

Beechcraft Bonanza

36 Series

SHOP MANUAL

36

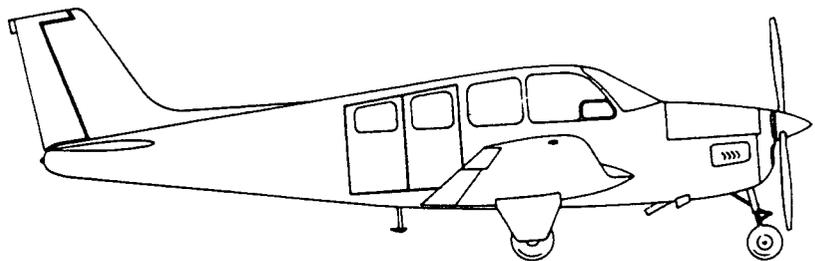
E-1 THRU E-184

A36

E-185 THRU E-1240 EXCEPT E-1111

A36TC

EA-1 THRU EA-10



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SHOP MANUAL

AMENDMENT RECORD

This page provides a record of the amendments issued since the latest revision of your manual and should be incorporated into the Shop Manual as soon as it is received. Insert the Amendment Record immediately following the List of Effective Pages (A Page). Retain this page until the information has become a part of the manual at the next amendment or revision. Eighteen months from the date of publication, the amendment will be deleted from stock and will no longer be available.

NUMBER	ISSUE DATE	SUBJECT
36-590001-3B/1	June, 1970	Installation of Velcro Tape with Replacement Fuel Cells
36-590001-3B/2	March, 1971	Troubleshooting and Maintenance of Bullock Strobe Light
36-590001-3B/3	September, 1971	General Changes and 1972 Model Changes
36-590001-3B/4	November, 1972	Wing Attach Fitting Changes and Flapper Valve Inspection
36-590001-3B/5	December, 1972	Wiring Diagram Changes - Model Change

LIST OF EFFECTIVE REVISIONS

Always destroy superseded pages when you insert revised pages.

LOG OF REVISIONS

B Reissue.....	April, 1970
B1 Revision.....	November 1, 1973
B2 Revision.....	December 31, 1973
B3 Revision.....	June 5, 1975
B4 Revision.....	October 17, 1975
B5 Revision.....	April 20, 1976
B6 Revision.....	June 18, 1976
B7 Revision.....	October 12, 1976
B8 Revision.....	January 7, 1977
B9 Revision.....	May 12, 1978
B10 Revision.....	April 19, 1979
B11 Revision.....	August 24, 1979
B12 Revision.....	June 18, 1980
B13 Revision.....	June 30, 1983
B14 Revision.....	May 31, 1985
B15 Revision.....	August 28, 1987

LIST OF EFFECTIVE PAGES

Title Page	B15	Aug 28/87	2-9 thru 2-10A	B11	Aug 24/79
Logo Page			2-11	B13	Jun 30/83
A Page	B15	Aug 28/87	2-12 thru 2-14	B11	Aug 24/79
B Page	B15	Aug 28/87	2-15 thru B16	Orig	Apr 1970
i thru ix	B15	Aug 28/87	3-1 thru 3-3	Orig	Apr 1970
1-1	B13	Jun 30/83	3-4 thru 3-24	B13	Jun 30/83
1-2	B10	Apr 19/79	4-1 thru 4-2	Orig	Apr 1970
1-2A	B11	Aug 24/79	4-2A thru 4-2B	B14	May 31/85
1-3 thru 1-4	B2	Dec 31/73	4-3 thru 4-4	Orig	Apr 1970
1-4A	B10	Apr 19/79	4-4A thru 4-4E	B14	May 31/85
1-4B	B11	Aug 24/79	4-5	B5	Apr 20/76
1-4C	B11	Aug 24/79	4-6	Orig	Apr 1970
1-5 thru 1-6	B13	Jun 30/83	4-7 thru 4-12A	B3	Jun 5/75
1-7	Orig	Apr 1970	4-13	B3	Jun 5/75
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2-1 thru 2-2	B15	Aug 28/87	4-16	B9	May 12/78
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2-8A	Orig	Apr 1970	5-6	B9	May 12/78

NOTE: A list of the effective pages will be found in the front of each chapter.

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Basic publications are assigned a part number which appears on the title page with the date of the issue. Subsequent revisions are identified by the addition of a revision code after the part number. A1 after a part number denotes the first revision to the basic publication, A2 the second, etc. Occasionally, it is necessary to completely reissue and reprint a publication for the purpose of obsoleting a previous issue and outstanding revisions thereto. As these replacement reissues are made, the code will also change to the next successive letter of the alphabet at each issue. For example, B for the first reissue, C for the second reissue, etc.

When ordering a handbook, give the basic number, and the reissue code when applicable, if a complete up-to-date publication is desired. Should only revision pages be required, give the basic number and revision code for the particular set of revision pages you desire.

98-36416C

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INTRODUCTION

The Bonanza 36 Shop Manual provides the factory recommended procedure for maintaining the Bonanza 36, A36 and A36TC in an easy to follow, easy to locate manner. Information in the Shop Manual is directed toward helping the experienced mechanic with specialized and more complex maintenance, while simple and repetitive procedures are given less emphasis. When necessary, an illustration supplements the text for further clarification.

In all instances where no serial designations are made the information applies to the 36, A36, and A36TC. In areas where E-185 or later "E" serials appear, the information will apply to both the A36 and A36TC, except when the same subject is also covered by "EA" serial designations. In the latter instance the serialized information applies only to its respective model.

The Shop Manual is divided into sixteen sections, with each section devoted to a specific system or major component. All pertinent information will be found in one place.

As shop procedures and aircraft modifications warrant, revisions to the Shop Manual may be issued.

Complete operating instructions for the BEECHCRAFT Bonanza 36, A36 and A36TC may be found in the applicable Model Owner's Manual.

To aid you in locating the information you need, an alphabetical index contains multiple entries for each subject.

The wiring diagrams for the Model 36 and A36, serials E-1 thru E-709, and E-711 thru E-762 are contained within Section 14 of this Shop Manual.

Refer to the BEECHCRAFT Bonanza Wiring Diagram Manual P/N 35-590102-7 for the wiring diagrams pertaining to the Bonanza Model A36 airplane serials E-710, E-763 through E-1240 except E-1111. On Bonanza Model A36 serials E-1111, E-1241 and after and Model A36TC serials EA-1 and after, refer to the BEECHCRAFT Wiring Diagram Manual P/N 35-590102-9.

WARNING

Use only genuine BEECHCRAFT or BEECHCRAFT approved parts obtained from BEECHCRAFT approved sources, in connection with the maintenance and repair of Beech airplanes.

Genuine BEECHCRAFT parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in Beech airplane applications. Parts purchased from sources other than BEECHCRAFT, even though outwardly identical in appearance, may

not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Salvaged airplane parts, reworked parts obtained from non-BEECHCRAFT approved sources, or parts, components, or structural assemblies, the service history of which is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or have other hidden damage, not discernible through routine visual or usual nondestructive testing techniques. This may render the part, component or structural assembly, even though originally manufactured by BEECHCRAFT, unsuitable and unsafe for airplane use.

BEECHCRAFT expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-BEECHCRAFT approved parts.

NOTICE

Beech Aircraft Corporation expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

CORRESPONDENCE

If a question should arise concerning the care of your airplane, it is important to include the airplane serial number in any correspondence. The serial number appears on the model designation placard, located inboard of the right flap on the fuselage.

NOTE

Service Publications reissues or revisions are not automatically provided to the holders of this manual. For information on how to obtain reissues or revisions applicable to this manual, refer to BEECHCRAFT Service Instructions No. 0250-010, Rev. IV or subsequent revisions.

NOTE

This manual covers data on systems which are standard or standard options as of the publication of this manual, however not all standard options may be designated as such.

SUPPLEMENTARY PUBLICATIONS

Following is a list of publications providing servicing, overhaul and parts information on various components of the BEECHCRAFT Bonanza 36, A36 and A36TC which you may obtain to supplement the Shop Manual. In most instances, you should obtain the publications directly from the manufacturer or his distributor. Only a few, vendor manuals and Beech supplementary publications, are available from Commercial Products Support, Beech Aircraft Corporation. Those which are available are listed in the current Publications Price List. Since a wide variety of radio equipment is available and because radio manufacturers normally supply parts and servicing manual with each set, radio publications have not been included in the list.

As publications on additional components become available, they will be added to this list of publications.

VENDOR PUBLICATIONS

ENGINE

Service Parts Catalog Form X-30040. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90 Mobile, Alabama 36601.

Maintenance and Overhaul Manual Form X-30039. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90 Mobile, Alabama 36601.

Operators Handbook Form X-30041, Teledyne Continental Motors Aircraft Products Division, Post Office Box 90 Mobile, Alabama 36601.

Overhaul Manual for TSIO-520 Series Aircraft Engines Form No. X-30042, Teledyne Continental Motors Aircraft Products Division, Post Office Box 90 Mobile, Alabama 36601.

Operators Manual for TSIO-520-U and -UB Engines Form No. X-30044, Teledyne Continental Motors Aircraft Products Division, Post Office Box 90 Mobile Alabama 36601.

TURBOCHARGER

Overhaul Manual and Parts Catalog Form No. X-30055, Teledyne Continental Motors Aircraft Products Division, Post Office Box 90 Mobile, Alabama 36601.

FUEL INJECTION

Overhaul Manual and Parts Catalog Form No. X-30052. Teledyne Continental Motors Corporation, Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

PROPELLER

Overhaul Manual and Parts Catalog Manual No. 720415 McCauley Industrial Corporation, Dayton, Ohio.

Hartzell Propeller Owner's Manual, 115B. Hartzell Propeller, Inc. Piqua, Ohio.

PROPELLER GOVERNOR

Overhaul Manual with Parts List Bulletin No. 33017 for the 35-380088 Propeller Governor. Woodward Governor Company, Rockford, Illinois.

Overhaul Manual with Parts List Bulletin No. 33080 for the 35-380088-1 Propeller Governor. Woodward Governor Company, Rockford, Illinois.

MAGNETOS

Overhaul Instructions for Bendix S-1200 Series Magnetos Form L-609. Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

Service Parts List for Bendix S-1200 Series Magnetos, Form L-608. Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

Parts Catalog and Service Manual for Slick 400 and 600 Series Magnetos, Form 1020, Slick Electro Inc., 530 Blackhawk Park Ave., Rockford, Illinois 61101.

Installation, Maintenance and Operation Instructions, S6RN-201 and S6RN-205 Magnetos, Form L-526. Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

Overhaul Instructions, S-600 Series Magnetos, Form L-551. Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

Service Parts List, S-600 Series Magnetos, Form L-552-1. Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

STARTING MOTOR

Maintenance Instructions Service Bulletin No. 1M-125 and Service Test Specifications Bulletin No. 1M-186, Delco-Remy, Anderson, Indiana.

Parts List Group 55A. Delco-Remy, Anderson, Indiana.

ALTERNATOR

Test and Maintenance Bulletin No. 1G-262 and Service Test Specifications Bulletin No. 1G-187, Delco-Remy, Anderson, Indiana.

Parts List Group 88-J and Group 88-K, Delco-Remy, Anderson, Indiana.

Equipment List, Service Parts and Technical Data OE-A1, Prestolite Service Department, Parts and Equipment Section, Toledo, Ohio 43601.

Service and Overhaul Instructions for Continental 642056A1 Alternator. Publication No. X-30531, Teledyne Continental Motors, Aircraft Products Division, Post Office Box 90 Mobile, Alabama 36601.

ELECTRIC PROPELLER DEICER

Installation of Deicer Boots, Report 66-707 (two blade propeller), Report 66-04-716A (three blade propeller). B. F. Goodrich Company, Akron, Ohio.

AUTOPILOT

B-5 Flight Control System Ground and Flight Check Procedures, Publication Number 3952, Brittain Industries, P.O. Box 51370 Tulsa, Oklahoma 74151.

B-5 Automatic Flight Control System Maintenance Manual, Publication Number 3950, Brittain Industries, P.O. Box 51370 Tulsa, Oklahoma 74151

B-7 Flight Control System Flight Procedures Manual, Publication Number 3959, Brittain Industries, P.O. Box 51370 Tulsa, Oklahoma 74151

B-7 Troubleshooting Manual, Publication Number 3960, Brittain Industries, P.O. Box 51370 Tulsa, Oklahoma 74151

STROBE LIGHT

Instruction and Service Manual for Airguard Anti-collision Beacon, Publication: 50082, Bullock Magnetics Corp., Pomona, California.

Overhaul Manual with Illustrated Parts List (60-1750-3 Power Supply), Publication Number: 33-40-58; Grimes Manufacturing Company, 515 North Russel Street, Urbana, Ohio 43078.

AIR CONDITIONER COMPRESSOR

Model 508 Compressor, Abacus International, P.O. Box 327 Dallas, Texas 75221.

FLIGHT CONTROLS

ELECTRIC ELEVATOR TRIM TAB

Edo-Aire Mitchell, Automatic Flight Control Systems, AK563 Bulletin No. 686 or AK669 Bulletin No. 798 EDO-AIRE MITCHELL, P.O. Box 610 Mineral Wells, Texas 76067.

BATTERY

Service Manual, Publication Number: GSM-1277, Teledyne Battery Products, P.O. Box 431, 840 W. Brockton Ave., Redlands, CA 92373.

SUPPLEMENTARY BEECHCRAFT PUBLICATIONS

98-33690B Installation, Maintenance and Illustrated Parts Breakdown for the 35-380093 and 35-380093-1 Voltage Regulator.

98-35012 Servicing Maintenance Instructions and Illustrated Parts Breakdown for the Main Wheel, Nose Wheel and Brake Assembly.

98-35655 B-5 and B-7 Owners Manual Automatic Flight Control Systems.

98-35776 Maintenance Information and Illustrated Parts Breakdown for 35-380094 Landing Gear Motor.

98-35850 Electronics Components Maintenance Manual and Parts Breakdown B-5, B-5A, B-7, B-VII, B-VIII Autopilot.

98-36234 Installation, Maintenance and Illustrated Parts Breakdown for the 35-380093-2 Voltage Regulator.

98-36486 Overhaul Instructions for Vertical Display Engine Indicators used on BEECHCRAFT Bonanza Series Airplanes.

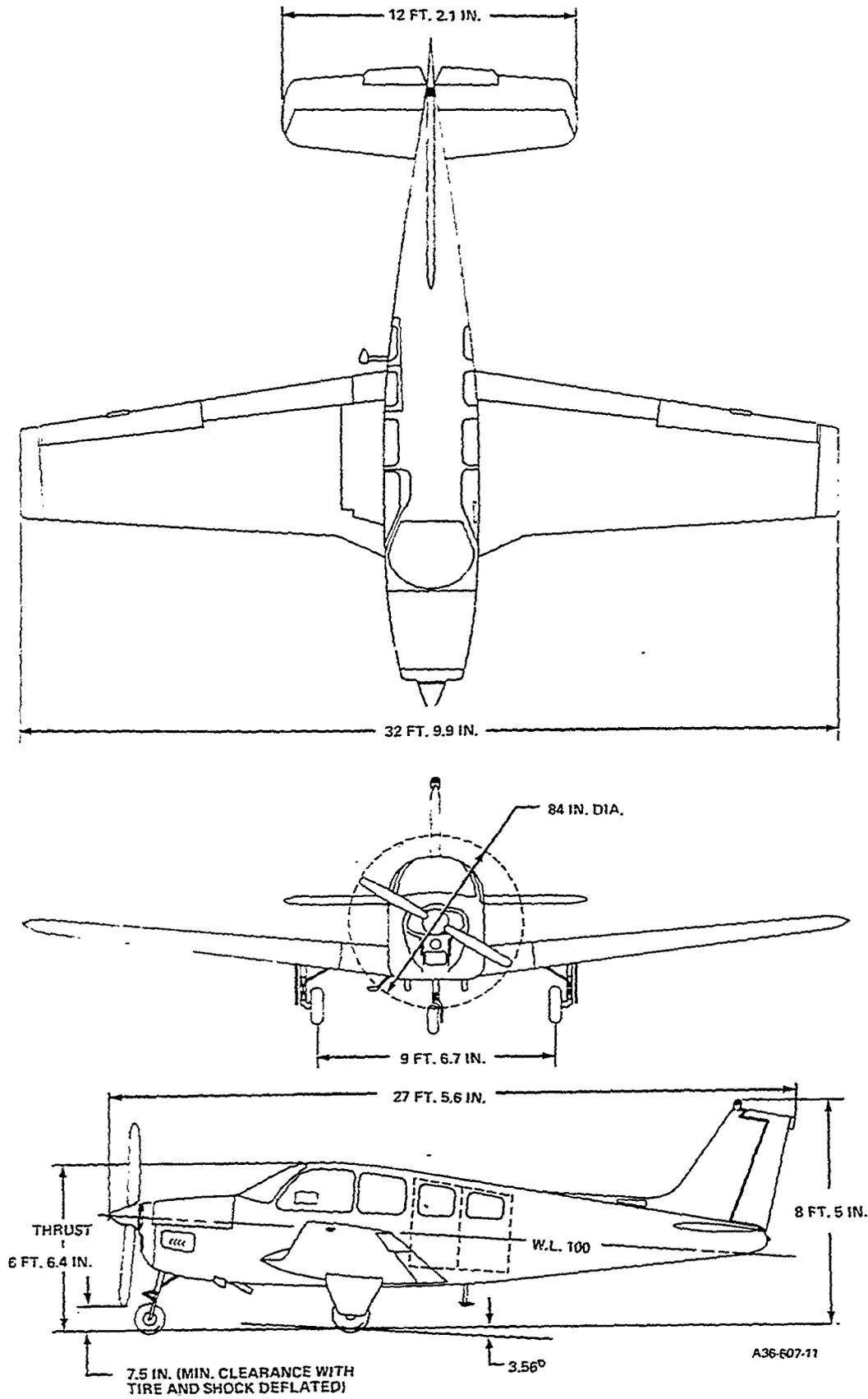


Figure 1-1. Three View (E-1 thru E-184)

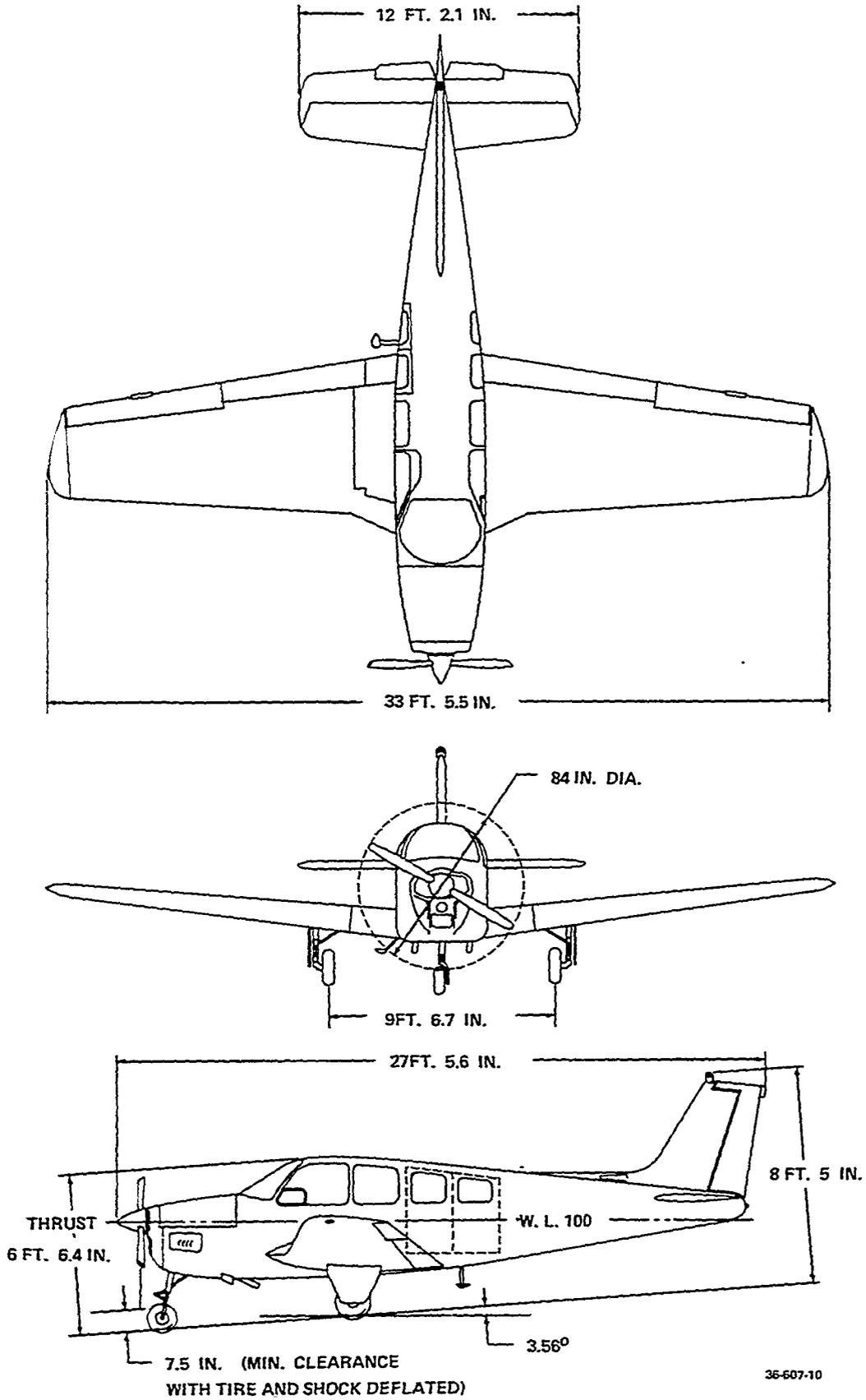
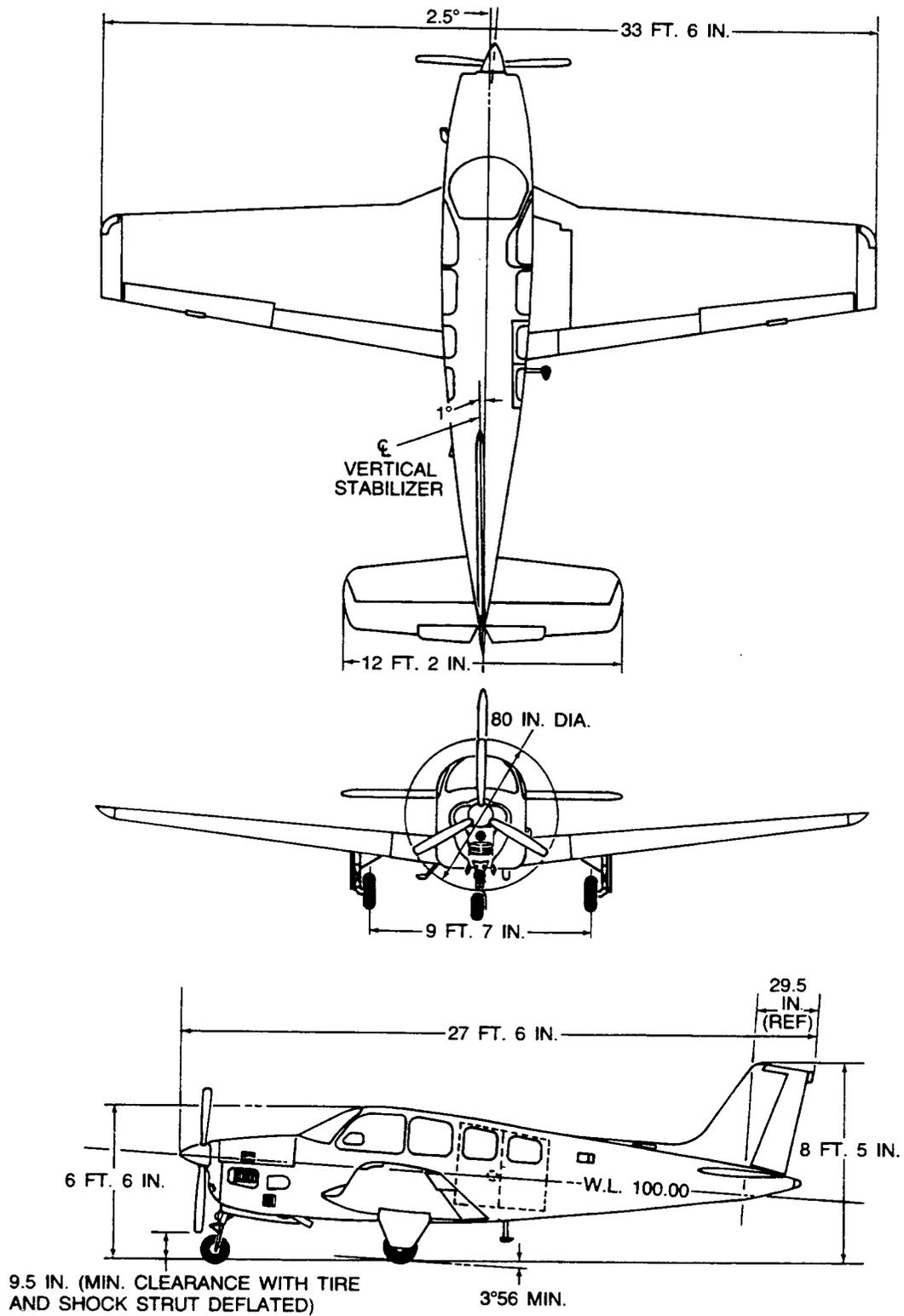


Figure 1-1A. Three View (E-185 and after)



A36TC-607-20

Figure 1-1B. Three View (EA-1 and after)

GENERAL INFORMATION

POWER PLANT

Continental E-1 through E-264 and
IO-520-BE-266 through E-272
IO-520-BA E-265 and E-273 through E-1370
IO-520-BB E-1371 and after

These 3 engines rated 285 horsepower at 2700 rpm.

Continental
TSIO-520-UEA-1
TSIO-520-UB EA-2 and after

These 2 engines rated 300 horsepower at 2700 rpm.

TURBOCHARGER

AiResearch TE0659

SPARK PLUGS

Champion	RHB32N	Gap:	.018 to .022
	RHB33E		.018 to .022
A.C.	AC271		.018 to .022
	AC281		.018 to .022
	AC273		.018 to .022
	AC283		.018 to .022

FIRING ORDER

163254

NOTE

Number one cylinder is the rear cylinder on the right hand side of the engine.

MAGNETO TIMING

22° + 0° - 2° (Before top center) of number 1 cylinder

OIL PRESSURE

Minimum (idle) 10 psi.
Operating range 30 to 60 psi.
Maximum (cold)..... 100 psi.

OIL TEMPERATURE

Minimum for takeoff.....24°C (75°F)
Recommended Minimum 38°C (100°F)
Recommended cruise 77°C (170°F)
Maximum allowable.....115°C (240°F)

OIL, SAE NUMBER

Above 4.4°C (40°F)50
Below 4.4°C (40°F)..... 30 or 10W30

OIL CAPACITY

12.0 qts. See Item 2 of the Consumable Materials Chart.

CYLINDER HEAD TEMPERATURE

Maximum238°C (460°F)

TURBINE INLET TEMPERATURE

Maximum1650°F

PROPELLER

E-1 and after

McCauley 2A36C23/84B-0 or 3A32C76/82NB
McCauley 2A36C23-CP/84B-0
McCauley 3A32C76S/84NB-2
Hartzell PHC-C3YF-1RF/F8468-6R or
PHC-C3YF1R/8468-6R .
Hartzell BHC-C2YF-1BF/4868 or BHC-C2YF-1B/4868

EA-1 and after

McCauley 3A32C76-U/82NB-2

DEICER (GOODRICH) BRUSH BLOCK REPLACEMENT (14 Volt System)

Replace brushes when 15/32 inch maximum distance is measured on wire inserted through inspection hole in brush support block.

FUEL SYSTEM

FUEL GRADE AND CAPACITY

Grade: 100 LL (Blue) or 100 (Green) See Item 1 of the Consumable Materials Chart.

Capacity:

Standard 50 gallons (usable 44 gallons)
Optional 80 gallons (usable 74 gallons)

FUEL PRESSURE ADJUSTMENT

See Fuel System, Section 8 or Power Plant Section 6.

GENERAL INFORMATION (Cont'd)

MISCELLANEOUS

AIRCRAFT DIMENSIONS

Overall Length	27' 5.6"
Wing Span (E-1 thru E-184)	32' 9.9"
(E-185 and after)	33' 5.5"
Tail Height	8' 5"
Tread Width	9' 6.7"
Propeller Diameter	
E-1 and after	84"
EA-1 and after	80"
Propeller Ground Clearance	
E-1 and after	7.5" minimum
EA-1 and after	9.5" minimum

(E-1371 and after)

0° = full up

15° ± 1° = approach

30° + 0° - 2° = full down

Aileron 20° ± 2° = full up

20° ± 2° = full down

Rudder 25° ± 1° = full left and right

Elevator 23° ± 1° = full up

20° ± 1° = full down

Elevator Tab 10° ± 1° = full up

27° ± 1° = full down

BRAKE FLUID RESERVOIR (in engine accessory section)

Fill to 1-1/2 inch of top with MIL-H-5606 hydraulic fluid, see Item 13, Consumable Materials Chart. Maintain visible fluid level on dip stick.

BRAKE WEAR LIMITS

Cleveland - Replace linings when they are worn 3/32 inch above rivet. Minimum brake disc thickness .330 inch.

ADJUSTMENT OF PRESSURE RELIEF VALVE

See Pressure System, Section 11.

OXYGEN CYLINDER

Fill slowly to 1850 psi at 70°F. Increase the system 3.5 psi for every degree of temperature increase and decrease 3.5 psi for every degree decrease.

STALL WARNING SWITCH

Adjust 7 to 9 mph above a complete stall.

CONTROL SURFACE TRAVEL

Flap
(E-1 through E-1370)
0° = full up
30° + 0° - 2° = full down

MOTOR BRUSH REPLACEMENT GUIDE

Flap 1/4" minimum required (Prior to E-953)
Landing Gear, Retract 5/16" minimum required
Starter, Engine 3/8" minimum required
Alternator 1/4" minimum

SERVICE

Battery (Lead acid)	
12 volt (35 amp/hour)	
E-1 thru E-1240 except E-1111	100 hours
24 volt (11 amp/hour)	
E-1111, E-1241 and after	100 hours
Main Gear Tires (7.00 x 6-6 ply)	33-40 psig
Nose Gear Tire (5.00 x 5-4 ply)	40 psig
Oil Filter	100 hours
Oil Change	100 hours
Induction Air Filter	500 hours (replace)
Gyro Instrument Air Filter	500 hours (replace)
Main Strut Extension	3 inches
Nose Strut Extension	3-1/2 inches
Fuel System Screens	100 hours
Wheel Bearing (repack)	100 hours

Courtesy of Bomar Flying Service
www.bomar.biz

TABLE OF TORQUES

ENGINE MOUNTING

Engine shock mount bolts and nuts 300 to 340 in./lbs.

ENGINE COMPONENTS

Engine alternator 150 to 180 in./lbs.
Engine starter 150 to 180 in./lbs.
Engine spark plugs 300 to 360 in./lbs.
Engine oil filter 18 to 30 ft./lbs.
Prop spinner bulkhead bolts 85 to 90 in./lbs.
Prop mounting nuts 660 to 720 in./lbs.

RUDDER AND ELEVATOR

Elevator horn hinge mounting bolts 50 to 70 in./lbs.
Rudder mounting bolts 50 to 70 in./lbs.
Rudder bell crank bolts 50 to 70 in./lbs.

HORIZONTAL AND VERTICAL STABILIZER

Attach bolts 50 to 70 in./lbs.

WING MOUNTING (WET TORQUE ONLY)

Lower forward wing attach bolt 2480 to 2600 in./lbs
Upper forward wing attach bolt 1180 to 1300 in./lbs
(E-1 thru E-379 except E-356)
Upper forward wing attach bolt 2480 to 2600 in./lbs
(E-356, E-380 and after, EA-1 and after)
Upper aft wing attach bolt 1180 to 1300 in./lbs
Lower aft wing attach bolt 1180 to 1300 in./lbs

LANDING GEAR

Main landing gear axle nut 15 to 20 ft./lbs.
Nose landing gear axle nut 10 to 15 ft./lbs.
Main landing gear brace bolts 180 to 200 in./lbs.
Cross arm to barrel attach bolts 70 in./lbs.
Main landing gear hinge bolts 250 to 800 in./lbs.
Retract drag leg bolt 25 to 75 in./lbs.

FUEL SYSTEM

Attaching bolts for:

Fuel filler 50 ± 5 in./lbs.
Fuel transmitter 25 in./lbs.

TORQUE WRENCHES

When a torque wrench and adapter is used, (Figure 1-2) compensation must be made for the extra leverage gained. New indicator readings must be calculated before the wrench is used. To figure the desired lower readings which will actually give the torques specified, use the following formula:

Example: D = Desired reading
 L_w = Length of torque wrench
 L_a = Adapter length
 T = Torque

D = ?
 L_w = 33 inches
 L_a = 11 inches
 L = 44 inches
 T = 5, inch-pounds

$$\frac{\text{Original wrench length} \times \text{specified torque}}{\text{length of wrench} + \text{adapter}} = \text{Desired reading}$$

$$\frac{33 \times 5,000}{33 + 11} = \frac{165,000}{44} = 3750 \text{ inch-pounds}$$

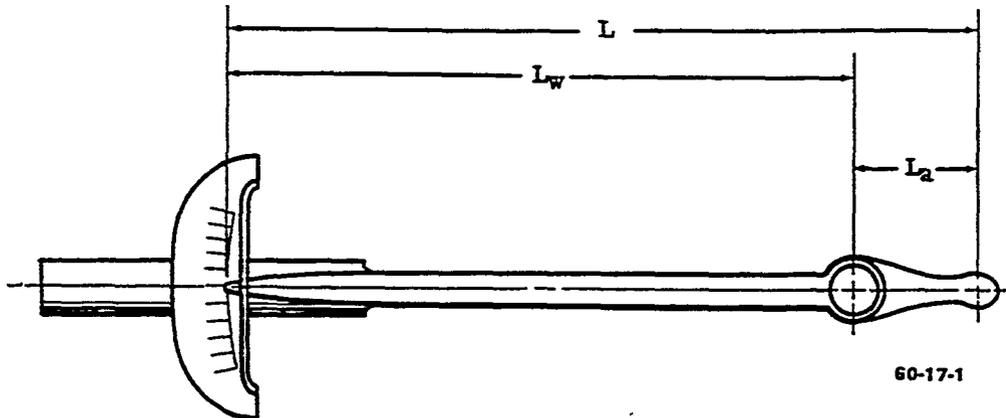


Figure 1-2. Torque Wrench and Adapter

An acceptable method of checking the torque if a torque wrench is not available (Figure 1-3), is to attach a spring scale to a conventional flex or "T" handle inserted in an adapter. Force should be applied in a direction perpendicular to an imaginary line extending from the center of the bolt through the spring scale attaching point.

When a torque wrench adapter is used, the length of the adapter must be added to the length of the flex or "T" handle wrench and a value calculated for that particular combination. The following is a typical example in finding a desired value.

To calculate the force in pounds (scale reading) required to obtain the specified torque, divide the torque in inch-pounds by the distance in inches between the center of the bolt and the scale attaching point. For example, if the specified torque is 5,000 inch-pounds and the distance is 25 inches, a pull of 200 pounds must be applied. Unless a bolt torque is specified as wet (lubricated), bolts to be torqued must be clean and free of all lubricants; otherwise, loss of normal friction allowed for establishing the torque values may result in overtorquing of the bolt.

Effective length of flex or "T"

handle wrench: 12 inches
 Length of adapter 3 inches
 Total length 15 inches
 Desired torque on bolt 2000 inch-pounds

$$\frac{2000 \text{ inch-pounds}}{15 \text{ inches}} = 133.3 \text{ pounds (scale reading)}$$

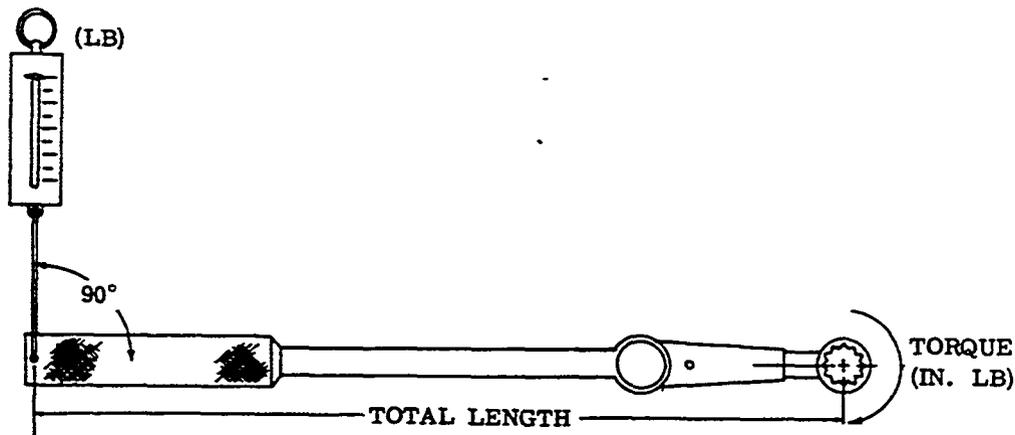


Figure 1-3. Computing Torque with Spring Scale

TORQUING FINE THREAD SERIES BOLTS LOADED IN SHEAR

NOTE

The following torque values may be used as a guide when specific torques are not called out within this shop manual.

SIZE	TORQUE LIMITS RECOMMENDED (INCH-POUNDS)		MAXIMUM ALLOWABLE TORQUE (INCH-POUNDS)	
	AN365 and AN310 Nuts Column 1	AN364 and AN320 Nuts Column 2	AN365 and AN310 Nuts Column 3	AN364 and AN320 Nuts Column 4
8-36	12-15	7-9	20	12
10-32	20-25	12-15	40	25
1/4 - 28	50-70	30-40	100	60
5/16 - 24	100-140	60-85	225	140
3/8 - 24	160-190	95-110	390	240
7/16 - 20	450-500	270-300	840	500
1/2 - 20	480-690	290-410	1100	660
9/16 - 18	800-1000	480-600	1600	960
5/8 - 18	1100-1300	660-780	2400	1400
3/4 - 16	2300-2500	1300-1500	5000	3000
7/8 - 14	2500-3000	1500-1800	7000	4200
1 - 14	3700-5500	2200-3300	10000	6000
1 - 1/8 - 12	5000-7000	3000-4200	15000	9000
1 - 1/4 - 12	9000-11000	5400-6600	25000	15000

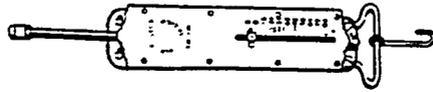
NOTE: The above values apply to Class 3 threads, cadmium plated and nonlubricated.

TORQUING COARSE THREAD SERIES BOLTS LOADED IN SHEAR

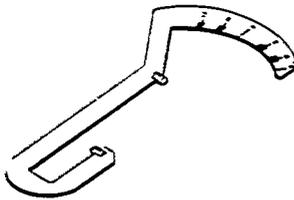
SIZE	TORQUE LIMITS RECOMMENDED (INCH-POUNDS)		MAXIMUM ALLOWABLE TORQUE (INCH-POUNDS)	
	AN365 and AN310 Nuts Column 1	AN364 and AN320 Nuts Column 2	AN365 and AN310 Nuts Column 3	AN364 and AN320 Nuts Column 4
8-32	12-15	7-9	20	12
10-24	20-25	12-15	35	21
1/4 - 20	40-50	25-30	75	45
5/16 - 18	80-90	48-55	160	100
3/8 - 16	160-185	95-110	275	170
7/16 - 14	235-255	140-155	475	280
1/2 - 13	400-480	240-290	880	520
9/16 - 12	500-700	300-420	1100	650
5/8 - 11	700-900	420-540	1500	900
3/4 - 10	1150-1600	700-950	2500	1500
7/8 - 9	2200-3000	1300-1800	4600	2700
1 - 8	3700-5000	2200-3000	7600	4500
1 - 1/8 - 8	5500-6500	3300-4000	12000	7200
1 - 1/4 - 8	6500-8000	4000-5000	16000	10000

NOTE: The above values apply to Class 3 threads, cadmium plated and nonlubricated.

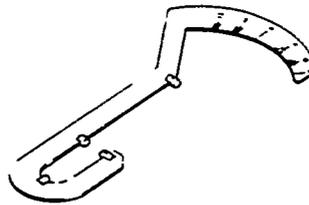
SPECIAL TOOLS



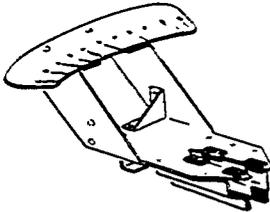
45-590074-7
Landing Gear Tension Gage Assembly



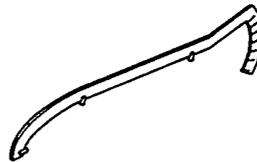
810-3 35660040 L.H.
810-3 356600401 R.H.
Elevator Check Fixture



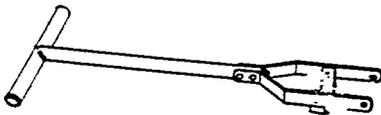
810 33524000
Rudder Check Fixture



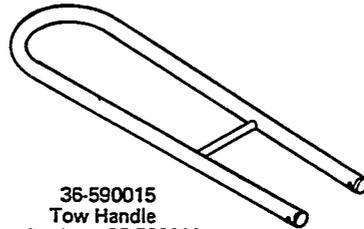
810 35660043-2
Elevator Trim Tab Jig



810-1 50590091
Aileron Travel Gage



35-590002
Tow Handle



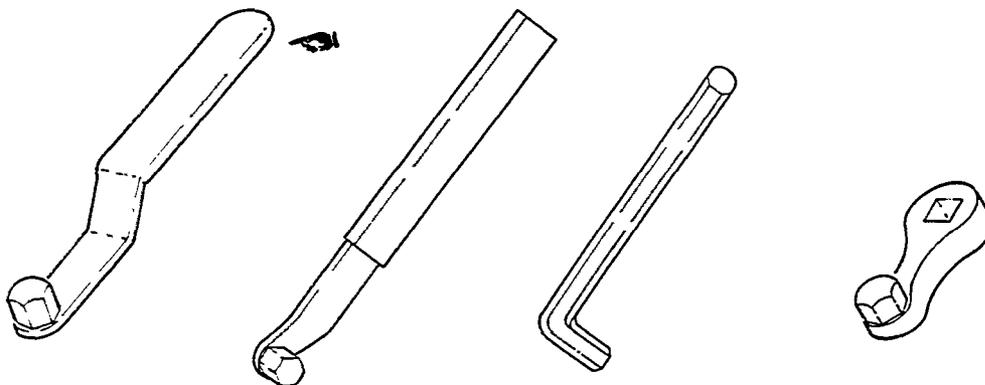
36-590015
Tow Handle
Replaces 35-590002



35-590021
Tail Support Assembly

36-17-1A

SPECIAL TOOLS



TS1253-1 (9/16 inch)

TS1222-4 (9/16 inch)
TS1222-8 (9/16 inch)
TS1222-3 (5/8 inch)
TS1222-6 (1/2 inch)
TS1222-9 (1/2 inch)

TS1222-5 (9/16 inch)
50-590012 (9/16 inch)

TS1171-2 (7/8 inch)
TS1176-2 (7/8 inch)
50-590013 (3/4 inch)
TS1171-1 (3/4 inch)
TS1176-1 (3/4 inch)

LOWER FORWARD WING BOLT WRENCHES:

TS1222-5
TS1222-4
TS1222-8
TS1253-1
50-590012

UPPER AND LOWER AFT WING BOLT WRENCHES:

50-590012
TS1222-5
TS1222-4
TS1222-8
TS1253-1

LOWER FORWARD WING NUT TORQUE WRENCH ADAPTERS:

TS1171-2
TS1176-2

UPPER AND LOWER AFT WING NUT TORQUE WRENCH ADAPTERS:

50-590013
TS1171-1
TS1176-1

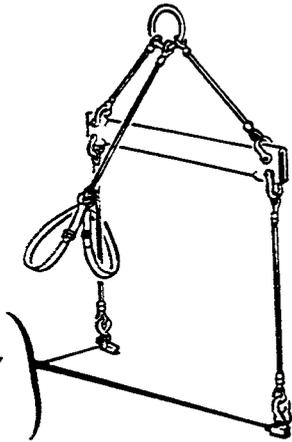
UPPER FORWARD WING BOLT WRENCHES:

50-590012 (for 9/16 inch-hex)
TS1222-5 (for 9/16 inch-hex)
TS1222-4 (for 9/16 inch-hex)
TS1222-8 (for 9/16 inch-hex)
TS1253-1 (for 9/16 inch-hex)
TS1222-6 (for 1/2 inch-hex)
TS1222-9 (for 1/2 inch-hex)
TS1222-3 (for 5/8 inch-hex)

UPPER FORWARD WING NUT TORQUE WRENCH ADAPTERS:

TS1176-1 (for 3/4 inch-hex)
TS1171-1 (for 3/4 inch-hex)
50-590013 (for 3/4 inch-hex)
TS1171-2 (for 7/8 inch-hex)
TS1176-2 (for 7/8 inch-hex)

SPECIAL TOOLS

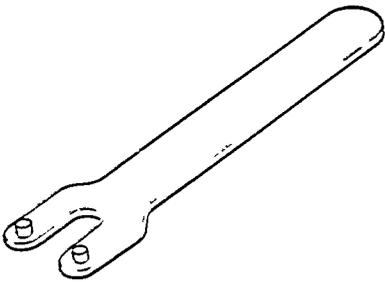


35-590067
Fittings

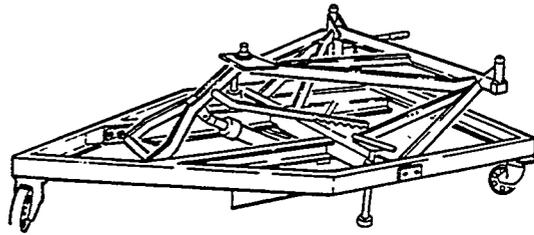
35-590064-1
Hoisting Sling Assembly



35-590006
Main Wheel Jack Adapter



35-590009
Throttle Retaining Nut Wrench



Model 300
Service Jack

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GROUND HANDLING

Exercise care in ground handling of the airplane to avoid unnecessary damage. The following procedures are provided to reduce the possibility of ground damage.

TOWING

WARNING

If the engine is warm and it is necessary to move the propeller to attach the tow bar, stand clear of the area of rotation and move the propeller against the normal direction of rotation. Make certain the magneto switch is off. While the engine is warm, residual fuel in the intake ports and injectors may ignite and cause the engine to kick.

CAUTION

Never tow or taxi with a flat strut. Even brief towing or taxiing with a deflated strut can cause severe damage.

NOTE

The top of the cabin door should not be used as a handhold while entering or leaving the cabin. Always open the storm window to relieve internal pressure when slamming the door. Never leave the cabin door open on the ramp as wing gusts may damage the door.

The two lugs on the nose gear lower torque knee are used with the hand tow bar furnished with each airplane. One man can move the airplane easily on a smooth and level surface with the tow bar.

CAUTION

After moving the airplane, always remove the tow bar. Never turn the engine over with the tow bar attached to the fork, as the propeller will not clear the bar.

In a hangar and where movement is restricted, two men may pivot the airplane on the main wheels. One man should push on the leading edge of the wing tip while the other workman lifts the nose wheel

from the ground by applying his weight on the fuselage just forward of the stabilizers. Points where pushing is permitted are the leading edge of the wing, wing tip, and the fuselage forward of the stabilizer leading edge.

CAUTION

Do not push on the propeller or the control surfaces. Do not place any weight on the horizontal stabilizers to raise the nose wheel off the ground.

To tow the airplane with a tractor or tug, attach the tow bar to the tow lugs on the nose gear lower torque knee. Always observe the turn limits of the nose gear when making turns. Turns greater than these limits can cause extensive damage to the nose gear. Also, exercise care when removing the tow bar from the nose gear lower torque knee to prevent damage to the lubrication fittings on the landing gear.

NOTE

Do not attempt to tow the airplane backward by the fitting in the tail skid. This tail skid was designed only to protect the tail in the tail-low landing and to provide attachment for the tail tie-down.

JACKING

CAUTION

Jacking the airplane for landing gear operation should only be accomplished within an enclosed hangar. Should it become necessary to jack the airplane in the open, no more than one jack point should be utilized at a time. For safety of personnel and the airplane, wind velocity in any direction must be considered prior to jacking the airplane in the open.

CAUTION

Prior to jacking the airplane, ensure that an unbalanced condition does not exist. Fuel should be distributed evenly in both wings to prevent an unbalanced

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condition which could cause the airplane to be unstable while on the jacks. Make certain a suitable weight is available to anchor the tail of the airplane to be jacked. The use of a tail tiedown device with suitable weight - 500 pounds - such as P/N 35-590021 embedded in a movable concrete filled barrel or equivalent.

WARNING

The landing gear does not incorporate a rebound control assembly. Do not attempt to remove the torque knees, the torque knee pins or the bolt connecting the torque knees, when the airplane has been placed on jacks, without first deflating the shock absorber assembly and supporting the gear. The torque knees provide the extension stop for the lower shock absorber assembly. When they are disconnected the cylinder is free to slide out of the upper barrel assembly.

A three-point jack is used to lift the airplane off the ground. Each jack pad is identified and located on the under side of the fuselage. One jack pad is located on each lower wing-to-fuselage attachment fitting along the front spar. The rear jack pad is located under a protective cap in the middle of the fuselage at the rear fuselage carry-thru spar. The rear jack fitting consists of an eye bolt that is screwed completely into the airplane.

WARNING

Be sure the rear jack point safety pin is in place to prevent the airplane from nosing over.

When one wing is to be removed, a stand should be placed under the opposite wing and the tail to counteract the resulting unbalanced condition of the airplane.

MAIN WHEEL JACKING

A main wheel jack adapter is included with each airplane prior to airplane serial E-243. On serials E-244 and after, the adapter is supplied as optional equipment. Before raising the airplane, be sure the

shock strut is properly inflated to the correct height. If the strut is not inflated to the recommended height, it will be impossible to insert the jack adapter into the main wheel axle. A scissor type jack is recommended for individual wheel jacking.

When lowering the airplane, caution should be exercised so that the shock strut does not become compressed and force the landing gear door against the jack adapter.

CAUTION

Do not walk on the wing walk with the airplane on the main wheel jack.

ANCHORING AND MOORING PROVISIONS

Three mooring eyes are provided: one in each wing and one in the tail bumper. To moor the airplane, chock the wheels fore and aft, install the control lock and tie down the airplane with a nylon line or chain of sufficient strength at each mooring eye. Avoid overtightening the rear line, which pulls up the nose so that wind will create higher lift on the wings. If bad weather is anticipated, it is advisable to nose the airplane into the wind.

PARKING BRAKE

The brakes are set for parking by pulling out the parking brake control and depressing the pilot's brake pedals to pressurize the system. Do not attempt to lock the parking brake by applying force to the parking brake handle; it controls a valve only, and cannot apply pressure to the brake master cylinders.

CAUTION

Do not set the parking control when the brakes are hot from severe use or during low temperature when an accumulation of moisture may cause the brakes to freeze.

CONTROL LOCK

A control column lock pin is provided for the control column and the aileron control wheel. The lock pin secures the aileron control wheel in neutral and the control column in neutral elevator position,

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unless modification of the control gust lock as been accomplished per BEEHCRAFT Service Instructions No. 0660-155 or subsequent issue. When this modification has been accomplished, the control wheel will be rotated 12° clockwise and 2 inches forward. Existing holes in the control column will be plugged. Ensure positive retention of the lock pin by positioning the attached red plate on top of the throttle and propeller controls.

HOISTING

The airplane may be hoisted for maintenance or parts replacement as follows:

- a. Install (P/N 35-590067) hoisting sling fitting on each upper forward wing attach bolt.
- b. Attach the sling assembly (P/N 35-590064-1) to the sling adapter.
- c. Install the strap assembly around the propeller blade shanks.
- d. Hoist the airplane smoothly.

NOTE

Adjust the strap assembly to keep the airplane in a level or slightly nose-down attitude.

- e. As an added precaution, a stand may be installed under the tail of the airplane.

If the airplane must be hoisted and the 35-590064-1 sling assembly is not available, remove the cabin door, the left front window and the front seats. Attach a sling to the front wing spar in the fuselage, and a line to the hoist fitting on the engine.

CAUTION

A spreader must be used above the cabin to prevent damaging the door molding and window frame.

LEVELING

To level the airplane longitudinally, attach a cord and plumb bob to the phillips head screw, located aft of the rear window on the left side of the airplane. Inflate or deflate the nose gear

shock strut as necessary to pass the cord through the center of a second phillips head screw directly below. Suspending the plumb bob in a can of light engine oil will assist in stabilizing it.

Lateral leveling is accomplished by removing the front seat(s) and placing a bubble level on the spar carry-thru structure. Deflate the tire or strut on the high side of the airplane to center the bubble.

EXTERNAL POWER

An external power unit with a negative ground may be used to supply power for ground checks, starting and battery charging. The power unit may be connected directly to the battery or to an optional polarized external power receptacle located on the lower engine cowling. The receptacle is designed for use with a standard AN type plug.

The optional external power circuit is equipped with a relay and a diode to protect the airplane electrical system against damage from an external power source with reversed polarity.

Observe the following precautions when using an external power source.

CAUTION

Check whether the airplane is equipped with a 14-volt or 28-volt electrical system.

- a. Before connecting an external power unit, turn off all radio equipment, the alternator switch, and the battery switch.

- b. To prevent arcing, make certain no power is being applied when the connection is made.

- c. After the external power unit is connected, turn on the battery switch before turning on any other equipment. Leave the battery on during the entire external power operation.

CAUTION

The battery may be damaged if exposed to voltages higher than 15 volts (prior to E-1241 except

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E-1111) or higher than 30 volts (E-1111, E-1241 and after).

SERVICING

Proper and periodic servicing of the airplane will prevent considerable wear and greatly lengthen the service life of parts and systems involved. For points of lubrication and the correct interval and materials, refer to the Lubrication and Servicing Charts in this section. The following information gives instruction on the servicing of major systems.

TIRES

The nose wheel tire is a 5.00-5 4-ply tire. The main wheel tires are 7.00-6 6-ply tires. Inflate the nose wheel tires to 40 pounds and the main wheel tires to 33 to 40 pounds. Maintaining proper tire inflation will minimize tread wear and aid in preventing tire rupture caused from running over sharp stones and ruts. When inflating tires, visually inspect them for cracks and breaks.

Beech Aircraft Corporation cannot recommend the use of recapped tires. The tires may pass the retraction test when first installed: however, recapped tires have a tendency to swell after use and may cause malfunction of the retract system or damage to the landing gear doors.

Oil and other hydrocarbons spilled on tires not only weaken the rubber, but may cause it to swell. Avoid spilling oil, fuel or solvents on tires and clean off any accidental spillage as soon as possible.

BRAKES

The brake fluid reservoir is located on the upper forward side of the firewall. The reservoir should be checked regularly and filled to within 1-1/2 inches of the top and visible fluid level should be maintained on the dip stick at all times by adding hydraulic fluid (Item 13, Consumable Materials Chart).

SERVICING SHOCK STRUTS

The shock struts are filled with hydraulic fluid, (Item 13, Consumable Materials Chart) and inflated with dry air or

nitrogen. The same procedure is used for servicing both the main and nose gear shock struts. To service a strut proceed as follows:

a. Remove the air valve cap and depress the valve core to release the air pressure.

WARNING

Do not unscrew the air valve assembly until all air pressure has been released or it may be blown off with considerable force, causing injury to personnel or property damage.

b. With the weight of the airplane on the gear, loosen the filler plug slowly to assure that all air has escaped, then remove the filler plug.

c. With the shock strut fully deflated, raise the strut barrel so that it is 1/4 inch (nose gear strut) or 1 to 2 inches (main gear strut) from the fully compressed position.

d. Fill the strut to the level of the filler plug with hydraulic fluid (Item 13, Consumable Materials Chart). Lower the strut barrel and with the strut in the fully compressed position, allow the excess oil to drain out.

e. Clean and install the filler plug and inflate the strut. The nose gear shock strut should be inflated until 3-1/2 inches of piston is exposed. The main gear shock strut should be inflated until 3 inches of the pistons are exposed.

CAUTION

If a compressed air bottle containing air under extremely high pressure is used, care should be taken not to overinflate the strut.

f. Rock the airplane gently to prevent sticking or binding the strut.

g. Remove all foreign material from the exposed piston of the shock strut with a cloth moistened with hydraulic fluid.

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**LUBRICATION OF LANDING GEAR UPLOCK
ROLLERS (E-283 AND AFTER AND PRIOR
AIRPLANE COMPLYING WITH SERVICE
INSTRUCTIONS NO. 0448-211)**

The uplock roller bearing should be lubricated with grease (Item 11, Consumable Materials Chart), every 100 hours or any time that, while the wheel well is being cleaned, the bearings are subjected to degreasing with solvent under pressure. Using a pressure gun, the uplock bearing is lubricated through a grease fitting installed in the uplock bearing bolt.

NOTE

The grease fitting on the drag leg, directly above the uplock roller bearing, does not supply lubrication for the uplock roller bearing.

FUEL SYSTEM

CAUTION

Any time the fuel system is drained or a fuel cell is empty for any reason, air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the applicable Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.

The standard fuel cell installation consists of a 25 gallon (22 gallon usable) fuel cell and filler cap in each wing leading edge. In the optional installation a 40 gallon (37 gallon usable) fuel cell replaces each 25 gallon fuel cell. Each 40 gallon fuel cell contains a visual measuring tab below the filler neck to permit partial filling, when desired. The tab bottom indicates 30 gallons of fuel and the tab slot indicates 35 gallons.

When filling the airplane fuel cells, always observe the following:

a. Service the fuel cells with grade 100LL or grade 100 or if not available, use 115/145 octane fuel (Item 1, Consumable Materials Chart).

b. Make sure the airplane is statically grounded to the servicing unit.

c. Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.

Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals, depending on service conditions, and fuel handling equipment or when operating in localities where there is an excessive amount of sand or dust. Open the three snap-type fuel drains daily to purge any condensed water vapor from the system. Each fuel cell drain is located on the bottom of the wing just outboard of the root. The system low spot drain at the bottom of the fuel selector valve is accessible through a door inboard of the left wing root.

NOTE

Care should be exercised while filling the fuel cell to prevent scratching, denting, or otherwise damaging the surface or leading edge of the wing.

OIL SYSTEM

CAUTION

If metal contamination of the oil system is detected and the cause is corrected, the oil cooler should be replaced. In addition, flush out the system through the interconnected oil system plumbing and replace or clean any other accessories that will remain with the engine.

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The airplane is equipped with a wet sump oil system requiring 12 quarts of oil. The oil filler cap is accessible by opening the left engine cowl.

To drain the engine sump, remove the right hand access plate and unscrew the sump drain plug in the lower right hand side of the engine crankcase. An oil drain trough, furnished with each airplane is used to convey the oil through the bottom of the engine cowl.

Under normal operating conditions, the recommended number of operating hours between oil changes is 100 hours. The oil filter should be removed and replaced at each oil change.

NOTE

A torque of 18-20 foot-pounds should be applied to the nut of the oil filter when the oil filter is replaced. If no torque wrench is available when the filter is replaced, clean and lubricate the new gasket with engine oil. Then turn the filter by hand to a light gasket contact. Tighten the filter with a suitable wrench, three quarters to one full turn after gasket contact.

When operating under adverse weather conditions or continuous high power settings, the oil should be changed more frequently. Before draining the oil, run up the engine until the oil reaches operating temperature to assure complete draining of the oil. Oil grades listed in the Approved Engine Oils Chart are general recommendations only, and will vary with individ-

ual circumstances. Check oil inlet temperature during flight in determining the use of the correct grade of oil. Inlet temperatures consistently near the maximum allowable indicates a heavier oil is needed. Use a detergent aviation grade oil in the heaviest weight that will give satisfactory starting. Above 40°F, SAE 50 viscosity should be used: below 40°F, SAE 30 is recommended. Any detergent aviation grade engine oil which meets Continental Motors Corporation Specification MHS-24B is acceptable for use.

BATTERY

CAUTION

Check to confirm the voltage (14 or 28 volts) of the system.

14-VOLT SYSTEM (12-VOLT BATTERY) (PRIOR TO E-1241 EXCEPT E-1111)

The battery is located on the right side of the engine compartment just forward of the firewall. The battery is accessible for servicing by raising the right engine cowl door and removing the battery box cover. Never add anything but distilled water to the battery. The water level in the BEECHCRAFT or Gill battery should be maintained at 1/2 inch above the separators. Never fill above this level.

NOTE

Do not overfill. When the battery cells are overfilled, water and acid will spill on the lower portions of the engine accessory section and lower fuselage.

28-VOLT SYSTEM (24-Volt Battery) E-1111, E-1241 and after)

A 24 volt, 110 ampere hour Teledyne battery is provided to operate the electrical system. The battery is located on the right side of the engine compartment just forward of the firewall. The battery is accessible for servicing by raising the right engine cowl door and removing the battery box cover.

The battery should be maintained in a fully charged state at all times and the electrolyte level checked at regular intervals. Never add anything but distilled water when adjusting the electrolyte level in the battery. If electrolyte is added each time the level in the battery is low, a high concentration of sulfuric acid may cause dissolution of the plates. Under high temperature conditions, this may be indicated by the presence of black particles in the electrolyte of the affected cells.

NOTE

Do not fill the battery over 3/8 inch above the separators. Only lead-acid equipment should be used when servicing lead-acid type batteries. Do not use tools that are used on nickel-cadmium batteries.

BATTERY MAINTENANCE PROGRAM

A systematic battery maintenance program should be established and carefully followed.

- a. The battery should be removed from the airplane for service.
- b. A log of the services performed on the battery should be maintained.
- c. The battery should be removed from the airplane and serviced after 100 flight hours or 30 days, whichever occurs first. If the ambient temperatures are above 90°F or the time between engine starts averages less than 30 minutes, the time between servicing should be reduced. During periods when the ambient temperature is below 32°F, the battery should be maintained in a fully charged state to prevent freezing. When water is added, the battery should be charged sufficiently to thoroughly mix the water with the electrolyte as a precaution against freezing.
- d. For peak performance, the battery must be kept clean and dry. If foreign materials are present in sufficient quantities the resultant deposits may form conductive paths that permit a rapid self discharge of the battery. To prevent the collection of such deposits the battery should be cleaned after each 100 hours of service or every 30 days, whichever occurs first.

CAUTION

Excessive spewage may result if cell vents are not kept clean and open.

- e. The log of battery service performed should be evaluated to determine the need to service the battery at the above recommended intervals or to extend the intervals if justified. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals.

INDUCTION AIR FILTER

The induction air filter should be cleaned periodically and replaced every 500 hours of service. Clean the filter as described in the manufacturer's instructions on the filter.

LUBRICATION

A lubrication chart in this section and a lubrication diagram (Figure 2-2) contains information that ensures the proper operation and preservation of the airplane. Location, interval and lubricant required are given. Bearings used in pulleys, bell cranks, hinge points, and rod-ends are of the sealed-type and do not require periodic lubrication. Avoid excessive application of lubricants.

AIR CONDITIONING SYSTEM

Servicing the air conditioning system consists of periodically checking the refrigerant level, checking compressor oil level, checking the compressor belt tension, and changing the system air filter. Recharge the system as outlined under **CHARGING THE AIR CONDITIONING SYSTEM** whenever the refrigerant level is low, air has entered the system, or components carrying refrigerant are replaced. Refrigerant leaks may be detected by inspection with a flameless leak detector.

CHARGING THE AIR CONDITIONING SYSTEM

WARNING

A face shield should be worn when servicing the lines; refrigerant, coming in contact with the eyes, can cause the loss of sight.

- When working on a refrigerant air cooling system, observe the following special servicing precautions.
 - a. Remember, this is a high pressure system. When disconnecting a line, loosen the fittings just enough to bleed off pressure slowly, then disconnect the fitting.
 - b. Whenever a line is disconnected, purge the entire system with a vacuum pump operating at the 125 micron level.
 - c. Use only refrigerant R-12 (Item 30, Consumable Material Chart) other refrigerants, particularly those containing methyl chloride, will cause rapid deterioration of the aluminum compressor components.

d. When servicing the system with refrigerant, avoid smoking or working near an open flame. Refrigerant passing over an open flame will produce a highly toxic phosgene gas.

e. Hook the service unit to the connections located under the copilot's seat. When charging a completely purged system, charge with 2 pounds of refrigerant. After charging, the sight glass should be observed for bubbles or a milky appearance caused by an insufficient refrigerant level. If it is necessary to add refrigerant to a partially charged system, add refrigerant slowly until a satisfactory condition is observed through the sight glass.

CHECKING COMPRESSOR OIL LEVEL

The air conditioner compressor oil level should be checked by a qualified air conditioner service man if the refrigerant charge is lost (evidenced by oil loss). The air conditioner system requires 12-14 ounces of 500 viscosity oil (Item 31, Consumable Material Chart) to maintain 4 ounces in the compressor.

Check the compressor oil level as follows:

a. Fabricate a dipstick by bending a wire to a 90° angle so that 1-1/2 inches of the wire will insert into the compressor.

b. Paint the dipstick with a flat black paint. Allow sufficient time for paint to dry.

c. Start engine in accordance with the applicable Pilot's Operating Manual and run the air conditioner. Run air conditioning system for 15 minutes with the engine running at low rpm to allow oil to accumulate in the compressor. Observe engine operating limitations as noted in the applica-

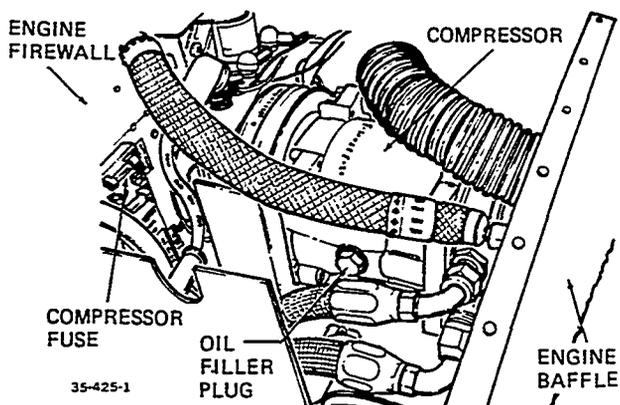


Figure 2-1. Servicing Compressor

ble Pilot's Operating Manual. Shut down engine in accordance with the applicable Pilot's Operating Manual.

d. Relieve the air conditioner system pressure by loosening the compressor filler plug just enough to bleed off pressure slowly.

e. After the system pressure is relieved, remove the oil filler plug.

f. Insert dipstick through oil filler port, slowly rotate clutch shaft until the dipstick will insert to the bottom of the compressor.

g. Withdraw dipstick, oil should register on the dipstick 5/8 inch below filler port. Add oil as necessary to obtain this measurement.

h. Install oil filler plug with O-ring and secure plug.

APPROVED ENGINE OILS

The marketers of the aviation lubricating oil listed below have supplied data to Teledyne Continental Motors indicating their products conform to all the requirements of TCM Specification MHS-24B, Lubricating Oil, Ashless Dispersant.

In listing the product names, TCM or Beech Aircraft Corporation make no claim of verification of marketer's statements or claims. Listing is made only for the convenience of the users.

<i>BRAND NAME</i>	<i>APPROVED</i>
Phillips Petroleum Company	Phillips 66 Aviation Oil, Type A
Shell Oil Company	Aeroshell Oil W
Continental Oil	Conoco Aero S
Texaco, Inc.	Texaco Aircraft Engine Oil - Premium AD
Mobil Oil Company	Mobil Aero Oil
Castro Limited (Australia)	Castrolaero AD Oil
Pennzoil Company	Pennzoil Aircraft Engine Oil
Sinclair Oil Company	Sinclair Avoil
Humble Oil & Refining Company	Esso Aviation Oil Enco Aviation Oil
BP Oil Corporation	BP Aero Oil
Quaker State Oil & Refining Co.	Quaker State AD Aviation Engine Oil
Delta Petroleum Company	Delta Avoil Oil
Union Oil Company of California	Union Aircraft Engine Oil HD
Gulf Oil Company	Gulfpride Aviation AD

NOTE

Make sure that the O-ring is not twisted and that no dirt or particles are on the O-ring or seat. The plug should be snug. Do not over-tighten plug.

i. Charge the air conditioning system as noted in **CHARGING THE AIR CONDITIONING SYSTEM**.

j. Check area around filler plug for leaks. If leaks exist, do not over-tighten filler plug, remove plug as noted in steps "c" and "d" and install a new O-ring. Secure plug and recharge system as noted in steps "h" and "i".

OXYGEN SYSTEM

To service the oxygen system, remove the protective cap from the filler valve located below and forward of the pilot's and copilot's seats.

NOTE

Use only Aviator's Breathing Oxygen, (Item 17, Consumable Materials Chart), when recharging the oxygen bottle.

WARNING

Keep fires, cigarettes, and sparks away when outlets are in use. Open and close all oxygen valves slowly. Make sure the oxygen shut-off valve is in the closed position. Inspect the filler connection for cleanliness before attaching it to the filler valve. Keep tools, hands and components clean, as fire or explosion may occur when pure oxygen comes in contact with organic material such as grease or oil.

Attach a hose from an oxygen recharging cart to the filler valve. To prevent overheating, fill the oxygen system slowly by adjusting the recharging rate with the pressure regulating valve on the cart. The oxygen cylinder should be filled to a pressure of 1850 ± 50 psi at a temperature of 70°F . This pressure may be increased an additional 3.5 psi for each degree of increase in temperature; similarly, for each degree of drop in temperature, reduce the pressure by 3.5 psi. When the oxygen system is properly charged, disconnect the filler hose from the filler valve and replace the protective cap.

NOTE

The cylinder pressure is connected directly to the pressure gage on the console.

CLEANING AND CARE OF AIRPLANE FINISH

Do not apply wax or polish for a period of 90 days after delivery to allow the paint to cure. Waxes and polish seal the paint from the air to prevent curing. For uncured painted surfaces, wash only with cold or lukewarm (never hot) water and a mild nondetergent soap. Any rubbing of the painted surface should be done gently and held to a minimum to avoid cracking the paint film.

After the paint cures, wash the airplane with a mild soap and water. Flush loose dirt away first with clear water. Harsh, abrasive, or alkaline soap or detergents which could cause corrosion or make scratches should never be used. Use soft cleaning cloths or chamois to prevent scratches when cleaning and polishing. Any good grade automobile wax may be used to preserve painted surfaces. To remove stubborn oil and grease, use a soft cloth dampened with naphtha. However, after cleaning with naphtha, the surface should be rewaxed and polished.

ENGINE CLEANING

The engine may be cleaned with kerosene, Stoddard solvent, or any standard solvent recommended for cleaning engines. The cleaner may be sprayed or brushed on the engine. Wipe the engine dry; compressed air may be used to remove excessive oil.

CLEANING PLASTIC WINDOWS

A commercial cleaning compound made specifically for acrylic plastic windows may be used. When using a commercial cleaner follow the instructions on the container.

If a commercial cleaner is not available, the following instructions should be followed.

Cleaning of the acrylic plastic windows should never be attempted when dry. The window should first be flushed with water or a mild soap solution, then rubbed slightly with a grit-free soft cloth, chamois or sponge. Stubborn grease or oil deposits are readily removed with aliphatic naphtha or hexane. Rinse with clear water.

CAUTION

Do not use thinner or aromatic abrasive cleaners to clean the windows; they will damage the surface of the plastic. Aliphatic naphtha and similar solvents are highly flammable, and extreme care must be taken when using them.

CLEANING INTERIOR CABIN TRIM

Proper care and cleaning of the interior cabin trim (Noryl plastics) is of primary importance to maintain a desirable appearance. Washing the interior cabin trim with a detergent soap and water, and brush scrubbing with a soft bristle brush will dislodge most dirt. Rinse with clean water and wipe dry. Alcohol may be used to remove foreign material that is alcohol soluble.

CAUTION

The interior cabin trim can be easily contaminated if cleaned with methyl ethyl ketone, naphtha, Mufti standard solvent, gasoline, lacquer thinner and other types of thinners. Sharp edges or cuts on the edge of the interior cabin trim material may cause it to crack.

RUBBER SEALS

Deterioration and/or sticking of rubber seals around doors, windows and cowlings may be prevented by coating them with Oakite 6 compound, (product of Oakite Products, Inc., 19 Rector St., New York 6, New York). No special care is required when applying the compound to keep it from coming in contact with any painted surfaces. The compound is noninjurious to paint and may be removed by employing normal cleaning methods.

SHIMMY DAMPENER

To check the fluid level in the shimmy dampener, insert a wire of approximately 1/16-inch diameter through the hole in the disc at the end of the piston rod until it

touches the bottom of the hole in the floating piston. Mark the wire, remove and measure the depth of insertion. Inserting the wire in the hole of the floating piston, rather than letting it rest against the face of the piston, will give a more accurate check.

NOTE

To determine if the wire is inserted in the hole of the floating piston, insert the wire several times, noting each insertion depth. When the wire is correctly inserted the length will be approximately 1/4 inch greater than when the wire is resting against the face of the floating piston.

When the shimmy dampener is full, the insertion depth is 2 - 3/16 inches. The empty reading is 3 - 1/16 inches. To add hydraulic fluid, (Item 13, Consumable Materials Chart), remove the shimmy dampener and proceed as follows:

- a. Remove the cotter key, washer and spring from the piston rod.
- b. Remove the internal snap ring, scraper ring and the end seal from the aft end of the barrel. (Opposite clevis end).
- c. Insert a 6/32 threaded rod into the floating piston and remove the piston, using extreme care when moving the "O" ring seal of the floating piston past the drilled holes in the piston rod.
- d. Push the piston rod to the clevis end and fill the barrel with hydraulic fluid.
- e. Slowly actuate the piston rod, allowing the fluid to flow into the clevis end chamber, then return the piston to the clevis end of the barrel.
- f. Refill the displaced fluid and replace the end seal, scraper ring and internal snap ring.
- g. Fill the piston rod with fluid.
- h. Reinstall the floating piston, spring washer and cotter pin. Spread the cotter pin to allow clearance for the measuring wire.

INSTRUMENT WEDGE LIGHTING
(E-185 and after)

Internal lighting of the instruments provides additional illumination across each instrument. A light tray mounted on the top side of the bezel of each instrument holds two bulbs wired in parallel. If the light bulbs are damaged or burn out, the light tray with bulbs must be replaced.

LIGHT TRAY REMOVAL

- a. Remove the screws that secure the instrument panel in place and tilt the instrument panel aft to gain access to the instruments.

NOTE

Instruments located at the lower edge of the panel may be removed if necessary to gain access to the light tray at the top of the instruments.

- b. Remove the two screws that attach the light tray to the instrument bezel.

LIGHT TRAY INSTALLATION

- a. Install the new light tray and secure in place with the two attaching screws.
- b. Install the instrument, if removed, in the instrument panel and secure in place with the attaching screws.
- c. Secure the instrument panel in place.

ROTON LOCKS
(Figure 2-1A)

Usually, Roton locks will need no service. If there is a grinding and binding in the lock as the seat reclines or the return action becomes jerky, a small amount of grease properly applied as follows should improve the operation.

- a. Use only (Item 28, Consumable Material Chart) on

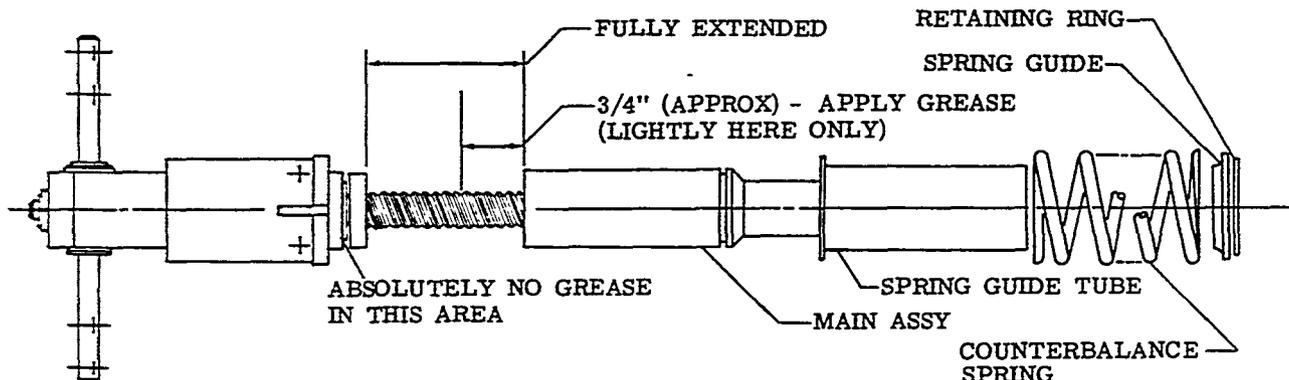


Figure 2-1A. Roton Lock

60-314-1

the thread as shown in Figure 2-1A. Too much grease or grease in the wrong place can cause improper operation.

b. Compress the spring guide and counter-balance spring approximately one inch.

c. Remove the retaining ring.

d. Relax pressure on the spring guide and counter-balance spring slowly until the spring is fully extended.

e. Remove the lock from the fixture and remove the spring guide, counter-balance spring, and spring guide tube.

f. Apply a small quantity of grease to the completely extended thrust screw (see Figure 2-1A).

g. Reassemble the lock. For service other than lubrications return the Roton lock to the manufacturer.

PROPELLER BLADE MAINTENANCE

Due to the high stresses to which propeller blades are subjected, their careful maintenance is vitally important, particularly on the leading edge of each blade from the tip inboard to just beyond the 33-inch station. All nicks and scratches must be repaired before the airplane is flown. Nicks and scratches set up concentrations of stress which can exceed the strength of the blade material; the result will be a crack and premature failure of the blade. The method and limits for this type of repair as outlined in the applicable Propeller Handbook should be followed carefully.

STATIC GROUND CABLE AND ADJUSTMENT (E-1 through E-236)

The static ground cable attached to the nose gear is designed to discharge static electricity on touchdown and need not make contact with the runway as the charge will arc from the cable. The cable should not drag on the runway while taxiing as this may create considerable radio interference and lead to rapid wear of the ground cable.

The following adjustment to the static ground cable is recommended:

a. Inflate tires to correct air pressure (see Servicing Tires this section).

b. Adjust the tip of the cable to provide $5.75 \pm .12$ inches of free cable between the attaching bolt and the bottom of the cable. The cable should then be between $1/4$ to $1/2$ inch from the ground.

WARNING

Do not wrap or tie the static ground cable to the mud scraper, landing gear fork, axle or any other part of the landing gear. Interference between structure and wheel well may develop.

TABLE OF THREAD LUBRICANTS

<i>SYSTEM</i>	<i>MATERIAL</i>	<i>SPECIFICATIONS</i>	<i>VENDOR PRODUCTS</i>
			Any product conforming to the referenced specification may be used.
Fuel	Anti-Seize, Graphite Petrolatum	MIL-T-5544	Armite Product, Armite Laboratories, Los Angeles, Calif. Anti-seize Compound I, Esso Standard Co.
Oil, Manifold Pressure Anti-icer, Vacuum	Lubricating Grease (Gasoline and Oil Resistant)	MIL-G-6032	L-237, Lehigh Chemical Co., Chestertown, Maryland Rockwell 950, Rockwell Mfg. Co., New York, N.Y. Royce 32, Royal Eng. Co., Whippany, N.J.
Brake, Deicer, Static and Pitot	Anti-Seize Compound White Lead Base	Federal Specification TT-A-580	Armite Product, Armite Laboratories, Los Angeles, Calif.
Oxygen	Thread Compound, Anti-Seize and Sealing, Oxygen Systems	MIL-T-5542	No. 15 Rector Well Equipment Co., Houston, Texas Dag 217 Acheson Colloies Co., Port Huron, Michigan Key Abso-Lute, Type B., Key Co., East St. Louis, Illinois
Oxygen, High Pressure Side Only	Ribbon Dope Thread Sealant	MIL-T-27730	Permacel Tape Corp., New Brunswick, N.J.

CONSUMABLE MATERIALS CHART

The vendor products appearing in this chart have been selected at random to help field personnel determine products conforming to the Military Specifications listed in this publication. The brand names are listed for ready reference and are not specifically recommended by Beech Aircraft Corporation. Any product which conforms to the referenced specification may be used.

<i>ITEM</i>	<i>MATERIAL</i>	<i>SPECIFICATIONS</i>	<i>VENDOR PRODUCTS</i>
1.	Fuel, Engine	Grade 100LL (blue) if not available use grade 100 (green) or 115/145 (purple)	
2.	Oil, Engine	Continental Motors Corp., Specification No. MHS-24B	See Approved Engine Oils Chart
3.	Corrosion Preventive Compound (Engine Oil)	MIL-C-6529 Type II	Anti-Corrode No. 205, Cities Service Oil Co., 60 Wall Tower, New York 5, N.Y. Rust Foil No. 652-2, Franklin Oil and Gas Co., Bedford, Ohio Kendex No. 7038, Kendall Refining Co., Bradford, Pa.
4.	Lubricating Oil	MIL-L-6081	Gulflite Turbojet Oil, No. 1010. Gulf Oil Corp., Pittsburg, Pa. Aeroshell No. 3 - 1286, Shell Oil Co., 50 West 50th Street, New York, N.Y. 10020 Jet Engine Oil No. 1010, Texaco, Inc., 135 East 42nd Street, New York, N.Y. 10017
5.	Lubricating Oil	SAE 20 or SAE 10W30	
6.	Lubricating Oil, Aircraft Reciprocating (Piston) Engine (First 20 to 30 hours of a new or remanufactured engine)	MIL-L-6082	Conoco Aero Oil No. 1065, Continental Oil Co., Ponca City, Oklahoma Phillips 66 Aviation Engine Oil, Grade 1065, Phillips Petroleum Co., Bartlesville, Oklahoma Skelflite No. 100, Skelly Oil Co., El Dorado, Kansas Avrey 10V1100, Socony Mobil Oil Co., Inc., 150 East 42nd Street, New York, N.Y. 10017 Or any approved aircraft engine oil [graded at 1100 (SAE 50) or 1065 (SAE 30)].

CONSUMABLE MATERIALS CHART (Cont'd)

<i>ITEM</i>	<i>MATERIAL</i>	<i>SPECIFICATIONS</i>	<i>VENDOR PRODUCTS</i>
7.	Lubricating Oil (Gear)	MIL-L-6086 Grade M Superseded by MIL-L-10324A Superseded by MIL-L-2105C Grade 75W or 101-380016	Trojan Gear Oil No. 6086 M. Cities Service Oil Co., 60 Wall Tower, New York 5, N.Y. Aeroshell Fluid 5M, Shell Oil Co., 50 W. 50th Street, New York, N.Y. L-1195, Sinclair Refining Co., 600 Fifth Avenue, New York, N.Y.
8.	Lubricating Grease (General Purpose)	MIL-G-7711 Superseded by MIL-G-81322	
9.	Lubricating Grease (Wide Temperature Range)	MIL-G-81322	Mobilgrease 28, Mobil Oil Corporation 150 E. 42nd Street New York, N.Y. 10017 Aeroshell Grease 22, Shell Oil Company One Shell Plaza P.O. Box 2463 Houston, TX 77001
10.	Lubricating Grease (Gear)	Mobil 636	
11.	Lubricating Grease (Aircraft and Instruments, Low and High Temperature)	MIL-G-23827	Supermil Grease No. A72832, American Oil Co., 910 South Michigan Avenue, Chicago, Ill. 60680 Royco 27A, Royal Lubricants Co., P.O. Box 95, River Road, Hanover, N.J. 07936 Aeroshell Grease 7, Shell Oil One Shell Plaza P.O. Box 2463 Houston, TX 77001
12.	Lubricant Molybdenum Disulfide Powder	MIL-M-7866B	Molykote Z. Wilco Co., Wichita, Kansas Molykote Z. Standard Oil of Kentucky Molykote Z. Hafkel Seals, Glendale, California Moly-Paul No. 4, K.S. Paul Products Ltd., Nobel Road, London, England

CONSUMABLE MATERIALS CHART (Cont'd)

<i>ITEM</i>	<i>MATERIAL</i>	<i>SPECIFICATIONS</i>	<i>VENDOR PRODUCTS</i>
13.	Hydraulic Fluid	MIL-H-5606	Brayco 756D, Bray Oil Co., 3344 Medford Street, Los Angeles 63, California TL-5874, Texaco Inc., 135 East 42nd Street, New York, N.Y. PED 3565, Standard Oil Co. of California, 225 Bush Street, San Francisco 20, Calif.
14.	Oxygen-System Leak Testing Compound	MIL-L-25567	
15.	Solvent	PD680	
16.	Lubricating Oil	SAE-10	
17.	Aviator's Breathing Oxygen	MIL-O-27210	
18.	Naphtha	TT-N-95	
19.	Methyl Ethyl Ketone	MIL-M-13999	
20.	Toluol	TT-T-548	
21.	Paint Remover		Turco No. 4260, Turco Pro- ducts Inc., Los Angeles, California
22.	Epoxy Primer	MIL-P-23377	Ameron Industrial Coatings Division, P.O. Box 2153 Wichita, Kansas 67201
23.	Wash Primer		EX2016G, Ameron Industrial Coatings Division, P.O. Box 2153 Wichita, Kansas 67201
24.	Zinc Chromate Primer	MIL-P-8585	
25.	Rubber Hose	MIL-H-5593	
26.	Oil, Engine Preservative	(Refer to Item 3)	
27.	Graphite, Lubricating	MIL-G-6711 (Refer to Item 12)	
28.	Lubricating Grease	ENCO ANDOK-B	Humble Oil Co., Houston, Texas
29.	Solvent		CRC-2-26, Corrosion Reaction Consultants, Inc., Philadelphia, Pa.

CONSUMABLE MATERIALS CHART (Cont'd)

<i>ITEM</i>	<i>MATERIAL</i>	<i>SPECIFICATIONS</i>	<i>VENDOR PRODUCT</i>
30.	Refrigerant	R-12	DuPont Inc., Freon Products Division, Wilmington, Delaware 19898
31.	Oil (Air Conditioner Compressor)	500 Viscosity	Suniso No. 5, Virginia Chemical and Smelting Co., West Norfolk, Virginia Texaco Capella E, Texaco Inc., 135 East 42nd Street, New York, N. Y. 10017
32.	Lubricant (Starter)		Lubricant No. 1960954, Delco-Remy Division of General Motors Corp., Anderson, IN
33.	Penetrating Oil	Mouse Milk WD-40	Worldwide Aircraft Filter Corporation, 1684 Abram Court, San Leandro, California 94577 Rocket Chemical Company, 5390 Napa Street, San Diego, California
34.	Lubricating Grease (Wheel Bearing)	Aero Shell No. 5	Aero Shell No. 5, Shell Oil Company, One Shell Plaza, P.O. Box 2463, Houston, Texas 77001
35.	Anti-seize Compound	MIL-A-907D	
36.	Coating	Alodine 1200, 1200S, 1201	Amchem Products Inc., Spring Garden St., Ambler, Pennsylvania 19002
37.	Corrosion preventive compound	MIL-C-16173 Grade 2	Braycote 137, Bray Oil Co., 1925 Marianna St., Los Angeles, California 90032 Petrotech 1-4, Penreco, P.O. Box 671, Butler, Pennsylvania 16001

NOTES

1. If 100LL (Blue) or 100 (Green) fuel is not available, 115 (Purple) fuel may be used as an alternate. Never use a lower grade fuel.
2. Precautions should be taken when using MIL-G-23827 and MIL-G-81322, since these greases contain chemicals harmful to painted surfaces.
3. Item 9, MIL-G-81322 grease and Item 34, Aero Shell No. 5 grease are not compatible, do not mix these greases.

LUBRICATION CHART

ITEM NO.	LOCATION	LUBRICATION	INTERVAL
DETAIL A			
1	Nose shock strut (1)	MIL-H-5606	AR
2	Shimmy Dampener (1)	MIL-H-5606	AR
3	Nose gear hinge points (2)	MIL-G-81322	100 hrs.
4	Nose gear linkage (2)	MIL-G-81322	100 hrs.
5	Nose gear torque knees (6)	MIL-G-81322	100 hrs.
6	"A" frame pivot points (2)	MIL-G-81322	100 hrs.
7	Nose wheel bearings (2)	†MIL-G-81322, Aeroshell 5 preferred	100 hrs.
8	Nose gear swivel (2)	MIL-G-81322	100 hrs.
9	Rod end fitting (1)	MIL-G-81322	100 hrs.
DETAIL B			
1	Steering mechanism linkage (3)	MIL-G-81322	100 hrs.
2	Steering mechanism (2)	MIL-G-81322	100 hrs.
DETAIL C			
1	Control column linkage (18)	SAE No. 20 or SAE 10W30	100 hrs.
2	Control column head (6)	SAE No. 20 or SAE 10W30	100 hrs.
3	Control column aileron link (3)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL D			
1	Door handle (1)	SAE No. 20 or SAE 10W30	100 hrs.
2	Door latch (3)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL E			
1	Landing gear motor gearbox (1)	MIL-G-81322	600 hrs.
2	Landing gear actuator gearbox (1)	Mobil 636 or Compound GG*	300 hrs.
3	Rod ends (5)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL F			
1	Door handle (1)	SAE No. 20 or SAE 10W30	100 hrs.
2	Door latch (3)	SAE No. 20 or SAE 10W30	100 hrs.
3	**Hinge (2)	MIL-M-7866B	100 hrs.
DETAIL G			
1	Flap motor gearbox (1) (Prior to E-953) (E-954 and after are non serviceable)	MIL-G-23827	600 hrs.
DETAIL H			
1	Elevator bell crank (2)	SAE No. 20 or SAE 10W30	100 hrs.
2	Elevator control push pull rods (2)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL I			
1	Trim tab control (2)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL J			
1	Flap actuator (2)	MIL-L-10324, MIL-2105C Grade 75W or 101-380016	900 hrs.
2	Flap flex drive (2)	MIL-G-23827	900 hrs.
DETAIL K			
1	Aileron bell crank pivot points (6)	SAE No. 20 or SAE 10W30	100 hrs.
2	★ Aileron push/pull rod ends (4)	SAE No. 20 or SAE 10W30 If removed MIL-G-23827	100 hrs.

LUBRICATION CHART (Cont'd)

ITEM NO.	LOCATION	LUBRICATION	INTERVAL
DETAIL L			
1	Main shock struts (2)	MIL-H-5606	AR
2	Hinge points and retract links (8)	MIL-G-81322	100 hrs.
3	Landing gear to torque knee (10)	MIL-G-81322	100 hrs.
4	Main wheel bearings (4)	†MIL-G-81322 or Aeroshell 5 preferred	100 hrs.
5	Landing gear uplock rollers (2)	MIL-G-23827 See Lubrication of Landing Gear Uplock Rollers in Section 5	
† Aeroshell 5 and MIL-G-81322 are not compatible with each other, do not mix them.			
DETAIL M			
1	Landing gear door hinges (10)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL N			
1	Rudder pedals (8)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL O			
1	Cowl flap hinges (6)	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL P			
1	**Elevator trim tab hinge (2)	MIL-M-7866B	100 hrs.
2	Elevator trim tab actuator (2)	MIL-G-23827	AR
3	Tab control horn pivot	SAE No. 20 or SAE 10W30	100 hrs.
DETAIL Q			
1	Nose wheel door hinges (4)	SAE No. 20 or SAE 10W30	100 hrs.

NOTES

1. MIL-G-81322 (maximum of 350°F) grease may be used in place of MIL-G-23827 (maximum of 200°F) grease in warm climates; however, in extremely cold climates MIL-G-23827 grease should be used.
 2. Landing gear components may require lubrication every 25 or 50 hours, depending on operation.
 3. Care should be exercised when using greases MIL-G-81322 and MIL-G-23827 since they contain synthetic lubricants which will discolor painted surfaces, and will soften rubber products.
- * Do not overfill. Maintain 1/2 pint volume. When properly filled, the oil level measured on a dip stick inserted through the filler hole will be approximately 1/4 inch.
- **Mix MIL-M-7866B with naphtha and apply with a brush.
- ★ Lubricate the aileron push/pull rod ends (in place) at 100 hr intervals using SAE 20 or 10W30 oil, or remove the aileron push/pull rod assembly and clean & lubricate rod ends using MIL-G-23827 grease. Rotate the rod end eye balls to assure adequate lubrication coverage. Check aileron rigging after reinstallation of the rod end assembly.
- () Indicates number of places to lubricate.

LUBRICATION DIAGRAM

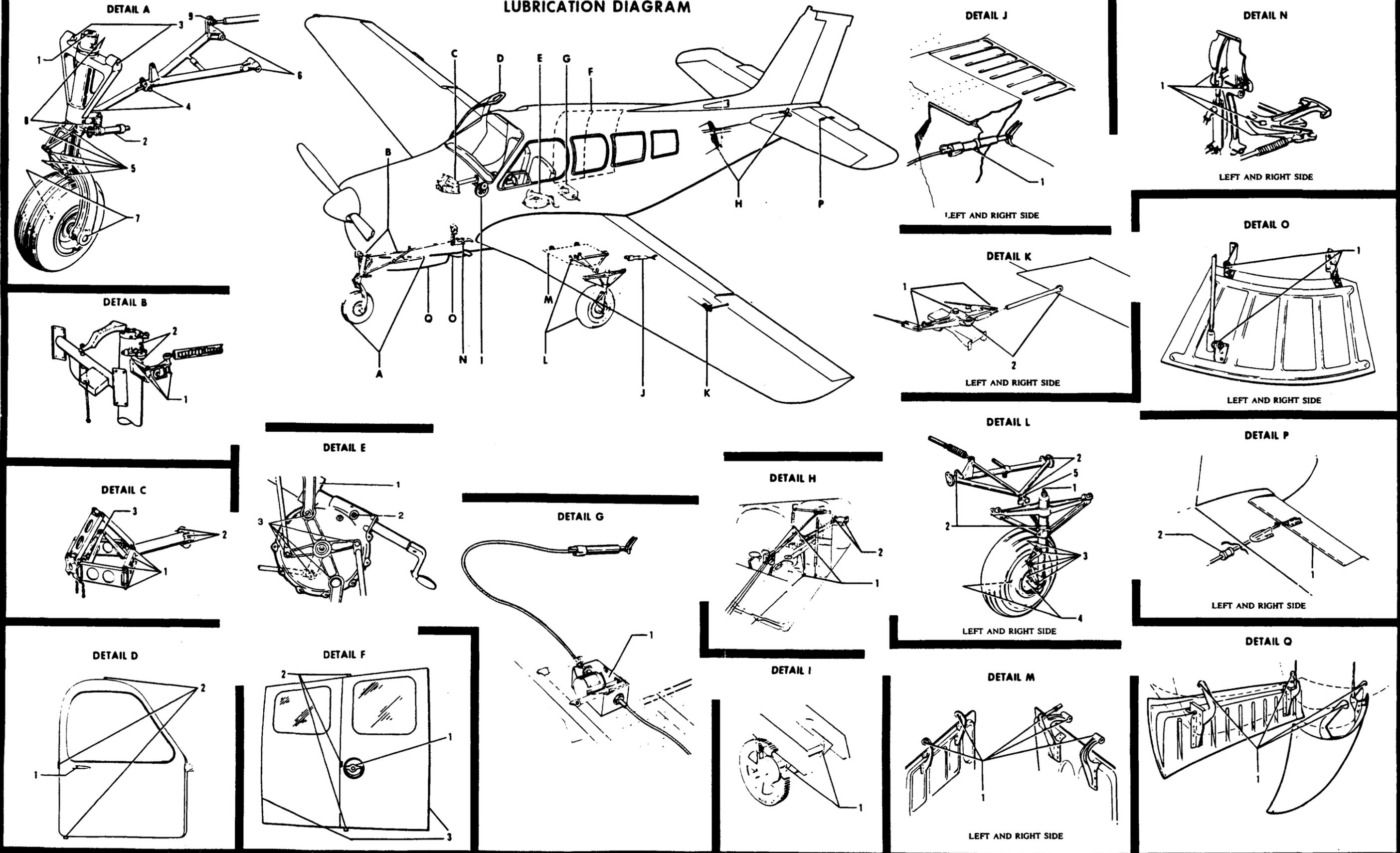


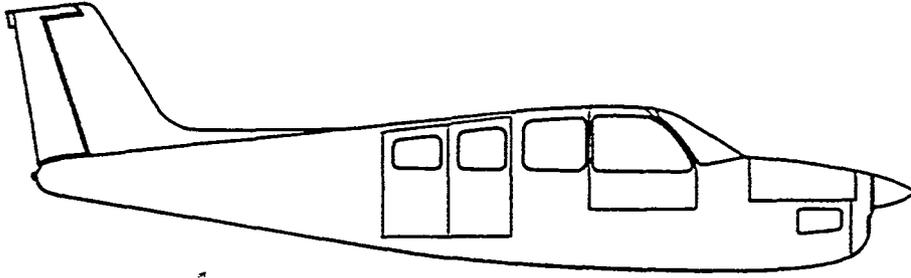
Figure 2-2. Lubrication Diagram

SERVICING CHART

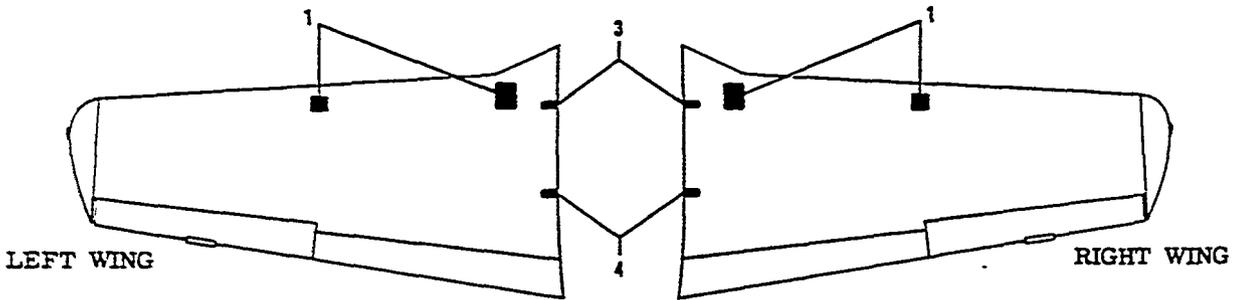
<i>ITEM</i>	<i>LOCATION</i>	<i>SERVICE WITH</i>	<i>INTERVAL</i>
CHECK			
Engine Oil Level	Access door on upper cowl (1)	See Approved Engine Oils Chart	Preflight
Battery Water	R H rear side of engine Compartment (1)	See Section 13 for detailed instructions	25 hrs.
CHANGE			
Engine Oil	Lower rear side of engine (1)	See Approved Engine Oils Chart	100 hrs.
Engine Oil Filter	Left rear side of engine (1)		100 hrs.
CLEAN			
Induction Air Filter	Fuselage nose section grill (1)	Clean as described in the manufacturer's instructions on the filter	50 hrs.
Fuel Injection Control Valve Screen	Fuel injection control valve on lower side of the engine (1)	Clean with solvent and blow dry with air pressure	50 hrs.
Fuel Selector Valve Strainer	Fuel selector valve inboard left wing root (1)	Clean with solvent and blow dry with air pressure	100 hrs.
Pressure Pump Intake Filter	Rear engine baffle (1)	Wash with soap and water	100 hrs.
DRAIN			
Fuel Sump Drain	Inboard left wing root (1)		Preflight
Fuel Cell Drains	Under both wings (2)		Preflight
Static Drain	Behind the aft upholstery panel (1)		50 hrs.
REPLACE			
Induction Air Filter	Fuselage nose section grill (1)		500 hrs.
Pressure System in Line Filter	Between pressure regulator and instruments (1)		300 hrs.
SERVICE			
Brake Fluid Reservoir	Upper forward side of the firewall (1)	MIL-H-5606, hydraulic fluid	AR
Oxygen Cylinder	Under front seats (1)	MIL-O-27210 aviator's breathing oxygen	AR
Main and Nose Landing Gear Struts	Top of each strut (3)	MIL-H-5606, hydraulic fluid and compressed air	100 hrs.
Shimmy Dampener	Nose landing gear (1)	MIL-H-5606, hydraulic fluid	100 hrs.

SEALING CHART

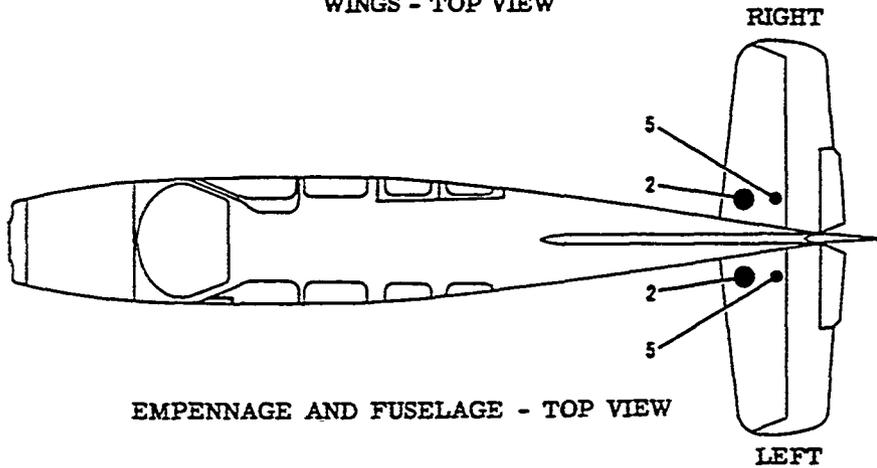
<i>ITEM</i>	<i>PRODUCT</i>	<i>VENDOR</i>
1.	A-56-B Cement	B. F. Goodrich Co., Akron, Ohio
2.	Presstite Sealer No. 576	Presstite Engineering Co., St. Louis, Mo.
3.	Silastic Sealer No. 140	Dow Corning, Midland, Michigan



FUSELAGE - RIGHT SIDE



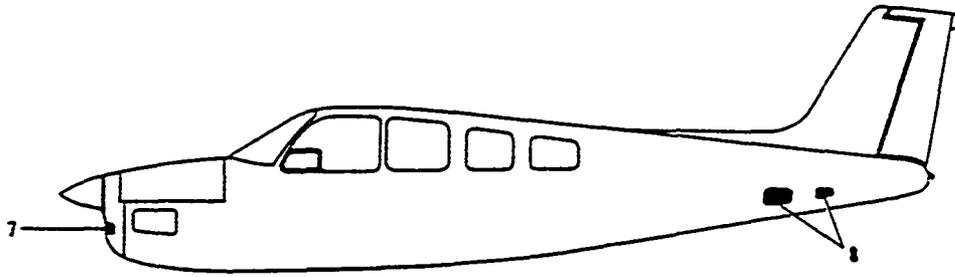
WINGS - TOP VIEW



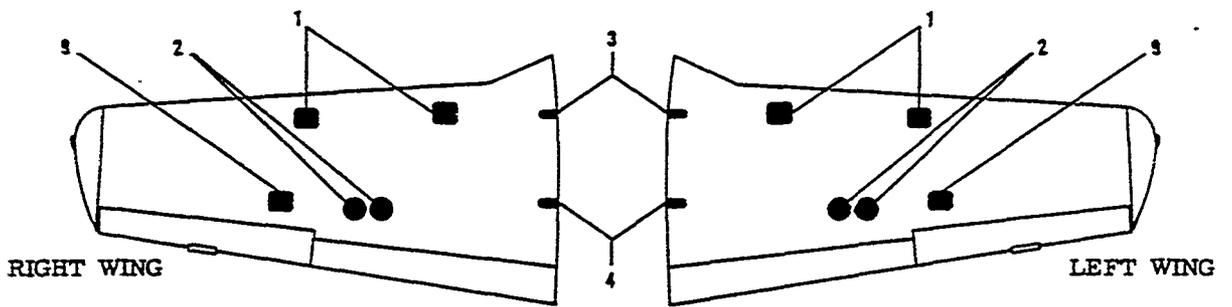
EMPENNAGE AND FUSELAGE - TOP VIEW

1. Upper Fuel Cell Access
2. Elevator Trim Tab Cable Access
3. Upper Forward Wing Attach Bolt
4. Upper Aft Wing Attach Bolt
5. Elevator Trim Tab Actuator Access

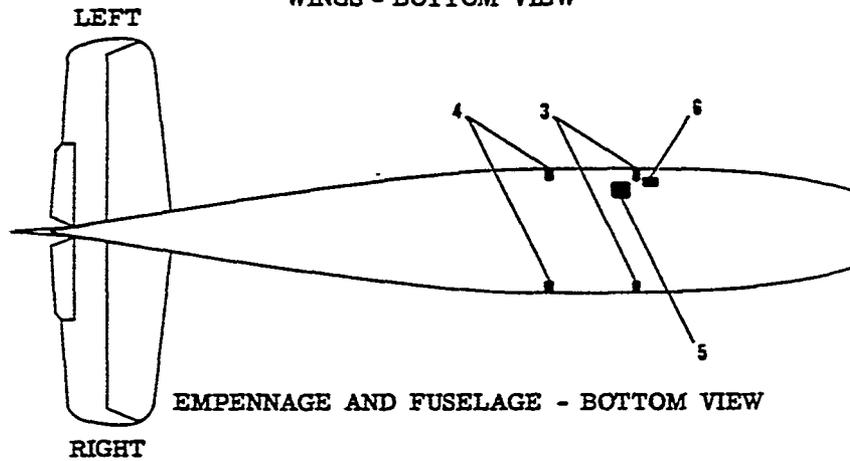
Figure 3-2. Access Openings (Sheet 1 of 2)



FUSELAGE - LEFT SIDE



WINGS - BOTTOM VIEW



EMPENNAGE AND FUSELAGE - BOTTOM VIEW

- | | |
|-----------------------------------|---------------------------------------|
| 1. Lower Fuel Cell Access | 6. Fuel Strainer Drain Access |
| 2. Flap Actuator Access | 7. Engine Air Induction Filter Access |
| 3. Lower Forward Wing Attach Bolt | 8. Aft Fuselage Access |
| 4. Lower Aft Wing Attach Bolt | 9. Aileron Bellcrank Access |
| 5. Nose Landing Gear Retract Rod | |

Figure 3-2. Access Openings (Sheet 2 of 2)

WINGS

WING TIP REMOVAL

- a. Remove the screws attaching the tip to the wing.
- b. Disconnect the electrical leads to the navigation light.
- c. Installation may be accomplished by reversing the above procedure.

WING REMOVAL

- a. Remove the front seats.
- b. Remove the rear seat panel.
- c. Drain and purge the fuel cells.
- d. Remove the wing mounting bolt access plates from the top and bottom of the wing.
- e. Place the aircraft on jacks and raise the aircraft until the wheels are clear of the ground. A three point jack should be used because of the unbalanced condition of the airplane after the wing is removed.
- f. Open the brake cylinder bleed ports and pump all fluid from the system. Disconnect hydraulic lines at the wing root.
- g. Operate the landing gear switch until the inboard landing gear doors are fully open.
- h. Disconnect the inboard door actuator rod from the control horn.
- i. Disconnect the landing gear uplock cable at the inboard connection in the wheel well.
- j. Disconnect the landing gear actuator rod from the V-brace in the wheel well.
- k. Disconnect the fuel lines between the wing root rib and the fuselage.
- l. Disconnect the pitot line at the left wing root in the wheel well.
- m. Disconnect electrical wiring in the wheel well.
- n. Disconnect the aileron cables at the turnbuckles located inside the cabin, forward of the rear spar below the floorboards.
- o. Disconnect the flap drive shaft from the motor.
- p. Cradle the wing.
- q. Place a wing stand under the wing not being removed and place a stand under the tail.
- r. Outline the position of the wing on the fuselage as a guide for reinstallation.

WARNING

The bushing installed in the upper forward spar (E-330 thru E-379 except E-356) and in the lower forward spar (E-330 and after) should not be removed and must be in place prior to installation of the wing attach bolts.

CAUTION

There should be no bolt binding during removal. Should binding occur, adjust the

position of the wing until the bolt disengages freely. Do not screw or drive a bolt in or out of the fittings.

- s. Remove the wing attach bolt nuts and washers.

NOTE

Discard the soft aluminum washers between the upper wing attach fittings. New washers must be installed upon reinstallation of the wing.

- t. Remove the wing by pulling it straight away from the fuselage.

REMOVAL OF LEADING EDGE AND MAIN SPAR

The wing must be removed from the airplane before the leading edge or main spar can be removed. Remove the attaching screws at the wing tip and wing butts. Pull the hinge pins which attach the leading edge, disconnect the landing gear and remove the main spar.

NOTE

Support the landing gear to avoid damaging the aft spar gear connection or remove the gear at both connections.

INSTALLATION OF LEADING EDGE AND MAIN SPAR

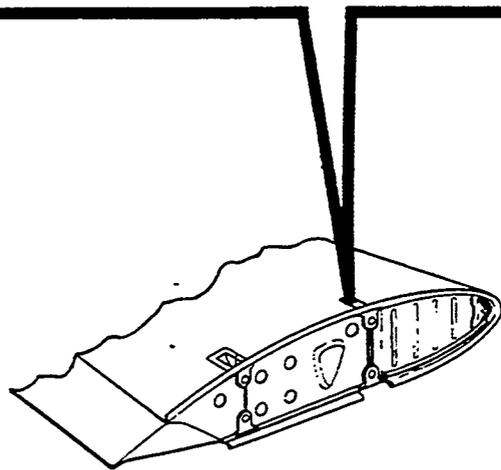
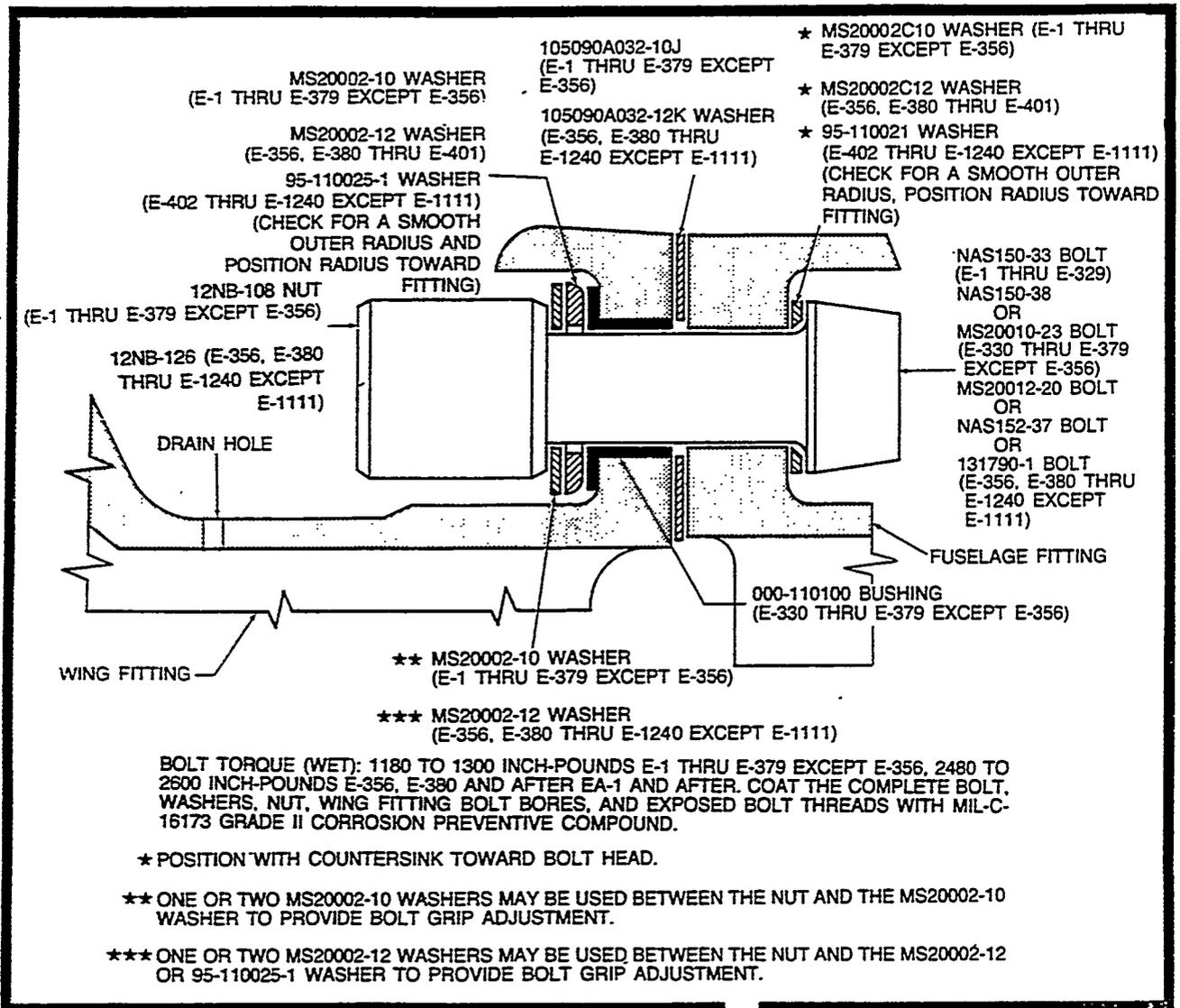
The hinge pins may be driven with a rivet gun by supporting the hinge pin in telescoping tube, repair kit 35-588. Make sure the hinge halves are mated before attempting to drive the hinge pin. Grind the end of the pin to a point before starting it in the hinge. A second rivet gun or mallet may be used to tap along the upper or lower edge of the main spar to help the pin through the hinge. Use a wooden block as a pad to prevent damage to the spar.

CAUTION

Do not attempt to spin the hinge pin in with a drill motor. Heat and expansion may cause the wire to seize or break.

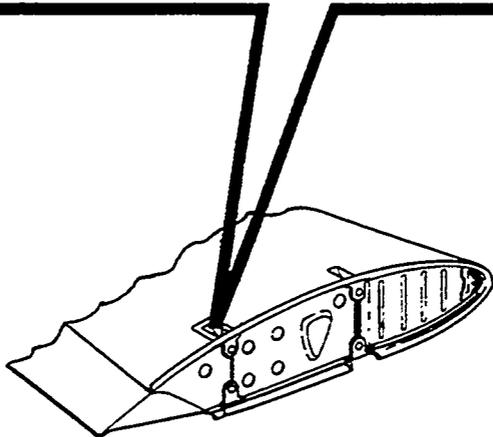
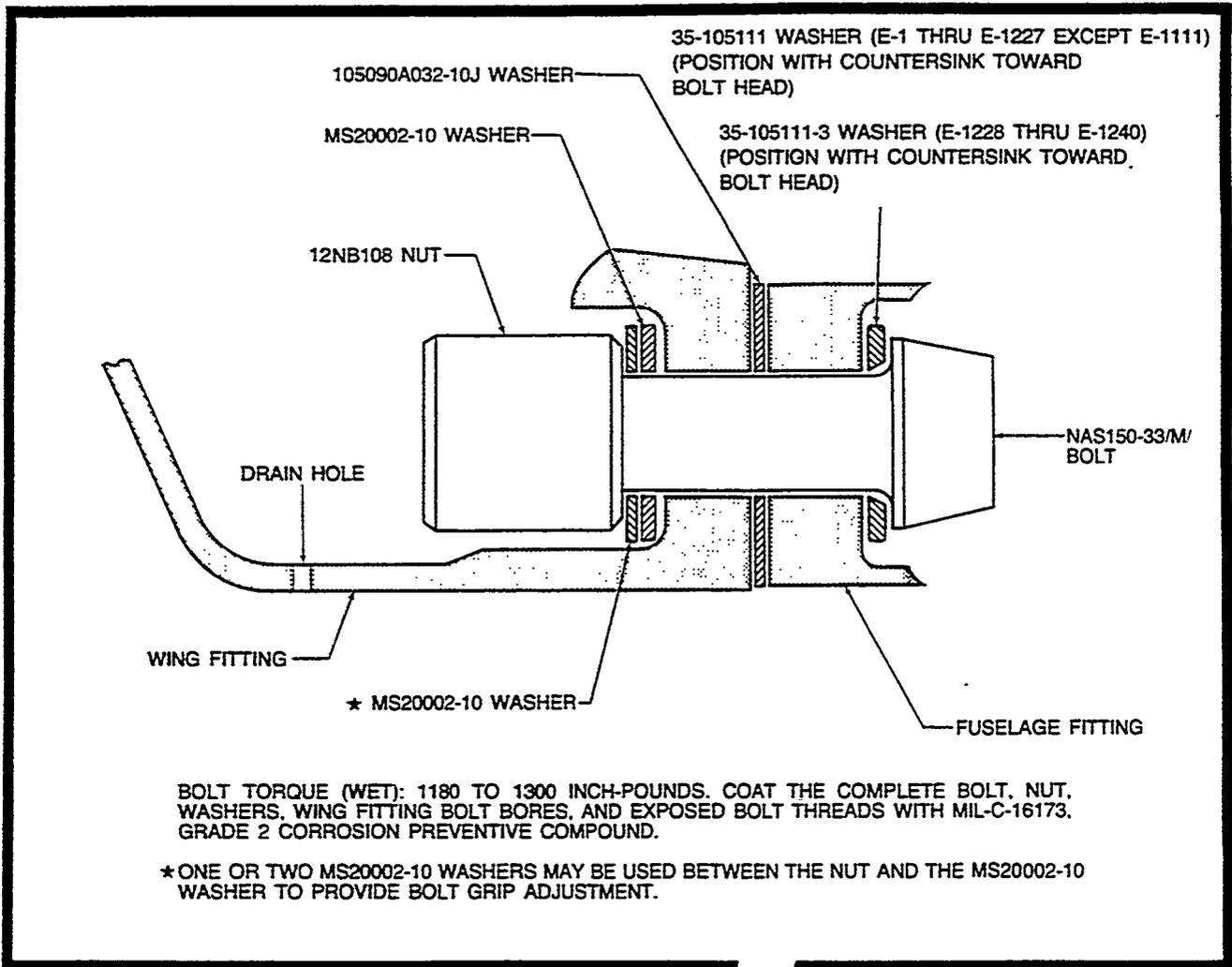
WING INSTALLATION

- a. Using a nonmetallic brush and naphtha or methyl ethyl ketone (Item 18 or 19, Consumable Materials Chart), clean all wing attach fittings and hardware (bolts, washers, and nuts). Inspect the wing attach fittings, bolts, washers, and nuts as instructed under WING BOLT, NUT, AND FITTING INSPECTION.



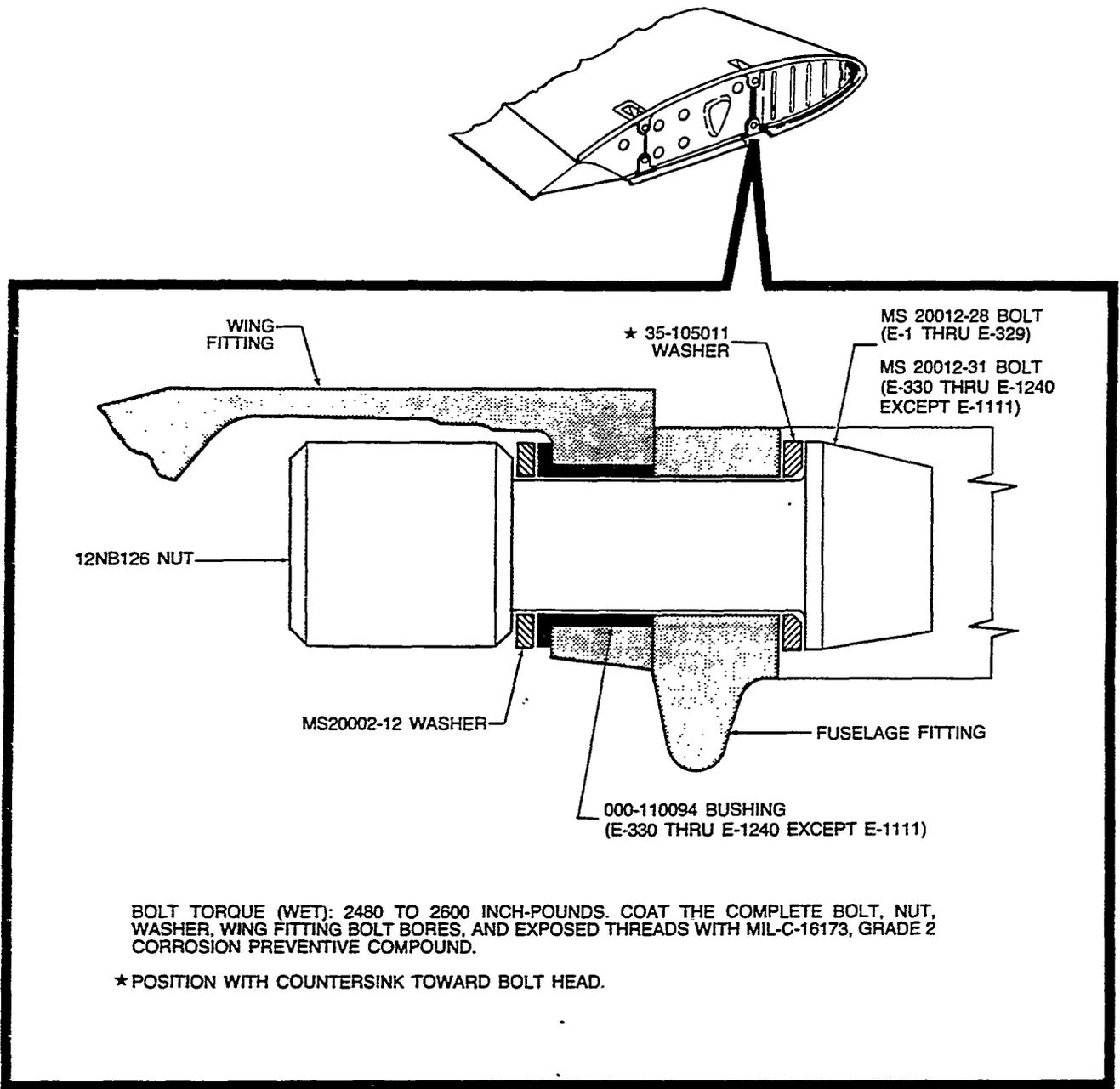
36-31-18

Figure 3-3. Upper Forward Wing Bolt Installation (E-1 Thru E-1240 Except E-1111)



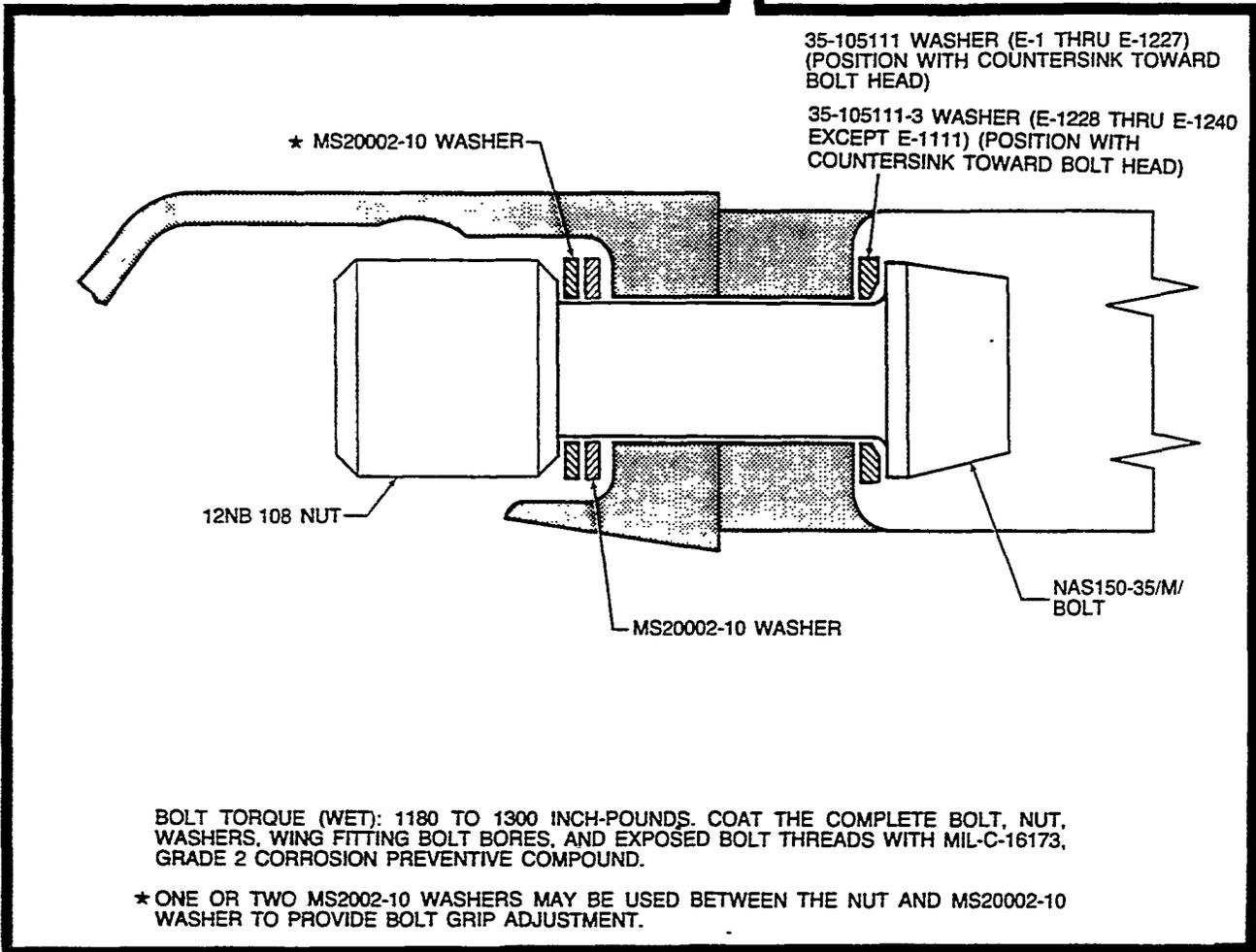
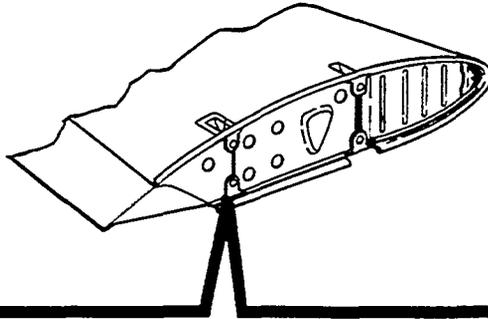
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Figure 3-3A. Upper Aft Wing Bolt Installation (E-1 Thru E-1240 Except E-1111)



36-31-17

Figure 3-3B. Lower Forward Wing Bolt Installation (E-1 Thru E-1240 Except E-1111)



36-31-20

Figure 3-3C. Lower Aft Wing Bolt Installation (E-1 Thru E-1240 Except E-1111)

WARNING

Wing bolts that have reached their life limit (10 years after the initial inspection), must not be reused.

b. Coat the fitting bolt bores and bearing faces, bolts, washers, and nuts with MIL-C-16173 Grade II corrosion preventive compound (Item 37, Consumable Materials Chart).

WARNING

The bushing installed in the upper forward wing fitting (E-330 thru E-379 except E-356) and in the lower forward wing fitting (E-330 and after) must be in place prior to installation of the wing bolts.

CAUTION

Each bolt must be inserted by hand without binding. If a bolt cannot be easily inserted, reposition the wing until the bolt moves freely through the fittings. Do not drive or screw the bolt into the fittings.

c. Move the wing into position, align the wing fittings with the carry through fittings, and insert the bolts into the fittings.

CAUTION

Bolts and washers and nuts must be oriented as shown in the applicable figure for each location (Figure 3-3, 3-3A, 3-3B, and 3-3C).

d. Start the nuts on the upper forward and aft bolts. Rotate the wing trailing edge until alignment with the outline drawn on the fuselage is realized. After alignment is established, verify that the lower forward bolt is not binding in the bolt bore. If bolt binding is encountered, adjust the wing position until the bolt moves freely.

e. Tighten the upper forward and aft nuts.

CAUTION

When torquing the wing bolts assure that the wing bolt wrenches do not bottom out on the wing attach fittings. Such an occurrence could cause false torque readings and damage the fittings. After torquing the upper forward wing attach nut, remove the holding force from the wing cradle and torque the remaining three nuts.

f. Torque the nuts in the following order: upper forward, upper aft, lower forward, and lower aft. When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Section 1.

CAUTION

Before the nut is torqued at the lower aft wing attach point, a slight gap may exist between the fittings. This gap must not exceed a width of .060 inch. No gap should remain after the nut is torqued to the specified wet torque.

- g. Connect the flap drive shaft to the flap motor.
- h. Connect the aileron cables at the turnbuckles.
- i. Connect the electrical wiring in the wheel well.
- j. Connect the pitot line in the LH wheel well.
- k. Connect the fuel lines.
- l. Connect the landing gear actuator rod.
- m. Connect the landing gear uplock cable.
- n. Connect the inboard door actuator rod.
- o. Connect the hydraulic brake lines and bleed the brakes.
- p. At the first scheduled inspection after wing installation, check for correct wing bolt torque. Check the drain holes in the upper wing attach fittings to assure that they are open.

ADJUSTING THE WING

After the wing has been reinstalled or repaired, flight tests may show the wing to be chronically heavy or light. This condition may be corrected by rotating the wing to lower the trailing edge of the heavy wing or to raise the trailing edge of the light wing or by a combination of adjusting both wings. The aluminum washers between the upper wing fittings must be replaced each time the position of the wing is changed. If both wings have been removed, install the right wing with the trailing edge at the highest point of the adjustment travel and the left wing 1/16-inch down from the highest point of travel. The total adjustment on each wing is approximately 1/8 inch. The following steps should be followed when adjusting the wing:

- a. Using a grease pencil, outline the position of the wing on the fuselage.
- b. Place the airplane on a three point jack and raise until the wheels are clear. See Section 2 for jacking instructions. Place a suitable cradle under the wing being adjusted and a wing stand under the opposite wing. A tail stand will also be required to assure stability.

c. Loosen the nuts on the lower wing attach bolts and remove the bolts and nuts from the upper wing attach fittings. Coat the bearing faces and bolt bores of the fittings, the bolt washers and nut with MIL-C-16173 Grade II corrosion preventive compound (Item 37, Consumable Materials Chart). Install new soft aluminum washers between the upper wing attach fittings. Install the bolts, washers, and nuts into the fittings. Raise or lower the

trailing edge as required and retorquing the nuts in the following order: upper forward, upper aft, lower forward and lower aft. There should be no gap between the fittings after the last nut is torqued. Torque each nut to the wet torque value shown in the appropriate illustration (Figure 3-3, 3-3A, 3-3B or 3-3C). Coat the exposed threads that protrude through the nuts with MIL-C-16173 Grade II corrosion preventive compound (Item 37, Consumable Materials Chart).

NOTE

After torquing the upper forward wing nut, remove the holding force from the wing cradle (installed in step "b") and torque the three remaining nuts.

d. Remove the wing and tail stands, remove the airplane from the jack, and test fly the airplane.

e. At the first scheduled inspection after the wing has been adjusted, check each bolt for correct torque. Check the drain holes in the upper wing attach fittings to assure that they are not obstructed.

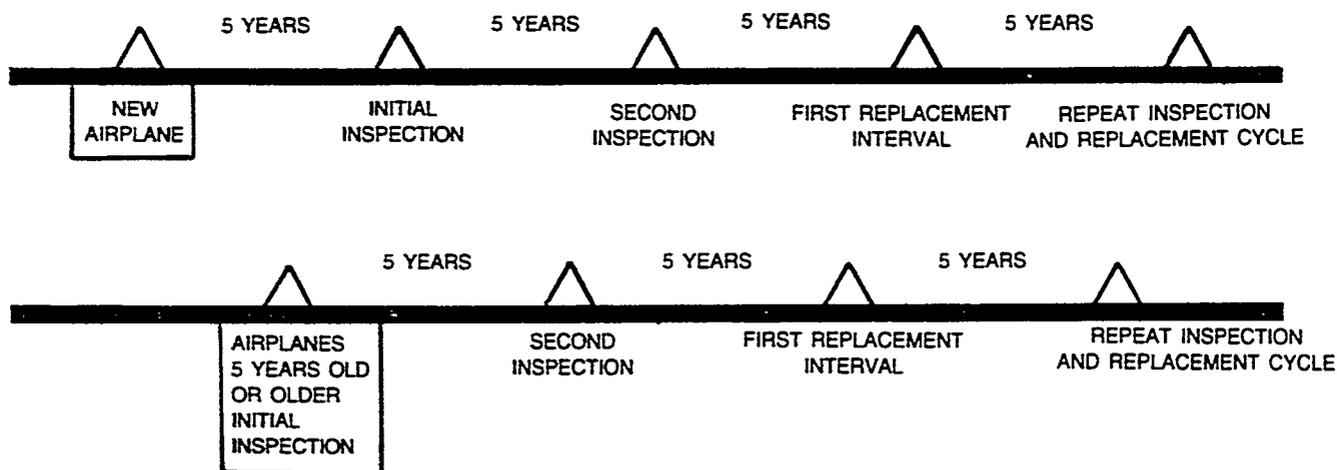
WING BOLT, NUT, AND FITTING INSPECTION

NOTE

Read the entire section before removing any wing bolts.

WARNING

The wing bolts and nuts installed in all Model 36 Series airplanes five years old or older must be removed and inspected. If after inspection the bolts and nuts prove to be free of corrosion, cracks, and mechanical damage, they may be reinstalled for an additional five year period at which time another inspection is required. Ten years after the initial inspection, all wing attach hardware (bolts, washers and nuts) must be replaced with new hardware. Render unserviceable all components removed in compliance with Chart 1.



35-31-36

NOTE

The first inspection for airplanes five years old or older must be performed at the first scheduled inspection following the issue date of revision B13.

NOTE

At each replacement interval, all wing attach bolts, washers, and nuts must be replaced with new hardware.

**Wing Bolt And Nut Inspection And Replacement Cycle
Chart 1**

a. Before removing any wing bolt, draw an outline of the wing position on the fuselage with a grease pencil. If wing bolt binding is encountered and the wing must be shifted, the outline will be helpful in returning the wing to its original position.

CAUTION

There should be no wing bolt binding during removal or installation. Do not screw or drive a bolt in or out of the fittings. If wing bolt binding is encountered, place the airplane on a three point jack and raise until the wheels are clear (see Section 2 for jacking instructions). Place a wing stand under each wing and a tail stand under the aft fuselage. Defuel the wing, loosen the remaining three bolts and reposition the wing until the binding bolt moves freely through the fittings. Replace the soft aluminum washers between the upper wing attach fittings and retorque the bolts as instructed under **INSTALLING THE WING**. If bolt binding is not encountered and the wing has not shifted, replacement of the soft aluminum washers between the upper wing attach fittings is not required.

NOTE

Beech Aircraft Corporation supplies wing attach hardware that has been given an additional magnetic particle inspection since manufacture. These components may be identified by the green dye on the head of the bolt and on some portion of the nut.

WARNING

Use only the components specified in the applicable illustrations. **DO NOT INSTALL THE BLACK P/N H-20 NUTS**; these nuts have been dry film lubricated with molybdenum disulfide. When MIL-C-16173 Grade II corrosion preventive compound is added to these nuts, the additional lubrication may cause improper preload in the bolt when it is torqued.

b. Starting at the lower wing attach point on each side, remove, inspect, and retorque one bolt at a time until the complete set of eight bolts and nuts have been inspected.

c. Using a nonmetallic brush, thoroughly clean the bolt, washers, and nut with naphtha or methyl ethyl ketone (Item 18 or 19, Consumable Materials Chart).

CAUTION

Assure that the 95-110025-1 washer shown in Figure 3-3 has a full complete radius with no sharp edges that could mark the fitting. Replace the washer if it has sharp edges or an incomplete radius.

d. If the bolts and nuts do not exceed the life limit shown in Chart 1, visually inspect each bolt and nut with a 10-power or stronger magnifying glass; inspect for corrosion, cracks and mechanical damage. The cadmium plating may display areas that appear rubbed, discolored or polished. These areas are usually the result of prevailing installation procedures and are of no significance. A bolt should not be rejected because of cadmium plating deterioration; however, any component that is cracked, corroded or has mechanical damage must be replaced.

e. Using the magnetic particle inspection process described in this chapter, check each nut for longitudinal crack indications and each bolt for circumferential crack indications. If the bolt and nut prove to be free of all damage (corrosion, cracks, and mechanical damage), they may be reused after demagnetization and cleaning.

f. Clean the spar fitting bolt bores with naphtha or methyl ethyl ketone (Item 18 or 19, Consumable Materials Chart). Do not strip the epoxy paint from this area. Inspect the surface condition of each fitting; focus special attention on the washer seat and bolt bore area. If scoring, corrosion pitting, or washer impressions are discovered in this area, contact the Commercial Service Department of Beech Aircraft Corporation. If the fitting is satisfactory, coat the bolt bores and bearing faces of the fittings with Alodine 1200, 1200S or 1201 (Item 36, Consumable Materials Chart). Allow the coating to remain on the surface for approximately five minutes. When the time has elapsed, wash the coated areas with water and blow dry (do not wipe dry). Paint the treated areas with zinc chromate primer (Item 24, Consumable Materials Chart) and allow to dry.

g. Coat the bearing faces and bolt bores of the fittings, the complete bolt, washers and nut with MIL-C-16173 Grade II corrosion preventive compound (Item 37, Consumable Materials Chart).

h. Install the bolt, washer or washers, and nut into the fittings.

CAUTION

Ensure that the wing bolt wrenches do not bottom out on the fittings when torquing the nut. This could result in damage to the wing fittings and erroneous torque readings.

i. Torque the nut to the wet torque value shown in the appropriate illustration (Figure 3-3, 3-3A, 3-3B, or 3-3C). When a torque wrench adapter is used, the length of

**CHART 2
WING BOLT WRENCHES AND TORQUE ADAPTERS**

<i>POSITION</i>	<i>BOLT P/N</i>	<i>WRENCH P/N</i>	<i>NUT P/N</i>	<i>NUT TORQUE ADAPTER</i>
LOWER FORWARD	MS20012-28 (E-1 thru E-329) MS20012-31 (E-330 thru E-1240 except E-1111)	TS1222-5 or TS1222-4 or TS-1222-8 or TS1253-1 or 50-590012.	12NB-126	TS1171-2 or TS1176-2.
UPPER FORWARD	NAS150-33 (E-1 thru E-329) NAS150-38 (E-330 thru E-379 except E-356) or MS20010-23 (E-330 thru E-379 except E-356) NAS152-37 (E-356, E-380 thru E-1240 except E-1111) or MS20012-20 (E-356, E-380 thru E-1240 except E-1111) or 131790-1 (E-356, E-380 thru E-1240 except E-1111)	TS1253-1 or TS1222-8 or TS1222-4 or TS1222-5 or 50-590012. TS1222-6 or TS1222-9. TS1222-3. TS1222-5 or TS1222-4 or TS1222-8 or TS1253-1 or 50-590012.	12NB-108 12NB-126	TS1176-1 or TS1171-1 or 50-590013. TS1171-2 or TS1176-2.
UPPER AFT	NAS150-33	TS1253-1 or TS1222-8 or TS1222-4 or TS1222-5 or 50-590012.	12NB-108	TS1171-1 or TS1176-1 or 50-590013
LOWER AFT	NAS150-35	TS1253-1 or TS1222-8 or TS1222-4 or TS1222-5 or 50-590012.	12NB-108	TS1171-1 or TS1176-1 or 50-590013

the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Section I.

j. Coat the exposed threads that protrude through the nut with MIL-C-16173 Grade II corrosion preventive compound (Item 37, Consumable Materials Chart).

k. Check that the decal shown in Figure 3-3D is affixed to the appropriate locations on the airplane.

l. Check the drain ports in the upper wing attach fittings to ensure that they are unobstructed and free to drain.

m. At the first scheduled inspection after the wing bolts have been loosened and retorqued, or after initial installation, they must be checked for proper torque.

MAGNETIC-PARTICLE INSPECTION

Magnetic-Particle Inspection is a method for locating surface and subsurface discontinuities in ferromagnetic materials (i.e. materials capable of being magnetized); consequently, nonferromagnetic materials (such as

aluminum alloys, magnesium alloys, copper alloys, lead, titanium alloys, nickel base alloys and many stainless steel alloys) cannot be inspected by this method. Magnetic-Particle Inspection is based upon the principle that any discontinuities lying in a direction generally transverse to the direction of the magnetic field of the part magnetized for the test will cause a leakage field to be formed at and above the surface of the part. The presence of the leakage field denoting the discontinuity is detected by the use of finely divided ferromagnetic particles over the surface of the part. Some of the particles are magnetically gathered and held by the leakage field to form an outline indicating the location, size, shape and extent of the discontinuity. In general, magnetic particle inspection utilizes a variety of types of equipment for magnetization as well as several methods for application of ferromagnetic particles to the test part. Additionally, the ferromagnetic particles are available in a selection of colors (including fluorescent) and particle shapes. Magnetic particle inspections required by this manual can best be accomplished utilizing the "wet continuous method" on the standard wet horizontal type equipment with either visible or fluorescent magnetic

particles suspended in a petroleum base vehicle (normally kerosene). Since magnetic particle indications are best obtained when the discontinuity lies in a direction transverse to the magnetic field, the following procedures are recommended for optimum detection of discontinuities in both bolts and nuts.

WARNING

Improper operation of the particle inspection, because of faulty equipment or untrained operators, can jeopardize the airworthiness of parts being tested. Minute electrical arc burns caused during inspection by improper operation of the test equipment can result in eventual failure of the part.

Bolts: Inspection of a bolt is accomplished by longitudinal magnetization in a multiturn low-fill factor coil (i.e. the inner diameter of the coil greatly exceeds the bolt diameter). For proper magnetization the bolt is positioned close to the coil inside wall with the bolt length perpendicular to the winding direction. The magnetic particle suspension is flowed on the bolt and the appropriate current is applied to achieve adequate field strength. Using the described procedure, laboratory testing has indicated that the ampere turn values listed in Chart 3 provide for optimum detection of discontinuities perpendicular to the bolt axis.

**CHART 3
MAGNETIC-PARTICLE INSPECTION
(STEEL BOLTS)**

BOLT DIAMETER	TOTAL BOLT LENGTH INCLUDING HEAD TO NEAREST 1/4 INCH	AMPERE TURNS*
5/8 INCH	2 1/2 INCH	7900
5/8 INCH	2 3/4 INCH	7100
5/8 INCH	3 INCH	6600
3/4 INCH	3 INCH	7900
3/4 INCH	3 1/4 INCH	7400
3/4 INCH	3 1/2 INCH	6700
3/4 INCH	3 3/4 INCH	6300
7/8 INCH	3 1/2 INCH	7900
7/8 INCH	3 3/4 INCH	7400
7/8 INCH	4 INCH	6900
7/8 INCH	5 INCH	5500
1 INCH	5 3/4 INCH	6300

*Ampere requirement is the ampere turns value divided by the number of turns on the coil. For example: A 1-inch diameter x 5-inch long bolt tested on a 5-turn coil would require $6300 \div 5$, or 1260 amps.

Nuts: Inspection of a nut is accomplished by circular magnetization on a central conductor (usually a copper rod) the approximate size of the nut inside diameter. For proper magnetization, the central conductor bar is inserted through

the nut and the bar is positioned between the heads of the wet horizontal equipment. The magnetic particle suspension is flowed on the nut and the appropriate current is applied through the central conductor to achieve adequate field strength. Using the described procedure, laboratory testing has indicated that the amperage values listed in Chart 4 provide for optimum detection of discontinuities parallel to the nut axis.

After magnetic particle inspection, the parts must be carefully demagnetized and cleaned of the ferromagnetic particles. Examine parts for any possible evidence of electric arc burn that may have occurred during the inspection.

**CHART 4
MAGNETIC-PARTICLE INSPECTION
(STEEL NUTS)**

NUT SIZE	CENTRAL CONDUCTOR SIZE	AMPERAGE
5/8 INCH	1/2 INCH	500 AMPS
3/4 INCH	5/8 INCH	600 AMPS
7/8 INCH	3/4 INCH	700 AMPS
1 INCH	7/8 INCH	800 AMPS

OUTBOARD WING - MAIN SPAR CAP INSPECTION

The outboard wing main spar cap must be inspected annually for corrosion.

WARNING

All areas of the spar cap from the wing attach fitting to the outboard end of the spar cap must be inspected.

BEECHCRAFT Kit No. 35-4008-1S provides the parts and information necessary to install a new 000-110011-1 LH spar and a new 000-110011-2 RH spar on the 36 and A36 series Bonanzas. The kit does not contain the spars which must be ordered separately.

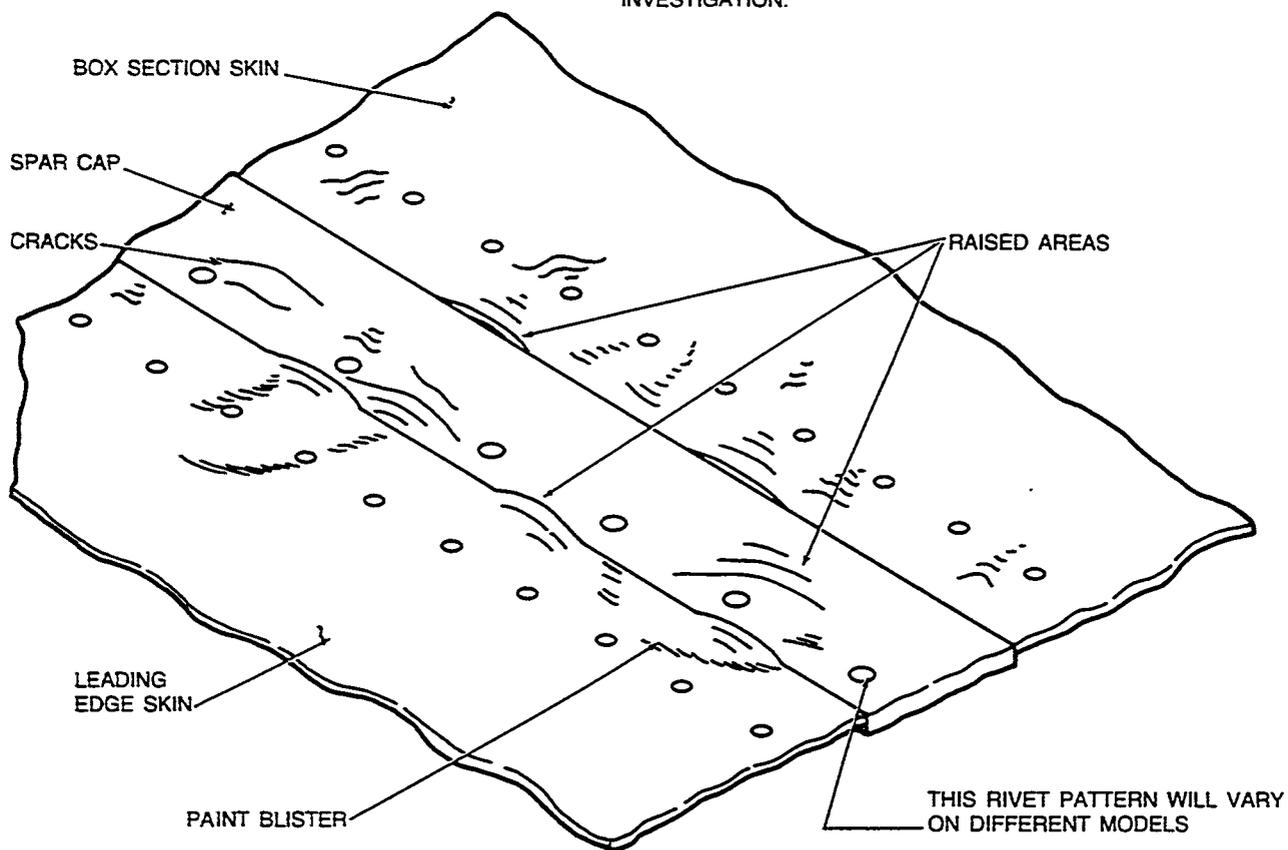
NOTE

Special emphasis should be placed on airplanes that have been operated or stored for extended periods (5 years or longer) where geographical locations or atmospheric conditions are highly conducive to corrosion.

Inspection of the upper and lower spar cap should be accomplished in the following manner:

- a. Examine the forward and aft sides of the spar cap where it meets the skin. If a whitish, salt-like, nonmetallic substance is noted in this area, a thorough inspection

THIS ILLUSTRATION REPRESENTS A TYPICAL SECTION OF THE SPAR CAP AREAS TO BE INSPECTED FOR INDICATORS OF POSSIBLE CORROSION. THE INDICATORS ARE ALL SHOWN IN ONE AREA AND ARE EXAGGERATED FOR CLARITY. ANY ONE OR ANY COMBINATION OF THE INDICATORS ARE CAUSE FOR FURTHER INVESTIGATION.



C99-35-23

Figure 3-3D. Visual Spar Cap Inspection

should be performed to determine if corrosion has occurred. Wax or paint trapped between the edge of the skin and the exposed section of the spar cap should not be misinterpreted as corrosion.

b. Wash all exposed areas of the upper and lower spar cap.

c. Visually inspect all exposed areas of the upper and lower spar caps for irregularities, such as paint blisters, raised or uneven areas and cracks. The exposed areas of the spar cap are extruded flat and irregularities could be an indication of corrosion. Investigate all irregularities to determine if any damage has occurred.

NOTE

Uneven or raised areas on the spar cap may be detected by sliding the fingers over the surface, by moving a straight edge over the surface or by sighting down the length of the spar cap surface.

If unusual conditions are encountered that cannot be resolved locally, contact the Commercial Service Department of Beech Aircraft Corporation for evaluation and determination of corrective action that may be required.

STABILIZERS

REMOVAL AND INSTALLATION OF THE HORIZONTAL STABILIZER

a. Remove the elevators. (See Section 4 - Elevator Removal Procedures.)

b. Remove the attaching bolts and the elevator center hinge bracket on the rear spar and disconnect the trim tab cable.

c. Remove the attach bolts at the front spar.

d. Remove the stabilizer.

e. Installation may be accomplished by reversing the above procedure.

NOTE

When installing the horizontal stabilizer, the nuts for the rear spar attaching bolts must be placed on the forward side of the spar to avoid contact with the elevator center hinge assembly.

f. Torque the AN4 attaching bolts to 50-70 inch-pounds.

REMOVAL AND INSTALLATION OF THE VERTICAL STABILIZER

a. Remove the rudder. (See Section 4 - Rudder Removal Procedure.)

- b. Disconnect the rotating beacon wires.
- c. Remove the saddle and fairings and pull the stabilizer straight up from the fuselage.
- d. Remove the bolts in the front and rear spars at the fuselage fittings.
- e. Installation may be accomplished by reversing the above procedure.
- f. Torque the AN4 attach fitting bolts to 50-70 inch-pounds.

SEATS

FIFTH AND SIXTH SEAT REMOVAL AND INSTALLATION

- a. Fold the bottom of the seat up to a vertical position and fold the seat support into the retract position.
- b. Remove the seat attach bolts.
- c. Installation may be accomplished by reversing the above procedure.

FIFTH AND SIXTH SEAT STOWAGE

The fifth and sixth seat may be folded either in a horizontal or vertical position to provide additional cargo space. This may be accomplished as follows:

VERTICAL POSITION

- a. Fold the seat bottom up to a vertical position.
- b. Fold the seat support into the retract position.
- c. Position the seat against the rear bulkhead in a vertical position.

HORIZONTAL POSITION

- a. Fold the seat support into the retract position and position the seat bottom on the floorboard.
- b. Fold the seat back forward and position it on top of the seat bottom.

FRONT SEAT REMOVAL

- a. Remove the seat stop at the aft end of the center track.
- b. Release the fore and aft adjustment lock.
- c. Move the seat aft until it clears the mounting tracks.

FRONT SEAT INSTALLATION

- a. Place the seat in position and align the seat guides with the mounting track.
- b. Release the fore and aft adjustment lock and slide the seat onto the mounting track. Engage the fore and aft lock and make certain the seat is securely in place.
- c. Replace the seat stop on the aft end of the center track.

THIRD AND FOURTH SEAT REMOVAL

- a. Release the fore and aft adjustment lock and move the seat forward against the stop.
- b. Remove the seat stop from the aft end of the center track.
- c. Release the fore and aft adjustment lock and move the seat aft until it clears the mounting tracks.

NOTE

On airplane serials E-825 to E-890, if the rear facing seats are to be changed to forward facing seats, the two MS24694S51 screws that secure the third & fourth seat center tracks and the rear spar carry-thru structure are to be replaced with the NAS1203-5 screws. The MS24694S51 screws are to be discarded. The third and fourth seat center track screws only need to be replaced one time unless an inspection reveals a broken screw or stripped threads. An entry is to be made in the Maintenance Log, that the **THIRD AND FOURTH SEAT CENTER TRACK SCREWS HAVE BEEN REPLACED.**

THIRD AND FOURTH SEAT INSTALLATION

- a. Place the seat in position and align the seat guides with the mounting track.
- b. Release the fore and aft adjustment lock and slide the seat onto the mounting track. Engage the fore and aft lock and make certain the seat is securely in place.
- c. Replace the seat stop on the aft end of the center track.

SEAT BACK ADJUSTMENT

A lever, located on the inboard side of each seat operates the seat back adjustment, which is controlled by a mechanical, three position, stop. An optional seat installation is available, wherein the adjustment of the front and center seat backs, except for the pilots seat, is controlled by a roton lock for selected positioning.

CABIN DOOR

CABIN DOOR REMOVAL AND INSTALLATION (E-1 through E-830 except E-754)

- a. Remove the inboard door handle, the ash tray assembly and the arm rest.

NOTE

The attaching screws for the ash tray assembly are located behind the ash tray insert and the attaching screws for the arm rest are located

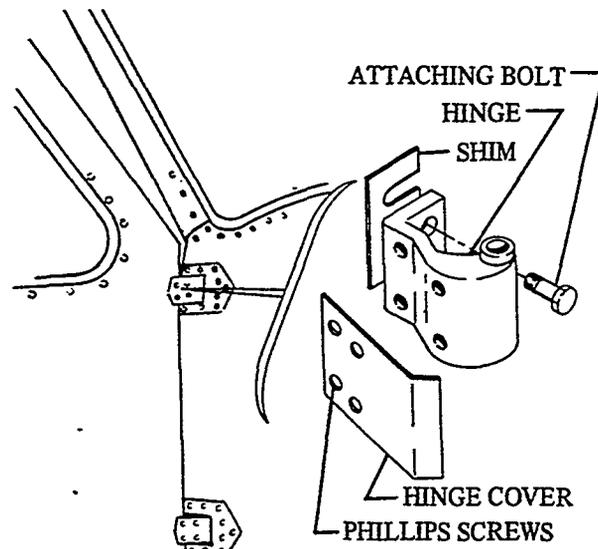
behind the two car plugs on the inboard side of the arm rest.

- b. Remove the attaching screws from the center upholstery panel. Lift the panel up and out.
- c. Remove the attaching screws and release the snaps on the lower upholstery panel.
- d. Remove the lower upholstery panel.
- e. Remove the phillips screws from each hinge cover.
- f. With the door open, insert a screw driver between the door stop and the bottom of the door. Slowly close the door while applying a downward pressure on the door stop until the stop is released from the door.
- g. Remove the attaching bolts from each door hinge.

NOTE

Shims have been installed between the hinges and the door to obtain a proper fit. The shims should be retained and the same number of shims installed under each hinge when the door is reinstalled. These shims help position the door forward and aft and/or raise or lower the aft edge.

- h. Installation is accomplished in the reverse of the removal procedure.



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**Figure 3-4. Cabin Door Hinge
(E-1 Thru E-830 Except E-754)**

CABIN DOOR REMOVAL (E-754, E-831 and after)

- a. Remove the inboard door handle.
- b. Remove the window upper moulding trim.
- c. Remove the armrest, upholstery panel and the ash tray.
- d. If the optional courtesy light is installed, disconnect the wire splice located behind the right side of the instrument panel.
- e. With the door open, insert a screw driver between the door stop and the bottom of the door. Slowly close the door while applying a downward pressure on the door stop until the stop is released from the door.
- f. Remove the two phillips screws from each hinge cover.
- g. Remove the remaining screws which secure the door frame to the hinges.

NOTE

On serials E-754, E-831 and after the upper hinge has four screws located aft of the hinge cover; on the lower hinge three screws are aft of the hinge cover.

- h. Carefully remove the door by pulling the door directly away from the hinges.

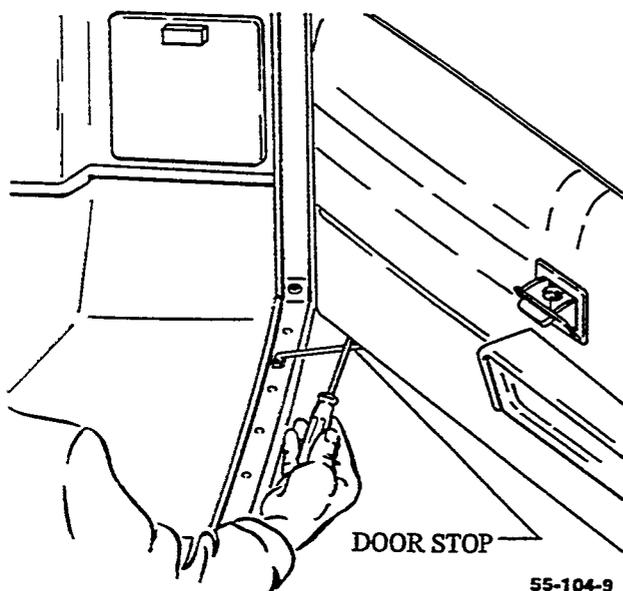


Figure 3-5. Cabin Door Stop

NOTE

Shims have been installed between the hinges and the door to obtain a proper fit. The shims should be retained and the same number of shims installed, where removed, under each hinge when the door is reinstalled. These shims are used to position the door in or out at the front edge of the door.

CABIN DOOR INSTALLATION (E-754, E-831 and after)

- a. If a new door is being installed, place the door in position and mark the door hinge tab and perimeter of the door frame where any excess material needs to be removed. Remove the excess material to obtain the best fit prior to installing the seal.
- b. On a new door, install new door seals around the inside edge of the door frame. Check the old door for reference to new door seal location.
- c. Place the door in position making sure the upper and lower door hinge shims are positioned to keep the door flush to the fuselage; if reinstalling the old door, use the same amount as removed.
- d. Install the phillips screws of the upper door hinge which secure the door frame to the hinge. Attach the phillips screws of the lower door hinge.
- e. Install the upper and lower hinge cover plates each attached with two phillips screws.
- f. Install the door stop in the channel located on the bottom edge of the door.

NOTE

The upper door hook latch bracket located in the door sill above the door should be pre-set flush with the door sill.

- g. If the door contains the optional courtesy light installation, feed the wire from the courtesy light to the location behind the right side of the instrument panel by routing the wire above the door hinge to behind the panel. Splice the courtesy light wire to its connecting wire.
- h. Install the upholstery panel, ashtray, and armrest.
- i. Install the window upper moulding trim.
- j. Install the inboard door handle.
- k. If adjustments to the installed door are required, refer to CABIN DOOR ADJUSTMENT in this chapter.

REMOVING AND INSTALLING THE CABIN DOOR TELEFLEX CABLE

- a. Remove the inside door handle and the machine screws on the door upper facing.
- b. Remove the door upholstery panels.
- c. Remove the bolt securing the teleflex cable to the upper door latch.

d. Remove the bolt securing the lower end of the cable to the lower latch actuating arm.

NOTE

Attach a length of safety wire to the lower end of the cable assembly before removing it from the door and leave the wire in the cable track as a means of positioning the new cable assembly.

e. Grasp the upper end of the cable with vise grip pliers and pull it out through the upper latch opening. Remove the safety wire from the cable.

NOTE

Braze or silver solder two AN340-832 nuts to two new AN742-H4 clamps.

f. Prior to installing the upper clevis, place one of the newly prepared clamps between the shoulders on the lower end of the cable housing and attach the safety wire remaining in the door to the lower end of the cable housing.

g. Pull the housing into position by gripping the safety wire with vise-grip pliers below the shoulder at the lower end. Pull on the safety wire attached to the lower end while carefully guiding the housing through the door channel.

NOTE

Do not force the teleflex cable housing as bending may result. This bend should not be tolerated.

h. Align the lower clamp with the hole in the door facing and secure it with a machine screw, then install the upper clamp in place on the housing and secure it in the same manner.

i. Install the upper clevis and attach the cables to the upper and lower latch connections.

j. Adjust cable tension by varying the cable length at either latch connection.

INSTALLING CABIN DOOR LOCK AND FITTING TUMBLER TO KEY

When a lock on the baggage compartment door, cabin door or ignition is broken or worn, it is not necessary to install a full set of replacement locks with a new key. A new tumbler can be readily converted (one time), for use with the old key. To fit a new tumbler to a key proceed as follows:

- a. Insert the key to be used in the new lock.
- b. With key in the unlocked position examine the

top of the lock barrel where the slot for the tumblers are located.

c. Note that one or more tumblers are protruding through the slot.

d. With a fine file remove the raised portion of each of these tumblers. The key will now operate the new lock.

To install a new lock in the cabin door, proceed as follows:

NOTE

In some instalces the lock plug may be changed by using an off-set screwdriver without removing the handle from the door. Open the door handle fully and follow steps "d" and "e"

a. Loosen the upholstery panel on the cabin door to gain access to the handle mechanism through the cutout in the channel under the latch assembly.

b. Remove the lower aft screw from the external door handle fairing directly under the lock mechanism, and remove the pin from the handle through the cutout in the door channel.

NOTE

Both the extreme aft screw and the lower aft screw of the outside latch housing serve as retainers. The extreme aft screw secures the door handle spring in position, and the lower aft screw retains the handle hinge pin in position.

c. Remove the aft screw from the external door handle fairing. This will free the handle spring and allow the handle to be pulled out from the door.

NOTE

There is a spring washer on each of the handle studs which may fall off when the connector links are removed.

d. Remove the screw, lock washer, and cam from the back of the lock plug assembly.

NOTE

On some earlier models the cam may be peened to the lock plug.

e. Install the new lock plug, cam, lock washer, and screw into the handle assembly.

NOTE

Apply Loctite No. 601 (product of Loctite Corporation, Newton, Conn.) to the threads of the screw. Do not allow Loctite to contact any other location.

- f. Reattach the connector links to the handle. Install the spring washers between the connector links and the handle.
- g. Place the handle in its location in the door and install the handle hinge pin in its location.
- h. Install the lower aft screw of the external door handle fairing. This screw, when installed, will hold the handle hinge pin in place.
- i. Install the aft screw in the external door handle fairing. Make certain the door handle spring is in place as this screw retains the spring in position.
- j. Reattach the panel to the cabin door.

CABIN DOOR ADJUSTMENT

Several adjustments may be made to assure proper closing and sealing of the door. If the door permits air leaks by the lower latch when completely closed (with the door seals in good condition) loosen the four retaining screws in the edge of the door and move the latch tongue guide outboard to create additional tension on the latch tongue.

Air leaks around the upper portion of the door may be caused by improper adjustment of the upper door latch bracket in the door sill above the door. This condition may be corrected by increasing the inward tension on the door (Figure 3-5A), thereby creating a tighter door seal. The upper door latch bracket is adjustable. Screwing the forward screw on the latch bracket "in" creates more inward tension on the door; adjusting the screw "out" provides less tension on the door.

The upper door latch hook engages with a roll pin located in the upper door latch bracket in the door sill (Figure 3-5A). The roll pin will adjust to four positions, forward to aft. If the upper door latch does not properly engage with the roll pin, move the roll pin aft to obtain tighter hook retention.

With the door handle rotated to the closed and locked position: the internal upper door latch mechanism must go over center; the sliding bolt latch should extend as far as possible into the fuselage; and the lower door pin latch should extend downward into the fuselage. With the door closed and locked, the leading edge of the outside flush type door handle may protrude into the slipstream up to 1/4 inch.

NOTE

The outside door handle moves with the aft bolt and is not separately adjustable.

With the inside door handle stop rotated full open against the stop pin: the sliding bolt latch on the aft side of the door should just clear the fuselage; the upper door latch hook should just be beginning to protrude through the upper door frame latch slot; and the lower door pin tip should be recessed into the pin guide assembly. If the door does not open freely, the main door sliding bolt latch may not be retracting enough. This can be corrected by removing the upholstery panel below the door window and shortening the length of the connecting tube assembly.

UTILITY DOOR REMOVAL

- a. With the door open, remove the screws that attach the scissors door stop to the door sill.
- b. Support the doors and remove the hinge pins by pulling straight up.

UTILITY DOOR INSTALLATION

- a. Support the doors and install the hinge pins.
- b. Install the screws that attach the scissors door stop to the door sill.

UTILITY DOOR ADJUSTMENT

If the utility door does not close properly or permits air leaks while completely closed, several adjustments may be made to assure proper sealing of the door. After determining the origin of the air leakage as to whether it is from around the forward half of the utility door or the aft half of the door, make the following adjustments as necessary:

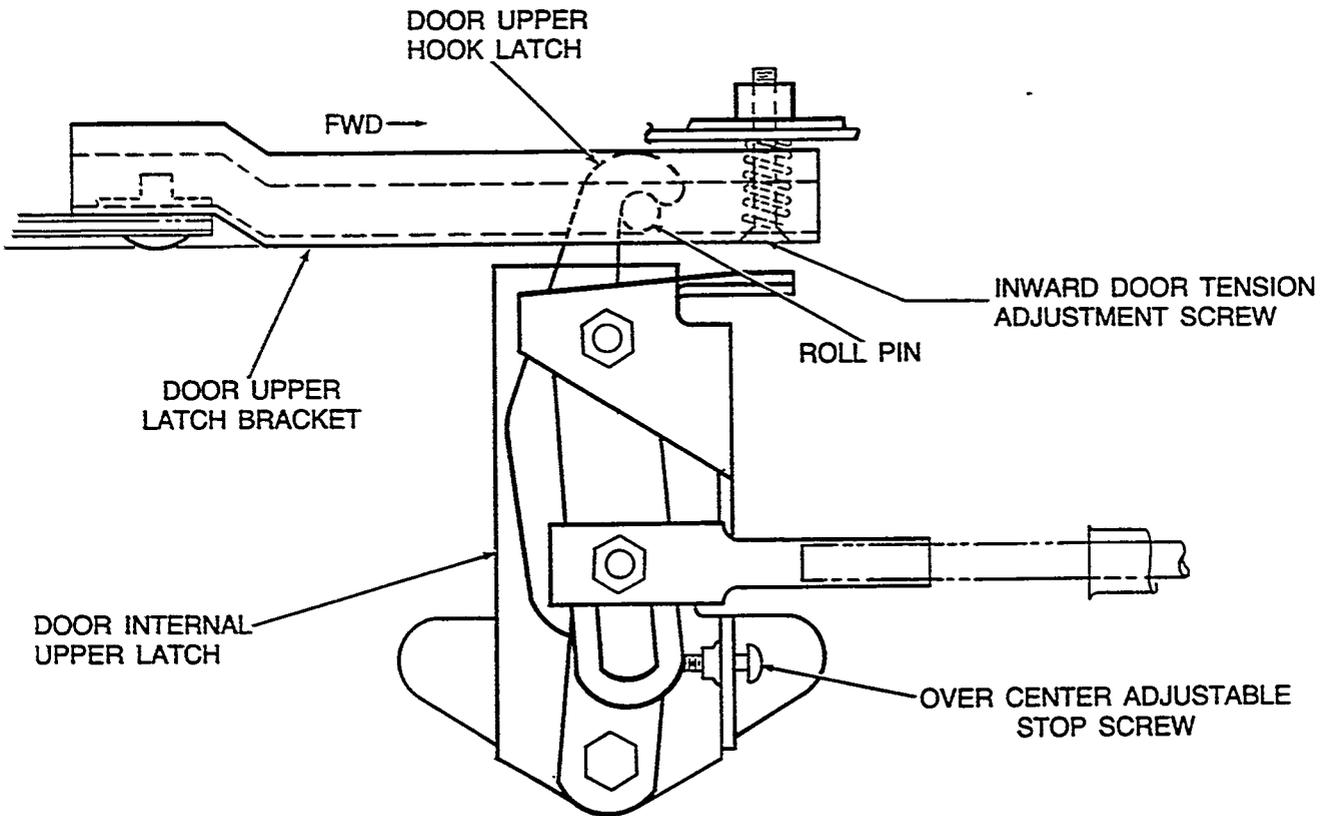
ADJUSTMENT OF THE AFT HALF OF THE UTILITY DOOR

- a. Adjustments of the aft door may be performed by removing the upholstery paneling and shortening or lengthening the door latch connecting tube assembly.

NOTE

By shortening the connecting tube assemblies, the door will be pulled tighter against the door seal.

- b. To adjust the length of the connecting tube assembly, remove the cotter key, washers and pin. Turn the pin eye "IN" to shorten the tube assembly and turn the pin eye "OUT" to lengthen the tube assembly.
- c. After the desired length has been set, install the pin, washers and cotter key.
- d. Replace the upholstery paneling.



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Figure 3-5A: Door Upper Latch Mechanism

ADJUSTMENT OF THE FORWARD HALF OF THE UTILITY DOOR

- a. If the air leakage is around the forward half of the door, the necessary adjustments may be made at the door latch striker plate, located in the center of the rear door.
- b. For a tighter fit, loosen the two phillips head screws and move the striker plate inboard.

UTILITY DOOR LATCH PIN ADJUSTMENT

If the forward door does not open freely, the door latch pins may not be retracting enough. This may be corrected by the following adjustments:

- a. Remove the upholstery paneling.
- b. Remove the cotter keys, pins and washers.
- c. Loosen the pin eye jam nut and turn the pin eye "IN" to shorten the tube assemblies; turn the pin eye "OUT" to lengthen the tube assemblies.
- d. After the desired length has been set, tighten the pin eye jam nut. Install the pins, washers and cotter keys.
- e. Replace the upholstery paneling.

WINDOWS

STORM WINDOW REMOVAL AND INSTALLATION (E-1 through E-184)

- a. Remove the attaching bolt from the storm window sleeve assembly.
- b. Remove the hinge pin.
- c. Installation is accomplished by reversing the above procedure.

STORM WINDOW REMOVAL AND INSTALLATION (E-185 and after)

- a. Remove the two internally threaded hinge-pins.
- b. Installation is accomplished by reversing the above procedure.

FORWARD L.H. WINDOW REMOVAL (E-1 through E-184)

- a. Remove the storm window.
- b. Remove the upholstery panels as required to gain

access to the window frame.

- c. Remove the trim strip from around the inside of the window.
- d. Remove the screws and nuts attaching the storm window strike to the window frame.
- e. Remove the rivets from around the window.
- f. Remove the window.

FORWARD L.H. WINDOW INSTALLATION (E-1 through E-184)

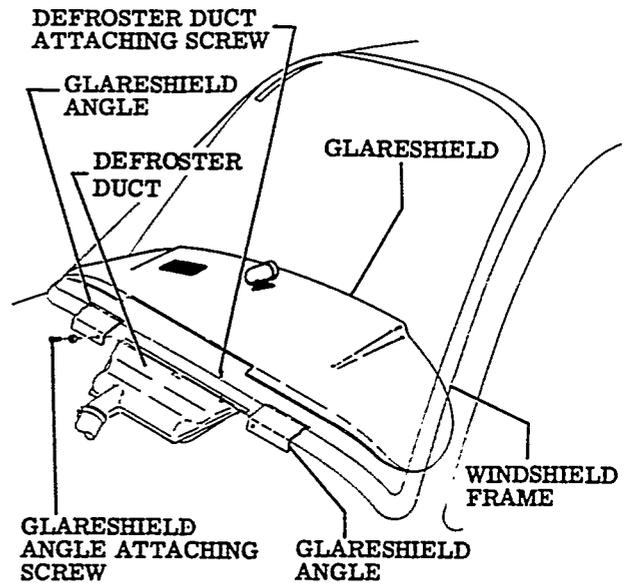
- a. Clean the sealer from the canopy section where the old window was removed using toluol, (Item 20, Consumable Materials Chart).
- b. Place the window in position and mark the areas where material must be removed to obtain a proper fit.
- c. Remove the window and trim off the excess material as determined in step "b".
- d. Place the window in position and cleco in place using the pilot holes provided.
- e. Back drill the window frame using the existing holes in the canopy section as a guide.
- f. Remove the window, burr all holes and apply sealer (Item 3, Sealing Chart) to an area approximately 1/2 inch wide on the canopy section where the old sealer was removed.
- g. Place the window in position and cleco in place.
- h. Using AN470AD4 rivets, secure the window to the canopy section.
- i. Install the trim strips.
- j. Attach the storm window strike to the window frame.
- k. Install the storm window.
- l. Clean the paint as necessary.
- m. Reinstall the upholstery panels.

FORWARD L.H. WINDOW REMOVAL (E-185 and after)

- a. Remove the upholstery panels as required to gain access to the window frame.
- b. Remove the trim strip from around the inside of the window.
- c. Remove the rivets from around the window.
- d. Remove the window.

FORWARD L.H. WINDOW INSTALLATION (E-185 and after)

- a. Clean the sealer from the canopy section where the old window was removed using toluol, (Item 20, Consumable Materials Chart).
- b. Place the window in position and mark the area where material must be removed to obtain a proper fit.
- c. Remove the window and trim off the excess material as determined in step "b".
- d. Burr all holes and apply sealer (Item 3, Sealing Chart) to an area approximately 1/2 inch wide on the canopy section where the old sealer was removed.
- e. Place the window in position and cleco in place.



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Figure 3-6. Windshield

- f. Using AN470AD4 rivets, secure the window to the canopy section.
- g. Install the trim strip.

WINDSHIELD REMOVAL (Figure 3-6)

- a. Remove the glareshield. Refer to Glareshield Removal.
- b. Remove the attaching screws from the defroster duct and move the duct to clear the lower row of rivets on the windshield.
- c. Remove the screws and spacers from the glareshield angles.
- d. Remove the trim strips from around the inside of the windshield.
- e. To facilitate reinstallation, mark the location of the trim strip clips.
- f. Remove the rivets from around the windshield.
- g. Remove the windshield.

NOTE

Due to the windshield being sealed, considerable effort may be required to break the windshield loose from the canopy section.

WINDSHIELD INSTALLATION

- a. Remove any sealer around the canopy with toluol. Touch-up any scratches or bare metal with zinc chromate primer.
- b. Trim the tooling tabs from the windshield, place the windshield in position and mark the area where material must be removed from the windshield to obtain a proper fit.

- c. Remove the windshield and trim off excess material as determined in step "b".
- d. Place the windshield in position and cleco in place using the pilot holes provided.
- e. Back drill the windshield frame using the existing holes in the canopy section as a guide.
- f. Remove the windshield, burr all holes and apply sealer (Item 3, Sealing Chart) to the windshield frame where it makes contact with the canopy section.
- g. Place the windshield in position and cleco in place.
- h. Using AN470AD4 rivets, secure the windshield to the canopy section.

NOTE

When riveting the windshield in place, install the trim strip clips in the same locations as marked in step "e" of the Windshield Removal procedure.

- i. Secure the glareshield angles in place with attaching screws, nuts and spacers.
- j. Position the defroster duct and secure in place with the attaching screws.
- k. Install the trim strips.
- l. Install the glareshield.
- m. Clean and paint as necessary.

CABIN DOOR WINDOW REMOVAL

- a. Remove the inboard door handle, ash tray and arm rest.
- b. Remove the center upholstery panel.

- c. Remove the trim strip around the inside of the window.
- d. To facilitate reinstallation, mark the location of the trim strip clips.
- e. Remove the rivets around the window.
- f. Remove the window.

CABIN DOOR WINDOW INSTALLATION

- a. Clean the sealer from the door where the old window was removed using toluol. (Item 20, Consumable Materials Chart).
- b. Place the window in position and mark the areas where material must be removed to obtain a proper fit.
- c. Remove the window and trim off excess material as determined in step "b".
- d. Place the window in position and cleco in place using the two pilot holes on the aft side of the window frame.

NOTE

To eliminate the possibility of the door being warped; the door must be closed and latched when drilling the attaching holes and securing the window in place.

- e. Back drill the window frame using the existing holes in the door as a guide.
- f. Remove the window, burr all holes and apply sealer, (Item 3, Sealing Chart) to an area approximately 1/2 inch wide on the door where the old sealer was removed.
- g. Place the window in position and cleco in place.
- h. Using AN470AD4 rivets, secure the window to the door.

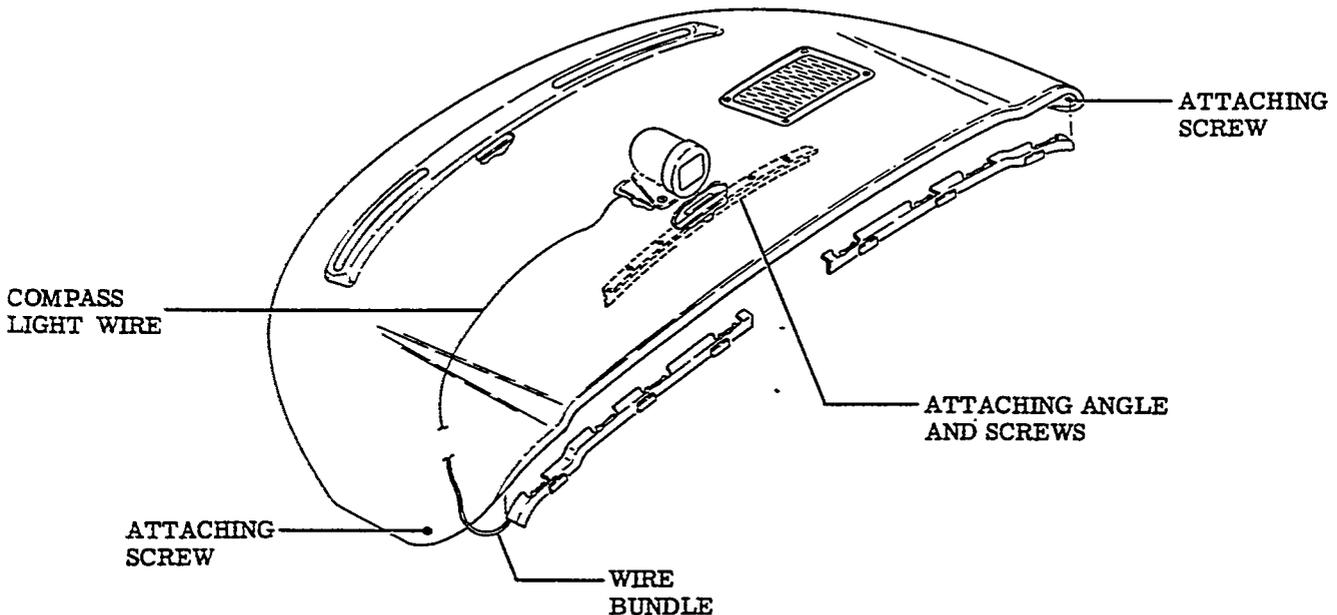


Figure 3-7. Glareshield

NOTE

When riveting the window in place, install the trim strip clips in the same locations as marked in step "d" of the window removal procedure.

- i. Install the trim strip.
- j. Clean and paint as necessary.
- k. Reinstall the center, upholstery panel.
- l. Reinstall the inboard door handle, ash tray and arm rest.

SECOND WINDOW REMOVA AND INSTALLATION

- a. Remove the emergency release pin.
- b. Remove the hinge pin.
- c. Installation is accomplished by reversing the above procedure.

THIRD AND FOURTH WINDOW REMOVAL

- a. Remove the upholstery panels as required to gain access to the window frame.
- b. Remove the trim strip from around the inside of the window.
- c. Remove the window.

THIRD AND FOURTH WINDOW INSTALLATION

- a. Clean the sealer from the cabin section where the old window was removed using toluol, (Item 20, Consumable Materials Chart).
- b. Place the window in position and mark the areas where material must be removed to obtain a proper fit.
- c. Remove the window and trim off the excess material as determined in step "b".
- d. Apply sealer (Item 3, Sealing Chart) to an area approximately 1/2 inch wide on the cabin section where the old sealer was removed.
- e. Place the window in position and using AN470AD4 rivets, secure the trim strips to the cabin section.
- f. Clean and paint as necessary.
- g. Reinstall the upholstery panels.

GLARESHIELD REMOVAL AND INSTALLATION (Figure 3-7)

- a. Remove the attach screws at each end of the glareshield and at the glareshield angle located above the instrument panel. On aircraft serial E-244 and after, velcro hook and pile are used in place of the attach screws in the angle located above the instrument panel.

NOTE

On aircraft serial E-244 and after, the velcro hook and pile may be released by prying gently upward under the glareshield.

- b. Lift the glareshield gently and disconnect the electrical quick disconnects for both the compass and glareshield lights.
- c. Disconnect the defroster heat duct.

NOTE

It is not necessary to remove the compass from the glareshield.

- d. Remove the glareshield.
- e. Installation of the glareshield may be accomplished by reversing the above procedure.

WARNING

Due to the effect of steel screws on the compass, brass screws must be used when installing the glareshield.

NOTE

On aircraft serial E-244 and after, the velcro hook and pile may be interlocked by pressing downward on the upper side of the glareshield.

ENGINE INSTRUMENTS

BEECHCRAFT Bonanza A36, serials E-283 through E-363 are equipped with vertical readout engine instruments operated electrically, lighted internally and installed in a box assembly which is installed in the instrument panel. A male connector attached to the rear of each instrument fits into a female connector attached to the rear of the box assembly. As the instrument is removed from the box assembly, the male connector is pulled from the female connector, removing the instrument from the electrical circuit.

REMOVAL AND INSTALLATION OF VERTICAL INSTRUMENTS

- a. Remove the six screws holding the plastic instrument retainer plate to the box assembly and remove the plate.
- b. Pull the desired instrument straight out.

NOTE

The EGT indicator must have thermocouple leads removed from the back of the instrument after it has been pulled from the box assembly.

c. Reinstallation may be accomplished in the reverse of the removal procedure.

CAUTION

In the event of a malfunction of an instrument or the dimming circuit, check the electrical circuitry, wiring, and connectors. If the fault is not in these items, do not attempt to repair the instrument itself. Replace the instrument and return the defective instrument to Beech Aircraft Corporation.

FIBERGLASS

REPAIR OF FIBERGLASS COMPONENTS

Large holes and cracks require that the damaged area be cut and trimmed just beyond the area of noticeable damage. If the parts are painted, remove paint and sand an area at least two inches beyond the edge of the cutout. Then prepare three patches of laminated glass cloth, specification MIL-F-9084, preferable No. 181 fabric. One patch should be the size of the sanded area, the second patch should be smaller so that approximately one-half inch of the first patch will be exposed. Cut the third patch to approximately one-half inch smaller than the second patch. Prepare a sufficient amount of resin, specification MIL-R-7575, which can be used in thirty minutes in accordance with the manufacturer's instructions. Never use catalytic resin which has been exposed to air more than thirty minutes. If

the repair is large, prepare small amounts of resin as required. Make sure that your hands are free of oil, grease and dirt.

NOTE

There are several different resins available which will cure when exposed to air and at room temperature. Two are suggested: American Cyanamide, Laminac 4116, blended 100 parts resin mixed 1/2 to 1 part of DDM Peroxide; or Gliddens 1001 resin blended 100 parts resin to 1/2 part cobalt with 1/2 to 1 part DDM Peroxide. Both resins conform to specifications MIL-R-7575 and MIL-P-8013.

WARNING

In preparing resin never mix DDM Peroxide and Cobalt together, as this will result in a spontaneous fire. Always add one catalytic agent to the resin and mix thoroughly before adding the other agent.

Apply an even coat of resin to the sanded area. Impregnate all three laminated glass cloth patches by laying the patches on clean paper and working the resin through the fabric with a 2 inch brush. Place the large patch over the cutout area, working out all air bubbles and wrinkles. If the cutout is large enough to cause the patch to sag, place a suitable support coated with automobile wax or waxed paper behind the repair area to prevent the resin from adhering to the support. Apply the second patch over the first patch working out all air bubbles and wrinkles. Apply a third patch over the second patch in the same manner. After all three patches have been applied, brush the area with an even coat of resin. Let the patches cure for a period of 24 hours at temperature of 23°C (75°F) to 66°C (150°F). With fine sandpaper smooth the patch area for desired finish. Repaint the finished area with matching paint.

Raytheon Aircraft

BEECH BONANZA 36 SERIES SHOP MANUAL

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Raytheon Aircraft

BEECH BONANZA 36 SERIES SHOP MANUAL

Manual Affected: BEECHCRAFT Bonanza 36 Series Shop Manual (36-590001-3B)
Instructions: Insert this page facing page 4-1 of Section 4.
Reason: Revise text under CONTROL COLUMN ARM REMOVAL and CONTROL COLUMN ARM INSTALLATION.

CONTROL COLUMN ARM REMOVAL

- a. Remove the four screws that secure the retainer collar assembly to the control column housing.
- b. Disconnect any electrical wiring.
- c. Remove the aileron trimmer as indicated in AILERON CONTROL TRIMMER.
- d. Pull the "T" handle located on the forward side of the control arm.
- e. Rotate the control column arm to the nearly vertical position and slide the control column arm off the housing.

CONTROL COLUMN ARM INSTALLATION

- a. Position the control arm vertical as shown in Figure 4-1. Make sure that the slot in the lower sprocket is approximately parallel to the sides of the arm and that the turnbuckles between the long and short chains are opposite each other near the access opening.
- b. The ailerons **MUST** be in the neutral position.
- c. Pull the "T" handle located on the forward side of the control arm.
- d. Slide the control column arm on the control column housing.
- e. Connect all electrical wiring.
- f. Install the retainer collar and attach it with the four screws.
- g. Install the aileron trimmer as indicated in AILERON CONTROL TRIMMER.
- h. Check the control column for full movement and the control surfaces for proper direction of movement.

FLIGHT CONTROLS AND SURFACES

SINGLE CONTROL COLUMN

(Figure 4-1)

CONTROL COLUMN ARM REMOVAL

- a. Remove the two screws that secure the retainer collar assembly to the control column housing.
- b. Disconnect any interfering electrical wiring.
- c. Rotate control column arm over to a near vertical position and slide the control column off of the housing.

RIGGING THE CONTROL COLUMN CHAIN

- a. With the control wheel in the neutral position, the

yellow marks on the sprockets must align with the yellow marks on the chain.

b. The slot in the sprocket as shown in Figure 4-1 must be in alignment with the yellow marks.

c. To tighten the chain, remove the safety wire from the turnbuckles and adjust as necessary. Check for freedom of movement.

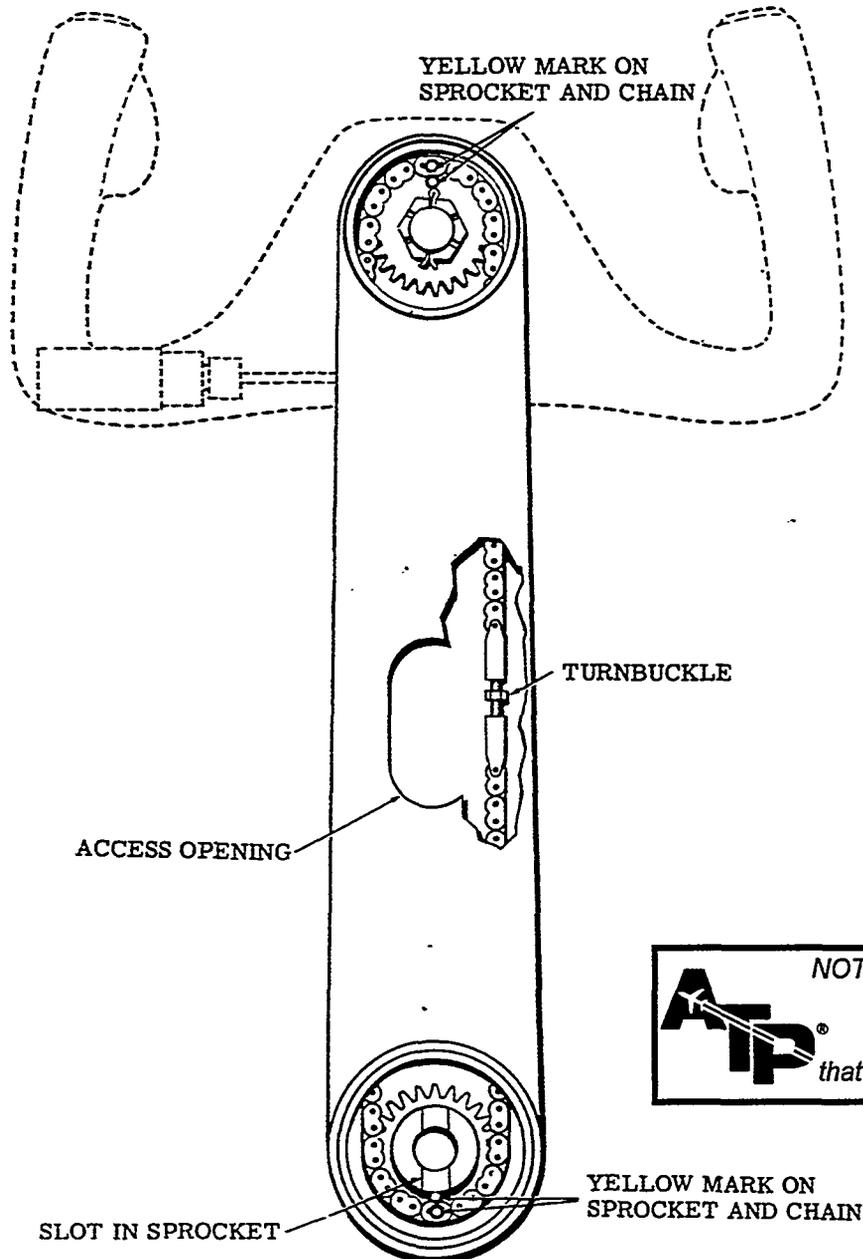
d. After proper adjustment of the chain, reinstall new safety wire.

CONTROL COLUMN ARM INSTALLATION

a. Slide the control column on the control column housing.

b. Install the chrome collar and attach with the two screws.

c. Attach all electrical wires.



ATP NOTE: Please see the
TEMPORARY
REVISION
that revises this page.

Figure 4-1. Control Column

EFFECT OF TEMPERATURE UPON CABLE TENSION

Graphs specifying the correct maximum and minimum cable tension permissible for the various controls appear on the individual rigging control system illustrations. The graphs provide rigging limits at temperatures varying from 0°F to 110°F. The horizontal scale on the graphs designates the temperature in degrees Fahrenheit at which the control cables may be rigged, and the vertical scale designates the correct tension in pounds for each temperature reading.

AILERON SYSTEM

(Figure 4-2)

AILERON REMOVAL

- a. Support the aileron and remove the two attaching screws from the top and bottom of each hinge bracket.
- b. Pull the aileron straight away from the wing to avoid damage to the attaching areas.
- c. Remove the screws attaching the bonding cables to the aileron.

AILERON INSTALLATION

- a. Attach the bonding cables to the aileron.
- b. Place the aileron in position on the hinge brackets. Be sure the hinge bracket is in the proper place between the aileron skin and the reinforcing structure.
- c. Install the upper and lower hinge bracket screws.

RIGGING THE AILERON CONTROL SYSTEM

- a. Aileron and flap surfaces must align with the upper and lower surfaces of the wing within 1/16 inch.
- b. Adjust the aileron down stops in the wing so the bellcrank just clears the gusset on the wing rib. Set the aileron up stop in the wing so that the aileron bellcrank just misses the aileron push rod.
- c. Adjust the link connecting the aileron to the bellcrank to allow full travel of the aileron surface between the up stop and the down stop.
- d. Adjust the cable from the wings to the control column cables. The turnbuckles are located just forward of the rear truss.
- e. Secure the control column wheel in neutral with the control surface lock. Adjust the cable tension as shown on the aileron cable tension temperature graph. Take the cable reading on the cable at the rear truss where it attaches to the wing cables.
- f. Remove the control surface lock and with the control wheel, feel the contact of the stops in both wings in relationship to the contact of the stops in the control column. The bellcrank in the wing should contact its stop first, and the travel of the control wheel should be equal in each direction. If there is less travel of the control wheel in one direction, tighten one turnbuckle on the lower cable and loosen the opposite lower cable turnbuckle depending on which way the travel is off. Maintain correct cable tension.

g. Secure the control wheel in neutral after correct travel of the wheel is obtained. Adjust the link connecting the aileron to the wing bellcrank to obtain the aileron neutral position. Neutral position of the aileron is determined by aligning the inboard end of the aileron with the outboard end of the flap, the flap being in the up position.

h. Remove the control surface lock and set the aileron travel by adjusting the bellcrank stop bolts in the wing. Set the stop bolts in the right wing so the bellcrank will contact the stops approximately 1/16 inch ahead of the stops in the control column. Be sure each bellcrank contacts its up stop at the same time the bellcrank in the opposite wing contacts the lower stop. Hold the ailerons against the stops in the right wing and adjust the stop bolts in the left wing until they barely touch the stops. Tighten all jam nuts.

- i. Set the aileron travel according to the table of travel.
- j. Re-check cable tension and safety the turnbuckles.

WARNING

Check for correct direction of aileron travel by moving the control wheel. When the control wheel is turned to the left, the left aileron should move up, and the right aileron should move down. When the control wheel is turned to the right the right aileron should move up, and the left aileron should move down.

AILERON CONTROL TRIMMER

The aileron control system is equipped with an aileron control trimmer which functions by applying tension on the aileron control cables to level the wings as needed. The holding pressure exerted by the aileron control trimmer can be easily overridden at the discretion of the pilot. The trimmer does not change the rigging system and should be removed before checking cable tension. To remove, unscrew the two body halves by holding the clutch body housing (outer half) and turning the clutch body nut (inner half) counterclockwise. Separate the two body halves by pulling out on the clutch body housing. When installing, carefully insert the shaft through the felt seal into the hub bearing, being careful not to shear the felt seal. Screw the two halves of the unit together by holding the clutch body and turning the clutch body nut. Care should be taken to see that the tangs of the drive shaft engage properly with the sprocket as the unit is being tightened by hand. Also note that the position indicator on the face of the unit is right side up as the shaft engages with the sprocket. Hand tightening the two halves should be sufficient.

AILERON TABS

The ailerons are equipped with sheet metal tabs which may be adjusted while the airplane is on the ground. The tabs are adjusted by bending them in opposite directions to each other. Bend the tabs only a small amount each time and check the setting by flight test.

ELEVATOR SYSTEM

(Figure 4-3)

ELEVATOR REMOVAL

- a. Detach the tail cone, disconnect the tail navigation light and remove the tail cone.
- b. Remove the tail section access doors on the left hand side of the aft fuselage.
- c. Disconnect the elevator push-pull tubes from the elevator torque tube fittings.
- d. Disconnect the elevator trim tab actuator rod at the actuator.
- e. Remove the hinge bolts. Disconnect the elevator bonding cables and remove the elevator.

INSTALLATION OF ELEVATOR

- a. Connect the elevator bonding cables and position the elevator on the stabilizer, install the hinge bolts and nuts. Tighten and safety.
- b. Connect the elevator trim tab actuator rod to the actuator.
- c. Install the attaching nut at the inboard elevator hinge point and torque to 50-70 inch-pounds.
- d. Connect the elevator push-pull tubes at the elevator torque tube fittings.
- e. Connect the tail light wires and install the tail cone. Install the access doors.

RIGGING THE ELEVATOR CONTROL SYSTEM

- a. Adjust the elevator down stop and push rods so that 19 to 21 degrees of travel are available from the neutral to the DOWN position. Maintain at least 1/8 inch distance between the aft edge of the bell crank and the aft bulkhead.
- b. Rig the cables to the tension shown on the rigging diagram, adjusting the cables so the control column has a 1/16 to 1/8 inch cushion when in the full forward position.
- c. Adjust the upstop to obtain 22 to 24 degrees UP travel from the neutral position and tighten locknuts.
- d. Employing a hand force gage on the control wheel, adjust the elevator down springs as follows: 23 maximum pounds breakout force at 20° DOWN elevator, 25 plus 1, minus 0 pounds force through NEUTRAL elevator and 24 plus 1, minus 1 pound force as 23° UP elevator is reached. The gage readings at NEUTRAL elevator and 23° UP elevator must be taken while the control wheel is in motion. Adjust each spring by transferring the upper end to a spring attaching hole providing increased or decreased tension, as applicable. The elevator system should have sufficient freedom to allow free return of the elevator from full UP to full DOWN.

NOTE

After rigging the elevator and elevator tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator trim tab should move up.

RIGGING THE ELEVATOR TRIM TAB

- a. Place cabin control indicator in the neutral position.
- b. Rig the cables to the tension shown on the Elevator Cable Tension Temperature Graph.
- c. Place elevator in neutral position and adjust the trim tab push rod to bring the tab into the neutral position.
- d. Adjust the stops on the cables to allow $10^{\circ} \pm 1^{\circ}$ UP travel and $27^{\circ} \pm 1^{\circ}$ DOWN travel.

NOTE

After rigging the elevator and elevator tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator trim tab should move UP.

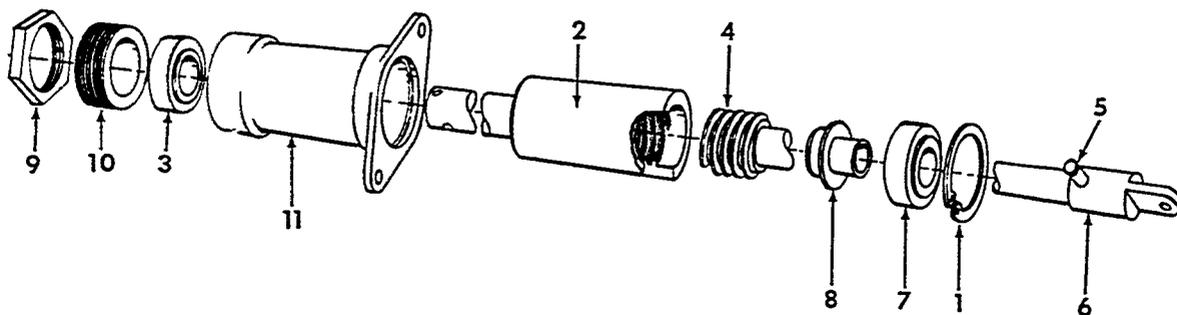
ELEVATOR TRIM TAB ACTUATOR DISASSEMBLY (E-1 thru E-794) (Figure 4-4)

- a. Remove the snap ring (1) from the actuator housing and pull the nut assembly (2) out of the housing.
- b. Remove the actuator screw (4) from the nut assembly.
- c. Drill out the pin (5) and remove the actuator rod end (6) from the screw. The bearing (7) and the bushing (8) can now be removed from the screw.
- d. Remove the check nut (9) and screw out the end adjusting bushing (10) with the appropriate spanner wrench.
- e. Remove the bearing (3) from the nut assembly.

Clean all parts in (Item 15, Consumable Materials Chart) and inspect for cracks, corrosion and distortion. Replace bushings and any parts showing evidence of deterioration. Lubricate all parts with lubricating grease (Item 11, Consumable Materials Chart) prior to assembly.

ELEVATOR TRIM TAB ACTUATOR ASSEMBLY (E-1 thru E-794) (Figure 4-4)

- a. Install bearing (3) into housing (11).



55-133-6

- | | | | |
|----|------------------|-----|-------------------|
| 1. | Snap Ring | 7. | Bearing |
| 2. | Nut Assembly | 8. | Bushing |
| 3. | Bearing | 9. | Check Nut |
| 4. | Actuator Screw | 10. | Adjusting Bushing |
| 5. | Pin | 11. | Actuator Housing |
| 6. | Actuator Rod End | | |

**Figure 4-4. Elevator Tab Actuator
(E-1 thru E-794)**

- b. Install adjusting bushing (10) and check nut (9). (Do not tighten.)
- c. Install bushing (8), bearing (7) and snap ring (1) on actuator screw (4).
- d. Install actuator rod end (6) on actuator screw (4) and secure.

NOTE

Lubricate all parts with MIL-G-23827 grease prior to assembly.

WARNING

The trim tab actuator to be installed on the left hand horizontal stabilizer **MUST** have threads on its actuator screw (4) that rotate clockwise when screwed into the nut assembly (2). The trim tab actuator to be installed on the right hand horizontal stabilizer **MUST** have threads on the actuator screw (4) that rotate counterclockwise when screwed into the nut assembly (2).

- e. Install screw (4) into nut (2).
- f. Install nut assembly (2) into housing (11); secure with snap ring (1).
- g. Screw adjusting bushing (10) into housing (11) until the end play has been removed from the nut assembly, and tighten the check nut (9). An end play of 0.003 inch is permissible. A maximum of 15 inch-pounds may be required to overcome internal friction.

ELEVATOR TRIM TAB ACTUATOR DISASSEMBLY (E-795 and after) (Figure 4-4A)

- a. Remove the retainer ring (2) from the housing (5) and pull the nut assembly (6) out of the housing.
- b. Remove the actuator screw (4) from the nut assembly (6).
- c. Drill out rivet (12).
- d. Remove nut (10), washer (11) and shoulder pin (9). The collar (3) can now be removed.
- e. Remove check nut (8) and screw out bushing (7) with the appropriate spanner wrench.

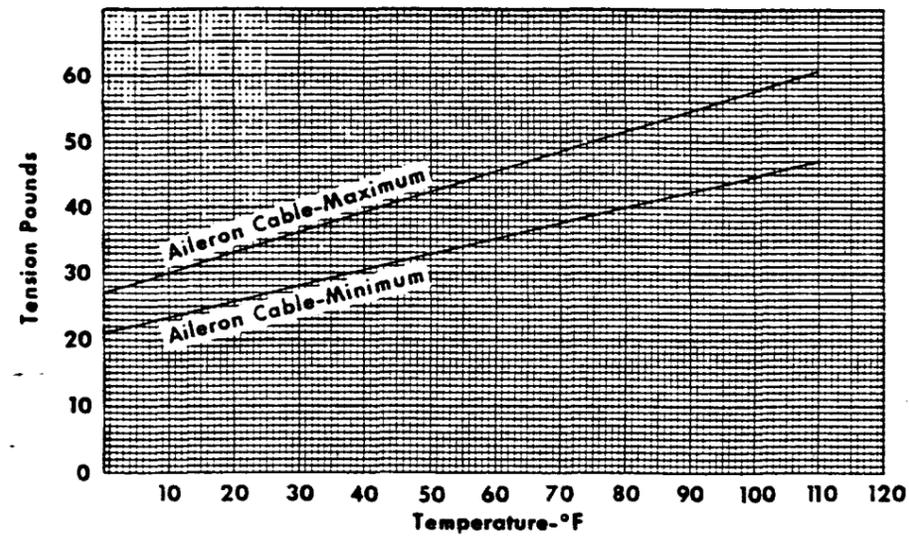
Clean all parts with solvent (Item 15, Consumable Materials Chart) and replace parts that are cracked, corroded and distorted. Lubricate all parts with lubricating grease (Item 11, Consumable Materials Chart) prior to assembly.

ELEVATOR TRIM TAB ACTUATOR ASSEMBLY (E-795 and after) (Figure 4-4A)

- a. Place collar (3) and retainer ring (2) on actuator screw (4).
- b. Install actuator rod end (1) on actuator screw (4) being careful to align the holes.
- c. Install shoulder pin (9) washer (11) and nut (10).
- d. Install rivet (12), P/N MS20613-3C10.

AILERON CONTROL SYSTEM

TEMPERATURE CABLE TENSION GRAPH



CABLES	CABLE TENSION	SURFACE TRAVEL
AILERON	40 LBS +5 LBS AT -5 59°F	20° +2 UP
		20° -2 DOWN

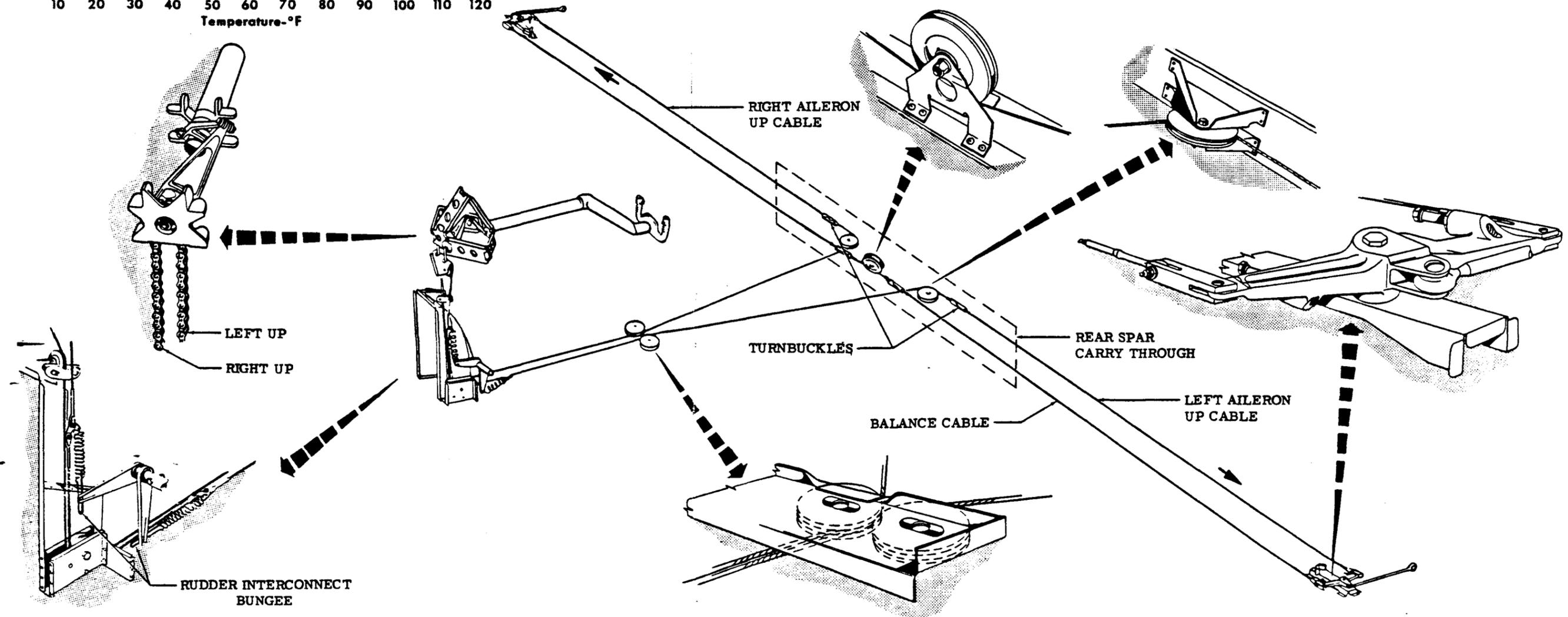
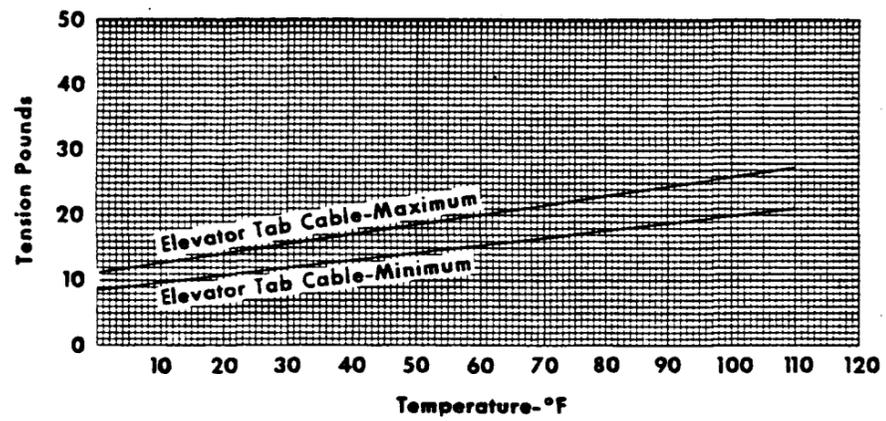
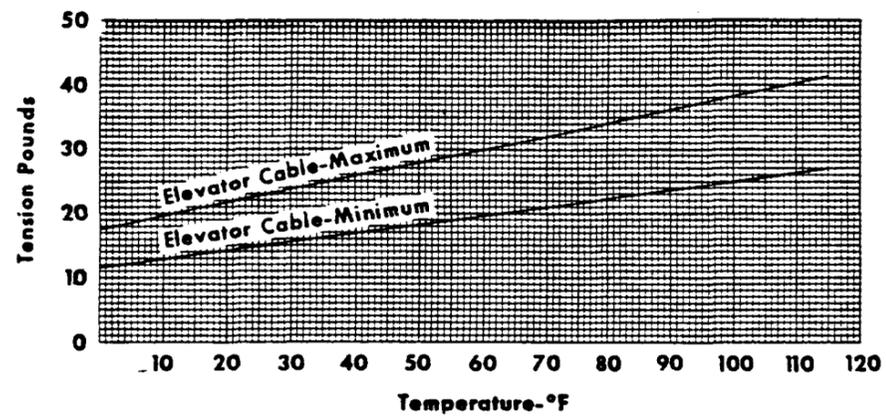


Figure 4-2. Rigging the Aileron Control System

ELEVATOR CONTROL SYSTEM

TEMPERATURE CABLE TENSION GRAPH



CABLES	CABLE TENSION	SURFACE TRAVEL
ELEVATOR	25 LBS +5 LBS AT -5 59°F	23° ± 1° UP 20° ± 1° DOWN
ELEVATOR TAB	15 LBS +5 LBS AT -5 59°F	10° ± 1° UP 27° ± 1° DOWN

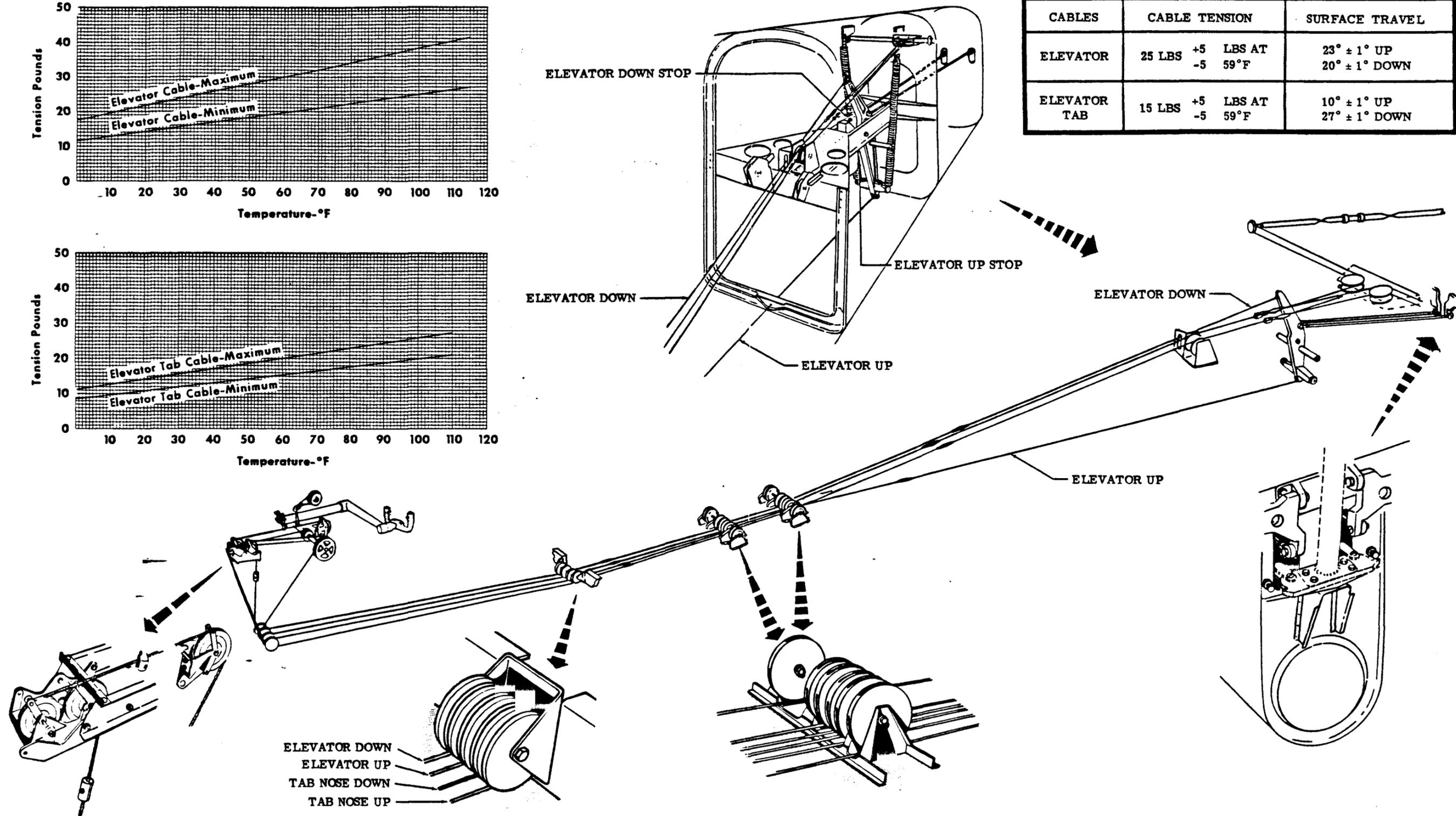


Figure 4-3. Rigging the Elevator Control System

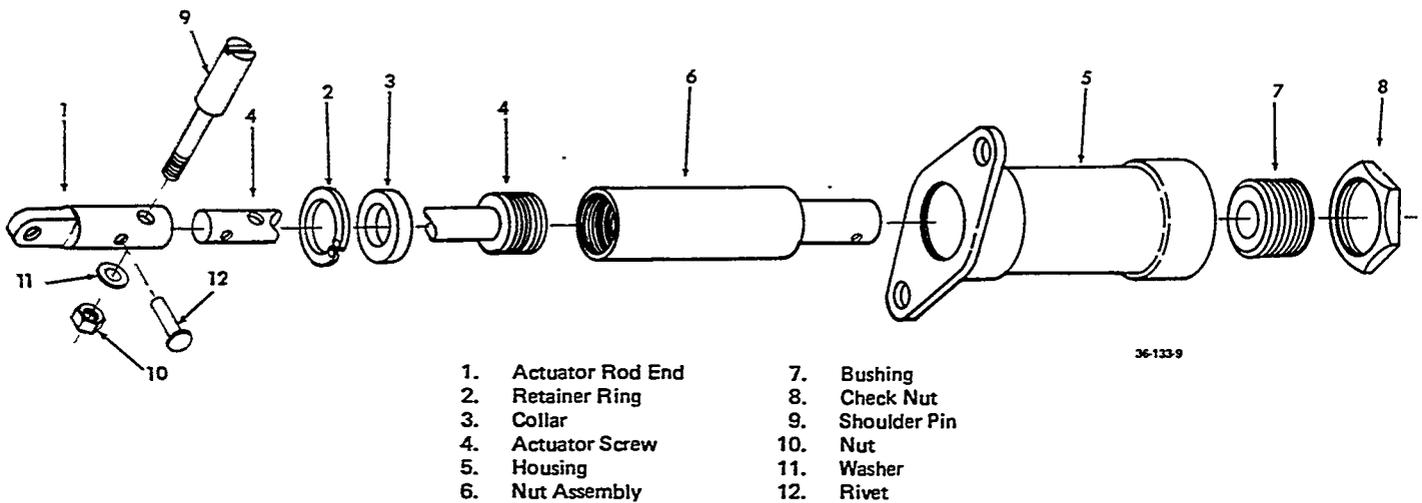


Figure 4-4A. Elevator Tab Actuator
(E-795 and after)

NOTE

Lubricate all parts with lubricating grease (Item 11, Consumable Materials Chart) prior to assembly.

WARNING

The trim tab actuator to be installed on the left hand horizontal stabilizer **MUST** have threads on its actuator screw (4) that rotate clockwise when screwed into the nut assembly (6). The trim tab actuator to be installed on the right hand horizontal stabilizer **MUST** have threads on the actuator screw (4) that rotate counterclockwise when screwed into the nut assembly (6).

- e. Install actuator screw (4) into nut assembly (6).
- f. Install nut assembly (6) into housing (5) and secure with retainer ring (2).
- g. Install bushing (7) and secure with check nut (8).

NOTE

When assembling the actuator, screw the threaded bushing (7) into the assembly (5) until end play of the nut assembly (6) has been removed then lock in place by tightening the check nut (8). The nut assembly (6) must be free to rotate and provide smooth operation through its full travel with a maximum end play of 0.0015 inch.

ELEVATOR TRIM TAB ACTUATOR REMOVAL

- a. Remove the access panel near the trailing edge of the horizontal stabilizer to gain access to the elevator trim tab actuator.
- b. Detach the tail cone, disconnect the tail navigation light wire and remove the tail cone.
- c. Remove the access panel on the left hand side of the fuselage just forward of the horizontal stabilizer.
- d. Remove the access panel near the leading edge of the horizontal stabilizer to gain access to the elevator trim tab actuator sprocket.
- e. Remove the elevator as outlined in Section 4 of this Shop Manual under the heading **ELEVATOR REMOVAL**.
- f. Disconnect the elevator trim tab cables at the turn-buckles in the aft fuselage. Secure the forward elevator trim tab cables to prevent them from unwinding at the universal.

CAUTION

- Do not damage the cables. Use a material such as phenolic to protect the cables.
- g. Remove the chain and cable assembly from the elevator trim tab actuator sprocket.
- h. Remove the hardware attaching the elevator trim tab actuator to the horizontal stabilizer. Remove the actuator from the airplane.

NOTE

If the actuator is to be reinstalled, identify with a tag to ensure proper movement of the elevator tabs upon reinstallation of the actuators.

ELEVATOR TRIM TAB ACTUATOR INSTALLATION

WARNING

To ensure proper movement of the trim tabs, make sure that the LH actuator is installed on the left hand horizontal stabilizer and the right hand actuator is installed on the right hand horizontal stabilizer.

- a. Position the elevator trim tab actuator in the horizontal stabilizer and install the attaching hardware.
- b. Position the chain and cable assembly on the actuator sprocket so that the ends of the chain are equidistant within $\pm .20$ inch at the sprocket centerline.
- c. Install the elevator as outlined in Section 4 of this Shop Manual under the heading INSTALLATION OF ELEVATOR.
- d. Connect the elevator trim tab cables to the turnbuckles in the aft fuselage.
- e. Remove material used to protect the cables.
- f. Rig the elevator trim tab control system as outlined in Section 4 of this Shop Manual under the heading RIGGING THE ELEVATOR TRIM TAB.

NOTE

After rigging the elevator and elevator trim tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator trim tab should move UP.

- g. Install the access panel located near the leading edge of the horizontal stabilizer.
- h. Install the access panel located near the trailing edge of the horizontal stabilizer.
- i. Install the access panel on the left hand side of the fuselage just forward of the horizontal stabilizer.
- j. Connect the tail navigation light wire and install the tail cone.

ELECTRIC ELEVATOR TRIM (Optional) (E-978 and after)

The optional electric trim system was originally offered on serial E-978 and after. This system allows the pilot to correct the elevator trim without removing his hands from the control wheel. The switch requires 2 actions before it will actuate the system, first depressed (enable switch) then moved forward (down trim) or rearward (up trim). There is also a quick interrupt switch (placarded TRIM INTER) on the control wheel left hand grip which opens the circuit to the servo and stops the action of the electric trim system. The PITCH TRIM OFF ON switch is located in the lower right corner of the floating instrument panel and the circuit breaker (placarded TRIM) is located in the electroluminescent circuit breaker panel below the instrument panel. The servo is located forward of the bulkhead at Fuselage Station 207.0.

ELECTRIC ELEVATOR TRIM TAB SERVO REMOVAL (E-978 and after)

- a. Gain access to the servo by removing the fifth and sixth seat (if installed) (refer to Section 3 FIFTH AND SIXTH SEAT REMOVAL AND INSTALLATION) and the partition between the baggage compartment and aft section of the airplane.
- b. Unsafety the turnbuckle on the left trim cable and loosen the cable.
- c. Remove the cable (make a note and diagram of the cable routing for reinstallation) from the pulleys and capstan.
- d. Remove the 4 bolts, 4 nuts, and 8 washers which secure the servo to the brackets in the airplane.
- e. Remove the servo (note on which side of the brackets the servo is mounted) from the airplane.

ELECTRIC ELEVATOR TRIM TAB SERVO INSTALLATION (E-978 and after)

- a. Place the servo in position and install the 4 bolts, 8 washers, and 4 nuts (make certain the servo is installed in the same position from which it was removed).
- b. Install the cables on the servo. The left (outboard) trim cable should be routed forward around the outside groove of the capstan and back to the aft pulley, then forward to the other pulley, wrap around it and aft around the inside groove of the capstan and forward to the turnbuckle.
- c. Install the right (inboard) elevator trim cable to the pulley in the same manner from which it was removed.
- d. Adjust the capstan cable guard to within 1/32 inch of the capstan and secure with attaching screws. Tighten the 2 idler pulleys attaching bolts.

e. Adjust the cable tension per Figure 4-3, RIGGING THE ELEVATOR CONTROL SYSTEM.

f. Operate the elevator trim system through its complete range of travel to check for any binding or restrictions.

ELECTRIC ELEVATOR TRIM GROUND CHECKS

(E-978 and after)

a. After inspection of the electric trim installation for loose wires, obstructions, safetied cables, etc., turn "ON" airplane master switch.

b. Turn ON trim master switch and engage "TRIM" system circuit breaker.

c. Simultaneously press enable switch and move pilot's control wheel switch forward. Note that trim wheel moves toward "DOWN" trim position.

d. With pilot's control wheel switch still engaged, grasp manual trim crank and check for manual override capability.

e. Simultaneously press enable switch and move pilot's control wheel switch rearward. Note trim crank moves toward "UP" trim position.

f. With pilot's control wheel switch still engaged, grasp trim wheel and check for manual override capability.

g. Press the enable switch only - Trim system must not run.

h. Move the trim switch fore and aft only - Trim system must not run.

i. TRIM EMERGENCY INTERRUPT SWITCH

The control wheel mounting includes a quick interrupt switch. This switch has the primary purpose of stopping all trim action by interrupting both the trim A+ and ground. The interrupt switch is a momentary type push-button.

(1) With the trim system still turned on, actuate the trim switch to drive trim system. While system is being driven push the interrupt switch and note the trim system stops running while the switch is depressed.

(2) If trim system operates while the interrupt switch is depressed, the trouble should be located and corrected before flying the airplane.

j. If circuit breaker trips or trim runs without both the enable switch and the direction switch actuated, pull trim circuit breaker, turn trim master switch OFF and leave disconnected until trouble is located. If trim runs with the circuit breaker out, do not fly the airplane.

k. After the electric trim system check-out, the airplane manual trim system should be free of excessive friction and should function normally.

CHECKING ELEVATOR TAB FREE PLAY (Figure 4-4B)

Visually inspect the elevator tabs for any damage, security of hinge attach points, and for tightness of the actuating systems. Inconsistencies should be remedied prior to checking the free play of the tabs. This check should be performed at least once a year to ensure that the trim tab free play falls within the prescribed limits.

A check fixture (P/N 45-135030-9/810 or the equivalent as shown in Figure 4-4B), a dial indicator, and a spring scale for applying accurate loading to the tabs, are required for making the inspection for free play of the tabs.

a. Securely lock the control surfaces to prevent movement of the elevators. Set the elevator tabs in the neutral position.

b. Affix the dial indicator check fixture so that the dial indicator point is positioned, on the outboard edge of the tab, 3.30 inches aft of the hinge line, measured along the top of the tab.

c. Apply a small piece of masking tape (for paint protection) 4.50 inches aft of the tab hinge line and along the centerline of the tab actuator. This will be the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding position on the bottom surface of the tab for the same purpose.

e. Zero the dial indicator at no load initially. Do not reset during the checking procedure.

f. With the push-pull scale at the point of the masking tape, apply a full 3-pound downward load. Record the dial reading as "A".

g. Release half the load until a 1.5-pound downward load is obtained. Record the dial reading as "B".

h. Apply a full 3-pound upward load at the masking tape on the bottom surface. Record the dial reading as "C".

i. Release half the load until a 1.5-pound upward load is obtained. Record the dial reading as "D".

j. Enter the recorded values on a copy of Chart 1 and proceed as follows:

1. Multiply "B" by 2 and record as "2B".
2. Subtract "A" from "2B" and record as "X".
3. Multiply "D" by 2 and record as "2D".
4. Subtract "C" from "2D" and record as "Y".

NOTE

The results of "X" and "Y" can be negative numbers.

5. Add "X" and "Y" and record as "E".

k. Repeat steps b through j on the opposite elevator tab.

l. If deflection of the tab is within the allowable limits, the tab and its linkage are in good condition.

m. If the free play is excessive, disconnect the trim tab actuator rod and visually inspect the bolts and bushing for indications of excessive wear. Replace excessively worn parts.

CHART 1
ELEVATOR TAB FREE PLAY LIMITS

1.5 POUND
READING

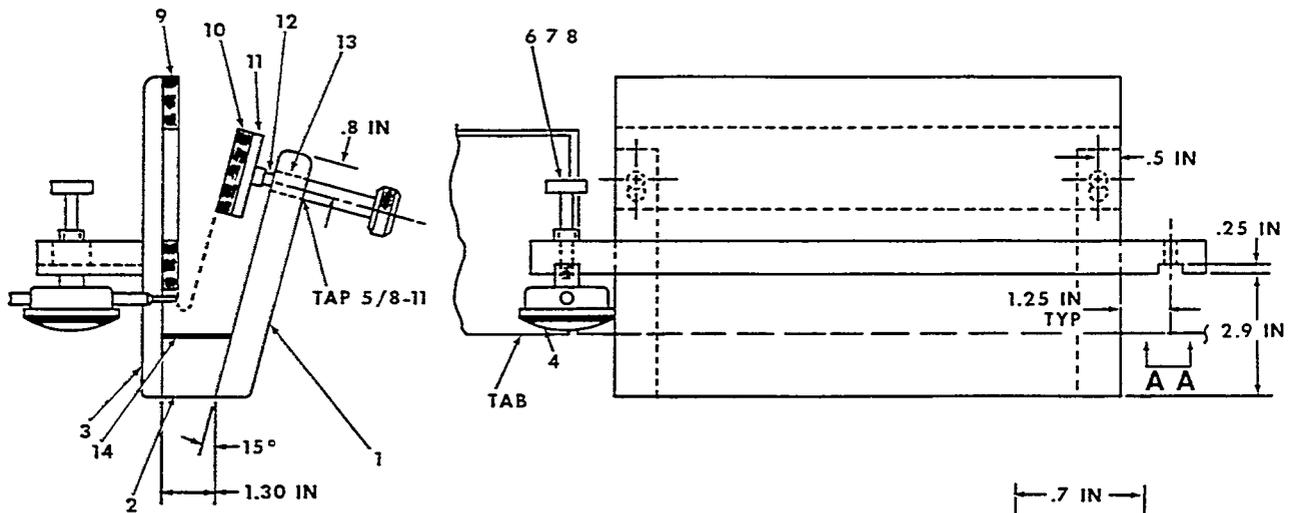
3-POUND
READING

B _____
2B _____ - A _____ = X _____

D _____
2D _____ - C _____ = Y _____

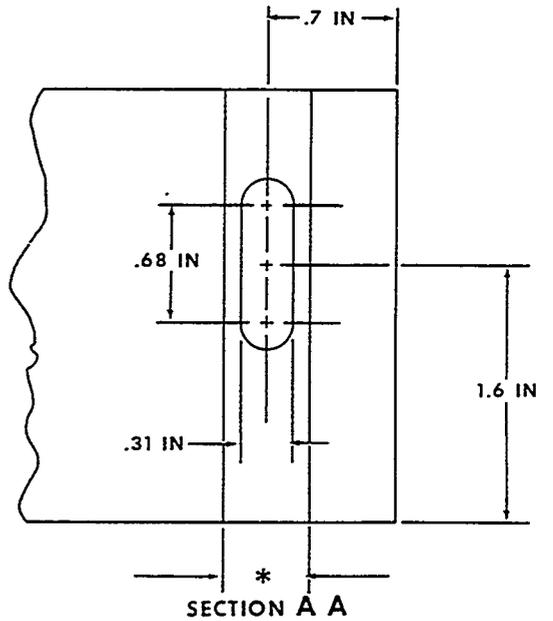
X _____ + Y _____ = E _____

(E = 0.050 inch maximum).



ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 x 1 x 6 aluminum or equiv.
2	2	1 x 1 3/8 x 1 3/4 aluminum or equiv.
3	1	1/2 x 7 1/2 x 10 aluminum or equiv.
4	1	C81Q Indicator**
5	1	3/4 x 2 1/2 x 14 aluminum or equiv.
6	1	1/4 Dia. x 2 corrosion res. stl.
7	1	1/4 Dia. x 1 corrosion res. stl.
8	1	1/4-28 nut
9	1	3/8 x 5 x 10 rubber
10	1	3/8 x 2 x 10 rubber
11	1	1/4 x 2 x 10 corrosion res. stl.
12	2	1/2 x 13 x 3 VLIER Torque screw
13	2	KN813 Keensert or tap 1/2 - 13
14	2	1/8 x 1 x 3/4 rubber

**P/N of Federal Products Corp., Providence, R. I.



* THIS GROOVE TO BE A SNUG FIT TO THE SCREW BRACKET ON THE DIAL INDICATOR

100-135-8

Figure 4-4B. Fabricating Check Fixture for Tab Deflection

RUDDER SYSTEM (Figure 4-6)

RUDDER REMOVAL

- a. Detach the tail cone, disconnect the tail navigation light wire and remove the tail cone.
- b. Remove the tail section access doors on the left hand side of the aft fuselage.
- c. Disconnect the four attach bolts from the rudder bell crank.
- d. Disconnect the rudder hinges and rudder bond cable.
- e. Remove the rudder.

RUDDER INSTALLATION

- a. Installation of the rudder may be accomplished by reversing the rudder removal procedure.
- b. Torque the four bolts that attach the rudder to the rudder bell crank to 50-70 inch-pounds.

RIGGING THE RUDDER CONTROL SYSTEM

- a. Place the rudder pedals in the aft position.
- b. Install a rig pin in the holes provided in the pilots rudder pedals.

NOTE

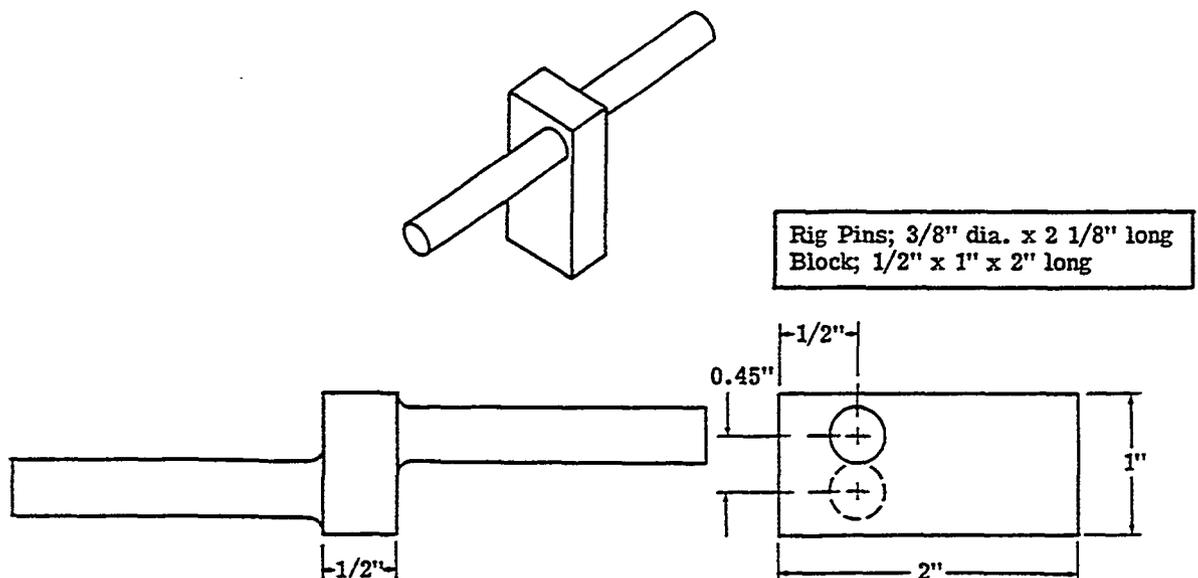
The right hand rudder pedals are rigged .45 inch forward of the neutral position.

- c. Rig cables to the tension shown on the Rudder Cable Tension Temperature Graph, with the bell crank in the neutral position, then remove the rig pin.
- d. Adjust the rudder travel at the rudder bell crank stops to $25^{\circ} \pm 1^{\circ}$ left and right.
- e. Adjust the rudder pedal travel at the rudder pedal stops so that contact of the rudder bell crank stops occurs immediately prior to contact of the rudder pedal stops.
- f. Make sure that the rudder movement corresponds to the movement of the rudder pedals.

NOTE

Installing the rig pin in the pilots rudder pedals, will bring the copilots pedals to the same adjustment as the pilots pedals.

To facilitate rigging of the rudder pedals to the above procedures a rigging tool may be fabricated from a steel block 1/2 inch x 1 inch x 2 inches; and two 3/8 inch x 2-1/8 inch long pins. The rig pins are located parallel and forward of the block, one on each side, and welded. The rig pins should be spaced as noted in the illustration. (Refer to Figure 4-5).

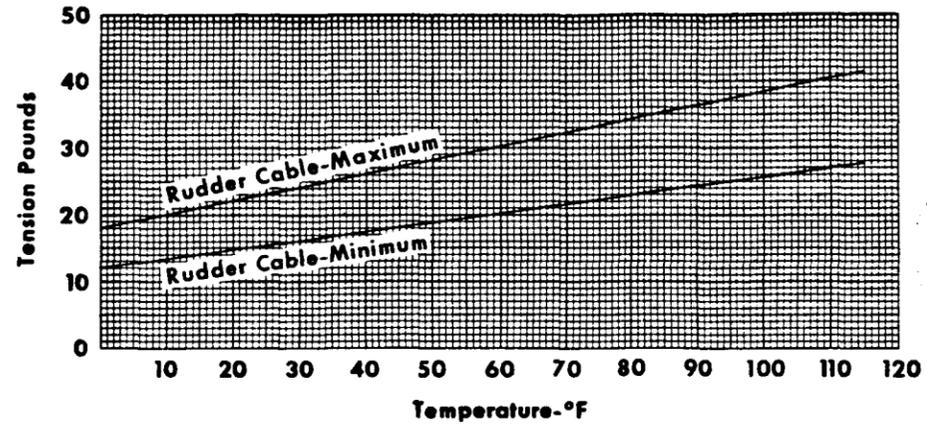


55-154-5

Figure 4-5. Rudder Pedal Rig Tool

RUDDER CONTROL SYSTEM

TEMPERATURE CABLE TENSION GRAPH



CABLES	CABLE TENSION	SURFACE TRAVEL
RUDDER	25 LBS +5 LBS AT -5 59°F	25° ± 1 LEFT AND RIGHT

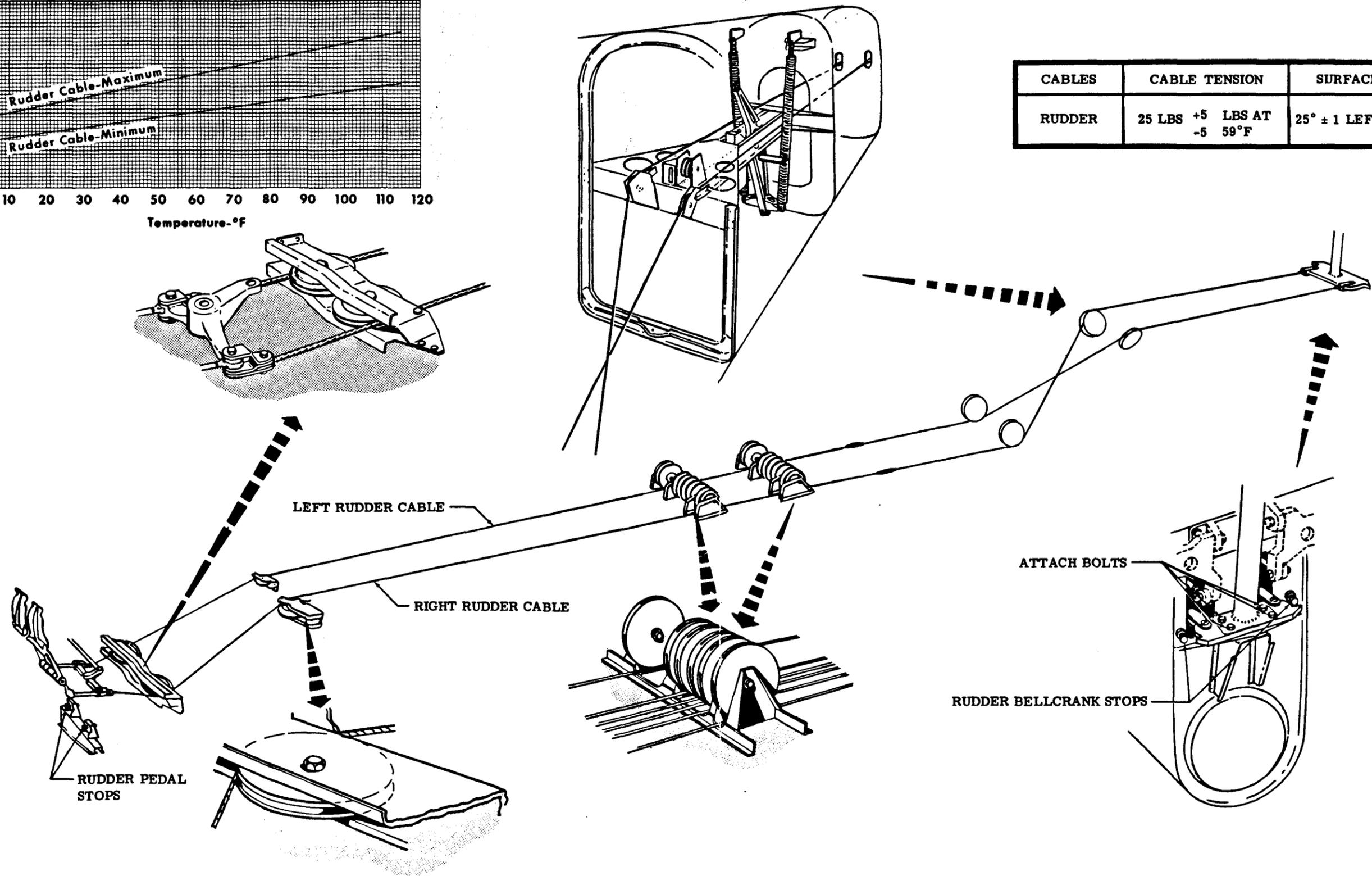


Figure 4-6. Rigging the Rudder Control System

BALANCING CONTROL SURFACES

AILERON

BALANCING THE AILERON

(Figure 4-7)

When the aileron control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. After any repainting or repair, the finished surface must be check balanced to ensure that its static moment about the hinge line is within the prescribed limits. The painted aileron assembly must be nose-heavy by 0.2 to 1.5 inch-pounds. The static moment of the aileron is determined by multiplying the unbalanced weight of the aileron assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced control surface is 0.0 inch-pounds. A tail-heavy surface exhibits static underbalance. A nose-heavy surface exhibits static overbalance.

CHECKING BALANCE

The aileron balance must be checked in a draft free area with the aileron completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

a. Counterbalancing - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the aileron assembly.

b. Actual Force Measurement - Measurement of the force applied by the aileron surface on a single support at a known distance from the center line of the hinge.

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING

a. A stand with knife edge supports as illustrated in Figure 4-7. The knife edges must be in the same horizontal plane.

b. A paper cup or similar light weight container.

c. Approximately 1 pound of lead shot.

d. A certified beam balance weighing device calibrated in units of .01 pound or less.

e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE

COUNTERBALANCING METHOD

a. Locate the chord line by placing a straight edge at the inboard end of the aileron assembly so that one end is on the trailing edge and the other end is centered on the leading edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.

b. Fit the correct size bolts in the hinge brackets and mount the aileron on the knife edge supports. Ascertain that the aileron is free to rotate about the hinge line.

c. To determine if weight should be added or removed, suspend a paper cup from a point near the center of the aileron trailing edge. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in Figure 4-7. The cup must be free to hang vertically.

d. Add small quantities of lead shot to the cup until the aileron balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.

e. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.

f. Remove the cup, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

g. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".

2. The over or underbalance moment is designated by "M".

3. $M = W \times D$

4. The following is a typical example of a balancing calculation: Assume the aileron is overbalance (nose-heavy) and the paper cup was suspended from the trailing edge. Assume that the aileron balances with the chord line level at "W = .150 pound" and "D = 10.0 inches", then . . .

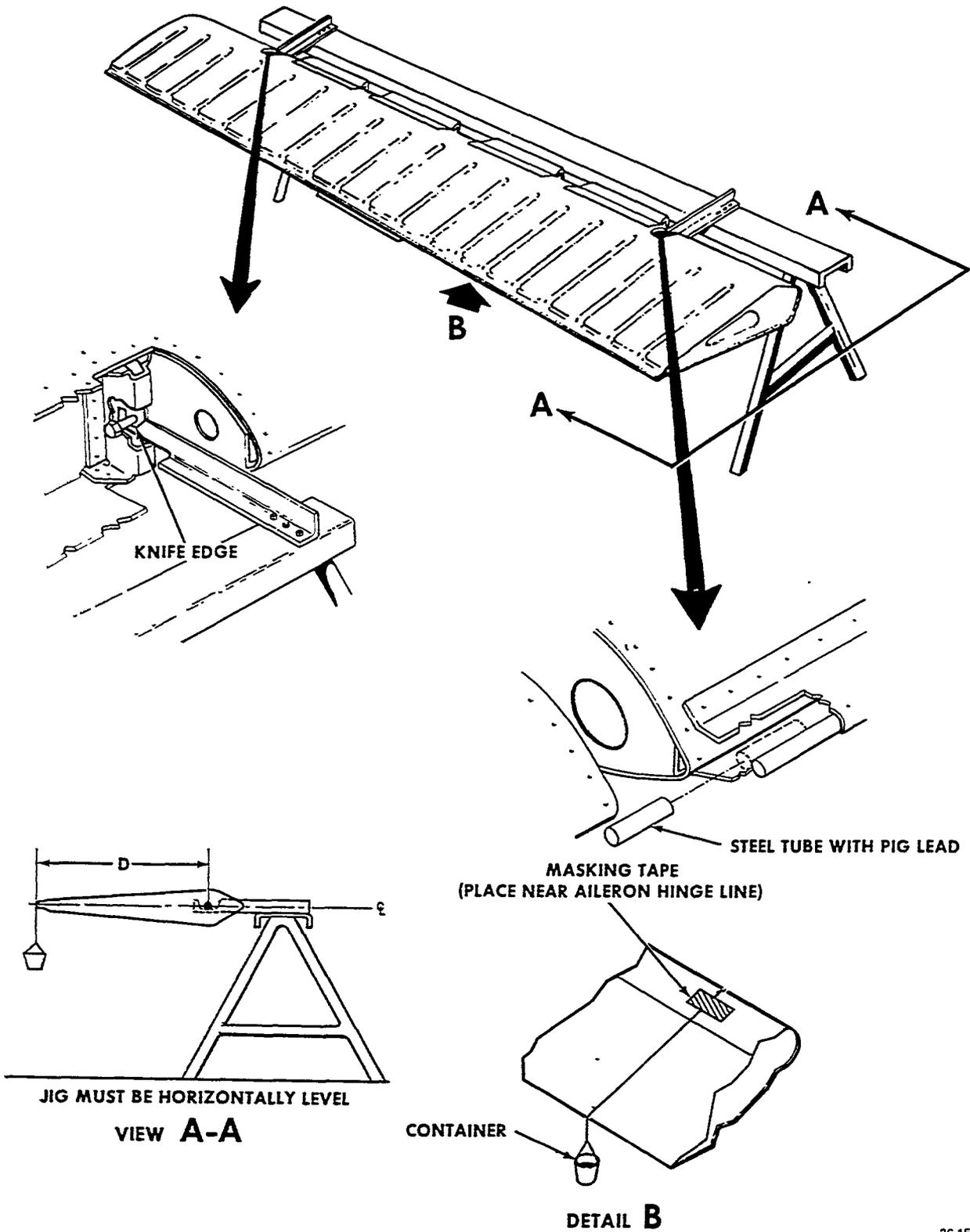
$M = .150 \times 10.0$

M = 1.50 inch-pounds. The product of "W x D". In this instance, "M" is within the required static balance range and is therefore acceptable.

h. The painted aileron assembly must be nose-heavy by 0.2 to 1.5 inch-pounds. The center of gravity of the aileron is forward of the hinge center line causing the surface to be nose-heavy. Proper aileron balance is obtained by adding or removing lead rod at the leading edge of the aileron. The rod is 15/32 inch diameter and is installed in brackets attached to the leading edge of the aileron. When adding additional lead rod the maximum total of the length of the rod to be added is not to exceed 5 inches. Add additional rod at the center brackets.

CAUTION

When a lead rod is added to obtain correct balance, it must be installed securely with rivets. A loosely installed rod will vibrate and may cause an undesirable vibration of the surface.



36-151-1A

Figure 4-7. Balancing the Aileron

ELEVATOR

BALANCING THE ELEVATOR

(Figure 4-8)

When the elevator control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. After any repainting or repair, the finished surface should be check balanced to ensure that its static moment about the hinge line is within the manufacturers prescribed limits. The complete elevator assembly, painted or unpainted, including the control arm and the tab control rod should not be tail-heavy over a maximum moment of 7.8 inch-pounds. The static moment is the total unbalanced weight of the elevator control surface multiplied by the perpendicular distance from its hinge center line to the center of gravity, when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced elevator control surface is 0.0 lb. A tail-heavy surface exhibits static underbalance. A nose-heavy surface exhibits static overbalance.

CHECKING BALANCE

The elevator balance must be checked in a draft free area with the elevator completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, tab push rod, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

- a. Actual Force Measurement - Measurement of the force applied by the elevator surface on a single support at a known distance from the center line of the hinge.
- b. Counterbalancing - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the elevator assembly.

CHECK BALANCE BY FORCE MEASUREMENT

The equipment required to perform the check balance by force measurement is as follows:

- a. A stand with knife edge supports as illustrated in Figure 4-8. The knife edges should be in the same horizontal plane.
- b. A certified beam balance calibrated in units of .01 lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2.0 lbs. minimum.
- c. A support spindle similar to the illustration and levelling blocks, as required. (Blocks + spindle = tare).
- d. A straight edge, rule and spirit level.

BALANCING PROCEDURE FORCE MEASUREMENT METHOD

Locate the chord line by placing a straight edge at the inboard end of the elevator so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straight edge. Fit correct size bolts in the outboard and center hinge brackets and mount the elevator on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a levelled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle, or by using blocks and shims under the spindle. Measure the perpendicular distance from the hinge center line to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance. Calculate the static underbalance moment "M" from the formula:

$M = D(R-T)$ inch-pounds where,

D = Perpendicular distance from the hinge center line to the spindle point (inches).

R = Reaction (Pounds) read from the beam balance.

T = Tare, i.e. spindle plus leveling blocks or shims on the scale platform (Pounds).

EXAMPLE

D is 13.5 inches, R is 1.49 lb. and T = 1.00 lb.

$M = 13.5 (1.49 - 1.00)$; $M = 6.6$ inch-pounds

M is within the range which is satisfactory.

If M is not within the prescribed range, refer to step i. under BALANCING PROCEDURE COUNTER BALANCING METHOD.

CHECK BALANCE BY COUNTER BALANCING

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING BY COUNTER BALANCING

- a. A stand with knife edge supports as illustrated in Figure 4-8. The knife edges must be in the same horizontal plane.
- b. A paper cup or similar light weight container.
- c. Approximately 2 pounds of lead shot.
- d. A certified beam balance weighing device calibrated in units of .01 pound or less.
- e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE COUNTER BALANCING METHOD

a. Locate the chord line by placing a straight edge at the inboard end of the elevator assembly so that one end is on the hinge center line and the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.

b. Secure the trim tab in its neutral position with a small piece of masking tape.

c. Fit the correct size bolts in the hinge clevises and mount the elevator on the knife edge supports. Ascertain that the elevator is free to rotate about the hinge line.

d. To determine if weight should be added or removed, use a short length of small diameter string secured to the surface with a small piece of masking tape and the cup hanging vertically as illustrated in Figure 4-8. Slightly loosen the forward top screw on the elevator leading edge tip. Suspend a paper cup on the inboard side of the tip and wrap the string around the screw. Secure the string to the surface with a small piece of masking tape aft of the top forward screw and near the hinge center line as shown in Figure 4-8. The cup must be free to hang vertically.

CAUTION

Be certain the forward top screw on the elevator leading edge tip is secured after the elevator has been balanced.

e. Add small quantities of lead shot to the cup until the elevator balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.

f. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.

g. Remove the cup, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

h. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".

2. The over or underbalance moment is designated by "M".

3. $M = W \times D$

4. The following is a typical example of a balancing calculation: Assume the elevator is underbalance (tail-heavy) and the paper cup was suspended from the horn. If the elevator balances with the chord line level at "W = 0.60 pound" and "D = 12.6 inches", then . . .

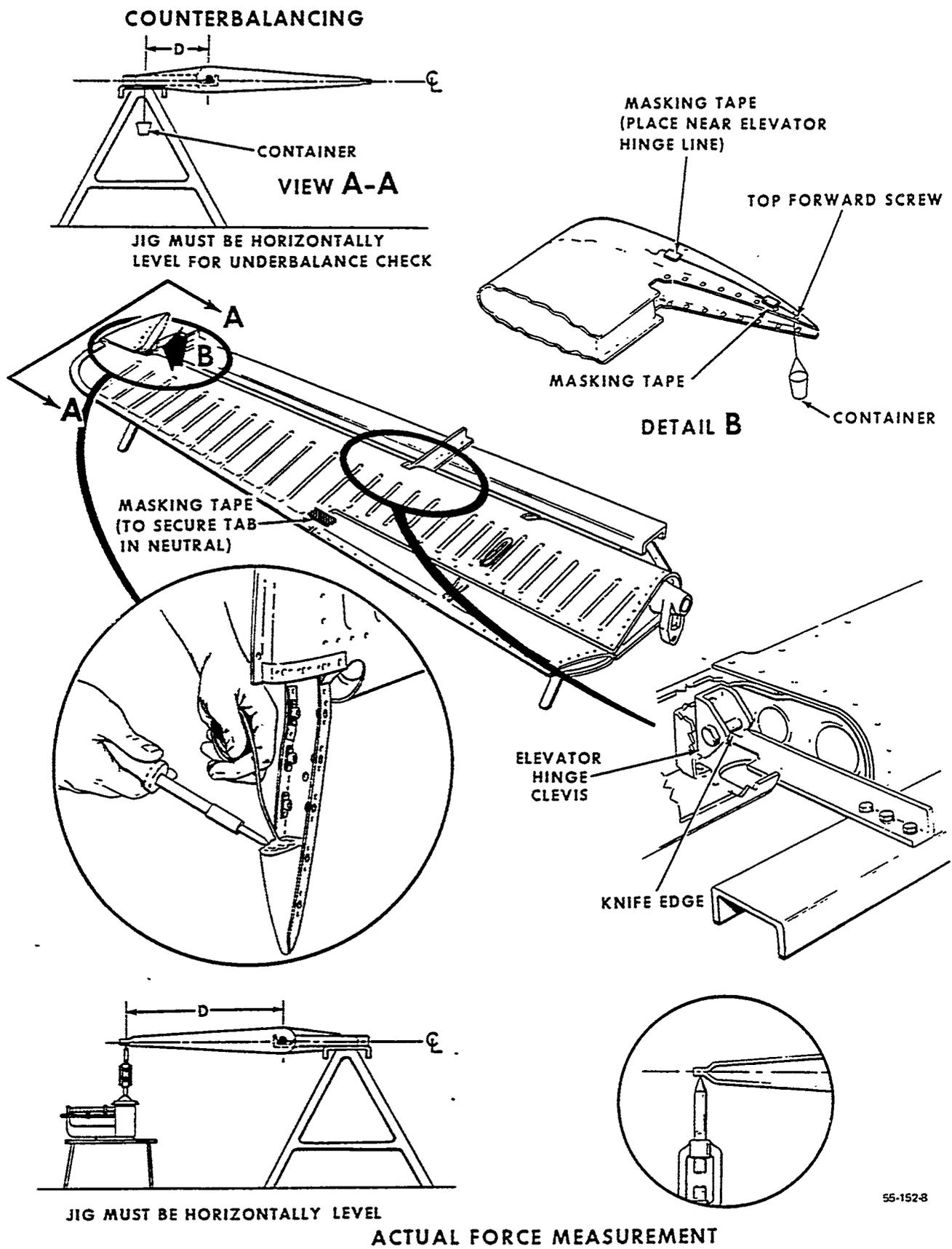
$$M = 0.60 \times 12.6$$

$M = 7.6$ inch-pounds. In this instance, "M" is within the required static balance range and is therefore acceptable.

i. The complete elevator assembly, painted or unpainted including the control arm and the tab control rod, must not be tail-heavy over a maximum moment of 7.8 inch-pounds. If the static balance does not comply, remove the elevator horn cover and add or remove solder to bring the elevator balance within required limits.

NOTE

Coat the weight with a corrosion preventative material such as zinc chromate primer to insulate the dissimilar metals. Replace the elevator horn cover and recheck the balance.



55-152-8

Figure 4-8. Balancing the Elevator

RUDDER

BALANCING THE RUDDER

(Figure 4-9)

When the rudder surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. After any repainting or repair, the finished surface must be check balanced to ensure that its static moment about the hinge line is within the manufacturers prescribed limits. The complete rudder assembly, painted or unpainted including the control arm should not be tail-heavy over a maximum of 8.4 inch-pounds. The static moment of the rudder is determined by multiplying the unbalanced weight of the rudder assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced rudder assembly is 0.0 inch-pounds. Tail heaviness indicates static underbalance while nose heaviness indicates static overbalance.

CHECKING BALANCE

The rudder balance must be checked in a draft free area with the rudder completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

- a. Actual Force Measurement - Measurement of the force applied by the rudder surface on a single support at a known distance from the center line of the hinge.
- b. Counterbalancing - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the rudder assembly.

CHECK BALANCE BY FORCE MEASUREMENT

The equipment required to perform the check balance by force measurement is as follows:

- a. A stand with knife edge supports as illustrated in Figure 4-9. The knife edges should be in the same horizontal plane.
- b. A certified beam balance calibrated in units of .01 lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2.0 lbs. minimum.
- c. A support spindle similar to the illustration and levelling blocks as required. (Blocks + spindle = tare).
- d. A straight edge, rule and spirit level.

BALANCING PROCEDURE FORCE MEASUREMENT METHOD

Locate the chord line by placing a straight edge at the inboard end of the rudder so that one end is aligned with the center of the torque tube and the other end is centered

on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straight edge. Fit correct size bolts in the outboard and center hinge brackets and mount the rudder on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a levelled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle, or by using blocks and shims under the spindle. Measure the perpendicular distance from the hinge center line to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance. Calculate the static underbalance moment "M" from the formula:

$M = D(R-T)$ inch-pounds where,

D = Perpendicular distance from the hinge center line to the spindle point (inches).

R = Reaction (Pounds) read from the beam balance.

T = Tare, i.e. spindle plus levelling blocks or shims on the scale platform (Pounds).

EXAMPLE

D is 13.8 inches, R = 1.49 lb. and T is 1.00 lb.

$M = 13.8 (1.49 - 1.00)$; $M = 6.8$ inch-pounds.

M is within the range which is satisfactory.

If M is not within the prescribed range, refer to step h, under BALANCING PROCEDURE COUNTER BALANCING METHOD.

CHECK BALANCE BY COUNTER BALANCING

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING BY COUNTER BALANCING

- a. A stand with knife edge supports as illustrated in Figure 4-9. The knife edges must be in the same horizontal plane.
- b. A paper cup or similar light weight container.
- c. Approximately 2 pounds of lead shot.
- d. A certified beam balance weighing device calibrated in units of .01 pound or less.
- e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE COUNTER BALANCING METHOD

a. Locate the chord line by placing a straight edge at the lower closure rib of the rudder so that one end is aligned with the center of the torque tube while the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.

b. Fit the correct size bolts in the hinge brackets and mount the rudder on the knife edge supports. Ascertain that the rudder is free to rotate about the hinge line.

c. To determine if weight should be added or removed, suspend a paper cup from a point near the center of the rudder trailing edge if the balance is nose-down or near the center of the horn leading edge if the balance is tail-down. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in Figure 4-9. The cup must be free to hang vertically.

d. Add small quantities of lead shot to the cup until the rudder balances with the chord line level. Check this by holding a spirit level aligned with the marked chord line.

e. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.

f. Remove the cup, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

g. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".

2. The over or underbalance moment is designated by "M".

$$3. M = W \times D$$

4. The following is a typical example of a balancing calculation: Assume the rudder was slightly underbalance (tail-heavy) and the paper cup was suspended from the horn leading edge. If the rudder balances with the chord line level at "W = .65 pound" and "D = 12.5 inches", then . . .

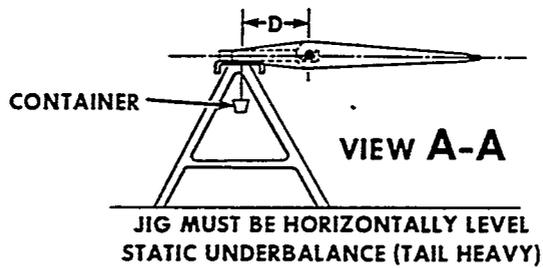
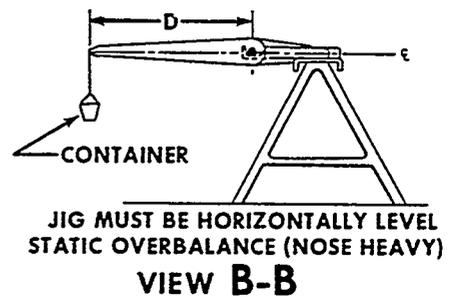
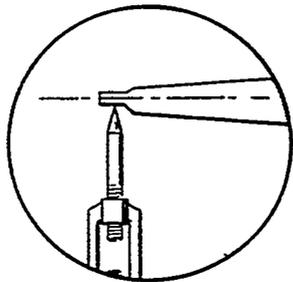
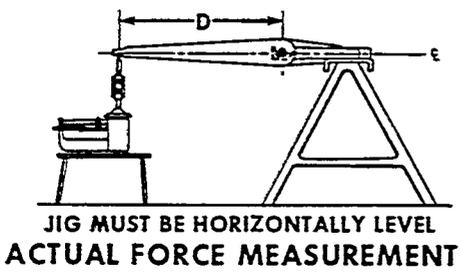
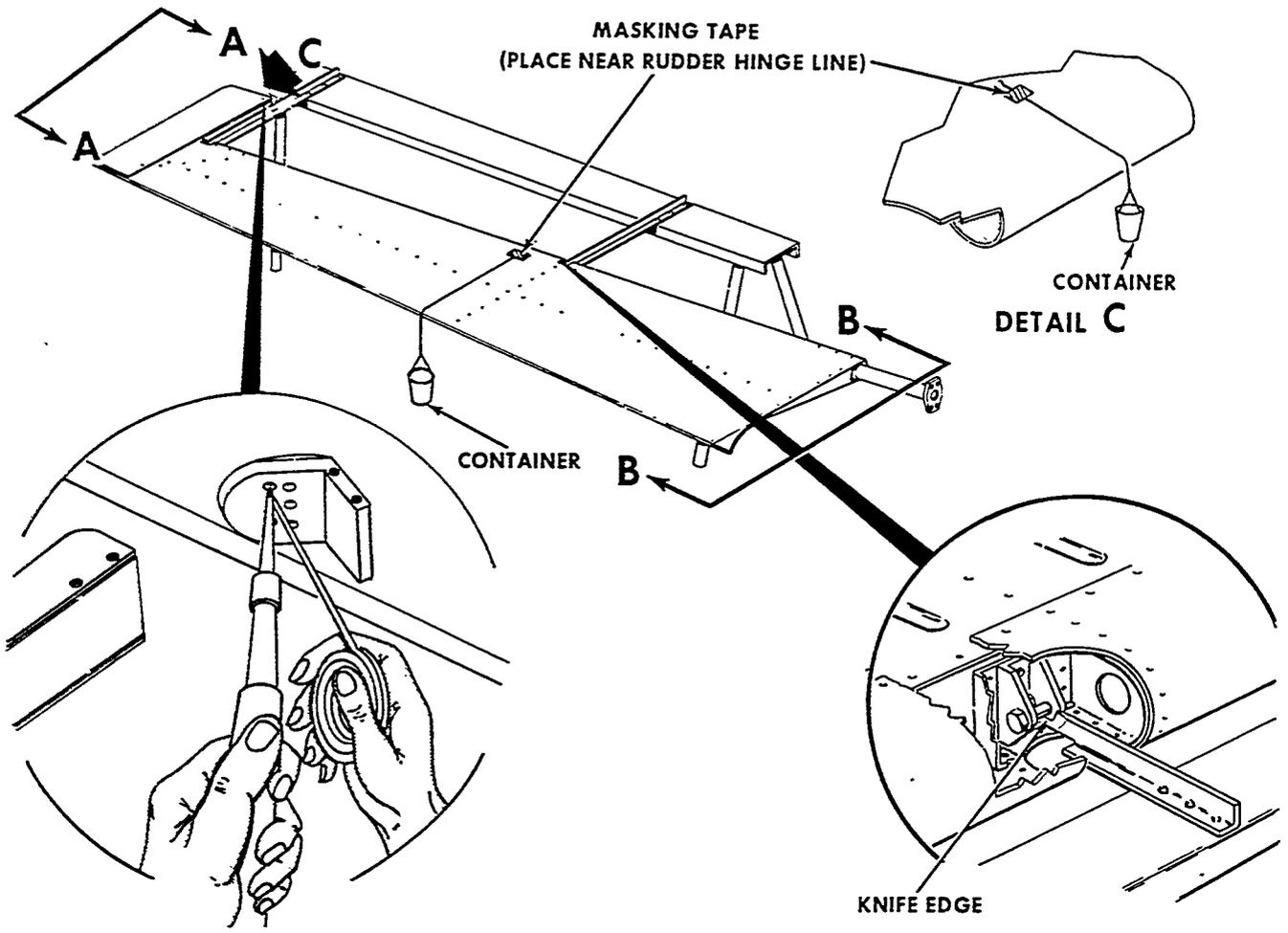
$$M = .65 \times 12.5$$

M = 8.1 inch-pounds. In this instance, "M" is within the required static balance range and is therefore acceptable.

h. The complete rudder assembly, painted or unpainted, including the control arm must not be tail-heavy over a maximum of 8.4 inch-pounds. If the static balance does not comply, remove the weight in the rudder horn and add or remove solder to bring the rudder balance within required limits.

NOTE

Coat the weight with a corrosion preventative material such as zinc chromate primer to insulate the dissimilar metals. Replace the weight in the rudder horn and recheck the rudder balance.



36-153-6A

Figure 4-9. Balancing the Rudder

FLAPS

The flaps are electrically operated and are hinged in specially designed tracks. When extended, the flap moves rearward as it pivots downward. This gives a large effective wing area, which produces additional lift and drag.

NOTE

In event of emergency flap extension at speeds above the normal extension speeds inspect the flaps for damage or distortion before the next flight.

FLAP REMOVAL

- a. Remove the bolt from the flap actuating arm.
- b. Remove the bonding cable from the flap tracks.
- c. Remove the bolts from the flap track brackets and remove the flap.

FLAP INSTALLATION

- a. Hold the flap in position and install the rollers and the bolts in the flap track bracket.

NOTE

Install the flap track rollers (four rollers per flap and two rollers per track) in the flap track brackets with the flanges of the rollers in one track facing the flanges of the rollers in the other track.

- b. Connect the bonding cable and install the bolt in the flap actuating arm.

FLAP TRACK WEAR LIMITS

The allowable track wear on the bearing surfaces is .032 inch resulting in a maximum flap track slot dimension of .785 inch. The allowable wear into the track side surface is .050 inch. Track wear within the preceding limitations may be dressed smooth with light emery cloth to prevent roller binding. Molykote Z mixed with naphtha may be brushed on the flap tracks during servicing of the airplane.

FLAP LIMIT SWITCH ADJUSTMENT

(Figure 4-10)

NOTE

Battery voltage is not sufficient to properly cycle the flaps during rigging. A $14.25 \pm .25$

volt power supply capable of maintaining the voltage setting should be used for serials prior to E-1241, except E-1111 and a $28.25 \pm .25$ volt power supply capable of maintaining the voltage setting for serials E-1111, E-1241 and after. If an external power receptacle is not available on the airplane, jumper cables may be used between the battery and the power supply. Be sure of the polarity before making the connection.

CAUTION

Excessive operation of the flap motor without proper cooling may cause damage to the motor. Allow a short cooling time after each extension and retraction cycle.

The flap limit switches are mounted on a bracket and installed on the outboard side of the inboard flap track in the left wing panel. The limit switches, control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of travel. They are accessible by lowering the flaps.

TWO POSITION FLAPS (E-1 through E-1370)

There are two limit switches in this system, one for the up limit position, and one for the down limit position. To adjust the flap to neutral position, loosen the screws of the switch assembly so that the assembly can pivot on the forward elongated hole. Adjust the switch as necessary to stop the flaps in neutral position. Actuate the flap switch to the down position and measure the degrees of travel. (Proper degree of travel is $30^\circ + 0^\circ - 2^\circ$.) Adjustment of the down position of the flaps is made on the downlimit switch.

THREE POSITION FLAPS (E-1371 and after)

The limit switches, one for up, two for the approach position and one for the down travel, control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of selected travel. The switches are accessible by lowering the flaps.

The flap travel is adjusted by moving the limit switches. The left flap is rigged first and then the right flap is synchronized with it. Rig as follows:

NOTE

Rig the flaps under a simulated flight load to reduce overtravel to a minimum after the limit switches have been adjusted.

- a. Adjust the uplimit switch so the flap will stop at the 0° position (determined by the flap travel board).
- b. Adjust the 14° limit (inboard) switch in its mounting slot until the flap is positioned at 14° to 14.5° after the flap has been actuated from the up to takeoff position (15° range). Adjust the 16° limit (outboard) switch in its mounting slot until the flap is positioned at 16° to 15.5° after the flap has been actuated from the down to takeoff position (15° range).
- c. Adjust the downlimit switch in its mounting slot until it actuates at 28° to 30° of flap travel.
- d. Remove the bolt attaching the right actuator to the right flap.
- e. Turn the jackscrew on the right actuator in or out to align the right flap with the left.
- f. Install the bolt connecting the actuator to the flap.

CAUTION

If the flaps are removed for any reason the main power switch should be in the OFF position.

NOTE

After the flap is completely rigged, adjust the rubber bumper (flap down) installed on the flap and aileron dividing rib. Turn the adjusting screw in or out, as required, to take out play or stop vibration when the flap is in the up position. A distinct change in the sound of the flap motor near the completion of the flap up travel may indicate an excessive outward adjustment of the bumper.

- g. Operate the flaps through full travel to ensure that the flaps contact the limit switches before they contact the rubber bumper.

FLAP POSITION INDICATOR AND ADJUSTMENT (Figure 4-10)

The flap position indicator gage is installed in the instrument panel. An adjustable flap position indicator

transmitter is installed on the flap actuator in the left wing just forward of the rear spar to coordinate gage reading with flap travel.

- a. Adjust the flap travel limit switches to provide the correct up and down travel of the flaps. (See Flap Limit Switch Adjustment.)
- b. Run the flaps down and check the pilot's compartment flap position indicator for 100% flaps. If down flaps are not indicated, loosen the transmitter attachment bolts and adjust transmitter fore and aft or rotate slightly until the reading is correct, then tighten the transmitter attaching bolts.
- c. Run the flaps up and check the indicator for up flaps reading.

FLAP MOTOR REMOVAL (E-1 thru E-953)

- a. Remove the front seat assemblies.
- b. Remove the access cover.
- c. Detach the clamp that supports the electrical wiring from the right hand flap shaft housing.
- d. Remove the woodruff key keepers and disconnect the flap shafts from the motor.
- e. Disconnect the motor electrical wiring (except the ground wire) at the quick disconnects.
- f. Remove the flap motor attaching bolts, and the ground wire that is secured to one of the bolts. Remove the flap motor.

FLAP MOTOR INSTALLATION (E-1 thru E-953)

- a. Place the flap motor in position and secure with the flap motor attaching bolts. Ensure that the ground wire is attached to one of the bolts.
- b. Connect the flap motor electrical wiring at the quick disconnect.
- c. Connect the flap shafts to the motor and install the woodruff keys.
- d. Attach the clamp that supports the electrical wiring to the right hand flap shaft housing.
- e. Install the access cover.
- f. Install the front seat assemblies.

TEMPORARY REVISION NO. 4-2

Manual Affected: Bonanza 36 Series Shop Manual (36-590001-3B).

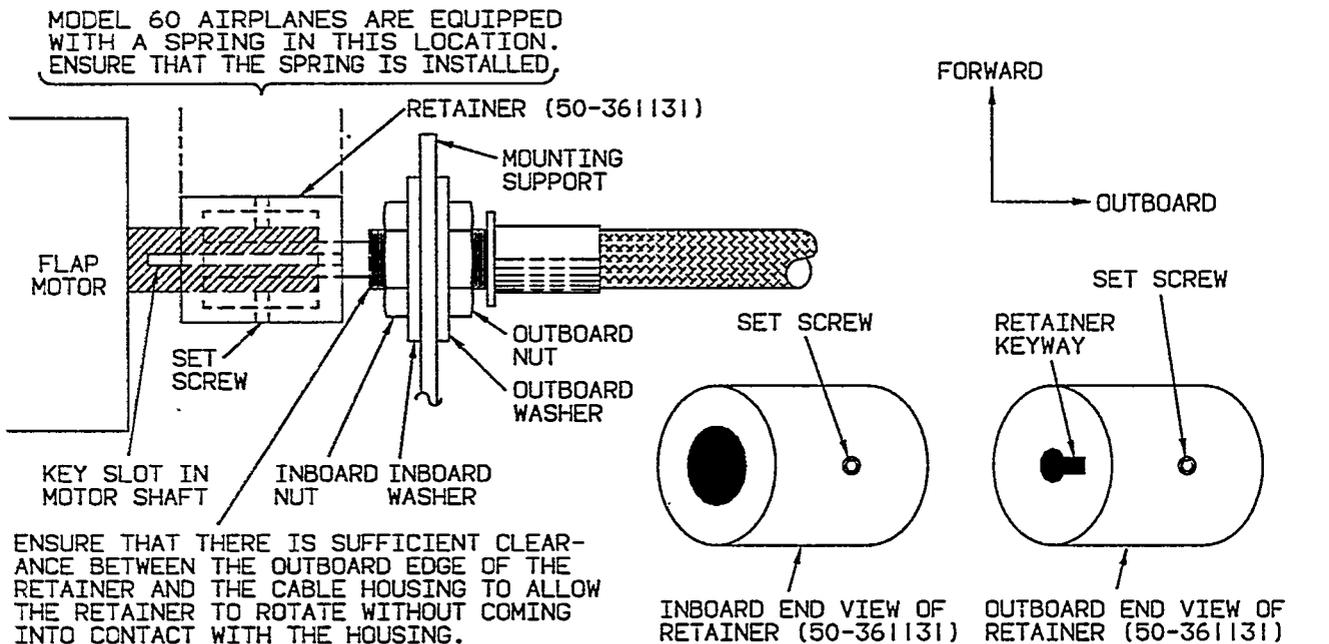
Filing Instructions: Insert adjacent to page 4-14B.

Reason: Revise procedures for flap drive cable connection.

FLAP DRIVE CABLE CONNECTION

Connect the LH and RH flap drive cables to the flap drive motor as follows, using the illustration for component locations:

- a. Install the outboard nut and washer as far as it will go on the threaded portion of the flap cable.
- b. Insert the retainer through the mount support and onto the motor shaft as far as it will go. Align the retainer keyway with the key slot in the flap motor drive shaft and tighten one set screw temporarily.
- c. While inserting the flap cable through the mount support, install the inboard washer and nut. Install the cable through the retainer and into the motor drive shaft until the keyway is just past the key slot in the retainer.
- d. Loosen the set screw that was tightened in Step b. Ensure that the retainer is still installed on the motor shaft as far as it will go and rotate the retainer 90°.
- e. Keep inboard pressure on the retainer and tighten both retainer set screws.
- f. Secure the flap drive cable to the mounting support by tightening the nuts. Tighten the inboard nut to ensure that there is sufficient clearance between the outboard edge of the retainer and the cable housing to allow the retainer to rotate without coming into contact with the cable housing. If the threaded part of the cable housing is not long enough to install the two nuts and washers, using a die, add 5/8-24 UNEF threads until .88 inch thread length is reached. Tighten the outboard nut against the mounting support.



C93D#0480116 C

FLAP MOTOR REMOVAL (E-954 and after)

CAUTION

The flap motor used on airplane serials E-954 and after, is NOT interchangeable with the flap motor used on prior serials. In the event of flap motor failure or it is determined that major overhaul is required for the flap motor to operate properly, the flap motor should be replaced. No attempt should be made to overhaul the motor in the field.

- a. Remove the front seat assemblies.
- b. Remove the spar cover.
- c. Detach the clamp supporting the electrical wiring from the right hand flap shaft housing.
- d. Remove the woodruff key keepers and disconnect the flap shafts from the motor.
- e. Disconnect the motor electrical wiring at the quick disconnect.
- f. Remove the flap motor attaching bolts and remove the flap motor.

FLAP MOTOR INSTALLATION (E-954 and after)

CAUTION

The flap motor used on airplane serials E-954 and after, is NOT interchangeable with the flap motor used on prior serials. In the event of flap motor failure or it is determined that major overhaul is required for the flap motor to operate properly, the flap motor should be replaced. No attempt should be made to overhaul the motor in the field.

- a. Place the flap motor in position and secure with the flap motor attaching bolts.
- b. Connect the flap motor electrical wiring at the quick disconnect.
- c. Connect the flap shafts to the motor and install the woodruff keys.
- d. Attach the clamp that supports the electrical wiring from the right hand flap shaft housing.
- e. Install the spar cover.
- f. Install the front seat assemblies.

FLAP SHAFT REMOVAL

- a. Remove the retainer nut on the flap shaft that is being removed, at the flex cable support bracket.
- b. Remove the woodruff key keepers and disconnect all clamps securing the shaft housing to the wing structure.
- c. Disconnect the flap actuator from the wing flap and the wing spar section.
- d. Pull the actuator and flap shaft housing out of the wing.

FLAP SHAFT INSTALLATION

- a. Pull the flap shaft and housing through the wing and attach the actuator to the wing flap and the wing spar section.
- b. Set the flaps in the neutral position.
- c. Install the flap shaft retainer nut.
- d. Install the clamps securing the shaft housing to the wing structure.

FLAP ACTUATOR REMOVAL

- a. Place the airplane on jacks and retract the landing gear until the inboard door is open.
- b. Lower the flaps and disconnect the flap actuator from the flaps.

NOTE

To retain the original rigging of the flaps, mark the extension of the flap actuator before it is removed so that it may be installed in the same position.

- c. Remove the dust cover in the rear section of the wheel well to gain access to the flap position transmitter and flap actuator.

NOTE

The flap position transmitter is on the left hand flap actuator only.

- d. Remove the flap position transmitter from the flap actuator.
- e. Remove the snap ring and disconnect the flexible drive housing.
- f. Remove the pivot bolts from the flap actuator mounting bracket and remove the flap actuator.

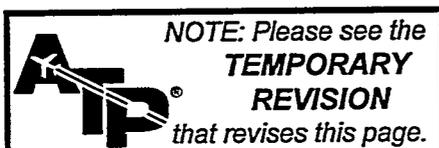
FLAP ACTUATOR INSTALLATION

- a. Place the flap actuator in position and secure it to the flap actuator mounting bracket with pivot bolts.
- b. Connect the flexible drive housing and install the snap ring.
- c. Install the flap position transmitter to the flap actuator.

NOTE

The flap position transmitter is on the left hand flap actuator only.

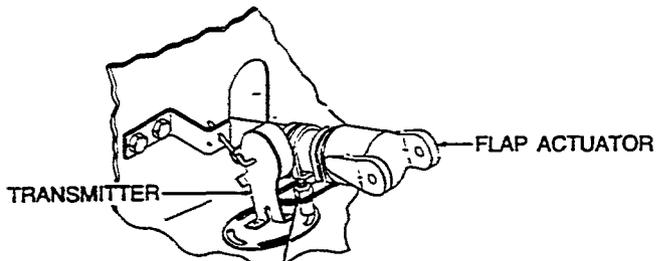
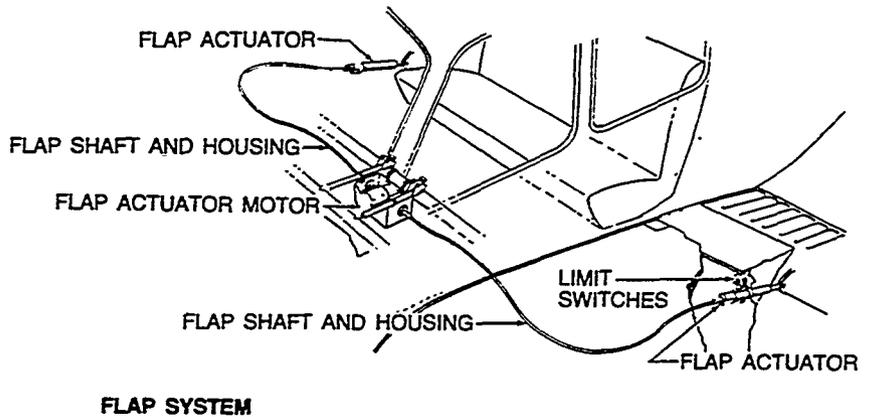
- d. Install the dust cover in the rear section of the wheel well.
- e. Connect the flap actuator to the flaps.
- f. Check the flap rigging.



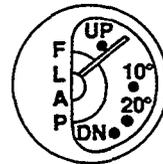
FLAP SETTING

E-1 THROUGH E-1370
 FULL UP = 0°
 FULL DOWN = 30° + 0° - 2°

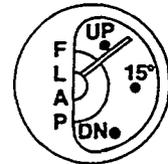
E-1371 AND AFTER
 FULL UP = 0°
 APPROACH = 15°
 FULL DOWN = 30° + 0° - 2°



TO ADJUST, LOOSEN MOUNTING BOLTS AND MOVE FORE AND AFT, OR ROTATE SLIGHTLY.

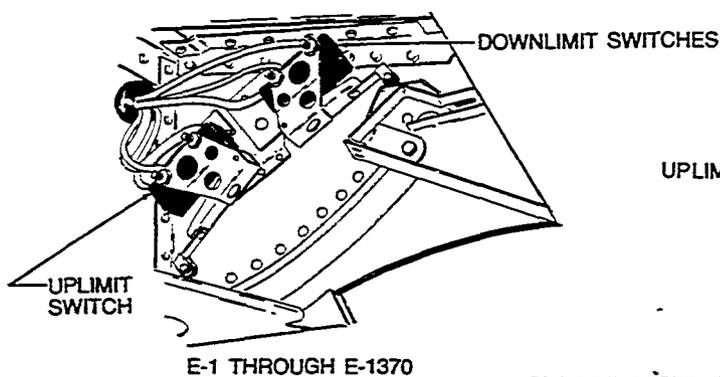


INDICATOR
 E-1 THROUGH E-1370

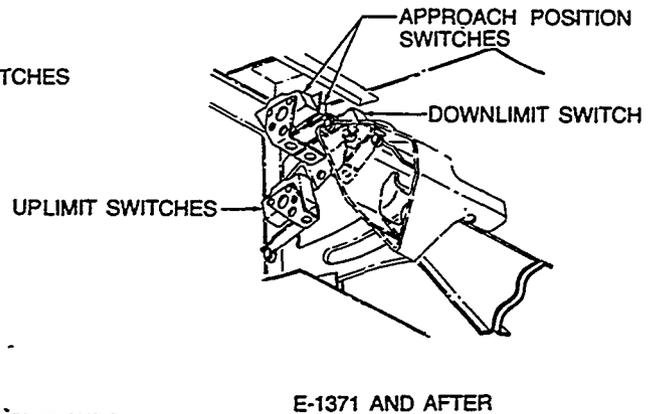


INDICATOR
 E-1371 AND AFTER

FLAP TRANSMITTER AND INDICATOR



FLAP LIMIT SWITCHES



36-161-12

Figure 4-10. Flap System

NOTE

For correct adjustment and rigging of the flap position transmitter refer to the Flap Position Indicator and Adjustment in this section.

FLAP ACTUATOR DISASSEMBLY AND ASSEMBLY (Figure 4-11)

- a. Remove the snap ring (1) to disconnect the flexible shaft (2) from the actuator.
- b. Tap on the piston plug (3) to drive out the seal (5) spacers (4) and bearings (6).
- c. Slide the piston (7) out of the housing (8) and unscrew the flap actuator screw (9) from the piston.
- d. Remove the O-ring (10) from the housing.
- e. Drill out the pin (11) and take the plug out of the piston.

Clean all parts with (Item 15, Consumable Materials Chart) and inspect for cracks, corrosion, distortion and excessive wear. Replace the O-ring and seals. Coat the plug and pin with zinc chromate before assembly. Peen the pin and file it flush with the piston. Pack the bearings with (Item 11, Consumable Materials Chart). Lubricate the O-rings with (Item 7, Consumable Materials Chart) before inserting the piston in the housing.

Pour (Item 7, Consumable Materials Chart) into the piston until it is about two inches from being full. Slide a bearing on the screw. Start the screw in the piston and slide the piston into the housing. Install the remaining bearing and seal. Seat these parts in the housing with approximately 1,000 lbs. pressure, or use a suitable drift and mallet if a press is not available. Install the spacers, shaft and snap ring. Tap the piston plug with a rawhide mallet to seat the parts against the snap rings. End play between the piston and housing should be between .010 inch and .031 inch. Run the actuator in and out several times to assure proper operation in its full travel. Excess lubricant will be forced out of the vent hole the first time the actuator is run all the way up. Install the actuator with the vent hole up.

FLAP MOTOR GEARBOX DISASSEMBLY (Figure 4-12) (E-1 thru E-953)

CAUTION

The flap motor gearbox used on airplane serials E-954 and after, is NOT interchangeable with the flap motor gearbox used on prior serials. In the event of flap motor gearbox failure or it is determined that major overhaul is required for the flap motor gearbox to operate properly, the flap motor gearbox should be replaced. No attempt should be made to overhaul the gearbox in the field.

- a. Cut and remove all safety wire.
- b. Remove the two long screws from the motor brush housing to separate the motor and gearbox.
- c. Remove the screws which secure the cover plate (8) and gasket (7) to the gear housing.
- d. A small set screw (11) must be removed to allow the counter shaft (10) to be drawn out of the gearbox.
- e. Take out the worm and gear (14), washers (12, 15), bearing (16) and bearing cup (17).
- f. Slip the spacer (21) and washer (22) down enough to remove the control shaft (20).

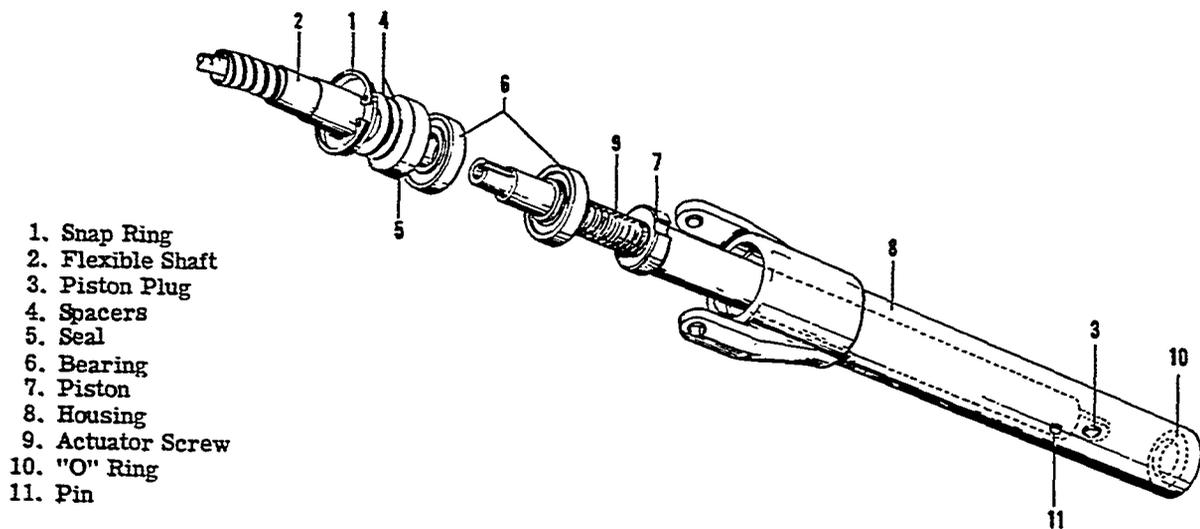
Clean all parts in (Item 15, Consumable Materials Chart) and inspect for worn, cracked or corroded components. Pay particular attention to the worm and worm wheel gear (19) and the bearings (9) in the side of the gearbox. Inspect the brushes of the flap motor for wear. The original length of the brushes is $\frac{1}{2}$ inch; if the length is less than $\frac{3}{16}$ inch they should be replaced. Refer to Airplane Parts Catalog for replacement brushes.

FLAP MOTOR GEARBOX ASSEMBLY (E-1 thru E-953)

CAUTION

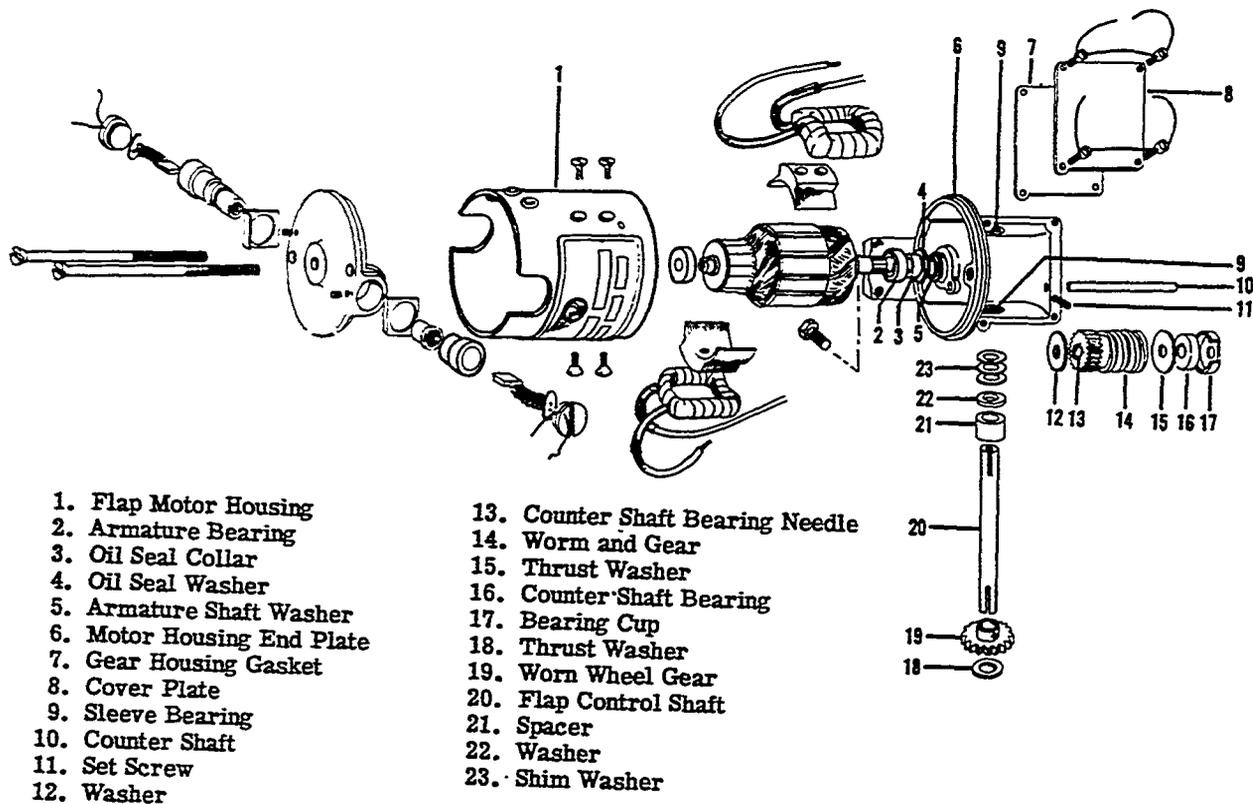
The flap motor gearbox used on airplane serials E-954 and after, is NOT interchangeable with the flap motor gearbox used on prior serials. In the event of flap motor gearbox failure or it is determined that major overhaul is required for the flap motor gearbox to operate properly, the flap motor gearbox should be replaced. No attempt should be made to overhaul the gearbox in the field.

- a. Slip the spacer (21) and washer (22) down enough to install the control shaft (20).
- b. Install the bearing cup (17), bearing (16), washers (12, 15) and worm and gear (14).
- c. Place the counter shaft (10) into the gearbox and install the small set screw (11).
- d. Fill the gearbox with lubricating grease (Item 11, Consumable Materials Chart).
- e. Install the cover plate (8) and gasket (7) to the gear housing and secure with screws.
- f. Install the gearbox to the motor and secure with the two long screws at the motor brush housing.
- g. Install all safety wire.



1. Snap Ring
2. Flexible Shaft
3. Piston Plug
4. Spacers
5. Seal
6. Bearing
7. Piston
8. Housing
9. Actuator Screw
10. "O" Ring
11. Pin

Figure 4-11. Flap Actuator



1. Flap Motor Housing
2. Armature Bearing
3. Oil Seal Collar
4. Oil Seal Washer
5. Armature Shaft Washer
6. Motor Housing End Plate
7. Gear Housing Gasket
8. Cover Plate
9. Sleeve Shaft
10. Counter Shaft
11. Set Screw
12. Washer

13. Counter Shaft Bearing Needle
14. Worm and Gear
15. Thrust Washer
16. Counter Shaft Bearing
17. Bearing Cup
18. Thrust Washer
19. Worn Wheel Gear
20. Flap Control Shaft
21. Spacer
22. Washer
23. Shim Washer

Figure 4-12. Flap Motor Gearbox

BRAKE SYSTEM

(Figure 5-1)

The fluid reservoir, located on the forward side of the firewall, should be filled to within 1 - 1/2 inches of the top and a visible fluid level maintained on the dip stick at all times by adding hydraulic fluid (Item 13, Consumable Materials Chart).

In service, the brake disc will assume a light straw color as the result of heat. These changes in color are normal and need not be a cause for concern. A glazed appearance of the brake linings also is normal; the glaze actually improves the effectiveness of the brakes.

BRAKE WEAR LIMITS

The brake lining should be replaced before the metal back plate is exposed through the abrasive surface. This can be checked visually without disassembling the brake. The minimum allowable thickness for the abrasive surface is 3/32 inch above the rivet. The brake disc should be replaced when its thickness measures .330 inch.

BLEEDING THE BRAKE SYSTEM

Use only hydraulic fluid (Item 13, Consumable Materials Chart) in the brake lines and insure that no dirt or foreign matter is allowed to get in the brake system. Dirt can get under seals and cause leaks or plug the compensating valve and cause the brakes to lock.

Use either gravity flow or pressure bleeding to bleed brakes. Using either method, the parking brake lever and toe brake pedals must both be fully released to open the compensating port in the brake master cylinders.

GRAVITY BLEEDING

The reservoir must be kept full during bleeding. The brake pedals should be operated slowly and smoothly to eliminate trapped air in the master cylinders. When no more air bubbles appear in the fluid drained from the bleeder plug, close the bleeder valve.

PRESSURE BLEEDING

(Figure 5-1)

Connect the hoses from a pressure pot to the bleeder fitting on the brake and bleed the system from the wheel cylinder up. Disconnect the fluid supply line at the reservoir, attach a hose to it and put the other end of the hose in a large, clean container. Using not more than 30 pounds pressure, bleed the system until all air bubbles are gone from the draining fluid. Tapping the brake pedals lightly will assist in removing air from the master cylinders.

BLEEDING DUAL BRAKE SYSTEM

(Figure 5-2)

In airplanes having the optional dual brake system, the co-pilot's brake system is bled by closing the valve on the pressure pot and pumping the co-pilot's brake pedal to change the shuttle valve position. This causes hydraulic

fluid to be routed through the co-pilot's system and this system should be bled as was the pilot's system.

After the pilot's and co-pilot's brakes have been bled, close the bleeder valve and repeat for the other wheel.

REMOVING THE WHEEL AND BRAKE ASSEMBLY

- a. Place the airplane on a jack.
- b. Remove the four bolts which attach the back brake plate and inner linings to the cylinders, then remove the back plate assembly.
- c. Disconnect the brake hydraulic line, and remove the cylinder assembly by sliding the two guide pins out of the torque plate.

NOTE

Removal of the wheel only, does not require the brake hydraulic line to be disconnected.

- d. Remove the cotter pin, wheel retaining nut and spacer. Slide the wheel and inner spacer off the axle.
- e. The brake disc assembly can be removed, if desired, by removing the six bolts which join the wheel halves.

NOTE

The brake linings and cylinder assembly can be removed without removing the wheel, by utilizing steps a, b, and c.

INSTALLING THE WHEEL AND BRAKE ASSEMBLY

- a. Clean and repack the wheel bearings (Item 15 and 9 or 34, Consumable Materials Chart). Replace any damaged grease seals, and be sure grease seal retaining rings are in place before reinstalling the wheel.
- b. Install inner spacer, wheel, spacer, retaining nut and cotter pin.
- c. Install the brake cylinder assembly by inserting the two guide pins into the torque plate.

NOTE

If the torque plate has been removed, it should be reinstalled so that the guide pin holes are positioned aft, and are centered above and below the horizontal centerline of the axle.

- d. Install the back plate (inner lining) assembly, and tighten the four attaching bolts.
- e. Connect the brake hydraulic line if it was removed.
- f. Torque the axle nut to 15 - 20 foot-pounds while rotating the wheel to seat the bearings. Back off the nut and re-tighten with fingers to remove end play. Using a wrench, tighten the nut to the next available keying position and install a new cotter pin.
- g. Bleed the brake system, if necessary.

RELINING THE BRAKES

CAUTION

Do not have the parking brake engaged while removing the brakes.

a. Remove the four bolts that attach the back plate assemblies to the cylinder assembly.

NOTE

The hydraulic brake line does not have to be disconnected to remove the brake linings.

b. Remove the back plate assemblies from the inboard side of the brake disc and the pressure plate assembly from the cylinder assembly.

c. Place the back plate assembly on a table with the lining facing down and punch or drill out the rivets that attach the linings to the back plate.

d. The linings on the pressure plate may be removed by using the same procedure as used on the back plate.

e. Place the new lining on the back plate and install the rivets. Using a punch, set the rivets with the punch until the lining is firmly against the back plate.

f. The rivets on the pressure plate may be set by using the same procedure as used on the back plate.

REMOVING AND INSTALLING THE BRAKE MASTER CYLINDERS

a. Close the parking brake valve by pulling the parking brake handle.

b. Unsnap the floor mat and remove the floorboard section below the brake pedals.

c. Disconnect the two brake hydraulic lines at each master cylinder and mark the lines to assure correct reinstallation.

d. Remove the master cylinder attaching bolts and nuts and remove the master cylinders.

e. If new master cylinders are to be installed, note the positions of the master cylinder 45-degree elbow fittings.

f. Reinstall the master cylinders by reversing the removal procedure.

g. Replenish hydraulic fluid and bleed the brake system.

ADJUSTING THE LINKAGE ON BRAKE MASTER CYLINDER

The proper linkage arrangement will adjust the brake pedals to a straight upright position. This is considered the best adjustment since it will prevent the pedals from hitting the firewall in their extreme forward position. Linkage adjustment is obtained by removing the clevis from the rudder pedal and turning the clevis on or off the piston rod as required. After both pistons are adjusted to the same length, tighten the jam nuts.

BRAKE MASTER CYLINDER OVERHAUL (Figure 5-3) (Paramount)

a. Remove the snap ring(1) and pull the assembled piston out of the brake cylinder (2).

b. Remove the clevis (3) from the piston (14) and the check nut (4); this will free the washer (5), piston guide bushing (6), retainer "O" ring (7) and the rear seat washer (8) from the piston (14).

c. Remove the cotter pin(9) from the collar (10) and pull the collar from the piston.

d. Remove the cotter pin (11) from the plunger end of piston and allow the flow lock piston (12) to come free. The return spring (13) will fall free of the cylinder with the piston removed.

Clean all parts with solvent (Item 15, Consumable Materials Chart). Check all parts for cracks, corrosion, distortion and wear. Replace all washers and seals at reassembly. Reassemble the cylinder in reverse of the above procedure. Lubricate all parts with Hydraulic fluid (Item 13, Consumable Materials Chart) prior to assembly.

BRAKE MASTER CYLINDER OVERHAUL (Figure 5-2A) (Gerdes)

a. Remove the snap ring (4) from clevis end of housing (17) and pull the assembled piston from the housing.

b. Remove the clevis (1) locknut (2) and cap end and bearing (6) from shaft (3).

c. Remove "O" rings (5) and (7) from cap, end and bearing (6).

d. Remove snap ring (8), thrust collar (9) and spacer (10) from shaft (3).

e. Remove "O" ring (11) from shaft (3).

f. Remove snap ring (15) and spring (14) from shaft (3).

g. Remove piston (13) from shaft (3).

h. Remove "O" ring (12) from piston (13).

i. Remove spring (16) from housing (17).

Clean all parts with solvent (Item 15, Consumable Materials Chart). Check all parts for cracks, corrosion, distortion and wear. Replace all washers and seals at reassembly. Reassemble the cylinder in reverse of the disassembly procedure. Lubricate all parts with hydraulic fluid (Item 13, Consumable Materials Chart) prior to assembly.

PARKING BRAKE VALVE REMOVAL AND INSTALLATION

a. Bleed the brake system of all hydraulic fluid.

b. Remove the floorboards forward of the pilot and copilot's seats.

c. Disconnect the parking brake cable from the parking brake valve by loosening the set screw and pulling the cable free of the cable attach fitting.

d. Disconnect and cap the hydraulic lines from the parking brake valve.

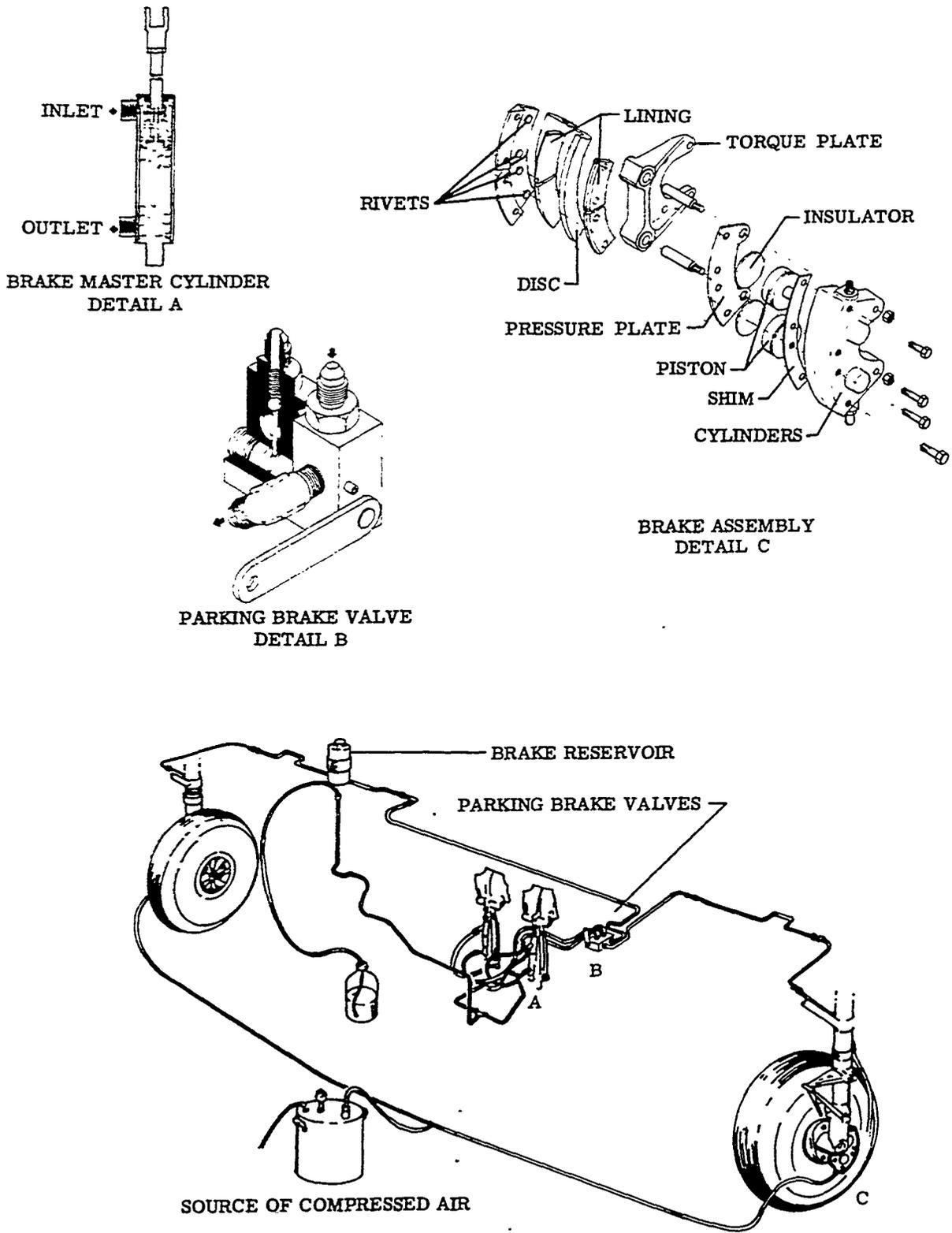
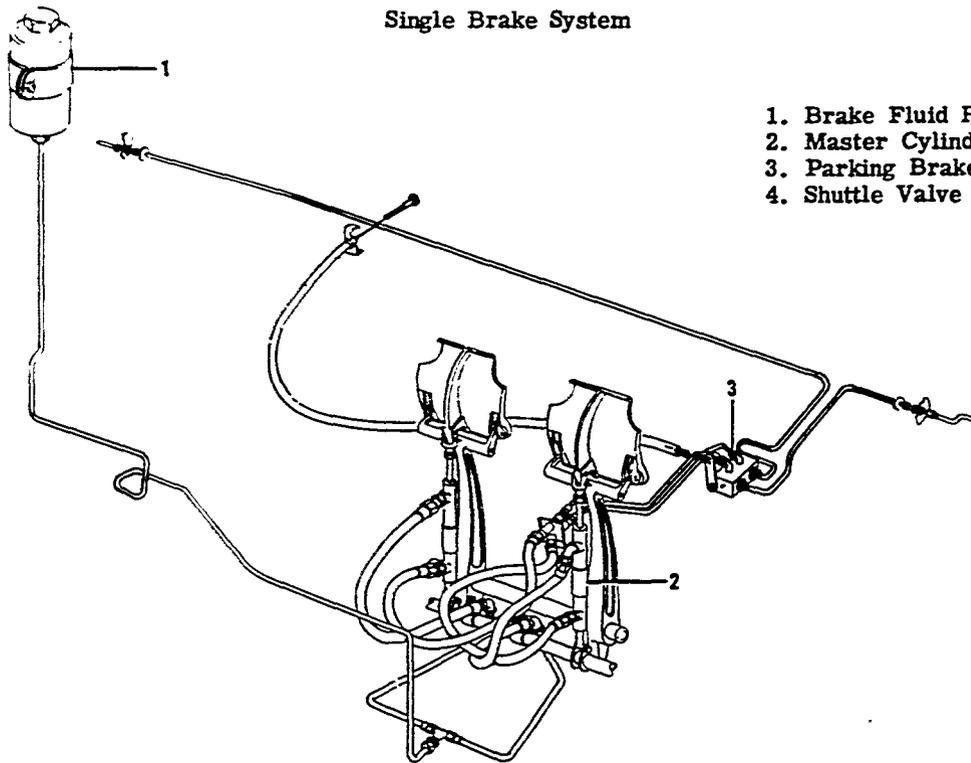


Figure 5-1. Brake System

Single Brake System



- 1. Brake Fluid Reservoir
- 2. Master Cylinder
- 3. Parking Brake Valve
- 4. Shuttle Valve

Dual Brake System

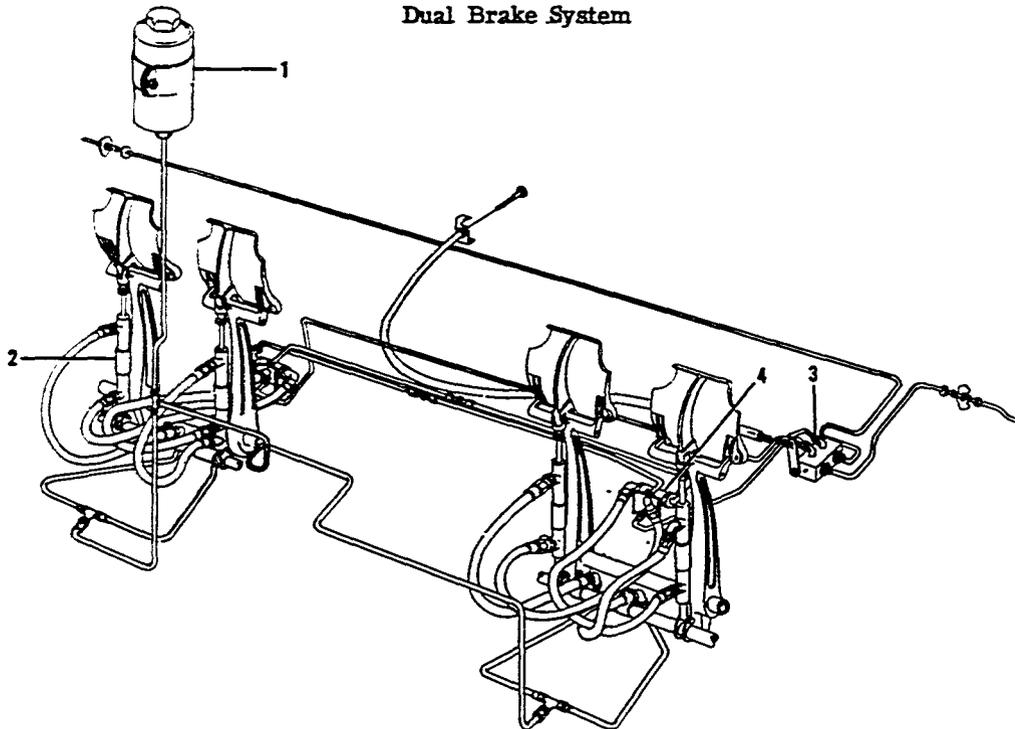


Figure 5-2. Single and Dual Brake System Plumbing

- e. Remove the attach bolts, and remove the valve.
- f. Installation of the parking brake valve may be accomplished by reversing the removal procedure.

PARKING BRAKE ADJUSTMENT

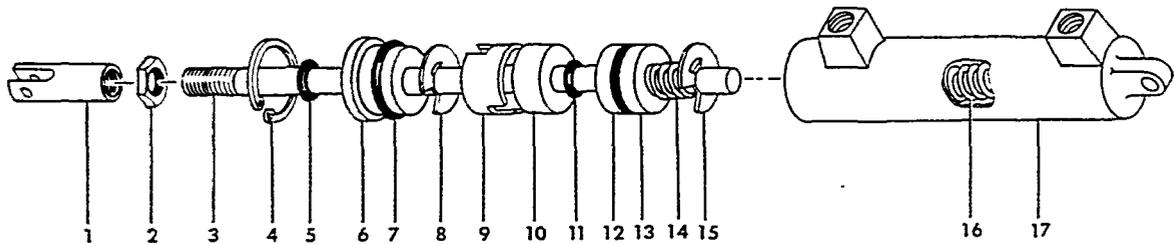
- a. Place the parking brake control in the OFF (valve OPEN) position.
- b. Remove the floorboards forward of the pilots seats.
- c. Loosen the set screw in the cable attach fitting and adjust the cable housing through the mounting block to obtain 1-1/2 inch travel between the cable housing and the cable attach fitting. The 1-1/2 inch clearance should be made with the parking brake valve lever in the OPEN position.
- d. Tighten the mounting block, insert the cable in the

cable attach fitting. tighten and safety wire the set screw in the attach fitting.

- e. Test the parking brake adjustment by pulling the parking brake handle out and operating the brake pedals.
- f. If the brake pedals are not solid, place the parking brake control in the OFF position and recheck the rigging.
- g. Inspect the parking brake valve for hydraulic fluid loss.

PARKING BRAKE VALVE OVERHAUL(Figure 5-4)

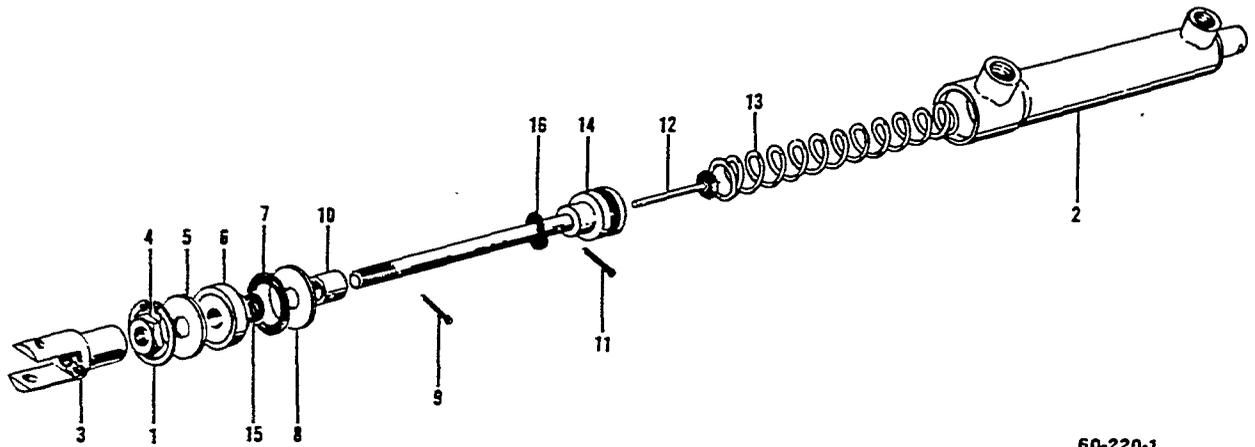
- a. Disconnect and remove the fitting (13). O-ring (7), spring (1), steel ball (6), O-ring (8), seal (2) and pin (3) from each of the two fittings on top of the valve body.



36-220-3

- | | | |
|-------------------------|------------------|---------------|
| 1. Clevis | 7. "O" Ring | 13. Piston |
| 2. Lock Nut | 8. Snap Ring | 14. Spring |
| 3. Shaft | 9. Thrust Collar | 15. Snap Ring |
| 4. Snap Ring | 10. Spacer | 16. Spring |
| 5. "O" Ring | 11. "O" Ring | 17. Housing |
| 6. Cap. End and Bearing | 12. "O" Ring | |

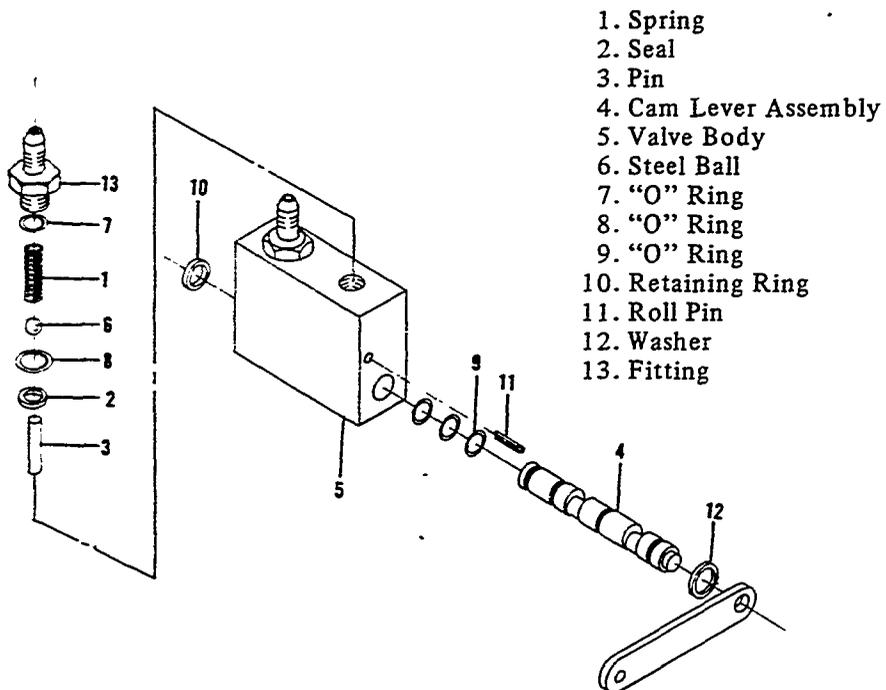
Figure 5-2A. Brake Master Cylinder (Gerdes)



60-220-1

- | | |
|-------------------------|----------------------|
| 1. Snap Ring | 9. Cotter Pin |
| 2. Cylinder | 10. Collar |
| 3. Clevis | 11. Cotter Pin |
| 4. Check Nut | 12. Flow Lock Piston |
| 5. Washer | 13. Return Spring |
| 6. Piston Guide Bushing | 14. Piston |
| 7. Retainer "O" Ring | 15. "O" Ring |
| 8. Rear Seat Washer | 16. Valve Spring |

Figure 5-3. Brake Master Cylinder (Paramount)



60-222-1

Figure 5-4. Parking Brake Valve

b. Disconnect and remove the snap-ring (10) from the end of the cam lever assembly (4).

c. Remove the cam lever assembly (4) by grasping the lever and rotating the cam lever assembly counterclockwise while pulling outward to prevent scoring of the cam lever assembly surface.

d. Prior to reassembly, inspect the cam lever assembly surface as well as all other moving parts for signs of excessive wear and replace the components if necessary.

e. Lubricate all parts with hydraulic fluid (Item 13, Consumable Materials Chart) and replace O-rings, (7, 8 and 9) and seal (2) before reassembly.

f. Assembly may be accomplished by reversing the above procedure.

LANDING GEAR SYSTEM

(Figure 5-5)

The landing gear are operated through adjustable linkage connected to an actuator assembly mounted beneath the front seats. The actuator assembly is driven by an electric motor controlled by the landing gear position switch mounted on the right-hand sub panel and limit switches mounted adjacent to the actuator assembly. The landing gear motor and the actuator assembly are accessible by removing the front seat. Access to the limit switches is accomplished by removing the front seats.

The landing gears may be electrically retracted and extended, and in an emergency may be lowered manually. The landing gear motor circuit consists of the landing gear position switch, limit switches, safety switch, motor and circuit breaker. The push button for resetting the landing gear motor circuit breaker is located in the left-hand subpanel.

NOTE

Do not attempt to retract the landing gear using the handcrank. The manual extension system is designed to lower the landing gear only. Refer to the appropriate Pilot's Operating Handbook for emergency operating instructions.

When the landing gear switch is placed in the "UP" position, the circuit is completed to the safety switch on the right hand landing gear. If the safety switch has been actuated to complete the circuit to the up winding of the landing gear motor, as would be the case if the airplane were airborne or supported on jacks, the landing gear motor will run until the landing gear is fully retracted and the uplimit switch is actuated, breaking the circuit to the landing gear motor. When the landing gear position switch is placed in the "DOWN" position, the circuit is completed to the down winding of the landing gear motor and the motor will operate until the landing gear has been fully extended and the down limit switch actuated, breaking the circuit to the landing gear motor. To prevent overtravel of the gear, the dynamic brake relay on E-1111 and E-1241 and after (or the up-brake and down-brake switches on earlier airplanes) simultaneously breaks the power circuit to the motor and makes a complete

circuit through the armature of the opposite field winding. The motor then acts as a generator and the resulting electrical load on the armature stops the gear almost instantly.

LANDING GEAR SAFETY SYSTEM (OPTIONAL)

The optional landing gear safety system functions through the action of a solenoid in the landing gear position switch in conjunction with a three-position safety system switch, a relay and diode mounted on the front spar, two pressure switches mounted on the inboard side of the left main landing gear wheel well, and a microswitch located adjacent to the existing throttle position warning switch in the engine compartment.

Each pressure switch is connected into the pitot and static system. The pressure switch in the gear-up circuit is actuated by the pressure differential that exists between the pitot and static air system and will close with increasing pressure at approximately 90 mph.

When the landing gear position switch is in the UP position and an airspeed of 90 mph has been attained, the pressure switch in the gear-up circuit closes and actuates a relay mounted on the front spar, thus completing the circuit and retracting the landing gear. A diode locks the relay in the closed position until the retraction cycle is completed. For the preceding to occur, however, the microswitch in the engine compartment must also be in the open position. This microswitch is actuated by the throttle control when the throttle is advanced sufficiently for the manifold pressure gage to register approximately 18 inches Hg. Conversely, if the throttle is retarded beyond the position corresponding to approximately 18 inches Hg of manifold pressure, the microswitch will close. If at the same time the microswitch closes the airspeed has dropped below 120 mph, the resultant pressure differential between the pitot and static systems will actuate the pressure switch in the gear-down circuit. With both the microswitch and pressure switch closed, the current flow through the solenoid will cause the landing gear position switch to drop into the DOWN position, thus completing the gear-down circuit.

If the landing gear position switch is placed in the UP position while the landing gear safety system switch is in the ON position, the landing gears will retract only when the following conditions are mutually fulfilled:

a. The airplane must have attained an airspeed of at least 90 mph.

b. The throttle setting must have been advanced sufficiently to have produced a manifold pressure of approximately 18 inches Hg.

NOTE

The throttle switch is set at the factory to close when an approximate manifold pressure of 18 inches of Hg is produced at about 3000 feet of altitude.

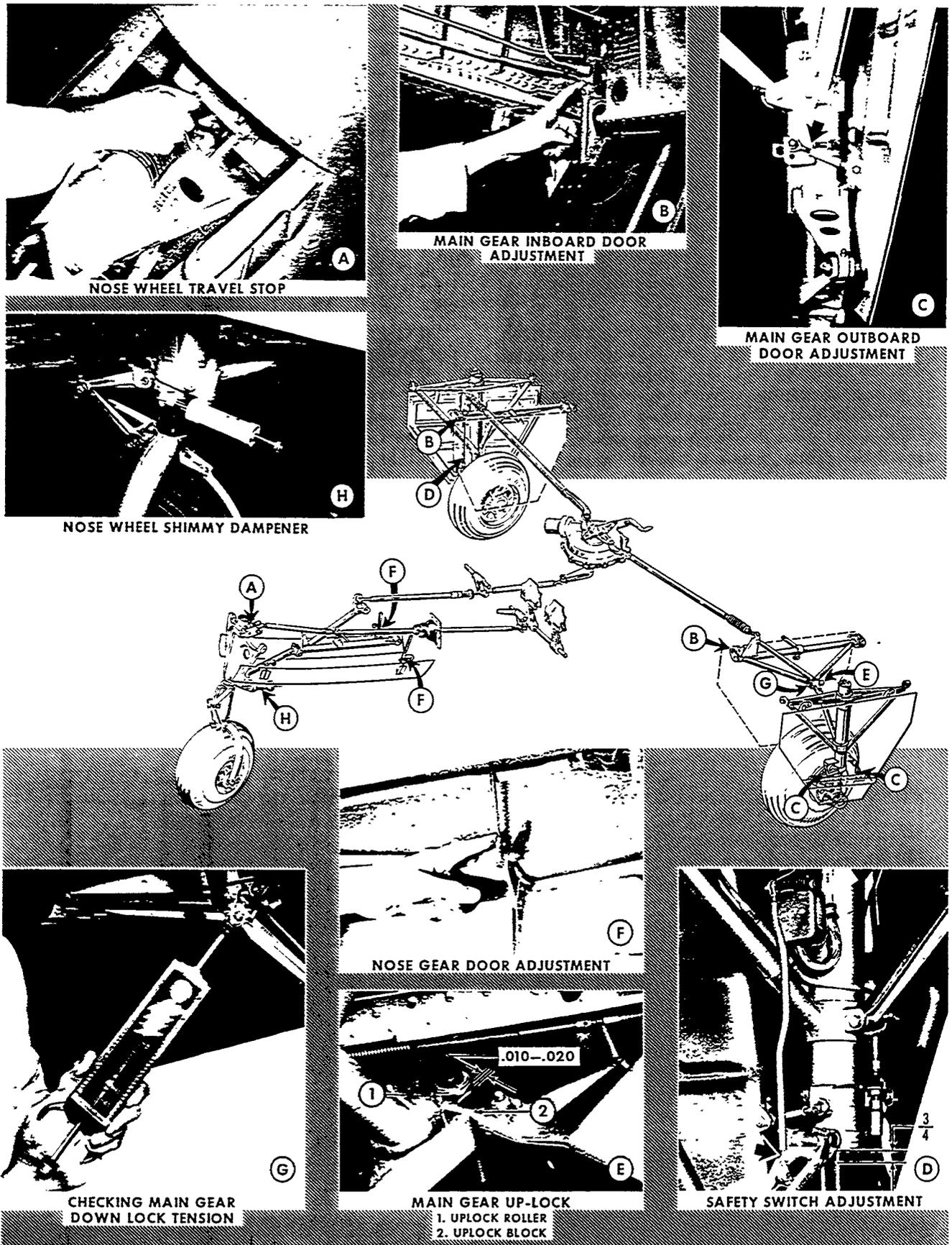


Figure 5-5. Landing Gear System

By the same token, the landing gear will automatically extend under the following conditions:

- a. The airspeed must have dropped below 120 mph.
- b. The throttle setting must have been retarded enough for manifold pressure to have dropped below approximately 18 inches Hg.

The safety system switch is a three position switch, with normally ON or OFF positions. The switch also contains a momentary or test position for checking that the system is functioning properly. When released from the test position, the switch returns to the ON position.

SYSTEM MAINTENANCE AND ADJUSTMENT

No maintenance is required for the landing gear safety system, other than replacing defective units or checking the electrical wiring for condition, security of attachment, and tightness of electrical connections. The switches are preset and adjustment will not normally be required; however, should the system fail to function properly, the following checks and adjustments may be accomplished.

CHECK OF SYSTEM WITH SAFETY SWITCH IN TEST POSITION

- a. Place the throttle in the closed or retarded position.
- b. Place the battery master switch ON. The landing gear circuit breaker may be either IN or OUT.
- c. Place the landing gear safety system switch in the momentary full up (TEST) position. Noise or movement of the solenoid in the landing gear position switch indicates that the automatic landing gear extension part of the system is functioning properly. The on-off switch returns normally to the ON position unless the pilot intentionally places the switch in the OFF position.

MICROSWITCH ADJUSTMENT

The microswitch cannot be accurately adjusted on the ground. Before the microswitch is adjusted, it must be ascertained that the throttle warning horn switch, is properly set (see Section 6 for proper setting of the throttle warning horn switch). The microswitch may then be adjusted as follows:

- a. With the airplane in flight, mark the throttle control at the control panel when the manifold pressure gage registers approximately 18 inches Hg.
- b. With the airplane on the ground, move the throttle until the mark on the control is aligned with the control panel just as it was when the mark was made while the airplane was in flight.
- c. Adjust the microswitch until the cam clicks the switch closed with the throttle in the position indicated in the preceding step.

PRESSURE SWITCH ADJUSTMENT

The pressure switches are preset and will not normally require adjustment. Because of the built-in tolerance of these switches, they should not be tampered with unless radically out of adjustment, that is unless the switch in question fails to actuate at an airspeed within 2 mph above or below the setting recommended for it. Even then the system plumbing and electrical wiring should be checked to ascertain that the source of trouble is not something other than improper adjustment of the pressure switches.

- a. Place the aircraft on jacks.
- b. With the master switch ON, the landing gear circuit breaker ON, and the landing gear warning circuit breaker OFF, advance the throttle to its maximum position.
- c. Place the landing gear safety position switch in the ON position.
- d. Place the landing gear position switch in the UP position.
- e. Clamp a section of soft rubber tubing over the pitot head inlet, making certain that the connection is airtight.
- f. Crimp the end of the tubing and roll it up until the airspeed indicator registers 90 mph. The landing gear will start retracting immediately if the pressure switch is properly adjusted.

CAUTION

To avoid rupturing the diaphragm of the airspeed indicator, the rubber tubing must be rolled SLOWLY.

- g. If the landing gear failed to retract in the preceding step, turn the master switch OFF and adjust the pressure switch (upper switch of the two installed in the left main wheel well) as follows:

1. Secure the rolled up tubing so that it will hold the airspeed indicator reading at 90 mph.
2. Connect a continuity tester across the contacts of the pressure switch, then turn the adjustment screw until the switch closes at the 90 mph reading on the airspeed indicator.

- h. Turn the master switch ON and roll up the rubber tubing until the airspeed indicator registers 130 mph, then secure the tubing so that the airspeed indicator will hold that reading.
- i. Retard the throttle.
- j. Slowly bleed off pressure until the airspeed indicator registers 120 mph. The landing gear will extend immediately if the pressure switch is properly adjusted.
- k. Should the landing gear fail to extend, turn the master switch OFF and adjust the pressure switch (lower switch of the two installed in the left main wheel well) as follows:

RIGGING THE LANDING GEAR

1. Secure the rolled up tubing so that it will hold the airspeed indicator reading at 120 mph.

2. Connect a continuity tester across the contacts of the pressure switch, then turn the adjustment screw until the switch closes at the 120 mph reading on the airspeed indicator.

1. Turn the master switch ON and check the landing gear safety system through the complete cycle of operation.

LANDING GEAR POSITION LIGHT ADJUSTMENT (E-185 and after)

The landing gear position lights on the instrument panel are operated by the up indicator switches and down indicator switches on each gear.

Before making the following adjustments place the aircraft on jacks. Main Gear: With the gear down and locked, adjust the down switch (located on the forward side of the main gear V-brace) so that the overtravel of the switch plunger is .050 inch after the switch is actuated to the "ON" position. With the gear in the full up position adjust the up switch (located inboard of the forward side of the main gear V-brace) so that the overtravel of the switch plunger is .050 inch after the switch is actuated to the "ON" position.

Nose Gear: With the gear in down and locked position adjust the down switch (located on the right hand side of the wheel well) so that the overtravel of the switch plunger is .050 inch after the switch is actuated to the "ON" position. With the gear in full up position adjust the up switch (located on the right hand side of the wheel well) so that overtravel of the switch plunger is .050 inch after the switch is actuated to the "ON" position. Check the instrument panel to be sure the indicator lights correspond to the gear position.

Recheck the switch adjustment and remove the aircraft from the jacks.

NOTE

Battery voltage is not sufficient to properly cycle the landing gear during rigging. A 14.25 ± .25 volt power supply capable of maintaining the voltage setting should be used for serials prior to E-1241, except E-1111 and a 28.25 ± .25 volt power supply capable of maintaining the voltage setting for serials E-1111, E-1242 and after. If an external power receptacle is not available on the airplane jumper cables may be used between the battery and the power supply. Be sure of the polarity before making the connection.

CAUTION

Excessive operation of the landing gear motor without proper cooling may cause damage to the motor. Allow a short cooling time after each extension and retraction cycle.

Whenever the landing gear mechanism or doors are removed or disconnected, retract the gear and check the rigging. The following procedure for rigging the landing gear was written on the assumption that the entire landing gear is out of rig.

NOTE

Over-tightening the nut on the bolt that connects the drag leg to the shock strut can bind the strut or distort the strut attaching points. Torque the nut to 25 to 75 inch-pounds.

- a. Lengthen the main and nose gear retract rods suf-

ficiently to eliminate the danger of the V-brace on the main gear damaging the skin when the gear is retracted and to prevent excessive tensions on the nose gear retract rods. Damage to vital parts may result if abnormal loads are applied to the retract system. By lengthening the retract rod, such danger is removed. Disconnect uplock cables at the brackets, leaving the springs attached. If the springs are disconnected, upon retraction of the gear the uplock arm may damage the top wing skin. Place the uplock block in the lower position.

b. Disconnect nose wheel door linkage at attaching point on the door and remove links by unscrewing at the upper ball joint.

c. Remove bolts attaching the main gear outboard door links at main strut. Remove the inboard door actuator rod by unscrewing from the inboard rod ends and removing bolt in door bracket.

d. Screw stop bolts in (V-brace assembly, main gear) until approximately four or five threads are showing.

CAUTION

When running the gear electrically before the switches are reset, or for the first time after resetting the switches, run it with extreme caution to make sure the switches open the electrical circuits before the sector gear hits the internal stops in the gearbox. The sector gear should not be touching the stop when the motor stops coasting. Serious damage may result if the internal stops are hit by the sector gear.

e. Run the gear about $2/3$ up, then stop and "bump" the gear the remaining distance to either the limit switch or the internal stop by intermittent operation of the circuit breaker. Check hand crank for $1/8$ to $1/4$ turn between retracted position and the internal stop. If this clearance is not obtained, adjust the landing gear up limit switch. To adjust the up limit switch, lower the landing gear $1/8$ to $1/4$ turn of the emergency hand crank and adjust the switch by turning the screw in the actuator so that it just breaks the circuit.

f. Extend the gear and check hand crank. There should be $1/8$ to $1/4$ turn between the extended position and the internal stop. The down limit switch adjustment is accomplished by bending the switch actuator arm tab so that it just breaks the circuit.

g. Extend and retract the gear two or three times to assure that the switches are correctly set. Check the hand crank each time to insure proper adjustment.

h. Adjust the main retract rod (either right or left) to maintain $1/16$ inch minimum clearance between the joint (knee) of the V-brace and lift leg and the top wing skin with the landing gear fully retracted. The main gear should retract only far enough to clear the inboard door in addition to maintaining the minimum of $1/16$ inch clearance. To decrease the clearance between the knee and the top wing skin, shorten the retract rod; to increase clearance, lengthen the retract rod.

i. When the proper setting is obtained, leave the gears in the retracted position and screw the stop bolt down

against the main strut. To assure a firm seating, insert a .003 feeler gage under the bolt head and adjust the bolt until a firm, steady effort is required to pull the feeler gage out. With the feeler gage removed, screw the bolt down an additional $3/4$ turn. Tighten locknut securely.

j. Check the uplock roller for free movement and a maximum clearance of .010 - .020 inch between the roller and the uplock block. If this clearance is not correct, the uplock block must be adjusted. To adjust, loosen the block retaining bolts and adjust the clearance between the roller and the uplock block. The uplock bracket and the block are serrated and the serrations must be interlocked.

k. Extend gears and attach the uplock cable to bracket.

l. Retract the gears intermittently as in step "e" above and observe the locking action of the uplock bracket. If it starts to lock too soon it is an indication that the uplock cable is too tight. The cable should be adjusted for a tension of $52.5 \pm 10 - 0$ pounds in the up position. The tension is adjusted at the outboard end of the cable. If sufficient adjustment is not obtainable at the cable eye, additional adjustment may also be made at No. 3 wing rib by moving the cable housing inboard or outboard.

m. Extend the gear and check the force required to deflect the main gear knee joint. With the gears in down position, it should take 45 to 65 pounds of force to deflect the knee joint. To increase tension, add 100951S063YU washers between the spring and rod end. A maximum of five washers may be added. If more tension is needed replace the spring.

NOTE

If unable to obtain adequate spring tension, check for worn bushings in the retract linkage. Wear in the bushings has the effect of lengthening the entire linkage, causing the rod end spring to compress and stack, leaving nothing for spring adjustments. New bushings will shorten the linkage, again permitting adjustment of the spring.

n. With the gears extended in the full down position and the wheel clearing the floor, adjust the nose gear tension at the aft retract rod (shorten or lengthen) to obtain a deflection force of 55 pounds or higher (providing the retract spring does not stack at any point during the full travel of the nose gear) at the union of the "V" brace and the drag leg assembly.

CAUTION

Do not adjust the rod end bearing out more than a maximum of .25 inch measured between the nut and the end of the threads on the rod end bearings.

NOTE

In the event correct tensions cannot be obtained, a maximum of three 100951DD064XM washers may be added at the aft end of the spring in the retract rod in the nose wheel well.

Retract the gears, and adjust the nose wheel well retract rod, with the nose strut against the rubber bumper and doors disconnected, a force of 30-35 pounds applied downward at the centerline of the tow pin, shall be required to move the strut off the bumper. With the nose wheel in the fully retracted position and both doors fully rigged a force of 20 pounds minimum applied as noted above, shall be required to move the strut .12 inch measured along the line of force application.

o. Unscrew main gear outboard door attaching link to assure the door is not damaged when retracted. Connect outboard door linkage and retract gear slowly, checking to see that clearance is maintained between the door and gear. After checking to see that the door is not too tight, run gear down and adjust linkage as required; continue this procedure until a snug, firm fit is obtained when the door is completely closed.

p. Connect main gear inboard door linkage, retract gear slowly and check for clearance between door linkage and root rib. Run gear to 3/4 down position and adjust to maintain 1/4 inch minimum clearance between gear and inboard door with the slack removed from the door linkage. Continue this procedure until the door will close tightly in both up and down positions. Adjust doors by varying the length of the push-pull linkage rods. Disconnect the rods at the clevis fitting to make this adjustment.

NOTE

Install the main landing gear door push rod attaching bolt in the door linkage bracket with the head to the rear. If installed wrong, the bolt may catch on the fuselage skin and root rib of the wing, causing damage to the landing gear retract mechanism or preventing the gear from retracting.

q. Connect nose door linkage and rig nose door. Check closely to see that right hand aft hinge clears the tire. Adjust the nose gear doors by varying the length of the push-pull linkage rods in the nose wheel well. With the gear retracted, the doors should have a slight tension on them from the actuator rods to keep the doors from vibrating.

NOTE

To aid in maintaining proper nose gear door tension, the drag brace assembly on E-437 and after, has an adjustable door actuating pin.

r. Check the landing gear safety switch for proper adjustment. Measure 3/4 inch down on the piston from the bottom of the right shock strut cylinder and mark the piston with a piece of tape. Raise the right wheel with a small jack, compressing the shock strut, until the tape is even with the lower edge of the cylinder. Adjust the switch actuating arm at the clevis so the switch is actuated as the tape touches the end of the cylinder.

s. Run gear up and check landing gear position indicator. To adjust the position indicator, remove the indicator cover and bend the actuating wire to move the flag, or bend the tab on the clamp to increase or decrease the flag travel. Set the covering in place, retract the gear and check the indicator position with the gear retracted.

NOTE

On aircraft serial E-262 and after the mechanical landing gear position indicator is no longer installed.

t. With the gears in the retracted position and the throttle closed, check the operation of the throttle warning horn. If the switch has been moved for any reason, it should be adjusted so that the distance from the center line of the roller on the switch to the shoulder on the throttle linkage measure approximately 3/8 inch with the throttle closed.

NOTE

This is a temporary adjustment only. To make the final adjustment refer to Throttle Warning Horn Switch Adjustment, (Section 6).

u. Check the landing gear position lights. The lights are mounted on the right of the control column on the fixed panel. On aircraft serials E-1 thru E-184 the green light should be on when the landing gear is in the fully extended position. The red light should be on when the landing gear is in the fully retracted position. When the landing gear is in an intransit position neither light should be on. On aircraft serials E-185 and after, three green lights, one for each gear, are illuminated whenever the landing gears are "down and locked". The red light illuminates any time one or all of the landing gears are intransit or in any intermediate positions. All of the lights will be out when the gears are up and locked.

v. Recheck limit switch adjustment and remove aircraft from the jack.

MAIN GEAR REMOVAL AND INSTALLATION

When removing the landing gear, take care to preserve the original adjustments at the rod end fittings to facilitate reinstallation.

a. With the aircraft on a jack, retract the gear until

the inboard landing gear door is in the full open position.

b. Disconnect the outboard landing gear door from the landing gear strut.

c. Disconnect the inboard landing gear door actuating rod at the forward door hinge.

d. Unsnap the canvas cover and disconnect the uplock assembly from the strut.

e. Open brake cylinder bleed ports and pump all fluid from the system.

f. Disconnect the hydraulic line where the flexible hose couples to the tubing on the landing gear.

g. Disconnect the safety switch wires.

h. Remove the bolt attaching the lift leg to the strut.

i. Remove the access door in the lower surface of the wing leading edge for access to the strut brace forward hinge bolt and remove the nut. The strut brace rear hinge bolt is accessible by lowering the flap.

j. Remove the hinge bolts securing the main gear strut assembly and lower it away from the aircraft. Be careful not to bend the skin at the wheel well edge when removing the strut.

k. Reinstall the main landing gear assembly by reversing the removal procedure. Torque the hinge bolts 250 to 800 inch-pounds. Operate the gear to check for proper rigging of uplock and doors.

DISASSEMBLY OF THE MAIN GEAR SHOCK STRUT

(Figure 5-7)

a. Deflate the strut completely and remove the air valve assembly.

WARNING

Do not unscrew the air valve assembly until all the air pressure has been released or it may be blown out with considerable force, causing injury or damage.

b. Remove the snap ring and pull the orifice tube assembly out of the barrel.

c. Invert the strut and drain the hydraulic fluid out of the strut.

d. Disconnect the torque knees and slide the piston out of the barrel.

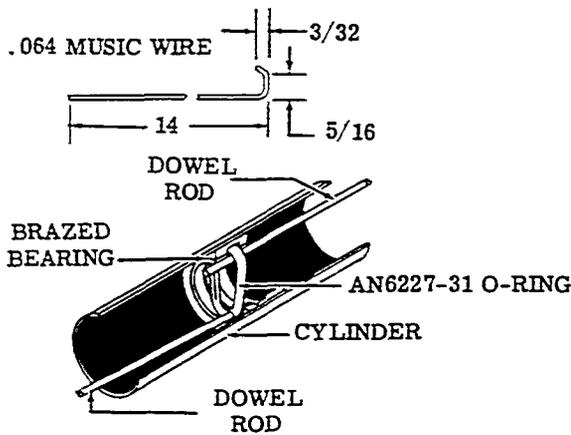


Figure 5-6. "O" Ring Removal and Installation

WARNING

Do not disconnect the torque knees without first deflating the strut. The torque knees provide the extension stop for the lower shock absorber assembly and when disconnected, the piston is free to slide out of the upper barrel.

e. Remove the scraper ring, felt pad and "O" ring. Removal of the "O" ring may be easier if a hook, manufactured from a length of music wire is used as shown in Figure 5-6.

INSPECTION AND PARTS REPLACEMENT

- Check the complete strut assembly for cracks and corrosion. Replace worn or defective parts.
- Replace the "O" ring seals. Clean parts with solvent (Item 15, Consumable Materials Chart) and immerse parts in clean hydraulic fluid (Item 13, Consumable Materials Chart) prior to assembly.
- If fluid leaks have been observed on top of the cap assembly, check the small "O" ring of the valve; then look for defects in the valve.

ASSEMBLY OF MAIN LANDING GEAR SHOCK STRUT (Figure 5-7)

- Install the "O" ring in the center brazed bearing, using two dowel rods to work into position, as shown in Figure 5-6.
- Soak the felt pad in SAE No. 10 oil and install it below the center brazed bearing.
- Slip the scraper ring over the piston.
- Slide the piston into the barrel exercising caution not to damage the "O" ring in the barrel. Work the scraper ring into the lower end of the barrel. Connect the torque knees.
- Pour 800 cc of hydraulic fluid (Item 13, Consumable Materials Chart) into the strut. Install the top "O" ring and the compression ring on the orifice tube and install the orifice tube into the barrel assembly. Install the snap ring and the air valve assembly. If a fluid measuring device is not available use the following procedure:

- With the strut extended at least 1/4 inch, fill the strut with hydraulic fluid (Item 13, Consumable Materials Chart) and fully actuate the strut slowly several times to remove all the air from below the orifice; then refill with the strut at least 1/4 inch from the fully compressed position.

- Install the orifice tube into the barrel assembly and install the snap ring.

- Install the "O" ring over the threads of the air valve assembly and screw the air valve assembly (minus the valve core) into the threaded hole in the orifice tube assembly.

- Extend the strut at least two inches then compress it completely allowing the excess air and fluid to escape through the air valve body.

NOTE

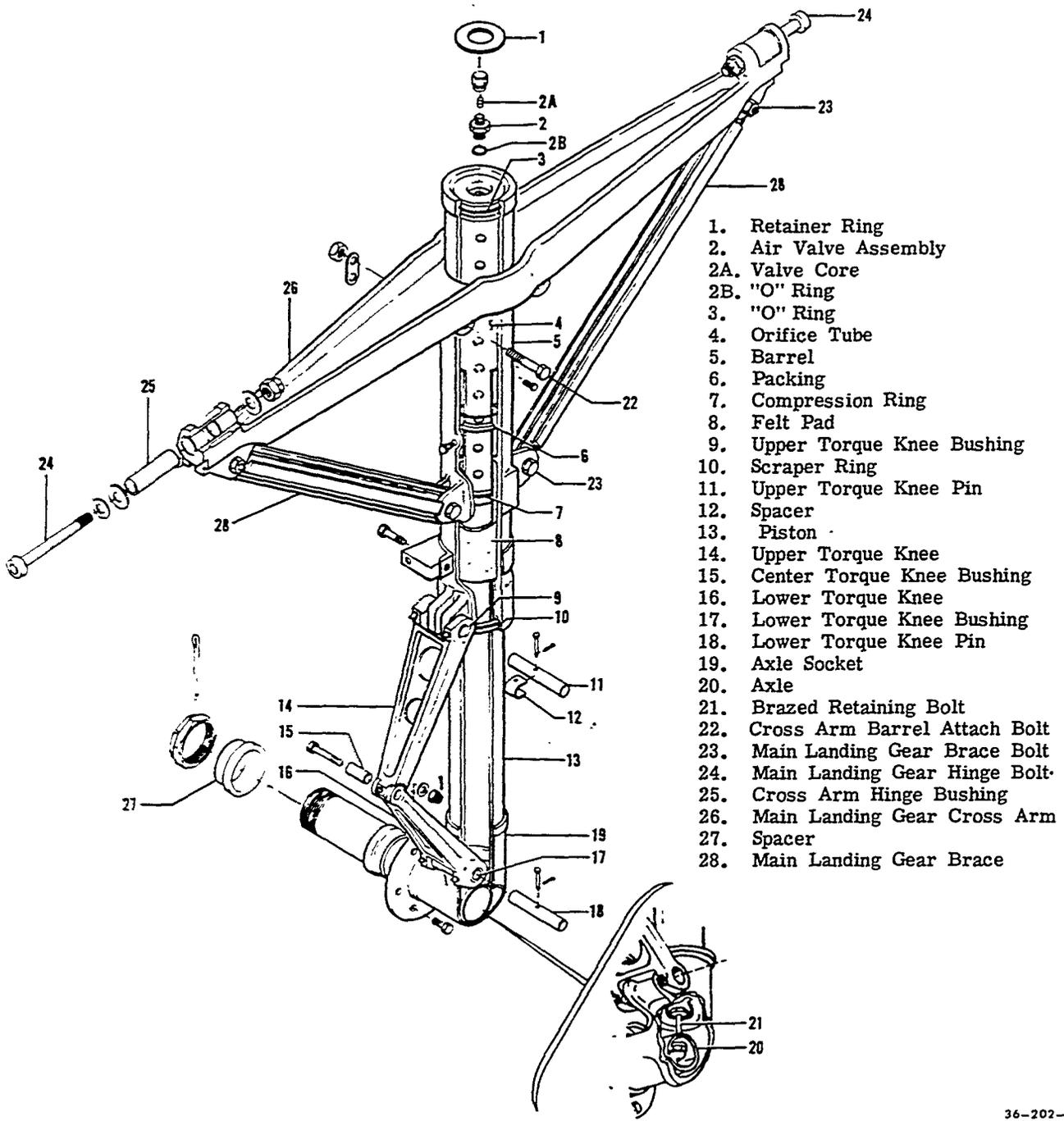
If the strut has been properly refilled a small amount of fluid will escape through the air valve body. If no fluid escapes, slowly actuate the strut several times, remove the snap ring and repeat steps 1, 2, 3, and 4.

f. Install the valve core.

MAIN GEAR TOLERANCES

The following are manufacturing tolerances which will aid in determining the extent of wear. The exact allowable deviation from these tolerances must be determined by the performance of the strut. See Figure 5-7 for Main Gear Assembly Illustration.

Piston	(13)	Maximum 1.8650 + .0010 - .0005
Upper Torque Knee Pin	(11)	Maximum .4990 + .0000 - .0005
Lower Torque Knee Pin	(18)	Maximum .4990 + .0000 - .0005



- 1. Retainer Ring
- 2. Air Valve Assembly
- 2A. Valve Core
- 2B. "O" Ring
- 3. "O" Ring
- 4. Orifice Tube
- 5. Barrel
- 6. Packing
- 7. Compression Ring
- 8. Felt Pad
- 9. Upper Torque Knee Bushing
- 10. Scraper Ring
- 11. Upper Torque Knee Pin
- 12. Spacer
- 13. Piston
- 14. Upper Torque Knee
- 15. Center Torque Knee Bushing
- 16. Lower Torque Knee
- 17. Lower Torque Knee Bushing
- 18. Lower Torque Knee Pin
- 19. Axle Socket
- 20. Axle
- 21. Brazed Retaining Bolt
- 22. Cross Arm Barrel Attach Bolt
- 23. Main Landing Gear Brace Bolt
- 24. Main Landing Gear Hinge Bolt
- 25. Cross Arm Hinge Bushing
- 26. Main Landing Gear Cross Arm
- 27. Spacer
- 28. Main Landing Gear Brace

36-202-1

Figure 5-7. Main Gear Shock Strut

g. To leak test the strut assembly, inflate the strut to approximately 100 psi air pressure. Coat the top of the orifice tube and the air valve with soap suds to test for air leaks.

WARNING

As with all operations involving equipment under high pressure, exercise caution when performing the leak test; avoid the areas directly above and below the strut.

h. Deflate the strut and install on the aircraft. With the weight of the airplane on the gear, check the strut inflation. There should be 3 inches of piston exposed with the airplane empty except for fuel when properly inflated with air.

LUBRICATION OF UP-LOCK ROLLERS

The up-lock roller bearings should be lubricated with grease (Item 11, Consumable Materials Chart), every 100 hours or any time that while cleaning the wheel well, the bearings are subjected to degreasing with solvent under pressure. Using a pressure gun, the up-lock bearing is lubricated through a grease fitting installed in the up-lock bearing bolt.

NOTE

The grease fitting on the drag leg, directly above the up-lock roller bearing, does not supply lubrication for the up-lock roller bearing.

NOSE GEAR REMOVAL AND INSTALLATION

When removing the nose gear, take care to retain the original adjustments at the rod end fittings to facilitate reinstallation.

- a. With the aircraft on a jack, partially retract the landing gear to relieve the load on the retract rod compression spring.
- b. Disconnect the steering yoke at its rod end fittings at the top of the landing gear.
- c. Disconnect the drag leg at its fitting on the nose gear brace assembly.
- d. Remove the hinge bolts securing the nose gear to the fuselage structure and lower the nose gear away from the aircraft.
- e. Reinstall the nose gear assembly by reversing the removal procedure.

DISASSEMBLY OF NOSE GEAR SHOCK STRUT (Figure 5-8)

- a. Deflate the strut and remove the air valve assembly.

WARNING

Do not unscrew the air valve assembly until all air pressure has been released or it may be blown off with considerable force and cause injury or damage.

- b. Remove the snap ring retaining the orifice tube assembly.
- c. Retract the piston to push the orifice tube out of the top of the barrel. Remove the orifice tube.
- d. Invert the strut and drain out the hydraulic fluid.
- e. Disconnect the torque knees by removing the bolt and bushing. Slide the piston and fork assembly out of the barrel. Remove the collar.

WARNING

Do not disconnect the torque knees without first deflating the strut. The torque knees provide the extension stop for the lower shock absorber cylinder assembly and when disconnected, the piston is free to slide out of the upper barrel assembly.

- f. Remove the lower snap ring, adapter, and scraper. Remove the "O" ring from the center bearing and remove the felt lubricating pad from inside the barrel.
- g. Remove the shimmy dampener and pull the barrel out of the brace.

INSPECTION AND PARTS REPLACEMENT

- a. Check all the metal parts of the strut assembly for cracks, and corrosion. Replace worn or defective parts. Clean parts with solvent (Item 15, Consumable Materials Chart); remove solvent and, to ease reassembly, apply hydraulic fluid (Item 13, Consumable Materials Chart) to all friction surfaces.
- b. If fluid leaks are observed on top of the air valve assembly, check the small "O" ring of the valve assembly; then look for defects in the valve assembly.
- c. Replace scored bushings, bearings and pins.
- d. Replace self locking nuts which have lost their locking ability and all cotter pins.
- e. Replace any other part considered to be worn or damaged beyond serviceable limits.

ASSEMBLY OF NOSE GEAR SHOCK STRUT (Figure 5-8)

- a. Install the "O" ring in the center bearing, using two dowel rods to work it into position. Soak the lubricating felt pad in SAE No. 10 oil before installation. Install the

1. Retainer Ring
2. "O" Ring
3. Collar
4. Air Valve Assembly
5. Shim
6. Orifice Tube
7. "O" Ring
8. Felt Pad
9. Upper Torque Knee Bushing
10. Upper Torque Knee Pin
11. Piston Ring
12. Shimmy Damper
13. Barrel
14. Upper Torque Knee
15. Torque Knee Bushing
16. Bearing
17. Scraper Adapter
18. Scraper
19. Snap Ring
20. Piston
21. Lower Torque Knee
22. Lower Torque Knee Pin
23. Plug
24. Fork Assembly
25. Brace

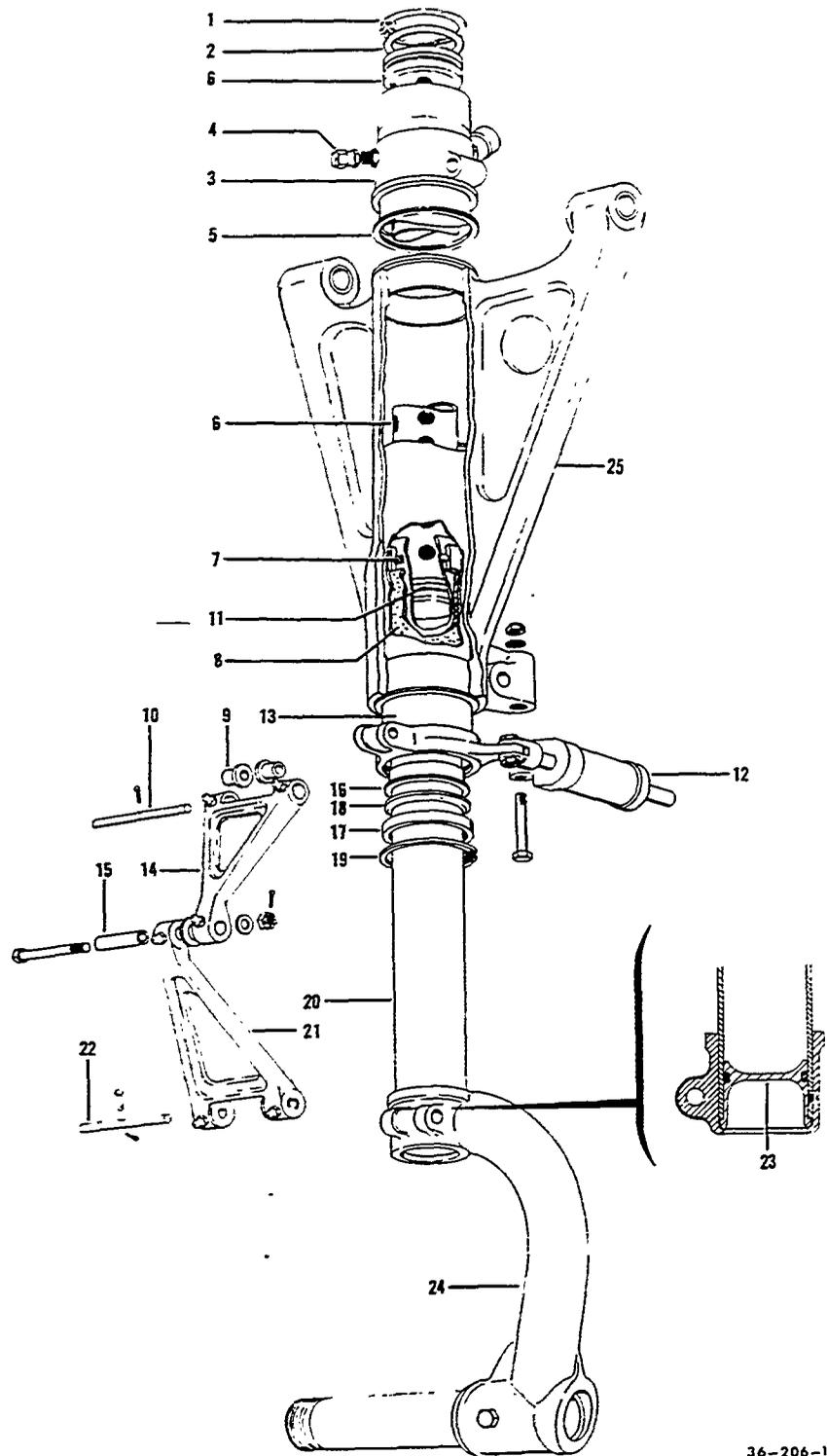


Figure 5-8. Nose Gear Shock Strut

"O" ring in the upper groove in the barrel.

b. Install the upper and lower torque knees using the shorter pin in the upper torque knee.

c. Slide the barrel assembly into the nose wheel brace and install the shimmy dampener, using washers between the shimmy dampener and the brace as required to align the dampener rod end and bracket.

d. Slide the snap ring, adapter, and scraper over the top of the piston. Slide the piston into the barrel and connect the torque knees.

e. Fill the strut with 500/550 cc of hydraulic fluid, (Item 13, Consumable Materials Chart).

NOTE

If bearings or laminated shim have not been replaced, disregard step "f".

f. Leave the shim (5) off of the barrel and install the collar temporarily. Peel one layer at a time from the laminated shim until it will fit freely into the space between the collar and the upper nose wheel brace bearing. Remove the collar after the shim has been fitted.

g. Install the shim, barrel collar, and roll assembly. Check the clearance between the shim and collar with a feeler gage. The maximum clearance is .012 inch. Install the "O" ring and air valve assembly.

h. Install the compression ring and the "O" ring on the orifice tube. Install the orifice tube in the barrel assembly. Install the orifice tube retaining snap ring.

i. Inflate the strut to approximately 100 psi. Coat the cap and air valve with soap suds to test for leaks. Deflate the strut and install on aircraft. With the weight of the airplane on the gear, check the strut inflation. There should be 3-1/2 inches of piston exposed with the airplane empty except for fuel when properly inflated with air.

NOSE GEAR TOLERANCES

Listed below are manufacturing tolerances which will aid in determining the extent of wear. Exactly how much deviation from those tolerances can be allowed must be determined by the performance of the strut. See Figure 5-8 for Nose Gear Assembly Illustration.

Upper Gear Brace Bearing (5)	I.D. 2.250 + .002 - .000	O.D. 2.379 + .000 - .001
Lower Bearing (16)	I.D. 1.751 + .001 - .000	O.D. 1.8750 + .0015 - .0000
Orifice Tube (6)	I.D. 1.484 ± .002	O.D. 1.7490 + .0010 - .0005
Upper Torque Knee Roll Pin (10)	O.D. Maximum .3730 ± .0005	
Upper Torque Knee Bushing (9)	I.D. .3750 ± .0005	O.D. .438 + .001 - .000
Torque Knee Bushing (15)	I.D. .2500 ± .0005	O.D. .311 + .000 - .001
Lower Torque Knee Roll Pin (22)	O.D. Maximum .3730 ± .0005	

NOSE GEAR SHIMMY DAMPENER DISASSEMBLY

(Figure 5-9)

a. Remove cotter pin (8), washer (7), aft retainer ring (1), and the scraper ring (2). Force the barrel end (3) out of the barrel by working the piston back and forth. Remove the "O" rings (4) from the barrel end.

b. Remove all remaining hydraulic fluid from the shimmy dampener.

c. Remove the forward snap ring (5) and slide the piston rod (6) and parts out of the barrel.

d. Remove the compression spring (9).

e. Remove the aft floating piston (10) with a 6-32 screw and remove the "O" ring (11).

f. Insert a long 6-32 screw into the hole at the clevis end of the piston and engage the floating piston (12). Maintain tension on the floating piston while driving out the piston retaining pin (13).

g. Release the floating piston slowly and push it out the open end of the piston rod and remove the "O" ring (14).

h. Remove the remaining compression spring (15) from the rod and slide the piston (16) off the piston rod. Remove the "O" rings (17) from the piston (16).

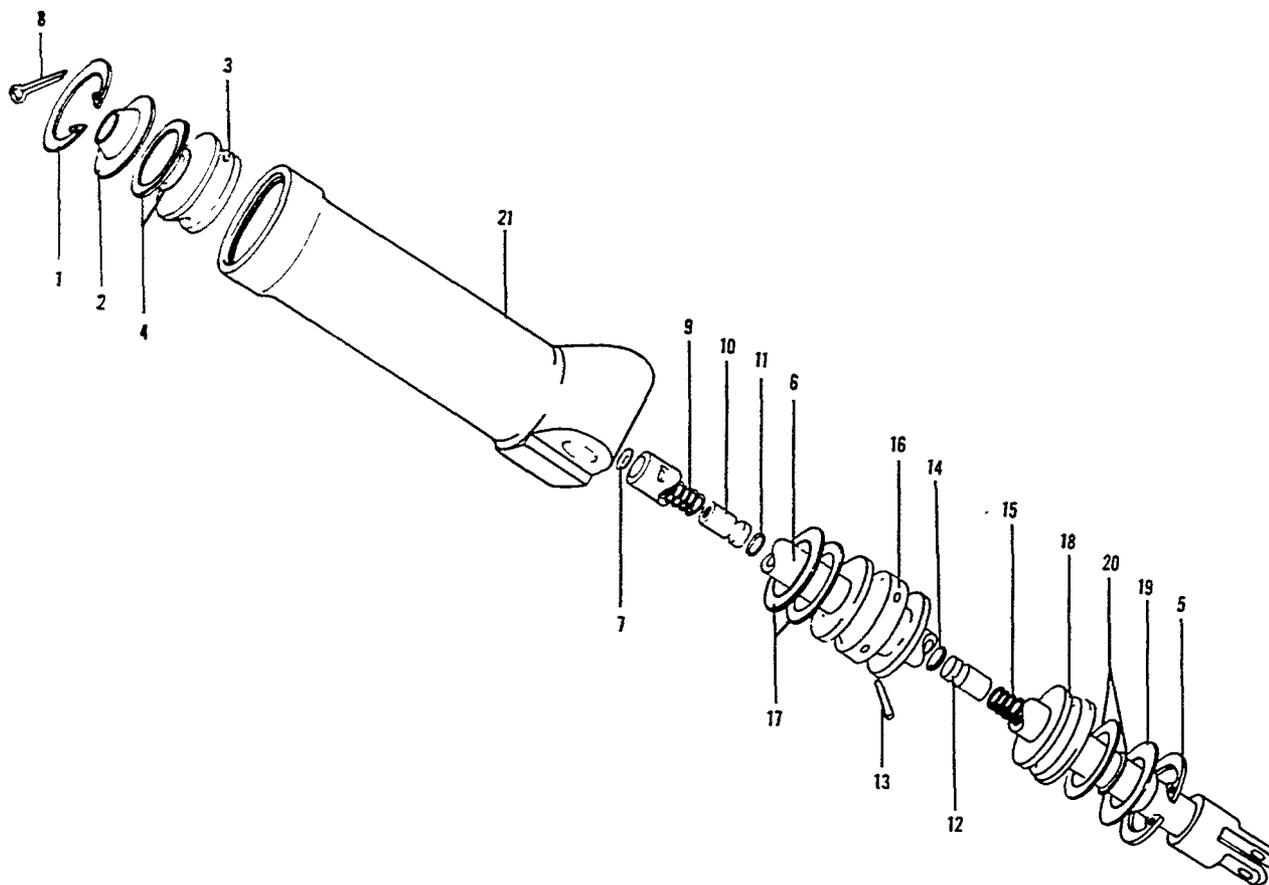
i. Remove the barrel end (18) and scraper ring (19) from the piston rod and remove the "O" ring (20) from the barrel end (18).

TABLE OF MANUFACTURER'S TOLERANCES

NOTE

Parts may be reused if maximum wear is no greater than 0.005 inch below the tolerances listed below. For example, the barrel may be reused if its inside diameter does not exceed 0.867.

Barrel Inside Diameter	Max. 0.862 Min. 0.860
Piston Outside Diameter	Max. 0.857 Min. 0.853
Piston Rod Outside Diameter	Max. 0.3745 Min. 0.3735
Piston Rod Inside Diameter (Reservoir Portion)	Max. 0.250 Min. 0.246
Floating Piston Diameter	Max. 0.240 Min. 0.235
Barrel End Inside Diameter	Max. 0.377 Min. 0.376



- 1. Internal Retainer Ring
- 2. Scraper Ring
- 3. Barrel End
- 4. "O" Ring
- 5. Snap Ring
- 6. Piston Rod
- 7. Washer
- 8. Cotter Pin
- 9. Compression Spring
- 10. Floating Piston

- 11. "O" Ring
- 12. Floating Piston
- 13. Piston Retaining Pin
- 14. "O" Ring
- 15. Compressions Spring
- 16. Piston
- 17. "O" Ring
- 18. Barrel End
- 19. Scraper Ring
- 20. "O" Ring
- 21. Barrel

Figure 5-9. Shimmy Dampener

CLEANING, REPAIR, AND PARTS REPLACEMENT

Repairs on the shimmy dampener should be confined to replacing worn or leaking "O" rings or replacing the complete assembly. When disassembled, clean all parts with cleaning solvent (Item 15, Consumable Materials Chart) and lubricate the parts with hydraulic fluid (Item 13, Consumable Materials Chart).

REASSEMBLY OF SHIMMY DAMPENER

(Figure 5-9)

a. Replace the "O" rings (20) on the barrel end (18). Slide the scraper ring (19) and barrel end on the piston rod (6).

b. Replace the "O" ring (14) on the forward floating piston (12) and insert the compression spring (15) and the floating piston into the piston rod (6). With a long 6-32 screw, engage the floating piston (12) and pull it toward the clevis end of the piston rod to compress the spring (15) until the dampener piston retaining pin (13) can be inserted.

c. Place the dampener piston (16) on the piston rod and insert the retaining pin. Replace the "O" rings (17) on the dampener piston.

d. Insert the piston rod assembly into the barrel (21) and place the snap ring (5) into position.

e. Place the dampener in a vise with the open end up and fill the barrel and piston with hydraulic fluid (Item 13, Consumable Materials Chart). Work the piston rod up and down until bubbles stop appearing in the fluid, then refill the barrel and the piston rod.

f. Replace the "O" rings in the barrel end (3), and "O" ring (11) on the floating piston (10), insert the barrel end and the scraper ring (2) into the barrel (21) and secure them with the internal retainer ring (1).

g. Engage the forward floating piston (12) with the 6-32 long screw and pull forward. At the same time, insert the aft floating piston (10) and compression spring (9) and push down. The piston will follow the fluid down and prevent the entry of air into the rod assembly. Secure the spring and piston with the washer (7) and the cotter pin (8). To check the fluid level in the shimmy dampener, spread the portion of the cotter pin within the piston rod and insert a wire through the hole in the washer at the aft end of the piston rod until the wire touches the bottom of the hole in the floating piston. If the wire enters the piston rod over 2-3/8 inches, remove the floating piston and add more fluid to the piston rod.

REMOVING AND INSTALLING THE LANDING GEAR ACTUATOR ASSEMBLY

a. Remove the cabin front seats.

b. Remove the access covers on top and directly behind the front carry through structure.

c. Disconnect the main landing gear retract rods at the actuator.

d. Remove the flap motor attaching bolts and disconnect the landing gear door actuating rods at the actuator.

e. Remove the four screws securing the landing gear

limit switch assembly on the left hand side of the actuator and move the switch assembly aside to permit removal of the actuator.

f. Disconnect the landing gear motor electrical wiring.

g. Remove the landing gear actuator access door on the bottom of the fuselage, and remove the nose gear actuator retract arm and linkage from the actuator.

h. Remove the four actuator attaching nuts and remove the actuator.

i. Installation is the reverse of removal. When reinstalling the nose gear actuator retract arm on the actuator, make certain that the index mark on the arm coincides with the index mark on the actuator shaft.

j. Make certain that the landing gear limit switch actuators are installed when the retract rods are connected to the actuator.

k. Reinstall cotter pins and safety wire.

l. After completing the landing gear actuator installation, check the landing gear for proper rigging.

OVERHAUL OF THE LANDING GEAR ACTUATOR (Figure 5-10)

a. Remove the motor (1) from the actuator and remove the gear (2) from the face of the motor.

b. Remove the snap ring (3) from the end of the shaft (19) and remove the gear (4) from the shaft.

c. Remove the snap ring (5) from the end of the actuator drive shaft (7) and remove the actuator retract arm (6) from the shaft.

NOTE

Before the shaft is removed from the actuator, mark a line with paint on the actuator drive shaft and actuator worm sector at the index marks to aid in reassembly, then push the shaft out of the assembly in the direction of the arrow.

d. Remove the screws (8) and the bolt (9) from the housing. Separate the housing and remove the sector gear (10), sector gear stop (32), and spacer (33).

e. Remove the screw (11) from the actuator hand crank (12) and remove the spacer (13) and "O" ring (14) from the shaft.

f. Remove the screws (15) from the hand crank housing (16) and remove the hand crank housing from the actuator housing.

g. With a lug spanner wrench remove the retainer nut (17) from the actuator housing. Tap the shaft (19) out in the direction of the arrow. The bearing (20) will now come out with the shaft and the seal (22) is now free. Remove the cotter pin and screw in the lock nut (21) and push down on the bearing (20) and remove the two sections of the half-ring (18) from the shaft.

h. Remove the bearings (23 and 24) from the actuator housing.

i. Remove the seal (25) and the bearing (26) from the top and bottom housing halves.

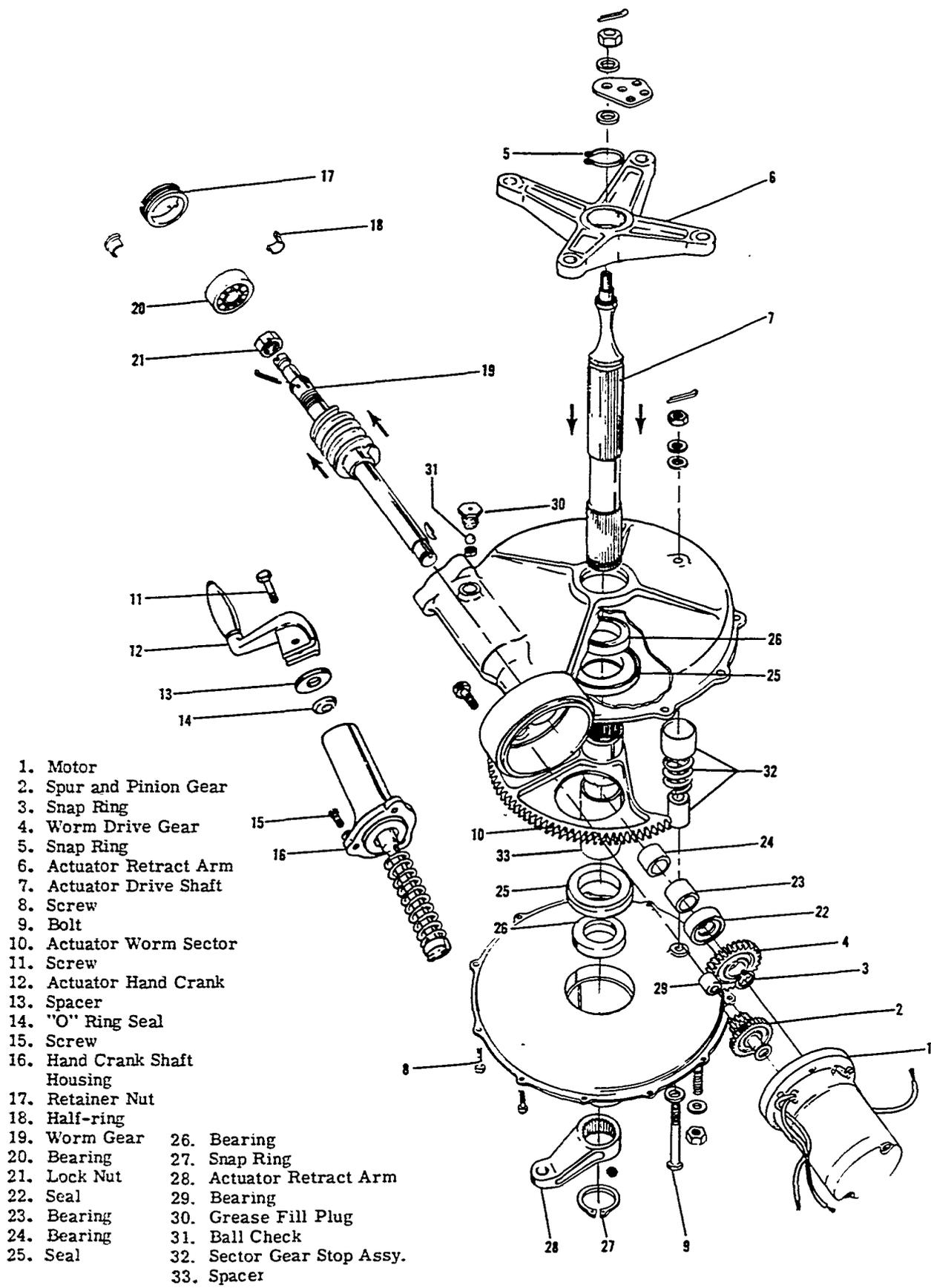
j. Remove the snap ring (27) from the shaft (7) and slide the nose gear actuator retract arm (28) off the shaft.

k. Remove the bearing (29) from the housing. Clean all parts in solvent (Item 15, Consumable Materials Chart) removing the grease and oil. Check all bearings for cracks and wear. Check the teeth of the sector gear for cracks and wear. Replace parts as necessary. Replace all seals at re-assembly. Seal the upper and lower housing joints using Sealing Compound (Item 3, Sealing Chart). Reassemble the actuator in the reverse of the above procedure. Remove the filler plug from the actuator housing and fill the housing with 1/2 pint of gear grease (Item 10, Consumable Materials Chart). Before attaching the motor, pack the motor gear housing with approximately one ounce of grease

(Item 8, Consumable Materials Chart). Fill within + .00 - .10 inch of the housing center-line.

NOTE

At assembly when installing the actuator drive shaft (7) through the actuator worm sector (10) make sure the index marks on each piece match. The same applies when installing the nose gear actuator retract arm (28) and the main actuator retract arm (6) on each end of the actuator drive shaft (7).



- 1. Motor
- 2. Spur and Pinion Gear
- 3. Snap Ring
- 4. Worm Drive Gear
- 5. Snap Ring
- 6. Actuator Retract Arm
- 7. Actuator Drive Shaft
- 8. Screw
- 9. Bolt
- 10. Actuator Worm Sector
- 11. Screw
- 12. Actuator Hand Crank
- 13. Spacer
- 14. "O" Ring Seal
- 15. Screw
- 16. Hand Crank Shaft
- 17. Retainer Nut
- 18. Half-ring
- 19. Worm Gear
- 20. Bearing
- 21. Lock Nut
- 22. Seal
- 23. Bearing
- 24. Bearing
- 25. Seal
- 26. Bearing
- 27. Snap Ring
- 28. Actuator Retract Arm
- 29. Bearing
- 30. Grease Fill Plug
- 31. Ball Check
- 32. Sector Gear Stop Assy.
- 33. Spacer

Figure 5-10. Landing Gear Actuator

REMOVING AND INSTALLING THE LANDING GEAR MOTOR

- a. Remove the right front seat.
- b. Remove the access plate over the motor and disconnect the electrical wiring.
- c. Remove the three landing gear motor attaching bolts and remove the landing gear motor.
- d. Reinstall the landing gear motor by reversing the above removal procedure and safety the three attaching bolts.

REMOVAL AND INSTALLATION OF MAIN LANDING GEAR RETRACT ROD

- a. Remove the pilot's and co-pilot's seats.
- b. Remove the access covers directly behind the front carry-through spar.
- c. With airplane on jack, partially retract the gear until the inboard door is fully open.
- d. Remove attaching bolts and disconnect retract rod from landing gear actuator retract arm.
- e. Remove attaching bolt and disconnect retract rod from main landing gear V-brace.
- f. Remove retract rod through the wheel well.
- g. Reinstall the retract rod by reversing the above removal procedure.

CAUTION

When installing a landing gear retract rod, be extremely careful to install the rod so that the curved portion of the rod end will fit around the actuator shaft when the gears are in the retracted position.

NOSE WHEEL STEERING MECHANISM

The nose wheel should be parallel to the fore and aft center line of the airplane with the rudder pedals in the neutral position. Loosen the nose gear steering actuator arm at the aft end and screw the end fitting either in or out

to make the adjustment.

NOSE WHEEL TRAVEL STOP ADJUSTMENT

The travel stop must be adjusted so that the nose wheel travel is stopped when the shimmy dampener is 1/32 inch from its maximum travel.

If adjustment is required the following procedure is recommended:

- a. Loosen the locknuts on the adjustment bolts so that they clear the stops on the nose wheel straightener.
- b. Turn the nose wheel to the extreme left turn position; the adjustment bolts must be clear of the stops with the nose wheel in this position.
- c. Place tape around the aft end of the shimmy dampener piston rod 1/32 inch from the scraper ring.
- d. Turn the locknuts on the adjustment bolts so that the nose wheel is turned, and the tape on the piston rod just contacts the scraper ring. Tighten the locknuts securely.
- e. Repeat steps "b", "c", and "d" above except turn the nose wheel to the extreme right, and place the tape on the forward end of the piston rod.

WHEEL AND TIRE MAINTENANCE

Smooth wheel abrasions, nicks and burrs with a fine file and retouch with zinc chromate primer and aluminum lacquer to prevent corrosion. Replace any damaged wheel parts. Replace tire casings showing breaks, blisters, or excessive wear.

In service, tire carcasses grow slightly due to shock loads in landing. Normally, this growth is balanced by tread wear so there is no increase in tire diameter.

Beech Aircraft Corporation cannot recommend the use of recapped tires. The tires may pass the retraction test when first installed; however, recapped tires have a tendency to swell after use and may cause malfunctions of the retract system or damage the landing gear doors.

TROUBLESHOOTING

LANDING GEAR ELECTRICAL SYSTEM

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Landing gear motor fails to shut off when gear is retracted.	a. Up limit switch out of adjustment.	a. Readjust switch.
	b. Defective switch.	b. Replace switch.
2. Landing gear fails to retract.	a. Safety switch not closing.	a. Readjust.
	b. Up limit switch remaining open.	b. Replace limit switch.
3. Landing gear motor fails to shut off when gear is extended.	a. Down limit switch does not open.	a. Readjust limit switch.
	b. Defective down limit switch.	b. Replace limit switch.
4. Landing gear actuator is hitting internal stops.	a. Limit switch out of adjustment.	a. Readjust limit switch.
	b. Limit switch is inoperative.	b. Replace switch.
5. Warning horn inoperative or malfunctioning.	a. Open or grounded circuit.	a. Check continuity.
	b. Throttle switches inoperative.	b. Check and adjust as necessary.
6. Landing gear fails to extend.	a. Tripped circuit breaker.	a. Reset circuit breaker.
	b. Down limit switches open.	b. Check down limit switch. With the gear retracted the down limit switch should be closed.
	c. Open circuit.	c. Run a continuity check on the down limit switch.
	d. Landing gear motor inoperative.	d. Check brushes, overhaul or replace motor.
7. Landing gear will not retract or extend.	a. Bad electrical connections.	a. Run a continuity check from circuit breaker to switch.
	b. Landing gear motor not grounded.	b. Check motor ground.
	c. Defective control circuit.	c. Check items 1 through 3.
	d. Landing gear motor inoperative.	d. Check brushes overhaul or replace motor.

BRAKE SYSTEM

1. Solid pedal and no brakes.	a. Brake lining worn beyond allowable limit.	a. Replace lining.
2. Spongy brake.	a. Air in system.	a. Bleed brake system.
3. Unable to hold pressure.	a. Leak in brake system.	a. Visually check entire system for evidence of leaks.
	b. Defective master cylinder.	b. Check master cylinder seals, replace if scored.

TROUBLESHOOTING
BRAKE SYSTEM (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
4. Parking brake will not hold.	a. Air in system. b. Defective parking brake valve.	a. Bleed brake system. b. Replace the valve.
5. Brakes grab.	a. Stones or foreign matter locking brake disc. b. Warped or bent disc.	a. Clean brake disc and lining. b. Replace disc.

POWER PLANT

E-1 AND AFTER

The Bonanza airplane Serials E-1 and after are equipped with either IO-520-B, IO-520-BA or IO-520-BB Continental engines. Airplane serials E-1 through E-272 except E-265 are equipped with IO-520-B engines; E-265, E-273 through E-1370 are equipped with IO-520-BA engines; and E-1371 and after are equipped with IO-520-BB engines. These are normally aspirated, fuel injected engines rated at 285 horsepower at 2700 rpm. The IO-520-BA engine differs from the IO-520-B engine in that the harmonic balancers are different. The IO-520-BB engine differs from the other engines in that it has an improved crankshaft and other changes related to the improved crankshaft.

EA-1 AND AFTER

The Turbocharged Bonanza A36TC airplanes are equipped with turbocharged Continental engines. Airplane serial EA-1 is equipped with TSIO-520-U and EA-2 and after are equipped with TSIO-520-UB engines. These engines are rated at 300 horsepower at 2700 rpm. The turbocharger provides a means by which the engine can maintain takeoff power from sea level through a critical altitude of 20,500 feet with a maximum operating altitude of 25,000 feet.

The turbocharger is located beneath and to the left rear of the engine and is driven by exhaust gases. The turbocharger is lubricated by engine oil and is dependent upon the engine oil pump for its lubrication. For this reason the engine should be allowed to run at idle for a short period of time (4 to 5 minutes) before it is shut down. This idle time will allow the turbocharger to slow down and cool before its oil supply is shut off. The turbocharger can obtain maximum continuous speeds of 96,000 rpm (in an overspeed condition it must not exceed 115,000 rpm) and run for 1 to 2 minutes after the engine has been shut down. This 1 to 2 minutes of turbocharger operation occurs without oil pressure because the engine oil pump is not running. Therefore it is important that the turbocharger be allowed to slow down before the engine is shut down.

The engine is designed to operate with a maximum manifold pressure of 36 in. Hg., and is protected from overboost by an automatic pressure relief valve. This valve is located downstream from the turbocharger and will relieve pressure if the system reaches an overboost condition of 39.5 in. Hg.

ENGINE BAFFLES

The engine baffles main functions are cooling the engine. The baffle behind number 2 cylinder is extremely important from the standpoint of engine cooling, and should be checked for a bent or abnormal condition if cylinder head over heating is experienced. Also for proper cooling the baffle seals, which contact the cowl door, should curve forward or up (toward the air flow) when the cowl door is closed.

GROUND RUNNING AND WARM-UP

- a. Head the aircraft into the wind.
- b. Operate the engine on the ground with the propeller blade set at the minimum angle (high rpm) setting.
- c. Maintain the cylinder head temperature between 200°F and 460°F. Never allow the cylinder head temperature to exceed 460°F.
- d. Extended periods of idling at low rpm may result in fouled spark plugs.
- e. The mixture control should remain in the "FULL RICH" position unless leaning is required during the checkout.
- f. Use a throttle setting of 1200 rpm for engine warm-up.

NOTE

An oil pressure indication of 10 psi should be noted within 30 seconds in warm weather, and 60 seconds in cold weather. If no pressure is noted within the specified time, stop the engine and investigate the cause. Normal oil pressure at maximum rpm should be 30-60 psi and 10 psi at idle.

COWLING REMOVAL

- a. Check to assure the magneto switch is in the "OFF" position.
- b. Disconnect the necessary electrical wiring from the engine cowling.
- c. Remove the AN bolts at each end of the center cowling angle and remove the cowling.
- d. To reinstall, reverse the removal procedure.

COWL FLAPS

The cowl flaps (E-1 and after) are used to help cool the engine by allowing air to more easily flow out of the engine compartment. The cowl flaps are controlled by a knob in the instrument panel, and can be opened or closed as needed to maintain proper engine temperature. On EA-1 and after there are no cowl flaps, but fixed gills. There is no adjustment to the gills.

ENGINE REMOVAL AND INSTALLATION (E-1 and after)

- a. Remove the propeller. (See Propeller Removal procedure in Section 7).
- b. Remove the cowling.
- c. Disconnect the ducts, engine controls, plumbing and wiring harnesses. Be sure to cap all open lines and fittings.

CAUTION

The magnetos should be considered hot when the ground lead is disconnected. To avoid accidental starting of the engine, ground the magneto by connecting a wire to the magneto switch lead and then to the engine case, or disconnect the spark plug leads.

- d. Place a support under the tail of the aircraft.
- e. Place the engine hoist in position and attach to the lifting eyes on the engine.
- f. Hoist the engine sufficiently to remove the tension from the shock mount bolts.
- g. Remove the shock mount bolts.

NOTE

Mark the shock mounts so they can be rotated and installed on the opposite sides of the engine at reinstallation.

- h. Position the engine slightly nose down and hoist slowly, making certain that the engine crankshaft flange clears the nose cowl.

CAUTION

As the engine is hoisted away from the cowl, check to make certain that all wires, hoses and lines have been disconnected.

- i. To reinstall the engine, reverse the removal procedure. When reinstalling the engine, torque the engine mount bolts to 300 to 350 inch-pounds.

ENGINE REMOVAL (EA-1 and after)

CAUTION

The magnetos should be considered hot when the ground lead is disconnected. To avoid accidental starting of the engine, ground the magneto by connecting a wire to the magneto switch lead and then to the engine case, or disconnect the spark plug leads.

- a. Remove the propeller. (See PROPELLER REMOVAL procedure in Section 7.)
- b. Remove the cowl as described in COWLING REMOVAL in this section.
- c. Remove the upper portion of the nose bug by

removing the screws and hinge pins.

- d. Disconnect the heater induction tubing at the mixer valve.
- e. Remove the air induction tubing between the air box and the turbocharger inlet.
- f. Disconnect the exhaust stack from the turbocharger.
- g. Disconnect the engine controls, plumbing, and wiring harness. Tag and label all items for reinstallation. Be sure to cap all open tubing.
- h. Place a support under the tail of the airplane.
- i. Place the engine hoist in position and attach to the lifting eyes on the engine.
- j. Hoist the engine sufficiently to remove the tension from the shock mount bolts.
- k. Remove the 2 front and the right rear shock mount bolts. Remove the 6 bolts attaching the left rear engine mount to the wheel well.
- l. Carefully hoist the engine from the airplane.

CAUTION

As the engine is hoisted away from the airplane, check to make certain that all wires, hoses and lines have been disconnected.

ENGINE INSTALLATION (EA-1 and after)

- a. Install the left rear engine mount to the engine and torque to 300 to 350 inch-pounds.
- b. Carefully lower the engine into the airplane.
- c. Install the remaining 3 shock mount bolts and torque to 300 to 350 inch-pounds. Install the 6 bolts securing the left rear mount to the wheel well. Torque these bolts to 100 to 105 inch-pounds.
- d. Remove the hoist from the engine.
- e. Install the wiring harness, plumbing, and engine controls.
- f. Connect the exhaust to the turbocharger.
- g. Install the induction tubing between the air box and turbocharger.
- h. Connect the heater tubing at the mixer valve.
- i. Install the upper portion of the nose bug.
- j. Install the cowl as described in COWLING REMOVAL in this Section.
- k. Install the propeller as described in PROPELLER REMOVAL AND INSTALLATION in Section 7.

IDLE SPEED AND MIXTURE ADJUSTMENT (E-1 and after)

(Figure 6-1)

- a. Remove the engine cowl doors.
- b. Start and run the engine according to the warm-up procedures. (This Section).
- c. Proceed to check the magnetos. (See Magneto Shut-Off Check) Maximum differential should not exceed

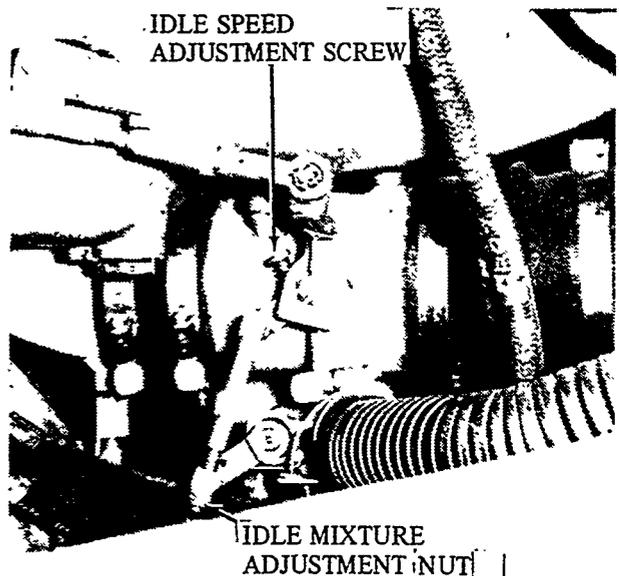
50 rpm. If the differential is within limitations, proceed with the idle adjustment.

d. Slowly retard the throttle lever to the idle position. The engine tachometer should indicate 600 rpm, (normal idle setting). To adjust, turn the idle speed adjusting screw at the throttle lever stop until the desired rpm is reached.

e. When the idle setting has been stabilized, move the cockpit mixture control lever with a smooth steady pull into the "IDLE CUT-OFF" position. Observe the rpm during the leaning out process. Adjust the idle mixture to obtain a slight and momentary gain in the idle speed as the mixture control is slowly moved toward the "IDLE CUT-OFF". (If the mixture is set too lean, the idle speed will drop under the same conditions.) The idle mixture adjustment is the locknut at the metering valve end of the linkage between the metering valve and air throttle levers. 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.

f. After each idle mixture adjustment change, clear the engine by running it up to 2000 rpm before making a mixture check.

g. If the idle setting does not remain stable, check the idle linkage; any looseness in this linkage will cause erratic idling. In all cases, allowance should be made for the effect of weather conditions upon idling adjustments.



36-241-28

Figure 6-1. Idle and Mixture Adjustment

FUEL SYSTEM ADJUSTMENT

(EA-1 and after)

(Figure 6-2)

The fuel system on the Continental TSIO-520-U or TSIO-520-UB engines may be adjusted as follows:

a. Install an appropriate pressure gage in the fuel line between the fuel pump and metering unit to monitor pump outlet pressures. This gage to be vented to atmosphere.

b. Start and run engine to bring cylinder head temperatures up to approximately 250°F.

c. Using throttle lever, set engine idle speed at approximately 650 RPM.

d. Set pump pressure at idle RPM to 6 - 7 PSI using the relief valve adjustment screw (1) on the centerline of the fuel pump. Turn screw CW to increase pressure, CCW to decrease pressure.

e. Maintain the idle RPM and idle pump pressure specified above (reset as required), adjust the idle mixture screw (4) on the metering unit to obtain the desirable fuel-air ratio which will result in a 25 - 50 RPM rise when the engine is leaned to best power setting with the mixture control. Turn the adjustment screw CW to lean the mixture and CCW to richen.

NOTE

If this adjustment cannot be accomplished with screw (4), butterfly linkage (3), may be used to make this adjustment.

NOTE

Cylinder head temperature must be 200-250°F each time RPM rise is checked, otherwise the results will be inconsistent.

f. Advance throttle to full (rated) power setting to check pump pressure and fuel flow. With approximately 2700 RPM, full throttle, and 36.0 in. Hg. manifold pressure, set fuel flow at 195 - 205 lbs/hr. The full power fuel flow setting is made by using the variable orifice adjusting screw (2) located on the aft end of the fuel pump aneroid housing. Turn screw CW to decrease fuel flow and CCW to increase. (Jamb nut must be loosened before turning screw and retightened carefully after each adjustment.)

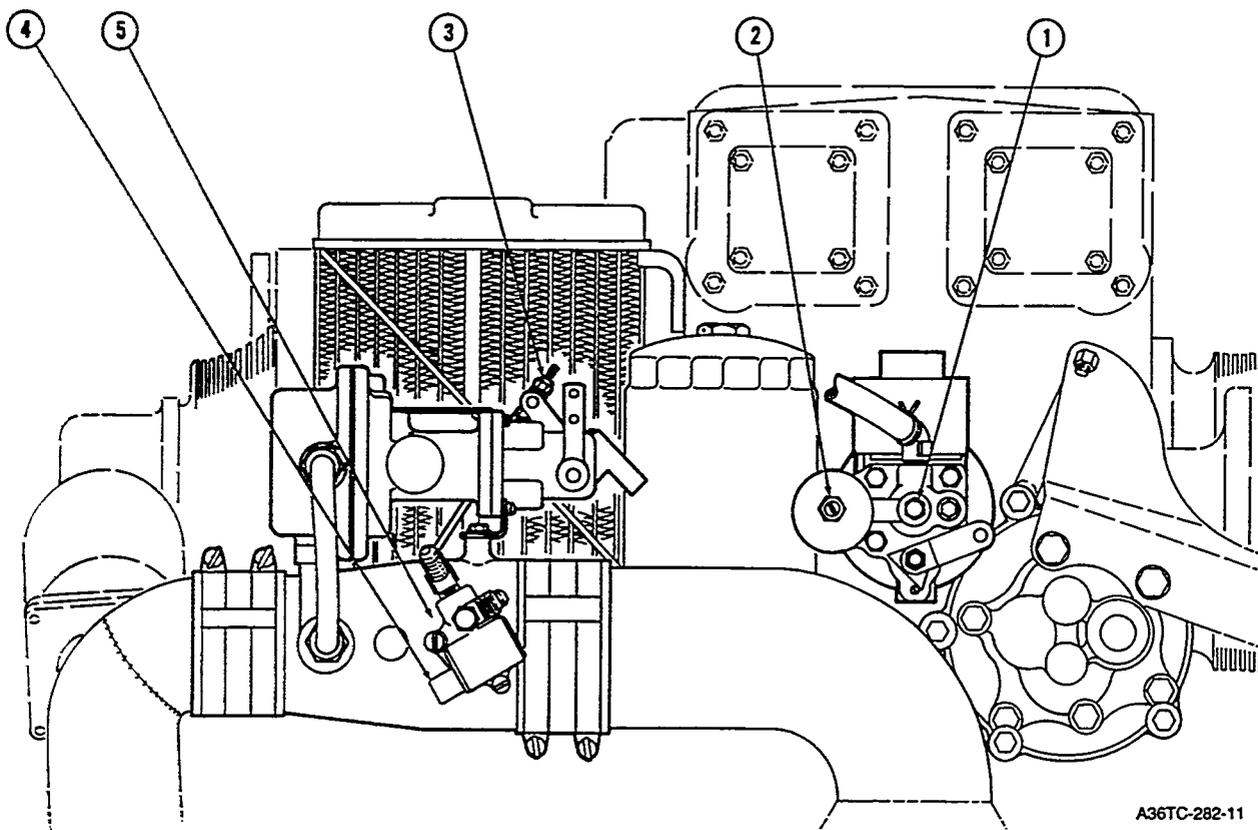
Pump pressure should be 33 to 37 PSI. Pump pressure values at full power are given for reference only to evaluate the functioning of other components in the fuel system.

g. After completion of item f, recheck items c, d and e. Readjust as required.

h. When fuel system is accurately adjusted, set engine idle speed to approximately 650 RPM with throttle stop adjusting screw (5), CW to increase, CCW to decrease.

NOTE

Throttle stop adjusting screw (5) (butterfly stop) is located on the forward side of the induction tubing.



A36TC-282-11

Figure 6-2. Fuel Adjustment (EA-1 and after)

i. When setting up full throttle fuel flow on a hot day (above 60°F) the system should be set toward the lower flow limit. On a cold day (below 60°F) the system should be set toward the higher flow limit.

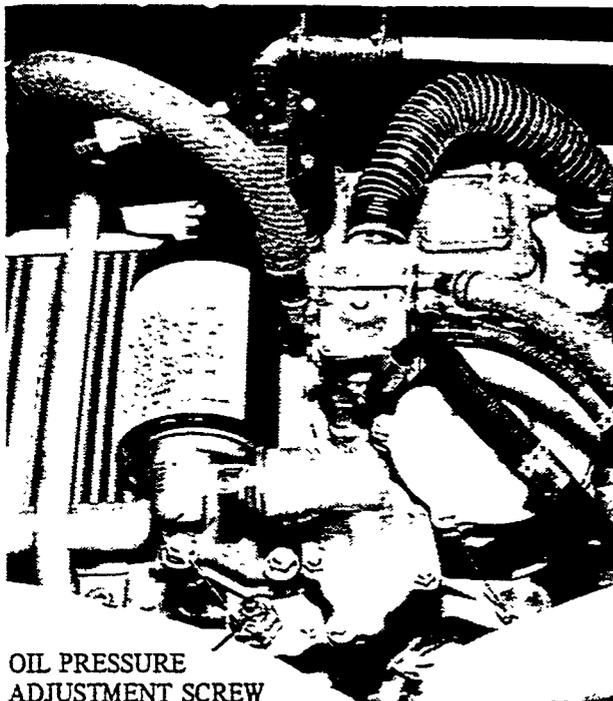
OIL PRESSURE ADJUSTMENT

(Figure 6-3)

The oil pressure adjustment screw is located approximately 3 inches below the oil filter housing. To adjust, turn the adjusting screw clockwise to increase or counterclockwise to decrease the oil pressure. The oil pressure should be between 30 and 60 psi at maximum operating rpm and temperature and 10 psi minimum at idle rpm.

HIGH OIL TEMPERATURE

Oil temperature is controlled by a spring loaded vernatherm oil cooler control valve. This valve will operate properly if the oil has not become contaminated with dirt or other foreign particles. If indications are that the valve is not operating properly remove the valve and clean it in solvent. (Item 15, Consumable Materials Chart). Also inspect the valve seat for damage. No repairs can be made to this valve and readjustments are not recommended since special testing equipment is required. The travel of the valve can be checked by immersing the valve assembly in heated water. The minimum amount of travel should be 0.090 inch as the temperature is raised from 120°F to 170°F. Replace defective valves.



OIL PRESSURE
ADJUSTMENT SCREW

36-257-1

Figure 6-3. Oil Pressure Adjustment

THROTTLE WARNING HORN ADJUSTMENT

- a. With the aircraft in flight, place the propeller control in low pitch and slowly pull the throttle control out until 12 to 14 inches (17 inches on EA-1 and after) of manifold pressure is indicated.
- b. Mark the position of the throttle control.
- c. After the aircraft has landed and with the engine shut-down, position the throttle control at the mark made in step b.
- d. Adjust the micro-switch at this position until the cam "clicks" the switch closed.
- e. Secure the switch in this position.

ENGINE AIR INDUCTION SYSTEM

Engine induction air is available from two sources, primary and alternate air. The primary air source is supplied through an intake duct, located on the forward cowling below the propeller. The primary air passes through an air filter and then into the induction system.

NOTE

If, after cleaning, the surfaces of the air filter show metallic wires through the remaining flocking material, the filter is no longer effective and should be replaced.

If the primary source of air is obstructed, the induction system forms a suction that opens an "Alternate Air Source" door and permits the required volume of air flow for normal engine performance. The alternate air door is located just aft of the air filter on the left side (EA-1 and after is on the right side) of the primary induction. If the alternate air door becomes frozen closed a T-handle located on the lower center section of the instrument panel, placarded ALTERNATE AIR PULL AND RELEASE, may be used to break the door open.

IGNITION

E-1 AND AFTER

The ignition system incorporates 2 magnetos either of the impulse coupled or nonimpulse coupled type. The impulse coupling allows the magneto to be retarded during start, and is also responsible for the additional magnet speed required for a strong spark while cranking. The impulse coupled magnetos are single points magnetos and are both operating during start. If the engine is equipped with nonimpulse coupled magnetos the left magneto has 2 sets of points. The retarded set of points is used in conjunction with a starter vibrator during start. With these magnetos the right magneto is grounded while the engine is cranking.

EA-1 AND AFTER

The ignition system incorporates a shower of sparks magneto and a starter vibrator. The left magneto has 2 sets of points, 1 set is used when the engine is running and the other set is used only during start.

When the starter is engaged the right magneto is grounded and the left magneto (using the retarded set of points) is supplied with pulsating current from the starter vibrator, which received its current from the starter solenoid. The starter vibrator is located on the left aft side of the firewall.

MAGNETOS

MAGNETO DROP-OFF CHECK

The drop-off check is accomplished by switching the magneto switch from "BOTH" to either the "RIGHT" or "LEFT" position and noting any loss or variance in rpm.

- a. Thoroughly warm up the engine and set the propeller control in low pitch. Place the mixture control in "FULL RICH".
- b. Set the throttle to produce 1700 rpm.
- c. Note the amount of rpm differential between the "LEFT" and "RIGHT" magnetos as the magneto switch is turned from "BOTH" to "LEFT" back to "BOTH" and then to the "RIGHT" position. The difference between the two magnetos operated individually should not exceed 50 rpm.

NOTE

Due to the design changes in today's higher performance engines, the comparison of single magneto operation versus both magnetos is no longer a sound criteria for evaluation of magneto performance. Therefore, all magneto checks should be performed on a comparative basis between Right and Left magneto performance. Also absence of magneto drop-off should be cause for suspicion that the timing has been bumped up in advance of the specified setting.

CAUTION

Operation on one magneto should not exceed 5 seconds to avoid fouling the spark plugs.

d. Normal magneto drop-off on either magneto should not exceed 150 rpm. If the magneto drop-off is excessive on either magneto, an inspection to determine the cause should be accomplished. Common causes are incorrectly timed magnetos, or incorrect fuel/air ratio.

MAGNETO POINT GAP AND TIMING

It is assumed that the magnetos have been properly internally timed and points adjusted per the applicable Bendix, or Slick vendor publication. To adjust the magneto points other than that specified in the applicable vendor publication manual will alter the magneto "E gap" and cause a weak spark. This internal timing and point adjustment should not be made on the airplane. For inspection purposes the point gap may be checked when the cam follower is resting on the high point of the cam lobe. The magneto point gap should be as follows:

MAGNETO POINT GAP IN INCHES

Bendix S6RN-1201 and S6RN-1205	
main breaker	0.016 ± 0.003
retard breaker.....(S6RN-1201 only)	0.016 ± 0.006
Bendix S6RN-12250.016 ± 0.003	
Slick 662 and 680	No point gap is specified for the Slick magnetos but the points should be ready to break open, with the timing pin in place, and the timing marks aligned (when viewed through the side vent hole).

On the Bendix series magnetos the internal timing and point adjustment should be made at the time of assembly or overhaul. (Bendix Timing Kit No. 11-8150-1 is available for internal timing of the magneto.)

NOTE

For adjustment of contact opening and internal timing of Bendix magnetos, refer to Bendix, for applicable manuals. Magneto contact assemblies should be checked after the first 25 and 50 hours operation and each 50 hours thereafter.

PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE

BENDIX MAGNETOS

On Bendix magnetos turn the magneto drive in the direction opposite to normal rotation (this keeps the impulse couplers from engaging) (nonimpulse coupled magnetos may also be rotated opposite to normal rotation) until the respective timing mark (viewed through the inspection hole) on the distributor gear is aligned with the divided casting line of the magneto housing. Now the magneto is ready to install on the engine and to fire number 1 cylinder.

SLICK MAGNETOS

On Slick magnetos turn the magneto drive in the direction opposite to normal rotation (this keeps the impulse couplers from engaging) until the timing marks are aligned, (as viewed through the inspection hole) and the timing pin is in place through the frame and rotor shaft. Now the magneto is ready to install on the engine and fire number 1 cylinder.

REMOVAL OF THE MAGNETOS

a. Remove the four screws retaining the high tension outlet and remove the outlet from the magneto.

CAUTION

Current production magnetos do not have the automatic grounding devices featured on earlier Scintilla magnetos. To be safe, treat all magnetos as hot whenever the ground lead is disconnected. To ground the magneto, connect a wire to the switch lead of the magneto and ground the wire to the case.

b. Remove the grounding wire from the magneto.
c. Remove the two magneto retaining nuts and washers and pull the magneto away from the accessory case.

INSTALLATION AND TIMING OF MAGNETOS (With Engine Timing Marks) (E-1 and after)

NOTE

There is a noticeable amount of back lash in the nylon gears of slick magnetos at room temperature. At running temperature the nylon expands enough so that the gears are in proper mesh.

- a. Remove the lower spark plug from each cylinder.
- b. Cover the lower spark plug hole of No. 1 cylinder with thumb and turn the crankshaft until pressure is felt on thumb.
- c. Remove the plug in front of No. 6 cylinder and observe the timing mark on the alternator drive gear as the crankshaft is rotated slowly. When the mark on the gear is centered in the viewing hole, No. 1 piston is at the $22^{\circ} + 0^{\circ} - 2^{\circ}$ BTC position.

NOTE

Prepare the magneto for installation on the engine as described in PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE.

- d. Hold the magneto in the position it will occupy when installed, and check alignment of gear coupling slot and impulse coupling lugs. If not aligned, pull the gear out of mesh, but not out of the oil seal, and turn to correct alignment. Push the gear back into mesh.
- e. Place a new gasket on the magneto flange and install the magneto carefully so drive coupling lugs mate with the slots of the drive coupling. Install holding washers, lockwashers and nuts, but tighten only enough to permit turning the magneto for final timing, without looseness. Remove the timing pin (Slick magneto only).
- f. Connect the timing light lead to the ground terminal of each magneto. Both timing lights should be on. Tap the right magneto up with a non-marring hammer until that light goes out. Tap the left magneto down until the light goes out. Secure the magnetos.
- g. Turn the crankshaft a few degrees counterclockwise and bring it back again until the timing marks are aligned. At this point both timing lights should go out at the same instant that the timing mark on the crankshaft flange aligns with the crankcase parting flange or the timing mark on the alternator drive gear appears in the center of the crankcase inspection hole.
- h. If the timing lights do not go out at the same time, loosen the magneto that is late or early and repeat the process outlined in step "e" and "f" above.

TIMING THE MAGNETOS TO THE ENGINE (EA-1 AND AFTER)

- a. Remove the top spark plug from each cylinder.

b. Rotate the crankshaft in the direction of normal rotation to bring No. 1 cylinder up on its compression stroke.

c. Remove the plug in front of No. 6 cylinder and observe the timing marks on the alternator drive gear as the crankshaft is rotated. There are 2 marks, 1 at the 20° BTC position, and 1 at the 24° BTC position. When a position halfway between these marks is centered in the viewing hole, No. 1 cylinder is at the 22° BTC position of the compression stroke.

d. Connect a timing light to the switch terminal of the right magneto and rotate the crankshaft approximately 6° in the direction opposite of normal rotation.

e. Turn the crankshaft in the normal direction of rotation until the light just goes out. If 22° BTC is indicated by the timing marks on the alternator drive gear the magneto is correctly timed.

f. Repeat steps "d" and "e" for the left magneto.

If the magnetos are not correctly timed proceed as follows:

- a. Install the timing light on the magneto which is not properly timed.
- b. Set No. 1 cylinder at 22° BTC as indicated in step "c" preceding.
- c. Loosen the magneto mounting nuts.
- d. Rotate the magneto until the light just goes out.
- e. Tighten the magneto mounting nuts.

INSTALLATION AND TIMING OF MAGNETOS (With a Timing Disc and Pointer)

Even though the Continental engines have factory installed timing marks, a positive top dead center (TDC) locator and timing disc similar to that provided with the "Universal Engine Timing Indicator" may be used to time the magneto to the engine or to check the accuracy of the engine timing marks. The engine should be timed to fire at $22^{\circ} + 0^{\circ} - 2^{\circ}$ before top center (BTC).

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, disconnect all spark plug leads to prevent accidental firing of the engine.

CAUTION

The internal, automatic grounding devices used on the original Scintilla S series magnetos have proven unreliable in service and current production magnetos do not have this feature. To be safe, treat all magnetos as hot whenever the ground lead is disconnected. To ground the magneto, connect a wire to the switch lead at the filter capacitor and ground the wire to the engine case.

a. 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.

b. 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.

c. After locating the compression stroke of number 1 cylinder, locate the advanced firing position of number 1 cylinder by the use of a timing disc and pointer or the factory installed timing marks on the engine.

NOTE

On IO-520 and TSIO-520 series engines the timing marks are located on the alternator drive gear. Remove the plug in front of number 6 cylinder to observe the TDC and advance timing marks.

In all cases, it must be definitely determined that the number one cylinder is at the correct firing position on the compression stroke, after the crankshaft is turned in its normal direction of rotation.

d. If a universal timing disc and pointer is to be used, install the TDC locator in the top spark plug hole of number 1 cylinder.

e. Slowly rotate the engine in the normal direction of rotation until the piston lightly touches the locator.

f. Install the timing disc on the propeller spinner and rotate the timing disc until 0° (TC) is located under the pointer.

g. Rotate the engine in the opposite direction to normal rotation until number 1 piston lightly touches the locator.

h. Note the reading on the timing disc. Now rotate the disc toward 0° (TC) until 1/2 the reading noted is shown.

i. Remove the TDC locator from the spark plug hole.

j. Rotate the engine in the normal direction of rotation to the compression stroke of number 1 cylinder and until the pointer arrives at the number of degrees noted last in step "h" (1/2 the first noted reading in step "h").

k. Rotate the timing disc until the pointer is positioned at 0° (TC).

l. Rotate the engine opposite the normal direction of rotation to approximately 5° beyond the specified timing for the engine being timed.

m. Rotate the engine in the normal direction to the specified before top center (BTC) firing position (this is to remove gear backlash). Further movement of the engine should not be necessary until the magnetos are installed.

NOTE

Without turning the magneto coupling, hold the magneto in the position it will occupy when

installed on the engine and check alignment of engine drive coupling slot, and magneto impulse coupling lugs. If not aligned, pull engine gear out of mesh (but not out of the oil seal) and turn to alignment. Push gear back into mesh.

NOTE

The magnetos were prepared for installation, to fire number 1 cylinder, in PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE in this chapter.

n. Place new gaskets on magneto flanges and install the magnetos carefully so drive coupling lugs mate with slots of engine drive coupling. Install holding washers, lockwashers and nuts, but tighten only enough to permit turning the magnetos for final timing, without looseness.

NOTE

On Slick series magnetos check the distributor lead spring to make sure it is located in the center of the distributor shaft hole in the distributor bearing plate. Before removing the timing pin and reinstalling the distributor block housing on the magneto frame assembly, apply a drop of SAE 20 lubricating oil to the oilite bearings.

o. Install timing lights on the magnetos.

p. With the engine still positioned to fire number 1 cylinder at the specified BTC rotate the right magneto in the direction necessary to cause the points to just break open as indicated by the timing light.

q. Secure the right magneto.

r. Repeat steps "p" and "q" on the left magneto.

s. Recheck the magneto setting to confirm the + 0° - 2° has not been exceeded.

t. Turn the engine crankshaft a few degrees in the opposite direction to normal rotation and bring it back again until the advance timing mark is under the pointer on timing disc. At this point both timing lights should indicate, at the same time, that the magneto points opened.

u. If the timing lights do not respond at the same time, loosen the magneto that is either early or late and repeat the process outlined in step "p".

v. Remove the timing lights and reinstall the electrical leads to the magnetos.

AIR PRESSURE PUMP REMOVAL

- a. Access to the air pressure pump is gained through the left hand cowl door.
- b. Disconnect the necessary plumbing from the pump.
- c. Remove the four attaching nuts and washers and pull the pump straight aft.

AIR PRESSURE PUMP INSTALLATION

- a. Install a new gasket on the mounting pad flange.
- b. Position the pump on the mounting pad and install the attaching nuts and washers.
- c. Reinstall the plumbing.
- d. Start the engine and check for leakage at the

mounting flange, and check for proper operation and pressure readings.

OIL COOLER REMOVAL

- a. Access to the oil cooler may be gained through the left cowl door.
- b. Disconnect the oil temperature wire and the oil pressure line.
- c. Remove the nine bolts and washers securing the baffling to the oil cooler.
- d. Remove the five attaching nuts and washers, (two at the top of the oil cooler, and three at the oil cooler inlet). Remove the oil cooler.

OIL COOLER INSTALLATION

- a. Install a new gasket at the oil cooler inlet.

- b. Install the attaching nuts and washers.
- c. Install the oil temperature wire and the oil pressure line.
- d. Start the engine and check for leakage and proper operation and temperatures.

ENGINE DRIVEN FUEL PUMP REMOVAL AND INSTALLATION

- a. Access to the engine-driven fuel pump is gained through the left cowl door.
- b. The fuel pump is located at the rear, in the center of the engine.
- c. Disconnect the fuel plumbing and drain the fuel from the pump.
- d. Remove the fuel pump cooling shroud from the pump.
- e. Remove the pump retaining nuts and remove the pump.
- f. To install the pump, reverse the removal procedure.

TURBOCHARGER

The turbocharger is fully automatic, requiring no additional controls in the cockpit, and is designed to increase the power output and efficiency of the engine by supplying compressed air to the engine intake manifold. The power to drive the turbocharger is drawn from the exhaust gases passing through the turbine housing and over the turbine wheel to spin the shaft which is connected to the compressor. Ambient, filtered, air is then drawn in through the air inlet duct to the compressor where it is compressed and delivered to the throttle. As the engine power output increases, the flow of exhaust gases increases resulting in a proportionate increase in speed of the rotating assembly and turbocharger output. The turbocharger system (see Figure 6-4) consists of an exhaust driven turbine and centrifugal compressor mounted on a common shaft. The center section of the unit contains the bearings and lubrication passages and supports the turbine and compressor housing. Lubrication to the center section is supplied by regulated engine oil pressure at the oil cooler providing a constant oil flow over the bearings. The oil then drains by gravity into the sump tank located at the lowest point in the system and is returned by scavenge pump to the engine sump. Exhaust headers, crossover pipe, turbine inlet plenum, wastegate, exhaust by-pass duct, and tail pipe make up the exhaust system.

Automatic control of the system is supplied by three principal components; the variable absolute pressure controller, the wastegate actuator and engine oil pressure. Engine oil is supplied to the inlet port of the actuator which is permanently restricted by a capillary tube. The actuator is a hydraulic cylinder with oil pressure acting against spring tension. The piston inside the cylinder with an actuating rod attached, is heavily spring loaded in the up, or retracted position. As the oil pressure increases within the

chamber an expander-type seal on the piston seals the upper oil chamber from the lower chamber, forcing the piston down, against spring tension, extending the actuator rod which moves the attached wastegate butterfly toward the closed position. A decrease in oil pressure allows spring tension to return the piston, retracting the actuating rod, and returning the wastegate butterfly to the open position. Oil from the outlet oil port of the actuator is not restricted at the actuator but is pressure controlled by the variable absolute pressure controller which contains an aneroid bellows sensitive to pressure changes in the induction manifold. As the pressure it senses decreases, it expands, extending a metering pin which reduces the flow of oil through the body of the unit and increases the pressure across the actuator diaphragm forcing the piston down and moving the wastegate toward the closed position. The lower chamber of the controller equipped with an adjustable cam is linked to the throttle valve and is designed so that the controller setting is varied proportionally to the amount of power the pilot selects with the throttle by moving the metering pin seat. The compressor output is automatically controlled at a constant pressure by the variable absolute pressure controller providing the engine fuel pump and injector nozzles with the required flow and pressure at altitudes they are referenced to. The fuel flow gage diaphragm is also referenced to this pressure to prevent an erroneous reading.

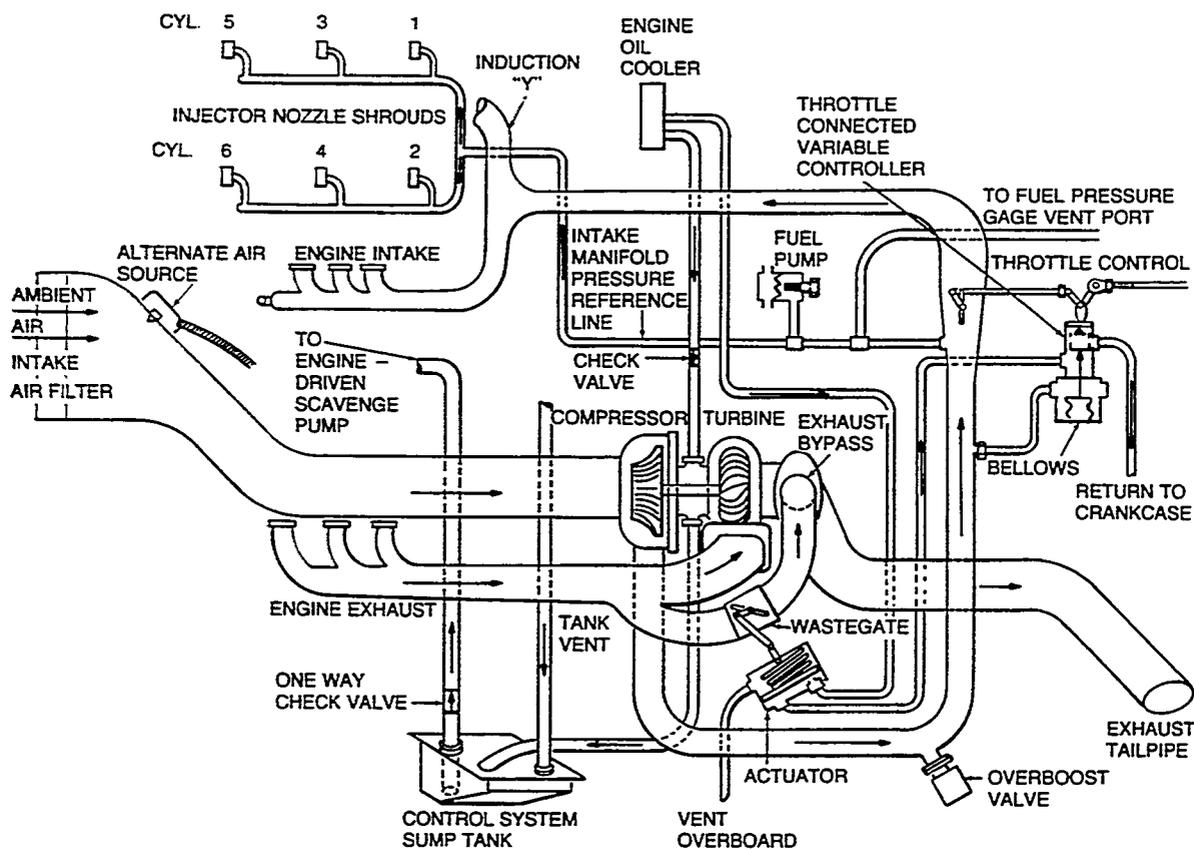
ADJUSTMENT AND TEST PROCEDURE (Figure 6-5)

- a. Head airplane into the wind. Set brakes and securely chock wheels.
- b. Warm up the engine until the oil temperature reaches at least 180° - 200°F.
- c. Slowly and smoothly apply the throttle until 36 in. Hg manifold pressure or the full throttle position is reached.

CAUTION

DO NOT EXCEED 36 IN. HG MANIFOLD PRESSURE.

- d. If at the full throttle position the manifold pressure HAS NOT REACHED 36 IN. HG:
 - 1. Shut the engine down.
 - 2. Loosen the lock nut on screw (13).
 - 3. Turn screw (13) counterclockwise to increase manifold pressure (one full turn approximates 1/2 inch manifold pressure).
 - 4. Retighten the lock nut on screw (13).
- e. If the manifold pressure REACHES 36 IN. HG BEFORE THE APPLICATION OF FULL THROTTLE:
 - 1. Shut the engine down.
 - 2. Loosen the lock nut on screw (13).



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Figure 6-4. Turbocharger Schematic

3. Turn the screw (13) clockwise to decrease manifold pressure (one full turn approximates 1/2 inch manifold pressure).

4. Retighten the lock nut on screw (13).

f. Repeat steps "b" through "e" until the manifold pressure at full throttle is 36 in. Hg.

CAUTION

DO NOT EXCEED 36 IN. HG MANIFOLD PRESSURE.

TURBOCHARGER LEAK TEST PROCEDURE

The turbocharger system may be checked for leaks in the induction, exhaust and air reference sections of the system as outlined in the following procedure.

a. Plug the exhaust stack with a large rubber stopper.

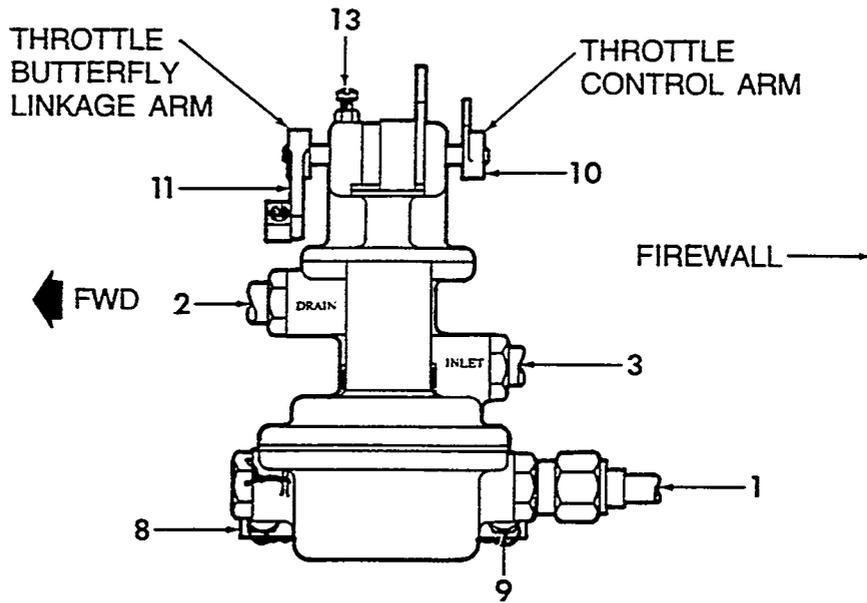
b. Remove the tube between the induction filter and the compressor inlet. Plug the inlet with a large rubber stopper.

c. Plug the manifold drain hose extending out the right side of the cowl opening.

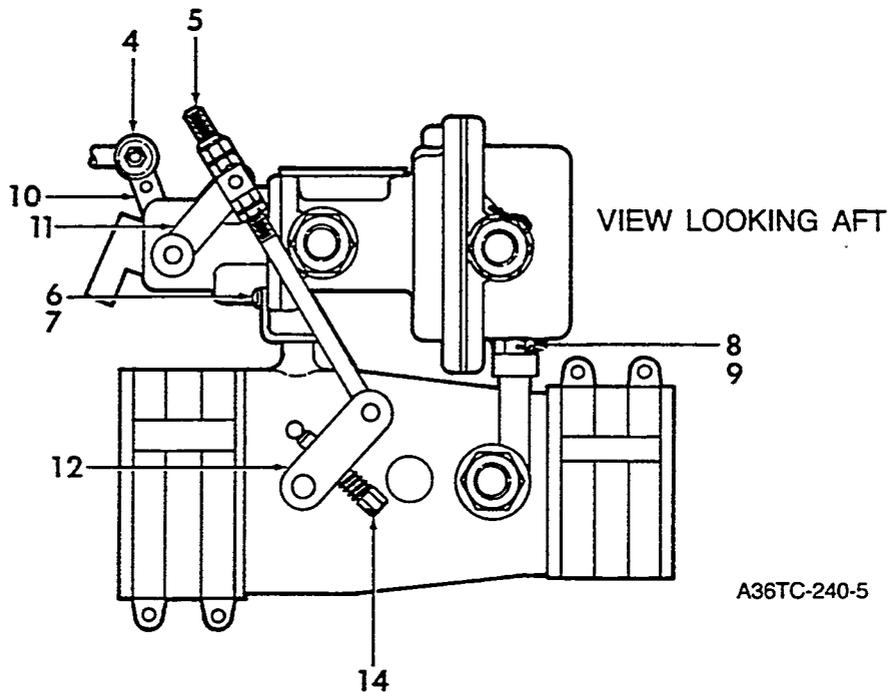
d. Remove one spark plug from any cylinder and rotate the propeller until the intake valve for the cylinder is in the open position. Proceed with the test as described below. When the intake valve test is complete, rotate the propeller until the exhaust valve for the cylinder is in the open position and again test the system as described below.

e. Install a regulator valve to a shop air supply line. Apply approximately 5 psi air pressure to the turbocharger system through the spark plug port of the cylinder described in step "d".

The following areas of the system should be tested for leaks by applying a soap solution.



VIEW LOOKING DOWN ON CONTROLLER FROM PILOT'S SIDE



A36TC-240-5

Figure 6-5. Turbocharger Controller

- a. The hose clamps on the induction manifold of the engine.
- b. The clamp at the compressor discharge outlet.
- c. The clamps on the compressor discharge elbow at the throttle inlet.
- d. The clamps at the throttle outlet to the riser manifold.
- e. All fittings in the compressor discharge pressure reference lines to the fuel nozzles and fuel pressure gage.
- f. The exhaust flanges at the cylinder exhaust ports. (With the exhaust valve in the open position.)
- g. The waste gate flanges. (With the exhaust valve in the open position.)

NOTE

The waste gate flanges must be aligned correctly and care taken on assembly to prevent damage to the thin metal gaskets.

- h. The turbo inlet gasket and flange bolts.
- i. The clamp holding the exhaust tail pipe to the turbo outlet.
- j. The slip joint between the exhaust elbow and the turbo inlet.

NOTE

The slip joint must be a good fit. However, it will not be a leak tight joint.

- k. Rigging of the waste gate in the completely closed position.

NOTE

Rigging of the waste gate is checked by removing the waste gate assembly from the exhaust bypass, plugging the oil outlet line applying an air pressure of 40 to 50 psi to the oil inlet line of the waste gate actuator. Observe the valve movement. Adjust the linkage between the actuator and the valve to obtain a tolerance of .005 to .025 inch between the waste gate butterfly and bore.

After completing the preceding steps, remove all plugs and reassemble the induction system.

FREEING TURBOCHARGER SHAFT

Rust deposits may form in the area of the turbocharger turbine shaft piston ring seal as a result of water vapor accumulation if the airplane is subjected to short intervals of engine operation. This condition occurs only when the

unit is new and combustion deposits have not formed a protective barrier on the seal surfaces. Although these deposits do restrict, and even stops shaft rotation, they are not harmful to subsequent turbocharger operation once they are removed sufficiently to give free shaft movement.

When this condition is noted, remove the exhaust discharge stack and apply WD-40 penetrating oil or Mouse Milk (Item 33, Consumable Materials Chart) liberally to the area behind the wheel around the turbine shaft seal. After a few minutes, attempt to turn the shaft. A light tap on the shaft end with a soft mallet will often assist in freeing the shaft. Once the shaft is free, the engine can be started and a power check made to confirm turbocharger output either on the ground or in flight.

TURBOCHARGER REMOVAL

- a. Open the engine cowl on the left side of the airplane.
- b. Remove the two louvered access openings on the left side of the engine compartment.
- c. Remove the heater ram air inlet duct.
- d. Remove the induction tube with the relief valve, by removing the clamps and lifting the tube away from the engine.
- e. Disconnect the red and yellow TIT wires.
- f. Remove the heat shield from over the turbocharger.
- g. Loosen the flex ducts on the turbocharger air inlet duct, and remove the air inlet duct.
- h. Remove the tail pipe by removing the clamp and bolt.
- i. Remove the oil lines from the turbocharger. Install dust covers.
- j. Remove the inlet to heater exhaust system.
- k. Remove the turbo inlet assembly above the turbocharger.
- l. Remove the bolts that secure the turbocharger to the mounting bracket.
- m. Remove the turbocharger through the forward access opening.

TURBOCHARGER INSTALLATION

- a. Install the turbocharger through the forward access opening on the left side of the airplane.
- b. Install the bolts which secure the turbocharger to the mounting bracket.
- c. Install the gaskets and the turbo inlet assembly on the turbocharger.
- d. Install the inlet to the heater exhaust system.
- e. Remove the dust covers from the oil lines and oil ports. Install the oil lines.
- f. Install the tail pipe. Tighten the V-band coupling to 12 inch pounds. Tap the periphery of the band to distribute tension, then torque to 20 inch pounds.
- g. Install the turbocharger air inlet duct and tighten the flex duct clamps.

- h. Install the heat shield over the turbocharger.
- i. Connect the red and yellow TIT wires.
- j. Install the induction tube which contains the relief valve. Install and tighten the clamps.
- k. Install the heater ram air inlet duct.
- l. Install the two louvered access openings on the left side of the engine compartment.
- m. Close the cowling on the engine compartment.

TURBOCHARGER CONTROLLER REMOVAL

- a. Remove the linkage to the throttle.
- b. Remove the linkage to the butterfly.
- c. Remove the manifold pressure reference line.
- d. Remove the oil lines. Install dust covers.
- e. Remove the safety wire on the two larger

mounting bolts.

- f. Remove the three mounting bolts.
- g. Remove the turbocharger controller.

TURBOCHARGER CONTROLLER INSTALLATION

- a. Place the turbocharger controller in its mounting location.
- b. Install the mounting bolts.
- c. Safety wire the two appropriate bolts.
- d. Remove the dust covers from the oil lines and install the oil lines.
- e. Install the manifold pressure reference line.
- f. Install the linkage to the throttle butterfly.
- g. Install the linkage to the throttle.

TROUBLESHOOTING ENGINE

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Engine will not start.	a. No fuel gage pressure - No fuel to engine.	a. Check fuel control for proper position, auxiliary pump "ON" and operating, feed valves open. Fuel filters open, and tank fuel level.
	b. Have gage pressure - engine flooded.	b. Turn off auxiliary pump and ignition switch, set throttle to "FULL OPEN" and fuel control to "IDLE CUT-OFF", and crank engine to clear cylinders of excess fuel. Repeat starting procedures.
	c. Have gage pressure - No fuel to engine.	c. Check for bent or loose fuel lines. Loosen one line at fuel nozzle. If no fuel shows replace fuel manifold valve.
2. Engine starts but fails to keep running.	a. Inadequate fuel to fuel manifold valve.	a. Set fuel control in "FULL RICH" position, turn auxiliary pump "ON" check to be sure feed lines and filters are not restricted. Clean or replace defective components.
	b. Defective ignition system.	b. Check accessible ignition cables and connections. Tighten loose connections. Replace defective spark plugs.
3. Engine runs rough at idle.	a. Improper idle mixture adjustment.	a. Readjust idle setting. Tighten adjustment nut to richen mixture and back off adjustment nut to lean mixture.
	b. Fouled spark plugs.	b. Remove and clean plugs, adjust gaps. Replace defective plugs.

TROUBLESHOOTING ENGINE (Cont'd)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
4. Engine has poor acceleration.	a. Idle mixture too lean.	a. Readjust idle mixture as described in 3a.
	b. Incorrect fuel-air mixture, worn control linkage, or restricted air cleaner.	b. Tighten loose connections, replace worn elements of linkage. Service air cleaner.
	c. Defective ignition system.	c. Check accessible cables and connections. Replace defective plugs.
5. Engine runs rough at speeds above idle.	a. Improper fuel-air mixture.	a. Check manifold connections for leaks. Tighten loose connections. Check fuel control and linkage for setting and adjustment. Check fuel filters and screens for dirt. Check for proper pump pressure, and replace pump if defective.
	b. Restricted fuel nozzle.	b. Remove and clean all nozzles.
	c. Ignition system and spark plugs defective.	c. Clean and regap spark plugs. Check ignition cables for defects. Replace defective components.
6. Engine lacks power, reduction in maximum manifold pressure or critical altitude.	a. Incorrectly adjusted throttle control, "sticky" linkage or dirty air cleaner.	a. Check movement of linkage by moving control from idle to full throttle. Make proper adjustments and replace worn components. Service air cleaner.
	b. Defective ignition system.	b. 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. Spark plug gap to be 0.018 to 0.022 inch.
	c. Loose or damaged intake manifold.	c. Inspect entire manifold system for possible leakage at connections. Replace damaged components, tighten all connections and clamps.
	d. Fuel nozzles defective.	d. Check for restricted nozzles and lines and clean or replace as necessary.
7. Low fuel pressure.	a. Restricted flow to fuel metering valve.	a. Check mixture control for full travel. Check for restrictions in fuel filters and lines, adjust control and clean filters. Replace damaged parts.
	b. Fuel control lever.	b. Check operation of throttle control and for possible contact with cooling shroud. Adjust as required to obtain correct operation.

TROUBLESHOOTING ENGINE (Cont'd)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
7. Low fuel pressure_(Cont'd)	c. Incorrect fuel injector pump adjustment and operation.	c. Check and adjust using appropriate equipment. Replace defective pumps.
	d. Defective fuel injector pump relief valve.	d. Replace pump.
8. High fuel pressure.	a. Restricted flow beyond fuel control assembly.	a. Check for restricted fuel nozzles or fuel manifold valve. Clean or replace nozzles. Replace defective fuel manifold valve.
	b. Defective relief valve operation in fuel injector.	b. Replace fuel injector pump.
	c. Restricted re-circulation passage in fuel injector pump.	c. Replace pump.
9. Fluctuating fuel pressure.	a. Vapor in fuel system, excess fuel temperature.	a. Normally operating the auxiliary pump will clear system. Operate auxiliary pump and purge system.
	b. Fuel gage line leak or air in gage line.	b. Bleed gage line and tighten connections.
	c. Restriction in vapor separator vent.	c. Check for restriction in ejector jet of vapor separator cover. Clean jet with solvent (only). Do Not Use Wire As Probe. Replace defective parts.
10. Low oil pressure on engine gage or high oil temperature.	a. Insufficient oil in oil sump, oil dilution or using improper grade oil for prevailing ambient temperature.	a. Add oil, or change oil to proper viscosity.
	b. Defective vernatherm valve.	b. Check for defective vernatherm valve. Replace valve if defective.
	c. Oil cooler restriction.	c. Clean oil cooler.
	d. Leaking, damaged, or loose oil line connection. Restricted screen or filter.	d. Check for restricted lines and loose connections and for partially plugged oil filter. Clean parts, tighten connections and replace defective parts.
	e. Low oil pressure.	e. Readjust oil pressure if necessary.
11. Poor engine idle cut-off.	a. Engine getting fuel.	a. Check fuel control for being in full "IDLE CUT-OFF" position. Check auxiliary pump for being "OFF". Check for leaking fuel manifold valve. Replace defective components.

TROUBLESHOOTING TURBOCHARGER SYSTEM

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Turbocharger inoperative.	a. Turbocharger rotor jammed.	a. Replace.
	b. Controller malfunctioning.	b. Replace.
	c. Wastegate linkage not functioning.	c. Adjust or replace.
	d. Metering jet in actuator inlet blocked.	d. Backflush with PD680 solvent (Item 15, Consumable Materials Chart), 50 psi.
	e. Turbocharger inlet blocked.	e. Remove obstruction.
	f. Controller pressure sensing line blocked.	f. Remove obstruction.
2. Engine has low critical altitude.	a. Controller out of calibration.	a. Replace.
	b. Controller malfunctioning.	b. Replace.
	c. Wastegate out of rig.	c. Adjust.
	d. Leak in exhaust system.	d. Eliminate any leaks.
	e. Metering jet in actuator inlet blocked.	e. Backflush with PD680 solvent (Item 15, Consumable Materials Chart), 50 psi.
	f. Controller pressure sensing line blocked.	f. Remove obstruction.
	g. Compressor discharge duct loose or leaking.	g. Eliminate any leaks.
3. Manifold pressure surges at altitude.	a. Controller malfunctioning.	a. Replace.
	b. Metering jet in actuator inlet blocked.	b. Backflush with PD680 solvent, 50 psi.
	c. Controller pressure sensing line blocked.	c. Remove obstruction.
	d. Compressor discharge duct loose or leaking.	d. Eliminate any leaks.
	e. Leak in exhaust system.	e. Eliminate any leaks.
4. Engine smokes at idle.	a. Turbocharger jammed.	a. Replace.
	b. Seal ruptured in controller.	b. Replace.
	c. Turbocharger bearing seals leaking.	c. Replace.
5. Oil leaking from actuator drain.	a. Actuator piston seal ruptured.	a. Replace.

TROUBLESHOOTING TURBOCHARGER SYSTEM (Cont'd)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
6. High manifold pressure at take-off.	a. Controller out of calibration.	a. Replace.
	b. Controller malfunctioning.	b. Replace.
	c. Controller pressure sensing line broken.	c. Replace.
	d. Wastegate linkage not functioning.	d. Adjust or replace.
	e. Controller pressure sensing line blocked.	e. Remove obstruction.
7. Low manifold pressure at take-off.	a. Controller out of calibration.	a. Replace.
	b. Controller malfunctioning.	b. Replace.
	c. Controller pressure sensing line blocked.	c. Remove obstruction.
	d. Compressor discharge duct loose or leaking.	d. Eliminate any leaks.
	e. Metering jet in actuator inlet blocked.	e. Backflush with PD680 solvent (Item 15, Consumable Materials Chart), 50 psi.
	f. Leak in exhaust system.	f. Eliminate any leaks.
8. High fuel pressure at altitude.	a. Leak in pressure reference line at fuel pressure line.	a. Eliminate any leaks.
	b. Pressure reference line blocked.	b. Remove obstruction.
9. Low fuel pressure at altitude.	a. Leak in pressure reference line at fuel pump.	a. Eliminate any leaks.
	b. Pressure reference line blocked.	b. Remove obstruction.
	c. Auxiliary fuel pumps not on or inoperative.	c. Repair or replace.
10. Turbocharger overspeeding.	a. Controller malfunctioning.	a. Replace.
	b. Wastegate out of rig.	b. Adjust.
	c. Compressor discharge duct loose or leaking.	c. Eliminate any leaks.

TROUBLESHOOTING TURBOCHARGER SYSTEM (Cont'd)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
11. Excessive noise or vibration.	a. Improper bearing lubrication.	a. Clean or replace oil line; clean oil strainer, and supply oil pressure. If trouble still persists, overhaul turbocharger.
	b. Leaking engine intake or exhaust manifold.	b. Tighten connections or replace manifold gaskets as necessary.
12. Engine will not deliver rated power.	a. Clogged manifold system.	a. Clear all ducting.
	b. Foreign material lodged in compressor turbine or impeller.	b. Disassemble and clean.
	c. Excessive dirt build-up in compressor.	c. Thoroughly clean compressor. Service air cleaner and check for leakage.
	d. Leak in engine intake or exhaust manifold.	d. Tighten connections or replace manifold gaskets as necessary.
	e. Rotating assembly bearing seizure.	e. Overhaul turbocharger.

EGT INDICATOR (E-1 AND AFTER)

The exhaust gas temperature (EGT) indicator is used to lean the engine under cruise conditions at approximately 75% power or less. Under normal conditions this instrument should not require calibration.

TIT INDICATOR CALIBRATION (EA-1 AND AFTER)

If the exhaust gas temperature indicator is used only for leaning the engine under conditions of 75% cruise power or less, calibration is not required. But calibration is desirable because the engine or turbocharger may be damaged by operating at excessive temperatures (operation at above a TIT of 1650° F. is limited to 60 seconds). It is recommended that the engine be operated at least 100°F. on the rich side of peak TIT.

CAUTION

Damage to the turbocharger turbine blades, excessive turbine coking and excessive oil consumption may be caused by turbine inlet temperatures above 1650°F.

To prevent a turbine inlet over-temperature condition due to an inaccurate TIT indicator reading, the indicator should be checked every 100 hours and calibrated if required.

The following procedure may be used to check and calibrate the TIT indicator:

- a. Remove the TIT probe from the turbocharger intake manifold. (Do not disconnect the wires from the probe.)
- b. Using the AICal test equipment, heat the probe to 1650°F.

c. If the TIT indicator reads 1650°F the indicator is properly calibrated. If the reading is not 1650°F the calibration screw on the face of the instrument should be adjusted to obtain this reading.

d. If the seal was broken on the calibration screw, reseal by applying a small amount of torque seal as shown in Figure 6-6.

e. Reinstall the probe in the turbocharger intake manifold.

ALCAL CALIBRATION UNIT (EA-1 AND AFTER)

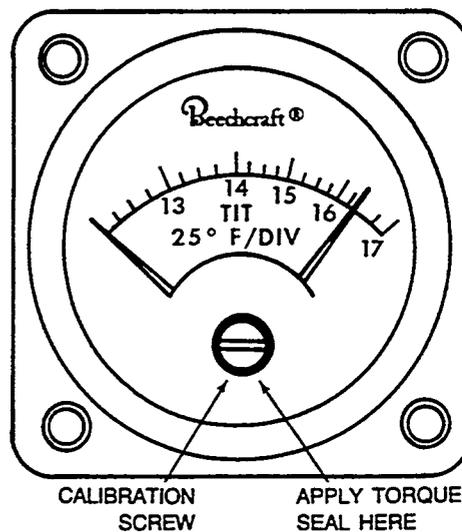
The AlCal Calibration unit, available locally through the Beechcraft Aero or Aviation Center and International Distributors and Dealers, provides a simple and accurate method for checking and, if necessary, recalibrating airplanes piston engine EGT systems. If the red line temperature is exceeded by the TIT indicators, the calibration unit will quickly determine if the fault lies with the indication system or the engine. The following method will accomplish the TIT calibration test:

a. Light the AlCal unit and support it from the engine cowling.

b. Place the TIT thermocouple into the comparator port of the AlCal unit until it is touching the reference thermocouple.

c. Raise the heat of the AlCal unit until the temperature of 1650°F (900°C) is indicated on the unit's reference meter.

d. Because both thermocouples are measuring the same temperature, the aircraft-installed TIT indicator



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Figure 6-6. TIT Indicator

should indicate the same red line temperature. If the indicator corresponding to the engine being tested does not register 1650°F (900°C), refer to the adjustment procedure outlined under TIT INDICATOR CALIBRATION in this chapter.

e. Replace the TIT thermocouple in the turbocharger intake manifold. Lubricate the threads on the probe with MIL-A-907D anti-seize compound (Item 35, Consumable Materials Chart).

PROPELLER

PROPELLER REMOVAL AND INSTALLATION

Standard Equipment (Two Blade)
Optional Equipment (Three Blade)

a. Remove the six nuts from the studs that attach the propeller to the engine crankshaft flange.

NOTE

When propeller deice is installed, it is necessary to tape the brushes in place before the propeller is removed.

b. Place a drain trough under the attaching point of the propeller and crankshaft, to prevent oil draining into the engine cowl.

c. Remove the propeller from the engine crankshaft flange.

d. Use clean shop rags to plug the center of the engine crankshaft and the propeller hub.

NOTE

Before installation of the propeller lubricate the "O" ring that is installed in the circular groove of the propeller hub with engine oil, (Item 2, Consumable Materials Chart).

e. To install the propeller align the No. 1 blade directly over the TIC mark on the crankshaft flange. (Torque the propeller nuts 660 to 720 inch pounds.)

f. It may be necessary to check the alignment of the deicer brushes to the slip ring as noted in Section 11.

PROPELLER GOVERNOR REMOVAL AND INSTALLATION

The governor is mounted on the forward left hand side of the engine. Four studs and nuts secure the governor on the engine. The governor may be removed as follows:

a. Disconnect the control rod at the governor control lever.

NOTE

Exercise care not to loosen the jam nut on the control rod which could alter the setting of the control rod.

b. Remove the four mounting nuts and pull the governor from the studs.

c. Cover the governor base and engine pad to protect them.

d. Reinstall the governor by reversing the above procedure.

ADJUSTING THE PROPELLER GOVERNOR (Figure 7-1)

The propeller governor can be adjusted for a high and low rpm setting. The high rpm adjustment must be checked while the aircraft is in flight. Observe the take-off rpm to see if it exceeds the redline figure. If excessive rpm is indicated, land the plane and adjust the governor high rpm screw located on the governor control lever stop. Adjust the screw clockwise to reduce the rpm; to increase the rpm adjust the screw counterclockwise. One complete revolution of the screw will decrease or increase the propeller rpm by approximately 30 revolutions.

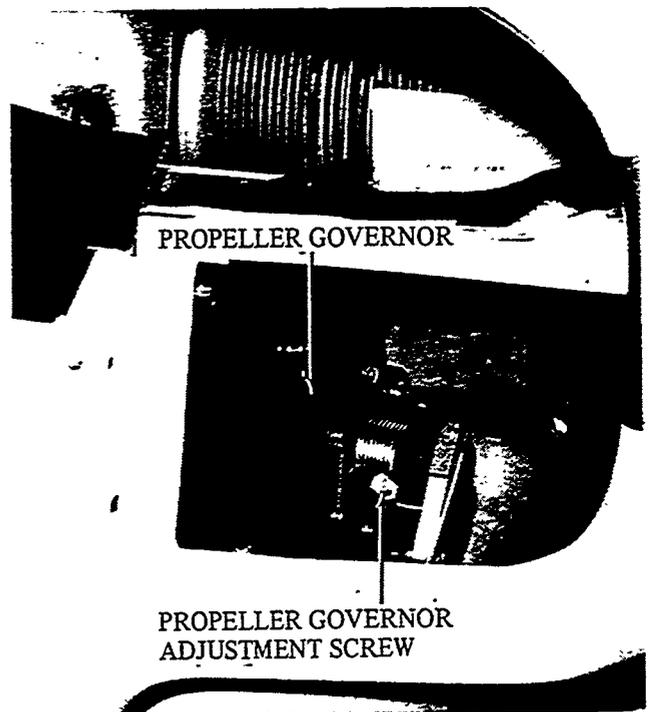


Figure 7-1. Propeller Governor Adjustment

PROPELLER ADJUSTMENT

For High and Low Pitch adjustments, service, overhaul and maintenance procedures, refer to the manufacturers applicable FAA Approved Propeller Manual.

MINOR PROPELLER BLADE REPAIR (Figure 7-2)

Minor nicks, dents, and gouges may be dressed out by approved line personnel. Blend any nicks or gouges into the leading edge with smooth curves, and generous radii as shown in figure 7-2. Reanodize reworked area by the chromic acid process only.

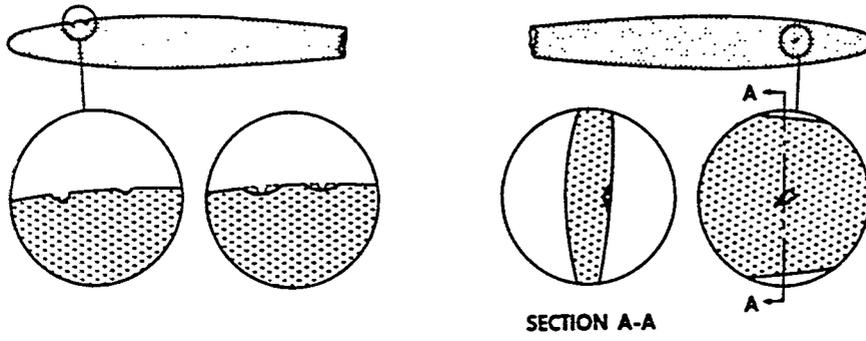


Figure 7-2. Minor Propeller Blade Repair

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FUEL SYSTEM
(Figure 8-1)

CAUTION

Any time the fuel system is drained or a fuel cell replaced, air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the applicable Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.

The standard fuel system consists of a 25 gallon (22 gallon usable) fuel cell located in each wing. The cells are filled through independent flush type filler caps. The fuel cells may be drained through the drain fittings provided in each cell. The drain fittings are located at the root of each wing on the underside of the airplane. An optional fuel system provides a 40 gallon (37 gallon usable) fuel cell for each wing in place of the standard 25 gallon fuel cell.

Normal maintenance and repair procedures for the fuel system conform to usual aircraft practices; keeping connections and fittings tight and the supporting clamps in place to avoid vibration and chafing, replacement of defective or doubtful parts and protecting the system from dirt and contamination. The fuel cells, their fittings and certain other components require some special handling; these items are discussed in the following paragraphs.

NOTE

Only VV-P-236 petrolatum thread lubricants should be used on fuel system fittings. Avoid sealers and lubricants which are not soluble in fuel.

The fuel inlet hose between the firewall and the fuel pump should be inspected at each periodic inspection for leakage and looseness between the hose and the hose

fittings. This inspection should be made while the system is under pressure.

Inspecting and cleaning the fuel strainers should be considered of the utmost importance as a regular part of preventive maintenance. The frequency of inspecting and cleaning the fuel filters will depend upon service conditions and fuel handling equipment cleanliness. However, when operating in localities where there is an excessive amount of sand or dust, the strainers should be inspected at more frequent intervals. It is recommended that the fuel strainer located in the fuel selector valve be inspected and cleaned at intervals of at least 50-hours of operation and under no condition should the period be extended over 100 hours. The finger strainers in the fuel cell outlets should be removed and cleaned whenever solid materials are found in the cells, or when the airplane has been in storage for an extended period of time.

INSPECTION OF FUEL CELL VENT LINES
AND FUEL FILLER CAPS
(Figure 8-2)

The following procedure is recommended for inspection of fuel tank vent lines and filler caps:

- a. Remove the access plate for each wing fuel cell from the lower wing surface.
- b. Disconnect the fuel cell vent line from the fuel cell.
- c. Apply air pressure to the fuel cell end of the vent line.
- d. Alternately plug each vent opening to assure that air is passing through all branches of the vent system for the cell. Continue to blow air through each branch until any obstructions have been removed.
- e. Remove the siphon break check valve and blow air through the siphon break line from the check valve end, then reinstall the valve.
- f. Reconnect the fuel cell vent line to the fuel cell.
- g. Reinstall the access plate below each fuel cell.

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h. Visually check each fuel cell filler cap for looseness or deterioration of the seal which could cause leakage. If seals are deteriorated or damaged in any way, they should be replaced.

i. Check the extended vent to ascertain that the vent extends a minimum of 1.75 inches below the lower wing skin surface. The vent tube should be scarfed at a 45° angle on the forward side and should be canted forward 10° perpendicular to the skin.

NOTE

Any configuration of the vent other than as noted in step "i", may create a negative vent pressure. A negative vent pressure will pull the air, or air and fuel, from the tank.

**INSPECTION OF MAIN FUEL CELL
FLAPPER VALVE**

On airplanes that are equipped with baffled main fuel cells, the flapper valves (metal or phenolic) should be inspected periodically (Beech Aircraft Corporation recommends that the inspection be accomplished at each annual inspection) for freedom of operation and proper seating.

The inspection may be accomplished as follows:

a. Drain all fuel from the airplane.

b. Remove the rectangular access plate located just outboard of the fuselage on the upper skin of each wing leading edge.

c. Cut the safety wire and remove the attaching bolts from the fuel cell access plate.

NOTE

Clean the area around the access plate before removing the plate.

d. Remove the fuel cell access plate and open the zipper in the baffle.

e. Locate the flapper valve in the lower outboard section of the baffle and

determine if the flapper valve is metal or phenolic.

f. If the flapper valve is metal, it should be inspected and repaired, if necessary, as described below.

1. Move the flapper element of the valve through its full travel. There should be no binding and the element should seat securely against the valve plate.

2. If the flapper element binds and/or does not seat properly, the flapper element arm could be bent. The arm can be straightened by placing a screwdriver between the arm and the element and pressing the element toward the closed position.

g. If the flapper element still binds and/or does not seat properly after the arm is straightened, the flapper element should be removed and replaced with a new flapper element assembly. The flapper element assembly may be replaced by removing the two attaching bolts from the upper part of the flapper valve. The same attaching parts should be used to install the new flapper element assembly. The new flapper element assembly should be inspected, to determine that the assembly did not receive damage during installation that could cause it to bind and/or not seat properly.

h. If the flapper valve is phenolic, it should be inspected and reworked, if necessary, as described below:

1. Move the flapper valve element through its full travel. There should be no binding and the element should seat securely against the valve plate.

2. If the flapper element binds and/or does not seat properly, the upper rear side of the flapper element may be binding against the valve plate.

3. The flapper valve element may be relieved from binding by filing a small radius on the upper rear side of the element.

NOTE

A shop towel saturated with light oil may be placed directly below

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the flapper valve to absorb the phenolic dust during rework.

4. After determining that the flapper valve is functioning properly, thoroughly wipe the area in the vicinity of the flapper valve with an oil-saturated shop towel.

i. Clean the gasket contact area on the fuel cell and fuel cell access plate.

j. Close the zipper in the baffle.

k. Install a new gasket, and secure the fuel cell access plate in place.

l. Tighten the fuel cell access plate attaching bolts to a torque of 45 to 50 inch-pounds and safety wire.

m. Reinstall the rectangular access plate on the wing leading edge skin.

AIRPLANE DEFUELING

To ensure that all fuel is removed from the system, the fuel should be drained through the boost pump. To expedite the defueling operation, the boost pump may be used to pump the fuel out of the system. The following steps must be accomplished before energizing the pump:

a. Apply external power to the airplane electrical system.

b. Place the fuel selector valve in the ON position and the mixture lever in IDLE CUT-OFF.

c. Remove the filler caps to vent the system.

d. Disconnect the fuel line at the firewall and attach a drain hose. Provide a suitable container for the fuel.

e. Energize the boost pump.

f. When fuel is no longer pumped from the airplane, open the sump drains to complete the defueling operating.

FUEL CELL REMOVAL

a. Drain and purge the fuel cells.

b. Remove the outboard fuel cell access plate and fuel quantity sensor.

(The outboard fuel quantity sensor is installed only in the optional 80-gallon fuel system).

c. Remove the inboard access cover and fuel quantity sensor.

d. Disconnect all fuel and vent plumbing.

e. Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

CAUTION

Tape the edge of the access hole to prevent damage to the fuel cell.

FUEL CELL INSTALLATION

CAUTION

Care should be taken when replacing fuel cells to ensure that the correct type fuel cell is used as a replacement. All 36 Series airplanes use baffled fuel cells.

To avoid damage to the fuel cells, the fuel cell cavities MUST be clean of any debris before installing a replacement cell.

a. Return the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION

Before closing the zipper, inspect the fuel cell for any foreign material. If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

b. Close the zipper in the fuel cell dam. Reinstall the filler adapter, flow line, quantity sensors, drain and access covers that were previously removed. Use new gaskets.

CAUTION

The molded nipple fittings used on the fuel cell are lightweight

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fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to exercise certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

1. Insert the flow tube into the fitting until 3/8 inch or more of the tube extends through the fitting.
2. Locate the hose clamp on the fabric reinforced area of the nipple: it should clear the end of the fitting by 1/4 inch.
3. Torque the hose clamps as indicated in Chart 1 in this Chapter. They should be drawn up in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.
4. Use no sealing paste or gasket compounds.
5. Apply a thin film of Simonize wax to metal flow tubes as a lubricant. No other lubricant should be used.

**Chart 1
Fuel Cell Nipple Clamp Torques**

Inside diameter (in inches) of nipple	Inch-pounds of torque for fuel cell nipple clamps
.25 thru .62	12 to 16
.75 and 1.00	15 to 20
1.50	25 to 30
2.00	30 to 35
3.00	35 to 40

CAUTION

If replacement Goodyear fuel cells have clear/yellow nipples, torque the fuel cell nipple clamps to 25 ±5 inch-pounds.

FUEL QUANTITY INDICATOR CALIBRATION (E-364 AND AFTER, EA-1 AND AFTER)

EMPTY POSITION

- a. Make certain the fuel cell is empty.
- b. Remove the access cover from over the transmitter.
- c. Disconnect the electrical wiring.
- d. Remove the fuel quantity transmitter.
- e. Bend the arm as required to get a correct reading on the indicator.
- f. Install the transmitter.
- g. Connect the electrical wiring.
- h. Install the access cover.

FULL POSITION

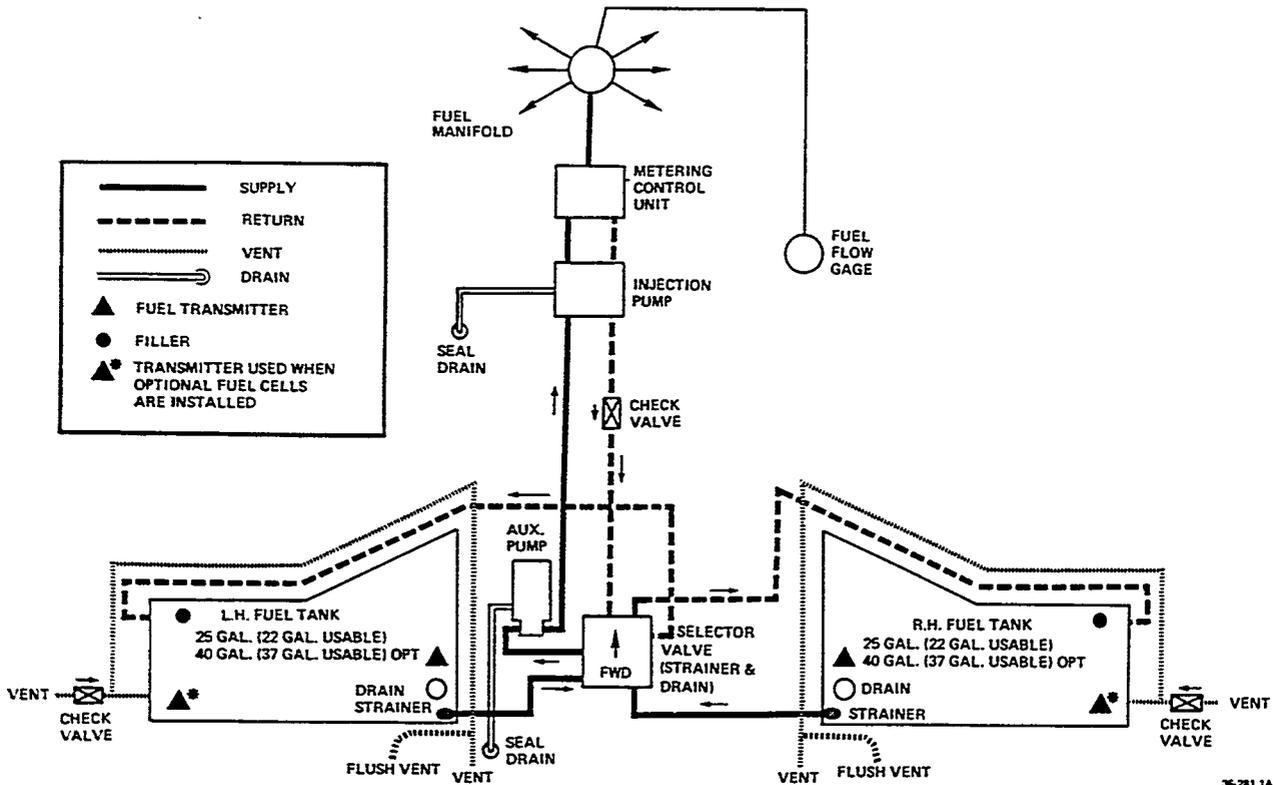
- a. Remove the glareshield over the instrument panel.
- b. Locate the two printed circuit boards located on the back of the instrument panel just to the left of center.
- c. Locate the calibration screw in the back of each printed circuit board.

NOTE

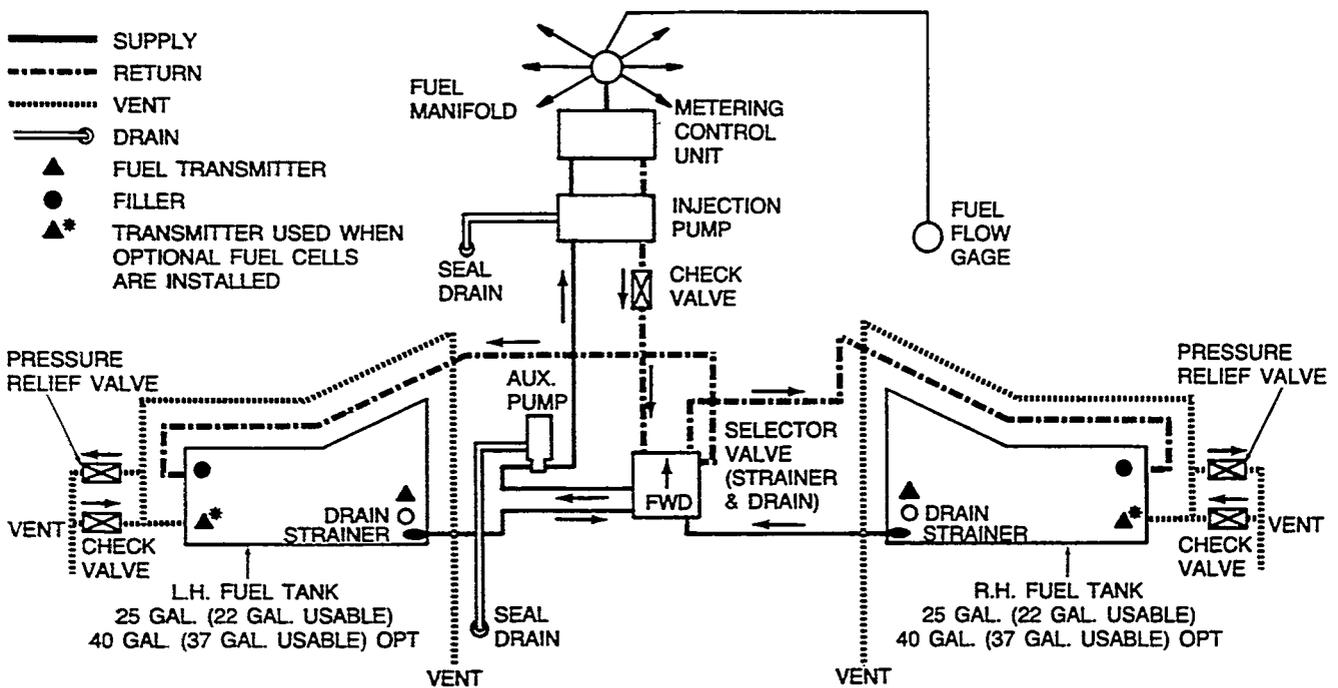
Calibration should be done only with a bus voltage of 14.25 ±.25 or 28.25 ±.25 as applicable to the airplane system.

- d. Calibrate the fuel quantity indicator as follows:
 1. Ensure that the fuel tank that corresponds to the fuel quantity indicator being calibrated is full.
 2. Turn the calibration screw in back of the corresponding printed circuit board until the needle on the fuel quantity indicator points to the "F" (full) mark.

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Fuel System (E-1 and after)
Figure 8-1



Fuel System (EA-1 and after)
Figure 8-1A

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e. Reinstall the glareshield.

**AUXILIARY OR FUEL BOOST PUMP (EA-1
AND AFTER)**

The single speed auxiliary fuel pump is mounted in front of the forward spar carry-thru on the left side of the airplane. The switch is located on the fuel control panel and placarded AUX FUEL PUMP OPERATION, ON OFF.

**AUXILIARY OR FUEL BOOST PUMP (EA-1
AND AFTER)**

The 2 speed auxiliary fuel pump is located in front of the forward spar carry-thru on the left side of the airplane. The pump is controlled by three switches located in the cabin. One of the switches is located on the fuel control panel and placarded AUX FUEL PUMP, OFF, LOW and AUTO. In the AUTO position the pump is operating at all times. At low power settings it operates at low boost, and at higher power settings (27 to 30 in. Hg

manifold pressure) it operates at high boost. The mode at which the boost pump operates in the AUTO position is determined by a switch actuated by manifold pressure. Another switch is located in the subpanel just to the left of the fuel control panel and placarded EMERGENCY FUEL PUMP, OFF and ON. This switch will override the other switches and actuate the high pressure side of the pump for emergency operation, such as with a failed engine-driven fuel pump. The third switch is located forward of the instrument panel and plumbed into the manifold pressure gage line. This switch is actuated by manifold pressure and closes between 29 to 30 in. Hg on increasing pressure (to actuate the high pressure side of the pump), and opens between 27 to 30 in. Hg on decreasing pressure (to return the pump to low pressure operation). This switch actuates the high pressure side of the pump, but only functions if the switch on the fuel control panel is in the AUTO position.

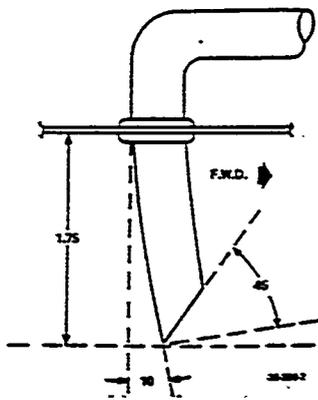


Figure 8-2. Fuel Vent

CAUTION

The molded nipple fittings used on the fuel cell are lightweight fittings, developed for ease in installation in certain locations in the aircraft. To get the best service from this type fitting, it is necessary to exercise certain precautions at the time of installation. The specific precautions other than the general care in handling are as follows:

- a. Insert the flow tube into the fitting until 3/8 inch or more of the tube extends through the fitting.
- b. Locate the hose clamp on the fabric-reinforced area of the nipple; it should clear the end of the fitting by 1/4 inch.
- c. Tighten the hose clamps. They should be drawn up in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.
- d. Use no sealing paste or gasket compound.
- e. Apply a thin film of Simonize wax to the metal flow tubes, as a lubricant. No other lubricant should be used.

INSTALLATION OF VELCRO TAPE WITH REPLACEMENT FUEL CELLS
(Serials E-1 through E-184)

Aircraft that have had or will have existing fuel cells replaced with spare fuel cells P/N 35-380135-1, 35-380135-2, 35-380135-3, 35-380135-4, 96-380046-1 and 96-380046-2 should install kit 35-9009 S in the fuel cell liner top, bottom, root rib and spar as described below and in Service Instruction 0365-281. Serial E-185 and after are delivered from the factory with the equivalent of Kit 35-9009 S installed.

- a. Remove the fuel cell as described in REMOVAL AND INSTALLATION OF THE FUEL CELLS.

NOTE

Aircraft that have had any of the above fuel cells previously installed do not require complete removal of the fuel cell. Access covers and inboard fittings should be removed and the inboard end of the fuel cell pulled back far enough to allow installation of the velcro tape.

- b. Lightly sand the surface that the velcro tape will be bonded to as shown in Figure 8-2A and clean the sanded surface with Naphtha, Item 18, Consumable Materials Chart.

- c. Activate the velcro by dipping into Methyl Ethyl Ketone, Item 19, Consumable Materials Chart, and press the velcro tape in place as shown in Figure 8-2A.

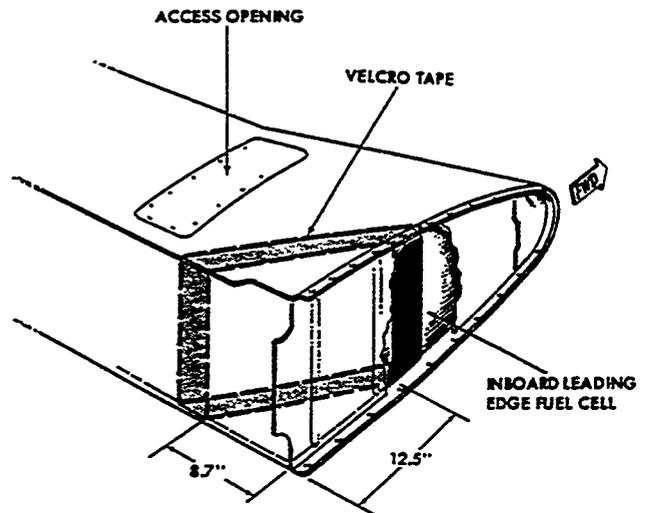
- d. Position the fuel cell in place and press the velcro pile and hook together pressing outward in the area of the velcro tape.

- e. Inspect the flapper valve for free movement under its own weight. If the flapper valve binds, work up and down by hand until it works freely.

NOTE

Before closing the zipper inspect the fuel cell for any foreign material.

- f. Close the zipper and refer to REMOVAL AND INSTALLATION OF THE FUEL CELLS for further instructions on installing the fuel cell.



36-33-1

Figure 8-2A. Installation of Velcro Tape

CARE AND REPAIR OF FUEL CELLS

The following is a recommended method of handling bladder-type fuel cells, including storage, and post-installation inspection.

When synthetic rubber fuel cells are placed in service, the gasoline has a tendency to extract the plasticizer from the inner liner of the cell. This extraction of plasticizer is not detrimental as long as gasoline remains in the fuel cell, inasmuch as the gasoline itself will act as a suitable plasticizer.

A thin coating of light engine oil should be flushed, sprayed or rubbed on the inner liners of all serviceable fuel cells which have contained gasoline, if it is evident that the cells will remain without fuel for more than 10 days, whether installed in airplanes or not, or if cells are to be collapsed or deformed inside their bays. The oil will act as a temporary plasticizer and will prevent the inner liner from drying out and cracking.

The cell should not be removed or handled until 24 hours after the oil has been applied.

The following method of repair is recommended by Uni Royal, Inc., Mishawaka, Indiana.

NOTE

No repairs are to be made on the radius of a cell or in the fitting area of the cell. Cells with such damage are to be returned to the Uni Royal, Inc., Fuel Cell Division, Mishawaka, Indiana, for repair. No damage area larger than 2 inches may be repaired in the field.

OUTSIDE PATCH

a. Use a piece of synthetic rubber coated (Uni Royal, Inc. 5264) outside repair material large enough to cover damage at least 2 inches from the cut in any direction. Buff this material lightly and thoroughly with fine sandpaper and wash with methyl ethyl ketone (Uni Royal, Inc. 3339 solution) to remove buffing dust.

b. Cement the buffed side of the patch with two coats of black rubber cement (Minnesota Mining and Manufacturing Co. EC678). Allow each coat to dry 10 to 15 minutes.

c. Buff the cell area to be patched, lightly and thoroughly with fine sandpaper and wash with methyl ethyl ketone to remove buffing dust.

d. Cement the buffed area with two coats of Minnesota Mining and Manufacturing Co. EC678 cement. Allow each coat to dry 10 to 15 minutes.

e. Freshen the cemented area of the patch and the cemented area of the cell with methyl ethyl ketone.

f. Place the patch on the damaged area while the cement is still tacky. Make contact first at the center of the patch, and then roll the patch outward by hand. Next, apply pressure to the patch with a 1/4 inch roller. Begin at the center and work outward to prevent air or solvent from

being trapped between the patch and cell.

g. Cover the patch with a sheet of polyethylene and lay a 50 pound shot bag over the repair. Allow the shot bag to remain undisturbed for 6 hours.

h. Seal the patch and a half-inch strip of the cell beyond the patch with one coat of black rubber cement and allow the patch to remain undisturbed for 6 hours.

INSIDE PATCH

After the damaged area has been patched on the outside of the cell and the repair allowed to stand a minimum of 6 hours, the cell is then ready to have the patch applied on the inside of the cell. The damaged area, to which this patch is to be applied, may be pulled through the filler neck opening to make the repair simpler. The repair procedure for the inside of the cell is the same as for the outside, except Uni Royal, Inc., repair material 5200/5187 must be used.

TESTING FOR FUEL CELL LEAKS

Although the chemical test is more sensitive, either of the following test procedures may be used to detect leaks in the bladder cells.

a. Soap Suds Test

1. Attach test plates to all fittings.
2. Inflate the cell with air to a pressure of 1/4 psi maximum.
3. Apply a soap and water solution to all repaired areas and any areas suspected of leakage. Bubbles will appear at any point where leakage occurs.
4. After test, remove all plates and wipe soap residue from the exterior of the cell.

b. Chemical Test

1. Attach test plates to all fitting openings except one.
2. Pour ammonia on the absorbent cloth in the ratio of 3 cc per cubic foot of cell capacity. Place the saturated cloth inside the cell and install the remaining test plate.
3. Make up a phenolphthalein solution as follows: add 40 grams phenolphthalein crystals to 1/2 gallon of ethyl alcohol, mix, then add 1/2 gallon of water.
4. Inflate the cell with air to a pressure of 1/4 psi maximum.
5. Soak a large white cloth in the phenolphthalein solution, then wring it out thoroughly and spread it smoothly on the outer surface of the cell. Press the cloth down to insure detection of minute leaks.
6. Check the cloth for red spots which will indicate a leak. Mark any leaks found and move the cloth to a new location. Repeat this procedure until the entire exterior surface of the cell has been covered. If red spots appear on the cloth, they may be removed by resoaking the cloth in the solution.
7. The solution and test cloth are satisfactory only as long as they remain clean. Indicator solution that is not in immediate use should be stored in a closed container to prevent evaporation and deterioration.

After the test, remove all plates and test equipment. Allow the cell to air out.

NOTE

In conducting the tests outlined above, the cell need not be confined by a cage or jig, providing the 1/4 psi pressure is not exceeded.

INSTALLATION OF FUEL FLARED FITTINGS

When installing flared fittings and hoses, make sure the threads are lubricated properly (see Figure 8-3) with anti-seize compound (in accordance with the TABLE OF THREAD LUBRICANTS). When previously installed fittings are removed, they should be wiped clean and re-lubricated before they are reinstalled. Torque all fittings in accordance with the FLARE FITTING AND HOSE FITTING TORQUE CHART.

ENGINE DRIVEN FUEL PUMP ADJUSTMENT

- a. With the mixture control in full rich position, set the adjusting screw on the throttle butterfly control lever to obtain an engine idle speed of 600 rpm, \pm 25 rpm. Turning the screw clockwise will increase speed.
- b. With the mixture control still at full rich, and without a flowmeter installed, set the fuel pump relief valve adjustment (located on the centerline of the fuel pump) to give 6 to 8 psi outlet pressure at idle speed. Turning this screw clockwise will increase pressure. The outlet pressure gage should be located in the fuel line between the pump discharge port and the metering unit inlet port.
- c. Adjust the idle mixture so that when the mixture control is moved in the direction of idle cut-off the en-

gine speed increases approximately 25 rpm. Metered fuel pressure at idle (full rich) should be 3.5 to 4 psi; and the fuel flow should be 7 to 9 lbs. per hour. Reset idle rpm if necessary.

d. Adjust the full throttle fuel pressure to give 28.5 to 30.5 psi pump outlet pressure and 16.4 to 18.2 psi metered fuel pressure at 2700 rpm. Make this adjustment using the fuel pump orifice adjusting screw which is located on the rear of the aneroid housing. Turning this screw counterclockwise increases pressure. The flowmeter should be located in the fuel line between the metering unit discharge port and the manifold valve inlet port, if a flowmeter other than the panel gage is used.

For Engine-Driven Fuel Pump Removal And Installation, (refer to the Power Plant Section 6).

FUEL SELECTOR VALVE REMOVAL AND INSTALLATION

- a. Drain and purge the fuel system.
- b. Remove the handle from the selector valve.
- c. Remove the royalite cover from around the fuel selector valve.
- d. Disconnect the fuel plumbing from the fuel selector valve.
- e. Remove the bolts securing the selector valve to the mounting bracket.
- f. Assembly is accomplished by reversal of the above procedure. Lubricate the fuel line threads with anti-seize compound (See Table of Thread Lubricants) before installation.

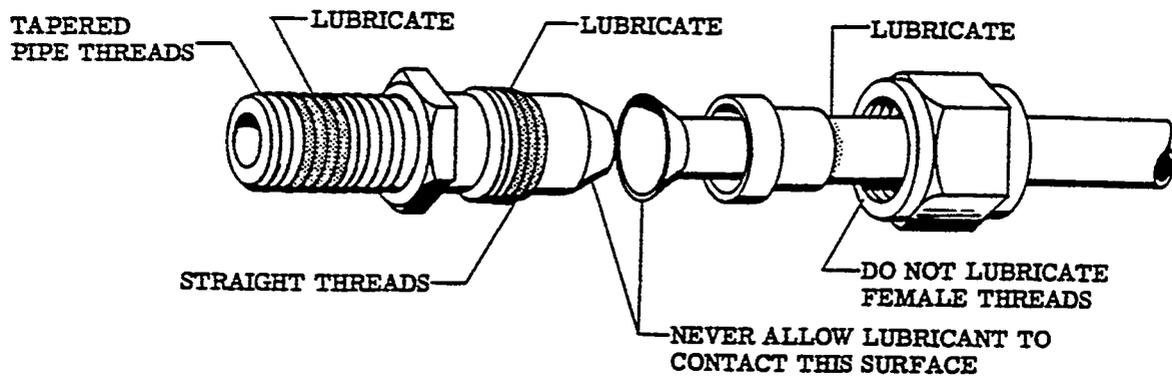


Figure 8-3. Lubrication of Flare Fittings

FLARE FITTING TORQUE CHART

TUBING OD INCHES	TORQUE - INCH POUND					
	ALUMINUM - ALLOY TUBING FLARE AND 10061 OR AND 10078		STEEL TUBING FLARE AND 10061		HOSE END FITTING AND HOSE ASSEMBLIES	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1/8	—	—	—	—	—	—
3/16	—	—	90	100	70	100
1/4	40	65	135	150	70	120
5/16	60	80	180	200	85	180
3/8	75	125	270	300	100	250
1/2	150	250	450	500	210	420
5/8	200	350	650	700	300	480
3/4	300	500	900	1000	500	850
1	500	700	1200	1400	700	1150
1-1/4	600	900	—	—	—	—
1-1/2	600	900	—	—	—	—
1-3/4	—	—	—	—	—	—
2	—	—	—	—	—	—

THIS SECTION IS NOT APPLICABLE TO THE BEEHCRAFT BONANZA 36

CABIN HEATING

A heater muff on the right hand engine exhaust stack provides heated air to five outlets in the forward and aft areas of the cabin.

Ram air enters an intake at the rear engine baffle (on EA-1 and after ram air enters an air scoop on the left side of the engine compartment), passes through the heater muff, then into a mixer valve on the forward side of the firewall. In the mixer valve, the heated air is combined with a controlled quantity of unheated ram air picked up at an intake on the right side of the nose. Air of the desired temperature is then directed from the mixer valve to the outlets in the cabin.

HEATER MUFF REMOVAL

E-1 AND AFTER

- a. Remove the heater muffler access panel from the right side of the engine compartment.
- b. Remove both heat ducts from the heater muff.
- c. Disconnect the heater from the exhaust system, and remove it from the airplane.
- d. Remove the screws from the heater shroud and slide the shroud off the heater.

EA-1 AND AFTER

- a. Remove the upper right rear louvered access panel.
- b. Remove heater muff ducting.
- c. Remove 4 bolts on the right side of heater muff which attach it to the exhaust system.
- d. Loosen the clamp on the left side of the heater muff.
- e. Remove the heater muff through the access hole.
- f. Remove heater shroud from heater muff.
- g. Pressure test the heater muff as indicated in HEATER MUFF PRESSURE TESTING in this section.

HEATER MUFF PRESSURE TESTING

On normally aspirated engines visually inspect the heater muff every 100 hours and pressure test every 500 hours. On turbocharged engines visually inspect and pressure test every 100 hours. Leaks in the system could introduce carbon monoxide gas into the heating system. The pressure test may be accomplished as follows:

- a. Remove the heater muff as indicated in HEATER MUFF REMOVAL.
- b. Inspect the heater muff visually and pressure test to determine leak tightness. The heater muff should be pressurized to approximately 25 psig (5 psig on EA-1 and

after) with air or gas, and either immersed in water or "painted" with a soap solution. If any leaks are apparent, replace the heater muff. This test is also recommended for the heater muff at every engine change.

NOTE

The heat transfer studs along with the internal baffle and/or cone must be in place for a correct supply of heat. Any warpage is cause for replacement.

- c. If the inspection indicates a good heater muff, reinstall the heater muff as indicated in HEATER MUFF INSTALLATION.

HEATER MUFF INSTALLATION

E-1 AND AFTER

- a. Install heater shroud and retaining screws.
- b. Install the heater in the airplane.
- c. Connect the engine exhaust system to the heater muff.
- d. Connect the heater ducts to the heater muff.
- e. Install the heater muffler access panel.

EA-1 AND AFTER

- a. Install the heater shroud on the heater muff.
- b. Install the heater muff through the access hole.
- c. Tighten the clamp on the left side of the heater muff.
- d. Install the 4 bolts on the right side of the heater muff which attach it to the exhaust system. Torque to 100 to 110 inch-pounds.
- e. Install the ducts to the heater muff.
- f. Install the access panel.

CABIN VENTILATION

Fresh air is provided for the cabin by an air intake on the left side of the dorsal fin. The air is then ducted to individual outlets above each seat. A manually controlled shutoff valve, installed in the duct between the fresh air intake and the individual outlets, is operated by a control knob in the overhead panel. Adjustable outlets in the upholstery panel forward of each front seat provide additional air by means of a duct in each wing root.

Prior to E-106 a fixed exhaust in the upholstery panel below the utility door is vented through an opening in the fuselage below the utility compartment. Also, prior to E-921 a

manually controlled cabin air exhaust is located aft of the radio speaker in the overhead panel.

At serial E-106 and after and EA-1 and after a fixed cabin exhaust was installed in the upholstery panel to the rear of the hat shelf, and vented to the outside through the left side of the airplane.

INSPECTION OF HEATING AND VENTILATION SYSTEM

Inspect the air intake duct leading to the heater. All connections and clamps should be checked for tightness and the duct for holes and cracks.

Inspect the heater control box and the condition of the air ducts leading to the windshield defroster and cabin heat outlets. Seal or tape openings around wires, tubes, or cables passing through the firewall.

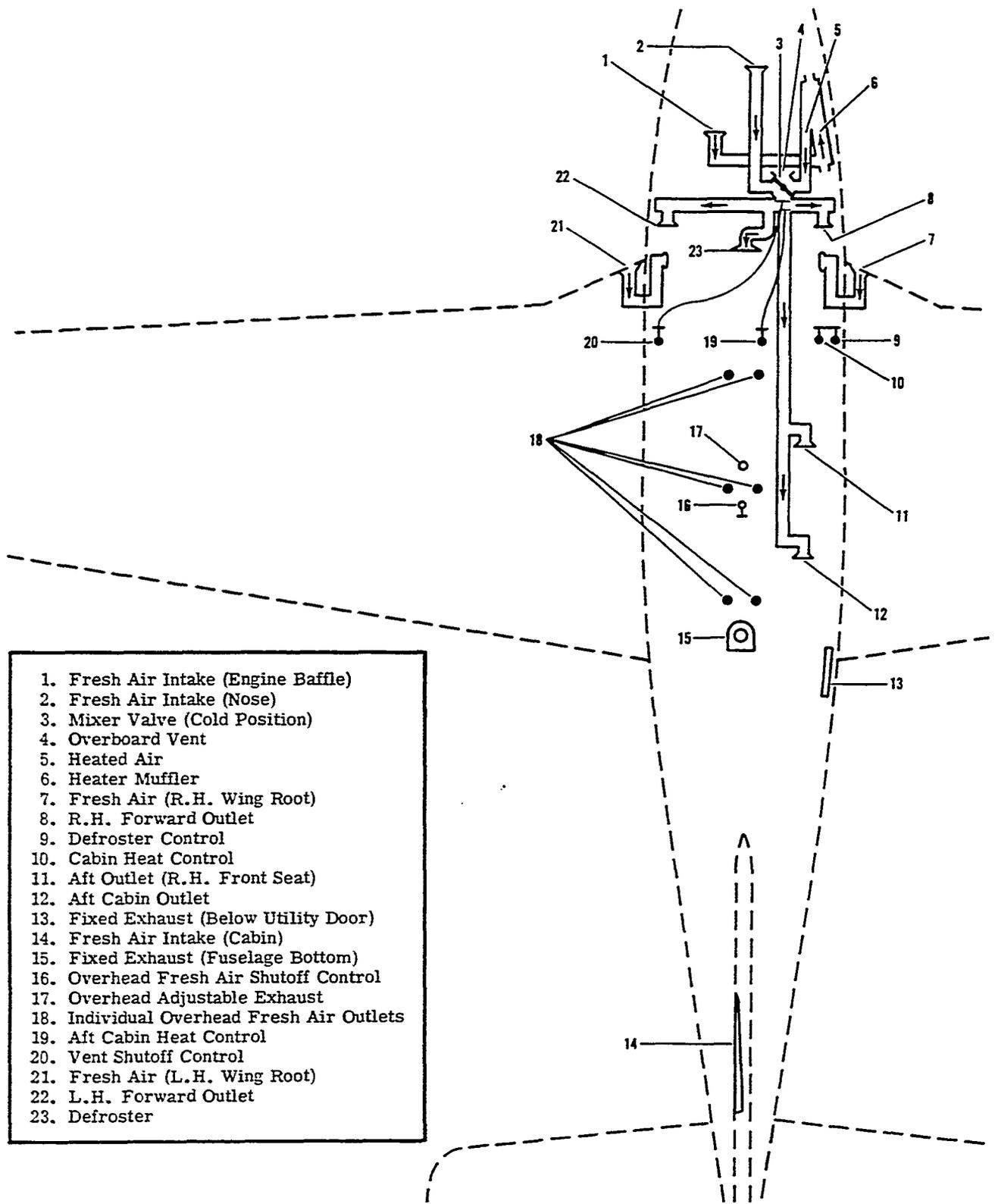
Inspect around the cabin rear bulkhead for leaks. This panel may be made airtight by cementing felt strips to the edge of the bulkhead. Openings, cutouts or cracks may be filled with sealing compound.

CABIN COOLING

The refrigerant R-12 air conditioning system has a capacity of 12,000 BTU per hour and consists of an evaporator module in the cabin, a compressor in the engine section, a condenser beneath the airplane and a condenser air scoop door to introduce prop blast and ram air to the condenser.

Controls consist of a two position switch placarded, AIR COND OFF HI LO located on the fuel control panel.

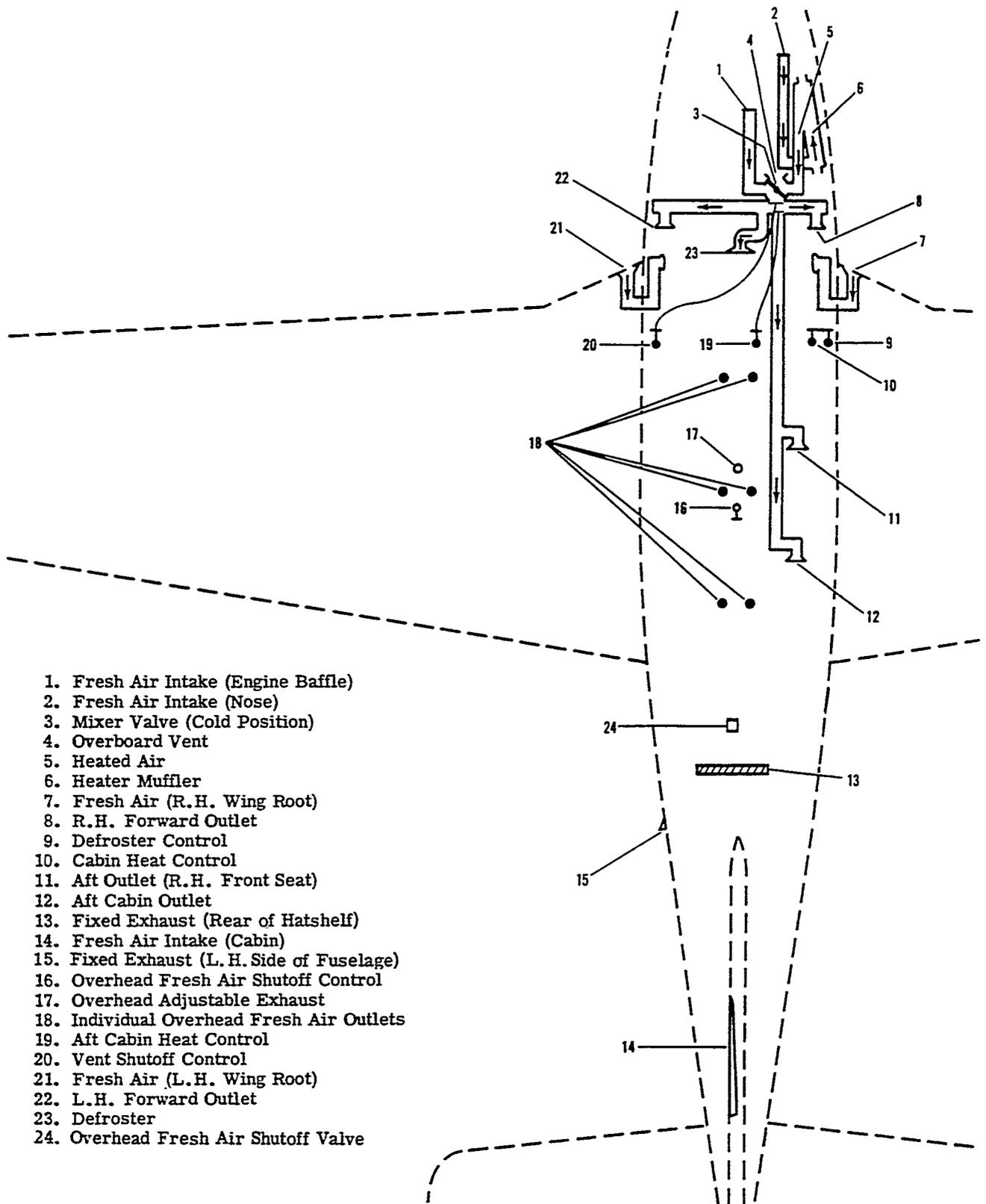
When the system is on, the condenser air scoop door is open full on the ground and closes automatically to the flight position during flight.



1. Fresh Air Intake (Engine Baffle)
2. Fresh Air Intake (Nose)
3. Mixer Valve (Cold Position)
4. Overboard Vent
5. Heated Air
6. Heater Muffler
7. Fresh Air (R.H. Wing Root)
8. R.H. Forward Outlet
9. Defroster Control
10. Cabin Heat Control
11. Aft Outlet (R.H. Front Seat)
12. Aft Cabin Outlet
13. Fixed Exhaust (Below Utility Door)
14. Fresh Air Intake (Cabin)
15. Fixed Exhaust (Fuselage Bottom)
16. Overhead Fresh Air Shutoff Control
17. Overhead Adjustable Exhaust
18. Individual Overhead Fresh Air Outlets
19. Aft Cabin Heat Control
20. Vent Shutoff Control
21. Fresh Air (L.H. Wing Root)
22. L.H. Forward Outlet
23. Defroster

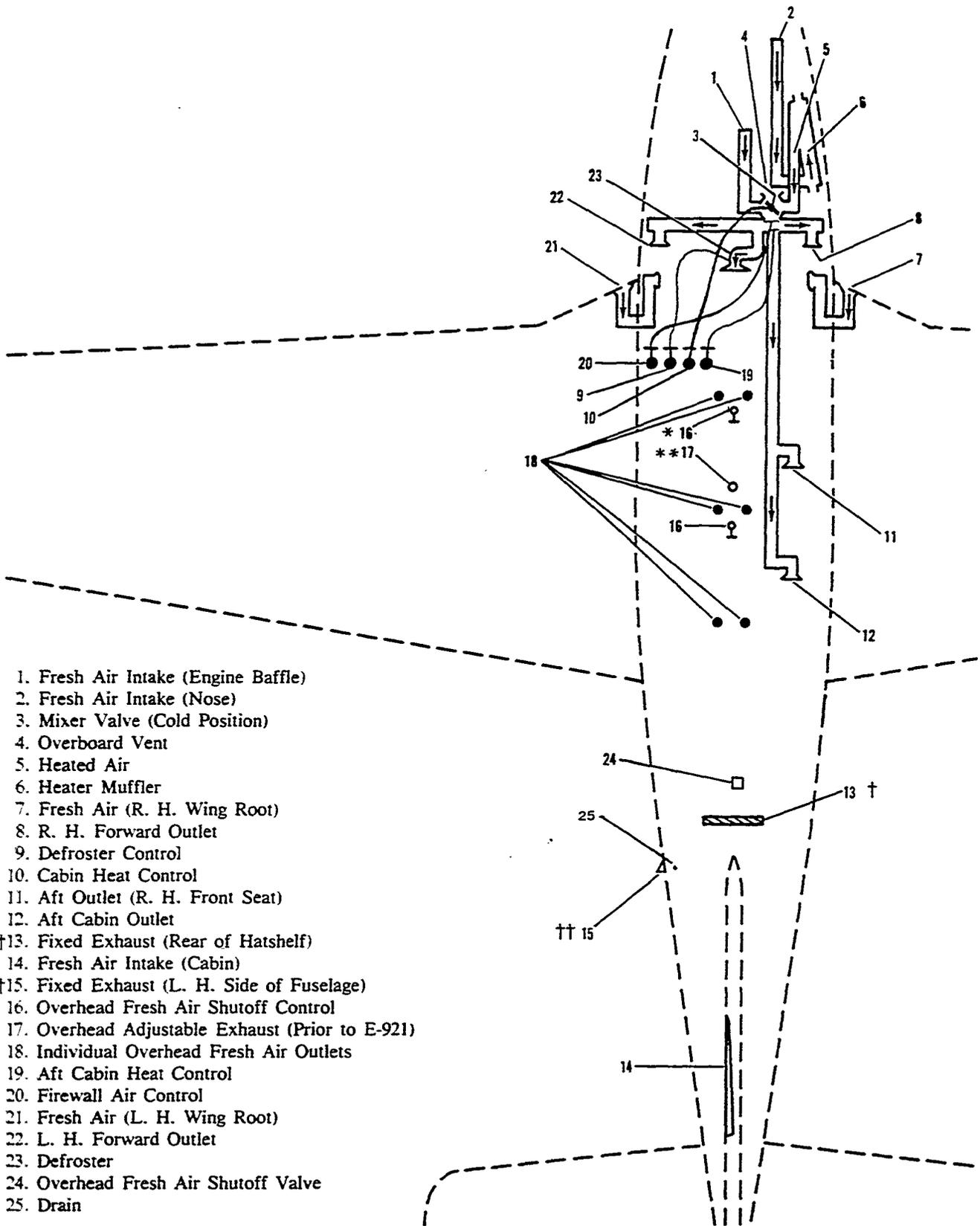
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Figure 10-1. Heating and Ventilating System (Serial E-1 through E-105)



1. Fresh Air Intake (Engine Baffle)
2. Fresh Air Intake (Nose)
3. Mixer Valve (Cold Position)
4. Overboard Vent
5. Heated Air
6. Heater Muffler
7. Fresh Air (R.H. Wing Root)
8. R.H. Forward Outlet
9. Defroster Control
10. Cabin Heat Control
11. Aft Outlet (R.H. Front Seat)
12. Aft Cabin Outlet
13. Fixed Exhaust (Rear of Hatshelf)
14. Fresh Air Intake (Cabin)
15. Fixed Exhaust (L. H. Side of Fuselage)
16. Overhead Fresh Air Shutoff Control
17. Overhead Adjustable Exhaust
18. Individual Overhead Fresh Air Outlets
19. Aft Cabin Heat Control
20. Vent Shutoff Control
21. Fresh Air (L.H. Wing Root)
22. L.H. Forward Outlet
23. Defroster
24. Overhead Fresh Air Shutoff Valve

Figure 10-2. Heating and Ventilating System Serials E-106 through E-184.

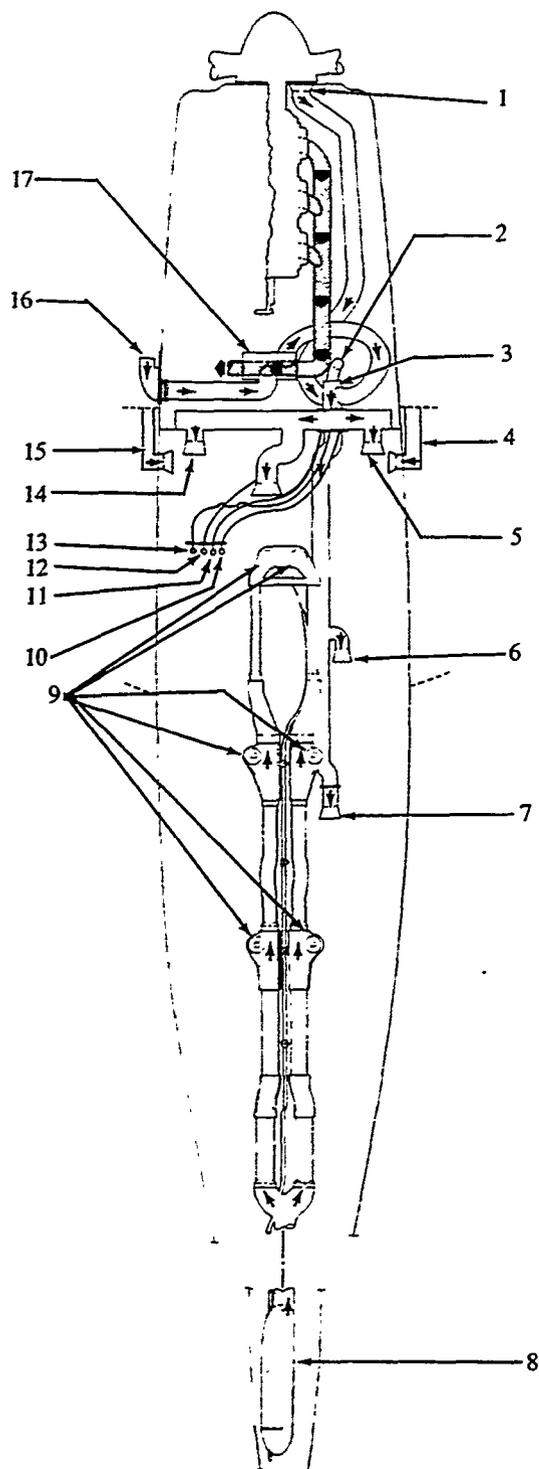


- 1. Fresh Air Intake (Engine Baffle)
- 2. Fresh Air Intake (Nose)
- 3. Mixer Valve (Cold Position)
- 4. Overboard Vent
- 5. Heated Air
- 6. Heater Muffler
- 7. Fresh Air (R. H. Wing Root)
- 8. R. H. Forward Outlet
- 9. Defroster Control
- 10. Cabin Heat Control
- 11. Aft Outlet (R. H. Front Seat)
- 12. Aft Cabin Outlet
- †13. Fixed Exhaust (Rear of Hatshelf)
- 14. Fresh Air Intake (Cabin)
- ††15. Fixed Exhaust (L. H. Side of Fuselage)
- 16. Overhead Fresh Air Shutoff Control
- **17. Overhead Adjustable Exhaust (Prior to E-921)
- 18. Individual Overhead Fresh Air Outlets
- 19. Aft Cabin Heat Control
- 20. Firewall Air Control
- 21. Fresh Air (L. H. Wing Root)
- 22. L. H. Forward Outlet
- 23. Defroster
- 24. Overhead Fresh Air Shutoff Valve
- 25. Drain

35-411-4

^ E-283 and after
 ** Removed at E-921 and after
 † Moved aft to fuselage station 190.00 at serial E-1370 and after
 †† Moved aft to approximate fuselage station 192.00 at serial E-1370 and after

Figure 10-3. Heating and Ventilating System (Serials E-185 Thru E-1240 Except E-1111)



1. Fresh Air Intake (Nose)
2. Air Exhaust
3. Mixer Valve
4. Fresh Air (Right Wing Root)
5. Right Forward Outlet
6. Aft Outlet (Right Front Seat)
7. Aft Outlet (Right Rear Seat)
8. Overhead Fresh Air Scoop
9. Individual Overhead Fresh Air Outlets
10. Aft Cabin Heat Control
11. Cabin Heat Control
12. Defroster Control
13. Firewall Air Control
14. Left Forward Outlet
15. Fresh Air (Left Wing Root)
16. Heater Air Inlet
17. Heater Muffler

A36TC-603-25

Figure 10-3A. Heating and Ventilating System (Serials EA-1 Thru EA-10)

AIR CONDITIONING SYSTEM

(E-391, E-716, E-732 and after)

The optional air conditioning system is a recirculating 12,000 BTU cooling system. The system is controlled by a switch on the fuel control panel and 2 pressure sensing switches. The circuit breaker, and switch which control the system are located on the fuel control panel (console) and placarded A/C CIR BKR or AIR COND OFF HI LO respectively. On E-1111 and E-1241 and after, the circuit breaker was moved from the console to the RH subpanel.

The air conditioner is wired through the right landing gear uplock position switch, the left landing gear safety switch, and the normally closed full throttle switch. With the air conditioner operating on the ground, the control circuit is wired through the left landing gear safety switch, which fully opens the condenser air scoop door located under the airplane. With the gear extended and the throttle fully opened, action of the full throttle switch will remove power from the compressor clutch coil, and drive the condenser air scoop door closed. When the airplane is airborne and the landing gear is retracted, power is transmitted from the normally open contacts of the full throttle switch (actuated closed when the throttle is fully open) through the right landing gear uplock position switch (actuated closed when the gear is up and locked) to the compressor clutch permitting the compressor to operate. Also power from the circuit just described is transmitted to the condenser air scoop door actuator, through the normally open contacts of the door flight position limit switch located at the aft end of the door (actuated closed when the door is closed) causing the actuator to open the door to the flight position.

On E-716 and E-732 through E-1240, except E-1111, the entire air conditioner system is protected by a 30-ampere circuit breaker. The compressor and condenser air scoop door have the added protection of a 10-ampere fuse on airplanes prior to E-763. Additional protection was provided by separate fuses for the compressor and air scoop door on E-763 through E-1240, except E-1111. A 10-ampere circuit breaker provides protection for the entire air conditioning system on E-1111 and on E-1241 and after. On airplanes with these later serials, the compressor and condenser air scoop door are protected by separate 5-ampere fuses. The use of separate fuses permits operation of the evaporator fan in the event of a blown fuse to the compressor. On all the airplanes previously noted, the fuses are located directly in front of the copilot on the forward side of the firewall.

If the condenser air scoop door is open while the landing gear is extended, a switch actuated by the door provides power through the nose gear uplock switch to illuminate a warning light in the lower LH corner of the instrument panel.

A high pressure switch is used to monitor the pressure of the refrigerant from the compressor to the expansion valve. When the pressure in the line reaches 390 ± 10 psi, it actuates the normally closed high pressure switch to open the circuit to the compressor clutch coil, thereby disabling the compressor. The high pressure switch automatically resets

to the normally closed position when the refrigerant falls to a safe pressure. There is also a high pressure poppet relief valve, located on the forward side of the firewall, which will relieve the system if the pressure reaches 450 psi, and will reset again at 400 psi.

The low pressure switch, normally open (actuated closed when the system is charged with refrigerant) senses system pressure. The switch closes, actuating the compressor clutch coil when the line pressure exceeds 5 to 8 psi. The low pressure switch will prevent damage to the compressor should oil and/or refrigerant loss occur.

The condenser air scoop door under the airplane automatically opens when the air conditioner is turned on. On the ground the door opens to approximately 3 inches. In flight the door opens to approximately $3/4 + 1/2 - 0$ inch. The air scoop door actuator limit switches are preset with no adjustment required.

The belt-driven compressor, which is coupled with a magnetic clutch, compresses the refrigerant to a high pressure, high temperature gas. This gas passes through the condenser where cooling air removes heat from the gas, condensing it to a liquid state. The liquid then passes through the expansion valve where it is metered into the evaporator at a rate of 55 psi, which allows most of the liquid to return to a gas. The heat required for evaporation is absorbed from cabin air passing over the evaporator coils. After passing through the evaporator, the refrigerant returns to the compressor at a reduced pressure.

MAINTENANCE OF AIR CONDITIONER

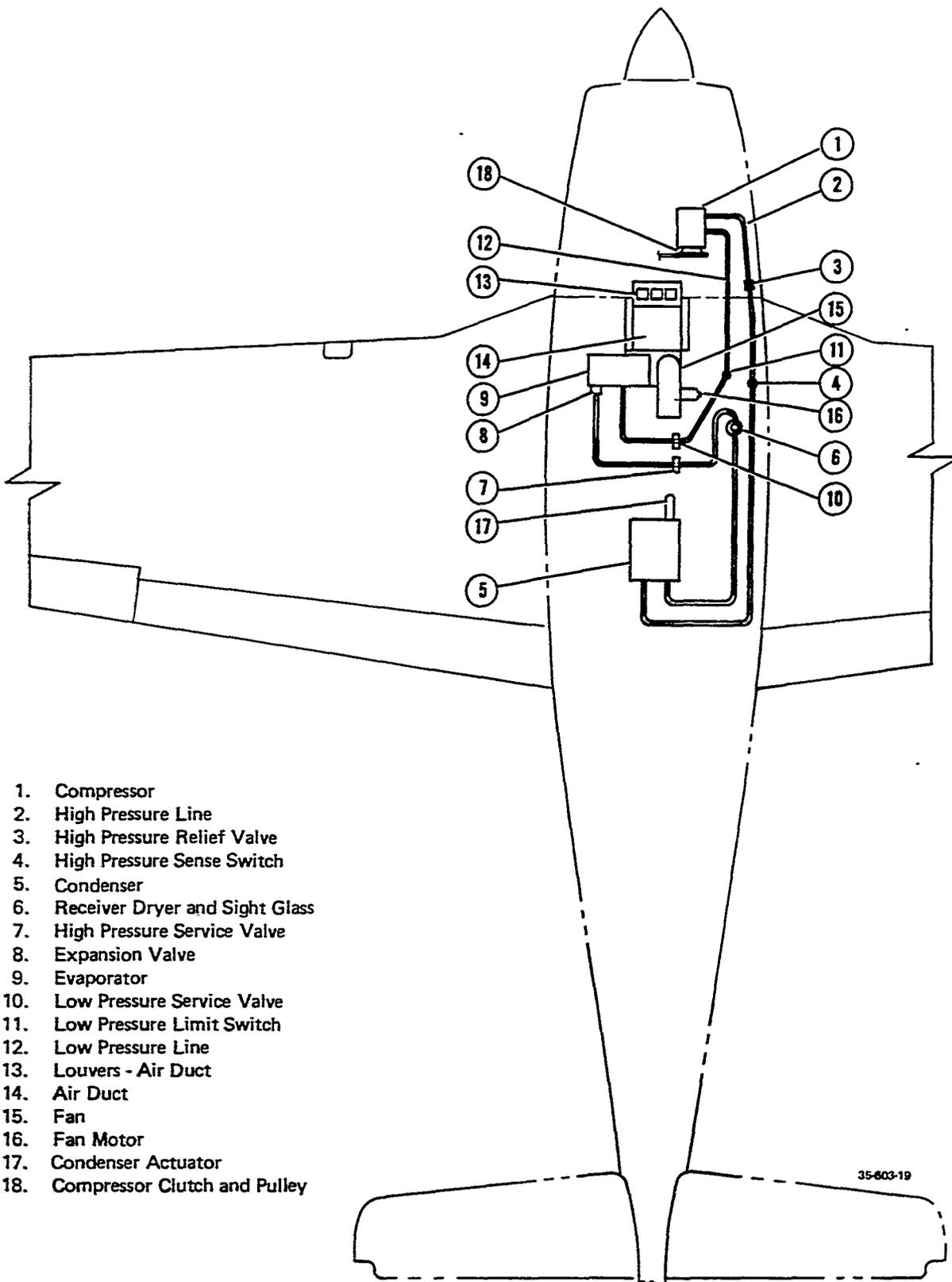
Servicing the air conditioning system consists of periodically checking the refrigerant level, checking compressor oil level and changing the system air filter. Recharge the system whenever the refrigerant level is low, air has entered the system or components carrying refrigerant are replaced. Refrigerant leaks may be detected by inspection with flameless leak detector.

PRECAUTIONARY SERVICE MEASURES

Before any service is attempted which requires opening of refrigeration plumbing or units, the person doing the work should be thoroughly familiar with instructions on servicing the system. He should follow very carefully these instructions when performing the tasks that will maintain this system in a proper functioning order.

The major reason for these measures are for safety and to prevent dirt and moisture from entering the system. Dirt contaminant may cause leaky valves or wear in the compressor. Moisture may not only freeze into ice at the expansion valve, but can also cause the formation of hydrochloric or hydrofluoric acids in the system.

All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause it to leak. Any fittings getting grease or dirt on them should be wiped clean with a cloth dampened with alcohol.



1. Compressor
2. High Pressure Line
3. High Pressure Relief Valve
4. High Pressure Sense Switch
5. Condenser
6. Receiver Dryer and Sight Glass
7. High Pressure Service Valve
8. Expansion Valve
9. Evaporator
10. Low Pressure Service Valve
11. Low Pressure Limit Switch
12. Low Pressure Line
13. Louvers - Air Duct
14. Air Duct
15. Fan
16. Fan Motor
17. Condenser Actuator
18. Compressor Clutch and Pulley

35-803-19

Figure 10-4. Air Conditioner System (E-391, E-716, E-732 and after)

Do not use chlorinated solvents such as trichloroethylene for cleaning agent, for they are contaminants. If dirt, grease or moisture gets inside lines and cannot be removed, the lines will have to be replaced. Use a small amount of clean 500 viscosity refrigeration oil (Item 31, Consumable Materials Chart) on all tube joints and dip the O-ring in this oil before assembling the joint. This will help in making a leak-proof joint.

WARNING

A face shield should be worn when servicing the lines; refrigerant, coming in contact with the eyes, can cause the loss of sight.

CAUTION

Insufficient torque, when tightening tubing connections, can result in loose joints and excessive torque can result in deformed joint parts. Either condition can result in refrigerant leakage.

When connecting aluminum fittings in the refrigerant system, torque all 5/8-inch fittings to 18 - 21 foot-pounds and all 1/2-inch fittings to 11 - 13 foot-pounds.

NOTE

The receiver-dryer is the last assembly to be connected. This is necessary to ensure maximum moisture protection of the refrigeration system.

For charging the air conditioner or checking the oil see Section 2, Servicing.

AIR CONDITIONING FUNCTIONAL TEST

With the engine running at 1,000 rpm and the system on, observe the sight glass, if refrigerant appears milky or bubbles appear, charge the system as noted in CHARGING THE AIR CONDITIONING SYSTEM in Section 2. Check the system for leaks using a flameless leak detector.

SYSTEM LEAK DETECTION

A reduction of system cooling ability or the presence of bubbles in the refrigerant, may indicate a partial loss of refrigerant. Check for bubbles in the sight glass located under the copilot seat. The sight glass should be checked during operation at maximum available ambient and cabin temperatures. Streams of bubbles past the glass or foam in the glass indicates an inadequate refrigerant quantity. If a

loss of refrigerant is suspected; an inspection of the system plumbing should be carried out to locate the source of the leak. Large leaks may be located by the appearance of oily spots where oil has been carried out by escaping refrigerant. Smaller leaks, which are much more difficult to locate, may be detected by detergent bubbles, or an electronic detector.

COMPRESSOR BELT TENSION ADJUSTMENT

After 36 to 48 hours operating time, a new belt will stretch to its normal operating length. The belt tension should be checked at this time and adjusted (by torquing the adjustment bolt on the idler pulley bracket) so that a belt tension gage, placed at a point midway between the idler pulley and the compressor will register a belt tension of 70 pounds with 0.13 inch deflection with 6.38 pounds load. After adjusting the belt tension, be sure the belt has ample clearance on all sides.

COMPRESSOR BELT REMOVAL

- a. Open the engine cowling to gain access to the compressor belt.
- b. Loosen the adjustment bolt on the idler pulley bracket to remove tension on the compressor belt.
- c. Remove the compressor belt.

COMPRESSOR BELT INSTALLATION

- a. Install the compressor belt over the compressor pulley, idler pulley and drive pulley.
- b. Tighten the adjustment bolt on the idler pulley bracket to increase tension on the compressor belt as stated in the COMPRESSOR BELT TENSION ADJUSTMENT.
- c. Close the engine cowling.

CONDENSER REMOVAL

- a. The condenser is located beneath the airplane aft of the main spar carry through.
- b. Remove the beacon light.
- c. Remove the fairing aft of the condenser.
- d. Disconnect the hoses at the condenser.
- e. Remove actuator bolts.
- f. Remove the attach bolts.
- g. Remove the condenser.

CONDENSER INSTALLATION

- a. Place the condenser in position.
- b. Secure condenser by the attaching bolts.
- c. Install the actuator bolt.
- d. Connect the hoses to the condenser.
- e. Install the fairing.
- f. Install the beacon light.

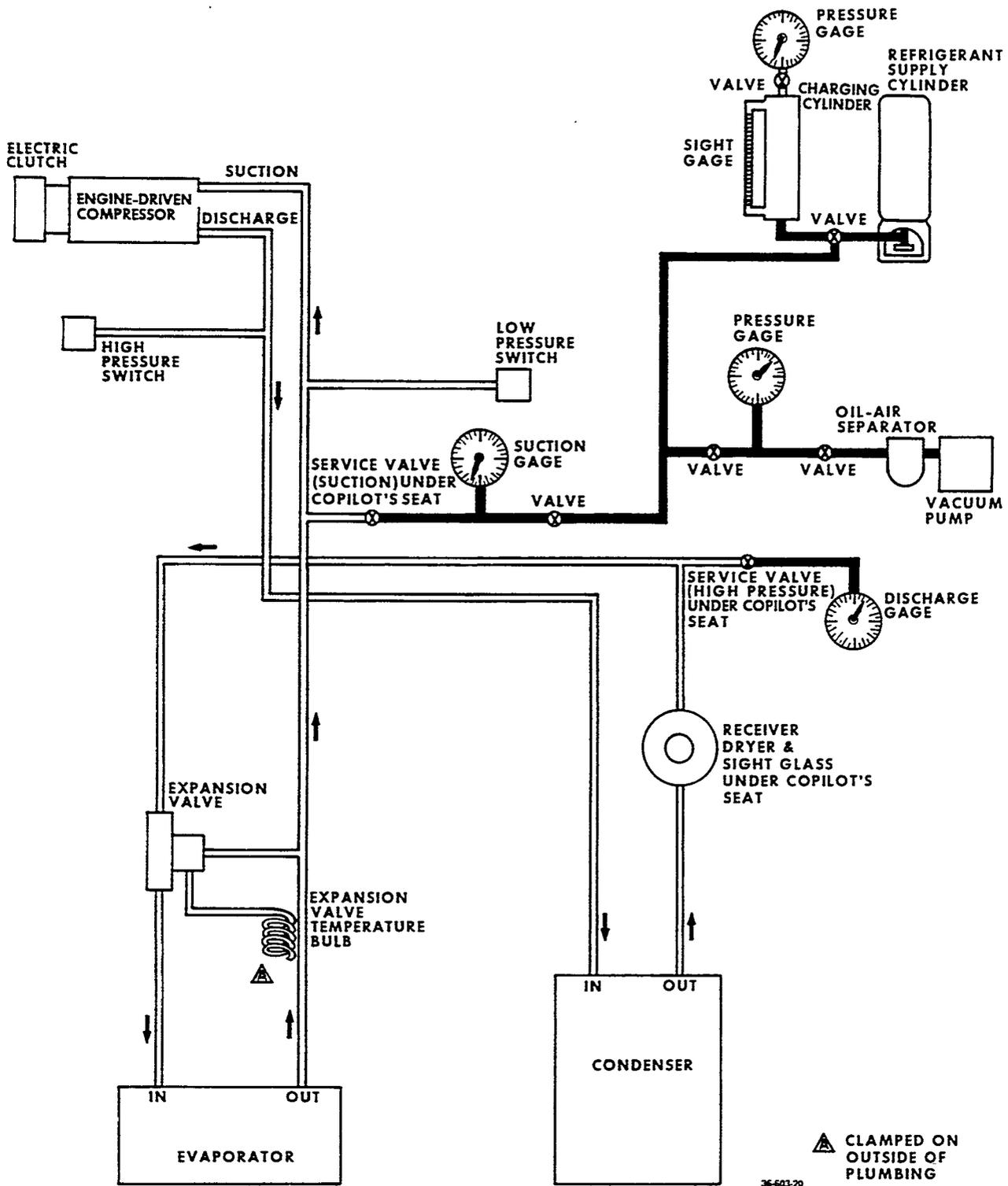


Figure 10-5. Air Conditioning System Schematic

CONDENSER CONTROL RIGGING

The condenser is controlled by the electrical circuitry that controls the airscoop actuator. Check condenser for proper operation. If condenser fails to operate, check for open circuit between the PRESS AIR COOL switch and control actuator.

COMPRESSOR REMOVAL

- a. Open the right engine cowling.
- b. Remove electrical leads from compressor clutch terminals.

WARNING

The air conditioning system is a high pressure system. When disconnecting a line, loosen the fittings just enough to bleed off pressure slowly, then disconnect the fitting.

- c. Disconnect refrigerant lines at the compressor. Cap refrigerant lines and compressor fittings.
- d. Remove compressor belt as noted in COMPRESSOR BELT REMOVAL in this Section.
- e. Remove the compressor mounting bolts and nuts and remove compressor.

COMPRESSOR INSTALLATION

- a. Position compressor on the mounting bracket and install the attaching bolts and nuts.
- b. Install compressor belt as noted in COMPRESSOR BELT INSTALLATION in this Section.
- c. Adjust belt tension as noted in COMPRESSOR BELT TENSION ADJUSTMENT in this Section.
- d. Remove caps from lines and compressor and install lines to the fittings on the compressor.
- e. Install the electrical leads to the magnetic clutch.
- f. Service the system with oil as noted in CHECKING COMPRESSOR OIL LEVEL in Section 2.
- g. Charge the system with refrigerant as noted in CHARGING THE AIR CONDITIONING SYSTEM in Section 2.
- h. Close the engine cowling.

VENTILATION BLOWER REMOVAL

- a. Remove the pilot and copilot seats.

- b. Remove the spar cover.
- c. Disconnect the electrical leads from the motor.
- d. Remove the bolts which attach the blower to the evaporator and remove the blower.

VENTILATION BLOWER INSTALLATION

- a. Position the blower assembly on the evaporator.
- b. Bolt the assembly to the evaporator.
- c. Connect the electrical leads to the motor.
- d. Install the spar cover.
- e. Install the pilot and copilot seats.

EVAPORATOR REMOVAL

- a. Remove the pilot and copilot seats.
- b. Remove the filter cover and filter.
- c. Remove the cover assembly from over the ducts.
- d. Disconnect the drain tubes and remove the tape between the evaporator and duct.
- e. Remove the spar cover.
- f. Remove the ducts.
- g. Loosen the refrigerant inlet line connection just enough to allow all pressure to bleed off.
- h. Remove the electrical leads from the motor.
- i. Remove the refrigerant lines and cap the four openings.
- j. Remove the bolts attaching the evaporator to the floor, and remove the evaporator.

EVAPORATOR INSTALLATION

- a. Position the evaporator in the airplane and install the bolts attaching it to the floor.
- b. Attach the refrigerant lines.
- c. Attach the electrical connections to the motor.
- d. Install the ducts, tape (No. 27 Minnesota Mining and Manufacturing Co.) the duct to the evaporator, and connect the drain tubes.
- e. Install the spar cover.
- f. Install the filter and filter cover.
- g. Install the cover over the ducts.
- h. Install the pilot and copilot seats.

EVAPORATOR FILTER REPLACEMENT

The evaporator filter should be replaced on condition. To gain access to the filter remove the screws in the filter cover.

TROUBLESHOOTING AIR CONDITIONING SYSTEM

<i>TROUBLE</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Insufficient cooling.	a. Blower not functioning.	a. Repair.
	b. Obstructed or disconnected air duct.	b. Remove obstruction or repair.
	c. Compressor clutch or belt slipping.	c. Repair or adjust.
	d. Evaporator filter clogged.	d. Replace.
	e. Refrigerant level low.	e. Leak-test and recharge.
	f. Expansion valve malfunction.	f. Replace.
2. No cooling.	a. Blown fuse, loose connection.	a. Check connections, fuse, continuity.
	b. Blower not functioning.	b. Repair.
	c. Leak in system.	c. Leak-test and recharge.
	d. Compressor valves inoperative.	d. Repair or replace.
3. Excessive vibration of unit.	a. Overcharged.	a. Correct refrigerant charge.
	b. Air in system.	b. Purge and recharge system.
	c. Mount or compressor bolts loose.	c. Tighten.
	d. Drive pulley loose.	d. Tighten.
4. Noisy unit.	a. Compressor oil level low.	a. Add oil.
	b. Defective belt.	b. Replace.
	c. Low refrigerant level.	c. Add refrigerant.
	d. Fan hitting shroud.	d. Align and tighten shroud.
	e. Defective compressor.	e. Replace.
5. Hissing in evaporator module.	a. Low charge.	a. Add refrigerant.
6. Chatter or knock in evaporator module.	a. Defective expansion valve.	a. Replace.
7. Belt slipping.	a. Loose.	a. Adjust.
	b. Overcharged.	b. Correct refrigerant level.
	c. Air in system.	c. Evacuate and recharge.

**TROUBLESHOOTING
AIR CONDITIONING SYSTEM
(Continued)**

<i>TROUBLE</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
8. Excessive belt wear.	a. Pulleys not in line.	a. Align pulleys.
	b. Belt too tight.	b. Adjust or replace.
	c. Pulley groove wrong size.	c. Replace.
	d. Belt width wrong.	d. Replace.
9. Broken belt.	a. Check all causes above.	a. Replace.

UTILITY SYSTEM

OXYGEN SYSTEM

(Figure 11-1)

The oxygen cylinder is located beneath the front spar cover below and forward of the front seat. The system is available with either a 38, 49, or 114 cu. ft. oxygen cylinder and at serial E-1370 and after a 76.5 cu. ft. cylinder is available. The supply of oxygen to the system is controlled by a shut-off valve on the oxygen console. The pressure gage indicates the supply (psi) of oxygen available. The altitude compensated regulator limits system operation to above 8,000 feet where its sensing element meets each increase in altitude with increased oxygen flow. When the system is not in use, shut off the control valve on the console to prevent oxygen loss. For system servicing refer to Section 2.

WARNING

Keep fires, cigarettes and sparks away when outlets are in use. Open and close all oxygen valves slowly. Make sure the oxygen shut-off valve is in the closed position. Inspect the filler connection for cleanliness before attaching it to the filler valve. Keep tools, hands and components clean, as fire or explosion may occur when pure oxygen comes in contact with organic material such as grease or oil.

OXYGEN SYSTEM PURGING

The oxygen system may be rid of obnoxious and offensive odors by purging. Also, the system should be purged any time the system pressure falls below 50 psi or the lines are left open for a period of time. The purging operation consists of nothing more than connecting a recharging cart filler hose to the oxygen filler valve and allowing oxygen to flow through the system and escape at the outlets carrying away the bad odors. The following steps outline the procedure for purging the oxygen system.

- a. Connect a line from a recharging cart to the oxygen filler valve.
- b. Slowly open the oxygen supply.
- c. Slowly open the high pressure line valve on the oxygen control console.
- d. Plug in an oxygen mask at each outlet in the cabin and cockpit.
- e. Open all doors and windows.
- f. Set the cart pressure regulator to deliver 50 psi to the system.
- g. Allow system to purge for one hour and check for the presence of odor. If the odor is still present continue purging for one additional hour. If the odor is still present after the second hour of purging replace the supply cylinder.

OXYGEN CYLINDER REPLACEMENT

WARNING

Keep fire, cigarettes and sparks away from the

vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

- a. Slowly close the oxygen supply cylinder valve.
- b. Disconnect the line from the supply cylinder.
- c. Cap the open line immediately with a clean metal fitting.
- d. Loosen the bracket clamp wing nuts.
- e. Raise the cylinder clamps and remove the cylinder from the brackets.
- f. Place the new cylinder in the brackets and close the cylinder clamps.
- g. Tighten the bracket clamp wing nuts.
- h. Carefully inspect the fittings on both the cylinder and the line for cleanliness and the presence of foreign matter, which may contaminate the oxygen until it is unfit for breathing.
- i. Connect the line fitting to the cylinder fitting.
- j. Slowly open the supply cylinder valve.
- k. Test the connections for leaks with Oxygen System Leak-Test Compound, (Item 14, Consumable Materials Chart.)

ELECTRIC PROPELLER DEICING, GOODRICH

The electric propeller deicer system includes an on-off switch (on the LH instrument subpanel), an ammeter, a timer, a brush assembly, slip rings, and an electrically heated boot for each propeller blade. When the on-off switch is turned ON, the ammeter (to the left of the switch) registers the amount of current (two-blade; 20-24 amperes, three-blade; 30-34 amperes.) passing through the system. If the current rises beyond the switch limit, an integral circuit breaker will cut off the power to the timer. The current flows from the timer (on the RH aft side of the firewall) to the brush assembly (mounted in front of the engine case) and is conducted by the brush assembly to the slip rings installed on the spinner backing plate. The slip rings distribute current to the deicer boots on the propeller blades. Heat from the boots reduces the grip of the ice, which is then removed by the centrifugal effect of propeller rotation and by the blast of the airstream. The timer cycles power to the two heating elements on each blade in the following sequence: outboard, inboard, outboard, inboard. The four phases make one complete cycle. Since each of the phases is 30 seconds in duration, the timer makes a complete cycle every two minutes. Whenever the timer switches to the next phase of operation, the ammeter on the LH subpanel registers a momentary deflection.

DEICER BRUSH REPLACEMENT

- a. Check brush wear by inserting a piece of safety wire into the holes above the brush assembly block. If the wire will insert more than 15/32 inch it is time to replace the brushes (see Figure 11-2).
- b. Disconnect the cannon plug and remove the brush assembly from the bracket (see Figure 11-3).

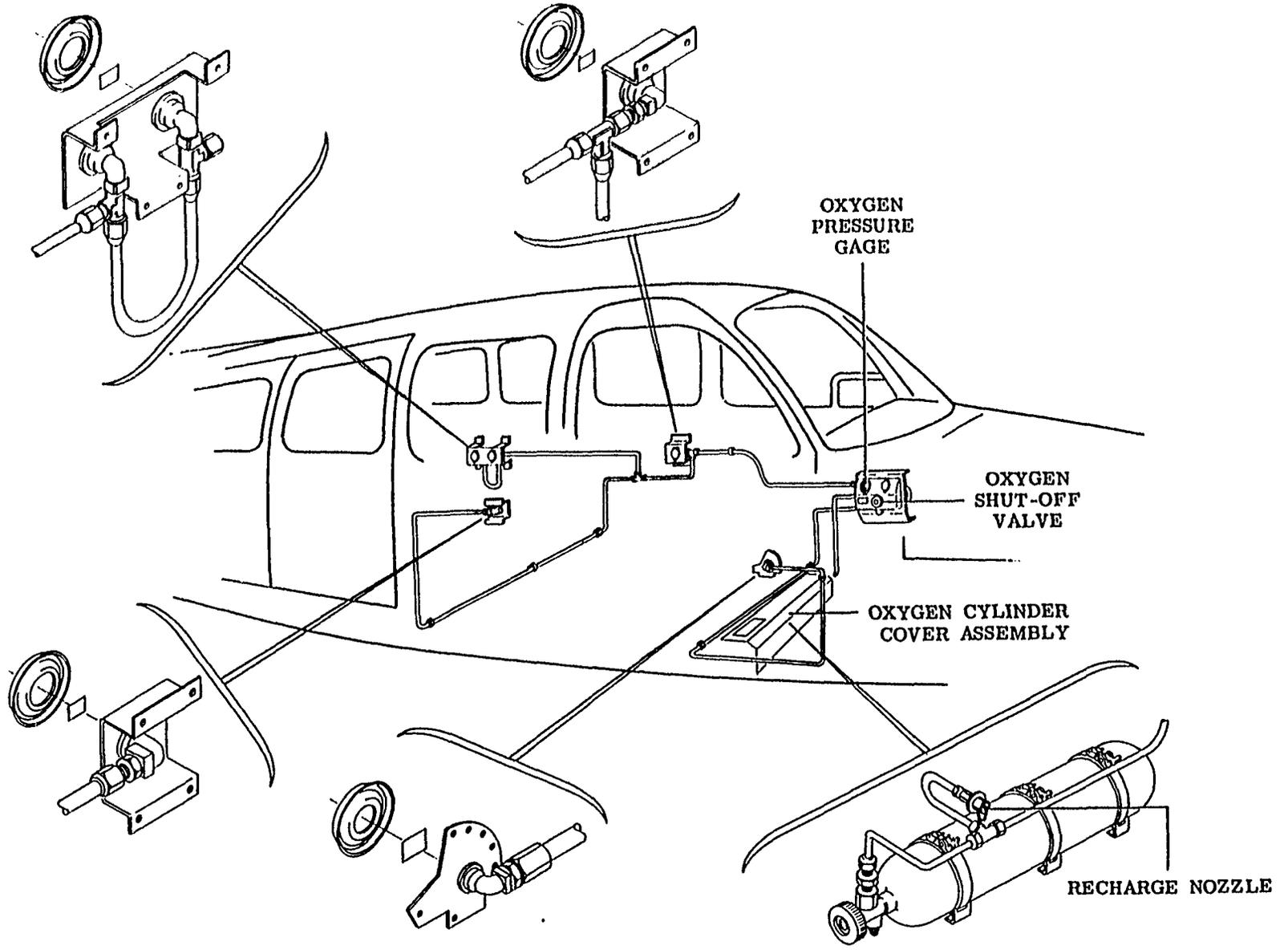


Figure 11-1. Oxygen System

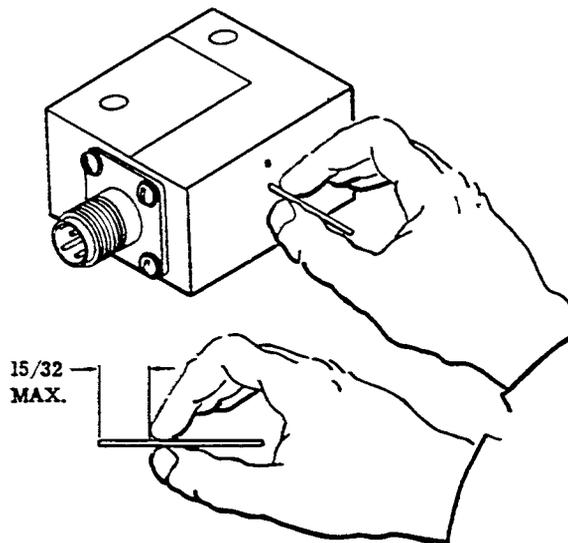


Figure 11-2. Propeller Deicer Brush Wear

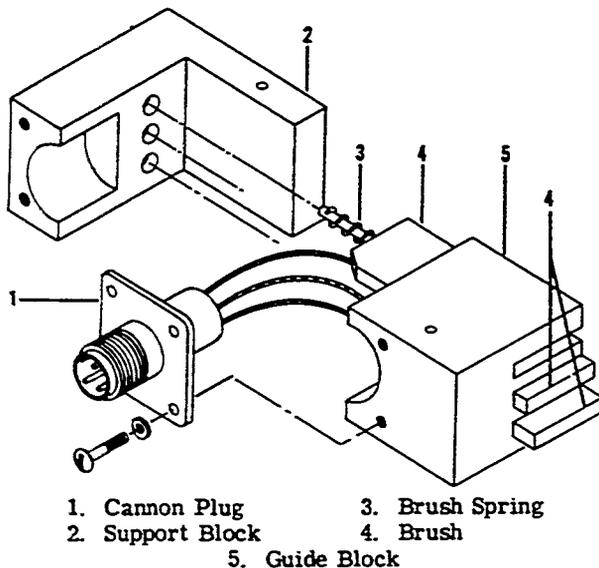


Figure 11-3. Propeller Deicer Brush Assembly

NOTE

To prevent breaking reusable brushes during and after removal, tape the brushes in place before removing the brush assembly.

c. Remove the screws attaching the cannon plug to the brush holder, then disassemble the brush holder by pulling the guide block approximately 1/4 inch toward the cannon plug to disengage the pins.

d. Remove the plug, brushes and springs from the brush holder, then slide the springs off the brushes.

e. Unsolder the wires for the brushes being replaced, noting which pin on the cannon plug they correspond to.

f. Solder the wire from the new brush to the appropriate pin on the plug, holding the "wicking" to 1/8 inch maximum.

g. Set the springs in the holes of the larger block and insert the brush rods far enough to partially compress the springs. Taking care against applying a side load on the brushes and against pinching or damaging the brush leads, slip the smaller block over the brushes and onto the larger block.

NOTE

When replacing brushes or brush retainer assemblies, always install new springs.

h. Install the cannon plug on the brush block with the attaching screws and washers. Note that, to assure proper deicer operation, the guide pin of the plug must be toward the brush support block and the brush wires must not be crossed.

NOTE

Tape the brushes in the brush holder to prevent breakage during assembly and installation. Remove the tape after installation is completed.

i. Check how far the brushes protrude from the block. If the brushes protrude less than 7/16 inch, the brush leads should be untwisted to give more length. If the brushes protrude more than 9/16 inch, the leads should be twisted to shorten the effective length until the brushes protrude from 7/16 to 9/16 inch. The brushes should then be checked for free sliding action.

j. Place the brush block assembly on the mounting bracket and insert the mounting screws through both the block and the bracket.

k. Before installing the retaining nuts, make sure that the brushes are aligned with the slip rings so that each brush face contacts in its entirety with the copper ring it slides on. If the brushes do not align with the slip rings throughout the entire 360 degrees of slip ring rotation, install shims (P/N 1 E1157) between the brush holder and the mount until each brush is properly aligned with the approximate center of the copper ring it slides on.

l. Install the retaining washers and nuts, making certain that 1/16 plus or minus 1/32 inch is maintained between the brush block and slip ring surface. To prevent damage to the brushes, the brush block assembly should be angled in such a manner that the brushes contact the slip ring at an angle of approximately two degrees from the perpendicular, as measured toward the direction of slip ring rotation (see Figure 11-4).

m. Connect and safety the cannon plug.

n. To prevent arcing caused by the rough surfaces of the new brushes, the engine should be operated for at least five hours before the deicer system is turned on. This does not apply to ground checks of the system performed while the engine is not running.

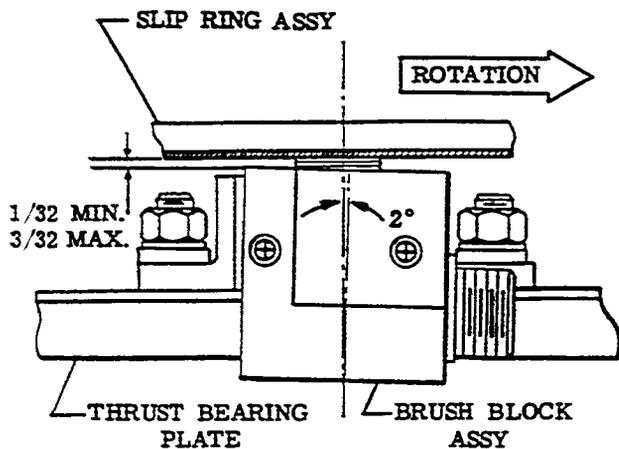


Figure 11-4. Deicer Brush Block Installation

DEICER TIMER CHECK

Experience in the field has indicated that often the timer is considered defective when the source of the trouble lies elsewhere. For this reason, the following test should be performed before the timer is removed as defective:

a. With the wiring harness disconnected at the timer, and the deicer switch in the ON position, check the voltage from pin B of the harness plug to ground. If no voltage is present, the timer is NOT at fault; however, if system voltage is present at pin B, check the circuit from harness plug pin G to ground with an ohmmeter. If no circuit is indicated, the fault is in the ground lead rather than in the timer. If ground connection is open, the timer step switch will not change position.

b. After the ground and power circuits have been checked, connect a jumper wire from pin B of the timer receptacle to terminal B of the connector plug and from pin G of the timer receptacle to ground. With the deicing system switch ON, check the voltage to ground from pin B of the timer. The voltmeter should indicate approximately 14 volts when the aircraft battery supply is being used. Next, check the DC voltage to ground from pins C, D, E, and F, the points at which the system voltage is impressed in sequence to cycle power to the propeller deicers. Each of the plugs should read 14 volts in the following sequence:

Timing Sequence	Time ON	Areas of Prop Deicers Heated
Pin C	30 sec.	Outboard halves of prop.
Pin D	30 sec.	Inboard halves of prop.
Pin E	30 sec.	Outboard halves of prop.
Pin F	30 sec.	Inboard halves of prop.

NOTE

The timer does not reposition itself to start at pin C when the system is turned off, but begins its cycling at the same position it held when last turned off. Cycling will then proceed, as before, in the order of C, D, E, and F.

After obtaining a voltage reading of 14 volts DC, hold the voltmeter probe on the pin until the voltage drops to zero before moving the probe on to the next pin in the sequence noted above. After establishing the correctness of the cycling sequence, to facilitate performance of the following test, turn the deicing system switch OFF at the beginning of one of the "on-time" periods and record the letter of the pin at which the voltage supply is present.

HEAT TEST

Before this test can be performed, the jumper wire installed for the timer test must be removed so that the connector plug can be replaced in the timer receptacle. Two men are required to perform this test: one in the cockpit to monitor the ammeter; the other outside by the prop to check the deicer boots. The man in the cockpit turns the deicer system ON while the man outside feels the deicer boots to see if they are heating properly. The man in the cabin observes the ammeter for the proper readings (20-24 amperes, two-blade; 30-34 amperes, three-blade) throughout the timing sequence. The ammeter needle should deflect every 30 seconds in response to the switching action of the timer. Each time this occurs, the man in the cockpit must notify the man inspecting the propeller deicer boots so that the latter can change the position of his hands to check the proper heating sequence of the propeller deicer areas. If any irregularities are detected, a continuity check should be performed on the wiring from the timer to the brush block holder and the propeller deicer terminal connections.

CAUTION

While following the instructions of the "HEAT TEST" section, move the propeller back and forth to prevent arcing between the brushes and slip ring.

WARNING

Before moving the propeller, make certain that the ignition switch is off and that the engine has cooled completely. There is always some danger of a cylinder firing when the propeller is moved.

CONTINUITY TEST

After removing the plug from the timer, use an ohmmeter to check continuity from:

- Pin C of the plug to the outboard terminal of one prop boot.
- Pin D of the plug to the inboard terminal of one prop boot.
- Pin E of the plug to the outboard terminal of one prop boot.
- Pin F of the plug to the inboard terminal of one prop boot.
- Pin G of the plug to ground.
- Ground terminal of one prop boot to ground.

DEICER RESISTANCE CHECK

To check for incorrect resistance or the presence of a short or open circuit at the brush-to-slip ring contact, disconnect the harness at the timer and using a low range ohmmeter, check the resistance from each deicer circuit lead (pins C, D, E, and F of the harness plug) to ground. If the resultant readings are not 0.48 to 0.58 ohm (two-bladed propeller) or 0.31 to 0.39 ohm (three-bladed propeller), disconnect the deicer lead straps to measure heater resistance individually. Individual boot resistance should measure between 0.95 and 1.15 ohms. If the readings in the first check are not within the accepted limits but those in the second check are, the trouble is probably in the brush-to-slip ring area. If the readings in the second check are also off, the deicer concerned is damaged and must be replaced.

BRUSH BLOCK RESISTANCE CHECK

To check for a short circuit, or high resistance in the brush block, measure the resistance from the face of the brush to its terminal studs or receptacle pin with a low range ohmmeter. If this resistance measures over 0.013 ohm, locate and repair the cause of excessive resistance. If the resistance measures zero, locate and correct the open circuit or else replace the brush. Check the resistance between the three terminal studs or receptacle pins. This resistance should not be less than 0.5 meg-ohm.

SLIP RING ALIGNMENT

The slip rings are properly aligned when they run in a true plane relative to the brush block. This condition may be checked by attaching a dial indicator gage to the front of the engine crankshaft housing in such a manner that a reading of the slip ring wobble may be obtained. To avoid error in readings, rotate the slip rings slowly while pushing in on the propeller to take the play out of the thrust bearings. If the total run-out over 360 degrees of rotation exceeds 0.002 inch, the slip rings should be aligned as follows:

a. Approximately a 0.012 inch adjustment may be made to correct the slip ring wobble by varying the torque on the attachment bolts. Using the dial indicator to follow the points of maximum deviation, adjust the slip ring assembly to the prescribed run-out limits by varying the torque of the mounting bolts as required, within a range of 25 to 65 inch-pounds.

b. If more than 0.012 inch of adjustment is required for alignment, the slip ring assembly may be shimmed to within the prescribed limits for true running by the addition of AN960C416L washers on the mounting bolts between the slip ring assembly and the spinner bulkhead. If necessary, fabricate thinner shims to the AN960 size.

NOTE

The above adjustments may affect the clearance between the brush block and slip rings; consequently, after slip ring alignment, a check should be made to ascertain that a distance of from 1/32 to 3/32 inch is maintained between the brush block and slip ring surface (see Figure 11-4).

SLIP RING MACHINING

Slip rings which have roughened or damaged surfaces, but which are structurally sound, can be machined and restored to serviceability. Remove the slip ring assembly from the aircraft and mount it in a lathe. Position it concentrically in the lathe, with not over 0.002 inch wobble or run-out over 360 degree rotation. Take light cuts for a smooth finish and cut no deeper than required to remove surface damage. The contact surfaces of the three slip rings must be parallel within 0.005 inch, and flat within 0.005 inch overall. Deviation from flat is not to exceed 0.002 inch over a 4 inch arc. If necessary, undercut the insulation between the slip rings to a depth of 0.020 to 0.030 inches below the contact surface of the slip rings. In this operation, width of the slip ring MUST NOT be reduced more than 0.005 inch. Contact surfaces of the slip rings must have a finish of 29-35 micro inches. Deburr the slip ring edges and reinstall in the aircraft and align.

NOTE

If, in machining, the solder or braze connection on the underside of the slip ring is exposed, replacement of the slip ring assembly will be necessary.

PROPELLER DEICER BOOT REMOVAL

- a. Remove the propeller spinner.
- b. Disconnect the deicer boot leads from the spinner bulkhead.
- c. Remove the clip securing the lead strap to the spinner bulkhead and the clamp securing it to the propeller hub.
- d. Using methyl ethyl ketone or toluol to soften the adhesion line between the boot and the blade, loosen one corner of the boot sufficiently to grasp it with vice grip pliers or a similar tool.

CAUTION

Unless the boot being removed is to be scrapped, cushion the jaws of any pulling tool to prevent damaging the boot surface.

- e. Apply a slow, steady pull on the boot to pull it off the propeller surface while continuing to use the solvent to soften the adhesive.
- f. Remove the remaining adhesive from the boot and propeller blade with toluol or methyl ethyl ketone.

PROPELLER DEICER BOOT INSTALLATION

- a. Position the deicer boot on the propeller blade so that its center line at the inboard end is adjacent to the

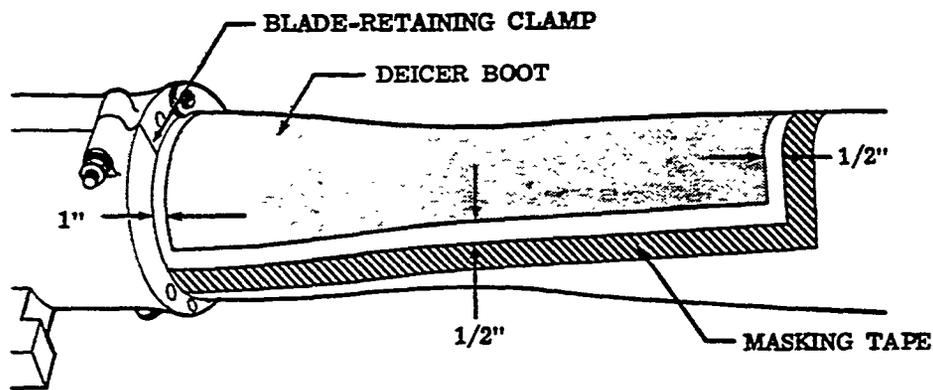


Figure 11-5. Deice Boot Installation

split in the propeller blade clamp and 1 inch outboard of the clamp, and the center line at the outboard end falls on the blade leading edge. Be sure the lead strap is in the proper position to be clamped to the blade retaining clamp.

b. Mask off an area approximately 1/2 inch from the end of each side of the boot. (See Figure 11-5).

c. Remove the deicer boot and strip any paint in the masked area from the retaining clamp outboard. Clean the area thoroughly with methyl ethyl ketone or toluol. For final cleaning, wipe the solvent off quickly with a clean, dry, lint-free cloth to avoid leaving a film.

CAUTION

The metal and rubber parts must be thoroughly clean to assure maximum adhesion.

d. Moisten a clean cloth with methyl ethyl ketone or toluol and clean the unglazed surface of the deicer boot, changing the cloth frequently to avoid contamination of the clean area.

e. Thoroughly mix EC-1403 cement and apply one even brush coat to the propeller blade. Allow the cement to dry for at least one hour at 40°F or above when the relative humidity is less than 75%, or two hours if the humidity is between 75% and 90%. Do not apply the cement if the relative humidity is higher than 90%.

f. After allowing sufficient drying time, apply a second brush coat of cement to the propeller and one coat of cement to the unglazed surface of the deicer boot. It is not necessary to cement more than 1/2 inch of the deicer lead strap. Allow the cement to dry.

g. Position the deicer boot on the propeller, starting 1 inch from the blade retaining clamp, making sure the lead strap is in position to clamp to the blade retaining clamp. Moisten the cement lightly with methyl ethyl ketone or toluol and tack the boot center line to the blade leading edge. If the center line of the boot deviates from the blade leading edge, pull up with a quick motion and replace properly. Roll firmly along the center line with a rubber roller. (See Figure 11-6).

CAUTION

Never use a metal or wooden roller for this purpose, for they would damage the heating elements in the deicer boot.

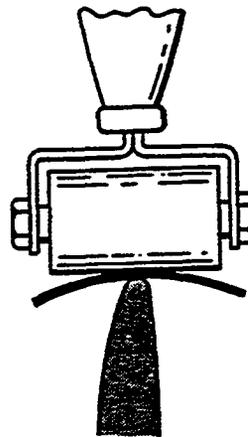


Figure 11-6. Center Rolling

h. Gradually tilting the roller, work the boot carefully over each side of the blade contour. Avoid trapping air pockets under the boot. (See Figure 11-7).

i. Roll outwardly from the center line to the edges of the boot. (See Figure 11-8). If excess material at the edges tends to form puckers, work them out smoothly and carefully with the fingers.

j. Roll the tapered edges of the boot with a narrow steel stitcher roller.

k. Clean the blade with a clean cloth moistened with toluol or methyl ethyl ketone. Be careful not to let solvent run into the edge of the boot.

l. Apply one even brush coat of A-56-B cement around the edges of the boot, allowing 1/16 to 1/8 inch overlap on the boot but extending to the masking tape. Remove the masking tape after applying the cement to obtain a neat border.

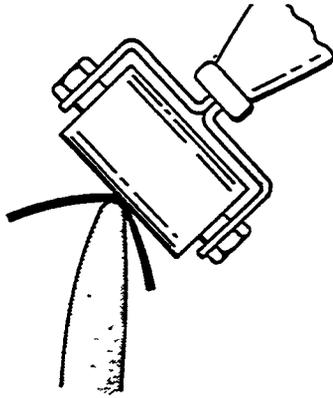


Figure 11-7. Side Rolling

m. Install the clamp securing the lead strap to the propeller blade retaining clamps.

n. Connect the lead terminals and install the clip on the spinner bulkhead. There must be no slack between the terminal and the clip to assure enough slack between the clip and the clamp on the blade to allow full propeller travel.

TROUBLESHOOTING - PROPELLER ELECTRICAL DEICER SYSTEM

The ammeter of the deicer system can be used to indicate the general nature of most electrical problems. Consequently, it is recommended that, to determine which circuits are involved, troubleshooting be preceded by the ammeter test outlined in step a. of the 50-hour inspection (Section 16), and the heat test described in this Section. A reading of two-thirds the normal amount of current (or of one-half on two-blade props) is an indication that one

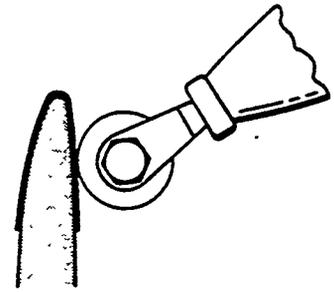


Figure 11-8. Edge Rolling

of the circuits is open between the slip ring assembly and deicer heater. If the ammeter registers excess current, the power lead is shorted to ground. It is possible that the excess current has welded the timer contacts in one phase. Under these circumstances, the timer will either feed current to the welded contacts continuously or not cycle. If the former is true, the heat test will show two phases heating simultaneously throughout three of the four phases. Unless the grounded power lead is located and corrected, any new timer that is installed may suffer the same internal damage during the first use of the system. In general, for most effective use of the troubleshooting chart, all of the "indication" entries should be read to locate that which matches conditions of the particular system being checked. The numbered "probable cause" and "remarks" then indicate the proper sequence of checks. It should be noted, however, that such numbers are assigned with respect to the approximate usefulness of the check rather than to the most likely sequence of occurrence.

TROUBLESHOOTING PROPELLER DEICER SYSTEM

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Ammeter shows zero current. (All 4 phases of the 2 minute cycle.)	a. Switch circuit breaker tripped.	a. Locate and correct short before resetting circuit breaker by turning switch OFF, then ON.
	b. Switch faulty.	b. If no voltage at switch output with voltage at switch input, replace the switch. If voltage is OK at switch output, go to step d.
	c. No power from aircraft.	c. If no voltage into switch, locate and correct open circuit.
	d. Ammeter faulty. (If some or all Deicers heat with ammeter at zero, replace ammeter.)	d. Test for voltage up to and out of ammeter. If low or zero output but proper input, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	e. Open circuit between ammeter and timer.	e. Disconnect harness at timer and check voltage pin B (of harness) to ground. If none, locate and correct open circuit.
2. Ammeter shows normal current part of cycle, zero current rest of cycle.	a. Open in wiring between timer and firewall connector.	a. Refer to the paragraph on heat test to find Deicers not heating and test for voltage on that pin of firewall connector. If zero over 2 minutes, locate and fix open in wiring from timer to firewall.
	b. Open between firewall and Deicer lead straps.	b. If voltage OK to firewall plug, try voltage at junction of Deicer lead and slip ring lead. If no voltage, find and correct open in wiring to brush block, open within brush block, or no contact brush to slip ring.
	c. No ground circuit.	c. If voltage at Deicer leads, locate and fix open from Deicer to ground.
3. Ammeter shows normal current part of cycle, low current rest of cycle.	a. Inner and outer Deicers heating same phase.	a. Locate and repair incorrect connections.
	b. Open in Deicer or slip ring assembly.	b. Disconnect Deicer straps to check heater resistance. If resistance is within specified limits, locate and fix open in slip ring leads. If not, replace Deicer with open circuit.

TROUBLESHOOTING PROPELLER DEICER SYSTEM (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
	c. High resistance in circuit with low current.	c. If not in contact of brush to slip ring (including ground brush), trace wiring to Deicer and to timer to fix partially broken wire, loose or corroded connection.
4. Ammeter shows low current over entire cycle.	a. Aircraft voltage low. b. Ammeter faulty. c. High resistance up to timer.	a. Check voltage into switch. b. Refer to step 1-d. c. Check for partially broken wire, loose or corroded connection in wiring from aircraft supply to timer input.
5. Ammeter shows excess current over entire cycle.	a. Ammeter faulty. b. Ground between ammeter and timer.	a. Refer to step 1-d. b. Disconnect harness at timer and, with ohmmeter, check from pin B (of harness) to ground. If ground is indicated, locate and correct.
6. Ammeter shows normal current part of cycle, excess current rest of cycle.	a. Ground between brush block and timer. b. Ground between brush block and Deicers. (Excluding ground brush circuit.) c. Short between two adjacent circuits. d. Timer faulty.	a. Disconnect leads at brush block and check from power leads to ground with ohmmeter. If ground is indicated, locate and correct. b. If no short exists at brush-slip ring contact, check for ground from slip ring lead to bare prop while flexing slip ring and Deicer leads. If a ground is indicated, locate and correct. c. Check for shorts or low resistance between circuits; if any, locate and correct. d. Test timer as indicated in paragraph on timer check.
7. Ammeter does not "flick" each 30 seconds.	a. Timer ground open. b. Timer contacts are welded (caused by short circuit in system.)	a. Disconnect harness at timer and check with ohmmeter from pin G (of harness) to ground. If no circuit, refer to wiring diagram in Section 14 to fix open circuit. b. Test timer as in paragraph on timer check. If timer does not cycle with voltage at pin B, replace timer but be sure short causing original failure has been located and corrected.

TROUBLESHOOTING PROPELLER DEICER SYSTEM (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
8. Ammeter flicks between 30 second phase periods.	a. Loose connection between aircraft power supply and timer input.	a. If trouble occurs over entire cycle, trace wiring from power source to timer input to locate and tighten loose connection.
	b. Loose or poor connection timer to Deicers.	b. If trouble occurs in part of cycle, find which Deicers are affected and check for rough or dirty slip rings causing brush to "skip." If not this, trace circuits to locate and fix loose or poor connection. (If all Deicers on the prop are affected, check the ground circuit.)
	c. Timer cycles erratically.	c. Test timer as indicated in paragraph on timer check.
	d. Electrical wiring breakdown.	d. Replace the faulty deicer boot.
9. Radio noise or interference with Deicers on.	a. Brushes "arcing."	a. Check brush alignment as in step h of 100 hour inspection (Section 16). Look for rough or dirty slip rings. If this is the cause, clean, machine or replace slip ring assembly. Check for slip ring alignment.
	b. Loose connection.	b. Refer to step g. of 100 hour inspection (Section 16).
	c. Switch faulty.	c. Try jumper wire across switch. If radio noise disappears, replace the switch.
	d. Wiring located within less than 8 inches of radio equipment wiring.	d. Replace at least 8 inches from input wiring to radio equipment.
10. Cycling sequence not correct.	a. Crossed connections.	a. Check system wiring against circuit diagram for improper connections.
11. Rapid brush wear or frequent breakage.	a. Brush block out of alignment.	a. Check brush alignment as in step h. of 100 hour inspection (Section 16).
	b. Slip ring wobbles.	b. Check slip ring alignment with dial indicator.

STATIC AIR SYSTEM

(Figure 11-9)

Proper functioning of the static air system is vital to safety of flight, particularly on instrument flight. Correct maintenance of the system should be performed as required.

The amount of attention required by the static system will depend largely on operating conditions. Extremes of humidity or precipitation, or of dry, dusty conditions, should be signals for increased emphasis on static systems check, since both are favorable to accumulations of foreign matter in the ports and lines.

CLEANING THE STATIC AIR SYSTEM

Blow LOW air pressure air through the lines from the disconnected line at the airspeed indicator to the static ports. Cover each static port separately when blowing to insure that each line is clear. Instrument error or possible damage could result if even one port is clogged with dirt or foreign matter.

CAUTION

Never blow air through the line toward the instrument panel; to do so will seriously damage the instruments. When blowing back through the line from the instrument panel, make sure that no air is blown into the instruments.

NOTE

Wax or polish applied to the static air buttons can cause wrong instrument readings. The static air buttons should be cleaned periodically with a cleaning solvent to insure that no film exists on the static air buttons.

Drain the static air system by opening the static drain valve located aft of the rear seat panel in the tail section.

TESTING THE STATIC SYSTEM FOR LEAKS

The static system should be checked for leaks in accordance with the instructions in Federal Aviation Regulations 91.170.

CAUTION

To avoid damaging the airspeed indicator, the indicator should be removed from the system and the lines capped or an equal pressure should be applied to the pitot side of the indicator while leak testing the system.

Check the hoses connecting the static air line to the instrument plumbing and the tygon tubing which forms the static air line drain. Hoses which are cracked, particularly at the bends or connection points, or which have become hard, should be replaced with rubber hose complying to (Item 25, Consumable Materials Chart).

NOTE

On aircraft serial E-278 and after, the aluminum static lines are replaced by Poly-flo tubing and on serial E-283 and after, the rubber hoses that connect the static air line to the instrument plumbing are replaced by Poly-flo tubing.

PITOT SYSTEM

(Figure 11-9)

A functional test of the pitot system can be made by using an observer in the cabin to watch the airspeed indicator while air pressure is built up artificially by using a section of soft rubber tubing as follows:

- a. Clamp the rubber tubing over the pitot head inlet, making certain that the connection is airtight.
- b. Crimp the end of the tubing and slowly roll it up until the airspeed indicator registers approximately 100 miles per hour.

CAUTION

To avoid rupturing the diaphragm of the airspeed indicator, roll up the rubber tubing slowly.

- c. Secure the rolled up tubing so that it will hold the airspeed indicator reading.
- d. If there is no decline in the reading after several minutes, there is no leak in the pitot system.
- e. If a decline in the reading of the airspeed indicator is observed, check the pitot system plumbing for leaky hoses and loose connections.

CAUTION

Release the air pressure slowly by unrolling the rubber tubing; a sudden release of the air pressure may damage the airspeed indicator.

After the system is checked for leaks, the hose sections should be visually inspected for signs of deterioration. There are two sections of hose in the pitot system: one hose at the pitot mast, accessible by removing the inspection door adjacent to the mast, and the other hose behind the floating instrument panel which connects the pitot line to the airspeed indicator, accessible through the access door in the left side of the firewall. Replace defective hose only with the hose meeting the specifications described for the static system.

STALL WARNING SYSTEM**ADJUSTMENTS**

(Figure 11-10)

The stall warning switch is carefully adjusted when the airplane is test flown at the factory. Should it require readjusting, proceed as follows: Locate the switch installation on the under surface of the left wing and loosen the two Phillips-head screws, one on either side of the vane. If the stall warning has been coming on too early, pull the vane

back and down. If the stall warning has been coming on too late, push the vane up and forward. Moving the vane, with the Phillips-head screws loosened, moves the entire unit up or down inside the wing causing the switch to be closed

earlier or later. Retighten the screws after making each adjustment. NEVER TRY TO ADJUST THE SWITCH BY BENDING THE VANE.

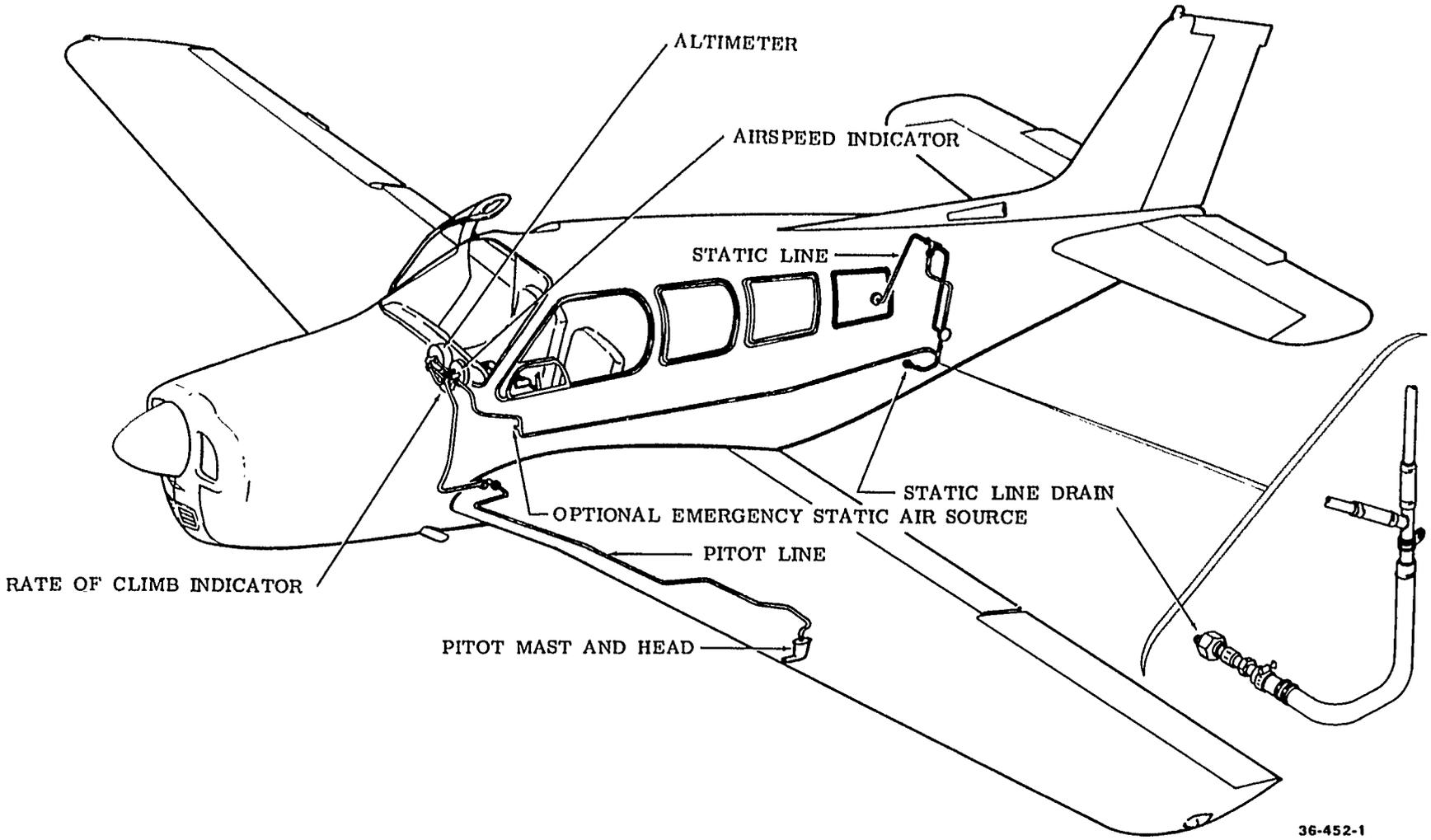
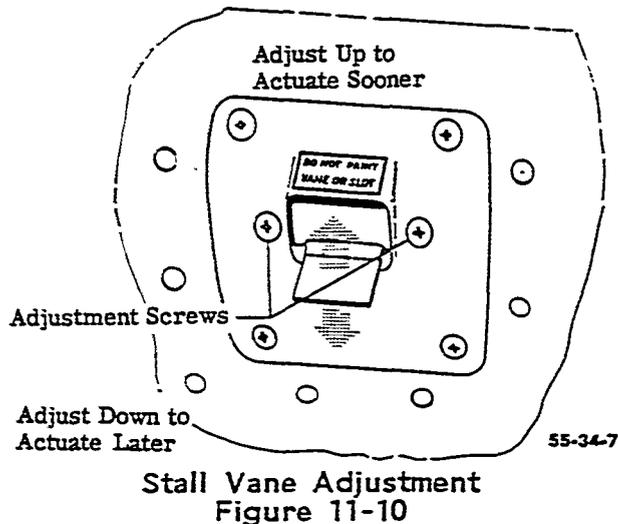


Figure 11-9. Pitot and Static System

BEECHCRAFT
BONANZA 36 SERIES
SHOP MANUAL



As a rule of thumb, moving the vane 1/4 inch will change the time the stall warning actuates by about 5 mph of indicated airspeed. The only way to test the accuracy of the setting is to fly the airplane into a stall, noting the speed at which the warning horn comes on and the speed at which the full stall occurs.

The stall should be made with the flaps and gear up and power off. Prior to stalling, decelerate no faster than one mph per second. It may be necessary to make several alternate adjustments and test flights before the desired setting can be reached. The stall warning should actuate, ideally, at 7 to 9 mph ahead of the complete stall. The switch setting should be checked and adjusted as necessary whenever a wing or wing leading edge is replaced or extensively repaired, or if a new switch is installed. The switch should require no adjustment in normal service.

PRESSURE SYSTEM (Figures 11-11)

The pressure system provides the air required for operation of the autopilot and instruments. Air pressure from an externally filtered engine-driven dry air pump is regulated by a pressure relief regulator valve mounted in the RH side of the engine compartment aft of the rear engine baffle. The air is then routed through an inline system filter and an adjustable orifice to the instrument panel. If an autopilot is installed, air is

plumbed off the pressure system prior to the adjustable orifice.

NOTE

If the pressure pump has failed or operation of the instruments indicates a fluctuation of the system pressure or a decrease in the system pressure, check for excessive pressure, a partial restriction in the lines, a filter partially obstructed, or pressure loss resulting from loose connections. These conditions may be checked by: (1) removing the inline filter from the system and checking it for obstructions by comparing the resistance to flow with a new filter. Use a dry, low pressure air source (max. of 10 psi) for this test. If air flow resistance in the filter removed from the airplane exceeds that of the new filter by more than 1.0 psi, replace the filter. (2) Check all connections for tightness. (3) Check the lines for bends, kinks and excessive carbon. With the discrepancy repaired, or whenever any components are replaced in the pressure system, adjust the pressure system as follows.

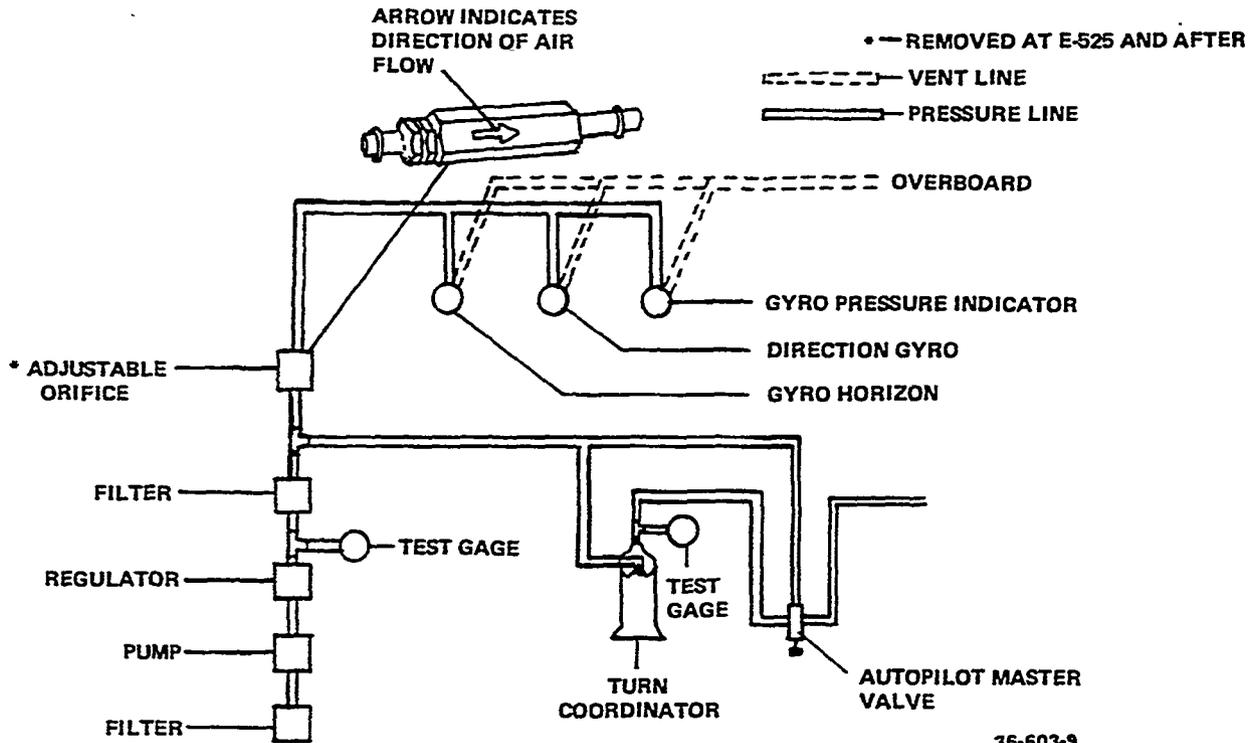
CAUTION

Never use a pressure pump which has been dropped or mishandled. Never jam or force the pump onto the engine mounting pad.

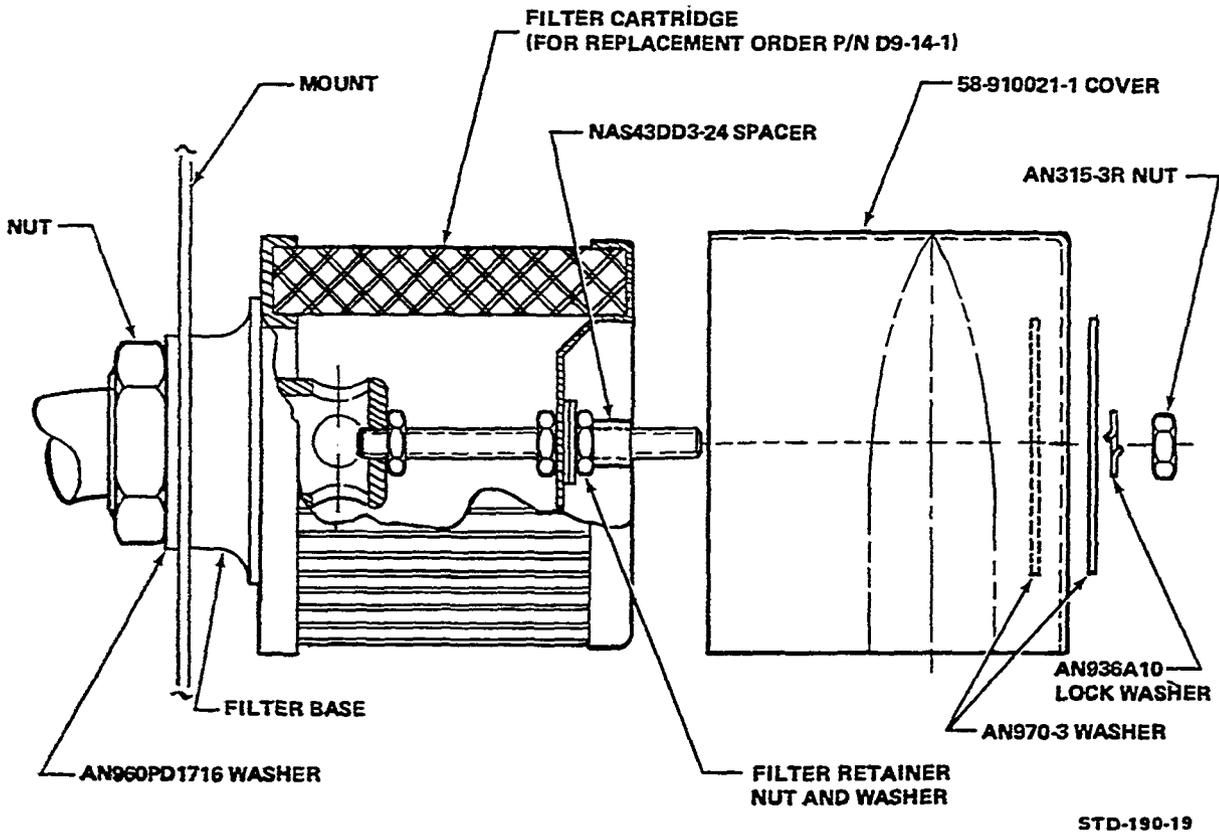
a. Install a test gage (0-10 psi) at the "out" side of the pressure regulator. If the airplane is equipped with a BEECHCRAFT New-Matic autopilot, an additional test gage (0-10 psi) should be installed in the turn coordinator supply line. (See Figure 11-11).

b. On airplanes without an autopilot, the pressure regulator should be adjusted to obtain a reading of 4.5 psi on the test gage at the pressure regulator with the engine operating at 2300 rpm. On airplanes equipped with an autopilot, the pressure regulator should be adjusted to obtain a reading of 5.0 +.0 -.5 psi on the test gage in the turn coordinator supply line with the engine operating at 2300 rpm

BEECHCRAFT
BONANZA 36 SERIES
SHOP MANUAL



Pressure System Schematic
Figure 11-11



Intake Air Filter
Figure 11-11A

BEECHCRAFT
BONANZA 36 SERIES
SHOP MANUAL

and the autopilot ON. Normally, a pressure of 6.5 psi on the test gage at the pressure regulator is sufficient to obtain the 5.0 +.0 -.5 psi reading at the turn coordinator. Rotating the adjusting screw on the pressure regulator clockwise increases pressure and counterclockwise rotation decreases pressure.

CAUTION

Under no circumstances should the reading at the pressure regulator exceed 7.0 psi.

c. Locate the adjustable orifice on the LH side of the airplane, forward of the instrument panel near the system filter and loosen the check nut. Rotate the orifice body to obtain a reading of 5.0 +.1 -.2 in Hg. on the gyro pressure indicator with the engine operating at 2300 rpm. Tighten the checknut. Check the gyro pressure indicator with the engine operating at 1500 rpm. The pressure should remain in the green arc at this speed.

d. After adjusting the orifice, check the pressure on the test gages with the engine operating at 2300 rpm. If the pressure on these gages has been affected by the adjustment of the orifice, the pressure regulator should be readjusted.

NOTE

Airplane serials E-525 and after do not have the adjustable orifice. Pressure system adjustment for those serials will be the same as noted in "a" through "b".

e. Remove the test gages from the airplane.

NOTE

When the airplane is equipped with four air-driven gyros and an air driven autopilot, it is necessary to have a higher capacity dry air pump in order to safely operate the gyros and/or the autopilot system.

PRESSURE SYSTEM FILTERS

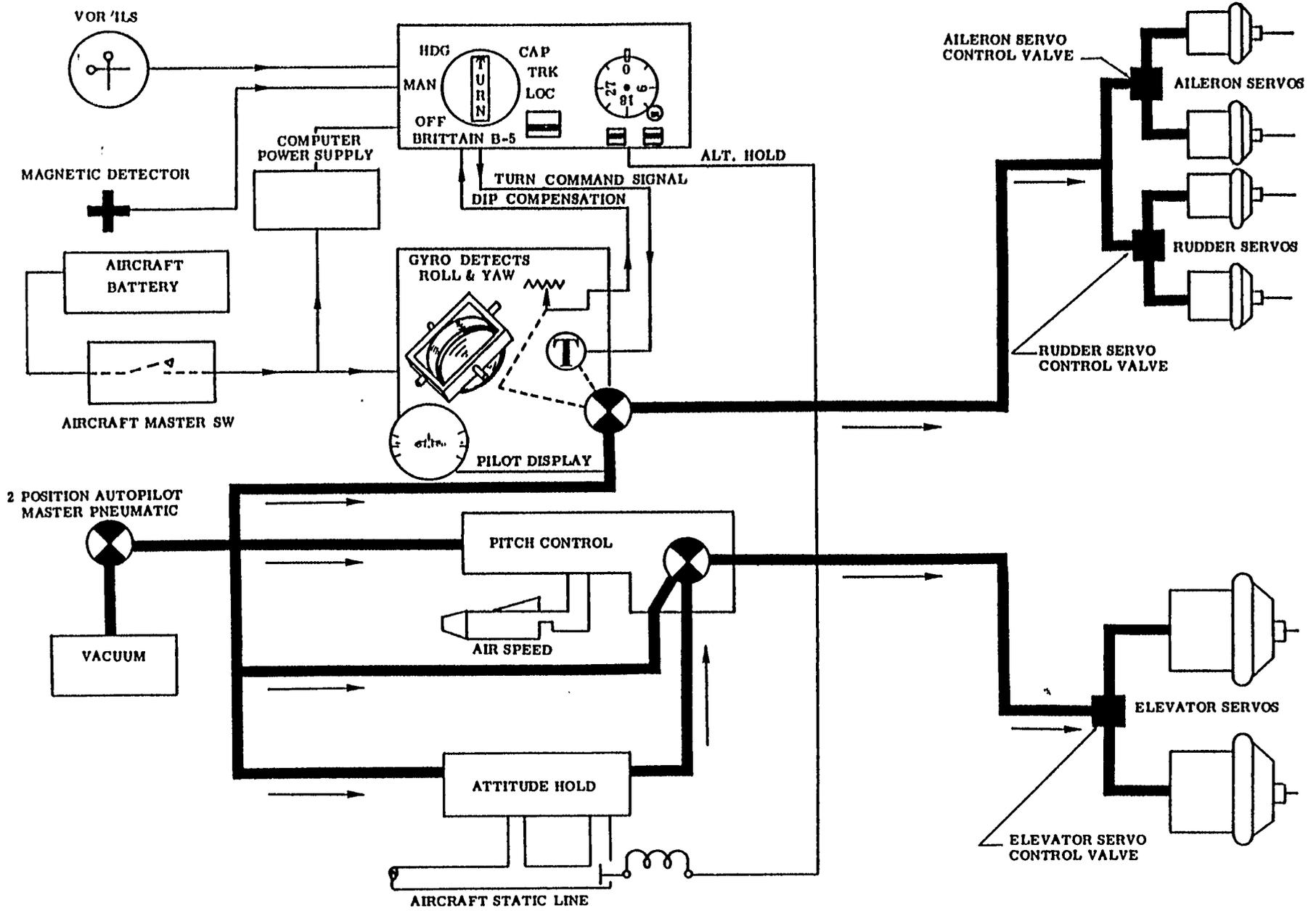
The pressure system has an air filter located between the gyro instruments and pressure regulator. This filter should be removed and replaced every 300 hours or sooner if conditions warrant. An additional filter is provided on the ambient air inlet located on the engine baffle. This filter should be removed every 100 hours and cleaned with soap and water.

On airplane serials E-542 and after, and those prior airplanes that have complied with Service Instructions No. 0581-194, will have the new 1J2-1 filter installed. This filter should be replaced annually or every 300 to 500 hours service time, depending upon operating conditions. The filter element must not be subjected to solvents and must be replaced if this occurs. Always reinstall the filter cover with the opening facing down.

**BEECHCRAFT NEW-MATIC AUTOPILOT
(Figures 11-12)**

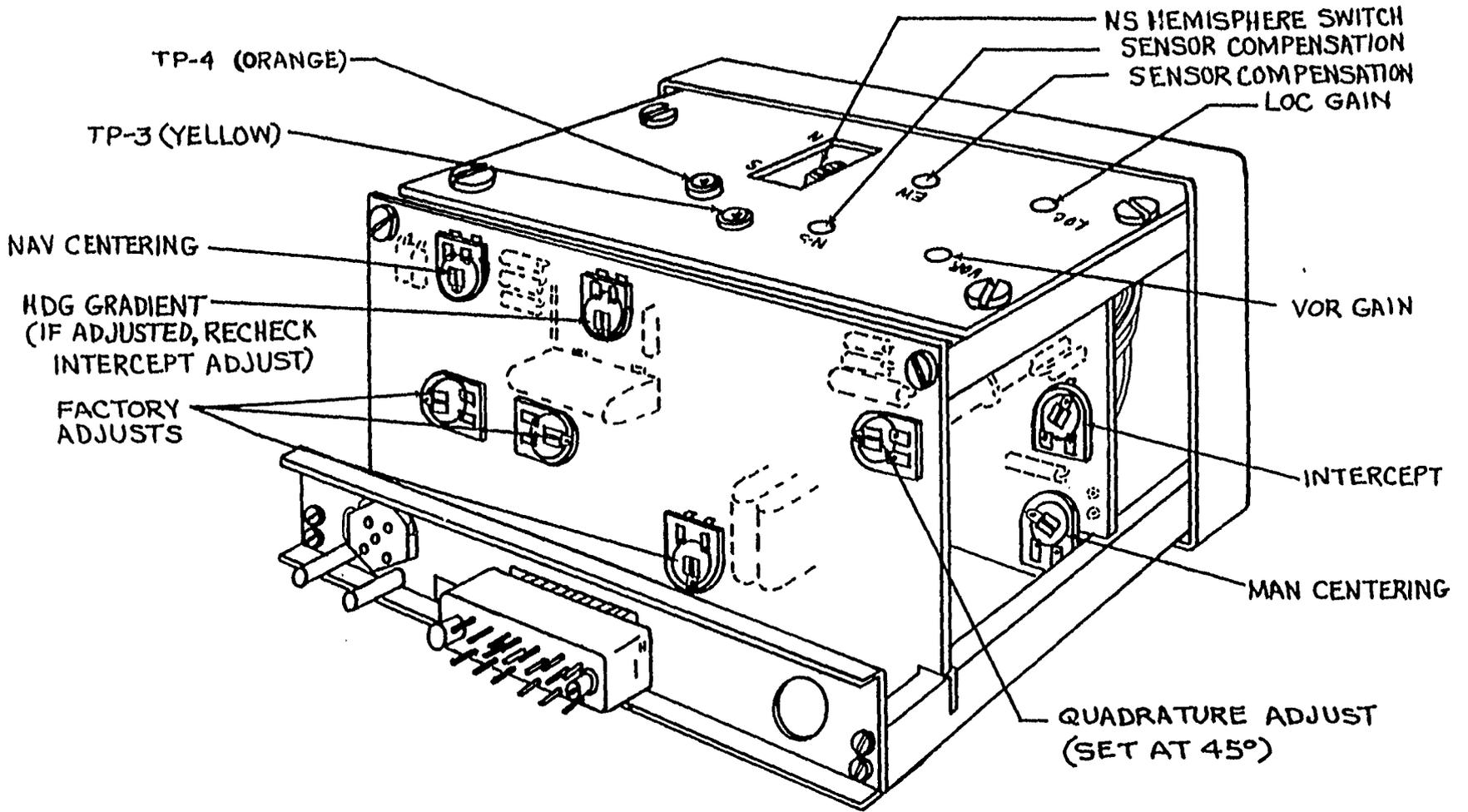
The BEECHCRAFT New-Matic autopilots operate on an electro-pneumatic concept. Electronic circuitry is used for navigational beam detection, magnetic heading direction and turn. Pneumatic servos are used for the flight control actuators. The systems are completely non-tumbling. Yaw, roll and turn detection is made by a tilted gyro (EVT turn coordinator, electrical vacuum, torquing combination) mounted in the instrument panel. A dampened miniature airplane serves as the instrument indicating arm. Any deviation from straight flight causes the rate gyro to move a pressure valve which puts force into the aileron or rudder to return the airplane to straight flight. Turns or beam following is made by rotating a valve sleeve by a torquing movement proportional to the voltage imposed upon it. This unit also supplies an output voltage proportional to the turning rate that is used for dip compensation and nose-up signal during turns. The pitch control system does not use a gyro for reference, but uses the airspeed, rate of airspeed change and inertial signals to control the elevator through the pitch servos. An altitude hold sensing unit works in conjunction with the pitch control to sustain a given altitude.

Figure 11-12. BEECHCRAFT New-Matic B-5 Autopilot System



B5 SYSTEM BLOCK DIAGRAM

Figure 11-13. BEECHCRAFT New-Matic B-5 and B-7 Heading Lock Navigation Coupler System Adjustment Points



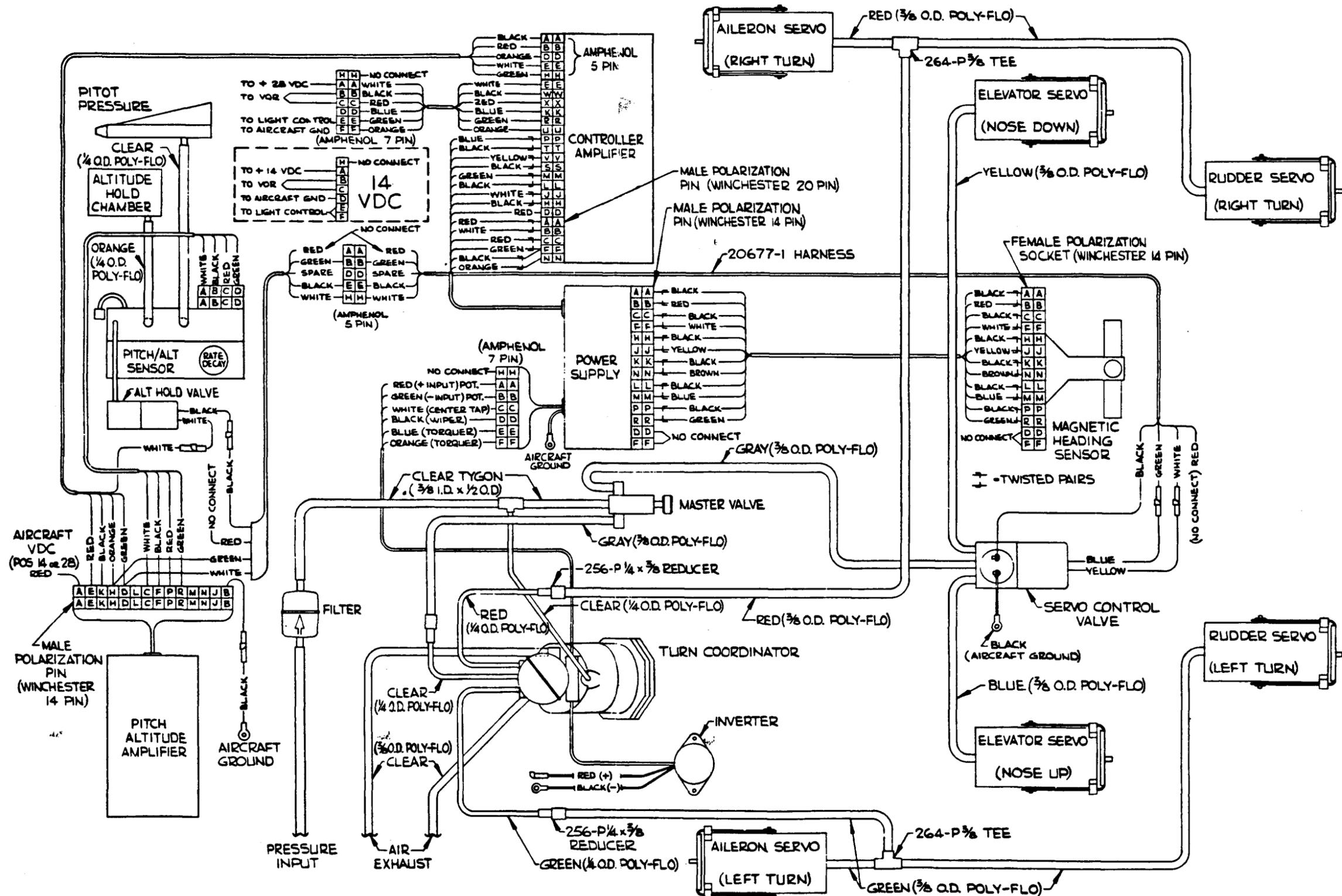


Figure 11-14. BEEHCRAFT New-Matic B-7 System Block Diagram

AUTOPILOT TROUBLESHOOTING GUIDE

NOTE

This procedure applies to the BEEHCRAFT New-Matic autopilot. Manuals noted in the Vendor and Supplementary Publications list and the appropriate test sets as listed in these manuals will aid further in troubleshooting procedures.

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
ROLL AXIS		
1. Insufficient or excessive pressure indicated on aircraft system gage.	a. Leak in aircraft pressure system.	a. Check all lines and fittings for breaks, looseness, kinks, etc.
	b. Regulator valve improperly adjusted.	b. Adjust as outlined in Section 11.
	c. Adjustable orifice improperly adjusted.	c. Adjust as outlined in Section 11.
	d. Faulty pressure pump.	d. Replace pump.
	e. Ambient air filter clogged.	e. Clean or replace.
	f. Clogged system filter.	f. Check as outlined in Section 11 and replace if necessary.
2. Aircraft hunts or recovers slowly from turn in one direction.	a. Regulator valve improperly adjusted.	a. Adjust as outlined in Section 11.
	b. Loose aircraft primary cables or excessive friction in aileron and/or rudder cables, pulleys, bellcranks or loose servo cables.	b. Check security of attachment, binding, etc. and adjust as outlined in Section 4.
	c. Leak in servo or servo lines.	c. Check for leaks.
	d. Obstruction in servo lines.	d. Check for foreign matter.
	e. Faulty turn coordinator gyro	e. Replace turn coordinator.
3. Autopilot sluggish	a. Low system pressure setting.	a. Check system filters and adjust as outlined in Section 11.
4. Aircraft turns continuously on basic stabilization (Controller "OFF")	a. Aircraft out of trim or improperly rigged.	a. Trim aircraft or check controls for proper rig as outlined in Section 4.
	b. Loose primary cables or excessive friction in cables and system. Loose servo cable.	b. Check security of attachment, binding, etc and adjust as outlined in Section 4.

AUTOPILOT TROUBLESHOOTING GUIDE (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
	c. Defective turn coordinator gyro.	c. Replace turn coordinator gyro.
	d. Leak in servo or servo line.	d. Check for servo or line leaks.
5. Aircraft rate of turn too fast or too slow.	a. Improper regulator adjustment.	a. Adjust regulator as outlined in Section 11.
	b. Turn coordinator faulty.	b. Replace turn coordinator.
6. Continuous control wheel oscillation in smooth air.	a. Turn coordinator faulty.	a. Replace turn coordinator.
	b. Improper gyro speed or excessive pressure in system.	b. Adjust system pressure as outlined in Section 11.
7. No turns or turns in one direction only, in response to turn control or on all modes of navigation coupler operation.	a. Faulty turn coordinator.	a. Replace turn coordinator.
	b. Faulty controller amplifier.	b. Replace controller amplifier.
8. Aircraft rolls in one direction only either left or right.	a. Servos improperly phased.	a. Plumb as noted on Figure 11-14.
	b. Turn coordinator not plumbed properly.	b. Plumb as noted on Figure 11-14.
9. Aircraft turns in the wrong direction in "CAP" and "TRK" modes.	a. Nav input signal reversed.	a. Reverse connectors to VOR.
10. No aircraft response from navigation coupler in any mode, ground checks shows electrical.	a. Faulty turn coordinator gyro.	a. Replace turn coordinator.
	b. Obstruction in lines.	b. Check for foreign matter.
11. Aircraft fails to turn to and hold magnetic headings.	a. Faulty heading sensor.	a. Replace magnetic heading sensor.
	b. Faulty heading selector resolver.	b. Replace controller-amplifier.
	c. Faulty controller-amplifier.	c. Replace controller-amplifier.
12. Magnetic headings consistently high or low.	a. Heading sensor misaligned in aircraft.	a. Check for proper installation.
	b. Heading azimuth dial shifted on shaft.	b. Tighten screw and recalibrate.
	c. Improper adjustment of controller-amplifier.	c. Calibrate for the magnetic cardinal points.
13. Cardinal headings inaccurate.	a. Controller-amplifier improperly adjusted.	a. Calibrate for the magnetic cardinal points.

AUTOPILOT TROUBLESHOOTING GUIDE (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
	b. Leak in servo system.	b. Check for leaks.
	c. Low primary pressure.	c. Adjust system as outlined in Section 11.
14. Cardinal headings accurate but intermediate headings inaccurate.	a. Faulty heading sensor. b. Faulty controller-amplifier.	a. Replace the heading sensor. b. Replace controller-amplifier.
15. Insufficient or no control in "CAP" and "TRK" modes.	a. Faulty controller-amplifier. b. Faulty omni converter. c. Insufficient signal from omni. d. "NAV SENS" improperly adjusted.	a. Replace controller-amplifier. b. Replace omni converter. c. Repair or replace omni indicator. d. Readjust.
16. Localizer approach is either sluggish or too sensitive.	a. Loc gain is set high or low.	a. Adjust localizer gain.
17. No electrical output left or right on controller-amplifier test jacks.	a. No A+ input or improperly grounded. b. Defective controller-amplifier or power supply.	a. Check A+ and ground. b. Replace controller-amplifier or power supply.
18. Output only one way on controller-amplifier test jacks.	a. Defective controller-amplifier.	a. Replace controller-amplifier.
19. No output on HDG mode on controller-amplifier test jacks.	a. Defective controller-amplifier, or harness, or heading sensor.	a. Replace controller-amplifier; or harness, or heading sensor.
20. Heading output on two reciprocal headings, but not on the other two.	a. Defective sensor; or harness; or faulty controller-amplifier.	a. Replace heading sensor, or check harness. Replace controller-amplifier.
21. "O" output when in CAP, TRK, or APP mode, with nav signal.	a. Defective nav switching console ; or no nav information; or defective controller-amplifier.	a. Check nav input leads. Replace controller-amplifier.
22. Output voltage in CAP mode decays to "O" voltage.	a. Wrong nav input signals. b. Defective switching console (if installed). c. Dirty input signal (AC volts).	a. Check wiring. b. Repair or replace console. c. Check indicators.

AUTOPILOT TROUBLESHOOTING GUIDE (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
23. Voltage output in MAN, CAP, TRK, and APP mode, but none in HDG mode.	a. Polarization pins reversed on heading sensor plug.	a. Reverse pins (See Figure 11-14).
24. Nav indicator needle deflects left or right when controller-amplifier or radio is turned on.	a. One of the components is shorted to ground.	a. Check for shorts.
25. Low or high intercept angle.	a. Incorrect setting on controller-amplifier.	a. Adjust intercept angle.
	b. Low or high voltage output on nav indicators.	b. Check nav indicators to manufacturer's specs.
 PITCH AXIS		
1. Pitch channel will not center up electrically	a. Defective pitch/altitude sensor or amplifier.	a. Check on Test Set TS-108 or replace one at a time.
2. Altitude channel will not center up electrically.	a. Defective pitch/altitude sensor or amplifier.	a. Check on Test Sets TS-108 or replace one at a time.
3. Altitude hold solenoid valve will not actuate.	a. Pressure switch on servo control valve out of circuit.	a. Check for faulty switch and replace if necessary.
	b. Defective solenoid valve.	b. Replace solenoid valve.
	c. Defective altitude switch on controller-amplifier.	c. Check continuity (see Figure 11-14).
4. Servo control valve will not center.	a. Improper pressure adjustment.	a. Adjust as outlined in Section 11.
	b. Sticky valve.	b. Replace valve.
5. Output voltage is inadequate.	a. Pitch/altitude amplifier sensor or harness shorted or improperly wired.	a. See Figure 11-14, run continuity check and check for shorts.
6. Pressure switch will not make contact when pressure is on.	a. Defective pressure switch or not set at proper pressure.	a. Replace pressure switch.
7. Output voltage one way only on pitch and altitude channels.	a. Servo control valve shorted to ground.	a. Replace valve.
8. System will not maintain trimmed configuration even though centered electrically.	a. Servo control valve not pneumatically centered.	a. Disconnect electrical power. Center valve pneumatically by use of differential gage to ± 0.4 in Hg.

AUTOPILOT TROUBLESHOOTING GUIDE (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
	b. Leak in servos or improperly rigged.	b. Check for leaks and rig.
	c. Leak in pitch/altitude sensor.	c. Replace sensor.
9. System will not respond to airspeed changes.	a. Primary pressure not set properly.	a. Adjust as outlined in Section 11.
	b. Pitot pressure inadequate.	b. Check pitot plumbing.
	c. Decay rate improperly adjusted.	c. Adjust as required.
10. System will not respond to up-command adjustment.	a. Defective pitch/altitude amplifier.	a. Replace pitch/altitude amplifier.
	b. No EVT potentiometer output.	b. Replace turn coordinator.
11. System will not respond to altitude gain adjustment.	a. Pitch/altitude amplifier limiter improperly set.	a. Adjust as required.
12. Aircraft has long term oscillation about pitch axis with altitude hold OFF.	a. Decay rate improperly adjusted.	a. Adjust as required.
	b. Pitch altitude gain improperly adjusted.	b. Adjust as required.
	c. Friction in elevator or servo system.	c. Check for friction and correct.
13. Aircraft has short term oscillation about pitch axis.	a. Decay rate too tight.	a. Adjust as required.
	b. Pitch gain too high.	b. Adjust as required.
	c. Primary pressure too high.	c. Readjust as outlined in Section 11.
14. Aircraft oscillates with altitude hold ON.	a. Altitude gain too high.	a. Adjust as required.
	b. Decay rate improperly adjusted.	b. Adjust as required.
15. Aircraft does not return to altitude when displaced.	a. Altitude hold solenoid inoperative.	a. Replace solenoid.
	b. Leak in altitude system.	b. Check for leaks.
	c. Altitude limiter improperly adjusted.	c. Adjust as required.
16. Aircraft descends or ascends continually when system engaged.	a. Servo control valve not phased correctly.	a. Apply positive 6.0 volts (max) to blue lead and verify nose up response.

PAINTING ALUMINUM

PREPARATION OF AIRPLANE ALUMINUM EXTERIOR FOR PAINT

- a. Mask windows with a double thickness of paper. Cover all openings where paint might enter airplane.
- b. Sand scratches and rough areas to improve smoothness.
- c. Clean surface of airplane with solvent, (lacquer thinner or methyl ethyl ketone), to remove shop primer, exposed sealer, and other shop soils.
- d. Lightly roughen the surface to be painted with a nylon pad to insure a satisfactory paint base.
- e. Reclean the roughened surface with solvents to insure removal of all hand prints, dirt, and etc.

APPLICATION OF EXTERIOR PAINT ON ALUMINUM SKINS

- a. Prime surfaces with (Item 24, Consumable Materials Chart). Mix only enough primer for use within an 8 hour period. Primer mixed longer than 8 hours must be discarded.
- b. Apply one coat of wash primer. Keep air pressure at a minimum to prevent overspray.

NOTE

Temperature and humidity will effect drying time of the primer. It should dry at least 15 minutes before recoating the surface (test surface with light fingernail pressure).

- c. Proceed to prime with a wet coat of zinc chromate primer, (Item 24, Consumable Materials Chart) thinned one part primer and two parts toluol. A heavy hiding coat of this primer is not desired and will impair performance.
- d. The exterior surfaces are now ready for color coat.

EXTERIOR AND INTERIOR FINISHES

The following list is included to be used as a reference should it become necessary to touch up or match an interior or exterior paint. Each paint is listed according to specific type and whether an exterior or interior paint.

Short cut masking jobs for your paint department are possible when you use pre-cut paint patterns and numbers. Stripe patterns and numeral patterns are available from Mid-American Markings, Inc., 517 South St. Francis, Wichita, Kansas 67202., or any other equivalent product may be used. Current listings include 4, 12, and 20 inch Call Letters and Numerals. Time can be saved when using these patterns and a much neater final paint job can be expected.

FINISHES

ENAMEL

(Exterior Colors)

Pacific Blue 118684-1

Morning Glory Blue	118684-3
Blueberry Blue	118684-5
Surf Green	118684-7
Shamrock Green	118684-9
Turquoise	118684-11
San Mateo Wheat	118684-13
Lemon Yellow	118684-15
Satum Gold	118684-17
Castle Tan	118684-19
Beaver Brown	118684-21
Huntsman Red	118684-25
Toreador Red	118684-27
Chianti Red	118684-29
Matterhorn White	118684-31
Black	118684-33
Champagne Gold	118684-39
Jubilee Gold	118684-221
Sable Brown	118684-223
Sunshine Yellow	118684-231
Capri Blue	118684-265
Omaha Orange	118684-273
Kingston Gray	118684-299

(E-185 and after)

Urethane

Enamel

Morning Glory Blue	118684-3
Blueberry Blue	118684-5
Surf Green	118684-7
Shamrock Green	118684-307
Turquoise	118684-11
Lemon Yellow	118684-15
Castle Tan	118684-312
Huntsman Red	118684-25
Toreador Red	118684-316
Chianti Red	118684-29
Matterhorn White	118684-318
Black	118684-319
Champagne Gold	118684-323
Jubilee Gold	118684-221
Capri Blue	118684-265
Metallic Gold	118684-271
Omaha Orange	118684-273
Kingston Gray	118684-299
Peacock Turquoise	118684-407
Terrace Blue	118684-335
Sahara Tan	118684-411
Prairie Beige	118684-339
Antique Gold	118684-415
Beechwood	118684-419
Embassy Red	118684-347
Marlin Blue	118684-393
Bahama Blue	118684-395
Pavonne Blue	118684-397
Matador Red	118684-355
Sunburst Yellow	118684-357
Jade Mist Green	118684-403
Astro Blue	118684-361
Sable Brown	118684-320
Gamma Gray	118684-521
Really Red	118684-523
Vendetta Red	118684-525
Bristol Blue	118684-527
Crater Blue	118684-529

Bright Gold	118684-531	118684-507	Yellow Jacket	118684-543	118684-519
Calypso Orange	118684-533	118684-509			
Mesa Gold	118684-535	118684-511	EPOXY		
Mandarin Orange	118684-537	118684-513	(Exterior colors E-185 and after)		
Citrus Green	118684-539	118684-515			
Olive Green	118684-541	118684-517	Matterhorn White		118684-217

INTERIOR COLORS (E-1 through E-282)

Listed below are the interior colors and the detail parts and assemblies that are painted with these colors.

LACQUER

(Autumn Smoke) 118684-155

- a. Forward trim on the cabin door frame.
- b. Unupholstered portion of the seat structure.
- c. Front seat rear portion, except the landing gear handcrank shaft cover.
- d. Seat track structure and the lower flanges of the seat track.
- e. Pilot and copilot fresh air vent except the air vent knob.
- f. Cabin window trim (canopy structure).
- g. Instrument panel.
- h. Glove compartment door.
- i. Radio panel.

(ANA Color No. 514)

- a. Instrument faces and bezels.
- b. Radio.

- c. Instrument panel cut-out covers (blank hole bezels).

BAKING ENAMEL

(Black) 94-515

- a. Control arm.

(Insignia Red) 94-509

- a. Fuel selector handle.
- b. Landing gear emergency operation handle.

VINYL

(Autumn Smoke) 118684-155

- a. Ignition panel
- b. Fuel selector cover.
- c. Front spar cover - forward.
- d. Front spar cover - top.
- e. Front spar cover - aft.
- f. Rear window trim.
- g. Engine control escutcheon.
- h. Overhead fresh air panel.
- i. Hat shelf.

The lower instrument panel paint trim is color coordinated with the leather or vinyl upper cabin sidewall panel. The following list contains the colors available for the upper sidewall panels, along with the corresponding color and paint number for the lower instrument panel paint trim.

LEATHER PANELS

(Interior Colors)

Black	CO 378C
Mocha	CO 380C
Parchment	CO 381C
Buckskin	CO 484C
Pumpkin	CO 1061C
Torquoise	CO 1062C
Royal Blue	CO 1064C

VINYL PANELS

(Interior Colors)

Platinum Bone Chalet	5647
Blue Chalet	5652

EXTERIOR AND INTERIOR PRIMERS

Interior (Aluminum)	MIL-P-8585
Exterior (Aluminum)	Enmar EX-2016G

INTERIOR COLORS (E-283 and after)**LACQUER**

Arctic Beige 118684-235

- (a) Forward trim on cabin door frame.
- (b) Inner side of baggage door and door frame not covered by upholstery.

LACQUER PAINT

(Interior Colors)

Instrument Black	ANA Color 514
Sable Brown	118684-257
Sandusky	118684-237
Sun Beige	118684-285
Pumpkin	118684-279
Torquoise	118684-275
Broadway Blue	118684-283

LACQUER PAINT

(Interior Colors)

Arctic Beige	118684-235
Alpine Blue	118684-63

ANA Color No. 514

- (a) Console cover.
- (b) Elevator tab drum shield.
- (c) Upper and lower center console.
- (d) Engine control levers.
- (e) Nose gear indicator bezel.
- (f) Instrument faces and bezels.
- (g) Radio.

INTERIOR COLORS (Continued)
(E-283 and after)

- (h) Bendix ignition switch handles.
- (i) Instrument panel cutout covers (blank hole bezels).
- (j) Compass case and bracket, correction plate context filled with black lacquer process paint equivalent to Warnow No. 2-700.

Black Vinyl Lacquer 42G-514

- (a) Fuel unit cover.

- (b) Ignition panel.

Dull Black Lacquer 118684-133

- (a) Passenger chair exposed frame areas and exposed cabin support structure.
- (b) Chair track structure and track lower flange.
- (c) Pilot's fresh air vent, except knob.
- (d) Instrument sub panel face.
- (e) Sloping radio panel.

Armrest escutcheon color is coordinated with sidewall material color as follows:

Sidewall Color	Escutcheon Color
Gold 244 CM	Use Chairman Gold 118684-479
Red 667 CM	Use Chairman Red 118684-481
Sky Blue 1125 CM	Use Chairman Blue 118684-483
Olive 323 CM	Use Olive 118684-485
Light Brown 105 E	Use Executive Brown 118684-487
Parchment 124 CM	Use Parchment 118684-489
Crimson Rogue RU-71	Use Red Antique 118684-493
Walnut Rogue RU-82	Use Walnut 118684-493
Blue Rogue RU-78	Use Blue Antique 118684-494
Rawhide Rogue RU-73	Use Rawhide 118684-495
Olive Rogue RU-86	Use New Bronze 118684-475
Parchment Rogue RU-74	Use Castle Tan 118684-61

BAKING ENAMEL

Insignia Red 94-509

- (a) Fuel selector handle.
- (b) Landing gear emergency operation handle.
- (c) Control lock assembly, except portion of pin which extends into control column.
- (d) Lock assembly - rudder pedal safety, and chain.

Black 94-515

- (a) Control arm.

VINYL

Arctic Beige 118684-243

- (a) Hat shelf.

EXTERIOR PAINT TOUCH-UP REPAIR

- a. Mask around the skin containing the damaged area.
- b. Remove any loose edges of paint by using a high tack adhesive tape around the edge of the damaged area.
- c. Using a coarse sandpaper, fair the edge of the damaged area with the metal.
- d. When the edge of the paint begins to "feather" into a

smooth joint, use a fine grade of sandpaper to eliminate the sand scratches left by the coarse paper so that the finish will be perfectly smooth. Take care to avoid removing any more metal than is absolutely necessary.

- e. Wash the sanded area with a solvent, such as naphtha or toluol. Change the wash cloths used for this purpose frequently so that all the sanding dust will be picked up.
- f. After the area to be touched up has been cleaned

with solvent until all trace of discoloration is gone, apply a coat of pretreatment primer to the damaged area.

g. Spray two or three coats of zinc chromate primer for a heavier than normal build-up.

h. After the primer has dried, sand the area being repaired with a medium fine sandpaper. Sand the edge of the repair area until the indentation where the metal and the old paint meet is gone. If it is necessary, apply additional primer until the junction of the paint and metal is no longer visible.

i. Spray on two thin topcoats of finish paint.

CLEANING AND WAXING THE AIRCRAFT FINISH

Because the wax seals the paint from the outside air, a new paint job should not be waxed for a period of 90 days to

allow the paint to cure. For uncured painted surfaces, wash only with cold or lukewarm (never hot) water and a mild nondetergent soap. Any rubbing of the painted surface should be done gently and held to a minimum to avoid cracking the paint film.

After the paint cures a thorough waxing will protect painted and unpainted metal surfaces from a variety of highly corrosive elements. Flush loose dirt away first with clear water, then wash the airplane with a mild soap and water. Harsh, abrasive or alkaline soaps or detergents should never be used. Use soft cloths or chamois to prevent scratches when cleaning and polishing. Any good grade automobile wax may be used to preserve painted surfaces. To remove stubborn oil and grease, use a soft cloth dampened with naphtha. After cleaning with naphtha, the surface should be rewaxed and polished.

ELECTRICAL SYSTEM

COMPONENT REPLACEMENT

Federal Aviation Agency Manual AC 43.13-1 should be used as a guide to aid in establishing a standard of workmanship for inspection, replacement and repair of electrical components.

BATTERY

Power for operation of the airplane electrical system is provided by a 12-volt, 35 ampere-hour battery (prior to E-1241, except E-1111), or a 24-volt, 110 ampere-hour battery (E-1111, E-1241 and after). The battery is located on the right side of the engine compartment, just forward of the firewall.

CAUTION

The battery may be damaged if exposed to voltages higher than 15 volts (for 12-volt batteries), or 30 volts (for 24-volt batteries).

BATTERY MAINTENANCE PROGRAM

The battery is accessible for servicing by raising the right engine cowl and removing the battery box cover. A systematic battery maintenance program should be established as follows:

- a. A log in the services performed on the battery should be maintained.
- b. The battery should be removed from the airplane and serviced after 100 flight hours or 30 days, whichever occurs first. If the ambient temperatures are above 90°F or the time between engine starts averages less than 30 minutes, the time between servicing may be reduced.
- c. The fluid level of the battery should be checked every 25 hours and maintained at 3/8 inch above the top of the separators. Add only distilled water to maintain the specific gravity of between 1.275 and 1.295.

NOTE

Do not overfill the battery. When the battery cells are overfilled, water and acid will spill on the lower portions of the engine accessory section and lower fuselage. Neutralize the acid in any such spillage immediately with a water solution of sodium bicarbonate (baking soda).

During periods when the ambient temperature is below 32°F,

the battery should be maintained in a fully charged state to prevent freezing. When water is added, the battery should be charged sufficiently to thoroughly mix the water with the electrolyte as a precaution against freezing.

d. For peak performance, the battery must be kept clean and dry. If foreign materials are present in sufficient quantities, the resultant deposits may form conductive paths that permit a rapid self discharge of the battery. To prevent the collection of such deposits, the battery should be cleaned after each 100 hours of service or every 30 days, whichever occurs first.

CAUTION

Excessive spewage may result if the cell vents are not kept clean and open.

e. The log of battery service performed should be evaluated to determine the need to service the battery at the above recommended intervals or to extend the intervals if justified. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals. For further servicing information instructions are furnished with each battery.

BATTERY CHARGING

The battery should be charged at a rate that will not produce gassing or bubbling of the electrolyte. Monitor battery temperature during the charging cycle to ensure that cell temperature does not exceed 115°F. If the temperature reaches this limit, the rate of charge should be reduced. The manufacturer recommends charging the battery at a rate of 2 amperes until four consecutive hourly readings show no rise in specific gravity and voltage for each cell. Refer to the Service Manual (P/N GSM-1277) for additional information on the charging procedure recommended by the battery manufacturer (Teledyne Battery Products).

ALTERNATOR

(Serials E-1 thru E-184)

The 70 ampere alternator output is controlled by a transistorized voltage regulator/overvoltage relay. The alternator is not self-excited and requires the airplane battery power for the electrical energy to excite the alternator field when the alternator is switched on. To meet emergencies such as a completely discharged battery, an emergency excitation circuit is incorporated into the electrical system. The circuit consists of a small, rechargeable battery and its charging circuit which will excite the alternator field when the "alt re exc" switch, located on the BATTERY/ALTERNATOR switch panel, is pressed momentarily.

On airplane serials E-1 through E-141, a relay senses the alternator output. The relay is energized by the output of the

alternator to interrupt the illumination of the alternator annunciator light. The output of the alternator is sensed by an alternator out sensor on the serials E-142 and after.

ALTERNATOR

(Serials E-185 thru E-1240, except E-1111)

The alternator output is controlled by a transistorized voltage regulator/overvoltage relay. Excitation current for the alternator field is normally derived from the airplane bus through a 5 ampere circuit breaker, the voltage regulator/overvoltage relay, and the alternator switch. The alternator used on serials E-185 and after is self-exciting and can be started in the event the battery has been discharged to the extent it will not energize the battery relay. The alternator field is designed to have a small amount of residual magnetism. This residual is strong enough to excite the alternator field circuit if the alternator is not heavily loaded. When attempting to start the alternator without battery current, turn off all electrical load and operate the engine at near cruise speed (a minimum of 2000 rpm). The output of the alternator is sensed by an alternator out sensor to illuminate an alternator annunciator light in the event of an alternator failure.

ALTERNATOR

(Serials E-1111, E-1241 and after)

On the serials noted above, a 28-volt, 50-ampere, gear-driven alternator is standard equipment, although a 100-ampere alternator may be installed as optional equipment.

The alternator output is controlled by a transistorized voltage regulator/overvoltage relay. Current to excite the alternator field is normally derived from the airplane bus through a 10 amp switch/circuit breaker and the voltage regulator/overvoltage relay. The alternator is designed to have a small amount of residual magnetism. In the event the battery is discharged to the extent that it will not excite the alternator field, the residual magnetism is strong enough to excite the alternator field if all load is removed from the airplane electrical system until the bus is brought up to proper voltage. When attempting to start the alternator without battery current, turn off all electrical load and operate the engine at near cruise speed. In the event of alternator failure the alternator sensor will illuminate an annunciator light.

ALTERNATOR REMOVAL

a. Access to the alternator is gained through the right hand cowl door and through the forward opening of the cowl.

CAUTION

The output terminal of the alternator is connected directly to the battery. Make sure the battery switch is "OFF" before removing the wires at the alternator or serious damage to the wiring harness and alternator may result from accidental grounding of the output stud.

b. Disconnect the electrical wiring harness from the alternator.

c. Remove the four attaching bolts. Remove the alternator.

ALTERNATOR INSTALLATION

a. Install a new gasket on the alternator flange.

CAUTION

Do not force the alternator into position or damage to the alternator or drive gears could result. Care must be taken to assure that the alternator pilot enters the crankcase pilot bore squarely.

b. Position the alternator on the mounting pad.

c. Install the attaching nuts and washers bringing to a snug condition. Torque the nuts to 150 to 180 inch-pounds in diagonally opposite pairs.

d. Connect the electrical wiring to the alternator.

CAUTION

Never turn the battery switch "ON" until all wiring harness connections have been made and properly tightened or serious damage to the wiring harness and alternator may result from accidental grounding.

f. Start the engine and check for oil seepage and proper operation.

NOTE

If a new alternator is to be installed, refer to **DRIVE GEAR AND COUPLING INSTALLATION ON NEW ALTERNATORS** to change the drive gear and coupling to the new alternator.

DRIVE GEAR AND COUPLING INSTALLATION ON NEW ALTERNATORS

The new alternator will be received without the drive gear and coupling. The drive gear and coupling from the old alternator will need to be installed on the new alternator. The drive and coupling may be changed by following the procedures as follows.

a. Remove the shipping spacer and washer (if installed) from the 100 ampere alternator.

b. Install the woodruff key (if not already installed), coupling assembly and thrust washer. Ensure the bearing surface (copper color) of the thrust washer is installed toward the alternator.

c. Install the nut and tighten to a torque of 400 inch-

pounds. If the slots of the castellated nut do not align with the cotter pin hole in the shaft, the nut should be tightened further, but not to exceed 500 inch-pounds. Do not back off the nut to align holes.

d. Install an MS24665-302 cotter pin carefully to ensure clearance when the alternator is installed in the engine.

NOTE

The cotter pin must be installed and then trimmed. The portion bent toward the alternator housing must NOT touch the thrust washer when bent over the nut. The portion bent away from the alternator housing must NOT reach beyond the threads on the end of the shaft.

ALTERNATOR OVERHAUL

Refer to applicable Vendor Publications for complete tests and maintenance procedures.

VOLTAGE REGULATOR ADJUSTMENTS (14 and 28-Volt Systems)

NOTE

The voltage regulator is set and sealed at the factory. Breaking the seal prior to the warranty limitations voids the warranty. Once the warranty limitations have been reached and it should become necessary to adjust the voltage regulator, adjustments may be made in the following manner.

CAUTION

Observe engine operating limitations.

a. Bring the voltage regulator and the alternator up to operating temperature by operating the engine at 1800 rpm with approximately 50% load for a minimum of 15 minutes.

b. Connect a precision voltmeter to the circuit breaker bus.

c. Operate the engine at cruise rpm (2500 rpm) with the alternator "ON", and the electrical load reduced to a minimum.

d. Check the bus voltage. If it is not $14.0 + .2 - .25$ vdc (14-volt electrical system) or $28.50 \pm .25$ vdc (28-volt electrical system), adjustment should be made as indicated in the following step.

e. Remove the plastic plug labeled "REG" from the corner of the regulator and adjust the regulator by turning the potentiometer clockwise to increase the voltage and counterclockwise to decrease the voltage. Make any adjustments in small increments and allow 2 or 3 minutes operation time for the system to stabilize between adjustments.

f. For final check and adjustment, the engine should be operated at cruise rpm (2500 rpm) with the alternator "ON" and carrying approximately 50% load.

ADJUSTING THE OVERVOLTAGE RELAY (14 and 28-Volt Systems)

If it is necessary to adjust the overvoltage relay and it is not feasible to make the adjustments on the bench, it may be made on the airplane. To make this adjustment the alternator is used as a power source, and the voltage regulator must be put out of adjustment and the entire system subjected to abnormal voltages. Prior to making the adjustment, turn off all unnecessary electrical and avionics equipment and open all circuit breakers not necessary for the test.

a. Connect a calibrated precision voltmeter to the circuit breaker bus.

CAUTION

Observe engine operating limitations.

b. Operate the engine at cruise rpm (2500 rpm).

c. Monitor the voltmeter to determine the voltage at which the overvoltage relay trips and remove the alternator from the line. Slowly adjust the voltage regulator to increase the bus voltage. The overvoltage relay must trip at $16.0 + .5 - .2$ volts (on 14-volt systems), or 32.0 ± 1 volts (on 28-volt systems).

d. If the overvoltage relay trips below 15.8 volts on 14-volt systems (31 volts on 28-volt systems) or does not trip when the bus reaches 16.5 volts on 14-volt systems (33.0 volts on 28-volt systems) as measured on a precision voltmeter, the overvoltage relay must be adjusted. Remove the plastic plug marked O. V. and turn the adjustable potentiometer clockwise to increase voltage and counterclockwise to decrease the trip voltage.

NOTE

To allow the overvoltage relay to reset all power must be momentarily removed from the unit.

e. Recheck the adjustment.

f. Readjust the voltage regulator to $14.0 + .2 - .25$ volts (on 14-volt systems), or $28.5 \pm .25$ volts (on 28-volt systems). This adjustment should be checked with the engine running at cruise rpm (2500 rpm) and the alternator on and stabilized as noted in VOLTAGE REGULATOR ADJUSTMENTS.

g. Replace the plastic plugs over the adjustable potentiometers.

STANDBY GENERATOR SYSTEM

A standby generator system is provided to power essential equipment in the event of loss of electrical power on the main system.

The standby generator system is an independent electrical system incorporated into the main system in such a manner to furnish power only to essential engine instruments, turn coordinator and navigation and communication system. A diode in the circuit from the battery to the standby generator system prevents the generator from furnishing any power to the battery, but allows the battery (if serviceable) to supply power to the essential equipment in the event of inadequate output or failure of the standby generator.

NOTE

The circuits from the battery to the standby generator system and the battery to the stall warning system are always alive, even though the battery switch may be in the OFF position.

The standby generator system should only be used when there is a loss of electrical power on the main electrical system. As soon as a loss of electrical power is evident, turn the alternator/generator and battery switches OFF. (This is to prevent possible damage to the main system if a short exists therein, and to save battery power for lowering the flaps and gear if the problem is determined to be only a faulty alternator/generator). After turning the switches OFF, turn the standby generator switch ON.

14-VOLT SYSTEM

The standby generator (optional on E-287, E-329 through E-1241 except E-1111 and EA-1 and after) requires an engine rpm of at least 1700 to function properly. With the engine running at 1700 rpm, place the standby generator switch momentarily to the TEST position. The GEN TEST and BAT TEST lights will illuminate, indicating that the battery and generator are both supplying power.

The standby generator is located on the alternate tachometer drive pad of the engine. The on-off-test switch and the GEN TEST and BAT TEST lights are located above the NAV COMM XFER switch on the instrument panel. The terminal board, zener diode and number 1 transistor (which controls the conductance of the number 2 transistor) is located on the bracket attached to the rear of the on-off-test switch. The number 2 transistor is located in the engine compartment on the lower left aft side.

On serials prior to E-763 except E-710 and EA-1 and after the overvoltage relay and rheostat are on the lower aft side of the firewall in the vicinity of the landing gear warning horn and flasher. At serial E-710, E-763 through E-1240 except E-1111 and EA-1 and after the standby generator overvoltage relay was moved to the structure forward of the control column, close to the center line of the airplane.

On serials prior to E-924 except EA-1 and after overvoltage relay will actuate at $15.7 \pm .1$ volts. On serial E-924 through E-1240 except E-1111 and EA-1 and after the overvoltage relay will actuate, at $16.0 \pm .3$ volts, and remove the standby generator from service should the standby voltage regulator fail. The overvoltage relay will reset when the input voltage is removed. When the overvoltage relay is actuated it bypasses the ON OFF switch to lock the relay in the actuated position until the engine is shutdown, at which time the regulator will reset. Generator and battery fuses are on the upper forward side of the firewall and the bus and circuit breakers are on the forward side of the cabin.

The two power relays are located on the upper right aft side of the firewall. Maintenance of the system is limited to isolating a defective component and replacing it in accordance with accepted electrical maintenance practices. Refer to the troubleshooting guide for probable cause and corrective action.

28-VOLT SYSTEM

At serial E-1424 and after a 28 volt standby generator is offered as optional equipment. The generator is mounted aft of the right magneto, aft of the engine baffle and is cooled by air that is picked up from the engine baffle on the left side of the engine. The switch and voltmeter are located on the right side of the instrument panel.

The switch is placarded OFF ON GEN/TEST. The voltage regulator/overvoltage relay is mounted aft of the firewall and controls the generator output.

The standby generator is self exciting and requires no external electrical power for it to function, although it does require 2925 to 4050 rpm (engine rpm is 1950 to 2700) to function properly. This standby system will supply sufficient power to operate essential instruments such as turn coordinator, fuel quantity, oil and cylinder temperature, Comm-1 and Comm-2, transponder, audio amplifier, panel voltmeter, glareshield light, and standby panel light. The generator will produce a continuous 6.5 amps at 28 volts or for intermittent (1 minute on 2 minutes off) operation 11 amps at 24 volts with a minimum engine speed of 1950 rpm.

The standby generator system is controlled and protected by a voltage regulator/overvoltage relay. The regulator will control the voltage at $28.50 \pm .50$ volts. The overvoltage relay will remove the standby generator from the circuit should the voltage reach 32.0 ± 0.1 volts. Although the overvoltage relay is set to trip and remove the generator from the circuit at 32.0 ± 0.1 volts it is not sensitive to small voltage spikes (at 33 volts it will not trip for 50 mill seconds). Should a transient voltage spike cause the overvoltage relay to trip removing the generator from the system, it may be reset in flight by moving the switch momentarily to the GEN/RESET position.

STARTER

STARTER REMOVAL

- a. Access to the starter may be gained through the right hand cowl door.
- b. Disconnect the electrical wiring from the starter.
- c. Remove the two hex nuts and washers from the mounting studs, and remove the starter.

STARTER INSTALLATION

- a. Install a new "O" ring on the flange of the starter.
- b. Position the starter on the mounting pad.
- c. Install the attaching nuts and torque the nuts to 150-180 inch-pounds.
- d. Secure the attaching nuts with "palnuts".
- e. Connect the electrical wiring to the starter.
- f. Start the engine to check for oil seepage at the mounting flange and check for proper operation.

STARTER OVERHAUL

Refer to applicable Vendor Publications for complete tests and maintenance procedures.

STARTER LUBRICATION

DELCO-REMY (14-Volt System)

No lubrication is required on the starting motor except at the time of overhaul. Bushings and the armature shaft should be coated with a small amount of Delco-Remy Lubricant No. 1960954. (Item 32, Consumable Materials Chart).

PRESTOLITE (14 and 28-Volt Systems)

Soak new absorbent bronze bearings in SAE 20 oil before installation. Saturate the felt oiling pad in the commutator end head with SAE 20 oil. Allow excess oil to drain out before installing end head on motor. Put a light film of Lubriplate #777 on the drive end of the armature shaft before and after installing the drive end head.

CAUTION

Do not clean the starter in any degreasing tank or grease dissolving solvents. Avoid excessive lubrication.

STARTER BRUSH REPLACEMENT

DELCO-REMY (14-Volt System)

The starter brushes should slide freely in the holder and make full contact on the commutator. The brushes should be

replaced when they have worn to a 3/8 inch length. Proper brush spring tension with new brushes installed is 24 ounces. This tension is measured with a scale hooked under the brush spring near the brush and the reading taken just as the spring leaves the brush.

PRESTOLITE (14 and 28-Volt Systems)

Brushes must be replaced when they have worn down to a length of 1/4" or less. Refer to Prestolite Service Bulletin ASM-1 for brush replacement procedure. There should be a spring tension of 32 to 40 ounces with new brushes. Measure with a spring scale hooked under the spring at the brush. Pull on a line opposite the line of force exerted by the spring and take the reading just as the spring leaves the brush.

CABIN LIGHTS

CABIN READING LIGHT BULB REPLACEMENT (E-283 and after; EA-1 and after)

The cabin reading lights use number 89 bulbs for 14 volt airplanes and number 303 bulbs for 28 volt airplanes (part number of General Electric, Cleveland, Ohio).

- a. Pull the black lens retainer ring out of the light assembly.

CAUTION

The lens, spring behind the lens, and reflector are free to fall when the retainer ring is removed.

- b. Replace the bulb.
- c. Assemble the reflector, spring, and lens into the light assembly and install the retainer ring in front of the lens.

OVERHEAD CONSOLE LIGHT BULB REPLACEMENT (E-283 and after; EA-1 and after)

The overhead console light uses two number 1816 bulbs for 14 volt airplanes and two number 1864 bulbs for 28 volt airplanes (part number of General Electric, Cleveland, Ohio).

- a. Remove the screws holding the console in place and lower the console from the headliner.
- b. Locate the inoperative light bulb and pull it and the socket from the light assembly.
- c. Replace the inoperative bulb and place the new bulb and socket back into the light assembly.
- d. Place the console into the headliner and install the screws.

STROBE LIGHT

BULLOCK UNIT

The system consists of a solid state power supply unit, a circuit breaker switch on the instrument panel, a shielded power cable and a single, ventral-mounted xenon gas light. System operation is based on the capacitance discharge principle. A DC converter steps up the aircraft battery voltage to approximately 400 volts to charge the capacitor. The trigger circuit consists of a unijunction oscillator and a silicon controlled rectifier which applies a pulse of negative voltage to the trigger transformer in the lamp. The trigger transformer produces an ionization voltage of approximately 4000 volts to ignite the xenon gas in the lamp. As the lamp ignites, the energy stored in the capacitor is discharged through the lamp to produce a peak light intensity of over a million candle power. When the capacitor voltage drops below 50 volts, the lamp will go out and the capacitor begins recharging for the next cycle. System operational cycle will repeat, until the strobe light is turned off, at a flash rate of 45 flashes per minute.

Trouble Analysis

Whenever trouble occurs, check all primary power lines, external circuit elements, fuses and wiring for a malfunction before troubleshooting the strobe light system. System electrical failure may be traced to any of three general areas; power unit, lamp assembly or wiring. A quick method of isolating the trouble source is to remove the lens of the xenon lamp and test the lamp. Inspect the lamp to see if it is broken or loose in its socket. If the lamp is intact, use a DC voltmeter to check for approximately 350 volts at the top of the lamp with the system turned on. The rate that the voltage peaks should be between 40 and 55 times per minute. If no voltage is present, the fault is probably located in the power unit.

Troubleshooting Power Unit

Disassemble the power unit by removing the screws securing the end plates to the power unit. Remove the end plate which has the power plug and slide the bottom heat sink forward until it can be separated. The large capacitor may be attached to the rear end plate by thermal epoxy for efficient heat transfer and care should be taken to avoid breaking this bond. The upper heat sink (with transistors mounted on it) can be slid forward, exposing the component board and capacitor bracket. Remove the nuts securing the board to the metal bracket and the component board will be completely accessible.

Converter Troubleshooting

a. If the fuse keeps blowing, check transistor 2N3055 for a possible short. It will be necessary to remove the emitter wire, and unsolder the base wire before an ohmmeter check can be made. Many times only one transistor will fail. Failure of Capacitor C1 will also cause the fuse to blow.

b. If the converter won't start when voltage is first

applied, a small current "kick" is noted and then no current is drawn; look for a poor solder joint in the starting circuit, R2 1.3K and R1 82 ohms. The converter may be started by applying about 2 volts to the junction of R1 and R2.

c. Low or no output voltage, but converter operates otherwise. Using an ohmmeter, look for a shorted diode in the bridge circuit. In extreme cases, the transformer could have a shorted winding. As a check, disconnect a lead from the transformer secondary, if the current remains the same, the transformer should be replaced.

d. Low output voltage can be the result of a faulty capacitor C2. Check by removing the positive lead from the capacitor.

e. Low voltage coupled with very slow voltage buildup can be traced to a faulty transistor 2N3055. An ohmmeter check will indicate which transistor has failed. Select replacement transistors having a collector to emitter resistance of 100 ohms minimum.

Trigger Circuit Troubleshooting

a. Using a high impedance voltmeter, check for 180 volts DC at the junction of R8, R9 and C5. If there is no voltage, check C5 and SCR T1145A2.

b. If there is voltage at the junction, it should periodically drop to around 30 volts as the SCR triggers. If the SCR does not trigger, measure the voltage across R7 (100 ohms). This voltage will be below .5 volts. If the voltage is indicated, place an oscilloscope across R7 and look for a positive going pulse of around 4 volts at the repetition rate of 40 to 55 times per minute. If the pulse is recorded on the scope, then the SCR is not triggering and should be replaced.

c. When no voltage is observed across R7, check for battery voltage at R5 and R6. If voltage is present, then the trouble is in the unijunction.

d. If normal voltage is observed across R7, check the capacitor C4 for shorts and leakage.

e. If unijunction Q3 is to be replaced, it may be necessary to readjust the flash rate. This can be done by changing R5 or by changing the value of C4. In many cases, the value is recorded on the component board, and it is only necessary to order the exact value from the manufacturer (see the Vendor Publication List).

NOTE

In some instances, power supply units which have been stored or not operated on the aircraft for a considerable period of time, may not operate instantly when the system is turned on. Before determining that the power unit is inoperative, leave the system on for a period of at least 30 minutes. If the power unit does not operate in this span of time, refer to TROUBLESHOOTING POWER UNIT.

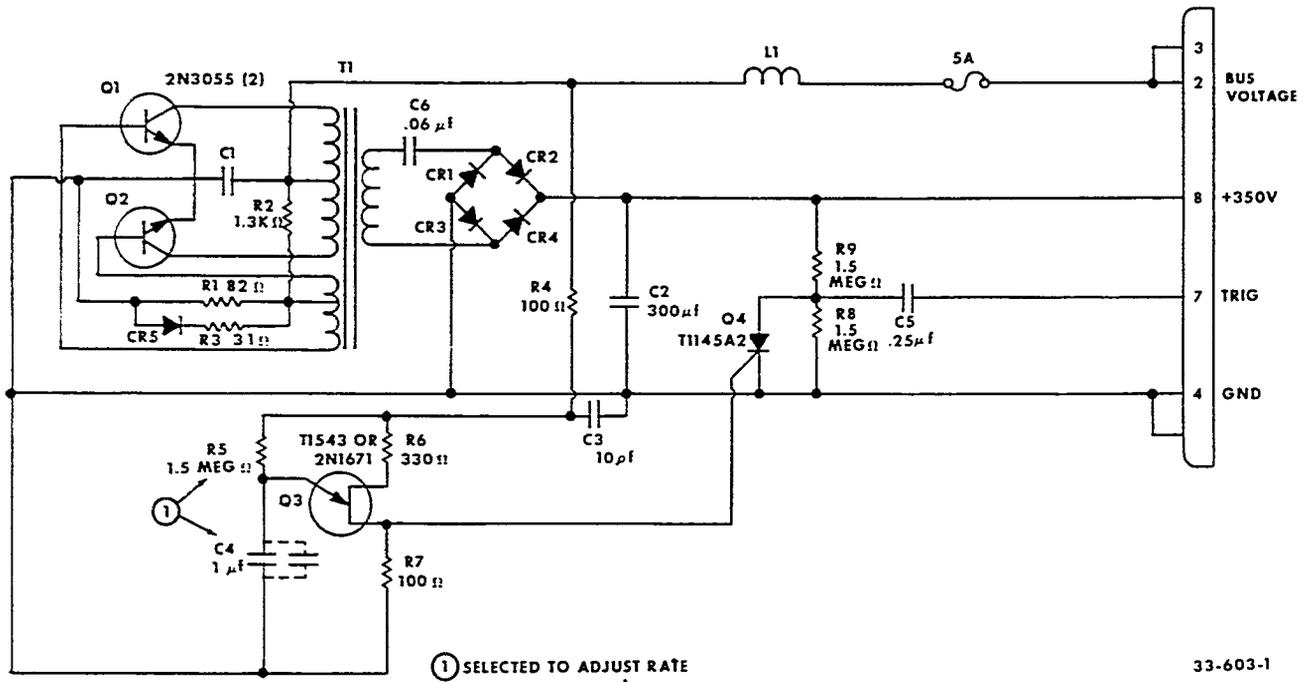


Figure 13-1. Bullock Power Supply Schematic (Internal)

GRIMES STROBE LIGHT SYSTEM

The system consists of a solid state power supply unit, a circuit breaker switch on the instrument panel, and 3 xenon gas lights mounted in the tail and each wing tip. The function of the Grimes Strobe Light system is essentially the same as the strobe light system described earlier in this section. Use that system description for a more detailed explanation of the method by which the Grimes system operates. The Grimes system does not incorporate a timing circuit, since all the lights flash at the same time at a rate of 60 flashes per minute.

POWER SUPPLY UNIT REMOVAL AND INSTALLATION (Prior to E-1371)

To gain access to the power supply unit, remove the floorboard on the RH side of the baggage compartment. The entire unit may be removed by disconnecting the electrical wiring to the power supply and removing the screws anchoring the module to the support structure. To reinstall the power supply unit, merely reverse the foregoing procedures.

CAUTION

Observe the precautions noted in STROBE LIGHT WIRING when removing and installing the power supply.

POWER SUPPLY UNIT REMOVAL (E-1371 and after, EA-1 and after)

WARNING

Make certain the power to the strobe lights is off, and that 10 minutes has elapsed so that stored power will have time to dissipate.

- a. Locate the access cover in the floorboard, aft of fuselage station 170, on the right side of the airplane, in the baggage compartment.
- b. Remove the 4 screws and washers from the cover and remove the cover.
- c. Disconnect the electrical wiring from the power supply.
- d. Remove the screws which hold the power supply in place and remove the power supply.

STROBE LIGHT WIRING

An incorrect hook-up of the wires at either the power input or between the strobe light assemblies and the power supply unit will cause a reversal of polarity that results in serious component damage and failure. Care must be taken to ensure that the red wire is connected to positive power and the black wire to ground. Make sure that the

connectors are properly assembled and that red, white, and black wires (white/red, white/black, and white/yellow wires on the 28-volt system) are connected to pins "A", "B", and "C" of the connector respectively. The shields for the wing and tail light cables should be grounded to the aircraft structure at the power supply.

WARNING

Although a bleed-off resistor is incorporated in the power supply circuit, high voltage is involved in the circuit between the power supply and light assemblies. For this reason, turn the control switch for the strobe lights OFF and wait for at least 10 minutes to elapse before disconnecting the cables at the power supply or light assemblies and before handling or disassembling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

POWER SUPPLY UNIT INSTALLATION (E-1371 and after, EA-1 and after)

- a. Place the power supply in its proper location and install the screws which hold it in place.
- b. Connect the electrical wiring to the power supply as indicated in STROBE LIGHT WIRING.
- c. Place the access cover in place and install the screws and washers.
- d. Reinstall the carpet.

REMOVAL AND INSTALLATION OF TAIL STROBE LIGHT

- a. Remove the tail cone and light cover to gain access to the strobe light assembly.

CAUTION

To avoid damage to the strobe light system or possible injury from electrical shock, observe the precautions outlined under STROBE LIGHT WIRING in this section before removing or installing the strobe light assembly.

- b. Remove the two retaining screws that secure the light assembly in place and disconnect the light from the aircraft electrical system.
- c. Remove the 2 screws on the side of the light assembly to free the retainer and lens.
- d. Rotate the lamp until free if it is to be replaced.
- e. If the flashtube is to be replaced, remove the 4 screws on the backside of the light subassembly and pull it apart from the light assembly.

f. Remove the 2 screws on the bottom of the subassembly and remove the flashtube.

g. Reverse the preceding steps to reinstall the strobe light assembly.

observe the precautions outlined under STROBE LIGHT WIRING before removing or installing the strobe light assembly.

REMOVAL AND INSTALLATION OF WING STROBE LIGHTS

CAUTION

To avoid damage to the strobe light system or possible physical injury from electrical shock,

- a. Remove the transparent shield over the wing tip lights.
- b. Remove the two screws securing the lens and light to the mounting bracket.
- c. Remove the lens, and lift the strobe light out to disconnect the electrical wiring.
- d. Reverse the preceding steps to reinstall the light assembly.

LIGHT BULB REPLACEMENT GUIDE

LOCATION	BULB NUMBER	
	14-VOLT SYSTEM	28-VOLT SYSTEM
Alternator Out Light	330	327
Cabin Overhead Light	1816 (E-283 and after)	1864
Clock Light	330	267
Compass Light	330	327
Condenser Door Open Light	330	327
Dome Light	89 (E-1 thru E-282)	
Courtesy Light	1816	1864
Door Ajar Warning Light	330	
Edgelighted Panel	330	
Flight Compartment Flood Lights	1815	313
Fuel Select Light	330	327
Glareshield Light	1815	
Instrument Floodlights	89	
Instrument Post Lights	330	327
Instrument Wedge Lights	266	267
Landing Gear In-Transit Light	330	327
Landing Gear Uplock Light	330	327
Landing Light	4313	4596
Light Tray Assembly	266	267
Map Light	1816	1495
Navigation Light (Tail)	1512	A7512-24
OAT Light	330	327
Reading Light	89 or 1816	303
Rotating Beacon (Lower)	D7080A6-12	D7080A5-24
Rotating Beacon (Upper)	D7080A1-12	D7080A1-24
Subpanel Post Lights	330	327
Strobe Light (Bullock)	82219	
Strobe Light, Tail (Grimes)	633 (Prior to E-763, except E-710)	
Strobe Light, Tail (Grimes)	30-0815-3 (E-710, E-763 thru E-1240, except E-1111)	30-0815-1 (E-1111, E-1241 and after)
Strobe Light, Wing (Grimes)	31-1850-1 (Prior to E-763, except E-710)	
Strobe Light, Wing (Grimes)	30-531-1 (E-710, E-763 thru E-1240, except E-1111)	30-1467-1 (E-1111, E-1241 and after)
Tail Light	4313	4596

**ELECTRICAL UTILIZATION LOAD CHART
(14-VOLT SYSTEM)**

MAXIMUM CONTINUOUS LOAD (STANDARD EQUIPMENT)

EQUIPMENT	NUMBER PER AIRPLANE	AMPS	
		EACH	TOTAL
Indicator, Flap	1	.10	.10
Indicator Light, Landing Gear	1	.08	.08
Indicator Light, Landing Gear Visual	1	.12	.12
Indicator Light, Trim Tab	1	.12	.12
Indicator, Oil Temp	1	.12	.12
Indicator, Cyl Head Temp	1	.12	.12
Indicator, Fuel Level	2	.30	.60
Indicator, Turn Coordinator	1	.75	.75
Light, Navigation Wing	2	1.60	3.20
Light, Navigation Tail	1	1.01	1.01
Light, Instrument Flood	2	.58	1.16
Light, Fuel Select	1	.12	.12
Light, Engine Instruments	3	.23	.69
Light, Sub-Panel, Post	2	.08	.16
Relay, Battery Master	1	.50	.50
Relay, Alt Out Light	1	.21	.21
Regulator, Voltage	1	.33	.33
Light, Glareshield	8	.10	.80
Light, Alt Out	1	.08	.08

MAXIMUM CONTINUOUS LOAD (OPTIONAL EQUIPMENT)

EQUIPMENT	NUMBER PER AIRPLANE	AMPS	
		EACH	TOTAL
Heated Pitot	1	6.50	6.50
Light, Instrument Post	25	.08	2.00
Light, Rotating Beacon	2	6.80	13.60
Light, Edgelighted Panel	8	.20	1.60

INTERMITTENT LOAD (STANDARD EQUIPMENT)

EQUIPMENT	NUMBER PER AIRPLANE	AMPS EACH	TOTAL
Horn, Stall Warning	1	.50	.50
Horn, Landing Gear Warning	1	.50	.50
Cigarette Lighter	2	7.50	15.00
Light, Landing	1	7.70	7.70
Motor, Starter	1	280.00	280.00
Motor, Flap	1	17.00	17.00
Relay, Starter	1	.50	.50
Light, Dome	1	.58	.58
Pump, Aux. Fuel	1	5.00	5.00
Motor, Landing Gear	1	20.00	20.00
Vibrator, Starter	1	2.00	2.00
Light, Compass	1	.08	.08
Light, OAT	1	.08	.08
Light, Door Ajar Warning	1	.08	.08

INTERMITTENT LOAD (OPTIONAL EQUIPMENT)

EQUIPMENT	NUMBER PER AIRPLANE	AMPS EACH	TOTAL
Relay, Magic Hand	1	.65	.65
Light, Landing Steerable	1	7.70	7.70
Deice, 2-Bladed Propeller	1	23.00	23.00
Deice, 3-Bladed Propeller	1	34.00	34.00
Light, Reading	2	.58	1.16
Switch, Magic Hand	1	3.40	3.40

ELECTRICAL UTILIZATION LOAD CHART

(28-VOLT SYSTEM)

The following specifies the electrical load for each piece of equipment, either standard or optional, available on the airplane. Based on this information, the total electrical load for the airplane may be determined. Intermittent items should not be figured into the total figure since the short duration of their usage will not significantly alter the standard load.

The electrical load has been divided into 4 categories as follows:

- a. Continuous load (standard equipment)
- b. Continuous load (optional equipment)
- c. Intermittent load (standard equipment)

- d. Intermittent load (optional equipment)

Under no condition shall the total continuous electrical load be more than 80% of the total alternator capacity. Total continuous load consists of loads listed as continuous and the avionics receiving loads. Transmit loads are intermittent loads.

NOTE

The loads listed as continuous loads are for equipment which will be operated for periods of 15 minutes or longer. However, the intermittent loads and the avionics transmitting loads should be considered for determining possible overloading during shorter periods of time, i.e., takeoff and landing.

CONTINUOUS LOAD (STANDARD EQUIPMENT)

EQUIPMENT	NUMBER PER AIRPLANE	AMPS EACH	AMPS TOTAL
Indicator, Flap Position and P.C. Board	1	.06	.06
Indicator, Fuel and P.C. Board	2	.02	.02
Inverter, Electroluminescent	1	.50	.50
Instrument, Engine	1	.32	.32
Heater, Pitot	1	4.60	4.60
Potentiometer, Light Dim	4	.03	.12
Relay, Annunciator Dim	1	.04	.04
Relay, Master Battery	1	.50	.50
Sensor, Alternator Out	1	.04	.04
Turn Coordinator	1	.40	.40
Voltage Regulator	1	3.00	3.00
Clock, Panel	1	.01	.01
LIGHTING			
3rd and 4th Reading	2	.30	.60
Cabin Light	2	.17	.34
Elevator Tab	1	.04	.04
Flap Position	1	.04	.04
Glareshield Flood	12	.17	2.04
Tail Position	1	1.02	1.02
Wing Tip Nav Light	2	.93	1.86
OAT	1	.04	.04
Fuel Select	2	.04	.08
Compass	1	.04	.04

CONTINUOUS LOAD (Optional Equipment)

EQUIPMENT	AMPS	
	NUMBER PER AIRPLANE	EACH TOTAL
Air Conditioning		
Actuator, Condenser Door	1	.86 .86 (1)
Compressor Clutch	1	1.70 1.70
Condenser Blower	1	13.5 13.5 (2)
Clock, Digital	1	.20 .20
Electrothermal Prop Anti-Ice		
(2 Blade)	1	10.0 10.0
(3 Blade)	1	15.0 15.0
Ammeter	1	.01 .01
Timer	1	.10 .10
Power Supply, Strobe	1	5.00 5.00
LIGHTING		
5th and 6th Seat Reading	2	.30 .30
Clock, Control Wheel 8-Day	1	.04 .04
Instrument, Post Light (Single)	26	.04 1.04
Instrument, Post Light (Dual)	37	.04 1.48
Instrument, Wedge Light (Single)	14(3)	.024 .67
Instrument, Wedge Light (Dual)	16(3)	.024 .77
Map	1	.30 .30
Rotating Beacon, Lower	1	3.22 3.22
Rotating Beacon, Upper	1	3.22 3.22
Tail Nav/Strobe	1	1.02 1.02

(1) Intermittent operation.

(2) Unit operates in gear down position only.

(3) Two bulbs in each light.

INTERMITTENT LOADS (Standard Equipment)

EQUIPMENT	NUMBER PER AIRPLANE	AMPS EACH	AMPS TOTAL
Cigarette Lighter	2	6.0	12.0
Flap Motor	1	11.0	11.0
Flasher, Gear Warning	1	.04	.04
Horn, Gear Warning	1	.20	.20
Horn, Stall Warning	1	.20	.20
Landing Gear Motor	1	40.0	40.0 (1)
Pump, Auxiliary Fuel	1	3.00	3.00
Pump, Auxiliary Fuel	1	3.0	3.00 (2)
Relay, Dynamic Brake	1	1.25	1.25
Relay, Starter	1	3.30	3.30
Starter, Engine	1	100.0	100.0
Relay, Landing Gear Latch	1	.08	.08

LIGHTING

Alternator Out	1	.04	.04
Courtesy Light	2	.17	.34
Door Ajar	1	.04	.04
Landing Gear Indicator	4	.04	.16
Landing Light	1	8.93	8.93
Condenser Door Open	1	.04	.04

INTERMITTENT LOADS (Optional Equipment)

Actuator, Elevator Trim	1	.85	.85
Resistor, Trim Shunt	1	.38	.38

LIGHTING

Taxi Light	1	8.93	8.93
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(1) Peak current after initial start-up load.

(2) Used only when dual auxiliary fuel pumps are required.

TROUBLESHOOTING BATTERY

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. No power indicated with battery master switch "ON".	a. Battery discharged or defective.	a. Test.
	b. Open circuit between battery and master switch.	b. Check continuity.
	c. Master switch defective.	c. Check switch for operation. Replace if necessary.
	d. Defective relay.	d. Check relay for operation. Replace if necessary.
2. Power on with master switch in "OFF" position.	a. Master switch defective.	a. Check switch for operation. Replace if necessary.
	b. Relay contacts stuck.	b. Replace relay.
3. Complete failure to operate.	a. Loose or broken lead.	a. Secure lead.
	b. Loose or disengaged terminals in battery.	b. Secure terminals.
	c. Battery not charged.	c. Charge battery.
4. Excessive spewage (crystalline deposits on outside of battery).	a. Excessive charge rate.	a. Clean the battery and adjust the electrolyte level.
	b. Excessive ambient temperature during charge.	b. Clean the battery and adjust the electrolyte level.

TROUBLESHOOTING STARTER SYSTEM

1. Starter inoperative.	a. Circuit breaker tripped.	a. Reset circuit breaker.
	b. Battery switch inoperative.	b. Check cockpit lights; if not operative, check switches and battery solenoid.
	c. Defective starter solenoid.	c. Check continuity of starter system.
	d. Low battery.	d. Test battery; if low, replace or start with external power.
	e. Open circuit.	e. Check continuity of circuit.
	f. Defective starting motor.	f. Check brushes, springs, condition, and commutator. Replace if necessary.

TROUBLESHOOTING ALTERNATOR SYSTEM

1. No ammeter indication.	a. Loose connection.	a. Check connections throughout system.
	b. No alternator output.	b. Check alternator output.

TROUBLESHOOTING ALTERNATOR SYSTEM (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
	c. Defective voltage regulator.	c. Replace regulator.
	d. Overvoltage relay tripped.	d. Check overvoltage relay (See Item 2).
	e. Defective ammeter.	e. Replace ammeter.
2. Overvoltage relay trips.	a. Alternator overcharging.	a. Check alternator output. Repair or replace as necessary.
	b. Defective voltage regulator.	b. Replace regulator.
	c. Defective overvoltage relay.	c. Replace relay.
3. No alternator output.	a. Circuit breaker tripped.	a. Reset.
	b. Open circuit.	b. Check continuity of circuit.
	c. Defective control switch.	c. Replace switch.
	d. Brushes worn out.	d. Replace brushes.
	e. Dirty slip rings.	e. With alternator running, clean slip rings with No. 400 or finer sandpaper. Use air jet to remove grit.
	f. Brushes not contacting slip rings.	f. Clean brushes and holders with a clean, lint-free, dry cloth. Replace weak springs.
	g. Open or shorted circuit in rotor.	g. Test resistance of rotor. Replace if defective.
	h. Open or shorted circuit in stator.	h. Test resistance of stator. Replace if defective.
	i. Defective voltage regulator.	i. Replace regulator.
4. Alternator output low.	a. Defective rectifier diode.	a. Replace diode.

TROUBLESHOOTING IGNITION SYSTEM

1. Engine fails to start.	a. Spark plugs loose, wet, fouled, or defective.	a. Clean or replace defective spark plugs.
	b. Magneto primary ground wire short circuited.	b. Check primary ground wire between magneto and switch.
	c. Dirty, burned or pitted magneto breaker points.	c. Clean points or replace if badly burned or pitted.
	d. Moisture or oil in magneto distributor.	d. Clean magneto distributor.
	e. Internal trouble with magnetos.	e. Turn engine over and check spark jump. Replace magneto if there is no spark or if spark is weak.

TROUBLESHOOTING IGNITION SYSTEM (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>	
2. Hard starting.	a. Low voltage at vibrator input.	a. Measure voltage between vibrator terminal marked "in" and the ground terminal while operating starter. Must be at least 13 volts.	
	b. Inoperative or defective vibrator.	b. If voltage is adequate, listen for buzzing of vibrator during starting. If no buzzing is heard, either the vibrator is defective or the circuit from the "output" terminal on the vibrator to the retard (dual breaker) magneto is open. Check both "Switch" and "Retard" circuits. Also check for good electrical ground.	
	c. Retard breaker or impulse coupling not operating. Engine may kick back during cranking due to advance timing of ignition.	c. Points may not be closing due to wrong adjustment, or may not be electrically connected in the circuit due to a poor connection. Inspect points to see if they close. Check for proper contact at the terminals of magneto and at the vibrator. Check wiring.	
	d. Vibrator-magneto combination not "functioning" electrically.	d. Turn engine in proper direction of rotation until retard points just open on No. 1 cylinder position. Remove input connection from starter to prevent engine turning and while holding No. 1 plug lead 5/16 inch from ground energize vibrator by turning switch to start. Plug lead should throw a 5/16 inch spark. If spark is weak or missing try new vibrator. If this does not correct trouble remove magneto and check for improper internal timing or improperly meshed distributor gears.	
	e. Magneto improperly timed to engine.	e. Check magneto-to-engine timing.	
	f. Advance breaker out of adjustment (internal timing off).	f. Check magneto internal timing.	
	g. Retard points opening too late or impulse coupling timing wrong.	g. Check timing of retard points or impulse coupling.	
	3. Rough running engine.	a. Spark plugs loose or fouled.	a. Clean and regap spark plugs.
		b. Spark plugs leads or connectors oily, dirty or cracked.	b. Clean leads and connectors and replace damaged connectors.

TROUBLESHOOTING IGNITION SYSTEM (Continued)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
	c. Defective ignition harness.	c. Make continuity and high voltage tests on harness. Replace harness or leads if necessary.
	d. Magnetos incorrectly timed.	d. Time magnetos to engine.
	e. Dirty or burned breaker points.	e. Clean or replace if badly burned.
4. Low power.	a. Burned or defective ignition harness.	a. Check continuity of harness and replace if necessary.
	b. Magnetos incorrectly timed.	b. Time magnetos to engine.
	c. Internal trouble with magnetos.	c. Turn engine over and check spark. Replace magneto if there is weak or no spark.

TROUBLESHOOTING LANDING GEAR POSITION INDICATOR CIRCUIT

1. One indicator light inoperative.	a. Defective light bulb or indicator.	a. Check bulb for proper contact and burned out filament.
	b. Defective switch.	b. Check continuity of switch. Replace if necessary.
	c. Open circuit.	c. Check continuity of circuit affected.
2. Both indicator lights inoperative.	a. Tripped circuit breaker.	a. Check for short circuit. Reset circuit breaker.
	b. Defective bulbs or indicators.	b. Check bulbs for proper contact and burned out filament.
	c. Open circuit.	c. Make continuity check on circuit and check for loose connections.
3. Indicator lights inoperative when navigation lights are turned on.	a. Open circuit through dimming resistor.	a. Check dimming resistor for open circuit and loose wire connections.

TROUBLESHOOTING WARNING HORN CIRCUIT

1. Warning horn inoperative.	a. Tripped circuit breaker.	a. Check for short circuit. Reset circuit breaker.
	b. Throttle switch out of adjustment.	b. Check throttle switch for proper adjustment and continuity.
	c. Open circuit.	c. Check circuit for continuity and loose connections.

TROUBLESHOOTING FLAP CONTROL AND INDICATOR CIRCUIT

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Flaps will not lower.	a. Tripped circuit breaker.	a. Check circuit. Reset circuit breaker.
	b. Defective down limit switch.	b. Check continuity of switch. Check for loose connections. Replace switch if defective.
	c. Open circuit or loose connections.	c. Run continuity check on circuit. Check for loose connections.
	d. Defective flap motor.	d. Check brushes, springs, condition of commutators. Replace if necessary.
	e. Defective flap motor switch.	e. Check continuity of switch. Replace if necessary.
2. Flaps will not raise.	a. Tripped circuit breaker.	a. Check circuit. Reset circuit breaker.
	b. Defective up limit switch.	b. Check continuity of switch. Replace if necessary. Check for loose connections.
	c. Open circuit or loose connections.	c. Run continuity check on circuit. Check for loose connections.
	d. Defective flap motor.	d. Check brushes, springs, condition of commutators. Replace if necessary.
	e. Defective flap motor switch.	e. Check continuity of switch. Replace if necessary.

TROUBLESHOOTING STALL WARNING INDICATOR CIRCUIT

1. Warning buzzer inoperative.	a. Tripped circuit breaker.	a. Check and reset circuit breaker.
	b. Open circuit.	b. Check continuity of circuit.
	c. Defective switch.	c. Check switch for proper operation. Replace if necessary.
	d. Defective indicator.	d. Check buzzer for proper operation.
2. Buzzer operates continuously.	a. Grounded circuit between buzzer and switch.	a. Test for ground in circuit.
	b. Defective switch.	b. Check for proper switch operations.

TROUBLESHOOTING LANDING LIGHT CIRCUIT

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
1. Light inoperative.	a. Tripped circuit breaker.	a. Check for short circuit. Reset circuit breaker.
	b. Defective light.	b. Check bulb for proper contact and burned out filament.
	c. Open circuit.	c. Check continuity of circuit.
	d. Landing light switch defective.	d. Check continuity through switch. Replace if necessary.

TROUBLESHOOTING NAVIGATION LIGHT CIRCUIT

1. Navigation lights inoperative.	a. Tripped circuit breaker.	a. Check for short circuit Reset circuit breaker.
	b. Open circuit.	b. Check continuity of entire circuit.
2. One navigation light inoperative.	a. Defective light.	a. Check bulb for proper contact and for burned filament.
	b. Open circuit.	b. Check continuity of circuit wiring from switch to ground.

TROUBLESHOOTING FUEL QUANTITY INDICATOR CIRCUIT

1. Fuel indicator inoperative on one tank only.	a. Defective selector switch.	a. Check selector for proper contact.
	b. Defective transmitter.	b. Check continuity for fuel transmitter.
	c. Open circuit from switch transmitter.	c. Check continuity of circuit.
2. Fuel indicator inoperative on both tanks.	a. Tripped circuit breaker.	a. Check for short circuit. Reset circuit breaker.
	b. Open circuit.	b. Check continuity of circuit.

TROUBLESHOOTING STANDBY GENERATOR

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
ENGINE NOT RUNNING		
NOTE		
The number 2 transistor and other components mounted to the rear of the ON-OFF-TEST switch will be referred to as the voltage regulator.		
1. Battery switch OFF. ON-OFF-TEST switch to TEST-BAT TEST light will not illuminate.	<ul style="list-style-type: none"> a. Open circuit between battery and BAT TEST light. b. Fuses between battery and ON-OFF-TEST switch blown. c. Faulty diode between battery and ON-OFF-TEST switch. d. Defective BAT TEST lamp. e. Defective ON-OFF-TEST switch. 	<ul style="list-style-type: none"> a. Locate and repair open circuit. b. Check for and correct cause of blown fuse. Replace fuse. c. Replace diode. d. Replace lamp. e. Replace switch.
2. With STBY switch to ON and PWR XFER switch to NAV COMM 1 - COMM 1, NAV 1, Audio Amplifier, Turn Coordinator, and Engine Instruments are inoperative.	<ul style="list-style-type: none"> a. Defective power relay. 	<ul style="list-style-type: none"> a. Replace relay.
3. With STBY switch to ON and PWR XFER switch to NAV COMM 2, NAV 2 and COMM 2 are inoperative.	<ul style="list-style-type: none"> a. PWR XFER switch defective or wired incorrectly. 	<ul style="list-style-type: none"> a. Replace switch or rewire as necessary.
ENGINE RUNNING		
4. With STBY switch to TEST, engine at 1200 RPM, GEN TEST light will not illuminate.	<ul style="list-style-type: none"> a. Loose connections. b. Defective GEN TEST lamp. c. Blown standby generator fuse. d. Defective overvoltage relay. e. Defective voltage regulator. f. Defective standby generator. g. Defective ON-OFF-TEST switch. 	<ul style="list-style-type: none"> a. Secure connections. b. Replace lamp. c. Check for correct cause of blown fuse. Replace fuse. d. Replace relay. e. Replace faulty component of voltage regulator. f. Replace standby generator. g. Replace switch.

TROUBLESHOOTING STANDBY GENERATOR (Cont'd)

<i>INDICATION</i>	<i>PROBABLE CAUSE</i>	<i>REMARKS</i>
ENGINE RUNNING (Cont'd)		
5. With the STBY switch to TEST, engine at 1200 RPM, GEN TEST light illuminates dimly but will not get brighter as engine RPM is increased.	a. Faulty overvoltage relay	a. Replace relay.
	b. Rheostat out of adjustment.	b. Bench set rheostat or replace.
	c. Faulty generator.	c. Replace generator.
	d. Faulty voltage regulator.	d. Replace faulty component of regulator.
6. With the STBY switch to TEST, engine at 1200 RPM GEN TEST light will illuminate dimly but goes out as engine RPM increases.	a. Faulty overvoltage relay.	a. Replace relay.
	b. Rheostat out of adjustment.	b. Bench set rheostat or replace.
	c. Defective voltage regulator.	c. Replace faulty component of regulator.
	d. Defective generator.	d. Replace generator.

WIRING DIAGRAMS

The individual circuit diagrams shown on the following pages identify each wire with a code assigned according to its usage in the aircraft. The individual circuit components are indexed and listed in the nomenclature accompanying each diagram. Wire bundles and harnesses are not indicated. The arrangement of the components in the diagram was chosen for clarity without the attempt to indicate the actual location in the aircraft.

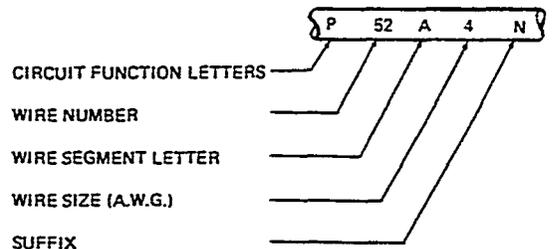
Optional equipment and changes have been noted by placing them in emphasized manner such as dotted lines and heavily outlined sections. Notes have been added for clarity when specific requirements need to be met.

Electrical symbols used in diagrams appear on pages 14-3 and 14-4.

The wire codes used, closely follow the military numbering system. Briefly, a wire code consists of; a circuit function letter, wire number, wire segment letter, and wire size (American Wire Gage). Frequently, a suffix indicating a ground (N), phase (A, B, etc.), or material (alumei, etc.) is added.

The wiring diagrams for the Model 36 and A36, serials E-1 thru E-709, and E-711 thru E-762 are contained within Section 14 of this Shop Manual.

Refer to the BEECHCRAFT Bonanza Wiring Diagram Manual P/N 35-590102-7 for the wiring diagrams pertaining to the Bonanza Model A36 airplane serials E-710, E-763 through E-1240 except E-1111. On airplane serials E-1111, E-1241 and after refer to the BEECHCRAFT Wiring Diagram Manual P/N 35-590102-9.



STD-369-24

A list of circuit function designations follows:

- A Armaments
- B Photographic
- C Control surfaces; automatic pilot
- D Instruments other than flight or engine instrument; ammeter, landing gear position, free air temperature, cabin pressure, etc.
- E Engine instrument; fuel flow, fuel quantity, tachometer, synchroscope, etc.
- F Flight instrument
- G Landing gear, actuator, retraction, warning, down lock, etc.
- H Heating, ventilating, deicing
- J Ignition
- K Engine control; starter, prop pitch, prop synchronizer, etc.
- L Lighting
- M Miscellaneous electric; windshield wiper, etc.
- P DC power
- Q Fuel and oil; fuel valves, fuel pump motors, throttle control, coil pumps, etc.
- R Radio; RC-radio command, RM-marker beacon, etc.
- S Radar; SA-altimeter, SS-search, etc.
- T Special electronics; TK-telemetry, TR-receivers, etc.
- U Miscellaneous electronics (other than R, S or T)
- V DC power for AC systems
- W Warning and emergency
- X AC power
- Y Armaments special systems

INDEX OF WIRING DIAGRAMS

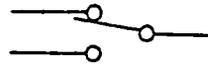
<p style="text-align: center;">A</p> <p>Air Conditioner 14-58</p> <p>Alternator 14-11</p> <p>Auxiliary Fuel Pump 14-18</p> <p style="text-align: center;">B</p> <p>Battery and External Power . . 14-5</p> <p>Beacon, Rotating 14-22</p> <p style="text-align: center;">C</p> <p>Cigarette Lighters 14-54</p> <p>Constant Copilot 14-49</p> <p>Coordinator, Turn 14-55</p> <p>Courtesy Light 14-53</p> <p>Cylinder Head Temperature 14-18A</p> <p>Cylinder Head and Oil Temperature 14-19</p> <p style="text-align: center;">D</p> <p>Deice, Propeller Three Blade 14-48</p> <p>Two Blade 14-47</p> <p>Distribution, Power 14-7</p> <p>Door Warning, Utility 14-44</p> <p style="text-align: center;">E</p> <p>Electrical Symbols 14-3</p> <p>Electroluminous Panel Lights 14-31</p> <p>Engine Instrument Wedge Lights 14-27</p> <p>Exhaust Gas Temperature 14-45</p> <p>External Power, Battery and 14-5</p> <p style="text-align: center;">F</p> <p>Flap Motor 14-34</p> <p>Flap Position Indicator 14-35</p> <p>Flight Instrument Wedge Lights 14-28B</p> <p>Flood Lights Instrument 14-30</p> <p>Fuel Fuel Flow Indicator 14-33</p> <p>Pump, Auxiliary 14-18</p> <p>Quantity, Optional 14-16</p> <p>Quantity, Standard 14-15</p> <p>Selector Light 14-14C</p> <p style="text-align: center;">I</p> <p>Ignition, Starter and 14-9</p> <p>Indicator, Cylinder Head Temperature 14-19</p>	<p style="text-align: center;">I</p> <p>Indicator (Continued)</p> <p>Exhaust Gas Temperature . 14-45</p> <p>Flap Position 14-35</p> <p>Fuel Flow 14-33</p> <p>Fuel Quantity 14-15</p> <p>Landing Gear Position . . 14-42</p> <p>Oil Temperature 14-32</p> <p>Tachometer 14-46A</p> <p>Instrument Flood Lights . . 14-30</p> <p>Instrument Post Lights Engine 14-28</p> <p>Flight 14-29</p> <p>Instrument Wedge Lights, Engine 14-27</p> <p>Flight 14-28B</p> <p>Interior Lights 14-26A</p> <p>Interior and Instrument Lights 14-25</p> <p style="text-align: center;">L</p> <p>Landing Gear, Without Safety System . . 14-36</p> <p>With Safety System . . . 14-38</p> <p>Landing Gear and Throttle Warning 14-40</p> <p>Landing Gear Position Indicator 14-42</p> <p>Landing Lights 14-21</p> <p>Lighters, Cigarette 14-54</p> <p>Lights, Courtesy 14-53</p> <p>Electroluminous Panel . . 14-31</p> <p>Engine Instrument 14-27</p> <p>Flight Instrument 14-28B</p> <p>Fuel Selector 14-14C</p> <p>Instrument Flood 14-30</p> <p>Interior Lights 14-26A</p> <p>Interior and Instrument . . 14-25</p> <p>Landing 14-21</p> <p>Navigation 14-23</p> <p>Optional Internally Lit Instruments 14-28C</p> <p>Rotating Beacon 14-22</p> <p>Strobe 14-50</p> <p>Taxi 14-21</p> <p style="text-align: center;">M</p> <p>Manifold Pressure 14-46</p> <p>Motor, Flap 14-34</p> <p style="text-align: center;">N</p> <p>Navigation Lights 14-23</p> <p style="text-align: center;">O</p> <p>Oil Temperature Indicator . . 14-32</p>	<p style="text-align: center;">P</p> <p>Pitot Heat 14-20</p> <p>Position Indicator, Flap 14-35</p> <p>Landing Gear 14-42</p> <p>Post Lights Engine Instrument 14-28</p> <p>Flight Instrument 14-29</p> <p>Power, Battery and External 14-5</p> <p>Power Distribution 14-7</p> <p>Propeller Deice, Three Blade 14-48</p> <p>Two Blade 14-47</p> <p>Pump, Auxiliary Fuel 14-18</p> <p style="text-align: center;">Q</p> <p>Quantity, Fuel 14-15</p> <p>Optional 14-16</p> <p style="text-align: center;">R</p> <p>Rotating Beacon 14-22</p> <p style="text-align: center;">S</p> <p>Stall Warning 14-20</p> <p>Starter and Ignition 14-9</p> <p>Strobe Light 14-50</p> <p>Symbols, Electrical 14-3</p> <p>Standby Generator 14-56</p> <p style="text-align: center;">T</p> <p>Tachometer 14-46A</p> <p>Taxi Lights 14-21</p> <p>Temperature Indicator, Cylinder Head 14-19</p> <p>Exhaust Gas 14-45</p> <p>Oil 14-32</p> <p>Throttle Warning, Landing Gear and 14-40</p> <p>Turn Coordinator 14-55</p> <p style="text-align: center;">U</p> <p>Utility Door Warning 14-44</p> <p style="text-align: center;">W</p> <p>Warning, Landing Gear 14-40</p> <p>Stall 14-20</p> <p>Throttle 14-40</p> <p>Utility Door 14-44</p> <p>Wedge Lights Engine Instrument 14-27</p> <p>Flight Instrument 14-28B</p>
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ELECTRICAL SYMBOLS

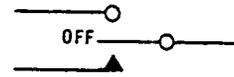
SWITCHES & RELAYS

- Positive Contact
- ▲ Momentary Contact

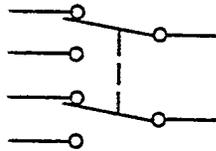
These contacts may be found in various combinations on most of the following type switches and relays.



2 - Position



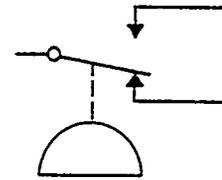
3 - Position



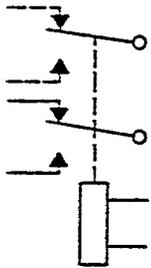
2 - Pole



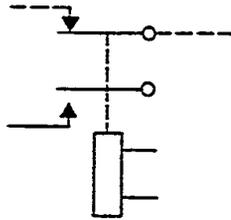
Thermal Switch



Pressure Switch



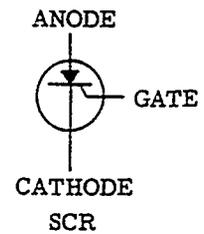
Low Current



High Current



Transistor



SCR

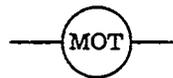


Circuit Breaker

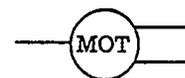


Diode

MOTORS

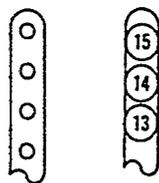


2 - Wire

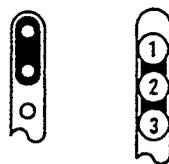


3 - Wire

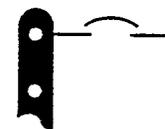
TERMINAL BOARDS & BUS BARS



Terminal Board



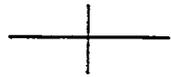
Terminal Board with Bus Bar



Open Bus Bar

ELECTRICAL SYMBOLS (Cont'd)

WIRES, CONNECTORS, CABLES



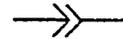
Wire Crossing
(Not Connected)



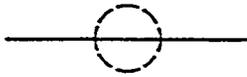
Permanent Splice



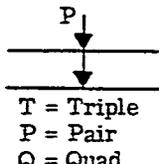
Wire Connection



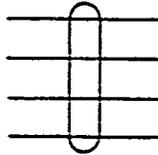
Quick Disconnect



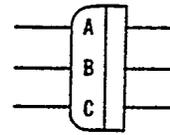
Shielded Wire



Twisted Wiring



Multiple Conductor
Cables



Plug and Receptacle

GROUND CONNECTORS

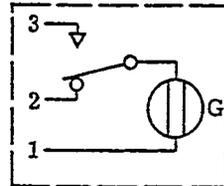


Ground Connection

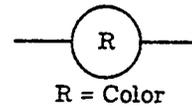


Case Ground
Connection

LIGHTS



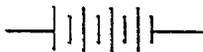
Press to Test Light



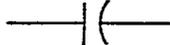
R = Color

Light

MISCELLANEOUS



Battery



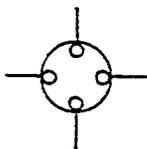
Capacitor



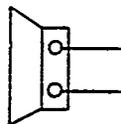
Heating Element



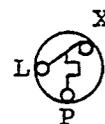
Thermocouple



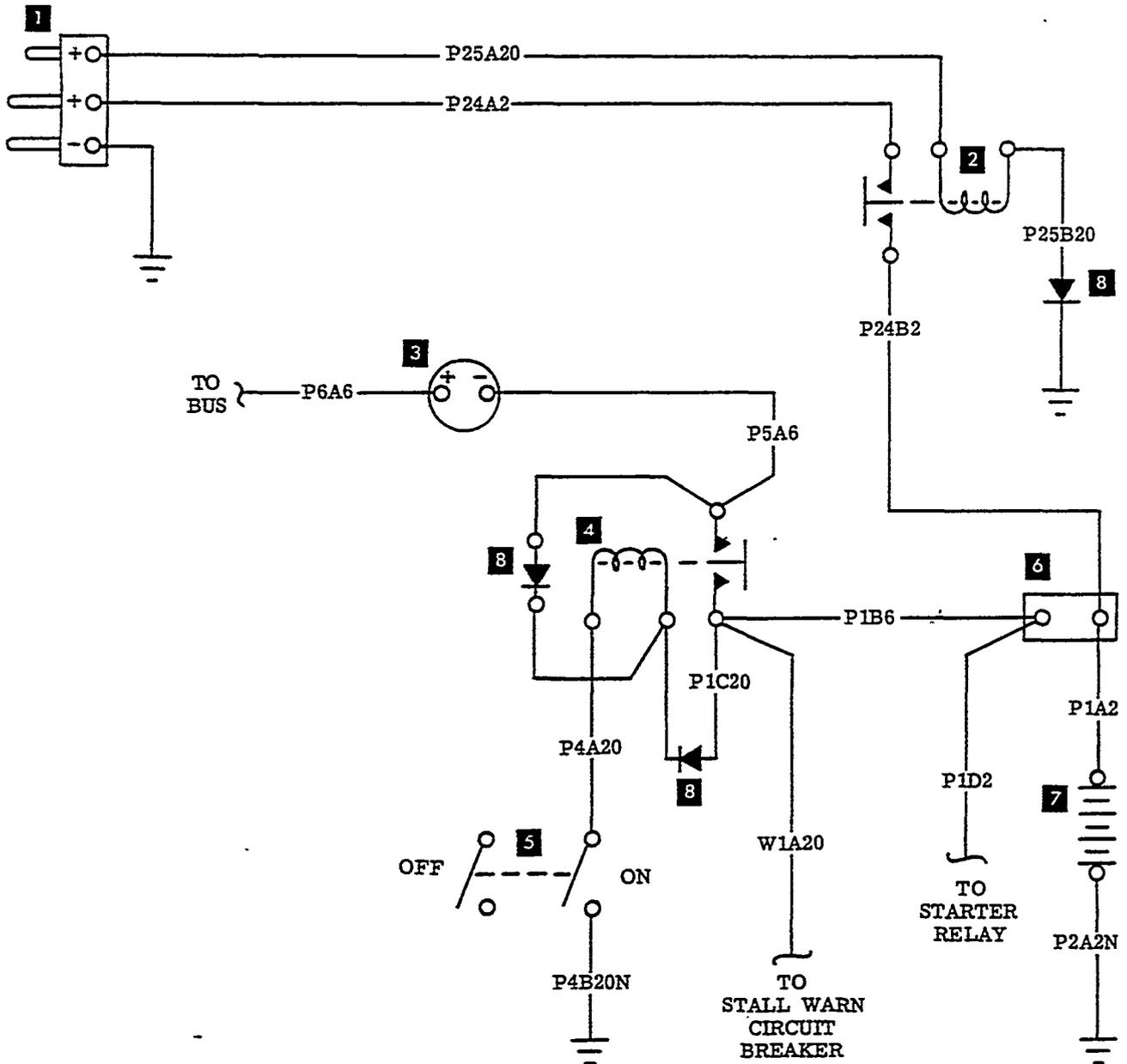
Electrical Instrument



Speaker or
Warning Horn



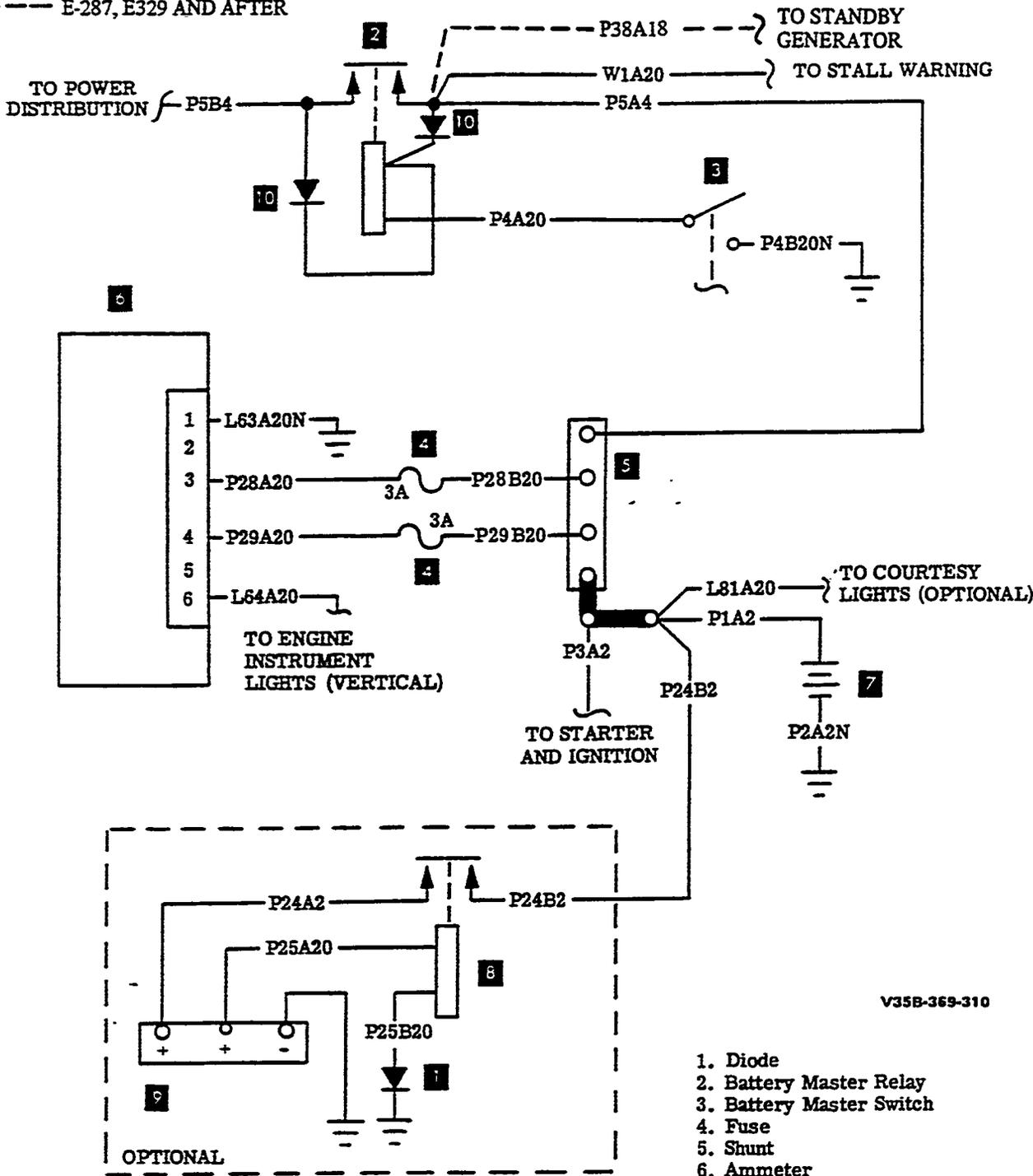
Warning Horn Flasher



1. External Power Receptacle (Optional)
2. External Power Relay (Optional)
3. Ammeter
4. Battery Relay
5. Battery Master Switch
6. Terminal Board
7. Battery
8. Diode

Figure 14-1. Battery and External Power
E-1 thru E-184

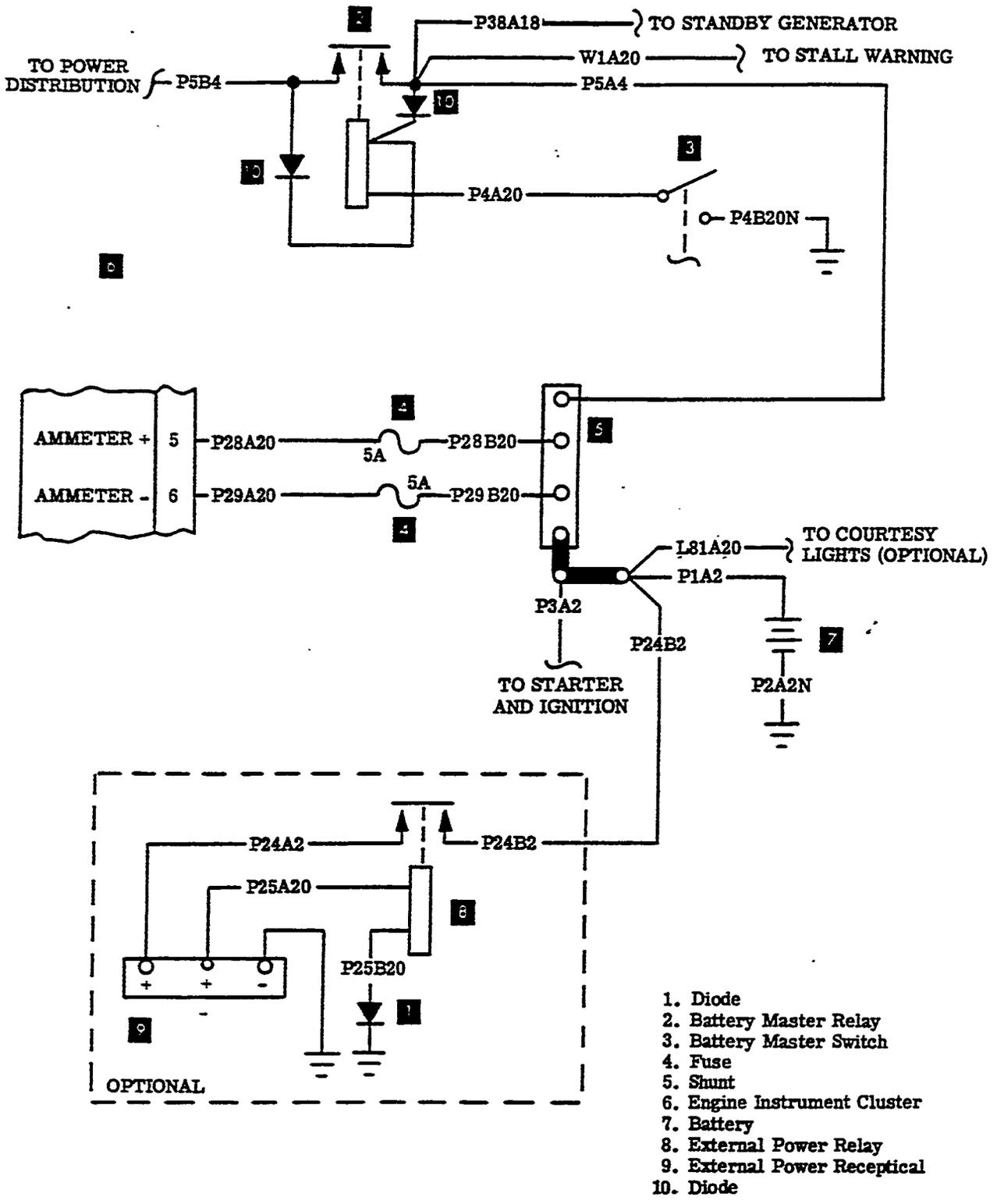
----- E-287, E329 AND AFTER



V35B-369-310

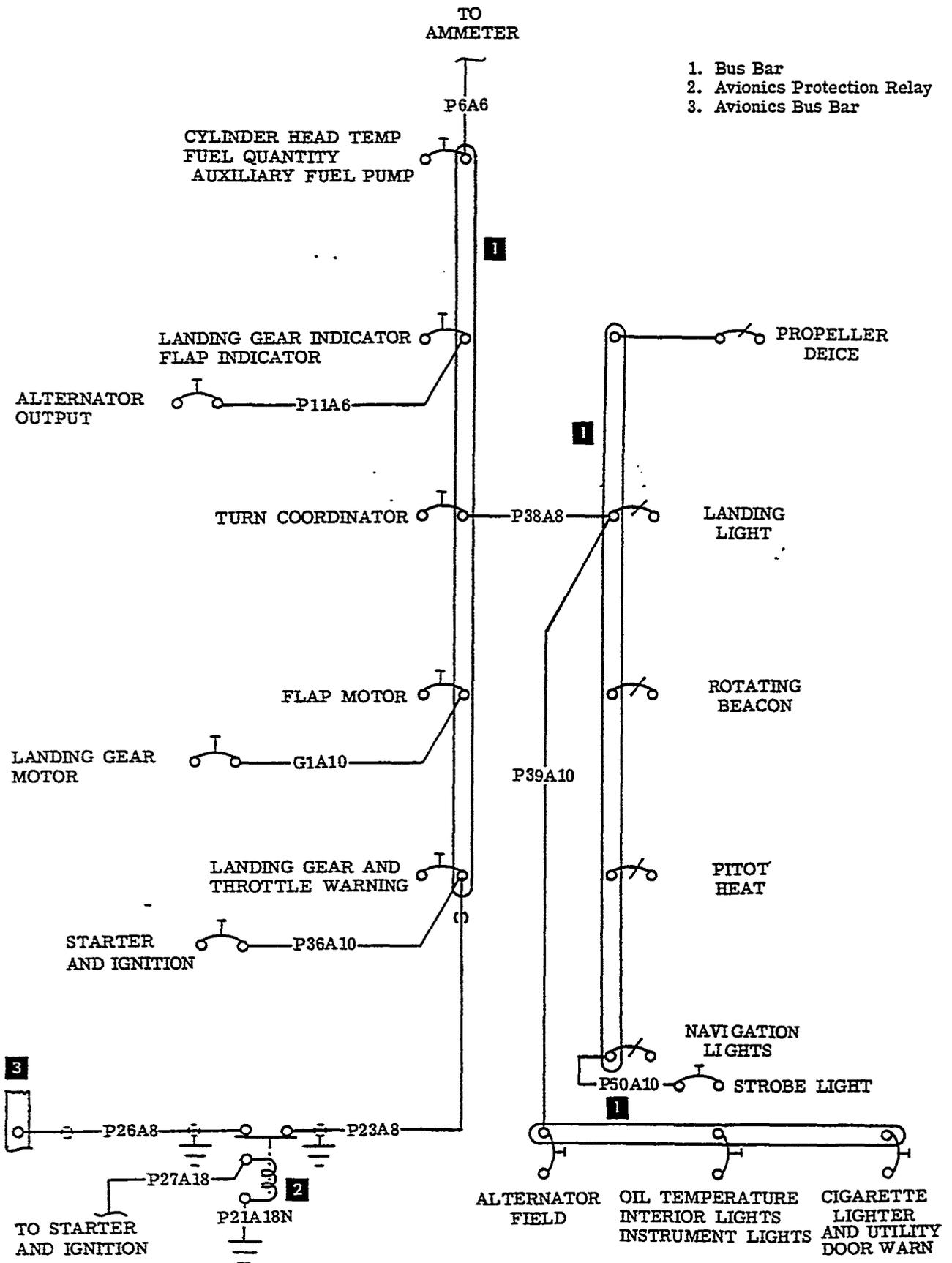
- 1. Diode
- 2. Battery Master Relay
- 3. Battery Master Switch
- 4. Fuse
- 5. Shunt
- 6. Ammeter
- 7. Battery
- 8. External Power Relay
- 9. External Power Receptical
- 10. Diode

Figure 14-1B. Battery and External Power (Vertical Instruments)
E-283 thru E-363



V358-388-5A

Figure 14-1C. Battery and External Power
 E-364 thru E-762 except E-710



- 1. Bus Bar
- 2. Avionics Protection Relay
- 3. Avionics Bus Bar

Figure 14-2. Power Distribution
E-1 thru E-184

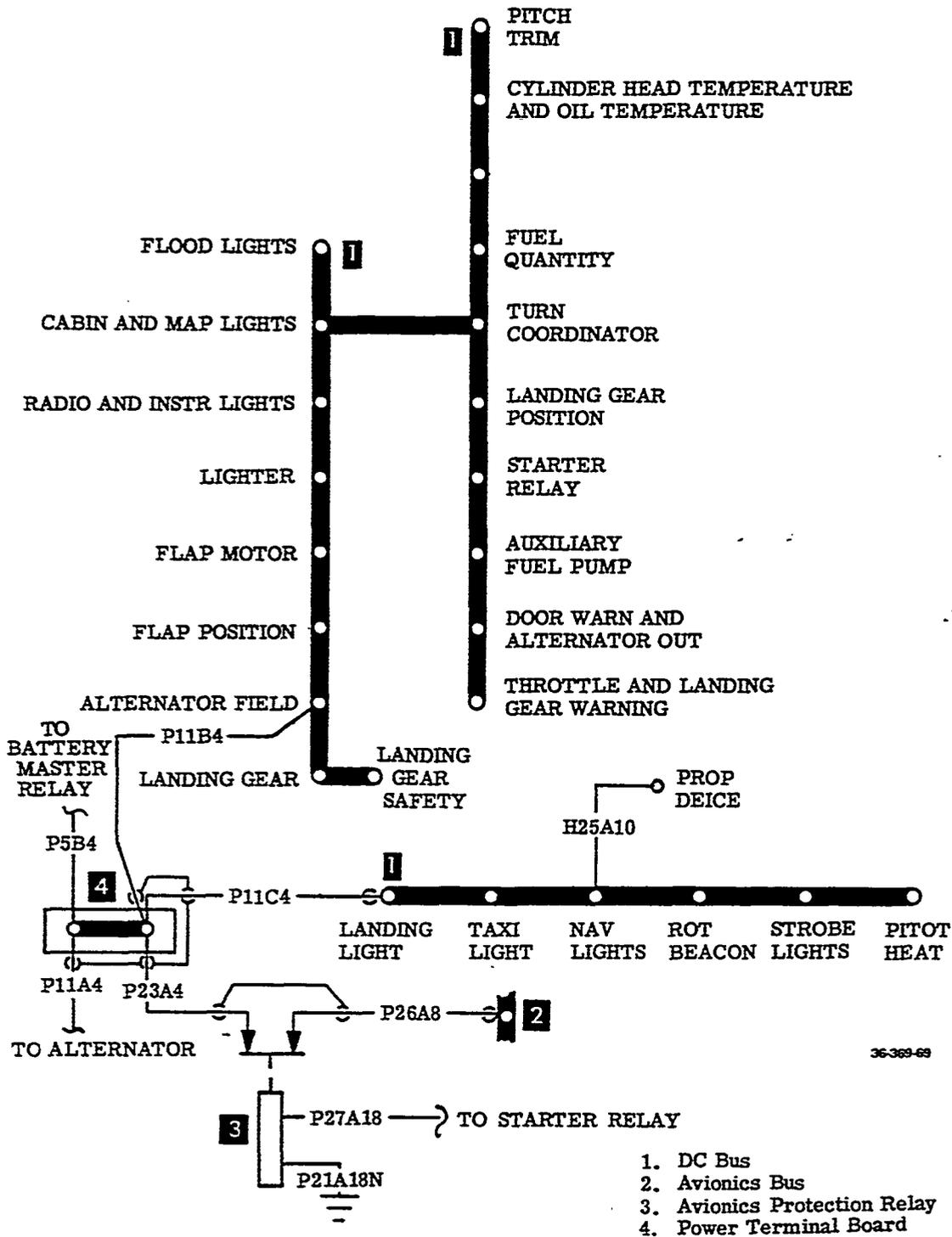


Figure 14-2A. Power Distribution
E-185 thru E-282

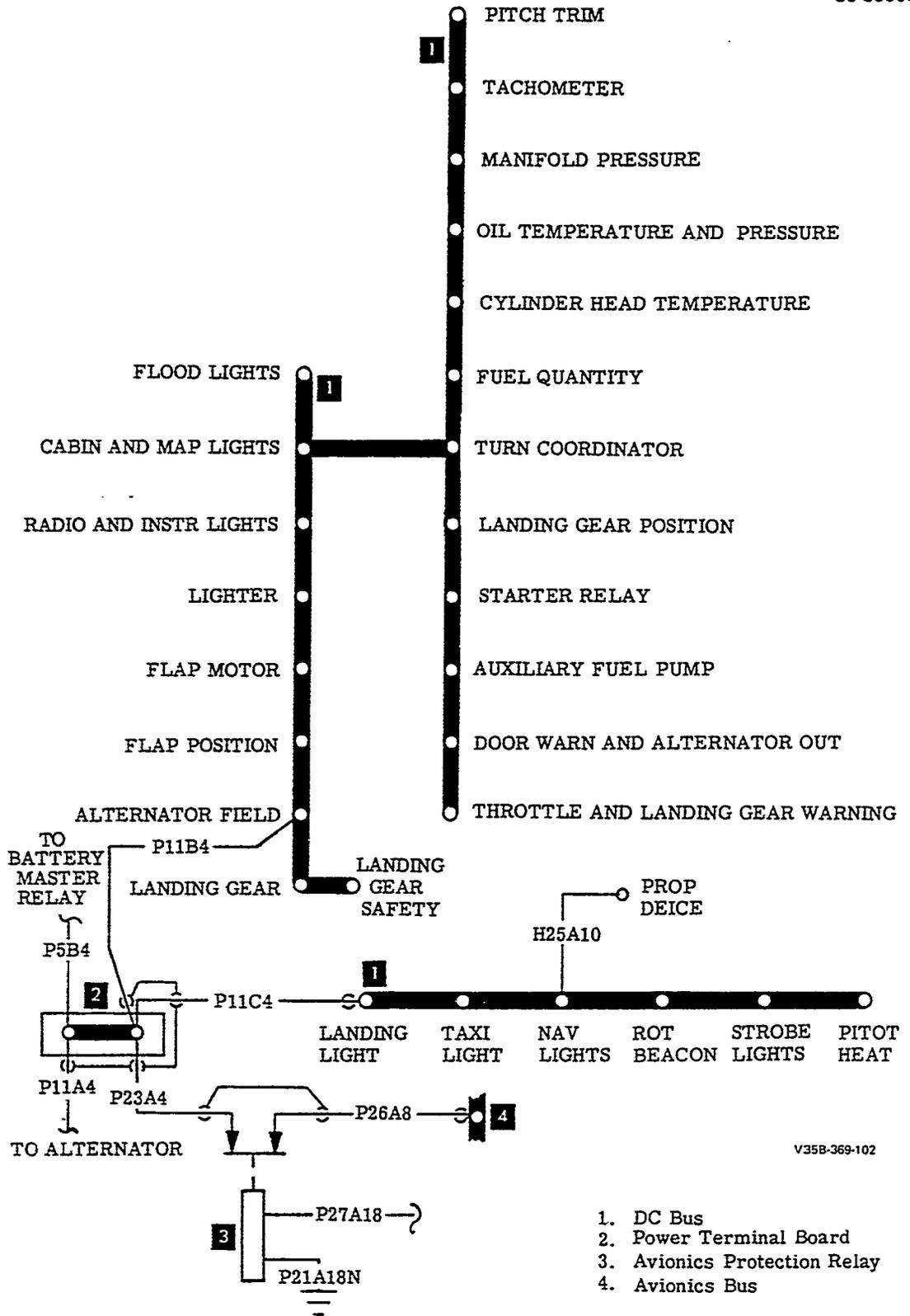


Figure 14-2B. Power Distribution (Vertical Instruments) E-283 thru E-286

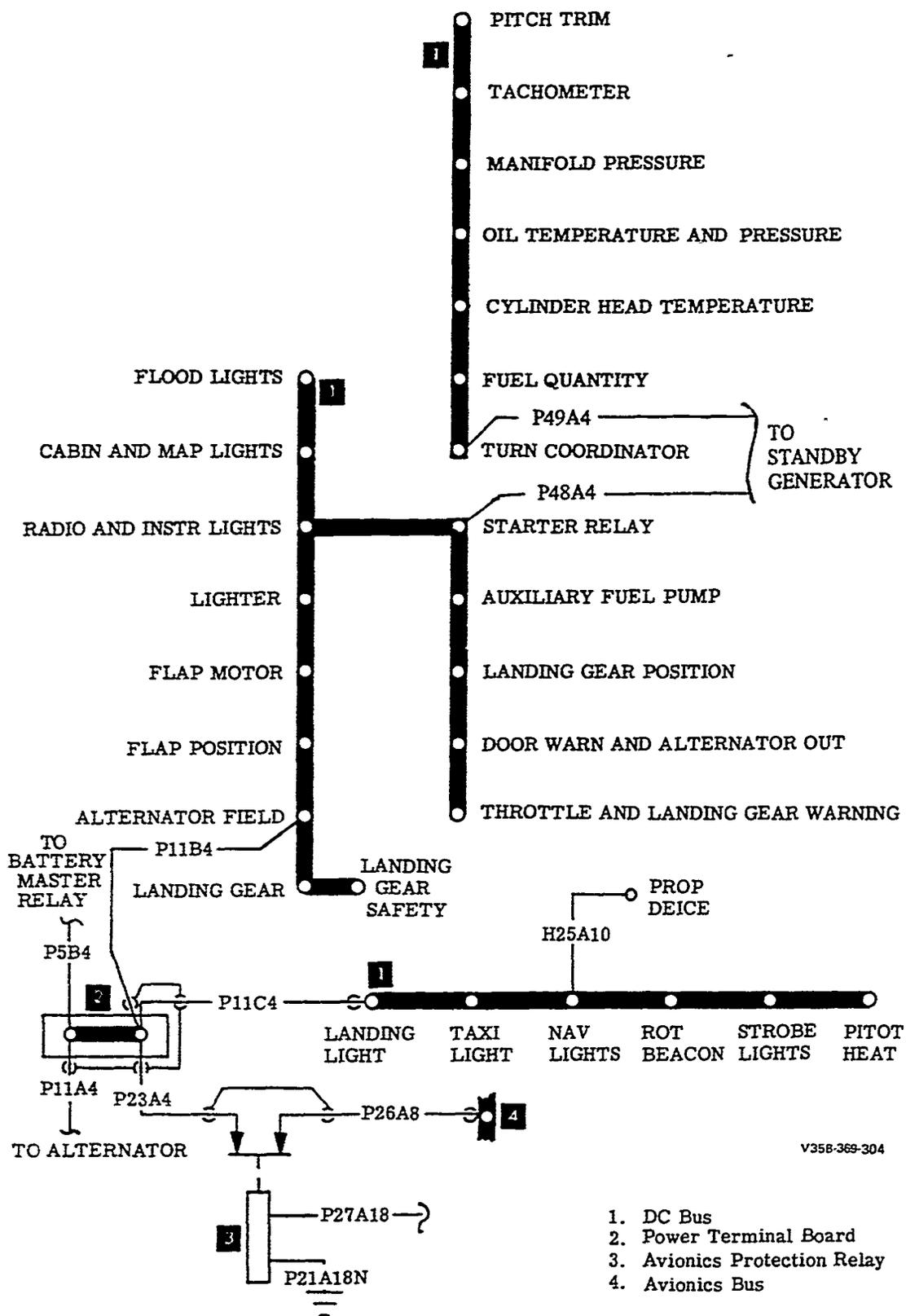
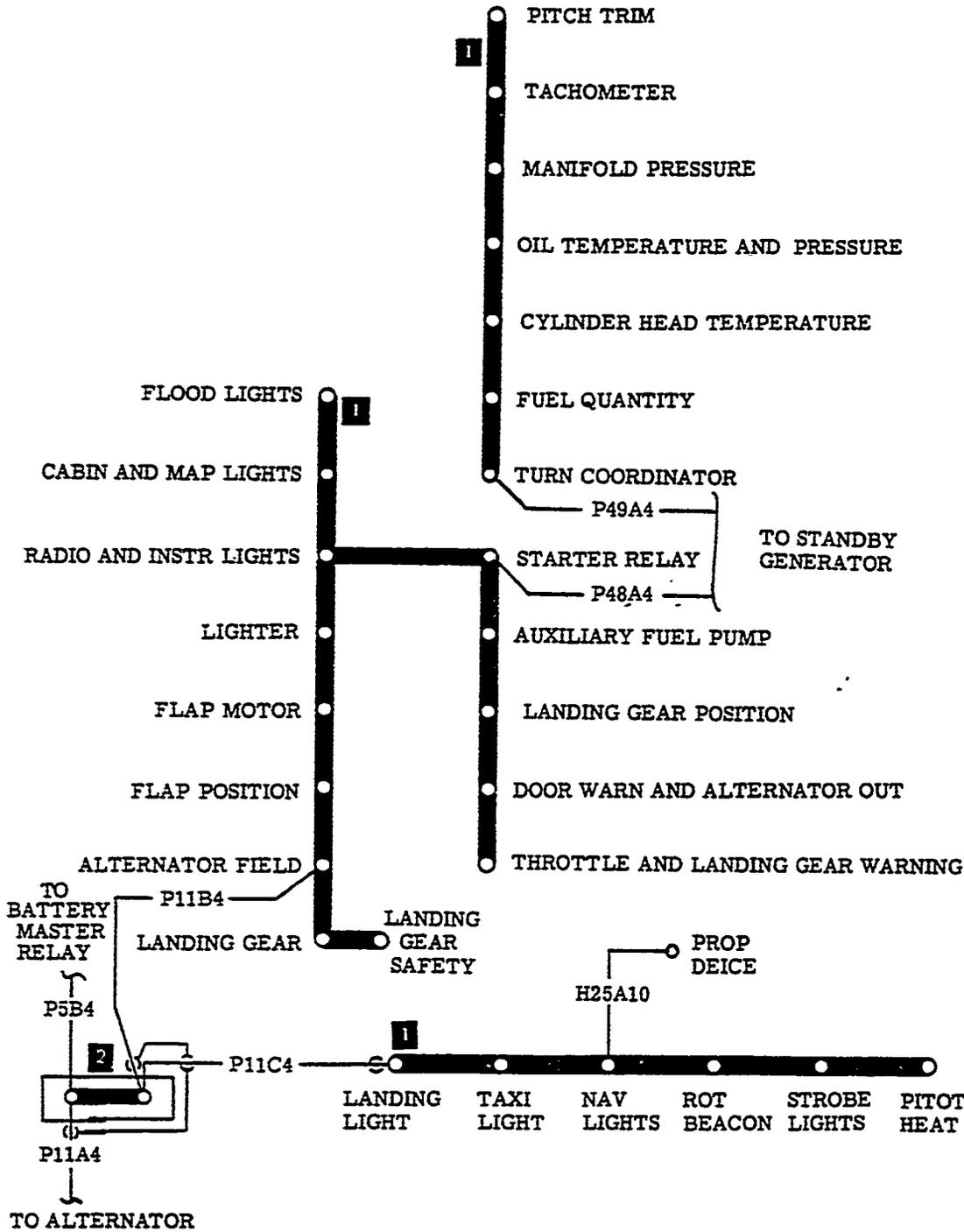


Figure 14-2B. Power Distribution (Vertical Instruments)
E-287

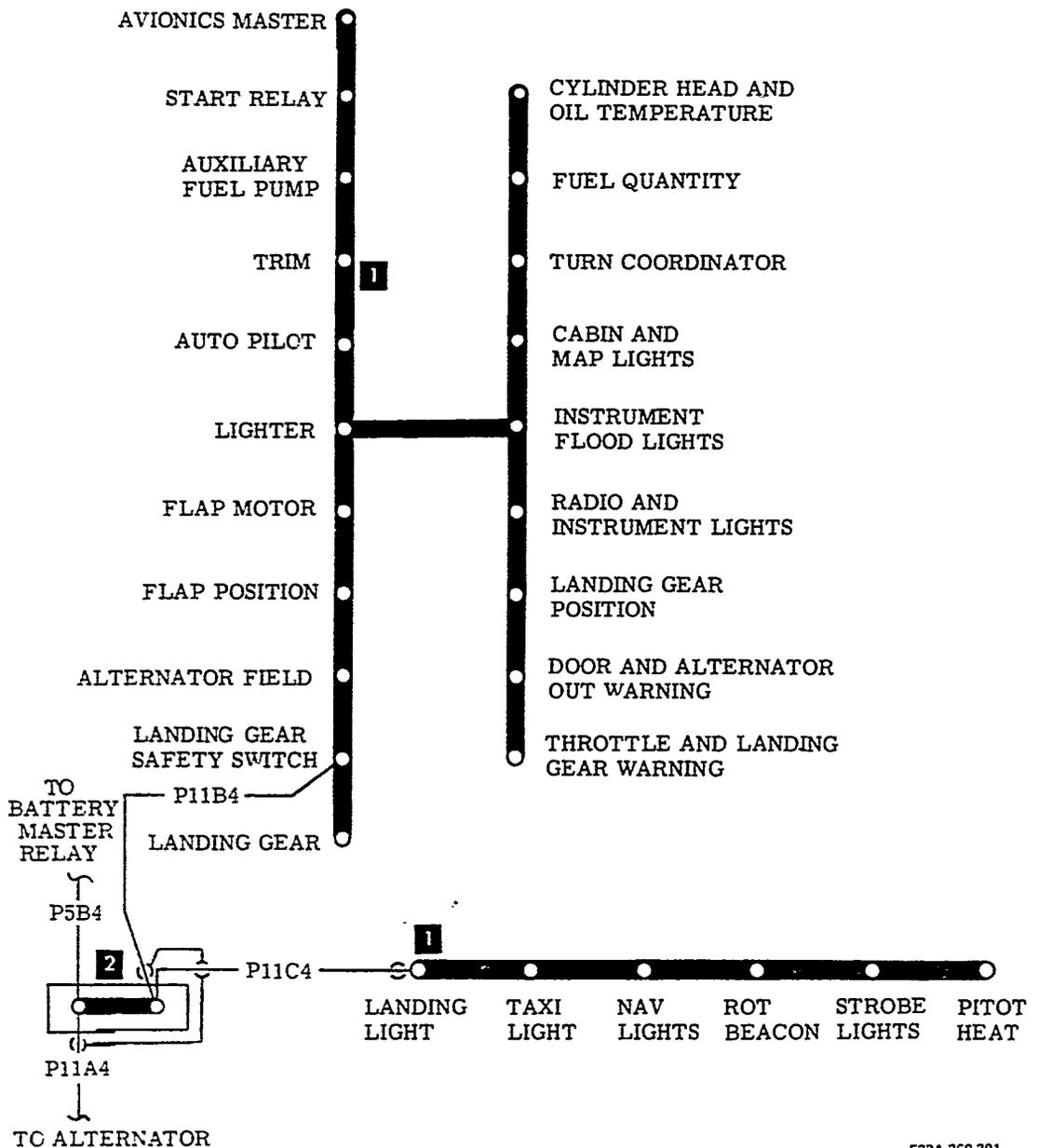


A36-369-306

- 1. DC Bus
- 2. Power Terminal Board

Figure 14-2B. Power Distributions (Vertical Instruments) E-288 thru E-363

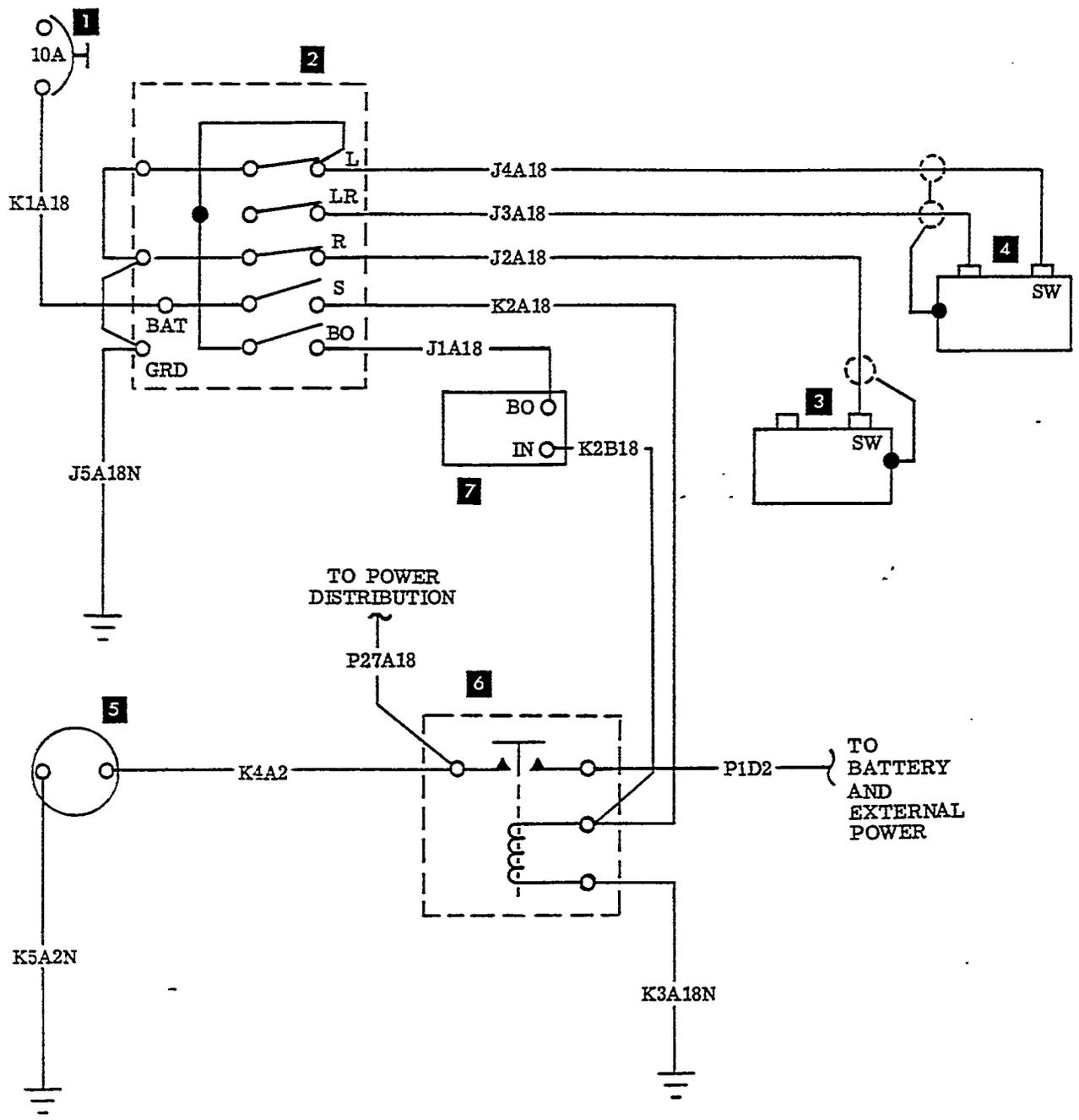
TO AVIONICS
CIRCUIT BREAKERS



F33A-369-301

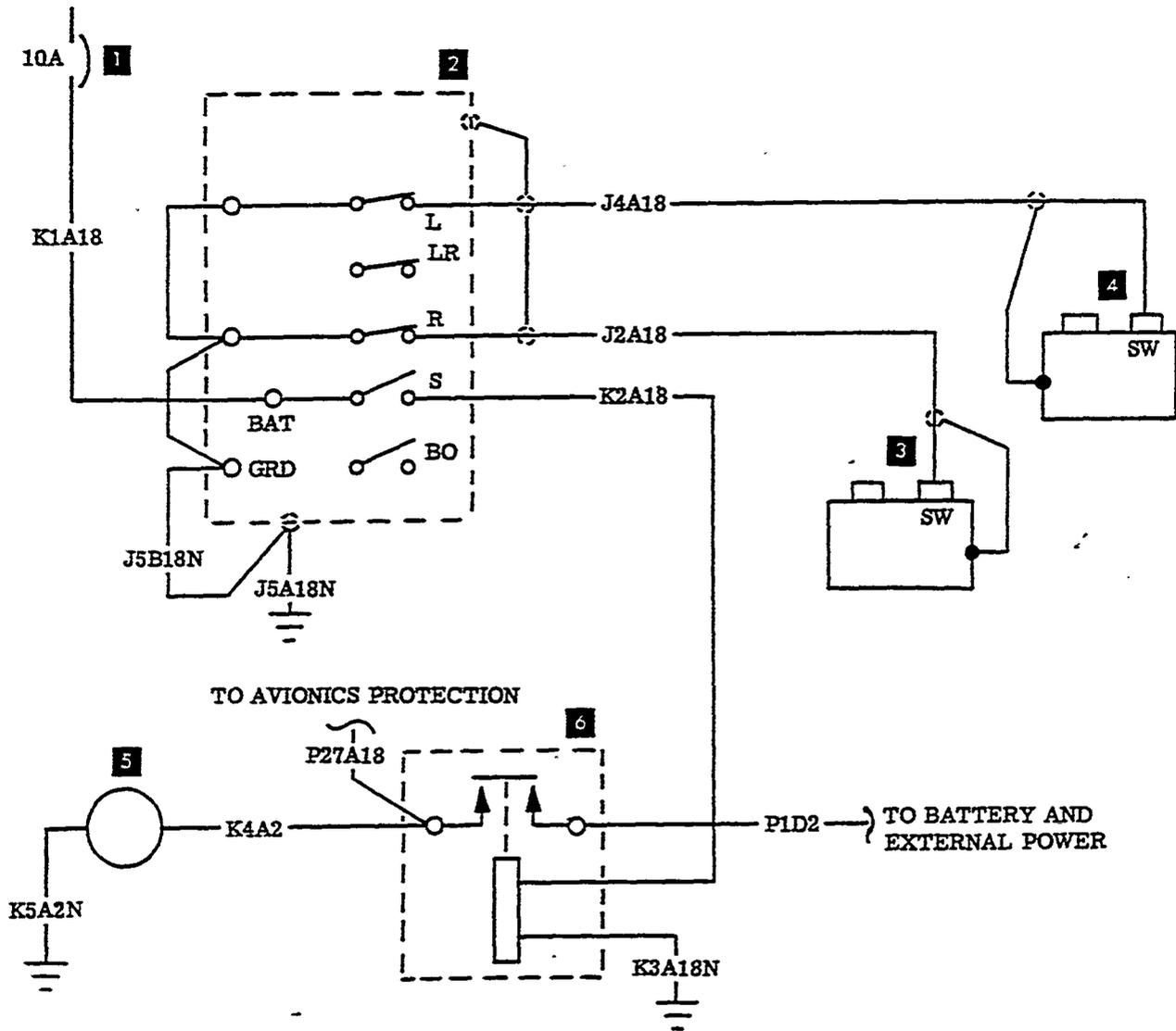
- 1. DC Bus
- 2. Power Terminal Board

Figure 14-2D. Power Distribution (without standby generator)
E-364 thru E-762 except E-710



1. Circuit Breaker
2. Ignition Switch
3. R. H. Magneto
4. L. H. Magneto
5. Starter
6. Starter Relay
7. Vibrator

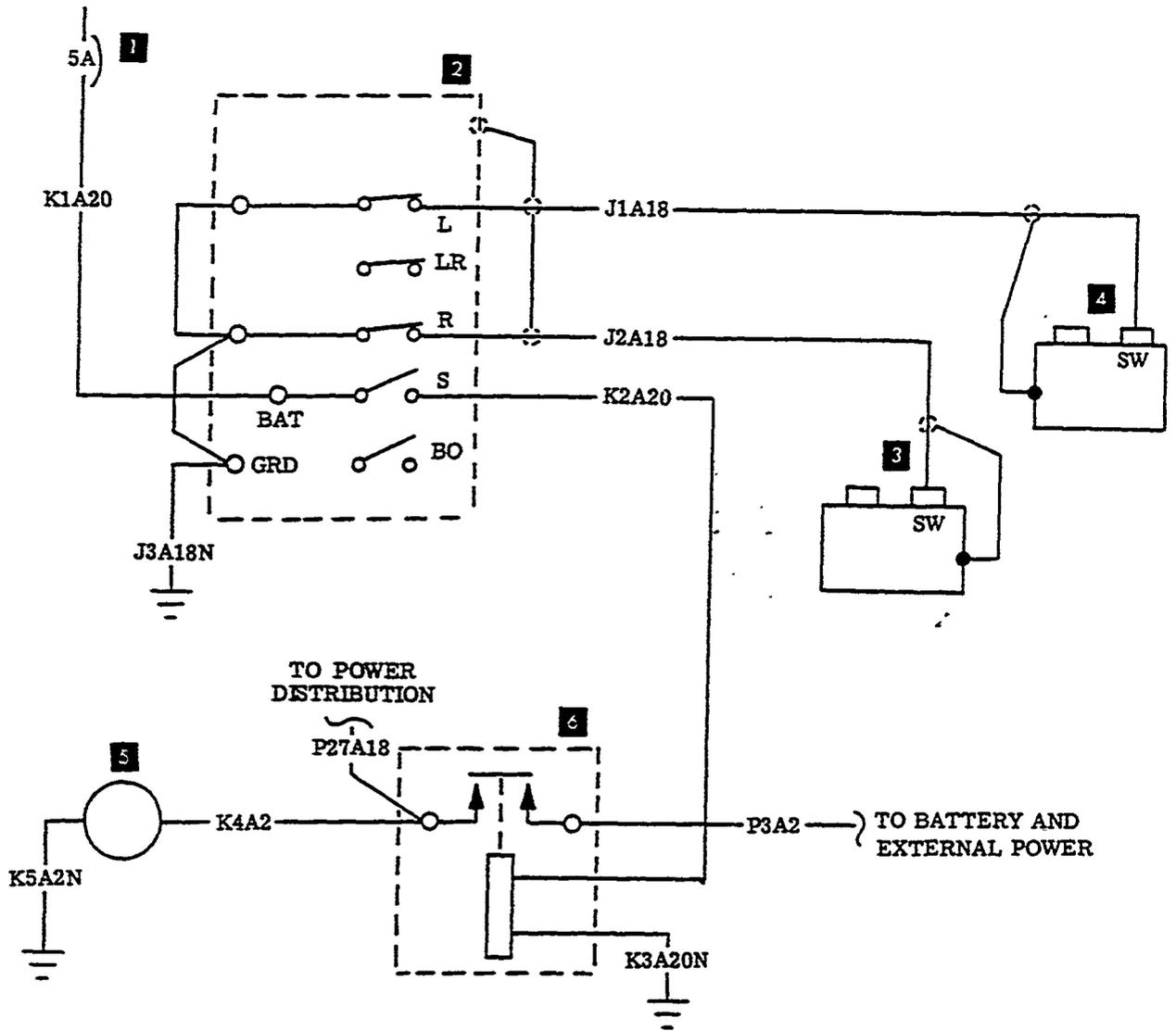
Figure 14-3. Starter and Ignition
E-1 thru E-155



1. Ignition Boost and Pitch Trim Circuit Breaker
2. Ignition Switch
3. RH Magneto
4. LH Magneto
5. Starter
6. Starter Relay

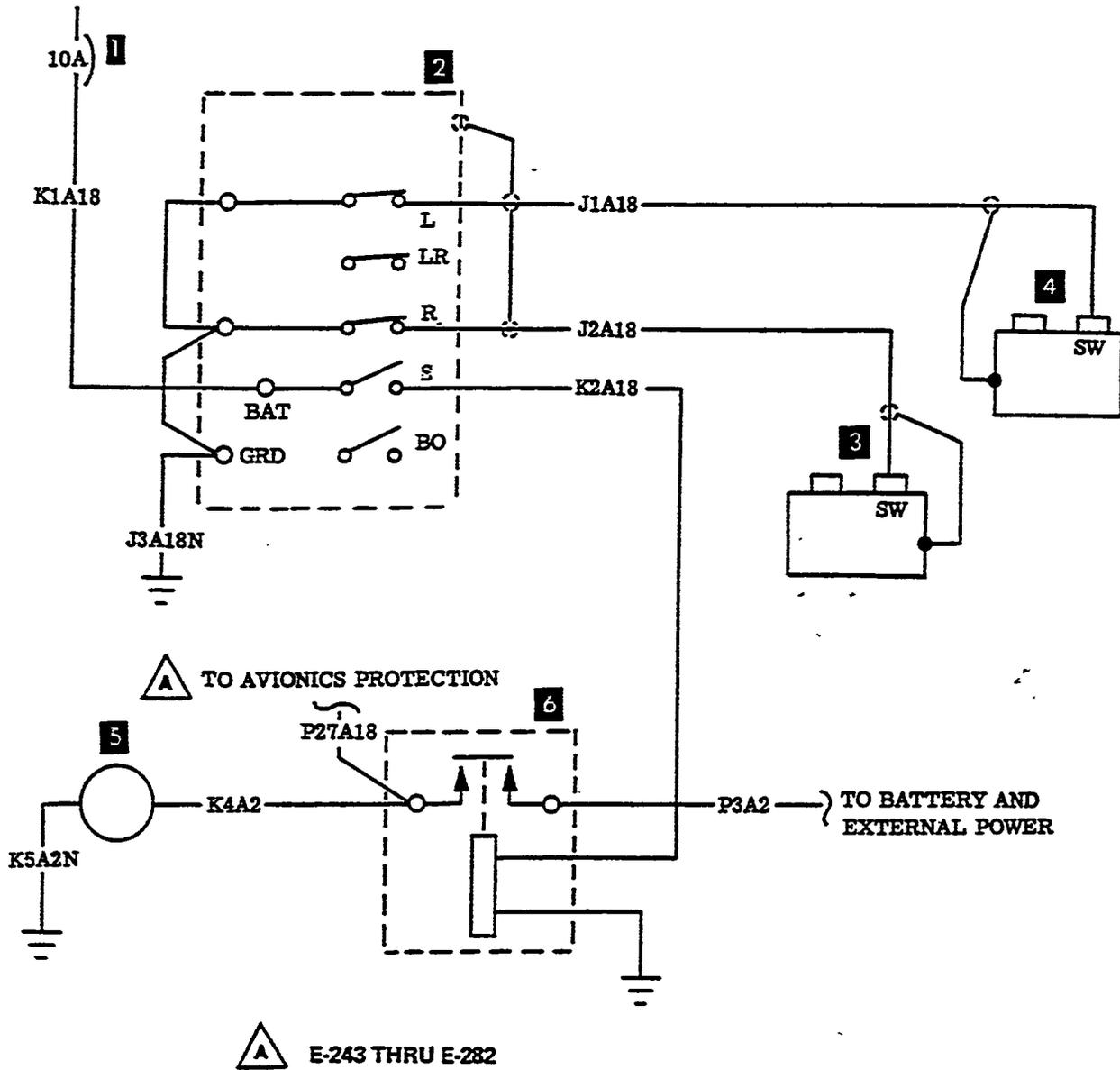
v35-369-7

Figure 14-3A. Starter and Ignition
E-156 thru E-184



1. Engine Start Relay Circuit Breaker
2. Ignition Switch
3. RH Magneto
4. LH Magneto
5. Starter
6. Starter Relay

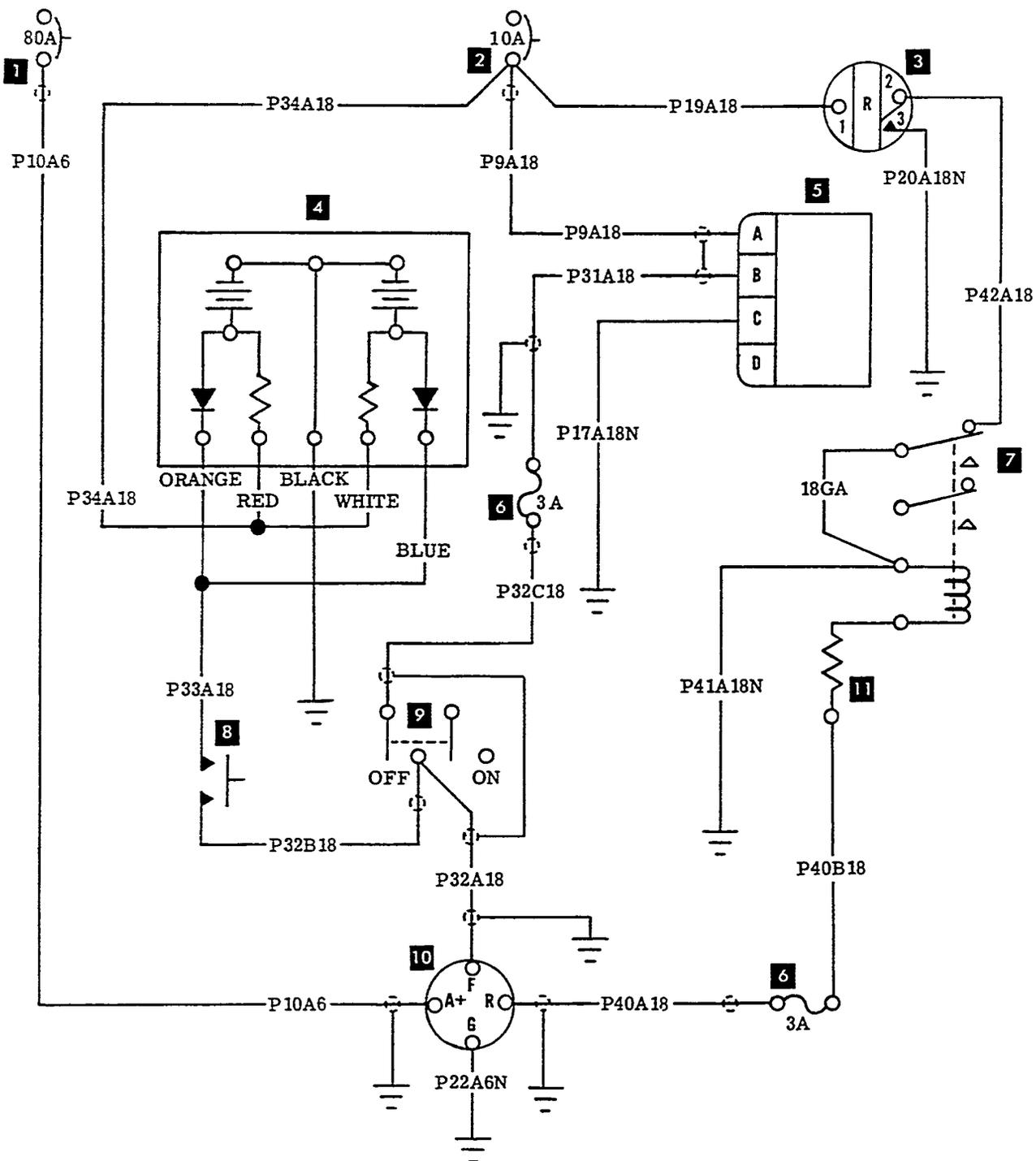
Figure 14-3B. Starter and Ignition
E-185 thru E-242



1. Engine Start Relay Circuit Breaker
2. Ignition Switch
3. RH Magneto
4. LH Magneto
5. Starter
6. Starter Relay

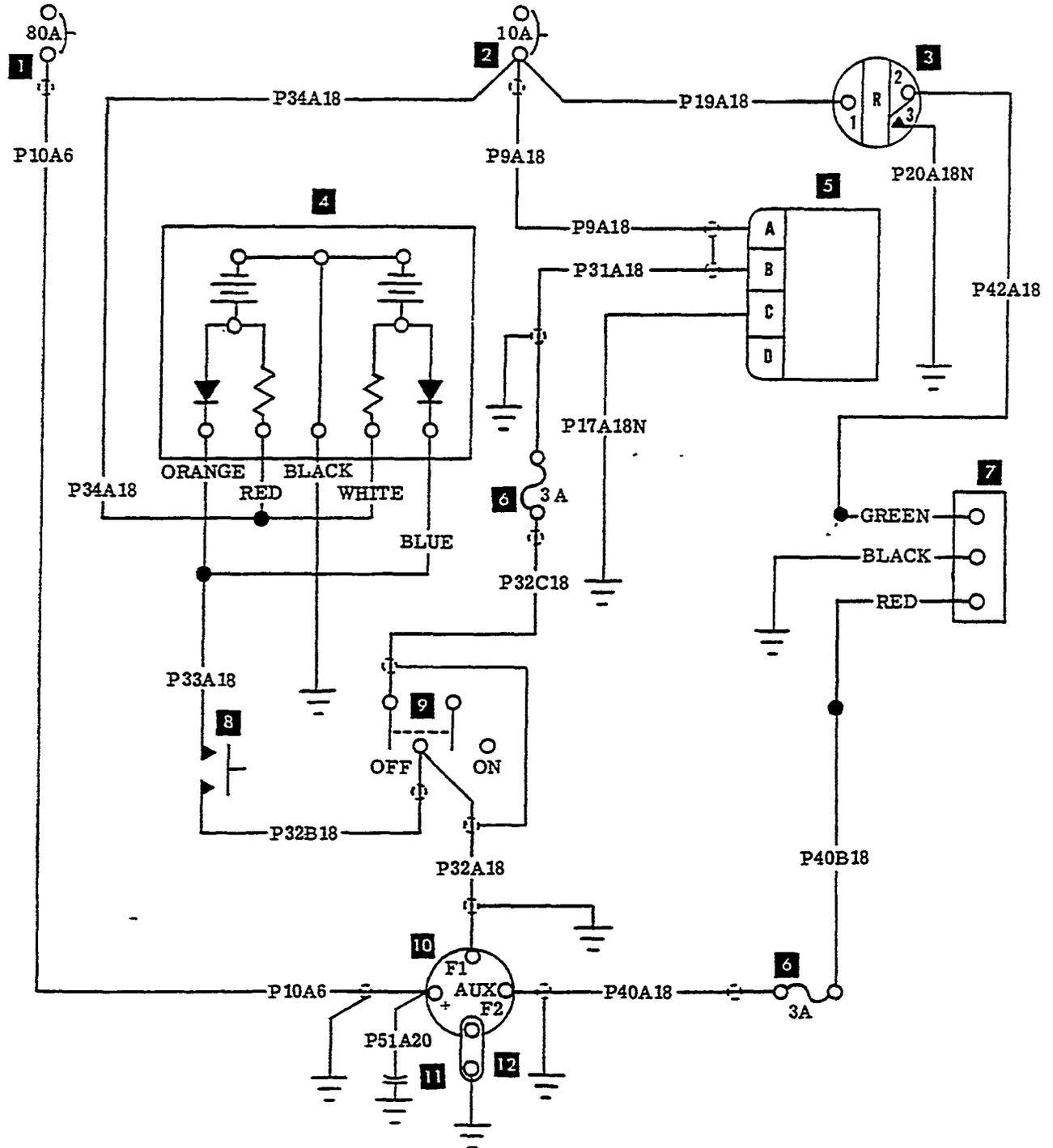
G33-389-88~

Figure 14-3C. Starter and Ignition
E-243 and after and earlier aircraft
in compliance with S. I. 0410-354



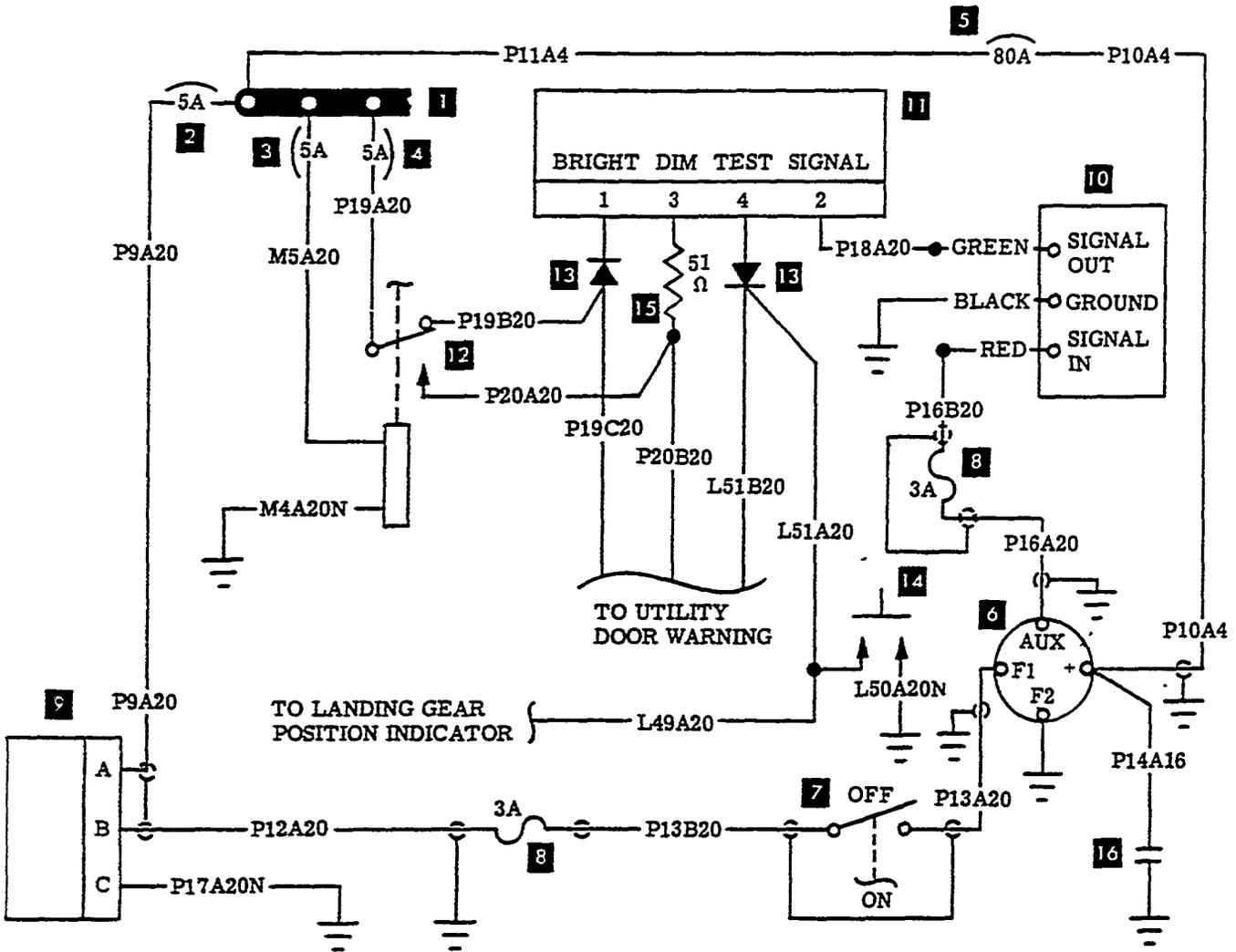
- | | |
|-------------------------------------|-------------------------|
| 1. Alternator Circuit Breaker | 7. Alternator Out Relay |
| 2. Alternator Field Circuit Breaker | 8. Re-excite Switch |
| 3. Alternator Out Light | 9. Alternator Switch |
| 4. Emergency Excitation Supply | 10. Alternator |
| 5. Overvoltage Relay Regulator | 11. Resistor |
| 6. Fuse | |

Figure 14-4. Alternator
E-1 thru E-123



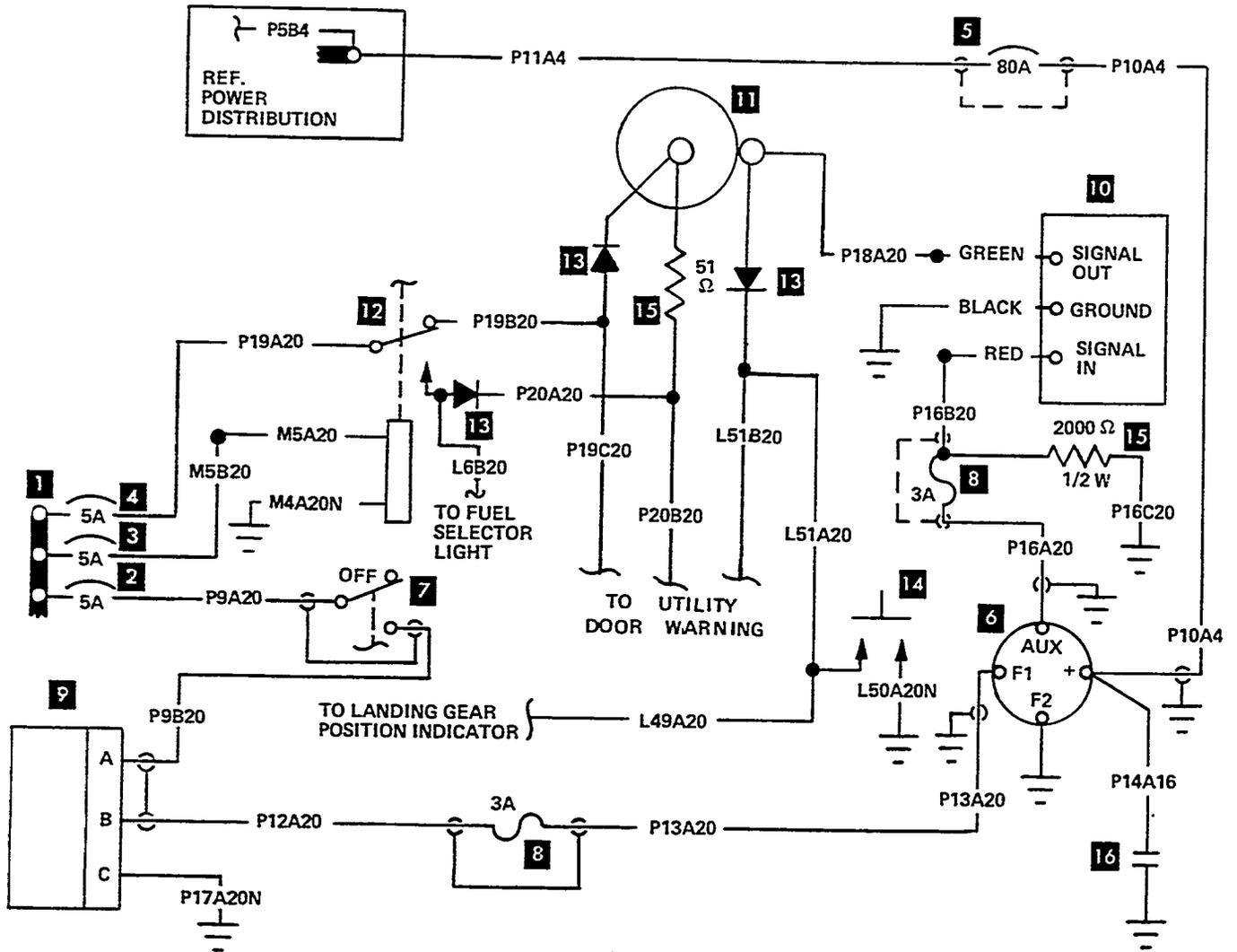
- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Alternator Circuit Breaker 2. Alternator Field Circuit Breaker 3. Alternator Out Light 4. Emergency Excitation Supply 5. Overvoltage Relay Regulator 6. Fuse | <ol style="list-style-type: none"> 7. Alternator Out Sensor 8. Re-excite Switch 9. Alternator Switch 10. Alternator 11. Filter Capacitor 12. Bus Bar |
|--|--|

Figure 14-4B. Alternator
E-142 thru E-184



1. Bus
2. Alternator Field Circuit Breaker
3. Navigation Lights Circuit Breaker
4. Door and Alternator Out Circuit Breaker
5. Alternator Circuit Breaker
6. Alternator
7. Alternator Master Switch
8. Fuse
9. Overvoltage Relay
10. Low Voltage Sensor
11. Alternator Out Light
12. Warning Light dim Relay
13. Diode
14. Warning Lights Switch
15. Resistor
16. Capacitor

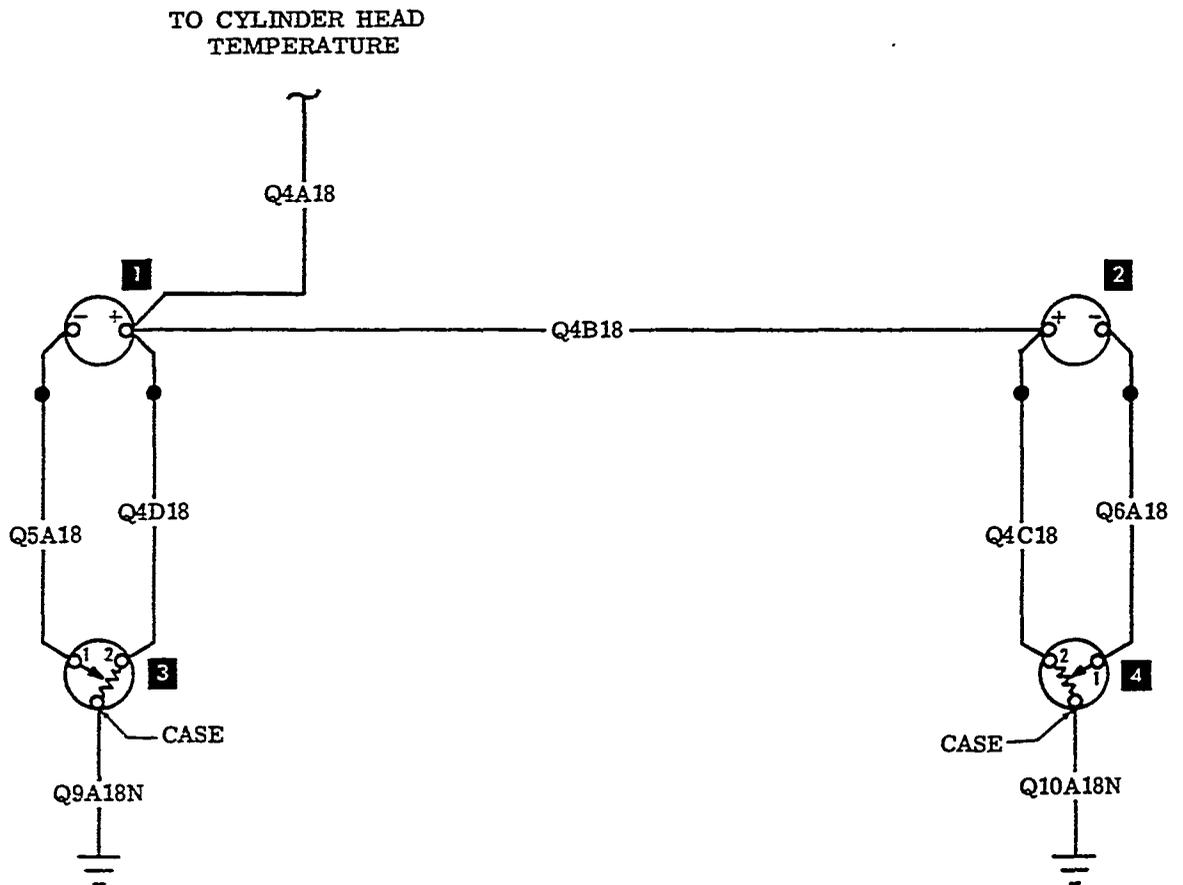
Figure 14-4C. Alternator
E-185 thru E-269



F33A-369-107C

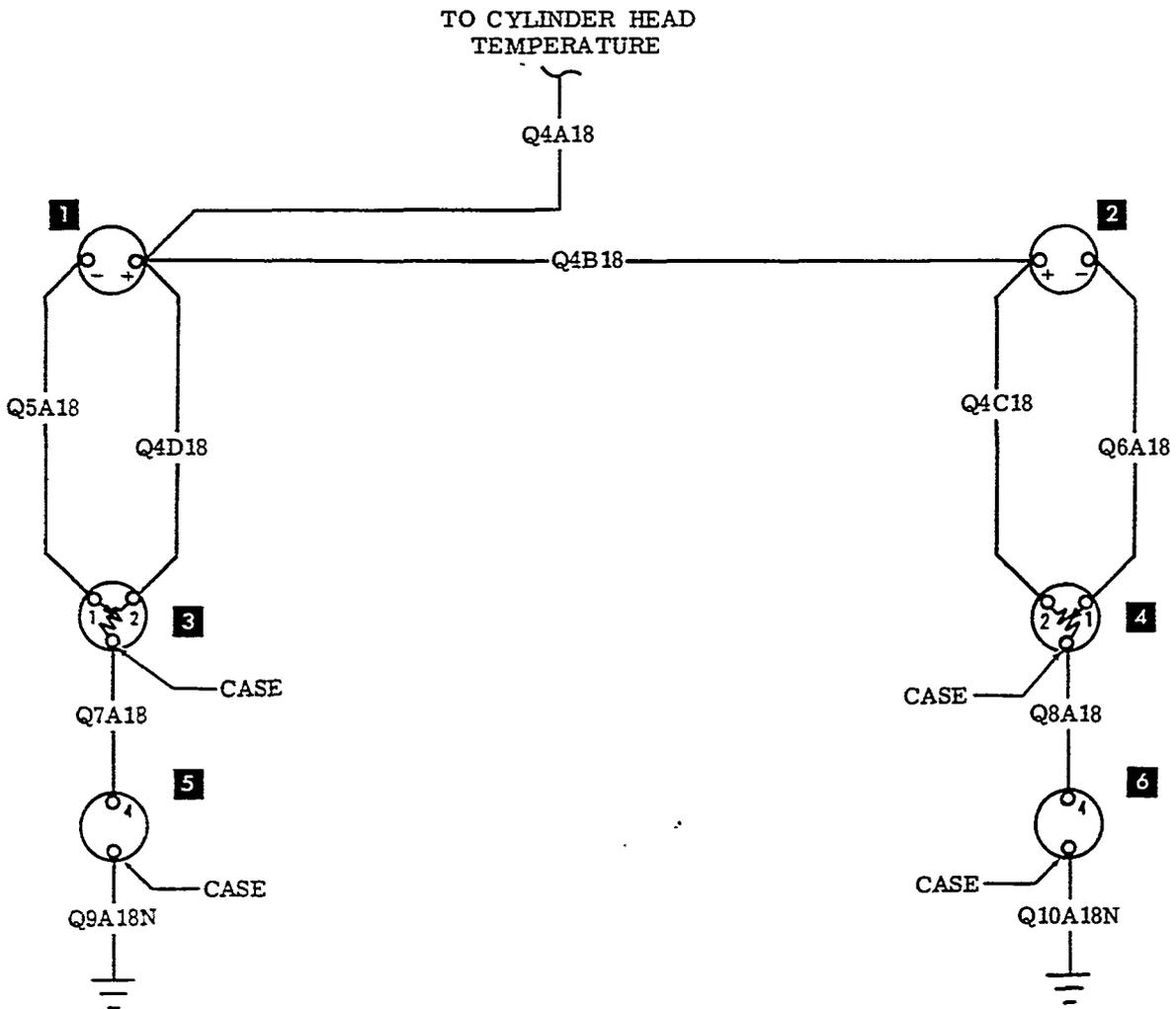
1. Bus
2. Alternator Field Circuit Breaker
3. Navigation Lights Circuit Breaker
4. Alternator Out Circuit Breaker
5. Alternator Circuit Breaker
6. Alternator
7. Alternator Master Switch
8. Fuse
9. Overvoltage Relay
10. Low Voltage Sensor
11. Alternator Out Light
12. Warning Light dim Relay
13. Diode
14. Warning Lights Switch
15. Resistor
16. Capacitor

Figure 14-4E. Alternator
E-538 thru E-762 except E-710



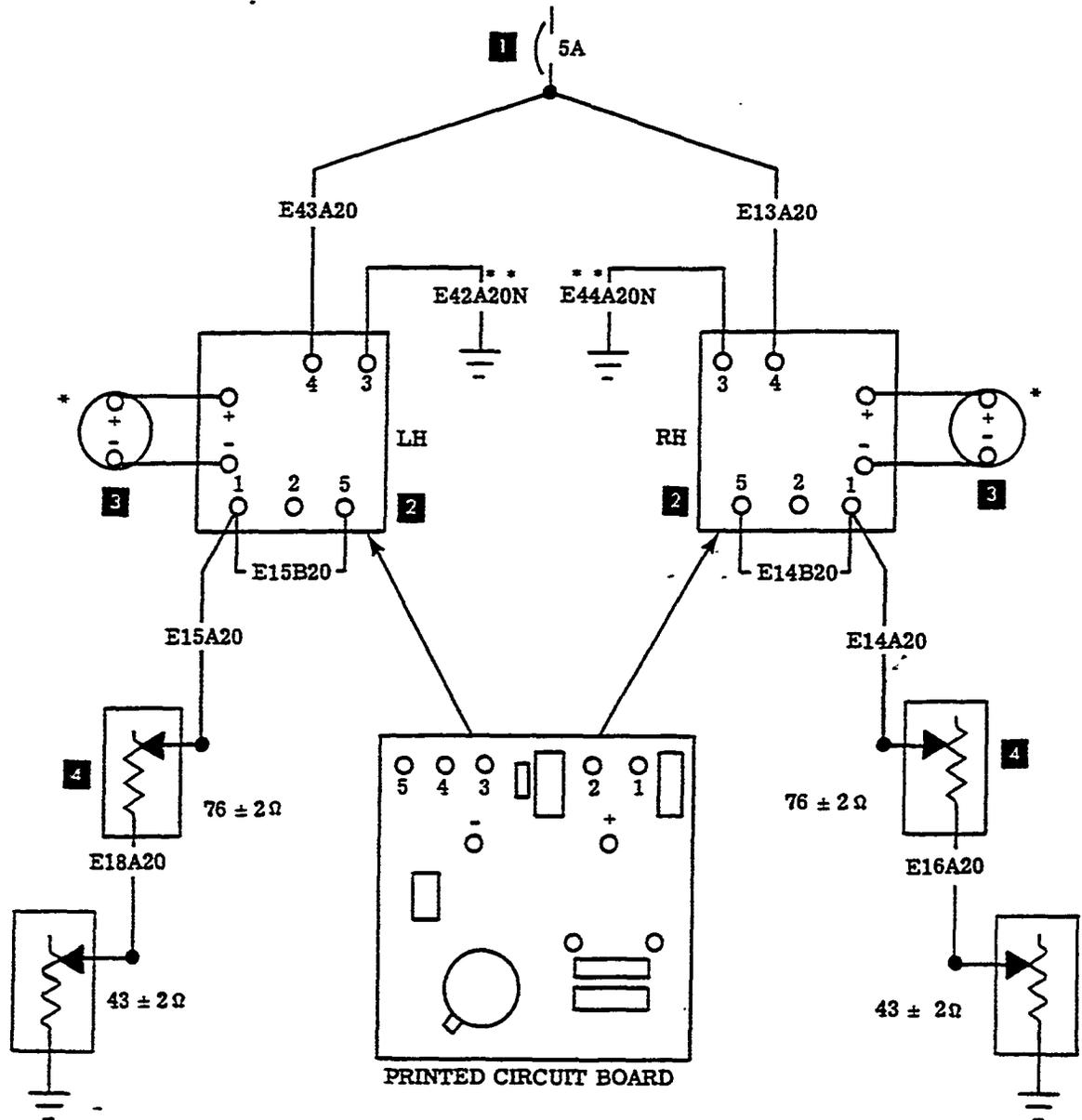
1. L.H. Fuel Quantity Indicator
2. R.H. Fuel Quantity Indicator
3. L.H. Fuel Quantity Transmitter
4. R.H. Fuel Quantity Transmitter

Figure 14-5. Fuel Quantity
E-1 thru E-184



1. L.H. Fuel Quantity Indicator
2. R.H. Fuel Quantity Indicator
3. L.H. Inboard Transmitter
4. R.H. Inboard Transmitter
5. L.H. Outboard Transmitter
6. R.H. Outboard Transmitter

Figure 14-5A. Fuel Quantity (Optional)
E-1 thru E-184

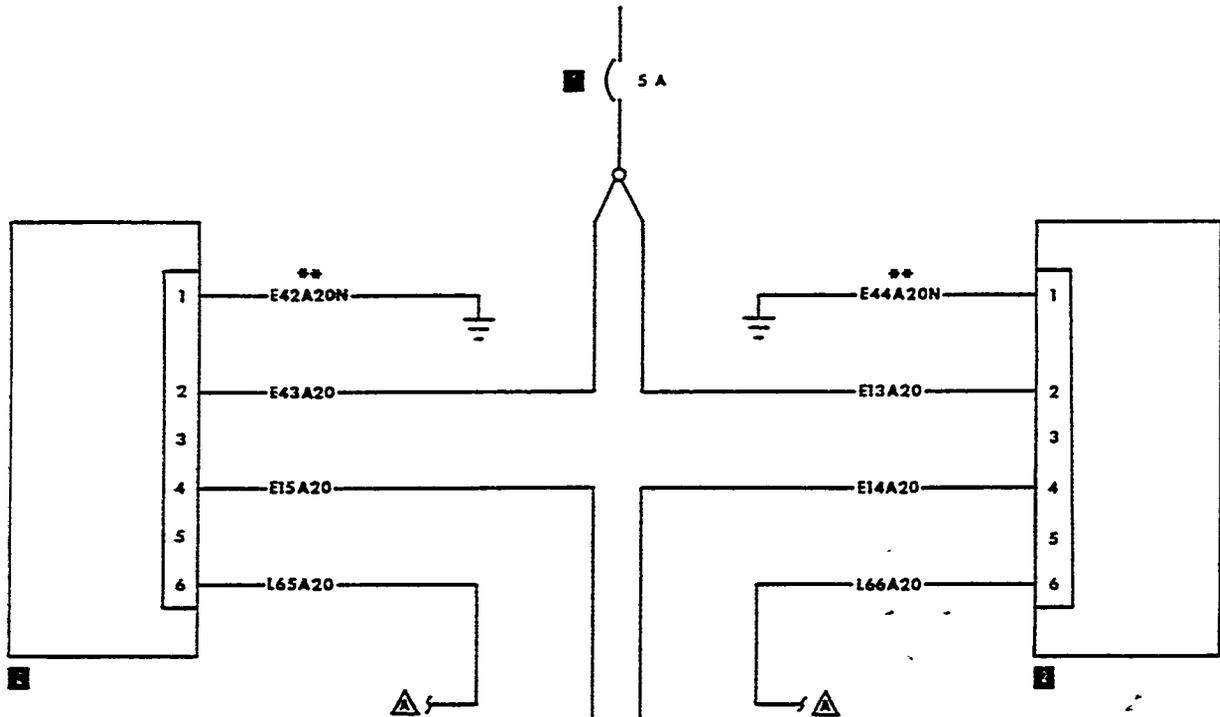


* PRINTED CIRCUIT BOARD IS MOUNTED ON INDICATOR TERMINALS

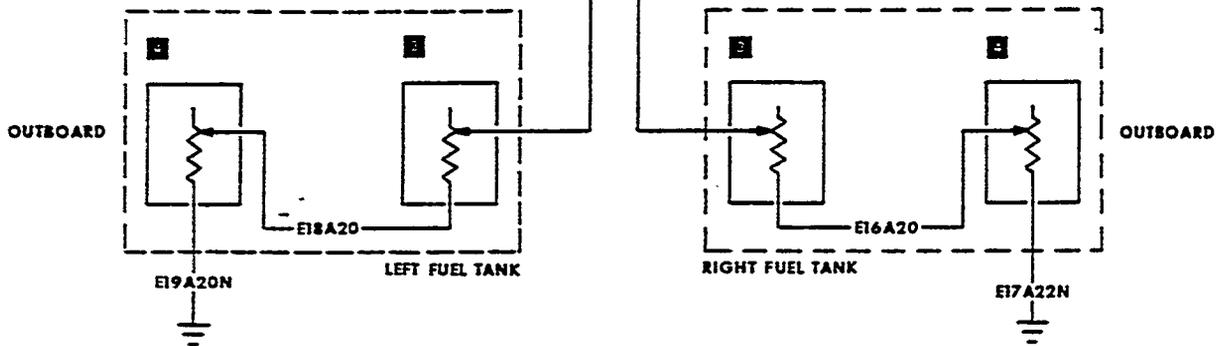
** GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (CYLINDER HEAD), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.

- 1. Fuel Quantity Circuit Breaker
- 2. Printed Circuit Board
- 3. Fuel Quantity Indicator
- 4. Inboard Fuel Cell Transmitter
- 5. Outboard Fuel Cell Transmitter

Figure 14-6. Fuel Quantity E-185 thru E-282



** GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (OIL TEMPERATURE), E39A20N (CYLINDER HEAD TEMPERATURE), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.

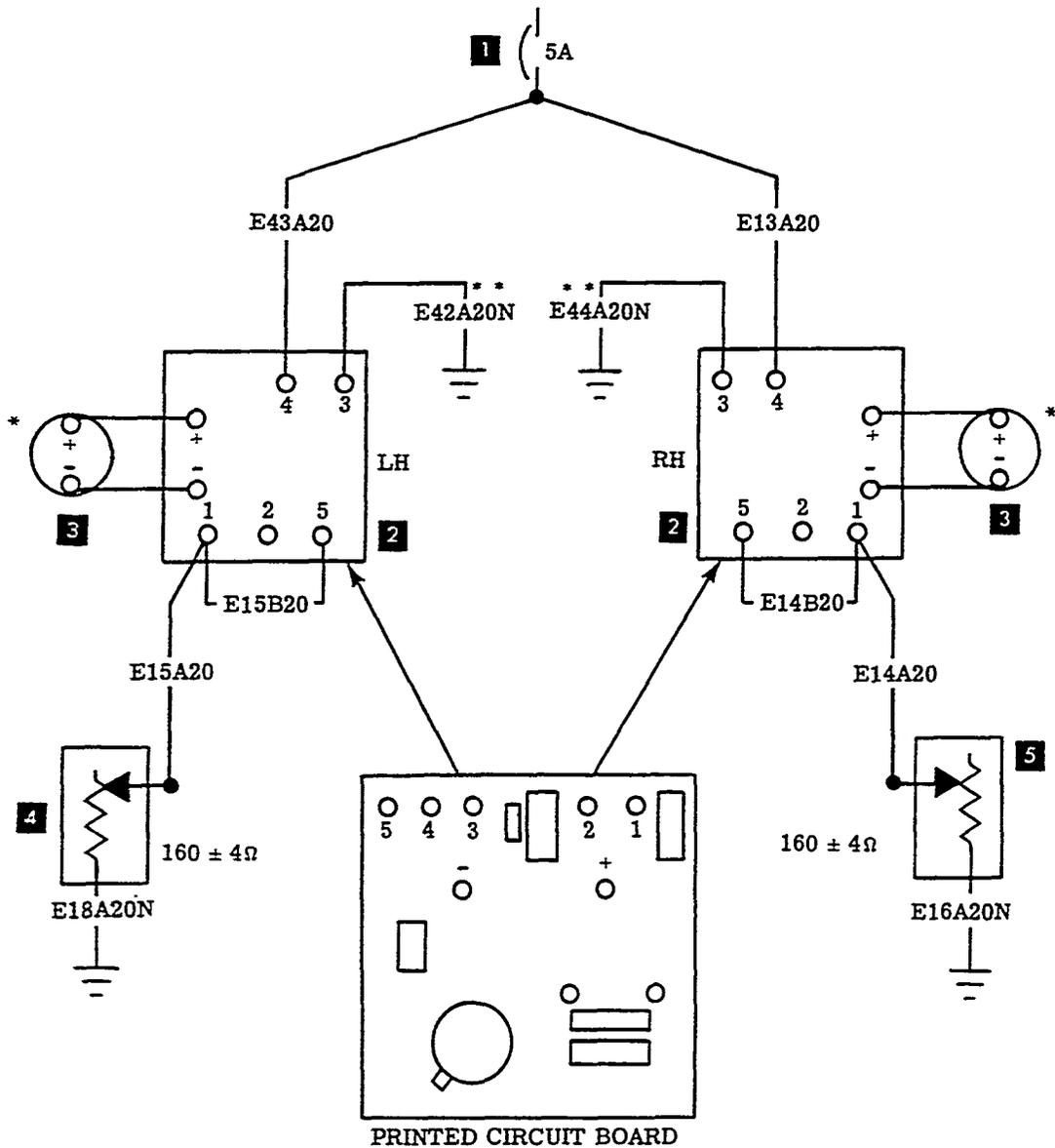


△ TO ENGINE INSTRUMENT LIGHTS

- 1. Circuit Breaker
- 2. Fuel Quantity Indicator
- 3. Inboard Fuel Quantity Transmitter
- 4. Outboard Fuel Quantity Transmitter

35-369-75

Figure 14-6A. Fuel Quantity (Vertical Instruments)
E-283 thru E-363



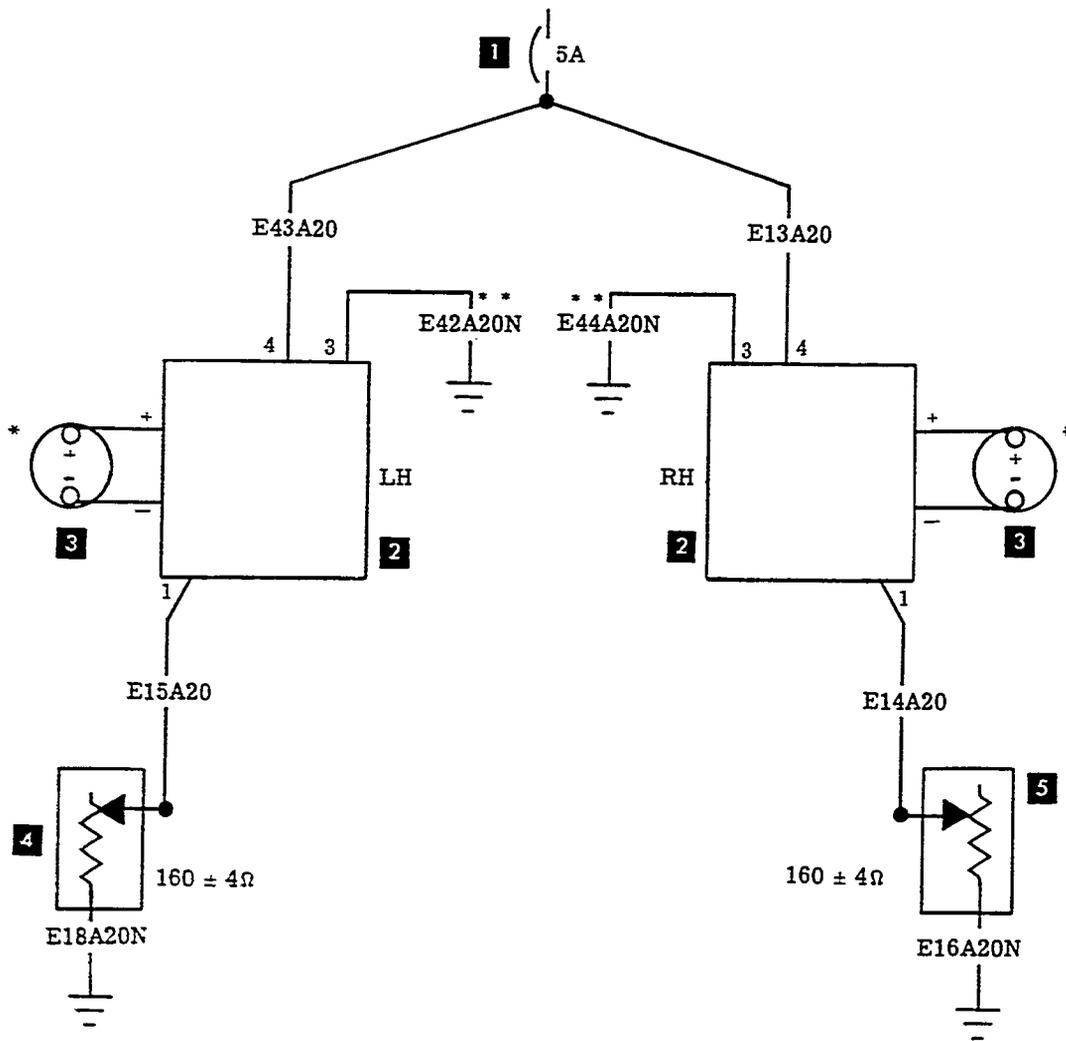
* PRINTED CIRCUIT BOARD IS MOUNTED ON INDICATOR TERMINALS

F33-369-302

* *GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (CYLINDER HEAD), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.

1. Fuel Quantity Circuit Breaker
2. Printed Circuit Board
3. Fuel Quantity Indicator
4. LH Fuel Cell Transmitter
5. RH Fuel Cell Transmitter

Figure 14-6A. Fuel Quantity (Standard)
E-364 thru E-504



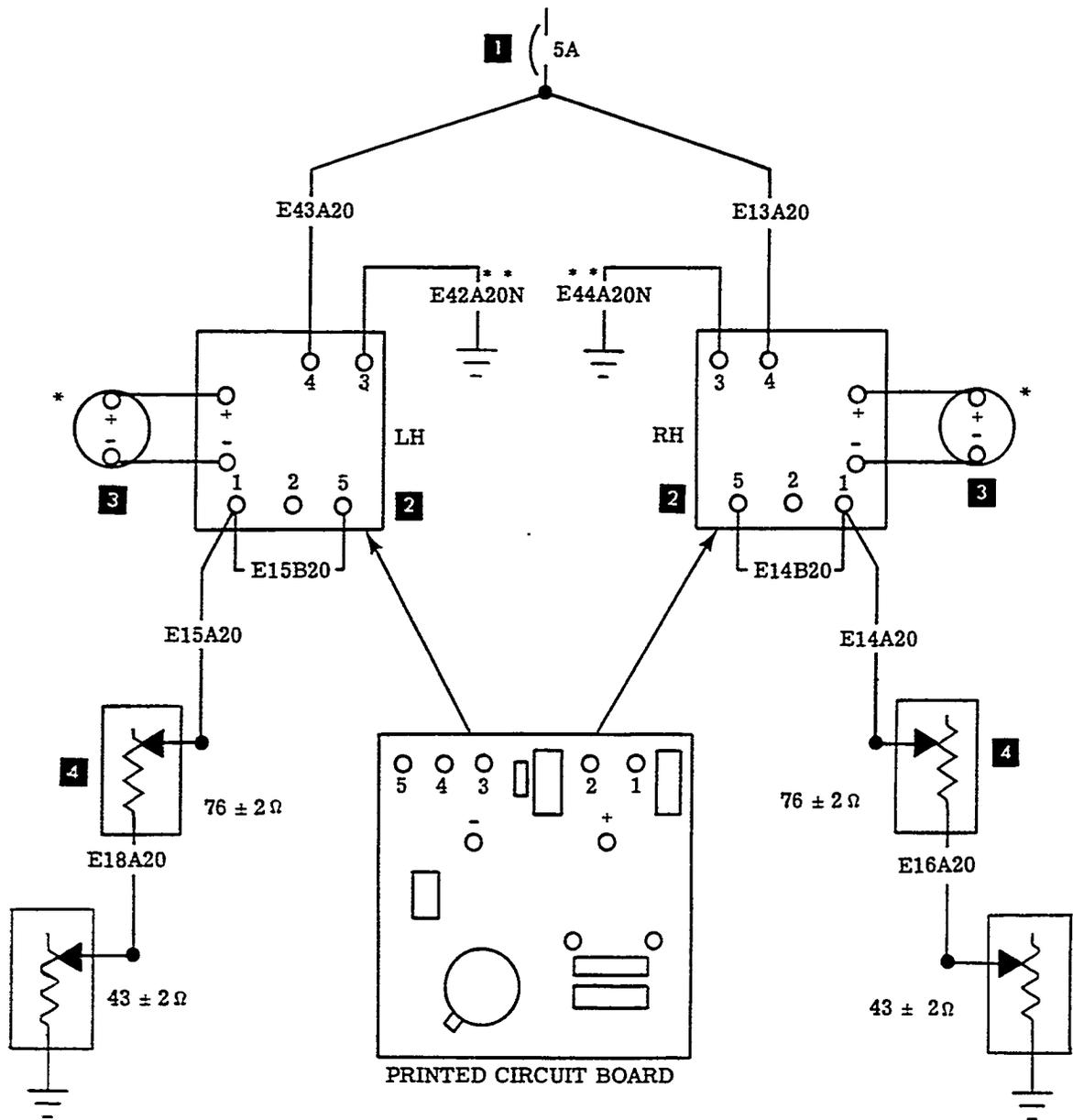
*PRINTED CIRCUIT BOARD IS MOUNTED ON GLARESHIELD SUPPORT (UPPER PORTION OF FIXED INSTRUMENT PANEL)

F33-369-302A

**GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (CYLINDER HEAD), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.

1. Fuel Quantity Circuit Breaker
2. Printed Circuit Board
3. Fuel Quantity Indicator
4. LH Fuel Cell Transmitter
5. RH Fuel Cell Transmitter

Figure 14-6. Fuel Quantity (standard)
E-505 thru E-762 except E-710

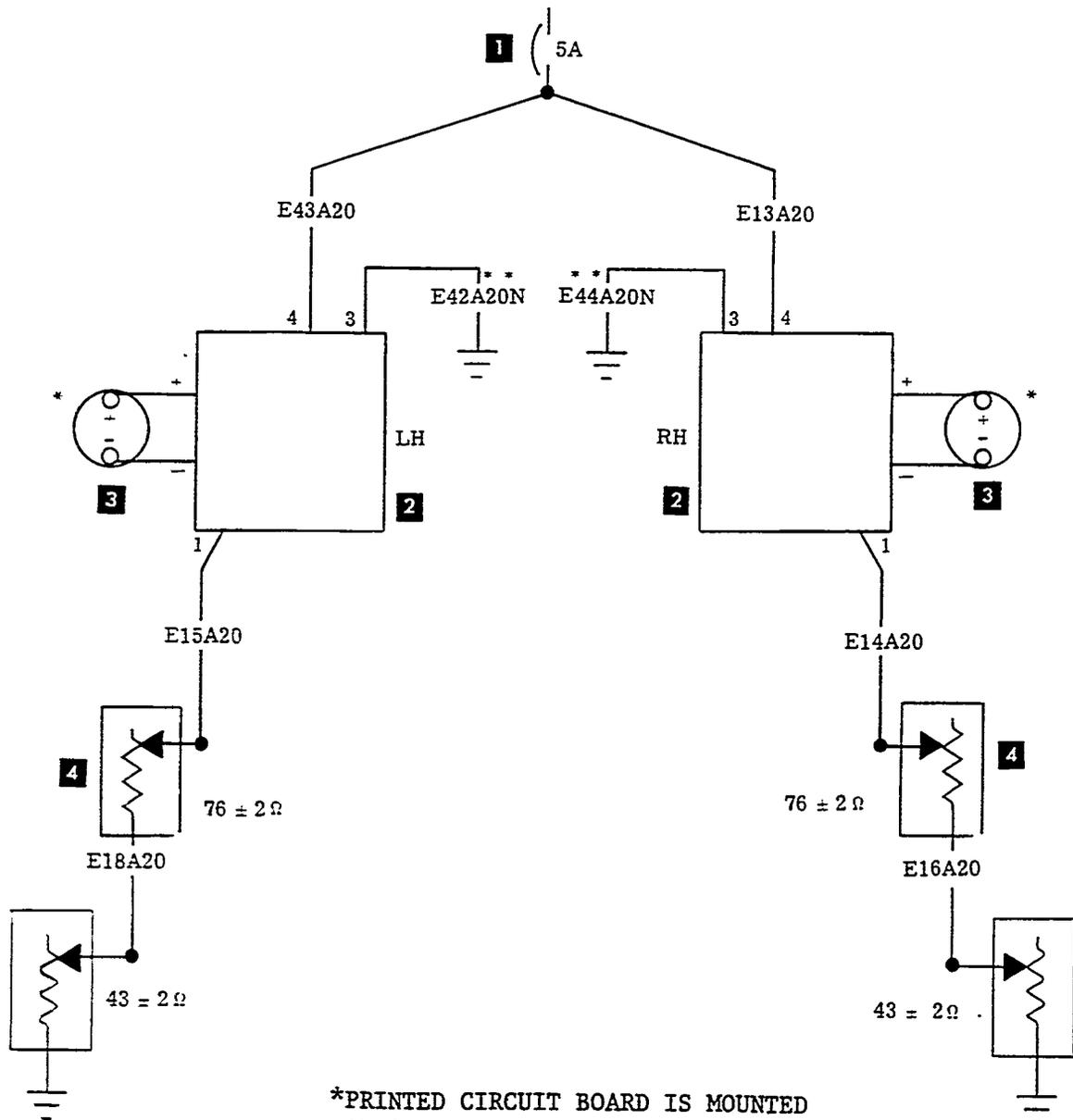


* PRINTED CIRCUIT BOARD IS MOUNTED ON INDICATOR TERMINALS

** GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (CYLINDER HEAD), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.

1. Fuel Quantity Circuit Breaker
2. Printed Circuit Board
3. Fuel Quantity Indicator
4. Inboard Fuel Cell Transmitter
5. Outboard Fuel Cell Transmitter

Figure 14-6A. Fuel Quantity (Optional) E-364 thru E-504



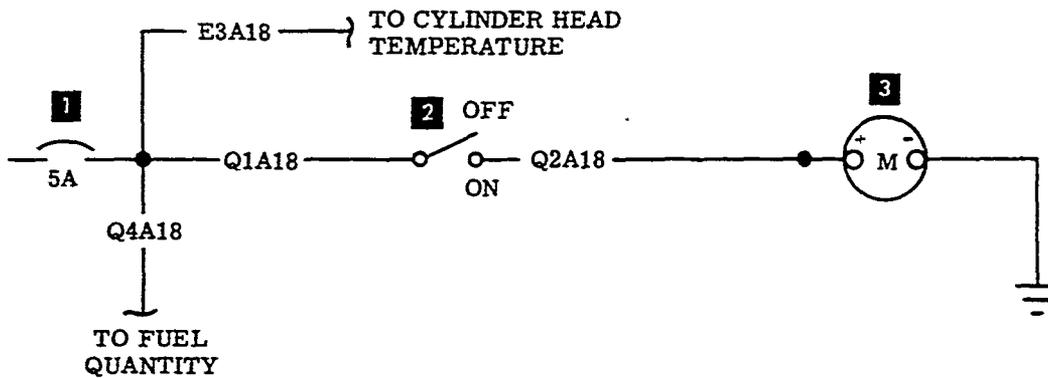
V35-369-168

*PRINTED CIRCUIT BOARD IS MOUNTED ON GLARESHIELD SUPPORT (UPPER PORTION OF FIXED INSTRUMENT PANEL)

** GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (CYLINDER HEAD), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.

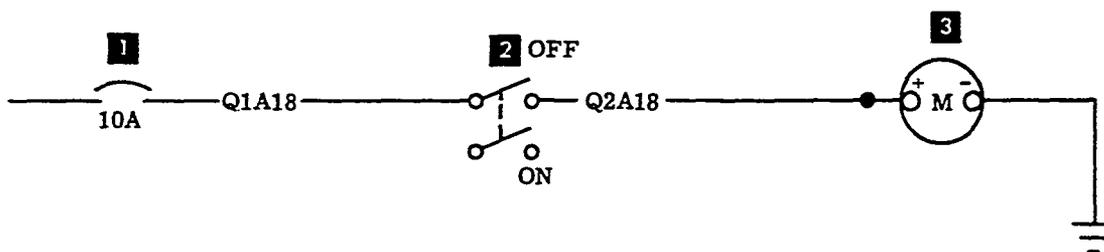
1. Fuel Quantity Circuit Breaker
2. Printed Circuit Board
3. Fuel Quantity Indicator
4. Inboard Fuel Cell Transmitter
5. Outboard Fuel Cell Transmitter

Figure 14-6A. Fuel Quantity (optional)
E-505 thru E-762 except E-710



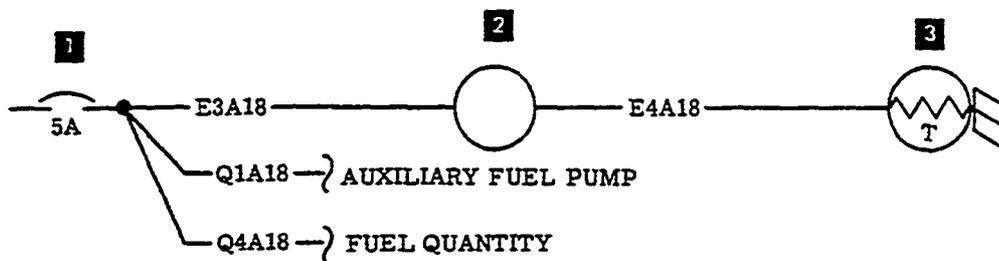
1. Fuel Quantity Indicator, Cylinder Head Temperature, and Auxiliary Fuel Pump Circuit Breaker
2. Auxiliary Fuel Pump Switch
3. Auxiliary Fuel Pump

Figure 14-7. Auxiliary Fuel Pump
E-1 thru E-184



1. Auxiliary Fuel Pump Circuit Breaker
2. Auxiliary Fuel Pump Switch
3. Auxiliary Fuel Pump Motor

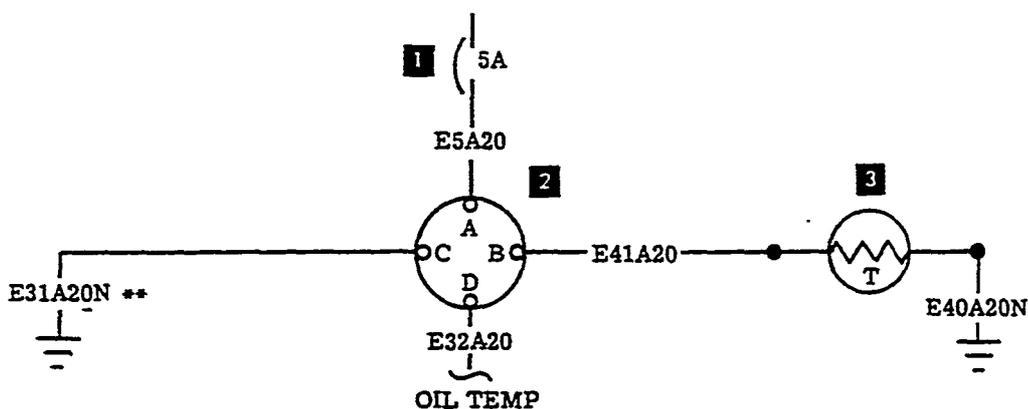
Figure 14-7A. Auxiliary Fuel Pump
E-185 thru E-762 except E-710



V35-369-21

1. Fuel Quantity Indicator Cylinder Head Temperature and Auxiliary Fuel Pump Circuit Breaker
2. Cylinder Head Temperature Indicator
3. Cylinder Head Temperature Transmitter

Figure 14-8. Cylinder Head Temperature E-1 thru E-184

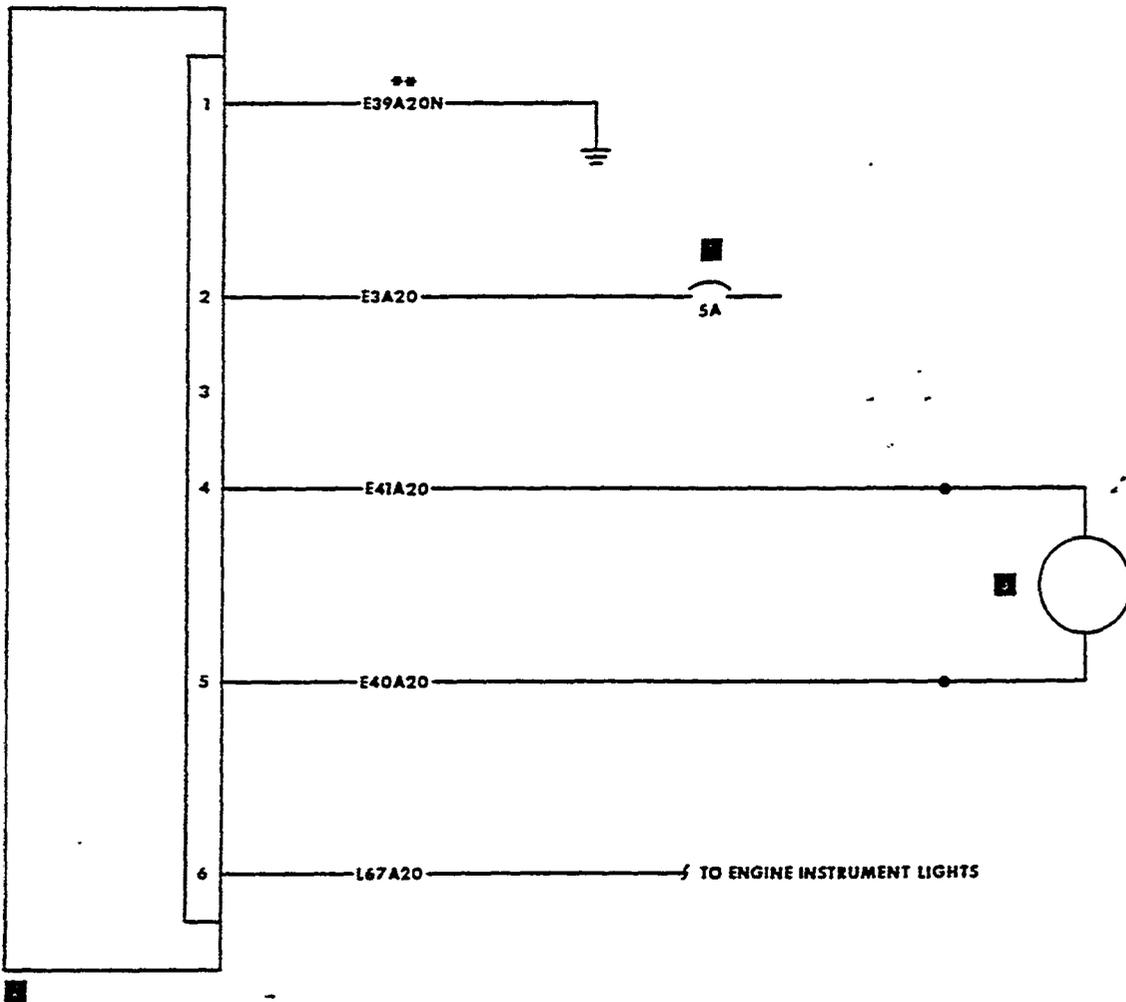


V35-369-22

****GROUND WIRE E31A20N (CYLINDER HEAD TEMPERATURE) AND WIRES E42A20N AND E44A20N (FUEL QUANTITY) AT A SINGLE POINT. DO NOT GROUND ANY OTHER WIRES AT THIS POINT**

1. Cylinder Head and Oil Temperature Circuit Breaker
2. Cylinder Head, Oil Temperature, and Oil Pressure Indicator
3. Cylinder Head Temperature Transmitter Bulb

Figure 14-8A. Cylinder Head Temperature E-185 thru E-282

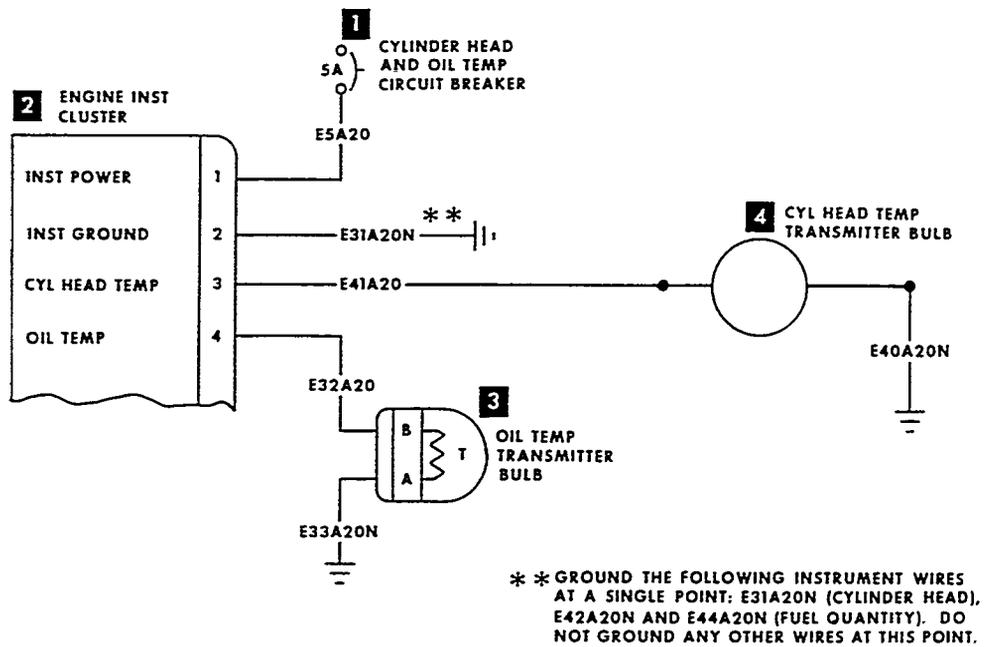


**** GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (OIL TEMPERATURE), E39A20N (CYLINDER HEAD TEMPERATURE), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.**

- 1. Circuit Breaker
- 2. Cylinder Head Temperature Indicator
- 3. Cylinder Head Temperature Transmitter

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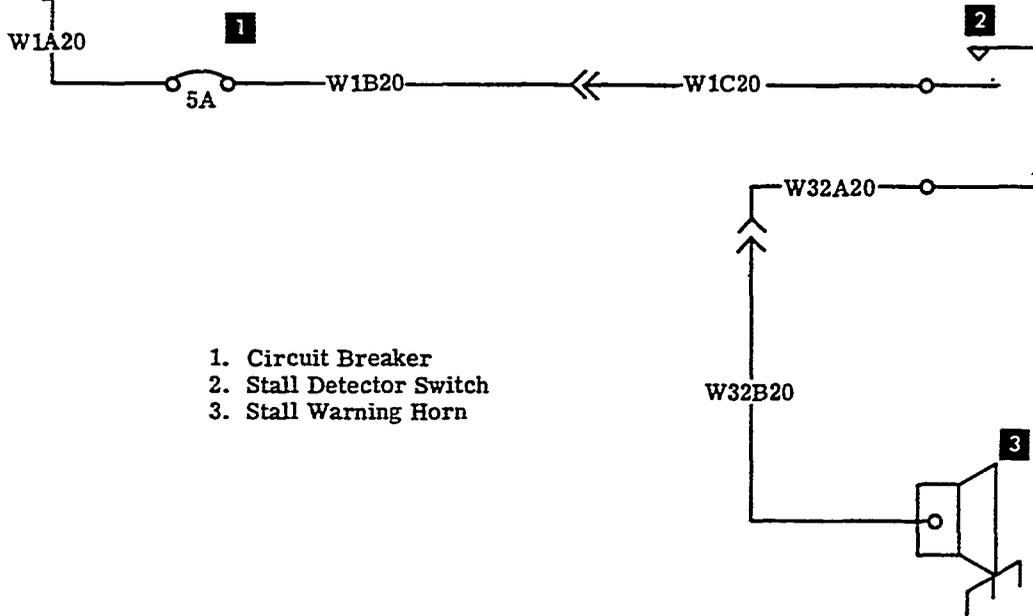
Figure 14-8B. Cylinder Head Temperature (Vertical Instruments)
E-283 thru E-363



F33A-369-299

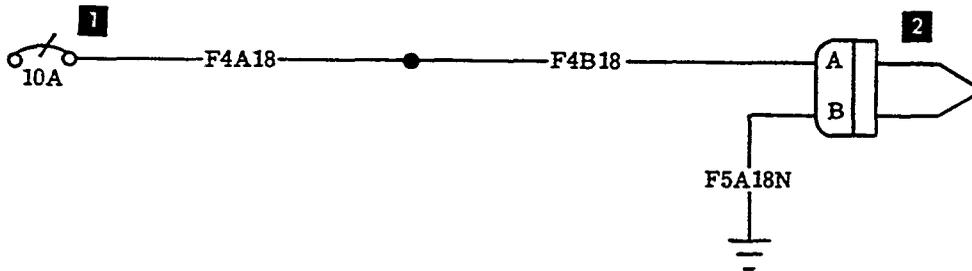
Figure 14-8C. Cylinder Head and Oil Temperature
E-364 thru E-762 except E-710

TO BATTERY AND
EXTERNAL POWER



- 1. Circuit Breaker
- 2. Stall Detector Switch
- 3. Stall Warning Horn

Figure 14-9 Stall Warning
E-1 thru E-762 except E-710



- 1. Circuit Breaker
- 2. Pitot Heater

Figure 14-10. Pitot Heat
E-1 thru E-762 except E-710

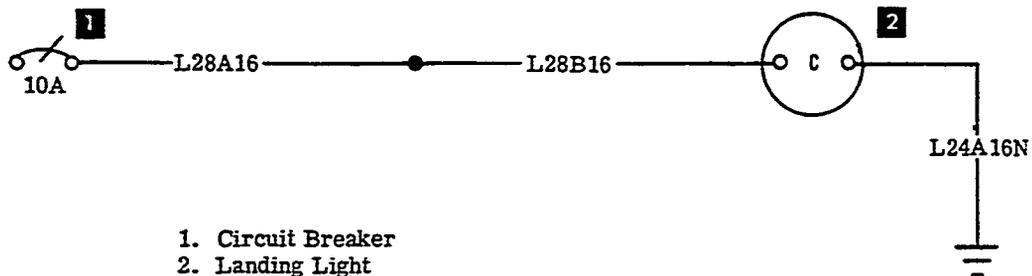
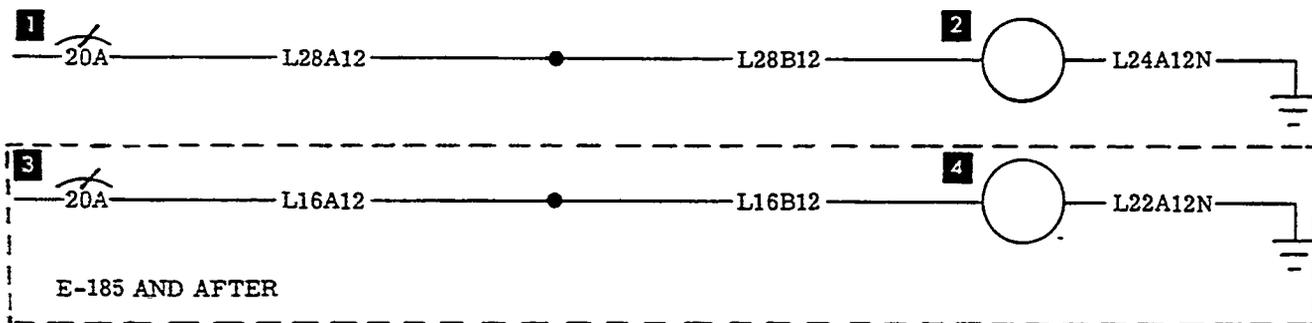


Figure 14-11. Landing Light
E-1 thru E-162



1. Landing Light Circuit Breaker
2. Landing Light
3. Taxi Light Circuit Breaker
4. Taxi Light

Figure 14-11A Landing and Taxi Lights
E-163 thru E-762 except E-710 and those serial airplanes
in compliance with S.I. 0312-360

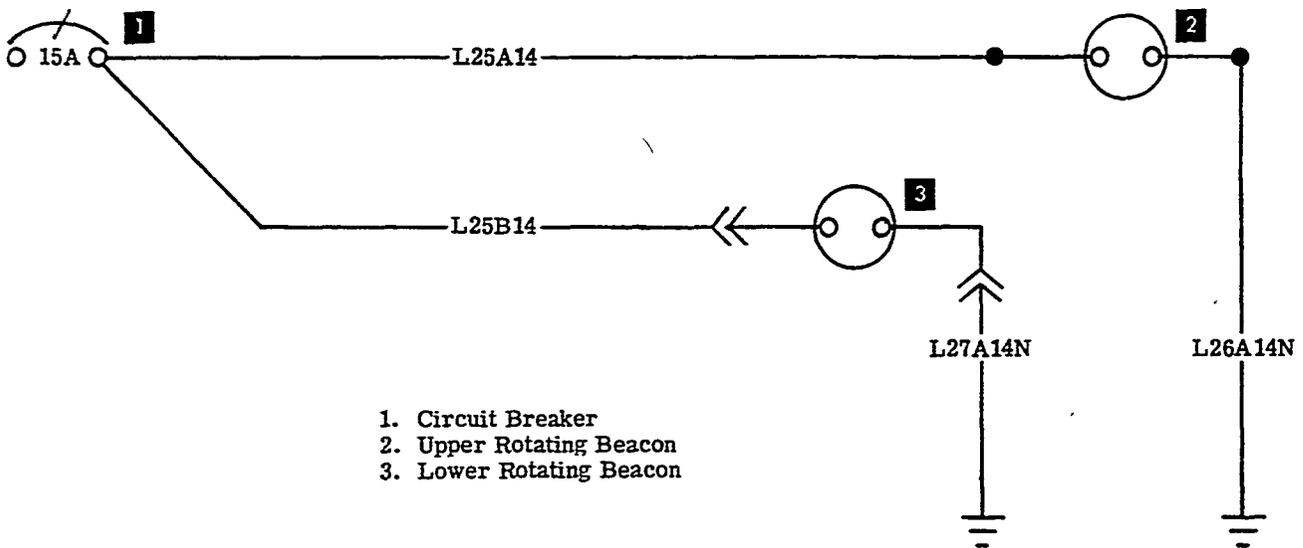
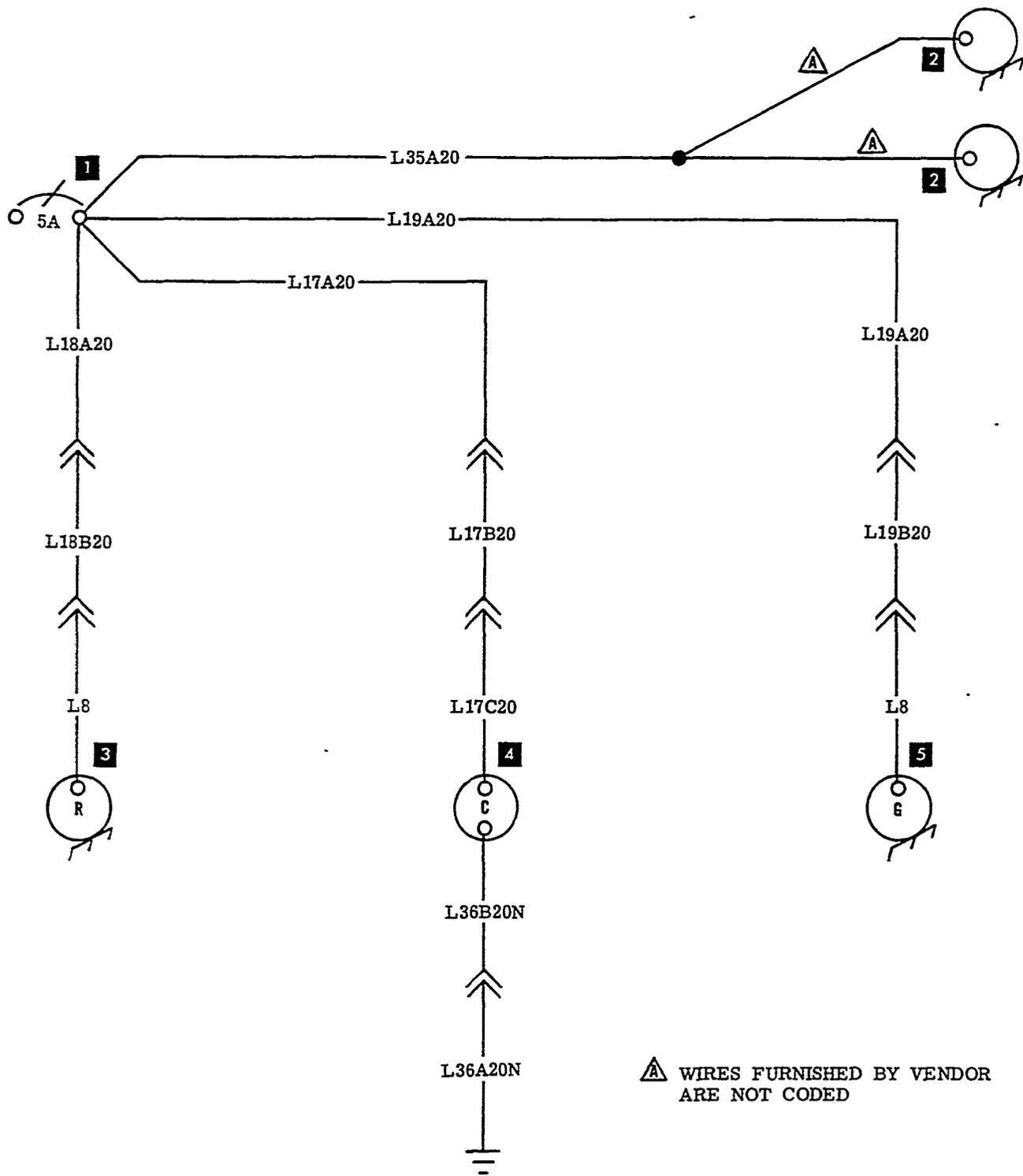
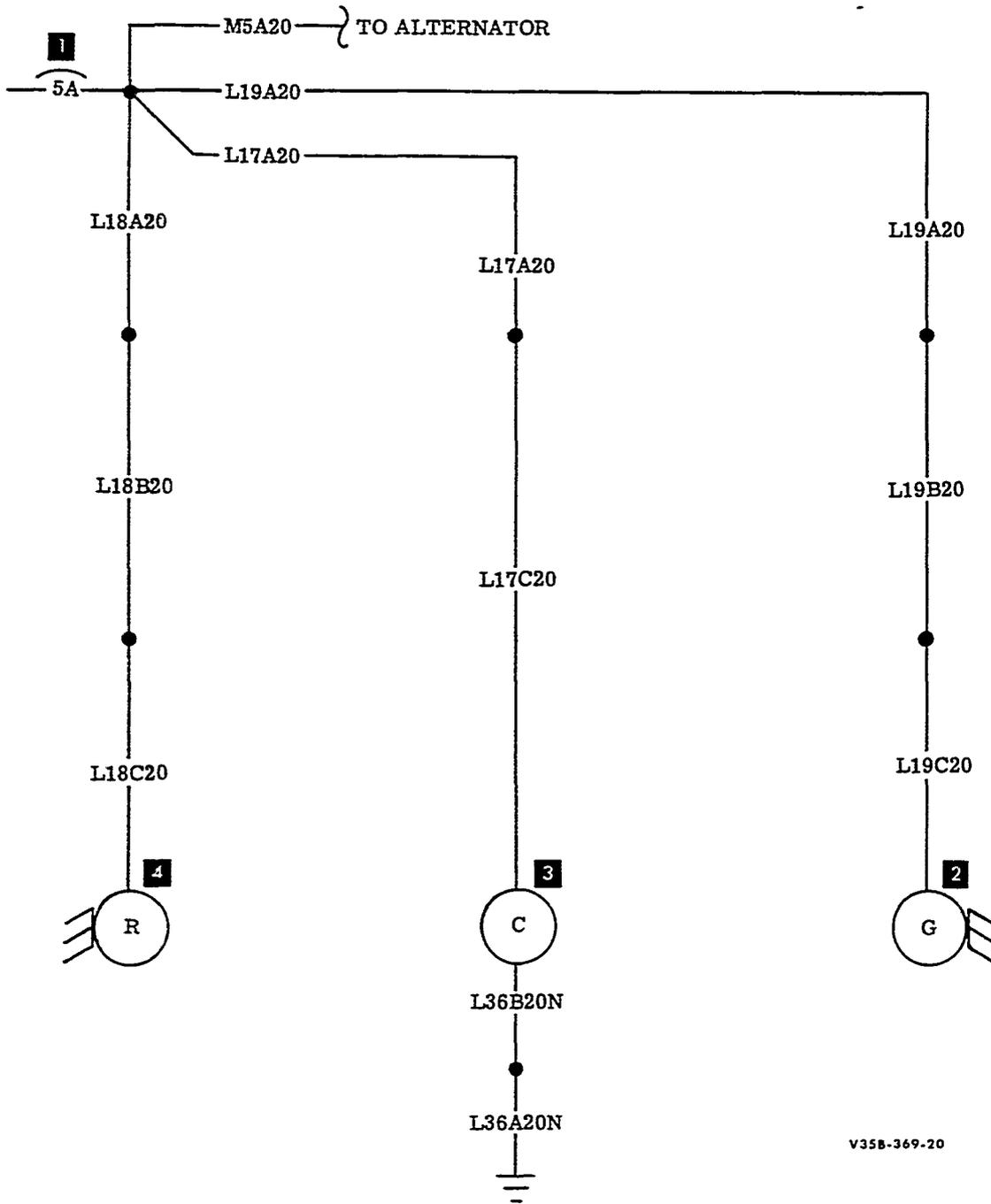


Figure 14-12. Rotating Beacon
 E-1 thru E-762 except E-710



1. Circuit Breaker
2. Subpanel Post Lights
3. L.H. Position Light
4. Tail Position Light
5. R.H. Position Light

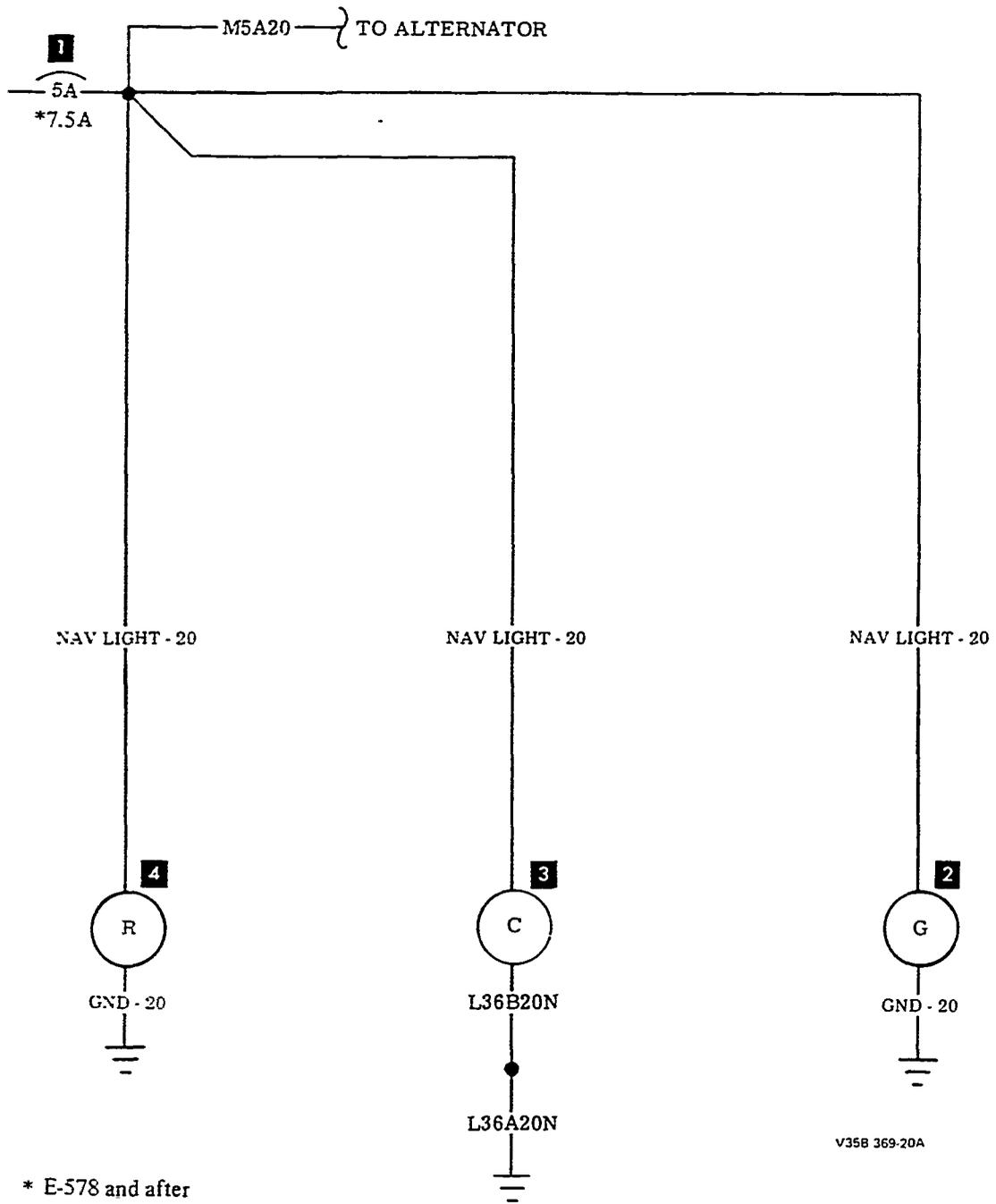
Figure 14-13. Navigation Lights
E-1 thru E-184



V35B-369-20

1. Navigation Lights Circuit Breaker
2. RH Navigation Light
3. Tail Navigation Light
4. LH Navigation Light

Figure 14-13A. Navigation Lights E-185 thru E-423



* E-578 and after

- 1. Navigation Lights Circuit Breaker
- 2. RH Navigation Light
- 3. Tail Navigation Light
- 4. LH Navigation Light

Figure 14-13A. Navigation Lights
E-424 thru E-762 except E-710

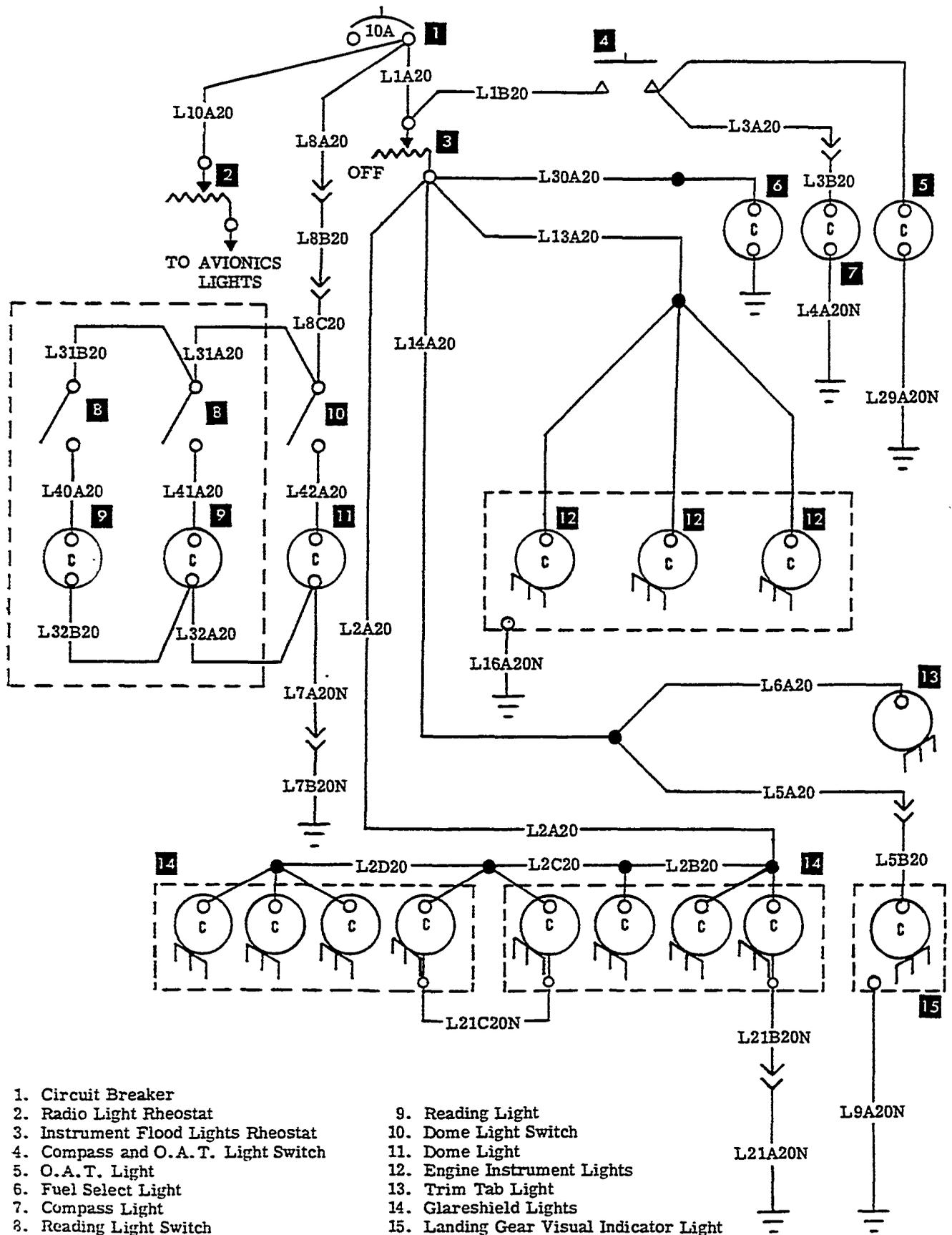


Figure 14-14. Interior and Instrument Lights
 E-1 thru E-184

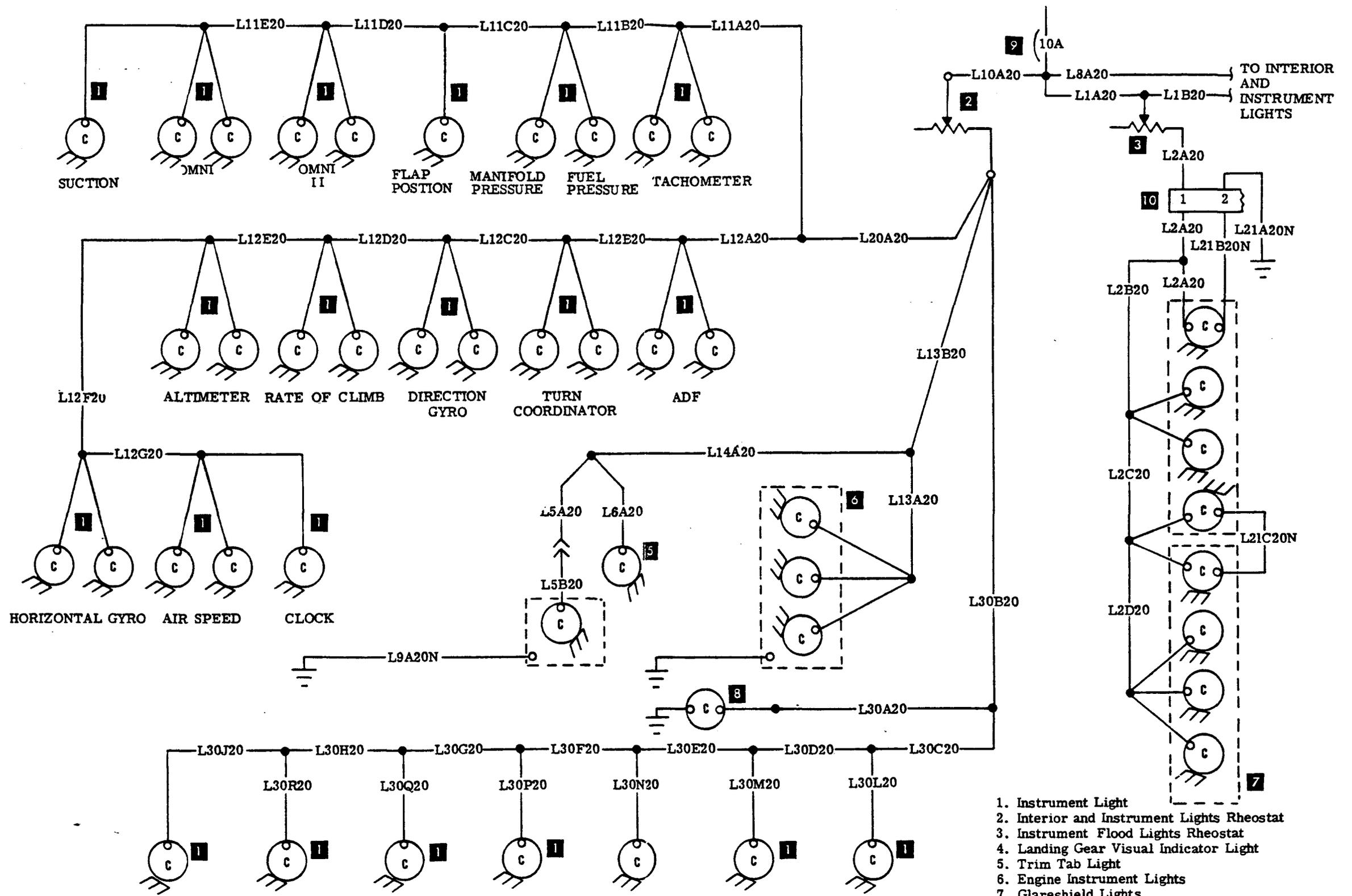


Figure 14-14A. Interior and Instrument Lights (Optional)
 E-1 thru E-184

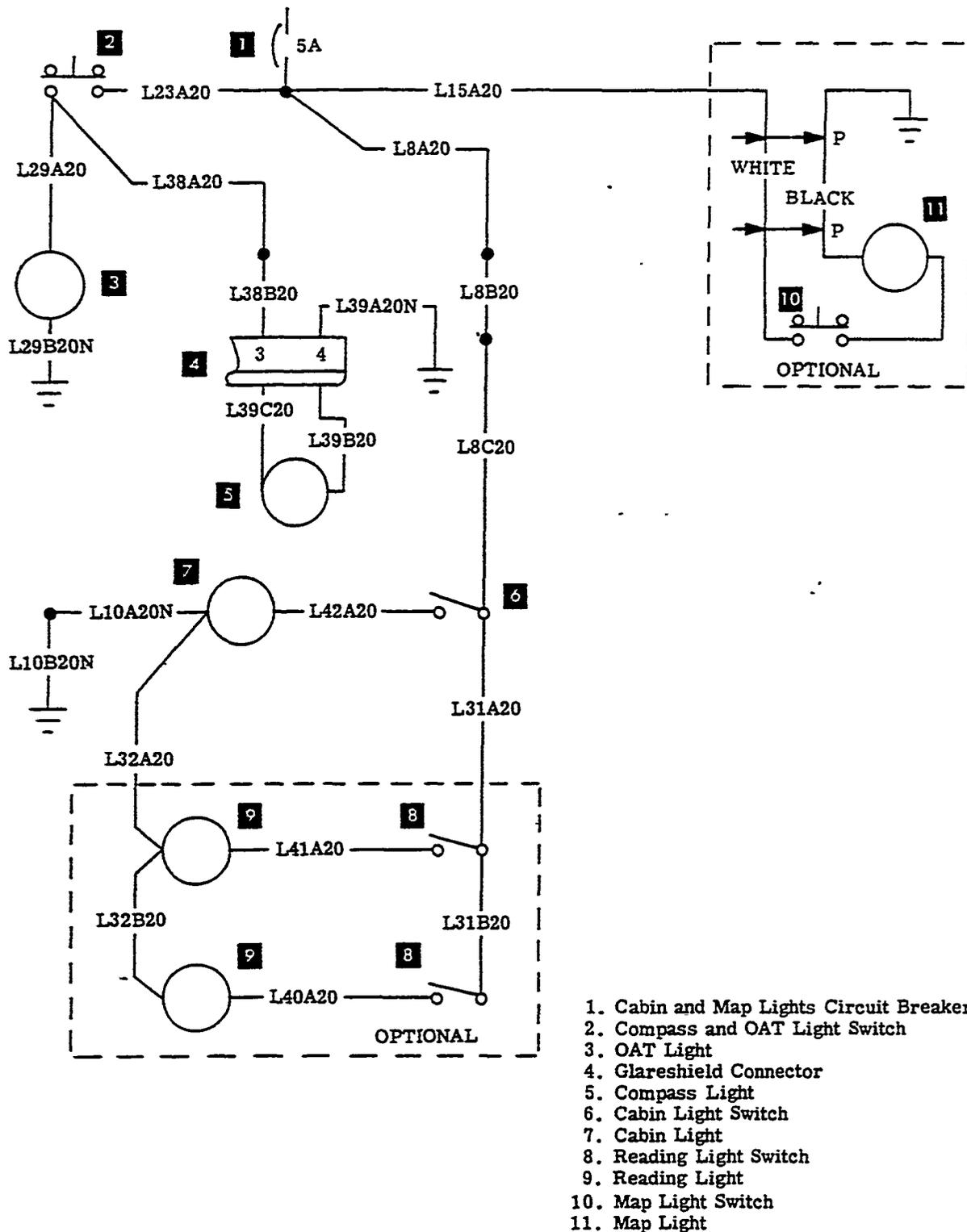
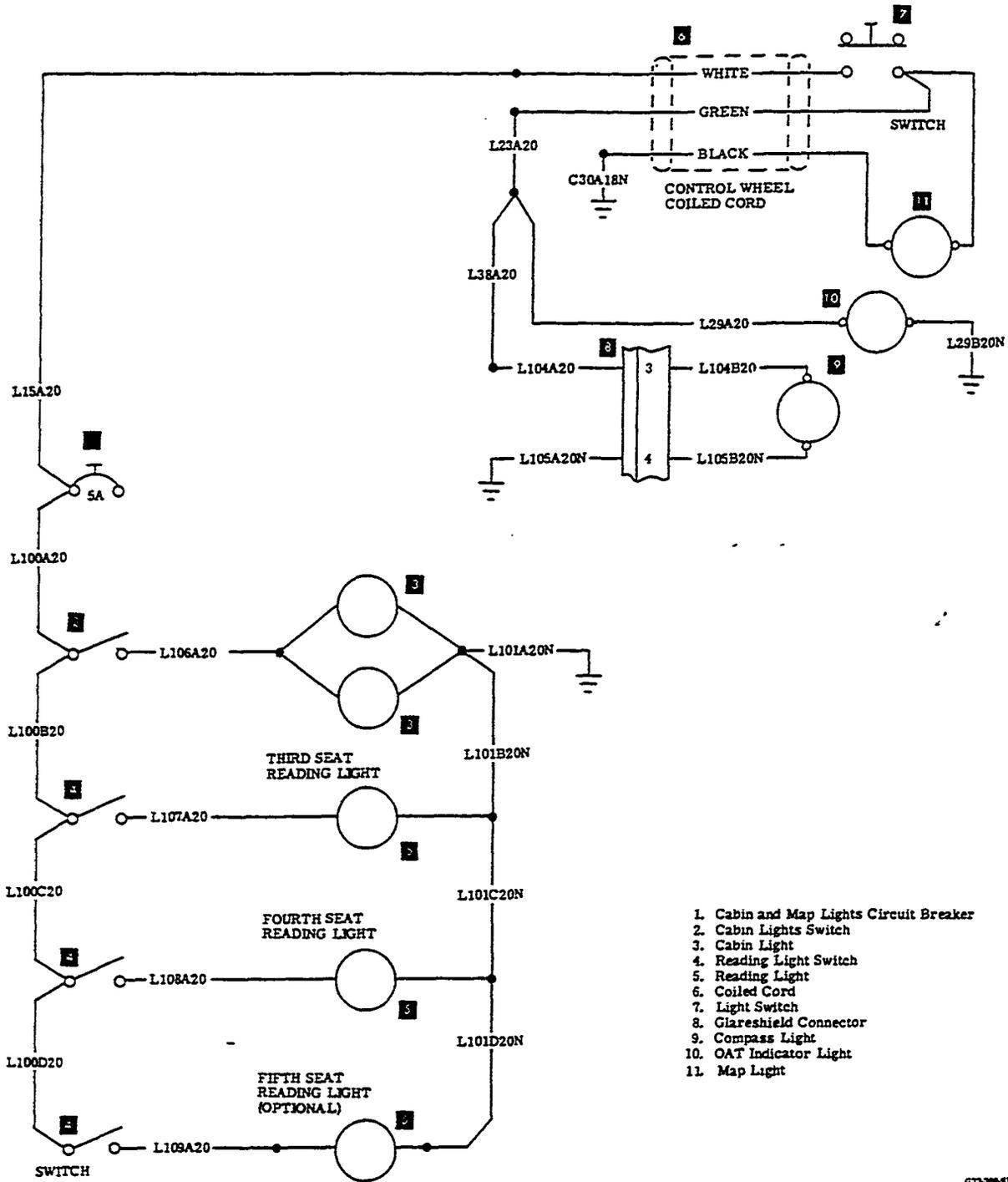


Figure 14-15. Interior Lights
 E-185 thru E-282



1. Cabin and Map Lights Circuit Breaker
2. Cabin Lights Switch
3. Cabin Light
4. Reading Light Switch
5. Reading Light
6. Coiled Cord
7. Light Switch
8. Glareshield Connector
9. Compass Light
10. OAT Indicator Light
11. Map Light

Figure 14-15A. Interior Lights
E-283 thru E-476

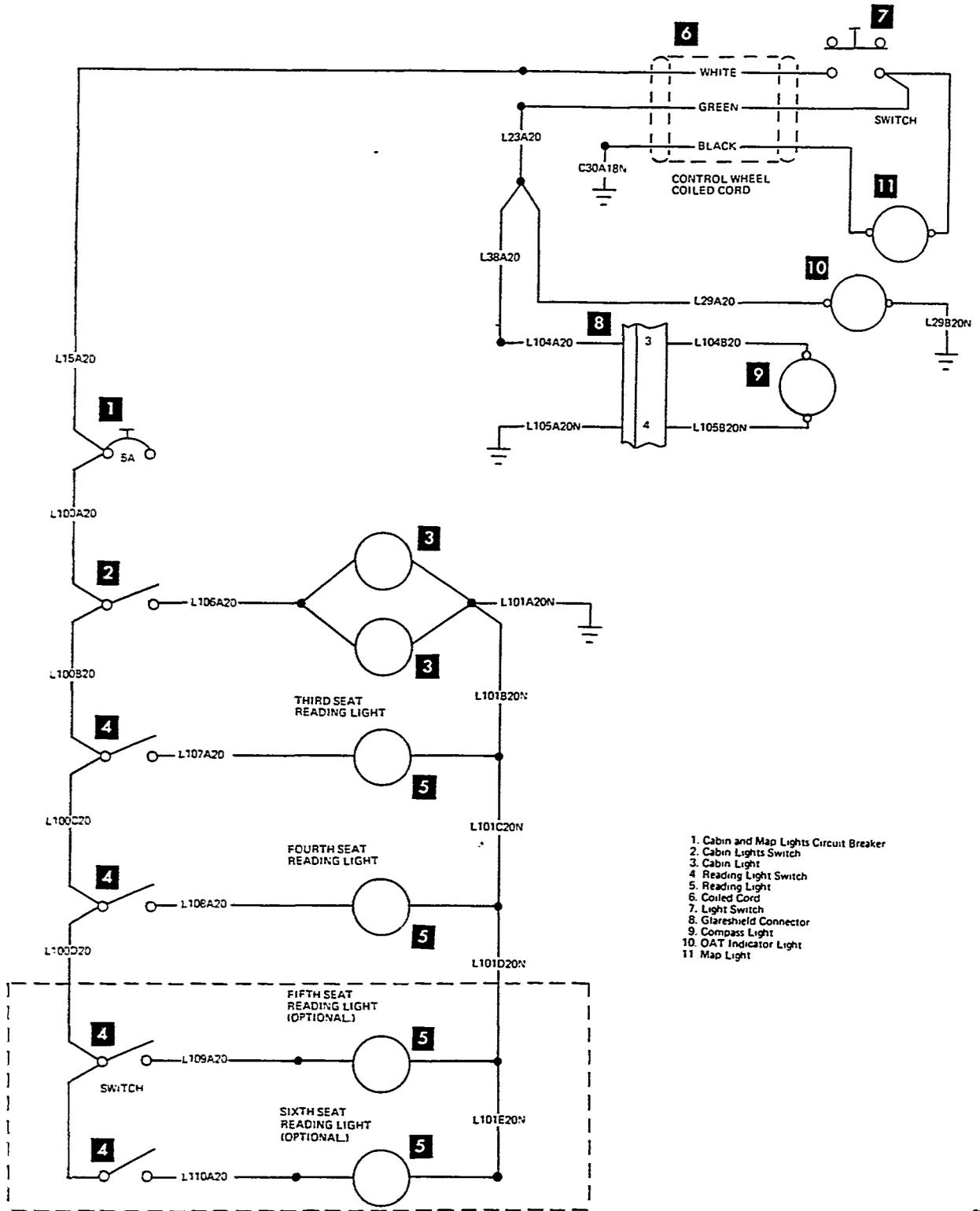
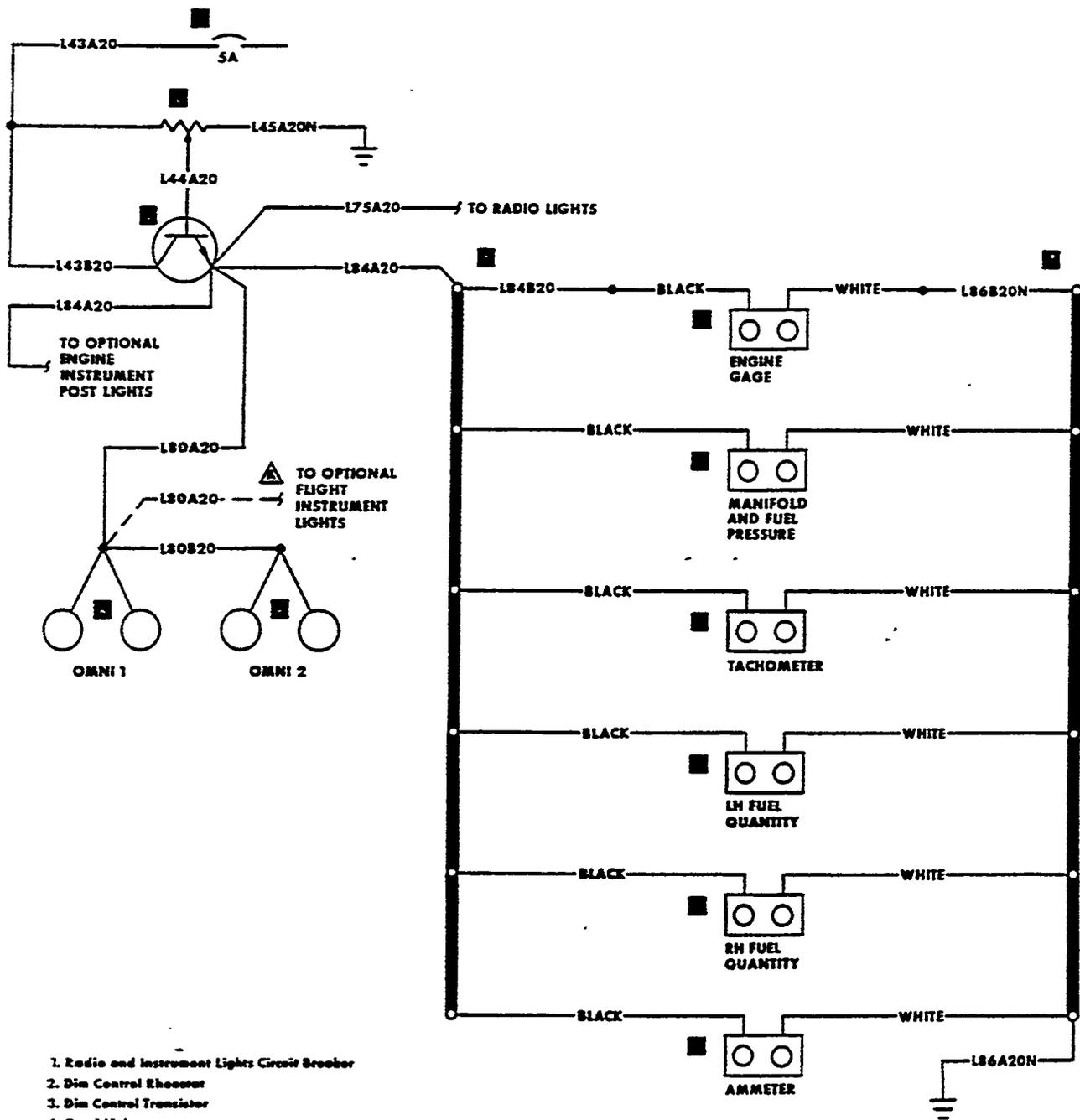


Figure 14-15A. Interior Lights
 E-477 thru E-762 except E-710

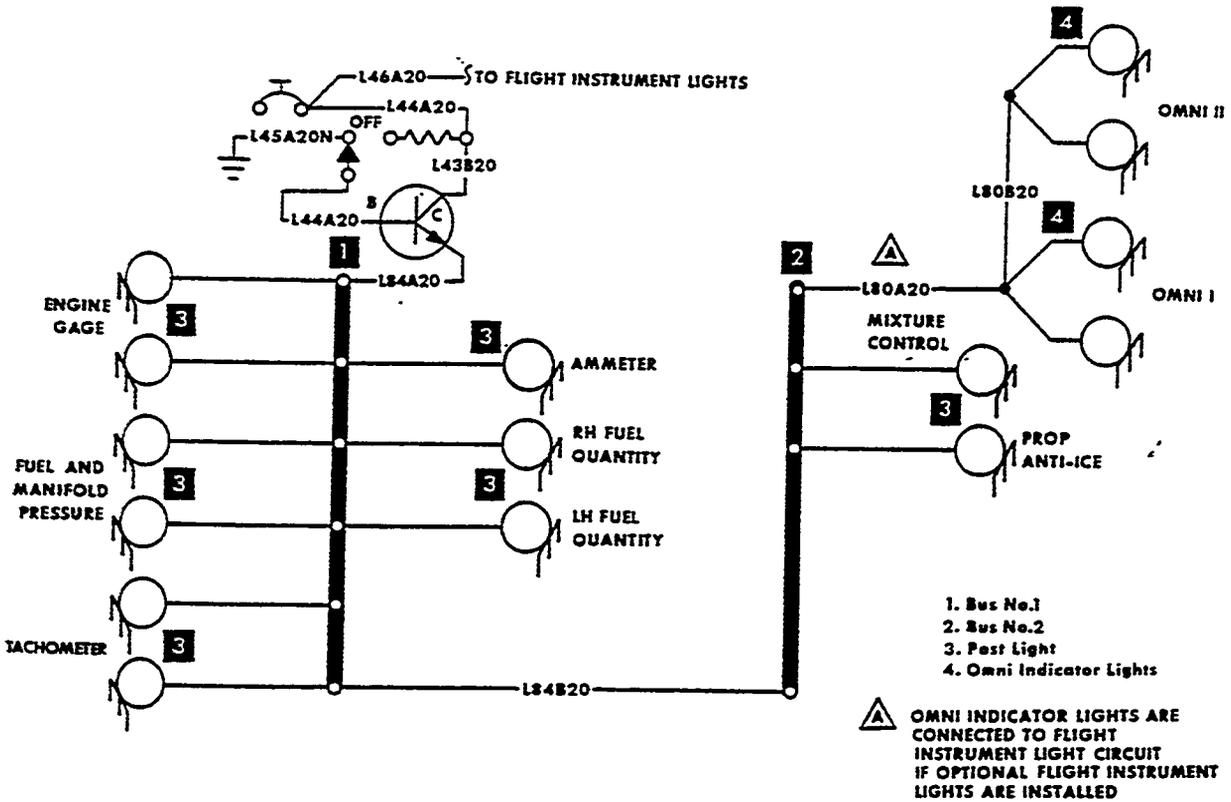


- 1. Radio and Instrument Lights Circuit Breaker
- 2. Dim Control Rheostat
- 3. Dim Control Transistor
- 4. Omni Lights
- 5. Wedge Lights
- 6. Sec No. 3
- 7. Sec No. 4

⚠ OMNI LIGHTS CONNECTED TO FLIGHT INSTRUMENT DIMMING WHEN OPTIONAL FLIGHT INSTRUMENT LIGHTS INSTALLED

G33-389-95A

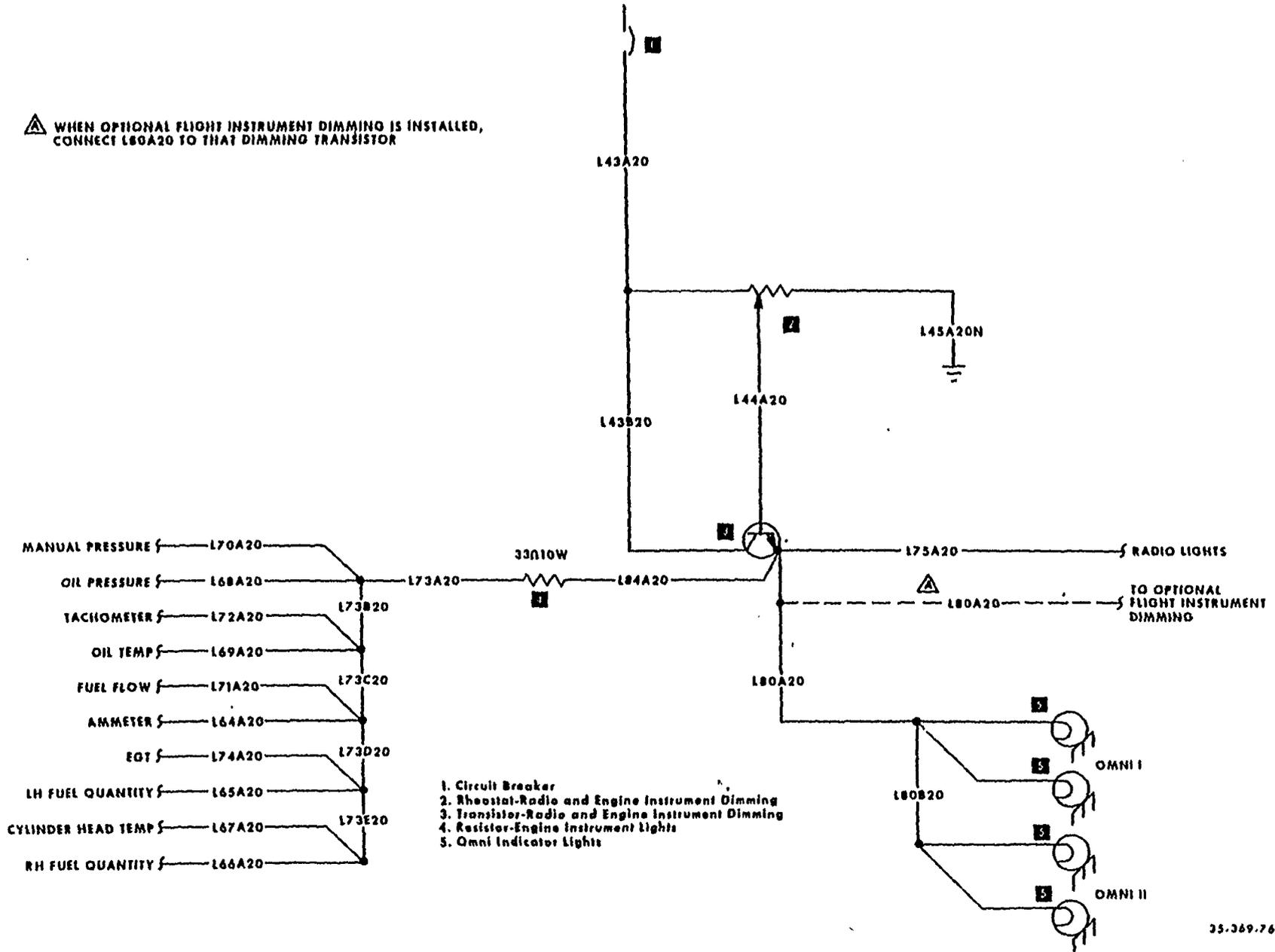
Figure 14-16. Engine Instrument Wedge Lights E-185 thru E-282



G33-369-84 A

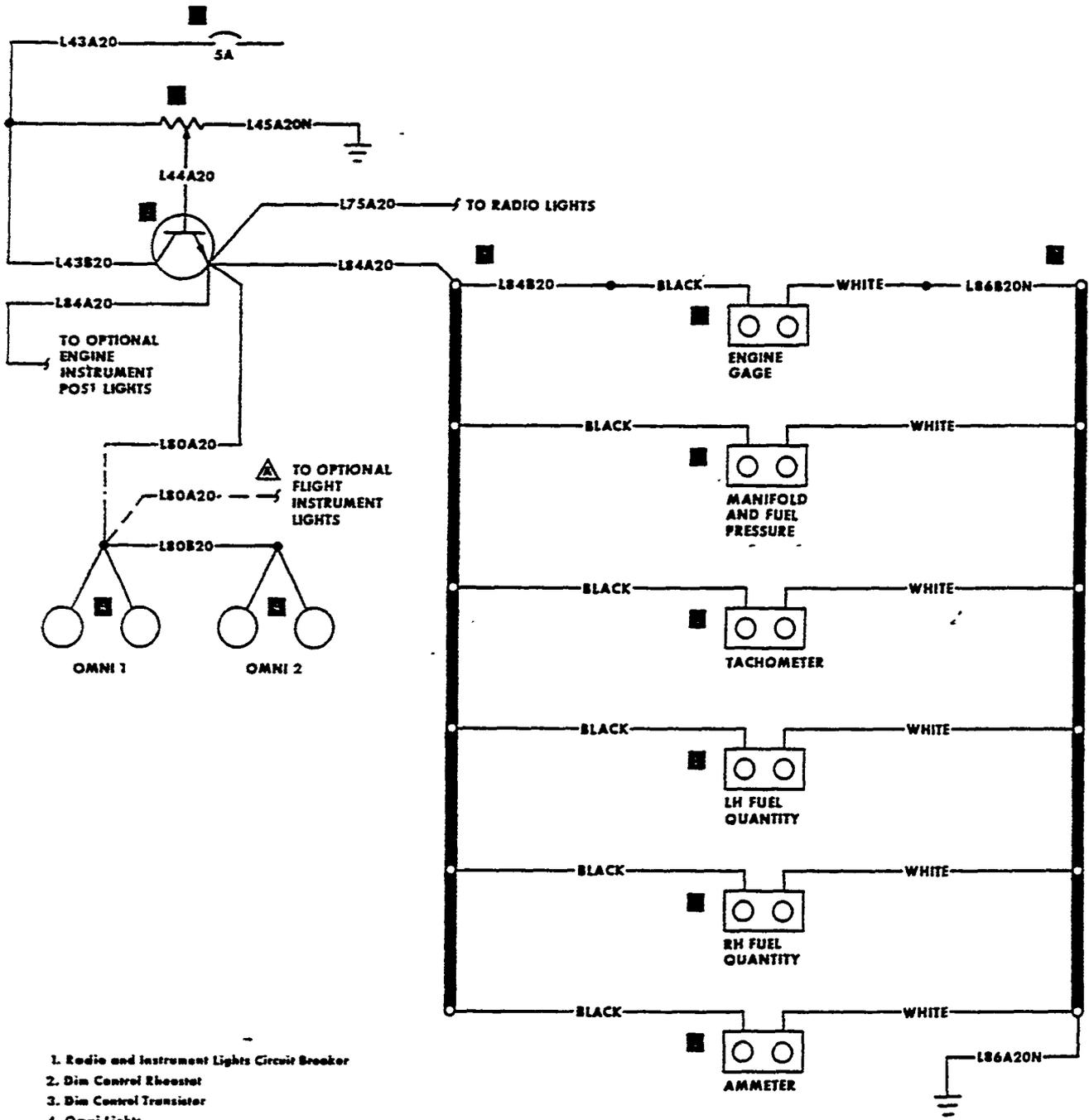
Figure 14-16A. Engine Instrument Post Lights
E-269 thru E-282

Figure 14-16B. Engine Instrument Lights (Vertical Instruments)
E-283 thru E-363



35-369-76

36-590001-3B/5

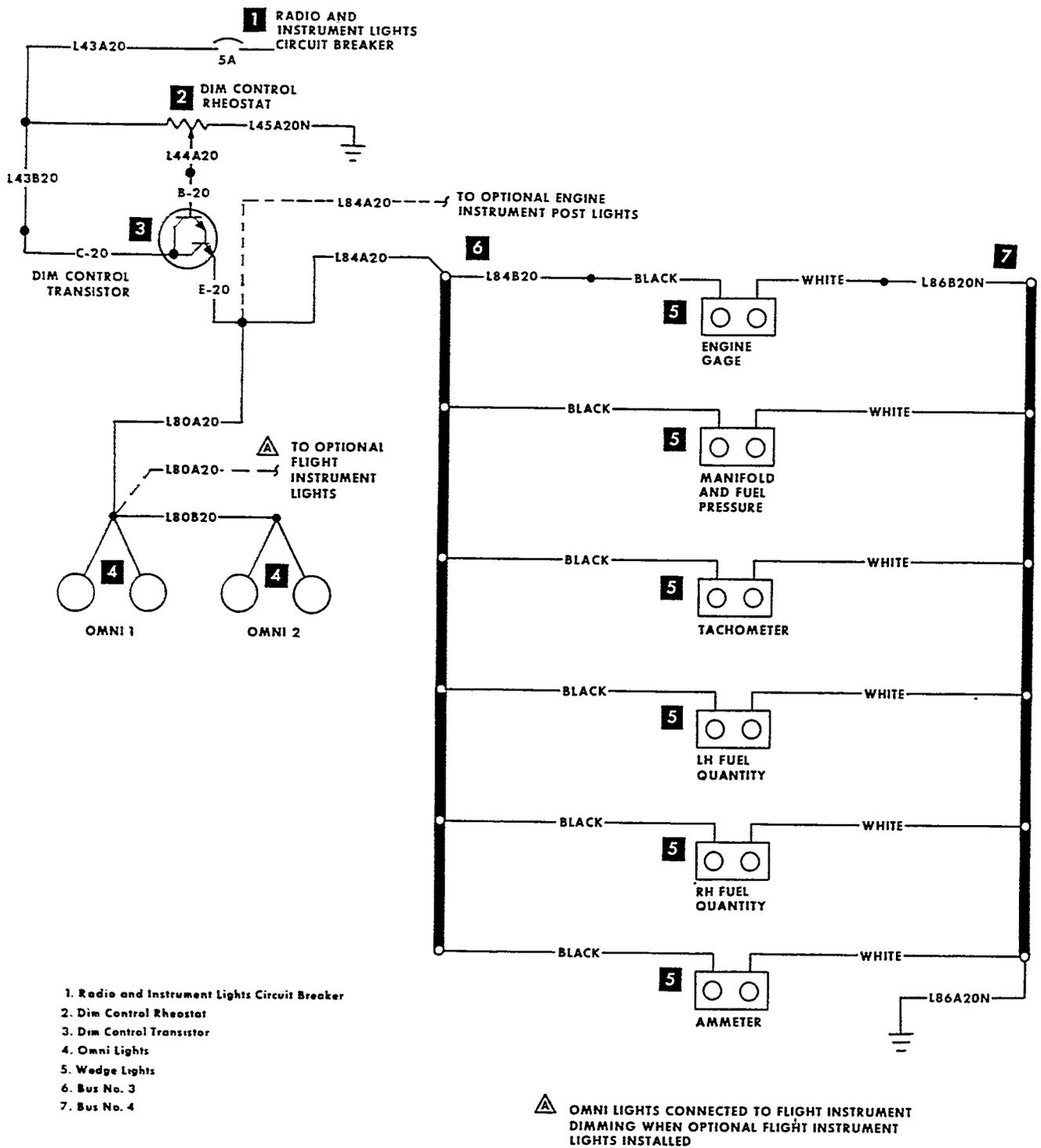


- 1. Radio and Instrument Lights Circuit Breaker
- 2. Dim Control Rheostat
- 3. Dim Control Transistor
- 4. Omni Lights
- 5. Wedge Lights
- 6. Bus No. 3
- 7. Bus No. 4

⚠️ OMNI LIGHTS CONNECTED TO FLIGHT INSTRUMENT DIMMING WHEN OPTIONAL FLIGHT INSTRUMENT LIGHTS INSTALLED

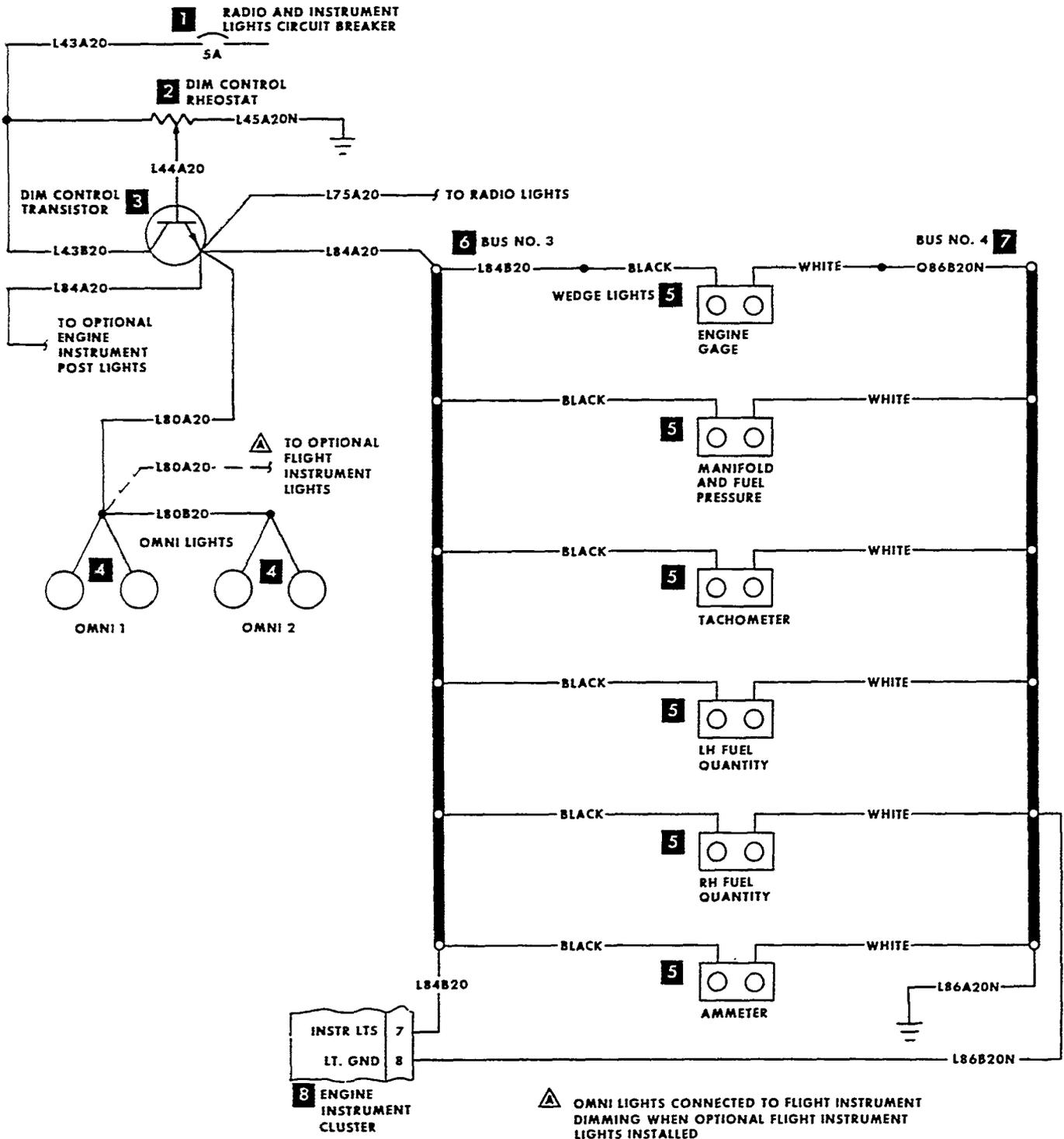
G23-388-85A

Figure 14-16C. Engine Instrument Wedge Lights E-364 thru E-493



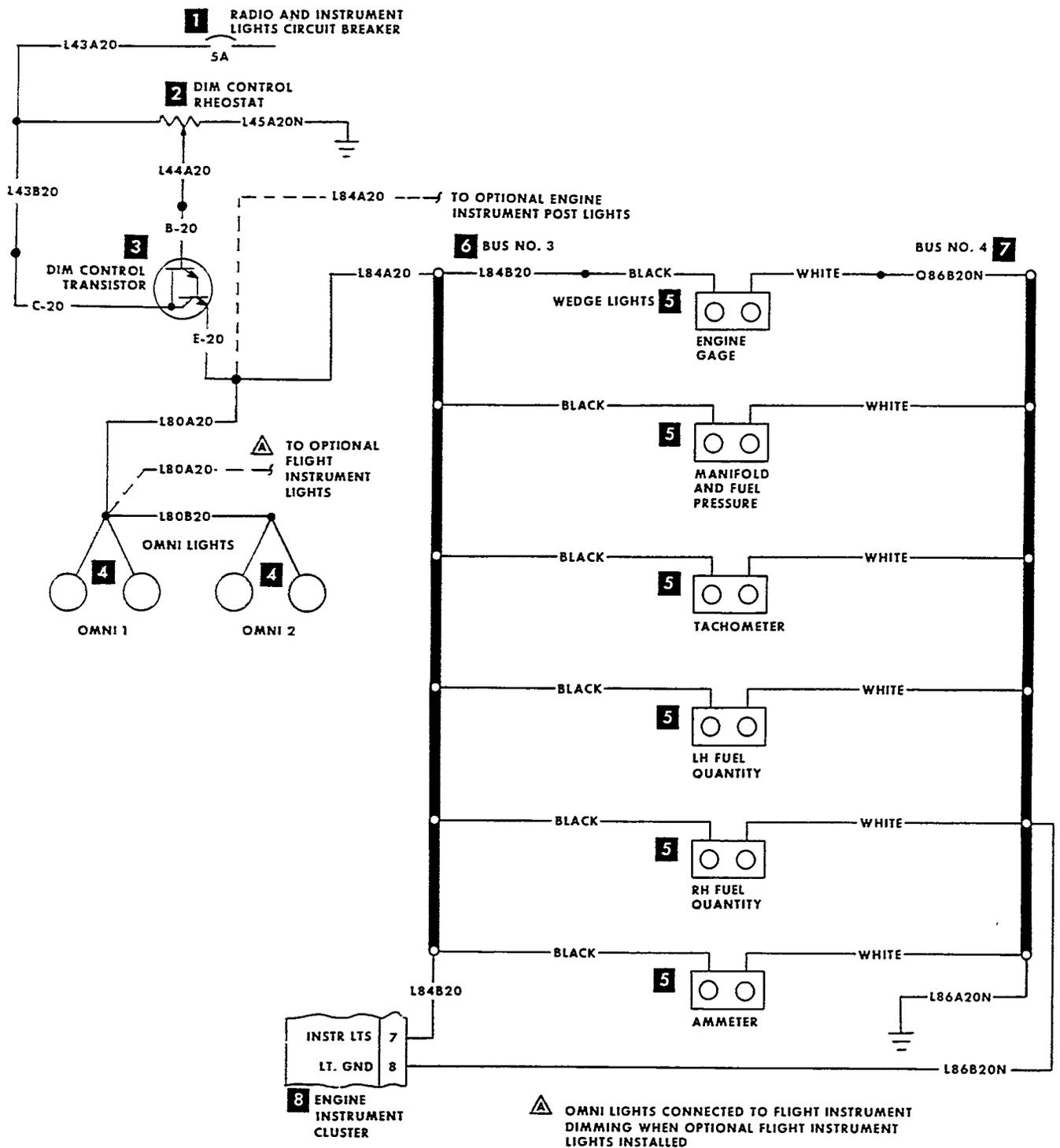
G33-369-85B

Figure 14-16C. Engine Instrument Wedge Lights ; E-494 thru E-762 except E-710



F33A-369-298

Figure 14-16D. Optional Internally Lit Instruments E-364 thru E-493



F33A-369-298A

Figure 14-16D. Optional Internally Lit Instruments E-494 thru E-762 except E-710

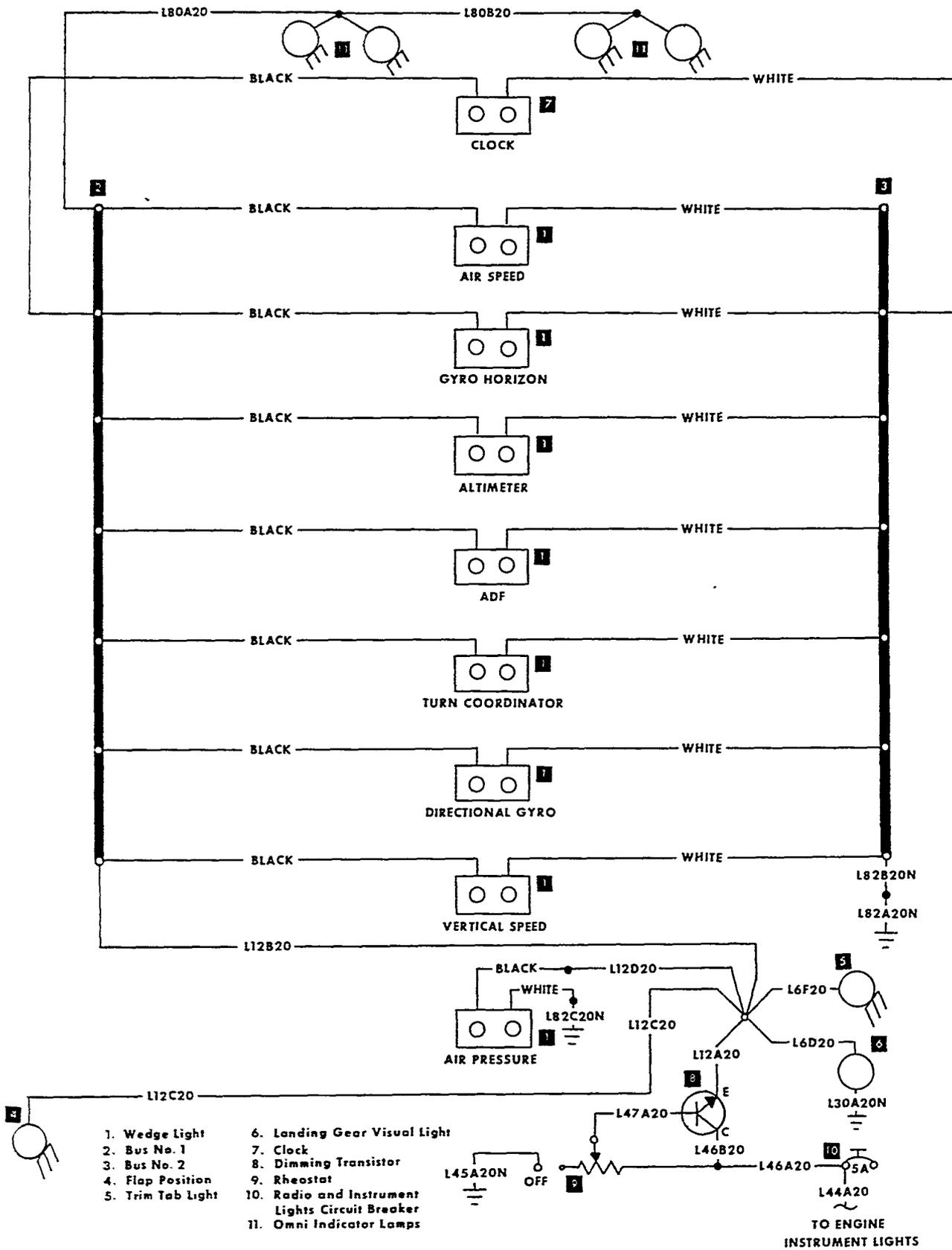


Figure 14-17. Flight Instrument Wedge Lights E-185 thru E-762 except E-710

G33-369-86A

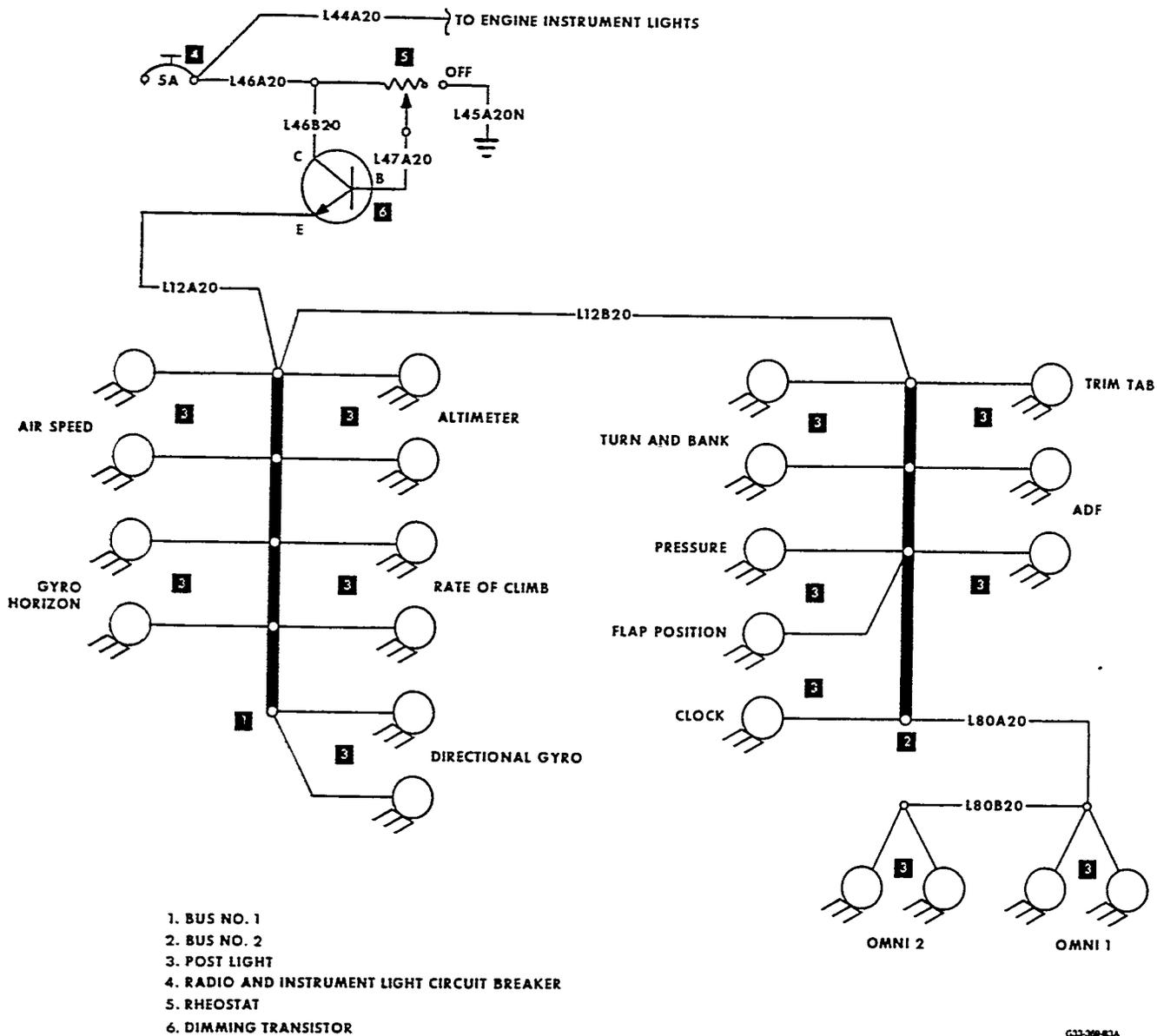
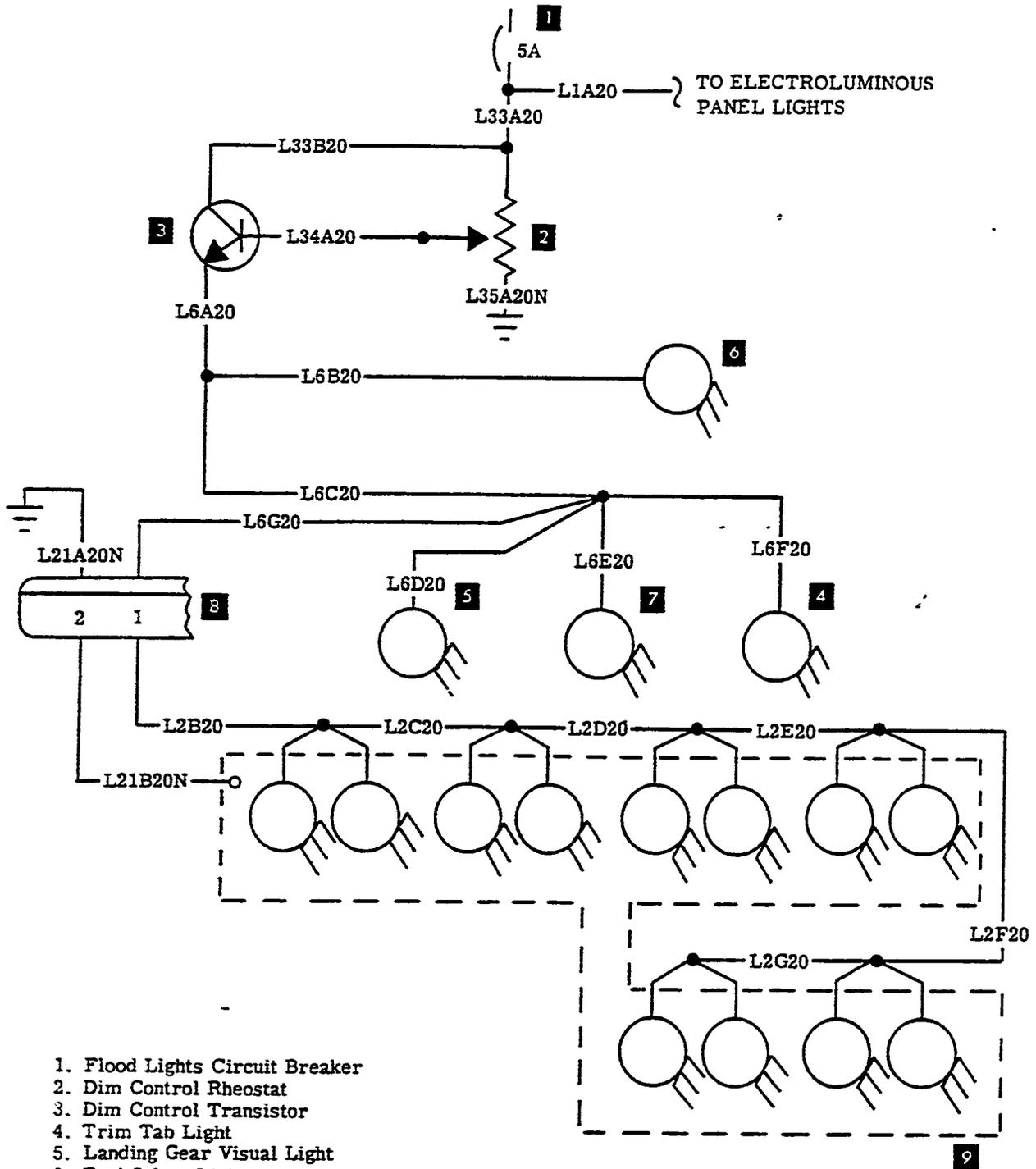
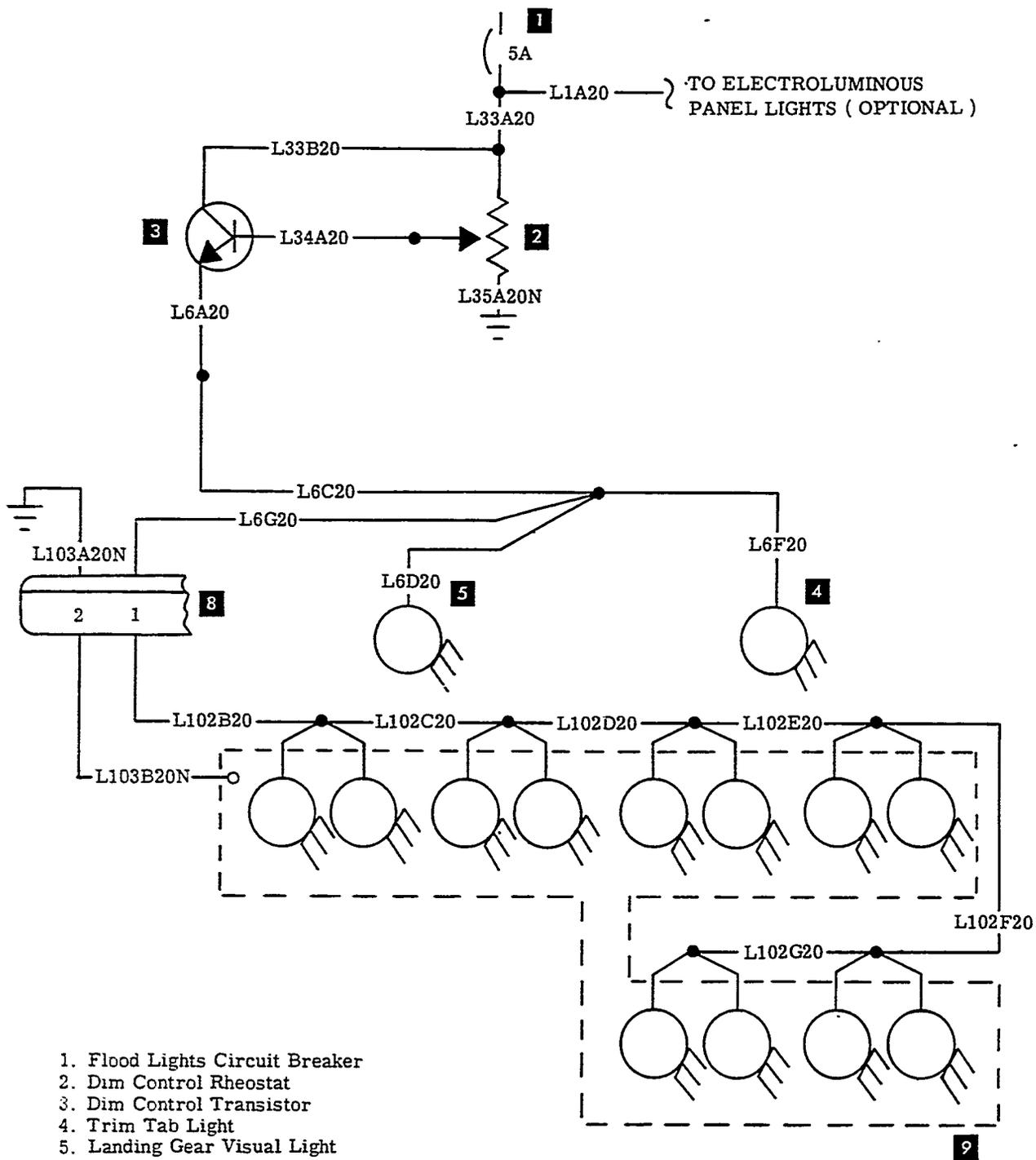


Figure 14-17. Flight Instrument Post Lights E-269 thru E-493



- 1. Flood Lights Circuit Breaker
- 2. Dim Control Rheostat
- 3. Dim Control Transistor
- 4. Trim Tab Light
- 5. Landing Gear Visual Light
- 6. Fuel Select Light
- 7. Clock Light (Optional)
- 8. Glareshield Connector
- 9. Glareshield Flood Lights

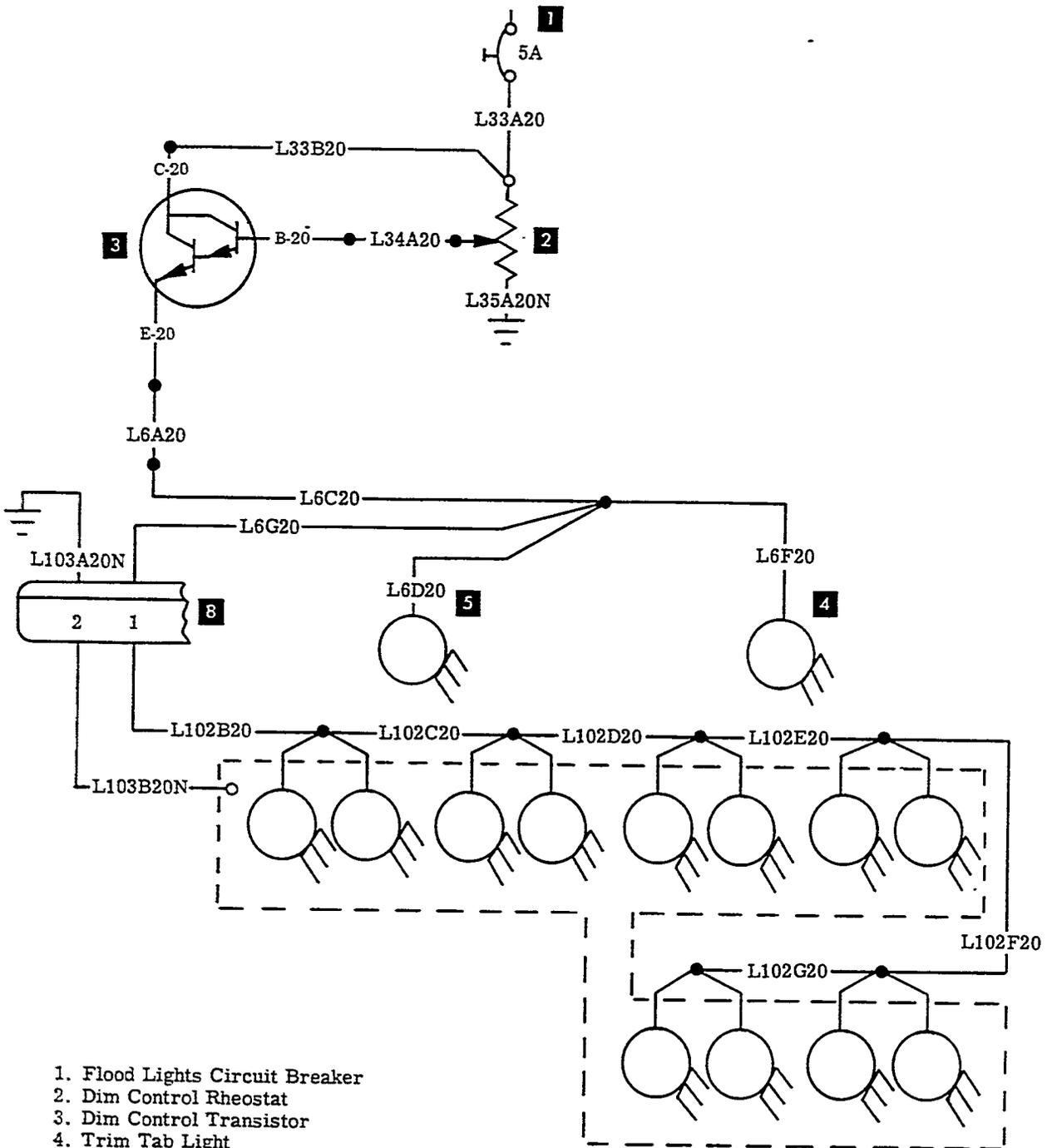
Figure 14-18. Instrument Flood Lights
E-185 thru E-282



1. Flood Lights Circuit Breaker
2. Dim Control Rheostat
3. Dim Control Transistor
4. Trim Tab Light
5. Landing Gear Visual Light
6. Not Used
7. Not Used
8. Glareshield Connector
9. Glareshield Flood Lights

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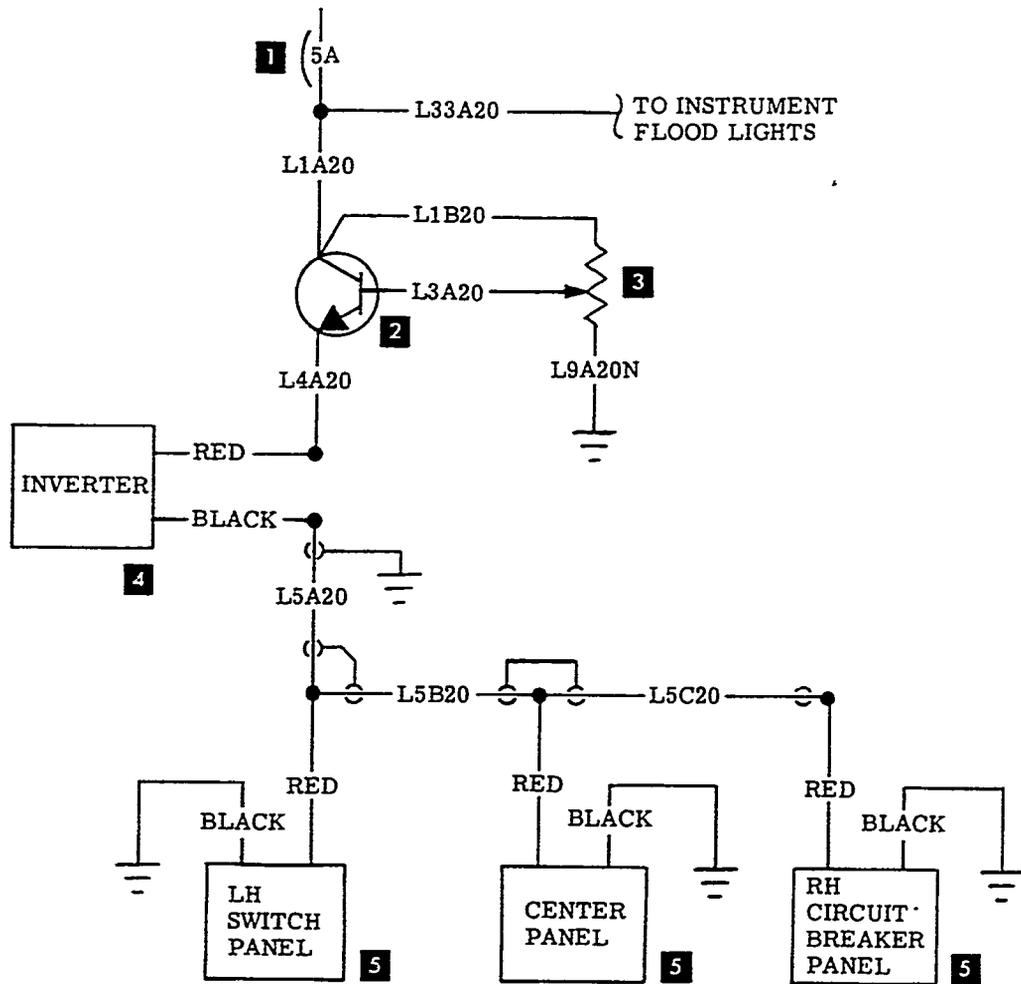
Figure 14-18A. Instrument Flood Lights
E-283 thru E-493



- 1. Flood Lights Circuit Breaker
- 2. Dim Control Rheostat
- 3. Dim Control Transistor
- 4. Trim Tab Light
- 5. Landing Gear Visual Light
- 6. Not Used
- 7. Not Used
- 8. Glareshield Connector
- 9. Glareshield Flood Lights

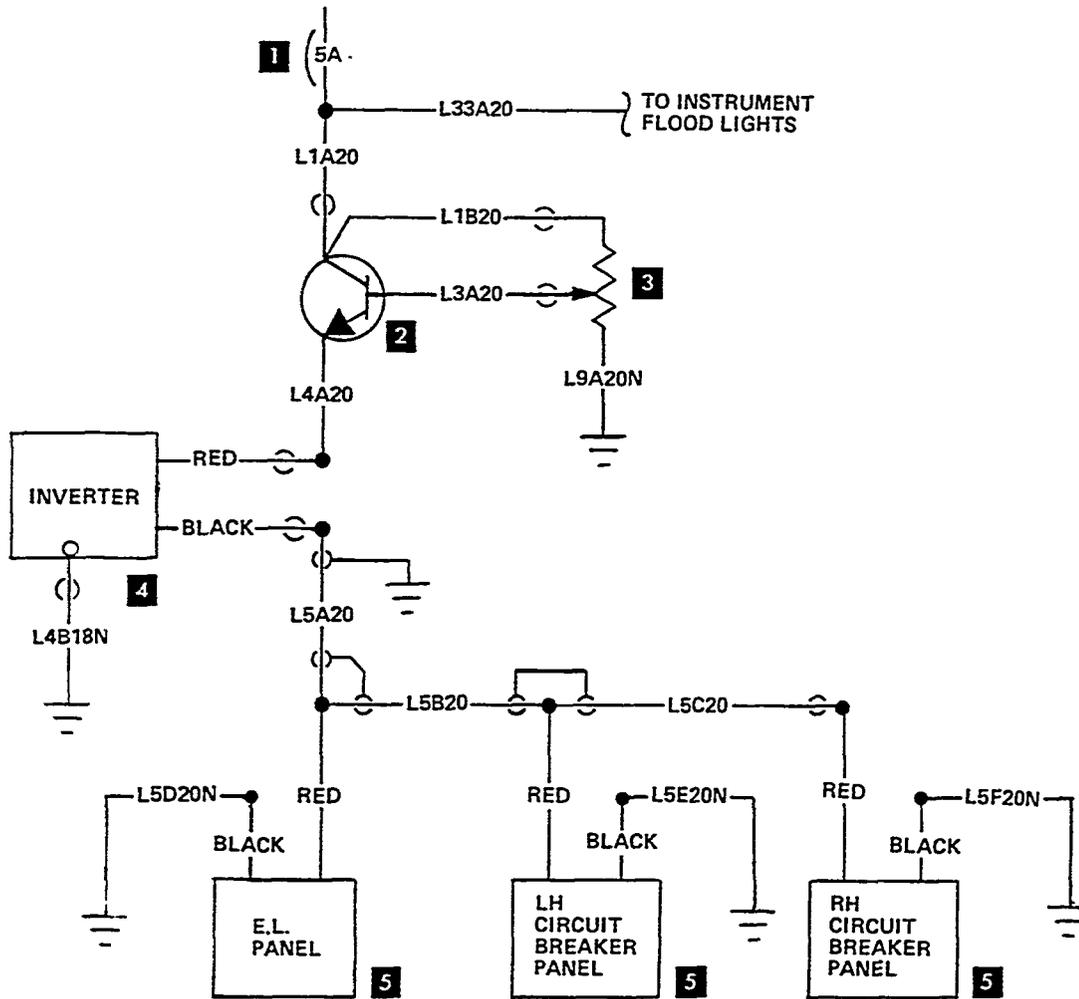
V35B-369-54A

Figure 14-18A. Instrument Flood Lights
E-494 thru E-762 except E-710



1. Flood Lights Circuit Breaker
2. Electroluminescent Panel Lights Dim Transistor
3. Dim Control Rheostat
4. Inverter
5. Electroluminescent Panel

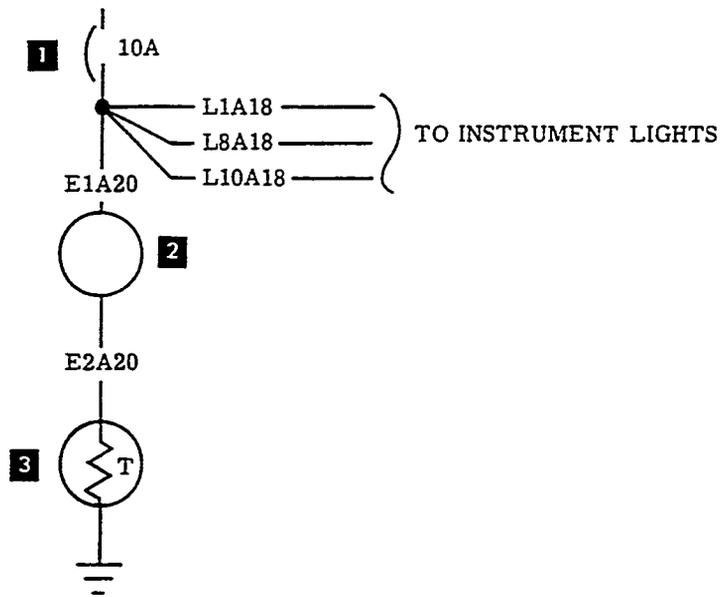
Figure 14-19. Electroluminescent Panel Lights
E-185 thru E-476



V35B-369-57B

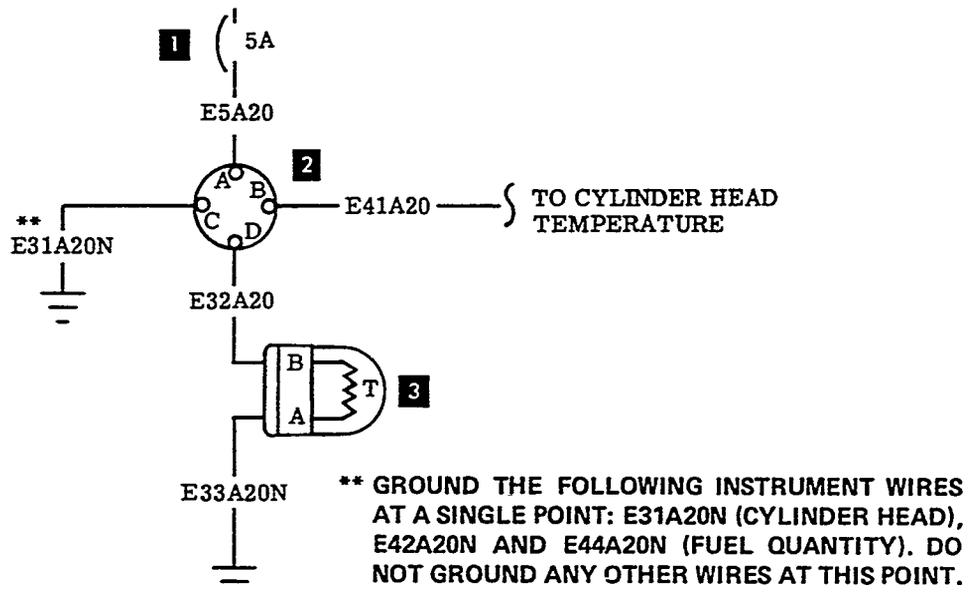
1. Flood Lights Circuit Breaker
2. Electroluminescent Panel Lights Dim Transistor
3. Dim Control Rheostat
4. Inverter
5. Electroluminescent Panel

Figure 14-19. Electroluminescent Panel Lights
E-477 thru E-762 except E-710



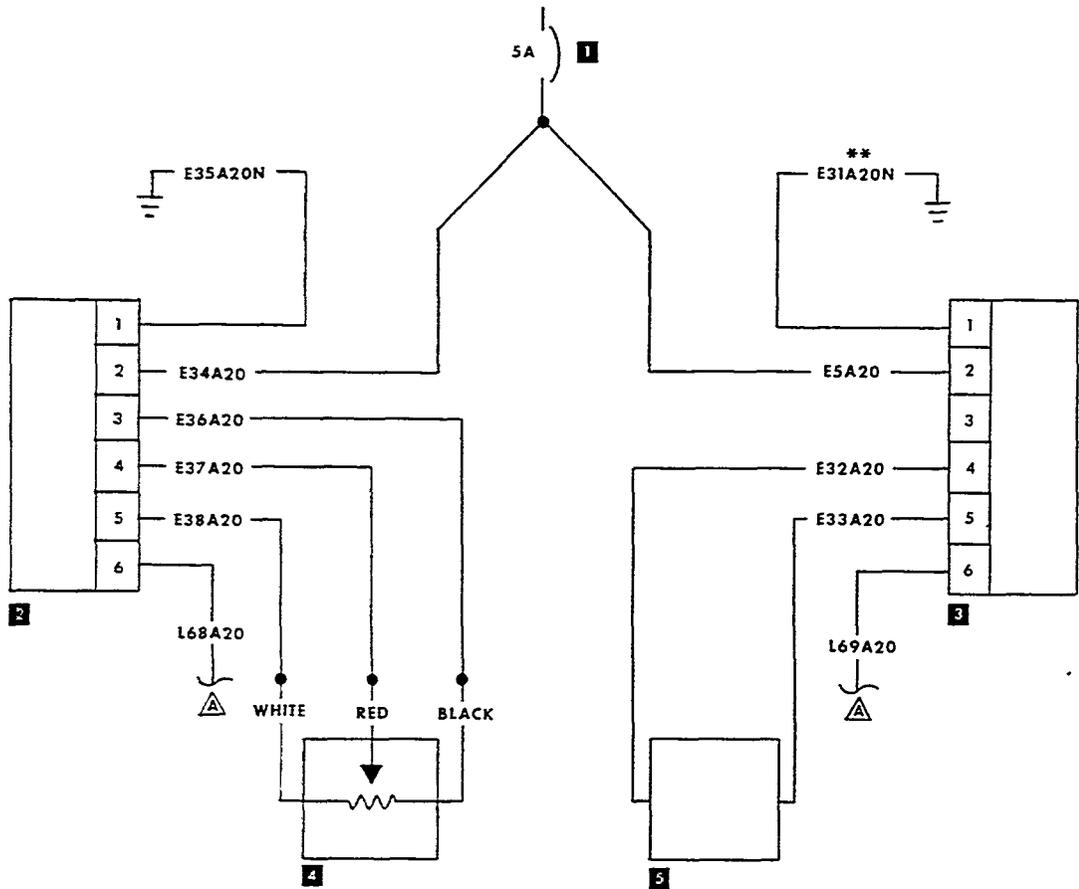
1. Instrument Lights Circuit Breaker
2. Oil Temperature Indicator
3. Oil Temperature Transmitter

Figure 14-20. Oil Temperature E-1 thru E-184



1. Cylinder Head and Oil Temperature Circuit Breaker
2. Cylinder head, Oil Temperature, and Oil Pressure Indicator
3. Oil Temperature Transmitter Bulb

Figure 14-20A. Oil Temperature E-185 thru E-282



1. Circuit Breaker
2. Oil Pressure Indicator
3. Oil Temperature Indicator
4. Oil Pressure Transmitter
5. Oil Temperature Transmitter

△ To Engine Instrument Lights

35-369-74

**** GROUND THE FOLLOWING INSTRUMENT WIRES AT A SINGLE POINT: E31A20N (OIL TEMPERATURE), E39A20N (CYLINDER HEAD TEMPERATURE), E42A20N AND E44A20N (FUEL QUANTITY). DO NOT GROUND ANY OTHER WIRES AT THIS POINT.**

**Figure 14-20B. Oil Temperature and Oil Pressure (Vertical Instruments)
E-283 thru E-363**

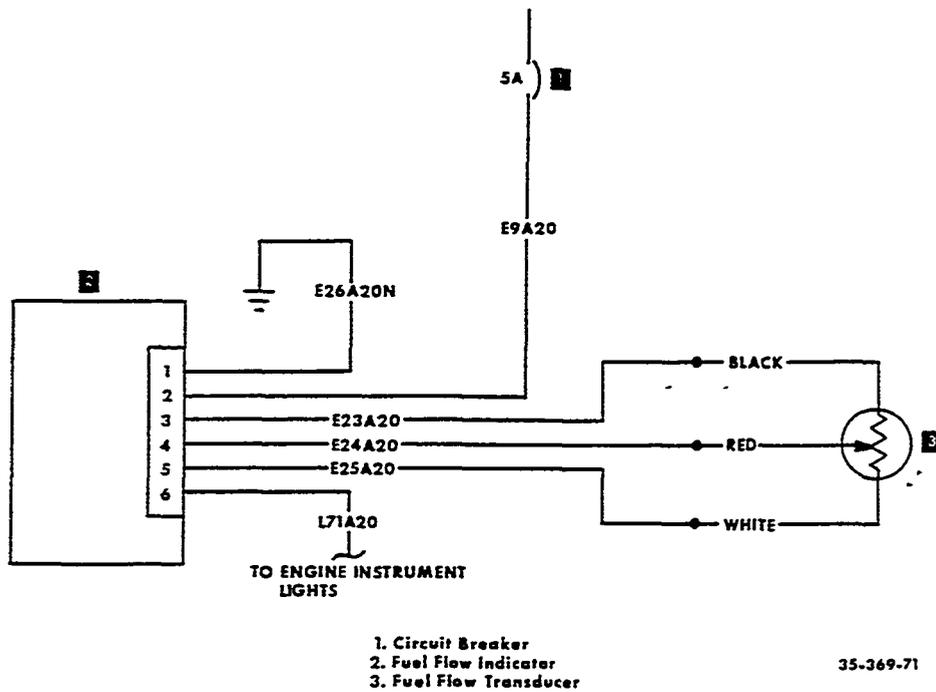


Figure 14-21. Fuel Flow Indicator (Vertical Instruments)
 E-283 thru E-363

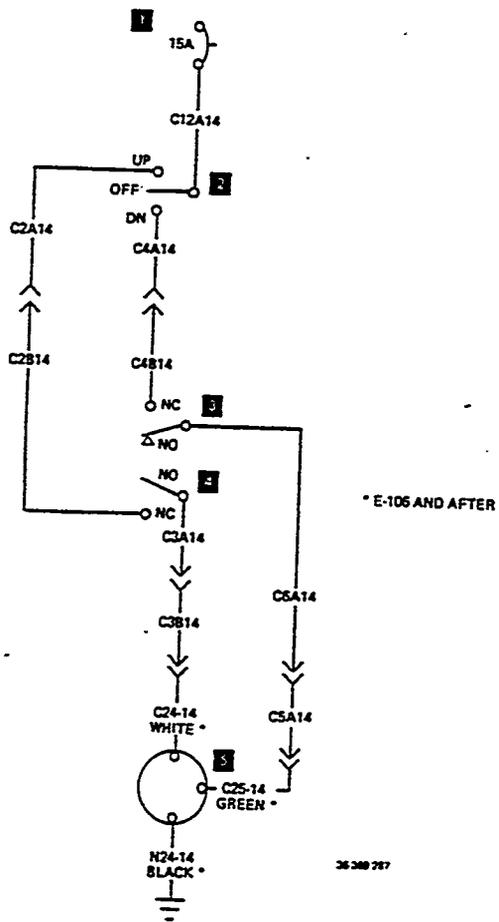


Figure 14-22. Flap Motor
E-1 thru E-762 except E-710

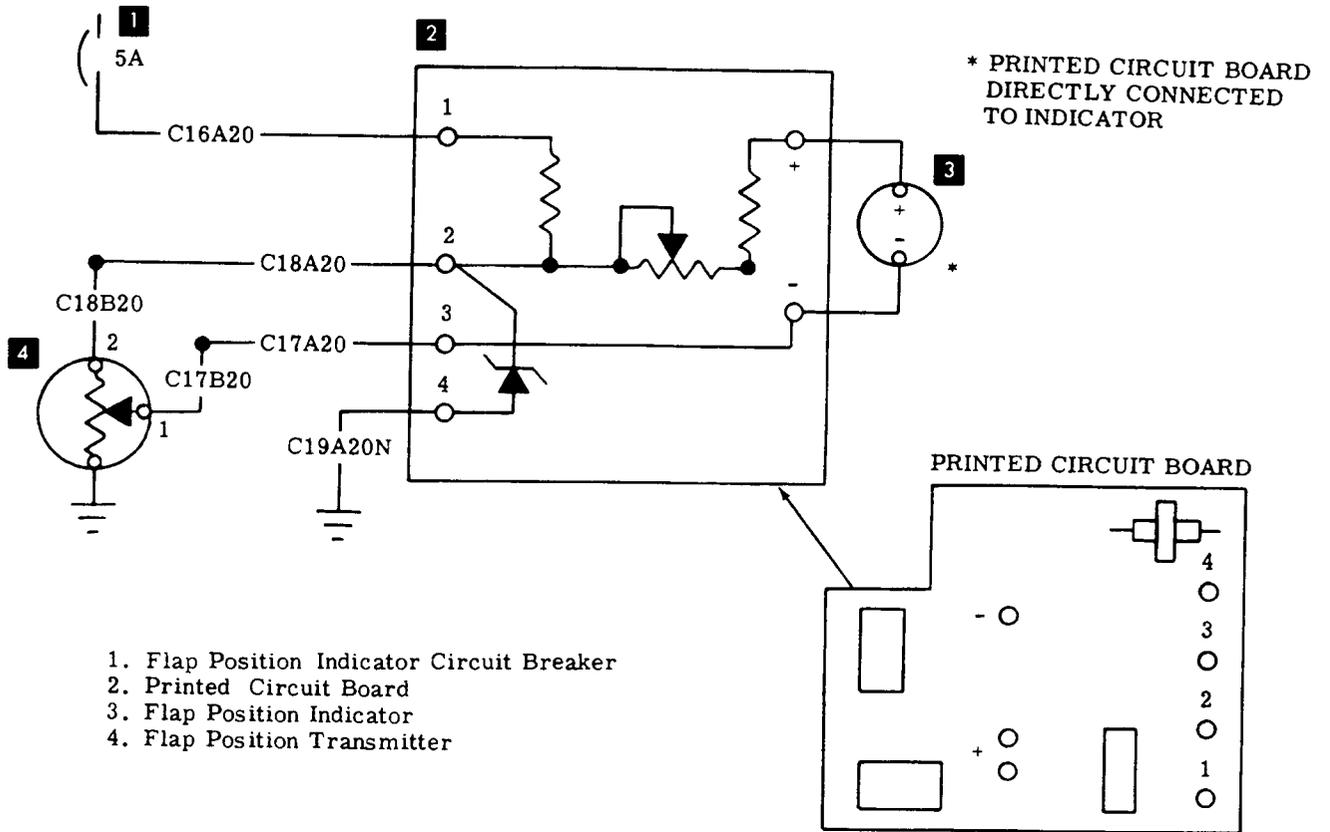
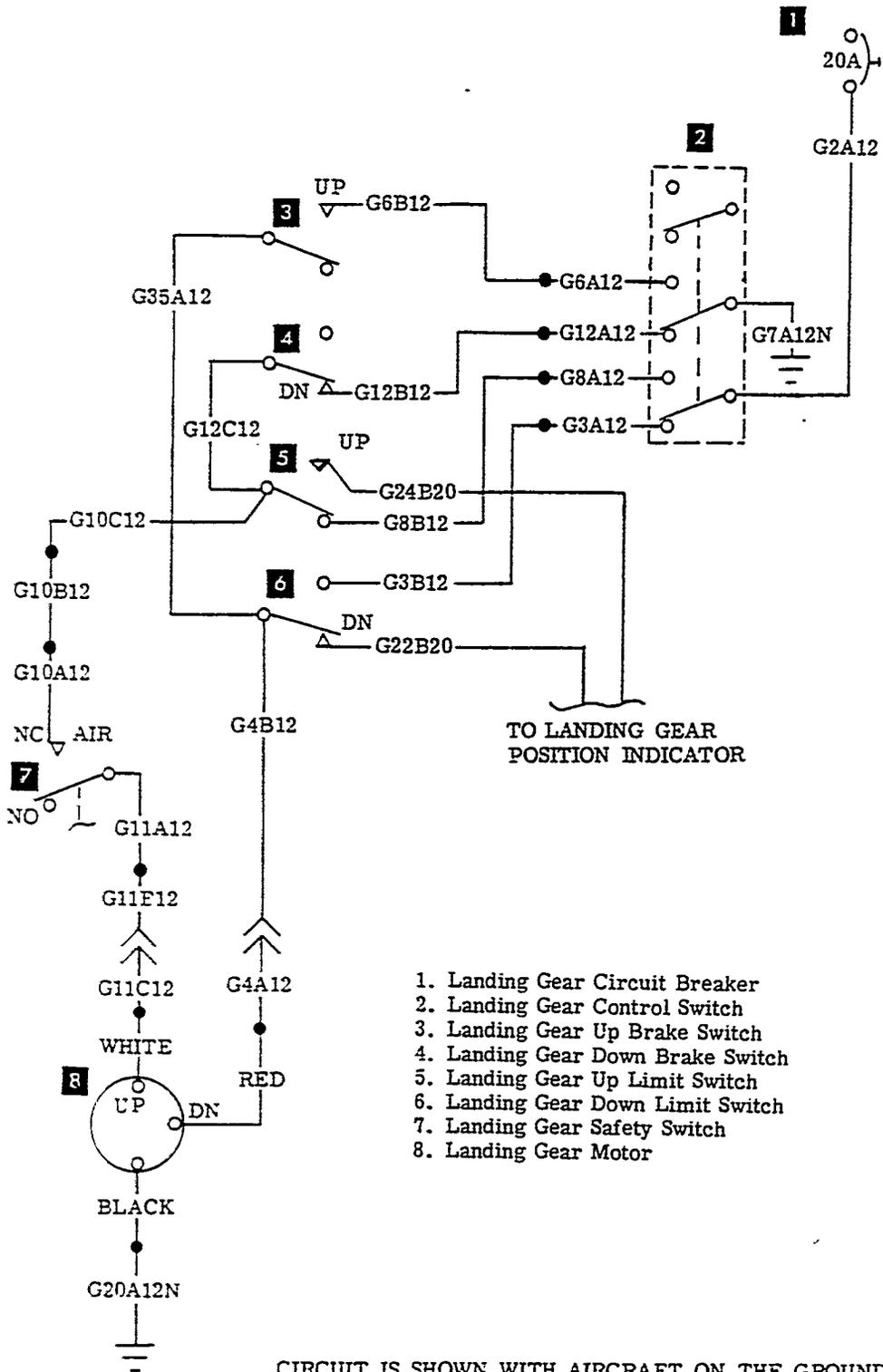


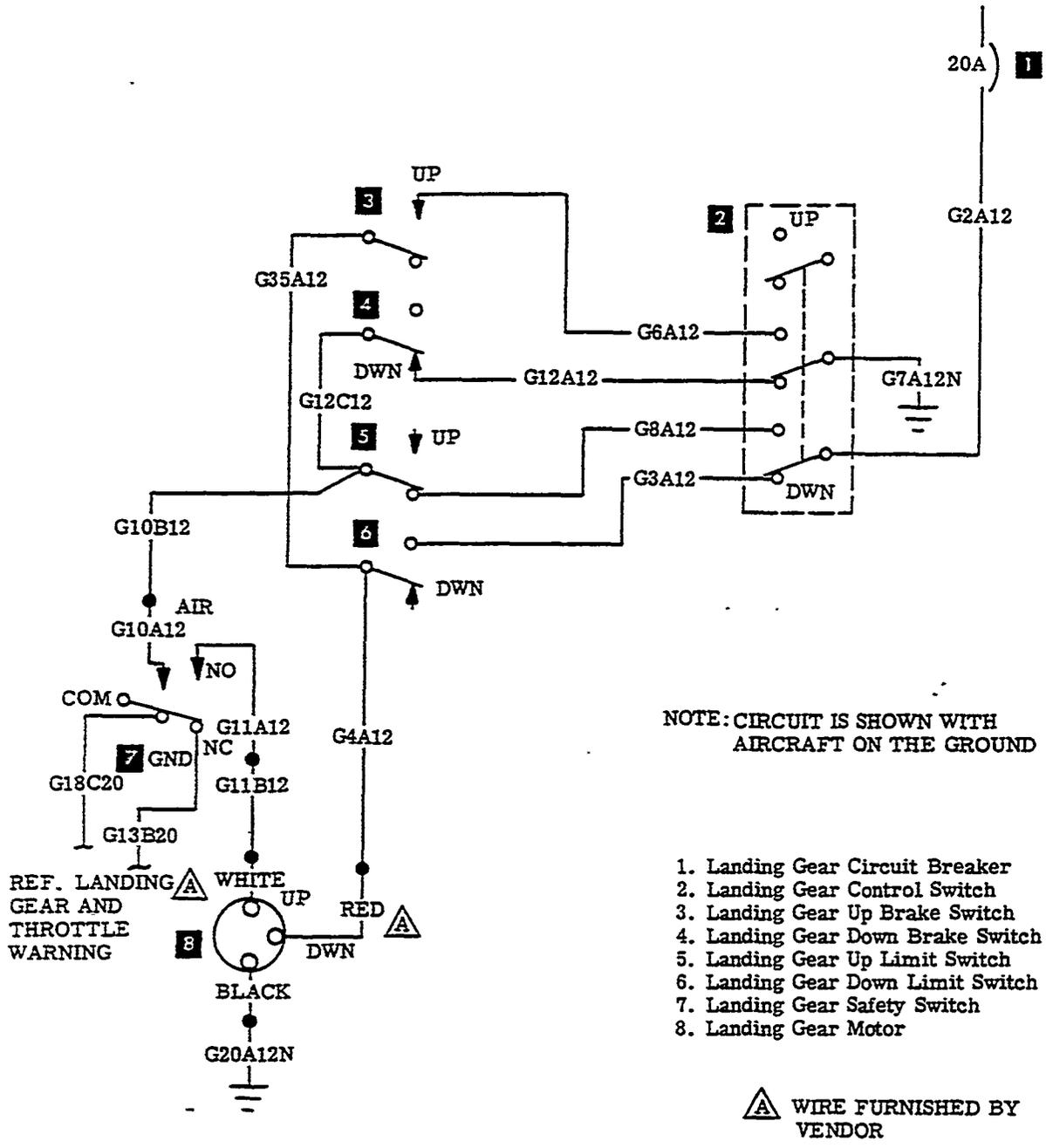
Figure 14-23. Flap Position Indicator E-1 thru E-762 except E-710

V35-369-26



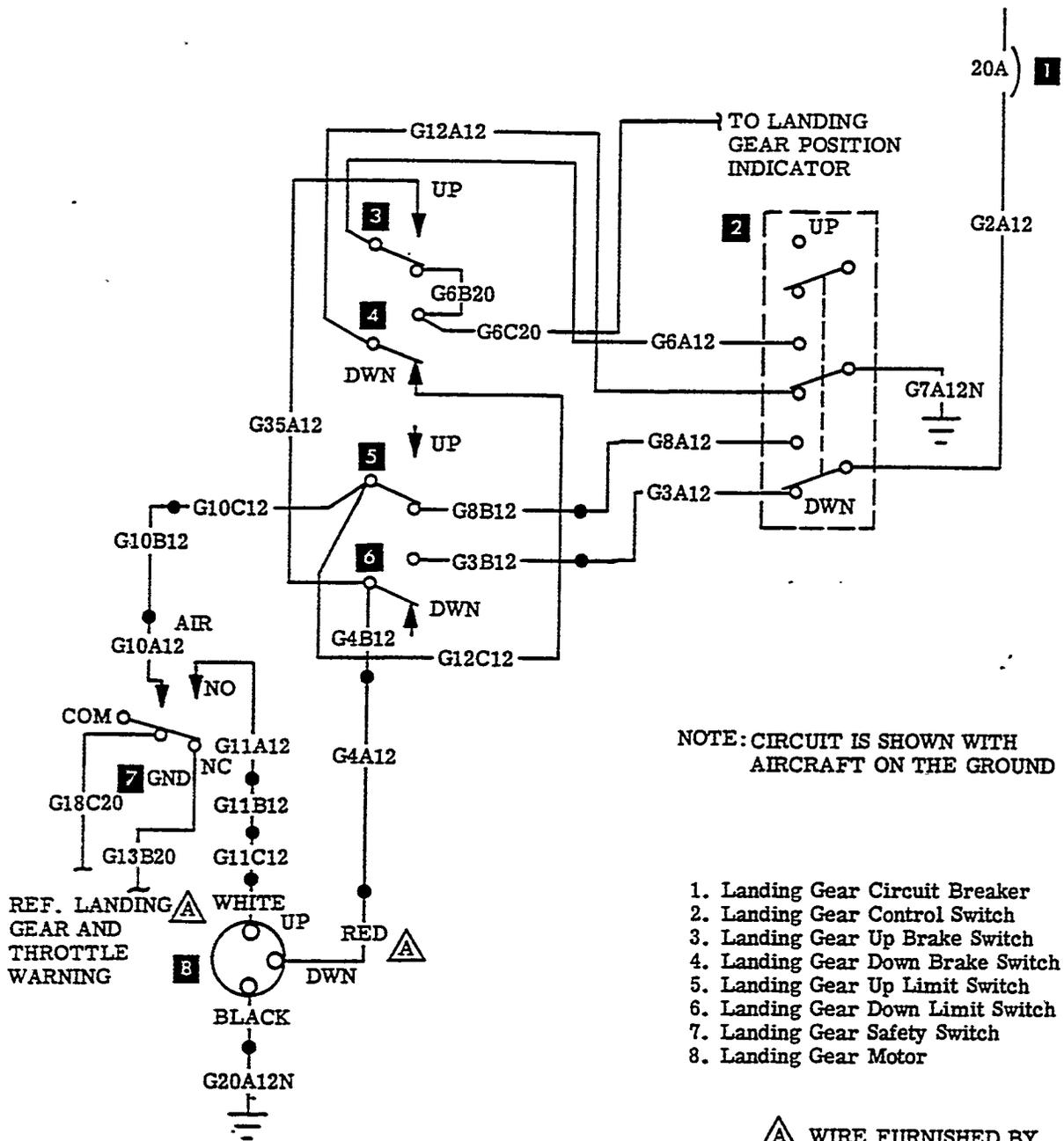
1. Landing Gear Circuit Breaker
2. Landing Gear Control Switch
3. Landing Gear Up Brake Switch
4. Landing Gear Down Brake Switch
5. Landing Gear Up Limit Switch
6. Landing Gear Down Limit Switch
7. Landing Gear Safety Switch
8. Landing Gear Motor

Figure 14-24. Landing Gear (Without Safety System)
E-1 thru E-184



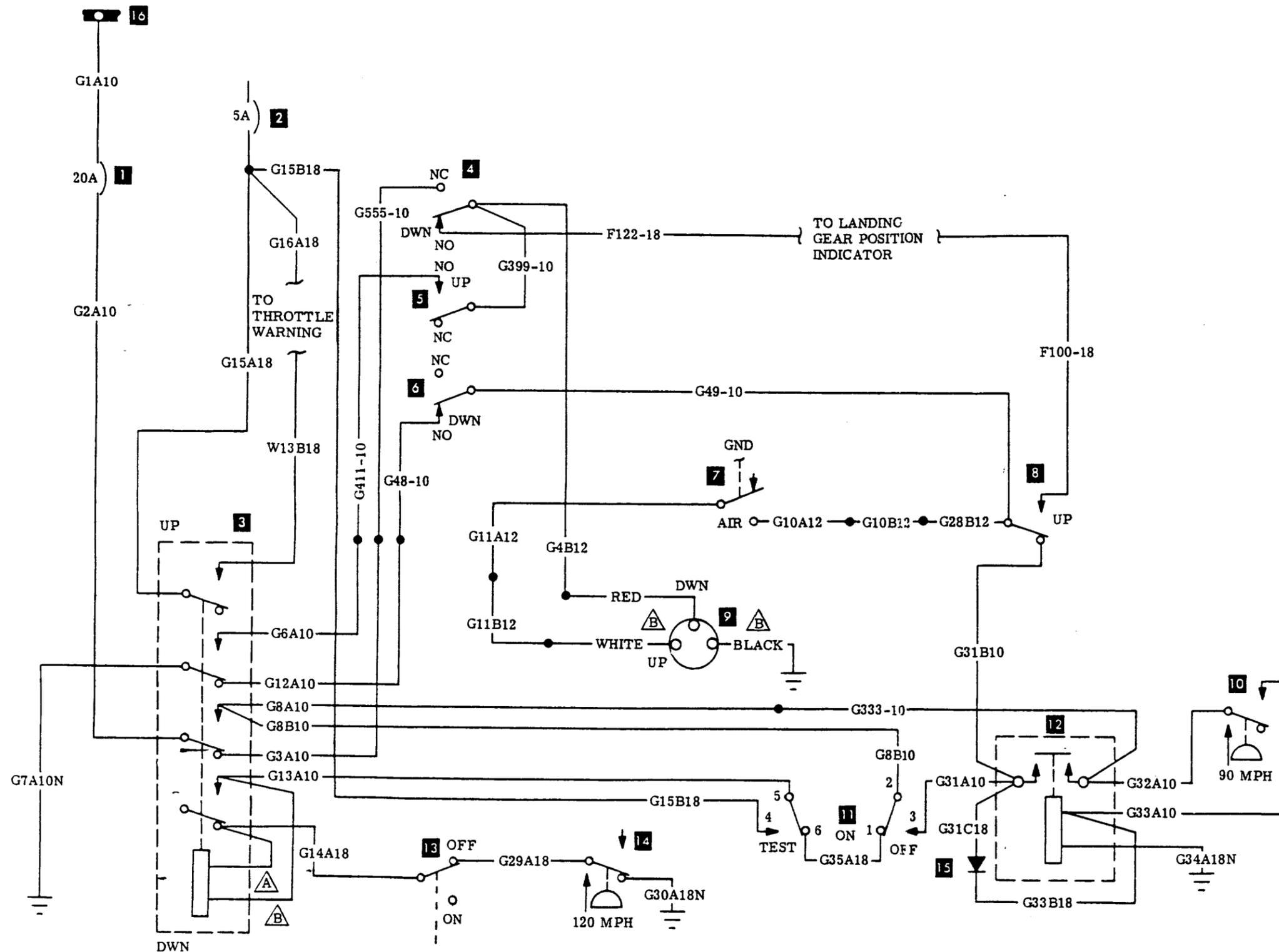
V358-369-28

Figure 14-24A. Landing Gear (Without Safety System)
E-183 thru E-225



G33-369-81

Figure 14-24B. Landing Gear (Without Safety System)
E-226 thru E-603



NOTE: CIRCUIT SHOWN WITH AIRCRAFT ON THE GROUND AND THROTTLE OFF

1. Landing Gear Circuit Breaker
2. Throttle and Landing Gear Warn Circuit Breaker
3. Landing Gear Control Switch
4. Landing Gear Down Limit Switch
5. Landing Gear Up Brake Switch
6. Landing Gear Down Brake Switch
7. Landing Gear Safety Switch
8. Landing Gear Up Limit Switch
9. Landing Gear Motor
10. 90 MPH Pressure Switch
11. Landing Gear Safety System Switch
12. Landing Gear Safety Relay
13. Throttle Control Switch
14. 120 MPH Pressure Switch
15. Diode
16. Bus

- △ LATCHING SOLENOID
- △ WIRES FURNISHED BY VENDOR

Figure 14-25. Landing Gear (With Safety System)
E-1 thru E-184

NOTE: CIRCUIT SHOWN WITH AIRCRAFT ON GROUND AND THROTTLE OFF

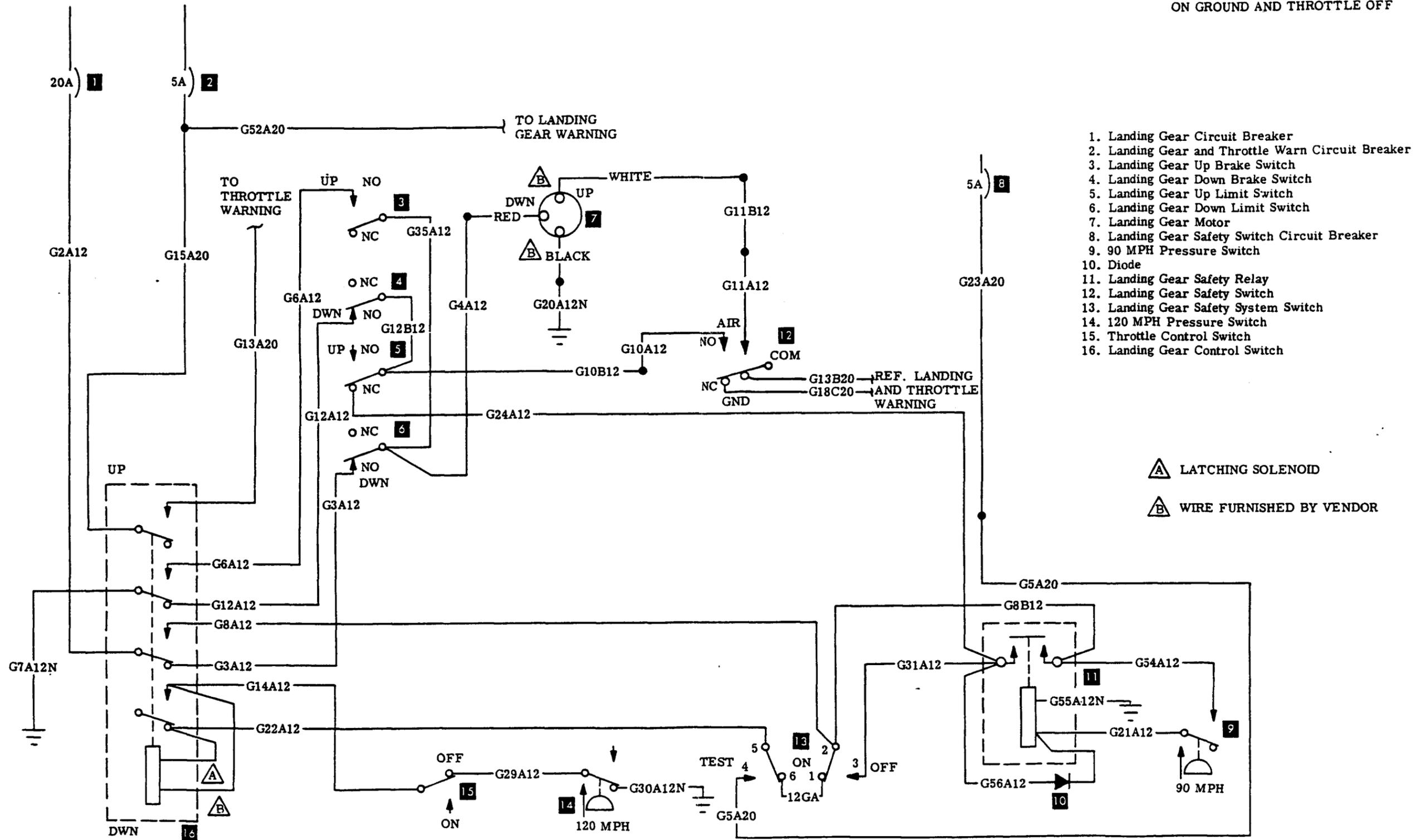
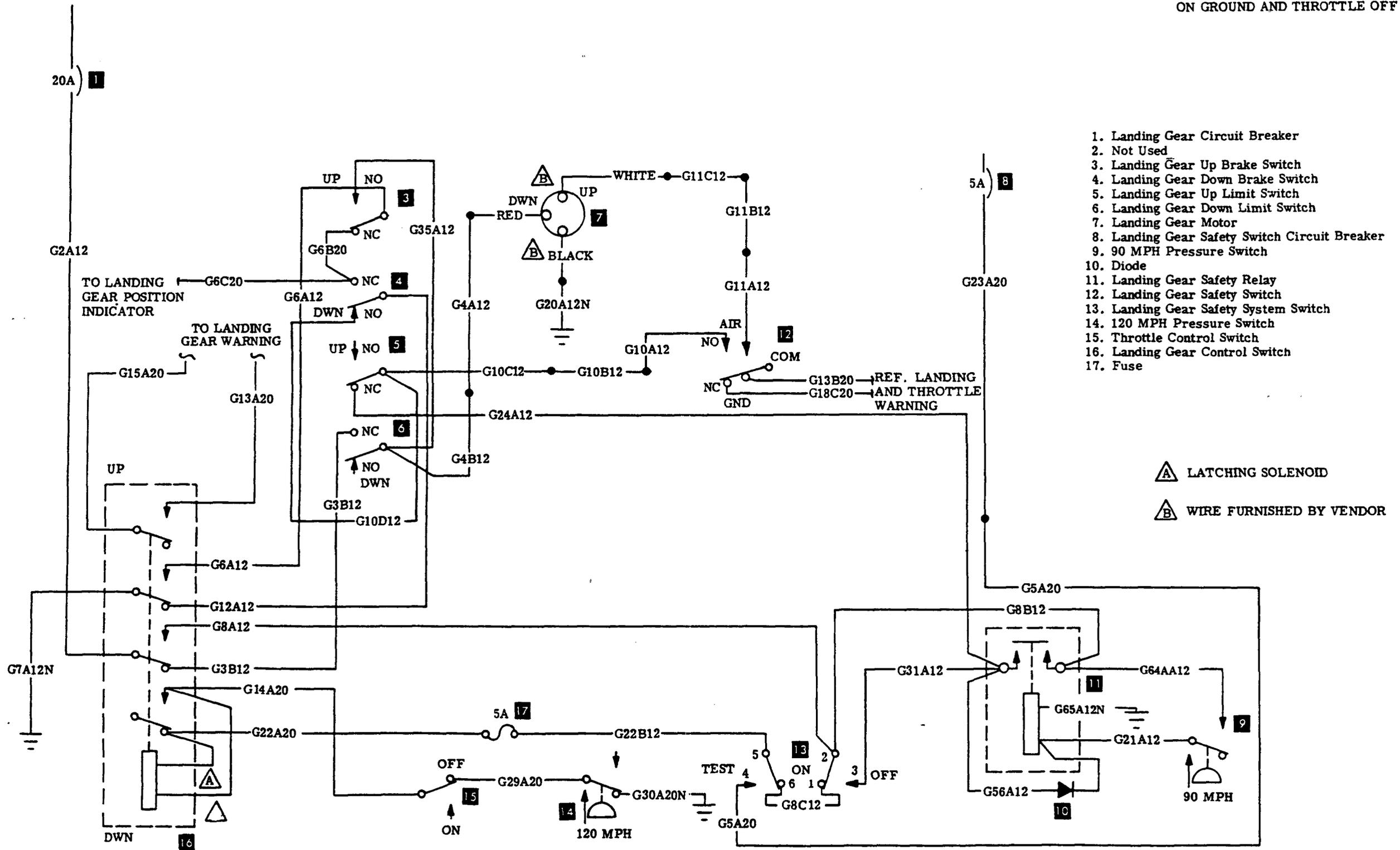


Figure 14-25A. Landing Gear (With Safety System)
E-185 thru E-225

V358-369-65

NOTE: CIRCUIT SHOWN WITH AIRCRAFT ON GROUND AND THROTTLE OFF

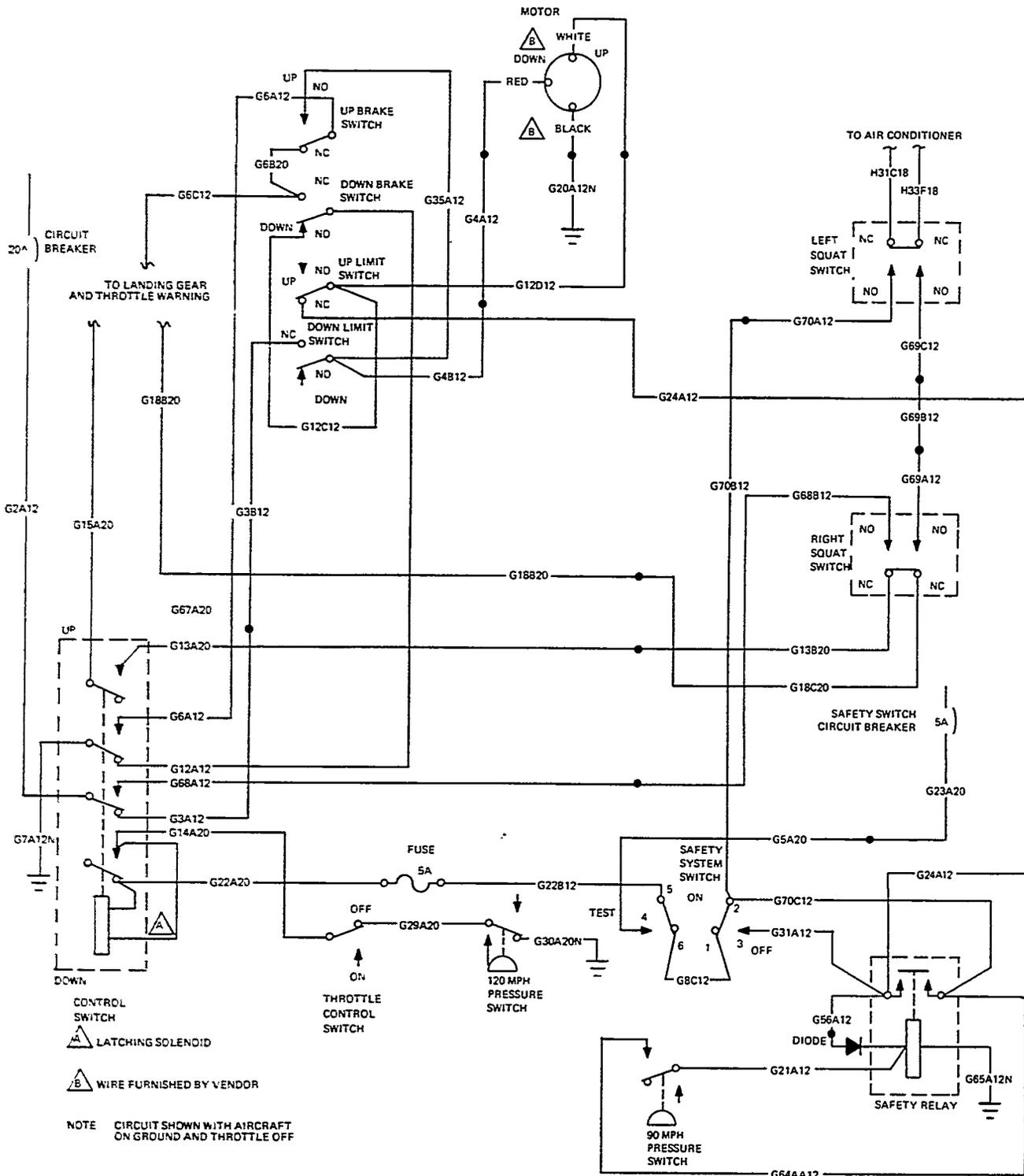


1. Landing Gear Circuit Breaker
2. Not Used
3. Landing Gear Up Brake Switch
4. Landing Gear Down Brake Switch
5. Landing Gear Up Limit Switch
6. Landing Gear Down Limit Switch
7. Landing Gear Motor
8. Landing Gear Safety Switch Circuit Breaker
9. 90 MPH Pressure Switch
10. Diode
11. Landing Gear Safety Relay
12. Landing Gear Safety Switch
13. Landing Gear Safety System Switch
14. 120 MPH Pressure Switch
15. Throttle Control Switch
16. Landing Gear Control Switch
17. Fuse

△ LATCHING SOLENOID
 △ WIRE FURNISHED BY VENDOR

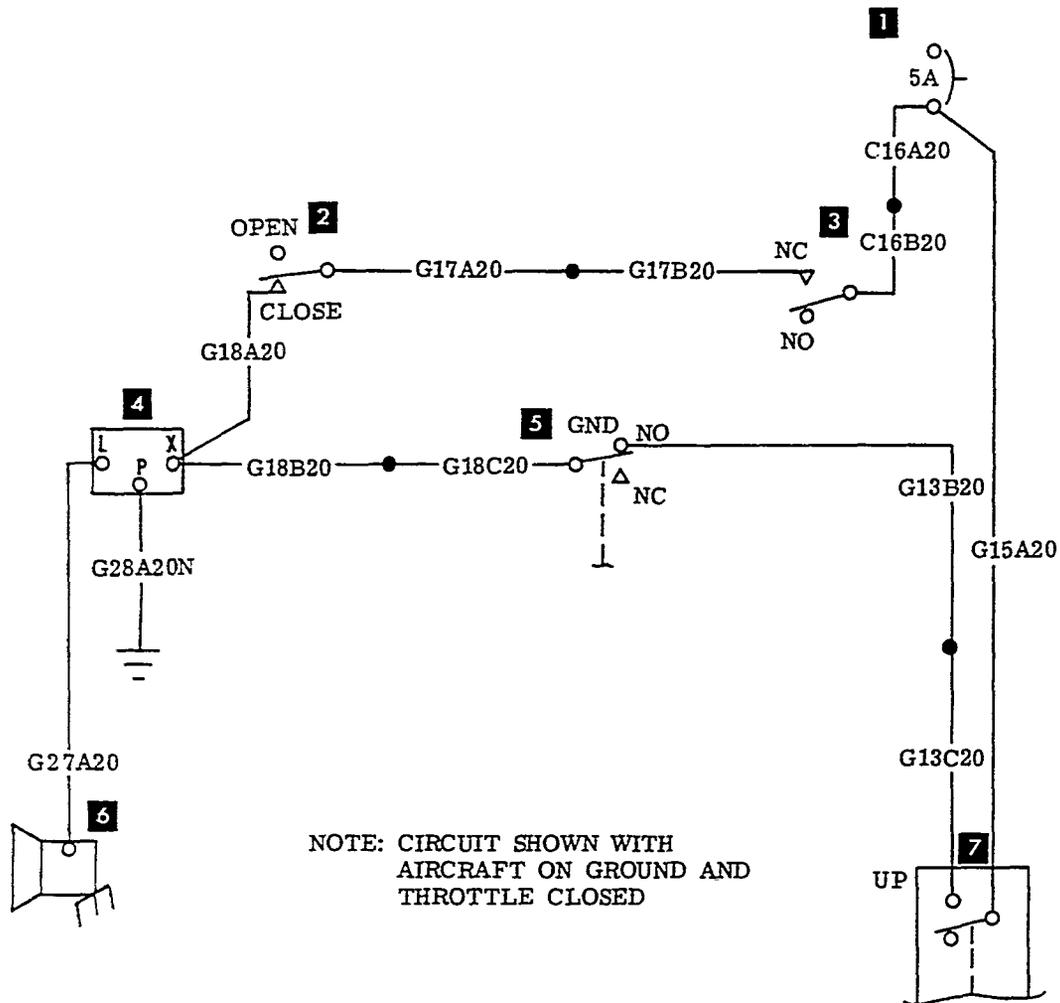
G33-369-82A

Figure 14-25B. Landing Gear (With Safety System)
 E-226 thru E-605



G33-269-316A

Figure 14-25C. Landing Gear (with safety system) E-606 thru E-762 except E-710



1. Circuit Breaker
2. Throttle Warning Switch
3. Landing Gear Warning Switch
4. Flasher
5. Landing Gear Safety Switch
6. Landing Gear Warning Horn
7. Landing Gear Control Switch

Figure 14-26. Landing Gear and Throttle Warning
E-1 thru E-184

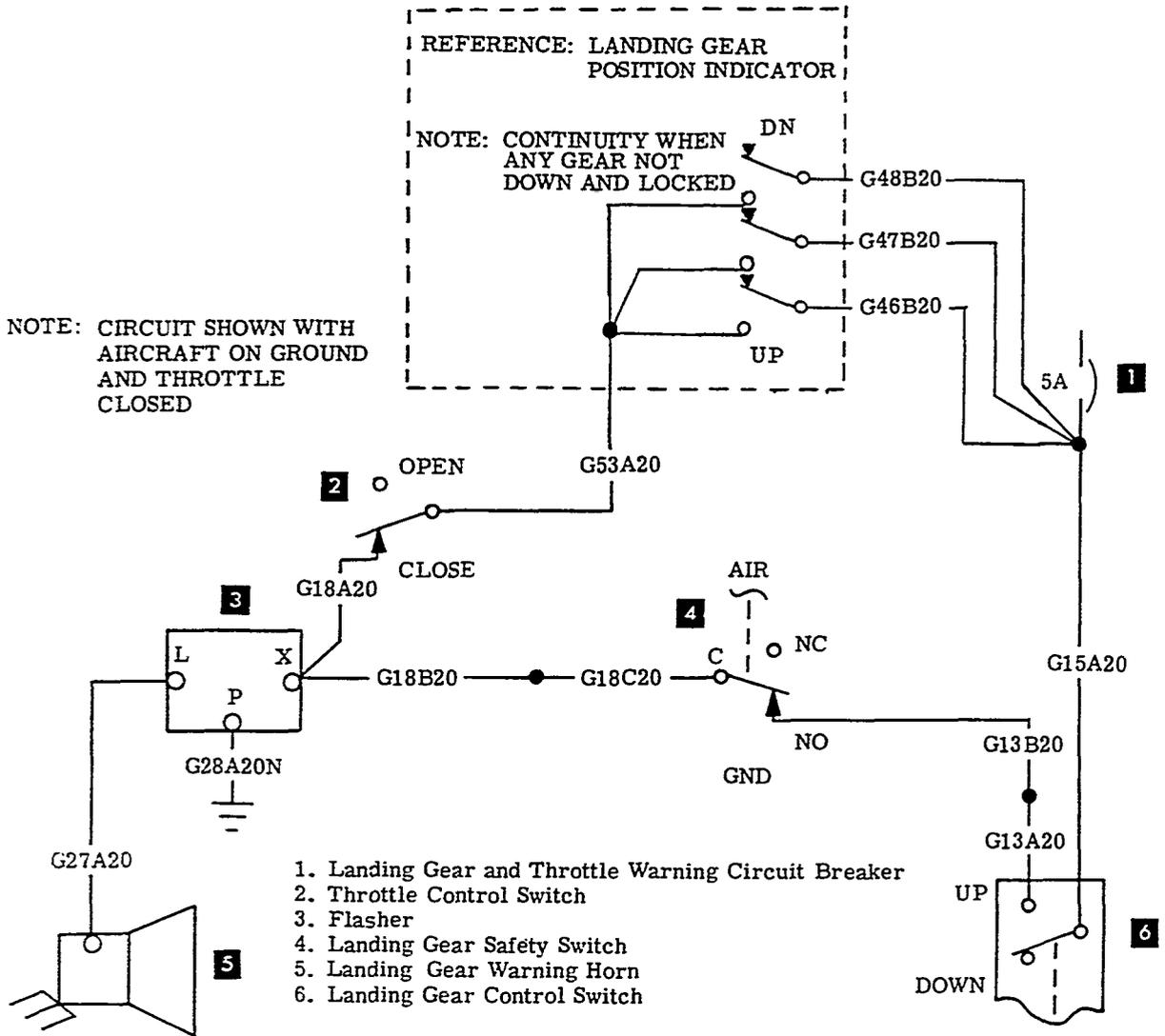
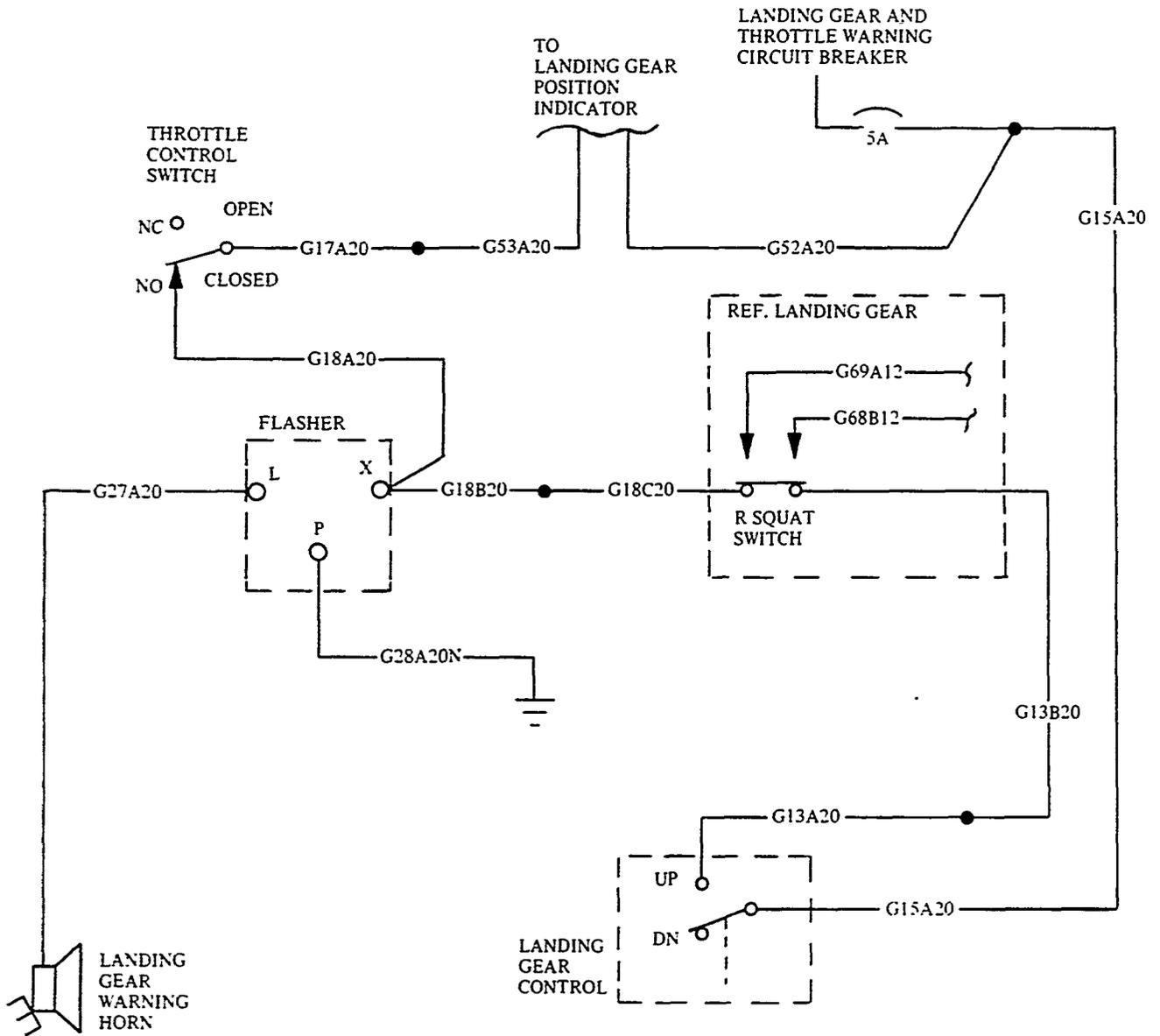


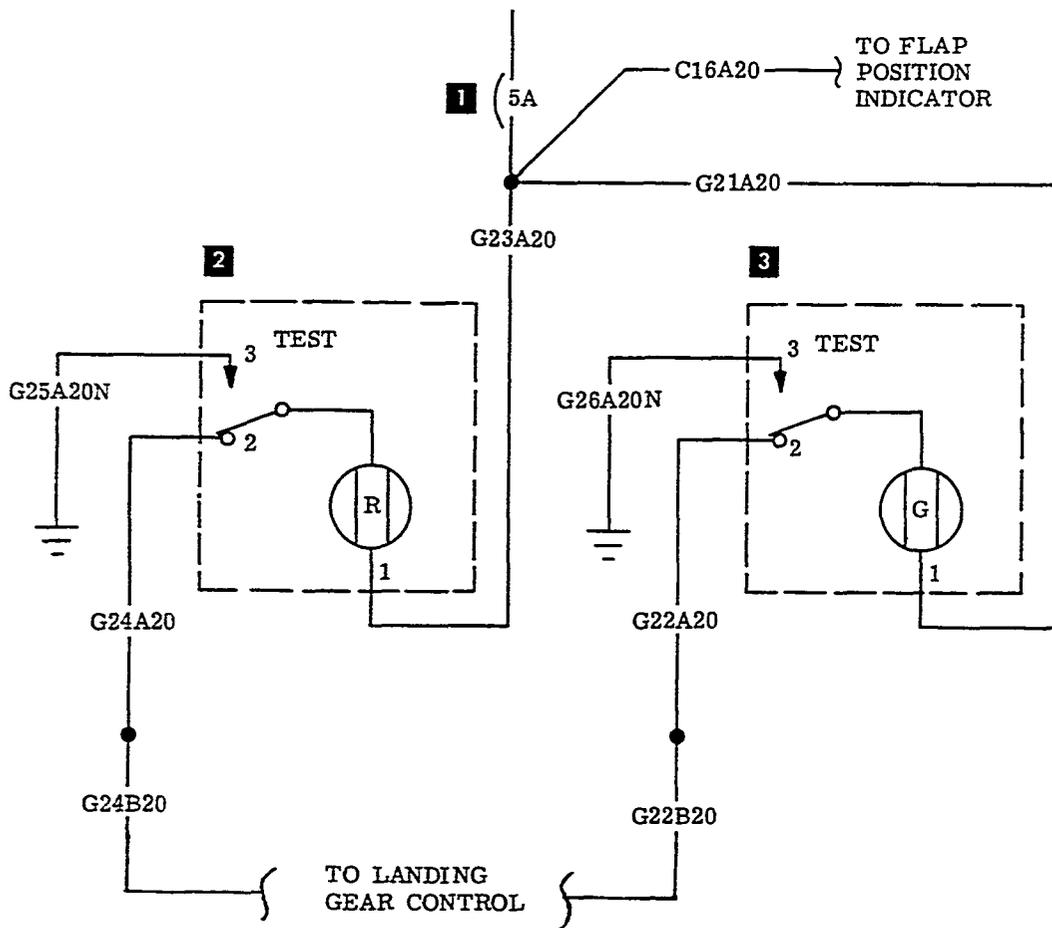
Figure 14-26A. Landing Gear and Throttle Warning E-185 thru E-603

NOTE: CIRCUIT SHOWN WITH AIRPLANE ON GROUND AND THROTTLE CLOSED



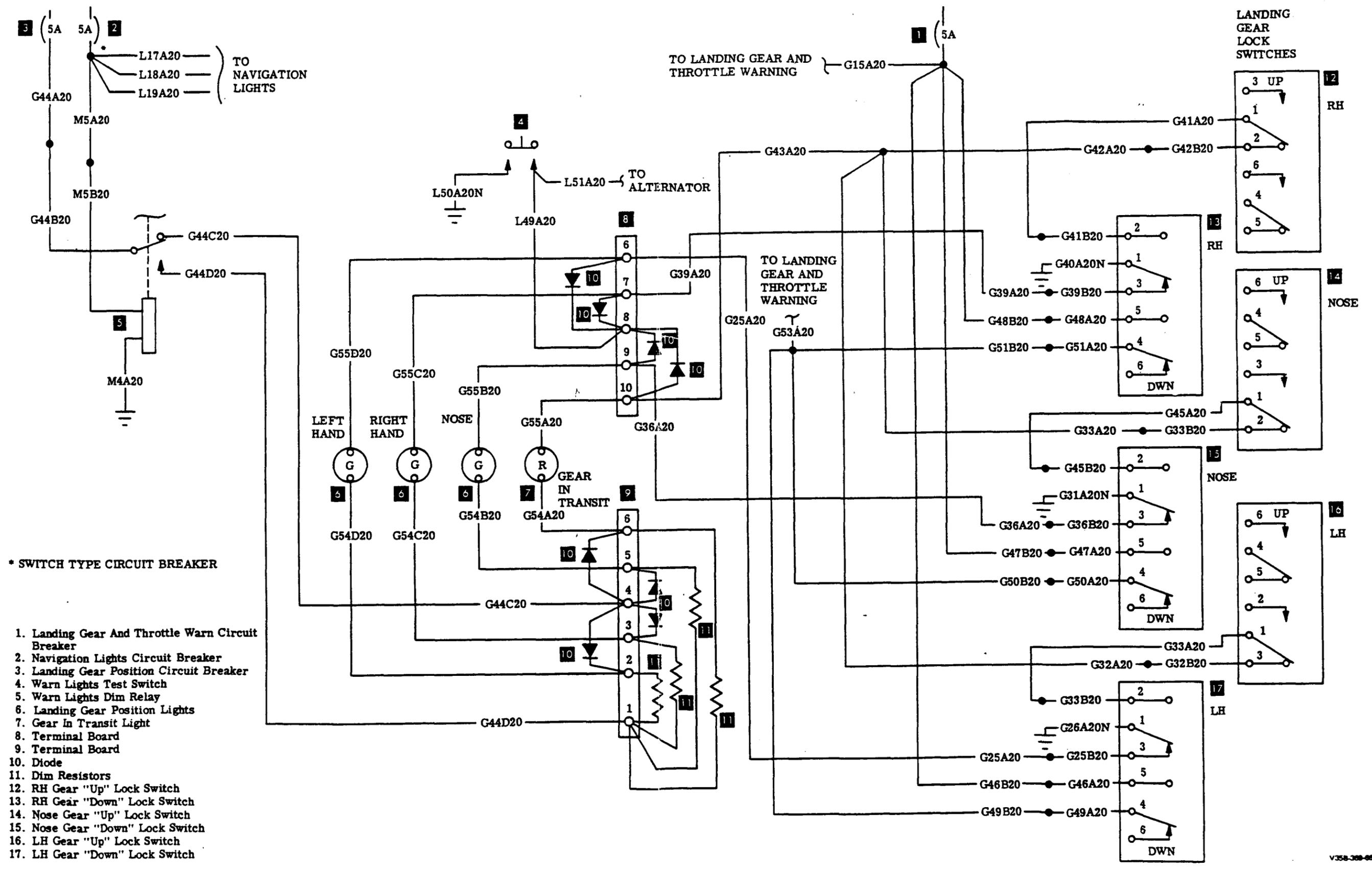
F33-369-319

Figure 14-26A. Landing Gear and Throttle Warning , E-604 thru E-762 except E-710



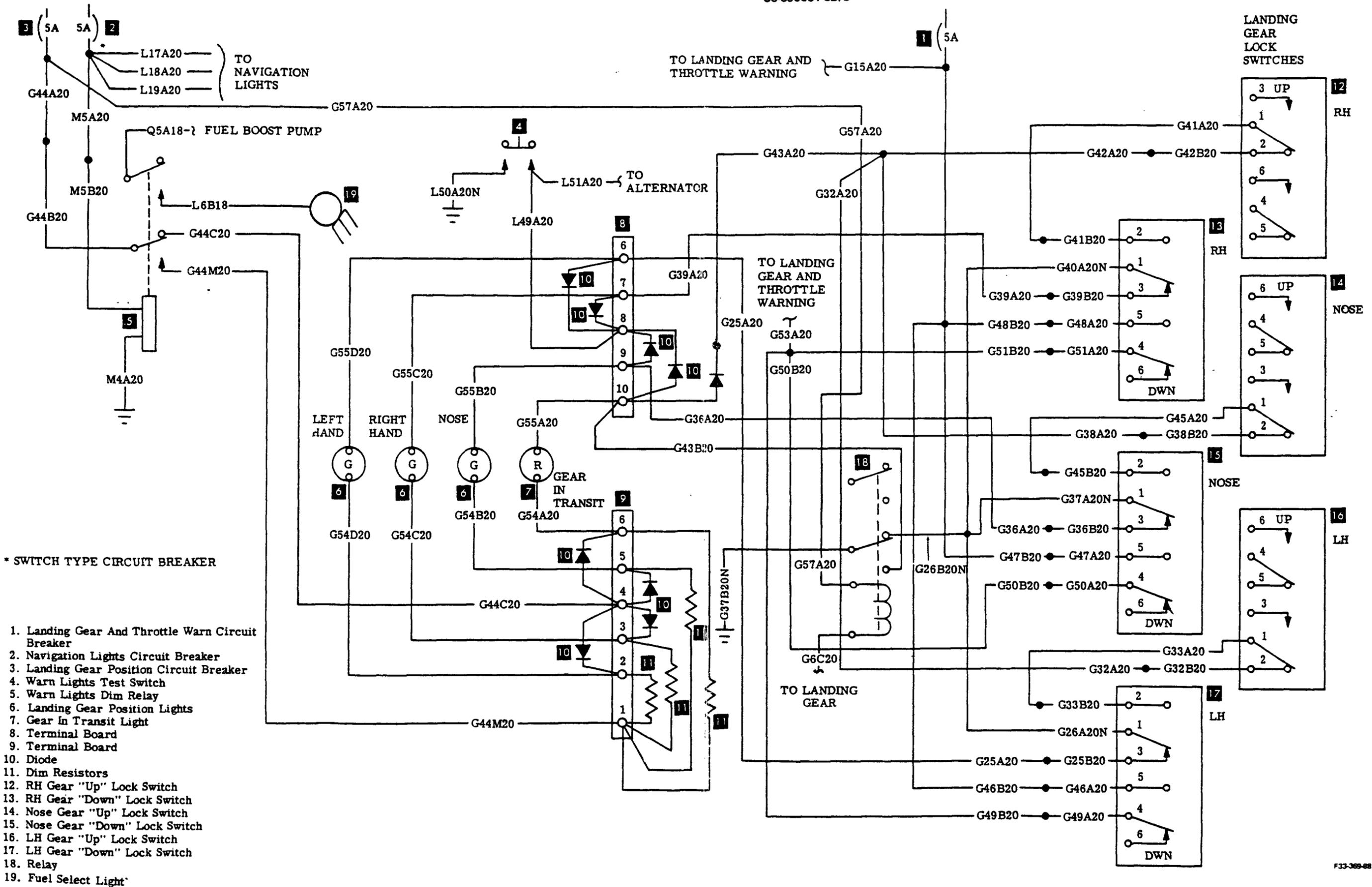
- 1. Flap and Landing Gear Position Indicator
Circuit Breaker
- 2. Landing Gear Up Indicator
- 3. Landing Gear Down Indicator

Figure 14-27. Landing Gear Position Indicator
E-1 thru E-184



- * SWITCH TYPE CIRCUIT BREAKER
1. Landing Gear And Throttle Warn Circuit Breaker
 2. Navigation Lights Circuit Breaker
 3. Landing Gear Position Circuit Breaker
 4. Warn Lights Test Switch
 5. Warn Lights Dim Relay
 6. Landing Gear Position Lights
 7. Gear In Transit Light
 8. Terminal Board
 9. Terminal Board
 10. Diode
 11. Dim Resistors
 12. RH Gear "Up" Lock Switch
 13. RH Gear "Down" Lock Switch
 14. Nose Gear "Up" Lock Switch
 15. Nose Gear "Down" Lock Switch
 16. LH Gear "Up" Lock Switch
 17. LH Gear "Down" Lock Switch

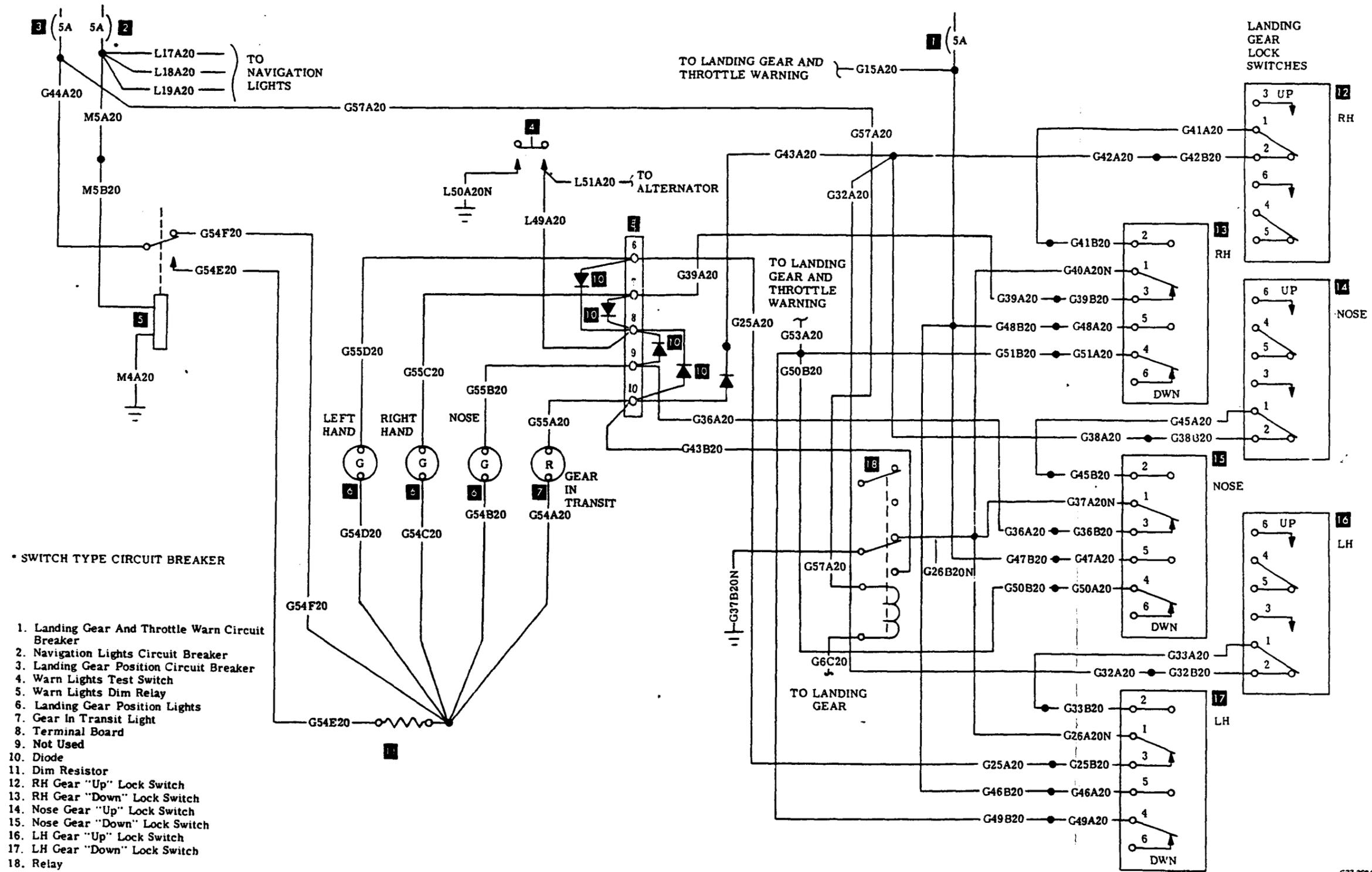
Figure 14-27A. Landing Gear Position Indicator
E-185 thru E-225



* SWITCH TYPE CIRCUIT BREAKER

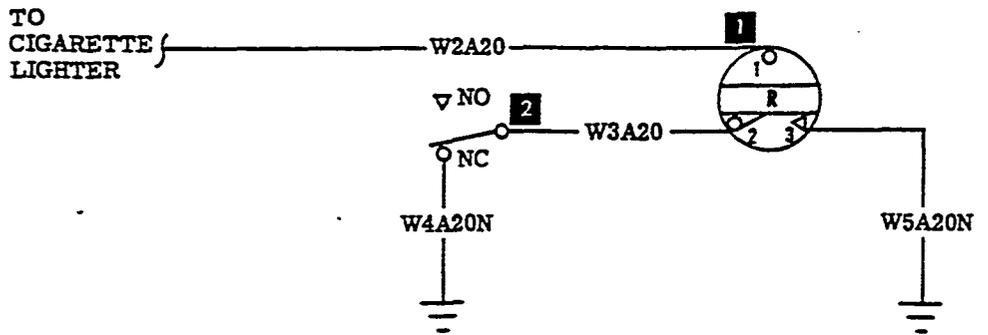
1. Landing Gear And Throttle Warn Circuit Breaker
2. Navigation Lights Circuit Breaker
3. Landing Gear Position Circuit Breaker
4. Warn Lights Test Switch
5. Warn Lights Dim Relay
6. Landing Gear Position Lights
7. Gear in Transit Light
8. Terminal Board
9. Terminal Board
10. Diode
11. Dim Resistors
12. RH Gear "Up" Lock Switch
13. RH Gear "Down" Lock Switch
14. Nose Gear "Up" Lock Switch
15. Nose Gear "Down" Lock Switch
16. LH Gear "Up" Lock Switch
17. LH Gear "Down" Lock Switch
18. Relay
19. Fuel Select Light

Figure 14-27B. Landing Gear Position Indicator E-226 thru E-282



G33-369-928

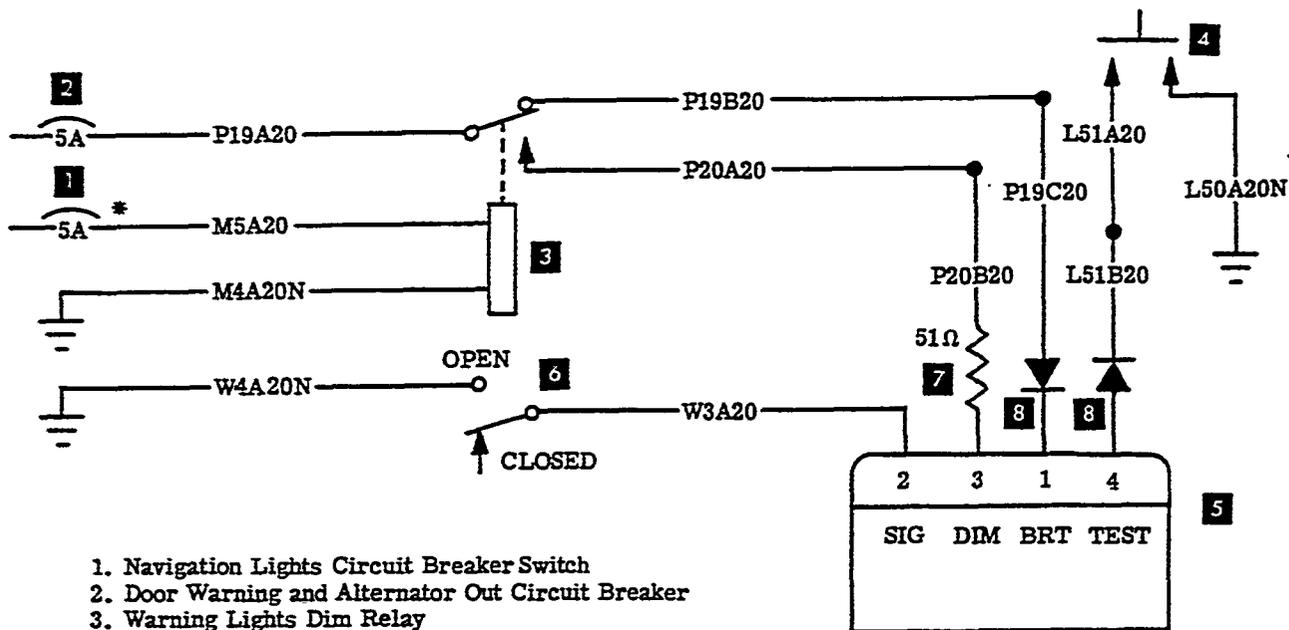
Figure 14-27C. Landing Gear Position Indicator E-283 thru E-762 except E-710



36-369-292

- 1. Warning Light
- 2. Switch

Figure 14-28. Utility Door Warning E-1 thru E-184

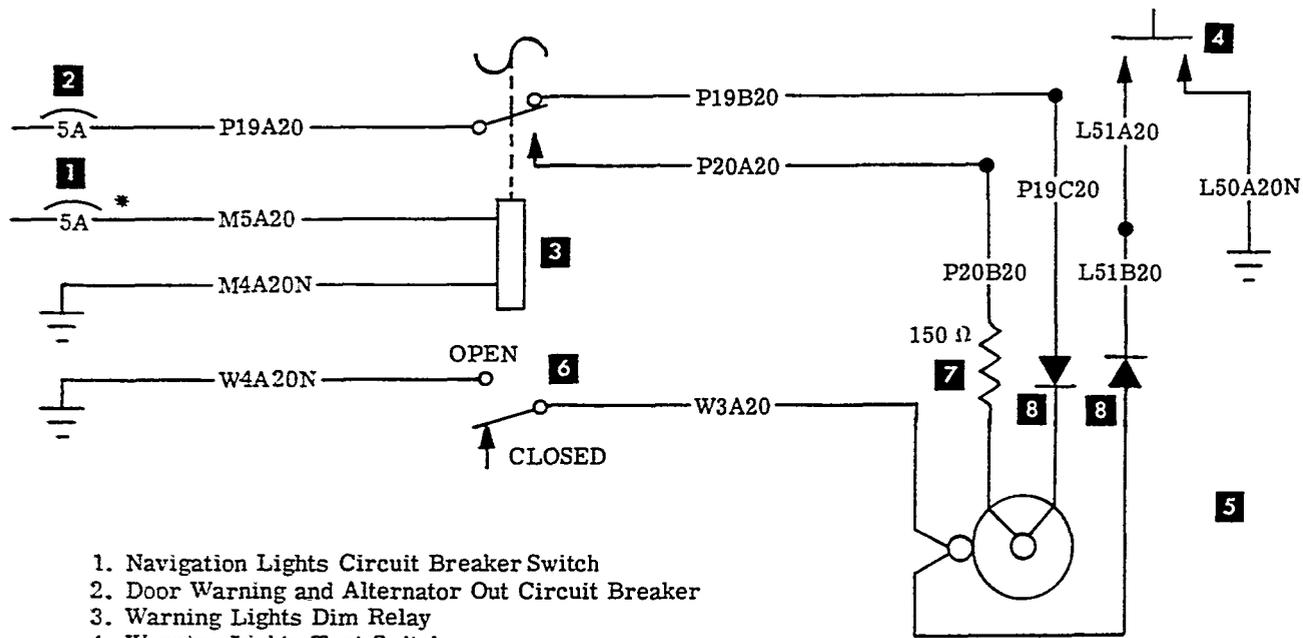


- 1. Navigation Lights Circuit Breaker Switch
- 2. Door Warning and Alternator Out Circuit Breaker
- 3. Warning Lights Dim Relay
- 4. Warning Lights Test Switch
- 5. Utility Door Warning Light
- 6. Utility Door Switch
- 7. Dim Resistor
- 8. Blocking Diode

*SWITCH TYPE CIRCUIT BREAKER

Figure 14-28A. Utility Door Warning E-185 thru E-427

Issued: December, 1972



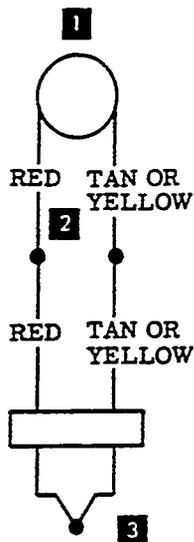
1. Navigation Lights Circuit Breaker Switch
2. Door Warning and Alternator Out Circuit Breaker
3. Warning Lights Dim Relay
4. Warning Lights Test Switch
5. Utility Door Warning Light
6. Utility Door Switch
7. Dim Resistor
8. Blocking Diode

* SWITCH TYPE CIRCUIT BREAKER

36-369-104A

Figure 14-28A. Utility Door Warning
E-428 thru E-762 except E-710

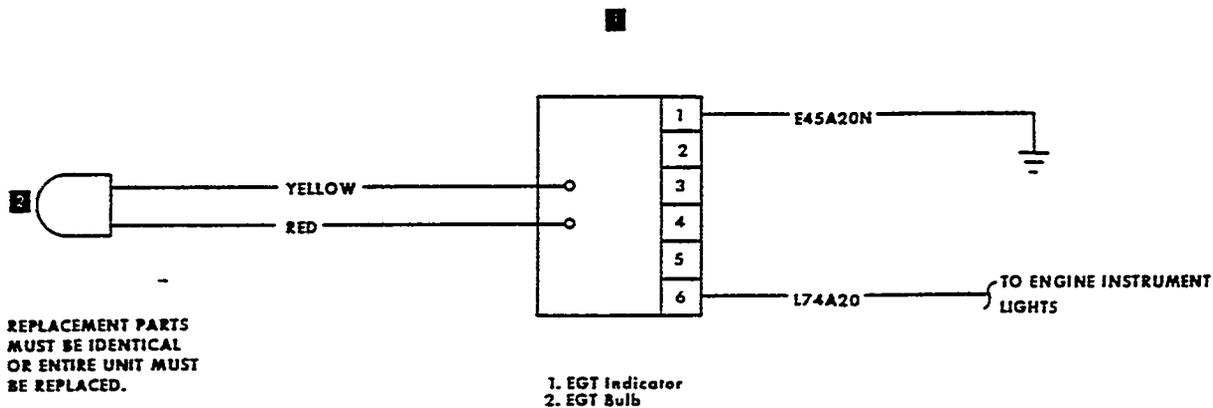
- 1. Indicator
- 2. Thermocouple Harness
- 3. Thermocouple Probe



REPLACEMENT PARTS
MUST BE IDENTICAL
OR ENTIRE UNIT
MUST BE REPLACED

V35-369-33

Figure 14-29. Exhaust Gas Temperature
E-1 thru E-282, E-364 and after

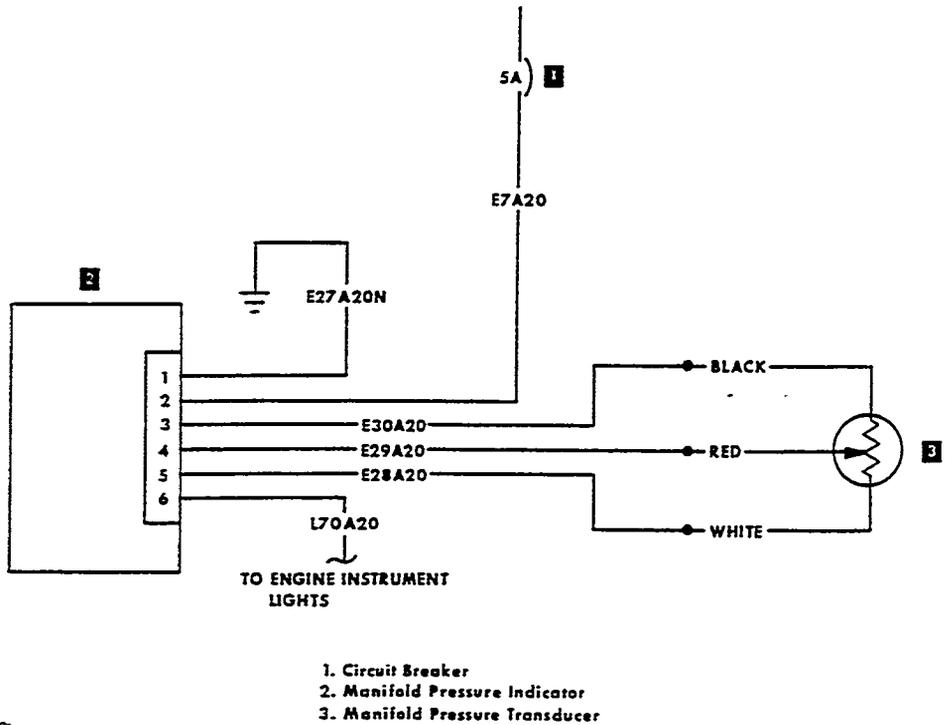


REPLACEMENT PARTS
MUST BE IDENTICAL
OR ENTIRE UNIT MUST
BE REPLACED.

- 1. EGT Indicator
- 2. EGT Bulb

35-369-70

Figure 14-29A. Exhaust Gas Temperature (Vertical Instruments)
E-283 thru E-363



35-369-72

Figure 14-30. Manifold Pressure (Vertical Instruments)
E-283 thru E-363

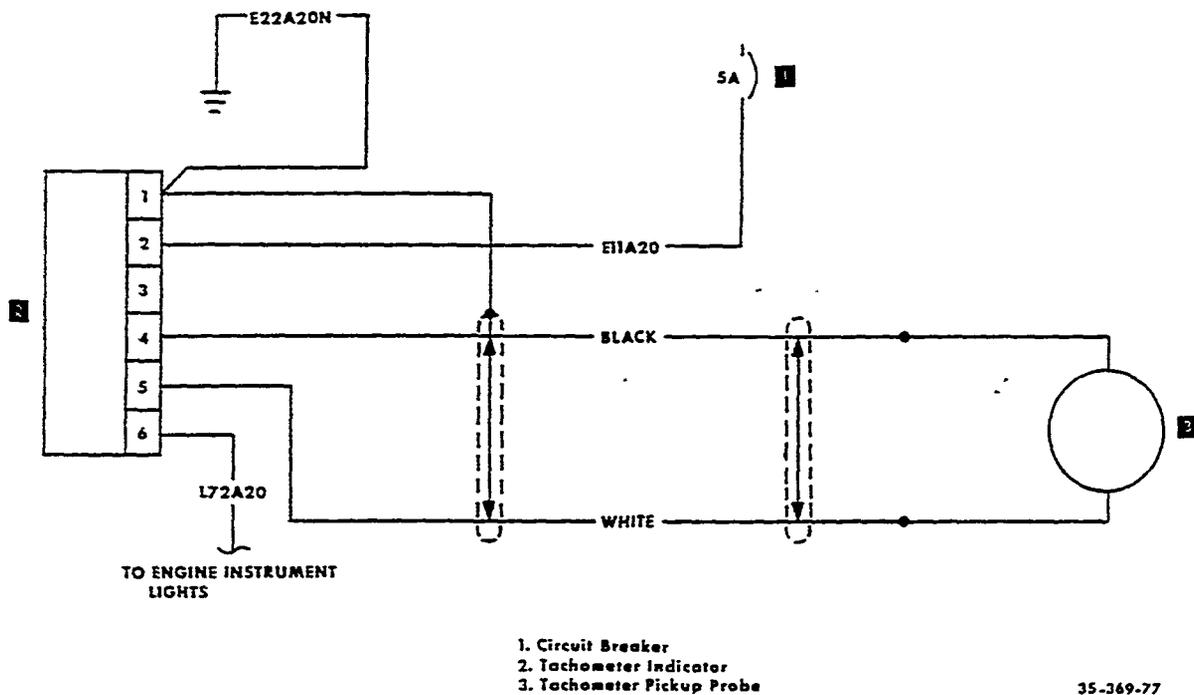


Figure 14-31. Tachometer (Vertical Instruments)
 E-283 thru E-346 except E-287

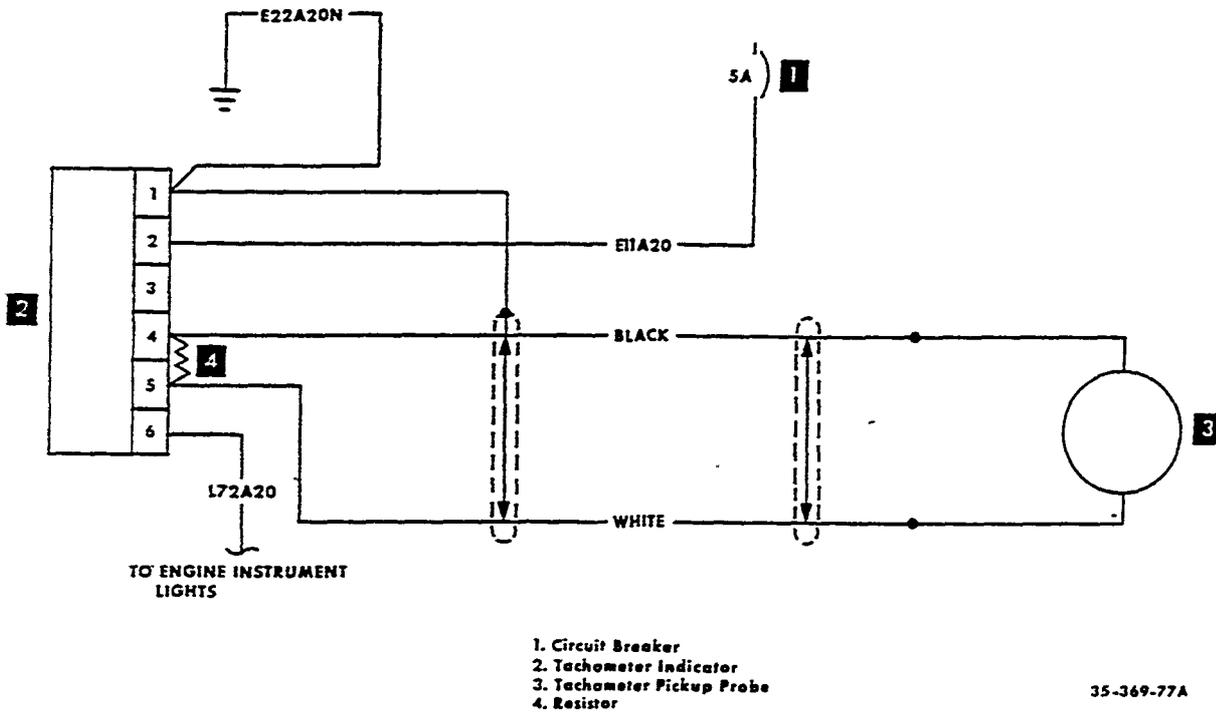
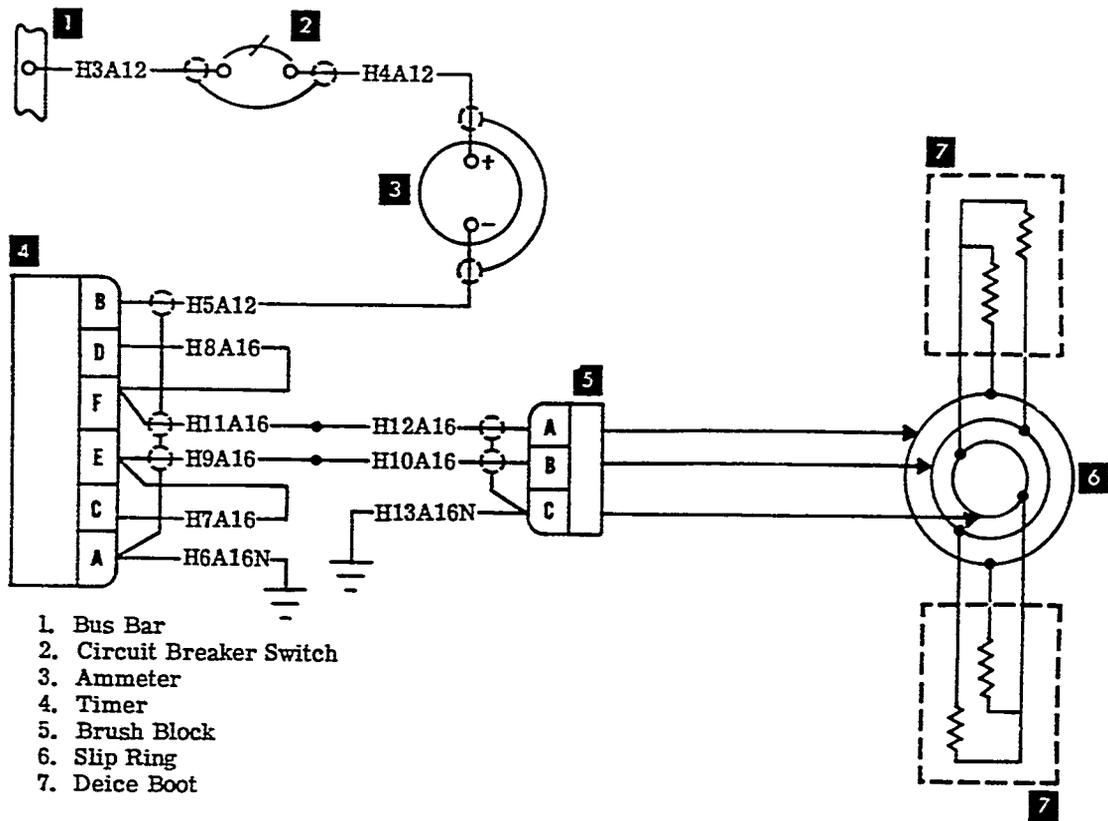
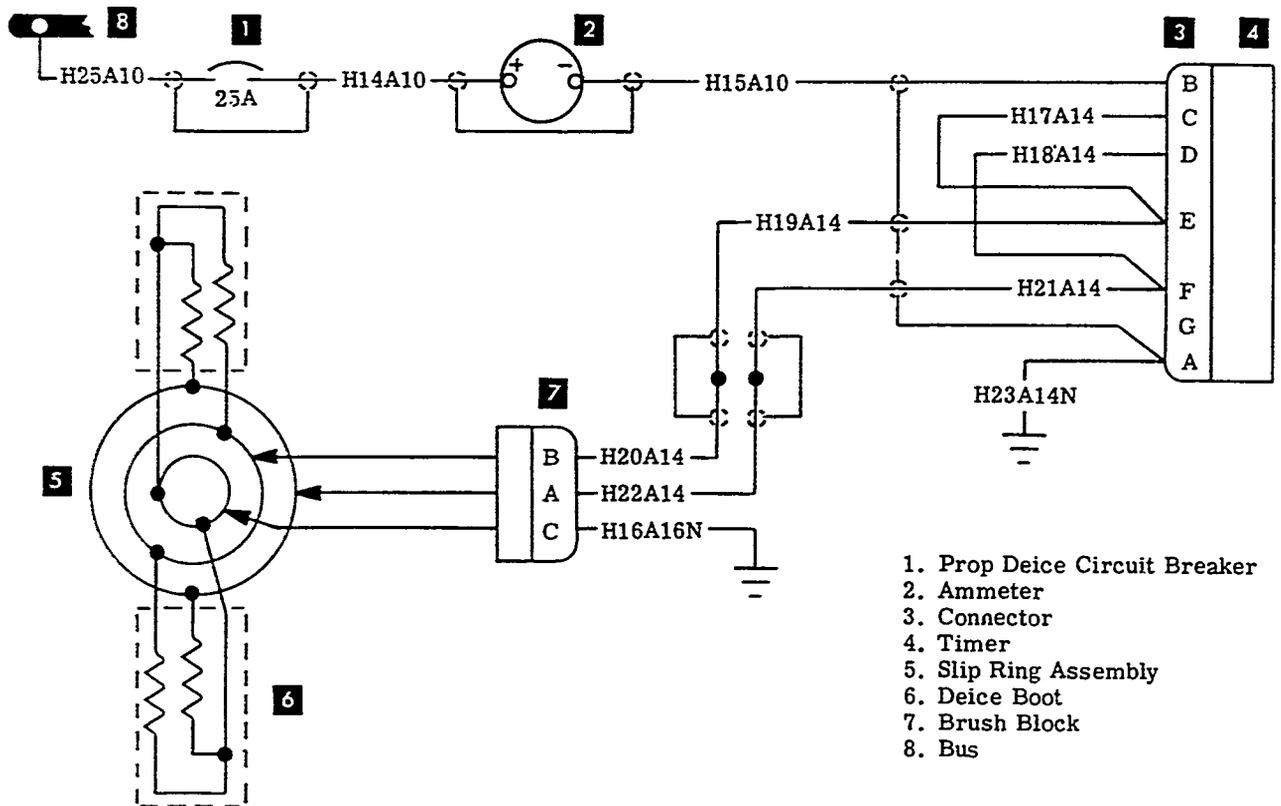


Figure 14-31. Tachometer (Vertical Instruments)
E-287, E-347 thru E-363



- 1. Bus Bar
- 2. Circuit Breaker Switch
- 3. Ammeter
- 4. Timer
- 5. Brush Block
- 6. Slip Ring
- 7. Deice Boot

Figure 14-32. Propeller Deice (Two Bladed)
E-1 thru E-184



- 1. Prop Deice Circuit Breaker
- 2. Ammeter
- 3. Connector
- 4. Timer
- 5. Slip Ring Assembly
- 6. Deice Boot
- 7. Brush Block
- 8. Bus

Figure 14-32A. Propeller Deice (two bladed)
E-185 thru E-762 except E-710

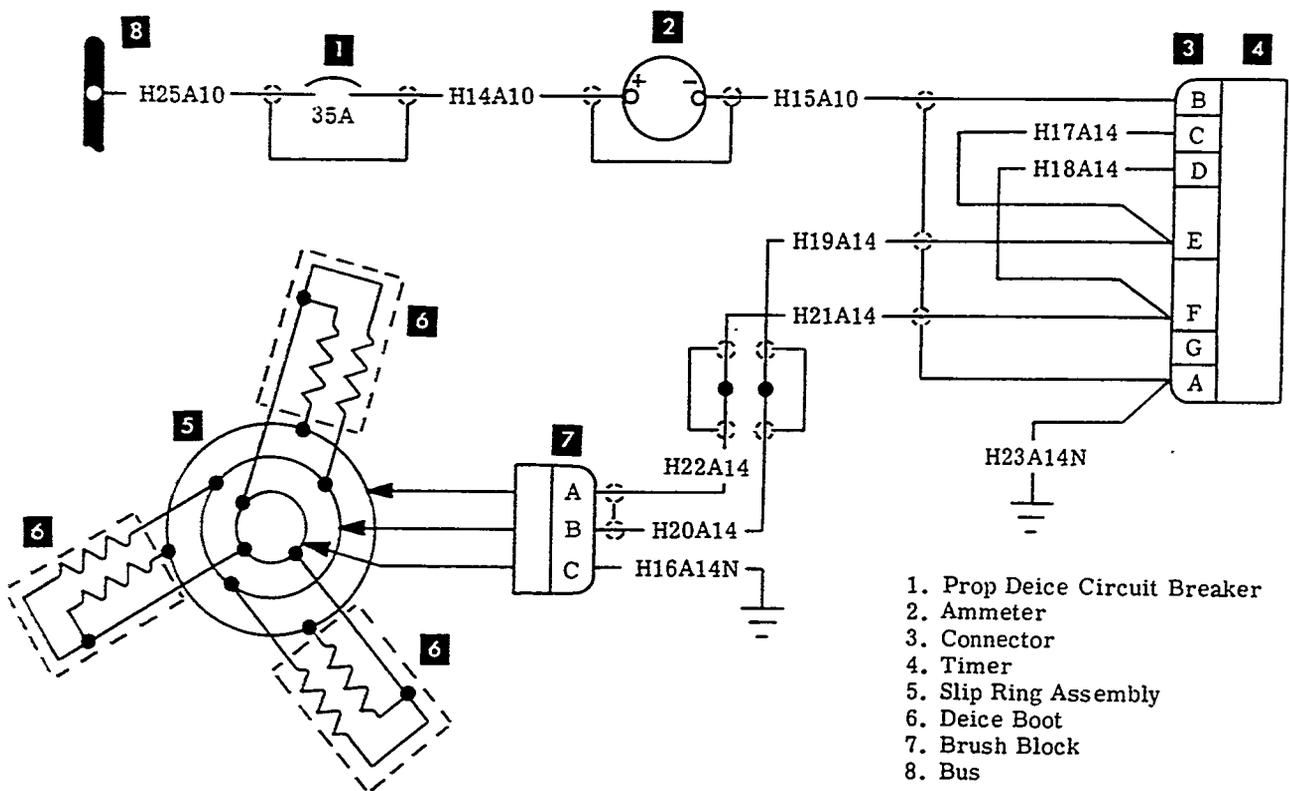
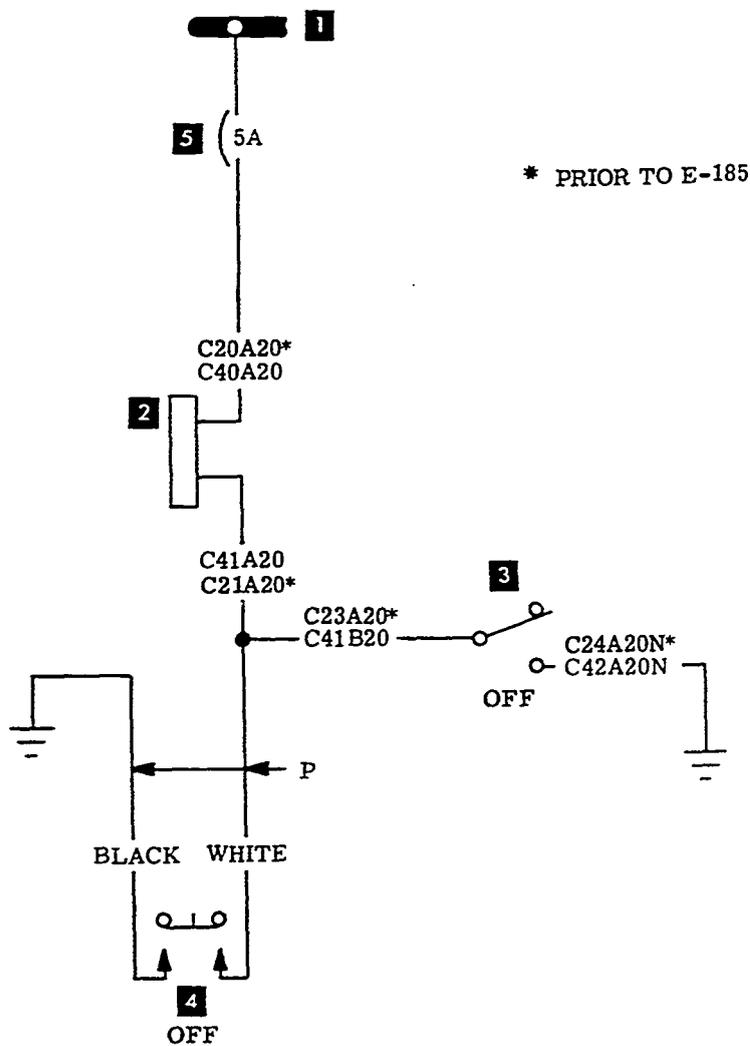


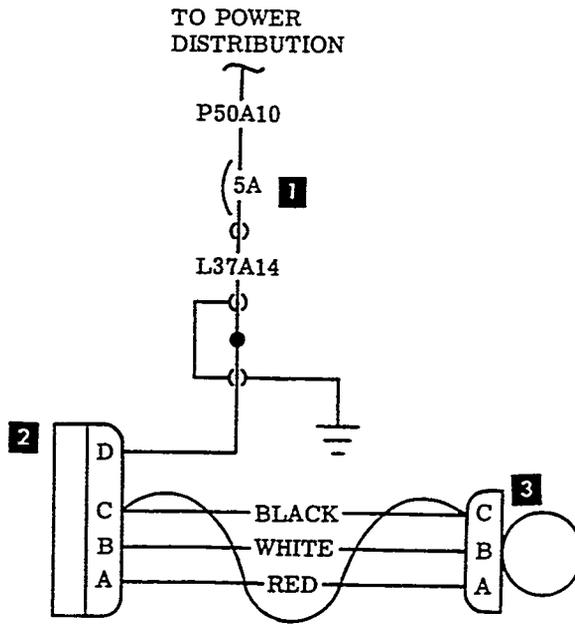
Figure 14-33. Propeller Deice (three bladed)
 E-1 thru E-762 except E-710



* PRIOR TO E-185

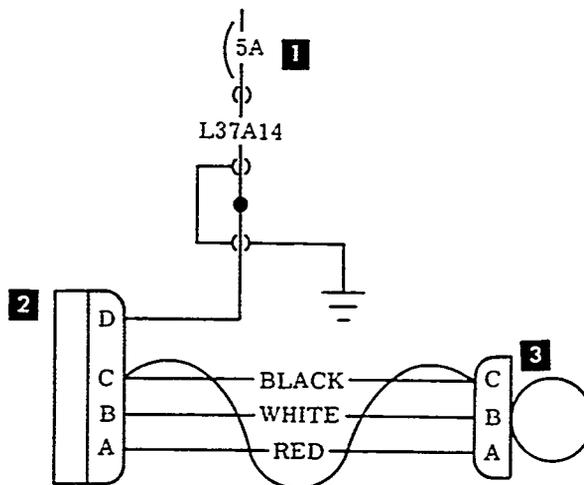
1. Avionics Bus
2. Constant Copilot Solenoid Valve
3. Constant Copilot Switch
4. Constant Copilot Wheel Switch
5. Constant Copilot Autopilot Circuit Breaker

Figure 14-34. Constant Copilot
E-1 thru E-762 except E-710



1. Strobe Light Circuit Breaker
2. Power Supply
3. Strobe Light

Figure 14-35. Strobe Light (Hoskins)
E-1 thru E-184



1. Strobe Light Circuit Breaker
2. Power Supply
3. Strobe Light

Figure 14-35A Strobe Light (Hoskins)
E-185 thru E-762 except E-710

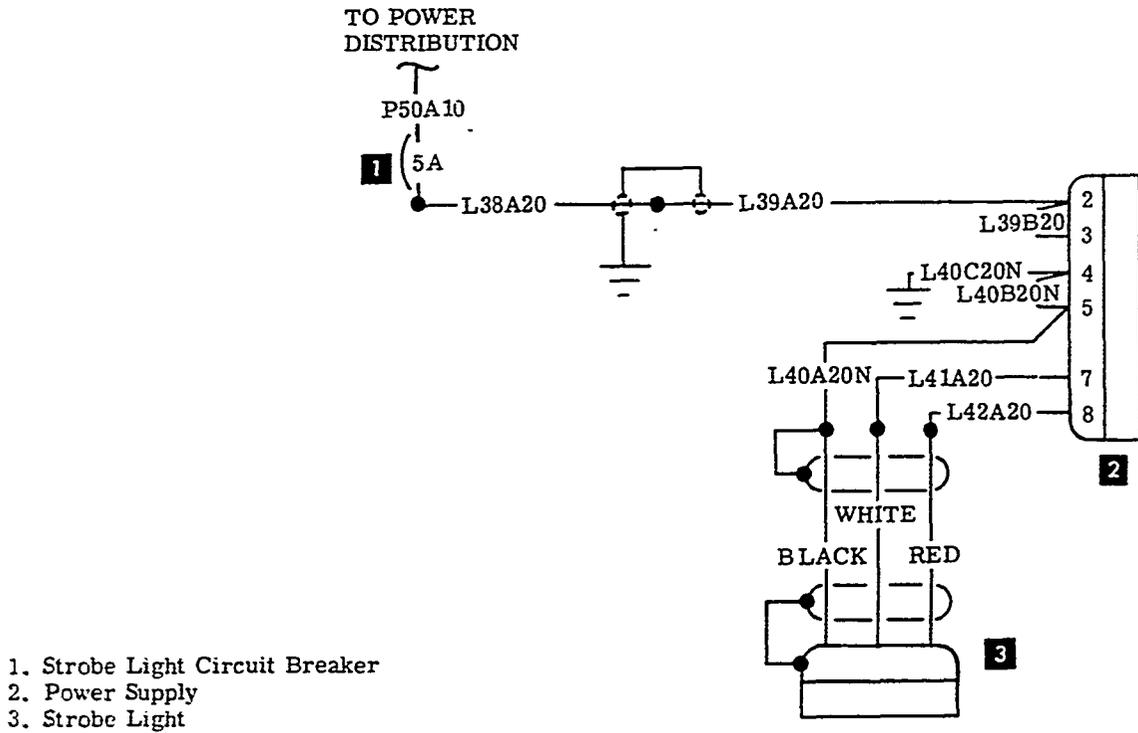


Figure 14-36. Strobe Light (Bullock)
E-1 thru E-184

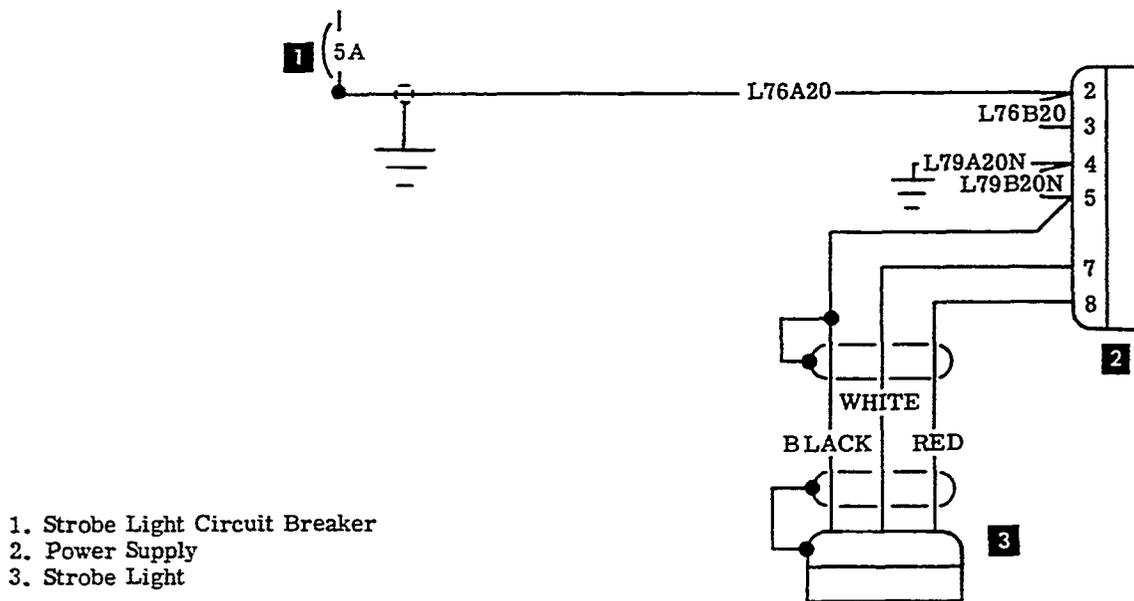
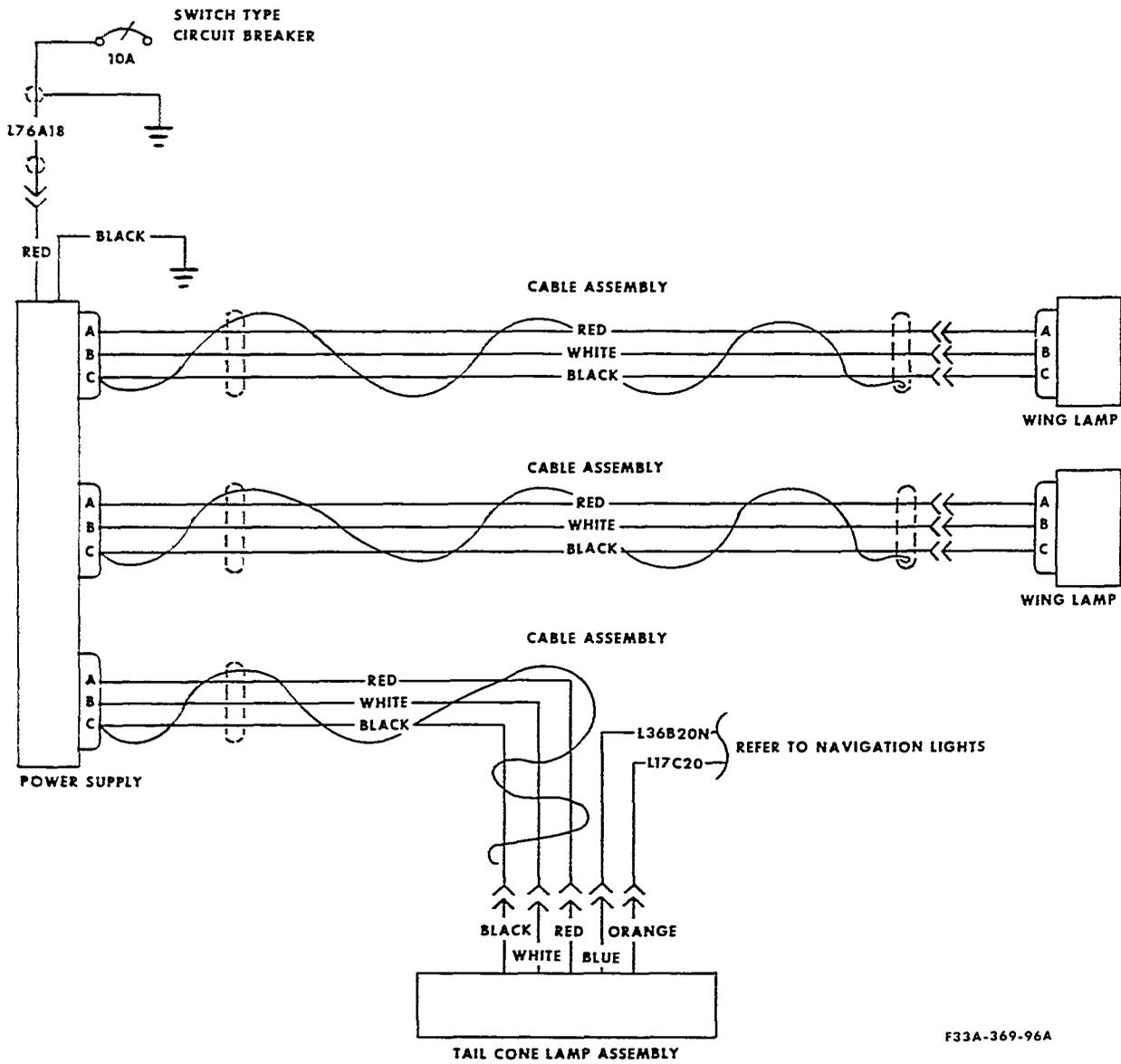
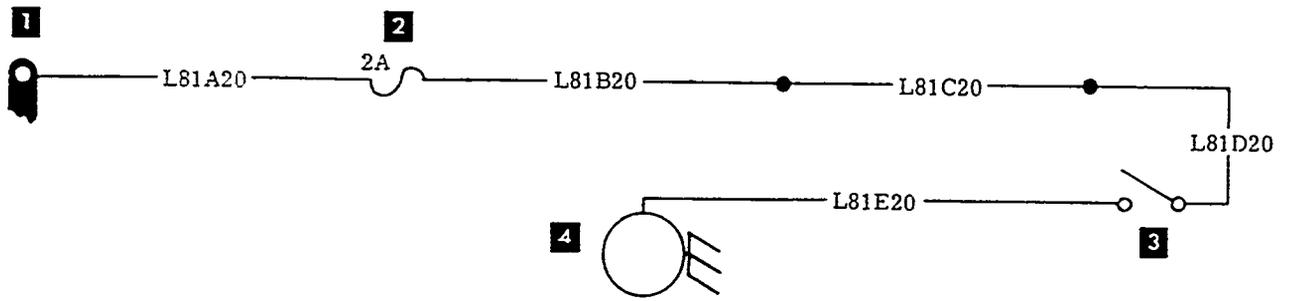


Figure 14-36A Strobe Light (Bullock)
E-185 thru E-762 except E-710



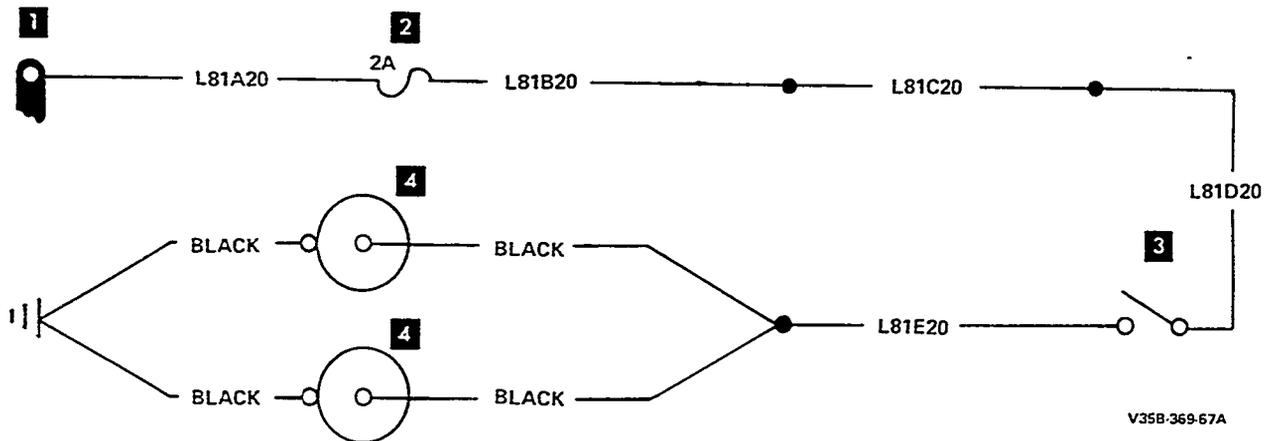
F33A-369-96A

Figure 14-37. Strobe Light (Grimes)
E-291 thru E-762 except E-710



1. Battery Bus
2. Courtesy Light Fuse
3. Courtesy Light Switch
4. Courtesy Light

Figure 14-38. Courtesy Light
E-1 thru E-476



V35B-369-67A

1. Battery Bus
2. Courtesy Light Fuse
3. Courtesy Light Switch
4. Courtesy Light

Figure 14-38. Courtesy Light
E-477 thru E-762 except E-710

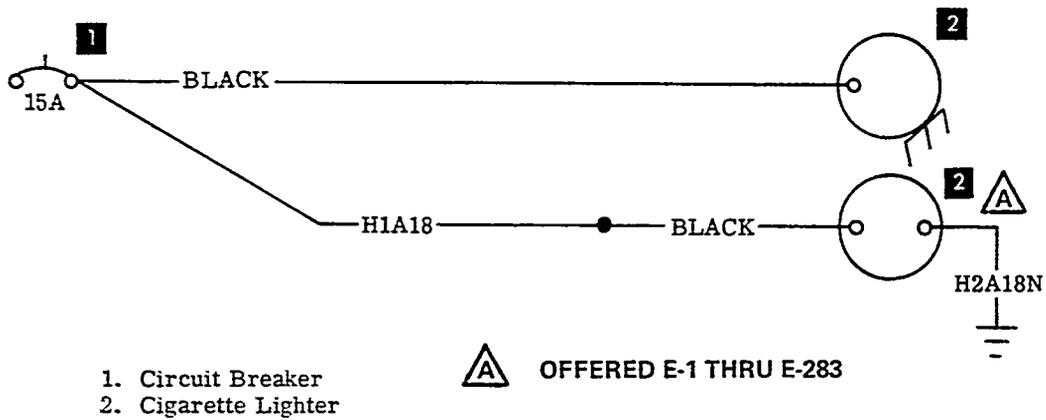
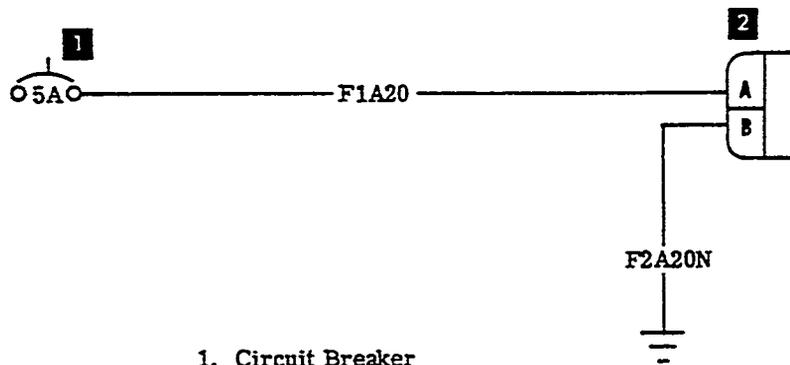
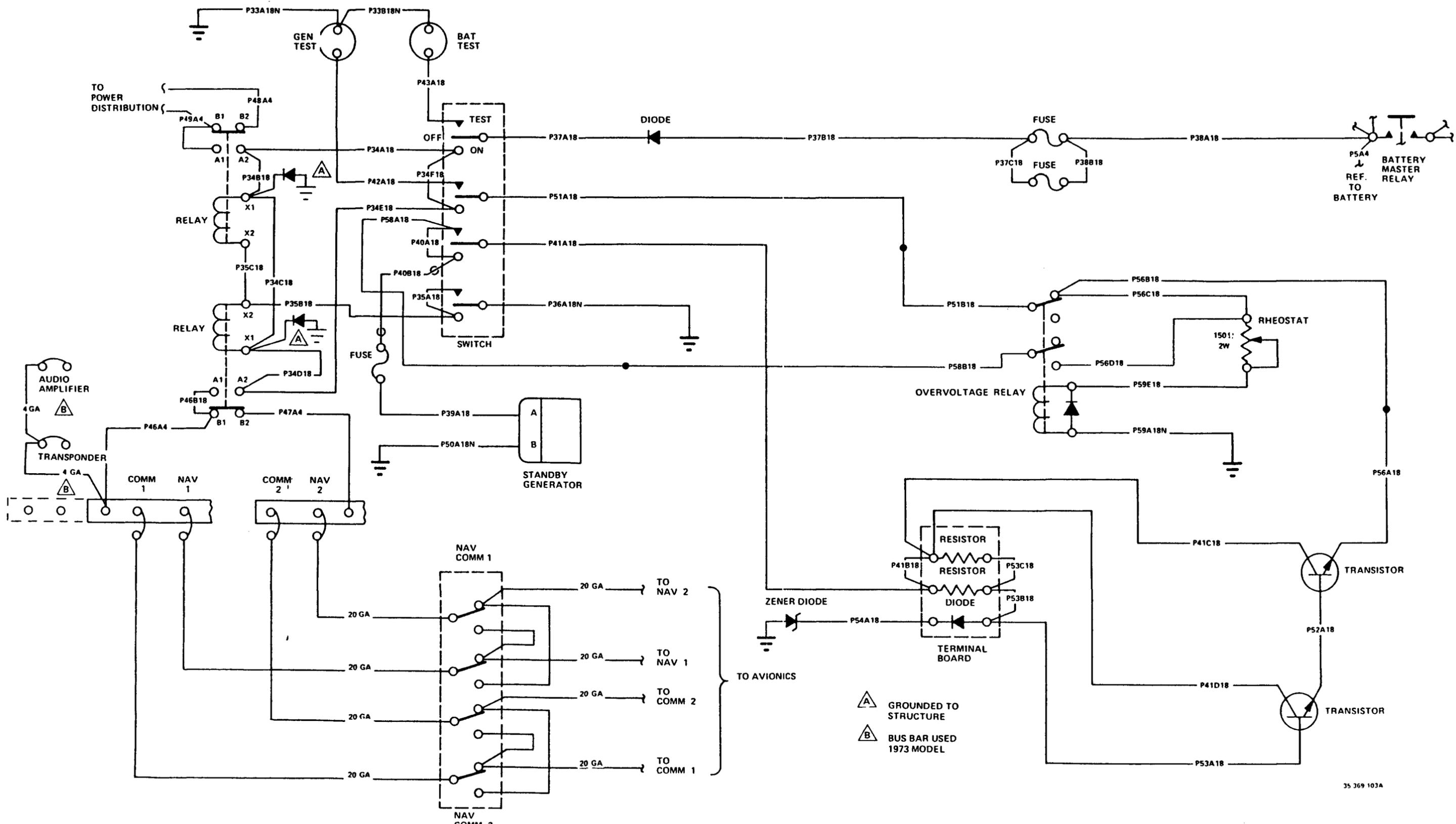


Figure 14-39. Cigarette Lighter
E-1 thru E-762 except E-710



1. Circuit Breaker
2. Turn Coordinator

Figure 14-40. Turn Coordinator
E-1 thru E-762 except E-710



35 369 103A

Figure 14-41. Standby Generator E-287, E-329 thru E-762 except E-710

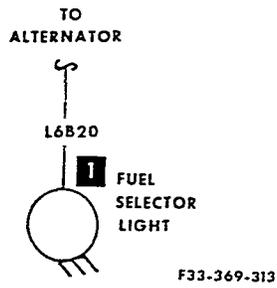


Figure 14-42. Fuel Selector Light
E-226 thru E-476

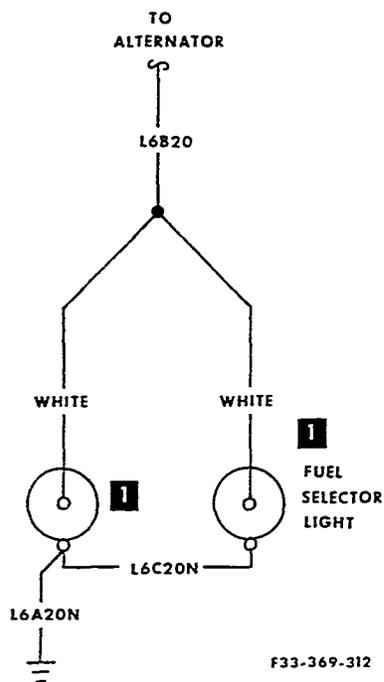


Figure 14-42. Fuel Selector Light
E-477 thru E-762 except E-710

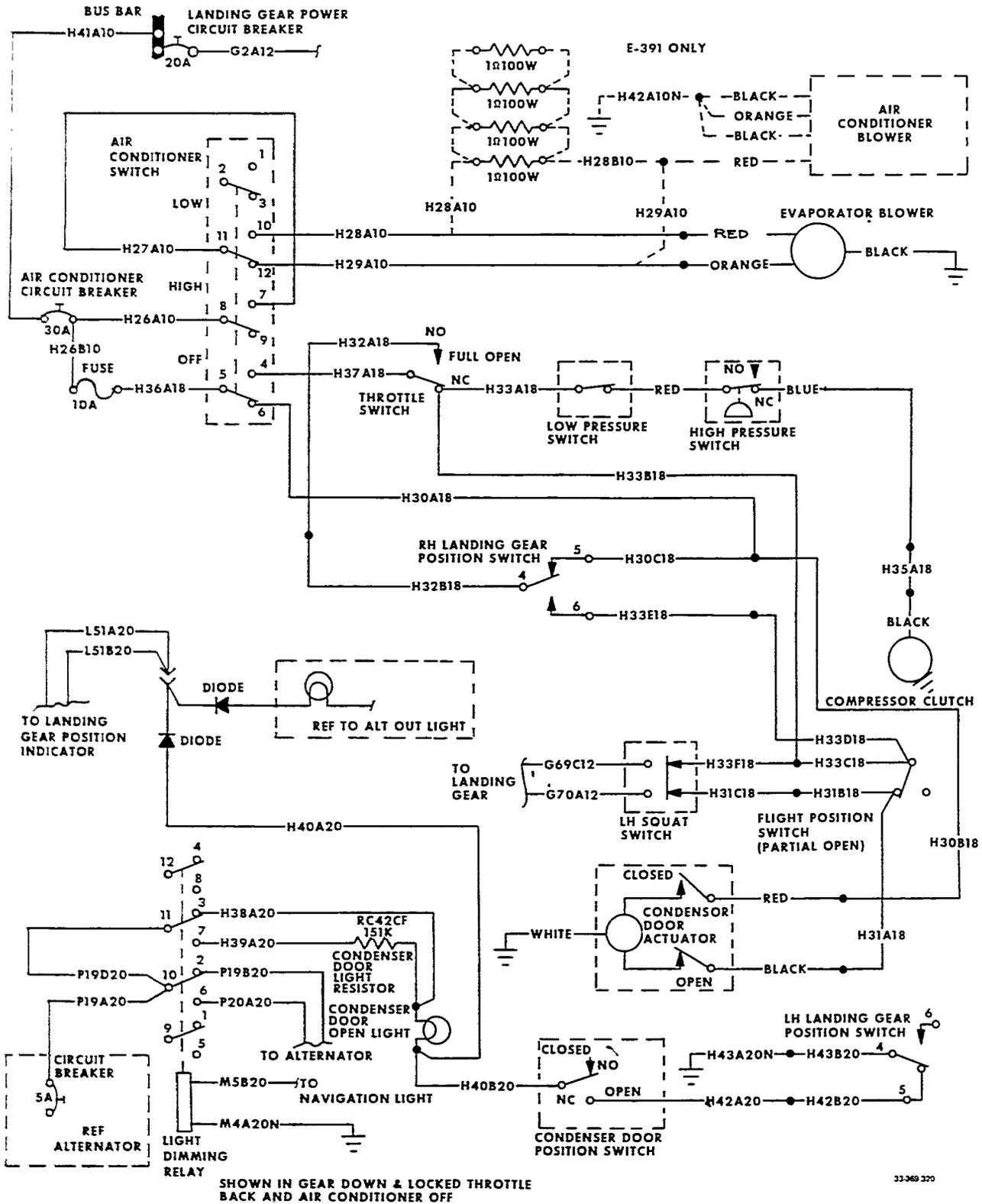


Figure 14-43. Air Conditioner
E-391, E-716, E-732 thru E-762

OVERHAUL AND REPLACEMENT SCHEDULE

All overhaul and replacement times designated herein are but guidelines, NOT MANDATORY REQUIREMENTS. Climatic conditions, maintenance practices, and other factors may either extend or decrease these times. In the final analysis, adjustments in the overhaul and replacement periods should be determined by inspection findings and servicing experience.

A TBO recommendation is in no way to be construed as a warranty or engine life proration basis. The TBO recommendation is based on the projected time for the most advantageous initial overhaul. The individual operator's experience may indicate a departure in either direction from the recommended TBO for the particular operation.

Raytheon Aircraft

BEECH BONANZA 36 SERIES SHOP MANUAL

Manual Affected: BEECHCRAFT Bonanza Shop Manual (36-590001-3B)
Instructions: Insert this page facing page 15-2 (B11) of Section 15.
Reason: Revise text under OVERHAUL AND REPLACEMENT SCHEDULE.

OVERHAUL AND REPLACEMENT SCHEDULE

ITEM	OVERHAUL OR REPLACE
<i>LANDING GEAR</i>	
Main Gear	On condition (Leaking or collapsed struts that cannot be corrected by seal replacement will constitute the "On condition" requirement. Any pitting, corrosion, cracking, distortion or visible wear noted during the seal replacement will also constitute the requirement for an overhaul.)
Nose Gear	On condition (Leaking or collapsed struts that cannot be corrected by seal replacement will constitute the "On condition" requirement. Any pitting, corrosion, cracking, distortion or visible wear noted during the seal replacement will also constitute the requirement for an overhaul.)
Actuator Assembly	Gray and green color actuators every 2,000 hours. White color actuators every 4,000 hours.

Raytheon Aircraft

BEECH BONANZA 36 SERIES SHOP MANUAL

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OVERHAUL AND REPLACEMENT SCHEDULE

ITEM

OVERHAUL OR REPLACE

LANDING GEAR

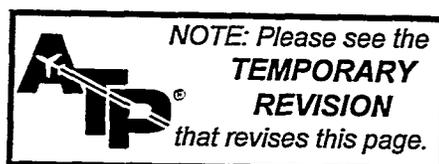
Main gear	Every 2000 hours
Nose gear	Every 2000 hours
Actuator assembly	Every 2000 hours
Retract motor	Every 2000 hours
Retract motor brushes	Every 500 hours
Shimmy dampener	Every 1000 hours
Wheels and tires	On condition
Brake assembly	On condition
Brake lining	On condition
Master cylinder	On condition
Shuttle valve assembly	On condition
Parking brake valve	On condition
All hose	On condition

POWER PLANT

* Engine (E-1 and after)	Every 1500 hours
* Engine (EA-1 and after)	Every 1400 hours
Turbocharger and wastegate	Every 1400 hours or on condition
Engine controls	On condition
Engine vibration isolator mounts	On condition
Exhaust system	On condition
Starter	Inspect at engine overhaul, overhaul or replace on condition.
Alternator	On condition
Oil cooler	On condition (replace when contaminated)
Propeller (E-1 and after)	At engine overhaul but not to exceed 1500 hours
Propeller (EA-1 and after)	Every 1400 hours or 3 years
Propeller controls	On condition
Propeller governor	At engine overhaul
Pressure pump	Every 1200 hours
All hose not carrying flammable liquid	On condition
All hose carrying flammable liquid	At engine overhaul or 5 years
Standby generator	1500 hours
Standby generator (14 or 28 volt system)	1500 hours
Standby generator brushes (28 volt system)	500 hours

FLAPS AND FLIGHT CONTROLS

Flight controls	On condition
Elevator tab actuator	On condition
Flap motor and drives	Every 2000 hours
Flap motor brushes	On condition
Flap gear box	Every 2000 hours
Flap actuators	Every 2000 hours
Flap flexible shaft	Every 2000 hours



OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

<i>ITEM</i>	<i>OVERHAUL OR REPLACE</i>
FUEL SYSTEM	
Fuel Cells	On condition
Wing fuel quantity transmitters	On condition
Fuel cell drain valve	On condition
Fuel system check valves	On condition
Fuel selector valve	Inspect every 600 hours Overhaul every 1200 hours
Fuel boost pump	Every 1200 hours
All hose not carrying flammable liquid	On condition
All hose carrying flammable liquid	At engine overhaul or 5 years from date of delivery, whichever occurs first

INSTRUMENTS

Turn coordinator	On condition
Altimeter	Every 24 months per FAA Directive
Directional gyro	On condition
Gyro horizon	On condition
Gyro pressure gage	On condition
Engine gage units	On condition
Airspeed indicator	On condition
Rate-of-climb	On condition
Fuel flow/manifold pressure indicator	On condition
Tachometer	On condition
Clock	On condition
Flap position indicator	On condition
Free air temperature indicator	On condition
All hose	On condition
Pressure system filter	Every 500 hours
Air pressure regulator valve	On condition

ELECTRICAL SYSTEM

Battery master relay	On condition
All other relays	On condition
Voltage regulator	On condition
Starter relay	On condition
Battery (Emergency Locator Transmitter)	Replace at 50% of useful life (as stated on the battery) or any time transmitter is used more than one cumulative hour.

MISCELLANEOUS

Hand fire extinguisher	Inspect every 12 months, recharge as necessary
Cabin heating and ventilating ducts	On condition, inspect every 12 months
Oxygen regulator	Every 48 months or 2000 hours
Oxygen cylinder (light weight)	Hydrostatically test every 3 years and replace every 24 years (ICC Regulation)
Air conditioner filter	On condition
Air conditioner compressor	On condition
Wing attach bolts	Replace 10 years after the initial inspection or on condition. See Section 3.

* Refer to Teledyne Continental Motors Service Bulletin M74-20 Rev. 1 dated November 7, 1974 or later issue.

100-HOUR INSPECTION GUIDE

NOTE

This inspection procedure meets the intent of FAR 91.169 and Part 43 Appendix D.

The owner or operator is primarily responsible for maintaining the airplane in an airworthy condition, including compliance with all applicable Airworthiness Directives as specified in Part 39 of the Federal Aviation Regulations. It is further the responsibility of the owner or operator to ensure that the airplane is inspected in conformity with the requirements of Parts 43 and 91 of the Federal Aviation Regulations. Beech Aircraft Corporation has prepared this inspection guide to assist the owner or operator in meeting the foregoing responsibilities. This inspection guide is not intended to be all-inclusive, for no such guide can replace the good judgment of a certified airframe and powerplant mechanic in the performance of his duties. As the one primarily responsible for the airworthiness of the airplane, the owner or operator should select only qualified personnel to maintain the airplane.

NOTE

Additional inspection forms are available under Part Number 98-32227D or subsequent revision.

The time periods for the inspections noted in this schedule are based on normal usage under average environmental conditions. Airplanes operated in extremely humid tropics, or in exceptionally cold, damp climates, etc., may need more frequent inspections for wear, corrosion, lubrication, and/or lack of maintenance. Under these adverse conditions, perform periodic inspections in compliance with this guide at more frequent intervals until the operator can set his own inspection periods based on the contingencies of field experience. A 100-hour inspection **MUST** be accomplished within each 12-month period for compliance with the Federal Aviation Regulations. To the extent that the airplane is operated in excess of 100 hours per year,

Beech Aircraft Corporation strongly recommends that the airplane be inspected at 100-hour intervals rather than annually. The 100-hour interval between performance of the procedures specified herein should **NEVER** be exceeded by more than 10 hours, and then only if the additional time is required to reach a place where the inspection can be satisfactorily accomplished.

While this guide may be used as an outline, detailed information of the many systems and components in the airplane will be found in the various sections of this manual (especially Sections 1, 2, and 15) and the pertinent vendor publications. It is also recommended that reference be made to the applicable Maintenance Handbooks, Service Instructions, Service Letters, Service Bulletins, Installations Instructions, and Vendor's Specifications for torque values, clearances, settings, tolerances, and other requirements. It should further be verified that all interior and exterior placards are legible and in place during the inspection. In the final analysis, it is the responsibility of the owner or operator to ensure that the airframe and powerplant mechanic inspecting the airplane has access to the previously noted documents as well as to this inspection guide.

NOTE

In addition to the inspections prescribed by this schedule, the altimeter system and all ATC transponders **MUST** be tested and inspected at 24-month intervals in compliance with the requirements specified in FAR Parts 91.170 and 91.177 under Title 14 of the Code of Federal Regulations.

CAUTION

After the first twenty-five hours of engine operating time, a new, remanufactured or newly overhauled engine should be given the 100 hour inspection including draining and renewing lubricating oil.

	No. 1 100 Hrs.	No. 2 200 Hrs.	No. 3 300 Hrs.	
OPERATIONAL INSPECTION				
Starter	X	X	X	
Fuel Pressure	X	X	X	
Cylinder Head Temperature	X	X	X	
Alternator Output	X	X	X	
Propeller Operation	X	X	X	
Oil Pressure and Temperature	X	X	X	
Magnetos	X	X	X	
Power Check	X	X	X	
Ammeter	X	X	X	
Standby Generator	X	X	X	
Heating and Ventilating System	X	X	X	
Idle RPM and Mixture	X	X	X	
Idle Cut-Off	X	X	X	
Ignition Switch - Rotate the ignition switch through the OFF position to the extreme limit of its travel, if the engine stops firing the switch is normal. IF THE ENGINE CONTINUES TO RUN WITH THE SWITCH HELD IN THE PAST OFF position refer to Bendix Service Bulletin No. 583 dated February, 1976.....	X	X	X	
All Engine Controls	X	X	X	
Fuel Quantity Gages	X	X	X	
Auxiliary Fuel Pump	X	X	X	
Fuel Tank Selector	X	X	X	
All Lights	X	X	X	
Radio Operation	X	X	X	
Flaps	X	X	X	
Pitot Heat	X	X	X	
Brakes	X	X	X	
Emergency Exit Hatch - Check the emergency release handle and latch assembly for proper operation. Check that the hatch moves out freely. Check complete hatch assembly for condition and all moving parts for operation. With the hatch installed, check for proper latching and seal.	X	X	X	
Emergency Locator Transmitter - Check for proper operation.....	X	X	X	
NOTE				
Tune radio to 121.5 MHz on VHF or 243 MHz on UHF, then turn ELT switch to ON and monitor for one signal. Turn ELT switch OFF, then place in ARM position.				
Oxygen System	Check all moving parts twice a year.			

	No. 1 100 Hrs.	No. 2 200 Hrs.	No. 3 300 Hrs.	
POWER PLANT				
Nacelle Skin.....			X	
Nacelle Structure			X	
Cowling.....	X	X	X	
Cowl Flaps.....	X	X	X	
Cowl Latch Rig.....	X	X	X	
Battery.....	X	X	X	
Plumbing	X	X	X	
Brake Fluid Reservoir	X	X	X	
Induction System and Air Filter.....	X	X	X	
Alternate Air Valve.....	X	X	X	
Spark Plugs.....	X	X	X	
Engine Oil Sump	X	X	X	
†Propeller.....	X	X	X	
Propeller Spinner	X	X	X	
Magnetos.....	X	X	X	
Exhaust System	X	X	X	
Inspect turbocharger compressor wheel for broken blades and freedom of rotation.....	X	X	X	
Turbocharger Wastegate.....	X	X	X	
Turbocharger Exhaust and Induction System.....	X	X	X	
Turbocharger System.....	X	X	X	
Heater Muff (See Chapter 10)	X	X	X	
Engine Heat Shields and Baffles Check for cracks and location	X	X	X	
Cowling Seals - They should curve toward the air flow.....	X	X	X	
Cylinders and Baffles.....	X	X	X	
Ignition Harness.....	X	X	X	
Alternator See Service Instruction No. 0546-359 Rev 1	X	X	X	
Standby Generator	X	X	X	
Oil Cooler.....	X	X	X	
Engine Accessories.....	X	X	X	
Electrical Wiring and Equipment	X	X	X	
All Drains and Plugs.....	X	X	X	
Pressure Pump Intake Filter.....	X	X	X	
Engine Mounts	X	X	X	
Control Connections.....	X	X	X	
Air Conditioning - Check belt for tension and frayed or worn condition.....	X	X	X	
Exhaust System.....	X	X	X	
Cabin Heater System	X	X	X	

	No. 1 100 Hrs.	No. 2 200 Hrs.	No. 3 300 Hrs.	
CABIN				
Skin.....			X	
Structure.....			X	
Cables and Pulleys.....			X	
Landing Gear Gearbox and Actuating Linkage.....	X	X	X	
Flap Motor and Shafts.....			X	
Auxiliary Fuel Pump.....	X	X	X	
Brake Master Cylinders and Parking Brake Valve.....	X	X	X	
Rudder Pedals.....			X	
Control Column.....			X	
Engine Controls.....			X	
Electrical Wiring and Equipment.....			X	
Plumbing.....			X	
Windows and Doors.....			X	
Seats and Seat Belts.....			X	
Instruments and Instrument Panel.....			X	
Oxygen System.....	X	X	X	
Fuel Selector Valve.....	X	X	X	
Pressure System In-line Filter.....	X	X	X	
WINGS				
Skin.....			X	
Structure.....			X	
Access Doors.....			X	
Cables.....			X	
Ailerons.....			X	
Fuel Tanks, Caps and Vents (See Service Instruction No. 0488-281 and No. 0632-280).....	X	X	X	
Plumbing.....			X	
Electrical Wiring and Equipment.....			X	
Flaps and Actuators.....			X	
Wing Bolts.....				Check the wing bolts for proper torque at the first 100 hour inspection and at the first 100 hour inspection after each reinstallation of the wing attach bolts.
NOSE GEAR				
Wheel and Tire.....	X	X	X	
Landing Gear Strut.....	X	X	X	
Actuating Linkage.....	X	X	X	
Gear Doors and Linkage.....	X	X	X	
Shimmy Dampener.....	X	X	X	
Strut Fluid Level.....			X	
Strut and A-Frame Hinge Bolts.....	X	X	X	
Visual Indicator.....	X	X	X	
Static Cable (If Installed).....	X	X	X	

	No. 1 100 Hrs.	No. 2 200 Hrs.	No. 3 300 Hrs.	
MAIN GEAR AND BRAKES				
Brake Lining and Disc	X	X	X	
Wheels and Tires	X	X	X	
Landing Gear Strut	X	X	X	
Actuating Linkage	X	X	X	
Gear Doors and Linkage	X	X	X	
Strut Fluid Level			X	
Hinge Bolts	X	X	X	
*MAIN GEAR OPERATION				
Doors		X		
Position Lights		X		
Warning Horn		X		
Uplock Cable Tension		X		
Emergency Extension		X		
Downlock Tension		X		
Uplock Rollers	X	X	X	
Actuator Gear Box Rigging Clearance		X		
Safety Switch		X		
General Operation		X		
*NOSE GEAR OPERATION				
Doors		X		
Visual Indicator (If Installed)		X		
Nose Gear Up Tension		X		
Downlock Tension		X		
REAR FUSELAGE AND EMPENNAGE				
Skin			X	
Structure			X	
Cables and Pulleys			X	
Control Surfaces			X	
Trim Tabs and Actuators			X	
Static Ports	X	X	X	
Plumbing			X	
Electrical Wiring and Equipment			X	
Drain Static Lines	X	X	X	
GENERAL				
Airplane Cleaned and Serviced	X	X	X	
Airplane Lubricated in Accordance with Shop Manual Lubrication Chart	X	X	X	

For a complete or annual inspection of the airplane all items on the airplane that are noted on this guide should be inspected.

†Check the tip of the blades and shank of the blades for evidence of lightning strikes. If evidence of lightning strike, check the area of entering or leaving the blade for hardness. The inside and outside shank area should be checked for arcing. In all cases of lightning strikes the thrust bearings should be replaced, soft blades rejected, and all steel parts demagnetized.

*First 100 hours and every 200 hours thereafter, place the airplane on jacks and cycle the landing gear while checking to ascertain that the position lights operate in conjunction with the landing gear position. Check condition and operation of complete landing gear system.

ELECTRIC PROPELLER DEICER 50 HOUR INSPECTION

The various components of the propeller deicer system should be inspected every 50 hours for the appearance of defects. The following inspections may provide a means for detecting and correcting such defects before they render the deicer system inoperative:

- a. Lock the brakes and operate the engine at near take-off power. Turn the deicer systems switch ON and observe the ammeter for at least 2 minutes. If the ammeter needle does not rest within the shaded band (except for a flicker at 30 second intervals when the step switch of the timer cycles) refer to the troubleshooting chart for the probable sources of trouble.
- b. With the engine shut off, turn the deicer switch ON and feel the deicer boots on the propeller for the proper sequence of heater operation. The presence of local hot spots indicates service damage to the deicer heaters, which should be repaired before more serious damage develops.

CAUTION

While following the instructions of step b., move the propeller back and forth to prevent arcing between the brushes and slip ring.

WARNING

Before moving the propeller, make certain that the ignition switch is off and that the engine has cooled completely. There is always some danger of a cylinder firing when a propeller is moved.

- c. Remove the spinner dome and open all access doors pertaining to the wiring and components of the deicer system. Turn the deicer switch ON and station an assistant in the cockpit to observe the system ammeter. Flex all accessible wiring, particularly the lead straps, leads from the slip ring assembly, and the firewall electrical connectors and their wiring. Any movement of the ammeter, other than the cycling flicker that occurs at 30 second intervals, indicates a short or open circuit that must be located and corrected.

- d. To extend the life of the lead strap between the hub clamp and clip, reposition the bend in the strap at a point at least 1/2 inch from the existing location of the bend.

- e. Check for damaged brush rods or springs and for worn or damaged brushes.

100 HOUR INSPECTION

- a. Check for radio noise or radio compass interference by operating the engine at near take-off power with the radio gear turned on. If, under these conditions, noise or interference occurs when the deicer switch is ON and disappears when the switch is OFF, refer to the troubleshooting chart for the probable source of trouble.

- b. Check all clamps, clips, mountings, electrical connections and connectors for tightness and electrical soundness. Check also for loose, broken or missing safety wire.

- c. Closely check the deicer boots for wrinkled, loose or torn areas, particularly around the outboard end and at the point where the strap passes under the hub clamp. Look for abrasion or cuts along the leading edge of the flat or thrust face. If the heater wires are exposed in damaged areas or if the rubber is found to be tacky, swollen or deteriorated (as from contact with oil or solvent fluids), replace the damaged deicer boot.

- d. Check that the hub clamps are tight. Inspect for cracks or other damage. Check to see that the cushioning material is not missing or damaged in the area under the hub clamp or on the edge of the spinner dome. Manually operate the propeller from "high pitch" to "low pitch" while checking that the deicer lead straps do not come under tension.

- e. Check the slip rings for gouges, roughened surfaces, cracks, burned or discolored areas, and for deposits of oil, grease or dirt. Clean greasy or contaminated slip rings with CRC-2-26 solvent (a product of Corrosion Reaction Consultants, Inc., of Philadelphia, Pennsylvania). After such a cleaning, allow a run-in time of 5 hours of engine operation before turning on the deicer system.

- f. If uneven wear or wobble is detected, check the alignment of the slip rings to the prop shaft with a dial indicator. While turning the prop to check the slip ring alignment, push in on the prop to eliminate play in the propeller thrust bearing. If the runout over 360 degrees of rotation is over 0.005 inch or if over any 4-inch arc it exceeds 0.002 inch, refer to the paragraph on Slip Ring Alignment.

g. Examine the brush mounting bracket and housing for cracks, deformation, or other indications of damage. Make sure that connections are tight and that the leads are not chafed or binding.

h. Check to see that each brush rides fully on its slip ring over 360 degrees of rotation. If the brush is not properly aligned, add shims under the brush block or elongate the holes in the mounting bracket to raise or lower the brush block to the proper position. If the brushes ride BOTH high and low with respect to the slip rings in 360 degrees of rotation, the slip ring assembly is eccentrically mounted and the spinner bulkhead must be replaced.

i. Check for proper spacing between the brush block and slip rings as indicated in Deicer Brush Replacement. If this distance is not within the specified limits, loosen the mounting screws and reposition them in the elongated holes until the block is properly positioned. If necessary, add shims between the thrust bearing plate and mounting bracket until the brush block is properly located.

j. Estimate the contact angle of the brush block in relation to the slip rings. If this angle is not approximately 2 degrees, as indicated in Deicer Brush Replacement, loosen the mounting screws and reposition the brush block until the proper angle exists between the brush block and slip rings. The spacing established in Figure 11-4 must also be maintained after the proper contact angle is established.

k. With the deicer system operating and a man in the cockpit observing the ammeter, visually inspect and physically flex the wiring from the brush blocks to each component of the deicer system and to the airplane power supply. Jumps of the ammeter needle (other than the momentary flicker that occurs when the timer switches at 30 second intervals) indicate loose or broken wiring in the area under examination at the moment. In such instances, continue to flex the wiring in the area that first indicated trouble while checking the continuity through the individual wires of the affected harness until the source of trouble is located. Use the wiring diagram to trace the circuitry of the deicer system.

WARNING

Before moving the propeller, make certain that the ignition switch is off and that the engine has cooled completely. There is always some danger of a cylinder firing when a propeller is moved.

CAUTION

While following the instructions of step k. move the propeller back and forth to prevent arcing between the brushes and slip ring.

TURBOCHARGER

25 Hours

a. Visually inspect system for oil leaks, exhaust system leaks and general condition.

50 Hours

a. Visually inspect system for oil leaks, exhaust system leaks and general condition.

100 Hours

Inspect turbocharger system per the following method:

Remove compressor inlet duct assembly. Inspect the compressor wheel for nicks, cracks or broken blades. Turn wheel by hand and feel for excess bearing drag or wheel rubbing against housing. Reinstall air inlet duct.

The oil inlet and outlet ports in center housing should be checked for leaks, and the turbine heat blanket for condition and security.

b. Check for any interference with linkage between the by-pass valve (wastegate) and actuator, its general condition and security.

c. Inspect all exhaust system components for worn or damaged areas, loose clamps, cracks and leaks.

d. Inspect lubrication system components for worn or damaged areas, loose clamps and leaks. Special attention should be given to the ducting downstream (pressure side) of the compressor.

e. Inspect the fuel injection nozzle pressure reference manifold, for deteriorated hose, loose connections, leaks or obstructions.

f. All fluid power lines should be checked for leaks and security.

g. The compressor discharge reference line from the throttle air valve to the controller should be opened and inspected for oil leakage from the controller. Any leakage is cause for replacement of the controller.