Cessna

STATIONAIR SERIES, SKYWAGON 206 SERIES, AND SUPER SKYLANE SERIES 1969 THRU 1976

SERVICE MANUAL

CHANGE NOTICE

THIS REPRINT OF BASIC SERVICE MANUAL D2007-13 DATED 15 OCTOBER 1972 INCORPORATES CHANGE 1, DATED 15 OCTOBER 1973, CHANGE 2, DATED 1 SEPTEMBER 1974 AND CHANGE 3, DATED 1 OCTOBER 1975.

D2007-13-RAND-500-2/76

15 OCTOBER 1972

CHANGED 1 OCTOBER 1975

LIST OF EFFECTIVE PAGES

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Dates of issue for original and changed pages are:

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5-7	2
*5-8	3
*5-8A	3
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6-4	2
*6-5	3
6-6	1
6-7	0
*6-8	3
7-1	1
7-2	0
*7-3	3
7-4 thru 7-6	1
7-7 thru 7-8	0
7-9	2
*7-10 thru 7-12	3
*7-12A	3
*7-12B Blank	3
7-13	2
*7-14	3
*8-1	3
8-2 thru 8-7	2
*8-8 thru 8-9	3
*8-10 Blank	3
9-1 thru 9-2	1
9-2A thru 9-2B	1
9-3 thru 9-4	1
*9-4A	3
*9-4B Blank	3
9-5	1
*9-6	3
9-7 thru 9-12	1
9-12A	1
*9-12B	3
9-13	1
*9-14 thru 9-15	3
*9-16 Blank	3
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10-2	0
10-3	1
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*10-5	3
10-6	0
10-7	1
10-8	0
10-9	1
10-10 Blank	1
11-1 thru 11-4	2
*12-1 thru 12-4	3
12-5	1
12-6	0
12-7	1
12-8 thru 12-10	2
*12-11	3
12-12 thru 12-13	1
12-14 thru 12-15	0
12-16 thru 12-17	2
12-18	1
12-19 thru 12-20	0
*12-21	3
12-22	1
12-23	0
12-24	1
*12-25	3
12-26 thru 12-27	0
12-28	2
12-29	1
12-30	0
12-31 thru 12-34	1
*12-35	3
12-36	1
*12A-1	3
12A-2	1
12A-3	2
12A-4 thru 12A-8	0
12A-8A	1
12A-8B Blank	1
12A-9	1
12A-10 thru 12A-13	0
*12A-14 thru 12A-15	3
12A-16	0
12A-17 thru 12A-18	1
12A-19	0
*12A-20	3
12A-21	1
12A-22 thru 12A-27	0
12A-28	1
*12A-29	3
12A-30 thru 12A-31	0
12A-32 Blank	0
*13-1	3
13-2	2
13-3	0
13-4	2
13-5 thru 13-8	0
*13-9	3
13-10 thru 13-11	Deleted
13-12	1
13-13 thru 13-14	2
13-15	1
13-16 thru 13-17	0
*13-18 thru 13-20	3
14-1 thru 14-2	1
14-3	0
14-4	1
14-5	0
14-6	1
14-7	0
14-8 thru 14-10	1
15-1	0
*15-2	3
*15-2A	3
*15-2B Blank	3
15-3	0
*15-4 thru 15-5	3
15-6 thru 15-12	0
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16-2	2
16-3	1
16-4	0
16-5	1
16-6	0
*16-7	3
16-8	1
16-9	0
16-10	1
*16-11 thru 16-12	3
*16-12A thru 16-12B	3
16-13 thru 16-14	1
16-14A	1
16-14B Blank	1
16-15 thru 16-17	0
16-18	1
16-18A	1
16-18B Blank	1
16-19 thru 16-20	1
16-21 thru 16-22	0
16-23 thru 16-24	1
*17-1 thru 17-2	3
17-3 thru 17-6	1
*17-6A	3
17-6B	1
17-7 thru 17-11	1
17-12	0
17-13	1
17-14 thru 17-16	0
17-17	1
17-18	2
17-19	1
*17-20 thru 17-24	3
*17-24A	3
*17-24B Blank	3
17-25 thru 17-26	0
*17-27 thru 17-28	3
17-29	0
17-30 thru 17-32	1
17-33 thru 17-34	0
17-35	1
17-36	0
17-37 thru 17-38	2
17-39	0
17-40 thru 17-42	2
17-42A	2
17-42B Blank	2
17-43	1
17-44 thru 17-45	0
*17-46 thru 17-52	3
17-53	2
17-54 Blank	2
18-1	1
18-2 thru 18-5	2
18-6	0
*18-7	3
18-8 thru 18-28	0
*18-29	3
18-30	0
18-31	2
18-32 Blank	2
*19-1 thru 19-2	3
*20-1 thru 20-3	3
20-4 thru 20-5	0
*20-6	3
20-7 thru 20-10	1
*20-11 thru 20-12	3
*20-12A	3
*20-12B Blank	3
20-13	1
*20-14	3
20-15 thru 20-16	1
*20-17	3
20-18 thru 20-19	1
*20-20	3
20-21 thru 20-25	1
20-26	2
20-26A	2
20-26B Blank	2
20-27 thru 20-28	1
*20-29	3
20-30 thru 20-32	1
*20-33 thru 20-36	3
20-37 thru 20-42	1
20-43	2
*20-44	3
20-44A	2
20-44B Blank	2
20-45 thru 20-47	1
*20-48 thru 20-51	3
20-52 thru 20-53	1
*20-54	3
20-55 thru 20-56	1
*20-57	3
20-58 thru 20-59	1
*20-60 thru 20-61	3
20-62 thru 20-63	1
*20-64	3
20-65 thru 20-68	1
20-69 thru 20-70	2
*20-70A thru 20-70E	3
*20-71 thru 20-73	3
20-74 thru 20-76	1
*20-77	3
20-78	1
*20-79	3
20-80	1
*20-81 thru 20-82	3
20-83	1
20-84 thru 20-86	2
20-86A	2
20-86B Blank	2
20-87 thru 20-88	1
*20-89	3
20-90	1
*20-91	3
20-92	1
*20-93	3
20-94	2
*20-94A	3
*20-94B Blank	3
20-95 thru 20-99	1
*20-100 thru 20-101	3
20-102 thru 20-103	1
*20-104	3
20-105 thru 20-106	1
20-107	3
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20-113 thru 20-115	1
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* 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 the various aircraft, model numbers will be used in this publication unless names are required to differentiate between versions of the same basic model. The following table provides a cross reference listing popular name vs. model number.

POPULAR NAME	MODEL YEAR	MODEL	SERIALS BEGINNING	SERIALS ENDING
SKYWAGON 206 TURBO SKYWAGON 206	1969	U206D TU206D	U206-1235	U206-1444
SUPER SKYLANE TURBO-SYSTEM SUPER SKYLANE	1969	P206D TP206D	P206-0520	P206-0603
SKYWAGON 206 TURBO SKYWAGON 206	1970	U206E TU206E	U20601445	U20601587
SUPER SKYLANE TURBO SUPER SKYLANE	1970	P206E	P20600604	P20600647
STATIONAIR TURBO STATIONAIR	1971	U206E	U20601588	U20601700
STATIONAIR TURBO STATIONAIR	1972	U206F	U20601701	U20601874
STATIONAIR TURBO STATIONAIR	1973	U206F	U20601875	U20602199
STATIONAIR TURBO STATIONAIR	1974	U206F	U20602200	U20602579
STATIONAIR STATIONAIR II TURBO STATIONAIR TURBO STATIONAIR II	1975	U206F	U20602580	U20603020
STATIONAIR STATIONAIR II TURBO STATIONAIR TURBO STATIONAIR II	1976	U206F	U20603021	

FOREWORD

This manual contains factory recommended procedures and instructions for ground handling, servicing and maintaining Cessna Stationair, Skywagon and Super Skylane 206-Series aircraft. Also included are the turbocharged versions of these aircraft.

In addition to this book serving as a reference for the experienced mechanic, it also covers step-by-step procedures for the less experienced man. This manual should be kept in a handy place for ready reference. If properly used, it will better enable the mechanic to maintain Cessna 206 Series aircraft and thereby establish a reputation for reliable service.

The information in this book is based on data available at the time for 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 is 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 systems are described in separate manuals, available from the Cessna Service Parts Center.

SECTION 1

GENERAL DESCRIPTION

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1-1. GENERAL DESCRIPTION.

1-2. SKYWAGON AND TURBO SKYWAGON 206-SERIES.

1-3. DESCRIPTION. Cessna Skywagon and Turbo Skywagon 206-Series aircraft, described in this manual, are single-engine, high-wing, strut-braced monoplanes of all-metal, semimonocoque construction. These aircraft are equipped with a fixed tricycle landing gear employing spring-steel main landing gear struts and a steerable nose gear with an air/hydraulic fluid shock strut. Wing flaps are electrically-actuated. Both the Skywagon and Turbo Skywagon 206-Series aircraft are equipped with large double cargo doors on the right side of the fuselage and an entrance door on the left side of the cabin. The pilot's seat only is standard, but provisions are made for the addition of optional seats to make a six-place aircraft. Skywagon and Turbo Skywagon 206-Series aircraft are powered by a six-cylinder, horizontally opposed, air-cooled, fuel-injection Continental engine, driving an all-metal, constant speed propeller. In addition, Turbo Skywagon 206-Series aircraft engines are turbocharged.

1-4. SUPER SKYLANE AND TURBO SUPER SKYLANE 206-SERIES.

1-5. DESCRIPTION. Cessna Super Skylane and Turbo Super Skylane 206-Series aircraft, described in this manual, are single-engine, high-wing, strut-braced monoplanes of all-metal, semimonocoque construction. These aircraft are equipped with a fixed tricycle landing gear employing spring-steel main landing gear struts and a steerable nose gear with an air/hydraulic fluid shock strut. Wing flaps are electrically-actuated. Both the Super Skylane and the Turbo Super Skylane 206-Series aircraft are equipped with an entrance door on each side of the cabin, and a baggage door on the left side of the fuselage. The seating arrangement of these aircraft consists of six individual seats. Super Skylane and Turbo Super Skylane 206-Series aircraft are powered by a six-cylinder, horizontally opposed, air-cooled, fuel-injection Continental engine, driving an all-metal constant speed propeller. In addition, Turbo Super Skylane 206-Series engines are turbocharged.

1-6. STATIONAIR AND TURBO STATIONAIR-SERIES.

1-7. DESCRIPTION. Cessna Stationair and Turbo-Stationair-Series aircraft, described in this manual, are single-engine, high-wing, strut-braced monoplanes of all-metal, semimonocoque construction. These aircraft are equipped with a fixed tricycle landing gear employing spring-steel main landing gear struts and a steerable nose gear with an air/hydraulic fluid shock strut. Wing flaps are electrically-actuated. Both the Stationair and Turbo Stationair-Series aircraft are equipped with large double cargo doors on the right side of the fuselage and an entrance door on the left side of the cabin. The seating arrangement of these aircraft consists of six individual seats. Stationair and Turbo Stationair-Series aircraft are powered by a six-cylinder, horizontally opposed, air-cooled, fuel-injection Continental engine, driving an all-metal, constant speed propeller. In addition, Turbo Stationair engines are turbocharged.

1-8. 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.

1-9. STATIONS. A station diagram is shown in figure 1-2 to assist in locating equipment when a written description is inadequate or impractical.

1-10. 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.

MODEL P206 AND TP206 SERIES

GROSS WEIGHT	3600 lb
FUEL CAPACITY	
Standard Wing (Total)	65 gal.
Standard Wing (Usable)	63 gal.
Long-Range Wing (Total)	84 gal.
Long-Range Wing (Usable)	80 gal.
OIL CAPACITY	
(Without External Filter)	12 qt
(With External Filter)	13 qt
ENGINE MODEL	
P206 (Refer to Section 12 for Engine Data)	CONTINENTAL IO-520 SERIES
TP206 (Refer to Section 12A for Engine Data)	CONTINENTAL TSIO-520 SERIES
PROPELLER	
Standard (Two Blades)	82" McCAULEY
Optional (Three Blades)	80" McCAULEY
MAIN WHEEL TIRES (Standard)	6.00 x 6, 6-ply rating
Pressure	42 psi
MAIN WHEEL TIRES (Optional)	8.00 x 6, 6-ply rating
Pressure	35 psi
NOSE WHEEL TIRE (Standard)	5.00 x 5, 6-ply rating
Pressure	49 psi
NOSE WHEEL TIRE (Optional)	6.00 x 6, 6-ply rating
Pressure	29 psi
NOSE GEAR STRUT PRESSURE (Strut Extended)	80 psi
WHEEL ALIGNMENT	
Camber	4° ± 1° 30'
Toe-In	0" to .06"
AILERON TRAVEL	
Up	21° ± 2°
Down	14° 30' ± 2°
WING FLAP TRAVEL (Electrically-Operated)	0° to 40°, + 1° -2°
RUDDER TRAVEL (Measured parallel to water line)	
Right	24° ± 1°
Left	24° ± 1°
RUDDER TRAVEL (Measured perpendicular to hinge line)	
Right	27° 13' ± 1°
Left	27° 13' ± 1°
ELEVATOR TRAVEL	
Up	21° ± 1°
Down	17° ± 1°
ELEVATOR TRIM TAB TRAVEL	
Up	25°, +1° -0°
Down	5°, +1° -0°
PRINCIPAL DIMENSIONS	
Wing Span (Conventional Wing Tip)	36' 7"
Wing Span (Conical-Camber Wing Tip)	35' 10"
Tail Span	13'
Length	28' 3"
Fin Height (Maximum with Nose Gear Depressed and Flashing Beacon Installed on Fin)	9' 7-1/2"
Track Width	8' 1-3/4"
BATTERY LOCATION	Left Side of Firewall

Figure 1-1. Aircraft Specifications (Sheet 1 of 2)

MODEL U206 AND TU206 SERIES

GROSS WEIGHT	3600 lb	
FUEL CAPACITY		
Standard Wing (Total)	65 gal.	When not modified by Cessna Single-Engine Service Letter SE75-7 and prior to U20602127
Standard Wing (Usable)	63 gal.	
Long-Range Wing (Total)	84 gal.	
Long-Range Wing (Usable)	80 gal.	
Standard Wing (Total)	61 gal.	When modified by Cessna Single-Engine Service Letter SE75-7 and beginning with U20602127
Standard Wing (Usable)	59 gal.	
Long-Range Wing (Total)	80 gal.	
Long-Range Wing (Usable)	76 gal.	
OIL CAPACITY		
(Without External Filter)	12 qt	
(With External Filter)	13 qt	
ENGINE MODEL		
U206 (Refer to Section 12 for Engine Data)	CONTINENTAL IO-520 SERIES	
TU206 (Refer to Section 12A for Engine Data)	CONTINENTAL TSIO-520 SERIES	
PROPELLER		
Standard (Two Blades)	82" McCAULEY	
Optional (Three Blades)	80" McCAULEY	
MAIN WHEEL TIRES (Standard)	6.00 x 6, 6-ply rating	
Pressure	42 psi	
MAIN WHEEL TIRES (Optional)	8.00 x 6, 6-ply rating	
Pressure	35 psi	
NOSE WHEEL TIRE (Standard)	5.00 x 5, 6-ply rating	
Pressure	49 psi	
NOSE WHEEL TIRE (Optional)	6.00 x 6, 6-ply rating	
Pressure	29 psi	
NOSE GEAR STRUT PRESSURE (Strut Extended)	80 psi	
WHEEL ALIGNMENT		
Camber	4° ± 1° 30'	
Toe-In	0" to .06"	
AILERON TRAVEL		
Up	21° ± 2°	
Down	14° 30' ± 2°	
WING FLAP TRAVEL (Electrically-Operated)	0° to 40°, +1° -2°	
RUDDER TRAVEL (Measured parallel to water line)		
Right	24° ± 1°	
Left	24° ± 1°	
RUDDER TRAVEL (Measured perpendicular to hingeline)		
Right	27° 13' ± 1°	
Left	27° 13' ± 1°	
ELEVATOR TRAVEL		
Up	21° ± 1°	
Down	17° ± 1°	
ELEVATOR TRIM TAB TRAVEL		
Up	25° +1 -0°	
Down	5° +1 -0°	
PRINCIPAL DIMENSIONS		
Wing Span (Conventional Wing Tip)	36' 7"	(Add 2" for strobe lights)
Wing Span (Conical-Camber Wing Tip)	35' 10"	
Tail Span	13'	
Length	28'	
Fin Height (Maximum with Nose Gear Depressed and Flashing Beacon Installed on Fin)	9' 7-1/2"	
Track Width	8' 1-3/4"	
BATTERY LOCATION (12V)	Left side of firewall	
(24V) (Thru 1973)	Below engine in nose wheel tunnel	
(24V) (Beginning with 1974)	Left side of firewall	

Figure 1-1. Aircraft Specifications (Sheet 2 of 2)

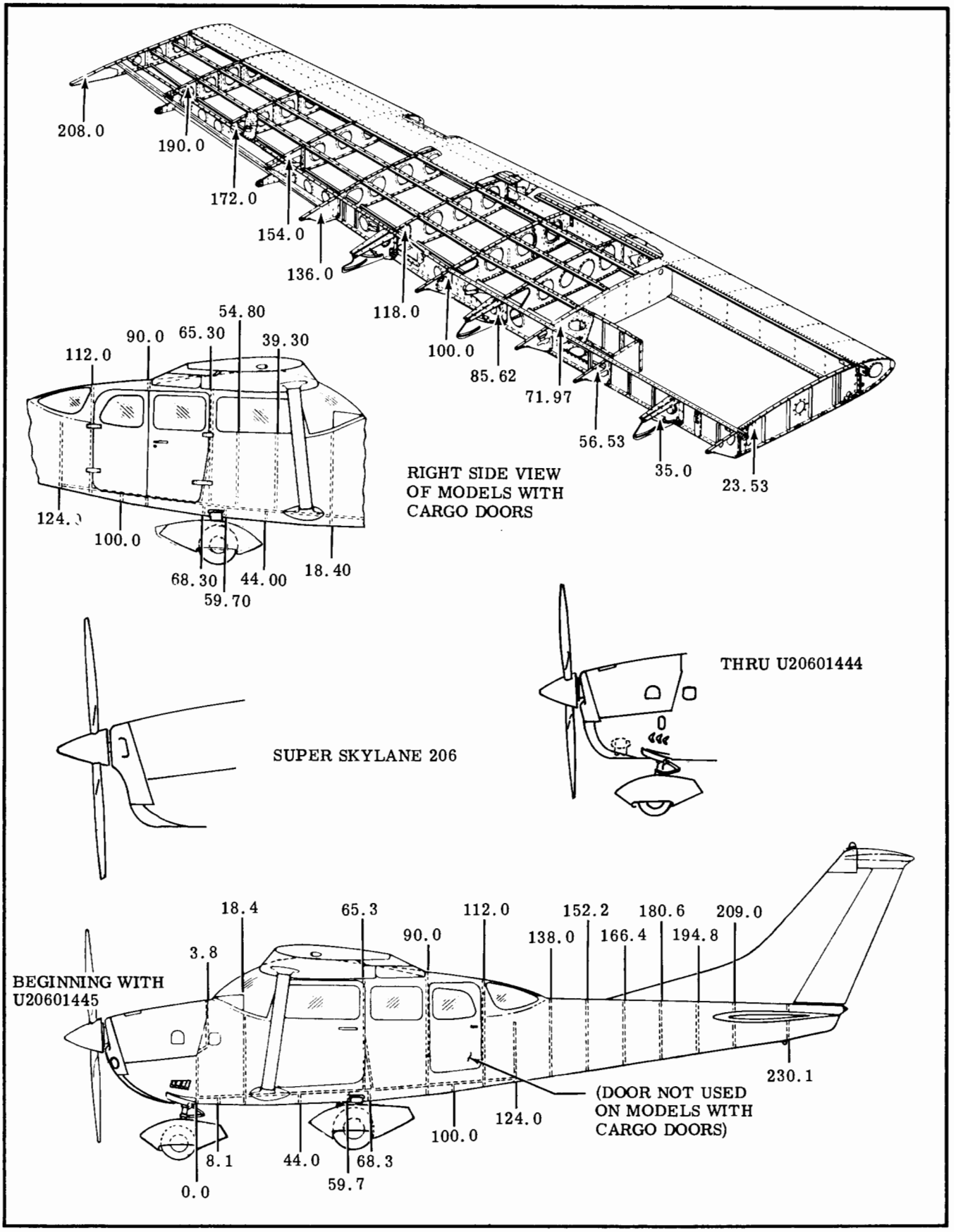

Figure 1-2. Wing and Fuselage Reference Stations

RECOMMENDED NUT TORQUES

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

TAP SIZE	TENSION TORQUE		SHEAR TORQUE	
	STD (NOTE 1)	ALT (NOTE 2)	STD (NOTE 3)	ALT (NOTE 2)
FINE THREAD SERIES				
8-36	12-15		7-9	
10-32	20-25	20-28	12-15	12-19
1/4-28	50-70	50-75	30-40	30-48
5/16-24	100-140	100-150	60-85	60-106
3/8-24	160-190	160-260	95-110	95-170
7/16-20	450-500	450-560	270-300	270-390
1/2-20	480-690	480-730	290-410	290-500
9/16-18	800-1000	800-1070	480-600	480-750
5/8-18	1100-1300	1100-1600	660-780	660-1060
3/4-16	2300-2500	2300-3350	1300-1500	1300-2200
7/8-14	2500-3000	2500-4650	1500-1800	1500-2900
1-14	3700-5500	3700-6650	2200-3300	2200-4400
1-1/8-12	5000-7000	5000-10000	3000-4200	3000-6300
1-1/4-12	9000-11000	9000-16700	5400-6600	5400-10000
COARSE THREAD SERIES				
	(NOTE 4)		(NOTE 5)	
8-32	12-15		7-9	
10-24	20-25		12-15	
1/4-20	40-50		25-30	
5/16-18	80-90		48-55	
3/8-16	160-185		95-100	
7/16-14	235-255		140-155	
1/2-13	400-480		240-290	
9/16-12	500-700		300-420	
5/8-11	700-900		420-540	
3/4-10	1150-1600		700-950	
7/8-9	2200-3000		1300-1800	
1-8	3700-5000		2200-3000	
1-1/8-8	5500-6500		3300-4000	
1-1/4-8	6500-8000		4000-5000	

NOTES

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

CAUTION

DO NOT REUSE SELF-LOCKING NUTS.

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

Figure 1-3. 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 wing struts and landing gear struts as push points. A tow bar attached to the nose gear should be used for steering and maneuvering the aircraft. When no tow bar is available, press down at the horizontal stabilizer front spar, adjacent to the fuselage, to raise the nose wheel off the ground. With the nose wheel clear of the ground, the aircraft can be turned by pivoting it about the main wheels.

CAUTION

When towing the aircraft, never turn the nose wheel more than 35 degrees either side of center or the nose gear will be damaged. Do not push on control surfaces or outboard empennage surfaces. When pushing on the tailcone, always apply pressure at a bulkhead to avoid buckling the skin.

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

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

CAUTION

When using the universal jack point, 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. Jacking both wheels simultaneously with universal jack points is not recommended.

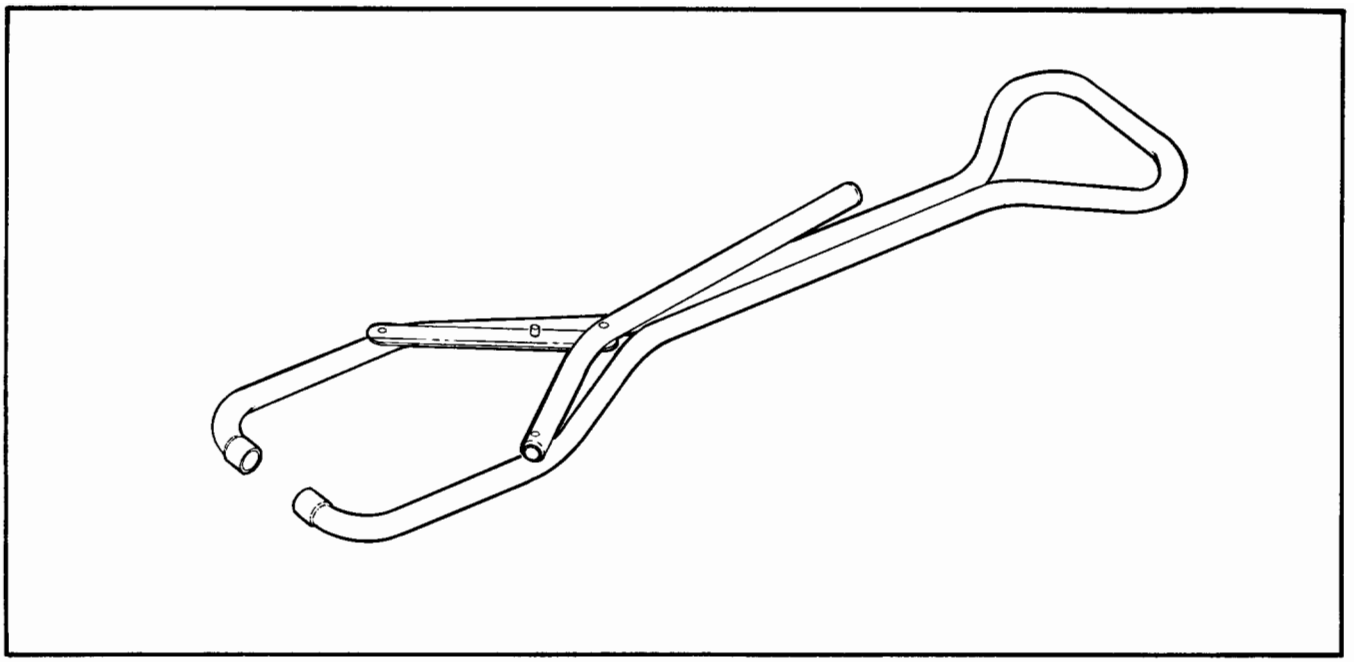


Figure 2-1. Typical Tow Bar

2-5. PARKING. Parking precautions depend principally on local conditions. As a general precaution, it is wise to set the parking brake or chock the wheels, and install the control lock. In severe weather, and high wind conditions, tie down the aircraft as outlined in paragraph 2-6 if a hangar is not available.

2-6. TIE-DOWN. When mooring the aircraft in the open, head into the wind if possible. Secure control surfaces with the internal control lock and set brakes.

CAUTION

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

a. Tie ropes, cables or chains to the wing tie-down fittings, located at the upper end of each wing strut. Secure the opposite ends of ropes, cables or chains to ground anchors.

b. Secure a tie-down rope (no chains or cables) to upper trunnion of the nose gear, and secure opposite end of rope to ground anchor.

c. Secure the middle of a rope to the tail tie-down ring. Pull each end of rope away at a 45-degree angle and secure to ground anchors at each side of tail.

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

e. These aircraft are equipped with a spring-loaded steering bungee which affords protection against normal wind gusts. However, if extremely high wind gusts are anticipated, additional locks may be installed.

2-7. 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.

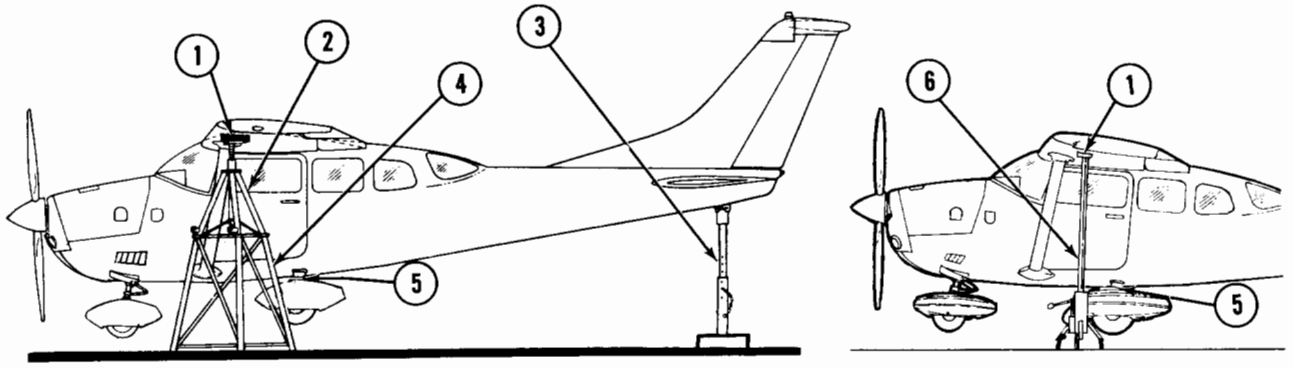
NOTE

The aircraft is delivered from Cessna with a Corrosion Preventive Aircraft Engine Oil (Military Specification 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 engine oil should be used for the first 25 hours of engine operation. Refer to paragraph 2-20 for oil changes during the first 50 hours of operation.

During the 30 day non-operational storage or the first 25 hours of intermittent engine operation, the propeller shall be rotated through five revolutions every seventh day, without running the engine. If the aircraft is stored outside, tie it down in accordance with paragraph 2-6. In addition, the pitot tube, static 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.

2-8. RETURNING AIRCRAFT TO SERVICE. After flyable storage, returning the aircraft to service is accomplished by performing a thorough pre-flight inspection. At the end of the first 25 hours of engine operation, drain engine oil, clean oil screens and change external oil filter element. Service engine with correct grade and quantity of oil. Refer to figure 2-4 and paragraph 2-20 for correct grade of engine oil.

2-9. TEMPORARY STORAGE. Temporary storage is defined as aircraft in a non-operational status for



ITEM NUMBER	TYPE AND PART NUMBER	REMARKS
(1)	Block (Jack point not available)	1x4x4 padded with 1/4" rubber
(2)	Jack	Any short jack of capable capacity
(3)	Cessna #SE-767	Universal tail stand (SEE NOTE 1)
(4)	Cessna #SE-576 (41-1/2" high)	Universal jack stand (FOR USE WITH ITEM 2)
(5)	Cessna #10004-98	Jack point (SEE NOTE 2)
(6)	#2-170 Basic jack #2-109 Leg Extension #2-70 Slide tube extension	Closed height: 69-1/2 inches; extended height: 92" Insert slide tube extension into basic jack)

1. Weighted adjustable stand attaches to tie-down ring.
2. Cessna #10004-98 jack point may be used to raise only one wheel thru U20602579. Brake line fairing will prevent jacking aircraft beginning with U20602580 at strut. Do not use brake casting as a jack point.
3. Items (3), (4), (5) and (6) are available from the Cessna Service Parts Center.

JACKING PROCEDURE

a. Lower aircraft tail so that wing jack can be placed under front spar just outboard of wing strut.
b. Raise aircraft tail and attach tail stand to tie-down ring. BE SURE the tail stand weighs enough to keep the tail down under all conditions and is strong enough to support aircraft weight.
c. Raise jacks evenly until desired height is reached.

When using the universal jack point, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must be lowered for a second operation. Jacking both main wheels simultaneously with universal jack points is not recommended.

Figure 2-2. Jacking Details

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

NOTE

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

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

NOTE

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

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

NOTE

The preservative oil must be Lubricating Oil - Contact and Volatile, Corrosion Inhibited, MIL-L-46002, Grade 1 or equivalent. The following oils are approved for spraying operations by Teledyne Continental Motors, Nucle Oil 105 - Daubert Chemical Co., 4700 So. Central Ave., Chicago, Illinois, Petratect VA - Pennsylvania Refining Co., Butler, Pennsylvania, Ferro-Gard 1009G - Ranco Laboratories, Inc., 3617 Brownsville Rd., Pittsburg, Pennsylvania.

h. Using a portable pressure sprayer, atomize 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 2-6. In addition, the pitot tube, static source vents, air vents, openings in the engine cowling and other similar openings should have protective covers installed to prevent entry of foreign material.
o. Attach a warning placard to the propeller to the effect that the propeller shall not be moved while the engine is in storage.

2-10. 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, again perform the procedural steps "g thru o" of paragraph 2-9.

2-11. RETURNING AIRCRAFT TO SERVICE. After temporary storage, use the following procedures to return the aircraft to service.
a. Remove aircraft from blocks and check tires for proper inflation. Check for proper nose gear strut inflation.
b. Check battery and install.
c. Check that oil sump has proper grade and quantity of engine oil.
d. Service induction air filter and remove warning placard from propeller.
e. Remove materials used to cover openings.
f. Remove, clean, and gap spark plugs.
g. While spark plugs are removed, rotate propeller several revolutions to clear excess rust preventive oil from cylinders.
h. Install spark plugs and torque to value specified in Section 12 or 12A.
i. Check fuel strainer. Remove and clean filter screen if necessary. Check fuel tanks and fuel lines

for moisture and sediment, drain enough fuel to eliminate moisture and sediment.

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

2-12. 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 2-13 are performed at the intervals specified.

a. Operate engine until oil temperature reaches normal operating range. Drain engine oil sump and close drain valve or 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.

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. Continental Motors Corporation recommends Cosmoline No. 1223, supplied by E. F. Houghton & Co., 305 W. LeHigh Avenue, Philadelphia, Pa. During all spraying operations corrosion 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.

d. After flight and with engine operating at 1200 to 1500 rpm and induction air filter removed, spray corrosion preventive mixture into induction airbox, at the rate of one-half gallon per minute, until heavy smoke comes from the exhaust stack, then increase the spray until engine is stopped.

CAUTION

Injecting corrosion-preventive mixture too fast can cause a hydrostatic lock.

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 interior surfaces of cylinders.

g. Install spark plugs or solid plugs in the lower spark plug holes and install dehydrator plugs in the upper spark plug holes. Be sure that dehydrator plugs are blue in color when installed.

h. Cover spark plug lead terminals with shipping plugs (AN4060-1) or other suitable covers.

i. With throttle in full open position, place a bag of desiccant in the induction air intake and seal opening with moisture resistant paper and tape.

j. Place a bag of desiccant in the exhausts tailpipe (s) and seal openings with moisture resistant tape.

k. Seal cold air inlet to the heater muff with moisture resistant tape.

l. Seal engine breather tube by inserting a protex plug in the breather and clamping in place.

m. Seal all other engine openings exposed to atmosphere using suitable plugs or non-hygroscopic tape.

NOTE

Attach a red streamer to each place plugs or tape is installed. Either attach red streamers outside of the sealed area with tape or to the inside of the sealed area with safety wire to prevent wicking of moisture into the sealed area.

n. Drain corrosion-preventive mixture from engine sump and reinstall drain plug or close drain valve.

NOTE

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

o. Attach a warning placard on the throttle control knob to the effect that the engine contains no lubricating oil. Placard the propeller to the effect that it should not be moved while the engine is in storage.

o. Prepare airframe for storage as outlined in paragraph 2-9 thru step "f."

NOTE

As an alternate method of indefinite storage, the aircraft may be serviced in accordance with paragraph 2-9 providing the aircraft is run-up at maximum intervals of 90 days and then reserviced per paragraph 2-9.

2-13. INSPECTION DURING STORAGE. Aircraft in an 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 desiccant material in the engine shall be replaced with new material.

d. Every 6 months respray the cylinders interior 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.

2-14. RETURNING AIRCRAFT TO SERVICE. After indefinite storage, use the following procedure to return the aircraft to service.

a. Remove aircraft from blocks and check tires for correct inflation. Check for correct nose gear strut inflation.

b. Check battery and install.

c. Remove all materials used to seal and cover openings.

d. Remove warning placards posted at throttle and

propeller.

e. Remove and clean engine oil screen, then reinstall and safety. On aircraft equipped with an external oil filter, install new filter element.

f. Remove oil sump drain plug or open drain valve and drain sump. Install or close drain valve and safety.

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.

g. Service and install the induction air filter.

h. Remove protex plugs and spark plugs or plugs installed in spark plug holes and rotate propeller by hand several revolutions to clear corrosion-preventive mixture from the cylinders.

i. Clean, gap and install spark plugs. Torque plugs to value specified in Section 12 or 12A.

j. Check fuel strainer. Remove and clean filter screen. Check fuel tanks and fuel lines for moisture and sediment, and drain enough fuel to eliminate.

k. Perform a thorough pre-flight inspection, then start and warm-up engine.

l. Thoroughly clean aircraft and flight test aircraft.

2-15. LEVELING. Reference point for leveling the aircraft longitudinally is the top centerline of the tailcone between the rear window and vertical fin. Corresponding points on front seat rails may be used to level the aircraft laterally.

2-16. SERVICING.

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

2-18. FUEL. Fuel cells should be filled immediately after flight to lessen condensation in the cells and lines. Cell capacities are listed in figure 1-1. The recommended fuel grade to be used is given in figure 2-4.

2-19. FUEL DRAINS. Drains are located at various places throughout the fuel system. Refer to Section 13 for locations of the various drains in the system. The strainer drain valve is an integral part of the fuel strainer assembly. The strainer drain is equipped with a control which is located adjacent to the oil dipstick. Access to the control is gained through the oil dipstick access door. Remove drain plugs and open drain valves at the intervals specified in figure 2-4. Also, during daily inspection of the fuel strainer, if water is found in the strainer, there is a possibility that the wing cell sumps or fuel lines contain water. Therefore, all fuel plugs should be removed and all water drained from the fuel system. On aircraft equipped with rubberized fuel cells, a fuel sampler cup is furnished. To activate drain valve for fuel sampling, place cup to valve and depress valve with rod protruding from cup. (Refer to figure 13-5.)

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. Ashless dispersant oil, conforming to Continental Motors Specification No. MHS-24A, shall be used in these engines. 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. 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 conforming to Specification MIL-6082. After the first 25 hours of operation, drain engine oil sump and clean both the oil suction strainer and the oil pressure screen. If an optional oil filter is installed, change filter element at this time. Refill sump with straight mineral oil and use until a total of 50 hours have accumulated or oil consumption has stabilized, then change to ashless dispersant 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. To drain the 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 oil has drained, close quick-drain valve, if installed, and remove hose. Install and safety drain plug.

e. Remove and clean oil screen.

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

NOTE

Refer to inspection charts for intervals for changing oil and filter elements. Refer to figure 2-4 for correct grade of engine oil, and refer to figure 1-1 for correct capacities.

2-21. ENGINE INDUCTION AIR FILTER. The induction air filter keeps dust and dirt from entering the induction system. The value of maintaining the air filter in a good clean condition can never be overstressed. More engine wear is caused through the use of a dirty or damaged air filter than is generally believed. The frequency with which the filter should be removed, inspected and cleaned will be determined primarily by aircraft operating conditions. A good general rule, however, is to remove, inspect and clean the filter at least every 50 hours of engine operating time, and more frequently if warranted by operating conditions. Some operators prefer to hold spare induction air filters at their home base of operation so that a clean filter is always readily available for use. Under extremely dusty conditions, daily servicing of the filter is recommended. To service the induction filter, proceed as follows:

a. Remove filter from aircraft.

NOTE

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

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

CAUTION

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

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

NOTE

The filter assembly may be cleaned with compressed air a maximum of 30 times or it may be washed a maximum of 20 times. A new filter should be installed after using 500 hours of engine operating time or one year, whichever should occur first. However, a new filter should be installed anytime 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 induction system. Any filter that appears doubtful, shall have a new filter installed in its place.

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

NOTE

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

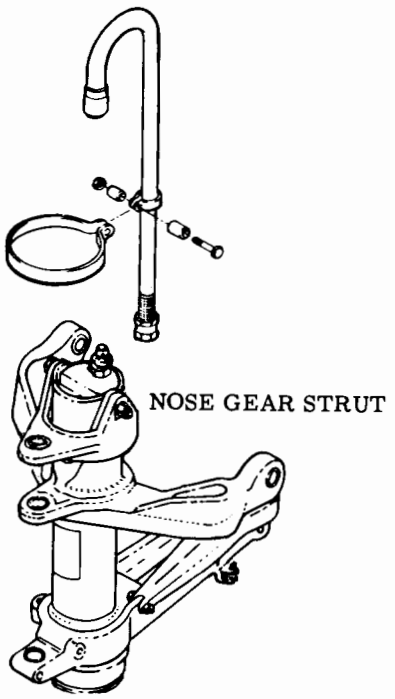
e. Be sure airbox is clean, and inspect filter. If filter is damaged, a new filter should be installed.

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

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 hours of operating time for damage. Change the central air filter element when damaged or at 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 even with the horizontal baffle plate or split ring at the bottom of the filler holes, checking cable connections, and neutralizing and cleaning off any spilled electrolyte or corrosion. Use bicarbonate of soda (baking soda) and clean water to neutralize electrolyte or corrosion. Follow with a thorough flushing with clean water. Do not allow bicarbonate of soda to enter battery. Brighten cable and terminal connection with a wire brush, then coat with petroleum jelly before connecting. Check the battery every 50 hours (or at least every 30 days), oftener in hot weather. Add only distilled water, not acid or "rejuvenators," to maintain electrolyte level in the battery. Inspect the battery box and clean and remove any evidence of corrosion.

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



NOTE

Valve core remains in strut valve. An internal flexible cable, in the valve extension, is used to depress the valve core in strut valve.

Figure 2-3. Strut Filler Valve Extension

NOTE

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

2-25. NOSE GEAR STRUT. The nose gear strut requires periodic checking to ascertain that the strut is filled with hydraulic fluid and is inflated to the correct air pressure. To fill the nose gear strut with hydraulic fluid and air, proceed as follows:

a. Weight tail to raise nose wheel off ground.

b. Remove filler valve cap from filler valve or from lower end of valve extension, and depress valve core to completely deflate nose strut.

c. Remove valve core from filler valve. It will be necessary to disconnect filler valve extension from valve at top of strut.

d. Attach a rubber hose to the filler valve.

e. With other end of rubber hose in a container of clean hydraulic fluid, compress and extend strut several times. This will draw fluid from container into the strut, filling strut with hydraulic fluid.

f. After strut has been cycled several times, allow strut to extend. Holding end of rubber hose above fluid level in container, slowly compress strut, allowing excess fluid to be drained into container.

g. While strut is compressed, remove hose and install valve core in filler valve. Connect valve extension to valve.

h. Inflate strut to the pressure specified in figure 1-1.

NOTE

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

2-26. NOSE GEAR SHIMMY DAMPENER. The shimmy dampener should be serviced at least every 100 hours. The dampener must be filled completely with hydraulic fluid, free of entrapped air with the compensating piston bottomed in the rod. Check that piston is completely bottomed as follows:

a. Remove shimmy dampener from the aircraft.

b. While holding the shimmy dampener in a vertical position with the filler plug pointed upward, loosen the filler plug.

c. Allow the spring to bottom out the floating piston inside the shimmy dampener rod.

d. When the fluid stops flowing, insert a length of stiff wire through the air bleed hole in the setscrew at the end of the piston rod until it touches the floating piston. The depth of insertion should be 3-13/16 inches.

NOTE

If the wire insertion is less than 3-13/16 inches, the floating piston is lodged in the shaft. If the wire cannot be used to free the piston, the rod assembly and piston should be replaced.

Service the shimmy dampener as follows:

a. Remove filler plug from dampener.

b. Move piston completely to opposite end from filler plug.

c. Fill dampener with clean hydraulic fluid completely full.

d. Reinstall filler plug and safety.

e. Wash dampener in solvent and wipe dry with a cloth.

f. Reinstall shimmy dampener in aircraft.

NOTE

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

2-27. HYDRAULIC BRAKE SYSTEMS. Check brake master cylinders and refill with hydraulic fluid as required every 200 hours. Bleed the brake system of entrapped air whenever there is a spongy response to the brake pedals. Refer to Section 5 for filling and bleeding the brake systems.

2-28. OXYGEN SYSTEM. Refer to Section 15.

2-29. FACE MASKS. Refer to Section 15.

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. Cleaning prolongs the life of upholstery fabrics and interior trim. To clean the interior, proceed as follows:

a. Empty all the ash trays.

b. Brush out or vacuum clean the upholstery and carpeting to remove dirt.

c. Wipe leather and plastic surfaces with a damp cloth.

d. Soiled upholstery fabrics and carpet may be cleaned with a foam-type detergent, used according to the manufacturer's instructions.

e. Oily spots and stains may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place in the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the packing and backing material.

f. Scrape off sticky materials with a dull knife, then spot clean the area.

2-33. PLASTIC TRIM. The instrument panel, plastic trim and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a 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. These solvents will soften and craze the plastic.

2-34. WINDSHIELD AND WINDOWS. These surfaces should be cleaned carefully with plenty of fresh water and a mild detergent, using the palm of the hand to feel and dislodge any caked dirt or mud. 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 the plastic with a dry cloth as this builds up an electrostatic charge which attracts dust. Oil and grease may be removed by rubbing lightly 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. These solvents will soften and craze the plastic.

After washing, the plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner with soft cloths and rub with moderate pressure. Allow the cleaner to dry, then wipe it off with soft flannel cloths. A thin, even coat of wax, polished out by hand with soft 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 may be washed with non-alkaline grease solvents to remove oil and/or grease. Household-type detergent soap powders are effective cleaners, but should be used cautiously since some of them are strongly alkaline. Many good aluminum cleaners, polishes and waxes are available from commercial suppliers of aircraft products.

2-36. PAINTED SURFACES. The painted exterior surfaces of the aircraft, under normal conditions, require a minimum of polishing or buffing. Approximately 15 days are required for acrylic paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the aircraft. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by an experienced painter. Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Harsh or abrasive soaps or detergents which cause corrosion or make scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent. After the curing period, the aircraft may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the engine nose cap will help reduce the abrasion encountered in these areas.

2-37. ENGINE COMPARTMENT. Cleaning is essential to minimize any danger of fire, and for proper inspection of engine components. The engine and engine compartment may be washed down with a suitable solvent, such as Stoddard solvent or equivalent, then dried thoroughly.

CAUTION

Particular care should be given to electrical equipment before cleaning. Solvent should not be allowed to enter magnetos, starters, alternators, voltage regulators, and the like. Hence, these components should be protected before saturating the engine with solvent. Any oil, fuel, and air openings on the engine and accessories 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 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 minor defects. Cracked wheel halves shall be replaced.

2-40. LUBRICATION.

2-41. GENERAL DESCRIPTION. Lubrication requirements are outlined in figure 2-5. Before adding lubricant to a fitting, wipe the fitting free of dirt. Lubricate until grease appears around part being lubricated and wipe excess grease from parts. The following paragraphs supplement figure 2-5 by adding details not shown in the figure.

2-42. NOSE GEAR TORQUE LINKS. Lubricate torque links every 50 hours. When operating in dusty conditions, more frequent lubrication is recommended.

2-43. TACHOMETER DRIVE SHAFT. Refer to Section 16 for lubrication instructions.

2-44. WHEEL BEARING LUBRICATION. Clean and repack wheel bearings at the first 100-hour inspection and at each 500-hour inspection thereafter. If more than the usual number of take-off and landings are made, extensive taxiing is required or the aircraft is operated in dusty areas or under seacoast conditions, clean and lubricate wheel bearings at each 100-hour inspection.

2-45. WING FLAP ACTUATOR

a. On aircraft prior to P20600648 and U20601673 which have not been modified by Service Kit SK150-37, 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 "n".

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 a wire brush, rinse with solvent and dry 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 Serials P20600648 and U206-601673 which have been modified by Service Kit SK150-37 proceed as follows:

1. At each 100-hour inspection, expose jack screw by operating flaps to full-down position, and inspect wing flap actuator jack screw for proper lubrication. If lubrication is required, 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 U20601673, clean and lubricate wing flap actuator jack screw each 100 hours as follows:

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

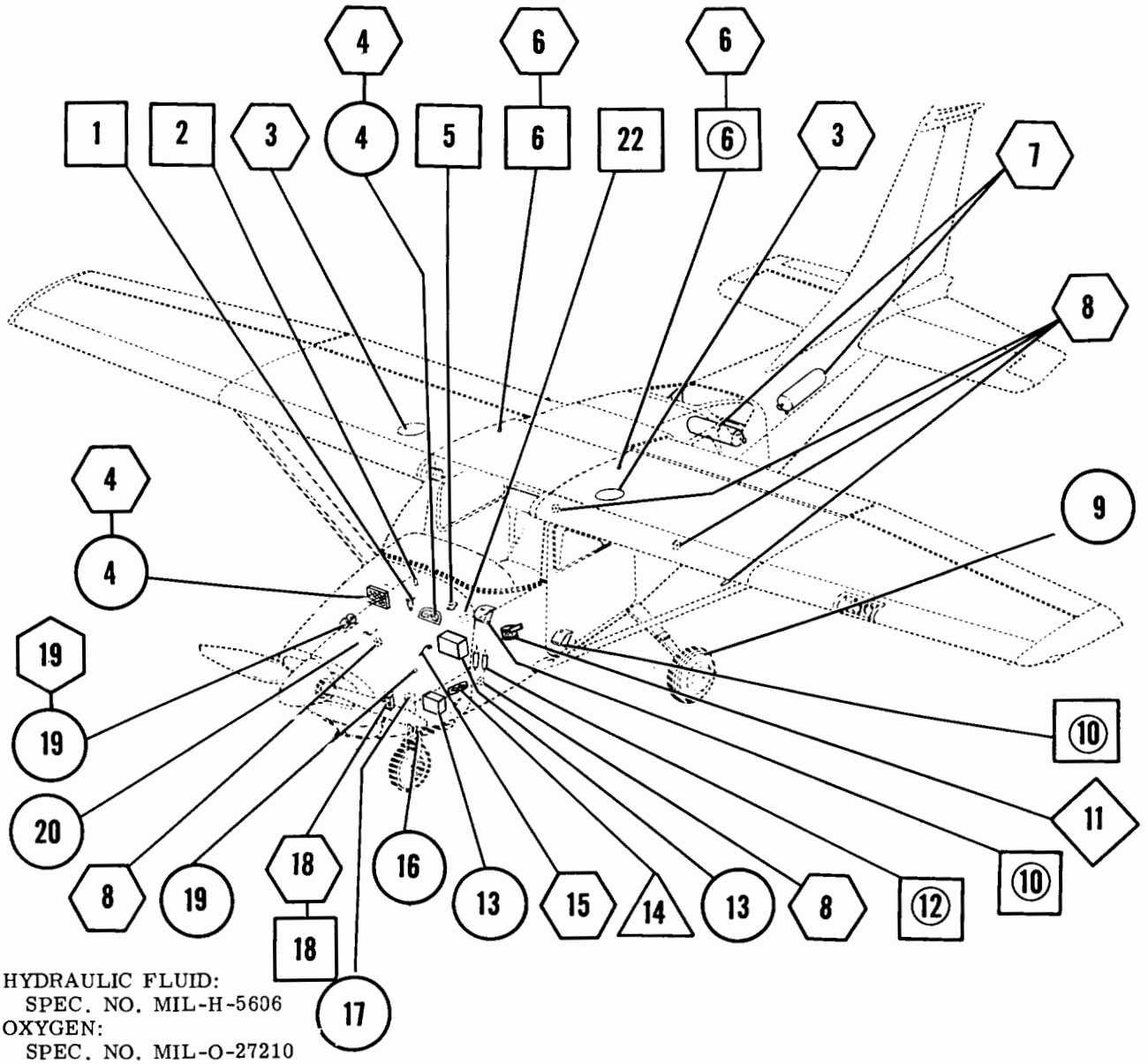
2. Clean jack screw threads with solvent rag and dry with compressed air.

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.

SHOP NOTES:



HYDRAULIC FLUID:
SPEC. NO. MIL-H-5606
OXYGEN:
SPEC. NO. MIL-O-27210

RECOMMENDED FUEL:

ENGINE MODEL IO-520 Series CONTINENTAL

FUEL: Compliance with conditions stated in Continental aircraft engine Service Bulletins M74-6 and M75-2 and supplements or revisions thereto, are recommended when using alternate fuel.

1. MINIMUM: 100/130 Aviation Grade
2. ALTERNATE:
a. 115/145 Aviation Grade (with lead content limited to a maximum of 4.6 cc Tetraethyl lead per gallon.)

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

RECOMMENDED ENGINE OIL:

ENGINE MODEL IO-520-Series CONTINENTAL

AVIATION GRADE:

40°F	SAE 50
40°F	SAE 30

Aviation grade ashless dispersant oil, conforming to Continental Motors Specification MHS-24 and all revisions and supplements thereto, must be used except as noted in paragraph 2-20. Refer to Continental aircraft Engine Service Bulletin M75-2 and any superseding bulletins, revisions or supplements thereto, for further recommendations.


DAILY

3 FUEL CELLS:
Service after each flight. Keep full to retard condensation. Refer to paragraph 2-18 for details.

6 FUEL CELL SUMP DRAINS:
Drain off any water and sediment before first flight of the day.

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

15 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.

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

7 OXYGEN CYLINDERS:
Check for anticipated requirements before each flight. Refer to Section 15 for details.

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


FIRST 25 HOURS

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


50 HOURS

4 INDUCTION AIR FILTER:
Clean per paragraph 2-21. Replace as required.

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

19 ENGINE OIL SYSTEM:
Change oil each 50 hours if engine is NOT equipped with external 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.

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

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

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

50 HOURS (Cont.)

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

20 SPARK PLUGS:
Remove, clean and re-gap all spark plugs. Refer to Section 12 or 12A.

100 HOURS

1 VACUUM SYSTEM OIL SEPARATOR:
Remove, flush with solvent, and dry with compressed air.

2 FUEL/AIR CONTROL UNIT SCREEN:
Remove and clean screen.

5 VACUUM RELIEF VALVE FILTER SCREEN:
Remove, flush with solvent and dry with compressed air.

18 FUEL STRAINER:
Disassemble and clean strainer bowl and screen.

22 ALTERNATOR SUPPORT BRACKET:
Check alternator support bracket for security and cracking.
Also refer to Service Letter SE71-42.

200 HOURS

6 FUEL CELL SUMP DRAINS:
Drain off any water or sediment.

10 FUEL RESERVOIR TANK AND/OR SELECTOR VALVE DRAINS:
Remove plugs and drain off any water and sediment. Reinstall and resafety plugs.

12 BRAKE MASTER CYLINDERS:
Check fluid level and fill as required with hydraulic fluid.

500 HOURS

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

AS REQUIRED

14 GROUND SERVICE RECEPTACLE:
Connect to 12-volt, or 24-volt if aircraft is equipped with a 24-volt battery, DC, negative-ground power unit for cold weather starting and lengthy ground maintainance of the aircraft electrical equipment with the exception of electronic equipment. Master switch should be turned on before connecting a generator type or battery type external power source.

NOTE

The ground power receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is connected correctly to the aircraft.

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

FREQUENCY (HOURS)

50 | 100 | 500 | 1000

METHOD OF APPLICATION

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

LUBRICANTS

PG	SS-G-659	POWDERED GRAPHITE
GR	MIL-G-81322A	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-8660	DC4 (DOW CORNING)
GP		NO. 10-WEIGHT, NON-DETERGENT OIL

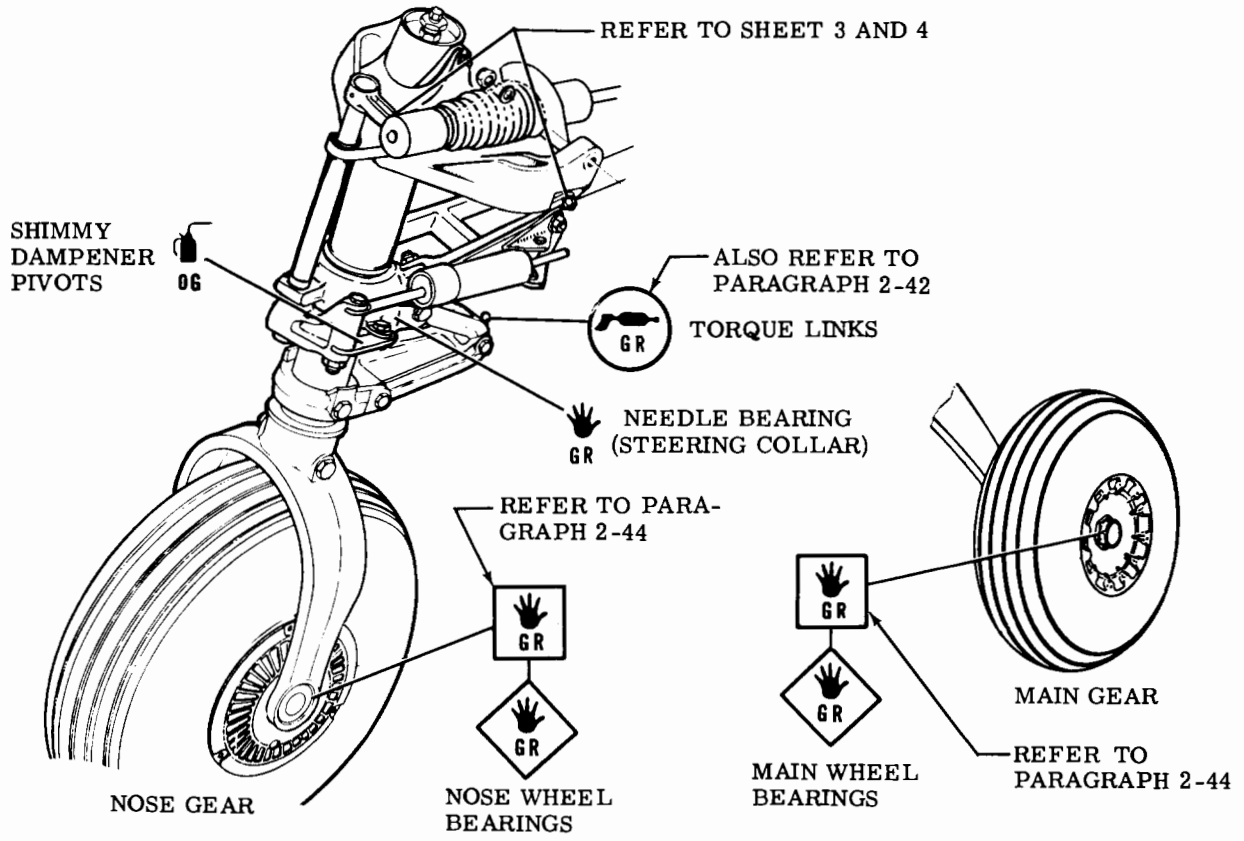


Figure 2-5. Lubrication (Sheet 1 of 4)

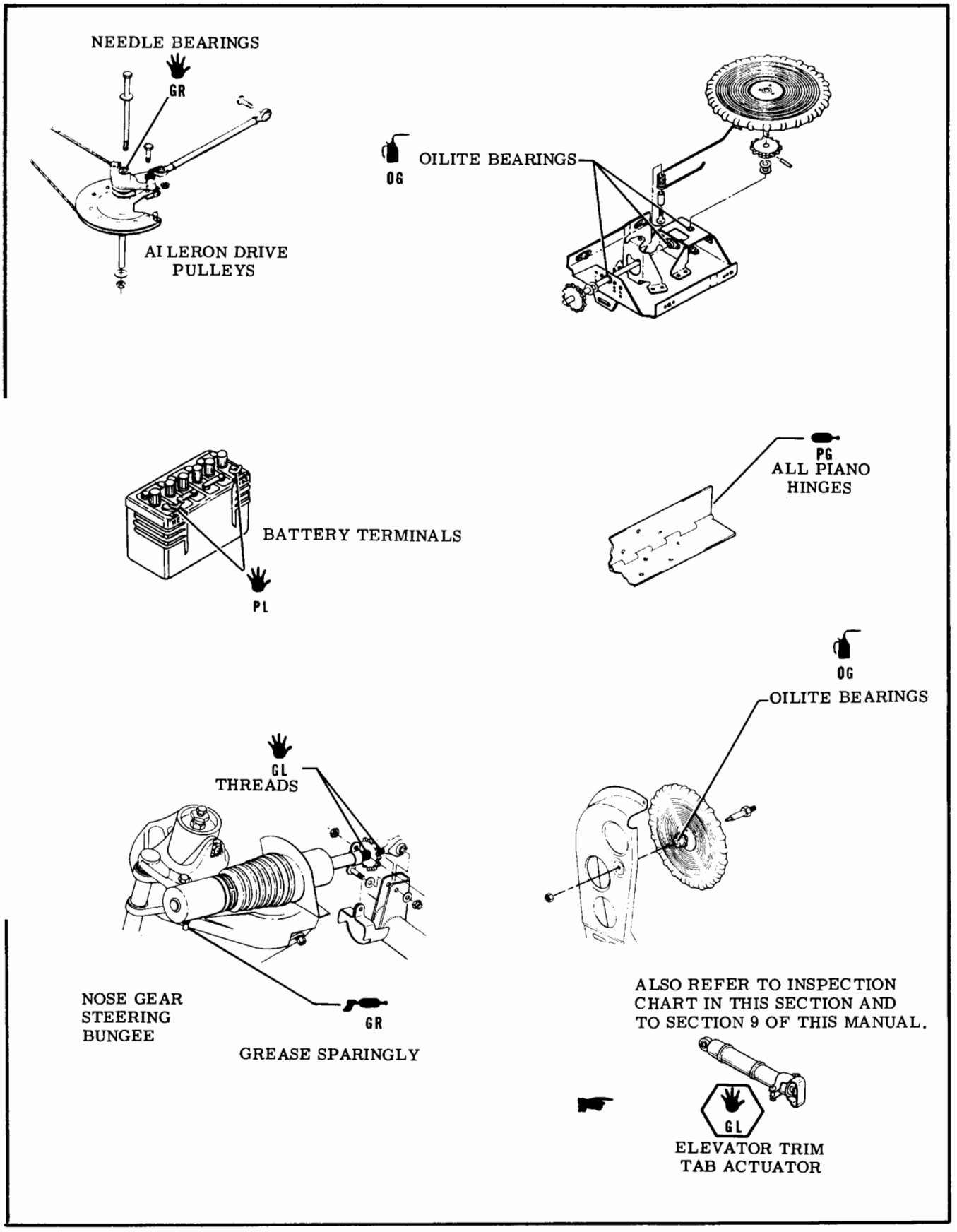


Figure 2-5. Lubrication (Sheet 2 of 4)

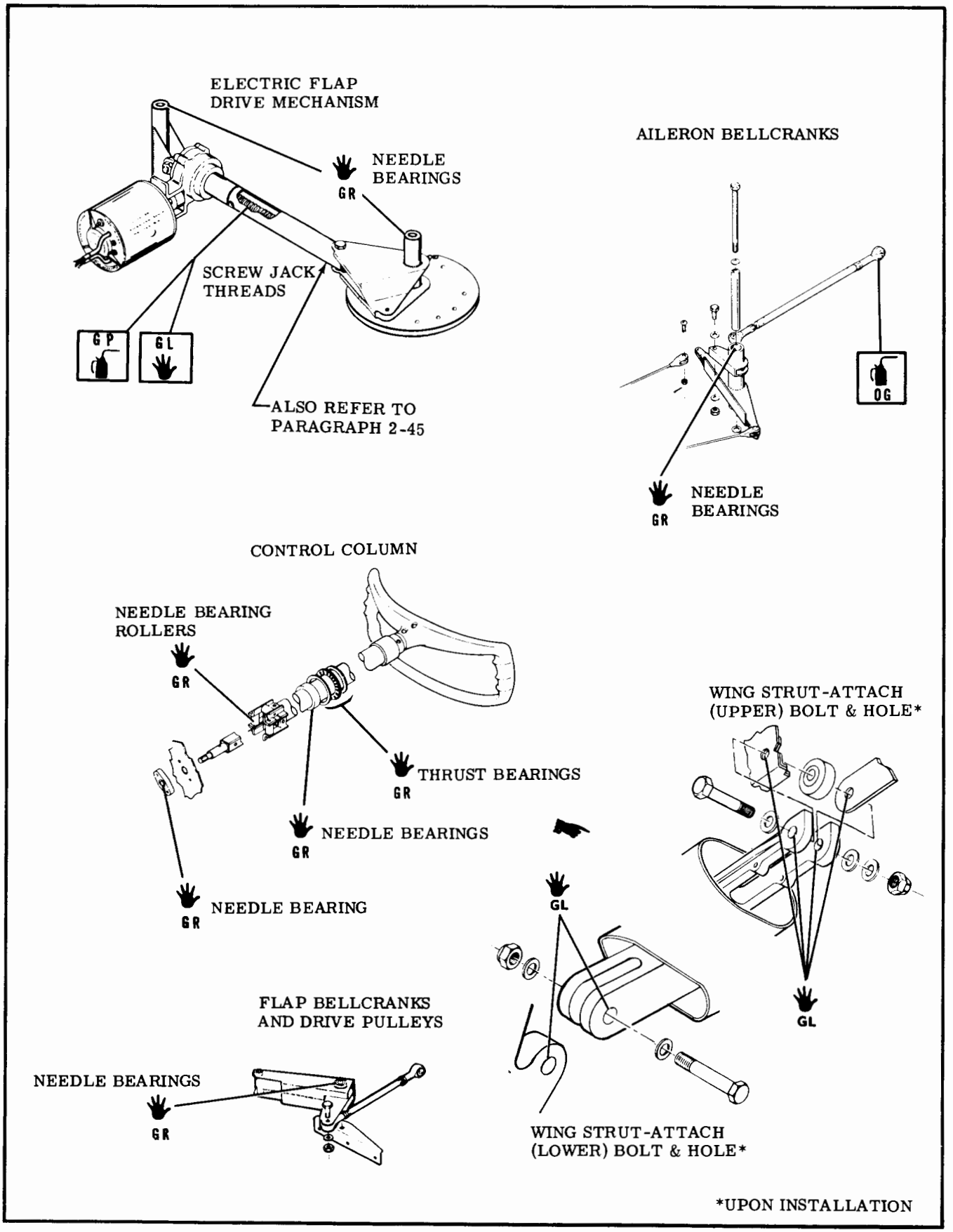
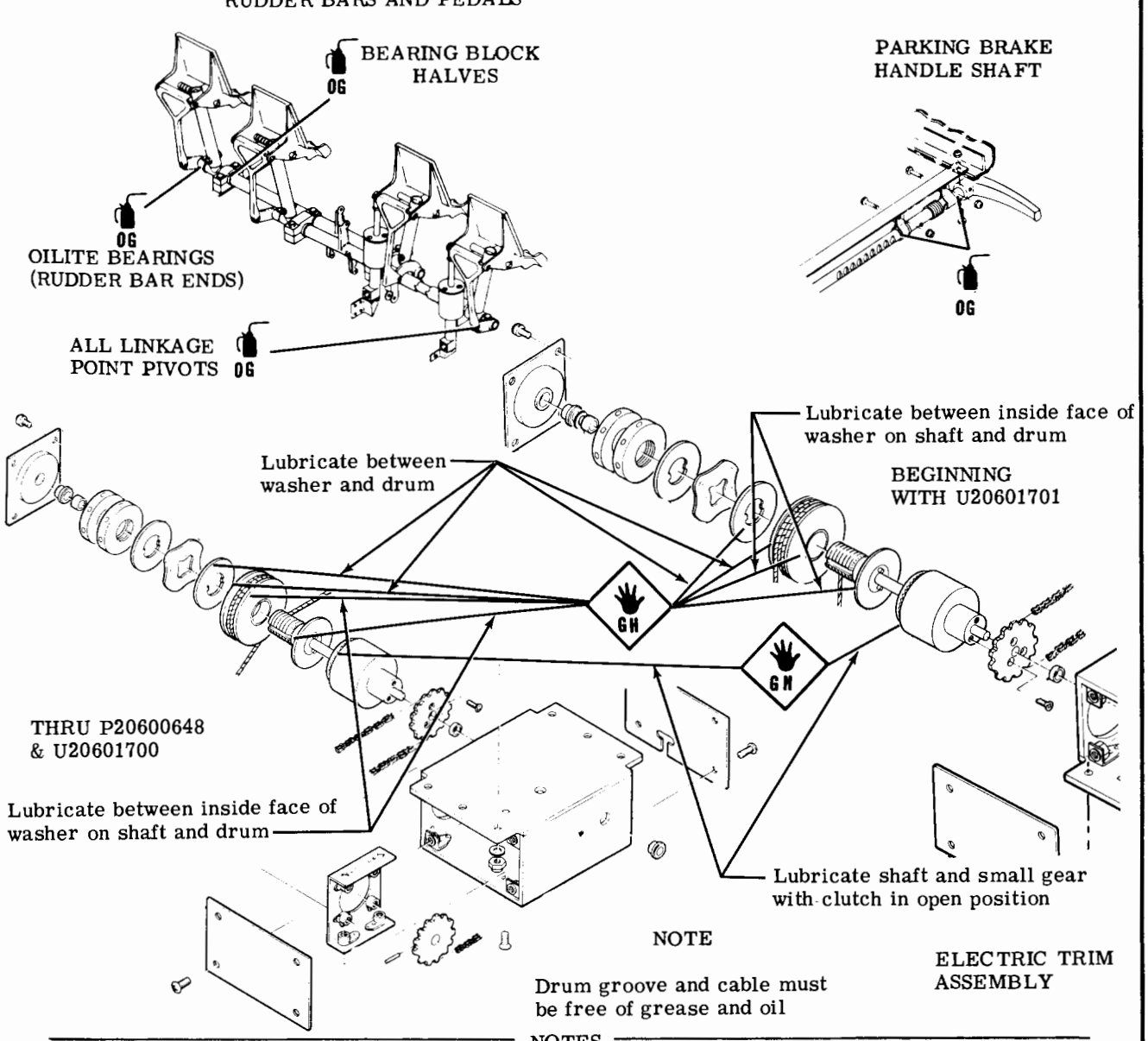


Figure 2-5. Lubrication (Sheet 3 of 4)



NOTES

Sealed bearings require no lubrication.

McCauley propellers are lubricated at overhaul and require no other lubrication.

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

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

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

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

Figure 2-5. Lubrication (Sheet 4 of 4)

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 12 or 12A of this Manual.)
3. Magneto drop. (Also refer to Section 12 or 12A 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.

	EACH 50 HOURS	EACH 100 HOURS	EACH 200 HOURS	SPECIAL INSPECTION ITEM
PROPELLER				
1. Spinner	●			
2. Spinner bulkhead			●	
3. Blades	●			
4. Bolts and Nuts			●	
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 shock mounts, mount structure and ground straps			●	

		SPECIAL INSPECTION ITEM	EACH 200 HOURS	EACH 100 HOURS	EACH 50 HOURS
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 ring	7			
25.	Voltage regulator mounting and electrical leads			●	
26.	Magnetos (externally) and electrical connections			●	
27.	Magneto timing	8			
28.	Fuel air (metering) control unit			●	
29.	Firewall				
30.	Fuel injection system				●
31.	Engine cowl flaps and controls				●
32.	Engine cowling			●	
33.	Turbocharger	9			
34.	All oil lines to turbocharger, waste gate and controller			●	
35.	Waste gate, actuator and controller			●	
36.	Turbocharger pressurized vent lines to fuel pump, discharge nozzles and fuel flow gage				●
37.	Turbocharger mounting brackets and linkage				●
38.	Alternator support bracket for security (Also refer to Service Letter SE71-42.)				●
FUEL SYSTEM.					
1.	Fuel strainer, drain valve and control, cell vents, caps and placards				●
2.	Fuel strainer screen and bowl			●	
3.	Fuel injector screen				●
4.	Fuel reservoirs				
5.	Drain fuel and check cell interior, attachment and outlet screens	5			
6.	Fuel cells and sump drains				
7.	Fuel selector valve and placards				●
8.	Auxiliary fuel pump			●	

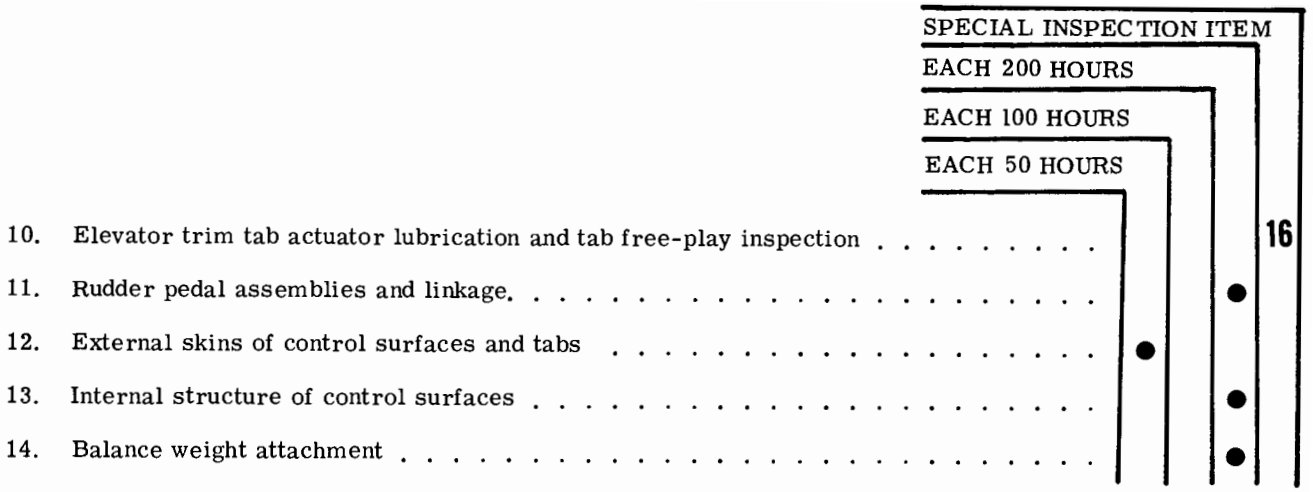
	SPECIAL INSPECTION ITEM	EACH 200 HOURS	EACH 100 HOURS	EACH 50 HOURS
9. Engine-driven fuel pump			●	
10. Fuel quantity indicators and transmitters				●
11. Vapor return line and check valve			●	
12. Turbocharger vent system			●	
13. Engine primer			●	
LANDING GEAR				
1. Brake fluid, lines and hose, linings, disc, brake assemblies and master cylinders		●		
2. Main gear wheels				●
3. Wheel bearings	10			
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 wheel				●
10. Nose gear fork		●		
11. Nose gear steering system		●		
12. Parking brake and toe brakes operational test				●
AIRFRAME				
1. Aircraft exterior				●
2. Aircraft structure		●		
3. Windows, windshield, doors and seals				●
4. Seat stops, seat rails, upholstery, structure and mounting		●		
5. Control column bearings, pulleys, cables, chains and turnbuckles		●		
6. Seat belts and shoulder harnesses				●
7. Control lock control wheel and control column mechanism		●		
8. Instruments and markings				●
9. Gyros central air filter	11	●		

		SPECIAL INSPECTION ITEM	EACH 200 HOURS	EACH 100 HOURS	EACH 50 HOURS
10.	Magnetic compass compensation	5			
11.	Instrument wiring and plumbing				●
12.	Instrument panel, shock mounts, ground straps, cover, decals and labeling				●
13.	Defrosting, heating and ventilating systems and controls				●
14.	Cabin upholstery, trim, sunvisors and ash trays				●
15.	Area beneath floor, lines, hose, wires and control cables				●
16.	Lights, switches, circuit breakers, fuses and spare fuses				●
17.	Exterior lights				●
18.	Pitot and static systems				●
19.	Stall warning unit and pitot heater				●
20.	Radios, radio controls, avionics and flight instruments				●
21.	Antennas and cables				●
22.	Battery, battery box and battery cables				●
23.	Battery Electrolyte	12			
24.	Emergency locator transmitter	13		●	
25.	Oxygen system				●
26.	Oxygen supply, masks and hose	14			●

CONTROL SYSTEMS

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

1.	Cables, terminals, pulleys, pulley brackets, cable guards, turnbuckles and fairleads				●
2.	Chains, terminals, sprockets and chain guards				●
3.	Trim control wheels, indicators, actuator and bungee				●
4.	Travel stops				●
5.	Decals and labeling				●
6.	Flap control switch, flap rollers and flap position indicator				●
7.	Flap motor, transmission, limit switches, structure, linkage, bellcranks etc.				●
8.	Flap actuator jackscrew threads	15			
9.	Elevators, trim tab, hinges and push-pull tube				●



SPECIAL INSPECTION ITEMS

1 First 25 hours: (refill with straight mineral oil and use until a total of 50 hours have accumulated or oil consumption has stabilized, then change to ashless dispersant oil. Change oil each 50 hours if engine is NOT equipped with external oil filter; if equipped with external oil filter, change oil filter element each 50 hours and oil at each 100 hours or every six months.

2 Clean filter 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 Sections 12 and 12A 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 Internal timing and magneto-to-engine timing are described in detail in Section 12.

9 Remove insulation blanket or heat shields and inspect for burnt area, bulges or cracks. Remove tailpipe and ducting; inspect turbine for coking, carbonization, oil deposits and turbine impeller for damage.

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

11 Replace each 500 hours.

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

13 Refer to Section 17 of this Manual.

14 Inspect masks, hose and fittings for condition, routing and support. Test operate and check for leaks.

15 Refer to paragraph 2-45 for detailed instructions for various serial ranges.

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

NOTE

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

NOTE

A high-time inspection is merely a 100-hour inspection with the addition of an engine overhaul. Continental Motors Corporation Inc. recommends overhaul at 1500 hours for the IO-520 series engines, except as stipulated in Contental aircraft engine Service Bulletin #M74-20 and revisions and/or supplements thereto. Recommended overhaul time for the TSIO-520 series engines is 1400 hours except as stipulated in Continental aircraft engine Service Bulletin #M74-20 and revisions and/or supplements thereto. At the time of overhaul, engine accessories should be overhauled.

Propeller overhaul shall coincide with engine overhaul, but the interval between overhauls shall not exceed 1200 hours, except as stipulated in current issues of the McCauley Accessory Divisions Service Information Summary and currently effective Service Manuals, Bulletins and Letters.

SHOP NOTES:

SECTION 3

FUSELAGE

TABLE OF CONTENTS

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 the exception of the wing root area. The wing root fairing has a heavy felt strip that 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 damaged part from aircraft. Three types of temporary repairs for cracked plastic are possible. No repairs of any kind are recommended on highly-stressed or compound curves where repair would be likely to affect pilot's field of vision. Curved areas are more difficult to repair than flat areas and any replaced area is both structurally and optically inferior to the original surface.

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

a. Wrap a piece of No. 320 (or finer) sandpaper or abrasive cloth around a rubber pad or wood block. Rub surface around scratch with a circular motion, keeping abrasive constantly wet with clean water to prevent scratching surface further. Use minimum pressure and cover an area large enough to prevent formation of "bull's-eyes" or other optical distortions.

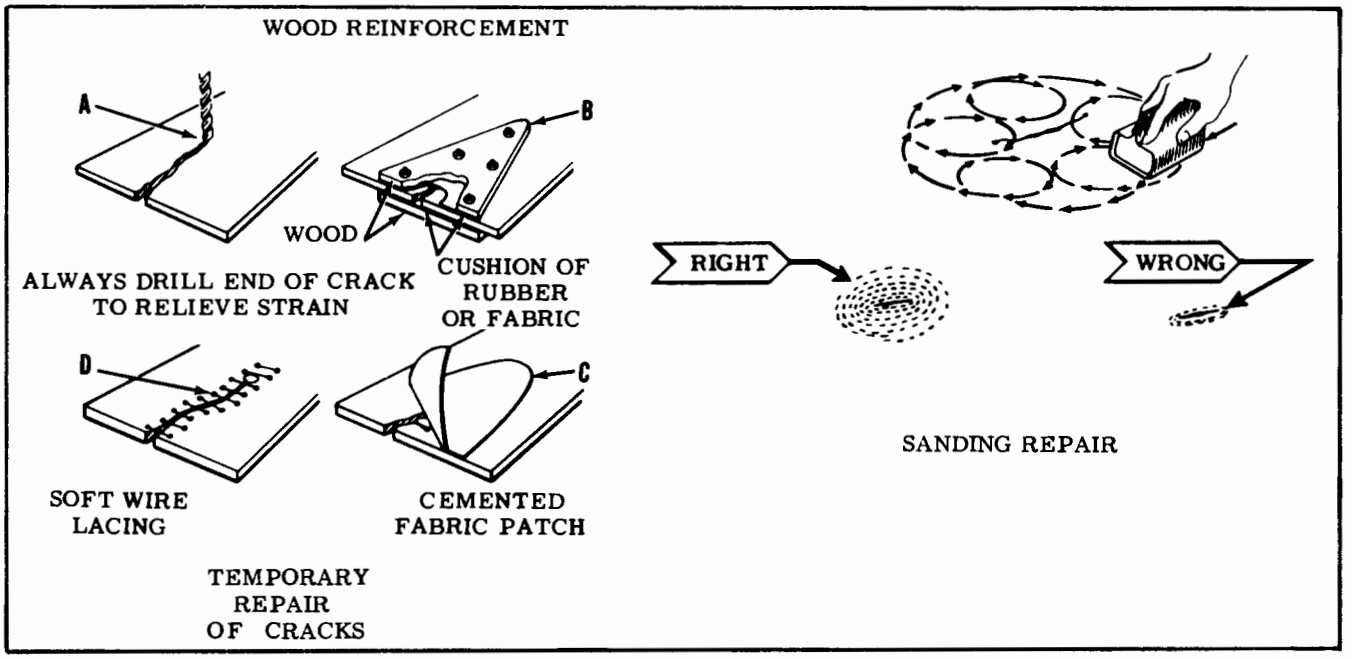


Figure 3-1. Repair of Windshield and Windows

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 scratches disappear.

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

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

NOTE

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

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

NOTE

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

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

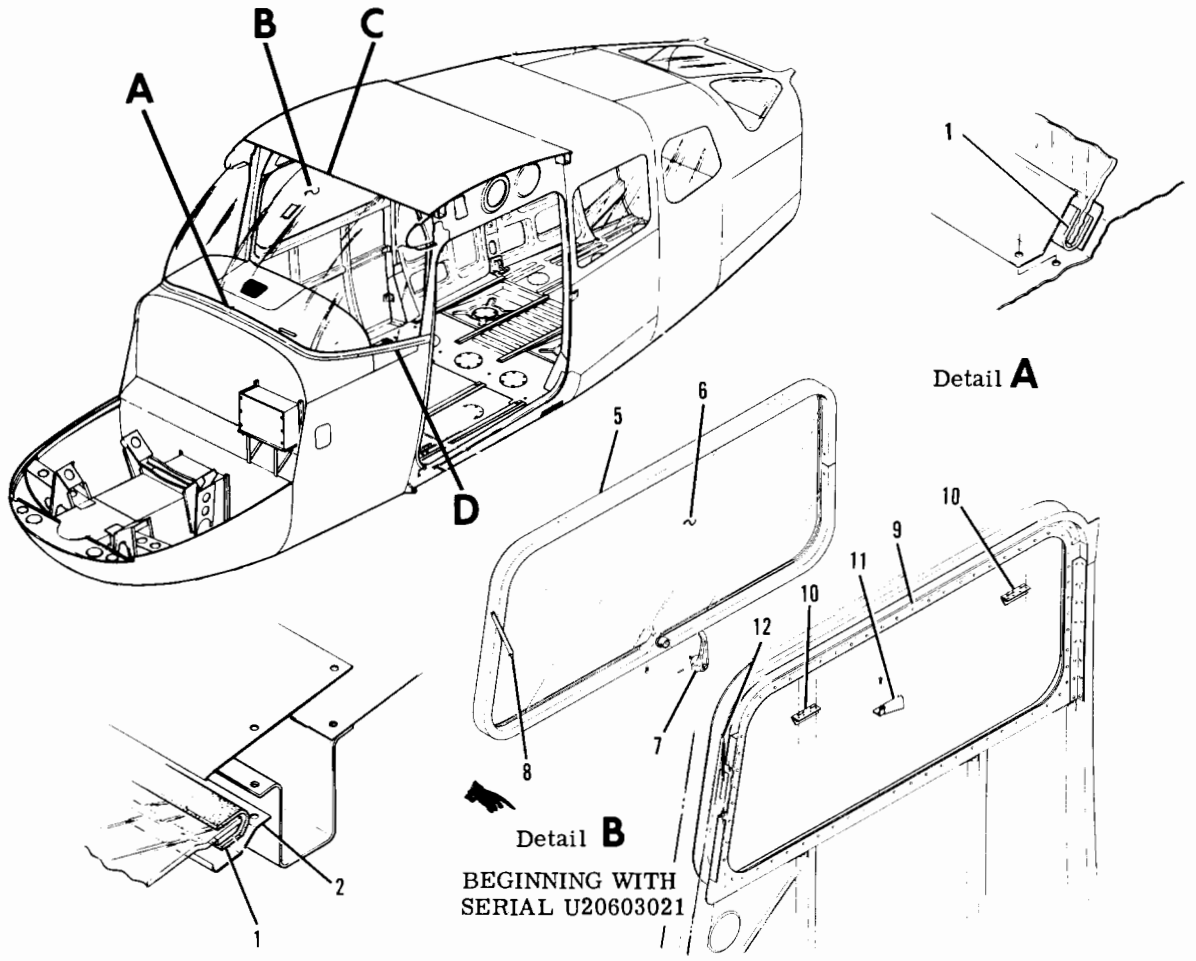
3-8. CRACKS. (Refer to figure 3-1.)

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

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

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

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



1. Felt Seal
2. Retainer
3. Window
4. Fuselage Skin
5. Window Frame
6. Window
7. Latch Assembly
8. Stop
9. Fuselage Structure
10. Hinge
11. Striker Plate
12. Spring

Typical Side Window Seals

NOTE

Presstite No. 579.6 sealer should be applied to all edges of windshield and windows where felt sealing strip (1) is used.

Figure 3-2. Windshield and Window Installation.

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

3-10. REMOVAL AND INSTALLATION.

a. Drill out rivets securing top retainer strip.
b. Remove screws securing front retainer strip.
c. Remove wing fairings over windshield edges.
d. Pull windshield straight forward, out of side retainers.
e. Reverse preceding steps for reinstallation. Apply felt strip and sealing compound to all edges of windshield to prevent leaks. Check fit and carefully file or grind away excess plastic.

3-11. WINDOWS.

3-12. MOVABLE. (Refer to figure 3-2.) A movable window hinged at the top is installed in the left cabin door thru 1975 models and beginning with 1976 models in the RH forward side window position. The window assembly is a tinted plastic and frame unit which may be replaced by removing hinge pins and disconnecting window stop. To remove plastic panel from frame, drill out blind rivets at frame splice. When replacing plastic panel, ensure an adequate coating of Presstite 579.6 sealing compound is applied to all edges of panel.

3-13. FIXED. (Refer to figure 3-2.) Fixed windows, mounted in sealing strips and sealing compound, are held in place by various retainer strips. To replace side windows, remove upholstery and trim panels as necessary and drill out rivets securing retainers.

3-14. REAR. (Refer to figure 3-2.) The curved triangular rear side windows are mounted in retaining and sealing strips. Windows are removed from inside the cabin after rivets securing strips are drilled out. Removal of the rectangular rear window requires drilling out three rows of rivets immediately forward and above the window. Remove screws securing retainer strips at each side of the window and deflect strips up and aft from skin splice above the window. Remove the window from inside the aircraft. Reverse the preceding procedure for installation. Check fit of the new window and carefully file or grind away excess plastic. Apply felt strips and sealing compond to all edges.

3-15. CABIN DOORS. (Refer to figure 3-3.)

3-16. REMOVAL AND INSTALLATION. Removal of cabin doors is accomplished by removing screws which attach hinges and door stop or by removing hinge pins attaching door and door stop. If permanent hinge pins are removed from door hinges, they may be replaced by clevis pins secured with cotter pins or new hinge pins may be installed and "spinbradded." When fitting a new door, some trimming of door skin at edges and some forming of door edges with a soft mallet may be necessary to achieve a good fit. Forming of the flanges on the bonded door is not permissible as forming of the flanges could cause damage to the bonded area.

3-17. ADJUSTMENT. Cabin doors should be adjusted so skin fairs with fuselage skin. Slots at latch plate permit repositioning of striker plate. Depth of latch engagement may be changed by adding or removing washers or shims between striker plate and doorpost.

3-18. WEATHERSTRIP. Rubber seals are installed around the edges of the cabin door. Beginning with serial U20602790 an improved type door seal is used which has a hollow center and small flutes extending along its length. When replacing door seals ensure mating surfaces are clean, dry and free of oil and grease. Position butt ends of seal at door low point and cut a small notch in the hollow seal for drainage. Apply a thin, even coat of EC-880 adhesive (3M Co) or equivalent to each surface and allow to dry until tacky before pressing into place.

3-19. WEDGE ADJUSTMENT. Wedges at upper forward edge of door aid in preventing air leaks at this point. They engage as door is closed. Several attaching holes are located in wedges and holes which gives best results should be selected.

3-20. CABIN DOOR LATCHES. (Refer to figure 3-6.)

3-21. DESCRIPTION. The cabin door latch is a push-pull bolt type, utilizing a rotary clutch for positive bolt engagement. As door is closed, teeth on underside of bolt engage gear teeth on clutch. The clutch gear rotates in one direction only and holds door until handle is moved to LOCK position, driving bolt into slot.

3-22. ADJUSTMENT. Adjustment of latch or clutch cover is afforded by oversize and/or slotted holes. This adjustment ensures sufficient gear-to-bolt engagement and proper alignment. To adjust bolt (item 2) figure 3-6, loosen the four latch base bolts (item 29) sufficient to move latch base plate aft to extend the bolt or forward to retract the bolt.

CAUTION

Close the door carefully after adjustment and check for clearance between door jamb and bolt and alignment with clutch assembly.

NOTE

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

3-23. LOCK. In addition to interior locks, a cylinder and key type lock is installed on left door. If lock is to be replaced, the new one may be modified to accept original key. This is desirable, as the same key is used for ignition switch and cabin door lock. After removing old lock from door, proceed as follows:

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

3-24. INDEXING INSIDE HANDLE. (Refer to figure 3-6.) When inside door handle is removed, install in relation to position of bolt (2) which is spring-loaded to CLOSE position. The following procedure may be used:

a. THRU SERIALS P20600647 AND U20602199. (Refer to figure 3-6, sheet 1.)

1. Temporarily install handle (15) on shaft assembly (19) approximately vertical.

2. Move handle (15) back and forth until handle centers in spring-loaded position.

3. Without rotating shaft assembly (19), remove handle and install spring (9) and escutcheon (13).

4. Install handle (15) in vertical position and install clip (16).

5. Ensure bolt (2) clears doorpost and teeth engage clutch gear (26) when handle (15) is in CLOSE position.

b. BEGINNING WITH SERIALS U20602200. (Refer to figure 3-6, sheet 2.) These models feature an inside door handle positioned forward on the door. The handle folds into the armrest when in the "LOCKED" position.

1. Complete steps 1 and 2 as outlined in step "a."

2. Without rotating shaft assembly (19), remove handle and install spring (9) and nylon washer (10).

3. Install handle (15) to align with CLOSE position on upholstery panel (12).

4. Complete step "5" as outlined in step "a."

5. Readjust handle on serrated shaft as necessary to position the forward end of the handle approx. 8° above the handle shaft centerline when in the LOCKED position.

3-24A. ASSIST STRAPS. (Refer to figure 3-3A)

3-24B. REMOVAL AND INSTALLATION. Figure 3-3A may be used as a guide for removal and installation of the assist straps.

3-25. BAGGAGE DOOR. (Refer to figure 3-4.)

3-26. REMOVAL AND INSTALLATION.

a. Disconnect door stop (2) at door.

b. Remove hinge pins (3) securing door to hinges (4).

c. Reverse preceding steps for installation.

3-27. CARGO DOORS. (Refer to figure 3-5.)

3-28. DESCRIPTION. U206 and TU206 aircraft are equipped with two cargo doors located on the right side of fuselage. The aft door is hinged at fuselage station 112 and is a structural, load-carrying member when closed and locked. The aft door handle is located in forward edge of door and is inaccessible with forward door closed, preventing inadvertent opening during flight. As rear door handle is moved to CLOSED position, hooks engage latch plates on upper and lower door sills holding door tightly closed. Telescoping door stops, with detent positions, are used to hold doors open. An entrance step is located on fuselage, below front cargo door. Flight with doors removed is only permissible when an optional spoiler kit is installed. This spoiler kit consists of a spoiler assembly which attaches to front door hinge points and deflects air away from door opening. Addition of screws to rear wall is required with installation of spoiler kit.

NOTE

A flap interrupt switch is installed to prevent operation of flaps with cargo doors open. Switch adjustment is provided by means of slotted holes on front cargo door frame. A switch depressor is provided with spoiler kit to retain use of flaps.

3-29. REMOVAL AND INSTALLATION.

a. Remove cotter pins and hinge pins from door hinges.

b. Disconnect door stops from doors.

c. Reverse preceding steps for installation.

3-30. LATCHES. (Refer to figures 3-5 and 3-6.)

3-31. REMOVAL AND INSTALLATION. Figures 3-5 and 3-6 show details of cargo door latches and may be used as guides during removal, disassembly, assembly and installation.

3-32. RIGGING. (Refer to figure 3-5.)

a. Three results must be obtained by rigging.

1. Hooks (8) must fully engage latch plates (3), but must clear them .05" minimum as door is opened.

2. Load-carrying pins (7) must fully engage their sockets when door is locked.

3. Door must be flush with fuselage skin when door is locked.

NOTE

Adjusting door slightly less than flush is permissible if air leaks around door seal are encountered.

b. There are four sets of adjustments for rigging:

1. Adjusting bolts (10). These determine depth of hook engagement and clearance of hooks as door is opened.

2. Slots in latch plates (3). Plates may be moved inboard or outboard as necessary for full load-carrying pin engagement.

3. Washers under socket (6). These may be added as required to make door flush with fuselage skins.

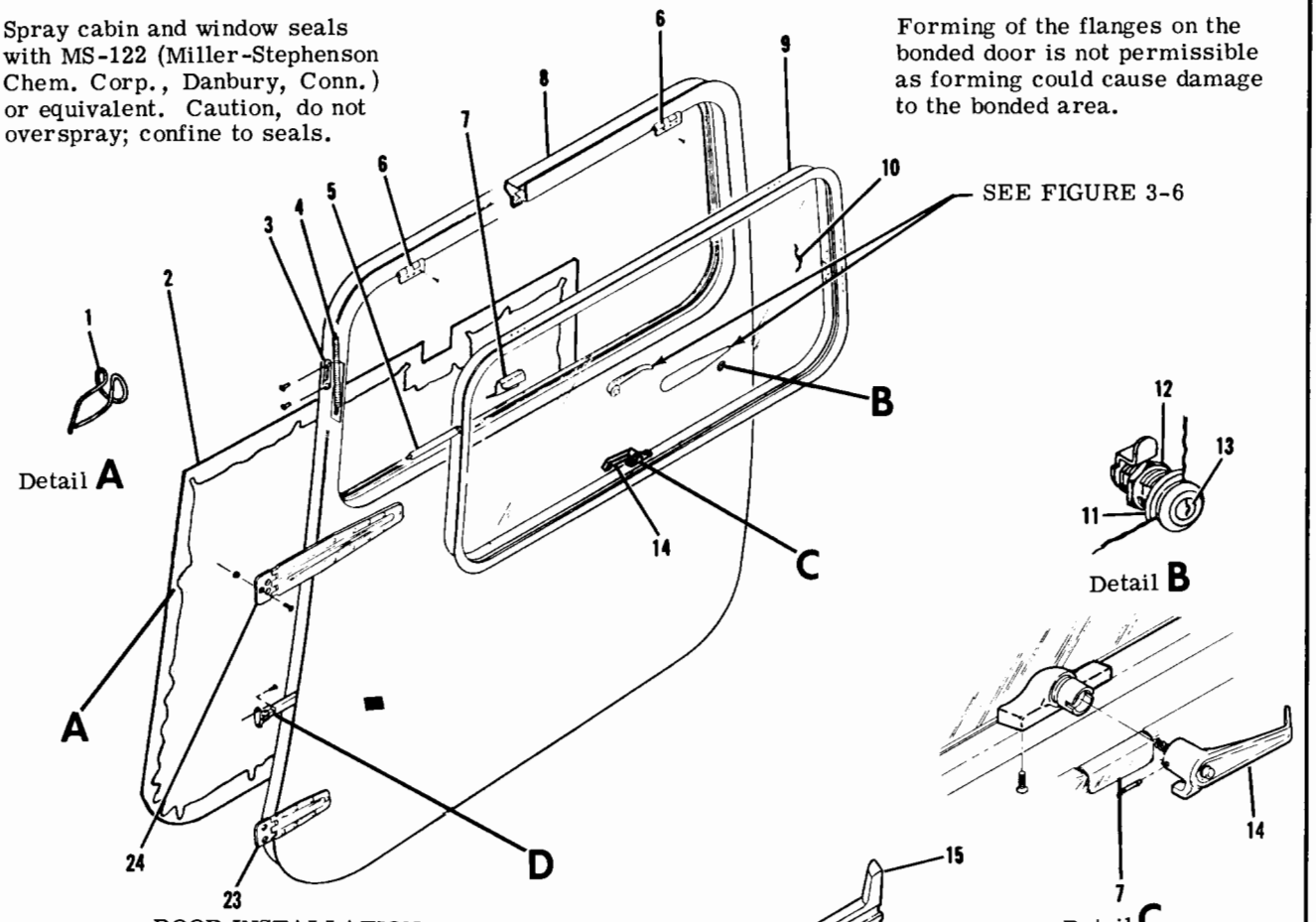
4. Turnbuckles (11). These must be adjusted to cause both hooks to pull door closed tightly. Handle should snap over-center snugly, but excessive force should not be required for handle operation.

NOTE

Spray cabin and window seals with MS-122 (Miller-Stephenson Chem. Corp., Danbury, Conn.) or equivalent. Caution, do not overspray; confine to seals.

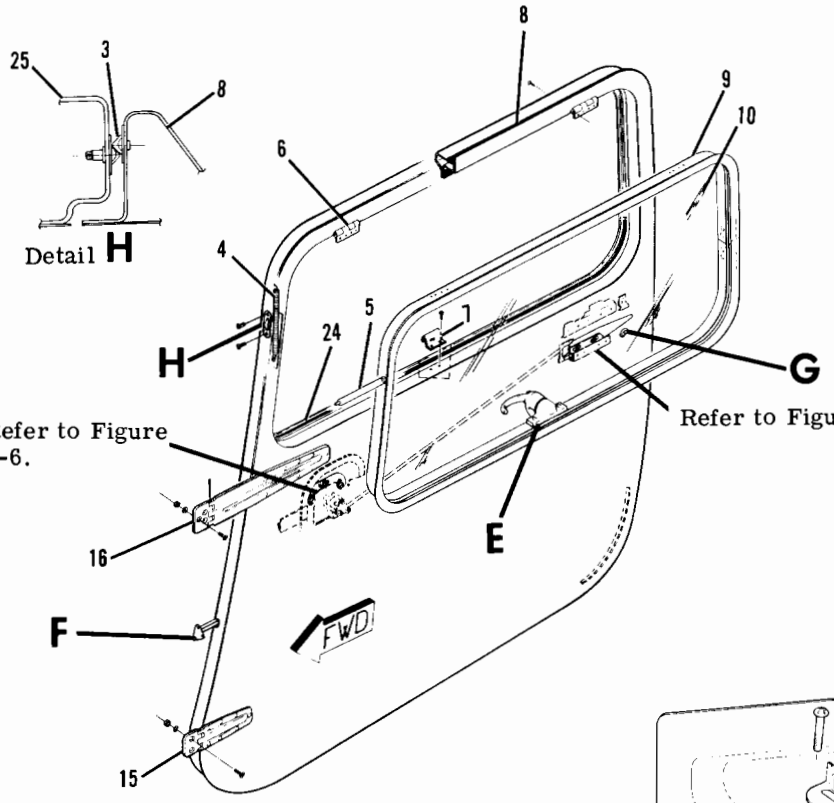
NOTE

Forming of the flanges on the bonded door is not permissible as forming could cause damage to the bonded area.

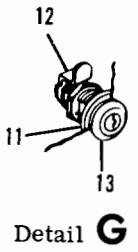


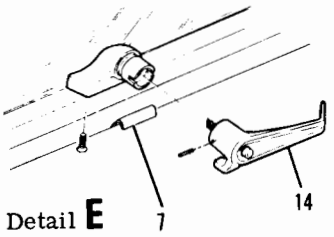
1. Upholstery Clip
2. Upholstery Panel
3. Wedge
4. Spring
5. Window Stop
6. Window Hinge
7. Latch Plate
8. Cabin Door
9. Window Frame
10. Window
11. Washer
12. Nut
13. Lock Assembly
14. Latch Assembly
15. Door Stop Arm
16. Spring-Loaded Plunger
17. Wedge
18. Spacer
19. Stop Assembly
20. Reinforcement
21. Hinge
22. Pin
23. Lower Hinge
24. Upper Hinge
25. Door Jamb

Figure 3-3. Cabin Door Installation (Sheet 1 of 2).



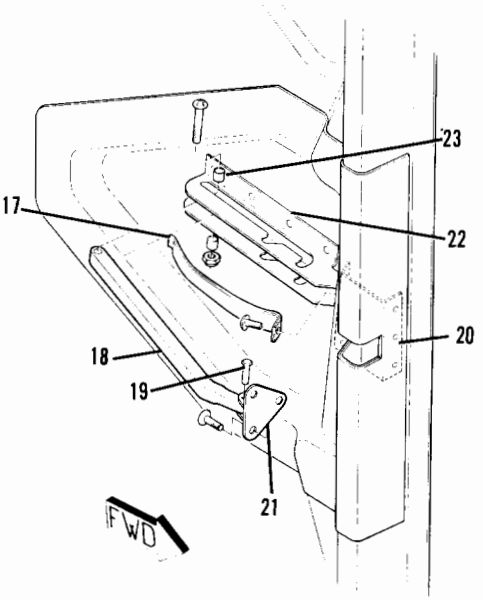
DOOR INSTALLATION BEGINNING WITH AIRCRAFT SERIAL U20602200





NOTE

Forming the flange of a bonded door is not permissable as it could cause material separation.

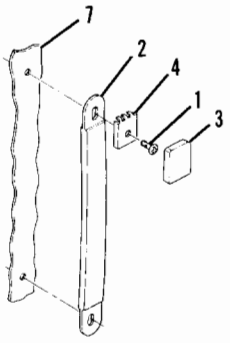


Detail F BEGINNING WITH AIRCRAFT SERIAL U20601875

NOTE

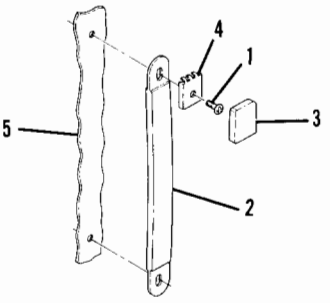
Spray cabin and window seals with MS-122 (Miller-Stephenson Chem. Corp., Danbury, Conn.) or equivalent. Caution, do not overspray; confine to seals

Figure 3-3. Cabin Door Installation (Sheet 2 of 2)



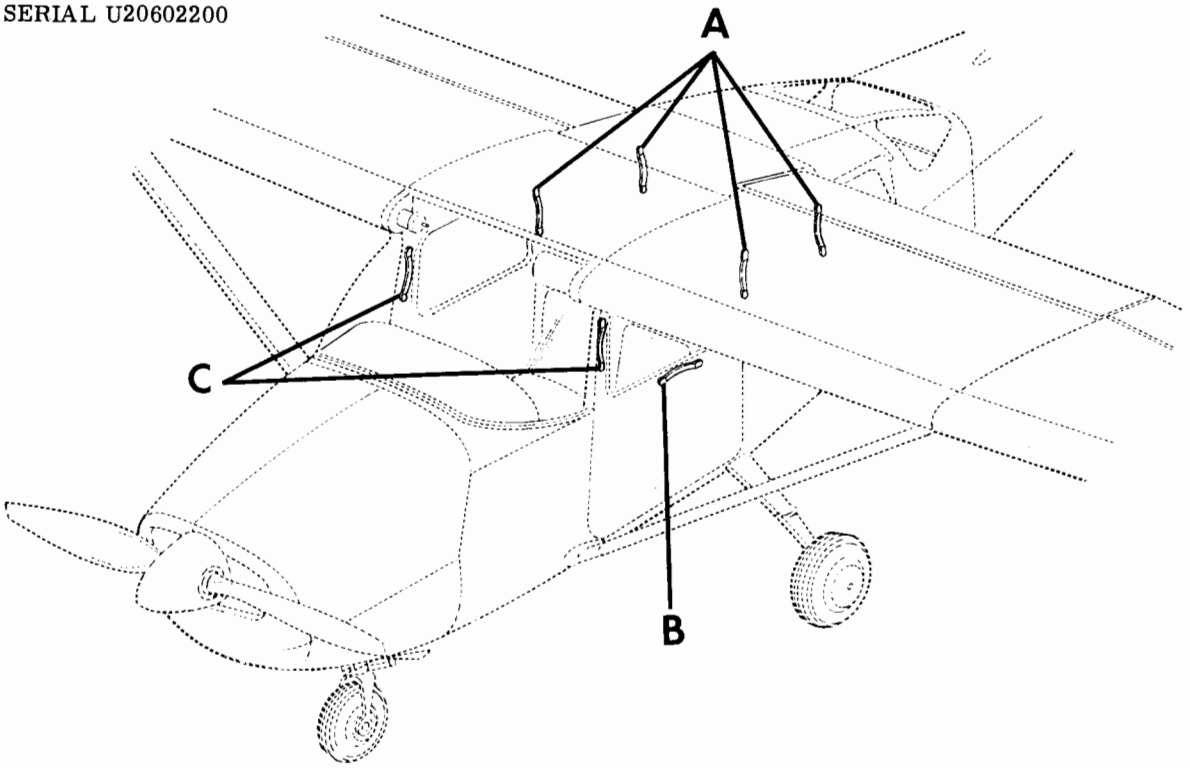
Detail C

BEGINNING WITH AIRCRAFT
SERIAL U20602200

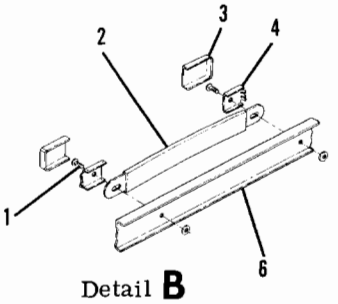


Detail A

AVAILABLE BEGINNING WITH
AIRCRAFT SERIAL U20602580



1. Screw
2. Pull Handle
3. Clamp Cover
4. Clamp
5. Fuselage
6. Window Moulding
7. Door Post



Detail B

BEGINNING WITH AIRCRAFT
SERIAL U20602360

Figure 3-3A. Assist Strap Installation

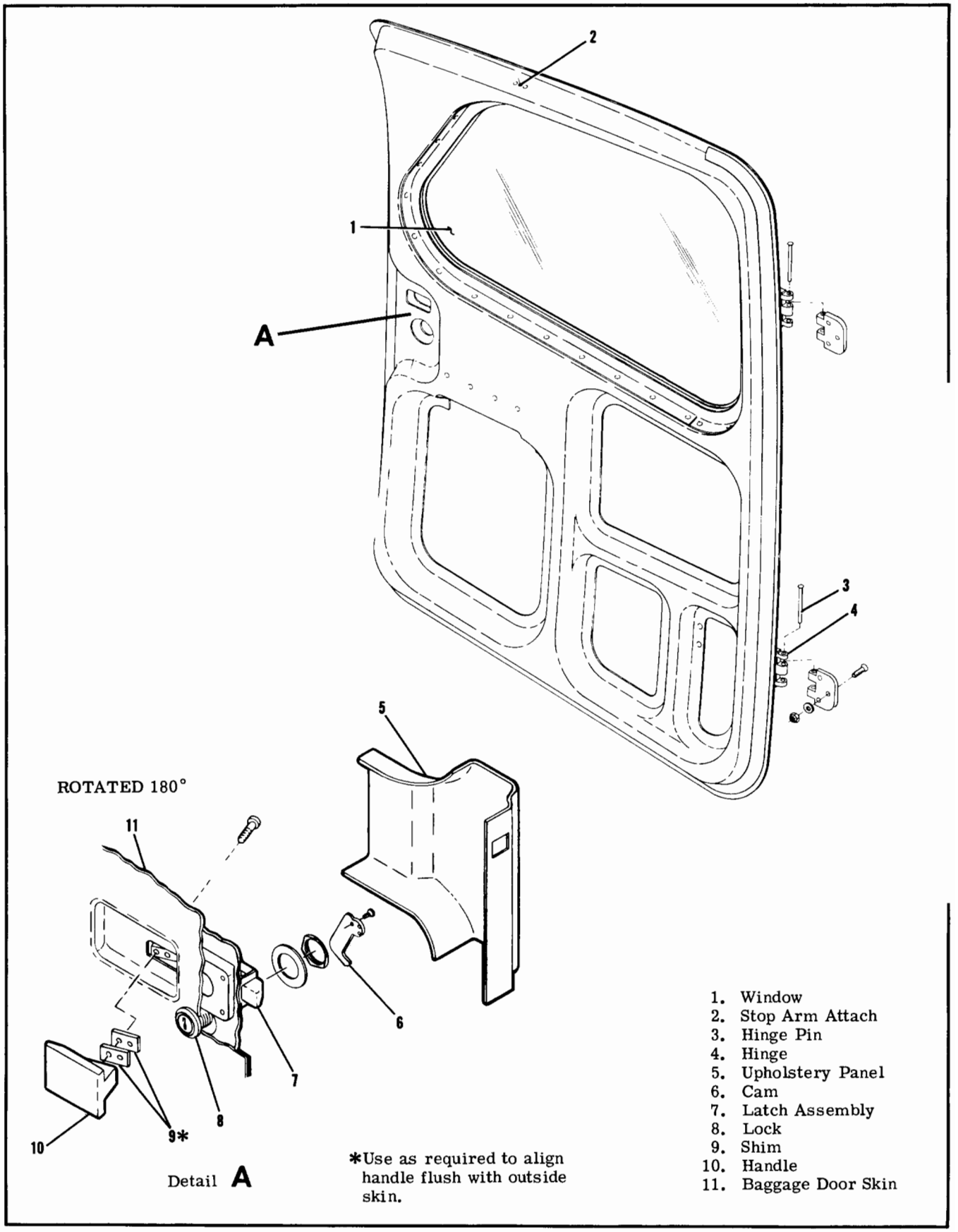
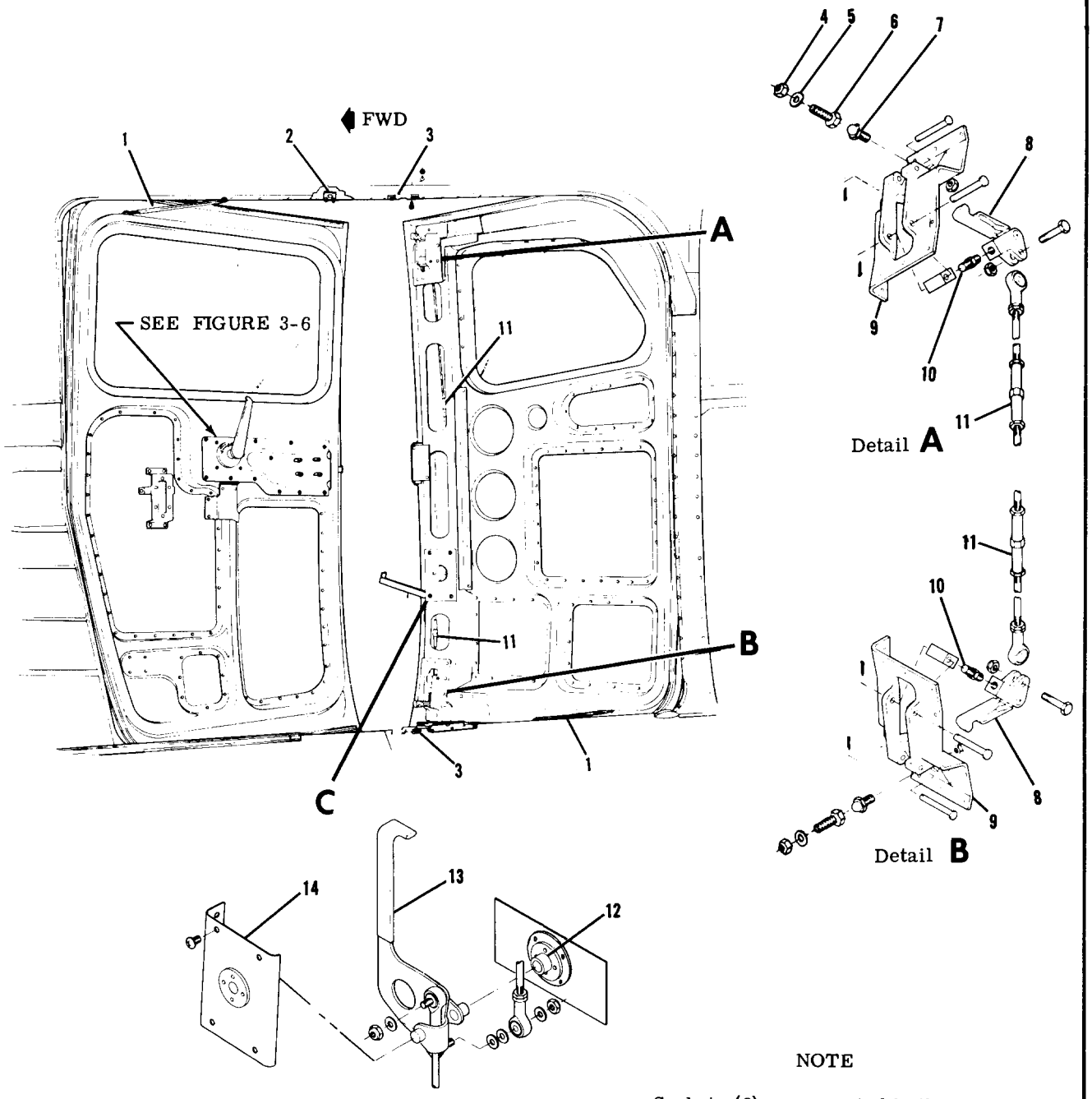


Figure 3-4. Baggage Door Installation



1. Door Stop
2. Flap Interrupt Switch
3. Latch Plate
4. Nut
5. Washer
6. Socket
7. Load Carrying Pin
8. Upper Hook
9. Upper Latch Carrier
10. Adjusting Bolt
11. Turnbuckle
12. Bushing
13. Handle
14. Cover

NOTE

Sockets (6) are mounted in the upper a and lower door sills. Install an abrasive shim beneath latch plate (3) to prevent latch plate from slipping.

To aid in cargo loading, the center seat bolt attach points on the floor are designed to fold flat.

A tee handle is stowed in the glove compartment. The front cargo door may be locked and unlocked externally through a hole opposite the inside handle.

Figure 3-5. Cargo Door Installation

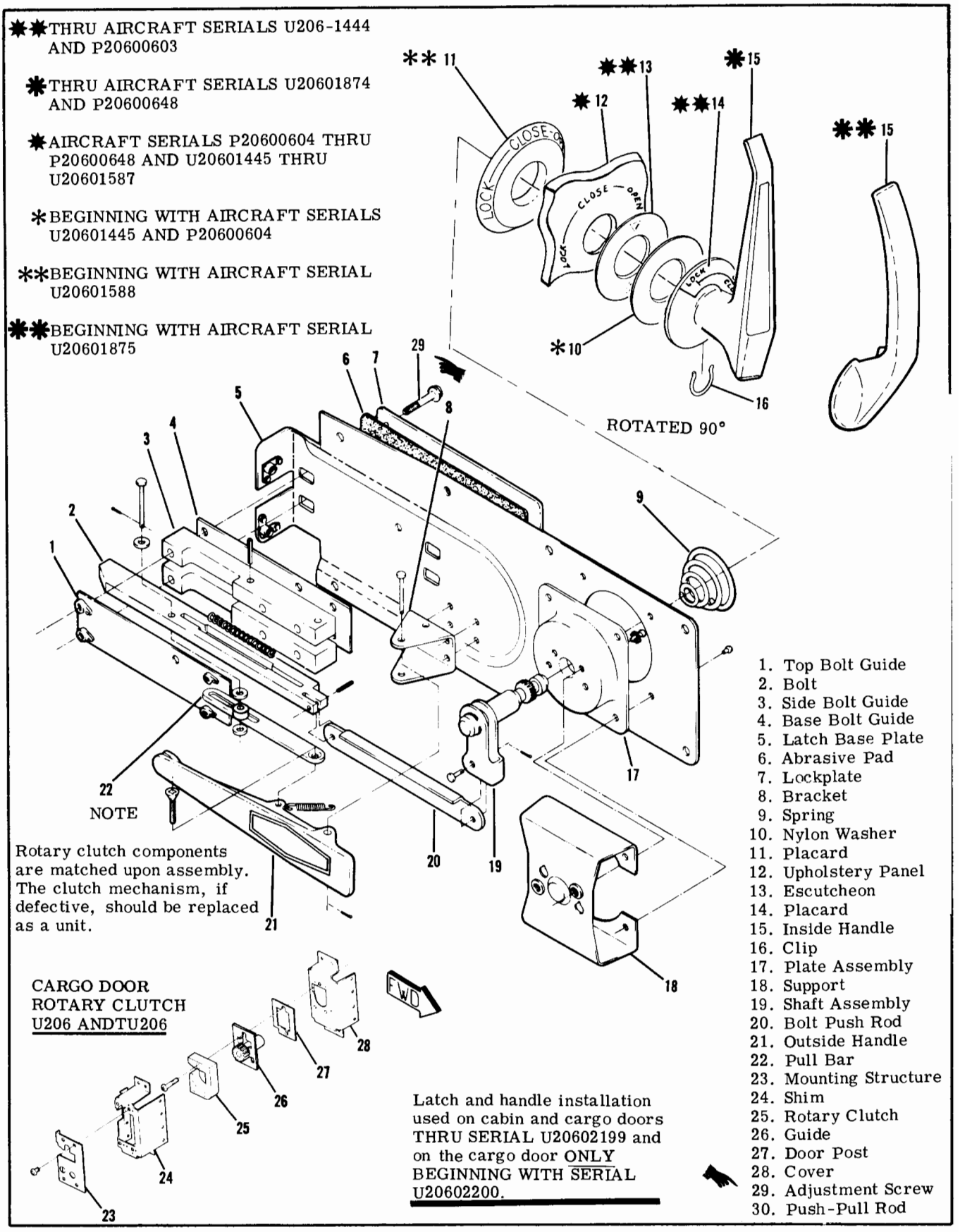


Figure 3-6. Door Latch and Rotary Clutch Components (Sheet 1 of 2)

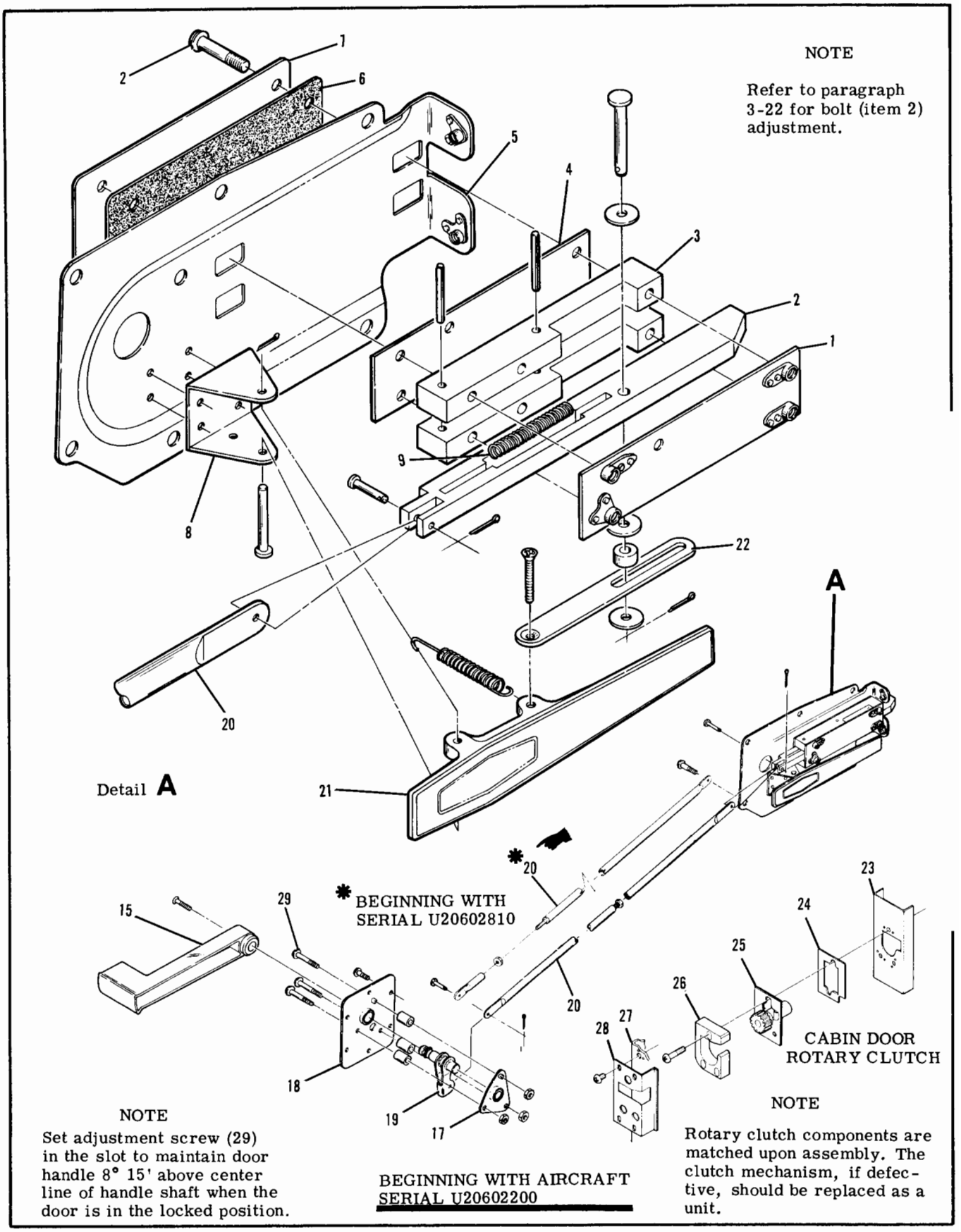


Figure 3-6. Door Latch and Rotary Clutch Components (Sheet 2 of 2)

3-33. SEATS. (Refer to figure 3-7.)

3-34. PILOT AND COPILOT.

a. RECLINING BACK. (Standard pilot/Optional copilot.)

b. RECLINING BACK/VERTICAL ADJUST. (Optional 1969 ONLY.)

c. ARTICULATING RECLINE/VERTICAL ADJUST. (Optional 1970 AND ON.)

3-35. DESCRIPTION. These seats are manually-operated throughout their full range of operation. Seat stops are provided to limit fore-and-aft travel. Install seat stops on rails as follows:

1. Pilots seat: inbd rail fwd and aft.
2. Copilots seat: outbd rail fwd and aft.
3. Center L H seat: outbd rail fwd and aft.
4. Center R H seat: outbd rail fwd and inbd rail aft.
5. Aft L H seat: outbd rail fwd and aft.
6. Aft R H seat: outbd rail aft only.

3-36. REMOVAL AND INSTALLATION.

a. Remove seat stops from rails.

b. Slide seat fore-and-aft to disengage seat rollers from rails.

c. Lift seat out.

d. Reverse the preceding steps for installation. Ensure all seat stops are reinstalled.

WARNING

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

3-37. CENTER AND REAR.

a. RECLINING BACK/FORE-AND-AFT ADJUST.

b. NON-RECLINING BACK/FORE-AND-AFT ADJUST.

3-38. DESCRIPTION. These seats are provided with fore-and-aft adjustment provisions. Seat stops are installed to limit travel. Removal and installation is outlined in paragraph 3-36.

3-39. REPAIR. Replacement of defective parts is recommended in repair of seats. However, a cracked framework may be welded, provided crack is not in an area of stress concentration (close to a hinge or bearing point). The 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. Figure 3-8 outlines instructions for replacing defective cams on reclining seat backs.

3-40. CABIN UPHOLSTERY. Due to the wide selection of fabrics, styles and colors, it is impossible to depict each particular type of upholstery. The following paragraphs describe general procedures which will serve as a guide in removal and replacement of upholstery. Major work, if possible, should be done by an experienced mechanic. If work must be done by a mechanic unfamiliar with upholstery practices, the mechanic should make careful notes during removal of each item to facilitate its replacement later.

3-41. MATERIALS AND TOOLS. Materials and tools will vary with job. Scissors for trimming upholstery to size and a dull-bladed putty knife for wedging material beneath retainer strips are the only tools required for most trim work. Use industrial rubber cement to hold soundproofing mats and fabric edges in place. Refer to Section 18 for thermo-plastic repairs.

3-42. SOUNDPROOFING. The aircraft is insulated with spun glass mat-type insulation and a sound deadener compound applied to inner surfaces of skin in most areas of cabin and baggage compartment. All soundproofing material should be replaced in its original position any time it is removed. A soundproofing panel is placed in the gap between the wing and fuselage and held in place by the wing root fairing.

3-43. CABIN HEADLINER. (Refer to figure 3-10.)

3-44. REMOVAL.

a. Remove sun visors, all inside finish strips and plates, door post upper shields, front spar trim shield, dome light console and any other visible retainers securing headliner.

b. Work edges of headliner free from metal teeth which hold fabric.

c. Starting at front of headliner, work headliner down, removing screws through metal tabs which hold wire bows to cabin top. Pry loose outer ends of bows from retainers above doors. Detach each bow in succession.

NOTE

Always work from front to rear when removing headliner.

d. Remove headliner assembly and bows from aircraft.

NOTE

Due to difference in length and contour of wire bows, each bow should be tagged to assure proper location in headliner.

e. Remove spun glass soundproofing panels.

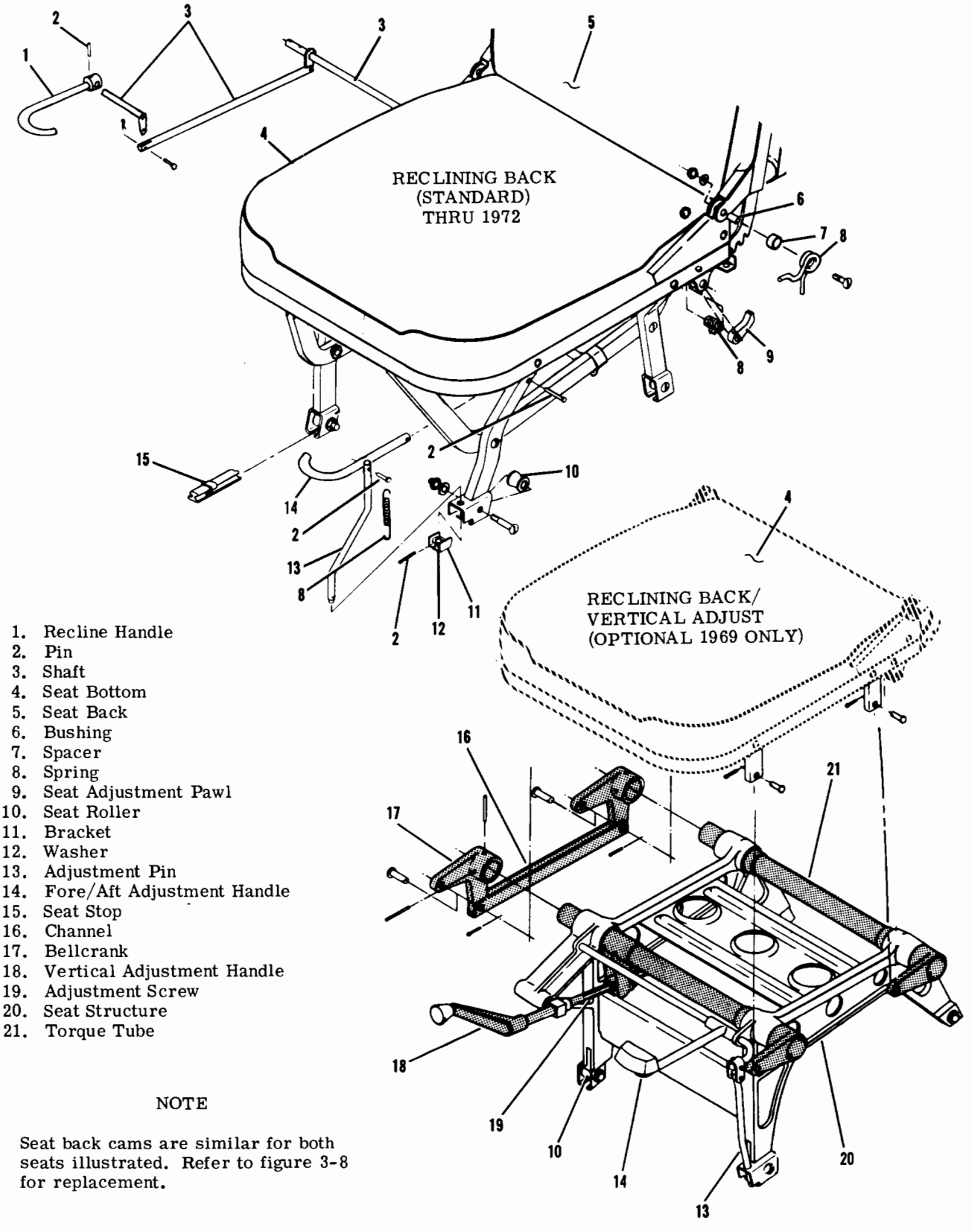
NOTE

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

3-45. INSTALLATION.

a. Before installation, check all items concealed by headliner for security. Use wide cloth tape to secure loose wires to fuselage and to seal openings in wing roots. Straighten tabs bent during removal of headliner.

PILOT AND COPILOT SEATS



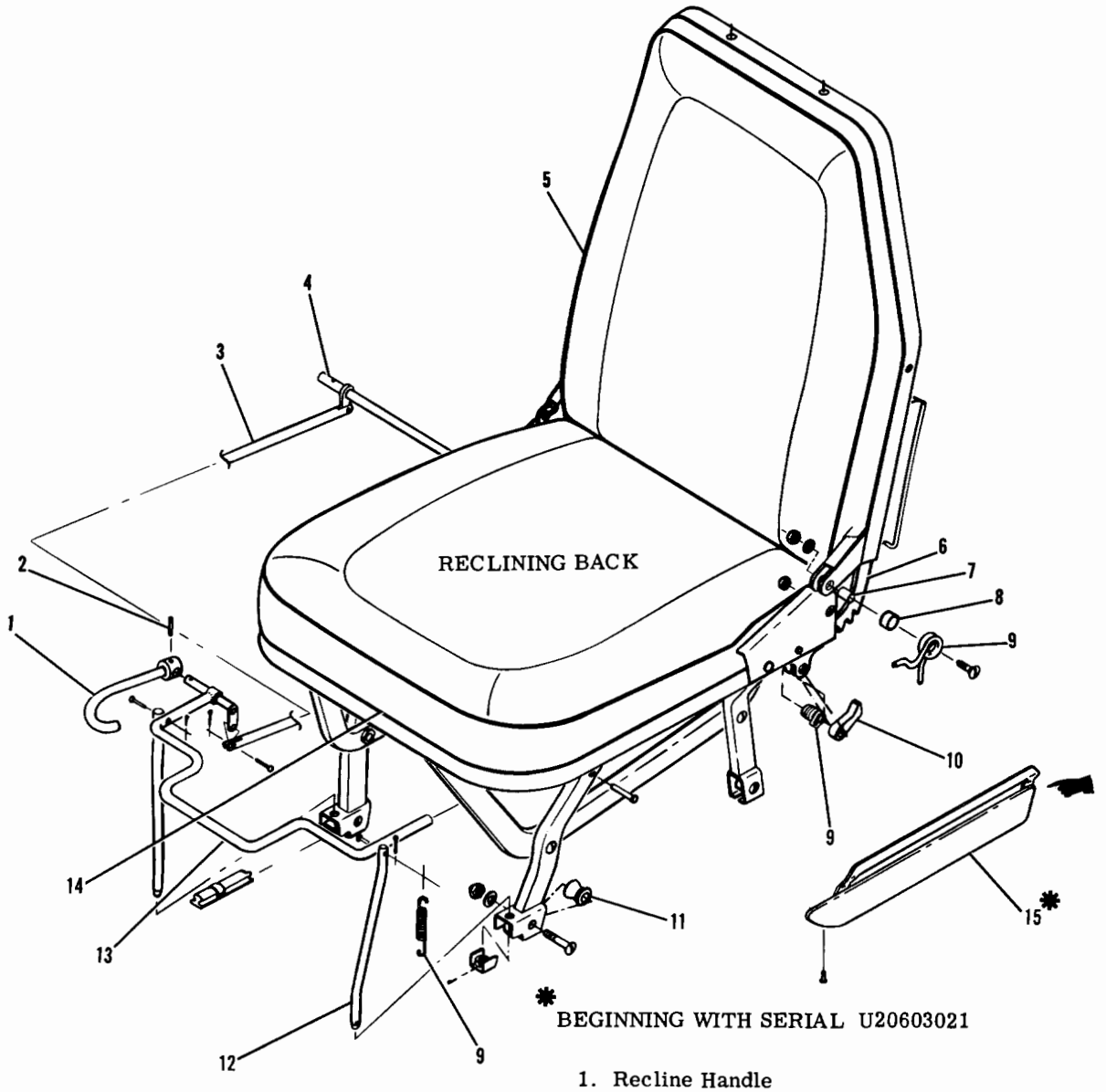
1. Recline Handle
2. Pin
3. Shaft
4. Seat Bottom
5. Seat Back
6. Bushing
7. Spacer
8. Spring
9. Seat Adjustment Pawl
10. Seat Roller
11. Bracket
12. Washer
13. Adjustment Pin
14. Fore/Aft Adjustment Handle
15. Seat Stop
16. Channel
17. Bellcrank
18. Vertical Adjustment Handle
19. Adjustment Screw
20. Seat Structure
21. Torque Tube

NOTE

Seat back cams are similar for both seats illustrated. Refer to figure 3-8 for replacement.

Figure 3-7. Seat Installation (Sheet 1 of 11)

PILOT AND COPILOT SEAT
(STANDARD BEGINNING WITH 1973)

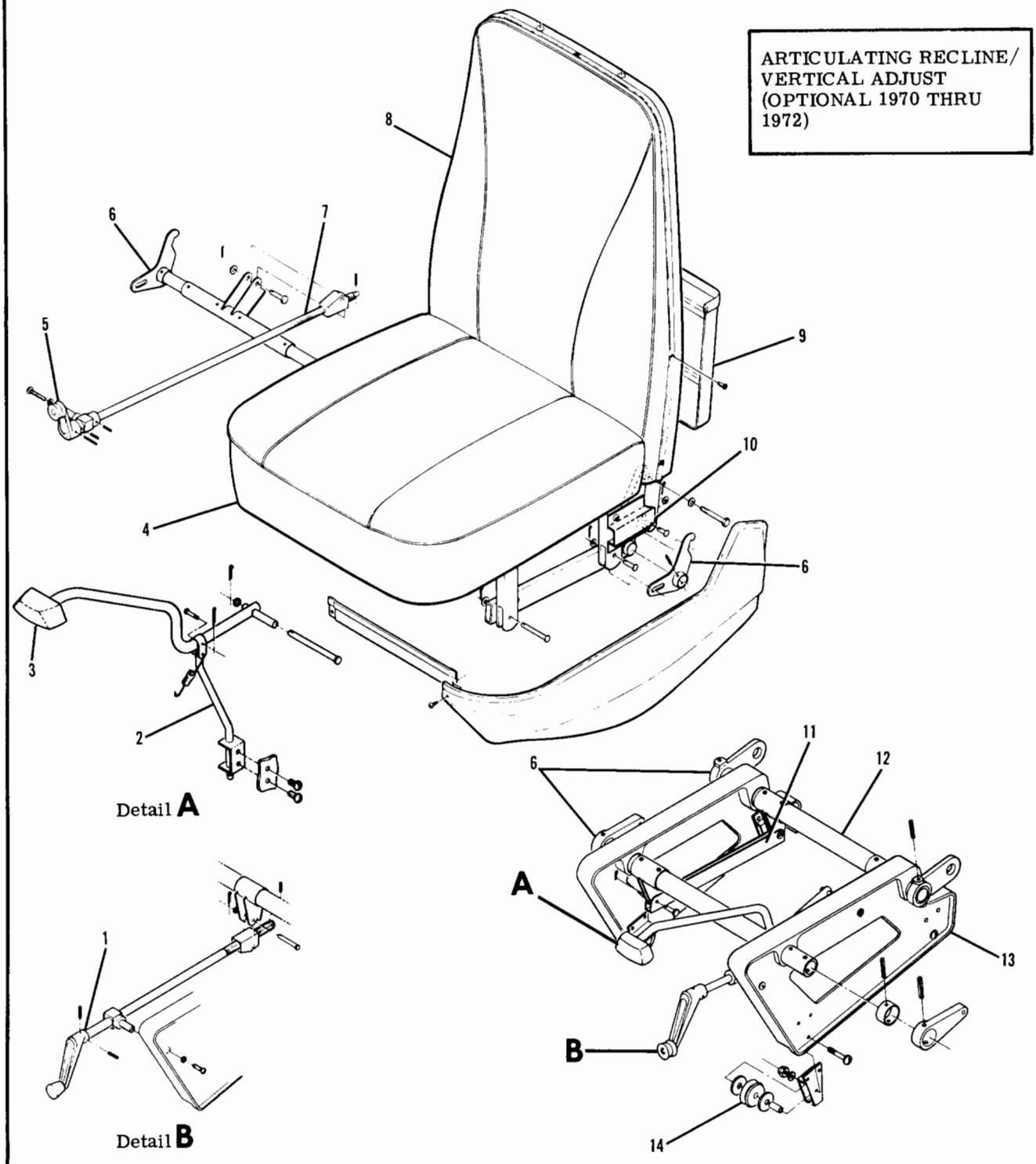


* BEGINNING WITH SERIAL U20603021

1. Recline Handle
2. Pin
3. Link Assembly
4. Torque Tube
5. Seat Back
6. Recline Cam
7. Bushing
8. Spacer
9. Spring
10. Pawl
11. Roller
12. Adjustment Pin
13. Fore/Aft Adjustment Handle
14. Seat Bottom
15. Seat Belt Retainer

Figure 3-7. Seat Installation (Sheet 2 of 11)

PILOT AND COPILOT SEAT



1. Vertical Adjustment Handle
2. Adjustment Pin
3. Fore-and-Aft Adjustment Handle
4. Seat Bottom
5. Articulating Adjustment Handle
6. Bellcrank
7. Adjustment Screw
8. Seat Back
9. Magazine Pocket
10. Trim Bracket
11. Channel
12. Torque Tube
13. Seat Structure
14. Roller

Figure 3-7. Seat Installation (Sheet 3 of 11)

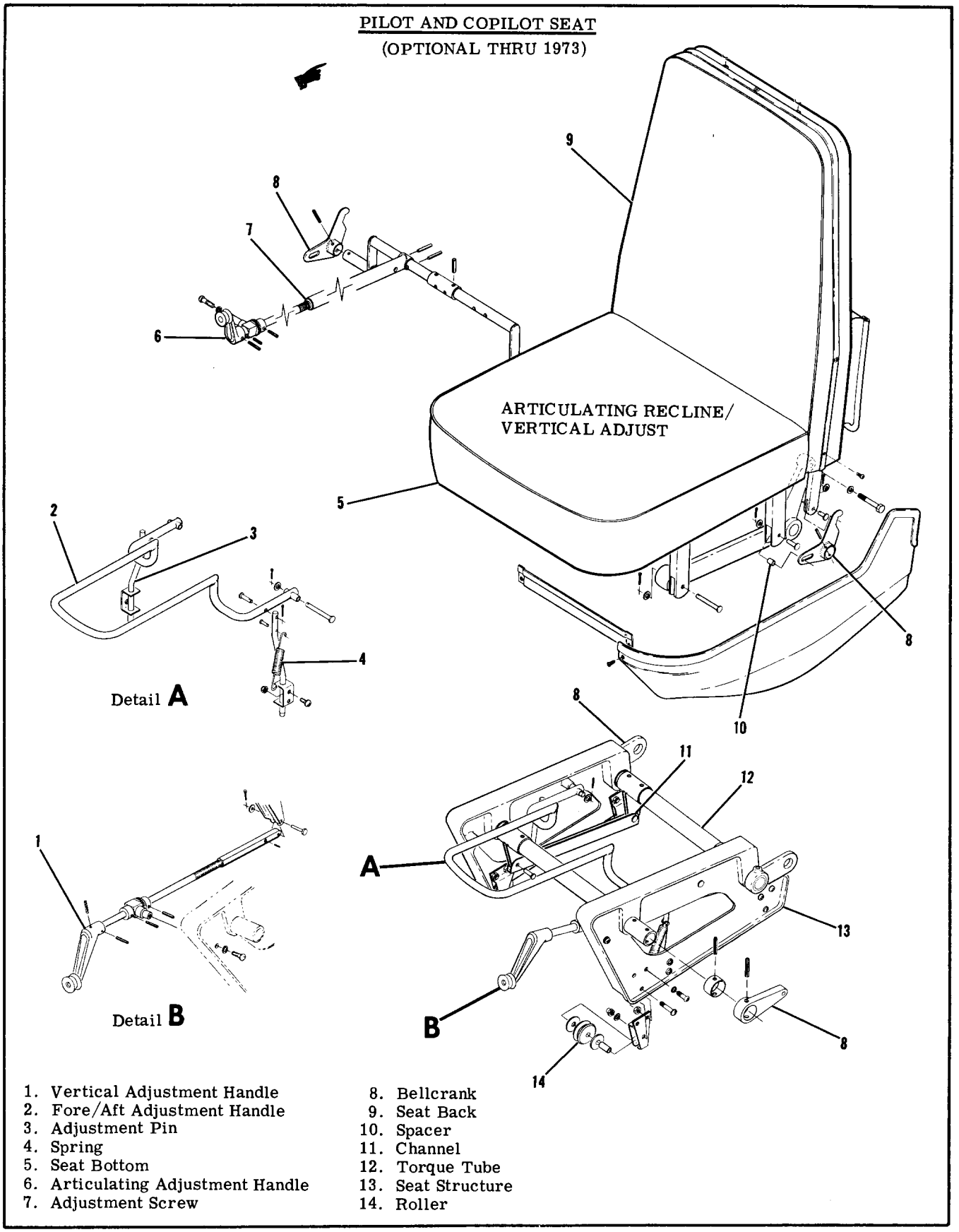


Figure 3-7. Seat Installation (Sheet 4 of 11)

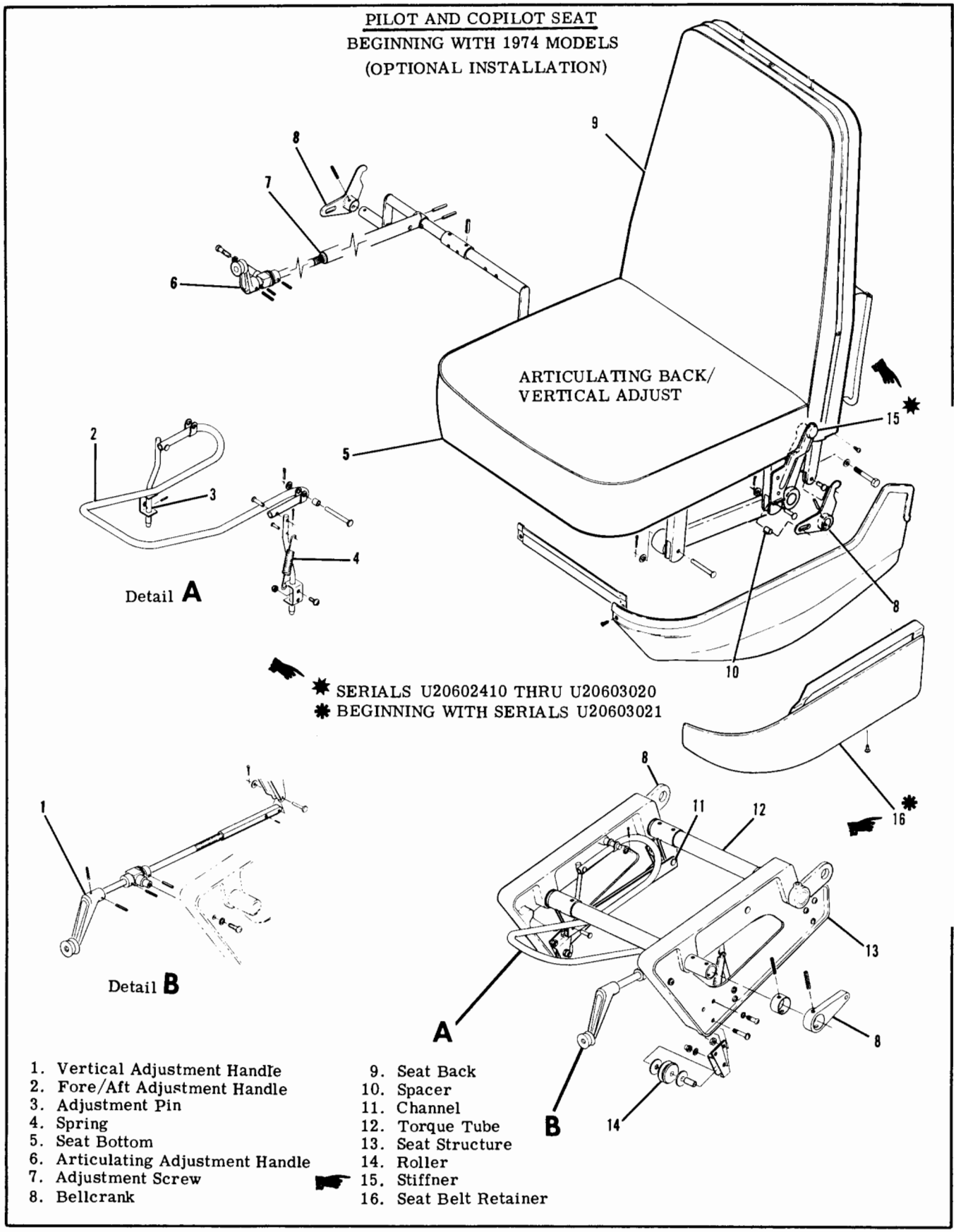


Figure 3-7. Seat Installation (Sheet 5 of 11).

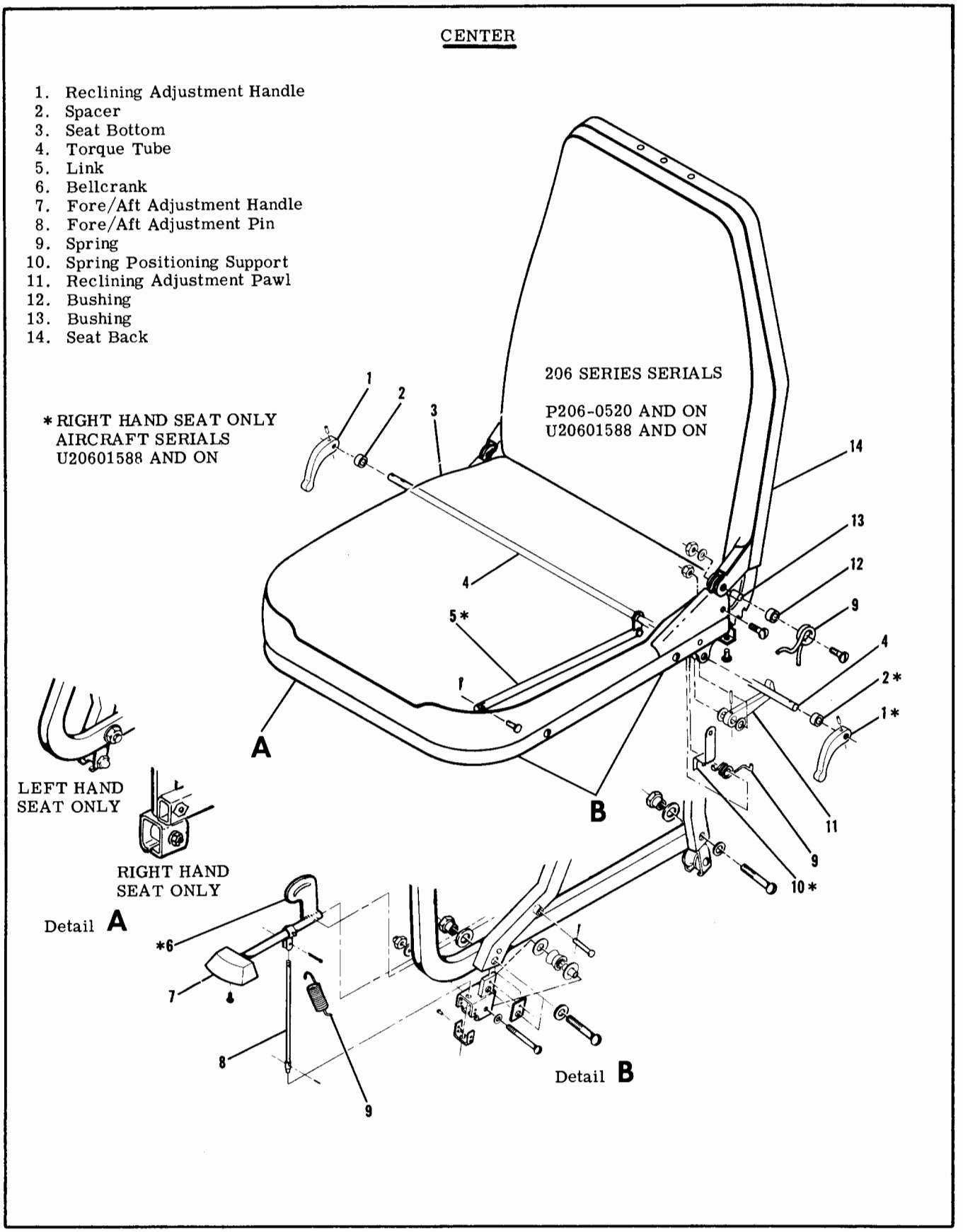
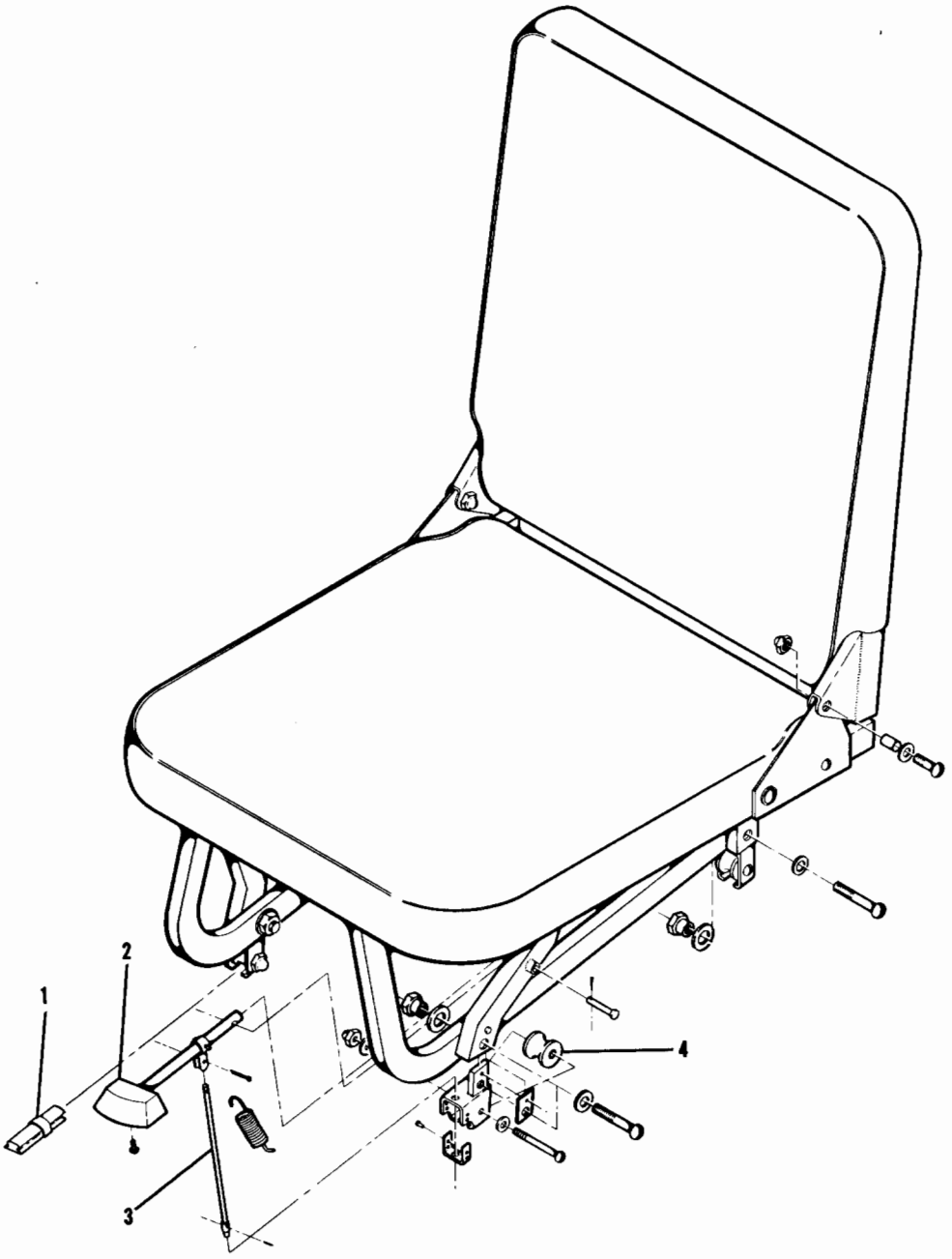


Figure 3-7. Seat Installation (Sheet 6 of 11)

CENTER

U206 AND TU206



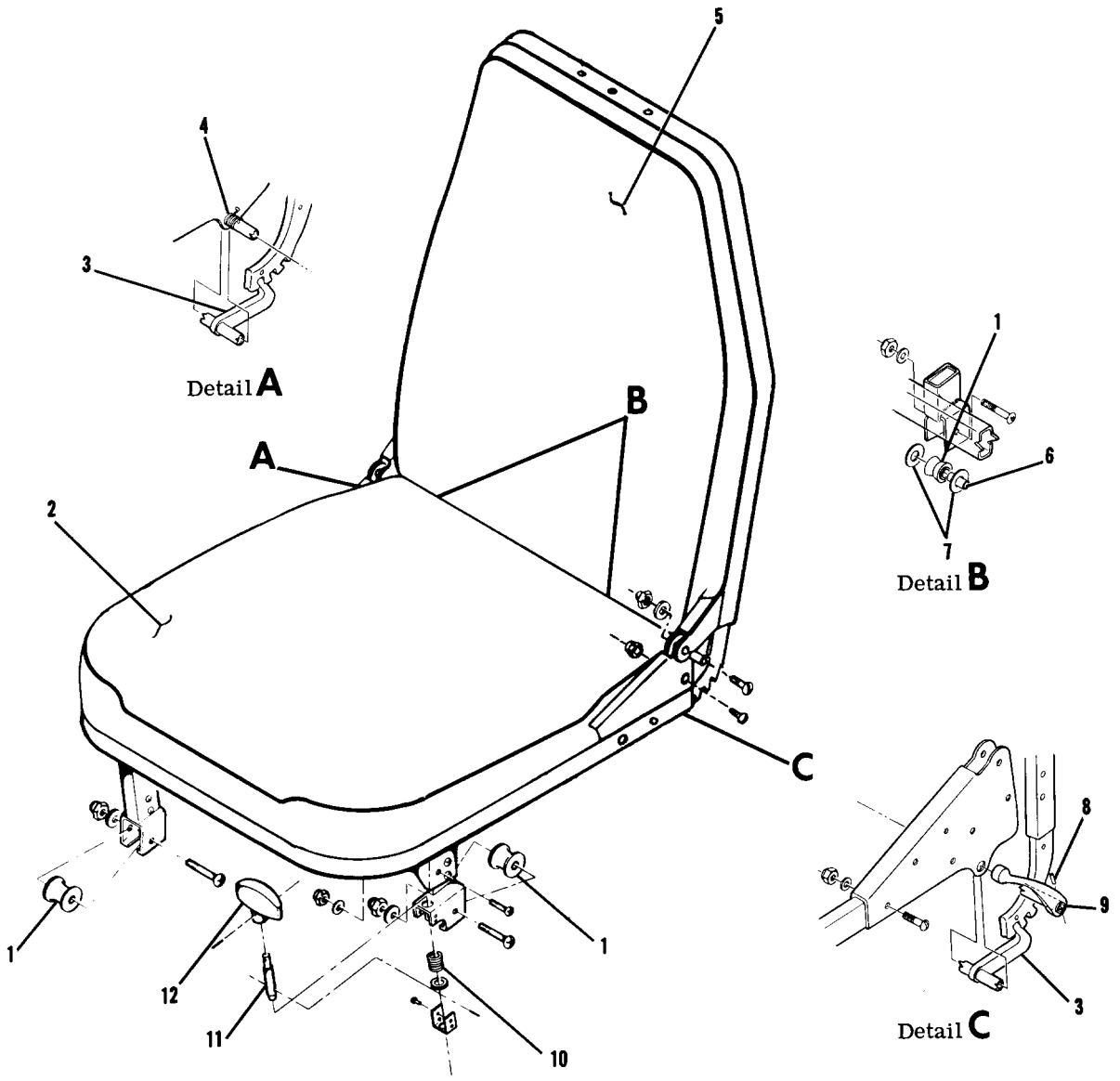
1. Seat Stop
2. Fore/Aft Adjustment Handle
3. Adjustment Pin
4. Roller

Figure 3-7. Seat Installation (Sheet 7 of 11)

REAR

1969

P206 AND TP206



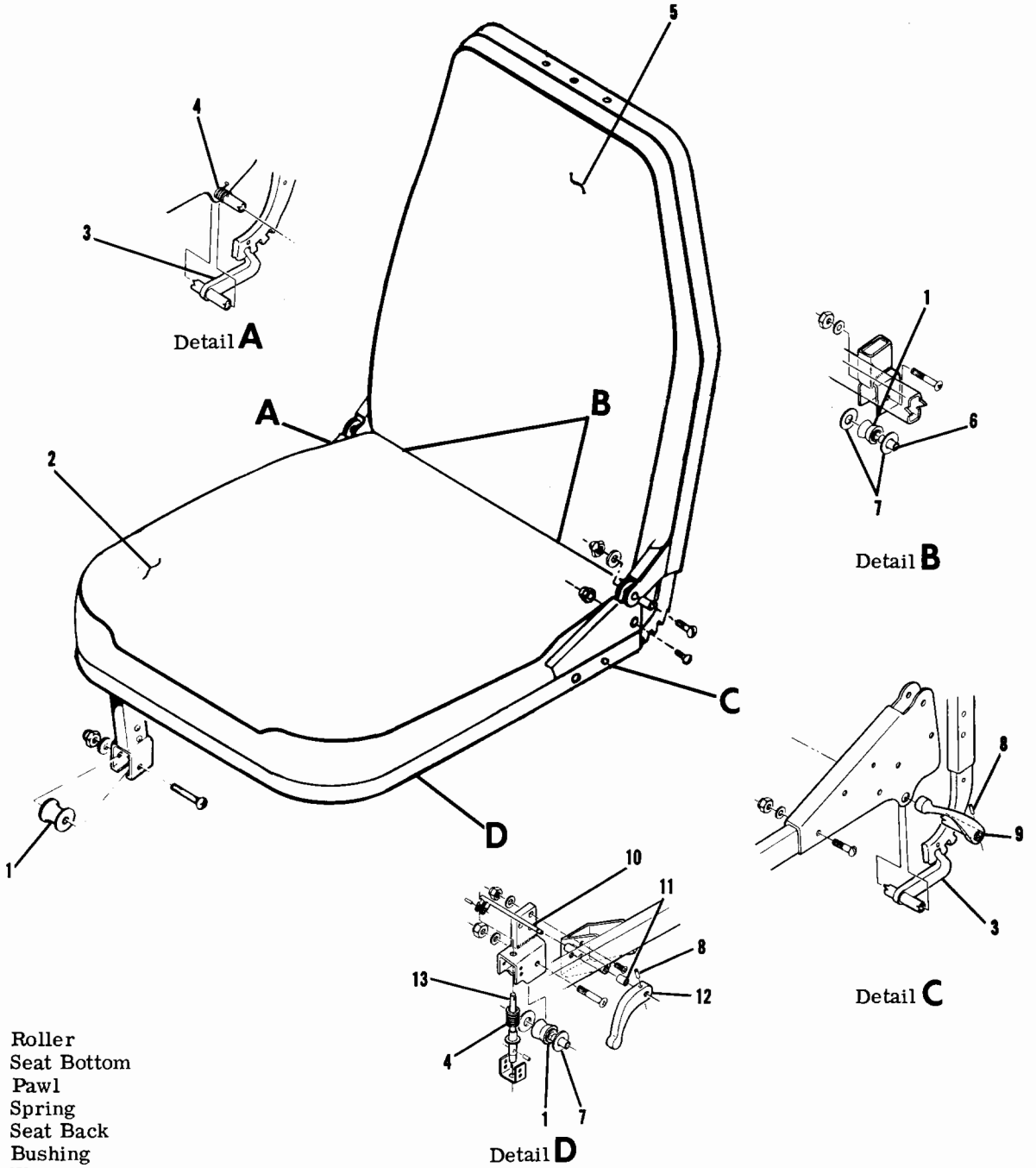
1. Roller
2. Seat Bottom
3. Pawl
4. Spring
5. Seat Back
6. Bushing
7. Washer
8. Pin
9. Handle
10. Spring
11. Adjustment Pin
12. Handle

Figure 3-7. Seat Installation (Sheet 8 of 11)

REAR

1970

P206 AND TP206



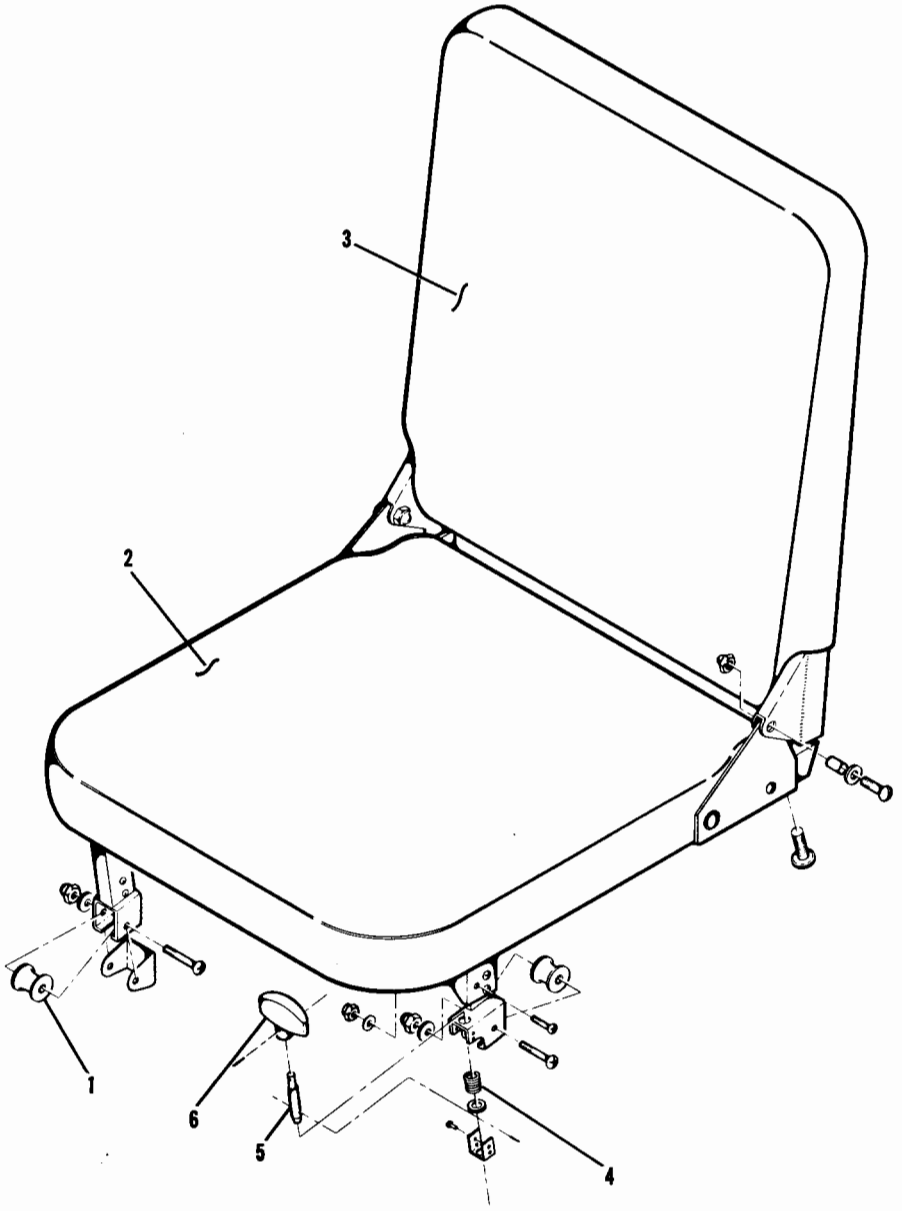
1. Roller
2. Seat Bottom
3. Pawl
4. Spring
5. Seat Back
6. Bushing
7. Washer
8. Pin
9. Reclining Adjustment Handle
10. Adjustment Arm
11. Spacer
12. Fore/Aft Adjustment Handle
13. Adjustment Pin

Figure 3-7. Seat Installation (Sheet 9 of 11)

REAR

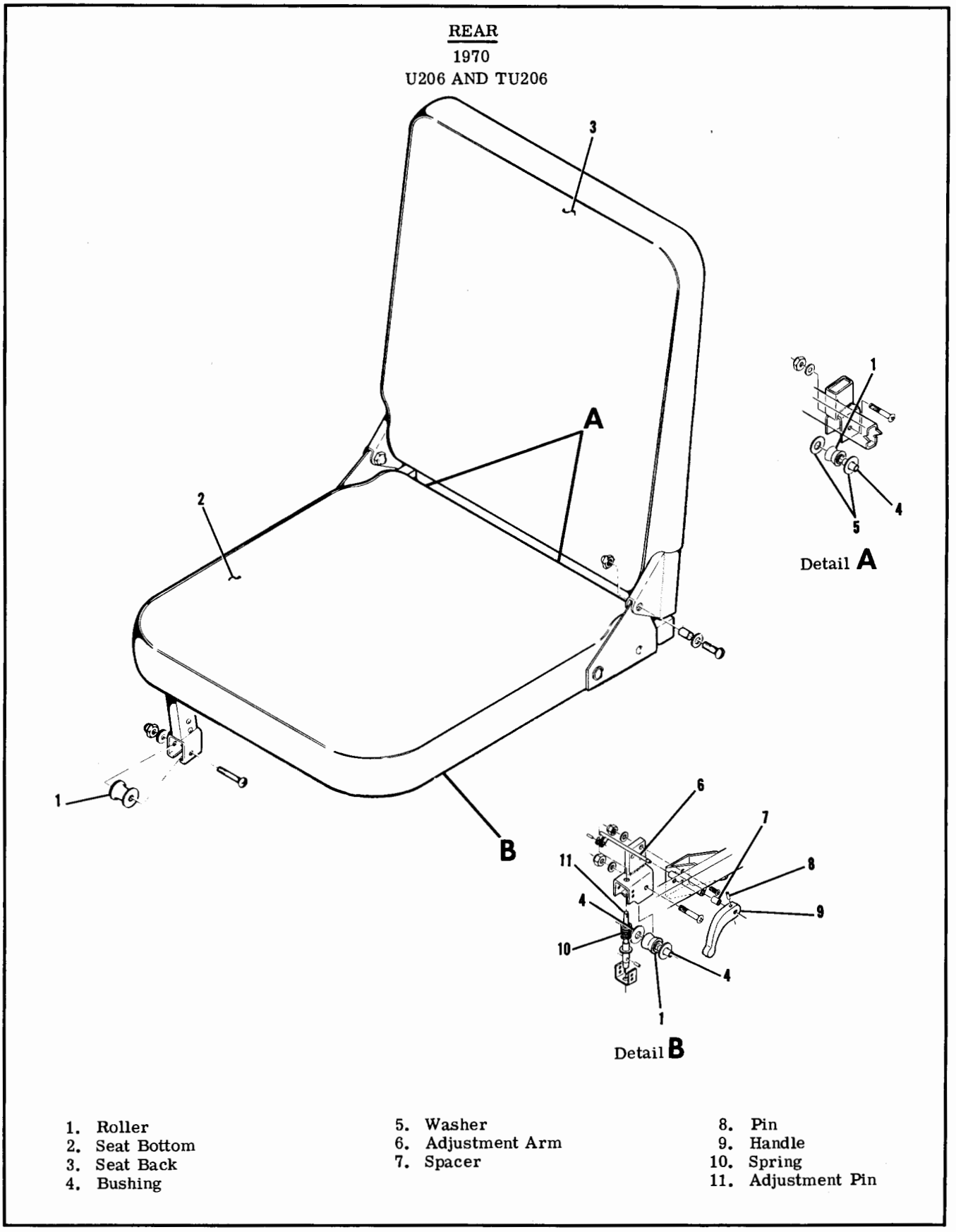
1969

U206 AND TU206



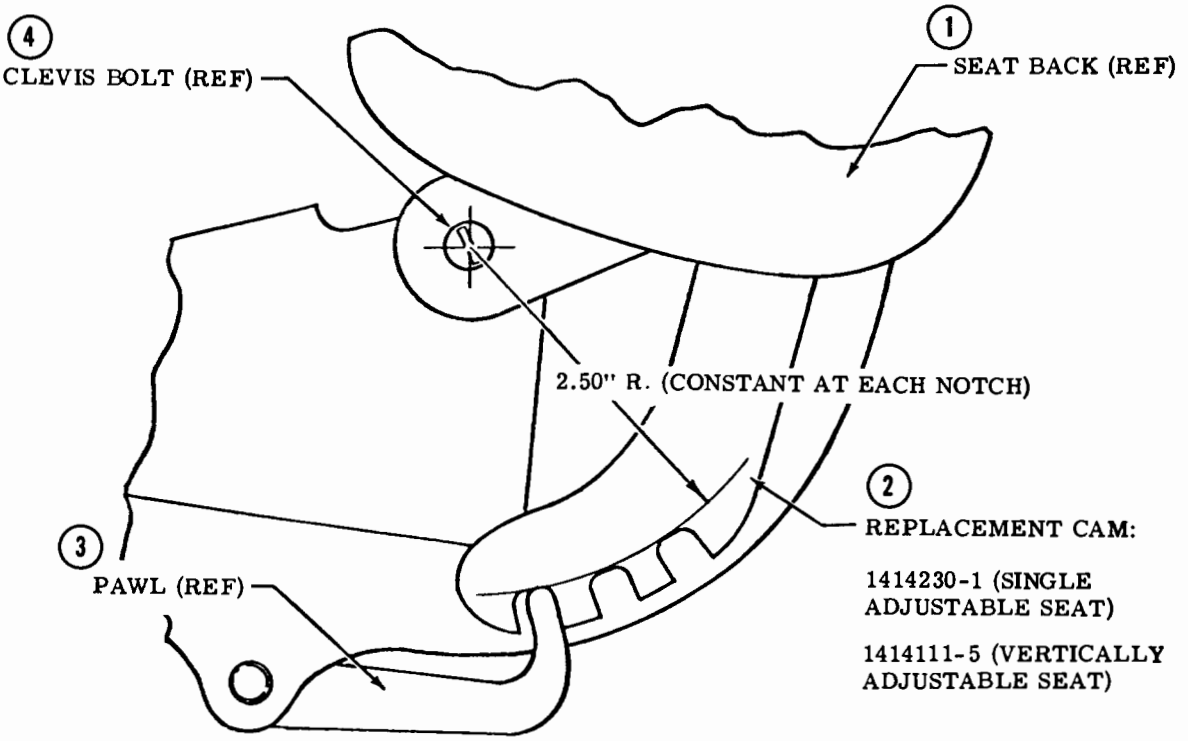
1. Roller
2. Seat Bottom
3. Seat Back
4. Spring
5. Adjustment Pin
6. Fore/Aft Adjustment Handle

Figure 3-7. Seat Installation (Sheet 10 of 11)



1. Roller
2. Seat Bottom
3. Seat Back
4. Bushing
5. Washer
6. Adjustment Arm
7. Spacer
8. Pin
9. Handle
10. Spring
11. Adjustment Pin

Figure 3-7. Seat Installation (Sheet 11 of 11)



REPLACEMENT PROCEDURE:

a. Remove seat from aircraft.

b. Remove plastic upholstery panels from aft side of seat back, then loosen upholstery retaining rings and upholstery material as required to expose the rivets retaining the old cam assembly.

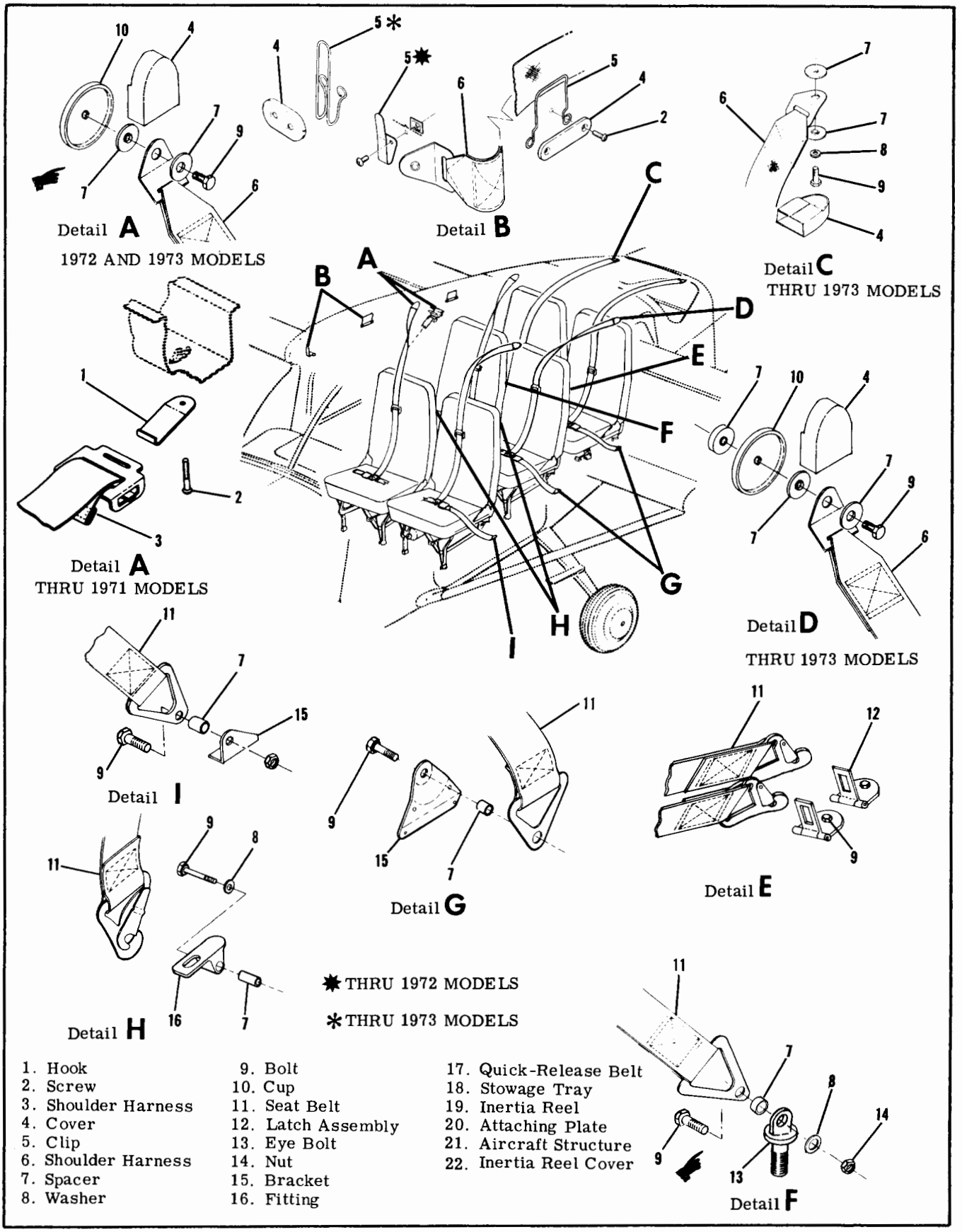
c. Drill out existing rivets and insert new cam assembly (2). Position seat back so that pawl (3) engages first cam slot as shown.

d. Position the cam so each slot bottom aligns with the 2.50" radius as shown.

e. Clamp securely in this position and check travel of cam. Pawl must contact bottom of each cam slot. Using existing holes in seat frame, drill through new cam and secure with MS20470AD6 rivets.

f. Reinstall upholstery, upholstery panels and seat.

Figure 3-8. Seat Back Cam Replacement



1. Hook
2. Screw
3. Shoulder Harness
4. Cover
5. Clip
6. Shoulder Harness
7. Spacer
8. Washer
9. Bolt
10. Cup
11. Seat Belt
12. Latch Assembly
13. Eye Bolt
14. Nut
15. Bracket
16. Fitting
17. Quick-Release Belt
18. Stowage Tray
19. Inertia Reel
20. Attaching Plate
21. Aircraft Structure
22. Inertia Reel Cover

Figure 3-9. Seat Belt and Shoulder Harness Installation (Sheet 1 of 3)

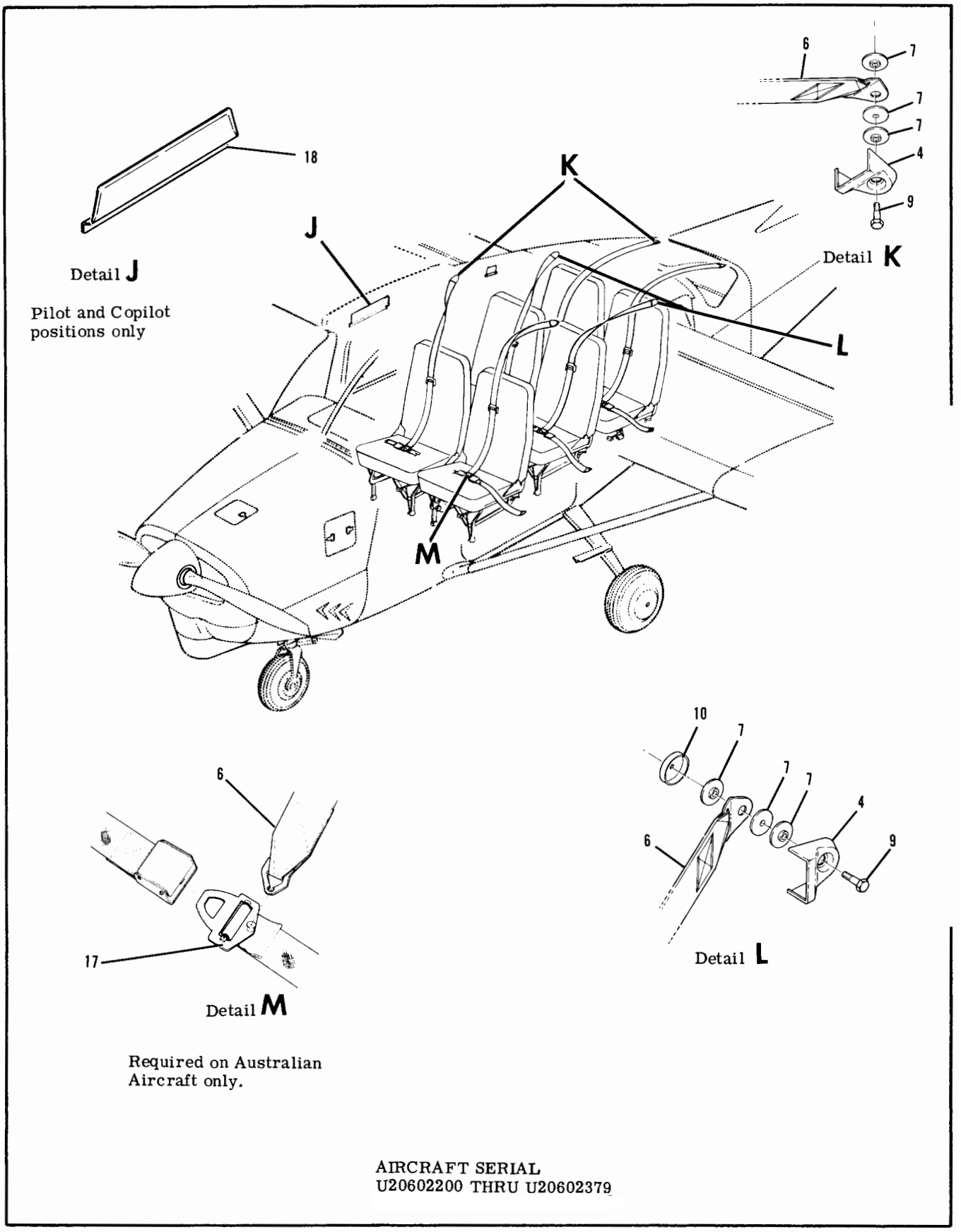


Figure 3-9. Seat Belt and Shoulder Harness Installation (Sheet 2 of 3)

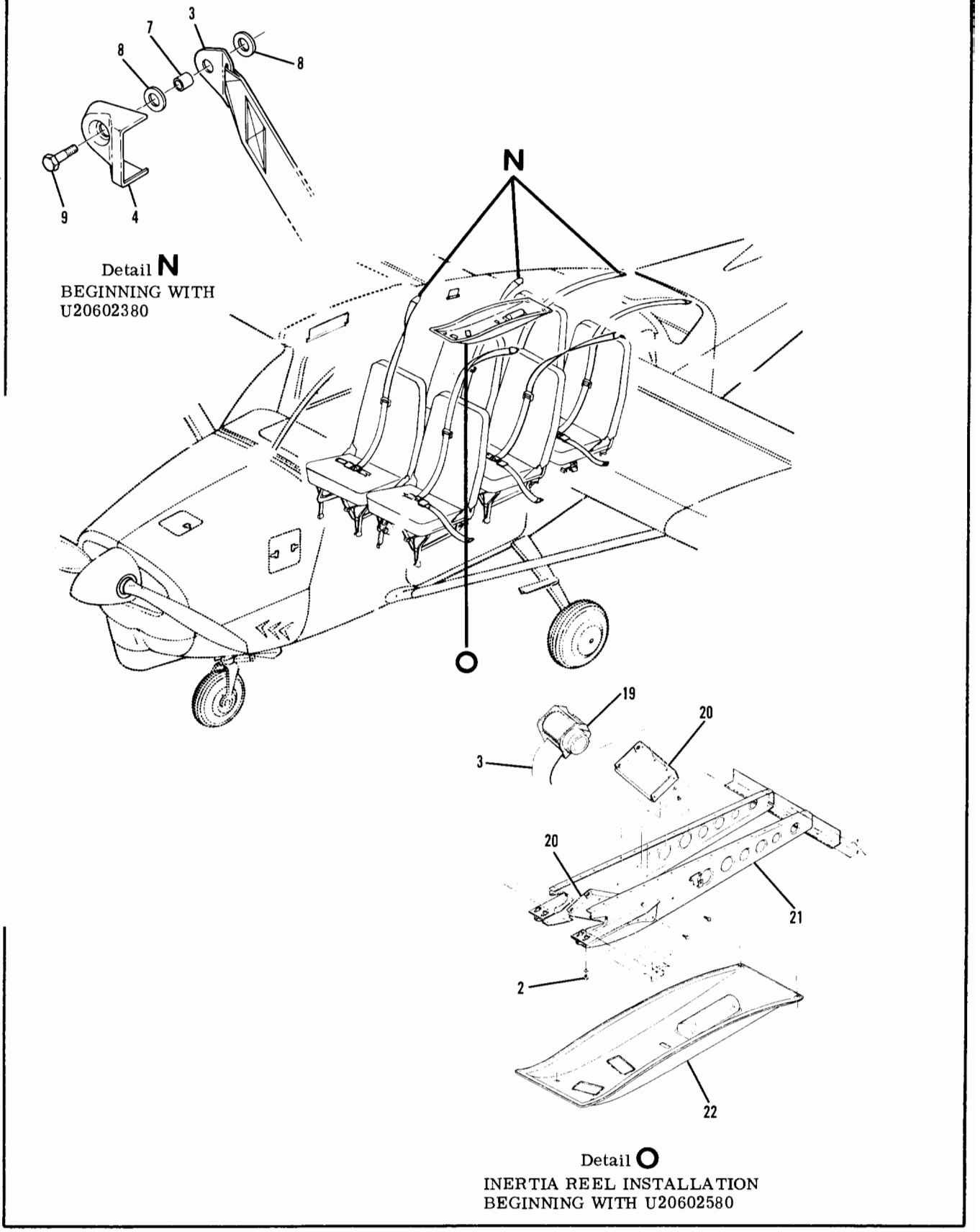


Figure 3-9. Seat Belt and Shoulder Harness Installation(Sheet 3 of 3)

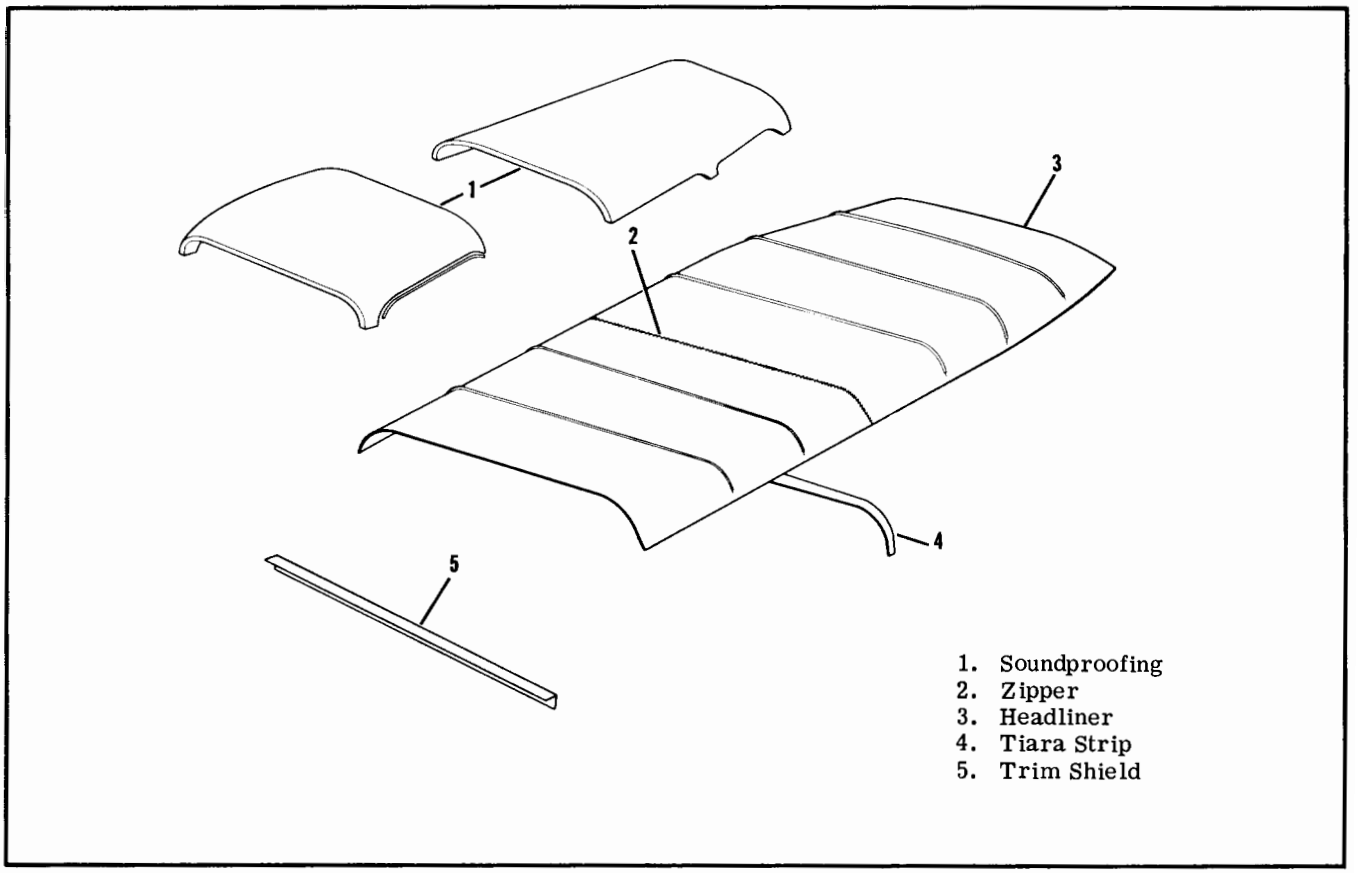


Figure 3-10. Cabin Headliner

b. Apply cement to inside of skin in areas where soundproofing panels are not supported by wire bows and press soundproofing in place.

c. Insert wire bows into headliner seams and secure rearmost edges of headliner after positioning two bows at rear of headliner. Stretch material along edges to ensure it is properly centered, but do not stretch enough to destroy ceiling contours or distort wire bows. Secure edges of headliner with metal teeth or rubber cement.

d. Work headliner forward, installing each wire bow in place with tabs. Wedge ends of wire bows into retainer strips. Stretch headliner just taut enough to avoid wrinkles and maintain a smooth contour.

e. When all bows are in place and fabric edges are secured, trim off excess fabric and reinstall all items removed.

3-46. UPHOLSTERY SIDE PANELS. Removal of upholstery side panels is accomplished by removing seats for access, then removing parts attaching panels. Remove screws, retaining strips, arm rests and ash trays as required to free panels. Automotive type spring clips attach most door panels. A dull putty knife makes an excellent tool for prying loose clips. When installing upholstery side panels, do not over-tighten sheet metal screws. Larger screws may be used in enlarged holes as long as area behind hole is checked for electrical wiring, fuel lines and other components which might be damaged by using a longer screw.

3-47. WINDLACE (DOOR SEAL). To furnish an ornamental edging for door opening and to provide additional sealing, a windlace is installed between upholstery panels or trim panels and doorpost structure. The windlace is held in place by sheet metal screws.

3-48. CARPETING. Cabin area and baggage compartment carpeting is held in place by rubber cement, small sheet metal screws and retaining strips. When fitting a new carpet, use old one as a pattern for trimming and marking screw holes.

3-49. SAFETY PROVISIONS.

3-50. 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 3-11. The eyebolt and nutplate can be located at various points. The sliding tie-down lug also utilizes eyebolt and attaches to a seat rail. Different combinations of all four may be used.

3-51. SAFETY BELTS. 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. (Refer to figure 3-9.)

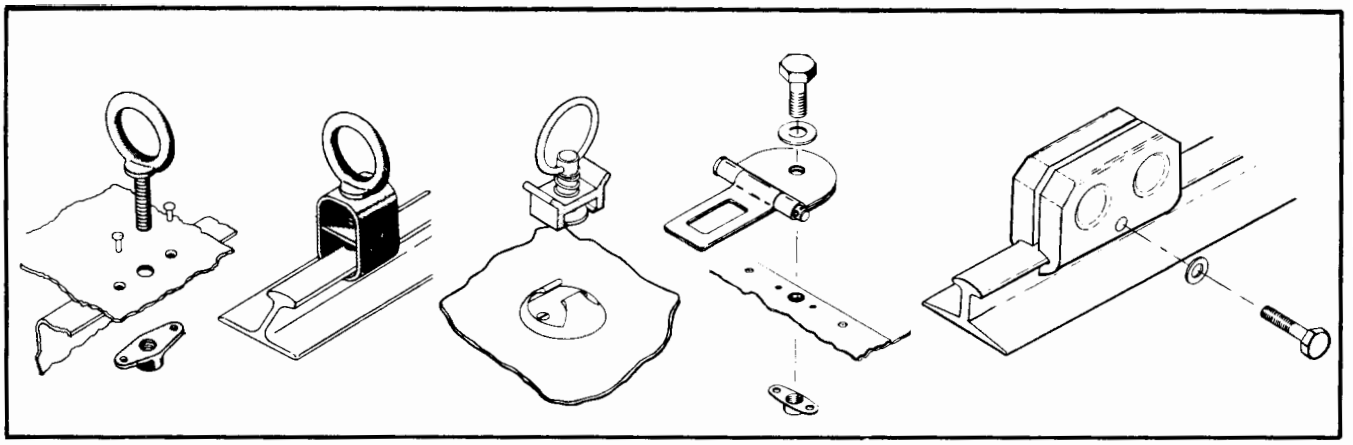


Figure 3-11. Cargo Tie-Down Rings

3-52. SHOULDER HARNESS. Individual shoulder harnesses may be installed at 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. (Refer to figure 3-9.) Beginning with aircraft U20602580, an inertia reel installation is offered. Refer to figure 3-9 for installation.

3-53. GLIDER TOW-HOOK. A glider tow-hook, which is mounted in place of tail tie-down ring, is available for all models.

3-54. REAR VIEW MIRROR. A rear view mirror may be installed on cowl deck above instrument panel. Figure 3-11 shows details of rear view mirror installation.

3-55. CARGO PACK.

3-56. REMOVAL.

a. Remove screws, fairing and seal from around each landing gear spring.

b. Position a suitable support under pack.

c. Remove screws attaching pack to aircraft and remove pack.

NOTE

If aircraft is to be returned to its original configuration (minus cargo pack), the four small panels which enclose area around nose gear shock strut and drag brace may be left installed instead of the two larger panels. However, the control extension and cowl flap baffles must be removed as outlined in paragraph 3-59.

3-57. INSTALLATION. Prior to positioning pack under aircraft, inspect all rivnuts in bottom of fuselage for obstructions. Also check the small panels which enclose area around nose gear shock strut and drag brace. Two panels are provided in this area on standard aircraft; these are to be replaced by four smaller panels when a cargo pack is installed. If not previously removed, remove standard panels by unsnapping quick-release fasteners. Install the smaller panels furnished with cargo pack.

NOTE

Install the rearmost panels first, right hand panel lapping over left hand panel along aircraft centerline. Install the forward panels in a similar manner.

a. Move pack into position under aircraft. Raise aft end of pack and place a support under it.

b. Raise forward end of pack and align two forward holes in pack rim with two front rivnuts. Install two screws to support forward end of pack.

NOTE

Install lock washers and flat washers under heads of all pack attaching screws.

c. Raise aft end of pack and install two attaching screws.

d. Check pack for proper alignment, install and tighten all remaining screws, except for one screw just forward and aft of each landing gear spring. These two screws will be utilized later to help secure fairing which covers each landing gear opening.

e. Position rubber seal and fairing around each main landing gear spring by spreading these components, at their split side, enough to slip them over gear spring. When installed, split should be at back of gear spring. Check alignment and proper fit of fairing, then install fairing retaining screws.

NOTE

Seven screws are used to secure fairing at each landing gear. Two screws, previously mentioned in step "d," secure top of fairing and rim of cargo pack, in this area, to fuselage. Five additional screws secure and seal sides and bottom of each fairing to pack.

f. Install cowl flap baffles and control extensions in accordance with paragraph 3-60.

3-58. COWL FLAP BAFFLES AND CONTROL EXTENSIONS. (Refer to figure 3-13.)

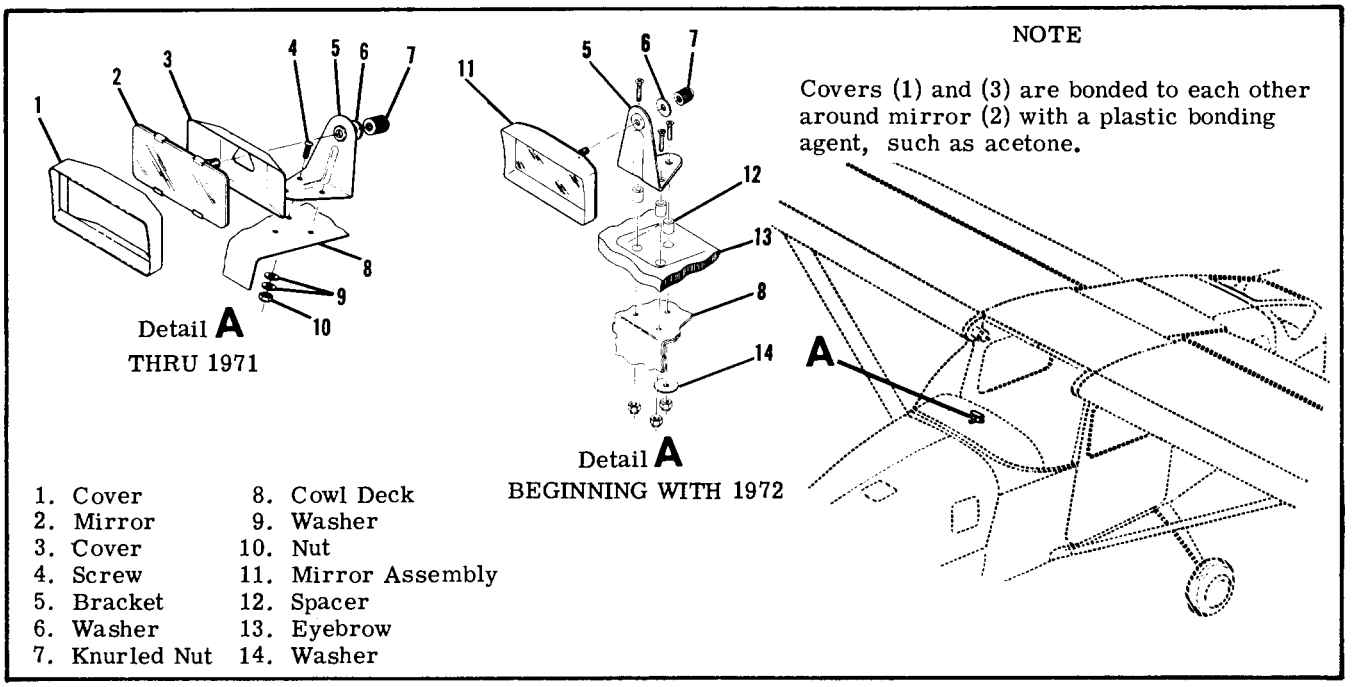


Figure 3-12. Rear View Mirror Installation

3-59. REMOVAL.

a. Disconnect cowl flap control clevises (7) from flaps and take off baffles (1) by removing screws (3) and nuts (2).

b. Remove clevis (7) and link (5) from each control end (8) and reinstall clevises.

c. Rig cowl flaps on standard aircraft per Section 12 and turbocharged aircraft per Section 12A.

3-60. INSTALLATION.

a. Disconnect cowl flap control clevises (7) from flaps and remove clevises. Leave jam nuts (4) on control ends (8).

b. Install links (5) on control ends (8), install jam nuts (6) on links and attach clevises (7) to links. Do not tighten jam nuts.

c. Position baffles (1) along sides of cowl flaps so attaching holes are aligned and install attaching screws and nuts.

NOTE

Each baffle is designed for installation on a specific cowl flap. Determine correct baffle for each flap. Turbocharged aircraft have baffles as standard equipment. Note that flanges on baffles are turned toward inside of each cowl flap opening.

d. Check to ensure flexible controls reach their internal stops in each direction. Mark controls so full control travel can readily be checked and maintained during remaining rigging procedure.

e. Place cowl flap control lever in "OPEN" position and connect control ends (8) to flaps, but do not secure at this time.

f. On standard aircraft, measure distance from trailing edge of cowl skin. Disconnect clevises and adjust links (5) and clevises (7) so each cowl flap opens 6.00 inches with cockpit control OPEN and 1.05 inches with cockpit control CLOSED. On turbocharged aircraft, adjust clevis to obtain measurements of 8.00 inches (cockpit control OPEN) and 2.50 inches (cockpit control CLOSED), then secure clevises. These measurements are made in a straight line from the aft edge of cowl flap, just outboard of cutout to lower edge of firewall. Do not measure from aft corners of cowl flap. If either control needs to be lengthened or shortened, the lower clamp may be loosened and housing slipped in clamp or lower clevis may be adjusted. Maintain sufficient thread engagement of clevis.

g. Check that locknuts are tight, clamps are secure, then cycle cowl flaps several times, checking operation.

3-61. CASKET CARRIER. (Refer to figure 3-14.)

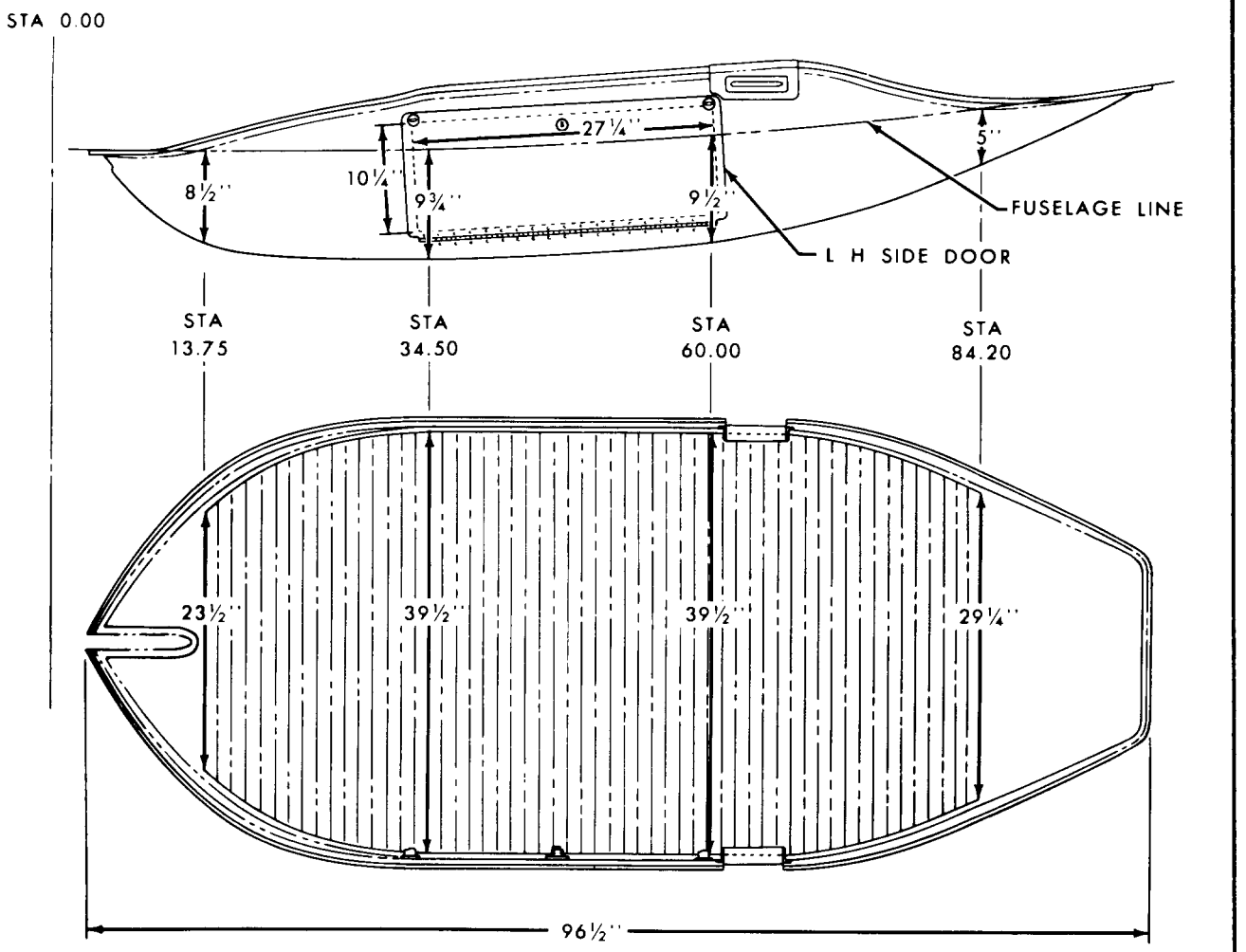
3-62. DESCRIPTION. An optional mortuary kit consists of a casket carrier platform, rack assembly and belt tie-down assemblies. The kit provides aircraft modification instructions and parts required to make the installation.

3-63. INSTALLATION. The following instructions may be used to install platform, rack and tie-down belts, and to load and secure casket:

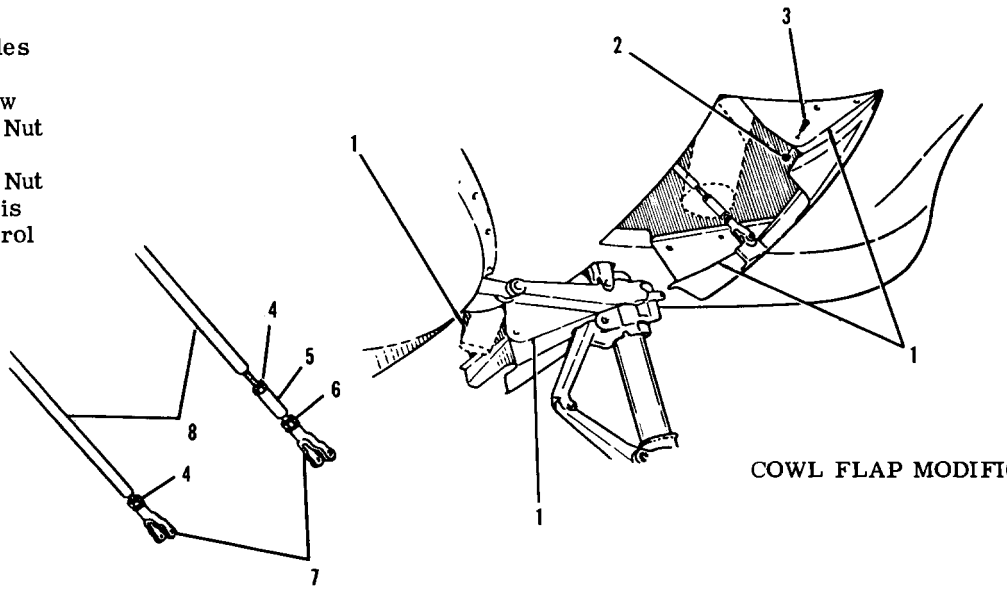
a. Remove all seats and safety belts except pilot's and copilot's.

b. Move pilot's and copilot's seats forward to their limit of travel.

c. Attach belt assemblies to existing left forward and left aft seat attach brackets as shown in detail "G."

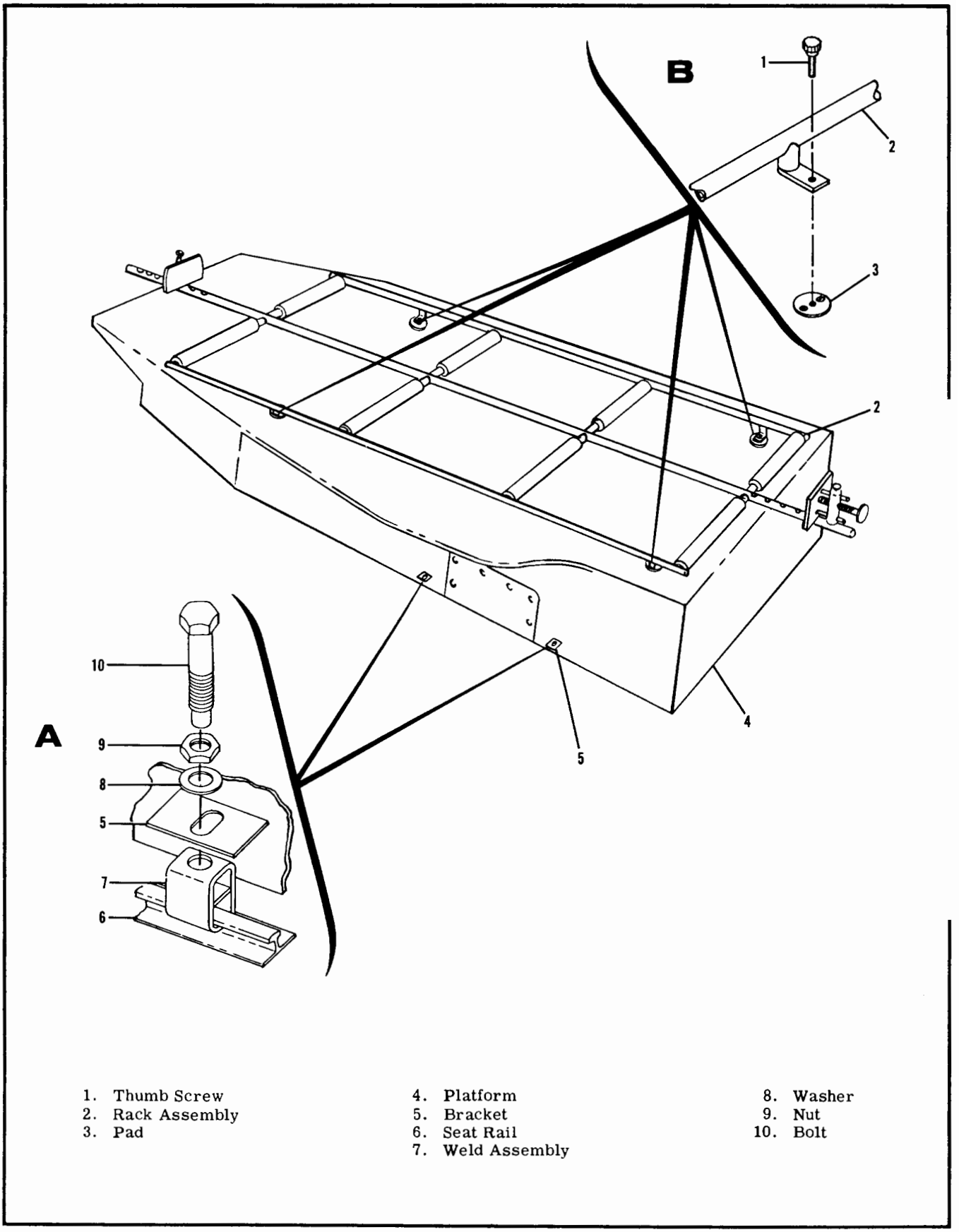


1. Baffles
2. Nut
3. Screw
4. Jam Nut
5. Link
6. Jam Nut
7. Clevis
8. Control



COWL FLAP MODIFICATION

Figure 3-13. Cargo Pack Installation



1. Thumb Screw
2. Rack Assembly
3. Pad
4. Platform
5. Bracket
6. Seat Rail
7. Weld Assembly
8. Washer
9. Nut
10. Bolt

Figure 3-14. Casket Carrier Installation (Sheet 1 of 2)

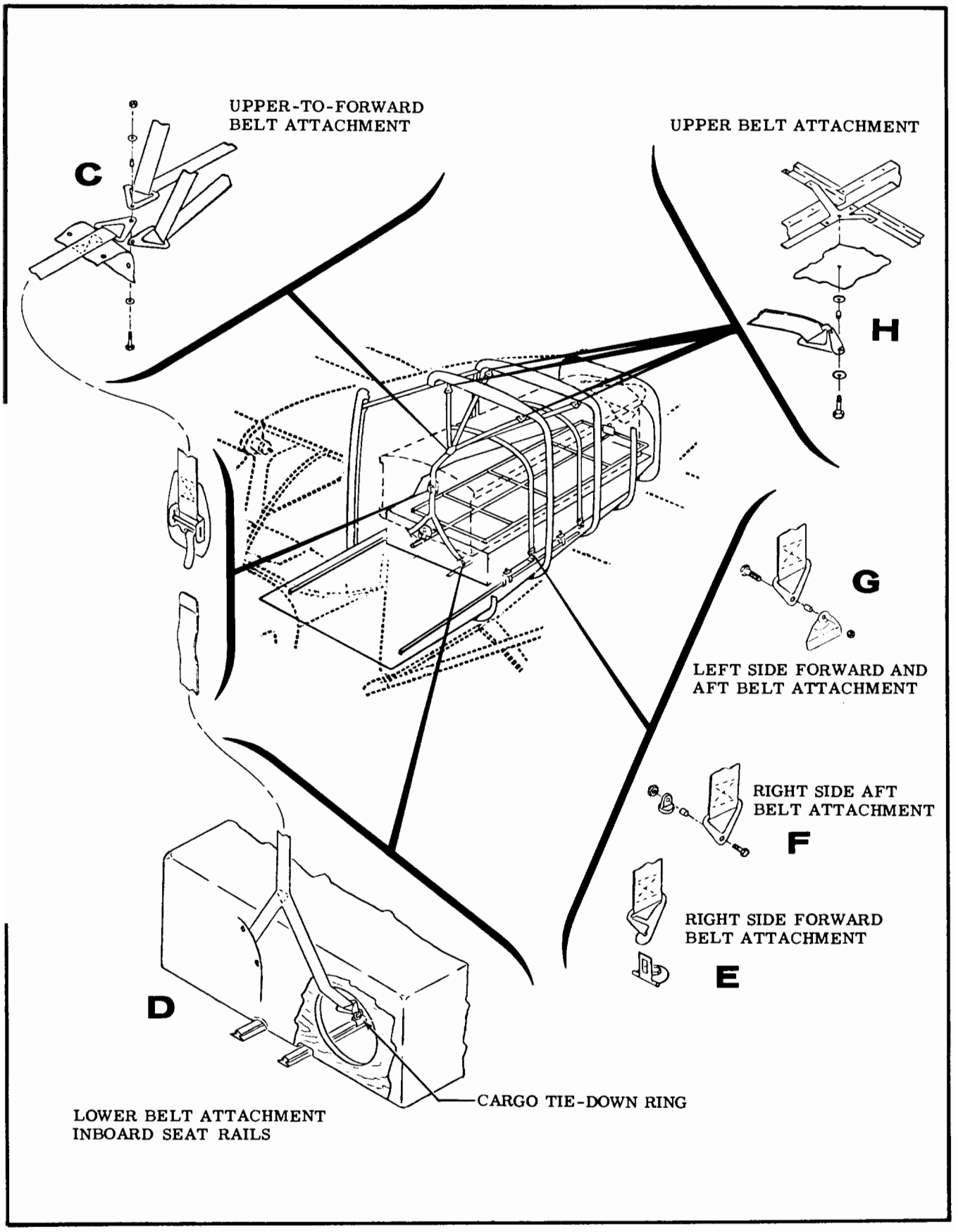


Figure 3-14. Casket Carrier Installation (Sheet 2 of 2)

d. Place platform in cabin and butt aft end of platform against step.
e. Secure both sides of platform to outboard seat rails as shown in detail "A."
f. Install rack on platform as shown in detail "B."
g. Install cargo tie-down rings on inboard seat rails and attach lower belt as shown in detail "D."

NOTE

The cargo tie-down ring on left inboard seat rail is tightened down against seat rail, since no seat adjusting hole exists in rail at this point. The cargo tie-down ring on right inboard seat rail will engage an existing seat adjustment hole.

h. Attach upper belt at four points as shown in detail "H."
i. Attach upper belt to forward belt as shown in detail "C."
j. Attach right forward and right aft belts to existing seat belt attach points as shown in details "E" and "F."
k. Remove pilot's seat back by removing quick-release pins.
l. Load casket, adjusting end plates on rack according to casket length. Tighten forward end plate snugly.
m. Tighten all belts securely and recheck all tie-down attachments.
n. Reinstall pilot's seat back.

3-64. REMOVAL. After casket has been removed, platform, rack, and belts may be removed by reversing installation procedure.

SHOP NOTES:

SECTION 4

WINGS AND EMPENNAGE

TABLE OF CONTENTS

4-1. WINGS AND EMPENNAGE.

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

4-3. DESCRIPTION. Each all-metal wing panel is a semicantilever, semimonocoque type, with two main spars and suitable ribs for attachment of the skin. Skin panels are riveted to ribs, spars and stringers to complete the structure. Beginning with U20601701 the leading edge skins are bonded. An all-metal, balanced aileron, a flap, and a detachable wing tip are mounted on each wing assembly. A single rubberized bladder-type fuel cell is mounted between the wing spars at the inboard end of each wing and the leading edge of the left wing, thru 1971 models, has landing and taxi lights installed. Beginning with 1972 models the landing and taxi lights are mounted in the lower engine nose cowl. Navigation/strobe lights are mounted at each contoured wing tip.

4-4. REMOVAL. Wing panel 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 screws securing cabin top skin to the wing top skin.
b. Remove all wing inspection plates.
c. Drain fuel from cell of wing being removed.
d. Disconnect:
1. Electrical wires at wing root disconnects.
2. Fuel lines at wing root. (Refer to precautions outlined in paragraph 13-3.)
3. Pitot line (left wing only) at wing root.
4. Cabin ventilator hose at wing root.
e. Slack off tension on flap and aileron cables by loosening turnbuckles, then disconnect cables at flap and aileron bellcranks.

NOTE

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

f. Support wing at outboard end and disconnect strut at wing fitting. Tie strut up with wire to prevent it from swinging down and straining strut-to-fuselage fittings. If the fuselage fitting projects from the fuselage and is covered by the strut fairing, loosen the fairing and slide it up the strut; the strut may then be lowered without damage.

NOTE

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

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

NOTE

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

i. Remove wing and lay on padded stand.

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

4-6. INSTALLATION.

a. Hold wing in position and install bolts, bushings, washers and nuts attaching wing spars to fuselage fittings. Ensure eccentric bushings are positioned as marked when removed.

b. Install bolts, spacers and nuts to secure upper and lower ends of wing strut to wing and fuselage fittings.

c. Route flap and aileron cables, using guide wires. (See note in paragraph 4-4.)

d. Connect:

1. Electrical wires at wing root disconnects.
2. Fuel lines at wing root. (Refer to precautions outlined in paragraph 13-3.)
3. Pitot line (if left wing is being installed.)
4. Wing leveler vacuum line, if installed, at wing root.
5. Ventilator hose at wing root.

e. Rig aileron system (Section 6).

f. Rig flap system (Section 7).

g. Refuel fuel cell and check for leaks.

h. Check operation of navigation/strobe also landing and taxi lights thru 1971 models.

i. Check operation of fuel quantity indicator.

j. Install wing gap fairings.

NOTE

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

k. Install all wing 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.

a. Remove wing fairing strip on "wing-heavy" side of aircraft.

b. (See figure 4-1.) Loosen nut (7) and rotate bushings (5) simultaneously until the bushings are positioned with the thick side of the eccentrics up. This will lower the trailing edge of the wing, and decrease "wing-heaviness" by increasing the angle-of-incidence of the wing.

CAUTION

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

c. Tighten nut and reinstall fairing strip.

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

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

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

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

4-10. REMOVAL AND INSTALLATION.

a. Thru U20602501 remove screws from strut fairings and slide fairing along strut. Beginning with U20602501 the upper strut fairing is split along the aft edge and attached together with screws for easy removal.

b. Remove fuselage and wing inspection plates at strut junction points.

c. Support wing securely, then remove nut and bolt securing strut to fuselage.

d. Remove nut, bolt and spacer used to attach strut to wing, then remove strut from aircraft.

e. Reverse preceding steps to install strut.

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

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

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

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

a. Remove fairings on either side of fin.

b. Disconnect flashing beacon lead, tail navigation light lead, antennas and antenna leads, and rudder cables, if rudder has not been removed.

c. Remove screws attaching dorsal to fuselage.

d. Remove bolts attaching fin front and rear spars to fuselage, and remove vertical fin.

e. Install fin by reversing preceding steps. Be sure to check and reset rudder and elevator travel if any stop bolts were removed or settings disturbed.

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

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

4-17. DESCRIPTION. The horizontal stabilizer is primarily of metal construction, consisting of ribs and a front and rear spar which extend throughout the full spars and ribs. Stabilizer tips are of ABS construction. The elevator tab actuator screw is contained within the horizontal stabilizer assembly, and is supported by a bracket riveted to the rear spar. The underside of the stabilizer contains a covered opening which provides access to the elevator tab actuator screw. Hinge brackets at the rear spar support the elevators.

4-18. REMOVAL AND INSTALLATION.

a. Remove elevators and rudder in accordance with procedures outlined in Sections 8 and 10.

b. Remove vertical fin in accordance with procedures outlined in paragraph 4-14.

c. Disconnect elevator trim control cables at clevis and turnbuckle inside tailcone, remove pulleys which route aft cables into horizontal stabilizer, and pull cables out of tailcone.

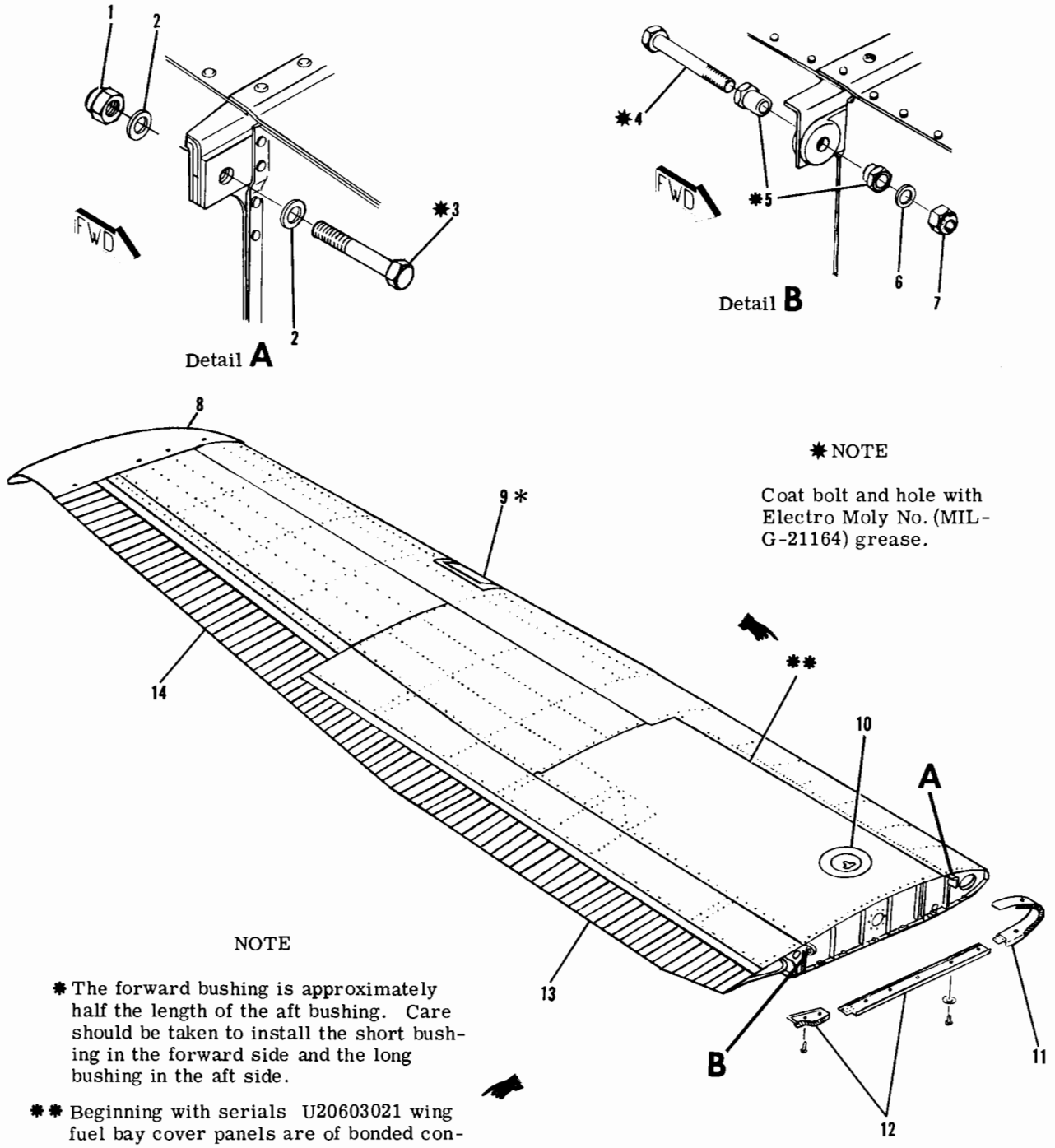
d. Remove bolts securing horizontal stabilizer to fuselage.

e. Remove horizontal stabilizer.

f. Install horizontal stabilizer by reversing preceding steps. Rig control systems as necessary. Check operation of tail navigation light and flashing beacon.

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

SHOP NOTES:



✱NOTE

Coat bolt and hole with Electro Moly No. (MIL-G-21164) grease.

NOTE

✱ The forward bushing is approximately half the length of the aft bushing. Care should be taken to install the short bushing in the forward side and the long bushing in the aft side.

✱✱ Beginning with serials U20603021 wing fuel bay cover panels are of bonded construction.

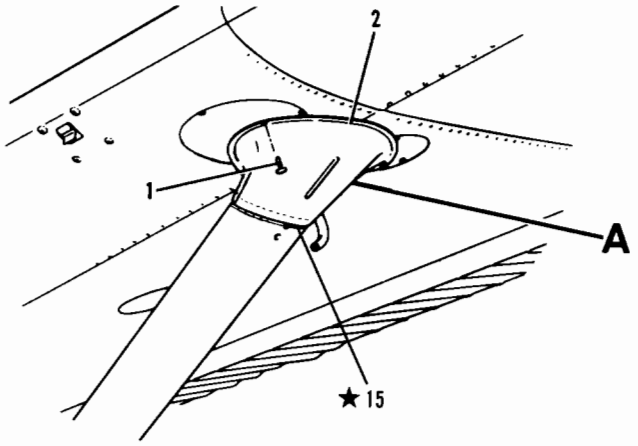
✱THRU AIRCRAFT SERIAL U20601700

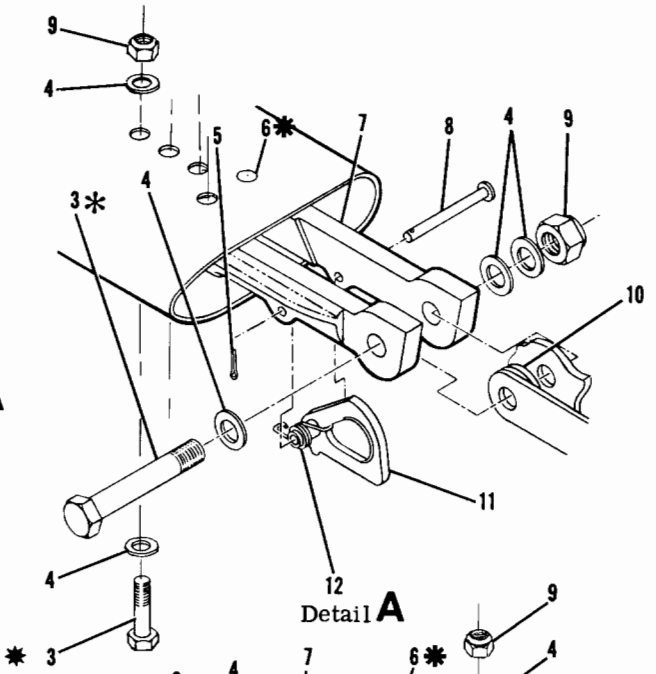
1. Nut
2. Washer
3. Bolt
4. Bolt
5. Bushing
6. Washer
7. Nut
8. Tip Assembly
9. Landing and Taxi Light
10. Fuel Filler Cap
11. Fillet
12. Fairing
13. Flap
14. Aileron

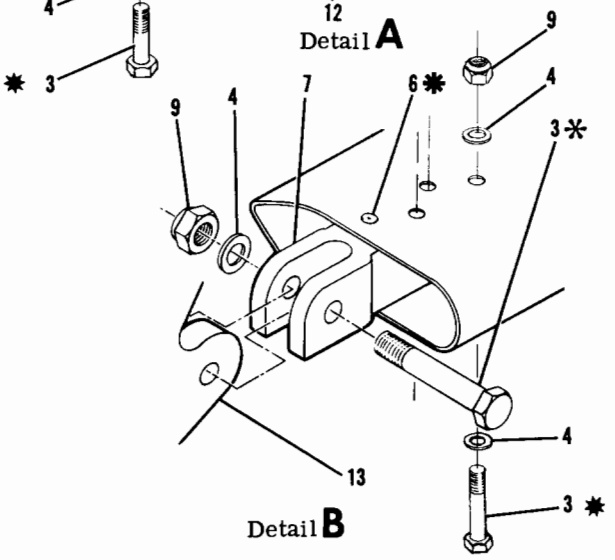
Figure 4-1. Wing Installation

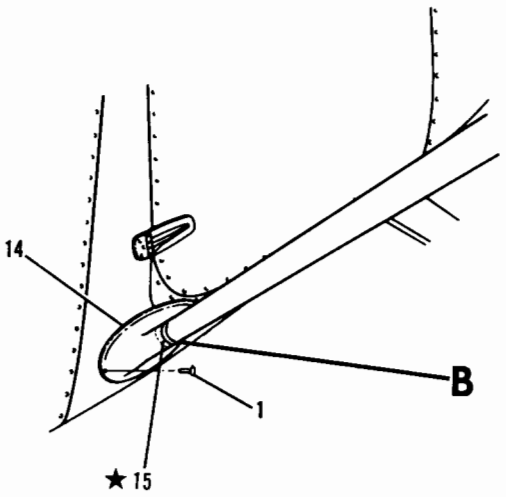
★NOTE

Beginning with aircraft serial U20602502 wrap strut using Y8562 polyurethane tape (1" wide) centered at point where strut cuff terminates.









✱THRU U20601700

✱BEGINNING WITH U20601701

✱NOTE

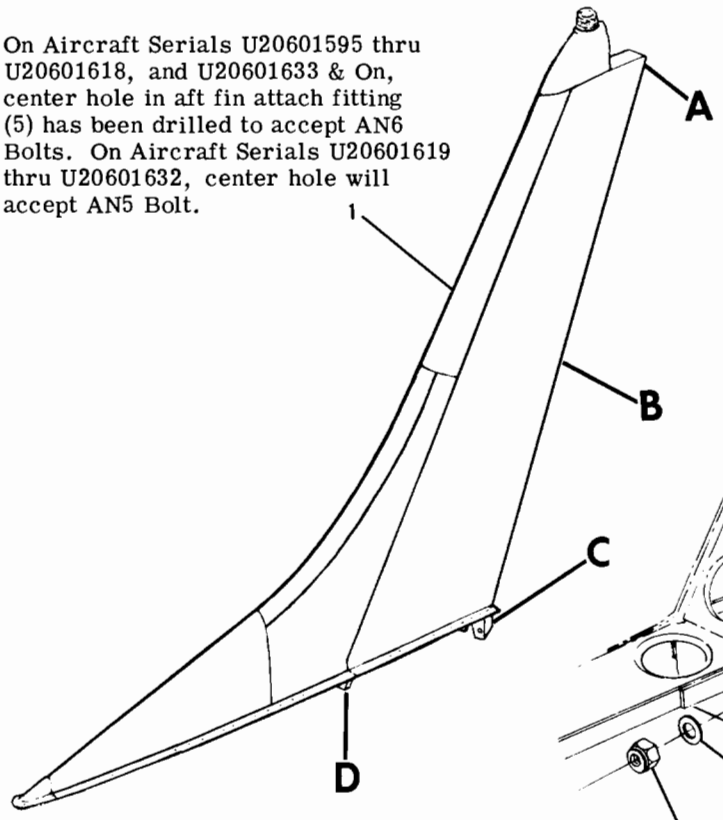
Coat bolt and hole with Electro Moly No. (MIL-G-21164) grease.

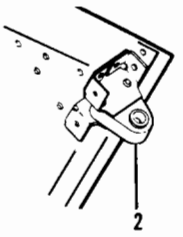
1. Screw
2. Upper Fairing
3. Bolt
4. Washer
5. Cotter Pin
6. Rivet
7. Strut Fitting
8. Pin
9. Nut
10. Spacer
11. Mooring Ring
12. Spring
13. Fuselage Fitting
14. Lower Fairing
15. Tape

Figure 4-2. Wing Strut Installation

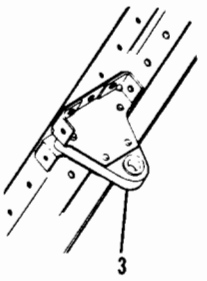
NOTE

On Aircraft Serials U20601595 thru U20601618, and U20601633 & On, center hole in aft fin attach fitting (5) has been drilled to accept AN6 Bolts. On Aircraft Serials U20601619 thru U20601632, center hole will accept AN5 Bolt.

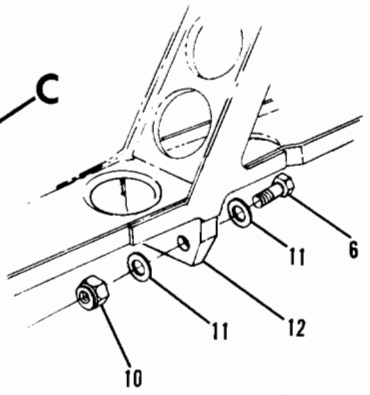




Detail **A**

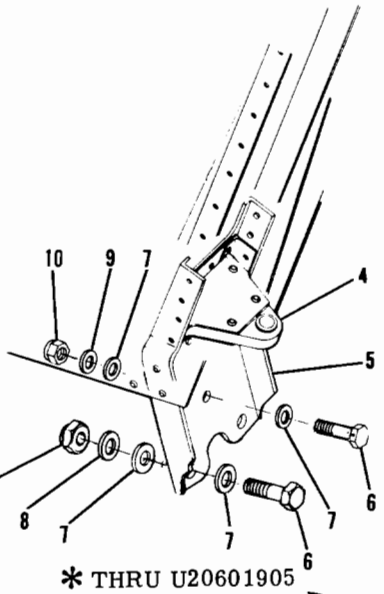


Detail **B**



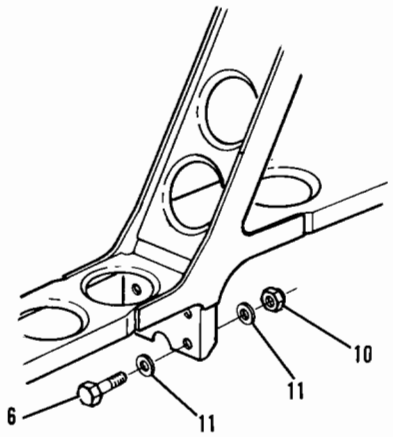
THRU U20601905

Detail **D**



* THRU U20601905

Detail **C**



BEGINNING WITH U20601906

Detail **D**

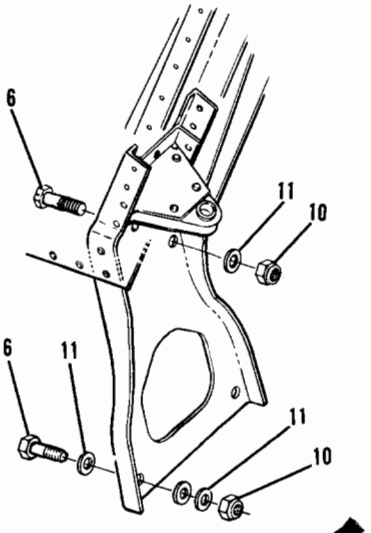
*THRU AIRCRAFT SERIAL P20600648 and U20601587 when not modified per Single-engine Service Letter SE71-29, Dated October 15, 1971, use washers (7) and (8) on rear fin fitting. Use washers (7), (8) and (9) when modified by installation of new bulkhead, and all Service Parts. Use washers (7) when modified by reaming of bolt holes.

AIRCRAFT SERIALS U20601588 THRU U20601904, use washers (7), (8) and (9).

TORQUE AN5 BOLTS TO 140-225 LB IN.
TORQUE AN6 BOLTS TO 190-390 LB IN.
TORQUE AN7 BOLTS TO 500-840 LB IN.

NOTE

Beginning with 1962 Models, Cessna Single-engine Service Letter SE72-3 dated, February 11, 1972 should be complied with.

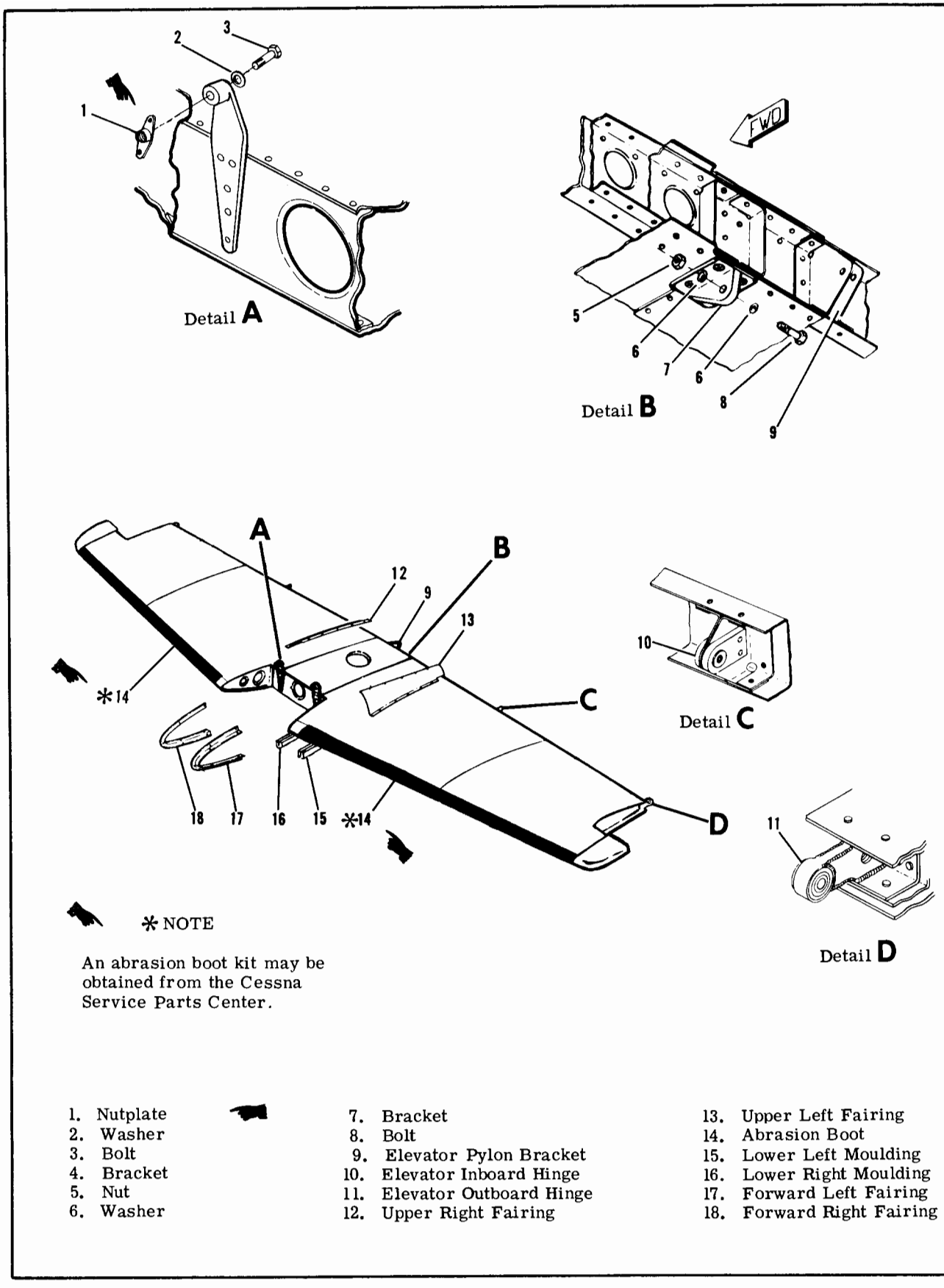


BEGINNING WITH U20601906

Detail **C**

1. Fin Assembly
2. Upper Rudder Hinge
3. Center Rudder Hinge
4. Lower Rudder Hinge
5. Aft Attach Fitting
6. Bolt
7. Washer
8. Washer
9. Washer
10. Nut
11. Washer
12. Fwd Attach Fitting

Figure 4-3. Vertical Fin Installation



1. Nutplate
2. Washer
3. Bolt
4. Bracket
5. Nut
6. Washer
7. Bracket
8. Bolt
9. Elevator Pylon Bracket
10. Elevator Inboard Hinge
11. Elevator Outboard Hinge
12. Upper Right Fairing
13. Upper Left Fairing
14. Abrasion Boot
15. Lower Left Moulding
16. Lower Right Moulding
17. Forward Left Fairing
18. Forward Right Fairing

Figure 4-4. Horizontal Stabilizer

SECTION 5

LANDING GEAR AND BRAKES

TABLE OF CONTENTS

5-1. LANDING GEAR.

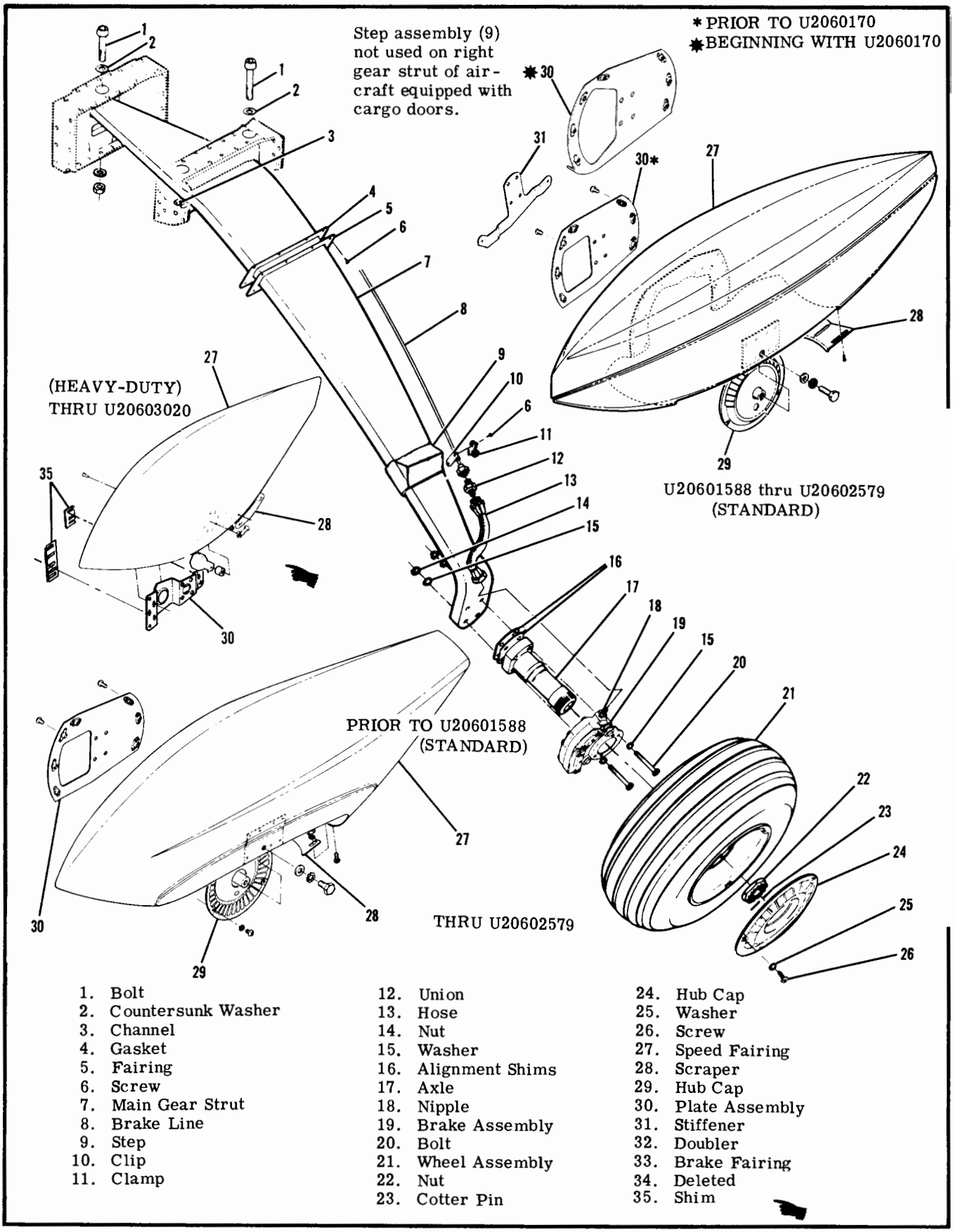
5-2. DESCRIPTION. These aircraft are equipped with non-retractable, tricycle landing gear, utilizing flat spring-steel main gear struts. Disc-type brakes and tube-type tires are installed on the axle at the lower end of the strut. Speed fairings or heavy-duty wheels may be installed on some aircraft. The nose gear is a combination of a conventional air/oil (oleo) strut and fork, incorporating a shimmy dampener. The nose wheel is steerable with the rudder pedals up to a maximum pedal deflection, after which it becomes free-swiveling up to a maximum travel right or left of center. Through the use of the brakes, the aircraft can be pivoted around the outer wing strut fitting. A speed fairing or a heavy-duty shock strut and wheel may be installed on some aircraft.

5-3. MAIN LANDING GEAR.

5-4. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
AIRCRAFT LEANS TO ONE SIDE.	Incorrect tire inflation.	Inflate to correct pressure.
	Landing gear attaching parts not tight.	Tighten loose parts; replace defective parts.
	Sprung landing gear spring.	Replace spring.
	Bent axle.	Replace axle.
	Different quantity of fuel in wing cells.	Refuel aircraft.
	Structural damage to landing gear bulkhead components.	Replace damaged parts.
UNEVEN OR EXCESSIVE TIRE WEAR.	Incorrect tire inflation.	Inflate to correct pressure.
	Wheels out of alignment.	Align wheels. See figure 5-2.
	Wheels out of balance.	Refer to paragraph 5-16.
	Sprung landing gear spring.	Replace spring.
	Bent axle.	Replace axle.
	Dragging brake.	Refer to paragraph 5-48.
	Wheel bearings not adjusted properly.	Tighten axle nut properly.
WHEEL BOUNCE EVIDENT EVEN ON SMOOTH SURFACE.	Out of balance condition.	Correct in accordance with 5-16.

SHOP NOTES:



1. Bolt
2. Countersunk Washer
3. Channel
4. Gasket
5. Fairing
6. Screw
7. Main Gear Strut
8. Brake Line
9. Step
10. Clip
11. Clamp
12. Union
13. Hose
14. Nut
15. Washer
16. Alignment Shims
17. Axle
18. Nipple
19. Brake Assembly
20. Bolt
21. Wheel Assembly
22. Nut
23. Cotter Pin
24. Hub Cap
25. Washer
26. Screw
27. Speed Fairing
28. Scraper
29. Hub Cap
30. Plate Assembly
31. Stiffener
32. Doubler
33. Brake Fairing
34. Deleted
35. Shim

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

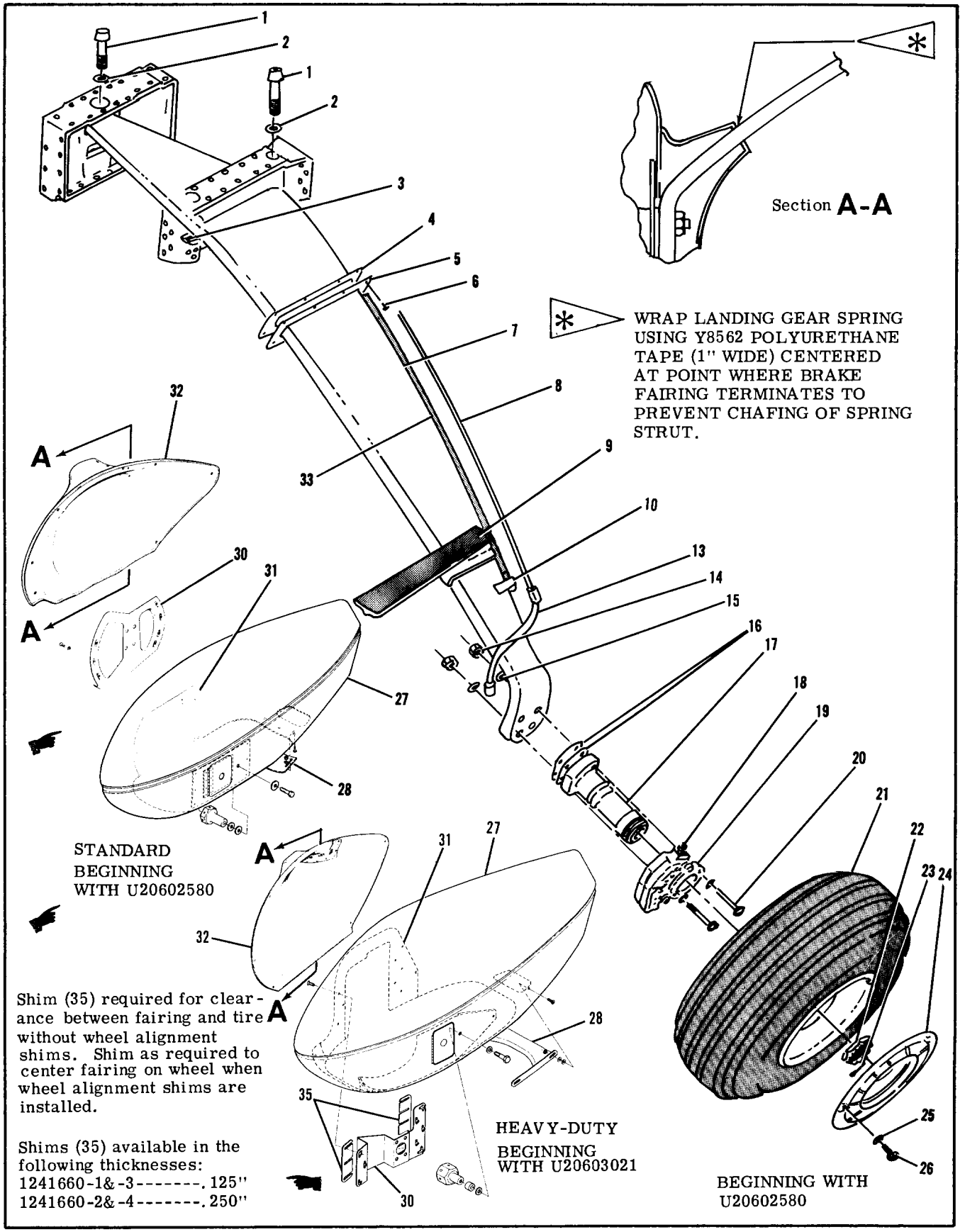


Figure 5-1. Main Landing Gear (Sheet 2 of 2)

5-5. REMOVAL. (Refer to figure 5-1.)
a. Remove floorboard access covers over spring-strut being removed.
b. Hoist or jack aircraft as outlined in Section 2.
c. Remove brake bleeder screw and drain hydraulic brake fluid from gear being removed.
d. Disconnect and cap or plug brake line at bulkhead fitting in fuselage.
e. Remove screws attaching landing gear strut fairing and gasket to fuselage.
f. Remove inboard bolt, loosen two outboard bolts and work strut out to remove.

NOTE

Use care when removing strut to prevent damage to hydraulic brake line. Retain any shims under inboard bolt.

5-6. INSTALLATION. (Refer to figure 5-1.) To install the main landing gear, reverse the procedures outlined in the preceding paragraph. Special attention should be paid to the following:
a. When installing main landing gear strut, the outboard channel attaching bolts should be tightened to a torque value of 600 - 750 pound-inches.

NOTE

The convex surface of the outboard channel is installed against the lower side of the strut. When channel attaching bolts are torqued to 600 - 750 pound-inches, the channel should have a minimum of 80 percent contact with the lower side of the strut.

b. After installation, fill and bleed affected brake system in accordance with paragraph 5-60.

5-6A. REMOVAL AND INSTALLATION OF MAIN LANDING GEAR BRAKE FAIRINGS. (Refer to figure 5-1, sheet 2.)
a. Remove screws from perimeter of fairing.
b. Remove screws from nutplates holding fairing together.
c. Flex brake fairing over landing gear spring strut to remove.
d. Reverse preceding steps to install brake fairing.

5-7. REMOVAL AND INSTALLATION OF STANDARD MAIN WHEEL SPEED FAIRINGS. Main wheel speed fairings are removed by removing the screws attaching the inboard side of the fairing to the adapter plate, and removing the bolt securing the outboard side to the axle nut. Installation is the reverse of removal. Refer to Service Kit SK182-12 for repair of speed fairings installed on models prior to 1971. Standard main wheel speed fairing scraper-to-tire clearance should be adjusted for a minimum clearance of 0.25-inch to a maximum clearance of 0.38-inch. Optional heavy-duty main wheel scraper-to-tire clearance should be adjusted to 0.40 to 0.60-inch. Elongated holes in the scraper are provided so the scraper may be adjusted.

CAUTION

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

5-7A. MAIN WHEEL AND TIRE ASSEMBLY.

5-7B. DESCRIPTION. The aircraft may be equipped with either Cleveland or McCauley wheel and tire assemblies. Separate disassembly, inspection and reassembly instructions are provided for each type. Basic differences of the two types are discussed in paragraph 5-11D, and thru-bolt nut and capscrew torque valves are listed in figure 5-11A.

CAUTION

Use of recapped tires is not recommended. However, if recapped tires are used on the aircraft, make sure there is sufficient clearance between tire and wheel fairings, if fairings are installed. Ensure that speed fairing scraper-to-tire clearance is adjusted to the values specified in paragraph 5-7.

5-8. REMOVAL OF MAIN WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-11.)

NOTE

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

a. Using universal jack point, jack wheel as outlined in Section 2.
b. Remove speed fairing as outlined in paragraph 5-7.
c. Remove cotter pin and axle nut after removing hub cap.
d. Remove bolts and washers attaching back plate; remove back plate.
e. Pull wheel from axle.

5-9. DISASSEMBLY OF CLEVELAND MAIN WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-11.)
a. Deflate tire and break tire beads loose.

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 grease seal rings, felts and bearing cones from wheel halves.

NOTE

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

5-10. INSPECTION AND REPAIR OF CLEVELAND MAIN WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-11.)

a. Clean all metal parts and grease seal felts in cleaning solvent and dry thoroughly.

b. Inspect wheel halves for cracks. Cracked wheel halves shall be discarded and new parts used. Sand out small nicks, gouges and corroded areas. When the protective coating has been removed, the area should be cleaned thoroughly, primed with zinc chromate and painted with aluminum lacquer.

c. If excessively warped or scored, or worn to a thickness of .340-inch, brake disc should be replaced with a new part. Sand smooth small nicks and scratches.

d. Carefully inspect bearing cones and cups for damage and discoloration. After cleaning, pack bearing cones with clean aircraft wheel bearing grease (Section 2) before installing in the wheel.

5-11. REASSEMBLY OF CLEVELAND MAIN WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-11.)

a. Insert thru-bolts through brake disc and position in the inner wheel half, using the bolts to guide disc. Assure that the disc is bottomed in wheel half.

b. Position the tire and tube with the inflation valve through hole in outboard wheel half. Place the inner wheel half in position. Apply a light force to bring wheel halves together. Maintaining the light force, assemble a washer and nut on one thru-bolt and tighten snugly. Assemble the remaining nuts and washers on thru-bolts and torque to value specified in figure 5-11A.

CAUTION

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

c. Clean and repack bearing cones with clean aircraft wheel bearing grease (Section 2).

d. Assemble the bearing cones, grease seal felts, and rings into the wheel halves.

e. Inflate tire to seat tire beads, then adjust to correct pressure.

5-11A. DISASSEMBLY OF McCAULEY MAIN WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-11.)

a. Remove screws attaching hub cap; remove hub cap.

WARNING

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

b. Remove valve core and deflate tire and tube. Break tire beads loose from wheel flanges.

c. Remove cap screws.

d. Remove brake disc.

e. Separate wheel flanges from wheel hub. Retain spacers on each side of wheel hub.

f. Remove wheel hub from tire.

g. Remove retainer rings and remove grease seal retainers, grease seal felts and bearing cones.

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 in boiling water for 30 minutes or in an oven to exceed 121°C (250°F). Using an arbor press, if available, press out the bearing cup and press in the new bearing cup while the wheel hub is still hot.

5-11B. INSPECTION AND REPAIR OF McCAULEY MAIN WHEEL AND TIRE ASSEMBLY. (Refer to figure 9-11.)

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. If excessively warped or scored, or worn to a thickness of 0.190-inch, brake disc should be replaced with a new part. Sand smooth small nicks and scratches.

d. Carefully inspect bearing cones and cups for damage and discoloration. After cleaning, pack bearing cones with clean aircraft wheel bearing grease (refer to Section 2) before installing in the wheel hub.

5-11C. REASSEMBLY OF McCAULEY WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-11.)

a. Place wheel hub in tire and tube with tube inflation stem in cutout of wheel hub.

b. Place spacer and wheel flange on inboard side of wheel hub (opposite of tube inflation stem), then place washer under head of each capscrew and start capscrews into wheel hub threads.

c. Place spacer and wheel flange on other side and align valve stem in cutout in wheel flange.

d. Place washer under head of each capscrew and start capscrews into hub threads.

CAUTION

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

e. Tighten capscrews evenly and torque to the value specified in figure 5-11A.

f. Clean and pack bearing cones with clean aircraft wheel bearing grease.

g. Assemble bearing cones, grease seal felts and retainers into wheel hub.

h. Inflate tire to seat tire beads, then adjust to correct tire pressure. Refer to Section 1 for correct tire pressure.

5-11D. MAIN AND NOSE WHEEL THRU-BOLT NUT OR CAPSCREW TORQUE VALUES. (Refer to figure 5-11A.) During assembly of the main and nose wheel, the thru-bolt nuts or capscrews should be tightened evenly and torqued to the values specified in figure 5-11A. To facilitate identification of wheel manufacturers, solid wheels are manufactured by Cleveland Aircraft Products Co., and webbed wheels are manufactured by McCauley Industrial Corporation. Cleveland wheels are also identified by having two wheel halves as shown in figure 5-4 and figure 5-11. McCauley wheels are identified by having two wheel flanges and a hub as shown in figure 5-4 and figure 5-11.

5-12. INSTALLATION OF MAIN WHEEL AND TIRE ASSEMBLY.

a. Place wheel on axle.

b. Install axle nut and tighten until a slight bearing drag is obvious when the wheel is rotated. Back off nut to nearest castellation and install cotter pin.

c. Place brake back plate in position and secure with bolts and washers. Safety wire the bolts.

d. Install speed fairing as outlined in paragraph 5-7.

CAUTION

Always check scraper-to-tire clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustment has been disturbed. The standard main wheel speed fairing scraper-to-tire clearance should be adjusted for a minimum clearance of 0.25 inch to a maximum clearance of 0.38 inch. The optional heavy-duty main wheel fairing scraper-to-tire clearance should be adjusted to 0.40 to 0.60 inch. Elongated holes in the scraper are provided so that scraper may be adjusted. Wipe fuel and oil from the speed fairings to prevent stains and deterio-

SHOP NOTES:

ration. If the aircraft is flown from surfaces with mud, snow, or ice, the fairings should be checked to make sure there is no accumulation which could prevent normal wheel rotation.

5-13. REMOVAL OF MAIN WHEEL AND AXLE.

a. Remove speed fairing in accordance with paragraph 5-7.

b. Remove wheel in accordance with paragraph 5-8.

c. Disconnect, drain, and plug the hydraulic brake line at the brake cylinder.

d. Remove four nuts and bolts securing axle and brake components to spring strut.

NOTE

When removing axle from spring strut, 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.

5-14. INSTALLATION OF MAIN WHEEL AND AXLE.

a. Secure axle and brake components to spring sturt, making sure that wheel alignment shims and speed fairing mounting plate are reinstalled in their original positions.

b. Install wheel assembly on axle in accordance with paragraph 5-12.

c. Connect hydraulic brake line to brake cylinder.

d. Fill and bleed affected brake system in accordance with paragraph 5-60.

5-15. MAIN WHEEL ALIGNMENT. Correct main wheel alignment is obtained through the use of tapered shims between the gear strut and the flange of the axle. See figure 5-2 for procedure to use in checking alignment. Wheel shims, and the correction imposed on the wheel by the various shims, are listed in the illustration.

NOTE

Failure to obtain acceptable wheel alignment through the use of the shims indicates a deformed main gear strut or strut attaching bulkhead out of alignment.

5-16. WHEEL BALANCING. Since uneven tire wear is usually the cause of wheel unbalance, replacing the tire probably will correct this condition. Tire and tube manufacturing tolerances permit a specified amount of static unbalance. The lightweight point of the tire is marked with a red dot on the tire sidewall and the heavyweight 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.

5-17. STEP BRACKET INSTALLATION.

NOTE

The step bracket is secured to the landing gear spring strut with EA9309, or a similar epoxy base adhesive.

a. Mark the position of the bracket so that the replacement bracket will be installed in approximately the same position.

b. Remove all traces of the original adhesive as well as any rust, paint, or scale with a wire brush and coarse sandpaper.

c. Leave surfaces slightly roughened or abraided, but deep scratches or nicks should be avoided.

d. Clean the surfaces to be bonded thoroughly. If a solvent is used, remove all traces of the solvent with a clean, dry cloth. It is important for the surfaces to be clean and dry.

e. Check the fit of the step bracket on the spring. A gap of not more than 1/32 inch is permissible.

f. Mix the adhesive carefully according to manufacturer's directions.

g. Spread a coat of adhesive on the surfaces to be bonded, and place step bracket in position on the spring. Tap the bracket upward to insure a tight fit.

h. Form a small fillet of the adhesive at all edges of the bonded surfaces. Remove excess adhesive with lacquer thinner.

i. Allow the adhesive to cure thoroughly according to manufacturer's recommendations before flexing the gear spring or applying loads to the step.

j. Repaint gear spring and step bracket after curing is complete.

5-17A. BRAKE LINE FAIRING REPLACEMENT. (Refer to figure 5-1, sheet 2.)

a. Disconnect brake line (13) at brake assembly (19) and drain fluid, or plug line to avoid draining.

b. Work brake line and split hose out of clip (10) and flex line (8) away from spring strut (7).

c. Remove all traces of original adhesive as well as any rust, paint or scale with a wire brush and sandpaper. Sand inner surface of fairing strip (33), running sandpaper marks lengthwise; leave primer on spring strut (7).

d. Thoroughly clean surfaces to be bonded. If a solvent is used, remove all traces of the solvent with a clean dry cloth. It is important for the surfaces to be clean and dry. Solvent should not be used on the vinyl fairing strip (33).

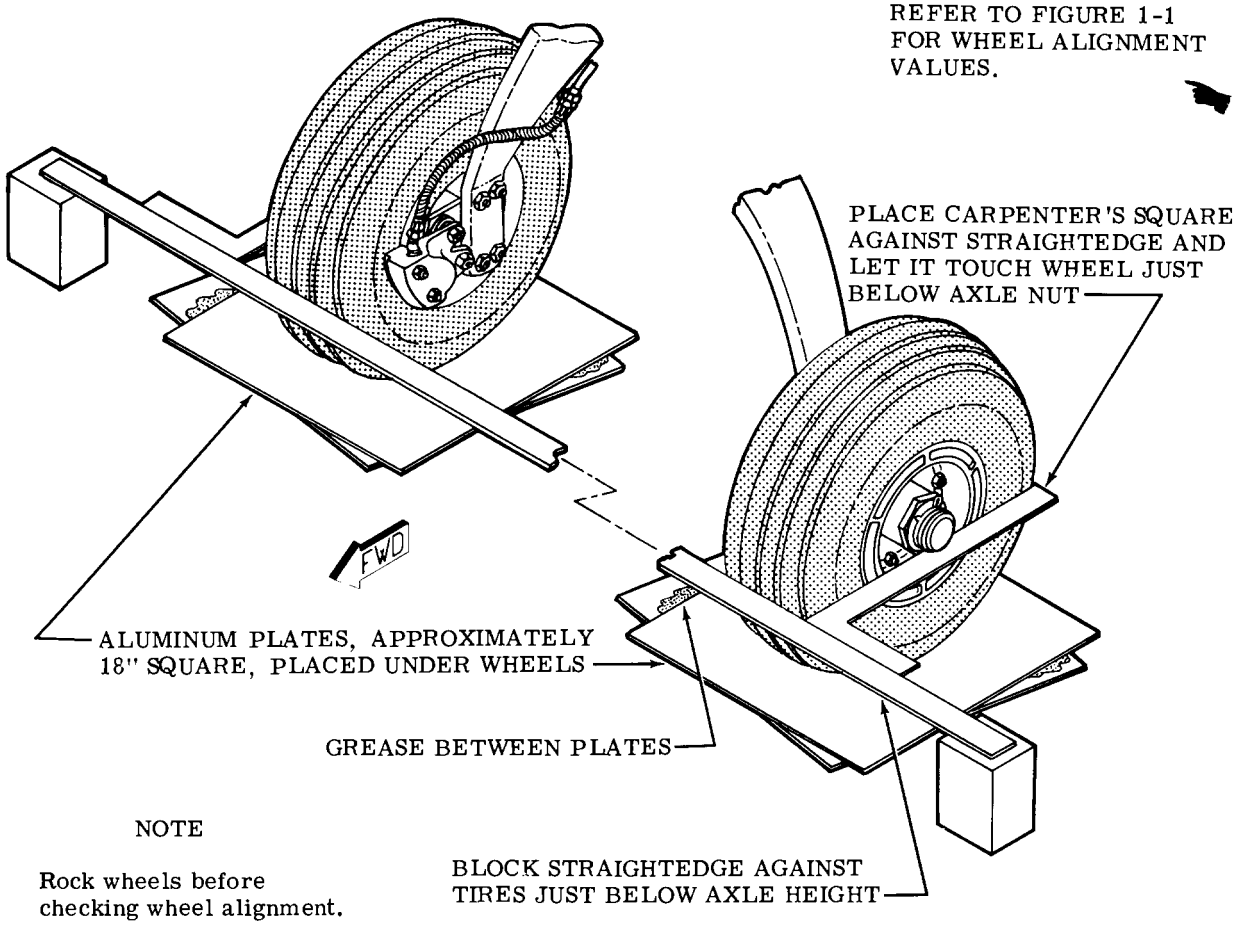
e. Leave surfaces slightly roughened or abraded. Deep scratches or nicks should be avoided.

f. Mix the adhesive (A-1186-B, B. F. Goodrich, Akron, Ohio 44318), according to manufacturer's directions.

g. Apply a thin uniform coat of adhesive to each bonding surface. Work life of A-1186-B is approximately 8 hours at 75° F. The material will cure in 24 hours at 75° or in 20 minutes at 200° F.

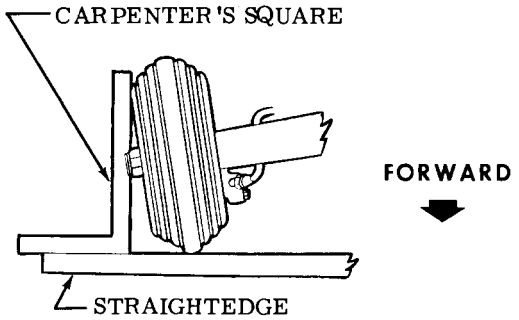
h. Press brake line (8) into groove of fairing strip (33) and raise line and strip to attach to aft side of spring strut (7) and fit into clip (10).

i. Immediately wrap fairing strip (33) and spring strut (7) with masking tape in five equally-spaced



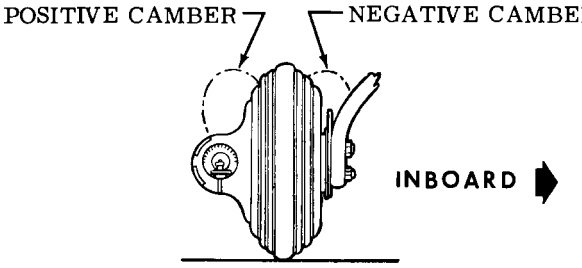
TOP VIEW OF TOE-IN CHECK

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



FRONT VIEW OF CAMBER CHECK

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



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. Therefore, if normal operation is at less than gross weight and abnormal tire wear occurs, realign the wheels to attain the ideal setting for the load conditions. Refer to sheet 2 of this figure for shims availability and their usage. Always use the least number of shims possible to obtain the desired result.

Figure 5-2. Main Wheel Alignment (Sheet 1 of 2)

SHIM CHART

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	.06"	----	----	0°3'
	FWD	----	.06"	0°3'	----
0541157-2	UP	.006"	----	0°30'	----
	DOWN	----	.006"	----	0°30'
1241061-1	UP & FWD	.008"	----	2°50'	----
	UP & AFT	.04"	----	2°49'	----
	DOWN & FWD	----	.04"	----	2°49'
	DOWN & AFT	----	.008"	----	2°50'
0441139-5	UP & FWD	----	.11"	0°25'	----
	UP & AFT	.12"	----	0°11'	----
	DOWN & FWD	----	.12"	----	0°11'
	DOWN & AFT	.11"	----	----	0°25'
0441139-6	UP & FWD	----	.22"	0°50'	----
	UP & AFT	.24"	----	0°22'	----
	DOWN & FWD	----	.24"	----	0°22'
	DOWN & AFT	.22"	----	----	0°50'

SHIM NO.	1241061-1	0441139-6	0441139-5	0541157-2	0541157-1
1241061-1	0	0	0	0	0
0441139-6	0	0	0	1	1
0441139-5	0	0	1	1	2
0541157-2	0	1	1	2	2
0541157-1	0	1	1	2	2

Max. number of shims to be used with shims in column 1.

COLUMN 1 — COLUMN 2

Figure 5-2. Wheel Alignment (Sheet 2 of 2)

places. Excessive adhesive may be removed with solvents.

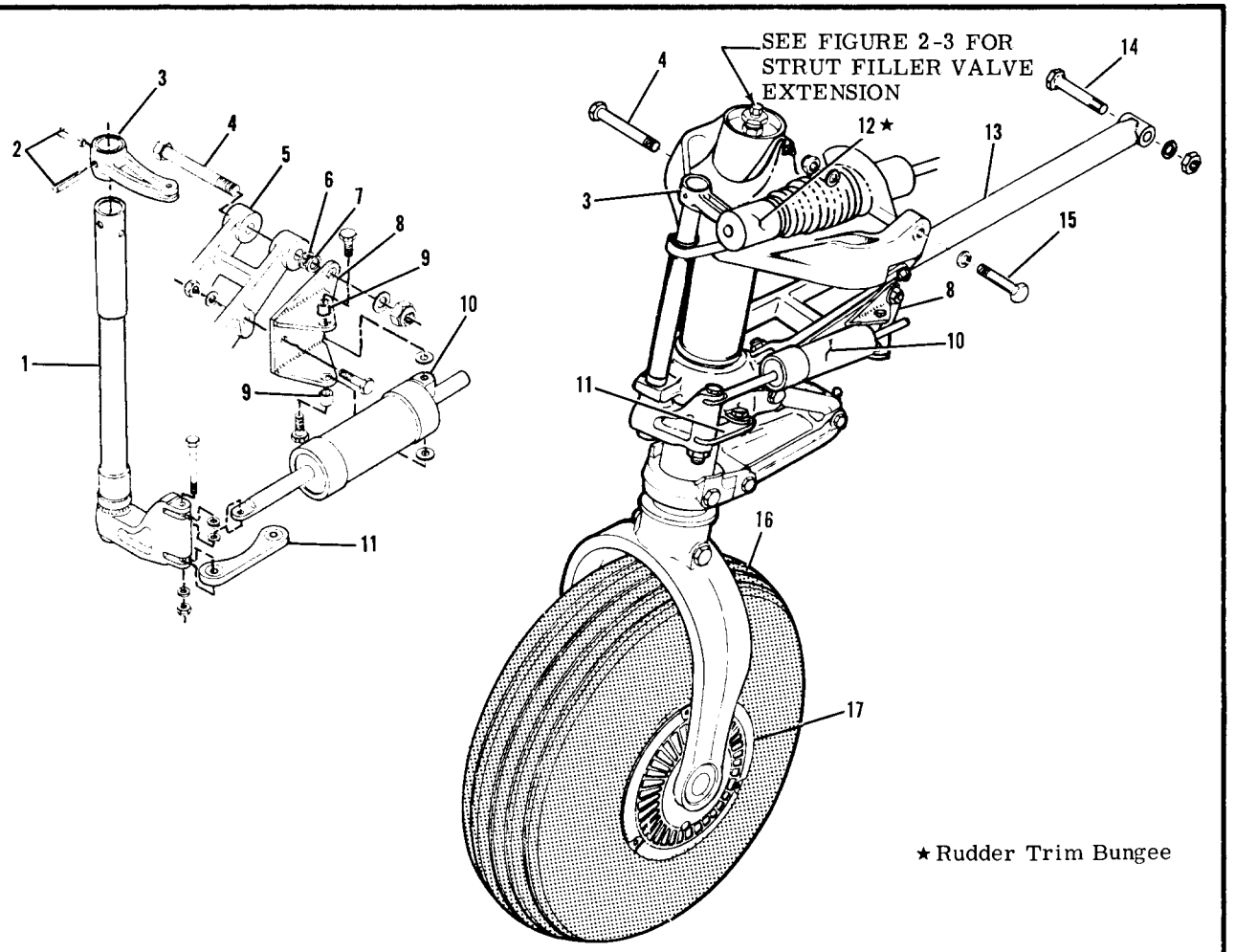
j. Allow adhesive to cure thoroughly according to manufacturer's directions before flexing the gear.

k. After recommended curing time, remove tape and connect brake line.

l. If necessary, prime spring strut with White Rust Inhibitive Primer - 32W6 (Kansas Paint Co., Wichita, Kansas), and repaint to original color.

m. Fill and bleed brake system.

n. Wrap landing gear spring with polyurethane tape as noted in Section A-A.



1. Steering Shaft
2. Roll Pin
3. Steering Arm
4. Bolt
5. Lower Trunnion
6. Thin Washer
7. Thick Washer
8. Bracket
9. Bushing
10. Shimmy Dampener
11. Link
★12. Steering Bungee
13. Drag Link
14. Bolt
15. Bolt
16. Nose Wheel
17. Hub Cap
18. Cover Plate
19. Standard Speed Fairing
20. Tow Bar Spacer
21. Wheel Scraper
22. Axle Ferrule
23. Access Door
24. Heavy-Duty Fairing

Figure 5-3. Nose Landing Gear (Sheet 1 of 2)

5-18. NOSE GEAR.

5-19. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
TIRES WEAR EXCESSIVELY.	Loose torque links.	Add shim washers and replace parts as necessary.
NOSE WHEEL SHIMMY.	Nose strut attachment loose.	Secure attaching parts.
	Shimmy dampener lacks fluid.	Service as outlined in Section 2.

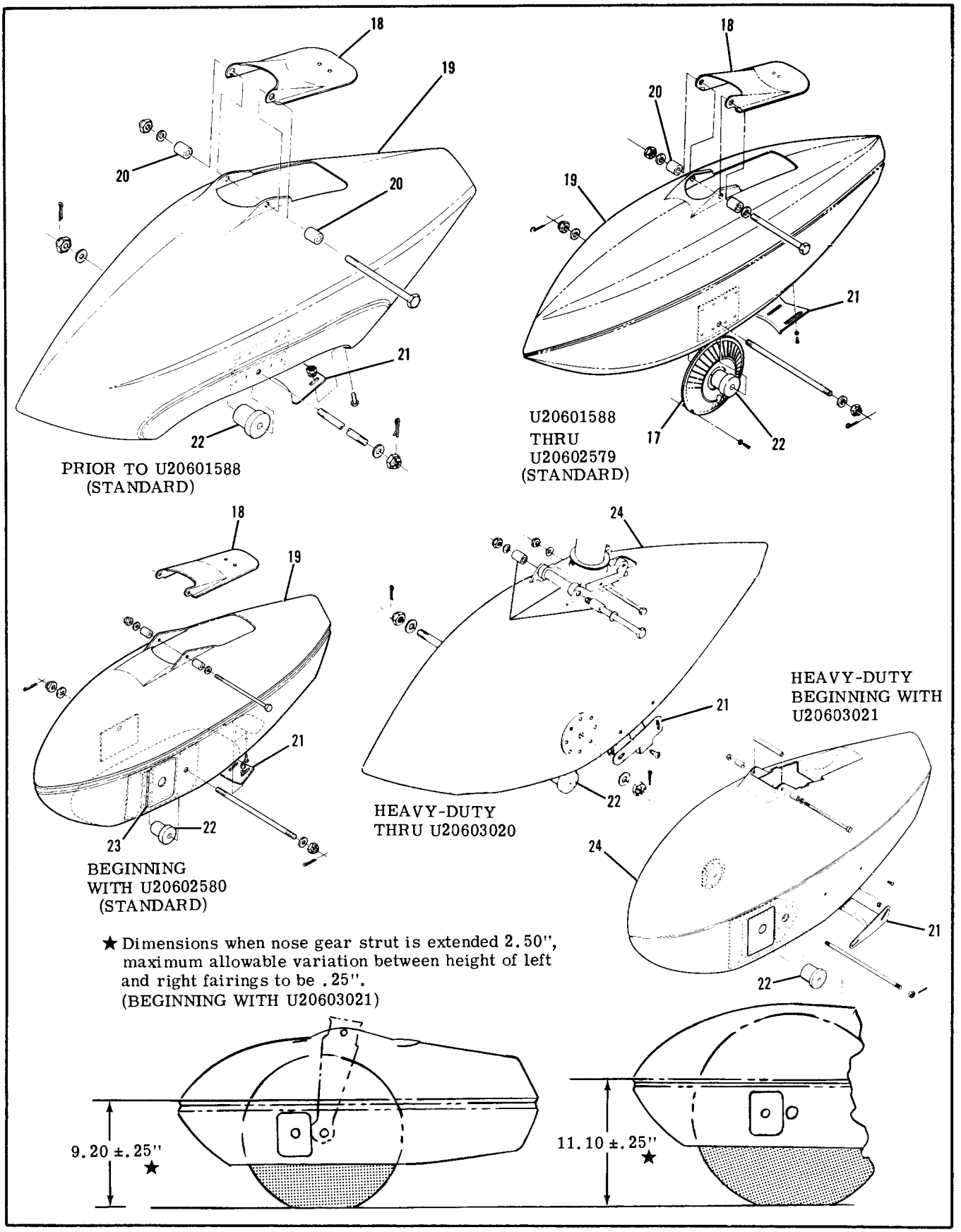


Figure 5-3. Nose Landing Gear (Sheet 2 of 2)

5-19. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
TIRES WEAR EXCESSIVELY (Cont).	Defective shimmy dampener.	Repair or replace dampener.
	Loose or worn steering components.	Tighten loose parts; replace if defective.
	Loose torque links.	Add shim washers and replace parts as necessary.
	Loose wheel bearings.	Replace bearings if defective; tighten axle nut properly.
	Nose wheel out of balance.	Refer to paragraph 5-39.
HYDRAULIC FLUID LEAKAGE FROM NOSE GEAR STRUT.	Defective strut seals and/or defects in lower strut.	Replace defective seals; stone out small defects in lower strut. Replace lower strut if badly scored or damaged.
NOSE GEAR STRUT WILL NOT HOLD AIR PRESSURE.	Defective air filler valve or valve not tight.	Check gasket and tighten loose valve. Replace defective valve.
	Defective O-ring at top of strut.	Replace O-ring.
	Result of fluid leakage at bottom of strut.	Replace defective seals; stone out small defects in lower strut. Replace lower strut if badly scored or damaged.

5-20. REPLACEMENT OF NOSE GEAR. (See figure 5-3.)

a. Weight tail of the aircraft to raise nose wheel off the ground and remove access plates around nose gear.

b. Disconnect nose gear steering bungee from steering arm.

c. Remove bolt and washers to disconnect drag strut at forward end. Note position of washers during removal of bolt.

d. Remove bolts to disconnect upper trunnion from fuselage structure. Access to bolts is obtained from inside the cabin after removing carpet on each side of tunnel at firewall.

e. Install the nose gear by reversing the preceding steps. Be sure to install washers in the position shown.

5-21. STANDARD NOSE WHEEL SPEED FAIRING REPLACEMENT. (See figure 5-3.)

a. Weight the tail of the aircraft to raise the nose wheel off the ground.

b. Remove nose wheel axle stud.

c. Deflate strut completely.

WARNING

Be sure strut is deflated completely before removing bolt that attaches speed fairing to strut or disconnecting the torque link.

d. Disconnect lower torque link from lower strut and allow strut to extend.

e. Remove bolt attaching speed fairing to strut and remove cover plate. This is the bolt that attaches the fork as well as the tow-bar spacers.

f. Slide speed fairing up and remove the nose wheel. Loosen scraper if necessary. Use a rod or long punch inserted through one ferrule to tap the opposite one out of the fork. Remove both ferrules and pull the nose wheel from the fork.

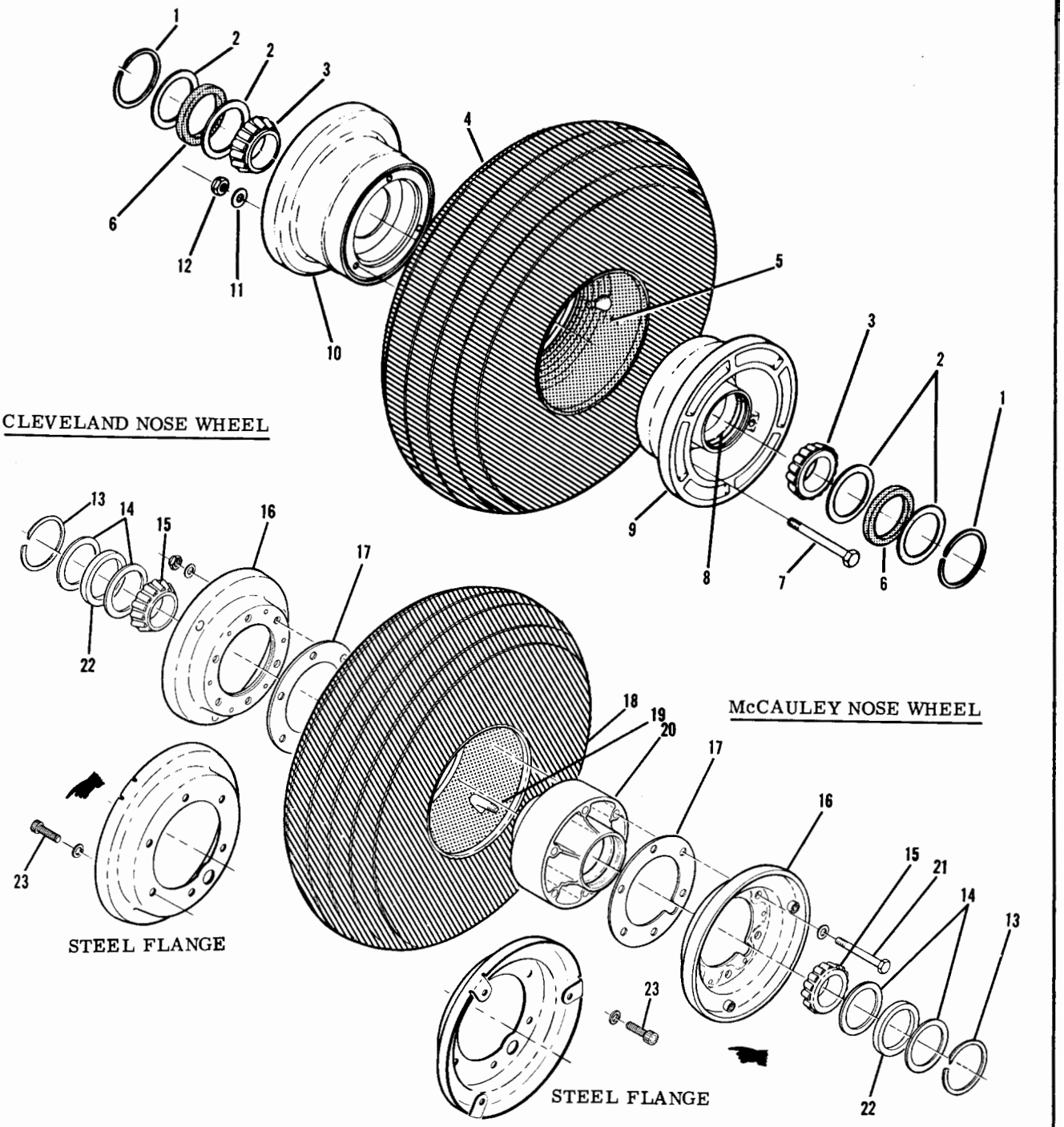
g. Rotate speed fairing 90° and work it down over the nose gear fork.

h. Install speed fairing by reversing the preceding steps. Tighten axle stud until a slight bearing drag is obvious when the wheel is turned. Back off the nut to the nearest castellation and install cotter pins.

i. Service shock strut after installation has been completed.

CAUTION

Always check scraper clearance after installing speed fairings, whenever a tire has been changed, and whenever scraper adjustments has been disturbed. Set clearance between tire and scraper at 0.38 inch. Elongated holes in scraper are provided for adjustment. Wipe fuel and oil from the speed fairings to prevent stains and deterioration. If the aircraft is flown from surfaces with mud, snow, or ice, the fairings should be checked to make sure



1. Snap Ring
2. Grease Seal Ring
3. Bearing
4. Tire
5. Tube
6. Grease Seal Felt
7. Thru-Bolt
8. Bearing Cup
9. Male Wheel Half
10. Female Wheel Half
11. Washer
12. Nut
13. Retaining Ring
14. Grease Seal Ring
15. Bearing
16. Wheel Flange
17. Spacer
18. Tire
19. Tube
20. Hub Assembly
21. Thru-Bolt
22. Grease Seal Felt
23. Capscrew

Figure 5-4. Nose Wheels

there is no accumulation which could prevent normal wheel rotation.

5-22. HEAVY-DUTY NOSE WHEEL SPEED FAIRING REPLACEMENT.

a. Weight the tail of the aircraft to raise nose wheel off the ground.

b. Remove nose wheel axle stud.

c. Deflate strut and disconnect lower torque link from fork hub.

WARNING

Be sure strut is deflated completely before disconnecting torque link.

d. Remove bolt securing speed fairing to fork hub. The speed fairing is attached to the lugs on the forward side of the fork hub and the tow-bar spacers are also attached with same bolt.

e. Slide speed fairing up and remove the nose wheel. Loosen scraper if necessary. Use a rod or long punch inserted through one ferrule to tap the opposite one out of the fork. Remove both ferrules and pull the nose wheel from the fork.

f. Remove bolts attaching wheel fork to lower strut and remove fork and speed fairing.

g. Install speed fairing by reversing the preceding steps. Tighten axle stud until a slight bearing drag is obvious when the wheel is turned. Back off the nut to the nearest castellation and install cotter pins.

h. Service shock strut after installation has been completed.

CAUTION

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

5-22A. NOSE WHEEL AND TIRE ASSEMBLY.

5-22B. DESCRIPTION. The aircraft may be equipped with either Cleveland or McCauley wheel assemblies. Separate disassembly, inspection and reassembly instructions are provided for each type. Basic differences of the two types are discussed in paragraph 5-11D, and thru-bolt nut and capscrew torque values are listed in figure 5-11A.

CAUTION

Use of recapped tires is not recommended. However, if recapped tires are used on the aircraft, make sure there is sufficient clearnace between tire and wheel fairings, if fairings are installed. Ensure that speed fairing scraper-to-tire clearance is adjusted to values specified in paragraph 5-21 or 5-22.

5-23. REMOVAL OF NOSE WHEEL AND TIRE ASSEMBLY. Removal of nose wheel and tire assembly may be accomplished as outlined in paragraph 5-21 or 5-22.

5-24. DISASSEMBLY OF CLEVELAND NOSE WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-4.)

a. Completely deflate the tire and break tire beads loose.

WARNING

Injury can result from attempting to separate wheel halves with tire inflated. Avoid damaging wheel flanges when breaking tire beads loose.

b. Remove thru-bolts and separate wheel halves.

c. Remove tire and tube.

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 replacement 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.

5-25. INSPECTION AND REPAIR OF CLEVELAND NOSE WHEEL AND TIRE ASSEMBLY. Procedures outlined in paragraph 5-10 for the main wheel and tire assemblies may be used as a guide for inspection and repair of the nose wheel and tire assembly.

5-26. REASSEMBLY OF CLEVELAND NOSE WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-4.)

a. Place tire and tube on wheel half. Insert thru-bolts, position other wheel half, and secure with nuts and washers. Torque nuts to value specified in figure 5-11A.

CAUTION

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

b. Clean and repack bearing cones with clean wheel bearing grease.

c. Assemble bearing cones, seals, and retainers into the wheel halves.

d. Inflate tire to seat tire beads, then adjust to correct pressure.

5-27. DISASSEMBLY OF McCAULEY NOSE WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-4.)

a. Remove screws attaching hub caps; remove hub caps.

WARNING

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

b. Completely deflate tire and break tire beads loose at wheel flanges.
c. If the wheel and tire assembly is equipped with thru-bolts, remove thru-bolt nuts and washers, remove thru-bolts and separate wheel flanges from wheel hub. Retain spacers between wheel flanges and wheel hub.
d. If the wheel and tire assembly is equipped with capscrews, remove capscrews and washers and separate wheel flanges from wheel hub. Retain spacers on each side of wheel hub.
e. Remove wheel hub from tire and tube.
f. 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° (250°F). Using an arbor press, if available, press out the bearing cup and press in the new bearing cup while the wheel hub is still hot.

5-28. INSPECTION AND REPAIR OF McCAULEY NOSE WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-4.)
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 hubs shall be discarded and new parts will be 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 before installing in the wheel hub. (Refer to Section 2 for grease type.)

5-29. REASSEMBLY OF McCAULEY NOSE WHEEL AND TIRE ASSEMBLY. (Refer to figure 5-4.)
a. Install tube in tire, aligning index marks on tire and tube.
b. Place wheel hub in tire with valve stem in cutout of wheel hub.
c. If the wheel and tire assembly is equipped with thru-bolts, place spacer and wheel flange on one side of wheel hub. With washer under head of thru-bolt, insert bolt through wheel flange and wheel hub. Place spacer and wheel flange on other side and align valve stem in cutout in wheel flange. Install washers and nuts on thru-bolts.
d. If the wheel and tire assembly is equipped with capscrews, place spacer and wheel flange on one side of wheel hub. Place washer under head of each capscrew, insert capscrew through wheel flange and spacer and start capscrews into wheel hub threads. Place spacer and wheel flange on other side of wheel hub and align valve stem in cutout in wheel flange. Place washer under head of each capscrew, insert capscrew through wheel flange and spacer and start capscrews into wheel hub threads.

CAUTION

Be sure that spacers and wheel flanges are seated on flange of wheel hub. Uneven or improper torque of thru-bolts or capscrews can cause failure of the thru-bolts capscrews or hub threads with resultant wheel failure.

e. Tighten thru-bolts or capscrews evenly and torque to the value specified in figure 5-11A.
f. Clean and pack bearing cones with clean aircraft wheel bearing grease. (Refer to Section 2 for grease type.)
g. Assemble bearing cones, grease seal felts and retainer into wheel hub.
h. Inflate tire to seat tire beads, then adjust to correct pressure specified in figure 1-1.

5-30. INSTALLATION OF NOSE WHEEL AND TIRE ASSEMBLY. Procedures are outlined in paragraphs 5-21 or 5-22.

5-31. STANDARD NOSE GEAR STRUT.

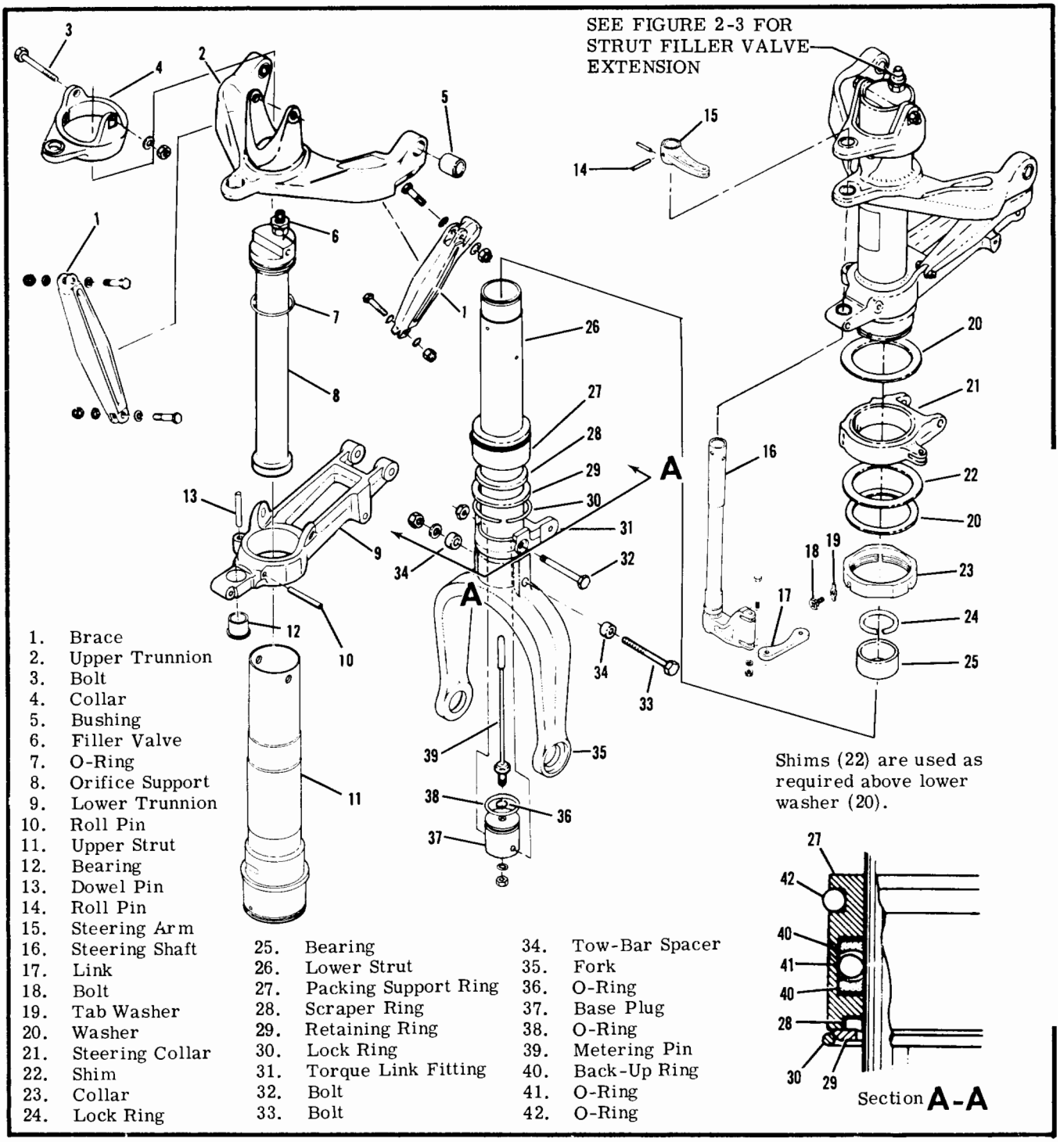
5-32. DESCRIPTION. The standard nose gear shock strut is shown in figure 5-5. The optional heavy-duty shock strut is shown in figure 5-6. Replacement of the nose gear is accomplished as outlined in paragraph 5-20.

5-33. STANDARD NOSE GEAR DISASSEMBLY. (See figure 5-5.) The following procedure applies to the nose gear shock strut after it has been removed from the aircraft, and the speed fairing and nose wheel have been removed. In many cases, separating the upper and lower struts will permit inspection and parts replacement without removal or complete disassembly.

WARNING

Deflate strut completely before removing bolt (3), lock ring (30), or bolt (32). Also deflate strut before disconnecting torque links.

a. Remove torque links. Note position of washers, shims, spacers, and bushings.
b. Remove shimmy dampener.
c. Remove steering shaft by driving out roll pins and removing steering arm.
d. Remove lock ring from groove inside of lower end of upper strut. A small hole is provided in the lock ring groove to facilitate removal.



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-Ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. Steering Shaft
17. Link
18. Bolt
19. Tab Washer
20. Washer
21. Steering Collar
22. Shim
23. Collar
24. Lock Ring
25. Bearing
26. Lower Strut
27. Packing Support Ring
28. Scraper Ring
29. Retaining Ring
30. Lock Ring
31. Torque Link Fitting
32. Bolt
33. Bolt
34. Tow-Bar Spacer
35. Fork
36. O-Ring
37. Base Plug
38. O-Ring
39. Metering Pin
40. Back-Up Ring
41. O-Ring
42. O-Ring

Figure 5-5. Standard Nose Gear Shock Strut

NOTE

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

e. Using a straight, sharp pull, remove lower strut from upper strut. Invert lower strut and drain hydraulic fluid from strut.

f. Remove lock ring and bearing from top of lower strut.

g. Slide packing support ring, scraper ring, retaining ring, and lock ring from lower strut. Note relative position and top side of each ring and bearing to aid in reassembly.

h. Remove and discard O-rings and back-up rings from packing support ring.

i. Remove bolt and slide torque link fitting from lower strut.

j. Remove metering pin and base plug. Remove O-rings and metering pin from base plug.

NOTE

Lower strut and fork are a press fit, drilled on assembly. Separation of these parts is not recommended except for replacement of parts.

k. Remove bolt, tab washer, and unscrew collar, and remove shim(s), washers, and steering collar from upper strut.
l. Remove clamp attaching the filler extension valve to strut and disconnect from filler valve at top of the strut.
m. Remove bolt at top of strut, and remove collar and orifice support. Remove O-ring and valve from orifice support.
n. Bushings and bearings in lower trunnion, upper trunnion and collar may be replaced as required. Needle bearing in steering collar should not be replaced; replace the steering collar if needle bearing is defective.

NOTE

Upper and lower trunnions are press-fitted to the upper strut, with braces installed during assembly. Pin is also press-fitted to the lower trunnion.

5-34. STANDARD NOSE GEAR STRUT ASSEMBLY.
a. Thoroughly clean all parts in solvent and inspect them carefully. Replace all worn or defective parts and all O-rings, seals, and back-up rings with new parts.
b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5-33 with the exception that special attention must be paid to the following procedures.
c. Sharp metal edges should be smoothed with No. 400 emery paper, then thoroughly cleaned with solvent.
d. Used sparingly, Dow Corning DC-4 compound is recommended for O-ring lubrication. All other internal parts should be liberally coated with hydraulic fluid during assembly.

NOTE

Cleaniness and proper lubrication, along with careful workmanship are important during assembly of the shock strut.

e. Lubricate needle bearings as shown in Section 2 before installing.
f. When installing collar, screw it onto the upper strut until it is flush with the lower end of the strut, to the nearest one-third turn. Use shims as required above lower washer, to fill gap between collars. Shims are available from the Cessna Service Parts Center as follows:

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

Use a new tab washer to safety bolt.
g. Install the contoured back-up ring, one on each side of O-ring with concave surface of back-up ring next to the O-ring.
h. When installing bearing at top of lower strut, be sure that beveled edge of bearing is installed up next to lock ring.
i. When installing lock ring, position the lock ring so that one of its ends covers the small access hole in the lock ring groove at the bottom of upper strut.
j. When installing shimmy dampener, do not tighten attaching bolts to a torque value in excess of 10 lb-in.
k. Tighten torque link center bolt snug. Then tighten to next castellation and install cotter pin.
l. Service the shock strut with hydraulic fluid and compressed air. Install strut filler valve extension and install strut in aircraft.

NOTE

It is easier to service the shock strut just before installation, although it may be serviced after installation if desired. Refer to Section 2.

5-35. HEAVY-DUTY NOSE GEAR STRUT.

5-36. DESCRIPTION. The heavy-duty nose gear is shown in figure 5-6, which may be used as a guide during maintenance. Replacement procedures are the same as those given in paragraph 5-20. Refer to paragraph 5-22 for speed fairing replacement.

5-37. HEAVY-DUTY NOSE GEAR DISASSEMBLY. (See figure 5-6.) This paragraph outlines complete disassembly of the heavy-duty nose gear shock strut after it has been removed from the aircraft, and the nose wheel and speed fairing have been removed from the strut. In many cases, separating the upper and lower struts will permit inspection and parts replacement without removal or complete disassembly.

WARNING

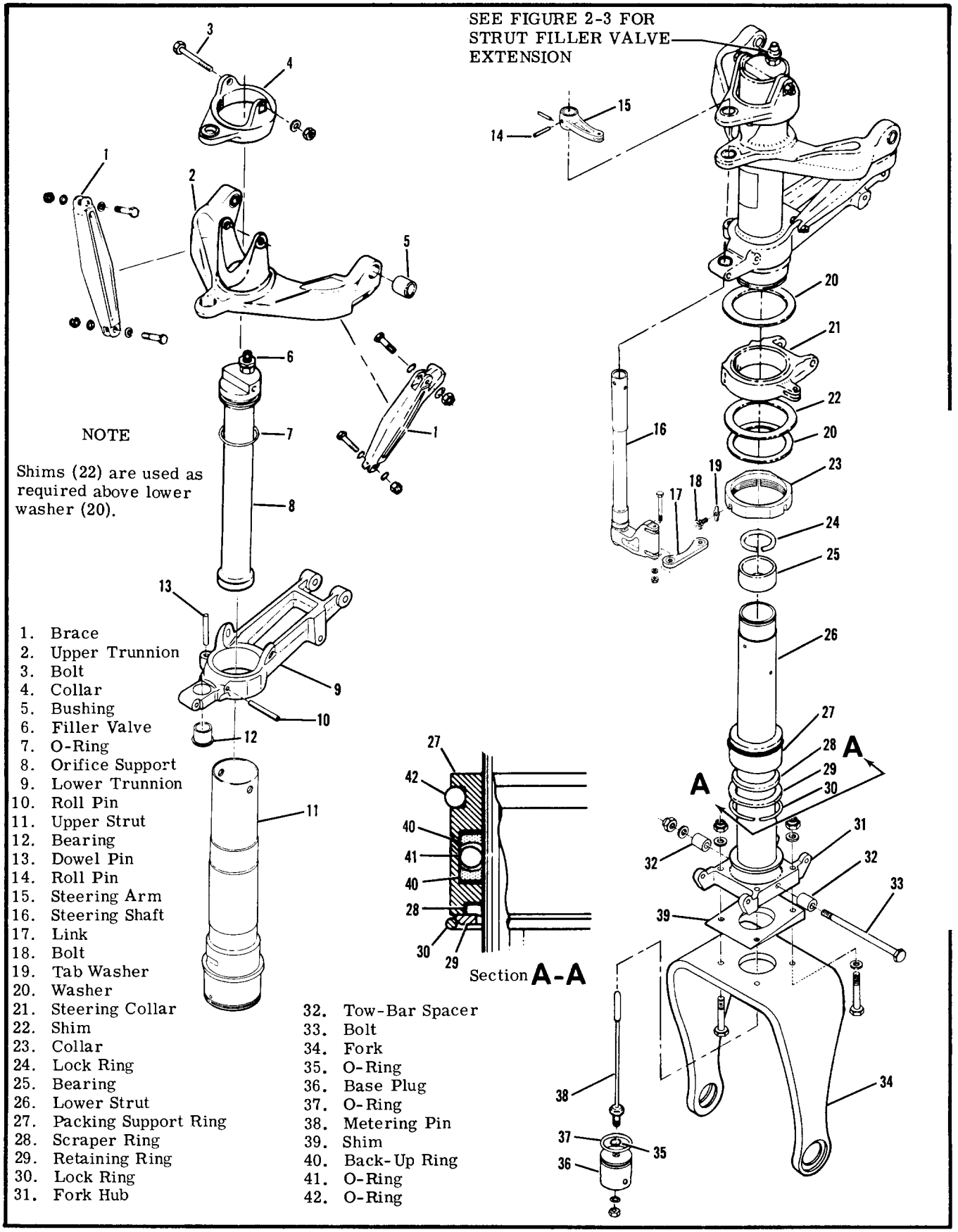
Deflate strut completely before removing bolt (3), lock ring (30), or bolt (33). Also deflate strut before disconnecting torque links.

a. Remove torque links. Note position of washers, shims, spacers, and bushings.
b. Remove shimmy dampener.
c. Remove link from steering shaft and collar.
d. Remove steering shaft by driving out roll pins and removing steering arm.
e. Remove lock ring from groove inside of lower end of upper strut. A small hole is provided in the lock ring groove to facilitate removal.

NOTE

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

f. Using a straight, sharp pull, remove lower strut from upper strut. Invert lower strut and drain hydraulic fluid from strut.
g. Remove lock ring and bearing from top end of lower strut.
h. Slide packing support ring, scraper ring, retaining ring, and lock ring from lower strut. Note



1. Brace
2. Upper Trunnion
3. Bolt
4. Collar
5. Bushing
6. Filler Valve
7. O-Ring
8. Orifice Support
9. Lower Trunnion
10. Roll Pin
11. Upper Strut
12. Bearing
13. Dowel Pin
14. Roll Pin
15. Steering Arm
16. Steering Shaft
17. Link
18. Bolt
19. Tab Washer
20. Washer
21. Steering Collar
22. Shim
23. Collar
24. Lock Ring
25. Bearing
26. Lower Strut
27. Packing Support Ring
28. Scraper Ring
29. Retaining Ring
30. Lock Ring
31. Fork Hub
32. Tow-Bar Spacer
33. Bolt
34. Fork
35. O-Ring
36. Base Plug
37. O-Ring
38. Metering Pin
39. Shim
40. Back-Up Ring
41. O-Ring
42. O-Ring

Figure 5-6. Heavy-Duty Nose Gear Shock Strut

relative position and top side of each bearing and ring to aid in reassembly.

i. Remove and discard O-rings and back-up rings from packing ring support.

j. Remove four bolts, washers, and nuts attaching fork to fork hub and remove shim.

k. Remove bolt securing metering pin and base plug. Remove O-rings and metering pin from base plug.

NOTE

Fork hub and lower strut are a press-fit, drilled on assembly. Separation of these parts is not recommended, except for replacement of parts.

l. Remove bolt and tab washer, unscrew collar, and remove washers, shim, and steering collar.

m. Remove clamp attaching the filler valve extension valve to strut and disconnect from filler valve at top of strut.

n. Remove bolt at top of upper strut, and remove collar and orifice support. Remove O-ring and filler valve from orifice support.

o. Bushings and bearings in lower trunnion, upper trunnion, and collar may be replaced as required. Needle bearings in steering collar should not be replaced; replace the steering collar if needle bearing is defective.

NOTE

Upper and lower trunnions are press-fitted to upper strut, with braces installed during assembly. Pin is also press-fitted to the lower trunnion.

5-38. HEAVY-DUTY NOSE GEAR ASSEMBLY. (See figure 5-6.)

a. Thoroughly clean all parts in solvent and inspect them carefully. Replace all worn or defective parts and all O-rings, seals, and back-up rings with new parts.

b. Assemble the strut by reversing the order of the procedure outlined in paragraph 5-37 with the exception that special attention must be paid to the following procedures.

c. Sharp metal edges should be smoothed with No. 400 emery paper, then thoroughly cleaned with solvent.

d. Used sparingly, Dow Corning DC-4 compound is recommended for O-ring lubrication. All other internal parts should be liberally coated with hydraulic fluid during assembly.

NOTE

Cleanliness and proper lubrication, along with careful workmanship are important during assembly of the shock strut.

e. Lubricate needle bearings as shown in Section 2 before installing.

f. When installing collar, screw it onto the upper strut until it is flush with bottom end of the strut, to the nearest one-third turn. Use shim as required above lower washer to fill gap between collars. Refer to paragraph 5-34 for the available shims. Use a new tab washer to safety bolt.

g. Install the contoured back-up rings, one on each side of O-ring, with concave surface of back-up ring next to the O-ring.

h. When installing bearing at top of lower strut, be sure that beveled edge of bearing is installed up next to lock ring.

i. When installing lock ring, position the lock ring so that one of its ends covers the small access hole in the lock ring groove in the bottom of the upper strut.

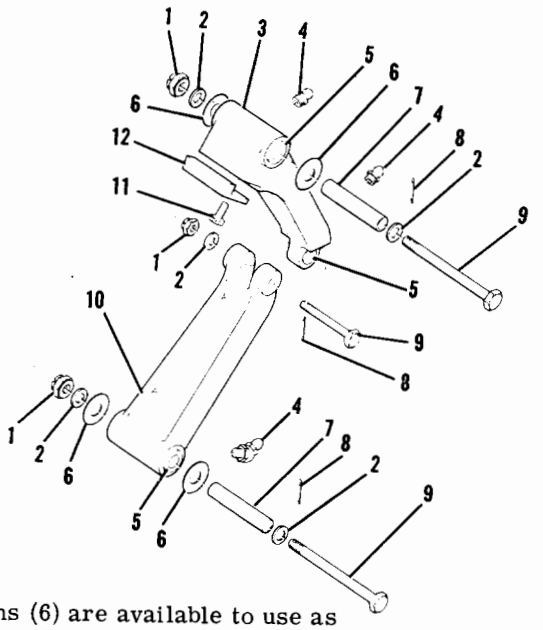
j. When installing shimmy dampener, do not tighten attaching bolts to a torque value in excess of 10 lb-in.

k. Tighten torque link center bolt snug, then tighten to next castellation and install cotter pin.

l. Service the shock strut with hydraulic fluid and compressed air. Install strut filler valve extension and install strut in aircraft.

NOTE

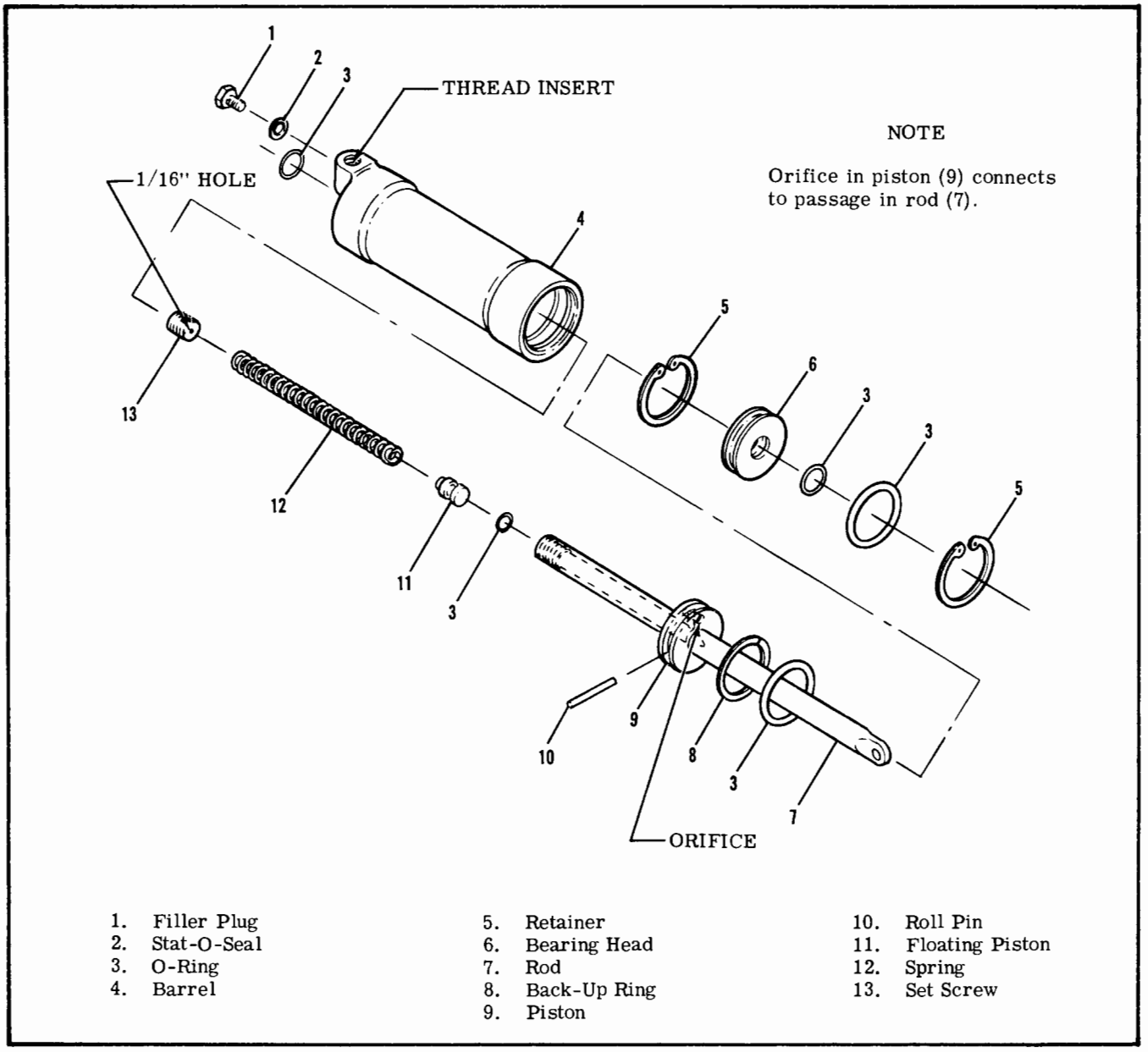
It is easier to service the shock strut just before installation, although it may be serviced after installation if desired. Refer to Section 2.



Shims (6) are available to use as required between torque link and nose gear fork to remove any looseness.

1. Nut	7. Spacer
2. Washer	8. Cotter Pin
3. Upper Torque Link	9. Bolt
4. Grease Fitting	10. Lower Torque Link
5. Bushing	11. Bolt
6. Shim	12. Centering Lug

Figure 5-7. Torque Link



1. Filler Plug
2. Stat-O-Seal
3. O-Ring
4. Barrel
5. Retainer
6. Bearing Head
7. Rod
8. Back-Up Ring
9. Piston
10. Roll Pin
11. Floating Piston
12. Spring
13. Set Screw

Figure 5-8. Shimmy Dampener

5-39. WHEEL BALANCING. Refer to paragraph 5-16 for wheel balancing.

5-40. TORQUE LINKS. The torque links are illustrated in figure 5-7, which may be used as a guide for disassembly and assembly. Grease fittings and torque link bushings should not be removed except for replacement. Excessively worn parts should be replaced. Always deflate nose gear strut before disconnecting torque links.

5-41. SHIMMY DAMPENER. The shimmy dampener is illustrated in figure 5-8, which may be used as a guide for disassembly and assembly. Replace any parts found defective. When assembling shimmy dampener, use new O-rings and back-up rings. Lubricate parts during assembly with clean hydraulic fluid. Refer to Section 2 for servicing procedures. When installing dampener, do not tighten attaching bolts to a torque value in excess of 10 pound-inches.

5-42. NOSE WHEEL STEERING SYSTEM. (Refer to figure 5-9.)

5-43. DESCRIPTION. The nose wheel steering system links the rudder pedals to the nose wheel steering arm, affording steering control through the use of the rudder pedals and brakes. When moving the aircraft by hand, never turn the nose wheel more than 35 degrees either side of center.

5-44. REMOVAL AND INSTALLATION. Figure 5-9 shows details of the nose wheel steering system and may be used as a guide during replacement of parts. Refer to Section 2 for lubrication.

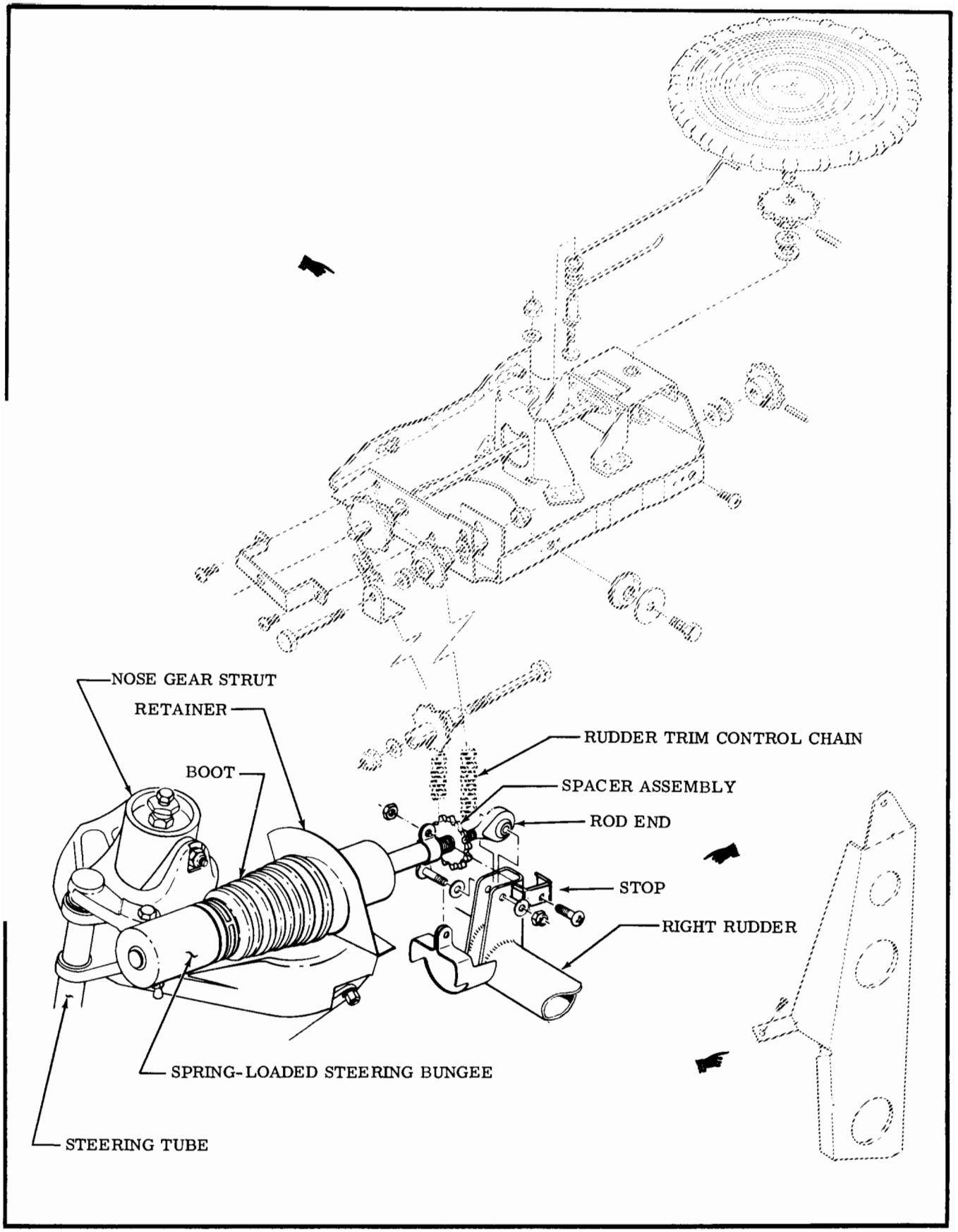


Figure 5-9. Nose Wheel Steering System

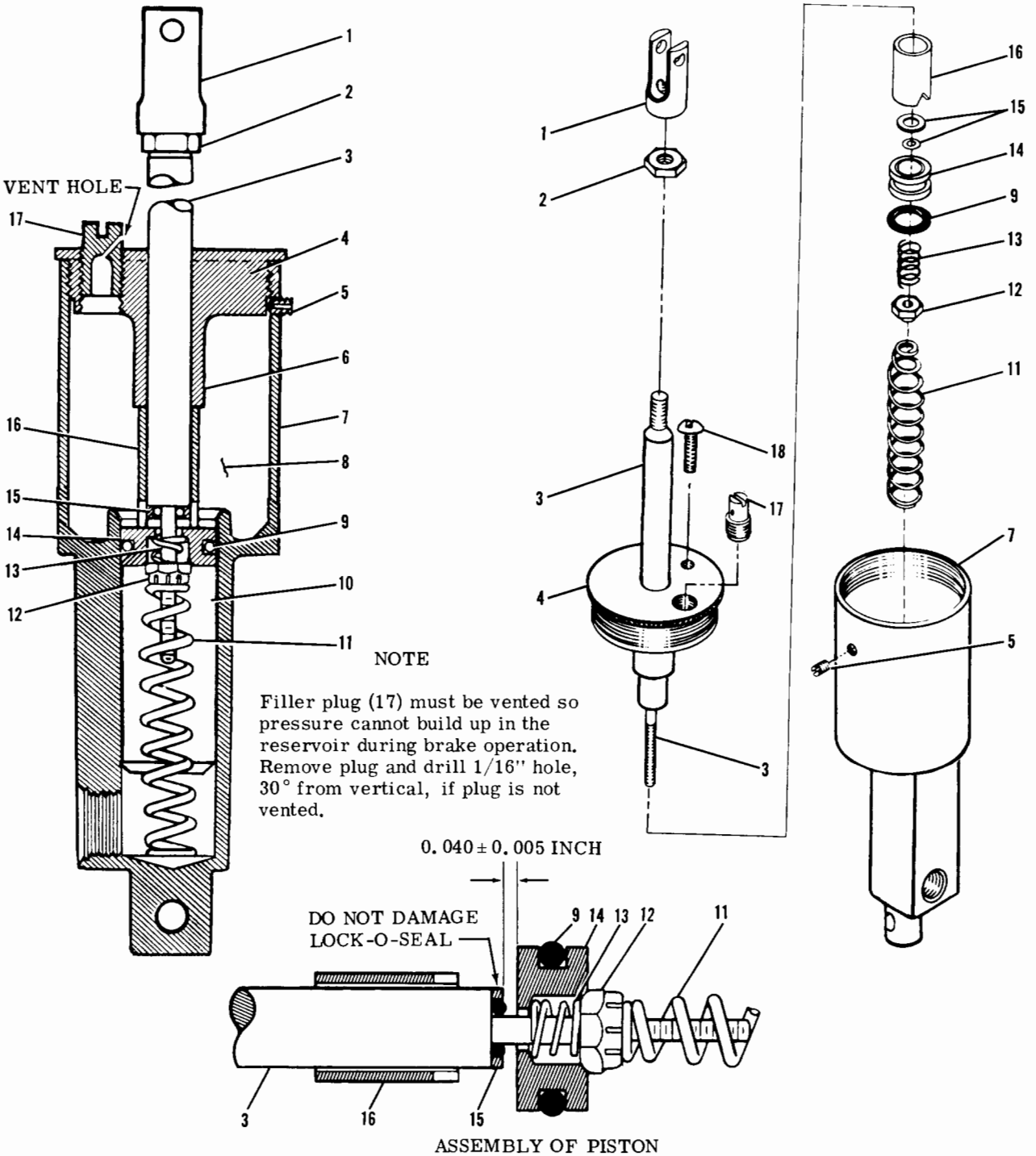
5-45. RIGGING. Since the nose wheel steering system is connected to the rudder control system, refer to Section 10 for rigging procedures.

5-46. BRAKE SYSTEM.

5-47. DESCRIPTION. The hydraulic brake system is comprised of two master cylinders, located immediately forward of the rudder pedals, brake lines connecting each master cylinder to its wheel brake cylinder, and the single disc, floating cylinder-type brake assembly, located at each main landing gear wheel.

5-48. 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 at Lock-O-Seal in master cylinder.	Adjust as shown in figure 5-10.
	Restriction in hydraulic lines or restriction in compensating port in master brake cylinders.	Drain brake lines and clear the inside of the brake line with filtered compressed air. Fill and bleed brakes. If cleaning the lines fails to give satisfactory results, the master cylinder may be faulty and should be repaired.
	Worn, scored or warped brake discs.	Replace brake discs and linings.
	Damage 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.	If brake master cylinders or wheel brake assemblies are leaking, they should be repaired or replaced.
	Air in system.	Bleed system.
	Lack of fluid in master cylinders.	Fill and bleed if necessary.
	Master cylinder defective.	Repair or replace master cylinder.



1. Clevis
2. Jamb Nut
3. Piston Rod
4. Cover
5. Setscrew
6. Cover Boss
7. Body
8. Reservoir
9. O-Ring
10. Cylinder
11. Piston Return Spring
12. Nut
13. Piston Spring
14. Piston
15. Lock-O-Seal
16. Compensating Sleeve
17. Filler Plug
18. Screw

Figure 5-10. Brake Master Cylinder

5-49. BRAKE MASTER CYLINDERS. The brake master cylinders, located just forward of the pilot's 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 it with fluid. Where dual brakes are installed, mechanical linkage permits the copilot's pedals to operate the master cylinders.

5-50. REMOVAL AND INSTALLATION OF BRAKE MASTER CYLINDERS.

a. Remove bleeder screw at wheel brake assembly and drain hydraulic fluid from brake system.
b. Remove front seats and rudder bar shield for access to brake master cylinders.
c. Disconnect parking brake linkage and brake master cylinders from rudder pedals.
d. Disconnect brake master cylinders at bottom attach points.
e. Disconnect hydraulic hoses from brake master cylinders and remove cylinders.
f. Plug or cap hydraulic fittings, lines, and hoses to prevent entry of foreign materials.
g. Reverse the preceding steps to install brake master cylinders, then fill and bleed brake system in accordance with paragraph 5-60.

5-51. DISASSEMBLY AND REPAIR OF BRAKE MASTER CYLINDERS. Figure 5-10 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 as a lubricant during assembly of the cylinders.

5-52. HYDRAULIC BRAKE LINES. The lines are of rigid tubing, except for flexible hose used at the brake master cylinders and at the wheel cylinders. A separate line is used to connect each brake master cylinder to its corresponding wheel brake cylinder.

5-53. 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 5-11.

5-54. REMOVAL OF WHEEL BRAKES. Wheel brake assemblies are a floating type and can be removed after disconnecting the brake line and removing the back plates.

NOTE

The brake disc can be removed after wheel removal and disassembly. To remove the torque plate, remove the wheel and axle in accordance with paragraph 5-13.

5-55. INSPECTION AND REPAIR OF WHEEL BRAKES.

a. Clean all parts except brake linings and O-rings in dry cleaning solvent and dry thoroughly.
b. O-rings are usually replaced at each overhaul. If their re-use is necessary, they should be wiped with a clean cloth soaked in 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 5-58.
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 the anchor bolts are replaced they should be pressed out. New bolts can be installed by tapping in place with a soft hammer.
f. Inspect brake disc. If excessively warped or scored, or worn to a thickness of .340-inch, the brake disc should be replaced with a new part. Sand smooth small nicks and scratches.

5-56. ASSEMBLY OF WHEEL BRAKES. Lubricate parts with hydraulic fluid and assemble components with care to prevent damage to O-rings. Refer to figure 5-11 during assembly of wheel brakes.

5-57. INSTALLATION OF WHEEL BRAKES. Place the brake assembly in position with pressure plate in place, then install back plate and safety the attaching bolts. 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.

5-58. CHECKING BRAKE LININGS. 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 brake linings.

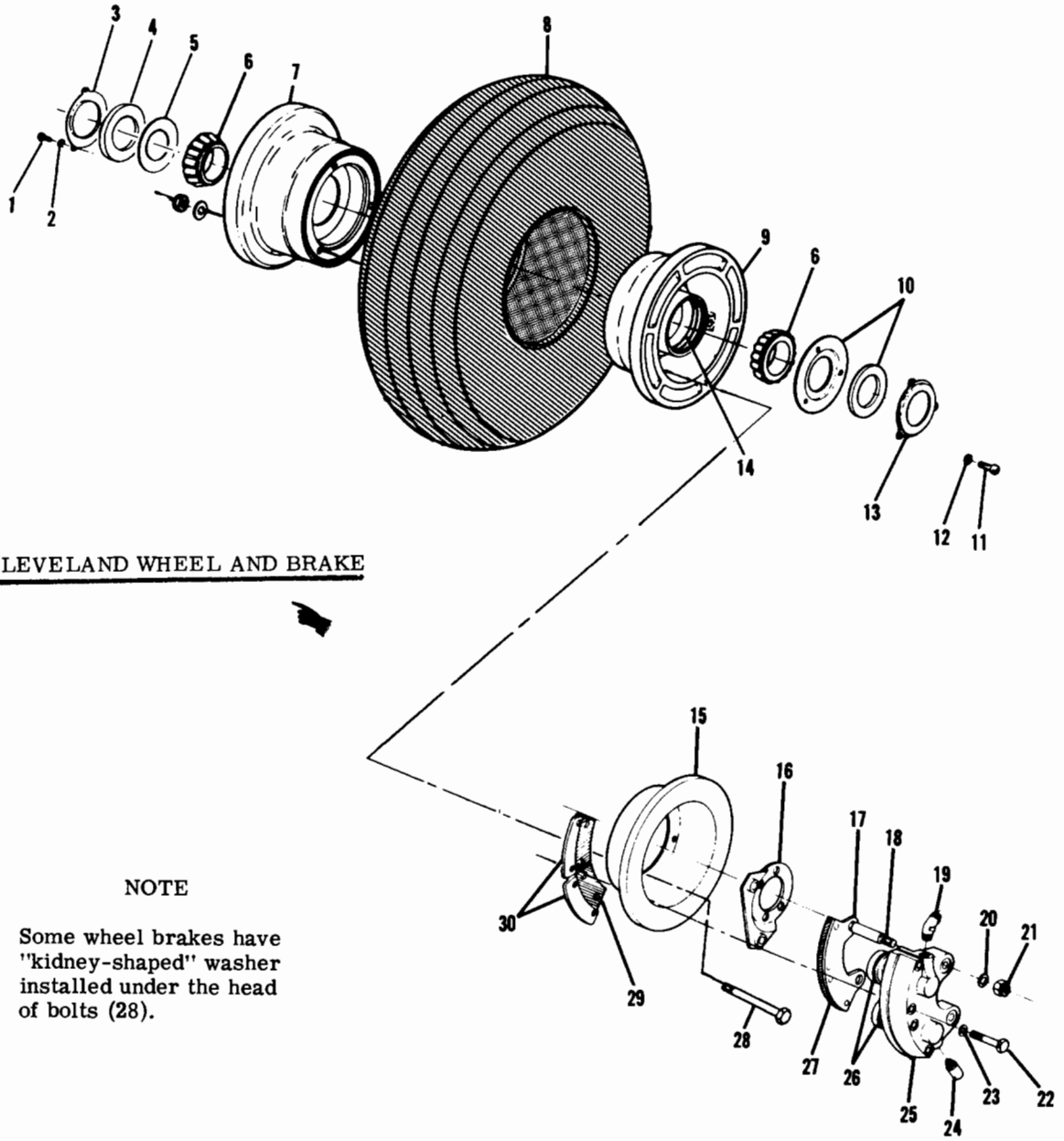
5-59. BRAKE LINING REPLACEMENT. (See figure 5-11.)

a. Remove bolts, washers, and back plate.
b. Pull the brake cylinder out of torque plate and slide pressure plate off anchor bolts.
c. Place back plate on a table with lining side down flat. Center a 9/64 inch (or slightly smaller) punch in the rolled rivet, and hit the punch crisply with a hammer. Punch out all rivets securing the linings to the back plate and pressure plate in the same manner.

NOTE

A rivet setting kit, Part No. R561, is available from the Cessna Service Parts Center. This kit consists of an anvil and punch.

d. Clamp the flat sides of the anvil in a vise.
e. Align new lining on back plate and place brake rivet in hole with the rivet head in the lining. Place rivet head against the anvil.
f. Center the rivet setting punch on the lips of the



1. Screw
2. Lockwasher
3. Grease Seal Ring
4. Felt Seal
5. Grease Seal Ring
6. Bearing Cone
7. Outer Wheel Half
8. Tire and Tube
9. Inner Wheel Half
10. Grease Seal Plate and Felt
11. Screw
12. Washer
13. Grease Seal Ring
14. Bearing Cup
15. Brake Disc
16. Torque Plate
17. Pressure Plate
18. Anchor Bolt
19. Hydraulic Fitting
20. Washer
21. Nut
22. Bolt
23. Washer
24. Bleeder Cap
25. Brake Cylinder
26. Piston
27. Brake Lining
28. Bolt
29. Brake Lining
30. Back Plate

Figure 5-11. Wheels and Brakes (Sheet 1 of 2)

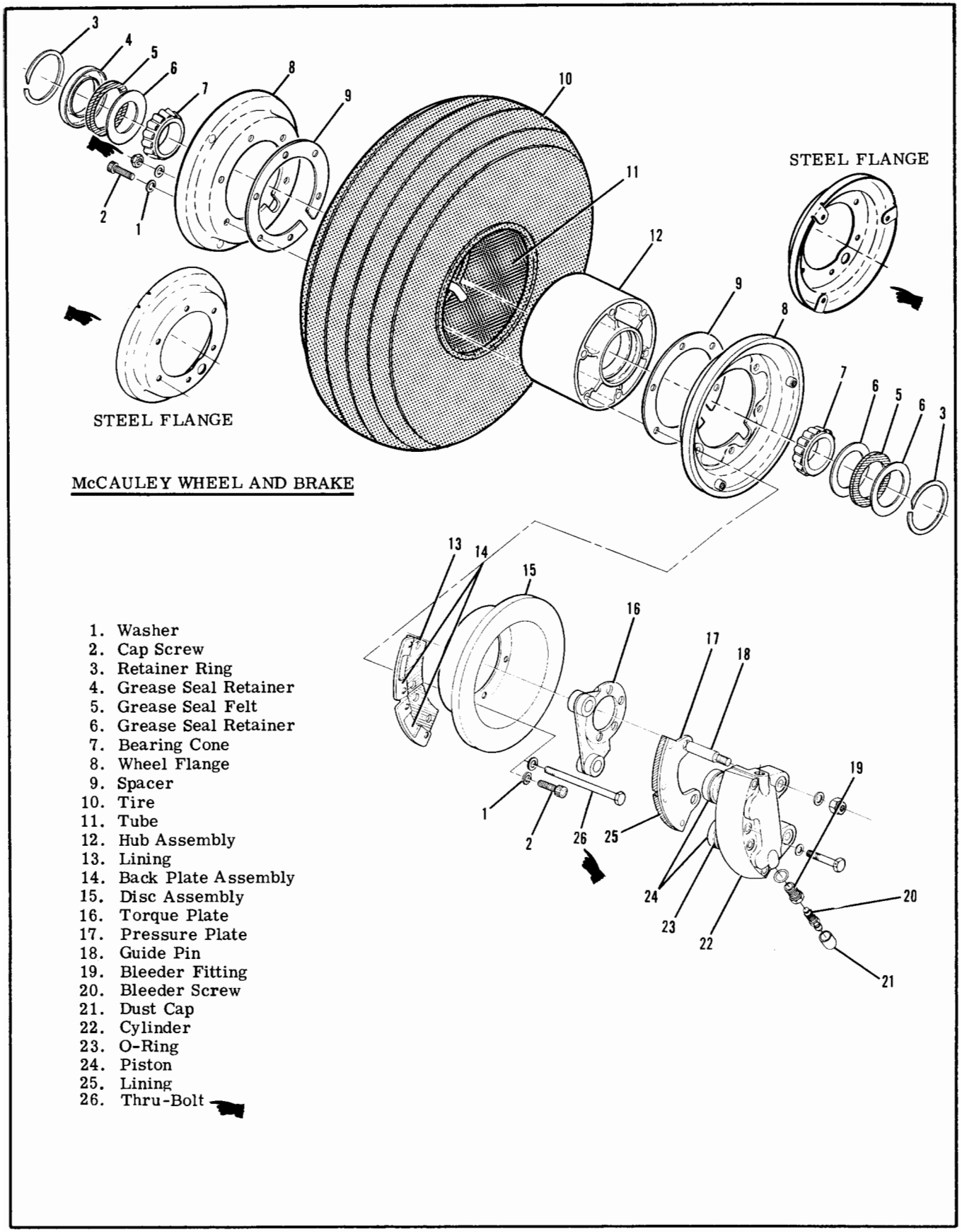


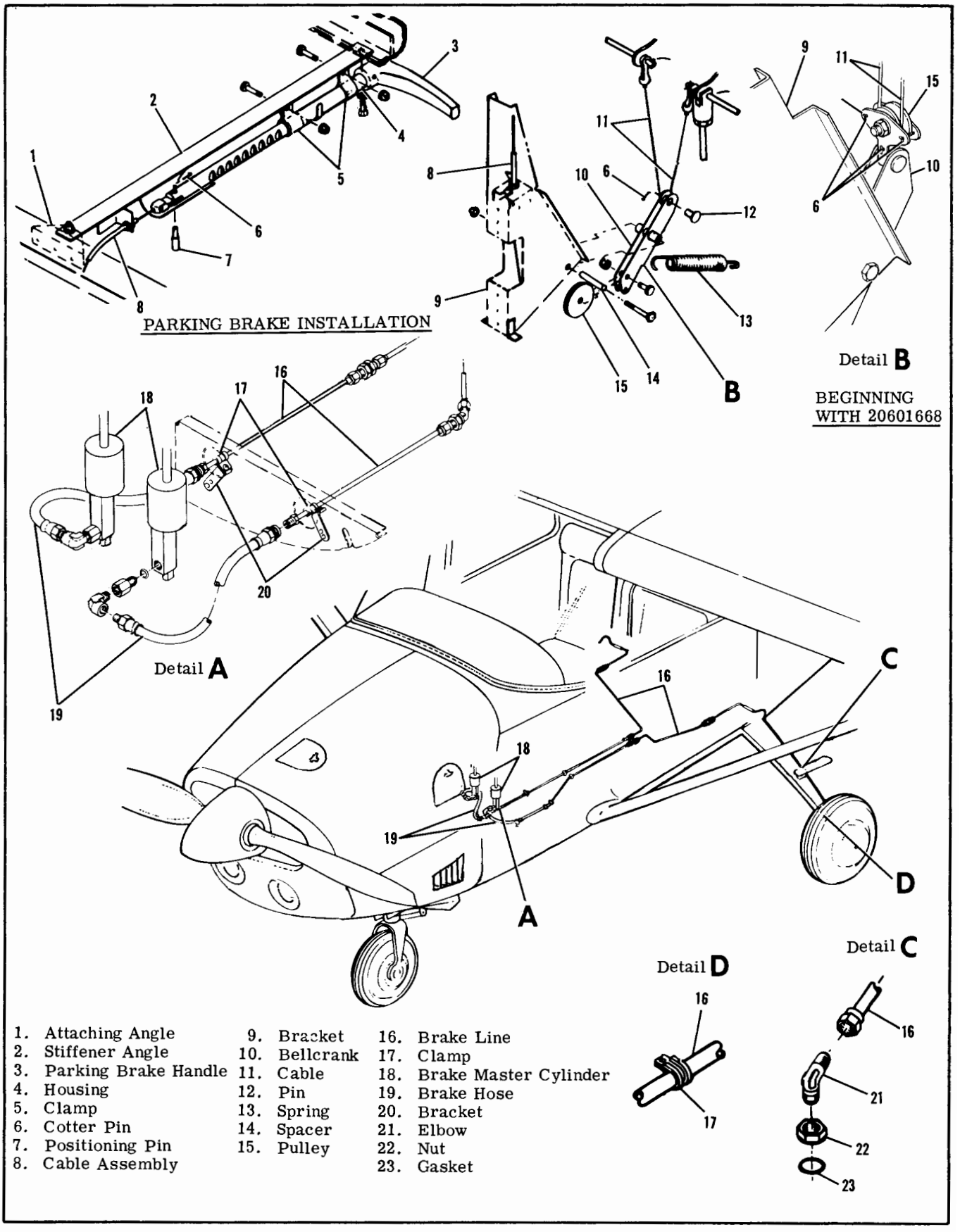
Figure 5-11. Wheels and Brakes (Sheet 2 of 2)

MAIN GEAR	NOSE GEAR	WHEEL NUMBER	TIRE SIZE	MANUFACTURER	NUT/CAPSCREW TORQUE	WHEEL HALF FLANGE
X		C163001-0301	6.00X6	CLEVELAND	150 lb-in.	MAGNESIUM
X		C163001-0302	8.00X6	CLEVELAND	150 lb-in.	MAGNESIUM
X		C163002-0103	6.00X6	McCAULEY	90-100 lb-in.	ALUMINUM
X		C163002-0104	8.00X6	McCAULEY	90-100 lb-in.	ALUMINUM
X		C163004-0102	6.00X6	McCAULEY	*190-200 lb-in.	STEEL
X		C163004-0101	8.00X6	McCAULEY	*190-200 lb-in.	STEEL
	X	1241156-12	5.00X5	CLEVELAND	90 lb-in.	MAGNESIUM
	X	1241156-11	6.00X6	CLEVELAND	150 lb-in.	MAGNESIUM
	X	C163002-0201	5.00X5	McCAULEY	90-100 lb-in.	ALUMINUM
	X	C163003-0201	5.00X5	McCAULEY	* 90-100 lb-in.	STEEL
	X	C163003-0301	6.00X6	McCAULEY	*190-200 lb-in.	STEEL
	X	C163003-0401	5.00X5	McCAULEY	*190-200 lb-in.	STEEL

Figure 5-11A. Landing Gear Wheel Thru-Bolt Nut and Capscrew Torque Values

*Capscrews

SHOP NOTES:



1. Attaching Angle
2. Stiffener Angle
3. Parking Brake Handle
4. Housing
5. Clamp
6. Cotter Pin
7. Positioning Pin
8. Cable Assembly
9. Bracket
10. Bellcrank
11. Cable
12. Pin
13. Spring
14. Spacer
15. Pulley
16. Brake Line
17. Clamp
18. Brake Master Cylinder
19. Brake Hose
20. Bracket
21. Elbow
22. Nut
23. Gasket

Figure 5-12. Brake System

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 pressure plate in the same manner.

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

j. Install the back plates with bolts and washers. Safety wire the bolts.

5-60. BRAKE BLEEDING. Standard bleeding, with 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.

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

NOTE

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

d. Remove hose from brake master cylinder and replace filler plug. Be sure vent hole in filler plug is open.

5-61. PARKING BRAKE SYSTEM.

5-62. DESCRIPTION. The parking brake system is essentially a ratchet-held handle which depresses and holds the brake master cylinders in the compressed position. No adjustment is provided in the system. Replacement of worn or defective parts will restore the system to its correct operation. Figure 5-12 may be used as a guide for replacement of parts.

SHOP NOTES:

SECTION 6

AILERON CONTROL SYSTEM

TABLE OF CONTENTS

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 6-17.

TROUBLE	PROBABLE CAUSE	REMEDY
LOST MOTION IN CONTROL WHEEL.	Loose control cables.	Check cable tension. Adjust cables to proper tension.
	Broken pulley or bracket, cable off pulley or worn rod end bearings.	Check visually. Replace worn or broken parts, install cables correctly.
RESISTANCE TO CONTROL WHEEL MOVEMENT.	Cables too tight.	Check cable tension. Adjust cables to proper tension.
	Pulleys binding or cable off.	Observe motion of the pulleys. Check cables visually. Replace defective pulleys. Install cables correctly.
	Bellcrank distorted or damaged.	Check visually. Replace defective bellcrank.
	Defective quadrant assembly.	Check visually. Replace defective quadrant.
	Clevis bolts in system too tight.	Check connections where used. Loosen, then tighten properly and safety.

6-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
CONTROL WHEELS NOT LEVEL WITH AILERONS NEUTRAL.	Improper adjustment of cables.	Refer to paragraph 6-17.
	Improper adjustment of aileron push-pull rods.	Adjust push-pull rods to obtain proper alignment.
DUAL CONTROL WHEELS NOT COORDINATED.	Cables improperly adjusted.	Refer to paragraph 6-17.
INCORRECT AILERON TRAVEL.	Push-pull rods not adjusted properly.	Refer to paragraph 6-17.
	Incorrect adjustment of travel stop bolts.	Refer to paragraph 6-17.

6-4. CONTROL COLUMN. (Refer to figure 6-2.)

6-5. DESCRIPTION. Rotation of the control wheel rotates four bearing roller assemblies (3) on the end of the control wheel tube (4), which in turn, rotates a square control tube assembly (18) inside and extending from the control wheel tube (4). Attached to this square tube (18) is a quadrant (32) which operates the aileron system. This same arrangement is provided for both control wheels. Synchronization of the control wheels is obtained by the interconnect cable (38), turnbuckle (37) and adjustment terminals (35). The forward end of the square control tube (18) is mounted in a bearing block (27) on firewall (33) and does not move fore-and-aft, but rotates with the control wheel. The four bearing roller assemblies (3) on the end of the control wheel tube reduce friction as the control wheel is moved fore-and-aft for elevator system operation. A sleeve weld assembly (7), containing bearings which permit the control wheel tube to rotate within it, is secured to the control wheel tube by a sleeve and retaining ring in such a manner it moves fore-and-aft with the control wheel tube. This movement allows the push-pull tube (19) attached to the sleeve weld assembly (7) to operate an elevator arm assembly (22), to which one elevator cable (39) is attached. A torque tube (21) connects this arm assembly (22) to the one on the opposite end of the torque tube (21), to which the other elevator cable is attached. When dual controls are installed, the copilot's control wheel is linked to the aileron and elevator control systems in the same manner as the pilot's control wheel.

6-6. REMOVAL AND INSTALLATION.

a. THRU AIRCRAFT SERIAL 20601700. (Refer to figure 6-2, sheet 1.) Remove screws attaching control wheel (2) to control wheel tube assembly (4) and remove wheel. Disconnect electrical wiring to map light and mike switch, if installed.

b. BEGINNING WITH AIRCRAFT SERIAL 206-01701. (Refer to figure 6-2, sheet 2.) Slide cover (2) toward instrument panel to expose adapter (3). Remove screws securing adapter (3) to control wheel tube assembly (1) and remove control wheel assembly. Disconnect electrical wiring to map light, mike switch and electric trim switch at connector (18), if installed. Slide cover (2) off control wheel tube assembly (1).

c. (Refer to figure 6-2, sheet 1.) Remove decorative cover from instrument panel.

d. Remove screw securing adjustable glide plug (16) to control tube assembly (18) and remove plug (16) and glide (17).

e. Disconnect push-pull tube (19) at sleeve weld assembly (7).

f. THRU AIRCRAFT SERIAL 20601700. (Refer to figure 6-2, sheet 1.) Remove screws securing cover plate (15 or 24) at instrument panel.

g. BEGINNING WITH AIRCRAFT SERIAL 206-01701. (Refer to figure 6-2, sheet 2.) Remove screws securing cover plate (20) at instrument panel.

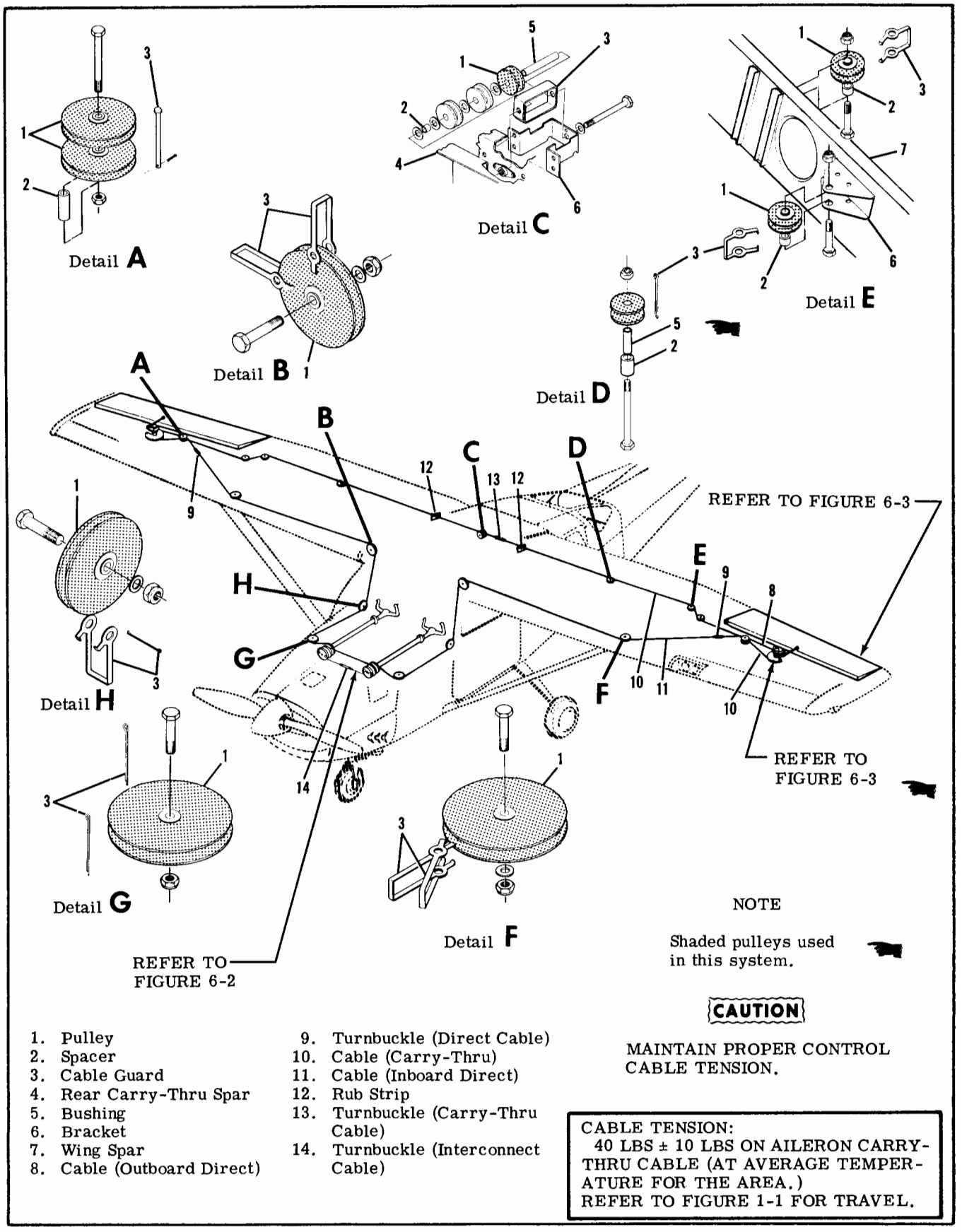
h. (Refer to figure 6-2, sheet 1.) Using care, pull control wheel tube assembly (4) aft and work assembly out through instrument panel.

NOTE

To ease removal of control wheel tube assembly (4), snap ring (11) may be removed from its locking groove to allow sleeve weld assembly (7) additional movement.

● If removal of control tube assembly (18) or quadrant (32) is necessary, proceed to step "i."

i. Remove safety wire and relieve direct cable tension at turnbuckles (index 9, figure 6-1).



1. Pulley
2. Spacer
3. Cable Guard
4. Rear Carry-Thru Spar
5. Bushing
6. Bracket
7. Wing Spar
8. Cable (Outboard Direct)
9. Turnbuckle (Direct Cable)
10. Cable (Carry-Thru)
11. Cable (Inboard Direct)
12. Rub Strip
13. Turnbuckle (Carry-Thru Cable)
14. Turnbuckle (Interconnect Cable)

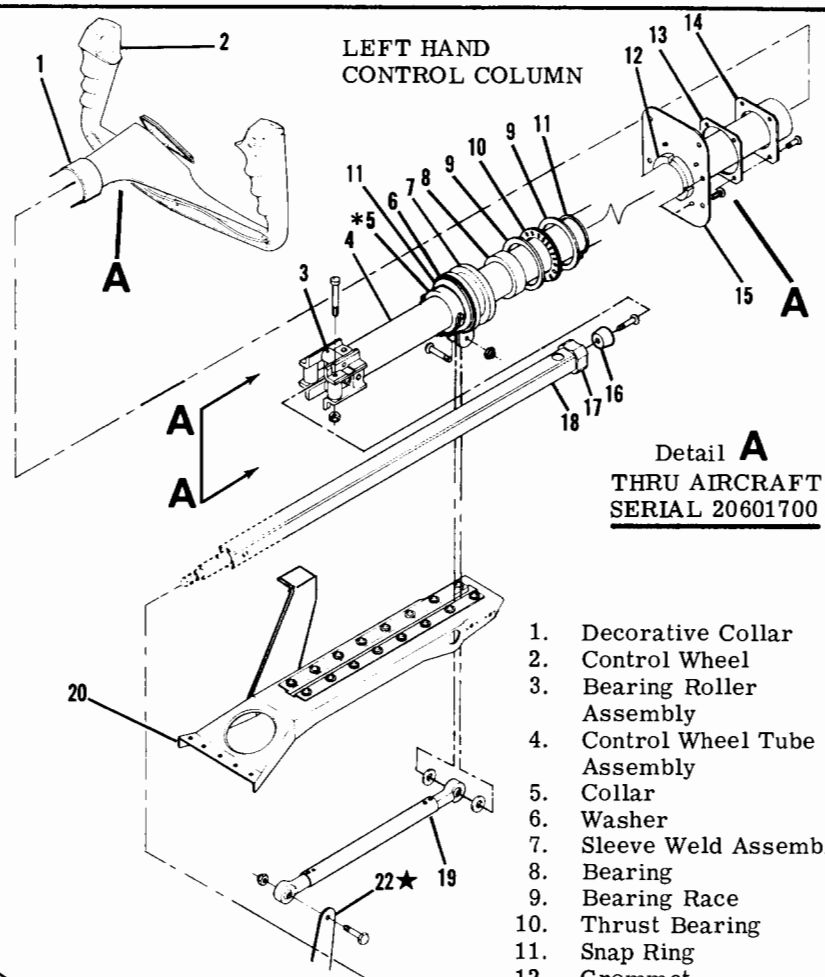
Figure 6-1. Aileron Control System

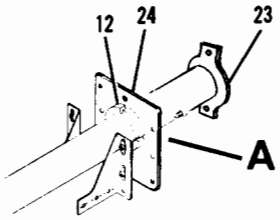
NOTES

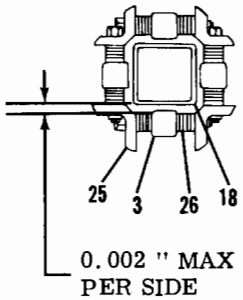
Allow 0.030 " maximum clearance between bearing block (27) and nut (34) after tightening.

Adjust interconnect cable (38) tension to 30 ± 10 lbs.

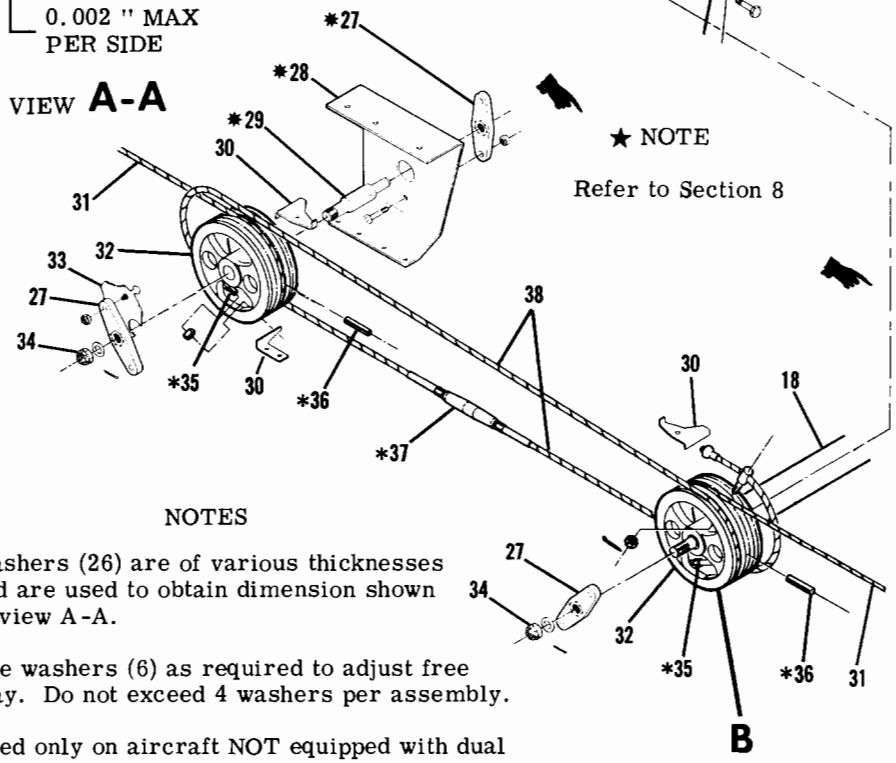
*Safety wire these items.







VIEW A-A



★ NOTE

Refer to Section 8

NOTES

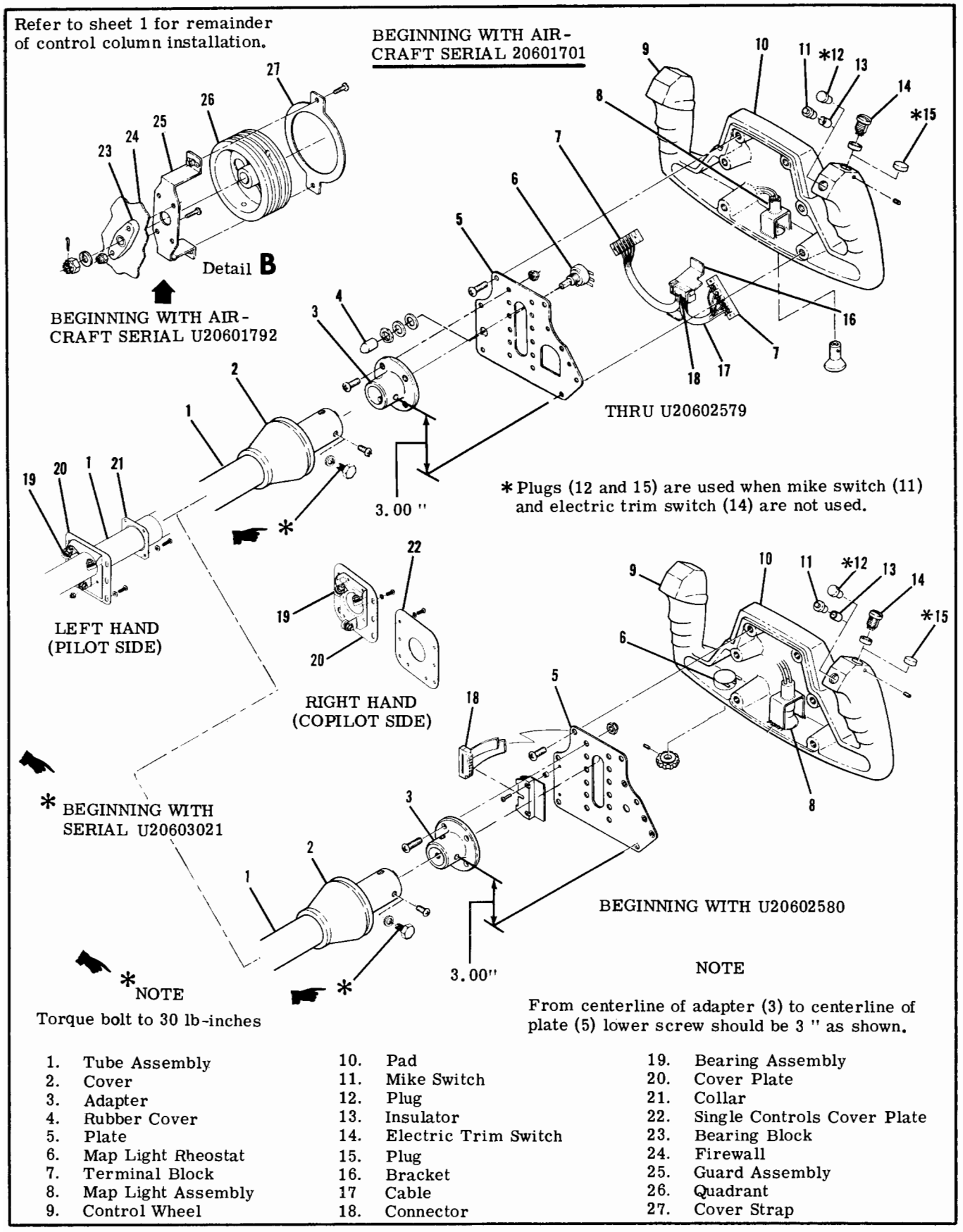
Washers (26) are of various thicknesses and are used to obtain dimension shown in view A-A.

Use washers (6) as required to adjust free play. Do not exceed 4 washers per assembly.

* Used only on aircraft NOT equipped with dual control wheel installation.

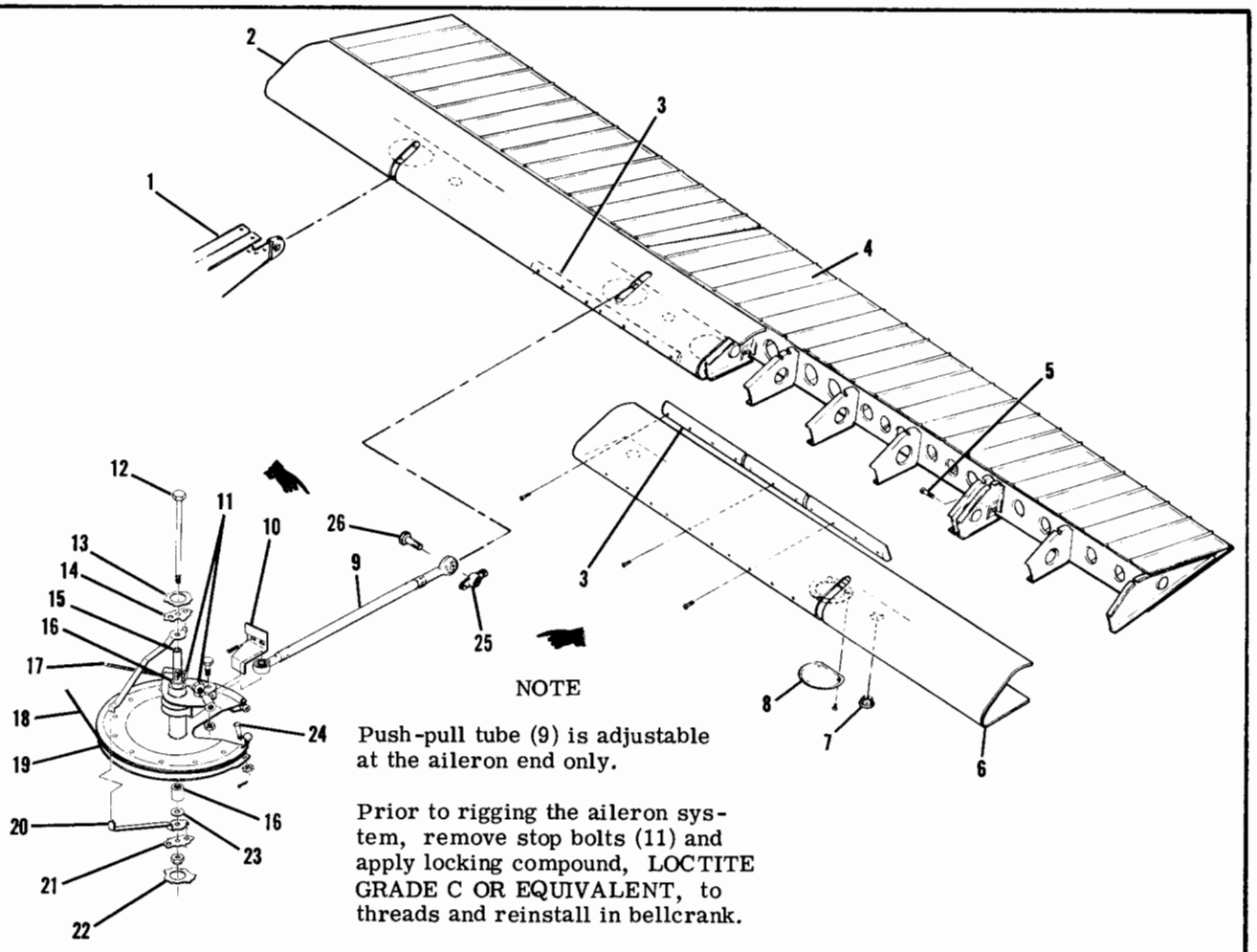
1. Decorative Collar
2. Control Wheel
3. Bearing Roller Assembly
4. Control Wheel Tube Assembly
5. Collar
6. Washer
7. Sleeve Weld Assembly
8. Bearing
9. Bearing Race
10. Thrust Bearing
11. Snap Ring
12. Grommet
13. Spacer
14. Collar
15. Cover Plate
16. Adjustable Glide Plug
17. Control Tube Glide
18. Control Tube Assembly
19. Push-Pull Tube
20. Guide Assembly
21. Deleted
22. Arm Assembly (Elev)
23. Retainer
24. Cover Plate
25. Retainer
26. Washer
27. Bearing Block
28. Support Bracket
29. Idler Shaft
30. Cable Guard
31. Cable (Aileron Direct)
32. Quadrant (Cable Drum)
33. Firewall
34. Nut
35. Adjustable Nut
36. Roll Pin
37. Turnbuckle (Interconnect Cable)
38. Cable (Interconnect)

Figure 6-2. Control Column Installation (Sheet 1 of 2)



1.	Tube Assembly	10.	Pad	19.	Bearing Assembly
2.	Cover	11.	Mike Switch	20.	Cover Plate
3.	Adapter	12.	Plug	21.	Collar
4.	Rubber Cover	13.	Insulator	22.	Single Controls Cover Plate
5.	Plate	14.	Electric Trim Switch	23.	Bearing Block
6.	Map Light Rheostat	15.	Plug	24.	Firewall
7.	Terminal Block	16.	Bracket	25.	Guard Assembly
8.	Map Light Assembly	17	Cable	26.	Quadrant
9.	Control Wheel	18.	Connector	27.	Cover Strap

Figure 6-2. Control Column Installation (Sheet 2 of 2)



1. Hinge Support
2. Aileron Assembly
3. Balance Weight
4. Upper Skin
5. Bolt
6. Leading Edge Skin
7. Plug Button
8. Access Plate
9. Push-Pull Tube
10. Retainer
11. Travel Stop Bolt
12. Pivot Bolt
13. Upper Wing Skin
14. Upper Aileron Bellcrank Bracket
15. Bushing
16. Bearing
17. Cable (Outboard Direct)
18. Cable (Carry-Thru)
19. Bellcrank
20. Cable Guard
21. Lower Aileron Bellcrank Bracket
22. Lower Wing Skin
23. Brass Washer
24. Cable Lock
25. Nutplate
26. Bolt

Figure 6-3. Aileron Installation

j. Remove safety wire, relieve interconnect cable tension at turnbuckle (37) and remove cables from quadrant (32).

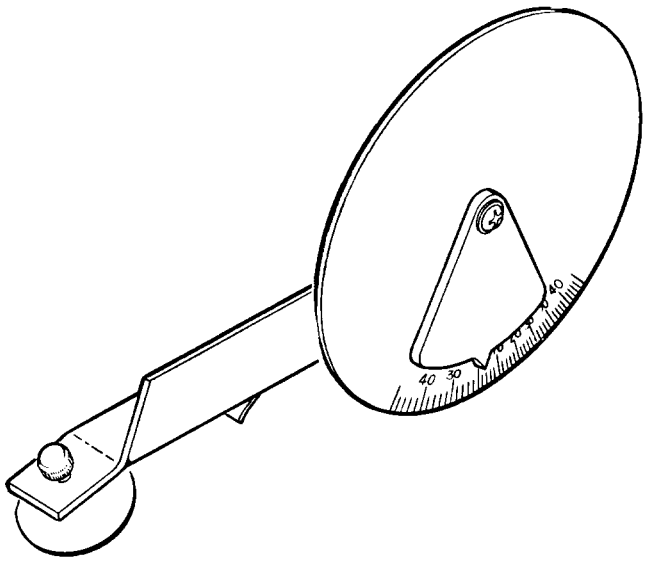
k. Remove safety wire and remove roll pin (36) through quadrant (32) and control tube assembly (18).

l. Remove pin, nut (34) and washer from control tube assembly (18) protruding through bearing block (27) on forward side of firewall (33).

m. Using care, pull control tube assembly (18) aft and remove quadrant (32).

n. Reverse the preceding steps for reinstallation. Rig aileron and elevator control systems in accordance with paragraphs 6-17 and 8-13 respectively. Safety turnbuckles and all other items previously safetied. Tighten nut (34) securing control tube assembly (18) to firewall snugly, then loosen nut to 0.030" maximum clearance between nut and bearing block, 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.



AVAILABLE FROM CESSNA SERVICE PARTS CENTER (TOOL NO. SE 716)

Figure 6-4. Inclinometer for Measuring Control Surface Travel

6-8. BEARING ROLLER ADJUSTMENT. (BEGINNING WITH AIRCRAFT SERIAL 20601701.) (Refer to figure 6-2.) Each bearing assembly (index 19, sheet 2) has an 0.062" eccentric adjustment when installed, for aligning the control tube weld assembly (index 7, sheet 1) and push-pull tube (index 19, sheet 1) with the guide assembly (index 20, sheet 1). For alignment, proceed as follows:

a. Remove control wheel assembly in accordance with paragraph 6-6.

b. Install cover plate (index 20, sheet 2) backwards (bearings on aft side) and leave loose with instrument panel.

c. Align control wheel tube assembly (index 4, sheet 1) for free travel of push-pull tube (index 19, sheet 1) along full length of guide assembly (index 20, sheet 1).

d. Center cover plate (index 20, sheet 2) over tube and bearing assembly and secure plate to instrument panel.

e. Adjust each bearing (index 19, sheet 2) to control wheel tube assembly and tighten bearings in place.

f. Remove cover plate and reinstall with bearings facing forward.

6-9. AILERON BELLCRANK. (Refer to figure 6-3.)

6-10. REMOVAL AND INSTALLATION.

a. Remove access plate inboard of each bellcrank (19) on underside of wing.

b. Remove safety wire and relieve cable tension at turnbuckles (index 9, figure 6-1).

c. Disconnect control cables from bellcrank (19).

d. Disconnect push-pull tube (9) at bellcrank (19).

e. Remove bolt securing bellcrank to wing structure.

f. Remove bellcrank through access opening, using care that bushing (15) is not dropped from bellcrank.

NOTE

Brass washers (23) may be used as shims between lower end of bellcrank and lower bracket (21). Retain these shims. Tape open ends of bellcrank to prevent dust and dirt from entering bellcrank needle bearings (16).

g. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 6-17, 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. Remove safety wire and relieve cable tension at turnbuckles (9 and 13).

c. Disconnect cables from aileron bellcranks (index 19, figure 6-3) and quadrants (index 32, figure 6-2).

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

NOTE

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

e. Reverse the preceding steps for reinstallation.

f. After cables are routed in position, install pulleys and cable guards. Ensure cables are positioned in pulley grooves before installing guards.

g. Re-rig aileron system in accordance with paragraph 6-17, safety turnbuckles and 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 plates (8) and plug buttons (7) from underside of aileron.

b. Disconnect push-pull tube (9) at ailerons.

c. Remove bolts (5) attaching ailerons to hinge supports (1).

d. Using care, pull ailerons out and down.

e. Reverse the preceding steps for reinstallation.

NOTE

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

f. Check aileron travel and alignment, re-rig if necessary, in accordance with paragraph 6-17.

6-16. REPAIR. Aileron repair may be accomplished in accordance with instructions outlined in Section 18. Before installation, ensure balance weights and hinges are securely attached.

6-17. RIGGING.

a. (Refer to figure 6-1.) Remove access plates and upholstery as required.

b. Remove safety wire and relieve cable tension at turnbuckles (9 and 13).

c. (Refer to figure 6-3.) Disconnect push-pull tubes (9) at ailerons (2).

d. (Refer to figure 6-2.) Adjust turnbuckle (37) and adjustment nuts (35) on interconnect cable (38) to remove slack, acquire proper tension (30±10 pounds) and position both control wheels level (synchronized).

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

f. (Refer to figure 6-1.) Adjust direct cable turnbuckles (9) and carry-thru cable turnbuckle (13) to position bellcranks (index 19, figure 6-3) approximately in neutral while maintaining proper cable tension.

g. Streamline ailerons with reference to flaps (flaps full UP positions), then adjust push-pull tubes (index 9, figure 6-3) to fit and install.

h. With ailerons streamlined, mount an inclinometer on trailing edge of aileron and set pointer to 0°.

i. Remove bar from control wheels and adjust travel stops (index 11, figure 6-3) to obtain travel specified in figure 1-1.

j. Ensure all turnbuckles are safetied, all cables and cable guards are properly installed, all jam nuts are tight and replace all parts removed for access.

WARNING

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

SHOP NOTES:

SECTION 7

WING FLAP CONTROL SYSTEM

TABLE OF CONTENTS

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, synchronizing push-pull tubes, bellcranks, push-pull rods, cables, pulleys and a follow-up control. Power from the motor and transmission assembly is transmitted to the flaps by a system of drive pulleys, cables and synchronizing tubes. 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, a switch is tripped 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 cam, breaking the circuit. To reverse the direction of flap travel, the control lever is moved in the opposite direction. When the control lever cam contacts the second switch the flap motor is energized in the opposite direction. Likewise, the follow-up control moves the floating arm until the second switch is clear of the control lever cam.

7-3. OPERATIONAL CHECK.

a. Operate flaps through their full range of travel, observing for uneven or jumpy motion, binding and lost motion in the system. Ensure flaps are moving together through their full range of travel.

b. THRU AIRCRAFT SERIALS P20600648 AND U20601673 WHEN NOT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. Check for positive shut-off of motor at the flap travel extremes, the motor should NOT continuously freewheel at travel extremes.

c. BEGINNING WITH AIRCRAFT SERIAL U206-01674 AND ALL AIRCRAFT MODIFIED IN ACCORDANCE WITH FIGURE 7-2 SHEET 3. 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. In flight at 110 MPH (THRU AIRCRAFT SERIALS P206-00648 AND U20601700) and 120 MPH (BEGINNING WITH AIRCRAFT SERIAL U20601701), indicated airspeed, flaps should fully extend in approximately 15.5 seconds and retract in approximately 7.5 seconds. On the ground, with engine running, the flaps should extend in approximately 8 seconds and retract in approximately 7.5 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 as specified in figure 1-1. Check approximate mid-range percentage setting against degrees as indicated on inclinometer. Repeat the same procedure for the opposite flap.

NOTE

An inclinometer for measuring control surface travel is available from 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 and defective parts.

7-4. TROUBLE SHOOTING.

NOTE

Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraphs 7-21 and 7-22.

TROUBLE	PROBABLE CAUSE	REMEDY
BOTH FLAPS FAIL TO MOVE.	Popped circuit breaker.	Reset and check continuity. Replace breaker if defective.
	Defective switch.	Place jumper across switch. Replace switch if defective.
	Defective motor.	Remove and bench test. Replace motor if defective.
	Broken or disconnected wires.	Run continuity check of wiring. Connect or repair wiring as necessary.
	Disconnected or defective transmission.	Connect transmission. Remove, bench test and replace transmission if defective.
	Defective limit switch.	Check continuity of switches. Replace switches found defective.
	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.	Open access plates and observe pulleys. Route cables correctly over pulleys.
	Bind in drive pulleys.	Check drive pulleys in motion. Replace drive pulleys found defective.
	Broken or binding pulleys.	Check pulleys for free rotation or breaks. Replace defective pulleys.
	Frayed cable.	Check condition of cables. Replace defective cables.
	Flaps binding on tracks.	Observe flap tracks and rollers. Replace defective parts.
LEFT FLAP FAILS TO MOVE.	Disconnected or broken cable.	Check cable tension. Connect or replace cable.
	Disconnected push-pull rod.	Attach push-pull rod.
FLAPS FAIL TO RETRACT.	Disconnected or defective UP limit switch.	Check continuity of switch. Connect or replace switch.

7-4. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
FLAPS FAIL TO EXTEND.	Disconnected or defective DOWN limit switch.	Check continuity of switch. Connect or replace switch.
INCORRECT FLAP TRAVEL.	Incorrect rigging.	Refer to paragraphs 7-21 and 7-22.
	Defective limit switch.	Check continuity of switches. Replace switches found defective.

7-5. FLAP MOTOR AND TRANSMISSION ASSEMBLY.

7-6. REMOVAL AND INSTALLATION.

a. THRU AIRCRAFT SERIALS P20600648 AND U20601673 WHEN NOT MODIFIED IN ACCORDANCE WITH SK150-37 AND WHEN NOT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. (Refer to figure 7-2, sheet 1.)

1. Run flaps to full DOWN position.
2. Disconnect battery cables at the battery and insulate cable terminals as a safety precaution.
3. Remove access plates adjacent to drive pulley and motor assembly on right wing.

NOTE

Remove motor (1), transmission (4), hinge assembly (2) and actuating tube (8) from the aircraft as a unit.

4. Remove bolt (20) securing actuating tube (8) to drive pulley (16).
5. Screw actuating tube (8) IN toward transmission (4) by hand to its shortest length.
6. Remove bolt (3) securing flap motor hinge assembly (2) to wing, or remove bolt (5) securing transmission (4) to hinge assembly (2). Retain brass washer between lower end of hinge and wing structure. Remove hinge assembly (2) through access opening, using care not to drop bushing from hinge. Tape open ends of hinge to protect bearings.
7. Disconnect motor electrical wiring (21) at quick-disconnects.
8. Using care, work assembly from wing through access opening.
9. Reverse the preceding steps for reinstallation. If the hinge (2) was removed from the transmission for any reason, ensure the short end of hinge is reinstalled toward the top.
10. Complete an operational check as outlined in paragraph 7-3 and re-rig flap system in accordance with paragraphs 7-21 and 7-22.

b. THRU AIRCRAFT SERIALS P20600648 AND U20601673 WHEN MODIFIED IN ACCORDANCE WITH SK150-37 AND WHEN NOT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. (Refer to figure 7-2, sheet 2.)

1. Complete steps 1, 3 and 4 of subparagraph "a."
2. Run flap motor to place actuating tube (8) IN to its shortest length.
3. Complete steps 2, 6, 7, 8, 9 and 10 of subparagraph "a."

c. BEGINNING WITH AIRCRAFT SERIAL U206-01674 AND ALL AIRCRAFT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. (Refer to figure 7-2, sheets 2 and 3.)

1. Complete steps 1 thru 7 of subparagraph "a."
2. Disconnect electrical wiring at limit switches (31 and 34). Tag wires for reference on reinstallation.
3. Complete steps 8, 9 and 10 of subparagraph "a."

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

7-8. FLAP CONTROL LEVER.

7-9. REMOVAL AND INSTALLATION.

a. THRU AIRCRAFT SERIALS P20600648 AND U20601700. (Refer to figure 7-3, sheet 1.)

1. Remove follow-up control (1) from switch mounting arm (14).
2. Remove flap operating switches (11 and 13) from switch mounting arm (14). DO NOT disconnect electrical wiring at switches.
3. Remove knob (9) from control lever (8).
4. Remove remaining items by removing bolt (17). Use care not to drop parts into tunnel area.
5. Reverse the preceding steps for reinstallation. Do not overtighten bolt (17) causing lever (8) to bind. Rig system in accordance with paragraphs 7-21 and 7-22.

b. BEGINNING WITH AIRCRAFT SERIAL U206-01701. (Refer to figure 7-3, sheet 2 and 3.)

1. Disconnect follow-up control bellcrank (24) from switch mounting arm (8).
2. Remove flap operating switches (15 and 16) from switch mounting arm (8). DO NOT disconnect electrical wiring at switches.

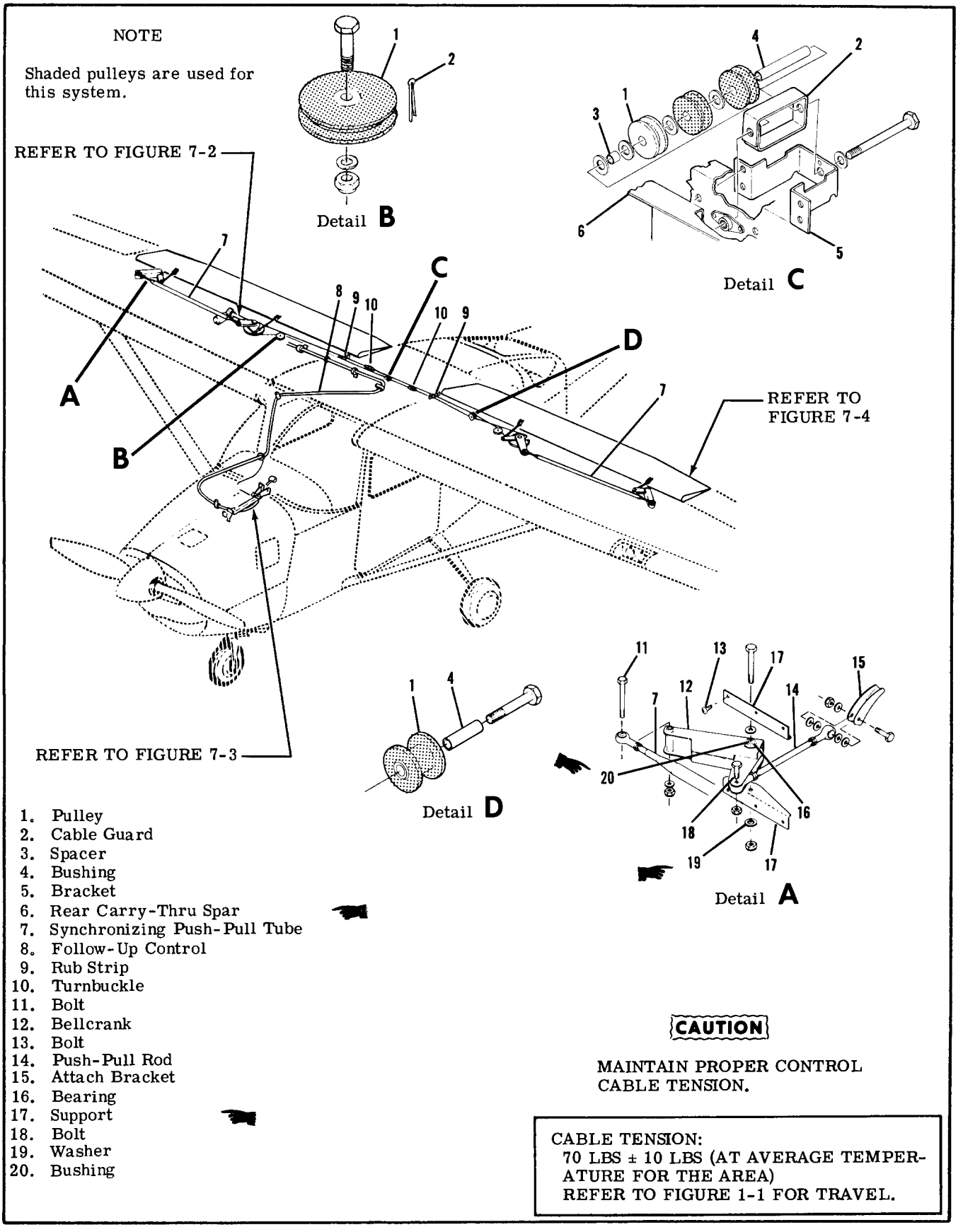


Figure 7-1. Wing Flap Control System

3. Remove knob (11) from control lever (12).
4. Remove remaining items by removing bolt (18). Use care not to drop parts into tunnel area.
5. Reverse the preceding steps for reinstallation. Do not overtighten bolt (18) causing lever (12) to bind. Rig system in accordance with paragraphs 7-21 and 7-22.

7-10. DRIVE PULLEYS. (Refer to figure 7-2.)

7-11. REMOVAL AND INSTALLATION.
a. Remove access plates adjacent to drive pulley (16) in right wing.
b. Unzip or remove headliner as necessary for access to turnbuckles (index 10, figure 7-1), remove safety wire and loosen turnbuckles.
c. Remove bolt (18) securing flap push-pull rod (14) to drive pulley (16).
d. Remove bolt (10) securing synchronizing push-pull tube (9) to drive pulley (16) and lower RIGHT flap gently.
e. Remove bolt (20) securing actuating tube (8) to drive pulley (16) and lower LEFT flap gently. Retain bushing.
f. Remove cable locks (13) securing control cables to drive pulley (16). Tag cables for reference on reinstallation.
g. THRU AIRCRAFT SERIALS P20600648 AND U20601700. Remove bolt (11) attaching follow-up control bellcrank (17) to drive pulley (16).
h. Remove bolt (12) attaching drive pulley (16) to wing structure.
i. Using care, remove drive pulley through access opening, being careful not to drop bushing. Retain brass washer between drive pulley and wing structure for use on reinstallation. Tape open ends of drive pulley after removal to protect bearings.
j. To remove left wing drive pulley, use this same procedure omitting steps "e" and "g."
k. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraphs 7-21 and 7-22, 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. (Refer to figure 7-1.)

7-14. REMOVAL AND INSTALLATION.
a. Run flaps to full DOWN position.
b. Remove access plate adjacent to bellcrank (12).
c. Remove bolt (18) securing outboard push-pull rod (14) to bellcrank (12).
d. Remove bolt (11) securing synchronizing push-pull tube (7) to bellcrank (12).
e. Remove bolts (13) securing upper and lower Supports (17).
f. Work bellcrank out through access opening.
g. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraphs 7-21 and 7-22.

7-15. REPAIR. Repair is limited to replacement of bearings. Cracked, bent or excessively worn bellcranks must be replaced. Lubricate bearings as outlined in Section 2.

7-16. FLAPS. (Refer to figure 7-4.)

7-17. REMOVAL AND INSTALLATION.
a. Run flaps to full DOWN position.
b. Remove access plates (5) from top leading edge of flap.
c. Disconnect push-pull rods at flap brackets (4).
d. Remove bolts (12) at each flap track, pull flap aft and remove remaining bolt. As flap is removed from wing, all washers, rollers and bushings will fall free. Retain these for reinstallation.
e. Reverse the preceding steps for reinstallation. If push-pull rod adjustment is not disturbed, re-rigging of system should not be necessary. Check flap travel and rig in accordance with paragraphs 7-21 and 7-22, if necessary.

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

7-19. CABLES AND PULLEYS. (Refer to figure 7-1.)

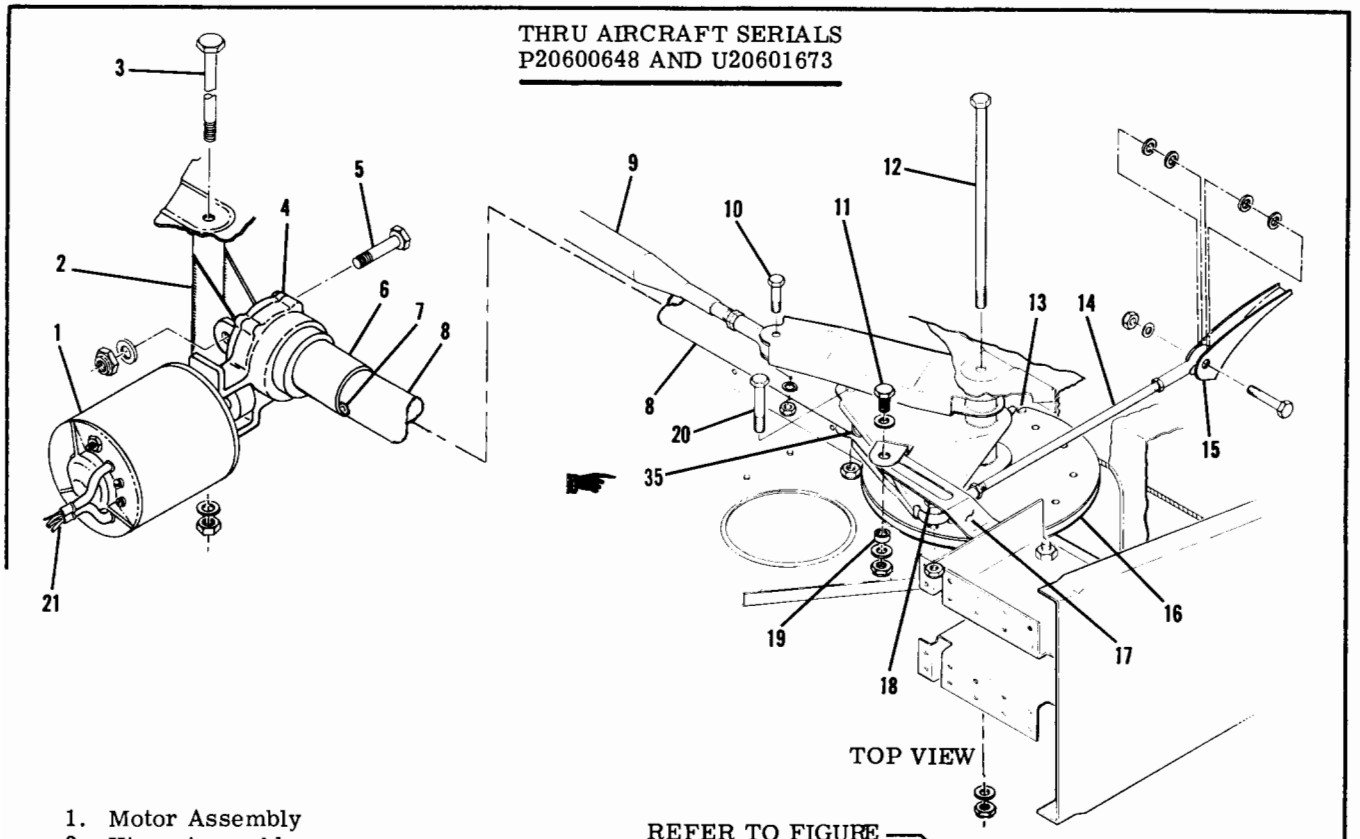
7-20. REMOVAL AND INSTALLATION.
a. Remove access plates, fairings, headliner and upholstery as necessary for access.
b. Remove safety wire, relieve cable tension, disconnect turnbuckles (10) and carefully lower LEFT flap.
c. Disconnect cables at drive pulleys, remove cable guards and pulleys as necessary to work cables free of aircraft.

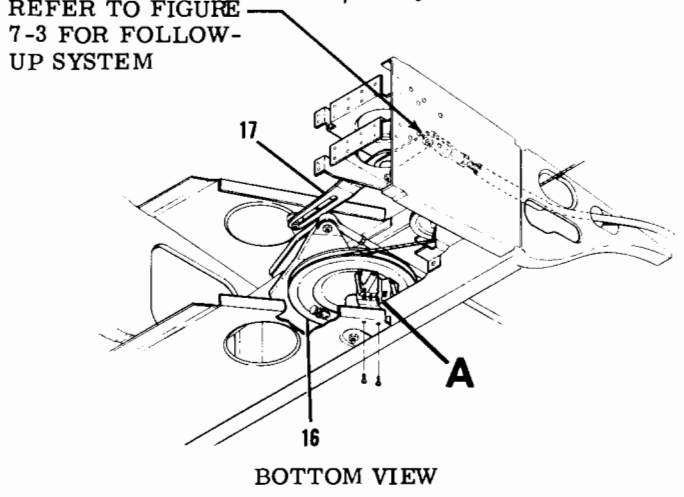
NOTE

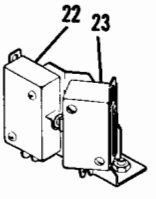
To ease routing of cables, a length of wire may be attached to the end of cable being withdrawn from the aircraft. Leave wire in place, routed through structure; then attach the cable being installed and use wire to pull cable into position.

d. Reverse the preceding steps for reinstallation.
e. After cables are routed in position, install pulleys and cable guards. Ensure cables are positioned in pulley grooves before installing guards.
f. Re-rig flap system in accordance with paragraphs 7-21 and 7-22, safety turnbuckles and reinstall all items removed in step "a."

7-21. RIGGING-FLAPS. (Refer to figure 7-2.)
a. Unzip or remove headliner as necessary for access to turnbuckles (index 10, figure 7-1).
b. Remove safety wire, relieve cable tension, disconnect turnbuckles and carefully lower LEFT flap.
c. Remove bolt (18) securing flap push-pull rod (14) to drive pulleys (16) in both wings.







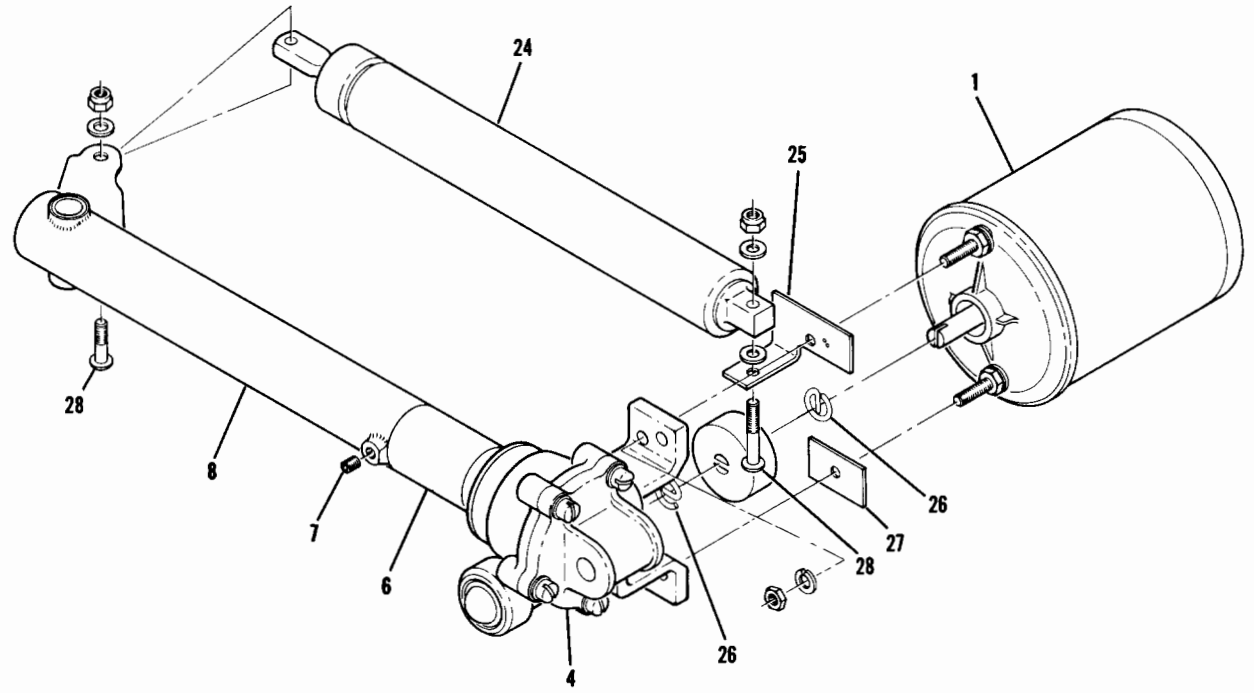
1. Motor Assembly
2. Hinge Assembly
3. Pivot Bolt
4. Transmission Assembly
5. Bolt
6. Nut and Ball Assembly
7. Setscrew
8. Actuating Tube
9. Synchronizing Push-Pull Tube
10. Bolt
11. Bolt
12. Pivot Bolt
13. Cable Lock
14. Push-Pull Rod
15. Attach Bracket
16. Drive Pulley
17. Bellcrank
18. Bolt
19. Spacer
20. Bolt
21. Electrical Wiring
22. Down-Limit Switch
23. Up-Limit Switch
24. Snubber Assembly
25. Bracket
26. Spacer
27. Shim
28. Screw
29. Setscrew
30. Switch Adjusting Block
31. Up-Limit Switch
32. Switch Actuating Collar
33. Switch Support
34. Down-Limit Switch
35. Bushing

NOTE

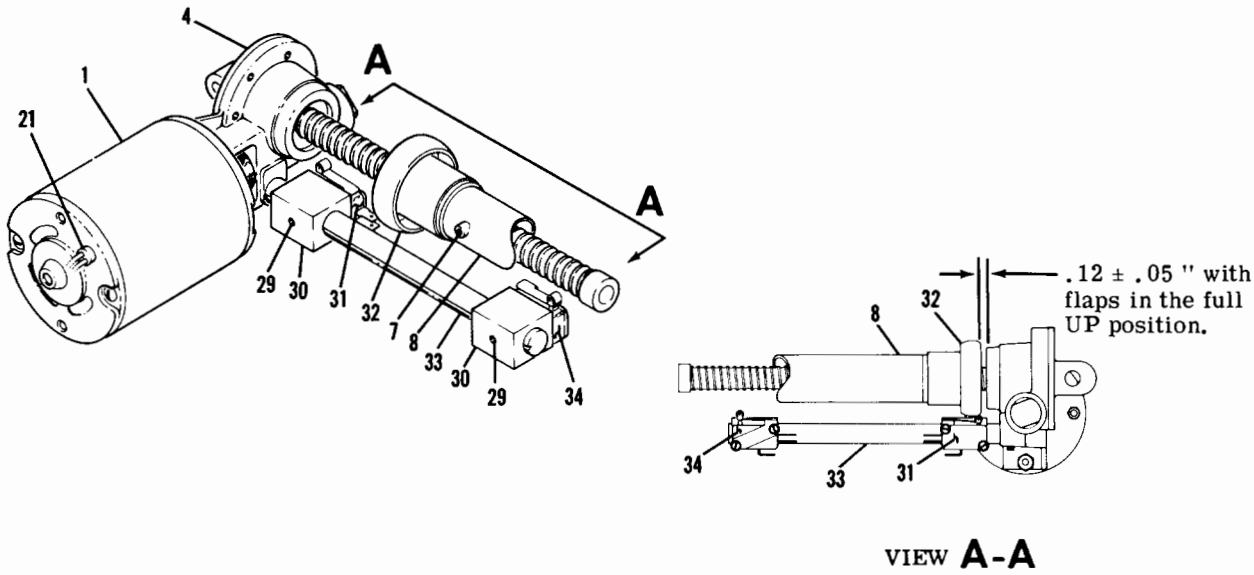
Use Loctite Sealant, Grade "C" on threads of setscrew (7) after final adjustment.

Ensure shortest end of hinge (2) is at top.

Figure 7-2. Flap Motor and Transmission Assembly (Sheet 1 of 3)

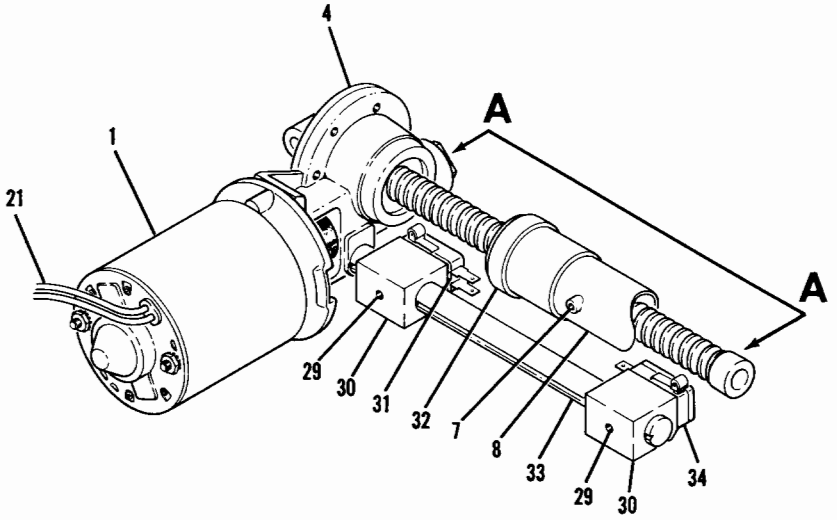


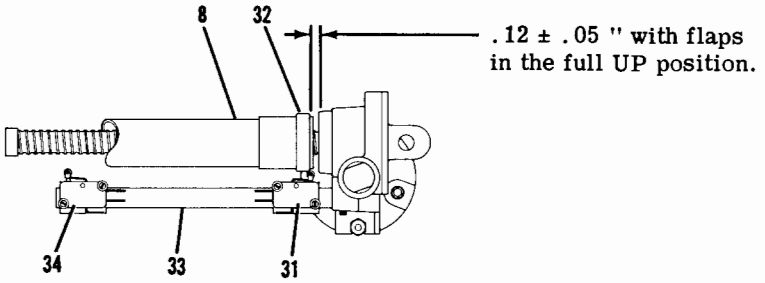
THRU AIRCRAFT SERIALS P20600648 AND U20601673
WHEN MODIFIED IN ACCORDANCE WITH SK150-37



BEGINNING WITH AIRCRAFT
SERIAL U20601674

Figure 7-2. Flap Motor and Transmission Assembly (Sheet 2 of 3)





VIEW **A-A**

THIS FLAP ACTUATOR INSTALLATION IS EFFECTIVE THRU AIRCRAFT SERIALS P20600648 AND U20601673 WHEN USED AS A REPLACEMENT SPARE FOR SK150-37 OR PRODUCTION FLAP ACTUATOR INSTALLATIONS PRIOR TO U20601674

Figure 7-2. Flap Motor and Transmission Assembly (Sheet 3 of 3)

d. Remove bolt (10) securing synchronizing push-pull tube (9) to drive pulley (16) in right wing and carefully lower RIGHT flap.

e. Remove bolt securing synchronizing push-pull tube to drive pulley in left wing.

f. Disconnect outboard flap push-pull rods from bellcranks in both wings.

g. Disconnect actuating tube (8) from drive pulley (16).

NOTE

Ensure that the 3/32 inch retract cable is connected to the forward side of the right drive pulley and to the aft side of the left drive pulley and that the 1/8 inch direct cable is connected to the aft side of the right drive pulley and to the forward side of the left drive pulley. Ensure that the right drive pulley rotates clockwise, when viewed from below, as the flaps are extended. (Refer to figure 7-5.)

h. Adjust synchronizing push-pull tube (9) in RIGHT wing to 48.69 inches between centers of rod end holes, tighten jam nuts and connect to bellcrank and drive pulley.

i. THRU AIRCRAFT SERIALS P20600648 AND U20601673 WHEN NOT MODIFIED IN ACCORDANCE WITH SK150-37 AND WHEN NOT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. (Refer to figure 7-2, sheet 1.) Screw actuating tube (8) IN toward transmission (4) by hand to its shortest length (flaps full up position). Loosen setscrew (7) securing actuating tube to nut and ball assembly (6), hold nut and ball assembly so that it will not move and adjust actuating tube IN or OUT as necessary to position the RIGHT drive pulley so that the centerline of bolt hole for the inboard push-pull rod attachment is 4.20 inches aft of fuel well bulkhead (refer to figure 7-5). Tighten setscrew (7) and secure actuating tube to drive pulley with bolt (20).

j. THRU AIRCRAFT SERIALS P20600648 AND U20601673 WHEN MODIFIED IN ACCORDANCE WITH SK150-37 AND WHEN NOT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. Operate flap motor until actuating tube (8) is IN to its shortest length (flaps full up position). Loosen setscrew (7) securing actuating tube to nut and ball assembly (6), hold nut and ball assembly so that it will not move and adjust actuating tube IN or OUT as necessary to position the RIGHT drive pulley so that the centerline of bolt hole for the inboard push-pull rod attachment is 4.20 inches aft of fuel well bulkhead (refer to figure 7-5). Tighten setscrew (7) and secure actuating tube to drive pulley with bolt (20).

k. BEGINNING WITH AIRCRAFT SERIAL U206-01674 AND ALL AIRCRAFT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3. Screw actuating tube (8) IN toward transmission (4) by hand to .12±.05 inches between switch actuating collar (32) and transmission as illustrated in figure 7-2, VIEW A-A. Loosen setscrew (7) securing actuating collar (32). Hold actuating collar to maintain .12±.05" and adjust actuating tube (8) IN or OUT as necessary to align RIGHT drive pulley so that the centerline of bolt hole for inboard push-pull rod is 4.20 inches aft of fuel well bulkhead (refer to figure 7-5). Tighten setscrew (7) in accordance with procedures outlined in the following note and secure actuating tube to drive pulley with bolt (20).

NOTE

Thru Aircraft Serial U20602223: Tighten setscrew (7). Aircraft Serials U20602224 thru U20602376: Apply grade CV sealant to setscrew (7) threads and torque to 45 lb-in. Beginning with Aircraft Serial U20602377: Apply grade CV sealant to setscrew (7) threads and torque to 60 lb-in.

l. Manually holding RIGHT flap full up, adjust push-pull rods to align with drive pulley and bellcrank attachment holes. Connect push-pull rods and tighten locknuts.

NOTE

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

m. Mount an inclinometer on trailing edge of RIGHT flap.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

n. THRU AIRCRAFT SERIALS P20600648 AND U20601673 AND ALL AIRCRAFT NOT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3.

1. With RIGHT flap in full UP position, adjust UP-LIMIT switch (23) to operate and shut-off electrical power to motor at degree of travel specified in figure 1-1.

2. Run RIGHT flap to DOWN position and adjust DOWN-LIMIT switch (22) to operate and shut-off electrical power to motor at degree of travel specified in figure 1-1.

o. BEGINNING WITH AIRCRAFT SERIAL U206-01674 AND ALL AIRCRAFT MODIFIED IN ACCORDANCE WITH FIGURE 7-2, SHEET 3.

1. With RIGHT flap in full UP position, loosen setscrew (29) and slide UP-LIMIT switch (31) adjustment block (30) to operate switch and shut-off electrical power to motor at degree of travel specified in figure 1-1. Tighten setscrew (29).

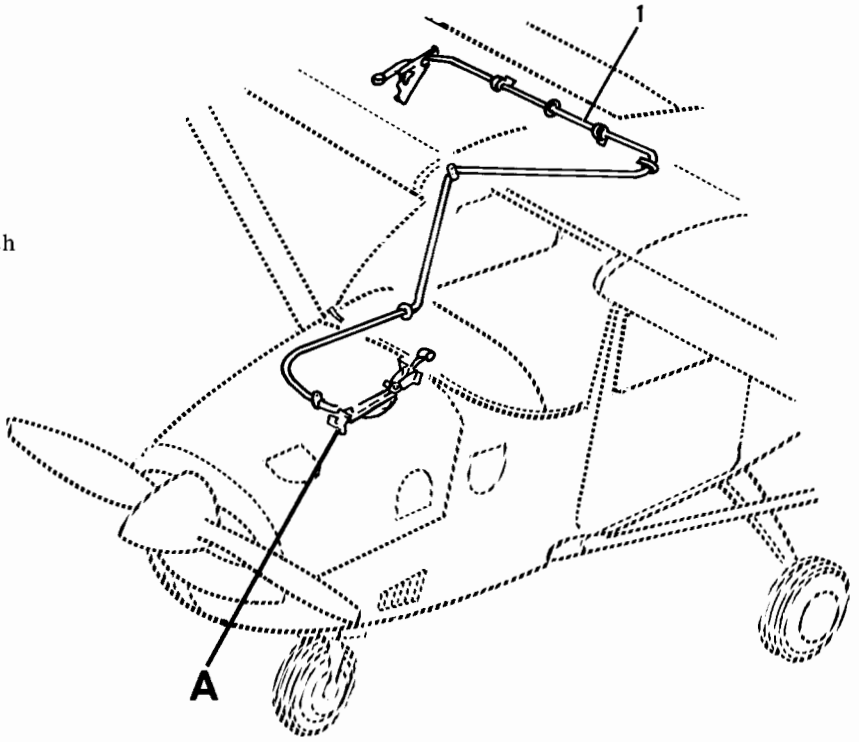
2. Run RIGHT flap to DOWN position and adjust DOWN-LIMIT switch (34) adjustment block (30) to operate switch and shut-off electrical power to motor at degree of travel specified in figure 1-1. Tighten setscrew (29).

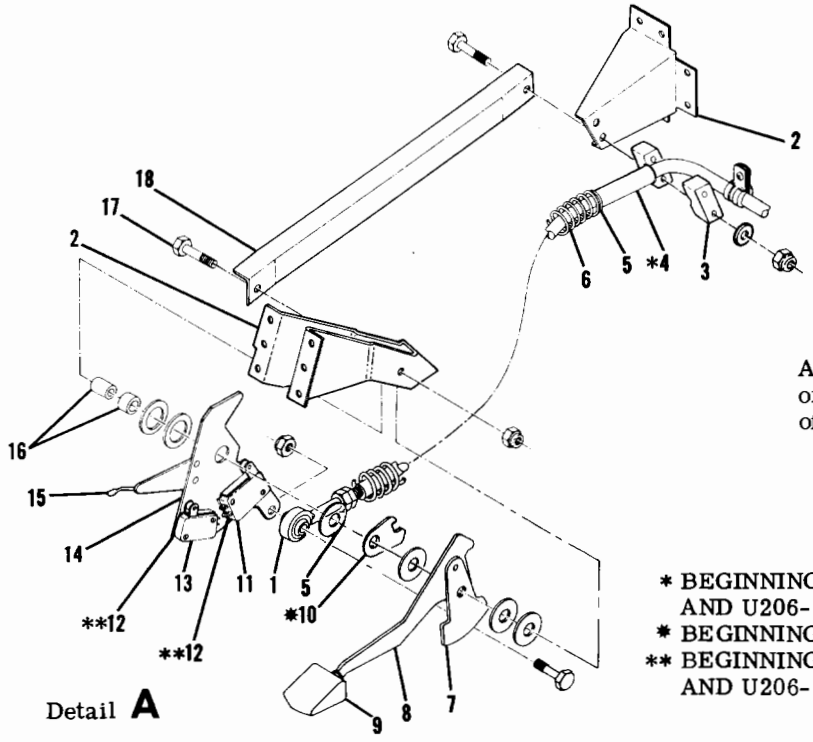
p. Run RIGHT flap to full UP position.

q. Complete step "h" for synchronizing push-pull tube in LEFT wing.

r. Connect control cables at turnbuckles (index 10, figure 7-1). Adjust turnbuckles to position left drive pulley so that the centerline of bolt hole for the in-

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



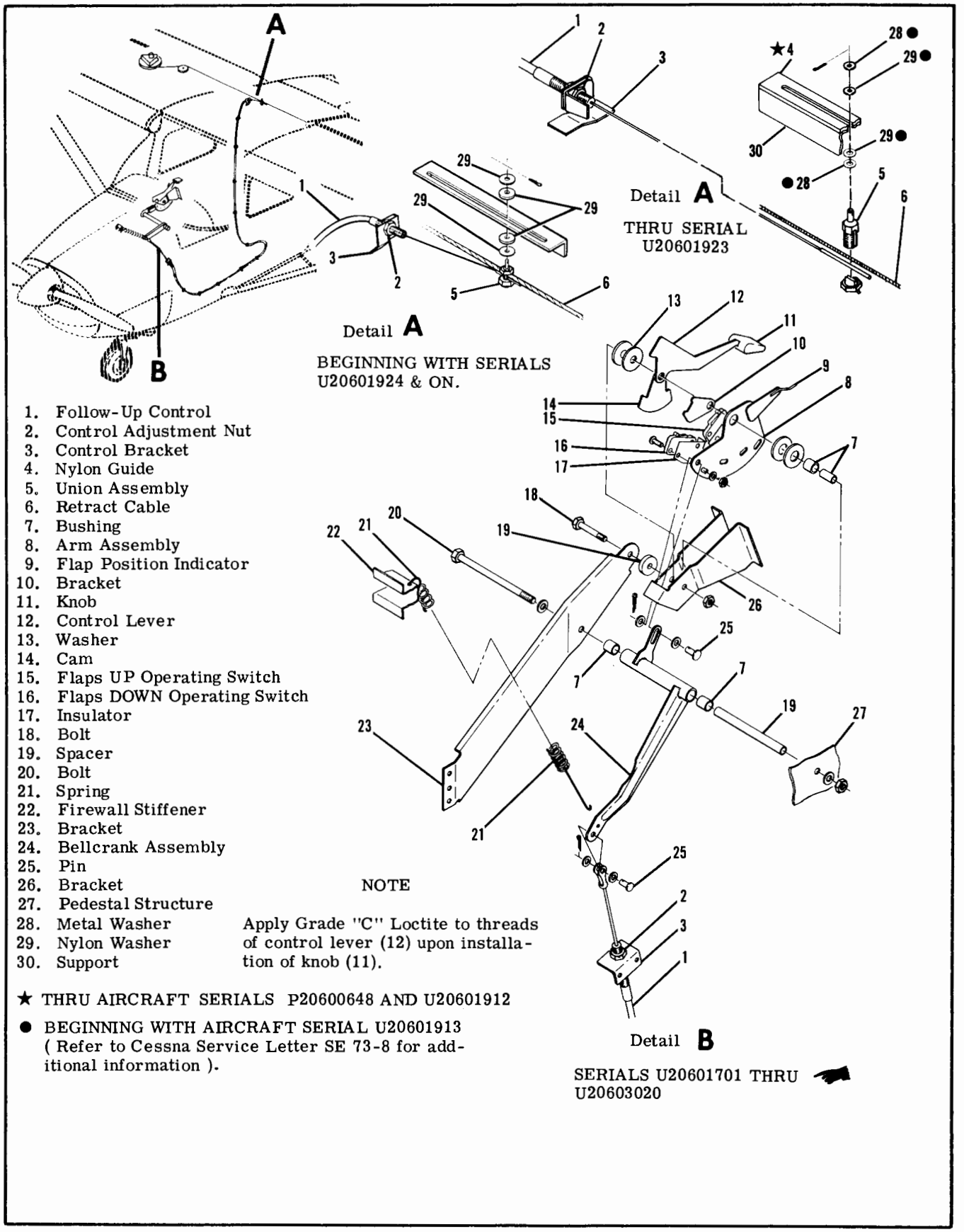


NOTE

Apply Grade "C" Loctite to threads of control lever (8) upon installation of knob (9).

* BEGINNING WITH AIRCRAFT SERIALS P206-0534 AND U206-1237 THRU U20601590
* BEGINNING WITH AIRCRAFT SERIAL U20601633
** BEGINNING WITH AIRCRAFT SERIALS P206-0557 AND U206-1248

Figure 7-3. Flap Control Lever Installation (Sheet 1 of 3)



1. Follow-Up Control
2. Control Adjustment Nut
3. Control Bracket
4. Nylon Guide
5. Union Assembly
6. Retract Cable
7. Bushing
8. Arm Assembly
9. Flap Position Indicator
10. Bracket
11. Knob
12. Control Lever
13. Washer
14. Cam
15. Flaps UP Operating Switch
16. Flaps DOWN Operating Switch
17. Insulator
18. Bolt
19. Spacer
20. Bolt
21. Spring
22. Firewall Stiffener
23. Bracket
24. Bellcrank Assembly
25. Pin
26. Bracket
27. Pedestal Structure
28. Metal Washer
29. Nylon Washer
30. Support

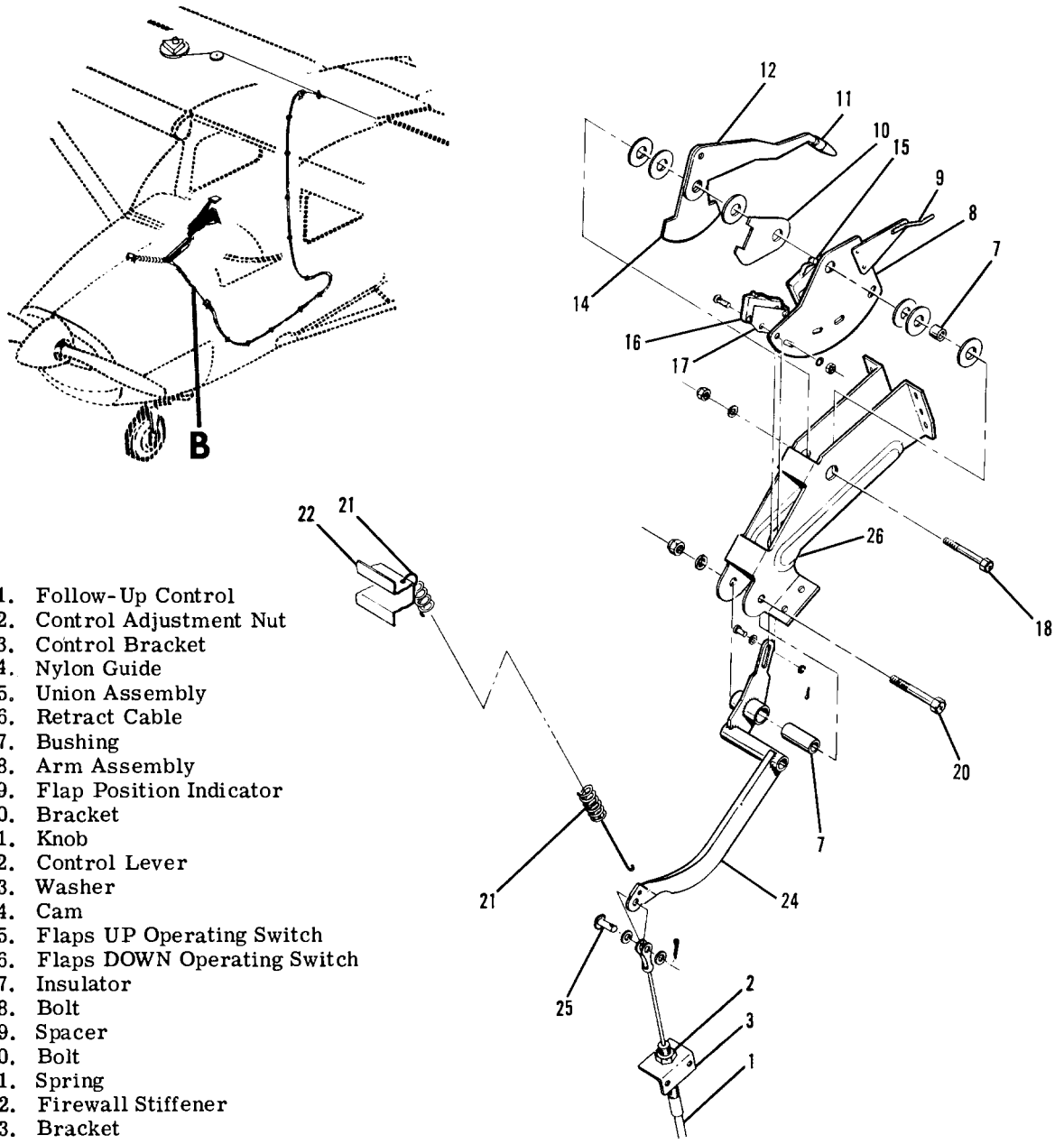
NOTE

Apply Grade "C" Loctite to threads of control lever (12) upon installation of knob (11).

★ THRU AIRCRAFT SERIALS P20600648 AND U20601912

● BEGINNING WITH AIRCRAFT SERIAL U20601913 (Refer to Cessna Service Letter SE 73-8 for additional information).

Figure 7-3. Flap Control Lever Installation (Sheet 2 of 3)

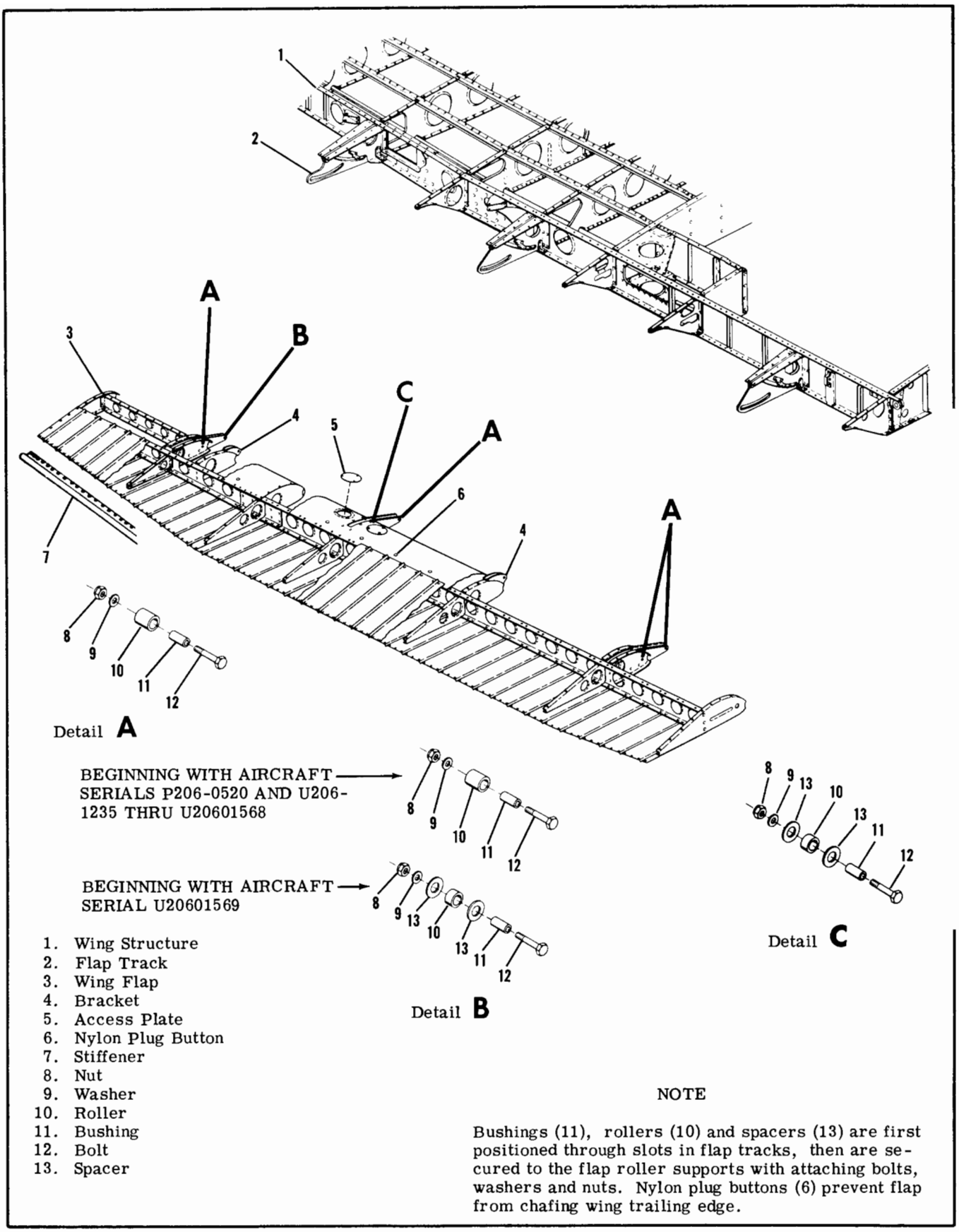


1. Follow-Up Control
2. Control Adjustment Nut
3. Control Bracket
4. Nylon Guide
5. Union Assembly
6. Retract Cable
7. Bushing
8. Arm Assembly
9. Flap Position Indicator
10. Bracket
11. Knob
12. Control Lever
13. Washer
14. Cam
15. Flaps UP Operating Switch
16. Flaps DOWN Operating Switch
17. Insulator
18. Bolt
19. Spacer
20. Bolt
21. Spring
22. Firewall Stiffener
23. Bracket
24. Bellcrank Assembly
25. Pin
26. Bracket
27. Pedestal Structure
28. Metal Washer
29. Nylon Washer
30. Support

Detail **B**

BEGINNING WITH SERIAL
U20603021

Figure 7-3. Flap Control Lever Installation (Sheet 3 of 3)



1. Wing Structure
2. Flap Track
3. Wing Flap
4. Bracket
5. Access Plate
6. Nylon Plug Button
7. Stiffener
8. Nut
9. Washer
10. Roller
11. Bushing
12. Bolt
13. Spacer

NOTE

Bushings (11), rollers (10) and spacers (13) are first positioned through slots in flap tracks, then are secured to the flap roller supports with attaching bolts, washers and nuts. Nylon plug buttons (6) prevent flap from chafing wing trailing edge.

Figure 7-4. Flap Installation

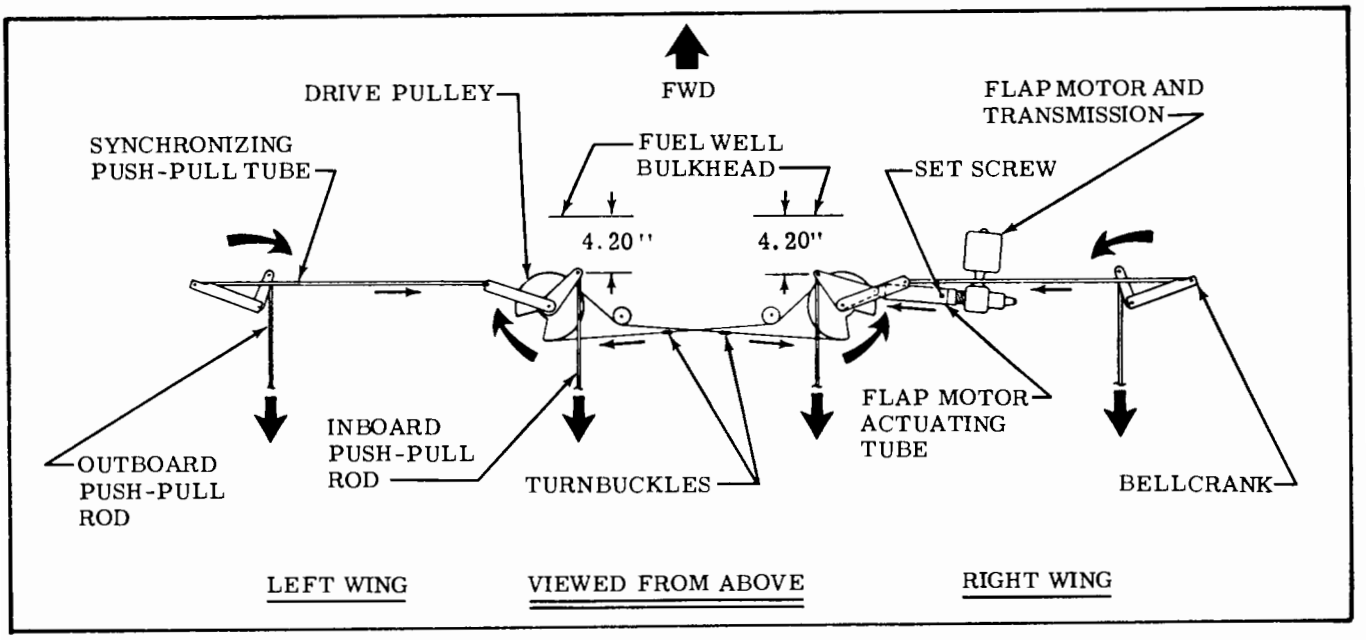


Figure 7-5. Flap System Schematic

board push-pull rod attachment is 4.20 inches aft of fuel well bulkhead, maintaining 70±10 pounds tension. Adjust retract cable first.

NOTE

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

s. Manually holding LEFT flap full UP, adjust push-pull rods to align with drive pulley and bellcrank attachment holes. Connect push-pull rods and tighten locknuts.

t. After completion of steps "a" thru "s", operate flaps and check for positive shut-off of flap motor through several cycles. Check for specified flap travel with inclinometer mounted on each flap separately.

NOTE

Since the flap rollers may not bottom in the flap tracks with flaps fully extended, some free play may be noticed in this position.

7-22. RIGGING-FLAP CONTROL LEVER AND FOLLOW-UP.

a. THRU AIRCRAFT SERIALS P20600648 AND U20601700. (Refer to figure 7-3, sheet 1.)

1. Disconnect follow-up control rod end (1) at switch mounting arm (14).

2. Move control lever (8) to full UP position, then without moving control lever, move switch mounting arm (14) until cam (7) is centered between switches (11 and 13). Adjust follow-up control rod end (1) to align with the attaching hole in the switch mounting arm and secure rod end to mounting arm maintaining this position.

3. Mount an inclinometer on trailing edge of one flap and set to 0°. Turn master switch ON and move control lever to the 10° position. If flap travel is more than 10°, adjust flaps DOWN operating switch (11) away from cam (7) and recycle flaps. If flap travel is less than 10°, adjust flaps DOWN operating switch (11) closer to cam (7) and recycle flaps.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

4. Adjust flaps UP operating switch (13) in slotted holes for .062 inch clearance between switch roller and cam (7) when the flaps 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.

5. Turn master switch ON and run flaps through several cycles, stopping at various mid-range settings and checking that cable tension is within limits. Retract cable tension may increase to 90 pounds when flaps are fully retracted.

6. Check all rod ends and clevis ends for sufficient thread engagement, all jam nuts are tight and reinstall all items removed for access.

7. 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 2, 3 and 4.

b. BEGINNING WITH AIRCRAFT SERIAL U20601701. (Refer to figure 7-3, sheet 2 and 3.)

1. Run flaps to full UP position.
2. Remove upholstery and headliner as necessary for access.
3. Pull all slack from follow-up control cable and with position indicator (9) in the full UP position, secure follow-up cable to retract cable (6) with union assembly (5). Ensure union assembly is at end of support (30).
4. Connect spring (21) to bellcrank (24).
5. Make minor cable length adjustments at brackets (3) by adjusting nuts (2).
6. With control lever (12) in full UP position, adjust switches (15 and 16) in slotted holes until cam (14) is centered between switch rollers. Be sure control lever (12) is in full UP position during this adjustment.
7. Mount an inclinometer on trailing edge of one flap and set to 0°. Turn master switch ON and move control lever to 10° position. If flap travel is more than 10°, adjust flaps DOWN operating switch (16) away from cam (14) and recycle flaps. If flap travel is less than 10°, adjust flaps DOWN operating switch (16) closer to cam (14) and recycle flaps.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

8. Adjust flaps UP operating switch (15) in slotted holes for .062 inch clearance between switch roller and cam (14) when the flaps 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.

9. Turn master switch ON and run flaps through several cycles, stopping at various mid-range settings and checking that cable tension is within limits. Retract cable tension may increase to 90 pounds when flaps are fully retracted.

SHOP NOTES:

SECTION 8

ELEVATOR CONTROL SYSTEM

TABLE OF CONTENTS

8-1. ELEVATOR CONTROL SYSTEM. (THRU U20602579) (Refer to figure 8-1.)

8-2. DESCRIPTION. The elevators are operated by power transmitted through fore-and-aft movement of the pilot or copilot control wheels. The system is comprised of control columns, an elevator torque tube, cables and pulleys. The elevator control cables, at their aft ends, are attached to a bellcrank mounted on a bulkhead in the tailcone. A push-pull tube connects this bellcrank to the elevator arm assembly, installed between the elevators. An elevator trim tab is installed in the trailing edge of the right elevator and is described in Section 9.

8-2A. ELEVATOR CONTROL SYSTEM BEGINNING WITH AIRCRAFT SERIAL U2062580. (Refer to figure 8-1A.)

8-2B. DESCRIPTION. Beginning with aircraft serial U20602580 and on, the single large elevator down spring is replaced by two smaller springs which attach to each side of the elevator bellcrank and anchor to the lower forward face of the tailcone bulkhead. The elevator up and down cables are re-routed from the elevator control arm assembly through the fuselage to the elevator bellcrank in the tailcone. The elevator up cable is routed to the top turnbuckle connected to the elevator bellcrank.

8-3. TROUBLE SHOOTING.

NOTE

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

TROUBLE	PROBABLE CAUSE	REMEDY
NO RESPONSE TO CONTROL WHEEL FORE-AND-AFT MOVEMENT.	Forward or aft end of push-pull tube disconnected.	Check visually. Attach push-pull tube correctly.
	Cables disconnected.	Check visually. Attach cables and rig system in accordance with paragraph 8-14.

8-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
BINDING OR JUMPY MOTION FELT IN MOVEMENT OF ELEVATOR SYSTEM.	Defective bellcrank or arm assembly pivot bearings or push-pull tube attach bearings.	Move bellcrank or arm to check for play or binding. Disconnect push-pull tube and check that bearings rotate freely. Replace defective parts.
	Cables slack.	Check and adjust to tension specified in figure 8-1.
	Cables not riding correctly on pulleys.	Check visually. Route cables correctly over pulleys.
	Nylon grommet on instrument panel binding.	Replace grommet.
	Defective control column bearing rollers.	Check visually. Replace defective rollers.
	Defective control column torque tube bearings.	Disconnect necessary items and check that bearings rotate freely. Replace defective bearings.
	Control guide on aft end of control square tube adjusted too tightly.	Loosen screw and tapered plug in end of control tube enough to eliminate binding.
	Defective elevator hinges.	Disconnect push-pull tube and move elevators by hand. Replace defective hinges.
	Defective pulleys or cable guards.	Check visually. Replace defective parts and install guards properly.
ELEVATORS FAIL TO ATTAIN PRESCRIBED TRAVEL.	Stops incorrectly set.	Rig in accordance with paragraph 8-14.
	Cables tightened unevenly.	Rig in accordance with paragraph 8-14.
	Interference at instrument panel.	Rig in accordance with paragraph 8-14.

8-4. CONTROL COLUMN. (Refer to figure 6-2.) Section 6 outlines removal, installation and repair of control column.

8-5. ELEVATORS. (Refer to figure 8-2.)

8-6. REMOVAL AND INSTALLATION.

a. Remove stinger.

b. Disconnect trim tab push-pull tube at tab actuator. (Refer to Section 9.)

NOTE

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

c. Remove bolts (13) securing elevator torque tubes (7) to arm assembly (8).

d. Remove bolts (6) from elevator hinges (5).

e. Using care, remove elevator.

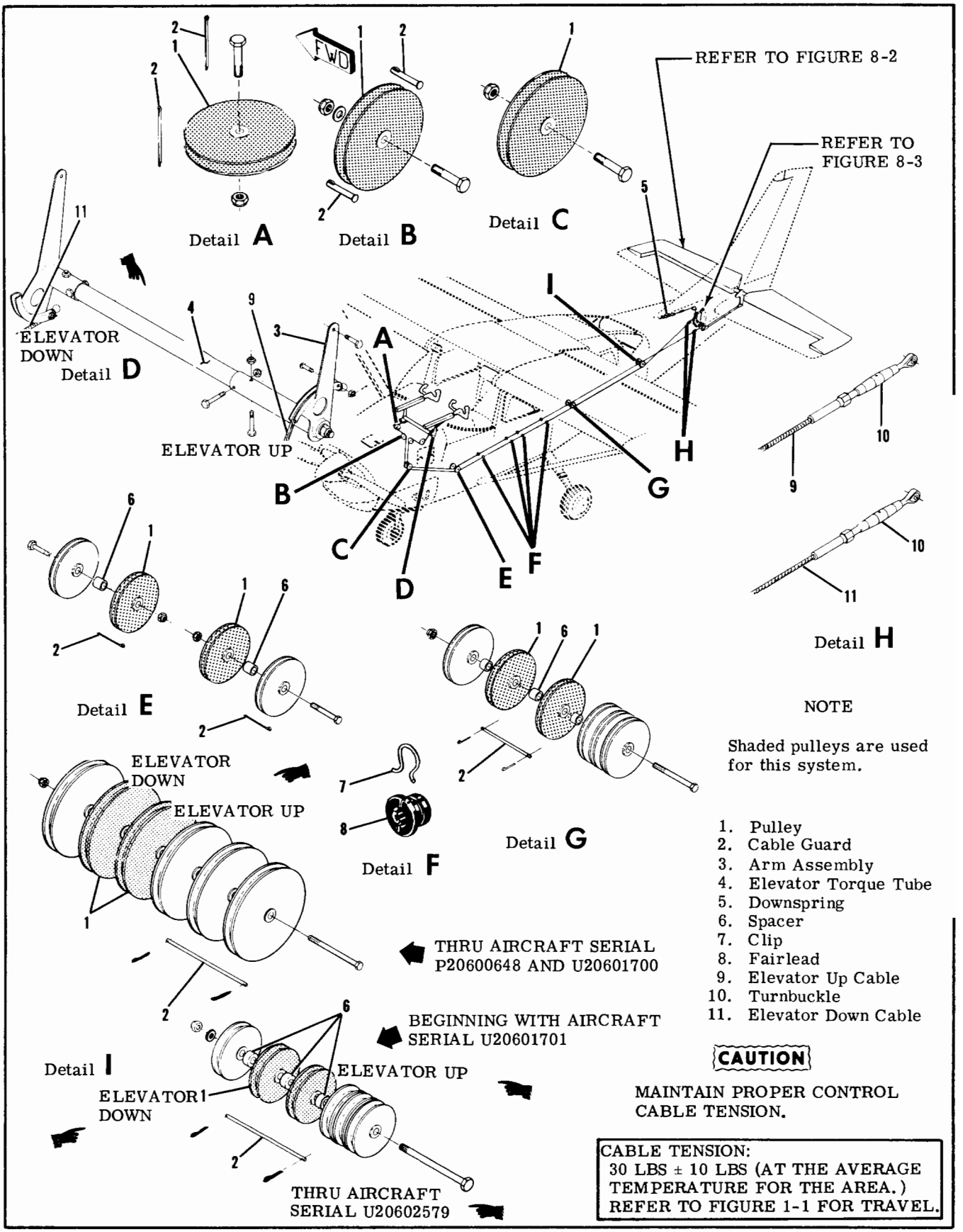


Figure 8-1. Elevator Control System

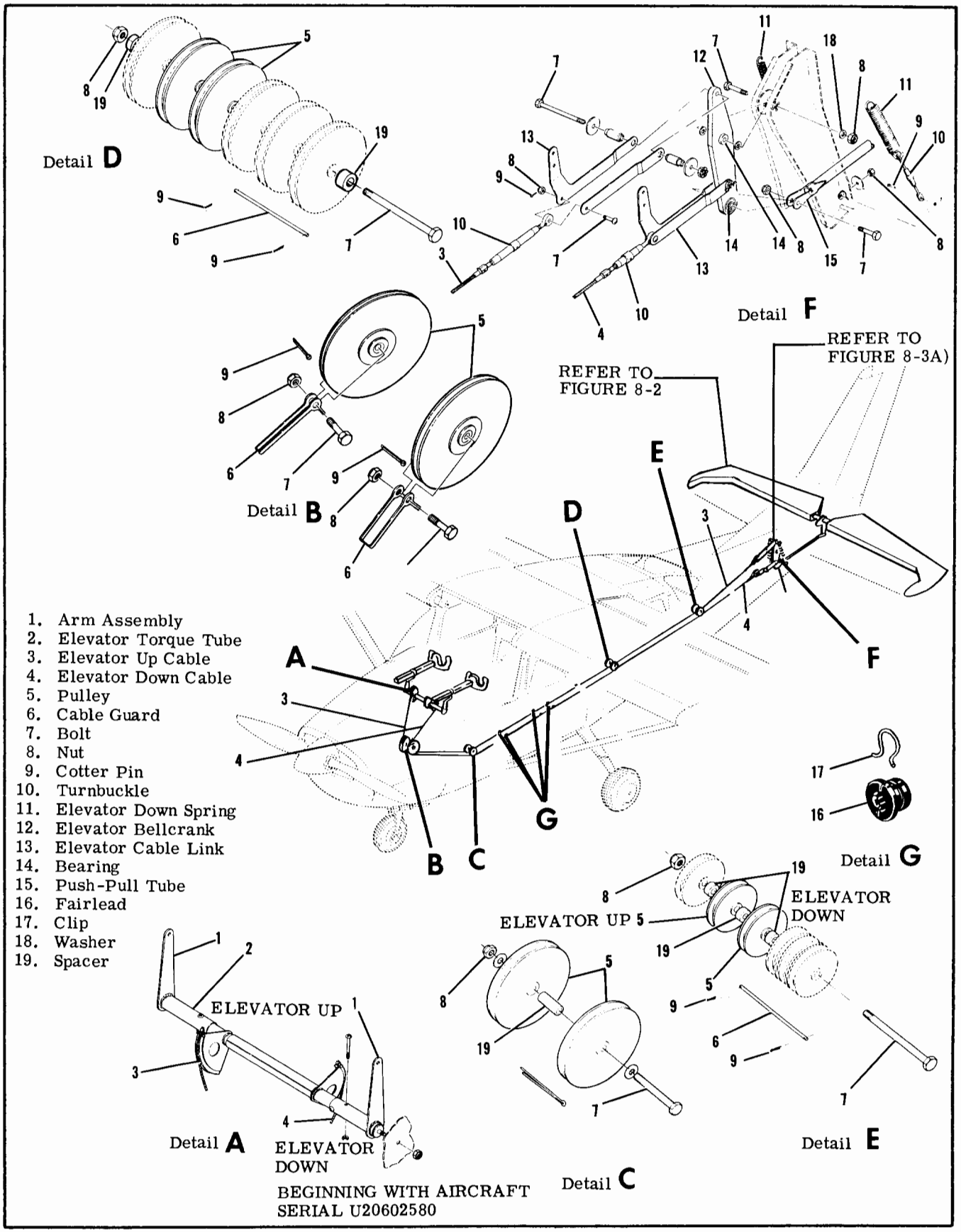
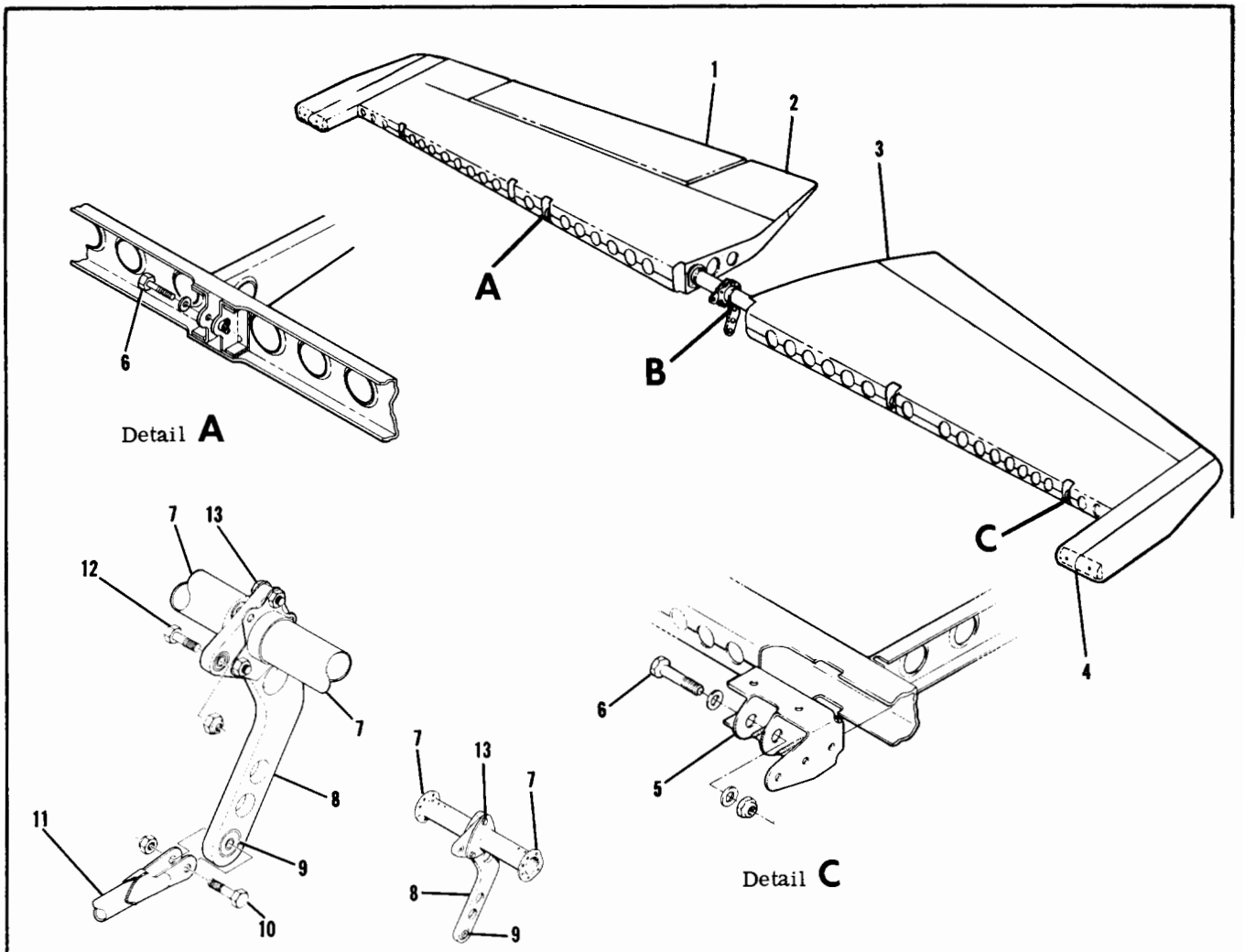


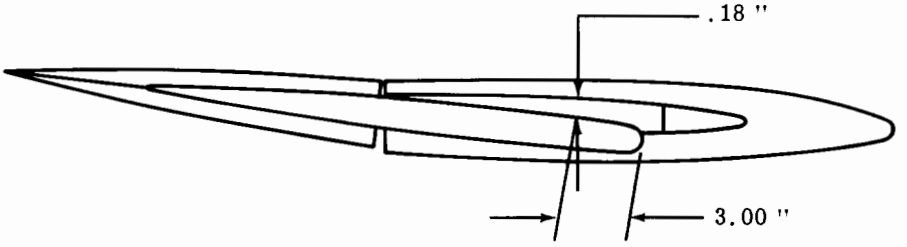
Figure 8-1A. Elevator Control System



THRU AIRCRAFT SERIALS P20600648 AND U20601874

BEGINNING WITH AIRCRAFT SERIAL U20601875

Detail B



THIS VIEW APPLIES TO THE RIGHT HAND ELEVATOR WHEN THE LEFT HAND ELEVATOR IS STREAMLINED

1. Trim Tab
2. Right Elevator
3. Left Elevator
4. Balance Weight
5. Hinge Assembly
6. Bolt
7. Torque Tube
8. Arm Assembly
9. Needle Bearing
10. Bolt
11. Push-Pull Tube
12. Pivot Bolt
13. Bolt

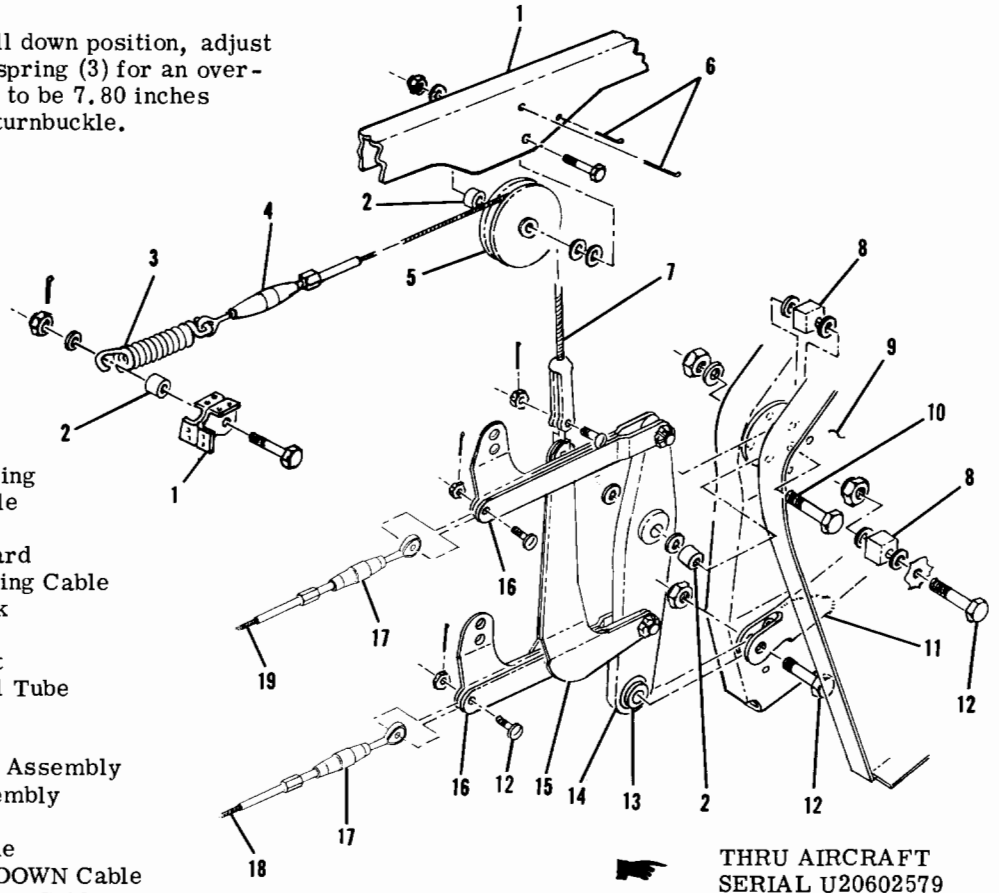
NOTE

Do not attempt to align the elevator trailing edges as there is a 0° 54' twist designed into the connecting torque tube. This twist causes the right elevator to be higher than the left.

Figure 8-2. Elevator Installation

With elevators in the full down position, adjust turnbuckle (4) and downspring (3) for an overall length of downspring to be 7.80 inches (71±3 lbs); safety wire turnbuckle.

1. Bracket
2. Spacer
3. Down-Spring
4. Turnbuckle
5. Pulley
6. Cable Guard
7. Down-Spring Cable
8. Stop Block
9. Bracket
10. Pivot Bolt
11. Push-Pull Tube
12. Bolt
13. Bearing
14. Bellcrank Assembly
15. Link Assembly
16. Link
17. Turnbuckle
18. Elevator DOWN Cable
19. Elevator UP Cable



With elevators in the full down position, adjust turnbuckle (4) and downspring (3) to a length of 10.45 inches at 36±1 lbs spring tension(measured from centerline of turnbuckle fork to outside of spring loop); safety wire turnbuckle.

BEGINNING WITH
AIRCRAFT SERIAL
U20602580

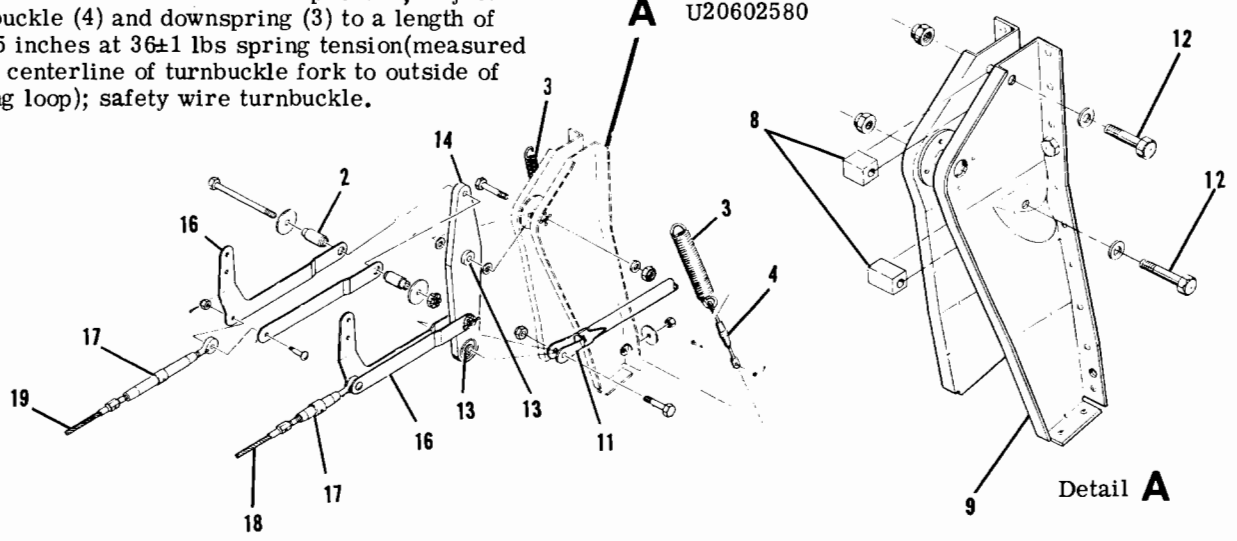


Figure 8-3. Elevator Bellcrank Installation

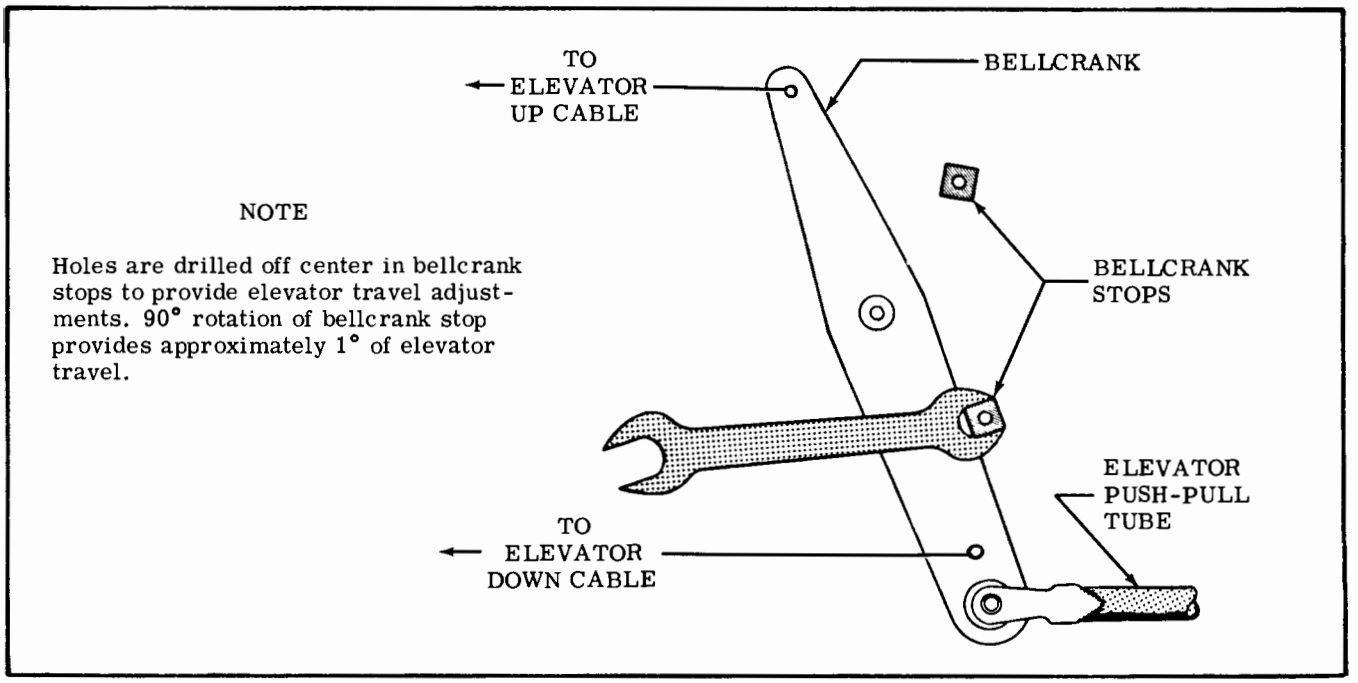


Figure 8-4. Elevator Bellcrank Travel Stop Adjustment

f. To remove left elevator use same procedure, omitting step "b."
g. Reverse the preceding steps for reinstallation.

8-7. REPAIR. Repair may be accomplished as outlined in Section 18. Hinge bearings may be replaced as necessary. If repair has affected static balance, check and rebalance as required.

8-8. BELLCRANK. (Refer to figure 8-3.)

8-9. REMOVAL AND INSTALLATION.
a. Remove access plate below bellcrank on tailcone.

CAUTION

Position a support stand under tail tie-down ring to prevent the tailcone from dropping while working inside.

b. Remove safety wire, relieve cable tension at turnbuckles (17) and disconnect turnbuckle eyes at bellcrank links (16).
c. Remove safety wire, relieve cable tension at turnbuckle (4) and disconnect cable (7) at link assembly (15).
d. Remove bolt (12) securing push-pull tube (11) to bellcrank (14).
e. Remove pivot bolt (10) attaching bellcrank (14) to brackets (9) and remove bellcrank.
f. Reverse the preceding steps for reinstallation. Rig system in accordance wtih paragraph 8-14, safety turnbuckles and reinstall all items removed for access.

8-10. ARM ASSEMBLY. (Refer to figure 8-2.)

8-11. REMOVAL AND INSTALLATION.
a. Remove stinger.
b. Remove bolt (10) securing push-pull tube (11) to arm assembly (8).
c. Remove bolts (13) attaching elevator torque tubes (7) to arm assembly (8).
d. Remove pivot bolt (12) securing arm assembly (8) and slide assembly from between elevator torque tubes.
e. Reverse the preceding steps for reinstallation and reinstall all items removed for access.

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

8-13. REMOVAL AND INSTALLATION.

CAUTION

Position a support stand under tail tie-down ring to prevent the tailcone from dropping while working inside.

a. Remove seats, upholstery and access plates as necessary.
b. Remove safety wire and relieve cable tension at turnbuckles (10).
c. Disconnect cables at control column arm assemblies (3).
d. Disconnect cables at bellcrank links (index 16, figure 8-3).

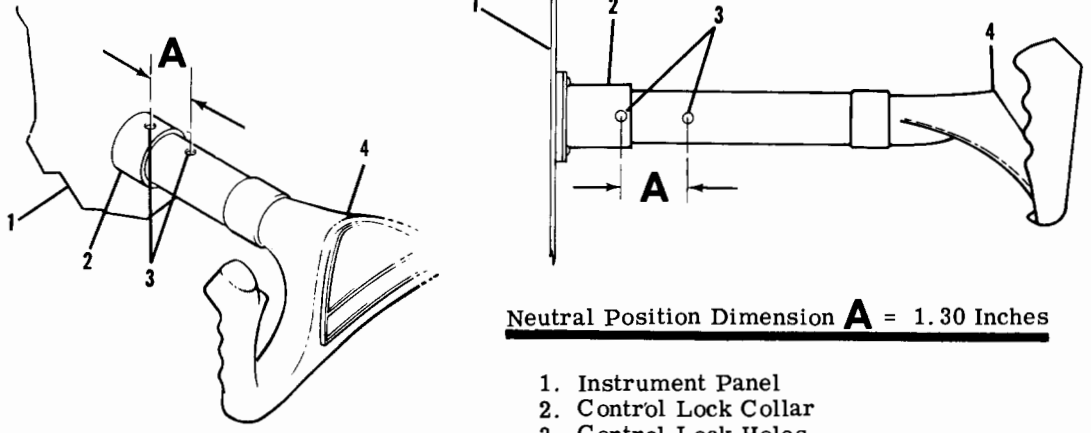


Figure 8-5. Control Column Neutral Rigging Position.

e. Remove fairleads, cable guards and pulleys as necessary to work cables free of aircraft.

NOTE

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

f. Reverse the preceding steps for reinstallation.

g. After cables are routed in position, install pulleys and cable guards. Ensure cables are positioned in pulley grooves before installing guards.

h. Re-rig system in accordance with paragraph 8-14, safety turnbuckles and reinstall all items removed in step "a."

8-14. RIGGING. (Thru U20602579) (Refer to figure 8-3.)

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

a. Lock control column in neutral position. (Refer to figure 8-5)

b. Adjust turnbuckles (17) equally to streamline LEFT elevator with horizontal stabilizer and to obtain 30±10 lbs cable tension. (RIGHT elevator will be higher than the left elevator) as illustrated in figure 8.) Safety turnbuckles.

NOTE

Disregard counterweight areas of elevators when streamlining. These areas are contoured to be streamlined at cruising speed (elevators approximately 3° down).

c. With elevators in the full down position, adjust turnbuckle (4) and downspring (3) for an overall length of downspring to be 7.80 inches (71±3 lbs); safety wire turnbuckle (4).

d. Install bellcrank assembly, connect downspring and cable assembly.

e. With LEFT elevator streamlined, mount an inclinometer on elevator 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.)

f. Adjust bellcrank travel stop blocks (8) to obtain degree of elevator travel as specified in figure 1-1.

NOTE

Bellcrank stop blocks (8) are four-sided bushings, drilled off-center so they may be rotated to any one of four positions to attain correct elevator travel. Each 90-degree rotation of the stop changes the elevator travel approximately one degree.

g. Move control wheel through full range of travel and check cable tension in various positions. Tension should not be less than 20 pounds or more than 40 pounds in any position.

h. Check to see that all turnbuckles are safetied and all parts are secured, then reinstall all parts removed for access.

WARNING

Be sure elevators move in the correct direction when operated by the control wheels.

8-14A. RIGGING. (Beginning with U20602580).

CAUTION

Position a support stand under tail tie-down ring to prevent the tailcone from dropping while working inside.

a. Place contour block on left hand elevator and lock control column in neutral position. (Refer to figure 8-5.)
b. With elevators in the full down position, adjust turnbuckles (4) and downspring (3) to a length of 10.45 inches at 36±1 lbs spring tension (measured from centerline of turnbuckle fork to outside of spring loop; safety wire turnbuckles (4).
c. Install turnbuckles (4) and downsprings (3) to elevator bellcrank and elevator control cables.
d. With left elevator in streamlined position, mount an inclinometer on elevator 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. Adjust bellcrank travel stop blocks (16) to obtain of elevator travel as specified in figure 1-1.)
f. Move control wheel through full range of travel and check cable tension in various positions. Tension should not be less than 20 pounds or more than 40 pounds in any position.
g. Ensure that all turnbuckles are safetied and all parts secured, then re-install all parts removed for access.

WARNING

Be sure elevators move in the correct direction when operated by the control wheels.

SHOP NOTES:

SECTION 9

ELEVATOR TRIM TAB CONTROL SYSTEM

TABLE OF CONTENTS

9-1. ELEVATOR TRIM TAB CONTROL SYSTEM. (Refer to figure 9-1.)

9-2. DESCRIPTION. The elevator trim tab, located on the trailing edge of the right elevator, is controlled by a trim wheel mounted in the pedestal. Power to operate the tab is transmitted from the trim control wheel by means of roller chains, cables, an actuator and a push-pull tube. A mechanical pointer, adjacent to the trim wheel indicates nose attitude of the aircraft. Forward rotation of the wheel trims the nose down and aft rotation of the wheel trims the nose up. An electric trim assist may be installed and is described in paragraph 9-16. When de-energized the electric trim assist has no effect on manual operation.

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.	Check cable tension and adjust.
	Pulleys binding or rubbing.	Check pulleys visually. Repair or replace as necessary.
	Cables not in place on pulleys.	Check visually. Install cables correctly.
	Trim tab hinge binding.	Disconnect actuator and move tab up and down to check hinge resistance. Lubricate or replace hinge as necessary.
	Defective trim tab actuator.	Remove chain from actuator sprocket and operate actuator manually. Replace defective actuator.
	Rusty chain.	Check visually. Replace rusty chain.

9-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE (CONT).	Damaged sprocket.	Check visually. Replace damaged sprockets.
	Bent sprocket shaft.	Observe motion of sprockets. Replace defective shafts.
LOST MOTION BETWEEN CONTROL WHEEL AND TRIM TAB.	Cable tension too low.	Check cable tension and adjust.
	Broken pulley.	Check visually. Replace defective pulley.
	Cables not in place on pulleys.	Check visually. Install cables correctly.
	Worn trim tab actuator.	Disconnect trim tab and check for play in actuator. Replace defective actuator.
	Actuator attachment loose.	Check actuator for security and tighten.
TRIM INDICATION INCORRECT.	Indicator incorrectly engaged on wheel track.	Check visually. Reset indicator.
INCORRECT TRIM TAB TRAVEL.	Stop blocks loose or incorrectly adjusted.	Adjust stop blocks on cables. Refer to figure 9-4.
	Incorrect rigging.	Refer to paragraph 9-14.

9-4. TRIM TAB. (Refer to figure 9-2.)

9-5. REMOVAL AND INSTALLATION.

a. Disconnect push-pull tube (9) from horn assembly (6).

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 screw (11) securing hinge pin (10), pull pin until free of tab and remove tab.

NOTE

It is not necessary to completely remove hinge pin.

c. Reverse the preceding steps for reinstallation. Rig system, if necessary, in accordance with paragraph 9-14.

9-6. TRIM TAB ACTUATOR. (Refer to figure 9-1.)

9-7. REMOVAL AND INSTALLATION.

a. Relieve cable tension at turnbuckle (11).

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

b. Disconnect push-pull tube (15) at actuator (19).

c. Remove access plate beneath actuator.

d. Remove chain guard (21) and disengage roller chain (23) from actuator sprocket (20).

e. Remove screws attaching clamps (22) to bracket (18) and remove actuator (19) through access opening.

f. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 9-14, safety turnbuckle and reinstall all items removed for access.

9-7A. DISASSEMBLY. (Refer to figure 9-2A.)

a. Remove actuator in accordance with paragraph 9-7.

b. Disassemble actuator assembly (1) as illustrated in Detail A as follows:

1. Remove chain guard (3) if not previously removed in step "e" of paragraph 9-7.
2. Using suitable punch and hammer, remove roll pins (8) securing sprocket (5) to screw (9) and remove sprocket from screw.
3. Unscrew threaded rod end (15) and remove rod end from actuator.
4. Remove roll pins (10) securing bearings (6 and 14) at the housing ends.
5. Lightly tap screw (9) toward the sprocket end of housing, remove bearing (6) and collar (7).
6. Lightly tap screw (9) in the opposite direction from sprocket end, remove bearing (14), O-ring (13) and collar (7).
7. It is not necessary to remove retaining rings (11).

9-7B. CLEANING, INSPECTION AND REPAIR. (Refer to figure 9-2A.)

a. DO NOT remove bearing (16) from threaded rod end (15) unless replacement of bearing is necessary.

b. Clean all component parts, except bearing (16), by washing Stoddard solvent or equivalent. Do not clean sealed bearing (16).

c. Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.

d. Check bearings (6 and 14), screw (9) and threaded rod end (15) for excessive wear and scoring. Dimensions of the parts are as follows:

BEARING (6)	
INSIDE DIAMETER	0.370" MIN.
INSIDE DIAMETER	0.373" MAX.
BEARING (14)	
INSIDE DIAMETER	
SMALL HOLE	0.248" MIN.
SMALL HOLE	0.253" MAX.
LARGE HOLE	0.373" MIN.
LARGE HOLE	0.380" MAX.
THREADED ROD END (15)	
OUTSIDE DIAMETER (SHANK)	0.242" MIN.
	0.246" MAX.
SCREW (9)	
OUTSIDE DIAMETER	0.367" MIN.
	0.370" MAX.

NOTE

Relative linear movement between internal threaded screw (9) and bearing (14) should be 0.004 to 0.010 inch at room temperature.

e. Examine threaded rod end (15) and screw (9) for damaged threads or dirt particles that may impair smooth operation.

f. Check sprocket (5) for broken, chipped and/or worn teeth.

g. Check bearing (16) for smoothness of operation.

h. DO NOT attempt to repair damaged or worn parts of the actuator assembly. Discard all defective items and install new parts during reassembly.

9-7C. REASSEMBLY. (Refer to figure 9-2A.)

a. Always discard the following items and install new parts during reassembly.

1. Bearings (6 and 14)
2. Roll pins (8 and 10)
3. O-Ring (13)
4. Nuts (2).

b. During reassembly, lubricate collars (7), screw (9) and threaded rod end (15) in accordance with Section 2.

c. Press sprocket (5) into the end of screw (9), align roll pin holes and install new roll pins (8).

d. Slip bearing (6) and collar (7) on screw (9) and slide them down against sprocket (5).

e. Insert screw (9), with assembled parts, into housing (12) until bearing (6) is flush with the end of housing.

NOTE

When inserting screw (9) into housing (12), locate the sprocket (5) at the end of housing which is farther away from the groove for retaining ring (11).

● The bearings (6 and 14) are not pre-drilled and must be drilled on assembly. The roll pins (10) are 1/16 inch in diameter, therefore, requiring a 1/16 (0.0625) inch drill.

f. With bearing (6) flush with end of housing (12), carefully drill bearing so the drill will emerge from the hole on the opposite side of housing (12). DO NOT ENLARGE HOLES IN HOUSING.

g. Press new roll pins (10) into pin holes.

h. Insert collar (7), new O-ring (13) and bearing (14) into opposite end of housing (12).

i. Complete steps "f" and "g" for bearing (14).

j. If a new bearing (16) is required, a new bearing may be pressed into the boss. Be sure force bears against the outer race of bearing.

k. Screw the threaded rod end (15) into screw (9).

l. Install retaining rings (11), if they were removed.

m. Test actuator assembly by rotating sprocket (5) with fingers while holding threaded rod end (15). The threaded rod end should travel in and out smoothly, with no indication of binding.

n. Reinstall actuator assembly in accordance with paragraph 9-7.

9-7D. TRIM TAB FREE-PLAY INSPECTION.

a. Place elevators 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 .166",(total motion up and down) measured at the trim tab trailing edge is permissible

d. If the trim tab free-play is less than .166", the system is within prescribed limits.

e. If the trim tab free-play is more than .166", check the following items for looseness while moving the trim tab up and down.

1. Check push-pull tube to trim tab horn assembly attachment for looseness.

2. Check push-pull tube to actuator assembly threaded rod end attachment for looseness.

3. Check actuator assembly threaded rod end for looseness in the actuator assembly with push-pull tube disconnected.

f. If looseness is apparent while checking steps e-1 and e-2, repair by installing new parts.

g. If looseness is apparent while checking step e-3, refer to paragraphs 9-6 through 9-7C. Recheck trim tab free-play.

SHOP NOTES:

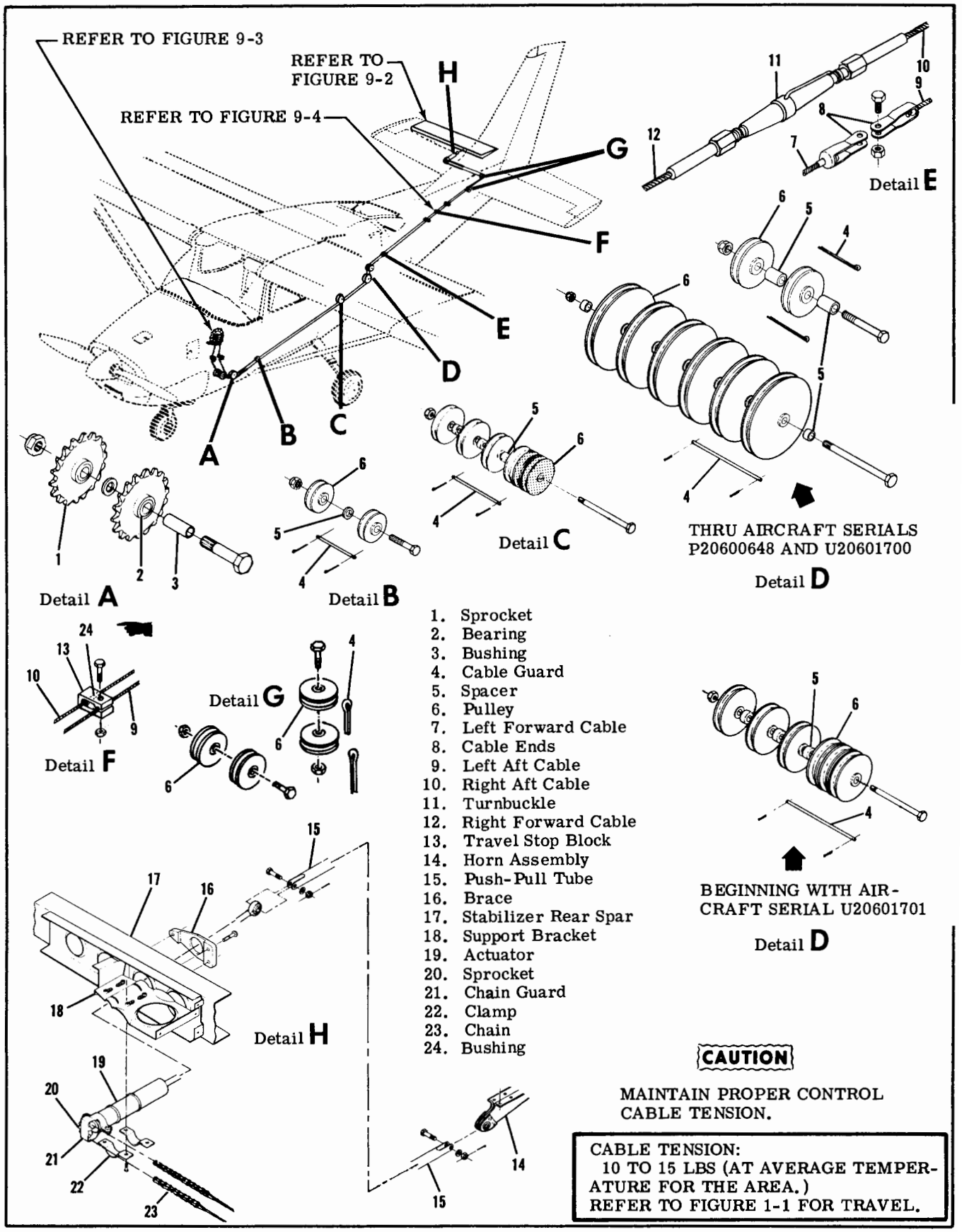


Figure 9-1. Elevator Trim Tab Control System

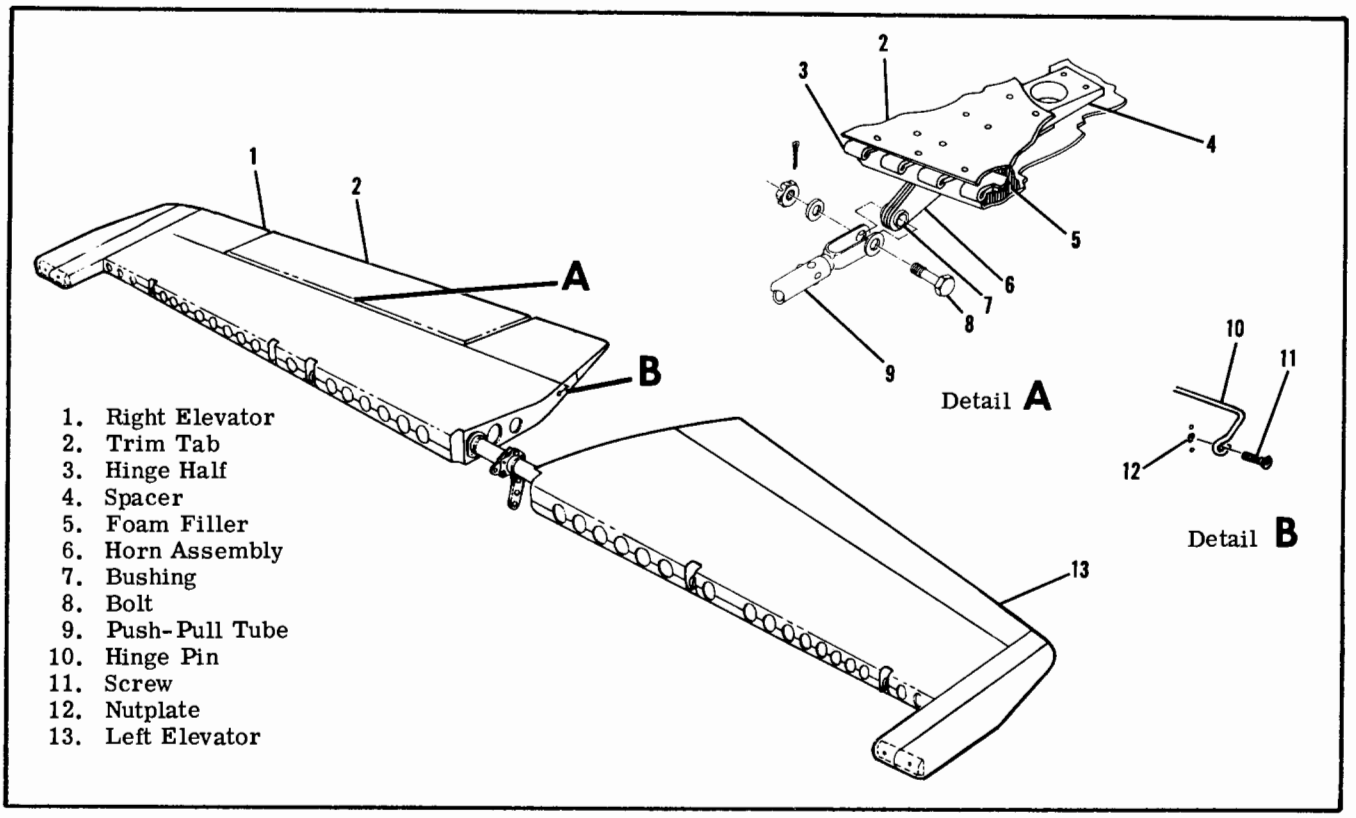


Figure 9-2. Elevator Trim Tab Installation

9-8. TRIM TAB CONTROL WHEEL. (Refer to figure 9-3.)

9-9. REMOVAL AND INSTALLATION.

a. Remove pedestal cover as outlined in paragraph 9-13.

b. Remove screws (8) and nuts (6) securing chain guard (7) to pedestal structure (9).

c. Remove nut (4) securing indicator (2) to pivot stud (1). Retain washers (3) for reinstallation.

d. Loosen bolts (12) securing idler sprockets (11) to pedestal structure (9), slide idler sprockets in slotted holes and disengage chain (13) from sprockets.

e. Remove bolts (12) and remove chain guard (7) using care not to bend indicator (2) or drop parts into tunnel area.

f. Remove roller chain (13) from trim wheel sprocket and carefully slide wheel (5) from pivot stud (20).

g. Reverse the preceding steps for reinstallation. Remove roller chain (13) slack by adjusting idler sprockets (11) in slotted holes and reinstall all items removed for access.

9-10. CABLES AND PULLEYS.

9-11. REMOVAL AND INSTALLATION.

a. FORWARD CABLE. (WITHOUT ELECTRIC TRIM.) (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 turnbuckle (11).

3. Disconnect cable ends (8).

4. (Refer to figure 9-3.) Remove pedestal cover as outlined in paragraph 9-13.

5. Remove lower pedestal panel (19) and disengage roller chain (15) from drive sprocket assembly (16).

6. 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 aircraft. Leave wire in place, routed through structure; then attach the cable being installed and pull cable into position.

7. Reverse the preceding steps for reinstallation.

8. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley grooves before installing guards. Ensure roller chain (15) is positioned correctly over drive sprocket (16).

9. Re-rig system in accordance with paragraph 9-14, safety turnbuckle (index 11, figure 9-1) and reinstall all items removed for access.

b. FORWARD CABLE. (WITH ELECTRIC TRIM.) (THRU AIRCRAFT SERIALS P20600648 AND U206-01700.) (Refer to figure 9-5.)

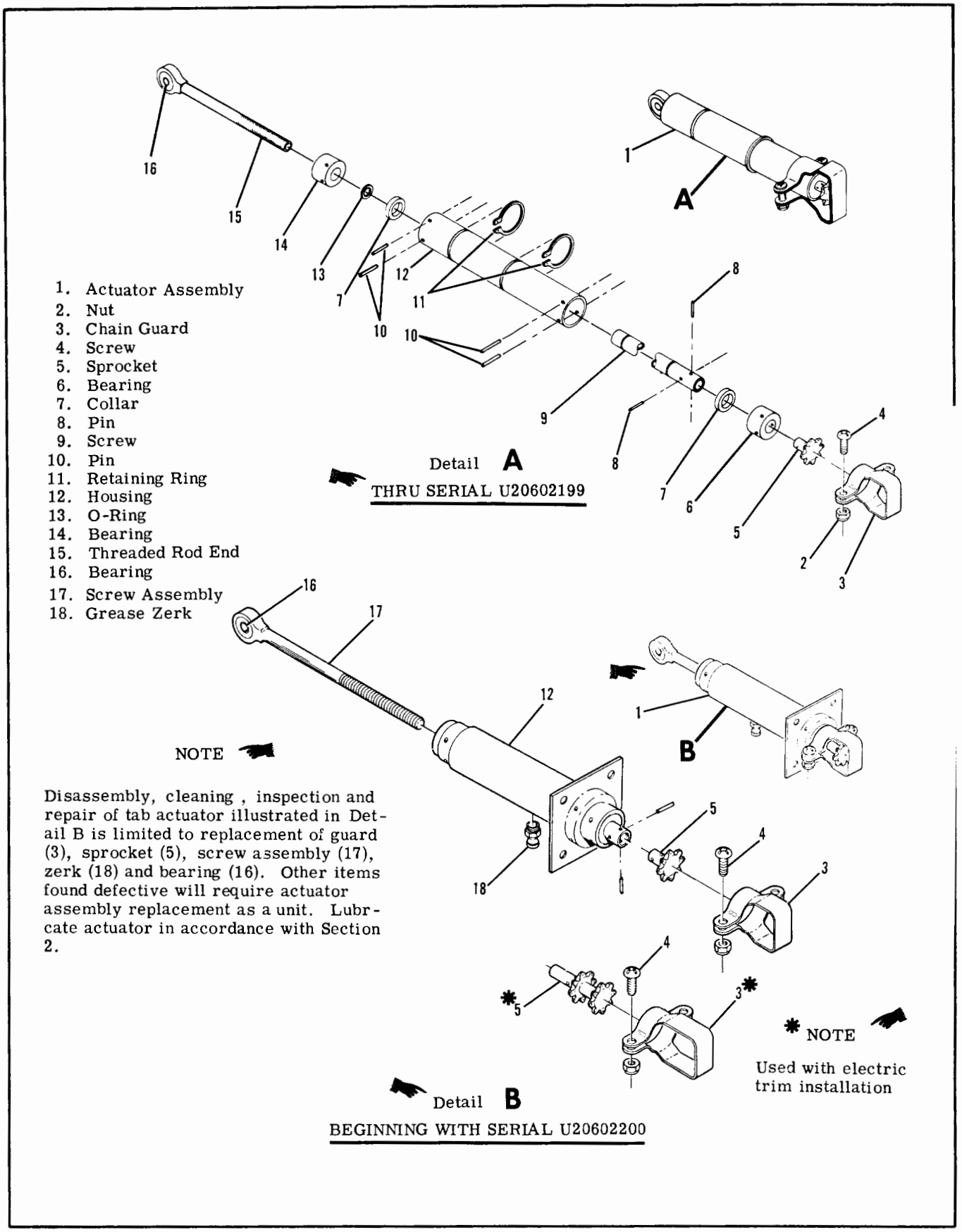
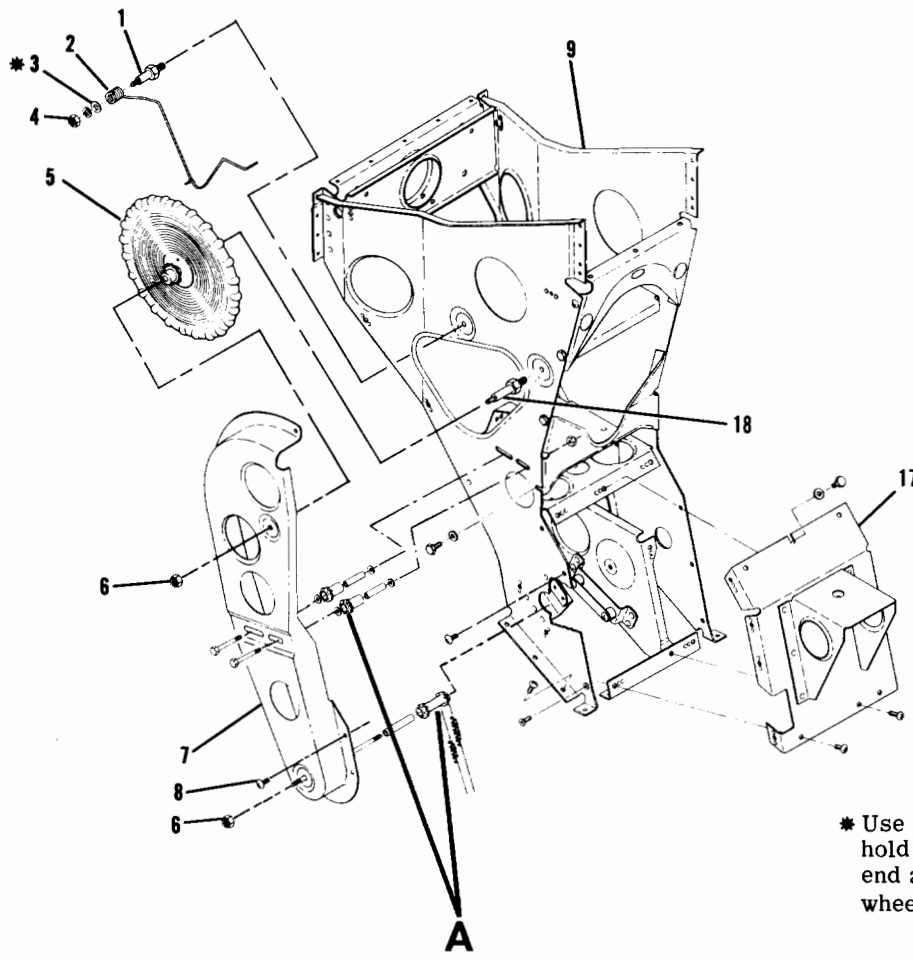
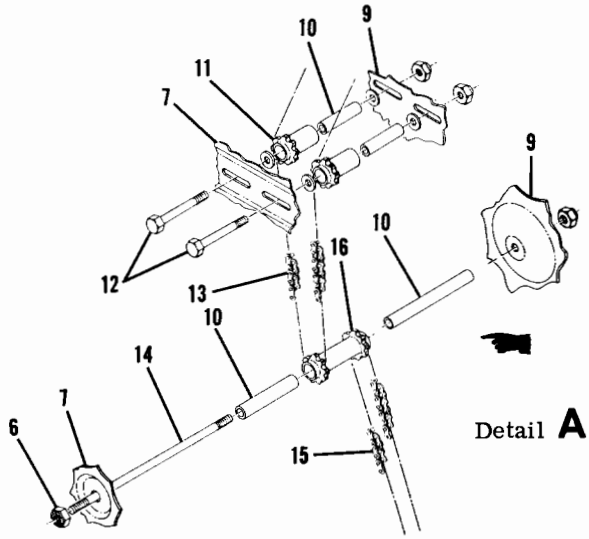


Figure 9-2A. Elevator Trim Tab Actuator Assembly



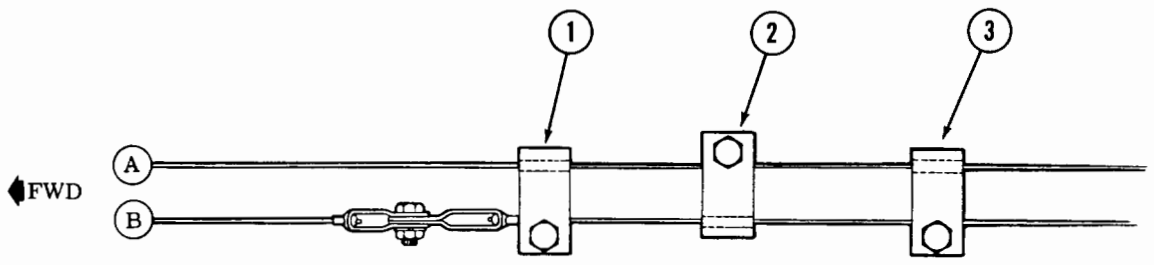
* Use as required to hold indicator pivot end away from trim wheel (5).



Detail **A**

1. Pivot Stud
2. Position Indicator
3. Washer
4. Nut
5. Trim Wheel
6. Nut
7. Chain Guard
8. Screw
9. Pedestal Structure
10. Bushing
11. Idler Sprocket
12. Bolt
13. Roller Chain
14. Bolt
15. Roller Chain
16. Drive Sprocket
17. Lower Pedestal Panel
18. Pivot Stud

Figure 9-3. Elevator Trim Wheel Installation



1. With elevators in neutral, set trim tab to neutral (streamlined).
2. Position stop block (1) against clevis on cable B and secure to cable B.
3. Place inclinometer on trim tab and lower tab to degree specified in figure 1-1.
4. Position stop block (2) against stop block (1) and secure to cable A.
5. Raise trim tab to specified degree, place stop block (3) against stop block (2) and secure to cable B.

Figure 9-4. Elevator Trim Tab Travel Stop Adjustment

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 turnbuckle (6).
3. Disconnect cable ends (9) shown in Detail B forward of the electric trim installation.
4. Complete steps 4 thru 9 of subparagraph "a."

c. FORWARD CABLE. (WITH ELECTRIC TRIM.) (BEGINNING WITH AIRCRAFT SERIAL U20601701.) (Refer to figure 9-6.)

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 turnbuckle (28).
3. Disconnect clamps and keepers (36) from left forward cable (30).
4. Disconnect cables (29 and 30) at cable ends.
5. Complete steps 4 thru 9 of subparagraph "a."

d. AFT CABLE. (WITHOUT ELECTRIC TRIM.) (Refer to figure 9-1.)

1. Remove rear baggage compartment wall.
2. Remove safety wire, relieve cable tension and disconnect turnbuckle (11).

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

3. Disconnect cable ends (8).
4. Remove travel stop blocks (13).
5. Remove access plate beneath trim tab actuator (19) and remove chain guard (21).
6. Disengage roller chain (23) from actuator sprocket (20).
7. 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 aircraft. Leave wire in place, routed through structure; then attach the cable being installed and pull cable into position.

8. Reverse the preceding steps for reinstallation.
9. After cable is routed in position, install pulleys and cable guards. Ensure cable is positioned in pulley grooves before installing guards. Ensure roller chain (23) is positioned correctly over actuator sprocket (20). Ensure bushing (24) is positioned in stop blocks (13).
10. Re-rig system in accordance with paragraph 9-14, safety turnbuckle (11) and reinstall all items removed for access.

e. AFT CABLE (WITH ELECTRIC TRIM.) (THRU AIRCRAFT SERIALS P20600648 AND U20601700.) (Refer to figure 9-5.)

1. Complete step 1 of subparagraph "d."
2. Remove safety wire, relieve cable tension and disconnect turnbuckle (6).

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

3. Disconnect cable ends (9) shown in Detail B aft of the electric trim installation.

4. Remove travel stop blocks (3).

5. (Refer to figure 9-1.) Complete steps 6 thru 11 of subparagraph "d."

f. AFT CABLE. (WITH ELECTRIC TRIM.) (BEGINNING WITH AIRCRAFT SERIAL U20601701.) (Refer to figure 9-6.)

1. Complete steps 1 and 2 of subparagraph "d."

2. Remove safety wire, relieve cable tension and disconnect turnbuckle (28).

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

3. Disconnect cables (29 and 30) at cable ends.

4. Remove travel stop blocks (2).

5. (Refer to figure 9-1.) Complete steps 6 thru 11 of subparagraph "d."

9-12. PEDESTAL COVER.

9-13. REMOVAL AND INSTALLATION.

a. Turn fuel selector valve to OFF position and drain fuel from strainer and lines.

b. Remove knurled nut from engine primer if installed and pull plunger from primer body. Protect primer from dirt.

c. Remove fuel selector handle and placard.

d. Remove cowl flap handle knob.

e. Remove electric trim circuit breaker nut and microphone mounting bracket, if installed.

f. Fold carpet back as necessary and remove screws securing cover to floor and pedestal.

g. Disconnect electrical wiring to pedestal lights.

h. Carefully work cover from pedestal to prevent damage.

i. Reverse the preceding steps for reinstallation.

9-14. RIGGING - STANDARD TRIM SYSTEM. (Refer to figure 9-1.)

CAUTION

Position a support stand under tail tie-down ring to prevent tailcone from dropping while working inside.

a. Remove rear baggage compartment wall and access plates as necessary.

b. Loosen travel stop blocks (13) on trim tab cables (9 and 10).

c. Disconnect push-pull tube (15) from actuator (19).

d. Check cable tension for 10-15 pounds and readjust turnbuckle (11), if necessary.

NOTE

If roller chains and/or cables are being installed, permit actuator screw to rotate freely as roller chains and cables are connected. Adjust cable tension and safety turnbuckle (11).

e. (Refer to figure 9-3.) Rotate trim control wheel (5) full forward (nose down). Ensure pointer (2) does not restrict wheel movement. If necessary to reposition pointer, proceed as follows:

1. Remove pedestal cover as outlined in paragraph 9-13.

2. Loosen nut (6) at trim wheel pivot stud (20).

3. Loosen screws (8) securing chain guard (7) far enough that trim wheel (5) can be moved approximately 1/8 inch, then reposition pointer (2) using a thin screwdriver to pry trailing leg of pointer out of groove in trim wheel. Reposition pointer as required.

4. Tighten nut (6) and screws (8), but do not reinstall pedestal cover until rigging is complete.

NOTE

Full forward (nose down) position of trim wheel is where further movement is prevented by the roller chain or cable ends contacting sprockets or pulleys.

f. With elevator and trim tab both in neutral (streamlined), mount an inclinometer on trim tab and set to 0°. Disregard counterweight areas of elevators when streamlining. These areas are contoured so they will be approximately 3° down at cruising speed.

NOTE

An inclinometer for measuring control surface travel is available from the Cessna Service Parts Center. Refer to figure 6-4.

g. Rotate actuator screw in or out as required to place trim tab up with a maximum of 2° overtravel, with actuator screw connected to push-pull tube (index 15, figure 9-1).

h. Rotate trim wheel to position trim tab up and down, readjusting actuator screw as required to obtain overtravel in both directions.

i. Position stop blocks and adjust as illustrated in figure 9-4 to degree of trim tab travel specified in figure 1-1.

j. Install pedestal cover and adjust trim tab pointer (2) as follows:

1. Rotate trim control wheel (5) to place tab at 10° up position.

2. Locate the pointer (2) at the "TAKE-OFF" triangle as viewed from the pilot seat. (Refer to step "e," and reposition pointer if necessary.)

3. Bend pointer (2) as required to clear pedestal cover. (Pointer must NOT rub against pedestal cover or clear cover more than .125 inch maximum.)

k. Safety Turnbuckle and reinstall all items removed in step "a".

WARNING

Be sure trim tab moves in correct direction when operated by trim control wheel. Nose down trim corresponds to tab up position.

9-15. ELECTRIC TRIM ASSIST INSTALLATION. (Refer to figure 9-5, 9-6 and 9-7.)

9-16. DESCRIPTION. AIRCRAFT SERIALS P206-00648 THRU U20602199. The electric trim assist is operated by a control wheel-mounted switch. The servo unit includes a motor and a chain driven, solenoid-operated, adjustable clutch. The trim tab UP cable enters the servo housing and double wraps around a drive drum. When the clutch is not energized, the drive drum "free wheels" and has no effect on manual operation. AIRCRAFT BEGINNING WITH SERIAL U20602200 (Refer to figure 9-7.) The electric trim assist is operated by two switches mounted on control wheel one switch operating the disengage switch, the other switch operating electric trim assist. The electric trim circuit breaker is mounted on pedestal cover, the electrical wiring is routed thru cabin and fuselage to Sta. 209.00 then routed UP thru elevator to voltage regulator and drive assembly. The drive assembly includes a gear motor and two sprockets that operates a chain driven, solenoid-operated, adjustable clutch. The actuator assembly has dual sprockets. The manual trim tab UP cable connects to the actuator around the AFT sprocket. The drive assembly connects to the actuator by a chain around the FWD sprocket. When the clutch is not energized, the drive drum "free wheels" and has no effect on manual operation.

9-17. TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
SYSTEM INOPERATIVE.	Circuit breaker out.	Check visually. Reset breaker.
	Defective circuit breaker.	Check continuity. Replace defective breaker.
	Defective wiring.	Check continuity. Repair wiring.
	Defective trim switch.	Check continuity. Replace defective switch.
	Defective trim motor.	Remove and bench test. Replace defective motor.
TRIM MOTOR OPERATING - TRIM TAB FAILS TO MOVE.	Defective clutch solenoid.	Check continuity. Replace solenoid.
	Improperly adjusted clutch tension.	Check and adjust spanner nuts for proper tension.
	Disconnected or broken cable.	Operate manual trim wheel. Connect or replace cable.
	Defective actuator.	Check actuator operation. Replace actuator.

9-18. REMOVAL AND INSTALLATION.

a. THRU AIRCRAFT SERIALS P20600648 AND U20601700. (Refer to figure 9-5.)

1. Remove aft baggage compartment wall.
2. Remove safety wire and relieve cable tension at turnbuckle (6).

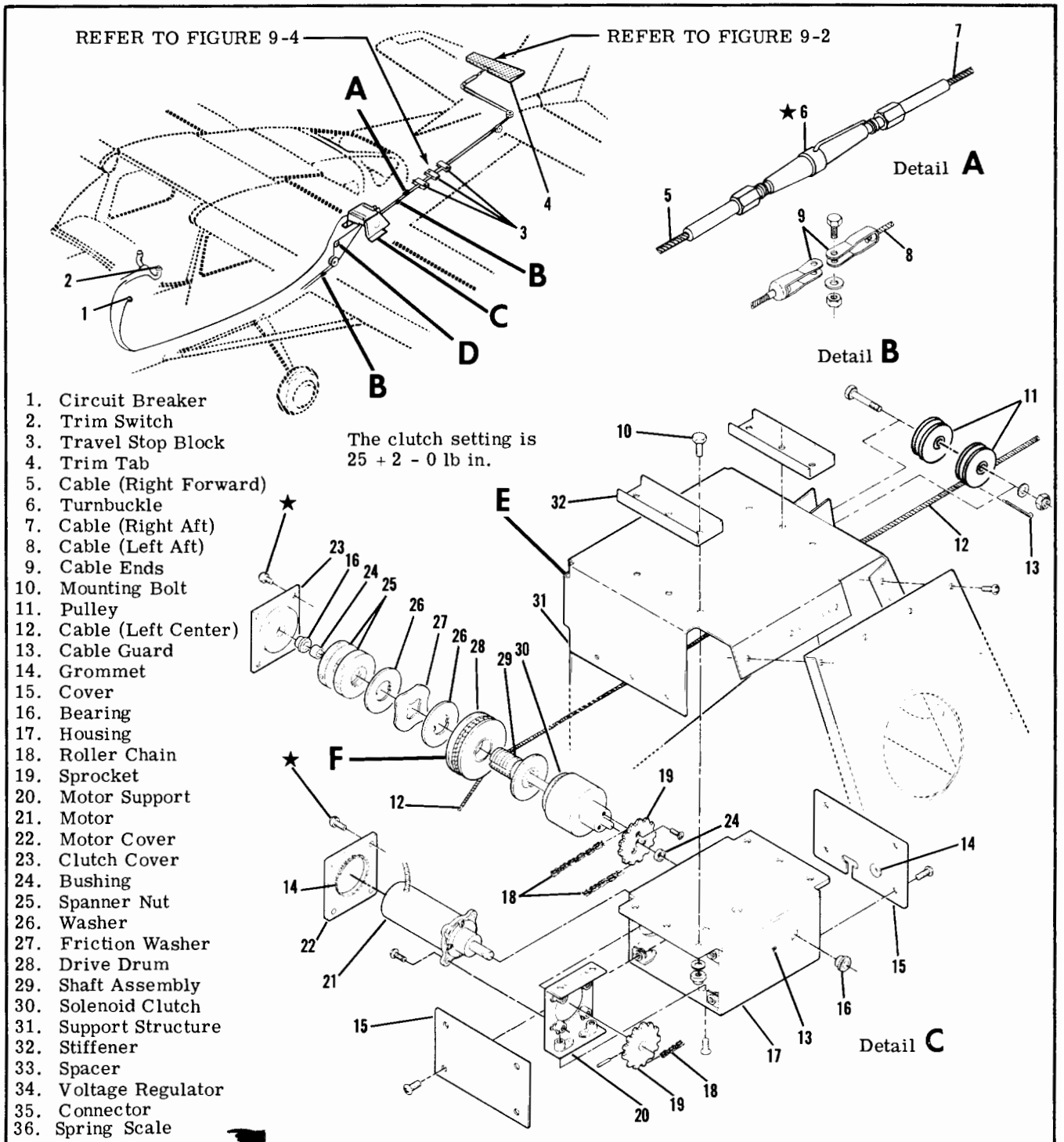
NOTE

Position a support stand under tail tie-down ring to prevent the tailcone from dropping while working inside.

3. Disconnect left center cable (12) at both cable ends (9).
4. Disconnect electrical wiring to servo unit.
5. Remove mounting bolts (10) and remove unit from aircraft.
6. Reverse the preceding steps for reinstallation. Rig system in accordance with paragraph 9-21, safety turnbuckle (6) and reinstall all items removed for access.

b. BEGINNING WITH AIRCRAFT SERIAL U20601701 THRU U20602199 (Refer to figure 9-6.)

1. Remove aft baggage compartment wall.
2. Disconnect electric trim assist cable (35) at both ends by removing clamps and keepers (36).
3. Remove cable guard (25) from bracket (26).
4. Disconnect electrical wiring to servo unit.
5. Remove mounting bolts (22) and remove unit from aircraft.
6. Reverse the preceding steps for reinstallation. Check system rigging in accordance with paragraph 9-21 and re-rig, if necessary.



1. Circuit Breaker
2. Trim Switch
3. Travel Stop Block
4. Trim Tab
5. Cable (Right Forward)
6. Turnbuckle
7. Cable (Right Aft)
8. Cable (Left Aft)
9. Cable Ends
10. Mounting Bolt
11. Pulley
12. Cable (Left Center)
13. Cable Guard
14. Grommet
15. Cover
16. Bearing
17. Housing
18. Roller Chain
19. Sprocket
20. Motor Support
21. Motor
22. Motor Cover
23. Clutch Cover
24. Bushing
25. Spanner Nut
26. Washer
27. Friction Washer
28. Drive Drum
29. Shaft Assembly
30. Solenoid Clutch
31. Support Structure
32. Stiffener
33. Spacer
34. Voltage Regulator
35. Connector
36. Spring Scale

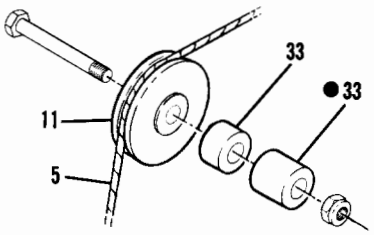
★ Safety wire these items.

Remainder of the elevator trim system is illustrated in figure 9-1.

Refer to Section 2 for lubrication requirements.

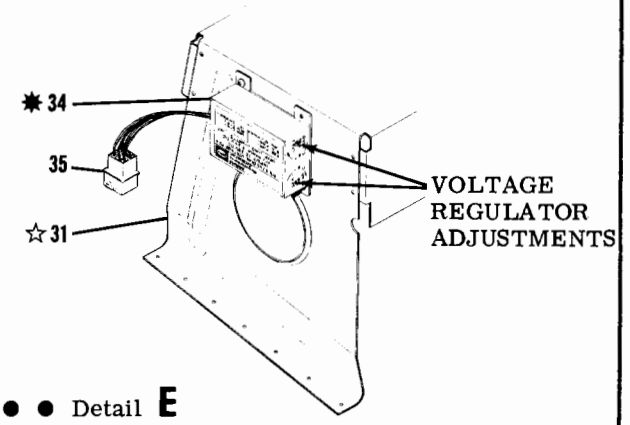
CABLE TENSION:
20 LBS + 5 - 0 LBS (AT AVERAGE TEMPERATURE FOR THE AREA.)
REFER TO FIGURE 1-1 FOR TRAVEL.

Figure 9-5. Electric Elevator Trim System thru P20600648 & U20601700 (Sheet 1 of 2)



Detail **D**

● Spacer (33) replaces the pulley normally installed in the standard system when the electric trim system is installed in the aircraft.

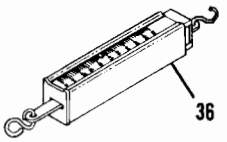


● ● Detail **E**

☆ Support (31) is rotated 90° to expose voltage regulator (34).

NOTE

Beginning with aircraft serial U20601588 a 24 volt electrical system may be installed.



NOTE

✸ With an external power source supplying 27.5 volts to the aircraft, adjust the voltage regulator (34) to 10 volts output in both directions.

NOTE

● ● Detail E applies only to aircraft serials U20601588 thru U20601700 when equipped with a 24 volt electrical system and an electric trim system. Detail E does not apply to 12 volt systems equipped with electric trim.

Figure 9-5. Electric Elevator Trim System thru P20600648 & U20601700 (Sheet 2 of 2)

1. Trim Tab
2. Travel Stop Block
3. Trim Switch
4. Circuit Breaker
5. Clutch Cover
6. Bearing
7. Bushing
8. Spanner Nut
9. Washer
10. Friction Washer
11. Drive Drum
12. Shaft Assembly
13. Solenoid Clutch
14. Sprocket
15. Roller Chain
16. Grommet
17. Motor Cover
18. Motor
19. Motor Support
20. Cover
21. Housing
22. Mounting Bolt
23. Support Assembly
24. Pulley
25. Cable Guard
26. Bracket
27. Cable (Right Aft)
28. Turnbuckle
29. Cable (Left Aft)
30. Cable (Left Forward)
31. Cable (Right Forward)
32. Spacer
33. Voltage Regulator
34. Swaged Ball
35. Assist Cable
36. Clamp and Keeper
37. Connector
38. Spring Scale

★ Safety wire these items.

Remainder of elevator trim system is illustrated in figure 9-1.

Refer to Section 2 for lubrication requirements.

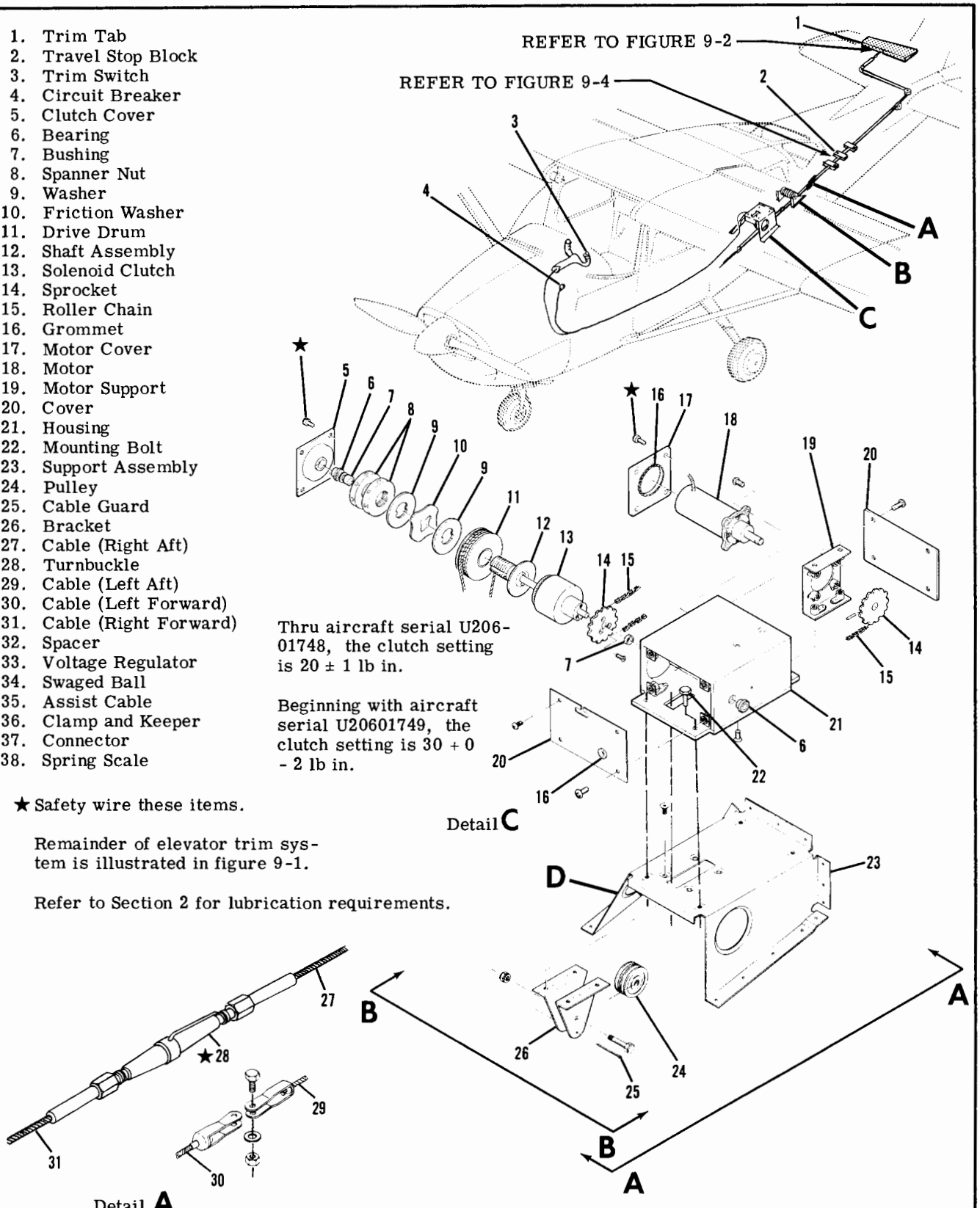
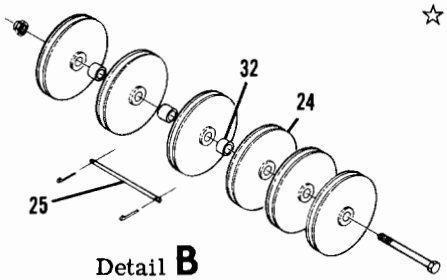
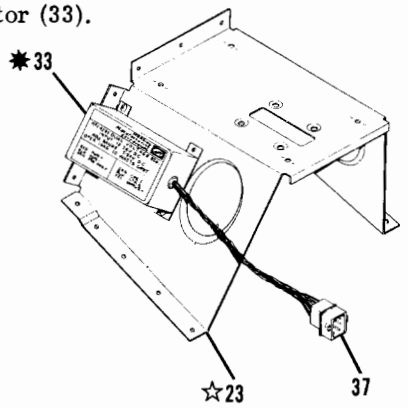


Figure 9-6. Electric Elevator Trim System Beginning U20601701 Thru U20602199 (Sheet 1 of 2)

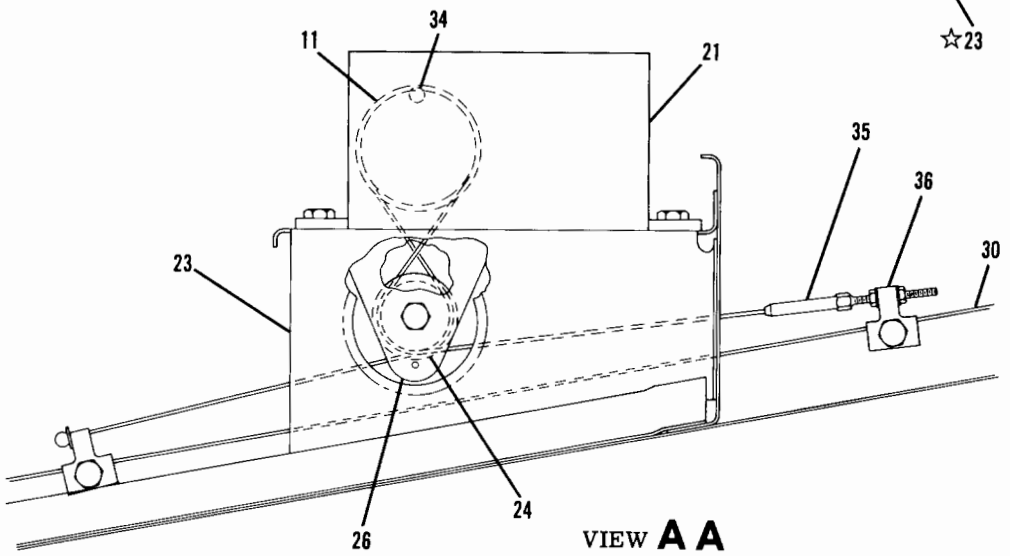


Detail **B**

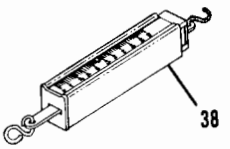
☆ Support (23) is rotated 90° to expose voltage regulator (33).

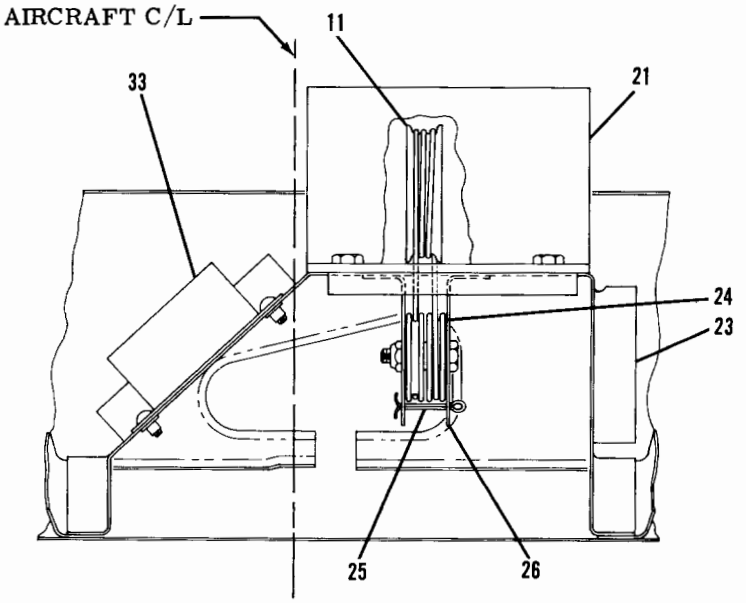


Detail **D**



VIEW **A A**





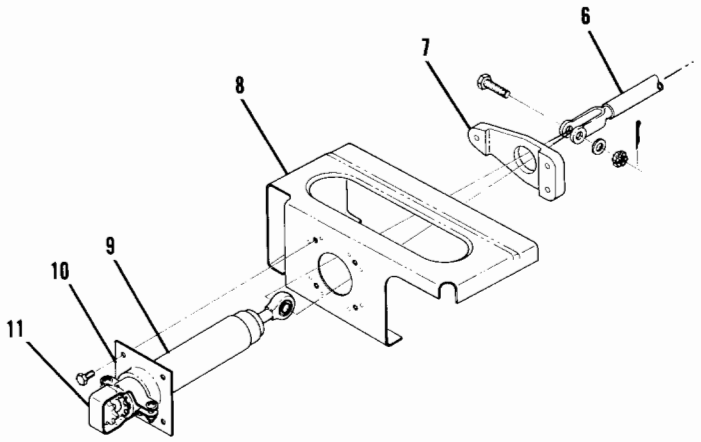
VIEW **B B**

NOTES

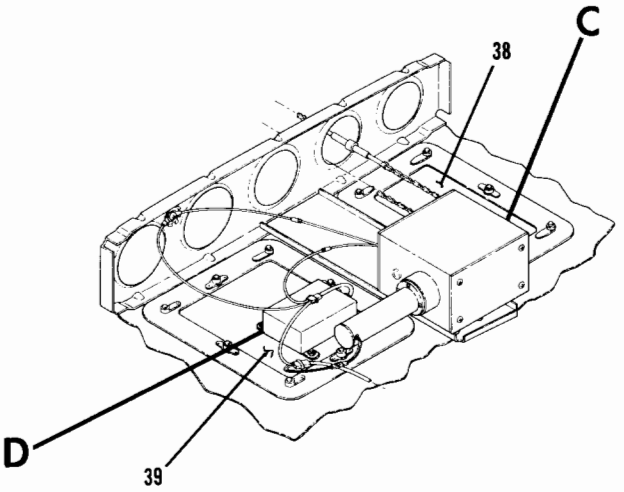
Assist cable (35) must be wrapped around drive drum (11) so that the threaded end of the assist cable exits the housing on the same side where the motor end is visable.

✸ With an external power source supplying 13.75 volts to the aircraft. (when equipped with 12 volt electrial system) or 27.5 volt when (aircraft equipped with 24 volt system) adjust the voltage regulator (33) to 10 volts output in both directions.

Figure 9-6. Electric Elevator Trim System Beginning U20601701 (Sheet 2 of 2)



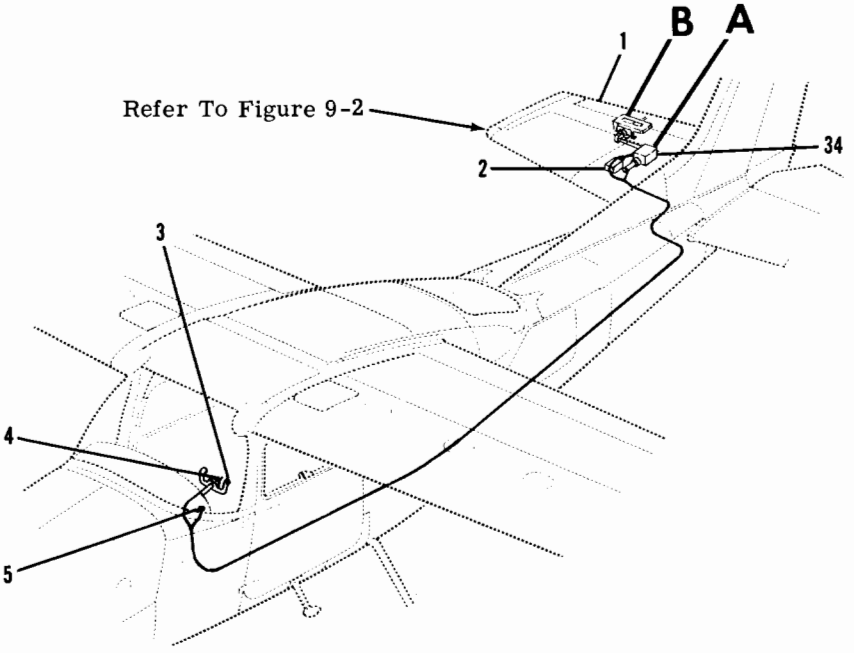
Detail **B**



Detail **A**

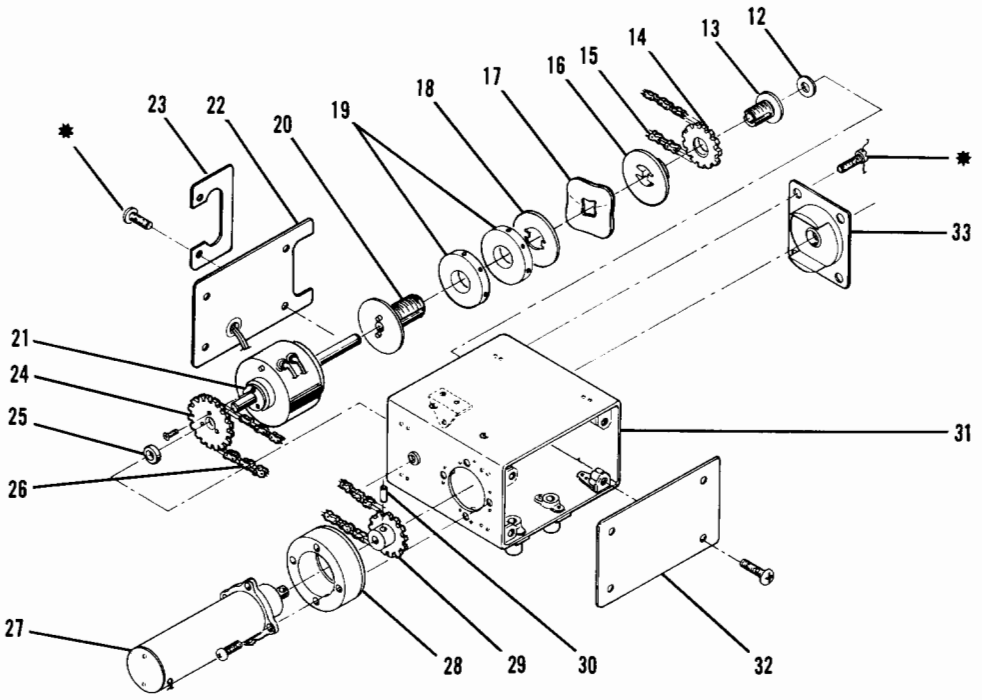
1. Trim Tab
2. Voltage Regulator
3. Trim Switch
4. Disengage Switch
5. Circuit Breaker
6. Push-Pull Tube
7. Brace
8. Mounting Bracket Assembly
9. Actuator Assembly
10. Mounting Plate - FWD.
11. Sprocket Guard
12. Washer
13. Shaft
14. Sprocket
15. Chain Assembly
16. Washer Assembly
17. Spring Washer
18. Washer
19. Nut
20. Shaft Assembly
21. Clutch
22. Cover Assembly
23. Rub Strip
24. Sprocket
25. Bushing
26. Chain
27. Gear Motor
28. Mounting Plate
29. Sprocket
30. Pin
31. Housing Assembly
32. Cover
33. Mounting Plate Assembly
34. Drive Assembly
35. CTR1 Adjustment
36. CTR2 Adjustment
37. Connector
38. Cover
39. Cover

* SAFETY WIRE THESE ITEMS

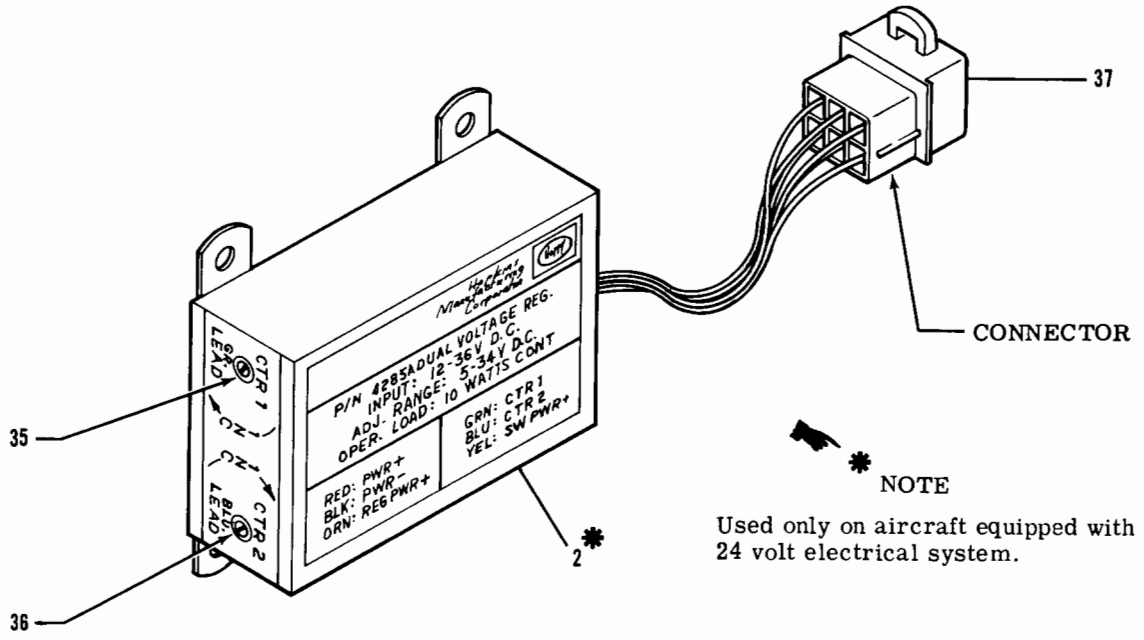


BEGINNING WITH AIRCRAFT SERIAL U20602200

Figure 9-7. Electric Elevator Trim System Beginning U20602200 (Sheet 1 of 2)



Detail **C**



Detail **D**

* NOTE

Used only on aircraft equipped with 24 volt electrical system.

Figure 9-7. Electric Elevator Trim System Beginning U20602200 (Sheet 2 of 2)

c. AIRCRAFT WITH OPTIONAL ELECTRIC TRIM ASSIST INSTALLATION BEGINNING WITH SERIAL U20602200 (Refer to figure 9-7.)

1. Remove access plate below actuator and covers (38) & (39).
2. Disconnect electric trim assist cable (37) and three Mate-N-Lok connectors on drive assembly. Remove bolt and nut from ground wire thru rib.
3. Remove sprocket guard (11) from actuator body.
4. Remove mounting bolts from voltage reulator (2) and drive assembly (34) actuator (9) and remove units from aircraft.
5. Reverse the preceding steps for reinstallation. Check system rigging in accordance with paragraph 9-21 and safety wire turnbuckle if re-rigging is necessary.

9-19. CLUTCH ADJUSTMENT.

a. THRU AIRCRAFT SERIALS P20600648 AND U20601700. (Refer to figure 9-5.)

1. Remove aft baggage compartment wall.
2. Remove safety wire and relieve cable tension at turnbuckle (6).
3. Disconnect left center cable (12) at both cable ends (9).
4. Disconnect electrical power to the motor assembly (21) by unplugging the connector installed in the RED wire leading to the motor assembly.

NOTE

Step 4 isolates the motor assembly from the remainder of the electric trim system so it cannot be engaged during clutch adjustment.

5. Remove screws securing cover (15) to housing (17) and slide the cover down over electrical wiring far enough to expose the clutch assembly.
6. Ensure the electric trim circuit breaker on the pedestal cover is pushed IN and place master switch in the ON position.
7. Operate control wheel-mounted switch UP or DOWN to energize the solenoid clutch (30).
8. Attach the spring scale (38) to the left center cable (12) and pull scale slowly until slippage is noticed.
9. Repeat steps 7 and 8 several times to break the initial friction of the clutch, making sure that cable (12) is re-wound on drive drum (28) after each slippage test.
10. Repeat steps 7 and 8 very slowly, carefully watching the indicator on the spring scale (38). Slippage should occur between 28.22 to 30.47 lbs on 12 volt aircraft systems and between 21.44 to 23.70 lbs on 24 volt aircraft systems.
11. If tension is not within tolerance, loosen OUTSIDE spanner nut (25) which acts as a lock. Tighten INSIDE spanner nut to increase clutch tension and loosen nut to decrease clutch tension.

NOTE

Spanner nuts (25) may be loosened or tightened with a suitable hammer and punch.

12. Repeat steps 10 and 11 until tension is in accordance with step 10, then tighten outside spanner nut against inside nut.
13. Connect electrical wiring to motor assembly which was removed in step 4, re-rig trim system in accordance with paragraphs 9-14 and 9-21 and reinstall all items removed for access.

b. BEGINNING WITH AIRCRAFT SERIAL U20601701. THRU U20602199 (Refer to figure 9-6

1. Remove aft baggage compartment wall.
2. Disconnect assist cable (35) at both ends by removing clamps and keepers (36).
3. Disconnect electrical power to the motor assembly (18) by unplugging the connector installed in the RED wire leading to the motor assembly.

NOTE

Step 3 isolates the motor assembly from the remainder of the electric trim system so it cannot be engaged during clutch adjustment.

4. Remove screws securing cover (20) to housing (21) and slide the cover down over electrical wiring far enough to expose the clutch assembly.
5. Ensure the electric trim circuit breaker on the pedestal cover is pushed IN and place master switch in the ON position.
6. Operate control wheel-mounted switch UP or DOWN to energize the solenoid clutch (13).
7. Attach the spring scale (38) to the assist cable (35) and pull scale slowly until slippage is noticed.

Slippage should occur between 33.86 to 37.25 lbs on 12 and 24 volt aircraft systems.

8. Repeat steps 6 and 7 several times to break the initial friction of the clutch, making sure that cable (35) is re-wound on drive drum (11) after each slippage test.
9. Repeat steps 7 and 8 very slowly, carefully watching the indicator on the spring scale (38).
10. If tension is not within tolerance, loosen OUTSIDE spanner nut (8) which acts as a lock. Tighten INSIDE spanner nut to increase clutch tension and loosen nut to decrease clutch tension.

NOTE

Spanner nuts (8) may be loosened or tightened with a suitable hammer and punch.

11. Repeat steps 9 and 10 until tension is in accordance with step 9, then tighten outside spanner nut against inside nut.
12. Connect electrical wiring to motor assembly which was removed in step 3, re-rig trim system in accordance with paragraphs 9-14 and 9-21 and reinstall all items removed for access.

BEGINNING WITH AIRCRAFT SERIAL U20602200
(Refer to figure 9-7.)

1. Remove access plate below actuator and covers (38) & (39).
2. Remove safety wire and relieve cable tension and chain tension at turnbuckles.
3. Disconnect electric motor by unplugging the three Mate-N-Lok connectors leading to the motor assembly.
4. Remove mounting bolts from drive assembly. It is necessary to remove from elevator to make the necessary adjustments to clutch.

NOTE

Step 3 isolates the motor assembly from the remainder of the electric trim system so it cannot be engaged during clutch adjustment.

5. Remove screws securing covers (23) and (22) to housing (31) and slide the cover down over electrical wiring far enough to expose the clutch assembly.
6. Ensure the electric trim circuit breaker on the pedestal cover is pushed in and place master switch in the ON position.
7. Operate control wheel-mounted switch UP or DOWN to energize the solenoid clutch (21).
8. Attach the spring scale (Index (38) in Figure 9-6 to chain and pull scale slowly until slippage is noticed.
9. Repeat Steps 7 & 8 several times to break the initial friction of the clutch.
10. Repeat Steps 8 and 9 very slowly, carefully watching the indicator on the spring scale. Slippage should occur between 29.1 to 32.9 lbs. on 12 and 24 volt aircraft systems.
11. IF tension is not within tolerance, loosen OUTSIDE spanner nut (19) which acts as a lock. Tighten INSIDE spanner nut to increase clutch tension and loosen nut to decrease clutch tension.

NOTE

Spanner nut (19) may be loosened or tightened with a suitable hammer and punch.

12. Repeat Steps 10 and 11 until tension is in accordance with 10. then tighten outside spanner nut against inside nut.
13. Connect electrical wiring to motor assembly which was removed in Step 3, re-rig trim system in accordance with paragraphs 9-14 and 9-21 and reinstall all items removed for access.

9-20. DUAL VOLTAGE REGULATOR ADJUSTMENT. (Beginning with aircraft serials U20601588 (24 volt systems only) and U20601701 (12 volt and 24 volt systems.)

a. Remove the aft baggage compartment wall.
b. Connect an external power source of 13.75 volts (aircraft equipped with 12 volt electrical systems) or 27.5 volts (aircraft equipped with 24 volt electrical systems) dc continuous to the aircraft electrical system, or if an external power supply is not available, run the aircraft engine at approximately 1000 rpm to maintain the normal operating aircraft voltage.
c. Disconnect the electrical power leads to the motor by unplugging the connectors installed in the RED and BLACK wires leading to the motor assembly.
d. Connect one lead of a dc voltmeter capable of measuring the aircraft voltage to either the RED or BLACK wire leading to the motor and the other voltmeter lead to a good aircraft ground.
e. Operate the electric trim switch to the NOSE UP and NOSE DOWN positions and check voltage present at the RED and BLACK wires.
f. Adjust CTR 1 and CTR 2 adjustment screws on the voltage regulator counterclockwise (CCW), then slowly turn adjustment screws clockwise (CW) until a 10 volt output is obtained for both (RED and BLACK) leads.
g. Remove voltmeter and reconnect the motor assembly power leads. Be sure to connect RED to RED and BLACK to BLACK when reconnecting leads.
h. Check trim system for proper operation and reinstall all items removed for access.

9-20A. DUAL VOLTAGE REGULATOR ADJUSTMENT. (24 VOLT SYSTEM ONLY BEGINNING WITH U20602200)
(Refer to figure 9-7.)

a. Remove access cover (39).
b. Connect an external power source of 13.75 volts (aircraft equipped with 12 volt electrical systems) or 27.5 volts (aircraft equipped with 24 volt electrical systems) dc continuous to the aircraft electrical system, or if an external power supply is not available, run the aircraft engine at approximately 1000 RPM to maintain the normal operating aircraft voltage.
c. Disconnect the electrical power leads to the motor by unplugging the connectors installed in the RED and BLACK wire leading to the motor assembly.
d. Connect one lead of a dc voltmeter capable of measuring the aircraft voltage to either the RED or BLACK wire leading to the motor and the other voltmeter lead to a good aircraft ground.
e. Operate the electric trim switch to the Nose UP and Nose DOWN positions and check voltage present at the RED and BLACK wires.
f. Adjust CTR 1 and CTR 2 adjustment screws on the voltage regulator counterclockwise (CCW), then slowly turn adjustment screws clockwise (CW) until a 13.5 volt output is obtained for both (RED and BLACK) leads.
g. Remove voltmeter and reconnect the motor assembly power leads. Be sure to connect RED to RED and BLACK to BLACK when reconnecting leads.
h. Check to see if full "NOSE UP" to full "NOSE DOWN" and full "NOSE DOWN" to full "NOSE UP" cycle time is 32±3 seconds.
i. Readjust voltage regulator as required to obtain 32±3 seconds cylce time.
j. Check trim system for proper operation and reinstall all items removed for access.

CAUTION

The trim motor should be allowed to cool between voltage regulator adjustments for approximately 5 minutes if several actuations of the motor becomes necessary during adjustment.

9-21. RIGGING - ELECTRIC TRIM ASSIST.

a. THRU AIRCRAFT SERIALS P20600648 AND U20601700. (Refer to figure 9-5.)

1. The standard manual elevator trim control system MUST be rigged in accordance with paragraph 9-14 prior to rigging the electric trim assist.
2. Remove rear compartment baggage wall.
3. Remove safety wire and adjust turnbuckle (6) to increase trim system cable tension from 10 to 15 lbs to 20+5-0 lbs.
4. Recheck trim tab travel with an inclinometer for degree of travel specified in figure 1-1, safety turnbuckle (6) and reinstall all items removed for access.

b. AIRCRAFT SERIALS U20601701 THRU U206-01748. (Refer to figure 9-6.)

1. Complete steps 1 and 2 of subparagraph "a."
2. Disconnect assist cable (35) at both ends by removing clamps and keepers (36).
3. Remove safety wire and adjust turnbuckle (28) to increase trim system cable tension from 10 to 15 lbs to 20+5-0 lbs.
4. Rotate trim control wheel to place trim tab in the approximate mid-travel position (10° up).
5. Index the swaged ball (34) to the top of drive drum (11).
6. Connect assist cable (35) to left forward cable (30) and adjust the assist cable to 25+5-0 pounds tension.
7. Recheck trim tab travel with an inclinometer for degree of travel specified in figure 1-1, safety turnbuckle (28) and reinstall all items removed for access.

c. AIRCRAFT SERIAL U20601749 THRU U20602199 (Refer to figure 9-6.)

1. Complete steps 1 thru 5 of subparagraph "b."
2. Connect assist cable (35) to left forward cable (30) and adjust the assist cable to 10+5-0 pounds tension.

d. BEGINNING WITH AIRCRAFT SERIAL U206-02200 (Refer to figure 9-7.)

1. Complete steps 1 and 2 of subparagraph "a".
2. Rig electric trim drive chain as follows:
   a. Move elevator trim tab to full "NOSE UP" position.
   b. Locate NAS288 terminal on upper side of chain at a point 0.75 inches from drive assembly housing.
   c. Adjust AN155 barrel until chain deflection between sprockets is approximatley 0.25 inch.
   d. Resafety turnbuckle and reinstall all items removed for access.

SHOP NOTES:

SECTION 10

RUDDER CONTROL SYSTEM

TABLE OF CONTENTS

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. When dual controls are installed, stowable rudder pedals are provided at the copilot's position.

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.	Open access plates and check visually. Connect or replace cables.

10-3. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
BINDING OR JUMPY MOVEMENT OF RUDDER PEDALS.	Cables too tight.	Refer to figure 10-1 for cable tension. Rig system in accordance with paragraph 10-11.
	Cables not riding properly on pulleys.	Open access plates and check visually. Route cables correctly over pulleys.
	Binding, broken or defective pulleys or cable guards.	Open access plates and check visually. Replace defective pulleys and install guards properly.
	Pedal bars need lubrication.	Refer to Section 2.
	Defective rudder bar bearings.	If lubrication fails to eliminate binding. Replace bearing blocks.
	Defective rudder hinge bushings.	Check visually. Replace defective bushings.
	Clevis bolts too tight.	Check and readjust bolts to eliminate binding.
	Steering rods improperly adjusted.	Rig system in accordance with paragraph 10-11.
LOST MOTION BETWEEN RUDDER PEDALS AND RUDDER.	Insufficient cable tension.	Refer to figure 10-1 for cable tension. Rig system in accordance with paragraph 10-11.
INCORRECT RUDDER TRAVEL.	Incorrect rigging.	Rig in accordance with paragraph 10-11.
STOWABLE PEDALS DO NOT DISENGAGE.	Broken or defective control.	Disengage control and check manually. Replace control.
STOWABLE PEDALS DO NOT STOW.	Defective cover, catch or latch pin.	Check visually. Replace defective parts.
STOWABLE PEDALS DO NOT RE-ENGAGE.	Binding control.	Check control operation. Repair or replace control.
	Misaligned or bent mechanism.	Check visually. Repair or replace defective parts.

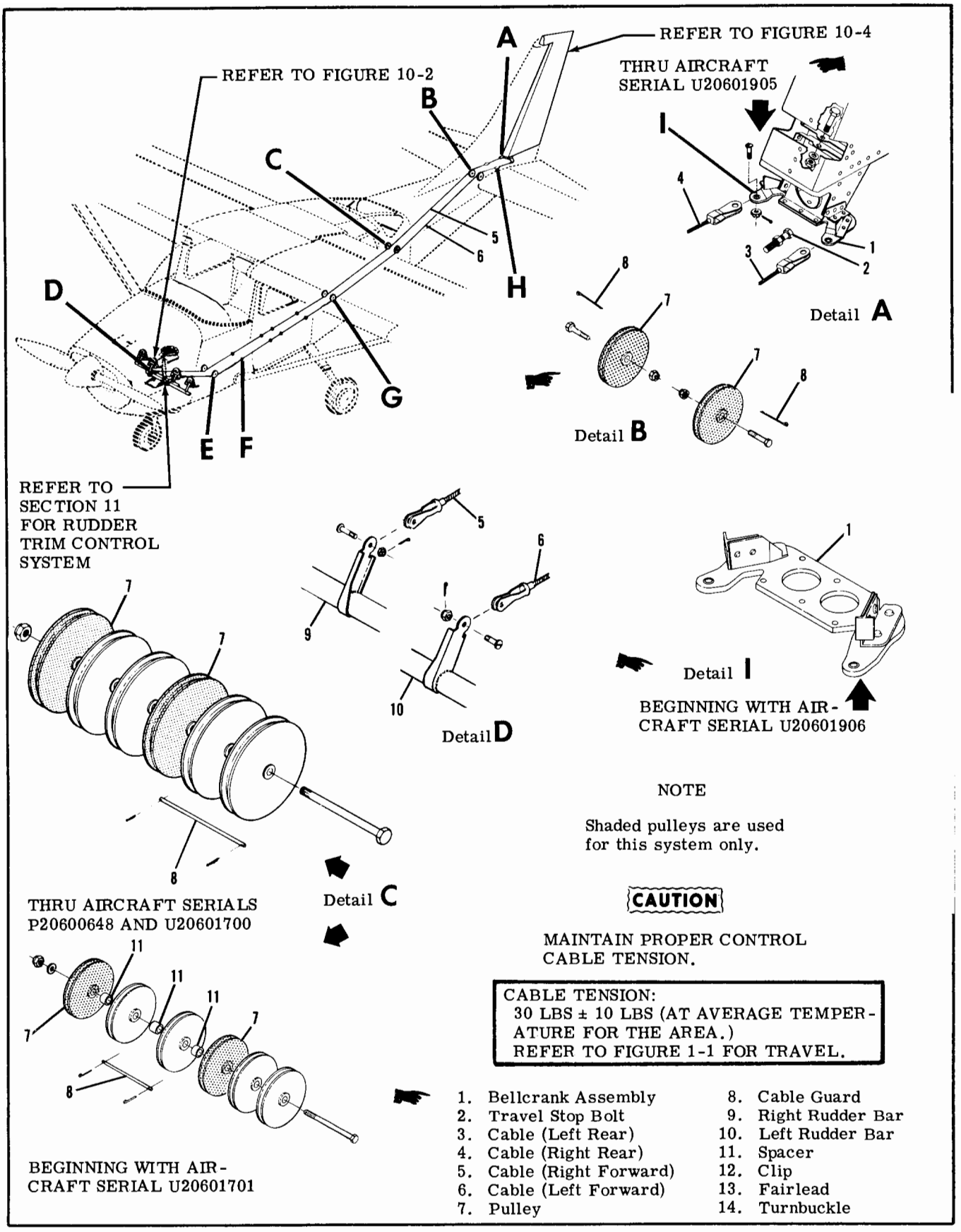
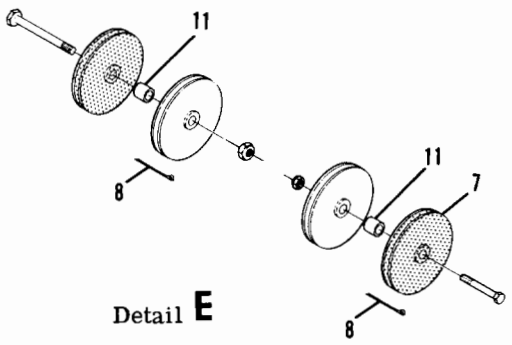
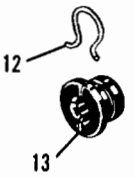


Figure 10-1. Rudder Control System (Sheet 1 of 2)



Detail **E**



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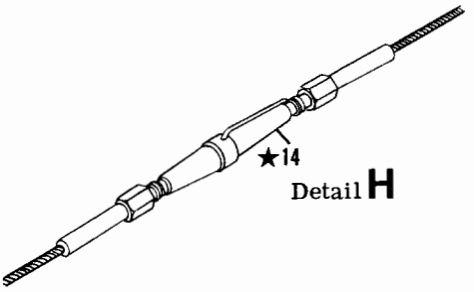
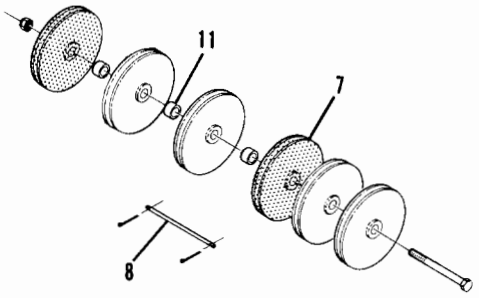


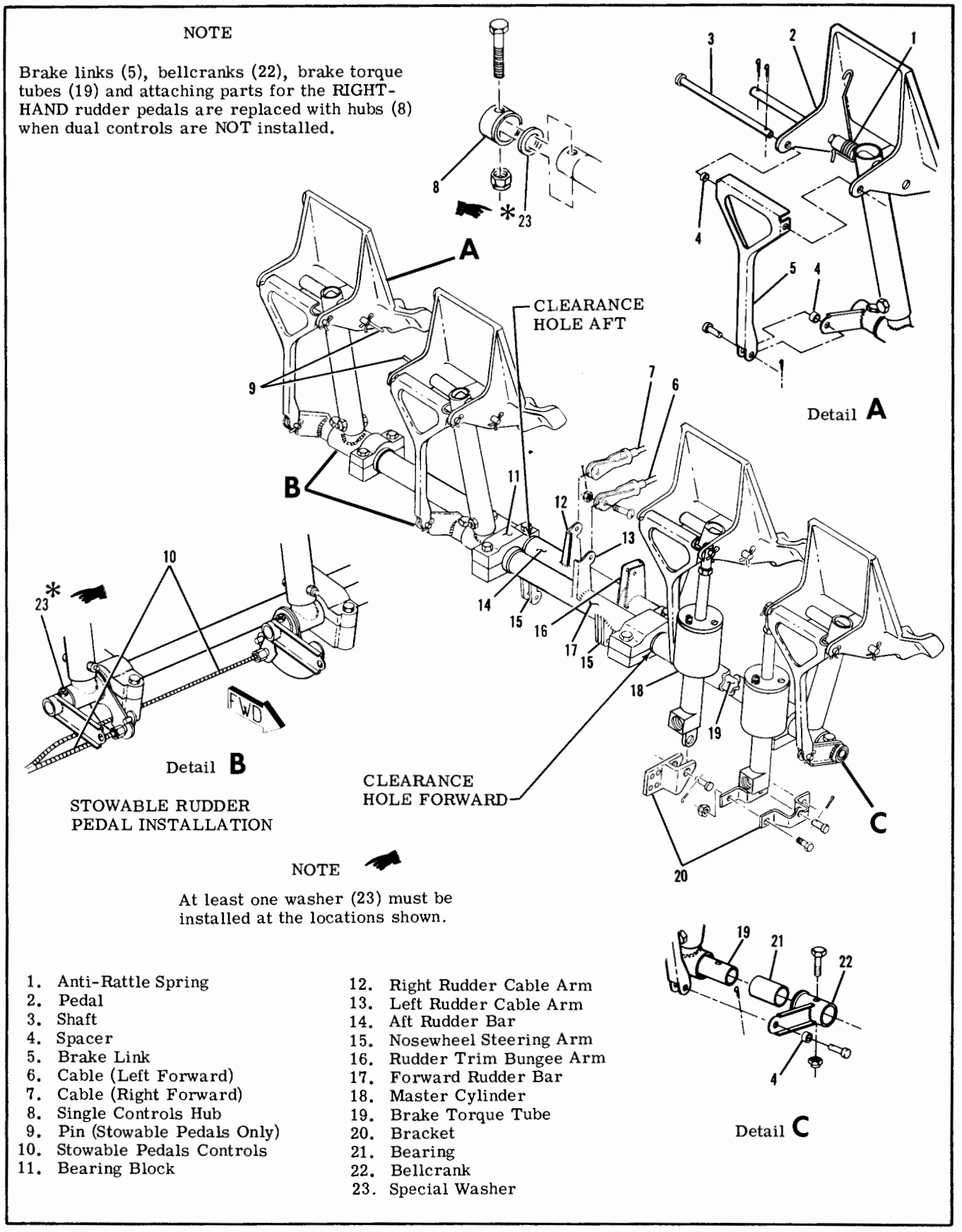
Detail **H**



Detail **G**

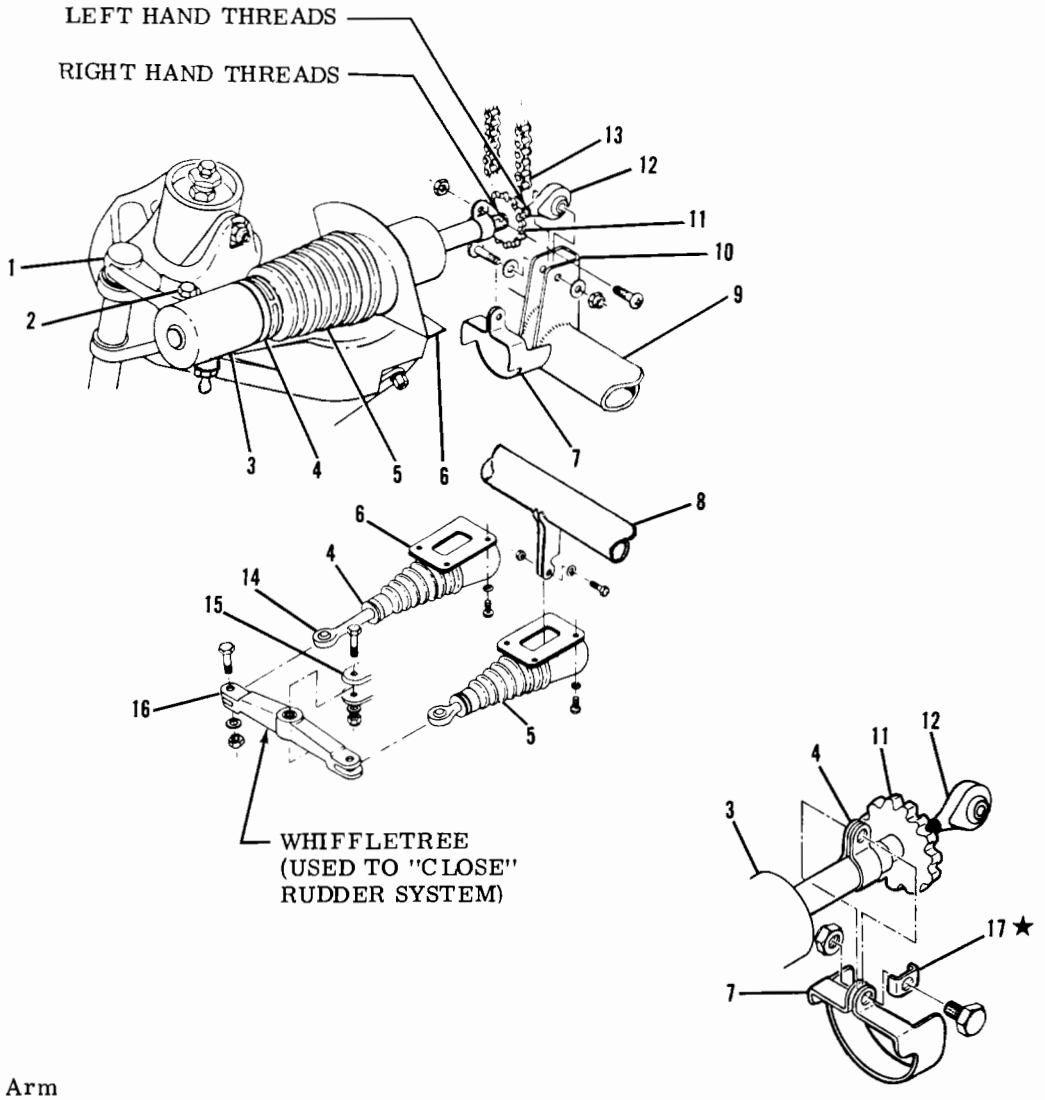
★ Safety wire these items.

Figure 10-1. Rudder Control System (Sheet 2 of 2)



1. Anti-Rattle Spring
2. Pedal
3. Shaft
4. Spacer
5. Brake Link
6. Cable (Left Forward)
7. Cable (Right Forward)
8. Single Controls Hub
9. Pin (Stowable Pedals Only)
10. Stowable Pedals Controls
11. Bearing Block
12. Right Rudder Cable Arm
13. Left Rudder Cable Arm
14. Aft Rudder Bar
15. Nosewheel Steering Arm
16. Rudder Trim Bungee Arm
17. Forward Rudder Bar
18. Master Cylinder
19. Brake Torque Tube
20. Bracket
21. Bearing
22. Bellcrank
23. Special Washer

Figure 10-2. Rudder Pedals Installation



1. Steering Arm
2. Bolt
3. Steering Bungee
4. Clamp
5. Boot
6. Retainer
7. Cable Guard
8. Left Rudder Bar
9. Right Rudder Bar
10. Bungee Attachment Arm
11. Sprocket
12. Rod End
13. Chain
14. Link Rod Assembly
15. Aircraft Structure
16. Whiffletree
17. Stop

★ Beginning with aircraft serials P206-0532 and U206-1237 (Install with legs around guard ends.)

Figure 10-3. Nosewheel Steering Linkage

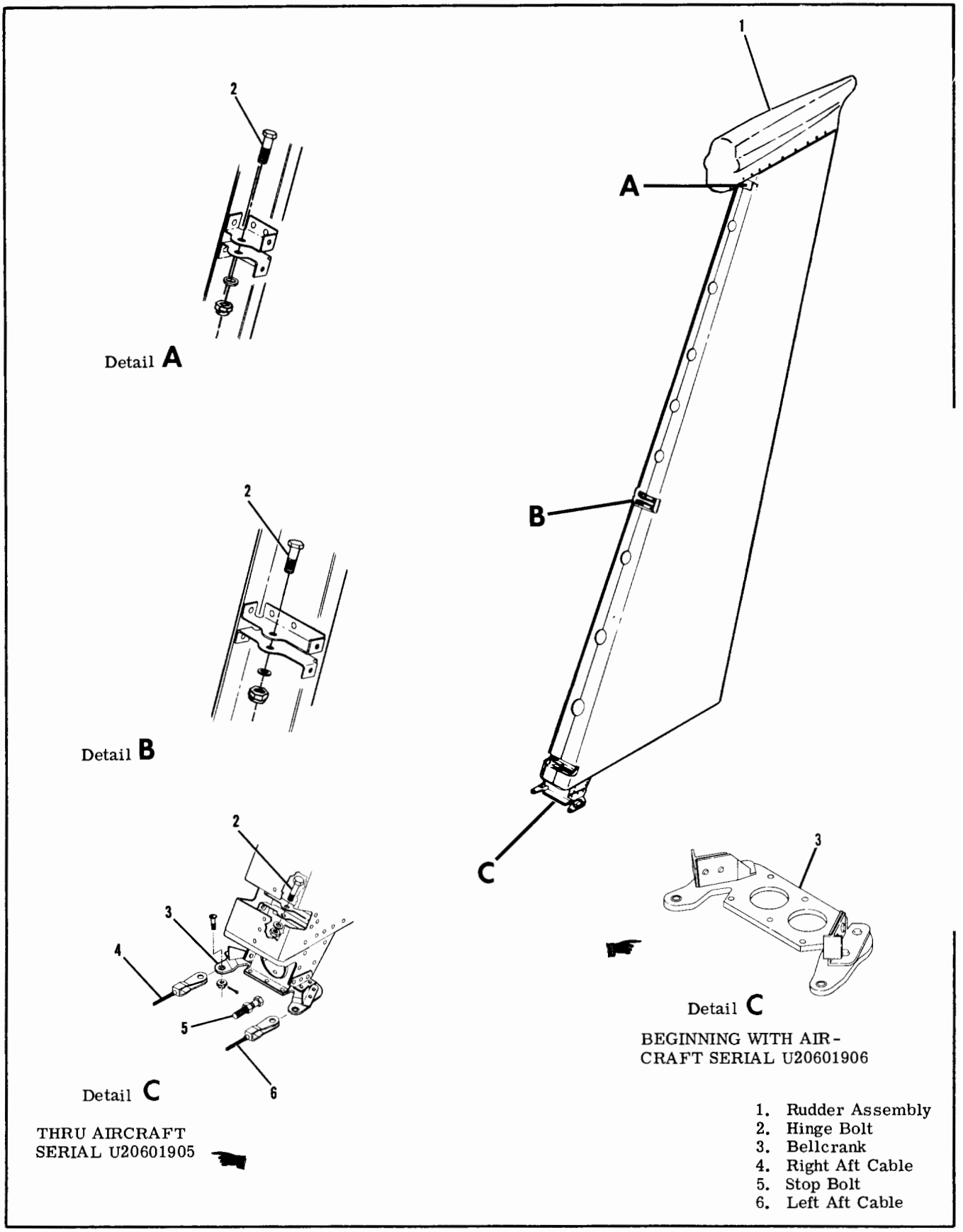
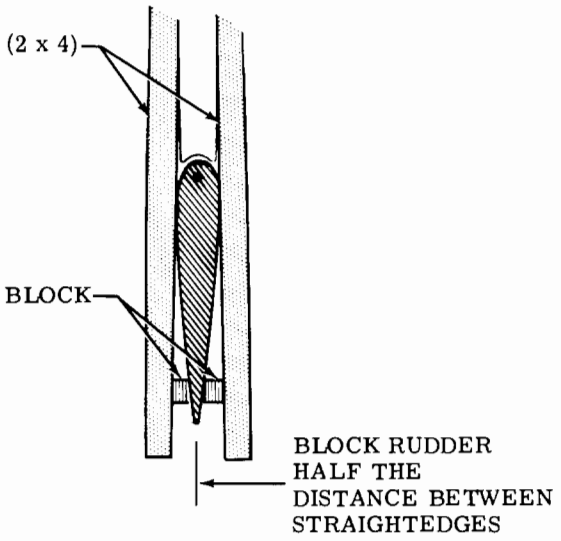
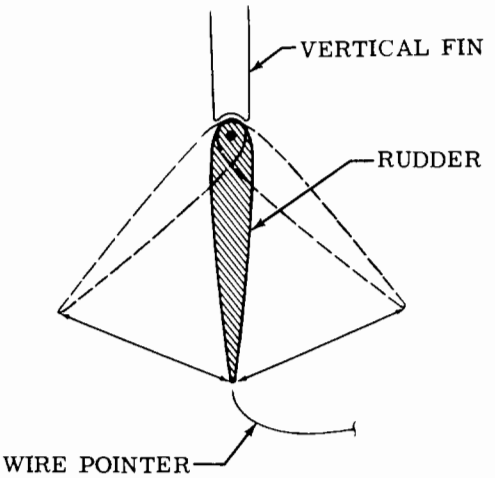


Figure 10-4. Rudder Installation



ESTABLISHING NEUTRAL POSITION OF RUDDER



MEASURING RUDDER TRAVEL

1. Establish neutral position of rudder by clamping straightedge (such as wooden 2 x 4) on each side of fin and rudder and blocking trailing edge of rudder half the distance between straightedges as shown.
2. Tape a length of soft wire to 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 8.12" and 8.72".

Figure 10-5. Checking Rudder Travel

10-4. RUDDER PEDAL ASSEMBLY.

10-5. REMOVAL AND INSTALLATION. (Refer to figure 10-2.)

a. Remove carpeting, shields and soundproofing from the rudder pedal and tunnel areas as necessary for access.

b. Disconnect brake master cylinders (18) and parking brake cables at pilot's rudder pedals.

c. Remove rudder pedals (2) and brake links (5).

d. Disconnect stowable rudder pedal controls (10).

e. Remove fairing from either side of vertical fin, remove safety wire and relieve cable tension by loosening turnbuckles (index 14, figure 10-1).

f. Disconnect cables (6 and 7) from rudder bar arms (12 and 13).

g. (Refer to figure 10-3.) Disconnect steering bungee (3) from rudder bar arm (10). This is a dual-purpose bungee, serving as both rudder trim and nose gear steering.

h. Disconnect whiffletree push-pull rods (14) at rudder bar arms.

i. (Refer to figure 10-2.) Remove bolts securing bearing blocks (11) and carefully work rudder bars out of tunnel area.

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.

j. Reverse the preceding steps for reinstallation. Lubricate rudder bar assemblies as outlined in Section 2. Rig system in accordance with paragraph 10-11, safety turnbuckles and reinstall all items removed for access.

10-6. RUDDER. (Refer to figure 10-4.)

10-7. REMOVAL AND INSTALLATION.

a. Remove stinger.

b. Disconnect tail navigation light wire.

c. Remove fairing from either side of vertical fin, remove safety wire and relieve cable tension by loosening turnbuckles (index 14, figure 10-1.)

d. Disconnect cables (4 and 6) from rudder bellcrank (3).

e. With rudder supported, remove all hinge bolts (2) and using care, lift rudder free of vertical fin.

f. Reverse the 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 may be accomplished as outlined in Section 18.

10-9. CABLES AND PULLEYS. (Refer to figure 10-1.)

10-10. REMOVAL AND INSTALLATION.

a. Remove seats, upholstery and access plates as necessary.

b. Remove safety wire, relieve cable tension and disconnect cables at turnbuckles (14).

c. Disconnect cables (5 and 6) at rudder bars (9 and 10).

d. Remove cable guards, pulleys and fairleads as necessary to work cables free of aircraft.

NOTE

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

e. Reverse the preceding steps for reinstallation.

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

g. Re-rig system in accordance with paragraph 10-11, safety turnbuckles and reinstall all items removed in step "a."

10-11. RIGGING.

a. Remove fairing from either side of vertical fin, remove safety wire and relieve cable tension at turnbuckles (index 14, figure 10-1).

b. Tie down or weight tail to raise nosewheel free of ground.

c. Extend strut and ensure nose gear is centered against the external centering stop.

d. (Refer to figure 10-3.) Disconnect steering bungee adjustable rod end (12) from rudder bar arm (10).

e. Clamp rudder pedals in neutral position.

f. Adjust turnbuckles (index 14, figure 10-1) to streamline rudder with 30±10 lbs tension on cables.

g. Remove clamps from rudder pedals.

h. Adjust travel stop bolts (index 2, figure 10-1) to obtain degree of travel specified in figure 1-1. Figure 10-5 illustrates correct travel and one method of checking.

i. Connect steering bungee and rig trim system as outlined in Section 11.

j. Operate rudder system, checking for ease of movement and full travel. Check cable tension with rudder in various positions. Cable tension should not be less than 20 pounds or more than 40 pounds in any position.

k. Check that all turnbuckles are safetied and reinstall all items removed for access.

l. Lower nosewheel to ground.

WARNING

Be sure rudder moves in the correct direction when operated by the rudder pedals.

SECTION 11

RUDDER TRIM CONTROL SYSTEM

TABLE OF CONTENTS

11-1. RUDDER TRIM CONTROL SYSTEM.

11-2. DESCRIPTION. The rudder trim system is operated by a trim control wheel, mounted in the pedestal. A sprocket-operated screw mechanism is incorporated at the aft end of the steering bungee which attaches to the aft rudder bar. The nose gear steering, rudder control system and rudder trim control system are interconnected, therefore, adjustments to one system will affect the others. For maintenance to nose gear steering, other than rigging, refer to Section 5.

11-3. TROUBLE SHOOTING.

NOTE

This trouble shooting chart should be used in conjunction with the trouble shooting chart in paragraph 10-3.

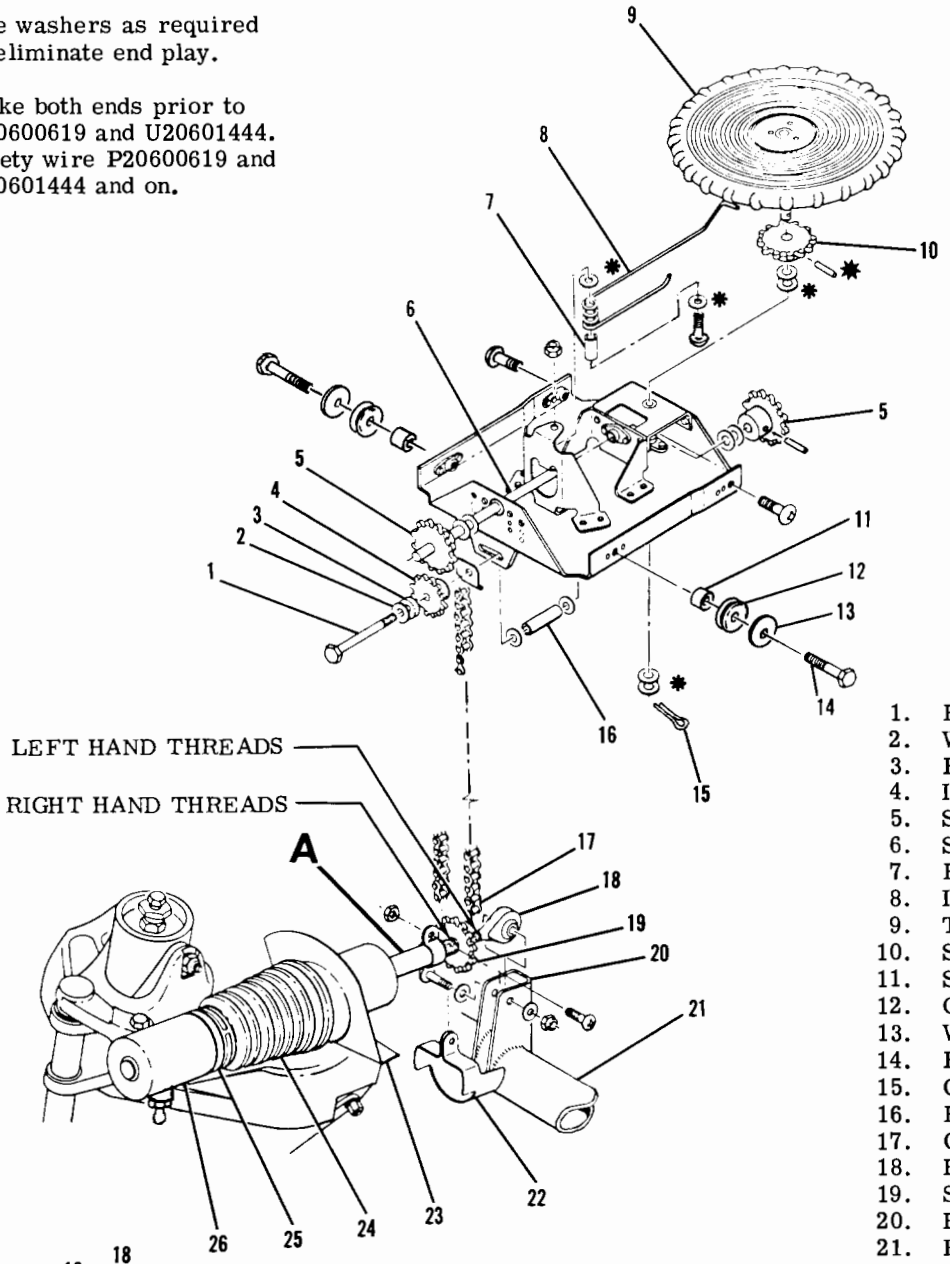
NOTE

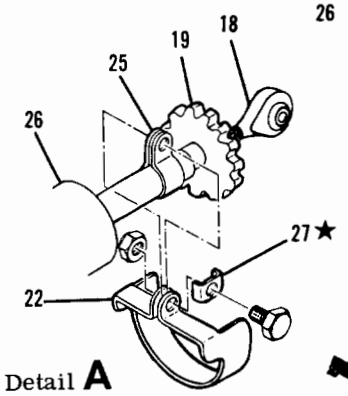
Due to remedy procedures in the following trouble shooting chart it may be necessary to re-rig system, refer to paragraph 11-8.

TROUBLE	PROBABLE CAUSE	REMEDY
FALSE READING ON TRIM POSITION INDICATOR.	Improper rigging.	Refer to paragraph 11-8.
	Worn, bent or disconnected linkage.	Check visually. Repair or replace parts as necessary.
HARD OR SLUGGISH OPERATION OF TRIM WHEEL.	Worn, bent or binding linkage.	Check visually. Repair or replace parts as necessary.
	Incorrect rudder cable tension.	Check and adjust rudder cable tension.
FULL TRIM TRAVEL NOT OBTAINED.	Rudder trim system improperly rigged.	Refer to paragraph 11-8.

✱ Use washers as required to eliminate end play.

✱ Stake both ends prior to P20600619 and U20601444. Safety wire P20600619 and U20601444 and on.





Detail A

★ Beginning with aircraft serials P206-0532 and U206-1237 (Install with legs around guard ends.)

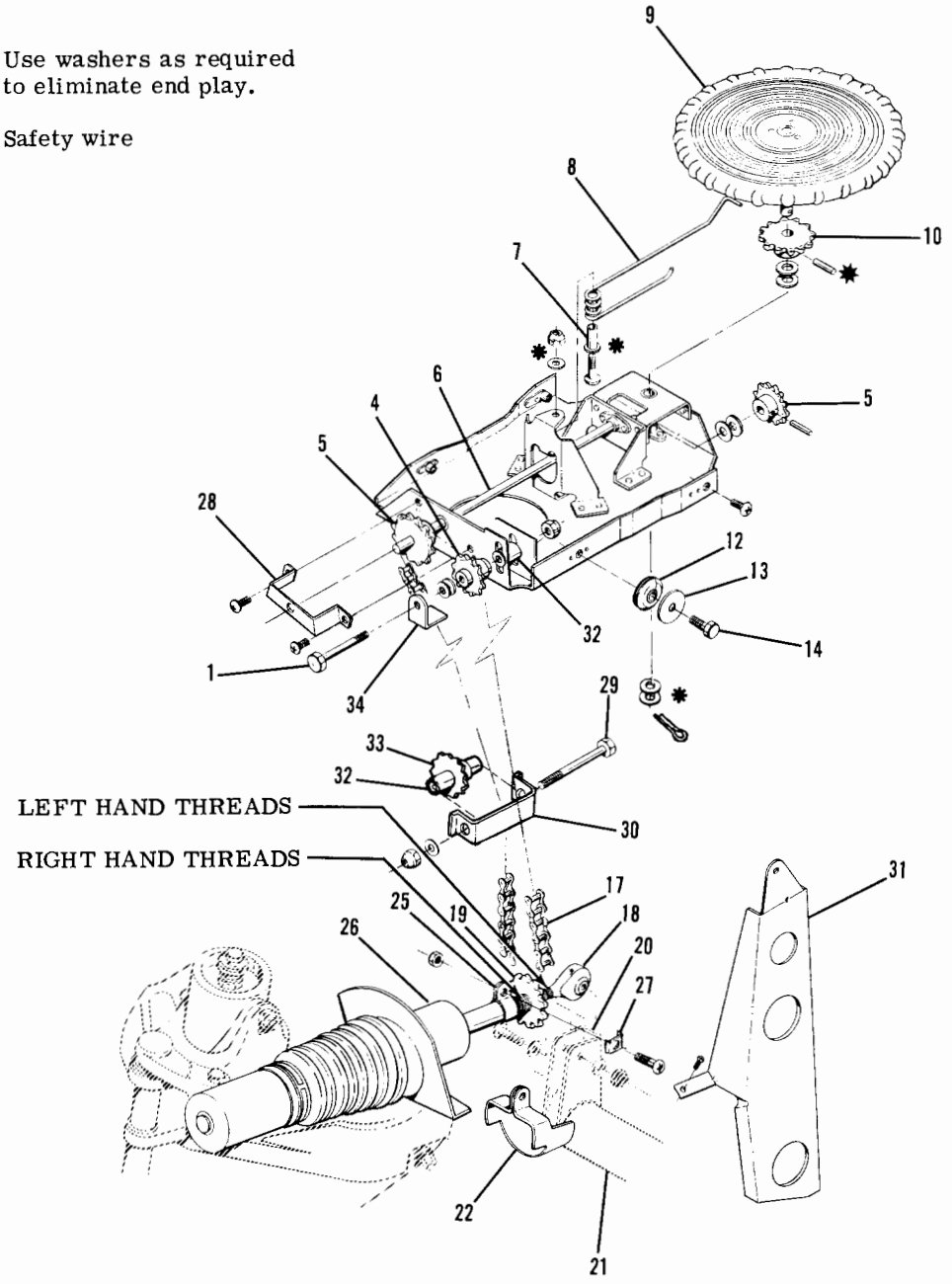
THRU AIRCRAFT SERIAL U20602579

1. Bolt
2. Washer
3. Bushing
4. Idler Sprocket
5. Sprocket
6. Shaft
7. Bushing
8. Indicator
9. Trim Wheel
10. Sprocket
11. Spacer
12. Grommet
13. Washer
14. Bolt
15. Cotter Pin
16. Bushing
17. Chain
18. Rod End
19. Sprocket
20. Rudder Bar Arm
21. Rudder Bar
22. Chain Guard
23. Retainer
24. Boot
25. Clamp
26. Bungee
27. Stop
28. Guard
29. Bolt
30. Chain Guard
31. Chain Guard
32. Bushing
33. Idler Sprocket
34. Guard

Figure 11-1. Rudder Trim Control System (Sheet 1 of 2)

✸ Use washers as required to eliminate end play.

✸ Safety wire



BEGINNING WITH AIRCRAFT SERIAL U20602580

Figure 11-1. Rudder Trim Control System (Sheet 2 of 2)

11-4. STEERING BUNGEE. (Refer to figure 11-1.)

11-5. REMOVAL AND INSTALLATION. (Refer to figure 11-1).

a. Thru Aircraft Serial U20602579.

1. Remove pedestal cover in accordance with Section 9.

2. Remove pilot's rudder bar shield.

3. Loosen bolt (1) securing idler sprocket (4), slide idler sprocket in the adjustment slot to release tension on chain (17).

4. Disconnect steering bungee adjustable rod end (18) from rudder bar arm (20).

5. Remove chain guard (22) and disengage chain (17) from sprocket (19).

6. Remove clamp (25) at bungee (26).

NOTE

The nose gear must be removed to allow access to steering bungee. Refer to Section 5 for nose gear removal.

7. Reverse the preceding steps for reinstallation. Rig nosewheel steering and rudder trim system in accordance with paragraph 10-11 and 11-8 respectively.

b. Beginning with Aircraft Serial U20602580.

1. Remove pedestal cover in accordance with Section 9.

2. Remove chain guard (31).

3. Complete steps 3 thru 7 under subparagraph a.

11-6. TRIM WHEEL. (Refer to figure 11-1.)

11-7. REMOVAL AND INSTALLATION.

a. Remove pedestal cover in accordance with Section 9.

b. Remove cotter pin (15) and washers.

c. Lift trim wheel (9) up and out using care not to drop washers or bend indicator (8).

NOTE

Removal of sprocket (10) from trim wheel shaft is not recommended except for replacement of parts.

d. Reverse the preceding steps for reinstallation.

11-8. RIGGING.

a. Remove pedestal cover in accordance with Section 9.

b. Remove pilot's rudder bar shield.

c. Disconnect steering bungee rod end (18) at rudder bar arm (20).

d. Tie down or weight tail to raise nosewheel free of ground.

e. Extend strut and ensure nose gear is centered against the external centering stop.

f. Loosen bolt (1) securing idler sprocket (4), slide idler sprocket in the adjustment slot and disengage chain (17) from sprocket (19).

g. Clamp rudder pedals in neutral position.

NOTE

Rudder control system MUST be correctly rigged prior to rigging trim system.

h. Screw bungee sprocket (19) in against bungee shaft, then screw rod end (18) in against sprocket (19) to obtain bungee shortest length.

i. Holding rod end (18) to prevent turning, rotate sprocket (19) until hole in rod end aligns exactly with attaching hole on rudder bar arm (20) and connect.

j. Engage chain (17) on sprockets and tighten idler sprocket (4) so chain is taut but not tight.

k. Remove clamps and run trim wheel (9) through its full range of travel, observing full indicator (8) travel is reached before full bungee extension or contraction.

l. Lower nose gear to ground and install all parts removed for access.

WARNING

Be sure rudder moves in the correct direction when operating trim wheel.

SECTION 12

ENGINE

(NORMALLY ASPIRATED)
REFER TO SECTION 12A FOR TURBOCHARGED ENGINE

TABLE OF CONTENTS

12-1. ENGINE COWLING.

12-2. DESCRIPTION. The engine cowling is divided into four major removable segments. The left upper cowling segment has two access doors, one at the upper front provides access to the oil filler neck and one at the left aft side provides access to the oil dipstick. The right and left nose caps are fastened to the lower engine nacelle and to each other with screws. The right and left upper cowl segments are secured with quick-release fasteners and either segment may be removed individually. The lower engine nacelle is an extension of the fuselage.

12-3. REMOVAL AND INSTALLATION.

a. Release the quick-release fasteners attaching the cowling to the fuselage and at the parting surfaces of the left and right segments.

b. Remove screws securing the left and right nose cap together and to the lower engine nacelle.

c. Disconnect air ducts from nose caps and remove caps.

d. Reverse the preceding steps for reinstallation. Ensure the baffle seals are turned in the correct direction to confine and direct air flow around the engine. The vertically installed seals must fold forward and the side seals must fold upwards.

12-4. CLEANING AND INSPECTION. Wipe the inner surfaces of the cowling segments with a clean cloth saturated with cleaning solvent (Stoddard or equivalent). If the inside surface of the cowling is coated heavily with oil or dirt, allow solvent to soak until foreign material can be removed. Wash painted surfaces of the cowling with a solution of mild soap and water and rinse thoroughly. After washing, a coat of wax may be applied to the painted surfaces to prolong paint life. After cleaning, inspect cowling for dents, cracks, loose rivets and spot welds. Repair all defects to prevent spread of damage.

12-5. REPAIR. If cowling skins are extensively damaged, new complete sections of the cowling should be installed. Standard insert-type patches may be used for repair if repair parts are formed to fit contour of cowling. Small cracks may be stop-drilled and small dents straightened if they are reinforced on the inner surface with a doubler of the same material as the cowling skin. Damaged reinforcement angles should be replaced with new parts. Due to their small size, new reinforcement angles are easier to install than to repair the damaged part.

12-6. COWL FLAPS.

12-7. DESCRIPTION. Cowl flaps are provided to aid in controlling engine temperature. Two cowl flaps, operated by a single control in the cabin, are located at the lower aft end of the engine nacelle. The engine exhaust tailpipes extend through cutouts in the aft portion of each cowl flap.

12-8. REMOVAL AND INSTALLATION. (Refer to figure 12-1.)

a. Place control lever (2) in the OPEN position.

b. Disconnect control clevises (13) from shock-mounts (14).

c. Remove safety wire securing hinge pins (9) to cowl flaps, pull pins from hinges and remove flaps.

d. Reverse the preceding steps for reinstallation.

NOTE

AIRCRAFT SERIALS THRU U20601775. When cowl flap lever assembly is replaced, the new part will be in a straight condition. It is necessary to bend cowl flap lever (2) assembly to position knob $\mathcal{L}$ 2.00" inboard of the knob position when lever assembly projects straight aft.

Rig cowl flaps, if necessary, in accordance with paragraph 12-9.

12-9. RIGGING. (Refer to figure 12-1.)

a. Disconnect control clevises (13) from shock-mounts (14).

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 control lever (2) in the CLOSED position. If the control lever cannot be placed in the closed position, loosen clamp (5) at upper end of controls and slip housings in clamp or adjust controls at upper clevis (4) to position control lever in bottom hole of position bracket (3).

d. With the control lever in CLOSED position, hold one cowl flap closed (against the rubber bumpers on the fuselage), loosen jam nut and adjust clevis (13) on the control to hold cowl flap in this position and install bolt.

NOTE

If the lower control clevis (13) cannot be adjusted far enough to streamline flap and still maintain sufficient thread engagement, loosen the lower control housing clamp (8) and slide housing in clamp as necessary. Be sure threads are visible in clevis inspection holes.

e. Repeat the preceding step for the opposite cowl flap. Cowl flaps should open approximately 5.00 inches when measured in a straight line from the aft edge of cowl flap, just outboard of cutout to lower edge of firewall.

g. Check that all clamps and jam nuts are tight.

12-10. ENGINE.

12-11. DESCRIPTION. An air cooled, wet-sump, six-cylinder, horizontally-opposed, direct-drive, fuel injected, Continental IO-520 series engine driving a constant-speed propeller is used to power the aircraft. The cylinders, numbered from rear to front are staggered to permit a separate throw on the crankshaft for each connecting rod. The right rear cylinder is number 1 and cylinders on the right side are identified by odd numbers 1, 3 and 5. The left rear cylinder is number 2 and the cylinders on the left side are identified as numbers 2, 4 and 6. Refer to paragraph 12-12 for engine data. For repair and overhaul of the engine, accessories and propeller, refer to the appropriate publications issued by their manufacturer's. These publications are available from the Cessna Service Parts Center.

12-12. ENGINE DATA.

Aircraft Series	P206	U206
Model (Continental)	IO-520-A	IO-520-F
BHP at RPM	285 at 2700	
BHP Maximum for Take-Off (5 Minutes) at RPM		300 2850
BHP Maximum Except Take-Off RPM (Max. Continuous)		285 2700
Number of Cylinders	6-Horizontally Opposed	Same
Displacement	520 Cubic Inches	Same
Bore	5.25 Inches	Same
Stroke	4.00 Inches	Same
Compression Ratio	8.5:1	Same
Magnetos	Slick Model No. 662	Same
Right Magneto	Fires 22° BTC Upper Right and Lower Left	Same
Left Magneto	Fires 22° BTC Upper Left and Lower Right	Same
Firing Order	1-6-3-2-5-4	Same
Spark Plugs	18 MM (Refer to current Continental active factory approved spark plug chart.)	Same
Torque	330 ±30 LB-IN.	Same
Fuel Metering System	Continental Fuel Injection	Same
Unmetered Fuel Pressure	9.0 to 11.0 PSI at 600 RPM 29.0 to 32.0 PSI at 2700 RPM	Same 31.0 to 33.0 PSI at 2850 RPM
Oil Sump Capacity	12 U.S. Quarts	Same
With External Filter	13 U.S. Quarts	Same
Tachometer	Mechanical Drive	Same
Oil Pressure (PSI)		
Minimum Idling	10	Same
Normal	30 to 60	Same
Maximum (Cold Oil Starting)	100	Same
Connection Location	Between No. 2 and No. 4 Cylinders	Same
Oil Temperature		
Normal Operating	Within Green Arc	Same
Maximum Permissible	Red Line (240°F)	Same
Probe Location	Below Oil Cooler	Same
Cylinder Head Temperature		
Normal OPerating	Within Green Arc	Within Green Arc
Maximum	Red Line (460° F.)	Red Line (460° F.)
Probe Location	Lower side of Number 1 Cylinder	Lower Side of Number 1 Cylinder thru 1973, Number 2 Cylinder on 1974, and Number 3 Cylinder on 1975 Models. On U20602581 thru 02588, 02590 thru 02693, 02695 thru 02728, 02730 thru 02752, 02754, 02755, 02757 thru 02759, 02763 thru 02766, 02768, 02769, 02774, 02777, 02778, 02781, 02782, 02786, 02790, 02792,

		02796, Refer to Cessna Single-Engine Service Letter SE75-12 Dated June 27, 1975.
Approximate Dry Weight	471 LB. (Weight is approximate and will vary with optional accessories installed.)	Same

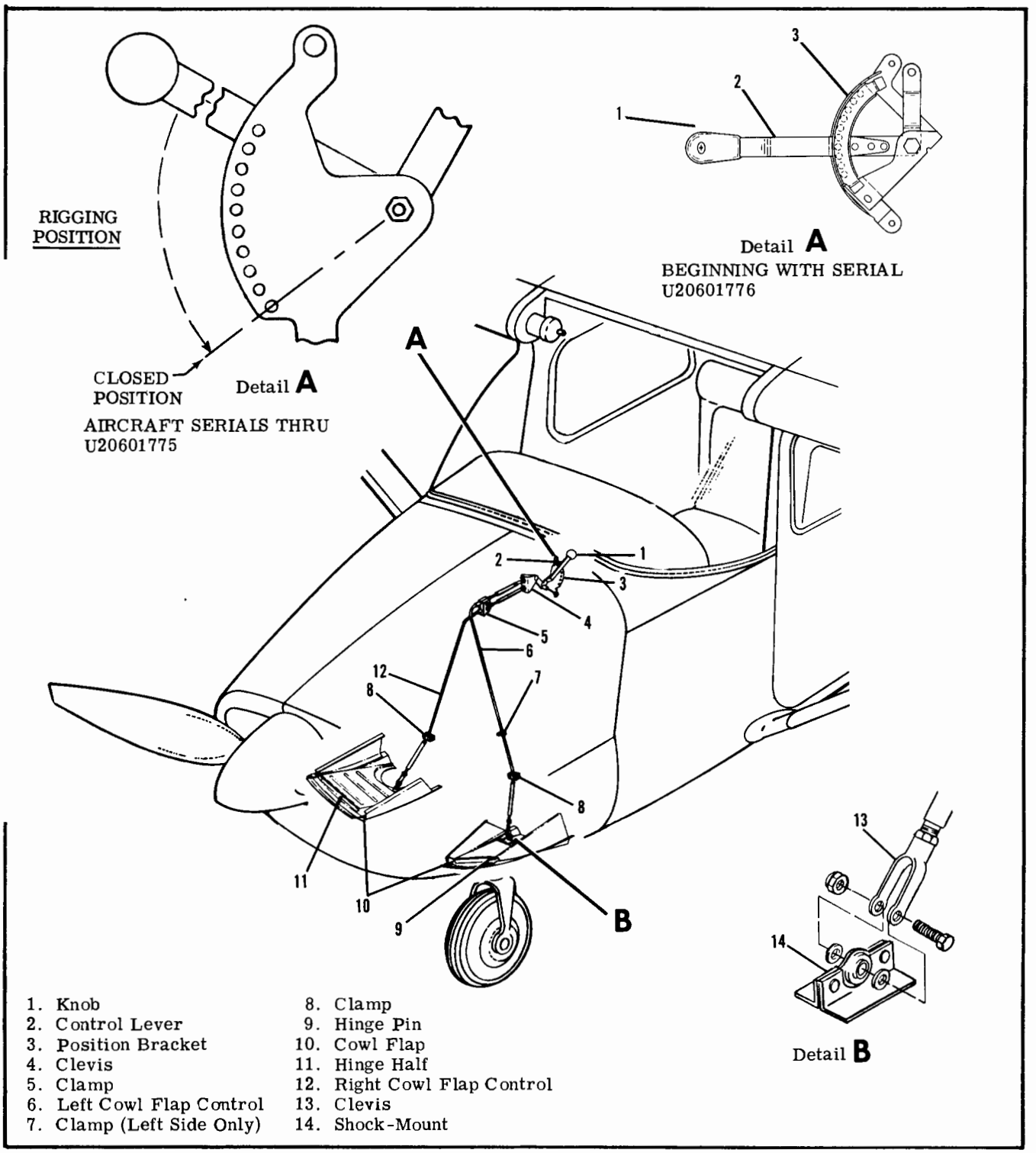
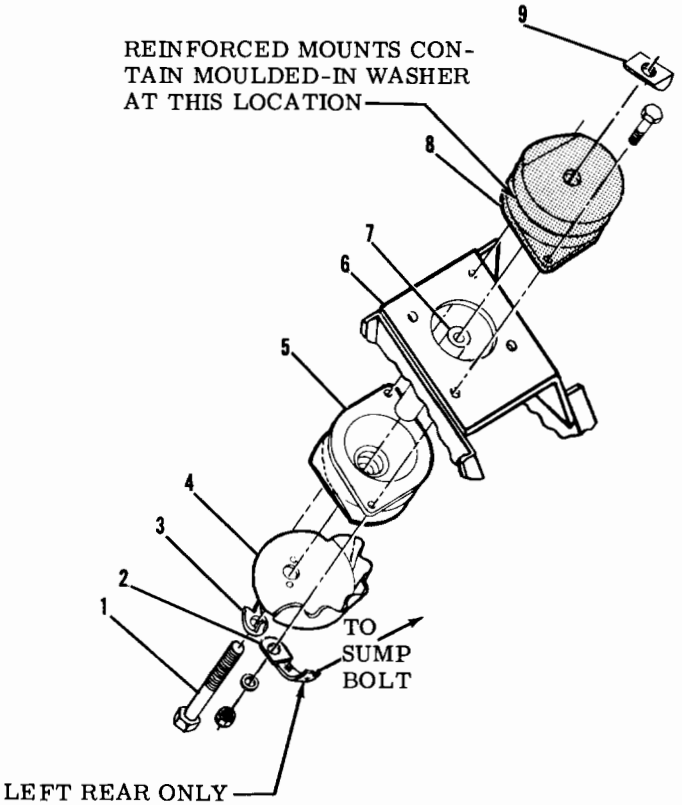


Figure 12-1. Cowl Flaps Installation



Detail **A**

NOTE

BEGINNING WITH AIRCRAFT SERIAL * P20600604 & U20601445 ON NON-TURBOCHARGED ENGINES.

NOTES

ON ALL MODELS:

It is important that the correct engine mounts be installed in the correct positions. Install upper mounts with beveled edge at the top, except as noted below for turbocharged engines. Install lower mounts with beveled edge at the front, except as noted below for turbocharged engines. In addition, be sure that the two reinforced mounts are used at the upper, forward positions.

To determine which two of the eight mounts are the reinforced ones, use fingernail to feel whether moulded-in washer is present.

Torque bolts (1) to 300 +50 -00 lb-in.

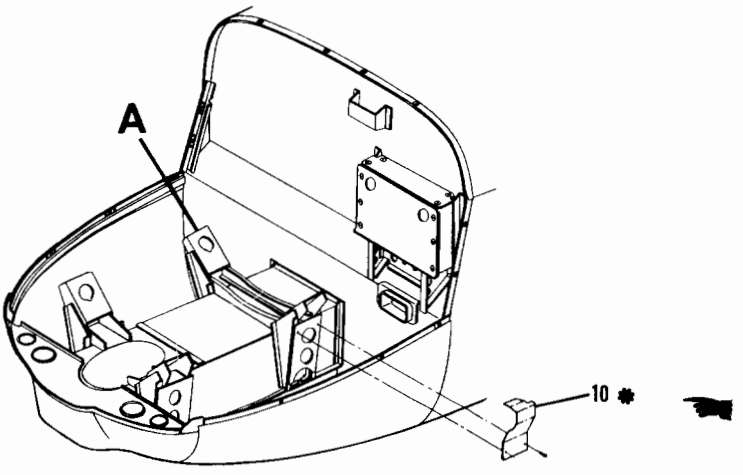
ON TURBOCHARGED ENGINES:

Barrel nuts (9) are replaced with turbine support shafts at the right mounts of turbocharged engines.

Heat shields (10) replace heat deflectors (4) on turbocharged engines.

Install left, forward, lower mount with beveled edges at the front and at the top on turbocharged engines.

If shock-mounts will be re-used, mark each one so it will be reinstalled in exactly the same position. If new shock-mounts will be installed, position them as noted above.



1. Bolt
2. Ground Strap
3. Tab Lockwasher
4. Heat Deflector
5. Lower Mount
6. Engine Mount Support
7. Spacer
8. Upper Mount
9. Barrel Nut
10. Heat Shield

Figure 12-2. Engine Mount Installation

12-13. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE FAILS TO START.	Improper use of starting procedure.	Review starting procedure. Refer to Owner's Manual.
	Defective aircraft fuel system.	Refer to Section 13.
	Spark plugs fouled.	Remove and clean. Check gaps and insulators. Use new gaskets. Check cables to persistently fouled plugs.
	Defective magneto switch or grounded magneto leads.	Check continuity, repair or replace switch or leads.
	Defective ignition system.	Refer to paragraph 12-79.
	Excessive induction air leaks.	Check visually. Correct cause of air leaks.
	Dirty screen in fuel control unit or defective fuel control unit.	Check screen visually. Check fuel flow through control unit. Replace defective fuel control unit.
	Defective electric fuel pump.	Refer to Section 13.
	Defective fuel manifold valve or dirty screen.	Check fuel flow through valve. Remove and clean. Replace if defective.
	Clogged fuel injection lines or discharge nozzles.	Check fuel through lines and nozzles. Clean lines and nozzles. Replace if defective.
	Fuel pump not permitting fuel from auxiliary pump to bypass.	Check fuel flow through engine-driven fuel pump. Replace engine-driven pump.
	Vaporized fuel in system.	Refer to paragraph 12-100.
	Fuel tanks empty.	Visually inspect tanks. Fill with proper grade and quantity of gasoline.
	Fuel contamination or water in fuel system.	Open fuel strainer drain and check for water. Drain all fuel and flush out fuel system. Clean all screens, fuel lines, strainer, etc.
	Mixture control in the IDLE CUT-OFF position.	Move control to the full RICH position.
	Engine flooded.	Refer to paragraph 12-100.
	Fuel selector valve in OFF position.	Place selector valve in the ON position to a cell known to contain gasoline.

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE STARTS BUT DIES, OR WILL NOT IDLE.	Idle stop screw or idle mixture incorrectly adjusted.	Refer to paragraph 12-46.
	Spark plugs fouled or improperly gapped.	Remove, clean and regap plugs. Replace if defective.
	Water in fuel system.	Open fuel strainer drain and check for water. If water is present, drain fuel tank sumps, lines and strainer.
	Defective ignition system.	Refer to paragraph 12-79.
	Vaporized fuel. (Most likely to occur in hot weather with a hot engine.)	Refer to paragraph 12-100.
	Induction air leaks.	Check visually. Correct the cause of leaks.
	Manual primer leaking.	Disconnect primer outlet line. If fuel leaks through primer, repair or replace primer.
	Dirty screen in fuel control unit or defective fuel control unit.	Check screen visually. Check fuel flow through control unit. Clean screen. Replace fuel control unit if defective.
	Defective manifold valve or clogged screen.	Check fuel flow through valve. Replace if defective. Clean screen.
	Defective engine-driven fuel pump.	If engine continues to run with electric pump turned on, but stops when it is turned off, the engine-driven pump is defective. Replace pump.
	Defective engine.	Check compression. Listen for unusual engine noises. Engine repair is required.
	Propeller control set in high pitch position (low rpm).	Use low pitch (high rpm) position for all ground operation.
	Defective aircraft fuel system.	Refer to Section 13.
	Restricted fuel injection lines or discharge nozzles.	Check fuel flow through lines and nozzles. Clean lines and nozzles. Replace if defective.
ENGINE RUNS ROUGHLY, WILL NOT ACCELERATE PROPERLY, OR LACKS POWER.	Propeller control in high pitch (low rpm) position.	Use low pitch (high rpm) for all ground operations.
	Restriction in aircraft fuel system.	Refer to Section 13.
	Restriction in fuel injection system.	Clean system. Replace any defective units.

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE RUNS ROUGHLY, WILL NOT ACCELERATE PROPERLY, OR LACKS POWER. (Cont.)	Engine-driven fuel pump pressure improperly adjusted.	Refer to paragraph 12-61.
	Worn or improperly rigged throttle or mixture control.	Check visually. Rig properly. Replace worn linkage.
	Spark plugs fouled or improperly gapped.	Clean and regap. Replace if defective.
	Defective ignition system.	Refer to paragraph 12-79.
	Defective engine.	Check compression. Listen for unusual engine noises. Engine repair is required.
POOR IDLE CUT-OFF.	Worn or improperly rigged mixture control.	Rig properly. Replace worn linkage.
	Defective or dirty manifold valve.	Operate electric fuel pump and check that no fuel flows through manifold valve with mixture control in IDLE CUT-OFF. Remove and clean. Replace if defective.
	Fuel leakage through primer.	Repair or replace primer.
	Auxiliary fuel pump ON.	Turn to OFF position.
	Defective fuel control unit.	If none of the preceding causes corrects the problem, the control unit is probably at fault. Replace control unit.

12-14. REMOVAL. If an 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 storage preparation. The following engine removal procedure is based upon the engine being removed from the aircraft with the lines and hoses being disconnected at the firewall.

NOTE

Tag each item when disconnected to aid in identifying wires, hoses, lines and control linkages when engine is reinstalled. Likewise, shop notes made during removal will often clarify reinstallation. Protect openings, exposed as a result of removing or disconnecting units, against entry of foreign material by installing covers or sealing with tape.

a. Place all cabin switches in the OFF position.
b. Place fuel selector valve in the OFF position.
c. Remove engine cowling in accordance with paragraph 12-3.
d. Disconnect battery cables and insulate terminals as a safety precaution.
e. Drain fuel strainer and lines with strainer drain control.

NOTE

During the following procedures, remove any clamps or lacings which secure controls, wires, hoses or lines to the engine, engine nacelle or attached brackets, so they will not interfere with engine removal. Some of the items listed can be disconnected at more than one place. It may be desirable to disconnect some of these items at other than the places indicated. The reason for engine removal should be the governing factor in deciding at which point to disconnect them. Omit any of the items which are not present on a particular engine installation.

f. Drain the engine oil sump and oil cooler.
g. Disconnect magneto primary lead wires at magnetos.

WARNING

The magnetos are in a SWITCH ON condition when the switch wires are disconnected. Ground the magneto points or remove the high tension wires from the magnetos or spark plugs to prevent accidental firing.

h. Remove the spinner and propeller in accordance with Section 14. Cover exposed end of crankshaft flange and propeller flange to prevent entry of foreign material.

i. Disconnect throttle, mixture and propeller controls from their respective units. Remove clamps attaching controls to engine and pull controls aft clear of engine. Use care to avoid bending controls too sharply. Note EXACT position, size and number of attaching washers and spacers for reference on reinstallation.

j. Disconnect all hot and cold air flexible ducts and remove.

k. Remove exhaust system in accordance with paragraph 12-96.

l. Disconnect wires and cables as follows:

1. Disconnect tachometer drive shaft at adapter.

CAUTION

When disconnecting starter cable do not permit starter terminal bolt to rotate. Rotation of the bolt could break the conductor between bolt and field coils causing the starter to be inoperative.

2. Disconnect starter electrical cable at starter.
3. Disconnect cylinder head temperature wire at probe.
4. Disconnect oil temperature wire at probe below oil cooler.
5. Disconnect electrical wires and wire shielding ground at alternator.
6. Disconnect exhaust gas temperature wires at quick-disconnects.
7. Disconnect electrical wires at throttle microswitch.
8. Disconnect fuel strainer drain control from strainer.
9. Remove all clamps and lacings attaching wires or cables to engine and pull wires and cables aft to clear engine.

m. Disconnect lines and hoses as follows:

1. Disconnect vacuum hose at firewall.
2. Disconnect oil breather and vacuum system oil separator vent lines where secured to the engine.

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.

3. Disconnect fuel supply and vapor return hoses at fuel pump.
4. Disconnect primer line at firewall fitting.
5. Disconnect fuel-flow gage hose at firewall.
6. Disconnect oil pressure line at firewall fitting.
7. Disconnect manifold pressure hose at firewall.
8. Disconnect manifold and balance tube drain lines.

n. Carefully check the engine again to ensure ALL hoses, lines, wires, cables, clamps and lacings are disconnected or removed which would interfere with the engine removal. Ensure all wires, cables and engine controls have been pulled aft to clear the engine.

CAUTION

Place a suitable stand under tail tie-down ring before removing engine. The loss of engine weight will cause the aircraft to be tail heavy.

o. Attach a hoist to the lifting lug at the top center of the engine crankcase. Lift engine just enough to relieve the weight from the engine mounts.

p. Remove bolts, ground strap and heat deflectors.

q. Slowly hoist engine out of nacelle and clear of aircraft checking for any items which would interfere with the engine removal. Balance the engine by hand and carefully guide the disconnected parts out as the engine is removed.

r. Remove engine shock-mounts.

NOTE

If shock-mounts will be re-used, mark each one so it will be reinstalled in exactly the same position. If new shock-mounts will be installed, position them as illustrated in figure 12-2.

12-14A. 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 2775 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 14 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 or 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 conditions.

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).

12-15. 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, etc. Protect these components before saturating the engine with solvent. 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.

12-16. 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 foreign material. If suitable covers are not available, tape may be used to cover the openings.

12-17. INSPECTION. For specific items to be inspected, refer to the 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.

12-18. BUILD-UP. Engine build-up consists of installation of parts, accessories and components to the basic engine to build up an engine unit ready for installation on the aircraft. All safety wire, lockwashers, nuts, gaskets and rubber connections should be new parts.

12-19. INSTALLATION. Before installing the engine on the aircraft, install any items which were removed from the engine or aircraft after the engine was removed.

NOTE

Remove all protective covers, plugs, caps and identification tags as each item is connected or installed. Omit any items not present on a particular engine installation.

a. Hoist the engine to a point just above the nacelle.

b. Install engine shock-mounts and ground strap as illustrated in figure 12-2.

c. Carefully lower engine slowly into place on the engine mounts. Route controls, lines, hoses and wires in place as the engine is positioned on the engine mounts.

NOTE

Be sure engine shock-mounts, spacers and washers are in place as the engine is lowered into position.

d. Install engine-to-mount bolts, then remove the hoist and support stand placed under tail tie-down fitting. Torque bolts to 300+50-00 lb-in.

e. Route throttle, mixture and propeller controls to their respective units and connect. Secure controls in position with clamps.

NOTE

Throughout the aircraft fuel system, from the fuel cells to the engine-driven pump, use NS-40 (RAS-4) (Snap-On-Tools Corp., Kenosha, Wisconsin), MIL-T-5544 (Thread Compound Antiseize, Graphite Petrolatum), USP Petrolatum or engine oil as a thread lubricator or to seal a leaking connection. Apply sparingly to male threads only, omitting the first two threads, exercising extreme caution to avoid "stringing" sealer across the end of the fitting. Always ensure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system.

f. Connect lines and hoses as follows:

1. Connect manifold and balance tube drain lines.
2. Connect manifold pressure hose at firewall.
3. Connect oil pressure line at firewall fitting.
4. Connect fuel-flow gage hose at firewall.
5. Connect primer line at firewall fitting.
6. Connect fuel supply and vapor return hose at firewall.
7. Connect oil breather and vacuum system oil separator vent lines where secured to the engine.
8. Connect vacuum hose at firewall.
9. Install clamps and lacings securing hoses and lines to the engine to prevent chafing.

g. Connect wires and cables as follows:

1. Connect electrical wires and wire shielding ground at alternator.
2. Connect cylinder head temperature wire at probe.

CAUTION

When connecting starter cable, do not permit starter terminal bolt to rotate. Rotation of the bolt could break the conductor between bolt and field coils causing the starter to be inoperative.

3. Connect starter electrical cable at starter.
4. Connect tachometer drive shaft at adapter. Be sure drive cable engages drive in adapter. Torque housing attach nut to 100-lb-in.
5. Connect exhaust gas temperature wires at quick-disconnects.
6. Connect electrical wires at throttle micro-switch.
7. Connect oil temperature wire to probe below oil cooler.
8. Connect fuel strainer drain control to strainer.
9. Install clamps and lacings securing wires and cables to engine, engine mount and brackets.

h. Install exhaust system in accordance with paragraph 12-96.

i. Connect all hot and cold air flexible ducts.

j. Install propeller and spinner in accordance with instructions outlined in Section 14.

k. Complete a magneto switch ground-out and continuity check, then connect primary lead wires to the magnetos. Remove the temporary ground or connect spark plug leads, whichever procedure was used during removal.

WARNING

Be sure magneto switch is in OFF position when connecting switch wires to magnetos.

l. Clean and install induction air filter in accordance with Section 2.

m. 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.

n. Check all switches are in the OFF position and connect battery cables.

o. Rig engine controls in accordance with paragraphs 12-85, 12-86 and 12-87.

p. Inspect engine installation for security, correct routing of controls, lines, hoses and electrical wiring, proper safetying and tightness of all components.

q. Install engine cowling in accordance with paragraph 12-3.

r. Perform an engine run-up and make final adjustments on the engine controls.

12-20. FLEXIBLE FLUID HOSES.

12-21. 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. Operate the auxiliary fuel pump in the high 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 12-17 for detailed inspection procedures for flexible hoses.

12-22. 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, Chapter 10, for additional installation procedures for flexible fluid hose assemblies.

12-23. ENGINE BAFFLES.

12-24. DESCRIPTION. The sheet metal baffles installed on the engine direct 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. The vertical seals must fold forward and the side seals must fold upwards. Removal and installation of the various baffle segments is possible with the cowling removed. Be sure that any new baffles seal properly.

12-25. 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.

12-26. REMOVAL AND INSTALLATION. Removal and installation of the various baffle segments is possible with the cowling removed. Be sure that any replaced baffles and seals are installed correctly and that they seal to direct the airflow in the correct direction. Various lines, hoses, wires and controls are routed through some baffles. Make sure that these parts are reinstalled correctly after installation of baffles.

12-27. REPAIR. Repair of an individual segment of engine baffle is generally impractical, since, due to the small size and formed shape of the part, replacement is usually more economical. However, small cracks may be stop-drilled and a reinforcing doubler installed. Other repairs may be made as long as strength and cooling requirements are met. Replace sealing strips if they do not seal properly.

12-28. ENGINE OIL SYSTEM. (Refer to figure 12-3.)

12-29. DESCRIPTION. A wet-sump, pressure-lubricating oil system is employed in the engine. Oil under pressure from the oil pump is fed through drilled crankcase passages which supply oil to the crankshaft main bearings and camshaft bearings. Connecting rod bearings are pressure-lubricated through internal passages in the crankshaft. Valve mechanisms are lubricated through the hollow push-rods, which are supplied with oil from the crankcase oil passages. The propeller is supplied oil, boosted by the governor through the forward end of the crankshaft. Oil is returned by gravity to the engine oil sump. Cylinder walls and piston pins are spray-lubricated by oil escaping from connecting rod bearings. The engine is equipped with an oil cooler and a thermostat valve to regulate engine oil temperature. A pressure relief valve is installed to maintain proper oil pressure at higher engine speeds. Removable oil filter screens are provided within the oil system. An external, replaceable element oil filter is available as optional equipment. The engine may also be equipped with a non-congealing oil cooler.

SHOP NOTES:

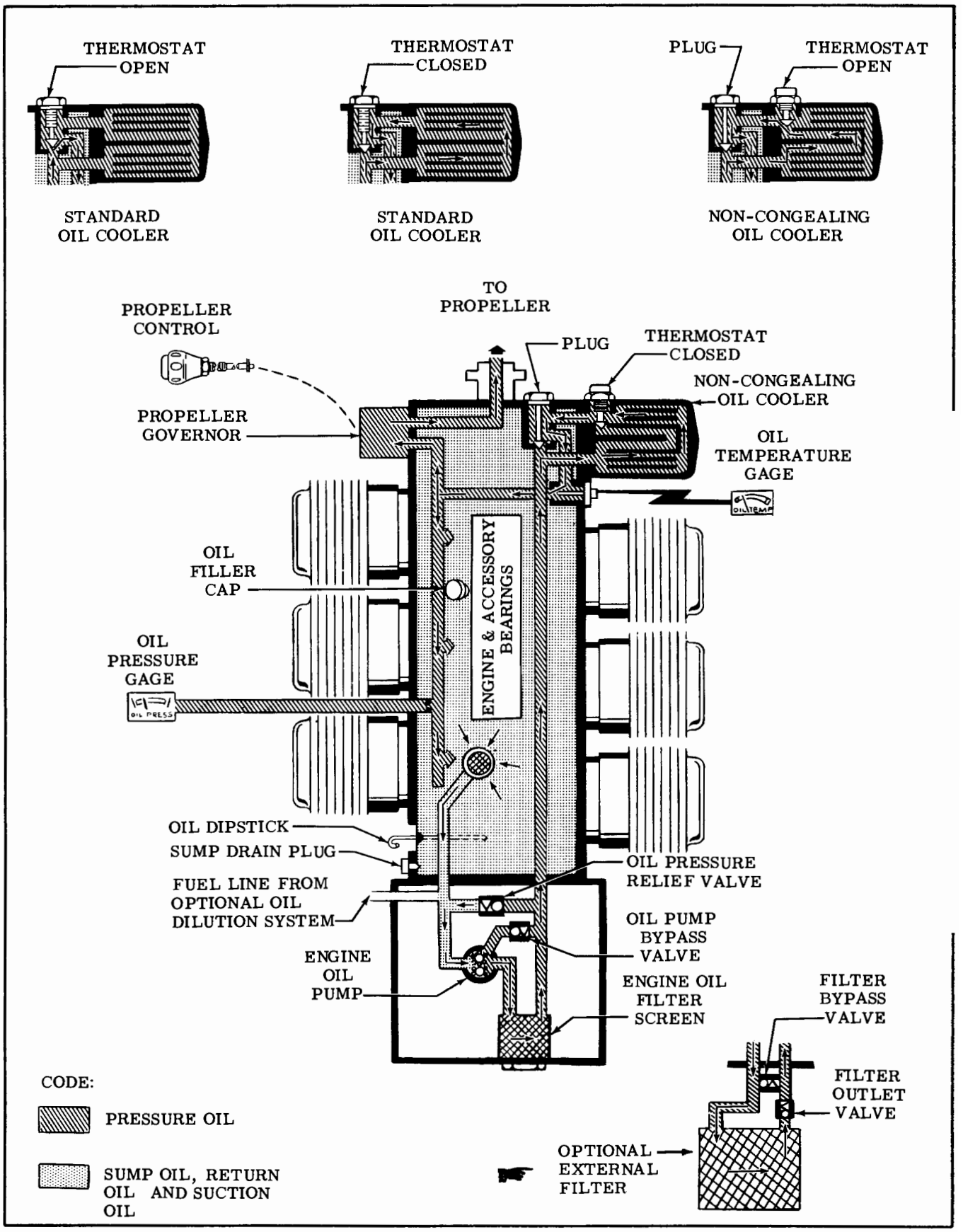


Figure 12-3. Oil System Schematic

12-30. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
NO OIL PRESSURE.	No oil in sump.	Check with dipstick. Fill sump with proper grade and quantity of oil. Refer to Section 2.
	Oil pressure line broken, disconnected or pinched.	Inspect pressure lines. Replace or connect lines as required.
	Oil pump defective.	Remove and inspect. Examine engine. Metal particles from damaged pump may have entered engine oil passages.
	Defective oil pressure gage.	Check with a known good gage. If second reading is normal, replace gage.
	Oil congealed in gage line.	Disconnect line at engine and gage; flush with kerosene. Pre-fill with kerosene and install.
	Relief valve defective.	Remove and check for dirty or defective parts. Clean and install; replace valve if defective.
LOW OIL PRESSURE.	Low oil supply.	Check with dipstick. Fill sump with proper grade and quantity of oil. Refer to Section 2.
	Low viscosity oil.	Drain sump and refill with proper grade and quantity of oil.
	Oil pressure relief valve spring weak or broken.	Remove and inspect spring. Replace weak or broken spring.
	Defective oil pump.	Check oil temperature and oil level. If temperature is higher than normal and oil level is correct, internal failure is evident. Remove and inspect. Examine engine. Metal particles from damaged pump may have entered oil passages.
	Secondary result of high oil temperature.	Observe oil temperature gage for high indication. Determine and correct reason for high oil temperature.
	Dirty oil screens.	Remove and clean oil screens.

12-30. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
HIGH OIL PRESSURE.	High viscosity oil.	Drain sump and refill with proper grade and quantity of oil.
	Relief valve defective.	Remove and check for dirty or defective parts. Clean and install; replace valve if defective.
	Defective oil pressure gage.	Check with a known good gage. If second reading is normal, replace gage.
LOW OIL TEMPERATURE.	Defective oil temperature gage or temperature bulb.	Check with a known good gage. If second reading is normal, replace gage. If reading is similar, the temperature bulb is defective.
	Oil cooler thermostatic bypass valve defective or stuck.	Remove valve and check for proper operation. Replace valve if defective.
HIGH OIL TEMPERATURE.	Oil cooler air passages clogged.	Inspect cooler core. Clean air passages.
	Oil cooler oil passages clogged.	Attempt to drain cooler. Inspect for sediment. Remove cooler and flush thoroughly.
	Thermostatic bypass valve damaged or held open by solid matter.	Feel front of cooler core with hand. If core is cold, oil is bypassing cooler. Remove and clean valve and seat. If still inoperative, replace.
	Low oil supply.	Check with dipstick. Fill sump with proper grade and quantity of oil. Refer to Section 2.
	Oil viscosity too high.	Drain sump and refill with proper grade and quantity of oil.
	Prolonged high speed operation on the ground.	Hold ground running above 1500 rpm to a minimum.
	Defective oil temperature gage.	Check with a known good gage. If second reading is normal. Replace gage.
	Defective oil temperature bulb.	Check for correct oil pressure, oil level and cylinder head temperature. If they are correct, check oil temperature gage for being defective; if similar reading is observed, bulb is defective. Replace bulb.

12-30. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
HIGH OIL TEMPERATURE (Cont.)	Secondary effect of low oil pressure.	Observe oil pressure gage for low indication. Determine and correct reason for low oil pressure.
	Oil congealed in cooler.	This condition can occur only in extremely cold temperatures. If congealing is suspected, use an external heater or a heated hangar to warm the congealed oil.
OIL LEAK AT FRONT OF ENGINE.	Damaged crankshaft seal.	Replace.
OIL LEAK AT PUSH ROD HOUSING.	Damaged push rod housing oil seal.	Replace.

12-31. FULL-FLOW OIL FILTER.

12-32. DESCRIPTION. An external oil filter may be installed on the engine. The filter and filter adapter replace the regular engine oil pressure screen. The filter adapter incorporates a bypass valve which will open allowing pressure oil from the oil pump to flow to the engine oil passages if the filter element should become clogged.

12-33. REMOVAL AND INSTALLATION. (Refer to figure 12-4.)

NOTE

Filter element replacement kits are available from the Cessna Service Parts Center.

a. Remove engine cowling in accordance with paragraph 12-3.
b. Remove both safety wires from filter can and unscrew hollow stud (1) to detach filter assembly from adapter (12) as a unit. Remove filter assembly from aircraft and discard gasket (10). Oil will drain from filter as assembly is removed from adapter.
c. Press downward on hollow stud (1) to remove from filter element (5) and can (4). Discard metal gasket (2) on stud (1).
d. Lift lid (7) off filter can (4) and discard lower gasket (6).
e. Pull filter element (5) out of filter can (4).

NOTE

Before discarding removed filter element (5), 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 (7), hollow stud (1) and filter can (4) in solvent and dry with compressed air.

NOTES

When installing a new filter element (5), 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 (1). 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.

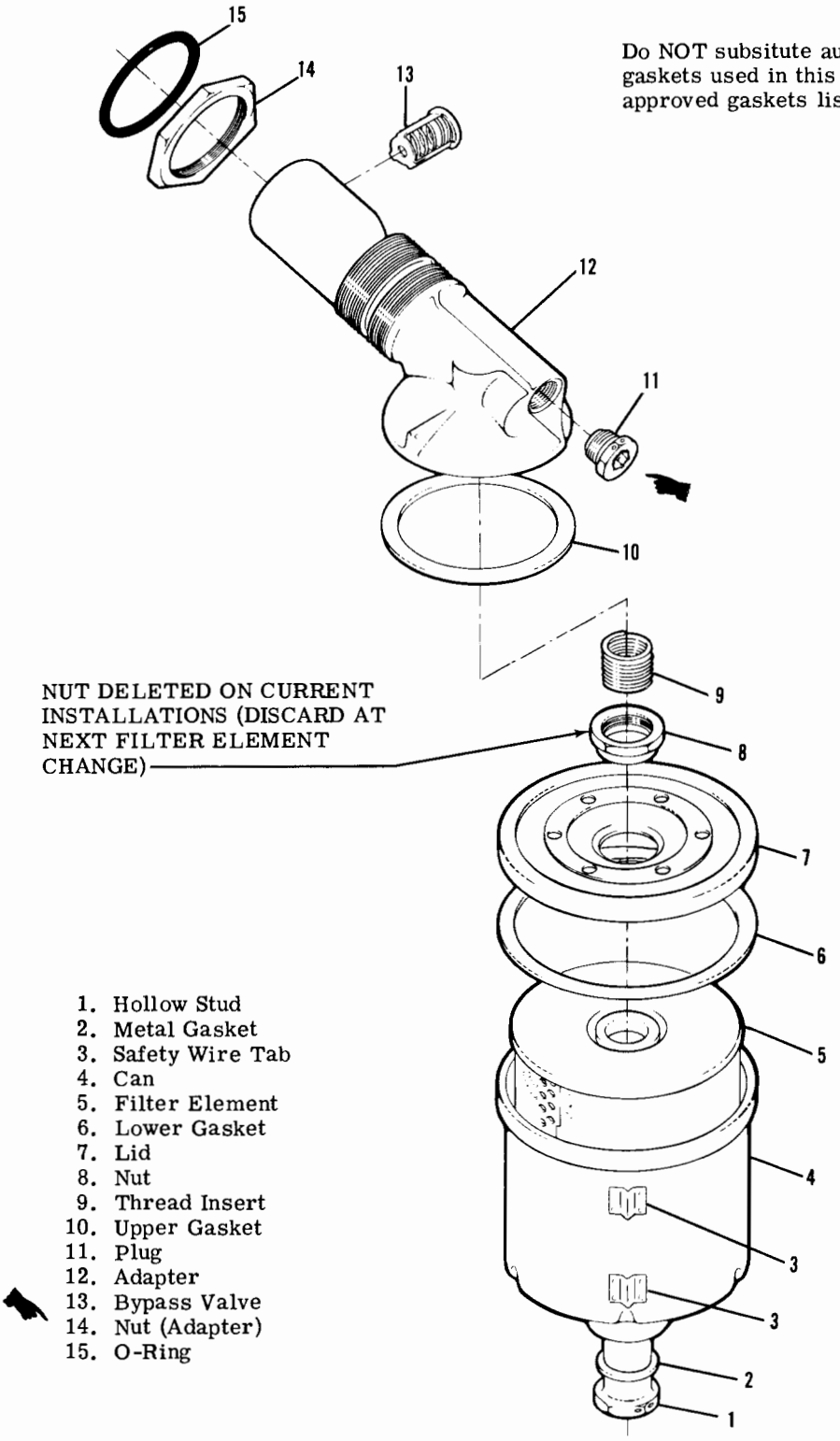
- Lubricate all rubber grommets in the new filter element, lid gaskets and metal gasket with clean engine oil or general purpose grease before installation. Dry gaskets may cause false torque readings, again resulting in oil leakage.

- 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 exist.

- After installing a new gasket on lid, turn lid over. If gaskets falls, try a different gasket and repeat test. If this gasket falls off, install a new lid.

NOTE

Do NOT subsitute automotive gaskets for any gaskets used in this assembly. Use only approved gaskets listed in the Parts Catalogs.



1. Hollow Stud
2. Metal Gasket
3. Safety Wire Tab
4. Can
5. Filter Element
6. Lower Gasket
7. Lid
8. Nut
9. Thread Insert
10. Upper Gasket
11. Plug
12. Adapter
13. Bypass Valve
14. Nut (Adapter)
15. O-Ring

Figure 12-4. Full-Flow Oil Filter

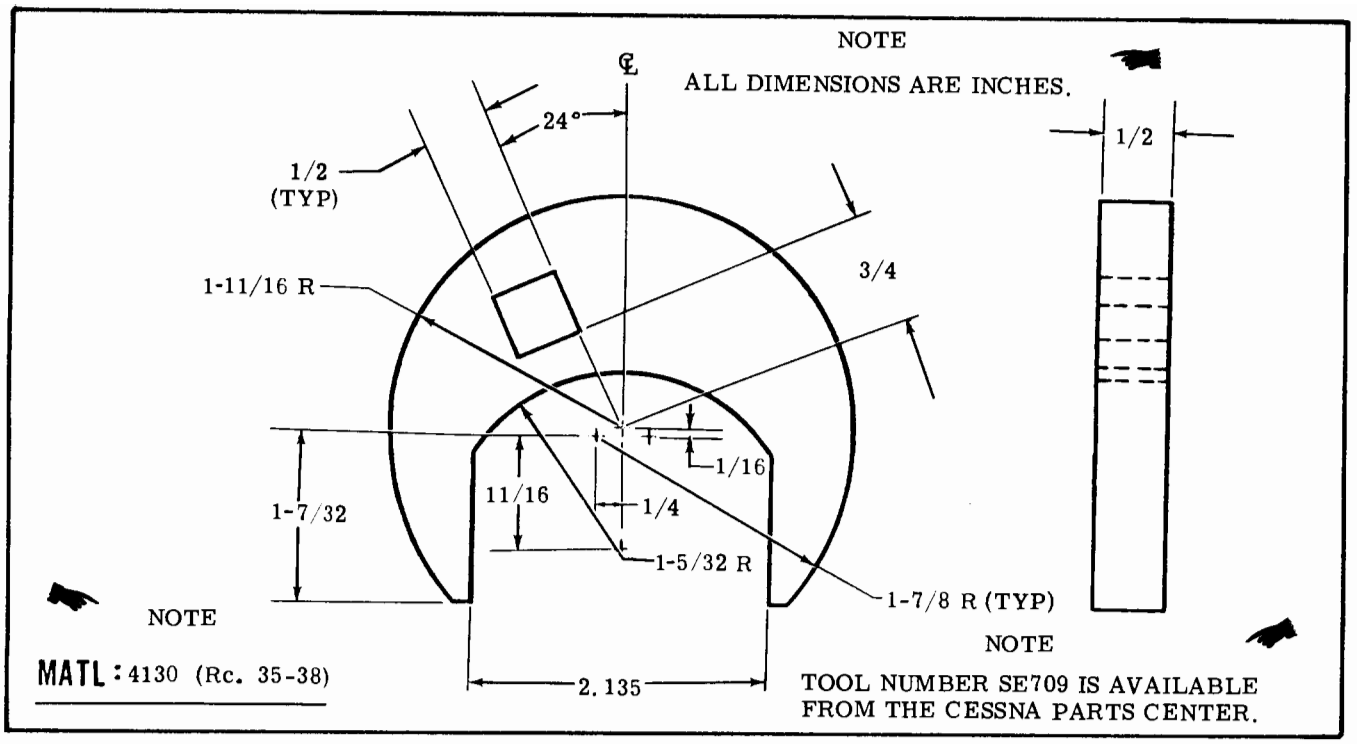


Figure 12-5. Oil Filter Adapter Wrench Fabrication

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 (5) in can (4) and insert the hollow stud (1) with a new metal gasket (2) in place, through the filter can and element.

i. Position a new gasket (6) inside flange of lid (7) and place lid in position on filter can.

j. With new gasket (10) on face of lid, install filter can assembly on adapter (12). While holding filter can to prevent turning, tighten hollow stud (1) 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 (1) then safety stud to lower tab (3) on filter can and safety adapter (12) to upper tab on filter can.

12-34. FILTER ADAPTER.

12-35. REMOVAL. (Refer to figure 12-4.)

a. Remove filter assembly in accordance with paragraph 12-33.

NOTE

A special wrench adapter for adapter nut (15) (Part No. SE-709) is available from the Cessna Service Parts Center, or one may be fabricated as shown in figure 12-5. Remove any engine accessory that interferes with removal of the adapter.

b. Note angular position of adapter (12), then remove safety wire and loosen adapter nut (15).

c. Unscrew adapter and remove from engine. Discard adapter O-ring (16).

12-36. DISASSEMBLY, INSPECTION AND REASSEMBLY. Figure 12-4 shows the relative position of the internal parts of the filter adapter and may be used as a guide during installation of parts. The bypass valve is to be installed as a complete unit, with the valve being staked three places. The heli-coil type insert (9) in the adapter may be replaced, although special tools are required. Follow instructions of the tool manufacturer for their use. Inspect threads

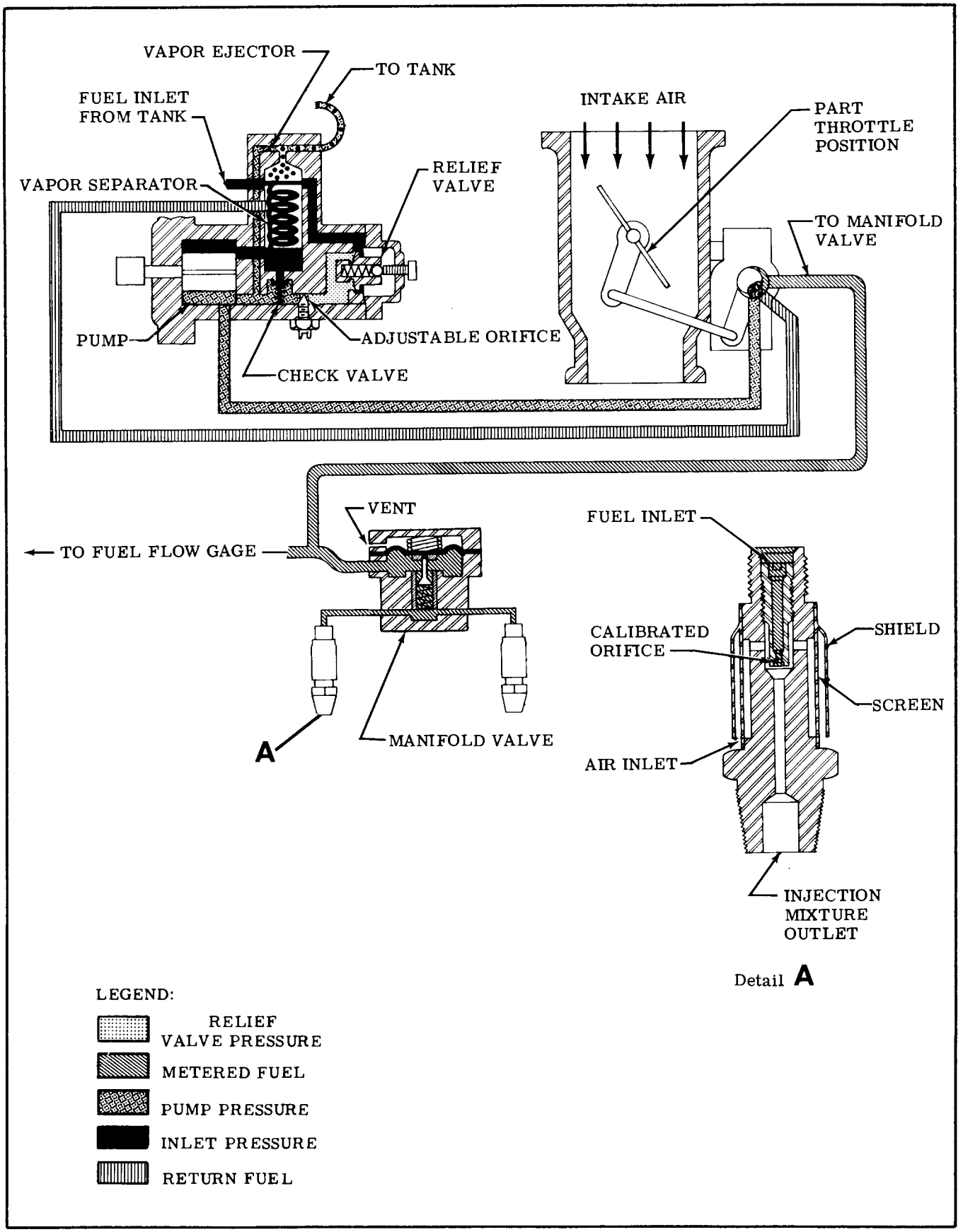


Figure 12-6. Fuel Injection Schematic

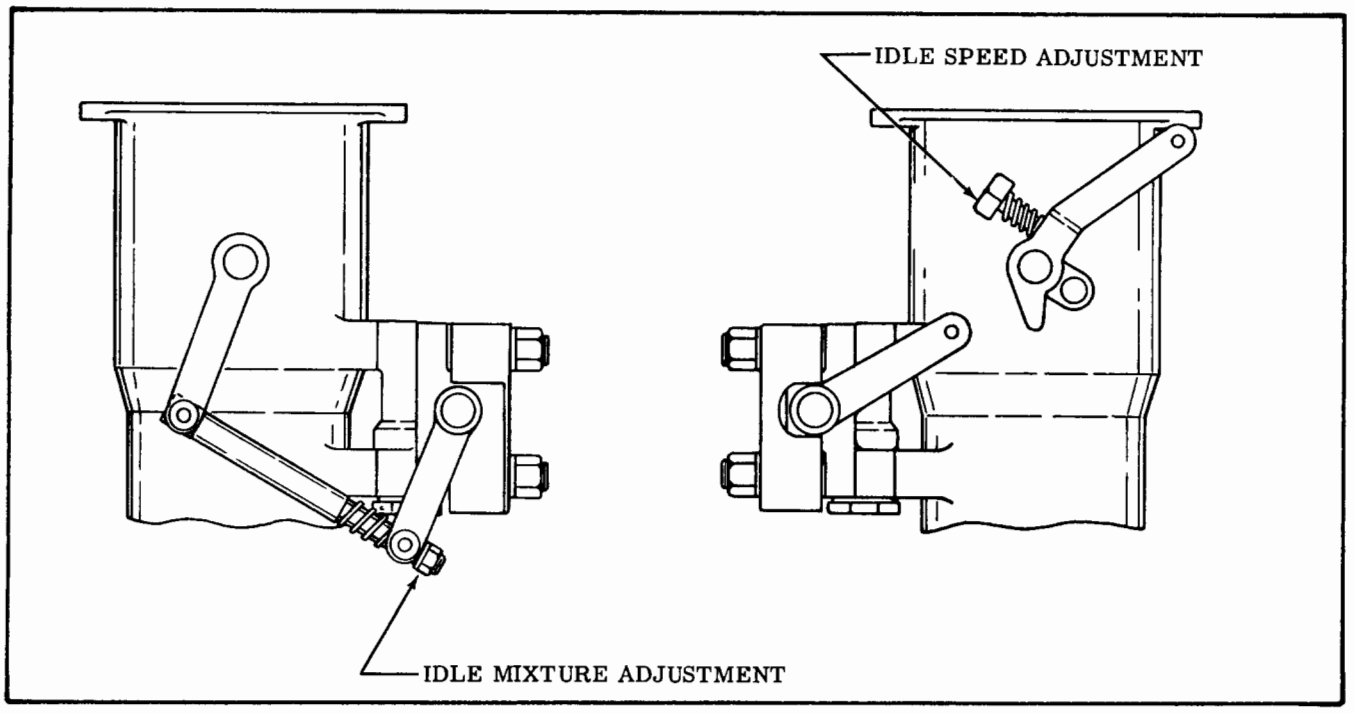


Figure 12-7. Idle Speed and Idle Mixture Adjustment

on adapter and in engine for damage. Clean adapter in solvent and dry with compressed air. Ascertain that all passages in the adapter are open and free of foreign material. Also, check that bypass valve is seated properly.

12-37. INSTALLATION.

a. Assemble adapter nut (15) and new O-ring (16) on adapter (12) in sequence illustrated in figure 12-4.

b. Lubricate O-ring on adapter with clean engine oil. Tighten adapter nut until O-ring is centered in its groove on the adapter.

c. Apply anti-seize compound sparingly to the adapter threads, then simultaneously screw adapter and adapter nut into engine until O-ring seats against engine boss without turning adapter nut (15). Rotate adapter to approximate angular position noted during removal. Do not tighten adapter nut at this time.

d. Temporarily install filter assembly on adapter, and position so adequate clearance with adjacent parts is attained. Maintaining this position of the adapter, tighten adapter nut to 50-60 lb-ft (600-720 lb-in.) and safety. Use a torque wrench, extension and adapter as necessary when tightening adapter nut.

e. Using new gaskets, install filter assembly as outlined in paragraph 12-33. Be sure to service the engine oil system.

12-38. OIL COOLER.

12-39. DESCRIPTION. A non-congealing oil cooler may be installed on the aircraft. The cooler is mounted on the right forward side of the engine crankcase directly in front of number five cylinder and has no external oil lines. Ram air passes through the oil cooler and is discharged into the engine compartment. Oil circulating through the engine is allowed to circulate continuously through warm-up passages to prevent the oil from congealing when operating in low temperatures. On the standard and non-congealing oil coolers, as the oil increases to a certain temperature, the thermostat valve closes, causing the oil to be routed to all of the cooler passages for cooling. Oil returning to the engine from the cooler is routed through the internally drilled oil passages.

12-40. ENGINE FUEL SYSTEM. (Refer to figure 12-6.)

12-41. DESCRIPTION. The fuel injection system is a low pressure system of injecting fuel into the intake valve port of each cylinder. It is a multi-nozzle, continuous-flow type which controls fuel flow to match engine airflow. Any change in throttle position, engine speed, or a combination of both, causes changes in fuel flow in the correct relation to engine airflow. A manual mixture control and a fuel flow indicator are provided for leaning at any combination of altitude and power setting. The fuel flow indicator is calibrated in gallons per hour and indicates approximately the gallons of fuel consumed per hour. The continuous-flow system uses a typical rotary vane fuel pump. There are no running parts in this system except for the engine-driven fuel pump.

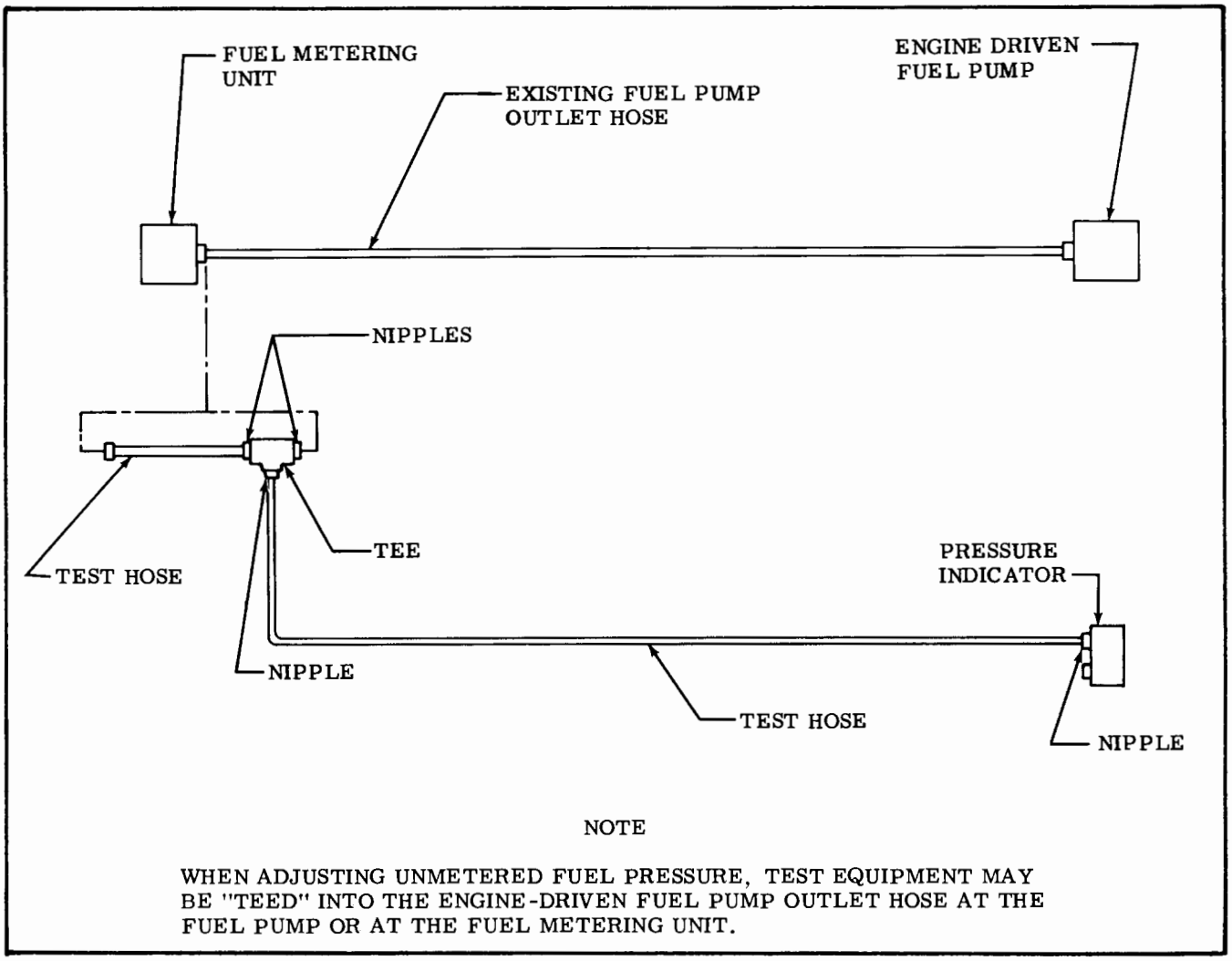


Figure 12-8. Fuel Injection Pump Adjustment Test Harness

NOTE

Throughout the aircraft fuel system, from the fuel cells to the engine-driven pump, use NS-40 (RAS-4) (Snap-On-Tools Corp., Kenosha, Wisconsin), MIL-T-5544 (Thread Compound Antiseize, Graphite Petrolatum), USP Petrolatum or engine oil as a thread lubricator or to seal a leaking connection. Apply sparingly to male threads only, omitting the first two threads, exercising extreme caution to avoid "stringing" sealer across the end of the fitting. Always ensure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system.

12-42. FUEL-AIR CONTROL UNIT.

12-43. DESCRIPTION. This unit occupies the position ordinarily used for a carburetor, at the intake manifold inlet. The function of this unit is to control engine air intake and to set the metered fuel pressure for proper fuel-air ratio. There are three control elements in this unit, one for air and two for fuel. One of the fuel control elements is for fuel mixture and the other is for fuel metering. Fuel enters the control unit through a strainer and passes to the metering valve. The position of the metering valve controls this fuel passed to the manifold valve and nozzles. A linkage connecting the metering valve to the air throttle proportions airflow to fuel flow. The position of the mixture valve determines the amount of fuel returned to the fuel pump. The fuel control portion of the fuel-air control unit is enclosed in a shroud and is blast-air cooled to help prevent vapor lock.

12-44. REMOVAL AND INSTALLATION.

a. Place all cockpit switches and fuel shut-off valve in the OFF position.

b. Remove cowling in accordance with paragraph 12-3.

c. Remove induction airbox in accordance with paragraph 12-65.

d. Disconnect engine controls at throttle and mixture control arms.

NOTE

Cap all disconnected hoses, lines and fittings.

e. The three fuel lines which attach to the fuel control unit are routed inside flexible tubing to help cool the fuel. Loosen tubing clamps at the control unit and slide tubing back to gain access to the fuel line fittings.

f. Disconnect fuel lines at control unit.

g. Loosen hose clamps which secure the control unit to the right and left intake manifolds.

h. Remove control unit.

i. Cover the open ends of the intake manifold piping to prevent entry of foreign matter.

j. Reverse the preceding steps for reinstallation. Use new gaskets when installing control unit. Rig throttle and mixture controls in accordance with paragraphs 12-85 and 12-86 respectively. Rig throttle-operated microswitch in accordance with Section 13.

12-45. CLEANING AND INSPECTION.

a. Check control connections, levers and linkage for security, safetying and for lost motion due to wear.

b. Remove the fuel screen assembly and clean in solvent (Stoddard or equivalent). Reinstall and safety.

c. Check the air control body for cracks and control unit for overall condition.

12-46. ADJUSTMENTS. (Refer to figure 12-7.) The idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. The idle mixture adjustment is the locknut at the metering valve end of the linkage. Tightening the nut to shorten the linkage provides a richer mixture. A leaner mixture is obtained by backing off the nut to lengthen the linkage. Idle speed and mixture adjustment should be accomplished after the engine has been warmed up. Since idle rpm may be affected by idle mixture adjustment, it may be necessary to readjust idle rpm after setting the idle mixture correctly.

a. Set the throttle stop screw to obtain 600 ± 25 rpm, with throttle control pulled full out against idle stop.

NOTE

Engine idle speed may vary among different engines. An engine should idle smoothly, without excessive vibration and the idle speed should be high enough to maintain idling oil pressure and to preclude any possibility of engine stoppage in flight when the throttle is closed.

b. Advance throttle to increase engine speed to 1000 rpm.

c. Pull mixture control knob slowly and steadily toward the idle cut-off position, observing tachometer, then return control full IN (RICH) position before engine stops.

d. Adjust mixture adjusting nut to obtain a slight and momentary gain of 25 rpm maximum at 1000 rpm engine speed as mixture control is moved from full IN (RICH) toward idle cut-off position. Return control to full IN (RICH) to prevent engine stoppage.

e. If mixture is set too LEAN, engine speed will drop immediately, thus requiring a richer mixture. Tighten adjusting nut (clockwise) for a richer mixture.

f. If mixture is set too RICH, engine speed will increase above 25 rpm, thus requiring a leaner mixture. Back off adjusting nut (counterclockwise) for a leaner mixture.

NOTE

After each adjustment to the idle mixture, run engine up to approximately 2000 rpm to clear engine of excess fuel to obtain a correct idle speed.

12-47. FUEL MANIFOLD VALVE (FUEL DISTRIBUTOR).

12-48. DESCRIPTION. Metered fuel flows to the fuel manifold valve, which provides a central point for distributing fuel to the individual cylinders. An internal diaphragm, operated by fuel pressure, raises or lowers a plunger to open and close the individual cylinder supply ports simultaneously. A needle valve in the plunger ensures that the plunger fully opens the outlet ports before fuel flow starts and closes the ports simultaneously for positive engine shut-down. A fine-mesh screen is included in the fuel manifold valve.

NOTE

The fuel manifold valves are supplied in two flow ranges. When replacing a valve assembly, be sure the replacement valve has the same suffix letter as the one stamped on the cover of the valve removed.

12-49. REMOVAL.

NOTE

Cap all disconnected lines, hoses and fittings.

a. Disconnect all fuel and fuel injection lines at the fuel manifold.

b. Remove bolts which secure fuel manifold and remove manifold.

12-50. CLEANING.

a. Remove manifold valve from engine in accordance with paragraph 12-49 and remove safety wire from cover attaching screws.

b. Hold the top cover down against internal spring until all four cover attaching screws have been removed, then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below cover.
c. Remove the upper spring and lift the diaphragm assembly straight up.

NOTE

If the valve attached to the diaphragm is stuck in the bore of the body, grasp the center nut, rotate and lift at the same time to work gently out of the body.

CAUTION

Do not attempt to remove needle or spring from inside plunger valve. Removal of these items will disturb the calibration of the valve.

d. Using clean gasoline, flush out the chamber below the screen.
e. Flush above the screen and inside the center bore making sure that outlet passages are open. Use only a gentle stream of compressed air to remove dust and dirt and to dry.

CAUTION

The filter screen is a tight fit in the body and may be damaged if removal is attempted. It should be removed only if a new screen is to be installed.

f. Clean diaphragm, valve and top cover in the same manner. Be sure the vent hole in the top cover is open and clean.
g. Carefully replace diaphragm and valve. Check that valve works freely in body bore.
h. Position diaphragm so that horizontal hole in plunger valve is 90 degrees from the fuel inlet port in the valve body.
i. Place upper spring in position on diaphragm.
j. Place cover in position so that vent hole in cover is 90 degrees from inlet port in valve body. Install cover attaching screws and tighten to 20±1 lb-in. Install safety wire on cover screws.
k. Install fuel manifold valve assembly on engine in accordance with paragraph 12-51 and reconnect all lines and hoses to valve.
l. Inspect installation and install cowling.

12-51. INSTALLATION.
a. Secure the fuel manifold to the crankcase with the two crankcase bolts.
b. Connect the fuel lines and the six fuel injection lines. Inspect completed installation and install cowling.

12-52. FUEL DISCHARGE NOZZLES.

12-53. DESCRIPTION. From the fuel manifold valve, individual, identical size and length fuel lines carry metered fuel to the fuel discharge nozzles located in the cylinder heads. The outlet of each nozzle is directed into the intake port of each cylinder. The nozzle body contains a drilled central passage with a counterbore at each end. The lower end is used as a chamber for fuel-air mixture before the spray leaves the nozzle. The upper bore contains an orifice for calibrating the nozzles. Near the top, radial holes connect the upper counterbore with the outside of the nozzle body for air admission. These radial holes enter the counterbore above the orifice and draw outside air through a cylindrical screen fitted over the nozzle body. This screen prevents dirt and foreign material from entering the nozzle. A press-fit shield is mounted on the nozzle body and extends over the greater part of the filter screen, leaving a small opening at the bottom of the shield. This provides an air bleed into the nozzle which aids in vaporizing the fuel by breaking the high vacuum in the intake manifold at idle rpm and keeps the fuel lines filled. The nozzles are calibrated in several ranges. All nozzles furnished for one engine are the same range and are identified by a number and a suffix letter stamped on the flat portion of the nozzle body. When replacing a fuel discharge nozzle be sure it is of the same calibrated range as the rest of the nozzles in the engine. When a complete set of nozzles is being installed, the number must be the same as the one removed, but the suffix letters may be different, as long as they are the same for all nozzles being installed on a particular engine.

12-54. REMOVAL.

NOTE

Plug or cap all disconnected lines and fittings.

a. Disconnect the fuel injection lines at the fuel discharge nozzles. Remove nozzles with a 1/2 inch deep well socket wrench.

12-55. CLEANING AND INSPECTION. To clean nozzles, immerse in clean solvent and use compressed air to dry them. When cleaning, direct air through the nozzle in the direction opposite of normal fuel flow. Do not remove the nozzle shield or distort it in any way. Do not use a wire or other metal object to clean the orifice or metering jet. After cleaning, check the shield height from the hex portion of the nozzle. The bottom of the shield should be approximately 1/16 inch above the hex portion of the nozzle.

12-56. INSTALLATION.
a. Install nozzles in the cylinders and tighten to a torque value of 60 to 80 lb-in.
b. Connect the fuel lines at discharge nozzles.
c. Check installation for crimped lines, loose fittings, etc.

12-57. FUEL INJECTION PUMP.

12-58. DESCRIPTION. The fuel pump is a positive-displacement, rotating vane type, connected to the accessory drive section of the engine. Fuel enters the pump at the swirl well of the pump vapor separa-

tor. Here, vapor is separated by a swirling motion so that only liquid fuel is fed to the pump. The vapor is drawn from the top center of the swirl well by a small pressure jet of fuel and is fed into the vapor return line, where it is returned to the aircraft fuel system. Since the pump is engine-driven, changes in engine speed affects total pump flow proportionally. A check valve allows the auxiliary fuel pump pressure to bypass the engine-driven fuel pump for starting, or in the event of engine-driven fuel pump failure. The pump supplies more fuel than is required by the engine; therefore, a spring-loaded, diaphragm type relief valve is provided, with an adjustable orifice installed in the fuel passage to the relief valve to maintain desired fuel pressure for engine power setting. The adjustable orifice allows the exact desired pressure setting at full throttle. The fuel pump is equipped with a manual mixture control to provide positive mixture control throughout the range required by the injection system. This control limits output of the pump from full rich to idle cut-off. Non-adjustable mechanical stops are located at these positions. The fuel pump is ram-air cooled to help prevent high fuel temperatures. The ram air is picked up at the upper left engine baffle and directed through a flexible tube to the fuel pump shroud. The fuel supply and return lines from the fuel pump to the control unit are routed inside flexible tubes to help prevent vaporized fuel at these points.

12-59. REMOVAL.

a. Place fuel shut-off valve in OFF position and mixture control in IDLE CUT-OFF position.

b. Remove cowling in accordance with paragraph 12-3.

c. Loosen the clamps and slide the flexible tubes free of the horns on the fuel pump shroud to gain access to the fuel lines.

d. Remove the alternator drive belt.

e. Tag and disconnect all lines and fittings attached to the fuel pump.

NOTE

Plug or cap all disconnected lines, hoses and fittings.

f. Remove the shroud surrounding the fuel pump.

g. Remove the nuts and washers attaching the fuel pump to the engine.

h. Remove fuel pump and gasket.

WARNING

Residual fuel draining from lines and hose constitutes a fire hazard. Use caution to prevent accumulation of fuel when lines or hoses are disconnected.

i. If a replacement pump is not being installed immediately, a temporary cover should be installed on the fuel pump mount pad.

12-60. INSTALLATION.

a. Position a new gasket and fuel pump on the mounting studs with fuel pump inlet to the left. Be sure pump drive aligns with drive in the engine.

b. Secure pump to engine with plain washers, internal tooth lock washers and nuts. Tighten nuts evenly.

c. Install cooling shroud on fuel pump.

d. Install all fittings and connect all lines.

e. Install the flexible ram air tube on the air horn of the fuel pump shroud and install clamp

f. Replace the alternator drive belt and tighten the nuts on the adjusting arm so that the drive belt has proper tension. Refer to Section 17.

g. Inspect completed installation.

12-61. ADJUSTMENT. The full rich performance of the fuel injection system is controlled by manual adjustment of the air throttle, fuel mixture and pump pressure at idle and only by pump pressure at full throttle. To make full rich adjustments, proceed as follows:

a. Remove engine cowling in accordance with paragraph 12-3.

NOTE

Inspect the slot-headed adjustable orifice needle valve (located just below the fuel pump inlet fitting) to see if it is epoxy sealed or safety wired to the brass nut. If the needle valve is epoxy sealed, Continental Aircraft Engine Service Bulletin No. 70-10 must be complied with before calibration of the unit can be performed.

b. Disconnect the engine-driven fuel pump outlet fitting or the fuel metering unit inlet fitting and "tee" the test gage into the fuel injection system as illustrated in figure 12-8.

NOTE

Cessna Service Kit No. SK320-2 provides a test gage, line and fittings for connecting the test gage into the system to perform accurate calibration of the enginedriven fuel pump.

c. The test gage MUST be vented to atmosphere and MUST be held as near to the level of the engine-driven fuel pump as possible. Bleed air from test gage line prior to taking readings.

NOTE

The test gage should be checked for accuracy at least every 90 days or anytime an error is suspected. The tachometer accuracy should also be determined prior to making any adjustments to the pump.

d. Start engine and warm-up thoroughly. Set mixture control to full rich position and propeller control full forward (low pitch, high rpm).

e. Adjust engine idle speed to 600 ± 25 rpm and check test gage for 9-11 PSI. Refer to figure 12-7 for idle mixture adjustment.

NOTE

Do not adjust idle mixture until idle pump pressure is obtained.

WARNING

DO NOT make fuel pump pressure adjustments while engine is operating.

f. If the pump pressure is not 9 to 11 PSI, stop engine and turn the fuel pump relief valve adjustment, on the centerline of the fuel pump clockwise (CW) to increase pressure and counterclockwise (CCW) to decrease pressure.

g. Maintaining idle pump pressure and idle RPM, obtain correct idle mixture in accordance with paragraph 12-46.

h. Completion of the preceding steps have provided:

1. Correct idle pump pressure.
2. Correct fuel flow.
3. Correct fuel metering cam to throttle plate orientation.

i. Advance to full throttle and maximum rated engine speed with the mixture control in full rich position and propeller control in full forward (low pitch, high rpm).

j. Check test gage for pressures specified in paragraph 12-12. If pressure is incorrect, stop engine and adjust pressure by loosening locknut and turning the slotheaded needle valve located just below the fuel pump inlet fitting clockwise (CW) to increase pressure and counterclockwise (CCW) to decrease pressure.

NOTE

If at static run-up, rated RPM cannot be achieved at full throttle, adjust pump pressure slightly below limits making certain the correct pressures are obtained when rated RPM is achieved during take-off roll.

k. After correct pressures are obtained, safety adjustable orifice and orifice locknut.

l. Remove test equipment, run engine to check for leaks and install cowling.

12-61A. AUXILIARY ELECTRIC FUEL PUMP FLOW RATE ADJUSTMENT. Refer to Section 13.

12-62. INDUCTION AIR SYSTEM.

12-63. DESCRIPTION. Ram air enters the induction air system through a filter at the upper left engine baffle. A spring-loaded alternate air door is incorporated in the airbox and will open by engine suction if the air filter should become clogged. This permits unfiltered induction air to be drawn from within the engine compartment.

12-64. AIRBOX.

12-65. REMOVAL AND INSTALLATION.

a. Remove cowling in accordance with paragraph 12-3.

b. Remove induction air filter.

c. Disconnect electrical wiring at throttle-operated micro-switch and tape terminals as a safety precaution.

d. Remove clamps attaching lines, wires and controls to airbox.

e. Remove bolts securing airbox to fuel-air control unit and engine and remove airbox and gasket.

f. Install a cover over fuel-air control opening.

g. Reverse the preceding steps for reinstallation. Adjust throttle operated switch in accordance with Section 13.

12-66. CLEANING AND INSPECTION. Clean metal parts of the induction airbox with Stoddard solvent or equivalent. Inspect for cracks, dents, loose rivets, etc. Minor cracks may be stop-drilled. In case of continued or severe cracking, replace airbox. Inspect alternate spring-loaded door for freedom of operation and complete closing.

12-67. INDUCTION AIR FILTER.

12-68. DESCRIPTION. An induction air filter, mounted at the airbox inlet, removes dust particles from the ram air entering the engine.

12-69. REMOVAL AND INSTALLATION.

a. Remove cowling in accordance with paragraph 12-3.

b. Remove bolts securing filter to the upper left engine baffle and induction airbox inlet.

c. Reverse the preceding steps for reinstallation. Make sure the gasket is in place between the filter and airbox intake.

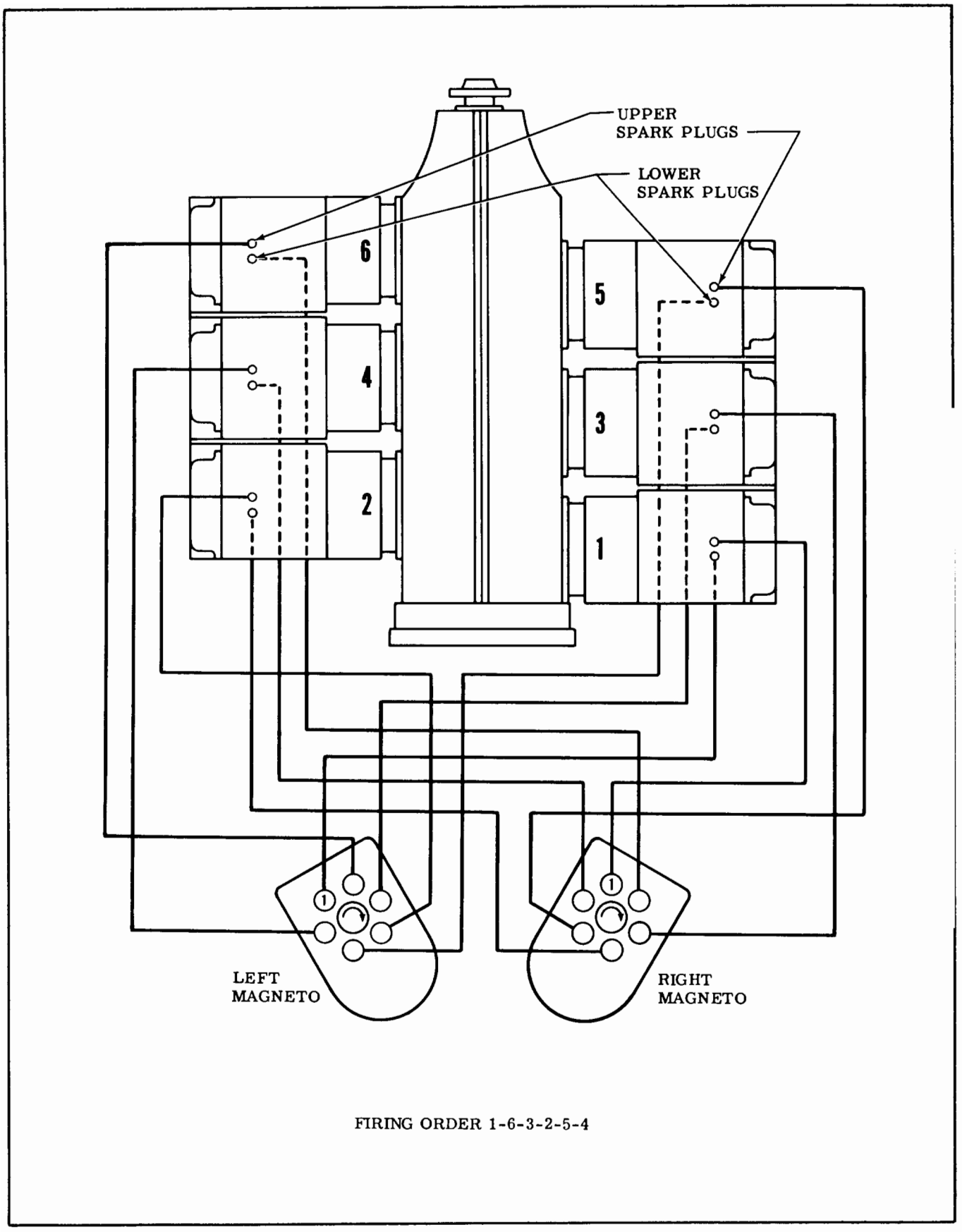
12-70. CLEANING AND INSPECTION. Clean and inspect filter in accordance with instructions in Section 2.

12-71. IGNITION SYSTEM.

12-72. 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.

12-73. 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 12-79.
	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 12-79.
	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.



FIRING ORDER 1-6-3-2-5-4

Figure 12-9. Ignition Schematic

12-74. MAGNETOS.

12-75. DESCRIPTION. The magnetos contain a conventional two-pole rotating magnet (rotor), mounted in ball bearings. Driven by the engine through an impulse coupling at one end, the rotor shaft operates the breaker points at the other end of the shaft. The nylon rotor gear drives a nylon distributor gear which transfers high tension current from the wedge-mounted coil to the proper outlet in the distributor block. A coaxial capacitor is mounted in the distributor block housing to serve as the condenser as well as a radio noise suppressor. Both nylon gears are provided with timing marks for clockwise or counterclockwise rotation. The distributor gear and distributor block have timing marks, visible through the air vent holes, for timing to the engine. A timing hole is provided in the bottom of the magneto adjacent to the magneto flange. A timing pin or 6-penny nail can be inserted through this timing hole into the mating hole in the rotor shaft to lock the magneto approximately in the proper firing position. The breaker assembly is accessible only after removing the screws fastening the magneto halves together and disconnecting the capacitor slip terminal. Do not separate magneto halves while it is installed on the engine.

12-76. REMOVAL.

a. Remove engine cowling in accordance with paragraph 12-3.

b. Tag for identification and remove high tension wires from the magneto being removed.

WARNING

The magneto is in a SWITCH ON condition when the switch wire is disconnected. Remove the high tension wires from magneto or disconnect spark plug leads from the spark plugs to prevent accidental firing.

c. Disconnect switch wire from condenser terminal at magneto. Tag wire for identification so it may be installed correctly.

d. Rotate propeller in direction of normal rotation until No. 1 cylinder is coming up on its compression stroke.

NOTE

To facilitate the installation of a replacement magneto, it is good practice to position the crankshaft at the advanced firing angle for No. 1 cylinder during step "d." Any standard timing device or method can be used, or if the magneto being removed is correctly timed to the engine, the crankshaft can be rotated to a position at which the breaker points will be just opening to fire No. 1 cylinder.

e. Remove magneto retainer clamps, nuts and washers and pull magneto from crankcase mounting pad.

NOTE

As the magneto is removed from its mounting, be sure that the drive coupling rubber bushing and retainer do not become dislodged from the gear hub and fall into the engine.

12-77. INTERNAL TIMING.

a. Whenever the gear on the rotor shaft or the cam (which also serves as the key for the gear) has been removed, be sure that the gear and cam are installed so the timing mark on the gear aligns with the "O" etched on the rotor shaft.

b. When replacing breaker assembly or adjusting contact breaker points, place a timing pin (or 0.093 inch 6-penny nail) through the timing hole in the bottom of the magneto next to the flange and into the mating hole in the rotor shaft. Adjusting contact breaker points so they are just starting to open in this position will give the correct point setting. Temporarily assemble the magneto halves and capacitor slip terminal and use a timing light to check that the timing marks, visibly through the ventilation plug holes are approximately aligned.

NOTE

The side of the magneto with the manufacturer's insignia has a red timing mark and the side opposite to the insignia has a black timing mark viewed through the vent plug holes. The distributor gear also has a red timing mark and a black timing mark. These marks are used for reference only when installing magneto on the engine. Do not place red and black lines together on the same side.

c. Whenever the large distributor gear and rotor gear have been disengaged, they must be engaged with their timing marks aligned for correct rotation. Align the timing mark on the rotor gear with the "RH" on the distributor gear. Care must be taken to keep these two gears meshed in this position until the magneto halves are assembled.

12-78. INSTALLATION AND TIMING TO ENGINE. The magneto MUST be installed with its timing marks correctly aligned, with the number one cylinder on its compression stroke and with number one piston at its advanced firing position. Refer to paragraph 12-12 for the advanced firing position of number one piston.

WARNING

The magneto is grounded through the ignition switch, therefore, any time the switch (primary) wire is disconnected from the magneto, the magneto is in a switch ON or HOT condition. Before turning the propeller by hand, remove the high tension wires from the magneto or disconnect all spark plug leads to prevent accidental firing of the engine.

To locate the compression stroke of number one cylinder, remove the lower spark plugs from each cylinder except number one cylinder. Remove the top plug from number one cylinder. Place thumb of one hand over the number one cylinder spark plug hole and rotate the crankshaft in the direction of normal rotation until the compression stroke is indicated by positive pressure inside the cylinder lifting the thumb off the spark plug hole. After the compression stroke is obtained, locate number one piston at its advanced firing position. Locating the advanced firing position of number one cylinder may be obtained by use of a timing disc and pointer, Timrite, protractor and piston locating gage or external engine timing marks alignment.

NOTE

External engine timing marks are located on a bracket attached to the starter adapter, with a timing mark on the alternator drive pulley as the reference point.

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 crankshaft 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.

NOTE

Install the magneto drive coupling retainer and rubber bushings into the magneto drive gear hub slot. Insert the two rubber bushings into the retainer with the chamfered edges facing toward the front of the engine.

a. Turn the magneto shaft until the timing marks visible through the ventilation plug holes are aligned (red-to-red or black-to-black) and insert a timing pin (or 0.093 inch 6-penny nail) through the timing hole in the bottom of the magneto next to the flange and into the mating hole in the rotor shaft. This locks the magneto approximately in the firing position while installing on the engine.

NOTE

If the magneto drive gear was disengaged during magneto removal, hold the magneto in the horizontal position it will occupy when installed, make certain that the drive gear coupling slot is aligned with the magneto coupling lugs. If it is not aligned, pull the magneto drive gear out of mesh with its drive gear and rotate it to the aligned angle, then push it back into mesh. DO NOT WITHDRAW THE MAGNETO DRIVE GEAR FROM ITS OIL SEAL.

b. After magneto gasket is in place, position the magneto on the engine and secure, then remove the timing pin from the magneto. Be sure to remove this pin before turning the propeller.

c. Connect a timing light to the capacitor terminal at the front of the magneto and to a good ground.

d. Turn propeller back a few degrees (opposite of normal rotation) to close the contact points.

NOTE

Do not turn the propeller back far enough to engage the impulse coupling or the propeller will have to be turned in normal direction of rotation until the impulse coupling releases, then backed up to slightly before the firing position.

e. Slowly advance the propeller in the normal direction of rotation until the timing light indicates the contact points breaking. Magneto mounting clamps may be loosened so that the magneto may be shifted to break the points at the correct firing position.

f. Tighten magneto mounting nuts and recheck timing.

g. Repeat steps "a" through "f" for the other magneto.

h. After both magnetos have been timed, check synchronization of both magnetos. Magnetos must fire at the same time.

i. Remove timing devices from magneto and engine.

j. Connect spark plug leads to their correct magneto outlets.

NOTE

The No. 1 magneto outlet is the one closest to the ventilation plug on the side of the magneto having the manufacturer's insignia. The magneto fires at each successive outlet in clockwise direction. Connect No. 1 magneto outlet to No. 1 cylinder spark plug lead, No. 2 outlet to the next cylinder to fire, etc. Engine firing order is listed in paragraph 12-12.

k. Connect ignition switch (primary) leads to the capacitor terminals on the magnetos.

1. Inspect magneto installation and install engine cowling in accordance with paragraph 12-3.

12-79. MAINTENANCE. At the first 25-hour inspection and at each 100-hour inspection thereafter, the breaker compartment should be inspected. Magneto-to-engine timing should be checked at the first 25-hour inspection, first 50-hour inspection, first 100-hour inspection and thereafter at each 100-hour

inspection. If timing is as specified in paragraph 12-12, 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. In the event the magneto internal timing marks are off more than plus or minus five degrees when the breaker points open to fire number one cylinder, remove the magneto and check the magneto internal timing. Whenever the magneto halves are separated the breaker point assembly should always be checked. As long as internal timing and magneto-to-engine timing are within the preceding tolerances, it is recommended that the magneto be checked internally only at 500 hour intervals. It is normal for contact points to burn and the cam to wear a comparable amount so the magneto will remain in time within itself. This is accomplished by having a good area making contact on the surface between the points and the correct amount of spring pressure on the cam. The area on the points should be twenty-five percent of the area making contact. The spring pressure at the cam should be 10.5 to 12.5 ounces. When the contact points burn, the area becomes irregular, which is not detrimental to the operation of the points unless metal transfer is too great which will cause the engine to misfire. Figure 12-10 illustrates good and bad contact points. A small dent will appear on the nylon insulator between the cam follower and the breaker bar. This is normal and does not require replacement.

NOTE

If ignition trouble should develop, spark plugs and ignition wiring should be checked first. If the trouble definitely is associated with a magneto, use the following to help disclose the source of trouble without overhauling the magneto.

a. Moisture Check.

1. Remove magneto from engine and remove screws securing the magneto halves together, disconnect capacitor slip terminal and remove distributor. Inspect for moisture.

2. Check distributor gear finger and carbon brush for moisture.

3. Check breaker point assembly for moisture, especially on the surfaces of the breaker points.

4. If any moisture is evident in the preceding places, wipe with a soft, dry, clean, lint-free cloth.

b. Breaker Compartment Check.

1. Check all parts of the breaker point assembly for security.

2. Check breaker point surface for evidence of excessive wear, burning, deep pits and carbon deposits. Breaker points may be cleaned with a hard-finish paper. If breaker point assembly is defective, install a new assembly. Make no attempt to stone or dress the breaker points. Clean new breaker points with clean, unleaded gasoline and hard-finish paper before installing.

3. Check capacitor mounting bracket for cracks or looseness.

4. Check the carbon brush on the distributor gear for excessive wear. The brush must extend a minimum of 1/32 inch beyond the end of the gear shaft. The spring which the carbon brush contacts should be bent our approximately 20 degrees from vertical, since spring pressure on the brush holds the distributor gear shaft against the thrust bearing in the distributor block.

5. Oil the bearings at each end of the distributor gear shaft with a drop of SAE 20 oil. Wipe excess oil from parts.

6. Make sure internal timing is correct and reassemble magneto. Install and properly time magneto to engine.

12-80. MAGNETO CHECK. Advanced timing settings in some cases, is the result of the erroneous practice of bumping magnetos up in timing in order to reduce RPM drop on single ignition. NEVER ADVANCE TIMING BEYOND SPECIFICATIONS IN ORDER TO REDUCE RPM DROP. Too much importance is being attached to RPM drop on single ignition. RPM drop on single ignition is a natural characteristic of dual ignition design. The purpose of the following magneto check is to determine that all cylinders are firing. If all cylinders are not firing, the engine will run extremely rough and cause for investigation will be quite apparent. The amount of RPM drop is not necessarily significant and will be influenced by ambient air temperature, humidity, airport altitude, etc. In fact, absence of RPM drop should be cause for suspicion that the magneto timing has been bumped up and is set in advance of the setting specified. Magneto checks should be performed on a comparative basis between individual right and left magneto performance.

a. Start and run engine until the oil and cylinder head temperature is in the normal operating range.

b. Place the propeller control in the full low pitch (high rpm) position.

c. Advance engine speed to 1700 rpm.

d. 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.

e. Turn the switch to the "L" position and note the rpm drop, then return the switch to the "BOTH" position.

f. 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.

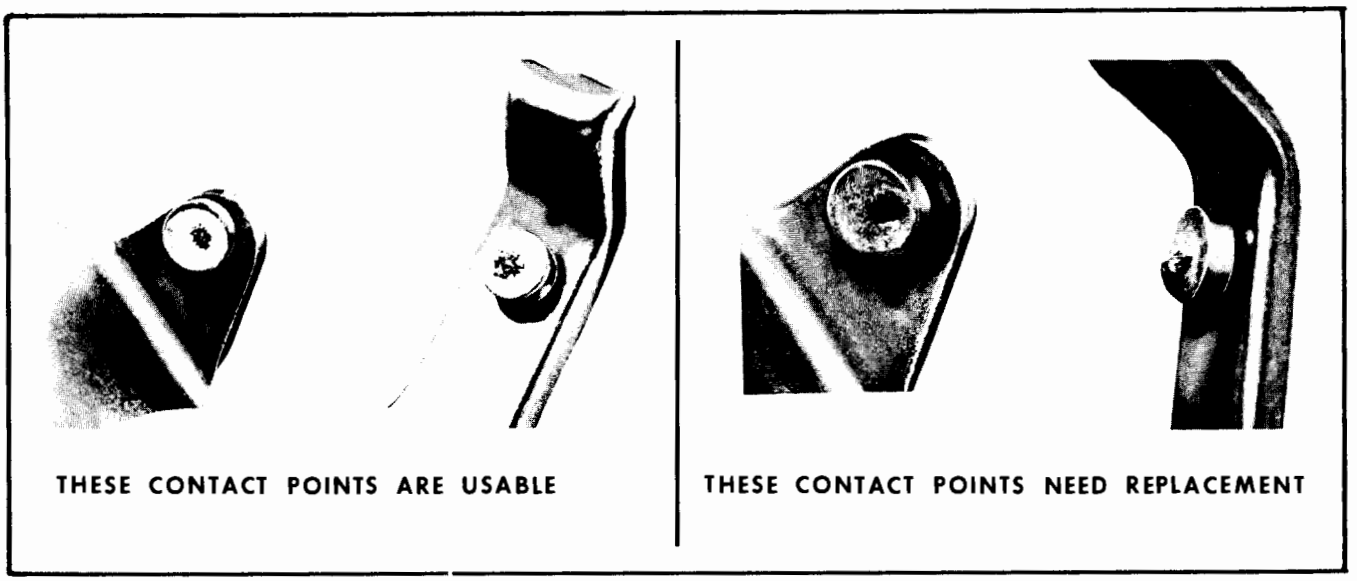


Figure 12-10. Magneto Contact Breaker Points

12-81. SPARK PLUGS. Two 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 service 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 spark plugs, rotating helps prolong spark plug life.

12-82. ENGINE CONTROLS.
(Refer to figure 12-10A)

12-83. 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.

12-84. 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

Whenever engine controls are being disconnected, pay particular attention to the EXACT position, size and number of attaching washers and spacers. Be sure to install attaching parts as noted when connecting controls.

12-85. THROTTLE CONTROL.
a. Push throttle control full in, then pull control out approximately 1/8 inch for cushion.
b. Check that throttle control arm is against the mechanical stop. If necessary, loosen locknut and screw rod end IN or OUT as necessary to align with attachment hole while throttle arm is against the mechanical stop.
c. Pull control full out and check that throttle arm contacts the idle stop.
d. The throttle arm must contact the stops in each direction and the control should have approximately 1/8 inch cushion when pushed full in.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the throttle control.

12-86. MIXTURE CONTROL.
a. Push mixture control full in, then pull control out approximately 1/8 inch for cushion.

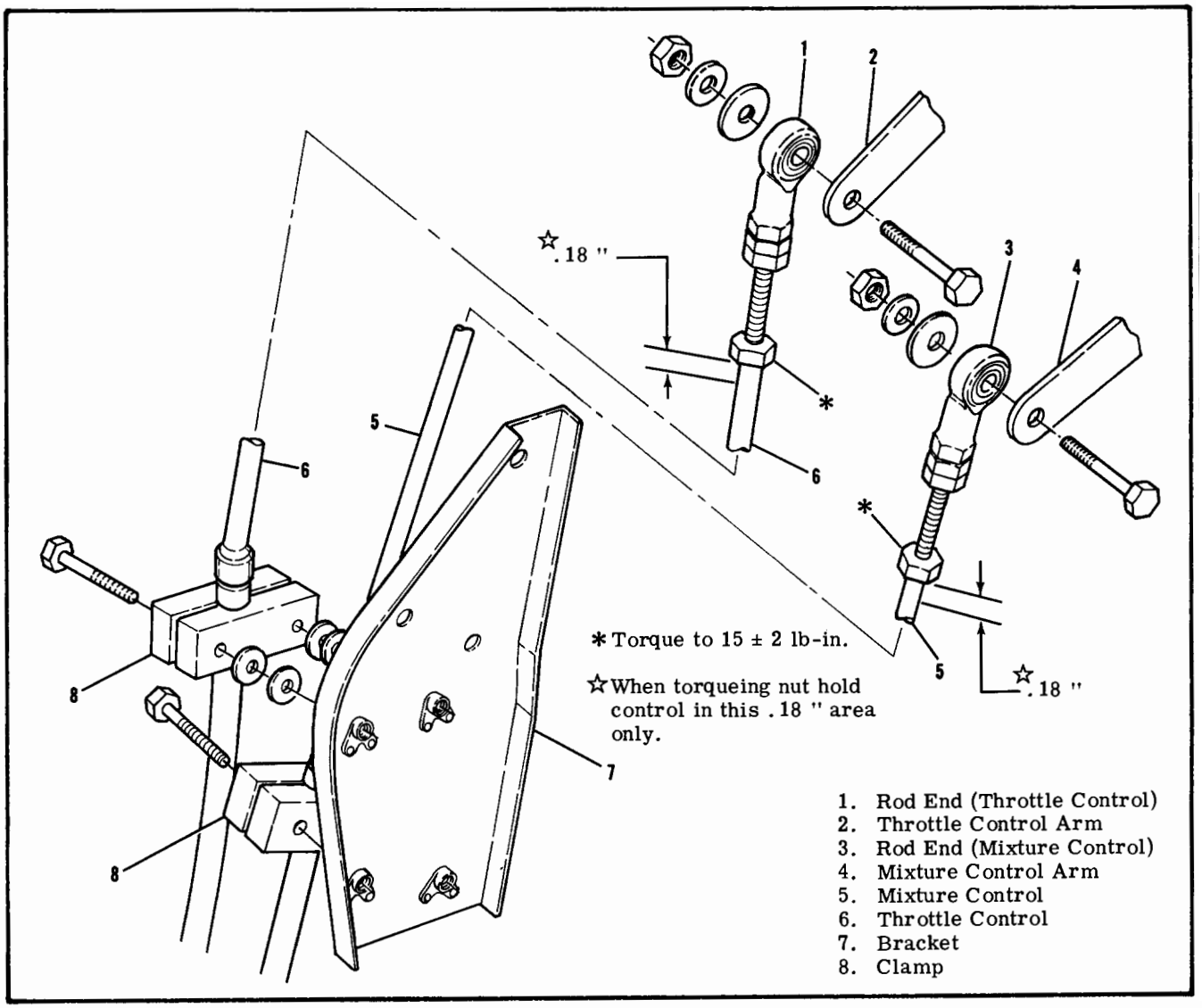


Figure 12-10A Engine Controls

b. Check that mixture control arm is in full rich position (against stop). If necessary, loosen locknut and screw rod end IN or OUT as necessary to align with attachment hole while mixture arm is against the mechanical stop.

c. Pull control full out and check that mixture arm contacts the idle cut-off stop.

d. The mixture arm must contact the stops in each direction and the control should have approximately 1/8 inch cushion when pushed full in.

NOTE

Refer to the inspection chart in Section 2 for inspection and/or replacement interval for the mixture control.

12-86A THROTTLE OPERATED MICROSWITCH. (Refer to Section 13.)

12-87. PROPELLER CONTROL. Refer to Section 14.

12-88. STARTING SYSTEM.

12-89. DESCRIPTION. The automatically-engaged starting system employs an electrical starter motor mounted to a 90-degree adapter. A solenoid is activated by the ignition switch on the instrument panel. When the solenoid is activated, its contacts close and electrical current energizes the motor. Initial rotation of the motor engages the starter through an overrunning clutch in the starter adapter, which incorporates worm reduction gears. The starter motor is located just aft of the right rear cylinder.

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.

12-90. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
STARTER WILL NOT OPERATE.	Defective master switch or circuit.	Check continuity. Install new switch or wires.
	Defective starter switch or switch circuit.	Check continuity. Install new switch or wires.
	Defective starter motor.	Check electrical power to motor. Repair or replace starter motor.
STARTER MOTOR RUNS, BUT DOES NOT TURN CRANK-SHAFT.	Defective overrunning clutch or drive.	Check visually. Install new starter adapter.
	Starter motor shaft broken.	Check visually. Install new starter motor.
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.	Check visually. Install new cable.
	Loose or dirty 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.
	Dirty or worn commutator.	Check visually. Clean and turn commutator.
STARTER EXCESSIVELY NOISY.	Worn starter pinion.	Remove and inspect. Replace starter drive.
	Worn or broken teeth on crankshaft gears.	Check visually. Replace crankshaft gear.

12-91. PRIMARY MAINTENANCE. The starting circuit should be inspected at regular intervals, the frequency of which should be determined by the amount of service and conditions under which the equipment is operated. Inspect the battery and wiring. Check battery for fully charged condition, proper electrolyte level with approved water and terminals for cleanliness. Inspect wiring to be 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 brushes). Check the commutator for uneven wear, excessive glazing or evidence of excessive arcing. If the commutator is only slightly dirty, glazed or discolored, it may be cleaned with a strip of No. 00 or No. 000 sandpaper. If the commutator is rough or worn, it should be turned in a lathe and the mica undercut. Inspect the armature shaft for rough bearing surfaces. New brushes should be properly seated when installing by wrapping a strip of No. 00 sandpaper around the commutator (with sanding side out) 1-1/4 to 1-1/2 times maximum. Drop brushes on sandpaper covered commutator and turn armature slowly in the direction of normal rotation. Clean sanding dust from motor after sanding operations.

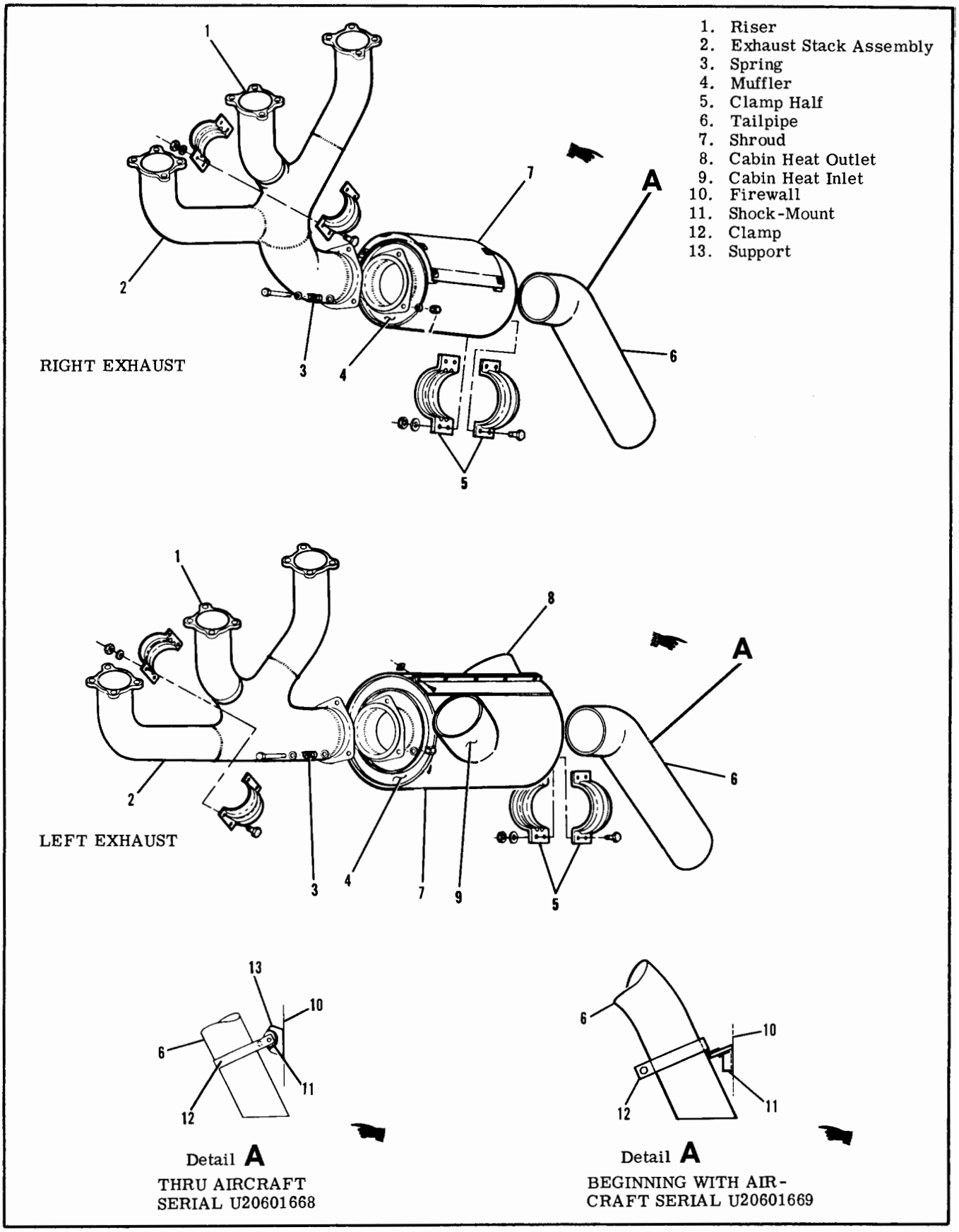


Figure 12-11. Exhaust System

12-92. STARTER MOTOR.

12-93. REMOVAL AND INSTALLATION.

a. Remove engine cowling in accordance with paragraph 12-3.

CAUTION

When disconnecting starter electrical cable, do not permit terminal bolt to rotate. Rotation of the bolt could break the conductor between bolt and field coils causing the starter to be inoperative.

b. Disconnect battery cables and insulate as a safety precaution.

c. Disconnect electrical cable at starter motor.

d. Remove nuts and washers securing motor to starter adapter and remove motor. Refer to engine manufacturer's overhaul manual for adapter removal.

e. Reverse the preceding steps for reinstallation. Install a new O-ring seal on motor, then install motor. Be sure motor drive engages with the adapter drive when installing.

12-94. EXHAUST SYSTEM.

12-95. DESCRIPTION. The exhaust system consists of two exhaust stack assemblies, for the left and right bank of cylinders. Each cylinder has a riser pipe attached to the exhaust port. The three risers at each bank of cylinders are joined together into a collector pipe forming an exhaust stack assembly. The center riser on each bank is detachable, but the front and aft risers are welded to the collector pipe. The left muffler is enclosed in a shroud which captures exhaust heat which is used to heat the cabin.

12-96. REMOVAL AND INSTALLATION. (Refer to figure 12-11.)

a. Remove engine cowling in accordance with paragraph 12-3.

b. Disconnect ducts from heater shroud on left muffler assembly.

c. Disconnect tailpipe braces from shock-mounts at firewall brackets.

d. Remove nuts, springs and bolts attaching tailpipe and muffler to collector pipe and remove muffler and tailpipe assemblies.

e. Remove nuts attaching exhaust stack assemblies to the cylinders and remove exhaust stacks and gaskets.

f. Reverse the preceding steps for reinstallation. Install a new copper-asbestos gasket between each riser and its mounting pad on each cylinder, regardless of apparent condition of those removed. Torque exhaust stack nuts at cylinders to 100-110 pound-inches.

12-97. 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 required so that ALL surfaces of the exhaust assemblies can be visually inspected.

NOTE

Especially check the areas adjacent to welds and slip joints. Look for gas deposits in surrounding 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. Forming of bubbles is considered acceptable, If bubbles are blown away system is not considered acceptable.

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 openings.
3. Using a manometer or gage, apply approximately 1-1/2 psi (3 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 that system is acceptable

12-98. EXTREME WEATHER MAINTENANCE.

12-99. COLD WEATHER. Cold weather starting will be made easier by the installation of an oil dilution system, an engine primer system and a ground service receptacle. The primer system is manually-operated from the cabin. Fuel is supplied by a line from the fuel strainer to the plunger. Operating the primer forces fuel to the engine. With an external power re-
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 runup after these conditions have been followed, preheat the drained engine oil.
ceptacle installed, an external power source may be connected to assist in cold weather or low battery starting. Refer to paragraph 12-103 for use of the external power receptacle.

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 engine oil, gasoline may be mixed with the heated oil in a ratio of 1 part gasoline to 12 parts engine oil before pouring into the engine oil sump. If the free air temperature is below minus 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 propeller through several revolutions by hand before attempting to start the engine.

CAUTION

Due to the desludging effect of the diluted oil, engine operation should be observed closely during the initial warm-up of the engine. Engines that have 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 sump. Small deposits may actually enter the oil sump 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 engine oil change. This will also prevent the accumulation of the sludge and carbon deposits.

12-100. HOT WEATHER. Engine starting in hot weather or with a hot engine is sometimes hampered by vapor formation in the fuel lines. To purge the vapor, move the mixture control to full rich, open the throttle 1-1/2 inches and prime with the auxiliary fuel pump switch in the HI position until the fuel flow indicator reads 4-6 gal/hr. Then shut off the fuel pump switch and engage the starter. As the flooded mixture becomes progressively leaner, reaching a combustible mixture, the engine will start. If the engine tends to die, turn the auxiliary fuel pump switch momentarily to HI at appropriate intervals until vapor is fully cleared and the engine runs smoothly.

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.

12-101. SEACOAST AND HUMID AREAS. In salt water areas special care should be taken to keep the engine, accessories and airframe clean to prevent oxidation. In humid areas, fuel and oil should be checked frequently and drained of condensation to prevent corrosion.

12-102. DUSTY AREAS. Dust induced into the intake system of the engine is probably the greatest single cause of early engine wear. When operating in high dust conditions, service the induction air filter daily as outlined in Section 2. Also change engine oil and lubricate airframe items more often than specified.

12-103. GROUND SERVICE RECEPTACLE. With the ground service receptacle installed, the use of an external power source is recommended for cold weather starting, low battery starting and lengthy maintenance of the aircraft electrical system. Refer to Section 17 for additional information.

12-104. HAND-CRANKING. A normal hand-cranking procedure may be used to start the engine.

SHOP NOTES:

SECTION 12A

ENGINE
(TURBOCHARGED)

TABLE OF CONTENTS

12A-1. ENGINE COWLING.

12A-2. DESCRIPTION. The engine cowling is similar to that described in Section 12, except it is wider at the front, with additional ram air openings in the right and left nose caps. The opening in the right side supplies ram air to the turbocharger. The opening in the left side supplies ram air to the cabin heating system.

12A-3. REMOVAL AND INSTALLATION. Refer to paragraph 12-3.

12A-4. CLEANING AND INSPECTION. Refer to paragraph 12-4.

12A-5. REPAIR. Refer to paragraph 12-5.

12A-6. COWL FLAPS.

12A-7. DESCRIPTION. The cowl flaps are similar to that described in Section 12, except the overboard exhaust tube for the cabin heater extends through the cutout in the aft portion of the left cowl flap.

12A-8. REMOVAL AND INSTALLATION. Refer to paragraph 12-8.

12A-9. RIGGING. Refer to paragraph 12-9. (Refer to figure 12-1)

12A-10. ENGINE.

12A-11. DESCRIPTION. An air-cooled, horizontally-opposed, direct-drive, fuel-injected, six-cylinder turbocharged Continental TSIO-520 series engine, driving a constant-speed propeller, is used to power the aircraft. The cylinders, numbered from rear to front, are staggered to permit a separate throw on the crankshaft for each connecting rod. The right rear cylinder is number 1 and cylinders on the right side are identified by odd numbers 1, 3 and 5. The left rear cylinder is number 2 and the cylinders on the left side are identified as 2, 4 and 6. Refer to paragraph 12A-12 for engine data. For repair and overhaul of the engine, accessories and propeller, refer to the appropriate publications issued by their manufacturer's. These publications are available from the Cessna Service Parts Center.

SHOP NOTES:

12A-12. ENGINE DATA.

Aircraft Series	TP206	TU206
Model (Continental)	TSIO-520-C	Same
BHP at RPM	285 at 2700	Same
Limiting Manifold Pressure (Sea Level)	32.5 Inches Hg.	Same
Number of Cylinders	6-Horizontally Opposed	Same
Displacement	520 Cubic Inches	Same
Bore	5.25 Inches	Same
Stroke	5.00 Inches	Same
Compression Ratio	7.5:1	Same
Magnetos	Slick Model No. 662	Same
Right Magneto	Fires 20° BTC Upper Right and Lower Left	Same
Left Magneto	Fires 20° BTC Upper Left and Lower Right	Same
Firing Order	1-6-3-2-5-4	Same
Spark Plugs	18 MM (Refer to current Continental factory approved spark plug chart.)	Same
Torque	330±30 Lb-In.	Same
Fuel Metering System	Continental Fuel Injection	Same
Unmetered Fuel Pressure	6 to 7 PSI at 600 RPM	Same
	29 to 32 PSI at 2700 RPM	Same
Oil Sump Capacity	12 U.S. Quarts	Same
With Filter Element Change	13 U.S. Quarts	Same
Tachometer	Mechanical Drive	Same
Oil Pressure (PSI)		
Minimum Idling	10	Same
Normal	30 to 60	Same
Maximum (Cold Oil Starting)	100	Same
Connection Location	Between No. 2 and No. 4 Cylinders	Same
Oil Temperature		
Normal Operating	Within Green Arc	Same
Maximum Permissible	Red Line (240°F)	Same
Probe Location	Below Oil Cooler	Same
Cylinder Head Temperature	Red Line (460°F) Max.	Same
Probe Location	Lower Side No. 1 Cylinder	Same
Approximate Dry Weight With Accessories (Excluding Turbocharger System)	483 Lb. (Weight is approximate and will vary with optional accessories installed.)	Same

12A-13. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE FAILS TO START.	Engine flooded or improper use of starting procedure.	Use proper starting procedure. Refer to Owner's Manual.
	Defective aircraft fuel system.	Refer to Section 13.
	Fuel tanks empty.	Service fuel tanks.
	Spark plugs fouled or defective.	Remove, clean, inspect and regap. Use new gaskets. Check cables to presistently fouled plugs. Replace if defective.
	Magneto impulse coupling failure.	Repair or install new coupling.
	Defective magneto switch or grounded magneto leads.	Repair or replace switch and leads.
	Defective ignition system.	Refer to paragraph 12-79.
	Induction air leakage.	Correct cause of air leakage.
	Clogged fuel screen in fuel control unit or defective unit.	Remove and clean. Replace defective unit.
	Clogged fuel screen in fuel manifold valve or defective valve.	Remove and clean screen. Replace defective valve.
	Clogged fuel injection lines or discharge nozzles.	Remove and clean lines and nozzles. Replace defective units.
	Defective auxiliary fuel pump.	Refer to Section 13.
	Engine-driven fuel pump not permitting fuel from auxiliary pump to bypass.	Install new engine-driven fuel pump.
	Vaporized fuel in system. (Most likely to occur in hot weather with a hot engine.)	Refer to paragraph 12A-114.
ENGINE STARTS BUT DIES, OR WILL NOT IDLE PROPERLY.	Propeller control in high pitch (low rpm) position.	Use low pitch (high rpm) position for all ground operations.
	Improper idle speed or idle mixture adjustment.	Refer to paragraph 12-46.
	Defective aircraft fuel system.	Refer to Section 13.
	Spark plugs fouled or defective.	Remove, clean, inspect and regap. Use new gaskets. Check cables to persistently fouled plugs. Replace if defective.
	Water in fuel system.	Drain fuel tank sumps, lines and fuel strainer.
	Defective ignition system.	Refer to paragraph 12-79.

12A-13. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE STARTS BUT DIES, OR WILL NOT IDLE PROPERLY (CONT).	Induction air leakage.	Correct cause of air leakage.
	Clogged fuel screen in fuel control unit or defective unit.	Remove and clean. Replace defective unit.
	Clogged fuel screen in fuel manifold valve or defective valve.	Remove and clean. Replace defective valve.
	Restricted fuel injection lines or discharge nozzles.	Remove, clean lines and nozzles. Replace defective units.
	Defective engine-driven fuel pump.	Install and calibrate new pump.
	Vaporized fuel in system. (Most likely to occur in hot weather with a hot engine.)	Refer to paragraph 12A-114.
	Manual engine primer leaking.	Disconnect primer outlet line. If fuel leaks through primer, repair or replace primer.
	Obstructed air intake.	Remove obstruction; service air filter, if necessary.
	Discharge nozzle air vent manifolding restricted or defective.	Check for bent lines or loose connections. Tighten loose connections. Remove restrictions and replace defective components.
	Defective engine.	Check compression and listen for unusual engine noises. Check oil filter for excessive metal. Repair engine as required.
ENGINE HAS POOR ACCELERATION, RUNS ROUGHLY AT SPEEDS ABOVE IDLE OR LACKS POWER.	Idle mixture too lean.	Refer to paragraph 12-46.
	Propeller control in high pitch (low rpm) position.	Use low pitch (high rpm) position for all ground operations.
	Incorrect fuel-air mixture, worn control linkage or restricted air filter.	Replace worn elements of control linkage. Service air filter.
	Defective ignition system.	Refer to paragraph 12-79.
	Malfunctioning turbocharger.	Check operation, listen for unusual noise. Check operation of wastegate valve and for exhaust system defects. Tighten loose connections.
	Improper fuel-air mixture.	Check intake manifold connections for leaks. Tighten loose connections. Check fuel controls and linkage for setting and adjustment.

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE HAS POOR ACCELERATION, RUNS ROUGHLY AT SPEEDS ABOVE IDLE OR LACKS POWER (CONT).	Spark plugs fouled or defective.	Remove, clean, inspect and regap. Use new gaskets. Check cables to persistently fouled plugs. Replace if defective.
	Fuel pump pressure improperly adjusted.	Refer to paragraph 12A-62.
	Restriction in fuel injection system.	Clean out restriction. Replace defective items.
	Propeller out of balance.	Check and balance propeller.
	Defective engine.	Check compression, check oil filter for excessive metal. Listen for unusual noises. Repair engine as required.
	Exhaust system leakage.	Refer to paragraph 12A-99.
	Turbocharger wheels rubbing.	Replace turbocharger.
	Improperly adjusted or defective waste-gate controller.	Refer to paragraph 12A-111.
	Leak in turbocharger discharge pressure system.	Correct cause of leaks. Repair or replace damaged parts.
	Manifold pressure overshoot. (Most likely to occur when engine is accelerated too rapidly.)	Move throttle about two-thirds open. Let engine accelerate and peak. Move throttle to full open.
	Engine oil viscosity too high for ambient air.	Refer to Section 2 for proper grade of oil.
POOR IDLE CUT-OFF.	Mixture control linkage improperly rigged.	Refer to paragraph 12-86.
	Defective or dirty fuel manifold valve.	Remove and clean manifold valve.
	Fuel contamination.	Drain all fuel and flush out fuel system. Clean all screens, fuel strainers, fuel manifold valves, nozzles and fuel lines.
	Defective mixture control valve in fuel pump.	Replace fuel pump.
ENGINE LACKS POWER, REDUCTION IN MAXIMUM MANIFOLD PRESSURE OR CRITICAL ALTITUDE.	Incorrectly adjusted throttle control, "sticky" linkage or dirty air filter.	Check movement of linkage by moving control through range of travel. Make proper adjustments and replace worn components. Service air filter.

12A-13. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
ENGINE LACKS POWER, REDUCTION IN MAXIMUM MANIFOLD PRESSURE OR CRITICAL ALTITUDE (CONT).	Defective ignition system.	Inspect spark plugs for fouled electrodes, heavy carbon deposits, erosion of electrodes, improperly adjusted electrode gaps and cracked porcelains. Test plugs for regular firing under pressure. Replace damaged or misfiring plugs.
	Improperly adjusted waste-gate valve.	Refer to paragraph 12A-111.
	Loose or damaged exhaust system.	Inspect entire exhaust system to turbocharger for cracks and leaking connections. Tighten connections and replace damaged parts.
	Loose or damaged manifolding.	Inspect entire manifolding system for possible leakage at connections. Replace damaged components, tighten all connections and clamps.
	Fuel discharge nozzle defective.	Inspect fuel discharge nozzle vent manifolding for leaking connections. Tighten and repair as required. Check for restricted nozzles and lines and clean and replace as necessary.
	Malfunctioning turbocharger.	Check for unusual noise in turbocharger. If malfunction is suspected, remove exhaust and/or air inlet connections and check rotor assembly, for possible rubbing in housing, damaged rotor blades or defective bearings. Replace turbocharger if damage is noted.
BLACK SMOKE EXHAUST.	Turbo coking, oil forced through seal of turbine housing.	Clean or change turbocharger.
HIGH CYLINDER HEAD TEMPERATURE.	Defective cylinder head temperature indicating system.	Refer to Section 16.
	Improper use of cowl flaps.	Refer to Owner's Manual.
	Engine baffles loose, bent or missing.	Install baffles properly. Repair or replace if defective.
	Dirt accumulated on cylinder cooling fins.	Clean thoroughly.
	Incorrect grade of fuel.	Drain and refill with proper fuel.

12A-13. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
HIGH CYLINDER HEAD TEMPERATURE (CONT).	Incorrect ignition timing.	Refer to paragraph 12-78.
	Improper use of mixture control.	Refer to Owner's Manual.
	Defective engine.	Repair as required.
HIGH OR LOW OIL TEMPERATURE OR PRESSURE.		Refer to paragraph 12-30.
NOTE Refer to paragraph 12A-106 for trouble shooting of controller and waste-gate actuator.		

12A-14. REMOVAL. If an 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 storage preparation. The following engine removal procedure is based upon the engine being removed from the aircraft as a complete unit with the turbocharger and accessories installed.

NOTE

Tag each item when disconnected to aid in identifying wires, hoses, lines and control linkages when engine is reinstalled. Likewise, shop notes made during removal will often clarify reinstallation. Protect openings, exposed as a result of removing or disconnecting units, against entry of foreign material by installing covers or sealing with tape.

a. Place all cabin switches in the OFF position.
b. Place fuel selector valve in the OFF position.
c. Remove engine cowling in accordance with paragraph 12-3.
d. Disconnect battery cables and insulate terminals as a safety precaution. Remove battery and battery box for additional clearance, if desired.
e. Drain fuel strainer and lines with strainer drain control.

NOTE

During the following procedures, remove any clamps or lacings which secure controls, wires, hoses or lines to the engine, engine nacelle or attached brackets, so they will not interfere with engine removal. Some of the items listed can be disconnected at more than one place. It may be desirable to disconnect some of these items at other than the places indicated. The reason for engine removal should be the governing factor in deciding at which point to disconnect them. Omit any of the items which are not present on a particular engine installation.

f. Drain the engine oil sump and oil cooler.
g. Disconnect magneto primary lead wires at magnetos.

WARNING

The magnetos are in a SWITCH ON condition when the switch wires are disconnected. Ground the magneto points or remove the high tension wires from the magnetos or spark plugs to prevent accidental firing.

h. Remove the spinner and propeller in accordance with Section 14. Cover exposed end of crankshaft flange and propeller flange to prevent entry of foreign material.
i. Disconnect throttle, mixture and propeller controls from their respective units. Remove clamps attaching controls to engine and pull controls aft clear of engine. Use care to avoid bending controls too sharply. Note EXACT position, size and number of attaching washers and spacers for reference on reinstallation.
j. Disconnect wires and cables as follows:
1. Disconnect tachometer drive shaft at adapter.

CAUTION

When disconnecting starter cable do not permit starter terminal bolt to rotate. Rotation of the bolt could break the conductor between bolt and field coils causing the starter to be inoperative.

2. Disconnect starter electrical cable at starter.
3. Disconnect cylinder head temperature wire at probe.
4. Disconnect oil temperature wire at probe below oil cooler.
5. Disconnect electrical wires and wire shielding ground at alternator.
6. Disconnect exhaust gas temperature wires at quick-disconnects.
7. Disconnect electrical wires at throttle microswitch.
8. Remove all clamps and lacings attaching wires or cables to engine and pull wires and cables aft to clear engine.

k. Disconnect lines and hoses as follows:

1. Disconnect vacuum hose at vacuum pump and remove oil separator vent line.

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.

2. Disconnect fuel supply and vapor return hoses at fuel pump. Disconnect and remove fuel pump drain line.
3. Disconnect manifold pressure line at intake manifold.
4. Disconnect the fuel-flow gage line at firewall.
5. Disconnect the oil pressure line at the engine.
6. Disconnect and remove the right and left manifold drain lines and the balance tube drain line.
7. Disconnect air and oil lines at the waste-gate controller, located on the firewall.
8. Disconnect the air vent line to fuel-flow gage, at firewall.
9. Disconnect engine primer lines at right and left intake manifolds.
10. Disconnect the oil drain line from oil deflector under external oil filter.

l. Carefully check the engine again to ensure ALL hoses, lines, wires, cables, clamps and lacings are disconnected or removed which would interfere with the engine removal. Ensure all wires, cables and engine controls have been pulled aft to clear the engine.

CAUTION

Place a suitable stand under tail tie-down ring before removing engine. The loss of engine weight will cause the aircraft to be tail heavy.

m. Attach a hoist to the lifting lug at the top center of the engine crankcase. Lift engine just enough to relieve the weight from the engine mounts.

n. Remove mount bolts, ground strap and heat shields.

o. Slowly hoist engine out of nacelle and clear of aircraft checking for any items which would interfere with the engine removal. Balance the engine by hand and carefully guide the disconnected parts out as the engine is removed.

p. Remove engine shock-mounts

NOTE

If shock-mounts will be re-used, mark each one so it will be reinstalled in exactly the same position. If new shock-mounts will be installed, position them as illustrated in figure 12-2.

12A-14A. 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 rup-up.

c. Average the results of the RPM obtained. It should be within 50 RPM of 2650 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 14 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 conditions.
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).

12A-15. CLEANING. Refer to paragraph 12-15.

12A-16. ACCESSORIES REMOVAL. Refer to paragraph 12-16.

12A-17. INSPECTION. Refer to paragraph 12-17.

12A-18. BUILD-UP. Refer to paragraph 12-18.

12A-19. INSTALLATION. Before installing the engine on the aircraft, install any items which were removed from the engine or aircraft after the engine was removed.

NOTE

Remove all protective covers, plugs, caps and identification tags as each item is connected or installed. Omit any items not present on a particular engine installation.

a. Hoist the engine to a point just above the nacelle.
b. Install engine shock-mounts and ground strap as illustrated in figure 12-2.
c. Carefully lower engine slowly into place on the engine mounts. Route controls, lines, hoses and wires in place as the engine is positioned on the engine mounts.

NOTE

Be sure engine shock-mounts, spacers and washers are in place as the engine is lowered into position.

d. Attach ground strap under engine sump bolt and install engine mount bolts. Torque bolts to 300+ 50-00 lb-in. Bend tab washers to form lock for mount bolts. Install heat shields.
e. Remove support stand placed under tail tie-down fitting and remove hoist.

NOTE

If the exhaust system was loosened or removed, refer to paragraph 12A-98.

f. Connect flexible ducting on heater shroud and cabin valve.
g. Route propeller governor control along left side of engine and secure with clamps.

SHOP NOTES:

NOTE

Throughout the aircraft fuel system, from the fuel cells to the engine driven fuel pump, use RAS-4 (Snap-On Tools 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 fittings 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 fuel injection system fittings.

h. Connect lines and hoses as follows:

1. Install and connect the left and right manifold drain lines and the balance tube drain line.
2. Connect the oil pressure line at its fitting.
3. Connect the fuel-flow gage line at firewall.
4. Connect the fuel supply and the vapor return lines at the fuel pump. Connect and install fuel pump drain line.
5. Connect manifold pressure line at intake manifold.
6. Connect vacuum line at the vacuum pump, and install oil separator vent line.
7. Connect air and oil lines at waste-gate controller on firewall.
8. Connect air vent line to fuel-flow gage line at firewall.
9. Connect engine primer lines at right and left intake manifolds.
10. Connect oil drain line to oil deflector under external oil filter.
11. Install all clamps securing lines and hoses to engine or structure.

i. Connect wires and cables as follows:

1. Connect oil temperature wire at probe below oil cooler.
2. Connect tachometer drive to adapter and torque to 100 lb-in.

WARNING

When connecting starter cable, do not permit starter terminal bolt to rotate. Rotation of the bolt could break conductor between terminal and field coils causing starter to be inoperative.

3. Connect starter electrical lead.
4. Connect cylinder head temperature wire at probe.
5. Connect electrical wires and wire shielding ground to alternator.
6. Connect electrical wires to throttle switch.
7. Connect exhaust gas temperature wires at quick-disconnects.
8. Install clamps that attach wires or cables, to engine or structure.

j. Connect engine controls and install block clamps.

k. Rig engine controls in accordance with paragraphs 12-85, 12-86 and 12-87.

l. Install propeller and spinner in accordance with instructions outlined in Section 14.

m. Complete a magneto switch ground-out and continuity check, then connect primary lead wires to the magnetos. Remove the temporary ground or connect spark plug leads, whichever procedure was used during removal.

WARNING

Be sure magneto switch is in OFF position when connecting switch wires to magnetos.

n. Clean and install induction air filter in accordance with Section 2.

o. 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.

p. Check all switches are in the OFF position and connect battery cables.

q. Inspect engine installation for security, correct routing of controls, lines, hoses and electrical wiring, proper safetying and tightness of all components.

NOTE

When installing a new or newly overhauled engine, and prior to starting the engine, disconnect the oil inlet line at the controller and the oil outlet line at the controller. Connect these oil lines to a full-flow oil filter, allowing oil to bypass the controller. With filter connected, operate engine approximately 15 minutes to filter out any foreign particles from the oil. This is done to prevent foreign material from entering the controller.

r. Install engine cowling in accordance with paragraph 12-3.

s. Perform an engine run-up and make final adjustments on the engine controls.

12A-20. FLEXIBLE FLUID HOSES. Refer to paragraph 12-20.

12A-21. PRESSURE TEST. Refer to paragraph 12-21.

12A-22. REPLACEMENT. Refer to paragraph 12-22.

12A-23. ENGINE BAFFLES. Refer to paragraph 12-23.

12A-24. DESCRIPTION. Refer to paragraph 12-24.

12A-25. CLEANING AND INSPECTION. Refer to paragraph 12-25.

12A-26. REMOVAL AND INSTALLATION. Refer to paragraph 12-26.

12A-27. REPAIR. Refer to paragraph 12-27.

12A-28. ENGINE OIL SYSTEM. Refer to figure 12A-1.

12A-29. DESCRIPTION. The engine lubrication system is a full-pressure, wet-sump type. Lubricating oil is drawn from the engine sump to the oil pump through a suction screen and tube. From the pump, oil under pressure is passed to the full-flow oil filter, where it is filtered before entering the passages of the engine. Bypass valves are provided. Oil from the filter is routed through drilled and cored passages to all moving parts requiring lubrication. Oil furnished to the propeller governor for propeller operation is also routed through internal passages. Oil pressure is maintained by an adjustable, spring-loaded relief valve mounted in the lower portion of the pump body. Oil temperature is automatically regulated by an oil cooler and a thermostat control valve. When the oil temperature reaches a predetermined temperature the thermostat valve closes, causing the oil to be routed through the externally mounted cooler. Engine oil is also used to control the waste-gate and lubricate the turbocharger bearings. Oil is returned to the engine sump from the turbocharger by a scavenger pump, which is integral with the engine oil pump. The oil filler neck is located on top of the engine and is reached through an access door in the top of the left cowl. The oil level in the sump is checked on a dipstick at the rear of number two cylinder and is reached through an access door in the side of the left cowl.

12A-30. TROUBLE SHOOTING. Refer to paragraph 12-30.

12A-31. FULL-FLOW OIL FILTER. Refer to paragraph 12-31.

12A-32. DESCRIPTION. Refer to paragraph 12-32.

12A-33. REMOVAL AND INSTALLATION. Refer to paragraph 12-33.

12A-34. FILTER ADAPTER. Refer to paragraph 12-34.

12A-35. REMOVAL. Refer to paragraph 12-35.

12A-36. DISASSEMBLY, INSPECTION AND REASSEMBLY. Refer to paragraph 12-36.

12A-37. INSTALLATION. Refer to paragraph 12-37.

12A-38. OIL COOLER. Refer to paragraph 12-38.

12A-39. DESCRIPTION. Refer to paragraph 12-39.

12A-40. ENGINE FUEL SYSTEM. Refer to figure 12A-2.

12A-41. DESCRIPTION. The fuel injection system is a low pressure system of injecting fuel into the intake valve port of each cylinder. It is a multi-nozzle, continuous-flow type which controls fuel flow to match engine airflow. Any change in throttle position, engine speed, or a combination of both, causes changes in fuel flow in the correct relation to engine airflow. A manual mixture control and a fuel flow indicator are provided for leaning at any combination of altitude and power setting. The fuel flow indicator is calibrated in gallons per hour and indicates approximately the gallons of fuel consumed per hour. The continuous-flow system uses a typical rotary vane fuel pump. There are no running parts in this system except for the engine-driven fuel pump. The four major components of the system are: the fuel injection pump, fuel-air control unit, fuel manifold valve and the fuel discharge nozzles. The fuel injection pump incorporates an adjustable aneroid sensing unit which is pressurized from the discharge side of the turbocharger compressor. Turbocharger discharge air pressure is also used to vent the fuel discharge nozzles and the vent port of the fuel-flow gage.

NOTE

Throughout the aircraft fuel system, from the fuel cells to the engine-driven fuel pump, use RAS-4 (Snap-On Tools 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 fittings 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 the fitting threads. Do not use any other form of thread compound on the injection system fittings.

12A-42. FUEL-AIR CONTROL UNIT. Refer to paragraph 12-42.

12A-43. DESCRIPTION. Refer to paragraph 12-43.

12A-44. REMOVAL.

a. Place all cabin switches and fuel shut-off valve in the OFF position.

b. Remove cowling in accordance with paragraph 12-3.

c. Loosen clamp and disconnect flexible duct from elbow at top of air throttle.

d. Tag and disconnect electrical wires from electric fuel pump microswitch.

e. Disconnect throttle and mixture control rod ends at fuel-air control unit.

NOTE

Cap or plug all disconnected hoses, lines and fittings.

f. Disconnect cooling air blast tube from fuel control valve shroud.

g. Disconnect and tag all fuel lines at the fuel control valve.

h. Remove nuts and washers securing triangular brace to fuel-air control unit and engine, at lower end of control unit. Remove brace.

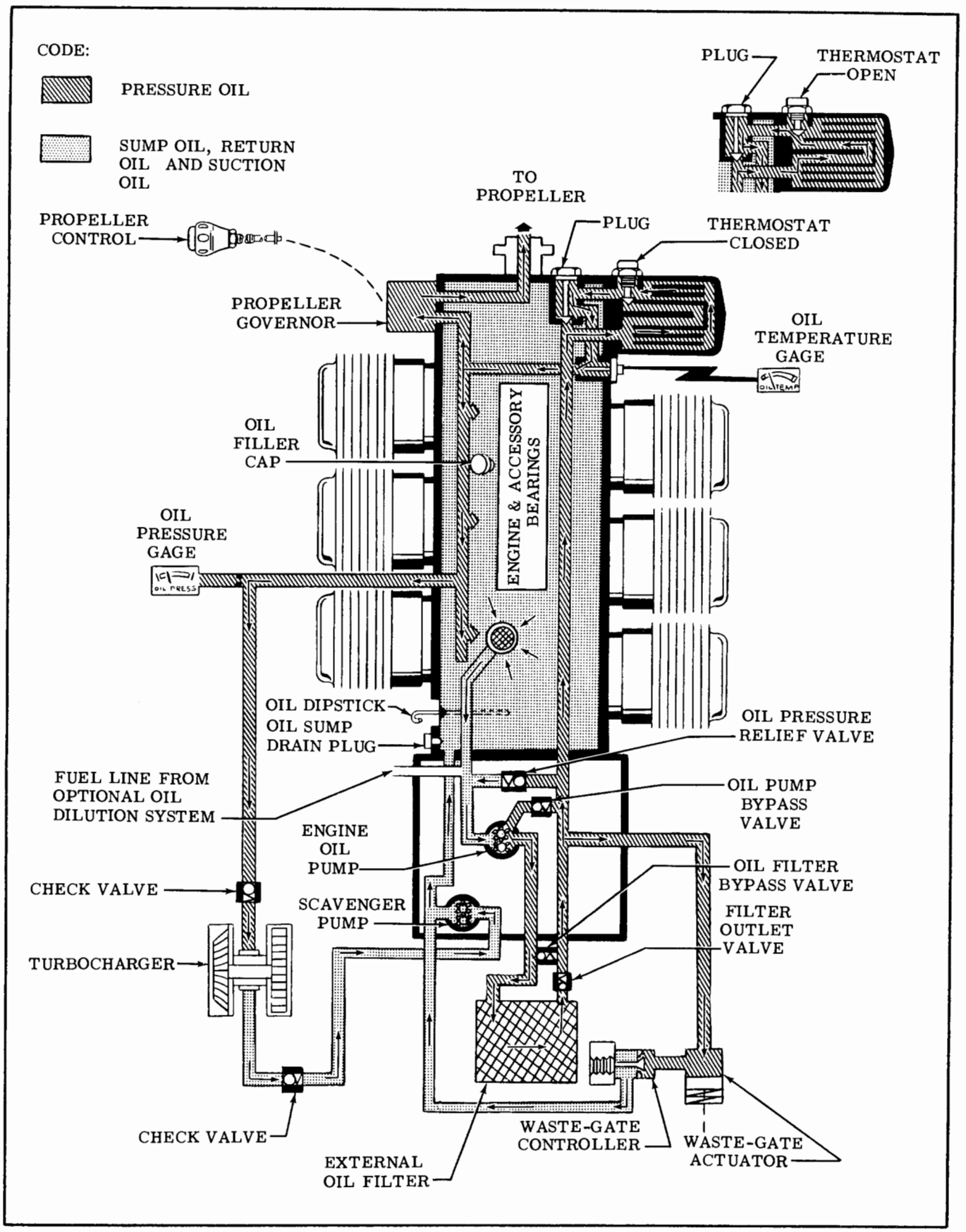


Figure 12A-1. Oil System Schematic

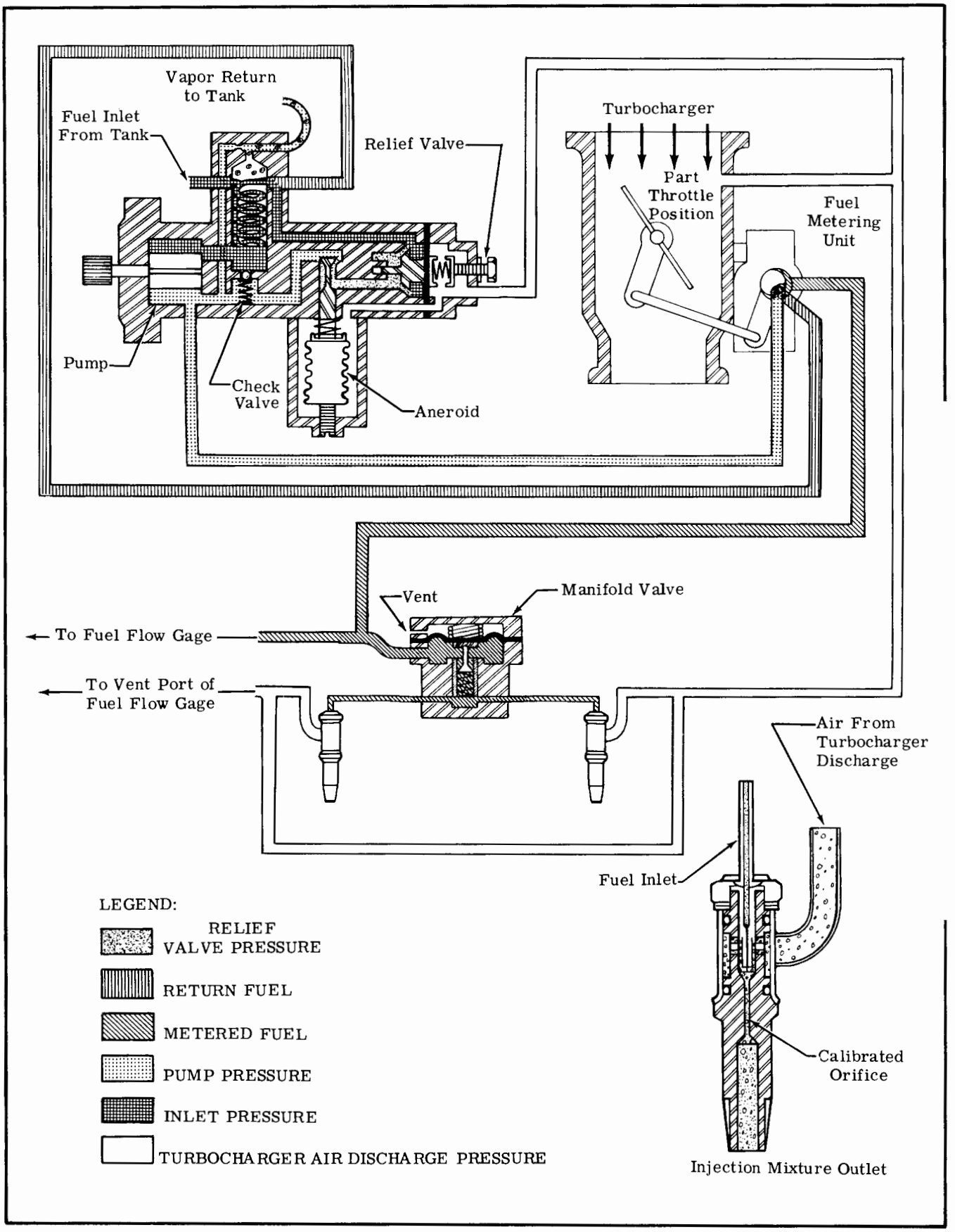


Figure 12A-2. Fuel System Schematic

i. Remove bolt attaching fuel-air control unit to brace at top of control unit.
j. Loosen hose clamps which secure fuel-air control unit to right and left intake manifold assemblies and slip hoses from fuel-air control unit.
k. Remove fuel-air control unit.

12A-45. CLEANING AND INSPECTION. Refer to paragraph 12-45.

12A-46. INSTALLATION.
a. Place control unit in position at rear of engine.
b. Install bolt attaching control unit to brace at top of unit. Ascertain that shock-mount is in place and in good condition.
c. Install triangular brace at lower end of control unit.
d. Install hoses and clamps which secure control unit to right and left intake manifold assemblies. Tighten hose clamps.
e. Connect fuel lines to unit and connect air blast tube at fuel control shroud.
f. Connect throttle and mixture control rod ends to control unit.
g. Connect electrical wires to electric fuel pump microswitch. Check switch rigging in accordance with Section 13.
h. Install induction air duct to elbow at top of control unit.
i. Inspect installation and install cowling.

12A-47. ADJUSTMENTS. Refer to paragraph 12-46.

12A-48. FUEL MANIFOLD VALVE (FUEL DISTRIBUTOR). Refer to paragraph 12-47.

12A-49. DESCRIPTION. Refer to paragraph 12-48.

12A-50. REMOVAL. Refer to paragraph 12-49.

12A-51. CLEANING. Refer to paragraph 12-50.

12A-52. INSTALLATION. Refer to paragraph 12-51.

12A-53. FUEL DISCHARGE NOZZLES.

12A-54. DESCRIPTION. From the fuel manifold valve, individual, identical size and length fuel lines carry metered fuel to the fuel discharge nozzles located in the cylinder heads. The outlet of each nozzle is directed into the intake port of each cylinder. An air bleed and nozzle pressurization arrangement is incorporated in each nozzle to aid in vaporization of the fuel. The nozzles are calibrated in several ranges. All nozzles furnished for one engine are of the same calibrated range and are identified by a number and suffix letter stamped on the flat portion of the nozzle body. When replacing a fuel discharge nozzle, be sure that it is of the same calibrated range as the rest of the nozzles in that engine. When a complete set of nozzles is being replaced, the number must be the same as the one removed but the suffix letter may be different, as long as they are the same for all nozzles being installed in a particular engine.

12A-55. REMOVAL.
a. Remove engine cowling in accordance with paragraph 12-3.

NOTE

Plug or cap all disconnected lines and fittings.

b. Disconnect nozzle pressurization line at nozzles and disconnect pressurization line at "tee" fitting so that pressurization line may be moved away from discharge nozzles.
c. Disconnect fuel injection line at fuel discharge nozzle.
d. Using care to prevent damage or loss of washers and O-rings, lift sleeve assembly from fuel discharge nozzle.
e. Using a standard 1/2-inch deep socket, remove fuel discharge nozzle from cylinder.

12A-56. CLEANING AND INSPECTION. Refer to paragraph 12-55.

12A-57. INSTALLATION.
a. Using a standard 1/2-inch deep socket, install nozzle body in cylinder and tighten to a torque value of 60-80 lb-in.
b. Install O-rings, sleeve assembly and washers.
c. Align sleeve assembly and connect pressurization line to nozzles. Connect pressurization line to "tee" fitting.
d. Install O-ring and washer at top of discharge nozzle and connect fuel injection line to nozzle.
e. Inspect installation for crimped lines and loose fittings.
f. Inspect nozzle pressurization vent system for leakage. A tight system is required, since turbocharger discharge pressure is applied to various other components of the injection system.
g. Install cowling.

12A-58. FUEL INJECTION PUMP.

12A-59. DESCRIPTION. The fuel pump is a positive displacement, rotating vane type. It has a splined shaft for connection to the accessory drive section of the engine. Fuel enters the pump at the swirl well of the pump vapor separator. Here, vapor is separated by a swirling motion so that only liquid fuel is fed to the pump. The vapor is drawn from the top center of the swirl well by a small pressure jet of fuel and is fed into the vapor return line where it is returned to the fuel tank. Since the pump is engine-driven, changes in engine speed affect total pump flow proportionally. A check valve allows the auxiliary fuel pump pressure to bypass the engine-driven pump for starting, or in the event of engine-driven fuel pump failure in flight. The pump supplies more fuel than is required by the engine; therefore, a relief valve is provided to maintain a constant fuel pump pressure. The engine-driven fuel pump is equipped with an aneroid. The aneroid and relief valve are pressurized from the discharge side of the turbocharger compressor to maintain a proper fuel/air ratio at altitude. The aneroid is adjustable for fuel pump outlet pressure at full throttle and the relief valve is adjustable for fuel pump outlet pressure at idle.

12A-60. REMOVAL.

a. Place fuel selector valve handle in OFF position.

b. Remove engine cowling in accordance with paragraph 12-3.

c. Remove alternator and left rear intake elbow.

d. Hoist engine far enough to remove weight from engine mount and remove left rear engine mount leg, shock-mount and alternator bracket.

e. Remove flexible duct and shroud, removing fuel lines and fittings as necessary. Tag each fitting and line for identification and cap or seal to prevent entry of foreign material. Flanges of shroud may be straightened to facilitate removal and installation, but must be re-formed after installation. Note angular position of fittings before removal.

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f. Remove nuts and washers attaching fuel pump to engine and pull pump aft to remove. Remove thin gasket.

g. Place temporary cover on pump mounting pad.

12A-61. INSTALLATION.

a. Install and align any fittings removed after pump removal.

b. Using new thin gasket, install pump with aneroid chamber down.

c. Install cooling shroud and remainder of fittings, bending flanges of shroud to their original positions and aligning fittings as noted during removal.

d. Connect all fuel lines and shroud flexible duct.

e. Install alternator bracket, shock-mount and engine mount leg. Remove hoist, then adjust alternator drive belt tension. Refer to Section 17.

f. Install intake elbow.

g. Start engine and perform an operational check, adjusting fuel pump if required.

h. Install cowling.

12A-62. ADJUSTMENT. Adjustments of the fuel injection pump requires special equipment and procedures. Adjustment to the aneroid applies only to the full throttle setting. Adjustment of the idle position is obtained through the relief valve. To adjust the pump to the pressures specified in paragraph 12A-12, proceed as follows:

a. Remove engine cowling in accordance with paragraph 12-3.

b. Disconnect the engine-driven fuel pump pressure hose and fittings, connect the test gage pressure and vent ports into the fuel injection system in accordance with SK320-2.

NOTE

Cessna Service Kit No. SK320-2 provides a test gage, lines and fittings for connecting the test gage into the system to perform accurate calibration of the engine-driven fuel pump.

c. The test gage MUST be vented to upper deck pressure and MUST be held as near to the level of the engine-driven pump as possible. Bleed air from test gage line prior to taking readings.

NOTE

The test gage should be checked for accuracy at least every 90 days or anytime an error is suspected. The tachometer accuracy should also be determined prior to making any adjustments to the pump.

d. Start engine and warm-up thoroughly. Set mixture control to full rich position and propeller control full forward (low pitch, high rpm).

e. Adjust engine idle speed to 600 ± 25 rpm and check test gage for 6-7 PSI. Refer to figure 12-7 for idle mixture adjustment.

NOTE

Do not adjust idle mixture until idle pump pressure is obtained.

WARNING

DO NOT make fuel pump pressure adjustments while engine is operating.

f. If the pump pressure is not 6 to 7 PSI, stop engine and turn the fuel pump relief valve adjustment, on the centerline of the fuel pump clockwise (CW) to increase pressure and counterclockwise (CCW) to decrease pressure.

g. Maintaining idle pump pressure and idle RPM, obtain correct idle mixture in accordance with paragraph 12-46.

h. Completion of the preceding steps have provided:

1. Correct idle pump pressure.
2. Correct fuel flow.
3. Correct fuel metering cam to throttle plate orientation.

i. Advance to full throttle and maximum rated engine speed with the mixture control in full rich position and propeller control in full forward (low pitch, high rpm).

j. Check test gage for pressures specified in paragraph 12A-12. If pressure is incorrect, stop engine and adjust pressure by loosening locknut and turning the adjusting screw located at rear of aneroid counterclockwise (CCW) to increase pressure and clockwise (CW) to decrease pressure.

NOTE

If at static run-up, rated RPM cannot be achieved at full throttle, adjust pump pressure slightly below limits making certain the correct pressures are obtained when rated RPM is achieved during take-off roll.

k. After correct pressures are obtained, tighten locknut.

l. Remove test equipment, run engine to check for leaks and install cowling.

12A-62A. RIGGING THROTTLE OPERATED MICRO-SWITCH. Refer to Section 13,

12A-62B. AUXILIARY ELECTRIC FUEL PUMP FLOW RATE ADJUSTMENT. Refer to Section 13.

12A-63. INDUCTION AIR SYSTEM.

12A-64. DESCRIPTION. Ram air to the engine enters an induction air duct at the right side of the nose cap. The air is filtered through a dry filter, located in the induction airbox. From the filter, the air passes through a flexible duct to the inlet of the turbocharger compressor. The pressurized air is then routed through a duct to the fuel-air control unit mounted behind the engine and is then supplied to the cylinders through the intake manifold piping. The fuel-air control unit is connected to the cylinder intake manifold by elbows, hoses and clamps. The intake manifold is attached to each cylinder by four bolts through a welded flange, which is sealed by a gasket. A balance tube passes around the front side of the engine to complete the manifold assembly. An alternate air door, mounted in the duct between the filter and the turbocharger compressor, is held closed by a small magnet. If the induction air filter should become clogged, suction from the turbocharger compressor will open the door permitting the compressor to draw heated, unfiltered air from within the engine compartment. The alternate air door should be checked periodically for freedom of operation and complete closing. The induction air filter should be removed and cleaned at each 50-hour inspection, more often when operating under dusty conditions. Refer to Section 2.

12A-65. AIRBOX.

12A-66. REMOVAL AND INSTALLATION.

a. Remove engine cowling in accordance with paragraph 12-3.
b. Loosen clamp at lower end of airbox and remove flexible duct.
c. Remove two screws, washers and nuts attaching airbox to upper rear engine baffle.
d. Remove four screws attaching airbox to induction air duct and work airbox and filter from duct.
e. Remove screws attaching clips on duct to clips on rocker box covers.
f. Remove screws attaching lower side of induction air duct to the two front cylinder rocker box covers.
g. Loosen clamp and remove air duct from flexible inlet air duct and remove duct.
h. Reverse the preceding steps for reinstallation

NOTE

Clean filter and ascertain that induction air ducts and airbox are clean when installing.

12A-67. CLEANING AND INSPECTION. Refer to paragraph 12-66.

12A-68. INDUCTION AIR FILTER.

12A-69. DESCRIPTION. An induction air filter, mounted in the aft end of the airbox removes dust particles from the ram air entering the engine.

12A-70. REMOVAL AND INSTALLATION.

a. Remove right half of engine cowling in accordance with paragraph 12-3.
b. Remove screws attaching airbox to upper rear baffle.
c. Loosen clamp and disconnect flexible air duct to airbox.
d. Remove four screws attaching airbox to forward air duct and work airbox and filter from aircraft.
e. Remove four bolts, washers and nuts attaching filter between airbox halves.

NOTE

When installing filter, note direction of air flow. Inspect and install gasket at aft face of filter assembly. Also, when tightening bolts fastening filter, push inward on lower end of the upper duct (where turbocharger inlet connects to the upper duct). This is done so that inlet hose doesn't chafe against the cowling.

f. Reverse the preceding steps for reinstallation.

12A-71. CLEANING AND INSPECTION. Clean and inspect filter in accordance with Section 2.

12A-72. IGNITION SYSTEM. Refer to paragraph 12-71.

12A-73. DESCRIPTION. Refer to paragraph 12-72.

12A-74. TROUBLE SHOOTING. Refer to paragraph 12-73.

12A-75. MAGNETOS. Refer to paragraph 12-74.

12A-76. DESCRIPTION. Refer to paragraph 12-75.

12A-77. REMOVAL. Refer to paragraph 12-76.

12A-78. INTERNAL TIMING. Refer to paragraph 12-77.

12A-79. INSTALLATION AND TIMING-TO-ENGINE. Refer to paragraph 12-78.

12A-80. MAINTENANCE. Refer to paragraph 12-79.

12A-81. MAGNETO CHECK. Refer to paragraph 12-80.

12A-82. SPARK PLUGS. Refer to paragraph 12-81.

12A-83. ENGINE CONTROLS. Refer to paragraph 12-82.

12A-84. DESCRIPTION. Refer to paragraph 12-83.

12A-85. RIGGING. Refer to paragraph 12-84.

12A-86. THROTTLE CONTROL. Refer to paragraph 12-85.

12A-87. MIXTURE CONTROL. Refer to paragraph 12-86.

12A-88. PROPELLER CONTROL. Refer to Section 14.

12A-89. STARTING SYSTEM. Refer to paragraph 12-88.

12A-90. DESCRIPTION. Refer to paragraph 12-89.

12A-91. TROUBLE SHOOTING. Refer to paragraph 12-90.

12A-92. PRIMARY MAINTENANCE. Refer to paragraph 12-91.

12A-93. STARTER MOTOR.

12A-94. REMOVAL AND INSTALLATION.

a. Remove cowling in accordance with paragraph 12-3.

b. Remove induction airbox in accordance with paragraph 12A-66.

c. Disconnect electrical power cable at starter and insulate terminal as a safety precaution.

d. Remove nuts securing starter and remove starter.

e. Reverse the preceding steps for reinstallation. Install a new O-ring and be sure the starter drive engages with the drive in the adapter.

12A-95. EXHAUST SYSTEM. Refer to figure 12A-3.

12A-96. DESCRIPTION. The exhaust system consists of two exhaust stack assemblies, one for the left and one for the right bank of cylinders. These exhaust stack assemblies are joined together to route the exhaust from all cylinders through the waste-gate or turbine. The three risers on the left bank of cylinders are joined together into a common pipe to form the left stack assembly. The right rear cylinder exhaust is routed down and aft to the rear of the engine where it connects to the left stack assembly. The risers on the two right front cylinders are connected to a common pipe to form the right stack assembly. The right stack assembly connects to the left stack assembly at the front of the engine. Mounting pads for the waste-gate and turbine are provided on the right stack assembly. From the exhaust port of the turbine, a tailpipe routes the exhaust overboard through the lower fuselage. The exhaust port of the waste-gate is routed into the tailpipe so the exhaust gas can be expelled from the system when not needed at the turbine. The waste-gate is actuated by the waste-gate actuator which, in turn, is controlled by the waste-gate controller. Also, sleeving is installed on the fuel hose from the engine-driven pump to the fuel metering body and on the hose from the auxiliary fuel pump to the engine-driven pump. This is to prevent excessive heat on these fuel hoses as they route close to the exhaust stack.

12A-97. REMOVAL.

a. Remove engine cowling and right and left nose caps in accordance with paragraph 12-3.

b. Remove intake manifold balance tube from front of engine.

c. Remove heat shield at front of engine.

d. Loosen clamp and disconnect flexible duct at aft end of cabin heater shroud on left exhaust stack assembly.

e. Remove clamps and bolts securing rear heat shield to engine and remove heat shield.

f. Remove clamps attaching left exhaust stack assembly to riser pipes and to rear crossover pipe on left side of engine.

g. Work left exhaust stack assembly down from risers and out of crossover pipes at front and rear of engine.

h. Remove four nuts and washers attaching exhaust riser pipe to each cylinder on left bank of cylinders and remove riser pipes and gaskets.

i. Remove clamp attaching exhaust tailpipe to exhaust port of turbine.

j. Remove bolts attaching waste-gate to right exhaust stack assembly. Work tailpipe from turbine and lower waste-gate and tailpipe into cowling.

k. Remove bolts attaching turbocharger to mounting brackets.

l. Remove bolts and nuts attaching turbocharger to right exhaust stack assembly. Lower turbocharger into cowling.

m. Remove bolts, nuts and clamps attaching right exhaust stack assembly to riser pipes on right side of engine.

n. Work right exhaust stack assembly down from risers and remove.

o. Remove nuts and washers attaching riser pipes to front two cylinders on right side of engine and remove riser pipes and gaskets.

p. Remove nuts and washers attaching exhaust pipe to rear cylinder on right side of engine and remove pipe and gasket.

12A-98. INSTALLATION.

NOTE

It is important that the complete exhaust system, including the turbocharger and waste-gate, be installed without pre-loading any section of the exhaust stack assembly.

a. Use new gaskets between exhaust stacks and engine cylinders, at each end of waste-gate and between turbocharger and exhaust stack.

b. Place all sections of exhaust stacks in position and torque nuts attaching them to the cylinders evenly to 100-110 lb-in., while riser clamps are loose.

c. Manually check that crossover pipe slip-joints do not bind. Tighten clamp attaching left risers to left stack assembly. Tighten the clamp attaching right stack to right front riser.

d. Raise turbocharger into position and install bolts and nuts attaching turbocharger to right exhaust stack and those attaching turbocharger to front and rear turbocharger supports (figure 12A-5). Tighten bolts securely.

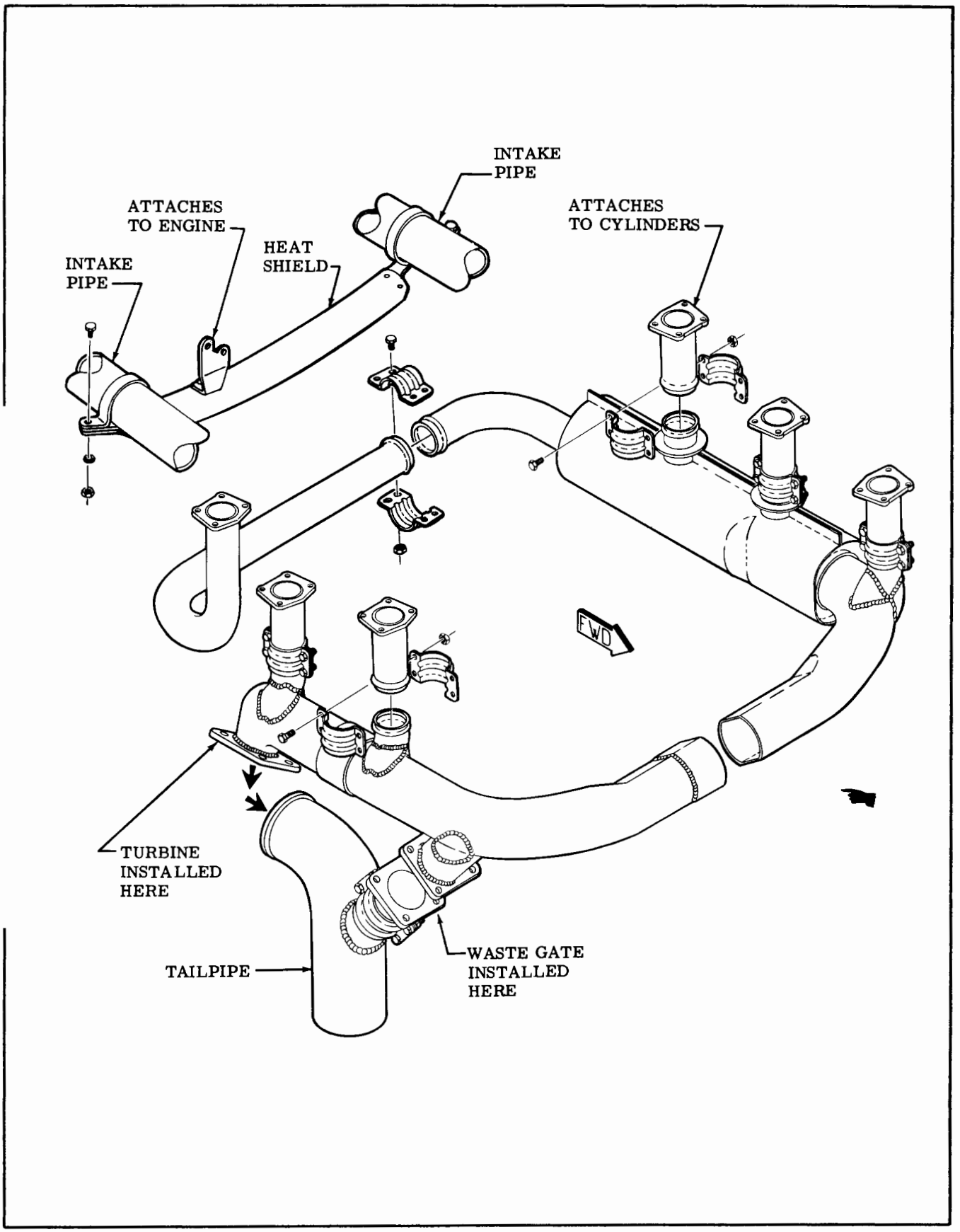
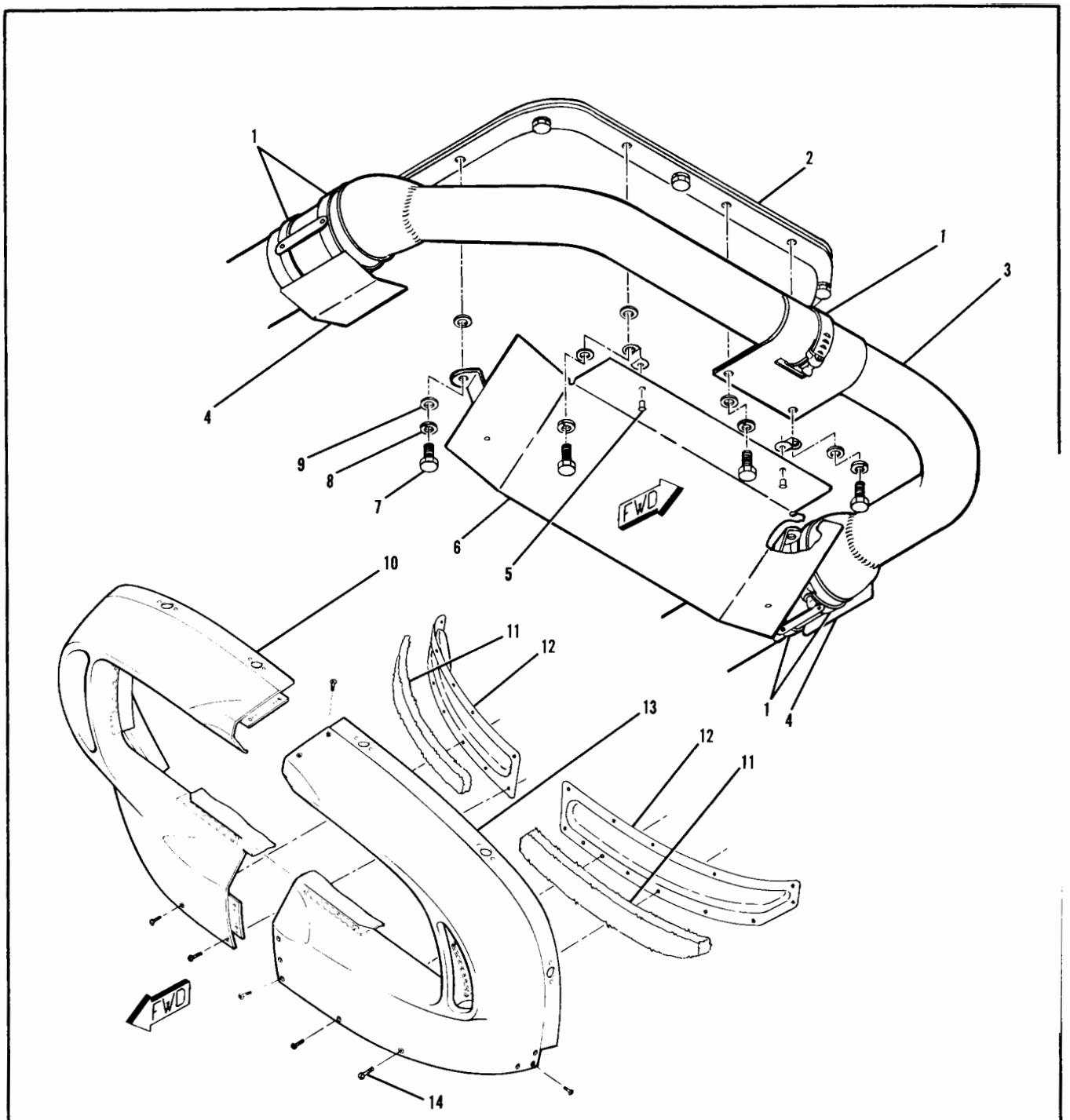


Figure 12A-3. Exhaust System (Sheet 1 of 2)



HEAT DEFLECTORS AND INSULATORS

1. Clamp
2. Crankcase
3. Intake Manifold Balance Tube
4. Heat Deflector
5. Rivet
6. Heat Shield
7. Bolt
8. Lockwasher
9. Washer
10. Right Nosecap
11. Insulation
12. Retaining Skin
13. Left Nosecap
14. Screw

Figure 12A-3. Exhaust System (Sheet 2 of 2)

e. Install bolts and nuts attaching waste-gate to right hand exhaust stack and tighten securely.

f. While applying an upward force of one G to counteract weight of turbocharger and waste-gate assembly, tighten clamp attaching exhaust stack to riser.

g. Tighten clamp securing tailpipe to turbocharger.

h. Be sure all parts are secure and safetied as required, then perform step "b" of paragraph 12A-99 to check for air leaks.

i. Install heater shroud duct and heat shields.

j. Install intake manifold balance tube at front of engine and install heat shields at front of engine, then install nose caps and cowling.

NOTE

The lower sections of turbocharger supports (index 8, figure 12A-5) are supplied as service parts with their upper holes omitted. These undrilled parts are also supplied when a new turbocharger inlet stack, right front stack, or either of the two right front risers is ordered. The following steps outline the proper procedure for drilling and installing the supports.

k. Install all parts but do not tighten attaching clamps or bolts.

l. Torque nuts attaching risers to cylinders evenly to 100-110 lb-in.

m. Tighten bolts and clamps per steps "d" through "g".

NOTE

It is important that weight of turbocharger and waste-gate assembly be counteracted, as listed in step "f", when tightening clamps attaching stacks to risers.

n. Make hole locations in undrilled supports to match existing holes in upper supports.

o. Remove lower supports, leaving all other parts tight.

p. Drill the marked holes with a 3/8-inch drill. On earlier models the holes were 0.257-inch, therefore, it may be necessary to enlarge the holes in upper supports.

q. Reinstall supports, install bolts fastening upper and lower supports together, then tighten all bolts securely. If any exhaust system bolts or clamps were loosened while lower supports were not installed, loosen all clamps and bolts and repeat the installation procedure to be sure no pre-loading is present.

r. Be sure all parts are secure and safetied as required, reinstall any parts removed for access, then install nose caps and cowling.

12A-99. 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 optimum turbocharger efficiency and engine power. To inspect the engine exhaust system, proceed as follows:

a. Remove engine cowling as required so that ALL surfaces of the exhaust assemblies can be visually inspected.

WARNING

Never use highly flammable solvents on engine exhaust systems. Never use a wire brush or abrasives to clean exhaust systems or mark on the system with lead pencils.

NOTE

Especially check the areas adjacent to welds and slip joints. Look for gas deposits in surrounding 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. Forming of bubbles is acceptable, if bubbles are blown away system is not acceptable. Also, some bubbles will appear at the joint of the turbocharger turbine and compressor bearing housing.

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 openings.
3. Using a manometer or gage, apply approximately 1-1/2 psi (3 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 that sysyem is acceptable.

12A-100. TURBOCHARGER.

12A-101. DESCRIPTION. The turbocharger is an exhaust gas-driven compressor, or air pump, which provides high velocity air to the engine intake manifold. The turbocharger is composed of a turbine wheel, compressor wheel, turbine housing and compressor housing. The turbine, compressor wheel and interconnecting drive shaft comprise one complete assembly and are the only moving parts in the turbocharger. Turbocharger bearings are lubricated with filtered oil supplied from the engine oil system. Engine exhaust gas enters the turbine housing to drive the turbine wheel. The turbine wheel, in turn, drives the compressor wheel, producing a high velocity of air entering the engine induction intake manifold. Exhaust gas is then dumped overboard through the exhaust outlet of the turbine housing and exhaust tailpipe. Air is drawn into the compressor through the induction air filter and is forced out of the compressor housing through a tangential outlet to the intake manifold. The degree of turbocharging is varied by means of a waste-gate valve, which varies the amount of exhaust gas allowed to bypass the turbine.

12A-102. REMOVAL AND INSTALLATION.

a. Remove engine cowling as required.
b. Remove waste-gate to tailpipe clamp.
c. Loosen clamp at turbine exhaust outlet and work tailpipe from turbine outlet.
d. Loosen clamps and remove air inlet and outlet ducts from turbocharger compressor.
e. Disconnect oil pressure and scavenger lines from turbocharger. Plug or cap open oil lines and fittings. Remove clamp on oil supply line to the turbocharger.
f. Loosen clamp and remove induction air inlet elbow at turbocharger compressor.
g. Remove right cowl flap by disconnecting control at cowl flap and removing hinge pin.
h. Cut safety wire and remove two bolts attaching turbine to forward mounting bracket.
i. Remove three bolts attaching turbine to turbine rear mounting bracket.
j. Remove three remaining bolts, washers and nuts attaching turbine to exhaust manifold.
k. Work turbocharger from aircraft through cowl flap opening in lower cowling.
l. Reverse the preceding steps for reinstallation. When installing the turbocharger, install a new gasket between exhaust manifold and turbine exhaust inlet. Reinstall safety wire.

12A-103. CONTROLLER AND WASTE-GATE ACTUATOR.

12A-104. FUNCTIONS. The waste-gate actuator and controller uses engine oil for power supply. The turbocharger is controlled by the waste-gate, waste-gate actuator, the absolute pressure and overboost control valve. The waste-gate bypasses engine exhaust gas around the turbocharger turbine inlet. The waste-gate actuator, which is physically connected to the waste-gate by mechanical linkage, controls the position of the waste-gate butterfly valve. The absolute pressure controller controls the maximum turbocharger compressor discharge pressure, the overboost control valve prevents an excessive pressure increase from the turbocharger compressor.

12A-105. OPERATION. The waste-gate actuator is spring-loaded to position the waste-gate to the normally open position when there is not adequate oil pressure in the waste-gate actuator power cylinder during engine shut down. When the engine is started, oil pressure is fed into the waste-gate actuator power cylinder through the capillary tube. This automatically fills the waste-gate actuator power cylinder and lines leading to the controllers, blocking the flow of oil by normally closed metering and/or poppet valves. As oil pressure builds up in the waste-gate actuator power cylinder, it overcomes the force of the waste-gate open spring, closing the waste-gate. When the waste-gate begins to close, the exhaust gases are routed through the turbocharger turbine. As the engine increases its power and speed, the increase of

SHOP NOTES:

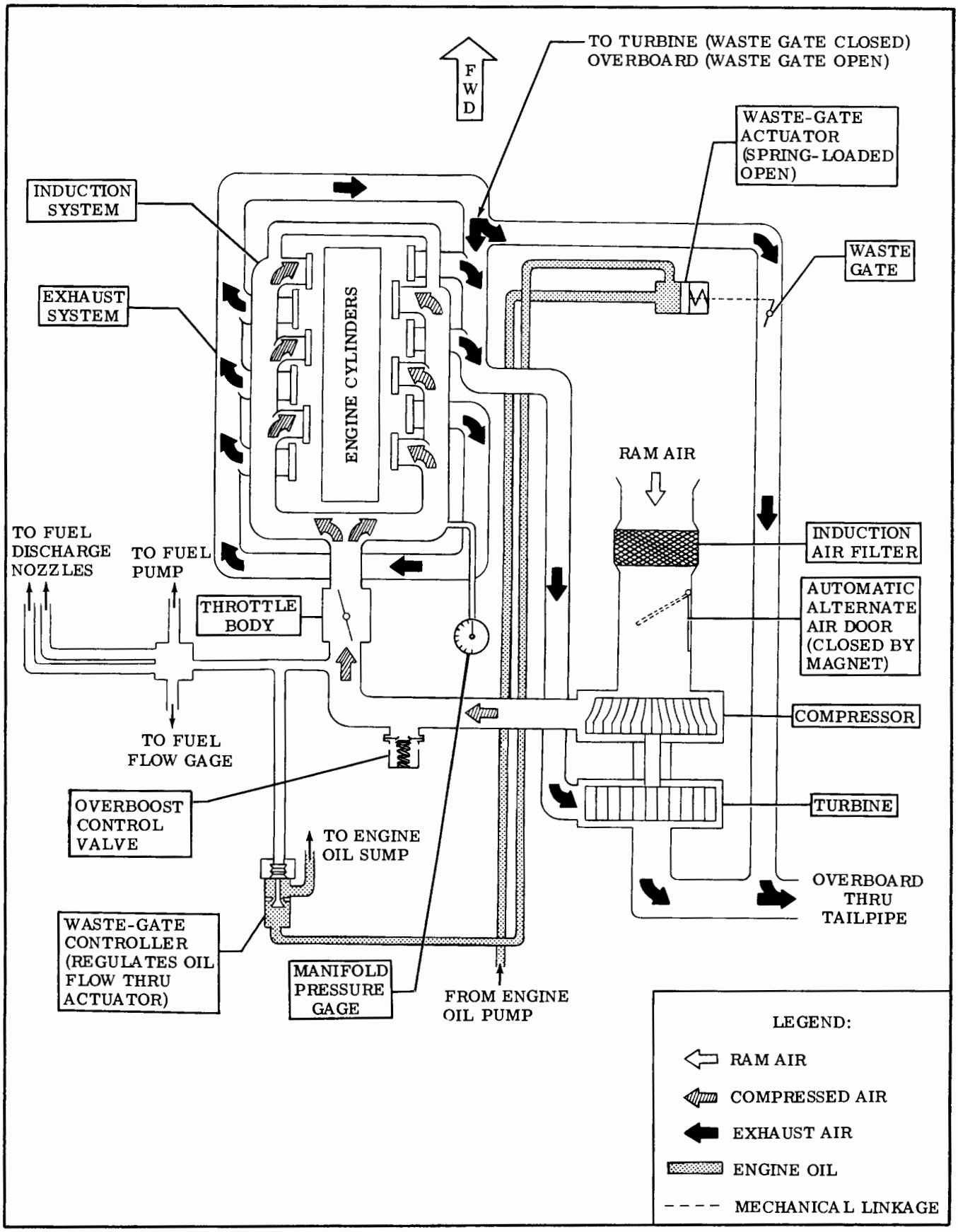


Figure 12A-4. Turbocharger System Schematic

temperature and pressure of the exhaust gases causes the turbocharger to rotate faster, raising the turbocharger compressor outlet pressure. As the compressor outlet pressure rises, the aneroid bellows and the absolute pressure controller sense the increase in pressure. When at high engine speed and load and the proper absolute pressure is reached, the force on the aneroid bellows opens the normally closed metering valve. When the oil pressure in the waste-gate actuator power cylinder is lowered sufficiently, the waste-gate actuator open spring forces the mechanical linkage to open the waste-gate. A portion of the exhaust gases then bypasses the turbocharger turbine, thus preventing further increase of turbocharger speed and holding the compressor discharge absolute pressure to the desired valve. Conversely, at engine idle, the turbocharger runs slowly with low compressor pressure output; therefore, the low pressure applied to aneroid bellows is not sufficient to affect the unseating of the normally closed metering valve. Consequently, engine oil pressure keeps the waste-gate closed. The overboost control valve acts as a pressure relief valve and will open to prevent an excessive pressure increase from the turbocharger compressor. Above 19,000 feet, the absolute pressure controller will continue to maintain 32.5±.5 inches of mercury manifold pressure at full throttle. It is necessary to reduce manifold pressure with the throttle to follow the maximum manifold pressure versus altitude schedule shown on the instrument panel placard.

CAUTION

All turbocharged engine installations on Cessna aircraft are equipped with controller systems which automatically control the engine within prescribed manifold pressure limits. Although these automatic controller systems are very reliable and eliminate the need for manual control through constant throttle manipulation, they are not infallible. For instance, such things as rapid throttle manipulation (especially with cold oil), momentary waste-gate sticking, air in the oil system of the controller, etc., can cause overboosting.

Consequently, it is still necessary that the pilot observe and be prepared to control the manifold pressure, particularly during take-off and power changes in flight.

The slight overboosting of manifold pressure beyond established minimums, which is occasionally experienced during initial take-off roll or during a change to full throttle operation in flight, is not considered detrimental to the engine as long as it is momentary. Momentary overboost is generally in the area of 2 to 3 inches and can usually be controlled by slower throttle movement. No corrective action is required where momentary overboosting corrects itself and is followed by normal engine operation. However, if overboosting of this nature persists, or if the amount of overboost goes as high as 6 inches, the controller and overboost control should be checked for necessary adjustment or replacement of the malfunctioning component.

OVERBOOST EXCEEDING 6 INCHES beyond established minimums is excessive and can result in engine damage. It is recommended that overboosting of this nature be reported to your Cessna Dealer, who will be glad to determine what, if any, corrective action needs to be taken.

12A-106. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
UNABLE TO GET RATED POWER BECAUSE MANIFOLD PRESSURE IS LOW.	Controller not getting enough oil pressure to close the waste-gate.	Check oil pump outlet pressure, oil filter and external lines for obstructions. Clean lines and replace if defective. Replace oil filter.
	Controller out of adjustment or defective.	Refer to paragraph 12A-109. Replace controller if defective.
	Defective actuator.	Refer to paragraph 12A-111. Replace actuator if defective.
	Leak in exhaust system.	Check for cracks and other obvious defects. Replace defective components. Tighten clamps and connections.
	Leak in intake system.	Check for cracks and loose connections. Replace defective components. Tighten all clamps and connections.
ENGINE SURGES OR SMOKES.	Defective controller.	Refer to paragraph 12A-109. Replace if not adjustable.
	Waste-gate actuator linkage binding.	Refer to paragraph 12A-111.
	Waste-gate actuator leaking oil.	Replace actuator.
TURBOCHARGER NOISY WITH PLENTY OF POWER.	Turbocharger overspeeding from defective or improperly adjusted controller.	Refer to paragraph 12A-109. Replace if defective.
	Waste-gate sticking closed.	Correct cause of sticking. Refer to paragraph 12A-109. Replace defective parts.
	Controller drain line (oil return to engine sump) obstructed.	Clean line. Replace if defective.
ENGINE POWER INCREASES SLOWLY OR SEVERE MANIFOLD PRESSURE FLUCTUATIONS WHEN THROTTLE ADVANCED RAPIDLY.	Overboost control valve out of adjustment or defective.	Replace if defective.
	Waste-gate operation is sluggish.	Refer to paragraph 12A-111. Replace if defective. Correct cause of sluggish operation.
ENGINE POWER INCREASES RAPIDLY AND MANIFOLD PRESSURE OVERBOOSTS WHEN THROTTLE ADVANCED RAPIDLY.	Overboost control valve out of adjustment or defective.	Replace if defective.
	Waste-gate operation is sluggish.	Refer to paragraph 12A-111. Replace if defective. Correct cause of sluggish operation.

12A-106. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
FUEL PRESSURE DECREASES DURING CLIMB, WHILE MANIFOLD PRESSURE REMAINS CONSTANT.	Compressor discharge pressure line to fuel pump aneroid restricted.	Check and clean out restrictions.
	Leaking or otherwise defective engine-driven fuel pump aneroid.	Replace engine-driven fuel pump.
MANIFOLD PRESSURE DECREASES DURING CLIMB AT ALTITUDES BELOW NORMAL PART THROTTLE CRITICAL ALTITUDE, OR POOR TURBOCHARGER PERFORMANCE INDICATED BY CRUISE RPM FOR CLOSED WASTEGATE. (Refer to paragraph 12A-107.)	Leak in intake system.	Check for cracks and other obvious defects. Tighten all hose clamps and fittings. Replace defective components.
	Leak in exhaust system.	Check for cracks and other obvious defects. Tighten all clamps and fittings. Replace defective components.
	Leak in compressor discharge pressure line to controller.	Check for cracks and other obvious defects. Tighten all clamps and fittings. Replace defective components.
	Controller seal leaking.	Replace controller.
	Waste-gate actuator leaking oil.	Replace actuator.
	Waste-gate butterfly - closed gap is excessive.	Refer to paragraph 12A-111.
	Intake air filter obstructed.	Service air filter. Refer to Section 2 for servicing instructions.
FUEL FLOW DOES NOT DECREASE AS MANIFOLD PRESSURE DECREASES AT PART-THROTTLE CRITICAL ALTITUDE.	Defective engine-driven fuel pump aneroid mechanism.	Replace engine-driven fuel pump.
	Obstruction or leak in compressor discharge pressure line to engine-driven fuel pump.	Check for leaks or obstruction. Clean out lines and tighten all connections.
FUEL FLOW INDICATOR DOES NOT REGISTER CHANGE IN POWER SETTINGS AT HIGH ALTITUDES.	Moisture freezing in indicator line.	Disconnect lines, thaw ice and clean out lines.
SUDDEN POWER DECREASE ACCOMPANIED BY LOUD NOISE OF RUSHING AIR.	Intake system air leak from hose becoming detached.	Check hose condition. Install hose and hose clamp securely.
MANIFOLD PRESSURE GAGE INDICATION WILL NOT REMAIN STEADY AT CONSTANT POWER SETTINGS.	Defective controller.	Replace controller.
	Waste-gate operation is sluggish.	Refer to paragraph 12A-111. Replace if defective. Correct cause of sluggish operation.

12A-107. CONTROLLER AND TURBOCHARGER OPERATIONAL FLIGHT CHECK. The following procedure details the method of checking the operation of the absolute controller overboost control valve, and a performance check of the turbocharger.

(1) TAKE-OFF-ABSOLUTE CONTROLLER CHECK.

a. Cowl Flaps - Open.
b. Airspeed - 110 MPH IAS.
c. Oil Temperature - Middle of green arc.
d. Engine Speed - 2700 ± 25 RPM.
e. Fuel Flow - 28.0 to 29.5 GPH (168.0 to 177.0 LBS/HR) (Full Rich Mixture).
f. Full Throttle M. P. - Absolute controller should maintain 32.5 ± .5 in. Hg (stabilized).

Climb 2000 feet after take-off to be sure manifold pressure has stabilized. It is normal on the first take-off of the day for full throttle manifold pressure to decrease 1/2 to 1.0 inch of mercury within one minute after the initial application of full power. Refer to paragraph 12A-109 for absolute controller adjustment.

(2) CLIMB - ABSOLUTE CONTROLLER AND TURBOCHARGER PERFORMANCE CHECK.

a. Cowl Flaps - Open.
b. Airspeed - 120 MPH IAS.
c. Engine Speed - 2500 RPM.
d. Fuel Flow - Adjust mixture for 20 GPH (120.0 LBS/HR).
e. Part - Throttle M. P. - 27.5 in. Hg.
f. Climb to 20,000 feet - Check part-throttle critical altitude during climb.

This part-throttle critical altitude is where manifold pressure starts decreasing during the climb at a rate of approximately 1.0 inch of mercury per 1000 feet. After noting this altitude and the outside air temperature, the desired manifold pressure should be maintained by advancing the throttle during the remainder of the climb.

Once the climb power setting is established after take-off, the controller should maintain a steady manifold pressure up to the part-throttle critical altitude indicated in the following chart. If part-throttle critical altitude has not been reached by 20,000 feet, discontinue check and proceed to cruise check.

Outside Air Temperature	Part-Throttle Critical Altitude (75% Power)
Standard or Colder	Above 24,000 feet
20°F Above Standard	16,000 to 22,000 feet
40°F Above Standard	10,000 to 16,000 feet

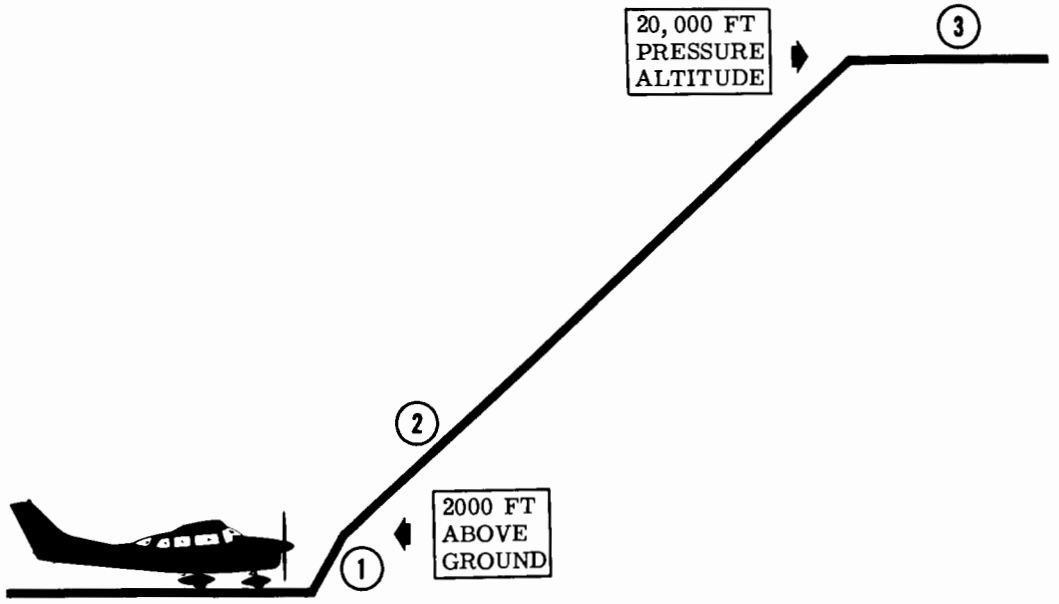
Part-throttle critical altitudes lower than those listed indicate the turbocharger system is not operating properly (refer to the trouble shooting chart in paragraph 12A-106). Critical altitudes above those listed indicate turbocharger performance better than normal. Also check that fuel flow decreases as manifold pressure decreases at critical altitude. Refer to the trouble shooting chart if fuel flow does not decrease.

(3) CRUISE - TURBOCHARGER PERFORMANCE CHECK.

a. Cowl Flaps - Closed.
b. Airspeed - Level flight.
c. Pressure Altitude - 20,000 feet.
d. Engine Speed - 2700 RPM.
e. Part-Throttle M. P. - 27.5 in. Hg.
f. Fuel Flow - Lean to 18 GPH (108.0 LBS/HR).
g. Propeller Control -
   (1) Slowly decrease RPM until manifold pressure starts to drop, indicating waste-gate is closed.
   (2) Note outside air temperature and RPM as manifold pressure starts to drop, which should be in accordance with the following chart.
   (3) After noting temperature and RPM, increase engine speed 50 RPM to stabilize manifold pressure, with the waste-gate modulating exhaust flow to control compressor output.

Outside Air Temperature	RPM where M. P. Starts to Decrease
40°F Above Standard	2700 to 2550
20°F Above Standard	2600 to 2450
Standard Temperature	2500 to 2350
20°F Below Standard	2400 to 2550
40°F Below Standard	2300 to 2150

If the waste-gate is closed at engine speeds higher than those listed, refer to the trouble shooting chart in paragraph 12A-106. Closing of the waste-gate at engine speeds lower than those listed indicates turbocharger performance better than normal.



NOTE

Circled numbers refer to corresponding flight checks required in preceding text.

12A-108. REMOVAL AND INSTALLATION OF TURBOCHARGER CONTROLLER.

a. Disconnect and tag oil lines from controller and plug or cap open lines and fittings.

b. Disconnect compressor outlet pressure sensing line from controller and plug or cap open line and fitting.

c. Remove two bolts attaching controller to mounting bracket on firewall.

d. Remove controller from aircraft, being careful not to drop controller unit.

e. Installation of the controller may be accomplished by reversing the preceding steps. Resafety bolts attaching controller to bracket.

12A-109. ABSOLUTE CONTROLLER ADJUSTMENTS. (Refer to figure 12A-6.)

a. With engine oil temperature at middle of green arc, slowly open throttle and note maximum manifold pressure obtainable. Do not exceed 32.5±.5 in. Hg.

b. Cut safety wire and remove plug from bottom of absolute controller (the vertical unit).

c. Using a flat-bladed screwdriver, rotate metering valve seat clockwise to increase manifold pressure and counterclockwise to decrease manifold pressure. Lightly tap the unit after each adjustment to seat internal parts.

NOTE

When adjusting, rotate in VERY small increments as this is an extremely sensitive adjustment. Approximately 13 degrees rotation will change the manifold pressure reading about one inch Hg.

d. Install and safety plug in absolute unit, then operate engine as in step "a" to ascertain that adjustment has not caused radical change in manifold pressure.

NOTE

When making adjustment on the ground, the hotter the engine gets, the lower the manifold pressure will be.

e. After each adjustment, the aircraft must be flight tested to check results.

f. Repeat this procedure until desired results are obtained.

12A-110. REMOVAL AND INSTALLATION OF WASTE-GATE AND ACTUATOR.

a. Disconnect and tag oil lines from actuator and plug or cap open lines and fittings.

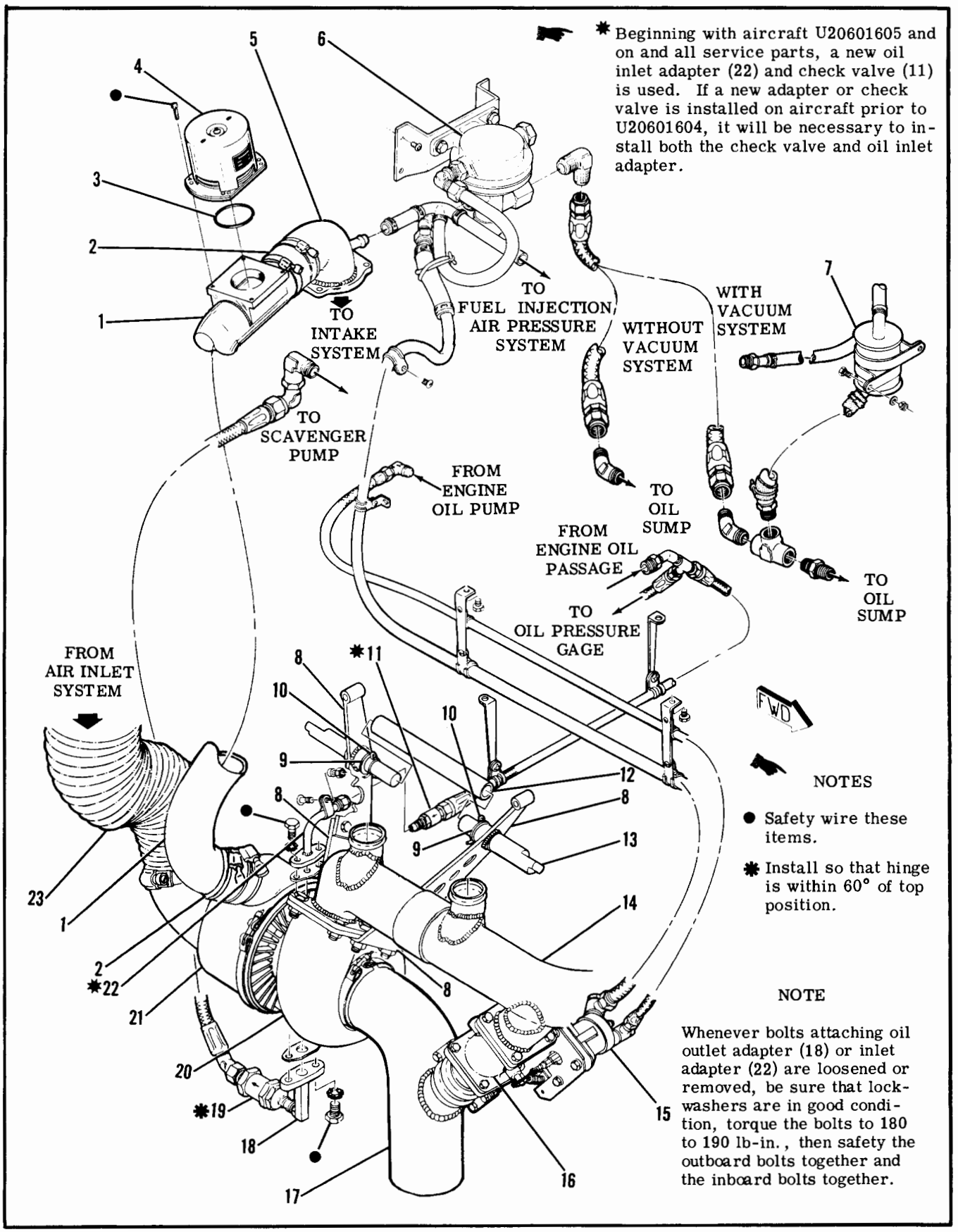
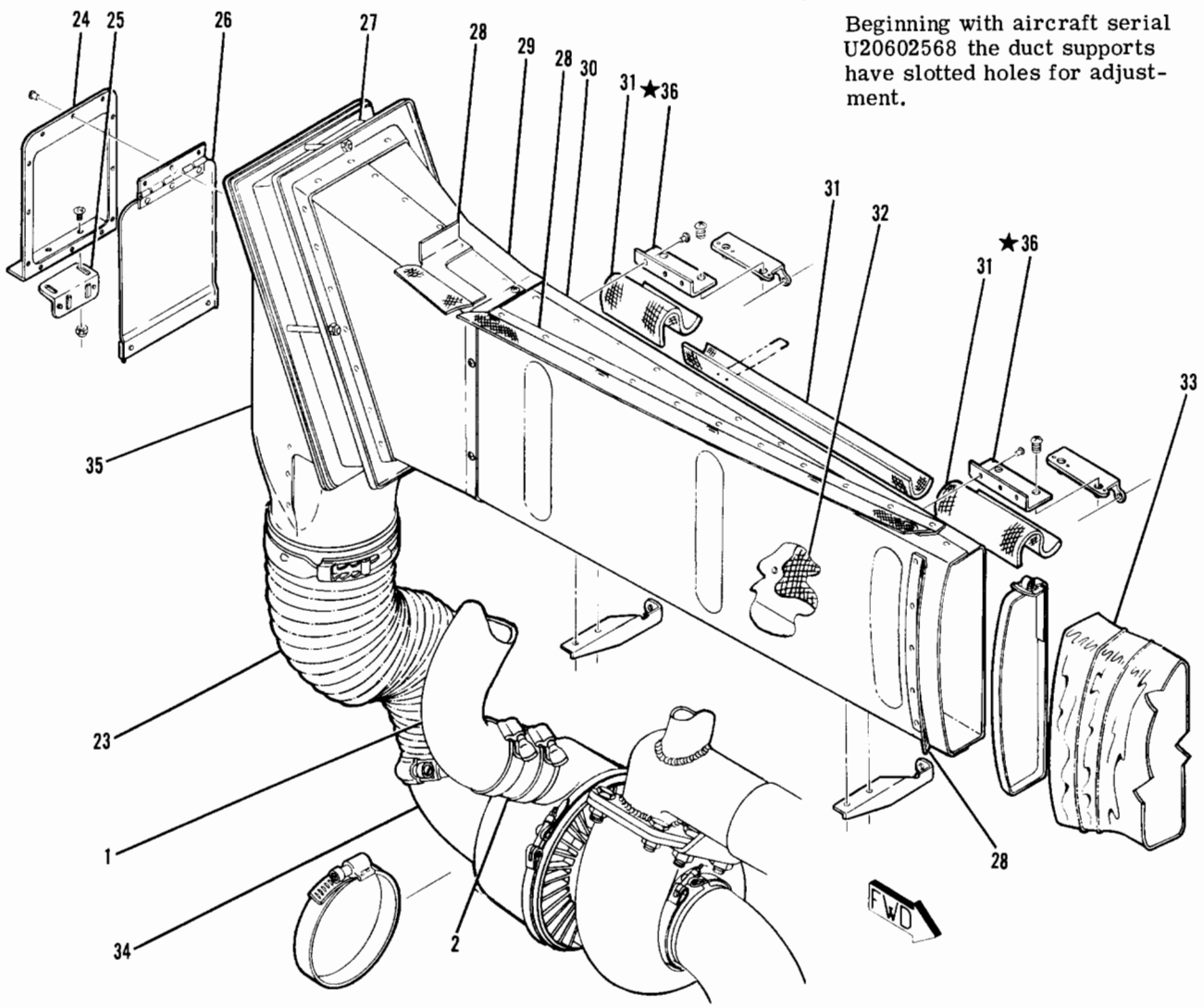


Figure 12A-5. Turbocharger System (Sheet 1 of 2)



1. Turbocharger Discharge Duct
2. Coupler
3. O-Ring Seal
4. Overboost Control Valve
5. Throttle Body Adapter
6. Absolute Controller
7. Vacuum System Oil Separator
8. Turbocharger Support
9. Washer
10. Cotter Pin
11. Check Valve
12. Tube
13. Shaft
14. Exhaust System
15. Waste-Gate Actuator
16. Waste-Gate
17. Tail Pipe
18. Oil Outlet Adapter
19. Check Valve
20. Turbine Housing
21. Compressor Housing
22. Oil Inlet Adapter
23. Turbocharger Inlet Hose
24. Doubler
25, Magnet
26. Door
27. Induction Air Filter
28. Baffle Assembly
29. Center Duct
30. Forward Duct
31. Seal
32. Wire Guard
33. Nose Cap Flexible Duct
34. Turbocharger Inlet Elbow
35. Aft Duct
36. Support

Figure 12A-5. Turbocharger System (Sheet 2 of 2)

b. Remove bolts, washers and nuts attaching waste-gate and actuator assembly to tailpipe.
c. Loosen clamp attaching tailpipe to turbine exhaust outlet and work tailpipe from turbine.
d. Remove bolts, washers and nuts attaching the assembly to the exhaust manifold.
e. Remove the assembly from aircraft, being careful not to drop the unit.
f. Installation may be accomplished by reversing the preceding steps.

NOTE

When installing the assembly, be sure the gaskets at inlet and outlet of valve are installed and are in good condition. Replace gaskets if damaged.

12A-111. ADJUSTMENT OF WASTE-GATE ACTUATOR. (Refer to figure 12A-7.)
a. Remove waste-gate actuator in accordance with paragraph 12A-110.
b. Plug actuator outlet port and apply a 50 to 60 psig air pressure to the inlet port of the actuator.
c. Check for 0.010 + 0-.005 inch gap between butterfly and waste-gate body as shown in figure 12A-7.
d. If adjustment is required, remove pin from actuator shaft.
e. Hold clevis end and turn shaft clockwise to increase gap or counterclockwise to decrease gap of butterfly. Install pin through clevis and shaft, securing pin with washer and cotter pin.
f. After adjusting closed position and with zero pressure in cylinder, check butterfly for a clearance of 1.100 + .000 -.125 inch in the full-open position as shown in figure 12A-7.
g. If adjustment is required, loosen locknut and turn stop screw clockwise to decrease or counterclockwise to increase clearance of butterfly.
h. Recheck butterfly in the closed position to ascertain that gap tolerance has been maintained.

NOTE

To assure correct spring loads, actuate butterfly with air pressure. Actuator shaft and butterfly should move freely. Actuator shaft should start to move at 15±2 psig and fully extend at 35±2 psig. Two to four psi hysteresis is normal, due to friction of O-ring against cylinder wall.

i. Remove air pressure line and plug from actuator.
j. Install waste-gate and actuator as outlined in paragraph 12A-110.

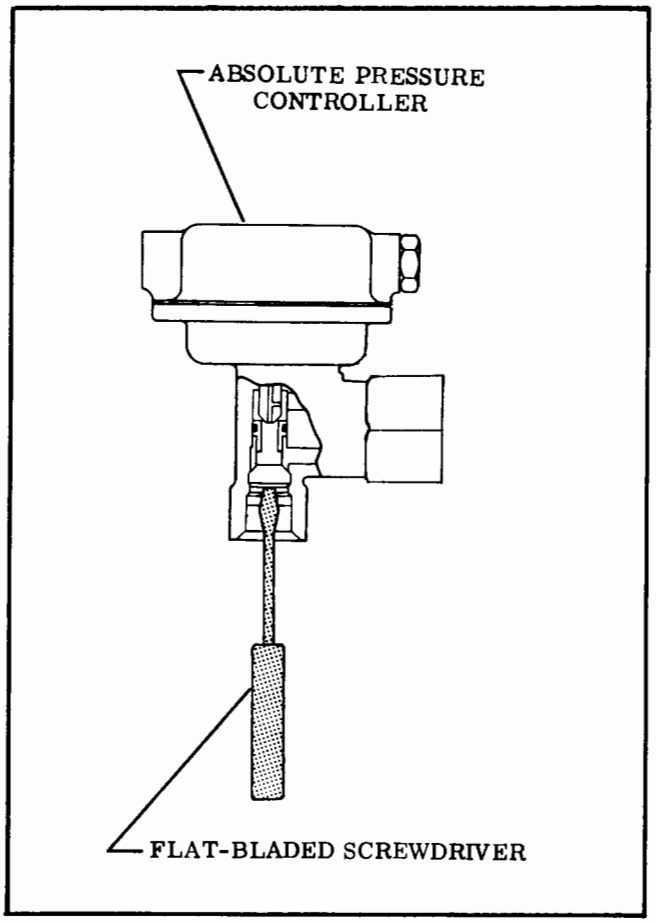


Figure 12A-6. Controller Adjustment

12A-112. EXTREME WEATHER MAINTENANCE. Refer to paragraph 12-98.

12A-113. COLD WEATHER. Refer to paragraph 12-99.

12A-114. HOT WEATHER. When the engine is hot or the outside air temperature is high, the engine may die after running several seconds because the mixture became either too lean due to fuel vapor or too rich due to excessive prime fuel. The following procedure will prevent over-priming and take care of fuel vapor in the system.
a. Set the throttle 1/3 to 1/2 open.
b. When the ignition key is on BOTH and you are ready to engage the starter, turn the fuel pump on HI until the fuel flow comes up to 4-6 gal/hr and then turn the pump off.

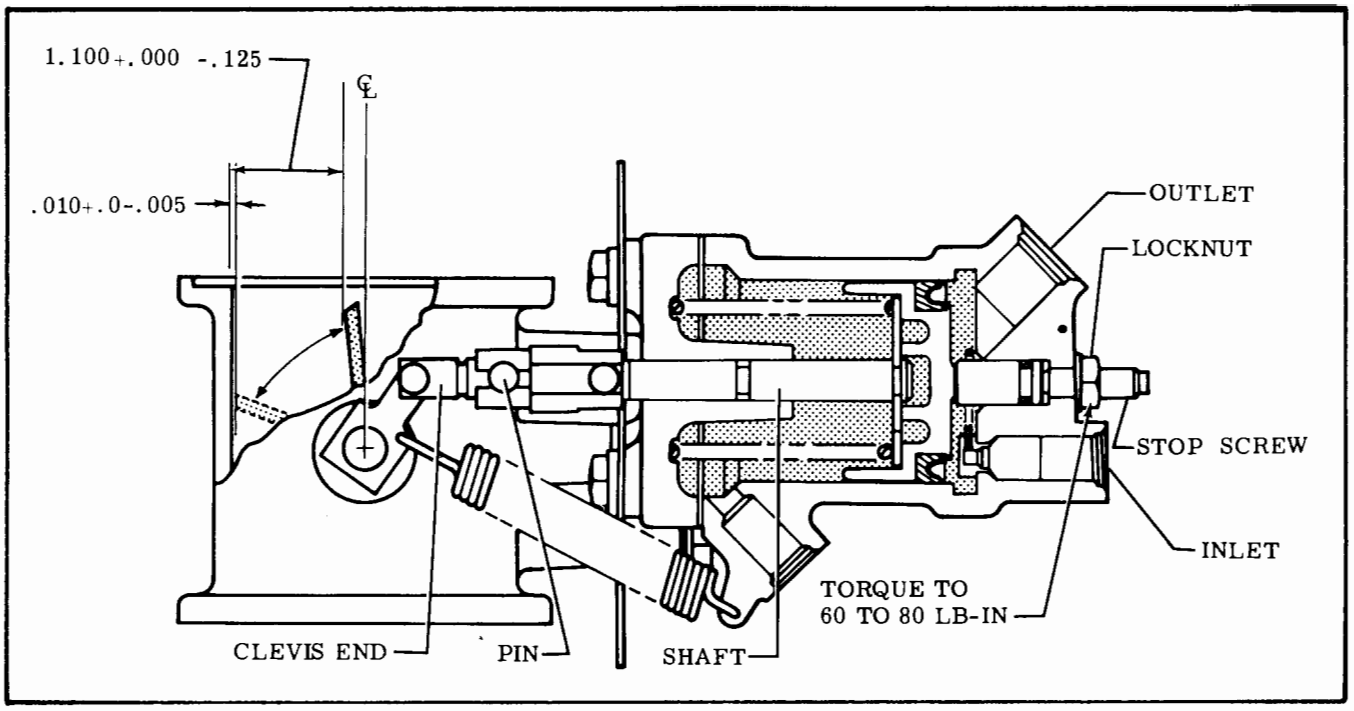


Figure 12A-7. Waste-Gate Adjustment

NOTE

During a restart after a brief shut-down in extremely hot weather, the presence of fuel vapor may require the pump to run on HI for up to 1 minute or more before the vapor is cleared sufficiently to obtain 4-6 gal/hr for starting.

c. Without hesitation, engage the starter and the engine should start in 3 to 5 revolutions. Adjust the throttle for 1200-1400 RPM.

d. If there is fuel vapor in the lines, it will pass into the injector nozzles in 2 to 3 seconds and the engine will gradually slow down and stop. When engine speed starts to decrease, turn the fuel pump on HI for approximately one second to clear out the vapor. Intermittent use of HI boost is needed since prolonged use of HI pump after the vapor is cleared will flood out the engine.

e. Let the engine run at 1200 to 1400 RPM until the vapor is eliminated and the engine idles normally. If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the armature.

12A-115. SEACOAST AND HUMID AREAS. Refer to paragraph 12-101.

12A-116. DUSTY AREAS. Refer to paragraph 12-102.

12A-117. GROUND SERVICE RECEPTACLE. Refer to paragraph 12-103.

12A-118. HAND CRANKING. Refer to paragraph 12-104.

SECTION 13

FUEL SYSTEM

TABLE OF CONTENTS

13-1. FUEL SYSTEM.

NOTE

The fuel system as described in this section does not include the fuel injection system. Refer to Section 12 or 12A for that part of the fuel system.

13-2. DESCRIPTION. Fuel from the cells in the wings is gravity-fed through fuel reservoir tanks installed forward of the front doorpost bulkheads, beneath the cabin floor, to the engine driven fuel pump The fuel line from the lower forward corner of each fuel cell to the reservoir tank serves as a combination fuel feed and vapor return line. The fuel bypasses the electric auxiliary fuel pump when the pump is not in operation. The fuel cells are individually vented overboard through check valves located in each cell.

13-3. PRECAUTIONS.

NOTE

There are certain general precautions and rules concerning the fuel system which should be observed when performing the operations and procedures in this Section. These are as follows:

a. During all fueling, defueling, tank purging, and tank repairing or disassembly, ground the airplane to a suitable ground stake.

b. Residual fuel draining from lines and hoses constitutes a fire hazard. Use caution to prevent the accumulation of fuel when lines or hoses 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 cells to the engine-driven fuel pump, use NS-40 (RAS-4) (Snap-On Tools Corp., Kenosha, Wisconsion), MIL-T-5544 (Thread Compound, Antiseize, Graphite Petrolatum), USP Petrolatum, or engine oil as a thread lubricant or to seal a leaking connection. Apply sparingly to male threads only, omitting the first two threads, exercising extreme caution to avoid "stringing" sealer across the end of the fitting. Always ensure that a compound, the residue from a previously used compound, or any other foreign material cannot enter the system. Throughout the fuel injection system, from the engine-driven fuel pump through the discharge nozzles, use only a fuel-soluble lubricant, such as engine oil, on fitting threads. Do not use any other form of thread compound on the injection system.

13-4. TROUBLE SHOOTING.

Use this chart in conjunction with the engine trouble shooting charts in Sections 12 and 12A.

TROUBLE	PROBABLE CAUSE	REMEDY
NO FUEL FLOW TO ENGINE-DRIVEN FUEL PUMP.	Fuel selector valve not turned on.	Turn fuel selector valve on.
	Fuel cells empty.	Service with proper grade and amount of fuel.

TROUBLE	PROBABLE CAUSE	REMEDY
NO FUEL FLOW TO ENGINE-DRIVEN FUEL PUMP. (Cont).	Fuel line disconnected or broken.	Connect or repair fuel lines.
	Fuel cell screen plugged.	Remove and clean screen. Flush out fuel cell.
	Defective fuel selector valve.	Remove and repair or replace selector valve.
	Plugged fuel strainer.	Remove and clean strainer and screen.
	Defective check valve in electric fuel pump.	Repair or replace electric pump.
	Fuel line plugged.	Disconnect lines as necessary to locate obstructions, then clean.
FUEL STARVATION AFTER STARTING.	Partial fuel flow from the preceding causes.	Use the preceding remedies.
	Malfunction of engine-driven fuel pump or fuel injection system.	Refer to Section 12 or 12A.
	Fuel vents plugged.	See paragraph 13-7.
	Water in fuel.	Drain fuel tank sumps, fuel lines, and fuel strainer.
NO FUEL FLOW WHEN ELECTRIC PUMP OPERATED.	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.	Replace defective pump.
	Defective engine-driven fuel pump bypass or defective fuel injection system.	Refer to Section 12 or 12A.
NO FUEL QUANTITY INDICATION.	Fuel cells empty.	Service with proper grade and amount of fuel.
	Circuit breaker open or defective.	Reset. Replace if defective.
	Loose connections or open circuit.	Tighten connections; repair wiring.
	Defective fuel quantity indicator.	Replace indicator or sending unit.
FLUCTUATING FUEL PRESSURE INDICATIONS. (TURBO AIRCRAFT)	Obstructed filter in fuel inlet strainer of metering unit.	Remove and clean.
	Manifold valve.	Replace.
	Fuel flow indicator.	Replace.

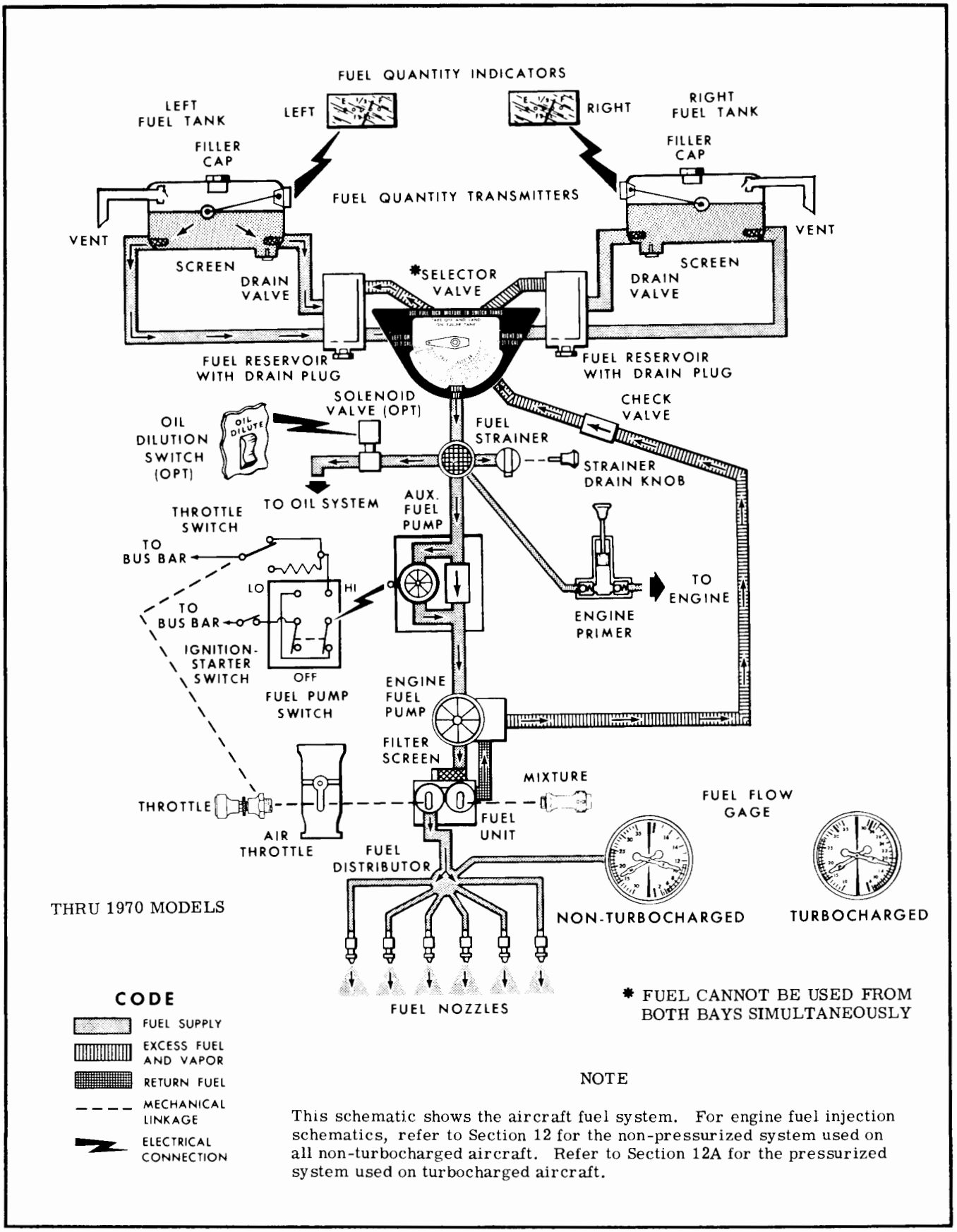
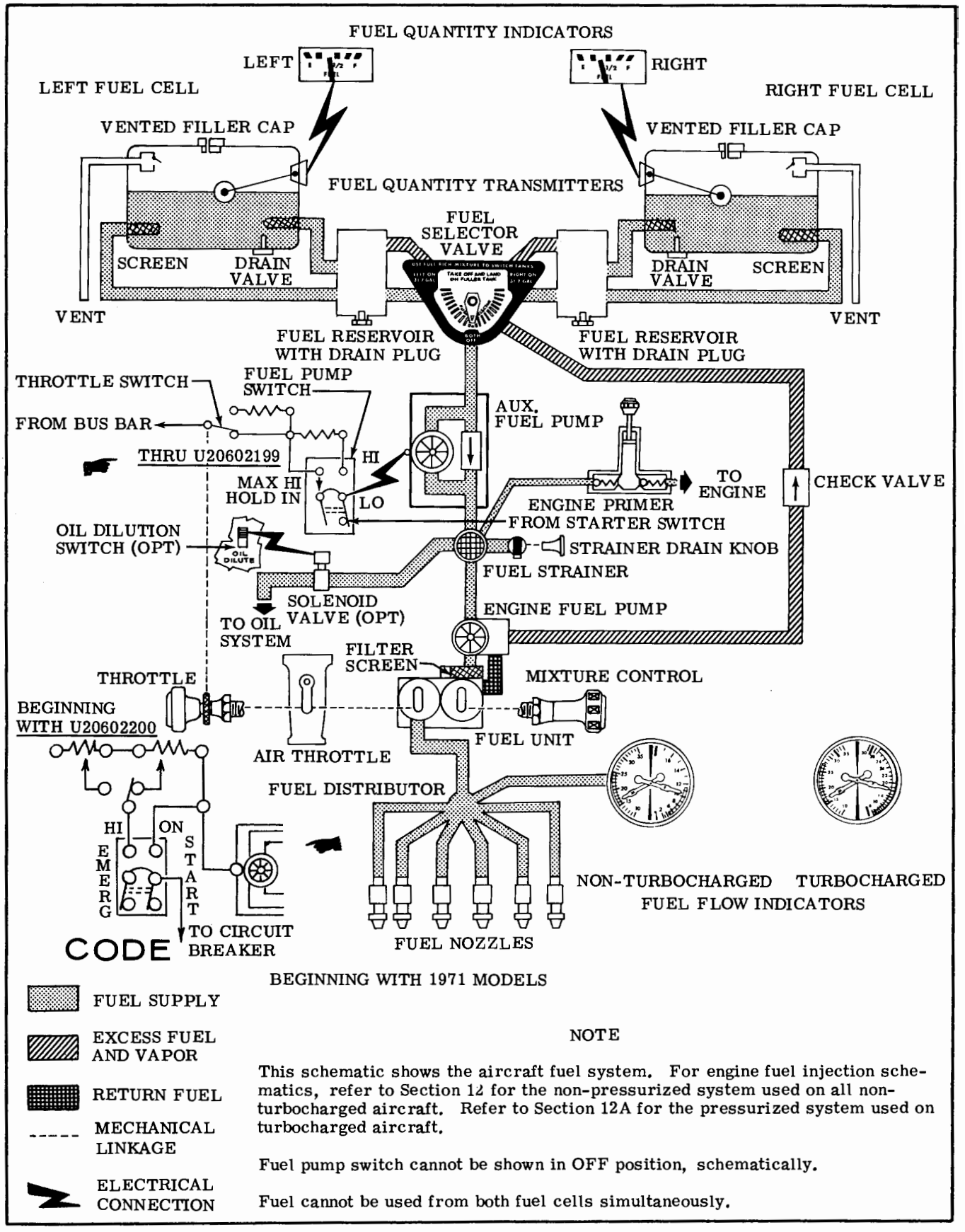


Figure 13-1. Fuel System Schematic (Sheet 1 of 2)



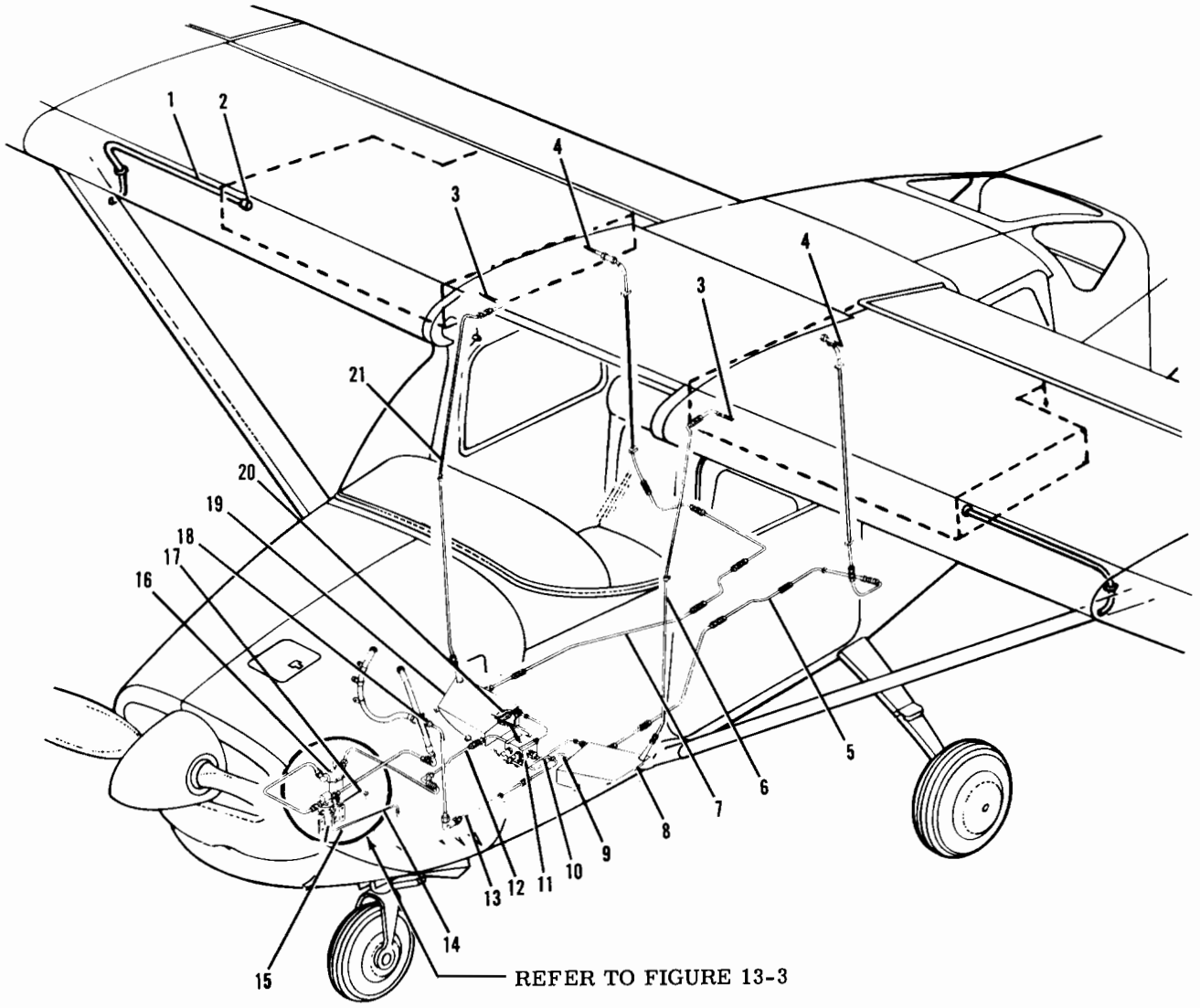
NOTE

This schematic shows the aircraft fuel system. For engine fuel injection schematics, refer to Section 12 for the non-pressurized system used on all non-turbocharged aircraft. Refer to Section 12A for the pressurized system used on turbocharged aircraft.

Fuel pump switch cannot be shown in OFF position, schematically.

Fuel cannot be used from both fuel cells simultaneously.

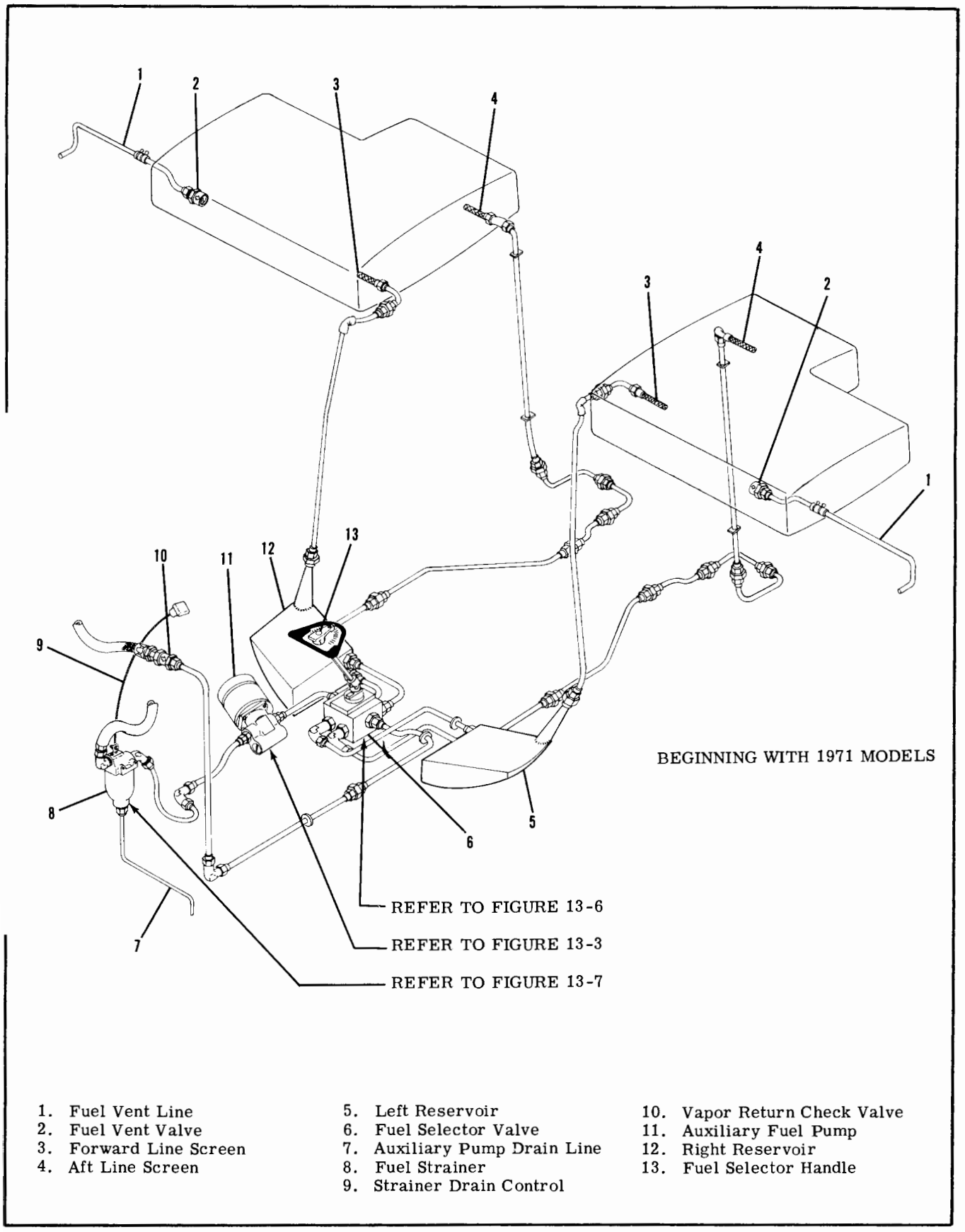
Figure 13-1. Fuel System Schematic (Sheet 2 of 2)



THRU 1970 MODELS

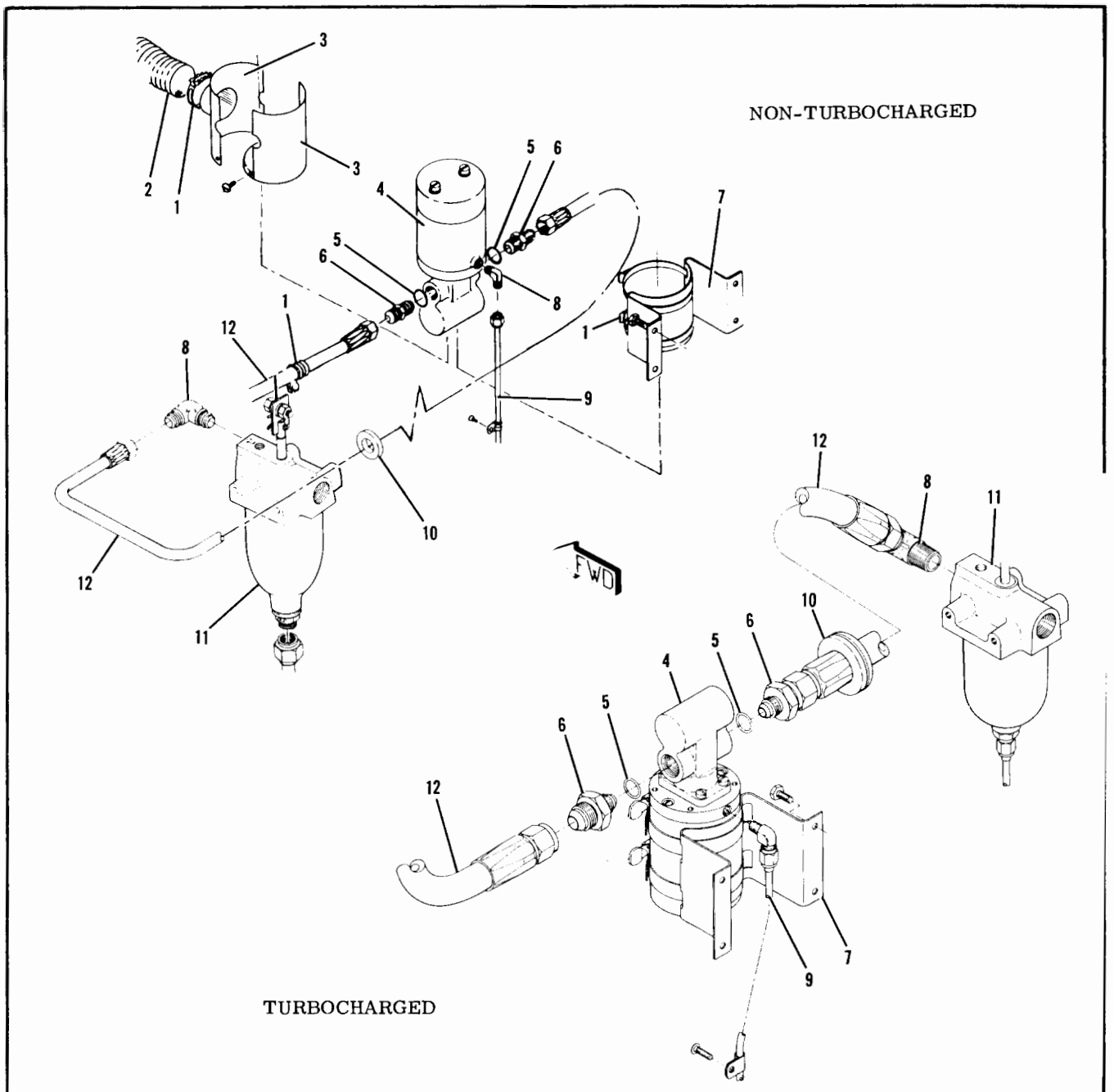
1. Fuel Vent Line
2. Fuel Vent Valve
3. Forward Line Screen
4. Aft Line Screen
5. Aft Fuel Line
6. Forward Fuel Line
7. Aft Fuel Line
8. Left Reservoir
9. Reservoir-to-Selector Valve Line
10. Vapor Return Selector-to-Reservoir Line
11. Selector Valve
12. Selector-to-Strainer Line
13. Vapor Return-to-Selector Line
14. Electric Pump Drain Line
15. Electric Fuel Pump
16. Fuel Strainer
17. Fuel Strainer Drain Line
18. Vapor Return Check Valve
19. Right Reservoir
20. Selector Valve Handle
21. Forward Fuel Line

Figure 13-2. Fuel System (Sheet 1 of 2)



1. Fuel Vent Line
2. Fuel Vent Valve
3. Forward Line Screen
4. Aft Line Screen
5. Left Reservoir
6. Fuel Selector Valve
7. Auxiliary Pump Drain Line
8. Fuel Strainer
9. Strainer Drain Control
10. Vapor Return Check Valve
11. Auxiliary Fuel Pump
12. Right Reservoir
13. Fuel Selector Handle

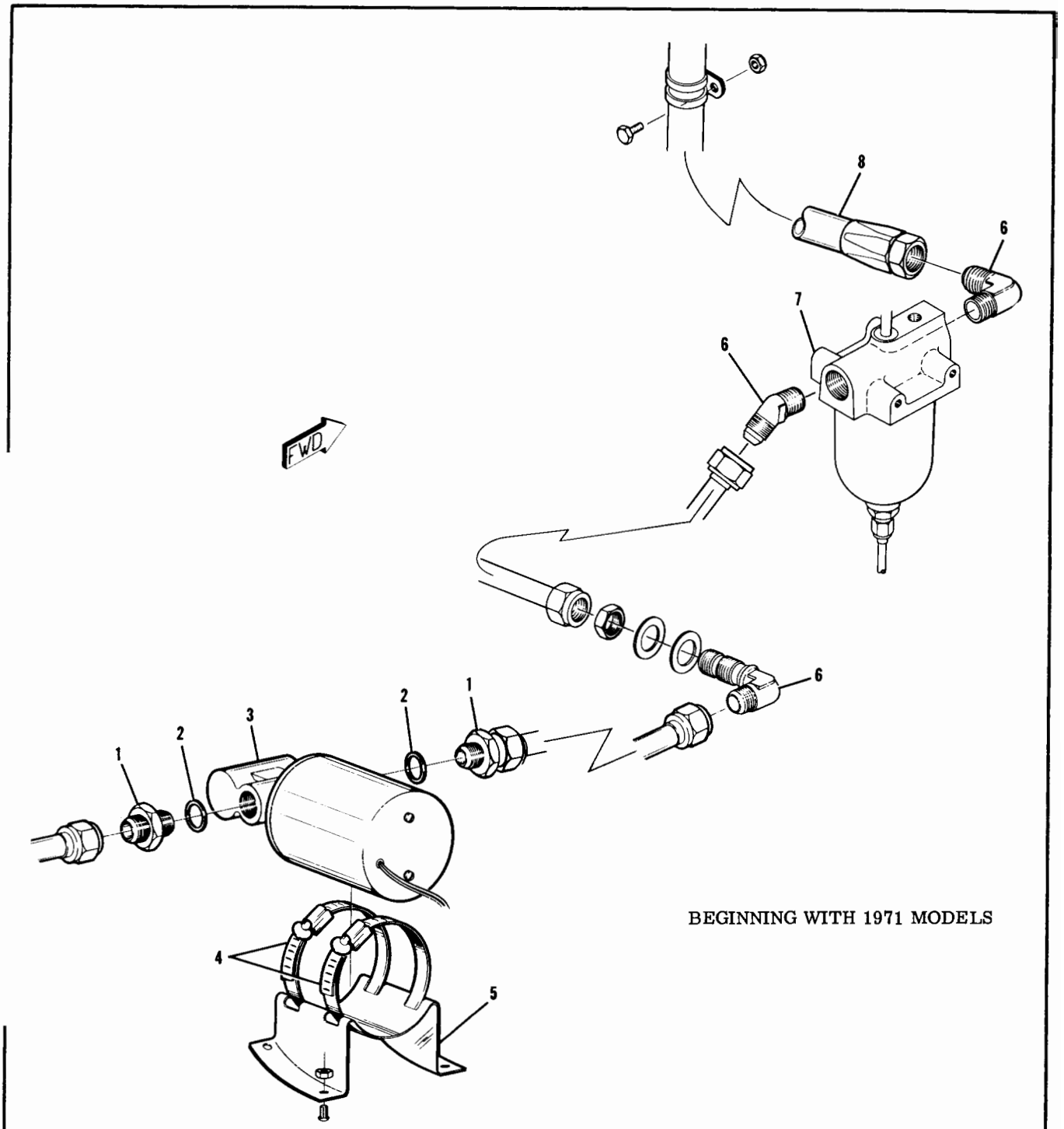
Figure 13-2. Fuel System (Sheet 2 of 2)



THRU 1970 MODELS

1. Clamp
2. Duct
3. Shroud Half
4. Auxiliary Fuel Pump
5. O-Ring
6. Reducer
7. Pump Bracket
8. Elbow
9. Drain Line
10. Grommet
11. Fuel Strainer
12. Fuel Hose

Figure 13-3. Electric Fuel Pump and Strainer Installation (Sheet 1 of 2)



1. Reducer
2. O-Ring
3. Auxiliary Fuel Pump
4. Clamp
5. Bracket
6. Elbow
7. Fuel Strainer
8. Fuel Hose

Figure 13-3. Electric Fuel Pump and Strainer Installation (Sheet 2 of 2)

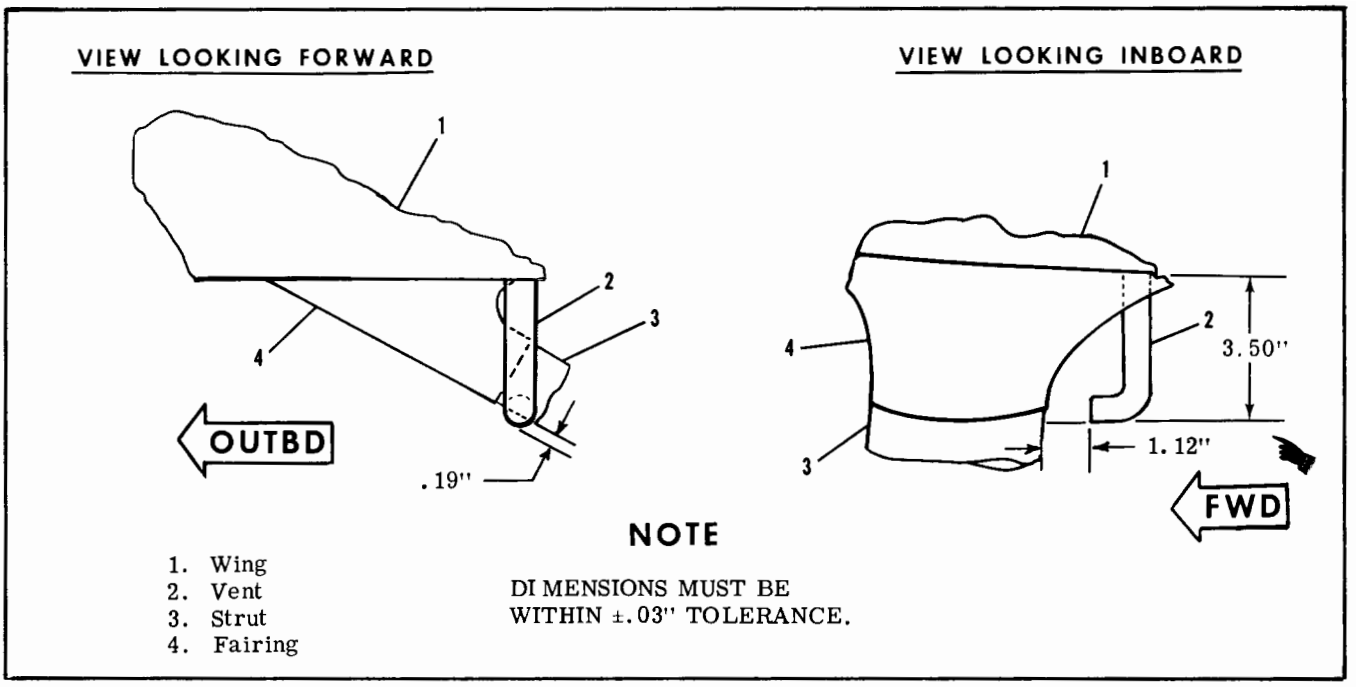


Figure 13-4. Fuel Vent Location

13-5. FUEL VENTS.

13-6. DESCRIPTION. A fuel vent line is installed in the outboard end of each fuel cell. The vent line extends overboard down through the lower wing skin. The inboard end of the vent line extends into the fuel cell, then is offset downward from cell upper surface. A vent valve is installed on the inboard end of the vent line inside the fuel cell.

13-7. CHECKING FUEL VENT. Field experience has demonstrated that fuel vents can become plugged, with possible fuel starvation of the engine, or collapse of fuel cells. Also, the bleed hole in the vent valve assembly could possibly become plugged, allowing pressure from expanding fuel to pressurize the cells. The following procedure may be used to check the vent and bleed hole in the valve assembly.

a. Attach a rubber tube to the end of the vent line beneath one wing.

b. Turn off fuel selector valve.

c. Blow into tube to slightly pressurize the tank. If air can be blown into tank, the vent line is open.

d. After tank is slightly pressurized, insert end of rubber tube into a container full of water and watch for a continuous stream of bubbles, which indicates the bleed hole in valve assembly is open and relieving pressure.

e. Repeat steps "a" through "d" for fuel vent beneath opposite wing.

NOTE

Remember that a plugged vent line or bleed hole can cause either fuel starvation and collapsing of fuel cell or the pressurizing of the cell by fuel expansion.

f. Any fuel vent found plugged or restricted must be corrected prior to returning airplane to service.

NOTE

The fuel vent line protruding beneath the wing near the wing strut must be correctly aligned to avoid possible icing of the vent tube. Dimensions are shown in figure 13-4.

13-8. FUEL CELLS. (RUBBERIZED.)

13-9. DESCRIPTION. Rubberized, bladder-type fuel cells are installed in the inboard bay of each wing panel. These cells are secured by fasteners to prevent collapse of the flexible cells.

13-10. GENERAL PRECAUTIONS. When storing inspecting or handling rubberized, bladder-type fuel cells, the following precautions should be adhered to:

a. Fold cells as smoothly and lightly as possible with a minimum number of folds. Place protective wadding between folds.

b. Wrap cell in moisture-proof paper and place in a suitable container. Do not crowd cell in container. Use wadding to prevent movement.

c. Stack boxed cells to allow access to oldest cells first. Do not allow stacks to crush bottom boxes. Leave cells in boxes until used.

d. Storage area must be cool, +30°F to +85°, and free of exposure to sunlight, dirt and damage.

e. Used cells must be cleaned with soap and warm water prior to storage. Dry and package as outlined in the preceding steps.

f. Do not carry cells by fittings. Maintain original cell contours or folds when refolding for boxing.

13-11. FUEL CELL REMOVAL.

a. Drain fuel from applicable cell.

NOTE

Prior to removal of cell, drain fuel, purge with fresh air, and swab out to remove all traces of fuel.

b. Remove wing root fairings and disconnect fuel lines at wing root.
c. Remove clamps from forward and aft fuel cell bosses at wing root and carefully work fuel strainers and lines from cell bosses.
d. Disconnect electrical lead and ground strap from fuel quantity transmitter and carefully work transmitter from fuel cell and wing rib.
e. Remove screws attaching drain adapter to lower surface of wing.
f. Remove clamps attaching crossover vent line to fuel cells and work vent line out of cell being removed. In aircraft equipped with long-range cells, remove vent extension tube from inside cell. Vent extension tube is attached to the crossover vent bars on the cell.
g. Remove fuel filler adapter and gaskets by removing screws attaching adapter to wing and fuel cell. On aircraft equipped with long-range cells, remove cover plate and gaskets, and remove nylon vent tube from inside cell.
h. Working through filler neck opening, loosen snap fasteners. Tilt snap fasteners slightly when pulling cell free, to prevent tearing rubber.
i. Collapse and carefully fold cell for removal, then work cell out of fuel bay through filler opening in upper wing surface. Use care when removing to prevent damage to cell.
j. Unfold cell and remove fittings, snap fasteners and fuel sump drain adapter.

13-12. FUEL CELL REPAIR.

NOTE

For fuel cell repair information, refer to Cessna Service News Letter dated August 28, 1970. For minor repair, a fuel cell repair kit is available from Goodyear, complete with required materials and instructions.

13-13. Deleted.

13-14. Deleted.

13-15. Deleted.

13-16. Deleted.

13-17. Deleted.

13-18. Deleted.

13-19. FUEL CELL INSTALLATION.
a. Cell compartment must be thoroughly cleaned of all filings, trimmings, loose washers, bolts, nuts, etc.
b. All sharp edges of cell compartment must be rounded off and protective tape applied over any other sharp edges and protruding rivets.
c. Inspect cell compartment just prior to installation of a cell for conditions noted in the preceding steps.
d. Install fuel drain adapter and snap fasteners.
e. Check to ensure cell is warm enough to be flexible and fold as necessary to fit through fuel cell access opening.
f. Place cell in compartment, develop it out to full size and attach fasteners, then reverse procedures outlined in the preceding paragraph for installation. Install all new gaskets when installing cell.
g. On aircraft equipped with long-range cells, install nylon vent tube inside cell, inserting tube through four hangers in top of cell. If a replacement cell is being installed, use nylon vent tube removed from old cell or order tube from applicable Parts Catalog.
h. When tightening screw-type clamps, apply a maximum of 20 pound-inches torque to clamp screws. No oil is to be applied to fittings prior to installation.
i. When installing filler adapter, cover plate and fuel quantity transmitter to the wing and fuel cell, tighten attaching screws evenly. The sealing or compression surfaces must be assembled when absolutely dry (NO SEALING PASTE IS TO BE USED).
j. After installation has been completed, cell should be inspected for final fit within compartment, making certain that cell is extended out to the structure and no corners are folded in.
k. The final inspection, prior to closing the cell, should be a close check to ensure that cell is free of foreign matter such as lint, dust, oil or any installation equipment. If a cell is not thoroughly clean, it should be cleaned with a lint-free cloth, soaked in water, alcohol or kerosene. NO OTHER SOLVENT SHALL BE USED.

NOTE

Throughout the aircraft fuel system, from the cells to the engine-driven fuel pump, use NS-40 (RAS-4) (Snap-On Tools Corp., Kenosha, Wisconsin), MIL-T-5544 (Thread Compound, Antiseize, Graphite-Petrolatum) or equivalent compound as a thread lubricant or to seal a leaking connection. Apply sparingly to male fittings 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.

13-20. FUEL QUANTITY TRANSMITTERS.

13-21. DESCRIPTION. Two fuel quantity indicators, located in a cluster on the instrument panel, are actuated individually by an electric fuel quantity transmitter installed in each fuel cell.

13-22. REMOVAL AND INSTALLATION. (Refer to Section 16.)

13-23. REMOVAL AND INSTALLATION OF FUEL RESERVOIR TANKS.
a. Remove front seats, carpeting, and access plates as necessary for access to tank to be removed.
b. Disconnect fuel lines at the tank to be removed.
c. Remove four screws securing tank mounting

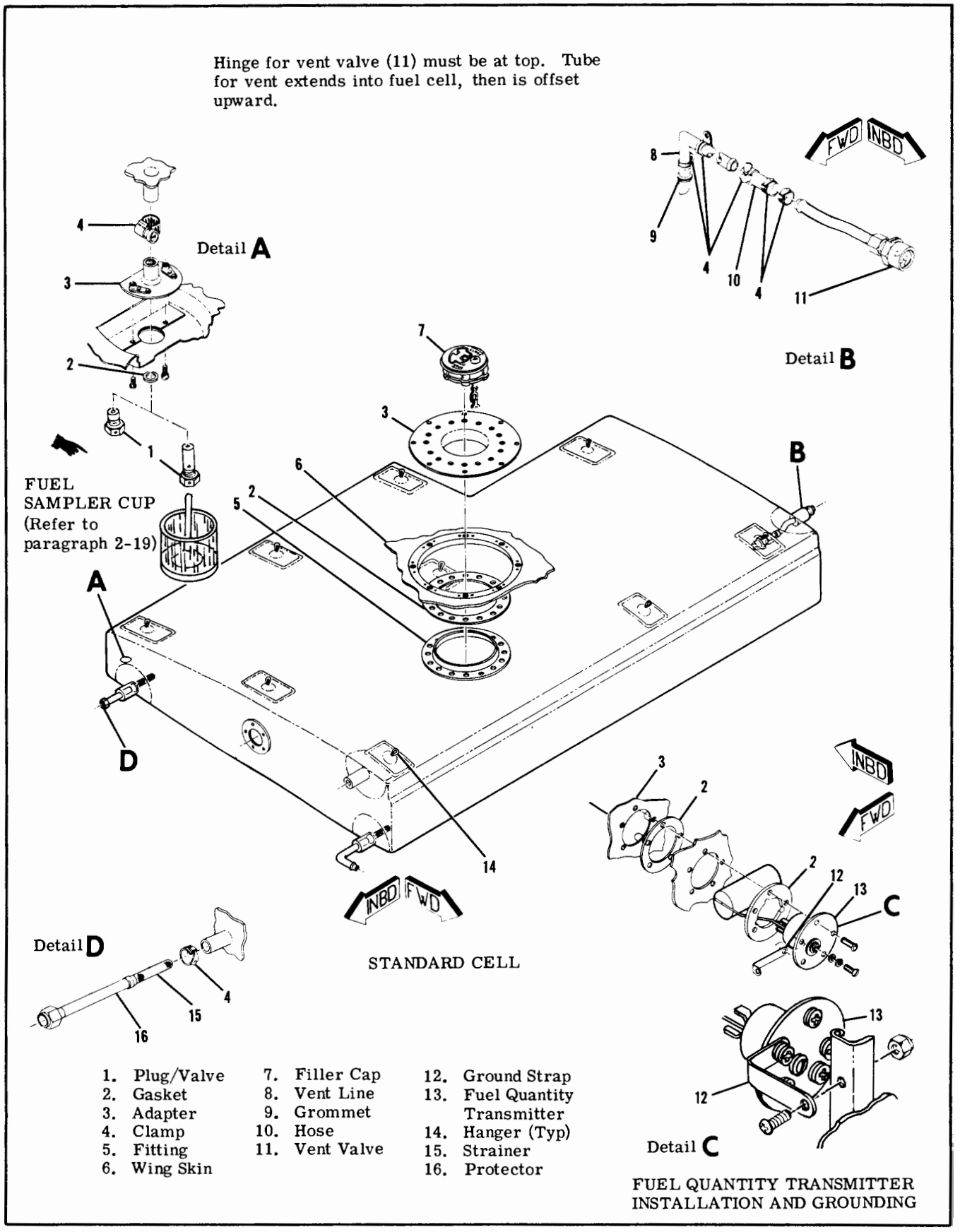
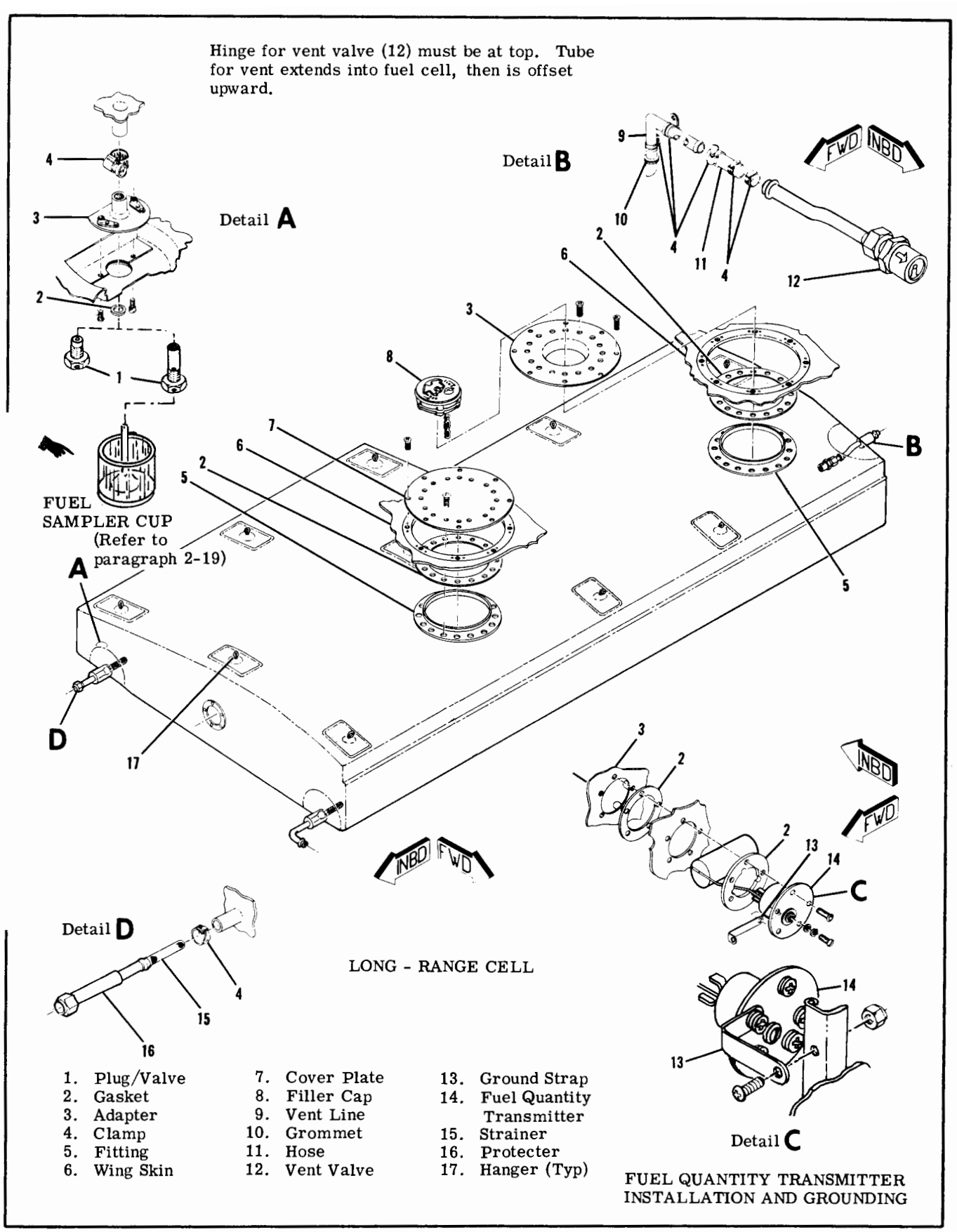


Figure 13-5. Fuel Cell Installation (Sheet 1 of 2)



1. Plug/Valve
2. Gasket
3. Adapter
4. Clamp
5. Fitting
6. Wing Skin
7. Cover Plate
8. Filler Cap
9. Vent Line
10. Grommet
11. Hose
12. Vent Valve
13. Ground Strap
14. Fuel Quantity Transmitter
15. Strainer
16. Protecter
17. Hanger (Typ)

Figure 13-5. Fuel Cell Installation (Sheet 2 of 2)

legs to fuselage structure.
d. Lift out the tank.
e. Reverse the preceding steps to install a reservoir tank.

13-24. REMOVAL AND INSTALLATION OF FUEL SELECTOR VALVE.
a. Drain all fuel from wing tanks at fuel tank sump drain plugs. With valve turned to LEFT TANK, drain left fuel lines at selector valve; with valve turned to RIGHT TANK, drain right fuel lines.
b. Remove control pedestal cover. (Refer to section 11 for procedures.)
c. Remove access hole covers in floorboard and fuselage skin in area of fuel selector valve.
d. Disconnect all fuel lines from selector valve.
e. Disconnect square shaft from valve by removing attached roll pin.
f. Remove bolts or screws attaching valve to support bracket and remove valve.
g. Install valve by reversing this procedure.

13-25. FUEL SELECTOR VALVE REPAIR. (See figure 13-6.) The fuel selector valve may be repaired by disassembly, replacement of defective parts, and reassembly as follows:

a. Mark sump plate (23) and body (1) to ensure correct reassembly, then remove sump plate (23) and O-ring (22) after removing four screws.
b. Drive out roll pin (5) securing yoke (6) to shaft. As yoke is lifted off, balls (8) and springs (7) are free. Retain them.
c. Lift off washer (9).
d. Mark cover (4) and body to assure later alignment of parts and remove screws (3).
e. With fine emery paper, sand off any burrs or sharp edges on shaft (21). Apply petrolatum to shaft as a lubricant, then work cover off shaft.
f. Drive back roll pin (13) and remove rotor (12). Teflon seal (14), O-rings (15), washers (16), and springs (17) are now free to be removed. Check all parts carefully to locate any defects.
g. Remove burrs or sharp edges on shaft, lubricate and slide it down, out of body (1). Remove teflon seals (20) and O-rings (19).
h. Remove O-ring (18) within body and O-ring (10) within cover.
i. Replace all O-rings, lap or replace teflon seals, and lubricate O-rings before installation.

CAUTION

Install all parts in the relative position depicted in figure 13-6, otherwise the valve will not operate correctly.

j. Install O-ring (18) in body shaft hole. Install O-rings (19) and teflon seals (20), then slide shaft and rotor into place. Position rotor in exact relative position shown in figure 13-6, then install O-ring (22) and sump plate (23).
k. Install .169" diameter pins in body ports, then slide springs (17), washers (16), O-rings (15) and teflon seals over pins. Slide rotor (12) over shaft. Remove .169" dia. pins and, readjusting rotor vs. shaft position as necessary, tap roll pin (13) into place, letting it protrude on the side depicted.

NOTE

This roll pin serves also as a stop, limiting valve shaft travel.

l. Install O-ring (10) in cover, lubricate shaft (21) with petrolatum, install large O-ring (11), and slide cover down into place.

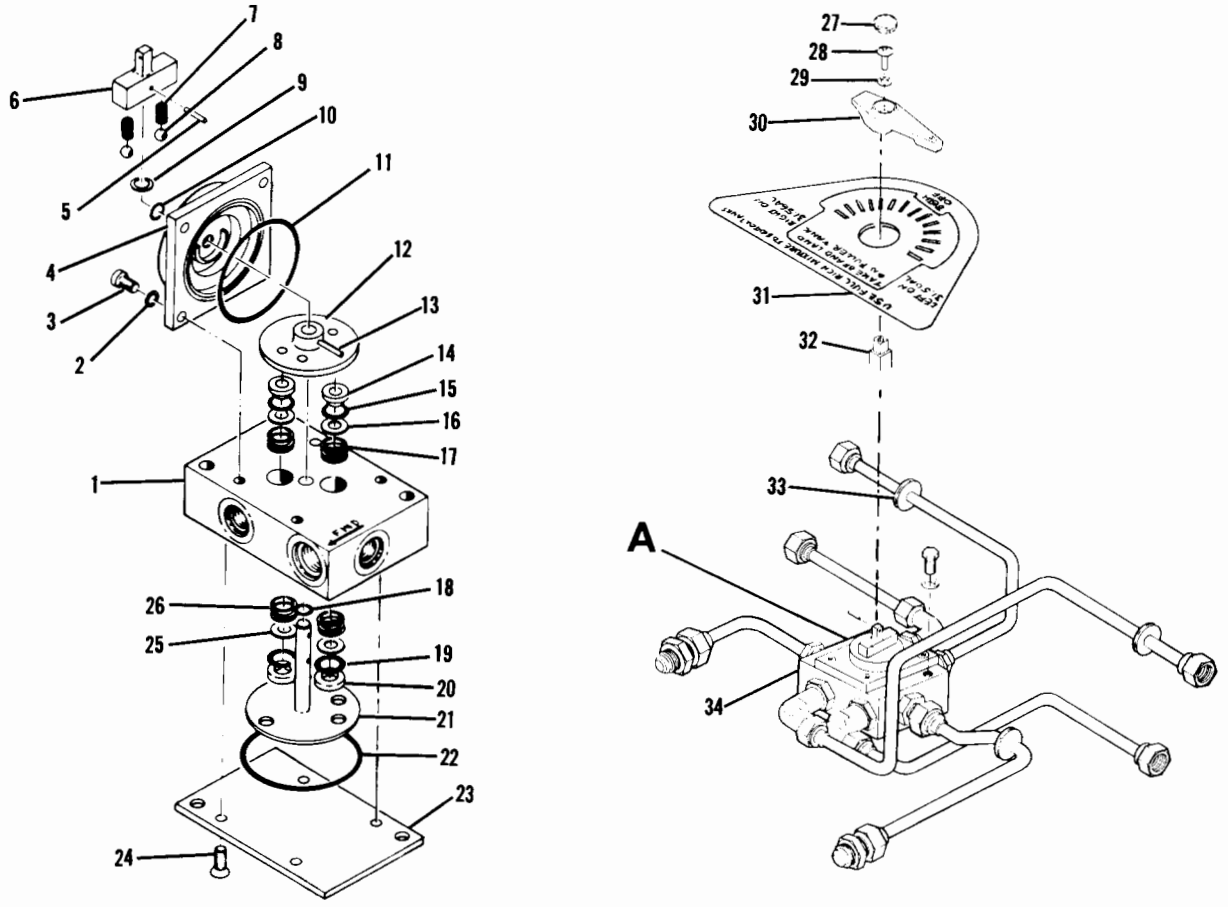
CAUTION

Make sure cover is installed in relative position illustrated. A lug on the cover protrudes to serve as a stop detent and if the cover is not installed correctly, the valve will not operate correctly.

m. Install brass washer (9) and yoke (6). Note the position of the small hole in the squared, upper portion of the yoke. If this is reversed, the valve linkage will not attach properly.

13-26. AUXILIARY ELECTRIC FUEL PUMP. On aircraft Serials U20601619 thru U20601632 and aircraft prior to Serial U20601605, the auxiliary electric fuel pump is mounted on either the left side or right side of the firewall. On aircraft Serials U20601605 thru U20601618 and beginning with U20601633, the auxiliary electric fuel pump is located under the floorboard on the right side of cabin, immediately

SHOP NOTES:



1. Valve Body
2. Lockwasher
3. Screw
4. Cover
5. Roll Pin
6. Yoke
7. Spring
8. Ball
9. Brass Washer
10. O-Ring
11. O-Ring
12. Rotor
13. Roll Pin
14. Seal
15. O-Ring
16. Washer
17. Spring
18. O-Ring
19. O-Ring
20. Seal
21. Rotor
22. O-Ring
23. Sump Plate
24. Screw
25. Washer
26. Spring
27. Cap
28. Screw
29. Washer
30. Handle
31. Placard
32. Selector Shaft
33. Grommet
34. Selector Valve

Figure 13-6. Fuel Selector Valve Assembly

forward of the copilot seat. An integral bypass 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.

13-27. REMOVAL AND INSTALLATION.

a. Firewall mounted:
   1. Place fuel selector in OFF position.
   2. Remove top half of cowl for access to pump.
   3. Disconnect all fuel lines and electrical connections from pump.
   4. Loosen clamps securing pump and lift pump out.
   5. Reverse preceding steps for installation.

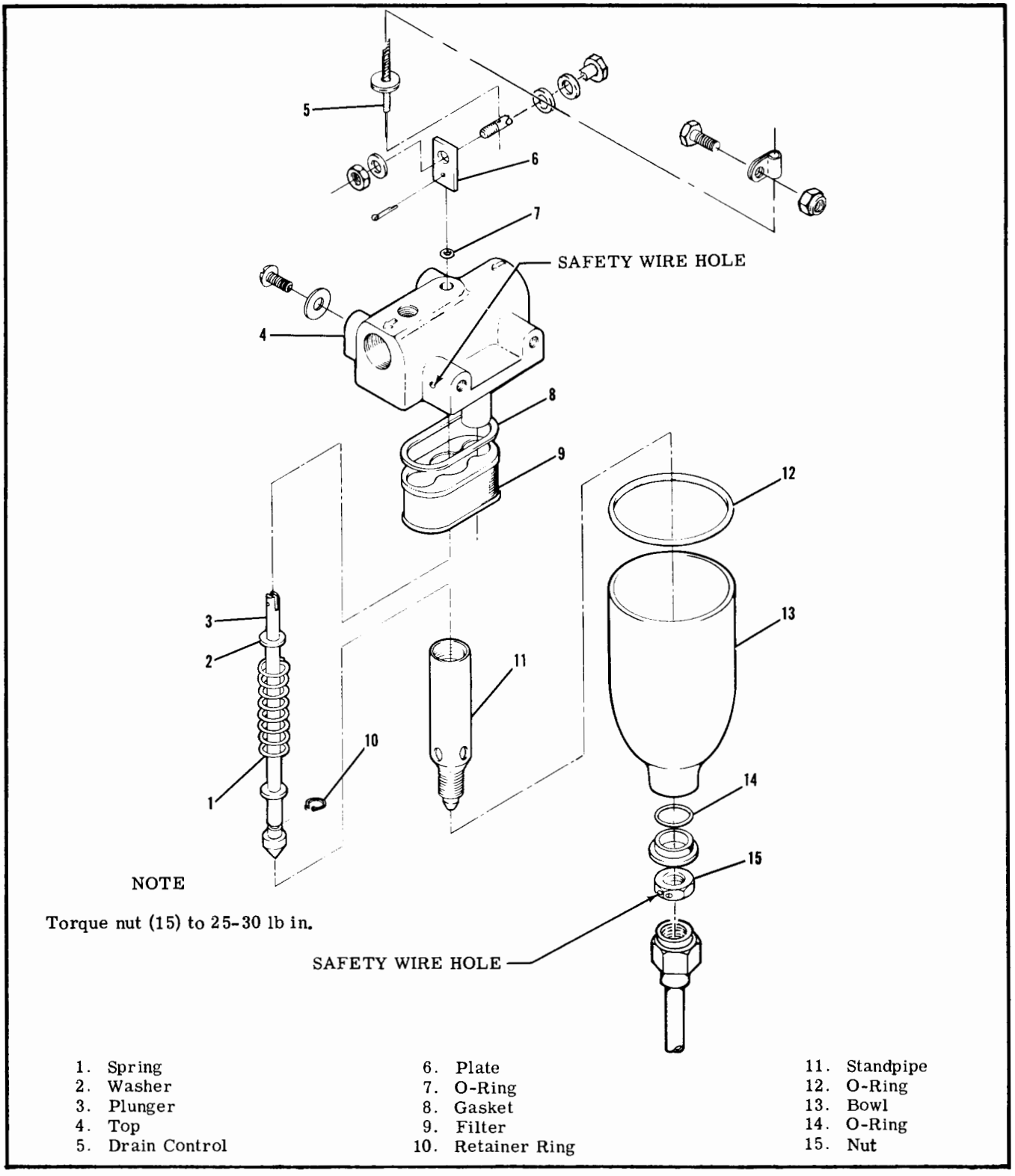


Figure 13-7. Fuel Strainer

b. Floor mounted:

1. Place fuel selector in OFF position.

2. Peel back carpet and remove access plate in floorboard immediately forward of copilot seat.

3. Disconnect all fuel lines and electrical connections from pump.

4. Loosen clamps securing pump and lift pump out.

5. Reverse preceding steps for installation.

13-28. ELECTRIC FUEL PUMP CIRCUITS. The electric fuel pump circuit is operated by a split

rocker-type switch. The low side of the switch is connected through the "START" position of the ignition switch so that the fuel pump will operate only while the ignition switch is in the "START" position and the low side of the fuel pump switch is turned on. When the ignition key is released, the pump will stop. The high side of the fuel pump switch will operate the pump regardless of ignition switch position. A throttle shaft operated microswitch adds a resistance to the high circuit to slow down the pump when the throttle is retarded to prevent an excessively rich mixture as throttle is retarded while the electric pump is operating in the high position. Refer to the following paragraph for rigging of the microswitch.

12-28A. DESCRIPTION. Thru Serial U20602199, the electric auxiliary fuel pump, which supplies fuel flow for starting and for engine operation if the engine-driven fuel pump should fail, is controlled by the auxiliary fuel pump switch, mounted on the instrument panel. The switch is a split-rocker type; the right half positions are "HI," "LO" and off and the left half positions are "MAX HI" and off. The right half of the switch incorporates an intermediate "LO" position used for normal starting, and a "HI" position (when the top of the switch is fully depressed) for vapor purging during hot engine starts. Maximum fuel flow is produced when the left half of the switch is held in the spring-loaded "MAX HI" position. In the "MAX HI" position, an interlock within the switch automatically trips the right half of the switch to its "HI" position. When the spring-loaded left half of the switch is released, the right half will remain in the "HI" position until manually returned to the off position. With the right half of the switch in the "LO" position, and the starter button depressed, the auxiliary fuel pump will operate at a low flow rate (providing proper fuel mixture for starting) as the engine is being turned over with the starter.

NOTE

The auxiliary fuel pump will not operate in the "LO" position until the starter button is depressed.

With the right half of the switch in the "HI" position, the pump operates at one of the two flow rates that are dependent upon the setting of the throttle. With the throttle open to a cruise setting, the pump is operating at a high capacity to supply sufficient fuel to maintain flight. When the throttle is moved toward the closed position (as during letdown, landing and taxiing), the fuel pump flow rate is automatically reduced, preventing an excessively rich mixture during these periods of reduced engine speed. When the engine-driven fuel pump is functioning and the auxiliary fuel pump is functioning and the auxiliary fuel pump is turned on "HI", a fuel/air ratio considerably richer than the best power is produced unless the mixture is leaned. If the auxiliary fuel pump switch is accidently placed on "HI" (with master switch on) with the engine stopped and the mixture rich, the intake manifold will be flooded.

12-28B. DESCRIPTION. Beginning with U20602200, the yellow right half of the switch is labeled "START", and its upper "ON" position is used for normal starting, minor vapor purging and continued engine operation in the event of an engine-driven pump failure. With the right half of the switch in the "ON" position, the pump operates at one of two flow rates that are dependent upon the setting of the throttle. With the throttle open to a cruise setting, the pump operates high enough capacity to supply sufficient fuel flow to maintain flight with an inoperative engine-driven fuel pump. When the throttle is moved toward the closed position (as during letdown, landing and taxiing), the fuel pump flow rate is automatically reduced, preventing an excessively rich mixture during these periods of reduced engine speed.

NOTE

If the engine-driven fuel pump is functioning and the auxiliary fuel pump switch is placed in the "ON" position, a fuel/air ratio considerably richer than best power is produced unless the mixture is leaned. Therefore, this switch should be turned off during take-off.

CAUTION

If the auxiliary fuel pump switch is accidently placed in the "ON" position with the master switch on and the engine stopped, the intake manifolds will be flooded.

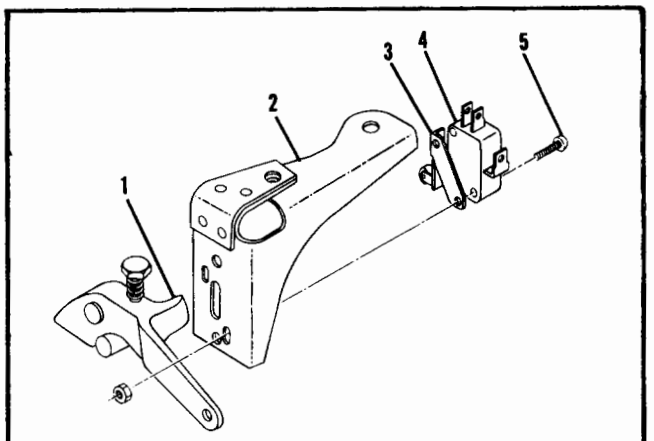
The red left half of the switch is labeled "EMERG", and its upper "HI" position is used in the event of an engine-driven fuel pump failure during take-off or high power operation. The "HI" position may also be used for extreme vapor purging. Maximum fuel flow is produced when the left half of the switch is held in the spring-loaded "HI" position. In this position, an interlock within the switch automatically trips the right half of the switch to the "ON" position. When the spring-loaded left half of the switch is released, the right half will remain in the "ON" position until manually returned to the "OFF" position.

13-29. RIGGING THROTTLE MICROSWITCH. (Refer to figure 13-8.) The aircraft is equipped with a throttle-operated microswitch which slows down the electric fuel pump whenever the throttle is retarded while the electric pump is being used. The electric fuel pump microswitch should slow down the pump as the throttle is retarded to approximately 19 inches of mercury manifold pressure (sea level aircraft) and 23 inches of mercury manifold pressure (turbocharged aircraft).

NOTE

These settings must be established during ground run-up only. These values will not apply in flight.

a. Start engine and set throttle to obtain 19 inches of mercury manifold pressure (sea level aircraft) or 23 inches of mercury manifold pressure (turbocharged



1. Throttle Shaft Lever Cam
2. Airbox Bracket
3. Switch Actuator
4. Microswitch
5. Mounting Screw

Figure 13-8. Rigging Throttle Microswitch

aircraft).

b. Mark position of throttle control at instrument panel and shut down engine.

c. Adjust microswitch at the engine throttle shaft lever as required to cause electric fuel pump to slow down as the throttle is retarded to the marked position.

c. With mixture control in "IDLE CUT-OFF," electric fuel pump switch in "HI," and master switch in "ON" position, listen for change in sound of electric fuel pump as the throttle is retard to the marked position.

13-30. FUEL FLOW TEST. (Refer to figure 13-9.)

NOTE

These tests are to be conducted with the engine stopped and external power supplied to the aircraft bus.

a. Apply 13.75 VDC ± .25V (27.75 VDC ± .25V) to aircraft bus.

b. Set mixture control at "FULL RICH."

c. Turn master switch "ON," and yellow auxiliary fuel pump rocker switch "ON."

d. Advance throttle to full open position.

e. Check metered fuel pressure/flow on ship's gage for a flow of 88-96 pounds/hour (14.7-16.0 gallons/hour).

f. Adjust number one resistor (6) if required.

g. Retard throttle slowly from the full "OPEN" position until the speed of the fuel pump can be audibly detected to change due to microswitch activation.

h. Wait momentarily for the fuel flow gage to respond.

i. The metered fuel pressure/flow on the ship's gage should read on the low end red line or approximately one red line width above.

j. Adjust number two resistor (5) if required.

13-31. MAXIMUM HIGH BOOST CHECK. To verify high position function, momentarily depress spring-loaded rocker and verify a noticeable increase in indicated fuel flow on the fuel flow gage.

13-32. FUEL STRAINER. The fuel strainer is located in the nose wheel well. Access to the strainer is gained by removing fairings aft of the nose gear. The fuel strainer drain control is located adjacent to the oil dipstick. Access to the drain control is gained through the oil dipstick cowling door.

13-33. FUEL STRAINER DISASSEMBLY. (Refer to figure 13-7.) To disassemble and assemble the strainer, proceed as follows:

a. Turn off fuel selector valve.

b. Disconnect strainer drain tube and remove safety wire, nut, and washer at bottom of filter bowl and remove bowl.

c. Carefully unscrew standpipe and remove.

d. Remove filter screen and gasket. Wash filter screen and bowl in solvent (Federal Specification P-S-661, or equivalent) and dry with compressed air.

e. Using a new gasket between filter screen and top assembly, install screen and standpipe. Tighten standpipe only finger tight.

f. Using all new O-rings, install bowl. Note that step-washer at bottom of bowl is installed so that step seats against O-ring. Connect strainer drain tube.

g. Turn on fuel selector valve, close strainer drain, and check for leaks. Check for proper operation.

h. Safety wire bottom nut to top assembly. Wire must have right hand wrap, at least 45 degrees.

13-34. ELECTRIC FUEL QUANTITY INDICATORS. AND TRANSMITTERS. Refer to Section 16 for description, removal, installation and calibration.

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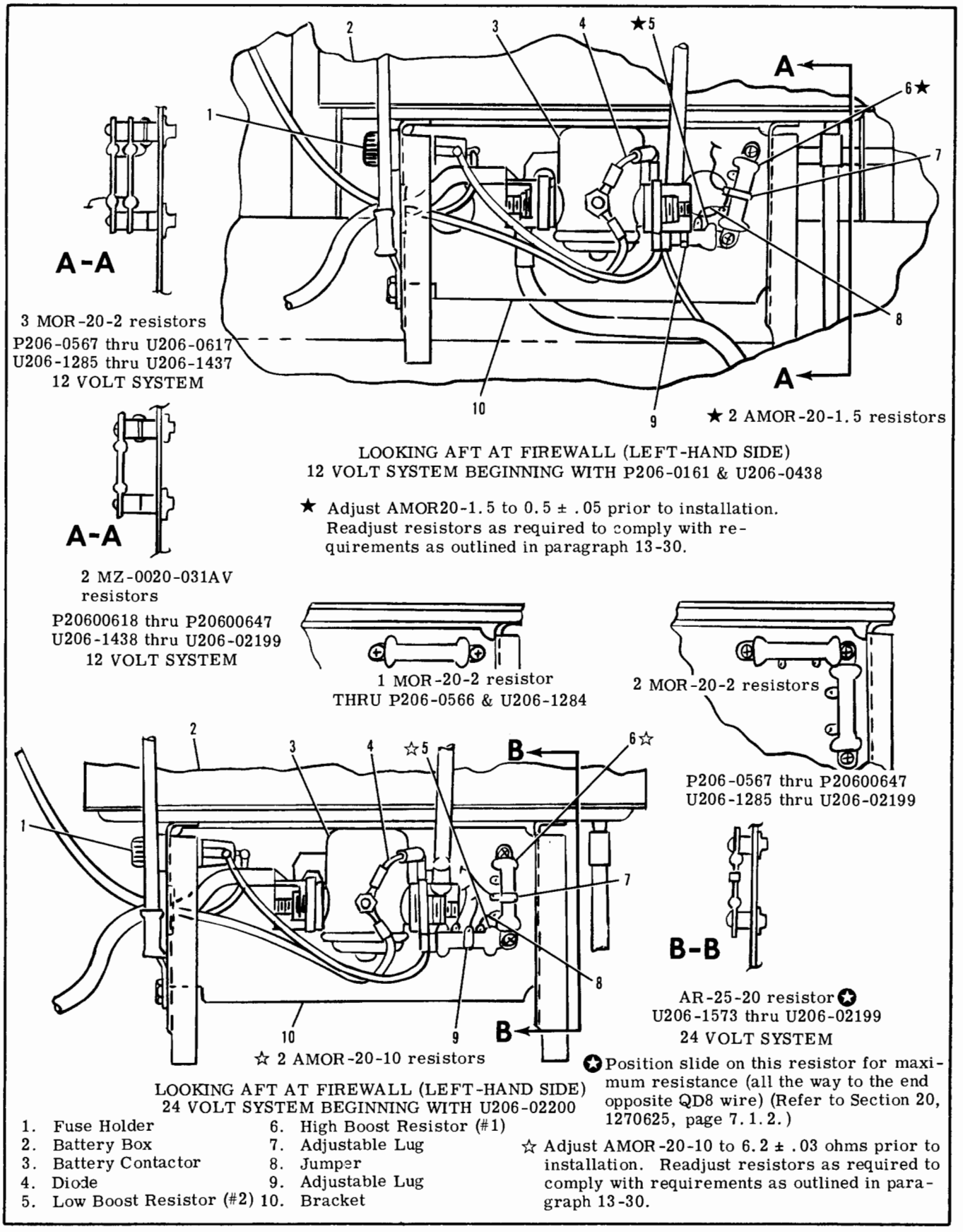


★ Adjust AMOR20-1.5 to 0.5 ± .05 prior to installation. Readjust resistors as required to comply with requirements as outlined in paragraph 13-30.

✪ Position slide on this resistor for maximum resistance (all the way to the end opposite QD8 wire) (Refer to Section 20, 1270625, page 7.1.2.)

☆ Adjust AMOR-20-10 to 6.2 ± .03 ohms prior to installation. Readjust resistors as required to comply with requirements as outlined in paragraph 13-30.

Figure 13-9. Fuel Pump Resistors

SECTION 14

PROPELLERS AND PROPELLER GOVERNORS

TABLE OF CONTENTS

14-1. PROPELLERS.

14-2. DESCRIPTION. The aircraft is equipped with an all-metal, constant-speed, governor-regulated propeller. The constant-speed propeller is single- acting, in which engine oil pressure, boosted and regulated by the governor is used to obtain the correct blade pitch for the engine load. Engine lubricating oil is supplied to the power piston in the propeller hub through the crankshaft. The amount and pressure of the oil supplied is controlled by the engine-driven governor. Increasing engine speed will cause oil to be admitted to the piston, thereby increasing the blade pitch. Conversely, decreasing engine speed will result in oil leaving the piston, thus decreasing the blade pitch.

14-3. REPAIR. Metal propeller repair first involves evaluating the damage and determining whether the repair will be a major or minor one. Federal Aviation Regulations, Part 43 (FAR 43), and Federal Aviation Agency, Advisory Circular No. 43.13 (FAA AC No. 43.13), define major and minor repairs, alterations and who may accomplish them. When making repairs or alterations to a propeller FAR 43, FAA AC No. 43.13 and the propeller manufacturer's instructions must be observed.

14-4. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
FAILURE TO CHANGE PITCH.	Governor control disconnected or broken.	Check visually. Connect or replace control.
	Governor not correct for propeller. (Sensing wrong.)	Check that correct governor is installed. Replace governor.
	Defective governor.	Refer to paragraph 14-9.
	Defective pitch changing mechanism inside propeller or excessive propeller blade friction.	Propeller repair or replacement is required.
FAILURE TO CHANGE PITCH FULLY.	Improper rigging of governor control.	Check that governor control arm and control have full travel. Rig control and arm as required.
	Defective governor.	Refer to paragraph 14-9.
SLUGGISH RESPONSE TO PROPELLER CONTROL.	Excessive friction in pitch changing mechanism inside propeller or excessive blade friction.	Propeller repair or replacement is required.
STATIC RPM TOO HIGH OR TOO LOW.	Improper propeller governor adjustments.	Perform static RPM check Refer to section 12 and 12A for procedures.
ENGINE SPEED WILL NOT STABILIZE.	Sludge in governor.	Refer to paragraph 14-9.
	Air trapped in propeller actuating cylinder.	Trapped air should be purged by exercising the propeller several times prior to take-off after propeller has been reinstalled or has been idle for an extended period.
	Excessive friction in pitch changing mechanism inside propeller or excessive blade friction.	Propeller repair or replacement is required.
	Defective governor.	Refer to paragraph 14-9.

SHOP NOTES:

14-4. TROUBLE SHOOTING (Cont.)

TROUBLE	PROBABLE CAUSE	REMEDY
OIL LEAKAGE AT PROPELLER MOUNTING FLANGE.	Damaged O-ring and seal between engine crankshaft flange and propeller.	Check visually. Remove propeller and install O-ring seal.
	Foreign material between engine crankshaft flange and propeller mating surfaces or mounting nuts not tight.	Remove propeller and clean mating surfaces; install new O-ring and tighten mounting nuts evenly to torque value in figure 14-1.
OIL LEAKAGE AT ANY OTHER PLACE.	Defective seals, gaskets, threads, etc., or incorrect assembly.	Propeller repair or replacement is required.

14-5. REMOVAL. Refer to figure 14-1.

a. Remove spinner attaching screws (2) and remove spinner (1), spinner support (3) and spacers (4). Retain spacers (4).

b. Remove cowling as required for access to mounting nuts (9).

c. Loosen all mounting nuts (9) approximately 1/4 inch and pull propeller (15) forward until stopped by nuts.

NOTE

As the propeller (15) is separated from the engine crankshaft flange, oil will drain from the propeller and engine cavities.

d. Remove all propeller mounting nuts (9) and pull propeller forward to remove from engine crankshaft (12).

e. If desired, the spinner bulkhead (11) can be removed by removing screws (10) attaching lugs (8) or bolts (19) attaching bulkhead (11) to propeller.

14-6. INSTALLATION.

a. If the spinner bulkhead (11) was removed, position bulkhead so the propeller blades will emerge from the spinner (1) with ample clearance and install spinner bulkhead attaching lugs and screws, or bolts (19) and nuts attaching spinner bulkhead to propeller.

CAUTION

Avoid scraping metal from bore of spinner bulkhead and wedging scrapings between engine flange and propeller. Trim the inside diameter of the bulkhead as necessary when installing a new spinner bulkhead.

b. Clean propeller hub cavity and mating surfaces of propeller and crankshaft.

c. Lightly lubricate a new O-ring (13) and the crankshaft pilot with clean engine oil and install the O-ring in the propeller hub.

d. Align propeller mounting studs and dowel pins with proper holes in engine crankshaft flange and slide propeller carefully over crankshaft pilot until mating surfaces of propeller and crankshaft flange are approximately 1/4 inch apart.

e. Install propeller attaching washers and nuts (9) and work propeller aft as far as possible, then tighten nuts evenly and torque to 660-780 lb-in.

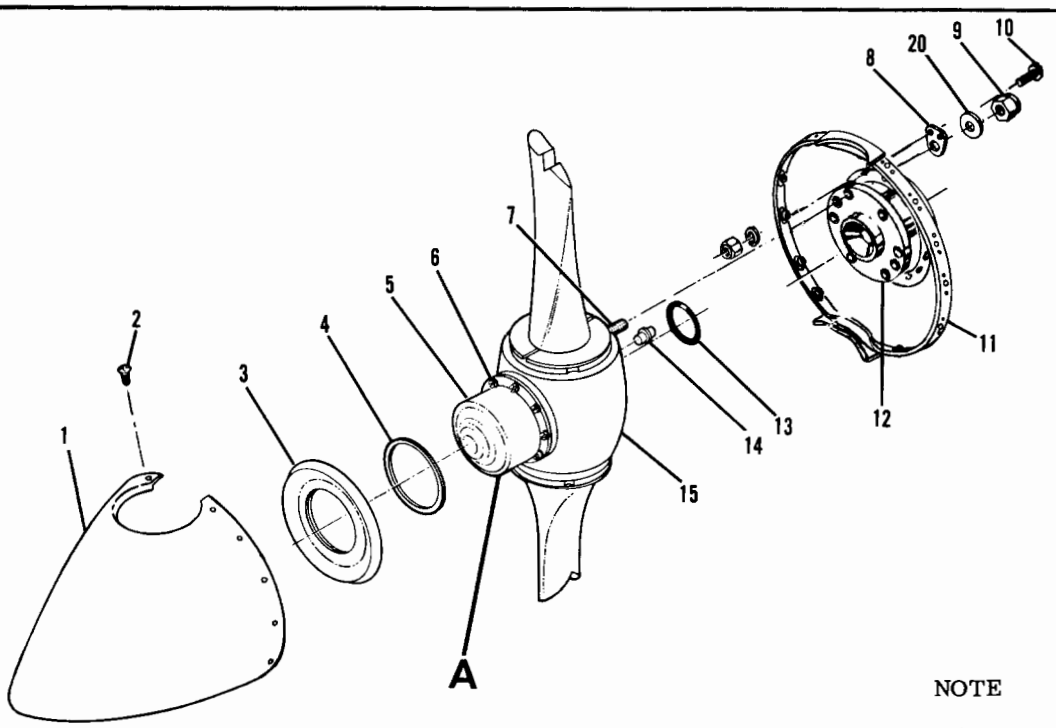
f. Install any spacers (4) used between spinner support and propeller cylinder, then install spinner support and spinner. The spacers are used as required to cause a snug fit between the spinner (1) and the spinner support (3).

14-7. PROPELLER GOVERNORS.

14-8. DESCRIPTION. The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch. A single-acting governor uses oil pressure to effect a pitch change in one direction only; a pitch change in the opposite direction results from a combination of centrifugal twisting moment of rotating blades and compressed springs. Oil pressure is boosted in the governor by a gear type oil pump. A pilot valve, fly weight and speeder spring act together to open and close governor oil passages as required to maintain a constant engine speed.

NOTE

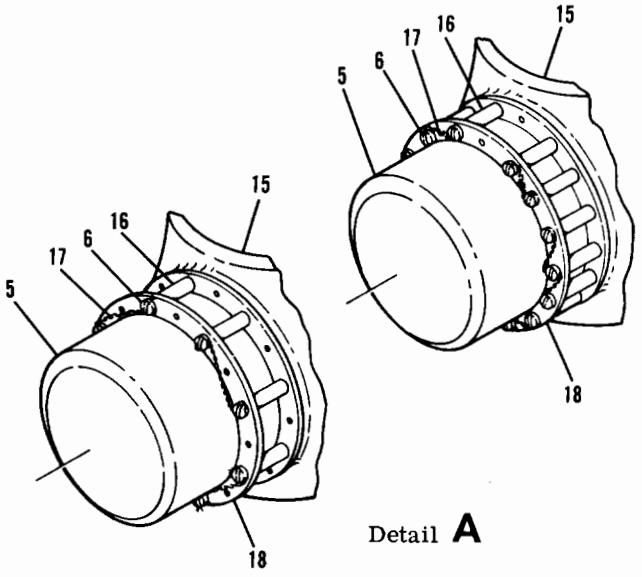
Outward physical appearance of specific governors is the same, but internal parts determine whether it uses oil pressure to increase or decrease blade pitch. The propellers used on these aircraft require governors which "sense" in a certain manner. "Sensing" is determined by the type pilot valve installed inside the governor. Since the basic governor may be set to "sense" oppositely, it is important to ascertain that the governor is correct for the propeller being used.



NOTE

Use spacers (4) as required to ensure a snug fit between spinner (1) and spinner support (3).

Torque propeller mounting nuts (9) to 660 - 780 lb-in.



Detail **A**

DETAIL "A" APPLIES TO CYLINDER (4) ATTACHMENT WHEN MODIFIED PER SERVICE LETTER SE71-18

1. Spinner
2. Screw
3. Spinner Support
4. Spacer
5. Cylinder
6. Screw
7. Stud
8. Lug
9. Mounting Nut
10. Screw
11. Spinner Bulkhead
12. Engine Crankshaft
13. O-Ring
14. Dowel Pin
15. Propeller
16. Tube
17. Safety Wire
18. Ring
19. Bolt
20. Washer

TWO-BLADED PROPELLER

Figure 14-1. Propeller Installation (Sheet 1 of 4)