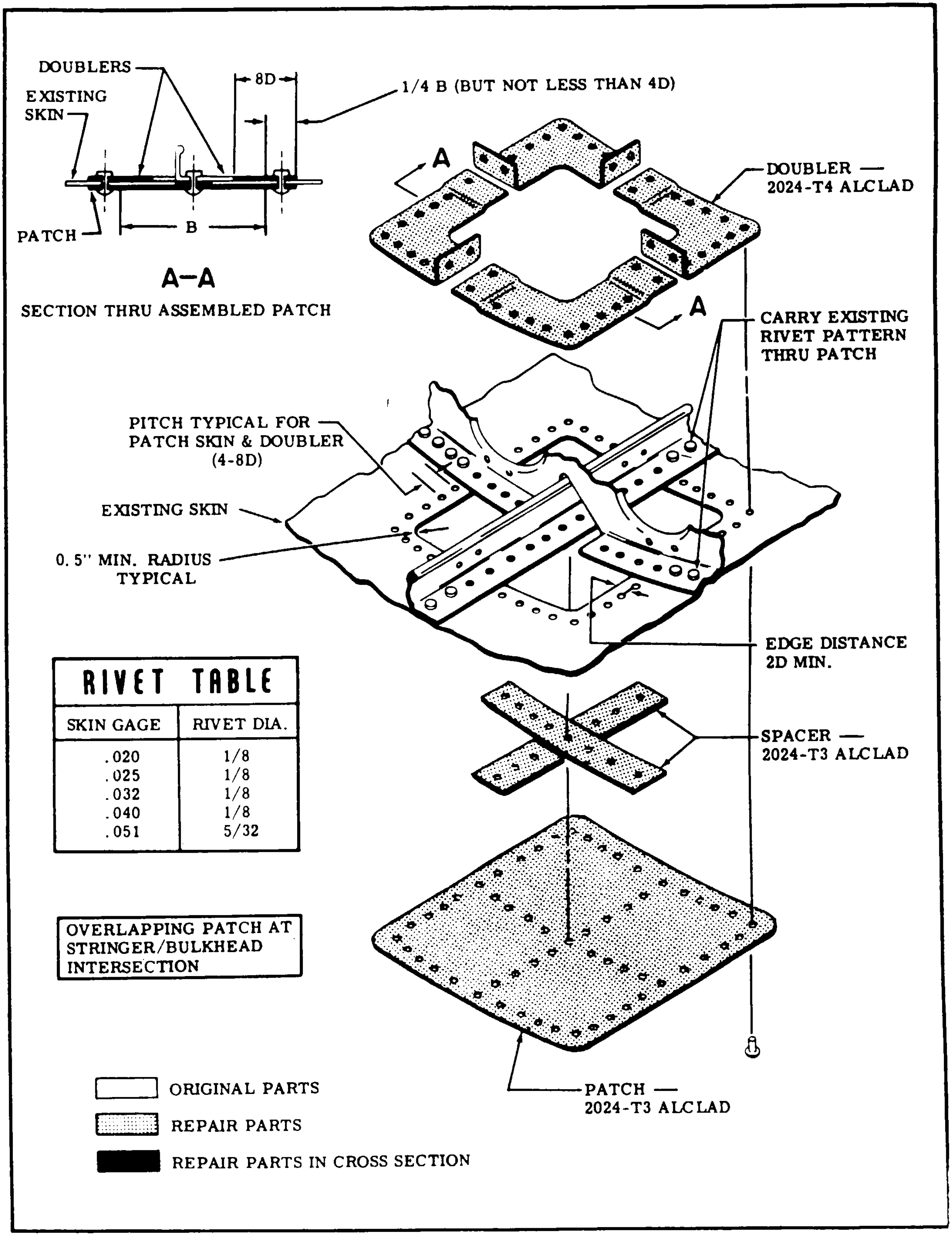
REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

NOTE

This procedure is not recommended in areas where stringers are riveted to bulkheads.

Figure 17-4. Skin Repair (Sheet 4 of 6)




**RIVET TABLE**

| SKIN GAGE | RIVET DIA. |
|---|---|
| .020 | 1/8 |
| .025 | 1/8 |
| .032 | 1/8 |
| .040 | 1/8 |
| .051 | 5/32 |

Figure 17-4. Skin Repair (Sheet 5 of 6)

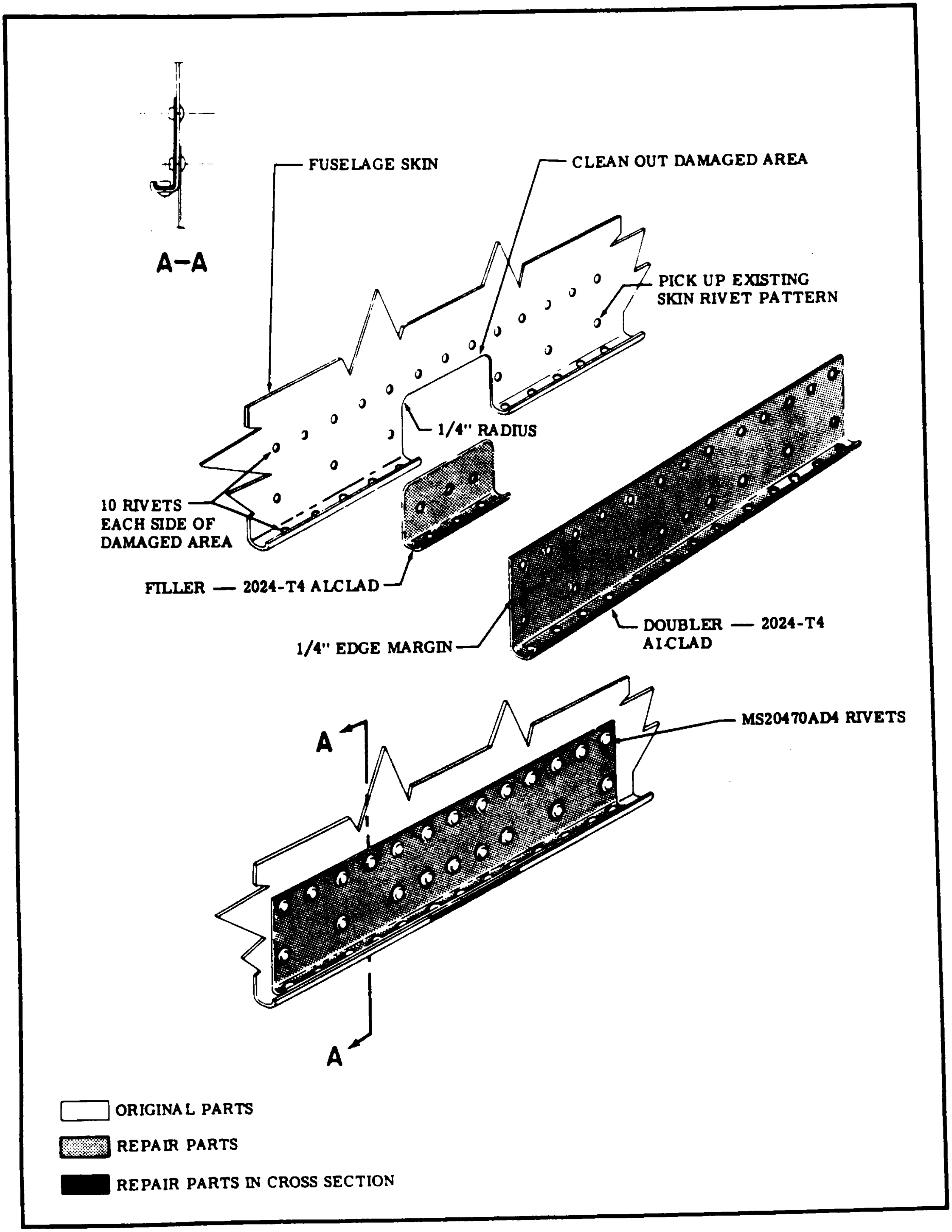



Figure 17-4. Skin Repair (Sheet 6 of 6)

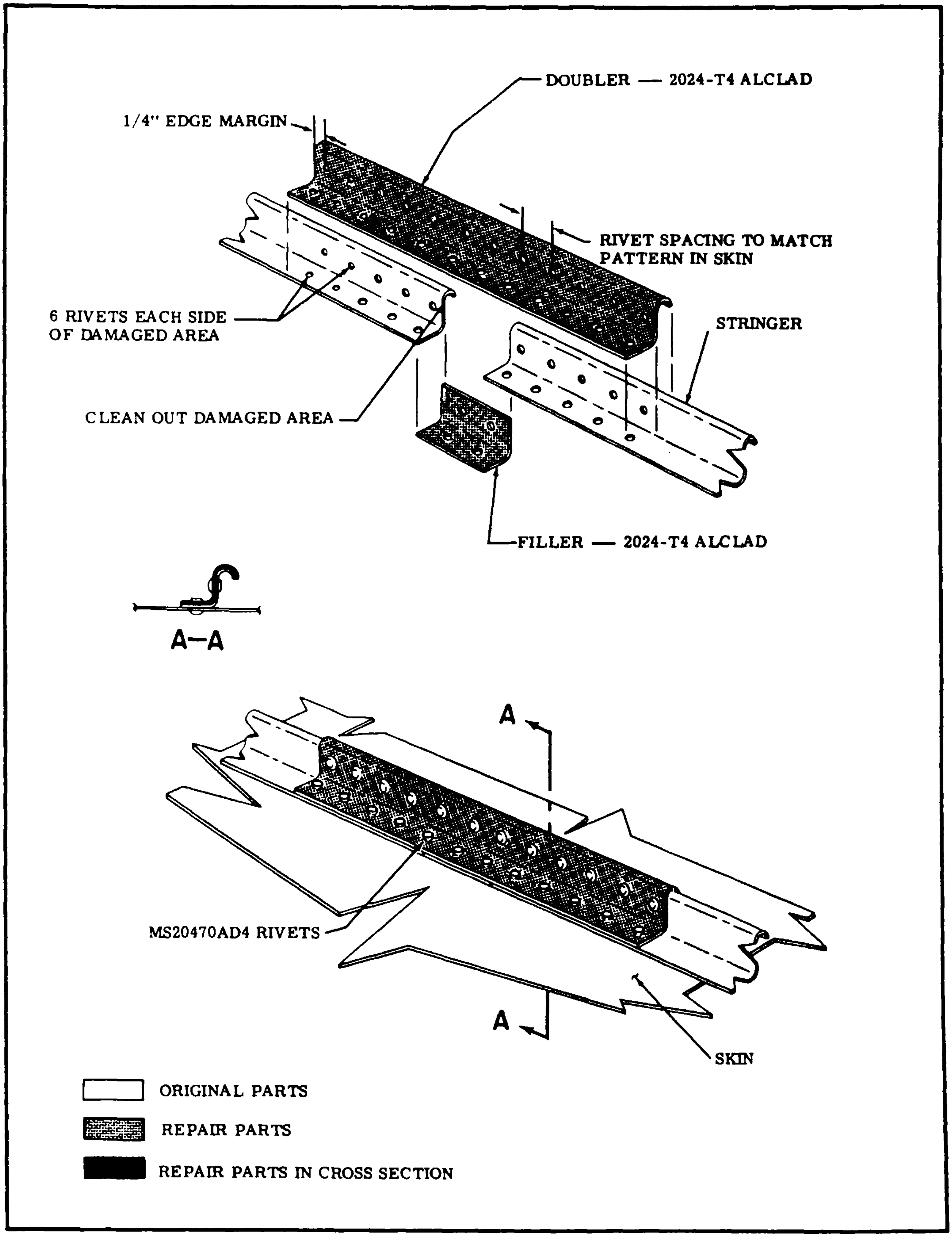



Figure 17-5. Stringer and Channel Repair (Sheet 1 of 4)

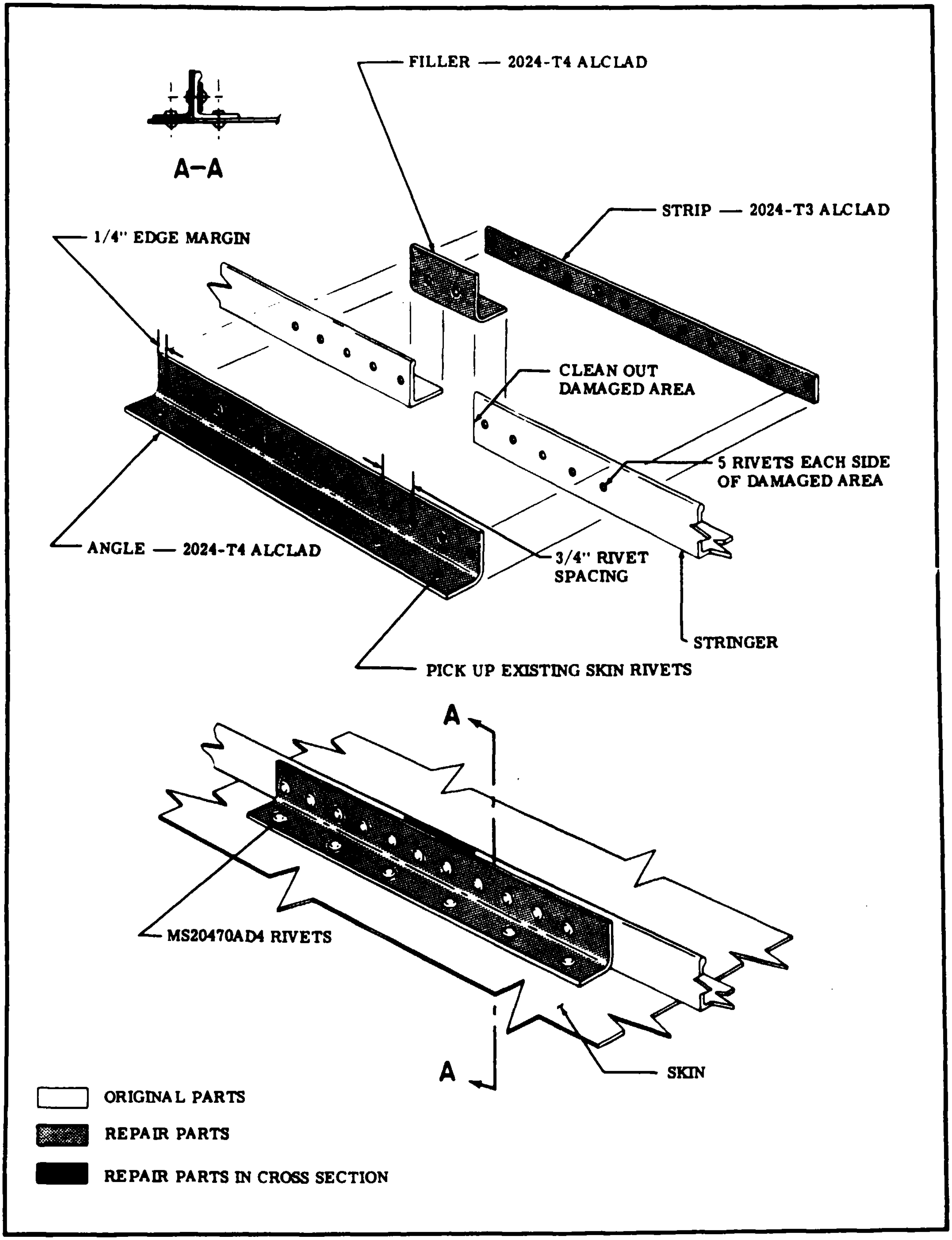



Figure 17-5. Stringer and Channel Repair (Sheet 2 of 4)

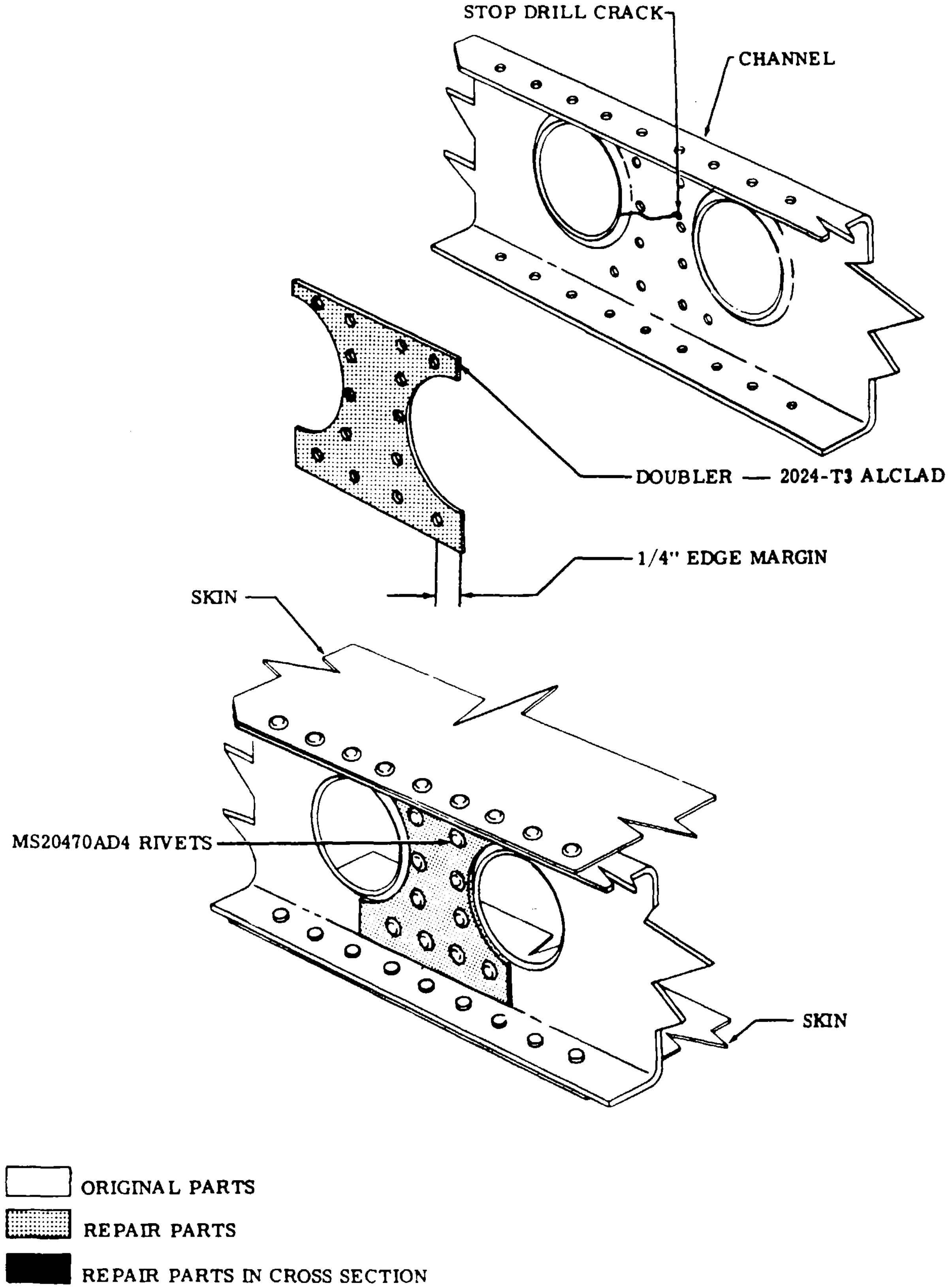



Figure 17-5. Stringer and Channel Repair (Sheet 3 of 4)

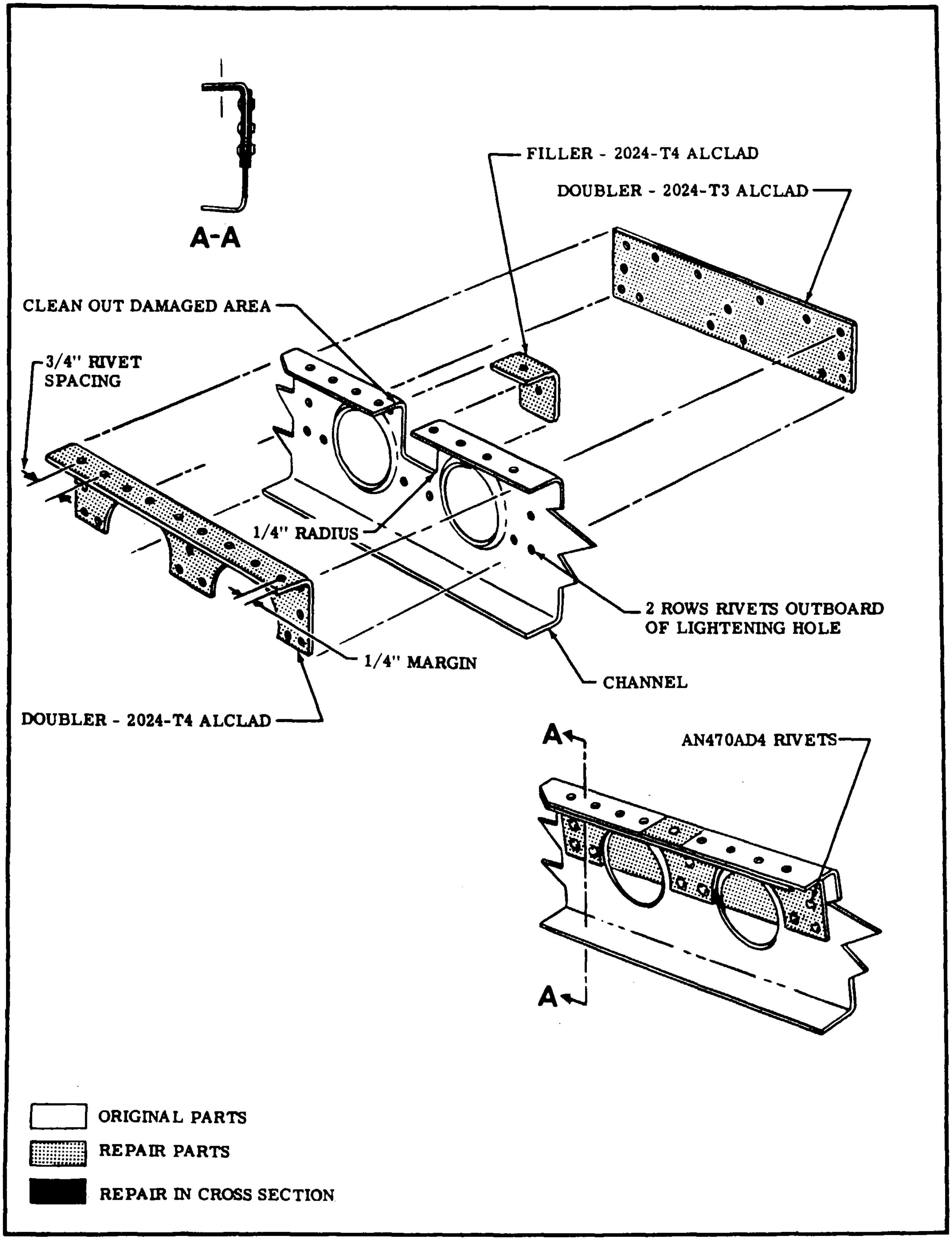



Figure 17-5. Stringer and Channel Repair (Sheet 4 of 4)

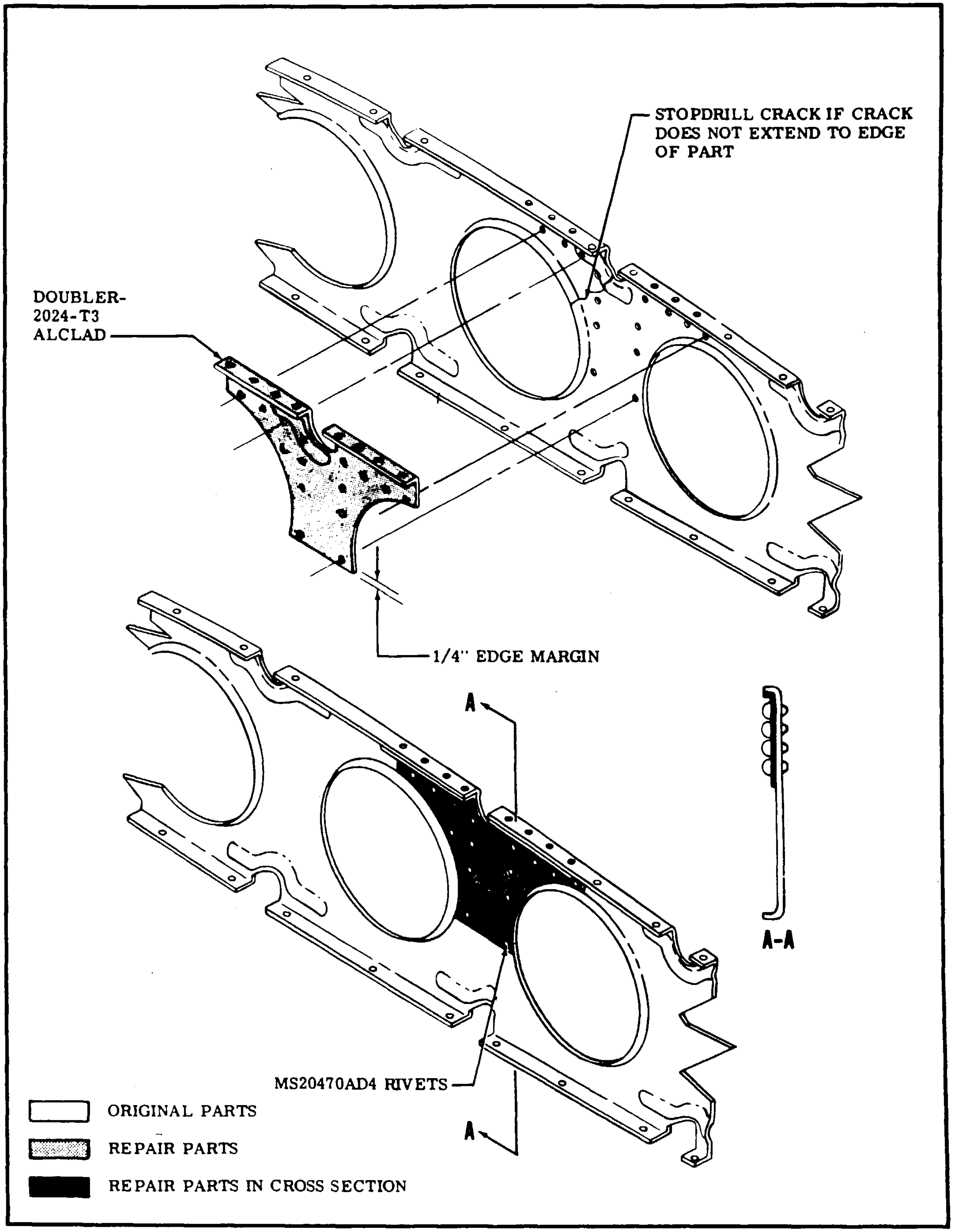



Figure 17-6. Rib Repair (Sheet 1 of 2)

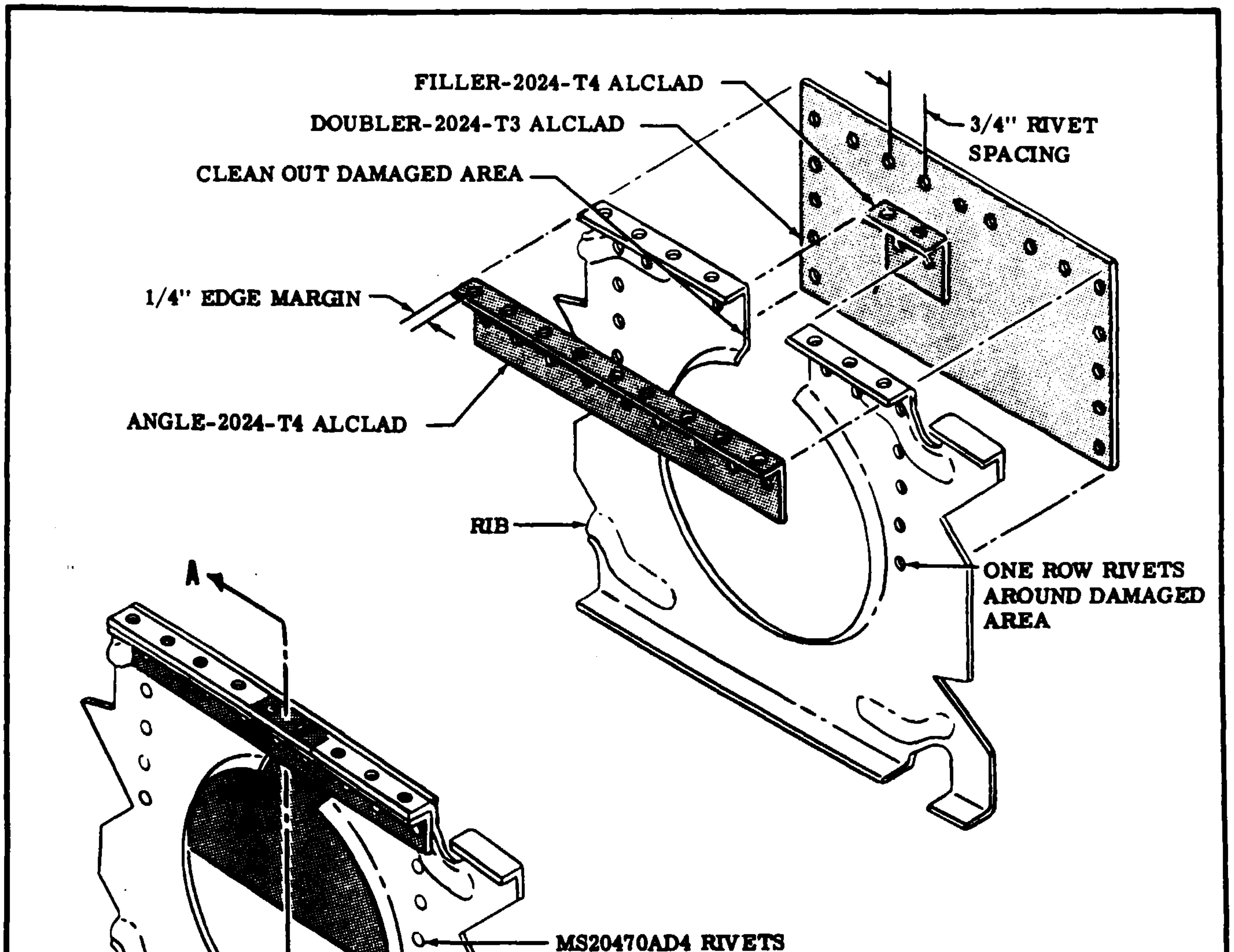
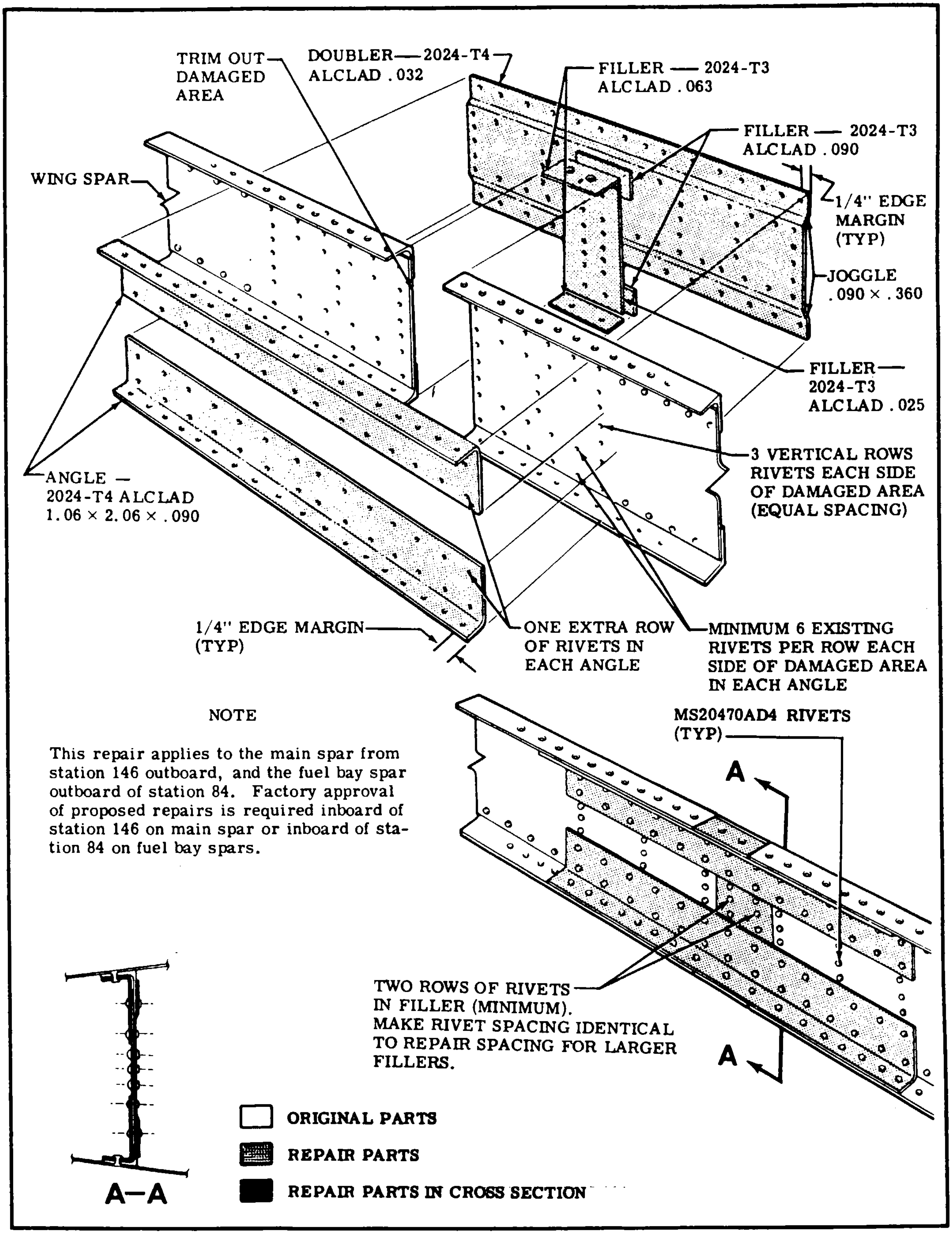



Figure 17-6. Rib Repair (Sheet 2 of 2)




NOTE

This repair applies to the main spar from station 146 outboard, and the fuel bay spar outboard of station 84. Factory approval of proposed repairs is required inboard of station 146 on main spar or inboard of station 84 on fuel bay spars.

Figure 17-7. Wing 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. On cantilever wing, vertical size is limited by ability to install doubler clear of front fuel spar or stringers outboard of spar. On flaps and ailerons, vertical size is limited by ability to install doubler clear of front spar. (Also refer to figure 17-9.)
6. Lateral size is limited to seven inches across trimmed out area.
7. Number of repairs is limited to one in each bay. On cantilever wings, consider a bay in the area forward of front fuel spar as if ribs extended to leading edge.

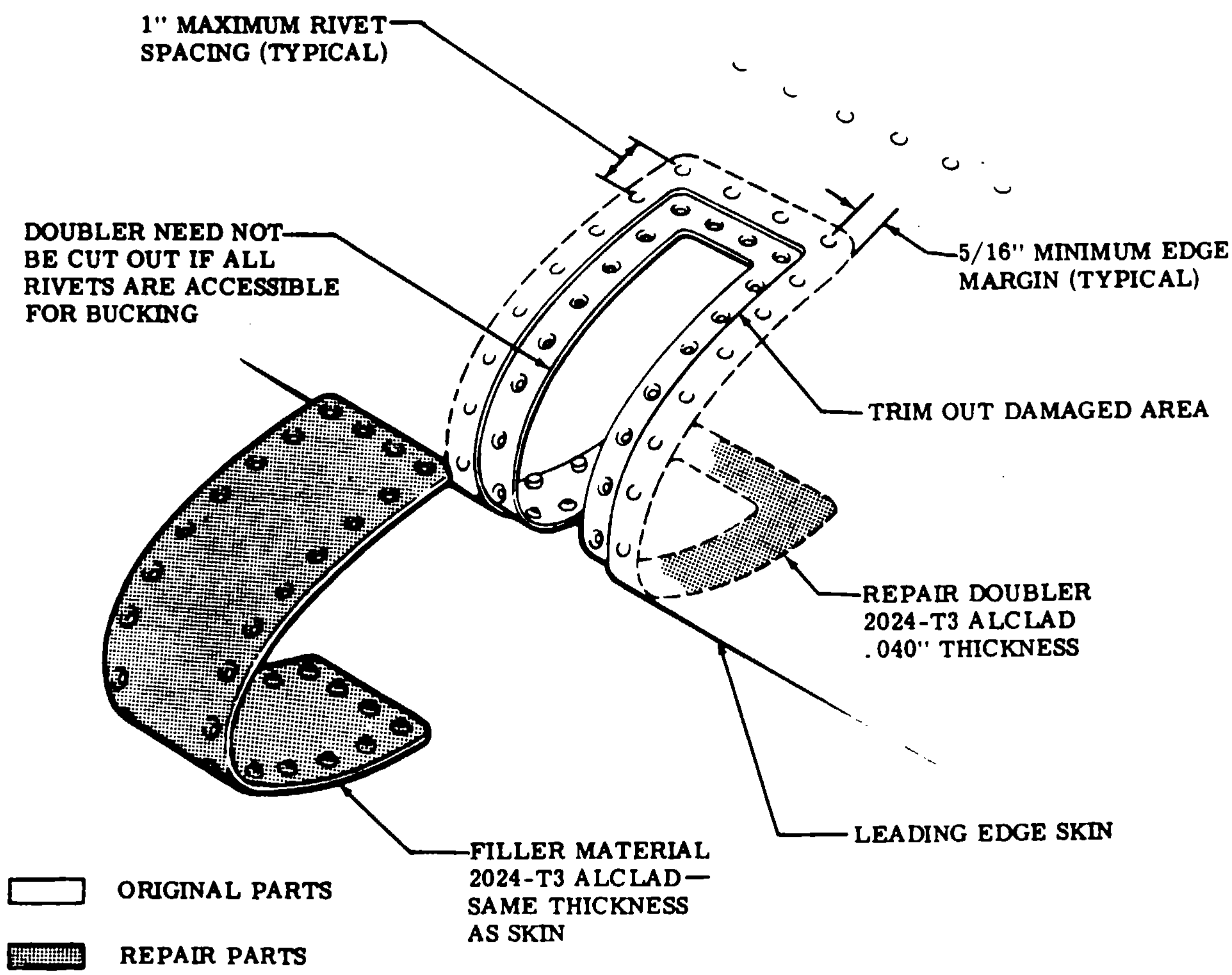



Figure 17-8. Leading Edge Repair

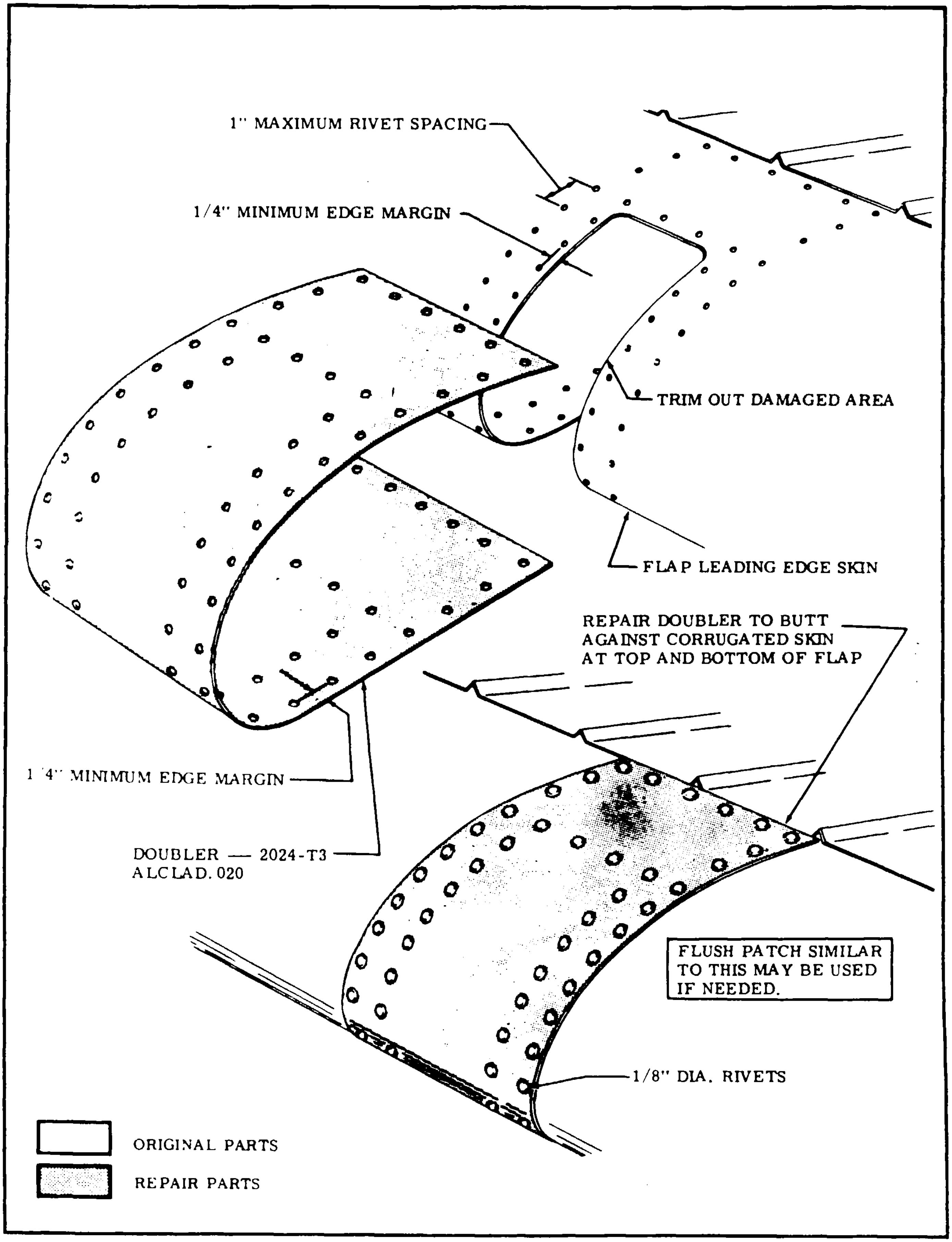
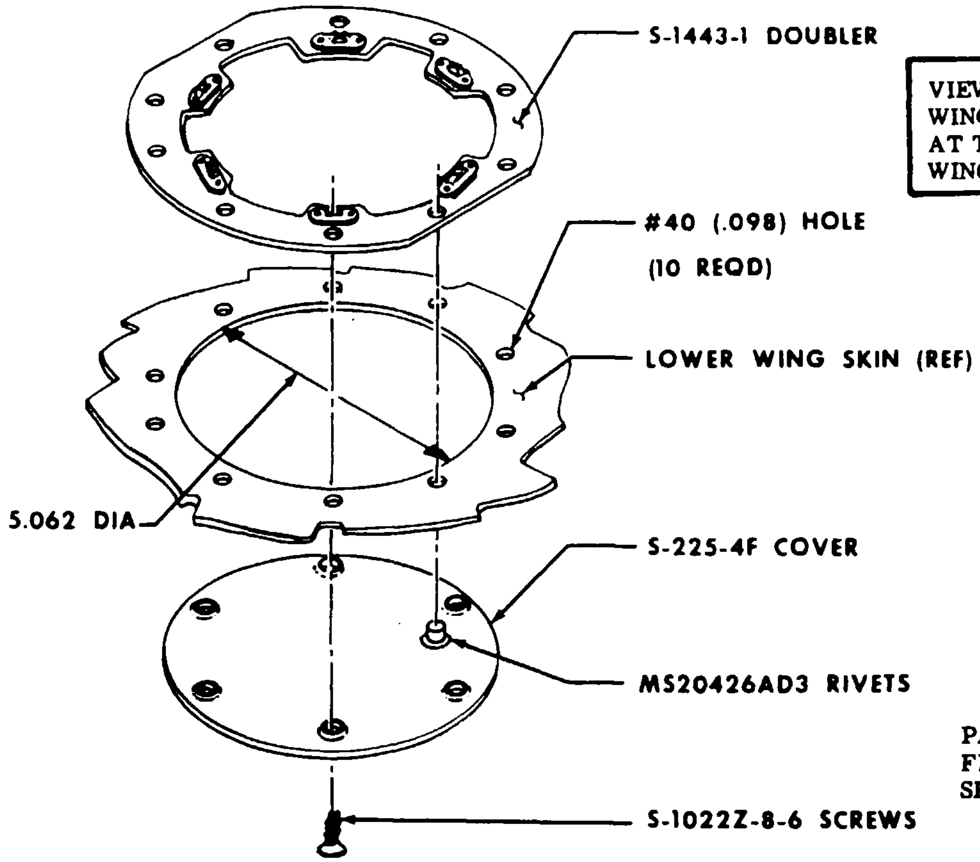



Figure 17-9. Flap Leading Edge Repair




VIEWED FROM INSIDE WING LOOKING DOWN AT TOP OF LOWER WING SKIN.

**CAUTION**

Do not install on cantilever wing without factory approval.

NOTE

PARTS ARE AVAILABLE FROM THE CESSNA SERVICE PARTS CENTER.

## 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. Use landing light installations instead of adding access holes where possible. 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. Cut out 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 17-10. Access Hole Installation

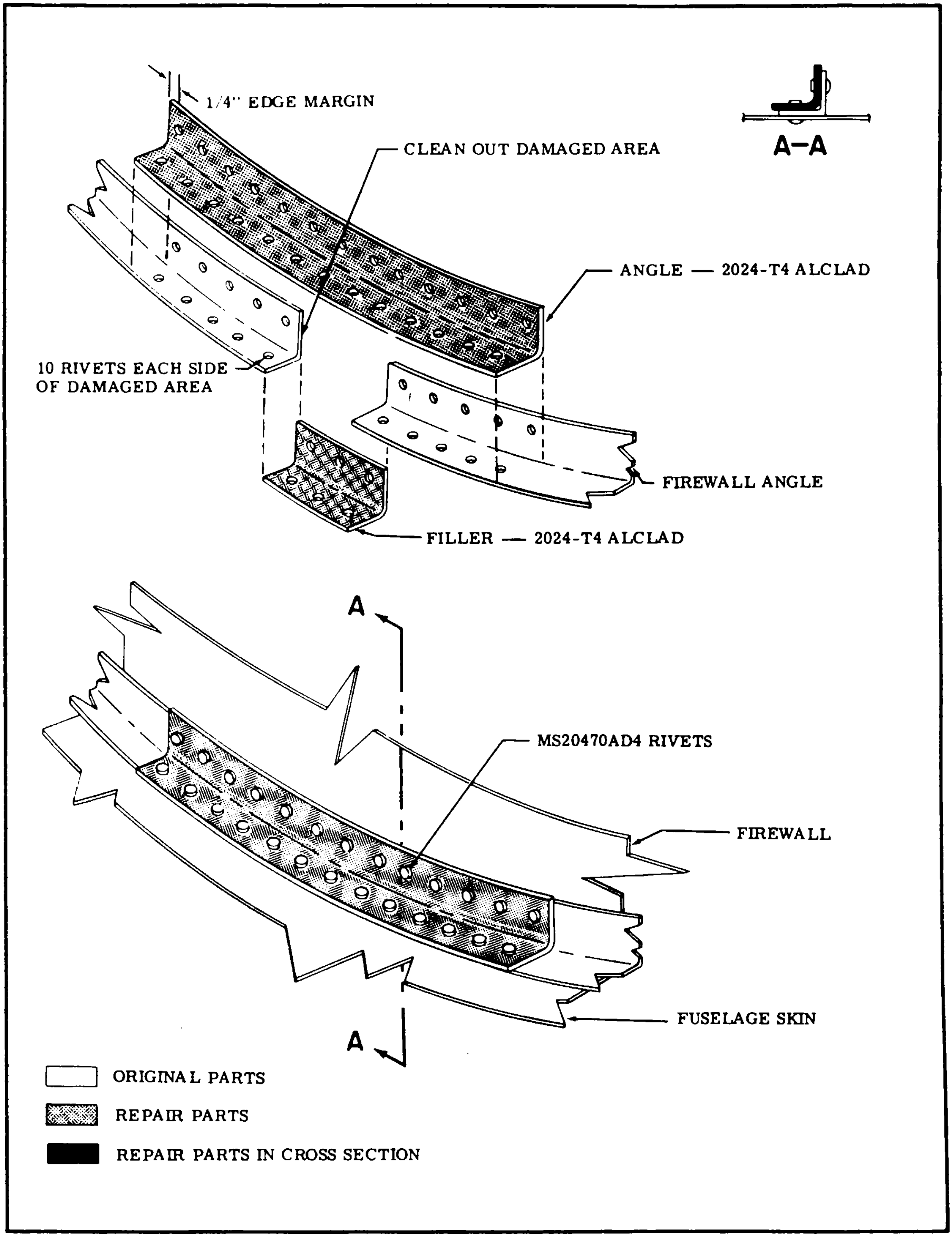



Figure 17-11. Firewall Angle Repair

# SECTION 18

# EXTERIOR 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 type of paint on the aircraft as some types of paint are not compatible. Materials may be obtained from the Cessna Service Parts Center.

| MATERIAL | NO/TYPE | 177RG | F177RG | AREA OF APPLICATION |
|---|---|---|---|---|
| PAINT | ACRYLIC LACQUER | X | | Aircraft exterior and color stripe. |
| PAINT | LACQUER | | X | Aircraft exterior and color stripe. |
| PRIMER | P60G2 WITH R7K46 ACTIVATOR | X | X | Used with lacquer or acrylic lacquer on aircraft exterior. |
| | ER-7 WITH ER-4 ACTIVATOR | X | X | Used with lacquer or acrylic lacquer on aircraft exterior. |
| THINNER | T-8402A | | X | Used to thin lacquer paint and for burndown. |
| | T-6094A | X | | Used to thin acrylic lacquer and for burndown. |
| SOLVENT | #2 SOLVENT | X | X | Used to clean aircraft exterior prior to priming. |

NOTE

Do not paint Pitot Tube or Gas Caps also do not paint Antenna Covers which were not painted at the factory.

**CAUTION**

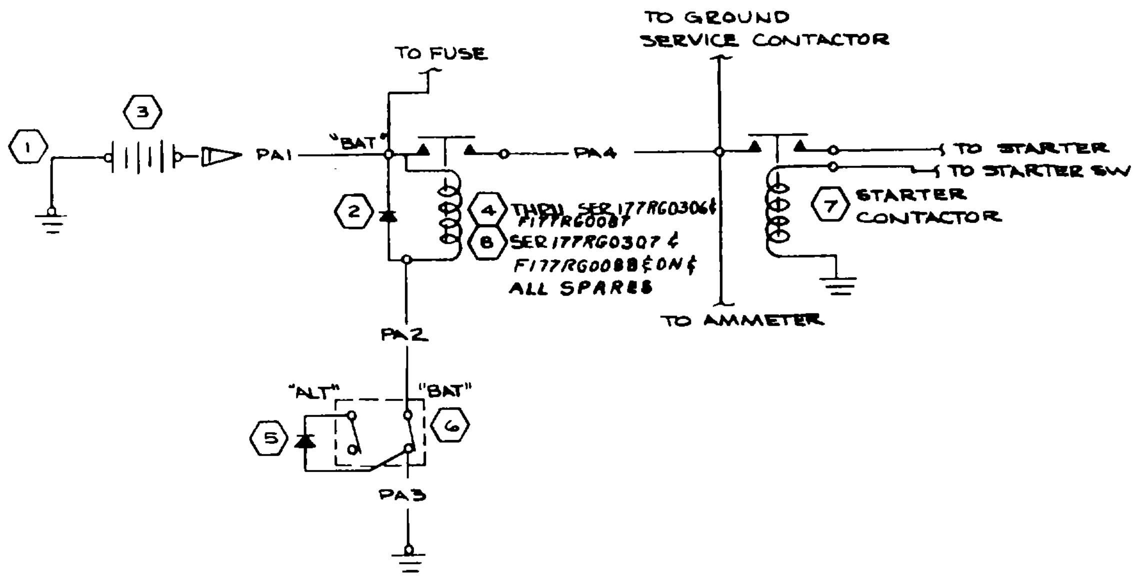
When stripping aircraft of paint, use caution to avoid stripper coming in contact with ABS parts. One area easecially to be avoided is in the wheel well area where the liners are ABS material.

SECTION 19

WIRING DIAGRAMS

TABLE OF CONTENTS Page

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN - NO CHANGE (SR6349) IX | SEB 8-24-70 | LKW BY HW WK RF WL |
| B | BY REV: SER OUT S-1579-1 & ADD S-1579-2 (SR7201) | BPH 6-16-72 | LKW BF HW |
| C | BY REV: ADD WIRE LENGTHS | SLO | BY HW RF |




NOTES:

1. 2.5 IN. OF S-1694-9 TUBING TO BE INSTALLED ON BOTH TERMINALS OF PA1.

| ITEM NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 8 | S-1579-2 | CONTACTOR |
| 7 | S1991-1 | CONTACTOR |
| 6 | S1994-1-1 | SWITCH |
| 5 | 0770718-2 | DIODE ASSY |
| 4 | S1579-1 | CONTACTOR |
| 3 | 0712605-1 | BATTERY, 33A-H |
| 2 | 0770728-1 | DIODE ASSY |
| 1 | 0412007-1 | GROUND STRAP |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| PA4 | 1/0 | S1563-1/0-9 | 227 | S1514-16-31 | S1514-1/0-81 | | |
| PA3 | 18 | | 8 | S1493-1 | S1367-1-8 | | |
| PA2 | 18 | | 170 | S1367-1-10 | S1493-1 | | |
| PA1 | 2 | S1562-2-9 | 12 | S1367-7-13 | S1367-7-13 | | |

WIRE TABLE

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — BATTERY CIRCUIT

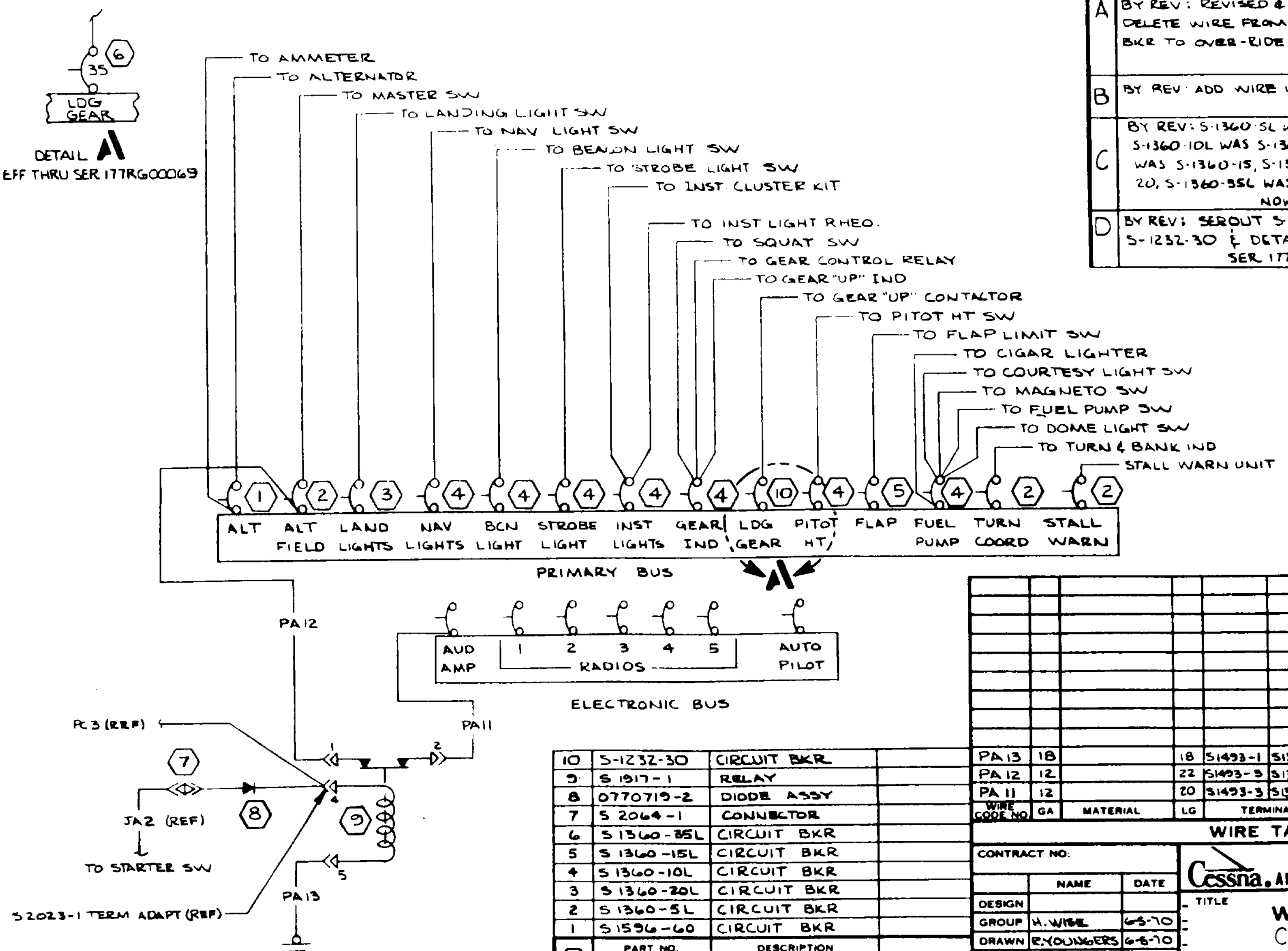
SIZE C | CODE IDENT NO. 71379 | DWG NO 2070001

SCALE: NONE | 177RG | PAGE: 4.1.0

(SR 6349) IX ED & RR 10056

FORM NO 80-2158

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: REVISED & REDRAWN - DELETE WIRE FROM "GEAR IND" CKT BKR TO OVER-RIDE SW SR 6349 IX | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | RF |
| C | BY REV: S-1360-5L WAS S-1360-5, S-1360-10L WAS S-1360-10, S-1360-15L WAS S-1360-15, S-1360-20L WAS S-1360-20, S-1360-35L WAS S-1360-35 NOW SHOP PRACTICE | JCY 3-7-73 | RF |
| D | BY REV: SEROUT S1360-35L; ADD S-1232-30 & DETAIL 'A' SER 177RG00069 | DLO 1-26-73 | RF |




| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 10 | S-1232-30 | CIRCUIT BKR | |
| 9 | S 1917-1 | RELAY | |
| 8 | 0770719-2 | DIODE ASSY | |
| 7 | S 2064-1 | CONNECTOR | |
| 6 | S 1360-35L | CIRCUIT BKR | |
| 5 | S 1360-15L | CIRCUIT BKR | |
| 4 | S 1360-10L | CIRCUIT BKR | |
| 3 | S 1360-20L | CIRCUIT BKR | |
| 2 | S 1360-5L | CIRCUIT BKR | |
| 1 | S 1596-60 | CIRCUIT BKR | |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| PA 13 | 18 | | 18 | S1493-1 | S1367-1-12 | |
| PA 12 | 12 | | 22 | S1493-3 | S1367-3-6 | |
| PA 11 | 12 | | 20 | S1493-3 | S1367-3-6 | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-8-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — CIRCUIT BREAKERS

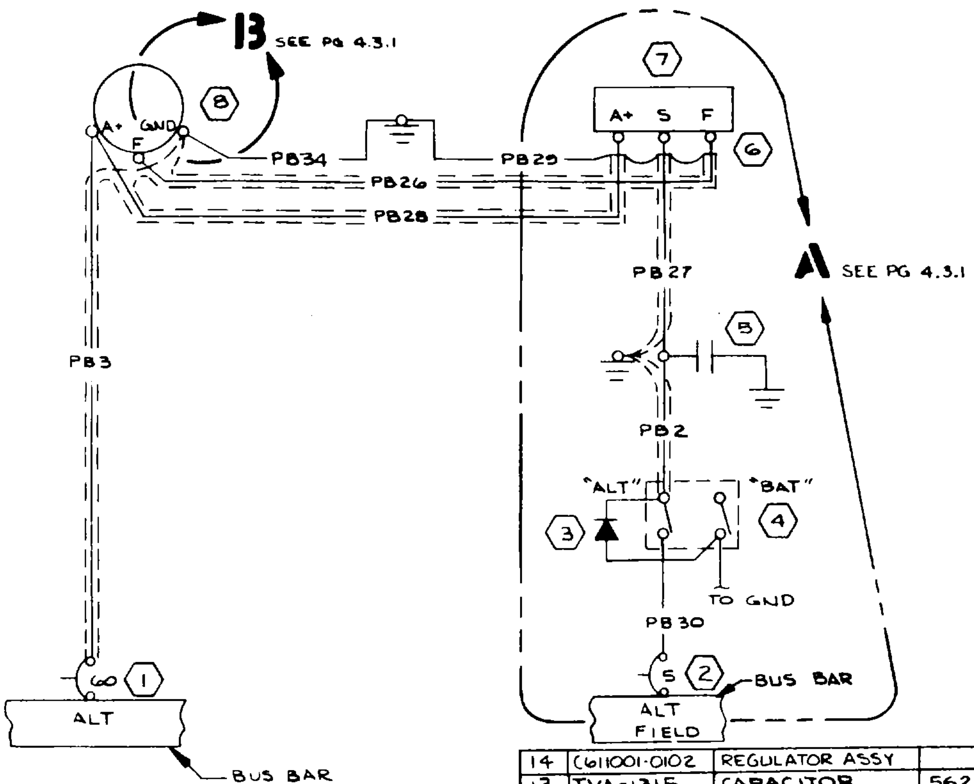
SIZE C | CODE IDENT NO. 71379 | DWG NO 2070001

SCALE NONE | 177RG | PAGE: 4.2.0

(SR 6340) IX ED #RR 10056

FORM NO 80-2138

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN - NO CHANGE (SR6349) IX | SEB 8-24-70 | [illegible] |
| B | BY REV: ADDED DETAIL A; S-2135-1 LIGHT ASSY; C593001-0101 OVER-VOLTAGE SENSOR; PB31 & PB32 WIRES (SR6786) IX | WDA 6-1-71 | [illegible] |
| C | BY REV: REPLACED S-1[illegible] TERM WITH S-1635-1 TERM [illegible] PB 32. ADDED S-1637-1 [illegible] TO EQ [illegible] TABLE. ADD TVA-1315 CAPACITOR TO E/T & F/D. SER 177RG0243 | [illegible] 1-4-71 | RF |
| D | BY REV: ADD WIRE LENGTHS | SLP 12-4-72 | [illegible] |
| E | BY REV: S-1360-5L WAS S-1360-5 NOW SHOP PRACTICE | JCY 3-7-73 | [illegible] RF |
| F | BY REV: SER OUT C611001-0101 & PB4 SER IN C611001-0102 : ADD DETAIL "B" & PB33 & SER (SR7624) (SR7639) | RAM 7-31-73 | RF |
| G | BY REV: S1367-1-12 WAS S1367-2-12 IN PB29; ADD NOTE 6/PB2 MER177RG0152 (NOW SHOP PRACTICE) | RJP 5-29-74 | [illegible] |
| H | BY REV: SER IN PB34, SER OUT PB33 (SER177RG0566) MER177E0105 | BRF 6-14-74 | JCY |




NOTES:

1. S-1943-2 FOR CENTER CONDUCTOR
   S-1367-3-10 FOR SHIELDING
2. S-1367-1-10 FOR CENTER CONDUCTOR
   S-1367-2-10 FOR SHIELDING
3. S-1367-1-6 FOR CENTER CONDUCTOR
   S-1367-2-8 FOR SHIELDING
4. S-1367-1-12 FOR CENTER CONDUCTOR
   S-1367-2-10 FOR SHIELDING
5. AMP TERMINAL 42281-2(00779) ON CONDUCTOR
   AMP TERMINAL 2-323931-2(00779) ON SHIELD & GROUNDING WIRE
6. S-1367-1-6 FOR CENTER CONNECTOR & S-1367-2-8 FOR SHIELDING

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 14 | C611001-0102 | REGULATOR ASSY | |
| 13 | TVA-1315 | CAPACITOR | 56289 |
| 12 | S-1637-2 | [illegible] SOCKET | |
| 11 | S-1637-1 | HOUSING - PIN | |
| 10 | S-2135-1 | LIGHT ASSY | |
| 9 | C593001-0101 | OVERVOLTAGE SENSOR | |
| 8 | C611501-0102 | ALTERNATOR ASSY | |
| 7 | C611001-0101 | REGULATOR ASSY | |
| 6 | C6AB-10A730-A | HOUSING | 88690 |
| 5 | 0770038-2 | FILTER | |
| 4 | S1994-1-1 | SWITCH | |
| 3 | 0770719-2 | DIODE ASSY | |
| 2 | S1360-5L | CIRCUIT BKR | |
| 1 | S1596-60 | CIRCUIT BKR | |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| PB 34 | 8 | S-1562-8-9 | 57 | S-1943-2 | S-1367-4-12 | | SER177RG0566 & ON |
| PB33 | 8 | S-1562-8-9 | 57 | S1943-3 | S-1367-4-12 | | THRU SER177RG0565 |
| PB 32 | 18 | | 65 | S-1635-1 | 42281-2 | (00779) | SER(SR6786)& ON |
| PB 31 | 18 | | 46 | S1367-1-6 | S-1635-1 | | SER(SR6786)& ON |
| PB 30 | 18 | | 26 | S1367-1-6 | S1493-1 | | THRU SER(SR6786) |
| PB 29 | 18 | | 4 | S1367-1-12 | 5 | | |
| PB 28 | 18S | | 62 | 4 | 5 | | |
| PB 27 | 18S | | 8 | 3 | 5 | | |
| PB 26 | 18S | | 62 | 2 | 5 | | |
| PB 4 | 10 | | 57 | S1367-3-10 | S1367-3-12 | | THRU SER (SR7639) |
| PB 3 | 8S | | 112 | 1 | S1367-4-10 | | |
| PB 2 | 18S | | 47 | S1493-1 | 6 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD NO

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L. KWHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

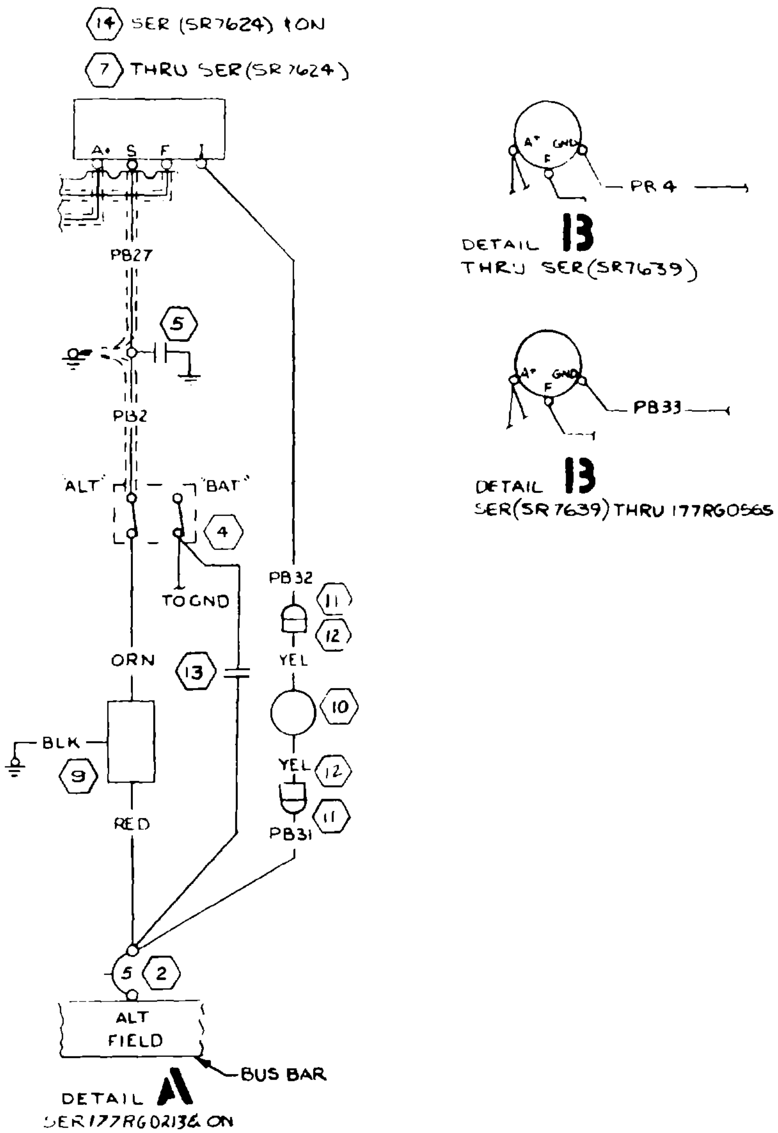
TITLE **WIRING DIAGRAM — ALTERNATOR SYSTEM**

| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |
| SCALE NONE | 177RG | PAGE: 4.3.0 |

FORM NO 80-2158

(SR6349) IX ED&RR 10056

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| H | SEE PG 4.3.0 FOR REVS. | | |




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| | EQUIPMENT TABLE | | |

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX=CESSNA SPEC NO. S-XXX OR CMXXXX=CESSNA STD NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Weiss | 6-1-71 |
| DRAWN | ACKERSON | 6-1-71 |
| CHECK | L.K. WHITE | 5-27-71 |
| STRESS | | |
| PROJ | R E [illegible] | 5-28-71 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV 5800 E PAWNEE WICHITA, KANSAS

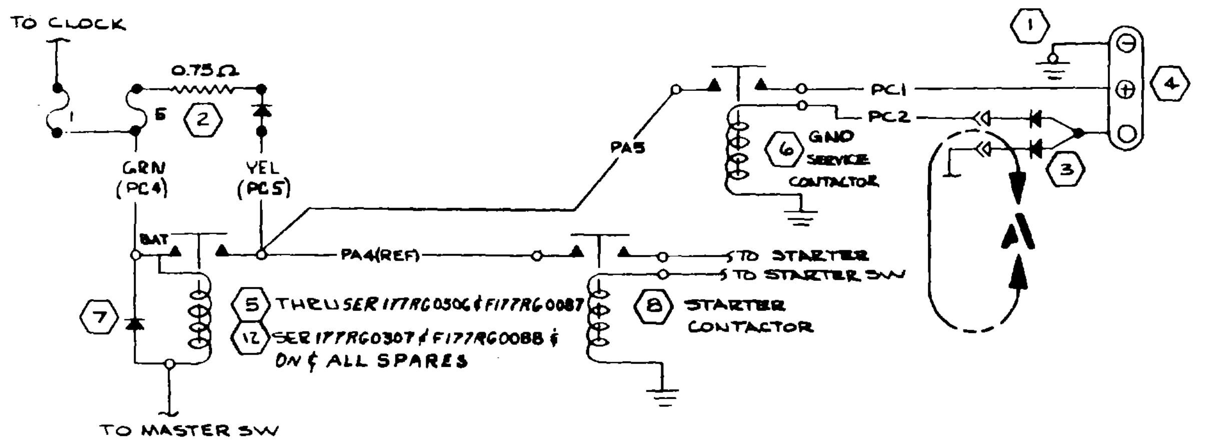
TITLE

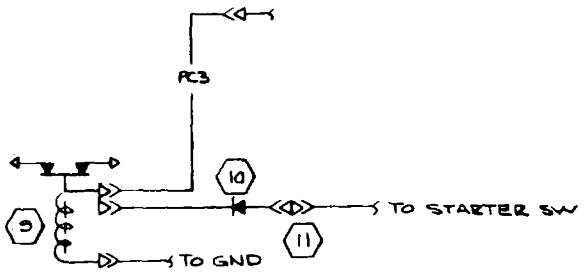
# WIRING DIAGRAM — ALTERNATOR SYSTEM

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177RG | PAGE 4.3.1

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: PA5 WAS 1770010-2 SR 6349 IX | SEB 8-24-70 | |
| B | BY REV: SER OUT S-1579-1 & ADD S-1579-2 (SR7201) | BPH 6-16-72 | |
| C | BY REV: ADD WIRE LENGTHS | | |
| D | BY REV: ADD WIRE COLORS YEL(PC5) WAS PC5; GRN(PC4) WAS PC4, LG18 WAS 12/PC4 & PC5 (MER 177E0040) (SR 7600) IX | JEF 5-13-74 BRF | |




DETAIL A
APPLICABLE FOR USE WITH FIRST RADIO INSTL.

NOTES:

1. 0712031-3 REPLACES 0712031-2.

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 12 | S-1579-2 | CONTACTOR | |
| 11 | S 2064-1 | CONNECTOR | |
| 10 | 0770719-2 | DIODE ASSY | |
| 9 | S1917-1 | RELAY | |
| 8 | S1991-1 | CONTACTOR | |
| 7 | 0770728-1 | DIODE ASSY | |
| 6 | S1660-1 | CONTACTOR | |
| 5 | S1579-1 | CONTACTOR | |
| 4 | AN2552-3A | RECEPTACLE | |
| 3 | 1570043-3 | DIODE ASSY | |
| 2 | 0712031-3 | FUSE & DIODE ASSY | |
| 1 | 0312155-10 | GND STRAP | |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| YEL (PC5) | 18 | | 18 | S1367-1-13 | SOLDER | | |
| GRN (PC4) | 18 | | 18 | S1367-1-13 | SOLDER | | |
| PC 3 | 18 | | 232 | S1493-1 | S1493-1 | | |
| PC 2 | 18 | | 8 | S1367-1-10 | S1493-1 | | |
| PC1 | 2 | S1562-2-9 | 8 | S1367-7-14 | S1367-7-13 | | |
| PA5 | 2 | S1562-2-9 | 8 | S1367-7-13 | S1367-7-13 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

| CONTRACT NO: | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | E. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM —
GROUND SERVICE RECEPTACLE (OPT)

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE 177RG PAGE: 4.4.0

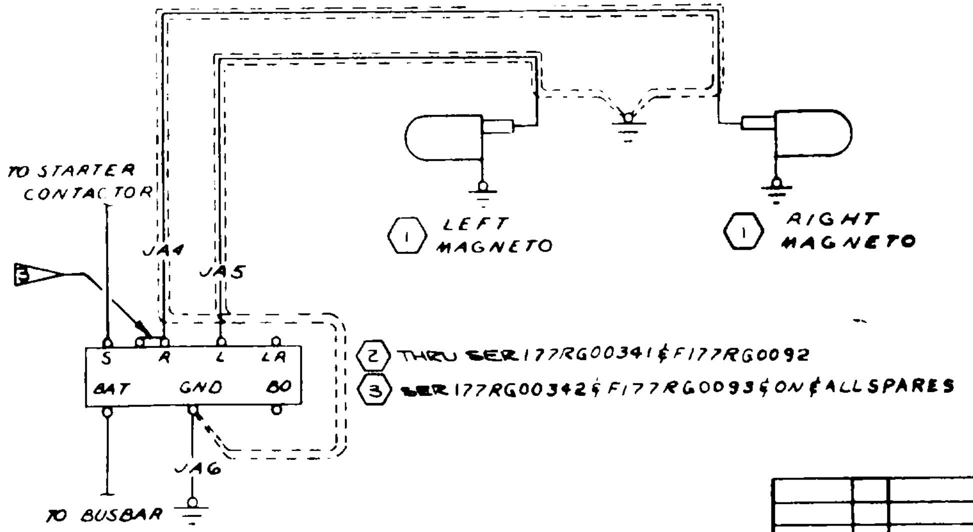
FORM NO 80-2188

(SR 6349) IX ED & RR 10086

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | REDRAWN - NO CHANGE (SR6349) IX | SEB 8-24-70 | HW ELY / HW DR VR / RF |
| B | BY REV: SER OUT C292501-0101; SER IN C292501-0105 (SR7126) | ZLY 5-1-72 | HW / RF |
| C | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | HW / RF |

NOTES:

1. S-1367-1-6 FOR CENTER CONDUCTOR. S-1367-2-6 FOR SHIELDING.
2. S-1367-1-8 FOR CENTER CONDUCTOR. S-1367-2-8 FOR SHIELDING.
3. INSTALL SHORTING BAR (VENDOR FURNISHED) BETWEEN TERMINAL "R" AND UNMARKED ADJACENT TERMINAL




INACTIVE
EFF THRU SER 177RG0282,
SER F177RG0062
GLW 2-19-73
HRW
RF

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| JA6 | 18 | | 8 | S-1367-1-6 | S-1367-1-6 | |
| JA5 | 18S | | 53 | 1 | 2 | |
| JA4 | 18S | | 58 | 1 | 2 | |

WIRE TABLE

| | PART NO. | DESCRIPTION |
|---|---|---|
| 3 | C292501-0105 | IGNITION SWITCH |
| 2 | C292501-0101 | STARTER SWITCH |
| 1 | 4051 | MAGNETO (09033) |

EQUIPMENT TABLE

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H.WISE | 6-5-70 |
| DRAWN | R.YOUNGERS | 6-5-70 |
| CHECK | L.K.WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R.FIFE | 6-8-70 |
| APPD | | |

SUPERSEDED BY PG 5.1.1

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE: WIRING DIAGRAM — MAGNETO SYSTEM

SIZE C | CODE IDENT. NO. 71379 | DWG NO. 2070001

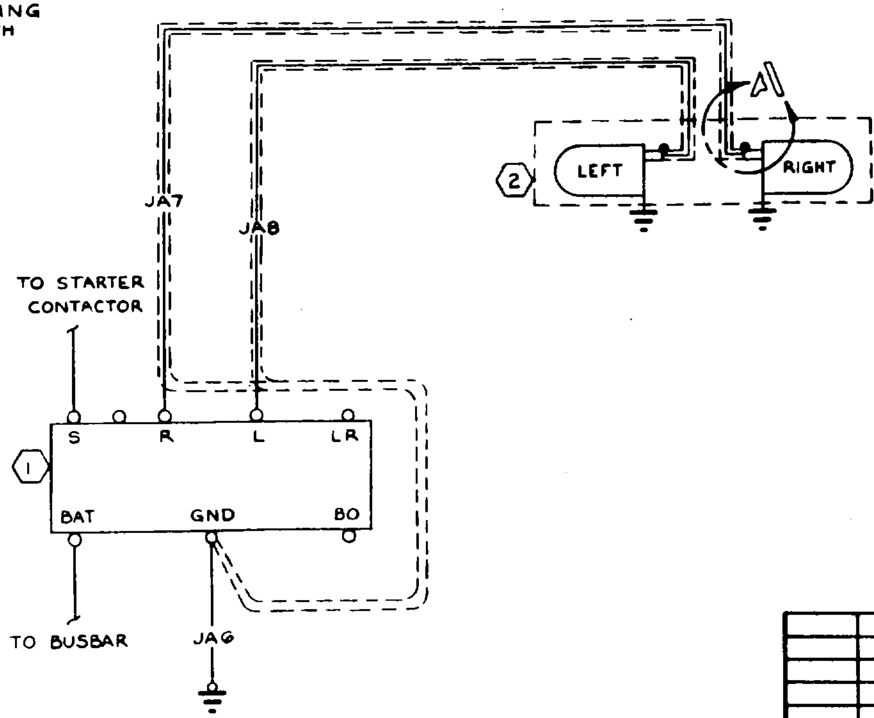
SCALE: NONE | 177RG | PAGE 5.1.0

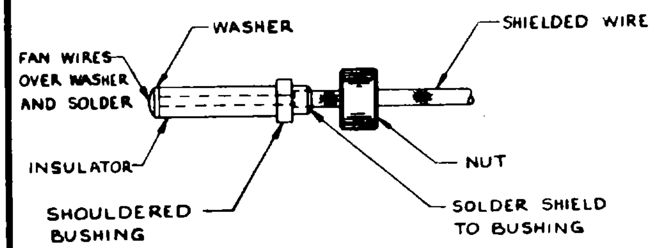
(SR6349) IX ED#RR 10056

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| | | | |

NOTES:

1. S-1367-1-6 FOR CENTER CONDUCTOR. S-1367-2-6 FOR SHIELDING
2. TERMINALS SUPPLIED WITH ENGINE.




DETAIL A
(TYP INSTL FOR RH & LH MAGNETOS)

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| JA8 | 18S | S1461 | 53 | 1 | 2 | | |
| JA7 | 18S | S1461 | 58 | 1 | 2 | | |
| JA6 | 18 | | 8 | S-1367-1-6 | S-1367-1-8 | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 2 | D4LN-2021 | MAGNETO | (77820) |
| 1 | C292501-0105 | IGNITION SWITCH | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: PAGE 5.1.0
SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Wise | 2-19-73 |
| DRAWN | G WOOD | 2-19-73 |
| CHECK | E. YOUNGERS | 2-21-73 |
| STRESS | | |
| PROJ | [illegible] | 2-22-73 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

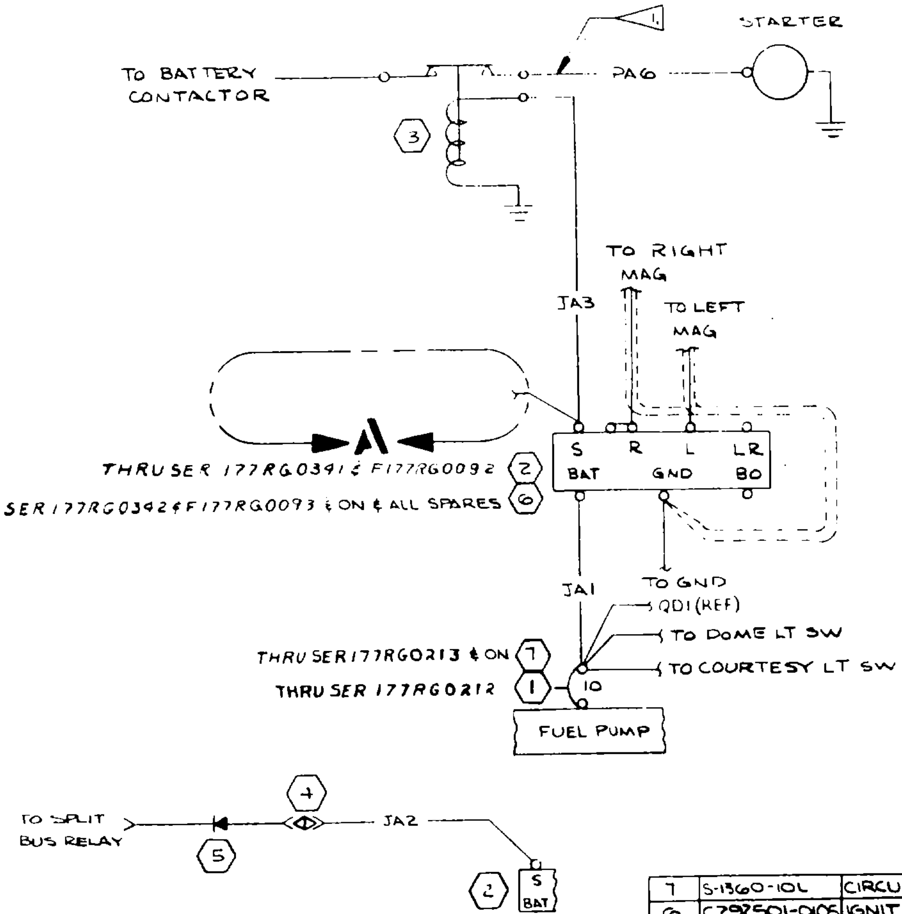
TITLE: WIRING DIAGRAM — MAGNETO SYSTEM

SIZE: C | CODE IDENT. NO. 71379 | DWG NO 2070001

SCALE: NONE | 177RG | PAGE: 5.1.1

(SERF177RG0063) & (SER177RG0283) & ON (SR7526)

FORM NO. 80-2150




DETAIL A
APPLICABLE FOR USE WITH FIRST RADIO INSTL

NOTES:

1. APPLY A 16" LENGTH OF ALPHA 92194 HEAT SHRINK SLEEVING NO. FIT 221-.750 TO S-1367-7-13 TERMINAL END OF CABLE BEFORE APPLYING WIRE TERMINAL.

REVISION

| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| A | REDRAWN - NO CHANGE (SR 6349) IX | SEB 8-24-70 | |
| B | BY REV: SER OUT C292501-0101; SER IN C292501-0105; SER OUT S-1360-10, SER IN S-1360-10L (SR7126), (SR6786) II (REF) | RLY 3-1-72 | RF |
| C | BY REV ADD WIRE LENGTHS | DLP 12-4-72 | RF |
| D | BY REV: ADD NOTE 1 (SR7306) IX | DLO 7-26-73 | RF |
| E | BY REV: S-1367-7-13 WAS S-1367-1-13/ NOTE 1, S-1367-7-13 WAS S-1367-1-14 / PA6; S-1367-2-6 WAS S-1367-1-6 / JA1; QD1 (REF) WAS TO FUEL PUMP SW. MER177RGE0156 (NOW SHOP PRACTICE) | RJP 6-3-74 | |

WIRE TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| PA6 | 2 | S1562-2-9 | 32 | S1367-7-13 | S1367-7-13 | 1 |
| JA3 | 18 | | 62 | S1367-1-6 | S1367-1-10 | |
| JA2 | 18 | | 37 | S1367-1-6 | S1493-1 | |
| JA1 | 18 | | 38 | S1367-2-6 | S1367-1-6 | |

EQUIPMENT TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 7 | S-1360-10L | CIRCUIT BREAKER |
| 6 | C292501-0105 | IGNITION SWITCH |
| 5 | 0770719-2 | DIODE ASSY |
| 4 | 32064-1 | CONNECTOR |
| 3 | S1991-1 | CONTACTOR |
| 2 | C292501-0101 | STARTER SW |
| 1 | S1360-10 | CIRCUIT BKR |

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES:

SUPERSEDED BY

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

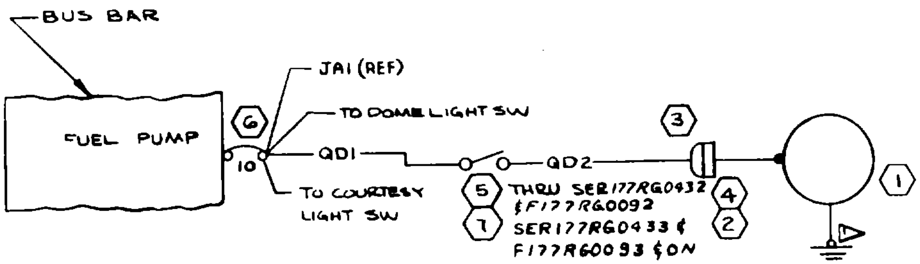
TITLE
WIRING DIAGRAM — STARTER

SIZE C | CODE IDENT NO 71379 | DWG NO 2070001

SCALE NONE | 177RG | PAGE

(SR 6349) IX 3D 8RR 10056

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN – NO CHANGE (SR6349) IX | SEB 8-24-70 | |
| B | BY REV ADD WIRE LENGTHS | DLP 12 4 72 | |
| C | BY REV: SER OUT S-1845-1-2 SER IN S-2160-1, C291504-0101 WAS 1216012-1 S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE (SR 7306) | JCY 3-7-73 | RF |
| D | BY REV: ADD NOTE 2 DELETE S-1367-1-6/QD1 JA1 (REF) WAS TO STARTER SW MER177RGE0156 (NOW SHOP PRACTICE) | RJP 6-3-74 | |




NOTES:

1. TERMINATE WITH S-1367-1-10 TERMINAL
2. TERMINATE WITH S-1367-2-6 OF JA1 P.6.1.0

| | | | | | | |
|---|---|---|---|---|---|---|
| QD2 | 18 | | 45 | S1493-1 | S1635-1 | |
| QD1 | 18 | | 39 | 2 | S1493-1 | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 7 | S-2160-1 | SWITCH |
| 6 | S1360-10L | CIRCUIT BKR |
| 5 | S1845-1-2 | SWITCH |
| 4 | S1637-2 | HOUSING – PLUG |
| 3 | S1637-1 | HOUSING – CAP |
| 2 | S1636-1 | SOCKET |
| 1 | C291504-0101 | PUMP |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — FUEL PUMP

SIZE C | CODE IDENT. NO 71379 | DWG NO 2070001

SCALE NONE | 177RG | PAGE: 7.1.0

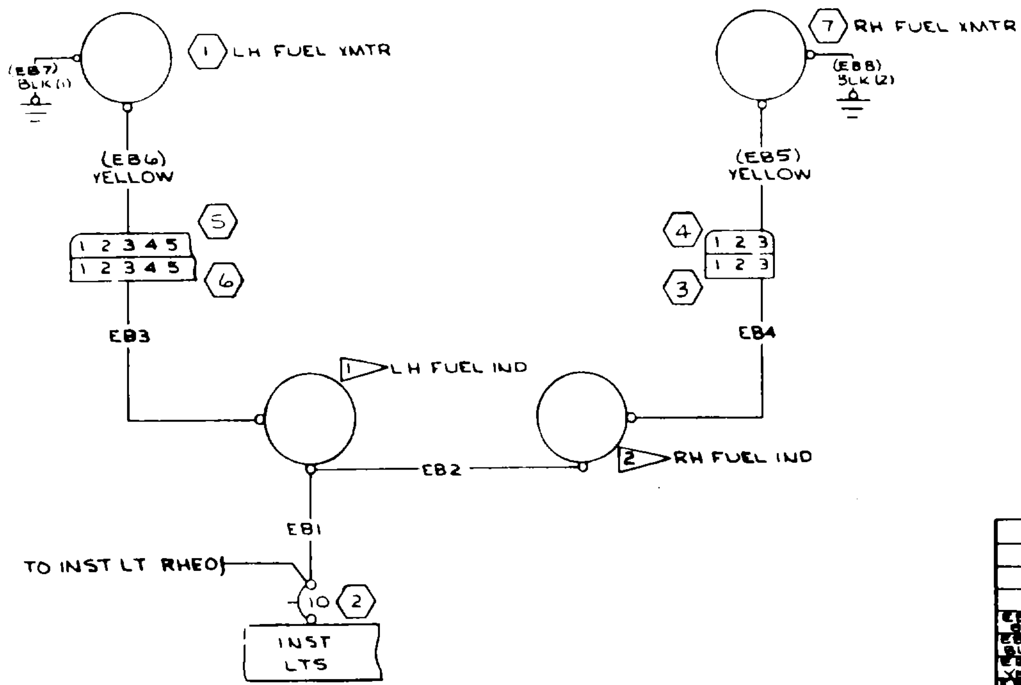
(SR 6349) IX ED&RR 10056

FORM NO 60-2158

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | ZEDRAWN — NO CHANGE (SR6349) IX | SRB 9-24-70 | |
| B | BY REV. ADD WIRE LENGTHS | JLP 12-4-72 | |
| C | BY REV: S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE | JCY 3-7-73 | |

NOTES:

1. PART OF C669504-0103 INST. CLUSTER
2. PART OF C669505-0101 INST CLUSTER




INACTIVE: EFF THRU SER (SR7875)(172R60…2) 4-5-74 RAM

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EB8 BLK (2) | 18 | 18-0 | 20 | S-1367-1-10 | S-1367-1-8 | | |
| EB7 BLK (1) | 18 | 18-0 | 20 | S-1367-1-10 | S-1367-1-8 | | |
| EB6 YELLOW | 18 | 18-4 | 50 | S-1635-1 | S-1367-1-10 | | |
| EB5 YELLOW | | 18-4 | 50 | S-1635-1 | S-1367-1-10 | | |
| EB4 | | | 110 | S-1367-1-10 | S-1638-1 | | |
| EB3 | | | 90 | S-1367-1-10 | S-1636-1 | | |
| EB2 | | | 14 | S-1367-1-10 | S-1367-1-10 | | |
| EB1 | 18 | | 32 | S-1367-1-10 | S-1367-1-10 | | |
| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 7 | C668002-0102 | RH FUEL XMTR |
| 6 | S-1641-9 | HOUSING-SOCKET |
| 5 | S-1640-9 | HOUSING-PIN |
| 4 | S-1638-2 | HOUSING-CAP |
| 3 | S-1638-1 | HOUSING-PLUG |
| 2 | S-1360-10L | CIRCUIT BREAKER |
| 1 | C668002-0101 | LH FUEL XMTR |

EQUIPMENT TABLE

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R. FIFE | 6-8-70 |
| APPD | | |
| SUPERSEDES: | | |
| SUPERSEDED BY: | P. 8.5.0 | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

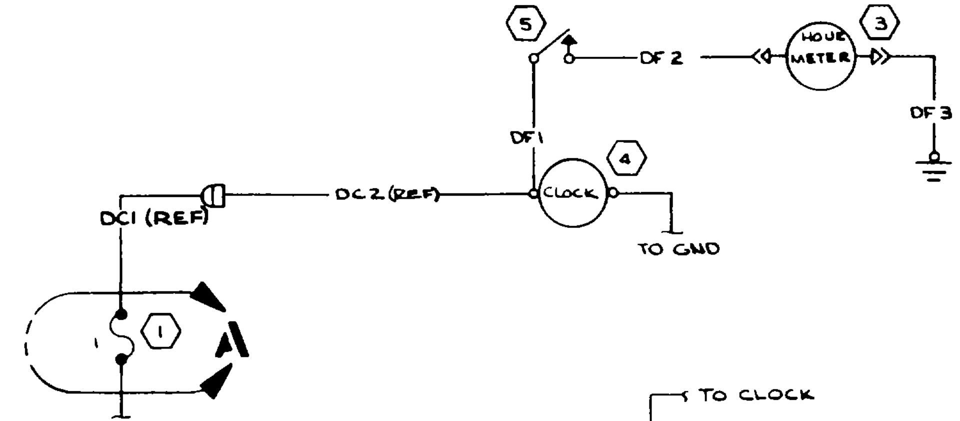
TITLE
WIRING DIAGRAM — FUEL GAGE & TRANSMITTER

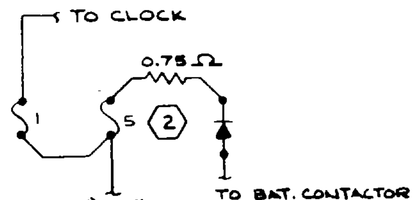
| SIZE | CODE IDENT NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE 1772G PAGE 8.1.0

(SR 6349) IX ED#RR 2056

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | BY REV: OBSOLETE NEVER USED DF4 (SR 6349)II | DLB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | |
| C | BY REV: S-1367-1-10 WAS S-1367-1-8 ON DF3, S-1367-1-8 WAS S-1367-1-6 ON DF1 & DF2: MER177RG0157 (NOW SHOP PRACTICE) | RJP 5-29-74 | |




DETAIL A
(APPLIES WHEN GND SERVICE RECP IS INSTALLED)

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| DF3 | 18 | | 20 | S-1493-1 | S-1367-1-10 | | |
| DF2 | 18 | | 45 | S-1367-1-8 | S-1493-1 | | |
| DF1 | 18 | | 50 | S-1367-1-8 | S-1367-1-6 | | |

WIRE TABLE

| ITEM NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 5 | S-1711-1 | OIL PRESS SW |
| 4 | S-1317N2 | CLOCK |
| 3 | C664501-0101 | HOURMETER |
| 2 | 0712031-3 | FUSE & DIODE ASSY |
| 1 | 0712031-2 | FUSE MTG ASSY |

EQUIPMENT TABLE

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R. FIFE | 6-8-70 |
| APPD | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — HOURMETER (OPT)

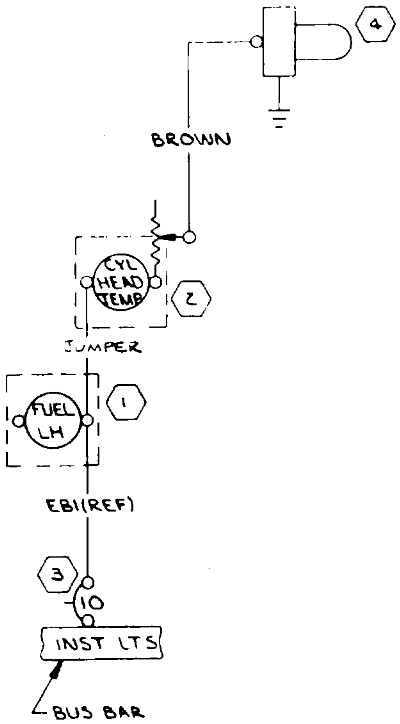
| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE | 177RG | PAGE: 8.2.0

(SR 6349) II ED&RR 10056

FORM NO. 80-715

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN – NO CHANGE (SR6349) IX | SEB 9-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | SLP 12-4-72 | |
| C | BY REV. S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE | JCY 3-7-73 | |




INACTIVE:
EFF THRU SER (SR7875)(177RG0592)
4-5-74
RAM
MTW
JR3

NOTES:

1. PART NO. 110691, (12984)

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| JUMPER | 18 | | 4 | S1367-1-10 | S1367-1-10 | |
| BROWN | 18 | 1. | 90 | S-1367-1-8 | S-1367-1-4 | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 4 | S-1372-1 | SENDING UNIT |
| 3 | S-1360-10L | CIRCUIT BKR |
| 2 | C669509-0103 | INST CLUSTER |
| 1 | C669504-0103 | INST CLUSTER |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO
S-XXX OR CMXXXX=CESSNA STD NO

SUPERSEDES

SUPERSEDED BY: F 8.6.0

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H WISE | 6-5-70 |
| DRAWN | R YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | Z FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA KANSAS

TITLE: WIRING DIAGRAM — CYLINDER HEAD TEMP

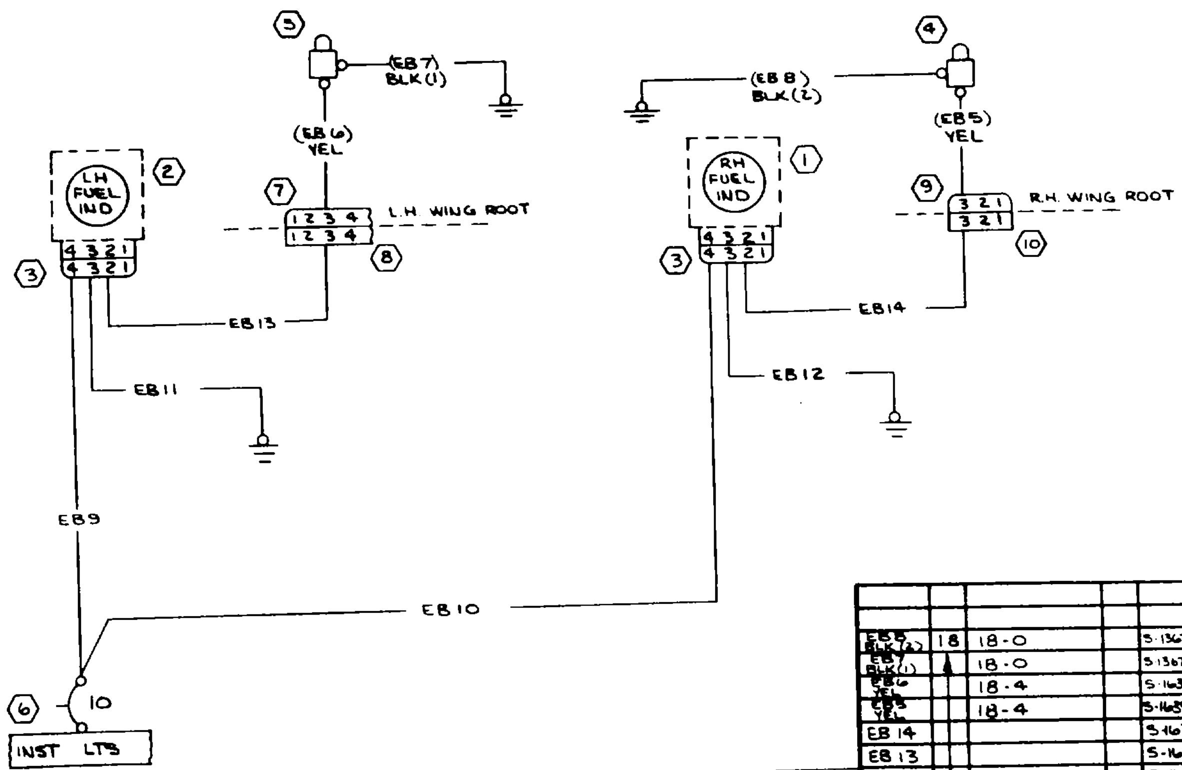
| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177RG | PAGE 8.4.0

(SR6349) IX ED122 2056

FORM NO 80 2198

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| | | | |




| ITEM NO. | PART NO. | DESCRIPTION | |
|---|---|---|---|
| | | | |
| 10 | S-1638-1 | HOUSING-PLUG | |
| 9 | S-1638-2 | HOUSING-CAP | |
| 8 | S-1641-9 | HOUSING-SOCKET | |
| 7 | S-1640-9 | HOUSING-PIN | |
| 6 | S-1360-10L | CIRCUIT BREAKER | |
| 5 | C668007-0101 | LH FUEL LEVEL XMTR | |
| 4 | C668007-0102 | RH FUEL LEVEL XMTR | |
| 3 | S-1638-4 | HOUSING-CAP | |
| 2 | C669515-0103 | INST CLUSTER | |
| 1 | C669516-0104 | INST CLUSTER | |

EQUIPMENT TABLE

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| EB8 BLK(2) | 18 | 18-0 | | S-1367-1-10 | S-1367-1-8 | | |
| EB7 BLK(1) | ↑ | 18-0 | | S-1367-1-10 | S-1367-1-8 | | |
| EB6 YEL | | 18-4 | | S-1635-1 | S-1367-1-10 | | |
| EB5 YEL | | 18-4 | | S-1635-1 | S-1367-1-10 | | |
| EB14 | | | | S-1635-1 | S-1636-1 | | |
| EB13 | | | | S-1635-1 | S-1636-1 | | |
| EB12 | | | | S-1635-1 | S-1367-1-8 | | |
| EB11 | | | | S-1635-1 | S-1367-1-8 | | |
| EB10 | ↓ | | | S-1367-1-6 | S-1635-1 | | |
| EB9 | 18 | | | S-1367-1-6 | S-1635-1 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: P. 8.1.0

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | [illegible] | 4-18-74 |
| GROUP | [illegible] | 4-17-74 |
| DRAWN | MERRICK | 4-5-74 |
| CHECK | M. MORIARTY | 4-17-74 |
| STRESS | | |
| PROJ | [illegible] | 4-24-74 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — FUEL GAGE & TRANSMITTER

| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE (5R7875) PAGE: 8.5.0

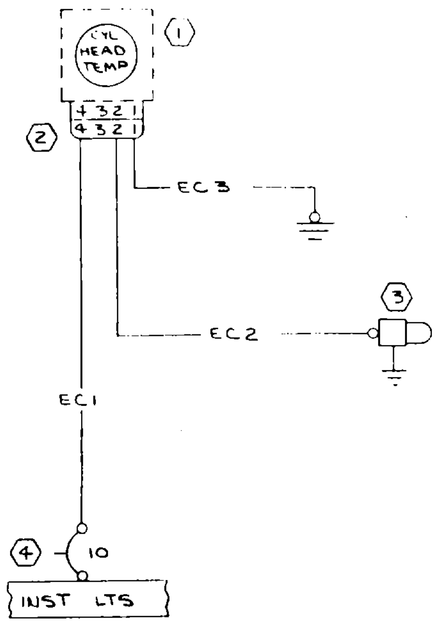
177RG

FORM NO. 80-21

NOTES:

1. PART NO. 110691 (12984)

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| | | | |




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| EC3 | 18 | | | S-1635-1 | S-1367-1-8 | | |
| EC2 | 18 | 1 | | S-1635-1 | S-1367-1-4 | | |
| EC1 | 18 | | | S-1367-1-6 | S-1635-1 | | |

**WIRE TABLE**

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 4 | S-1360-10L | CIRCUIT BREAKER | |
| 3 | C669520-0103 | TRANSDUCER | |
| 2 | S-1638-4 | HOUSING-CAP | |
| 1 | C669517-0102 | INST CLUSTER | |

**EQUIPMENT TABLE**

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: P 8.4.0

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | H. Stamm | 4-18-74 |
| GROUP | | |
| DRAWN | MERRICK | 4-5-74 |
| CHECK | M. Moriarty | 4-17-74 |
| STRESS | | |
| PROJ | W. Trekeighd | 4-14-74 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE

**WIRING DIAGRAM — CYLINDER HEAD TEMPERATURE**

SIZE C | CODE IDENT. NO. 71379 | DWG NO 2070001

SCALE: NONE | (SR7875) | PAGE 8.6.0

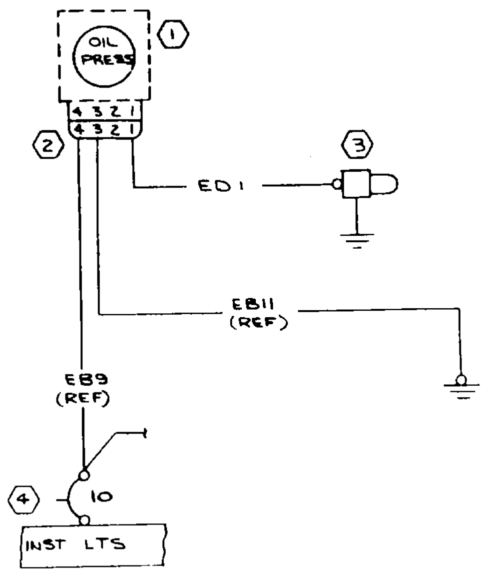
77RG

FORM NO. 80-2158

NOTES:

1. PART NO. 110691, (12984)

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| ED1 | 18 | 1. | | S-1635-1 | S-1367-1-10 | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 4 | S-1360-10L | CIRCUIT BREAKER | |
| 3 | C669520-0104 | TRANSDUCER | |
| 2 | S-1638-4 | HOUSING-CAP | |
| 1 | C669515-003 | INST CLUSTER | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | H. Stamm | 4-18-74 |
| GROUP | [illegible] | 4-17-74 |
| DRAWN | MERRICK | 4-5-74 |
| CHECK | M. MORIARTY | 4-17-74 |
| STRESS | | |
| PROJ | W. [illegible] | 4-24-74 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
**WIRING DIAGRAM — OIL PRESSURE**

| SIZE | CODE IDENT. NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE (5R7875) PAGE: 8.7.0

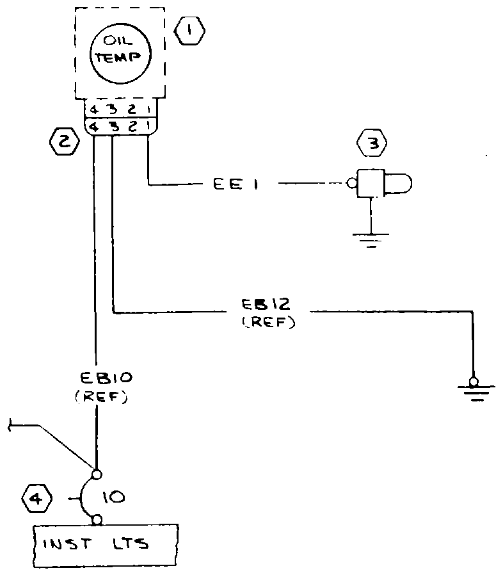
177RG

FORM NO. 80-3158

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| | | | |

NOTES:

1. PART NO. 110691, (12984)




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EE1 | 18 | 1. | | S-1635-1 | S-1367-1-10 | | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

**WIRE TABLE**

| | | | |
|---|---|---|---|
| 4 | S-1360-10L | CIRCUIT BREAKER | |
| 3 | C669520-0105 | TRANSDUCER | |
| 2 | S-1638-4 | HOUSING-CAP | |
| 1 | C669516-0104 | INST CLUSTER | |
| ITEM NO | PART NO. | DESCRIPTION | |

**EQUIPMENT TABLE**

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX=CESSNA SPEC. NO. S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | H. Stamm | 4-18-74 |
| GROUP | J. Scofield | 4-17-74 |
| DRAWN | MERRICK | 4-5-74 |
| CHECK | M. MORIARTY | 4-17-74 |
| STRESS | | |
| PROJ | W. Shockley | 4-24-74 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE **WIRING DIAGRAM — OIL TEMPERATURE**

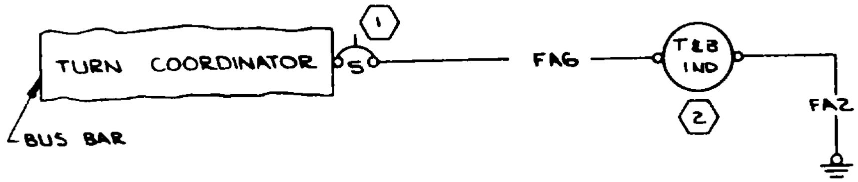
| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE (SR7875) PAGE: 8.B.0

77RG

FORM NO 80-2155

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN - NO CHANGE (SR6349) IX | TAEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS, ADD "OPT" TO TITLE | DLP 12-4-72 | RF |
| C | BY REV: S-1360-5L WAS S-1560-5 NOW SHOP PRACTICE | JCY 3-7-73 | RF |




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| FAG | 18 | | 48 | S-1367-1-6 | S-1367-1-8 | | |
| FA2 | 18 | | 25 | S-1367-1-8 | S-1367-1-8 | | |

WIRE TABLE

| ITEM NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 2 | S-1413N-1 | TURN & BANK IND |
| 1 | S-1360-5L | CKT BKR |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | E. YOUNGERS | 6-5-70 |
| CHECK | LK WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R FIFE | 6-8-70 |
| APPL | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — TURN & BANK (OPT)

SIZE: C | CODE IDENT NO: 71379 | DWG NO: 2070001

SCALE: NONE | 177 RG | PAGE: 9.1.0

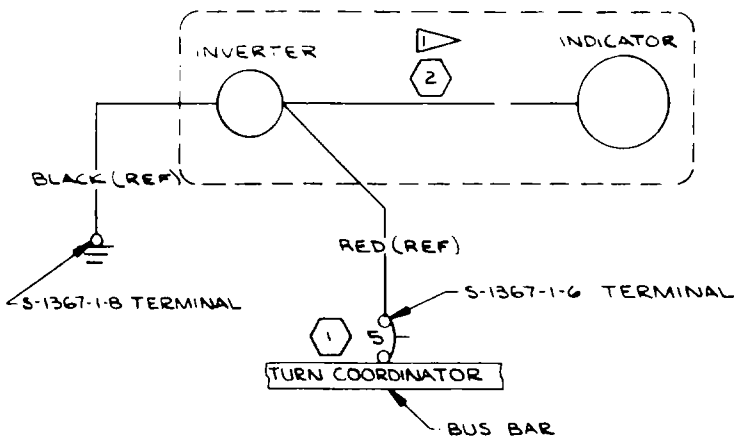
(SR6349) IX ED&RZ 10056

FORM NO. 80-2180

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | REDRAWN — NO CHANGE (SR6349) IX | SEB 8-24-70 | |
| B | BY REV: S-1360-5L WAS S-1360-5 NOW SHOP PRACTICE | XY 3-7-73 | N/W RF |

NOTES.

1. TURN COORDINATOR INDICATOR INCLUDES ALL WIRES AND CABLES BETWEEN INVERTER, INDICATOR AND CIRCUIT BREAKER




INACTIVE: EFF THRU SER 17760432 & F17760092 5-16-73 GDA DLP N/W RF

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 2 | 2904-1 | TURN COORD (27747) |
| 1 | S-1360-5L | CKT BKR |

EQUIPMENT TABLE

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R YOUNGERS | 6-5-70 |
| CHECK | LK WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R. FIFE | 6-8-70 |
| APPD | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E PAWNEE WICHITA, KANSAS

TITLE WIRING DIAGRAM — BRITTAIN WING LEVELER (OPT)

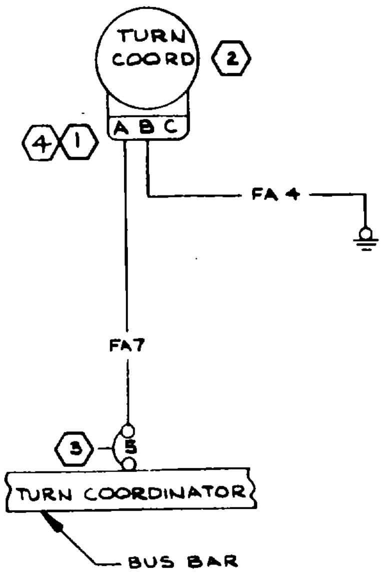
| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE 177RG PAGE 9.2.0

(SR6349) IX ED&RR 10056

FORM RO 80-715

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN — NO CHANGE (SR6349) II | SEB 8-28-70 | |
| B | BY REV: ADD WIRE LENGTHS; REMOVE "OPT" FROM TITLE | DLP 2-4-72 | |
| C | BY REV: S-1360-5L WAS S-1360-5 NOW SHOP PRACTICE | JCY 3-7-73 | |




## WIRE TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| FA7 | 18 | | 48 | S1367-1-6 | SOLDER | | |
| FA4 | 18 | | 23 | S1367-1-8 | SOLDER | | |

## EQUIPMENT TABLE

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 4 | MS3057-4A | CABLE CLAMP | |
| 3 | S1360-5L | CIRCUIT BKR | |
| 2 | C661003-0501 | TURN COORDINATOR | |
| 1 | MS3106A10SL3S | CONNECTOR | |

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — TURN COORDINATOR

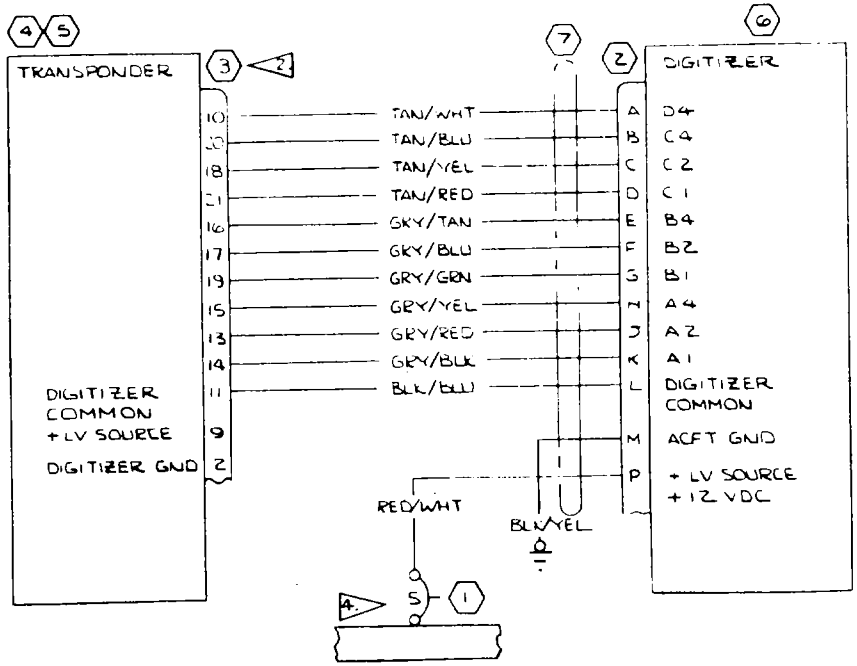
| SIZE | CODE IDENT NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177 RG | PAGE: 9.3.0

(SR6349) II ED # RR 10056

FORM NO. 80-2158

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: ADD NOTE NO 4 DELETE TURN COORDINATOR FROM BUS BAR (SR 7692) | MEM 3-5-79 | |




NOTES:

1. FOR WIRE & WIRE TERMINALS REFER TO 1270625 PAGE 9.7
2. TRANSPONDER CONNECTOR HOUSING IS PART OF TRANSPONDER CABLE ASSY
3. FOR WIRING DIAGRAM OF 300 & 400 TRANSPONDER REFER TO 3920143
4. ATTACH BOTH TRANSPONDER AND ENCODING ALTIMETER TO THE NO. 4 CIRCUIT BREAKER.

## EQUIPMENT TABLE

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 7 | 1570312-3 | CABLE ASSY | |
| 6 | EA-401A | ALT DIGITIZER | |
| 5 | RT-359A | TRANSPONDER | |
| 4 | RT-459A | TRANSPONDER | |
| 3 | S-2189-1 | CONNECTOR | |
| 2 | 42816 | CONNECTOR | |
| 1 | S-1360-5L | CIRCUIT BREAKER | |

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD NO.

SUPERSEDES:

SUPERSEDED BY:

## WIRE TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | W.J. Gardner | 11-12-73 |
| DRAWN | D. OLLER | 11-9-73 |
| CHECK | J. YOUEL | 11-9-73 |
| STRESS | | |
| PROJ | | 11-19-73 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — ENCODING ALTIMETER

| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

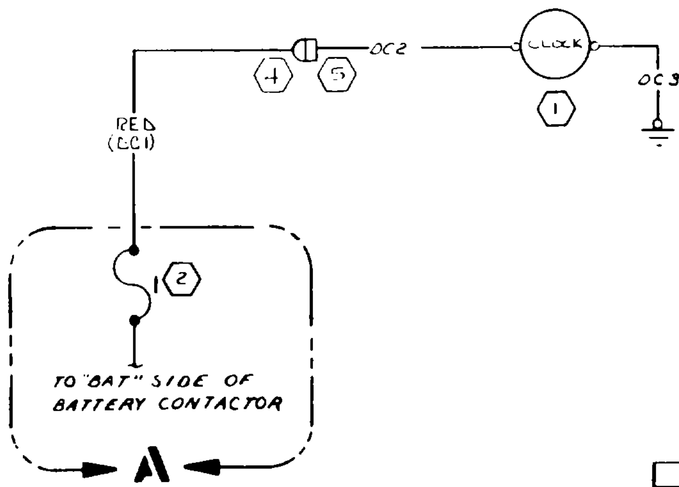
SCALE: NONE (SR 7692) PAGE: 3.4

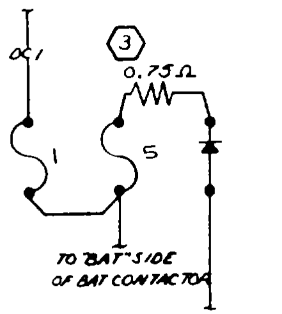
FORM NO 80-2158

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | REDRAWN - NO CHANGE (SR6349) IX | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | EF |
| C | BY REV: ADD WIRE COLOR RED(DC1) WAS DC1, LG 18 WAS 10/RED(DC1) (MER 177E0040) (SR 7606) IX | JEF 1-18-74 | DLD |

NOTES:

1. WHEN CLOCK ONLY IS INSTALLED USE 0712031-2; WHEN CLOCK & GROUND SERVICE RECEPTACLE ARE BOTH INSTALLED USE 0712031-3.




DETAIL A
(APPLIES WHEN GROUND SERVICE RECEPTACLE IS INSTALLED)

| ITEM NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 5 | S1637-2 | HOUSING - PLUG |
| 4 | S1637-1 | HOUSING - PIN |
| 3 | 0712031-3 | FUSE & DIODE ASSY |
| 2 | 0712031-2 | FUSE MTG ASSY |
| 1 | S-1317N2 | CLOCK |

EQUIPMENT TABLE

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| DC3 | 18 | | 15 | S-1367-1-8 | S-1367-1-8 | | |
| DC2 | 18 | | 182 | S1636-1 | S-1367-1-6 | | |
| RED (DC1) | 18 | | 18 | SOLDER | S1635-1 | | |

WIRE TABLE

| CONTRACT NO: | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R. FIPE | 6-8-70 |
| APPD | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

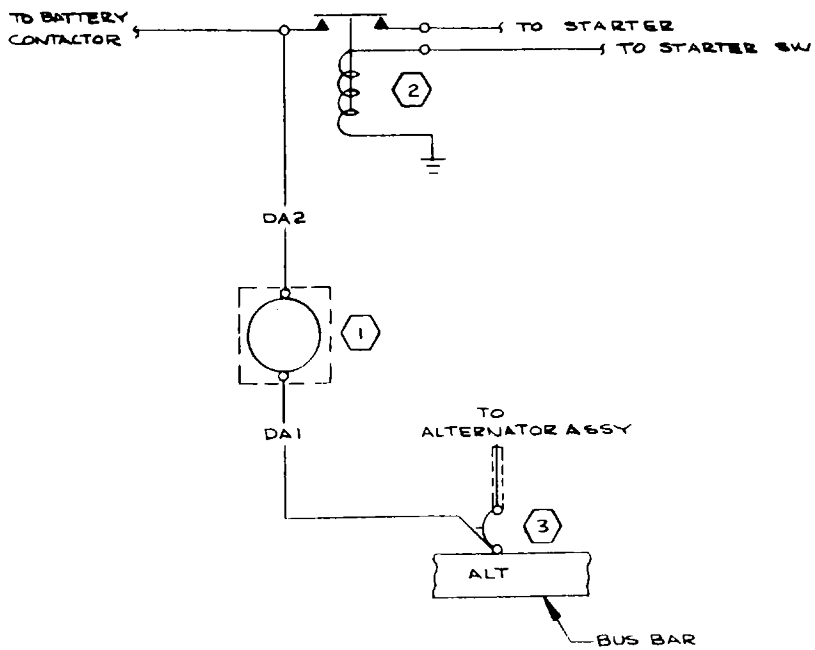
TITLE
WIRING DIAGRAM — CLOCK

| SIZE | CODE IDENT. NO. | DWG NO. |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE | 177RG | PAGE 10.1.0

(SR 6349) IX ED & RR 10056

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN – NO CHANGE (SR6349) II | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | RF |
| C | BY REV: S-1596-60L WAS S-1596-60 NOW SHOP PRACTICE | JCY 3-7-73 | RF |




INACTIVE: EFF THRU SER (SR7875)(177RG0592) 4-5-74 RAM MTM JRS

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| DA2 | 8 | S1562-8-5 | 44 | S1367-4-10 | S1367-4-13 | |
| DA1 | 8 | S1562-8-5 | 32 | S1367-4-10 | S1367-4-10 | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 3 | S1596-60L | CKT BKR |
| 2 | S1991-1 | CONTACTOR |
| 1 | C669509-0103 | INST CLUSTER |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY: P. 10.3.0

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE WIRING DIAGRAM — AMMETER

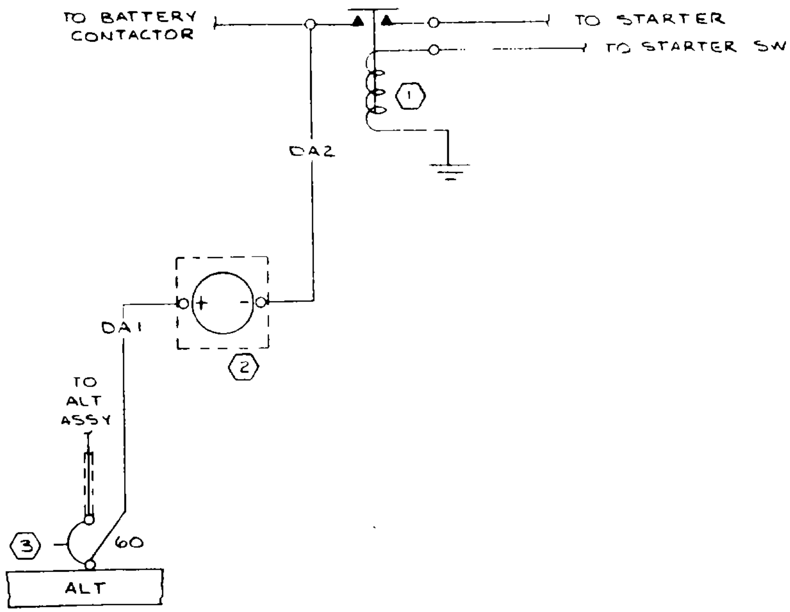
SIZE C | CODE IDENT. NO 71379 | DWG NO 2070001

SCALE NONE | 177 RG | PAGE: 10.2.0

(SR6349) II ED# RR 10056

FORM NO 80-2158

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| | | | |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DA2 | 8 | S-1562-8-9 | 44 | S-1367-4-10 | S-1367-4-15 | | |
| DA1 | 8 | S-1562-8-9 | 32 | S-1367-4-10 | S-1367-4-10 | | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

**WIRE TABLE**

| | | | |
|---|---|---|---|
| 3 | S-1596-60L | CIRCUIT BREAKER | |
| 2 | C669517-0102 | INST CLUSTER | |
| 1 | S-1991-1 | CONTACTOR | |
| ITEM NO | PART NO. | DESCRIPTION | |

**EQUIPMENT TABLE**

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: P. 10.2.0

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | [illegible] | 4-18-74 |
| GROUP | [illegible] | 4-17-74 |
| DRAWN | MERRICK | 4-5-74 |
| CHECK | M. MORIARTY | 4-17-74 |
| STRESS | | |
| PROJ | [illegible] | 4-22-74 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
8800 E. PAWNEE
WICHITA, KANSAS

TITLE
**WIRING DIAGRAM — AMMETER**

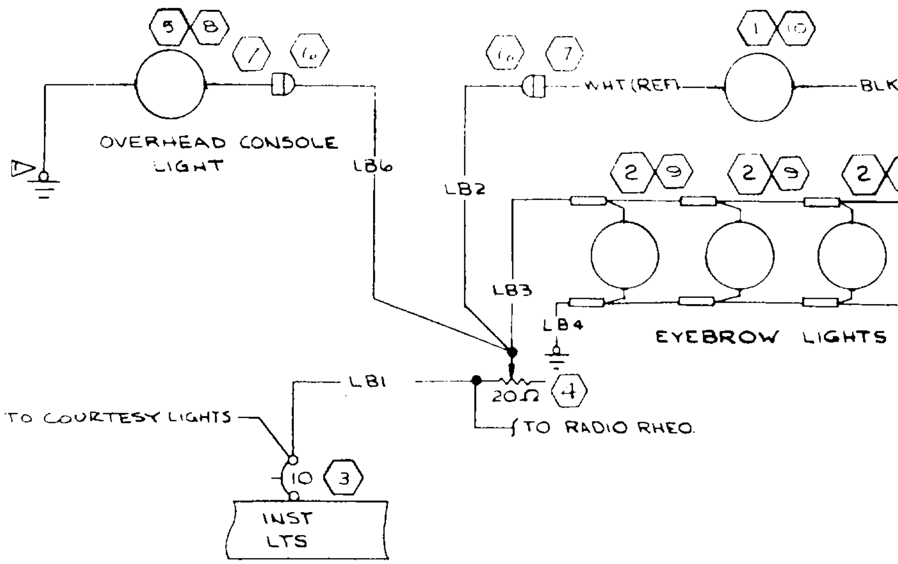
| SIZE | CODE IDENT. NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE | (SR7875) | PAGE: 10.3.0

177RG

FORM NO 80-2158

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | REDRAWN – NO CHANGE (SR6349) II | SEB 8-24-70 | |
| B | BY REV ADD WIRE LENGTHS, NO.94, NO 161 & NO.336 | DLP 12-4-72 | |
| C | BY REV: S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE | JCY 3-7-73 | RF |




INACTIVE: EFF THRU SER SR7606 II (177RG0602 & F177RG0122) 10-14-73

90 029 1024

NOTES:
▷ TERMINATE WITH S-1367-1-8 TERMINAL

| WIRE CODE NO. | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LB6 | 18 | | 162 | S1635-1 | SOLDER | | |
| LB5 | 18 | | 6 | S1636-1 | S-1367-1-8 | | |
| LB4 | 18 | | 20 | S-1370-2 | S-1367-1-8 | | |
| LB3 | 18 | | 30 | SOLDER | S-1370-2 | | |
| LB2 | 18 | | 162 | SOLDER | S1635-1 | | |
| LB1 | 18 | | 35 | S-1367-1-8 | SOLDER | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 10 | NO. 336 | LAMP |
| 9 | NO. 161 | LAMP |
| 8 | NO 94 | LAMP |
| 7 | S1637-2 | HOUSING – PLUG |
| 6 | S1637-1 | HOUSING – PIN |
| 5 | 0513208-1 | SOCKET |
| 4 | S-1880-2 | RHEOSTAT |
| 3 | S-1360-10L | CIRCUIT BREAKER |
| 2 | 23-288 | LIGHT ASSY (95263) |
| 1 | C660501-0101 | COMPASS LT |

EQUIPMENT TABLE

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H WISE | 6-5-70 |
| DRAWN | R YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R FIFE | 6-8-70 |
| APPD | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E PAWNEE WICHITA, KANSAS

TITLE: WIRING DIAGRAM – INSTRUMENT LIGHTS

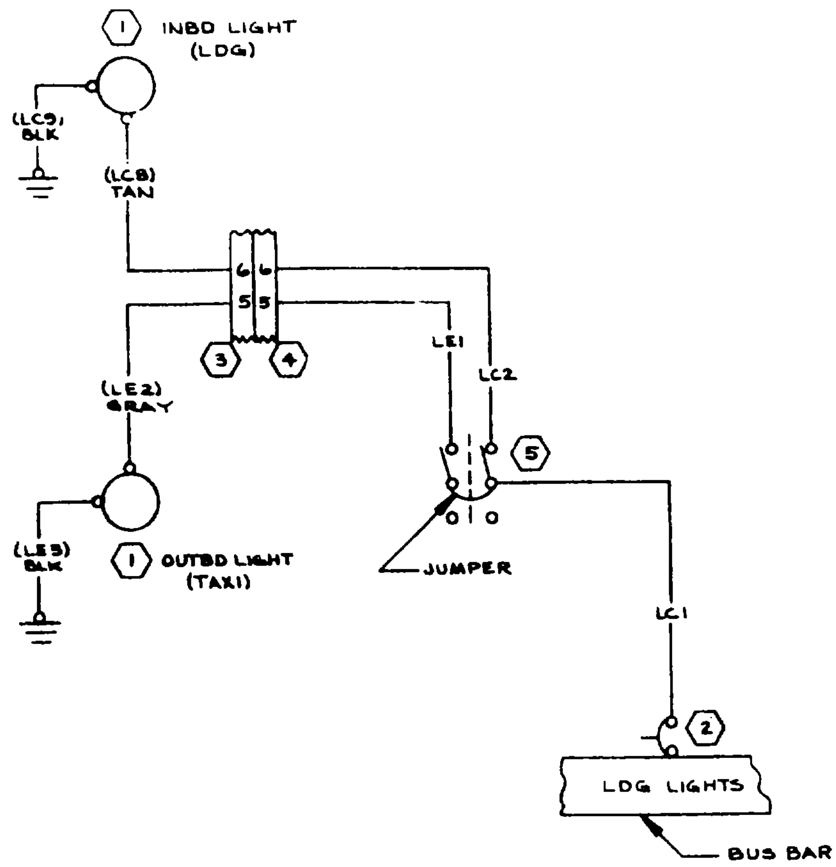
SIZE: C | CODE IDENT. NO. 71379 | DWG NO 2070001

11.9.0 | SCALE: NONE | 7726 | PAGE: 11.1.0

(SR6349) II ED&RR 10056

FORM NO 80-215

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN — NO CHANGE SR6349 | SEB 8-14-70 | [illegible] |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | BY NRJ RF |




Inactive
EFF THRU SER(SR6786)
7-8-71 GLW

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| LC9 BLK | 14 | 16-0 | 6 | S1367-2-8 | S1367-2-8 | | |
| LC8 TAN | 14 | 14-10 | 188 | S1635-2 | S1367-2-8 | | |
| LC2 | 14 | | 85 | S1493-2 | S1636-2 | | |
| LC1 | 12 | | 23 | S1367-2-6 | S1493-3 | | |
| LE3 BLK | 14 | 16-0 | 6 | S1367-2-8 | S1367-2-8 | | |
| LE2 GRAY | 14 | 14-8 | 188 | S1635-2 | S1367-2-8 | | |
| LE1 | 14 | | 85 | S1493-2 | S1636-2 | | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

WIRE TABLE

| | | | |
|---|---|---|---|
| 5 | S1846-1-3 | SWITCH | |
| 4 | S1641-5 | HOUSING - PLUG | |
| 3 | S1640-5 | HOUSING - CAP | |
| 2 | S1360-20 | CIRCUIT BKR | |
| 1 | 1221059-4 | LIGHT ASSY | |
| ITEM NO. | PART NO. | DESCRIPTION | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY: PAGE 11.2.1

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.C. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. RIPE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM —
LANDING LIGHT &
TAXI LIGHT

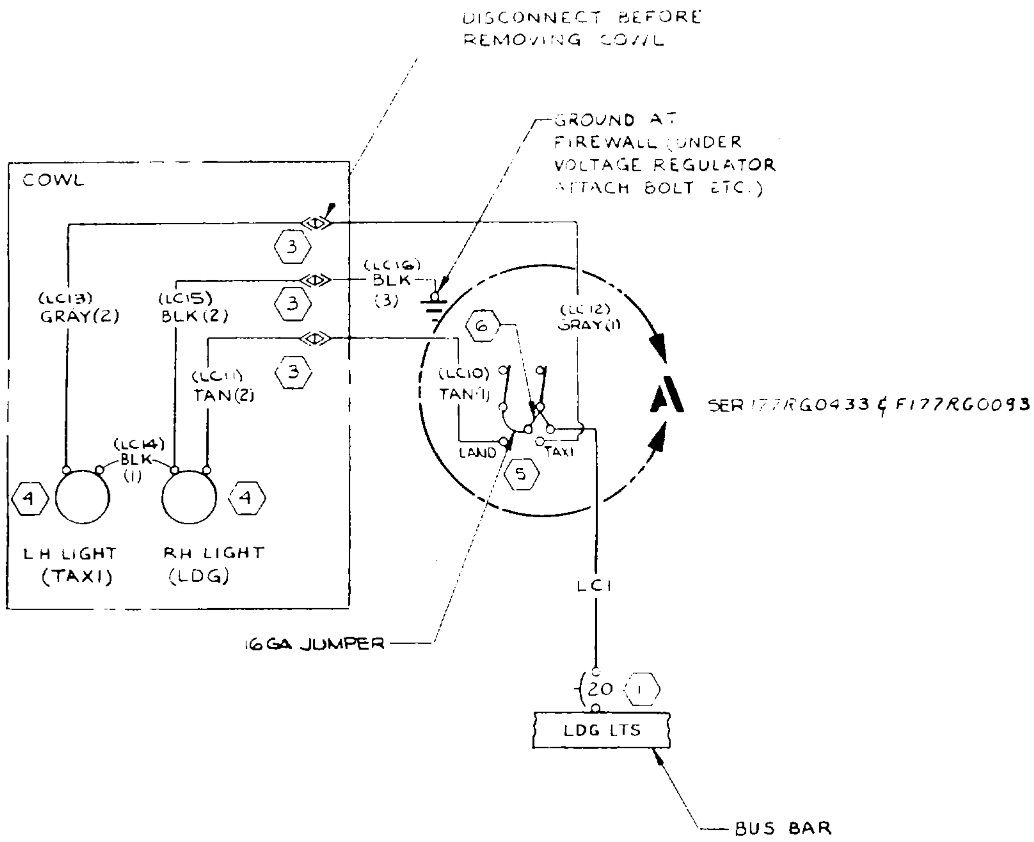
SIZE C | CODE IDENT NO. 71379 | DWG NO 2070001

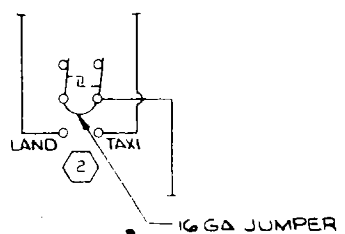
SCALE: NONE | 177 RG | PAGE: 11.2.0

(SR6349)[IX] ED8RR10056

FORM NO 60-2198

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: ADD WIRE LENGTHS, ADD WIRE NO. DESIGNATION TO WIRE COLORS, "LH LIGHT" WAS RH LIGHT" | DLP 12-4-72 | RF |
| B | BY REV: SER OUT S-1846-1-3 SER IN S-2160-4; S-1360-20L WAS S-1360-20; S-1493-2 WAS S-1493-3; ADD DETAIL 'A' & S-2023-2 NOW SHOP PRACTICE" (SR 7306)II | MTM & JCY 3-7-73 | RF |




DETAIL A
THRU SER 177RG0432 & F177RG0092

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| (LC16) BLK (3) | 12 | | 30 | S1493-3 | S1367-2-12 | | |
| (LC15) BLK (2) | 12 | | 64 | S1367-2-8 | S1493-3 | | |
| (LC14) BLK (1) | 12 | | 12 | S1367-2-8 | S1367-2-8 | | |
| (LC13) GRAY (2) | 14 | | 64 | S1493-2 | S1367-2-8 | | |
| (LC12) GRAY (1) | 14 | | 46 | S1493-2 | S-1493- | | |
| (LC11) TAN (2) | 14 | | 64 | S1493-2 | S1367-2-8 | | |
| (LC10) TAN (1) | 14 | | 46 | S1493-2 | S1493-2 | | |
| LC1 | 12 | | 23 | S1367-2-6 | S1493-3 | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | VENDOR CODE |
|---|---|---|---|
| 6 | S-2023-2 | ADAPTER | |
| 5 | S-2160-4 | SWITCH | |
| 4 | 4509 | LAMP | (24446) |
| 3 | S2064-1 | CONNECTOR | |
| 2 | S1846-1-3 | SWITCH | |
| 1 | S1360-20L | CIRCUIT BKR | |

EQUIPMENT TABLE

CES 1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: PAGE 11.2.0

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | G WOOD | 7-8-71 |
| GROUP | H Wise | 7-21-71 |
| DRAWN | G WOOD | 7-8-71 |
| CHECK | K WHITE | 7-22-71 |
| STRESS | | |
| PROJ | | 7-29-71 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — LANDING LIGHT & TAXI LIGHT — COWL MOUNTED

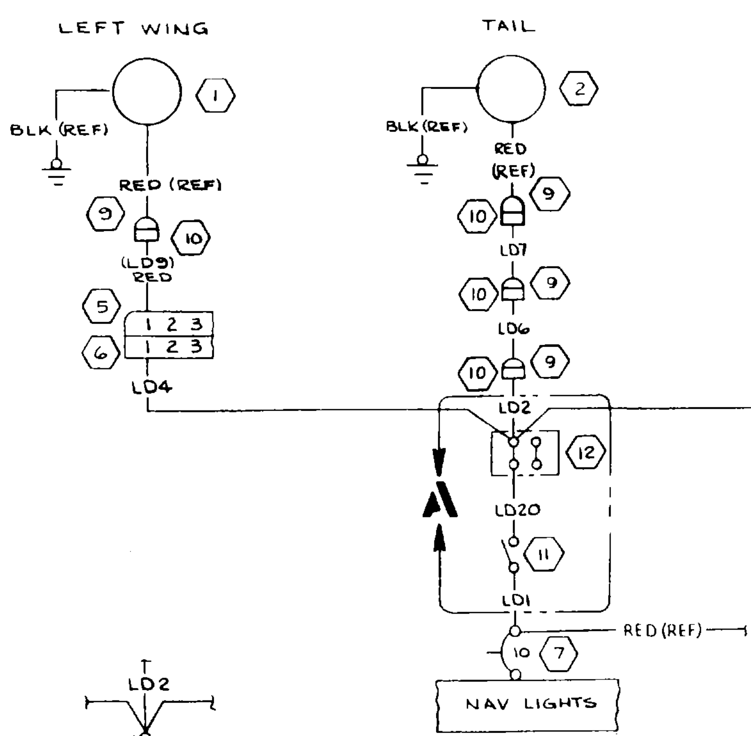
SIZE C | CODE IDENT NO 71379 | DWG NO 2070001

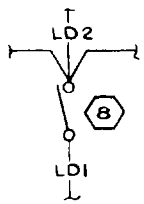
SCALE NONE | 177RG | PAGE: 11.2.1

(SR 6786)II

FORM NO. 80-213B

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: ADDED LD7 (SR 6349) IX | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | BY H/W RF |
| C | BY REV: ADD LD20, 34002-55 & DETAIL A; SER OUT S-1845-1-2 SER IN S-2160-1; S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE (SR 7306) IX | JCY 3-7-73 | BY H/W RF |
| D | BY REV: S-1636-2/LD7 WAS S-1635-2 (NOW SHOP PRACTICE) | DLO 10-11-73 | H/W RF |
| E | BY REV: S1829-1/LD2 & LD5 WAS S-1493-1 (NOW SHOP PRACTICE) | DLO 1-2-74 | JCY JRS |
| F | BY REV: ADD WIRE LENGTH TO LD20, S-1829-1 WAS S-1493-1/LD20, S-1367-2-6 WAS S-1367-1-6/LD1, S-1635-2 WAS S-1636-2/LD7 & LD6, S-1636-2 WAS S-1635-2/LD6 & LD2, & ADD RED(REF) MER177RG0161 (NOW SHOP PRACTICE) | RJP 6-3-74 | JRS |




DETAIL A
THRU SER 177RG0932 & F177RG0092

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| LD20 | 18 | | 10 | S-1493-1 | S-1829-1 | | SER 177RG0433 & F177RG0093 & ON |
| LD9 RED | 18 | -18-2 | 220 | S1635-2 | S1636-2 | | |
| LD8 RED | 18 | -18-2 | 220 | S1635-2 | S1636-2 | | |
| LD7 | 18 | | 90 | S1635-2 | S1636-2 | | |
| LD6 | 18 | | 285 | S1635-2 | S1636-2 | | |
| LD5 | 18 | | 105 | S-1829-1 | S1636-2 | | |
| LD4 | 18 | | 80 | SEE LD2 | S1636-2 | | |
| | | | | | | | |
| LD2 | 18 | | 20 | S-1829-1 | S1636-2 | | |
| LD1 | 18 | | 28 | S1367-2-6 | S-1493-1 | | |
| WIRE CODE NO | GA | MATERIAL | LG | & TERMINALS | | | SERIALS |

WIRE TABLE

| | | | |
|---|---|---|---|
| 12 | 34002-55 | TERM. BLOCK | |
| 11 | S-2160-1 | SWITCH | |
| 10 | S1637-2 | HOUSING - SOCKET | |
| 9 | S1637-1 | HOUSING - PIN | |
| 8 | S1845-1-2 | SWITCH | |
| 7 | S1360-10L | CIRCUIT BKR | |
| 6 | S1641-9 | HOUSING PLUG | |
| 5 | S1640-9 | HOUSING CAP | |
| 4 | S1638-2 | HOUSING CAP | |
| 3 | S1638-1 | HOUSING PLUG | |
| 2 | C622001-0401 | LT INSTL - TAIL | |
| 1 | C622001-0202 | LT INSTL - WING | |
| ITEM NO | PART NO. | DESCRIPTION | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX-CESSNA SPEC. NO.
S-XXX OR CMXXXX-CESSNA
STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — NAVIGATION LIGHTS

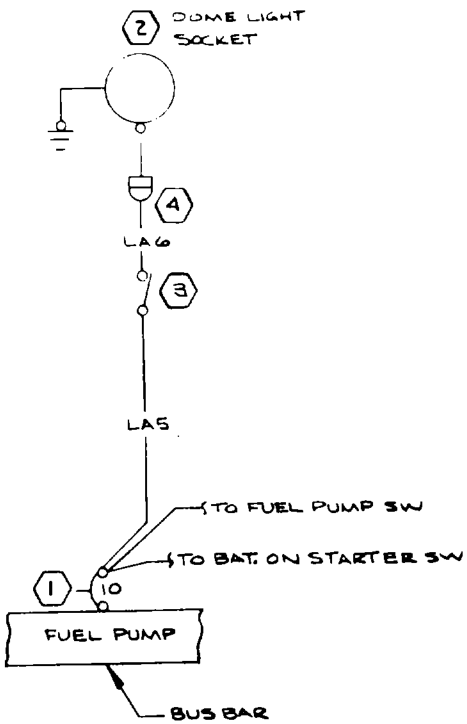
| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177RG | PAGE: 11.3.0

(SR 6349) IX ED & RR 10056

FORM NO. 80-2158

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN – NO CHANGE (SR6349) IX | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | RF |




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LA6 | 18 | | 8 | S-1830-1 | S-1635-2 | | |
| LA5 | 18 | | 105 | S-1367-1-6 | S-1830-1 | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 4 | S-1637-1 | HOUSING-PIN |
| 3 | S-1831-1 | SWITCH |
| 2 | S1893-1 | SOCKET |
| 1 | S1360-10 | CKT BKR |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA
STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | E. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — DOME LIGHT

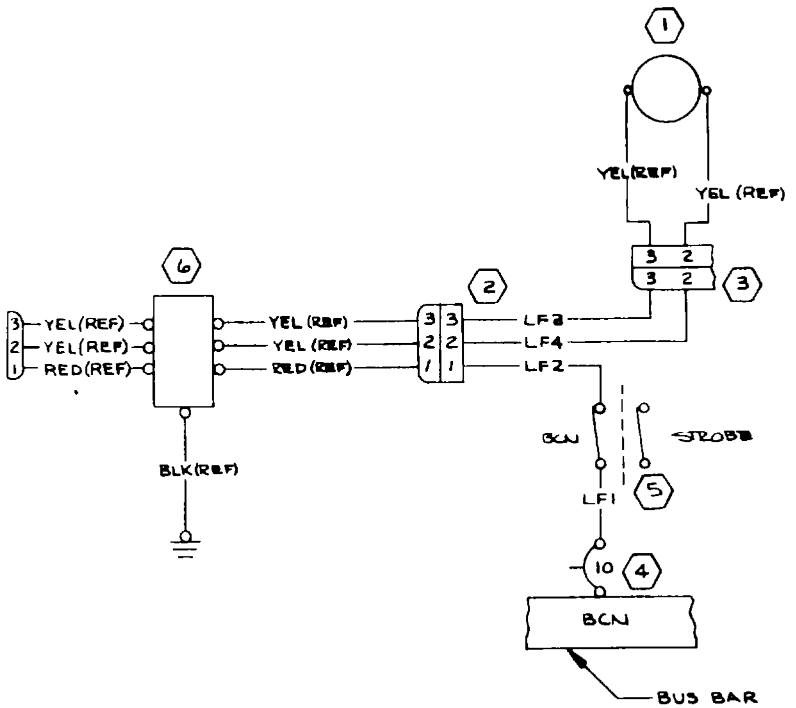
SIZE C | CODE IDENT NO 71379 | DWG NO 2070001

SCALE: NONE | 177RG | PAGE: 11.4.0

(SR6349) IX ED&RR 10056

FORM NO 80-215B

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: S1846-2-3 WAS S1845-1-2 (SR6349)IX | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | RF |
| C | BY REV: C621001-0106 WAS C621001-0103 | DLP 1-26-73 | RF |




INACTIVE:
EFF SER 177RG0001
THRU SER 177RG0282 & F177RG0062
RLY 5-23-72
HW
RF
RF

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LF4 | 16 | | 65 | S1636-2 | S1635-2 | | |
| LF3 | 16 | | 65 | S1636-2 | S1635-2 | | |
| LF2 | 16 | | 275 | S1493-2 | S1636-2 | | |
| LF1 | 16 | | 25 | S1367-2-6 | S1493-2 | | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

WIRE TABLE

| | | | |
|---|---|---|---|
| 6 | C594501-0203 | FLASHER ASSY | |
| 5 | S1846-2-3 | SWITCH | |
| 4 | S1360-10 | CIRCUIT BKR | |
| 3 | S1638-2 | HOUSING-CAP | |
| 2 | S1638-1 | HOUSING-PLUG | |
| 1 | C621001-0106 | BEACON LT ASSY | |
| ITEM NO | PART NO. | DESCRIPTION | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES:

SUPERSEDED BY: P 11.5.1

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-8-70 |
| DRAWN | R. YOUNGERS | 6-8-70 |
| CHECK | L.K WHITE | 6-8-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE

# WIRING DIAGRAM — FLASHING BEACON

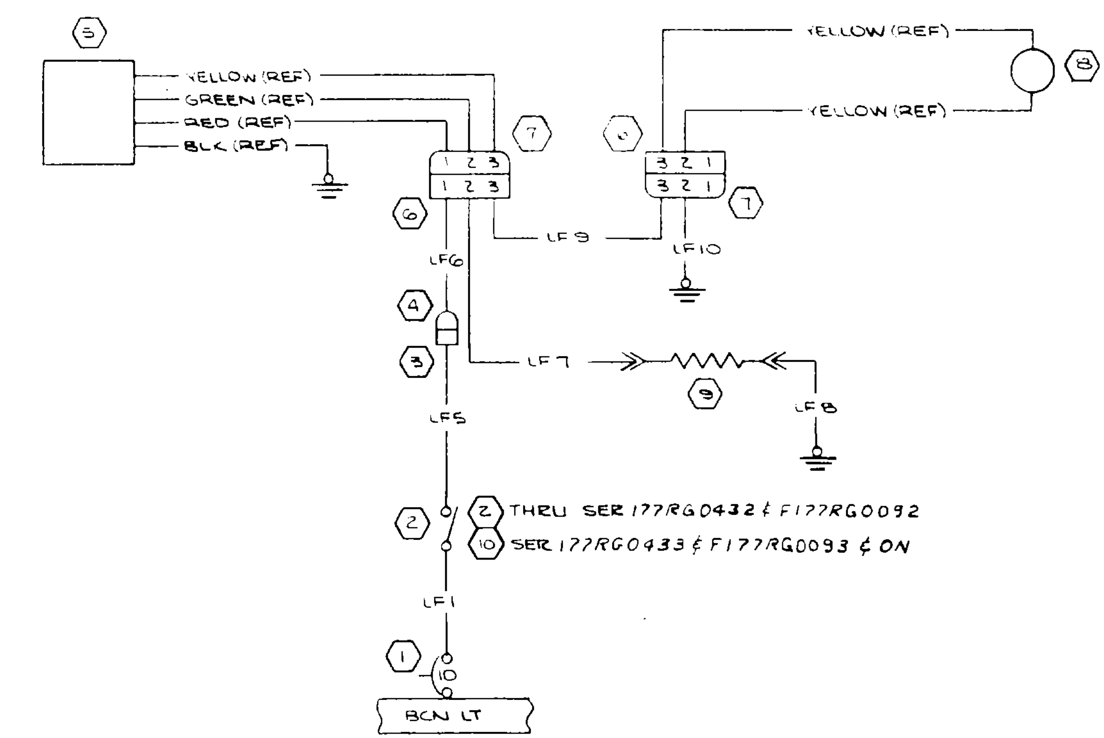
SIZE C | CODE IDENT. NO. 71379 | DWG NO 2070001

SCALE NONE | 177 RG | PAGE: 11.5.0

(SR6840)IX EO#RR 10086

FORM NO. 80-2158

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: ADD WIRE LENGTHS C621001-0106 WAS C621001-0103; ADD S-2160-1 & SER. SEE OUT S-1846-2-3 (SR7306) | DLP 73 | |
| B | BY REV: S-1638-2 WAS S-1638-1 & S-1638-1 WAS S-1638-2 MER177RG0162 (NOW SHOP PRACTICE) | RTP 6-3-74 | JRS |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LF10 | 16 | | 4 | S-1635-2 | S-1367-2-8 | | |
| LF9 | 16 | | 65 | S-1636-2 | S-1635-2 | | |
| LF8 | 16 | | 12 | S-1493-2 | S-1367-2-8 | | |
| LF7 | 16 | | 12 | S-1636-2 | S-1493-2 | | |
| LF6 | 16 | | 10 | S-1635-2 | S-1636-2 | | |
| LF5 | 16 | | 275 | S-1493-2 | S-1636-2 | | |
| LF1 | 16 | | 25 | S-1367-2-6 | S-1493-2 | | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

WIRE TABLE

| | | |
|---|---|---|
| 10 | S-2160-1 | SWITCH |
| 9 | OR95-1.5 | RESISTOR (83777) |
| 8 | C621001-0106 | LIGHT ASSY |
| 7 | S-1638-2 | HOUSING |
| 6 | S-1638-1 | HOUSING |
| 5 | C594502-0101 | FLASHER ASSY |
| 4 | S-1637-1 | HOUSING |
| 3 | S-1637-2 | HOUSING |
| 2 | S-1846-2-3 | SWITCH |
| 1 | S-1360-10L | CIRCUIT BREAKER |
| ITEM NO | PART NO. | DESCRIPTION |

EQUIPMENT TABLE

CES 1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: P11.5.0

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Wiest | 5-23-72 |
| DRAWN | R. YOUNGERS | 5-23-72 |
| CHECK | WHITE | 5-23-72 |
| STRESS | | |
| PROJ | D. Fife | 5-23-72 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.

COMMERCIAL AIRCRAFT DIV
5800 E PAWNEE
WICHITA KANSAS

TITLE
# WIRING DIAGRAM — FLASHING BEACON

SIZE C | CODE IDENT NO 71379 | DWG NO 2070001

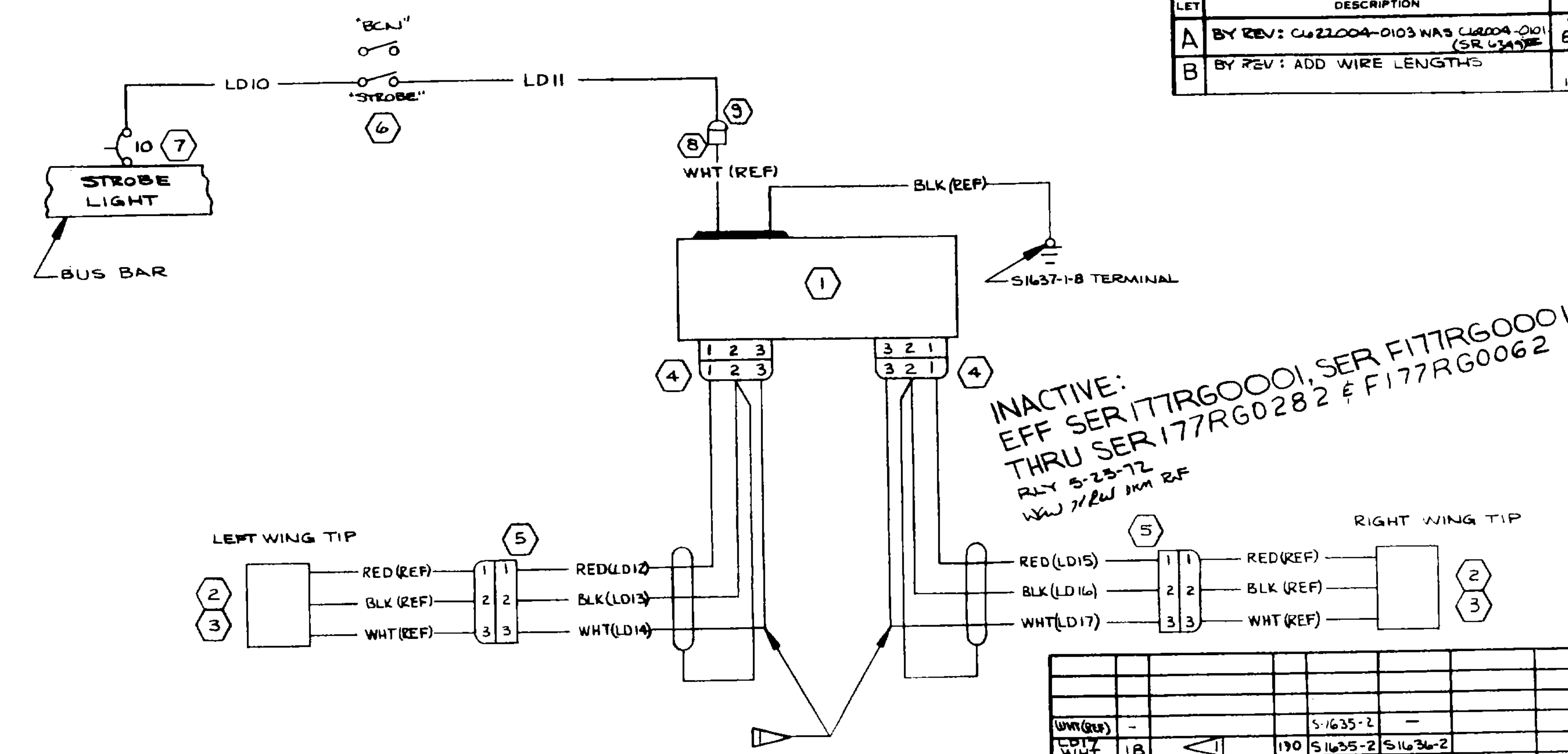
SCALE NONE | 77RG | PAGE 11.5.1

FORM NO 80-178

(SR7006) (SR7007) I

| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| A | BY REV: C622004-0103 WAS C622004-0101 (SR 6349) | SEB 8-24-70 | LKW RLY |
| B | BY REV: ADD WIRE LENGTHS | DLP 12-4-72 | RLY HKW RF |

REVISION




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| WHT (REF) | - | | | S-1635-2 | — | | |
| LD17 WHT | 18 | 1 | 190 | S1635-2 | S1636-2 | | |
| LD16 BLK | 18 | | 190 | | | | |
| LD15 RED | 18 | | 190 | | | | |
| LD14 WHT | 18 | | 140 | | | | |
| LD13 BLK | 18 | | 140 | | | | |
| LD12 RED | 18 | 1 | 140 | S1635-2 | S1636-2 | | |
| LD 11 | 20 | | 166 | S1636-2 | S1493-1 | | |
| LD 10 | 20 | | 30 | S1367-1-6 | S1493-1 | | |

WIRE TABLE

NOTES:

1. THREE CONDUCTOR CABLE, BELDEN (70903) PART NO. 8770 OR EQUIV. TO BE USED.

| ITEM NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 9 | S-1637-1 | HOUSING |
| 8 | S-1637-2 | HOUSING |
| 7 | S1360-10 | CIRCUIT BKR |
| 6 | S1846-2-3 | SWITCH |
| 5 | S1638-1 | HOUSING |
| 4 | S1638-2 | HOUSING |
| 3 | C622003-0102 | LENS |
| 2 | C622003-0101 | LIGHT UNIT |
| 1 | C622004-0103 | POWER SUPPLY |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY: P11.6.1

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

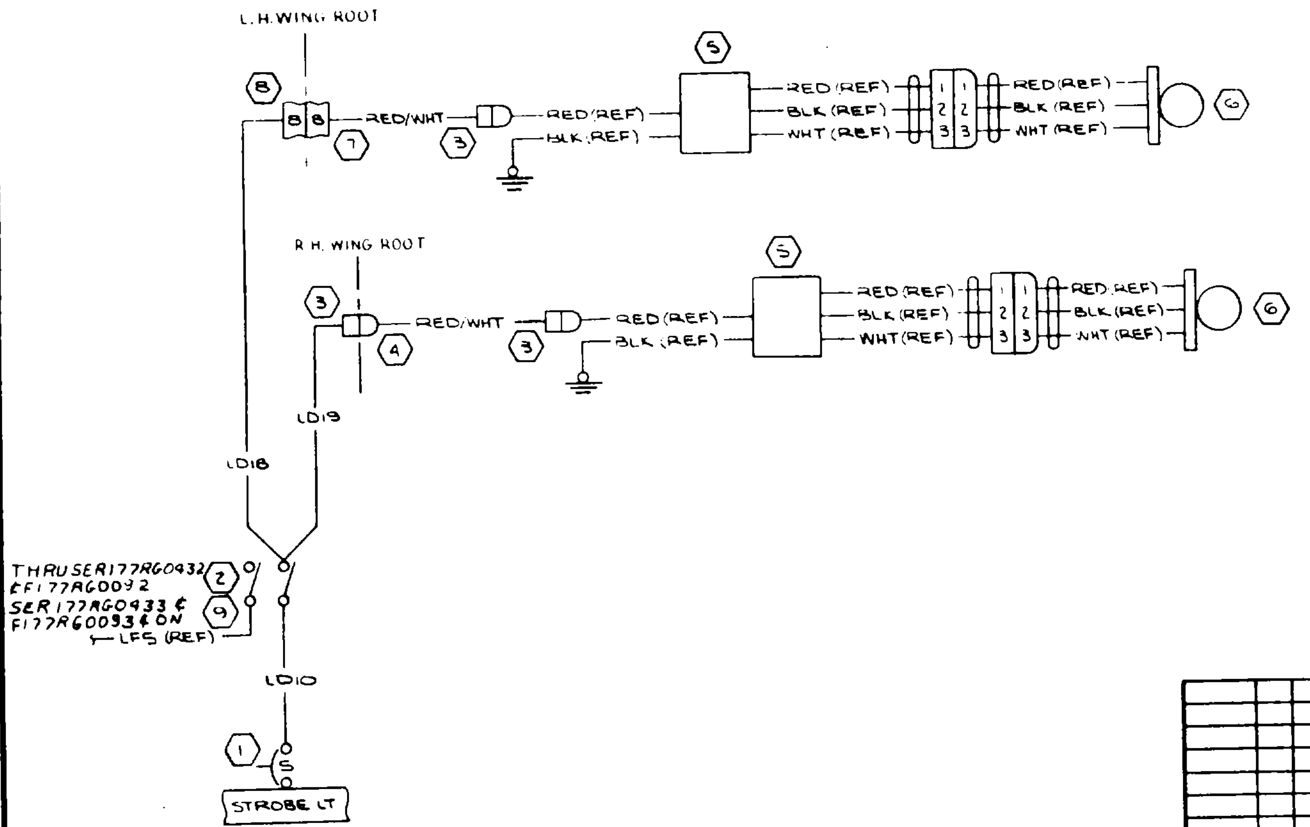
TITLE
# WIRING DIAGRAM — WING TIP STROBE LIGHT (OPT)

SIZE C | CODE IDENT NO. 71379 | DWG NO 2070001

SCALE: NONE | 177 RG | PAGE: 11.6.0

(SR 6349) IV ED # RR 10056

FORM NO 80-2198




| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| A | BY REV: ADD WIRE LENGTHS | DLP 2-4-72 | |
| B | BY REV: SER OUT S-1846-2-3 SER IN S-2160-1 (SR 7306)Ⅱ | SCY 3-7-73 | |
| C | BY REV: ADD L.H. & R.H. WING ROOT, S-1493-[illegible] WAS S-1493-1/LD18, & [illegible] LD18 WAS S-1493-1/LD19 MERIT/TRG 0162 (NOW SHOP PRACTICE) | RJP 2-3-74 | |

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LD19 | 18 | | 98 | SEE LD18 | S-1636-1 | | |
| LD18 | 18 | | 90 | S-1493-2 | S-1636-1 | | |
| LD10 | 20 | | 30 | S-1367-6 | S-1493-1 | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 9 | S-2160-1 | SWITCH |
| 8 | S-1641-9 | HOUSING |
| 7 | S-1640-9 | HOUSING |
| 6 | C622006-0101 | LAMP ASSY |
| 5 | C622007-0101 | POWER SUPPLY |
| 4 | S-1637-1 | HOUSING |
| 3 | S-1637-2 | HOUSING |
| 2 | S-1846-2-3 | SWITCH |
| 1 | S-1360-5L | CIRCUIT 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: P11.6.0

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Wise | 5-24-72 |
| DRAWN | R.YOUNGERS | 5-23-72 |
| CHECK | WHITE | 5-24-72 |
| STRESS | | 5-25-72 |
| PROJ | | 6-2-72 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E PAWNEE WICHITA KANSAS

TITLE WIRING DIAGRAM — WING TIP STROBE LIGHTS (OPT)

SIZE C | CODE IDENT NO. 71379 | DWG NO 2070001

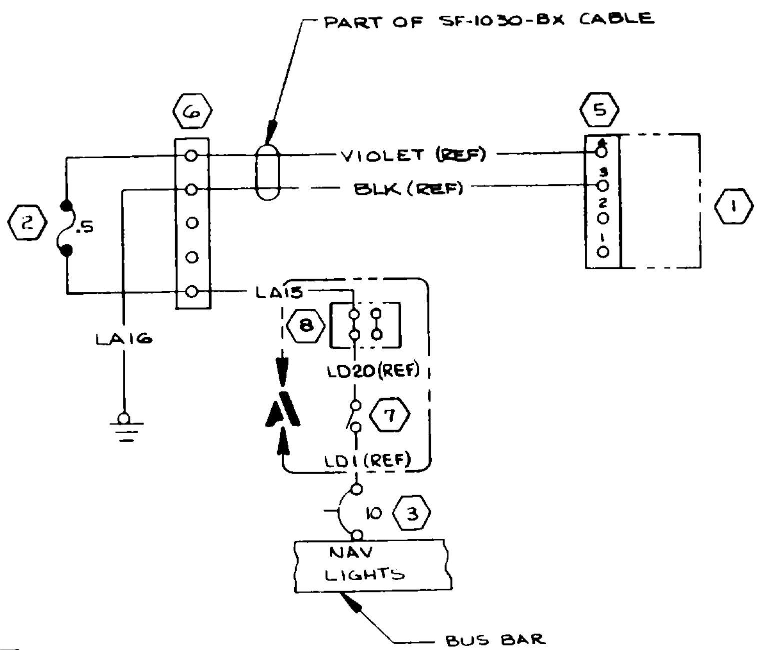
SCALE NONE | 177RG | PAGE 11.6.1

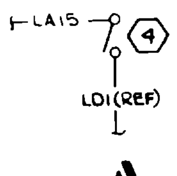
(SR7006)Ⅰ

NOTES:

1. VENDOR IS AMP INC (00779)

| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| A | REDRAWN — NO CHANGE (SR6349) II | SBB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS, 20 GA WAS 18GA/LA15 & LA16 | DLP 2 4 72 | RF |
| C | BY REV: SER OUT S-1845-1-2 SER IN S-2160-1; S-1360-10L WAS S-1360-10; ADD DETAIL A, LD20 (REF) & 34002-55 (REF) ADD NOTE 1 NOW SHOP PRACTICE (SR7306) | JCY 3-7-73 | RF |
| D | BY REV: S-1367-1-8 WAS S1493-1 | TJP 10-31-73 | RF |
| E | BY REV: S-1829-1 WAS S-1493-1 & 329626 WAS 329636 FOR LA15 & LA16 MER177RG0163 NOW SHOP PRACTICE | RJP 5-29-74 | WAS |




DETAIL A
THRU SER 177RG0432 & F177RG0092

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|---|
| LA16 | 20 | | 4 | S-1367-1-8 | 329626 | 1 | |
| LA15 | 20 | | 22 | S-1829-1 | 329626 | 1 | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 8 | 34002-55 | TERM. BLOCK | |
| 7 | S-2160-1 | SWITCH | |
| 6 | 391-11-05-001 | TERM. BLOCK | 71785 |
| 5 | 520-4 | TERM. BLOCK | 75382 |
| 4 | S1845-1-2 | SWITCH | |
| 3 | S1360-10L | CIRCUIT BKR | |
| 2 | 1570141-1 | FUSE ASSY | |
| 1 | 0570088-1 | MAPLIGHT ASSY | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES.

SUPERSEDED BY.

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV
5800 E PAWNEE
WICHITA KANSAS

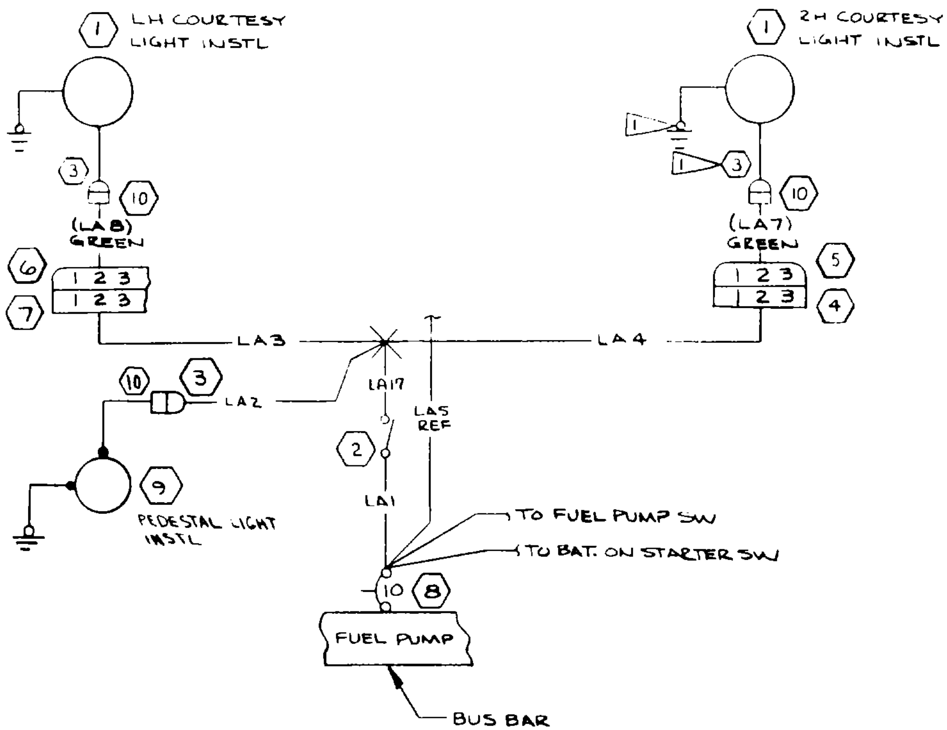
TITLE
WIRING DIAGRAM — MAPLIGHT — CONTROL WHEEL (OPT)

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE 177RG PAGE 11.7.0

(SR 6349) II ED & RR 10056

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN — NO CHANGE (SR6349) | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS | DLP 2 4 72 | |
| C | BY REV: ADD LA1 & LA17, S-1370-3 WAS S-1830-1/LA2, LA3 & LA4, S-1636-1 WAS S-1635-1/LA3 & LA4 MER177RG0164 (NOW SHOP PRACTICE) | AJF 5-7-74 | |




NOTES:

1. TERMINATE VENDOR FURNISHED WIRES WITH S-1635-1 & S-1367-1-8

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 10 | S-1637-2 | HOUSING - CAP |
| 9 | 0413138-1 | SOCKET |
| 8 | S1360-10 | CKT BKR |
| 7 | S1641-9 | HOUSING - SOCKET |
| 6 | S1640-9 | HOUSING - PIN |
| 5 | S1638-2 | HOUSING - SOCKET |
| 4 | S1638-1 | HOUSING - PLUG |
| 3 | S1637-1 | HOUSING - PLUG |
| 2 | S1831-1 | SWITCH |
| 1 | 0513208-3 | SOCKET ASSY |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LA17 | 18 | | 8 | S-1830-1 | SEE LA2 | | |
| LA1 | 18 | | 134 | S-1830-1 | S-1637-1-6 | | |
| LA2 | 18 | | 170 | S-1370-3 | S-1635-1 | | |
| LA8 GREEN | 18 | 18-5 | 20 | S1636-1 | S1635-2 | | |
| LA7 GREEN | 18 | 18-5 | 20 | S1636-1 | S1635-2 | | |
| LA4 | 18 | | 95 | SEE LA2 | S1636-1 | | |
| LA3 | 18 | | 76 | SEE LA2 | S1636-1 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |


Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS


TITLE

# WIRING DIAGRAM — COURTESY LIGHTS (OPT)

| SIZE | CODE IDENT NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE | 177RG | PAGE: 11.8.0

(SR6349) IX ED828 .0056

FORM NO 80-2198

NOTES:

1. INSTALL S-1635-1 TERMINAL ON VENDOR FURNISHED WIRE
2. INSTALL S-1367-1-B TERMINAL ON VENDOR FURNISHED WIRE
3. WHEN ELECTRO LUMINESCENT PANELS ARE INSTALLED S-1904-3 POT ASSY IS REPLACED WITH A S-2091-1 POT ASSY
4. WHEN POST LIGHTS ARE INSTALLED LB9 & LB12 ARE DELETED & LB29 MATES WITH LB28. LB27 CONNECTS FROM POST LIGHT SWITCH TO TERMINAL BOARD

REVISION

| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| A | BY REV: ADD LB29; S-1636-1 WAS S-1635-1 /LB12; REVISE NOTE 4; DELETE LB10: LB13(REF) WAS LB13 LB15(REF) WAS LB15 (SR7606) IX | DLO 12-12-73 | JRB WF |
| B | BY REV: ADDED WIRE LENGTHS, & YELLOW WIRE MERM7AG0165 (NOW SHOP PRACTICE) | RJP 5-31-74 | JRS |
| C | BY REV: ADD LB33, 1270479-8 & YEL(REF); DELETE 1270479-6 & YEL WIRE (SR7606)(REF) | MEM 6-14-74 | |

06 029 1024

| ITEM NO. | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 15 | 1270479-8 | LIGHT ASSY | |
| 14 | C660501-0101 | COMPASS LIGHT | |
| 13 | NO. 94 | LAMP | |
| 12 | 0513208-1 | SOCKET | |
| 11 | S-1637-1 | HOUSING | |
| 10 | S-1637-2 | HOUSING | |
| 9 | S-1910-2 | LIGHT ASSY | |
| 8 | S-1901-1 | LAMP | |
| 7 | 34002-55 | TERM. BOARD | |
| 6 | 27 OHM ½W | RESISTOR | |
| 5 | S-1904-3 | POT ASSY | |
| 4 | S-1360-10L | CIRCUIT BREAKER | |
| 3 | S-1640-6 | HOUSING | |
| 2 | S-1641-6 | HOUSING | |
| 1 | 1570166-1 | DIMMING ASSY | |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LB35 | 18 | | | S-1829-1 | S-1370-1 | | |
| LB29 | 18 | | 20 | S-1635-1 | S-1635-1 | 4 | |
| LB17 | 18 | | 20 | S-1635-3 | SOLDER | | |
| LB16 | 18 | | 60 | S-1635-1 | SOLDER | | |
| LB14 | 18 | | 43 | SEE LB17 | S-1367-1-B | | |
| LB12 | 18 | | 30 | S-1829-1 | S-1635-1 | 4 | |
| LB11 | 18 | | 20 | S-1367-1-B | S-1370-1 | | |
| LB9 | 18 | | 250 | S-1829-1 | S-1370-1 | 4 | |
| LB8 | 18 | | 250 | S-1829-1 | S-1636-1 | | |
| LB7 | 18 | | 35 | S-1829-1 | S-1370-1 | | |
| LB4 | 18 | | 20 | S-1370-1 | S-1367-1-B | | |

WIRE TABLE

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H Wiel | 10 17 73 |
| DRAWN | DL OLLER | 10-14-73 |
| CHECK | PAPE | 10-15-73 |
| STRESS | TRUNECEK | 10-17-73 |
| PROJ | | 10-18-73 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE WIRING DIAGRAM — INSTRUMENT LIGHTS

SIZE C | CODE IDENT. NO 71379 | DWG NO 2070001

SCALE: NONE | 177RG | PAGE: 11.9.0

(SR7606) IX

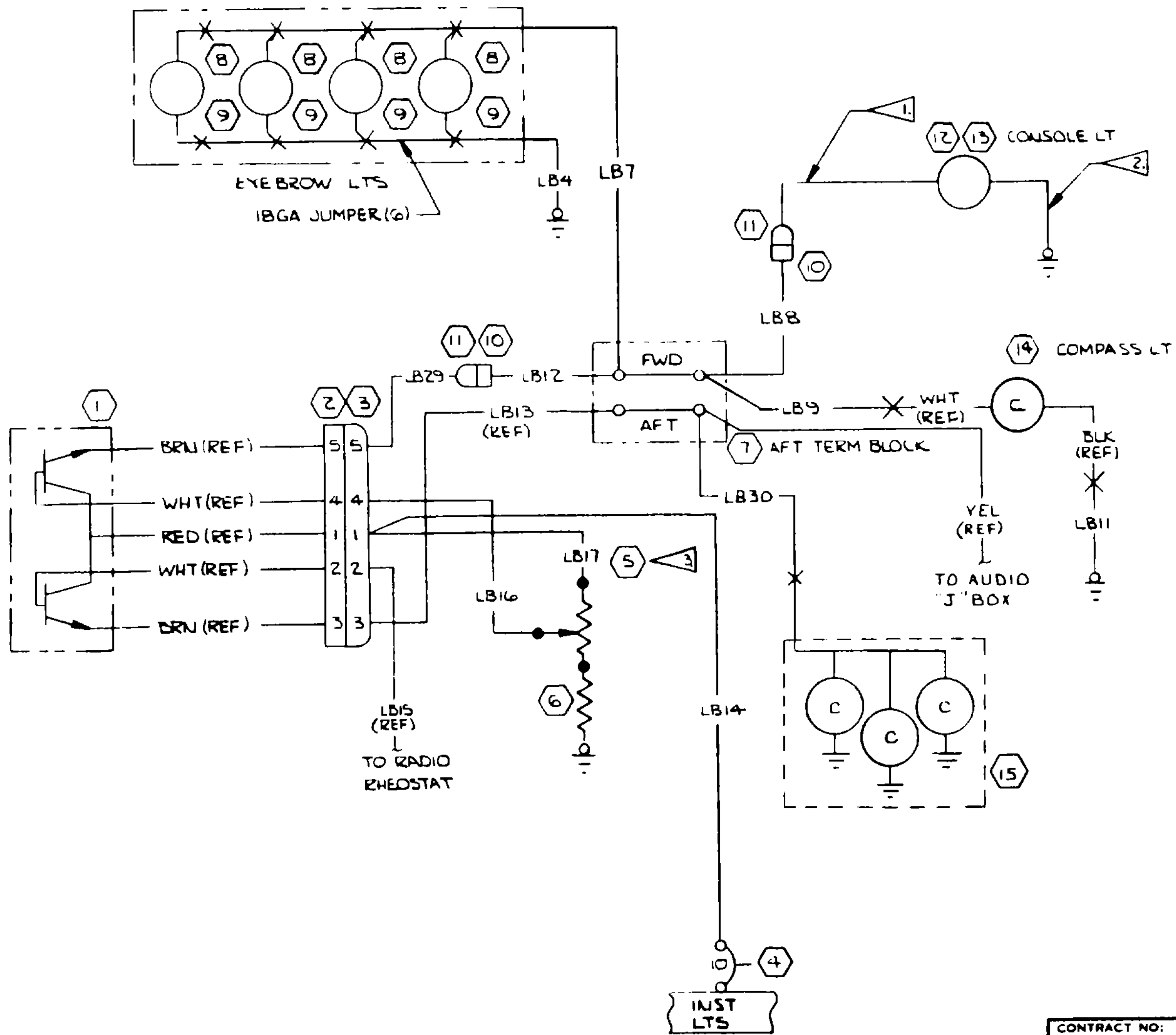
CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX=CESSNA SPEC. NO. S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES: PG 11.1.0

SUPERSEDED BY:

FORM NO. 80-2158

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| C | SEE PAGE 11.9.0 FOR REVISION | | |




0G 029 1024

| CONTRACT NO: | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | | |
| GROUP | V Wise | 10-17-73 |
| DRAWN | DL OLLER | 10-14-73 |
| CHECK | PAPE | 10-15-73 |
| STRESS | TRUHECEK | 10-17-73 |
| PROJECT | [signature] | 10-18-73 |
| APPD | | |
| SUPERSEDES | PG 11.1.0 | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

TITLE WIRING DIAGRAM - INSTRUMENT LIGHTS

| SIZE | CODE IDENT. NO. | DWG NO. |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE 177RG PAGE: .9.1

(SR7606)II

FORM NO. 80-216

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |

NOTES:

1. THESE WIRES ARE VENDOR FURNISHED
2. TERMINATE VENDOR FURNISHED WIRE WITH S-1367-1-8
3. THIS END OF RESISTOR TERMINATED WITH S-1367-1-14 TERMINAL & INSTALLED ON SHAFT OF TANDEM POT ASSY. DUE TO HEAT DISSIPATION, RESISTORS MUST BE KEPT FROM WIRE BUNDLE
4. WHEN ELECTRO LUMINESCENT PANELS ARE INSTALLED S-2091-1 POT ASSY REPLACES S-1904-3 POT ASSY

06 029 1024

| ITEM NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 16 | S-1904-3 | POT ASSY |
| 15 | 2013153-1 | EL PANEL-FLAP |
| 14 | 2013152-1 | EL PANEL-RH |
| 13 | 2013151-1 | EL PANEL-CTR |
| 12 | 2013150-1 | EL PANEL-LH |
| 11 | 27 OHM ½ W | RESISTOR |
| 10 | S-2091-1 | POT ASSY |
| 9 | 5.6K 2W 10% | RESISTOR |
| 8 | VAL-5-6000 | RESISTOR |
| 7 | S-1360-10L | CIRCUIT BREAKER |
| 6 | S-2160-1 | SWITCH |
| 5 | C613001-0201 | POWER SUPPLY |
| 4 | 34002-55 | TERM BOARD |
| 3 | S-1640-6 | HOUSING |
| 2 | S-1641-6 | HOUSING |
| 1 | 1570166-1 | DIMMING ASSY |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LB20 | 18 | | | S-1829-1 | S-1370-1 | | |
| LB19 | 18 | | | SOLDER | S-1370-1 | | |
| WHT(2) | 18 | -18-9 | | S-1370-1 | SEE WHT1 | | |
| WHT(1) | 18 | -18-9 | | SEE LB18 | S-1370-1 | | |
| LB18 | 22 | | | S-1370-1 | S-1370-1 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX-CESSNA SPEC. NO.
S-XXX OR CMXXXX-CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Wise | 10-17-73 |
| DRAWN | JL OLLER | 10-4-73 |
| CHECK | PAPE | 10-15-73 |
| STRESS | TRUNECEK | 10-17-73 |
| PROJ | P. Fife | 10-18-73 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV. 5800 E. PAWNEE WICHITA, KANSAS

TITLE WIRING DIAGRAM — ELECTRO LUMINESCENT PANEL (OPTIONAL)

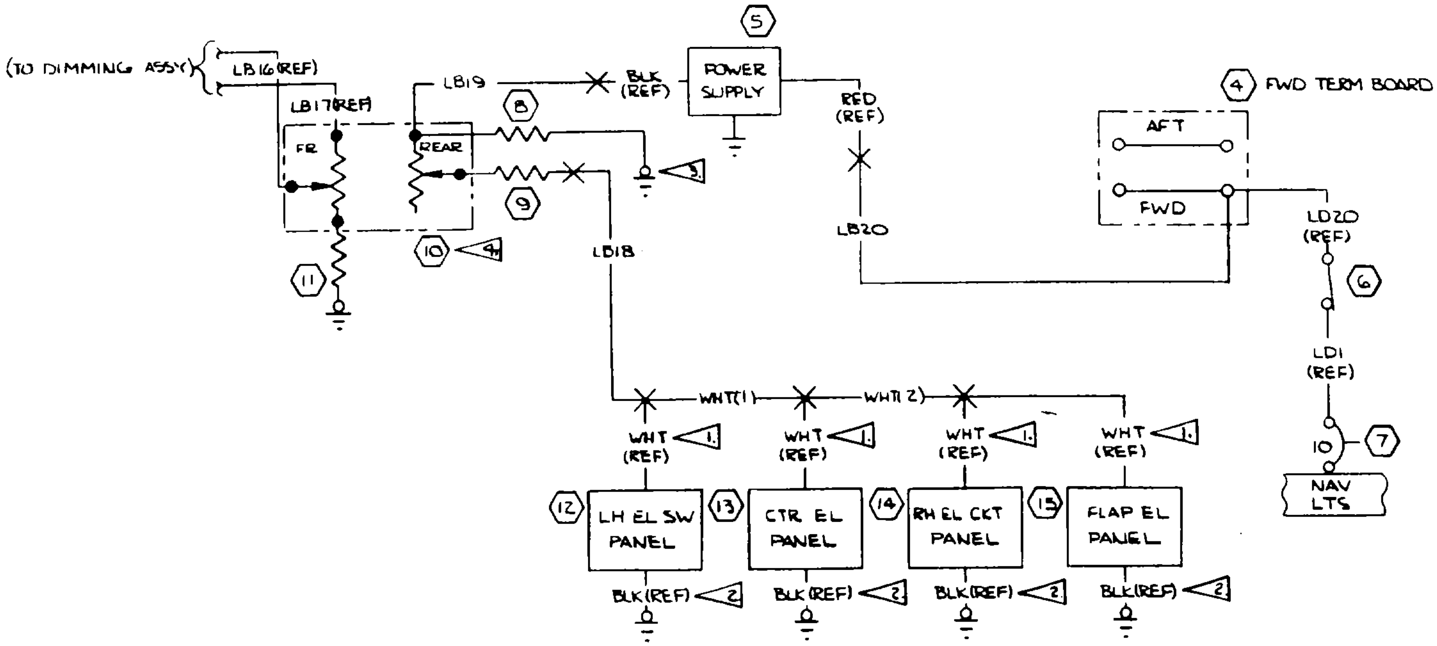
SIZE C | CODE IDENT. NO. 71379 | DWG NO 2070001

SCALE: NONE | 177 RG | PAGE: 11.10.0

(SR7606)[IX]

FORM NO. 80-2198

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| | | | |




06 029 1024

| CONTRACT NO: | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | | |
| GROUP | H. Wise | 10-17-73 |
| DRAWN | DL OLLER | 10-14-73 |
| CHECK | PAPE | 10-15-73 |
| STRESS | TRUNECEK | 10-17-73 |
| PROJECT | P. Fafe | 10-18-73 |
| APPD | | |

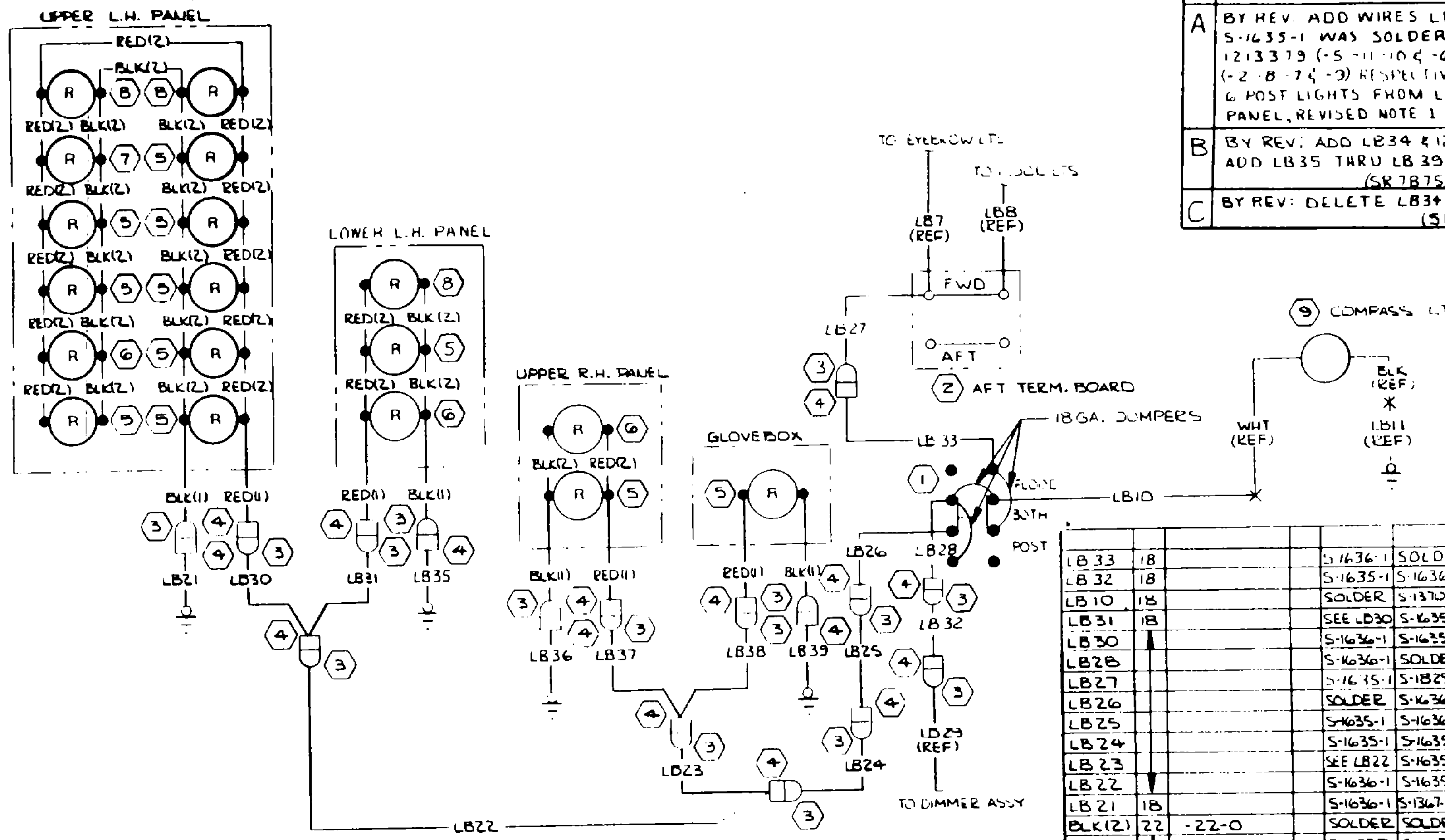
Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — ELECTRO LUMINESCENT PANEL (OPTIONAL)

| SIZE | CODE IDENT. NO. | DWG NO. |
|---|---|---|
| C | 71379 | 2070001 |
| SCALE: NONE | 177RG | PAGE: 11.10.1 |

FORM NO. 80-218

| LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| A | BY REV. ADD WIRES LB32 & LB33, S-1635-1 WAS SOLDER (LB27); 1213379 (-5 -11 -10 & -6) WAS 1213379 (-2 -8 -7 & -3) RESPECTIVELY; DELETED 6 POST LIGHTS FROM LOWER LH PANEL, REVISED NOTE 1. (SR 7605) IX | MEM 2-26-74 | |
| B | BY REV; ADD LB34 & 1270479-6 ADD LB35 THRU LB39 (SR 7875) (SR 1606) IX | RAM MEM 4-19-74 | MTM |
| C | BY REV: DELETE LB34 & 1270479-6 (SR 1606)(REF) | MEM 6-4-74 | |




NOTES:

1. WHEN POST LIGHTS ARE INSTALLED DELETE LB9 & LB12. LB 32 CONNECTS WITH LB29. LB27 CONNECTS TO TERM. BOARD & LB 33 WHICH CONNECTS TO POST LIGHT SWITCH.

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| LB 33 | 18 | | | S-1636-1 | SOLDER | 1 | |
| LB 32 | 18 | | | S-1635-1 | S-1636-1 | 1 | |
| LB 10 | 18 | | | SOLDER | S-1370-1 | 1 | |
| LB 31 | 18 | | | SEE LB30 | S-1635-1 | | |
| LB 30 | | | | S-1636-1 | S-1635-1 | | |
| LB 28 | | | | S-1636-1 | SOLDER | 1 | |
| LB 27 | | | | S-1635-1 | S-1829-1 | | |
| LB 26 | | | | SOLDER | S-1636-1 | | |
| LB 25 | | | | S-1635-1 | S-1636-1 | | |
| LB 24 | | | | S-1635-1 | S-1635-1 | | |
| LB 23 | | | | SEE LB22 | S-1635-1 | | |
| LB 22 | | | | S-1636-1 | S-1635-1 | | |
| LB 21 | 18 | | | S-1636-1 | S-1367-1-B | | |
| BLK(2) | 22 | -22-0 | | SOLDER | SOLDER | | |
| BLK (1) | | -22-0 | | SOLDER | S-1635-1 | | |
| RED (2) | | -22-2 | | SOLDER | SOLDER | | |
| RED (1) | 22 | -22-2 | | S-1636-1 | SOLDER | | |

WIRE TABLE

| CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| LB 39 | 18 | | | S-1636-1 | S-1367-1-8 | |
| LB 38 | 18 | | | S-1636-1 | S-1635-1 | |
| LB 37 | 18 | | | S-1636-1 | S-1635-1 | |
| LB 36 | 18 | | | S-1636-1 | S-1367-1-8 | |
| LB 35 | 18 | | | S-1636-1 | S-1367-1-8 | |

| ITEM NO | PART NO | DESCRIPTION |
|---|---|---|
| 9 | C660501-0101 | COMPASS LIGHT |
| 8 | 1213379-5 | POST LIGHT ASSY |
| 7 | 1213379-11 | POST LIGHT ASSY |
| 6 | 1213379-10 | POST LIGHT ASSY |
| 5 | 1213379-6 | POST LIGHT ASSY |
| 4 | S-1637-2 | HOUSING |
| 3 | S-1637-1 | HOUSING |
| 2 | 34002-55 | TERMINAL BOARD |
| 1 | S-1501-1 | SWITCH |

EQUIPMENT TABLE

| | NAME | DATE |
|---|---|---|
| CONTRACT NO | | |
| DESIGN | | |
| GROUP | | |
| DRAWN | D. LOLLER | 12-12-73 |
| CHECK | J. YOUEL | 12-13-73 |
| STRESS | | |
| PROJECT | | 12-17-73 |
| APPD | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV 5800 E. PAWNEE WICHITA, KANSAS

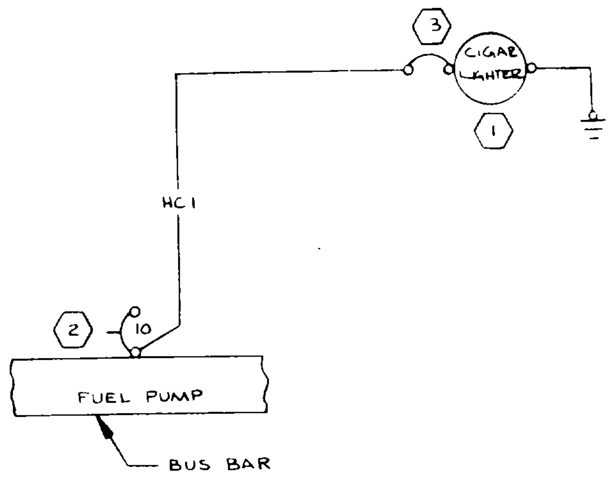
TITLE: WIRING DIAGRAM — POST LIGHTING (OPTIONAL)

SIZE C | CODE IDENT NO 71379 | DWG NO 2070001

SCALE NONE | 177RG | PAGE 11.2.0

(SR7606) IX

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: DELETE .770011-1 (SR 6349) IX | FEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTH | DLP 2-4-72 | RF |
| C | BY REV: S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE | JCY 3-7-73 | RF |
| D | BY REV: 16 GA WAS 18 GA. S-1367-2-6 WAS S-1367-2 & S-1367-2-8 WAS S-1367-2 / HC1 MER177RG0166 (NOW SHOP PRACTICE) | RJP 5-31-74 | JRS |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HC1 | 16 | | 30 | S-1367-2-6 | S-1367-2-8 | | |
| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 3 | 60232-1 | CIRCUIT BKR | 15472 |
| 2 | S1360-10L | CIRCUIT BKR | |
| 1 | S-1734-1 | CIGAR LIGHTER | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD NO

SUPERSEDES.

SUPERSEDED BY

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV
5800 E PAWNEE
WICHITA, KANSAS

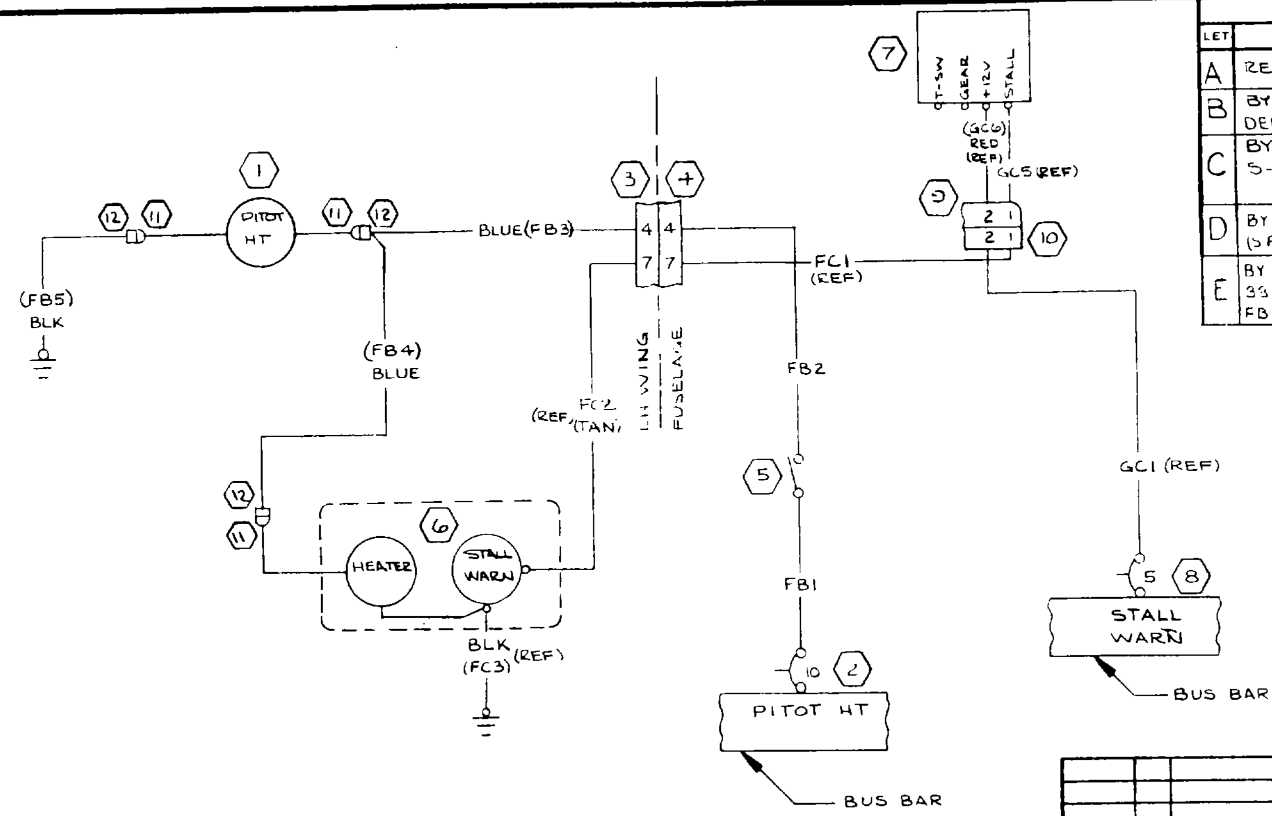
TITLE
WIRING DIAGRAM — CIGAR LIGHTER

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177RG | PAGE: 13.1.0

FORM NO 80-215B

(SR6349) IX ED&RR 10056




| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN — NO CHANGE (SR6349) IX | SEB 8-24-70 | |
| B | BY REV: ADD WIRE LENGTHS DELETED ITEM 13 & 14 | DLP 12-4-72 | |
| C | BY REV: S-1360-5L WAS S-1360-5 S-1360-10L WAS S-1360-10 NOW SHOP PRACTICE | JCY 3-7-73 | |
| D | BY REV: S-2160-1 WAS S-1845-1-2 (SR 177RG0433) | M.E.M 3-26-74 | |
| E | BY REV: 1493-2 WAS 1493-1/FB2 & FB1, 33 WAS 30 & S-1637-2-6 WAS S-1367-1-6/ FB1 MER177RGE0149 (NOW SHOP PRACTICE) | RJP 5-31-74 | |

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 12 | S-1637-2 | HOUSING - PLUG | |
| 11 | S-1637-1 | HOUSING - CAP | |
| 10 | S1641-6 | HOUSING - SOCKET | |
| 9 | S1640-6 | HOUSING - PIN | |
| 8 | S1360-5L | CIRCUIT BKR | |
| 7 | 2070005-1 | DUAL WARN UNIT | |
| 6 | S1672-2 | STALL WARN SENSOR | |
| 5 | S-2160-1 | SWITCH | |
| 4 | S1641-9 | HOUSING - PLUG | |
| 3 | S1640-9 | HOUSING - CAP | |
| 2 | S1360-10L | CIRCUIT BKR | |
| 1 | 1720099-3 | PITOT INSTL | |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| FB5 BLK | 18 | 18-0 | 6 | S1367-1-8 | S-1636-2 | | |
| FB4 BLUE | 18 | 16-6 | 36 | S-1636-2 | SEE FB3 | | |
| FB3 BLUE | 16 | 16-6 | 130 | S1635-2 | S-1635-2 | STD | |
| FB2 | 16 | | 81 | S1493-2 | S1636-2 | STD | |
| FB1 | 16 | | 33 | S1367-2-6 | S1493-2 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA KANSAS

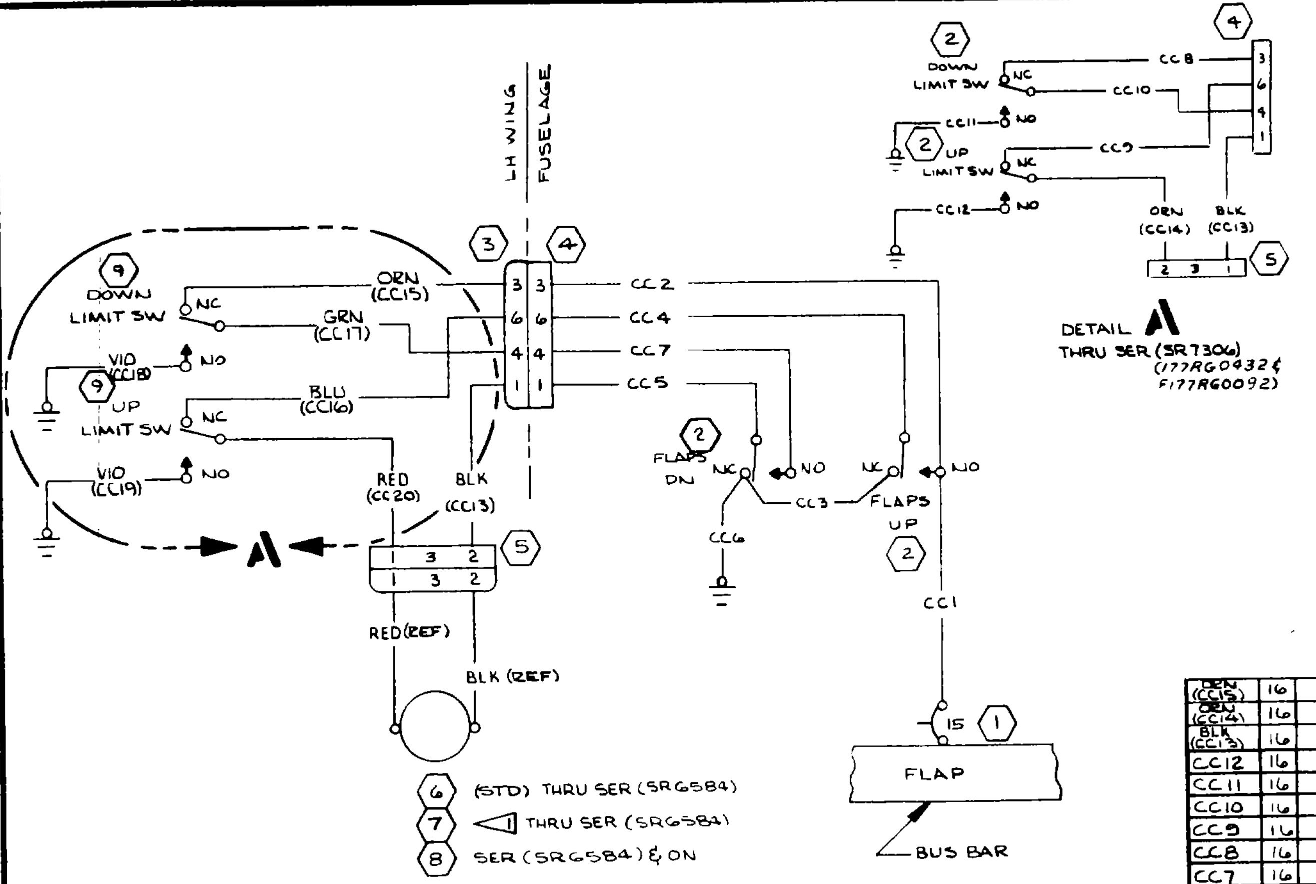
TITLE
## WIRING DIAGRAM — HEATED PITOT TUBE & HEATED STALL WARNING SYSTEM (OPT)

| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE | 177RG | PAGE: 13.2.0

(SR 6349) IX EP&RR 10056

FORM NO 80-2158




NOTES:

1 OPTIONAL WITH FIRST RADIO.

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | REDRAWN – NO CHANGE (SR6349) II | SEB 8-24-70 | |
| B | BY REV: ADD C301002-0201 ACTUATOR (SR6584) | WRC 2-1-70 | RF |
| C | BY REV: ADD WIRE LENGTHS | DLP 2-4-72 | RF |
| D | BY REV: SER OUT S-1906-1 SER IN S-1906-2; S-1360-15L WAS S-1360-15, SER OUT CC8 THRU CC12 & CC14, SER IN CC15 THRU CC20, ADD DETAIL "A" (SR 7306) II | JCY 3-13-73 | RF |
| E | BY REV: S-1906-1 AT INSTRUMENT PANEL WAS S-1906-2 (SR7306) II | DLP 6-22-73 | RF |
| F | BY REV: RED(CC13) WAS CC13, ORN(CC15) WAS CC15, BLU(CC16) WAS CC16, GRN(CC17) WAS CC17, VIO(CC18) WAS CC18, VIO(CC19) WAS CC19 & BLK(CC20) WAS CC20; S-1640-6 WAS S-1641-6, S-1641-6 WAS S-1640-6; S-1636-2 WAS S-1635-2 /CC2, CC4, CC5 & CC7: S-1635-2 WAS S-1636-2 RED(CC13), ORN(CC14), BLU(CC16), GRN(CC17) & BLK(CC20) MER E0015 (NOW SHOP PRACTICE) | DLO 1-8-75 | RF |
| G | BY REV: BLK(CC13) WAS RED (CC13), RED CC20 WAS BLK(CC20), BLK(REF) WAS ORN(REF), RED(REF) WAS BLK(REF), PIN 1 WAS PIN 2 & PIN 2 WAS PIN 1/ S1638-1 MER177RG0167 (NOW SHOP PRACTICE) | RJP 6-3-74 | RF |

## WIRE TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| ORN (CC15) | 16 | -16-3 | 13 | S1635-2 | S-1493-2 | | SER 177RG0433 & F177RG0093 & ON |
| ORN (CC14) | 16 | -16-3 | 14 | S1636-2 | S-1637-2-4 | | THRU SER 177RG0432 & F177RG0092 |
| BLK (CC13) | 16 | -16-0 | 13 | S1635-2 | S1636-2 | | |
| CC12 | 16 | | 10 | S-1637-2-4 | S1367-2-8 | | THRU SER 177RG0432 & F177RG0092 |
| CC11 | 16 | | 10 | S-1637-2-4 | S1367-2-8 | | |
| CC10 | 16 | | 20 | S1636-2 | S-1637-2-4 | | |
| CC9 | 16 | | 14 | S1636-2 | S-1637-2-4 | | |
| CC8 | 16 | | 20 | S1636-2 | S-1637-2-4 | | THRU SER 177RG0432 & F177RG0092 |
| CC7 | 16 | | 112 | S1367-2-4 | S1636-2 | | |
| CC6 | 16 | | 14 | S1367-2-4 | S1367-2-8 | | |
| CC5 | 16 | | 112 | S1367-2-4 | S1636-2 | | |
| CC4 | 16 | | 112 | S1367-2-4 | S1636-2 | | |
| CC3 | 16 | | 4 | S1367-2-4 | S1367-2-4 | | |
| CC2 | 16 | | 114 | S1367-2-4 | S1636-2 | | |
| CC1 | 16 | | 14 | S1367-2-6 | S1367-2-4 | | |
| RED (CC20) | 16 | -16-0 | 13 | S1635-2 | S1493-2 | | SER (SR7306) & ON |
| VIO (CC19) | 16 | -16-7 | 19 | S1493-2 | S1367-2-8 | | |
| VIO (CC18) | 16 | -16-7 | 19 | S1493-2 | S1367-2-8 | | |
| GRN (CC17) | 16 | -16-5 | 13 | S1635-2 | S1493-2 | | |
| BLU (CC16) | 16 | -16-6 | 13 | S1635-2 | S1493-2 | | SER (SR7306) & ON |

## EQUIPMENT TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 9 | S-1906-2 | SWITCH |
| 8 | C301002-0201 | ACTUATOR ASSY |
| 7 | C301001-0702 | ACTUATOR ASSY |
| 6 | C301001-0205 | ACTUATOR ASSY |
| 5 | S1638-1 | HOUSING – PLUG |
| 4 | S1641-6 | HOUSING – SOCKET |
| 3 | S1640-6 | HOUSING – PIN |
| 2 | S1906-1 | SWITCH |
| 1 | S1360-15L | CIRCUIT BKR |

CES-1000 IS APPLICABLE VENDOR CODES PER S-1400 CES-XXXX=CESSNA SPEC. NO. S-XXX OR CMXXXX=CESSNA STD NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — FLAP SYSTEM

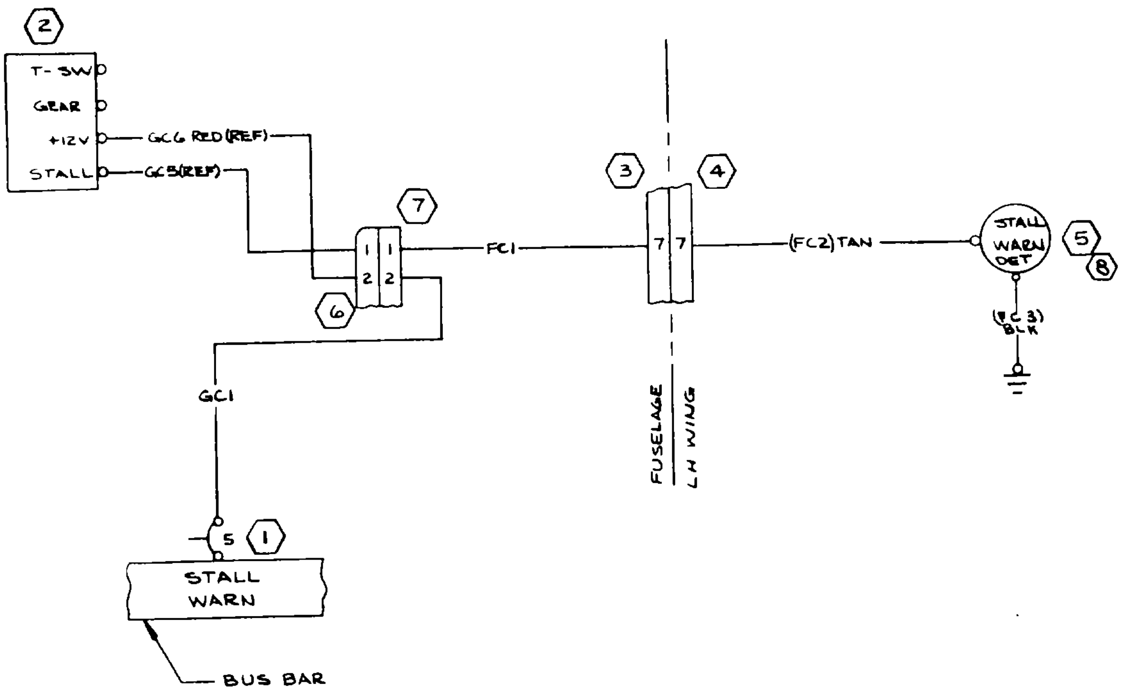
| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177RG | PAGE 14.1.0

FORM NO 80-2158

(SR6349) II ED & RR 10056

| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| REVISION. | | | |
| A | REDRAWN – NO CHANGE (SR6349) II | JEB 8-24-70 | RF |
| B | BY REV: ADD WIRE LENGTHS, 20 GA/FC1 WAS 18GA, 20 GA/GC1 WAS 16 GA | DLP 2-4-72 | RF |
| C | BY REV: S-1360-5L WAS S-1360-5 NOW SHOP PRACTICE | JCY 3-7-73 | RF |




| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| FC3 BLK | 16 | -18-10 | 6 | S-1367-2-6 | S1367-2-8 | | |
| FC2 TAN | 18 | -18-10 | 145 | S1635-2 | S1367-2-6 | | |
| FC1 | 20 | | 125 | S1636-2 | S1636-2 | | |
| GC1 | 20 | | 35 | S1367-2-6 | S1636-1 | | |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION |
|---|---|---|
| 8 | S-1672-2 | DETECTOR - STALL (HEATED) |
| 7 | S1641-6 | HOUSING - SOCKET |
| 6 | S1640-6 | HOUSING - PIN |
| 5 | S1672-1 | DETECTOR - STALL |
| 4 | S1640-5 | HOUSING - CAP |
| 3 | S1641-5 | HOUSING - PLUG |
| 2 | 2070005-1 | DUAL WARN UNIT |
| 1 | S1360-5L | CIRCUIT BKR |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
WIRING DIAGRAM — STALL WARNING SYSTEM

SIZE C | CODE IDENT NO 71379 | DWG NO 2070001

SCALE: NONE | 177RG | PAGE: 15.1.0

(SR 6349) II ED&RR 10161

FORM NO. 80-2158

NOTES:

1. SYSTEM SHOWN WITH LDG GEAR DOWN AND LOCKED; AIRPLANE ON GROUND AND POWER OFF

2. THIS SWITCH CAN BE EITHER A 12SE1-3 MICRO SWITCH (91929) OR AN EA3 UNIMAX (80207). THE TWO SWITCHES ARE INTERCHANGEABLE.

3. THIS SWITCH CAN BE EITHER A 12SE3-3 MICROSWITCH (91929) OR AN EA3-Y UNIMAX (80207). THE TWO SWITCHES ARE INTERCHANGEABLE.

4. SWITCH IS CLOSED WHEN MAIN GEARS ARE DOWN AND LOCKED.

5. ~~SWITCH IS CLOSED WHEN NOSE GEAR IS LOCKED IN EITHER UP OR DOWN POSITION.~~

6. ~~SWITCH CONTACTS "C" & "NO" ARE CLOSED WHEN NOSE GEAR IS DOWN. SWITCH CONTACTS "C" & "NC" ARE CLOSED WHEN THE NOSE GEAR IS UP.~~

7. SWITCH IS CLOSED WHEN NOSE GEAR STRUT IS EXTENDED (NO WEIGHT ON STRUT).

8. ~~SWITCH CONTACTS "NO" & "C" ARE CLOSED WHEN MAIN GEARS ARE UP.~~

9. PRESSURE SWITCH OPENS WHEN GEARS ARE UP AND HYDRAULIC PRESSURE BUILDS UP TO PROPER LEVEL.

10. ~~UNLOCKING ACTION IS INITIATED BY MOMENTARILY ENERGIZING 10 SOLENOIDS. SWITCHES ARE ACTUATED BY 10 GEAR UNLOCKING MECHANISM. SWITCHES ARE SHOWN IN GEAR DOWN & LOCKED POSITION.~~

11. THIS NORMALLY CLOSED RELAY IS ENERGIZED WHEN 16 & 24 ARE CLOSED (GEAR DOWN). THE RELAY OPENS AND IN TURN OPENS 7 TURNING OFF THE PUMP.

12. SWITCH CONTACTS "C" AND "NO" CLOSE WHEN MAIN GEARS ARE IN UP POSITION.

13. SWITCH CONTACTS "C" AND "NO" CLOSE WHEN NOSE GEAR IS IN UP POSITION.

14. SWITCH CONTACTS "C" AND "NO" CLOSE WHEN NOSE GEAR IS IN DOWN POSITION.

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: REDESIGNED & REDRAWN SR 6349 IX | SEB 5-24-70 | |
| B | REV... ADD ALTERNATE FOR 12SE3-3 SWITCH. ADD 12SE1-3 SWITCH & ALTERNATE. | GLW 10-14-70 | KF |
| C | ADD S-2035-1 CAP, S-2035-2 PLUG & TERMINALS TO ITEM 14. S-1636-1 ON S 1636-1 ON GA16 & GA17 WAS SOLDER (SR6349) | GLW 12-7-70 | KF |
| D | BY REV DELETE NOTES 5,6,& 8. INACTIVATE P. 15.2.1. ADD P. 15.2.2. ADD WIRE GE12 & WIRE GE13 (SR6892) | GLW 1-25-71 | KF |
| E | BY REVISION: INACTIVATE PAGE 15.2.2. ADD PG 15.2.0.1 & PAGE 15.2.3 (SR6786) | GLW 10-18-71 | KF |
| F | BY REVISION: ITEM 11 & 12 NO WAS NC. NC WAS NO. INACTIVATE DRAWING | WDA | |

INACTIVE

EFF THRU SER 177RG0282

WDA 3-23-72

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 30 | S-1367-2-8 | TERMINAL | |
| 29 | S-1232-30 | CIRCUIT BREAKER | |
| 28 | S-1377-1 | SWITCH | |
| 27 | S-2035-2 | PLUG | |
| 26 | S-2035-1 | CAP | |
| 25 | S-1635-1 | PIN | |
| 24 | 2 | SWITCH | |
| 23 | S1641-6 | HOUSING - SOCKET | |
| 22 | S1640-6 | HOUSING - PIN | |
| 21 | VM 911M-3A | GEAR DN IND | 87034 |
| 20 | VM 911M-4A | GEAR UP IND | 87034 |
| 19 | 2070005-1 | DUAL WARN UNIT | |
| 18 | USM-5W | SWITCH | 80207 |
| 17 | MS25253-1 | SWITCH | |
| 16 | 3 | SWITCH | |
| 15 | 602EN67-6B | MICRO SW (SQ SW) | 91929 |
| 14 | 107050 | HYD PRESS SW | 05044 |
| 13 | S1917-1 | RELAY | |
| 12 | MS25253-1 | SWITCH | |
| 11 | MS25253-1 | SWITCH | |
| 10 | S2110-1 | SOLENOID | |
| 9 | 1059328 | HYDRAULIC PUMP | 19728 |
| 8 | 1553112-1 | BUS BAR | |
| 7 | S2103-1 | CONTACTOR | |
| 6 | 8857K44 | CONTROL SW | 15605 |
| 5 | S1360-35 | CIRCUIT BKR | |
| 4 | S1360-10 | CIRCUIT BKR | |
| 3 | S1360-5 | CIRCUIT BKR | |
| 2 | S1637-2 | HOUSING - PLUG | |
| 1 | S1637-1 | HOUSING - CAP | |

EQUIPMENT TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| GE13 | 20 | | | SOLDER | S-1370-1 | | SER (SR6892) & ON |
| GE12 | 20 | | | S1370-1 | S-1635-1 | | SER (SR6892) & ON |
| GE11 | 20 | | | S-1637-1 | S-1637-1 | | EFFECTIVE THRU SER (SR6892) |
| GC8 | 20 | | | S1635-1 | SOLDER | | |
| GC7 | 20 | | | S1635-1 | SOLDER | | |
| GC6 RED | 20 | | | S1635-1 | SOLDER | | |
| GC5 | 20 | | | S1635-1 | SOLDER | | |
| GC4 | 20 | | | S1636-1 | SOLDER | | |
| GC3 | 20 | | | SOLDER | S1367-1-8 | | |
| GC2 | 20 | | | SOLDER | S1636-1 | | |
| GE10 | 20 | | | S1637-1-8 | SOLDER | | |
| GE9 | 20 | | | S1635-1 | SOLDER | | |
| GE8 | 20 | | | S1635-1 | S1635-1 | | |
| GE7 | 20 | | | S1367-1-4 | S1635-1 | | |
| GE6 | 20 | | | S1635-1 | S1367-1-4 | | EFFECTIVE THRU SER (SR6892) |
| GE5 | 20 | | | S1635-1 | S1367-1-8 | | EFFECTIVE THRU SER (SR6892) |
| GE2 | 20 | | | SOLDER | S1367-1-4 | | EFFECTIVE THRU SER (SR6892) |
| GE1 | 20 | | | S1367-1-6 | SOLDER | | |
| GA27 | 20 | | | S1635-1 | S1367-1-6 | | |
| GA22 | 20 | | | S1367-1-4 | S1367-1-10 | | |

FORM NO 80 2158

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| GA21 | 20 | | | S1367-1-6 | S1367-1-8 | | |
| GA20 | 20 | | | SEE GA10 | S1367-1-6 | | EFFECTIVE THRU SER (SR6786) |
| GA19 | 20 | | | ~~S1943~~-1 | S1367-1-6 | | |
| GA17 | 20 | | | S-1636-1 | S1493-1 | | |
| GA16 | 20 | | | S1367-1-4 | S-1636-1 | | |
| GA15 | 20 | | | S1367-1-4 | S1367-1-4 | | |
| GA14 | 20 | | | SEE GA13 | S1367-1-4 | | |
| GA13 | 20 | | | S1367-~~2~~-4 | S1635-1 | | |
| GA12 | 20 | | | S1635-1 | S1367-1-4 | | EFFECTIVE THRU SER (SR6786) |
| GA11 | 20 | | | S1635-1 | S1367-1-4 | | EFFECTIVE THRU SER (SR6786) |
| GA10 | 20 | | | S1635-2 | S1635-1 | | EFFECTIVE THRU SER (SR6786) |
| GA9 | 20 | | | S1367-1-10 | S1367-1-6 | | |
| GA7 | 20 | | | S1493-1 | SOLDER | | |
| GA6 | 20 | | | S1367-1-10 | S1493-1 | | |
| GA5 | 20 | | | S1367-1-10 | S1367-1-6 | | |
| GA3 | 10 | | | S1370-3 | S1367-3-13 | | |
| GA2 | 10 | | | S1367-3-13 | S1370-3 | | |
| GA1 | 10 | | | S1367-3-8 | S1367-3-13 | | |

WIRE TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES

SUPERSEDED BY 15.2.1

| CONTRACT NO | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L.K. WHITE | 6-5-70 |
| STRESS | | |
| PROJ | R. FIFE | 6-8-70 |
| APPD | | |
| OTHER | | |

Cessna. AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV
5800 E PAWNEE
WICHITA, KANSAS

TITLE
## WIRING DIAGRAM — GEAR WARNING SYSTEM

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE — 177 RG — PAGE 15.2.0

(SR 6349) IX ED 822 0161

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| F | SEE PAGE 15.2.0 FOR REVISION | | |

NOTES:

15 UNLOCKING ACTION IS INITIATED BY MOMENTARILY ENERGIZING 32 SOLENOIDS. SWITCHES ARE ACTUATED BY 32 GEAR UNLOCKING MECHANISM. SWITCHES ARE SHOWN IN GEAR DOWN & LOCKED POSITION.

16 61198-1 TERMINAL VENDOR IS 00779.

INACTIVE
EFF THRU SER 177RG0282
WDA 3-29-72
HRW WKW RF

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| GA37 | 20 | | | SEE GA34 | S1367-1-6 | | SER (SR6786) & ON |
| GA36 | 20 | | | S1493-1 | S1367-1-4 | | |
| GA35 | 20 | | | S1493-1 | S1367-1-4 | | |
| GA34 | 20 | | | S1493-1 | S1493-1 | | |
| GA33 | 14 | | | S1367-3-8 | SOLDER | | |
| GA32 | 14 | | | S1367-3-8 | SOLDER | | |
| GA31 | 14 | | | S1493-2 | S1370-2 | | |
| GA30 | 14 | | | S1493-2 | S1370-2 | | |
| 16 GA29 | 10 | | | 61198-1 | 61198-1 | | |
| 16 GA28 | 10 | | | S1367-3-8 | 61198-1 | | SER (SR6786) & ON |

WIRE TABLE

| ITEM NO | PART NO. | DESCRIPTION | |
|---|---|---|---|
| 35 | | | |
| 34 | 430-863 | THERMOSTAT | (26151) |
| 33 | F4 | DIODE | (84970) |
| 32 | 2070014-1 | SOLENOID ASSY | |
| 31 | S-1917-1 | RELAY | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO
S-XXX OR CMXXXX=CESSNA STD. NO.

SUPERSEDES:

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | G WOOD | 11-18-71 |
| GROUP | H. Wise | 11-19-71 |
| DRAWN | G WOOD | 11-18-71 |
| CHECK | L.K WHITE | 11-20-71 |
| STRESS | | |
| PROJ | | 11-20-71 |
| APPD. | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

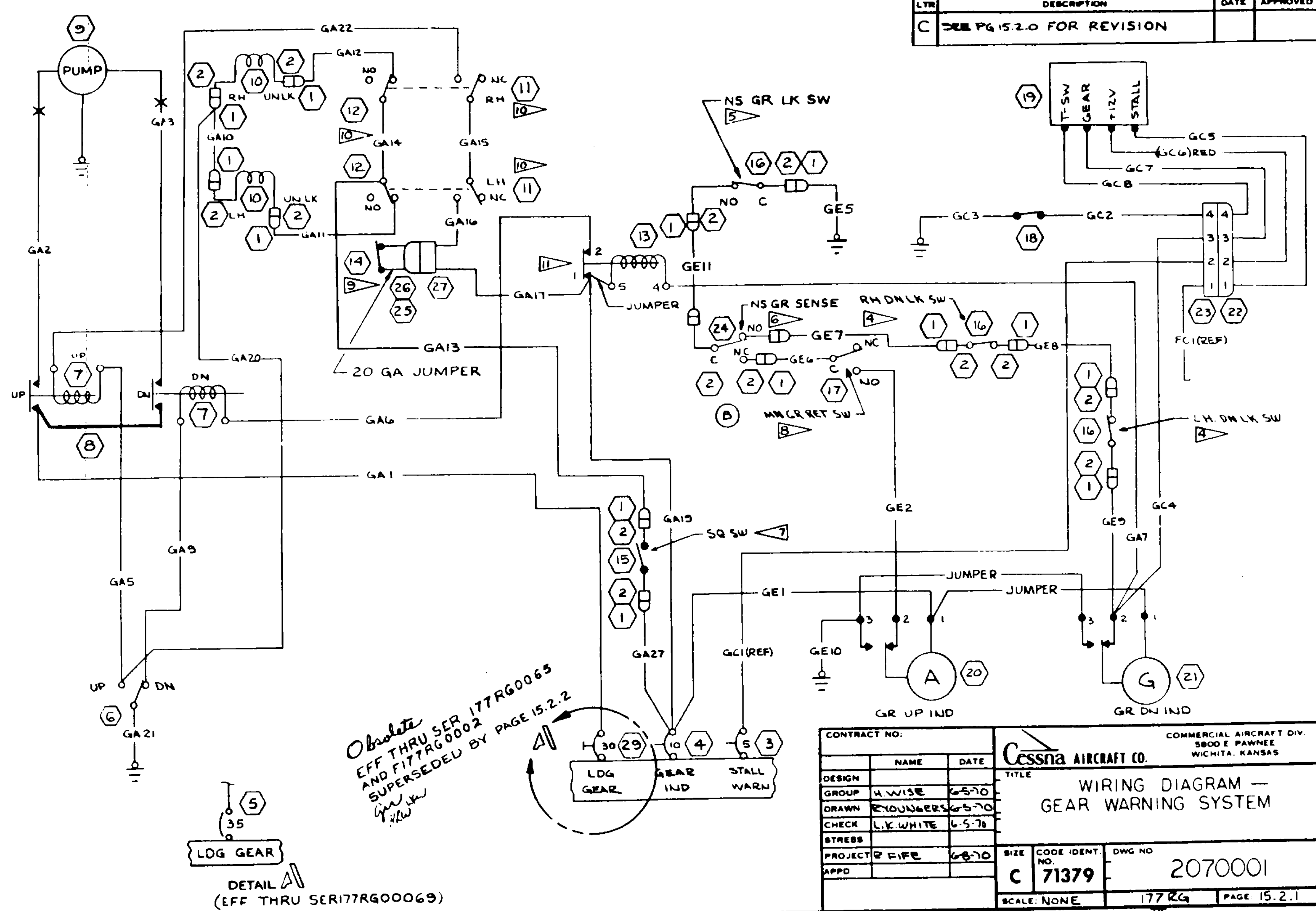
TITLE
WIRING DIAGRAM — GEAR & GEAR WARNING SYSTEM

SIZE C
CODE IDENT NO 71379
DWG NO 2070001
SCALE NONE
PAGE 15.

SER (SR6786) & ON

FORM NO 80 2159

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| C | SEE PG 15.2.0 FOR REVISION | | |




| CONTRACT NO: | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | | |
| GROUP | H. WISE | 6-5-70 |
| DRAWN | R. YOUNGERS | 6-5-70 |
| CHECK | L. K. WHITE | 6-5-70 |
| STRESS | | |
| PROJECT | R. FIFE | 6-8-70 |
| APPD | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E PAWNEE
WICHITA, KANSAS

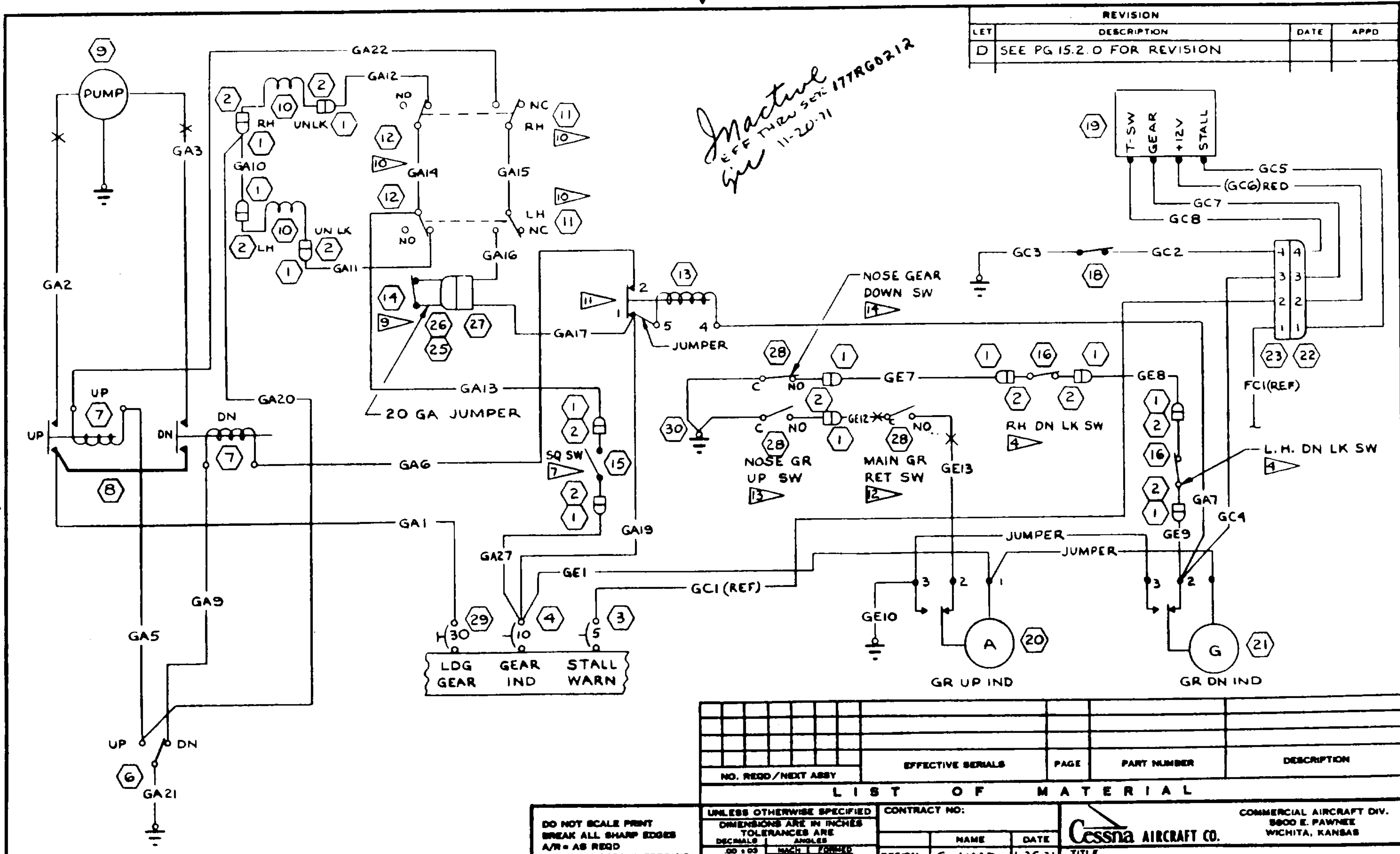
TITLE
WIRING DIAGRAM — GEAR WARNING SYSTEM

| SIZE | CODE IDENT. NO. | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE: NONE   177RG   PAGE 15.2.1

(SR 6349) IX   ED&R 10161

FORM NO 60-216




| NO. REQD / NEXT ASSY | EFFECTIVE SERIALS | PAGE | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|

LIST OF MATERIAL

DO NOT SCALE PRINT
BREAK ALL SHARP EDGES
A/R = AS REQD
CES-XXXX = CESSNA SPEC. NO.
S-XXX OR CMXXXX = CESSNA STD. NO.
S = APPROX EQUAL SPACES
CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE

SUPERSEDES: PAGE 15.2.1

SUPERSEDED BY: PAGE 15.2.5

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | G WOOD | 1-25-71 |
| GROUP | [illegible] | [illegible] |
| DRAWN | G WOOD | 1-25-71 |
| CHECK | L.K. WHITE | 2-16-71 |
| STRESS | | |
| PROJECT | | |
| APPD | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

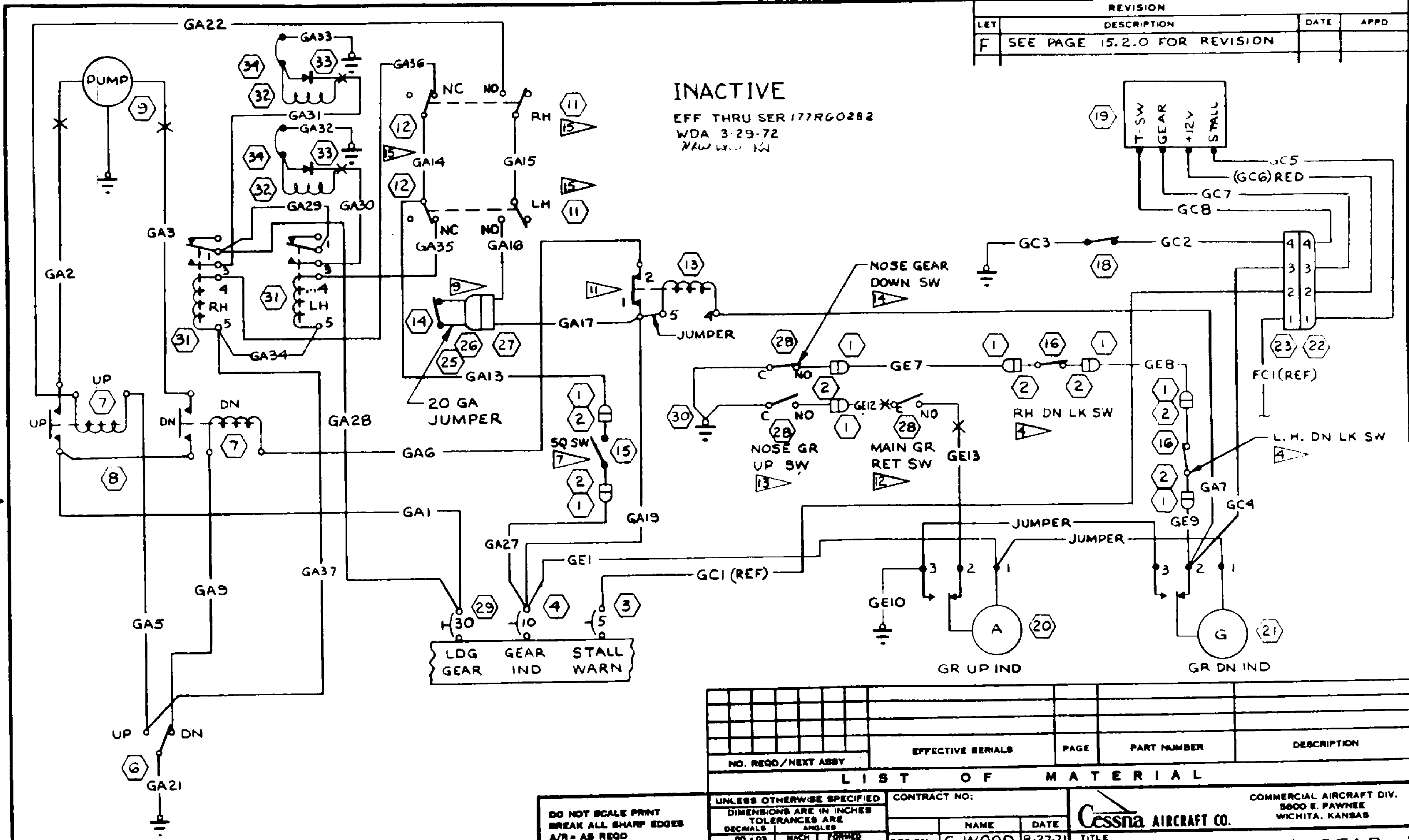
TITLE
WIRING DIAGRAM - GEAR WARNING SYSTEM

SIZE C | CODE IDENT. NO. 71379 | 2070001

SCALE: NONE | 177RG (SR6892) | PAGE: 15.2.2

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| F | SEE PAGE 15.2.0 FOR REVISION | | |

INACTIVE
EFF THRU SER 177RG0282
WDA 3-29-72




| NO. REQD/NEXT ASSY | EFFECTIVE SERIALS | PAGE | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|

LIST OF MATERIAL

DO NOT SCALE PRINT
BREAK ALL SHARP EDGES
A/R = AS REQD
CES-XXXX = CESSNA SPEC. NO.
S-XXX OR CMXXXX = CESSNA STD. NO.
S = APPROX EQUAL SPACES
CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FOR HOLES, CSNKS, ETC., SEE CES 1012
FOR BASIC CODES SEE NAS 523

SUPERSEDES:

SUPERSEDED BY: 15.2.4

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | G WOOD | 8-27-71 |
| GROUP | | 11-19-71 |
| DRAWN | G WOOD | 8-27-71 |
| CHECK | K WHITE | 11-20-71 |
| STRESS | | |
| PROJECT | | 11-22-71 |
| APPD | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM - GEAR & GEAR WARNING SYSTEM

SIZE C | CODE IDENT. NO. 71379 | 2070001

SCALE: NONE | PAGE: 15.2.3

SER (SRG786) & ON

NOTES:
1. SYSTEM SHOWN WITH LDG GEAR DOWN AND LOCKED; AIRPLANE ON GROUND AND POWER OFF
2. SWITCH IS CLOSED WHEN MAIN GEAR IS DOWN & LOCKED
3. SWITCH IS CLOSED WHEN NOSE GEAR STRUT IS EXTENDED (NO WEIGHT ON STRUT)
4. PRESSURE SWITCH OPENS WHEN GEAR IS UP AND HYDRAULIC PRESSURE BUILDS UP TO PROPER LEVEL.
5. THIS NORMALLY CLOSED RELAY IS ENERGIZED WHEN 16, 24 & 28 ARE CLOSED. (GEAR DOWN) THE RELAY OPENS AND IN TURN OPENS 7 WHICH TURNS OFF THE PUMP

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: S-1232-30L WAS S-1232-30 S-1360-5L WAS S-1360-5, S-1360-10L WAS S-1360-10, S-1360-35L WAS S-1360-35 ADD WIRE LENGTHS NOW SHOP PRACTICE INACTIVATE DWG | JCY 3-7-73 MTM | RLY DRM RF |
| B | BY REV: DELETE S-1360-35L, 5210-1 & MS25253-1 (NOW SHOP PRACTICE) | DLO 5-8-73 | RLY DRM HJW RF |

INACTIVE: EFF THRU SER 177RG0432 & F177RG0092
3-7-73 MTM RLY HJW DRM

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| GE13 | 20 | | 138 | SOLDER | S-1370-1 | |
| GE12 | 20 | | 160 | S-1370-1 | S-1635-1 | |
| GC8 | 20 | | 10 | S1635-1 | SOLDER | |
| GC7 | 20 | | 10 | S1635-1 | SOLDER | |
| GC6 RED | 20 | | 10 | S1635-1 | SOLDER | |
| GC5 | 20 | | 10 | S1635-1 | SOLDER | |
| GC4 | 20 | | 36 | S1636-1 | SOLDER | |
| GC3 | 20 | | 36 | SOLDER | S1367-1-8 | |
| GC2 | 20 | | 100 | SOLDER | S1636-1 | |
| GE10 | 20 | | 14 | S1637-1-8 | SOLDER | |
| GE9 | 20 | | 144 | S1635-1 | SOLDER | |
| GE8 | 20 | | 92 | S1635-1 | S1635-1 | |
| GE7 | 20 | | 224 | S1367-1-4 | S1635-1 | |
| GE1 | 20 | | 30 | S1367-1-6 | SOLDER | |
| GA27 | 20 | | 160 | S1635-1 | S1367-1-6 | |

FORM NO 80 215B

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 31 | 2070019-1 | SWITCH-M/G UP | |
| 30 | S-1367-2-8 | TERMINAL | |
| 29 | S-1232-30L | CIRCUIT BREAKER | |
| 28 | 2070021-1 | SWITCH-N/G DN | |
| 27 | S-2035-2 | PLUG | |
| 26 | S-2035-1 | CAP | |
| 25 | S-1635-1 | PIN | |
| 24 | 2070017-4 | SWITCH | |
| 23 | S1641-6 | HOUSING-SOCKET | |
| 22 | S1640-6 | HOUSING-PIN | |
| 21 | VM 911M-3A | GEAR DN IND | 87034 |
| 20 | VM 911M-4A | GEAR UP IND | 87034 |
| 19 | 2070005-1 | DUAL WARN UNIT | |
| 18 | USM-5W | SWITCH | 80207 |
| 17 | | | |
| 16 | 2070017-1 | SWITCH-LH M/G DN | |
| 15 | 602EN67-6B | MICRO SW (SQ.SW) | 91929 |
| 14 | 107050 | HYD PRESS SW | 05044 |
| 13 | S1917-1 | RELAY | |
| 12 | 2070023-1 | SWITCH-N/G UP | |
| 11 | F-4 | DIODE | |
| 10 | | | |
| 9 | 1055328 | HYDRAULIC PUMP | 19728 |
| 8 | 1553112-1 | BUS BAR | |
| 7 | S2103-1 | CONTACTOR | |
| 6 | 8857K44 | CONTROL SW | 15605 |
| 5 | | | |
| 4 | S1360-10L | CIRCUIT BKR | |
| 3 | S1360-5L | CIRCUIT BKR | |
| 2 | S1637-2 | HOUSING-PLUG | |
| 1 | S1637-1 | HOUSING-CAP | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES: PGS 15.2.0 & 15.2.0.1
SUPERSEDED BY:

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | SERIALS |
|---|---|---|---|---|---|---|
| GA21 | 20 | | 20 | S1367-1-6 | S1367-1-8 | |
| GA19 | 20 | | 204 | ~~S1943-1~~ | S1367-1-6 | |
| GA29 | 20 | | 25 | S1636-1 | S1367-1-10 | |
| GA28 | 20 | | 330 | S-1635-1 | S1636-1 | |
| GA9 | 20 | | 190 | S1367-1-10 | S1367-1-6 | |
| GA7 | 20 | | 187 | S1493-1 | SOLDER | |
| GA6 | 20 | | 160 | S1367-1-10 | S1493-1 | |
| GA5 | 20 | | 184 | S1367-1-10 | S1367-1-6 | |
| GA3 | 10 | | 18 | S1370-3 | S1367-3-13 | |
| GA2 | 10 | | 16 | S1367-3-13 | S1370-3 | |
| GA1 | 10 | | 203 | S1367-3-8 | S1367-3-13 | |

WIRE TABLE

CONTRACT NO:

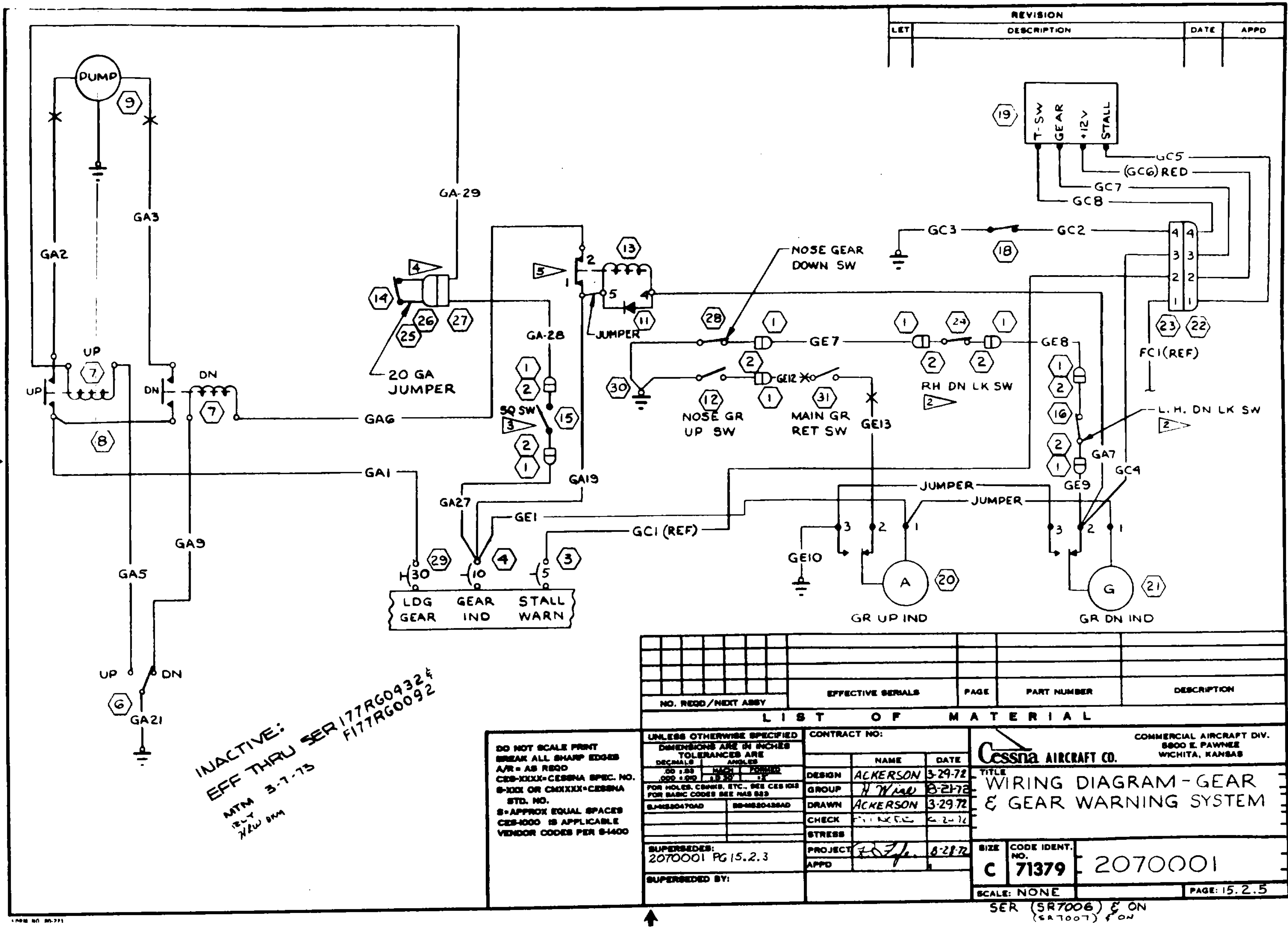
| | NAME | DATE |
|---|---|---|
| DESIGN | Ackerson | 3-29-72 |
| GROUP | V Wire | 8-21-72 |
| DRAWN | Ackerson | 3-29-72 |
| CHECK | [illegible] | [illegible] |
| STRESS | | |
| PROJ | [illegible] | 8-24-72 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
# WIRING DIAGRAM — GEAR WARNING SYSTEM

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE 177 RG A PAGE 15.2.4


REVISION
LET
DESCRIPTION
DATE
APPD
PUMP
GA2
GA3
GA-29
GA-28
UP
DN
GA6
GA1
GA19
GA27
GE1
GC1 (REF)
GA9
GA5
GA21
UP
DN
20 GA JUMPER
JUMPER
SQ SW
NOSE GEAR DOWN SW
NOSE GR UP SW
MAIN GR RET SW
GE7
GE12
GE13
GE8
GE9
GE10
RH DN LK SW
L.H. DN LK SW
GA7
GC4
T-SW
GEAR
+12V
STALL
GC5
(GC6) RED
GC7
GC8
GC3
GC2
FC1 (REF)
JUMPER
JUMPER
A
G
GR UP IND
GR DN IND
30
10
5
LDG GEAR
GEAR IND
STALL WARN
INACTIVE:
EFF THRU SER 177RG0432 & F177RG0092
MTM 3-7-73
12LY NEW DWG
NO. REQD/NEXT ASSY
EFFECTIVE SERIALS
PAGE
PART NUMBER
DESCRIPTION
LIST OF MATERIAL
DO NOT SCALE PRINT
BREAK ALL SHARP EDGES
A/R = AS REQD
CES-XXXX = CESSNA SPEC. NO.
S-XXX OR CMXXXX = CESSNA STD. NO.
S = APPROX EQUAL SPACES
CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
SUPERSEDES:
2070001 PG 15.2.3
SUPERSEDED BY:
CONTRACT NO:
NAME
DATE
DESIGN ACKERSON 3-29-72
GROUP H Wise 8-21-72
DRAWN ACKERSON 3-29-72
CHECK
STRESS
PROJECT 8-28-72
APPD
Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS
TITLE
WIRING DIAGRAM - GEAR & GEAR WARNING SYSTEM
SIZE C
CODE IDENT. NO. 71379
2070001
SCALE: NONE
PAGE: 15.2.5
SER (SR7006) & ON
(SR7007) & ON

NOTES:
1. SYSTEM SHOWN WITH LDG GEAR DOWN AND LOCKED; AIRPLANE ON GROUND AND POWER OFF
2. SWITCH IS CLOSED WHEN MAIN GEAR IS DOWN & LOCKED.
3. SWITCH IS CLOSED WHEN NOSE GEAR STRUT IS EXTENDED (NO WEIGHT ON STRUT)
4. PRESSURE SWITCH OPENS WHEN GEAR IS UP AND HYDRAULIC PRESSURE BUILDS UP TO PROPER LEVEL.
5. THIS NORMALLY CLOSED RELAY IS ENERGIZED WHEN (16), (24) & (28) ARE CLOSED. (GEAR DOWN) THE RELAY OPENS AND TURNS OFF THE PUMP
6. INSTALL S-1367-2-8 TERMINAL ON 2070017 & 2070021 SWITCH GND WIRES
7. INSTALL S-1635-1 PIN ON VENDOR FURNISHED WIRE

## REVISION

| LET | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| A | BY REV: S-1367-1-4 WAS S-1367-1-6 PER GA41, GA44, GA45 & GA46 (SR7306) REF | JLO 7-28-73 | RF |
| B | BY REV: USM-5B SWITCH WAS USM-5W; 1280840-1 WAS 107050; ADD BLU/YEL (REF) (REF) SR 7306) | JEF 11-8-73 | [illegible] |
| C | BY REV: ADD GC9 & GC10; S-1636-1 WAS S-1367-1-8/GC3, S-1635-1 WAS SOLDER/GC2 (NOW SHOP PRACTICE) | RAM 4-29-74 | [illegible] |

## EQUIPMENT TABLE

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 32 | S-1638-2 | CAP | |
| 31 | S-1638-1 | PLUG | |
| 30 | | | |
| 29 | S-1232-30 | CIRCUIT BREAKER | |
| 28 | 2070021-1 | SWITCH-N/G DN | |
| 27 | S-2035-2 | PLUG | |
| 26 | S-2035-1 | CAP | |
| 25 | | | |
| 24 | 2070017-4 | SWITCH | |
| 23 | S1641-6 | HOUSING-SOCKET | |
| 22 | S1640-6 | HOUSING-PIN | |
| 21 | VM 911M-3A | GEAR DN IND | 87034 |
| 20 | VM 911M-4A | GEAR UP IND | 87034 |
| 19 | 2070005-1 | DUAL WARN UNIT | |
| 18 | USM-5B | SWITCH | |
| 17 | | | |
| 16 | 2070017-1 | SWITCH-LH M/G DN | |
| 15 | 602EN67-6B | MICRO SW (SQ.SW) | 91929 |
| 14 | 1280840-1 | HYD PRESS SW | |
| 13 | S1917-1 | RELAY | |
| 12 | 2070023-1 | SWITCH-N/G UP | |
| 11 | F-4 | DIODE | |
| 10 | | | |
| 9 | 1055328 | HYDRAULIC PUMP | 19728 |
| 8 | MS25253-2 | SWITCH | |
| 7 | S2103-1 | CONTACTOR | |
| 6 | 2070019-1 | SWITCH-M/G UP | |
| 5 | | | |
| 4 | S1360-10L | CIRCUIT BKR | |
| 3 | S1360-5L | CIRCUIT BKR | |
| 2 | S1637-2 | HOUSING-PLUG | |
| 1 | S1637-1 | HOUSING-CAP | |

## WIRE TABLE

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| GC10 BLK | 20 | | 15 | S-1635-1 | S-1367-1-8 | | |
| GE13 | 20 | | 138 | SOLDER | S-1370-1 | | |
| GE12 | 20 | | 160 | S1370-1 | S-1635-1 | | |
| GC9 | 20 | | 36 | SOLDER | S-1636-1 | | |
| GC8 | 20 | | 10 | S1635-1 | SOLDER | | |
| GC7 | 20 | | 10 | S1635-1 | SOLDER | | |
| GC6 RED | 20 | | 10 | S1635-1 | SOLDER | | |
| GC5 | 20 | | 10 | S1635-1 | SOLDER | | |
| GC4 | 20 | | 36 | S1636-1 | SOLDER | | |
| GC3 | 20 | | 36 | SOLDER | S-1636-1 | | |
| GC2 | 20 | | 100 | S-1635-1 | S1636-1 | | |
| GE10 | 20 | | 14 | S1637-1-8 | SOLDER | | |
| GE9 | 20 | | 144 | S1635-1 | SOLDER | | |
| GE8 | 20 | | 92 | S1635-1 | S1635-1 | | |
| GE7 | 20 | | 224 | S1367-1-4 | S1635-1 | | |
| GE1 | 20 | | 30 | S1367-1-6 | SOLDER | | |

FORM NO 80 2150

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | | | SERIALS |
|---|---|---|---|---|---|---|---|
| GA48 | 20 | | | S1367-1-10 | S1367-1-12 | | |
| GA47 | 20 | | | S1636-1 | S1367-1-10 | | |
| GA46 | 20 | | | S1367-1-4 | S1635-1 | | |
| GA45 | 20 | | | S1367-1-4 | S1367-1-4 | | |
| GA44 | 20 | | | S1635-1 | S1367-1-4 | | |
| GA43 | 20 | | | S1636-1 | S1636-1 | | |
| GA42 | 20 | | | S1635-1 | S1636-1 | | |
| GA41 | 20 | | | S1635-1 | S1367-1-4 | | |
| GA40 | 20 | | | S1493-1 | S1636-1 | | |
| GA7 | 20 | | | S1493-1 | SOLDER | | |
| GA19 | 20 | | | S1367-1-6 | S1493-1 | | |
| GA27 | 20 | | 160 | S1635-1 | S1367-1-6 | | |
| GA2 | 10 | | 16 | S1367-3-13 | S1370-3 | | |
| GA1 | 10 | | 203 | S1367-3-8 | S1367-3-13 | | |

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES: P.15.2.4

SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Wiel | 5-14-73 |
| DRAWN | M. MORIARTY | 5-8-73 |
| CHECK | R. YOUNGERS | 5-10-73 |
| STRESS | [illegible] | 5-15-73 |
| PROJ | [illegible] | 5-15-73 |
| APPD | | |
| OTHER | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV
5800 E. PAWNEE
WICHITA, KANSAS

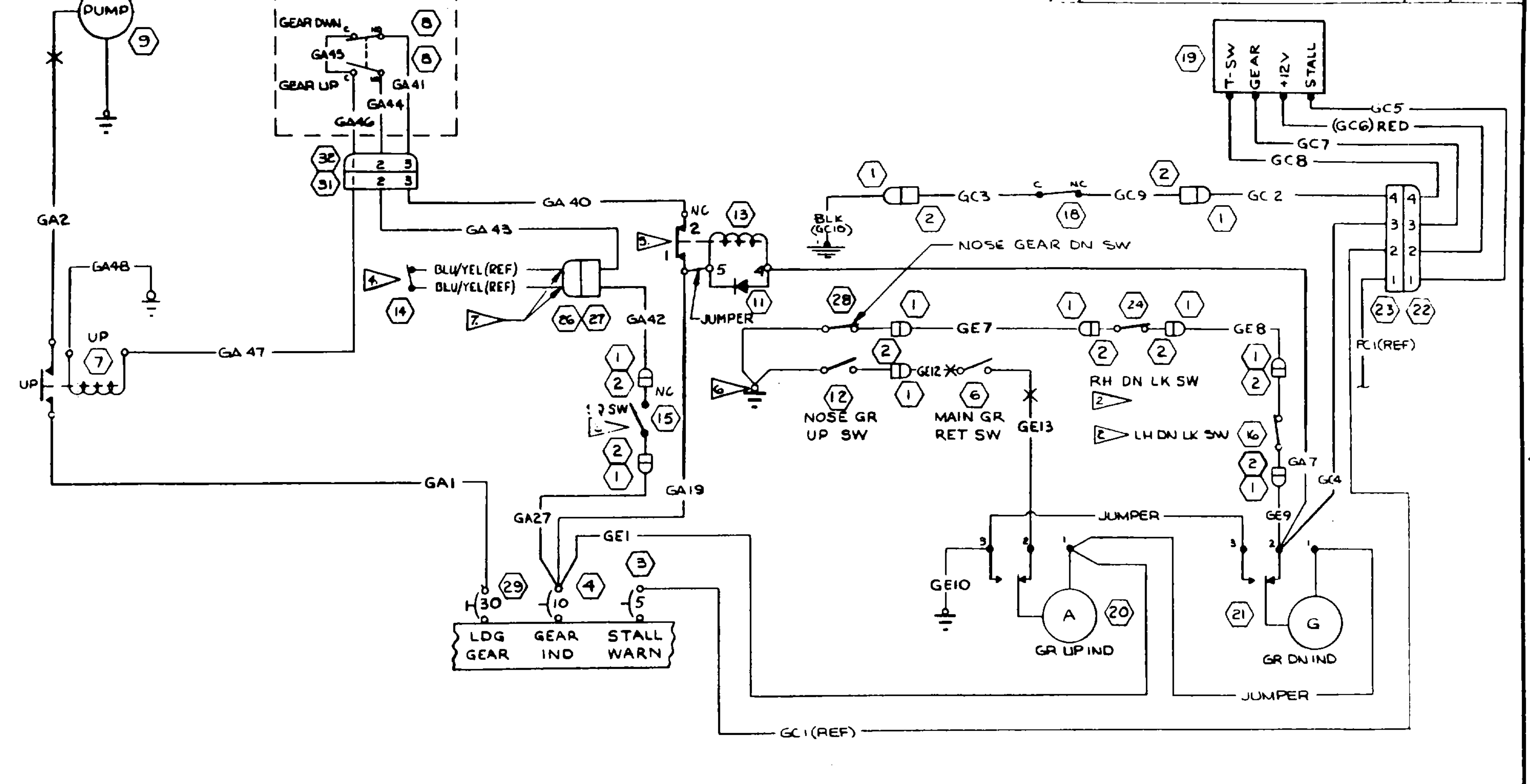
TITLE
WIRING DIAGRAM — GEAR WARNING SYSTEM

| SIZE | CODE IDENT NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE 177RG PAGE 15.2.6

(SR7306)

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| C | SEE P 15.2.6 FOR REVISION | | |




DO NOT SCALE PRINT
BREAK ALL SHARP EDGES
A/R = AS REQD
CES-XXXX = CESSNA SPEC. NO.
S-XXX OR CMXXXX = CESSNA STD. NO.
S = APPROX EQUAL SPACES
CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
DECIMALS .00 ±.03 .000 ±.010 | ANGLES MACH ±0 30' FORMED ±2°
FOR HOLES, CSNKS, ETC., SEE CES 1012
FOR BASIC CODES SEE NAS 523

SUPERSEDES: P.15.2.5
SUPERSEDED BY:

CONTRACT NO:

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | V Wise | 5-14-73 |
| DRAWN | M. MORIARTY | 5-8-73 |
| CHECK | Z. HOUNGER | 5-10-73 |
| STRESS | | 5-15-73 |
| PROJECT | | 5-15-73 |
| APPD | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

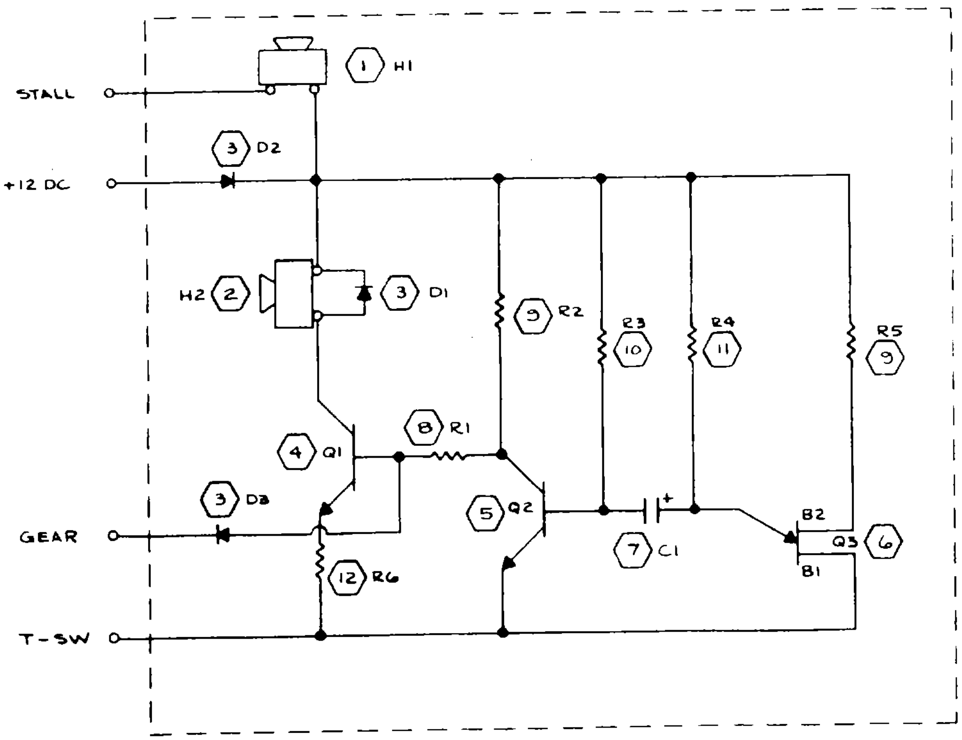
TITLE
WIRING DIAGRAM - GEAR WARNING SYSTEM

SIZE C | CODE IDENT. NO. 71379 | 2070001

SCALE: NONE | 177RG | PAGE: 15.2.7

(SR 7306) IX

| REVISION | | | |
|---|---|---|---|
| LET | DESCRIPTION | DATE | APPD |
| A | BY REV: 15K WAS 33K. 390Ω WAS 1K OHM. ADD NOTE 1. (THRU SR6888) IX | 3-2-71 GLW | | 




Inactive
177RG0152 & ON AND F177RG0021 & ON

NOTES:

1. THE MJE 3055 MUST BE SELECTED TO HAVE A GAIN (B) OF 50 OR BETTER.

| ITEM NO | PART NO. | DESCRIPTION | VENDOR |
|---|---|---|---|
| 12 | 2.7 OHM | RESISTOR 1/2 W | 44655 |
| 11 | 4.3K OHM | RESISTOR 1/2 W | |
| 10 | 15K OHM | RESISTOR 1/2 W | |
| 9 | 470 OHM | RESISTOR 1/2 W | |
| 8 | 390 OHM | RESISTOR 1/2 W | 44655 |
| 7 | K27C10K | CAPACITOR (27MFd 10WV DC) | 31433 |
| 6 | 2N 2646 | JCT DIODE | 24446 |
| 5 | 2N 3568 | TRANSISTOR | 24446 |
| 4 (1) | MJE 3055 | TRANSISTOR | 04713 |
| 3 | 1N 2077 | DIODE | 04713 |
| 2 | S2077-1 | HORN | |
| 1 | S2077-2 | HORN | |

EQUIPMENT TABLE

CES-1000 IS APPLICABLE
VENDOR CODES PER S-1400
CES-XXXX=CESSNA SPEC. NO.
S-XXX OR CMXXXX=CESSNA STD. NO

SUPERSEDES:

SUPERSEDED BY
PAGE 15.3.1

| WIRE CODE NO | GA | MATERIAL | LG | TERMINALS | SERIALS |
|---|---|---|---|---|---|

WIRE TABLE

CONTRACT NO

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| GROUP | H. Wise | 8-21-70 |
| DRAWN | BURKHART | 8-24-70 |
| CHECK | L.K. WHITE | 8-25-70 |
| STRESS | | |
| PROJ | | |
| APPD | R YOUNGERS | 6-25-70 |
| OTHER | | |

Cessna AIRCRAFT CO. COMMERCIAL AIRCRAFT DIV 5800 E PAWNEE WICHITA KANSAS

TITLE

WIRING DIAGRAM — DUAL WARNING HORN UNIT (P/N 2070005-1)

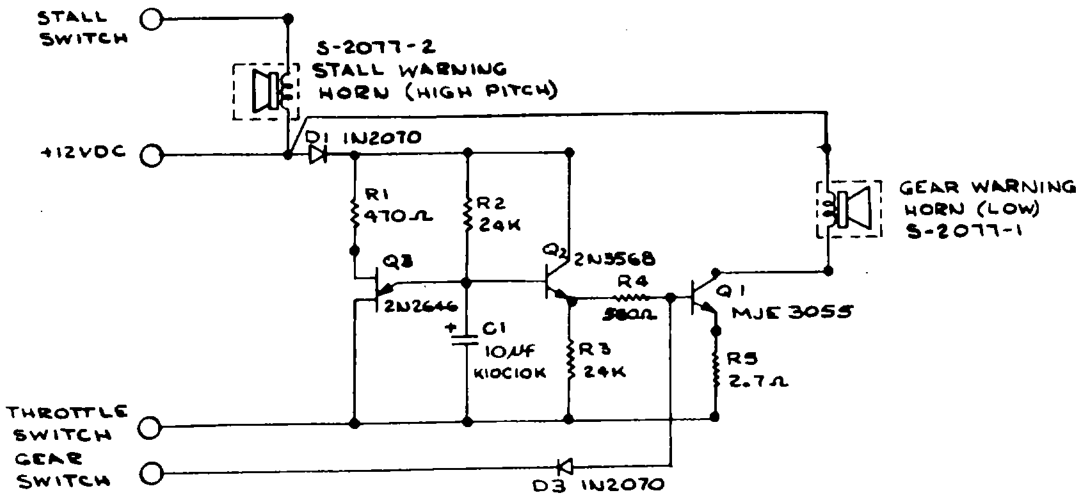
| SIZE | CODE IDENT. NO | DWG NO |
|---|---|---|
| C | 71379 | 2070001 |

SCALE NONE | 177 RG | PAGE 15.3.0

(SR 6349) I EDRR 10990A

FORM NO 80 2158

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| A | BY REV: DELETE D2 & CALLOUT SHOW GEAR WARN HORN CONNECTED BETWEEN +12VDC & Q.1 SR6888 | 5-5-71 | VRS |




| CONTRACT NO. | | |
|---|---|---|
| | NAME | DATE |
| DESIGN | VR SIPES | 12/23/70 |
| GROUP | H Weil | 3-2-71 |
| DRAWN | VR SIPES | 2/24/71 |
| CHECK | L.K. WHITE | 2-24-71 |
| STRESS | | |
| PROJECT | | 3-3-71 |
| APPD | | |
| SUPESEDES PG 15.3.0 | | |

Cessna AIRCRAFT CO.
COMMERCIAL AIRCRAFT DIV.
5800 E. PAWNEE
WICHITA, KANSAS

TITLE
SCHEMATIC DIAGRAM-
DUAL WARNING UNIT
12 VDC

| SIZE | CODE IDENT. NO. | DWG NO. |
|---|---|---|
| C | 71379 | 2070001 |
| SCALE: NONE | 177RG | PAGE: 15.3.1 |

(SR6888) IX

FORM NO. 80-216