TECHNICAL MANUAL
MAINTENANCE

USAF SERIES

T-33A-1, T-33A-5, T-33A-10, AND T-33A-15

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INTRODUCTION

This handbook contains field service and maintenance instructions for T-33A airplanes designed and manufactured by the Lockheed Aircraft Corporation under the following contracts:

T-33A-1 AIRPLANES

Lockheed Serial No.	*AF Serial No.*
Contract No. W33-038 ac 19283	
5001 thru 5020	48-356 thru 48-375
5021 thru 5028	48-913 thru 48-920
5029 thru 5156	49-879 thru 49-1006
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7095 thru 7114	51-16976 thru 51-16995
Contract No. AF33(600)-6578	
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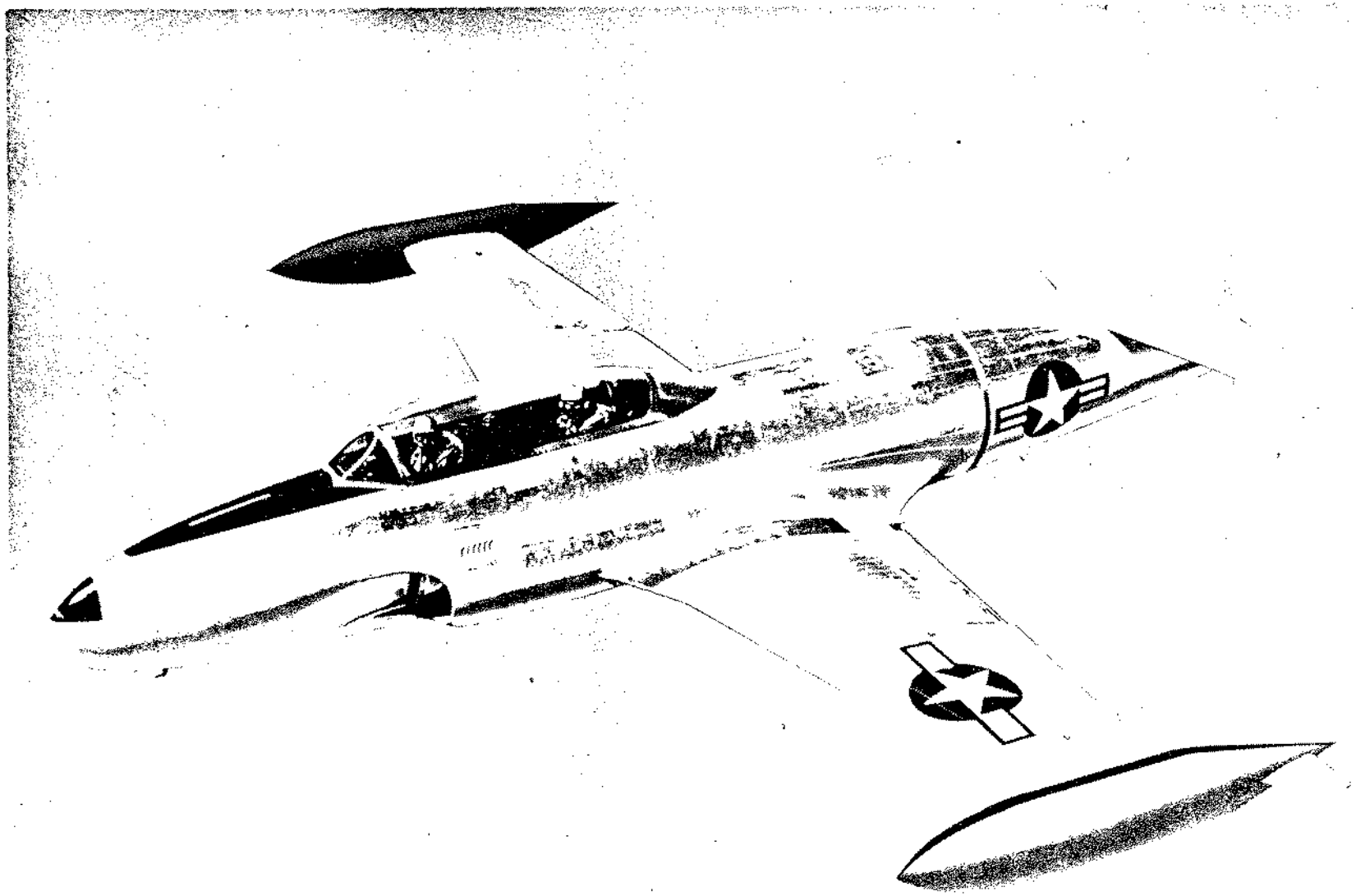
8579 thru 8595	53-5240 thru 53-5256
8597 thru 8611	53-5258 thru 53-5272
8613 thru 8629	53-5274 thru 53-5290
8631 thru 8646	53-5292 thru 53-5307
8648 thru 8660	53-5309 thru 53-5321
8662 thru 8673	53-5323 thru 53-5334
8675 thru 8685	53-5336 thru 53-5346
8687 thru 8697	53-5348 thru 53-5358
8699 thru 8709	53-5360 thru 53-5370
8711 thru 8722	53-5372 thru 53-5383
8724 thru 8734	53-5385 thru 53-5395
8736 thru 8747	53-5397 thru 53-5408
8749 thru 8758	53-5410 thru 53-5419
8760 thru 8768	53-5421 thru 53-5429
8770 thru 8779	53-5431 thru 53-5440
8781 thru 8787	53-5442 thru 53-5448
8789 thru 8795	53-5450 thru 53-5456
8797 thru 8804	53-5458 thru 53-5465
8806 thru 8812	53-5467 thru 53-5473
8814 thru 8820	53-5475 thru 53-5481
8822 thru 8829	53-5483 thru 53-5490
8831 thru 8837	53-5492 thru 53-5498
8839 thru 8846	53-5500 thru 53-5507
8848 thru 8855	53-5509 thru 53-5516
8857 thru 8863	53-5518 thru 53-5524
8865 thru 8871	53-5526 thru 53-5532
8873 thru 8877	53-5534 thru 53-5538
8879 thru 8884	53-5540 thru 53-5545
8886 thru 8891	53-5547 thru 53-5552
8893 thru 8898	53-5554 thru 53-5559

Lockheed Serial No.	*AF Serial No.*
8900 thru 8905	53-5561 thru 53-5566
8907 thru 8912	53-5568 thru 53-5573
8914 thru 8919	53-5575 thru 53-5580
8921 thru 8925	53-5582 thru 53-5586
8927 thru 8932	53-5588 thru 53-5593
8934 thru 8938	53-5595 thru 53-5599
8940 thru 8945	53-5601 thru 53-5606
8947 and 8948	53-5608 and 53-5609
8950 and 8951	53-5611 and 53-5612
8953 thru 8957	53-5614 thru 53-5618
8959 thru 8964	53-5620 thru 53-5625
8966 thru 8969	53-5627 thru 53-5630
8971 thru 8976	53-5632 thru 53-5637
8978 thru 8982	53-5639 thru 53-5643
8984 thru 8988	53-5645 thru 53-5649
8990 thru 8994	53-5651 thru 53-5655
8996 thru 9000	53-5657 thru 53-5661
9002 thru 9006	53-5663 thru 53-5667
9008 thru 9013	53-5669 thru 53-5674
9015 thru 9019	53-5676 thru 53-5680
9021 thru 9025	53-5682 thru 53-5686
9027 thru 9031	53-5688 thru 53-5692
9033 thru 9037	53-5694 thru 53-5698
9039 thru 9043	53-5700 thru 53-5704
9045 thru 9048	53-5706 thru 53-5709
9050 thru 9054	53-5711 thru 53-5715
9056 thru 9059	53-5717 thru 53-5720
9061 thru 9065	53-5722 thru 53-5726
9067 thru 9071	53-5728 thru 53-5732
9073 thru 9077	53-5734 thru 53-5738
9079 thru 9083	53-5740 thru 53-5744
9085 thru 9089	53-5746 thru 53-5750
9091 thru 9094	53-5752 thru 53-5755
9096 thru 9101	53-5757 thru 53-5762
9103 thru 9106	53-5764 thru 53-5767
9108 thru 9111	53-5769 thru 53-5772
9113 thru 9117	53-5774 thru 53-5778
9119 thru 9123	53-5780 thru 53-5784
9125 thru 9128	53-5786 thru 53-5789
9130 thru 9133	53-5791 thru 53-5794
9135 thru 9138	53-5796 thru 53-5799
9157 and 9158	53-5800 and 53-5801
9160 thru 9163	53-5802 thru 53-5805
9165 thru 9168	53-5806 thru 53-5809
9170 thru 9173	53-5810 thru 53-5813
9215 thru 9250	53-5814 thru 53-5849
9291 thru 9319	53-5850 thru 53-5878
9355 thru 9394	53-5879 thru 53-5918
Contract No. AF33(600)-26630	
9140 thru 9143	54-1523 thru 54-1526
9145 thru 9148	54-1528 thru 54-1531
9150 thru 9153	54-1533 thru 54-1536
9155 and 9156	54-1538 and 54-1539
9175 thru 9178	54-1544 thru 54-1547
9180 thru 9183	54-1549 thru 54-1552
9185 thru 9192	54-1554 thru 54-1561
9193 thru 9214	54-2689 thru 54-2710
9251 thru 9272	54-1562 thru 54-1583
9273 thru 9290	54-2711 thru 54-2728
9322 thru 9354	54-1586 thru 54-1618
9450 thru 9455	54-2950 thru 54-2955
9686 and 9687	54-4035 and 54-4036
Contract No. AF33(600)-28429	
9477 and 9479	55-2980 and 55-2962
9481 thru 9513	55-2984 thru 55-3016
9571 and 9572	55-3030 and 55-3031
9574 and 9575	55-3033 and 55-3034
9577 thru 9579	55-3036 thru 55-3038
9581 and 9582	55-3040 and 55-3041
9584 and 9585	55-3043 and 55-3044
9587 thru 9614	55-3046 thru 55-3073
9616 thru 9619	55-3075 thru 55-3078
9621 thru 9624	55-3080 thru 55-3083
9626 thru 9629	55-3085 thru 55-3088
9631 thru 9634	55-3090 thru 55-3093
9636 thru 9639	55-3095 thru 55-3098
9671 thru 9674	55-3101 thru 55-3104
9676 thru 9679	55-3106 thru 55-3109
9681 thru 9685	55-3111 thru 55-3115
9869 thru 9900	55-4425 thru 55-4456
9901 thru 9904	55-4807 thru 55-4810
9905 thru 9922	55-4945 thru 55-4962
Contract No. AF33(600)-31212	
9997 and 1001	56-1649 and 56-1651
1005 and 1009	56-1655 and 56-1659
1013 and 1017	56-1663 and 56-1667
1021 and 1025	56-1671 and 56-1675
1029 and 1033	56-1679 and 56-1683
1037 and 1041	56-1687 and 56-1691
1045 and 1049	56-1695 and 56-1699



The T-33A Airplane

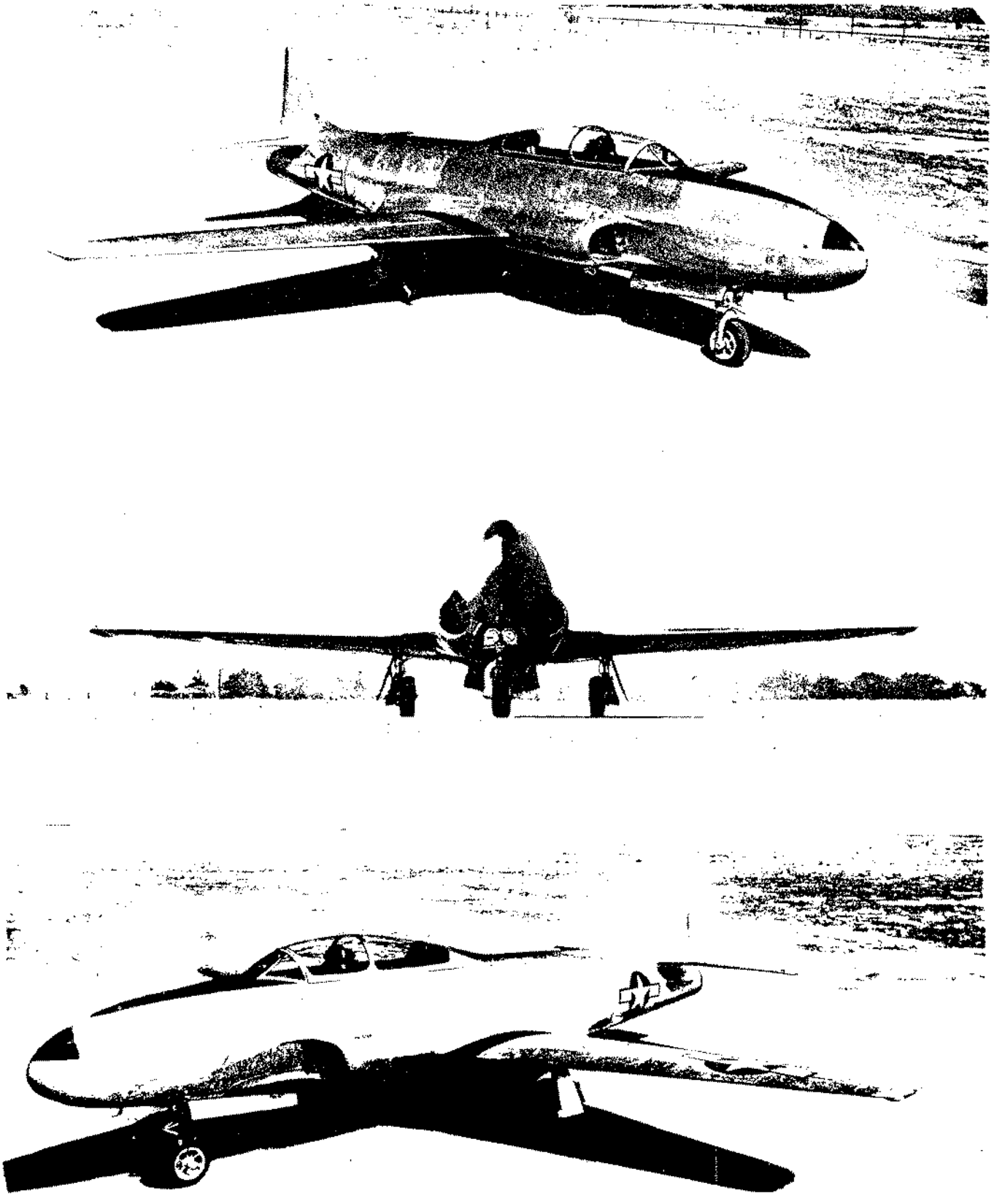


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Figure 1-1. Complete Airplane, Front Views

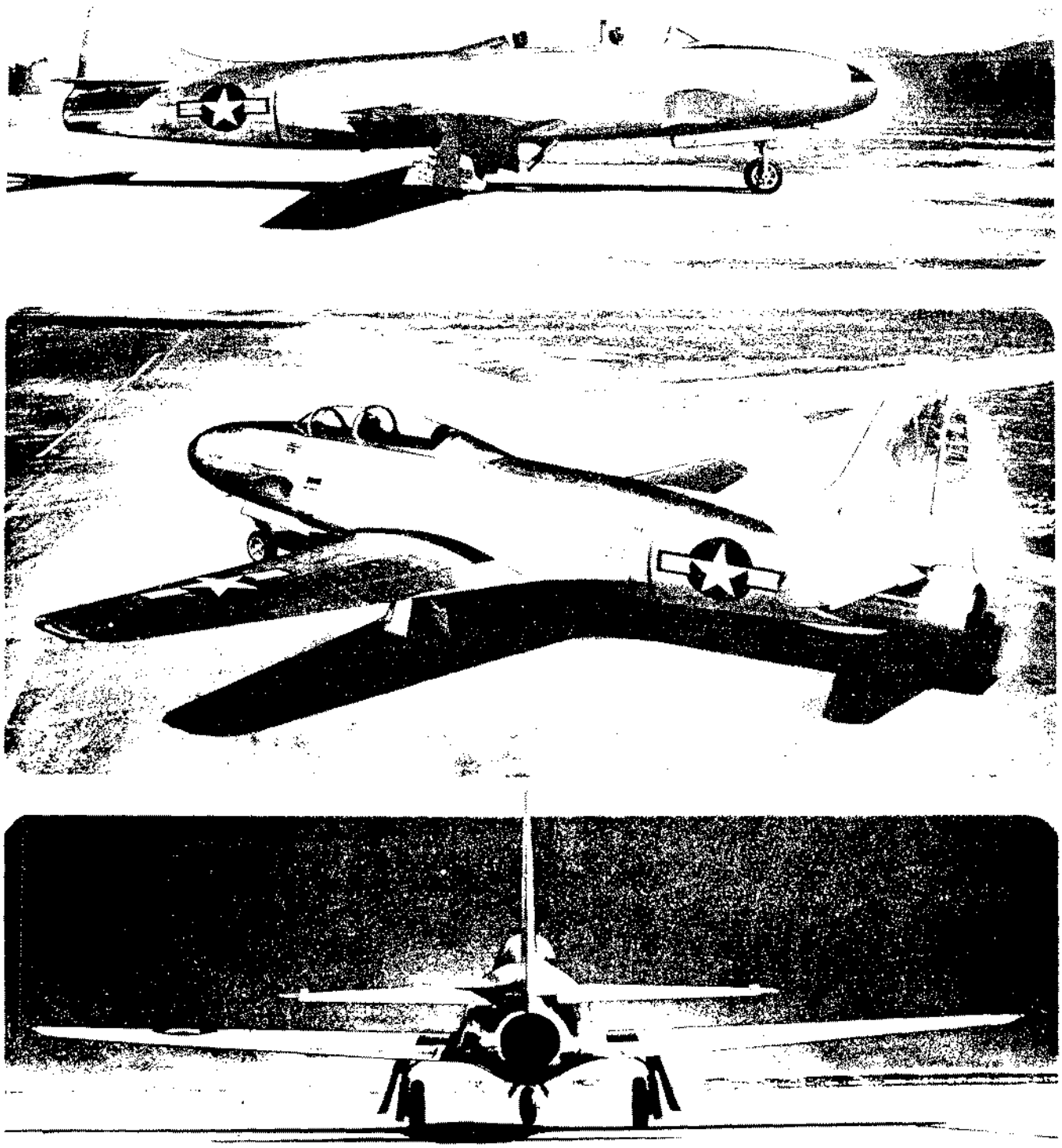

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Figure 1-2. Complete Airplane, Side and Rear Views

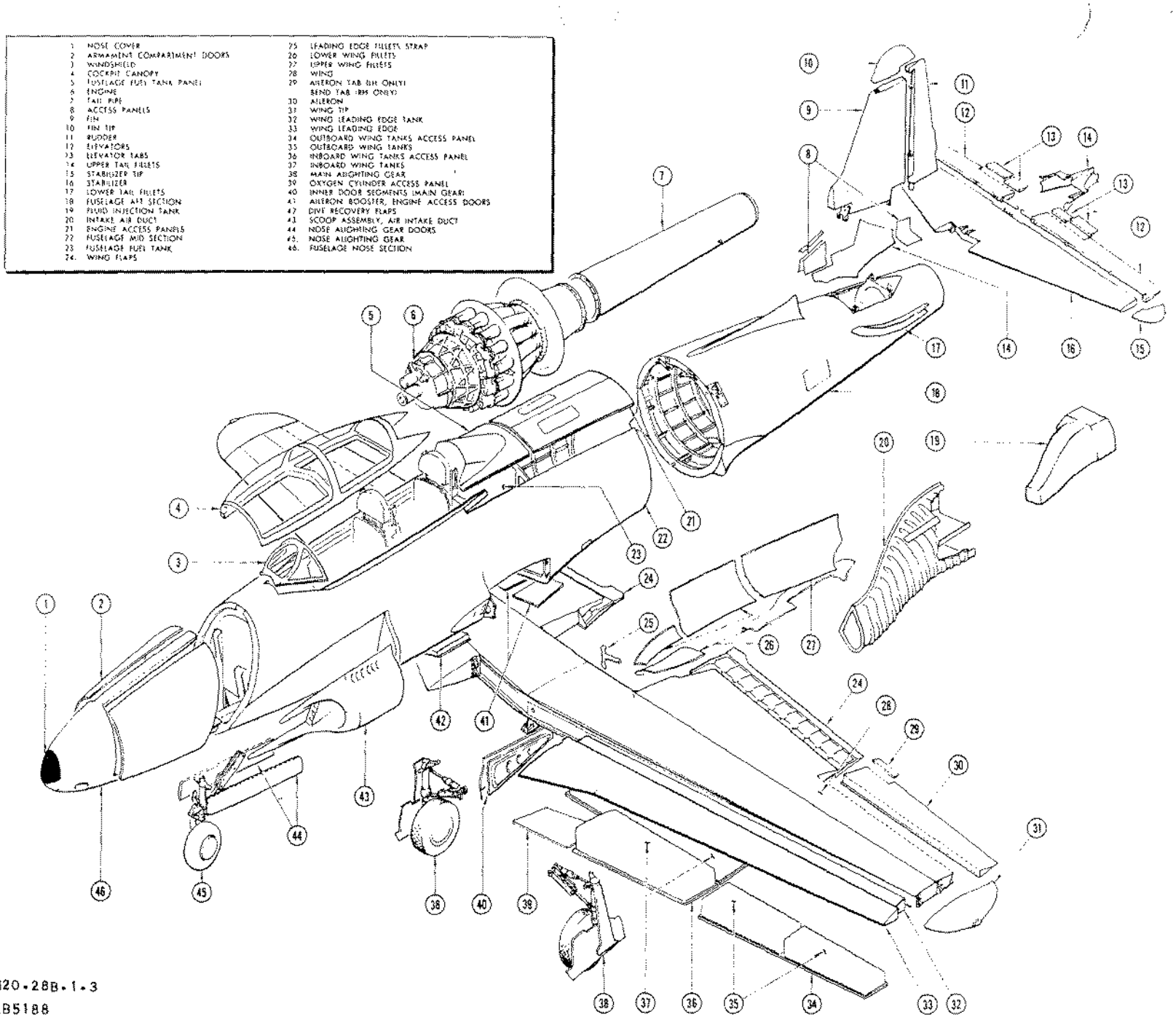

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Figure 1-3. Major Assemblies, Exploded View

1. AN ARN-6 RADIO COMPASS LOOP ANTENNA
2. AMMUNITION BOXES (2)
3. AN ARC-3 & AN ARN-6 RADIO INSTALLATION
4. INSTRUMENT PANEL (2)
5. BULLETPROOF WINDSHIELD PANEL
6. GUN SIGHT
7. JETTISONABLE PILOT'S SEATS
8. "G" VALVES
9. FUEL TANK
10. FUSELAGE AFT-SECTION ATTACHING POINT
11. DIAPHRAGM
12. DIAPHRAGM BELLOWS
13. TAIL PIPE SLING
14. TAIL PIPE SUPPORT TRACK
15. AN/ARC-3 RADIO PICK AXE ANTENNA
16. TAIL PIPE
17. GYROSYN COMPASS FLUX VALVE
18. TAIL PIPE CLAMP
19. TAIL PIPE ADAPTER
20. ELEVATOR TAB MOTOR
21. ENGINE
22. INTAKE AIR SEAL
23. ENGINE MOUNTS
24. FUEL FLOWMETER
25. AILERON BOOSTER UNIT
26. WING SPARS
27. AILERON TORQUE ROD
28. ELEVATOR PUSH-PULL ROD
29. DIVE RECOVERY FLAPS
30. MARKER BEACON RECEIVER
31. ELEVATOR AND AILERON CONTROL ASSEMBLY
32. NOSE ALIGHTING GEAR
33. RUDDER PEDALS
34. LANDING LIGHTS
35. FUSELAGE NOSE-SECTION ATTACHING POINT
36. CASE EJECTION DOOR
37. .50 CALIBER MACHINE GUNS (2)
38. BATTERY
39. AIR SPEED PITOT

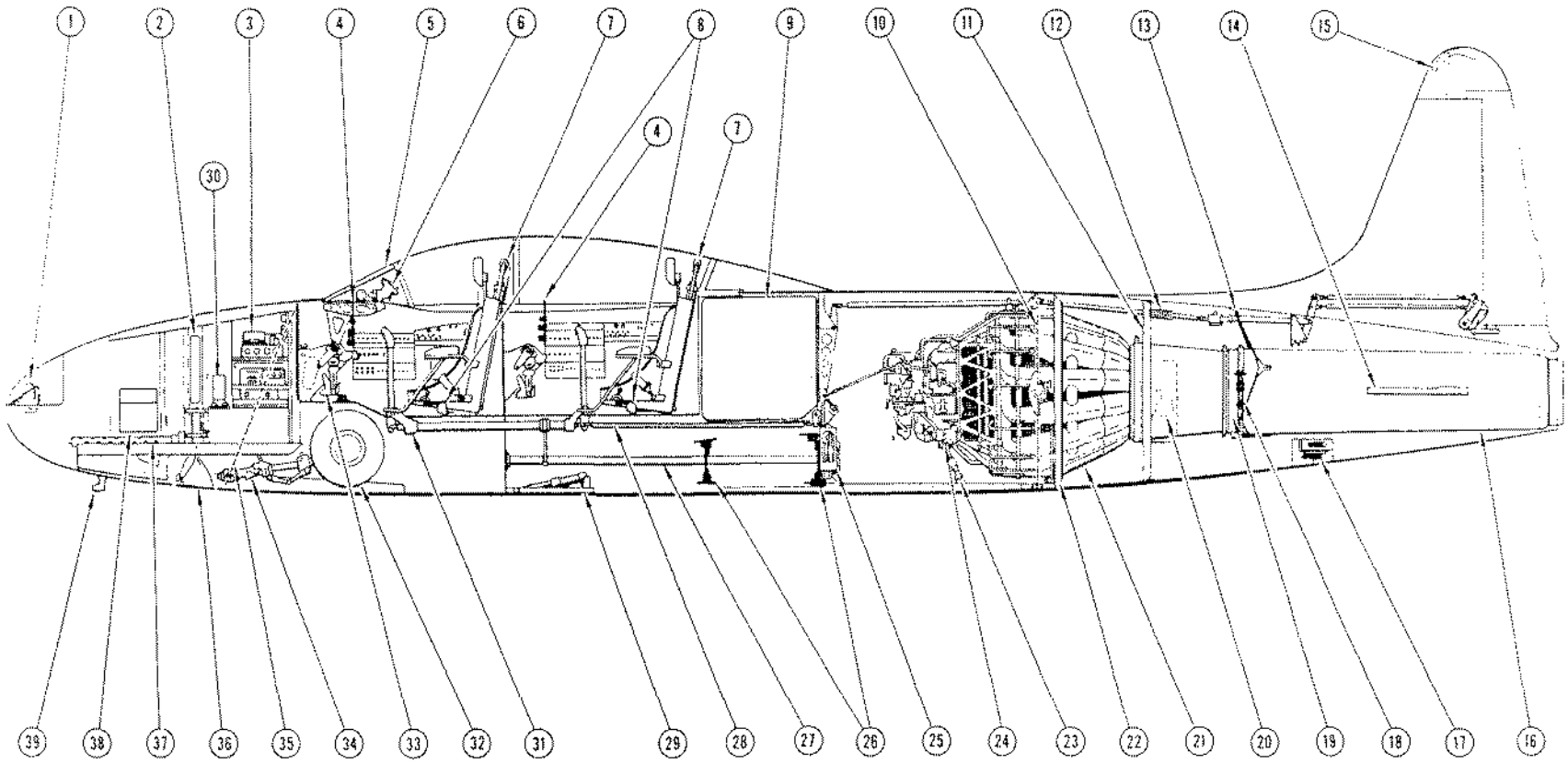

Figure 1-4. Interior Arrangement, T-33A-1 Airplanes

SECTION I

DESCRIPTION, DIMENSIONS, AND LEADING PARTICULARS

1–1. DESCRIPTION.

1–2. The T-33A is an all-metal, low-wing, two-seat, high performance airplane designed for the training of Air Force flight personnel. (See figures 1-1 through 1-4.) The airplane is powered by a single J33-A-35 turbojet engine, and incorporates a laminar flow wing section, aileron control hydraulic boost mechanism, dive flaps, pressurized and heated cockpit, and wing tip provisions for carrying droppable fuel tanks, bombs, or chemical tanks.

1–3. T-33A airplanes, having AF Serial No. 49-907 through 49-912, are winterized and differ from the basic airplane as follows: Replacement of "O" and "V" ring packings with extreme temperature rings; installation of natural rubber canopy seal; and replacement of lubricants in flap indicator cables, AN/ARC-3 radio dynamotor bearings, AN/ARN-6 compass tuning shaft and couplings, and in machine guns.

1–4. The wing is of full cantilever, stressed aluminum-alloy skin construction, made in one unit. Wing leading edge sections, wing tips, ailerons, and flaps are detachable. Interior structure consists of two main beams, and one auxiliary beam for attachment of ailerons and split-type flaps. Space is also provided for installation of fuel tanks, oxygen cylinders, and attachment and enclosure of the main alighting gears. Wing flaps are installed to increase lift and drag. Ailerons are conventional and are controlled by lateral motion of a control stick. A torque tube transmits motion of the stick to the aileron hydraulic booster mechanism which augments force applied by the pilot. A system of cables actuates the ailerons.

1–5. The fuselage structure is of aluminum-alloy construction, built in three sections: nose, mid section and aft section. The mid and aft sections are easily separable at station 277.5 ± 12 to accommodate the power plant installation. A fuel tank is installed in the mid section immediately aft of the cockpit. The cockpit is covered by a transparent, jettisonable, plastic canopy of the "free blown" type. Two jettisonable pilots' seats are installed in the cockpit. A heating, cooling, and pressurization system is installed for providing the proper amount of air at a controllable temperature. Two hydraulically operated dive recovery flaps are incorporated in the bottom of the fuselage at approximately station 164 ± 26.

1–6. The fuselage aft section incorporates the tail structure consisting of a horizontal stabilizer, two elevators, a vertical fin, and a rudder. Fore-and-aft motion of a control stick moves the elevators through a system of torque tubes and push-pull rods. The rudder is controlled by the rudder pedals and a cable system. At the extreme end of the fuselage aft section a steel ring serves to increase structural rigidity and a steel panel on the bottom serves to resist scuffing in event of tail-low landings.

1–7. On T-33A-1 airplanes, armament equipment consists of two or more .50 caliber machine guns with ammunition trays for 300 rounds per gun mounted in the nose section of the fuselage. A computing gun sight is mounted in the front cockpit directly behind the bulletproof windshield on the center line of the airplane. A gun camera is mounted in the outboard leading edge of the right-hand air intake scoop.

1–8. On T-33A-5 airplanes, a VHF Omnirange and localizer receiver (AN/ARN-14) and a glide slope receiver (AN/ARN-18 or AN/ARN-31) are installed in the airplane nose section in place of the machine guns and ammunition trays. The following MDAP T-33A-5 airplanes have the components of the VOR system removed, however, all wiring is in these airplanes: 56-1607 thru 56-1614, 56-1625 thru 56-1640, 56-1674, 56-1676 thru 56-1678, 56-1680 thru 56-1682, 56-1684 thru 56-1686, 56-1688 thru 56-1690, and 56-1692 thru 56-1694, 58-454, 58-515 thru 58-520, 58-556 thru 58-563, 58-593 thru 58-606, 58-637 thru 58-650, 58-679 thru 58-692 and 58-708 thru 58-710.

1–9. Prior to AF Serial No. 51-4141 on airplanes not incorporating T. O. 1T-33A-42, provisions are made in each wing tip to carry a bomb weighing from 100 to 1000 pounds, or droppable fuel tanks, or chemical tanks.

1–10. On AF Serial No. 51-4141 and subsequent and airplanes incorporating T. O. 1T-33A-42, provisions are made in each wing tip to carry droppable fuel tanks. On AF Serial No. 51-4141 through 51-4267, bomb-carrying pylons may be installed under each wing to accommodate bombs of from 100 to 1000 pounds.

1–11. Communication equipment consists of a short-range command transmitting and receiving radio (AN/ARC-3, AN/ARC-27 or AN/ARC-34), radio compass (AN/ARN-6), interphone communication equipment (AN/AIC-2A or AN/AIC-10), marker beacon receiver (AN/ARN-12, AN/ARN-32 or RC-193A), and associated microphone and headset equipment. Instruments and equipment necessary for day and night flying are provided.

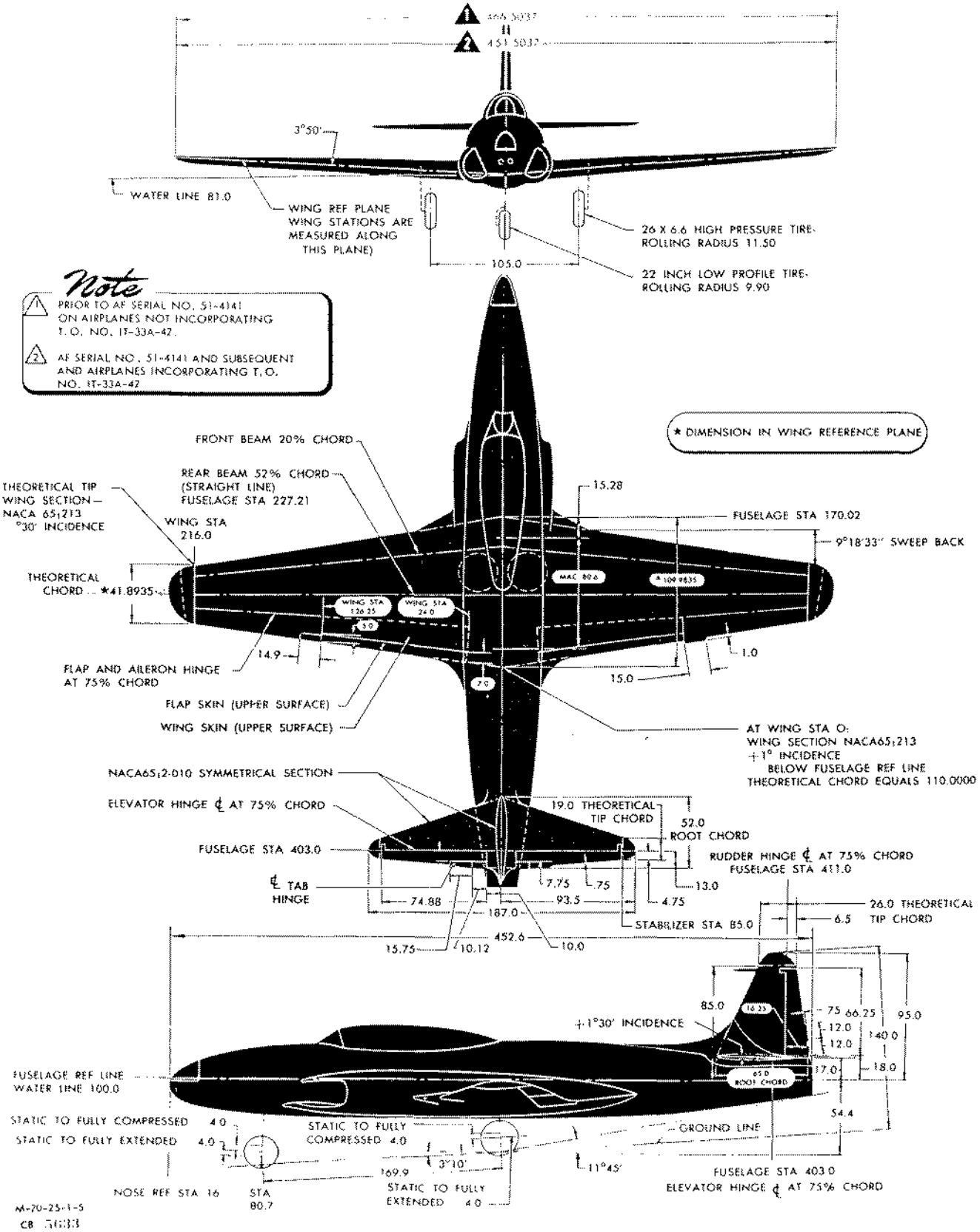

Figure 1-5. General Dimensions

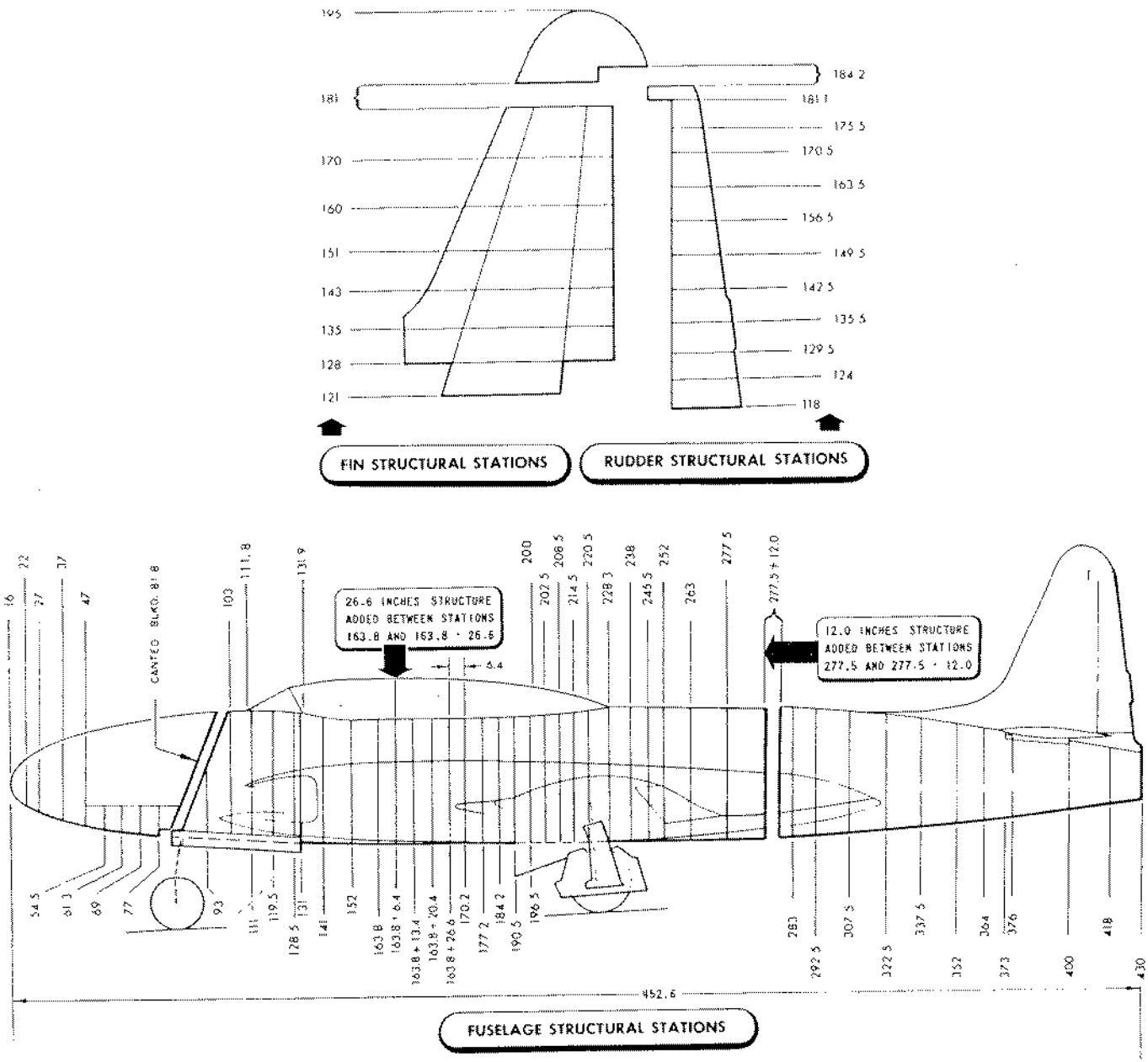

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Figure 1-6. Stations Diagram (Sheet 1 of 2)

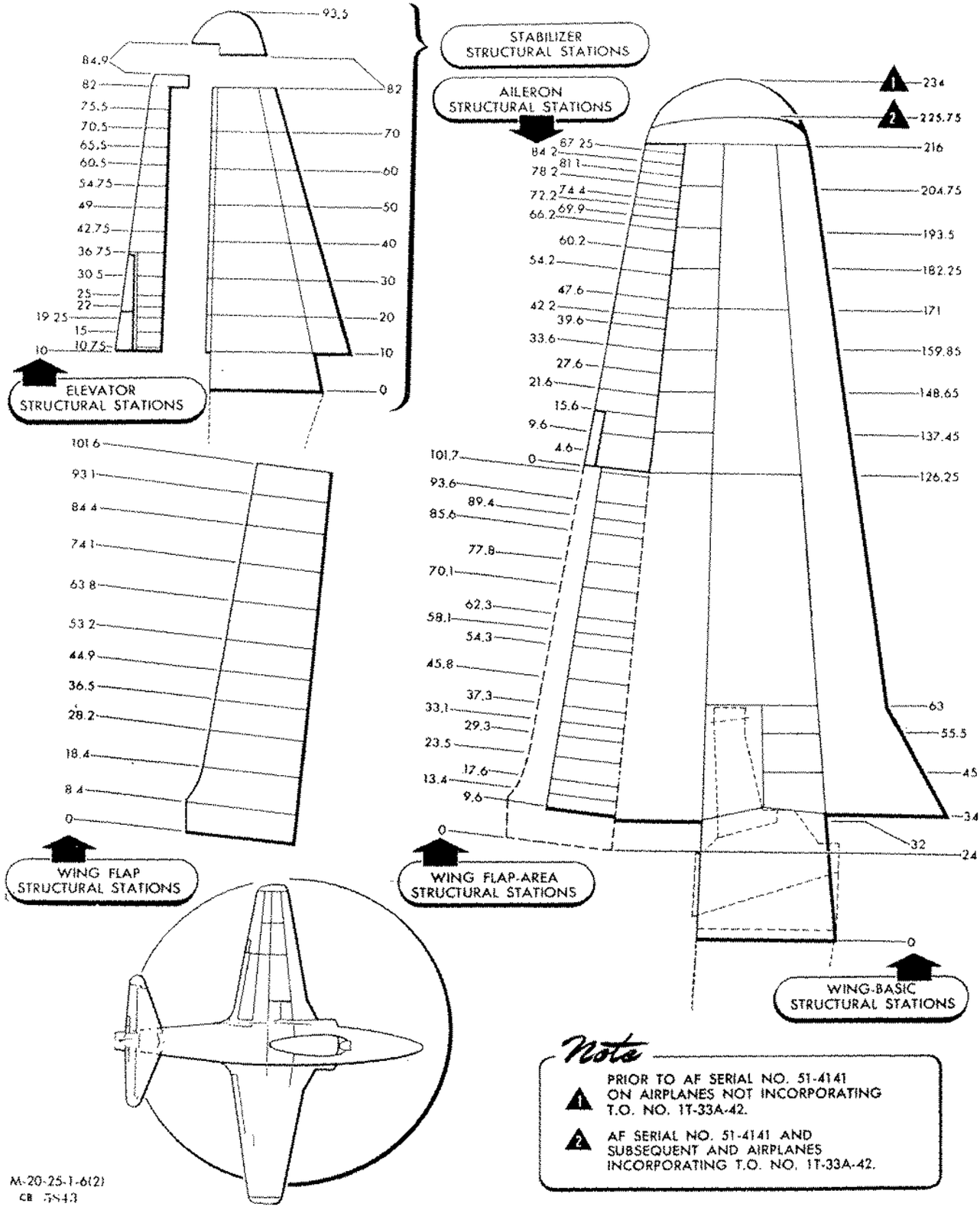


Figure 1-6. Stations Diagram (Sheet 2 of 2)

1–12. Hydraulically operated tricycle alighting gear consists of two main gears retracting inward, and a nose gear retracting aft. When retracted, all gears are enclosed by flush doors. Single-disc or double-disc, three-spot type brakes on the main gear wheels are hydraulically controlled by action of two independent master cylinders, one connected to each rudder pedal. A shimmy damper is provided on the nose gear. The nose gear has provisions for forward towing, and the main gear has provisions for forward and aft towing of the airplane.

1–13. A 1000-psi pressure hydraulic system is provided to operate the main hydraulic actuating units. An emergency hydraulic system is provided to actuate the alighting gear in the event of failure of the main system.

1–14. A low-pressure demand oxygen system is installed. Oxygen is directed to the pilots through pressure demand regulators from cylinders located in the wing and fuselage nose.

1–15. Wing flaps, elevator trim tabs, and aileron trim tab are electrically actuated.

1–16. Fuselage, empennage, and wing stations are shown on figure 1-6.

1–17. DIMENSIONS.

1–18. For principal over-all dimensions, see figure 1-5.

1–19. LEADING PARTICULARS.

1–20. Airplane designation, T-33A-1-LO and T-33A-5-LO.

1–21. PRINCIPAL DIMENSIONS. Airplane in level flight position unless otherwise stated.

COMPLETE AIRPLANE

Span (Wing) Prior to AF Serial No. 51-4141 on airplanes not incorporating T.O. 1T-33A-42	38 ft. 10.5 in.
Span (Wing) AF Serial No. 51-4141 and subsequent and airplanes incorporating T.O. 1T-33A-42	37 ft. 7.5 in.
Length (Not including distance tail pipe extends beyond aft end)	37 ft. 8.4 in.
Height (Airplane on ground)	11 ft. 8.4 in.

WING

Airfoil Section	Root: NACA $65_1$213, a = .5 Tip: NACA $65_1$213, a = .5
Chord at Root (Theoretical)	110.00 in.
Chord near Tip (Theoretical)	41.89 in.
Incidence at Root	+ 1°
Incidence at Tip	— 0° 30′
Dihedral at Trailing Edge of Wing Reference Plane	3° 50′
Sweepback at Leading Edge	9° 18′ 33″

STABILIZER

Airfoil Section	NACA $65_1$2-010 Sym Section
Span	15 ft. 7 in.
Chord at Root (Theoretical)	52.00 in.
Chord at Tip (Theoretical)	19.00 in.
Incidence	+ 1° 30′
Dihedral	0°

FIN

Airfoil Section	NACA $65_1$2-010 Sym Section
Height (From Bottom of Rudder)	77.00 in.
Chord at Root (Theoretical)	65.00 in.
Chord at Tip (Theoretical)	26.00 in.

FUSELAGE

Width (Maximum)	56 in.
Height (Maximum)	56 in.
Length (Not including distance tail pipe extends beyond aft end)	37 ft. 8.4 in.

1–22. AREAS.

WING (Including Projected Fuselage Area) Prior to AF Serial No. 51-4141 on airplanes not incorporating T. O. 1T-33A-42	237.60 sq. ft.
WING (Including Projected Fuselage Area) AF Serial No. 51-4141 and subsequent and airplanes incorporating T. O. 1T-33A-42	234.80 sq. ft.
Ailerons (Two, Including Tabs)	17.50 sq. ft.
Aileron Trim Tab (Left Side)	0.48 sq. ft.
Aileron Bend Tab (Right Side)	0.10 sq. ft.
WING FLAPS (Total)	30.70 sq. ft.
DIVE RECOVERY FLAPS (Total)	5.80 sq. ft.

HORIZONTAL TAIL SURFACES

Stabilizer	34.80 sq. ft.
Elevators (Two, Including Tabs)	8.70 sq. ft.
Elevator Trim Tabs (Total)	0.55 sq. ft.
Elevator Spring Tabs (Total)	0.52 sq. ft.

VERTICAL TAIL SURFACES

Fin	17.20 sq. ft.
Rudder (Including Tab)	5.30 sq. ft.

1–23. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES. Refer to paragraphs 4–610, 4–628, and 4–640 for detailed instructions and allowable tolerances for settings of control surfaces.

STABILIZER (Positive Incidence)	1° 30′
FIN Offset from Fuselage Center Line	0°

AILERONS	*Inches*	*Degrees*
Up Travel from Neutral	6.05	20
Down Travel from Neutral	6.05	20

(Measured between upper skin surface of aileron and upper skin surface of flap at trailing edge. Flap must be fully retracted before taking measurements.)

ELEVATORS	*Inches*	*Degrees*
Up Travel from Neutral	5.33	26
Down Travel from Neutral	3.34	16

(Measure between upper skin surface of spring tab and upper surface of adjacent fairing at inboard trailing edge. Measure to a point on tab adjacent to fairing trailing edge, not to extended trailing edge.)

RUDDER		
Right Travel from Neutral	8.43	30
Left Travel from Neutral	8.43	30

(Measure between center line of rudder trailing edge at bottom of rudder and center line of fairing.)

TRIM TABS

Elevator		
Up Travel from Trailing Edge (Elevator Down)		
Inboard End (Total)	1.16	20° 20′
Outboard End (Total)	0.63	20° 20′
(5° 20′ Servo plus 15° Trim)		
Down Travel from Trailing Edge (Elevator Up)		
Inboard End (Total)	2.76	26° 00′
Outboard End (Total)	1.50	26° 00′
(8° 40′ Servo plus 25° Trim)		

(Measure to a point on the tab adjacent to the elevator trailing edge, not to the extended trailing edge.)

Aileron		
Up Travel from Trailing Edge	1.29	20
Down Travel from Trailing Edge	1.29	20

(Measure between upper skin surface of tab and upper skin surface of aileron at outboard trailing edge of tab.)

ELEVATOR SPRING TABS		
Up Travel from Trailing Edge		
Inboard End	0.74	10
Outboard End	0.56	10
Down Travel from Trailing Edge		
Inboard End	1.63	22
Outboard End	1.26	22

(Measure between upper surface of tab skin and u surface of adjacent fairing at inboard trailing e Measure to point on tab adjacent to fairing trailing edge, not to extended trailing edge.)

WING FLAPS	*Inches*	*Degrees*
Down Travel (See figure 4-8)		
Inboard End	14.00	45
Outboard End	9.75	45

DIVE RECOVERY FLAPS

Down Travel (See figure 4-26)

1–24. WHEEL TYPE ALIGHTING GEAR.

MAIN GEAR

Type	Hydraulically Retractable
Tread	105 in.
Shock Struts	
Type	Air-oil
Make and Part No.	Menasco 506,000 L/R
Fluid Required	
Specification No.	MIL-H-5606
Trade Name	Gen. Petroleum RD 10-22[illegible]
Identification	Std. Oil of N. J. WS-491 Esso Aviation Univis No. 40 or No. J-43
Wheels	
Type	Goodyear 9530215 or 9530322, 26x6.6
Tires	26 x 6.6 12 or 14-ply Rayon Type VII, Specification MIL-C-5041A and 553C11A
Brake and Disc Assy.	Goodyear Type PD310 Single Disc, 14.5 x 2.375; or PD383 or PD383-1, Double Disc, 12.25 x 2.375.

NOSE GEAR

Type	Swiveling, Hydraulically Retractable
Shock Strut	
Type	Air-oil
Make and Part No.	Menasco 506,500
Fluid Required	
Specification No.	MIL-H-5606
Trade Name	Gen. Petroleum RD 10-220
Identification	Std. Oil of N. J. WS-491 Esso Aviation Univis No. 40 or No. J-43

Wheel	
Type	Goodyear 530819M-1
Tire	22 x 7.25 -11.50 Low-profile, 8-ply Rayon, Type VI

1–25. ENGINE.

Manufacturer	Allison Division of General Motors Corporation
AF Designation	J33-A-35 (Except BuAer Serial No. 137934 and 137978 and Subsequent)
Fuel	Specification MIL-F-5624, Grade JP-4
Oil	Low-temperature Lubricating Oil, Specification MIL-L-6081, Grade 1010
BuAer Designation	J33-A-20 (BuAer Serial No. 137934 and 137990 and Subsequent)
Fuel	Specification MIL-F-5624A, Grade JP-4
Oil	Low-temperature Lubricating Oil, Specification MIL-L-6081, Grade 1010

1–26. TANK CAPACITIES.

HYDRAULIC OIL (Approximate)

	Gallons U. S.	Gallons Imperial
Main System Total (Includes Tank, Plumbing Lines, and Units)	3.90	3.24
Main System Tank	1.00	0.83
Emergency System Tank	0.90	0.75

FUEL (Approximate Usable Capacity)

Tank	*Gals. Each* No.	*U. S.*	*Imp.*	*Gals. Total U. S.*	*Imp.*
Droppable (Prior to AF Serial No. 51-4141 on airplanes not incorporating T. O. 1T-33A-42)	2	165	137.5	330	275.0
Droppable (AF Serial No. 51-4141 and subsequent and airplanes incorporating T. O. 1T-33A-42	2	230	191.7	460	383.4
Wing Outer Outboard Wing Inner Outboard Wing Leading Edge	2	52	43.3	104	86.6
Wing Aft Inboard Wing Forward Inboard	2	77	64.2	154	128.4
Fuselage	1	95	79.2	95	79.2
Total (Prior to AF Serial No. 51-4141 on airplanes not incorporating T. O. 1T-33A-42				683	569.2
Total (AF Serial No. 51-4141 and subsequent and airplanes incorporating T. O. 1T-33A-42)				813	677.6

OIL. Sufficient oil (3.0 U.S., 2.5 Imperial gallons) is carried in the bottom of the engine accessory gear drive case; hence an auxiliary oil tank is not required. Two U.S. (1.7 Imperial) gallons of oil is sufficient for the engine flush run.

FLUID INJECTION (PRIOR TO AF SERIAL NO. 53-5083)

	Gallons U. S.	Gallons Imperial
Two interconnected tanks	50	41.50

FUEL DE-ICING

AF Serial No. 49-901 through 53-5082	30	25.0
AF Serial No. 53-5083 and Subsequent	5	4.17

SECTION 11
SHIPMENT AND ERECTION PROCEDURE

(Not Applicable)

SECTION III

GROUND HANDLING AND SERVICING INSTRUCTIONS

3–1. ACCESS AND INSPECTION PROVISIONS.

3–2. Access doors and removable inspection panels are shown on figure 3–1.

Note

Be sure all access doors and inspection panels are securely fastened and flush with skin before airplane is flown.

3–3. AIRPLANE MARKINGS.

3–4. Airplane markings are shown on figure 3-2.

3–5. GROUND HANDLING.

3–6. Tighten all structural bolts to torque limits specified in the "Wrench Torque Table" in Section VI, except as noted throughout this handbook.

3–7. HOISTING.

3–8. HOISTING THE COMPLETE AIRPLANE. *(See figure* 3-3.*)* Hoist complete airplane with sling No. 205216. Attach canvas part of sling to under side of fuselage nose at point marked "ATTACH JACK PAD HERE" by using -101 bolt and -102 washer. The -101 bolt is an AN8H14A bolt or equivalent, and the -102 washer is $\frac{1}{16}$-inch thick steel washer. Hoisting lugs for attaching aft cable of sling are in upper surface of wing at points marked "HOIST HERE." Screw an NAS205 screw into top of each hoisting lug and raise lugs into position before attaching sling. Attach -307 adapters to lifting lugs with -109 pins and AN415-2 pins as shown in view A, figure 3-3. The -406 hoisting ring should be approximately two-thirds of the way aft on the chain that connects the forward and aft parts of the sling. Raise airplane slightly. If it does not hang level, lower it, and move the -406 hoisting ring forward or aft until airplane hangs level when hoisted.

Note

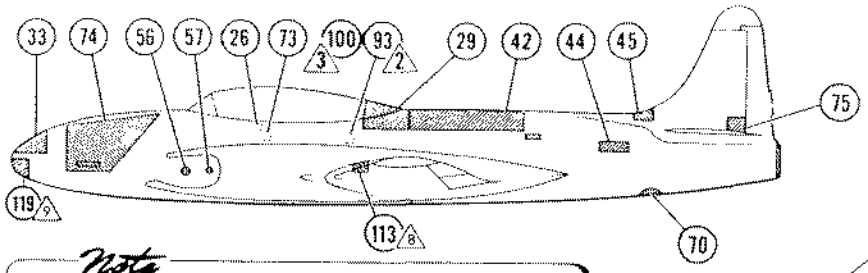
When guns, ammunition, radio, and batteries are removed, 300 pounds of ballast must be placed in nose section when airplane is hoisted.

3–9. HOISTING THE AIRPLANE LESS ENGINE AND FUSELAGE AFT SECTION. Proceed as directed in paragraph 3–6.

3–10. HOISTING THE FUSELAGE NOSE AND MID-SECTIONS. *(See figure* 3-3.*)* Hoist fuselage nose and mid sections with sling 205216. This sling is the same as that used for hoisting the complete airplane, but is rigged in a different way. Attach canvas part of sling to under side of fuselage nose as described in paragraph 3–8. Attach -412 spreader bar to upper aft-to-mid-section attaching points with aft-to-mid-section attaching bolts as shown in view B, figure 3-2. Attach -307 adapters to -412 spreader bar with -109 pins and AN415-2 pins. Double the chain between forward and aft cables of sling through the -406 hoisting ring, and secure it near the aft cable ring. The -406 hoisting ring should be approximately one-third of way aft on the chain. Raise sections slightly. If sections do not hang level, lower them, and move hoisting ring forward or aft until sections hang level when hoisted.

3–11. HOISTING THE ENGINE. *(See figure* 3-4.*)* Install Allison No. 9074017 lifting eye in boss on No. 1 diffuser elbow, and Allison No. 2835 lifting bracket on rear lifting bosses of the ring and tube assembly. Attach Allison No. 9074016 sling to lifting eye and bracket.

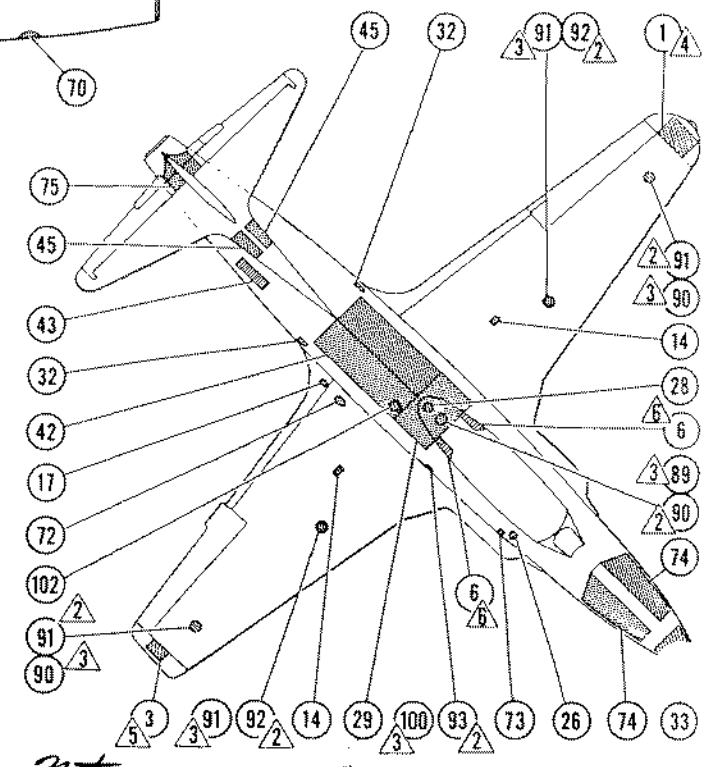
3–12. HOISTING THE FUSELAGE AFT SECTION. *(See figure* 3-5.*)* Hoist fuselage aft section with sling S84402. Place canvas part of sling under fuselage so center line of sling is slightly forward of leading edge of horizontal stabilizer, or so canvas just touches the horizontal stabilizer. Attach hook of forward cable to top of forward bulkhead. Attach hook of aft cable to top of tail pipe opening. Do not attach aft cable hook to tail pipe. When sling is properly rigged and section is hoisted, spring between forward hook and cable should not stretch more than approximately 2 inches, thus indicating that section is properly balanced for hoisting. If, when section is raised, spring stretches more than 3 inches, move the canvas part of the sling slightly forward. If spring stretches less than 1 inch, move canvas aft.



Note

1. USED PRIOR TO AF SERIAL NO. 49-967.
2. USED AF SERIAL NO. 48-358 AND 48-357.
3. USED AF SERIAL NO. 48-358 AND SUBSEQUENT.
4. USED PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-42.
5. USED AF SERIAL NOS. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-42.
6. USED AF SERIAL NO. 51-6819 AND SUBSEQUENT.
7. FLUID INJECTION TANKS PRIOR TO AF SERIAL NO. 53-5083, AND FUEL DE-ICING TANKS ON AF SERIAL NO. 53-5083 AND SUBSEQUENT.
8. USED AF SERIAL NO. 53-5286 AND SUBSEQUENT.
9. T-33A-5 AIRPLANES ONLY
10. T-33A-1 AIRPLANES ONLY

4 1. WING TIP ATTACHMENT, BOMB RACK, PLUMBING AND ELECTRICAL
4 2. BOMB HOIST AND MOORING HOOK
5 3. TIP TANK RELEASE
5 4. BOMB PYLON WIRING AND CABLE
4 5. WIRING TIP ATTACHMENT, BOMB RACK, PLUMBING AND ELECTRICAL
6 6. CANOPY HINGE
8. AILERON CONTROL MECHANISM
9. AILERON CABLE TURNBUCKLES
10. AILERON TAB ACTUATOR
12. FUEL TANK PANEL
14. MAIN ALIGHTING GEAR STRUT FILLER
16. FUEL BOOSTER PUMP
17. AFT SECTION ELECTRICAL, GYRO COMPASS, TAIL CONE THERMOCOUPLES AND COMMAND RADIO ANTENNA CABLE DISCONNECTS.
19. FUEL TANK PANEL
20. OXYGEN CYLINDERS
21. FUEL TANK PANEL
26. EMERGENCY HYDRAULIC RESERVOIR
10 27. G.S.A.P. CAMERA (INSIDE SCOOP)
28. FUSELAGE TANK FUEL QUANTITY TRANSMITTER
29. FUEL TANK PANEL
31. SPARK PLUG
32. FUSELAGE AFT SECTION ATTACHING BOLTS
33. AN/ARN-6 RADIO COMPASS ANTENNA
42. ENGINE, HYDRAULIC RESERVOIR, AND 7
43. TAIL PIPE AND THERMOCOUPLE DISCONNECTS AND ELEVATOR TAB ACTUATOR
44. TAIL PIPE AND THERMOCOUPLE DISCONNECTS
45. PLUMBING AND CONTROLS
10 50. CASE EJECTION CHUTE DOOR
56. UPLOCK INSPECTION
57. OXYGEN FILLER VALVE
59. HYDRAULIC COMPARTMENT, FUEL BOOSTER PUMPS AND DRAINS
65. ENGINE ACCESSORIES, AILERON BOOSTER, IGNITION EXCITER AND DYNAMOTOR
66. ENGINE ACCESSORIES, AILERON BOOSTER, HYDRAULIC ACCUMULATOR AND HYDRAULIC GROUND TEST FITTINGS
70. GYRO COMPASS FLUX VALVE
72. EXTERNAL POWER RECEPTACLE
73. CANOPY ACTUATING SWITCHES AND CRANK
74. ARMAMENT 10, RADIO AND OXYGEN CYLINDER
75. CONTROLS AND ELECTRICAL
3 89. FUSELAGE TANK FILLER
90. FUSELAGE TANK FILLER
2 91. OUTBOARD WING TANK FILLER
92. INBOARD WING TANK FILLER
93. CANOPY EXTERNAL JETTISON CABLE
94. MARKER BEACON ANTENNA
3 90. OUTBOARD WING TANK FILLER
91. INBOARD WING TANK FILLER
93. MARKER BEACON ANTENNA
1 98. TURBINE AND COOLER OIL
3 100. CANOPY EXTERNAL JETTISON CABLE
1 101. TURBINE AND COOLER OIL DRAIN VALVE
102. FLUID INJECTION (DE-ICING) FILLER
8 113. WING LEADING EDGE FUEL PUMP
9 119. AN/ARN-18 RADIO ANTENNA



Note

* COMBUSTION CHAMBER DRAIN VALVE

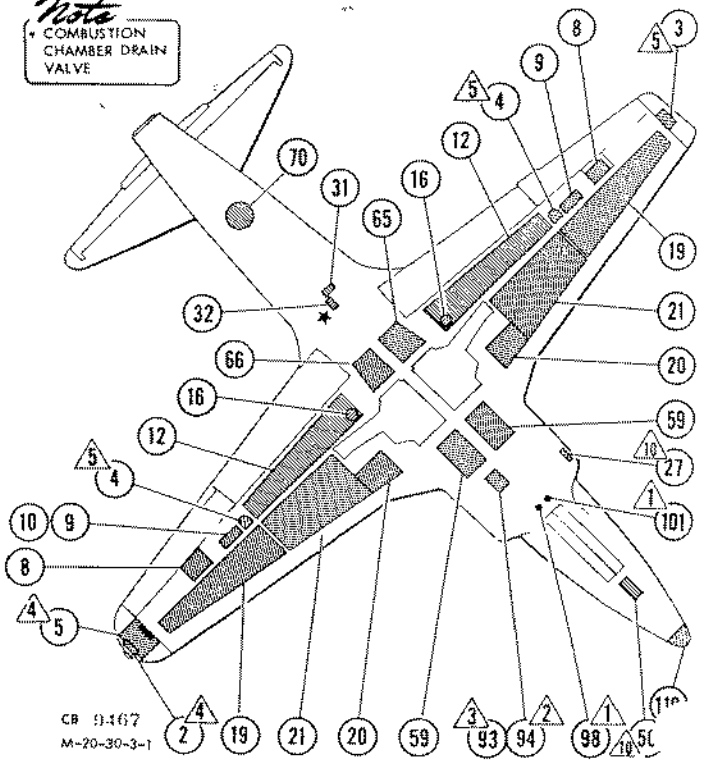
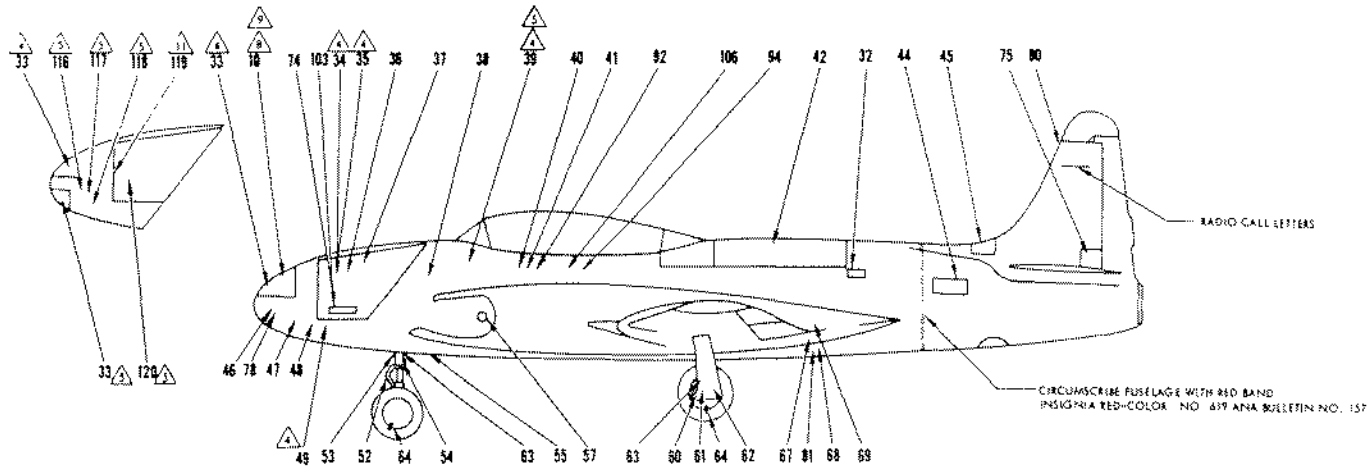


Figure 3-1. Access Provisions and Identification



NOTE

SPECIAL NOTE IS GIVEN FIRST FOLLOWED BY ITS LOCATION

1. PRIOR TO AF SERIAL NO. 51-4941
2. PRIOR TO AF SERIAL NO. 53-5431
3. AF SERIAL NO. 53-5431 AND SUBSEQUENT
4. APPLIES TO T-33A-1 AIRPLANES
5. APPLIES TO T-33A-5 AIRPLANES
6. PRIOR TO AF SERIAL 54-1584 EXCEPT 54-2689 THROUGH 54-2728
7. AF SERIAL NO. 54-1584 AND SUBSEQUENT EXCEPT 54-2689 THROUGH 54-2728
8. PRIOR TO AF SERIAL NO. 53-5086
9. AF SERIAL NO. 53-5086 AND SUBSEQUENT
10. AF SERIAL NO. 53-5989 AND SUBSEQUENT EXCEPT 54-2689 THROUGH 54-2728
11. USED ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-162
12. USED ON AIRPLANES INCORPORATING T. O. 1T-33A-162

1. SHACKLE. LOCATE ON TOP OF BOMB SHACKLE COVER LEFT AND RIGHT SIDE
2. MOOR HERE. LOCATE ON BOTTOM OF WING TIP ADJACENT TO BOMB HOIST CONNECTION LEFT AND RIGHT SIDE
3. TIP LIGHT CONNECTION. LOCATE ON UPPER SURFACE OF WING TIP TRAILING EDGE LEFT AND RIGHT SIDE
4. DISCONNECT ELECTRICAL AND PLUMBING BEFORE REMOVING TIP. LOCATE ON LEADING EDGE OF LARGE ACCESS DOOR ON BOTTOM SURFACE LEFT AND RIGHT SIDE
5. 5L OR 5R. LOCATE ON BOTTOM OF WING TIP OUTBOARD EDGE OF LARGE ACCESS DOOR. LEFT AND RIGHT SIDE
6. PAINT AN 0.18 CONTOUR BLACK LINE 3 INCHES LONG ON UPPER SURFACE AND 2 INCHES LONG ON LOWER SURFACE LEFT AND RIGHT SIDE
7. PAINT AN 0.18 CONTOUR BLACK LINE 3 INCHES LONG ON UPPER SURFACE AND 2 INCHES LONG ON LOWER SURFACE LEFT AND RIGHT SIDE
8. AILERON CONTROL MECHANISM. LOCATE ON CENTER OF DOOR BOTTOM LEFT AND RIGHT SIDE
9. TURN BUCKLES AILERON CONTROL. LOCATE ON CENTER OF DOOR BOTTOM LEFT AND RIGHT SIDE
10. AILERON TAB ACTUATOR. LOCATE ON EDGE OF DOOR BOTTOM LEFT SIDE ONLY
11. GROUND HERE. LOCATE AROUND GROUNDING RECEPTACLES 3-PLACES
12. FUEL TANK PANEL. LOCATE ON CENTER OF PANEL BOTTOM. LEFT AND RIGHT SIDE
13. ATTACH JACK PAD HERE. LOCATE ON BOTTOM SURFACE OF WING ADJACENT TO 1/4-INCH SCREWS. LEFT AND RIGHT SIDE
14. LANDING GEAR STRUT FILLER USE FLUID SPECIFICATION MIL-O-5606. LOCATE ADJACENT TO COVER PLATE TOP LEFT AND RIGHT SIDE
15. FUEL BOOSTER PUMP. LOCATE ON CENTER OF DOOR BOTTOM SIDE. LEFT AND RIGHT SIDE
16. ELECTRICAL DISCONNECT. LOCATE ON CENTER OF DOOR. TOP RIGHT SIDE ONLY
17. DRAIN FUEL HERE. LOCATE ON BOTTOM SIDE OF WING ADJACENT TO DRAIN - 10-PLACES, 5 LEFT AND 5 RIGHT
18. FUEL TANK PANEL. LOCATE IN CENTER OF PANEL ON BOTTOM OF WING. LEFT AND RIGHT SIDE
19. OXYGEN BOTTLES. LOCATE IN CENTER OF PANEL ON BOTTOM OF WING. LEFT AND RIGHT SIDE
20. FUEL TANK PANEL. LOCATE IN CENTER OF PANEL ON BOTTOM OF WING. LEFT AND RIGHT SIDE
21. PAINT A WHITE STRIPE 3-INCH WIDE AND 26-INCHES LONG. LOCATE ON CENTER LINE OF SHIP BETWEEN FUSELAGE STATION 64.00 AND FUSELAGE STATION 90.00. TOP SIDE ONLY
22. PULL DOWN TO JETTISON CANOPY. USE WHITE LETTERS ON BLACK. LOCATE ON RIGHT SIDE ABOVE JETTISON LEVER IN BOTH COCKPITS
23. TO JETTISON CANOPY PULL YELLOW HANDLE. LOCATE HORIZONTALLY ON RIGHT TRIM PANEL ADJACENT TO TOP EDGE OF MAP CASE IN BOTH COCKPITS
24. SURFACE CONTROL LOCK. LOCATE ON RIGHT TRIM PANEL IN FORWARD COCKPIT
25. EMERGENCY HYDRAULIC TANK FILL HERE. USE FLUID SPECIFICATION MIL-O-5606. LOCATE AROUND FILLER WELL OF EMERGENCY HYDRAULIC TANK
26. CAMERA ACCESS DOOR. LOCATE ON CENTER OF DOOR
27. FUEL LEVEL TRANSMITTER. LOCATE ADJACENT TO ACCESS DOOR ON RIGHT SIDE ONLY
28. FUEL TANK PANEL. LOCATE ON CENTER OF DOOR
29. NO STEP. LOCATE ON TOP OF DUCT FILLER LEFT AND RIGHT SIDE
30. SPARK PLUG ACCESS. LOCATE ON OR ADJACENT TO COVER AT FUSELAGE STATION 277.50+12.00
31. FUSELAGE DISCONNECT BOLT WRENCH. TORQUE 1100-1300 INCH-POUNDS. LOCATE ADJACENT TO ACCESS DOORS FUSELAGE STATION 277.5 +12.00 3-PLACES
32. CONDUCTING PLASTIC DO NOT PAINT. LOCATE ON UPPER PLASTIC NOSE. USE CONDUCTING PAINT COLOR, WHITE
33. CONDUCTING PLASTIC DO NOT PAINT. LOCATE ON LOWER PLASTIC NOSE USE CONDUCTING PAINT. COLOR, WHITE
34. GUN LEVELING LUGS. LOCATE IN ARMAMENT COMPARTMENT ON VERTICAL POST
35. ARMAMENT JUNCTION. LOCATION ARMAMENT COMPARTMENT ON BOX COVER
36. SPARE YAW INDICATORS AND RESIN LENS. LOCATE INSIDE RIGHT HAND ARMAMENT DOOR
37. CLEAR YAW INDICATOR BEFORE CLOSING DOOR. LOCATE ON BOTH ARMAMENT DOORS. RED LETTERS LEFT AND RIGHT SIDE
38. USE FLUID SPECIFICATION MIL-O-5606. LOCATE ON BRAKE HYDRAULIC RESERVOIR. RED LETTERS
39. AIR FORCE MODEL T-33A-5-LO AIR FORCE SERIAL NO.--A SERVICE THIS AIRPLANE WITH MIL-F-5624C-JP4 FUEL. REFERENCED T.O. 2-1-50. IF NOT AVAILABLE T.O. 42B1-1-14 WILL BE CONSULTED FOR EMERGENCY ACTION. LOCATE HORIZONTALLY 6-INCHES BELOW TOP OF CANOPY SILL AT FUSELAGE STATION 141.00 LEFT SIDE ONLY
39. AIR FORCE MODEL T-33A-5-LO AIR FORCE SERIAL NO.--A. SERVICE THIS AIRPLANE WITH MIL-F-5642A FUEL. IF NOT AVAILABLE T.O. 42B1-1-1 WILL BE CONSULTED FOR EMERGENCY ACTION. LOCATE HORIZONTALLY 6-INCHES BELOW TOP OF CANOPY SILL AT FUSELAGE STATION 141.00 LEFT SIDE ONLY
40. MAP CASE. LOCATION CENTER OF MAP CASE
41. PAINT 0.25 RED AND WHITE STRIPES ON EMERGENCY LANDING GEAR CONTROL HANDLES
42. HYDRAULIC TANK. LOCATE CENTER OF ENGINE ACCESS DOOR. LEFT SIDE NEAR HYDRAULIC TANK
43. ELEVATOR TAB MOTOR. LOCATE AT FUSELAGE STATION 330, 6-INCHES ABOVE ACCESS DOOR. RIGHT SIDE ONLY
44. TAIL PIPE DISCONNECT. LOCATE AT FUSELAGE STATION 330. 4-INCHES ABOVE ACCESS DOOR LEFT AND RIGHT SIDE
45. CONTROLS. LOCATE ON CENTER OF DOOR LEFT AND RIGHT SIDE
46. PLUMB LINE. LOCATE ADJACENT TO PLATE NUT. LEFT SIDE ONLY
47. ATTACH JACK PAD HERE. LOCATE AT FUSELAGE STATION 321. LETTERING TO BE HORIZONTAL LEFT AND RIGHT SIDE
48. AIR SPEED STATIC. LOCATE BELOW ARMAMENT DOOR. LEFT AND RIGHT SIDE
49. WARNING (RED LETTERS) DO NOT OPERATE SHELL EJECTION DOOR ON GROUND UNLESS NOSE LANDING GEAR IS STRAIGHT. LOCATE HORIZONTALLY BELOW EDGE OF ARMAMENT DOOR. LEFT AND RIGHT SIDE
50. WARNING KEEP FINGERS CLEAR. DOOR CLOSES WHEN GUN TRIGGER IS RELEASED. LOCATION-FORWARD OF SHELL EJECTION CHUTE. RED LETTERS. 1-PLACE
51. FOR CORRECT TIRE INFLATION PRESSURE SEE T.O. 4T-1-7. LOCATE ON LEFT NOSE WHEEL DOOR AND BOTH CENTER MAIN LANDING GEAR DOORS
52. TOW HERE. CENTER LETTERS ON OUTSIDE OF FLANGE ON BOTH SIDES OF THE LOWER TORQUE ARM ON NOSE LANDING GEAR. ARROW TO POINT TO LOWER TORQUE ARM PIN. STENCIL WITH RED LETTERS. LEFT AND RIGHT SIDE
53. CAUTION MAXIMUM TURN 45 DEGREES. LOCATE ON NOSE LANDING GEAR STRUT IN RED LETTERS
54. USE FLUID SPECIFICATION MIL-O-5606. LOCATE ON SHIMMY DAMPER CYLINDERS IN A VISIBLE LOCATION. LEFT AND RIGHT
55. LEVEL HERE. LOCATE IN NOSE WHEEL WELL ADJACENT TO LEVELING LUGS
56. UP LOCK INSPECTION. LOCATE. ADJACENT TO COVER RIGHT SIDE ONLY
57. OXYGEN FILLER VALVE. LOCATE. LEFT OUTSIDE SURFACE BELOW COVER PLATE
58. EXPANSION TURBINE AND INTERCOOLER. LOCATE AT AFT END OF NOSE WHEEL WELL
59. HYDRAULIC COMPARTMENT. FUEL BOOSTER PUMPS AND DRAIN. LOCATE ON OUTSIDE EDGE OF DOOR LEFT AND RIGHT SIDE
60. CHECK THAT HOOKS ARE COCKED BEFORE FLIGHT. LOCATE ON INSIDE MAIN LANDING GEAR DOOR LEFT AND RIGHT SIDE

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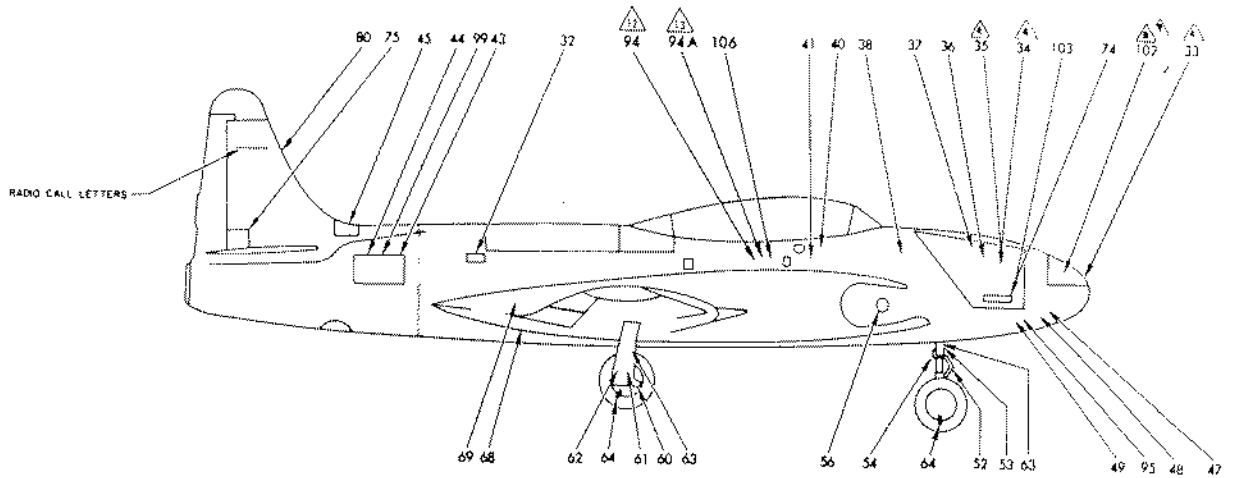
Figure 3-2. Airplane Markings Diagram (Sheet 1 of 5)



61 TOW HERE. LOCATE ON FORWARD TOW RING ON SLIDING PISTON TUBE LEFT AND RIGHT MAIN LANDING GEARS.

62 EMERGENCY TOW. LOCATE ON AFT TOW RING. PAINT AFT TOW RING RED. PAINT NOSE VERTICAL ON PISTON TUBE, RED LETTERS BOTH MAIN LANDING GEARS.

63 USE FLUID SPECIFICATION MIL-O-5606 LOCATE ON SHOCK STRUT ON BOTH MAIN GEARS AND NOSE GEAR IN A VISIBLE LOCATION.

64 PAINT A RED STRIPE 4-INCHES LONG AND 1-INCH WIDE WITH 2-INCHES ON TIRE AND 2-INCHES ON WHEEL. LOCATE STRIPE ON INBOARD SIDE OF BOTH MAIN LANDING GEAR WHEELS AND ON LEFT SIDE OF NOSE WHEEL.

65 ENGINE ACCESS DOOR AILERON BOOSTER. LOCATE IN CENTER OF DOOR RIGHT SIDE ONLY.

66 ENGINE ACCESS DOOR HYDRAULIC GROUND TEST CHECK AILERON BOOSTER ACCUMULATOR LOCATE IN CENTER OF DOOR. LEFT SIDE ONLY.

67. PLUMB LINE. LOCATE ADJACENT TO PLATE NUT LEFT SIDE.

68 FUSELAGE STATION 277.50+12.00 LOCATE AT LOWER FUSELAGE STATION 277.50+12.00 FORWARD AND AFT SECTION LEFT SIDE ONLY.

69 BATTERY LOCATION IN ARMAMENT COMPARTMENT. LOCATE 9.5-INCHES AFT OF FUSELAGE STATION 277.50+12.00 AND 3-INCHES ABOVE WATER LINE 100.00. LEFT SIDE ONLY.

70 REMOTE COMPASS. LOCATE IN CENTER OF DOOR.

71 DO NOT USE STEEL SCREWS TO HOLD COVER. LOCATE ON BOTTOM EDGE OF DOOR USE RED LETTERS.

72 24 VOLT EXTERNAL POWER CONNECTION LOCATE IN CENTER OF DOOR RIGHT SIDE ONLY.

73 CANOPY ACTUATING SWITCHES AND HAND CRANK LOCATE ABOVE DOOR RIGHT SIDE ONLY. USE ORANGE YELLOW LETTERS.

74 BATTERIES, RADIO AND OXYGEN CYLINDER. LOCATE ON ARMAMENT DOOR LEFT AND RIGHT SIDE.

75 CONTROLS AND ELECTRICAL LOCATE IN CENTER OF DOOR. LEFT AND RIGHT SIDE.

76 HOIST HERE. LOCATE BESIDE WING LIFT RUG. LEFT AND RIGHT SIDE.

77. PUSH LEVER DOWN TO DUMP CABIN AIR PRESSURE. LOCATE UNDER LEVER ON COCKPIT FLOOR. USE WHITE LETTERS ON BLACK PATCH.

78. 0.50 DIAMETER BLACK DOT. LOCATE ON LEFT SIDE OF NOSE, FUSELAGE STATION 22.19, WATER LINE 90.94, BUTT LINE 5.008.

79. 0.50 DIAMETER BLACK DOT. LOCATE 0.25-INCH FORWARD OF AFT END OF FUSELAGE ON VERTICAL CENTER LINE FUSELAGE STATION 429.75, WATER LINE 89.22, BUTT LINE 0.00.

80. 0.50 DIAMETER BLACK DOT. LOCATE ON LEADING EDGE OF VERTICAL STABILIZER FUSELAGE STATION 389.24, WATER LINE 379.82, BUTT LINE 0.00.

81. 0.50 DIAMETER BLACK DOT. LOCATE ON LEADING EDGE OF ENGINE ACCESS DOOR FUSELAGE STATION 257.00, WATER LINE 72.00, BUTT LINE 0.00.

82. 0.50 DIAMETER BLACK DOT. LOCATE AT FIRST SCREW OUTBOARD AND AFT OF REAR BEAM UNDER SIDE OF WING AT FUSELAGE STATION 228.71, WATER LINE 79.82, BUTT LINE 39.16 LEFT AND RIGHT SIDE.

83 0.50 DIAMETER BLACK DOT. LOCATE AT FIRST SCREW OUTBOARD AND AFT OF FRONT BEAM AT FUSELAGE STATION 197.49, WATER LINE 80 553, BUTT LINE 39.540 LEFT AND RIGHT SIDE.

84 0.50 DIAMETER BLACK DOT. LOCATE AT FIRST SCREW INBOARD OF WING TIP AFT LOWER SIDE AT FUSELAGE STATION 226.59, WATER LINE 93.27, BUTT LINE 234.540 LEFT AND RIGHT SIDE.

85. 0.50 DIAMETER BLACK DOT. LOCATE AT FIRST SCREW INBOARD OF WING TIP LOWER FORWARD SIDE FUSELAGE STATION 234.425, WATER LINE 92.222, BUTT LINE 234.330 LEFT AND RIGHT SIDE.

86. 0.50 DIAMETER BLACK DOT. LOCATE ON LEADING EDGE OF HORIZONTAL STABILIZER AT FUSELAGE STATION 287.66, WATER LINE 337.40, BUTT LINE 81.25 LEFT AND RIGHT SIDE.

87. 0.50 DIAMETER BLACK DOT. LOCATE AT FIRST SCREW ADJACENT TO EDGE OF ELEVATOR AT FUSELAGE STATION 400.48, WATER LINE 116.28, BUTT LINE 87.63 LEFT AND RIGHT SIDE.

89 FILLER WELL - USE GRADE JP-4 FUEL OR BETTER IF NOT AVAILABLE T.O. 42B1-1-14 WILL BE CONSULTED - 95 U.S. GALLONS LOCATE ON FUSELAGE FILLER WELL DOOR, WITH 3-INCH BORDER ON ADJACENT STRUCTURE SURROUNDING FILLER WELL DOOR. USE PAINT INSIGNIA RED SHADE 509, SPECIFICATION MIL-L-7178 LEFT AND RIGHT SIDE.

90 FILLER WELL - USE GRADE JP-4 FUEL OR BETTER, IF NOT AVAILABLE T.O. 42B1-1-14 WILL BE CONSULTED - 52 U.S. GALLONS LOCATE ON FILLER WELL DOOR WITH 1-INCH BORDER ON ADJACENT STRUCTURE SURROUNDING FILLER WELL DOOR. USE PAINT INSIGNIA RED, SHADE 509, SPECIFICATION MIL-L-7178 LEFT AND RIGHT SIDE.

91 FILLER WELL - USE GRADE JP-4 FUEL OR BETTER, IF NOT AVAILABLE T.O. 42B1-1-14 WILL BE CONSULTED - 27 U.S. GALLONS LOCATE ON FILLER WELL DOOR WITH 3-INCH BORDER ON ADJACENT STRUCTURE SURROUNDING FILLER WELL DOOR. USE PAINT INSIGNIA RED, SHADE 509, SPECIFICATION MIL-L-7178 LEFT AND RIGHT SIDE.

92 EXTERNAL CANOPY CONTROL ON RIGHT HAND SIDE. LOCATE 18-INCHES BELOW TOP OF SILL, LEFT SIDE AT FUSELAGE STATION 260.8 + 20.4.

△A 94 WARNING
THIS AIRPLANE CONTAINS A CANOPY REMOVER CONTAINING AN EXPLOSIVE CHARGE LOCATE ON BOTH SIDES OF FUSELAGE BETWEEN COCKPITS. WARNING IN RED LETTERS, BALANCE IN BLACK LETTERS.

△A 94A WARNING
THIS AIRCRAFT CONTAINS A CARTRIDGE ACTUATED EMERGENCY ESCAPE SYSTEM UTILIZING EXPLOSIVE CHARGES. SEE APPLICABLE TECHNICAL ORDER FOR COMPLETE INSTRUCTIONS. CENTERED AT FUSELAGE STATION 160.875. WORD-WARNING (5/8" RED LETTERS). RE-MAINDER OF LETTERING (7/16" BLACK LETTERS)

95 CABIN AIR STATIC AND AIR SPEED STATIC LOCATE AT FUSELAGE RIGHT SIDE ONLY.

97 DANGER - KEEP HANDS CLEAR. LOCATE ON COCKPIT SILLS IN BOTH COCKPITS. PAINT SILLS RED, LETTERS WHITE. LETTERS TO BE ON INBOARD FACE OF SILLS LEFT AND RIGHT SIDE.

99 THERMOCOUPLE DISCONNECT. LOCATE IN CENTER BETWEEN ELEVATOR TAB MOTOR AND TAIL PIPE DISCONNECT. STENCIL ABOVE ACCESS DOOR, RIGHT SIDE ONLY.

100 CANOPY EMERGENCY JETTISON HANDLE SEE DETAIL A.

△8 102. COMPASS LOOP CORRECTED T.O. 12-3-3 DATA LINE 60. LOCATED ON BOTH SIDES OF NOSE AFT OF COMPASS LOOP HOUSING.

△9 103. COMPASS LOOP CORRECTED T.O. 12-3-3 DATA LINE 102. LOCATE ON BOTH SIDES OF NOSE AFT OF COMPASS LOOP HOUSING.

103. TOW BAR TOWING LIMIT. LOCATE ON BOTH SIDES OF AIRPLANE ON ARMAMENT DOORS ABOVE RED STRIPE.

△6 104. WARNING
DO NOT REMOVE BRACKETS FROM FILLER WELL DOOR. LOCATE ADJACENT TO FUSELAGE FUEL TANK FILLER WELL DOOR.

△2 106. SEE DETAIL B.

△2 107. CANOPY HANDLE STOWAGE — LOCATE ON CANOPY FRAME, AFT COCKPIT RIGHT SIDE ONLY.

△3 107. STOW CANOPY HANDLE ON RIGHT HAND SHELF. LOCATE ON CANOPY FRAME AFT COCKPIT RIGHT SIDE.

108. DISCONNECT ELECTRICAL BEFORE REMOVING TIP LOCATE ON TOP REAR RIB JOINT LEFT SIDE.

109. TANK RELEASE ACCESS. LOCATE ON TOP OF WING TIP ADJACENT TO PANEL LEFT AND RIGHT SIDE.

110. PYLON CABLE ACCESS. LOCATE ON BOTTOM OF WING AFT OF ACCESS DOOR. OUTBOARD OF WING STATION 124.25.

△4 111. SHELL EJECTION DOOR. LOCATE ON SHELL EJECTION DOOR SO LETTERING MAY BE READ FROM EITHER SIDE LEFT AND RIGHT SIDE.

112. 0.25 RED LINE. LOCATE HORIZONTALLY ON AFT FUSELAGE FUEL VENT LINE AND ADJACENT MATING SURFACE.

113. FUEL PUMP ADAPTER ACCESS. LOCATE HORIZONTALLY IN CENTER OF WING FILLET ON BOTTOM LEFT AND RIGHT SIDE.

114 CANOPY LATCH STOW HANDLE BEFORE FLIGHT. LOCATE BELOW 13/16-INCH DIAMETER HOLE IN SKIN. ALSO STENCIL THE WORDS "LATCH" AND "UNLATCH" ABOVE 13/16-INCH DIAMETER HOLE IN SKIN.

115 ANTI-ICER RESERVOIR FILLER: SERVICE WITH ETHYL ALCOHOL MIL-A-6091, 5 U.S. GALLONS, LOCATE ON FORWARD OUTBOARD FLAP DOOR OF ENGINE COVER, RIGHT SIDE ONLY.

△5 116. BALLAST
THIS COMPARTMENT PROVIDES SPACE FOR EIGHT 25 LB. BALLAST BARS. LOCATE ON FORWARD FACE OF DOOR IN FRONT OF BALLAST COMPARTMENT.

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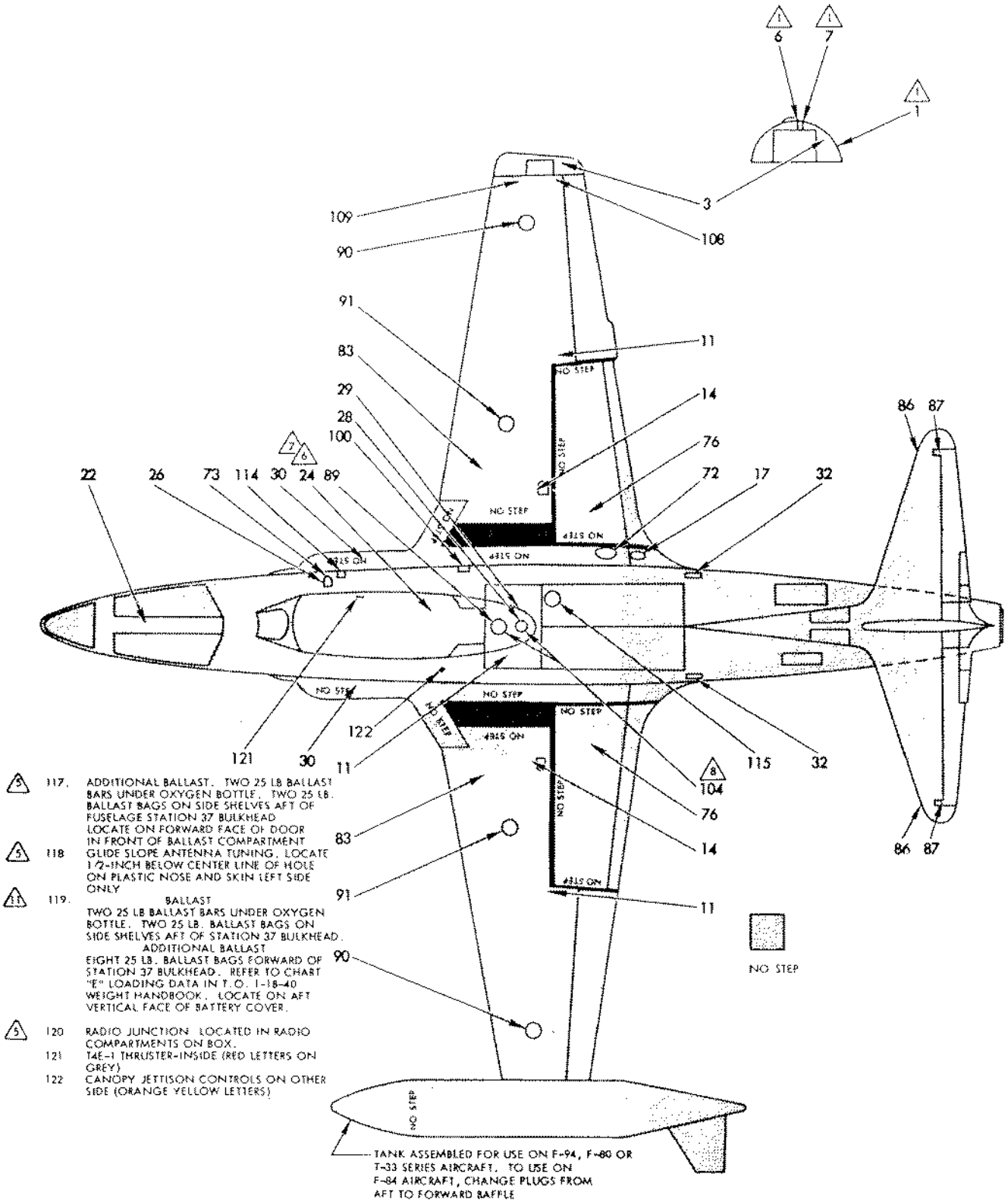
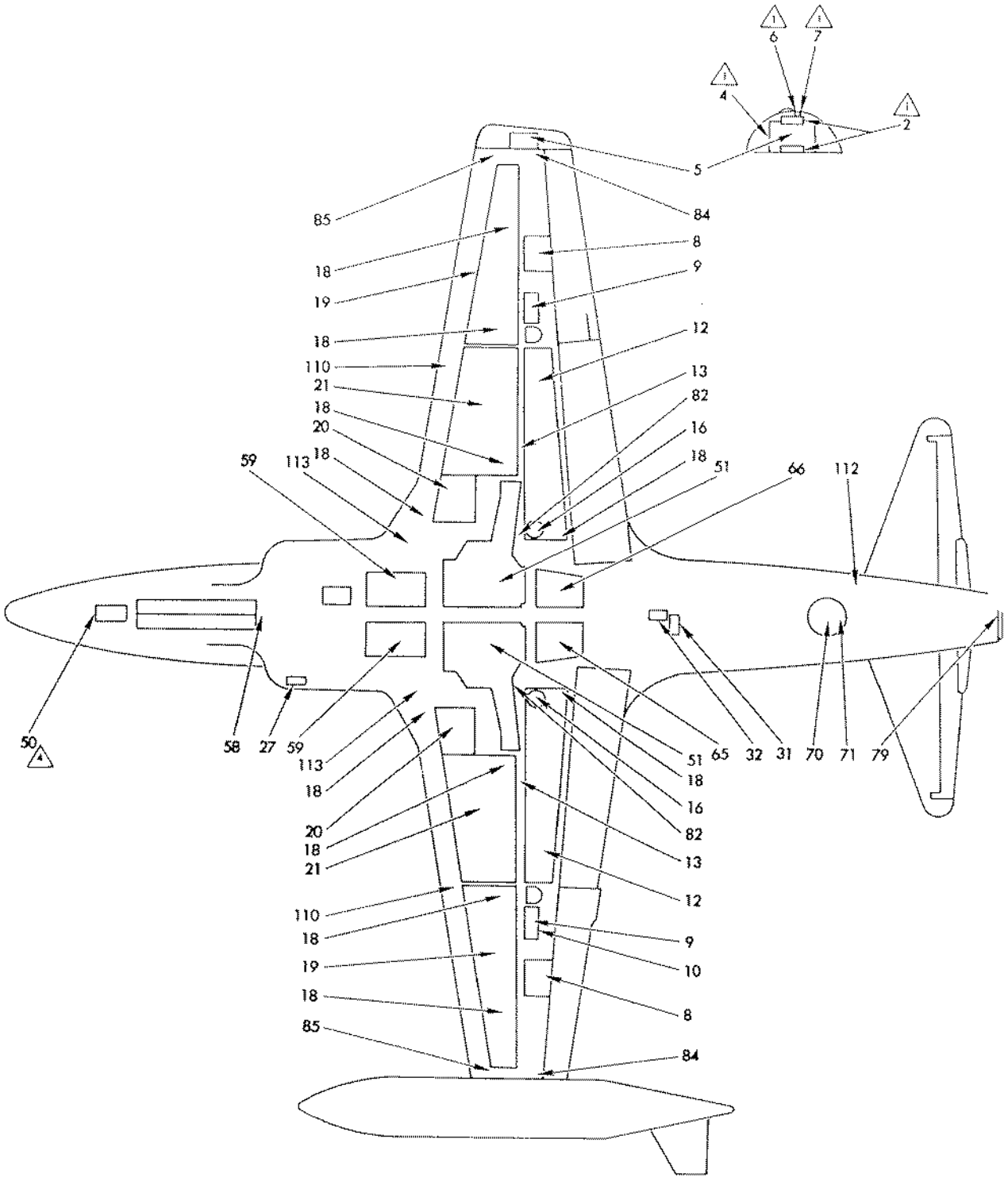
Figure 3-2. Airplane Markings Diagram (Sheet 2 of 5)



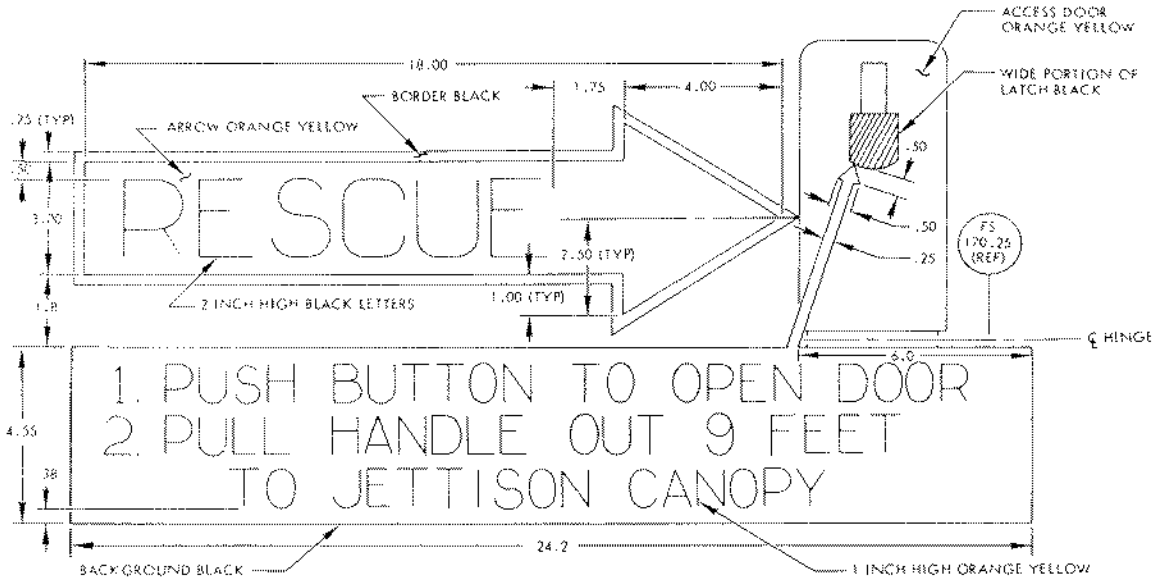
HF 08833
M20-5S-3-27(3)

Figure 3-2. Airplane Markings Diagram (Sheet 3 of 5)

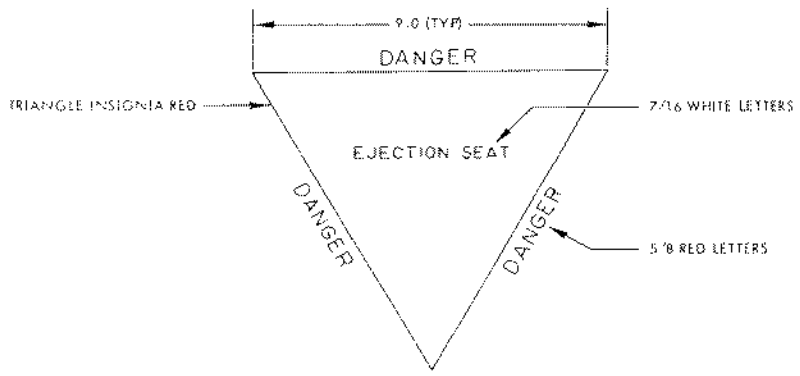


FB 2136
M 20-34-3-27 (4)

Figure 3-2. Airplane Markings Diagram (Sheet 4 of 5)



DETAIL A



DETAIL B

FB 38-1
M20-41-3-37(5)

Figure 3-2. Airplane Markings Diagram (Sheet 5 of 5)

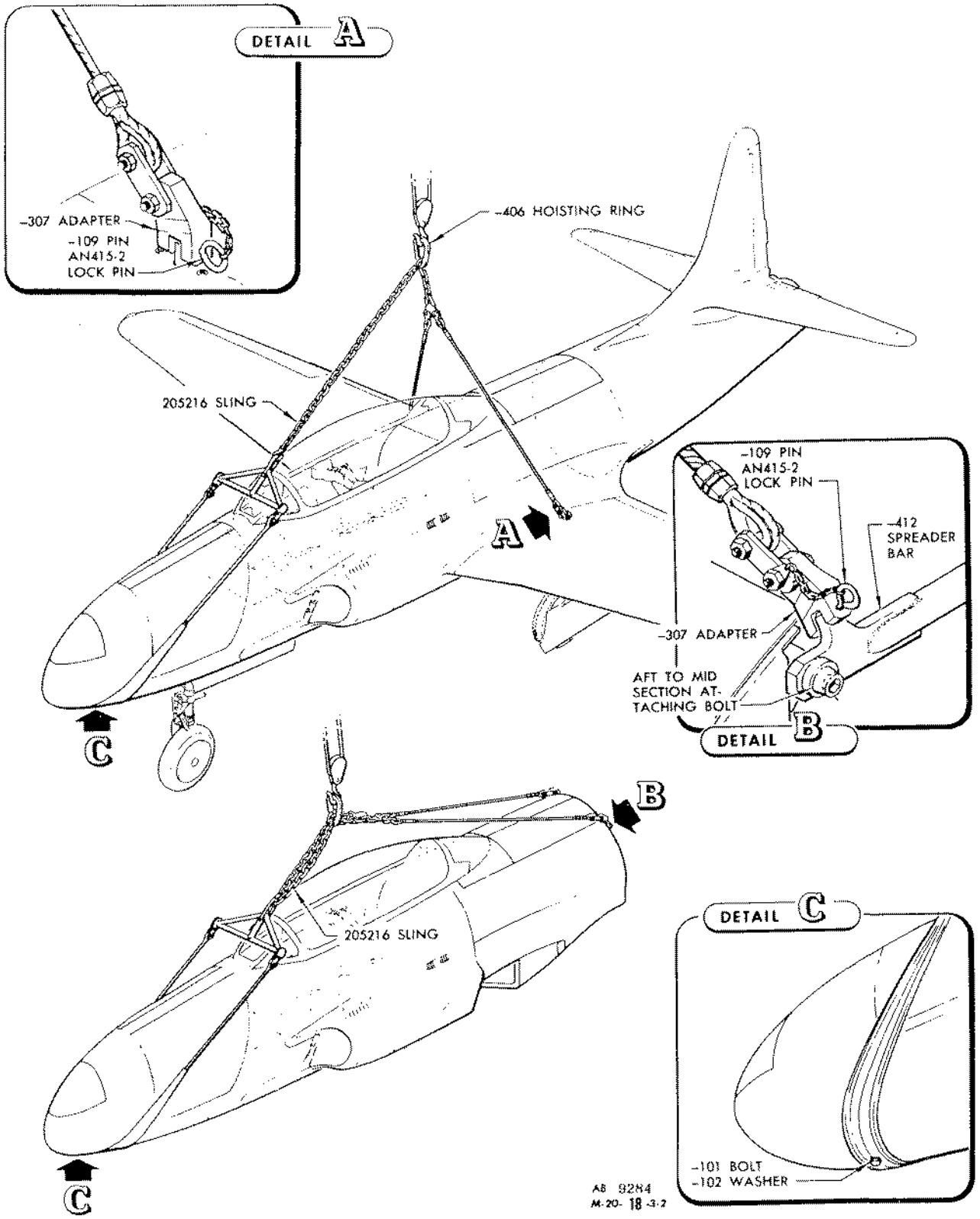
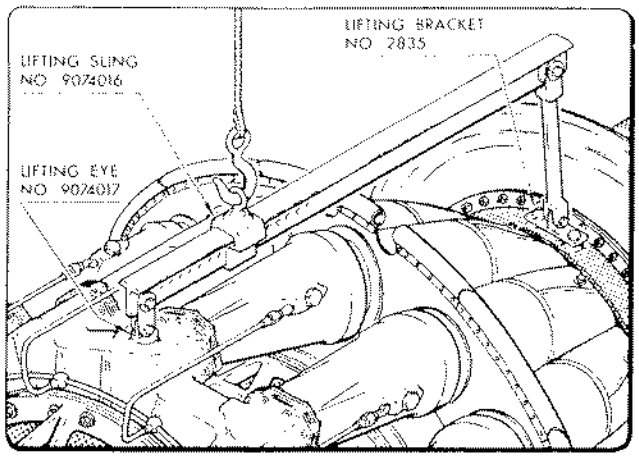


Figure 3-3. Hoisting the Complete Airplane



M20-288-3-3
K8231

Figure 3-4. Hoisting the Engine

3–13. HOISTING THE WING. *(See figure 3-6.)* Hoist wing with sling S80503. Place spreader bar so hoisting lug is aft, or toward wing trailing edge. Attach forward cable lugs of sling to upper holes of forward wing-to-fuselage attachment fittings. Be sure cables are attached to point marked "P-80" on lugs. Attach aft cable lugs of sling to upper holes of aft wing-to-fuselage attachment fittings. Use aft hole in hoisting lug for hoisting complete wing. Use forward hole in hoisting lug for hoisting wing without flaps, ailerons, and wing tips.

3–14. STORAGE STANDS.

3–15. STORAGE DOLLY FOR WING. *(See figure 3-7.)* A dolly, S84704, should be used to support the wing in two places for major overhaul, handling, or storage. Each end of the dolly can be adjusted independently of the other through a range of 40 to 51 inches in height. Two floor locks are provided on the under carriage to hold the dolly in place.

3–16. STORAGE DOLLY FOR FUSELAGE NOSE AND MID SECTION. *(See figure 3-8.)* A dolly, 205211 should be used to support the fuselage nose and mid sections for major overhaul, handling, or storage. The aft end of the dolly provides four supports, two for attachment to the forward wing-to-fuselage fittings, and two for attachment to the aft wing-to-fuselage fittings. The forward end of the dolly provides a padded cradle to support the fuselage nose section. Floor locks are provided on the under carriage to hold the dolly in place.

3–17. STORAGE DOLLY FOR ENGINE. Use a dolly similar to USAF No. 5150-I-40, or use truck, 456025, and adapter, 456025-4, to support the engine for major overhaul, handling, or storage.

3–18. AFT FUSELAGE TRUCK. *(See figure 3-9.)* A portable truck, 205226, is used for major overhaul and storage, or transportation of the fuselage aft section. The adapter kit, 455966-5, used with the truck, contains adapters, adapter support assemblies, and a strap. Position the two adapter support assemblies, 456231, so that hole No. 1 lines up with the hole in the truck front beam. Position the adapter support assemblies, 456225, so that hole No. 1 lines up with the hole in the truck aft beam. Fasten the two forward adapters, 455886-4, and two aft adapters, 455886-3, to the support assemblies by use of AN396-109 clevis pins, AN960-616 washers, and AN380-3-3 cotter pins. The truck must be positioned under the aft section so that fuselage stations 322.5 and 400 rest on the forward and aft adapters. The truck has a maximum capacity of 2650 pounds between arrows on the side rail. The truck may be raised by closing the pump valve and operating the pump, or lowered by releasing the safety pawl and opening the pump valve. The truck may be rolled by releasing the lock pins at the ends of the truck. Truck pitch is controlled by a crank near the pump. The aft section must be strapped to the truck prior to towing.

3–19. JACKING.

3–20. The complete airplane is jacked at three points (figure 3-10); one point on the under side of the fuselage nose, and two points on the under side of the wing. The jacks should be operated simultaneously and in a vertical direction to prevent excessive strain at the jacking points.

3–21. WING JACKING POINTS. On under side of the wing just outboard of each main gear at a point marked "ATTACH JACK PAD HERE," remove two ¼-inch screws, and on airplanes prior to AF Serial No. 51-4141 which do not incorporate T.O. No. 1T-33A-42 attach wing jack pad, S81907, or on AF Serial No. 51-4141 and subsequent and airplanes incorporating T.O. No. 1T-33A-42, attach wing jack pad and tie-down fitting, 205232. In either case make attachment with two AN4-12A bolts. Use standard Air Force jacks at these points.

CAUTION

The wing jack pads should have ⅛-inch rubber pads cemented to them. Be sure rubber pads are in place between wing skin and jack pads to prevent skin damage.

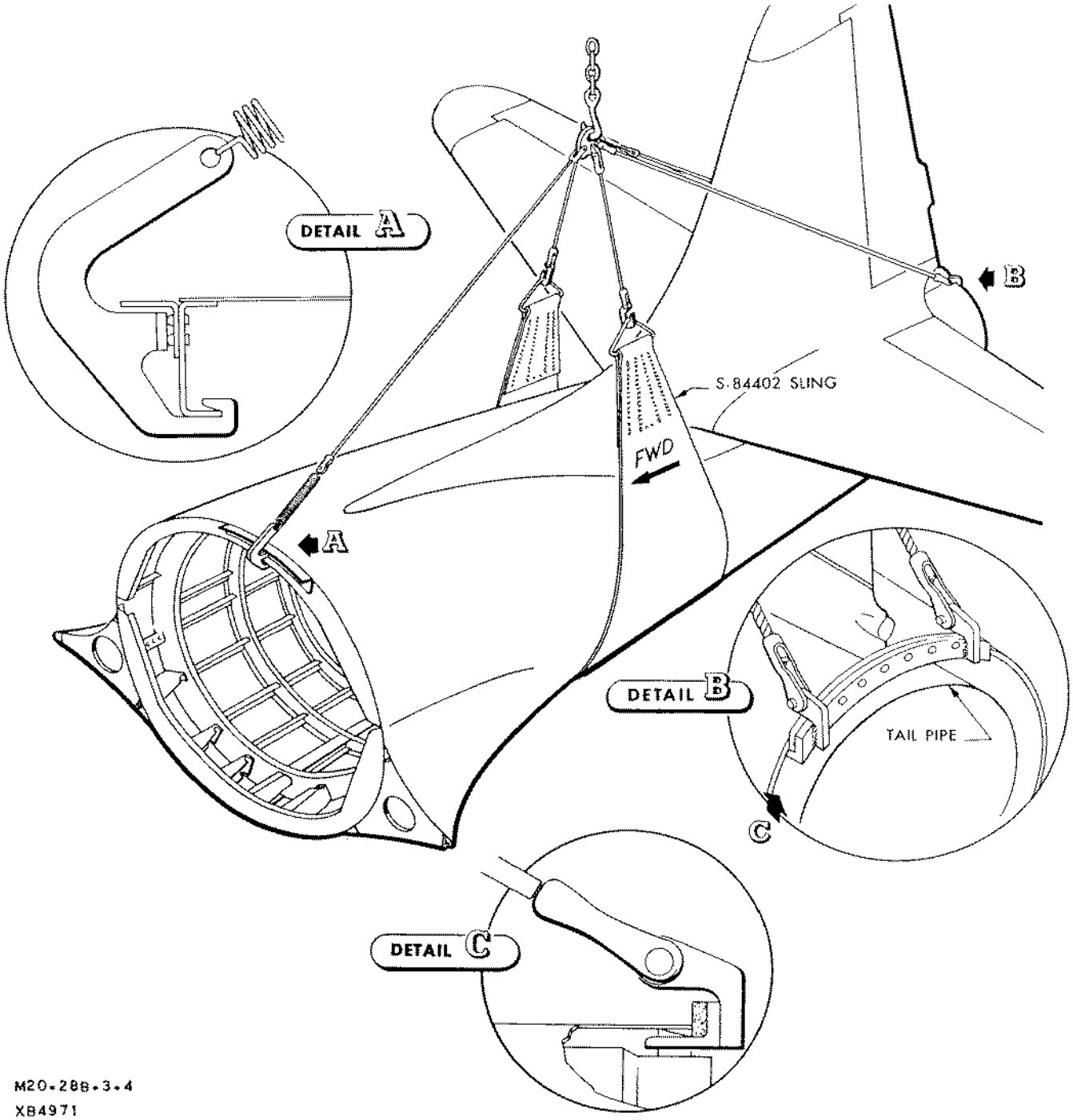


Figure 3-5. Hoisting the Fuselage Aft Section

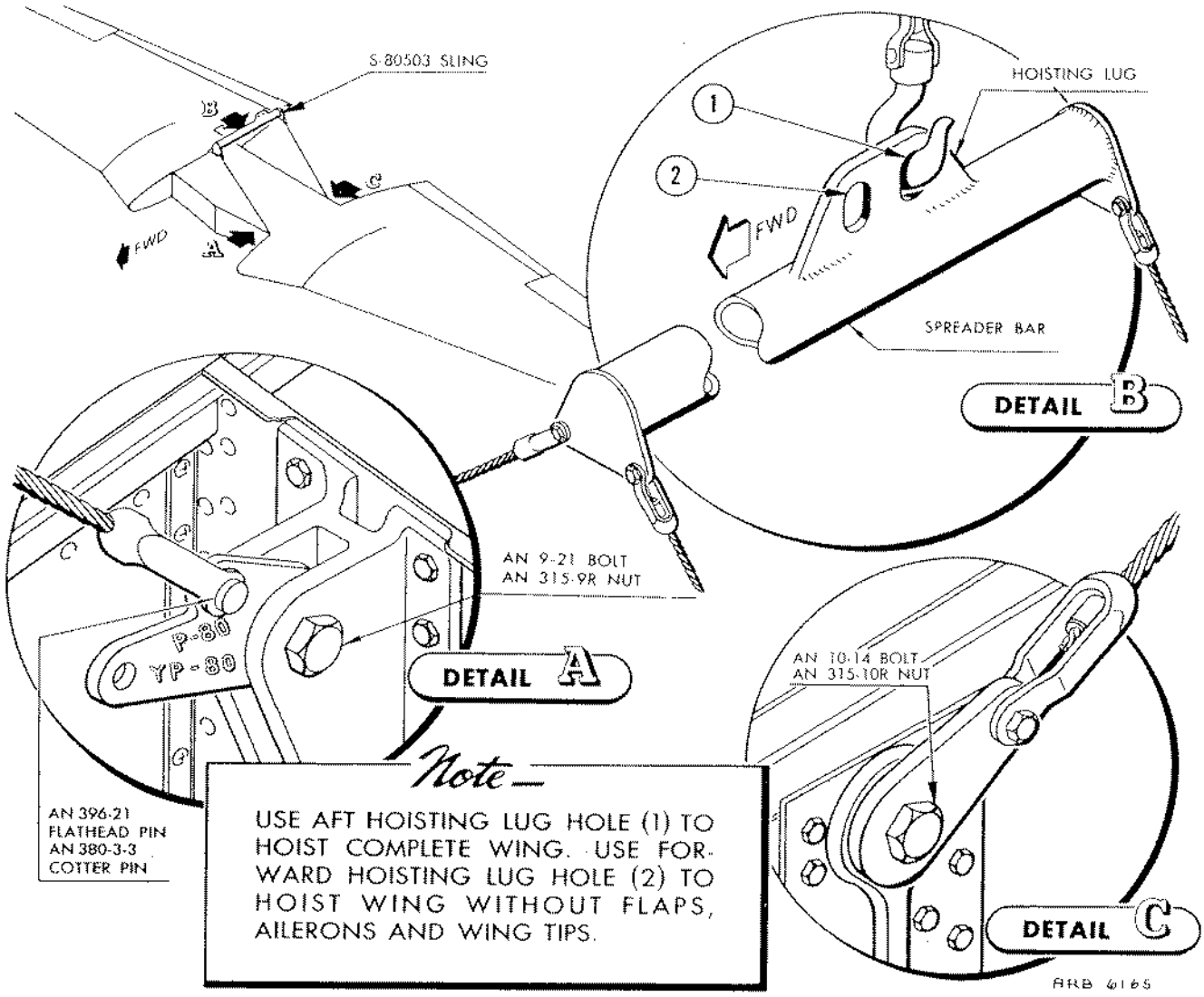


Figure 3-6. Hoisting the Wing

3–22. NOSE JACKING POINT. On under side of fuselage nose at a point marked "ATTACH JACK PAD HERE," screw nose tie-down and jack adapter, S81906, into the tapped hole. Use standard Air Force jack at this point.

3–23. EMERGENCY JACKING PROCEDURE FOR ONE FLAT MAIN WHEEL TIRE. *(See figure 3-11.)* Occasions often arise when it becomes necessary to remove a flat tire from the airplane, when it is not convenient to jack the airplane in a conventional manner. The following procedure may be used.

a. Fabricate a wood block and install on shock strut having flat tire as shown in figure 3-11.

Note

Length of wood block is for a 3-inch shock strut extension. If shock strut extension is in excess of 3-inches, reduce length of wood block ¼-inch for each additional one inch of strut extension.

b. Place standard Air Force jack at wing jack point and raise until airplane weight is on jack.

CAUTION

Install wheel chocks at those wheels not being jacked.

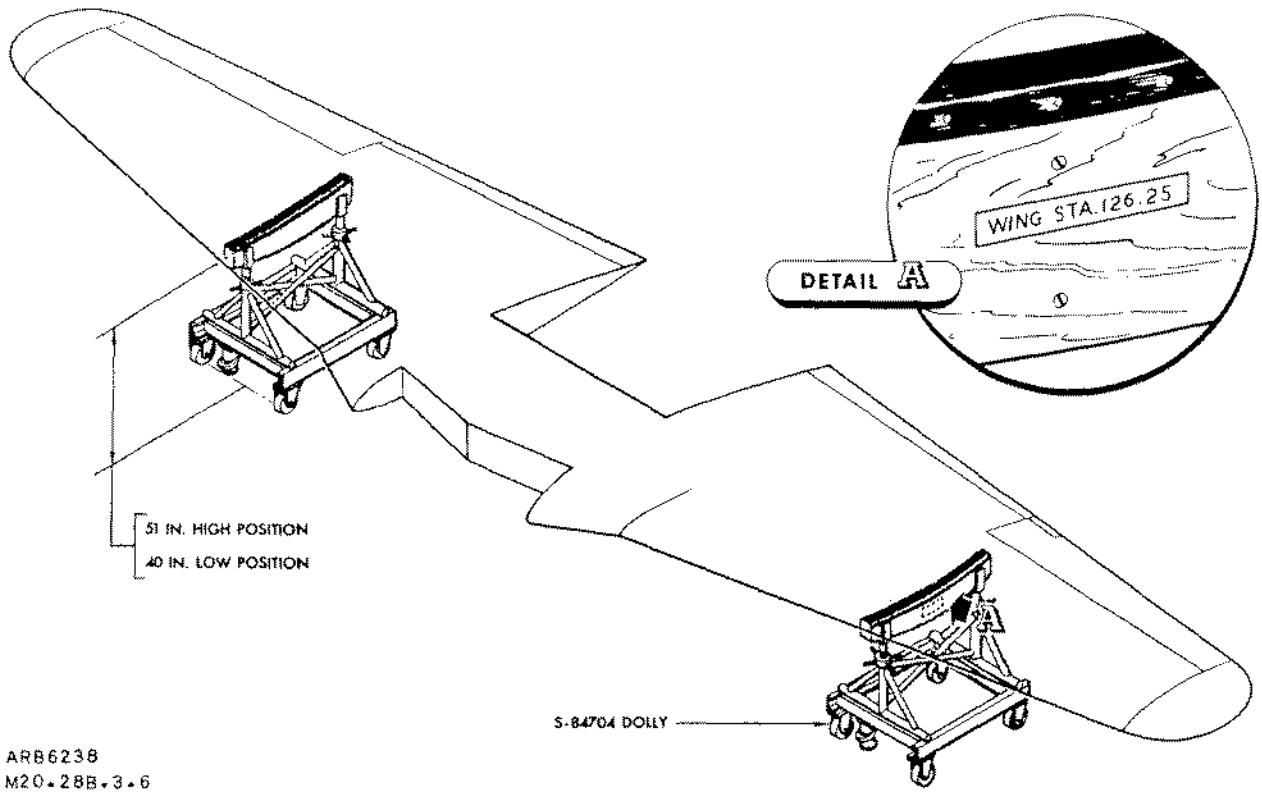


Figure 3-7. Storage Dolly for Wing

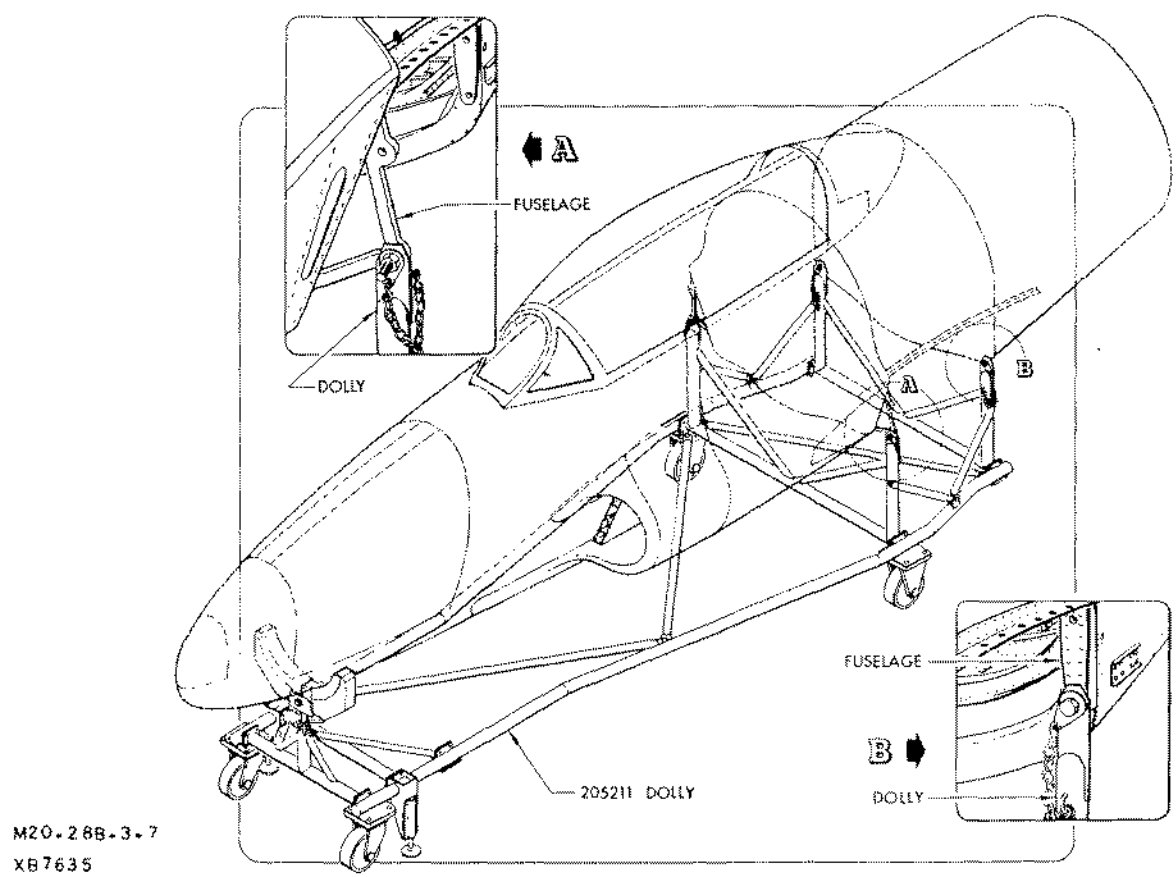
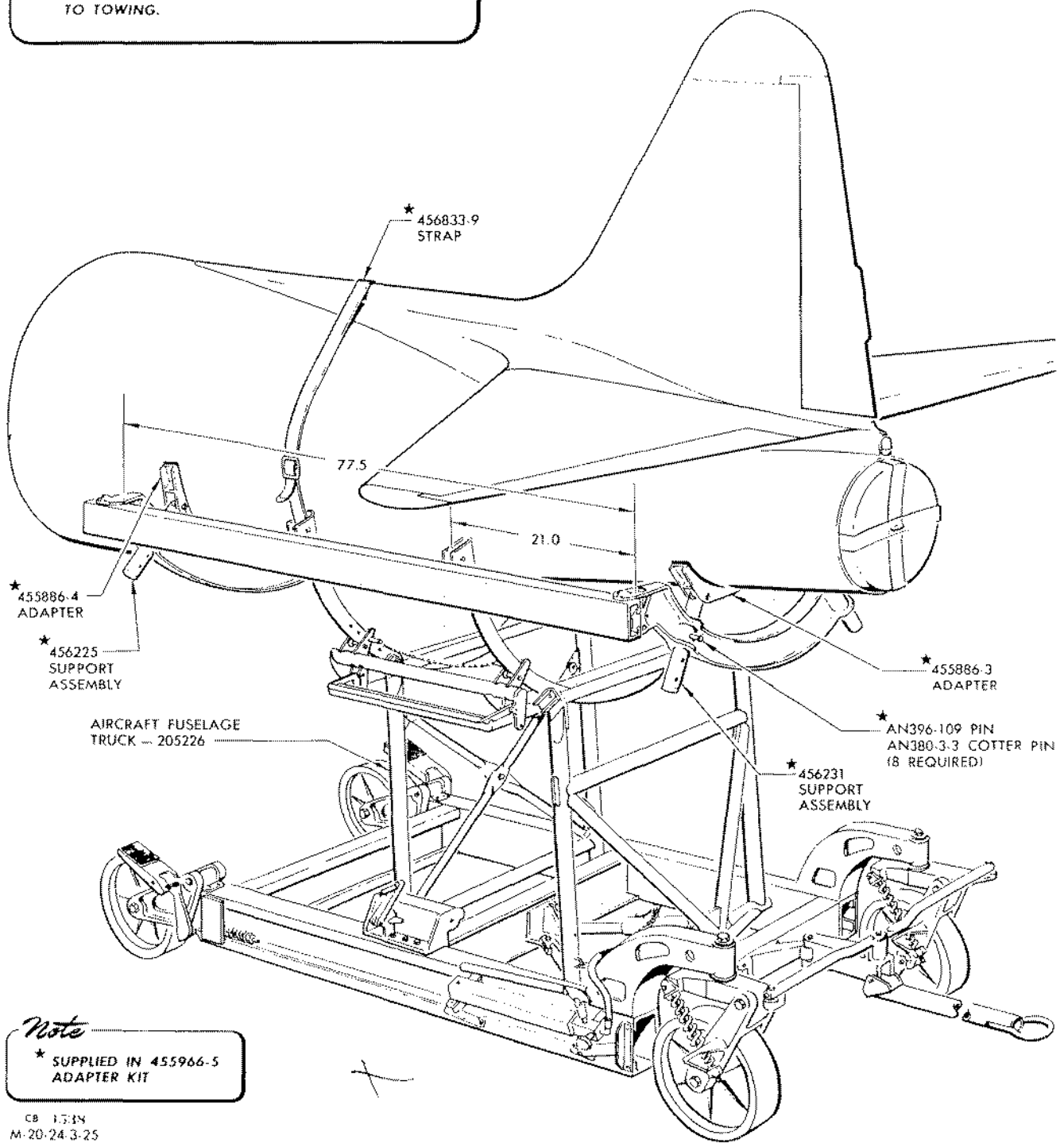


Figure 3-8. Storage Dolly for Fuselage Nose and Midsection

Caution

1. *TRUCK ADAPTERS MUST CONTACT AFT SECTION AT FUS STA 400 AND FUS STA 322.5.*
2. *AFT SECTION MUST BE STRAPPED TO TRUCK PRIOR TO TOWING.*
3. *TRUCK MUST BE IN LOWEST POSITION PRIOR TO TOWING.*



Note

★ *SUPPLIED IN 455966-5 ADAPTER KIT*

CB 1.5:N
M-20-24-3-25

Figure 3-9. Aft Fuselage Truck

e. Release air pressure from shock strut on side being jacked.

WARNING

Failure to release air pressure in shock strut may cause failure of wood block. Air pressure exerts a force of approximately 5600 pounds on shock strut piston.

d. Raise jack until wheel is clear of ground and replace wheel assembly with serviceable unit.

e. Lower jack slowly until wood block becomes free and remove from shock strut. Lower jack until free of wing jack point.

f. Inflate shock strut to proper height (refer to paragraph 4-159).

3-24. JACKING PRECAUTIONS.

WARNING

Whenever wing jacks are utilized in such a manner that failure of a jack could result in injury to personnel or damage to the airplane or other property, or whenever removal of airplane parts such as stressed skin plates could result in damage to the airplane or to other property, added protection must be provided in the form of suitable trestles, stands, shoring, chain hoists, or other adequate supporting devices. All protection devices, when applied to the under side of the airplane, will be of the required height, padded in the areas contacting the airplane, and will have sufficient supporting surface to allow for support of the airplane without damage to the airplane. Overhead supports such as chain hoists will be applied only to those upper portions of the airplane designated as lifting points.

a. See that jacks are placed level and solid.

b. Whenever possible, park airplane in hangar or in a shelter from wind. If necessary to jack airplane outdoors, head airplane down wind.

c. Extend jacks simultaneously and in a vertical direction.

d. Release brakes and remove chocks from wheels before operating jacks.

e. Avoid jarring airplane while it is resting on jacks.

f. If a jacked airplane is left unattended, remove all ladders and equipment which could damage structure if a jack should fail.

g. When necessary to jack from a single point, keep lift to an absolute minimum, and always within safe limits of jack. Place chocks under wheels that are not lifted.

h. Set locking devices on jack stands to prevent accidental lowering of airplane.

i. If alighting gear is to be retracted when airplane is jacked, check nose gear shock strut for proper inflation.

j. When guns, ammunition, radio, and batteries are removed, 300 pounds of ballast must be placed in the nose section when the airplane is jacked.

3-25. LEVELING.

3-26. Pads upon which to place a spirit level are attached to the lower longerons in the nose wheel well, two on the right side and one on the left. These leveling pads may be used as an aid in leveling the airplane for boresighting. (See figure 3-12.)

3-27. Provisions for attaching plumb lines to forward and aft ends of airplane are provided on the left side, and are marked with red circles and stamped "PLUMB LINE." The forward plumb line provision is on the side of the fuselage nose near the forward gun. The aft plumb line provision is on the lower left side of the fuselage near the juncture point of the fuselage aft and mid sections. Plumb lines are used in aligning the airplane for boresighting.

3-28. Additional provisions for plumb line attachment are located in each main gear wheel well. These points are readily accessible and clearly marked "F.S. 207.00 MEASURING POINT" on AF Serial Nos. 48-356 through 48-375, 48-913 through 48-920, and 49-879 through 49-886, and "233.6 INCHES AFT OF FUS. DATUM POINT" on AF Serial Nos. 49-887 and subsequent. Use these points as reference points in taking

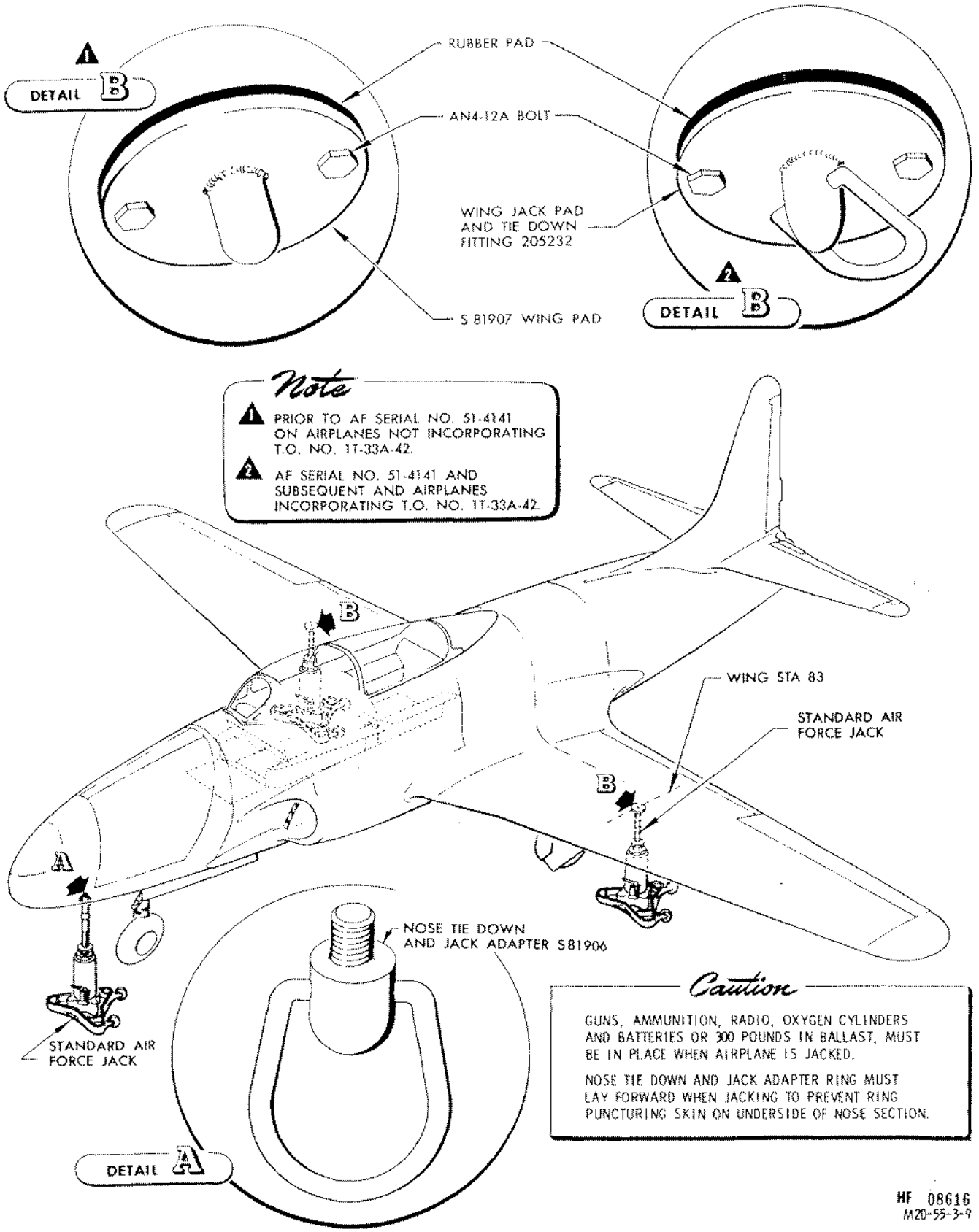


Figure 3-10. Jacking

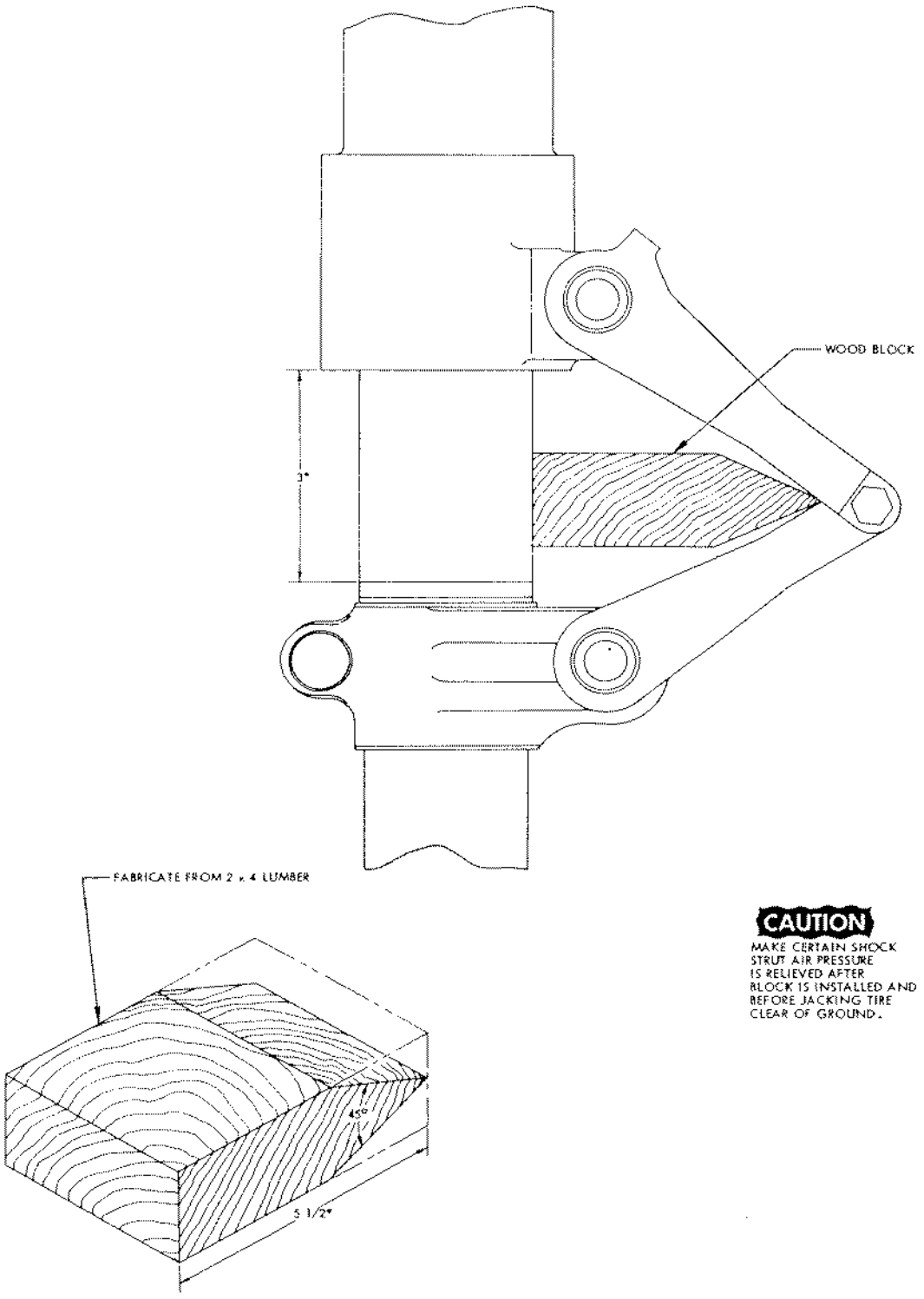


Figure 3-11. Jacking Procedure for Single Main Gear

forward and aft measurements when weighing the airplane to determine center of gravity. It is not necessary to use these points when leveling the airplane for boresighting.

3–29. PARKING AND MOORING. *(See figure 3-16.)*

3–30. PARKING. Set parking brakes and lock controls. (Refer to paragraph 3–46.)

Note

Do not set parking brakes until sufficient time has elapsed to permit brakes to cool.

3–31. WING TIE-DOWN (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-42). Remove two panels on under side of wing tips at bomb hoist connection marked "MOOR HERE," and attach wing tie-down fitting, S80401. Attach fixed arm of tie-down fitting to outboard bomb hoist hook, and swinging arm to inboard hook. Be sure that locating pin for swinging arm of tie-down fitting is locked in position.

Note

Droppable tanks must be removed in order to attach wing tie-down fittings.

3–32. WING TIE-DOWN (AF SERIAL NO. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. NO. 1T-33A-42). On the under side of the wing outboard of each main gear at wing station 83, remove two ¼-inch screws at the point marked "ATTACH JACK PAD HERE," and install wing jack pad and tie-down fitting 205232 with two AN4-12A bolts.

3–33. NOSE TIE-DOWN. On the under side of the fuselage nose at the point marked "ATTACH JACK PAD HERE," screw nose tie-down and jack adapter S81906 into the tapped hole.

3–34. MOORING FOR HIGH WINDS. *(See figure 3-13.)* The secure installation of the proper size wheel chocks is most important in mooring an aircraft for high velocity winds. When mooring the aircraft, use wheel chocks (four inches high) manufactured to the dimensions given in AF drawing No. 42D6594-2. For ice or snow, use metal collapsible ice-grip wheel chocks, stock No. 8200-159006, AF drawing 50D6602. Aircraft weights and relative wind velocities that make tie-down necessary are shown in figure 3-13. To make use of this figure it is advisable to know the approximate weight of the aircraft in its various configurations: fully equipped for missions, with or without drop tanks, and fully loaded or empty of fuel and ammunition. During emergencies, this information is necessary for selecting the aircraft that need to be tied down first.

CAUTION

Structural damage can occur from high velocity surface winds. If at all possible, evacuate aircraft to a safe weather area if a tornado, hurricane, or wind above 119 knots is expected. However, if the aircraft is subjected to these conditions, check the surface controls and their hinge points for damage.

3–35. MOORING. *(See figure 3-14.)* Aircraft should be headed as nearly as possible into the expected wind direction, when utilizing the standard 30 foot spaced tie-down grid pattern. This will allow aircraft to be moored within 45 degrees of the wind direction, and in accordance with the position determined on the mooring diagram. If high winds are expected to come from one direction without shifting, moor as follows:

a. Head aircraft in the direction from which highest forecasted wind or gusts will come.

b. Locate aircraft not less than wing-span distance from other aircraft with nose mooring point approximately five feet downwind from ground mooring anchor, if practicable.

c. Deflate nose gear strut. (Refer to paragraph 4–230.)

d. If time permits, fill all fuel tanks to capacity, including drop tanks, if installed.

e. Place wheel chocks in front of main gear wheels.

f. Install nose tie-down fitting, part No. S81906. (Refer to paragraph 3–33.)

g. Attach mooring tie-down to mooring fittings. (detail A, figure 3-17.) Make tie-down from 3/16-inch aircraft cable or chain that will sustain 3000 pounds pull-test. Secure cable to nose tie-down with two wire rope clips, stock No. 6700-195135. Secure chain with aircraft steel bolts. Use ¾-inch manila rope if cable or chain tie-down is not available. Rope is the least desirable because of its tendency to shrink when wet. Secure mooring rope with a square or bowline knot.

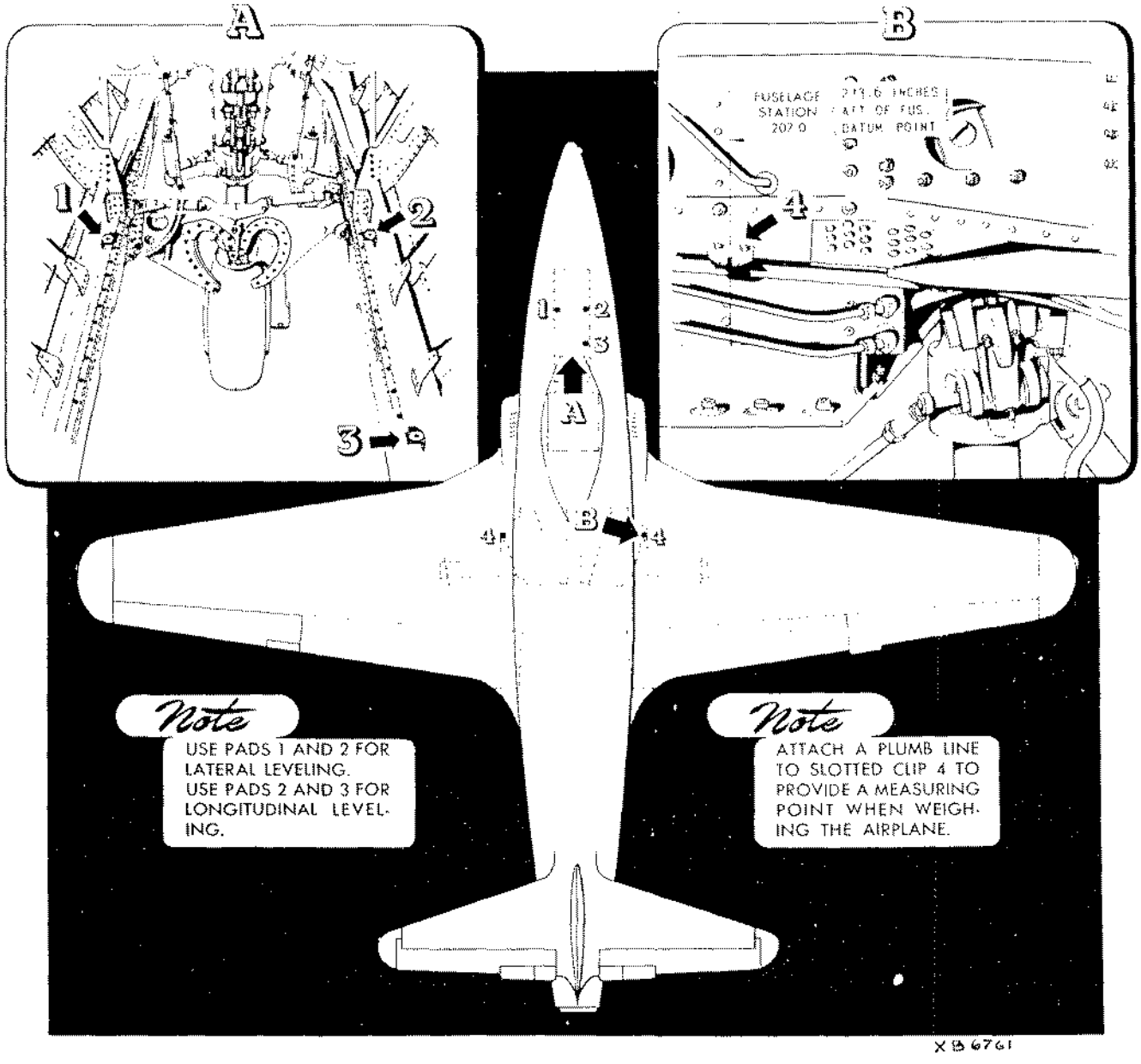


Figure 3-12. Leveling and Measuring Points

h. Slip mooring tie-down through ground mooring anchor and tighten to keep as much movement as possible out of nose strut. Secure anchor end of tie-down as in step "g."

i. Place chocks aft of main gear wheels and secure by nailing wood cleats from chock to chock on each side of wheel. Use ropes to secure chocks when wood cleats are not available or when using ice-grip chocks.

j. Chock nose wheel fore and aft and secure chocks as in step "i."

k. Install intake and tailpipe dust plugs (after engine has cooled). (See figure 3-17 and paragraph 3–40.)

l. Align and lock surface controls. (Refer to paragraph 3–47.)

m. Set parking brakes. (Refer to paragraph 3–48.)

n. Retract wing flaps and dive flaps.

o. Close canopy and other openings.

p. As climatic conditions dictate, install canopy cover and other protective covers, or tape openings. (Refer to paragraph 3–38 and figure 3-16.)

q. Disconnect battery.

r. Secure all maintenance stands and loose equipment.

Note

After high winds, check aircraft for damage from flying objects. Check all surface controls throughout their full range of travel. Inflate nose gear strut, connect battery and remove nose tie-down fitting before flight.

s. If high winds are expected to be variable or shifting, install wing tie-down fittings (refer to paragraphs 3–31 and 3–32) and install additional mooring tie-downs as shown in figure 3-15 and detail B of figure 3-17. (Length as required to reach mooring anchors.) These tie-downs should be tight and secure; do not tighten to the extent a strain is placed on aircraft structure or forward mooring point. Heading aircraft in direction of highest velocity winds is not critical with additional tie-downs.

Note

When parking area mooring anchors are not available or accessible, use "dead man" type anchors that will sustain 3000 pounds pull without failure, or mooring kit, part No. AN 8015-2.

3–36. INSTALLATION OF MOORING KIT, PART NO. AN8015-2.

a. Screw anchor rod into arrow.

b. Slip driving rod over anchor rod and into socket of arrow.

c. Turn cam of driving rod so that prongs of arrow are not spread by driving.

d. If ground is hard, break the surface with ground breaking pin.

e. Align rod with aircraft mooring fitting and drive arrow in ground until driving rod handle is approximately three inches from ground.

f. Rotate driving rod handle 90 degrees and give it a sharp blow to spread arrow prongs.

g. Return driving rod to driving position and withdraw.

h. Align squared socket of eye assembly with squared end of anchor rod, fit it in place, and screw knurled nut down tightly.

i. Set arrow prongs by pulling up on eye assembly.

Note

Withdraw the anchor rods by turning the eye assembly counterclockwise. Leave the arrows in the ground.

3–37. COVERS.

3–38. Cover canopy with cockpit canopy cover 205203 or 49J20260.

3–39. Cover pitot tube with pitot tube cover 179379 or 48C26486.

3–40. To exclude dirt and moisture from engine section, install duct dust plugs 207998 L/R in air intake duct openings, and engine exhaust dust plug shield S79250 in tail pipe opening. Install plugs whenever airplane is to be moored.

3–40A. *(See figure 3-16.)* To exclude dirt and moisture from nose compartments of aircraft modified in accordance with T.O.s 1T-33A-577 and 1T-33A-585, cover nose compartment scoops with plug 412255-1 (two each) and exhaust louvers with covers 412252-1 and 412252-2.

CAUTION

Do not stow duct dust plugs or other ground handling equipment in airplane.

3–41. TOWING.

3–42. Provisions are made on the alighting gear for use of tow bars. (See figure 3-18.) If tow bars are not available, airplane may be towed by ropes. Length of tow ropes should be at least 32 feet, particularly when towing over soft or rough ground. A man should be stationed in the cockpit to control airplane by use of brakes. If limited movement of airplane is desired, it may be pushed by hand.

3–43. NOSE GEAR TOWING. Airplane may be towed by nose gear tow bar S78903, 205214, 205231, or a standard Air Force tow bar. Tow bar must be attached to towing bolt at lower attachment of the torque arms to the strut. Prior to AF Serial No. 49-960, the towing bolt was at the upper torque arm attachment point. For these airplanes, the upper and lower torque arm bolts must be interchanged so that towing can be from the lower attachment point.

3–44. MAIN GEAR TOWING. Towing eyes are provided on main gear for forward or aft towing. Eye for forward towing is at lower end of main gear shock strut on side opposite torque arm attachment. Eye for aft towing is on shock strut axle between wheel and inner door segment.

3–45. TOWING PRECAUTIONS.

a. Do not allow nose wheel to turn more than 45 degrees from forward position.

b. Do not push backward with main gear tow bar attached to forward towing eye.

c. Use nose gear tow bar for towing only when airplane is on hard, level ground.

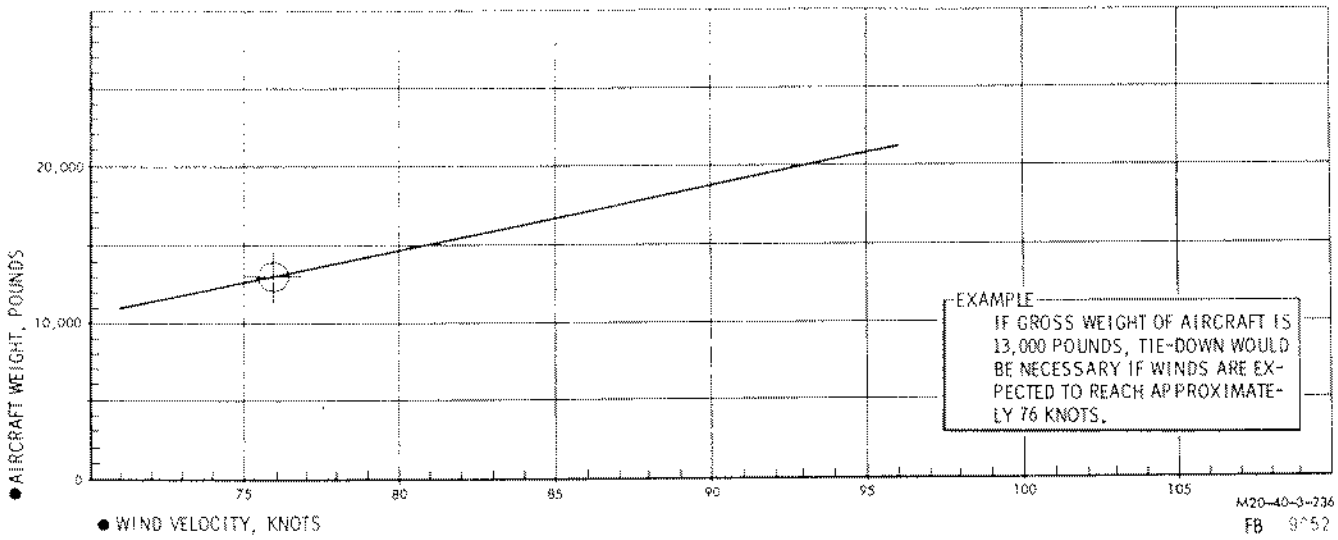


Figure 3-13. Aircraft Tie-down Requirements for High Winds

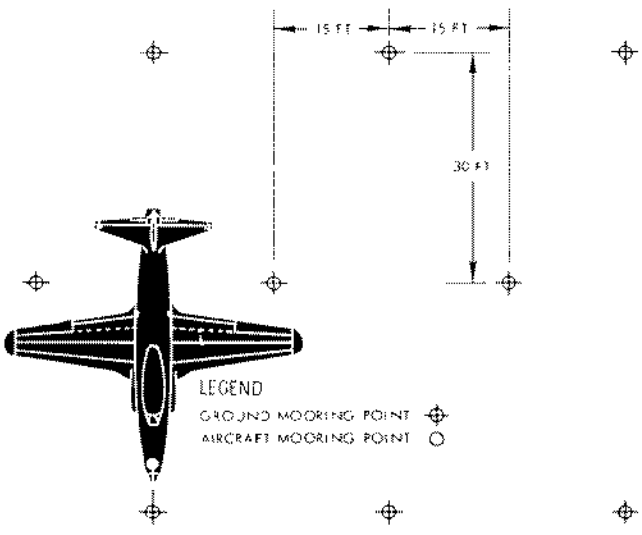


Figure 3-14. Mooring Pattern, Wind Direction and Velocity Steady

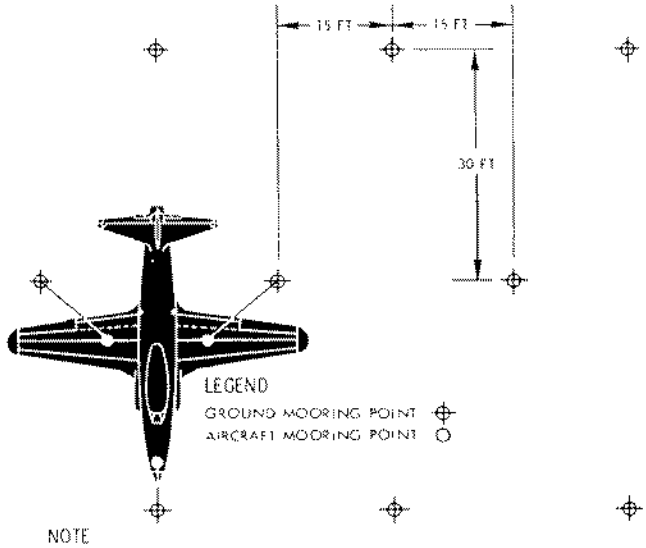


Figure 3-15. Mooring Pattern, Wind Direction and Velocity Unsteady

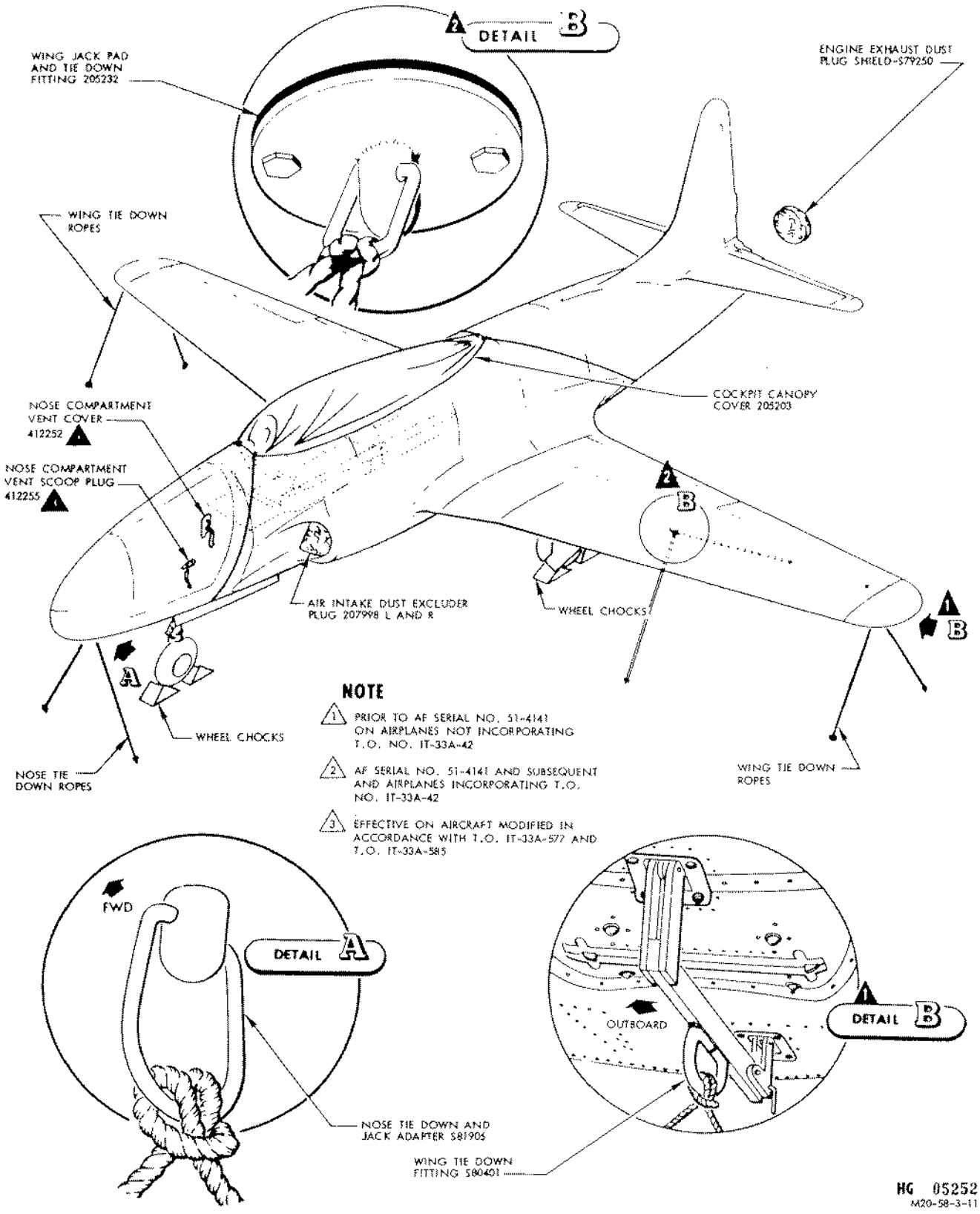


Figure 3-16. Mooring

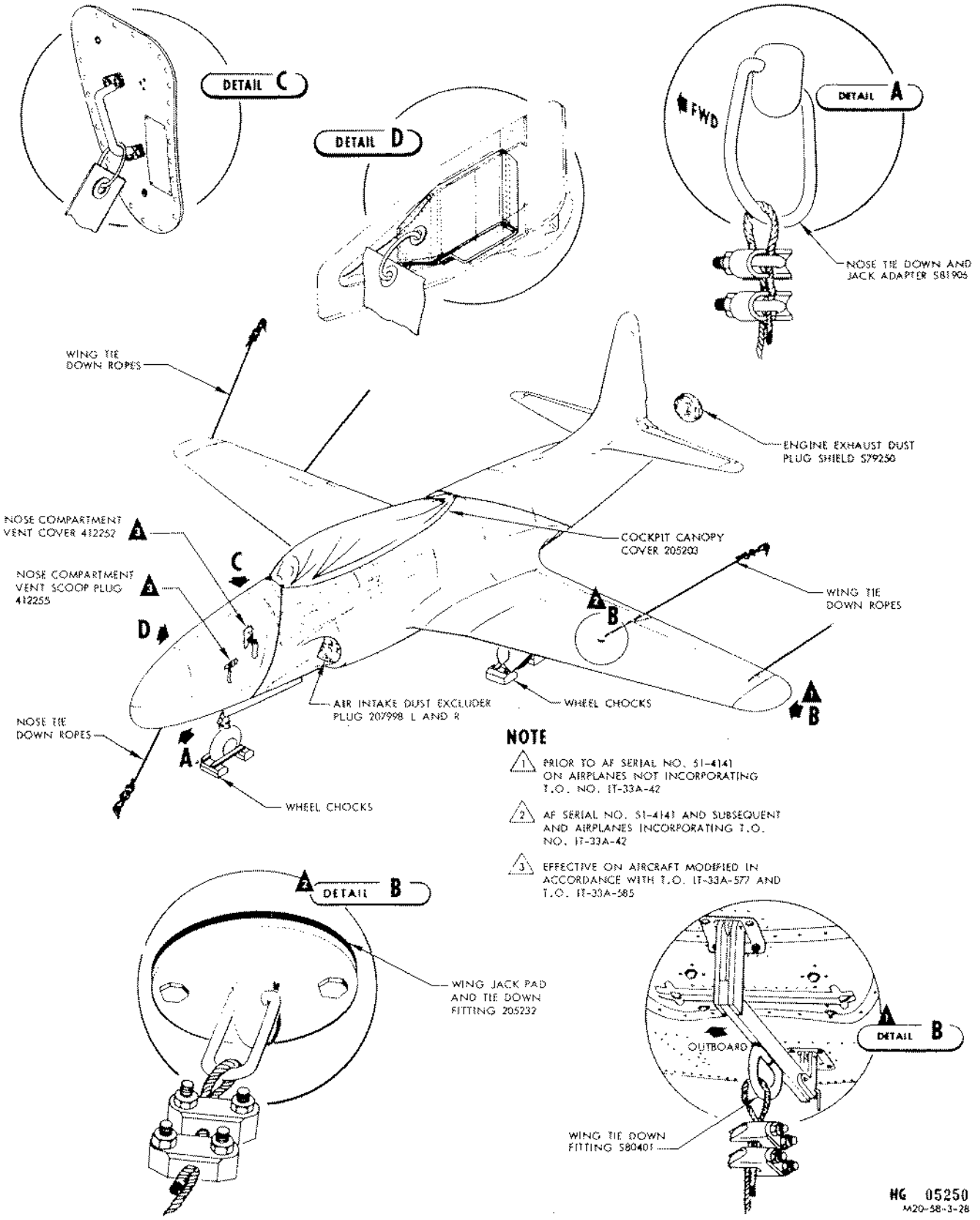


Figure 3-17. High Wind Mooring

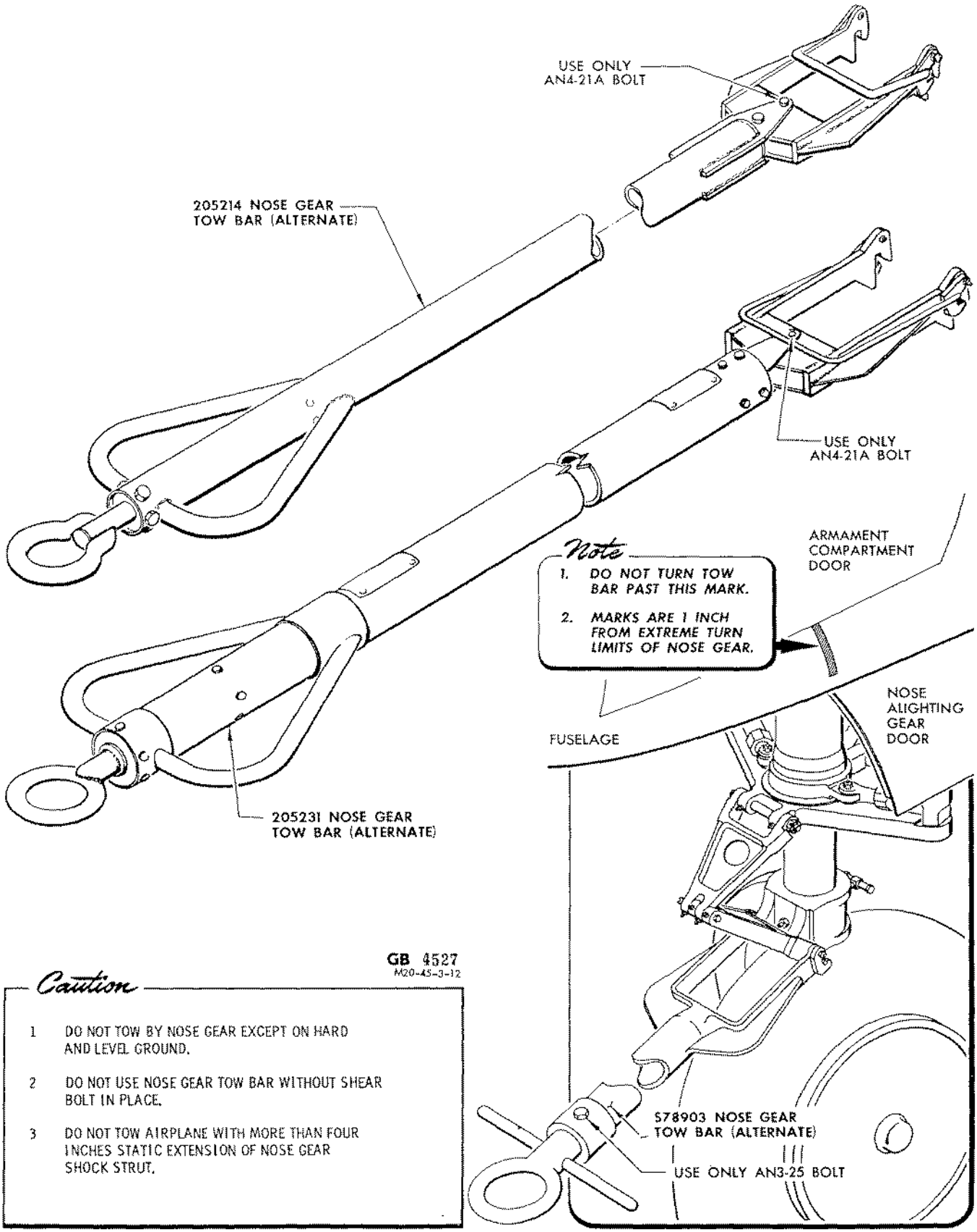


Figure 3-18. Towing

d. Do not use tow bar unless shear bolt is in place as shown in figure 3-18. Failure of shear bolt is a warning that a load has been applied which would endanger structure of the airplane.

e. If handling the airplane by hand, do not push on ailerons, empennage, or fuselage-nose plastic housing.

f. Do not tow airplane with more than four inches static extension of nose gear shock strut.

g. Do not operate engine while towing tug or tractor is connected to airplane.

h. Tow airplane slowly, avoiding sudden starts or stops, especially on ice, snow, or rough, soggy, or muddy terrain.

3–46. PARKING BRAKES AND CONTROL LOCKS.

3–47. PARKING BRAKES. *(See figure 4-125.)* Refer to paragraph 4–187 for description and operation of parking brakes. Use wheel chocks (figure 3-16) as extra braking precautions.

3–48. LOCKING THE CONTROL SURFACES. *(See figure 3-19.)* A surface control lock is provided to lock the rudder, aileron, and elevator in neutral when the airplane is moored or parked. Install as follows:

a. Insert tubes in inboard holes of rudder pedals.

b. Insert pins in holes of control stick.

c. Clamp lock to control stick by tightening wing nut.

3–49. Additional precautions may be taken to secure control surfaces when airplane is to be stored or transported, by blocks clamped at trailing edges. Blocks should be carefully shaped to contour of these surfaces, and pads placed between blocks and skin surfaces to prevent injury.

3–50. LOCKING THE ALIGHTING GEARS. *(See figure 3-20.)* The nose and main gears may be locked in down position with alighting gear down-lock clamp S-85204. On airplanes AF Serial No. 53-5086 and subsequent and airplanes incorporating T.O. 1T-33A-198, clamp No. 464085 is used to lock the nose gear in the down position. Clamp is attached on each main gear to spring-loaded cartridge rod between upper side strut members. Clamp is attached on nose gear to spring-loaded cartridge rod between upper drag strut members.

WARNING

Remove all locking devices before airplane is flown.

3–51. EMERGENCY ESCAPE SYSTEMS SAFETY PINS. *(See figure 3-21.)* To prevent accidental operation of the pilots escape systems, while the airplane is on the ground, safety pins are installed in specific places to render the escape systems inoperative. Certain safety pins are installed only while the airplane is in flight status, while additional safety pins are installed whenever maintenance is performed on the airplane. The following precautions must be taken when extensive maintenance in the cockpit area or maintenance on the egress system is anticipated:

a. Disconnect seat and canopy system quick disconnects.

b. Install egress system safety pins.

c. Disconnect external canopy jettison thruster initiator line to thruster.

d. Disconnect initiator canopy remover hose to canopy remover.

e. Cap and plug all openings, install appropriate warning tag, and make a red X form entry in AFTO Form 781A.

3–51A. Compliance with the above will prevent inadvertent firing of the egress system components and insure a system check after completion of maintenance. Figure 3-21 illustrates the location and identification of all emergency escape systems safety pins.

WARNING

Remove all ground handling safety pins when airplane is returned to flight status after maintenance is accomplished.
Remove all safety pins before airplane is flown.

3–52. SERVICING.

3–53. Walkways for servicing equipment in cockpit and wing fuel tanks are Vulcabond V118A, manufactured by American Latex Corp. See figure 3-30 for servicing equipment used.

3–54. See figure 3-24 for locations of filler valves and openings for water-alcohol mixture (on airplanes prior to AF Serial No. 53-5083), fuel, air, oil, hydraulic oil, and oxygen.

3–55. Refueling units other than Air Force units may be used to service the airplane, provided the units are equipped with filters which will remove all solid particles having dimensions of five microns or larger, and are capable of removing 99.5 percent of all free water.

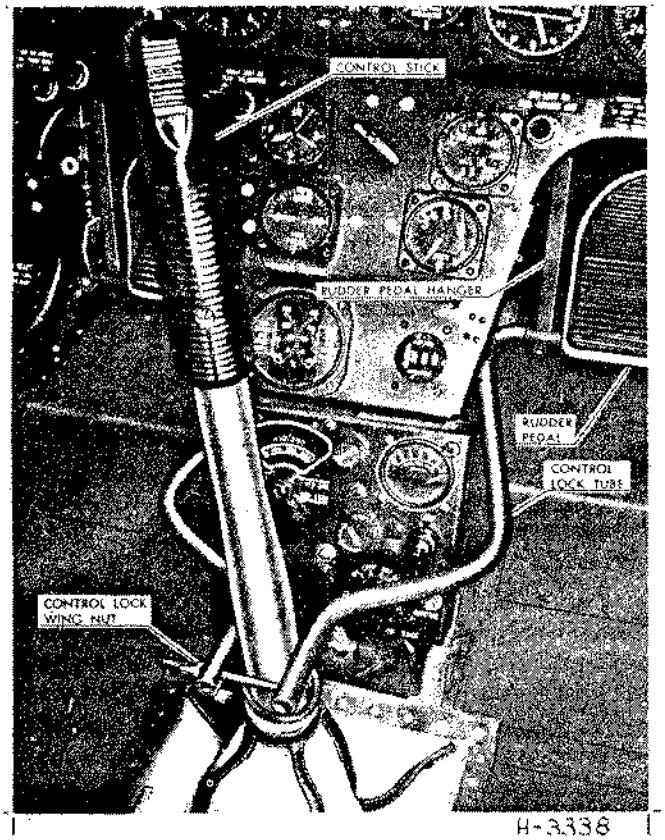


Figure 3-19. Surface Controls Lock, Cockpit

3-56. See figure 3-25 for drain and vent locations.

3-57. FUEL SYSTEM SERVICING. In all possible cases, service aircraft with "cold fuel" (fuel which has attained a temperature essentially the same as the ambient temperature). Correct fuel for this aircraft is Grade JP-4, Specification MIL-T-5624. Alternate and emergency fuels are listed and discussed in T.O. 42B1-1-14. Direct any question regarding the use of alternate or emergency fuel to SMAMA (MMAT) McClellan AFB CA 95652.

WARNING

Servicing this aircraft with unauthorized type fuel can result in loss of life.

- In fueling operations of aircraft, a minimum distance of 10 feet from other aircraft must be maintained. This distance will be measured from the fueling point and/or vents of the aircraft being serviced to the closest part of adjacent aircraft.

a. Locate aircraft in an area approved for fuel servicing, draining or fuel system maintenance, according to work requirements.

b. Service aircraft as soon as possible after landing.

c. Attach static ground wire to main landing gear during all servicing, defueling, purging or maintenance.

d. Use static grounding receptacles provided on the aircraft that have T.O. 1T-33-538 complied with. These aircraft are equipped with four MS 90298-1 receptacles that will accept 69B52267 plugs for static grounding. Receptacles are located on the underside of the aircraft aft of the nose gear at station 139, in the aft section at station 324.5 and under both wings at station 139.10. Static grounding receptacles are also located adjacent to the fuel tank filler inlets. All static grounding receptacles are conspicuously identified with decals, P/N 68B40894 or MS27606-1. Receptacles will be checked periodically to insure a good electrical contact is available and that sufficient axial force is required for engagement and removal of the ground plug. Continuity check should be made using a AN/PSM-6 or equivalent multimeter. Measurement should be made between clean adjacent aircraft structure and inner sleeve of receptacle, and between aircraft structure and contact arm of the receptacle. Resistance should be 10 ohms or less. Axial force required for engagement or separation of jumper plug shall be sufficient to prevent accidental disconnection of the plug.

e. All other work on aircraft will be suspended during servicing, maintenance or draining, except when the portion of fuel system being worked on has been purged and declared safe and free from all explosive vapors.

f. Ground all work stands, power units and other equipment to same ground as used for aircraft.

g. Place fire extinguishers convenient to aircraft and work area.

h. Before removing fuel cap, ground fuel hose nozzle to airplane structure through grounding jacks located near filler caps.

i. Check quantity of fuel in tank and fill to desired level.

j. Install filler caps and check for security.

k. Non-synthetic clothing will be worn while performing fuel system maintenance, preferably cotton clothing).

l. All power tools will be air driven.

m. Electric lights and flashlights will be type that are explosion proof.

n. Drain residual fuel through a hose into a closed container grounded to aircraft. Remove hose and container from work area.

o. Make every effort to avoid spillage. If fuel is spilled, work will be suspended until fuel is mopped up and saturated rags are placed in a covered container. In case of excessive spillage, suspend work, call fire department and stand by until hazard is eliminated.

p. Components will not be removed from a fuel cell unless a replacement part or a suitable coverplate is available to seal the opening.

q. During removal or installation of booster pumps, inlet and outlet openings will be closed by a suitable block, plug or cap.

r. Disconnect all electrical wiring to leading components requiring maintenance.

s. Before starting removal of any fuel system component, discharge static electricity to ground with an insulated jumper wire.

t. Ground all components before installing components in fuel cells.

u. Tape will not be used to seal any fuel line, hose, cell or container.

3-58. COLD WEATHER FUEL SERVICING. It is important that the following additional fuel servicing instructions be observed during cold weather fueling to prevent fuel contamination from water.

a. Refuel aircraft as soon as possible after landing.

b. Remove all snow, water, ice, and mud from fuel filler caps, filler wells, and servicing nozzles.

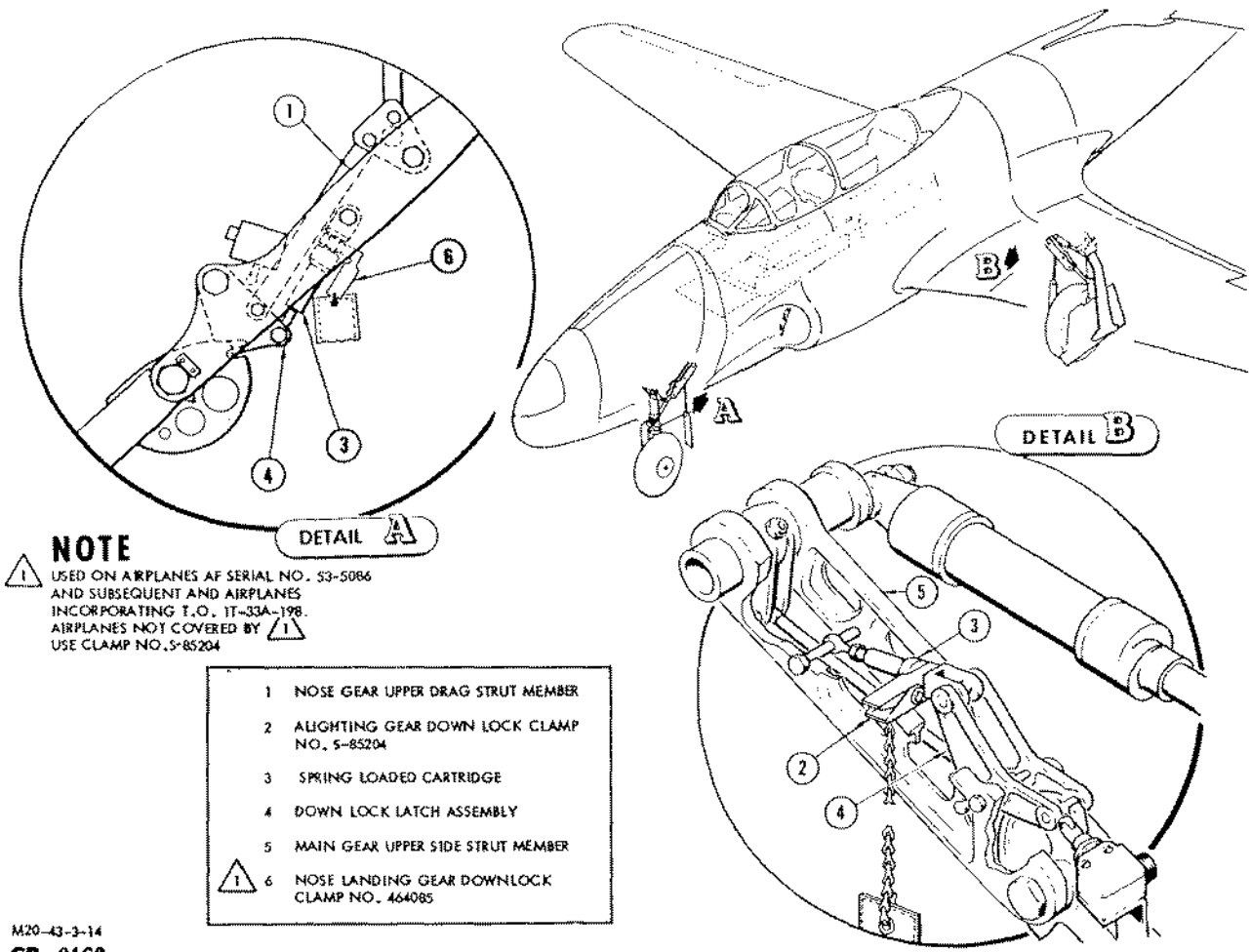


Figure 3-20. Installation of Alighting Gear Safety Clamp

c. Remove only one filler cap at a time, and replace immediately after filling.

d. Fuel tanks, filter cases, and pumps will be drained on preflight inspection just prior to flight. Enough fuel will be drawn from each drainage point to insure that the fuel tank, filter, or pump has no contamination or water in it.

e. Preferably 1 hour, but at least 30 minutes should elapse between filling of the fuel tanks and drainage of fuel tanks, filter cases, and pumps, unless flight schedules would be unduly hampered by this time interval.

f. The fuel will be drained slowly (static electricity does not build up rapidly when draining slowly) from each drain point into a clear glass or plastic container to permit a careful examination for the presence of water and other contaminants. Continue draining until fuel is free of water. It is suggested that one or two drops of a water-soluble food coloring be placed in the container first to aid in distinguishing the water from the fuel. Coloring is unnecessary when a color-coded fuel is being drained.

g. In order to prevent an accumulation of static electricity, several safety procedures will be utilized prior to filling a container. The drain or container will be grounded by inserting a ground wire into the drain in a manner that allows contact between the fuel and the aircraft or by inserting a ground wire into the container. The latter procedure is considered more efficient. The container will be emptied as soon as practicable into a waste fuel receptacle utilizing one of the above safety procedures.

WARNING

Overflowing tanks are a serious fire hazard and should be avoided. Immediately wipe up spilled fuel. Aircraft will be grounded to dissipate static electricity prior to fueling, defueling, tank purging, and tank repair operation. A hazard exists due to the electrical charge imparted to metal articles within the vicinity of operating radar or high frequency radio transmitting equipment. Fuel servicing will not be accomplished within 100 feet of aircraft operating radar or high frequency radio transmitting equipment.

PAGES 38A THRU 38B DELETED

NOTE

★ FLIGHT STATUS SAFETY PINS

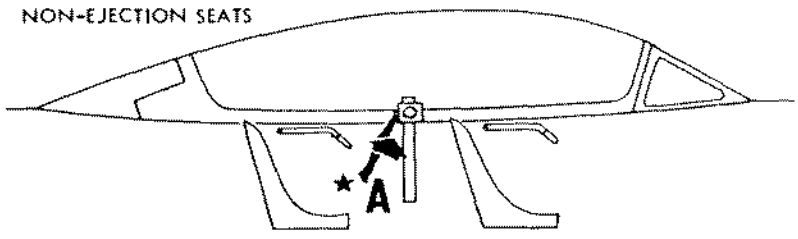
▲ GROUND HANDLING SAFETY PINS

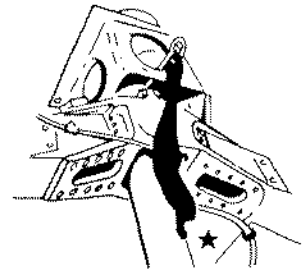
SYSTEM NO 1

AIRPLANES AF SERIAL NO. 48-356 THROUGH 51-4039

CABLE ACTUATED CANOPY JETTISON

NON-EJECTION SEATS





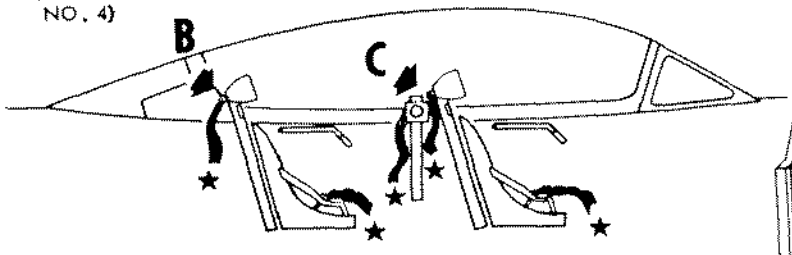
DETAIL A

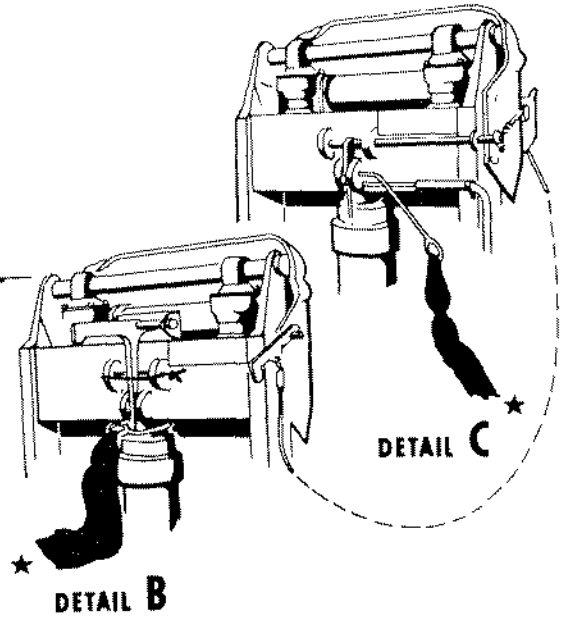
SYSTEM NO 2

AIRPLANES AF SERIAL NO. 51-4040 THROUGH 51-9035

CABLE ACTUATED CANOPY JETTISON

CABLE ACTUATED EJECTION SEATS (UNLESS MODIFIED TO SYSTEM NO. 4)



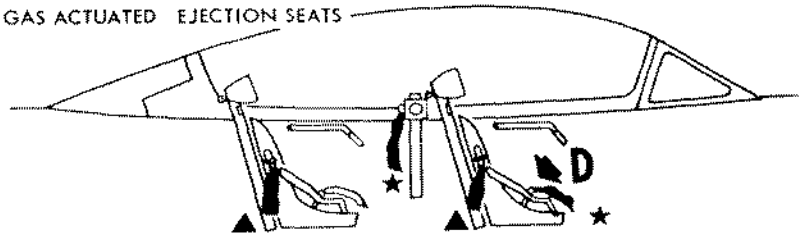


SYSTEM NO 3

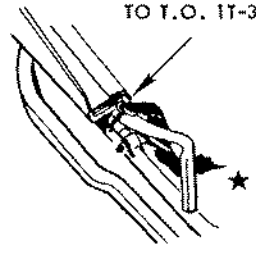
AIRPLANES AF SERIAL NO. 51-9036 THROUGH 52-9334

CABLE ACTUATED CANOPY JETTISON (UNLESS MODIFIED TO SYSTEM NO. 4)

GAS ACTUATED EJECTION SEATS



AIRPLANES MODIFIED TO T.O. 1T-33A-215



DETAIL D

FB 9299

M20-40-3-234

Figure 3-21. Emergency Escape System Safety Pins (Sheet 1 of 2)

(Refer to figure 4-200K for aircraft modified by T.O. 1T-33A-615)

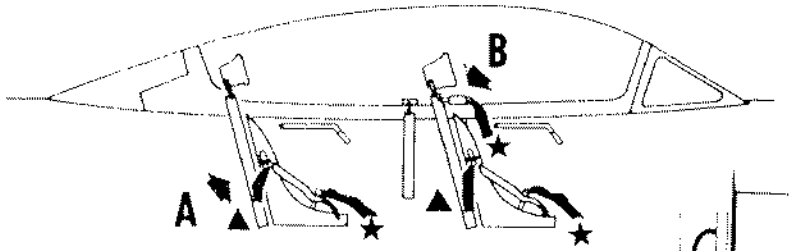
Note

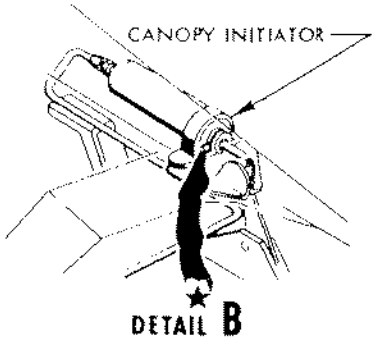
★FLIGHT STATUS SAFETY PINS

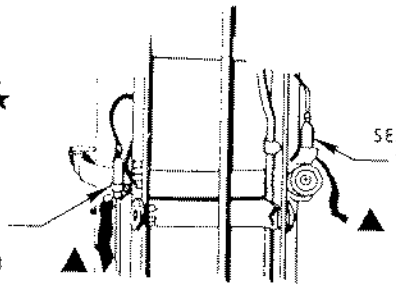
▲GROUND HANDLING SAFETY PINS

SYSTEM NO 4

AIRPLANES AF SERIAL NO.
52-9335 THROUGH 53-5285
GAS ACTUATED CANOPY JETTISON
GAS ACTUATED EJECTION SEATS

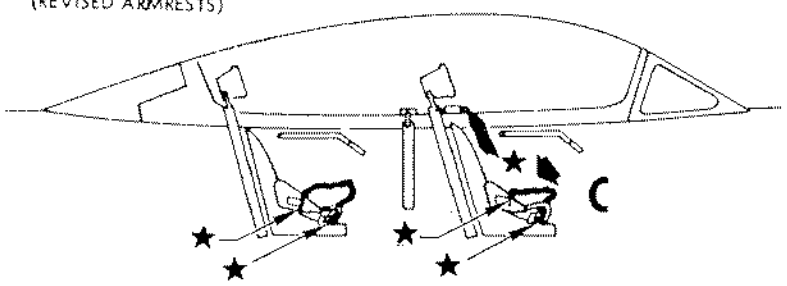


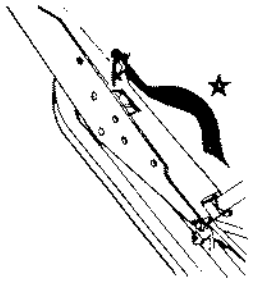




SYSTEM NO 5

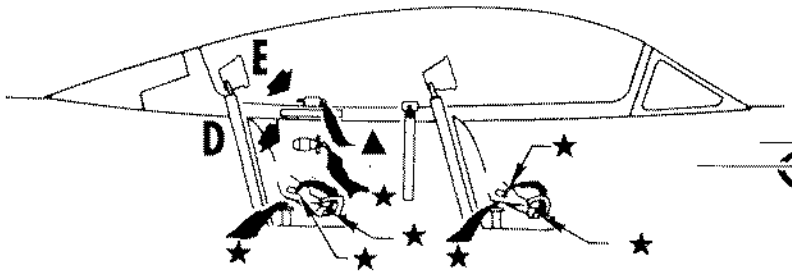
AIRPLANES AF SERIAL NO.
53-5286 THROUGH 53-5878
GAS ACTUATED CANOPY JETTISON
GAS ACTUATED EJECTION SEATS
(REVISED ARMRESTS)





SYSTEM NO 6

AIRPLANES AF SERIAL NO.
53-5879 AND SUBSEQUENT
GAS ACTUATED CANOPY JETTISON (INTERCONNECTED TO ARMRESTS)
GAS ACTUATED EJECTION SEATS



EXTERNAL JETTISON INITIATOR SAFETY PIN RH SIDE

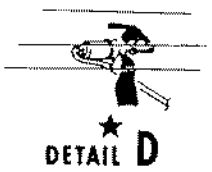


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Figure 3-21. Emergency Escape System Safety Pins (Sheet 2 of 2)

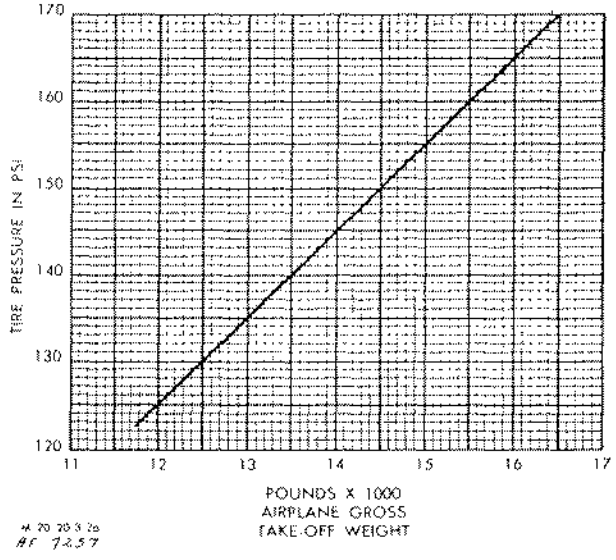


Figure 3-23. Main Gear Tire Pressure Versus Airplane Weight

3–59. TIRE INFLATION. Inflate nose gear 8-ply tire to 80 psi (6-ply tire to 60 psi) for all weight conditions. See figure 3-23 for main gear tire pressures versus airplanes gross weight.

3–60. GROUND OPERATING INSTRUCTIONS.

3–61. Refer to T.O. 1T-33A-1 for ground operating instructions.

3–62. LUBRICATION.

3–63. See figure 3-26 for lubrication points and requirements.

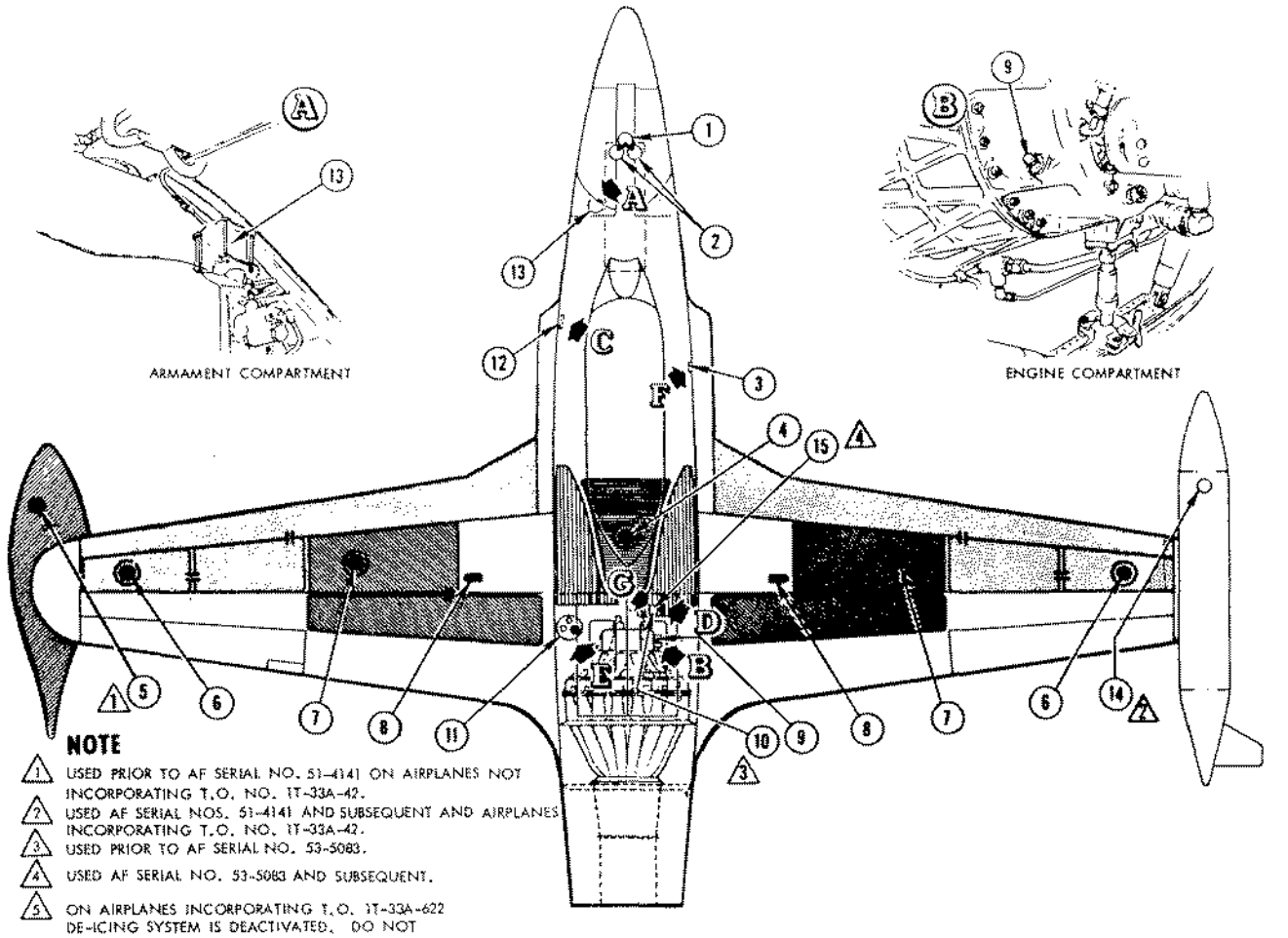
3–64. SPECIAL TOOLS AND EQUIPMENT.

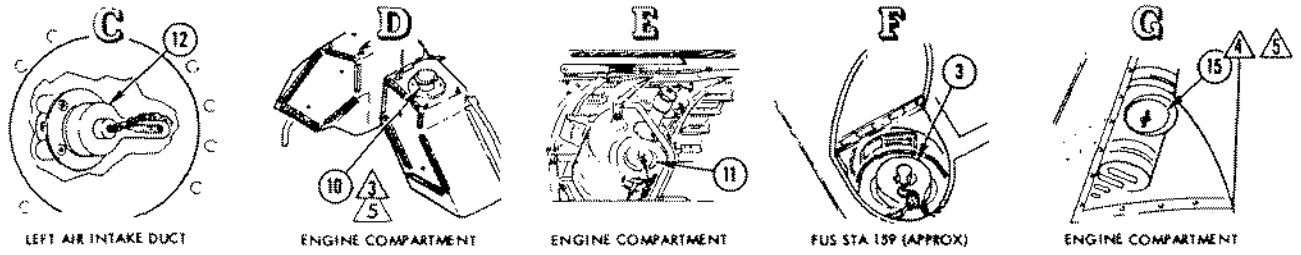
3–65. See figures 3-27 through 3-30 for special tools and equipment required for servicing the airplane.

3–66. COCKPIT LADDER (AF SERIAL NO. 51-4159 AND SUBSEQUENT). The difference between the 453471 and the 453471-600 cockpit ladders is the pads at the top of the ladder that hook over the cockpit sill and the curved pads that rest against the fuselage. Replace the pads on the 453471 ladder, when necessary, with 453471-12 and 453471-13 pads. Secure these pads to the ladder with cement, Specification MIL-A-1154.

3–67. GROUND HANDLING DIMENSIONS.

3–68. See figures 3-31 and 3-32 for ground handling dimensions.





1 NOSE GEAR SHOCK STRUT AIR-OIL FILLER VALVE - FILL WITH HYDRAULIC FLUID, SPECIFICATION MIL-H-5606

2 NOSE GEAR SHIMMY DAMPER RESERVOIR - FILL WITH HYDRAULIC FLUID, SPECIFICATION MIL-H-5606

3 EMERGENCY HYDRAULIC SYSTEM RESERVOIR - FILL WITH HYDRAULIC FLUID, SPECIFICATION MIL-H-5606

4 FUSELAGE TANK -95.0 U.S. (79.2 IMPERIAL) GALLONS CAPACITY, SPECIFICATION MIL-F-5624A, GRADE JP-4 ON AF SERIAL NO. 53-5085 AND SUBSEQUENT, FILL TO LEVEL OF SCREEN

5 DROPPABLE TANKS - 330 U.S. (275 IMPERIAL) GALLONS CAPACITY, SPECIFICATION MIL-F-5624A, GRADE JP-4

6 LEADING EDGE AND OUTBOARD WING TANKS - 104.0 U.S. (86.6 IMPERIAL) GALLONS, SPECIFICATION MIL-F-5624A, GRADE JP-4

7 INBOARD WING TANKS - 154.0 U.S. (128.4 IMPERIAL) GALLONS CAPACITY, SPECIFICATION MIL-F-5624A, GRADE JP-4

8 MAIN GEAR SHOCK STRUT AIR-OIL FILLER VALVE - FILL WITH HYDRAULIC FLUID, SPECIFICATION MIL-H-5606

9 ENGINE - 3 U.S. (2.5 IMPERIAL) GALLONS LOW TEMPERATURE LUBRICATING OIL, SPECIFICATION MIL-L-6081 GRADE 1010. (NOTE: AMBIENT TEMPERATURES ABOVE + 20° F USE ONLY GRADE 1010. FROM + 20° F TO - 20° F EITHER GRADE 1010 OR 1005. BELOW - 20° F GRADE 1005 ONLY.)

10 FLUID INJECTION TANKS - 50.0 U.S. (41.50 IMPERIAL GALLONS CAPACITY, SEE PARAGRAPH 4-522 FOR INFORMATION ON WATER-ALCOHOL MIXTURE, FUEL DE-ICING TANK: 30 U.S. (24.9 IMPERIAL) GALLONS CAPACITY, MINIMUM 5 U.S. (4.19 IMPERIAL) GALLONS. (APPLIES TO AF SERIAL NOS. 49-901 THROUGH 53-5082, SPECIFICATION MIL-A-6091, ALCOHOL

11 MAIN HYDRAULIC SYSTEM RESERVOIR - FILL TO FULL MARK ON SIGHT GAGE WITH HYDRAULIC FLUID, SPECIFICATION MIL-H-5606

12 OXYGEN SYSTEM - 425 PSI (±25 PSI), OXYGEN-AVIATORS BREATHING, SPECIFICATIONS MIL-O-27210, CURRENT ISSUE

13 BRAKE RESERVOIR - FILL TO FULL MARK ON PLASTIC RESERVOIR WITH HYDRAULIC FLUID, SPECIFICATION MIL-H-5606

14 DROPPABLE TANKS - 460 U.S. (383.4 IMPERIAL) GALLONS CAPACITY, SPECIFICATION MIL-F-5624A, GRADE JP-4

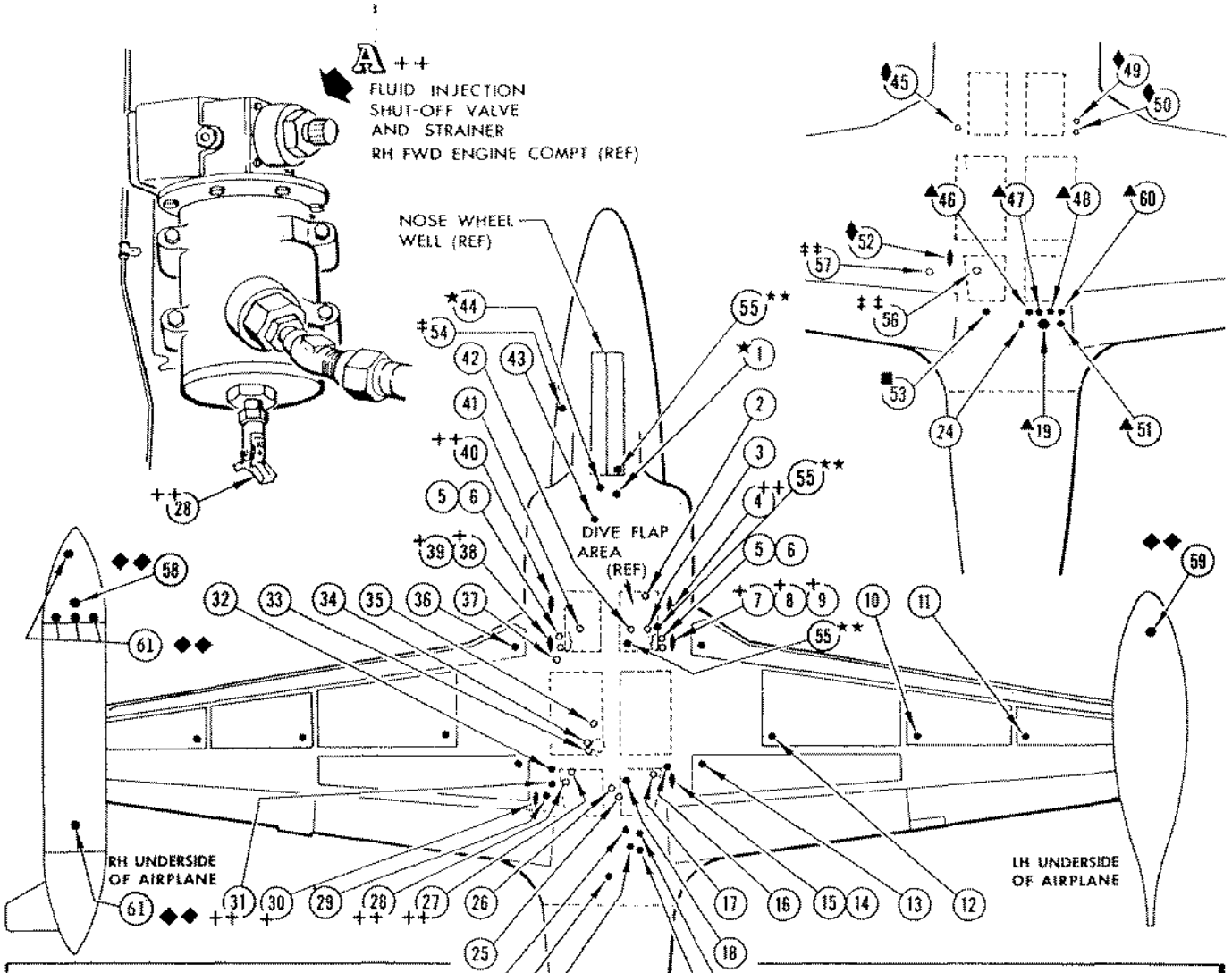
15 FUEL DE-ICING TANK - 5.0 U.S. (4.15 IMPERIAL) GALLONS CAPACITY, SPECIFICATION MIL-A-6091, ALCOHOL

NOTE: REFER TO SECTION IV FOR SPECIAL PRECAUTIONS AND PROCEDURES WHEN SERVICING ABOVE ITEMS

WARNING: GROUND AIRPLANE BEFORE REPLENISHING FUEL TANKS

HG 02871 M20-57-3-16

Figure 3-24. Replenishing Diagram



★ 1. TURBINE AND COOLER OVERFLOW DRAIN
2. FUEL LINE DRAIN (SEE D)
3. FUEL LINE DRAIN (SEE D)
++ 4. FLUID INJECTION TANK VENT
5. LEADING EDGE TANK PUMP ADAPTER DRAIN (SEE B)
6. SIPHON BREAKER DRAIN (SEE B)
+ 7. WING TANK VENT
+ 8. LEADING EDGE TANK PUMP SEAL DRAIN
+ 9. PILOT'S RELIEF DRAIN
10. INNER OUTBOARD FUEL TANK DRAIN
11. OUTER OUTBOARD FUEL TANK DRAIN
12. FORWARD INBOARD FUEL TANK DRAIN
13. AFT INBOARD FUEL TANK DRAIN
14. HYDRAULIC RESERVOIR VENT
15. INBOARD WING TANK SCUPPER DRAIN
16. HYDRAULIC RESERVOIR SCUPPER DRAIN
17. HYDRAULIC RESERVOIR DRAIN (SEE E)
18. WING TANK FUEL LINE DRAIN
19. ENGINE GEAR CASE VENT
★ 20. ENGINE ACCESSORIES DRAIN
21. TAIL PIPE SCUPPER DRAIN
★ 22. DRIP VALVE DRAIN
23. COMBUSTION CHAMBER DRAIN
24. ENGINE SCUPPER DRAIN
25. ENGINE OIL SUMP (SEE G)
26. ENGINE OIL PUMP FILTER AND DRAIN (SEE G)
++ 27. FLUID INJECTION TANKS DRAIN (SEE C)
++ 28. FLUID INJECTION SHUT-OFF VALVE AND STRAINER DRAIN (SEE A)

Note

★ PRIOR TO AF SERIAL NO. 49-967.
▲ AF SERIAL NOS 49-967 AND SUBSEQUENT
+ PRIOR TO AF SERIAL NO. 49-2758.
◆ AF SERIAL NOS 49-2758 AND SUBSEQUENT
■ AF SERIAL NOS 50-358 THROUGH 53-5082
‡ AF SERIAL NOS 50-402 AND SUBSEQUENT AF SERIAL NOS 51-9236 AND
★★ SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-102.
++ PRIOR TO AF SERIAL NO. 53-5083.
‡‡ AF SERIAL NO. 53-5083 AND SUBSEQUENT.
▲▲ PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-42
◆◆ AF SERIAL NO. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-42

29. INBOARD WING TANK SCUPPER DRAIN
+ 30. FUSELAGE TANK VENT
++ 31. FLUID INJECTION TANK SCUPPER DRAIN
32. FUSELAGE FUEL TANK SCUPPER DRAIN
33. LOW PRESSURE FUEL FILTER DRAIN (SEE F)
34. LOW PRESSURE FUEL FILTER DRAIN (SEE F)
35. FUSELAGE FUEL TANK DRAIN (SEE F)
36. LEADING EDGE FUEL TANK DRAIN
37. FUSELAGE FUEL TANK PUMP SEAL DRAIN (SEE B)
+ 38. LEADING EDGE TANK PUMP SEAL DRAIN
+ 39. WING TANK VENT
++ 40. FLUID INJECTION TANK VENT
41. FUEL LINE DRAIN (SEE B)
42. FUEL LINE DRAIN (SEE D)
43. EMERGENCY HYDRAULIC SYSTEM RESERVOIR SCUPPER DRAIN
★ 44. TURBINE AND COOLER DRAIN
◆ 45. LEADING EDGE TANK PUMP SEAL DRAIN
▲ 46. STARTING FUEL CONTROL DRAIN
▲ 47. MAIN FUEL CONTROL SEAL DRAIN
▲ 48. DUAL FUEL PUMP SEAL DRAIN
◆ 49. LEADING EDGE TANK PUMP SEAL DRAIN
◆ 50. PILOT'S RELIEF DRAIN
▲ 51. HYDRAULIC PUMP SEAL DRAIN
◆ 52. FUEL SYSTEM VENT
■ 53. FLUID INJECTION PUMP DRAIN
‡ 54. EMERGENCY HYDRAULIC PUMP SEAL DRAIN
★★ 55. COCKPIT WATER DRAIN
‡‡ 56. FUEL DE-ICING PUMP DRAIN
‡‡ 57. FUEL DE-ICING LINE DRAIN
◆◆ 58. TIP TANK DRAIN
◆◆ 59. TIP TANK DRAIN
▲ 60. MAIN FUEL CONTROL ANEROID DRAIN
◆◆ 61. TIP TANK WATER DRAIN SCREW

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Figure 3-25. Draining Provisions (Sheet 1 of 2)

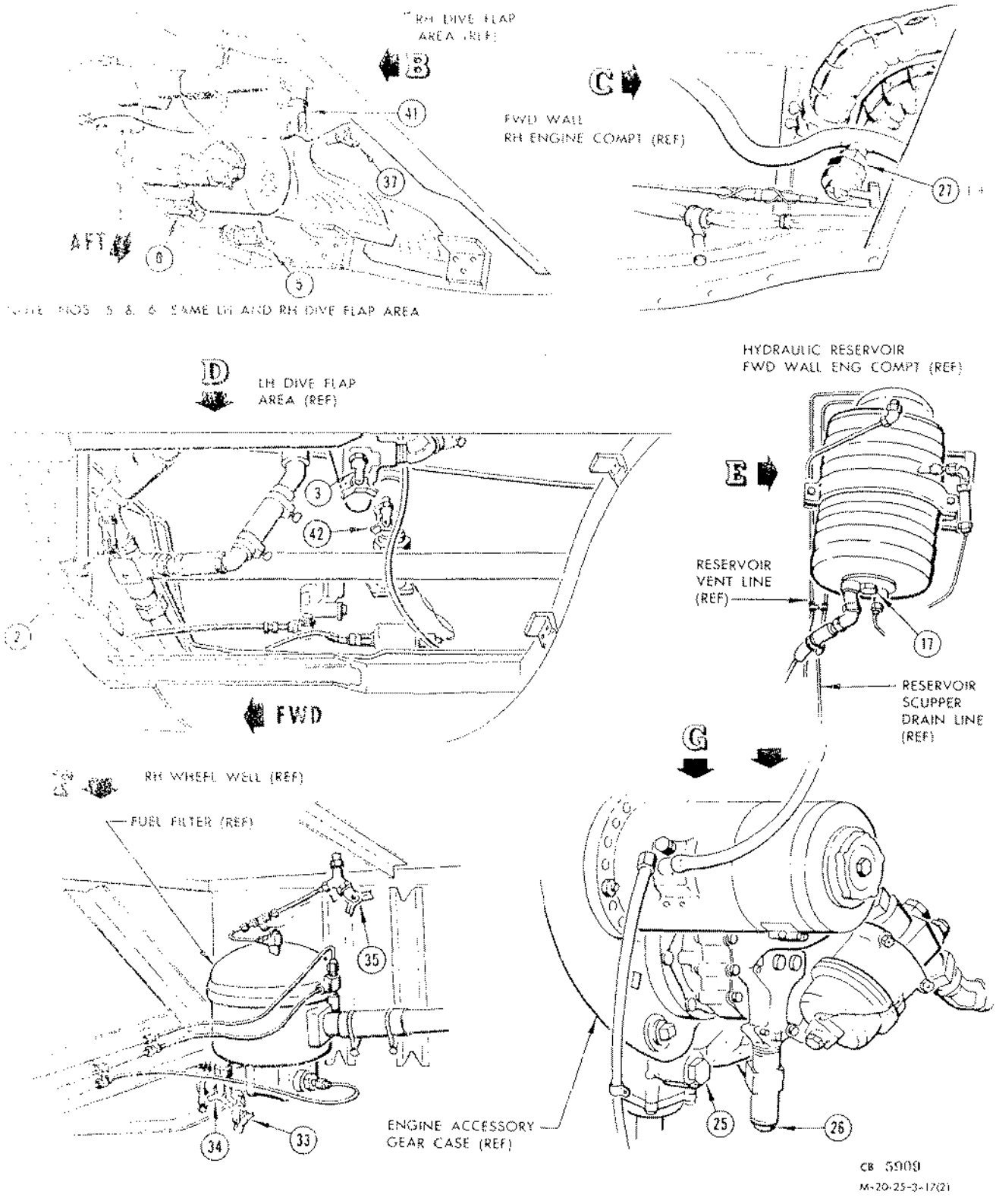


Figure 3-25. Draining Provisions (Sheet 2 of 2)

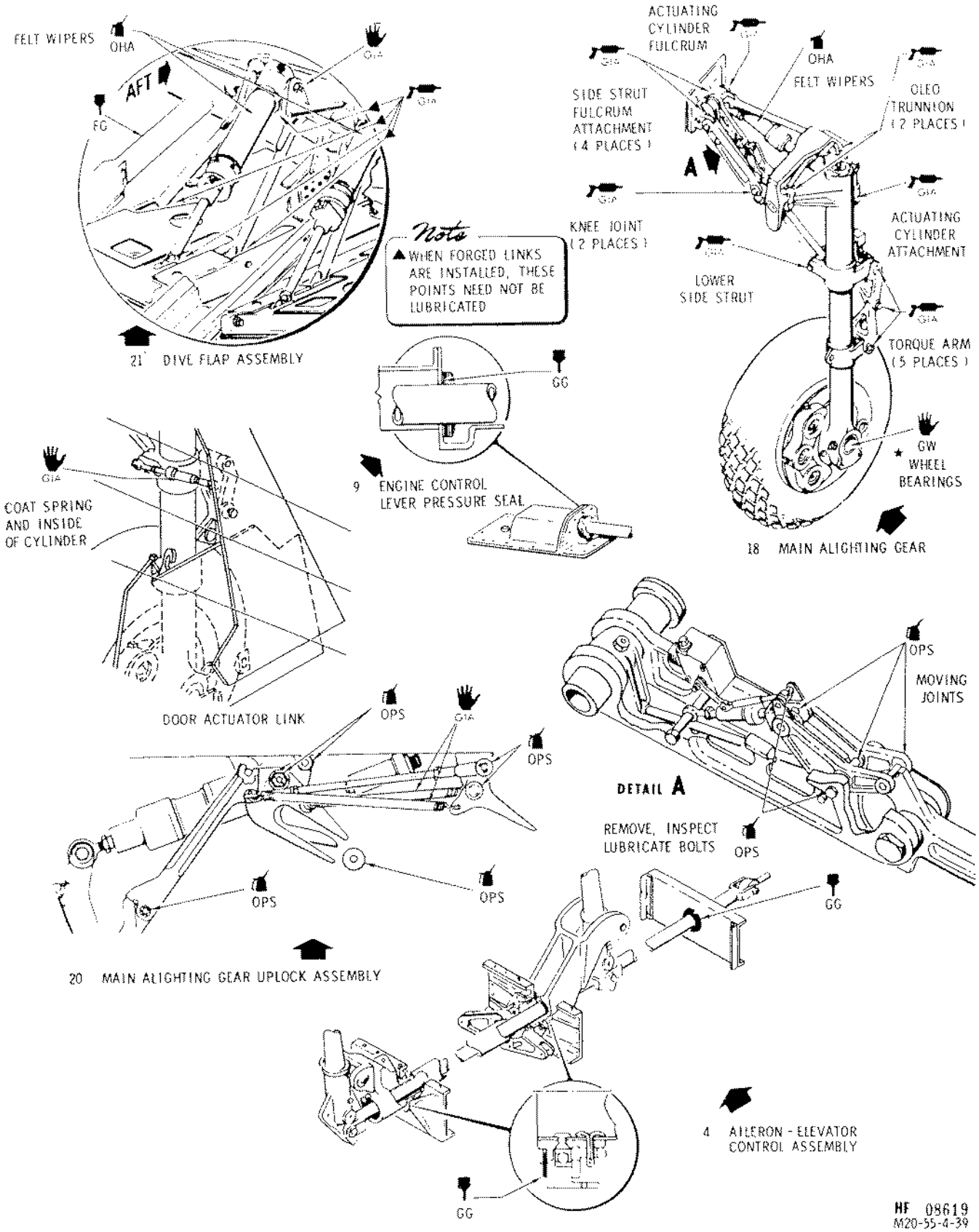


Figure 3-26. Lubrication Diagram (Sheet 2 of 6)

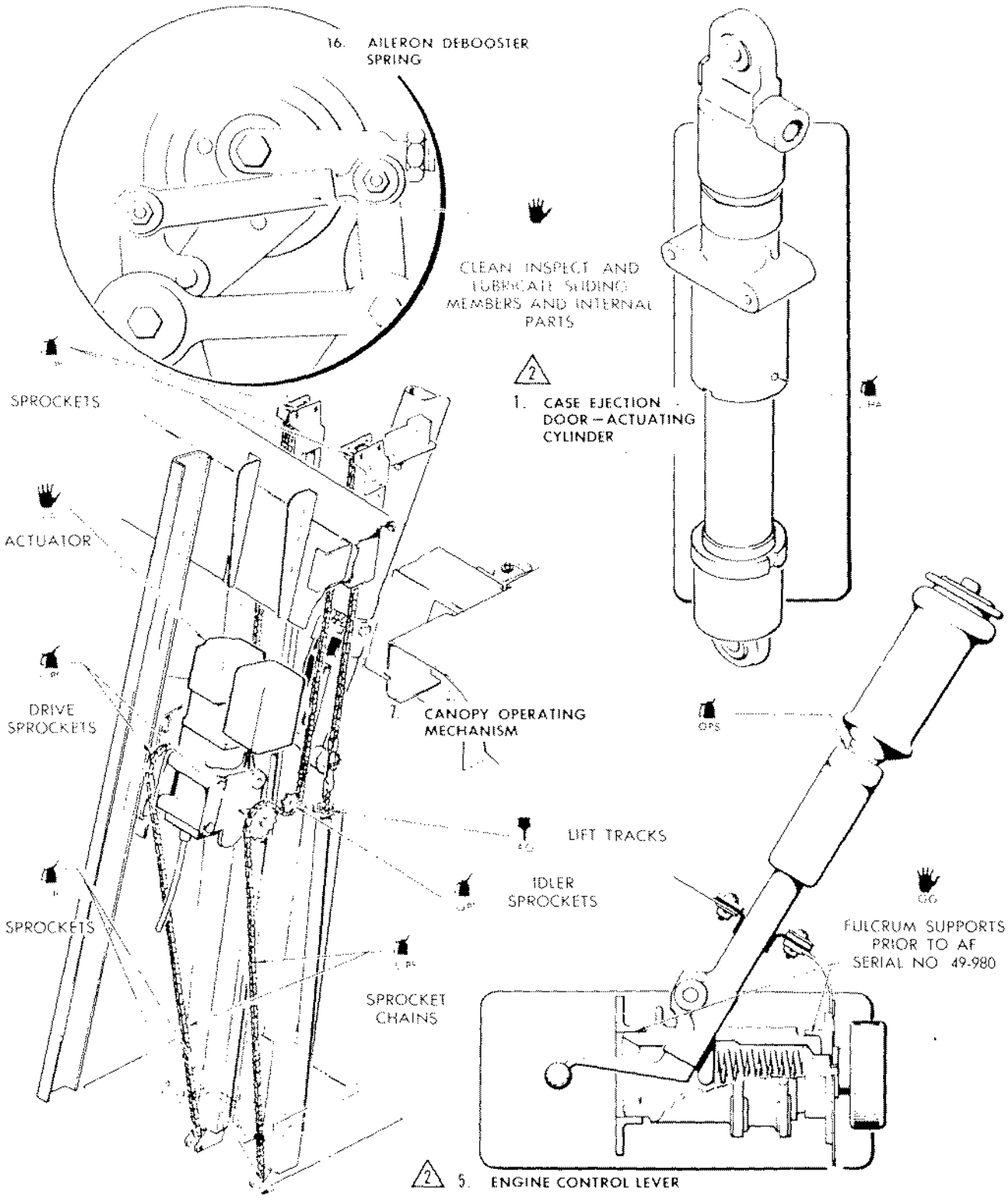
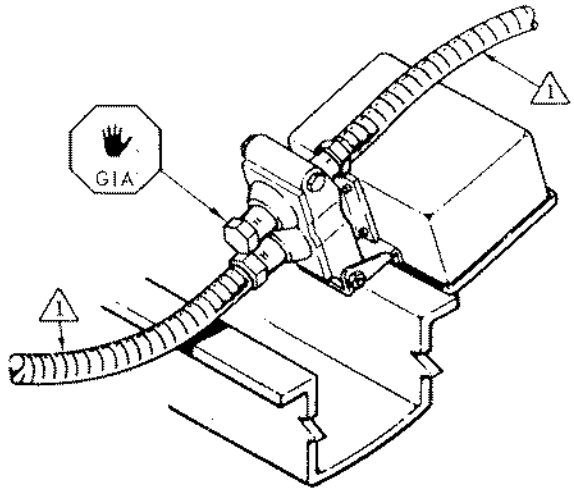
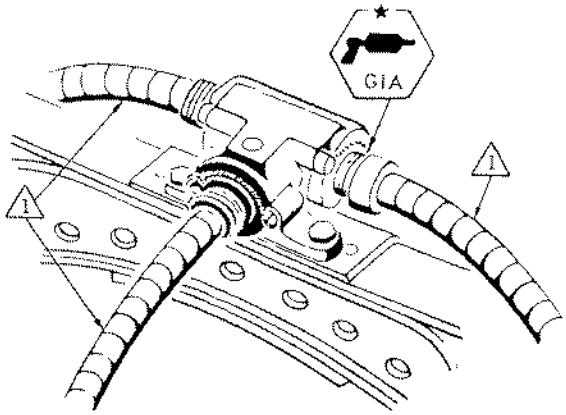


Figure 3-26. Lubrication Diagram (Sheet 3 of 6)



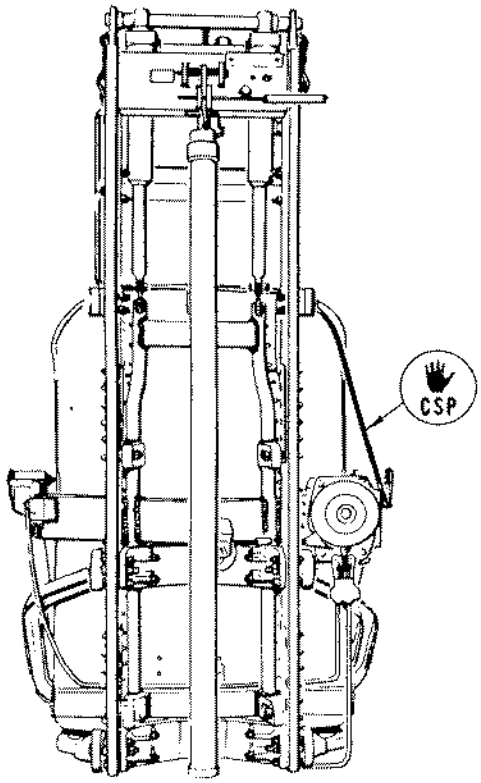
12. WING FLAP "H" GEAR BOX



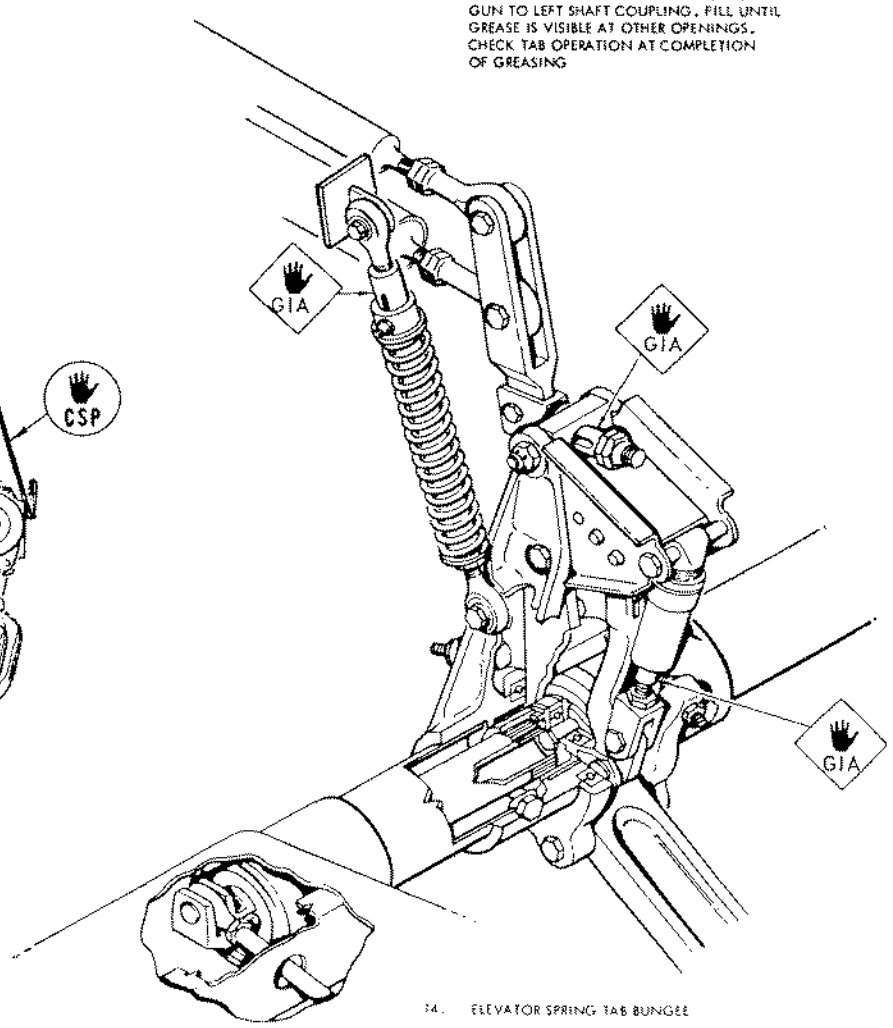
13. ELEVATOR TAB TEE DRIVE

1 FLEXIBLE SHAFTS WILL BE REMOVED FROM HOUSING, INSPECTED AND COATED WITH SPECIFIED LUBRICANT PRIOR TO REINSTALLATION

DISCONNECT FLEXIBLE SHAFTS AND HOLD GUN TO LEFT SHAFT COUPLING. FILL UNTIL GREASE IS VISIBLE AT OTHER OPENINGS. CHECK TAB OPERATION AT COMPLETION OF GREASING



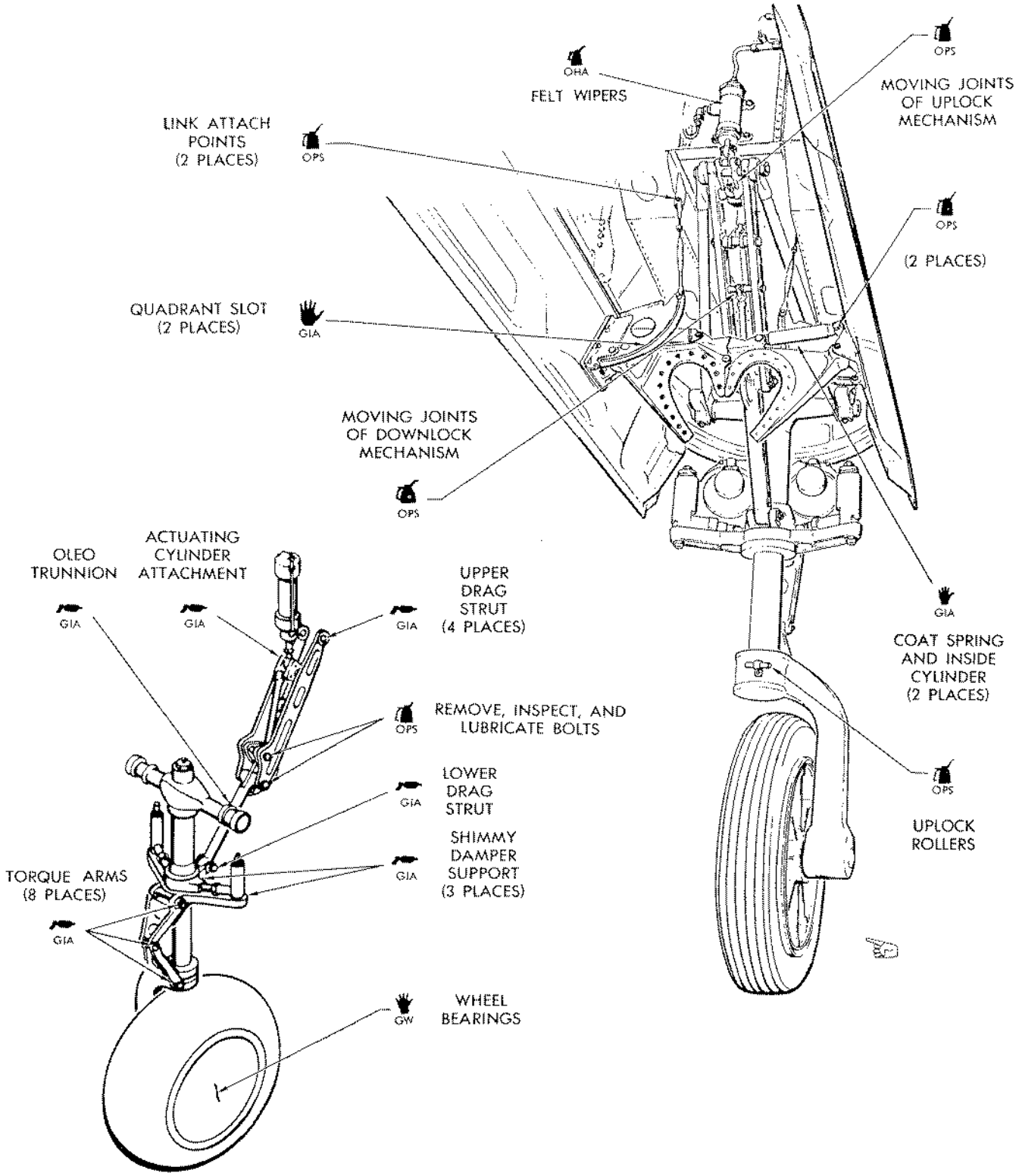
10. JETTISON SEAT PRIOR TO AF SERIAL NO. 51-9036



14. ELEVATOR SPRING TAB BUNGEE

CB 07172
M20-57-3-18(4)

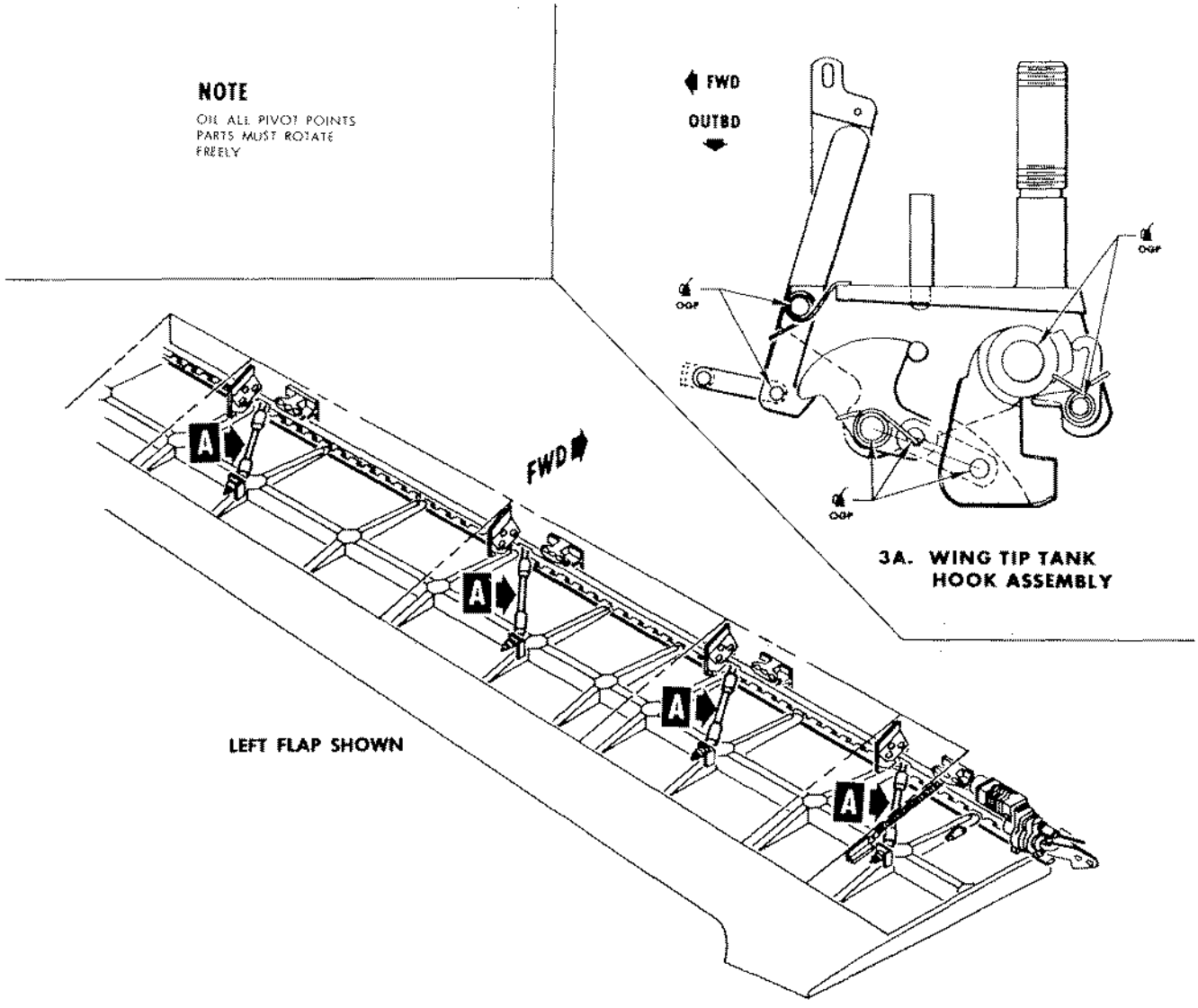
Figure 3-26. Lubrication Diagram (Sheet 4 of 6)



27. NOSE ALIGHTING GEAR AND NOSE GEAR DOOR ASSEMBLY

HF 08708
M20-55-3-18(5)

Figure 3-26. Lubrication Diagram (Sheet 5 of 6)



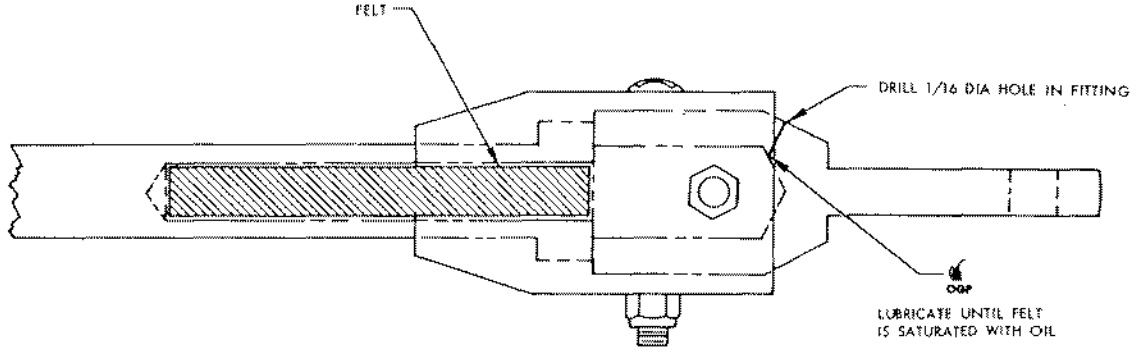


Figure 3-26. Lubrication Diagram (Sheet 6 of 6)

Table 3-1 — Special Tools List (Sheet 1 of 4)

TOOL NO.	REF. FIG. NO.	DESCRIPTION	OPERATIONAL SQUAD.	SERVICE SQUAD. & MAJOR OVERHAUL	GROUND HANDLING EQUIP.
178044	4-224	BRACKET, GUNSIGHT (T-33A-1 AIRPLANES, AF SERIAL NO. 53-5436 AND SUBSEQUENT)	x		
178046	4-224	SUPPORT, GUNSIGHT (T-33A-1 AIRPLANES, AF SERIAL NO. 53-5436 AND SUBSEQUENT)	x		
178232	4-220	BOMB DEFLECTOR SUPPORT ASSEMBLY (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O NO. 1T-33A-42)	x		
178233	4-220	BOMB DEFLECTOR (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O NO. 1T-33A-42)	x		
178716	NOT SHOWN	HYDROFUSE RETURN SPRING (PRIOR TO AF SERIAL NO. 51-6819)	x		
179178	NOT SHOWN	REAR GUN MOUNT WRENCH (T-33A-1 AIRPLANES)	x		
179379	NOT SHOWN	PITOT TUBE COVER (ALTERNATE)			x
179745	NOT SHOWN	GLARE SHIELD, FORWARD	x		
179746	NOT SHOWN	GLARE SHIELD, AFT (PRIOR TO SERIAL NO. 51-9136)	x		
179746-600	NOT SHOWN	GLARE SHIELD, AFT (AF SERIAL NOS. 51-9136 AND SUBSEQUENT)	x		
205202	NOT SHOWN	COCKPIT LADDER (PRIOR TO AF SERIAL NO. 51-4159)			x
205203	3-16	CANOPY COVER (ALTERNATE)			x
205210	NOT SHOWN	WRENCH ASSEMBLY, JETTISON SEAT CATAPULT (PRIOR TO AF SERIAL NO. 51-4040 EXCEPT AIRPLANES MODIFIED BY LOCKHEED AIRCRAFT SERVICE, INC.)			x
205211	3-8	FUSELAGE NOSE AND MID SECTION DOLLY			x
205214	3-18	TOW BAR — NOSE GEAR (ALTERNATE)			x
205216	3-3	SLING — AIRPLANE, WING AND FUSELAGE, FUSELAGE			x
205219	3-30	BAR — SPREADER FUSELAGE (ALTERNATE)	x	x	
205220	3-29, SH 1	FUNNEL ASSEMBLY — ENGINE AND HYDRAULIC RESERVOIR (ALTERNATE)	x	x	
205224	3-27	WRENCH — NOSE GEAR STRUT LOWER BEARING SUPPORT	x	x	
205226	3-9	TRUCK — AIRCRAFT FUSELAGE (ALTERNATE)			x
205227	NOT SHOWN	WALKWAY — WING PROTECTION (ALTERNATE)			x
205231	3-18	TOW BAR — NOSE GEAR (ALTERNATE)			x
205232	3-10, 3-16	WING JACK PAD AND TIE-DOWN FITTING (AF SERIAL NO. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. NO. 1T-33A-42)			x
205618-3	NOT SHOWN	GUNSIGHT THROTTLE CABLE KIT (T-33A-1 AIRPLANES, AF SERIAL NO. 53-5436 AND SUBSEQUENT)	x		

Table 3-1 — Special Tools List (Sheet 2 of 4)

TOOL NO.	REF. FIG. NO.	DESCRIPTION	OPERATIONAL SQUAD.	SERVICE SQUAD. & MAJOR OVERHAUL	GROUND HANDLING EQUIP.
206953	4-19, SH 3	CANOPY REMOVER SAFETY PIN (PRIOR TO AF SERIAL NO. 51-17486 AND ON 52-9129 THROUGH 52-9334 EXCEPT AIRPLANES INCORPORATING T.O. 1T-33A-162)	x		
207780	3-27	WRENCH — MAIN GEAR WHEEL AXLE NUT	x	x	
207925	NOT SHOWN	ADAPTER—SHIMMY DAMPER ORIFICE TORQUE WRENCH		x	
207998L/R	3-16	DUCT DUST PLUG (AF SERIAL NOS. 51-4266 AND SUBSEQUENT)			x
409123	NOT SHOWN	CRADLE — TIP TANK (AFSN 8220-326700)	x	x	x
409834	NOT SHOWN	WRENCH 5/16-INCH, ADAPTER FOR AFT FUSELAGE SECTION ATTACHING BOLT (AF SERIAL NO. 51-6957 AND SUBSEQUENT)	x	x	
451969	NOT SHOWN	NOSE TIE-DOWN AND JACK ADAPTER (ALTERNATE)			x
452276-8	NOT SHOWN	BLIND FLYING HOOD (AF SERIAL NO. 51-4140 THROUGH 52-9635 AND 52-9876 THROUGH 52-9905)	x		
453471	3-30	COCKPIT LADDER (AF SERIAL NO. 51-4159 THROUGH 52-9772)			x
453471-600	NOT SHOWN	COCKPIT LADDER (AF SERIAL NO. 52-9773 THROUGH 55-4400)			x
455966-5	3-9	ADAPTER KIT — LIGHT WEIGHT CRADLE			x
456025	4-65	TRUCK — ENGINE REPAIR AND TRANSPORT (AFSN 8220-750422-3)			x
456025-4	4-65	ADAPTER KIT—ENGINE REPAIR AND TRANSPORT TRUCK (FSN 1740-212-1915)			x
456652	3-29, SH 3	ADAPTER — TIP TANK ATTACHING BOLT WRENCH (AF SERIAL NO. 51-4141 & SUBSEQUENT AND AIRPLANES INCORPORATING T.O. NO. 1T-33A-42)	x	x	
456928	NOT SHOWN	COVER — TAILPIPE DUST			x
457407	NOT SHOWN	ADAPTER — WING TO FUSELAGE ATTACHMENT BOLT		x	
457461-500	NOT SHOWN	GAUGE ASSEMBLY — TIP TANK PRESSURE	x	x	
457758	4-198	STREAMER ASSEMBLY, INITIATOR (JETTISON SEATS, AF SERIAL NO. 51-9036 THROUGH 53-5285; CANOPY, AF SERIAL NO. 51-17487 THROUGH 51-17556 AND ON 52-9335 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-162)			x
458155	NOT SHOWN	PIN — EJECTION TIP TANK SAFETY (AF SERIAL NO. 51-9036 AND SUBSEQUENT)			x
458736	NOT SHOWN	ADAPTER ASSEMBLY — FUEL VENT LINE TORQUE WRENCH (AF SERIAL NO. 51-4266 AND SUBSEQUENT)			x
459370	4-65	FIXTURE — ENGINE INSTALLATION (FSN 1730-026-4619)			x
458931	4-199	PIN ASSEMBLY — SEAT BELT INITIATOR SAFETY (AF SERIAL NO. 51-17537 THROUGH 51-17556 AND ON 52-9485 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-222)			x
460167	NOT SHOWN	BLIND FLYING HOOD (AF SERIAL NO. 53-5286 AND SUBSEQUENT)	x		
460368	NOT SHOWN	WRENCH ASSEMBLY — SHIMMY DAMPER PISTON HEAD		x	
460521	4-110	FILLER ASSEMBLY — AIR SHUTOFF VALVE ACTUATOR			x
460791	4-199	PIN ASSEMBLY — JETTISONABLE SEAT SAFETY (AF SERIAL NO. 53-5286 THROUGH 53-5410)			x

Table 3-1 — Special Tools List (Sheet 3 of 4)

TOOL NO.	REF. FIG. NO.	DESCRIPTION	OPERATIONAL SQUAD.	SERVICE SQUAD. & MAJOR OVERHAUL	GROUND HANDLING EQUIP.
460791-600	4-199	PIN ASSEMBLY — JETTISONABLE SEAT SAFETY (AF SERIAL NO. 53-5411 THROUGH 53-5833, 54-1522 THROUGH 54-1561 AND 54-2689 THROUGH 54-2710			x
463006	4-199	PIN ASSEMBLY — JETTISONABLE SEAT SAFETY (AF SERIAL NO. 53-5834 AND SUBSEQUENT, EXCEPT 54-1522 THROUGH 54-1561 AND 54-2689 THROUGH 54-2710)			x
463758-1	4-23	FLAG ASSEMBLY CANOPY JETTISON SAFETY			x
463984	NOT SHOWN	COCKPIT LADDER (AF SERIAL NO. 55-4401 AND SUBSEQUENT)			x
67F38757	NOT SHOWN	CANOPY SLING			x
C-7500	NOT SHOWN	WEIGHING KIT, TYPE C-1 ELECTRONIC WEIGHING FSN 6670-526-8498			x
S10404	3-29, SH 1	SLIDE HAMMER	x	x	
S10406	3-30	AFT FUSELAGE MATING SPREADER BAR (ALTERNATE)	x	x	
S10802	3-29, SH 1	OIL BUFFER SPRING RELEASE PIN (PRIOR TO AF SERIAL NO. 51-17536 AND ON 52-9129 THROUGH 52-9484)		x	
S20808-6 or S20608-6	3-28	MAIN GEAR DOOR CYLINDER CAP LOCK NUT HOOK SPANNER WRENCH		x	
S20812-20 or S20612-20	3-28	BOOSTER CYLINDER LOCK NUT HOOK SPANNER WRENCH		x	
S20814-20 or S20614-20	3-28	MAIN GEAR ACTUATING CYLINDER CAP NUT HOOK SPANNER WRENCH		x	
S20817-21 or S20617-21	3-28	NOSE GEAR ACTUATING CYLINDER CAP NUT HOOK SPANNER WRENCH		x	
S20818-20 or S20618-20	3-28	DIVE FLAP ACTUATING CYLINDER LOCK NUT "U" SPANNER WRENCH		x	
S20811-29 or S20411-29	3-28	NOSE GEAR STRUT UPPER BEARING CAM "U" SPANNER WRENCH		x	
S20913-35 or S20413-35	3-28	ACCUMULATOR RETAINER NUT "U" SPANNER WRENCH	x	x	
S20913-46 or S20413-46	3-28	MAIN GEAR STRUT PISTON BEARING "U" SPANNER WRENCH		x	
S20224-36 or S20424-36	3-28	NOSE GEAR STRUT LOCK NUT "U" SPANNER WRENCH		x	
S32550	3-27	MAIN GEAR FULCRUM NUT SPANNER WRENCH	x	x	
S34102	3-29, SH 3	GUN ADJUSTING WRENCH (ALTERNATE) (T-33A-1 AIRPLANES)			x
S34103	3-29, SH 3	REAR GUN POST ADJUSTING WRENCH (ALTERNATE) (T-33A-1 AIRPLANES)			x
S34104	3-29, SH 2	FUEL TANK CAP WRENCH	x		
S34105	3-29, SH 1	GUN ADJUSTING RATCHET WRENCH (ALTERNATE) (T-33A-1 AIRPLANES)			x
S34802	3-29, SH 1	AILERON AND ELEVATOR HINGE PIN PULLER	x	x	
S35703	3-29, SH 1	FLAP JACKSHAFT SPLINE MALE ADAPTER	x	x	
S35704	3-29, SH 1	FLAP JACKSHAFT SPLINE FEMALE ADAPTER	x	x	
S37330	3-29, SH 1	FORWARD WING MATING ALIGNMENT PIN		x	
S37331	3-29, SH 1	AFT WING MATING ALIGNMENT PIN		x	

Table 3-1 — Special Tools List (Sheet 3 of 4)

TOOL NO.	REF. FIG. NO.	DESCRIPTION	OPERATIONAL SQUAD.	SERVICE SQUAD. & MAJOR OVERHAUL	GROUND HANDLING EQUIP.
S37403	3-29, SH 3	FUSELAGE LONGERON FITTING INSERT WRENCH		x	
S38406	3-27	MAIN GEAR STRUT LOWER BEARING SPANNER WRENCH	x	x	
S38505	3-27	NOSE GEAR STRUT CAM INSTALLING SPANNER WRENCH		x	
S40704	3-27	NOSE & MAIN GEAR STRUT PLUNGER TUBE SPANNER WRENCH		x	
S40751	3-29, SH 2	ENGINE & HYDRAULIC RESERVOIR FUNNEL (ALTERNATE)	x	x	

Table 3-1 — Special Tools List (Sheet 4 of 4)

TOOL NO.	REF. FIG. NO.	DESCRIPTION	OPERATIONAL SQUAD.	SERVICE SQUAD. & MAJOR OVERHAUL	GROUND HANDLING EQUIP.
S78903	3-18	TOWING & STEERING BAR, NOSE GEAR (ALTERNATE)			x
S79249-101L/R	NOT SHOWN	COVER ASSEMBLY — WING (ALTERNATE) (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-42			x
S79249-104L/R	NOT SHOWN	COVER ASSEMBLY — STABILIZER (ALTERNATE)			x
S79250	3-16	SHIELD — ENGINE EXHAUST DUST PLUG			x
S79251-101L/R	NOT SHOWN	DUCT DUST PLUG (PRIOR TO AF SERIAL NO. 51-4266)			x
S80401	3-16	WING TIE-DOWN FITTING (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-42)			x
S80503	3-6	WING HOISTING SLING			x
S81906	3-10, 3-16	NOSE TIE-DOWN & JACK ADAPTER (ALTERNATE)			x
S81907 or S81905	3-10	WING JACK PAD (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-42)			x
S84402	3-5	AFT FUSELAGE SECTION SLING			x
S84702	NOT SHOWN	CRADLE ASSEMBLY — LIGHT WEIGHT LIFTING (ALTERNATE)			x
S84704	3-7	WING DOLLY			x
464085	3-20	ALIGHTING GEAR DOWN LOCK CLAMP			x
S89801L/R	3-30	WING PROTECTION WALKWAY (ALTERNATE)			x
S91830	3-29, SH 2	AILERON SETTING GAGE	x	x	
S91831	3-29, SH 2	ELEVATOR SETTING GAGE	x	x	
S91832	3-29, SH 2	RUDDER SETTING GAGE	x	x	
48C26486	NOT SHOWN	PITOT TUBE COVER (ALTERNATE)			x
48D16920	NOT SHOWN	CRADLE ASSEMBLY — LIGHT WEIGHT LIFTING (ALTERNATE)			x
48J26500L/R	NOT SHOWN	COVER ASSEMBLY STABILIZER (ALTERNATE)			x
49J19760L/R	NOT SHOWN	COVER ASSEMBLY — WING (ALTERNATE) (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-42)			x
49J20260	NOT SHOWN	CANOPY COVER (ALTERNATE)			x
52R20342L/R	NOT SHOWN	COVER ASSEMBLY — WING (AF SERIAL NO. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. NO. 1T-33A-42)			x
52R20343L/R	NOT SHOWN	COVER ASSEMBLY — TIP TANK (AF SERIAL NO. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. NO. 1T-33A-42)			x
98MB-47B6412	NOT SHOWN	WRENCH ¾-INCH, ADAPTER FOR AFT FUSELAGE SECTION ATTACHING BOLT (PRIOR TO AF SERIAL NO. 51-6957)	x	x	
LOCAL MFG	3-29	DEFUEL ADAPTER HOSE - ASSEMBLE FROM FOLLOWING PARTS: 1 EA - MS28744-16 COUPLING ELBOW FSN 4730-433-2600; 1 EA - MS24587-16 FITTING FSN 4730-842-1139; 2 FT - MIL-H-4794 HOSE FSN 4720-595-1088 REMOVE ENG HOSE FROM QUICK DISCONNECT AND BOLT DEFUEL ADAPTOR HOSE TO THE QUICK DISCONNECT TO DEFUEL AIRCRAFT		O/H	x

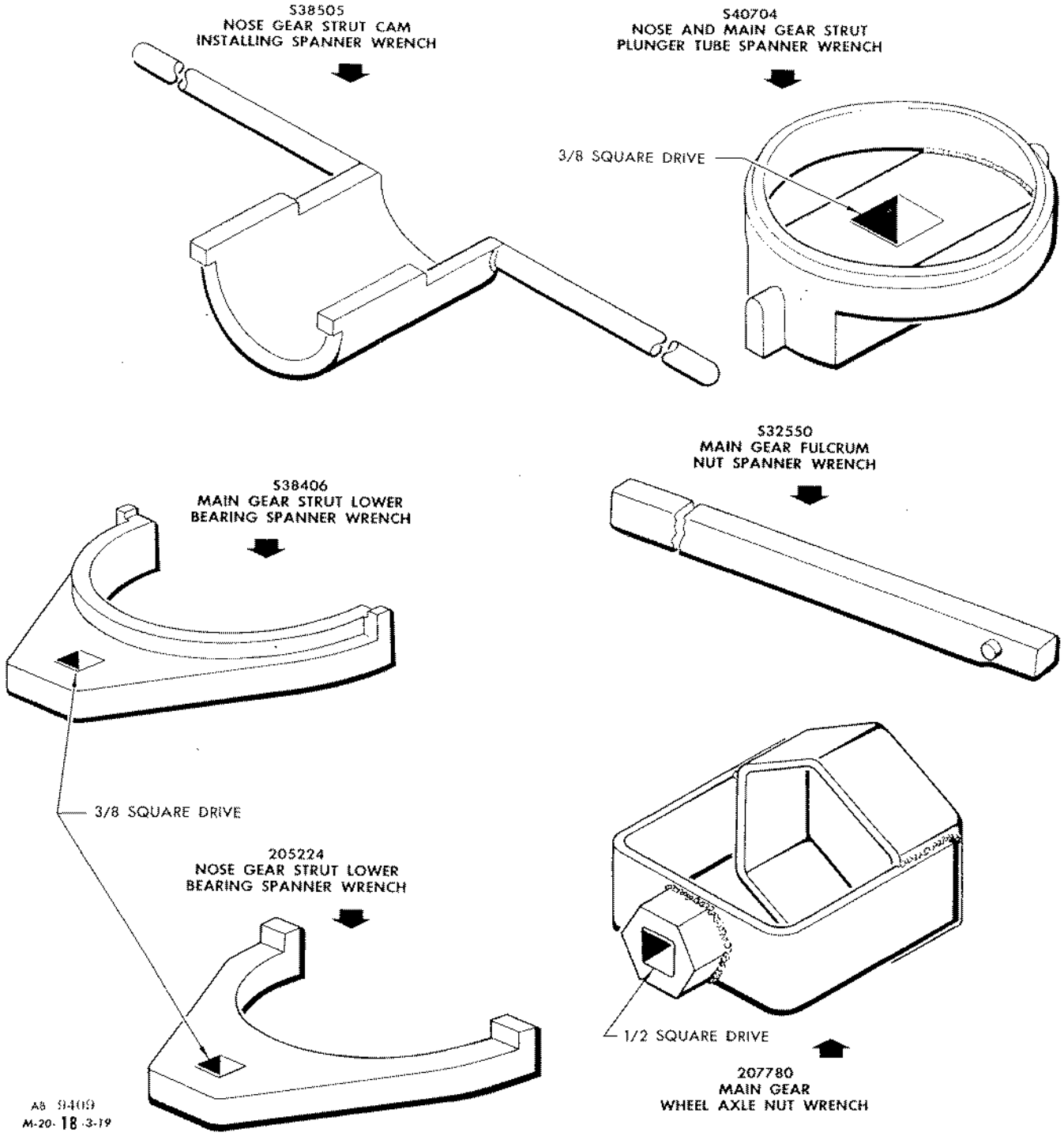
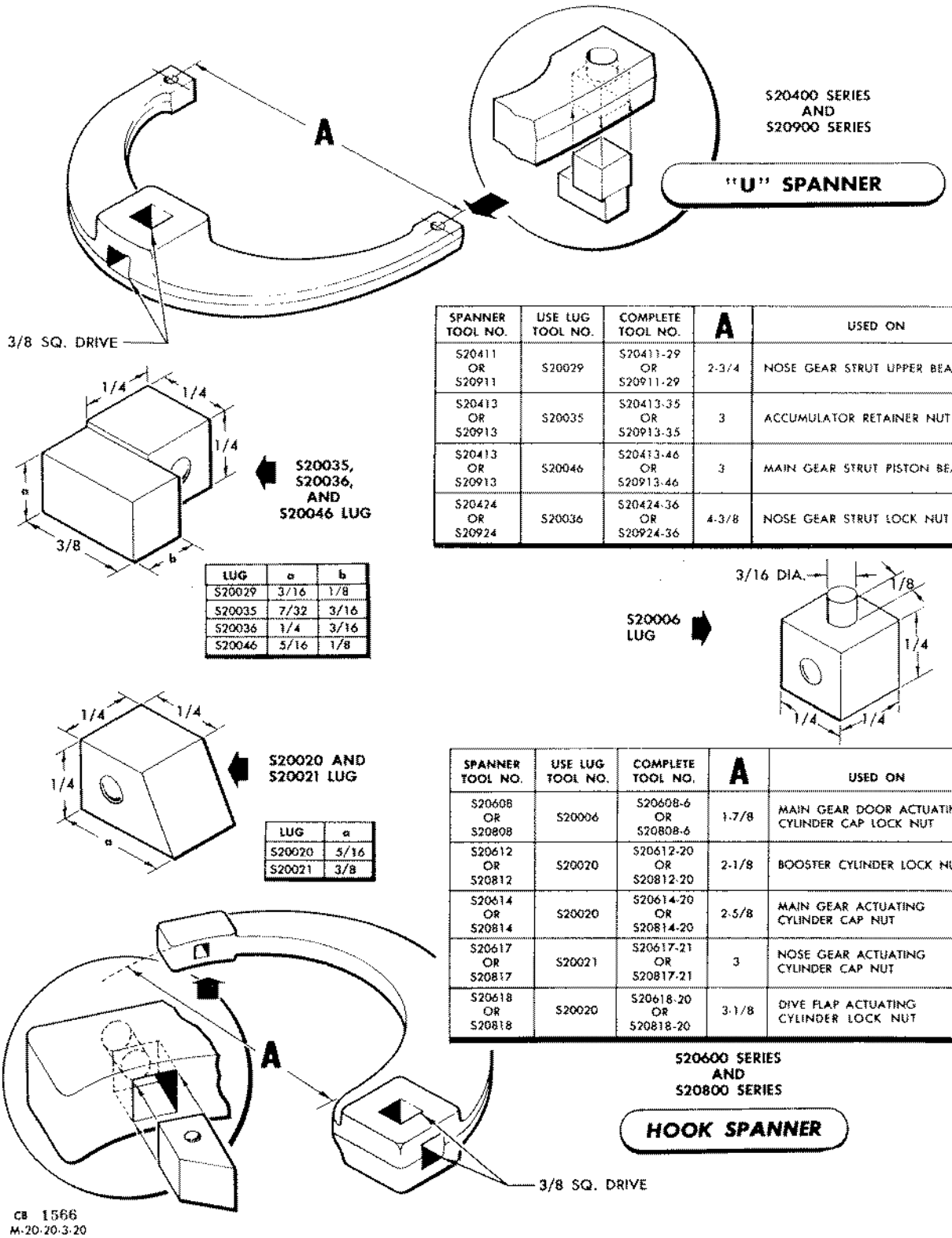


Figure 3-27. Alighting Gear Tools



SPANNER TOOL NO.	USE LUG TOOL NO.	COMPLETE TOOL NO.	A	USED ON
S20411 OR S20911	S20029	S20411-29 OR S20911-29	2-3/4	NOSE GEAR STRUT UPPER BEARING
S20413 OR S20913	S20035	S20413-35 OR S20913-35	3	ACCUMULATOR RETAINER NUT
S20413 OR S20913	S20046	S20413-46 OR S20913-46	3	MAIN GEAR STRUT PISTON BEARING
S20424 OR S20924	S20036	S20424-36 OR S20924-36	4-3/8	NOSE GEAR STRUT LOCK NUT

LUG	a	b
S20029	3/16	1/8
S20035	7/32	3/16
S20036	1/4	3/16
S20046	5/16	1/8

LUG	a
S20020	5/16
S20021	3/8

SPANNER TOOL NO.	USE LUG TOOL NO.	COMPLETE TOOL NO.	A	USED ON
S20608 OR S20808	S20006	S20608-6 OR S20808-6	1-7/8	MAIN GEAR DOOR ACTUATING CYLINDER CAP LOCK NUT
S20612 OR S20812	S20020	S20612-20 OR S20812-20	2-1/8	BOOSTER CYLINDER LOCK NUT
S20614 OR S20814	S20020	S20614-20 OR S20814-20	2-5/8	MAIN GEAR ACTUATING CYLINDER CAP NUT
S20617 OR S20817	S20021	S20617-21 OR S20817-21	3	NOSE GEAR ACTUATING CYLINDER CAP NUT
S20618 OR S20818	S20020	S20618-20 OR S20818-20	3-1/8	DIVE FLAP ACTUATING CYLINDER LOCK NUT

Figure 3-28. Universal Type Tools

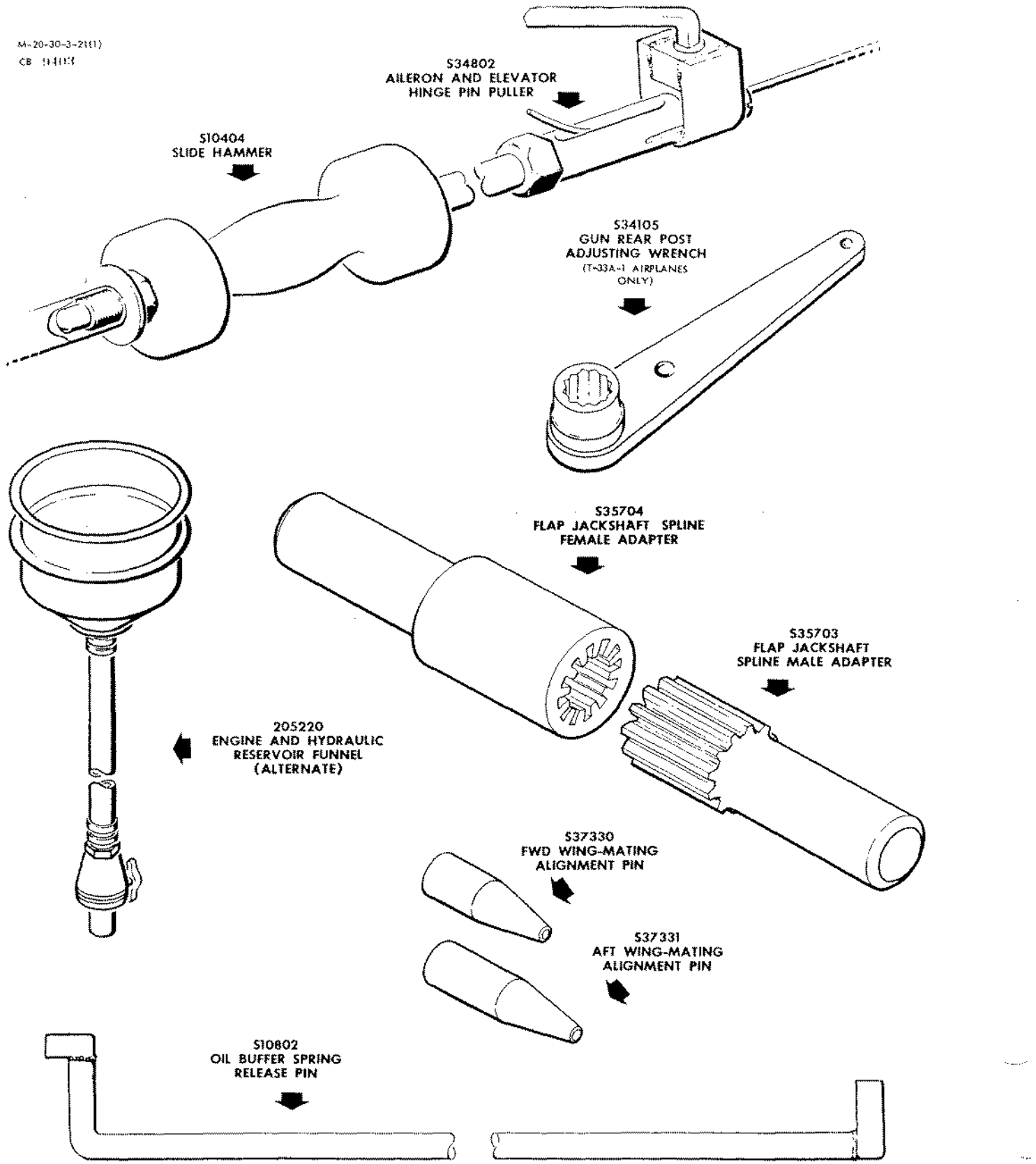


Figure 3-29. Miscellaneous Tools (Sheet 1 of 3)

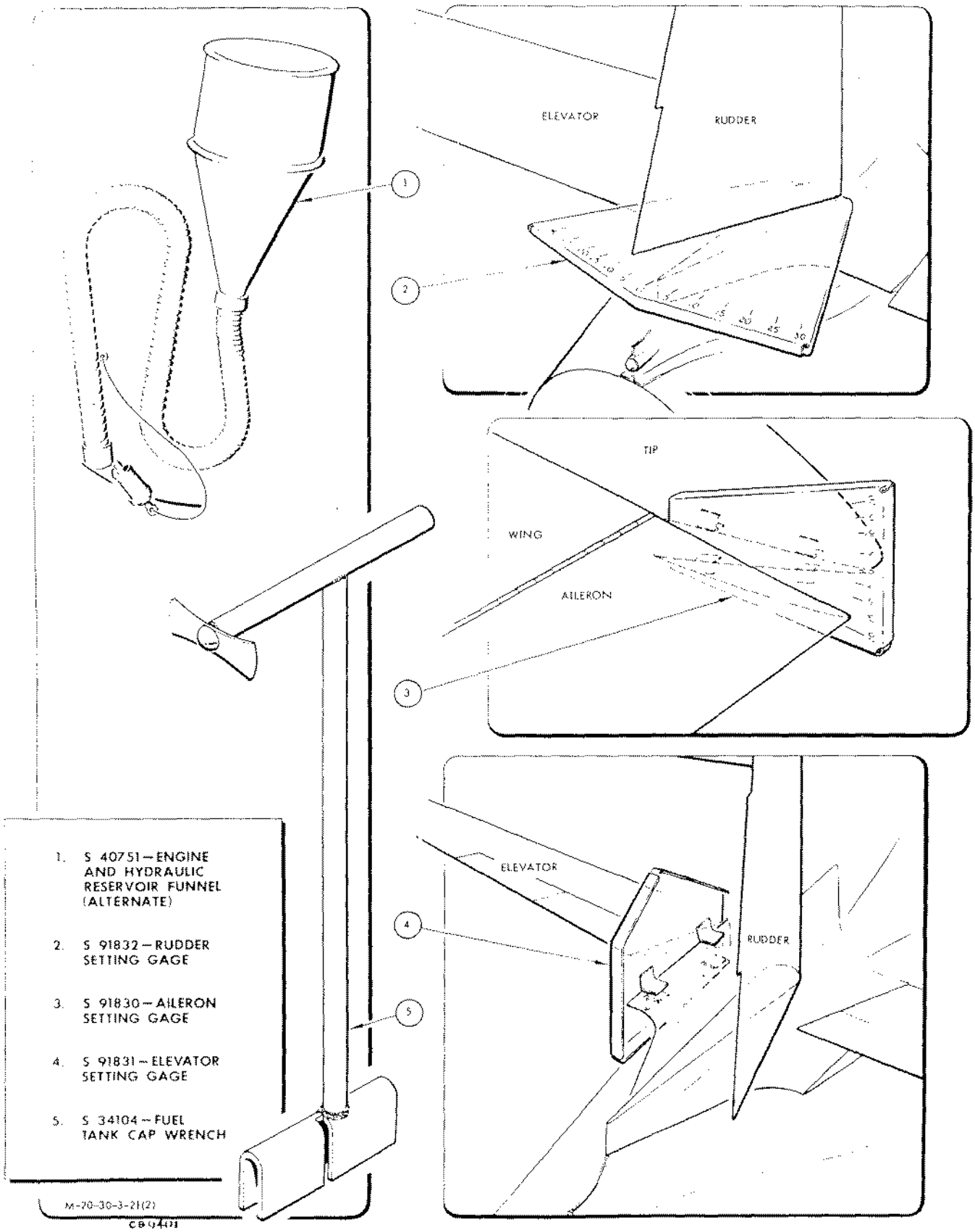


Figure 3-29. Miscellaneous Tools (Sheet 2 of 3)

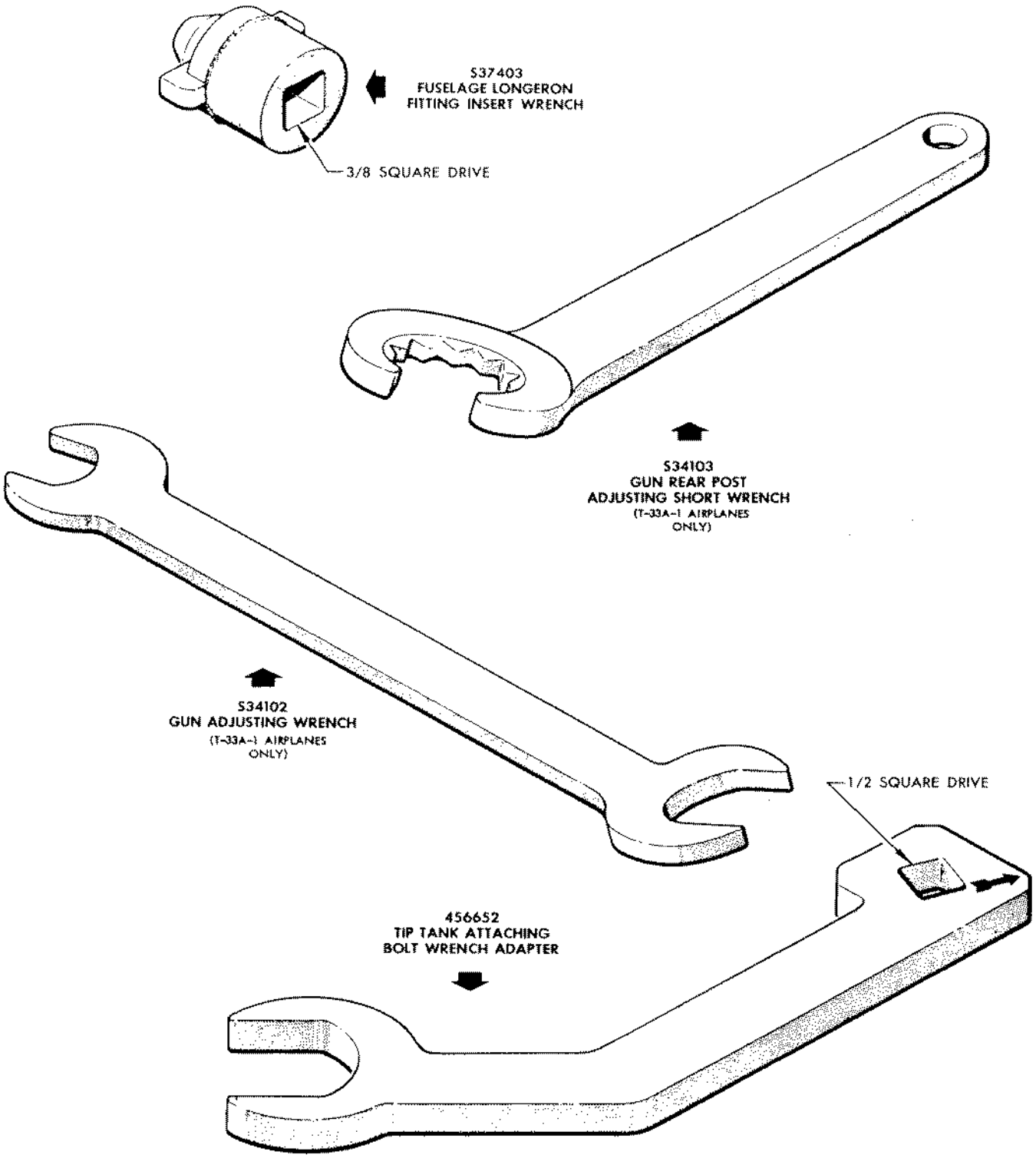


Figure 3-29. Miscellaneous Tools (Sheet 3 of 3)

Figure 3-29A. Defuel Adapter Hose

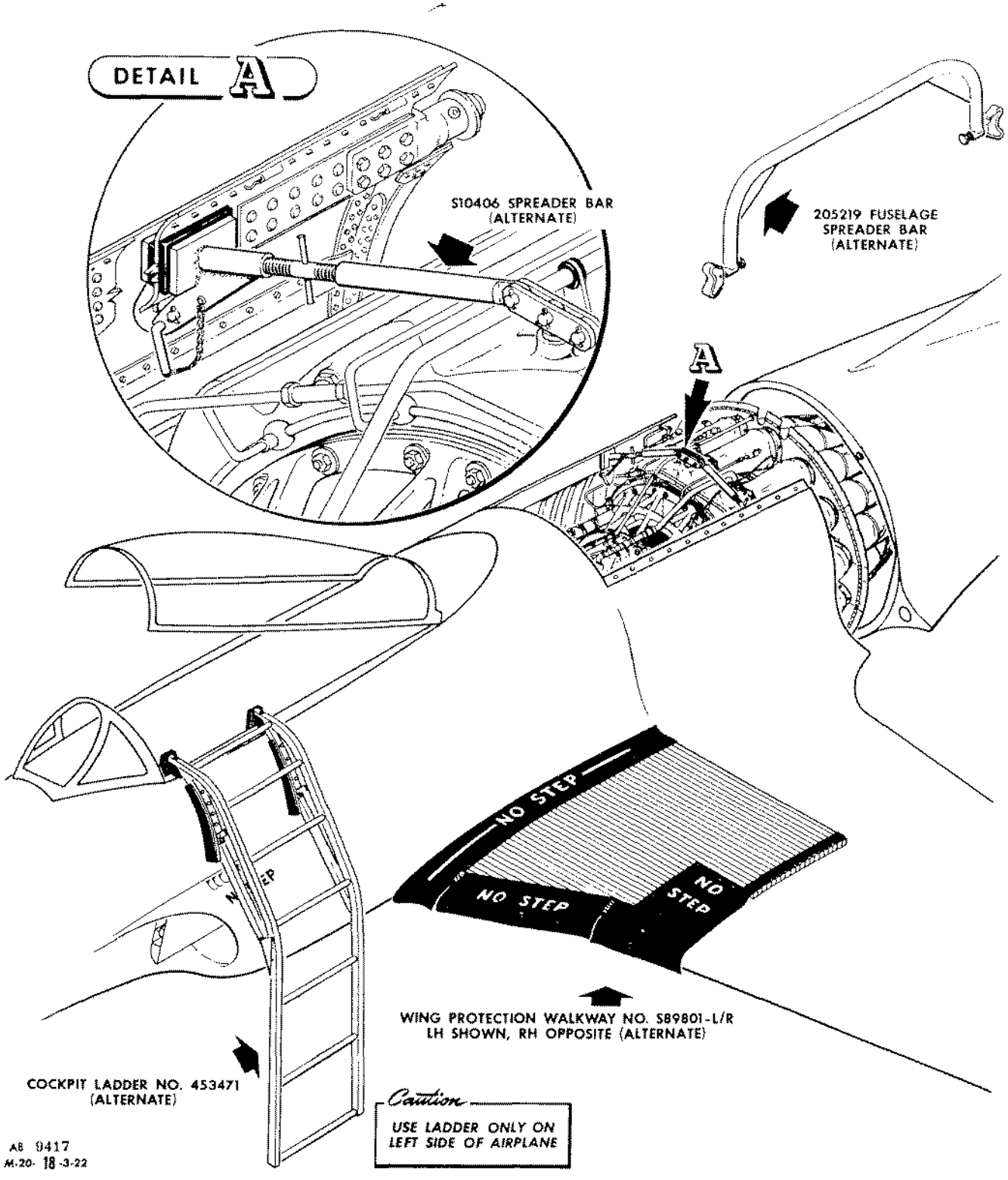
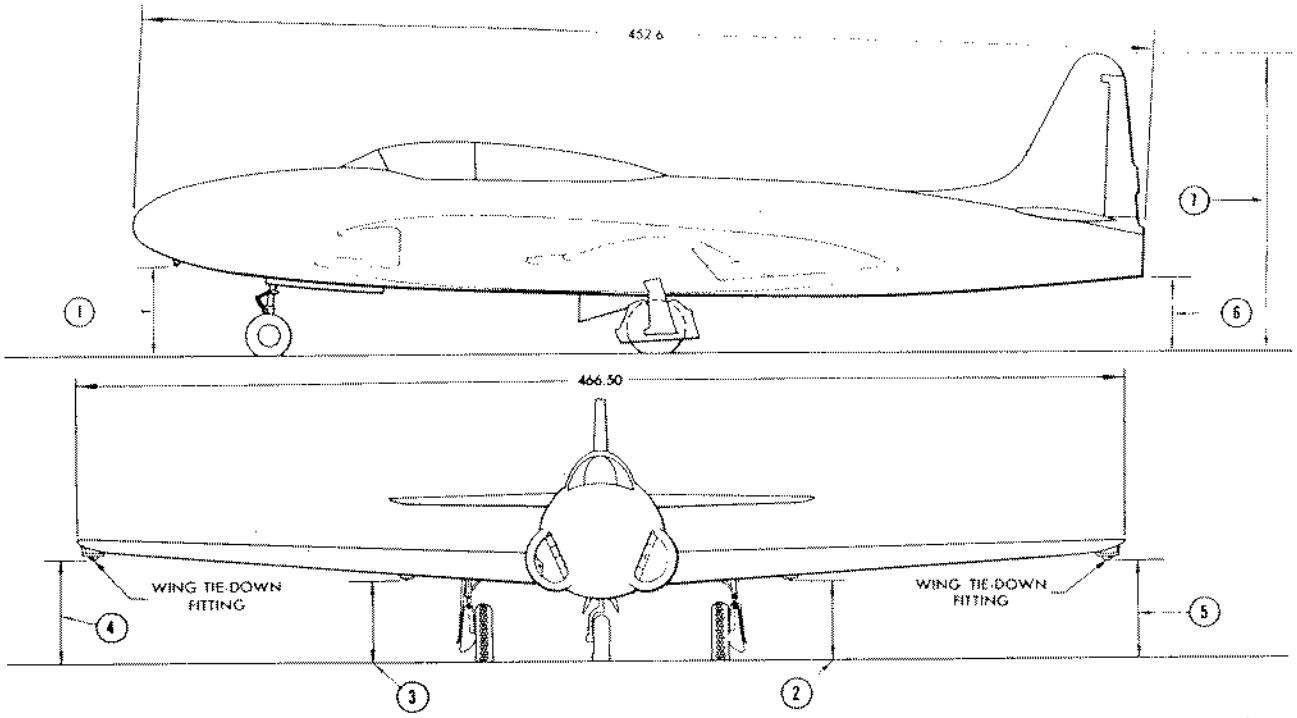
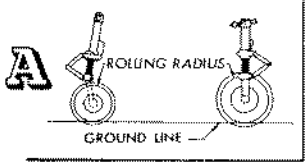


Figure 3-30. Miscellaneous Ground Handling Equipment



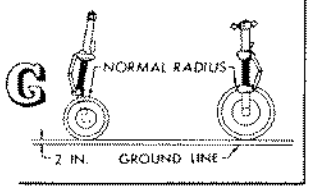
All struts in static position. All wheels on rolling radius.



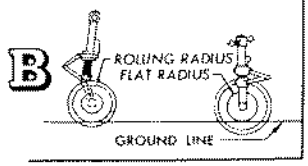
REF.	A	B	C	D	E	F	G
*1	45.6	47.0	38.1	39.6	46.4	37.0	53.0
*2	36.4	30.1	36.5	30.7	28.3	29.0	43.6
*3	36.4	30.1	36.5	30.7	38.2	38.5	43.5
4	44.8	38.4	44.8	38.5	55.1	53.9	52.0
5	44.8	38.4	44.8	38.5	28.4	28.6	52.0
6	32.8	19.2	41.0	27.1	25.8	35.4	35.9
7	140.0	127.1	147.2	134.3	129.5	142.0	147.2

*JACK POINTS—JACK PADS ATTACHED

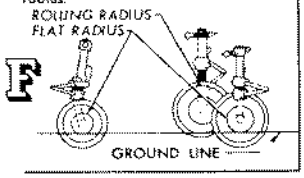
All struts fully extended. All wheels on normal radius and 2 inches off the ground.



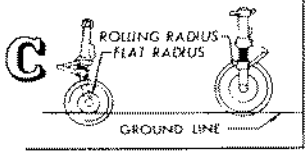
Nose strut in static position, wheel on rolling radius. Both main struts fully compressed, wheels on flat radius (tire deflated).



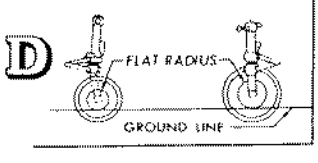
Nose strut fully compressed, wheel on flat radius (tire deflated). One main strut fully compressed, wheel on flat radius (tire deflated). Other main strut in static position, wheel on rolling radius.



Nose strut fully compressed, wheel on flat radius (tire deflated). Both main struts in static position, wheels on rolling radius.



All struts fully compressed. All wheels on flat radius (tires deflated).



Nose strut in static position, wheel on rolling radius. One main strut fully compressed, wheel on flat radius (tire deflated). Other main strut in static position, wheel on rolling radius.

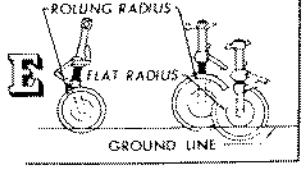


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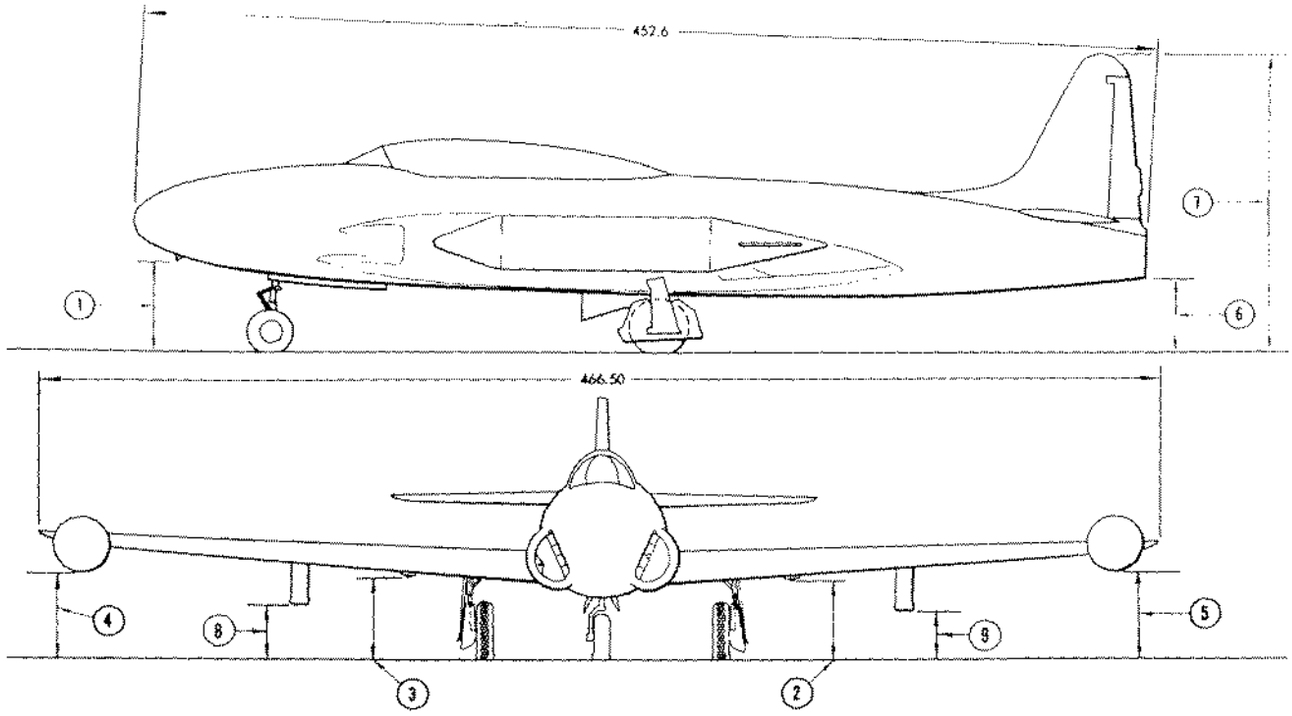
Figure 3-31. Ground Handling Dimensions, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T. O. 1T-33A-42



All struts in static position. All wheels on rolling radius.

A — ROLLING RADIUS — GROUND LINE

REF.	A	B	C	D	E	F	G
*1	45.6	47.0	38.1	39.6	46.4	37.0	53.0
*2	36.5	30.1	36.5	30.7	28.3	29.0	43.5
*3	36.5	30.1	36.5	30.7	38.0	38.5	43.5
4	37.3	32.2	36.9	32.6	46.9	46.6	45.9
5	37.3	32.2	36.9	32.6	22.6	22.9	45.9
6	32.8	19.2	40.8	27.1	25.8	35.4	35.9
7	140.0	127.1	147.0	134.3	129.5	142.0	147.2
8	30.0	25.6	29.5	25.3	34.3	34.1	38.8
9	30.0	25.6	29.5	25.3	20.9	21.0	38.8

*JACK POINTS—JACK PADS ATTACHED

All struts fully extended. All wheels on normal radius and 2 inches off the ground.

G — NORMAL RADIUS — 2 IN. — GROUND LINE

Nose strut in static position, wheel on rolling radius. Both main struts fully compressed, wheels on flat radius (tire deflated).

B — ROLLING RADIUS — FLAT RADIUS — GROUND LINE

Nose strut fully compressed, wheel on flat radius (tire deflated). One main strut fully compressed, wheel on flat radius (tire deflated). Other main strut in static position, wheel on rolling radius.

F — ROLLING RADIUS — FLAT RADIUS — GROUND LINE

Nose strut fully compressed, wheel on flat radius (tire deflated). Both main struts in static position, wheels on rolling radius.

C — ROLLING RADIUS — FLAT RADIUS — GROUND LINE

All struts fully compressed. All wheels on flat radius (tires deflated).

D — FLAT RADIUS — GROUND LINE

Nose strut in static position, wheel on rolling radius. One main strut fully compressed, wheel on flat radius (tire deflated). Other main strut in static position, wheel on rolling radius.

E — ROLLING RADIUS — FLAT RADIUS — GROUND LINE

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Figure 3-32. Ground Handling Dimensions, AF Serial No. 51-4141 and Subsequent and Airplanes Incorporating T. O. 1T-33A-42

SECTION IV

GENERAL MAINTENANCE

4—1. WING.

(See figure 4-1.)

4–2. DESCRIPTION OF WING. The wing is a full cantilever, stressed-skin structure of aluminum alloy, made as one unit except for detachable leading edges, wing tips, ailerons, and flaps. Compartments are provided in the leading edge sections and between the front and rear beams for removable fuel tanks. Removable stressed panels on the lower wing surface give access to fuel tanks aft of the leading edge section.

4–3. All tanks are protected from excessive bullet rupture by 0.030-inch laminated glass cloth sheets fastened to the inside of the wing upper surface, to both sides of each beam, and to the removable access panels.

4–4. Lifting lugs are located on both sides of the wing upper surface at wing stations 52.1 (See figure 3-2.) Provisions for jack pads are under the wing at wing station 83½.

4–5. Prior to AF Serial No. 51-4141 on airplanes not incorporating T.O. No. 1T-33A-42, a navigation light is installed in each wing tip. On AF Serial No. 51-4141 and subsequent and airplanes incorporating T.O. No. 1T-33A-42, navigation lights are situated, one on the top and one on the bottom of the wing, inboard of each wing tip.

4–6. Provisions for bomb pylons are installed under the wing outboard of the aileron-flap joint. They consist of a bolt hole and a door, through which wiring and manual release cable may be introduced inside the pylon fairing whenever pylons are installed.

4–7. An electrically operated trim tab is located on the inboard end of the left aileron.

4–8. A split flap mounted inboard of each aileron forms a continuation of the wing trailing edge.

4–9. A wing-to-fuselage attachment fitting is located on the inboard end of each leading edge section, and two fittings are on the aft side of the wing rear beam. Two serrated plates are on the top surface of the wing, one on each side of the center line. Contoured angles on the fuselage mate with these serrated plates and are held against them by 13 bolts on each side.

4–10. The rib at wing station 0 has two fuselage attachment fittings at the lower forward and aft points of the rib. The fittings mate with the lower longeron fittings of the fuselage, and have threaded inserts.

4–11. REMOVAL OF WING. *(See figure 4-2.)* Special tools required: Two S37330 wing mating pins, two S37331 wing mating pins, 205216 fuselage sling, two S84704 wing dollies, and 205211 nose and mid section storage dolly.

Note

When removing a wing, save all air system plumbing, bracketry and clamps for reuse with the 410612-1 universal spare wing as these parts are not supplied with the spare wing.

On T-33A-1 aircraft, remove the case ejection door check valve Part No. AN6207-4 and the associated plumbing and supporting clips for reuse on the universal spare wing.

a. Remove batteries. (Refer to paragraph 4–805.)

b. Drain all fuel tanks.

c. Drain hydraulic fluid from reservoir by removing plug in bottom of reservoir.

d. Remove fuselage aft section and engine. (Refer to paragraphs 4–299 through 4–301.)

e. Remove wing fillets and formers as follows:

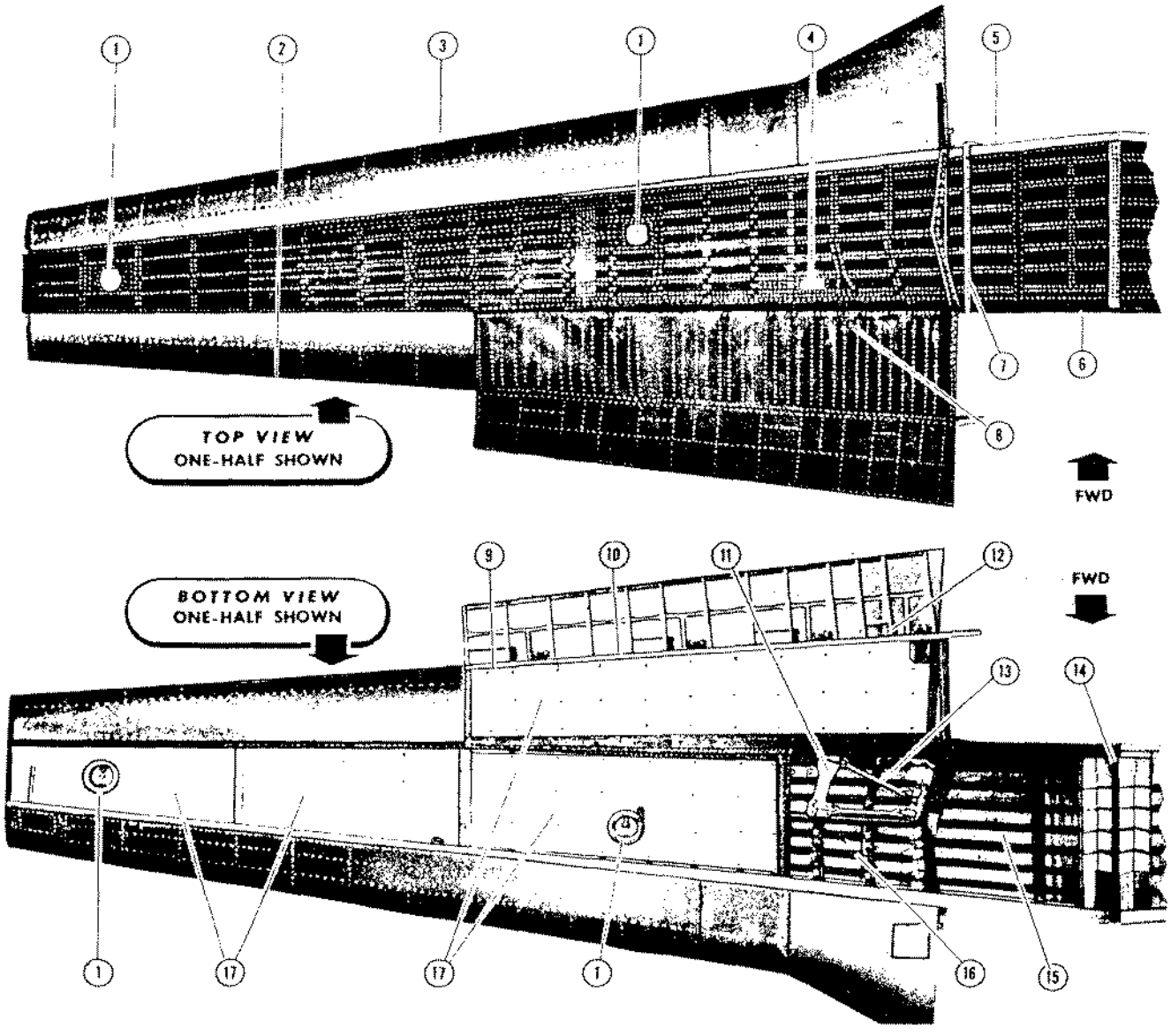
Remove upper and aft fillets.

Remove strap around leading edge, and remove upper leading-edge fillet.

Remove lower leading-edge and aft fillets. Do not remove screws from leading edge of lower forward fillet. Splice plate will stay with this fillet.

Remove lower leading-edge fillet former.

f. Prior to AF Serial No. 50-385 not incorporating T. O. 1T-33A-567, disconnect wing-flap position indicator cable at inboard end of left flap. Loosen sheath from clips on wing, and fasten sheath and cable to fuselage. (See figure 4-9.) On AF Serial No. 50-385 and subsequent and on airplanes incorporating T. O. 1T-33A-567, disconnect and remove the wing flap position transmitter.



1. FILLER WELLS
2. AILERON HINGE
3. LEADING EDGE SECTION
4. ACCESS DOOR (SHOCK STRUT SERVICING)
5. FRONT BEAM
6. REAR BEAM
7. SERRATED PLATE
8. LIFTING LUG
9. AUXILIARY BEAM
10. WING FLAP HINGE
11. ALIGHTING GEAR FULCRUM BEARING SUPPORT
12. WING FLAP PUSH-PULL TUBE ROLLERS
13. ALIGHTING GEAR TRUSS MEMBER
14. WING CENTER RIB
15. ALIGHTING GEAR WHEEL WELL
16. OXYGEN CYLINDER COMPARTMENT
17. FUEL TANK COMPARTMENTS

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Figure 4-1. Wing

g. Remove bolts, nuts, and spacers from both tip tank manual release handles in forward cockpit.

h. Remove clamps securing cable sheaths (left and right) to aft face of wing rear Leam at WS 15, 22, and FS 227.8 bulkhead ring.

i. Loosen tube nuts and remove sheaths (left and right) from two pulleys located slightly to left of airplane centerline on FS 227.8 bulkhead; remove sheaths from airplane.

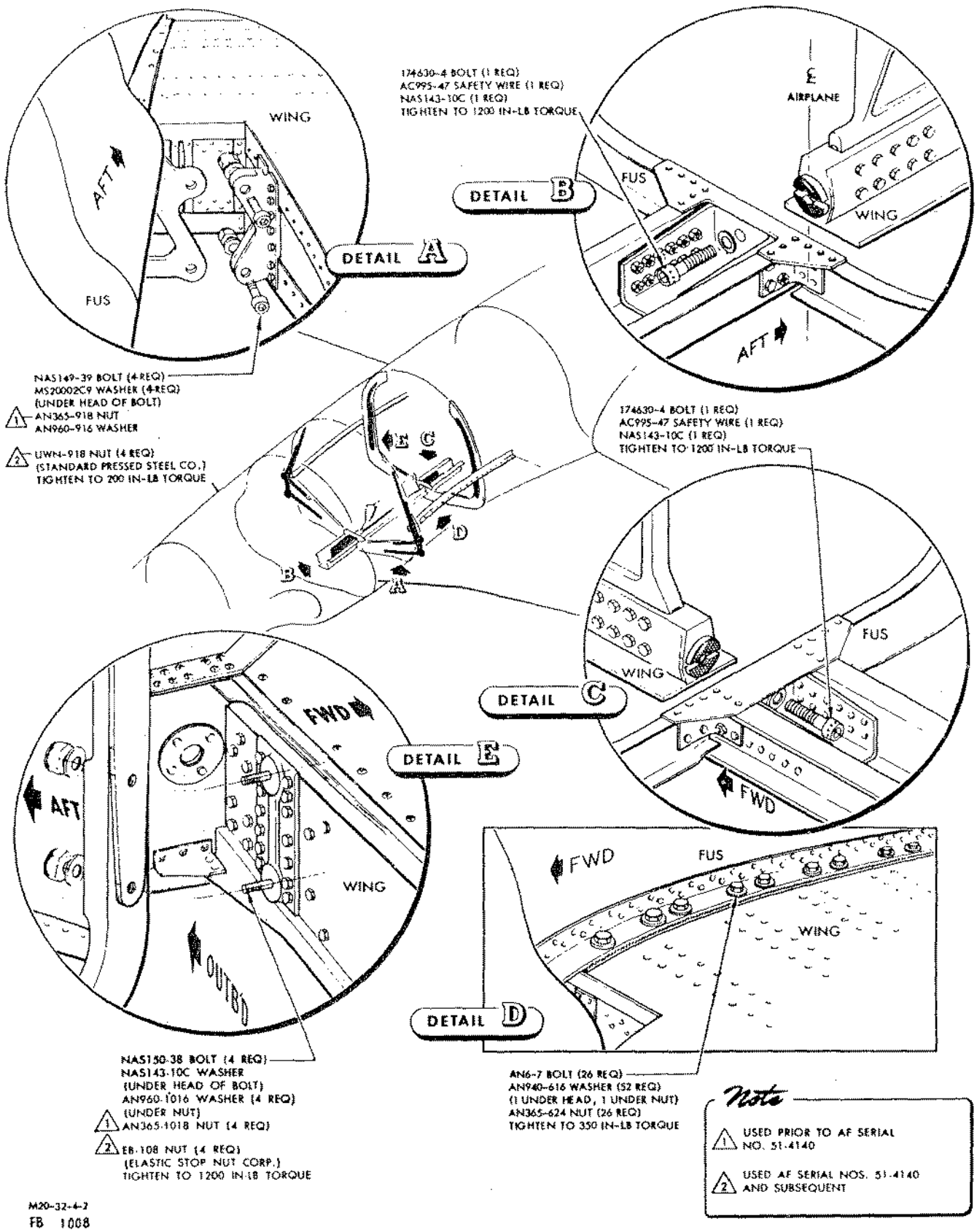

Figure 4-2. Wing to Fuselage Attachment

j. Pull cables through fuselage skin (left and right); coil and secure to wing. Access to cables is through lower aft wing to fuselage fillet areas.

k. Remove dive flaps and flap actuator support assembly. (Refer to paragraph 4–141.) It is not necessary to remove the actuator from the support assembly.

l. Remove electrical equipment as follows:

Disconnect and remove wing flap actuators. (Refer to paragraph 4–37.)

Disconnect all wires on terminal strips in right hydraulic compartment. Replace nuts and washers.

Release left and right wires from their strap clips. Coil and stow wires in wing.

Disconnect all electrical plugs and cables from engine-compartment seal below wing rear beam. Loosen straps and pull wires, cables, and receptacles through front beam and stow them in hydraulic compartment.

Disconnect all electrical fittings, fairleads, and brackets from engine compartment seal below wing rear beam.

m. Disconnect plumbing as follows:

Note

Upon removal, immediately cap all plumbing lines.

Disconnect droppable-tank air pressure line, droppable-tank fuel line, and wing leading-edge tank vent line from inboard ends of wing leading edges. (See figures 4-3 or 4-4.) Remove the hose between leading edge tank and vent line "Y" fittings.

Disconnect vent lines from "Y" fittings at wing front beam in left and right main wheel wells. Remove "Y" fittings.

Disconnect plumbing from left and right leading-edge tank booster pumps. Remove screws, attaching pump and its adapter, from wing leading edge. Remove strap from pump-support bracket. Remove pump and adapter. Replace strap on bracket.

Disconnect air lines from droppable-tank air pressure control valves.

Detach air-pressure control valves and brackets from front face of wing front beam by removing the attaching bolts.

Discharge oxygen system slowly by turning the demand regulator control dial to "SAFETY."

WARNING

Do not discharge oxygen system in the presence of oil, grease, an open flame, or an electric arc.

Disconnect all the plumbing lines at the wing front and rear beams and cap all bulkhead fittings.

Disconnect the two fuel hoses forward of the wing front beam. Remove drain cock from the fuel hose in left main wheel well, and disconnect hose aft of wing rear beam. Remove hose, and reinstall the drain cock. Disconnect fuel hose from filter in right main wheel well, and remove the hose.

Remove hose fitting from valve at forward connection of right hose.

Remove all bulkhead fittings from the wing rear beam.

Disconnect aileron booster shut-off valve from aft face of wing rear beam.

Disconnect inboard fuel-tank hoses from wing. Stow hoses in engine compartment.

n. Disconnect aileron cables from aileron booster unit and push cables into wing until they clear the fuselage.

o. Remove aileron booster unit. (Refer to paragraph 4–609.)

p. Remove aileron torque tube. (Refer to paragraph 4–594.)

q. In main wheel wells, remove bolt from lever (figure 4-42, reference 12) on inboard door-closing mechanism.

r. Support wing with two wing dollies S84704. (Refer to paragraph 3–15 and figure 3-8.)

s. Attach sling 205216 to fuselage nose and mid section. (Refer to paragraph 3–10 and figure 3-3.)

t. Remove 13 bolts from wing-to-fuselage attaching angle through serrated plate on each side of the fuselage in the upper surface of the wing.

u. From within the fuselage, remove forward and aft bolts attaching bottom of wing center rib to the fuselage.

v. Lift sling enough to take the load off the eight bolts (four on each side) which attach fuselage to front and rear main beams.

w. Remove the four lower bolts, and replace the two in the front beam with wing mating pins S37330 (figure 3-29) replace the two lower aft bolts with wing mating pins S37331 (figure 3-29).

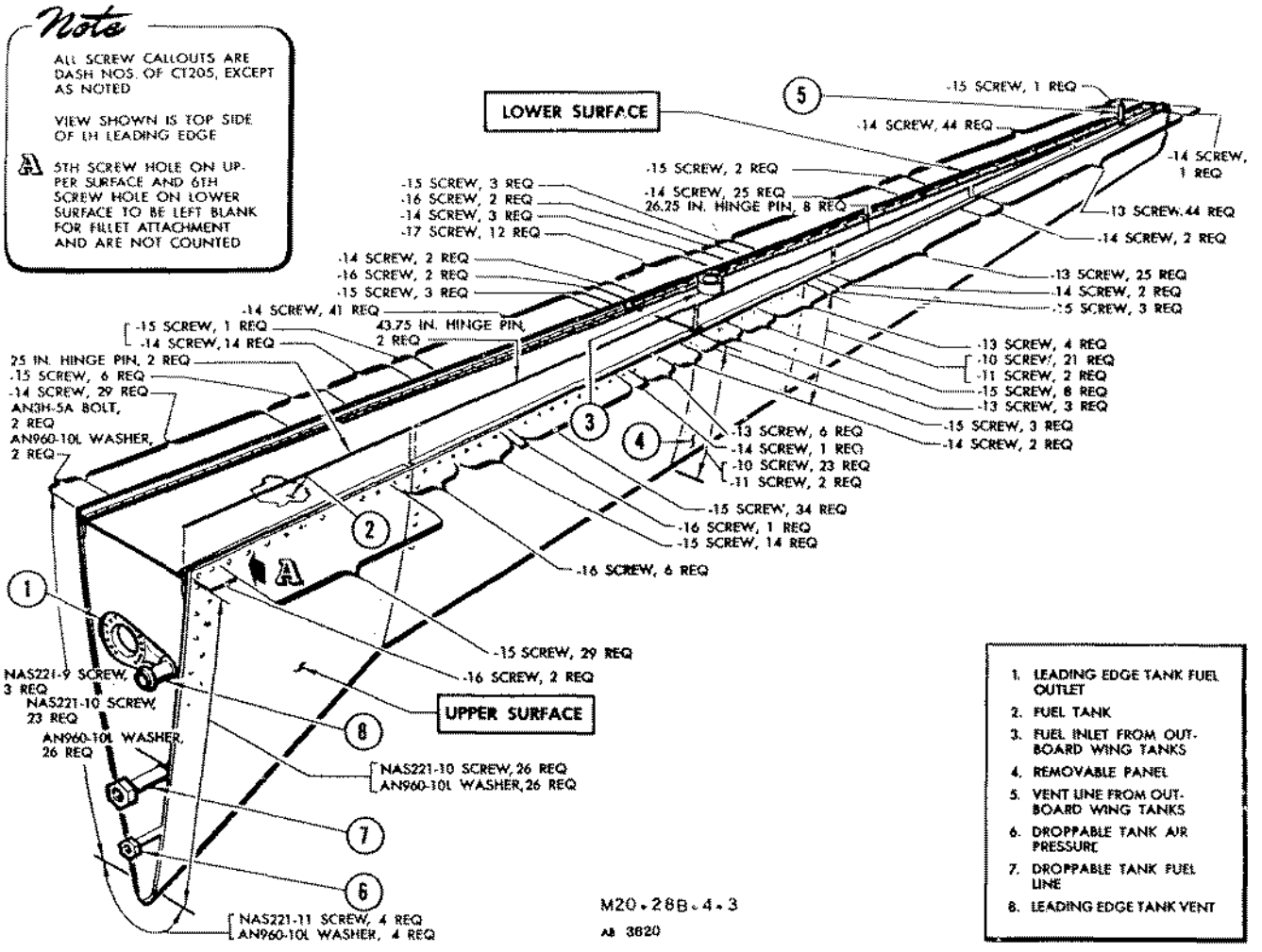

Figure 4-3. Attachment of Wing Leading Edge, Prior to AF Serial No. 51-4266

x. Remove the four upper bolts from the wing beam, then remove the adapters from the wing mating pins and drive the pins through.

CAUTION

Make final check to be sure that all electrical, hydraulic, and fuel connections, and all control cables are clear.

y. Hoist fuselage slowly straight up from the wing, Fuselage nose and mid-sections may be stored in storage dolly 205211. (See figure 3-8.)

4–12. INSTALLATION OF WING. *(See figure 4-2.)* Special tools required: Two S37330 and two S37331 wing mating pins, 205216 fuselage sling, two S84704 wing dollies, and 205211 nose and mid section storage dolly.

a. Support wing with two wing dollies S84704 (figure 3-7) at wing station 126.25 directly under rib.

b. Use sling 205216 to hoist fuselage nose and mid sections over wing. (Refer to paragraph 3–10 and figure 3-3.) Lower fuselage onto wing slowly. Be careful not to damage plumbing fittings on wing front beam. Use two pieces of 0.012-inch aluminum sheet approximately 2 x 12 inches, to protect the faces of the lower center attachment from the serrated face of the wing station 0 rib attachment. (See figure 4-2, details B and C.) Remove the pieces of aluminum sheet when the fuselage is in place. Support the fuselage nose section with a jack. (Refer to paragraph 3–22.)

Note

Tighten all structural bolts to torque limits specified in Section VI "Wrench Torque Table," except as noted in the following instructions.

c. Install the eight wing main-beam-to-fuselage bolts as follows:

Drive wing mating pin S37330 through lower bolt holes of forward wing-fuselage attachment points.

Drive wing mating pin S37331 through lower bolt holes of aft wing-fuselage attachment points.

Insert bolts in holes above each pin. Tighten forward bolts to 200 lb in. maximum torque. These forward bolts must be tightened only enough to take up slack. Approximately 1½ threads through the nut will be sufficient.

Remove wing mating pins and insert bolts. If holes do not line up, drive a wing mating pin, without the adapter, through the hole ahead of the bolt.

d. Install forward and aft center bolts.

e. Install 13 bolts on each side of the fuselage to secure attaching angle to serrated plate on upper surface of wing. Use AN940-616 washers under bolt heads and nuts. Tighten these bolts to 350 inch-pounds torque.

f. Install aileron torque tube.

g. Install aileron booster unit.

h. Connect cables to aileron booster unit.

i. In the main wheel wells, install bolt through lever in inboard door-closing mechanism. (See figure 4-41.)

j. To install plumbing, reverse removal procedure given in paragraph 4–11, step m.

Note

On T-33A-1 airplanes using the case ejection door, remove the AN814-8D plug from the AN783D8 tee on the left side of the spare wing and plumb in the case ejection door line and check valve which were removed from the old wing.

k. To install electrical equipment, reverse removal procedure given in paragraph 4–11, step l.

l. Install tip tank manual release cables and sheaths by reversing procedure described in steps g through j, paragraph 4–11.

m. Prior to AF Serial No. 50-385 on airplanes not incorporating T. O. 1T-33A-567, with the wing flap in the down position, connect the flap position indicator cable. For adjustment, refer to paragraph 4–43. Attach sheath to wing with clips. (See figure 4-9.) On AF Serial No. 50-385 and subsequent and on airplanes incorporating T. O. 1T-33-567 with the wing flaps in the full down position, install the wing flap position transmitter. For adjustment, refer to paragraph 4–1121.

n. Install wing flap actuators. (Refer to paragraphs 4–41 and 4–42.)

o. To install wing fillets, reverse removal procedure given in paragraph 4–11, step e.

p. Install the engine and fuselage aft section. (Refer to paragraphs 4–304 through 4–307.)

q. Replenish the hydraulic system. (See figure 3-24.)

r. Make operational check of aileron, elevator, and rudder controls, wing flaps, bomb manual release, alighting gear, fuel, hydraulic, and electrical systems.

s. Lower airplane onto alighting gear.

Note

Installation of used spare leading edges, panels, door assemblies, and stress plates with a maximum skin gap of ¼-inch is authorized, provided that: minimum edge distance of all holes is not less than that specified on drawings. A $^{3}/_{16}$-inch minimum lap, on all lands and overlaps, is maintained. The trim does not adversely affect the required weather sealing.

4–13. LEADING EDGE SECTIONS. *(See figures 4-3 and 4-4.)* The leading edge sections extend from the engine air intake scoops to the wing tips. They are attached to the wing by screws through the leading edge skin to the flanges of the extruded beam caps and by bolts through fittings at the inboard leading edge ribs. Fuel and air pressure lines for the droppable tanks are routed through the leading edge sections. On AF Serial Nos. 51-4266 and subsequent, a metal strip is installed on the inboard edge of the leading edge to improve the stall warning characteristics of the airplane. An additional stall strip is installed just outboard of the existing stall strip.

4–14. The leading edges contain fuel tanks extending the entire length of the sections. Each of these tanks is connected to the two outboard fuel tanks. Corrugations are used under the skin for stiffening and the sections are lined with laminated glass cloth. A fuel drain is located in the lower skin toward the inboard end. Removal of the panel exposes a manhole in the tank, through which access is gained to the clamp holding the tube in place.

4–15. REMOVAL OF LEADING EDGE SECTIONS.

a. Prior to AF Serial No. 51-4141 on airplanes not incorporating T.O. No. 1T-33A-42, remove wing tip. (Refer to paragraph 4–21.)

b. On AF Serial No. 51-4141 and subsequent and airplanes incorporating T.O. No. 1T-33A-42, remove wing tip leading edge, and remove fore and aft bolts which attach leading edge bracket to tip casting.

c. Remove upper and lower leading-edge fillets. (Refer to paragraph 4–11, step e.)

d. Drain fuel from leading-edge tank and from both outboard tanks.

e. Remove screws which attach outboard tank drain fitting to outboard tank panel.

f. Remove outboard tank panel.

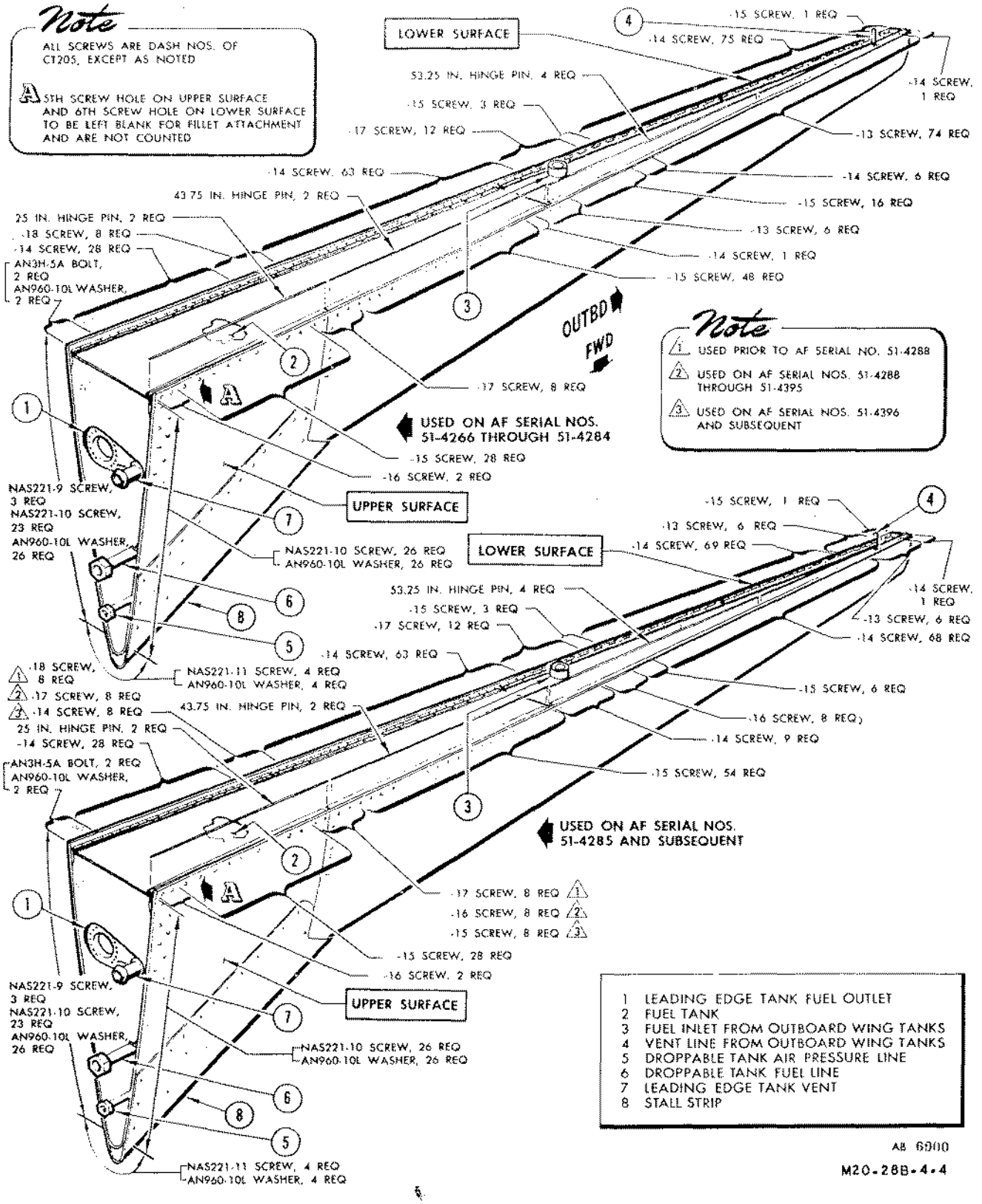

Figure 4-4. Attachment of Wing Leading Edge, AF Serial No. 51-4266 and Subsequent

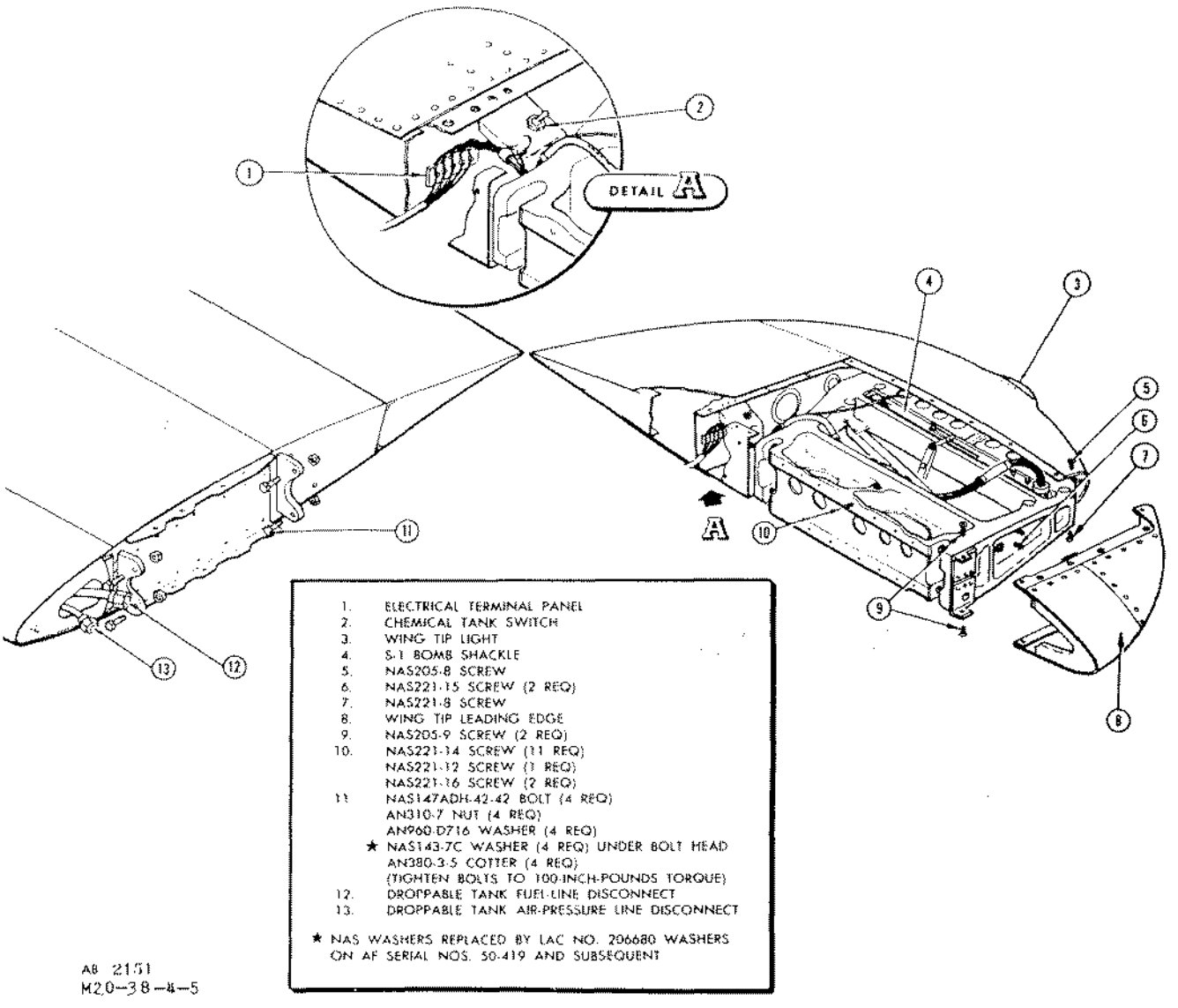

Figure 4-5. Wing Tip Attachment, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T. O. 1T-33A-42

g. Remove outboard-tank manhole cover and disconnect fuel and vent line connections to leading edge tank.

h. Disconnect all plumbing from the inboard end of the wing leading edge.

i. Remove leading-edge-tank fuel pump and adapter.

j. Fold down gasket and remove three flush screws that secure fitting on inboard end of leading edge tank to rib at wing station 34.

k. Remove 29 screws which attach the leading-edge lower skin to the inboard rib, and 28 screws which attach the leading-edge upper skin to the inboard rib.

l. Remove three screws attaching outboard rib to wing front beam.

m. Remove all screws which attach the leading edge lower skin to the wing front beam cap.

n. Support leading edge section and remove screws from the upper skin to front beam cap attachment.

o. To remove leading edge, pull forward on outboard end until plumbing to outboard tanks is clear, then pull section outboard to clear fittings from inboard rib.

CAUTION

When pulling leading edge section outboard, use extreme care not to contact and damage drop tank fuel and air line quick-disconnect fittings.

p. Pull 12 hinge pins, and remove tank casing cover. Start hinge pins by driving with a small pin, then use pliers to pull pins.

q. Remove three screws from leading-edge tank drain in lower skin near inboard end.

r. Unsnap clips from leading edge structure.

s. Remove leading edge tank.

4–16. INSTALLATION OF LEADING EDGE SECTION. *(See figures 4-3 and 4-4.)* When installing the original leading edge section, reverse removal procedure.

4–17. When replacing tank fittings or handhole covers, bring parts to the best possible alignment so that the bolts can be started with minimum torque. Tighten all bolts as much as possible with the fingers, as this may indicate any threads in poor condition. Replace bolts which have burred threads. Fittings with burred threads may be retapped with the same size tap. Tighten bolts alternately on opposite sides of fitting or cover. On Firestone fuel cells, all fitting bolts are torqued to between 40 and 50 lb in., except nipple type fittings, which are torqued to between 20 and 30 lb in. On B.F. Goodrich fuel cells, torque all fitting bolts to between 20 and 30 lb in., except slit type inspection doors which will be torqued to 70 (±5) lb in.

Note

On B.F. Goodrich fuel cells retorquing should be accomplished at least one hour after initial torquing, and preferably four hours after initial torquing.

4–18. On AF Serial No. 53-5666 and subsequent and on airplanes incorporating T. O. 1T-33A-506, a spring washer is installed under the head of each bolt in hand hole covers. Tighten bolts until spring washers are compressed, then torque bolts in accordance with torque value instructions noted in paragraph 4–17.

4–19. INSTALLATION OF REPLACEMENT LEADING EDGE. *(See figures 4-3 and 4-4.)*

a. Install new, untrimmed leading-edge section without tank. Put in 10 percent of the screws to hold the section in place.

b. With a butt transfer scribe, scribe a trim line around the new leading edge.

c. Remove the leading-edge section.

d. Trim leading-edge section to scribed line.

e. Install leading-edge tank.

f. Attach tank to drain fitting in lower inboard end of leading-edge section.

g. Install cover over the tank, using the 12 hinge pins provided.

h. Replace leading-edge section on wing and attach it with about 10 percent of the screws.

i. Countersink balance of the screw holes with a 100-degree countersinking tool, to the mean depth of the screw heads. Install screws and bolts as shown in figures 4-3 and 4-4.

Note

After installing the two bolts at the lower inboard end, lock-wire them together.

j. Remove the screws originally installed, countersink the holes, and reinstall screws as shown in figures 4-3 and 4-4.

4–20. WING TIPS. *(See figures 4-5, 4-6, and 4-217.)* The tips are attached to the wing with screws and bolts. Prior to AF Serial No. 51-4141 on airplanes not incorporating T.O. No. 1T-33A-42, the internal structure consists of a support casting to which is secured a bomb rack, and which incorporates sway braces for use with droppable tanks. A navigation light is mounted in a blister in each outboard edge. On AF Serial No. 51-4141 and subsequent and airplanes incorporating T.O. No. 1T-33A-42, the tips consist of steel fittings bolted to the wing beams, with fairings screwed to the fittings. A solenoid and a drop-tank hook are fastened to each fitting. A switch in the tank aft socket is installed to change from the wing navigation lights to the tip tank lights whenever the tank is installed. Sockets for wires to these lights are in the outboard edge of the tip.

4–21. REMOVAL OF WING TIPS (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. No. 1T-33A-42).

a. Remove bomb rack fairing and all inspection plates. (See figure 3-1.)

b. Remove wing-tip leading edge by removing six screws, and pulling leading-edge forward.

c. Disconnect plumbing at unions exposed by removal of tip leading edge.

d. Disconnect wiring at terminal panel aft of casting.

e. Disconnect bomb manual release at cable connector in wing tip.

f. Remove two screws from tip-to-wing attachment. Screws are located aft of casting.

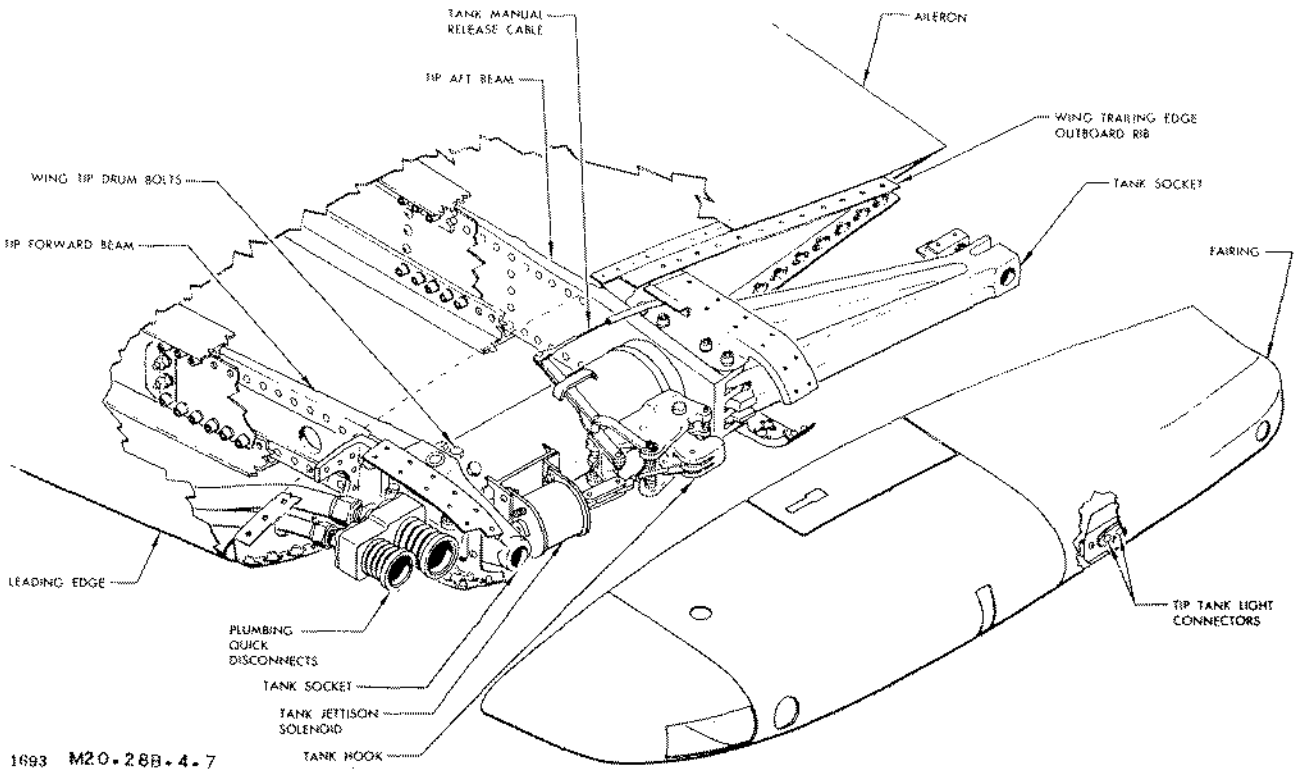

Figure 4-6. Wing Tip Attachment, AF Serial No. 51-4141 and Subsequent and Airplanes Incorporating T. O. 1T-33A-42

g. Remove 15 screws attaching bomb-support casting to wing.

h. Remove two bolts from wing-to-tip lower joint.

i. Support tip, remove two bolts from tip upper joint, and pull tip outboard to remove.

Note

On AF Serial No. 51-4141 and subsequent and airplanes incorporating T.O. No. 1T-33A-42, it is impractical to remove the wing tips.

4–22. INSTALLATION OF WING TIP (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-42). Reverse the removal procedure. When installing replacement wing tip, insert a bomb rack, electrical cable forward. Fasten in place with two NAS145DH44 bolts. Attach bonding jumper (furnished) to rack with AN526-1032R10 screw. This screw will replace screw from lower aft right corner of bomb rack.

CAUTION

Bolts mentioned in steps h and i of paragraph 4–21 must be tightened to 100 lb in. torque.

4–23. AILERONS. *(See figure 4-7.)* The two ailerons are mounted on full-length piano type hinges. Three stainless steel hinge pins attach each aileron to the wing structure. Each aileron is balanced by seven counter weights attached to brackets at the forward edge of the aileron. A cut-out for the electric trim tab is provided at the inboard end of the left aileron. A bend tab on the inboard end of the right aileron extends one inch beyond the trailing edge of the aileron.

4–24. REMOVAL OF AILERONS. Special tools required: Slide hammer S-10404 and hinge-pin puller S-34802.

a. Remove access panel No. 10 (figure 3-1) and disconnect tab flexible drive shaft at motor.

b. Place aileron in up position and disconnect actuating rod at aileron.

c. Remove the two hinge-pin locking clips from top surface of hinge.

d. Support aileron and pull out three hinge pins as follows:

Attach hinge-pin puller S-34802 to slide hammer S-10404. (See figure 3-29.)

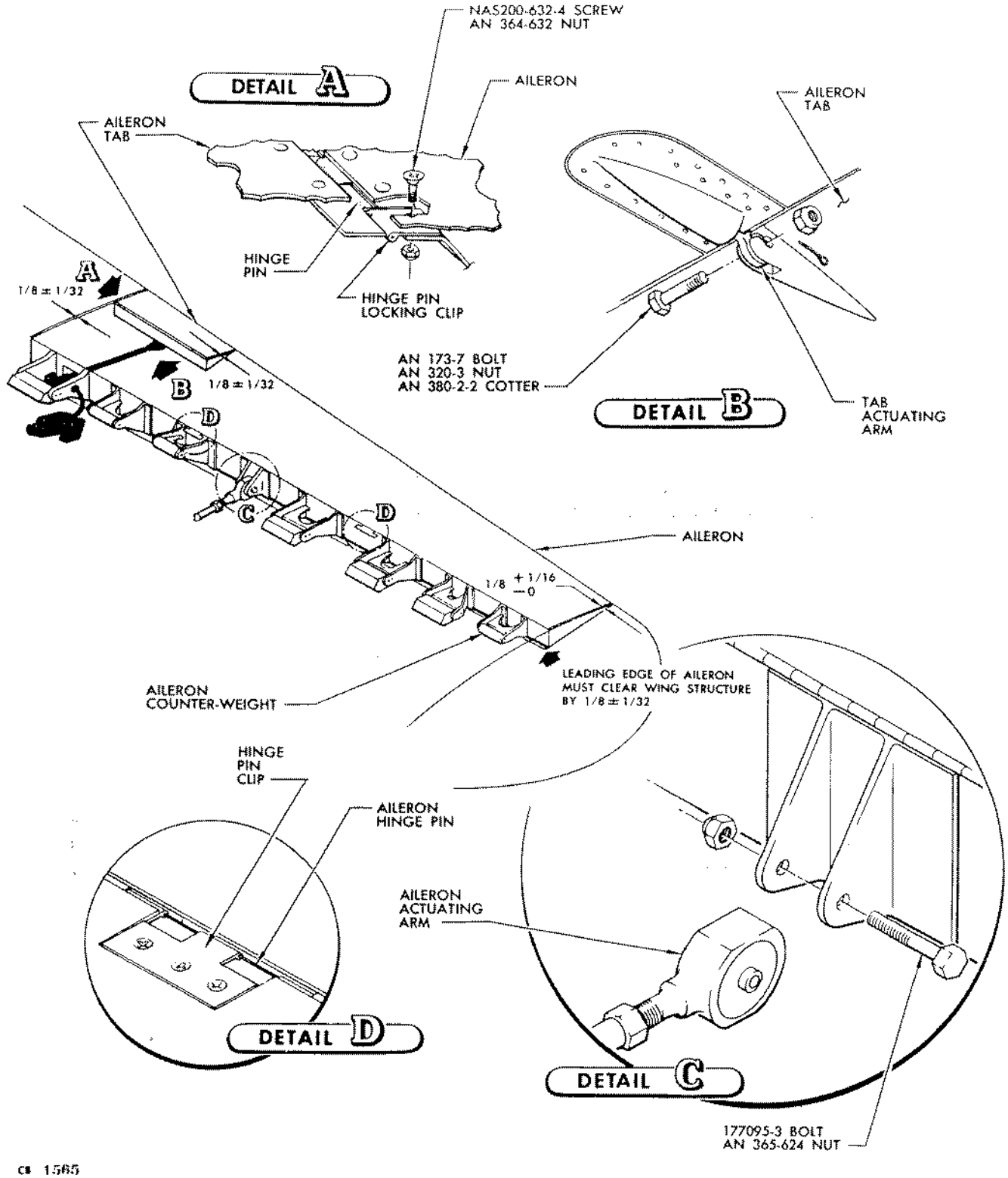

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Figure 4-7. Aileron and Tab Installation

Clamp hinge-pin puller to hinge pin and operate slide hammer by striking slide against nut on end of the hammer opposite pin puller. At the same time, pull on knurled handle of hammer to keep slack out of hinge pin.

Pull outboard pin inboard; pull inboard pin outboard; pull the middle pin from either end. Work aileron up and down to facilitate removal of pin.

CAUTION

When working aileron up and down, do not allow counterweights to strike and damage wing skin.

4–25. INSTALLATION OF AILERONS.

a. Examine aileron for cleanliness. Examine inside of wing through lightening holes in cut-out for any foreign matter.

b. Insert aileron counterweights through holes in wing, and mesh aileron-half of hinge with wing-half of hinge. Do not force aileron in place.

c. Drive the three hinge pins, using either an air hammer or a riveting gun. Do not bend the hinge pin, as it is easily broken.

Note

Use thin tubing around the hinge pin to keep it straight. The tubing should be 0.049 inch wall thickness, in sets of 1/4-, 3/8-, and 1/2-inch OD in order to form a telescoping set. Lubricate hinge pin with oil, Specification MIL-L-7870. Wipe off excess oil.

d. With aileron in neutral, check clearances at inboard and outboard ends of aileron. (See figure 4-7.)

CAUTION

Clearance is to be measured through the entire section to prevent binding.

e. Install two hinge-pin locking clips in cut-outs in the upper surface.

f. Adjust cable rigging as shown in paragraph 4–630.

g. Rotate aileron to its up position and connect aileron actuating arm.

h. Connect flexible shaft from aileron tab jackscrew to motor.

4–26. ALLOWABLE TOLERANCE FOR AILERON SURFACES.

a. Determine amount of aileron twist by streamlining inboard end with flap and trailing edge of wing. Measure amount outboard end varies from trailing edge of wing tip. A maximum of 1/4-inch is allowable.

Note

Always make sure that trailing edge of wing tip and wing is a true contour before making this check.

b. Determine amount of bow in trailing edge by measuring any variations from a straight line between inboard and outboard ends of aileron. A maximum of 1/8-inch is allowable.

4–27. ADJUSTMENT OF AILERONS. Refer to paragraph 4–630 for instructions on rigging. For stall characteristics of the airplane, refer to paragraph 4–663.

4–28. AILERON TAB. *(See figure 4-7.)* An electrically operated trim tab, on a piano type hinge, is mounted at the inboard end of the left aileron. The actuating unit, mounted inboard of the aileron control drum, is connected to the tab jackscrew by a flexible shaft.

4–29. REMOVAL OF AILERON TAB. Special tools required: Hinge pin puller S34802 and slide hammer S10404.

a. Remove screws which attach tab jackscrew shaft to faired fitting on lower surface of tab.

b. Remove locking clip at inboard end of tab.

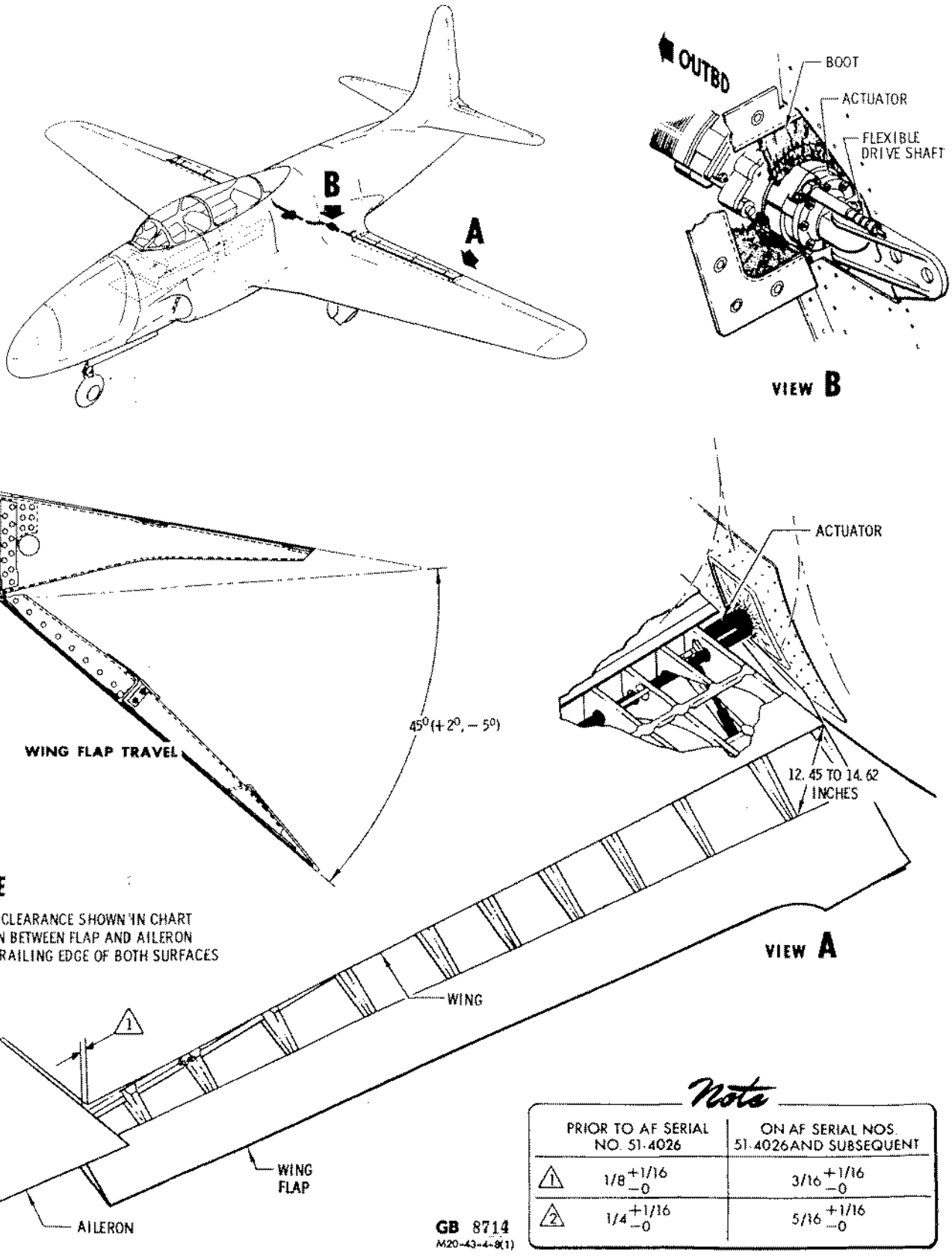
c. Remove hinge pin using hinge pin puller S34802 and slide hammer S10404. Remove tab by pulling it aft.

Note

Do not rotate jackscrew shaft after tab has been removed as tab rigging will be altered.

4–30. ADJUSTMENT OF AILERON TAB. There must be 1/16-inch clearance between aileron tab outboard edge and aileron. Refer to paragraph 4–633 for rigging.

4–31. WING FLAP SYSTEM. *(See figure 4-8.)* Split-type wing flaps are mounted on piano hinges under the trailing edge surface of each wing, extending from the



Note

	PRIOR TO AF SERIAL NO. 51-4026	ON AF SERIAL NOS. 51-4026 AND SUBSEQUENT
1	$1/8^{+1/16}_{-0}$	$3/16^{+1/16}_{-0}$
2	$1/4^{+1/16}_{-0}$	$5/16^{+1/16}_{-0}$

Figure 4—8. Wing Flap Installation (Sheet 1 of 3)

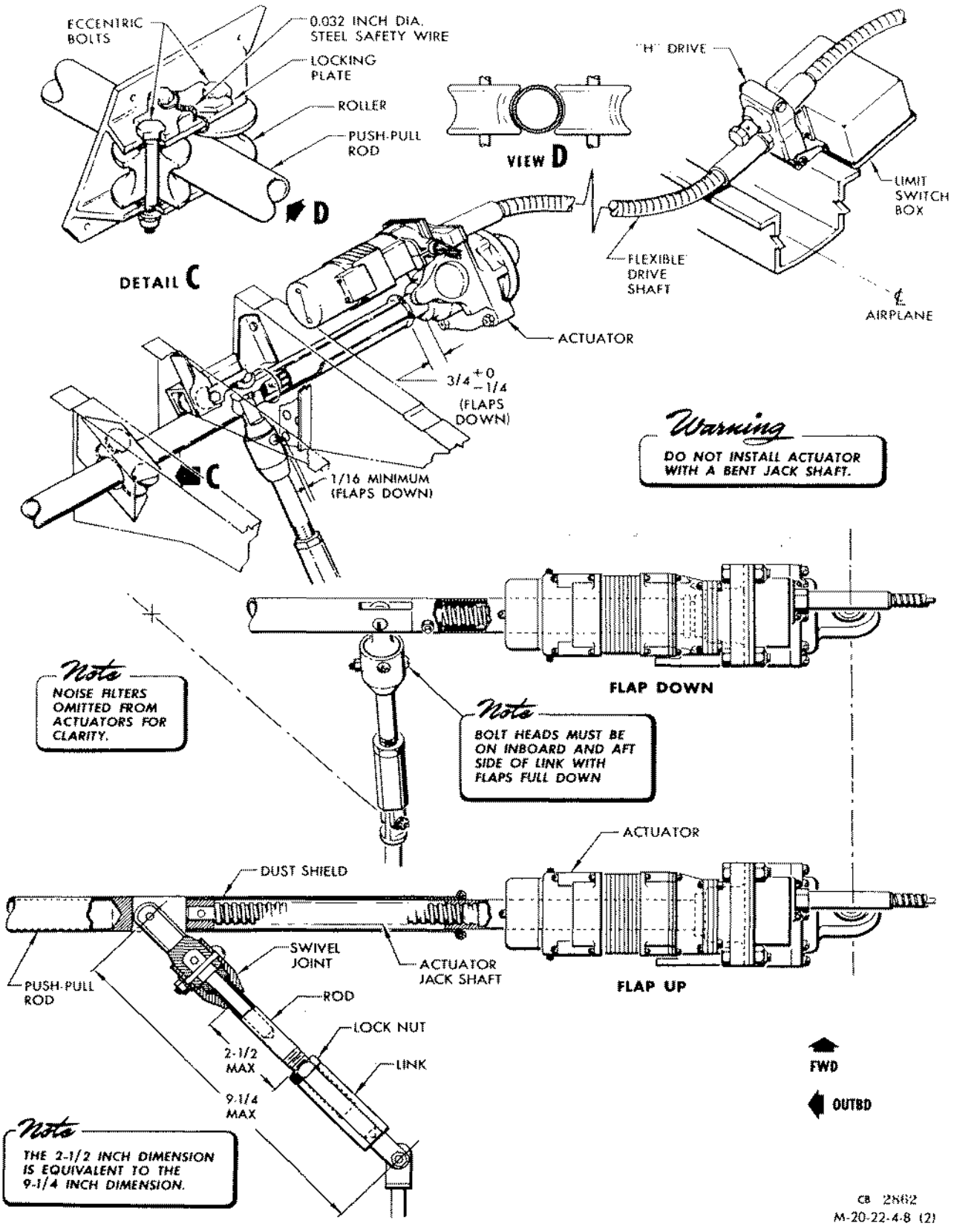


Figure 4-8. Wing Flap Installation (Sheet 2 of 3)

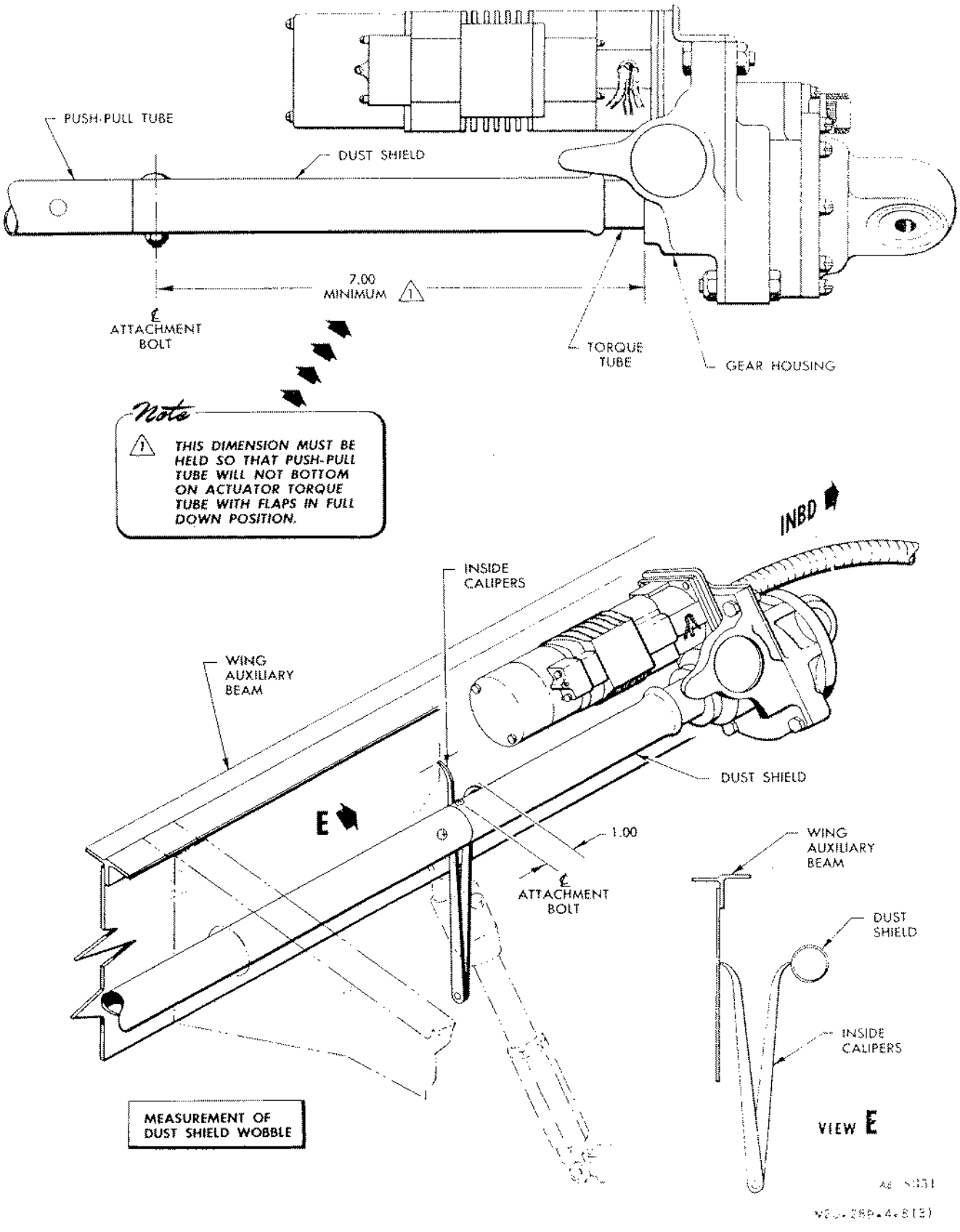


Figure 4-8. Wing Flap Installation (Sheet 3 of 3)

fuselage to the ailerons. Each wing flap is operated by a series of link rods connected to a push-pull tube which, in turn, is connected to an electrically driven linear actuator. The actuators are mounted on either side of the fuselage near the inboard edge of the flaps and they extend through cut-outs in the fuselage skin into the wing. A dust shield is mounted on each actuator to protect the jackshaft from dust. On AF Serial Nos. 51-6628 and subsequent, a witness hole is drilled in the dust shield to allow inspection of jackshaft threads when flaps are in full down position. The actuators are interconnected by flexible shafts and an "H" drive assembly. The actuator circuit is controlled by a switch in each cockpit and by limit switches mounted on the "H" drive assembly. On airplanes prior to AF Serial No. 50-385 not incorporating T. O. 1T-33A-567, a mechanical position indicator is provided which consists of a Bowden cable connected to linkage at the inboard end of the left flap, and to an indicator on each cockpit left shelf. (See figure 4-9.) On airplanes AF Serial No. 50-385 and subsequent and airplanes incorporating T. O. 1T-33A-567, an electrically operated d-c selsyn position-indicating system is used. For adjustment of the instrument, refer to paragraph 4–1121. For electrical information on the system refer to paragraph 4–864.

4–32. Operation of the actuator motor to extend the flaps pulls the flap push-pull tube inboard forcing the links aft and down, extending the flaps. Maximum up and down travel of the flaps is determined by the limit switches, however the flaps may be stopped in any intermediate position by releasing the control switch.

CAUTION

The wing flap actuators are designed for intermittent duty only. Do not operate through more than one cycle without a one minute cooling period.

4–33. REMOVAL OF WING FLAPS. Special tools required: Slide hammer S10404 and hinge pin puller S34802.

a. Lower flap to full down position.

b. Prior to AF Serial No. 50-385 not incorporating T. O. 1T-33A-567, detach position indicator cable at inboard end of left flap. On AF Serial No. 50-385 and subsequent and airplanes incorporating T. O. 1T-33A-567, disconnect position transmitter link rear inboard end of left flap.

c. Disconnect link rods either at the flap or at the push-pull tubes.

Note

Each link is adjusted to the length required for its location on the flap. If links are to be removed, mark each to identify its location.

d. Remove two bonding jumpers between flap and wing. One jumper is just inboard of the outboard link rod. The other jumper is just inboard of second link rod from the inboard end of the flap.

e. Remove hinge-pin locking clip at center of flap.

f. Support flap at both ends. Using slide hammer S10404 and hinge-pin puller S34802 (figure 3-27), withdraw the two hinge pins and remove the flap.

4–34. INSTALLATION OF WING FLAPS. Support the flap at both ends and drive both hinge pins with an air hammer or slide hammer, S10404, and hinge pin puller S34802. Lubricate link-to-flap attachment with oil, Spec MIL-L-644A. Wipe off excess oil. Inboard end of flap must have a structure clearance of 0.12 to 0.18 inch. For clearances between flap and aileron, see figure 4-8. Reverse removal procedure for flap installation, and check operation and adjustment.

CAUTION

Clearance is to be measured through the entire section to prevent binding.

4–35. REMOVAL OF WING FLAP PUSH-PULL TUBE.

a. Perform procedure as outlined in paragraph 4–37, steps a through d.

b. If left push-pull tube is to be removed, detach position indicator linkage. Prior to AF Serial No. 50-385 not incorporating T. O. 1T-33A-567, detach indicator cable at inboard end of left flap. On AF Serial No. 50-385 and subsequent and airplanes incorporating T. O. 1T-33A-567, disconnect transmiter link near inboard end of left flap.

c. Disconnect link rods at push-pull tube.

Note

Do not change length of links.

d. Remove aileron. (Refer to paragraph 4–24.)

e. Pull push-pull tube outboard through lightening hole in aileron-to-wing flap joint rib.

4–36. INSTALLATION OF WING FLAP PUSH-PULL TUBE. Reverse removal procedure.

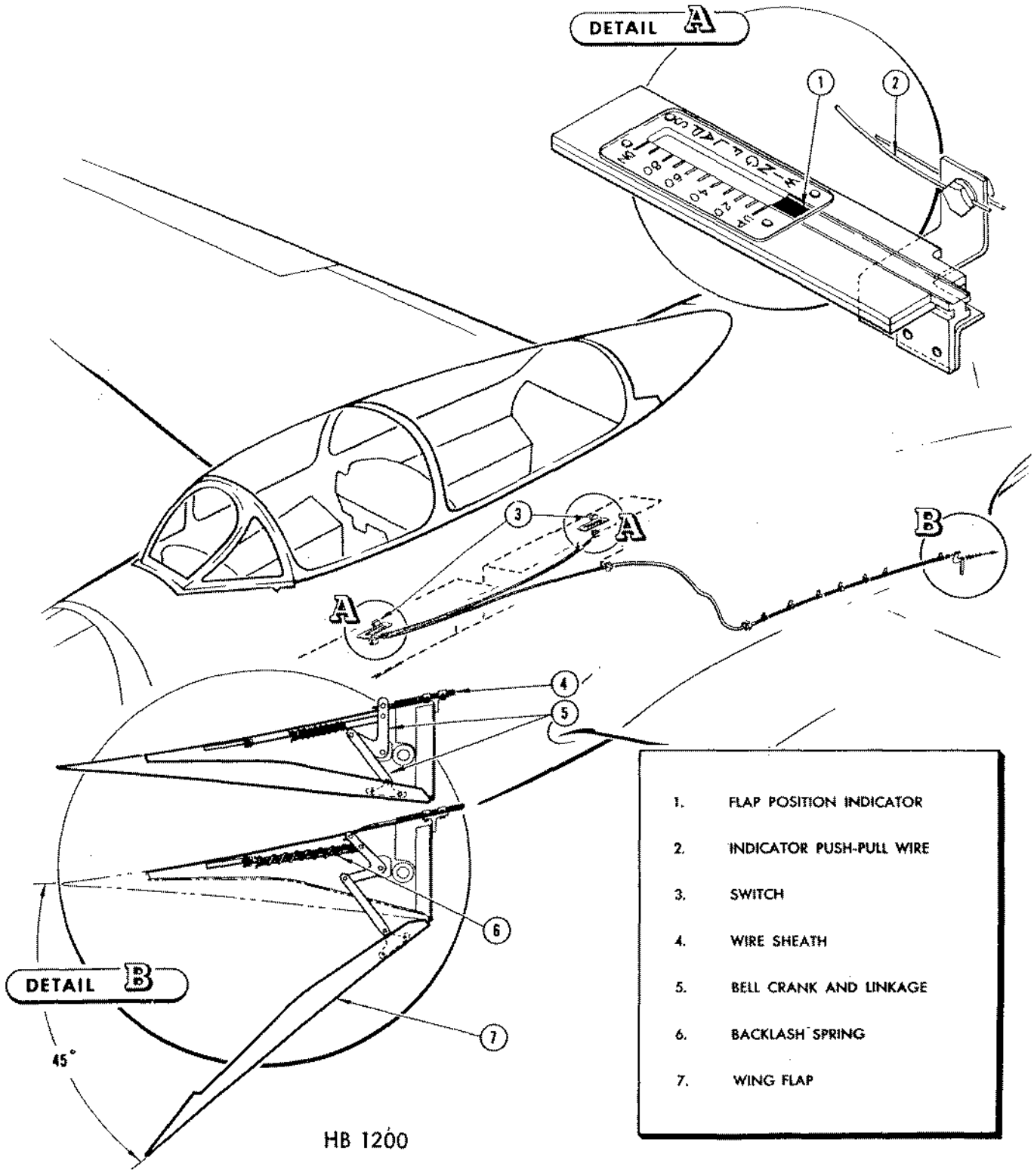


Figure 4-9. Wing Flap Position Indicator, Prior to AF Serial No. 50-385 Not Incorporating T. O. 1T-33A-567

Note

With "H" drive in same position as when push-pull tube was removed, extend actuator to length measured prior to push-pull tube removal.

4–37. REMOVAL OF WING FLAP ACTUATOR.

a. Lower flaps to approximately full down position.

Note

Flaps must be lowered enough to remove the push-pull-tube-to-jackshaft attachment bolt.

b. Open actuator boot.

c. Measure distance along actuator jackshaft between center of bolt at jackshaft-to-push-pull-tube attachment and point where jackshaft torque-tube enters actuator gear housing. Record this measurement.

d. Remove cotter pin, nut, and bolt attaching actuator jackshaft and dust shield to push-pull tube.

e. Detach push-pull tube from actuator jackshaft and dust shield by raising flap slightly, forcing push-pull tube outboard.

f. Disconnect three wires from filter terminals on actuator.

g. Disconnect actuator-to-fuselage bonding jumper at actuator.

h. Disconnect flexible drive shaft from actuator.

i. Remove nut, washer, and bolt attaching actuator to fuselage bracket and pull actuator outboard to remove.

Note

Raise flap slightly so that push-pull tube will be clear of actuator as actuator is removed.

4–38. CLEANING AND INSPECTION OF WING FLAP ACTUATING MECHANISM.

a. Remove all dust and grease from working parts.

b. Inspect push-pull tube rollers for proper alignment with tube. Washers in any combination as required may be used to obtain alignment and/or to compensate for excessive gap (0.045-inch maximum). Check rollers for excessive wear and freedom of rotation. Measure wear of rollers by attempting to insert a 1/16-inch diameter wire between rear roller and tube while pressing tube against front roller. If wire will go between roller and tube, adjust roller.

c. Inspect push-pull tube to be sure that it is straight and aligned with actuator jackshaft.

d. Remove jackshaft attaching bolt, disconnect push-pull tube from jackshaft and, without disturbing jackshaft adjustment, slide back dust shield and clean and inspect end of jackshaft for cracks and elongation of attachment hole.

CAUTION

Do not allow jackshaft to turn during this inspection.

e. If actuator is removed, wash threaded portion of actuator jackshaft with solvent, Federal Specification P-S-661. Inspect for bent or cracked shaft and for elongation of attachment hole.

Note

After completion of inspection, lubricate threaded portion of jackshaft with grease, Specification MIL-G-23827.

CAUTION

Exercise caution when using grease, Specification MIL-G-23827, to see that it does not come in contact with and soften paint, natural rubber, neoprene, and electrical insulating materials.

f. Inspect flexible shafts for kinks or worn spots.

4–39. WING FLAP "H" DRIVE. This unit, mounted on the fuselage lower longeron is connected to each flap actuator with a flexible shaft. Limit switches are included as a part of the assembly.

4–40. REMOVAL OF WING FLAP"H" DRIVE.

a. Open access door No. 65 (figure 3-1), and remove electrical receptacle from limit switch box.

b. Disconnect both flexible shafts from the "H" drive.

c. Remove two bolts that attach "H" drive to its mounting bracket and remove "H" drive.

Note

When "H" drive is installed, flap actuators and limit switches must be properly synchronized and adjusted. (Refer to paragraph 4-42.)

4–41. INSTALLATION AND ADJUSTMENT OF REPLACEMENT WING FLAP ACTUATOR. Special tools required: Bubble protractor and inside calipers.

CAUTION

If a new dust shield is to be installed, make certain attaching bolt holes are drilled in the proper location on the dust shield to insure that attaching bolt will engage actuator jackshaft and push pull tube, so that the 7.00 in. minimum is maintained as shown in figure 4-8.

CAUTION

Never use hand drill motor for driving the spline adapter. Use only hand drill or wrench.

a. With dust shield on actuator, mount replacement actuator in fuselage bracket and, working through access door No. 66 (figure 3-1), bolt actuator in place.

CAUTION

Be sure actuator jackshaft is fully retracted before installing actuator to prevent jackshaft from hitting push-pull tube and damaging jackshaft or push-pull tube. Install only actuators with a predrilled attachment hole in the jackshaft. Exercise caution during installation and adjustment of actuator to avoid bending jackshaft. If shaft is bent during installation or adjustment, replace actuator with serviceable unit.

b. Turn actuator jackshaft by hand to obtain length as measured in paragraph 4–37, step c.

c. With jackshaft in this position, slide dust shield over jackshaft and carefully slide push-pull tube into place over end of jackshaft.

CAUTION

Jackshaft and push-pull tube must be in alignment to prevent bending jackshaft. Refer to paragraph 4–42, step l for alignment procedure.

Note

On AF Serial Nos. 51-6628 and subsequent, locate dust shield so that witness hole in dust shield is towards flap when flap is full down.

d. With hole in push-pull tube aligned with hole in dust shield and hole in jackshaft, install bolt, nut, and cotter pin securing push-pull tube to jackshaft.

CAUTION

Bolt should slide into place easily. Do not drive bolt.

e. Connect flexible shaft from "H" drive to replacement actuator and safety wire shaft attaching nut to structure.

f. Connect bonding jumper between actuator and structure. Pull draw string on actuator boot.

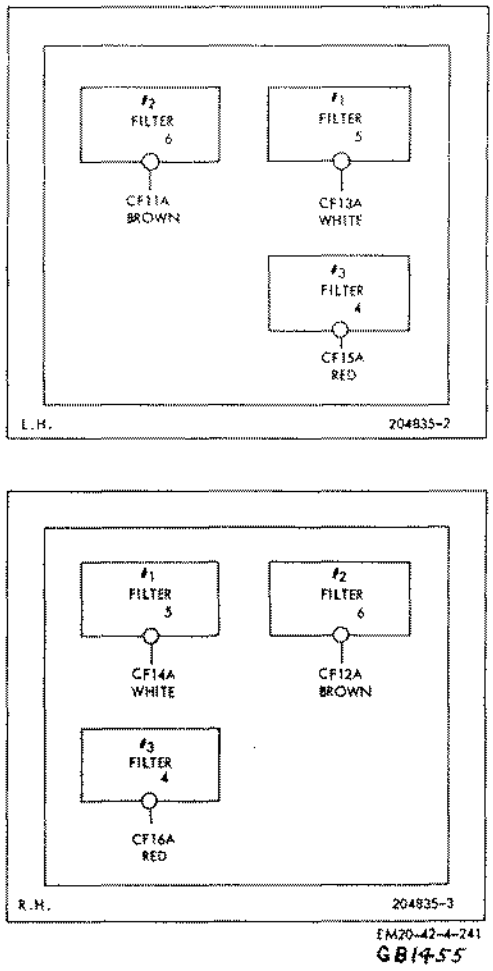


Figure 4-10. Wing Flap Actuator Decal

g. Connect three wires to filter terminals on actuator. (See figures 4-10, and 8-80 through 8-84.) A decal on the fuselage shows correct wiring.

Note

On airplanes AF Serial No. 53-6067 through 53-6152 and 55-3100 and subsequent, decals are similar to figure 4-10. Prior serials do not indicate terminals 4, 5 and 6. Color code dots are illustrated to assist rewiring if terminal numbers are not indicated on replacement actuator.

h. Using control switch, retract flaps fully and be sure they contact wing trailing edge simultaneously. Extend flaps and check for proper angle.

i. Check actuator jackshaft for wobble. (Refer to paragraph 4–42, step x.)

4–42. INSTALLATION AND ADJUSTMENT OF WING FLAP ACTUATING MECHANISM. *(See figures 4-8 and 4-9.)* Special tools required: Male spline adapter S35703, special male spline adapter, female spline adapter S35704, bubble protractor, and inside calipers.

Note

This procedure applies to airplanes that require a complete wing flap installation and adjustment.

The special male spline adapter may be made by welding the correct size drive socket to male spline adapter S35703 so that a torque wrench may be applied to the adapter.

a. With ailerons removed, insert push-pull tubes through lightening holes in aileron-to-wing flap joint ribs and guide tubes through rollers.

b. Install wing flaps (paragraph 4–34) but do not connect link rods.

c. Connect bonding jumpers between flap and wing.

d. Set inboard link to a length of approximately 9.13 inches (9.25 inches maximum) by turning clevis in or out. Measure length from center to center of attachment holes. Inspect links for bent eyebolts, elongated holes, or other signs of damage. See that eyebolts are free to rotate in their bushings. Replace defective eyebolts with serviceable parts. Install inboard link rod on push-pull tube.

Note

Distance between top of link-rod lock nut and bottom of clevis should be approximately $2\frac{7}{16}$ inches, but never more than $2\frac{1}{2}$ inches.

e. Adjust remaining links to same lengths as inboard link and connect to push-pull tube, but not to flap.

f. With dust shields on actuators, mount actuators on fuselage brackets and working through access doors Nos. 65 and 66 (figure 3-1), bolt actuators in place. Connect three wires to filter terminals on actuator. (See figures 8-81 through 8-84.) Decal near actuator shows correct wiring.

CAUTION

Be sure actuator jackshaft is fully retracted before installing actuator to prevent jackshaft from hitting push-pull tube and damaging jackshaft or push-pull tube.

Install only actuators with a predrilled attachment hole in actuator jackshaft. Exercise extreme caution during installation and adjustment of actuator to avoid bending actuator jackshaft. If jackshaft is bent during installation or adjustment, replace actuator with serviceable unit.

g. Connect link rods to flap. Back off attaching nuts so that rods are just free to rotate.

h. Lift flap up slightly and extend actuator jackshaft by hand until there is approximately $1\frac{3}{4}$ inches between jackshaft-to-push-pull tube attachment hole and outboard end of dust shield with dust shield pushed inboard. Lower flap until hole in end of push-pull tube lines up with hole in end of jackshaft.

CAUTION

Do not force tube onto jackshaft. If properly aligned, jackshaft and tube should mate easily.

i. Connect jackshaft and dust shield to push-pull tube with bolt, nut, and cotter pin.

CAUTION

Do not drive bolt. If holes are properly aligned, bolt should slide into place without forcing.

Note

On AF Serial Nos. 51-6628 and subsequent, locate dust shield so that witness hole in dust shield is towards flap.

j. Install "H" drive assembly including limit switch box.

k. Connect shaft to actuator and insert male spline adapter S35703 in end of flexible shaft. Driving adapter with a hand drill or wrench, lower the flap until center line of jackshaft attachment bolt is approximately in line with wing trailing edge inboard rib.

Note

Distance from center line of actuator attachment bolt to point where jackshaft torque tube enters actuator gear housing should be an absolute minimum of 7 inches. (See figure 4-8.)

l. Adjust rollers so that they are snug against tubes, but not binding, with tubes straight and in alignment with the actuator jackshafts. Adjust rollers as follows:

Note

If after adjustment of rollers any clearance exists between the roller and tube, replace worn rollers with a new roller and repeat adjustment procedure.

Working at outboard metal-roller bracket (bracket on wing beam) loosen locking plate attaching bolt and raise locking plate clear of roller eccentric bolts. Adjust rollers by turning eccentric bolts until rollers are contacting but not binding the tube.

Note

Position of eccentric bolt can be determined by location of two small dots on head of bolt.

Replace locking plate and attach it with locking-plate attaching bolt.

Working at outboard micarta-roller bracket (bracket on rib) loosen roller eccentric bolt nuts, and push bolts up so that bolt head clears locking plate. Adjust rollers by turning eccentric bolts until rollers are contacting but not binding the tube. Push down on bolts until bolt head is in locking plate, and tighten nuts.

Note

Adjust forward roller first. Be sure that locking-plate attaching bolt (on micarta-roller brackets) is safetied to locking plate with 0.032-inch diameter steel (cadmium plated) safety wire.

Adjust rollers on remaining brackets.

m. Insert male spline adapter S35703 in end of flexible shaft, and driving adapter with a hand drill or wrench, raise the flap until it nearly contacts the wing trailing edge, noting any misalignment between wing trailing edge and flap.

CAUTION

When retracting flap with hand drill use extreme caution when flap nears wing trailing edge. Do not retract flap tightly against wing when using drill.

n. If misalignment exists, extend flap and adjust links so that flap fairs evenly with wing trailing edge along the entire flap length. Adjust links by loosening lock nuts and turning threaded rods.

Note

Do not readjust inboard actuating link to more than 9¼ inches measured from center to center of attaching holes.

o. After links are properly adjusted, extend flap to approximately 3 inches below wing trailing edge.

p. Insert special male spline adapter into end of flexible shaft and using a suitable torque wrench on adapter, raise flap noting maximum torque required to turn flexible shaft.

CAUTION

If maximum torque required to drive the system exceeds 15 lb in. applied at the flexible shaft, misalignment or distortion of the push-pull tube, binding of the rollers or a bent jackshaft is indicated. Cause of the excessive torque must be located and corrected before proceeding with adjustment of system.

q. Continue raising flap until it is against wing trailing edge. Load flap against wing by turning flexible shaft to a torque of 4.0 ($\pm$1.0) lb in. more than that observed in step p. Remove adapter and torque wrench.

Note

If torque wrench is not available, rig a spring scale (figure 4-11) one-inch forward of flap trailing edge, one-inch outboard of the second rib from the inboard end of the wing flap. Pull down on scale and check force necessary to just break the flap from the wing. Required pull should be between 10 and 20 pounds. If less than 10 pounds, increase the flap loading against wing; if more than 20 pounds, decrease flap loading against wing.

r. Repeat steps l through q for other flap.

s. Insert female spline adapter S-35704 into "H" drive. Slowly turning the adapter by hand, turn "H" drive in the "up" direction until up limit switch "clicks" open. Stop turning immediately when "click" is heard.

Note

The "click" means that the up limit switch has opened. If the up limit switch is already open, back "H" drive off slightly, then turn adapter slowly until limit switch is heard to "click."

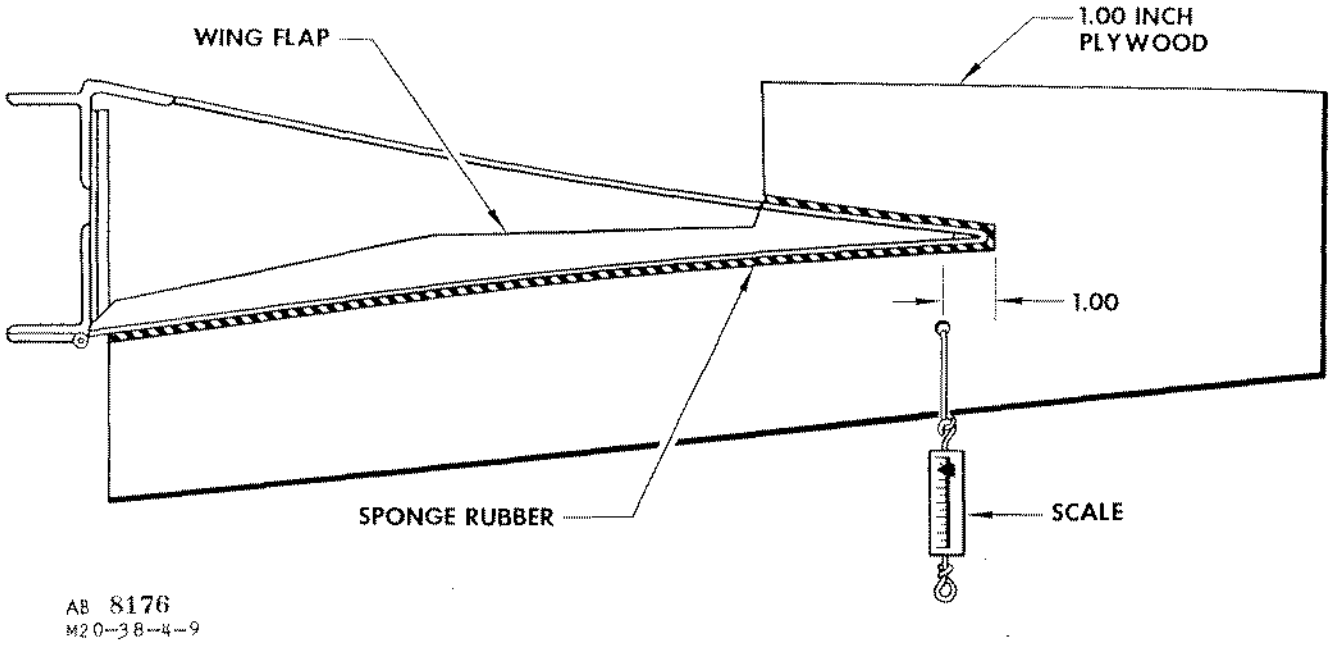


Figure 4-11. Wing Flap Loading

t. Connect flexible shafts from both actuators to "H" drive.

u. Extend flaps to full down position being careful not to allow actuator to bottom out in flaps down position. Adjust down limit switch (bottom switch in "A" on figure 4-165) so that with flap full down the distance from center line of actuator jackshaft attachment bolt to point where jackshaft torque tube enters actuator gear housing is an absolute minimum of 7 inches and flap angle is 45 (+2, —5) degrees (12.45 to 14.62 inches measured lineally near inboard end of flap as shown in figure 4–8). Adjust limit switch by turning adjustment screw with Allen wrench which is mounted in limit switch box. Rotate screw clockwise to decrease flap angle or counterclockwise to increase flap angle.

Note

Both flaps must be at the same angle at all times.

v. Check adjustment of down limit switch by retracting flaps about half way and then extending them to full down position. Check flap angle and jackshaft position as shown in step u.

Note

With flaps in full down position, distance between bolt head on the inboard actuating link and wing trailing edge inboard rib should be a minimum of $\frac{1}{16}$ inch.

On AF Serial Nos. 51-6628 and subsequent, with flaps in full down position, inspect jackshaft exposed threads through witness hole in dust shield. There should be a minimum of $\frac{1}{16}$ inch of threads exposed.

w. Apply "Glyptal" sealing compound, manufactured by General Electric Company, Lockheed Aircraft Corp. Specification 1-214, to the limit switch adjustment screws to insure better locking in position, and to indicate any change in setting.

x. Retract flaps fully and be sure they contact wing trailing edge simultaneously. While raising flaps, check actuator jackshaft for wobble. If no wobble is apparent, the installation is satisfactory. If any wobble is apparent, check wobble as follows:

Using control switch, lower flaps to full down position.

Insert inside calipers, or equivalent, between the aft face of the wing auxiliary beam and the forward side of the dust shield one inch inboard of the actuator-jackshaft-to-push-pull tube attachment point. (See figure 4-8.)

Using control switch, raise flap until jackshaft torque tube rotates through at least two revolutions. Take calipers out of airplane and place on linear scale. Record this minimum distance between auxiliary beam and dust shield.

Insert calipers between auxiliary beam and dust shield at same wing station as above.

Using control switch, raise flap a little at a time until maximum distance between beam and dust shield is obtained. Record this distance.

The second dimension less the first dimension will be the maximum wobble of the dust shield. Maximum permissible wobble is 0.040 inch. If wobble is greater than 0.040 inch, replace actuator with a serviceable unit.

y. Prior to AF Serial No. 50-385 on airplanes not incorporating T. O. 1T-33A-567, set Bowden cable on position indicators so that indicators will read zero at full up flap position. On AF Serial No. 50-385 and subsequent and on airplanes incorporating T. O. 1T-33A-567, set flap position transmitter so that indicators will read zero at full up flap position. Check indicators by operating flaps. (Refer to paragraph 4–1121.)

z. Secure draw string on actuator boot.

aa. Install ailerons. (Refer to paragraph 4–25.)

CAUTION

During adjustment do not operate flaps through more than one cycle without a cooling period of at least one minute.

4–43. OPERATIONAL CHECK OF FLAP ACTUATORS.

a. Disconnect flexible drive shafts from flap actuators and H-drive unit. Examine both male and female splines for galling and sheared splines. Replace worn flexible drive shafts and actuators and perform the following check.

b. Disconnect three wires from filter terminals on left actuator and with right actuator only, run flaps through a complete cycle, "up" and "down." Measure travel of both flaps. Connect electrical wires back to filter terminals on left actuator.

c. Disconnect three wires from filter terminals on right actuator. With left actuator only, operating, perform same operation as outlined in step b. Connect electrical wires back to filter terminals on right actuator.

d. Run flaps through a complete cycle, "up" and "down." Measure travel of both flaps. If it is found that there is a difference in the left or right flap travel when only one actuator is operating, or when both actuators are operating readjust flap actuating mechanism as outlined in paragraph 4–42.

4–44. For stall characteristics of the airplane, see paragraph 4–663.

4–45. TROUBLE SHOOTING OF WING FLAP ACTUATING MECHANISM.

Trouble	*Probable Cause*	*Remedy*
Flaps do not close completely.	Improper setting of limit switch.	Check setting of switch and adjust if necessary.
	Push-pull tube rollers out of alignment.	Adjust rollers.
	Link arm out of adjustment.	Adjust link arm.
Trailing edge of flap not straight.	Links out of adjustment.	Adjust link if trailing edge buckle is longer than 1 foot.
Flaps do not extend in from 9 to 12 seconds.	Binding in push-pull tube.	Readjust rollers so push-pull tube will be free.
	Actuator does not line up.	Align tube with actuator.
	Faulty actuator.	Replace actuator.
Intermittent action or complete failure.	Faulty actuator.	Replace actuator.

4–46. EMPENNAGE.

(See figure 4-12.)

4–47. DESCRIPTION OF EMPENNAGE. The empennage consists of a horizontal stabilizer, two elevators with their tabs, a vertical fin, and a rudder. Attachment to the fuselage aft section is by four shear type fittings, two mounted on the stabilizer front spar and two on the stabilizer rear spar. These fittings mate with similar fittings bolted to the upper portions of fuselage bulkhead rings, two at fuselage station 376 bulkhead and two at fuselage station 400 bulkhead. Smooth contours are provided by fillets riveted to the structure with the exception that the fin-to-stabilizer center fillets are fastened to the structure with screws to facilitate fin and stabilizer removal. Access to the empennage-to-fuselage attaching bolts is gained either by removing the horizontal stabilizer fillets or through the interior of the aft fuselage after the tail pipe has been removed.

4–48. REMOVAL OF EMPENNAGE.

a. Remove aft section. (Refer to paragraph 4–299, steps a through g.)

b. Remove the tailpipe. (Refer to paragraph 4–322.)

c. Remove screws attaching fillets to the stabilizer.

d. Through access panels Nos. 45 and 75 (figure 3-1) remove elevator control rods which extend through fin.

e. Disconnect rudder cables at rudder actuating arm at base of rudder torque tube. (See figure 4-124.)

f. Disconnect the elevator tab forward flexible drive shaft at the "T" drive on the stabilizer rear beam.

g. Disconnect wiring from the terminal panel in fairing under the rudder.

h. Remove fin tip and disconnect coaxial cable from bottom of antenna.

i. Disconnect clamp at command-radio antenna connector, and pull coaxial cable out of empennage.

j. Remove shroud from below empennage attaching bolts.

k. Support the empennage, and from within the fuselage remove the four attaching bolts, two at the stabilizer front spar and two at the stabilizer rear spar.

l. Remove the empennage by lifting it clear of the fuselage aft section. Weight is approximately 250 pounds.

4–49. INSTALLATION OF EMPENNAGE. Reverse removal procedure. Use Cherry blind self-plugging rivets where necessary for reinstallation of fillets. Torque the four attaching bolts to between 300 and 350 inch-pounds.

4–50. STABILIZER. *(See figure 4-13.)* The horizontal stabilizer is constructed as one unit with detachable tips. The left and right tips are interchangeable. The structure consists of a front spar and a rear spar interconnected by ribs, and extruded stringers which extend spanwise at the upper and lower surfaces. Support castings for hinging the elevators, and brackets for mounting the elevator tab jack screws are bolted to the rear spar.

4–51. REMOVAL OF HORIZONTAL STABILIZER. The stabilizer may be removed with the entire empennage as described in paragraph 4–48, or it may be detached from the fuselage aft section after the rudder, vertical fin, and elevators have been detached. (Refer to paragraphs 4–53, 4–61, and 4–71, for removal of elevators, vertical fin and rudder.)

4–52. ELEVATORS. *(See figure 4-13.)* The two elevators are joined at their inboard ends by torque tubes and a control horn assembly, and operate as a single unit. They are hinged on sealed, anti-friction bearings which are housed in brackets attached to the stabilizer rear spar. One external and two internal counterweights are provided at the forward edge of each elevator.

4–53. REMOVAL OF ELEVATORS.

a. Using elevator tab switch on control stick (figure 4-167), set trim tabs in neutral position. Observe green tab-neutral light on each instrument panel.

b. Remove stabilizer tips by removing eight screws attaching each tip to stabilizer.

c. At location of trim tab jack screw, remove four screws (two on top surface, two on bottom) which secure the outboard jack screw mounting bracket to stabilizer rear beam. Trim tab jack screw assembly is mounted on the horizontal stabilizer rear beam, but is removed with the elevator.

d. Remove access panel No. 75. Work through this opening to perform the following operations:

Disconnect elevator-tab flexible drive shaft at "T" drive coupling under stabilizer rear beam.

Support elevator, and remove four screws which attach elevator outer torque tube to control horn. (See figure 4-13.)

e. With elevator down, strike outboard on external counterweight with a shot bag. At same time, tap elevator spring tab mechanism inboard occasionally when elevator pulls it out of line. Work elevator outboard to free hinge pins from bearings, torque tube from control horn, and inner spring-tab torque tube from its horn. At same time, guide trim tab jackscrew clear of its inboard mounting by shifting it with a screw driver.

CAUTION

Do not pry on elevator hinges with a screw driver or sharp instrument, as hinge pin bearings are easily damaged.

f. When hinge pins, torque tube, and jackscrew have been freed, remove elevator by moving it outboard until torque tube has cleared hole in tail fillet.

4–54. INSTALLATION OF ELEVATORS. Reverse removal procedure. Be sure elevators, spring tabs, and the elevator control unit are all in neutral when splines on the spring tab torque tube engage splined horn. Be sure elevator trim tabs, actuator, and drive mechanisms are in neutral before connecting flexible drive shafts to "T" drive.

Note

Check tolerance of elevator hinge pins, maximum diameter of 0.2490 inch and a minimum

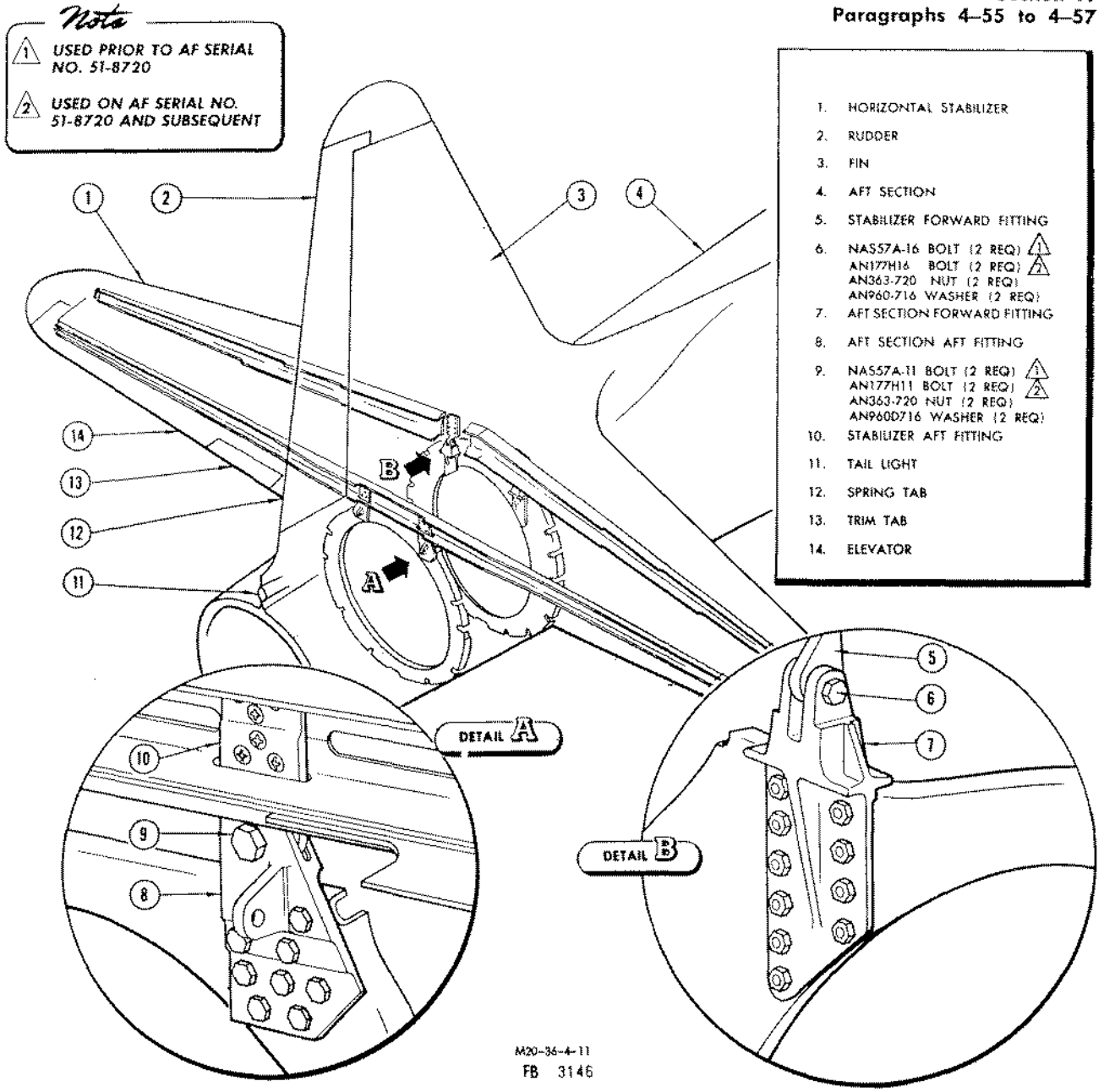


Figure 4-12. Empennage Installation

diameter of 0.2485 inch. Check tolerance of elevator hinge fitting hole, maximum diameter of 0.2511 inch and a minimum diameter of 0.2500 inch. Replace parts worn beyond these tolerances.

After elevator assembly has been installed, check the elevators for alignment. Misalignment should not exceed ½ degree difference between elevators. If either elevator exceeds ½ degree, remove and replace elevator with a serviceable item.

4–55. ADJUSTMENT OF ELEVATOR CONTROLS. (Refer to paragraph 4–649.)

4–56. ELEVATOR TABS. *(See figure 4-13.)* The elevator tabs consist of two electrically operated trim tabs and two spring controlled servo tabs. The tabs, mounted on piano type hinges, are on the inboard end of each elevator. The innermost tab of each pair is the spring tab. The tabs extend one inch beyond the trailing edge of the elevator.

4–57. REMOVAL OF ELEVATOR TABS. Special tools required: S34802 hinge pin puller and S10404 slide hammer.

a. Remove screws which attach actuating arms to faired fittings on lower surface of tabs.

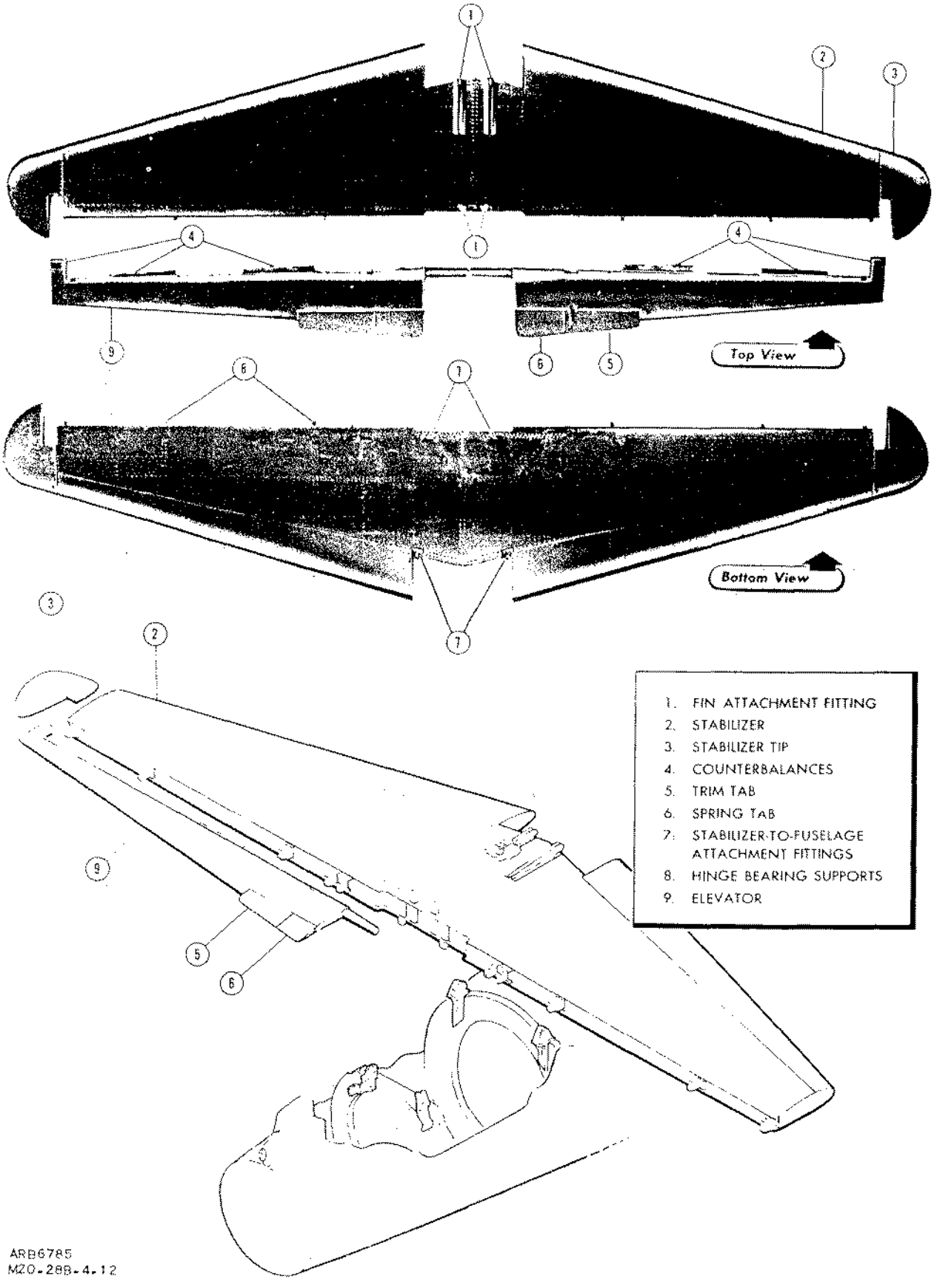


Figure 4-13. Elevator and Horizontal Stabilizer

b. Remove hinge-pin locking clip at inboard end of ...ng tab.

c. Remove hinge pin. Use hinge pin puller S34802 and slide hammer S10404. (See figure 3-29.)

d. Remove tabs by pulling them aft.

Note

Do not rotate jackscrew shaft after tab has been removed as tab rigging will be altered.

4–58. INSTALLATION OF ELEVATOR TABS. *(See figures 4-122 and 4-123.)*

a. Install tabs and hinge pins as described in paragraph 4–25, step c.

b. Install hinge pin locking clip at inboard end of hinge pin.

c. Install screws attaching actuating arms to faired fitting on lower surface of tabs.

d. Move electrically operated tab to neutral position.

e. On electrically operated tab (figure 4-122), distance from jackscrew shaft mounting lug to center of screw hole in end of shaft must be 7.75 inches when tab is in neutral. If necessary, unscrew cap, lift out key, and turn actuating shaft until this dimension is met.

f. Tabs must have the following clearances: between outboard tab and elevator, 0.12 (±0.031) inch; between the two tabs, 0.12 (±0.050) inch; between inboard tab and empennage structure, 0.12 (±0.031) inch.

4–59. ADJUSTMENT OF ELEVATOR TABS. Refer to paragraphs 4–649 and 4–650.

4–60. FIN. *(See figure 4-14.)* The fin is attached to the stabilizer upper surface with four shear pin fittings, two at the fin front beam and two at the rear beam. These fittings mate with similar fittings on the stabilizer front and rear beams. Two rudder hinge brackets, having sealed anti-friction bearings, are mounted in the rib structure at the aft edge. The removable leading edge section is attached with screws. The fin tip is attached to the upper end of the fin with eight screws. The leading edge of the fin is protected by an erosion-resistant neoprene coating.

4–61. REMOVAL OF FIN.

a. Remove the rudder. (Refer to paragraph 4–71.)

b. Remove fillets at the base of fin, and remove access panel No. 45. (See figure 3-1.)

c. Remove elevator control rods which extend through ...n.

d. Disconnect clamp at command-radio antenna connector, and pull coaxial cable out of empennage.

e. Support fin and remove four bolts attaching fin to horizontal stabilizer.

f. Remove the fin by lifting it straight up.

4–62. INSTALLATION OF FIN. Reverse the removal procedure. Torque the four attaching bolts to between 300 and 350 lb in.

4–63. ALLOWABLE REPAIR OF LAMINATED GLASS FABRIC-PLASTIC PARTS ON FIN. Repairs to such parts should be limited to the following:

a. Surface erosion only, with no penetration through any reinforcing layer; an unlimited area.

b. Erosion through only the first layer of reinforcing fabric; not more than a total area of one square inch within an area enclosed by a six-inch circle.

c. Pits extending through two or more layers of reinforcing fabric; individual pits not more than ¼-inch diameter, and total area pitted not more than one square inch within an area enclosed by a six-inch circle.

d. Long, narrow, eroded areas; not more than ¼ inch wide, no penetration through more than first layer of reinforcing fabric, no longer than 25 percent of the over-all dimension of the part, measured parallel to the eroded area.

e. For more extensive damage, or for damage which is considered dangerous to flight, replace the damaged part immediately.

Note

Antenna housings no longer used for communication purposes may be resurfaced in accordance with paragraph 4–80C.

4–64. REPAIR OF LAMINATED GLASS FABRIC-PLASTIC PARTS ON FIN.

Note

Repairs must be accomplished in a sheltered area protected from dust and weather, and at a temperature not lower than 15.5° C (60° F).

a. Trim loose or delaminated pieces, and sand to a smooth surface using No. 180 grit emery cloth or equivalent.

b. Clean the sanded surface with a dry-cleaning grade if trichlorethylene, Specification O-T-634, to remove oil or grease.

c. Apply filler, Filaplast No. P-24 manufactured by the Brooklyn Varnish Mfg. Co., to the depressions of the eroded area, using a spatula or knife to spread smoothly,

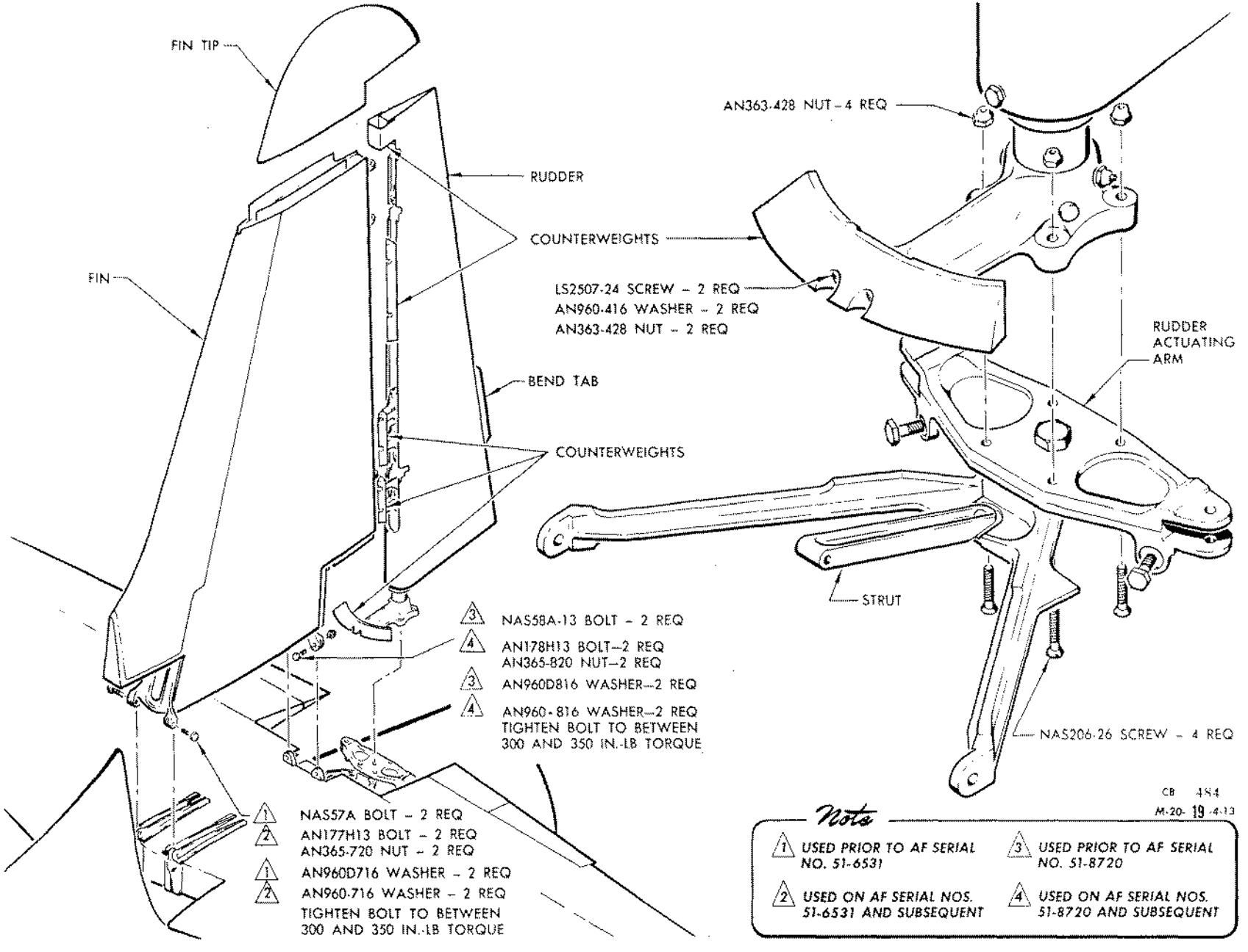


Figure 4-14. Fin and Rudder Removal

and allow filler to dry for one hour. If sink marks show in the filled-in areas, repeat the operation. Xylene, Specification TT-X-916, grade B may be used for thinning.

d. Remove excess filler by sanding. The prepared surface must have a dull appearance, and any glossy finish must be removed by sanding lightly. Remove dust by wiping with a clean lint-free cloth, and wash surface with toluene, Specification TT-T-548.

4–65. DELETED.

4–66. DELETED.

4–67. DELETED.

4–68. DELETED.

4–69. DELETED.

4–70. RUDDER. *(See figure 4-14.)* The rudder is hinged at four points, three along the rudder front spar, and one at the lower end of the torque tube. The lower hinge fitting is an integral part of the control quadrant which is attached to the torque tube. The bearing which supports the lower hinge fitting is contained in a cast truss assembly attached to the fuselage and horizontal stabilizer structures. The rudder is balanced by one external and three internal weights attached to the lower end of the torque tube. A bend tab is attached to the trailing edge.

4–71. REMOVAL OF RUDDER.

a. Through access panel No. 42 disconnect rudder cables at the quick disconnects.

b. Remove eight screws around the fin tip and remove tip. Remove antenna under fin tip by disconnecting cable under the antenna.

c. Remove access panel No. 75.

d. Remove two screws attaching lower counterweight to counterweight support arm, and remove counterweight.

e. Remove four screws attaching lower counterweight support arm to rudder actuating arm. If work is being done with tail pipe installed, an offset screw driver must be used to hold the screw heads under the actuating arm.

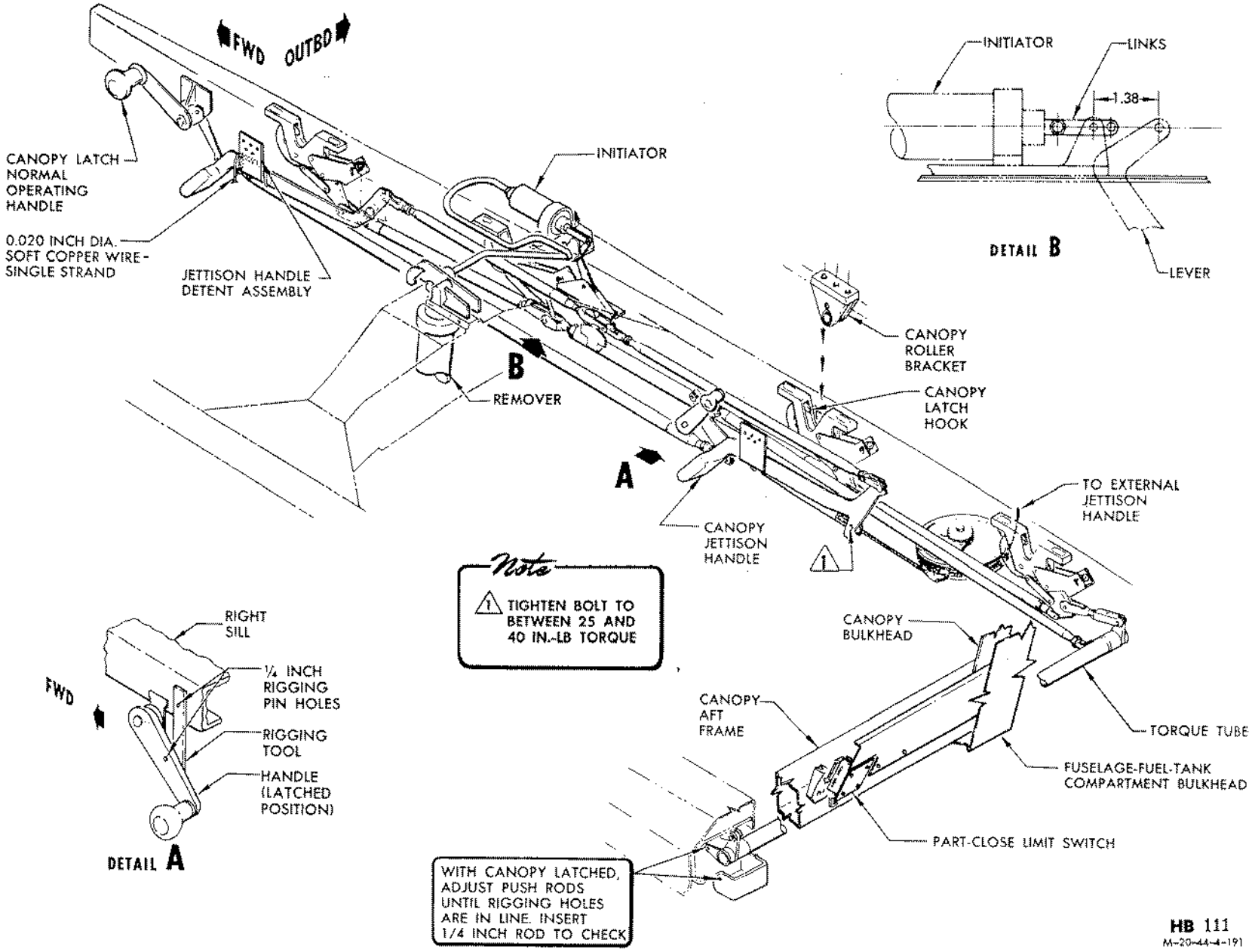


Figure 4-22. Canopy Mechanism, AF Serial No. 48-356 through 51-17556, 52-9335 through 5878 and 54-1522 through 54-2728, Except Airplanes Incorporating T.O. 1T-33A-264

4–92. REMOVAL OF CANOPY.

a. Disconnect sense antenna from airplane at canopy.

b. On T-33A-5 airplanes disconnect ARN-14 coaxial cable from balun at top aft inside end of canopy and remove clip attaching cable to left aft canopy frame.

WARNING

Be certain safety pins (0.080-inch diameter music wire) are installed in canopy initiator and seat initiators.

c. On AF Serial No. 53-5086 and subsequent, disconnect flood light and spot light wiring at terminal strip on left aft corner of canopy frame.

d. Disconnect hose from head of remover and canopy initiator.

e. On AF Serial No. 53-5879 through 53-6152 and 54-1584 and subsequent except 54-2689 through 54-2728, disconnect hose to thruster at canopy sill bracket. Install dust caps.

f. Remove bolt attaching remover to canopy yoke link.

g. With canopy closed but not latched, remove hinge cover plate and screw and washer used to safety each hinge pin. Screw a 1/4-28 screw into threaded head of each hinge and pull pins.

h. Lift off canopy.

4–93. RIGGING CANOPY LATCHES (PRIOR TO AF SERIAL NO. 53-5879).
(See figure 4-22.)

Note

Fabricate a tool from 5/16-inch sheet metal with 1/4-inch holes 3.90 inches on center.

a. With latches latched, insert tool between aft internal normal latch handle and sill in such a manner that one hole in tool aligns with hole in handle, and other hole aligns with hole in sill. Insert 1/4-inch pins in both holes.

b. Insert 1/4-inch pin through structure into lug in left end of torque tube.

c. Rig all link rods snug in this position so that there is a minimum of play.

Note

Be sure forward end of slot in rod does not contact bolt in aft jettison handle when jettison handle is in detent and normal latching handle is in unlocked position.

d. With latches and rods rigged for locked position, a minimum of one latch must contact latch-stop spacer when latch mechanism is in unlocked position.

e. If it is desired to rig initiator connections with the canopy closed, proceed as follows:

WARNING

Safety pin (0.080-inch diameter music wire) must be installed in initiator when airplane is on ground and must be removed just before flight and replaced immediately after flight.

Close and latch canopy.

Disconnect initiator links from lever. Position lever so hole in lever is 1.38 inch from hole in fitting.

Move jettison handles and latches to full open position.

Adjust jettison handle rods until idler link rests against lever. Be certain bushing on aft jettison handle is bottomed in override slot.

Restore mechanism for normal operation.

f. If it is desired to rig the initiator connections with the canopy open, proceed as follows:

Close canopy.

Disconnect initiator links from lever. Position lever so hole in lever is 1.38 inch aft of hole in fitting.

Open canopy just enough to slide a flat, square-ended plate between canopy frame and fuselage sill. Slide plate forward against aft face of lever and clamp plate in place. Open canopy to full open position.

Insert a small, square-ended plate through slot in sill to simulate the lever. Be certain this plate butts against the plate clamped on the fuselage sill, then clamp plate in place.

Rig aft jettison rod so idler link rests against the simulated lever, making certain that aft jettison handle is in full open (down) position with bushing on aft jettison handle bottomed in override slot.

Close latches and place aft jettison handle in detent assembly.

Adjust forward jettison rod so both handles fit properly in detent assemblies.

Remove plates and restore mechanism for normal operation.

Note

If ambient ground temperatures of −18° C (0° F) or lower are expected, a check at or below this temperature will be made to determine that adjustment is satisfactory.

4–94. RIGGING CANOPY DRIVE MECHANISM CHAIN ASSEMBLY.

a. Open canopy to extent that lift rollers are against stop brackets at top of tracks.

b. At a point approximately 10 inches below center of upper chain sprocket and with the pressure of one finger, deflect the chain aft to within 0.31 to 0.06 inch of forward face of track. Adjust idler sprocket to obtain proper tension in this portion of chain.

c. Lower canopy until lift rollers are between 1 and 3 inches from stop brackets at top of tracks.

d. At a point approximately 28 inches below center of upper chain sprocket and with the pressure of one finger, deflect the chain aft to between 0.62 and 1.00 inch of forward face of track. Adjust idler sprocket to obtain proper slack in this portion of chain.

Note

The left and right idler sprockets must be adjusted the same amount to prevent improper adjustment of the upper portion of the chains.

e. During extremely low temperatures eliminate slack in the "down" side of the canopy drive chain as follows:

Move idler sprockets down until all slack is eliminated in "down" side of chains.

Move idler sprockets up one serration on the backing plate and bolt in place.

4–95. CANOPY INSTALLATION AND ADJUSTMENT. *(See figure 4-21.)*

Note

Canopy seal may project below canopy frame from 0.00 to 0.090 inch. Gap between lower side of canopy and top of canopy sill may not be more than 0.094 inch. Gap between fuselage fuel tank cover and aft end of canopy may be between 0.060 and 0.170 inch.

a. Trim aft end of canopy to obtain proper fit with relation to fuselage fuel tank cover.

b. With canopy latching mechanism in latched position, measure distance between underside of each canopy latch hook and upper surface of fuselage sill.

c. Install shims between canopy roller brackets and canopy frame as necessary to provide proper clearances.

d. Unlatch canopy mechanism, place canopy in position on airplane, and install canopy hinge pins with index point on head of pins in down position.

dA. Attach canopy remover to canopy yoke. Install nut on bolt which attaches canopy remover head to canopy yoke finger tight only. Back off one castellation and install cotter pin.

Note

Self locking nuts are not authorized and if found installed will be replaced by a castellated nut.

dB. Make following connections:

(1) Connect sense antenna to airplane at canopy.

(2) On T-33A-5 airplanes, connect ARN-14 coaxial cable to balun at top aft inside end of canopy and install clip attaching the cable to left aft canopy frame.

(3) On AF Serial No. 53-5086 and subsequent, connect floodlight and spotlight wiring at terminal strip on left aft corner of canopy frame.

(4) On AF Serial No. 53-5879 through 53-6152, and 54-1584 and subsequent except 54-2689 through 54-2728, connect ballistic hose from airplane to thruster at canopy sill bracket.

Note

Assure that ballistic hose from thruster is not connected to canopy seal fitting or canopy seals will not inflate.

e. On AF Serial No. 50-429 and subsequent, turn the hinge pins to adjust the canopy laterally with respect to the windshield. If this adjustment changes the fit of the canopy frame to sill, adjust by moving shims from top to bottom, or bottom to top of hinge fitting. Install hinge-pin locking plate and fasten with screw. Lock-wire screw to locking plate.

Note

Prior to AF Serial No. 51-6819, it is necessary to remove the canopy to move the shims. On AF Serial No. 51-6819 and subsequent, it is not necessary to remove the canopy to move the shims, as access panels are installed over the hinges. Hinge pin index point (index mark on head of pin) may be turned a maximum of 90 degrees in either direction to adjust fit of canopy to sill.

f. Raise and lower canopy sufficiently to be certain that roller brackets will enter fuselage-sill cutouts without excessive rubbing at any latch point.

g. Latch canopy. All hooks must rotate freely into roller brackets without excessive rubbing. Latching must be possible with one hand from a normal sitting position.

Note

There must be a clearance of between 0.070 and 0.200 inch between canopy and windshield at 21 °C (70 °F) measured on center line of airplane. Gap may decrease 0.002 inch per .55° C (1.0° F) above 21 °C (70 °F) and increase 0.002 inch per .55°C (1.0°F) below 21 °C (70 °F). Windshield and canopy must be in same temperature area a minimum of two hours before measuring the gap.

h. Through witness hole in fuselage sill, check each latch hook for contact with roller. At least two hooks on each side must make positive contact. Clearance at the remaining hooks must not exceed 0.010 inch.

i. Install hinge pin access panels.

j. On AF Serial No. 40-901 and subsequent, proceed as follows:

k. Install safety pin (0.080-inch diameter music wire) in initiator.

l. Connect hose to neck of remover.

4–96. CANOPY OPERATIONAL CHECK.

a. Using the hand crank, raise and lower the canopy throughout its full range. There must be no evidence of sticking or binding.

b. Connect an external source of power to the airplane.

c. With the canopy closed, unlatch the canopy, then depress the canopy "OPEN" switch. The canopy shall open fully in six seconds, maximum.

d. Adjust canopy up limit switch so canopy remover adapter rollers do not contact canopy track upper stop brackets and so canopy uplock solenoid pin will enter tracks without contacting adapter rollers with rollers above solenoid pin.

Note

Manually release canopy uplock, located on the cross member between the cockpits, prior to closing canopy with hand crank. (See figure 4-22A.)

e. Operate the canopy switch to "CLOSED" position. There shall be no operation of the canopy actuator with the hooks open or closed.

f. Open the canopy latches and move the switch to "PART CLOSED" position. Adjust speed control rheostat on aft cockpit right shelf until the canopy moves to the partly closed position in four seconds maximum.

g. Close the canopy latches and move the switch to "CLOSED" position. The actuator must not operate.

h. Open the latches. The canopy shall close in two seconds maximum.

Note

Red warning lights in both cockpits must glow during operation of canopy, and whenever canopy latches are unlocked. When any canopy operation is initiated in one cockpit, it shall not be affected by operation of opposing switches in other cockpit.

i. Adjust canopy down limit switch so canopy actuator stops operating when bottom of canopy contacts fuselage sill.

j. Latch the canopy and operate the canopy "OPEN" switch. The canopy actuator must not operate.

k. Repeat the above electrical operations from the other cockpit.

l. Prior to AF Serial No. 54-1544, except Serial No. 53-5814 through 53-6152, disconnect external power source from airplane. Repeat above electrical operations from external switches.

CAUTION

Do not operate canopy external switches while external power source is turned on or the airplane batteries may be damaged.

m. On AF Serial No. 53-5814 through 53-6152 and AF Serial No. 54-1544 and subsequent, lock canopy, using external locking handle. Place canopy open switch in the "OPEN" position. Actuator must not operate. Place canopy close switch in "CLOSE" position. Canopy actuator must not operate.

4–97. (Deleted)

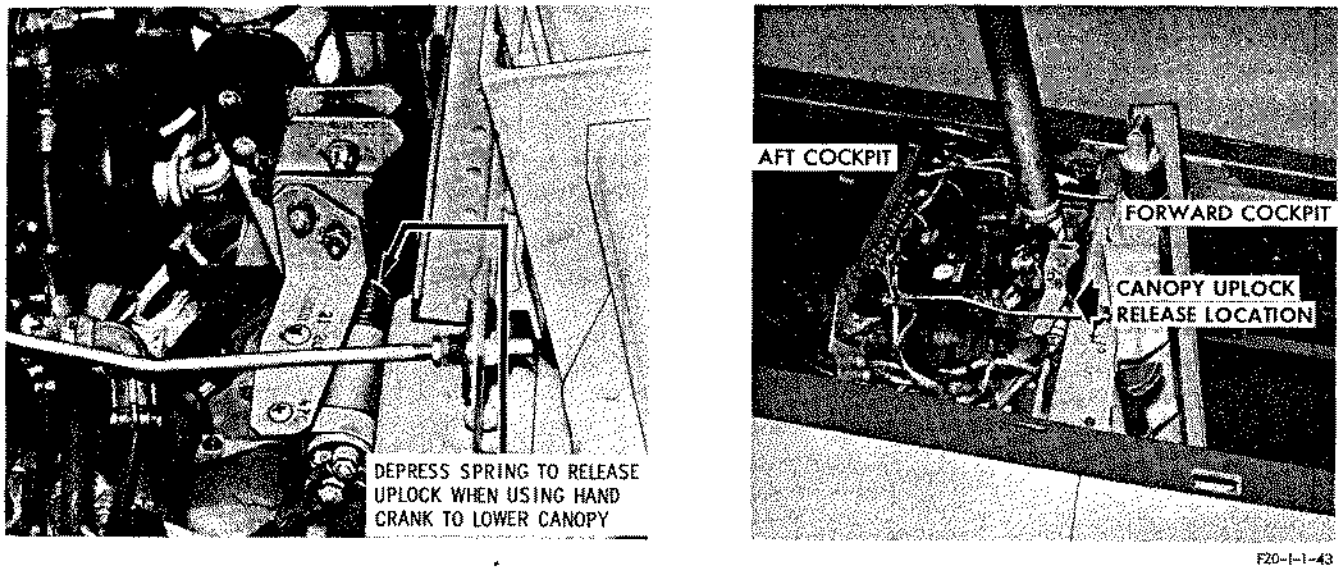


Figure 4-22A. Canopy Uplock Release

4–98. CANOPY JETTISON CHECK (AF SERIAL NO. 48-356 THROUGH 51-17556, 52-9335 THROUGH 53-5878 AND 54-1522 THROUGH 54-2728 EXCEPT AIRPLANES INCORPORATING T.O. 1T-33A-264).

WARNING

Be sure flagged safety pins (0.080-inch diameter music wire) are installed in canopy and seat initiators. Make certain that sear pin is bottomed in initiator and that safety pin is in groove of sear pin and not behind shoulder of sear pin. If safety pin is not in groove of sear pin, the initiator is in armed position. Care should be taken not to pull initiator sear pin at any time.

a. Raise canopy to full-open position.

b. Station a man in forward cockpit and another man at canopy external hand crank. Close and latch canopy.

c. Disconnect initiator links from lever.

d. Apply a slight upward pressure using external hand crank. Actuate jettison handle in forward cockpit and check for the following:

Jettison handle for not less than 25 and not more than 50 pounds pull to move handle out of detent. This pull may be measured at the center of the handle grip, normal to the grip, and in the plane of the handle travel. Measure pull, using a follow indicator type fish scale.

Note

If 25 to 50 pounds pull tolerance cannot be met, jettison handle may be filed at detent location to lower the amount of pull necessary to disengage handle from detent. If pull force is below 25 pounds, it will be necessary to replace either the detent or its spring, or both.

At end of jettison handle travel, distance between hole in lever and hole in aft end of initiator links should be between 1.00 and 1.08 inches and latches should be completely open.

e. Repeat above procedure using aft jettison handle.

Note

Be sure forward end of slot in rod does not contact bolt in aft jettison handle when jettison handle is in detent and normal latching handle is in unlocked position.

f. Repeat steps a through d using external jettison handle.

Note

Be sure to re-rig external jettison handle cable. (See figure 4-20.)

g. Connect links to lever.

h. Restore jettison mechanism for normal operation and safety in the following manner:

Using a piece of 0.020-inch diameter soft copper wire, make ONE loop around forward jettison lever just aft of jettison lever support. Pass both ends over shelf of jettison lever support and make ONE loop around jettison lever forward of jettison lever support, and twist wire.

Using a piece of 0.020-inch diameter soft copper wire, safety external jettison cable by making two loops through cable end and existing bracket and twist wire. Be sure cable drum is wound properly and cable has ½-inch slack.

4–99. CANOPY NORMAL OPERATING MECHANISM. *(See figure 4-21.)* An actuator assembly consisting of an electric motor geared down to drive a sprocket gear is mounted on the structure just forward of the aft instrument panel. This sprocket gear drives a counter shaft on which is mounted other sprocket gears which, by means of idler pulleys and chains, raise the remover in its tracks. The top of the remover is linked to the canopy yoke.

4–100 through 4–104. Deleted.

4–105. CANOPY JETTISON MECHANISM (AF SERIAL NO. 48-356 THROUGH 51-17566, 52-9335 THROUGH 53-5878, 54-1522 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728 EXCEPT AIRPLANES INCORPORATING T.O. 1T-33A-264). *(See figure 4-21.)* The canopy is jettisonable by an explosive initiator and a remover. A yellow handle in each cockpit, above the right shelf, or the external handle accessible from the right side of the airplane under door No. 93 (figure 3-1) may be used to jettison the canopy. Movement of the external handle or a cockpit handle pulls the sear pin in the initiator (on the canopy right frame) which allows the firing pin in the initiator to strike the explosive cartridge. The gas pressure from the initiator enters and fires the remover which jettisons the canopy.

WARNING

The canopy can be jettisoned from a closed and latched position only.

4–106. CANOPY REMOVER. This type M-3 remover is similar in design to the removers used previously, except that the neck of this remover has a plumbing connection, no sear lever, and no safety pins. The only safety pin in the system is installed in the neck of the initiator.

4–107. REMOVAL OF CANOPY REMOVER.

a. Run canopy full open.

WARNING

Be certain safety pin (0.080-inch diameter music wire) is installed in neck of initiator. If safety pin is not in groove of sear pin, the initiator is in armed position.

b. Disconnect hose from forward side of neck of remover.

c. With weight of canopy held by canopy support at forward end, remove bolt attaching head of remover to canopy yoke.

d. Remove four screws and connector plate on either left or right side of adapter near bottom of remover.

e. Slide remover outboard until opposite connector plate is disengaged. Lift remover out of airplane.

4–108. INSTALLATION OF CANOPY REMOVER. Reverse removal procedure.

CAUTION

Do not remove safety pin from initiator until just before flight and replace it immediately after flight.

Note

Adjust screws on top of adapter so that remover lines up with adapter; i.e., looking at side of remover, the remover must be in alignment with adapter.

4–109. INITIATOR (AF SERIAL NO. 48-356 THROUGH 51-17556, 52-9335 THROUGH 53-5878, 54-1522 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728, EXCEPT AIRPLANES INCORPORATING T.O. 1T-33A-264). The initiator is mounted on the canopy right frame near the canopy yoke. For further information on the initiator, refer to paragraph 4–1139.

4–110. CANOPY JETTISON MECHANISM (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT AND ON AIRPLANES INCORPORATING T.O. 1T-33A-264, EXCEPT 54-2689 THROUGH 54-2728). *(See figures 4-23 and 4-24.)* The canopy is jettisoned by an explosive initiator and a remover. A yellow tee-handle located below and just outboard of the arming lever (right arm rest) of each seat is provided to jettison the canopy without arming the seat. The tee-handle along with the cable that leads down from the seat arming lever is connected to the sear pin of a thruster initiator which is mounted on a bracket attached to the cockpit floor outboard of each seat. When the tee-handle is pulled the sear pin will in turn be pulled from the thruster initiator allowing the firing pin to strike the explosive charge. The gas pressure created by the explosion of the thruster initiator charge enters and fires the M5A2 thruster, causing the piston rod end to be forced out, striking a lever which actuates the canopy latches to the unlocked position and simultaneously pulls the sear pin from the initiator of the canopy remover. The gas pressure created by the explosion of the canopy remover initiator charge, enters and fires the canopy remover, which jettisons the canopy.

4–111. An external handle (see figure 4-24) accessible from the right side of the airplane inside door No. 93 (see figure 3-1) is provided to jettison the canopy from the outside. The external handle is attached by a cable to an initiator located in the aft cockpit on the right side between the shelf and the canopy sill. A pull on the external handle will fire the initiator. The gas pressure created by the explosion of the initiator charge enters the M5A2 thruster. The remainder of the cycle of operation is the same as that covered in paragraph 4–110.

WARNING

The canopy can be jettisoned from either the closed or open position.

4–112. M5A2 THRUSTER (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT, EXCEPT 54-2689 THROUGH 54-2728). *(See figure 4-24.)* The M5A2 thruster is a gas-operated cylinder and piston containing an explosive cartridge, mounted inside the canopy frame on the right side just aft of the canopy yoke. The thruster's function is to unlock the canopy latches and simultaneously pull the sear pin from the canopy initiator. When any one of the canopy jettison handles is pulled or the seat arming lever (right arm rest) is raised, an initiator is fired, releasing an initial pressure of 5200 psi which enters and fires the M5A2 thruster.

4–113. REMOVAL OF M5A2 THRUSTER.

WARNING

The M5A2 thruster contains an explosive cartridge and must be handled as live ammunition.

a. Run canopy full open.

WARNING

Make sure red flagged safety pins (0.080-inch diameter music wire) are installed in canopy and seat initiators.

b. Disconnect hose from canopy initiator to remover. Install dust caps.

c. Disconnect canopy initiator from thruster piston rod end by removing pin at connection of clevis and initiator sear pin.

d. Disconnect hose to thruster cylinder at canopy sill bracket. Install dust caps.

e. Remove screws from thruster cover and slide cover up on hose far enough to disconnect hose at forward end of thruster cylinder. Install dust caps.

f. Remove thruster cover and canopy initiator as a unit.

g. Remove 8 screws that extend through bottom face of canopy frame into thruster support brackets.

h. Remove thruster.

WARNING

Loaded thrusters must be placed in shipping containers for storage, and stored and handled as live ammunition. Any thruster showing any evidence of damage should be turned over to the Base Ordnance Officer for disposition.

4–114. INSTALLATION OF M5A2 THRUSTER. Reverse removal procedure.

WARNING

The M5A2 thruster contains an explosive cartridge and must be handled as live ammunition.

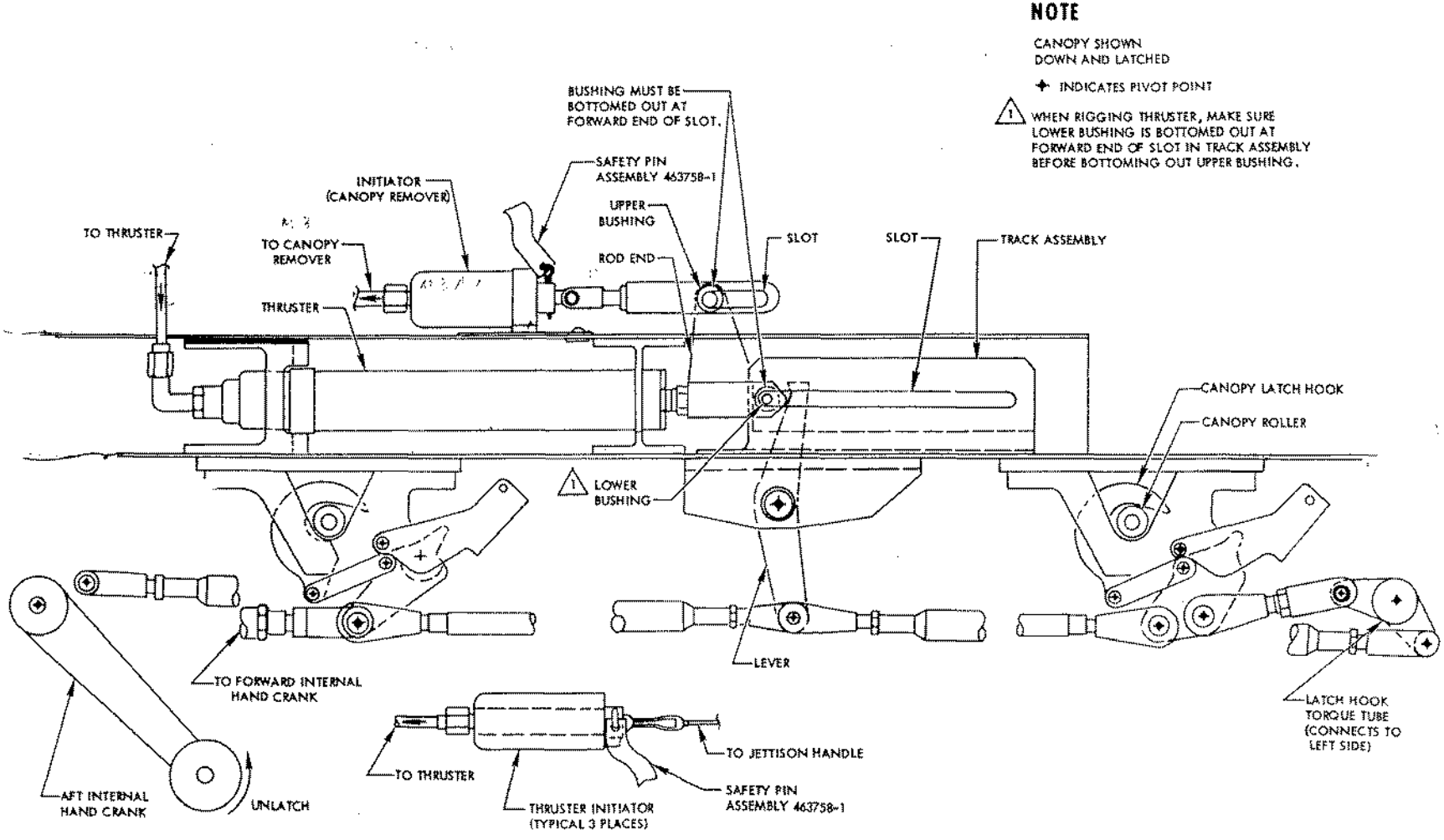


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Figure 4-23. Canopy Mechanism Schematic, AF Serial No. 53-5879 through 53-6152 and 54-1586 and Subsequent, and on Airplanes Incorporating T.O. 1T-33A-264 Except 54-2689 through 54-2728

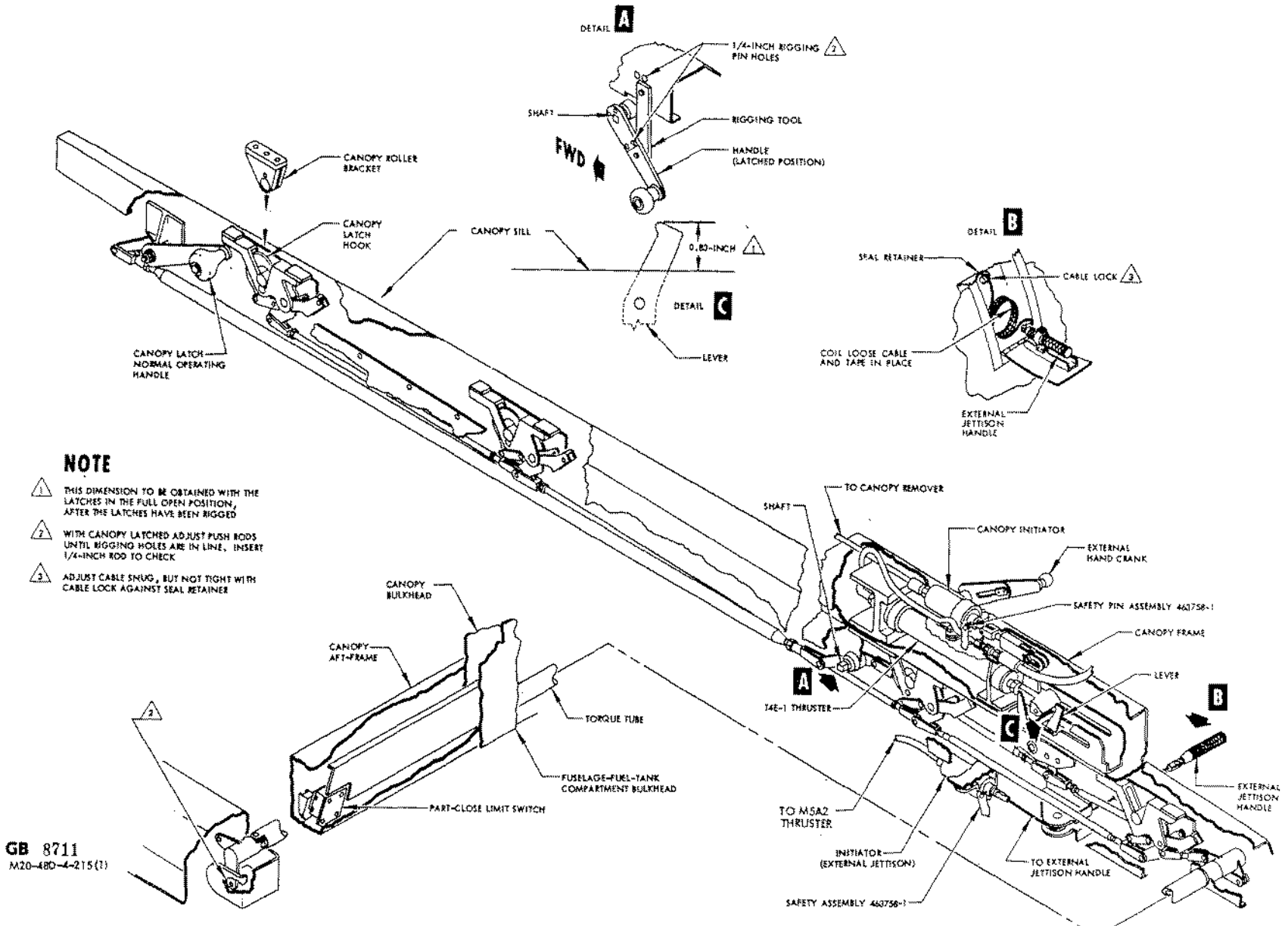

Figure 4-24. Canopy Mechanism, AF Serial No. 53-5879 through 53-6152 and 54-1586 and Subsequent and on Airplanes Incorporating T.O. 1T-33A-264, Except 54-2689 through 54-2728 (Sheet 1 of 2)

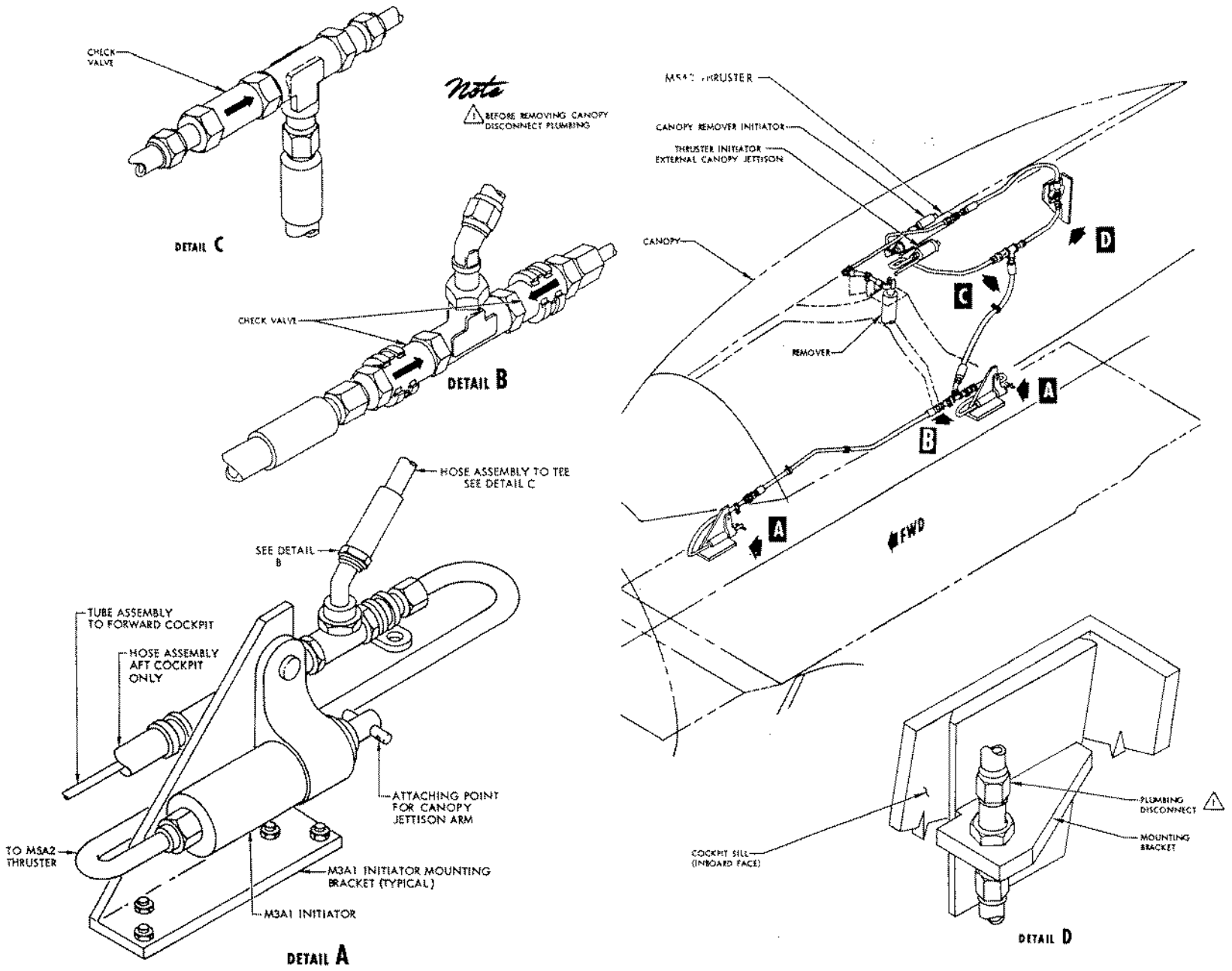

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Figure 4-24. Canopy Mechanism, AF Serial No. 53-5879 through 53-6152 and 54-1586 and Subsequent and on Airplanes Incorporating T.O. 1T-33A-264, Except 54-2689 through 54-2728 (Sheet 2 of 2)

Note

To assure alignment of thruster rod end in the track assembly, make certain the distance between the thruster cylinder barrel and inside bottom face of canopy frame is held to 0.683-inch. Two shims on top of forward mount may be shifted from top to bottom of mount to obtain the above dimension. (A maximum of four shims is permissible.)

4–115. CANOPY INITIATOR (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT, AND ON AIRPLANES INCORPORATING T.O. 1T-33A-264, EXCEPT 54-2689 THROUGH 54-2728). *(See figure 4-24.)* The initiator for the canopy remover is mounted on the cover of the M5A2 thruster located on the right canopy frame just aft of the canopy yoke. The initiator sear pin is connected to the thruster piston rod end by a link rod with the clevis end pinned to the initiator sear.

4–116. REMOVAL OF CANOPY INITIATOR.

WARNING

Make sure initiator has a red flagged safety pin (0.080-inch diameter music wire) installed through hole in neck.

a. Disconnect hose. Install dust caps.

b. Disconnect link rod from initiator sear pin by removing clevis pin.

c. Remove two nuts from initiator mount.

d. Remove initiator.

4–117. RIGGING OF M5A2 THRUSTER AND INITIATOR (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT, AND ON AIRPLANES INCORPORATING T.O. 1T-33A-264, EXCEPT 54-2689 THROUGH 54-2728). *(See figure 4-23.)*

WARNING

The thruster contains an explosive cartridge and must be handled as live ammunition. Make sure flagged safety pins (0.080-inch diameter music wire) are installed in canopy and seat initiators. Make certain that sear pin is bottomed in initiator and that safety is in groove of sear pin and not behind shoulder of sear pin. If safety pin is not in groove of sear pin, initiator is in armed position. Care should be taken not to pull initiator sear pin at any time.

a. Bottom out lower bushing of thruster piston rod end at forward end of slot in track assembly.

Note

To bottom bushing, loosen jam nut, turn piston rod clockwise (looking aft). Tighten jam nut. A maximum gap of 0.020-inch is permissible between bushing and end of slot.

b. Bottom out upper bushing of thruster piston rod end at forward end of slot in link rod.

Note

To bottom bushing, remove pin from clevis and initiator sear connection, loosen jam nut at link rod end and turn clevis counterclockwise (looking aft). Tighten jam nut and reconnect clevis to initiator sear. A maximum gap of 0.020-inch is permissible between bushing and end of slot.

4–118. RIGGING CANOPY LATCHES (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT, AND ON AIRPLANES INCORPORATING T.O. 1T-33A-264, EXCEPT 54-2689 THROUGH 54-2728). *(See figure 4-24.)*

Note

Fabricate a tool from $\frac{3}{16}$-inch sheet metal with ¼-inch holes 3.90-inches on center.

a. With latches latched, insert tool between aft internal latching handle and sill in such a manner that one hole in tool aligns with hole in handle, and other hole aligns with hole in sill. Insert ¼-inch pins in both holes.

b. Insert ¼-inch pin through lug in aft left end of torque tube.

c. Rig all link rods snug in this position so that there is a minimum of play.

d. With latches and rods rigged for the locked position, a minimum of one latch must contact the latch stop spacer when latch mechanism is in unlocked position.

e. After latches have been rigged and are in full open position, lever that extends through canopy sill must measure 0.83-inch from top most part of lever to canopy sill surface.

f. Adjust canopy rollers so that at least two rollers on each side make contact with latch hooks, with remaining rollers having a gap not exceeding 0.010-inch between roller and hook. (Measurements can be made through the witness holes in the canopy sill.)

4–119. M5A2 THRUSTER INITIATORS (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT, AND ON AIRPLANES INCORPORATING T.O. 1T-33A-264, EXCEPT 54-2689 THROUGH 54-2728). *(See figure 4-24.)* Three initiators, one located to the right of each seat on the cockpit floor and an external jettison initiator located in the aft cockpit on the right side between the shelf and the canopy sill, are interconnected through tubing and high pressure hose to the M5A2 thruster. When any one of the initiators are fired, an initial pressure of 5200 psi is released, enters and fires the M5A2 thruster.

4–120. CANOPY JETTISON CHECK (AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1586 AND SUBSEQUENT, AND ON AIRPLANES INCORPORATING T.O. 1T-33A-264, EXCEPT 54-2689 THROUGH 54-2728).

WARNING

Be sure flagged safety pins (0.080-inch diameter music wire) are installed in the canopy, thruster and seat initiators. Make certain that sear pin is bottomed in initiator and that safety pin is in groove of sear pin. If safety pin is not in groove of sear pin, the initiator is in armed position. Care should be taken not to pull initiator sear pin at any time.

Note

Before proceeding with canopy jettison check make certain the canopy jettison system is rigged as outlined in paragraphs 4–117 and 4–118.

a. Raise canopy to full open position.

b. Disconnect cables and plumbing from the two thruster initiators mounted on the cockpit floor, one to the right of each seat. (See figure 4-200.)

c. Disconnect cable and plumbing from the external jettison initiator, mounted in the aft cockpit on the right side between shelf and canopy sill.

d. Disconnect cables and plumbing from seat initiators.

e. Disconnect plumbing from canopy initiator.

f. With seat bucket bottomed, raise seat arming lever (right arm rest) to armed position. Cable end that was disconnected from thruster initiator must have traveled a minimum of 0.75-inch.

g. With seat bucket in full up position repeat step f.

h. Repeat steps d and e with aft seat.

WARNING

At no time is the trigger on the seat arming lever to be squeezed while the arming lever is in the up position.

i. Check external jettison cable for a minimum travel of 0.75-inch.

j. Restore jettison mechanism to normal operation.

4–120A. COCKPIT CANOPY JETTISON SYSTEMS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figures 4-24A and 4-24D.)* Two independent systems are provided to actuate the cockpit canopy jettison mechanism to jettison the canopy; the primary canopy jettison system and the secondary canopy jettison system.

CAUTION

Whenever any of the canopy ejection system hoses, tubing, check valves, fittings, adapters, connectors, or elbows are removed or replaced, an inspection for obstructions shall be made prior to installation. Purge with dry nitrogen at 50 psig through openings or visually inspect with a light to assure obstructions do not exist. Check valves shall be checked in both directions to assure free flow in one direction and no flow in the opposite direction. Assure that check valves are correctly installed to provide proper direction of flow.

4–120B. The primary canopy jettison system incorporates an M3A-1 initiator which is mounted on the right side of each ejection seat bucket and is connected through a link, to the right armrest. The initiator hose is routed to a disconnect which is mounted on the right rail of the seat. From the disconnect, the initiator hose is routed to the canopy jettison mechanism. The disconnect incorporates a lever which is tripped by a striker plate on the seat during ejection, automatically disconnecting the initiator hose. Actuation of the primary canopy jettison system is accomplished by pulling up on the right armrest. This action will pull the sear pin from the M3A-1 initiator on the seat, allowing the firing pin to strike the explosive charge. The gas pressure created by the explosion of the initiator charge enters and fires the M5A2 thruster, causing the thruster piston rod end to be forced out, striking a lever which actuates the canopy latches to the unlocked position and simultaneously pulls the sear pin from the M3A-1 canopy remover initiator. The gas pressure created by the explosion of this initiator charge enters and fires the canopy remover, which jettisons the canopy.

4–120C. *(See figure 4-24D.)* The secondary canopy jettison system incorporates a jettison handle mounted on the right side of the center pedestal in each cockpit and an external jettison handle mounted on the right side of the fuselage below the canopy sill. The handles in the cockpit are connected to an M3A-1 initiator by means of a teleflex cable and lever mechanism arrangement. Each handle can be operated independently to fire the initiator. The external jettison handle is connected to

the same lever mechanism by means of a cable. When any one of the three handles is pulled, the sear pin will be pulled from the initiator, allowing the firing pin to strike the explosive charge. The gas pressure created by the explosion of the initiator charge enters and fires the M5A2 thruster, causing the thruster piston rod end to be forced out, striking a lever which unlatches the canopy and simultaneously pulls the sear pin from the canopy remover initiator. The gas pressure created by the explosion of this initiator charge enters and fires the canopy remover, which jettisons the canopy.

WARNING

The canopy can be jettisoned from either the open or closed position.

4–120D. M5A2 THRUSTER (AIRPLANES INCORPORATING T.O. 1T-33A-615). Refer to paragraph 4–112.

4–120E. CANOPY REMOVER INITIATOR (AIRPLANES INCORPORATING T.O. 1T-33A-615). Refer to paragraph 4–115.

4–120F. M5A2 THRUSTER INITIATORS — PRIMARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615). Two M3A-1 initiators, one located on the right side of each seat bucket, are connected through tubing and high pressure hose to the M5A2 thruster. Each initiator sear pin is connected by linkage directly to the right armrest of the respective seat. When either one of the armrests is raised, the sear pin of the corresponding initiator is pulled, firing the initiator and releasing 5200 psi pressure which enters and fires the M5A2 thruster.

4–120G. REMOVAL OF M5A2 THRUSTER INITIATORS—PRIMARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figures 4-200K and 4-200L.)*

WARNING

Make certain that the ground safety pins are installed in the right armrests and the hole in the neck of each initiator before removal.

a. Disconnect hose from initiator.

b. Install dust caps.

c. Disconnect link rod from initiator firing pin by removing cotter pin and clevis pin.

d. Remove two bolts from initiator mount.

e. Remove initiator.

4–120H. INSTALLATION OF M5A2 THRUSTER INITIATORS — PRIMARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615). Reverse removal procedure.

4–120J. M5A2 THRUSTER INITIATOR—SECONDARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-24D.)* One M3A-1 initiator, located on the right side of the aft cockpit between the shelf and the canopy sill, is connected to the M5A2 thruster through tubing. The sear pin of the initiator is connected to the two canopy jettison handles in each cockpit by means of teleflex cables and a lever mechanism. The external canopy jettison handle is connected to the same lever mechanism by means of a cable. When any one of the handles is pulled, the initiator sear pin is pulled, firing the initiator. An initial pressure of 5200 psi is then released which enters and fires the M5A2 thruster.

4–120K. REMOVAL OF M5A2 THRUSTER INITIATOR—SECONDARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615).

WARNING

Make sure that the ground safety pin is installed through the hole of the neck of the initiator before removal.

a. Disconnect tubing from initiator.

b. Install dust caps.

c. Disconnect the link rod from the initiator firing pin by removing cotter pin and bolt.

d. Remove two bolts from initiator mount.

e. Remove initiator.

4–120L. INSTALLATION OF M5A2 THRUSTER INITIATOR—SECONDARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615). Reverse removal procedure.

4–120M. RIGGING FORWARD COCKPIT SECONDARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615).

a. Insert first 70 inches of cable with jettison handle assembly into open end of conduit, leaving approximately 39 inches of cable exposed.

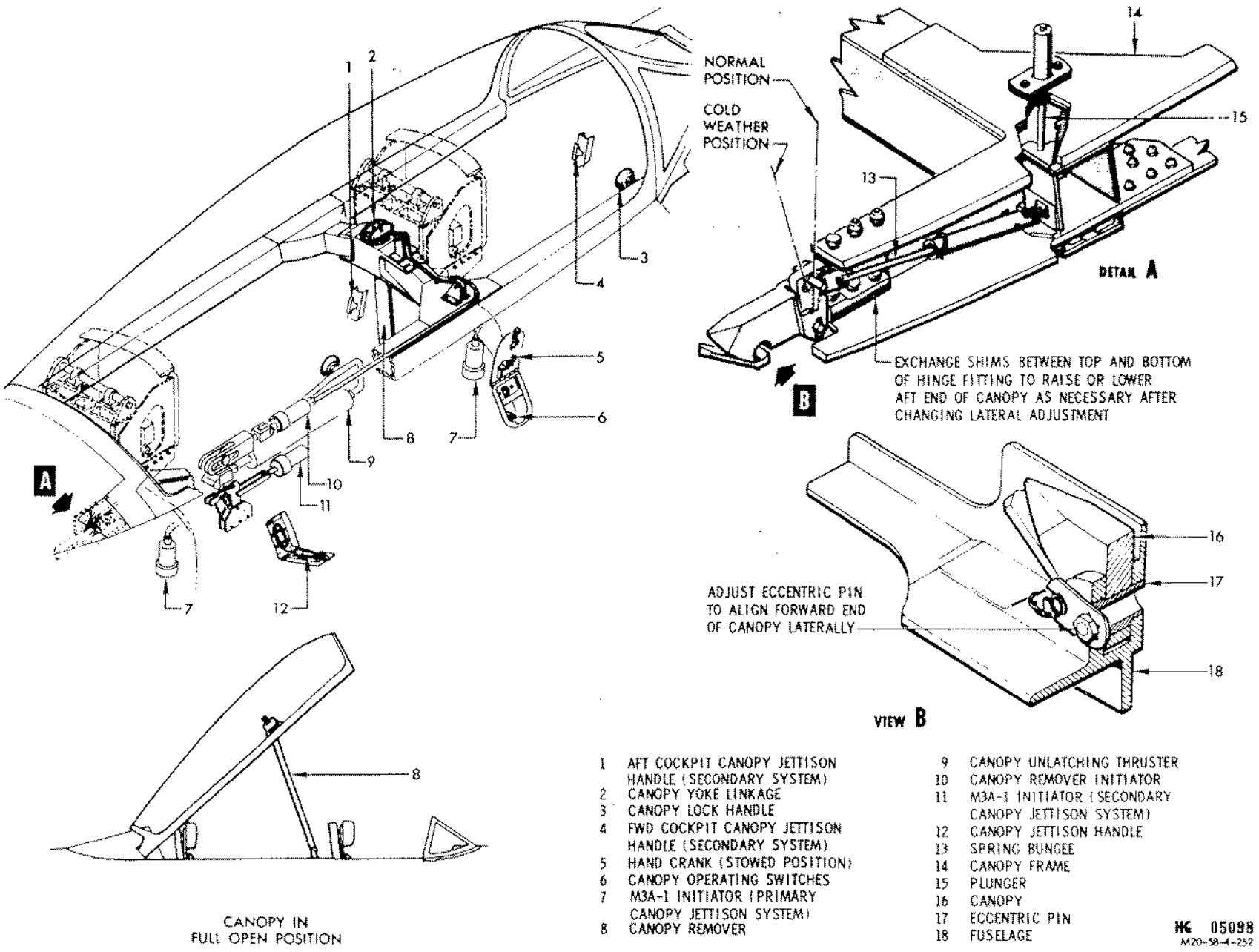
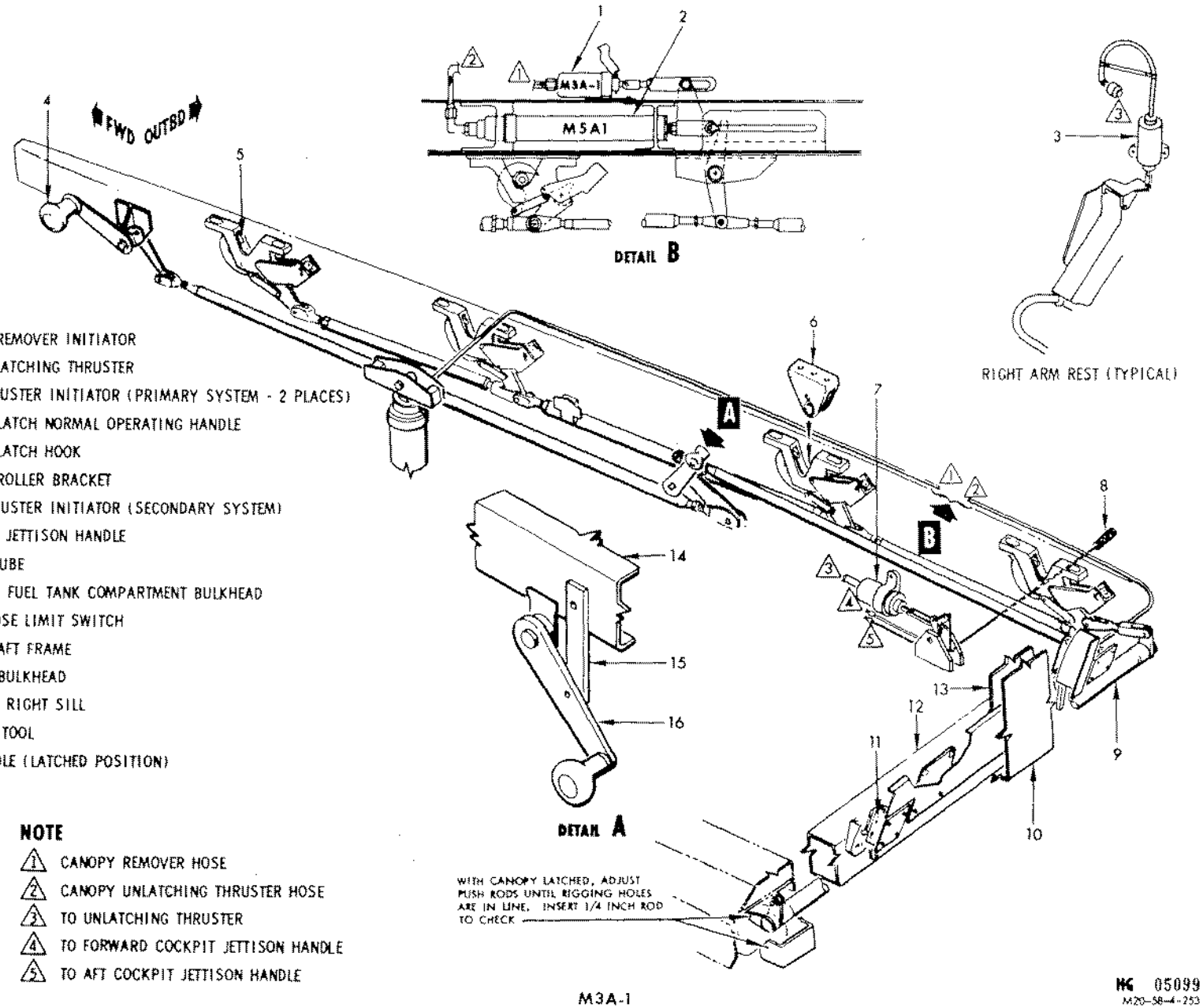


Figure 4-24A. Canopy Installation, Airplanes Incorporating T.O. 1T-33A-615



1 CANOPY REMOVER INITIATOR
2 M5A1 UNLATCHING THRUSTER
3 M5A1 THRUSTER INITIATOR (PRIMARY SYSTEM - 2 PLACES)
4 CANOPY LATCH NORMAL OPERATING HANDLE
5 CANOPY LATCH HOOK
6 CANOPY ROLLER BRACKET
7 M5A1 THRUSTER INITIATOR (SECONDARY SYSTEM)
8 EXTERNAL JETTISON HANDLE
9 TORQUE TUBE
10 FUSELAGE FUEL TANK COMPARTMENT BULKHEAD
11 PART-CLOSE LIMIT SWITCH
12 CANOPY AFT FRAME
13 CANOPY BULKHEAD
14 FUSELAGE RIGHT SILL
15 RIGGING TOOL
16 AFT HANDLE (LATCHED POSITION)

NOTE

1. CANOPY REMOVER HOSE
2. CANOPY UNLATCHING THRUSTER HOSE
3. TO UNLATCHING THRUSTER
4. TO FORWARD COCKPIT JETTISON HANDLE
5. TO AFT COCKPIT JETTISON HANDLE

Figure 4-24B. Canopy Mechanism Airplanes Incorporating T.O. 1T-33A-615

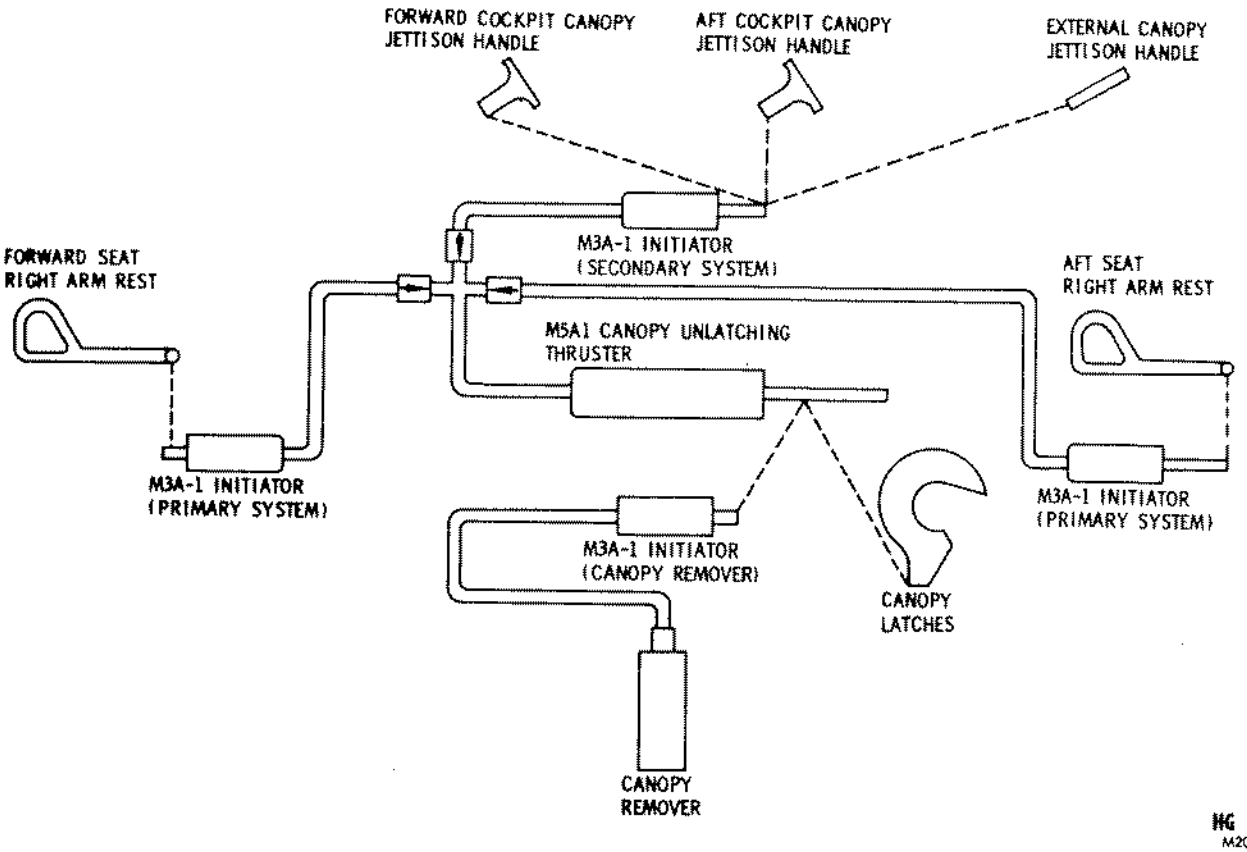


Figure 4-24C. Canopy Jettison System Schematic, Airplanes Incorporating T.O. 1T-33A-615

b. Apply light coating of Dow Corning No. 33 light grade grease to exposed cable.

c. Insert balance of cable into conduit.

d. Cycle cable in and out of conduit for approximately five to ten six-inch strokes to spread lubricant on inside of teflon-lined conduit.

e. Connect jettison handle assembly to conduit.

f. Mount jettison handle assembly to structure.

g. Install a dummy M3A-1 initiator at the secondary canopy jettison system thruster initiator position, located on the right side of the aft cockpit. Connect link rod to initiator firing pin.

h. Connect cable end fitting to airplane cable clevis.

i. Loosen cable clamp on end fitting enough to allow end fitting to be threaded onto teleflex cable.

j. Thread end fitting onto teleflex cable until all slack is removed from system.

k. When all slack is removed from system, back off two complete turns on end fitting. This will eliminate any preload on initiator.

l. Orient cable clamp to top side of end fitting and tighten clamp permanently.

WARNING

After the system is rigged, check to make certain that no preload exists on the initiator firing pin.

4–120N. RIGGING AFT COCKPIT SECONDARY CANOPY JETTISON SYSTEM (AIRPLANES INCORPORATING T.O. 1T-33A-615).

a. Insert first 30 inches of cable with jettison handle assembly into open end of conduit, leaving approximately 36 inches of cable exposed.

b. Apply light coating of Dow Corning No. 33 light grade grease to exposed cable.

c. Insert balance of cable into conduit.

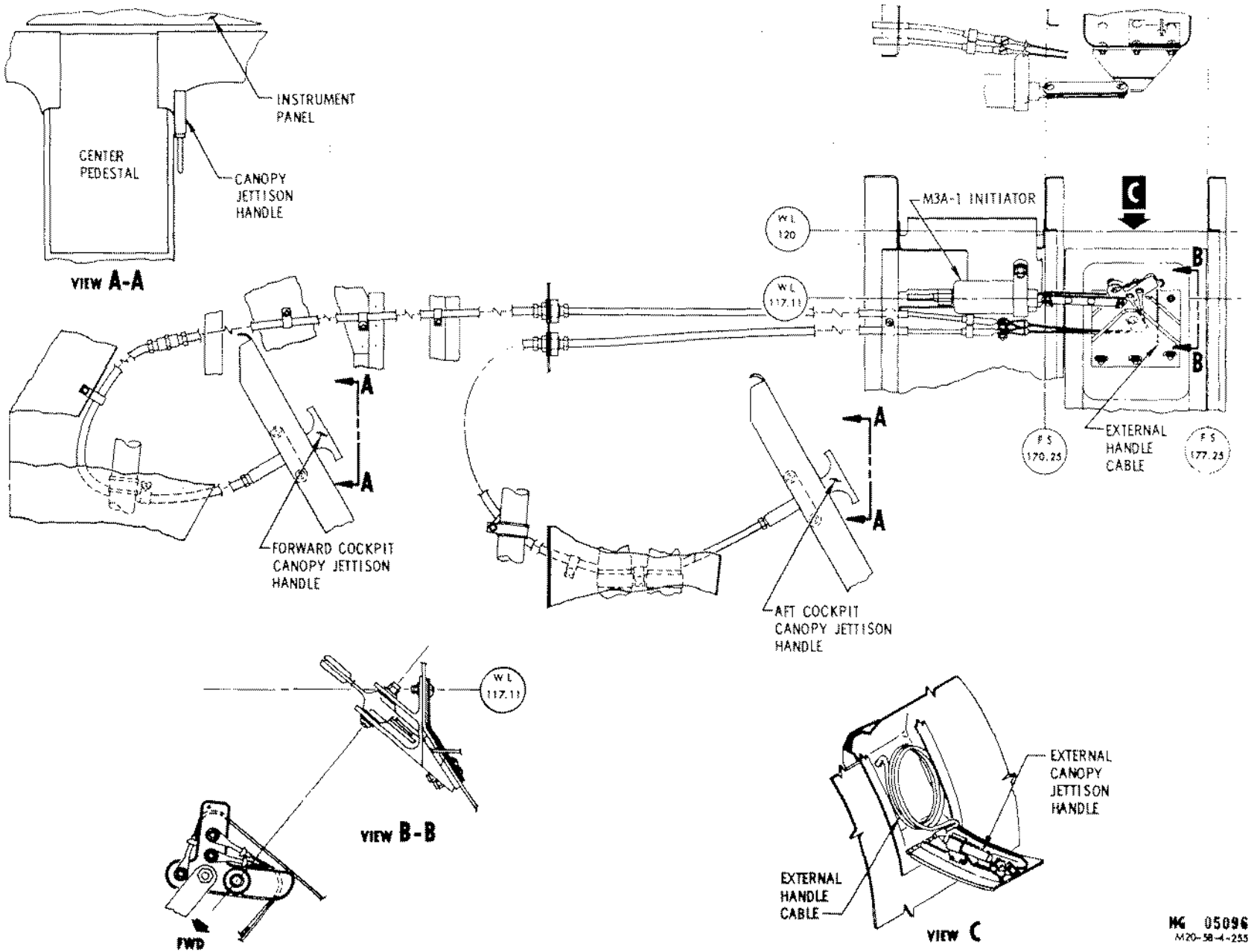


Figure 4-24D. Secondary Canopy Jettison System, Airplanes Incorporating T.O. 1T-33A-615

d. Cycle cable in and out of conduit for approximately five to ten six-inch strokes to spread lubricant on inside of teflon-lined conduit.

e. Connect jettison handle assembly to conduit.

f. Mount jettison handle assembly to structure.

g. Install a dummy M3A-1 initiator at the secondary canopy jettison system position, located on the right side of the aft cockpit. Connect link rod to initiator firing pin.

h. Connect cable end fitting to airplane cable clevis.

i. Loosen cable clamp on end fitting enough to allow end fitting to be threaded onto teleflex cable.

j. Thread end fitting onto teleflex cable until all slack is removed from system.

k. When all slack is removed from system, back off two complete turns on end fitting. This will eliminate any preload on initiator.

l. Orient cable clamp to top side of end fitting and tighten clamp permanently.

WARNING

After the system is rigged, check to make certain that no preload exists on initiator firing pin.

4-120P. PRIMARY CANOPY JETTISON SYSTEM CHECK (AIRPLANES INCORPORATING T.O. 1T-33A-615). Refer to paragraph 4-1163AK.

4-120Q. SECONDARY CANOPY JETTISON SYSTEM CHECK (AIRPLANES INCORPORATING T.O. 1T-33A-615).

a. Install a dummy M3A-1 initiator at the secondary canopy jettison system thruster initiator position, located on the right side of the aft cockpit.

b. Pull the forward cockpit jettison handle, located on the right side of the center pedestal, to its full travel position. The firing pin of the dummy M3A-1 initiator shall release from the initiator and the firing pin travel shall be 0.75 inch minimum. Restow the handle.

c. Recock the dummy M3A-1 initiator and pull the aft cockpit jettison handle to its full travel position. The firing pin of the dummy M3A-1 initiator shall release from the initiator and the firing pin travel shall be 0.75 inch minimum. Restow the handle.

d. Recock the dummy M3A-1 initiator. Open the external canopy jettison handle access door and pull out the external canopy jettison handle and cable.

e. Take up all slack on the cable and pull the external canopy jettison handle. The dummy M3A-1 initiator firing pin shall release and the firing pin travel shall be 0.75 inch minimum. Restow the external canopy jettison handle and cable.

f. Remove dummy M3A-1 initiator and install a live M3A-1 initiator.

WARNING

Make certain that the initiator is safetied.

4-121. CANOPY SEALING. *(See figure 4-25.)* A preformed rubber pneumatic tube is installed in a recess in the bottom and leading edge of the canopy frame. The tube is connected by means of a rubber or metal tube to a rubber block located on the right side of the canopy frame approximately 5-½ inches forward of the forward face of the canopy aft frame; where it mates with a plumbing fitting when the canopy closes. Through this plumbing fitting the tube is inflated by air pressure from the engine compressor, pressure sealing the canopy frame against the cockpit sill and the windshield.

4-122. INSTALLATION OF CANOPY PNEUMATIC SEAL.

a. Remove canopy and place it upside down on cradle or straps.

b. Coat bottom only of seal channel with adhesive, Specification MIL-A-5092, Type 1.

c. Coat that surface of the rubber seal which will contact bottom of seal channel with same cement.

d. Install seal air fitting in slot in aft channel.

e. Install seal in aft corners. Press seal in place to about four inches away from corners in both directions.

f. Place forward ends of seal in position, and press firmly in place about four inches aft.

g. Press centers of remaining loops of seal into channel.

h. Cut three pieces of ST aluminum alloy approximately 0.081 inch thick by 3 inches wide to fit over seal in channel. Hold-down pieces must overlap seal about one inch on each side, and turn over on the forward ends to hold the seal at those points. Clamp hold-down pieces in place over seal, using C clamps spaced three or four inches apart.

i. Prior to AF Serial No. 51-6548, connect air seal fitting tube to rubber block as follows:

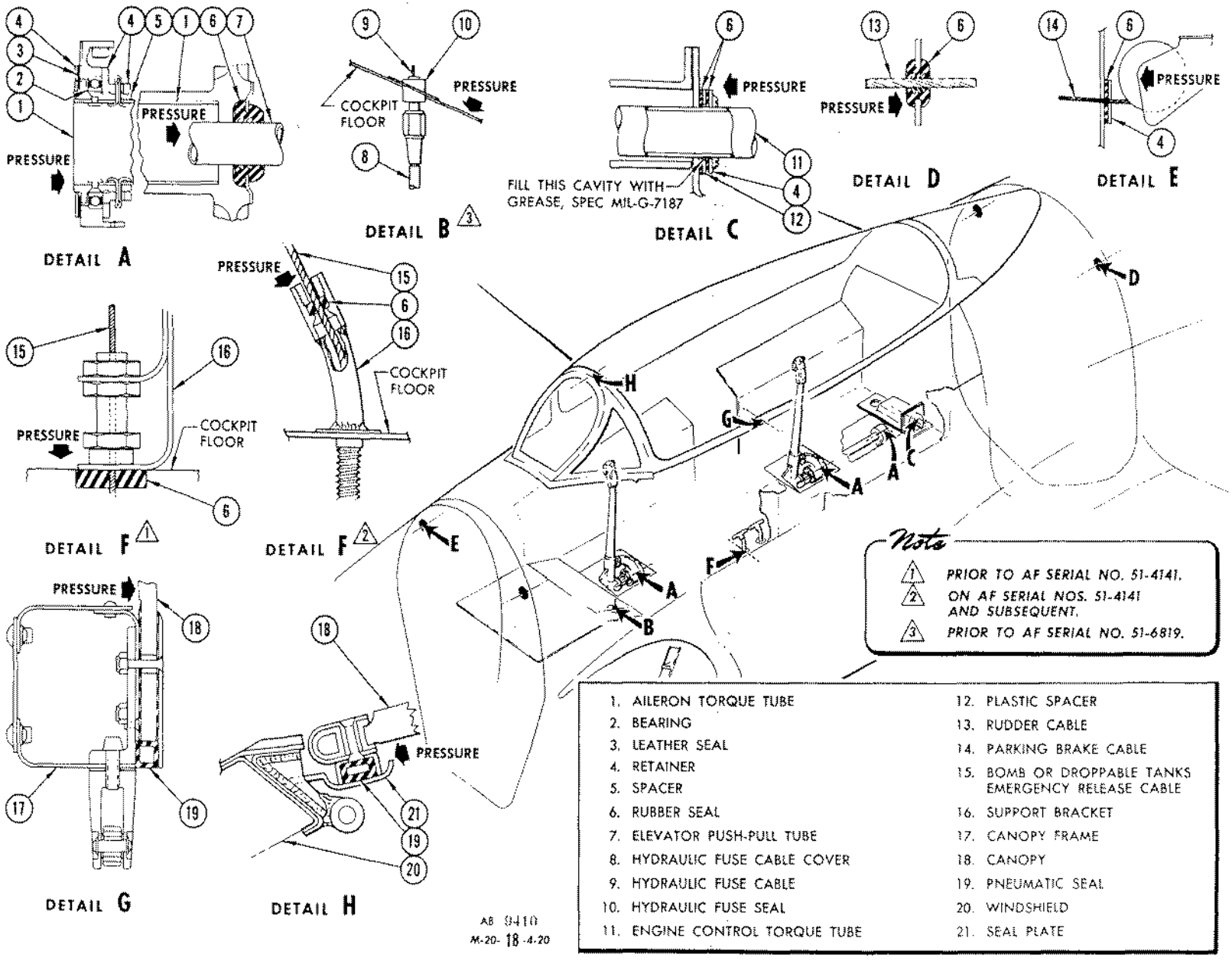


Figure 4-25. Cockpit Pressurization Seals

Remove cover plate from forward side of canopy aft frame.

Cut rubber tube, that projects out of spacer, to a length of 0.75 to 1.00 inch above spacer.

Insert one end of metal tube through slot in top of canopy aft frame and into rubber tube until metal tube projects below top of spacer approximately $1\frac{1}{2}$-inch.

Insert other end of metal tube in rubber block on right side of canopy frame.

Clamp tube in place.

Install cover plate on forward side of canopy aft frame.

j. On AF Serial Nos. 51-6548 and subsequent, insert air seal fitting rubber tube into rubber block on right side of canopy frame and clamp tube in place. Wrap length of air seal fitting rubber tube, that is exposed to sun, with $\frac{1}{2}$-inch glass cloth tape so that there is $\frac{1}{16}$ inch overlap on each wrap.

k. Apply 12 to 15 psi pressure to inside of seal for $1\frac{1}{2}$ hours.

l. Relieve air pressure, and remove clamps and hold-down pieces.

m. Apply one coat of rubber preservative, LAC Specification No. 37-672, Type I (MIL Spec. number not available), manufactured by Willard Tire Co. (No. R-8-N-C-186), to exposed surfaces of rubber seal. Do not apply rubber preservative to air seal fitting tube.

4-123. REMOVAL OF SINGLE PIECE PLASTIC PANEL FROM CANOPY FRAME.

a. Pull pneumatic seal tube from canopy ferrule.

b. Remove cover plates along inside of canopy frame.

c. Remove all screws from sides and back of canopy.

d. Drill out seven rivets attaching canopy frame to ferrule on forward edge of plastic. Do not remove ferrule from canopy.

e. Remove outer back frame. Sheet rubber should stay with outer back frame.

f. Lift out plastic canopy.

Note

Side frames can be sprung back enough to permit removal of plastic canopy.

4-124. INSTALLATION OF SINGLE PIECE PLASTIC PANEL IN CANOPY FRAME.

a. Thoroughly clean and slightly roughen plastic panel along area to be gripped by canopy frame.

b. Install all spacers in plastic panel in accordance with LAC Drawing 205405.

c. Cement a $\frac{1}{16}$-inch synthetic rubber strip, Specification AM8240, to inside and outside of plastic panel along frame contact area. Use Cement, Specification MIL-C-5092, Type 1.

Note

Rubber surfaces to be cemented shall be thoroughly cleaned and roughened slightly with sandpaper. Application of cement shall be confined to area of canopy which is covered by rubber seal.

d. Cement a $\frac{1}{16}$-inch synthetic rubber strip along forward and aft end of plastic panel on area to be gripped by frame. Use precautions and materials specified in step c.

e. Allow sufficient drying time for cement to firmly hold rubber seal in place.

f. Using a sharp instrument, pierce holes through rubber at spacers.

g. Mask-off all plastic and frame areas next to joint.

h. Thoroughly clean canopy frame and rubber strip on plastic panel.

i. Apply compound, sealing, Specification MIL-S-7126, Type 1, on surface of canopy frame with a spatula. This coating should be of sufficient thickness to fill all gaps between plastic panel and canopy frame after pressure is applied. (See figure 4-26.)

Note

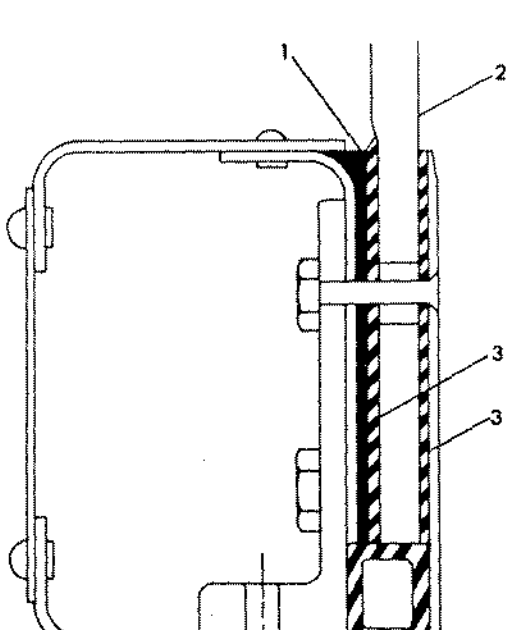
Compound must be mixed with the catalyst found in small container on top of can. Mix thoroughly for three minutes and apply immediately. Pot life of this compound is approximately 15 to 30 minutes.

j. After application of compound, place plastic panel in position. Spread slightly if necessary to avoid scraping compound off joint.

k. Install and tighten screws in lower row of holes only and across back bow and clamp panel in place in frame.

l. Allow compound to cure for at least six hours.

m. Install all screws in accordance with LAC Drawing No. 205405. Remove masking tape and trim off excess compound along joint.



1 COMPOUND SEALING, SPECIFICATION MIL-S-7126 TYPE 1
2 PLASTIC PANEL
3 1/64 INCH SYNTHETIC RUBBER STRIP SPECIFICATION AMS 3240
4 PNEUMATIC SEAL
5 CANOPY FRAME

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Figure 4-26. Canopy Frame and Canopy Cutaway View

i. Install cover plates along inside of canopy frame.

i. Install seven AN426AD4 rivets at lower end of ward edge. Use NAS42DD4-28 or -24 spacers with ets. Use outer frame as drill template.

i. Install pneumatic seal as described in paragraph 22.

25. REMOVAL OF FORWARD PLASTIC PANEL FROM CANOPY FRAME.

Pull pneumatic seal tube from canopy ferrule.

Disconnect "sense" antenna at canopy splice.

Remove forward cover plates along inside of py frame.

d. Remove screws from sides of canopy forward of splice and from aft end of forward plastic.

e. Drill out seven rivets attaching canopy frame to ferrule on forward edge of forward plastic. Do not remove ferrule from canopy.

f. Remove inside and outside retainers and seals from aft end of forward plastic.

g. Lift out forward plastic.

Note

Side frames can be sprung back enough to permit removal of plastic.

4–126. INSTALLATION OF FORWARD PLASTIC PANEL IN CANOPY FRAME.

a. Cement a $\frac{1}{64}$-inch synthetic rubber strip, Specification AMS3240, to inside and outside of plastic along area to be gripped by canopy frame. Remove tape holding screw spacers, and be sure that all spacers are in place when rubber is cemented in place. Use adhesive, Specification MIL-A-5092, Type 1.

b. Cement a $\frac{1}{64}$-inch synthetic rubber strip, Specification AMS3240, to outside of aft end of plastic along area to be gripped by retainer.

c. Cement a $\frac{1}{16}$-inch synthetic rubber strip, Specification AMS3198, to inside of aft end of plastic along area to be gripped by retainer.

d. Install plastic panel, two retainers, and screws.

e. Install forward cover plates along inside of canopy frame.

f. Seal intersection of splice and canopy frame with sealing compound, Specification MIL-S-7126, Type 1.

g. Connect "sense" antenna at canopy splice.

h. Install seven AN426AD4 rivets in lower end of forward edge. Use NAS42DD-28 or -24 spacers with rivets. Use outer frame as drill template.

i. Install pneumatic seal as described in paragraph 4–122.

4–127. REMOVAL OF AFT PLASTIC PANEL FROM CANOPY FRAME.

a. If desired, remove blackout curtain by removing slides and curtain.

b. Pull pneumatic seal tube from canopy ferrule.

c. Disconnect "sense" antenna at canopy splice.

d. Remove aft cover plates along inside of canopy frame.

e. Remove screws from sides of canopy aft of splice and from across back of canopy.

f. Remove outer back frame. Sheet rubber should stay with this frame.

g. Remove inside and outside retainers and seals from forward end of aft plastic.

h. Lift out aft plastic.

Note

Side frames can be sprung back enough to permit removal of plastic.

4-128. INSTALLATION OF AFT PLASTIC PANEL IN CANOPY FRAME.

a. Cement a 1/64-inch synthetic rubber strip, Specification AMS3240, to inside and outside of plastic along area to be gripped by canopy frame. Remove tape holding screw spacers, and be sure that all spacers are in place when rubber is cemented in place. Use adhesive, Specification MIL-A-5092, Type 1.

b. Cement 1/16-inch synthetic rubber strip to inside of back end of canopy on area to be gripped by frame.

c. Cement 1/64-inch synthetic rubber strip to area above that covered in step b.

d. Using a sharp instrument, pierce holes through rubber at spacers.

e. Cement a 1/64-inch synthetic rubber strip, Specification AMS3240, to outside of forward end of plastic along area to be gripped by retainer.

f. Cement a 1/16-inch synthetic rubber strip, Specification AMS3198, to inside of forward end of plastic along area to be gripped by retainer.

g. Install plastic panel, two retainers, and screws.

h. Seal intersection of splice and canopy frame with sealing compound, Specification MIL-S-7126, Type 1.

i. Connect "sense" antenna at canopy splice.

j. Install cover plates along inside of canopy frame.

4-129. WINDSHIELD. *(See figure 4-16.)* The windshield is composed of three panels which are set in 1/8-inch synthetic sponge rubber, and held in a corrosion-resistant steel frame by corrosion-resistant steel strips. The side panels are 3/8-inch molded transparent acrylate base plastic. The center panel is 1 1/2-inch, three-ply bulletproof glass. Frame and retaining strips around the side panels are held together by screws and elastic stop nuts so that the edge of the glass and the rubber seal are squeezed between the frame and the retainer to make a pressure-tight joint. The retaining strips around the center panel are held together at the top and bottom by clamp assemblies.

4-130. REMOVAL OF WINDSHIELD SIDE PANELS. Remove screws from retaining strips and lift out the panels.

4-131. REMOVAL OF WINDSHIELD CENTER PANEL.

a. Remove defroster tube by disconnecting it below the windshield and removing one support clip from each side.

b. Remove all screws from windshield frame which go through mid section structure. Retain flush nuts on inside.

c. Lift windshield off airplane.

d. Remove strap from outside top of windshield by removing six screws.

e. Remove one bolt at top center of bulletproof glass and two bolts at bottom center.

f. Separate the two halves of the frame, being careful not to damage the rubber seal. Remove the bulletproof glass.

4-132. INSTALLATION OF WINDSHIELD SIDE PANELS.

Note

Windshield side panels should be fitted and trimmed where needed to insure proper installation.

a. Cement sealing strips to edges of plastic as follows:

Clean surfaces to be cemented. Be sure to remove all traces of grease, oil, or other foreign matter.

Roughen all contact surfaces with emery cloth.

Clean roughened surfaces with aromatic naphtha, Federal Specification TT-N-97, and allow to dry thoroughly.

Spray or brush one thin coat (0.010 inch) of adhesive, Specification MIL-A-5092, Type 1, on both surfaces and allow cement to dry to a "tacky" condition. Bring tacky surfaces together and apply pressure with a hand roller. Be sure there are no air bubbles under the sealing strip, and that strip is free from wrinkles.

b. Push top edge of panel into the frame, and position the lower and aft edges. Tighten screws in the retaining strips.

4–133. INSTALLATION OF WINDSHIELD CENTER PANEL.

a. Cement sealing strips to edges of the glass. (Refer to paragraph 4–132.)

b. Coat outside of seal and inside of frame with same cement. Allow cement to dry until tacky.

c. Place glass in the frame. Be sure that ¼-x½-x 1⅜-inch synthetic rubber seal is in place under extreme forward edge of glass.

d. Place $\frac{1}{32}$-inch synthetic seals between mating surfaces of clamps, and reinstall bolts through the clamps.

e. Install the windshield frame on airplane.

f. Seal metal-to-metal joint between frame and fuselage with sealing compounds.

4–134. CLEANING OF PLASTIC AND GLASS.

a. Using a grit-free soft cloth, chamois, or sponge, clean glass and plastic panels with one of the following cleaners only:

Turco Plastic — Glyst, manufactured by Turco Products Company;

Franklin Plexiglas, manufactured by Franklin Products Corporation;

Whiz Cleaner, manufactured by R. W. Hollingshead Corporation;

Mirror Glaze Plexiglas Cleaner, manufactured by Griffin Aircraft Company;

Jewell Liquid Plastic Cleaner, manufactured by Paul W. Jewell and Associates.

CAUTION

Do not use acetone, benzine, lacquer thinner, or window-cleaning solvents on plastic, as these chemicals will soften or craze the surface. Never clean a dry panel with a dry cloth, as this tends to scratch the surface, and builds up an electrostatic charge which will attract dust.

b. After the cleaning operation, blot the panel with a clean damp chamois to neutralize any electrostatic charge.

4–135. INSPECTION AND REPAIR CRITERIA FOR CANOPY AND WINDSHIELD ACRYLIC PANELS.

a. Definitions:

Nicks—Broken indentations or cavities having sharp edges but not extending through face ply or sheet.

Dents—Depressions or hollows left by blows or concentrated pressure.

Spalls—Cavities left by the loss of a fragment having at least one feather edge.

Scratches—Tears in the surface made by a pointed object; a shallow mark, groove, furrow or channel. Hairline scratches with a maximum depth of 0.001-inch.

Cracks—Narrow fractures extending deeper than scratches having a pointed bottom and a high depth to width ratio.

Crazing—Fissures or splits (material separation) in the surface of plastic resembling cracking in the glaze of pottery.

Critical Vision Area—The total windshield side panels (except the one inch outside border) and that portion of the canopy forward of a vertical line one foot aft of rear seat occupants eye point and below a horizontal line passing through a point two inches above this eye point, with the exception of the one inch border around the canopy.

Critical Stress Area—That portion of the canopy that supports or carries the installation loads of the assembly. This area includes that region on the transparent assembly directly above the latch or roller position and within a radius of five inches, the point of origin of the radius being on the top edge of the attachment and on a line passing through the latch or roller position and perpendicular to the horizontal through the said position.

Note

In all cases of overlapping areas, the critical vision areas shall have preference over critical stress areas and non-critical areas. Critical stress areas shall have preference over non-critical areas. All areas not designated as critical vision or stress areas shall be considered non-critical.

b. Remove dirt, grease or foreign material from panels (refer to paragraph 4–134).

c. Acceptable repairs in the critical vision area shall not distort or impair vision. A slight vision impairment is permissible in non-critcial areas. Waxing is required to minimize vision impairment.

d. Nicks, dents and spalls in the area of support blocks for sun shields and radio antenna are acceptable up to $\frac{1}{16}$ inch depth.

e. Discoloration is permissible up to one inch from the edge of plastic panels.

f. Inspect panels per steps d and e and Table 4-1.

g. Sand the area around the repairable defects with coarse wet sandpaper (No. 280 or No. 320). Work deep defects over a large area to reduce distortion. Sand with light pressure to avoid burning the plastic and to avoid scratches as deep or deeper than the original defect. Wipe the surface clean.

h. Finish-sand the surface with fine wet sandpaper (No. 400). Clean the surface.

i. Buff the sanded area with a cotton buffing wheel and buffing rouge. Keep the wheel moving over the surface to avoid burning the plastic or causing ridges. Whenever hand buffing is required, apply a small quantity of rouge to the plastic surface and rub with a clean soft cloth, preferably at right angles to the scratches. Wipe off all buffing rouge with a clean soft cloth.

j. Repeat the buffing procedure using a finer rouge if condition of surface requires it.

k. Clean the surface thoroughly and allow it to dry.

l. Apply a coat of paste wax, and polish with a soft cloth.

m. Inspect the plastic blocks which support the ARN-6 and -14 antenna lead-ins. All edge surfaces of blocks should be lightly sanded with a medium grade sandpaper to diffuse the sun rays which pass through them. Care should be exercised not to scratch the canopy adjacent to the plastic blocks.

Table 4-1. Specific Area Inspection Criteria for Acrylic Panels

Area	*Type of Defect*	*Maximum Limits*			*Permissible*	*Repairable*	*Not Allowed*
		Length	*Width*	*Depth*			
Critical—Vision	Scratches			0.001	X		
Critical—Vision	Scratches			0.031		X	
Critical—Vision	Nicks, Dents and Spalls	0.125	0.06	0.01	X		
Critical—Vision	Nicks, Dents and Spalls			0.031		X	
Critical—Vision	Cracks						X
Critical—Vision	Crazing						X
Critical—Vision	Scratches						X
Critical—Stress	Scratches	10.0	0.02	0.031		X	
Critical—Stress	Nicks, Dents and Spalls						X
Critical—Stress	Cracks						X
Critical—Stress	Nonpropagating Crazing	Not to exceed 2 sq in. at one attaching point or 3 sq in. per canopy.			X		
Critical—Stress	Propagating Crazing						X
Non-Critical	Scratches			0.001	X		
Non-Critical	Scratches	12.0	0.02	0.02	X		
Non-Critical	Scratches	12.0	0.02	0.031		X	
Non-Critical	Nicks, Dents and Spalls			0.031	X		
Non-Critical	Nicks, Dents and Spalls			0.063		X	
Non-Critical	Cracks						X
Non-Critical	Slight Crazing	Up to 15% if not concentrated in one area.			X		
Non-Critical	Severe Crazing	Up to 5% if not concentrated in one area.			X		

NOTE: The combined total length of scratches listed as permissible in the non-critical area must not exceed the longest dimension of the panel. Any defect that causes distraction or impairs vision will not be allowed. Defects not included in, and in excess of those listed above, shall be cause for rejection. In an emergency, use of panels with defects in excess of those listed above shall be at the discretion and risk of the using activity.

4–136. WINDSHIELD INSPECTION CRITERIA (ARMOR GLASS).

a. Definitions:

Nicks—Broken indentations or cavities having sharp edges but not extending through the face ply or sheet.

Chips — Broken indentations extending through the face ply or sheet.

Spalls — Cavities left by the loss of a fragment having at least one feather edge.

Scratches — Tears in the surface made by a pointed object, a shallow mark, groove, furrow or channel.

Hairline Scratches — Scratches that are not over 0.001-inch in depth.

Cracks — Narrow fractures extending deeper than a scratch into the face ply and having a pointed bottom and a high depth to width ratio.

Delaminations — Bubbles, separations and/or discolorations due to deterioration of the plasticizer.

Bubble — An internal void or trapped globule of air or other gas.

Critical Area — Vision area portion of the windshield over which the gunsight reflection occurs and/or all the area within a ¾ inch border down to two inches from the bottom of the windshield.

Non-Critical Area — ¾ inch border and bottom two inches of the windshield.

Major Defects — Gross distortion, chips, cracks, any defect which causes distortion, defects of such size and nature so as to be disconcerting when viewing an object through the panel or hairline scratches so grouped as to produce a fogged area.

Minor Defect — Imbedded particles, bubbles, and any defect which does not cause distortion or is not disconcerting when viewing an object through the panel.

b. Cracks, nicks, spalls or distortion are not acceptable in the vision area.

c. Hairline scratches and minute pits that do not cause vision blur, distortion or are not grouped so as to produce a fogged area are acceptable.

d. Delaminations within a ¼ inch border measured from the edge of the metal frame are acceptable for any or all layers.

e. Delaminations within a ¾ inch border measured from the edge of the metal frame are acceptable, provided they do not extend more than 10 inches from the bottom edge of the windshield or exceed a total aggregate length of two inches on each side (face or back).

f. Delaminations within one inch of bottom edge of the windshield measured from the edge of the metal frame are acceptable.

g. Delaminations within a ¾ inch border around the top and side edges down to within 10 inches from the bottom edge of the metal frame are acceptable, provided the combined length of all delaminations in this area does not exceed two inches.

h. A maximum of two nicks or spalls on each edge are acceptable, provided they are a minimum of two inches apart and do not extend more than ⅛ inch into the polished surface.

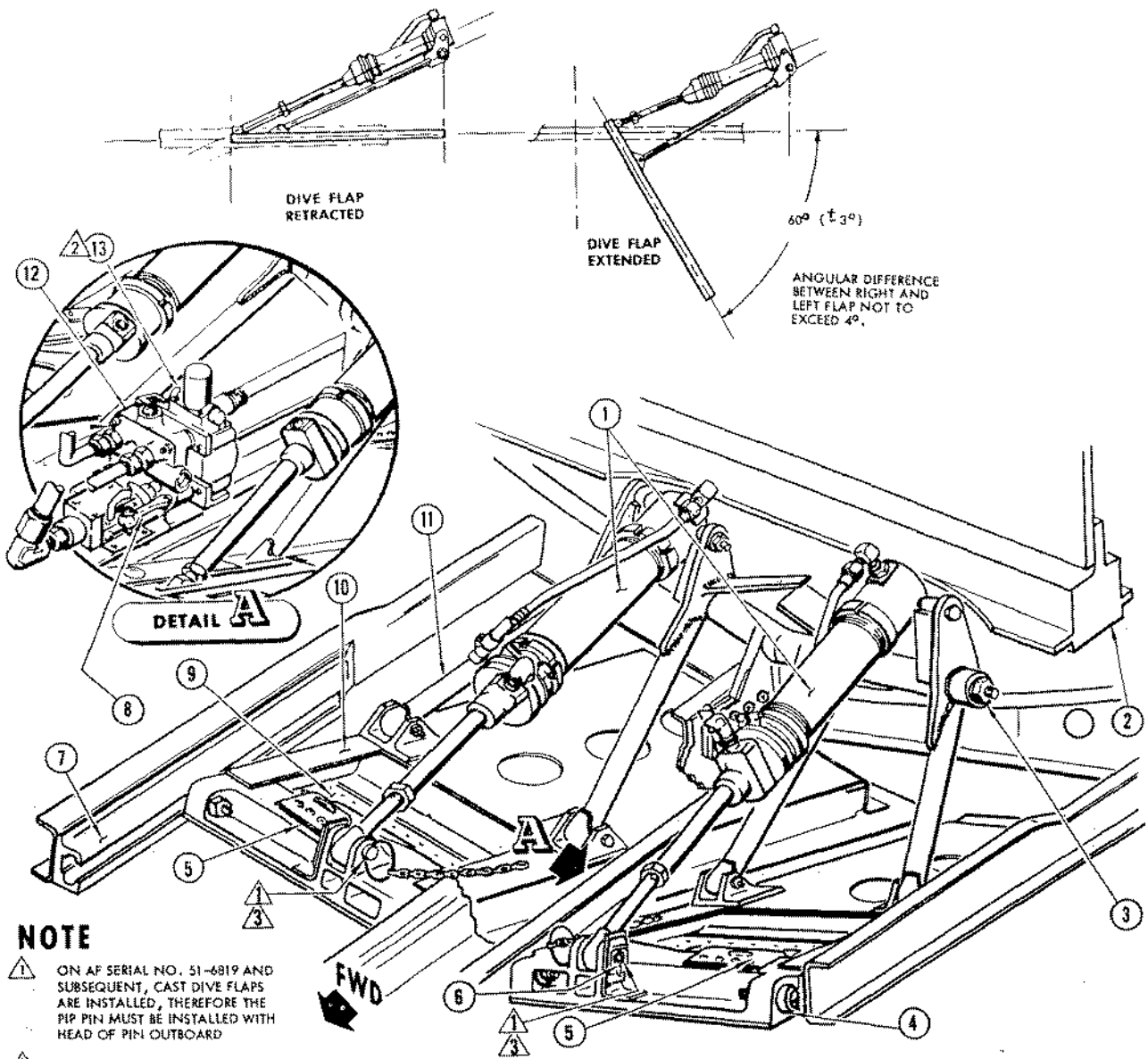
4–137. DIVE RECOVERY FLAPS. *(See figure 4-27.)* Two hydraulically actuated dive flaps are located one on each side of the airplane center line, between the main alighting gears. The forward end of each flap pivots on rollers which run in tracks. Access to the flap actuating mechanism is through the opening made by the flaps. A spring-loaded door is installed on each flap to relieve excessive air loads when the flap is in the extended position. For hydraulic information on the dive-flap actuating cylinder, refer to paragraph 4–743.

WARNING

When using flap opening for access to hydraulic compartment, shut off hydraulic pressure to dive-flap selector valve. Accidental operation of flaps may cause injury to personnel.

4–138. OPERATION OF DIVE RECOVERY FLAPS The dive flaps are controlled by a switch on each engine control lever. The switches operate an electric actuator, which in turn operates the hydraulic selector valve. Refer to figure 4-27.) Prior to AF Serial No. 53-5286, there were no intermediate positions for the flaps. On AF Serial No. 53-5286 and subsequent, incremental positioning of the dive flaps is possible.

4–139. For information on the electrical actuator, prior to AF Serial No. 53-5286, refer to paragraph 4–886.



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1	FLAP ACTUATING CYLINDERS	6	QUICK DISCONNECT CLIP	11	FLAP LINKS
2	WING FORWARD SPAR	7	TRACK	12	SELECTOR VALVE
3	AXLE	8	DIVE FLAP SHUT-OFF VALVE	2 13	ELECTRICAL ACTUATOR
4	ROLLER	9	SPRING LOADED DOOR		
5	SPRING-LOADED-DOOR STOP	10	DIVE FLAP		

Figure 4-27. Dive Flap Installation

4-140. REMOVAL OF DIVE RECOVERY FLAPS. *(See figure 4-27.)*

a. Extend the dive flaps, close ground check shutoff valve, and remove bolts from flap links at the flap.

b. Remove quick-disconnect pin from the flap actuating cylinder arm at flap by pressing lever on quick-disconnect clip.

c. Slide flap aft until rollers disengage track.

d. To remove actuating cylinder, proceed as follows:

Relieve hydraulic pressure in the system by operating the aileron booster.

Disconnect and immediately cap all hydraulic lines at the actuator.

Remove bolt and nut which attach the flap actuating cylinder.

e. To remove flap link and actuator support assemblies, remove nut and cotter pin from axle and slide the assemblies outboard off axle. Links must be rotated until they are inside the fuselage in order to clear the opening made by the dive flaps.

f. Remove the dive flap axle only if replacement is necessary. Remove one bolt from each axle. Remove axle.

g. Remove dive flap axle support by removing 16 bolts from the bathtub fitting; remove support and replace bolts.

4-141. CLEANING AND INSPECTION OF DIVE RECOVERY FLAPS.

a. Inspect flaps for cracks in skin, and distorted contour.

b. Inspect flap tracks for warping and cracks. See that the tracks do not contain dirt or foreign matter. Clean with solvent, Federal Specification P-S-661.

c. Inspect welds on flap-link and dive-flap support assemblies for cracks. Inspect bushings for wear.

d. Inspect all bolts for tightness. (Refer to Wrench Torque Table in Section VI.)

e. Inspect fuselage lower longeron near actuating mechanism support and near tracks for possible cracks.

4-142. ADJUSTMENT OF DIVE RECOVERY FLAPS. *(See figure 4-27.)*

WARNING

Extend dive flaps and turn manual shutoff valve to off position to prevent inadvertent operation of dive flaps while working in dive flap area.

a. Angle of travel should be 60° (±3°).

Note

Angular difference between right and left dive flap must not exceed 4 degrees.

b. With dive flap closed, i.e., flush with skin contour, and piston rod in fully extended position, piston must be bottomed against forward end cap. If necessary, make adjustment with dive flap in open position. Check closed position through opening of opposite dive flap.

c. If necessary, loosen lock nut on piston rod terminal and screw away from cylinder. Terminal fitting can be adjusted to proper length by rotating piston rod while holding terminal fitting in position.

Note

Install new lockwasher if bend tangs are damaged.

d. Screw terminal fitting partially in to make piston rod assembly shorter than required length.

e. Close dive flap, noting how far it is out of contour.

f. Open dive flap and screw terminal fitting out to lengthen piston rod assembly.

Note

Change in piston rod length of 0.010 inch will result in approximately 0.18 inch movement of aft end of dive flap.

g. Several trials may be necessary to have dive flap closed exactly to contour with no pressure between dive flap and bulkhead ring at station 190.5 when piston is bottomed in cylinder.

Note

As a test for this condition, close dive flap hydraulically on a piece of paper, such as newsprint, between dive flap and station 190.5 bulkhead ring. If paper can just be pulled out without tearing, proper adjustment has been made.

If paper tears, dive flap is bearing against bulkhead ring and must be loosened by readjusting terminal end fitting.

h. Bend tangs on each flat of surface of piston rod and or at least two flat surfaces of terminal locknut.

CAUTION

Adjustment of dive flap is critical because any preload of dive flap against structure caused by an unbottomed piston rod can result in breakage of dive flap.

Note

If dive flap open position is not within specified limits, piston stroke length must be changed by adjusting forward end cap on cylinder, and readjusting for closed position by repeating steps b through h.

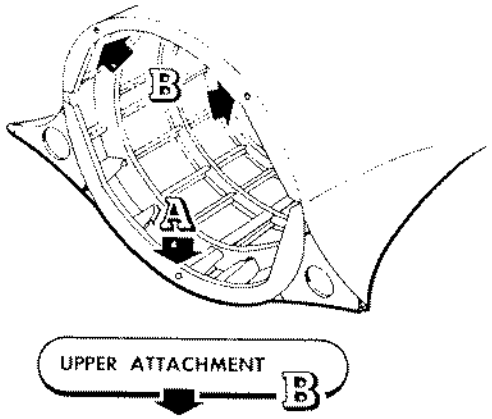
4–143. FUSELAGE AFT SECTION. *(See figures 4-28 and 4-29.)* The fuselage aft section supports the empennage and provides mounting for the aft end of the engine tail pipe. By removing the fuselage aft section, access is gained for removal of the engine and tail pipe. Three fittings on the forward end of this section attach with bolts to mating fittings on the fuselage mid section. Four fittings, two at station 376 bulkhead ring and two at station 400 bulkhead ring, provide attachment for the empennage. A compartment for the gyrosyn compass transmitter is located in the bottom of the aft section. (See figure 4-179.) The elevator tab actuator, mounted on a shelf on the right side of the fuselage just forward of the gyrosyn compass transmitter, is connected to the tab jackscrews with flexible shafts. A tail pipe joint scupper is installed to drain overboard any fuel leakage from this point. (See figure 4-29.) An overheat warning system, connected to an indicator light on each instrument sub-panel, is provided in the fuselage aft section. Access to the interior of the aft section is gained by removing it from the mid section.

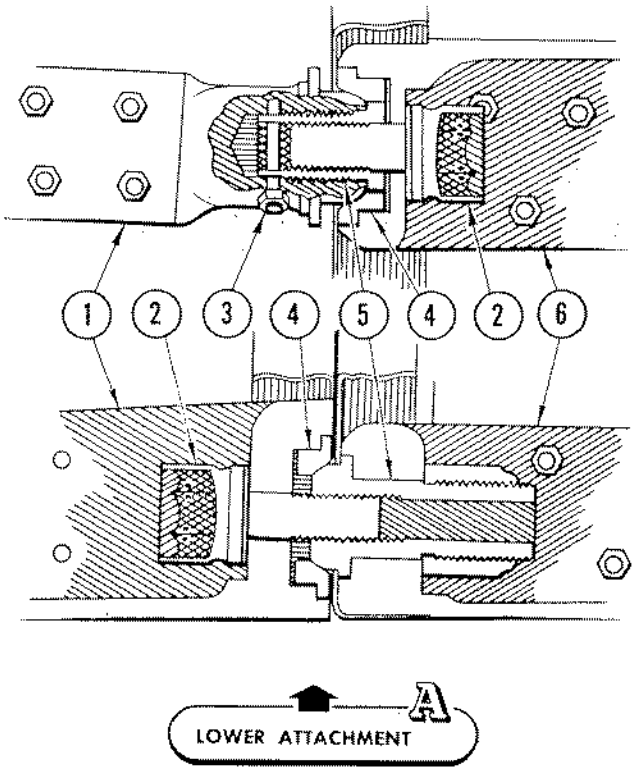
4–144. REMOVAL OF FUSELAGE AFT SECTION. Refer to paragraph 4–299.

4–145. INSTALLATION OF FUSELAGE AFT SECTION. Refer to paragraph 4–306.

4–146. MAIN ALIGHTING GEAR.

(See figures 4-30 and 4-31.)





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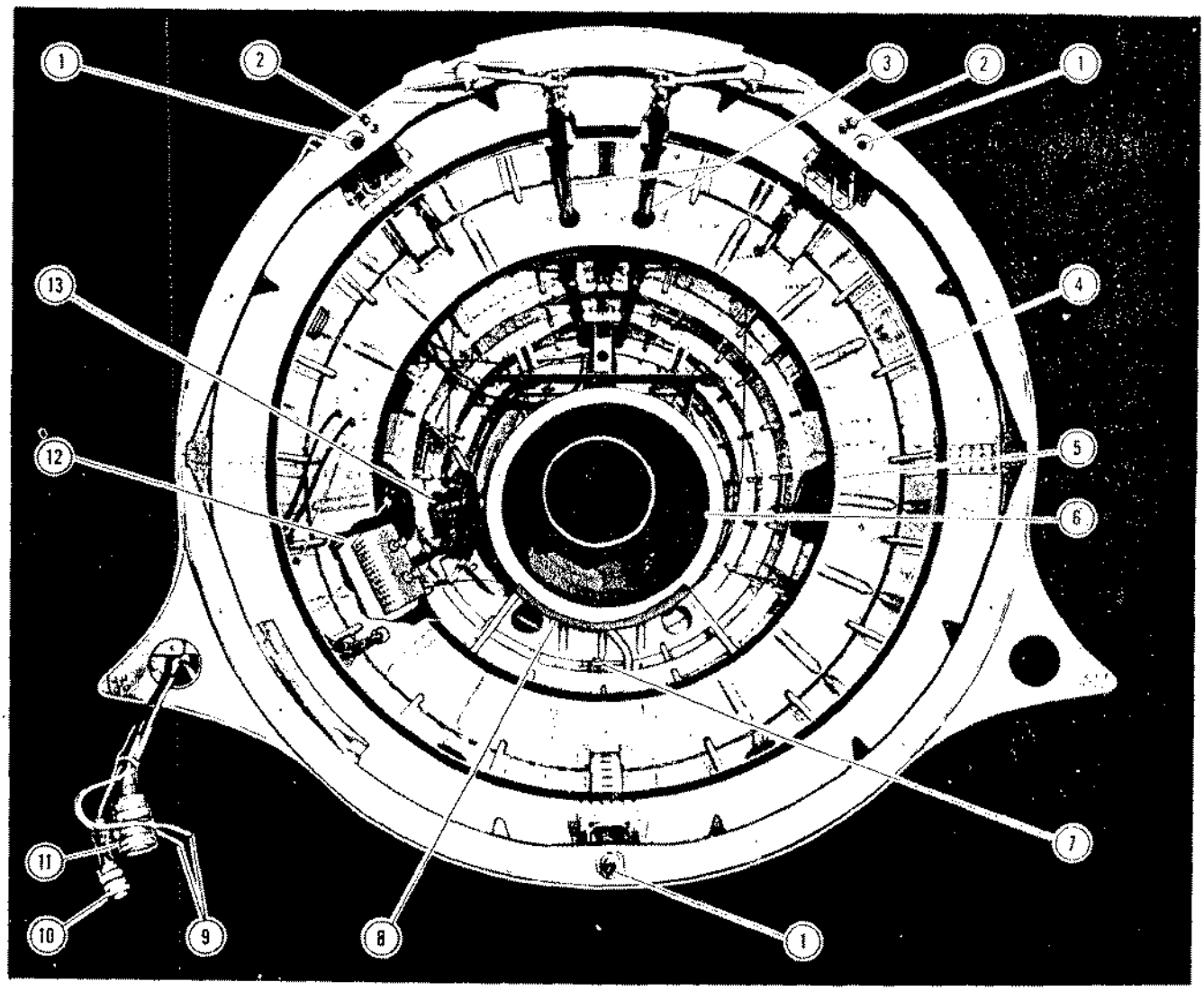
1. MID SECTION ATTACHMENT FITTINGS
2. ATTACHMENT BOLT
3. INSERT ATTACHING SCREW
4. FITTING INSERT
5. FITTING ADAPTER
6. AFT SECTION ATTACHMENT FITTINGS

Figure 4-28. Aft Section to Midsection Fuselage Attachment



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1. AFT SECTION ATTACHING POINTS
2. RUDDER CABLES
3. ELEVATOR PUSH-PULL TUBES
4. FORWARD ENGINE-SEAL BULKHEAD
5. AFT ENGINE-SEAL BULKHEAD
6. TAIL PIPE
7. FIRE WARNING THERMOSWITCHES
8. TAIL PIPE SCUPPER
9. TAIL PIPE THERMOCOUPLE DISCONNECT
10. GYROSYN COMPASS LEAD DISCONNECT
11. AFT SECTION ELECTRICAL DISCONNECT PLUG
12. ELEVATOR TABS RHEOSTAT
13. ELEVATOR TAB ACTUATOR

Figure 4-29. Interior of Aft Section

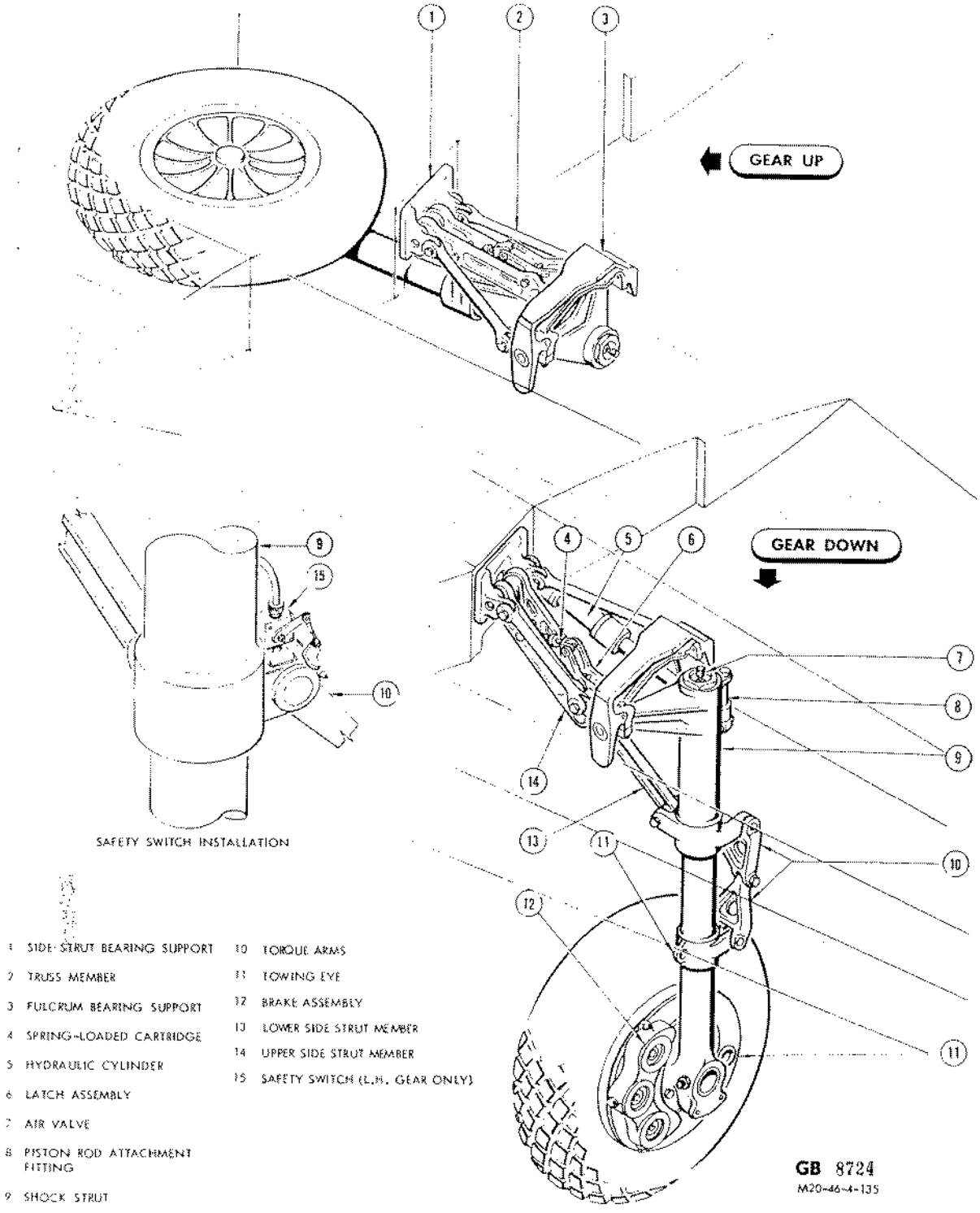
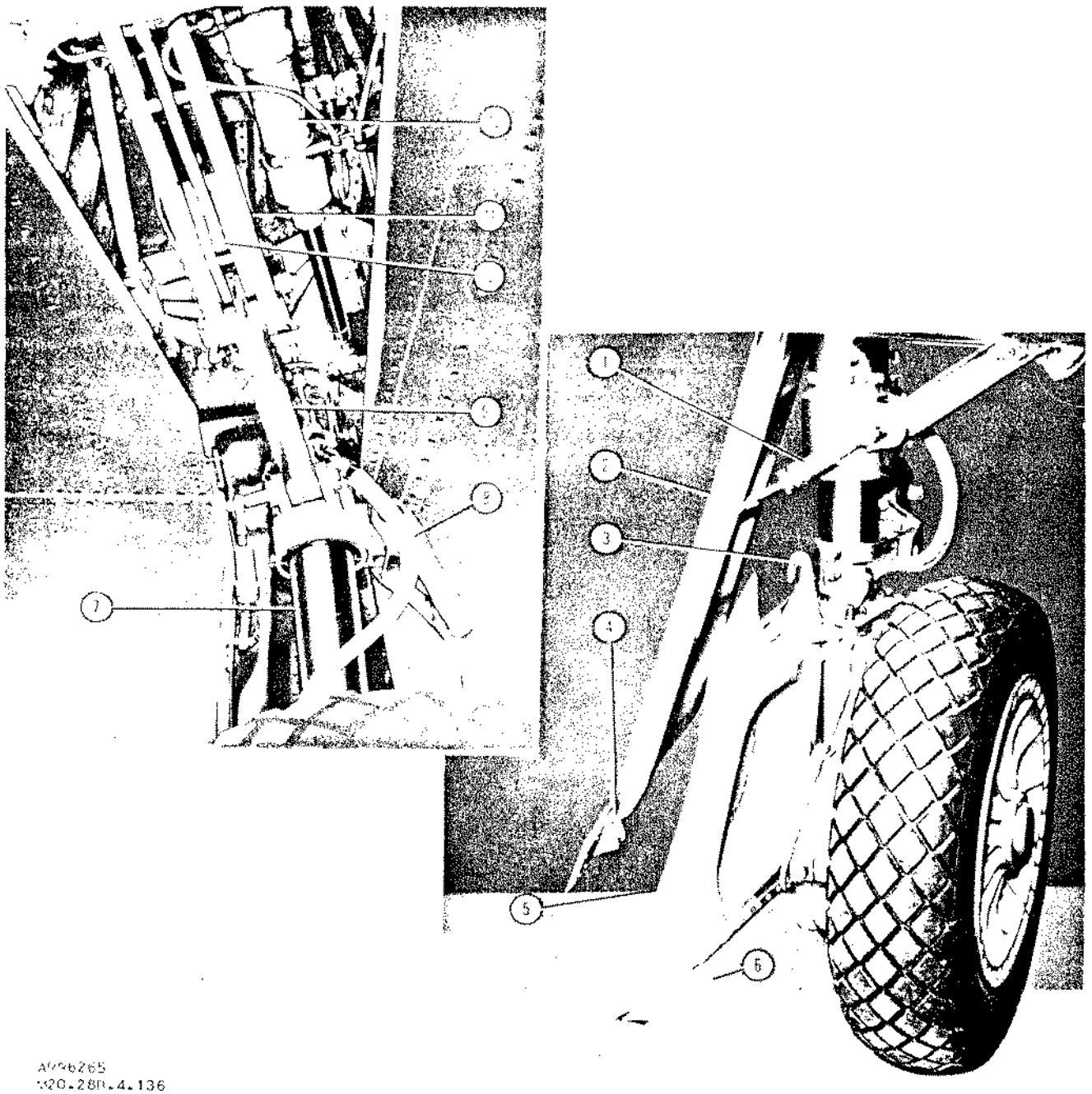


Figure 4-30. Main Alighting Gear



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1.	DOOR ACTUATOR ROD	7.	SHOCK STRUT
2.	OUTER DOOR SEGMENT	8.	BRAKE LINE
3.	DOOR CONNECTOR HOOK	9.	LOWER SIDE STRUT MEMBER
4.	DOOR CONNECTOR FITTING	10.	DOWN LOCK LATCH ASSEMBLY
5.	CENTER DOOR SEGMENT	11.	UPPER SIDE STRUT MEMBER
6.	DOOR MECHANISM BUMPER	12.	ACTUATING CYLINDER

Figure 4-31. Main Alighting Gear Installation

4–147. DESCRIPTION. The hydraulically actuated, fully retractable alighting gear is controlled by a valve on the left side of the cockpit. Each main gear retracts inboard into the wing and is enclosed by flush doors mechanically linked to the gear. The gear is locked down mechanically.

4–148. The emergency extension system is powered by an electric motor driven hydraulic pump, controlled by a switch in each cockpit.

4–149. Safety devices consist of cockpit control lever locks, position indicators, and a warning horn.

4–150. Each main alighting gear consists of an air-oil shock strut assembly, a side strut assembly with down lock mechanism, a hydraulic actuating cylinder, two torque arms, and a wheel and brake assembly.

4–151. For further information on hydraulic units which are related to the main alighting gear, refer to paragraph 4–693.

4–152. OPERATION OF MAIN GEAR. *(See figure 4-30.)* When the alighting gear control lever is placed in the "UP" position, hydraulic pressure moves the piston rod inward. During initial movement of the piston rod, the gear does not move as the side struts are on dead-center position. Instead, the force is transformed into rotation of the crank connected to the other end of the cylinder. The crank actuates the down lock mechanism and releases the lock. After the down lock is released, additional force applied through the crank to the down lock mechanism breaks the side struts from dead-center position, thus permitting retraction of the gear. Extension of the gear is essentially a reversal of this operation. For further details on operation of the down lock, refer to paragraph 4–169.

4–153. For further information about alighting gear electrical circuits and electrical units, and for switch adjustment information, refer to the "Electrical System."

4–154. REMOVAL AND DISASSEMBLY OF MAIN GEAR.

a. Jack the airplane. (Refer to paragraph 3–19.)

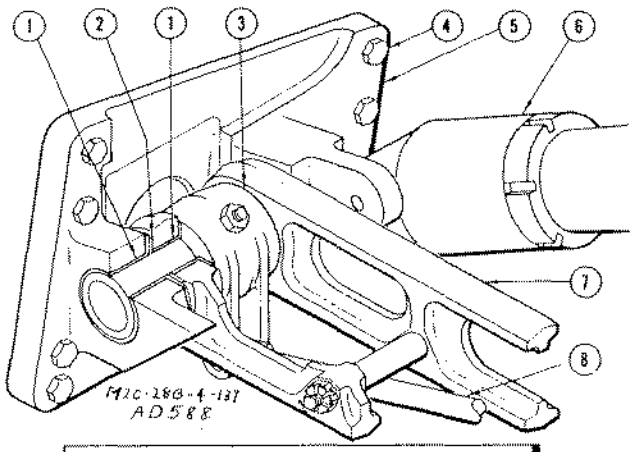
b. If desired, remove wheel assembly. (Refer to paragraph 4–175.)

c. Disconnect outer door segment at door actuator rod attached to shock strut. (See figure 4-31.)

d. Relieve hydraulic system pressure by operating aileron booster.

e. Disconnect hydraulic lines at hydraulic cylinder. Remove cylinder by disconnecting piston rod fitting from shock strut and detaching upper cylinder end at crank assembly.

f. Disconnect and immediately cap swing joint fitting of brake line at fulcrum.



1. BEARINGS
2. WASHER
3. CRANK ASSEMBLY
4. SIDE SUPPORT MOUNTING BOLTS
5. SIDE STRUT BEARING SUPPORT
6. ALIGHTING GEAR ACTUATING CYLINDER
7. UPPER SIDE STRUT MEMBER
8. DOWN LOCK LATCH ROD

Figure 4-32. Main Gear Side Strut Upper Pivot

g. Disconnect electrical wiring leading to switches.

h. Remove complete side strut assembly as follows:

Disconnect lower side strut member at shock strut.

Disconnect upper side strut member by removing bolt which extends through the arm, and pulling crank assembly aft. (See figure 4-32.)

Note

Side strut arm and washers will fall free as crank assembly is removed. Keep washers for reinstallation.

i. Support gear and remove four bolts in bearing caps of fulcrum. (See figure 4-33.)

Note

Bearing caps and fulcrum assembly are line reamed and must be attached together upon disassembly.

j. Remove bearing caps and lower the gear clear of the airplane.

k. Disassemble bearings from fulcrum by removing lock ring, pin, and nut.

4–155. CLEANING MAIN GEAR. Wash parts with kerosene or solvent, Federal Specification P-S-661. Wipe parts dry with clean cloth.

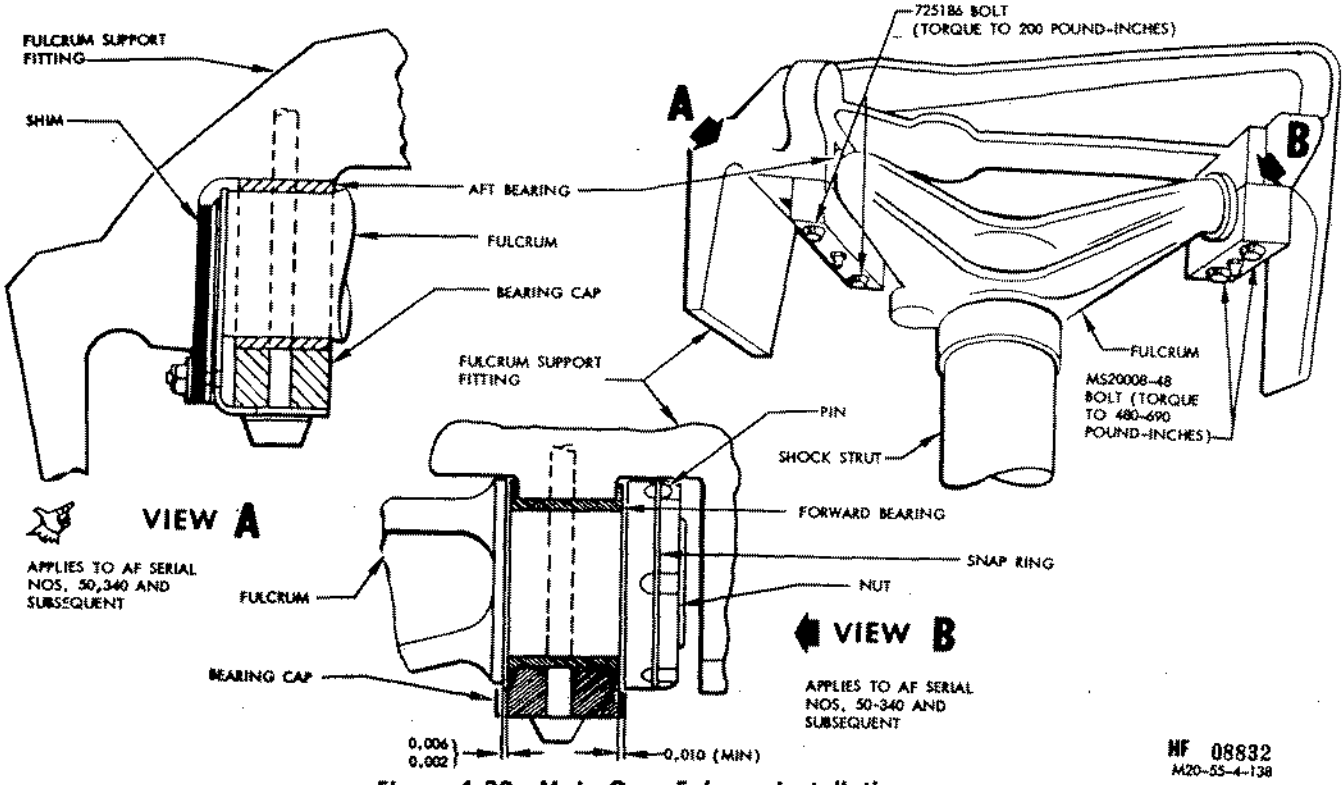


Figure 4-33. Main Gear Fulcrum Installation

4–156. ASSEMBLY AND INSTALLATION OF MAIN GEAR. (See figure 4-33.) Special tool required: S32550 main gear fulcrum nut spanner wrench.

CAUTION

Assure that bushing P/N 174967-5 is installed with the alignment rivet towards the shock strut.

Note

On AF Serial No. 57-769 and subsequent, a 411337 main landing gear assembly is installed which requires a 410861 fulcrum fitting assembly. On airplanes prior to AF Serial No. 57-769, a 206522 main landing gear assembly is installed which requires a 174967 fulcrum fitting assembly. The installation of the fulcrum fitting assemblies are interchangeable but the landing gear assemblies must be matched with the correct fulcrum fitting assembly.

a. Assemble bearings on fulcrum and secure with nut. Insert crank in first bearing of side support just far enough to retain first washer.

b. Position arm in strut and insert strut and arm between the two support bearings. Push crank through strut, second washer, and remaining support arm.

c. Align holes in arm and crank and install bolt.

d. Lift gear to place, and seat bearing firmly in support fitting.

Note

If bearings do not fit freely into support fitting, chill bearings prior to installation.

e. Install bearing caps. On airplanes AF Serial No. 50-340 and subsequent, install spacer assembly in aft fulcrum.

Note

If aft end of fulcrum is not chrome plated, coat with high-temperature water resistant grease, Specification MIL-L-3545, prior to spacer installation.

When installing a 411337 main landing gear assembly, make certain that bearing cap bolts do not protrude through barrel nut far enough to break barrel nut retainer. This can be accomplished by placing an AN960-616L washer or an MS20002-6 washer or both between spacer assembly bracket and MS20002C6 washer when bolt is installed. When bolt is installed, the shank end chamfer must be at least flush with the fiber locking device. However, further projection of the bolt shank is permitted as long as it does not contact the barrel nut retainer.

f. On airplanes prior to AF Serial No. 50-340, tighten bearing retaining nut on forward fulcrum with tool No. S32550 to assure minimum side play, yet permit gear to swing freely. Install pin and lock ring.

g. On airplanes AF Serial Nos. 50-340 and subsequent, tighten bearing retaining nut on forward fulcrum with tool No. S32550 to assure a minimum clearance of 0.010 inch between nut and bushing with aft end of fulcrum against spacer assembly. Install pin and lock ring.

h. On airplanes AF Serial Nos. 50-340 and subsequent, with aft end of fulcrum against spacer assembly, clearance between forward fulcrum shoulder and bearing must be maintained at 0.002 to 0.006 inch. Peel shims off spacer assembly to maintain clearance.

i. Connect lower side strut to shock strut. The attaching point should be at the lowest point of the attachment fitting.

Note

Pin of attachment fitting should be installed in line with the landing gear doors. (See figure 4-34, item 26.)

j. Connect cylinder at crank and at shock-strut fitting. Connect hydraulic lines.

k. Connect outer door segment to shock strut.

l. Connect brake line and electrical wiring.

CAUTION

Position brake line attachment fittings so that when gear is retracted brake line is not pinched between gear and wing structure.

m. Lubricate affected parts. Bleed brakes. (Refer to paragraph 4–205.)

4–157. ADJUSTMENTS OF MAIN GEAR. The down position of the gear is controlled by the side strut and down lock mechanism. The up position is automatically determined by the center door segment (attached to the strut) and the stop bumper. The gear must retract to seat the door firmly against the wing and the strut firmly against the stop bumper. The gear must extend far enough to engage the down lock mechanism properly. Adjustment for the up position is made at the gear actuating cylinder and stop bumper; for down position at the gear actuating cylinder.

a. Remove inboard door mechanism bumper from center door.

b. Adjust outer and center door mechanism. (Refer to paragraph 4–217.)

Note

Prior to retracting gear, check for proper installation of AN6-36 bolt that attaches down-lock spring cartridge to upper members of side strut. Bolt should be oriented with bolthead aft, that is, installed from aft side of strut.

c. Retract gear and see if door seats firmly.

d. If gear up travel is insufficient to seat door, loosen hex jam nuts and adjust stop bumper. Rotate piston rod sufficiently to close the door.

e. Check and adjust travel until door makes firm contact.

f. There is no adjustment for dead-center position of side strut. This position is automatic when down lock is engaged, thus gear down-position adjustment actually insures proper engagement of down-lock mechanism. Adjust down lock as follows:

With gear in down position, adjust length of cylinder so that a latch engagement of 0.31-inch minimum to a maximum of full slot depth is obtained. This adjustment is made by altering the extended length of cylinder by adjusting clevis end of piston rod.

With gear partially retracted (less than half way) adjust the spring-loaded cartridge so that cartridge gap for ground lock installation measures 0.03 to 0.06 inch.

g. Install inboard door mechanism bumper on center door.

h. Adjust inboard door mechanism. (Refer to paragraph 4–218.)

4–158. MAIN GEAR SHOCK STRUT. *(See figure 4-34.)* The shock strut is an air-oil type with a maximum stroke of 8 inches. The cylinder is made with an integral fulcrum at upper end and two sets of lugs at lower end. One set of lugs provides for attachment of side strut; other set provides for attachment of upper torque arm. The piston incorporates an offset axle for wheel, and two lugs for attachment of lower torque arm. An eyebolt for aft towing of airplane extends through lower end of piston and through axle. The forward towing eye is made integral with piston.

4–159. SERVICING THE MAIN GEAR SHOCK STRUT. The air valve and filler cap are located on top of the strut and are accessible for servicing through a hinged access door in the wing upper surface.

a. On airplanes using AN6287-1 valve assembly, release air pressure in strut by loosening ⅝-inch hex nut on air valve assembly one-half to one complete turn and depressing valve stem.

CAUTION

Do not loosen ⅝-inch hex nut more than one turn as further loosening may cause valve stem and housing assembly to fall into cylinder.

b. On airplanes using MS28889-1 valve assembly, loosen valve cap about one turn to allow escape of any pressure trapped between metal to metal seal of valve and cap. Remove valve cap and loosen upper ¾-inch hex nut to permit air within strut to escape.

WARNING

MS28889-1 valve assembly does not contain a valve core AN809-1, therefore rapid loosening of valve cap may cause cap to fly off, injuring personnel.

c. Remove air valve assembly.

d. Compress strut completely.

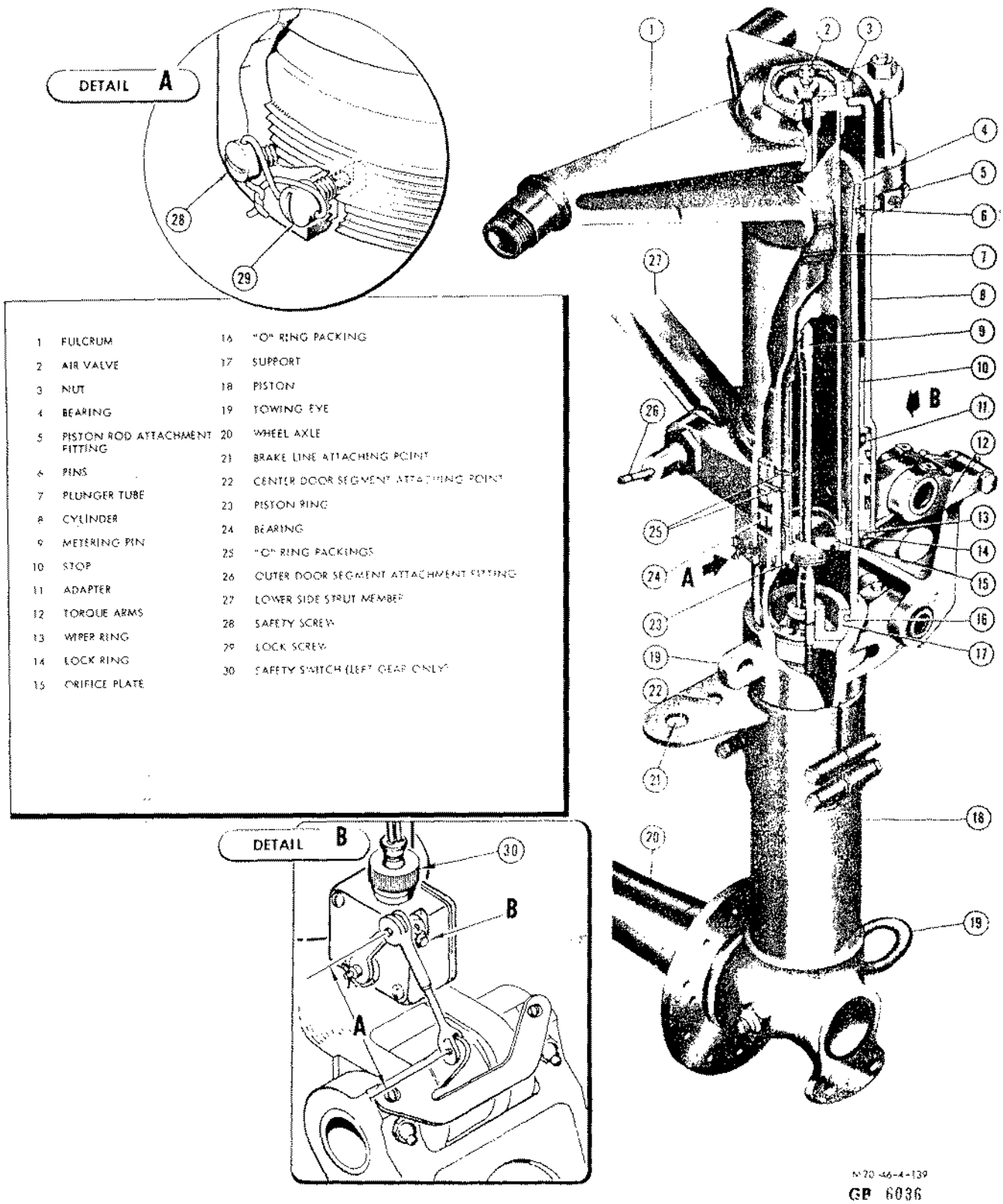


Figure 4-34. Main Gear Shock Strut

e. Fill to level of filler hole with hydraulic fluid, Specification MIL-H-5606.

f. Prior to installing air valve assembly, install new aluminum gasket between valve assembly and shock strut. Torque air valve assembly to between 100 and 110 lb in.

g. Since strut extension varies with airplane weight, check struts after airplane has been loaded. For takeoff gross weights under 12,000 pounds (full fuel load without droppable tanks), inflate strut with air pressure until piston is extended 4 ±1/4 inches from cylinder. For takeoff gross weights over 12,000 pounds (full fuel load with droppable tanks), inflate strut until piston is extended 3 ±1/8 inches from cylinder or until upper and lower torque arm bolts are 6-1/2 ±1/8 inches apart.

Note

Maximum strut inflation pressure is 1100 psi.

h. Rock airplane while inflating struts, to overcome packing friction.

i. Following inflation of strut, tighten upper hex nut of air valve assembly to a torque of from 50 to 70 lb in.

4–160. MAINTENANCE OF THE MAIN GEAR SHOCK STRUT. If leakage of fluid is apparent, do not tighten bearing (see figure 4-34, reference 24) at lower end of the cylinder, as this bearing does not bring pressure upon the packing. For correction of packing leakage, install new replacement packings.

4–161. REMOVAL OF THE MAIN GEAR SHOCK STRUT Shock strut is removed with complete alighting gear. (Refer to paragraph 4–154.)

4–162. DISASSEMBLY OF THE MAIN GEAR SHOCK STRUT. *(See figure 4-34.)* Special tool required: Spanner wrench S-38406. (See figure 3-27.)

a. Release air pressure in strut by loosening the valve assembly hex nut one-half to one complete turn.

WARNING

Do not loosen valve assembly more than one complete turn until all air has escaped from the strut to prevent injury to personnel.

b. On airplanes AF Serial Nos. 49-897 and subsequent, release air pressure in strut by loosening 5/8-inch hex nut on air valve assembly one-half to one complete turn and depressing valve stem.

CAUTION

Do not loosen 5/8-inch hex nut more than one turn as further loosening may cause valve stem and housing assembly to fall into cylinder.

WARNING

Failure to deflate strut before disassembly may cause serious bodily injury to personnel or damage to equipment.

c. Remove filler plug and drain fluid from strut.

d. Disconnect or remove torque arms.

e. Remove lockring (14) which secures wiper (13).

f. Remove the two screws (28) and (29) which lock bearing (24) in place.

g. With spanner wrench S-38406, unscrew the bearing from the cylinder.

h. Pull piston assembly out of cylinder. Alternate jarring action when pulling out piston should dislodge stop (10), adapter (11), and O-ring packings (25) from the cylinder. If this method is not successful, cautiously inflate strut sufficiently to force piston and internal parts free. Two pins (6) secure bearing (4) to upper end of piston. The pins are free to fall out when piston is clear of cylinder, and bearing can be removed when pins are out.

i. If there is a leakage at O-ring packing (16), remove metering pin (9) and its support (17). Since there is no movement of the metering-pin support in relation to the piston wall, it is not expected that any trouble will develop with the O-ring packing. However, in the event that it is necessary to replace the packing, the axle will have to be removed. As the axle is pressed in place, do not remove it unless absolutely necessary. After removing the axle, a tool can be inserted in the piston to remove the nut on the bottom of the metering pin. The pin and support are then free to be removed by driving them out with a soft metal rod inserted from the bottom of the piston.

j. Remove O-ring (16) from support.

k. With pointed tool, remove piston ring (23) from bottom of plunger tube (7).

l. Remove plunger tube by removing nut (3) at top of cylinder and withdrawing plunger tube from bottom of cylinder.

m. Remove O-ring packing from adapter (11).

4–163. CLEANING THE MAIN GEAR SHOCK STRUT.

a. Wash all disassembled parts with kerosene or unleaded gasoline.

b. Wipe parts dry with clean cloth.

4–164. INSPECTION OF MAIN GEAR SHOCK STRUT.

a. Visually inspect the entire outer surface of the cylinder assembly. Inspect inside of cylinder for corrosion, scoring and worn spots. Use magnifying glass to inspect the area approximately four inches below the top of the strut. Replace defective parts.

b. Inspect piston for breaks in plating, or pits.

c. Inspect piston-ring groove (figure 4-34, reference 23) at bottom of plunger tube for possible wear at sides of groove.

d. Inspect metering pin orifice at bottom of plunger tube for wear caused by possible misalignment of metering pin.

4–165. REPLACEMENT FOR MAIN GEAR SHOCK STRUT. Whenever strut is disassembled, replace with new parts all O-ring packings, gasket at large retainer nut on top of cylinder, gasket under filler cap, and valve core.

4–166. ASSEMBLY OF MAIN GEAR SHOCK STRUT. *(See figure 4-34.)* Special tool required: Spanner wrench S-38406.

a. Insert plunger tube in cylinder and secure with large nut (3) using new replacement gasket. Tighten firmly; gasket will seat in chamfer of cylinder head.

b. Assemble the following parts on the piston:

Lockring (14).

Wiper (13) with sharp edge at bottom.

Bearing (24).

Adapter (11) with new replacement O-ring packings (25). Install adapter so widest edge is at bottom.

Slip one of the O-ring packings (25) down on piston until it is under lip of adapter.

Stop (10).

Upper bearing (4) and two pins (6).

c. If metering pin support (17) has been removed, install new replacement O-ring packing on support. Press support in piston and replace nut on pin.

Note

Be sure that support is firmly seated and that metering pin is in true vertical alignment so it will center in orifice (15) of plunger tube.

d. Wet inside of cylinder and piston assembly with clean hydraulic fluid, Specification MIL-H-5606.

e. Insert piston assembly in cylinder. Do not drop pins (6) from the assembly.

f. Screw bearing (24) in place and tighten snugly with spanner wrench S-38406 (figure 3-22). Bearing has six slots, spaced 60 degrees apart. Align one of the slots with either one of the two tapped holes for lock screw (29) and safety screw (28). Select slot with bearing in tightest possible position.

Note

One of the locking screws is an AC501-416-5 and does not safety the bearing. It is used only for the purpose of securing lock-wire for the other screw (part No. 206593) which has an extended shank to penetrate the bearing slot. The screws are interchangeable in either tapped hole to provide greater range of adjustment.

g. Install wiper in place and secure with lockring.

h. With strut fully compressed, fill to level of filler hole with hydraulic fluid, Specification MIL-H-5606.

i. Work piston several times to eliminate trapped air.

j. Install filler cap with new gasket and tighten securely.

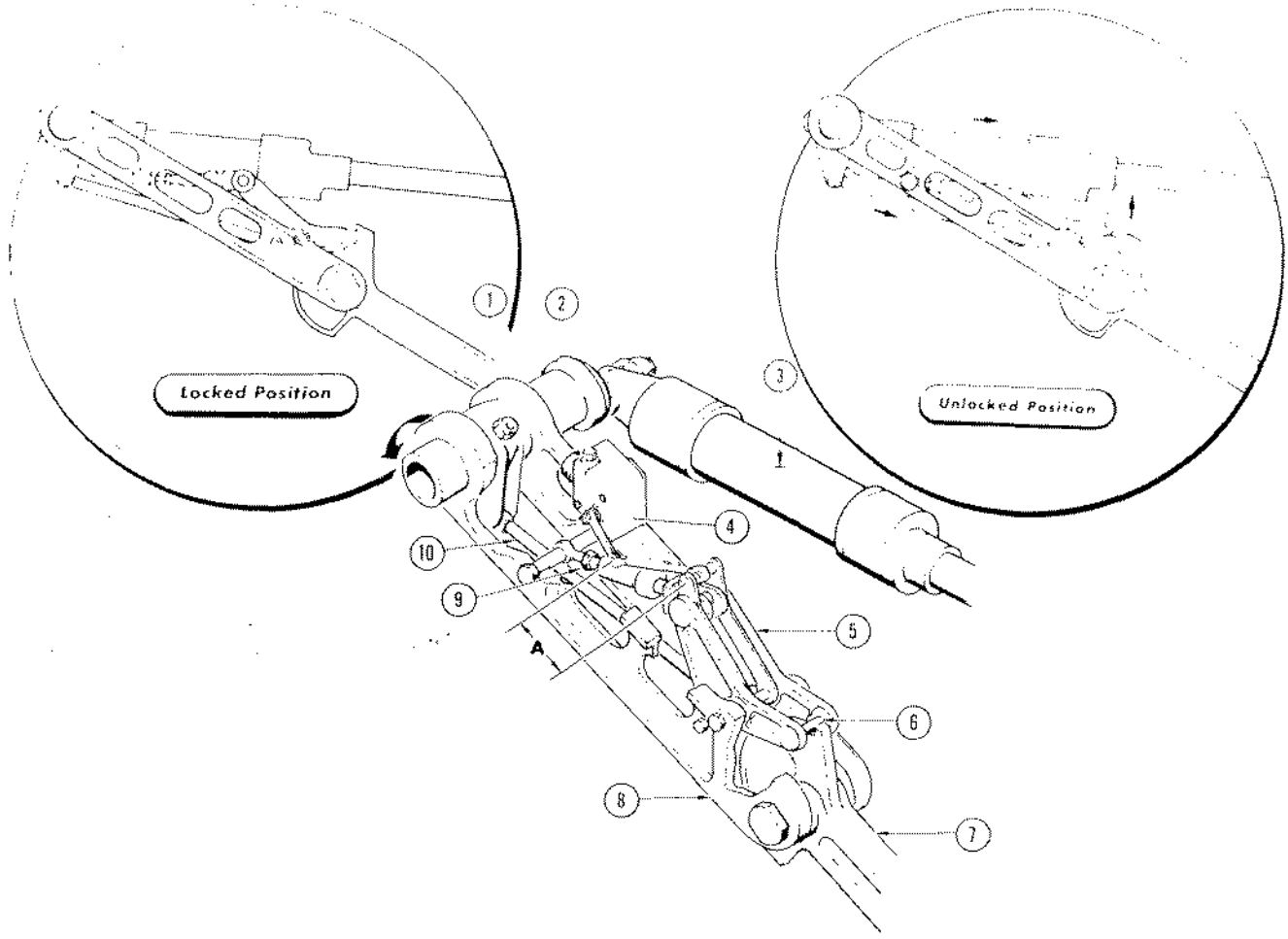
k. Install new valve core.

l. Install torque arms.

m. Inflate with air pressure to approximately 630 psi.

n. On airplanes having AF Serial Nos. 49-897 and subsequent, following inflation of strut, tighten 5/8-inch hex nut on air valve assembly to a torque of between 50 and 70 lb in.

4–167. TESTING MAIN GEAR SHOCK STRUT. Test with soapy water for air leakage around filler cap and valve core. Fluid seepage around other parts will indicate leakage.



1	ARM	6	LATCH BLOCK
2	CRANK	7	LOWER SIDE STRUT MEMBER
3	HYDRAULIC CYLINDER	8	UPPER SIDE STRUT MEMBER
4	DOWNLOCK SWITCH	9	SPRING-LOADED CARTRIDGE
5	LATCH ASSEMBLY	10	ROD

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GB 5791

Figure 4-35. Main Gear Downlock

4–168. INSTALLATION OF MAIN GEAR SHOCK STRUT. Shock strut is installed with complete alighting gear. (Refer to paragraph 4–156.) After installing, and with weight of airplane on strut, regulate air pressure until piston is extended 4 inches from the cylinder, without full tip tanks and with no bombs on pylons; or 3 inches from cylinder with full tip tanks and/or bombs on pylons. Rock the airplane to overcome packing friction. For information on strut inflation, refer to paragraph 4–159.

4–169. MAIN GEAR SIDE STRUT AND DOWN LOCK MECHANISM. *(See figures 4-32 and 4-35.)* The side strut assembly includes two upper members and a lower member. The side strut upper members are attached to a crank and support assembly mounted on the wing structure. The lower member is attached to the shock strut. The down lock mechanism is located between the two upper members and consists of the crank, arm, rod, spring-loaded cartridge, and latch assembly. A cam on the end of the lower side strut member acts as a guide for the latch assembly and provides a notch to receive the latch block in the locked position.

4–170. OPERATION OF SIDE STRUT AND DOWN LOCK MECHANISM. When the alighting gear is being

retracted, the crank actuates the arm and the rod. The rod rotates the latch assembly and lifts the latch hook free of the notch in the cam. The spring-loaded cartridge functions as a stop for the latch assembly in the released position only.

4–171. In the extension of the alighting gear, the above operation is reversed, except that the latch block rides on the cam until it reaches the notch, then it snaps into the engaged position.

4–172. REMOVAL, INSTALLATION, AND ADJUSTMENT OF SIDE STRUT AND DOWN LOCK MECHANISM. Refer to paragraphs 4–154 through 4–157. If down lock mechanism is removed, lubricate it with oil, lubricating preservative, Specification MIL-L-644.

4–173. MAIN GEAR WHEELS AND BRAKES. The two main alighting gear wheels are constructed of magnesium alloy. Single-disc, three-spot, hydraulically operated brakes are mounted on the main gear shock struts and are actuated by the rudder pedals. Two master cylinders, replenished from a hydraulic fluid reservoir, supply pressure for brake operation.

CAUTION

When brakes have been in use under load conditions, they must be allowed to cool for a minimum of 15 minutes. Too frequent use may result in tire failure because of heat dissipation from overheated brakes.

4–174. MAIN GEAR WHEEL ASSEMBLY. The wheel assembly consists of a 26 x 6.6 wheel, a 26 x 6.6 casing, 12 or 14-ply rating, type VII, Specification AN-C-55, and a 26 x 6.6 inner tube, Specification MIL-C-5041A and 553C11A. The two sections of the wheel are bolted together and can be separated for tire removal. Both rim flanges are cast integral with the wheel. Keys under the rim flange on the brake side of the wheel drive the brake discs which are provided with slots to receive the keys. The wheel assembly is mounted on the axle with two roller bearings, one on each side.

4–175. REMOVAL OF MAIN GEAR WHEEL ASSEMBLY.

a. Jack airplane (see figures 3-10 and 3-11.)

b. Remove hub cap snapring and hub cap.

c. Remove cotter pin from retaining nut.

d. Remove retaining nut.

e. Slide wheel assembly from axle.

Note

Do not allow inboard bearing and race to drop as the wheel is removed. The outboard bearing is held in the wheel by a grease retainer and lockring.

4–176. LUBRICATING MAIN GEAR WHEEL BEARINGS. (See figure 3-26.)

4–177. INSTALLATION OF MAIN GEAR WHEEL ASSEMBLY.

WARNING

Loss of main wheel will result if nose wheel inner bearing 18200 is inadvertently installed as main wheel outer bearing 368. These bearings are not interchangeable even though bearing inside diameter are same.

WARNING

Extensive damage will result if the wrong collar is used. Use collar Part No. 34A15-17 with wheel Part No. 5000563. Use collar Part No. 34A15-3 with wheel Part Nos. 9530322, 9530322M1 and 9531504.

a. After checking main wheel bearings for proper part numbers, align brake discs and install wheel, inboard bearing, washer, and retaining nut.

b. Tighten retaining nut until a slight drag is felt when wheel is rotated by hand.

c. Loosen retaining nut by backing off one cotter pin hole.

d. Insert cotter pin and check wheel for free rotation. Wheel should rotate without drag. If drag or binding is noted, remove nut and check for proper outer bearing installation.

e. Check wheel for bearing play. Wheel sould rotate without bearing play.

f. Secure cotter pin.

g. Install hub cap and snapring.

4–178. REMOVAL OF MAIN GEAR TIRE AND TUBE.

a. Release tire pressure completely.

b. Remove wheel assembly from airplane.

WARNING

Failure to deflate tire before separating wheel sections may result in injury from sudden expansion of the tire.

c. Remove bolts, and separate wheel sections.

d. Push valve stem through hole in rim base, and remove tube.

4-179. INSTALLATION OF MAIN GEAR TIRE AND TUBE. Since tire failure can easily result if mounting is carelessly accomplished, the following instructions must be closely observed.

a. Entirely deflate tube, and insert it in casing. Folding tube makes this operation easier. Install valve core. Inflate until tube is rounded out.

b. Insert valve-hole section of wheel into tire. Push valve stem through valve-stem hole in wheel.

c. Insert other side of wheel, holding valve in position. Assemble the two sections with arrow pointing at valve.

d. Install locking nuts and tighten them securely. On newer type wheels, required wrench torque will be stamped on the wheel.

e. Inflate until beads are properly seated against rim flanges. Deflate the tire, then reinflate to proper pressure. Check pressure with an accurate gage. Deflating and reinflating relieves pressure of folds or buckles, and permits tube to assume its proper contour within the casing.

4-180. OPTIONAL METHOD OF INSTALLING TIRE AND TUBE ON MAIN GEAR WHEEL ASSEMBLY. If inner tube is slightly oversize, or if casing is slightly undersize, the following procedure may be used.

a. Place inner tube in casing, and inflate very slightly.

b. Place valve-hole section of wheel in casing, and place assembly on the floor. To facilitate later installation of two wheel bolts, place casing and wheel on wooden blocks so that bolts may be inserted and held from the under side.

c. Insert tube in casing all around, and press sidewalls together so that both beads are on one section of wheel. It will be necessary to have an assistant hold the beads together as the tube is inserted in the casing. This may be accomplished by having the assistant stand on the tire, first on one foot, and later on both feet.

d. Insert other wheel section, with bosses marked "B" opposite each other. Secure wheel sections in place with two bolts diametrically opposite. Take care during this operation to hold the valve in position. Install remainder of bolts.

e. Inflate, deflate, and reinflate tire to relieve pressure of folds and buckles and to permit tube to assume its proper contour within the casing.

4-181. MAINTENANCE OF TIRES AND TUBES.

a. Remove when wear reaches the bottom of any tread groove (Reference T.O. 4T-1-3).

b. If fabric is exposed by any wear or damaged by cuts in the sidewall, tread ribs or tread grooves, remove and condemn the tire. Tires with cuts in tread ribs, tread grooves or sidewalls, where cuts have not damaged the cord body, should be left on the aircraft unless evidence of serious cut growth or separation appears. Cross sectional cuts are far more apt to result in serious cut progression than cuts running circumferentially around the tire. Tires showing evidence of any of the following will be removed prior to further flight: Tires with partially loose treads, ply separation (bulges), cut body cords, heat damage or severe skid spots. Every effort should be made to obtain maximum service from tires, not authorized for recapping or repair, without sacrificing safety.

c. If casing is cupped because of wheel camber or toe-in conditions, reverse casing on wheel to equalize wear.

4-182. Whenever a casing is known to have experienced abnormal usage or abuse such as striking large stones or other damaging objects, remove casing at the earliest opportunity. Inspect for damage to interior cord body or to tube.

4-183. Whenever a casing is removed for any reason, look for the following:

a. Ruptures or breaks in cord body.

b. Damage to beads which extends through outside rubberized chafing fabric.

c. Cut in tread or through tread which might expose fabric to moisture or dirt.

d. Corrosion to wheel.

e. Damage to inner tube air valve.

f. Wrinkles or creases on inner tube.

g. Indications of cuts or punctures, or thinning of inner tube adjacent to bead due to brake heat.

h. Indications of tube chafing or pinching due to casing breaks.

4-184. To improve the balance of a wheel, tire, and tube assembly whenever a casing is to be assembled on a wheel, align the mark on tube which indicates heavy portion of tube with the red dot which marks lightest portion of casing.

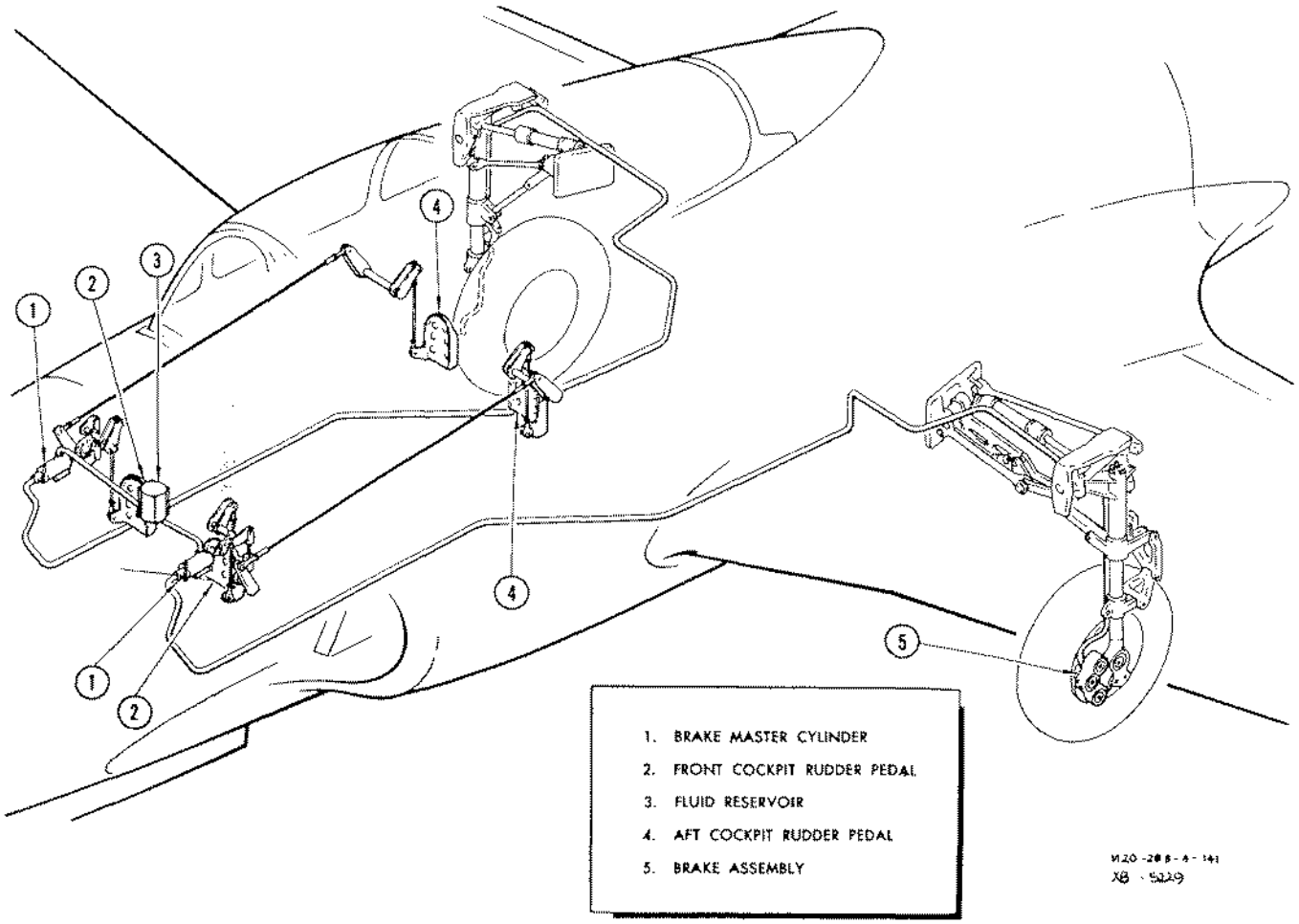


Figure 4-36. Brake System

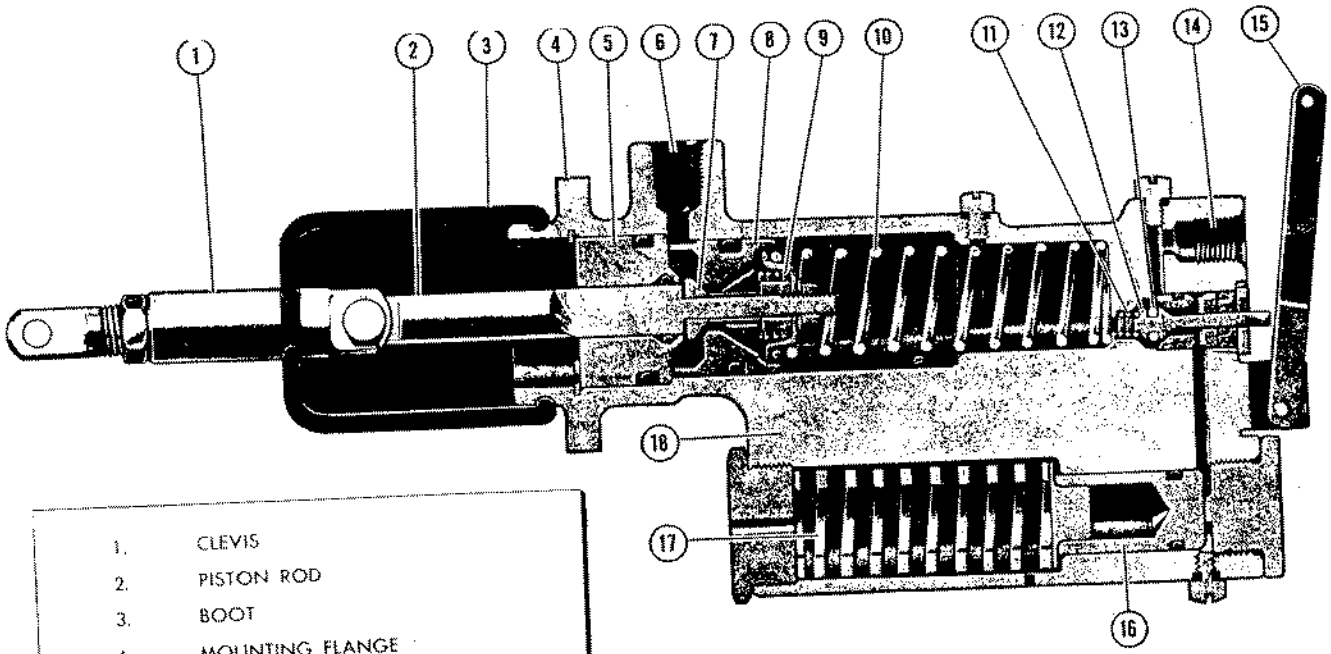
4–185. MAIN GEAR BRAKE SYSTEM. *(See figure 4-36.)* The airplane is equipped with hydraulic brakes operated by the rudder pedals. Hydraulic fluid is supplied by a reservoir connected to the master cylinders. The reservoir is mounted in the nose section. The master cylinders supply pressure through lines to the single-disc brake assemblies, mounted one on each main alighting gear. Since the master cylinders are connected individually to the left and right brake units, the two brakes are independent systems, and may be applied individually or simultaneously. A parking brake, with control handle located below each instrument panel on the airplane center line, is also included in the brake system, except on airplanes incorporating T.O. IT-33A-573.

4–186. BRAKE MASTER CYLINDER. *(See figure 4-37.)* The two master cylinders are mounted on the cockpit forward pressure bulkhead. Seals are installed under the mounting flanges to prevent loss of cockpit pressure. The piston-rod ends protrude into the cockpit where they are connected to the rudder pedal linkage. The assembly contains a master cylinder and a parking brake unit.

4–187. OPERATION OF BRAKE MASTER CYLINDER. *(See figure 4-37.)* When brakes are applied, piston rod (2) closes poppet valve (7), against back pressure in the cylinder. Movement of piston rod then forces piston (8) into cylinder and fluid is displaced into brake line, actuating wheel brake pistons. A parking brake unit is an integral part of the master cylinder assembly. It consists of a thermal relief cylinder containing a spring loaded piston, and the parking brake valve. When the brake is applied, pressure in the brake line is also transmitted to the thermal relief cylinder piston head, compressing its spring. When the parking brake lever (15) is operated, the parking brake poppet valve (12) seats against the pressure cylinder port and holds the pressure in the brake line.

4–188. REMOVAL OF BRAKE MASTER CYLINDER. *(See figure 4-37.)*

a. Working in the cockpit, remove bolt attaching master cylinder piston rod to rudder pedal linkage.



1.	CLEVIS
2.	PISTON ROD
3.	BOOT
4.	MOUNTING FLANGE
5.	BEARING
6.	ENTRY PORT
7.	POPPET VALVE
8.	PISTON HEAD
9.	SPRING (PISTON VALVE)
10.	SPRING (PISTON)
11.	SPRING (POPPET VALVE)
12.	POPPET VALVE (PARKING BRAKE)
13.	"O" RING
14.	PRESSURE PORT
15.	PARKING BRAKE LEVER
16.	PISTON (THERMAL RELIEF)
17.	SPRING (THERMAL RELIEF)
18.	BODY (BRAKE ASSEMBLY)
19.	BRAKE RESERVOIR
20	BRAKE MASTER CYLINDER

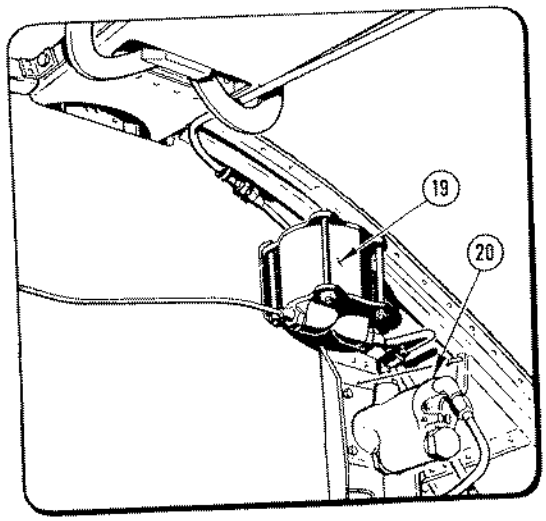


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Figure 4-37. Brake Master Cylinder

b. Remove boot (3).

c. Working in armament compartment, detach parking brake cable at lever (15) on master cylinder.

d. Disconnect brake and reservoir lines.

e. Remove four mounting bolts.

f. Remove cylinder assembly and its seal.

4–189. INSTALLATION OF BRAKE MASTER CYLINDER. Reverse removal procedure. Be sure that pressure seal between cylinder flange and bulkhead is installed. Flush and bleed the brake system. (Refer to paragraph 4–205.)

4–190. PRESSURE TESTING COCKPIT AFTER BRAKE MASTER CYLINDER INSTALLATION. Pressurize the cockpit, and check with soapy water for leakage around cylinder seals. If there are any leaks, do not attempt correction by overtightening cylinder mounting bolts. Remove the cylinder and inspect for proper fit and sealing.

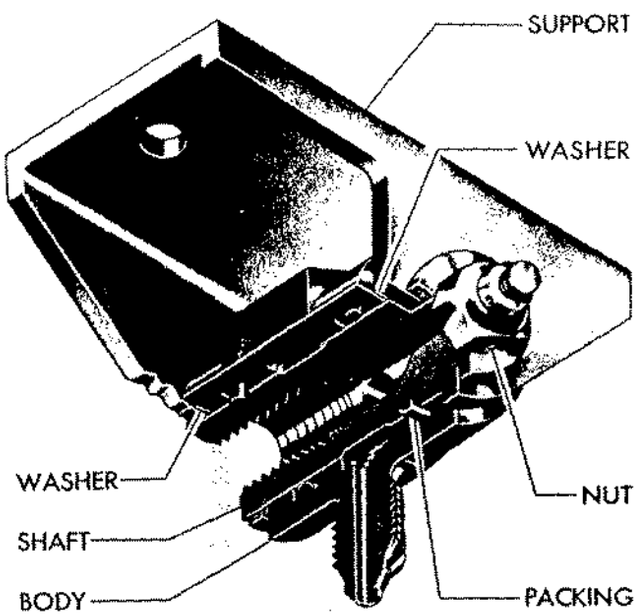


Figure 4-38. Swing Joint

4–191. ADJUSTMENT OF BRAKE MASTER CYLINDER. Refer to paragraphs 4–206 and 4–207.

4–192. SWING JOINT. *(See figure 4-38.)* A swing joint is installed in each brake line between the brake master cylinder and the main gear brake assembly. The joint is between the forward and aft main gear fulcrums in the wheel well.

4–193. REMOVAL OF SWING JOINT.

a. Drain brake system.

b. Disconnect brake lines from joint.

c. Remove two bolts holding unit in airplane, and remove joint. Outboard attaching nut is accessible through access panel No. 14.

4–194. DISASSEMBLY OF SWING JOINT.

a. Remove shaft retaining nut and washer.

b. Push shaft out of body and supports.

c. Remove all O-rings.

4–195. MAINTENANCE OF SWING JOINT. Replace all O-rings with new parts. Clean out all corrosion.

4–196. ASSEMBLY OF SWING JOINT.

a. Install shaft O-rings.

b. Push shaft into body and supports.

c. Install shaft retaining nut and washer.

Note

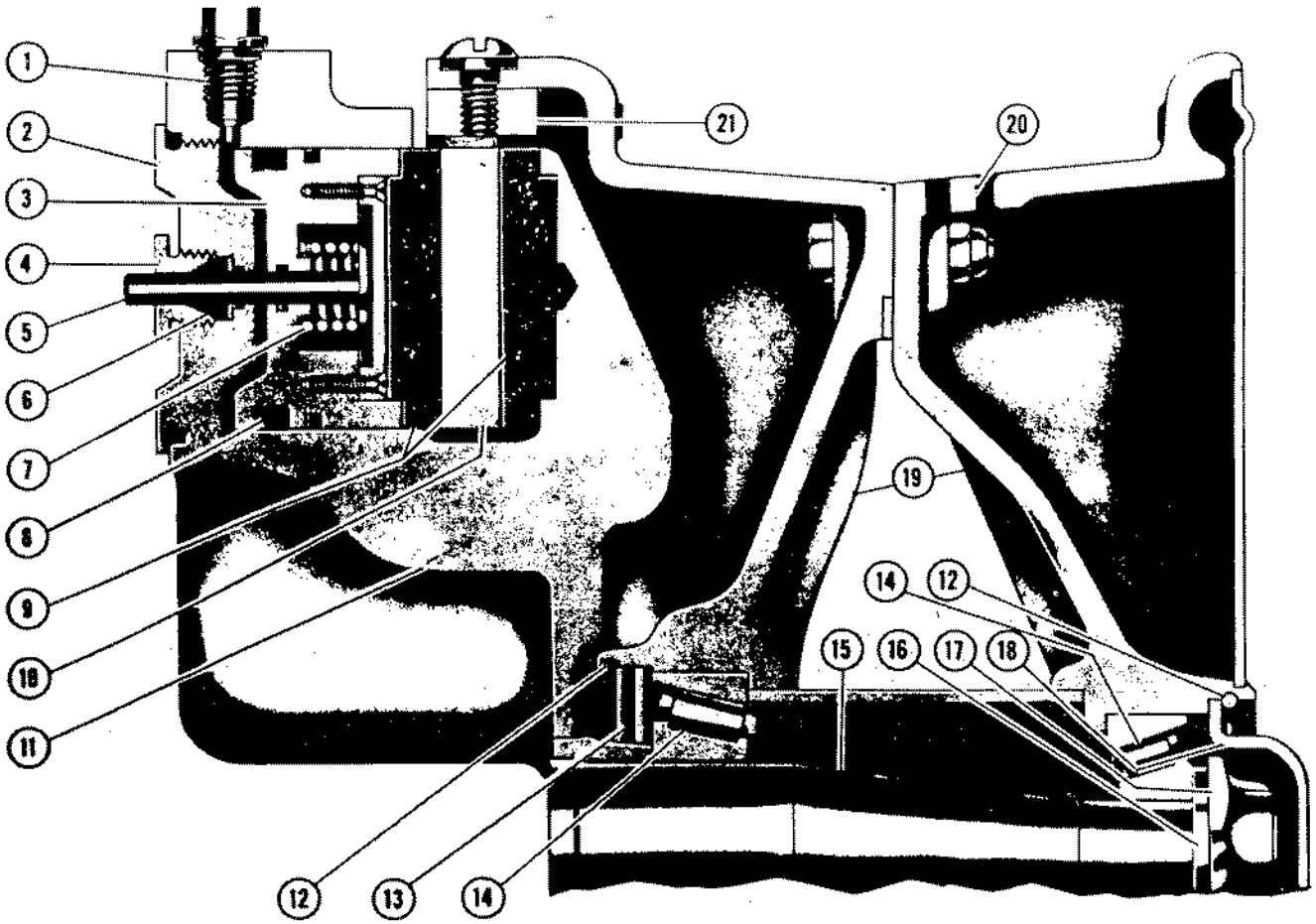
Replace 175913 washer with a 206772 stainless steel washer, or manufacture a 1.000-inch outside diameter, 0.760-inch inside diameter by 0.032 to 0.034-inch thick washer from type 302-1A stainless steel, Spec AMS5515.

4–197. BRAKE ASSEMBLY. A Goodyear part No. 9530216 or 9530424 brake assembly is installed on airplanes AF serial Nos. 48-356 through 48-375, 48-913 through 48-920, and 49-879 through 49-941. A Goodyear part No. 9540281 brake assembly is installed on airplanes AF serial Nos. 49-942 through 49-984. A Goodyear part No. 9540418 or 9540726 brake assembly is installed on AF serial No. 49-985 and subsequent. Goodyear brake assemblies, part No. 9540281 and 9540418, are converted to part No. 9540726. Brake assembly, part No. 9540726, is interchangeable with and replaces part No. 9540281 and 9540418. The brake assembly, part No. 9530216 or 9530424, consists of a cylinder housing and a single disc mounted on each main gear shock strut. Brake assemblies, part Nos. 9540281 and 9540418, consist of a cylinder housing and dual discs. The housing is bolted to a flange on the wheel axle and contains three piston and brake lining puck assemblies. The notched discs are keyed to the wheel. At the time of installation or upon replacement of the pucks, the brake assembly must be adjusted. Other than this adjustment, it needs no further adjustment during the life of the lining pucks. Brake lining puck clearance remains constant, and the brake pedal remains in the same position with any degree of lining puck wear.

4–198. OPERATION OF BRAKE ASSEMBLY. *(See figures 4-39 and 4-40.)* Hydraulic pressure applied through the fluid port forces the piston outboard, clamping the brake discs between the lining pucks. When hydraulic pressure is released, the piston return spring forces the piston away from the pucks, relieving the bind on the brake discs. Hydraulic pressure when the brake is applied is sufficient to move the adjusting pin, outboard against the packing friction, but the pressure of the return spring is sufficient only to move the piston through the distance necessary to contact the head of the adjusting pin, and is not sufficient to move the adjusting pin inboard. The brake clearance, once set, remains constant, regardless of lining wear.

4–199. REMOVAL OF BRAKE ASSEMBLY.

a. Remove center door segment and wheel. (Refer to paragraph 4-175.)



1.	BRAKE FLUID PORT	8.	"O" RING PACKING	15.	AXLE
2.	CYLINDER HEAD	9.	BRAKE LINING	16.	WASHER
3.	PISTON	10.	BRAKE DISC	17.	NUT
4.	ADJUSTING PIN NUT	11.	BRAKE HOUSING	18.	COVER
5.	ADJUSTING PIN	12.	LOCK RING	19.	WHEEL SECTIONS
6.	AUTOMATIC ADJUSTING GRIP	13.	GREASE SEAL	20.	VALVE STEM OPENING
7.	PISTON RETURN SPRING	14.	BEARING	21.	DISC DRIVE KEY

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Figure 4-39. Main Wheel and Brake Unit, Goodyear Part No. 9530216 and 9530424

b. Detach brake line at center piston fitting, and plug the opening.

c. Remove bolts at the mounting flange.

d. Remove brake assembly, taking care that lining pucks do not fall out.

4–200. INSTALLATION OF BRAKE ASSEMBLY. Reverse removal procedure. Flush and bleed the system. (Refer to paragraph 4–205.)

CAUTION

Inspect brake disc to insure that discs are clean and rust preservative is removed prior to installation.

4–201. REPLACEMENT OF BRAKE LINING PUCKS (BRAKE ASSEMBLIES 9530216 AND 9530424).

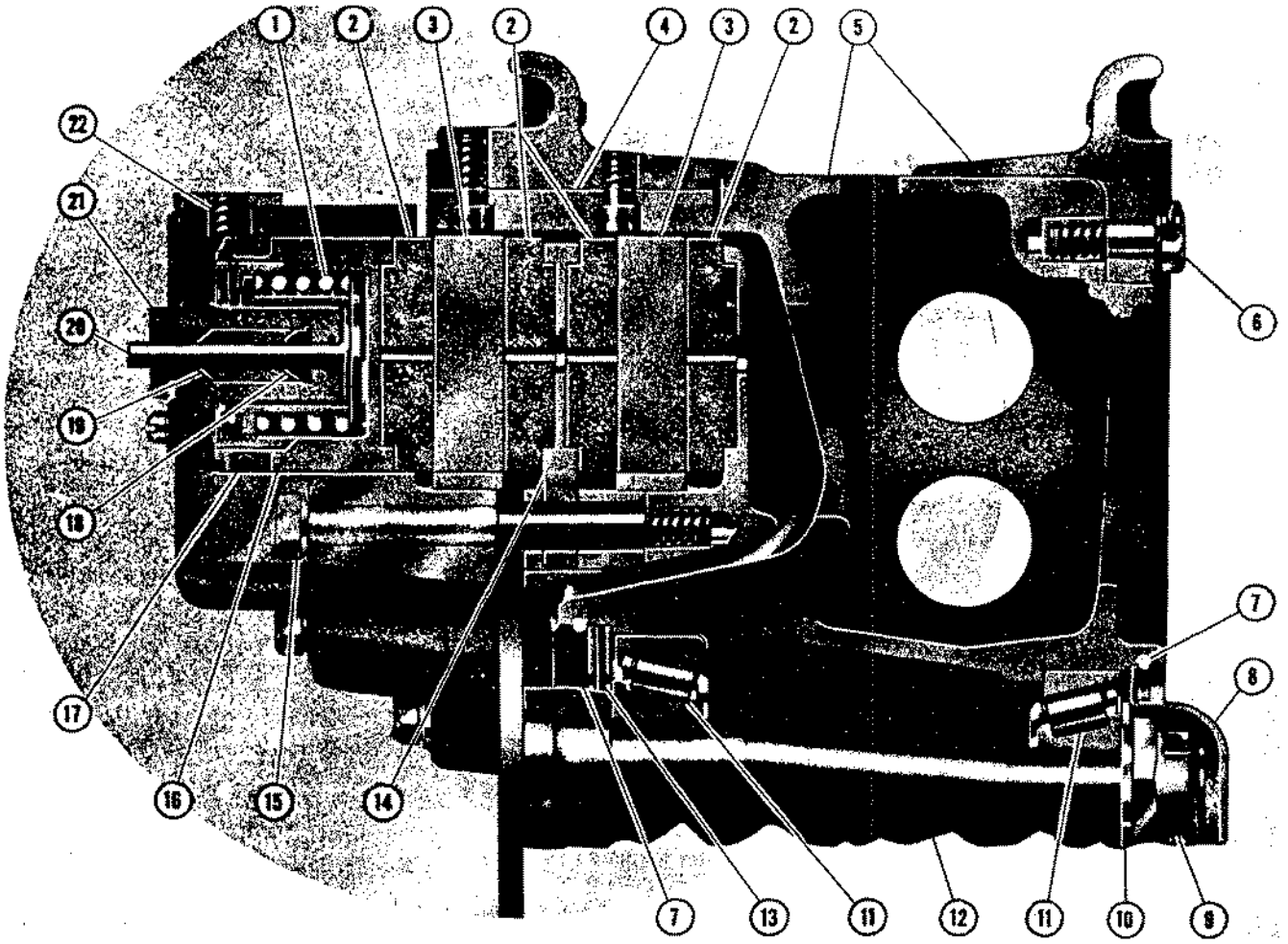
Note

Whenever lining is changed, brake assembly will be disassembled, cleaned, inspected for cracks and corrosion, and excessively worn parts replaced.

a. Jack airplane by placing jack under axle, directly beneath strut.

b. Remove wheel assembly. (Refer to paragraph 4–175.)

c. Remove brake assembly. (Refer to paragraph 4–199.)



1.	PISTON RETURN SPRING	12.	AXLE
2.	BRAKE LINING PUCKS	13.	GREASE SEAL
3.	BRAKE DISC	14.	BRAKE LINING PUCK CARRIER
4.	DISC DRIVE KEY	15.	CARRIER RETAINING BOLT
5.	WHEEL SECTIONS	16.	PISTON
6.	WHEEL SECTION ATTACHING BOLTS	17.	"O" RING PACKING
7.	SNAP RING	18.	AUTOMATIC ADJUSTING GRIP
8.	HUB CAP	19.	ADJUSTING GRIP SPACER
9.	WHEEL RETAINING NUT	20.	ADJUSTING PIN
10.	BEARING SPACER	21.	ADJUSTING GRIP TORQUE NUT
11.	BEARING	22.	FLUID PORT

Figure 4-40. Main Wheel and Brake Unit, Goodyear Part No. 9540281, 9540418 and 9540726

d. Loosen the three adjusting pin nuts and shake disc to move adjusting pins outboard as far as possible.

e. Remove brake disc and lining pucks.

f. Remove adjusting pin nuts, and cylinder heads.

g. Remove piston assemblies; clean and inspect for corrosion and scoring.

h. Clean and inspect cylinder cavities for corrosion and scoring that would effect proper operation of the O-ring seals.

i. Remove and clean O-ring seals, cleaning with clean hydraulic fluid, Specification MIL-H-5606. Inspect for flat spots, cracks, cuts and damage.

j. Inspect brake disc for scoring, roughness, and warpage. Replace if disc thickness is 0.436-inch or less, or if disc key slot width is 0.687-inch or more.

k. Coat cylinder walls, contacting piston surfaces, O-ring packing grooves, O-ring packing, seals, and cylinder head threads with grease, Specification MIL-L-7711.

l. Reinstall O-ring seals on pistons, and insert piston assemblies into cylinder cavities.

m. Install O-ring seals in cylinder head and insert or screw cylinder head into the cylinder cavity. On brake, 9530424, insert cylinder head retainer ring. On brake, 9530216, torque cylinder head to 75 lb ft.

n. Lubricate adjusting pin grip with hydraulic fluid, Specification MIL-H-5606. Place adjusting pin washer and adjusting pin grip on adjusting pin. Screw adjusting pin nut into cylinder head, but do not tighten.

o. Install new brake lining pucks in lining recesses and pistons.

Note

Apply a small amount of heavy grease to back side of lining pucks to hold them in place while brake disc is installed.

p. Insert brake disc between brake lining pucks.

q. Install brake assembly on axle. (Refer to paragraph 4–200.)

r. Adjust brakes. (Refer to paragraph 4–203.)

s. Fill and bleed brake system. (Refer to paragraph 4–205.)

t. Install wheel and remove jack.

4–202. REPLACEMENT OF BRAKE LINING PUCKS (BRAKE ASSEMBLIES, 9540281, 9540418, AND 9540726).

Note

Whenever lining is changed, brake assembly will be disassembled, cleaned, inspected for cracks and corrosion, and excessively worn parts replaced.

a. Jack airplane by placing jack under axle directly beneath strut.

b. Remove wheel assembly. (Refer to paragraph 4–175.)

c. Remove brake assembly. (Refer to paragraph 4–199.)

d. Remove the housing bolts, nuts, and washers.

e. Separate brake lining puck carrier from housing back plate.

f. Remove discs and lining pucks.

g. Remove adjusting grip torque nut, spacers, grips, and washers.

h. Remove piston assemblies; clean and inspect for corrosion and scoring.

i. Clean and inspect cylinder cavities for corrosion and scoring that would affect proper operation of O-ring seals.

j. Inspect brake discs for scoring, roughness, and warpage. Replace if disc thickness is 0.675-inch or less, or if disc key slot width is 0.811-inch or more.

k. Coat cylinder walls, contacting piston surfaces, O-ring packing grooves, O-ring packings and seals with grease, Specification MIL-L-7711.

l. Install new O-ring seals on piston assemblies and in adjusting pin cavities. Insert piston assemblies into cylinder cavities.

m. Lubricate adjusting pin grip with hydraulic fluid, Specification MIL-H-5606. (See figure 4-40 for correct installation.) Place adjusting pin washer, grip, and spacer on adjusting pin. Screw adjusting pin nut into adjusting pin boss, but do not tighten.

n. Install new brake lining puck on pistons, center carrier, and housing back plate.

Note

On brake assemblies, 9540281 and 9540418, apply a small amount of heavy grease to the back side of lining pucks to hold them in place while brake discs are installed. On brake assembly, 9540726, lubricate lining sockets with a small amount of grease, Specification MIL-L-7711.

o. Position discs on housing back plate and between piston and center carrier linings.

Note

Center carrier subassembly must be installed with the guide linings facing the cylinder housing.

p. Lubricate housing bolt threads with anti-seize compound, Specification MIL-C-5544. Install housing bolts, nuts and washers. Torque to 8 lb ft.

q. Reinstall brake assembly on axle. Torque mounting bolts to 22 lb ft.

r. Adjust brakes. (Refer to paragraph 4–203.)

s. Fill and bleed brake system. (Refer to paragraph 4–205.)

t. Install wheel and remove jack.

4–203. ADJUSTMENT OF BRAKE ASSEMBLY. The brakes are self-adjusting after installation, however, upon installation of a new assembly or upon replacement of the lining pucks, it is necessary to set the adjusting pins. Adjust as follows:

a. Loosen the torque nuts until the adjusting pins can be moved.

b. Move the adjusting pin out as far as possible by shaking the brake disc next to the brake cylinders.

c. On brake assemblies 9530216 and 9530424, torque to 15 lb ft. On brake assemblies 9540281, 9540418 and 9540726, torque to 20 lb ft. Lock-wire adjusting pin nuts.

Note

Do not exceed the required torque, faulty operation or damage to the adjusting pin grip may result. If the nut flange should bottom against the cylinder head before reaching the required torque, replace the split collet adjusting pin grip.

d. Depress brake pedal in cockpit. The brake unit will then automatically adjust to the designed clearance.

4–204. SERVICING BRAKE SYSTEM. The reservoir is accessible from the left side of the nose section. Remove filler plug and fill to mark on reservoir with hydraulic fluid, Specification MIL-H-5606. Replace filler plug.

4–205. BLEEDING BRAKE SYSTEM. Each main gear wheel is equipped with a complete brake system, and each system must be bled separately.

Note

Bleed the brake system carefully or faulty brake action will result from air remaining in the system. Be careful to prevent any fluid from getting on linings or disc, it must be cleaned off thoroughly.

CAUTION

Do not use auxiliary air pressure when bleeding brakes.

a. Flush the entire system and fill the reservoir. Use hydraulic fluid, Specification MIL-H-5606.

Note

It is important that reservoir be kept full of fluid during bleeding process.

b. Open lower port on brake casting and allow fluid to flow freely. Close port.

c. Remove bleeder plug at top of brake assembly and insert in its place a standard bleeder hose. Place the free end of the hose in a clean glass receptacle.

d. When the fluid flows from the bleeder hose, depress the brake pedal slowly several times, closing the bleeder port on the return stroke of the pedal by pinching the hose. Continue this operation until no air bubbles appear. Shaking the brake disc will help trapped air escape from the brake.

e. Release pressure on hose and slowly depress the pedal. With fluid flowing, remove the bleeder hose and replace the plug in the bleeder port.

f. With parking brake on, open two bleed ports on top of master cylinder and allow air to escape. Close ports.

g. Check brake pedal action and if it still feels spongy, repeat above steps.

h. When brake action is found to be satisfactory, check fluid in reservoir and add if necessary.

4–206. ADJUSTMENT OF BRAKE PEDAL LINKAGE. *(See figures 4-125 and 4-126.)* Adjust each brake pedal and linkage to its respective master cylinder as follows:

a. With brakes off, adjust master cylinder clevis so that bellcrank arm connected to front cockpit brake pedal is in position shown in figure 4-126.

Note

This adjustment must be made accurately to insure correct amount of piston travel at master cylinder.

b. Fix front rudder-pedal hangers in neutral position. This may be checked with a protractor-level, using the cockpit floor for reference. Front and rear faces of hanger each have a 2-degree taper.

c. Adjust brake rod connected to front rudder pedal so that a forward angle of not more than 8 degrees is obtained between aft face of pedal and aft face of hanger.

d. Adjust aft cockpit brake pedal as described in steps b and c.

4–207. ADJUSTMENT OF PARKING BRAKE SYSTEM. *(See figure 4-37.)*

a. Adjust parking brake cable from left to right arms on master brake cylinders so that, with full brake pressure applied to the cylinders, the arms clear the plungers in cylinders by approximately $\frac{1}{16}$ inch.

b. Operate parking brake system approximately ten times to insure that clearances are maintained.

4–208. INSPECTION OF LINING PUCKS AND DISCS ON BRAKE ASSEMBLIES, 9530216 AND 9530424. Replace lining pucks when wear area is worn to 1/16-inch thick. Inspect lining pucks for excessive wear as follows:

a. Apply brakes.

b. Measure distance between cylinder housing and disc face. If distance is 0.390-inch or more on brake, 9530216, or 0.313-inch or more on brake, 9530424, inboard lining should be replaced.

c. Visually check outboard linings. If worn to 1/16-inch or less, replace.

Note

Replace lining pucks in complete sets. Do not mix new and used lining pucks.

d. Release brakes.

e. Brake disc should be replaced under the following conditions:

When disc thickness is 0.436-inch or less.

When disc key slot width is 0.687-inch or more.

When disc face surfaces are rough, scored or warped.

4–209. INSPECTION OF LINING PUCKS AND DISCS ON BRAKE ASSEMBLIES, 9540281, 9540418, AND 9540726. Replace lining pucks when wear area is worn to 1/16-inch thick. Inspect lining pucks for wear as follows:

a. Apply brakes.

b. Measure distance between cylinder housing and disc face. If distance is 1.00-inch or more, remove wheel and visually check lining pucks for excessive wear. Replace lining pucks when worn to 1/16-inch thick.

Note

Replace lining pucks in complete sets. Do not mix new and used linings.

c. Release brakes.

d. Brake discs should be replaced under the following conditions:

When disc thickness is 0.675-inch or less.

When disc key slot width is 0.811-inch or less.

When disc face surfaces are rough, scored, or warped.

4–210. TROUBLE SHOOTING OF THE BRAKE SYSTEM.

Trouble	*Probable Cause*	*Remedy*
Excessive pedal action or insufficient braking action.	Worn linings.	Replace with new set of linings. Refer to paragraph 4–201.
	Leak in system.	Check for leaks. Replace worn, deteriorated, or damaged seals.
	Air in system (rubbery, springy pedal action).	Bleed system.
	Lack of fluid in supply line.	Reservoir must be kept full to marking on brake reservoir.
	Reservoir vent clogged.	Open vent to allow passage of air.
	Improper adjustment of brake linkage.	Check linkage for adjustments shown on figure 4–125.
Dragging brakes.	Dirt in system.	Disassemble and clean master cylinders and brake units. Flush lines and reservoir with hydraulic fluid.
	Brake piston binding.	Remove piston and clean with isopropyl alcohol.
	Improper fluid.	Drain system; flush with isopropyl alcohol, kerosene, or naphtha. Replace seals if damaged. Fill system with hydraulic fluid, Specification MIL-H-5606, and bleed.
	Improper adjustment of parking brake.	Be sure the parking brake is disengaging properly.
	Incorrect lining clearance.	Adjust wheel brake assembly. Refer to paragraph 4–203.

4-211. MAIN GEAR DOORS AND UP LOCK MECHANISM. *(See figure 4-41.)* The doors for each main gear consist of an inner segment hinged parallel to the airplane center line, a center segment attached to the shock-strut lower end, and an outer segment hinged on the wing and connected to the shock strut by a spring-loaded actuator rod. The inner door segment is hydraulically operated by an actuating cylinder and mechanical linkage, in automatic sequence with the gear operation. A separate hydraulic actuating cylinder is installed for emergency release of the inner door segment.

4-212. OPERATION OF MAIN GEAR DOORS AND UPLOCK MECHANISM. *(See figure 4-41.)* The center and outer door segments move with the gear to their closed positions before the inner door segment closes. During retraction, a hook on the center door engages a roller on the outer door to lock the two segments in a flush position when completely closed. This sequence in closing operation is due to a mechanical delay provided by the inner-segment actuating linkage. When the gear has nearly reached its retracted position, lever (12) is struck by the center door segment. This moves rod (10) to force a link over dead-center position. Hydraulic pressure in the door cylinder (5) is prevented from moving the door by dead-center position of link (14), thus, when the link has moved from dead-center, the cylinder is free to swing the door to closed position. Upon closing, a roller (17) mounted on the door first contacts retainer hook (16) and moves the hook slightly inboard. This action relieves the cylinder force on trigger hook (15) at its notched end, and frees both hooks to rotate as further force by the cylinder moves them onto the roller. When up and locked, the doors serve to lock the gear in retracted position.

4-213. In opening, inner door and gear extension are almost simultaneous. As soon as the door actuating cylinder releases the uplock and starts the inner door to opening, the weight of the gear as it extends helps to force the door open. Emergency opening of the inner door segment is effected by a small release cylinder (11) which rotates the hooks to their normal open position. When rotated to the open positions, the hooks partially open the door. The door is then forced completely open by the gear as it extends.

4-214. REMOVAL OF MAIN ALIGHTING GEAR DOORS.

a. Use the following procedure to remove inner door.

Detach stiff-knee link.

Detach hydraulic actuating cylinder.

Remove screws along inboard edge of door.

b. Use following procedure to remove center door.

Remove two bolts from clamp around shock strut at top of door.

Remove two bolts from bracket at bottom of shock strut.

c. Use the following procedure to remove outer door.

Detach spring-loaded actuator link.

Release sliding pins at top of door.

4-214A. INSTALLATION OF MAIN ALIGHTING GEAR DOORS.

a. Reverse removal procedures for installation of the gear doors.

NOTE

Upon installation of the inboard gear door actuating cylinder, to the inner door attachment fitting, torque nut from 60 to 85 inch-pounds prior to installation of the cotter key.

4-215. REMOVAL AND DISASSEMBLY OF SPRING-LOADED ACTUATOR LINK. *(See figure 4-42.)*

a. Remove spring-loaded actuator link (8) by removing rod end attaching bolts.

b. Loosen rod and locknut and remove rod end. Remove locknut.

c. Remove snapring and remove spring retaining nut.

d. Remove piston rod, piston and spring.

e. Disassemble spring and piston from rod.

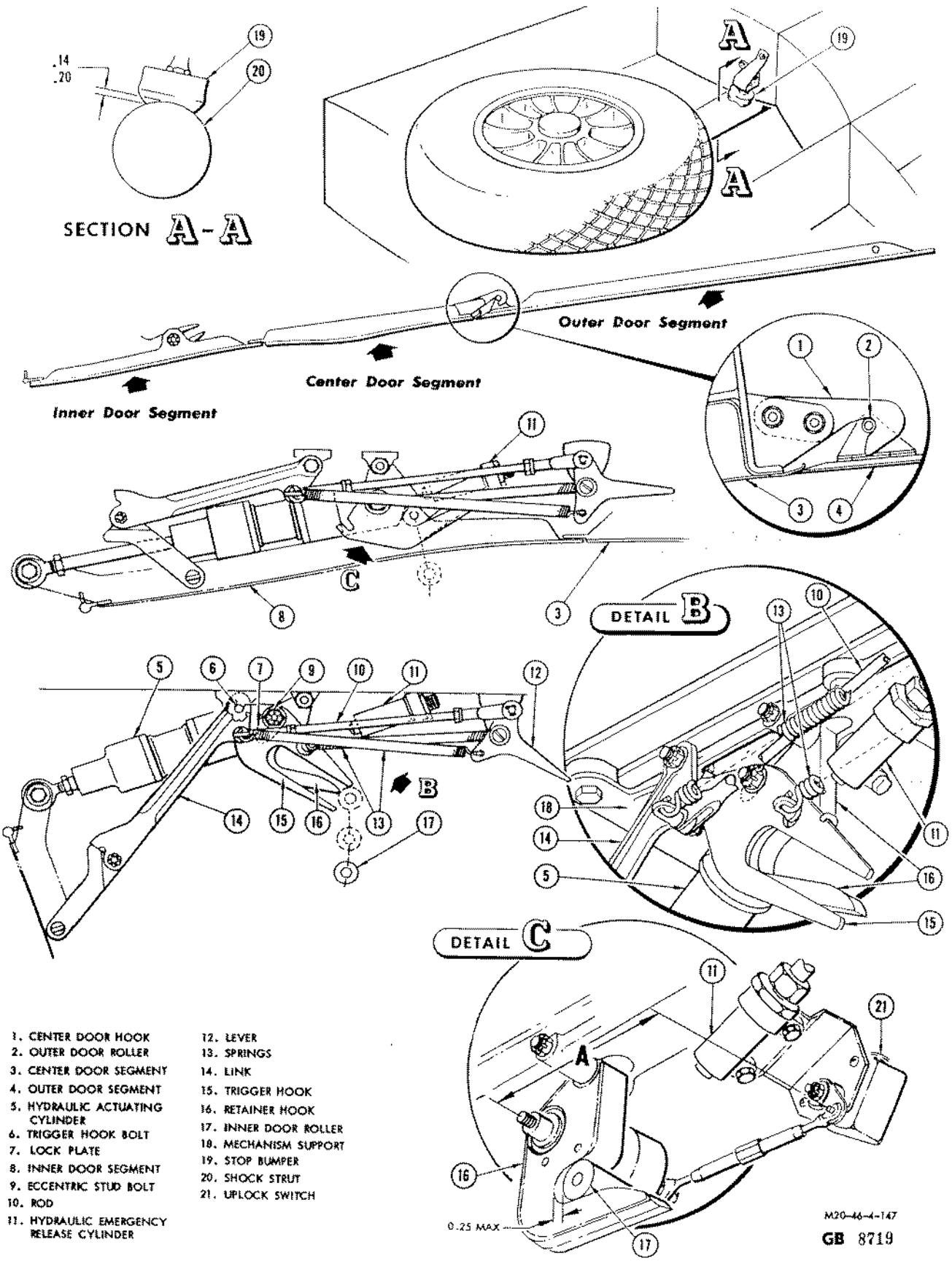
4-216. ADJUSTMENT OF MAIN GEAR DOORS AND UPLOCK MECHANISM. *(See figure 4-41.)* Hook and roller mechanisms must be carefully adjusted to ensure positive closing and locking of all doors. The roller (2) on outer door must be within 0.080 inch from bottom of center door hook (1) when doors are closed. The trigger-hook notch must bottom against trigger hook bolt (6) when inner door is open; inner door roller must first contact hook (16) when closing.

4-217. ADJUSTMENT OF OUTER DOOR TO CENTER DOOR HOOKING MECHANISM.

a. Spring-loaded actuator link must have a travel of from 0.090 to 0.150-inch. If travel cannot be obtained, link may be backed off a maximum of one full turn to obtain above dimensions. If travel is too great, add washers AN 960-616L between piston and spring to restrict travel to above dimensions.

b. Place clay on inside of center door hook (1).

c. As gear retracts observe approach of roller and hook on center door. When outer and center doors are closed, roller shall be 0.080-inch from bottom of hook.



1. CENTER DOOR HOOK
2. OUTER DOOR ROLLER
3. CENTER DOOR SEGMENT
4. OUTER DOOR SEGMENT
5. HYDRAULIC ACTUATING CYLINDER
6. TRIGGER HOOK BOLT
7. LOCK PLATE
8. INNER DOOR SEGMENT
9. ECCENTRIC STUD BOLT
10. ROD
11. HYDRAULIC EMERGENCY RELEASE CYLINDER
12. LEVER
13. SPRINGS
14. LINK
15. TRIGGER HOOK
16. RETAINER HOOK
17. INNER DOOR ROLLER
18. MECHANISM SUPPORT
19. STOP BUMPER
20. SHOCK STRUT
21. UPLOCK SWITCH

Figure 4-41. Main Gear Door and Uplock Mechanism

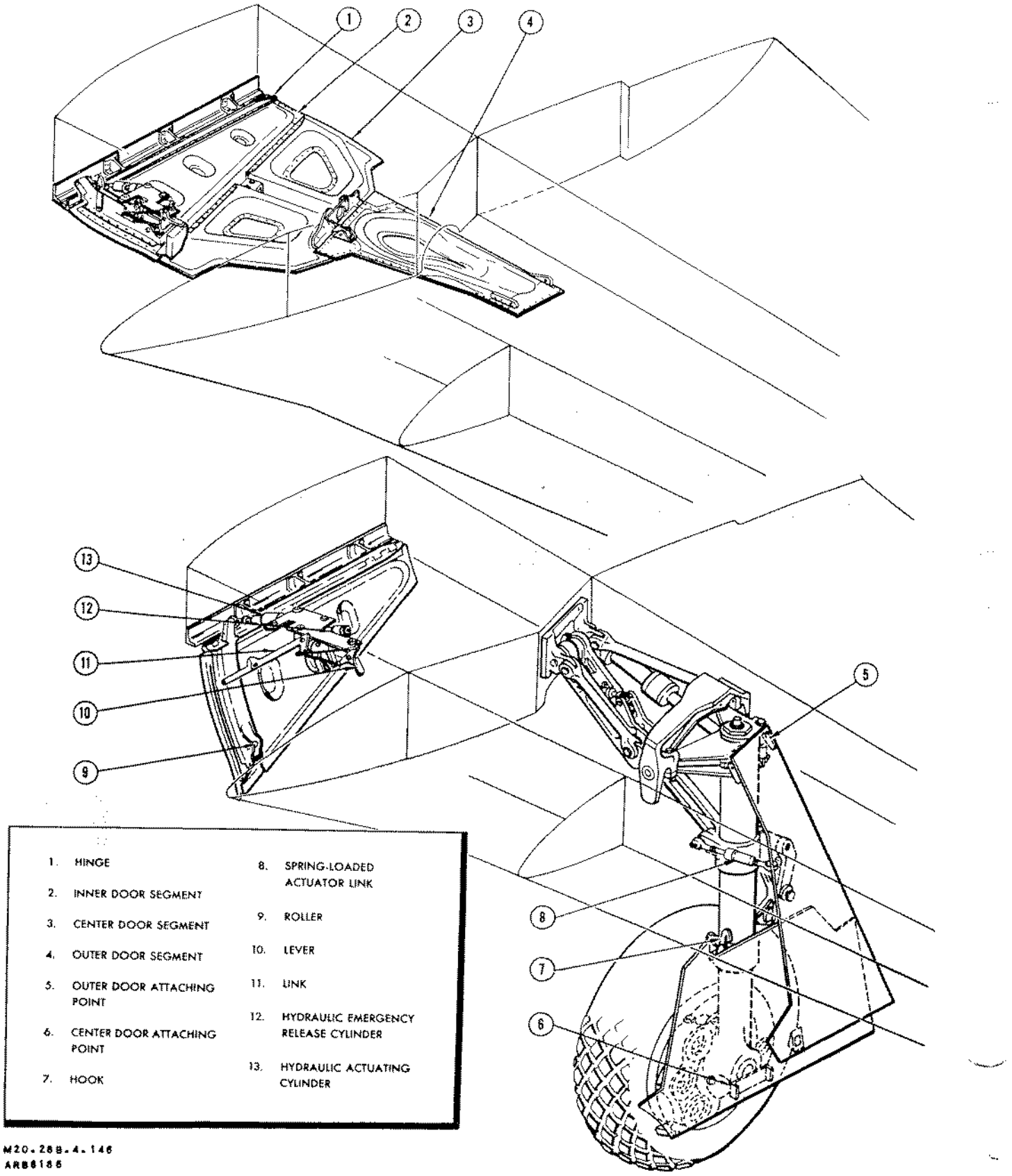


Figure 4-42. Main Gear Door Linkage

d. If roller does not properly engage hook, as determined from measuring clay, loosen hook and move along slotted holes.

e. Adjust spring-loaded actuator link (by screwing rod ends in or out) until outer door roller enters hook at approximately middle of hook opening. Roller must not hit point of hook.

f. Remove roller from bracket. Place strip of cloth around end of outboard door. Retract gear and doors. Exert opening force on outboard door by pulling on ends of cloth. There shall be evidence of door movement before bottoming of spring actuator. This travel is required to prevent overloading of actuator attaching pin when gear is in retracted position.

4–218. ADJUSTMENT OF INNER DOOR MECHANISM.

a. With inner door open and knee joint (14) over center, adjust rod end of door actuating cylinder so that with piston bottomed in cylinder, rod end hole aligns with hole in door arm.

b. With door open, check for seating of bolt (6) in notch of trigger hook (15). Trigger hook shall be considered seated when spring tension or a maximum of 50 psi hydraulic pressure in door actuating cylinder has removed slack from door mechanism. Clearance between trigger hook notch and roller must not exceed a maximum of 0.032 inch.

Note

Prior to AF Serial No. 53-4955, a clevis bolt (figure 4-39, item 6) is installed. A roller engages the notch in the trigger hook on AF Serial No. 53-4955 and subsequent.

c. Close door until roller (17) contacts hook (16) and deflects hook from 0.03 to 0.09 inch. If it is necessary to adjust deflection, loosen eccentric stud bolt (9) and lock plate (7); rotate bolt (9) until correct hook deflection is obtained; tighten lock plate and bolt. Be sure that hook (16) rotates freely on bolt (9).

CAUTION

Alighting gear handle must be in "UP" and 50 psi (maximum) hydraulic pressure in system when making above adjustment.

Note

If installing a new knee-joint link (14), center line of joint bolt must have offset of from 0.06 to 0.10 inch from center line through upper and lower link attachment point. File as necessary at joint stop points to obtain this off-center dimension.

If trigger fails to hold position under door actuating cylinder load after conforming to above procedure, replace trigger. Deformation in the area of roller contact will cause malfunction regardless of adjustment.

4–219. For stall characteristics of the airplane, refer to paragraph 4–663.

4–220. NOSE ALIGHTING GEAR.

(See figures 4-43 and 4-44.)

4–221. DESCRIPTION OF NOSE GEAR. The nose alighting gear is part of the airplane tricycle alighting gear and operates in conjunction with the main gear. Controls, emergency extension system, and warning devices are common to both main and nose gears. The gear consists of an air-oil shock strut assembly with shimmy damper device, a drag strut assembly with down lock mechanism, a hydraulic actuating cylinder, two torque arms, and a wheel assembly.

4–222. The gear is mounted by a fulcrum made integral with the shock strut. The fulcrum pivots in a bearing support attached to the bottom of station 81 canted bulkhead. The lower drag strut member is connected to the shock strut, the upper drag strut member is connected to a fitting on the forward side of station 103 bulkhead. The fitting provides mounting at its upper extremity for the hydraulic actuating cylinder. The cylinder piston rod is connected to the two links of the down lock mechanism, which is in turn mounted between the two members of the upper drag strut. Two truss members interconnect the fulcrum bearing support and fitting at point where drag strut attaches, thus forming a rigidly aligned assembly. The hydraulically operated up lock is located on the aft side at station 103 bulkhead.

4–223. For detailed information on hydraulic units and electrical system which are related to the alighting gear, refer to paragraphs 4–693 through 4–726 and 4–903 through 4–917.

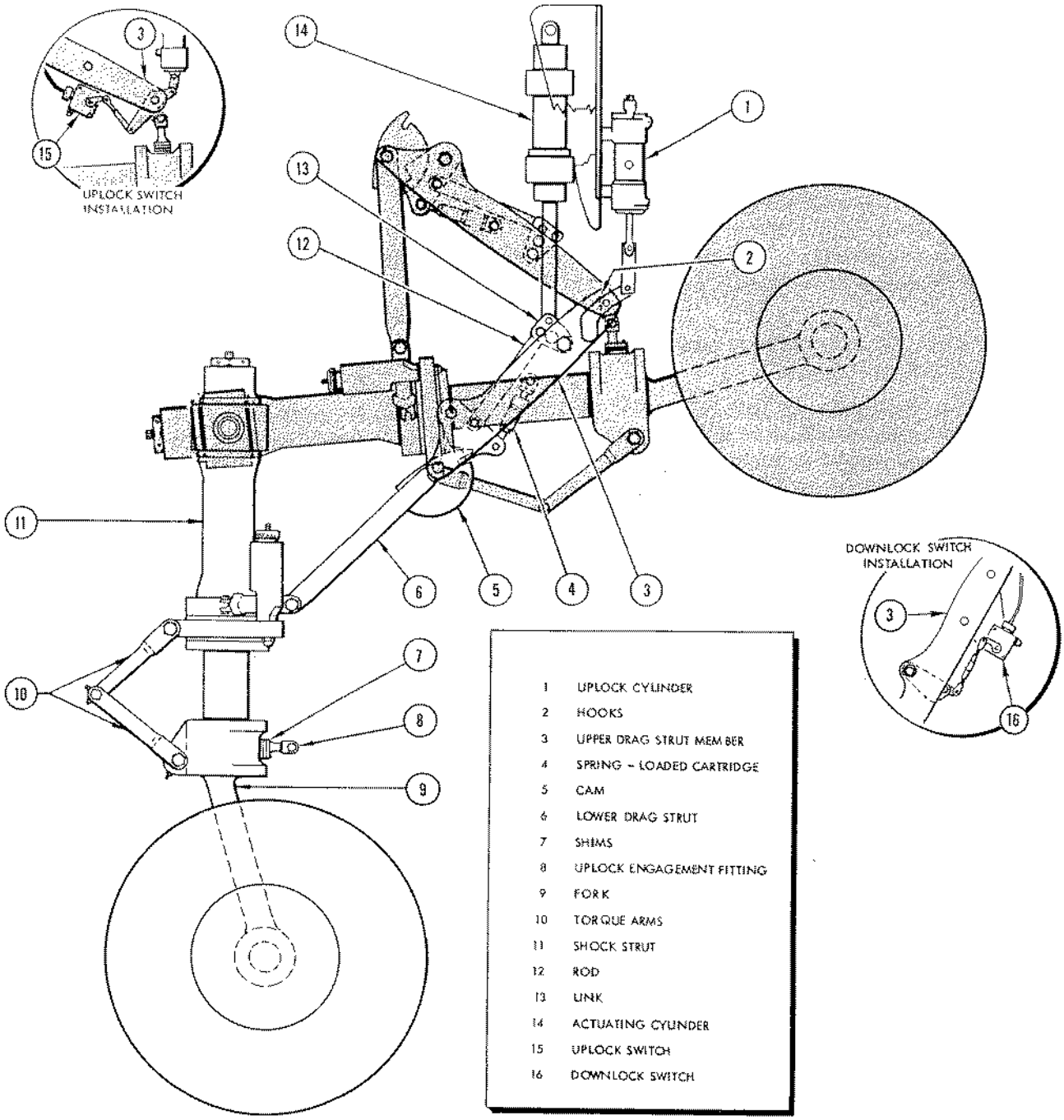


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Figure 4-43. Nose Alighting Gear

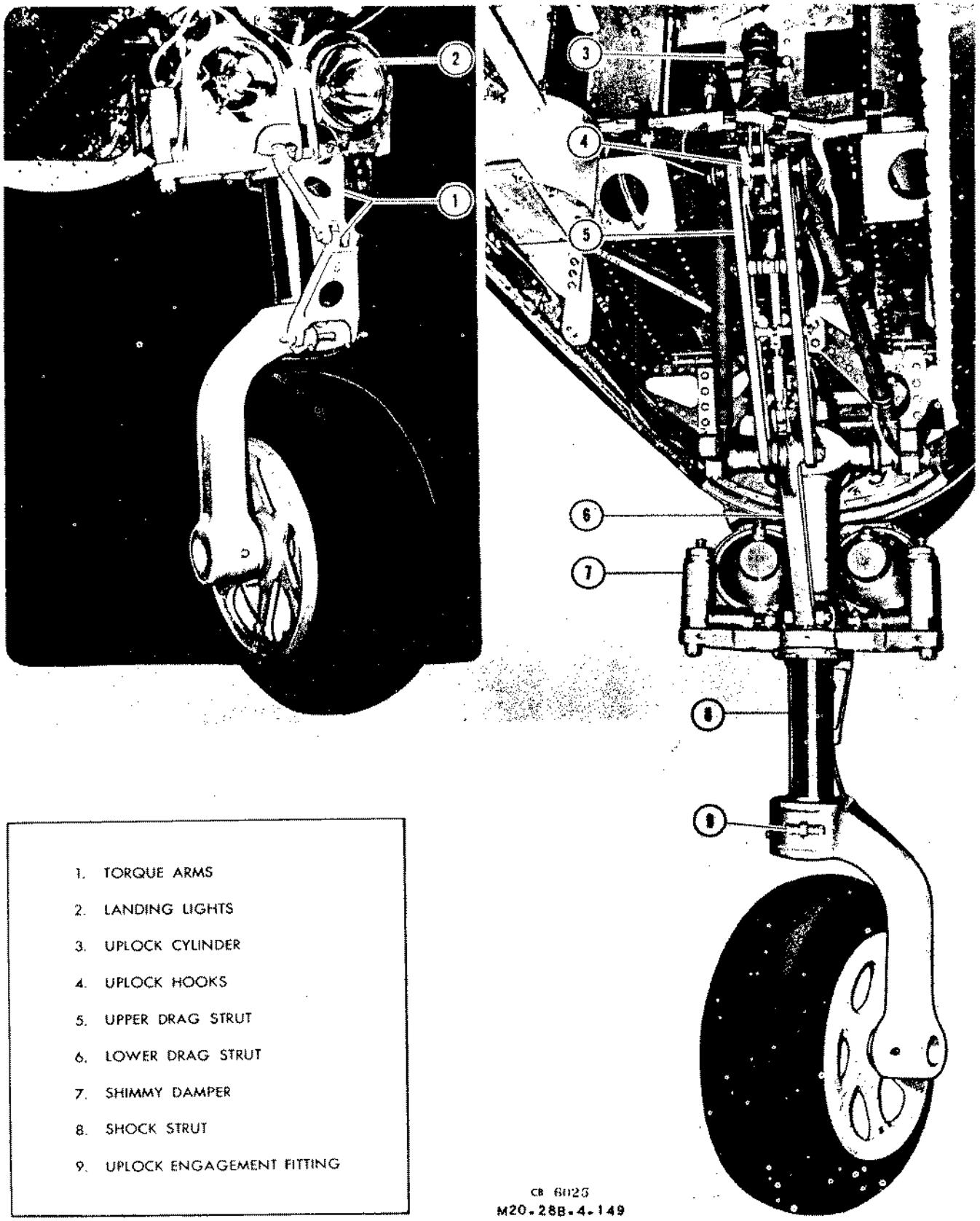

Figure 4-44. Nose Alighting Gear Installation

4–224. OPERATION OF NOSE GEAR. When the cockpit control lever is placed in "UP" position, hydraulic pressure delivered to the cylinder moves the piston rod up, releasing the down lock and breaking the upper and lower drag struts from dead-center position. The struts then pull the gear aft and up into the wheel well, where it is locked by the up lock mechanism. Extension of the gear is essentially a reversal of the retracting operation. For details of the operation of locks, refer to paragraphs 4–241 and 4–244.

4–225. REMOVAL AND DISASSEMBLY OF NOSE GEAR.

a. Jack the airplane. (Refer to paragraph 3–19.)

b. If desired, remove the wheel assembly.

c. Disconnect cylinder piston rod at links of down lock mechanism.

d. Disconnect lower drag strut at shock strut.

e. Disconnect electrical wiring.

f. Remove bolt from upper drag strut attachment fitting and remove complete drag strut assembly. When bolt is removed, truss members, drag strut, up lock hooks and switch assembly, and spacer washers are freed. Hook assembly will be retained by bolt in its actuating link and may be removed if desired. Save washers for reinstallation.

g. Remove four bolts in bearing caps of fulcrum. (See figure 4-45.)

Note

Note the side from which each cap is removed so that caps can be matched to fulcrum support fitting upon installation of nose gear.

h. Remove bearing caps, and lower gear, clear of airplane.

i. Truss members are detachable only after gear is removed. Detach by removing pin, spacer, shim, and outer bearing.

4–226. CLEANING THE NOSE GEAR.

a. Wash bearing parts, shims, etc., with either kerosene or solvent, Federal Specification P-S-661.

b. Wipe parts dry with clean cloth.

4–227. ASSEMBLY AND INSTALLATION OF THE NOSE GEAR.

a. Pace a shim, truss member, washer, bearing, shim, and spacer on each side of the fulcrum in that order. Lock spacer in place with pin. Separate washer and bearing so that bearing supports will slip between them when gear is lifted into place.

b. Lift gear into place and seat fulcrum firmly in bearing support.

c. Install bearing caps and secure with four bolts.

CAUTION

Match cap to correct fitting. An impression stamp on the face of the caps corresponds to the fulcrum support fittings, and is to be used as a guide for correct installation of caps. Matching of caps to fitting is important because hole size tolerance for cap and fitting is 0.001 inch.

Note

Gear should be free to fall of its own weight. Torque on bearing cap bolts may be as low as 100 lb in. to get this result.

d. Check for free rotation of fulcrum in bearings, and for end play of 0.005 inch maximum. Either add or peel shims for adjustment.

e. Install drag strut. Be sure truss members, uplock, and washers are correctly installed as shown in figure 4-45.

f. Connect cylinder piston rod.

g. Connect electrical wiring.

h. Lubricate affected parts.

4–228. ADJUSTMENT OF NOSE GEAR. *(See figures 4-43 and 4-44.)* The gear down position is controlled by the drag strut and no adjustment for dead center position of the drag strut is required. The gear up position is regulated by shimming the uplock engagement fitting on the strut only. Add to or reduce the number of shims so that up lock hooks are completely engaged when the gear reaches its maximum up position. Check engagement of the up lock hooks by looking through spection hole in right side of the fuselage.

For adjustment of uplock switch and switch actuating mechanism refer to paragraph 4–910.

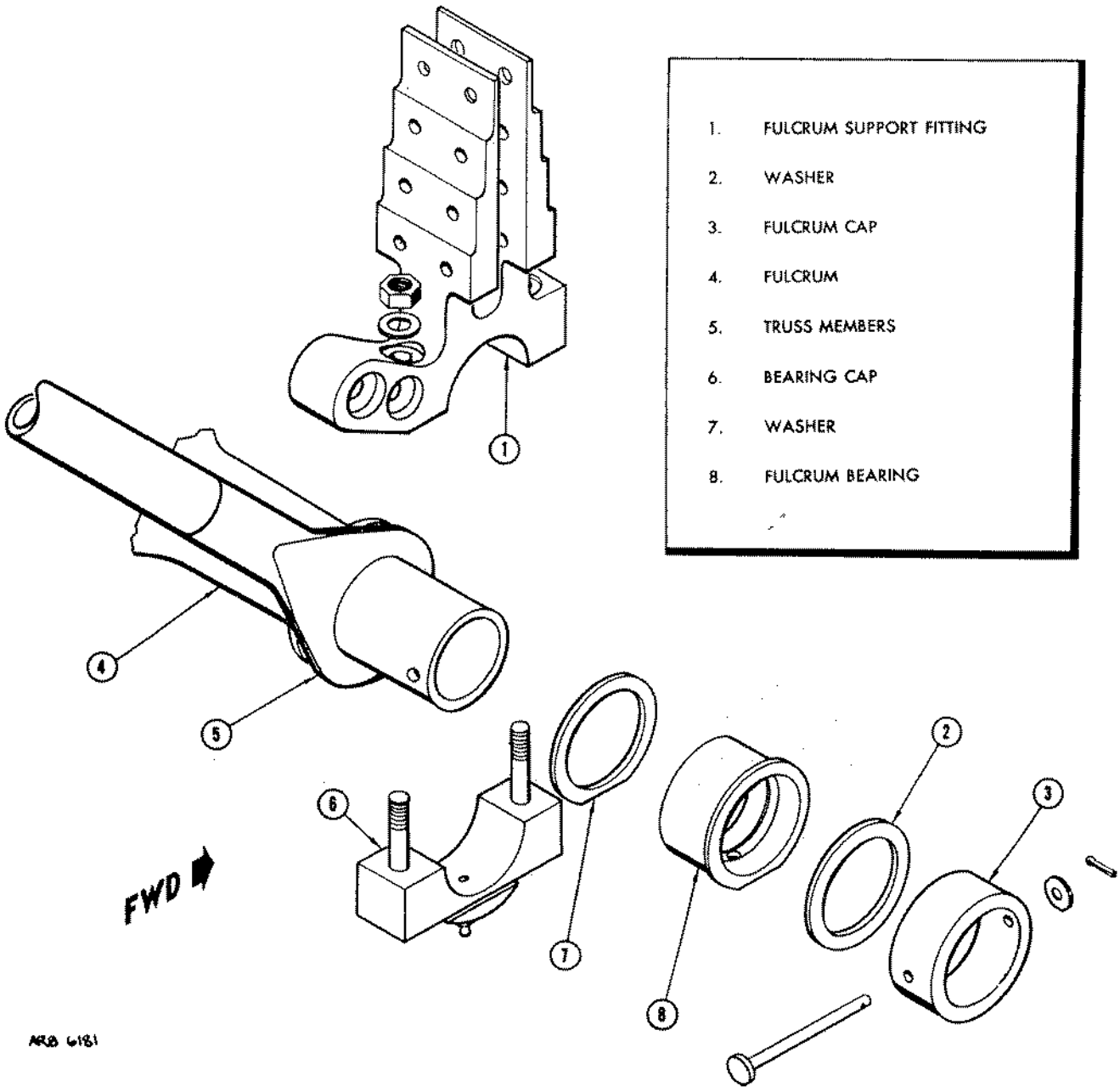

Figure 4-45. Nose Gear Fulcrum Bearing Cap Removal

Note

Adjustment of drag strut and downlock mechanism must be accomplished or checked prior to adjustment of uplock position. (Refer to paragraph 4–243.)

4–229. NOSE GEAR SHOCK STRUT. *(See figure 4-46.)* The shock strut is an air-oil type with a maximum stroke of 8 inches. The cylinder is made with an integral fulcrum at the upper end, and lugs at the lower end for attachment of the upper torque arm and the two shimmy-damper pistons. The piston incorporates a cantilever fork and axle for the wheel. An engagement bolt for the uplock hooks is installed at the upper end of the fork where the fork is attached to the piston. The torque arms interconnect the piston and fork assembly with the shimmy damper support which pivots on the cylinder.

4–230. Internal construction of the nose-gear shock strut is similar to that of the main-gear strut except that no metering pin is used, and cams are provided for centering the nose wheel when weight is off the wheel.

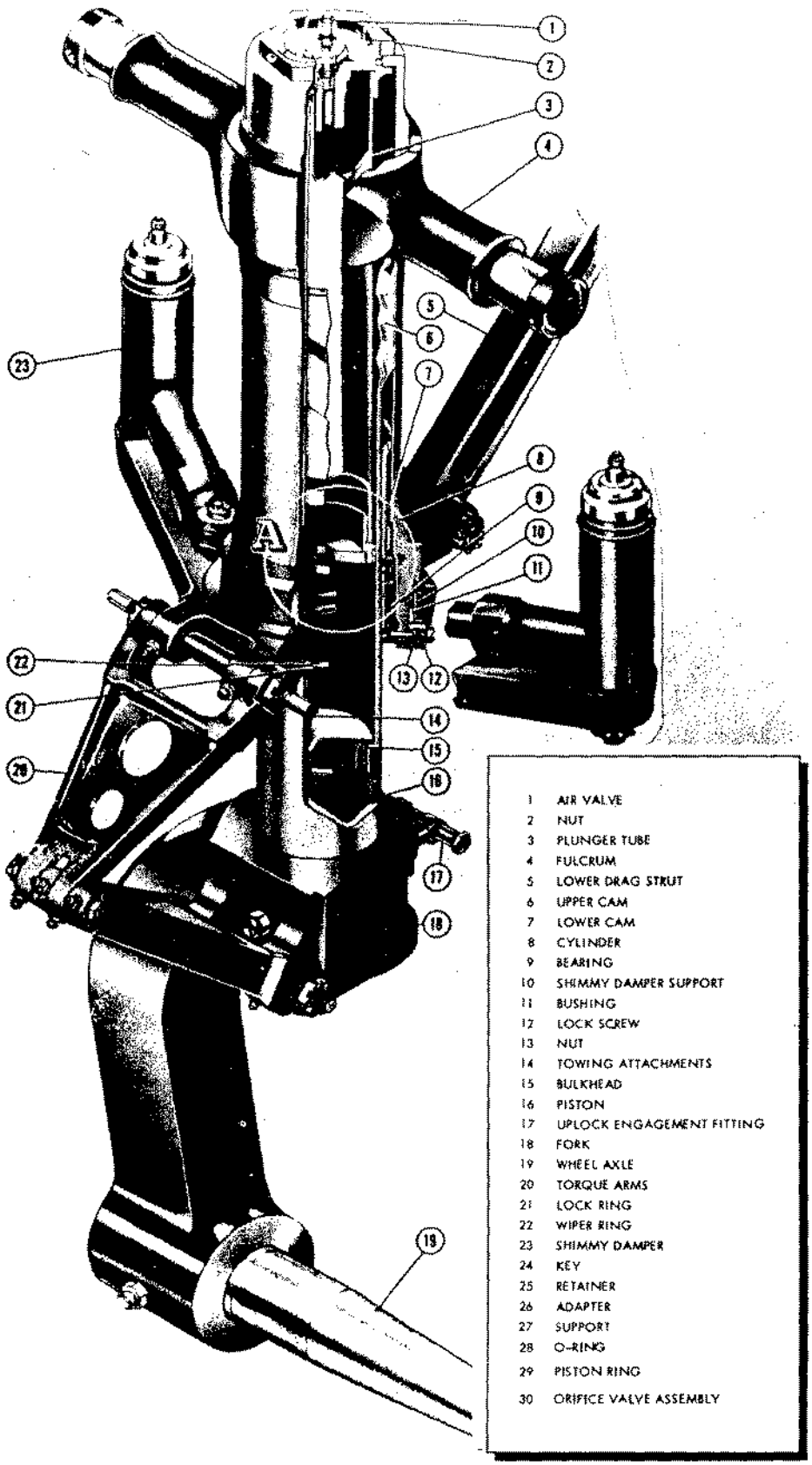

Figure 4-46. Nose Gear Shock Strut (Sheet 1 of 2)

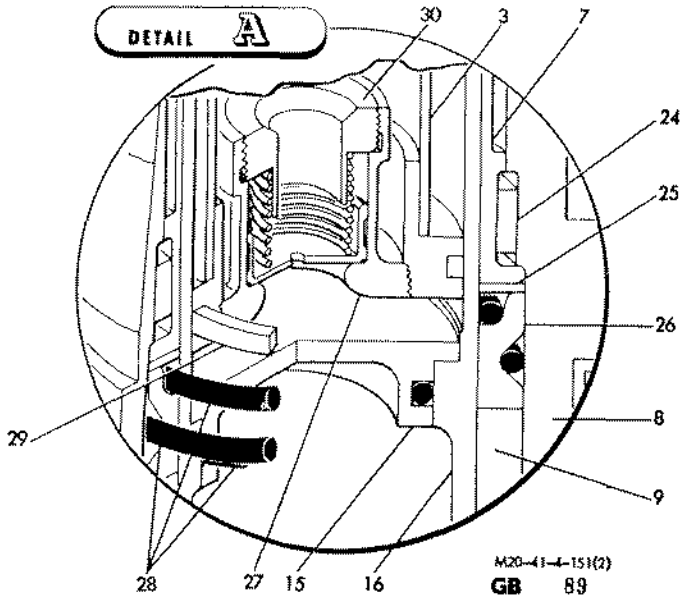

Figure 4-46. Nose Gear Shock Strut (Sheet 2 of 2)

A restrictor check valve on top of the orifice plate reduces the rate of piston extension to minimize porpoising.

4–231. SERVICING THE NOSE GEAR SHOCK STRUT. The air valve and filler cap are located on top of the strut. Service as follows:

a. On airplanes using AN6287-1 valve assembly, release air pressure in strut by loosening ⅝-inch hex nut on air valve assembly one-half to one full turn and depressing the valve stem.

CAUTION

Do not loosen ⅝-inch hex nut more than one turn as further loosening may cause valve stem and housing assembly to fall into cylinder.

b. On airplanes using MS28889-1 valve assembly, loosen valve cap about one turn to allow escape of any pressure trapped between metal to metal seal of valve and cap. Remove valve cap and loosen upper ¾-inch hex nut to permit air within strut to escape.

WARNING

MS28889-1 valve assembly does not contain a valve core AN809-1, therefore rapid loosening of valve cap may cause cap to fly off, injuring personnel.

c. Remove air valve assembly.

d. Compress the strut completely.

e. Fill with hydraulic fluid, Specification MIL-H-5606, to level of filler hole.

f. Prior to installing air valve assembly, install new aluminum gasket between valve assembly and shock strut. Torque air valve assembly to between 100 and 110 lb in.

g. Check strut for installation of red bottoming tape, Federal Specification L-T-101, Type III. Tape will be installed 0.03-inch from end of packing gland nut, with strut in collapsed position.

h. Since strut extension varies with weight, check struts after airplane has been loaded. For takeoff gross weights under 12,000 pounds (full fuel load without droppable tanks), inflate strut with air pressure until piston is extended 4 inches from red bottoming tape. For takeoff gross weights over 12,000 pounds (full fuel load with droppable tanks), inflate strut until piston is extended 3 inches from red bottoming tape.

Note

Maximum unloaded-strut inflation pressure is 500 psi.

i. Following inflation of strut tighten upper hex nut on air valve assembly to a torque of 50 to 70 lb in.

4–232. MAINTENANCE OF NOSE GEAR SHOCK STRUT.

a. Wipe piston after each landing with clean cloth saturated with hydraulic fluid, Specification MIL-H-5606.

b. If leakage of fluid is apparent, do not tighten bearing at the lower end of the cylinder, as bearing does not bring pressure upon the packings. For correction of leakage, remove the strut, disassemble, and install new replacement packings.

4–233. REMOVAL OF NOSE GEAR SHOCK STRUT. Shock strut is removed with complete alighting gear. (Refer to paragraph 4–220.)

4–234. DISASSEMBLY OF NOSE GEAR SHOCK STRUT. *(See figure 4-46.)* Special tools required: Spanner wrenches 205224, S20924-36, S38505, S20911-29, and S40704.

a. Release air pressure in the strut by loosening the valve assembly hex nut one-half to one complete turn.

WARNING

Do not loosen valve assembly more than one complete turn until all air has escaped from strut, to prevent injury to personnel.

b. On airplanes having AF Serial Nos. 49-897 and subsequent release air pressure in strut by loosening 5/8-inch hex nut on air valve assembly one-half to one full turn and depressing the valve stem.

WARNING

Failure to deflate strut before disassembly may cause serious injury to personnel or damage to equipment.

CAUTION

Do not loosen 5/8-inch hex nut more than one turn as further loosening may cause valve stem and housing assembly to fall into cylinder.

c. Remove filler plug and drain fluid from the strut.

d. Disconnect or remove torque arms (20).

e. Remove the four lock screws (12) which secure (13) at bottom of cylinder, and remove nut with spanner wrench S-20924-36 (figure 3-28).

f. Remove lockring (21) which secures wiper ring (22).

g. With spanner wrench 205224 (figure 3-27) unscrew bearing (9) from cylinder.

h. Pull piston assembly out of cylinder.

Note

Alternate jarring action when pulling out piston should dislodge lower cam (7), key (24), retainer (25), O-ring packings (29), and adapter (27). If this method is not successful, inflate strut sufficiently to force piston and internal parts free.

i. Disconnect shimmy damper pistons from cylinder.

j. Remove shimmy damper and support assembly from cylinder. Landing lights can be removed with shimmy damper support, or can be removed from support.

k. To remove upper cam (6), packings, etc., from piston, unscrew Allen-head setscrews (prior to AF Serial No. 52-9208), or remove pin (AF Serial No. 52-9208 and subsequent), and with spanner wrench S38505 (figure 3-27) remove upper cam. Slide parts off the piston.

l. If leakage at bulkhead O-ring packing is in evidence, remove bulkhead (15) and packing by driving it out with a soft metal bar inserted from the bottom of the piston.

m. With a pointed tool, remove piston ring (30) from support (27).

n. Remove plunger tube (3) by removing nut (2) at top of cylinder and withdrawing plunger tube from bottom of the cylinder. Hold plunger tube with spanner wrench S-40704 (figure 3-27) to keep it from turning while removing the nut.

4–235. CLEANING OF NOSE GEAR SHOCK STRUT. Wash all disassembled parts with either kerosene or solvent, Federal Specification P-D-680, Type II. Wipe parts dry with a clean cloth.

4–236. INSPECTION OF NOSE GEAR SHOCK STRUT.

a. Inspect inside of cylinder for corrosion, scoring, and worn parts.

b. Inspect piston for continuity of plating and for pitted condition.

c. Inspect piston ring (30) groove at bottom of plunger tube for possible wear at sides of groove.

d. Inspect keys (24) and keyways for possible wear.

4–237. REPLACEMENTS FOR NOSE GEAR SHOCK STRUT. Whenever strut is disassembled, replace with new parts all O-ring packings, gasket at large retainer nut on top of cylinder, gasket under filler cap, and valve core.

4–238. ASSEMBLY OF NOSE GEAR SHOCK STRUT. *(See figure 4-46.)* Special tools required: Spanner wrenches S38505, S40704, S38403, and 205224.

a. Insert plunger tube in cylinder and secure with large nut (2). Use new replacement gasket. Tighten firmly holding plunger tube with spanner wrench S40704; gasket will seat in chamfer of cylinder head.

b. Install piston ring (30) on plunger tube.

c. If bulkhead (15) has been removed, install new replacement O-ring packing and press bulkhead in piston.

d. Place cam, packings, etc., on piston in following order:

Lockring (21).

Wiper ring (22) with sharp edge at bottom.

Bearing (9).

Adapter (26) with new replacement O-ring packing installed. Install adapter so that widest edge is at the bottom.

O-ring packing. Slip O-ring down on piston until it is under the lip of the adapter.

Lower cam (7) with keys (24) in slots.

CAUTION

Keys must be in place to lock the cam, or strut will not center itself.

e. Screw upper cam (6) on piston and safety with three Allen-head setscrews (prior to AF Serial No. 52-9208), or pin (AF Serial No. 52-9208 and subsequent).

CAUTION

Piston head acts as a centering cam. Be sure cam lobes of piston head are positioned parallel to wheel axle.

f. Assemble shimmy damper and support on cylinder and secure temporarily with nut (13).

g. Wet inside of cylinder and piston assembly with hydraulic fluid, Specification MIL-H-5606.

h. Insert piston assembly in cylinder, being sure that cam and keys are aligned with slot in cylinder. Use spanner wrench S-38505 (figure 3-27) to position cam for engagement of keys in keyways.

i. Screw bearing (9) in place and tighten securely with spanner wrench 205224 (figure 3-27); then unscrew sufficiently to align lock screw holes.

j. Adjust shimmy-damper support bearing by inserting a 0.005-inch shim between bearing and nut (13). Tighten nut firmly against shim using spanner wrench S20924-36 then unscrew to nearest adjustment position that will permit support (10) to turn freely without binding.

k. Insert four lock screws (12) and safety in place.

l. Connect shimmy damper pistons to cylinder.

m. Place wiper ring (22) in position and secure with lockring (21).

n. Install torque arms and insert shims as shown in figure 4-47 so that maximum clearance between torque arm parts is less than 0.002 inch.

o. With strut fully compressed, fill to level of filler hole with hydraulic fluid, Specification MIL-H-5606.

p. Work piston several times to eliminate trapped air.

q. Install filler cap with new gasket, and tighten securely.

r. Install new valve core.

s. Inflate with air pressure to approximately 275 psi and check for leaks.

t. On airplanes AF Serial Nos. 49-897 and subsequent, after inflation of strut, tighten $\frac{5}{8}$-inch hex nut on air valve assembly to between 50 to 70 lb in.

CAUTION

Never install nose gear shock strut with more than 275 psi air pressure. (Refer to paragraph 4–231.)

4–239. TESTING THE NOSE GEAR SHOCK STRUT. Test with soapy water for air leakage around filler cap and valve core. Leakage around other parts will be evidenced by fluid seepage.

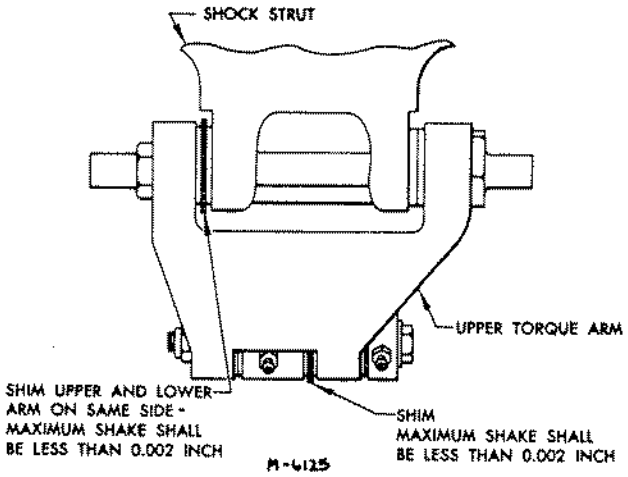

Figure 4-47. Installation of Torque Arm Shims, AF Serial No. 50-385 and Subsequent

4–240. INSTALLATION OF NOSE GEAR SHOCK STRUT. Shock strut is installed with complete alighting gear. (Refer to paragraph 4–227.) After installation, and with weight of fully-loaded airplane on strut, regulate air pressure until piston is extended 4 inches from cylinder. (Refer to paragraph 4–231.)

4–241. NOSE GEAR DRAG STRUT AND DOWNLOCK MECHANISM. *(See figures 4-43 and 4-48.)* The drag strut and downlock mechanism for the nose gear consists, as does the side strut and downlock mechanism used on the main gear, of two upper members, a lower member, a spring-loaded cartridge, and a latch assembly. While operation and construction of the two gear strut and downlock mechanisms is essentially the same, a difference exists in the method of connection used in attaching the nose gear actuating-cylinder piston rod to the drag strut assembly. On the nose gear the piston rod is connected between two links attached to the upper drag strut member. A rod is connected to the links and to the downlock latch assembly and movement of the links moves the rod and latch.

4–242. OPERATION OF DRAG STRUT AND DOWNLOCK MECHANISM. Upon application of hydraulic pressure in the actuating cylinder, the cylinder piston rod moves upward rotating the links, lifting the latch assembly from the notch in the cam. This movement then breaks the drag struts from dead-center position and permits retraction of the gear by the cylinder.

4–243. ADJUSTMENT OF DRAG STRUT AND DOWN LOCK MECHANISM. Since there is no provision for adjustment of for down and lock position of the drag strut, adjustment must be made on the activ ing cylinder piston rod terminal fitting to insure that the downlock snap into and remains in the notch in the cam on which it rides.

a. Adjust nose gear activating cylinder piston rod terminal fitting until latch block contacts rounded portion of bottom of cam slot with activating cylinder bottomed and pressurized (1075 PSI). Back off adjustment approximately one half turn or until a slight movement can be detected when applying hand pressure to drag strut in alternate directions. Check gear downlock assembly to insure that latch block is not bottoming or binding with activating cylinder bottomed and pressurized (latch block should engage approximately ⅜ inch).

b. With gear partially retracted (less than half way), adjust the spring-loaded cartridge (in fully compressed position) so that gap between latch block and face of cam measures 0.03 to 0.06 inch.

Note

For adjustment of downlock switch and linkage, see figure 4-48.

c. For adjustment of the gear-up position see paragraph 4–228.

4–244. NOSE GEAR UPLOCK MECHANISM. *(See figure 4-49.)* The nose gear uplock mechanism consists of two hooks, a bolt fitting, and a hydraulic cylinder. The hooks are mounted on the same pivot as the upper drag strut member. A bolt is inserted through the hooks, drag strut, and a support fitting mounted on station 103 bulkhead. The hooks are actuated simultaneously by linkage of the hydraulic uplock cylinder. (For information on the cylinder refer to paragraph 4–707.) When the gear is in the retracted position, the hooks engage the fitting provided on the aft side of the wheel fork. (Refer to paragraph 4–228.)

4–245. NOSE GEAR WHEEL ASSEMBLY. *(See figure 4-50.)* The nose wheel assembly consists of a 22 x 7.25 x 11.50, low-profile, cantilever wheel, a 22 x 7.25 x 11.50, smooth contour, six-ply or eight-ply rayon tire, and a 22 x 7.25 x 11.50, low-profile tube. The wheel is the split type, with the two sections bolted together, similar to the main-gear wheel.

Note

For 8-ply nose wheel tires, inflation pressure for normal operation is 80 psi. For 6-ply nose wheel tires, inflation pressure for normal operation is 60 psi.

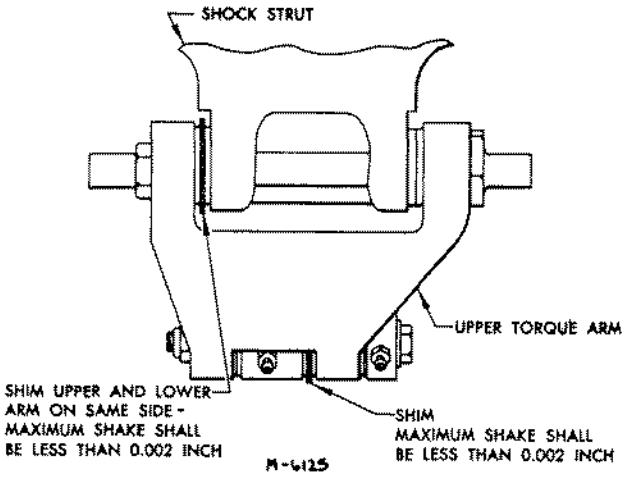

Figure 4-47. Installation of Torque Arm Shims, AF Serial No. 50-385 and Subsequent

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b. With gear partially retracted (less than half way), adjust the spring-loaded cartridge (in fully compressed position) so that gap between latch block and face of cam measures 0.03 to 0.06 inch.

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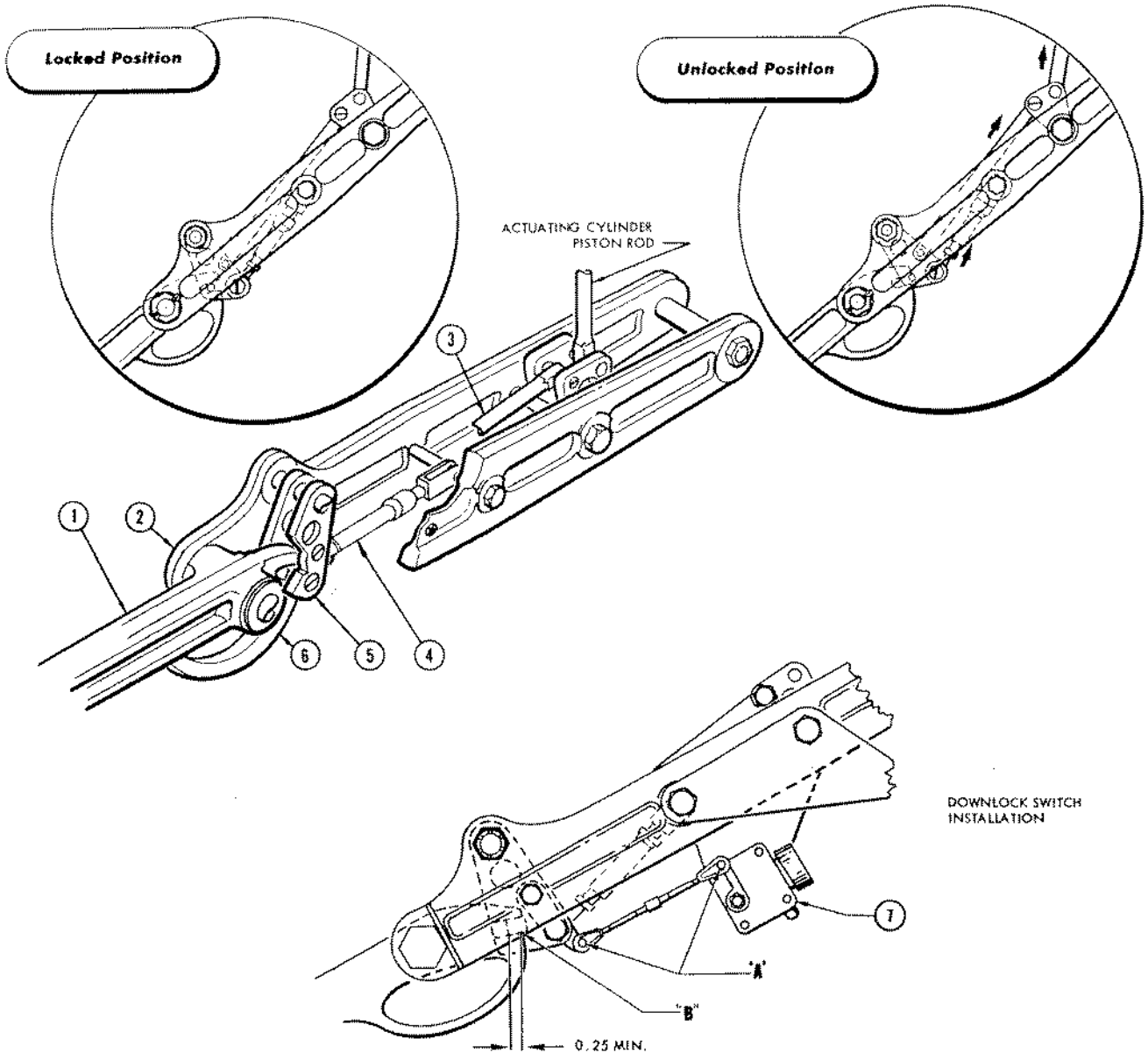

1	LOWER DRAG STRUT MEMBER
2	UPPER DRAG STRUT MEMBER
3	ROD
4	SPRING-LOADED CARTRIDGE
5	LATCH ASSEMBLY
6	CAM
7	DOWNLOCK SWITCH

Note

INSTALL LINKAGE, BARREL AND FORKS AS SHOWN SO THAT DISTANCE BETWEEN FORK CENTERS ("A") IS APPROXIMATELY 3.75 INCHES. ADJUST LINKAGE TO PROVIDE A GEAR DOWN AND LOCKED INDICATION AFTER LATCH BLOCK "B" HAS ENGAGED THE LOWER STRUT A MINIMUM OF 0.25 INCH AS SHOWN. ADDITIONAL FINE ADJUSTMENT MAY BE MADE WITH ADJUSTING SCREW ON THE DOWN LOCK SWITCH.

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Figure 4-48. Nose Gear Downlock

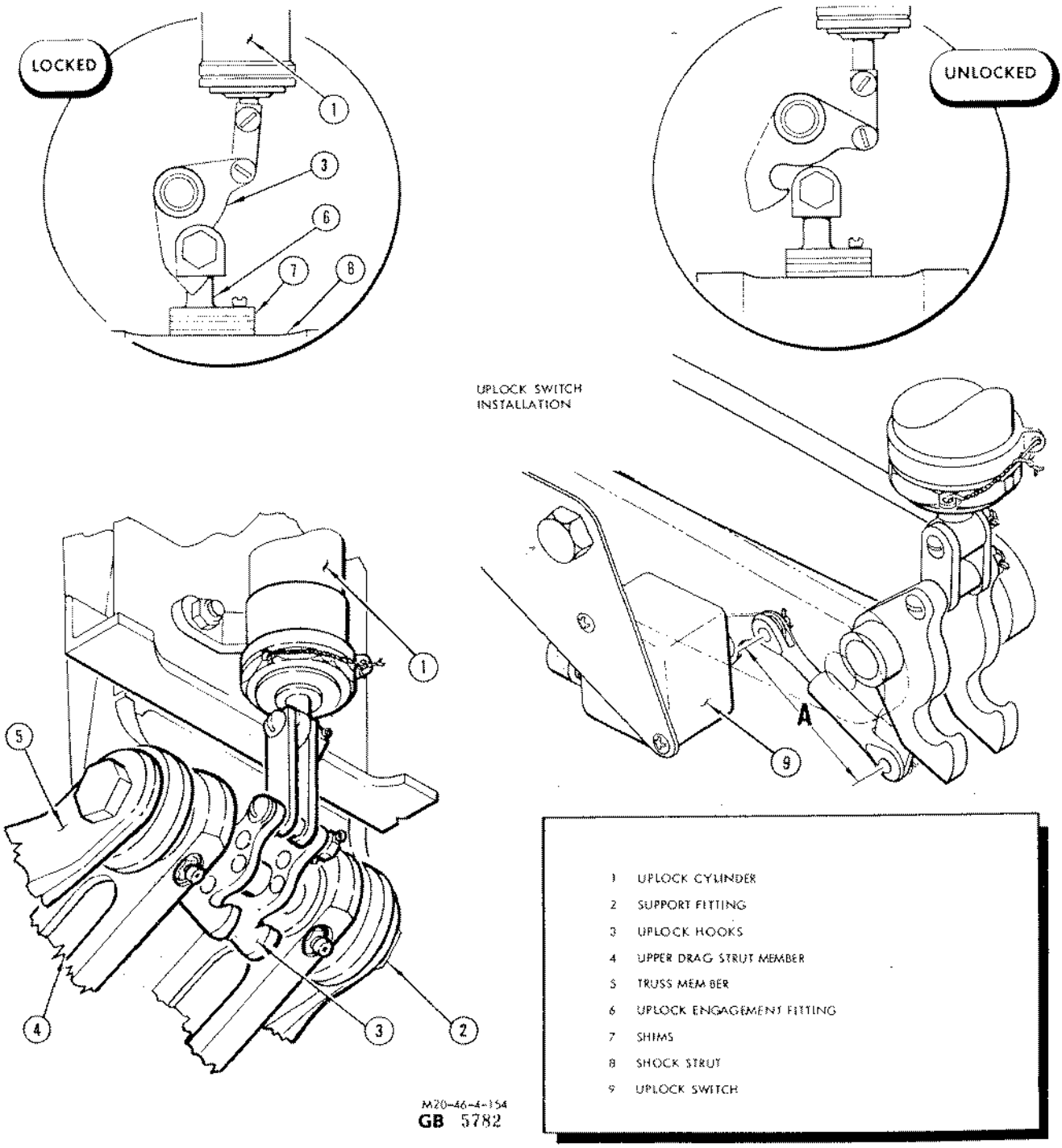


Figure 4-49. Nose Gear Drag Strut Upper Pivot and Uplock

4–246. REMOVAL OF NOSE LANDING GEAR WHEEL.

a. Jack airplane (see figure 3-10).

b. Remove hub cap.

c. Remove cotter pin from retaining nut.

d. Remove retaining nut.

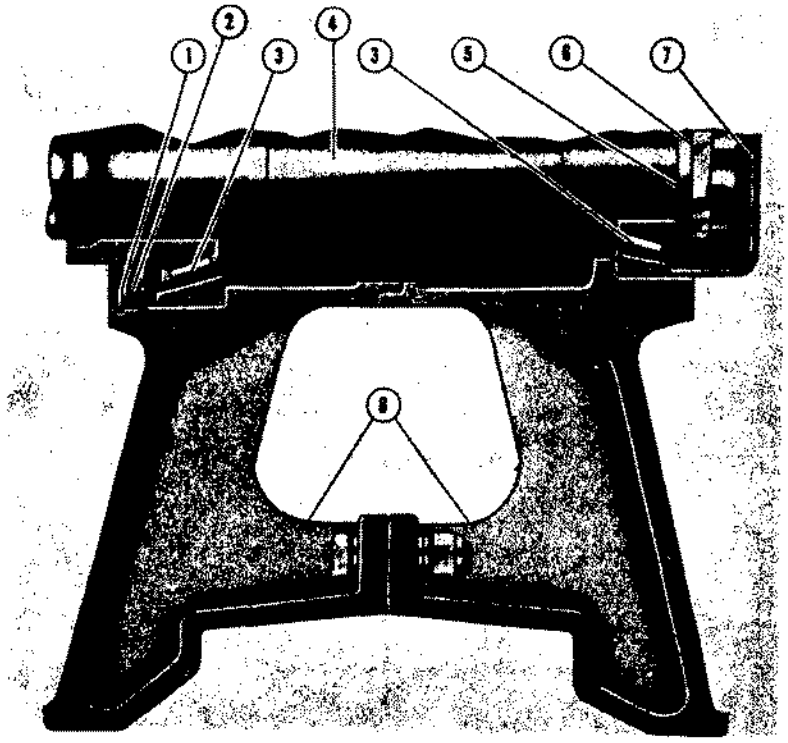
e. Slide wheel from axle.

4–247. LUBRICATING NOSE LANDING GEAR WHEEL BEARINGS. *(See figure 3-26.)*

4–248. INSTALLATION OF NOSE LANDING GEAR WHEEL.

a. Install wheel, outer bearing, washer and retaining nut.

b. Tighten retaining nut until a slight drag is felt when wheel is rotated by hand.



1. LOCK RING
2. GREASE SEAL
3. BEARING
4. AXLE
5. WASHER
6. NUT
7. COVER
8. WHEEL SECTIONS

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Figure 4-50. Nose Wheel

c. Loosen retaining nut by backing off one cotter pin hole.

d. Insert cotter pin and check wheel for free rotation. Wheel should rotate without drag.

e. Check wheel for bearing play. Wheel should rotate without bearing play.

f. Secure cotter pin and install hub cap.

4-249. NOSE GEAR DOORS. *(See figure 4-51.)* Two enclosure doors for the nose gear are mounted on piano type hinges and are mechanically actuated by the gear as it retracts or extends. In addition to the doors, the assembly includes stop plates, spring-loaded cartridges, stop arms, and the operating cams, all of which are mounted on the doors.

4-250. OPERATION OF NOSE GEAR DOORS. The mouth-shaped operating cams are contacted by and wrap around the shock strut piston when the gear retracts. This action pivots the cam upward and closes the doors. When the gear extends, a reverse action takes place. The doors are held open by two spring-loaded cartridges, one mounted on each cam and door. The cartridges operate on an over-center principle in that they also tend to hold the doors tightly in the closed position. The closed position of the doors is limited by the gear travel; the open position is restricted by the stop arms.

4-251. REMOVAL OF NOSE GEAR DOORS.

a. Grasp either one of the operating cams and swing it up sufficiently to align locking holes in the spring-loaded cartridges. Place pins or PK screws in holes of cartridges to lock them in place.

CAUTION

Do not remove spring-loaded cartridges without first locking them with pins or PK screws.

b. Disconnect and remove spring-loaded cartridges.

c. Disconnect stop arms.

d. Pull hinge pins and remove doors.

4-252. ADJUSTMENT OF NOSE GEAR DOORS IN CLOSED POSITION. Adjust and align doors in the closed position by varying the number of shims where the mechanism attaches to the doors, and by positioning

1.	SHIMS	5.	STOP ARM
2.	SERRATED PLATE	6.	PIANO HINGE
3.	STOP PLATE	7.	DOOR
4.	SPRING LOADED CARTRIDGE	8.	OPERATING CAM

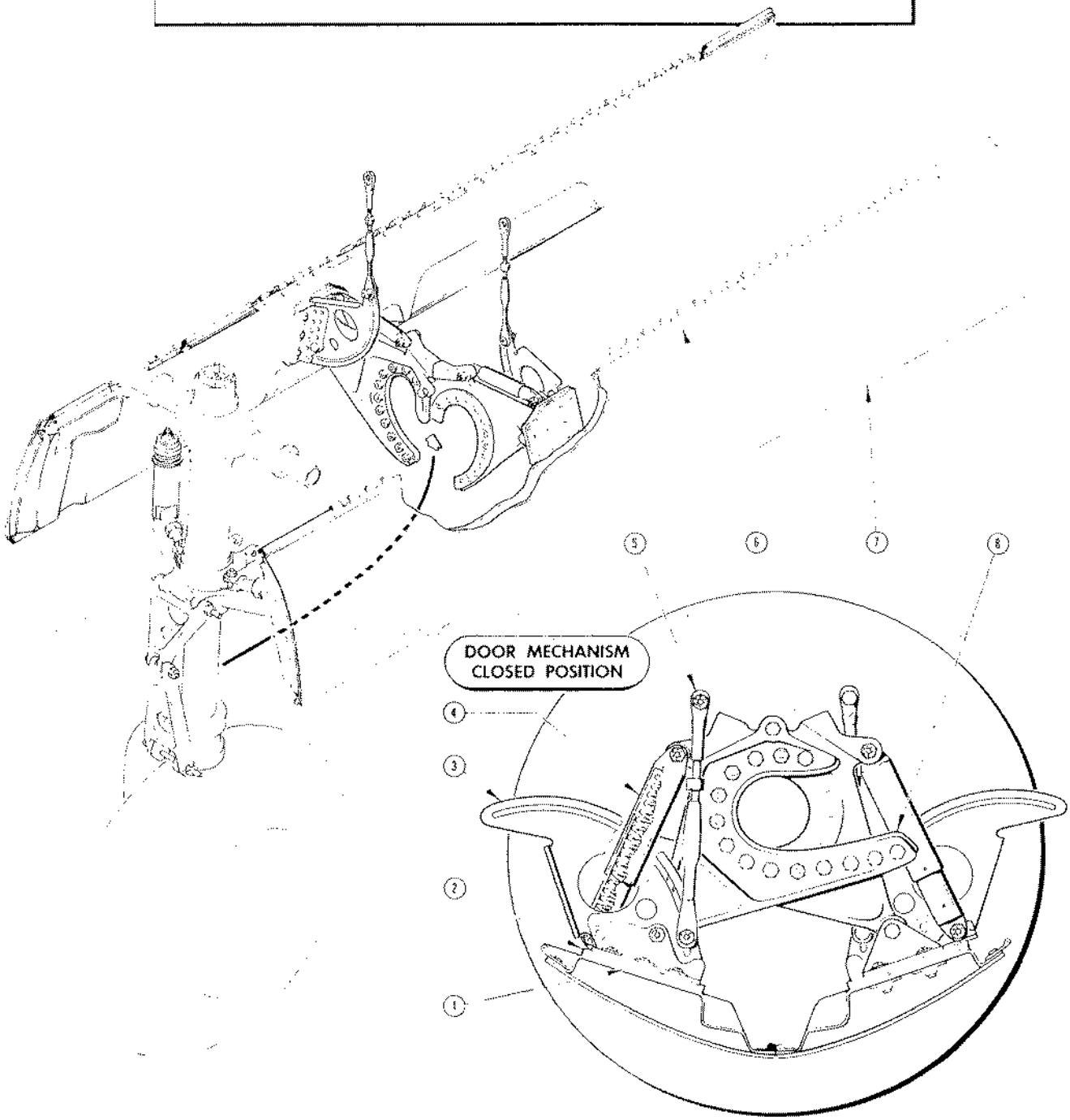

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Figure 4-51. Nose Gear Doors

the attachment brackets with respect to the door hinge line. Slotted holes with which to make the latter adjustment are provided in the brackets. Proceed as follows:

a. Install sufficient shims under brackets to give approximately 1/4-inch thickness. Place same number of shims under each bracket.

b. Retract gear and note alignment of doors.

Note

Maximum skin gap at forward and aft ends of doors is $^3/_{64}$-inch.

c. If doors are not in alignment with each other, extend gear and adjust as follows:

Loosen brackets on both doors.

Move brackets on lower door toward hinge line and tighten in place.

Move brackets on higher door away from hinge line and tighten in place.

Retract gear and again note alignment of doors.

If doors are not in true alignment, repeat preceding steps until doors are even.

Remove shims as necessary to bring doors to fully closed position.

4–253. ADJUSTMENT OF NOSE GEAR DOORS IN OPEN POSITION. After the doors have been adjusted for closed position, they must be adjusted for clearance between the lower ends of the operating cams and the shock strut piston.

Note

When adjusting, be sure that bottoming of stop arms in slots is determining factor for open position, and not the cam mechanism.

a. Retract gear until piston is between ends of operating cams and check for equal clearance on each side.

b. To move doors to left, lengthen left stop arm and shorten right stop arm.

c. To move doors to right, lengthen right stop arm and shorten left stop arm.

d. Lengthen or shorten both stop arms equal amounts until a definite spring action can be felt when pushing up on center of mechanism. The spring action must be sufficient to spring the door back to full open position after pushing mechanism up approximately one inch.

4–254. NOSE GEAR SHIMMY DAMPER. *(See figure 4-52.)* The shimmy damper assembly consists of two spring-oil damper units mounted on a support member which pivots around the lower end of the shock-strut cylinder. The support rotates with the wheel fork since the two assemblies are joined by the torque arms. Pistons of the damper units are attached to the shock-strut cylinder and operate when the support is oscillated by the wheel fork.

4–255. Each shimmy damper unit is composed of the body or reservoir, the spring-loaded reservoir piston, the cylinder, and the cylinder piston. A poppet valve incorporating an orifice and screen is screwed into the port between the reservoir and cylinder.

4–256. OPERATION OF NOSE GEAR SHIMMY DAMPER. When the cylinder piston is extended, fluid is forced through the check valve by action of the spring-loaded reservoir piston. The return stroke of the cylinder piston is retarded by the resistance of the orifice to the flow of fluid. The check valve is closed on this return stroke. By this action, oscillating motion of the wheel fork and shimmy damper support is resisted and progressively reduced.

4–257. SERVICING THE NOSE GEAR SHIMMY DAMPER.

a. Remove shimmy damper from airplane.

b. Remove lockring from upper end of reservoir.

c. Remove cap, spring, and piston from reservoir.

WARNING

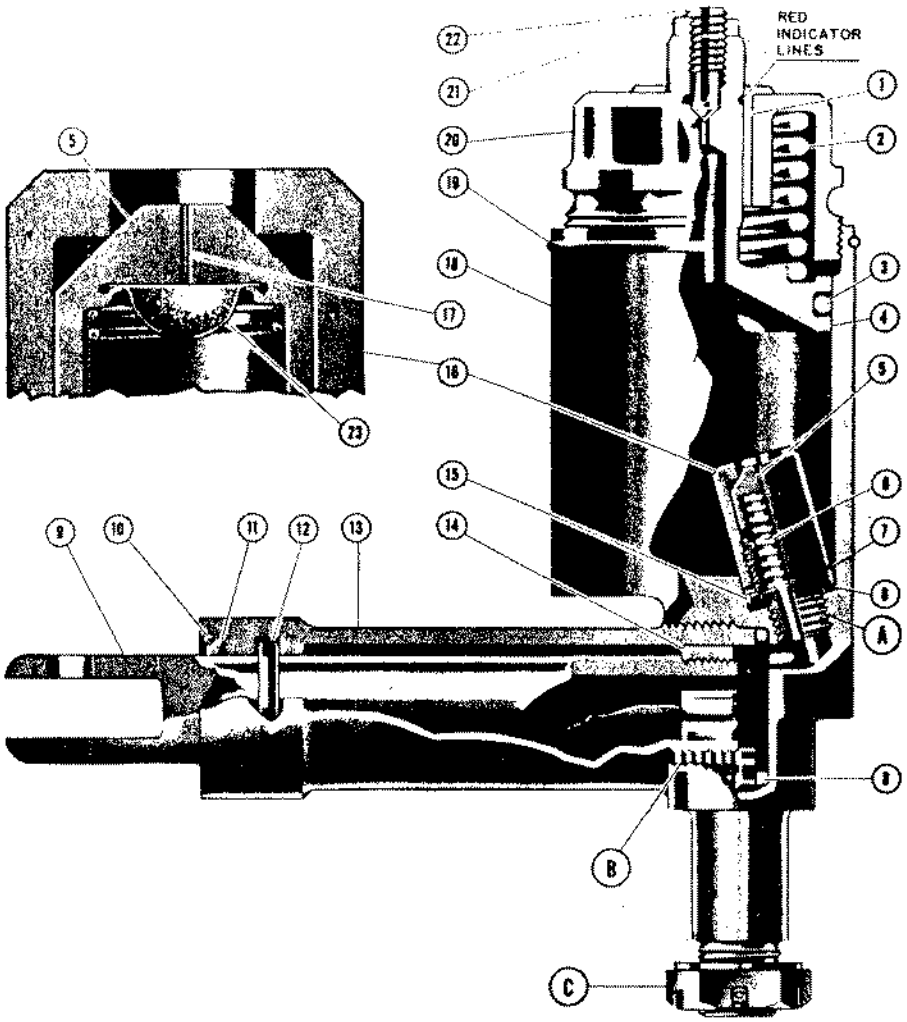
Bleed damper before removing cap to lessen danger from sudden expansion of reservoir piston spring.

d. Fill reservoir with hydraulic fluid, Specification MIL-H-5606.

CAUTION

Care must be taken that hydraulic fluid contains no foreign matter. Clogging of the damper orifice will cause poor damper action, and serious damage may result.

1. BUSHING
2. SPRING
3. "O" RING PACKING
4. PISTON
5. POPPET
6. POPPET SPRING
7. WASHER
8. GASKET
9. PISTON ROD
10. LOCK RING
11. WIPER
12. "O" RING PACKING
13. CYLINDER
14. PISTON
15. ORIFICE CAP
16. ORIFICE BODY
17. ORIFICE
18. BODY (RESERVOIR)
19. LOCK RING
20. CAP
21. LOCK NUT
22. BLEED
23. SCREEN



Note

A – INSTALL WITH TORQUE OF 80 TO 100 INCH – POUNDS
B – INSTALL WITH TORQUE OF 500 TO 700 INCH – POUNDS
C – INSTALL FINGER TIGHT

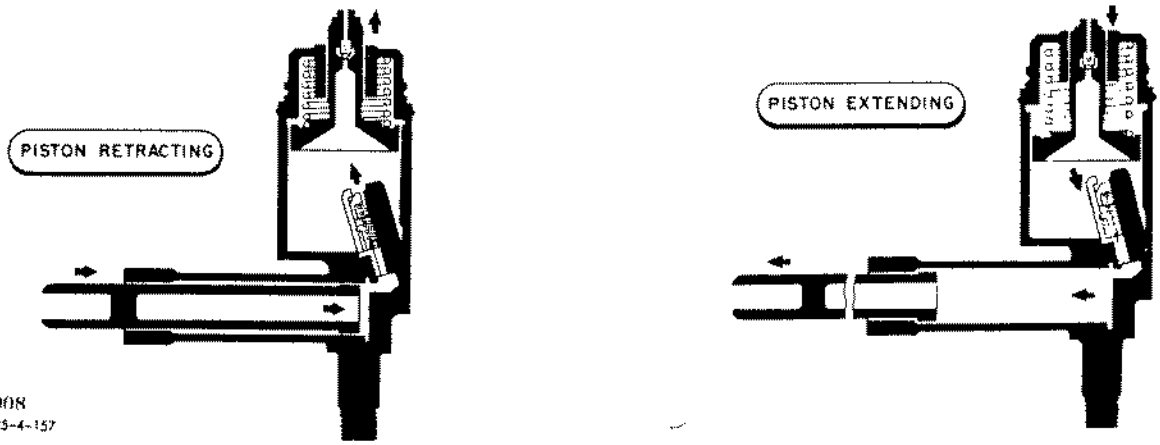


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Figure 4-52. Shimmy Damper

e. With the cylinder piston rod pointed down approximately 30 degrees from horizontal and reservoir on top side, actuate the piston rod slowly through its full travel until all air is eliminated from the cylinder.

f. Loosen bleeder screw in reservoir piston and install piston in reservoir. Press piston down until its top flange is even with the bottom threads of the reservoir.

g. Tighten bleeder valve. Replace spring cap, and lockring.

h. Install shimmy damper on nose gear and tighten nut finger tight so that free rotation is allowed in nose gear shimmy damper boss, and connect piston rod; bleed off fluid as necessary for installation.

Note

A 0.070-inch diameter vent hole is drilled in some shimmy damper cap assemblies. However, the vent hole has been discontinued on later cap assemblies. Installation of one vented and one unvented shimmy damper is permissible when necessary, although matched pairs should be installed when available.

i. If lower red indicator line shows, open bleeder valve and allow fluid to escape until the lower line is hidden. Wheel should be in straight forward position. If upper red indicator line does not show, add fluid to the reservoir.

Note

Torque value of cylinder (13, figure 4-52) attachment to shimmy damper assembly should be 500 to 700 lb in.

4–258. CLEANING AND FLUSHING THE NOSE GEAR SHIMMY DAMPER.

a. Remove shimmy damper from airplane.

b. Remove lockring from upper end of reservoir.

WARNING

Bleed damper before removing cap to lessen the danger from sudden expansion of reservoir piston spring.

c. Remove cap, spring, and piston from reservoir and pour out hydraulic fluid.

d. Flush out the cylinder with clean hydraulic fluid, Specification MIL-H-5606. Accomplish this by submerging the cylinder body in clean hydraulic fluid and while holding the piston rod vertically, pump in and out. This will remove loose foreign particles and flush out all old hydraulic oil. Repeat this procedure until all foreign particles are removed and unit is thoroughly clean.

e. Wash the orifice assembly in clean hydraulic oil. Check poppet for free movement and cleanliness.

f. Reinstall orifice assembly, using new gasket. Tighten to torque of between 80 and 100 lb in. using wrench 207925.

g. Service and reassemble shimmy damper in accordance with instructions contained in paragraph 4–257.

4–259. CHANGING SHIMMY DAMPER ORIFICE.

a. Remove shimmy damper from airplane.

b. Remove lockring from upper end of reservoir.

WARNING

Bleed damper before removing cap to lessen the danger from sudden expansion of reservoir piston spring.

c. Remove cap, spring, and piston from reservoir and pour out hydraulic fluid.

d. Using wrench, 207925, remove orifice assembly and gasket. Discard gasket.

e. Install new gasket and orifice assembly. Tighten to torque of 80 to 100 lb in., using wrench, 207925.

f. Replace piston spring and cap in reservoir and replace lockring.

g. Service and install shimmy damper according to paragraph 4–257.

4–260. TESTING AND PRIMING THE NOSE GEAR SHIMMY DAMPER. To check shimmy dampers for proper priming, the upper torque arm must be disconnected from the lower torque arm so it can be used as a lever for turning the damper support. Turn the support rapidly approximately 5 degrees on each side of centered position. If shimmy dampers are properly primed, there will be no appreciable lost motion. Piston must feel solid on compression. Spongy action indicates air trapped in the shimmy damper. If spongy action is noted, disconnect cylinder piston rod from shock strut and repeat servicing process.

4–261. ENGINE.

4–262. GENERAL DESCRIPTION OF ENGINE. *(See figure 4-54.)* The J33-A-35 turbo-jet engine is installed at fuselage station 277.5 ± 12.0. The engine is suspended on three quickly detachable mounts. The compartment in which it is installed receives air rammed in flight through two ducts contained within the fuselage contour. Air enters the ducts through two scoops, one on either side of the fuselage forward of the wing leading edge.

4–263. The engine unit consists basically of a centrifugal air compressor and a single-stage gas turbine. The compressor is made up of a casing, a diffuser, and an impeller. The impeller shaft is connected to the turbine by a coupling and a turbine shaft. The turbine is driven by burning a liquid hydrocarbon in combustion chambers. Air, for supporting combustion, reaches the combustion chambers through air adapters. The exhaust cone is on the rear of the unit. Accessories are on the accessory-drive gear case in front of the engine.

4–264. EXHAUST GAS PRECAUTIONS. Due to the velocity and temperature of the exhaust gas, adequate precautions must be taken to assure safety of ground operating personnel, other aircraft, and adjacent structures. (See figure 4-53.)

4–265. INTAKE AIR PRECAUTIONS. Suction at the intake air duct entrances is not dangerous, although loose clothing or small articles may be drawn in if a person stands close to the entrance. This is also true at the intake doors in the top of the fuselage.

4–266. ENGINE COMPARTMENT PRECAUTIONS. Wear suitable ear plugs as protection against high noise level, when working in engine compartment with engine running. Hats, glasses, or other loose equipment should be removed before any work is attempted in these areas during engine operation. If it is necessary to work inside the top of the engine compartment while engine is running, shut down engine before removing upper access panels, then restart engine. Do not attempt to remove panels while engine is running. If work must be done through lower access doors during engine operation, clamp lower doors together to prevent their being closed by suction.

Note

Broken engine access door hinge springs, 176520-4, may fall into the engine, causing foreign object damage, since there is no method of retaining the springs if they should break.

Clean the engine access door hinge area and cover the hinge area with two-inch strip of cloth-back tape, stock number 8135-559-3149 or 8135-579-8492. This will preclude any parts of broken springs dropping into the engine.

4–267. ENGINE PRECAUTIONS. The cooling period required after engine run-up and before work should be attempted depends upon location of work. One-half hour cooling should be sufficient before inspection of tail pipe, tail cone, or turbine wheel. Time may be reduced by blowing cold air into pipe. Remainder of engine installation may be worked on immediately after engine is shut down.

4–268. DESCRIPTION OF ENGINE COMPRESSOR UNIT. The compressor unit includes a compressor casing, an impeller, a diffuser, bearing supports, and guide blades. The impeller is a multi-vaned forging supported by bearings at front and rear and surrounded by the compressor casing and diffuser. The diffuser is cast with symmetrical channels radiating outward from the center. Through these channels the air is distributed into the air adapters leading to the combustion chambers. Guide blades direct rammed air into each side of impeller.

4–269. MAINTENANCE OF COMPRESSOR UNIT. Compressor impeller and rotating guide vanes do not normally require inspection during the service life of the engine. However, if foreign objects have passed through the engine and the rotating guide vanes are found to be nicked, a visual inspection should be performed to determine serviceability.

a. Any nick or dent $\frac{1}{8}$- to $\frac{3}{16}$-inch deep in the outer $\frac{2}{3}$ of the leading edge will be blended into the contour of the vane.

b. Any nick or dent on rotating guide vanes $\frac{1}{16}$- to $\frac{1}{8}$-inch deep in the inner $\frac{1}{3}$ of the leading edge will be blended into the contour of the vane.

c. Depth of final blend will be $\frac{1}{16}$-inch greater than original nick or dent, and length of final blend will be six times final depth. All edges of blend will be rounded.

d. Nicks or dents exceeding depths specified in steps a and b will be cause for engine removal.

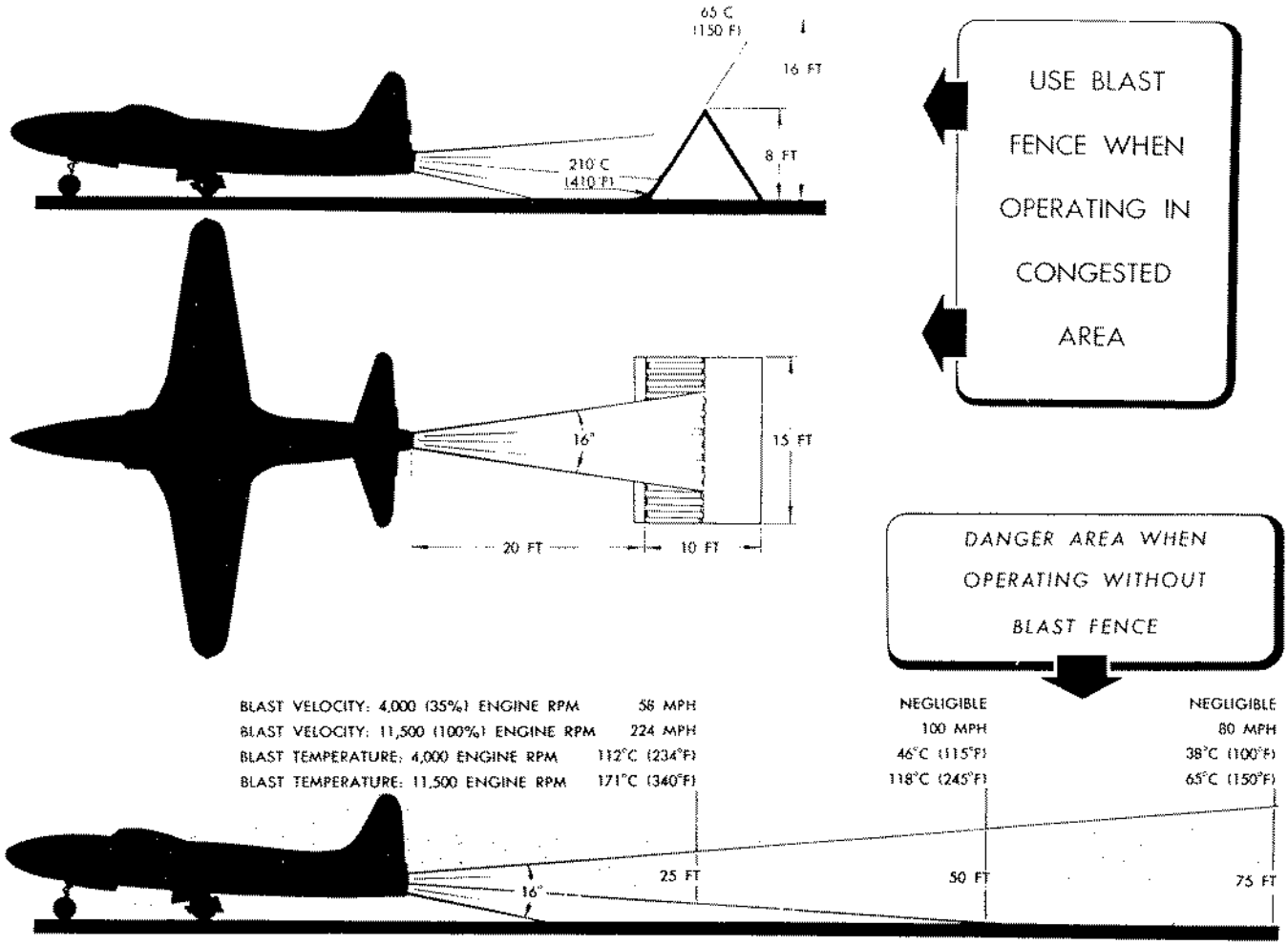

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Figure 4-53. Ground Operating Precautions Diagram

e. There is no limit to the number of nicks per blade or nicked blades per impeller as long as the limits of steps a and b are not exceeded.

f. Bent rotating guide vanes will be continued in service if no cracks are evident. However, any evidence of cracks will be cause for engine removal.

g. If at any time the compressor shim is found to have slipped from position and protrudes less than 0.375-inch, retorque the compressor case attaching nuts to the values specified in Section VI. Record shim movement. Engines having compressor case attaching nuts torqued as specified will be retorqued at each following installation. If additional slippage occurs after torquing and shim protrudes more than 0.375-inch, engine will be removed from service.

4–270. REPAIR OF COMPRESSOR AIR INLET SCREENS.

a. Unweave each end of broken screen wire far enough to secure it to a sound cross wire.

b. Fill the gap left by the severed wire by weaving a piece of 0.032-inch diameter stainless steel lock-wire through cross wires remaining. Wrap ends of lock-wire around the same two cross wires which anchor severed ends of the screen wire when possible.

c. Cut off surplus ends of lock-wire. Securely soft solder all ends of wire to sound members of screen. Solder each intersection of lock-wire to provide additional strength.

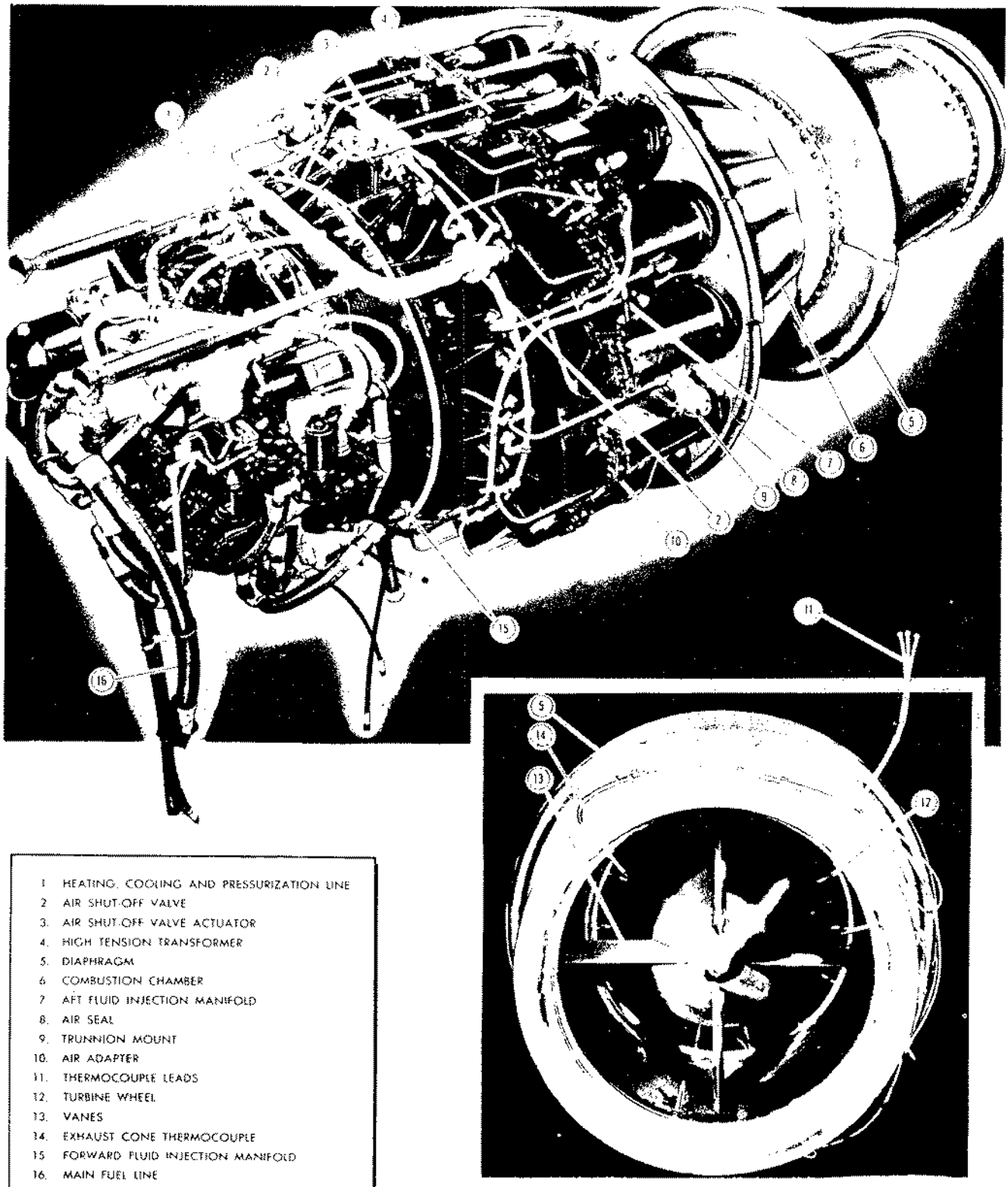


Figure 4-54. Complete Engine

d. The above operation will be repeated as often as necessary to repair all of the broken screen wires. The ends of the repair lock-wires may only be anchored to sound strands of screen wire and will not be anchored to other strands of repair lock-wire.

e. To patch screens, use screen patching material, Part No. 6746154. Unweave edges of patch, bend fringe down and place it over hole so that patch is supported on each side by two strands of original screen. Wrap wires of patch around screen and secure with soft solder.

4-271. MAINTENANCE OF INLET GUIDE VANES. Cracks emanating from Phillips head screw locations will be stop drilled at end of crack, using a 1/8-inch drill.

a. Only one crack is permitted at each screw hole.

b. A crack emanating from the screw hole toward the rolled edge must not be longer than 1⅛-inches, cracks exceeding this dimension will be cause for engine removal. A maximum of three cracks are allowed.

c. A crack emanating from the screw hole toward the mounting flange may be any length, a maximum of three cracks are allowed.

d. Tighten loose screws and peen them if the engine has external screens.

e. If the screws are still loose, replace them. If the new screws cannot be tightened, replace the engine. Torque the screws (size 8-32) to between 30 and 35 lb-in.

f. On engines with internal screens, replace the engine if the screw head is worn or if the screw hole is enlarged.

4-272. DESCRIPTION OF ENGINE AIR ADAPTERS. The diffuser of the compressor is connected to the ring-and-tube assembly of the turbine unit by 14 air adapters and spacers. The spacers adjoin the diffuser openings. The combustion-chamber end of each air adapter is recessed to accommodate for tube expansion caused by heat. Each air adapter contains a dome-and-nozzle assembly through which the fuel is injected into each combustion chamber. The air adapters for outer tubes Nos. 7 and 14 (see figure 4-65 for chamber numbering) each have a mounting pad for a spark plug which ignites the fuel. Adapters No. 5 through No. 11 have outlets for draining unburned fuel through a drain manifold from the combustion unit.

4-273. REMOVAL OF ENGINE AIR ADAPTERS.

a. Remove engine from airplane. Refer to paragraph 4-301 for removal instructions.

Note

Take care to prevent entrance of dirt and other foreign material into engine. Wherever practicable, temporary covers should be used.

b. Disconnect drain manifold coupling nuts from fittings on Nos. 5, 6, 7, 8, 9, 10, and 11 air adapters. Remove drain manifolds.

c. Remove main fuel manifold coupling nuts from Nos. 7 and 14 starting fuel manifold check valves. Disconnect starting fuel system hose at each starting fuel manifold check valve. Remove check valves. Remove remaining fuel manifold coupling nuts from air adapter elbows.

d. Remove spark plugs.

e. Remove 10 hex-head bolts securing each air adapter and spacer to the diffuser. Remove air adapter spacer and gaskets. Discard gaskets. Slide air adapter forward and remove it.

f. Remove three nuts securing combustion dome brackets to air adapter. Remove dome, lifting it carefully over nozzle tip.

g. Remove hex-head plug, gasket, and filter retaining spring. Discard gasket.

h. Insert puller No. 9074026 in open end of tubular filter and rotate handle slightly in either direction to free filter in housing. Remove filter.

i. Remove fuel nozzle and gasket, using particular care not to damage nozzle orifice and filter screen. Discard gasket.

j. Clean nozzles in a carbon solvent conforming to Federal Specification P-S-661. Hold nozzle in solvent in a downward position and, using a soft bristle brush, stroke down toward the nozzle tip.

CAUTION

Care will be taken to assure that no carbon particles are lodged in nozzle tip orifice.

k. Replace any damaged air adapter studs which do not require redrilling and rettapping.

l. If the lower ring boss of the fuel filter has broken off the filter and remained in the air adapter during disassembly, remove it. Use a tool to fit under the boss and pry it loose.

m. Remove any burrs from the mounting face of each adapter, using a fine grade of abrasive cloth.

n. With a fine stone remove any burrs or roughness from the sleeve at the large end of adapter.

o. If the steel sleeve has been loosened and shifted in adapter bore, reposition sleeve and replace retaining rivets or set screws.

p. Replace any fitting on which threads are damaged.

q. If dome supports are cracked or broken off, replace dome.

4–274. INSTALLATION OF ENGINE AIR ADAPTERS.

a. Coat threads of each fuel nozzle with a light coat of compound Specification No. MIL-C-5544, and install nozzle and new gasket. Tighten to torque specified in Section VI.

b. Carefully place dome in position over fuel nozzle and secure it with nuts.

c. Install tubular filter, retaining spring, new gasket, and hex-head plug. Coat plug threads with Permatex No. 3 or equivalent, and tighten plug to torque specified in Section VI.

Note

All air adapters are numbered and must be installed at diffuser elbows having corresponding numbers.

d. Install compression rings by hand in combustion chamber ring grooves. Position rings so that their gaps are above the horizontal center line of tube opening and at least 60 degrees apart before air adapter is installed.

e. Install air adapters. Gently, but firmly, press recessed end of adapter over compression rings, turning adapter at the same time. The flared edge of adapter recess will compress rings, allowing adapter to slide into position. Rotate adapter until it is in proper position for installation of spacer.

f. Place a new gasket on each face of spacer, and install spacer so that index marks line up.

g. Apply lubricant, Specification JAN-A-699, to bolt threads. Install bolts using a plain washer and rectangular washer, Part No. 671196. Backing plate, Part No. 6729691, does not use the rectangular washer. Draw bolts down evenly and lightly contact gasket. Tighten locating bolts on sides of adapter to a torque of 30 lb in. Torque remaining bolts to 30 lb in. Retorque all bolts to between 50 and 60 lb in. Secure bolt heads with 0.032-inch lock-wire using a single strand type safety through all bolt heads. Lock washers are not used in this part of assembly.

h. Install drain manifolds.

i. Install combustion chamber check valves. Install main fuel manifold coupling nuts, and starting fuel hoses. Refer to Section VI for torque values of coupling nuts and fittings.

j. Install spark plugs. Refer to Section VI for torque values of spark plug mounting nuts.

4–275. DESCRIPTION OF ENGINE TURBINE UNIT. The turbine unit consists of a turbine wheel and shaft, a nozzle diaphragm, and a series of combustion chambers called the ring-and-tube assembly. A continuous ring of curved blades (buckets) is dovetailed into the outer rim of the turbine wheel. The nozzle diaphragm directs the gas against the buckets of the wheel. The ring-and-tube assembly, in which combustion takes place, consists of 14 interconnected stainless-steel cylinders which converge on a supporting ring. Each tube contains a removable liner, or flame tube, which is joined to its adjacent liner by crossover tubes.

4–276. REMOVAL OF INNER LINERS AND INNER CROSSOVER TUBES.

a. Remove engine from airplane. Refer to paragraph 4–301 for removal procedure.

b. Remove engine air adapters. Refer to paragraph 4–273 for removal procedure.

c. Straighten tab washers under the 14 inner-liner retaining dowel bolts on outside of combustion chambers near exhaust end. Remove dowel bolts.

d. Remove even-numbered inner liners.

e. Slide inner crossover tubes and spacer springs out of position. Remove odd-numbered inner liners.

4–277. INSTALLATION OF INNER LINERS AND CROSSOVER TUBES.
(See figure 4-55.)

a. Install inner liners in odd-numbered combustion chambers.

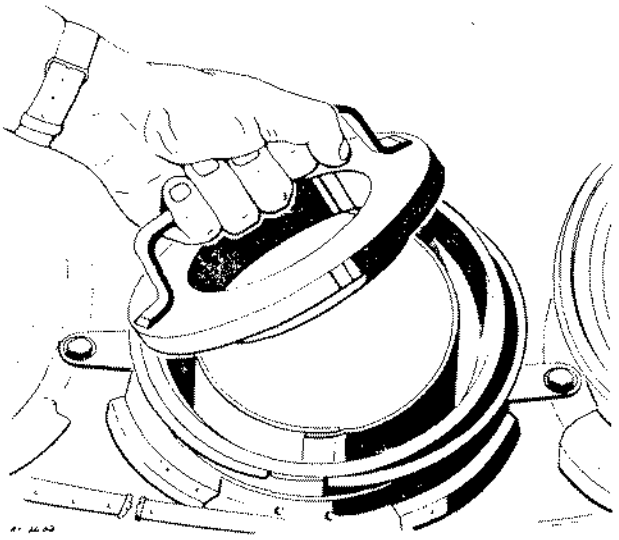


Figure 4-55. Installation of Inner Liners

b. Install inner liner centering and positioning tool, Allison Part No. 3144, in front end of inner liner so that front edge of inner liner will be firmly seated against the shoulder of the tool.

c. Insert the inner liner into the combustion chamber, using the positioning tool and lightly tap with a mallet if necessary, until the flange of the positioning tool bottoms against the combustion chamber.

d. Mark the location of the dowel bolt hole on the elongated pad of the inner liner. Remove inner liner from combustion chamber. Drill and ream a 0.181 to 0.183 inch hole in the inner liner at the position marked on the liner pad.

e. Reinstall liner in combustion chamber. Use positioning tool to radially center the front end of inner liner while locating-dowel-bolt and locking-clip are installed.

f. Remove positioning tool from inner liner, exercising care to avoid disturbing radially centered position of inner liner.

g. Install inner crossover tube in the crossover tube spring spacer and position spacer so that its ends are equidistant from ends of crossover tube.

h. Install crossover tube assembly in outer crossover tube so that the centerline of opening between ends of spring spacer, will be 90 degrees from the axial centerline of the combustion chamber.

i. Install even-numbered inner liners, using procedure outlined above for replacement liners.

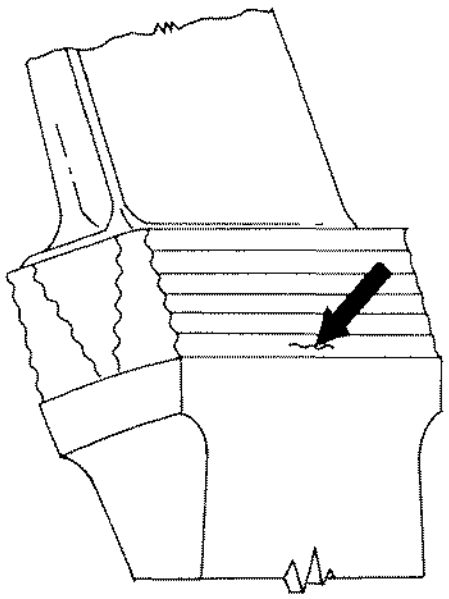


Figure 4-56. Turbine Wheel Serration Crack Location

j. Install engine air adapters according to paragraph 4-274.

4-278. MAINTENANCE OF ENGINE TURBINE UNIT. *(See figures 4-56 through 4-59.)*

a. With shroud ring removed, spin the turbine wheel by hand and check wheel for rubbing or interference. Slowly rotate turbine wheel while pushing forward on it. Any indication of rubbing against the gas baffle or diaphragm inner spacer ring is cause for engine replacement. Use turbine bucket radial stretch gage No. 3682 to check turbine bucket stretch. Proceed as follows:

(1) Place the main body of the gage on the master gage so that the spring-loaded steel ball, located in the center of the gage, is seated in the center drilled hole in the master gage.

(2) Press the radial stretch gage firmly onto the master so that the spring is compressed and the gage seat on the 1.4-inch diameter dowel pin is on the master.

(3) While preparing to check S-816 type turbine buckets for stretch, place the stretch gage on the master. Move the stretch gage until the lowest reading is obtained on the dial indicator. Then set the dial indicator on zero; this positions the stretch gage for use on the turbine wheel. The master gage is machined to give an indicator setting of 13.2170 (+0.000 −0.005) inches radius. When preparing to check Waspaloy type turbine buckets for stretch, place the stretch gage on the master. Move

the stretch gage until the lowest reading is obtained on the dial indicator. Then set the dial indicator on plus 0.030 inch. This compensates for the 0.020 inch additional overall length of Waspaloy buckets and the 0.010 inch tolerance in the radial measurement over the S-816 type buckets. This positions the stretch gage for use on turbine wheels having Waspaloy buckets installed.

(4) Place the radial stretch gage on the rear face of the turbine wheel so that the spring-loaded steel ball is seated in the drilled hole in the center of the turbine wheel. Press the gage firmly onto the rear face of the turbine wheel so that the spring is compressed and the gage is seated on the rim of the turbine wheel. Hold the gage in this position on the back face of the turbine wheel while the wheel is rotated slowly to determine the radial measurement over each turbine blade tip.

(5) Replace any S-816 bucket stretched in excess of 0.020 inch. Replace any Waspaloy bucket stretched in excess of 0.020 inch. This 0.020 inch is in addition to the plus 0.030 inch previously set on the dial indicator to compensate for the added length and tolerance of the Waspaloy bucket.

(6) Shroud ring installed, clearance between the S-816 type bucket tips and the turbine shroud must not be less than 0.045 inch. If clearance is less than 0.045 inch relocate or replace the turbine shroud. The replacement shroud must have a minimum clearance of 0.065 inch. This requirement is the same for new or overhauled shrouds.

(7) Clearance between Waspaloy type bucket tips and the turbine shroud must not be less than 0.045 inch. If the clearance is less than 0.045 inch relocate or replace the turbine shroud. This clearance is the same for new or overhauled shrouds as the length and stretch characteristics for the Waspaloy and S-816 type buckets are not the same.

b. Inspect turbine wheel for cracks using Met-L-Check dye-penetrant kit, (FSC 6850-582-2024, Specification MIL-I-25135, Type II, 1 qt. can) in the following manner:

(1) Remove a minimum of six blades equidistant (approximately 60 degrees apart) around the turbine wheel, starting with No. 1 blade on initial inspection. A different set of blades will be removed on subsequent inspections to assure full wheel coverage.

(2) Position the serration to be inspected on the horizontal axis to prevent foreign material from falling into No. 4 bearing area and to obtain the maximum of dye-penetrant in the affected area. Dye penetrant should be in the sixth serration area only.

(3) Clean serration with any approved solvent or carbon tetrachloride to remove oil and dirt, then dry thoroughly with compressed air. Clean the opposite slot in the same manner.

(4) Place the special serration brush, Part No. 6795808, FSC 5120-570-2395, in the bottom of the blade slot with its width extending under the two innermost serrations.

(5) Move brush fore and aft until all oxide or carbon residue has been removed from the serration. The brushed area need not be highly polished but all roughness should be removed. Blow all loose residue from serration with compressed air. The opposite blade slot should be cleaned in the same manner. The use of the brush may be facilitated by bending a small loop in the end or use of small chuck type handle. Pliers may also be used on shorter type handles.

(6) Apply dye-penetrant solution to lower innermost serration of the two opposed blade slots with a small No. 2 or 3 artist brush with at least 1/2 inch length bristle. (Brush must be reformed at bristle end to permit proper application as follows: Bend the last 3/16 inch of metal tip at approximately 45 degree angle with a pair of pliers. Do not bend too sharp or metal will break.) Be sure the entire sixth serration being inspected is covered.

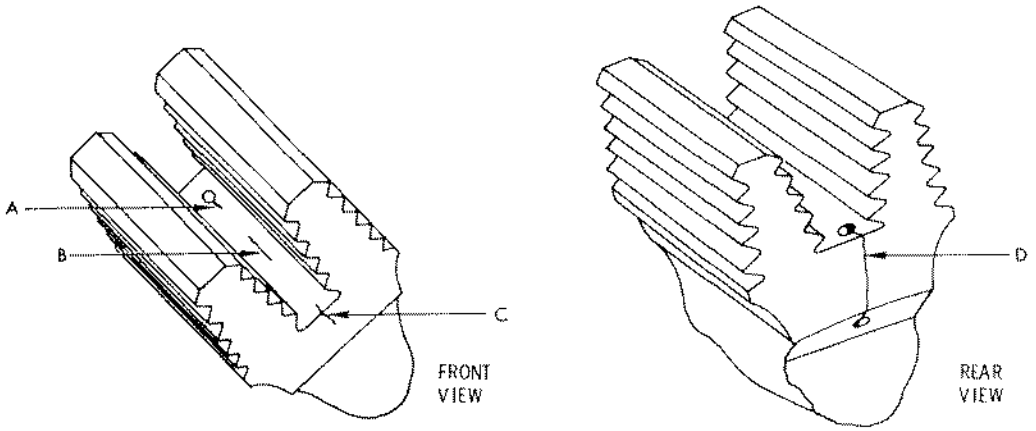
Note

Do not move wheel from its horizontal position after dye-penetrant has been applied. The serration must contain sufficient penetrant for deep penetration. If moved from the horizontal position, the dye-penetrant will drain from the serration.

(7) Permit serrations to soak for five to ten minutes. Remove all excess dye-penetrant with a cloth, cotton swab or pipe cleaner. After excess dye has been removed, dry brush the serration again to remove all traces of dye.

Note

Do not use a cleaning solution of any kind to remove dye-penetrant. This will remove dye from a shallow crack.



A AXIAL CRACK, UP TO 1/8 INCH LONG EMANATING FORWARD FROM PIN HOLE.

B AXIAL CRACK, UP TO 1/2 INCH LONG IN BOTTOM LAND, NOT CONNECTED WITH A PIN HOLE CRACK OR A CRACK ON FRONT FACE OF WHEEL.

C RADIAL CRACK, UP TO 1/16 INCH LONG, EMANATING INWARD FROM THE BOTTOM LAND ON FRONT FACE OF WHEEL. THESE SHALL BE REMOVED BY BLENDING EDGE TO A MAXIMUM RADIUS OF 0.070 INCH.

D CRACKS EXTENDING REARWARD FROM THE BLADE PIN HOLE AND INTO THE FACE OF THE WHEEL ARE ACCEPTABLE UP TO THE LENGTH ILLUSTRATED.

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Figure 4-57. Turbine Wheel Crack Inspection (A-286 Material)

(8) Before applying Met-L-Check developer, shake container vigorously to assure that solution is properly mixed. Developer must be thoroughly mixed prior to each application. Apply developer in the serration being inspected with a small artist brush of the same size and configuration as noted above.

CAUTION

Do not use same brush for dye-penetrant and developer. The developer will be contaminated with dye-penetrant and cause an unsatisfactory coating of developer.

(9) A very thin coating of developer is required to obtain best results. This can be accomplished by gently blowing excess developer away by mouth or compressed air immediately after application. Dry the developer with air as soon as possible after application. This will prevent dye from bleeding from shallow cracks prior to normal drying of developer. When completely dry, developer must be white or as nearly white as possible. If developer coating is not white, it must be removed and a second application made. (Normally two applications of developer can be made without repeating application of dye-penetrant. However, this will require additional bleed-out time.) If the developer coating is still too pinkish on second application to observe a crack, the serration must be recleaned thoroughly and dye-penetrant reapplied and removed as previously accomplished.

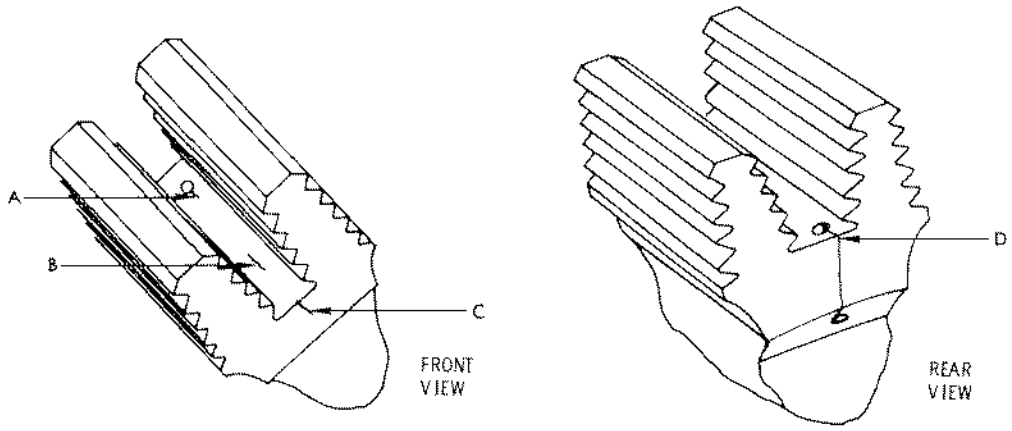
(10) Allow sufficient time for dye-penetrant to bleed from crack, if present, and penetrate the developer coating. A minimum of five minutes should be required. Examine the bottom of serration V groove shown in figure 4-56, for cracks with the use of a bright light and small mirror. The mirror may be locally fabricated from a piece of chrome plated metal or cut from a thin glass mirror. It should not be over 5 16 inch wide. The 5 16 inch width is necessary to obtain proper angle of mirror to observe the sixth serration area being inspected and also prevents observation of a serration above the one being inspected. Only the sixth serration requires inspection. Do not apply dye-penetrant or developer

to any serration other than the sixth (one nearest wheel hub). Place the mirror in the serration being inspected and shine the light beam directly on the mirror. Pay particular attention to the bottom of the V recess. A comparatively large crack will become evident almost immediately after the developer has dried as a distinct red jagged line. Shallow or tight cracks will require a longer period of time for the dye to bleed out and penetrate the developer coating. These are evidenced by a dotted or interrupted red line.

(11) Any crack indication is cause for turbine rotor removal.

(12) Only one-half of each blade slot is inspected at one time. Rotate the turbine rotor and inspect serrations as outlined until all six blade slots have been inspected on both sides of the sixth serration. Make an AFTO Form 44 entry as to locations inspected and remove a different set of blades at next inspection.

(13) This inspection will also be made on turbine rotor whenever a blade has been removed because of shroud ring failure or being broken with resultant engine vibration. This requirement is mandatory regardless of periodic requirements.



A AXIAL CRACKS IN BOTTOM LAND EMANATING FROM PIN HOLE, 3/64 INCH MAXIMUM LENGTH.

B AXIAL CRACKS IN BOTTOM LAND, WHICH DO NOT CONNECT WITH 3/64 INCH CRACK ON THE FORWARD FACE, WILL BE LIMITED TO 1/4 INCH MAXIMUM LENGTH.

C RADIAL CRACK ON FORWARD FACE OF WHEEL EMANATING 1/32 INCH INWARD ON BOTTOM LAND WILL BE BLENDED AS REQUIRED TO MAXIMUM 0.070 INCH TO REMOVE THESE SLIGHT INDICATIONS.

D A CRACK FROM PIN HOLE THAT PROGRESSES REARWARD AND REACHES THE AFT FACE IS NOT PERMISSIBLE.

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Figure 4-57A. Turbine Wheel Crack Inspection (Tempkin 16-25-6 Material, Type BLK and LK)

CAUTION

Do not confuse the serration inspection with the pin hole and bottom land broach or face crack inspection. Both inspections will be made independently of each other.

(14) Bottom land broaches of all slots from which buckets have been removed shall be thoroughly cleaned and inspected for cracks using same dye-penetrant materials outlined above for sixth serration cracks. See figure 4-57 for maximum allowable crack limits.

c. Any number of cracks are permissible in outer combustion chambers providing none show soot deposits, but no crack shall exceed a maximum of 1-1/2 inches in length with a minimum distance of 1/2 inch between any two cracks. Repair cracks by welding, using welding rod (Type 19-9, Specification MIL-E-6844, Composition 6).

d. Cracks in outer burner tube wall adjacent to rear flange of ring and tube assembly will not warrant engine removal unless soot or carbon deposits are present in cracks or on outer burner exterior surfaces.

e. When hot spots are found on the ring and tube assembly transition end, and an inspection of the fuel nozzle is made to correct the difficulty, remove the inner liners for inspection. If buckling is of a minor nature, or cracks do not converge from hole to hole or hole to louver, or progress in such a manner that a piece may break out, and no more than one crack emanates from either hole or louver, and no cracks are existent on the liner transition end, the liner is considered satisfactory for additional use.

f. Axial clearance between the turbine wheel and inner exhaust cone will be 0.125 to 0.315 inch.

g. A dent is an imperfection on the blade surface or on the leading or trailing edge of a bucket, and is generally shallow with rounded edges and bottom.

Such impressions are believed to occur most commonly when the wheel is operating, and result from the bucket being struck by some object passing through the engine. The impression may be likened to that caused by a steel ball striking a surface. Any dent on the blade surface or on the leading or trailing edge, not exceeding 0.1875-inch in diameter at the surface, prior to stoning, and which has not caused metal deformation on through to the opposite side of the blade or cause visible damage on the leading or trailing edge, will be lightly stoned to remove the crater outline on the surface. The allowable depth of a dent on the leading or trailing edge shall not exceed 0.015-inch after stoning, although the surface measurement of the stoned area may exceed the acceptable limit of the original dent and still be acceptable. (See views 1, 2, 3, 4, 5, 6, and 7 of figure 4-58.)

h. A nick is a gouge or furrow showing increasing depth in travel from its source, usually sharp-sided and V-shaped in the bottom. Such markings are the results of sharp objects passing through the engine, e.g., the mark made by the edge of a cap-screw head when driven against a piece of metal at high velocity. Any nick on the blade surfaces which is not greater than 0.1875-inch in length prior to stoning and which has not caused metal deformation through to the opposite side of the blade, will be lightly stoned to remove furrow outlines on the surface. (See views 1, 3, and 6 of figure 4-58.) Any nick on the leading edge of the blade which is not greater than 0.125-inch in length, prior to stoning, and which has not caused metal deformation of the edge, other than to raise furrow sides, will be lightly stoned to remove the furrow outline. The depth of the nick after stoning shall not exceed 0.015-inch, although the surface measurement of the stoned area may exceed the acceptable limit of the original nick and still be acceptable. (See views 3 and 7 of figure 4-58.) Any nick on the trailing edge or on the trailing edge radius of the blade will be cause for engine rejection. (See views 1, 2, 3, 4, and 5 of figure 4-58.)

i. A crack is a distinct break in the surface of a bucket or in the leading or trailing edge. This type of damage may be the result of unusual bucket stretch, deformation, and/or fatigue of the metal. Cracks resulting from bucket stretch or unusual deformation, generally present jagged surface characteristics, and tend to follow the grain boundaries in the metal. Fatigue cracks, at least at their points of origin, are somewhat smooth and straight in appearance, and are generally intracrystalline. A short distance from their point of origin, they may become less regular and tend to follow the grain boundaries. Any crack, either on the blade surfaces or on the leading or trailing edges, will be cause for engine removal.

j. Scuffing shall be recognized as the burnishing or gouging of blade tips caused by contacting the exhaust cone shroud during engine operation. Scuffing may or may not result in feathering the edges of the blade tip. Any scuffing which results in the bending of one or more buckets or results in the start of cracks, shall be cause for blade rejection. In cases when rubbing has occurred, a special examination of the trailing edges of the buckets will be made with a magnifying glass to determine if any fine cracks are developing. The maximum allowable rework of turbine bucket tip wear that can be tolerated before blade change is 0.030-inch in depth, and may extend all the way across the bucket tip. If the turbine wheel buckets meet these requirements, stone any feathered edges from the affected buckets (view 8) and stone all metal deposits from the exhaust cone shroud ring.

k. Nozzle diaphragms will be acceptable for further service under the following conditions:

If the diaphragm is a pinned type unit (as evidenced by inspection through the turbine wheel blades), inspection of the mounting flange-to-inner spacer ring weld for cracks will not be necessary. Cracks may be evident in pinned type units, however, the engine will be retained in service. Unpinned type diaphragms will be inspected for cracks after the first 50 hours and each succeeding 25 hours thereafter. When 200 hours of operation is attained the engine will be rejected. If cracks are found prior to 200 hours, reject the engine.

Inspect diaphragm in accordance with figure 4-59, views F and G, and reject engine if cracks in either ring indicate danger of pieces breaking out or if any crack exceeds $\frac{1}{32}$-inch in width or if cracks emanate from both leading and trailing edges of same vane.

Distortion or warpage of vanes will not be cause for engine removal unless engine performance is affected.

If nicks are no greater than 0.010-inch deep, regardless of number, continue engine in service. One nick per vane to a maximum depth of $\frac{1}{8}$ inch is permitted in addition to the above.

If a dent does not exceed the distortion limits as set forth above, dents are acceptable.

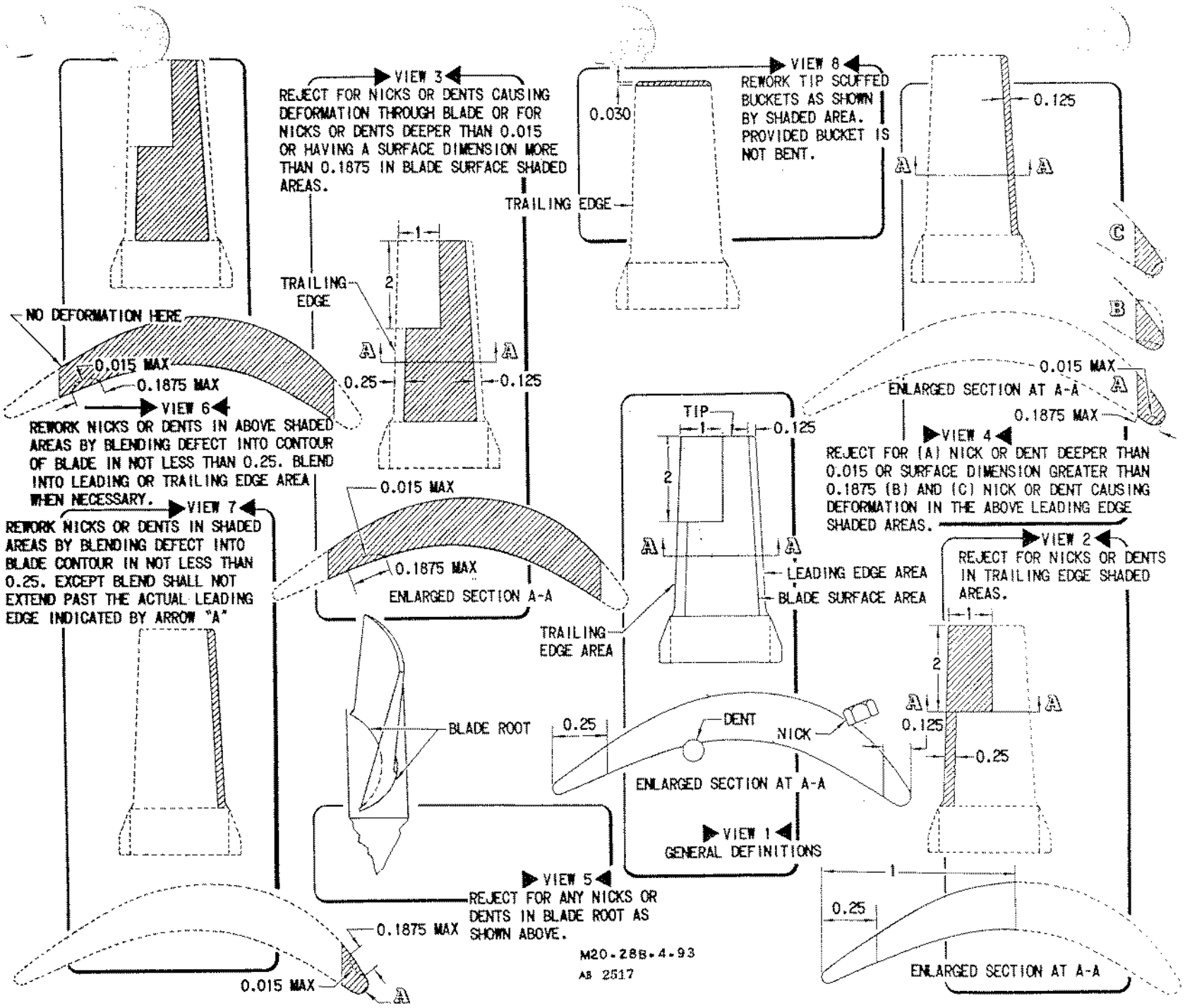
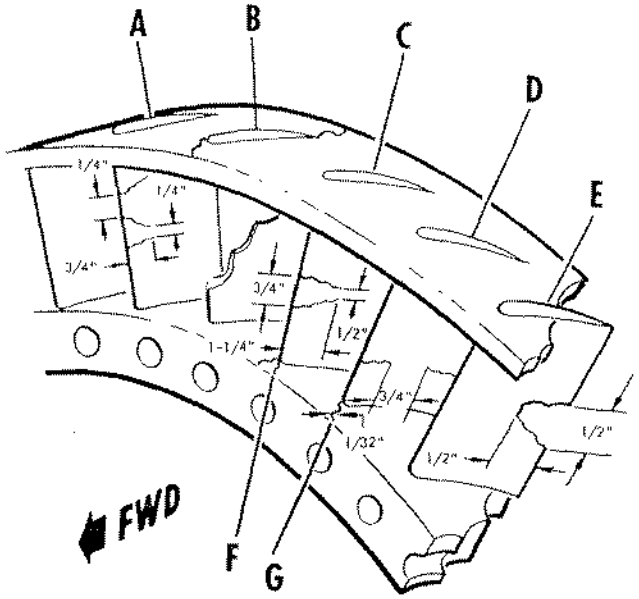


Figure 4-58. Maintenance of Turbine Buckets



	NUMBER ALLOWABLE	SEPARATION LIMIT	CONVERGENCE LIMIT
A. VANE CRACKS - LESS THAN 3/4 IN. LONG	ANY NUMBER	1/4 IN. MINIMUM	1/4 IN. MINIMUM
B. CRACKS - IN BOTH LEADING AND TRAILING EDGE OF INNER OR OUTER SPACER RING OF SAME VANE LOCATION	NONE		
C. VANE CRACKS - 3/4 TO 1-1/4 IN. LONG	3 PER VANE	3/4 IN. MINIMUM	1/2 IN. MINIMUM
D. VANE CRACKS IN LEADING AND TRAILING EDGE OF SAME VANE	1 PER VANE		3/4 IN. MINIMUM
E. PIECE BROKEN OUT OF VANE ON TRAILING EDGE ONLY	1 PER VANE NO LARGER THAN 1/2 IN. X 1/2 IN.		
F. TWO CONVERGING CRACKS IN INNER OR OUTER RINGS	ANY NUMBER		1/2 IN. MINIMUM
G. CRACK IN INNER OR OUTER SPACER RING NICKS OR DENTS DISTORTION OR WARPAGE OF TRAILING EDGE OF VANE	ANY NUMBER NO LIMIT NO LIMIT ON SIZE OR NUMBER OF VANES AFFECTED	1/32 IN. MAX. WIDTH	

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Figure 4-59. Maintenance of Nozzle Diaphragms

If a crack or cracks emanate from a dent which does not exceed the distortion limits, the acceptability must be further judged by the crack limitations as outlined in figure 4-57.

4-279. TURBINE NOZZLE INSPECTION. Determine fore and aft position of turbine nozzle ring by inserting a locally manufactured gage (see figures 4-60 and 4-61) between leading edge of inner ring and inner ring and tube mounting flange face at eight or more equally spaced positions. If gage blade will enter any position so that tip bottoms on either side of mounting flange, reject engine.

4-280. TURBINE AIR DIFFUSER INSPECTION.

a. Remove turbine shroud and any two adjacent turbine wheel buckets (not a pair of diametrically opposed buckets).

b. Direct a beam of light between turbine gas baffle lips and forward face of turbine wheel broach from which a turbine bucket has been removed. From adjacent empty dovetail slot, view the aft edges of diffuser vanes on old type turbine diffusers or the shroud on outer rim of new type diffusers. When light beam is properly aligned, the vanes or shroud will become visible. Inspect the entire circumference of turbine diffuser vane or shroud area for disintegration and/or melting by viewing and turning the turbine wheel one complete revolution. The cooling diffuser vanes or shroud are ¼-inch below the lower gas baffle lip.

c. Engines which have turbine diffuser vanes or shroud disintegration and/or melting shall be removed from

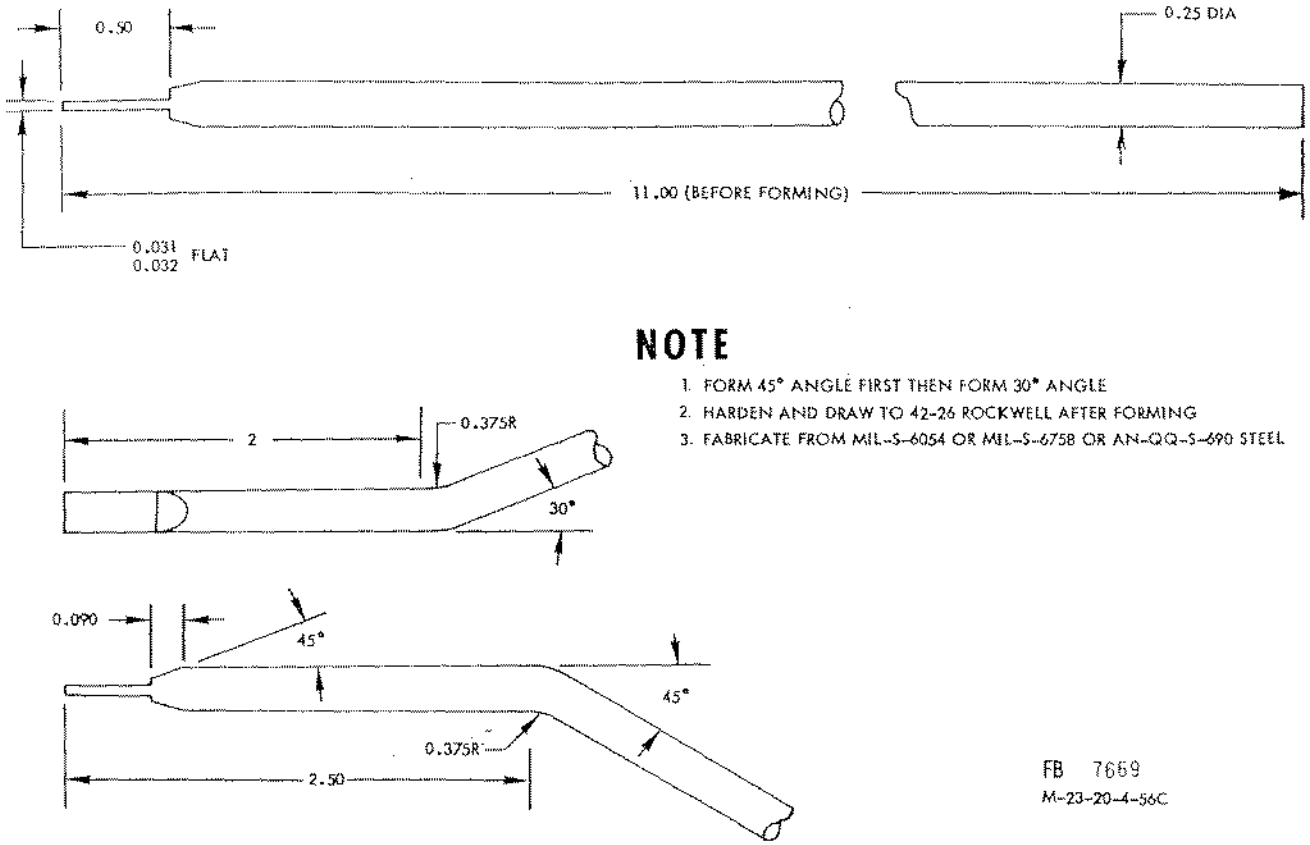

Figure 4-60. Turbine Nozzle Inner Ring Gage

service and forwarded to a maintenance facility for further disassembly to determine the cause.

4-281. REPLACEMENT OF TURBINE WHEEL BUCKETS.

a. Special tools required: AF Stock No. 8004-3143, puller-turbine bucket impact, Class 18; AF Stock No. 8700-501570 or 8700-501580, paper-stencil board oiled smooth Grade I, Class 25-B; and six locally manufactured plug gages made to the following dimensions:

	"GO" End	
Standard	0.124 (+0.0000, −0.0005)	inch
0.010 Oversize	0.134 (+0.0000, −0.0005)	inch
0.020 Oversize	0.144 (+0.0000, −0.0005)	inch
0.030 Oversize	0.154 (+0.0000, −0.0005)	inch
0.040 Oversize	0.164 (+0.0000, −0.0005)	inch
0.050 Oversize	0.174 (+0.0000, −0.0005)	inch

	"NO-GO" End	
Standard	0.127 (+0.0005, −0.0000)	inch
0.010 Oversize	0.137 (+0.0005, −0.0000)	inch
0.020 Oversize	0.147 (+0.0005, −0.0000)	inch
0.030 Oversize	0.157 (+0.0005, −0.0000)	inch
0.040 Oversize	0.167 (+0.0005, −0.0000)	inch
0.050 Oversize	0.177 (+0.0005, −0.0000)	inch

b. Removal of buckets. Buckets may be replaced 100 per cent if necessary. When a bucket that has failed is replaced, the bucket diametrically opposite shall also be replaced.

Place a piece of stencil paper between gas baffle and base of bucket to prevent baffle damage.

Using a composition or plastic drift against bucket base, drive bucket forward carefully with a one-pound hammer until bucket retaining pin is sheared.

Install turbine bucket impact-puller and remove bucket from wheel by tapping rearward with impact hammer.

c. Removal of bucket-retaining pin. Removal of buckets will leave sheared portion of retaining pin in the turbine wheel.

Apply penetrating oil to pin to be removed and let it stand approximately two hours before working on pin.

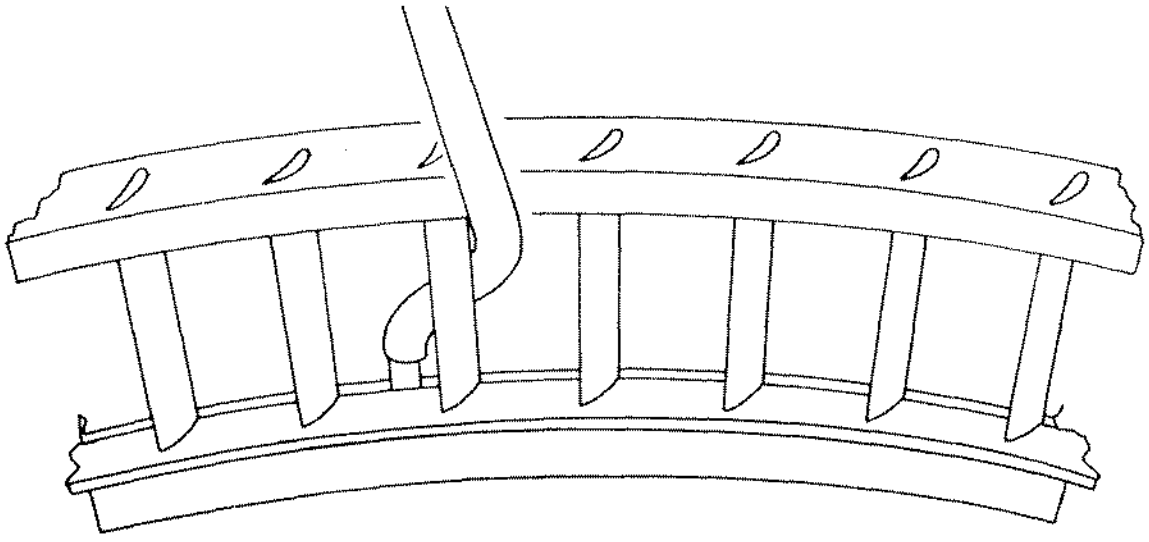

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Figure 4-61. Turbine Nozzle Ring Inspection

Drift pin from wheel using a 0.112-inch diameter straight shank drift. The pin will be driven from wheel fillet toward serrations.

Gage pinhole to determine its minimum diameter, taking into consideration that wheel metal may have been upset at wheel fillet. Ream fillet end of pinhole with a tapered reamer of same size as gage to prevent pin seizure when replacement pin is installed.

d. New bucket installation.

Position buckets in turbine wheel. Insert gage in pinhole to make certain that bucket is properly positioned. Be sure that gage enters and bottoms in pin slot of bucket. This can be determined by "feel."

Note

Do not attempt to hammer gage into position.

Tap retaining pins through wheel hole into bucket slot until bucket begins to tighten in wheel. Use a 0.112-inch diameter straight shank drift to install pin.

Using a composition or plastic drift, tap each bucket on platform at rear of bucket base to make sure that bucket is not binding on pin, and that it is free for circumferential shaking.

4–282. DESCRIPTION OF ENGINE EXHAUST CONE. The exhaust cone is a tapered cylindrical outlet for the exhaust gas. It has a closed, smaller cone within it, around which the gas is ejected in a gradually expanding jet form. The exhaust cone is bolted to the turbine unit over the turbine wheel, and forms the rear end of the unit.

4–283. REMOVAL OF ENGINE EXHAUST CONE AND TURBINE SHROUD RING.

a. Remove engine from airplane. Refer to paragraph 4–300 for removal procedure.

b. Remove tail pipe clamp from exhaust cone.

CAUTION

Extreme care shall be taken when removing tail pipe clamp from exhaust cone to prevent damage to insulating blanket.

c. Remove exhaust cone thermocouples.

d. Remove wire lacing of tail pipe adapter insulation pad, and carefully unwrap insulation from adapter.

e. Remove air diaphragm from between ring and tube flange and exhaust cone.

f. Remove wire lacing of ring and tube rear-flange and exhaust cone insulation pads, and carefully unwrap insulation from engine and exhaust cone.

g. Remove all exhaust cone retaining bolts, and remove exhaust cone.

h. Remove all turbine shroud ring retaining screws, and remove shroud ring.

4–284. INSPECTION OF RING AND TUBE ASSEMBLY. Inspect gusset plate welds of ring and tube assembly from the rear with exhaust cone and turbine shroud removed.

a. Four cracks per assembly at gusset junction corner weld which are within ¾-inch in length are permitted, provided any two cracks are separated by a minimum of two uncracked gusset plate corner junctions.

b. For cracks other than at corners, one crack per side for each compartment is permitted, provided no crack is longer than ¾-inch in length and no compartment has more than two cracks.

c. Engines having cracks which exceed the above limits will be rejected.

Note

Do not reject engines because of cracks in gusset plate-to-outer ring welds, which are visible between combustion chambers. They are not structural welds.

4–285. INSPECTION OF GAS BAFFLE ASSEMBLY. With turbine shroud removed, inspect gas baffle assembly for cracks.

a. Radial cracks in seal lips of any length are permitted, provided the maximum gap is less than $\frac{1}{16}$-inch. Any number of cracks are permitted.

b. Circumferential cracks up to two inches in length are permitted, provided there is not more than one circumferential crack in each seal lip.

c. Any piece broken off the seal lip larger than ¼ by ¼ inch is cause for engine rejection.

d. Wear on aft edge of seal lips is permitted but baffle-to-wheel clearance must be between 0.120 and 0.175 inch.

e. Reject engines if cracks exceed above limits.

4–286. INSTALLATION OF ENGINE EXHAUST CONE AND TURBINE SHROUD RING.

a. Lubricate the four, $\frac{5}{16}$-24 x $\frac{13}{16}$ recessed head screws and the fifty-six ⅜-24 x $1\frac{13}{32}$ bolts with compound, Spec MIL-C-5544.

b. Install turbine shroud ring over the turbine wheel exercising extreme caution to prevent damaging the turbine buckets and align the four $\frac{5}{16}$-inch holes in the ring and tube flange. Insert four recessed head screws and install four $\frac{5}{16}$-24 Klincher nuts finger tight.

c. Make a preliminary measurement of bucket to shroud ring clearance with feeler gage, Allison Part No. 2825. Refer to paragraph 4–287, step b for clearances. The shroud ring may be shifted radially to equalize clearances. If turbine shroud ring fails to meet required limits, remove and select another shroud ring until clearances are within limits.

d. Tighten and torque the four $\frac{5}{16}$-24 Klincher nuts to values shown in section VI.

e. Install exhaust cone assembly so that inner cone supporting vanes are in the vertical and horizontal plane through the cone axis. The thermocouple boss, which is located equidistant between two vanes, should be at the 10:30 o'clock position as viewed from the rear of the engine.

f. Install exhaust cone flange reinforcing ring in such a position as to expose the four recessed head screws that secure turbine shroud ring to ring and tube assembly. Insert four of the ⅜-24 bolts at approximately 90 degree intervals through the assemblies and install four ⅜-24 Klincher nuts finger tight. Measure inner exhaust cone to turbine wheel axial clearance in four places at approximately 90 degrees intervals with feeler gage, Allison Part No. 2825. Refer to paragraph 4–278, step f for clearances.

g. Install remaining fifty-two ⅜-24 bolts, with heads to the front (nuts to exhaust cone side), except the two bolts on top which are reversed because of engine lifting boss. Tighten and torque the ⅜-24 Klincher nuts to values shown in section VI.

h. Install air diaphragm.

i. Place the insulation pads in place, using two springs at each splitline to equalize the gap. Install a double loop of lock-wire between each pair of eyelets; leave a little slack to allow for expansion and do not lace between adjacent pairs of eyelets. Remove the springs and replace with lock-wire.

Insulation blankets should be placed in position as near as possible before installing springs. Springs are not strong enough to pull blankets to final locations.

Springs should be installed by holding with duckbill pliers instead of fingers. This is to equalize stretch in each coil.

Springs should be installed alternately at split lines. Install two springs only at each of three split lines, then add one additional spring at each split line until all fifteen springs are installed.

Spring stretch (length increase) during installation must not exceed 1¼ inches. Blankets can be adjusted during installation to keep spring stretch to a minimum.

j. Install exhaust cone thermocouples.

4–287. MAINTENANCE OF EXHAUST CONE.

a. If the radial clearance between bucket tips and inner diameter of exhaust cone shroud ring, or axial clearance between turbine wheel and inner exhaust cone are not within specified limits (paragraph 4–278), replace the exhaust cone shroud ring; or it is permissible to rotate exhaust cone or shroud ring from original position to meet minimum clearance requirements.

b. If the rubbed exhaust cone shroud ring does not meet the minimum clearance limits, and if in any instance where the metal deposited cannot be removed by stoning, install a new replacement exhaust cone shroud ring. Check for clearance of 0.065-inch minimum when a new shroud ring and new S816 turbine buckets are installed. Check for clearance of 0.045 inch minimum clearance when a used shroud ring and used S816 turbine buckets are installed. A 0.045-inch minimum clearance will be used when used shroud ring and used turbine buckets are installed or a combination of new shroud ring and used buckets or used shroud ring and new buckets are installed. Check for clearance of 0.045-inch minimum with new or used exhaust cone shroud ring and new or used Waspaloy turbine buckets installed.

c. Limit for looseness of inner cone of exhaust unit assembly will not exceed 0.125-inch. Buckling from original contour of exhaust cone is permissible, provided buckling does not exceed 0.75-inch or buckling does not have sharp radii which may result in cracking.

d. Exhaust cones with cracked welds at outer reinforcement band will be removed and repaired by field maintenance by heli-arc welding. Crack will be repaired regardless of length. Use welding rod (Type 18-8CB, Specification MIL-R-5031, Composition 5, S/N 6800-725100) or welding rod (Type 19-9WX, Specification MIL-R-5031, Composition 6, S/N 6800-725400). If welding equipment is not available, install a serviceable cone, and return repairable cone to overhaul.

4–288. INSPECTION OF UPPER IDLER GEAR ASSEMBLY.

a. Remove fuel pump and generator. Install generator drive shaft locking fixture tool number 6505, over four studs on generator pad. Engage splines, tighten spline expansion screw until no axial movement of tool is possible. Lock tool in position with four generator mounting nuts.

b. Install accessory upper idler gear key looseness gauge, tool number 6504, on fuel pump drive pad in same manner. Apply 400-500 lb-in torque in a counterclockwise direction to looseness gauge. (This torque is necessary to force slippage between hubs of two idler gears in case initial idler shaft assembly retainer nut is still tight.) Relieve torque to 10 lb-in and while maintaining this torque, (counterclockwise) set the zero of vernier with the zero of protractor, and secure.

Note

Torque in excess of 500 lb-in will result in permanent damage to gauge.

c. Apply 400-500 lb-in to gauge in clockwise direction. After gear nut slippage is felt, reduce clockwise torque to 10 lb-in. If gauge reads 3 percent while holding this torque, engine will be designated for Field or Depot maintenance.

d. Clean generator and fuel pump splines; lubricate with lubricant, stock number 7500-435200. Reinstall removed assemblies, if engine is acceptable by this inspection.

4–289. ENGINE SPECIFICATIONS.
See Table 4-2.

Table 4-2. Engine Specifications

Model T-33A Airplanes	J33-A-35
Type	For turbo-jet propulsion
Number of Combustion Chambers	14
Normal Rating (Sea Level)	
Thrust	3900 pounds
Speed	11,250 rpm
Exhaust Temperature (Normal Rated and below including idle)	655°C (1210°F) Max
Military Rating (Sea Level)	
Dry	
Thrust	4600 pounds
Speed	11,750 rpm
Exhaust Temperature	715°C (1319°F) Max
Wet	
Thrust	5400 pounds
Speed	11,750 rpm
Exhaust Temperature	715°C (1319°F) Max
Altitude	47,500 feet
Idling Speed	4,000 (±80) rpm
Maximum Exhaust Temperature During Manually Controlled Acceleration	900°C (1650°F)
Weight (Less generator and tachometer generator)	1,795 pounds
Mounting	2 trunnions, 1 ball support

Table 4-2. Engine Specifications (Continued)

Dimensions	
Diameter	50½ inches
Length	107 inches
Height over fittings	50½ inches

4–290. (Deleted)

Table 4-3. Deleted

4–291. RUNUP CHECK. The instrument readings in table 4-4 are normal for ground checking at the specified speeds at standard conditions of 29.92 inches mercury barometric pressure and 15° C (59° F) free air temperature.

4–292. Fuel manifold pressure varies inversely as the atmospheric temperature, and directly as atmospheric pressure. If the indicated pressure is questionable, correct the pressure to approximately standard conditions for comparison with the values shown in paragraph 4–291 as follows. For each degree Fahrenheit above standard conditions, add one pound to the indicated pressure; for each 0.10 inch mercury less than standard atmospheric pressure, add two pounds to the indicated fuel pressure. These figures are approximately correct only in the takeoff range of 11,750 rpm.

Table 4-4. Runup Check

Check Runs	*Schedule A 4000 RPM (34%)*	*Schedule B 6000 RPM (51%)*	*Schedule C 11,750 RPM (100%)*
Fuel Manifold Pressure	38-63 psi at 3750 rpm (32%)	43-73 psi	130-200 psi
Oil Pressure	2 psi (min)	2 psi (min)	7-50 psi
Max. Indicated Exhaust Gas Temperature refer to paragraph 4–293.			

CAUTION

Do not operate an engine installed in an aircraft on the ground with access doors closed (except taxiing). Remove the engine upper access doors. Open the engine lower access doors and wire them together to prevent them from slamming shut when the engine starts. This will allow more cooling air in the plenum chamber and prevent possible damage to internal engine parts due to abnormal temperatures. If an overtemperature condition is experienced, perform enough hot section inspection to determine whether heat has damaged the turbine cooling fan and diffuser.

Note

A fast engine acceleration causes an abrupt internal air flow and pressure change throughout the engine which in turn influences a low frequency high amplitude vibration. This type of vibration is not detrimental to engine life, if not associated with compressor stall. In order to prove beyond any reasonable doubt that the high amplitude vibration encountered during high rate transient speeds is not the detrimental type, the speed at which this peak vibration was noted must be allowed to stabilize. If the steady state speed vibration is normal, the transient speed vibration is acceptable.

4–293. OVERTEMPERATURE LIMITS. See Table 4-5.

Table 4-5. Overtemperature Limits

Condition	*EGT° C*	*Time*	*Action Required*
All conditions except starting	716—899	20 seconds or more	*
All conditions including starts	900	Anytime	*

*Inspect turbine wheel and buckets in accordance with T.O. 1T—33A—6, Section 2, Part A.

4–294. OPERATION OF ENGINE. Atmospheric air enters on both sides of the compressor casing where it is compressed by a multi-vaned impeller. The compressed air leaves the impeller and passes to the combustion chambers where it is mixed with fuel (introduced by nozzles) and burned. The exhaust gas leaves the combustion chambers and passes through diaphragm nozzles

on to the turbine bucket wheel. The energy of this gas passing through the turbine turns the shaft which, being connected to the impeller shaft, furnishes the motive power for the compressor. As the gas leaves the bucket wheel it enters the exhaust cone and passes through the tail pipe.

4–295. ENGINE FUEL SYSTEM. Refer to paragraph 4–370.

4–296. ENGINE MOUNTS. The engine is mounted on three ball-socket fittings. The sockets are located one on the left side and one on the right side of fuselage station 277.5±12 bulkhead, and one at the bottom center of fuselage station 264 bulkhead. The two sockets at fuselage station 277.5±12, where the aft section detaches, hold the trunnion mounted balls that are located on either side of the engine. The lower socket at fuselage station 264 receives a ball support which extends downward from the forward face of the engine. Each socket is constructed in the form of a hinged clamp, the halves of which are secured with a toggle bolt and wing nut to permit quick disassembly for engine removal.

4–297. The balls and trunnion bolts on either side of the engine are interchangeable left and right, although the hex heads of the trunnion bolts differ slightly in design. One of the bolts has a hex head smaller than the inside diameter of the ball, which permits the ball to slide the full length of the bolt. This feature is provided to allow for expansion and contraction of the engine. The bolt with the smaller head may be installed on either side of the engine and with either ball since the balls are identical parts.

4–298. INSPECTION OF TRUNNION SPINDLES. Inspect trunnion spindles for scoring, galling, nicks or dents. Reject trunnion spindles for damage exceeding limits listed below in the areas shown in figure 4-62.

a. Any surface damage in area 1.

b. Scoring and/or galling to a depth of 0.030-inch in area 2.

c. Scoring and/or galling to a depth of 0.050-inch for more than one-fourth the circumference for a total width of 0.030-inch in area 3.

d. Scoring, galling, nicks or dents to a depth of 0.100-inch in area 4.

e. Spindles which are damaged but within the above limits, will be repaired as follows:

Remove all metal which has been raised above any of the surfaces marked for inspection.

Radius or blend out any sharp corners at metal surface or at bottom of any cuts into material.

4–299. REMOVAL OF FUSELAGE AFT SECTION. Special tools required: A fuselage aft section stand, or

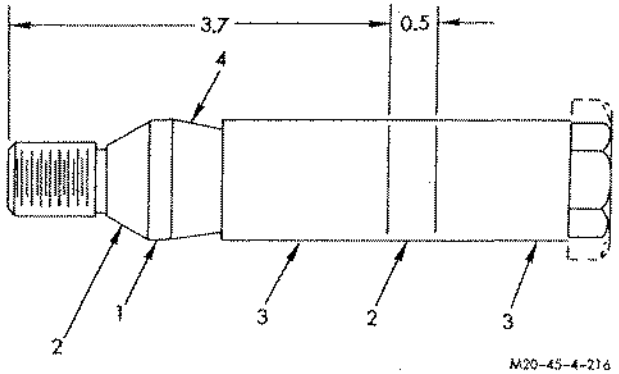

Figure 4-62. Inspection of Trunnion Spindle

fuselage aft section sling, S84402, and prior to AF Serial No. 51-6957 a ¾-inch internal wrenching adapter, AF Part No. 9BMB-47B6412, and on AF Serial No. 51-6957 and subsequent a piece of $\frac{9}{16}$-inch hex bar or a $\frac{9}{16}$-inch internal wrenching adapter, No. 409834.

a. Clamp the elevator in neutral position.

b. Through access panels Nos. 43 and 44, open the tail pipe clamp to disconnect the tail pipe, and disconnect the tail cone thermocouple leads.

CAUTION

Place tail pipe clamp on tail cone with extreme caution to prevent damage to insulation blanket.

c. Remove access panels No. 42 and, through this opening, disconnect the elevator control rods (refer to paragraph 4–638) and disconnect the rudder cables (refer to paragraph 4–656). On airplanes AF Serial No. 51-4267 and subsequent, disconnect the fuel system vent line at the flexible line between the aft and mid section.

d. Through access panel No. 17 at trailing edge right wing fillet, disconnect two electrical disconnect plugs, and command radio antenna coaxial cable.

e. Support the aft section by either a cradle or sling S-84402.

f. Through access panels No. 32 remove locking pins and three tension bolts which attach aft section to mid-section. Prior to AF Serial No. 51-6957 use the internal wrenching adapter, AF Part No. 9BMB-47B6412, and on AF Serial No. 51-6957 and subsequent use $\frac{9}{16}$-inch hex bar or internal wrenching adapter, No. 409834.

g. Remove the fuselage aft section.

CAUTION

On airplanes AF Serial Nos. 51-4267 and subsequent, extreme care must be exercised to prevent fuel system vent line from damaging air adapter baffle No. 2.

4–300. DISCONNECTION OF ENGINE.

a. Through access panels No. 42:

Disconnect the heating, cooling, and pressurization lines aft of the fluid injection tanks.

Disconnect the generator cable at the positive terminal on the generator.

Disconnect the miscellaneous engine wiring at the plug near the tachometer generator.

Disconnect the ignition wiring at the plug below the miscellaneous engine wiring plug.

Disconnect the hudraulic pump return line from the top of the hydraulic reservoir.

Install protective covers over all electrical connectors that are disconnected.

b. Open access doors Nos. 65 and 66, and perform the following steps:

Disconnect the main fuel line to the engine.

On airplanes prior to AF Serial No. 49-922, disconnect the oil pressure line at the pressure transmitter on the right of the engine compartment. On airplanes AF Serial Nos. 49-922 and subsequent, the electrical lead from the oil pressure transmitter is disconnected at the engine miscellaneous wiring plug.

Disconnect the starter negative and positive cables at their terminals on the starter.

Prior to AF Serial No. 53-5083, disconnect the fluid injection line at the shutoff valve and strainer.

Prior to AF Serial No. 53-5083, disconnect the fluid injection pressure line at the fluid injection pressure-gage transmitter.

Prior to AF Serial No. 53-5083, disconnect the pressure transmitter for the air shutoff valve actuator at the fluid injection pump.

Disconnect engine control rod at quick-disconnect fitting.

Disconnect the hydraulic pump suction and pressure lines at the hose-end fittings on the fuselage.

Disconnect the accessory case drain line on airplanes prior to AF Serial No. 49-967, the hydraulic pump drain line, dual fuel pump drain line, main fuel control drain line, and main fuel control aneroid chamber drain line on airplanes AF Serial Nos. 49-967 and subsequent.

Disconnect the accessory case vent line, and starting fuel control drain line at fuselage fittings under the engine. On airplanes prior to AF Serial No. 50-385, disconnect the fuel pressure line at the fuselage fitting under the engine. On airplanes AF Serial Nos. 50-385 and subsequent, the electrical lead from the fuel pressure transmitter is disconnected at the engine miscellaneous wiring plug.

c. Remove access panel No. 32 and disconnect combustion chamber drain line.

d. Disconnect bonding wires on Nos. 5 and 11 air adapters and on trunnion.

4–301. ENGINE REMOVAL. *(See figure 4-63.)* Equipment required: Engine repair and transport truck, 456025; adapter kit, 456025-4, attached to truck; engine installation fixture, 459370.

a. Install engine lift lugs on engine, 460027 at aft lift point and 460067 at forward lift point.

b. Remove adapter kit side mounts from engine truck to clear fire seal as engine is moved aft.

c. Disconnect engine lower mount.

d. Position engine truck so that truck upper truss is between 1 and 2 inches aft of airplane bulkhead and centerline of truck engine mounts is 3 inches below centerline of airplane engine side mounts.

Note

Rotate engine truck index bar aft to clear airplane bulkhead.

e. Align truck on centerline of airplane. Lock casters and set brakes.

f. Roll hoist on fixture over lift lugs on engine.

g. Pin aft link assembly, 460085-4, to aft lift lug on engine.

h. Pin forward link assembly, 461580 to forward lift lug on engine.

i. Take up slack in fore and aft links by handcrank and hoist gearbox on fixture track rail.

j. Disconnect aircraft side mount clamp blocks.

k. Raise engine to clear side mounts using hydraulic pump on truck.

l. Roll engine aft using hand wheel until engine ball mounts are approximately 3 inches aft of truck mounting points.

m. Release brakes on truck and roll truck aft until engine and truck are clear of airplane. Set brakes.

n. Lower front of engine using hand crank so that truck adapter kit side mounts may be installed.

Note

Lowering of the engine is necessary to obtain clearance between the engine air adapters for installation of the side mounts.

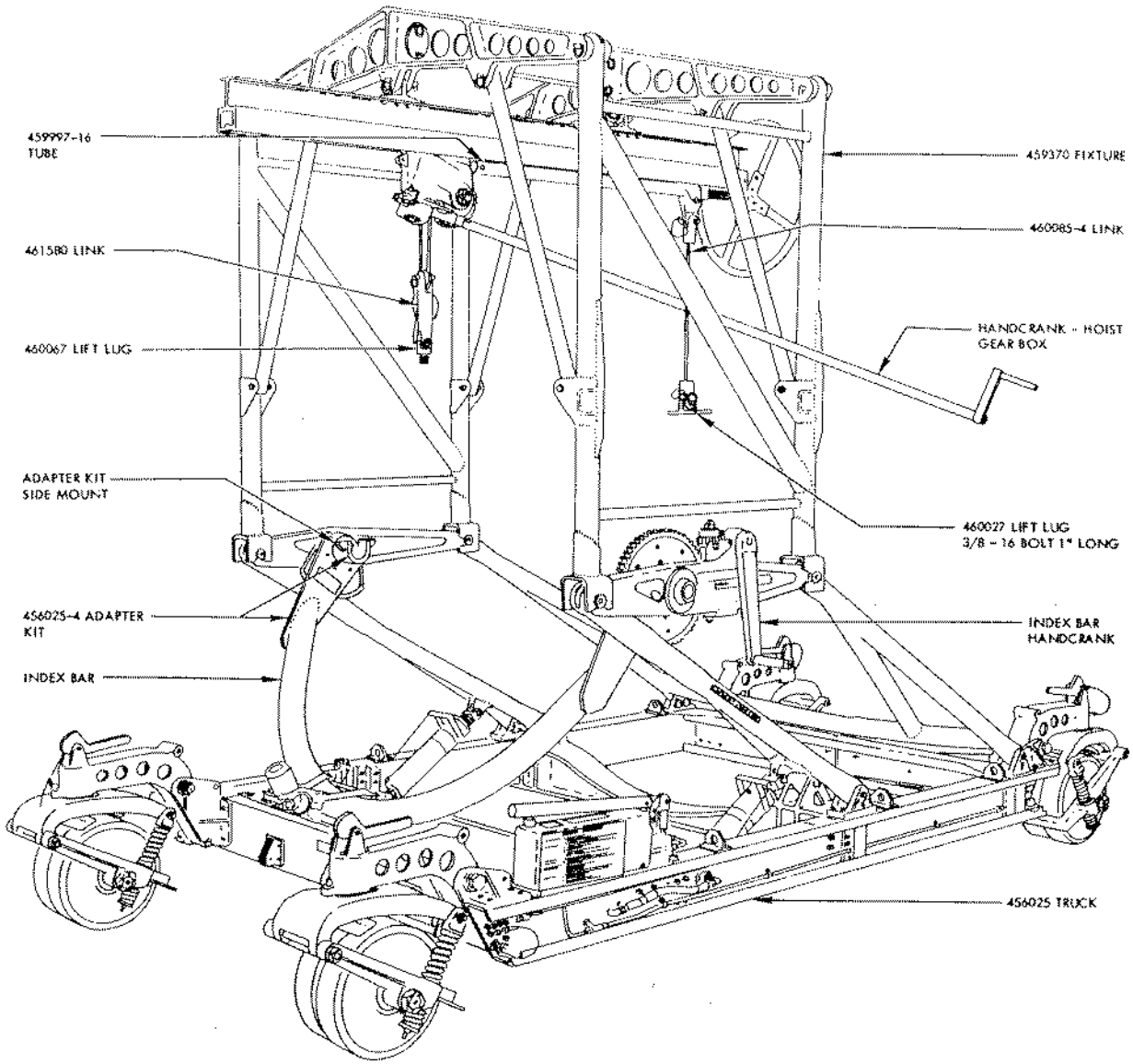

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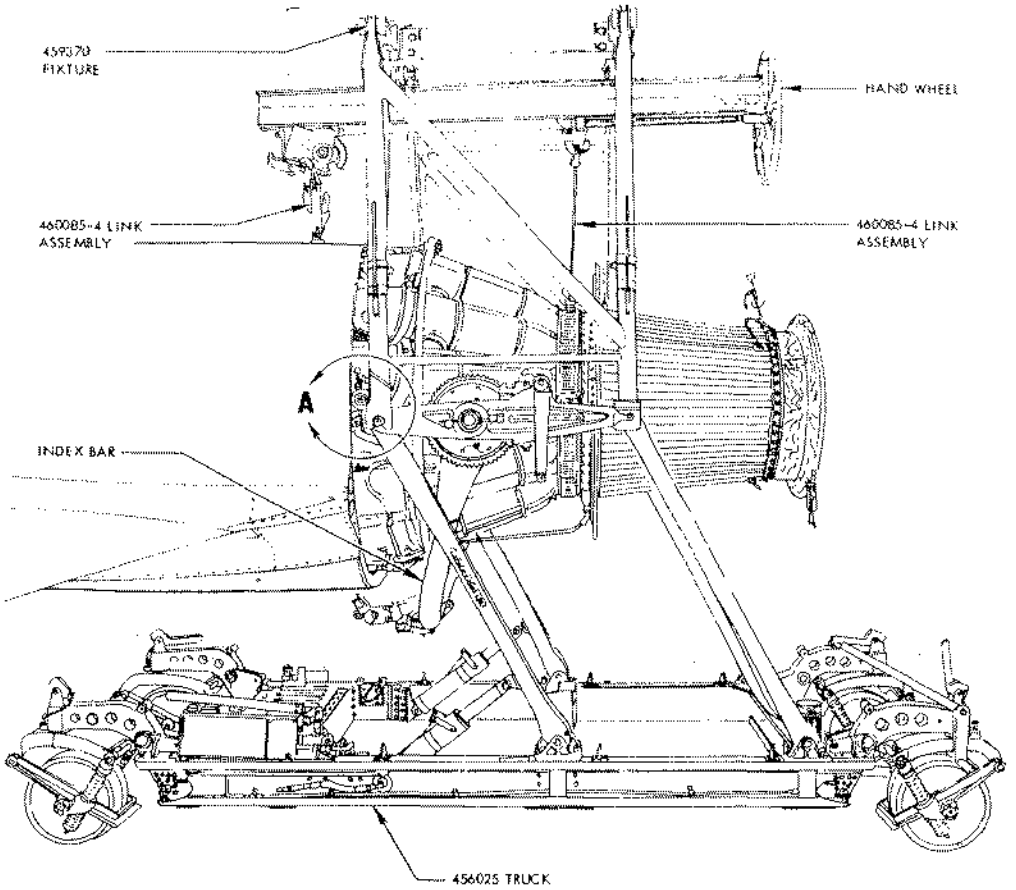
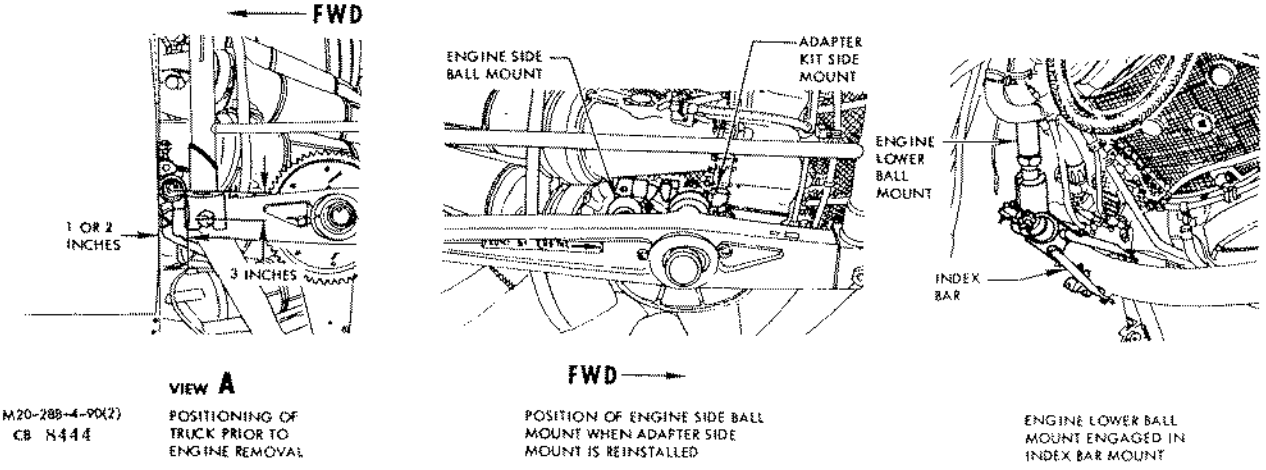
Figure 4-63. Engine Removal (Sheet 1 of 2)





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VIEW A
POSITIONING OF TRUCK PRIOR TO ENGINE REMOVAL

POSITION OF ENGINE SIDE BALL MOUNT WHEN ADAPTER SIDE MOUNT IS REINSTALLED

ENGINE LOWER BALL MOUNT ENGAGED IN INDEX BAR MOUNT

Figure 4-63. Engine Removal (Sheet 2 of 2)

o. Raise engine using hand crank on fixture and roll engine forward with hand wheel until engine ball mounts are over truck mounts.

p. Lower engine into truck side mounts and install clamp blocks.

q. Rotate index bar on truck forward to pick up engine lower ball mount.

r. Slack cable at forward link assembly with fixture hand crank and disconnect link assembly from forward lift lug.

s. Rotate index bar aft until slack is obtained in aft link assembly and disconnect link assembly from aft lift lug.

t. Remove lift lugs from engine.

4–302. INSPECTION OF FUSELAGE AFT SECTION.

a. Inspect the skin for burns.

b. Inspect the engine seal canted bulkhead for dents. This bulkhead must be smooth, as it forms part of the seal for the engine compartment.

4–303. ASSEMBLY OF ENGINE QUICK-CHANGE UNIT. *(See figure 4-64.)* The following assembly procedure will be used when building up a new or overhauled engine prior to installation. Refer to section VI for torque values of fittings, clamps, and nuts.

a. On airplanes prior to AF Serial No. 51-17537 and on 52-9129 through 52-9484, install 637903 tail pipe adapter (14) on engine exhaust cone (15) using forty-eight 175718 bolts, forty-eight 175719 nuts, ninety-six AN960C516 washers, and forty-eight AN380C2-3 cotter keys.

b. On airplanes AF Serial No. 51-17537 through 51-17556 and on 52-9485 and subsequent, install 637903 tail pipe adapter (14) on engine exhaust cone (15) using forty-eight 175718 bolts, forty-eight Z-1200-054 nuts, ninety-six AN960C516 washers, and forty-eight AN380C2-3 cotter keys.

c. Prior to torquing and safetying the tail pipe adapter, install four, 179526, engine thermocouple standoff assemblies (42, 44, 45, and 46) as indicated in view B.

d. Install one AN742-7 clamp (12) on standoff assembly (42), one AN742-6 clamp (47) on standoff assembly (46) and one AN742-4 clamp (43) on each standoff assembly (44 and 45). Install each clamp with one AN520-10R8 screw, one AN315-3R nut, and one AC363C-1032 nut.

e. Install three 629139-12 thermocouple assemblies (13) in tail cone adapters. Install thermocouple leads in AN742 clamps so that all leads terminate at standoff assembly (42).

f. Install scupper assembly (92) at forward end of tail cone using tail cone attaching bolts for installation.

g. Drill one No. 10 hole in engine air seal (11). Locate hole to center 175692–23 tube (91).

h. Install 175692-23 tube (91) with AN901-8C gasket, AN837-8 elbow, and AN924-8 nut.

Note

If a rubber grommet is installed on tube, P/N 175692-23, remove and discard the grommet.

i. Fasten 175692-23 tube (91) to engine air seal (11) with Adel No. 782-1-8 clamp (88), two AN520-10R10 screws, and two AN365-1032 nuts.

j. Install AN6264-8D-26½ hose assembly (89) and AN815-8D union on 175692-23 tube (91).

k. Install one AN815-4D union (90) and AN902-4 gasket on No. 8 engine air adapter to accept combustion chamber drain line.

l. Install engine diaphragm (16) so that parting surfaces between halves are horizontal. Attach halves of diaphragm together with six NAS221 screws, six AN960-10 washers, and six AN365-1032 nuts. Attach diaphragm to engine using existing tail cone attaching bolts.

Note

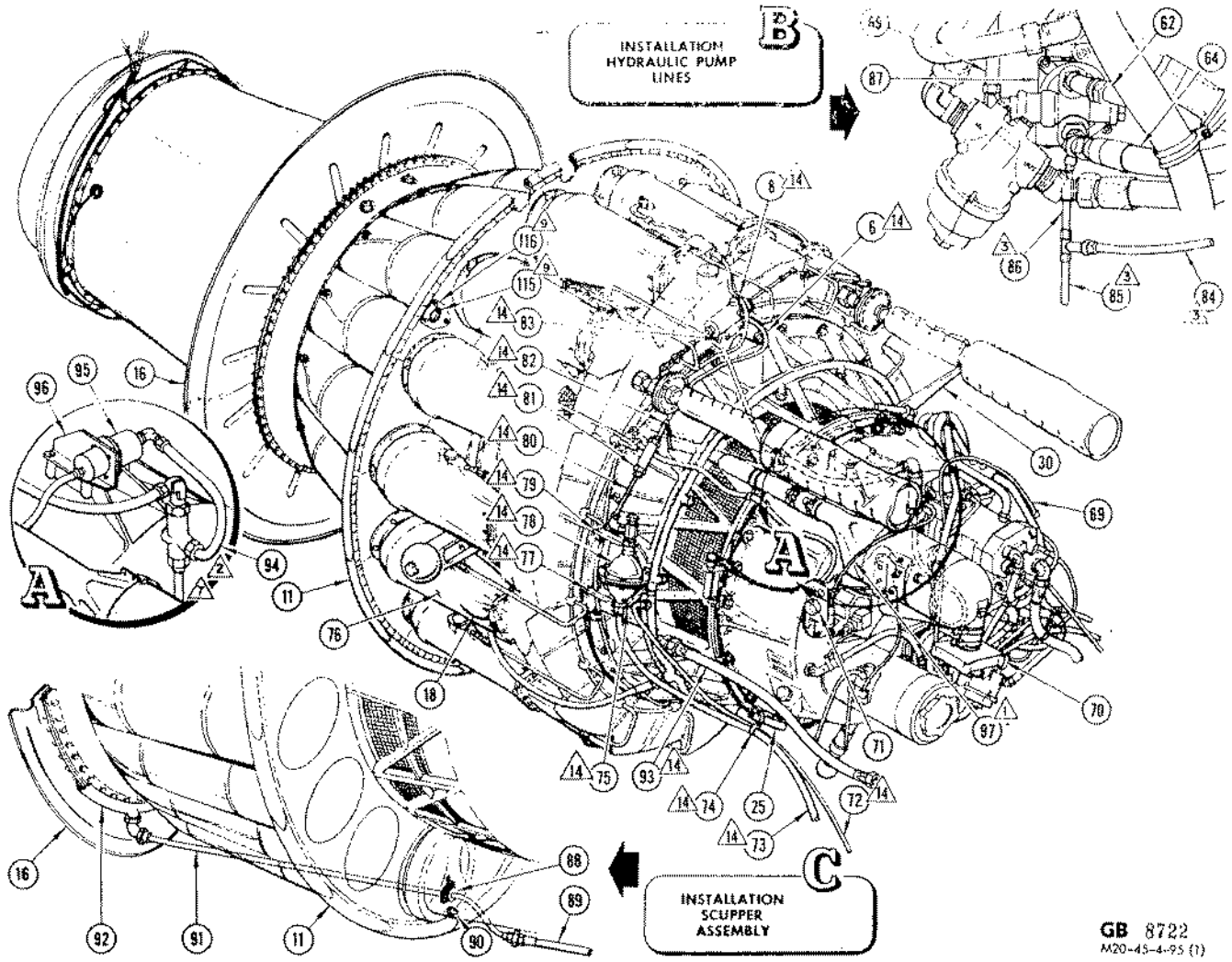
All the following steps preceded by an asterisk (*) are applicable only to airplanes prior to AF Serial No. 49-2758.

*m. Install one 178064 bracket (36), one Adel No. 668-3 clip (28), one AN515-8R6 screw, and one AN365-832 nut on engine accessory gear case using existing attaching bolts as indicated in view A.

*n. Install six 178798 brackets (32), six Adel No. 668-3 clips (28), six AN515-8R6 screws, and six AN365-832 nuts on engine accessory gear case using existing attaching bolts, and position brackets as shown in view L.

*o. Install four 650145-12 fire detector switches (25) on four 179857 brackets (26) with twelve AN515-8R8 screws and twelve AN365-832 nuts.

*p. Install two fire detector switch and bracket assemblies on two 178341 brackets (27 and 39) with four AN515-8R8 screws and four AN365-832 nuts, and mount assemblies on engine accessory gear case mounting studs



1. LS1569-40-14 1/2 BLANKET
2. LS1569-24-8 1/2 BLANKET
3. 644268 AIR SHUT-OFF VALVE
4. 178331 ADAPTER
5. 178335-2 ROD
6. 178330-7 TUBE ASSEMBLY
7. 663147 CYLINDER
8. AN742-10C CLAMP
9. 178335-3 ROD
10. NO. 14 AIR ADAPTER
11. ENGINE AIR SEAL
12. AN742-7 CLAMP
13. 629139-12 THERMOCOUPLE ASSEMBLY
14. 637903 TAIL PIPE ADAPTER
15. ENGINE EXHAUST CONE
16. ENGINE DIAPHRAGM
17. NO. 11 AIR ADAPTER
18. WHITTAKER NO. CF7GX JUMPER
19. FUEL FLOWMETER
20. 205605 ROD ASSEMBLY
21. AEROQUIP NO. 9550-24-33 1/2 HOSE ASSEMBLY
22. GENERATOR
23. 179423 BRACKET
24. 179420 DIFFUSER ASSEMBLY
25. 6500145-12 FIRE DETECTOR SWITCH
26. 179857 BRACKET
27. 178341 BRACKET
28. ADEL NO. 668-3 CLIP
29. WIRE NO. WE18A18
30. 179422 BRACKET
31. 178798 BRACKET
32. 178798 BRACKETS
33. WIRE NO. WE17A18
34. WIRE NO. EF6D20
35. 178798 BRACKETS
36. 178064 BRACKET
37. 179418-2 BRACKET ASSEMBLY
38. WIRE NO. WE20A18
39. 178341 BRACKET
40. ENGINE ACCESSORY GEAR CASE
41. WIRE NO. WE19A18
42. 179526 STANDOFF ASSEMBLY
43. AN742-4 CLAMP
44. 179526 STANDOFF ASSEMBLY
45. 179526 STANDOFF ASSEMBLY
46. 179526 STANDOFF ASSEMBLY
47. AN742-6 CLAMP
48. AN6264-16D-31 3/8 HOSE ASSEMBLY
49. FLOWMETER FILTER
50. 179413-3 HOSE
51. AN6264-4-14 3/8 HOSE ASSEMBLY
52. AN6264-4-13 1/2 HOSE ASSEMBLY
53. STARTING FUEL CONTROL
54. AN742-22C CLAMP
55. AN6264-16D-13 HOSE ASSEMBLY
56. AN742-22C CLAMP
57. WHITTAKER NO. CE5GX JUMPER
58. AN832-16D UNION
59. MAIN DOUBLE CHECK VALVE
60. MAIN FUEL CONTROL
61. AN742-14C CLAMP
62. AN6264-8D-23 1/4 HOSE ASSEMBLY
63. AN742-22C CLAMP
64. AN6264-12D-21 3/8 HOSE ASSEMBLY
65. AN742-18C CLAMP
66. AN742-22C CLAMP
67. AN742-30C CLAMP
68. AN742-22C CLAMP
69. AN6264-6-37 HOSE ASSEMBLY
70. FLAME ARRESTOR ASSEMBLY
71. ENGINE MISCELLANEOUS WIRING PLUG
72. AN6264-4-38 7/8 HOSE ASSEMBLY
73. AN6264-8D-29 3/4 HOSE ASSEMBLY
74. AN742-14C CLAMP
75. 178337 BRACKET
76. NO. 5 AIR ADAPTER
77. 178330-12 BRACKET
78. 633463 TRANSMITTER
79. 178330-12 BRACKET
80. 178330-6 TUBE ASSEMBLY
81. 667628 VALVE
82. 178330-13 CLAMP
83. 178333 BRACKET
84. AN6264-4-19 1/2 HOSE ASSEMBLY
85. AN6264-4-13 HOSE ASSEMBLY
86. AN6264-4-8 7/8 HOSE ASSEMBLY
87. HYDRAULIC PUMP
88. ADEL NO. 782-1-8 CLAMP
89. AN6264-8D-26 1/2 HOSE ASSEMBLY
90. AN815-4D UNION
91. 175692-23 TUBE
92. 177267 SCUPPER ASSEMBLY
93. AN6264-16D-25 3/4 HOSE ASSEMBLY
94. AN6264-4-8 7/8 HOSE ASSEMBLY
95. TYPE F-2 OIL PRESSURE TRANSMITTER
96. 205643 BRACKET
97. AN6264-4-13 HOSE ASSEMBLY
98. AN6264-4-23 HOSE ASSEMBLY
99. AN742D20C CLAMP
100. AN742D10C CLAMP
101. AN6264-4-20 1/2 HOSE ASSEMBLY
102. AN742D16C CLAMP
103. AN6264-4-22 HOSE ASSEMBLY
104. AN6264-4-30 HOSE ASSEMBLY
105. 205624-2 HOSE
106. 207408 BRACKET ASSEMBLY
107. TYPE E-5 FUEL PRESSURE TRANSMITTER
108. AN6264-4-7 3/4 HOSE ASSEMBLY
109. AN6264-4-48 HOSE ASSEMBLY
110. DUAL FUEL PUMP
111. AN742D10C CLAMP
112. OIL PUMP
113. AN742D10C CLAMP
114. FLOWMETER BRACKET
115. 206783 GASKET
116. 206784 PLATE
117. LS3839-40-14 1/2 BLANKET
118. LS3839-24-8 1/2 BLANKET
119. TYPE MS28005-7 PRESSURE TRANSMITTER
120. MS28741-4-0144 HOSE ASSEMBLY

Figure 4-64. Assembly of Engine Quick-change Unit (Sheet 1 of 3)

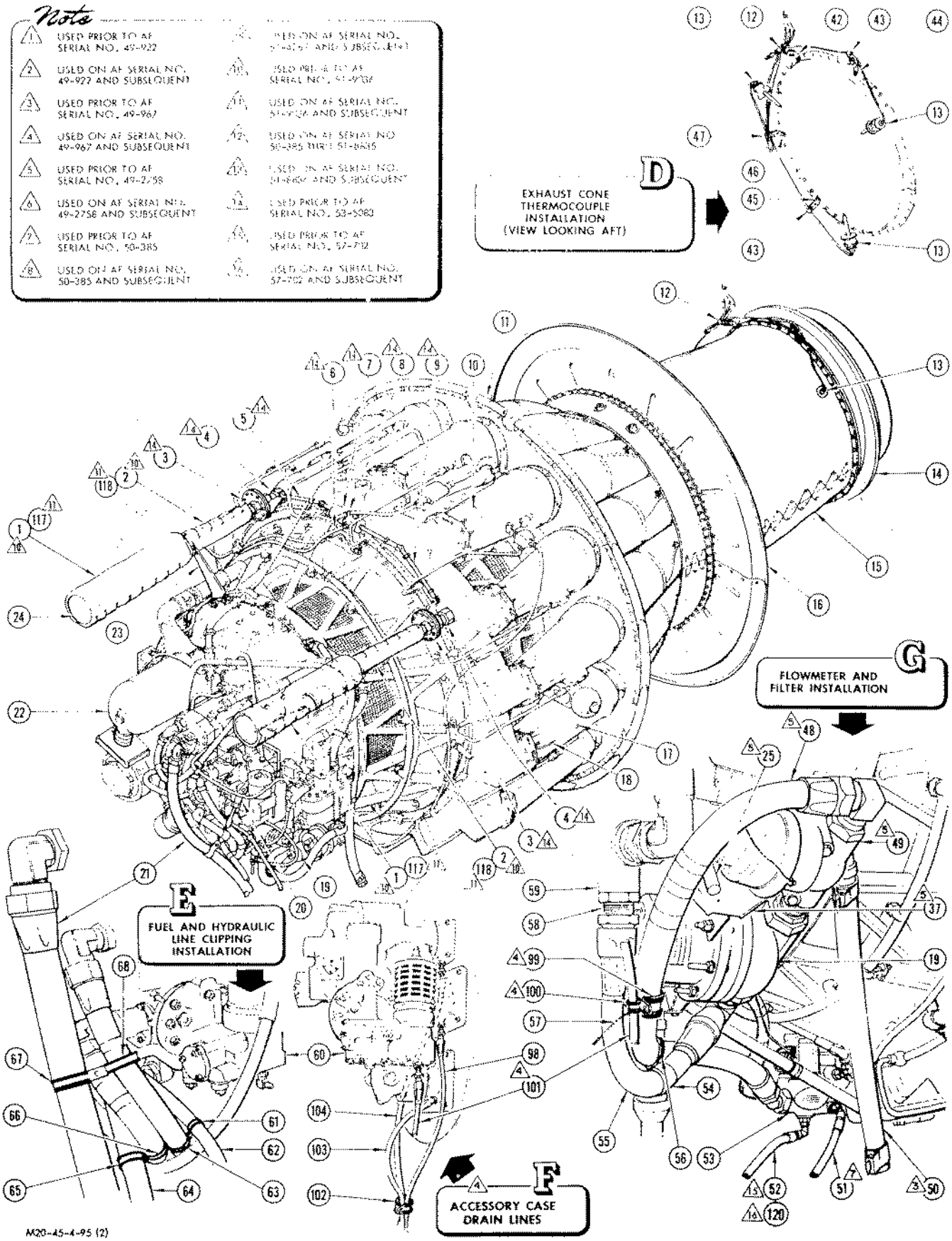


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Figure 4-64. Assembly of Engine Quick-change Unit (Sheet 2 of 3)

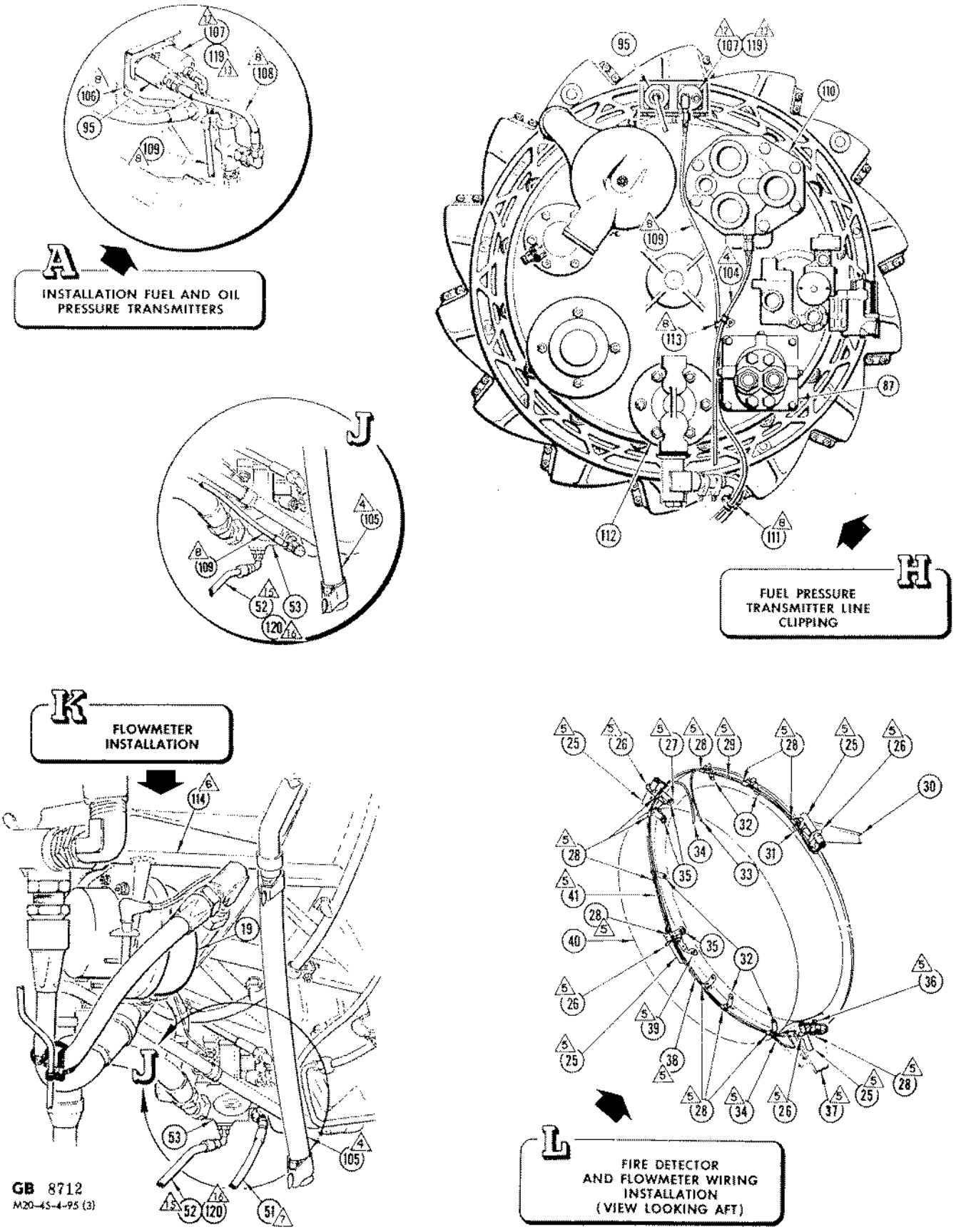


Figure 4–64. Assembly of Engine Quick-change Unit (Sheet 3 of 3)

in positions shown by references (27 and 39) in view A. Install three 178798 brackets (35), three Adel No. 668-3 clips (28), three AN515-8R6 screws, and three AN365-832 nuts on accessory gear case mounting studs with four AN960-616 washers to replace existing engine washers prior to installation of existing engine nuts.

*q. Install one fire detector switch and bracket assembly on 179442 bracket (30) with two AN515-8R8 screws and two AN365-832 nuts. Install assembly on engine accessory gear case in position shown by reference (30) in view L. Install one 178798 bracket (31), one Adel No. 668-3 clip (28), one AN515-8R8 screw, and one AN365-832 nut on accessory gear case mounting stud in position shown by reference (31) in view L. Install two AN960-616 washers to replace washers removed from engine when installing 179442 bracket.

*r. Install one fire detector switch and bracket assembly on 179418-2 fuel flowmeter and filter bracket assembly (37) with two AN515-8R8 screws and two AN365-832 nuts.

*s. Thread WE20A18 wire (38) through one Rubbercraft No. 6068 nipple and attach to fire detector switch on flowmeter bracket.

*t. Install AN plug in flowmeter receptacle. Attach NE1A20 wire to 179418-2 flowmeter and filter bracket with AN520-10R10 screw, AN936A10 washer, AN345-10 nut, AN935-10 washer, and AN365-1032 nut.

u. Install hydraulic pump (87) using an AN4044-1 gasket. Fasten to mounting pad by upper left stud only.

*v. Install 179418-2 bracket assembly (37), flowmeter (19), and filter (49) on hydraulic pump lower mounting studs. Fasten to engine by lower left mounting stud only.

w. Reinstall main double check valve (59) and bracket on hydraulic pump right-side mounting studs. Install remaining hydraulic pump mounting nuts.

*x. Thread WE20A18 wire (38) and WE19A18 wire (41) through one Rubbercraft No. 6068 nipple and attach wires to fire detector switch installed on 178341 bracket (39). Fasten wires to Adel No. 668-3 clips (28).

*y. Clip wire EF6D20 (34) to Adel No. 668-3 clips (28) to engine miscellaneous wiring plug (71) and connect wire to pin "A" of plug.

*z. Thread WE19A18 wire (41) and WE18A18 wire (29) through one Rubbercraft No. 6068 nipple and attach wires to fire detector switch installed on 178341 bracket (27). Fasten wires to Adel No. 668-3 clips (28).

*aa. Thread WE18A18 wire (29) and WE17A18 wire (33) through one Rubbercraft No. 6068 nipple and attach wires to fire detector switch installed on 179422 bracket (30). Fasten wires to Adel No. 668-3 clips (28).

*ab. Connect WE17B18 wire (33) to pin "R" of engine miscellaneous wiring plug (71). Fasten wires to Adel No. 668-3 clips (28).

*ac. On airplanes AF Serial Nos. 49-901 and subsequent, thread WE37A18 wire through Rubbercraft No. 6068 nipple and attach to fire detector switch on flowmeter bracket. Connect other end of wire to pin "P" of engine miscellaneous wiring plug (71). Fasten wire to Adel No. 668-3 clips (28).

ad. On airplanes AF Serial Nos. 49-2758 through 51-4532, install one 628110 fuel flowmeter (19) with six AN365-524 nuts on flowmeter mounting bracket (114). Connect electrical connector to flowmeter.

ae. On airplanes AF Serial Nos. 51-4533 and subsequent, install one 628121–2 fuel flowmeter (19) with six AN365-524 nuts on flowmeter mounting bracket (114). Connect electrical connector to flowmeter.

af. On airplanes prior to AF Serial No. 50-385, install an AN833-4D elbow, AN902-4 gasket, AN924-4D nut, and AN6264-4-14⅜ hose assembly (51) at the fuel pressure connection on the starting fuel control.

ag. On airplanes prior to AF Serial No. 57-702, install an AN833-4D elbow, AN6290-4 gasket, AN924-4D nut and AN6264-4-13½ hose assembly (52) at drain connection on starting fuel control. On airplanes AF Serial No. 57-702 and subsequent, an MS28741-4-0144 hose assembly (120) is installed instead of the AN6264-4-13½ hose assembly.

*ah. Install an AN832-16D union, AN833-16D elbow, AN902-16 gasket, AN924-16D nut, and AN6264-16D-31 ⅜ hose assembly (48) between flowmeter filter (49) and starting fuel control (53). Use existing fitting on starting fuel control.

*ai. Install an AN833-16D elbow, AN902-16 gasket, AN924-16D nut, and AN6264-16D-13 hose assembly (55) between fuel flowmeter (19) and main double check valve. Replace AN837-16 elbow on main double check valve with AN832-16D union (58).

aj. Install an AN742-22C clamp (54) on the -13 hose assembly (55), and an AN742-22C clamp (56) on the -31⅜ hose assembly (48) as shown in view G. Join the two clamps with one AN520-10R screw and one AN365-1032 nut.

ak. On airplanes prior to AF Serial No. 49-967, install 179413-3 hose (50), two AN748-46 clamps, and 633408 body on accessory case vent line. On airplanes

AF Serial Nos. 49-967 and subsequent, install 205624-2 hose (105), two AN748-46 clamps, and 633408 body on accessory case vent line.

al. On airplanes prior to AF Serial No. 49-967, install AN6264-4-19½ hose assembly (84) on drain fitting of main fuel control (60).

am. On airplanes prior to AF Serial No. 49-967, install one AN816-4D nipple in hydraulic pump drain opening. Attach AN6264-4-87⁄8 hose assembly (86) to nipple.

an. On airplanes prior to AF Serial No. 49-967, attach one AN824-4D tee to AN6264-4-13 hose assembly (85) and connect to -19½ and -87⁄8 hose assemblies.

ao. On airplanes AF Serial Nos. 49-967 and subsequent, install one AN832-4D union, one AN924-4 nut, one AN902B-4 gasket, and one AN6264-4-30 hose assembly (104) on dual fuel pump seal drain.

ap. On airplanes AF Serial Nos. 49-967 and subsequent, install one AN823-4D elbow, and one AN6264-4-22 hose assembly (103) on hydraulic pump seal drain.

aq. On airplanes AF Serial Nos. 49-967 and subsequent, install one AN832-4D union, one AN924-4 nut, one AN902-4 gasket, and one AN6264-4-23 hose assembly (98) on main fuel control seal drain.

ar. Clip lines (98, 103, and 104) together so that no excess movement is possible following engine installation; use one AN742D16C clamp (102), one AN520-10R8 screw, and one AN365-1032 nut.

as. On airplanes AF Serial Nos. 49-967 and subsequent, install one AN832-4D union, one AN924-4 nut, one AN902-4 gasket, and one AN6264-4-20½ hose assembly (101) on main fuel control aneroid drain line.

at. Clip -20½ hose assembly (101) to -31⅜ hose assembly (48) with one AN742D20C clamp (99), one AN742D10C clamp (100), one AN520-10R10 screw, and one AN365-1032 nut as shown in view G.

au. Install one AN833-6D elbow, one AN902-6 gasket, one AN924-6D nut, and one AN6264-6-37 hose assembly (69) on hydraulic pump return port. Clip -27 hose assembly to accessory case vent line at first bend after it leaves accessory case with two Adel No. 784-10 clamps, one AN520-10R8 screw, and one AN365-1032 nut.

av. Install one AN837-8D elbow, one AN902-8 gasket, one AN924-8D nut, and one AN6264-8D-23¼ hose assembly (62) on hydraulic pump pressure port. Clip -23¼ hose assembly in horizontal position over fuel line between main fuel control and main double check valve with one AN742-22C clamp (63), one AN742-14C clamp (61), one AN520-10R10 screw, and one AN365-1032 nut.

aw. Install one AN837-12D elbow, one AN902-12 gasket, one AN924-12D nut, and one AN6264-12D-21⅜ hose assembly (64) on the hydraulic pump suction port. Clip -21⅜ hose assembly to fuel line between main fuel control filter and main fuel control with one AN742-22C clamp (66), one AN742-18C clamp (65), one AN520-10R10 screw, and one AN365-1032 nut.

ax. Install Aeroquip No. 9550-24-33½ hose assembly (21) on inlet port of dual fuel pump. Clip -33½ hose assembly to fuel line between main fuel control filter and main fuel control as shown in view E with one AN742-30C clamp (67), one AN742-22C clamp (68), one AN520-10R10 screw, and one AN365-1032 nut.

ay. On airplanes prior to AF Serial No. 51-4061, install one flame arrestor assembly (70) composed of one 179132 holder, one 179046 bracket, one Zenith C177-6 element, and four AN515-8R7 screws with one 178317-3 hose and two AN737TW-82 clamps on type R-1 generator (22).

az. On airplanes prior to AF Serial No. 51-4061, install one flame arrestor assembly composed of one 179132 holder, one 208945 bracket assembly, one Zenith C177-6 element, and four AN515-8R7 screws with one 208906-2 hose and two AN737TW-114 clamps on AN3633-1 generator.

Note

All following steps preceded by a star (★) are applicable prior to AF Serial No. 53-5083.

★ba. Install one AN833-4D elbow, AN902-4 gasket, AN924-4D nut, and AN6264-4-387⁄8 hose assembly (72) on forward fluid injection manifold. Prior to AF Serial No. 53-5086, cap hose assembly (72) with one AN929-4 cap assembly when engine fluid injection manifold is not installed. Clamp capped end of hose to AN6264-8D-29¾ hose assembly (73).

bb. Install 179423 bracket (23) on engine accessory gear case in position shown. Use existing engine bolts for mounting.

★bc. Attach 663147 cylinder (7) to 178333 bracket (83) with two NAS221-12 screws, and two AN365-1032 nuts. Install cylinder (7) on engine accessory gear case using existing mounting bolts with one AN960D616 washer under right nut in place of existing beveled engine washer.

*bd. Install one 178331 adapter (4), one AN924-16D nut, and one AN902-16 gasket on each engine compressor outlet.

be. On AF Serial No. 53-5083 and subsequent, install one 725602 adapter, one AN924-16D nut, and one MS29513-217 packing on each engine compressor outlet.

*bf. Install one 178332 lever on each 644268 valve (3) with one CT205-18 screw and AN960-10 washer. Install one 644268 valve (3) on each 178331 adapter (4).

*bg. Install one 179420 diffuser assembly (24) on each 644268 valve (3). Attach left 179420 diffuser assembly (24) to 179422 bracket with two AN520-10R screws, two AN960-616 washers, and two AN365-1032 nuts. Attach right 179420 diffuser assembly (24) to 178423 bracket with two AN520-10R screws, two AN960-616 washers, and two AN365-1032 nuts. On airplanes prior to AF Serial No. 51-9036, cover each 179420 diffuser assembly (24) with one LS1569-24-8½ blanket (2) and one LS1569-40-14½ blanket (1). On airplanes AF Serial Nos. 51-9036 and subsequent cover each 179420 diffuser assembly (24) with one LS3839-24-8½ blanket (118) and one LS3839-40-14½ blanket (117).

bh. On AF Serial No. 53-5083 and subsequent, install one 179420 diffuser assembly (24) on each 725602 adapter. Attach left 179420 diffuser assembly (24) to 179422 bracket with two AN520-10R screws, two AN960-616 washers, and two AN365-1032 nuts. Attach right 179420 diffuser assembly (24) to 178423 bracket with two AN520-10R screws, two AN960-616 washers, and two AN365-1032 nuts. Cover each 179420 diffuser assembly (24) with one LS3839-24-8½ blanket (118) and one LS3839-40-14½ blanket (117).

*bi. Install one 178334 yoke and AN316-5R nut on each 663147 cylinder (7) piston-rod end.

*bj. Assemble two Fafnir REB3N bearings, two AN316-4R nuts, and one 178335-3 rod (9). Install rod assembly between 663147 cylinder (7) and left 644268 valve (3) with one AN23-16 bolt, one AN23-13 bolt, one LS881-6 washer, two AN320-3 nuts, and two AN380C-2 cotter keys.

*bk. Assemble two Fafnir REB3N bearings, two AN316-4R nuts, and one 178335-2 rod (5). Install rod assembly between 663147 cylinder (7) and right 644268 valve (3) with one AN23-16 bolt, one AN23-13 bolt, one LS881-6 washer, two AN320-3 nuts, and two AN380C-2 cotter keys.

*bl. Clip 633463 transmitter (78) to 178337 bracket (75) with two 178330-11 clamps, two NAS221-11 screws, and two AN365-1032 nuts. Attach two 178330-12 brackets (77 and 79) to upper portion of 178337 bracket (75). Attach 633463 transmitter and bracket assembly to engine truss ring in position shown with two 178330-14 clamps, two NAS221-8 screws, and two AN365-1032 nuts. Attach 178330-12 bracket (79) to existing ignition harness clamp on engine accessory gear case. Attach 178330-12 bracket (77) to one 178798 bracket with one NAS221-10 screw and one AN365-1032 nut. Attach lower bracket assembly to engine accessory gear case with existing engine nut.

*bm. Install one AN902-6 gasket, one AN919-12D reducer, and one AN6264-8D-29¾ hose assembly (73) to lower end of 633463 transmitter (78).

*bn. Install one AN919-12D reducer, one AN926-8D tee, one AN814-8D plug, one AN733-8D elbow, one AN924-8D nut, three AN902-8 gaskets, and one AN902-6 gasket on upper end of 633463 transmitter (78).

*bo. Attach 178330-6 tube assembly (80) to AN833-8D elbow on transmitter. Attach 667628 valve (81) to -6 tube.

*bp. Attach 178330-7 tube assembly (6) between 667628 valve (81) and 663147 cylinder (7) with one AN919-10D reducer and one AN902-4 gasket. Clip -7 tube to valve (81) and 663147 cylinder (7). Clip -7 tube to engine truss approximately two inches from 667628 valve with one 178330-13 clamp (82), one Adel No. 782-1-8 clamp, two AN520-10R10 screws, and two AN365-1032 nuts. Clip -7 tube assembly to No. 14 air adapter (10) ignition lead with two AN742-10C clamps (8), one AN520-10R8 screw, and one AN365-1032 nut.

*bq. Clip -38⅞ hose assembly (72) to -29¾ hose assembly (73) at lower fire detector switch (25) with one AN742-10C clamp, one AN742-14C clamp (74), one AN520-10R8 screw, and one AN365-1032 nut. Attach -29¾ hose assembly (73) to lower fire detector switch bracket with one AN742-14C clamp, and replace AN515-8R8 screw in bracket with AN515-8R10 screw.

br. Install one Whittaker No. CE5GX jumper (57) and two AN960D10 washers under forward left trunnion mounting bolt.

bs. Install one Whittaker No. CF7GX jumper (18) and two AN960D416L washers under spring and washer of each center bolt of Nos. 5 (76) and 11 (17) engine air adapters.

bt. Install one 205605 rod assembly (20) with one AN4-11A bolt, one NAS70A-.261-.750 washer, and one MS21045-4 nut on auxiliary fuel control lever on main fuel control.

bu. On AF Serial No. 53-4886 and subsequent, install one General Electric No. 2CM95B19 starter using existing attaching nuts.

bv. If a Jack and Heintz generator is installed, cover the generator vent openings with an Aircraft Standard Mfg. Co. No. QS200-M100S clamp to render the generator flame arrestor effective. On airplanes AF Serial Nos. 50-432 and subsequent, cover the generator vent opening with one 207411 clamp.

bw. Install one AN6264-16D-25¾ hose assembly (93) on inlet connection of forward fluid injection manifold.

bx. On airplanes prior to AF Serial No. 49-922, install one AN833-4D elbow, one AN902-4 gasket, one AN924-4D nut, and one AN6264-4-13 hose assembly (97) on engine oil pressure connection as shown. Place loose end of hose in hole on engine miscellaneous wiring plug bracket and install one 667487 nipple and one AN924-4D nut. On AF Serial Nos. 49-922 through 49-1006, 49-2757 through 49-2772, and 50-320 through 50-384, install one type F-2 oil pressure transmitter (95) on one 205643 bracket (96) using existing transmitter bolts. Mount bracket and transmitter assembly on engine accessory gear case in position shown in view A, using existing engine bolts. Connect pressure transmitter to engine oil pressure take-off with two AN833-4D elbows, two AN902-4 gaskets, two AN924-4D nuts, and one AN6264-4-8-⅞ hose assembly (94). Connect electrical receptacle to transmitter and connect NE7B20 wire to pin "M," EG1F20 wire to pin "X," EG2E20 wire to pin "C," and EG3E20 wire to pin "H" of engine miscellaneous wiring plug.

by. On airplanes AF Serial Nos. 50-385 and subsequent, install one 207408 bracket assembly (106) on engine as shown in view A, using two AN5H-5A bolts. On airplanes AF Serial Nos. 50-385 through 51-8835, mount F-2 oil pressure transmitter (95) in the right mounting hole of the bracket and the E-5 fuel pressure transmitter (107) in the left mounting hole with four NAS220-15 screws, four AN365-832 nuts and eight LS881-15 washers. On airplanes AF Serial Nos. 51-8836 and subsequent, mount F-2 oil pressure transmitter (95) in right mounting hole of bracket, and MS28005-7 fuel pressure transmitter (119) in left mounting hole with four NAS220-15 screws, four AN365-832 nuts, and eight LS881-15 washers. Install one AN6264-4-48 hose assembly (109) between fuel pressure transmitter and pressure port on standing fuel control with one AN837-4D elbow, one AN833-4D elbow, two AN902-4 gaskets, and two AN924-4D nuts. Clip -48 hose assembly (109) to dual fuel pump drain line (104) just above the hydraulic pump (8") with two AN742-10C clamps (103), one AN520-10R8 screw, and one AN365-1032 nut. Clip -48 hose assembly (109) to the oil pump inlet line with one AN742D10C clamp (111), one AN742D14C clamp, one AN520-10R10 screw, and one AN365-1032 nut. Install one AN6264-4-7-¾ hose assembly (108) between oil pressure transmitter and pressure port with one AN815-4D elbow, one AN833-4D elbow, two AN902-4 gaskets, and two AN924-4D nuts. Install one 209815-3 wire assembly on engine. The connector containing wire Nos. NE8G, EU1G, EU2F, and EU3F is installed on the fuel pressure transmitter. The remaining connector is installed on the oil pressure transmitter. Connect EG2E wire to pin "C," EG3E wire to pin "H," NE7B wire to pin "M," NE8G wire to pin "N," EU1G wire to pin "U," EU2F wire to pin "Y," EU3F wire to pin "W," and EG1F wire to pin "X" of engine miscellaneous wiring plug. Clip wire assembly to engine using existing clips.

bz. On airplanes AF Serial Nos. 51-4267 and subsequent, drill one 2.25 inch hole in the No. 2 engine air baffle 2.50 inches above the bottom of the baffle and on the baffle center line. Drill three No. 2 holes in the baffle using 206784 plate (116) as a template. Install one 206783 gasket (115) and one 206784 plate (116) on baffle with three AN520-10R8 screws and three AN363-C-1032 nuts.

4–303A. MOUNTING OF ENGINE QUICK-CHANGE UNIT FOR THRUST CHECK. The engine quick-change unit is cradle-mounted on an installation and removal trailer for delivery to the test area. The engine unit is supported in three cradle trunnions on three engine-mounted ball-socket fittings. The cradle moves on rollers along rails of the transport trailer. The cradled engine unit is roll-transferred to rails on the thrust stand and secured. This procedure is reversed on completion of the test.

4–303B. EQUIPMENT REQUIREMENTS.

Name	*AN Type or Designation*	*Alternate*	*Use and Application*
Installation and Removal Trailer	Model 4000 (Space Corp.)	Model 4000A Type ETU-8/E or Model 4100 Type ETU-9/E	To transport engine quick-change unit and install on and remove from thrust stand.
Forward Support Assembly	8-5-6-1 (Space Corp.)		To support engine quick-change unit on installation and removal trailer.
Aft Support Assembly	8-5-5-1 (Space Corp.)		To support engine quick-change unit on installation and removal trailer.
Coupling Bar	8-11-8-25 (Space Corp.)		To couple forward and aft support assemblies together.
Engine Lifting Sling	9074016		To hoist engine quick-change unit onto installation and removal trailer.
Engine Lifting Eye	9074017		To attach lifting sling to engine.
Engine Lifting Bracket	2835		To attach lifting sling to engine.
Calibrated Tail Pipe and Nozzle Assembly	3659 (Allison)		To maintain safe exhaust pressure and temperature during thrust check.
Tail Pipe Support Assembly	8-5-11-1 (Space Corp.)		To support calibrated tail pipe and nozzle.
R.H. Engine Trunnion Support Assembly	175619R		To attach to engine in order to support engine quick-change unit on installation and removal trailer.
L.H. Engine Trunnion Support Assembly	175619L		To attach to engine in order to support engine quick-change unit on installation and removal trailer.
Engine Trunnion Mount Ball Assembly	175612		Used with engine trunnion support assembly to support engine quick-change unit on installation and removal trailer.
Air Adapter Drain Hose	37-21-1-7 (Space Corp.)		To drain air adapter into ground container.
Drip Valve Drain Hose	37-21-1-6 (Space Corp.)		To drain drip valve into ground container.
Cabin Pressure Duct Cap and Clamp	37-21-1-9 (Space Corp.)		Prevents entry of foreign matter into duct and allows turbine discharge pressure to be monitored from the L.H. cap.
Cabin Air Supply Pressure Connection and Cap	37-21-1-23		To permit compressor discharge pressure to be monitored.

4-303C. INSTALLATION OF HANDLING AND TEST SUPPORTS. *(See figure 4-64A.)* Installation of supports forming the cradle on the transport trailer is as follows:

a. Remove four rail lock quick-release pins of forward and aft support assemblies.

b. Lift support assemblies onto trailer rails, individually with fwd support assembly toward towbar end of trailer. Replace quick-release pins.

WARNING

Weight of each support assembly may be too great to be handled safely without a hoist. To avoid personal injury a lifting device should be employed.

c. Position support assemblies at approximate center of trailer.

d. Install coupling bars and quick-release pins.

e. Set brake on each roller assembly by tightening brake set knob.

f. Loosen trunnion cap wing nuts and open three trunnion caps on forward and aft support assemblies.

g. Position trailer for engine unit installation. Set brakes.

4-303D. MOUNTING OF ENGINE QUICK-CHANGE UNIT ONTO INSTALLATION AND REMOVAL TRAILER. *(See figures 4-64B and 4-64C.)* Install support assemblies as follows:

a. Using a lifting sling, hoist engine unit over support assemblies.

b. Align engine unit ball supports with trunnions on support assemblies.

c. Lower engine unit slowly into place in cradle.

d. Close trunnion caps and tighten wing nuts.

e. Slacken hoist and remove sling.

f. Check that all attachments are secure.

g. Release trailer brakes when ready to move.

4-303E. TRANSFER OF ENGINE UNIT TO THRUST STAND. *(See figures 4-64D, 4-64E and 4-64F.)* Transfer engine unit to thrust stand from transport trailer as follows:

a. Align trailer ahead of thrust stand and move it aft until units join.

b. Raise trailer rails to align them with thrust stand rails, using jack handles. Couple each mating pair of rails by means of horizontal quick-release pin through couplers on underside of rails.

c. Set brakes on transport trailer.

d. Retract and tie four vertical rail stops on trailer and thrust stand to permit roll-transfer of engine unit to thrust stand.

e. Release brakes on four roller assemblies by pulling brake release knobs.

f. Roll engine unit aft onto thrust stand rails until positioned at approximate center of thrust stand.

g. Connect two thrust stand tie rods, clevises and turn buckles to aft support assembly using quick-release coupling pins. Adjust turn buckles as necessary. Do not set roller brakes.

h. Remove two rail coupling quick-release pins beneath rails. Release four rail stops.

i. Lower transport trailer using jack handles. Release brakes. Move trailer clear of test area.

4-303F. INSTALLATION OF CALIBRATED TAIL PIPE. *(See figures 4-64G and 4-64H.)* Install calibrated tail pipe on engine quick-change unit as follows:

a. Remove bell reducer from engine quick-change unit. Reinstall bell reducer in reverse position.

b. Install calibrated tail pipe and nozzle on bell reducer flange.

c. Position tail pipe and nozzle arch support over tail pipe and fasten to rails.

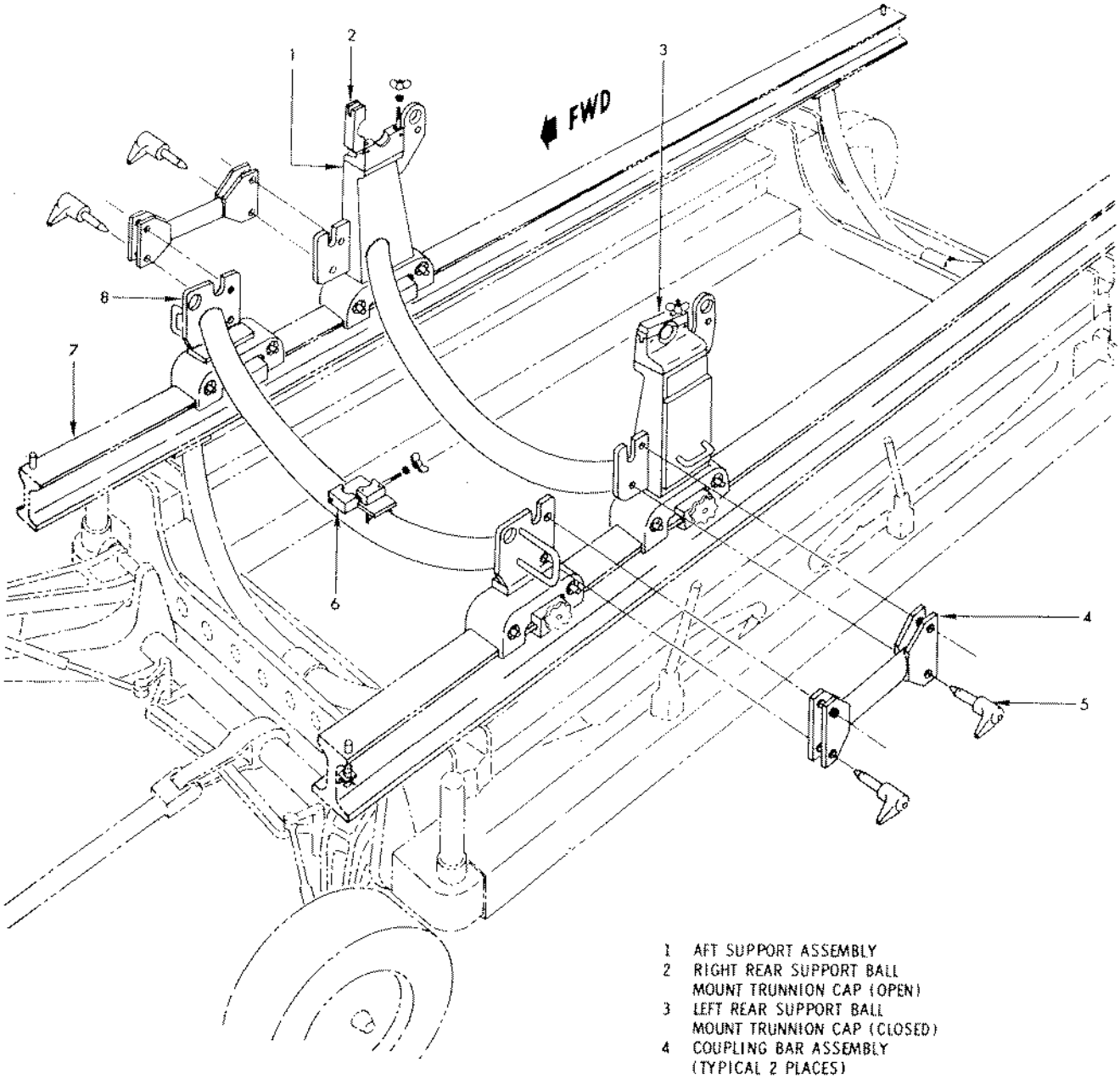
d. Install yoke and hoops on the tail pipe using quick-release pins.

e. Attach support arch turnbuckle clevis to yoke using quick-release pin. Adjust turnbuckle to bring support of tail pipe and nozzle into support arch, relieving strain on bell reducer and engine flange.

4-303G. OPERATIONAL HOOK-UP OF THE ENGINE QUICK-CHANGE UNIT. *(See figures 4-64J thru 4-64Q.)* After installation of the engine quick-change unit, make the following line connections, installations and attachments:

a. Connect throttle linkage rod from positioner actuator arm to fuel control quadrant on engine for remote operation.

b. Connect hydraulic suction hose from hydraulic load bank to hydraulic pump on engine.



1 AFT SUPPORT ASSEMBLY
2 RIGHT REAR SUPPORT BALL MOUNT TRUNNION CAP (OPEN)
3 LEFT REAR SUPPORT BALL MOUNT TRUNNION CAP (CLOSED)
4 COUPLING BAR ASSEMBLY (TYPICAL 2 PLACES)
5 COUPLING BAR QUICK RELEASE PIN (TYPICAL 4 PLACES)
6 FWD SUPPORT BALL MOUNT TRUNNION CAP (OPEN)
7 INSTALLATION AND REMOVAL TRAILER
8 FWD SUPPORT ASSEMBLY

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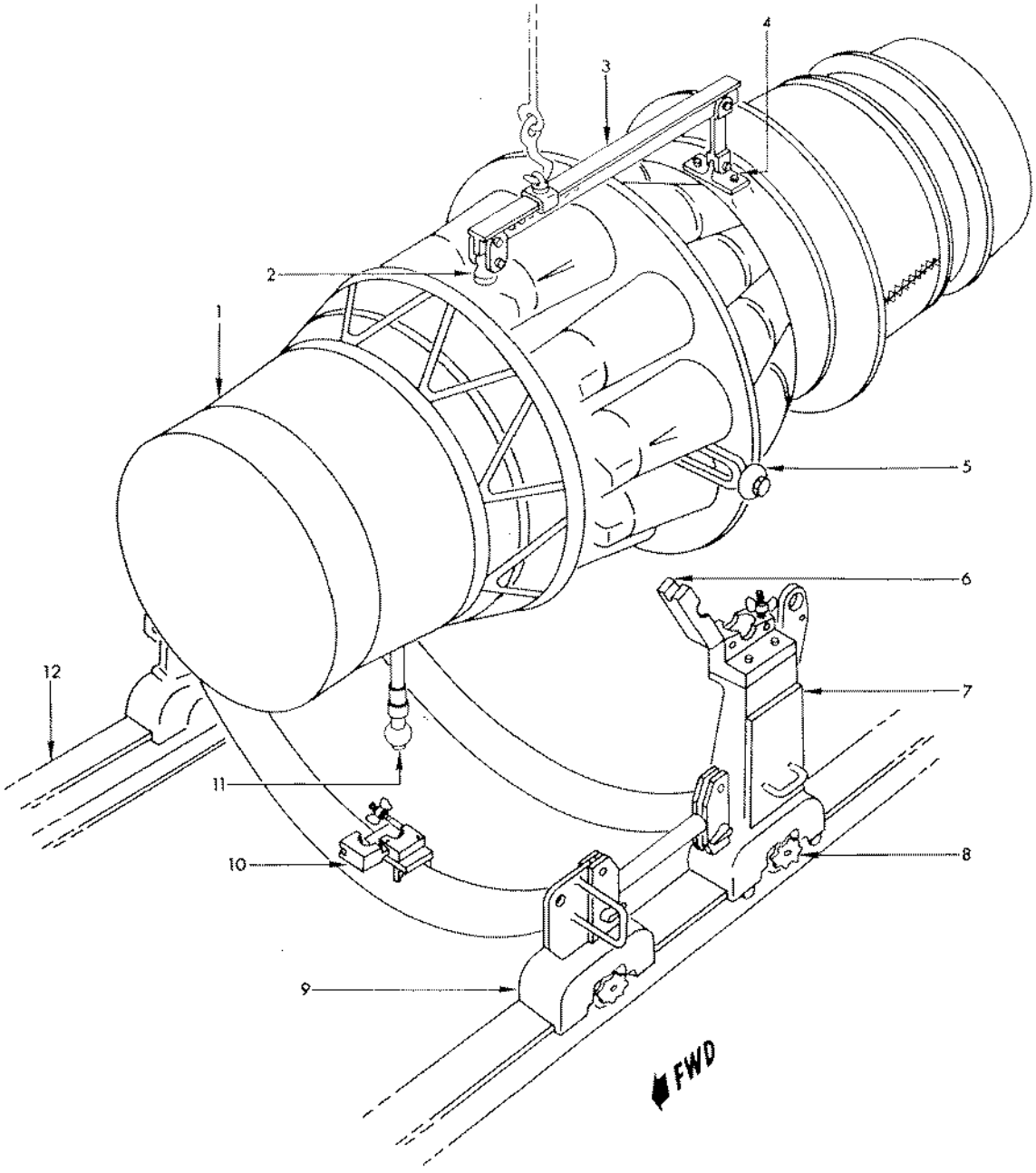
Figure 4-64A. Handling and Test Adapter Support Assemblies Installed for Engine Quick-Change Unit Thrust Check



1 J33-A-35 ENGINE
2 LIFTING EYE
3 LIFTING SLING
4 LIFTING BRACKET
5 AFT ENGINE BALL SUPPORT ASSEMBLY (TYPICAL 2 PLACES-PART OF ADAPTOR KIT)
6 TRUNNION CAP (OPEN)
7 AFT SUPPORT ASSEMBLY
8 BRAKE SET KNOB (TYPICAL 4 PLACES)
9 FORWARD SUPPORT ASSEMBLY
10 TRUNNION CAP (OPEN)
11 FORWARD ENGINE BALL SUPPORT ASSEMBLY
12 INSTALLATION AND REMOVAL TRAILER

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Figure 4-64B. Engine Quick-Change Unit Being Lowered onto Installation and Removal Trailer for Thrust Check

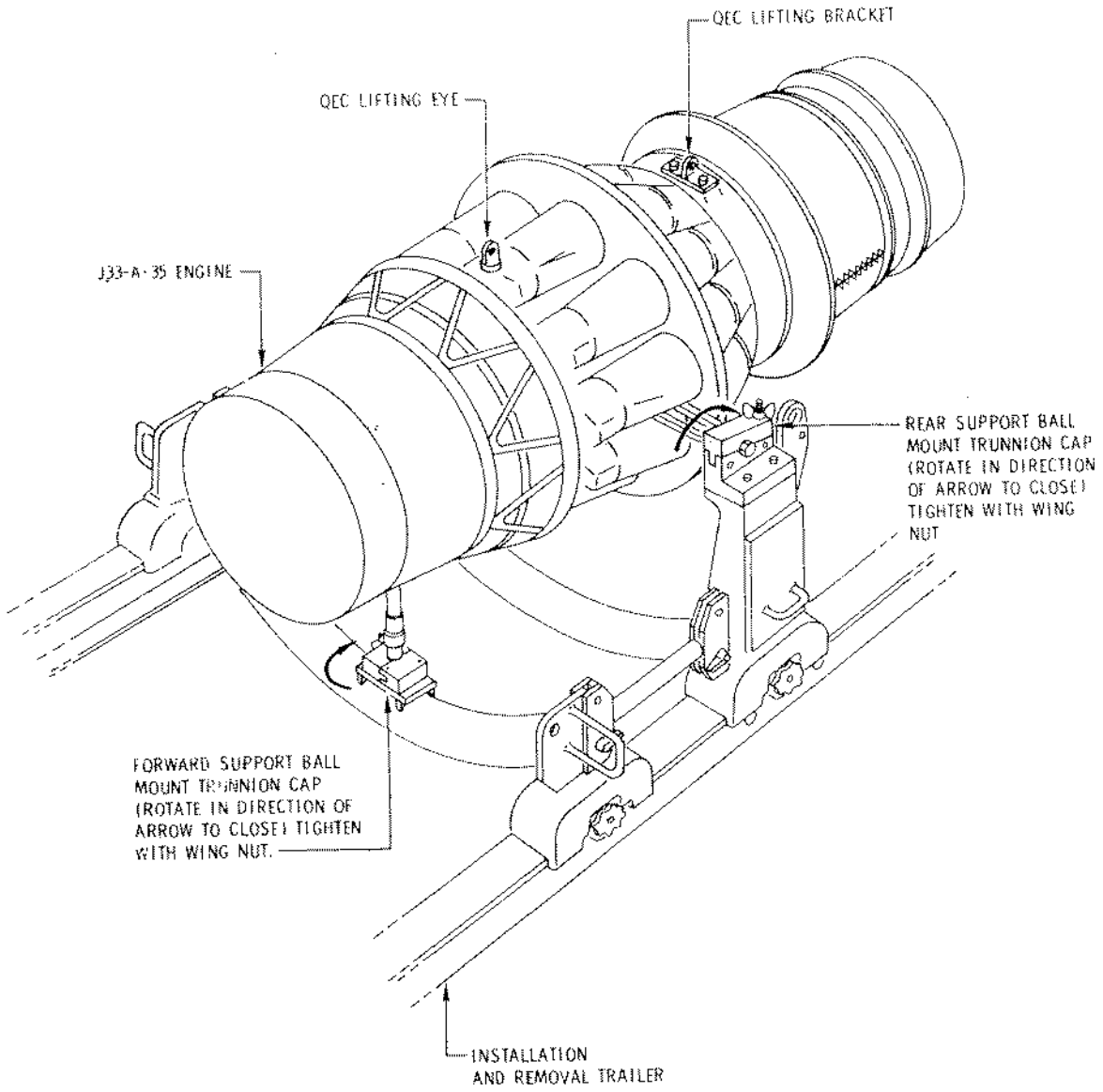


Figure 4-64C. Engine Quick-Change Unit Mounted on Installation and Removal Trailer for Delivery to Test Area

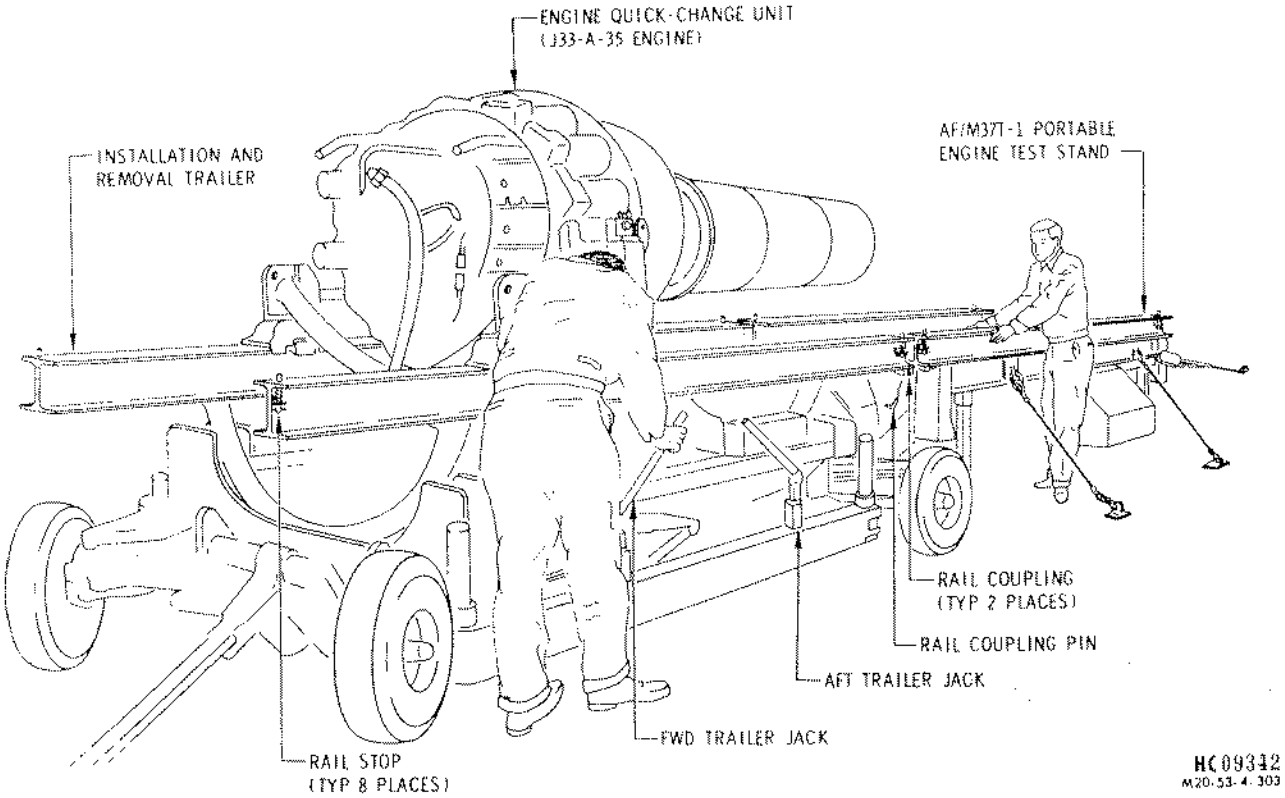


Figure 4-64D. Alignment of Installation and Removal Trailer with Thrust Stand

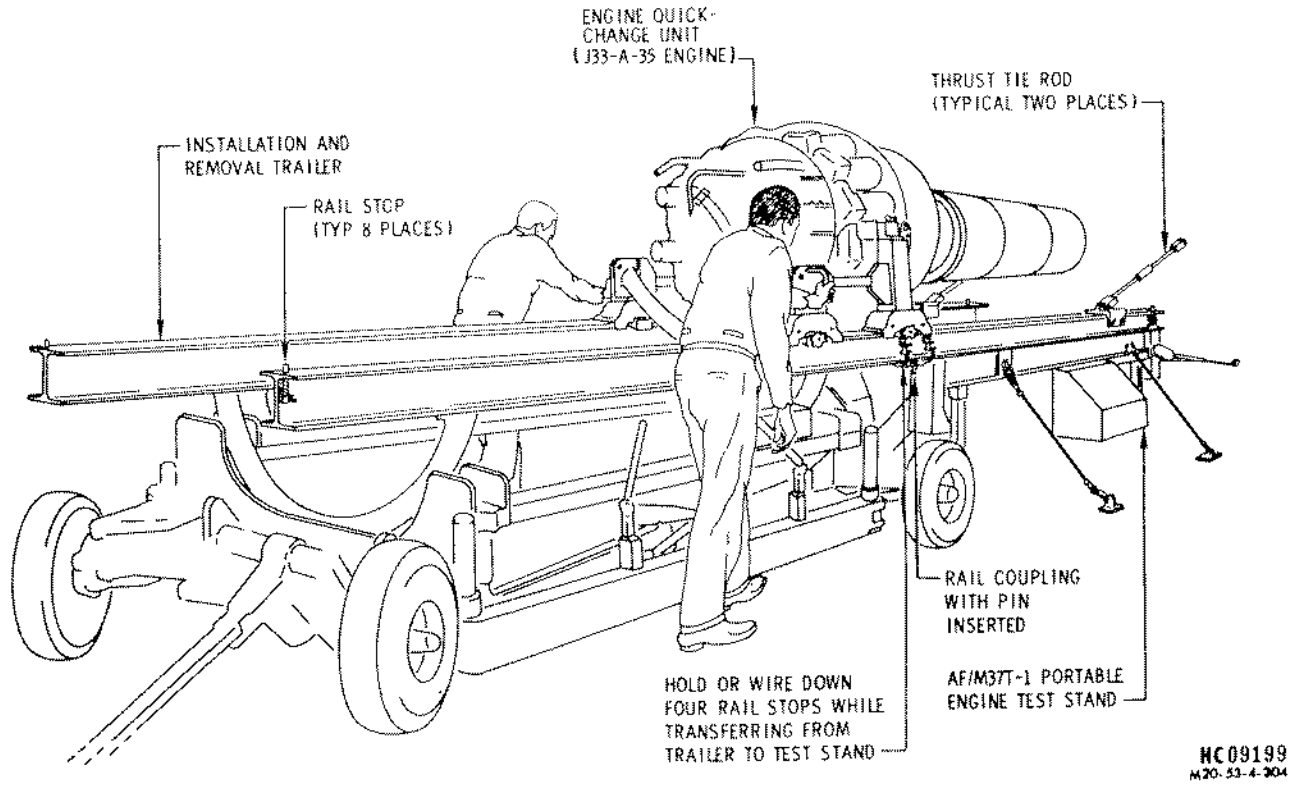


Figure 4-64E. Roll-Transfer of Engine Quick-Change Unit onto Thrust Stand

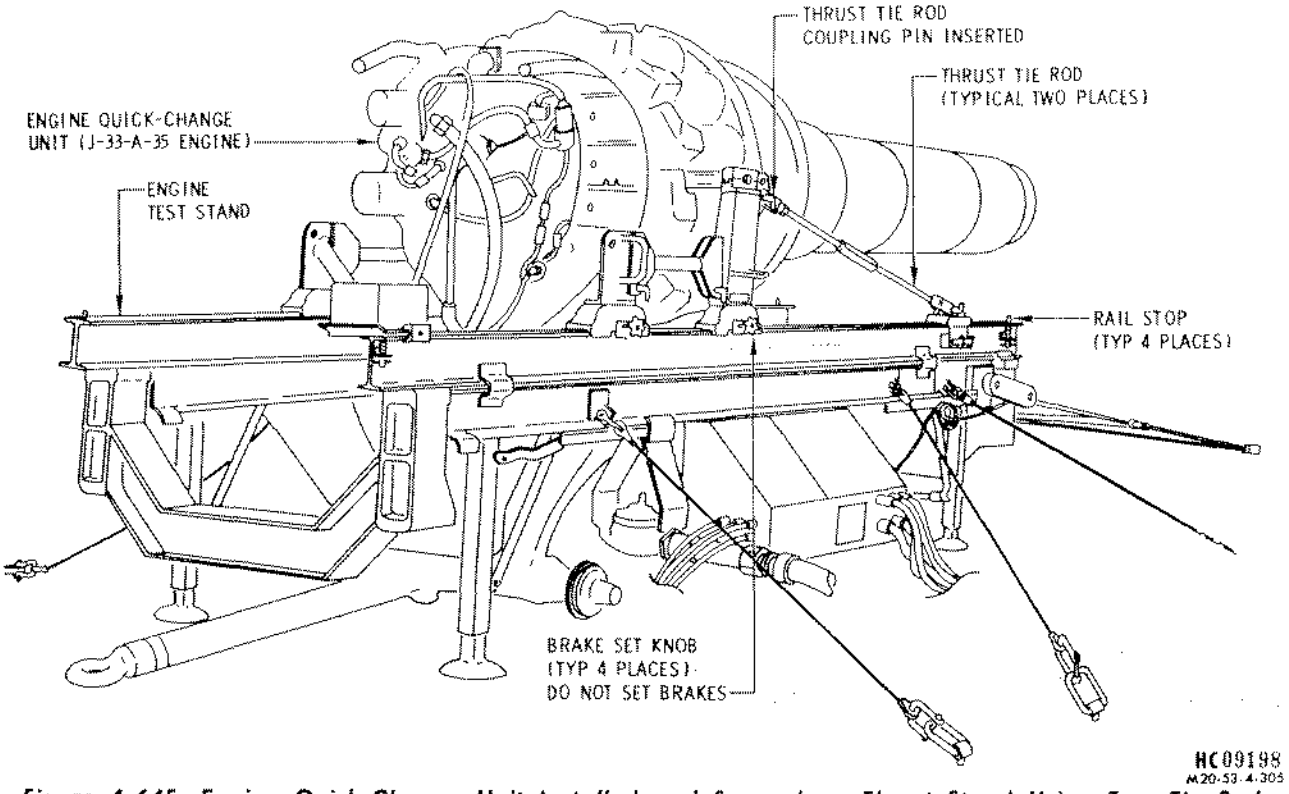


Figure 4-64F. Engine Quick-Change Unit Installed and Secured on Thrust Stand Using Two Tie Rods

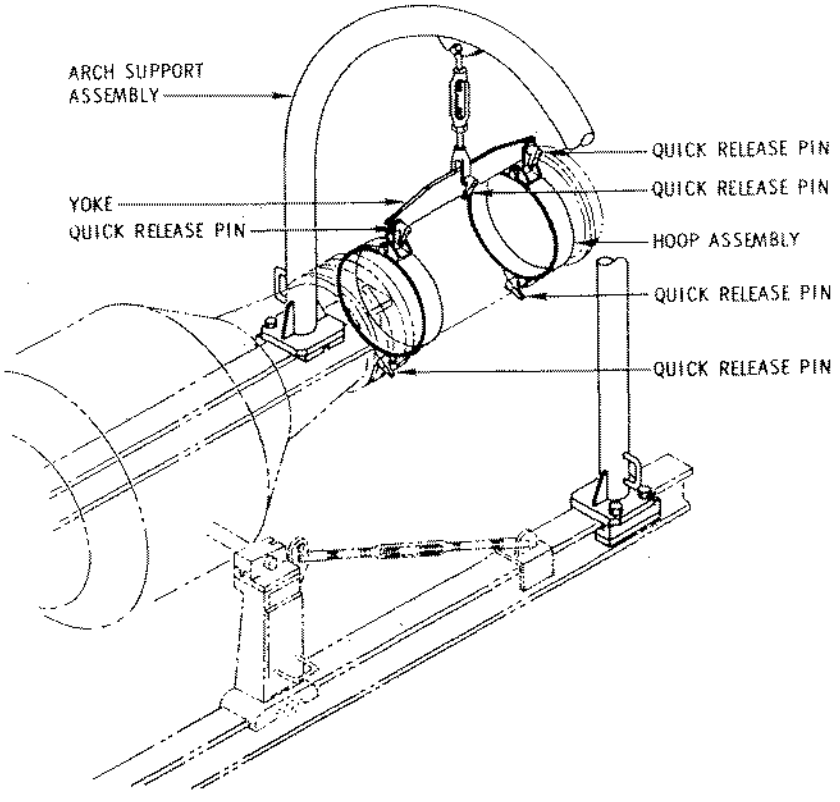
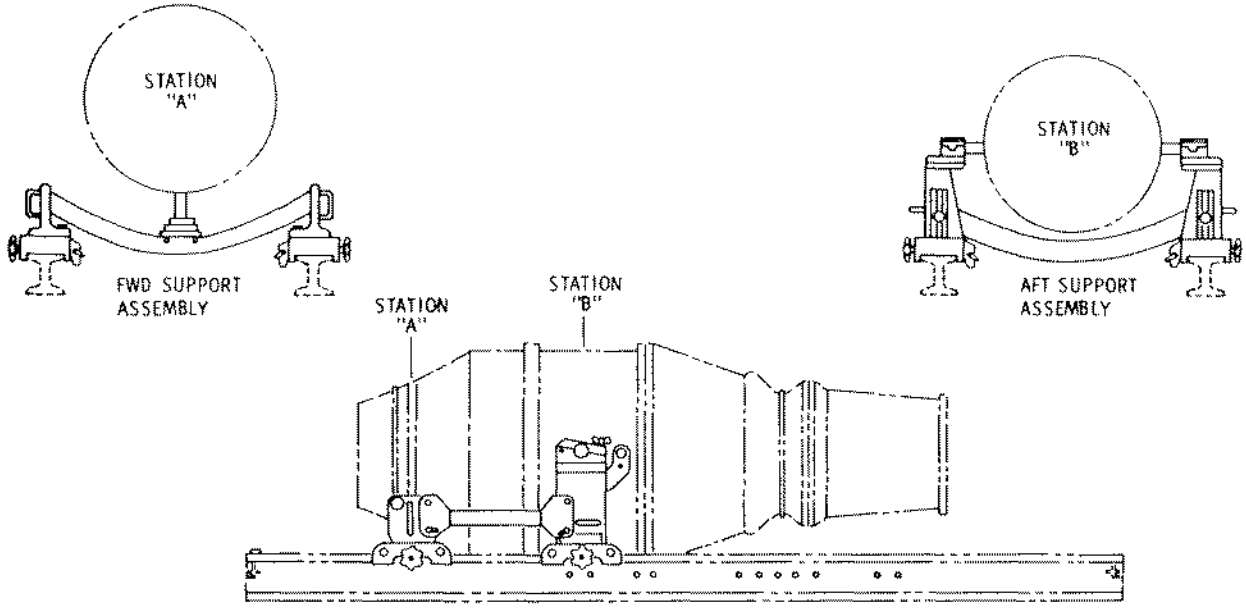
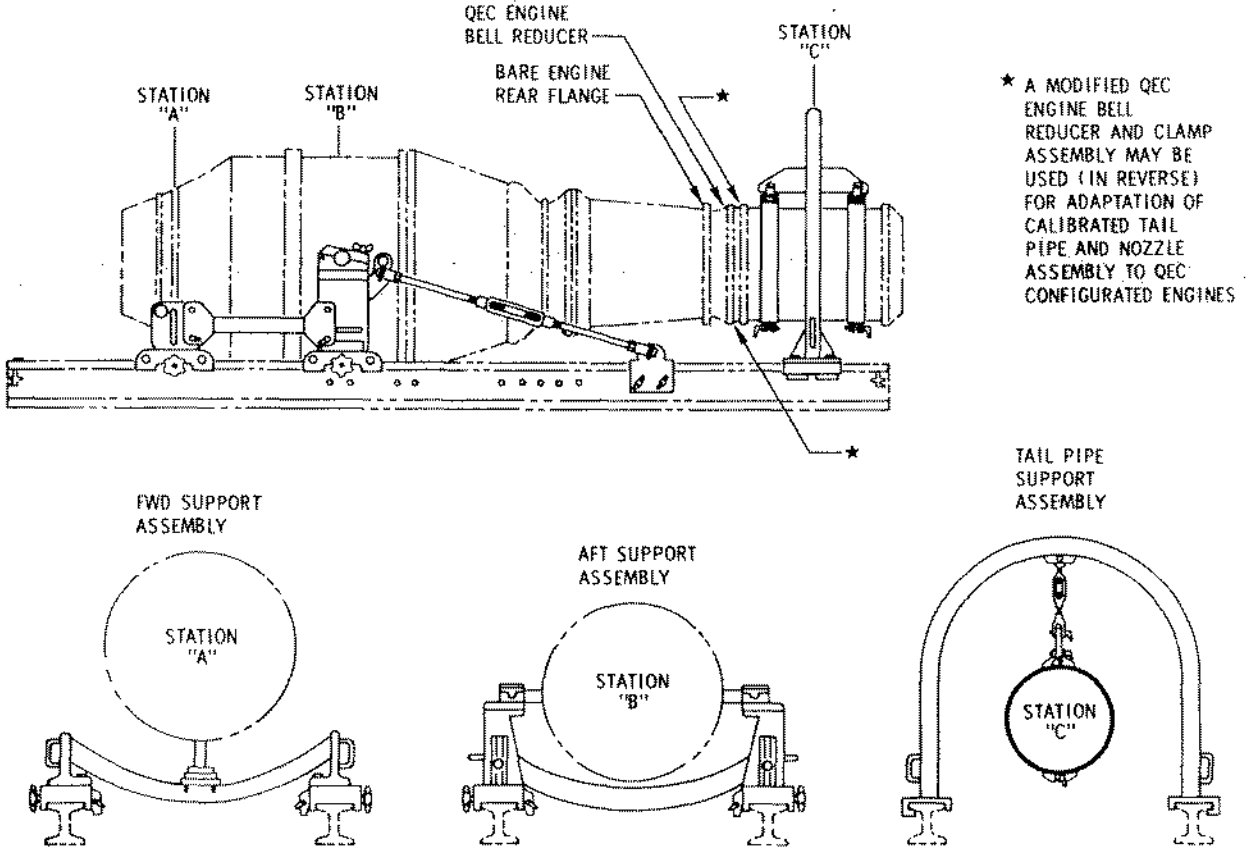


Figure 4-64G. Installation of Calibrated Tail Pipe Using Arch Support, Yoke and Hoops



J33-A-35, T33 QEC ENGINE SUPPORTED BY HANDLING AND TEST ADAPTERS ON MODEL 4000 INSTALLATION AND REMOVAL TRAILER IN PREPARATION FOR RAIL TRANSFER AND/OR TRANSPORT.



T-33 QEC ENGINE ON TEST STAND WITH CALIBRATED TAIL PIPE AND NOZZLE ASSEMBLY INSTALLED IN PREPARATION FOR ENGINE TEST.

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Figure 4-64H. Summary of Steps for Installation of Engine Quick-Change Unit on Thrust Stand

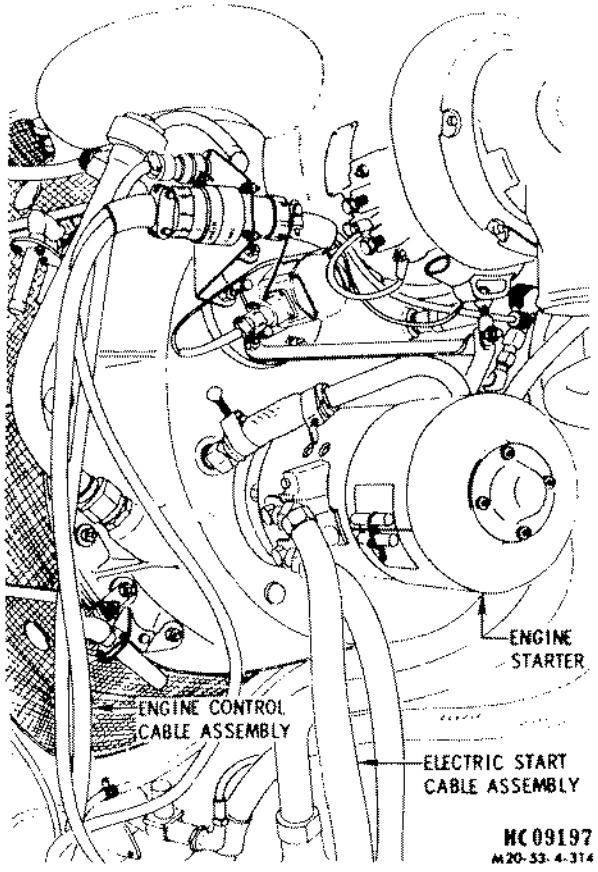


Figure 4-64J. Installation of Engine Start and Control Cables

c. Connect hydraulic case drain hose from hydraulic load bank case to hydraulic pump case on engine for draining pump case.

d. Connect fuel inlet pressure hose from thrust stand terminal panel to fuel supply hose on bell reducer in order to register pressure in control cab.

e. Connect fuel supply hose from fuel pressure regulator and shutoff valve to fuel pump inlet on engine to carry regulated fuel to engine.

f. Connect combustion chamber drain hose to combustion chamber with "T" fitting hanging free.

g. Connect starting fuel control and scupper drain hose to scupper and to "T" fitting on ground end of combustion chamber drain hose to prevent whipping action and drainage beneath engine. Direct interconnected hoses into ground container.

h. Connect engine control cable from thrust stand terminal panel to engine control connection on engine.

i. Connect electric starter cable from thrust stand terminal panel to engine starter terminals on engine.

j. Connect average exhaust gas temperature cable from thrust stand terminal panel to engine average exhaust gas temperature connection on engine to record temperature in control cab.

k. Install cabin pressure duct cap and clamp on right hand diffuser bleed air, heating, cooling and pressurization line connection on engine to prevent entry of foreign matter and allowing monitoring of turbine discharge pressure from left hand cap.

l. Install cabin air supply pressure connection and cap on left hand diffuser bleed air line connection on engine in order to monitor turbine discharge pressure.

m. Attach air adapter drain hose to air adapter drain connection. Direct hose into ground container.

n. Attach drip valve drain hose to valve drain connection. Direct hose into ground container.

4–303H. ENGINE START. Accomplish engine start in accordance with applicable sections of T. O. 33D4-6-88-1, T. O. 2J-J33-6 and T. O. 2J-J1-10.

WARNING

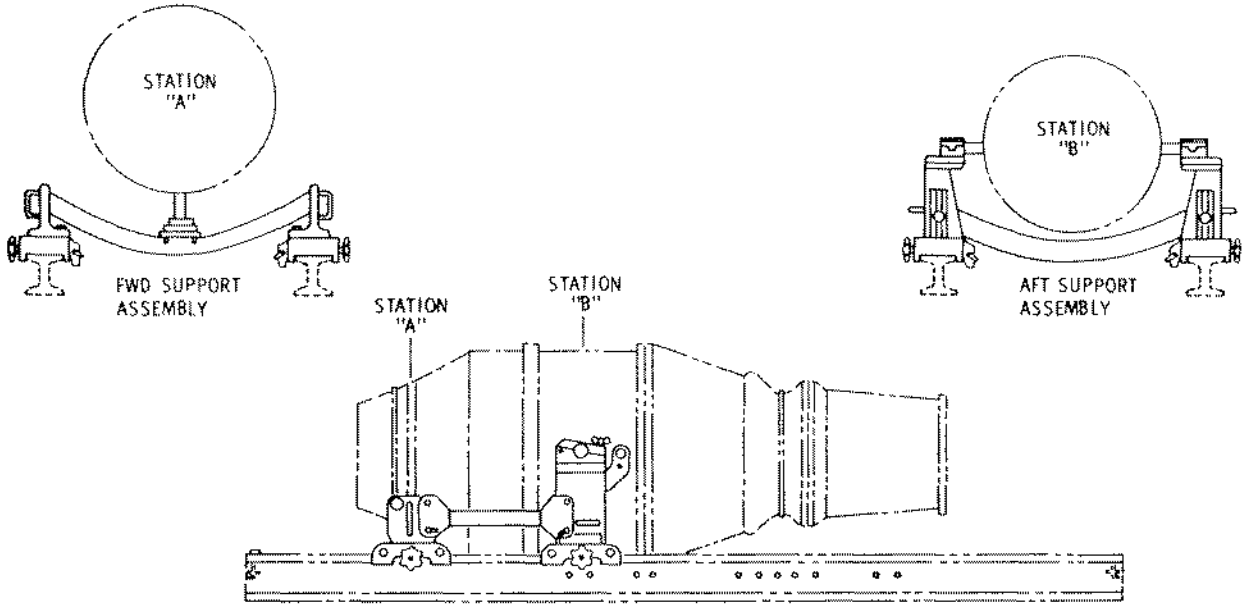
Do not start engine with a full load of engine and test accessories in operation. Check starting procedures for equipment accessories requirements for engine start.

4–303J. THRUST CHECK OF ENGINE QUICK-CHANGE UNIT. Accomplish thrust check in accordance with applicable sections of T. O. 33D4-6-88-1, T. O. 2J-J33-6 and T. O. 2J-J1-10.

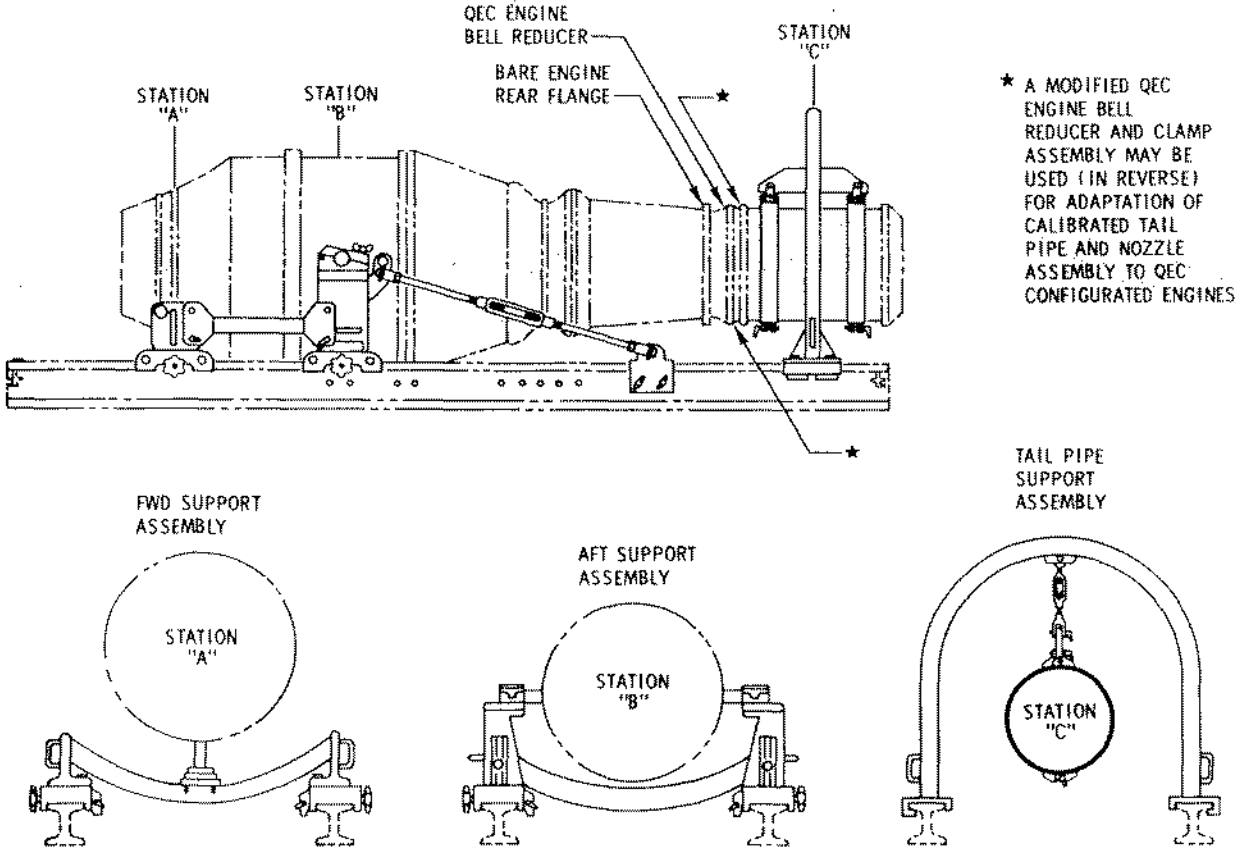
Note

A thrust reduction should be expected in thrust readings for engine quick-change unit as compared with readings for bare engine under all surrounding conditions of atmospheric pressure, temperature and humidity due to increased load of quick-change unit accessories.

Check for leakages in accessories and in system hookup. If excessive temperatures or vibrations are evident, shut down engine. Remove accessories one at a time and by process of elimination pin-point the trouble item. Start engine after each removal.



J33-A-35, T33 QEC ENGINE SUPPORTED BY HANDLING AND TEST ADAPTERS ON MODEL 4000 INSTALLATION AND REMOVAL TRAILER IN PREPARATION FOR RAIL TRANSFER AND/OR TRANSPORT.



T-33 QEC ENGINE ON TEST STAND WITH CALIBRATED TAIL PIPE AND NOZZLE ASSEMBLY INSTALLED IN PREPARATION FOR ENGINE TEST.

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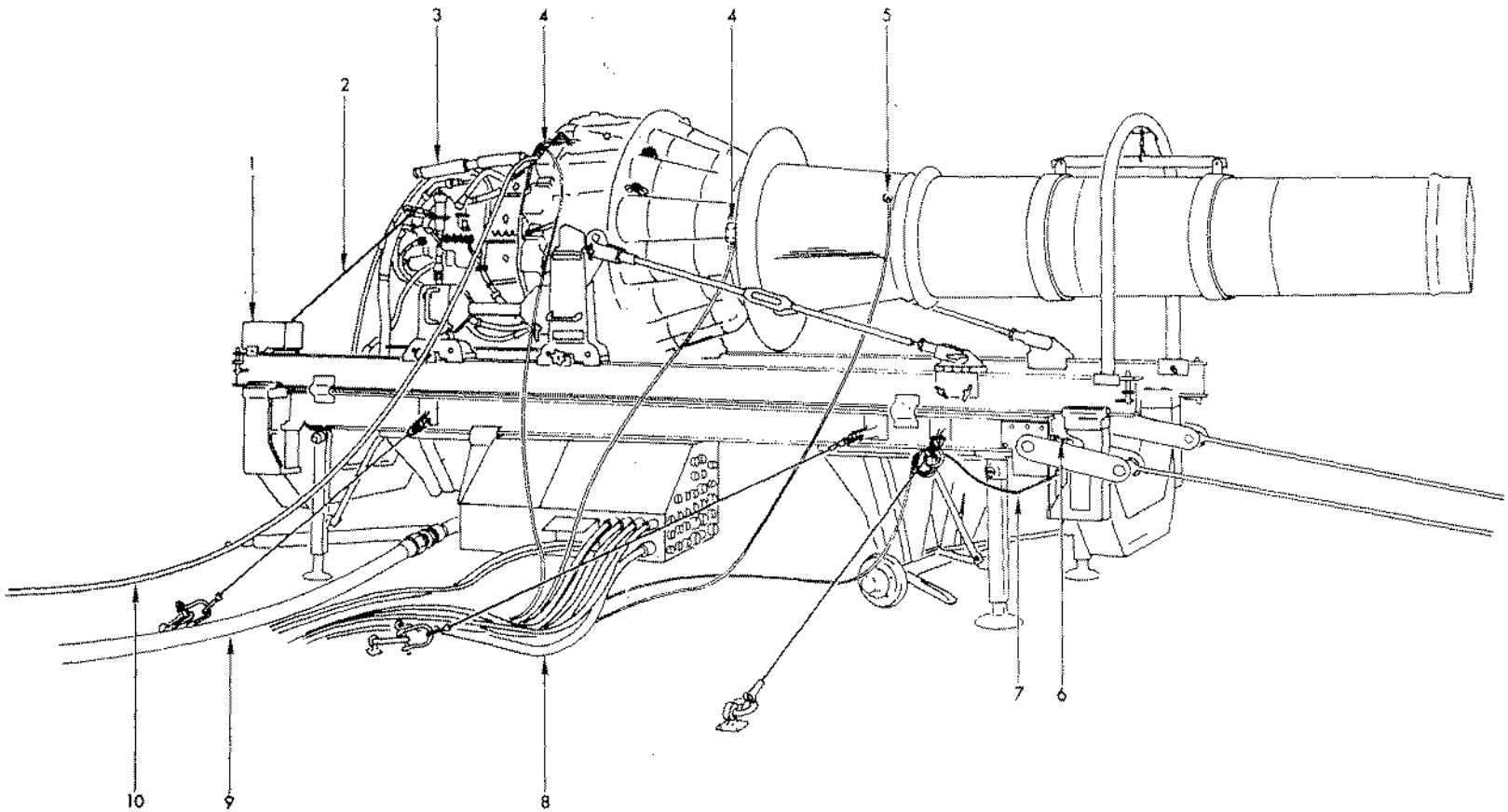
Figure 4-64H. Summary of Steps for Installation of Engine Quick-Change Unit on Thrust Stand



1 THROTTLE LINKAGE CONTROL ASSEMBLY
2 THROTTLE LINKAGE ROD
3 CABIN AIR SUPPLY PRESSURE CONNECTION AND CAP ASSEMBLY
4 VIBRATION PICKUP
5 AVERAGE EGT CABLE
6 THRUST CELL
7 THRUST CELL CABLE
8 HYDRAULIC LINES
9 FUEL LINES
10 COMPRESSOR DISCHARGE PRESSURE HOSE

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Figure 4-64K. Engine Quick-Change Unit Installed on Thrust Stand — All Lines Connected and Ready for Engine Start

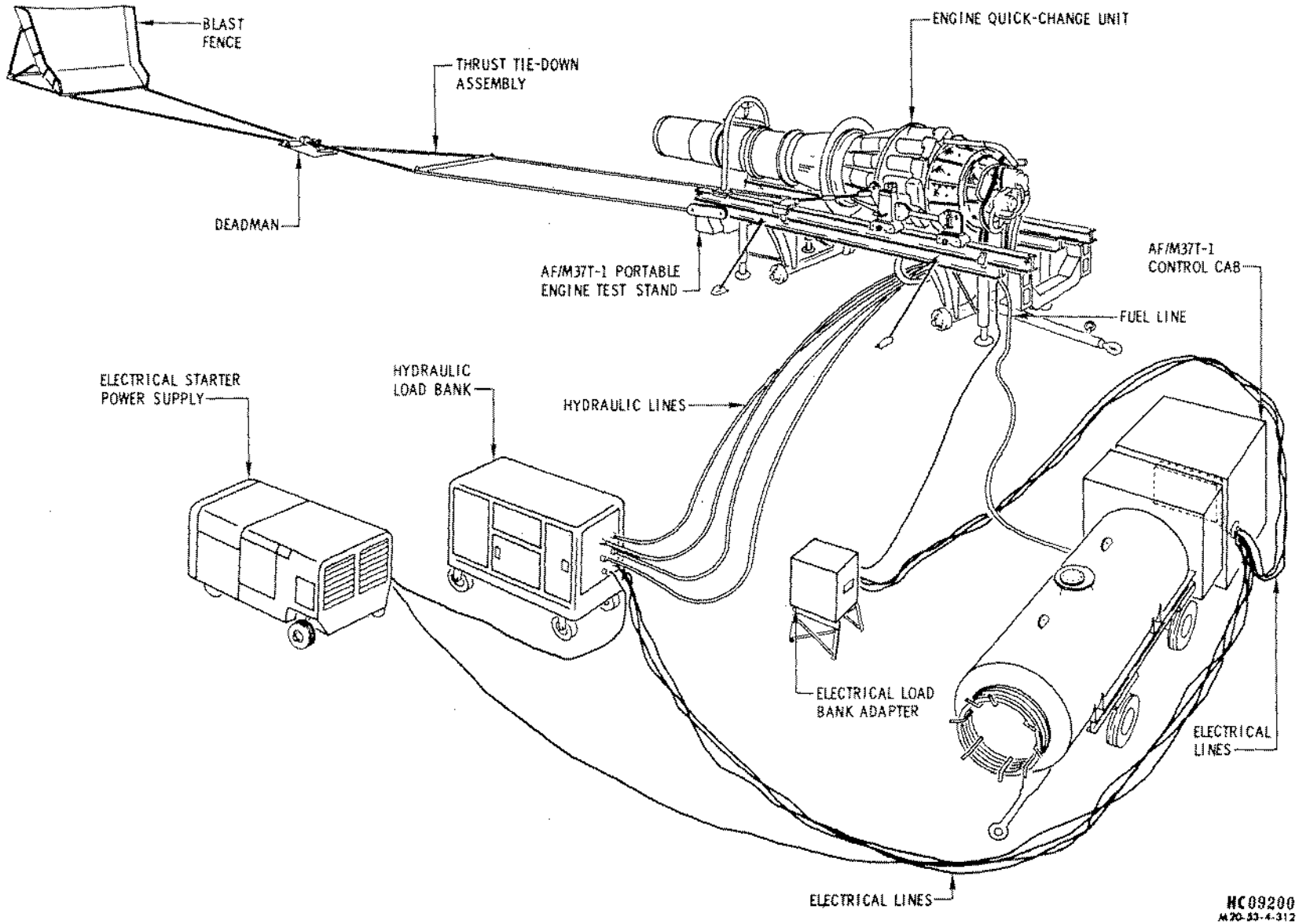

Figure 4-64L. Complete System — Engin ick-Change Unit Thrust Check

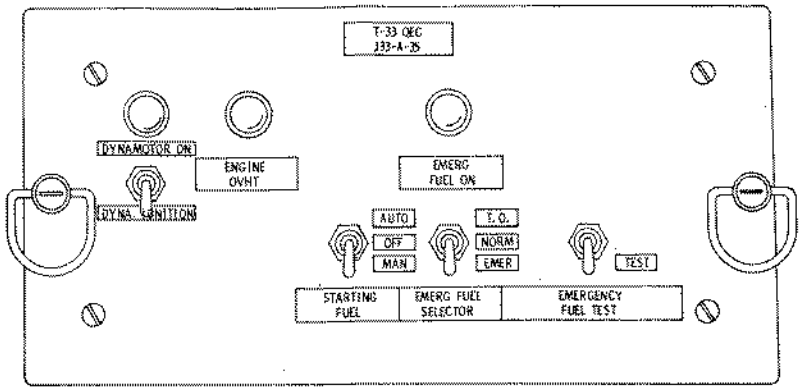

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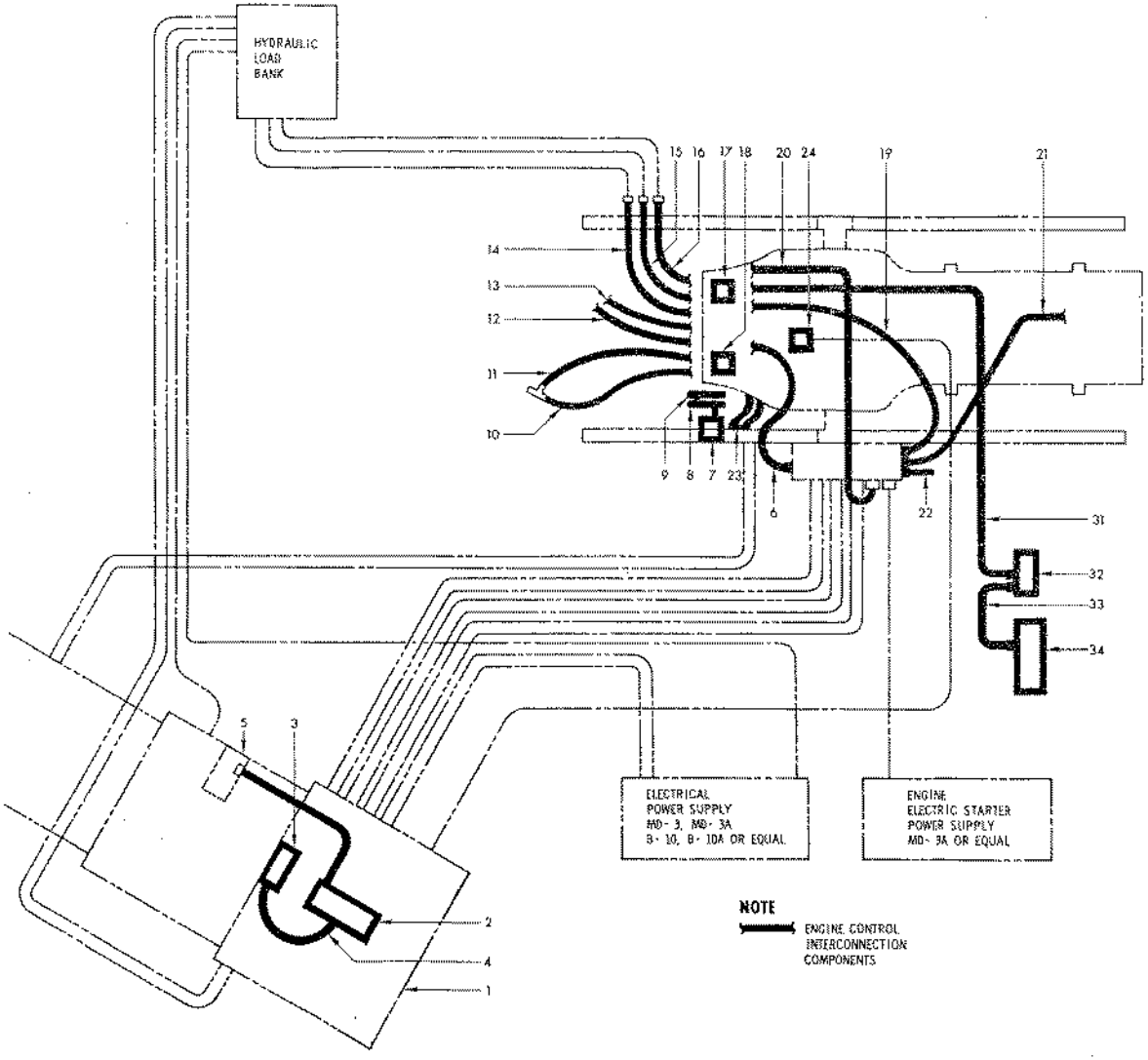
Figure 4-64M. Engine Control Panel Located in Control Cab

4-304. INSTALLATION OF ENGINE. Engine installation is the reverse of the removal procedure. Before installation, adjust the forward support until approximately 11 threads are showing. This will lessen adjustment after installation.

WARNING

Operation of the engine without a jet nozzle is strictly prohibited. Excessive axial loads are imposed upon turbine thrust bearing which will drastically reduce endurance life of bearing and probably result in bearing failure. If it is necessary to run up engine with aft section and tailpipe removed be sure that some type of short run-up pipe or jet nozzle is placed on engine to prevent damage to turbine thrust bearing. Also, install a locally manufactured thermocouple lead for temporary installation from the right wing root connection to the exhaust cone connection. To prevent false temperature readings, assure that the resistance in the jumper is the same as in a standard installation. This jumper is required to detect overtemperature conditions.

Prior to running engine with aft section removed, attach a flexible hose approximately 10 feet in length at the fuel vent line flexible connection. Route hose overboard and away from the airplane. This is to prevent fuel or fumes from entering the compressor section.



INDEX NO.	NOMENCLATURE
1	AFWM377-1 CONTROL CAB ASSEMBLY
2	ENGINE CONTROL PANEL
3	AUXILIARY INSTRUMENT PANEL
4	ENGINE CONTROL TO AUXILIARY INSTRUMENT PANEL CABLE
5	DYNAMOTOR IGNITION CABLE
6	FUEL INLET PRESSURE HOSE ASSY
7	THROTTLE ACTUATOR MOUNTING BRACKET
8	ACTUATOR ARM ASSY
9	THROTTLE LINKAGE ROD ASSY
10	COMBUSTION CHAMBER DRAIN HOSE
11	STARTING FUEL AND SCUPPER DRAIN HOSE
12	DRIP VALVE DRAIN HOSE
13	AIR ADAPTER DRAIN HOSE
14	HYDRAULIC PRESSURE HOSE
15	HYDRAULIC SUCTION HOSE
16	HYDRAULIC CASE DRAIN HOSE
17	CABIN PRESSURE DUCT CAP AND CLAMP ASSY
18	CABIN AIR SUPPLY PRESSURE CONNECTION AND CAP ASSY (QEC)
19	ENGINE CONTROL CABLE ASSY
20	ELECTRIC START CABLE
21	AVERAGE EGT CABLE
22	SHORTING PLUG CENTRIFUGAL SWITCH
23	FUEL SUPPLY HOSE ASSY
24	HOSE ADAPTER - COMPRESSOR DISCHARGE AND PLUG ASSEMBLY (BARE)
25	FUEL INLET PRESSURE
26	N_2 TACHOMETER
27	EGT AVERAGE
28	SHORTING PLUG
29	ENGINE "T" BOX (CONTROL)
30	AC LOAD BANK PANEL
31	GENERATOR CONTROL CABLE TO GENERATOR
32	GENERATOR CONTROL JUNCTION BOX
33	DC LOAD BANK CABLE
34	DC LOAD BANK

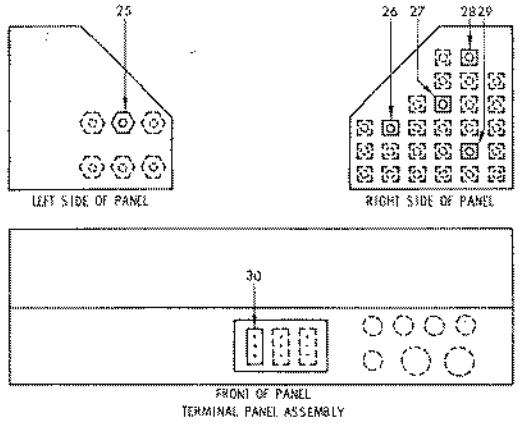


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Figure 4-64N. Engine Quick-Change Unit Thrust Check System Equipment Interconnection Diagram

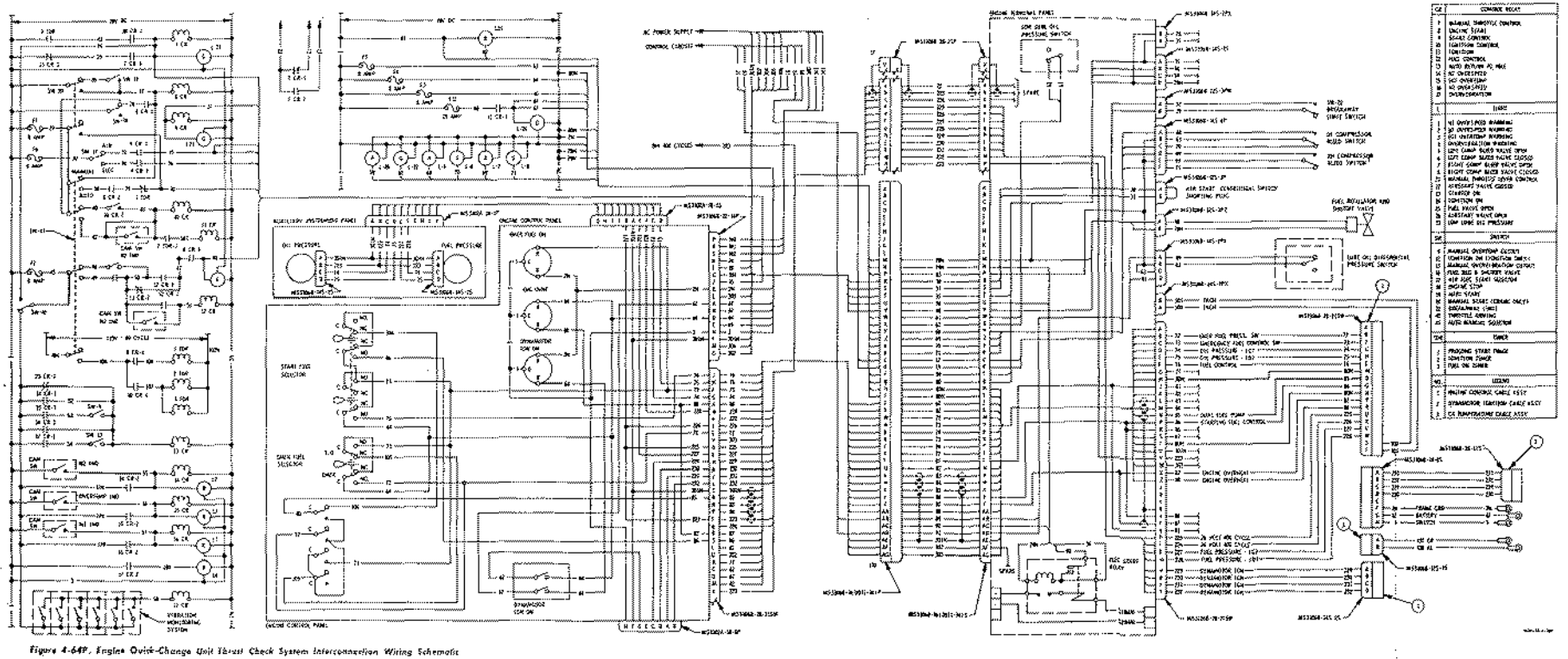


Figure 4-64F. Engine Quick-Change Unit Thrust Check System Interconnection Wiring Schematic

Changed 1 May 1960

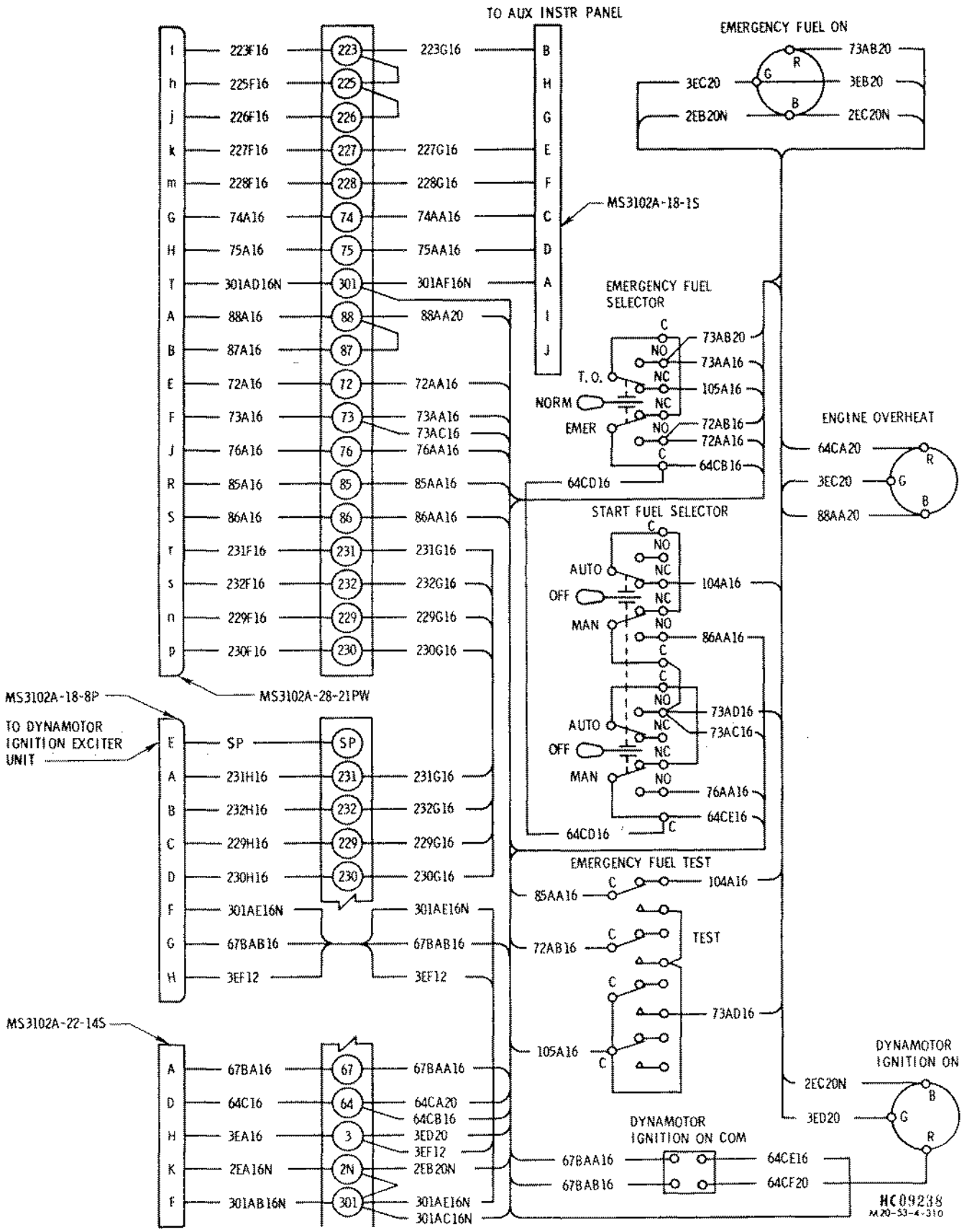


Figure 4-64Q. Engine Control Panel Wiring Diagram

4-305. Prior to installing aft section place tail pipe clamp on engine exhaust cone. Position so that threaded end of latch bolt will be down, on right hand side of fuselage, to facilitate torquing the nut when clamp is installed. (See paragraph 4-308.)

4-306. INSTALLATION OF FUSELAGE AFT SECTION. Reverse the removal procedure. Use spreader bar S-10406 (figure 3-30) to align the two upper attachment points. Attach the spreader bar to the upper structure of the airplane on each side of the midsection at the aft to midsection attaching fittings. The bar may be extended or retracted to align the airplane midsection with the aft section upper attachment holes.

Note

Torque aft to midsection attaching bolts to between 1100 and 1300 lb in.

4-307. When connecting rudder cables, be sure they are not twisted. Twisted cables cause inaccurate movement of the rudder.

4-308. ENGINE ALIGNMENT. Work through access panels No. 43 and 65 to align the engine as follows:

a. Adjust the forward support until the machined face of the support mounting on the engine is 10.85 ±0.12 inches measured in a vertical line from the top of the fuselage lower longeron.

b. Check gaps between upper and lower sides of the adapter and tailpipe flanges. If unequal, make the gaps as nearly the same as possible by readjusting the forward support.

Note

Adjustment must be kept within the 0.12-inch tolerance given. Any remaining gap variation will be taken care of by the tail pipe clamp.

c. Install tail pipe clamp with latch between 1-o'clock and 2-o'clock position (looking forward) and close latch.

d. Torque latch bolt to 150 lb. in. when clamp is at ambient temperature. If engine has been run and then shut down and bolt is still hot, or if bolt is torqued at ambient temperature without first loosening the clamp, the maximum permissible torque is 100 lb in.

e. Assure that tailpipe trunnion bearings are not binding in tailpipe support tracks. Check by moving tailpipe up and down at the aft (nozzle) end. Inability to relieve binding through adjustment, within specified limits, of forward engine support will be cause for investigation to determine reason for binding.

CAUTION

To prevent possible distortion of clamp and bolt, tap on clamp with a mallet while torqueing bolt.

4-309. OPERATIONAL CHECK OF ENGINE. Check all affected electrical and control systems for proper functioning.

4-310. TROUBLE SHOOTING OF ENGINE.

Trouble	*Probable Cause*	*Remedy*
Engine fails to start.	Battery switch "OFF."	Turn switch "ON."
	Ignition switch "OFF."	Turn switch "ON."
	Low starter rpm.	Low battery voltage. Check voltage. Dirty starter commutator. Clean commutator and replace glazed brushes.
	Starter does not motor engine.	No power supply to starter. Turn off all fuel and ignition switches. Disconnect lead to starter. Turn on starter switch and check power supply to starter. If no power, check continuity of all wiring. Check voltage at starter relay. Replace starter relay if defective. Open circuit in starter. With starter relay operating and test lamp across starter terminals, check power supply. If power supply is satisfactory, replace starter.
	Starting clutch in accessories gear casing damaged.	Replace engine.
	Manual shut-off valve in "OFF" position.	Place manual shut-off valve in proper position.
	Lack of fuel.	See figure 3-24 for specified fuel and quantity.
	Air in starting fuel control and lines.	Try second start.
	Spark plugs temporarily fouled by flushing oil.	Try second start.

Trouble	*Probable Cause*	*Remedy*
	Fuel booster pumps inoperative.	Check electrical operation of booster pumps by watching aircraft ammeter for correct discharge when pumps are energized. If correct power drain does not occur, check wiring to pumps for breaks or shorts.
	Broken or leaking fuel line to engine.	Replace defective lines.
	Dirty fuel filters.	Clean filter and element.
	Clogged fuel line to engine.	Remove fuel line and check for obstruction.
	Water or other contaminant in fuel.	Check sample of fuel. If contaminated, drain all fuel from system. See figure 3-24 specified fuel and quantity.
	Incorrect fuel specification.	Same as preceding item.
	No spark obtained at either spark plug.	Check all ignition disconnects. Check battery voltage; 16 volts required at dynamotor. Check battery-to-dynamotor connection. Check control switches and dynamotor. Check transformers by temporarily replacing with known satisfactory units. Check for spark plugs with broken electrodes. Set spark plug gap at 0.070-0.080 inch. Turn switch "ON."
	Drip valve sticking in open position. Fuel drains from starting fuel control.	Replace starting fuel control.
	Starting fuel control inlet solenoid valve inoperative.	Check electrical connection at starting fuel control. Check throttle switch on main fuel control for open circuit. Check starting fuel control switch in cockpit for defects.
	Regulator valve in starting fuel control stuck.	Replace starting fuel control.
Spark obtained at one spark plug only.	Defective spark plug, high-tension lead, or transformer unit.	Replace each unit successively with another unit known to be satisfactory.
	Defective exciter unit.	Replace exciter unit.
Starting temperatures too high or temperatures of acceleration to changeover speed too high.	Dirt in starting fuel control dashpot piston, stuck in lowest position.	Replace starting fuel control or comply with procedures outlined in Field Maintenance Handbook.
	Leakage of fuel from emergency fuel control or main fuel control.	Check linkage to fuel controls to ensure that both controls are set at the cut-off position when engine control lever is "OFF." To check controls for leakage at "OFF" positions: Disconnect main fuel control-to-main double check valve and emergency fuel control-to-main double check valve hose at either check valve or controls. Turn ignition switch "OFF." With engine control lever closed and engine motored with starter, no fuel should flow from either control. If flow occurs, check linkage and adjust as necessary. Replace control if leakage continues with engine control lever "OFF."
	Regulator valve in starting fuel control stuck open.	Replace starting fuel control.
Engine starts slowly and temperature of acceleration changeover speed too high.	Engine manifold Nos. 7 or 14 check valve leaking.	Remove dirt or replace leaking valve.
	Starting fuel control cut-off valve stuck closed or dirt in cut-off bleed.	Replace starting fuel control.
	Bleed plugged in Nos. 7 and 14 fuel manifold supply port on starting fuel control.	Remove bulkhead fitting from fuel control and remove dirt from bleed.

Trouble	*Probable Cause*	*Remedy*
Engine acceleration to changeover speed too slow or acceleration temperatures too low.	Fuel supply to starting fuel control too low (emergency fuel control bypassing total output of emergency pump to inlet of pump.)	Connect a fuel pressure gage to emergency fuel control outlet (emergency fuel filter outlet pressure sensing connection). Turn ignition switch "OFF" and energize emergency fuel control bypass solenoid. Motor engine with starter. If emergency fuel control inlet pressure is less than 400 psi, emergency control bypass valve is probably bypassing total output of emergency pump to pump inlet. If investigation reveals that wire "F" to emergency control is energized while valve is bypassing total pump output, replace emergency fuel control.
	Dirt in starting fuel control dashpot piston bleed or piston stuck in lowest position.	Replace starting fuel control or comply with procedures outlined in Field Maintenance Handbook.
	Regulator valve in starting fuel control stuck open.	Replace starting fuel control.
Engine temperature too high at changeover speed.	Main control throttle switch not breaking circuit at changeover.	Adjust switch operating lever for cut-out or replace switch if short circuit is found.
	Dirt under solenoid operated inlet valve seat in starting fuel control.	Replace starting fuel control.
Engine will not go onto emergency fuel system.	Defective emergency fuel control solenoid.	Replace solenoid.
Unable to obtain desired RPM on emergency system.	Defective emergency fuel control solenoid.	Replace solenoid.
Engine unable to reach full speed (low manifold fuel pressure) on main fuel system.	Engine control system linkage, Main fuel control maximum speed stop incorrectly set.	Check linkage between engine control lever and main fuel control. With engine control lever in full open position, main control full-rpm-stop adjustable-stop-shoe should be against full rpm fixed stop.
	Dirt or other obstruction in fuel supply system.	Check lines for obstructions. Clean all filters and check fuel flowmeter.
	Fuel leaks.	Check all fuel lines and connections.
	Dual fuel pump defective.	Replace pump.
	Fuel pressure or tachometer gage reads incorrectly.	Recalibrate gages. Check tachometer by temporarily replacing with known satisfactory unit.
	Main or starting double-check valve allowing fuel to leak to emergency bypass fuel.	Replace defective check valve.
	Drip valve leaking.	If drip valve leaks excessively during normal operation, replace starting fuel control.
	Bypass valve in main fuel control sticking.	Bleed fuel control. If no improvement, replace fuel control.
Acceleration temperature too high during ground operation.	Defective exhaust gas temperature gage.	Recalibrate gage and check thermocouples.
	Main fuel control altitude compensation needle stuck in rich position.	Bleed fuel control. If no improvement, replace fuel control.
	Emergency fuel system supplying additional fuel.	During operation on main fuel system only, bypass valve of emergency fuel control should be open. Check airplane switches to ensure wire "F" to emergency fuel control is not energized, and make electrical check of wire "F" if necessary. Replace emergency fuel control if bypass valve is stuck closed.
Temperatures too high or too low during acceleration or deceleration.	Centrifugal pressure regulator or governor valve in main fuel control sticking.	Bleed fuel control. If no improvement, replace fuel control.
Excessive exhaust gas temperature.	Wrong type of fuel. Water of other contaminant in fuel.	Check sample of fuel. If fuel is of incorrect specification or contaminated, drain all fuel from tanks and flush system. See figure 3-24 for specified fuel and quantity.
	Exhaust gas temperature gage reading incorrect.	Recalibrate gage.

Trouble	*Probable Cause*	*Remedy*
Excessive exhaust gas temperature (continued)	Fuel nozzles out of balance. Combustion chamber inner liner damaged.	Inspect inner area of exhaust cone for heat streaks or excessive warpage. Location of heat streaks on inner surfaces of exhaust cone provides a rough check of location of combustion chamber where nozzle (or inner liner) is malfunctioning. Defective nozzles may be replaced individually but nozzles must not be disassembled.
	Foreign matter clogging compressor inlet screens or inlet ducts.	Remove foreign matter.
	Tail pipe nozzle out of round.	Replace if not possible to rework to satisfactory condition.
	Damaged or defective turbine wheel buckets or nozzle diaphragm.	Refer to T.O. 1T-33A-6 for inspection instructions.
Engine speed fluctuates (on main fuel system).	Main fuel control centrifugal pressure regulator dragging.	Bleed fuel control. If no improvement, replace fuel control.
	Starting fuel control supplying additional fuel.	Replace starting fuel control.
	Emergency fuel system supplying additional fuel.	Check airplane switches to ensure that wire "F" to emergency fuel control is not energized, and make electrical check of wire "F" if necessary. Replace emergency fuel control if bypass valve is stuck closed.
	Water or other contaminant in fuel.	Check sample of fuel. If contaminated, drain all fuel from tanks and flush system. See figure 3-24 for specified fuel and quantity.
	Bypass valve in main fuel control sticking.	Bleed fuel control. If no improvement, replace fuel control.
	Low fuel supply.	See figure 3-24 for specified fuel and quantity.
	Defective airplane booster pumps.	With engine operating, turn off all booster pumps not necessary for continued operation and watch ammeter for changing current demand, indicating defective booster pump. Check wiring to pumps for shorts.
	Restrictions in fuel supply lines to engine-driven pump.	Check fluid supply lines to pumps for internal damage. Check for air leaks at inlet.
Engine overspeeding.	Faulty tachometer generator or indicator.	Check indicator by temporarily replacing with unit known to be satisfactory. Recalibrate gage.
	Main fuel control maximum governor speed set too high or governing mechanism defective.	Refer to paragraph 4–332 for instructions regarding checking and setting of maximum governor setting on main fuel control. NOTE If engine overspeeds after having operated satisfactorily for several hours, do not reset main control maximum governor setting until cause of overspeeding is found. Check maximum rpm locking bolt for tightness as well as adjustable stop.
Engine speed in power range increases with altitude at fixed engine control setting.	Main fuel control altitude needle or linkage sticking.	Bleed fuel control. If no improvement, replace fuel control.
	Bypass valve in main fuel control sticking.	Bleed fuel control. If no improvement, replace fuel control.
Idle speed too high at altitudes over 30,000 feet.	Excessive leakage by regulator, or regulator sticking (in main fuel control).	Increase or decrease speed to dislodge dirt. Replace main fuel control if no improvement.
	Emergency fuel system supplying additional fuel.	Check airplane switches to ensure wire "F" to emergency fuel control is not energized, and make electrical check of wire "F" if necessary. Replace emergency fuel control if bypass valve is stuck closed.

Trouble	*Probable Cause*	*Remedy*
Idle speed too high at altitudes over 30,000 feet. (Cont'd.)	Starting fuel system supplying additional fuel.	Replace starting fuel control.
	Main fuel control altitude needle sticking in rich position.	Bleed fuel control. If no improvement, replace fuel control.
Idle speed too low at altitude.	Idle bleed in main control plugged.	Bleed fuel control. If no improvement, replace fuel control.
	Main fuel control bypass or relief valve stuck open. **Note** Bleed main fuel control (refer to paragraph 4–501) prior to removing it for the following malfunctions: RPM fluctuation, excessive altitude droop, idle speed too high or too low at altitude, or excessive EGT.	Replace main fuel control.
Rumbling noise with movement of engine control lever.	Looseness of spindle trunnion supports.	Make thorough inspection for looseness at spindle trunnion supports and other loose parts, such as front engine mount ball socket joint, air intake ducts, and tail cone mounts.
Excessive fuel or oil leakage from drain.	Starting fuel control drip valve stuck.	Lightly tap drip valve housing to release. If necessary, replace defective starting fuel control.
	Defective accessory.	Isolate particular accessory from where leakage occurs and replace defective unit.
Low oil pressure.	Lack of oil in reservoir.	Check oil level.
	Dirty oil filter.	Clean oil filter.
	Oil leaks.	Check all lines and connections.
	Defective oil pump.	Remove pump and check for sheared drive.
	Oil pressure gage records inaccurately.	Replace gage.
High oil pressure.	Oil pressure gage records inaccurately.	Replace gage.
	Improper oil.	Fill reservoir with MIL-O-6081 Grade 1010.
	Dirt in oil jet screens.	Remove engine and forward to overhaul depot.
	Plugged pressure oil line.	If an external line is plugged, remove and clean. If an internal line is plugged, remove engine and forward to overhaul depot.
Excessive oil consumption.	Loose fittings or connections.	Check for and tighten loose connections and fittings.
	Excessive clearance around oil seals.	Fill oil reservoir to 12-quart mark on oil bayonet gage. Drain oil into a clean 5-gallon container. Let oil drain for 5 minutes. Weigh and record weight of oil and container. Service engine with contents of container. Accomplish a normal one-hour flight. Stop engine and drain oil into 5-gallon container. Let oil drain for 5 minutes. Container must not be used for other purposes during this check, nor shall it be cleaned prior to end of check. Weigh and record weight of oil. If the differential between recorded weights exceeds 2 pounds per hour for check flight, remove engine and forward to overhaul depot.
	Scavenge lines not air tight.	Check connections and tighten if loose.
Burning continues in one or more combustion chambers after closing engine control lever.		If combustion does not stop, keep starter in operation (with all fuel switches "OFF") and admit CO_2 into compressor inlet.

Trouble	*Probable Cause*	*Remedy*
Burning continues in one or more combustion chambers after closing engine control lever (Cont'd.)	Main control valve not seating.	Check linkage from engine control lever to main fuel control. Also check linkage between main and emergency fuel controls.
	Combustion chamber drain valve or connecting lines clogged.	Remove and clean.

4–311. ENGINE ACCESSORIES. *(See figures 4-65 and 4-66.)* For information on the engine accessories, refer to the indicated paragraphs.

a. Generator, 4–791.

b. Starter, 4–340.

c. Hydraulic pump, 4–676.

d. Lubricating and scavenger pump, 4–360.

e. Tachometer generator, 4–853.

f. Combustion chamber drain valve, 4–514.

g. Spark plugs, 4–347.

h. Fuel check valve, 4–459.

i. Oil filter, 4–364.

j. Oil pressure transmitter, 4–367.

k. Oil heater and thermostat, 4–369.

l. Fuel pressure fuel filter, 4–465.

m. High pressure fuel filter, 4–446.

n. Dual fuel pump, 4–494.

o. Starting fuel control, 4–506.

p. Emergency fuel control, J33-A-35 engines, 4–502.

q. Ignition transformers, 4–349.

4–312. AIR INTAKE AND EXHAUST SYSTEM.

(See figure 4-67.)

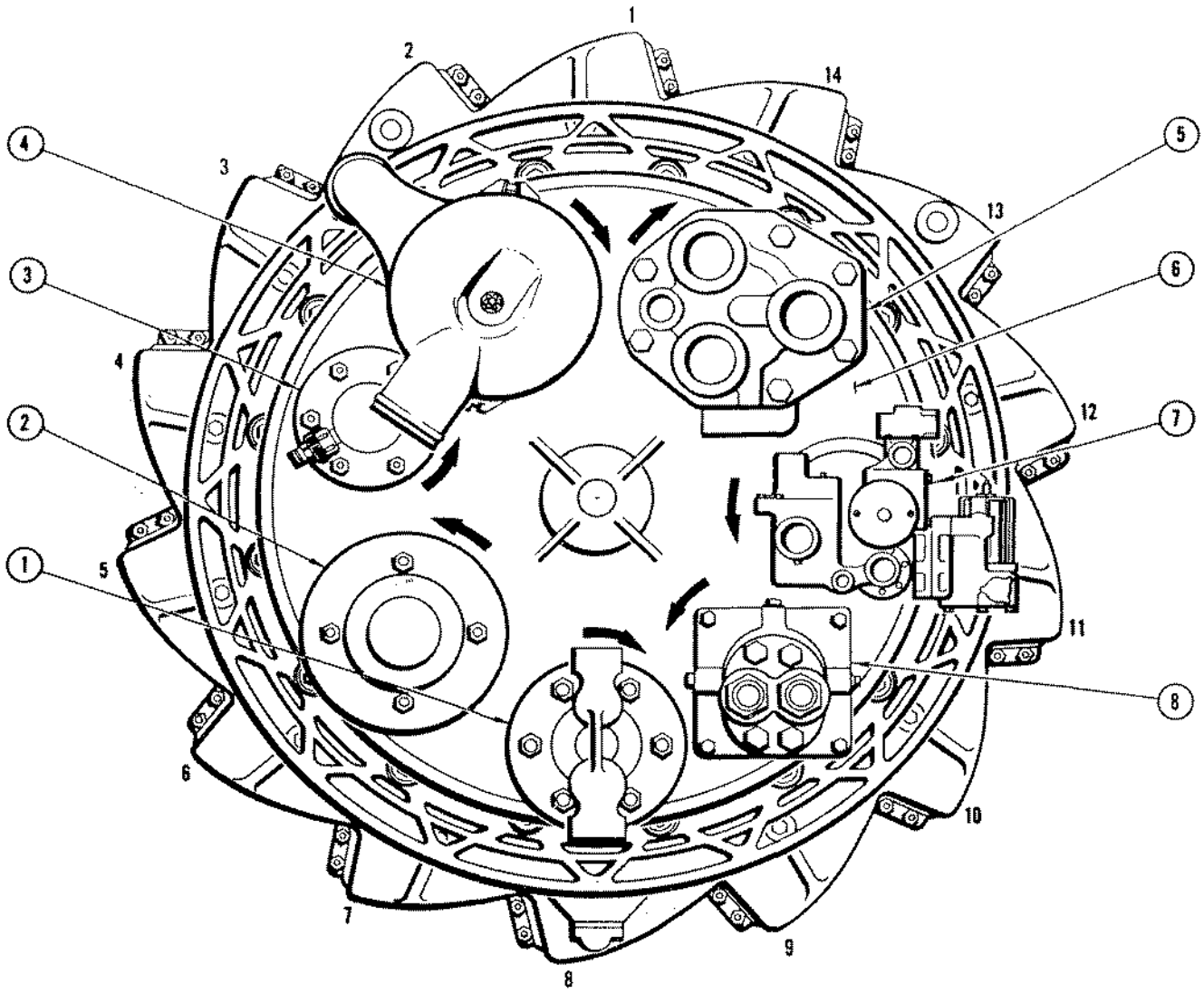
4–313. DESCRIPTION OF AIR INTAKE SYSTEM. Two ducts contained within the fuselage contour supply air to the power plant. Air enters the ducts through two faired scoops, one on each side of the fuselage, forward of the wing leading-edge. Each scoop contains ducts and louvres for venting overboard the inboard intake boundary layer air.

4–314. During ground operation of the power plant, air is admitted to the engine compressor openings through two auxiliary air inlet doors. These doors are spring-loaded to keep them closed during flight. Differential air pressure across the engine compartment and fuselage exterior during ground operation overcomes the spring force to open the doors.

4–315. Air entering the intake scoops or ground operating doors is dumped into the engine compartment where it enters the compressor. A seal around the engine periphery prevents loss of intake air through the fuselage aft section.

4–316. AIR INTAKE DUCT. *(See figure 4-67.)* The intake ducts are constructed of aluminum alloy sheet metal, with a beaded outer skin. Hat-section stiffeners on the inboard sides of the ducts serve to strengthen the structure. The ducts extend from fuselage station 163.875 to station 228.30. Attachments are made with bolts and screws around each end of the ducts. A fluid injection tank is installed in the upper portion of each air intake duct.

4–317. AIR INTAKE SYSTEM. *(See figure 4-68.)* Air at engine-compartment pressure enters the engine compressor on both sides of the double-inlet multi-vaned impeller wheel. The air is compressed and forced out through the diffusers and air adapters into the combustion chambers. Each combustion chamber consists of an outer wall and an inner perforated liner. The compressed air is forced between the outer wall and inner liner and through the perforations into the interior of the chamber. The compressed air admitted to the inner chamber is mixed with fuel from the fuel nozzle, and burned. The exhaust gases pass through the turbine wheel. The turbine wheel is directly connected to the impeller, and drives the impeller and the accessories. The gases leaving the turbine wheel enter the exhaust cone and the tail pipe. The exhaust cone consists of a short tapered pipe covering an inner cone. It contains four fins to straighten the flow of gas as the gas leaves the turbine wheel.



1. OIL PUMP
2. STARTER
3. TACHOMETER GENERATOR
4. GENERATOR
5. DUAL FUEL PUMP
6. ACCESSORY GEAR CASE
7. MAIN FUEL CONTROL
8. HYDRAULIC PUMP

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Figure 4-65. Direction of Rotation, Engine Accessories

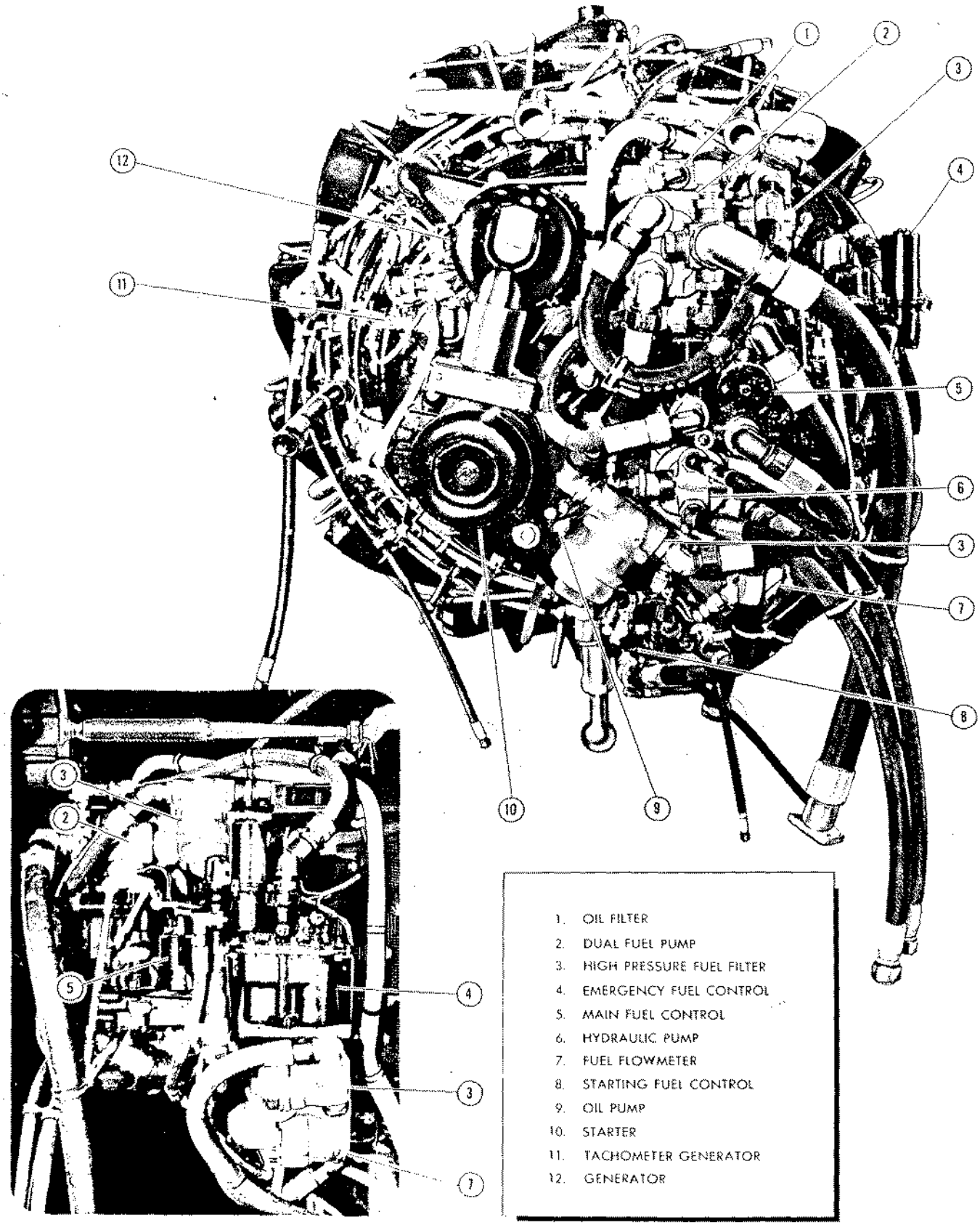

Figure 4-66. Engine Accessories

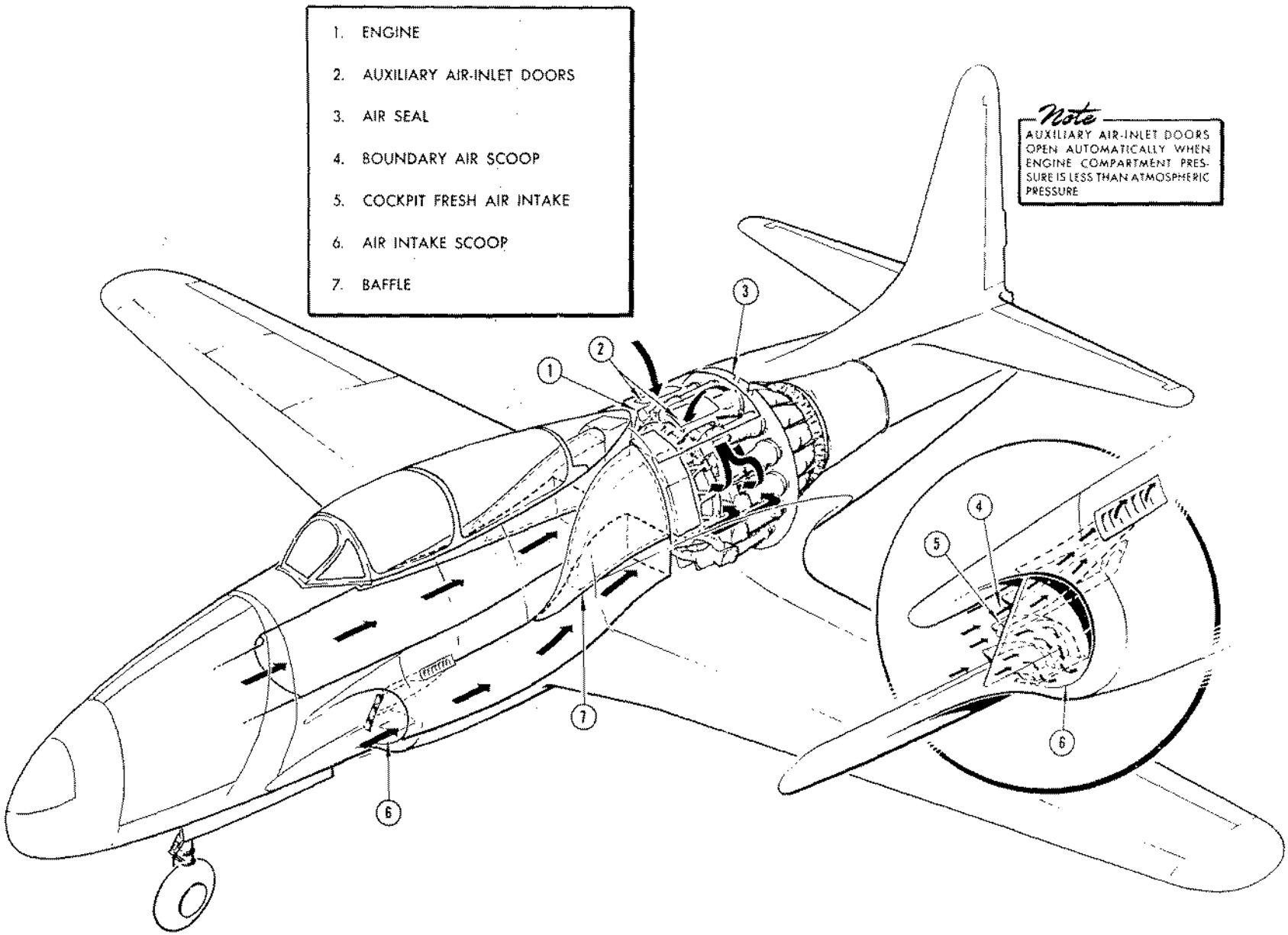

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Figure 4-67. Engine Intake System

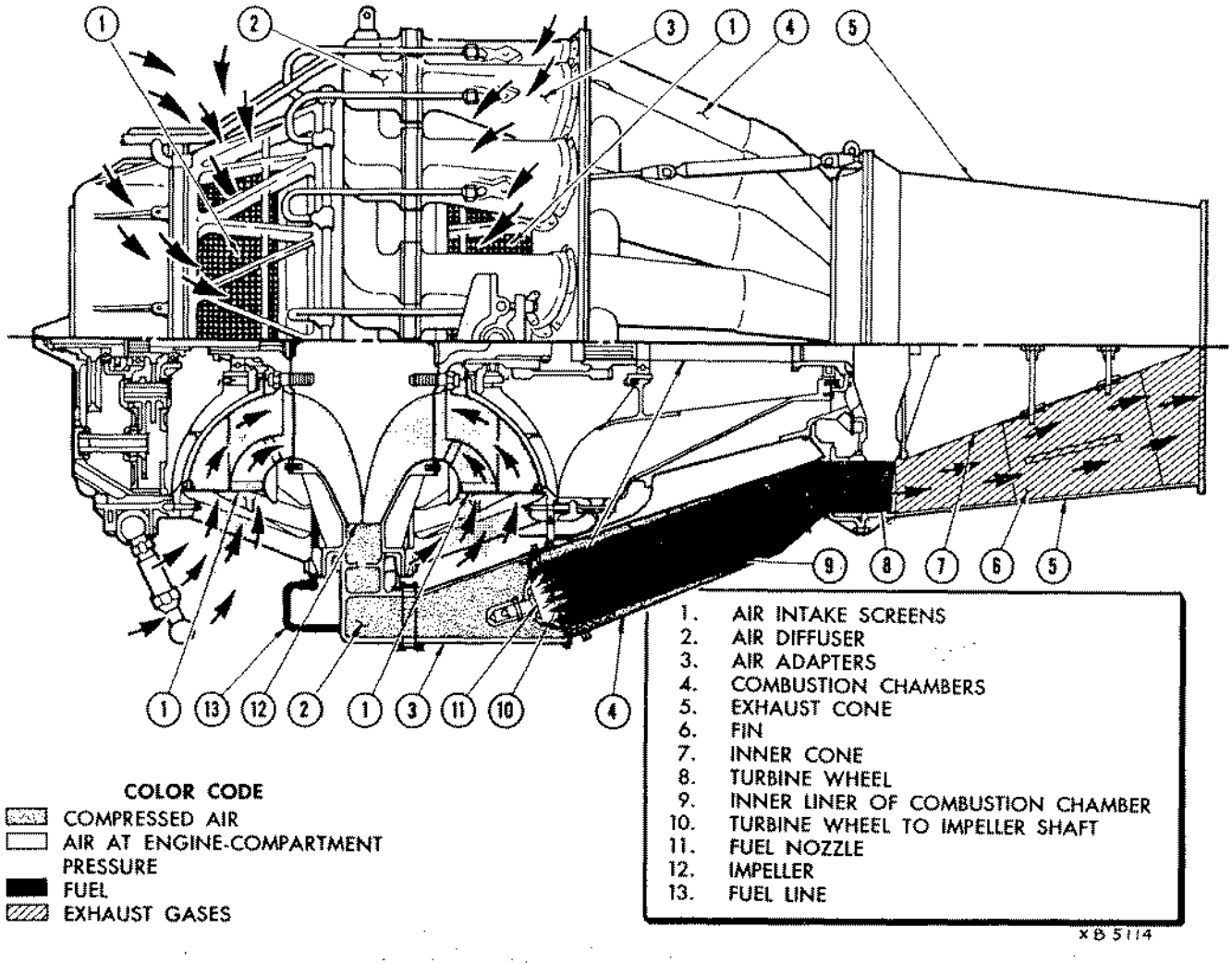


Figure 4-68. Engine Induction and Exhaust System

4–318. DESCRIPTION OF EXHAUST SYSTEM. *(See figures 4-68 and 4-69.)* The exhaust system consists of the engine exhaust cone, a tail pipe adapter, and the tail pipe. The exhaust cone is an integral part of the engine. It extends aft from the turbine wheel a short distance, and is covered by an asbestos cover. The adapter is a section bolted to the exhaust cone to connect the cone to the tail pipe. The tail pipe extends from the adapter just past the aft extremity of the fuselage.

4–319. TAILPIPE AND TAILPIPE ADAPTER. The tail pipe adapter is attached to the engine exhaust cone by bolts around the mounting flange, using Klincher nuts or castle nuts safetied with cotter keys. The tail pipe is connected to the adapter by a quickly detachable clamp, and is supported in the fuselage aft section by a sling and roller system. A triangular sling arrangement supports the forward end of the tail pipe by two cables from each of three points on the fuselage structure to fittings on the tail pipe. The upper cables are adjustable at the end which is fastened to the cable attaching plate on the tailpipe. The lower cables (horizontal cables) are adjustable at the end fastened to the cable attaching plate on the fuselage structure. The tail pipe maintains its position relative to the fuselage when the engine is removed. The aft end of the tail pipe is supported by rollers which ride in tracks located one on each side of the fuselage.

CAUTION

Adjust the tail pipe sling so it will be taut when the pipe flange is parted from the adapter a distance of 1 inch. This is to prevent the loss of the tail pipe should the attachments fail.

Note

Track wear on roller contact surface shall not exceed 0.030 inch in depth on each surface. The outside of the lips shall not exceed 0.060 inch in wear.

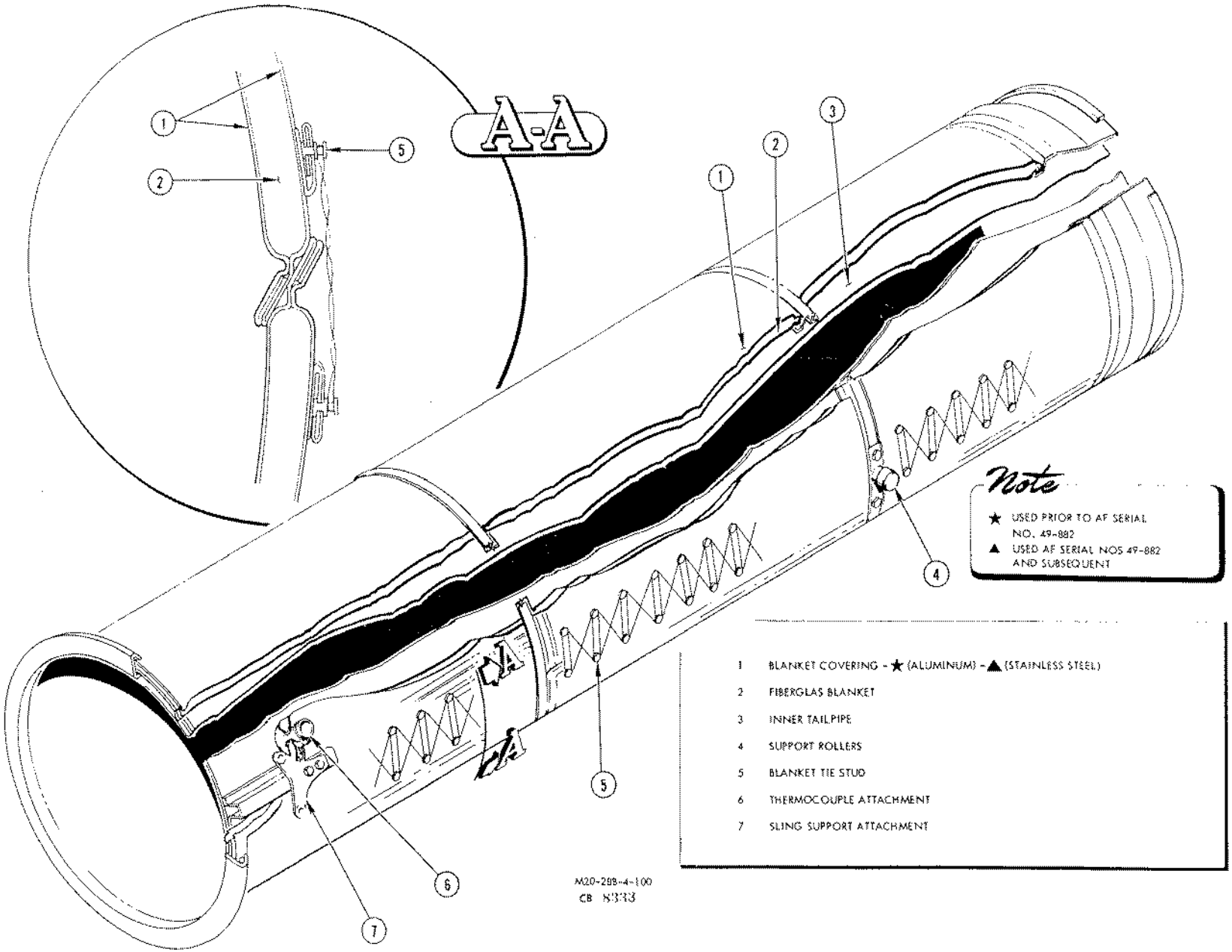


Figure 4-69 Tailpipe

4–320. The adapter, when attached to the engine exhaust cone, extends aft approximately 3½ inches. A flange at the aft end attaches to the tail pipe. From the flange, a section of the adapter slips inside the installed tail pipe. The detachable clamp fastens around the flanges of the adapter and tail pipe.

CAUTION

Some engine exhaust cones and some tail pipe adapters have 24 holes in the attaching flanges, while others have 48 holes for attaching bolts. While tail pipe adapters with 24 holes may be used with exhaust cones containing 48 holes, the 48-hole adapters must not be used with 24-hole exhaust cones. Having unused holes in the adapters weakens the flange and may result in exhaust leakage between attaching bolts.

4–321. The tailpipe is approximately 96 inches long and tapers from an inside diameter of approximately 21 inches to approximately 19.0 inches at the aft end. The inner skin of the tail pipe is of corrosion-resistant steel, wrapped with an aluminum covered fiberglas blanket on airplanes prior to AF Serial No. 49-901. On AF Serial Nos. 49-901 and subsequent, the fiberglas blanket is covered with corrosion resistant steel.

4–322. REMOVAL AND INSPECTION OF TAILPIPE. The tail pipe is removable after the fuselage aft section has been removed from the airplane. Refer to paragraph 4–299. The tail pipe adapter is removed with the engine.

WARNING

Use asbestos gloves when handling a hot tail pipe.

CAUTION

Handle tail pipe carefully to prevent damage to outer cover.

a. Remove sling cables from attaching plates on fuselage structure.

b. Remove pipe by pulling it forward.

Note

The tracks which support the rollers are approximately 23 inches long. Support the aft end of the tail pipe to prevent damage when rollers reach the end of the track.

c. Check the tailpipe nozzle for out of roundness. For engines having a 34 vane impeller, the inside diameter is 19 (+.075, −.000) inches. The maximum allowable diameter if the tailpipe is out of round is 19.40 inches along the major axis and 18.60 inches along the minor axis.

Note

Replace the tailpipe if it is not possible to return it to round.

d. Slight evidence of wrinkling may be acceptable, but deep wrinkles (½-inch or more in depth) will be cause for replacement.

e. No cracks are allowed in the tailpipe skin.

CAUTION

After installation of a new tailpipe, to eliminate possible tailpipe collapse, unlace blanket, start and run engine for two minutes at approximately 36 percent rpm. Shut engine down and allow tailpipe to cool prior to replacing blanket. The above procedure will permit possible moisture accumulation in blanket to evaporate.

As an alternate method of drying, blanket may be placed in an oven for approximately five minutes, at 460 degrees centigrade prior to installation.

f. Component parts of articulated type tailpipe should not be interchanged when a serviceable tailpipe is received from supply or an overhaul facility. The major components are provided an interference fit, during depot level repair, to prevent exhaust gas leakage. Leakage that develops in service may be corrected as outlined in T.O. 1T-33A-3, Section VI, Figure 6-8.

g. The same blankets fit both designs of tailpipe. Blankets are installed on the non-articulated type tailpipe as shown in figure 4-69. If the "Z" ring has been removed, the forward and center blankets will be butted together. On the articulated type tailpipe (T.O. 1T-33A-4, Figure 33A) install the center blanket first. The front blanket, positioned against the flare of ring assembly part number 412839-1, will overlap center blanket approximately three and one half inches. The aft blanket is installed in the same manner on either tailpipe.

4–323. REPAIR OF TAIL CONE AND TAILPIPE INSULATING BLANKETS. The following repairs can be made to the blankets using Welding Machine, Type AF/E24M-1 or the equivalent:

a. Holes from 1/16 inch to 6 inches in diameter.

b. Slits from ⅛ inch to 18 inches in length.

c. Repairs not to exceed 25 percent of the total blanket area.

4–324. ENGINE CONTROLS.

(See figure 4-70.)

4–325. DESCRIPTION OF ENGINE CONTROLS. An engine control lever is mounted on each cockpit left

shelf. Movement of the two levers is synchronized by push-pull tubes. The lever in the aft cockpit is connected by push-pull tubes, bellcranks, and a cockpit pressure seal assembly to the main fuel control and emergency fuel control units mounted on the engine. A quick disconnect fitting at the bell crank on Station 227 bulkhead facilitates engine removal.

4–326. On airplanes AF Serial No. 55-4370 and subsequent, and airplanes incorporating T.O. 1T-33A-561, a throttle linkage shield and boot is installed at fuselage station 190.0 to prevent the possibility of foreign material from interfering with engine control movement.

4–327. ENGINE CONTROL LEVER. *(See figure 4-71.)* Each engine control lever is mounted on a pivot-and-fulcrum assembly. Fore and aft movement of either lever controls the speed of the engine. The levers can be locked in position by means of a spring loaded friction lock on the fulcrum. A serrated adjustment plate (18) is mounted on the slotted fulcrum cover plate to provide for fine adjustment of the engine idling speed. A command-radio microphone switch is mounted in the top of each control lever. A dive flap control switch is located on each lever, just below the grip. Forward motion of either switch raises the dive flaps, and aft motion lowers them. The grip on the forward cockpit control lever can be rotated about its vertical axis to operate the gun-sight range control.

4–328. REMOVAL OF ENGINE CONTROL LEVER.

a. Remove trim around cockpit shelf.

b. Disconnect the three microphone-switch wires from the terminal panel in the side shelf.

c. Disconnect the three dive flap switch wires from the terminal panel in the side shelf.

d. Remove the nut and bolt attaching the engine control valve push-pull rod to the fulcrum assembly. (Nut and bolt are accessible from under the side of the shelf.)

e. Remove the screws attaching the slotted cover plate to the side shelf.

f. Displace the control lever from the side shelf sufficiently to gain access to the gun-sight actuating arm. (Applies to front cockpit control lever only.)

g. Remove the cotter pin from the gun-sight actuating arm on control lever, and disconnect arm from control lever. (Applies to front cockpit control lever only.)

h. Remove the control lever assembly, including the cover plate.

4–329. DISASSEMBLY OF ENGINE CONTROL LEVER.

a. Remove the bolt, washer, and nut attaching the control lever to the fulcrum.

b. Remove the friction-adjusting knob and washer.

c. Remove the control lever, including the cover plate, and fulcrum support.

d. Remove the disc, spring, and friction plug, by sliding them out of the fulcrum body.

e. Remove the serrated idle adjustment plate.

f. Remove the spacer from the end of the fulcrum.

g. Drill out the small pin the base of the control lever, and remove the gun-sight arm. (Applies to front cockpit control lever only.)

h. Drill out small pin near base of pivot. (Applies to aft cockpit control lever only.)

i. Slide out the inner part of the control lever, and remove the cover plate assembly.

j. To remove the microphone switch from the control lever handle, unscrew the cap. Remove the bushing and microphone switch.

k. To remove the dive flap switch from the control lever sleeve, unscrew the two hold down bolts. Remove the switch cover plates and the switch from the control lever sleeve.

4–330. ASSEMBLY OF ENGINE CONTROL LEVER. Reverse disassembly procedure.

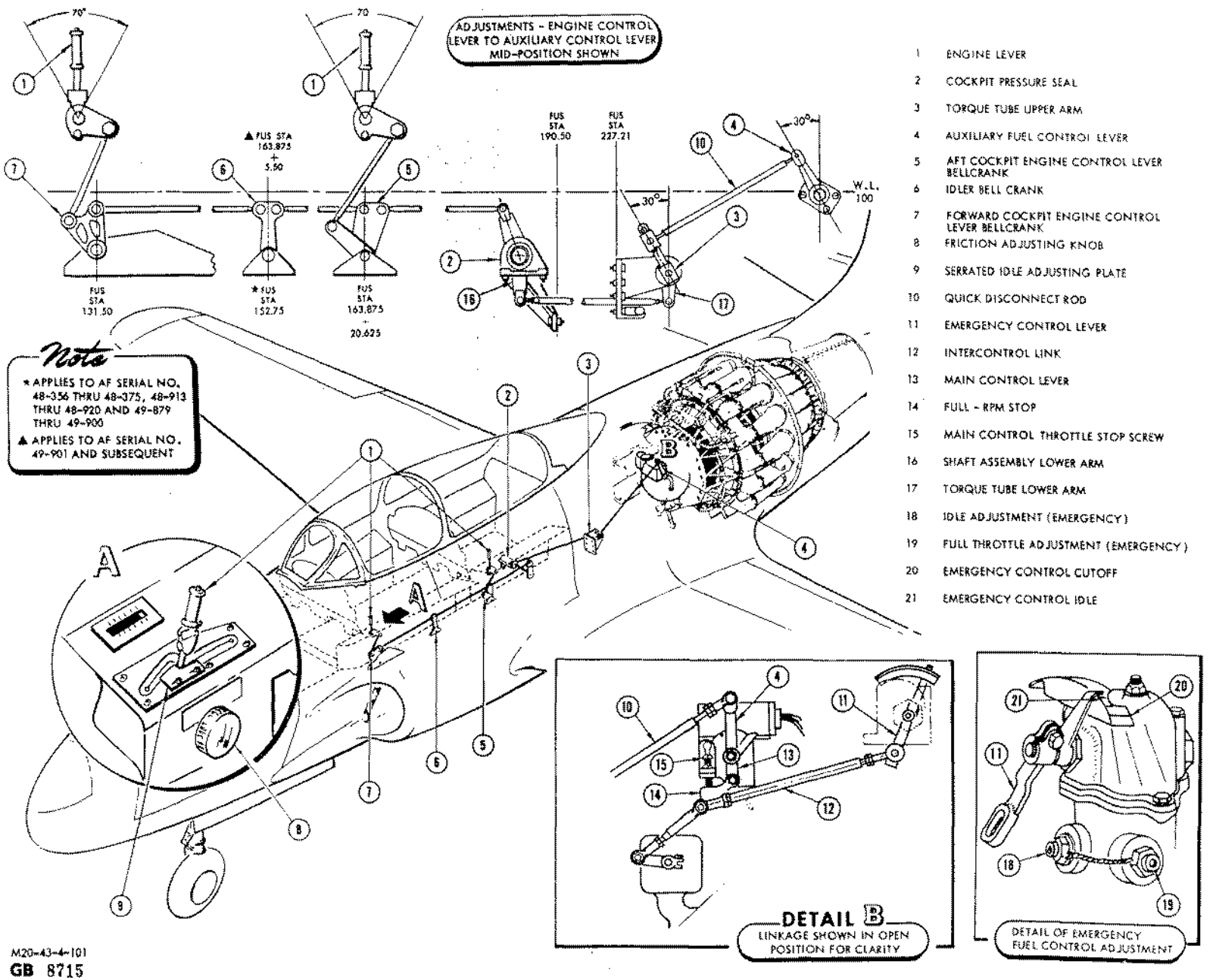
Note

To assemble gun-sight actuating arm to control lever, use 0.094 pin, and stake in place. (Applies to front cockpit control lever only.) To assemble aft cockpit control lever, use 0.094 pin, and stake in place.

Dive flap switch mounting screws must engage in fiber of stop nuts but need not protrude through fiber of nuts.

CAUTION

Be sure that special washer is placed between friction-adjusting knob and side support. Omission of washer results in binding of control lever when friction knob is tightened.



1 ENGINE LEVER
2 COCKPIT PRESSURE SEAL
3 TORQUE TUBE UPPER ARM
4 AUXILIARY FUEL CONTROL LEVER
5 AFT COCKPIT ENGINE CONTROL LEVER BELLCRANK
6 IDLER BELL CRANK
7 FORWARD COCKPIT ENGINE CONTROL LEVER BELLCRANK
8 FRICTION ADJUSTING KNOB
9 SERRATED IDLE ADJUSTING PLATE
10 QUICK DISCONNECT ROD
11 EMERGENCY CONTROL LEVER
12 INTERCONTROL LINK
13 MAIN CONTROL LEVER
14 FULL - RPM STOP
15 MAIN CONTROL THROTTLE STOP SCREW
16 SHAFT ASSEMBLY LOWER ARM
17 TORQUE TUBE LOWER ARM
18 IDLE ADJUSTMENT (EMERGENCY)
19 FULL THROTTLE ADJUSTMENT (EMERGENCY)
20 EMERGENCY CONTROL CUTOFF
21 EMERGENCY CONTROL IDLE

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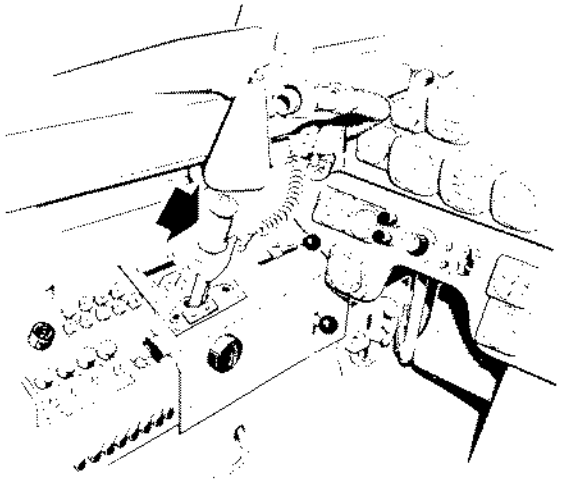
Figure 4-70. Engine Controls Diagram



1	MICROPHONE SWITCH	10.	THROTTLE ARMS
2	CAP	11.	SPRING
3	HANDLE	12.	DISC
4	DIVE FLAP SWITCH	13.	FULCRUM
5	SLOTTED PLATE	14.	ARM (GUN SIGHT ACTUATING)
6	FRICTION KNOB	15.	PIN
7	FRICTION PLUG	16.	LEVER SUPPORT PIVOT
8	SIDE PLATE	17.	THROTTLE SEAL- NATURAL RUBBER
9	FULCRUM SUPPORT	18.	IDLE ADJUSTMENT PLATE

Note

★ APPLIES TO FRONT COCKPIT ONLY

▲ APPLIES TO AFT COCKPIT ONLY

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Figure 4-71. Engine Control Lever

4–331. INSTALLATION OF ENGINE CONTROL LEVER. Reverse removal procedures.

Note

Rotate control lever to check operation of gunsight equipment. (Applies to front cockpit engine control lever only.) Tighten friction-adjusting knob and operate lever to see that lever does not bind.

4–332. ENGINE CONTROL SYSTEM RIGGING. *(See figure 4-70.)*

a. Check throttle control lever friction with engine control lever disconnected and friction control released. Friction shall not exceed three pounds measured at tip of throttle handle.

b. Place front cockpit engine control lever in center of serrated idle adjustment plate, and tighten friction lock.

c. Adjust pushrod connecting front cockpit control lever with bellcrank (7) at station 131.50 so that aft end of bellcrank is perpendicular to cockpit floor.

d. Adjust pushrod connecting station 131.50 bellcrank (7) and idler bellcrank (6) at station 152.75 on airplanes AF Serial No. 48-356 through 49-900. On airplanes AF Serial No. 49-901 and subsequent, bellcrank (6) is at station 163.857 + 5.50. Centerline of idler bellcrank (6) must be perpendicular to cockpit floor.

e. On airplanes AF Serial No. 48-356 through 49-900, adjust pushrod connecting idler bellcrank (6) at station 152.75 to aft cockpit control lever bellcrank (5) so that forward arm of bellcrank (5) is perpendicular to cockpit floor. On airplanes AF Serial No. 49-901 and subsequent, bellcrank (6) is at station 163.875 + 5.50.

f. Adjust pushrod between aft cockpit bellcrank and aft cockpit engine control lever so that lever is in center of slotted plate on left shelf, and tighten friction lock.

g. Adjust pushrod between aft cockpit bellcrank (5) and cockpit pressure seal (2) so that lower arm (16) of shaft assembly is perpendicular to cockpit floor.

h. Adjust pushrod between shaft assembly lower arm (16) and torque tube lower arm (17) so that lower arm (17) is perpendicular.

i. Adjust torque tube upper arm (3) so that is it four serrations (approximately 30 degrees forward of vertical position).

j. Set fuel control lever on engine at mid-point travel.

k. Adjust quick-disconnect rod assembly (10) so that arm (3) and auxiliary fuel control lever (4) are both 90 degrees to quick-disconnect rod (10). Reposition arms on splined shafts to obtain position to nearest spline. Tighten the check (Jam) nut AN316-5R on control rod (10) to 60-85 pound inches.

CAUTION

Do not exceed 45 lb. in torque on Bendix control arm.

l. Perform procedures outlined in paragraphs 4–333 through 4–338.

m. Check throttle control friction with throttles connected to engine and friction lock released. Friction shall not exceed 7½ pounds measured at tip of throttle handle.

4–333. PRE-OPERATIONAL ADJUSTMENTS OF ENGINE CONTROLS.

a. Whenever an engine is initially installed in an aircraft or whenever main or emergency fuel control is replaced, check and adjust main and emergency controls and linkage.

b. Check positions of emergency fuel control lever and pointer. (See figure 4–70.) The lever must be set 180° (± one serration) opposite pointer. To adjust pointer position, loosen Allen head screw and rotate pointer.

c. Attach small end of link to center of elongated hole in emergency control lever. Adjust length of link so that emergency pointer will move to more than 1/16 inch below "CUTOFF" mark and be 1/16 to 1/4 inch below full-throttle mark as main control is moved from "CUT-OFF" to "FULL THROTTLE". Attach link to main control lever. (See figure 4-70.)

CAUTION

The emergency control must not reach either full-open or closed position before main control is on maximum speed stop or at cutoff.

d. Operate controls from closed to open position several times to be certain that control linkage jamming is impossible.

e. Attach aircraft throttle rod to main control, observing following precautions:

CAUTION

Aircraft throttle should have approximately 1/8 inch springback at throttle quadrant in closed position when main control is at cut-off.

Aircraft throttle should have approximately 1/8 inch springback at throttle quadrant in open position when main control is against maximum speed stop.

4–334. OPERATIONAL ADJUSTMENTS. The engine oil pressure must be within the limits shown in table 4-6. Do not operate an installed engine at 96 percent speed (11,280 rpm) or above for more than one minute while the aircraft is on the ground.

Table 4-6. Oil Pressure Limits

	Engine Speed	*Oil Pressure*
At ambient temperature of 15°C (59°F) or above at any altitude	Over 75% (8800 rpm)	7-42 psi
At ambient temperature of less than 15°C (59°F) at any altitude following warm-up	Over 75% (8800 rpm)	7-50 psi
Minimum oil pressure at idle	34% (4000 rpm)	2 psi
Maximum oil pressure fluctuation		3 psi
Maximum oil pressure during warm-up		100 psi

4–335. MAIN FUEL CONTROL FULL THROTTLE ADJUSTMENT. *(See figure 4-70.)*

a. Start engine slowly and increase speed to full throttle, being careful not to exceed 101 percent (11,870 rpm).

CAUTION

The engine speeds listed in table 4-7A are the maximum speeds normally obtainable at low inlet temperatures. If the main fuel control throttle stop has previously been adjusted to obtain 100-101 percent (11750-11870 rpm) do not readjust at these low inlet temperatures unless 101 percent rpm is exceeded. In case main fuel control replacement and initial checkout is being made at these low inlet temperatures, the main fuel control throttle stop may be adjusted. However, do not adjust to exceed the engine speeds specified in table 4-7A (in some cases it may not be possible to obtain these speeds). If the throttle stop is adjusted at these low inlet temperatures, the main and emergency controls must be readjusted, per paragraphs 4–335 through 4–338, when the inlet temperature increases to above 6°F (−14°C).

Note

Exhaust temperature must not exceed 715°C (1319°F).

b. If engine fails to reach rated speed or tends to exceed normal ground setting of 100-101 percent (11,750-11,870 rpm) with slight additional throttle increase, change setting of the maximum speed adjustment screw. Turning screw clockwise reduces speed, turning it counterclockwise increases speed.

c. Reduce engine speed to idle and make a tentative adjustment.

d. Advance throttle and check full-throttle speed; repeat this process until maximum speed is within limits. Refer to paragraph 4–333, step d, after adjustment.

4–336. MAIN FUEL CONTROL IDLE ADJUSTMENT. There is no provision for field adjustment of idle setting in the main control. Make the idle setting by adjustment on cockpit throttle quadrant.

a. Loosen screws locking serrated idle-adjustment plates (9) to engine control lever cover plates in cockpit.

b. With engine operating at 34 to 35 percent rpm, on main fuel system, move serrated idle adjustment plate (9) in front cockpit forward until joggle contacts engine control lever. Secure idle adjustment plate (9) in this position.

c. On airplanes prior to USAF Serial No. 51-4315, with front cockpit serrated idle-adjustment plate locked in position and front cockpit engine control lever against idle stop of serrated adjustment plate, move aft cockpit serrated idle adjustment plate forward until it touches engine control lever. Secure idle adjustment plate in this position.

d. Accelerate engine to approximately 68 percent rpm and then retard engine control lever to idle position. Engine speed should stabilize at 34 to 35 percent rpm.

Note

An allowable drop of 6 percent rpm from any setting between 32 and 36 percent rpm will be acceptable except that in no case shall a drop

below 28 percent rpm be accepted. Recovery from undershoot shall be within normal idle range.

e. If engine speed does not stabilize at 34 to 35 percent rpm, repeat steps a through d.

Note

If engine speed still undershoots the minimum of 28 percent rpm after repeating steps a through d, increase idle rpm setting toward the 36 percent idle setting so that undershoot rpm is not below 28 percent rpm. If undershoot below 28 percent rpm still occurs, replace main fuel control.

f. Stop engine, place engine control lever in idle detent and note position of pointer on emergency fuel control. The pointer should be in marked idle range.

g. If pointer is past high end of idle mark, lengthen intercontrol link (12) to get pointer 1/32 to 1/16 inch inside idle range. Decrease length of emergency control lever (11) to obtain a full open position approximately 5 degrees from full open mark.

4–337. EMERGENCY CONTROL IDLE ADJUSTMENT. *(See figure 4-70.)*

a. When main fuel control settings are completed satisfactorily, set emergency fuel control idle. With engine speed set at idle on main fuel system, move emergency fuel selector switch to EMERGENCY position. Maintain speed with throttle.

b. Find emergency idle band, a range of 15 degrees angular movement of emergency control throttle lever where no change in engine speed occurs by throttle movement. Check position of emergency control indicator to see that it is in idle band. If engine is not in this idle range, stop engine, advance throttle to idle detent, and set emergency pointer position in idle position by adjusting linkage. Increasing emergency lever arm length decreases the range of pointer; decreasing arm length increases range of pointer. Make check in paragraph 4–333, step d, after adjustment.

c. With throttle set in emergency control idle band and engine operating, adjust emergency idle speed to 34-37.5% (4000-4400 rpm) speed by turning needle clockwise to decrease speed or counterclockwise to increase it.

Note

This needle is very sensitive; a slight movement results in considerable change in speed.

d. Slowly accelerate engine to 68% speed (7990 rpm) and place emergency fuel selector switch in TAKEOFF AND LAND.

Note

When engine is operating at idle speed and changeover to main system is to be made, accelerate to 68% (7900 rpm) speed before returning emergency fuel selector switch to TAKEOFF AND LAND.

e. Reduce speed to 34% (4000 rpm) on main fuel system. Place emergency fuel selector switch in EMERGENCY and check position of emergency control indicator to be sure that pointer is in idle band. Adjust length of emergency link to obtain correct idle setting.

f. After each adjustment, start engine on main fuel system, switch operation to emergency fuel system, and retard throttle to idle detent.

g. Tighten emergency idle adjustment screw locknut to 30 to 35 lb in.

4–338. EMERGENCY CONTROL FULL THROTTLE ADJUSTMENT. *(See figure 4-70.)*

a. When emergency idle is properly set, check emergency control full-throttle speed. Maximum speed while operating on emergency fuel system is less than that available from the main system with the same cockpit throttle setting at compressor inlet temperatures below 30°C (86°F); emergency control does not compensate for temperature or engine speed. (Refer to tables 4-7 and 4-7A.)

Note

During operation with emergency fuel system and particularly during accelerations, regulate throttle to prevent excessive exhaust gas temperatures and overspeeding.

b. Slowly accelerate engine to full throttle on emergency fuel system. If full-throttle speed is not within limits in table 4-7, turn needle clockwise to decrease speed or counterclockwise to increase it. The needle has a range of 1/8 to 2-1/2 turns from fully seated.

c. When speed cannot be brought within limits of table 4-7 by needle adjustment, adjust emergency control link length to change full-throttle speed. If speed is too high, lengthen emergency control rod; if speed is too slow, shorten rod.

d. If it is necessary to make adjustments in order to obtain correct full-throttle position, recheck idle position and repeat idle adjustment procedure if necessary.

e. When engine is shut down, recheck "CUTOFF" and "FULL THROTTLE" positions of emergency control indicator.

f. Tighten emergency idle adjustment screw locknut to 30 to 35 lb in.

Table 4-7. Emergency Full Throttle Speed Limits

Ambient Temperature		*Minimum Speed*	*Maximum Speed*
°C	*°F*	*Percent rpm*	*Percent rpm*
−50	−58	85.8	89.8
−45	−49	86.4	90.4
−40	−40	87.0	91.0
−35	−31	87.6	91.6
−30	−22	88.2	92.2
−25	−13	88.9	92.9
−20	−4	89.3	93.3
−15	5	90.0	94.0
−10	14	90.6	94.6
−5	23	91.3	95.3
0	32	92.0	96.0
5	41	92.7	96.7
10	50	93.3	97.3
15	59	94.0	98.0
20	68	94.7	98.7
25	77	95.3	99.3
30	86	96.0	100.0
35	95	96.6	100.6
40	104	97.3	101.0
45	113	98.0	101.0

Table 4-7A. Maximum Engine Speed Normally Attainable During Low Temperature Operation

Ambient Temperature		*Engine Speed*
°C	*°F*	*Percent rpm*
−18	0	99.6
−23	−10	98.8
−29	−20	98.0
−34	−30	97.2
−40	−40	96.5
−46	−50	95.7
−51	−60	95.0

4–339. STARTING AND IGNITION SYSTEM.

4–340. DESCRIPTION OF STARTING SYSTEM. *(See figure 4-72.)* An electric starting motor receives energy from the battery or from an external power source, through a relay panel consisting of five relays. The starter control circuit is operated by a single-pole double-throw starter switch in each cockpit. When the starter switch in the aft cockpit is placed in either "START"

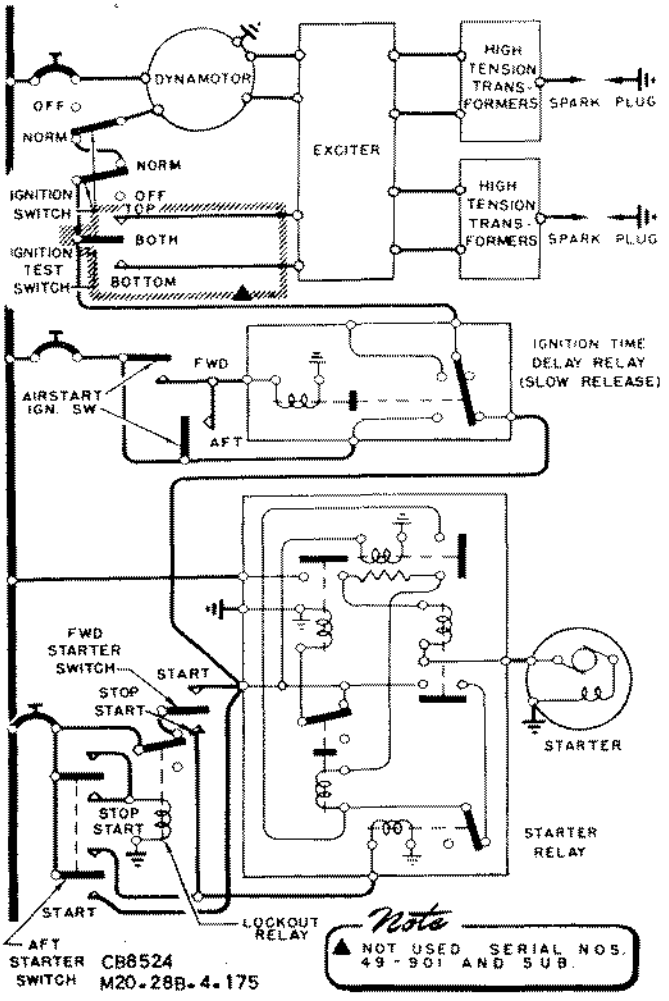


Figure 4-72. Starter and Ignition Circuit

or "STOP START" position, a lockout relay in the circuit overrides the forward cockpit starter switch. The aft cockpit switch may not be overridden from the front cockpit. The control circuit is protected by a 10-ampere circuit protector.

4–341. REMOVAL OF STARTER.

a. Disconnect starter electrical cables.

b. Remove six nuts securing starter to accessory case. Lift off starter.

c. Remove cotter pin, castellated nut, and washer from armature shaft.

d. Remove pinion gear and Woodruff key.

4–342. INSTALLATION OF STARTER.

a. Install Woodruff key in armature shaft of starter.

CAUTION

Omission of Woodruff key will permit starter armature to rotate without driving starter pinion gear.

b. Install pinion gear on armature shaft, and secure it with washer and castellated nut. Safety with cotter pin.

c. Install starter so that electrical terminals are in proper position. Install mounting washers and nuts. Refer to section VI for correct torque values.

d. Connect electrical cables.

4–343. OPERATION OF STARTER RELAY PANEL. *(See figures 4-73 and 4-74.)* When the bus is energized a small amount of current passes through the starter relay box and is grounded through the motor. This current holds the time delay open as shown in diagram "A," figure 4-73. Turning "ON" the starter switch energizes the control circuit, and, as shown in diagram "B," closes the accelerating relay, shorting out the time delay relay and connecting the bus to the motor through the 0.042 ohm current limiting resistor. After approximately ¾ second the time delay relay closes, energizing the motor relay. The motor relay shorts out the current limiting resistor and impresses full bus power on the motor. At this instant maximum current flows through the series relay, closing it. After the series relay has closed, the starter switch may be allowed to return to neutral, turning off the control circuit, and current from the bus will hold the accelerating relay and motor relay closed. The relay panel and resistor thus limit initial current delivered to the motor, and apply full battery voltage on the motor after it has begun to rotate.

4–344. When the engine starts and brings the engine rotor up to 17 to 19 per cent rpm, the current to the motor drops, opening the series relay. This in turn opens all the relays, disconnecting the power from the motor except for the very small amount used to keep the time delay relay open.

4–345. If it becomes necessary to stop the start before the motor has attained its speed, hold the starter switch in the "STOP START" position for one second. (See diagram "D.") This opens the stopping relay, breaks the circuit to the other relays, and shuts off power to the motor.

4–346. DESCRIPTION OF ELECTRONIC IGNITION CIRCUIT. *(See figure 4-72.)* The electronic ignition system consists of a dynamotor, an exciter, two transformers, and two ignition plugs. On airplanes having AF Serial Nos. 48-356 through 48-375, 48-913 through

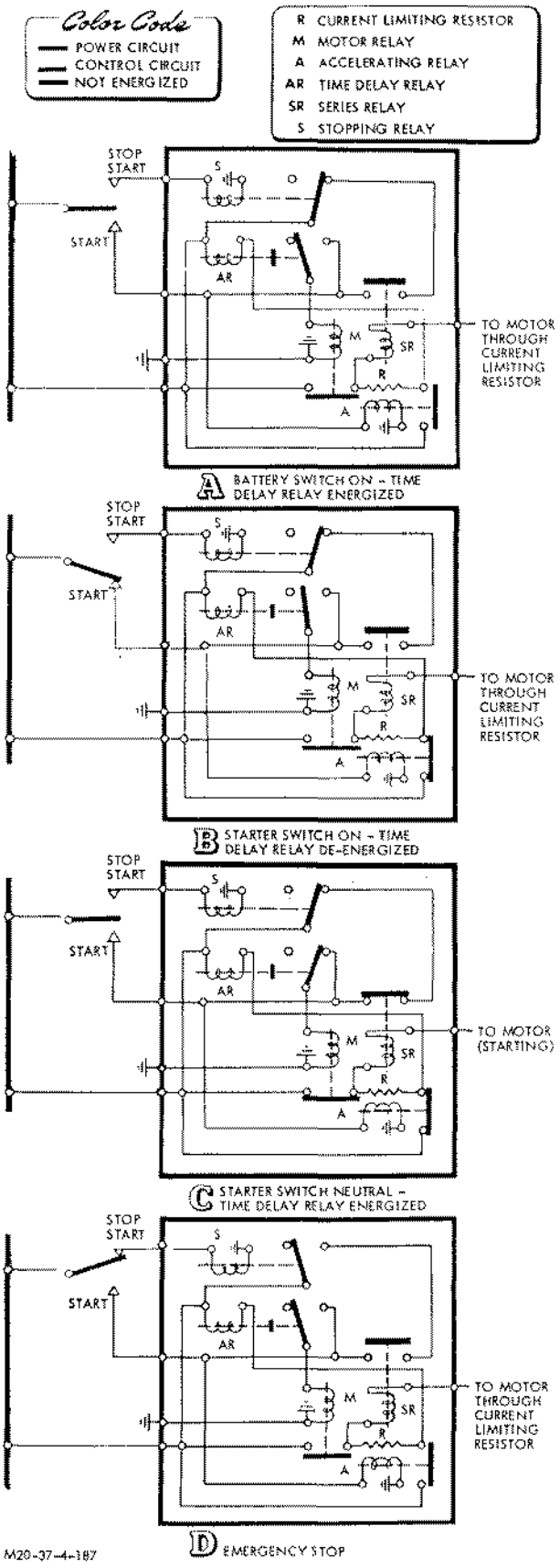
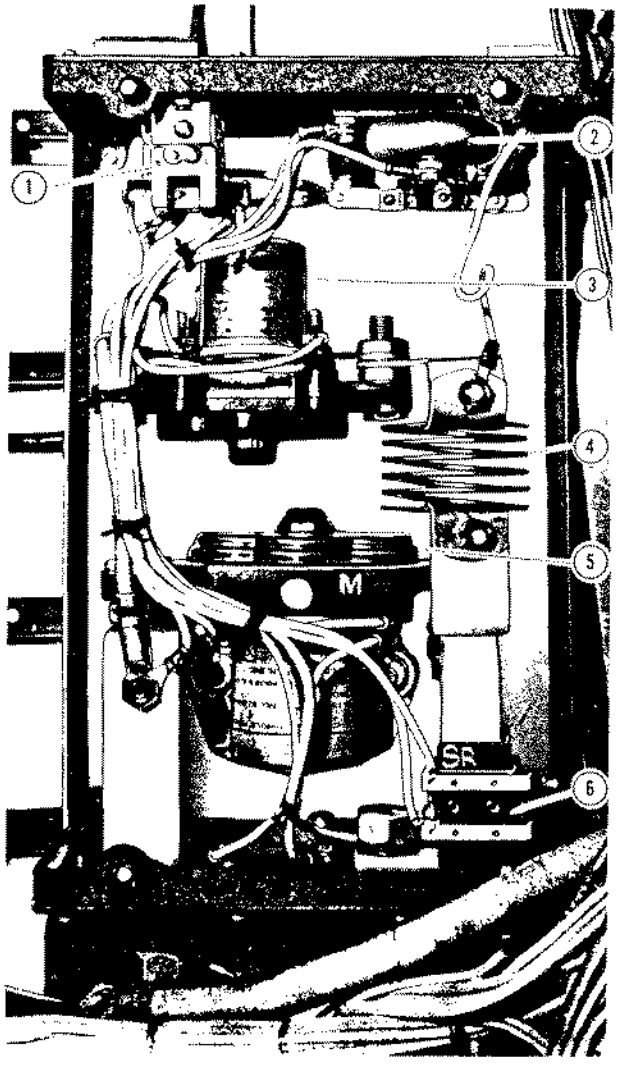


Figure 4-73. Starter Relay Panel Operation



1.	STOPPING RELAY
2.	TIME DELAY RELAY
3.	ACCELERATING RELAY
4.	CURRENT LIMITING RESISTOR
5.	MOTOR RELAY
6.	SERIES RELAY

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Figure 4-74. Starter Relay Panel

48-920, and 49-879 through 49-900, the exciter includes two charging and capacitance circuits, each triggered electronically. The low sparking rate circuit delivers approximately three to five sparks per second at the plugs through the dynamotor. The high sparking rate circuit in the exciter is not connected to the airplane starting and ignition system. On airplanes having AF Serial Nos. 49-901 and subsequent, the exciter contains two charging and capacitance circuits, each triggered electronically, but with a single sparking rate. The current delivered to the dynamotor produces approximately 30 sparks per second at the plugs.

CAUTION

On airplanes having AF Serial Nos. 48-356 through 48-375, 48-913 through 48-920, and 49-879 through 49-900, an ignition test switch is included in the circuit. This switch should be left in the "BOTH" position except when testing ignition circuits.

To hold the number of false starts to a minimum, aft cockpit ignition switch will be maintained in "NORMAL" position by lock-wiring switch guard with 0.020-inch soft copper wire, unless training requirements dictate otherwise.

4–346A. DESCRIPTION OF GANG START AIRSTART SWITCH CIRCUIT (AIRPLANES INCORPORATING T.O. 1T-33A-593). *(See figure 4-74A.)* The gang start airstart switch installed by T.O. 1T-33A-593 supplements and overrides the existing fuel and engine control switches. The circuit for this switch is a portion of the emergency airstart and ignition circuit (see figure 8-36A.) It is composed of momentary aft and forward gang start switches; gang start indicators (amber lights), ignition time delay relay, forward de-icing switch, aft and forward airstart engine ignition switches, airstart relay junction box, forward fuel sequence switch and circuit breakers. Actuating the gang start switches to their ON positions will simultaneously actuate the airstart ignition system, gang load the fuel booster pumps, turn the starting fuel ON in the automatic position, switch to the emergency fuel system and actuate the fuel de-icing system for approximately 45 seconds through the airstart ignition time delay relay. Once the gang start switches are actuated to their ON positions (indicated by the amber lights) all items controlled by these switches, except the airstart ignition and the fuel de-icing system, will remain ON until the gang start switches are momentarily depressed to their OFF positions. On airplanes incorporating T.O. 1T-33A-608, the gang start indicator light assembly, MS25041-4, which has been installed by T.O. 1T-33A-593 in both cockpits, is replaced with the AN3157-4 light assembly to eliminate any inadvertent actuation of the gang start system caused by the internal failure of the former light assembly. On airplanes that contain MS25331-8 light assembly, T.O. 1T-33A-608 converts the assembly to MS25331-4 configuration by installing the dimmable amber lens in lieu of the non-dimmable amber lens.

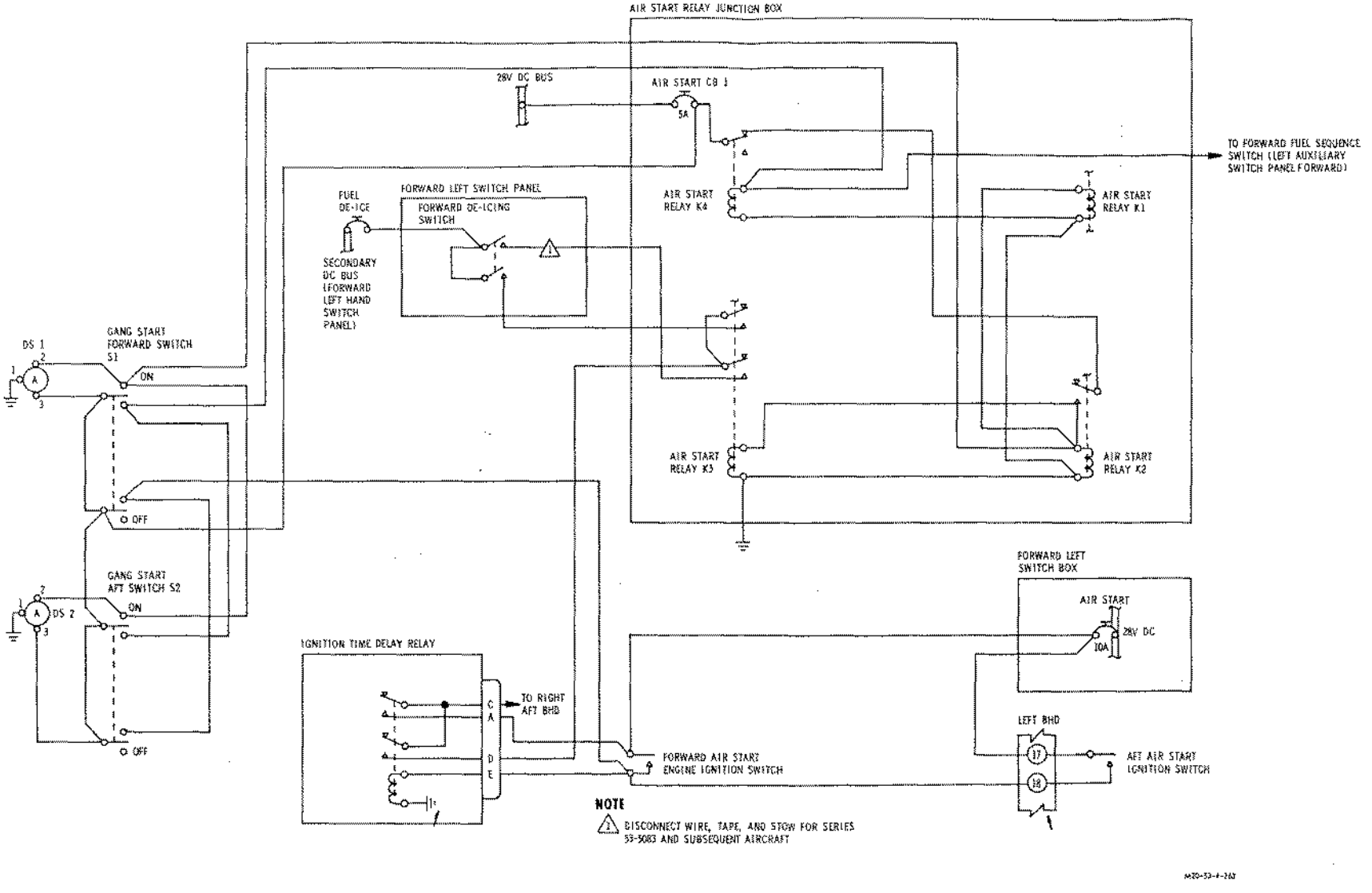


Figure 4-74A. Gang Start Airstart Switch Circuit

4-347. SPARK PLUGS. Spark plugs are used to ignite the fuel in the combustion chambers when starting the engine. Two spark plugs are used, and are mounted on bosses in the air adapters of combustion chambers Nos. 7 and 14. They are porcelain core plugs, and have electrodes long enough to extend into the combustion chambers. The gap between the electrodes should be maintained at from 0.070 to 0.080 inch.

4-348. REMOVAL OF SPARK PLUGS.

a. Turn aircraft ignition switch to "OFF." Disconnect high-tension shielded lead at spark plug.

WARNING

Serious injury to personnel may result from contact with an energized spark plug.

b. Remove two nuts securing spark plug to engine. Carefully remove plug and gasket.

4-349. DESCRIPTION OF STARTING TRANSFORMERS. Two transformers, one each adjacent to air adapters Nos. 7 and 14, are provided as part of the ignition system. Each transformer contains a removable air gap which may be replaced when failure occurs.

4-350. REMOVAL OF TRANSFORMERS.

a. Turn aircraft ignition switch "OFF." Disconnect high-tension lead and ignition harness at transformer.

WARNING

Serious injury to personnel may result from contact with an energized transformer.

b. Remove bolts holding transformer in place, and remove unit.

4-351. REMOVAL OF IGNITION HARNESS.

a. Remove engine from airplane. Refer to paragraph 4-301 for removal instructions.

b. Remove nuts and screws securing ignition harness lead connector to ignition disconnect plug.

c. Remove screw securing ignition harness lead mounting clamp to accessories gear case.

d. Disconnect ignition harness leads at both transformers.

e. Remove nuts securing ignition harness mounting brackets to engine, and remove harness.

f. Install protective covers over all electrical connectors that are disconnected.

4-352. MAINTENANCE OF SPARK PLUGS. To check spark plug operation, place ignition switch in "NORMAL," depress air start switch, and place ignition test switch in "TOP" position until sparking sound is heard. Place ignition test switch in "BOTTOM" position until sparking sound is heard. Release air start switch and place ignition test switch in "BOTH" position. On airplanes AF Serial Nos. 49-901 and subsequent, the ignition test switch is deleted. It will be necessary to remove plugs, ground shells, and reconnect high tension lead. Place ignition switch in "NORMAL," and depress air start switch. If spark across electrodes is unsatisfactory, replace defective plug.

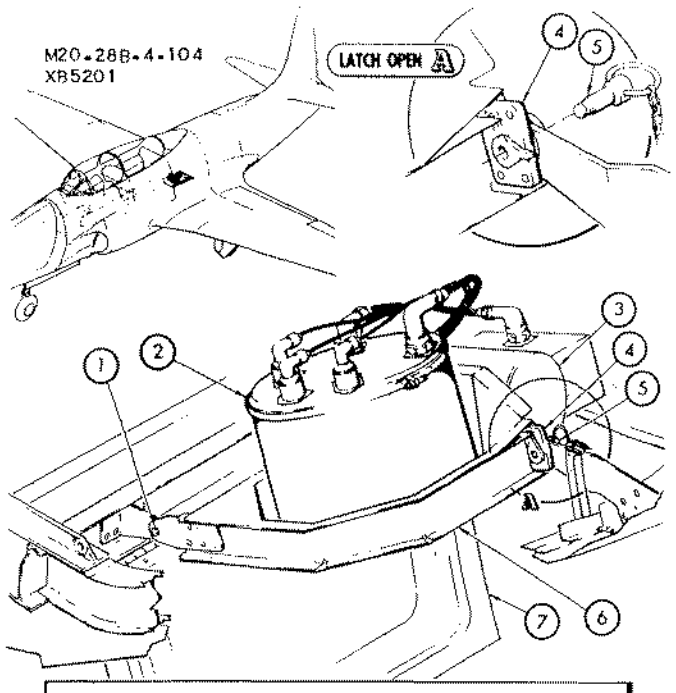
4-353. DESCRIPTION OF DYNAMOTOR AND EXCITER ASSEMBLY. *(See figure 4-75.)* One dynamotor and exciter assembly is installed on each airplane to supply current to operate the ignition system. The assembly is mounted on a door inside access door No. 65. The dynamotor supplies the ignition system voltage; the exciter stores the charge and triggers it through the transformers to the spark plugs.

4-354. REMOVAL OF DYNAMOTOR AND EXCITER ASSEMBLY.

a. Open lower right engine access door, No. 65.

b. Release assembly door latch; remove retaining pin and lower door.

c. Disconnect all electric leads from units.



1. HINGE BOLT
2. EXCITER
3. DYNAMOTOR
4. QUICK RELEASE LATCH
5. LATCH PIN
6. EXCITER MOUNTING FRAME
7. ENGINE LOWER RIGHT ACCESS DOOR

Figure 4-75. Dynamotor and Exciter Installation

d. Remove two bolts holding assembly door in place, and remove door.

e. Remove mounting screws holding individual units to door, and remove units.

4-355. TROUBLE SHOOTING OF IGNITION SYSTEM.

Trouble	*Probable Cause*	*Remedy*
Only one plug sparks.	Spark plug gap too wide.	Reset gap if necessary.
	Defective transformer.	Interchange transformers. Replace if defective.
	High-tension lead conductor broken.	Continuity test. Replace if defective.
	High-tension lead insulation defective.	High-voltage test. Replace if defective.
	Short circuit in harness.	Ohmmeter test. Replace if defective.
	Open circuit in harness.	Continuity test. Replace if defective.

Trouble	*Probable Cause*	*Remedy*
Only one plug sparks.	Short circuit in dynamotor-exciter lead.	Ohmmeter test. Replace if defective.
	Open circuit in dynamotor-exciter.	Continuity test. Replace if defective.
	* Solenoids inoperative.	Replace exciter assembly.
	Defective resistor or condenser in exciter.	Replace exciter assembly.
No spark at either plug in either ground or air start position.	Battery weak or battery circuit overloaded.	Recharge or replace batteries.
	Circuit breaker tripped.	Reset circuit breaker.
	Open circuit in dynamotor-exciter lead.	Continuity test. Replace if defective.
	Short circuit in dynamotor-exciter lead.	Ohmmeter test. Replace if defective.
	Short circuit in exciter-disconnect lead.	Ohmmeter test. Replace if defective.
	Open circuit in exciter-disconnect lead.	Continuity test. Replace if defective.
	Short circuit in harness.	Ohmmeter test. Replace if defective.
	Open circuit in harness.	Continuity test. Replace if defective.
	Dynamotor filter contacts fouled.	Clean relay contacts.
	Dynamotor filter coil defective.	Check relay. Replace complete filter if defective.
	Dynamotor defective.	Check dynamotor output. Replace dynamotor if defective.
Weak spark at one plug, or plug sparks intermittently.	Plug gap too wide.	Check and reset gap.
	Defective storage condenser in exciter.	Replace exciter.
	Defective resistor or condenser in exciter.	Replace exciter.
No spark at either plug in air start position (ground start position fires).	Fouled contacts in time delay switch.	Replace if defective.
	Fused contacts in time delay switch.	Replace if defective.
System produces radio interference.	Loose covers or connections.	Check all covers, securing nuts, and spanner nuts for tightness.
	Open condenser in filter assembly.	Replace filter assembly.
System trips circuit breaker.	Short-circuited condenser in dynamotor filter.	Replace filter assembly.
	Defective resistor or condenser in exciter.	Replace exciter.
	Defective dynamotor.	Replace dynamotor.
Dynamotor inoperative.	Weak battery.	Recharge or replace.
	Open wiring.	Continuity test. Repair if defective.
	Dynamotor relay defective.	Replace dynamotor.
Filter relay operates but dynamotor inoperative.	Relay contacts fouled.	*Remove filter cov and check voltag at dynamotor terminal No. 2 with system energized. If battery voltage appears at terminal No. 2, replace dynamotor. If no voltage appears at terminal No. 2, replace filter assembly. **Replace dynamotor.

* Applies to variable discharge rate system only.
** Applies to single discharge rate system only.

4–356. OIL SYSTEM.

(See figure 4-76.)

4–357. DESCRIPTION OF OIL SYSTEM. The engine lubrication system consists of a supply reservoir, a combination lubricating and scavenging pump, a filter, and a pressure transmitter. The pump and filter are mounted on the accessory gear casing. The supply reservoir is an integral part of the accessory-drive gear casing and is formed by the gear casing and the engine front-bearing support casting. The reservoir contains an oil supply of 12 U.S. quarts (10 Imperial quarts). The minimum supply allowable is 10 U.S. quarts (8.33 Imperi quarts). Oil quantity is measured with a bayonet gage

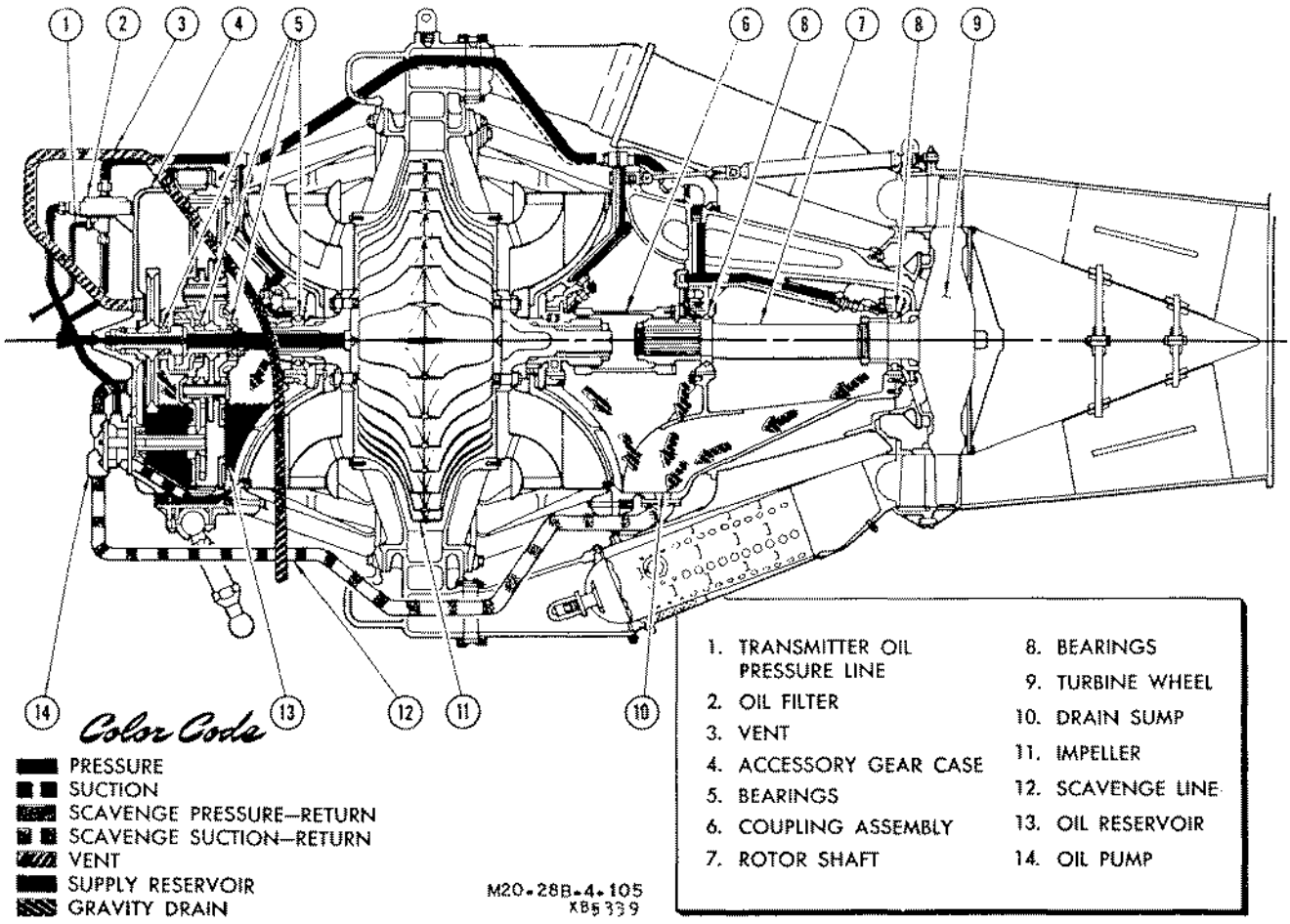


Figure 4-76. Engine Oil System

which is attached to the filler cover located on the left side of the accessory-gear casing, when facing the front. The oil supply is adequate for 10 hours of continuous operation at normal rated speed.

4–358. OPERATION OF OIL SYSTEM. Lubricating oil is delivered under pressure to the bearings through a two-element lubricating and scavenging pump. The pump is located on the accessory-gear casing. The lubricating oil passes from the pump to an oil filter, and then through external tubing to the four rotor bearings and the couplings. Oil seals prevent oil leakage past the front and rear compressor bearings and the rear turbine bearing. Oil is returned to the reservoir by gravity and suction.

4–359. All gears and bearings in the accessory drive casing are lubricated by a splash system from the gear which drives the pump.

4–360. OIL PUMP. A combination lubricating and scavenging pump is mounted on accessory-gear case slightly below the center, at front of engine. The pump is equipped with a relief valve, which bypasses oil from the discharge side of the lubricating pumping element through a port in the mounting flange directly back into the gear case. This valve is designed to open at from 80 to 100 psi, and is not adjustable. Except in an emergency, the pump must not be disassembled except for cleaning. If overhaul or repairs are necessary, replace pump.

4–361. REMOVAL OF OIL PUMP.

a. Disconnect oil lines to pump at fittings.

b. Remove six bolts securing pump to gear case, and remove pump.

c. Remove from pump all fittings which are necessary for installation of replacement pump. Inspect and clean scavenge port finger strainer. Install fittings on replacement unit.

4–362. INSTALLATION OF OIL PUMP. Reverse removal procedure.

Note

Refer to Section VI for torque values of mounting nuts, fittings, and hose clamps.

4–363. INSPECTION AND FLUSHING OF ENGINE OIL SYSTEM. The oil pump inlet finger screen should be inspected for indication of green lacquer particles when oil gage fluctuation is greater than plus or minus 3 psi, or oil consumption is in excess of one quart per hour. In the event such inspection discloses green particles are present in the oil pump inlet screen, and not exceeding the amount to cover one square inch of the total area of the screen, the following flushing procedure will be accomplished:

a. Remove all accessible oil filters and strainers.

b. Disconnect flex line from accessory case oil filter pressure outlet to front compressor bearing support at fitting on bearing support.

c. Remove magnetic oil drain plug.

d. Connect an external pumping system to fitting on compressor front bearing support.

e. Circulate kerosene, Specification VV-K-211B, through system for a period of 15 minutes, and completely drain from the accessory case.

f. Circulate engine oil, Specification MIL-L-6081, in the same manner for five minutes and allow oil to completely drain from engine.

g. Remove external circulating system line from fitting on compressor front bearing support.

h. Reinstall flex line to fitting on compressor front bearing support and reinstall filters, strainers and magnetic drain plug.

i. Fill engine oil system with 12 quarts of engine oil, Specification MIL-L-6081, and run up engine to check for fluctuating oil pressure. If no fluctuation beyond allowable plus or minus 3 psi is observed, return engine to service.

j. When engine has been in service for five hours, oil filter screens should again be checked for indications of lacquer particles. In the event further lacquer particles are found on oil pump inlet finger screens, and do not exceed in quantity the amount required to cover one square inch of total screen area, the same inspection and flushing procedure should be repeated.

CAUTION

All engines having green lacquer particles exceeding one square inch of total area of pump inlet screen will be removed for major overhaul.

4–364. OIL FILTER. *(See figure 4-77.)* A flat disc-type oil filter is located in oil pressure line on all engines between oil pump and engine bearings. Each unit incorporates filter discs and a relief valve. Relief valve is set to open between 15 and 19 psi differential pressure.

4–365. REMOVAL OF OIL FILTER.

a. Disconnect and cap inlet and outlet lines.

b. Remove bolt and spacer fastening accessories housing vent-tube clamp to oil filter. Slide clamp out of position, and remove bolts holding filter to engine. Remove filter.

4–366. CLEANING OIL FILTER.

a. Cover both ends of cartridge assembly shaft with tape.

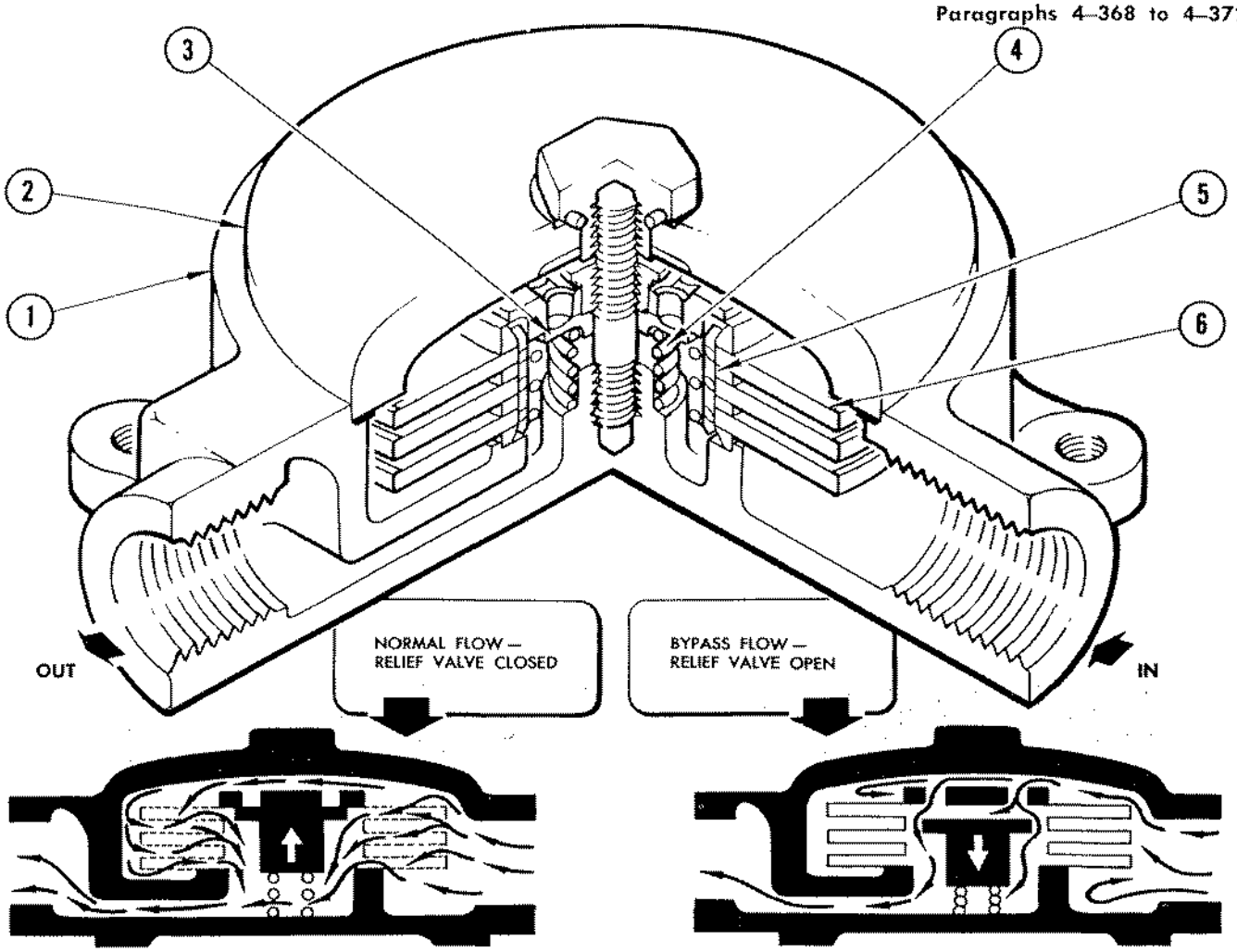
b. Slosh assembly in solvent. Remove tape and inspect filter discs.

CAUTION

Exercise great care to prevent entry of dirt or other foreign material into inner passage of filter cartridge assembly. Do not use compressed air for cleaning or drying filter as there is danger of damaging filter discs.

c. Wash filter body in solvent.

4–367. OIL PRESSURE TRANSMITTER, LIQUID (PRIOR TO AF SERIAL NO. 49-922). An oil pressure transmitter is located on the fuselage structure in the engine compartment. Pressure, through a line from the accessory gear case on the engine, registers on a gage on the instrument panel in the cockpit. The unit is the same as the fuel pressure transmitter, and is similar in operation and servicing. For detailed information, refer to paragraph 4–465 and figure 4-100.



1.	FILTER BODY	4.	VALVE RETURN SPRING
2.	FILTER CAP	5.	FILTER DISC SHAFT
3.	RELIEF VALVE	6.	FILTER DISC

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Figure 4-77. Oil Filter

4–368. OIL PRESSURE TRANSMITTER, ELECTRICAL (AF SERIAL NO. 49-922 AND SUBSEQUENT). An autosyn oil pressure transmitter is mounted on the engine accessory gear case. Pressure is transmitted to the autosyn by an oil actuated diaphragm in the transmitter unit.

4–369. OIL HEATER AND OIL THERMOSTAT. Provisions are made in the accessory gear case for two oil heaters and one oil thermostat. These units may be installed by removing threaded plugs and inserting the units.

4–370. FUEL SYSTEM.

WARNING

Observe safety precautions contained in paragraph 3–57, when performing maintenance on aircraft fuel system.

4–371. GENERAL DESCRIPTION OF FUEL SYSTEM. The fuel system is divided into two sections: the airplane system and the engine system. The parts that remain with the airplane when the engine is removed make up the airplane system. All other components are included in the engine system.

4–372. DESCRIPTION OF AIRPLANE FUEL SYSTEM. *(See figures 4-78 through 4-82.)* The airplane fuel system consists of the following parts: drop tanks, wing outboard and leading-edge tanks, wing inboard tanks, fuselage tank, float valves, fuel pumps, filters,

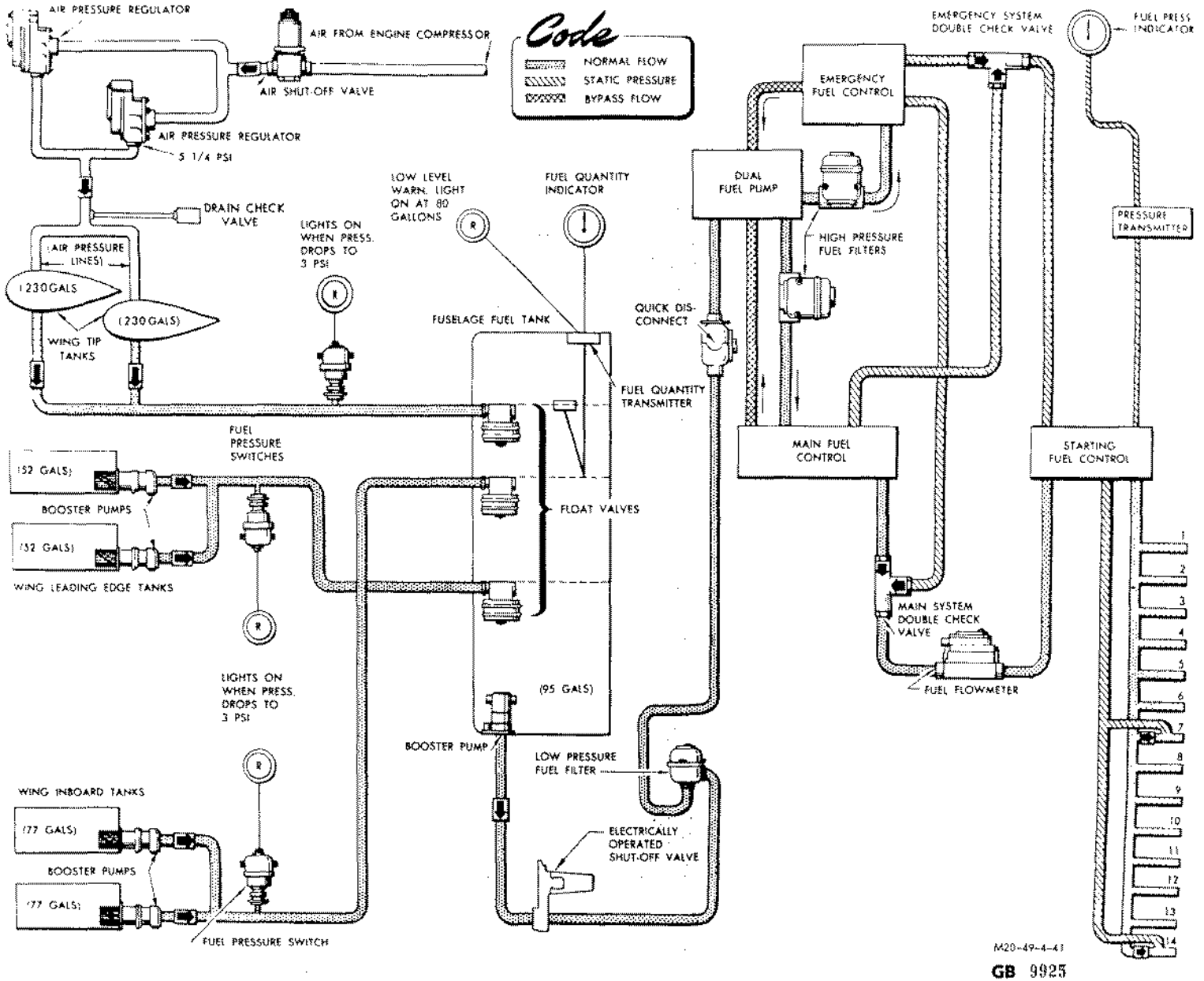
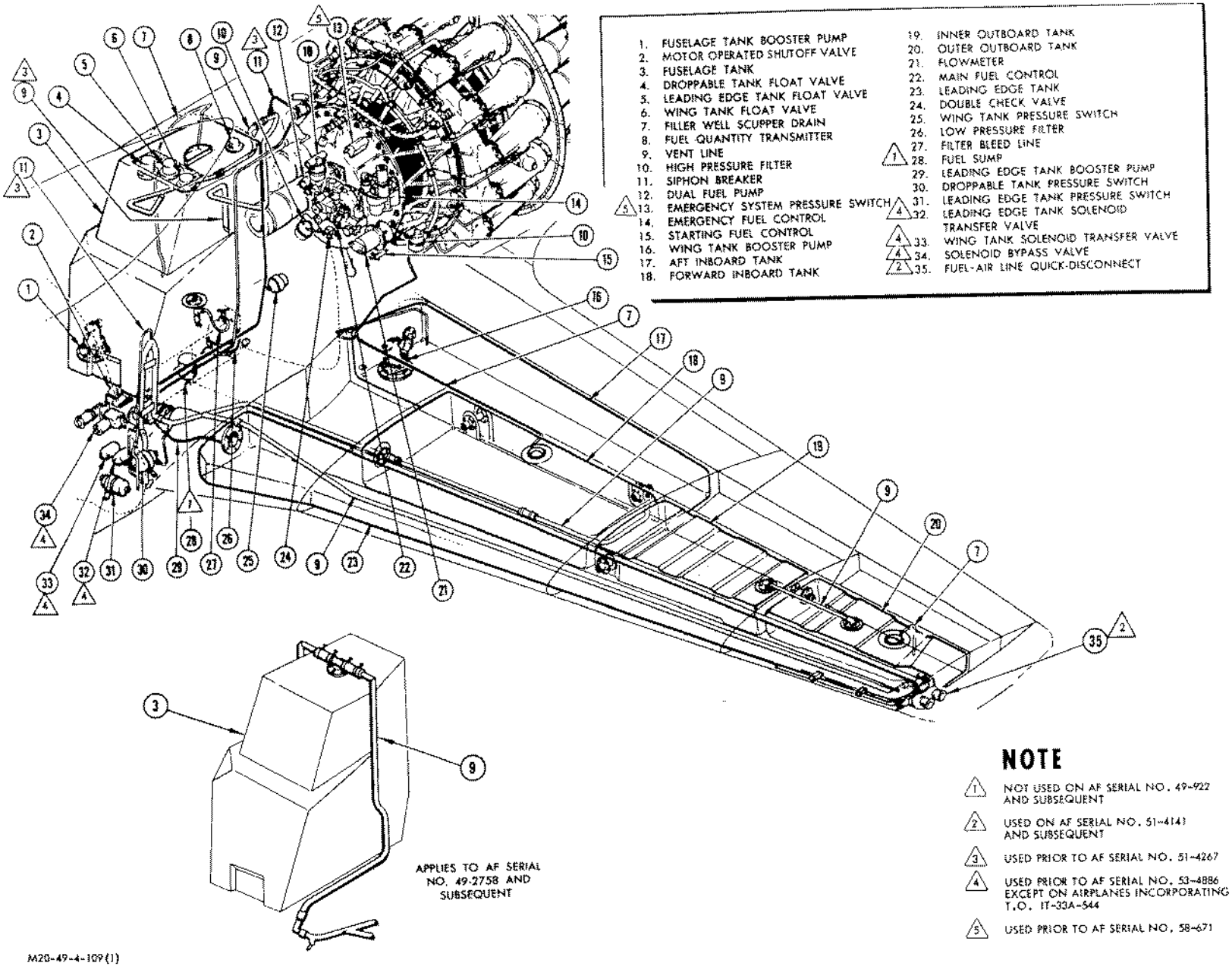


Figure 4-81A. Fuel System Schematic Diagram, AF Serial No. 58-671 and Subsequent



NOTE

△1 NOT USED ON AF SERIAL NO. 49-922 AND SUBSEQUENT

△2 USED ON AF SERIAL NO. 51-4141 AND SUBSEQUENT

△3 USED PRIOR TO AF SERIAL NO. 51-4267

△4 USED PRIOR TO AF SERIAL NO. 53-4886 EXCEPT ON AIRPLANES INCORPORATING T.O. 1T-33A-544

△5 USED PRIOR TO AF SERIAL NO. 58-671

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Figure 4-82. Fuel System Units Location Diagram (Sheet 1 of 2)

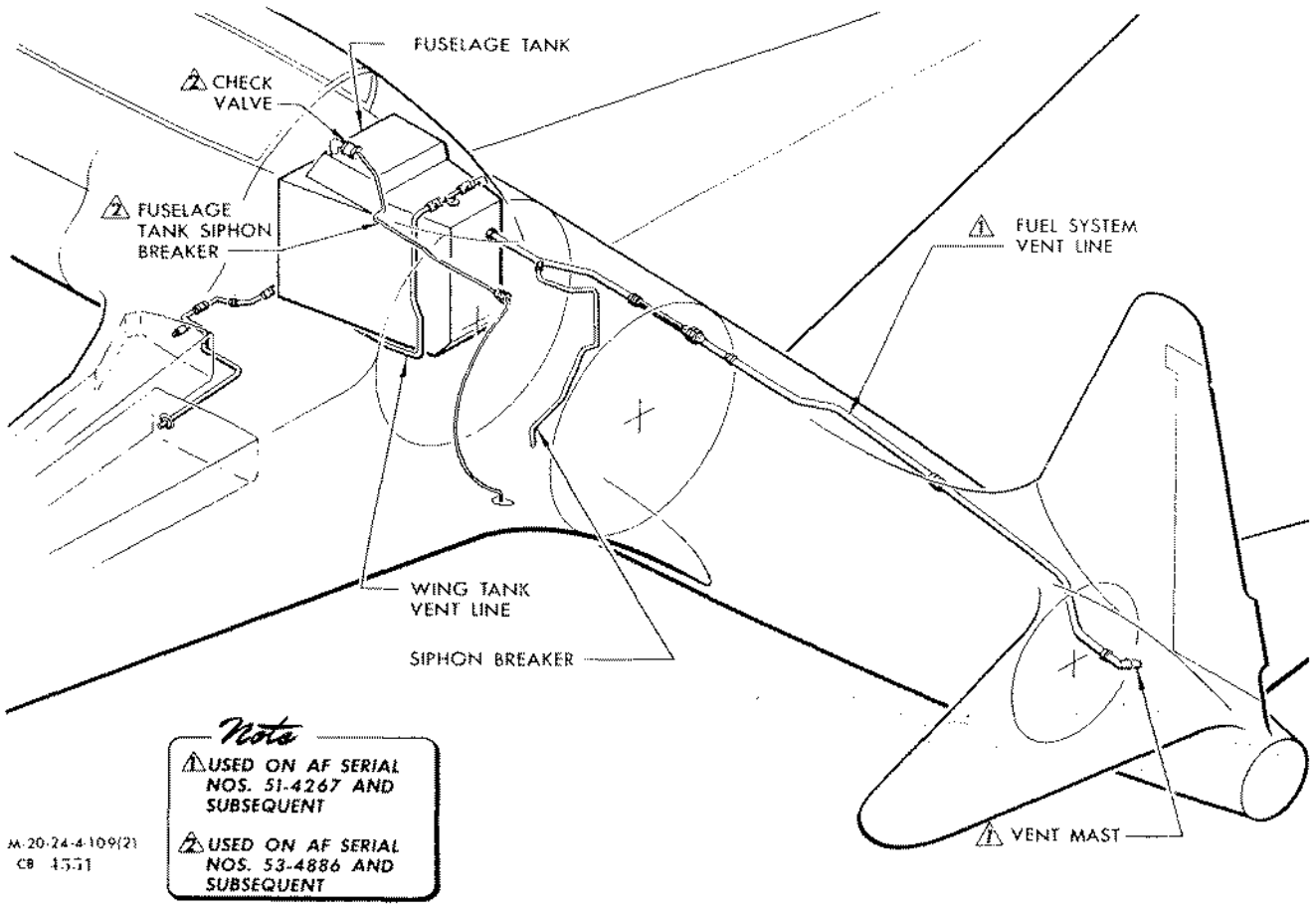


Figure 4-82. Fuel System Units Location Diagram (Sheet 2 of 2)

system shutoff valve, check valves, fuel pressure transmitter, fuel flowmeter, fuel level transmitter, fuel pressure switches and prior to AF Serial No. 53-4886, solenoid valves.

4–373. OPERATION OF AIRPLANE FUEL SYSTEM. There are 13 fuel tanks in the fuel system, all of which are suitable for use with aromatic fuels. Each side of the wing incorporates two inboard tanks, two outboard tanks, and a leading edge tank. The leading edge and both outboard tanks are interconnected, and the two inboard tanks are interconnected. A fuel tank is installed in the fuselage immediately aft of the cockpit. Provision is made for attachment of a droppable tank to each wing tip. Fuel is forced from the droppable tanks by air pressure supplied by the engine compressor. It is pumped from the wing tanks by electrically operated booster pumps, one located at the root of each leading edge tank, and one in the root of each aft inboard tank. Fuel is normally supplied to the engine from the fuselage tank, and, as the supply is depleted in this tank, is continuously replenished from the droppable tanks, and wing tanks.

CAUTION

Do not add alcohol to the fuel system by means of the fuel tanks, regardless of the type of tanks installed. Adding alcohol to the fuel tanks will result in damage to components of the fuel system.

4–374. To operate the fuel system, lift the selector bar of the fuel system switch panel. This opens the droppable tank air-pressure solenoid valve, and turns on the booster pumps for all tanks.

CAUTION

Under no condition will fuel booster pumps be energized when the respective fuel tanks are empty.

Note

If droppable tanks are not installed, return the droppable tank switch to the "OFF" position.

4–375. Transfer of fuel to the fuselage tank is regulated by three float valves installed in the tank. When the fuel level in the fuselage tank drops to the level of the upper float valve this opens and fuel is forced from the droppable tanks to the fuselage tank. When the droppable tanks are emptied, a pressure switch operates an indicator light adjacent to the control switches to show that the droppable tanks are empty. Additional lowering of the fuselage-tank fuel level opens the middle float valve to permit delivery of fuel from the leading edge tank, prior to AF Serial No. 53-4886, and from the inboard tanks, AF Serial No. 53-4886 and subsequent, to the fuselage tank. Upon transfer of all fuel from these tanks to the fuselage tank, a pressure switch operates a warning light indicating that the transfer of fuel has been completed. The leading-edge-tank fuel pumps, prior to AF Serial No. 53-4886, and the inboard tank pumps on AF Serial No. 53-4886 and subsequent, should be shut down at this time to reduce the electrical load. The indicator light will then turn off. When the fuel level in the fuselage tank reaches and opens the lowest float valve, fuel is transferred from the inboard tanks, prior to AF Serial No. 53-4886, and from the leading edge tanks on AF Serial No. 53-4886 and subsequent. An indicator light is actuated by a pressure switch in the fuel line to show when these tanks are empty. The tank pumps should be shut down at this time to decrease the electrical load and to turn off the indicator light.

4–376. All tanks are provided with drain plugs that extend through the tank panels. To drain fuel, turn the slotted head of the drain one complete revolution.

CAUTION

When replacing tank fittings or manhole covers, bring parts to the best possible alignment so the screws or bolts can be started with minimum torque. Then tighten all screws as much as possible with the fingers, as this may reveal threads in poor condition. Replace any screws with burred threads. Fittings with burred threads may be retapped with the same size tap. Tighten screws alternately on opposite sides of fitting or cover. Tighten all screws to three-fourths of the maximum required torque. Finally, tighten all screws in accordance with torque values called for in subsequent paragraphs.

4–377. The float valves are near the top of the fuselage tank, so that after all fuel has been transferred from the wing tanks, almost the entire capacity of the fuselage tank is still available.

4–378. A low-level switch contained within the fuel-gage transmitter actuates a warning light on the instrument sub-panel when the fuselage tank fuel level drops to approximately 80 gallons. The fuel gage indicates only the quantity of fuel in the fuselage tank.

4–379. Prior to AF Serial No. 53-4886, except on airplanes incorporating T. O. 1T-33A-544, the bypass switch is combined with the fuselage tank pump switch so that when the switch is placed in the "BYPASS" position, the fuselage tank pump is shut off. To return the system to normal operation, return the switch to the fuselage-tank pump "ON" position.

4–380. A fuel flowmeter is installed which actuates a counter on the instrument sub-panel to give the pilot an accurate indication of the total quantity of fuel remaining in all the fuel tanks.

4–381. FUEL SYSTEM CLEANING AND FLUSHING. This procedure is to be used at time of IRAN or when the fuel system is known to be contaminated, to restore the system to a "new airplane" state of cleanliness.

4–382. The normal fuel system contaminants are solid particles of dirt, sand, rust, paint and metal which enter the system through the filler caps and travel progressively through the system. If fuel contamination is detected promptly and those tanks provided with filler caps are cleaned, it may be unnecessary to clean the entire system except at IRAN. Whenever any of the fuel tanks are opened for maintenance, the tank interior should be inspected for contamination.

4–383. CLEANING AND FLUSHING PRECAUTIONS.

WARNING

In fueling and defueling operations a minimum distance of over 10 feet from any other aircraft must be maintained. This distance will be measured from the fueling, defueling point and/or vents of aircraft being serviced to the closest part of adjacent aircraft.

a. Attach static ground wire to main landing gear during all servicing, defueling, purging or maintenance.

b. Deleted.

c. All other work on aircraft will be suspended during servicing, maintenance or draining except when the portion of fuel system being worked on has been purged and declared safe and free from all explosive vapors.

d. Ground all work stands, power units and other equipment to same ground as used for aircraft.

e. Appropriately grounded fire extinguishers will be placed convenient to aircraft and work area.

f. Non-synthetic clothing will be worn while performing fuel system maintenance (preferably cotton clothing).

g. All tools will be non-ferrous and power tools will be air driven.

h. Electric lights and flashlights will be of explosion proof type.

i. Dust particles finer than 10 microns can pass through filters. Quantities of 10 grams (⅓ ounce) per thousand gallons can damage fuel controls or cause them to stick. It is therefore essential that all tubing be capped after cleaning and that all fuel cell openings be plugged with suitable closures.

WARNING

Tape will not be used to seal any fuel line, hose, cell or container.

j. Fuel cells that will remain without fuel in them for more than 72 hours will have a thin coating of oil, Federal Specification VV-O-581, SAE 8, 10, 20, or 30, AF Stock No. 7500-689000, applied to the tank interior.

k. Corrosion products will not normally be found in the fuel system. However, if white or yellow powdery materials are found, they may indicate corrosion from naphthenic acids or mercaptans. In the event these deposits are found in the tanks, all valves should be checked for similar deposits.

l. Rags can never be considered lint free and yet it is not practical to avoid their use. Metal surfaces on which rags have been used should be wiped dry and inspected for lint. On other surfaces, the use of rags should be followed by a rinse with solvent, Federal Specification P-D-680, Type II, to remove lint. Final wiping can be done with a chamois skin.

4–384. CLEANING AND FLUSHING OF TANKS AND PLUMBING. The general procedure is to clean or flush the entire system with solvent, Federal Specification P-S-661. Contaminants will normally collect in tanks and in any parts of valves and fittings which are not scrubbed by the natural turbulence of fuel flow. Fuel velocities in the transfer lines are usually sufficient to keep tubing scrubbed clean of contaminants so that this plumbing need not be flushed. It is possible for contaminants to be carried into the vent lines. This plumbing should be flushed at IRAN, but need not be cleaned in the field unless the system is heavily contaminated. Internal corrosion of transfer plumbing or the presence of adhering or encrusting deposits is highly improbable, but not impossible. At least one tube in the transfer line from each tank should be visually checked for this condition. It is only necessary to observe the few inches of the tube visible from the end. Corroded or encrusted tubes must be replaced. The sequence of the following procedure may be varied as necessary:

a. On airplanes prior to AF Serial No. 53-4886 and not incorporating T.O. 1T-33A-544, perform the following operations prior to defueling airplane:

Close fuel system shutoff valve.

Disconnect fuel line just upstream of low pressure fuel filter and plumb fuel line into a drum.

Open fuel system shutoff valve.

Place fuselage tank switch in "BYPASS".

Place leading edge tank switch in "ON" and pump approximately 10 gallons of fuel into drum.

Place leading edge tank switch in "OFF".

Place wing tanks switch in "ON" and pump approximately 10 gallons of fuel into drum.

Place wing tanks switch in "OFF".

Note

This procedure will flush the bypass system plumbing and eliminate the necessity of removing this tubing from the aircraft for cleaning.

b. Drain entire airplane fuel system, including tip tanks and all system water drains.

c. Remove tiptanks (refer to paragraphs 4–410 through 4–412) and clean (refer to paragraph 4–385).

d. Remove tiptank fuel-air quick-disconnect, 500-1251 (refer to paragraph 4–428). Flush disconnect with solvent over a screen. If contaminants found in screen do not contain evidence of corrosion, disconnect can be reinstalled without being disassembled for cleaning. If evidence of corrosion is found, disassemble disconnect, clean all parts in solvent, replace corroded parts and reassemble unit.

e. Disconnect air lines from top tank air shutoff valve and from both tip tank pressure control valves.

f. Blow out tip tank air lines with air at between 60 to 100 psi.

g. Blow out tip tank pressure control valve with air at a pressure not to exceed 60 psi.

CAUTION

Do not blow air into outlet port of valve.

h. Reinstall plumbing which was disconnected in steps e and f.

i. Disconnect leading-edge tank vent lines at leading edge tank boost pump adapters. Remove outboard wing tank filler cap. Flush vent line from subcockpit end with at least one gallon of solvent at a flow rate of not less than 10 gpm.

j. Cap wing tank vent lines at leading-edge tank disconnect point.

k. On airplanes prior to AF Serial No. 49-2758, disconnect wing tank vent lines from vent masts. Disconect aft wing tank vent lines from inverted U-vent lines. Remove inboard wing tank filler caps. Flush vent lines from subcockpit end into aft wing tanks with at least one gallon of solvent at a flow rate of not less than 10 gpm.

l. On airplanes prior to AF Serial 49-2758, remove inverted U-vent lines from subcockpit. Flush with solvent and reinstall.

m. On airplanes AF Serial No. 49-2758 and subsequent, disconnect wing tank vent lines from tee on top of fuselage tank. Remove inboard wing tank filler caps. Flush vent lines from end of line adjacent to fuselage tank tee with at least one gallon of solvent at a flow rate of not less than 10 gpm.

n. Drain all fuel tanks and vent lines. Reassemble tubing disconnected in steps k and l. Reinstall tank filler caps.

o. Remove inboard wing tank boost pump (refer to paragraph 4–437).

p. Remove screws attaching tank drain fittings to tank access panels.

q. Remove wing tank access panels.

r. Remove access bars from tanks and clean tank interiors by applying solvent with a rag or chamois.

s. Clean all fuel and vent interconnects between tanks with solvent injected into tubing from a spray nozzle.

t. Following cleaning with rags or chamois, spray tank interiors with solvent to further insure tank cleaness and to preserve tank flexibility.

u. Clean Thompson wing tank boost pumps (refer to paragraph 4–386). Replace Pesco wing tank boost pumps with new or overhauled units.

Note

Field cleaning of Pesco pumps should not be attempted due to critical clearances between pump impeller and pump housing which must be adjusted when assembling unit.

v. Remove leading edge tank boost pumps (refer to paragraph 4–432).

w. Inspect interior of leading-edge tanks for contamination through boost pump openings. If contamination is found, proceed with steps x through aa. If no contamination is found, skip to step ac.

Note

If contaminants are present, they will have gravitated to inboard end of tanks and can be seen through the use of a light and mirror.

x. Remove leading-edge (refer to paragraph 4–15, steps a through p).

y. Remove tank access bars and clean tank interiors by applying solvent with a rag or shamois.

z. Following cleaning with rags or chamois, spray tank interiors with solvent to further insure tank cleanliness and to preserve tank flexibility.

aa. If leading edge tanks contain contaminants and must be cleaned, replace leading edge tank boost pumps with new or overhauled units.

Note

Field cleaning of pump should not be attempted due to critical clearances between pump impeller and pump housing which must be adjusted when assembling unit.

ab. Install leading edge (refer to paragraph 4–16).

ac. Install leading edge boost pump (refer to paragraph 4–433).

ad. Close wing tanks and install wing tank access panels (refer to paragraphs 4–400 and 4–402 for tank torque values).

ae. Install wing tank boost pump (refer to paragraph 4–438).

af. Reconnect leading edge tank vent line which was disconnected in step g.

ag. Open fuselage fuel tank (refer to paragraph 4–404 steps a through s).

CAUTION

Do not enter tank.

ah. Cover fuselage tank boost pump screen with cloth or chamois.

ai. Flush tank walls with a solvent spray to make certain all contaminants are washed to bottom of tank.

aj. Swab out bottom of tank picking up as much of contaminants as possible so that upon entry into tank contaminating particles will not be ground into cell.

ak. Clean tank interior by applying solvent with a rag or chamois.

Note

Personnel entering fuselage fuel tank should wear wing socks to prevent fuel cell damage.

al. Following cleaning with rags or chamois, spray tank interior with solvent to further insure tank cleanliness and to preserve tank flexibility.

am. If heavy contamination is found in the field and at IRAN, remove fuselage tank boost pump (refer to paragraphs 4–404 and 4–436).

an. Clean Thompson or Romec fuselage tank boost pump, if removed (refer to paragraphs 4–387 and 4–388). Replace Pesco fuselage tank boost pump with new or overhauled unit.

Note

Field cleaning of Pesco pumps should not be attempted due to critical clearances between pump impeller and pump housing which must be adjusted when assembling unit.

ao. Clean fuel float valves (refer to paragraphs 4–389 and 4–390).

ap. Reassemble fuselage fuel tank (refer to paragraph 4–405).

CAUTION

If fuselage tank boost pump was not removed for cleaning, remove covering which was placed around pump screen.

aq. Remove two dual check valves in subcockpit. Flush with a stream of solvent and reinstall.

ar. Remove check valves from tip tank fuel transfer lines. Flush valves with a stream of solvent and reinstall.

as. Remove low pressure fuel filter (refer to paragraph 4–443).

at. Remove element from low pressure fuel filter (refer to paragraphs 4–441 and 4–442). Discard element.

au. Clean filter case and relief valve by sloshing in solvent. Install new element and reinstall filter.

av. Remove fuel system motor-operated shutoff valve (refer to paragraphs 4–456 and 4–457).

aw. Clean valve interior with a stream of solvent pay-ign particular attention to slot into which valve slide fits.

CAUTION

Keep solvent away from motor and electrical connector.

ax. Reinstall motor-operated shutoff valve (refer to paragraph 4–458).

ay. Remove fuel system quick-disconnect fitting half from aircraft and fitting half from engine. Mate two halves and flush fuel passage with a stream of solvent. Separate fitting and reinstall halves in aircraft and on engine.

az. Remove all fuel drain fittings from system and flush with a stream of solvent. Reinstall fittings.

ba. On airplanes prior to AF Serial No. 53-4886 and not incorporating T. O. 1T-33A-544, remove and clean the fuel transfer solenoid valves (refer to paragraphs 4–391 and 4–451).

bb. Reinstall fuel transfer solenoid valves.

bc. Remove high and low pressure sensing lines from de-icing system differential pressure switch and flush with solvent and reinstall.

bd. Install tip tanks (refer to paragraphs 4–413 through 4–415).

4–385. CLEANING AND FLUSHING OF TIP TANKS.

a. Remove access panels in tank center section.

b. Remove nuts holding tank clamp halves together and remove tank nose and aft sections from center section.

c. Remove tank sump cover and sump strainer.

d. Remove one web assembly from either forward or aft bulkhead in tank center section.

e. Remove fuel and air systm plumbing from center section.

f. Clean tank interior with a solvent spray taking particular care to clean under bulkheads and in all tank crevices.

Note

A wire brush or a stiff bristle brush can be used for this operation.

g. Flush all removed tubing with solvent.

h. Reassemble tank using new O-rings and gaskets.

CAUTION

Make certain that fuel and air system plumbing is properly positioned for the side of the aircraft on which the tank is to be used.

h. Plug fuel outlet at fuel disconnect fitting.

i. Apply air pressure at 15 psi to air disconnect fitting.

j. Tip tank sniffle valve should relieve at 9 ($\pm$ 0.5) psi.

k. Apply soap solution to all tank joints, access panels and drain screws. No external leakage is allowable.

4–386. CLEANING OF THOMPSON TF-29800 WING TANK BOOST PUMP.

a. Remove bolt and screw securing outlet fitting and cap to end frame assembly and remove outlet fitting.

b. Remove nuts retaining radio noise filter and remove filter.

c. Remove screw and unwrap screen from pump end frame assembly. Keep screen with pump from which it was removed for ease in reassembly as screen may have been trimmed to fit.

d. Remove screws attaching pump mounting flange to pump end frame assembly and remove flange.

e. Remove screws attaching pump throat to end frame assembly and remove throat.

f. Remove four screws and lock washers retaining bypass valve assembly and remove bypass valve.

g. Flush pump interior, throat, mounting flange, bypass valve and screen with a stream of solvent.

h. Reassemble pump using new gaskets and O-rings. Torque mounting flange screws to between 35 and 40 lb in. and outlet fitting bolt to a maximum of 200 lb in.

4–387. CLEANING OF THOMPSON TF-29600 FUSELAGE TANK BOOST PUMP.

a. Remove external fitting by removing fitting retaining bolt, washer and gasket. Remove screw, lift off cap retainer and cap.

b. Remove radio noise filter retaining screws and remove noise filter. Remove screw and nut and pull ground strap off shielding.

c. Remove screws securing screen to end frame assembly. Unwrap screen from end frame assembly. Keep screen with pump from which it was removed as screen may have been trimmed to fit.

d. Remove screws retaining pump mounting flange and remove mounting flange.

e. Remove screws holding pump throat to end frame assembly and remove throat.

f. Remove screws securing bypass valve assembly to end frame assembly and remove bypass valve.

g. Flush pump interior, throat, mounting flange, bypass valve and screen with a stream of solvent.

h. Reassemble pump using new gaskets and O-rings. Torque mounting flange screws to between 30 and 40 lb in. and outlet fitting bolt to a maximum of 200 lb in.

4–388. CLEANING OF ROMEC RR-11050 FUSELAGE TANK BOOST PUMP.

a. Remove external fitting by removing fitting retaining bolt, washer and gasket. Remove screw, lift off cap retainer and cap.

b. Remove four screws retaining bypass valve assembly to side of discharge port and remove bypass valve.

c. Remove radio noise filter.

d. Remove screws holding sump cover to lower body assembly and remove cover and inlet screen.

e. Remove screws securing pump shroud to lower body assembly and remove shroud.

CAUTION

Mark position of shims which lie between shroud and lower body assembly so that they may be reinstalled in exactly the same position.

f. Flush pump interior, shroud, screen, bypass valve and sump cover with a stream of solvent.

g. Reassemble pump using new gaskets and O-rings.

CAUTION

Make certain that shroud to lower body assembly shims are installed in the same position as originally installed.

4–389. CLEANING OF SCHULZ 2-652-1 FLOAT VALVE.

a. Remove screws attaching cage assembly to cover assembly and remove cage.

b. Remove screws attaching stem guide to poppet guide and remove stem guide.

c. Remove float assembly and stem as a unit.

d. Remove screws attaching cover assembly to valve body and remove cover.

e. Temporarily install stem guide with screws to use as a handle to remove poppet guide.

f. Remove poppet guide from body by using dowels inserted in body holes to compress guide retaining ring and at the same time pull on stem guide.

g. Remove spring from inside diaphragm.

h. Use pliers to extract diaphragm retaining ring.

i. Remove diaphragm retainer, diaphragm and poppet from body. Discard diaphragm.

j. Wash all parts in a bath of solvent.

k. Fit new diaphragm over poppet and place in body.

l. Fit diaphragm retainer inside diaphragm and secure with diaphragm retainer ring.

m. Place spring over stem of poppet fitting tapered end between stem and diaphragm.

n. Place poppet guide retaining ring around poppet guide. Slip stem of guide over stem of poppet but inside of spring. Compress ring to permit guide and ring to enter body until ring expands into body groove.

4–390. CLEANING OF SCHULZ 9-253-1 FLOAT VALVE.

a. Remove screws attaching cage assembly to cap and remove cage.

b. Remove screws attaching float and poppet assemblies to cap and remove assemblies as a unit.

Note

Do not disassemble this sub-assembly.

c. Remove screws securing cap assembly to body and remove cap.

d. Remove spring and piston from body.

Note

Do not attempt to remove Teflon ring from piston. If metal particles are embedded in Teflon ring, replace piston.

e. Clean all parts by washing in a bath of solvent.

f. Reassemble using new O-rings.

4–391. CLEANING OF FUEL TRANSFER SOLENOID VALVE.

a. Remove inlet fitting.

b. Remove piston and piston spring.

c. Remove solenoid and cartridge assembly as a unit.

d. Clean all parts except solenoid in a bath of solvent.

e. Reassemble using new O-rings.

Note

If O-ring which is spun into inlet fitting is damaged replace inlet fitting.

4–392. FUEL SYSTEM FLOW AND LEAK CHECK. The following procedure will be accomplished before the aircraft is returned to flight status after cleaning and flushing the fuel system:

a. Check fuel quantity indicator for "EMPTY" indication.

Note

Low level warning light shall be on.

b. Disconnect fuel system line upstream of low pressure fuel filter and plumb in a fuel flow transmitter and connect electrically to airplane fuel flow counter.

c. Connect a hose to flow transmitter of sufficient length to reach wing tank filler wells.

d. On airplanes prior to AF Serial No. 53-4886 and not incorporating T.O. 1T-33A-544, flow check the bypass system as follows:

Put 20 gallons of fuel in left leading edge tank and 3 gallons in each of the other three wing tanks.

Place bypass hose in left wing tank filler well. Turn on left leading edge tank boost pump and bypass entire 20 gallons. Minimum flow shall be 6 gallons in 30 seconds. Leading edge pressure switch shall be out during transfer and come on when tank is empty.

Repeat above flow test from left wing tank to right leading edge tank.

Repeat above flow test from right leading edge tank to right wing tank.

Repeat above flow test from right wing tank to fuselage tank.

e. Fill fuselage tank and check for operation of low level warning light and for full setting of quantity indicator.

f. Put 10 gallons of fuel in each leading edge tank, 10 gallons in each wing tank and 25 gallons in each tip tank.

g. With bypass hose in a drum, turn on fuselage and leading edge boost pumps. Minimum flow shall be 8.3 gallons in 30 seconds. Note that fuel quantity indicator remains constant during flow from leading edge tanks and that indicator drops when leading edge tanks stop flowing. Leading edge tank warning light shall be out during transfer and come on when leading edge tanks stop transferring.

Note

On airplanes AF Serial No. 55-4410 and subsequent, perform step h before step g.

h. With bypass hose in a drum, turn on fuselage and wing tank boost pumps. Minimum fuel flow shall be 8.3 gallons in 30 seconds. Note that fuel quantity indicator remains constant during flow from wing tanks and that indicator drops when wing tanks stop flowing. Wing tank warning light shall be off during transfer and come on when transfer stops.

i. With bypass hose in left wing tank, turn on fuselage and tip tank switches. Tip tanks must be pressurized from an outside air source. Time tip tank flow when flow starts in fuselage tank until tip tank light comes on. Maximum allowable time is 4 minutes 30 seconds. Note that fuel quantity indicator remains constant during tip tank flow and that indicator drops when the tip tanks stop flowing.

j. Make certain that fuel level in fuselage tank is below level of lowest float valve.

k. Remove bypass line and flow transmitter. Reconnect plumbing for normal operation.

l. Fill leading edge tanks. Transfer fuel to fuselage tank. Transfer must be stopped by leading edge float valve.

Note

On airplanes AF Serial No. 55-4410 and subsequent, perform step m before step l.

m. Fill wing tanks. Transfer fuel to fuselage tank. Transfer must be stopped by wing tip tank float valve.

n. Fill tip tanks. Transfer fuel to fuselage tank. Transfer must be stopped by wing tip tank float valve.

o. Top all fuel tanks.

p. Check all plumbing for leakage with all boost pumps operating .

4–393. OUTBOARD WING TANKS. *(See figure 4-83.)* Two outboard tanks are positioned end-to end spanwise of each wing, just inboard of the tip and aft of the front beam. These two tanks are interconnected and empty into the leading-edge tank. The filler neck for the outboard wing tanks and the leading-edge tank is located in the outboard tank. A fitting for draining each tank is provided. Access to the outboard tanks is gained through panel No. 19.

4–394. REMOVAL OF OUTBOARD WING TANKS.

a. Drain fuel from tanks.

b. Remove screws attaching filler well to wing upper surface.

c. Remove screws attaching drain fittings to access panel.

d. Remove access panel No. 19.

e. Remove manhole covers from tanks and disconnect hose clamps within the tanks from fuel and vent lines.

f. Unsnap tank from overhead portion of tank cavity.

g. Slip tank away from piping and disconnect filler-well overflow tube.

h. Remove tanks.

4–395. INSTALLATION OF OUTBOARD WING TANKS. Reverse removal procedure. Moisten tank fittings with water to facilitate installation of piping. On Firestone fuel cells, all fitting bolts are torqued to between 40 and 50 lb in., except nipple type fittings, which

d. On airplanes prior to AF Serial No. 53-4886 and not incorporating T.O. 1T-33A-544, flow check the bypass system as follows:

Put 20 gallons of fuel in left leading edge tank and 3 gallons in each of the other three wing tanks.

Place bypass hose in left wing tank filler well. Turn on left leading edge tank boost pump and bypass entire 20 gallons. Minimum flow shall be 6 gallons in 30 seconds. Leading edge pressure switch shall be out during transfer and come on when tank is empty.

Repeat above flow test from left wing tank to right leading edge tank.

Repeat above flow test from right leading edge tank to right wing tank.

Repeat above flow test from right wing tank to fuselage tank.

e. Fill fuselage tank and check for operation of low level warning light and for full setting of quantity indicator.

f. Put 10 gallons of fuel in each leading edge tank, 10 gallons in each wing tank and 25 gallons in each tip tank.

g. With bypass hose in a drum, turn on fuselage and leading edge boost pumps. Minimum flow shall be 8.3 gallons in 30 seconds. Note that fuel quantity indicator remains constant during flow from leading edge tanks and that indicator drops when leading edge tanks stop flowing. Leading edge tank warning light shall be out during transfer and come on when leading edge tanks stop transferring.

Note

On airplanes AF Serial No. 55-4410 and subsequent, perform step h before step g.

h. With bypass hose in a drum, turn on fuselage and wing tank boost pumps. Minimum fuel flow shall be 8.3 gallons in 30 seconds. Note that fuel quantity indicator remains constant during flow from wing tanks and that indicator drops when wing tanks stop flowing. Wing tank warning light shall be off during transfer and come on when transfer stops.

i. With bypass hose in left wing tank, turn on fuselage and tip tank switches. Tip tanks must be pressurized from an outside air source. Time tip tank flow when flow starts in fuselage tank until tip tank light comes on. Maximum allowable time is 4 minutes 30 seconds. Note that fuel quantity indicator remains constant during tip tank flow and that indicator drops when the tip tanks stop flowing.

j. Make certain that fuel level in fuselage tank is below level of lowest float valve.

k. Remove bypass line and flow transmitter. Reconnect plumbing for normal operation.

l. Fill leading edge tanks. Transfer fuel to fuselage tank. Transfer must be stopped by leading edge float valve.

Note

On airplanes AF Serial No. 55-4410 and subsequent, perform step m before step l.

m. Fill wing tanks. Transfer fuel to fuselage tank. Transfer must be stopped by wing tip tank float valve.

n. Fill tip tanks. Transfer fuel to fuselage tank. Transfer must be stopped by wing tip tank float valve.

o. Top all fuel tanks.

p. Check all plumbing for leakage with all boost pumps operating .

4–393. OUTBOARD WING TANKS. *(See figure 4-83.)* Two outboard tanks are positioned end-to end spanwise of each wing, just inboard of the tip and aft of the front beam. These two tanks are interconnected and empty into the leading-edge tank. The filler neck for the outboard wing tanks and the leading-edge tank is located in the outboard tank. A fitting for draining each tank is provided. Access to the outboard tanks is gained through panel No. 19.

4–394. REMOVAL OF OUTBOARD WING TANKS.

a. Drain fuel from tanks.

b. Remove screws attaching filler well to wing upper surface.

c. Remove screws attaching drain fittings to access panel.

d. Remove access panel No. 19.

e. Remove manhole covers from tanks and disconnect hose clamps within the tanks from fuel and vent lines.

f. Unsnap tank from overhead portion of tank cavity.

g. Slip tank away from piping and disconnect filler-well overflow tube.

h. Remove tanks.

4–395. INSTALLATION OF OUTBOARD WING TANKS. Reverse removal procedure. Moisten tank fittings with water to facilitate installation of piping. On Firestone fuel cells, all fitting bolts are torqued to between 40 and 50 lb in., except nipple type fittings, which

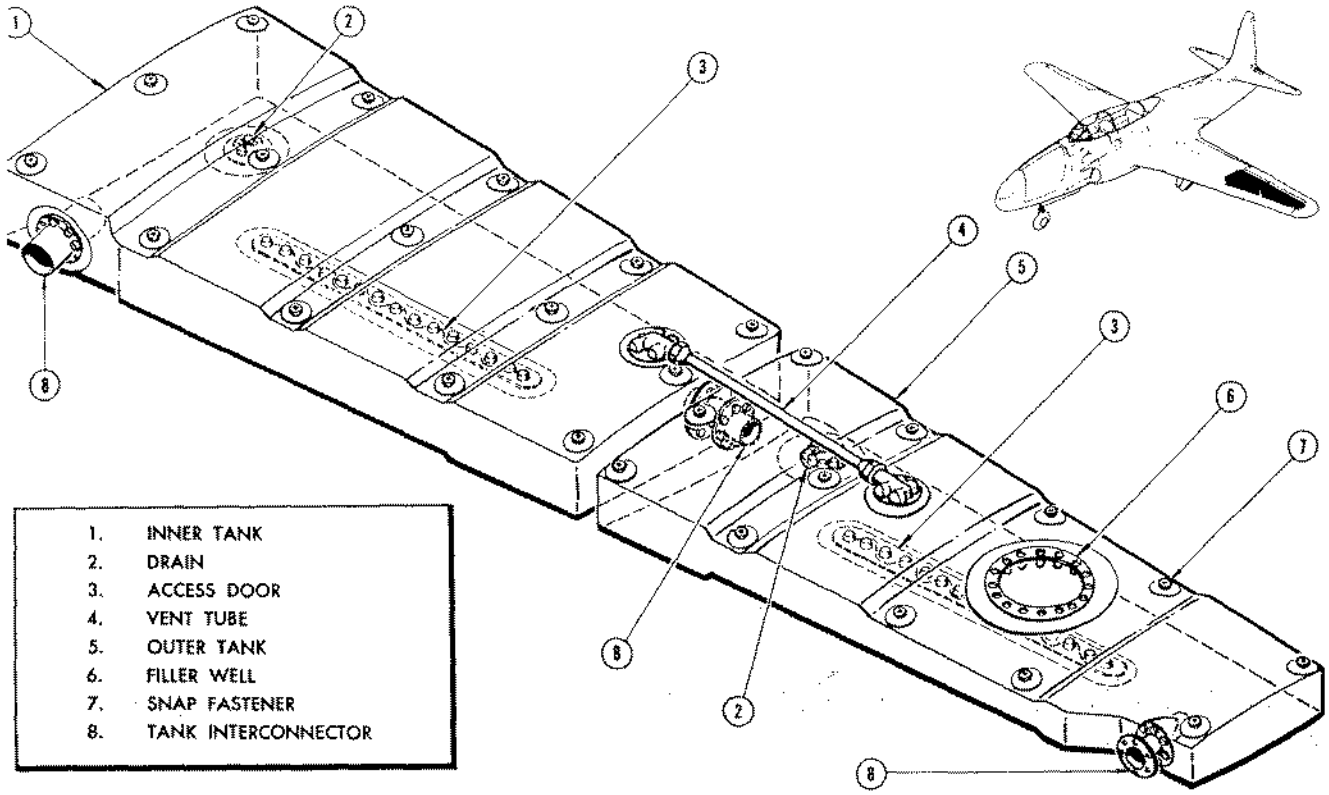


Figure 4-83. Outboard Wing Tanks

are torqued to between 20 and 30 lb in. On B.F. Goodrich fuel cells, torque all fitting bolts to between 20 and 30 lb in.

Note

On B.F. Goodrich fuel cells, retorquing should be accomplished at least one hour after initial torquing, and preferably four hours after initial torquing.

The gasket in the outer wing tank interconnectors must be properly seated before tightening bolts.

4–396. LEADING-EDGE TANKS. *(See figure 4-84.)* A tank is installed in each wing leading edge. Each tank is provided with a drain fitting in the bottom of the tank. The fuel from the outboard wing tanks is fed into the leading-edge tanks and from there to the fuselage tanks. Each leading-edge tank is filled through the outboard wing tank.

4–397. REMOVAL OF LEADING-EDGE TANKS. *(Refer to paragraph 4–15.)*

4–398. INBOARD WING TANKS. *(See figure 4-85.)* The wing inboard tanks are located one forward and one aft of the main beam just outboard of the main alighting gear. (See figure 4-82.) The fore and aft tanks are inter-connected and are filled through a well in the forward tank. The tanks are vented to each other by a tube at the outboard end of the tanks. Both tanks are vented to atmosphere by a tube from the inboard end of the forward tank. The fuel pump for both tanks is attached to the inboard lower surface of the aft tank.

4–399. REMOVAL OF FORWARD INBOARD WING TANKS.

a. Drain fuel from both the forward and aft tanks.

b. Remove screws attaching filler well to wings upper skin.

c. Remove screws attaching drain fitting to access panel.

d. Remove tank access panel No. 21.

e. Remove manhole covers and remove hose clamps from vent and fuel lines within the tanks.

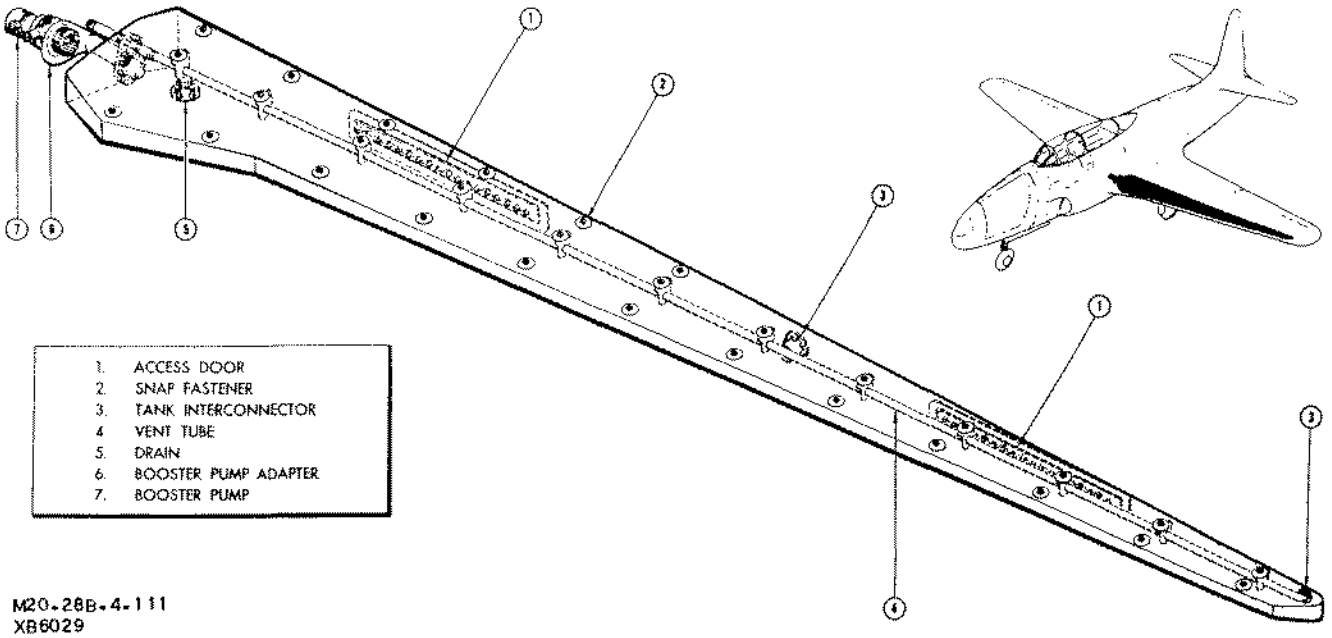


Figure 4-84. Leading Edge Wing Tank

f. Unsnap tank from overhead portion of tank cavity.

g. Disconnect external plumbing and remove tank.

4–400. INSTALLATION OF FORWARD INBOARD WING TANKS. Reverse removal procedure. Moisten piping with water to facilitate installation. On Firestone fuel cells, all fitting bolts are torqued to between 40 and 50 lb in., except nipple type fittings, which are torqued to between 20 and 30 lb in. On B.F. Goodrich fuel cells, torque all fitting bolts to between 20 and 30 lb in.

Note

On B.F. Goodrich fuel cells, retorquing should be accomplished at least one hour after initial torquing, and preferably four hours after initial torquing.

4–401. REMOVAL OF AFT INBOARD WING TANKS.

a. Drain fuel from both the forward and aft tanks.

b. Remove pump access panel.

c. Remove tank access panel and pump. For pump removal, refer to paragraph 4–437.

d. Remove tank manhole covers, and remove hose clamps from vent and fuel lines within tanks.

e. Remove external plumbing connections.

f. Unsnap tank from overhead portion of tank cavity.

g. Remove tank.

4–402. INSTALLATION OF AFT INBOARD WING TANKS. Reverse removal procedure. Moisten piping with water to facilitate installation. On Firestone fuel cells, all fitting bolts are torqued to between 40 and 50 lb in., except nipple type fittings, which are torqued to between 20 and 30 lb in. On B. F. Goodrich fuel cells, torque all fitting bolts to between 20 and 30 lb in.

Note

On B. F. Goodrich fuel cells, retorquing should be accomplished at least one hour after initial torquing, and preferably four hours after initial torquing.

4–403. FUSELAGE TANK. *(See figure 4-86.)* The fuselage fuel tank is located immediately aft of the cockpit, and is accessible through panel No. 29. The filler well is located on the upper forward surface of the tank. The filler-well overflow is routed over the right side of the tank. The fuel quantity gage transmitter is installed immediately aft of the filler well, and is accessible for adjustment through a hinged door. The forward end of the tank upper surface is fitted with a manhole cover. The vent outlet is on the aft face of the tank, and the drain cock and booster pump attachment are on the bottom surface. The three tank inlets are on the forward face of the tank.

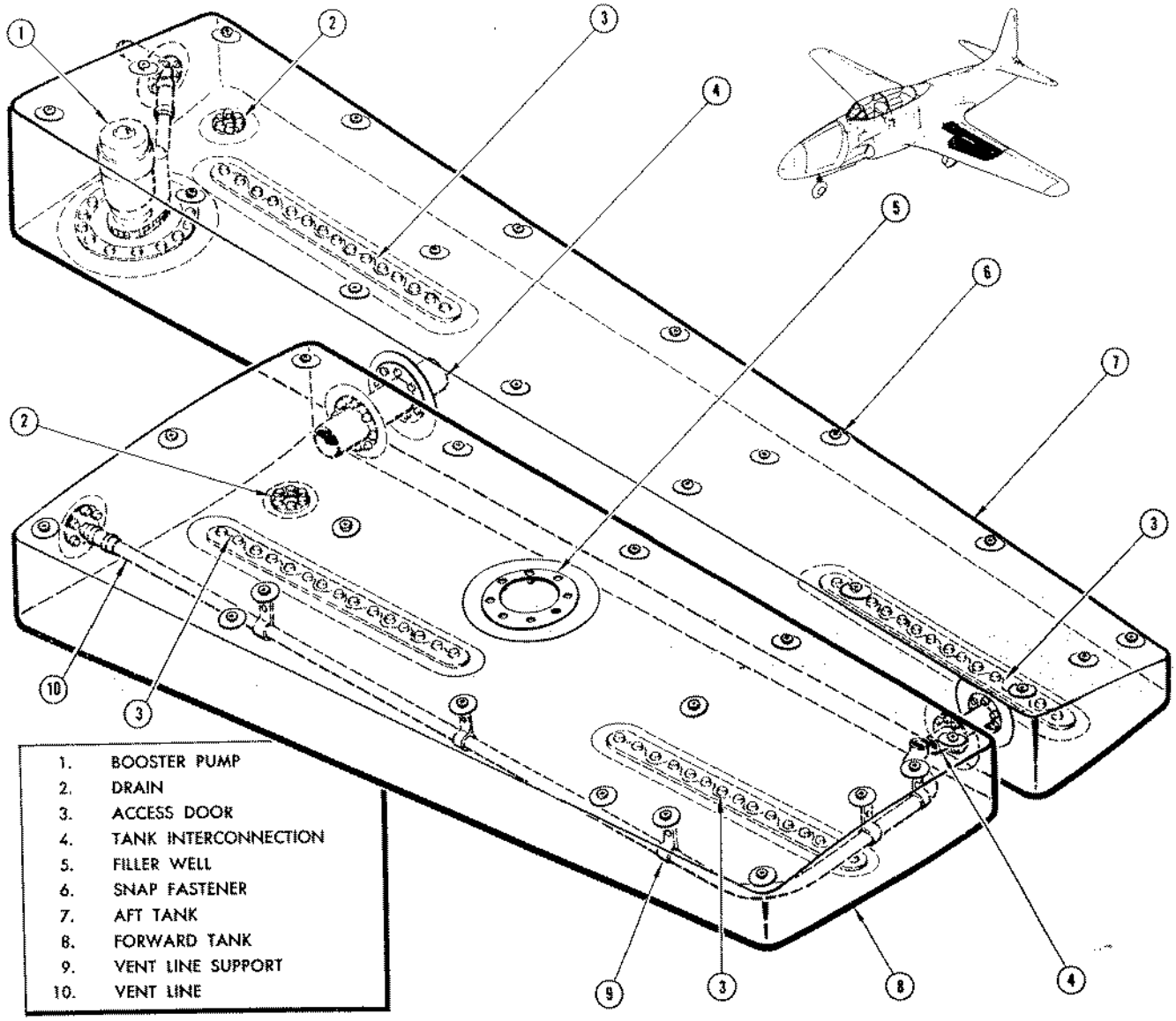


Figure 4-85. Inboard Wing Tanks

WARNING

Vapors from aircraft fuel, rubber cement, and solvent are dangerously toxic, even if inhaled for only a short period of time. If it is necessary to enter fuselage fuel tank for inspection and repair, personnel must wear an air supplied respirator with a full facepiece. A second member equipped with an air supplied respirator will standby in case of emergency. All air supplied during fuel cell inspection or repair must be filtered and completely free of oil, water, solvent vapors, dirt, and other foreign substances.

4–404. REMOVAL OF FUSELAGE TANK.

a. Drain fuel.

b. Prior to AF Serial No. 49-984, remove cockpit canopy. (Refer to paragraph 4–91.)

c. On AF Serial No. 53-5086 and subsequent, remove bolts holding filler cap assembly to filler well and remove cap assembly.

d. Remove bolts holding tank filler well to tank through filler well opening.

e. Remove screws securing tank cover panel.

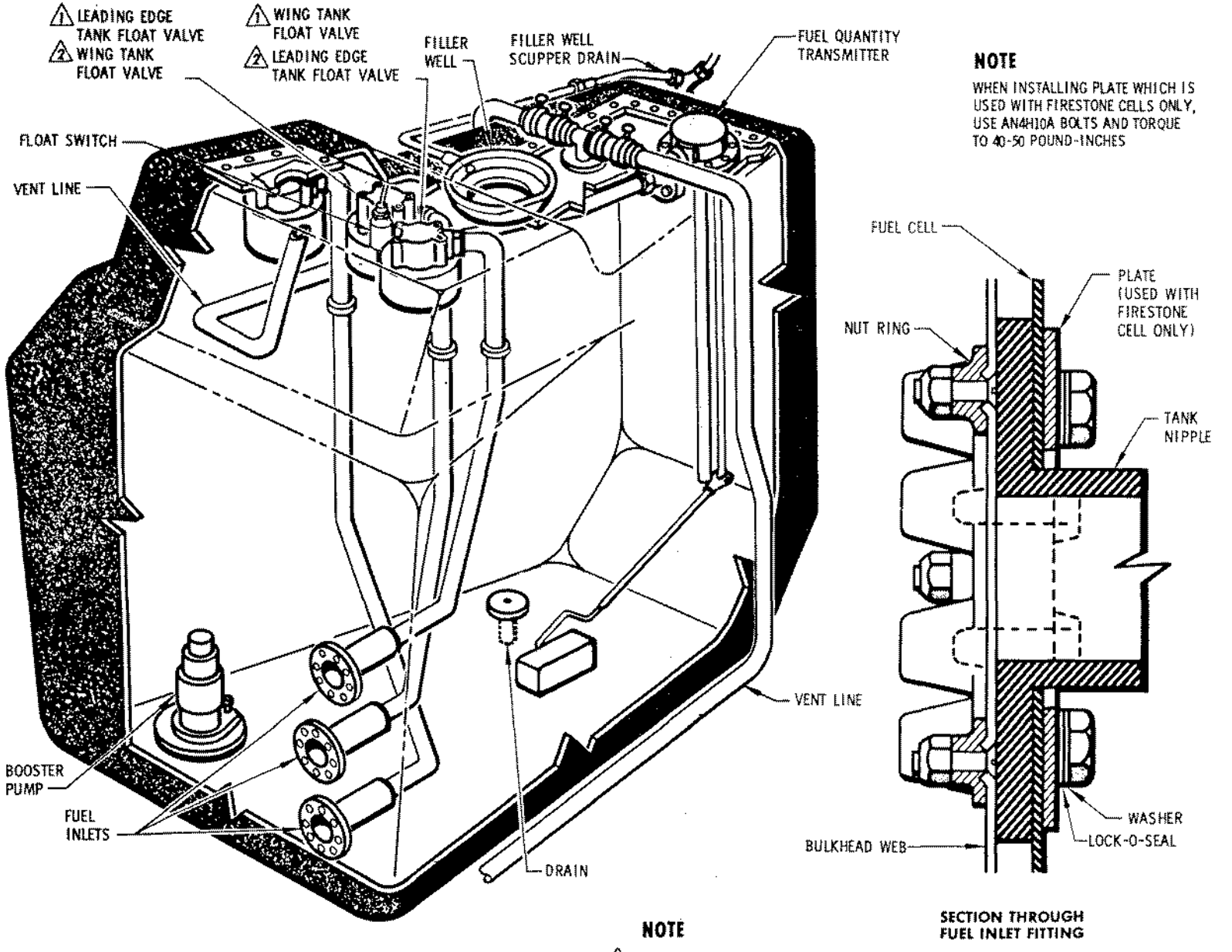


Figure 4-86. Fuselage Tank

f. Prior to AF Serial No. 55-4410, lift cover panel slightly and disconnect scupper drainline at filler well through fuel quantity transmitter access panel and remove panel.

g. On AF Serial No. 55-4410 and subsequent, remove screws securing tank cover panel.

h. On AF Serial No. 55-4410 and subsequent, remove screws securing tank cover panel to filler well.

i. On AF Serial No. 55-4410 and subsequent, remove tank cover panel.

j. On AF Serial No. 55-4410 and subsequent, disconnect scupper drainline at filler well.

k. On airplanes AF Serial No. 49-2758 and subsequent, disconnect wing tank vent lines from tee fitting on tank manhole cover.

l. Disconnect electrical lead at fuel quantity transmitter. Remove attaching screws and remove transmitter.

m. On AF Serial No. 58-580 and subsequent, disconnect fuel vented overboard float switch leads from tank forward bulkhead terminal strip.

n. Remove screws and bolts holding manhole cover to tank and angles to tank liners.

o. Remove manhole cover.

p. On AF Serial No. 53-4886 and subsequent, disconnect anti-siphon line at fuselage tank aft bulkhead and at check valve on float valve plate. Remove clamps holding line in place and remove line.

q. Remove bolts holding float valve plate to tank.

r. Remove screws attaching upper tank liner to aircraft structure and remove tank liner and float valve plate support as a unit.

s. Reaching through manhole, hold fuel inlet lines in position while removing float valves and plate.

t. Through manhole disconnect tank vent line from aft end of tank. Unsnap vent line from tank and remove line.

u. Loosen hose clamps at fuel inlet fittings inside tank and remove fuel inlet tubes.

v. Disconnect external vent line from tank at connection located in engine compartment.

w. Prior to AF Serial No. 49-984, remove aft seat. (Refer to paragraph 4-1142.)

x. Prior to AF Serial No. 49-984, remove seal plate from behind aft seat tracks.

y. Prior to AF Serial No. 49-984, remove fuel inlet lines from tank nipples.

z. Remove bolts holding tank nipples to tank bulkhead.

aa. Disconnect tank drain line at tee fitting in right wheel well.

ab. Disconnect and cap fuel outlet line at fuselage pump elbow.

ac. Remove pins holding tank to liner.

ad. On AF Serial No. 49-984 and subsequent, pull tank nipples from fuel inlet lines.

ae. Prior to AF Serial No. 49-963, fold tank into bottom of tank well so that four pump-to-tank floor retaining screws may be removed.

af. On AF Serial No. 49-963 and subsequent, remove bolts securing pump to tank floor.

ag. Disconnect motor-seal drain line at pump.

ah. Disconnect electrical leads at pump.

ai. Working in dive flap area, disconnect pump ground wire, pump sump drain line, and engine fuel feed hose.

aj. Remove pump from tank.

ak. Remove tank from airplane taking care not to damage tank while lifting drain fitting through floor.

4-405. INSTALLATION OF FUSELAGE TANK. Reverse removal procedure.

Note

Replace any bolt type fitting which is warped or deformed. Torque fittings on B. F. Goodrich tanks to between 20 and 30 lb in. and on Firestone tanks to between 40 and 50 lb in., except nipple type fittings, which are torqued to between 20 and 30 lb in. Place all bolts in mounting holes finger tight. Torque bolts to one-half recommended value using a diagonal cross pattern. Using diagonal cross pattern, torque bolts to full value. Retorque all bolts after two to four hours, using diagonal cross pattern. On AF Serial No. 53-5086 and subsequent, and airplanes incorporating T.O.1T-33A-572, bolt tank filler well to manhole cover omitting filler well screen and gasket. Torque bolts to between 40 and 50 lb in. Measure clearance between filler well and manhole cover at several points. If maximum clearance

at any one place is not more than 0.030-inch, remove filler well and install one 456211 gasket between filler well and manhole cover. Install screen and tank cover to complete installation and torque to between 50 and 60 lb in. If maximum clearance at any one point is between 0.031 and 0.060 inch, install two 456211 gaskets or one 461344 gasket. If maximum clearance at any one point is greater than 0.060-inch, install two 456211 gaskets and a locally manufactured spacer made from 24ST aluminum to make up clearance differential. Torque bolts that attach the float valves to tank cover plate to between 20 and 30 lb in.

4–406. FUSELAGE FUEL TANK FILLER CAP ASSEMBLY (AF SERIAL NO. 53-5086 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-572). *(See figure 4-87.)* The filler cap assembly is composed of a flange, a spring-loaded cover, and a spring-loaded pressure dome. The cover is spring-loaded in the open position and will return to the open position unless locked to the pressure dome by the cover fastener. The pressure dome is spring-loaded in the closed position and is forced open by the insertion of the fueling nozzle.

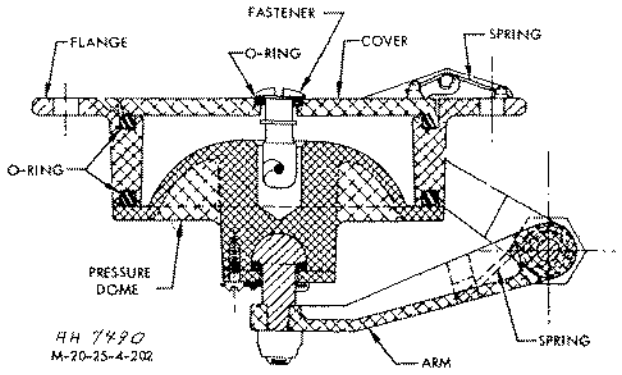


Figure 4-87. Fuselage Fuel Tank Fillercap Assembly, AF Serial No. 53-5086 and Subsequent and Airplanes Incorporating T.O. 1T-33A-572

4–407. EJECTOR TYPE DROP TANKS. *(See figure 4-91.)* An ejector type drop tank of 230 U.S. (191.6 Imperial) gallons capacity may be installed on each wing tip. Air from the engine compressor, controlled by a pressure control valve in the hydraulic compartment forces fuel from the drop tank to the fuselage fuel tank. A spring-loaded ejector mechanism which butts against a wing tip bumper is installed in each tank to insure positive tank jettisoning.

WARNING

The pressure system is capable of maintaining its pressure indefinitely. Prior to removing drop tank filler caps, slowly "crack" the cap until the pressure has been relieved.

CAUTION

Do not drop or roll tanks. When not installed on airplane, store tanks so they will not be damaged.

Note

Sway braces should remain with tank.

4-408. DISASSEMBLY OF TANK SECTIONS (See figure 4-88.)

WARNING

Tanks which have contained fuel are hazardous until all fumes and residual fuel have been removed. They are a potential explosion and health hazard and should be treated as such. Tanks which have contained fuel will be purged prior to repair. Purging will consist of steam cleaning the interior of the tank for a minimum period of three hours and then flushing with clear water. The interior of the tank must then be checked with an explosimeter. An explosion safe reading (20 percent of lower explosive level) must be obtained or the purging procedure must be continued. Tanks must be properly grounded prior to purging or repair.

a. Remove attaching screws (2) and remove tail section fairing (1).

b. Stabilizer assembly (8) may be removed by taking out attaching bolts (9,10, and 11), washers (12 and 13) and "0" ring packing (14).

c. To separate tail section (19) from center section (57), remove access cover (15) by taking out attaching bolts (16), plain washers (16a) and lock-o-seal washers (17). Reach into access hole and remove nuts (26) on the four rear section joint clamps. Separate tail section from center section and remove gasket ring (29).

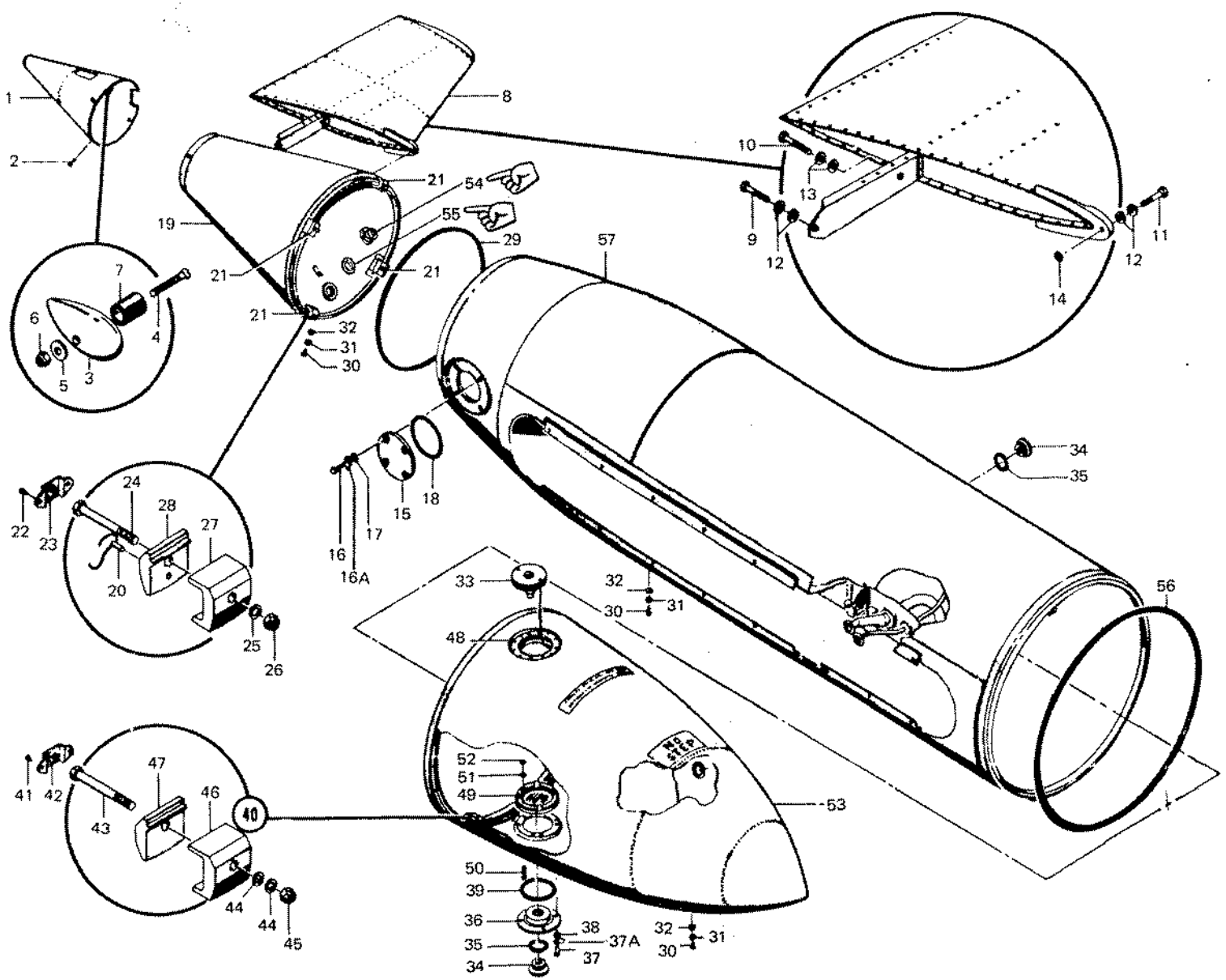
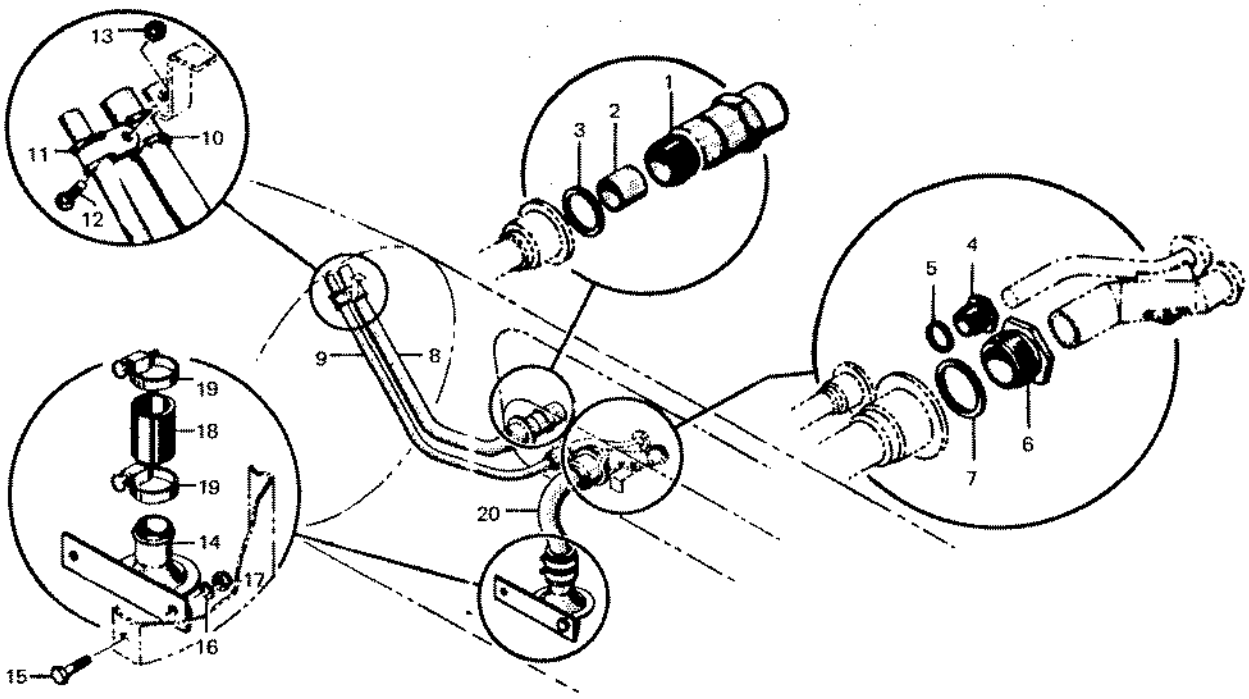


Figure 4-88. 230-Gallon Fuel Tank, Part No. ST25-230-4800A

KEY TO FIGURE 4-88

1. Tail Cone Fairing
2. Screw
3. Position Light Cover (Green
4. Screw
5. Washer
6. Nut
7. Hose
8. Stabilizer Assy
9. Bolt
10. Bolt
11. Bolt
12. Washer
13. Washer
14. "O" Ring Packing
15. Access Cover
16. Bolt
16A. Washer
17. Lock-O-Seal Washer
18. Packing
19. Tail Section
20. Pin
21. Clamp Assy
22. Screw
23. Retainer
24. Bolt
25. Washer
26. Nut
27. Clamp
28. Clamp
29. Ring
30. Screw
31. Washer
32. Lock-O-Seal Washer
33. Filler Assy
34. Plug
35. Packing
36. Sump Drain Cover
37. Bolt
37A. Washer
38. Lock-O-Seal Washer
39. "O" Ring Packing
40. Clamp Assy
41. Screw
42. Retainer
43. Bolt
44. Washer
45. Nut
46. Clamp
47. Clamp
48. Flange Instl
49. Flange Assy
50. Screw
51. Washer
52. Nut
53. Nose Assy
54. Plug
55. Gasket
56. Ring
57. Center Section Assy



1. Pressure Relief Valve
2. Bushing
3. Packing Ring
4. Packing Nut
5. Packing Ring
6. Packing Nut
7. Packing Ring
8. Vent Tube
9. Pressure Tube
10. Clamp
11. Clamp
12. Screw
13. Nut
14. Bellmouth Assy
15. Bolt
16. Washer
17. Nut
18. Hose
19. Clamp
20. Outlet Tube

Figure 4-88A. Fuel System Plumbing

d. Remove filler cap (33) and disassemble filler flange installation (48). Remove sump drain cover (36) and "O" ring packing (39) from bottom of nose section (53) by taking out attaching bolts (37), plain washers (37a) and lock-o-seal washers (38). While supporting nose section, work through forward access openings and remove the four nuts (45) and eight washers (44) securing section joint clamps (40). Remove clamps, separate nose section from center section and take off gasket ring (56).

CAUTION

Use care to avoid damage to gasket rings (29 and 56) which will be reinstalled unless condition inspection indicates they are unserviceable.

e. If necessary, sump flange (49) may be removed by taking out the three attaching screws (50), washers (51) and nuts (52).

4-409. REPAIR OR REPLACEMENT OF TANK SECTIONS.

a. Bumps and dents not exceeding 3/32 inch require no maintenance action.

b. Bumps and dents exceeding 3/32 inch, which are accessible without disassembly in excess of that outlined in paragraph 4-408 may be peened to within 3/32 inch of original tank contour.

c. In the sealed forward area of the nose section, dents deeper than 3/32 inch and having a diameter less than 2 inches may be filled in with aero-dynamic putty material to obtain the original contour.

d. Access to the sealed area of the tail section can be effected by cutting a hole (approximately 4 inch diameter) through the aft bulkhead. After dents are removed the hole will be repaired by welding in a flush patch.

e. Longitudinal scratches of any length, not exceeding the following depth limits after having been "dressed" or "blended", are acceptable:

(1) 40 percent of skin thickness for the sealed forward area of the nose section.

(2) 20 percent of skin thickness for the center section.

(3) 25 percent of skin thickness for the tail section and nose section except for the sealed forward area of the nose section.

f. Circumferential scratches not exceeding one quadrant in length and not exceeding the following depth limits, after having been "dressed" or "blended", are acceptable:

(1) 40 percent of skin thickness for the sealed forward area of the nose section.

(2) 15 percent of skin thickness for the center section.

(3) 20 percent of skin thickness for the tail section and nose section except for the sealed forward area of the nose section.

g. Scratches exceeding length and depth limits specified above may be repaired by inert gas welding procedure. Weld beads shall be ground to within 3/32 inch of skin contour.

h. Depth limits and repair criteria for scratches will also be applied to pits and gouges except that no unrepaired pit or gouge is acceptable in the skirt area (joint ring to baffle) of the nose section. Repair of pits and gouges, in the forward sealed area (baffle to tip) of the nose section, by blending in the surrounding metal and filling the depression with aero-dynamic putty is acceptable.

i. Repair of a tank assembly can be affected by replacement of any subassembly requiring repair beyond field level capability.

4-410. ASSEMBLY AND TESTING.

a. To assemble, reverse disassembly procedure (refer to figure 4-88).

b. Replace disturbed "0" rings and lock-o-seal washers with new material. Replace gasket rings (29 and 56) with new rings only if the removed rings show damage or deterioration.

c. Torque section clamp nuts (26 and 45) to 435 inch-pounds. Torque values for other hardware will be in accordance with T.O. 1-1A-9.

d. Pressure test after assembly of tank is complete.

e. Plug fuel outlet at fuel disconnect fitting. From a controlled pressure source, apply 15 PSI air pressure to pressure inlet line. Pressure relief valve should begin to relieve when tank internal pressure reaches 9½ to 10 PSI.

f. Using a soapsuds solution externally, check for air leakage at tank joints, sump, and filler cap openings,

and all other possible leakage points including repaired areas. No external leakage is allowable.

4-411. CONVERTING TANKS FOR OPPOSITE WING INSTALLATION. (See figure 4-88A.)

a. Remove nose section as outlined in paragraph 4-408d.

b. Cut safety wire and loosen pressure relief valve (1) and two plumbing nuts (4 and 6) in tank well.

c. Remove clamps (10 and 11) from ends of 1 inch vent tube (8) and 5/8 inch pressure tube (9).

d. Disconnect bell mouth (14) and 1½ inch fuel tube (20) from tank structure.

e. Swing ends of tubes to opposite side of tank and attach in new position.

f. Tighten relief valve and plumbing nuts, resafety wire.

Note

Fuel plumbing line positions are reversed for right and left hand tanks; however, open ends of pressure and vent lines must always be at top of tank, bell mouth on fuel outlet line must be at bottom.

g. Reinstall nose section.

h. Pressure test tank assembly.

4-412. REMOVAL OF EJECTOR TYPE DROP TANKS.

WARNING

On AF Serial No. 52-9635 and subsequent, except 52-9876 through 52-9905, pull external tank circuit breaker prior to removing a tank. This will prevent inadvertent jettisoning of opposite tank.

a. Relieve tank pressure.

b. Drain fuel from tank.

WARNING

A full fuel tank weighs over 1500 pounds. Make certain that tank is empty prior to removal.

c. Remove plug covering tank ejector mechanism with a ¼-inch drive adapter.

d. Using a $\frac{7}{16}$-inch socket and a ½-inch drive handle at least 12 inches long, turn ejector mechanism plunger counterclockwise until plunger contacts internal stop.

Note

This action requires approximately 30 revolutions of the turning bar.

e. Remove tank fairing.

f. Remove wing tip access panel.

g. With two men lifting at each end of tank or utilizing locally fabricated tank lift adapter with wing dolly, operate tank release lever to release tank.

CAUTION

Do not drop tanks. When not installed on airplane, store tanks so they will not be damaged.

Note

Sway braces should remain with tank.

h. Disconnect tank light electrical leads.

4-413. (Deleted)

4-414. (Deleted)

4-415. INSTALLATION OF EJECTOR TYPE DROP TANKS.
(See figures 4-89 and 4-91.)

(See paragraph 4-1289 for operational check required prior to installation of tip tanks.)

WARNING

On AF Serial No. 52-9635 and subsequent, except 52-9876 through 52-9905, pull external tank circuit breaker prior to installing a tank. This will prevent inadvertent jettisoning of opposite tank.

Note

- Prior to tank installation adjust hook assembly per figure 4-89.
- Prior to adjustment, the following should be ascertained; the hook must be in the locked position, the release lever must be in the locked position with the release lever and indicator arm in parallel alignment. The 0.010-inch maximum clearance is obtained by rotating the eccentric cam; when this tolerance is established, remaining dimensions will align if the component parts are in a serviceable condition. Check the slack in manual release cable in accordance with paragraph 4-1288.

a. Remove plug covering tank ejector mechanism with a ¼-inch drive adapter.

b. Using a 7/16-inch socket and a ½-inch drive handle at least 12 inches long, turn ejector mechanism plunger counterclockwise until plunger contacts internal stop and reinstall plug.

c. Remove wingtip access panel.

d. On airplanes prior to AF Serial No. 55-4412 except 55-6038, remove wingtip forward cover plate to expose fuel-air disconnect. Use a six-inch scale to measure fuel sleeve extended dimension (see figure 4-92) and record.

e. Loosen tiptank hook assembly.

f. Apply powdered graphite, Specification MIL-G-6711, to tank forward and aft ball fittings. Apply light film of grease, Specification MIL-G-23827, to tiptank fuel and air fittings, and exposed surfaces of fuel and air sleeves of fuel-air disconnect. Lubricate tiptank hook assembly (see figure 3-26). Clean actuator plunger hole and centerline tip tank support bushing, part No. 207027, located in tank support fitting. Check for flattened rear shear ball stud, part No. ST25-230-0081 on tip tank and for worn or flattened switch actuator plunger tip. (Refer to T.O. 6J14-2-4-14.)

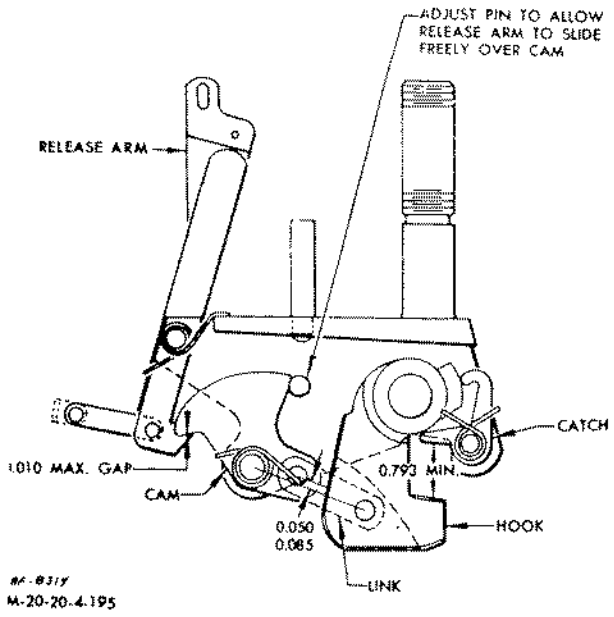


Figure 4-89. Drop Tank Hook Adjustment

Note

See paragraph 4-1289 for adjustment of wing tip auto-drop safety switches on aircraft incorporating unsealed switches, part No. DT-2R-A7 (MS25008-1) and for aircraft incorporating sealed wing tip switches part No. 1EN61-6B, installed by TCTO 1T-33-545.

g. Lift tank into position.

h. Plug tank light electrical connectors into wingtip sockets.

i. Insert ball fittings of tank in wingtip sockets and push tank inboard until tank hook closes. Indicator will show if hook is locked. Release lever may be moved by hand, if necessary, to final locked position. On airplanes AF Serial No. 51-8636 and subsequent, install ground safety pin in release lever.

FIGURE 4-90 DELETED

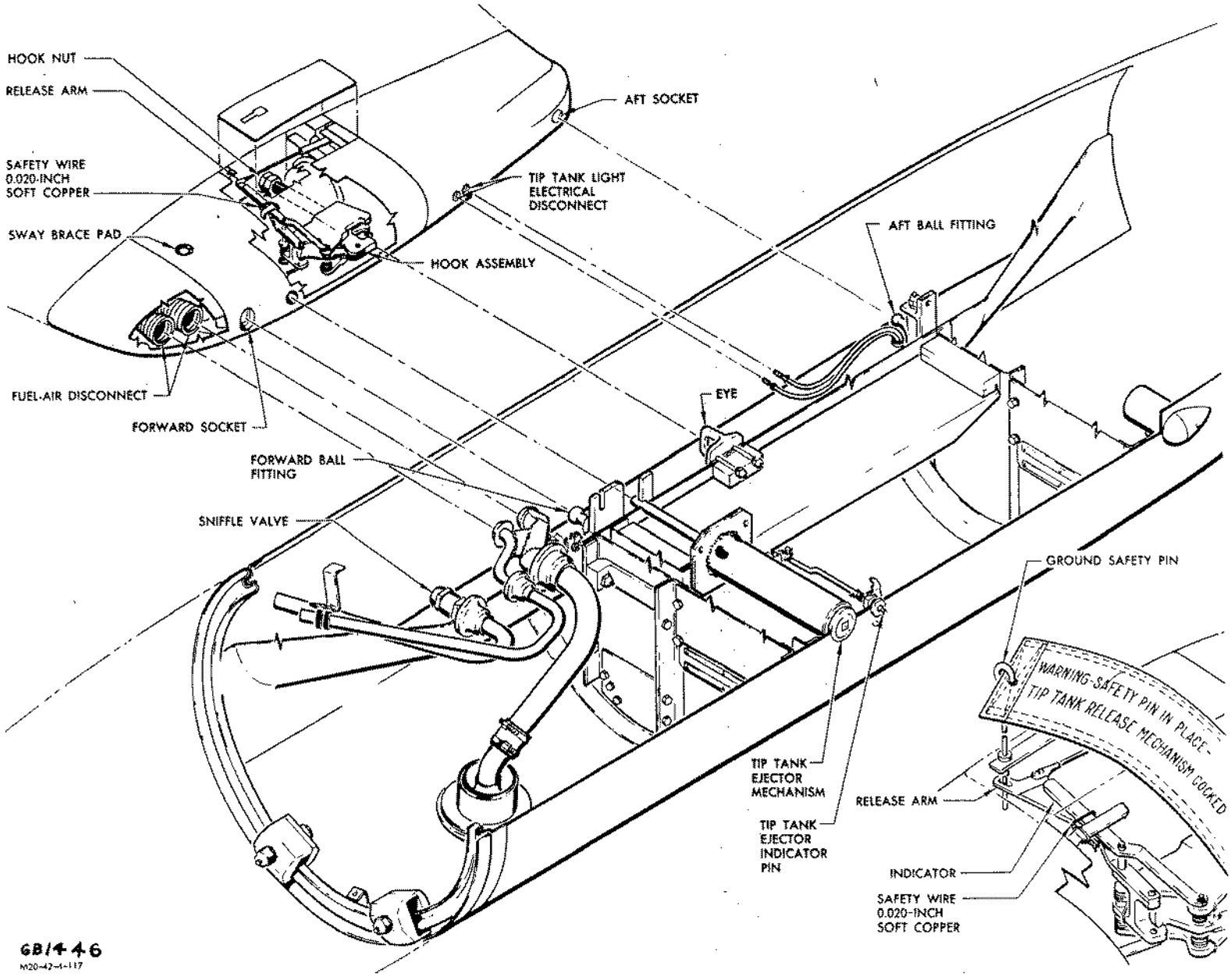


Figure 4-91. Ejector Type Drop Tank Installation

j. Safety release lever and indicator together with a single strand of 0.020-inch soft copper wire.

k. Tighten tiptank hook to a torque of 25 lb ft.

CAUTION

Failure of the auto-drop system during take-off with full fuel load in tip tanks will result in an extremely severe wing heavy condition should one tip tank separate from aircraft.

1. Deleted.

2. Deleted.

3. Deleted.

l. Insert sway braces into sockets in wing and tank. Tighten braces to a torque of 8 lb ft. Over-all length of the sway braces, when torqued, should be approximately 2.25 inches for the upper, and approximately 2.55 inches for the lower sway braces. Spring-loaded ends of sway braces must be inserted in tank sockets.

m. Tighten tiptank hook to a torque of 50 (+5, -0) lb ft. Tighten jamnut. Retorque upper sway brace to 34 lb ft.

n. Check tiptank release lever for proper alignment.

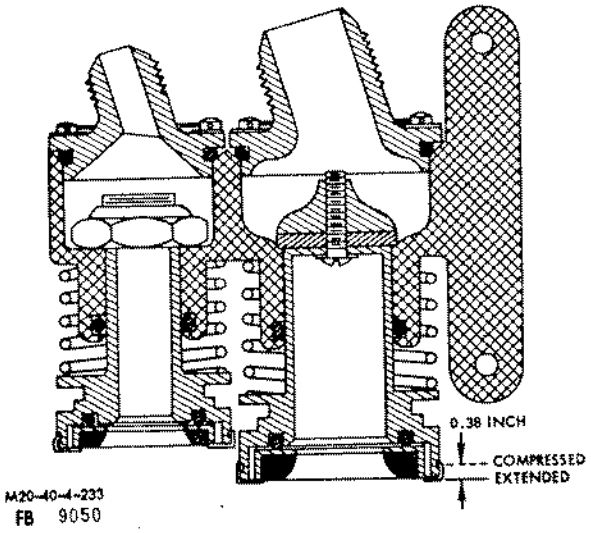


Figure 4-92. Wing Tip Tank Fuel-air Disconnect Prior to AF Serial No. 55-4412 except 53-6038 and Airplanes Incorporating T.O. 1T-33A-544

o. Remove plug covering tank ejector mechanism with a 1/4-inch drive adapter.

p. Using a 7/16-inch socket and a 1/2-inch drive handle at least 12 inches long, turn ejector mechanism plunger lockwise until indicator pin, located aft of ejector mechanism, is flush with the fitting through which it protrudes.

Note

Indicator pin will not start to move in until approximately 25 revolutions of turning bar have been made.

q. Fill tank and then retighten upper sway brace to a torque of 25 lb ft. Apply a red enamel alignment mark across sway brace torquing nut and lock nut.

Note

When making routine or precautionary checks of sway brace torque values, it is permissable to do so with tanks partially full. When tanks are empty, torque value is 34 lb ft, and for every 25 gallons of additional fuel subtract 1 lb ft of torque. When tanks are full, the torque will be 25 lb ft. Whenever the torque is within 3 lb ft of the required value, retorque sway braces. However, when the torque is not within these limits reduce torque to zero and check tip tank hook torque prior to retorquing sway braces.

r. On airplanes prior to AF Serial No. 55-4412 except 53-6038, and airplanes incorporating T.O. 1T-33A-544, use a six inch scale to measure fuel sleeve compressed dimension (see figure 4-92). Compressed dimension must be of minimum of 7/32-inch less than extended dimension recorded in step d and the amount of fuel sleeve compression between left tip tank fuel-air disconnect and right tip tank fuel-air disconnect must not vary more than 1/16-inch.

s. If only one tip tank is being installed and the amount of fuel sleeve compression is unknown on opposite tip tank installation, the latter tip tank must be removed or sufficiently loosened to obtain fuel sleeve compression dimension (extended dimension less compressed dimension).

WARNING

Fuel sleeve compression dimension of left and right tip tank fuel-air disconnects must not vary more than 1/16-inch or uneven tip tank fuel feeding may result.

t. Install 457614 gauge assembly in place of tip tank filler cap.

u. Operate engine and check for 5.25 (±0.5) psi air pressure. Retorque upper sway brace to 25 lb ft.

Note

The same dimensional difference in sway brace lengths as in step l must be maintained. The same dimensional difference in fuel-air disconnect as in step r must be maintained.

v. Upon completion of tank installation, indicator pin should be flush with plate.

w. Check fuel line fitting at disconnect joint for leakage. Check tank for alignment, security, evidence of shifting and leakage.

x. Bleed air pressure from tank through valve on gauge. Remove gauge assembly and fill tip tanks with fuel. Replace filler cap.

y. Install wing tip access panel.

z. On airplanes prior to AF Serial No. 55-4412 except 53-6038, install wing tip forward cover plate.

aa. Install tank fairing.

ab. After tip tanks have been installed and ground safety pins properly inserted, set the navigation light switches to flashing bright positions. Check that both the left and right tip tank lights flash as required.

WARNING

If any of the four upper or lower wing lights illuminate instead of the tip tank lights, this is a possible indication of misaligned aft tank ball socket with microswitch actuator. Operation of cockpit auto-drop switches under these conditions will jettison both tip tanks when ground safety pins are removed.

4-416. REMOVAL OF FLETCHER CENTERLINE TIP TANK FILLER CAP ASSEMBLY.

a. Turn lockscrew counterclockwise 3 to 4 complete turns.

CAUTION

Additional turns may shear retaining pin and allow cap parts to drop into tank.

b. Turn cap assembly ¼ turn counterclockwise and remove cap.

4-417. INSTALLATION OF FLETCHER CENTERLINE TIPTANK FILLERCAP ASSEMBLY.

a. Turn lockscrew counterclockwise until bottom of straddle bar is flush with bottom thread on lockscrew.

b. Make certain that safety chain is fastened to straddle bar and filler flange.

c. Install cap assembly into flange with arrows on cap at 90 degrees to arrows on flange. Turn cap assembly clockwise ¼ turn aligning arrows.

CAUTION

Do not strike cap or assembly will be damaged.

d. Center cap in flange and turn lockscrew until cap is flush with top surface of flange and lockscrew is hand tight.

CAUTION

Excessive torque required to tighten fillercap assembly may be interpreted as normal cap seating when actually the cap is not firmly seated. Do not force the lockscrew if it seems tight before cap is flush with top surface of flange. Remove cap and inspect for defective threads on lockscrew.

e. Rework fillercaps with mispositioned alignment arrows by grinding off mispositioned arrow and restamping a new alignment arrow to correspond with the arrow on the adapter, determining that cap is securely locked.

f. Rework straddle bars that fail to engage by removing cotter pin and backing off the filler lockscrew nut to a point where cotter pin can still be inserted, then tightening the filler lockscrew, forcing the straddle bar against the nut. This rework provides sufficient thread length to facilitate the straddle bar engaging adapter plate locking lugs.

g. Rework defective threads on filler lockscrews with a thread chaser.

4-418. TROUBLE SHOOTING OF CENTERLINE TIPTANK AIR SYSTEM (PRIOR TO AF SERIAL NO. 55-4410).

a. Disconnect air line between tiptank air shutoff valve and main air duct.

b .Connect air shutoff valve line through a regulator to an air supply.

c. Install one 457614 gage assembly on each tiptank in place of regular fillercap.

d. Turn on airplane electrical power and place tiptank switch in ON position. Tiptank warning light should glow.

e. Apply air pressure to the system at approximately 35 psi.

f. When tiptank warning light goes out, read pressure on tiptank gages. This reading should be 2.0 (±0.25) psi on airplanes AF Serial No. 48-356 through 51-6528, and 3.0 (±0.25) psi on airplanes AF Serial No. 51-6529 and subsequent.

g. Allow tank pressure to increase until it stabilizes. The gages should then read 5.25 (±0.5) psi.

h. Check the following units for leaks: tiptank fillercaps, disconnect fittings, and sniffle valves. Correct all leaks.

i. Remove air supply line and connect air shutoff valve line to main air duct.

j. Move aircraft to runup area and fill tiptanks.

k. Operate engine at between 80 and 100 percent rpm and check for stabilization of tank pressure at 5.25 (±0.5) psi.

Note

Often improper tank feeding is caused by a leak in main air supply line between engine and cockpit. If hanger check proved satisfactory but engine runup check did not, inspect all main air supply lines for proper installation, clamping and sealing.

l. Following engine shutdown, check tiptank fuel quantity to determine possibility of uneven feeding. If uneven feeding is evident check tiptank fuel transfer lines to see that check valves bear identical part numbers.

m. Remove tiptank gages and reinstall tank fillercaps.

4-419. TROUBLE SHOOTING OF CENTERLINE TIPTANK AIR SYSTEM (AF SERIAL NO. 55-4410 AND SUBSEQUENT).

a. Remove tiptank fillercap to relieve any tiptank pressure.

WARNING

The system can maintain pressure indefinitely. Before removing tiptank fillercaps, slowly crack cap until pressure has been relieved, or personnel may be injured.

b. Install one 457614 gage assembly on each tiptank in place of regular fillercap.

c. Disconnect airline between tiptank air shutoff valve and main air duct.

d. Connect air shutoff valve line through a regulator to an air supply.

e. Turn on airplane electrical power and place tiptank switch to ON position. Tiptank warning light should glow.

f. Apply air pressure to system at approximately 35 psi.

g. When tiptank warning light goes out, read pressure on tiptank gages. This reading should be 3.0 (±0.25) psi.

h. Allow tank pressure to increase until it stabilizes. The gauges should then read 5.25 (±0.5) psi with source of air pressure turned "OFF."

i. Observe gauge for any drop in pressure for 10 minutes (pressure should hold indefinitely).

j. If tip tanks do not hold pressure for prescribed interval, the following should be inspected for cause of leakage; tip tank fillercaps, tip tank connectors, sniffle and relief valve, drain check valve, and tip tank plumbing and connections.

Note

A remote possibility exists that fuselage tip tank float valve is not properly seated.

k. If pressure holds as indicated by tip tank gauges, crack line to bleed air at airline check valve connection at upstream end of check valve, which is located downstream of air pressure regulators. Observe tip tank gauge for pressure drop; if pressure drop occurs, replace check valve.

l. Plumb in a 0 to 15 psi pressure gauge, downstream of and into pressure regulator airline.

Note

Make certain gauge is upstream of tip tanks check valve.

m. Turn air source "ON" until plumbed-in air pressure gauge reads 5.25 (±0.5) psi.

n. Turn "OFF" air source and disconnect air source line.

o. Observe pressure gauge and if a pressure drop is indicated, replace check valve downstream of air shutoff valve.

p. Remove pressure gauge and reconnect airline.

q. If system pressure check is satisfactory, remove air supply line and reconnect air shutoff valve line to main air duct.

r. Move airplane to runup area and fill tip tanks with prescribed fuel.

s. Operate engine at between 80 and 100 percent rpm and check for stabilization of tank pressure at 5.25 (±0.5) psi.

t. Remove tip tank pressure gauge assembly 457614 and replace regular tip tank fillercap, observing pressure precautions.

4–420. For stall characteristics of the airplane, refer to paragraph 4–663.

4–421. DROP TANK FUEL LINE QUICK-DISCONNECT (AF SERIAL NO. 51-4141 (THROUGH 55-4412 AND AIRPLANES INCORPORATING T. O. 1T-33A-42.) *(See figure 4-92.)* Carruthers and Fernandez part number 500-1251 is a dual air-feed quick-disconnect mounted on the forward face of each wing tip forging. On airplanes incorporating T. O. 1T-33A-544, quick-disconnect valve part number 500-1251 is modified and is reidentified as part number 9100. The air line is unrestricted while the fuel line contains a spring-loaded shutoff valve. The shutoff valve remains in the closed position as long as a drop tank is not installed on the wing tip. The fuel line fitting on the drop tank, when installed, opens the valve permitting free fuel flow.

4–422. DROP TANK FUEL LINE QUICK-DISCONNECT (AIRPLANE AF SERIAL NO. 55-4412 AND SUBSEQUENT). Carruthers and Fernandez part number 9100 is a dual fuel-air coupling mounted on the forward face of each wing tip forging. Both fuel and air passages are unrestricted. External appearance is identical to Carruthers and Fernandez part number 500-1251.

4–423. REMOVAL OF DROP TANK FUEL LINE QUICK-DISCONNECT (AF SERIAL NO. 51-4141 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-42).

a. Remove wing tip skin.

b. Disconnect fuel and air lines at quick-disconnect valve.

c. Remove bolts holding quick-disconnect to wing tip forging and remove valve.

4–424. REPOSITIONING OF DROP TANK FILLER CAP TO MAKE IT VISIBLE FROM COCKPIT.

a. Loosen section joint clamps that attach nose section to center section.

b. Rotate nose section until centerline of fillercap is approximately 7¼ inches inboard from vertical or until index marks are aligned.

c. Tighten section joint clamps and torque clamp nuts to 435 lb in.

4–425. FLOAT VALVES. *(See figure 4-93.)* Three float valves mounted on the top surface of the fuselage fuel tank control the transfer of fuel from the droppable, leading edge, and inboard tanks. The valves are operated by changes in level of the fuel within the fuselage tank. Each float valve consists essentially of a cork float, a rubber diaphragm, a pilot valve, and a main poppet valve. The pilot valve is actuated by the float. When the fuel level is sufficiently high, the pilot valve is closed, and fuel pressure applied to the bottom surface of the main-valve rubber diaphragm through bleed holes in the main-valve stem keeps the main valve closed. When the fuel level drops, the pilot valve opens to relieve the pressure on the bottom surface of the rubber diaphragm. A ball check in the main valve is actuated by the pilot-valve stem. When the pilot valve opens, the ball check closes off pressure to the bottom of the rubber diaphragm. Fuel is then admitted to the fuselage tank through the valves.

Note

633400-4, -5, or -7 float valves must be used when high pressure leading edge boost pumps are installed.

4–426. REMOVAL OF FLOAT VALVES.

a. Remove fuselage tank cover (refer to paragraph 4–404, steps a through f).

b. Remove screws attaching float valve plate assembly to tank.

c. Remove screws attaching tank upper liner to aircraft structure and remove tank liner and float valve plate support as a unit.

d. Displace mounting plate assembly sufficiently to unfasten float-valve elbow connections.

e. Remove assembly.

f. Remove four bolts attaching float valve to plate and remove float valve.

4–427. ALTERNATE REMOVAL OF FLOAT VALVES.

a. Remove fuselage tank manhole cover (refer to paragraph 4–404, steps a through o.).

b. Working through manhole cover, remove bolts attaching float valve to float valve plate.

c. Disconnect float valve from tank piping and remove valve.

4–428. INSTALLATION OF FLOAT VALVES. Reverse removal procedure. If elbow has been removed from float valve, be sure the O-ring is installed at connection before valve is assembled to elbow. Be sure that O-ring is installed at bottom of elbow before valve is connected to piping within the tank.

CAUTION

When replacing cover assembly, tighten bolts to 40 lb in minimum and 50 lb in maximum torque.

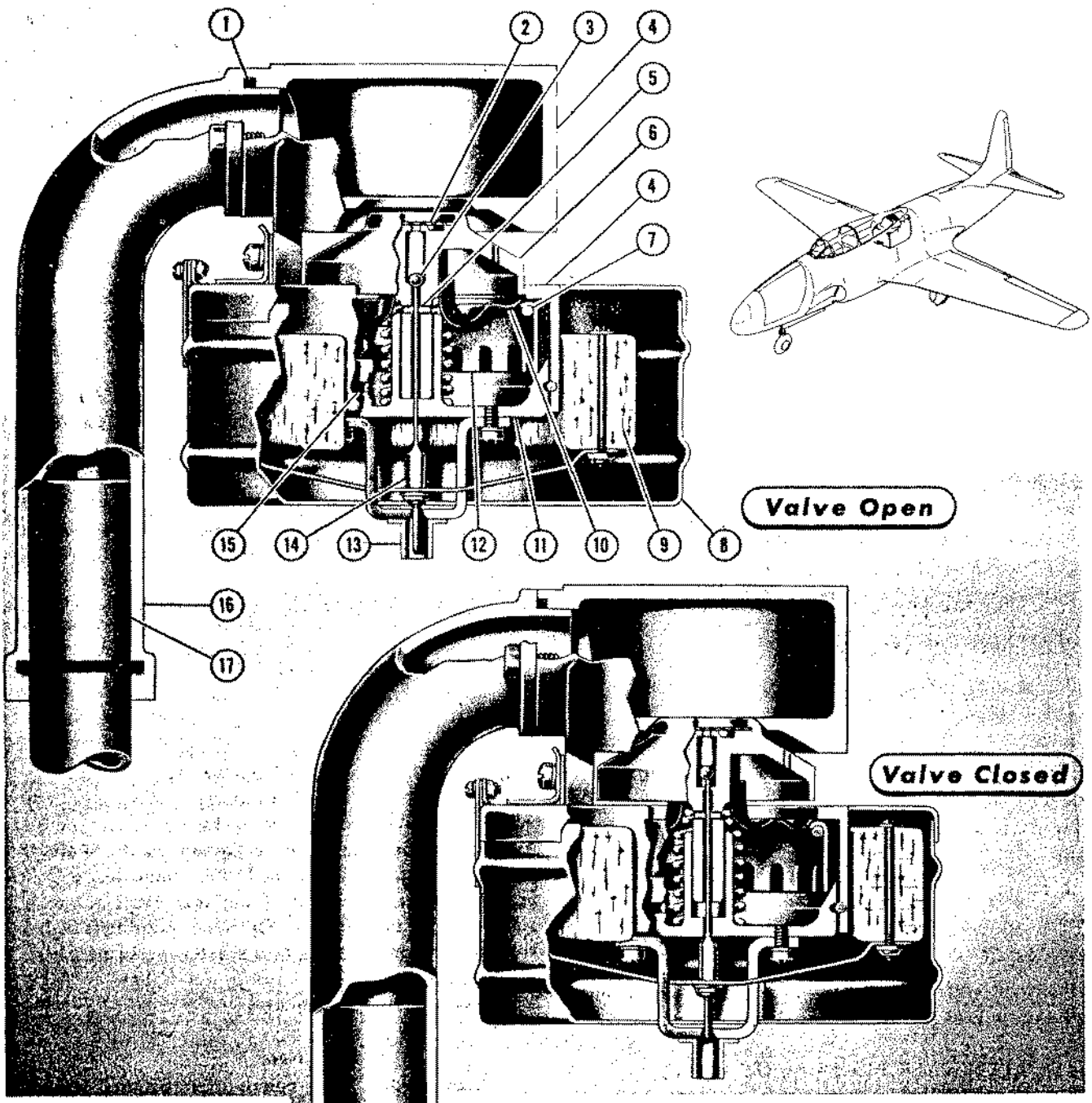
4–429. FLOAT VALVE GROUND CHECK. Fill wing, leading edge, and tip tanks. Connect external source of air to tip tank air line. With less than 90 gallons of fuel in fuselage tank, turn wing tank switch "ON" and watch for increase in fuselage fuel quantity. Fuel flow should stop when fuel level reaches center of float. Turn switch "OFF." Repeat this check on leading edge tanks and tip tanks. Any increase in fuel level after normal shut-off point is reached indicates a leaky valve.

4–430. GENERAL DESCRIPTION OF FUEL PUMPS. The airplane fuel system is equipped with five fuel booster pumps. One pump is located in each aft inboard wing tank, one on an adapter attached to each leading-edge tank, and one in the fuselage tank. All are centrifugal type pumps with built-in vapor eliminator. The impeller of each pump is driven by an electric motor. The armature of this motor is wound on the shaft to which the impeller is attached. The pump has a ball bearing on the motor-end of the shaft, and a carbon bearing on the impeller-end. The motor housing is sealed from the impeller housing by a rotating seal ring which rides against the carbon bearing and is held in place by a brass bellows and retainer.

Note

Leading edge boost pumps must be used in matched pairs. High pressure pumps must be matched with 633400-4, -5, or -7 float valves.

4–431. LEADING-EDGE TANK BOOSTER PUMPS. These pumps are located on either side of the subcockpit compartment. Access is gained through the dive flap openings.



1.	PACKING	7.	SNAP RING	13.	GUARD
2.	SCREEN	8.	SHIELD	14.	PILOT VALVE
3.	BALL CHECK	9.	FLOAT	15.	SNAP RING
4.	BODY	10.	DIAPHRAGM	16.	ELBOW
5.	BLEED HOLES	11.	VALVE GUIDE	17.	INLET PIPE
6.	POPPET	12.	DIAPHRAGM RETAINER		

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Figure 4-93. Fuel Float Valve

4–432. REMOVAL OF LEADING-EDGE TANK BOOSTER PUMP.

WARNING

Do not connect or disconnect electrical wiring to the pump when the circuit is energized.

a. Defuel airplane.

b. Prior to AF Serial No. 53-5286, remove wing leading edge fillet. On AF Serial No. 53-5286 and subsequent, remove fuel pump adapter access panel (see figure 3-1, item 113).

c. Remove all plumbing in dive flap area which will interfere with pump removal.

d. Disconnect plumbing and electrical lines from the pump.

e. Remove screws attaching pump and its adapter to the leading edge former.

f. Remove pump support bracket.

g. Remove pump and its adapter.

4–433. INSTALLATION OF LEADING-EDGE TANK BOOSTER PUMP. Reverse removal procedure. On Firestone fuel cells, torque hold-down screws to between 40 and 50 lb in. On B. F. Goodrich fuel cells, torque hold-down screws to between 30 and 40 lb in.

Note

On B. F. Goodrich fuel cells, retorquing should be accomplished at least one hour after initial torquing, and preferably four hours after initial torquing.

Do not cut pump electrical leads to shorten. Roll and tape leads to obtain desired length.

Use a new adapter gasket each time booster pump is installed.

4–434. FUSELAGE AND AFT INBOARD WING TANK BOOSTER PUMPS. The fuselage tank and each aft inboard wing tank is equipped with a submerged-type pump. The only difference between the wing inboard-tank pump and the fuselage-tank pump is in the outlet neck. On the wing inboard-tank pump, the outlet neck extends up into the tank and connects with a tube that carries the fuel out through the inboard side of the tank. The outlet neck of the fuselage-tank pump extends down on the outside of the mounting flange.

4–435. REMOVAL OF FUSELAGE TANK BOOSTER PUMP (PRIOR TO AF SERIAL NO. 49-963.) Refer to paragraph 4–404 for removal instructions.

4–436. REMOVAL OF FUSELAGE TANK BOOSTER PUMP (AF SERIAL NO. 49-963 AND SUBSEQUENT).

a. Drain fuel from tank.

b. Prior to AF Serial No. 49-984, remove cockpit canopy. (Refer to paragraph 4–91.)

c. On AF Serial No. 53-5086 and subsequent, remove bolts holding filler cap assembly to filler well and remove cap assembly.

d. Remove bolts holding tank filler well to tank through filler well opening.

e. Remove screws securing tank cover panel.

f. Lift cover slightly and disconnect scupper drain line at filler well through fuel quantity transmitter access panel.

g. On AF Serial No. 49-2758 and subsequent, disconnect wing tank vent lines from tee fitting on tank manhole cover.

h. Disconnect electrical lead at fuel quantity transmitter. Remove attaching screws and remove transmitter.

i. Remove screws and bolts holding manhole cover to tank and angle to tank liners. Remove manhole cover.

j. Disconnect and cap fuel outlet line at fuselage pump elbow.

k. Remove bolts securing pump to tank floor.

l. Disconnect pump motor seal drain line at pump.

m. Disconnect electrical lead at pump.

n. Working in dive flap area, disconnect pump ground wire, pump sump drain line, and engine fuel feed hose.

o. Remove pump from tank.

4–437. REMOVAL OF AFT INBOARD WING TANK BOOSTER PUMP.

a. Drain fuel from tank.

b. Remove pump inspection-hole cover.

WARNING

Do not connect or disconnect electrical wiring to the pump when the circuit is energized.

c. Disconnect electrical wiring.

d. Remove bolt securing outlet elbow, and push the elbow loose.

e. Unfasten pump-flange attaching bolts, and lower the pump out of the tank.

4-438. INSTALLATION OF FUSELAGE AND AFT INBOARD WING TANK BOOSTER PUMPS. Reverse the removal procedure. Torque fuselage cell hold-down screws to between 40 and 50 lb in for Firestone fuel cells and 30 to 40 lb in for Goodrich cells. Torque aft inboard wing cells to between 40 and 50 lb in.

Note

Do not cut pump electrical leads to shorten. Roll and tape leads to obtain desired length.

4-439. MAINTENANCE OF FUEL BOOSTER PUMPS. The pumps require no maintenance unless malfunctioning occurs. Trouble will usually be indicated by excessive current drain while the pump is operating.

4-440. FUEL FILTER. *(See figures 4-94 and 4-95.)* A micronic fuel filter is installed in the pressure line between the fuselage-tank booster pump and the engine. The filter contains an integral relief valve set to open at from 3 to 5 psi to insure fuel delivery should the filter element become clogged. The filter is located in the right-hand wheel well. The line from the filter to the engine-driven pump is equipped with a quick disconnect fitting. The filter element may be replaced without removing the filter base from the airplane. The filter dome is vented to the fuselage tank through a tube connected to the tank drain fitting.

4-441. REMOVAL OF FUEL FILTER ELEMENT (PRIOR TO AF SERIAL NO. 49-900.)

WARNING

Close main fuel shutoff valve before removing filter element.

a. Disconnect vent line, remove housing retaining nut, and remove housing.

b. Remove filter-element retaining nut.

c. Remove element compression spring, and remove element.

CAUTION

Before replacing filter dome, carefully check to see that no foreign material has fallen into the filter body or the outlet elbow. If the filter element retaining stud unscrews when the filter dome is being removed, it is possible to drop the washer from under the stud lock nut into the filter body or into the outlet elbow.

d. Open fuel shutoff valve and leak check filter with booster pump pressure.

4-442. REMOVAL OF FUEL FILTER ELEMENT (AF SERIAL NO. 49-900 AND SUBSEQUENT). *(See figure 4-95.)*

WARNING

Close main fuel shutoff valve before removing filter element.

a. Disconnect vent line, remove cover-to-body clamp, and remove filter cover.

b. Remove lock-wire from two filter element cap hold-down bolts.

c. Loosen and remove two hold-down bolts.

d. Remove filter element cap and upper filter gasket.

e. Remove filter element and lower filter gasket.

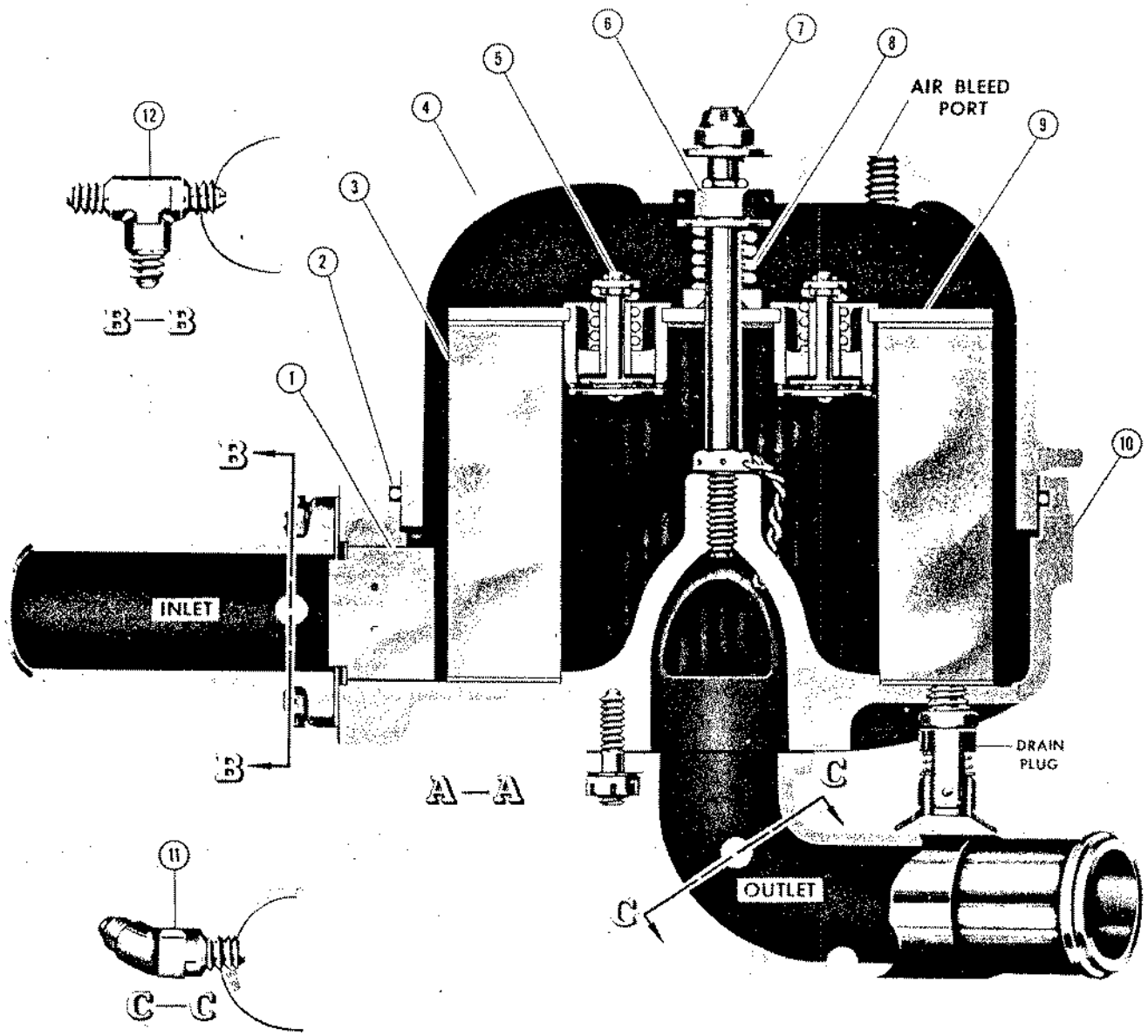
CAUTION

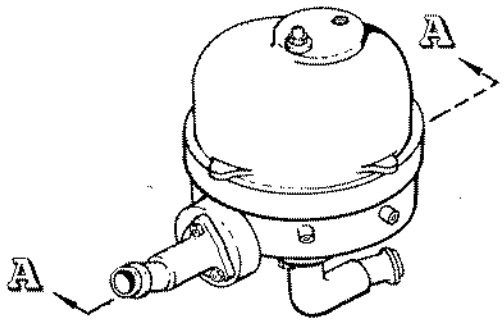
Before replacing filter element carefully check to see that no foreign material has fallen into filter body or outlet elbow. Check filter hold-down bolt springs for distortion, corrosion and evidence of permanent set. (Free length should be 0.937 inch, loaded length should be 0.625 inch at 15 pounds.) Replace filter cap hold-down bolt O-rings, and filter element upper and lower gaskets. Check seating surface of filter poppet and seat in filter element cap. Check filter poppet spring for distortion, corrosion, and evidence of permanent set. (Free length should be 2.375 inches, loaded length should be 0.870 inch at 4.00 $\pm$0.10 pounds.)

f. Open fuel shutoff valve and leak check filter with booster pump pressure.

4-443. REMOVAL OF FUEL FILTER. Disconnect and cap fuel inlet and outlet lines. Disconnect and cap high- and low-pressure sensing lines (AF Serial Nos. 49-901 and subsequent). Disconnect and cap de-icing fluid injection line (AF Serial Nos. 49-901 and subsequent). Remove attaching bolts, and remove filter.

4-444. FUEL SUMP (USED PRIOR TO AF SERIAL NO. 49-921). A welded aluminum alloy sump is located in the main fuel line between the micronic filter and the front main beam in the right wheel well. Draining is accomplished by opening a spring-loaded drain valve in the base of the sump.





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1.	DEFLECTOR	7.	NUT
2.	"O" RING	8	SPRING
3.	FILTER ELEMENT	9.	PLATE
4.	DOME	10.	BODY
5.	RELIEF VALVE	11.	ELBOW
6.	CHECK NUT	12.	TEE

Figure 4-94. Fuel Filter, Prior to AF Serial No. 49-900

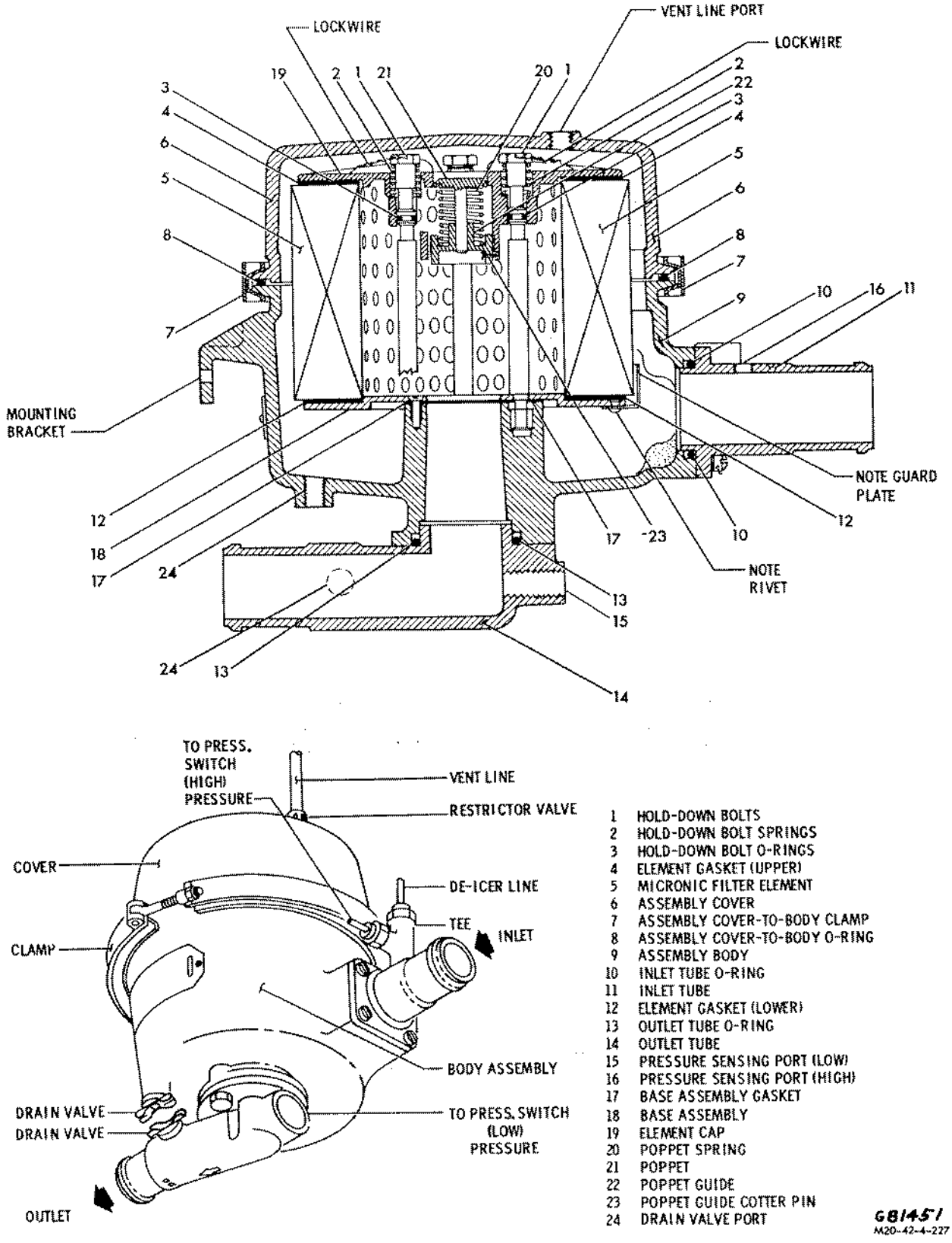


Figure 4-95. Fuel Filter, AF Serial No. 49-900 and Subsequent

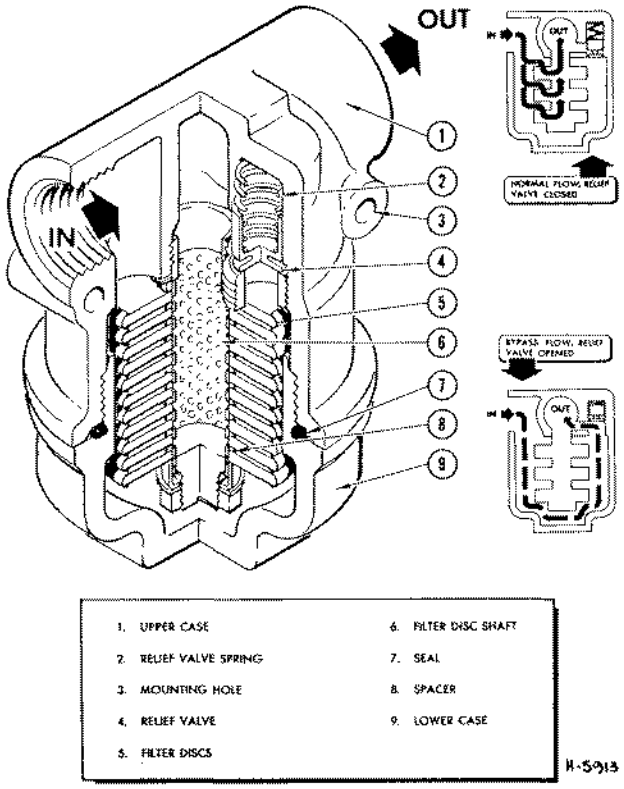


Figure 4-96. High Pressure Fuel Filter

4–445. REMOVAL OF FUEL SUMP. Close manual shutoff valve, and drain sump by opening drain valve. Place a container under sump and disconnect two fuel lines to the sump. Remove four mounting bolts and remove the sump.

4–446. HIGH PRESSURE FUEL FILTER. *(See figure 4-96.)* Two fuel filters are incorporated in the fuel system, one in the main fuel system and one in the emergency system. The filter assemblies are identical; an air-maze type filter in which the filter element is composed of a stock of reworkable screen discs (filter packs), a single relief valve set at 65 to 80 psi differential pressure, is incorporated in the filter body to bypass fuel around the filter element, should the element become clogged.

4–447. REMOVAL OF HIGH PRESSURE FUEL FILTER.

a. Disconnect and cap both inlet and outlet lines.

b. Remove bolts securing filter to mounting bracket and remove filter.

4–448. DISASSEMBLY AND CLEANING HIGH PRESSURE FUEL FILTER.

a. Remove filter sump and ring seal packing.

b. Unscrew complete filter stack from head using an Allen wrench. Remove ring seal packing.

c. Bend down locking tabs of washer. Remove tube and nut from tube.

d. Remove washer, retainer cup, packing ring, filter disc, and spacers from tube. Do not remove relief valve.

e. Thoroughly clean each disc with soft brush and approved solvent.

f. Visually inspect each disc for cleanliness and damage.

CAUTION

Do not use compressed air for cleaning or drying discs, as there is danger of damaging discs.

g. Wash inside of filter head and sump with an approved solvent.

h. Ultrasonic cleaning is recommended, if equipment is available.

i. Install in reverse of removal.

j. Torque filter nut on filter stack 60 to 80 lb in.

k. Torque filter stack in head 100 to 110 lb in.

l. Torque filter sump on head 30 to 40 lb ft.

4–448A. INSPECTION, CLEANING, READJUSTMENT OF DIFFERENTIAL PRESSURE RELIEF VALVE ON FUEL FILTERS, PART NO. 02S12385 AND 02S12247, EVERY 500 HOURS.

a. Remove filter and plug lines.

b. Remove filter sump and ring seal packing.

c. Unscrew complete filter stack from head using an Allen wrench. Install applicable size plug and O-ring.

d. Remove plug, Part No. MS9015-01 (reference figure 29-1, T. O. 2J-J33-14), nearest inlet port of filter head, and install 100 psi gage.

e. Install filter sump and ring seal packing.

f. Apply 0 to 100 psi regulated air pressure to inlet port with outlet port open. Determine relief valve opening. If relief valve opening is below or above 65 to 80 psi, adjust valve opening within these limits.

Note

If relief valve does not actuate due to excessive leakage on filter, Part No. 02S12247, remove relief valve seat and valve relief. Lap seating surface using 600 (wet or dry) paper, or equal.

Locally manufactured tool will be required for adjusting relief valve incorporated in filter, Part No. 02S12247. Filter, Part No. 02S12385, can be adjusted with 7/16 socket.

g. When relief valve is properly adjusted, peen threads to lock adjusting nut in place.

h. Disassemble and clean filter stack by bending down locking tabs of washer. Remove tube nut from tube. Remove washer, retainer cup, packing ring, filter disc, and spacers from tube.

i. Thoroughly clean each disc with a soft brush and approved solvent. Visually inspect each disc for cleanliness and damage. Do not use compressed air for cleaning or drying disc, as there is danger of damaging disc.

j. Wash inside of filter head and sump with an approved solvent.

k. Ultrasonic cleaning is recommended for cleaning disc, if equipment is available.

l. Install in reverse of removal.

m. Torque filter nut on filter stack 60 to 80 lb in.

n. Torque filter stack in head 100 to 110 lb in.

o. Torque filter sump on head 30 to 40 lb ft.

4-449. FUEL TRANSFER SOLENOID VALVES (PRIOR TO AF SERIAL NO. 53-4886 EXCEPT AIRPLANES INCORPORATING T. O. 1T-33A-544). *(See figure 4-97.)* The wing and leading-edge tank transfer valves are of the normally open solenoid-actuated pilot poppet type.

4-450. OPERATION OF FUEL TRANSFER SOLENOID VALVES (PRIOR TO AF SERIAL NO. 53-4886 EXCEPT AIRPLANES INCORPORATING T. O. 1T-33A-544). Fuel pressure against the nose of the piston overcomes the light spring and pushes the piston away from the O-ring seat. Pressure then escapes through the annular passage in the body and out the opposite end of the valve. However, a small portion of the flow passes through the small orifice in the piston and flows out by the pilot poppet which is normally open, creating a low-pressure area back of the piston, causing it to remain open. When the pilot poppet is closed by energizing the solenoid, the piston chamber is closed, and the pressure on the back of the piston becomes greater than that on the nose, causing the piston to be held firmly against the O-ring seat, thus shutting off the flow.

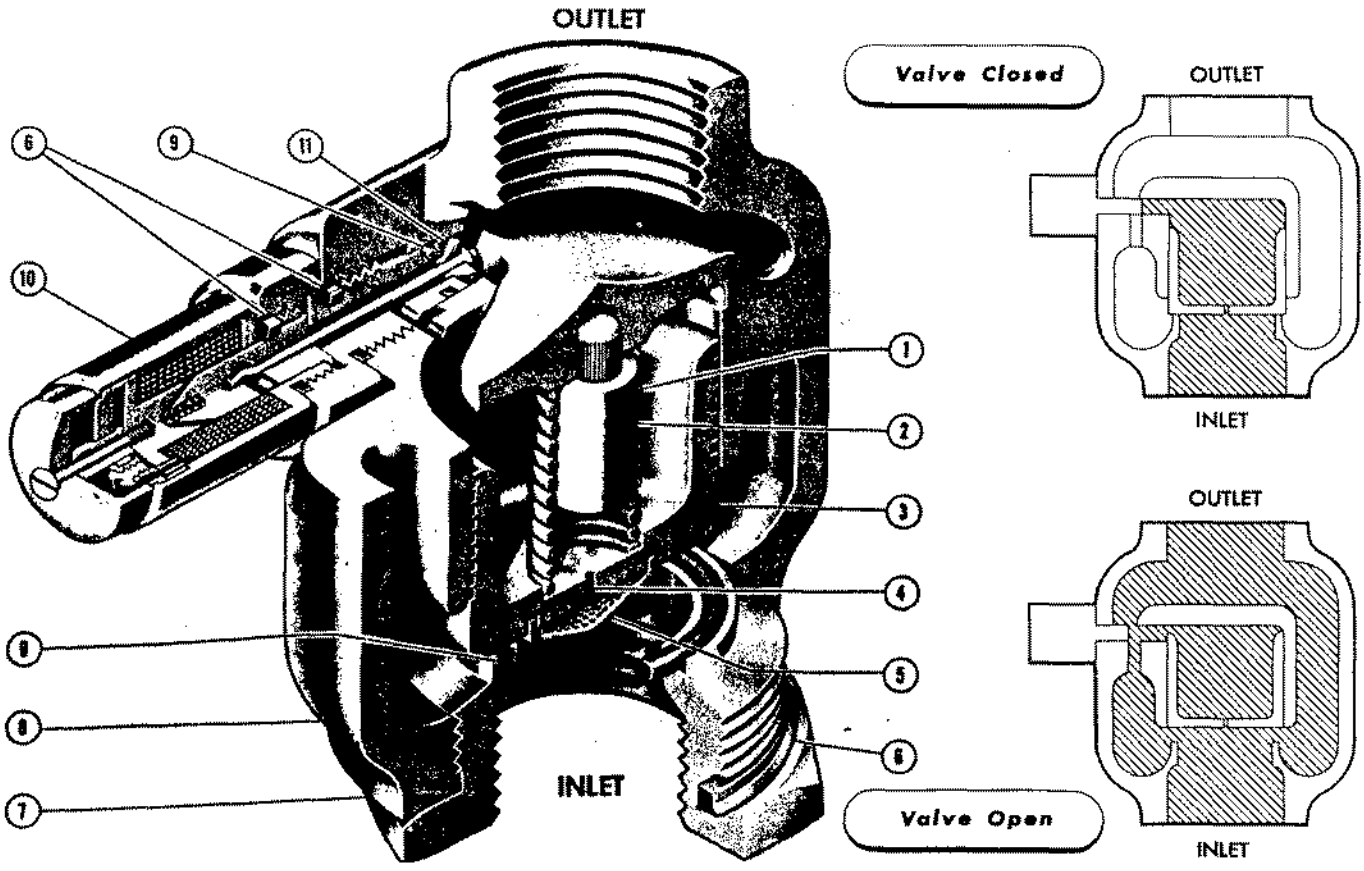


Figure 4-97. Fuel Transfer Solenoid Valve, Prior to AF Serial No. 53-4886 Except Airplanes Incorporating T. O. 1T-33A-544

4–451. REMOVAL OF FUEL TRANSFER SOLENOID VALVES (PRIOR TO AF SERIAL NO. 53-4886 EXCEPT AIRPLANES INCORPORATING T. O. 1T-33A-544).

a. Remove left dive flap. (Refer to paragraph 4–141.)

b. Remove leading edge and fuselage tank plumbing lines located below valves.

c. Disconnect electrical connection.

d. Remove the lines leading to valve.

4–452. FUEL BYPASS SOLENOID VALVE (PRIOR TO AF SERIAL NO. 53-4886 EXCEPT AIRPLANES INCORPORATING T. O. 1T-33A-544). *(See figure 4-98.)* The fuel bypass solenoid valve is a normally closed valve with no latching mechanism and only one solenoid is used.

4–453. OPERATION OF FUEL BYPASS SOLENOID VALVE (PRIOR TO AF SERIAL NO. 53-4886 EXCEPT AIRPLANES INCORPORATING T. O. 1T-33A-544). The valve remains closed until the solenoid is

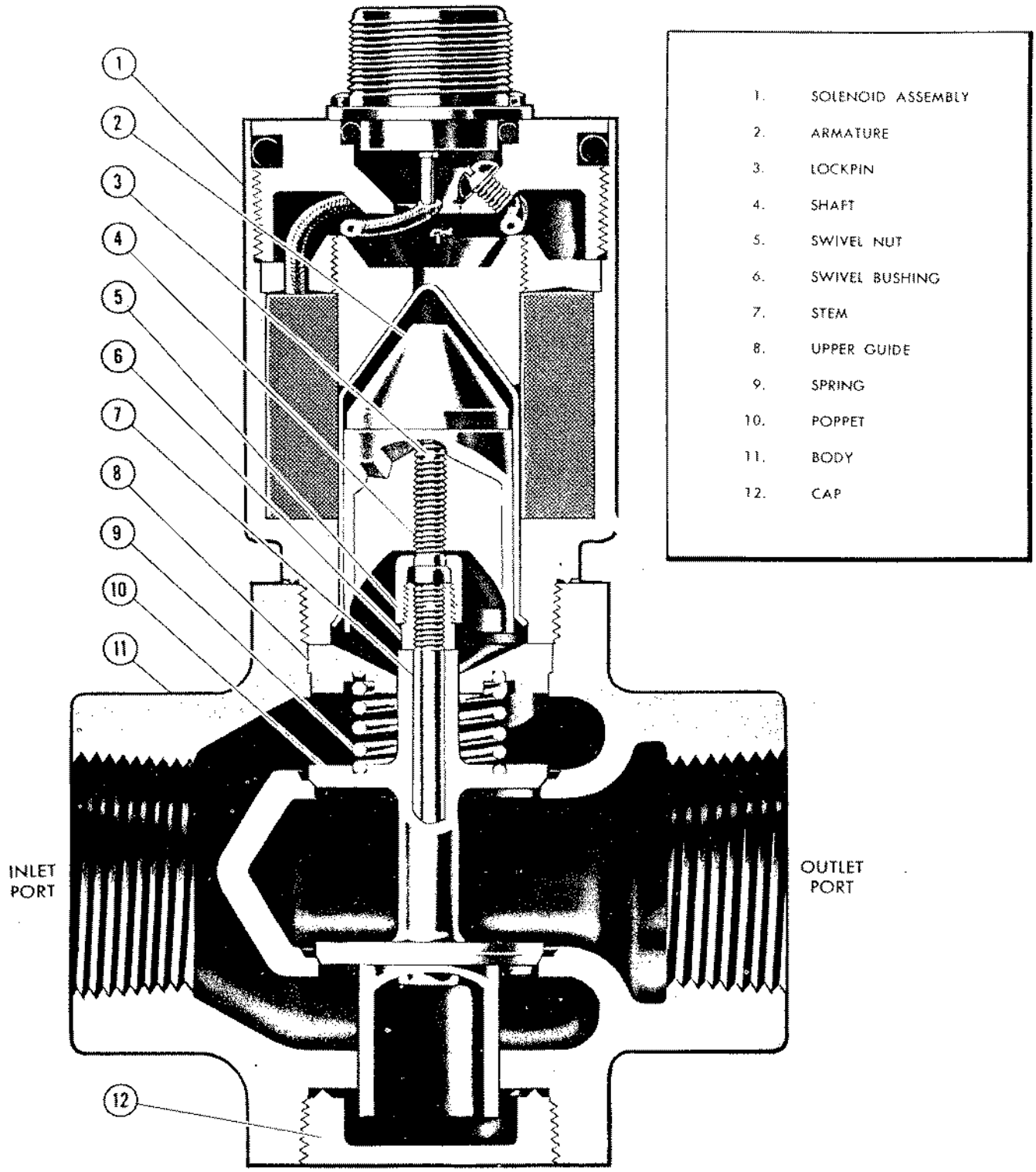


Figure 4-98. Fuel Bypass Solenoid Valve, Prior to AF Serial No. 53-4886 Except Airplanes Incorporating T. O. 1T-33A-544

energized by putting the fuel bypass switch in the BYPASS position. The valve will remain open as long as electrical energy is applied.

4–454. REMOVAL OF FUEL BYPASS SOLENOID VALVE (PRIOR TO AF SERIAL NO. 53-4886 EXCEPT AIRPLANES INCORPORATING T.O. 1T-33A-544).

a. Remove right dive flap. (Refer to paragraph 4–141.)

b. Remove droppable tank line located below bypass valve.

c. Disconnect electrical connection from valve.

d. Disconnect three fuel lines at bypass valve, motor-operated shut-off valve and check valve.

Note

Shut-off valve and check valve are removed with bypass solenoid valve.

e. Disconnect electrical lead from motor-operated shut-off valve.

f. Remove fairleads holding bypass valve, shutoff valve and check valve in place.

g. Remove two screws holding motor-operated shut-off valve in place.

h. Remove bypass valve, shutoff valve and check valve as a unit.

4–455. MOTOR-OPERATED SHUTOFF VALVE. The motor-operated fuel shutoff valve is located in the main fuel line between the fuselage tank and the micronic fuel filter. The valve is an intermittent duty, slide type valve operated by a switch in either cockpit. The valve is accessible through the right dive flap opening.

4–456. REMOVAL OF MOTOR-OPERATED SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 53-4886). This valve is removed with the fuel bypass solenoid valve. (Refer to paragraph 4–454.)

4–457. REMOVAL OF MOTOR-OPERATED SHUTOFF VALVE (AF SERIAL NO. 53-4886 AND SUBSEQUENT).

a. Remove right dive flap. (Refer to paragraph 4–141.)

b. Disconnect electrical lead from valve.

c. Disconnect fuel lines at valve.

d. Remove two bolts attaching valve to support and remove valve.

4–458. INSTALLATION OF MOTOR-OPERATED SHUTOFF VALVE.

a. Reverse removal procedure.

b. Clean exterior of valve at actuator and valve body, and at actuator electrical connector.

c. Wrap tape, FSN 5970-714-6892 around connector, extending 1½ inches onto electrical wiring and snug against actuator housing.

d. Apply sealing compound, Spec. MIL-S-8516 class 1, FSN 8030-881-2618, to the taped portion of the valve area adjoining the connector, and at actuator and valve body joint.

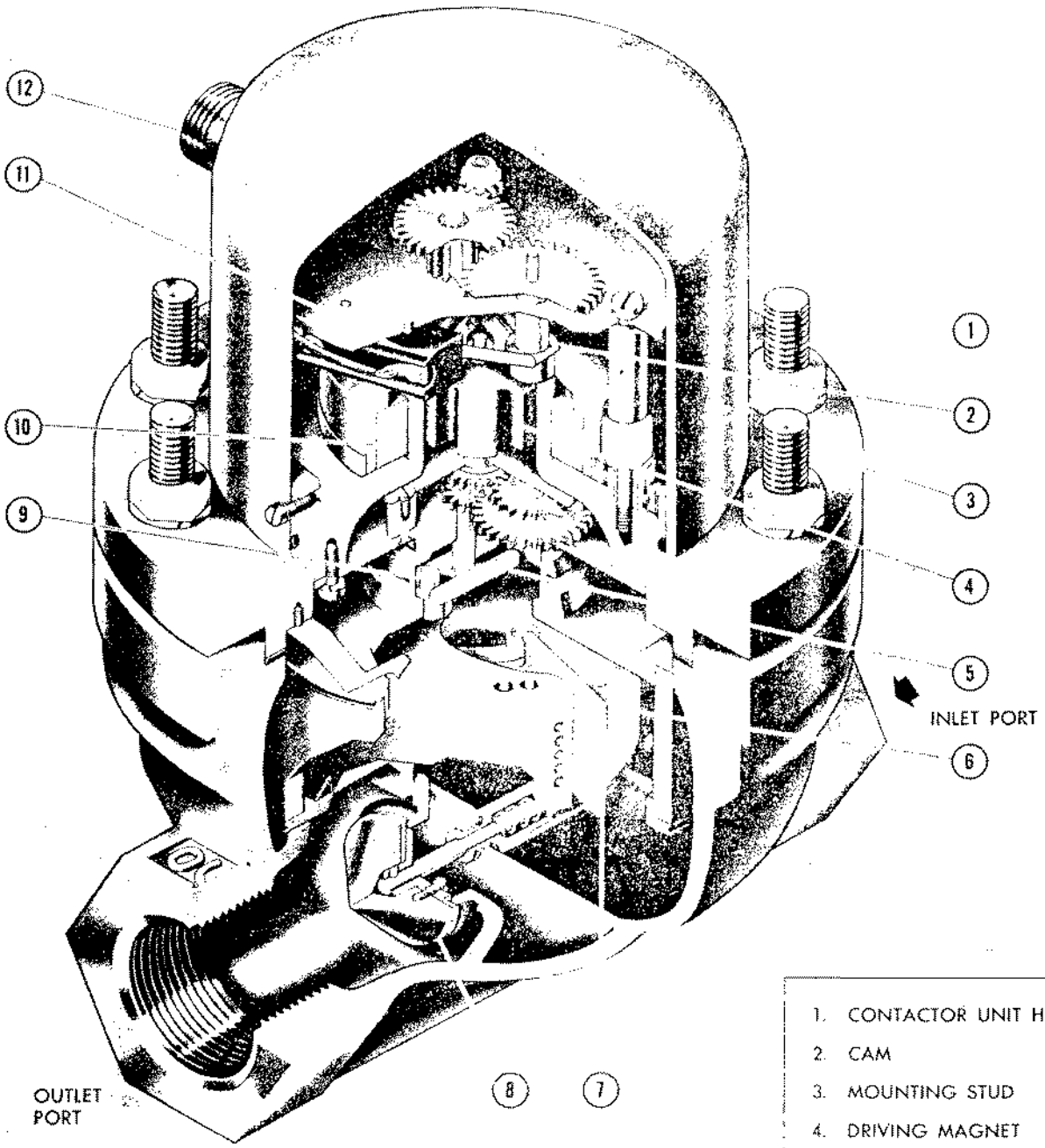
4–459. CHECK VALVES. There are a number of check valves installed in the fuel system to prevent fuel from flowing in the wrong direction. Each of these check valves consists of a cylindrical body in which is located a spring-loaded flapper disc. Fuel flow in the desired direction forces the flapper to open against the spring pressure. Reversed fuel flow forces the flapper to close against a flange. A small arrow is stamped into the body of each valve to indicate the direction of flow.

Note

When replacing the tip tank fuel transfer line check valves, assure that both the right and left valves bear the same part number. If valves are installed that are not matched, uneven tip tank feeding results.

4–460. FUEL QUANTITY TRANSMITTER. (Refer to paragraph 4–841.)

4–461. FUEL FLOWMETER. *(See figure 4-99.)* The fuel flowmeter is located on the engine accessory case between the main system double check valve and the starting fuel control. Access is gained to the unit by opening the lower left engine access door, No. 66. This meter is a volumetric measuring instrument of the oscillating piston type. It is suitable for an operating rate of flow of between 20 and 1200 gallons per hour. The registration accuracy of the meter is within plus or minus 1 per cent under normal operating temperatures and pressures. The meter measures the amount of fuel that has passed from the tanks to the engine. The measuring unit electrically actuates a subtracting counter located on the instrument subpanel. The counter must always be set to show the exact amount of fuel in the airplane at takeoff. The quantity of fuel, as it is used, is continuously subtracted from the original quantity shown on the counter, which therefore always indicates the quantity of fuel remaining



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1. CONTACTOR UNIT HOUSING
2. CAM
3. MOUNTING STUD
4. DRIVING MAGNET
5. DRIVING ARM
6. PISTON
7. DIAPHRAGM
8. BYPASS VALVE
9. DRIVING PIN
10. FOLLOWER MAGNET
11. MICROSWITCH
12. RECEPTACLE

Figure 4-99. Fuel Flowmeter

in the tanks. This meter does not indicate rate of flow. For electrical information refer to paragraph 4-847. The motion of the piston is transmitted by the upward projection of its spindle to a shaft which drives a permanent magnet. This magnet induces rotation in a second magnet on the opposite side of a metal seal. The second magnet drives a gear train to a cam-operated micro switch. Electrical impulses from the micro switch actuate a counter mechanism which indicates the quantity of fuel remaining in the tanks.

4-462. A relief valve is incorporated in the flowmeter to permit normal flow should the metering element jam.

4-463. REMOVAL OF FUEL FLOWMETER.

a. Disconnect electrical lead at flowmeter.

b. On airplanes prior to AF Serial No. 49-2758, remove high-pressure fuel filter on inlet side of flowmeter. (Refer to paragraph 4-447.)

c. Disconnect outlet line at elbow fitting.

d. Remove six nuts attaching flowmeter to mounting bracket, and remove unit from engine.

4-464. MAINTENANCE OF FUEL FLOWMETER. Little maintenance is required for this meter other than to see that proper operating conditions are preserved. Guard against foreign matter, such as air, sediment, and water, entering the measuring chamber.

a. The liquid passing through the measuring chamber must be free of grit and other forms of sediment in order to prevent unnecessary friction and scoring of the piston and chamber walls. Evidence of trouble from this source will be found in under-registration of the meter.

b. Inasmuch as this is an instrument which measures by volume, the meter will record passage of air as well as the liquid being measured. Over-registration is the result.

c. Incidental water will cause no damage to the meter. Trouble from this source may be expected only when water is allowed to stand in the meter for considerable periods of time.

4-465. FUEL PRESSURE TRANSMITTER, LIQUID (USED PRIOR TO AF SERIAL NO. 50-385). *(See figure 4-100.)* A fuel pressure transmitter is located in the lower left portion of the engine compartment. The transmitter is a cast aluminum alloy shell divided by a flexible diaphragm into two chambers. The half of the shell to which the transmitting line to the gage is connected is the outlet housing. A diaphragm disc and plunger assembly is incorporated in the pressure inlet housing for the purpose of centering and supporting the diaphragm when the pressure outlet side of the system is being filled with fluid. A spring-loaded ball check valve is installed in the lower port of the pressure-outlet housing to prevent loss of fluid or entry of air when the fluid supply tube is removed after filling. The pressure line to the indicator is filled with compass fluid.

4-466. REMOVAL OF FUEL PRESSURE TRANSMITTER.

a. Disconnect pressure inlet line at quick disconnect fitting.

b. Disconnect and immediately cap pressure outlet line at the transmitter.

c. Remove attaching screws and remove transmitter.

4-467. INSTALLATION OF FUEL PRESSURE TRANSMITTER. Reverse removal procedure.

CAUTION

Do not remove or loosen the mounting spacers or flange screws as they have been tightened to a definite torque.

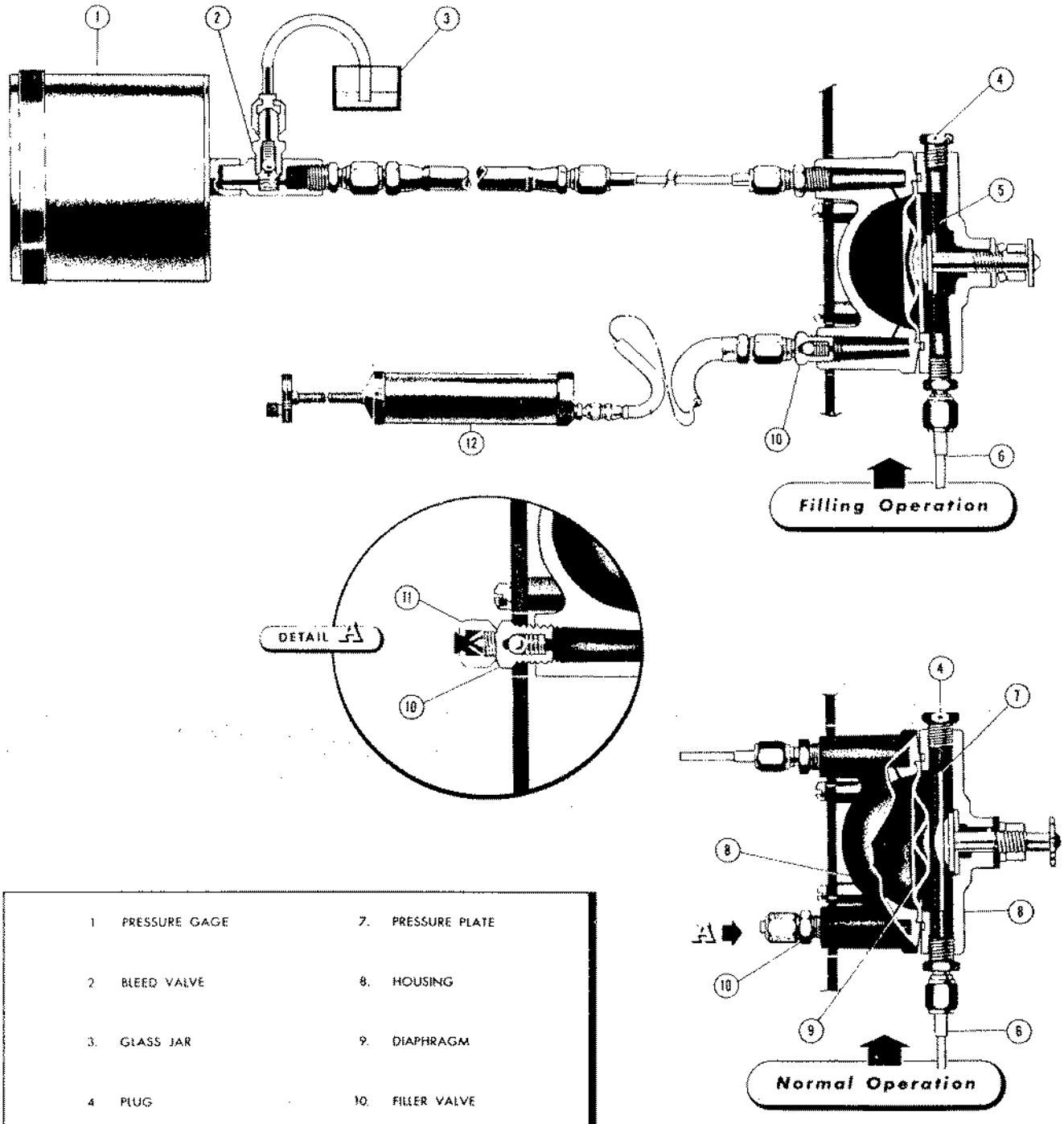
4-468. FILLING OF FUEL PRESSURE TRANSMITTER.

CAUTION

Use only aircraft compass fluid conforming to Specification MIL-C-5020.

a. Loosen the locknut and unscrew it from threaded portion of the stem. Push the knob in and turn it clockwise (approximately one-half turn) until plate (7) is felt to be firmly in place against diaphragm (9). If knob will not move in readily, tap it lightly with a hammer to loosen the gasket which has become sealed between the casting and the diaphragm disc. This procedure insures the diaphragm being centered.

b. Fill the transmitter and system, using either a portable filler gun or the master gage unit from a C-1 instrument field test set. Do not use a pressure filling system which has air under pressure in contact with the surface of the compass fluid.



1	PRESSURE GAGE	7.	PRESSURE PLATE
2	BLEED VALVE	8.	HOUSING
3.	GLASS JAR	9.	DIAPHRAGM
4	PLUG	10.	FILLER VALVE
5	FUEL CHAMBER	11	FILLER VALVE CAP
6	FUEL INLET	12.	FILLER GUN

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Figure 4-100. Fuel Pressure Transmitter

Note

Charging equipment must be clean. If equipment is not already filled with compass fluid, it must be thoroughly cleaned before being filled. After charging equipment has been cleaned and filled, attach a tag to indicate that the unit has been filled with compass fluid.

c. Remove cap (11) from filler valve (10) marked "F" located in the lower part of the transmitter, and connect filling line from the charging apparatus.

d. Remove cap from bleeder check valve marked "B" located on the gage fitting, and connect a suitable length of tube. Allow the end of the tube to vent under the surface of accumulated fluid in a container, to aid in determining complete elimination of air from lines. Continue charging until air bubbles no longer appear at the end of the bleeder line.

CAUTION

Do not exceed 25 psi on the master pressure gage, as excessive pressure will bend the pressure plate (7) and rupture the diaphragm. Be sure the supply reservoir of the charging equipment does not run out of fluid.

e. Remove bleed tube from bleed valve (2) on gage fitting and replace cap when fluid stops flowing. Tighten the cap securely.

f. Remove charging line from filling valve (10) on the transmitter and replace cap (11). Tighten the cap securely.

g. Turn transmitter knob counterclockwise and pull it out with the fingers as far as it will go. Tighten the lock nut with a wrench.

4–469. TROUBLE SHOOTING OF FUEL PRESSURE TRANSMITTER.

Trouble	*Probable Cause*	*Remedy*
Gage fails to show pressure, or pointer rises, then slowly returns to zero.	Leaks in lines or fittings; cap on bleeder or filler valve loose.	Tighten or replace.
	NOTE Caps should incorporate self-aligning seats. Caps made of one piece are likely to leak due to eccentricity of check valve nipple.	
	Clogged or crushed line.	Clean or replace line.
	Hole in gage fitting plugged.	Clean hole or replace fitting.
	Leaks between inlet and outlet housings of transmitter.	Tighten 10 flange screws to 32 inch-pounds torque. If leaks continue, replace transmitter.
	Defective gage.	Replace gage.
Gage does not operate in cold weather.	Unit filled with wrong fluid.	Drain and refill with compass fluid, Spec MIL-C-5020. If fluid is frozen, thaw and drain. Check for cracks by filling system with 20 psi air pressure and testing for leaks with solution of mild soap and water.
Gage shows pressure reading with temperature rise.	Unit was filled while diaphragm was back in operating position.	Open instrument line at transmitter. Put diaphragm in filling position. Replace line connection and refill unit.
	Bleeder cap replaced while filling pressure was on.	Put bleeder cap in place after all bleeding has stopped.
Diaphragm valve plate assembly will not move forward for filling.	Gasket sealed to plate.	Tap plunger lightly with hammer.
Leakage at lock nut under knob valve.	Loose lock nut.	Tighten.
	Defective gasket.	Replace transmitter.
Leakage through casting.	Porosity or cracks.	Replace transmitter.
Impossible to force compass fluid into the transmitter.	Empty or defective filling equipment.	Fill or replace filling equipment.

Trouble	*Probable Cause*	*Remedy*
Impossible to force compass fluid into the transmitter (cont'd).	Transfer holes in transmitter clogged.	Replace transmitter.
	Check valve in transmitter or gage clogged or have "B" and "F" valves reversed.	Inspect valves. Replace if necessary.
	Line clogged or crushed.	Clean or replace line.
	Remove fuel pressure connection on fuel inlet side. If filling liquid runs from opening, diaphragm is broken.	Replace transmitter.
	Pressure in filling equipment below minimum required.	Check pressure gage. Maintain 20 to 25 psi at all times.
	CAUTION Do not apply more than 25 psi at any time.	
Gage will not read zero.	Fluid has leaked from system.	Refill system.

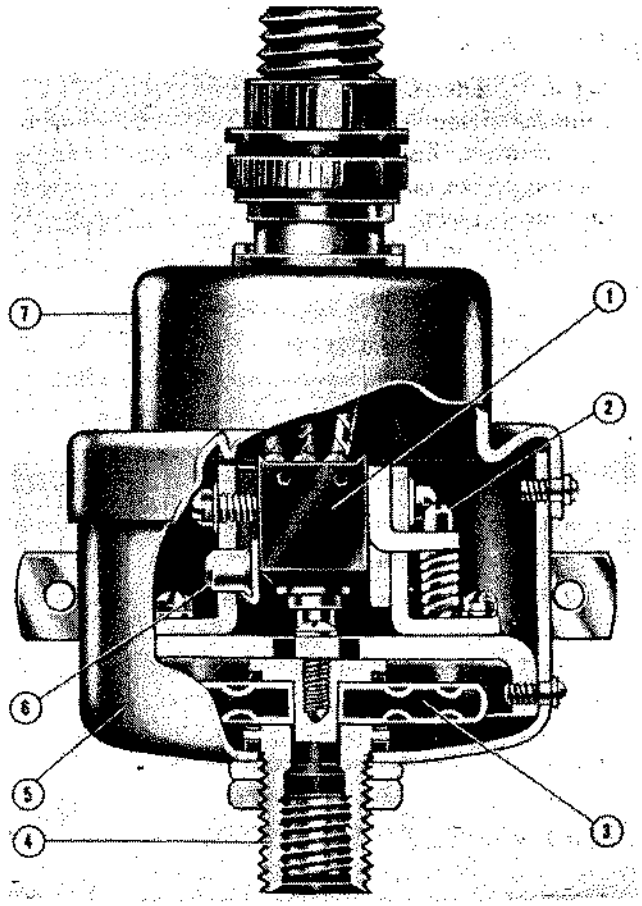
4–470. FUEL PRESSURE, TRANSMITTER, ELECTRICAL (AF SERIAL NOS. 50-385 AND SUBSEQUENT). An autosyn type fuel pressure transmitter is mounted on the engine accessory gear case. Pressure is transmitted to the autosyn by a fuel pressure-actuated diaphragm in the transmitter unit. For detailed information, refer to paragraph 4–956.

4–471. QUICK DISCONNECT FITTING. This fitting is installed in some of the plumbing lines between the engine and the forward fuselage section of the airplane. To disconnect, remove safety, place a wrench on the wrench flats and turn 90 degrees. To disassemble either half of the fitting, place a wrench on the wrench flats, and while pushing in on the spring located in the hole just below the wrench flat, turn the wrench 90 degrees.

CAUTION

If unit has been disassembled, upon assembly torque bolts to between 30 and 40 lb in. Do not over-torque as this will cause leakage.

4–472. FUEL PRESSURE WARNING SWITCH. There are three pressure switches (figure 4-101) in the main fuel system. One is located in the fuel line between the droppable tank and the fuselage tank, the second between the wing leading-edge tank and the fuselage tank, and the third between the aft inboard-wing tank and the fuselage tank. The purpose of these switches is to turn on the fuel-tank lights as the tanks are emptied. The operating parts of these switches are the bellows, the plunger, and the micro switch. Fuel pressure is applied to the port where it expands the bellows, forcing the plunger to operate the micro switch. The pressure switch controlling the drop tank warning light operates when fuel pressure drops to 2 psi. The pressure switches controlling the leading-edge and wing-tank warning lights operate when fuel pressure drops to 5 psi on airplanes having Serial Nos. AF48-356 through 48-364. Airplanes having Serial Nos. AF48-365 and subsequent have leading-edge and wing-tank pressure switches set at 3 psi.



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1. MICRO SWITCH
2. ADJUSTING SCREW
3. BELLOWS ASSEMBLY
4. FUEL PRESSURE CONNECTION
5. CASE
6. PIVOT
7. COVER

Figure 4-101. Fuel Pressure Warning Switch

4–473. Deleted.

4–474. A differential pressure switch is installed on airplanes having AF Serial Nos. 49-901 and subsequent. The switch is installed in the right wheel well, and is connected to the low-pressure fuel filter for use with the fuel de-icing system. See paragraph 4–547 for information on fuel de-icing sysem pressure switch.

4–475. REMOVAL OF EMERGENCY FUEL PRESSURE SWITCH.

a. Disconnect pressure sensing hose at pressure switch.

b. Disconnect electrical line at rear of switch.

c. Remove nuts and spacers securing switch bracket to engine gear case, and remove switch.

d. Remove nuts and screws holding switch to mounting bracket.

4–476. FUEL TRANSFER TEE FITTING, PART NO. 725407. To prevent fuel transfer tee fitting cracks, when replacing the drain valve in the tee fitting, use the following procedure:

a. Lubricate drain fitting threads with anti-seize compound, Specification JAN-A-669.

Note

Apply compound sparingly and do not lubricate the first two threads.

b. Install drain valve.

Note

Refer to Section VI, Table 6-1, Wrench Torque Table.

4–477. ENGINE FUEL SYSTEM. The engine fuel system consists of all fuel system parts that remain with the engine. They are: dual pump, main control unit, emergency control unit, three filters, flowmeter, starting control unit, and drain valve.

CAUTION

If it is necessary to replace AN3333 switch guard on starting fuel control switch, do not use an MS25233 guard. The spring in the MS25233 guard is so strong that it will return the switch to the "OFF" position as soon as the switch is released. This action will disrupt either an automatic or manual start.

4–478 through 4–486. Deleted.

4–486A. ENGINE FUEL SYSTEM, AUTOMATIC STARTING. (See figure 4-102.) In the first phase of automatic starting the starting fuel control switch and the engine control lever are in the "OFF" position. The emergency fuel switch is in the "NORMAL" position. Only the starter and ignition system circuits are energized. Fuel is bypassed back to both sides of the fuel pump by pressure relief valves in the main and emergency fuel control units. Fuel from the normal fuel system side of the dual fuel pump is under static pressure at the starting fuel control unit, and no fuel is admitted to the engine.

Note

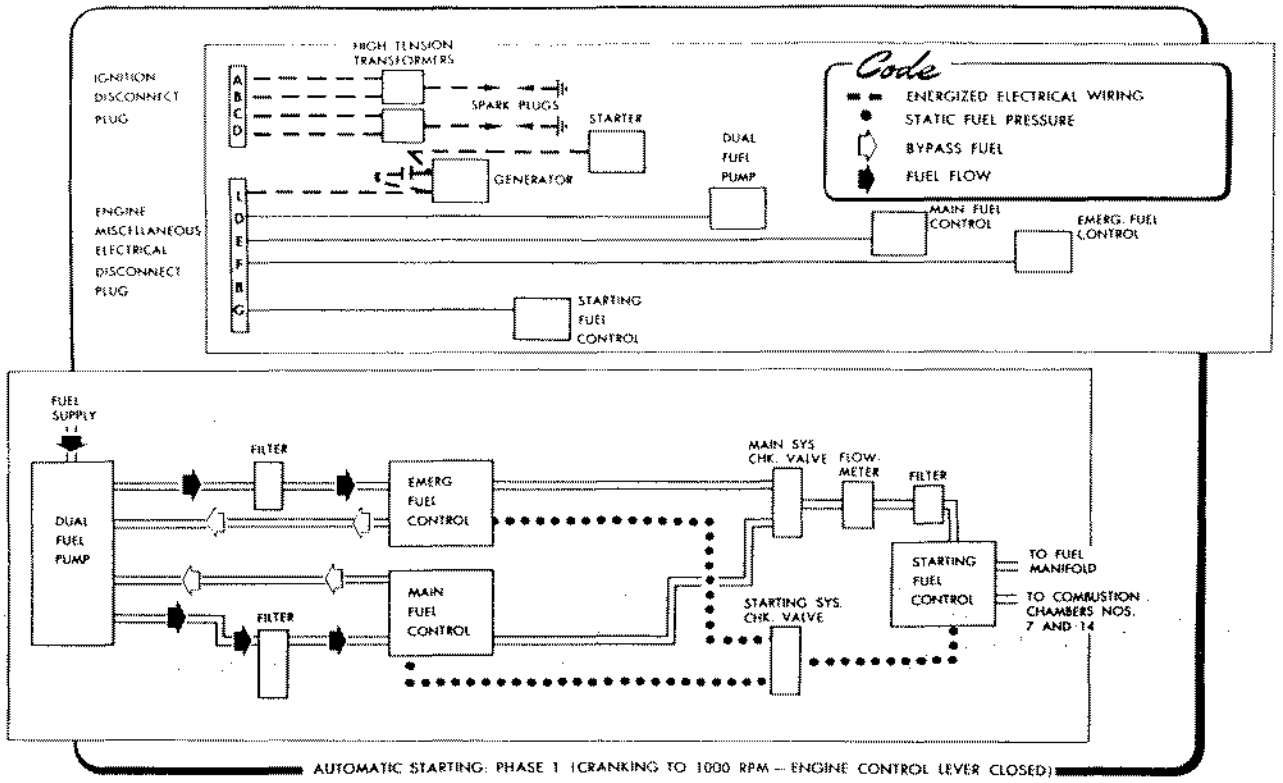
Fuel pressure is constantly supplied by both components of the dual fuel pump in all phases of normal operation.

4–486B. In the second phase when the engine speed reaches 10 percent rpm, the starter fuel control switch is placed in "AUTO" position. Fuel from both sides of the pump is delivered to combustion chambers No. 7 and No. 14, and ignited. The main fuel control is bypassed during this phase.

4–486C. The third phase is initiated by a dash-pot controlled cutoff valve in the starting fuel control unit. This valve diverts fuel from combustion chambers No. 7 and No. 14 to all chambers. The engine accelerates, and at approximately 17 percent rpm, the starter and ignition systems drop out. At approximately 3000 rpm (25.5 percent) the throttle is quickly moved to the idle position.

4–486D. In the fourth phase, the engine control lever is moved to "IDLE," the starting fuel control switch is moved to "OFF," and the fuel pump emergency pressure system is bypassed. Further operation is under manual control.

4–486E. ENGINE FUEL SYSTEM, MANUAL STARTING. (See figure 4-102.) In the first phase of manual starting, the engine control lever is in the "OFF" position. The emergency fuel switch is in the "NORMAL" position. The starting fuel system switch is placed in "MANUAL" position, and the starter system is energized. When 9 to 10 percent rpm is reached the ignition switch is placed in "NORMAL" position. Fuel is bypassed back to both sides of the fuel pump by the pressure relief valves in the main and emergency fuel control units. Fuel from the normal fuel system side of the dual pump is under static pressure at the starting fuel control unit, but no fuel is admitted to the engine.



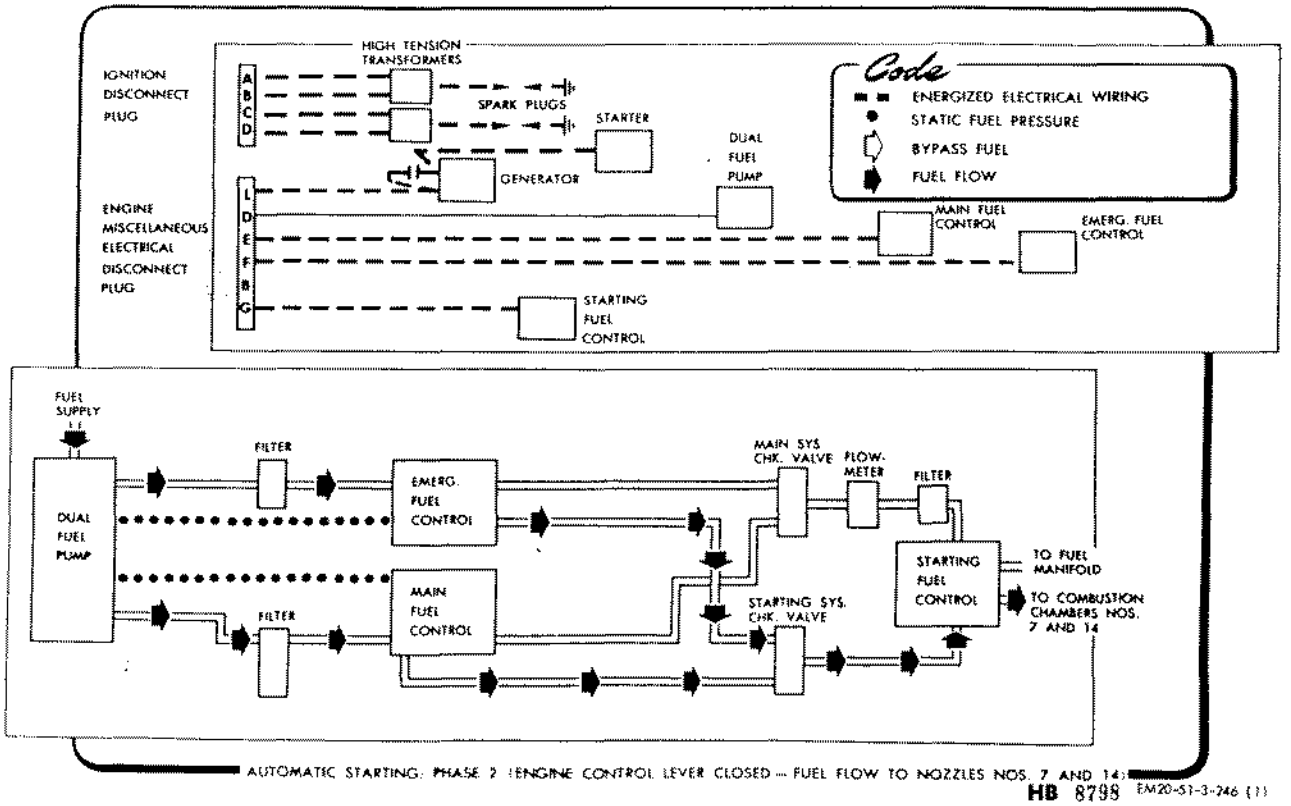


Figure 4-102. Engine Fuel and Electrical System, Prior to AF Serial No. 58-671 (Sheet 1 of 4)

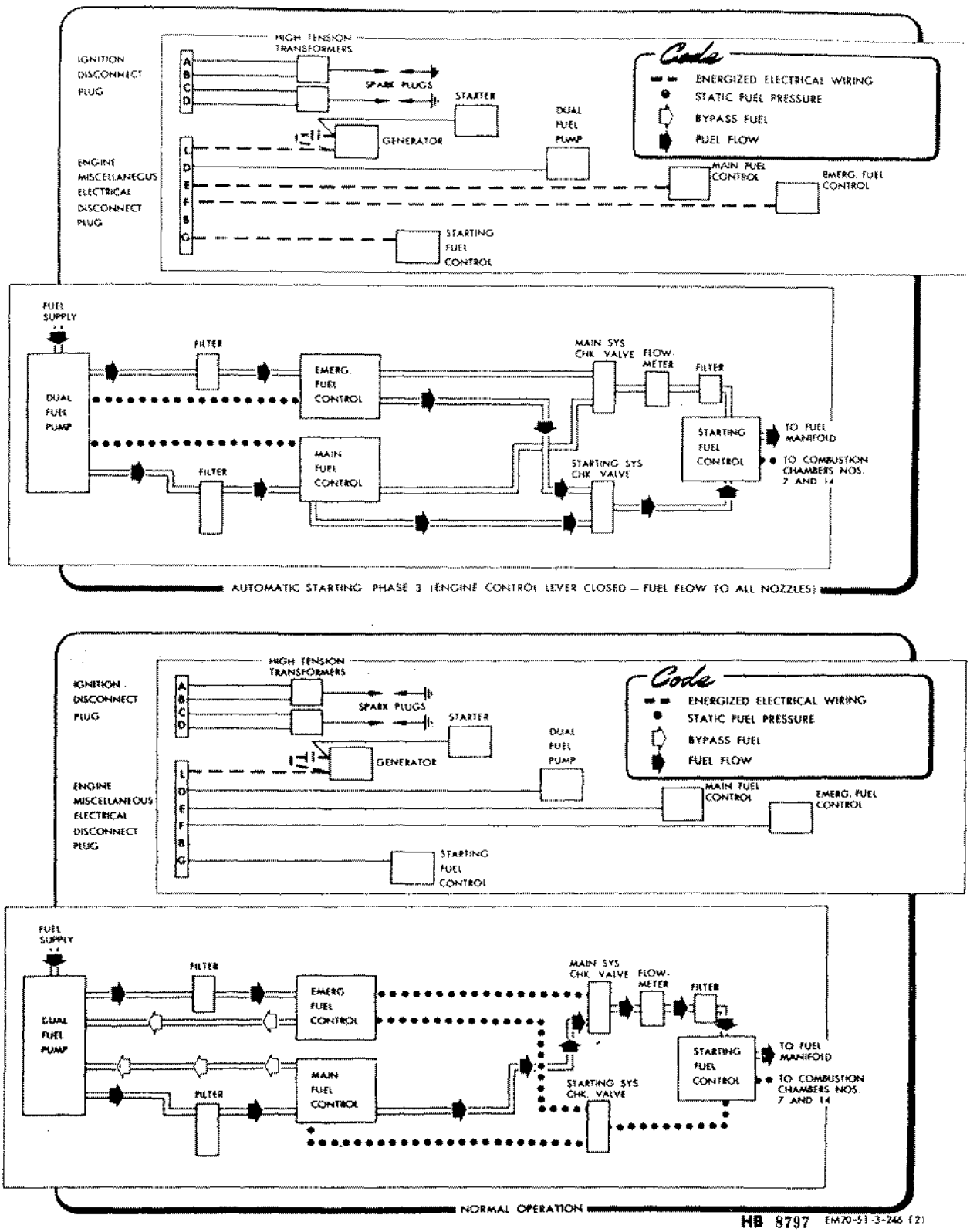


Figure 4-102. Engine Fuel and Electrical System, Prior to AF Serial No. 58-671 (Sheet 2 of 4)

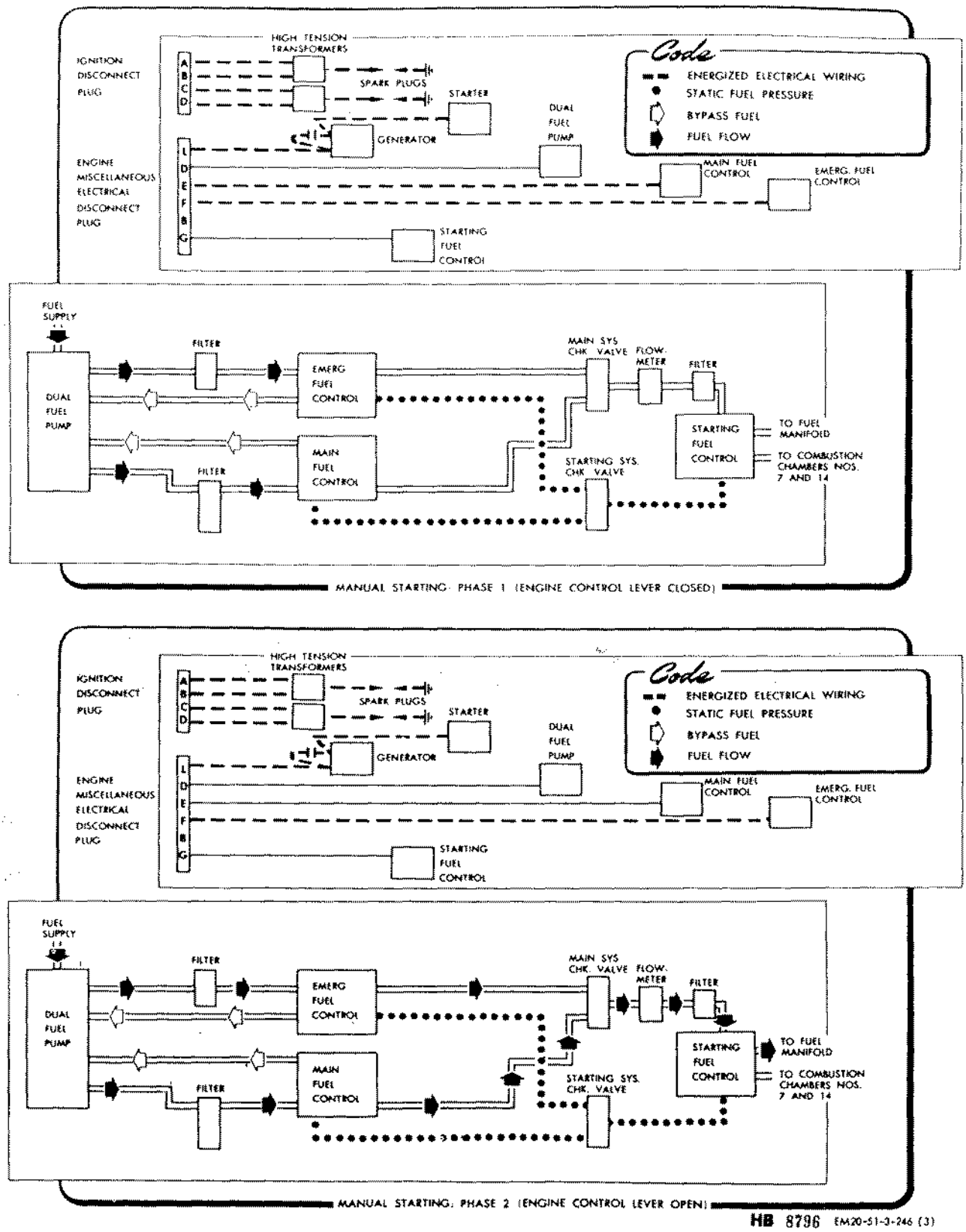


Figure 4-102. Engine Fuel and Electrical System, Prior to AF Serial No. 58-671 (Sheet 3 of 4)

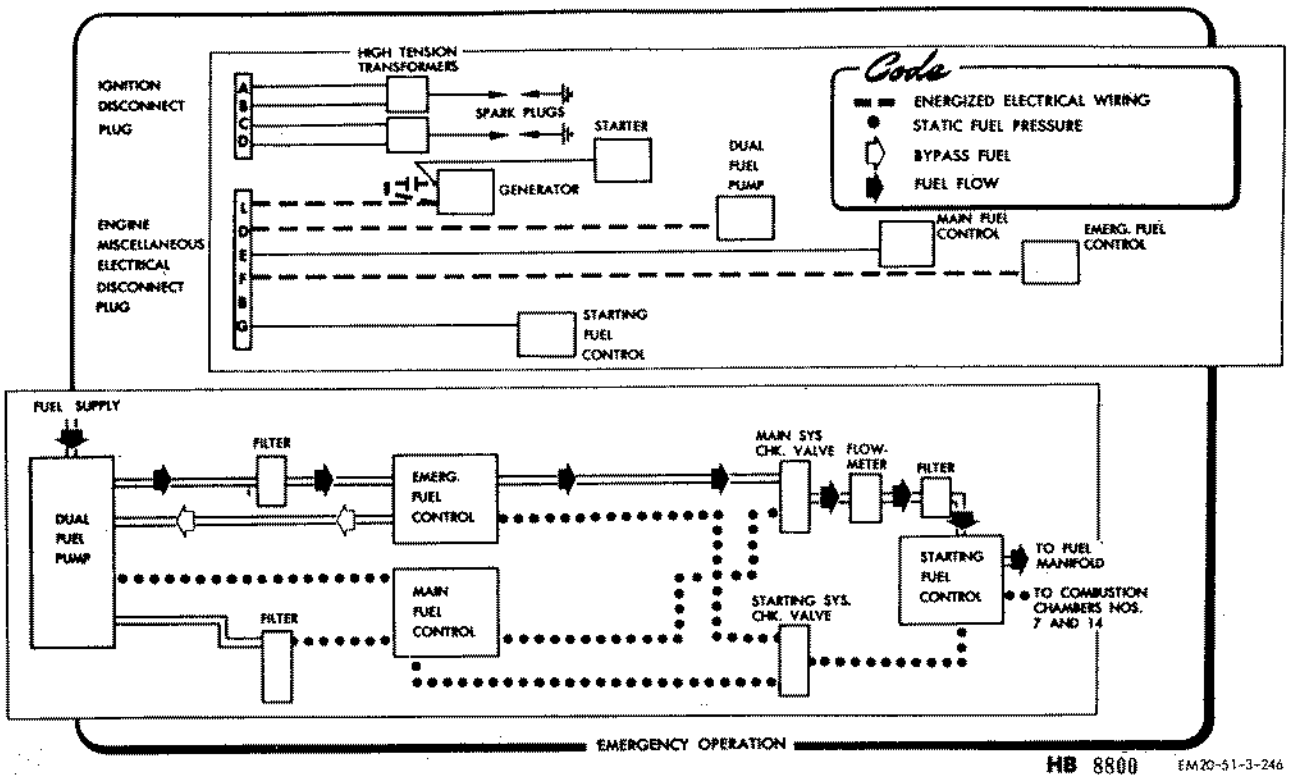


Figure 4-102. Engine Fuel and Electrical System, Prior to AF Serial No. 58-671 (Sheet 4 of 4)

4–486F. In the second phase of manual starting, when the engine speed reaches 1000 rpm, the engine control lever is opened approximately three-quarters of the way to permit fuel to flow to all combustion chambers. All fuel in the starting fuel system is under static pressure. Following engine light off the starting fuel system switch is returned to the "OFF" position.

4–486G. ENGINE FUEL SYSTEM, EMERGENCY OPERATION. *(See figure 4-102.)* During emergency operation, the starting fuel system switch is in the "OFF" position. The emergency fuel system switch is in the "EMERG." position and the engine control lever is advanced to obtain over 6400 rpm. The main system element of the dual fuel pump is dumped, creating a static pressure in the starting fuel lines. The emergency element of the dual fuel pump supplies all fuel to the combustion chambers.

4–486H. EMERGENCY FUEL SYSTEM OPERATIONAL CHECK.

a. Set engine speed at 55 percent rpm while operating on main fuel system.

b. Place starting fuel switch in "OFF" position.

c. Place emergency fuel system switch in "EMERG." position.

CAUTION

If a flameout occurs, close throttle to OFF. Do not return emergency fuel switch to NORMAL.

Note

Maximum rpm drop during changeover shall not exceed 12 percent. The normal rpm loss is 2 to 12 percent. The rpm will then return to a speed near the original 55 percent setting. The maximum speed while operating on emergency fuel system is less than that available from main fuel system with the same cockpit throttle setting at compressor inlet temperatures below 37.8° C (100° F). This is caused by lack of a temperature compensating feature and a governor sensitive to engine speed.

d. Retard throttle rapidly and return emergency fuel system switch to "NORMAL" simultaneously with throttle motion.

Note

The changeover from emergency to main system may result in a momentary overspeed condition accompanied by a noticeable "rumble." Changeover at speeds between 68 to 77 percent rpm will result in less "rumble."

4–486J. ENGINE FUEL SYSTEM, GANG START AIRSTARTING (AIRPLANES INCORPORATING T.O. 1T-33A-593). A single gang start airstart switch is located on the subinstrument panel in each cockpit.

Either switch will supplement and override, but not replace, existing fuel and engine control switches. Actuating the momentary contact gang start switch to the "ON" position in either cockpit will simultaneously gang-load the fuel booster pumps, actuate the airstart ignition system, turn the starting fuel "ON" in the automatic position, switch to the emergency fuel system and actuate the fuel de-icing system for approximately 45 seconds through the airstart ignition time delay relay. Once the gang start switch is actuated to the "ON" position, all items controlled by this switch, except the airstart ignition and the fuel de-icing system, will remain "ON" until the gang start switch is momentarily depressed to the "OFF" position.

4–486K. GROUND OPERATIONAL CHECKOUT PROCEDURE, GANG START AIRSTART SYSTEM.

a. Connect external power source to aircraft to supply dc power.

Note

Check that battery or battery-generator switch is "OFF," before applying external power to aircraft.

b. Turn main fuel shut-off valve "OFF."

c. Dynamotor circuit breaker out.

d. Check: Ignition switch "NORMAL," fuel booster pump switches "OFF," throttle—stop—cock, fuel selector switch "NORMAL."

e. Actuate gang start switch to "ON" position.

f. Check the following:

Gang start amber light on.

Emergency fuel amber light on.

Fuel booster pumps—operating—warning lights on.

Fuel de-icing pump—operating (45 seconds minimum).

Starting fuel control "ON" (fuel will drain from drip valve).

Emergency fuel switch "ON" and fuel sequence switch "MANUAL." Observe gang start amber light off. (This check to be made in the front cockpit only.)

Emergency fuel switch "NORMAL" and fuel sequence switch "OFF."

g. Depress gang start switch to "OFF" position. Check all previously operating equipment off or not operating. Repeat this operational check, except as noted, using rear cockpit gang start switch.

h. Turn main fuel shut-off valve "ON" and safety shut-off valve switch guard down with breakaway safety wire.

i. Start engine in accordance with the instructions for making a normal—automatic start in Flight Manual T.O. 1T-33A-1 or T.O. 1T-33(R)A-1.

CAUTION

Before attempting an engine start, drain tailpipe by pulling down until all fuel and alcohol has drained out. Inspect plenum chamber area and area between tailpipe and fuselage skin for the presence of fuel or fuel fumes which might cause a fire or explosion.

j. Check starting fuel switch "OFF."

k. Advance throttle to 55% rpm and actuate gang start switch to "ON." Check gang start and emergency fuel amber lights on.

l. Retard throttle to idle and then stop cock. Engine should continue to run on starting fuel.

m. Advance throttle to 70% rpm, then retard throttle while turning gang start switch "OFF." Check emergency fuel amber light off.

n. Advance throttle to 80% rpm.

o. Stop cock from 80% rpm and select gang start on *immediately*. Rpm should drop to between idle and 20% then recover to starting fuel setting. (If rpm drops below 15% or EGT rises to approximately 800 degrees, turn gang start "OFF" and reaccomplish check).

p. Return throttle to "IDLE" then 70% rpm. Retard throttle and turn gang start switch "OFF."

q. Make a normal engine shutdown.

r. Disconnect external power.

CAUTION

During any engine operation with the gang start system "ON," do not disconnect or turn the dc electrical power "OFF." To do so will result in a severe over-temperature condition.

4-487. DUAL FUEL PUMP. The engine-driven gear-type dual fuel pump incorporates emergency system gears and main pump gears. The two sets of gears are driven by concentric shafts with the shear section on each shaft located so that, if foreign material lodges in either pump, the gear section of that pump can fail without interfering with the operation of the alternate pump.

4-488. REMOVAL OF DUAL FUEL PUMP.

a. Disconnect all fuel lines to pump.

b. Disconnect fuel pump drain line.

c. Disconnect quick-disconnect electrical lead from pump.

d. Disconnect oil lines from oil filter.

e. Remove accessory case vent line from oil filter and bracket.

f. Remove emergency fuel filter from oil filter mounting bracket.

g. Remove two upper pump mounting nuts, and remove oil filter bracket from studs.

h. Remove two lower pump mounting nuts, and remove electrical lead bracket and dual fuel pump.

4-489. INSPECTION OF DUAL FUEL PUMP. To determine the serviceability of the dual fuel pump male drive spline and mating female drive spline, proceed as follows:

a. Remove fuel pump.

b. Remove felt plug from drive shaft recess, using a bent end scribe. Immerse plug in solvent, Federal Specification P-S-661, and thoroughly clean.

c. Thoroughly clean internal and external drive splines, using solvent, Federal Specification P-S-661.

d. Place 0.010-inch feeler gage against worn flank of male drive spline. If wear is greater than 0.010-inch, install a serviceable pump assembly.

e. Gage internal spline for wear, using Allison Tool No. 3696. With gage inserted, there should be 0.125 inch or more clearance between gage handle shoulder and rear edge of fuel pump driveshaft. Replace shaft if clearance is less.

f. If foregoing inspections show internal and external splines are within tolerances, impregnate felt oiler plug with high temperature lubricant and antiseize compound, Stock No. 7500-435200, and reinstall plug.

4-490. INSTALLATION OF DUAL FUEL PUMP. Reverse removal procedure.

Note

Refer to section VI for torque values of nuts and fittings.

If Technical Order 2J-J-33-5F (overhaul change 143) has been complied with, the felt plug is not required and the pump splines will not be lubricated. If overhaul change 143 has not been complied with, clean the felt plug with approved solvent, lubricate with Plastilube Number 3, and reinstall in the drive shaft. The pump male splines will be liberally coated, and the female drive splines will be packed one-half full with the same lubricant.

4-491. MAIN FUEL CONTROL. The main fuel control consists of the following components. A fuel bypass and relief valve assembly which maintains a constant fuel pressure in the relief valve chamber of the main fuel control. This valve also prevents damage to the main fuel control in the event of emergency shut-off at high engine speed. Bypassed fuel is routed to the inlet of the dual fuel pump. The chamber wall also contains a fixed altitude-idle jet.

4-492. A centrifugal governor fuel control which admits fuel to the engine from the main fuel control at a rate determined by pilot-selected position of engine control lever and governed by speed of the engine.

4-493. Fuel is supplied by the engine-driven fuel pump to the fuel pump bypass valve of the main fuel control. The bypass valve regulates the amount of fuel returned to the engine dual pump inlet to maintain a constant pressure drop from the control inlet to the high-pressure side of the control cutoff valve. This pressure drop is used by the regulator and governor valve to meter the fuel passing through the main fuel control to the engine. The maximum pressure relief valve in the bypass valve prevents buildup of excessive pressure.

4-494. The fuel is supplied to the regulator unit at a pressure determined by the bypass valve. The centrifugal regulator unit adjusts the fuel pressure supplied to the control unit and governor valve in response to variations of engine speed. This is accomplished by applying the thrust from centrifugal regulator weights to a linkage to which are connected the regulator valve and the metering head diaphragm. This thrust is opposed by the fuel pressure on the metering head diaphragm which is tending to close the regulator valve. The regulator valve regulates fuel flow by balancing these forces.

4-495. Fuel, at a pressure proportional to engine speed, passes from the regulator unit, through the governor valve in the fuel control, and out through the cutoff valve to the engine fuel manifold. The centrifugal governor valve is the prime control of fuel supplied to the engine. The pilot selects the desired engine speed by positioning the auxiliary fuel control lever through the engine control lever in the cockpit. For

each auxiliary control lever position, a definite spring force is set up, tending to open the governor valve. Likewise, for every engine speed, there is a definite thrust force supplied by the governor valve centrifugal speed-controlling weights tending to close the governor valve. The governor valve will seek a position which allows the fuel flow to increase engine speed until the thrust force from the centrifugal governor weights equals the spring force. The governor valve then will meter fuel so as to maintain the constant engine speed selected by the auxiliary fuel control lever.

4–496. The governor valve is against the maximum flow stop whenever the engine speed is below the preselected value, and likewise, it is against the minimum flow stop when the opposite is true. Thus, with a metering head across the governor valve being maintained by the regulator (proportional to engine speed during acceleration) the condition of maximum governor valve opening gives a fuel flow proportional to engine speed.

4–497. Altitude compensation of fuel pressure in the main fuel control body is provided by the action of a fuel differential pressure-actuated diaphragm in the metering chamber. The centrifugal fuel pressure regulator valve is linked to this diaphragm. Fuel is admitted to the metering chamber through two fixed jets in the diaphragm, and differential pressure across the diaphragm is controlled by the position of a contoured needle in the metering chamber outlet. The position of the contoured needle is controlled by the barometric fuel control which consists of an oil and gas filled bellows which expands when atmospheric pressure at the engine compressor inlet drops, and contracts when the same pressure rises. When the bellows expands (as altitude increases), it moves the contoured needle out of the metering chamber outlet jet, thereby increasing the outlet area. Since the metering chamber inlet area is fixed, this causes a pressure drop in the chamber. This pressure drop causes the diaphragm to deflect. Since the diaphragm is linked to the centrifugal pressure regulator valve, this deflection moves the valve toward the closed position. This lowers the pressure in the main fuel control chamber, and hence at the centrifugal governor valve through which fuel is delivered to the engine. At very high altitudes, with the engine control lever in the idle position, the pressure differential across the metering diaphragm is sufficient to close the centrifugal pressure regulator valve completely. Fuel then passes from the relief valve chamber only through the fixed altitude-idle jet.

4–497A. MAIN FUEL CONTROL ALTITUDE DROP. When operating on the main fuel system, it is permissible to have a maximum rpm drop of two percent at 20,000 feet, three percent at 30,000 feet and four percen 40,000 feet. If fuel control maintains these percentages, the unit is serviceable.

4–497B. ENGINE SPEED FLUCTUATIONS AND RECOVERY TIMES. *(See figure 4-102A.)*

4–497C. SPEED FLUCTUATION AFTER STABILIZATION. Maximum allowable RPM speed fluctuation at any speed after stabilization shall not exceed ±1/2 of 1 percent. See figure 4-102A, example 1.

4–497D. SPEED FLUCTUATION DURING RAPID THROTTLE BURST RECOVERY TIME. During rapid throttle burst, momentary large speed fluctuation may occur from the time the engine RPM first reaches full throttle or desired speed setting, until it stabilizes on this speed. This is recovery time and shall not exceed 5 seconds. The momentary speed fluctuation shall not exceed ±1-1/2 percent. See figure 4-102A, example 2.

4–497E. SPEED FLUCTUATION DURING RAPID THROTTLE DECREASE. During rapid throttle decrease, momentary large speed fluctuation may occur until the engine RPM stabilizes on desired speed setting. This is recovery time and shall not exceed 7 seconds. The momentary speed fluctuation shall not exceed ±3 p cent. See figure 4-102A, example 3.

4–498. REMOVAL OF MAIN FUEL CONTROL.

a. Remove bolt securing main fuel control lever arm to auxiliary fuel control lever arm.

b. Disconnect all fuel and drain lines from main fuel control.

c. Remove four screws securing cover on main fuel control switch, and disconnect electrical lead from switch.

d. Reinstall cover and screws.

e. Remove main fuel control top mounting nuts, and remove electrical lead bracket and hose supporting brackets.

f. Remove main fuel control lever mounting nuts, and remove main fuel control.

4–499. INSTALLATION OF MAIN FUEL CONTROL. Prior to initial installation of fuel control, drain preservation oil from control and refill with JP-4 fuel. Fuel will remain in the unit for a period of 8 hours. Reverse removal procedure.

Note

Install link on outboard side of main fuel control lever arm.

Refer to section VI for torque values of nuts and fittings.

4–500. REMOVAL AND CLEANING OF MAIN FUEL CONTROL ANEROID SCREEN.

a. Remove lock-wire from aneroid screen and remove two 8-32 screws which secure screen to bellows cage.

b. Remove screen and clean with an approved cleaning fluid and a soft brush.

CAUTION

While removing screen, do not loosen spanner nut at base of cage. Do not loosen locknut or change adjustment at top of cage. Do not use steel or any type of wire brush or buffer on screen as a means of cleaning.

c. Replace aneroid screen and secure with two 8-32 screws.

d. Lock-wire screws to spanner nut in a manner to produce a right and left pull on bellows housing.

4–501. BLEEDING OF MAIN FUEL CONTROL.

a. Remove lock-wire from bypass cover bleed plug. (See figure 4-102A-1.)

b. Remove bleed plug.

c. With ignition switch OFF, turn fuselage tank boost pump ON and fuel sequence switch to AUTO.

d. Motor engine with starter. Open and close throttle several times.

CAUTION

Do not operate starter continuously for over one minute.

e. Reinstall bleed plug and torque to between 35 and 40 lb in.

f. Lock-wire bleed plug in a manner to produce a right pull on bleed plug.

4–501A. DRAINING MAIN FUEL CONTROL BYPASS VALVE.

a. Remove plug and allow any fuel left in bypass valve cover to drain out. (See figure 4-102A-1.)

b. Take a small syringe with alcohol Specification MIL-A-6091 and insert into bypass valve cover (through plug opening) until alcohol runs freely from opening.

c. Immediately install plug with new O-ring to trap alcohol in this area.

d. This operation will alleviate this area from icing during flight.

4–502. EMERGENCY FUEL CONTROL. The emergency fuel control is an altitude compensated bypass and control valve. It provides a means of controlling the engine emergency fuel system in the event of failure of the main fuel system.

4–503. REMOVAL OF EMERGENCY FUEL CONTROL.

a. Remove nut securing terminal cover on emergency control solenoid housing. Lift off cover and disconnect electrical lead.

b. Disconnect all fuel lines to emergency fuel control.

c. Disconnect emergency control to main control link at emergency fuel control.

d. Remove four bolts securing unit to mounting bracket, and remove emergency fuel control unit.

4–504. INSTALLATION OF EMERGENCY FUEL CONTROL. Reverse removal procedure.

Note

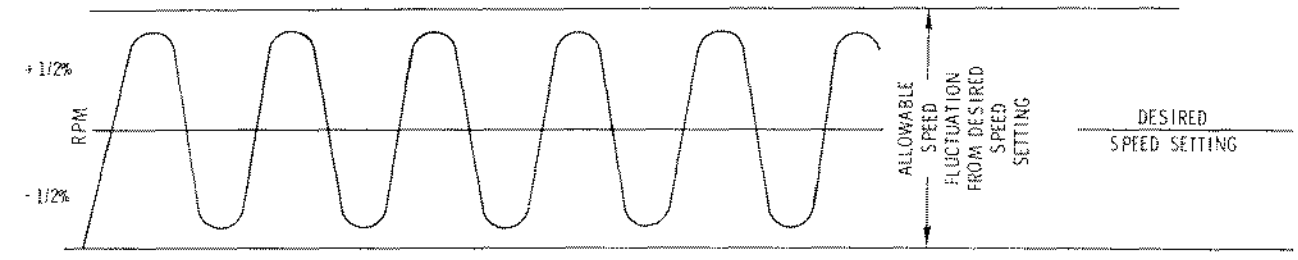
Refer to section VI for torque values of nuts and fittings.

4–505. SOLENOID ASSEMBLY, EMERGENCY FUEL CONTROL. When emergency fuel control solenoid assembly does not operate, remove solenoid and replace with a like serviceable item.

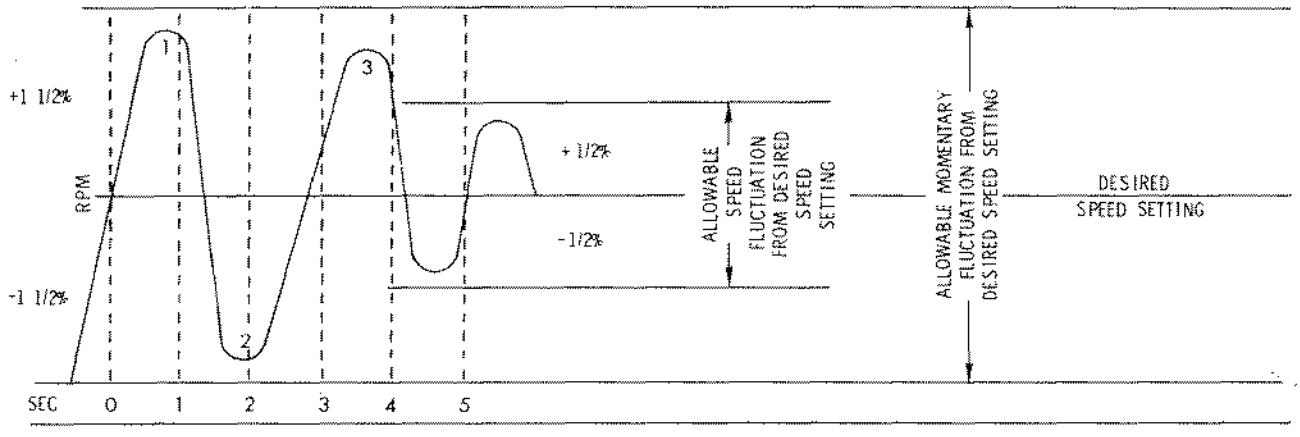
4–506. STARTING FUEL CONTROL. The starting fuel control provides fuel for initial light-up in No. 7 and 14 combustion chambers, a progressive spread of fire to remaining burners, and engine speed acceleration to an rpm setting for takeover by the main fuel control.

4–507. When the pilots starting fuel control switch is placed in AUTOMATIC, the throttle-operated starting fuel system cutout switch on the main fuel control closes and completes an electrical circuit to solenoid-operated fuel inlet and fuel manifold drain valves. The normally closed fuel inlet valve is opened, permitting fuel flow into the starting fuel control from the main fuel control; the normally open fuel manifold drain valve is closed, preventing leakage of fuel from the fuel manifold. The fuel manifold drain valve is also pressure controlled so that it will stay closed until fuel manifold pressure drops below 4 to 5 psi.

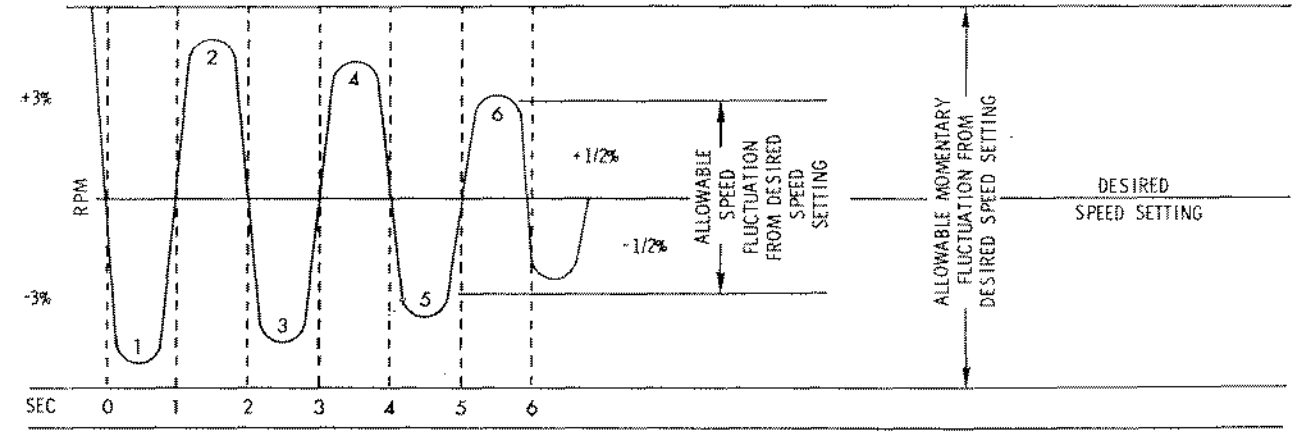
4–508. Fuel flow through the inlet valve is directed to a spring-operated pressure regulator which adjusts fuel



Example 1



Example 2



Example 3

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Figure 4-102A. Engine Speed Fluctuations and Recovery Times

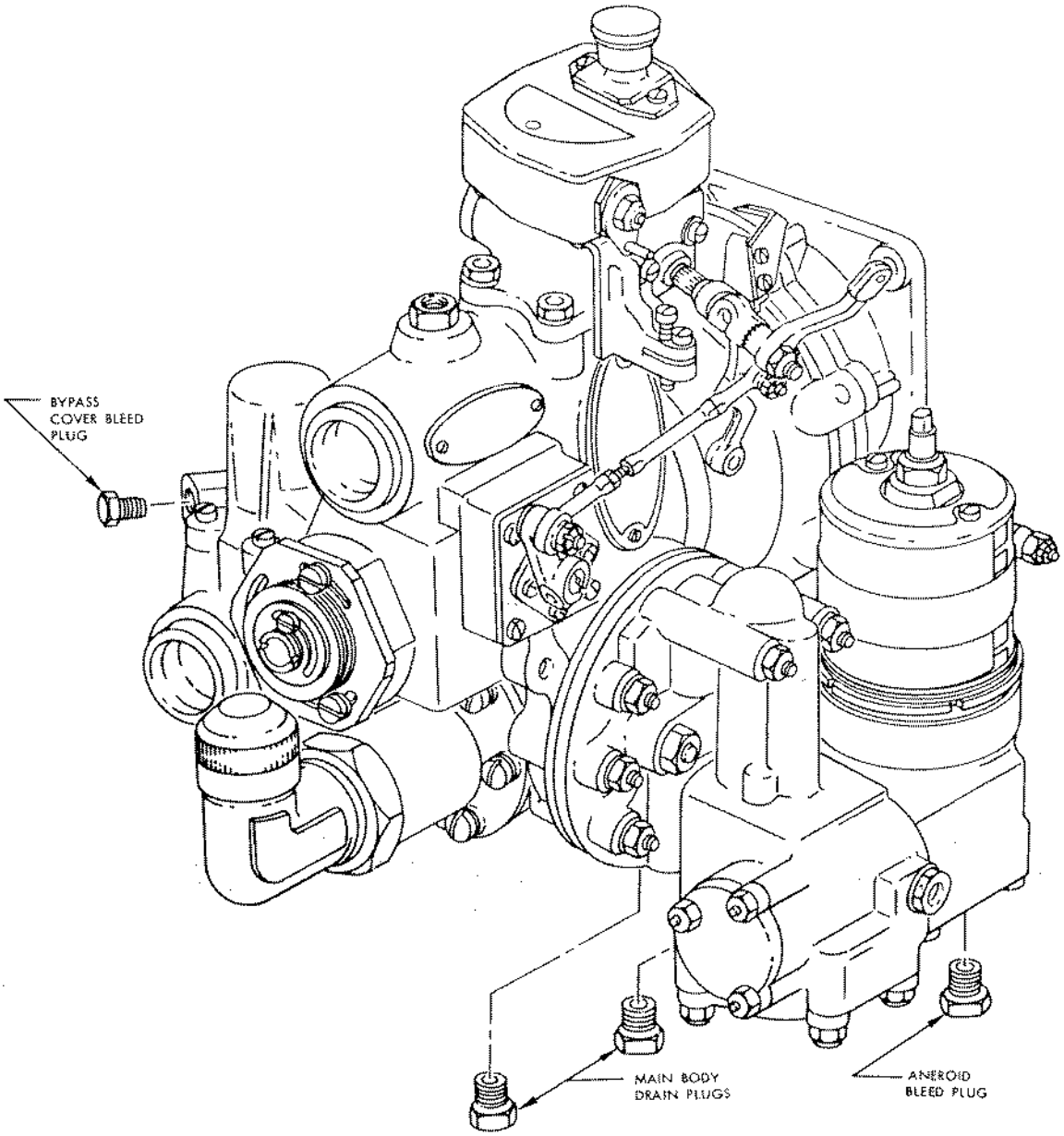

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Figure 4-102A-1. Main Fuel Control Bleed and Drain Plugs

pressure to a predetermined value. This pressure is applied to a contoured needle of a dash-pot unit, through a pressure cutoff valve to the top of the dash-pot piston, and to the fuel supply lines of No. 7 and 14 combustion chamber fuel nozzles. The fuel, at a pressure from the dash-pot needle, is applied to the bottom of the cutoff valve piston and to the engine fuel manifold.

4-509. During engine lightup, the dash-pot piston and attached needle are at the lowest position due to the action of fuel pressure coming through the cutoff valve from the regulator unit. Increasing fuel pressure, coming through a slot in the contoured dash-pot needle, forces the cut-off valve to close, cutting off the pressure from the regulator valve to the top of the dash-pot piston and closing off the fuel supply to No. 7 and 14 burner fuel nozzles.

4-510. Fuel now flows from the regulator valve through the dash-pot needle valve and into the engine fuel manifold. Fuel is discharged from all burner nozzles. No. 7 and 14 fuel nozzles receive their supply from the engine fuel manifold as the fuel manifold pressure check valves are overcome by the pressure buildup in the engine fuel manifold and the collapse of pressure in the supply lines from the cutoff valve.

4-511. Closing of the cutoff valve also cuts off the higher pressure from the regulator valve to the top of the dash-pot piston. The pressure on top of the dash-pot is now the same as underneath the piston. Since pressures are equalized, the spring will start the piston and attached needle moving toward the top of the dash-pot cylinder. The rate of travel for the dash-pot piston and needle will be timed by the flow of fuel from the top of the piston to the lower chamber of the cylinder through a fixed bleed located in the top of the dash-pot piston. This action increases the quantity of fuel as needed to accelerate engine speed to the required rpm for transfer to the operation of the main fuel control. The engine will remain at this predetermined rpm until the engine control lever is moved out of CUTOFF position. When the engine control lever is moved from CUTOFF to IDLE, the electrical circuit to the starting fuel control is broken by the throttle operated switch on the main fuel control. This permits the solenoid operated inlet valve to close, cutting off fuel supply to the starting fuel control.

4-512. REMOVAL OF STARTING FUEL CONTROL.

a. Remove terminal cover and disconnect electrical lead.

b. Disconnect all fuel and drain lines.

c. Disconnect fuel manifold coupling nuts at fuel control outlet T.

d. Remove nuts securing control bracket to engine, and remove unit and bracket.

e. Remove screws holding bracket to unit, and remove bracket.

4-513. INSTALLATION OF STARTING FUEL CONTROL.

Reverse removal procedure. Refer to section VI for torque values of nuts and fittings.

4-513A. ADJUSTMENT OF STARTING FUEL CONTROL. *(See figure 4-102B.)*

Note

Starting fuel control should stabilize between 26 to 38 percent rpm. If the starting fuel control stabilization point is below or above these percentages, readjust the starting fuel control to stabilize at 32 percent.

a. Take the following actions to minimize or eliminate hot starts:

(1) Assure that auxiliary power units are cranking the engine to at least 10 percent rpm prior to completion of the starting cycle. Do not continue the ground start attempt unless 10 percent cranking rpm can be obtained.

(2) Assure that the starter drop-out point is not less than 17 percent rpm. If it is less than 17 percent, adjust the aircraft starter controller to a minimum draw of 135 amps. Reject any controller that cannot be adjusted to the minimum allowable amperage draw of 135 amps.

b. To adjust starting fuel control (see figure 4-102B) break safety wire from starting control regulator adjusting screw, loosen regulator jamnut, and turn regulator valve adjusting screw clockwise to increase rpm and counterclockwise to decrease rpm. After final adjustment, tighten jamnut and resafety.

Note

Stabilized rpm adjustment point on the starting fuel control is 32 percent at all field elevations. Check on initial start, if this point is not reached, adjust control to 32 percent rpm. This adjustment point affords a starting operating range of approximately 26 to 38 percent rpm, based on 1 percent rpm increase or decrease per 1000 feet altitude increase or decrease. If the 32 percent stabilized rpm is maintained, normal automatic starts within established temperature limits can be expected, regardless of field elevation.

4–514. COMBUSTION CHAMBER DRAIN VALVE. The combustion chamber drain valve is a spring-loaded, ball-type valve used to drain the combustion chambers of any unburned fuel. It is located forward of access panel No. 32. The valve is connected to a drain manifold which, in turn, is connected to the seven lowest combustion chambers, namely, No. 5 to 11 inclusive. The upper combustion chambers drain internally to combustion chambers No. 5 and 11. The valve is designed to open and allow fuel to drain into the atmosphere when fuel pressure within the combustion chamber falls below 2 psi gage pressure. When raw fuel collects in the air adapters during a false start, or when the engine is stopped, it must be drained before another start is attempted. The chamber-drain manifold and combustion chamber drain valve automatically perform this draining function, thereby preventing a "hot start."

4–515. To check the operation of the combustion chamber drain valve, turn ignition switch OFF, energize starter momentarily, and momentarily open and close engine control lever. Drainage should be immediately apparent from combustion chamber drain valve. When fuel pressure drops below 10 psi, all fuel in fuel manifold should drain out through starting fuel control drain line.

4–515A. REMOVAL OF MAIN FUEL DOUBLE CHECK VALVE CAP ASSEMBLY FROM VALVE BODY.

a. Disconnect fuel lines to main fuel double check valve.

b. Remove the two cap assemblies from check valve body. Replace cap assembly if rubber seals on the swing assembly are deteriorated or damaged.

4–515B. INSTALLATION OF MAIN FUEL DOUBLE CHECK VALVE CAP ASSEMBLY ON VALVE BODY. Reverse removal procedure.

4–515C. REMOVAL OF STARTING FUEL DOUBLE CHECK VALVE AND CAP ASSEMBLIES.

a. Disconnect the two lines to the starting fuel double check valve.

b. Remove starting check valve from emergency fuel control.

c. Remove the two cap assemblies from check valve body. Replace cap assembly if rubber seals on the swing assembly are deteriorated or damaged.

4–515D. INSTALLATION OF STARTING FUEL DOUBLE CHECK VALVE AND CAP ASSEMBLIES. Reverse removal procedure.

CAUTION

When reassembling the starting fuel double check valve, be certain that the purple cap (marked EMERG on cap) is threaded into the emergency port, and the yellow cap (marked MAIN on cap) is threaded into the main port, since the purple cap has a drilled passageway and the yellow cap does not.

4–516. FLUID INJECTION AND FUEL DE-ICING SYSTEMS (PRIOR TO USAF SERIAL NO. 53-5083).

(See figure 4-103.)

Note

On USAF Serial No. 52-9692 through 52-9875, 52-9926 through 52-9975, 53-2690 through 53-2780, and 53-4886 through 53-5082 the fluid injection system is inoperative for lack of engine fluid injection manifolds.

4–517. DESCRIPTION OF FLUID INJECTION SYSTEM. The fluid injection system is composed of two tanks, a ground test shutoff valve for each of the tanks, a drain valve, pump, shutoff valve and strainer, manifolds, nozzles, pressure transmitter, restrictor check valve, air shutoff valve actuator, and a system shutoff valve.

4–518. Fluid injection is used to increase the engine thrust output by approximately 20 percent for short takeoffs, emergencies during extreme warm weather, and for short duration of flight or climb.

4–519. Fluid used in water injection systems must be clear and free of harmful impurities. Drinking water may be undesirable for use due to the inclusion of a relatively high concentration of dissolved minerals. These minerals will result in deposits of scale on engine internal parts and solenoid valves, and so reduce engine efficiency.

4–520. Water having a total solids concentration of not more than 50 parts per million is suitable for use in water injection systems for aircraft engines. Such water may be obtained by distillation or by chemical de-mineralization. Zeolite-softened water will not be satisfactory for this purpose, if the original concentration of hardness was high. Information on the analysis of water may be obtained from local water works officials, public health offices, or educational institutions.

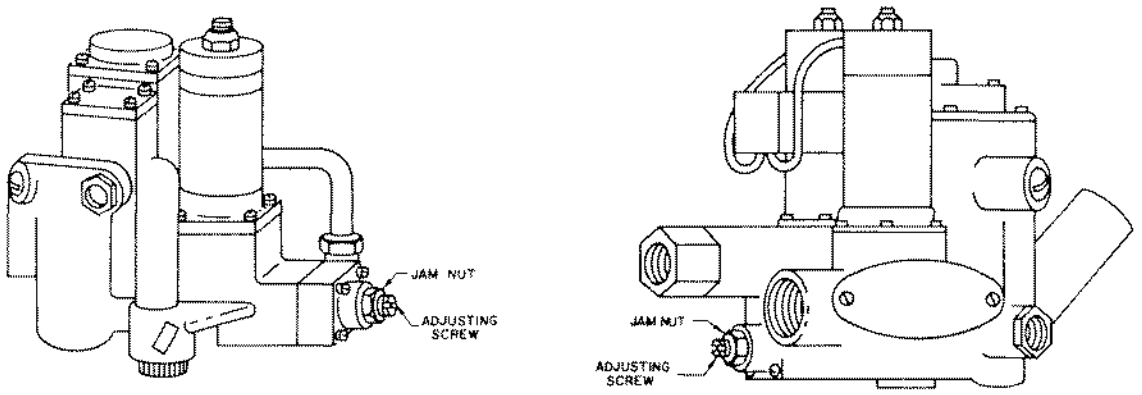

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Figure 4-102B. Starting Control Regulator Adjustment

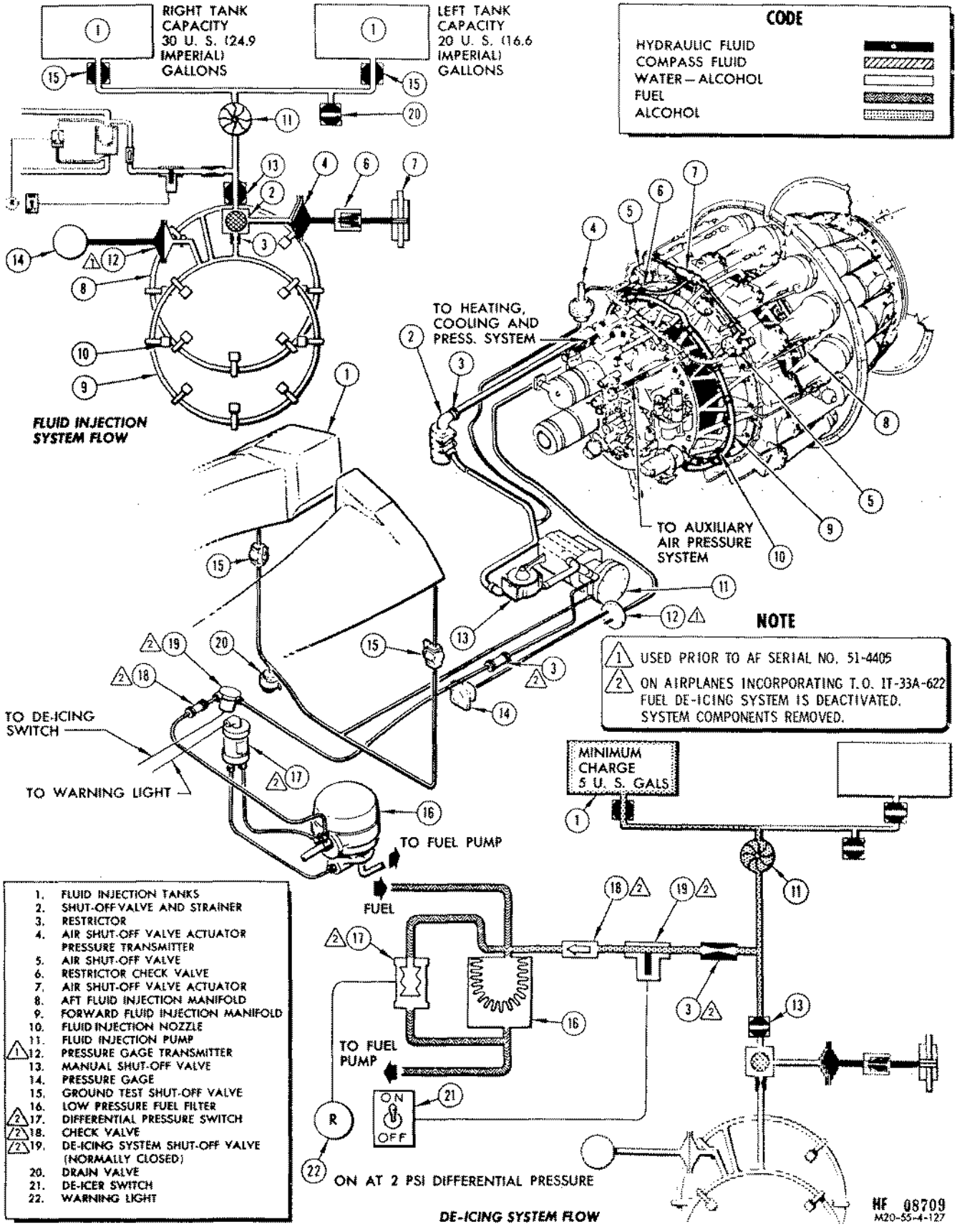


Figure 4-103. Fluid Injection and Fuel De-Icing Systems

4–521. If information relative to the analysis of local water supply cannot be obtained from these sources, a one-pint sample of the water in a clean glass container, rinsed with water from the same source as the sample, should be forwarded to the Air Material Command.

4–522. For operation at ambient air temperatures of 0°C (32°F) and above, mix alcohol, Specification AN-A-24 or MIL-A-6091, with water in the proportion of 33⅓ percent (by volume) alcohol and 66⅔ percent water. If Specification AN-A-24 is used initially, use until it is exhausted, then use MIL-A-6091. If temperatures of 0°C (32°F) and below are likely to be encountered in flight, drain the complete system, or consume the entire supply on takeoff and initial climb.

4–523. For operation at ambient air temperatures of 0°C (32°F) and below, prepare the system for fuel de-icing. (Refer to paragraph 4–527.)

4–524. DESCRIPTION OF FUEL DE-ICING SYSTEM. The fuel de-icing system is composed of a restrictor, check valve, solenoid shutoff valve, and pressure sensing switch. The system uses the right fluid injection tank for storage of the de-icing fluid, and the fluid injection pump for supplying system pressure. Fuel de-icing is used to prevent bypassing of unfiltered fuel through the low pressure fuel filter resulting from the ice crystal formation on the filter element.

4–525. Liquid used in the de-icing system is 100 per cent alcohol, Specification MIL-A-6091.

Note

If ethyl alcohol, Specification MIL-A-6091 is not available, the fuel filter de-icing system will be rendered inoperative by placing a placard in the forward cockpit on the auxiliary switch panel, and on the aft cockpit left shelf, stating (Fuel Filter De-Icing System Inoperative).

4–525A. On airplanes incorporating T.O. 1T-33A-622, the fuel filter de-icing system is deactivated. The restrictor, check valve, solenoid shutoff valve, and pressure sensing switch are removed.

Note

On airplanes incorporating T.O. 1T-33A-622, the de-icing system tank shall not be serviced with alcohol.

4–526. FILLING FLUID INJECTION SYSTEM.

a. Install placard adjacent to the fuel filter de-icing system switch in the cockpit to indicate that the system is inoperative.

b. Turn left fluid injection tank shutoff valve and the main shutoff valve to the "OPEN" position and lock-wire.

c. Fill tanks with 50 U.S. (41.5 Imperial) gallons of fluid injection mixture.

4–527. FILLING FUEL DE-ICING SYSTEM.

a. Remove the placard indicating system is inoperative, adjacent to the fuel filter de-icing system switch in the cockpit.

b. Close and lock-wire ground test shutoff valve adjacent to left fluid injection tank.

c. Close and lock-wire fluid injection system shutoff valve located on keelson, aft of the engine fuel quick disconnect.

d. Service right fluid injection tank with 100 percent Specification MIL-A-6091 alcohol.

Note

Tank must be serviced with minimum of 5 U.S. (4.15 Imperial) gallons of alcohol, Specification MIL-A-6091.

e. Install a placard adjacent to water injection system switch in cockpit, indicating that water is inoperative.

4–528. FLUID INJECTION TANKS. *(See figure 4-104.)* Two tanks made of rubberized nylon form the fluid injection tank system. Left tank is of 20 U.S. (16.6 Imperial) gallons capacity, and the right tank is of 30 U.S. (24.9 Imperial) gallons capacity. Tanks are collapsible and removable, and are supported by metal frames.

4–529. REMOVAL OF FLUID INJECTION TANKS.

a. Drain the tanks.

b. Remove the vent lines from the tanks.

c. Remove the outlet lines from each tank.

d. Remove the hinge pins from the tank compartment cover plates.

e. Remove the tank manhole cover.

f. Remove the tank filler neck.

g. Remove clips which hold the tank to walls. Collapse tank and remove it.

4–530. GROUND TEST SHUTOFF VALVE. A ground test shutoff valve is installed in the outlet line of each fluid injection tank. The valves are accessible through the upper engine accessory panel No. 42.

4–531. REMOVAL OF GROUND TEST SHUTOFF VALVE.

a. Drain the fluid injection tanks.

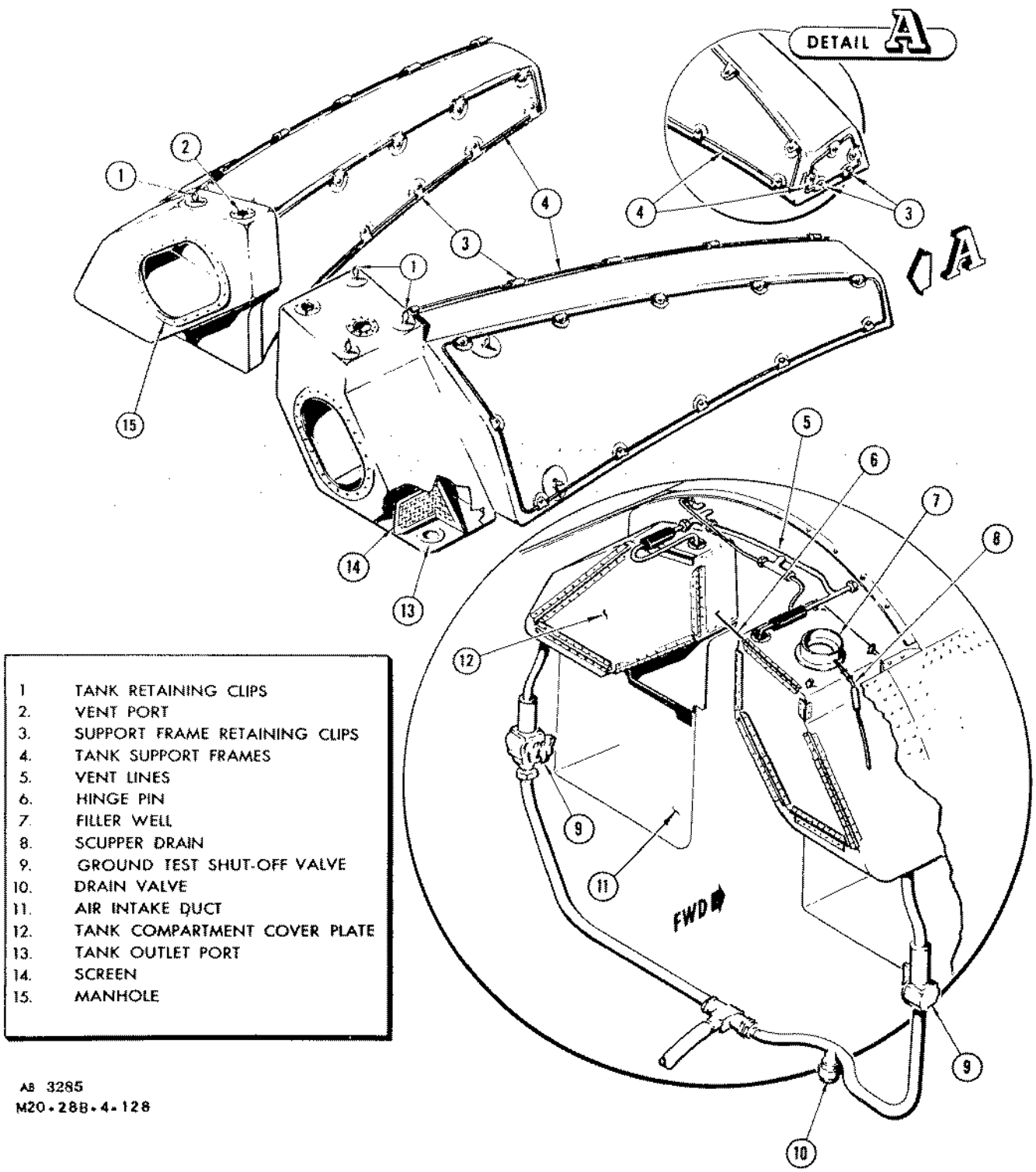
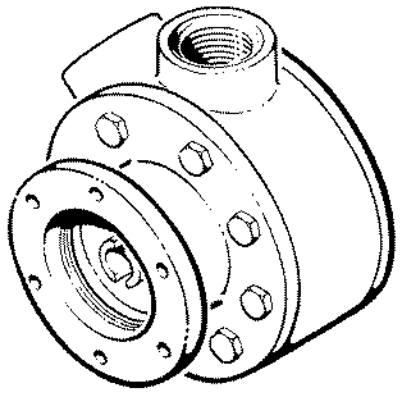
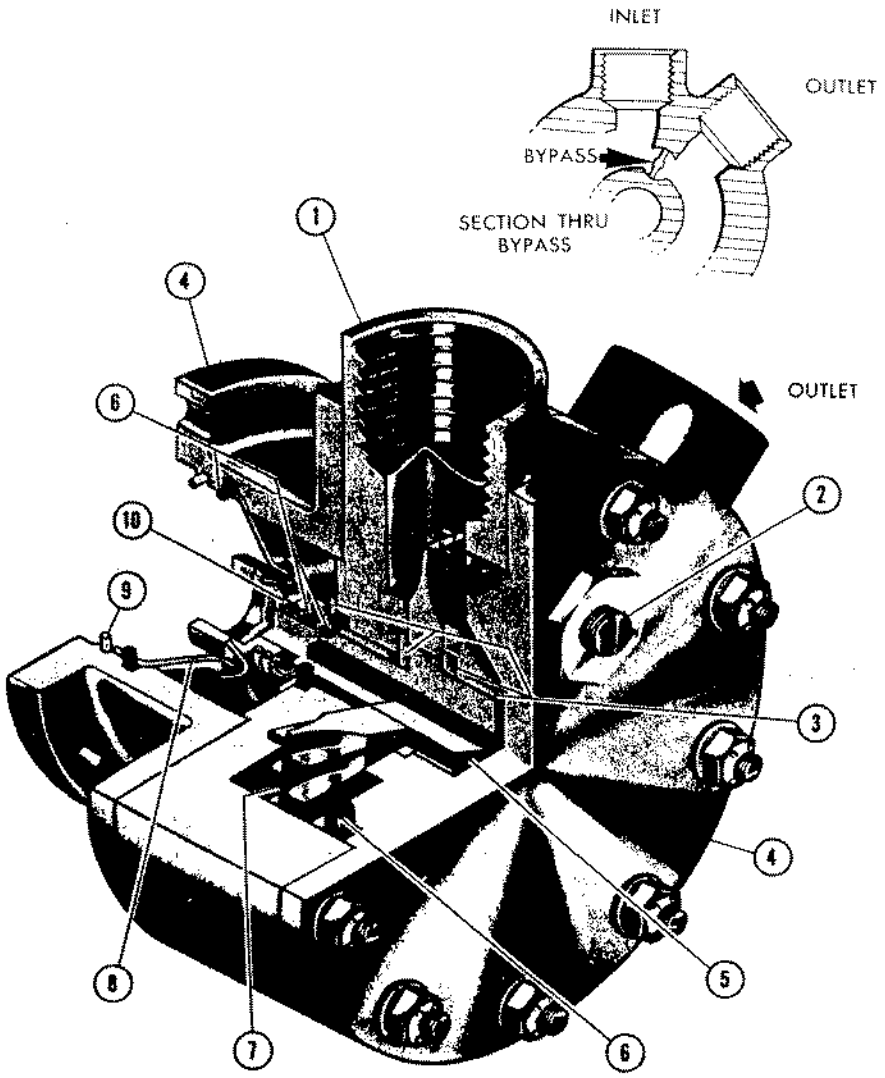


Figure 4-104. Fluid Injection Tanks





1.	BODY
2.	BYPASS ADJUSTMENT SCREW
3.	BUSHINGS
4.	BODY CAP
5.	SHAFT
6.	"O" RING PACKING
7.	IMPELLER
8.	BAFFLE
9.	SNAP RING
10.	SPRING

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Figure 4-105. Fluid Injection Pump

b. Disconnect fluid lines on either side of valve.

c. Remove the bolts holding the valve in position and remove.

4–532. DRAIN VALVE. A drain valve is located in line leading from the right fluid injection tank. The valve is an integral part of the fluid line. The unit is accessible from lower right-hand engine access panel No. 65.

4–533. REMOVAL OF DRAIN VALVE.

a. Close both ground test shutoff valves.

b. Disconnect the fluid line, of which the drain valve is a part, at the "Y" fitting and at the connection below the right ground shutoff valve and remove.

4–534. FLUID INJECTION-PUMP. *(See figure 4-105.)* The fluid injection pump turbine rotates between 3500-3750 rpm. The pump bypass is set to maintain a discharge pressure of 45 psi at the nozzles at a flow of from 25-28 gallons per minute.

4–535. A 27 volt, 160 ampere, series wound intermittent duty electric motor is used to drive the pump. The armature revolves at 9000 rpm and the drive shaft is geared down to the pump speed.

4–536. The pump and motor assembly is shock-mounted to the right-hand side of the fuselage between stations 252 and 263.

4–537. REMOVAL OF FLUID INJECTION PUMP.

a. Close both ground test shutoff valves.

b. Disconnect the fluid lines at the pump.

c. Disconnect the pump drain line.

d. Disconnect the electrical lead from the pump motor.

e. Remove the four bolts holding the pump and motor assembly to the mounting bracket or remove the four bolts holding the assembly and mounting bracket to the shock mount.

4–538. INSTALLATION OF FLUID INJECTION PUMP. Reverse the removal procedure. Before mounting a pump to a motor assembly, rotate the pump shaft by hand to insure that it is free to move without binding.

4–539. FUEL DE-ICING RESTRICTOR (AIRPLANES NOT INCORPORATING T.O. 1T-33A-622). A restrictor incorporating an 0.059-inch orifice is installed in the fuel de-icing system pressure line between the pump and the fuel system micronic filter to decrease pump flow to approximately 30 to 45 gallons per hour. The restrictor is located to the right and forward of the fluid injection system manual shutoff valve.

4–540. FUEL DE-ICING SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 51-17443 AND ON 52-9129 THROUGH 51-9165, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622). *(See figure 4-106.)* A normally closed solenoid operated shutoff valve is mounted on the aft face of the wing rear beam in the engine compartment. The valve is controlled by a momentary contact switch in the cockpit.

4–541. REMOVAL OF FUEL DE-ICING SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 51-17443 AND ON 52-9129 THROUGH 52-9165, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622).

a. Disconnect electrical lead on top of valve.

b. Disconnect inlet and outlet lines.

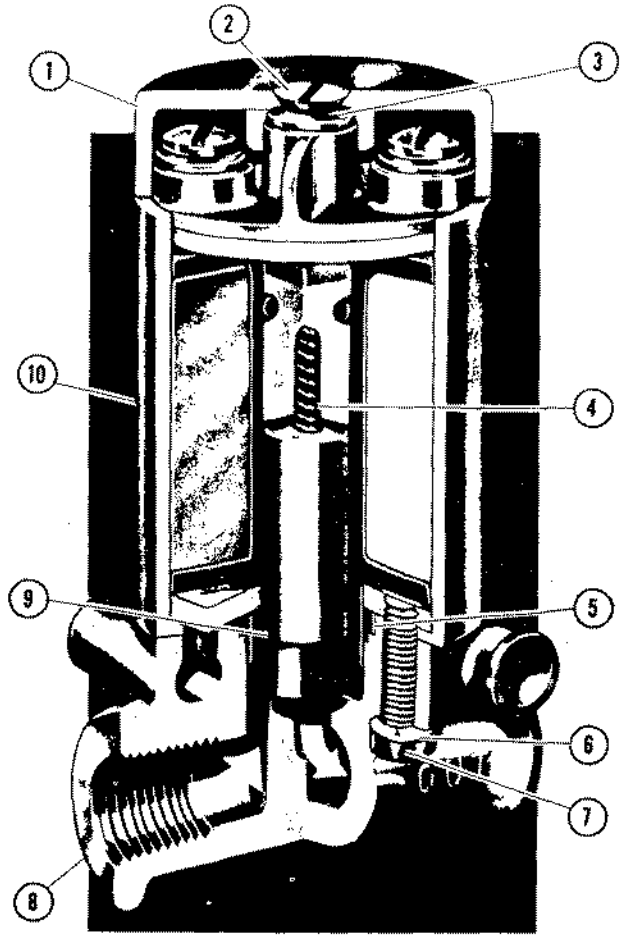
c. Remove mounting screws, and remove valve.

4–542. DISASSEMBLY OF FUEL DE-ICING SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 51-17443 AND ON 52-9129 THROUGH 52-9165, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622).

a. Remove cover (1) from solenoid assembly (10) by loosening screw (2).

Note

Fiber washer (3) which fits between cover (1) and solenoid assembly (10) prevents loss of screw (2).



1.	CAP
2.	SCREW
3.	FIBRE WASHER
4.	SPRING
5.	GASKET
6.	LOCK WASHER
7	SCREW
8.	VALVE BODY
9.	PLUNGER ASSEMBLY
10.	SOLENOID ASSEMBLY

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Figure 4-106. Fuel De-icing Shutoff Valve, Prior to AF Serial No. 51-17443 and on 52-9129 through 52-9165, Airplanes Not Incorporating T.O. 1T-33A-622

b. Remove solenoid assembly (10) from body (8) by removing two screws (7) and lockwashers (6).

c. Remove gasket (5) from solenoid assembly (10).

d. Remove spring (4) and plunger assembly (9) from solenoid assembly (10).

4–543. MAINTENANCE OF FUEL DE-ICING SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 51-17443 AND ON 52-9129 THROUGH 52-9165, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622). There are no repairs for individual parts or assemblies. Parts should be cleaned with alcohol, Specification MIL-A-6091.

4–544. ASSEMBLY OF FUEL DE-ICING SHUTOFF VALVE (PRIOR TO AF SERIAL 51-17443 AND ON 52-9129 THROUGH 52-9165, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622). Reverse removal procedure.

Note

Always replace gasket (5) with a new gasket.

4–545. FUEL DE-ICING SHUTOFF VALVE (AF SERIAL NO. 51-17456 THROUGH 51-17556 AND 52-9166 AND SUBSEQUENT, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622). A normally closed solenoid operated shutoff valve is mounted on the forward face of the wing rear beam in the right main wheel well. The valve is controlled by a momentary contact switch in the cockpit.

4–546. REMOVAL OF FUEL DE-ICING SHUTOFF VALVE (AF SERIAL NO. 51-17456 THROUGH 51-17556 AND 52-9166 AND SUBSEQUENT, AIRPLANES NOT INCORPORATING T.O. 1T-33A-622).

a. Disconnect electrical lead to valve.

b. Disconnect inlet line at valve and outlet line on aft face of wing rear beam.

c. Remove union holding valve to beam and remove valve.

4–547. FUEL DE-ICING PRESSURE SWITCH (AIRPLANES NOT INCORPORATING T.O. 1T-33A-622). The fuel de-icing pressure switch is mounted on the forward face of the wing rear beam in the right wheel well. On airplanes prior to AF Serial No. 51-6562, switch is normally open, and closes at a differential pressure 2 (±0.25) psi, reopening at a differential pressure of 1 (±0.25) psi. On airplanes AF Serial Nos. 51-6562 and subsequent, the switch is normally open, and closes at a differential pressure of 2.5 (±0.25) psi, reopening at a differential of 1.5 (±0.25) psi. The high-pressure sensing side of the switch is connected to the upstream side of the fuel filter, and the low-pressure sensing side is connected to the downstream side of the fuel filter. Closing the pressure switch illuminates the red fuel de-icing warning light in the cockpit.

4–548. REMOVAL OF FUEL DE-ICING PRESSURE SWITCH (AIRPLANES NOT INCORPORATING T.O. 1T-33A-622).

a. Disconnect electrical leads at receptacle.

b. Disconnect and cap high- and low-pressure sensing lines at switch.

c. Remove four bolts holding switch to mounting bracket and remove switch.

4–549. FLUID INJECTION SHUTOFF VALVE AND STRAINER. *(See figure 4-107.)* The shutoff valve and strainer is located on the right side of the fuselage aft of station 238. Fluid pressure acting on a diaphragm opens the valve at 30 to 35 psi. The valve reseats at a minimum pressure of 3 psi. The fluid is strained prior to being released to the engine.

4–550. REMOVAL OF FLUID INJECTION SHUTOFF VALVE AND STRAINER.

a. Close both ground test shutoff valves.

b. Drain the shutoff valve and strainer through the drain cock at the base of the unit.

c. Disconnect the two fluid lines from the shutoff valve and strainer.

d. Remove the four bolts holding the unit in place and lift it inboard to remove.

4–551. FLUID INJECTION MANIFOLD ASSEMBLY. The fluid injection manifold assembly consists of two hose-connected manifold tubes, one encircling each compressor inlet area. Each manifold is composed of two sections of corrosion resistant steel tube, with each section having receptacles for seven nozzles.

4–552. REMOVAL OF FLUID INJECTION MANIFOLD ASSEMBLY.

a. Disconnect fluid inlet line from manifold assembly.

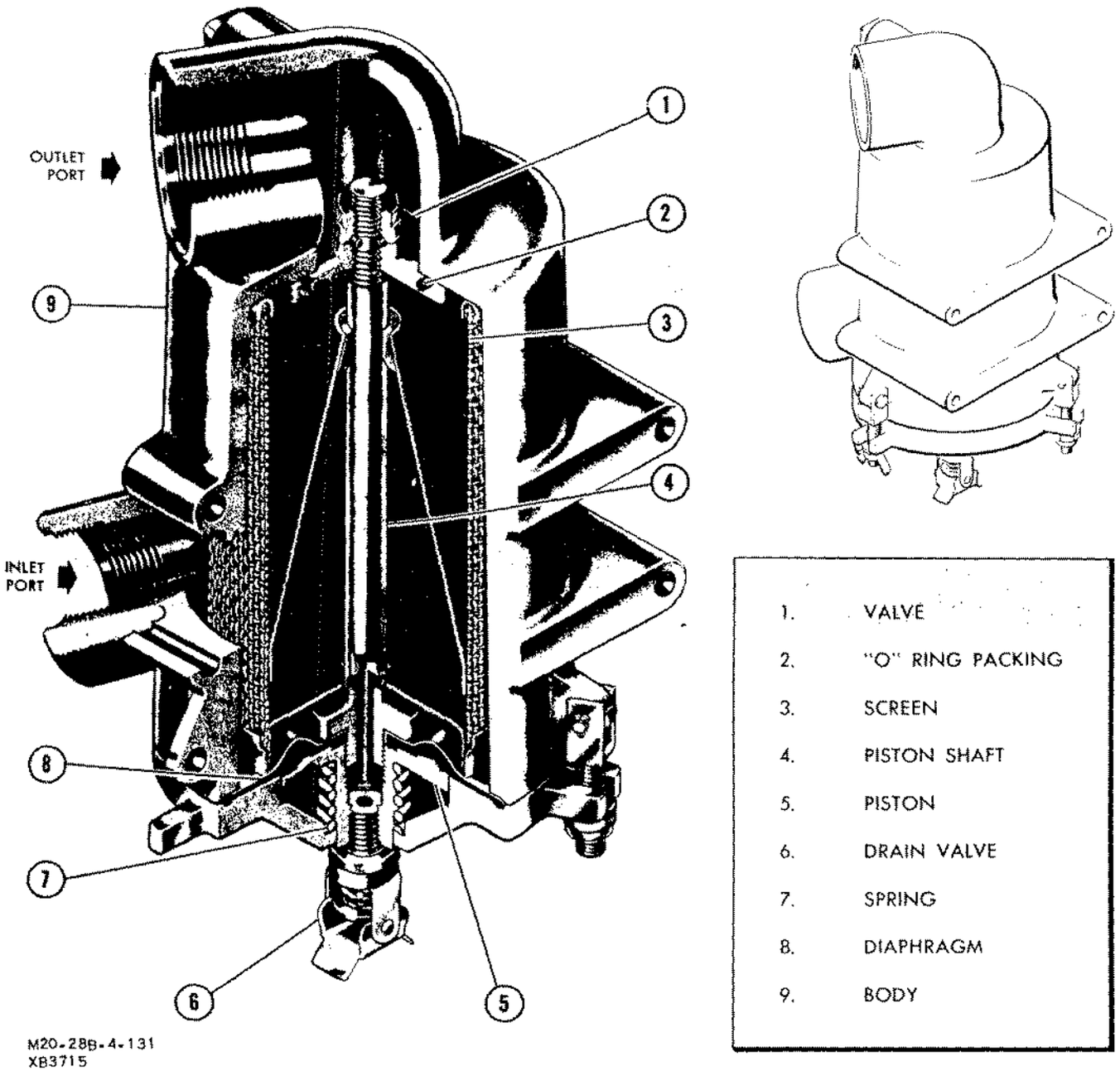
b. Disconnect fluid injection pressure line from manifold assembly.

c. Remove Nos. 1, 2, 3, and 4 air adapters.

d. Remove hose connecting front and rear manifolds.

e. Loosen coupling nuts holding manifold sections together.

f. Remove manifold attaching clamps, and remove manifold sections.



1.	VALVE
2.	"O" RING PACKING
3.	SCREEN
4.	PISTON SHAFT
5.	PISTON
6.	DRAIN VALVE
7.	SPRING
8.	DIAPHRAGM
9.	BODY

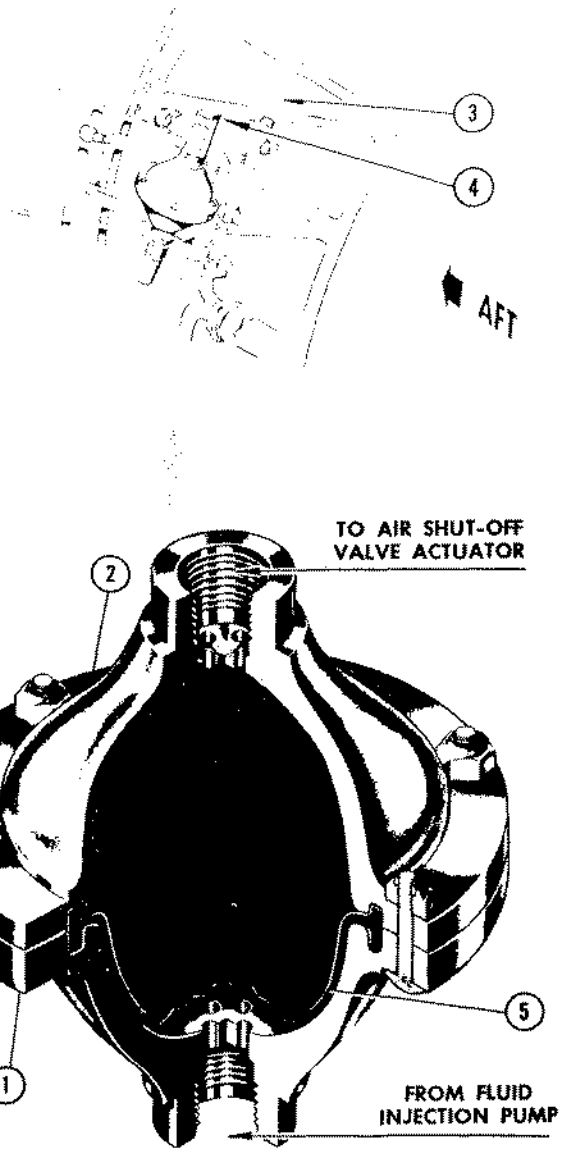
Figure 4-107. Shutoff Valve and Strainer

4–553. FLUID INJECTION NOZZLES. The fluid injection system uses 28 nozzles to distribute the system fluid. Each nozzle is made of corrosion resistant steel and is screwed into a fitting on the manifold.

4–554. FLUID INJECTION PRESSURE TRANSMITTER. *(See figure 4-108.)* The fluid injection pressure transmitter is located on the right side of the engine just forward of the fluid injection manifold. The pressure transmitter transmits fluid injection system pressure to the air shutoff valve actuator. The lower side of the transmitter contains the fluid injection liquid, while the portion of the transmitter nearest the air shutoff valve actuator contains hydraulic fluid.

4–555. REMOVAL OF FLUID INJECTION PRESSURE TRANSMITTER.

a. Drain the hydraulic fluid and fluid injection liquid from the pressure transmitter.



1.	LOWER BODY
2.	UPPER BODY
3.	FLUID INJECTION MANIFOLD
4.	FILLER CAP
5.	DIAPHRAGM

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Figure 4-108. Pressure Transmitter

b. Disconnect the lines to the pressure transmitter.

c. Remove the retaining clips from either end of the transmitter and remove.

4–556. RESTRICTOR CHECK VALVE. The restrictor check valve is located in the hydraulic line between the fluid injection pressure transmitter and the air shutoff valve actuator. The purpose of the valve is to retard the opening of the air shutoff valve when the load on the pressure transmitter is decreased.

4–557. REMOVAL OF RESTRICTOR CHECK VALVE.

a. Drain the hydraulic line between the fluid injection pressure transmitter and the air shutoff valve actuator.

b. Disconnect the lines at either end of the valve and remove.

4–558. AIR SHUTOFF VALVE ACTUATOR. *(See figure 4-109.)* The air shutoff valve actuator is located at the top and just forward of the engine compressor casing. The unit is actuated by hydraulic pressure and is returned to its original position by a spring.

4–559. REMOVAL OF AIR SHUTOFF VALVE ACTUATOR.

a. Drain and disconnect the hydraulic line at the actuator.

b. Disconnect the shutoff valve arms at the disconnects on the air shutoff valve actuator.

c. Remove the bolts holding the unit to the mounting bracket and remove.

4–560. SERVICING OF AIR SHUTOFF VALVE ACTUATOR.

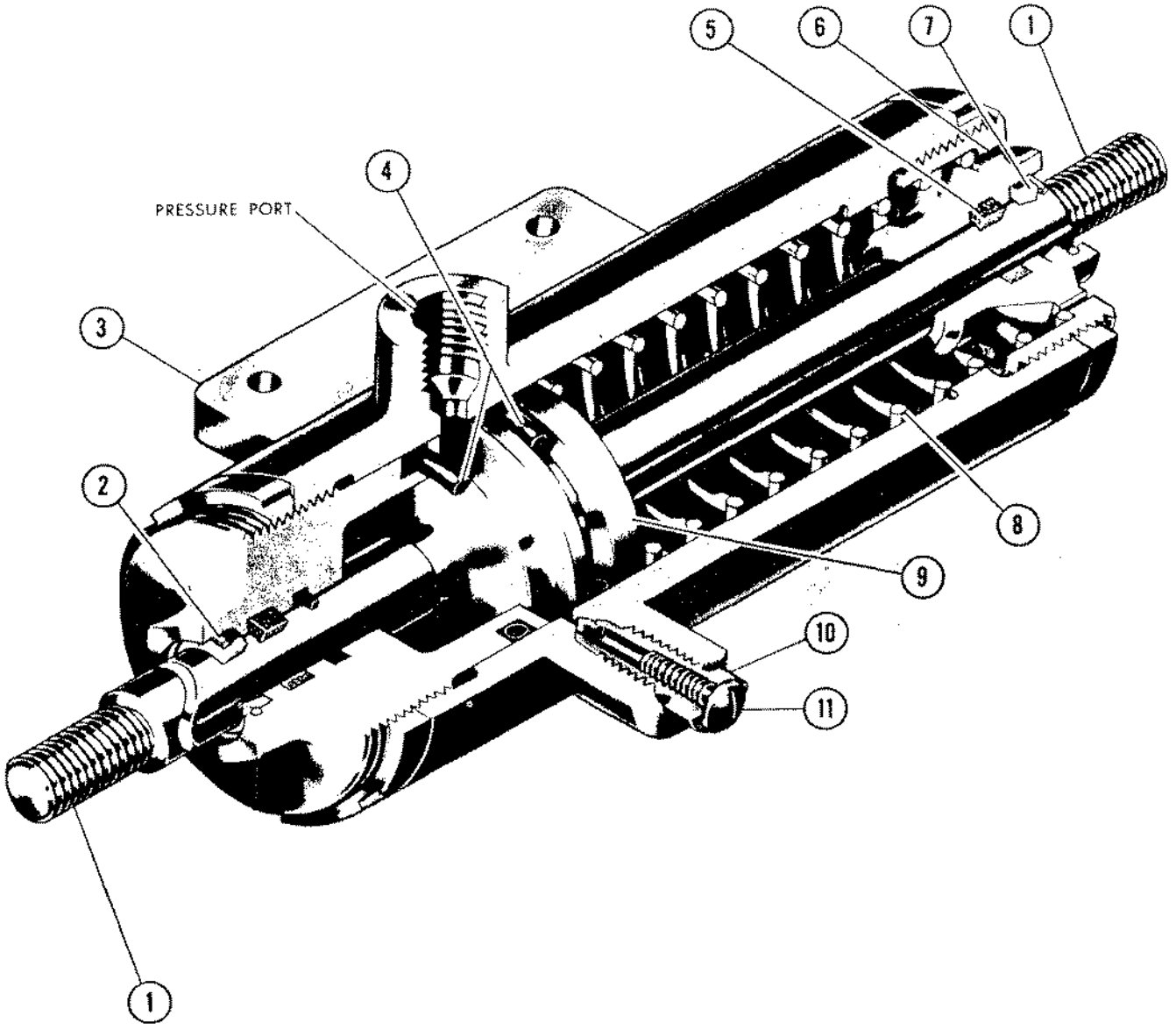
a. Remove screw (figure 4-109, reference 11) from bleeder port valve (figure 4-109, reference 10) of actuator.

b. Screw air shutoff valve actuator filling tool (figure 4-110) into bleeder port valve.

c. Loosen bleeder port valve approximately one-half turn.

d. Remove filler cap (figure 4-108, reference 4) of fluid injection pressure transmitter.

e. Attach hydraulic pressure pot to pressure transmitter line.



1.	AIR SHUT-OFF VALVE ATTACHMENT	7.	SCRAPER RING
2.	SNAP RING	8.	PISTON RETURN SPRING
3.	MOUNTING FLANGE	9	PISTON
4.	"O" RING PACKING	10.	BLEEDER PORT VALVE
5.	WIPER RING	11.	SCREW
6.	VENT HOLE		

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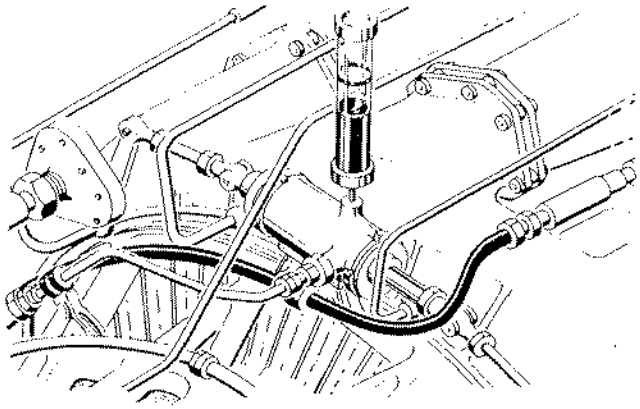
Figure 4-109. Air Shutoff Valve Actuator



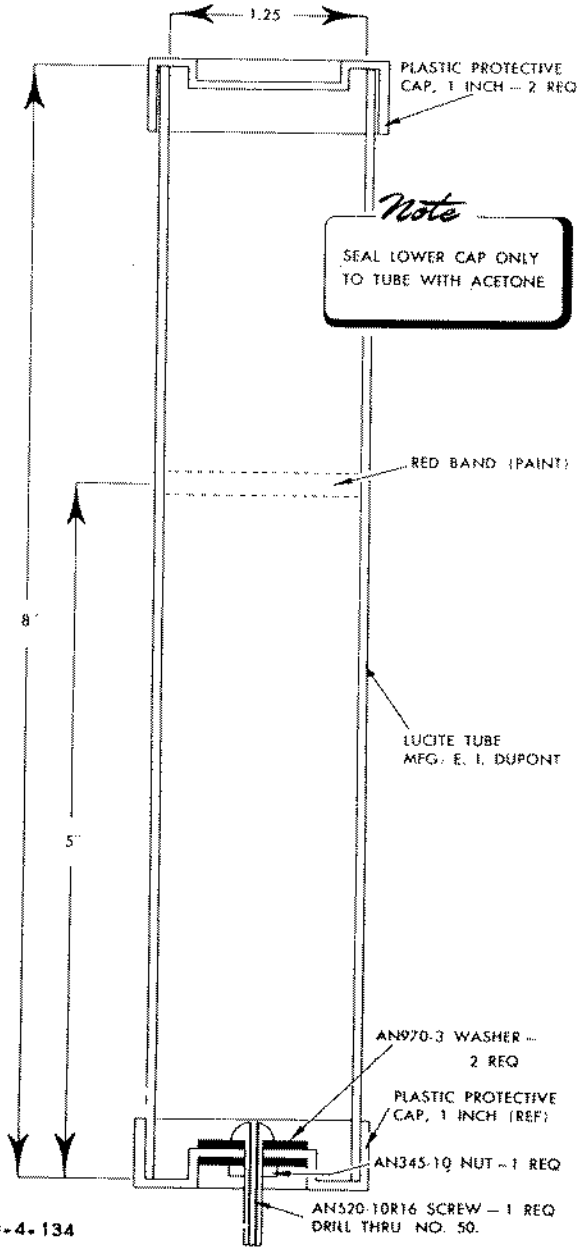


Figure 4-110. Air Shutoff Valve Actuator Filling Tool

f. Permit hydraulic fluid to flow into lines until fluid fills air shutoff valve actuator filling tool to red line.

g. Manually operate air shutoff valve actuator through several cycles to eliminate air trapped in system.

h. Tighten bleeder port valve.

i. Remove hydraulic pressure pot line connected to transmitter.

j. Open bleeder port valve approximately one-half turn until hydraulic fluid flows from uncapped pressure transmitter line.

k. Tighten bleeder port valve.

l. Install and safety cap in pressure transmitter line.

m. Remove air shutoff valve actuator filling tool.

n. Install screw in bleeder port valve.

4–561. GROUND CHECK OF FLUID INJECTION SYSTEM.

a. With tanks full, operate engine and cutin fluid injection system. Pump pressure should be 45 psi at 25 to 28 gallons per minute flow.

b. If necessary, adjust pump bypass valve to obtain the above pressure. This may be accomplished by loosening two adjusting nut lock screws and turning adjusting nut clockwise approximately $\frac{1}{32}$ inch per psi increase in pressure desired. Tighten lock screws.

c. Fill tanks and operate engine. Cut in fluid injection system for 60 seconds.

d. Measure quantity of fluid necessary to refill tanks. This should be approximately 37 gallons.

e. If quantity of fluid used is less than approximately 37 gallons, increase pump pressure as in step b to obtain desired flow. If rate of flow is greater than specified, reduce flow by decreasing pump pressure. Specified rate of flow is more critical than pump pressure.

f. In flight, duration of flow should be from 75 to 95 seconds.

4–562. FUEL DE-ICING SYSTEM (AF SERIAL NO. 53-5083 AND SUBSEQUENT).

4–563. DESCRIPTION OF FUEL DE-ICING SYSTEM. The fuel de-icing system is composed of a tank, pump, solenoid shutoff valve, check valve, and differential pressure switch. Fuel de-icing is used to prevent bypassing of unfiltered fuel through the low pressure fuel filter resulting from ice crystal formation on the filter element.

4–564. Liquid used in the de-icing system is 100 percent alcohol, Specification MIL-A-6091.

Note

If ethyl alcohol, Specification MIL-A-6091 is not available, the fuel filter de-icing system will be rendered inoperative by placing a placard in the forward cockpit on the auxiliary switch panel, and on the aft cockpit left shelf, stating (Fuel Filter De-Icing System Inoperative).

4–564A. On airplanes incorporating T.O. 1T-33A-622, the fuel de-icing system is deactivated. The solenoid shutoff valve, check valve, and pressure switch are removed.

Note

On airplanes incorporating T.O. 1T-33A-622, the system shall not be serviced with alcohol.

4–565. FUEL DE-ICING TANK, A 5 U.S. (4.15 Imperial) gallon aluminum alloy de-icing fluid tank is installed on the right side of the engine compartment just above the engine accessory case. The tank is accessible through the engine right upper access door.

4–566. REMOVAL OF FUEL DE-ICING TANK.

a. Drain tank at pump and tank drain valve located aft of de-icing pump.

b. Disconnect fluid "out" line at bottom of tank.

c. Disconnect scupper and vent lines at tank. Unclip vent line from tank scupper.

d. Disconnect two retaining strap turnbarrels and lift tank from its support.

4–567. FUEL DE-ICING PUMP. An intermittent-duty motor-driven pump is installed directly below the fuel de-icing tank in the engine compartment. The pump is accessible through the engine right lower access door. Pump flow is set at 60 gallons per hour at 40 psi by the pump relief valve.

4–568. REMOVAL OF FUEL DE-ICING PUMP.

a. Drain fuel de-icing tank.

b. Disconnect electrical lead at pump.

c. Disconnect pump inlet, outlet, and seal drain lines at pump.

d. Remove four bolts holding pump and mounting channel to support. Remove pump and mounting channel as a unit.

4–569. FUEL DE-ICING SHUTOFF VALVE. Refer to paragraph 4–545.

4–570. FUEL DE-ICING PRESSURE SWITCH. Refer to paragraph 4–547.

4–571. JATO SYSTEM.

4–572. DESCRIPTION OF JATO SYSTEM. Two sets of jet-assisted-takeoff (jato) support hooks are located on the underside of the fuselage just forward of the aft to mid-section parting surface. The hooks are operated by a conventional cable system connected to a handle located just below the engine control lever in the front cockpit.

4–573. REMOVAL OF JATO UNITS.

WARNING

Do not release units by operating cockpit jettison handle as this will drop both units simultaneously.

a. Disconnect electrical lines to units.

b. Support jato units and trip each jettison latch from inside engine compartment. Carefully lower each unit from airplane.

Note

Each jato unit weighs 200 pounds full, or 114 pounds empty.

4–573A. MAINTENANCE, REPLACEMENT, AND ADJUSTMENT OF JATO LATCHES AND CONTROL ASSEMBLY.

a. Remove and disassemble latch assembly.

b. Check shoulders providing engagement between trigger and latch for sharp edges or burrs.

c. Replace trigger and latch if edges of mating surface are worn.

d. Adjust both right and left control assemblies to provide enough slack for full engagement of trigger with latch in locked position.

e. Check swaged terminals at aft end of cables for restriction by control tubes. Eliminate restriction by flaring or adjusting tube end.

4–573B. INSTALLATION OF TRAVEL PODS.

a. If manual locks are locked, they may be released by depressing release just forward of locks or by pulling release handle in cockpit.

b. Open hooks to full open position.

c. Loosen attaching bolts on one forward pod bracket.

d. With assistance from another man, install pod from aft to forward until locks are latched.

e. If cockpit release handle is used, push handle forward and safety with breakaway wire.

f. Tighten attaching bracket bolt.

g. With jato mechanism locked, be sure a hole 0.70 (No. 50 drill) is in lower midsection of protruding trigger, as close as possible to plate, part number 178165-2.

h. Install a 1/16 inch cotter pin and check latching mechanisms for positive non-jettison capability by actuation of the manual release handles.

i. Check pod for secure installation by pushing on pod from forward to aft

4–574. SURFACE CONTROLS.

4–575. DESCRIPTION OF SURFACE CONTROLS. The ailerons are operated by control sticks through a hydraulic booster which augments the force applied by the pilot. The aileron tab is provided to aid in maintaining lateral stability, and is actuated by an electric motor controlled by a switch on each control stick.

4–576. The elevators are controlled by the control sticks through a system of push-pull tubes and bell cranks. The force applied by the pilot is supplemented by the tabs to reduce elevator stick forces. There are two separate sets of elevator tabs. One set operates in conjunction with the elevators, while the other is operated independently by an electric actuator controlled by a switch on each control stick.

4–577. The rudder is actuated by rudder pedals through a conventional cable system.

4–578. Cable assemblies are treated with corrosion-preventive compound, Specification MIL-C-6708. Terminals

are swaged to cable ends. (See figure 6-3.) Cables are identified by bands of colored cellulose tape wrapped around both ends of each cable as shown by the cable color code in figures 6-1 and 6-2.

4–579. Those push-pull tubes that require adjustment are equipped with threaded terminals. Terminals are fitted with self-aligning ball bearings.

4–580. Aileron, elevator and rudder controls in the forward cockpit are synchronized with the same controls in the aft cockpit. Adjustments for both control sticks are made at the controls in the forward cockpit.

4–581. MAINTENANCE REPAIRS, REPLACEMENT, AND ADJUSTMENT OF SURFACE CONTROLS.

a. Restake loose bearings. If the bearing does not turn freely in the race after staking, replace the bearing.

b. Replace frayed cables when more than six wires are broken in any inch length of cable. (The 7 x 19 cable is composed of 7 strands of 19 wires each.)

c. Replace cracked or damaged fittings and push-pull tubes.

d. Replace push-pull tubes that are dented or noticeably bowed.

e. Make sure there is no twist in the cables.

f. Be certain all control rod jam nuts on rod ends are tight.

g. Check all control rod attaching bolts for clearance. Be certain push-pull tubes attaching bolts are installed in such a manner as to assure maximum clearance between bolts and structure, or between control rods. Check clearances through full range of control travel.

4–582. CONTROL STICK. *(See figures 4-111 and 4-112.)* The control stick fits into a socket of the aileron-elevator control assembly in front of each pilots seat. The stick consists of a tube to which is fitted a plastic pistol grip. The ailerons and elevators are operated by the control stick. The elevator trim tabs and aileron trim tabs are controlled by a switch mounted on each control stick grip.

4–583. REMOVAL AND DISASSEMBLY OF CONTROL STICK.

a. Disconnect electrical wiring from terminal panel below control assembly.

b. Detach stick by removing bolt through the socket.

c. Detach grip by loosening screw in collar of grip. On AF Serial No. 51-8916 and subsequent, lock-wire is installed between grip and stick.

4–584. INSTALLATION OF CONTROL STICK.

a. Thread wire from stick grip down through control stick. Install stick grip on control stick and tighten set screw. On AF Serial 51-8916 and subsequent, install safety wire between control stick and stick grip.

b. Attach lower end of control stick to elevator push-pull tube. Install AN 176H36 bolt through control column and control stick socket.

c. Connect electrical wiring to terminal strip below control stick assembly.

4–585. ADJUSTMENT OF CONTROL STICK NEUTRAL POSITION. There is no provision for lateral adjustment. Fore-and-aft adjustment is as follows: Lock elevator control surfaces in neutral. Adjust terminals of push-pull tubes (figure 4-111) until control sticks are 5 degrees 40 minutes forward of vertical.

4–586. ADJUSTMENT OF CONTROL STICK TRAVEL FOR ELEVATOR.

a. Adjust the elevator stops at the elevator horn.

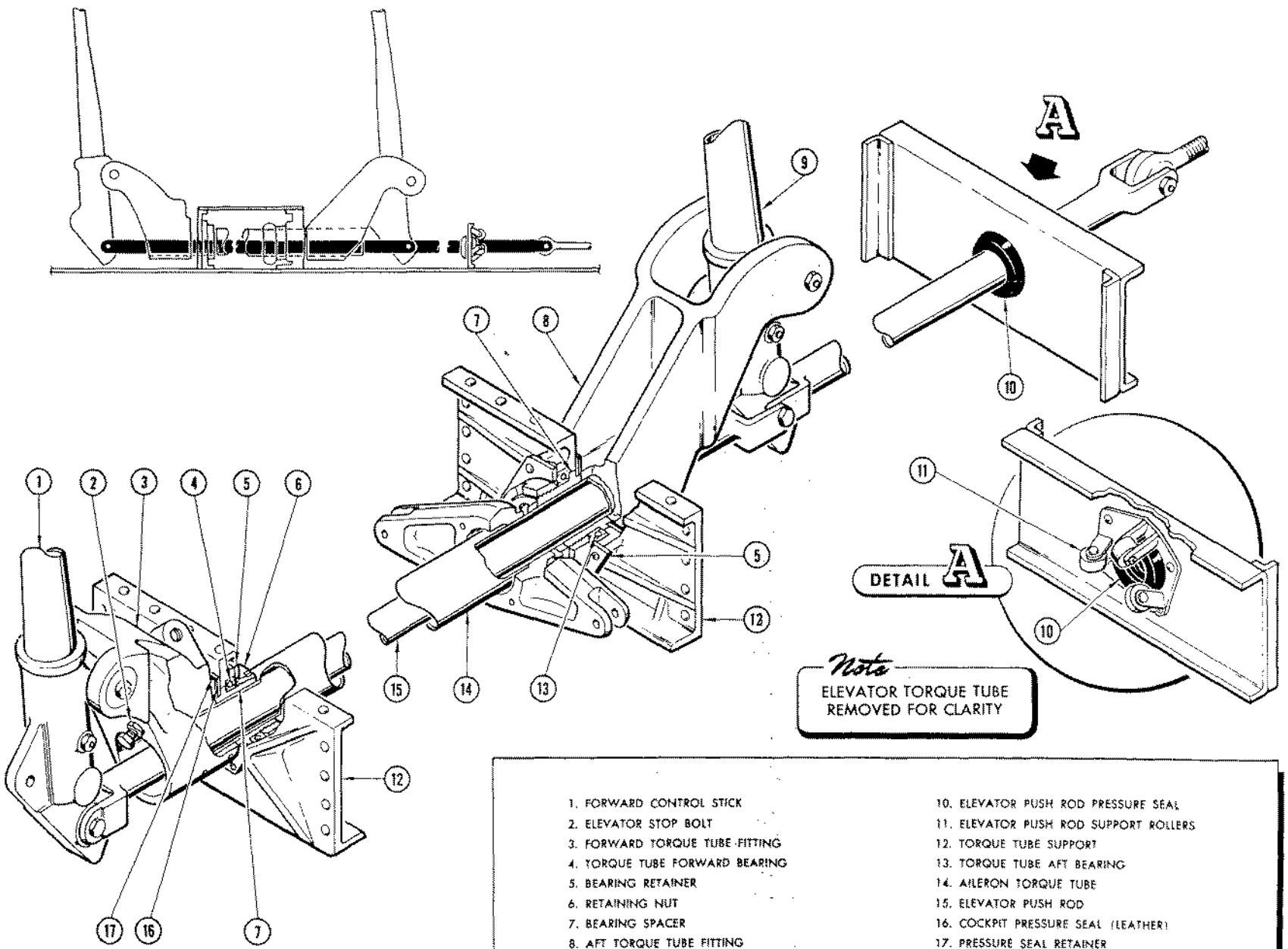
b. With the elevator spring tab in full down position (22 degrees from neutral), and elevator up stops contacting the elevator horn assembly, adjust the up-position elevator stop in forward cockpit to $\frac{1}{16}$ ($\pm\frac{1}{32}$)-inch clearance between stop and stick.

c. With the elevator spring tab in full up position (10 degrees from neutral) and elevator down stops contacting elevator horn assembly, adjust down-position elevator stop in the forward cockpit to $\frac{1}{16}$ ($\pm\frac{1}{32}$) inch clearance between stop and stick.

Note

Control stick play, measured at top of stick grip, is 0.25-inch maximum.

4–587. AILERON CONTROL SYSTEM. *(See figure 4-112.)* The aileron control system consists of four main components: Control stick to aileron booster unit, aileron booster unit, aileron booster unit to ailerons, and aileron tabs. The function of the aileron control system is to operate the ailerons through the aileron booster mechanism and the tabs.



1. FORWARD CONTROL STICK
2. ELEVATOR STOP BOLT
3. FORWARD TORQUE TUBE FITTING
4. TORQUE TUBE FORWARD BEARING
5. BEARING RETAINER
6. RETAINING NUT
7. BEARING SPACER
8. AFT TORQUE TUBE FITTING
9. AFT CONTROL STICK
10. ELEVATOR PUSH ROD PRESSURE SEAL
11. ELEVATOR PUSH ROD SUPPORT ROLLERS
12. TORQUE TUBE SUPPORT
13. TORQUE TUBE AFT BEARING
14. AILERON TORQUE TUBE
15. ELEVATOR PUSH ROD
16. COCKPIT PRESSURE SEAL (LEATHER)
17. PRESSURE SEAL RETAINER

Figure 4-111. Aileron Elevator Control Assembly

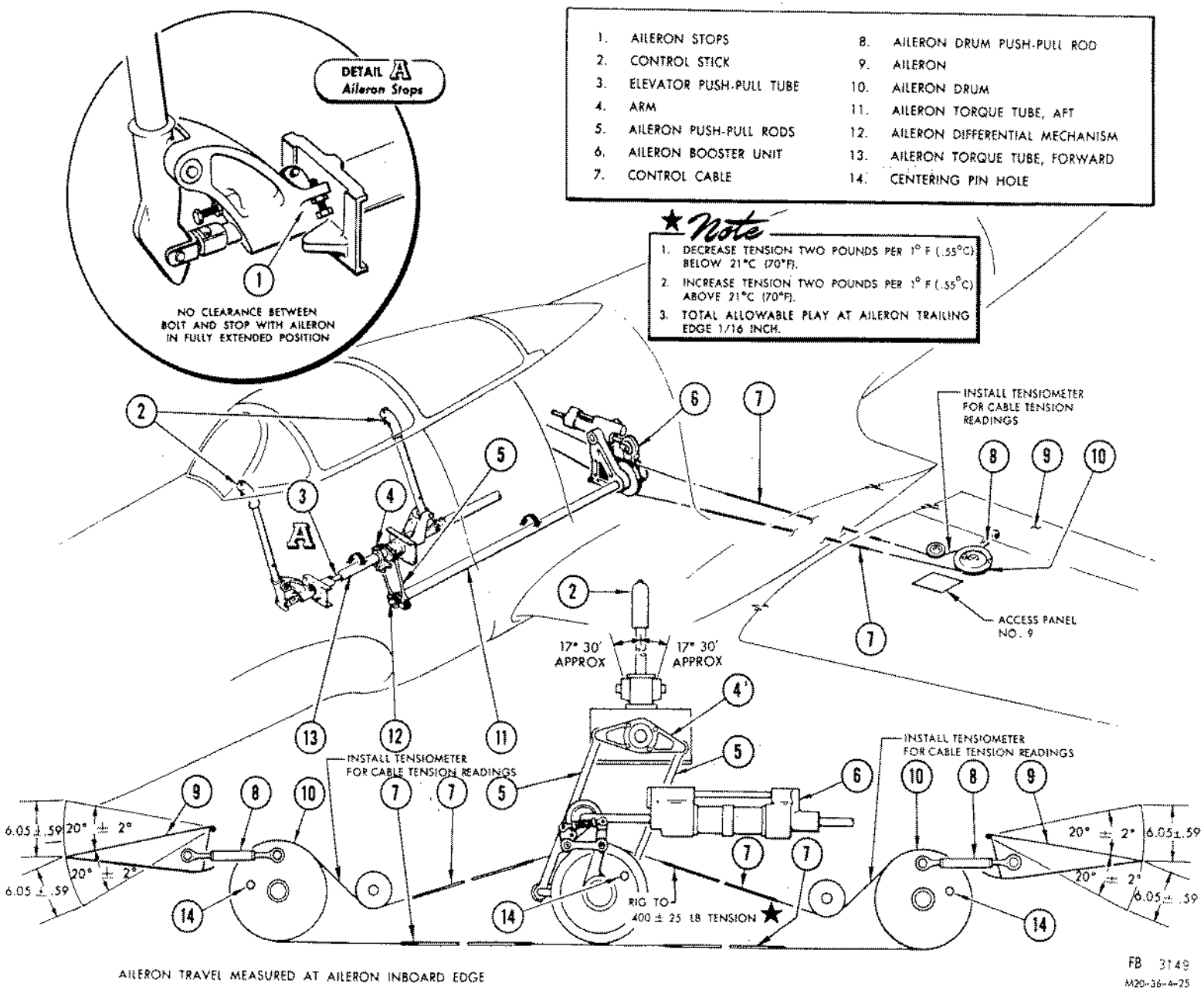


Figure 4-112. Aileron Control System

4–588. CONTROL STICK TO AILERON BOOSTER UNIT. *(See figure 4-112.)* This consists of the forward and aft aileron control assemblies, connected to a differential mechanism by push-pull tubes. The differential mechanism is connected to the booster by a torque tube.

4–589. AILERON-ELEVATOR CONTROL ASSEMBLY. *(See figure 4-111.)* The aileron-elevator control assembly is mounted in the cockpit floor tunnel and consists of two synchronized control sticks, the elevator push-pull tube, the aileron torque tube, and the cockpit pressure seals. The entire assembly is supported at each end by bearings mounted in support castings. Three rollers at the aft end of the assembly provide additional support for the elevator push-pull tube; lateral motion of the control stick rotates the aileron torque tube and the torque arm connected to it actuates the push-pull tubes connected to the differential mechanism. (See figure 4-113.)

4–590. DISASSEMBLY OF AILERON-ELEVATOR CONTROL ASSEMBLY. *(See figure 4-111.)*

Note

Refer to paragraph 4–637 for removal of elevator pushrod pressure seal.

a. Remove bolt attaching elevator push-pull tube to forward control stick fitting.

b. Pull elevator push-pull tube forward out of aileron torque tube.

c. Remove cotter pin and the front-bearing retainer nut.

d. Remove six screws from front bearing support through the bearing retainers. Slide the bearing, both retainers and leather seal aft to remove them from spacer. Remove support from tube.

e. Drill out four MS20426AD5 rivets to loosen forward bearing spacer.

f. Remove aft support bearing in the same manner as front bearing was removed.

g. Slide support and bearing forward to clear the spacer.

h. Drill out four MS20426AD5 rivets to loosen bearing spacer.

i. Remove screws from around aft torque tube fitting and remove fitting.

j. Remove screws from around actuating arm and remove it with parts above.

k. If removal of forward torque tube fitting is necessary, drill out 12 MS20470DD6 rivets and remove it.

4–591. ASSEMBLY OF AILERON-ELEVATOR CONTROL ASSEMBLY. Reverse disassembly procedure. Identical rivets must be used in assembling the riveted parts.

4–592. AILERON DIFFERENTIAL MECHANISM. *(See figure 4-113.)* The aileron differential mechanism consisting of a series of bell cranks and links, is located in the hydraulic compartment at the forward end of the aileron torque tube. It is accessible through the dive flap opening.

WARNING

When the dive flap opening is used for access to the hydraulic compartment, shut off the hydraulic pressure to the dive flap selector valve by means of the dive flap shutoff valve. (See figure 4-27.)

4–593. OPERATION OF AILERON DIFFERENTIAL MECHANISM. *(See figure 4-113.)* The unit is moved by push-pull tubes connected to a torque arm on the aileron torque tube in the cockpits. Figure 4-109 shows the mechanism in the neutral, full left, and full right positions. To move the ailerons left from neutral, the push-pull tubes (11) move bell cranks (3) counterclockwise. The bell cranks do not operate stub shaft (6) directly, but are connected with an arm (9) by links (7 and 8) through a roller attached to the push-pull tube clevis bolt. The arm (9) is attached directly to stub shaft (6). As the mechanism rotates, the bell cranks and links jackknife and the roller bearing on the push-pull tube clevis moves toward the center of rotation. This action progressively shortens the moment arm of the bell cranks to the position shown. The moment arm of bell cranks (3) is longest with the mechanism in neutral, and shortest at either full right or full left aileron.

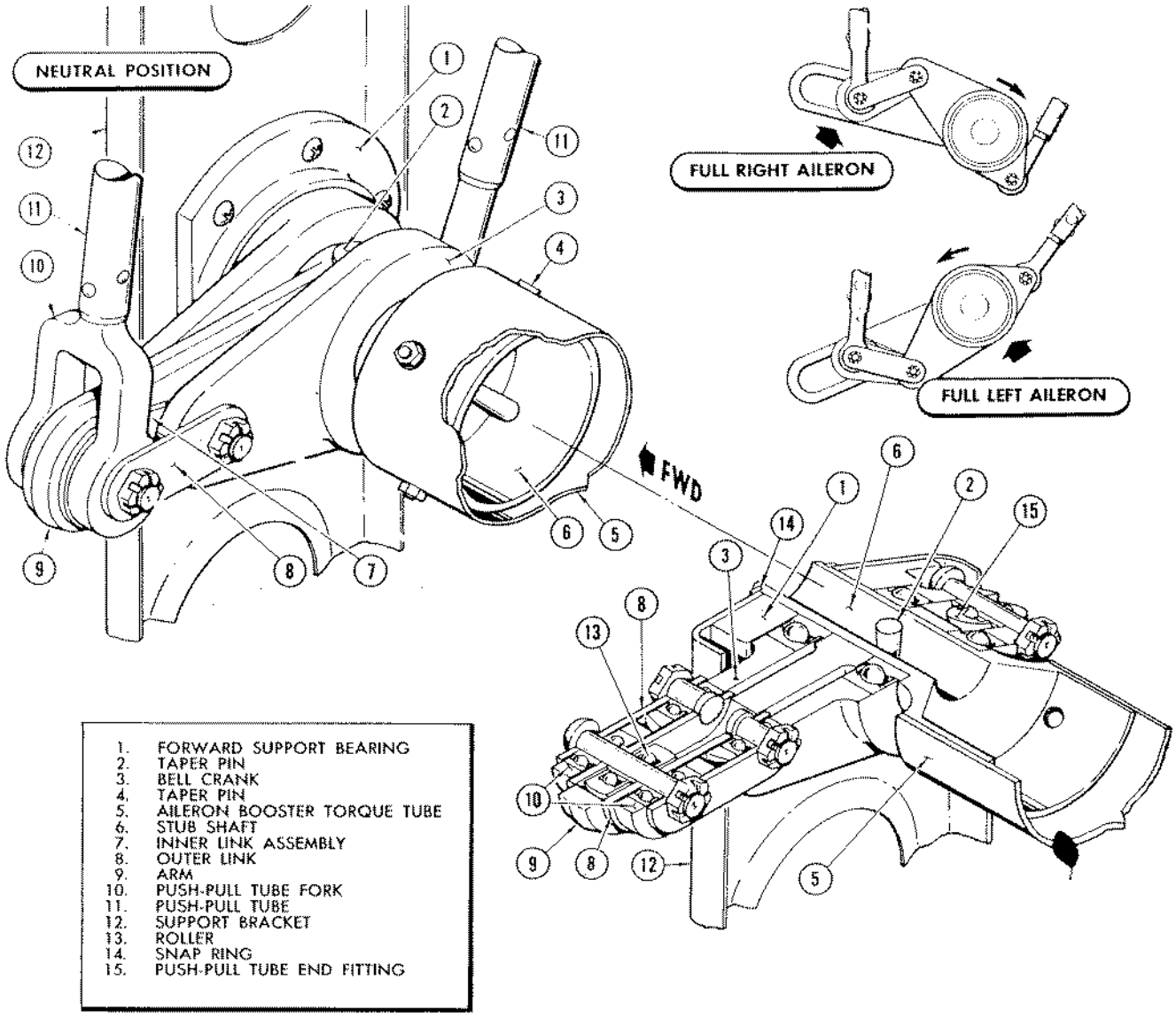


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Figure 4-113. Aileron Differential Mechanism

More stick movement is required to move the ailerons a given distance from neutral than from any other position. The movement of the ailerons is gradually accelerated with constant movement of the control stick.

4–594. REMOVAL OF AILERON DIFFERENTIAL MECHANISM. *(See figure 4-113.)*

a. Remove aileron booster unit. (Refer to paragraph 4–609.)

b. Remove marker beacon antenna. (Refer to paragraph 4–1001.)

c. Through the opening remaining after removal of marker beacon antenna remove taper pins.

d. Push aileron torque tube forward to clear stub shaft. If it is necessary to remove aileron torque tube, fuselage aft section and engine must be removed.

e. Disconnect both push-pull tubes from differential mechanism.

f. Disconnect five bolts holding torque tube forward bearing to the support bracket and remove differential mechanism, bearing and stub shaft.

4–595. CLEANING AND INSPECTION OF CONTROL STICK TO AILERON BOOSTER UNIT CONTROLS. Wipe off accumulated dirt and grease. Inspect for cracks in castings, and for bowed or bent tubes.

Note

Do not immerse ball bearings in cleaning fluid or solvent. Wipe them off with a clean dry cloth. These bearings are packed with grease on assembly, and will require no lubrication.

4–596. REPAIRS AND REPLACEMENTS FOR CONTROL STICK TO AILERON BOOSTER UNIT CONTROLS. Do not repair any parts of the control assembly; replace worn or damaged parts.

4–597. AILERON BOOSTER UNIT. *(See figure 4-114.)* The aileron booster unit consists of an actuating cylinder, a control valve, a filter, and a mechanical linkage. These are mounted on a triangular casting which is bolted to the wing rear beam with three bolts. The unit is connected to the control stick by means of torque tubes and push rods. (See figure 4-112.) The control valve, which is actuated by a mechanical linkage connected to the aileron torque tube, directs hydraulic pressure to either side of the actuating cylinder. A low-boost-ratio spring cartridge on the booster unit reduces stick sensitivity at low control-surface loads, particularly near neutral position. When aileron loads are sufficient to cause complete compression of the spring, the booster operates as described in paragraph 4–600. If hydraulic system pressure drops to approximately 250 psi, the bypass valve on the actuating cylinder opens to connect the two ends of the cylinder, thereby permitting manual operation of the ailerons. Access to the booster unit is through the engine compartment lower access doors Nos. 65 and 66.

4–598. On AF Serial No. 52-9752 through 52-9875, 52-9941 through 52-9975, 53-2726 and subsequent, and some airplanes prior to AF Serial No. 53-2726, a feel spring cartridge replaces the feel link. This feel spring cartridge will provide more uniform stick force during engagement of the aileron booster unit. The movement of the feel spring cartridge is identical to figure 4-115.

4–599. OPERATION OF AILERON BOOSTER UNIT. *(See figure 4-116.)* Diagram A shows the linkage in neutral position (pin in center of slot). With low aileron loads, moving the stick to the left moves the pin counterclockwise (diagram B). The stick force is then transmitted to the feel link and the spring cartridge. Because of the low-resistance load on the ailerons, the pin does not bottom in the feel slot, and the force from the operating arm is transmitted through the spring cartridge at a low-boost ratio.

4–600. When high aileron loads are present, the force applied to the operating arm is transferred to both the spring cartridge and the feel link. Since the resisting load on the ailerons is sufficient to compress the spring, the pin bottoms, and the load is transferred through the feel link (diagram C), giving a higher boost ratio.

4–601. Linkage motion for left aileron up is shown in figure 4-116. Linkage motion for left aileron down is similar but opposite. Instead of the operating arm pushing the spring cartridge to compress the spring, it pulls the ends apart to compress the spring as shown in figure 4-115.

4–602. Diagram A of figure 4-116 shows the booster unit in neutral position. Points are in alignment vertically, and the control valve piston is centered. When this piston is centered, fluid is trapped on both sides of the cylinder piston. At the same time, fluid under pressure holds the bypass valve closed.

4–603. As stick movement to the left is started, the feel link moves to the left rotating the feel arm center (3) clockwise about center (2). This rotates the drum slightly counterclockwise due to the eccentricity of center (2), and this slight movement of the drum, without the aid of the cylinder, deflects the ailerons against the resistance of the air stream to produce feel at the control stick.

4–604. With additional movement of the stick (diagram B) the valve linkage begins to push the control-valve piston to the right. Point (4) on the bottom of the operating arm and point (5) on the bottom of the drum move counterclockwise. The movement of point (4) is in advance of the movement of point (5). This pushes the upper valve link, applying force at point (7) and causing the vertical link to rotate clockwise about point (8). The force transmitted by the vertical link at point (6) to the valve piston pushes it to the right.

4–605. The control valve is a hydraulic four-way valve. As the piston is pushed to the right, it connects the hydraulic fluid pressure line with the right side of the cylinder, and the hydraulic fluid return line with the left side of the cylinder. Thus, fluid under pressure

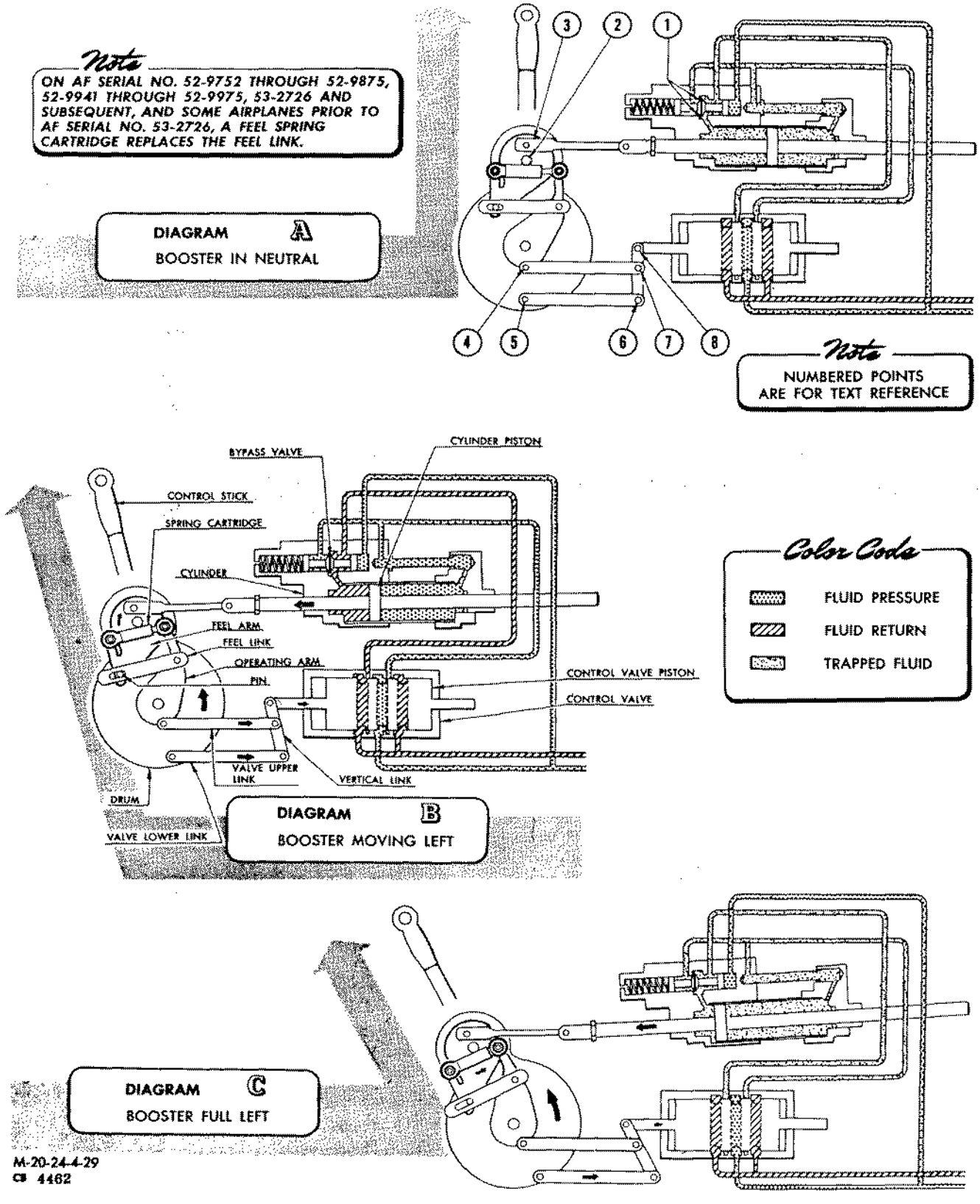


Figure 4-116. Aileron Booster Operation

f. Remove bolts that hold the two halves of the triangular support together, and remove aft half of support.

g. Remove cylinder and drain the assembly.

h. Remove bolt attaching piston-rod clevis to drum, and separate cylinder from drum assembly.

i. Remove bolts at each end of spring cartridge and feel linkage.

j. Remove bolts from parallel linkage.

k. Remove bolts from drum cable locks, and remove cables.

l. For disassembly of the booster cylinder, refer to paragraph 4–615.

4–611. CLEANING OF AILERON BOOSTER UNIT. Wipe accumulated dirt and grease from all parts. Inspect all parts for wear. Do not use cleaning fluids to clean parts equipped with sealed ball bearings. Mask off bearings to prevent entrance of dirt and foreign matter during cleaning operation.

4–612. REPAIRS AND REPLACEMENTS OF AILERON BOOSTER UNIT. Replace all damaged or worn parts. Bearing races must be securely staked. All bearings must turn freely in their races. Refer to paragraphs 4–616 through 4–623 for maintenance of the control valve and booster cylinder.

4–613. INSTALLATION OF AILERON BOOSTER UNIT. Reverse removal procedure.

Note

If backlash exists between the splines of the boost unit and the torque tube, brush the male and female spline teeth with aluminized lacquer. Allow lacquer to become tacky. Apply a second coat of lacquer and assemble while lacquer is still wet. Aluminized lacquer is made from clear lacquer, Specification MIL-L-7178 and aluminum pigment paste, Federal Specification TT-A-468, Type 2, Grade A. The proportions are one gallon of lacquer to 12 ounces of paste. Allow 4 to 6 hours for lacquer to dry after completing spline assembly.

4–614. AILERON BOOSTER ACTUATING CYLINDER. *(See figure 4-117.)* The balanced-piston-type cylinder is mounted on the booster assembly bracket with swivel mountings in which are drilled the cylinder pressure passages. A poppet bypass valve and passages are integral parts of the cylinder assembly.

4–615. DISASSEMBLY OF AILERON BOOSTER ACTUATING CYLINDER.

a. Loosen jam nut and remove clevis.

b. Loosen cylinder jam nuts.

c. Unscrew cylinder until end block comes free from bypass tube. Unscrew end block from cylinder.

e. Unscrew and remove cylinder.

f. Unscrew and remove bypass tube.

g. Remove snapring and unscrew end cap of bypass valve.

h. Remove bypass valve poppet and spring.

4–616. CLEANING AILERON BOOSTER ACTUATING CYLINDER. Clean all parts thoroughly using clean solvent, Federal Specification P-S-661, or kerosene, Federal Specification VV-K-211b.

4–617. REPAIRING AILERON BOOSTER CYLINDER BARREL AND PISTON.

a. Carefully inspect cylinder barrel bore for scratches, score marks, or other damage. Remove light marks with crocus cloth. If seriously damaged, replace the barrel assembly.

b. Inspect surface of piston rod for damage which might cause binding or leakage. Remove light surface marks or scratches with fine crocus cloth. If seriously damaged, or appreciably worn, replace parts.

4–618. REPAIRING AILERON BOOSTER CYLINDER END ASSEMBLIES.

a. Remove O-ring packings from end assemblies and install new parts.

b. Check condition of wiper rings. See that scraping edge is not nicked or cut, and that fit on piston rod is not excessively loose. Install new rings at overhaul.

c. Inspect cylinder barrel seal O-rings for cuts, nicks, or other damage. Replace if necessary.

d. Check bypass valve poppet for freedom of movement in bore, and valve face for damage which might cause leakage.

e. Check condition of bypass valve seat in end assembly. If valve poppet or seat is damaged, lap poppet to seat using suitable valve grinding compound. Use oscillating motion to avoid ringing seat.

f. Replace poppet-valve packing ring.

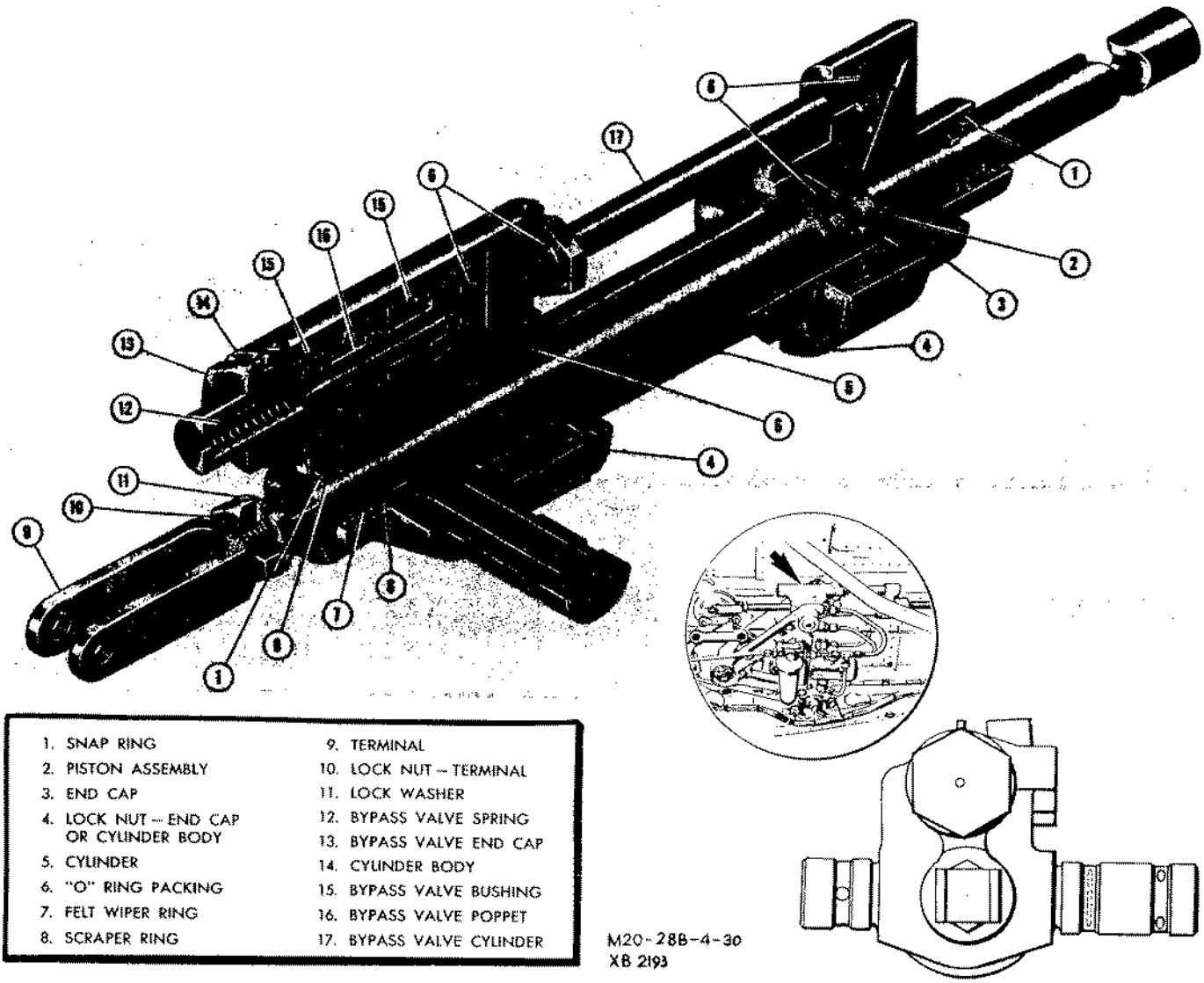


Figure 4-117. Aileron Booster Actuating Cylinder

g. Replace bypass tube and packings if damaged.

h. Inspect packing rings in swivel bearings and replace if necessary.

4–619. ASSEMBLY OF AILERON BOOSTER CYLINDER. Reverse disassembly procedure. Lubricate all packings and bores with hydraulic oil, Specification MIL-H-5606, prior to assembly to prevent damage to packing rings.

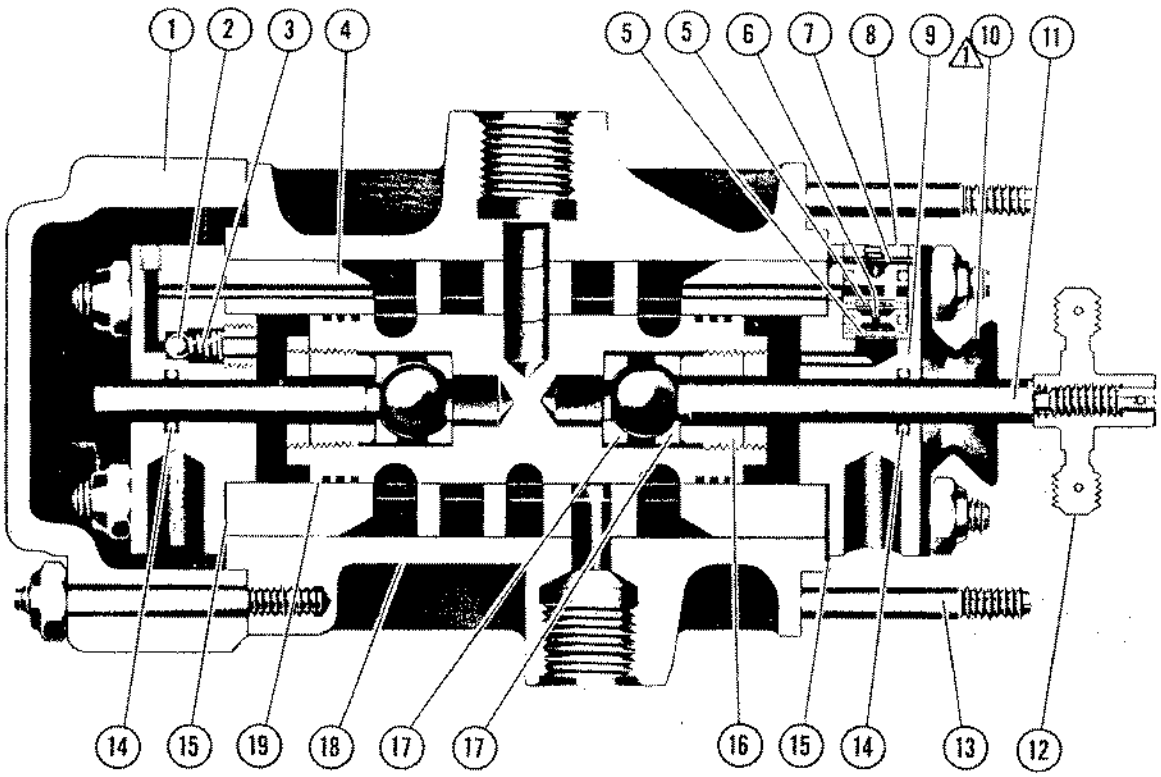
4–620. TESTING AILERON BOOSTER CYLINDER AFTER ASSEMBLY.

a. Apply 1500 psi pressure to extending port. Leakage at opposite port shall not exceed 10 drops per minute.

b. Apply 1500 psi pressure to retracting port. Leakage at opposite port shall not exceed 10 drops per minute.

c. Plug extending port and apply 1500 psi pressure to retracting port for five minutes. Then plug retracting port and apply 1500 psi pressure to extending port. There shall be no external leakage or distortion.

4–621. AILERON BOOSTER CONTROL VALVE. *(See figure 4-118.)* The aileron booster control valve is mounted on the aileron booster support casting and is part of the booster unit. It provides control of the hydraulic pressure flow to the booster actuating cylinder. The control valve is essentially a balanced-piston type, four-way valve, having an orifice and check valve hydraulic damper in each end of the piston chamber. The



Note

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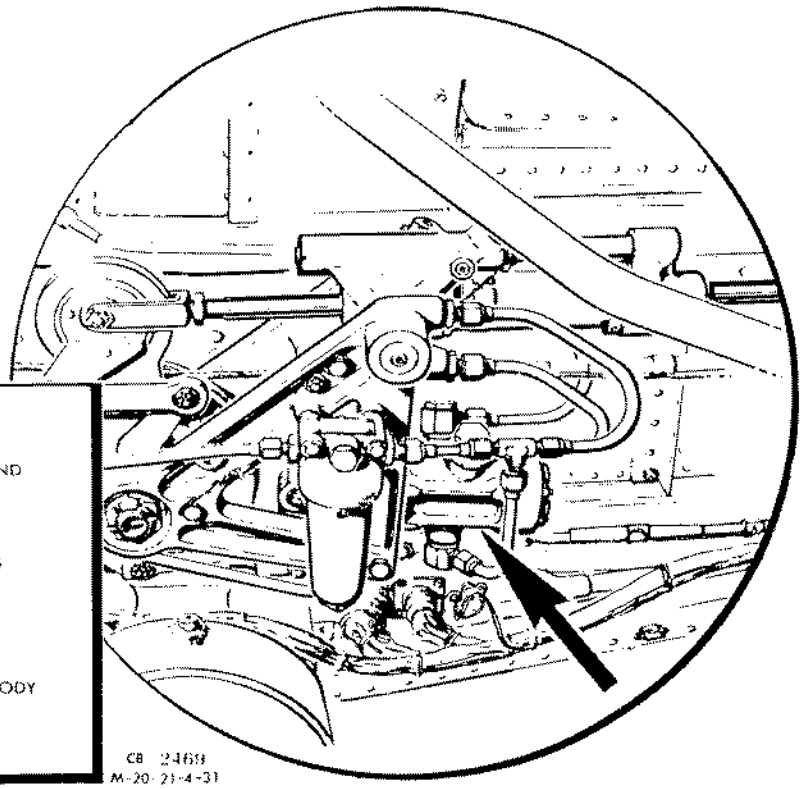

1.	CAP	11.	SHAFT
2.	BALL	12.	SHAFT END FITTING
3.	SPRING	13.	STUD
4.	SLEEVE	14.	PACKING
5.	SCREEN	15.	GASKET
6.	ORIFICE	16.	NUT
7.	PIN	17.	WASHER
8.	PLUG	18.	VALVE BODY
9.	BLOCK	19.	PISTON
⚠1 10.	DUST BOOT		

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Figure 4-118. Aileron Booster Control Valve

piston seal is metal-to-metal, and requires extreme cleanliness during overhaul and assembly operations.

4–622. REMOVAL OF AILERON BOOSTER CONTROL VALVE. *(See figure 4-114.)*

a. Relieve hydraulic pressure in accumulator by operating the ailerons.

b. Close aileron booster shutoff valve in cockpit.

c. Gain access to the aileron booster control valve through engine access doors No. 65 and 66. (See figure 3-1.)

d. Disconnect and immediately cap four hydraulic lines connected to the booster control valve.

e. Remove nuts from the studs that attach the control valve to the aileron booster support casting.

f. Disconnect control valve piston rod end from aileron booster at link.

g. Remove control valve.

4–623. INSTALLATION OF AILERON BOOSTER CONTROL VALVE. Reverse removal procedure. Perform aileron booster operational check and aileron booster leakage check. (Refer to paragraphs 4–764 and 4–765.)

4–624. REMOVAL OF AILERON BOOSTER SPRING CARTRIDGE. Refer to paragraph 4–610.

4–625. DISASSEMBLY OF AILERON BOOSTER SPRING CARTRIDGE. Remove snapring, eyebolt assembly, spring, and guides from housing.

4–626. ASSEMBLY OF AILERON BOOSTER SPRING CARTRIDGE. Reverse disassembly procedure.

Note

Upon reassembly of spring cartridge, lubricate internal parts with a light coat of grease, Specification MIL-G-23827A.

Be sure sharp edge of snap ring faces open end of housing to assure retention of snap ring in groove.

4–627. AILERON BOOSTER FILTER. *(See figure 4-119.)* The aileron booster filter is in the pressure line and insures a supply of clean fluid to the booster hydraulic unit. The filter has a capacity of 3 gallons per minute. A relief valve built into the cap bypasses fluid when differential pressure exceeds 50 (±5) psi.

4–628. AILERON BOOSTER UNIT TO AILERONS. *(See figure 4-112.)* Cables and pulleys are employed for this portion of the aileron control system. All cables are 1/4 inch 7 x 19 extra flexible.

4–629. REMOVAL OF AILERON CABLES.

a. Detach the turnbuckles.

b. Remove the clips attaching cables to the aileron drum and the booster drum.

c. Remove the metal-clad cables through inspection door No. 9. (See figure 3-1.)

d. Remove pulleys and the push-pull tube.

Note

If more than six wires are broken in any inch length of cable, replacement of the cable is mandatory.

4–630. ADJUSTMENT OF AILERON CONTROL SYSTEM.

a. Relieve hydraulic pressure by operating ailerons and close aileron booster shutoff valve in cockpit.

b. Lock control sticks in vertical position and insert 3/8-inch centering pin through booster assembly bracket and booster drum.

c. Disconnect pressure port fitting from booster valve, and center valve piston with a 1/4 inch centering pin.

d. Insert a 1/4-inch centering pin in aileron drums.

e. Rig aileron cables as shown in figure 4-112. The airplane structure and control cable system should be at a constant temperature before the cables are rigged. Adjust cables to neutral position so that centering pins slide freely in place.

f. With centering pins in place, adjust aileron push-pull tube so that aileron control surfaces are in neutral.

g. Unlock control sticks and remove centering pins from booster assembly bracket and aileron drum. Leave the centering pin in the booster valve.

h. Set cockpit stops to limit aileron travel to 20 (±2) degrees up from neutral and 20 (±2) degrees down from neutral. After setting stops, inspect aileron counterweights with aileron in both up and down positions to be sure counterweights do not strike wing skin. If a counterweight strikes the wing skin, readjust stop to restrict aileron travel enough so that counterweight will not strike the wing skin.

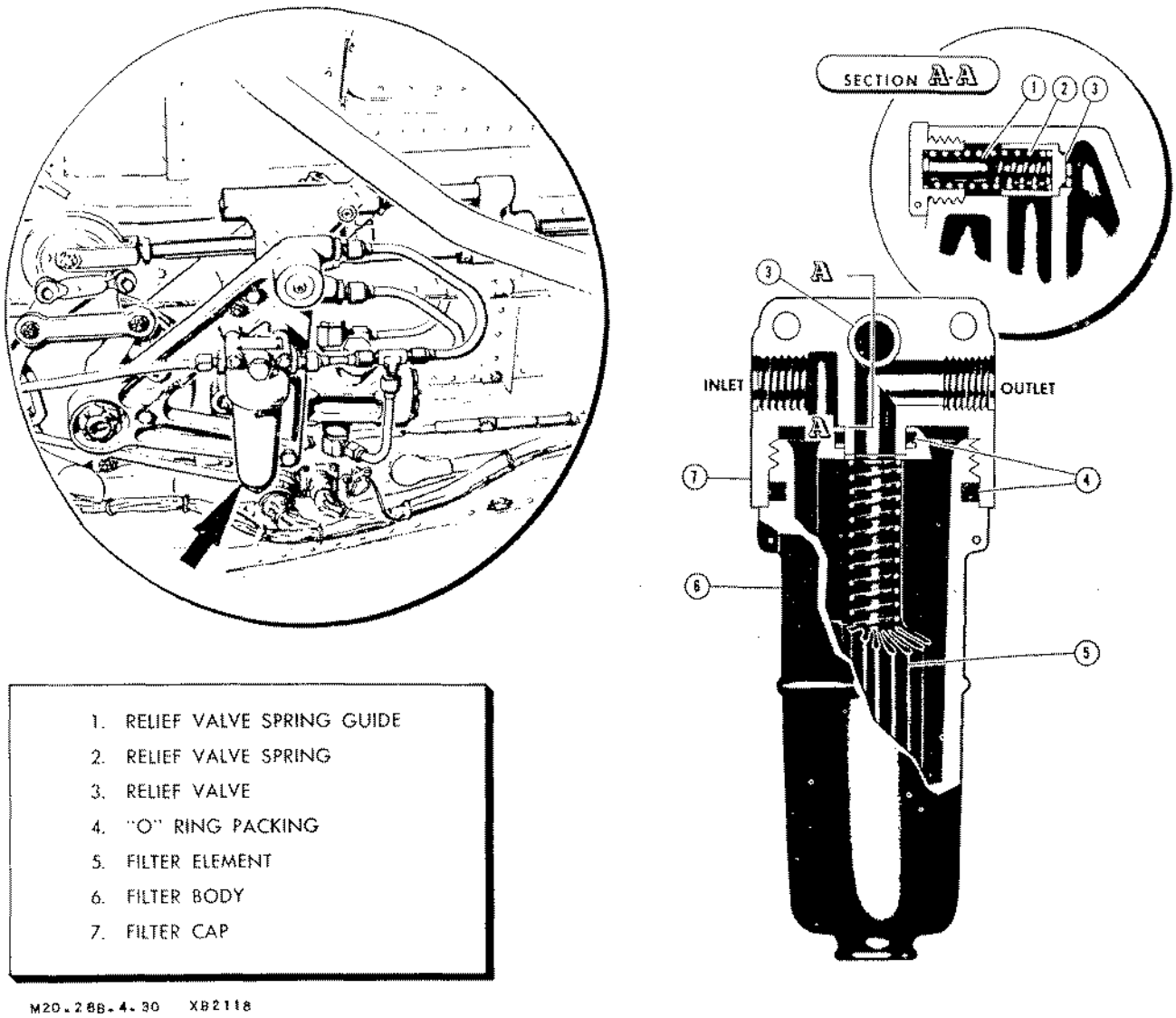


Figure 4-119. Aileron Booster Filter

i. Disconnect booster piston clevis from booster drum.

j. Move control stick to the extreme left position, and, with booster piston fully extended to the left, adjust clevis on the piston so that attaching bolt slides into place freely.

k. Move control stick to extreme right to see whether full aileron travel is obtained. If it is not rotate cylinder barrel with a strap wrench to increase or decrease distance between end caps.

l. Lock the clevis with the jam nut, and remove the centering pin from the booster valve.

WARNING

Check aileron control to be sure that when the control stick is moved to the left the left aileron moves up and the right aileron moves down; when the control is moved to the right the right aileron moves up and the left aileron moves down. If both ailerons move in the same direction at the same time, the cable turnbuckles in the wing are probably rigged to the wrong cables.

m. Lock ailerons in neutral position, using a clamp block. Check that maximum stick play in boost "OFF" position, as measured at the tip of trim switch button on top of control stick grip, does not exceed 2¼ inches in either direction from neutral position.

n. Remove clamp block from ailerons.

o. With hydraulic power applied, make certain that aileron travel is within specified limits and that aileron counterweights do not strike wing structure.

4–631. AILERON TAB CONTROL. *(See figure 4-120.)* The left aileron is equipped with an electrically operated trim tab. Tab movement is controlled by a three-position switch mounted on each control stick. (See figure 4-167.) Tab travel is set by limit switches in the actuator.

4–632. REMOVAL OF AILERON TAB JACK UNIT.

a. Remove left aileron from wing. (Refer to paragraph 4–24.)

b. Detach jackscrew (3) from aileron tab.

c. Remove inboard counterweight bracket by removing four screws.

d. Remove tab jack unit from aileron.

e. Disconnect flexible shaft from tab jack unit.

4–633. INSTALLATION AND ADJUSTMENT OF AILERON TAB JACK UNIT.

a. The distance from the mounting lugs to the forward end of riveted tube on the jackscrew (3) should be 4.19 ($4\frac{3}{16}$) inches.

b. If the distance is not $4\frac{3}{16}$ inches, adjust as follows: Unscrew cap and lift out the key. Turn jackscrew (3) until dimension is $4\frac{3}{16}$ inches. Replace key in slot so shaft will not turn, and replace cap.

c. Place tab jack unit in position in aileron, and secure it to brackets on forward face of aileron beam.

d. Replace aileron inboard counterweight.

e. Install aileron on wing. (Refer to paragraph 4–25.)

f. Clamp tab in neutral so that trailing edge of aileron is faired with trailing edge of aileron tab.

g. Rotate shaft until attaching bolt will slide freely through holes in shaft and the tab horn.

h. Insert and safety attaching bolt.

i. Remove clamp installed in step f preceding.

j. Adjust actuator limit switches to obtain 160 to 164 revolutions of output shaft; this should allow tab travel to be 20 (+2, —0) degrees up and 20 (+2, —0) degrees down. (Refer to paragraph 4–852.)

Note

Maximum allowable tab play (measured at outboard trailing edge) is $\frac{1}{16}$-inch for new units, $\frac{1}{8}$-inch for service units.

k. Operate tab from full up to full down and then to full up. If complete duty cycle takes longer than 9 seconds, check mechanism for friction and flexible shaft for lubrication.

4–634. AILERON BEND TAB. The right aileron is equipped with a fixed bend tab. This tab is set at the factory and should require no further adjustment. If wing heaviness occurs in service, all rigging should be thoroughly checked to determine the cause. The left aileron trim tab may be offset up to ¼ inch in either direction (measured at the aileron outboard trailing edge) to compensate for wing heaviness. If it becomes necessary to adjust the bend tab, the aileron trailing edge must be firmly supported to prevent warping. The tab must not be bent to more than 45 degrees off the aileron chord line.

4–635. ELEVATOR CONTROLS. *(See figure 4-121.)* The elevators are controlled by a series of push-pull tubes and bell cranks. A bungee spring device (17) provides supplemental boost to the elevators, coincident with stick action, at elevator positions above or below neutral. A $\frac{3}{16}$-inch drain hole is drilled through both walls of the bungee body, centered approximately 1.25 inches from the flanged end and in line with the slot in the body. Terminals at tube ends have self-aligning sealed ball bearings.

4–636. OPERATION OF ELEVATOR CONTROLS. *(See figure 4-121.)* Fore-and-aft motion of the control stick moves forward push-pull tube. This push-pull tube moves within the aileron torque tube and is held in alignment by three rollers. Motion is transmitted through push-pull tubes which are suspended by bell cranks and arms at points of direction change. The aft parallel push-pull tubes connect a bell crank to the operating arm which in turn is connected to the elevators through a spring-loaded linkage. Elevator movement is restricted by stops at the elevator horn assembly and at the base of the forward control stick.

4–637. REMOVAL OF ELEVATOR PUSHROD PRESSURE SEAL. Instead of removing aft cockpit floorboard cut a seven inch square hole in aft cockpit floorboard. Hole should be centered over pushrod tunnel, which is approximately nine inches wide. Aft side of hole should be two inches forward of aft bulkhead. When work is completed, secure a dural plate with wood screws to cover hole and prevent foreign objects from dropping into tunnel area.

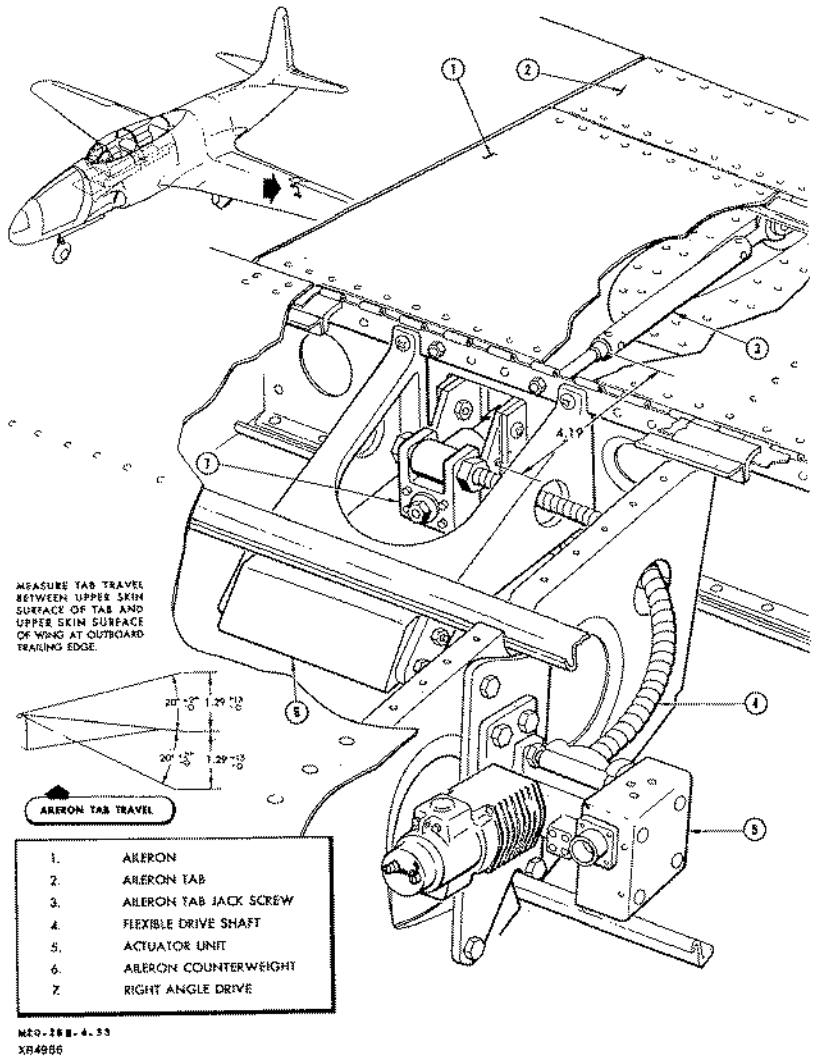
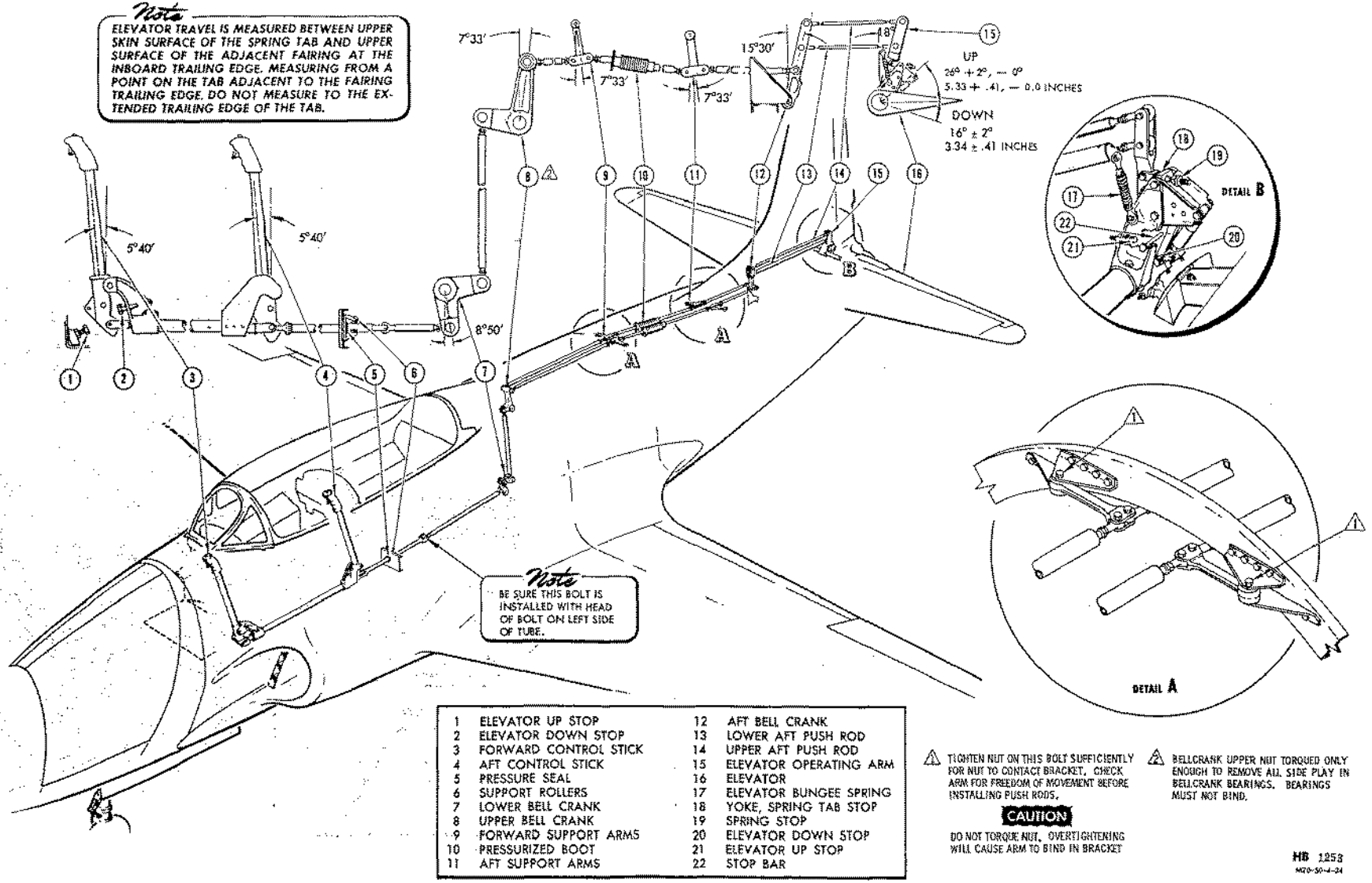


Figure 4-120. Aileron Tab Actuator System



1	ELEVATOR UP STOP	12	AFT BELL CRANK
2	ELEVATOR DOWN STOP	13	LOWER AFT PUSH ROD
3	FORWARD CONTROL STICK	14	UPPER AFT PUSH ROD
4	AFT CONTROL STICK	15	ELEVATOR OPERATING ARM
5	PRESSURE SEAL	16	ELEVATOR
6	SUPPORT ROLLERS	17	ELEVATOR BUNGEE SPRING
7	LOWER BELL CRANK	18	YOKE, SPRING TAB STOP
8	UPPER BELL CRANK	19	SPRING STOP
9	FORWARD SUPPORT ARMS	20	ELEVATOR DOWN STOP
10	PRESSURIZED BOOT	21	ELEVATOR UP STOP
11	AFT SUPPORT ARMS	22	STOP BAR

⚠ TIGHTEN NUT ON THIS BOLT SUFFICIENTLY FOR NUT TO CONTACT BRACKET. CHECK ARM FOR FREEDOM OF MOVEMENT BEFORE INSTALLING PUSH RODS.

CAUTION

DO NOT TORQUE NUT. OVERTIGHTENING WILL CAUSE ARM TO BIND IN BRACKET

⚠ BELLCRANK UPPER NUT TORQUED ONLY ENOUGH TO REMOVE ALL SIDE PLAY IN BELLCRANK BEARINGS. BEARINGS MUST NOT BIND.

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Figure 4-121. Elevator Control System

a. In aft cockpit, open zipper of boot and remove nut, bolt and washer which connects two pushrods to aft control stick.

b. Working in subcockpit area, remove nut and bolt to allow pushrod to move forward past pressure seal.

c. Remove pressure seal from retainer.

Note

When installing seal lubricate seal with graphite grease Specification MIL-G-7187. Be sure that saw tooth edge of seal is facing forward for proper pressurization.

4–638. REMOVAL OF ELEVATOR PUSH-PULL TUBES. *(See figure 4-121.)* Remove tubes aft of cockpit control assembly by removing the attaching bolts. In fuselage aft section remove tube to which accordion pleated boot is attached by loosening the clamp on the boot enough to allow the tube to slide out. Remove attaching bolts at each end and slide tube forward to disengage it from boot. For removal of tube refer to paragraph 4–590.

Note

When installing push-pull tubes, be sure there is maximum clearance between attaching bolts and structure, and between control rods. Check clearances through full range of control travel.

4–639. REMOVAL OF ELEVATOR BUNGEE SPRING.

a. Place elevator in down position.

b. Remove push-pull tubes connected to elevator actuator arm.

c. Compress spring slightly and remove spring assembly by removing screws through upper and lower attaching brackets.

WARNING

Full control of spring must be maintained at all times to avoid possible injury to personnel.

4–640. ELEVATOR TAB CONTROLS. Two sets of elevator tabs are provided. One set of tabs is electrically operated and used primarily as a trim tab, but does embody a servo action. The other set of tabs is spring loaded to apply servo assistance to the elevators during certain conditions of elevator travel.

4–641. ELECTRICALLY OPERATED ELEVATOR TABS. *(See figure 4-122.)* These tabs are outboard of the spring-loaded tabs, and are operated by an electric

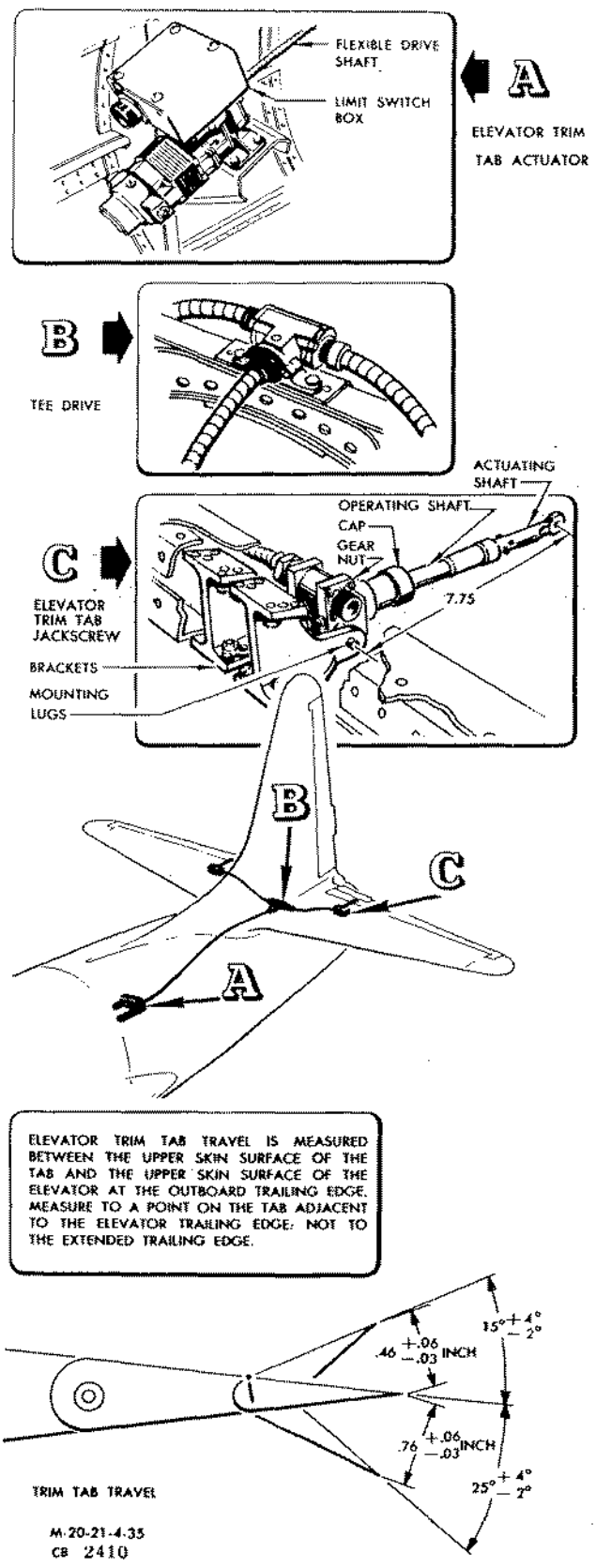


Figure 4-122. Elevator Tab Actuator System

actuator and flexible shafts. The actuator is on the right side of the aft fuselage at fuselage station 344. (See figure 4-29.) Power from the actuator is transmitted by a single flexible shaft to a "T" drive at the stabilizer rear beam. Flexible shafts extend from the "T" drive to the right and left tab jackscrews. The tab jackscrews are on brackets on the aft side of the stabilizer rear beam and are worm-and-pinion driven. The tab actuator is controlled by a switch on the control stick. (See figure 4-167.) On AF Serial No. 53-5486 and subsequent, an elevator tab override switch is installed on the left side of each cockpit to assure recovery from runaway elevator tabs caused by malfunctioning of the control stick switch or the elevator tab relays.

4–642. OPERATION OF ELECTRICALLY OPERATED ELEVATOR TABS. The tab jackscrews provide for two separate functions of the elevator tabs. With the elevator in neutral, the actuator and flexible shafts move the tabs 15 degrees up and 25 degrees down. Servo tab movement is accomplished with elevator movement. Since the tab jackscrew is attached to the stabilizer rear beam, movement of the elevator operates the tab. This movement is in a direction opposite to that of the elevator at a ratio of one-to-three. When the elevators are moved full down (16 degrees), the servo movement of the elevator tab will be 5 degrees 20 minutes up. When the elevators are moved full up (26 degrees) the servo movement of the elevator tab will be 8 degrees 40 minutes down.

4–643. REMOVAL OF ELECTRICALLY OPERATED ELEVATOR TAB CONTROLS.

a. Run tab to neutral position. Remove the elevator. (Refer to paragraph 4–53.)

b. Detach jackscrew from elevator trim tab.

c. Detach flexible shaft from jackscrew.

d. Enter through access panel No. 75 (figure 3-1) and detach forward flexible shaft from "T" drive.

e. Remove "T" drive by removing two screws from mounting bracket.

f. Remove trim tab actuator. (Refer to paragraph 4–871.)

4–644. REPAIR AND REPLACEMENT OF ELECTRICALLY OPERATED TAB CONTROLS. Do not repair damaged shafts, but remove attaching rivets and install new shaft. In case of failure of electric actuator, replace with a new unit. For installation of tabs, refer to paragraph 4–58.

4–645. SPRING-LOADED ELEVATOR TABS. *(See figure 4-123.)* These tabs are adjacent to and inboard of the electrically operated tabs and are operated by control-stick action through the spring-loaded elevator control linkage. The purpose of the tabs is to apply servo assistance to the elevator when stick pressure exceeds 5½ (±1) pounds. As the elevator air load increases, the deflection angle of the tab increases.

4–646. OPERATION OF SPRING-LOADED ELEVATOR TABS. Control-stick operation for elevator up or down position moves the elevator operating arm. Motion of the elevator operating arm actuates the tab horns through a link and bell crank, and simultaneously tends to compress the spring in the spring assembly. If the elevator air load is less than the compression value of the spring assembly, force is transmitted through the spring assembly to the elevator horn and bracket, thus operating the elevators and spring tab simultaneously. If elevator air loads exceed the compression value of the spring assembly, continued motion of the elevator operating arm gradually compresses the spring and operates the tabs until the tabs deflect enough to develop the necessary boost to the elevator controls. If elevator air loads are strong enough to compress the spring fully, jam nuts engage the yoke, and stick pressure is transmitted directly to the elevator horns.

4–647. REMOVAL AND DISASSEMBLY OF SPRING-LOADED ELEVATOR TAB CONTROLS.

a. Remove the elevator. (Refer to paragraph 4–53.)

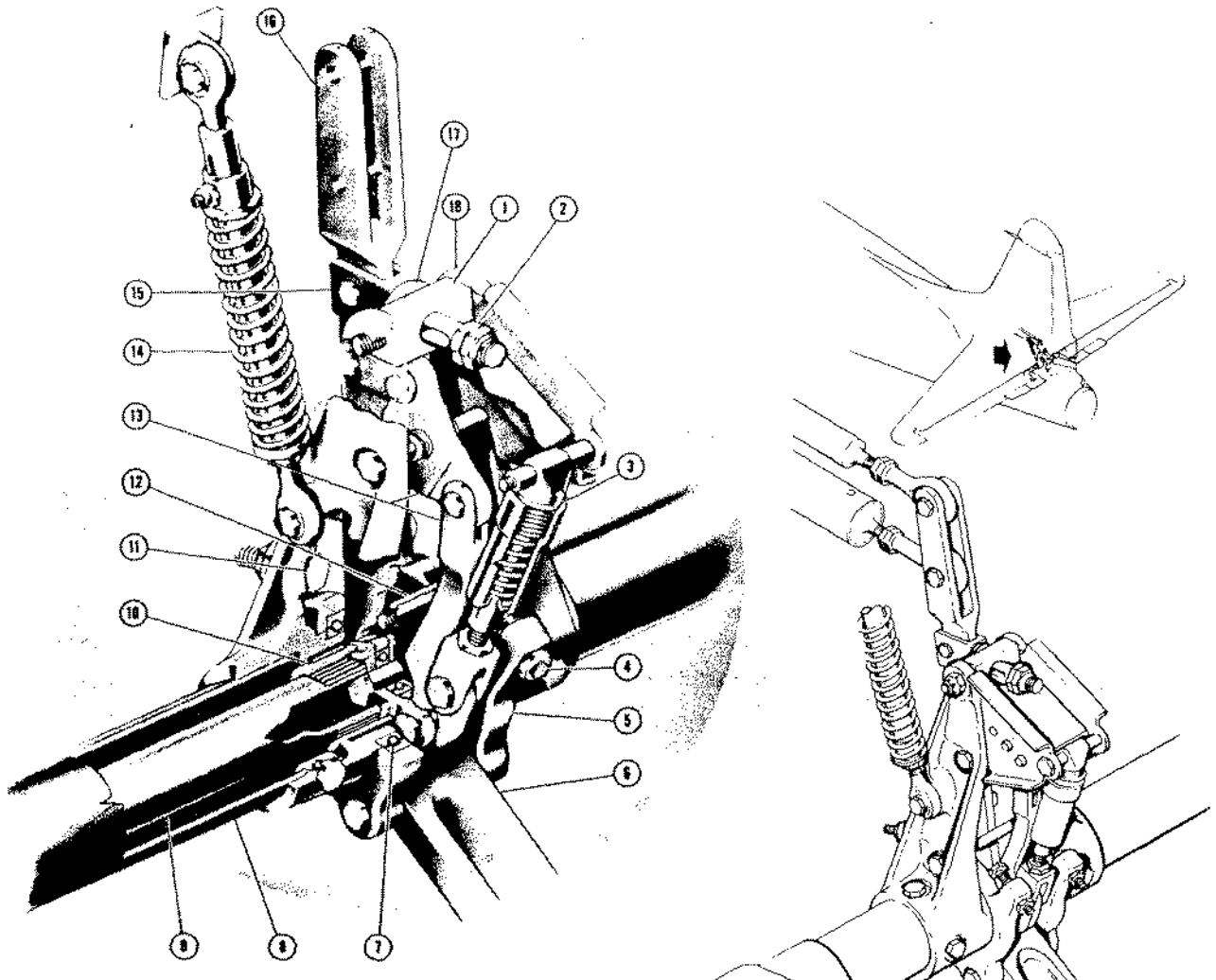
b. Remove the spring tabs. (Refer to paragraph 4–57.)

c. Disconnect push-pull tubes from the elevator actuating arm.

d. Remove the bungee spring. Refer to paragraph 4–639.)

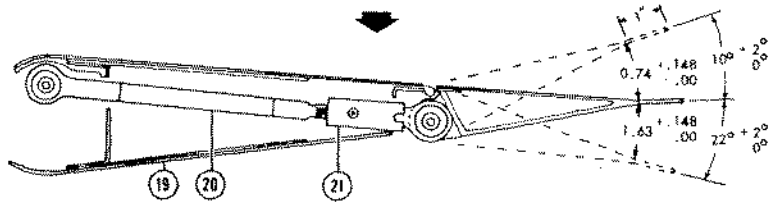
WARNING

Full control of bungee spring must be maintained at all times to avoid possible injury to personnel.



1. STOP YOKE
2. SPRING STOP
3. SPRING ASSEMBLY
4. BOLT, ELEVATOR DOWN STOP
5. SUPPORT, TORQUE TUBE
6. BRACE
7. BALL BEARING
8. ELEVATOR TORQUE TUBE
9. SPRING TAB TORQUE TUBE
10. NEEDLE BEARING
11. BOLT ELEVATOR UP STOP
12. STOP BAR
13. BELL CRANK
14. BUNGEE SPRING
15. CLEVIS BOLT
16. ELEVATOR OPERATING ARM
17. WASHERS
18. ELEVATOR HORN
19. ELEVATOR
20. SPRING TAB PUSH-ROD
21. JAM NUT

SPRING TAB TRAVEL



NOTE

MEASURED BETWEEN UPPER SURFACE OF TAB SKIN AND UPPER SURFACE OF ADJACENT FAIRING, ONE INCH FORWARD OF INBOARD TRAILING EDGE OF SPRING TAB.

MAXIMUM ALLOWABLE PLAY IN ELEVATOR SPRING TAB, MEASURED 1 INCH FORWARD OF INBOARD TRAILING EDGE, IS .062 TOTAL - TOTAL PLAY MUST BE FROM ACCUMULATED TOLERANCES, AND WILL NOT BE ACCEPTABLE IN RESULTING SOLELY FROM LOOSENESS IN ONLY ONE CONNECTION, PARTICULARLY AT PUSH-ROD END TO TAB ATTACHMENT.

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Figure 4-123. Elevator Spring Tab Mechanism

e. Disassemble the elevator spring-tab mechanism by removing four bolts through the elevator horns, four elevator stop bolts, and then remove elevator horns, sheet-metal brackets, spring assembly, elevator operating arm, and tab horns, in that order.

4–648. INSTALLATION OF SPRING-LOADED ELEVATOR TAB CONTROLS. Reverse removal procedure. When installing the elevator, hold the spring tab in neutral so that the serrations are in line when the four attaching holes in the elevator torque tube and elevator horn are in line.

Note

Elevator stop bolts at elevator and forward control stick are special bolts. If it is necessary to replace these bolts, and special bolts are not available, use AN bolts which have been threaded to bolt head. Lubricate bolt threads with grease, Specification MIL-L-7711, before installing bolts.

4–649. ADJUSTMENT OF ELEVATOR CONTROLS. *(See figures 4-121 and 4-123.)*

a. Lock elevator control surface and spring tabs in neutral.

b. Adjust aft control stick to same angle as forward.

c. Adjust forward push-pull tube so that bell crank (7) is 8 degrees 50 minutes aft of vertical.

d. Adjust vertical push-pull tube so that bell crank (8) is 7 degrees 33 minutes aft of vertical.

e. Adjust aft upper push-pull tubes so that support arms (9) and (11) are 7 degrees 33 minutes aft of vertical.

f. Adjust push-pull tubes so that bell crank (12) is 15 degrees 30 minutes aft of vertical.

g. Adjust aft push-pull tubes so that attaching bolts slide freely in place at both bell cranks.

h. To adjust elevator spring tab controls, proceed as follows:

Secure elevator control surface in neutral position.

Adjust spring-tab push rods so that spring tab surfaces are in neutral.

Note

To insure proper tightening of the jam nut against spring tab aft rod end assembly, tighten jam nut until it bottoms; back off approximately one half turn and retighten until jam nut again bottoms against spring tab aft rod end assembly. Maximum allowable spring tab play (measured one inch forward of inboard trailing edge) is $\frac{1}{16}$-inch total. Total play must be from accumulated tolerances, and will not be acceptable if resulting solely from looseness in any one connection, particularly at push-rod end to tab attachment.

Adjust clevis to allow tab up and down travel from neutral as shown in figure 4-123. Adjust tab up travel by adding or removing washers at the forward end of the clevis bolt. Adjust the tab down travel by changing the position of the spring stop jam nuts on the aft end of the clevis bolt.

With tab in neutral, set stops to allow elevator up and down travel as indicated on figure 4-121.

Set stops in cockpit to allow clearance of $\frac{1}{16}$ ($\pm\frac{1}{32}$) inch after stops have been contacted for up and down elevator travel, and after spring tab has been fully deflected.

Lock elevator control surface in neutral, and move control stick slightly to determine the force necessary to start movement of the spring tab. Use a spring scale. The force required should be $5\frac{1}{2}$ (± 1) pounds. If force required is more than $6\frac{1}{2}$ pounds, check entire system for excessive friction.

Note

Control stick play, measured at top of stick grip, is 0.25-inch maximum.

If replacement of bungee spring is necessary, adjust bungee spring so that distance from center of bolt on rod end to shoulder of sleeve is 1.02 inches. No other adjustment is necessary.

4–650. ADJJUSTMENT OF ELECTRICALLY OPERATED ELEVATOR TAB CONTROLS.

a. Turn battery switch "ON."

b. Hold trim-tab switch forward (nose down) until actuator reaches its fixed limit (tab up). If necessary, disconnect flexible drive shaft at actuator and turn shaft by hand until 15 (+4, —2) degrees tab up travel (from neutral) is obtained (measured at inboard end of the tab with elevator in neutral).

c. With flexible shaft connected, operate tab switch aft (nose up) until 25 (+4, —2) degrees tab down

travel from neutral is obtained, and adjust down limit switch in actuator. (Refer to paragraph 4-870.)

d. Run tab back to neutral with tab switch, and adjust tab-neutral switch in actuator until tab-neutral light glows. (Refer to paragraph 4-868.)

Note

Maximum allowable tab play (measured at outboard trailing edge) is $\frac{3}{64}$ inch for new units, $\frac{1}{8}$ inch for service units.

e. With elevator in neutral, check time it takes elevator tab to travel from full up (15 degrees) to full down (25 degrees). This should be 10.7 (± 2) seconds. Check time it takes elevator tab to travel from full down to full up. This should be 12.0 (± 2) seconds. If time is less, adjust elevator tab to lose speed; if time is greater, on either or both circuits, lubricate the tee fitting by disconnecting all three couplings and forcing grease, Specification MIL-G-3278, into the forward opening until it comes out the two side openings. Attach couplings and test again. If speed does not meet requirements, adjust elevator tab rheostats to bring tabs to correct speed.

4-651. RUDDER CONTROLS. *(See figure 4-124.)* The rudder controls consist of two similar sets of synchronized pedals between the two cockpits and connected to the rudder by flexible cables.

4-652. RUDDER CONTROL PEDALS. *(See figures 4-124, 4-125 and 4-126.)* Rudder control pedals are suspended by hangers from brackets which are attached to fuselage structure. Pedal hangers are connected by links to the rudder walking beam. The aft cockpit pedals are linked directly to the quadrants over which cables from the forward cockpit pass. Swaged lock wedges hold cables to the quadrants. All pedals are adjustable fore-and-aft to accommodate the pilots leg length.

4-653. OPERATION OF RUDDER PEDALS. *(See figure 4-125.)* The following describes the cycle of operation for left-rudder motion as viewed from the forward pilot's seat. When the left pedal is depressed, the left rudder arm rotates forward, placing a tension load on the cable, and the walking beam rotates clockwise. The right rudder arm and pedal swing back, since they are connected to the left pedal by the walking beam. When pressure is released on the left pedal, centering springs return pedals to neutral.

4-654. REMOVAL OF FORWARD RUDDER PEDALS. *(See figure 4-125.)*

a. Detach rudder cables from arms by unscrewing turnbuckles and removing bolts.

b. Detach centering springs.

c. Disconnect brake rod at the lower end.

d. Remove bolts that attach clevis to walking beam.

e. Remove bolts that attach inboard and outboard hanger-attaching brackets.

f. Swing walking beam attaching clevises out, then back and up.

g. Remove the rudder pedal assemblies by pulling them straight down.

4-655. REMOVAL OF AFT RUDDER PEDALS.

a. Disconnect brake rods at pedals.

b. Disconnect cable quadrant push rods.

c. Remove bolts that attach inboard and outboard hanger attaching brackets.

d. Remove rudder pedal assemblies by pulling them straight down.

4-656. RUDDER CONTROL CABLES. *(See figure 4-124.)* Cables from the rudder pedals to the rudder are supported at each point of direction change by pulleys. A quick disconnect fitting (figure 4-127) connects the forward and aft cables of each cable assembly at fuselage station 245. Pressure seals (figure 4-25) are installed at the points where the cables pass through the cockpit aft bulkhead, to prevent loss of pressure in the cockpit.

4-657. REMOVAL OF RUDDER CABLES.

a. Remove fuselage aft section and engine tail pipe. (Refer to paragraphs 4-299 and 4-322.)

b. Disconnect forward cables at the forward rudder pedals.

c. Remove the pressure seals.

d. Remove cable guards from pulley brackets in forward cockpit.

e. Attach flexible wires to forward end of forward cables. Pull forward cables aft into engine compartment, leaving the wire in position so that replacement cable can be pulled into place.

f. Disconnect aft cables at rudder control horn.

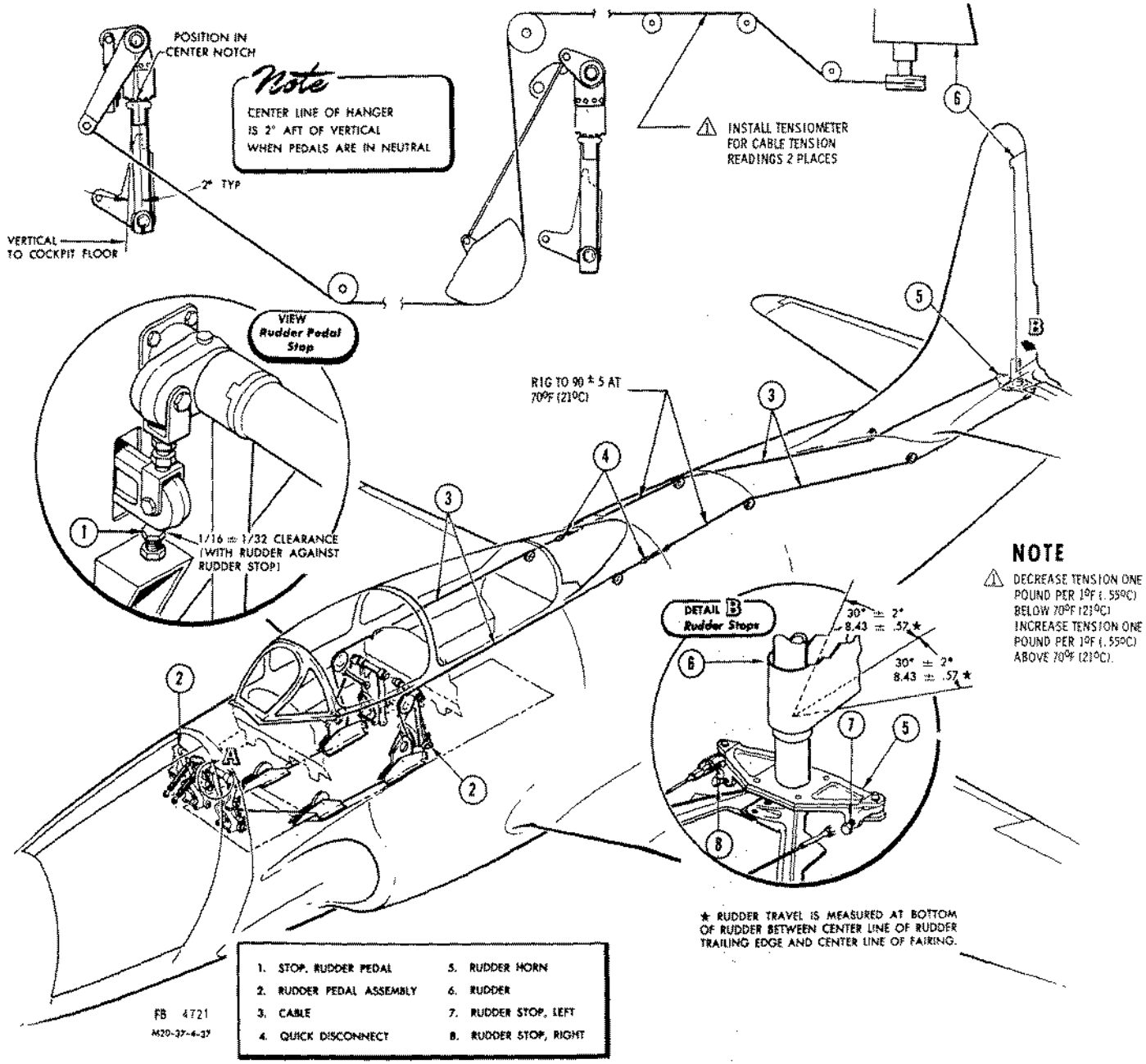
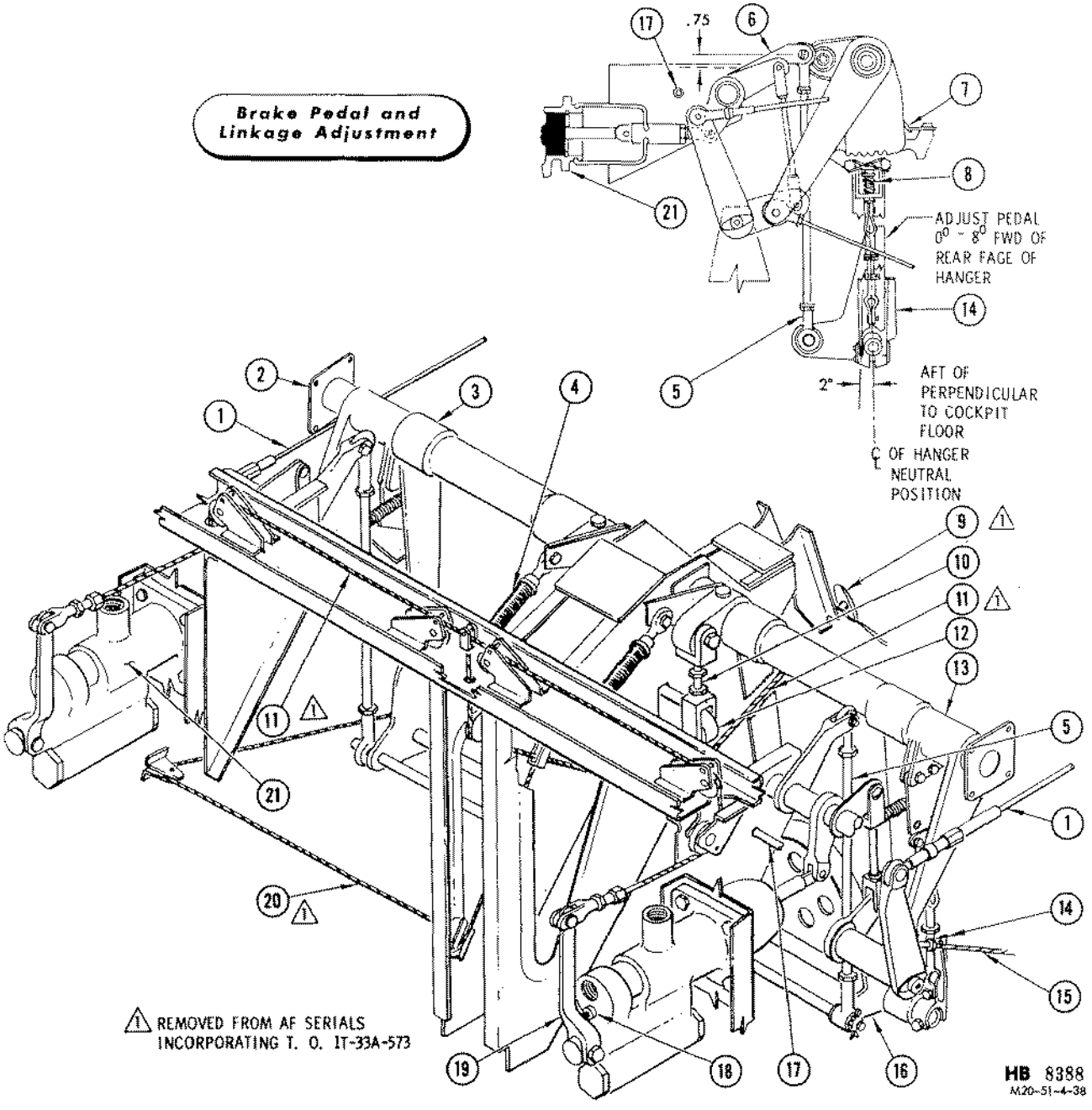


Figure 4-124. Rudder Control System



1	AFT COCKPIT BRAKE PUSH PULL TUBE	8	LOCK ASSEMBLY	15	RUDDER CABLE
2	BRACKET	9	PARKING BRAKE HANDLE	16	RUDDER PEDAL
3	PEDAL HANGER	10	CONNECTING LINK	17	BELL CRANK STOP
4	CENTERING SPRINGS	11	PARKING BRAKE CABLE	18	PARKING BRAKE VALVE
5	BRAKE ROD	12	WALKING BEAM	19	PARKING BRAKE LEVER
6	BELL CRANK	13	ARM ASSEMBLY	20	AFT PARKING BRAKE CABLE
7	PEDAL ADJUSTING SPRING	14	PEDAL ADJUSTING LEVER	21	BRAKE CYLINDER

Figure 4-125. Forward Cockpit Rudder Pedal Installation

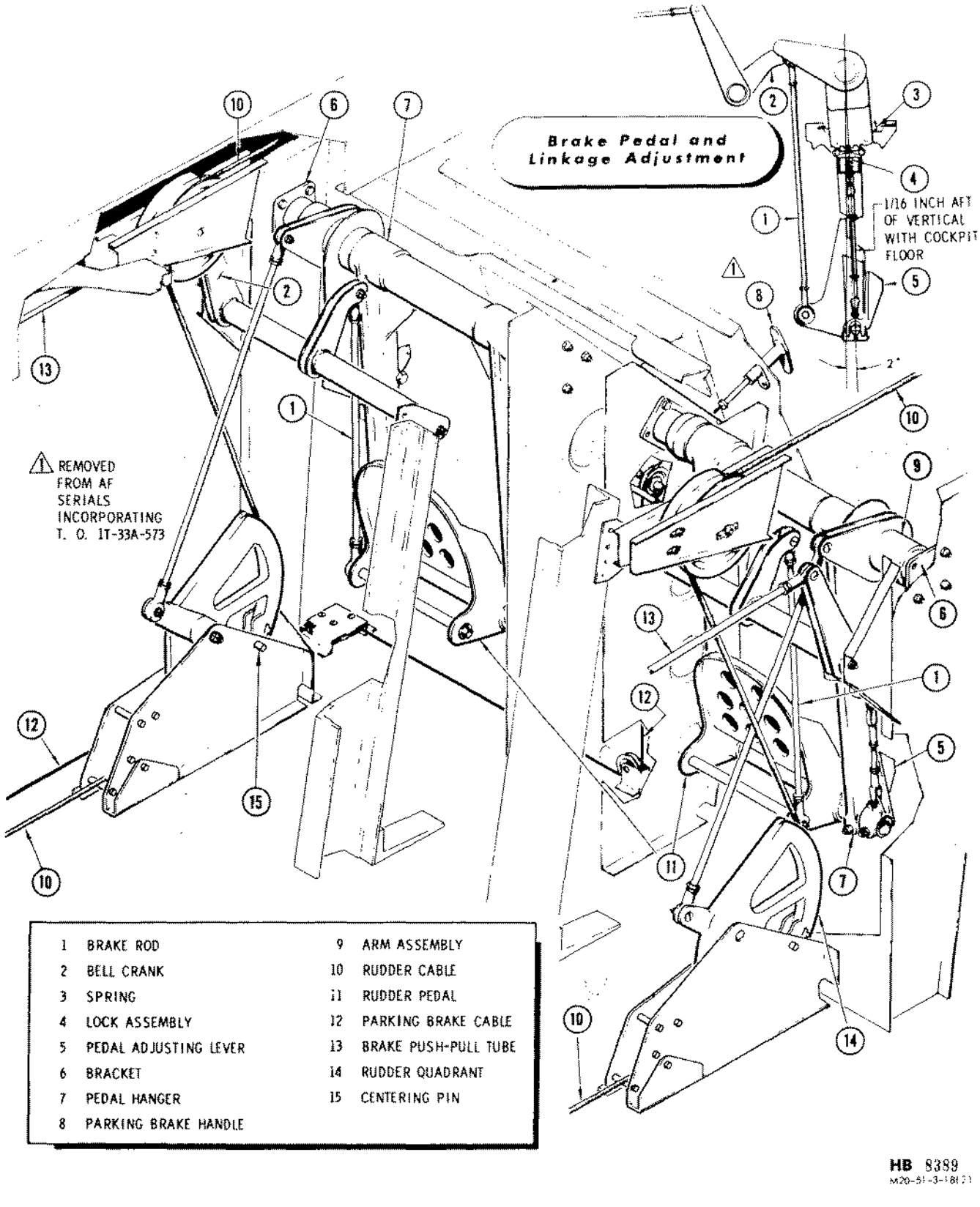


Figure 4-126. Aft Cockpit Rudder Pedal Installation

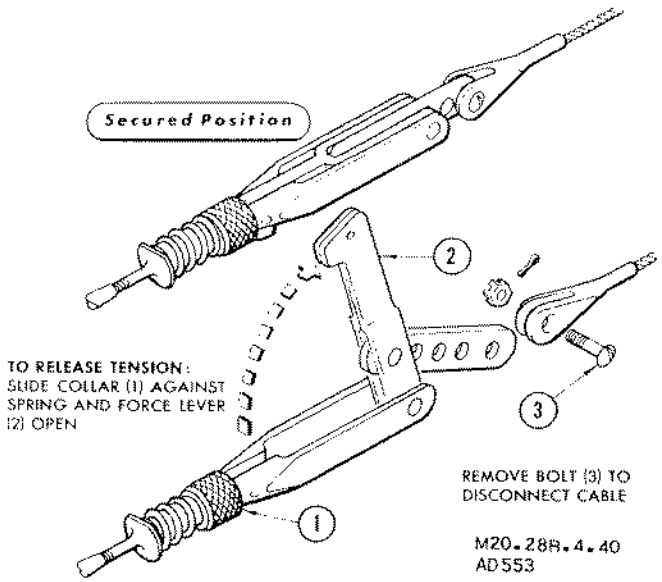


Figure 4-127. Rudder Cable Tension Release Fitting

g. Working in aft section, remove fairleads at bulkheads and remove cable guards at pulley brackets.

h. Attach flexible wires to aft end of aft cables. Pull aft cables forward into engine compartment, leaving the wire in position so that replacement cable can be pulled into place.

4-658. INSTALLATION OF RUDDER CABLES. Reverse removal procedure. Be sure that pressure seals are lubricated according to requirements on figure 3-26, lubrication diagram, and that seal prevents leakage of air from the cockpit. Rig cables to 90 (±5) pounds tension.

WARNING

Be sure cable guards are installed and that fittings are properly lock-wired.

4-659. RUDDER CABLES QUICK DISCONNECT. *(See figure 4-127.)* A tension release fitting is installed in each rudder cable assembly to facilitate removal of the aft fuselage section.

4-660. REPAIRS AND REPLACEMENTS OF RUDDER CONTROLS.

a. Inspect all parts for cracks, nicks or bent tubes.

b. Restake loose bearings. If the bearing does not turn freely in the race after staking, replace the bearing.

c. Replace frayed cables when more than six wires are broken in any inch length of cable. (The 7 x 19 cable is composed of 7 strands of 19 wires each.)

d. Replace cracked or damaged fittings.

e. There must be no twist in the cables.

f. No more than one-degree pull-off is permitted; i.e., there must be no less than 0.003-inch clearance between the pulley flange and the cable.

g. No more than three threads may show at either end of a turnbuckle.

4-661. ADJUSTMENTS OF RUDDER CONTROL SYSTEM.

a. Insert ¼-inch centering pin through aft cockpit rudder quadrant and brackets. (See figure 4-126.)

b. Set walking beam parallel to the floor.

c. Adjust walking-beam links to position pedal hangers 2 (±½) degrees aft of perpendicular to the floor.

Note

The pilots leg length adjustment must be in the center notch.

d. Hold forward pedals in place with control lock. Loosen turnbuckles to relieve tension in cables.

e. Secure rudder in neutral.

f. Adjust cable turnbuckles and tension release fitting to 90 (±5) pounds tension.

g. Safety the turnbuckles.

h. Remove control lock from pedals.

i. Release the rudder.

j. Remove centering pin from aft cockpit rudder quadrant.

k. Adjust rudder stops to allow 30 (±2) degrees travel in each direction from neutral.

l. Place rudder against left stop and adjust left pedal stop at the walking beam to a clearance of 1/16 (±1/32) inch.

m. Repeat step l preceding for the right stops.

n. Lock rudder pedals in neutral.

o. Adjust rudder centering springs so that the spring attaching bolts slide in place freely with the spring

holding assembly in the fully extended position with no initial compression on the spring. The centering springs are adjusted by unscrewing the rod end which attaches to the bulkhead at fuselage station 103. Adjust in increments of one-half turn.

p. Rig aft pedals so that clearance exists between head warmer tube and pedal with the pedal in forward adjustment notch, full right rudder and full brake.

Note

Abnormal pressure which results in deflecting the structure and brake mechanism should not be considered when determining clearance. Pedal shall clear instrument panel with the pedal in aft adjustment notch and fully back.

4–662. RUDDER TAB. The rudder is equipped with a fixed bend tab. Adjust this tab so that the airplane maintains a straight course, by bending the tab at its juncture with the rudder. Maximum allowable deflection of the tab is $\frac{3}{16}$-inch in either direction, measured at the trailing edge.

4–663. STALL CHARACTERISTIC CORRECTIONS. With tiptanks installed, and after replacing and rerigging either/or both ailerons or wing flaps (refer to paragraphs 4–25 or 4–34), an undesirable roll characteristic might occur at or prior to a stall.

Note

Be sure stall strips on wing leading edge are of correct contour.

a. If a wing drop occurs at stall speed it may be corrected by adjusting the wing flap mechanism so that the flap on the wing-low side is extended a maximum of 2 degrees more than the other flap. In some cases, adjustment of the flap on the wing-high side will correct the wing drop. It may be necessary to replace either or both tiptanks to further improve stall characteristics.

b. Aileron control near stall speed may be improved by rigging one or both ailerons up from neutral by adjusting the pushrod between the aileron and aileron bellcrank one-half to one full turn. It may be desirable to rig the aileron control system to 425 pounds tension.

c. A yawing tendency near stall speed may usually be corrected by realigning the main gear doors.

4–663A. NOSE-HEAVY CHARACTERISTIC CORRECTIONS. When nose-heavy characteristics are encountered, perform the following standard checks:

a. Perform a thorough weight and balance check:

(1) Completely defuel aircraft.

(2) Insure equipment and scales are not faulty.

(3) Insure recording of correct tare readings.

(4) Insure proper bar ballast.

b. Perform a thorough alignment and asymmetry check.

c. Perform a thorough rigging check. Insure proper functioning of trim tab limit switch.

d. If no discrepancies are disclosed in the standard checks, perform the following additional checks:

(1) Check for hidden loose items aboard aircraft.

(2) Check for hidden/overlooked "shot bag" ballast in nose section.

(3) Check for tailpipe and thrust line alignment.

(4) Check for proper position/installation of stall strips on inboard leading edge of wings.

(5) Exchange tail sections of two aircraft.

(6) Replace elevator actuator unit, 177750-2 per paragraphs 4–647 through 4–649.

4–664. HYDRAULIC SYSTEM.
(See figure 4-128.)

4–665. DESCRIPTION. The basic hydraulic system consists of a pressurized reservoir with an air pressure regulator, an engine-driven variable-volume pump, an accumulator, a system relief valve, a system pressure gage, external pressure and return connectors, and an accumulator air pressure gage. It operates the alighting gears, the main gear inner doors, the dive flaps, the aileron booster, and the case ejection doors. An emergency system is provided for both emergency and ground test operations. It consists of an electric motor-driven hydraulic pump, an emergency reservoir, a system relief valve, a system selector valve, a ground test selector valve, and separate tubing.

Note

If operation at ground temperature of less than −40° C (−40° F) is expected, replace gland packings on hydraulic actuating cylinder piston rods with AN6227 packings.

4–666. FLUSHING MAIN HYDRAULIC SYSTEM. The following procedure covers flushing of all lines, but does not include flushing actuating units. If inspection of actuating units reveals contamination, units must be removed from the airplane and flushed or cleaned independently.

a. Jack airplane (refer to paragraph 3–19).

b. Relieve hydraulic system pressure by operating aileron booster.

c. Install jumper in hydraulic system in the following places:

Nose gear actuating—remove lines from actuating cylinder; install a flexible jumper between these lines. Cap cylinder ports.

Nose gear uplock cylinder—remove line at center of cylinder; install a flexible jumper to line with a shutoff valve; place valve in off position. Cap cylinder port.

On T-33A-1 airplanes, remove line between manual shutoff valve and case ejection door actuator. Install flexible jumper to manual shutoff valve and cap actuator port. Place shutoff valve in off position.

Left and right dive flap actuating cylinders—disconnect flexible hoses from each cylinder. Connect the two hoses to each cylinder together using 90 degree fitting. Place ships dive flap shutoff valve in off position. Cap cylinder ports.

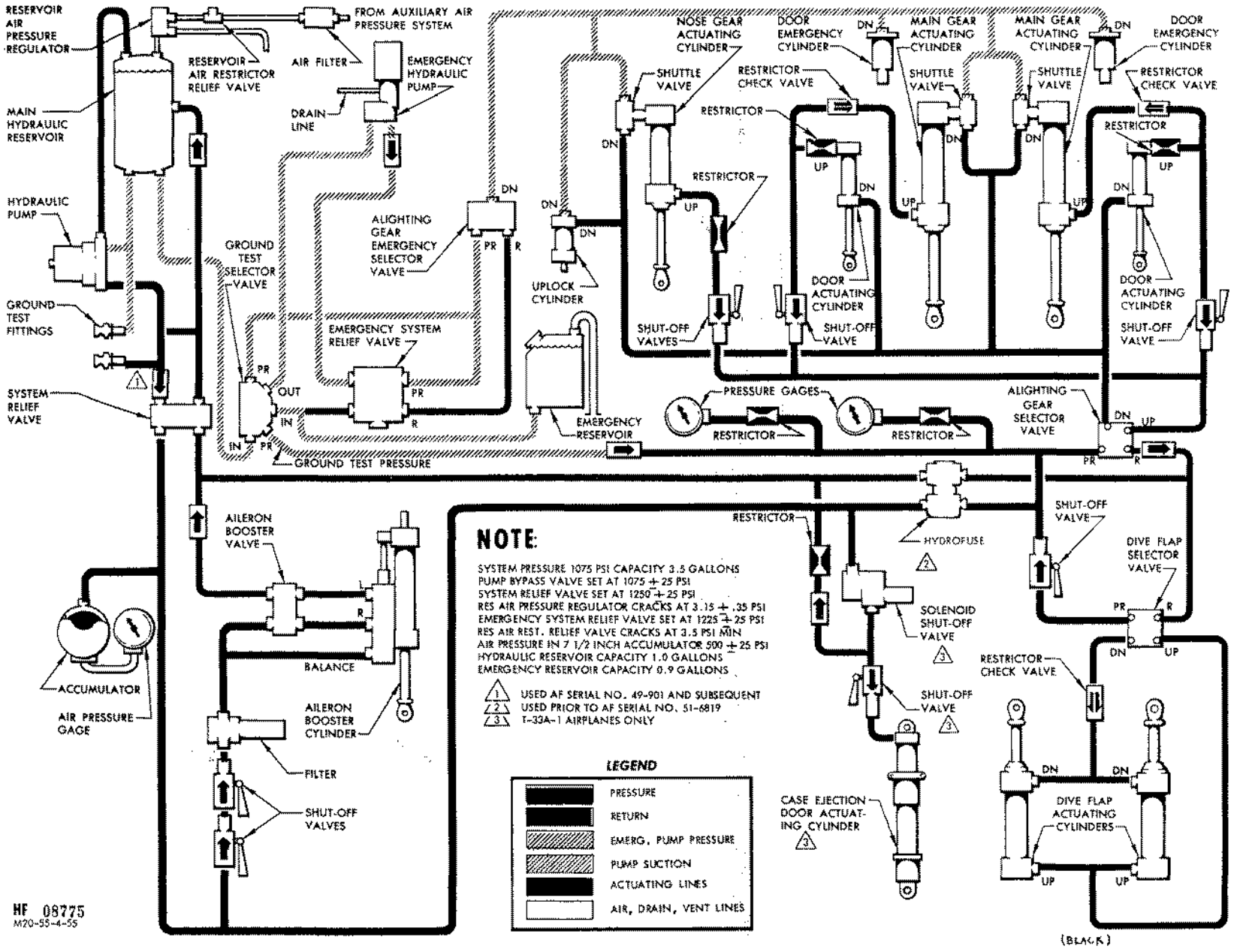


Figure 4-128. Hydraulic System Schematic Diagram

Left and right main gear actuating cylinders—disconnect flexible hoses from actuating cylinder and connect together using 90 degree fitting. Cap cylinder ports.

Left and right main gear door actuating cylinders—disconnect both flexible hoses from cylinder and connect together using 90 degree fitting. Cap cylinder ports.

Aileron booster cylinder—disconnect hydraulic pressure line from filter on booster. Disconnect return line from booster valve. Connect these two lines together using a flexible jumper and necessary fittings. Cap open fittings on booster unit.

d. Place ships shutoff valves in landing gear UP lines in off position (both main gear wheel wells and nose wheel well). Place ships shutoff valve in dive flap system in off position. Place forward cockpit aileron booster shutoff valve in "OFF" position.

e. Disconnect ships return line (flexible hose) from check valve near main hydraulic reservoir. Use a jumper and connect return line to gig supply line at quick-disconnect fitting with a tee in hydraulic gig supply line.

Note

This will direct return flow from ship through gig filters.

f. Connect hydraulic gig pressure and return lines to quick-disconnect fittings located in engine compartment.

Note

Hydraulic gig must have micronic filters.

g. Disconnect suction line at emergency hydraulic pump and install flexible jumper with shutoff valve in line. Place end of jumper in open container; shutoff valve in closed position. Cap pump port.

h. Fill hydraulic reservoir to proper level with hydraulic fluid, Specification MIL-H-5606, using funnel, 205220.

i. Place ground test selector valve handle in up position (ground test); open shutoff valve in emergency pump suction line jumper and allow approximately one quart of hydraulic fluid to run into open container (fluid will gravity feed from hydraulic reservoir). Close jumper line shutoff valve and return ground test selector valve handle to the down position (flight) and safety.

j. Refill hydraulic reservoir to proper level.

k. Start gig and open forward cockpit aileron booster shutoff valve; leave valve open for one minute.

l. Close forward cockpit aileron booster shutoff valve and open ships shutoff valve to left main gear system for one minute.

m. Close ships shutoff valve to left main gear system and open ships shutoff valve to right main gear system for one minute.

n. Close ships shutoff valve to right main gear system and open ships shutoff valve to dive flap system for two minutes during which time more dive flap switch in cockpit to extend and retract positions through two or more cycles.

o. Close ships shutoff valve to dive flap system and open ships shutoff valve to nose gear system for one minute.

p. Place end of flexible jumper on nose gear uplock cylinder line in open container; close ships shutoff valve to nose gear system and open jumper line shutoff valve in uplock cylinder line. Allow one quart of fluids to run into container and close jumper line shutoff valve.

q. On T-33A-1 airplanes, place open end of jumper line on case ejection door actuator line in nose compartment in open container. Block solenoid valve (in left side of nose wheel well) in open position. Open ships shutoff valve for this system and allow one quart of fluid to run into container and close shutoff valve. After one minute, stop hydraulic gig and return solenoid selector valve to closed position.

r. Open all ships shutoff valves, remove all jumper lines except hydraulic reservoir return line jumper, and reconnect all lines to actuating units.

s. Remove hydraulic reservoir filter, clean filter and reservoir including filter relief valve and reassemble.

t. Remove, clean and reinstall aileron booster filter.

u. Fill hydraulic reservoir to proper level.

v. Start hydraulic gig and operate all hydraulic systems, one at a time, through several cycles to eliminate all air throughout systems and insure proper operations.

w. Remove engine-driven hydraulic pump pressure, suction and by-pass lines from airplane and flush with clean hydraulic fluid. Inspect lines visually before reinstalling.

x. Remove hydraulic reservoir return line jumper and reconnect return line to check valve.

y. Remove hydraulic gig pressure and return lines and connect engine-driven hydraulic pump lines to quick disconnect couplings.

z. Remove airplane from jacks.

4–667. FLUSHING EMERGENCY HYDRAULIC SYSTEM. The following procedure covers flushing of all lines, but does not include flushing actuating units. If inspection of actuating units reveals contamination, units must be removed from the airplane and flushed or cleaned independently.

a. Fill emergency hydraulic system reservoir with hydraulic fluid Specification MIL-H-5606.

b. Place emergency selector valve in "EMERGENCY" position.

Note

Ground test selector valve handle must be down (flight position).

c. Disconnect emergency system line at shuttle valve on nose gear actuating cylinder; add extension if necessary and place open end in a container. Operate emergency hydraulic pump until approximately one pint of fluid has been pumped out and stop pump. Reconnect line to shuttle valve.

d. Disconnect emergency system line from left main gear actuating cylinder shuttle valve. Place open end in a container and operate emergency hydraulic pump until approximately one pint of fluid has been pumped out and stop pump. Reconnect line to shuttle valve.

e. Disconnect emergency system line from left main gear door emergency cylinder. Place open end in a container and operate emergency pump until approximately one pint of fluid has been pumped out and stop pump. Reconnect line to cylinder.

f. Repeat steps d and e for right main gear.

g. Return emergency selector valve to "NORMAL" position.

h. Fill emergency hydraulic reservoir to proper level.

i. Return alighting gear system to normal operation in accordance with paragraph 4–717.

4–668. POSITIONING-TYPE UNIVERSAL FITTING INSTALLATION (AF SERIAL NO. 51-6819 AND SUBSEQUENT). Install the nut, ring, and gasket at the tee in the hydraulic system return line in the left main wheel well as shown on figure 4-129.

4–669. HYDRAULIC RESERVOIR. *(See figure 4-130.)* The hydraulic fluid reservoir is constructed in detachable halves which are held together by a clamp. A filter element is installed in the middle of the reservoir to clean the return fluid. A filter relief valve is installed to bypass fluid around the filter should it become clogged. The suction outlet for the engine-driven pump is located in the bottom of the tank, while the suction outlet for the emergency pump is connected to a standpipe inside the tank. The return line enters the side of the tank, and the pump bypass line enters the top of the tank. The air pressure regulator is installed on the top of the tank and is connected to an air pressure line and a vent line. A sight gage on the side of the tank indicates the fluid level inside the tank. A check valve is installed at the return port to prevent reverse flow of fluid. The reservoir is located on the left side of the engine compartment, and access to the reservoir is through left access panel No. 42.

4–670. REMOVAL AND DISASSEMBLY OF HYDRAULIC RESERVOIR.

a. Remove access panel No. 42. (See figure 3-1.)

b. Drain fluid from reservoir by removing the plug in the bottom of the reservoir.

c. Disconnect all lines at the reservoir. Cap all openings and identify lines for proper reinstallation.

d. Remove bolts which attach reservoir to its bracket.

e. Remove air pressure regulator from top of reservoir.

f. Remove sight-gage name plate.

g. Unscrew clamp bolts and clamps, and separate the two sections.

h. Remove seal ring and gasket.

i. Lift filter element out of lower section.

j. Remove two bolts that attach filter bypass valve, and remove valve.

k. Remove filler cap, snap ring, filler screen guard, and filler screen.

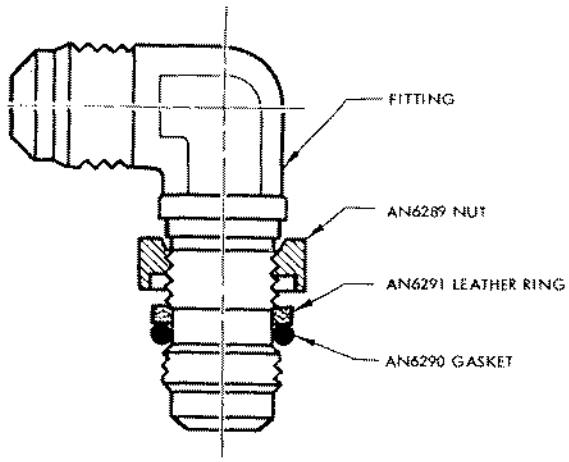
4–671. CLEANING, INSPECTION, AND REPLACEMENTS OF HYDRAULIC RESERVOIR.

a. Clean all parts, except filter element, with kerosene, Federal Specification VV-K-211b, or solvent, Federal Specification P-D-680.

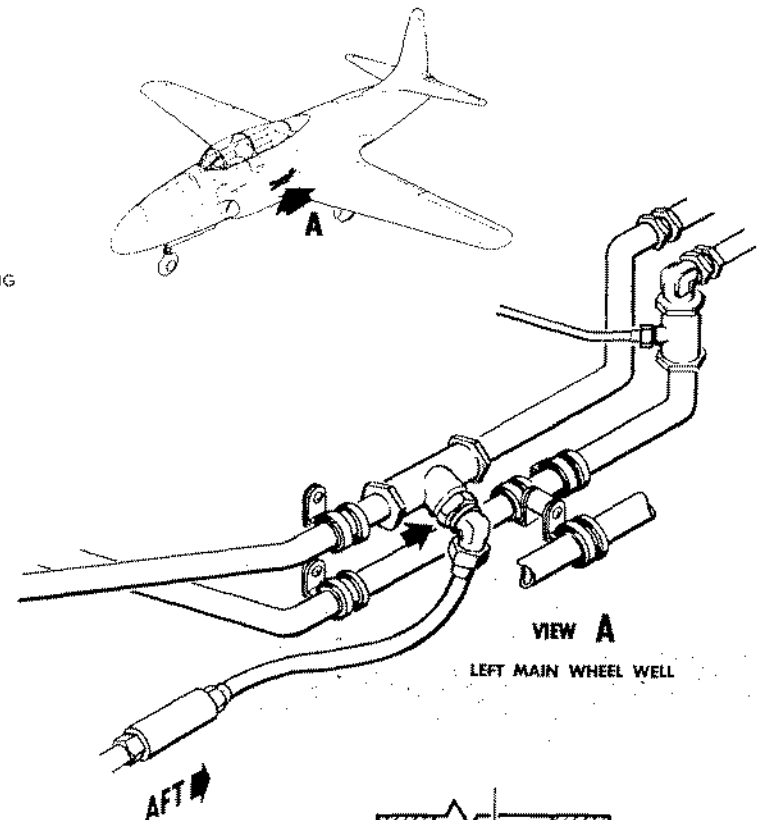
b. Inspect gaskets and seal rings for deterioration or damage, and replace as required.

c. Inspect poppet valve for proper seating.

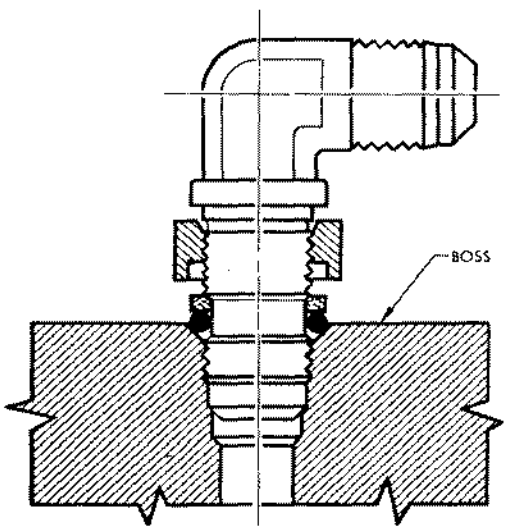
4–672. REPAIRING HYDRAULIC RESERVOIR. The reservoir is lagged with $\frac{1}{16}$-inch thick, inch-wide asbestos strip which is coated with sodium silicate (water



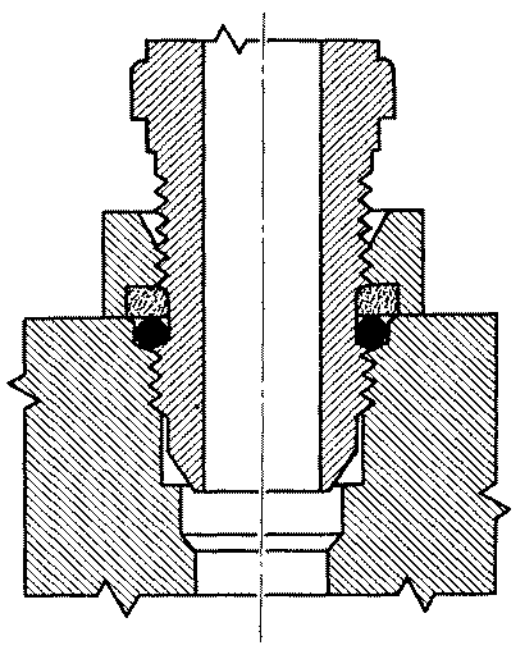
(1) INSTALL NUT ON FITTING. BE SURE NO PART OF NUT COVERS FITTING GASKET GROOVE. LUBRICATE GASKET WITH HYDRAULIC FLUID, SPECIFICATION MIL-O-5606. INSTALL LEATHER RING AND GASKET IN GROOVE.



VIEW A
LEFT MAIN WHEEL WELL



(2) SCREW FITTING INTO BOSS BY HAND UNTIL GASKET JUST CONTACTS BOSS. SCREW FITTING ANOTHER ONE-HALF TURN. ANY FURTHER POSITIONING OF FITTING MUST BE ACCOMPLISHED BY SCREWING FITTING IN UP TO AN ADDITIONAL 359°. HOLDING THE FITTING STATIONARY AT PROPER SELECTED POSITION, TURN NUT UNTIL IT CONTACTS LEATHER RING. INSTALL FLARE TUBE ON FITTING. USE ONE WRENCH TO TIGHTEN TUBE COUPLING NUT AND ANOTHER WRENCH ON FITTING TO RESIST COUPLING NUT TIGHTENING TORQUE.



(3) USING A WRENCH, TIGHTEN NUT UNTIL IT BOTTOMS TIGHTLY ON BOSS. IT WILL BE NECESSARY TO USE ANOTHER WRENCH ON FITTING WHEN NUT IS TIGHTENED TO PREVENT FITTING FROM TURNING.

Note

SLIGHT EXTRUSION OF LEATHER RING BETWEEN BOSS AND NUT IS PERMISSIBLE.

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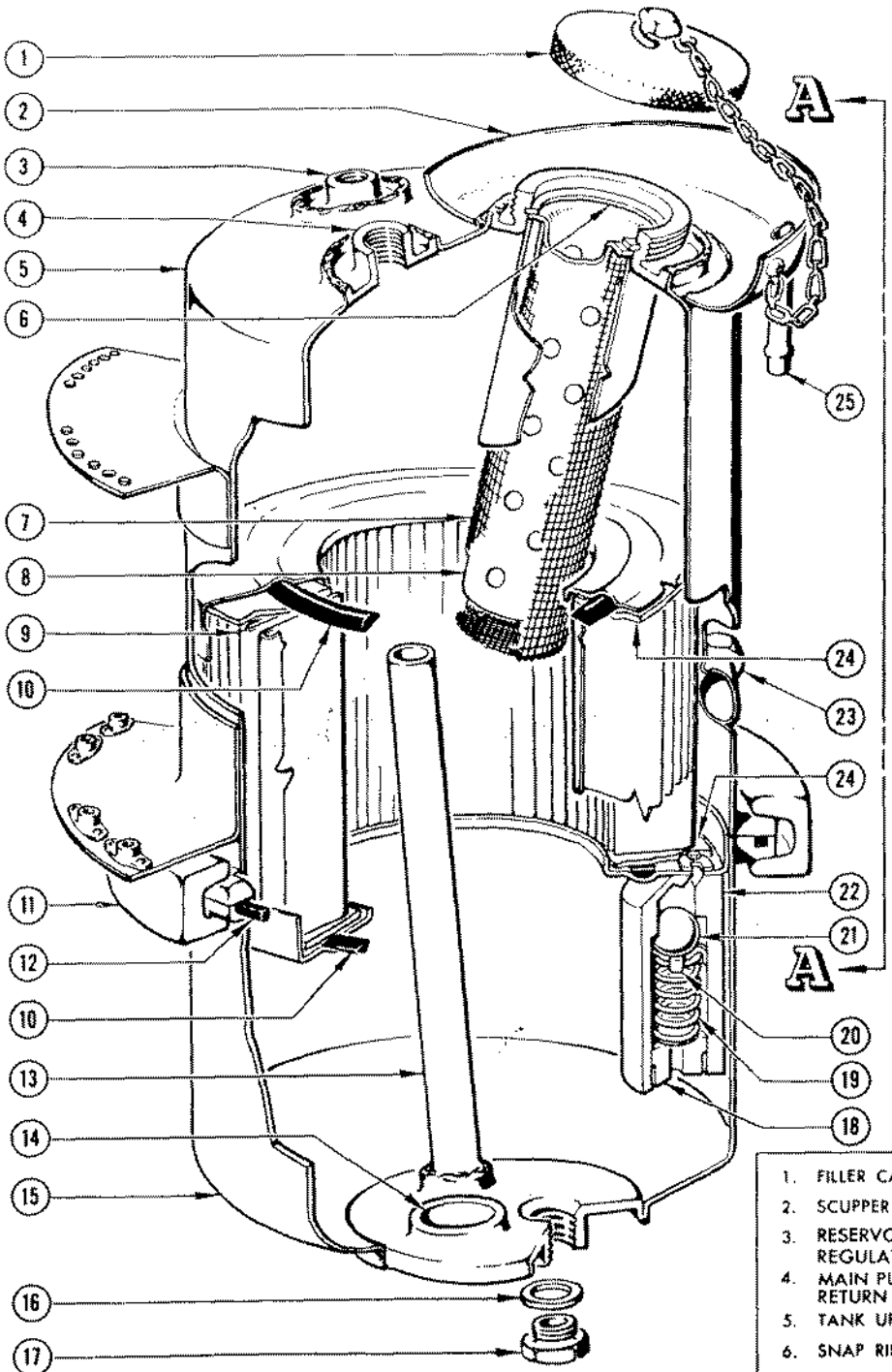
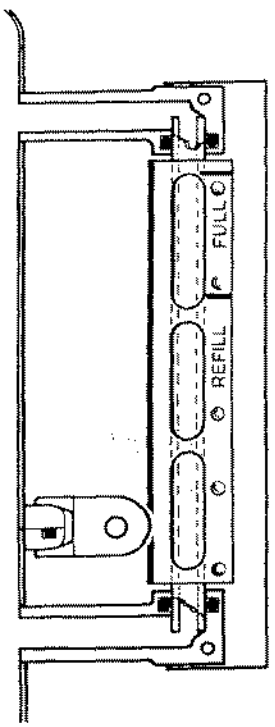
Figure 4-129. Positioning Type Universal Fitting Installation





FLUID LEVEL SIGHT GAGE
VIEW A-A

1.	FILLER CAP	14.	MAIN PUMP OUTLET
2.	SCUPPER	15.	TANK LOWER HALF
3.	RESERVOIR AIR PRESS. REGULATOR PORT	16.	GASKET
4.	MAIN PUMP BYPASS RETURN PORT	17.	DRAIN PLUG
5.	TANK UPPER HALF	18.	RETAINER
6.	SNAP RING	19.	SPRING
7.	STRAINER	20.	BALL GUIDE
8.	GUARD	21.	BALL (FILTER RELIEF VALVE)
9.	FILTER ELEMENT		
10.	SEAL	22.	BODY (FILTER RELIEF VALVE)
11.	CLAMP		
12.	PACKING	23.	SYSTEM RETURN PORT
13.	STAND PIPE — EMERG PUMP OUTLET	24.	GASKET
		25.	SCUPPER DRAIN TUBE

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Figure 4-130. Main Hydraulic System Reservoir

glass) Federal Specification O-S-605. This material must be replaced after repairing the reservoir.

4–673. ASSEMBLY, TEST, AND INSTALLATION OF HYDRAULIC RESERVOIR.

a. During assembly, be sure seal rings are properly located in their grooves.

b. Tighten clamp bolts evenly, not to exceed a torque of 70 lb in.

c. Plug all except one opening, and pressure test at 15 psi.

d. Install reservoir and connect all lines.

e. Fill reservoir to FULL with hydraulic fluid, Specification MIL-H-5606, using funnel, 205220.

4–674. RESERVOIR AIR PRESSURE REGULATOR. *(See figure 4-131.)* The reservoir air pressure regulator is on top of the reservoir. The upper port is connected to an air pressure line from the engine, and the lower port is connected to a line which is routed overboard.

4–675. DISASSEMBLY, INSPECTION, AND TEST OF RESERVOIR AIR PRESSURE REGULATOR. *(See figure 4-131.)*

a. Disassemble by removing locknut (2) on adjusting screw (1), and unscrewing cap (3).

b. Clean all parts with kerosene, Federal Specification VV-K-211b, or solvent, Federal Specification P-D-680.

c. Inspect O-ring (8) for scuffing, cuts, or other damage, and replace if required.

d. Assemble regulator, and adjust to open at 2-3/4 to 3-1/2 psi with pressure applied through tank connection.

4–676. HYDRAULIC PUMP. *(See figure 4-132.)* The hydraulic pump is a variable volume self lubricating pump mounted on the accessory gear case, and driven by the engine.

4–667. OPERATION OF HYDRAULIC PUMP. *(See figure 4-132.)* Nine spring-loaded pistons (21) arranged in a cylinder block (20) concentric with the drive shaft (2) are actuated by a wedge-shaped drive cam (4). The piston bearing against the thin section of the drive cam is fully extended, and the piston bearing against the thick section of the drive cam is fully depressed. As the drive cam rotates, the pistons are alternately extended and depressed as the thin or thick section of the drive cam passes each cylinder.

4–678. As each piston extends, it uncovers a suction port through which the hydraulic fluid flows from the hydraulic tank. The bottom of each cylinder contains a spring-loaded check valve (16) which opens under pressure, and allows fluid to flow through passages in the valve body to the pressure port.

4–679. When there is no demand on the pump from the system, a spring-loaded pressure regulating valve is operated by fluid pressure actuating a piston which closes the pump suction port. The spring (10) is adjustable and is set to close the suction port at over a range of 850 to 1150 psi. With the pump suction port closed fluid is admitted for cooling and lubricating purposes through a passage in the valve liner. The pilot piston opens the bypass through which the fluid is returned to the reservoir after circulating through the pump.

Note

The hydraulic pump may "squeal" during engine shutdown. This is not detrimental and is not a reason for replacement of pumps. The noise is caused by high frequency opening and closing of the system relief valve due to a low fluid flow through the pump bypass.

4–680. REMOVAL OF HYDRAULIC PUMP.

a. Operate aileron booster to exhaust system pressure.

b. Disconnect pressure, suction and relief lines.

c. Place a container under the suction port to catch fluid from the reservoir, and disconnect the reservoir line.

d. Remove four attaching bolts and pull the pump straight out from engine until drive coupling is freed.

CAUTION

The pump is lubricated and cooled by hydraulic fluid. Do not operate dry.

4–681. INSTALLATION OF HYDRAULIC PUMP.

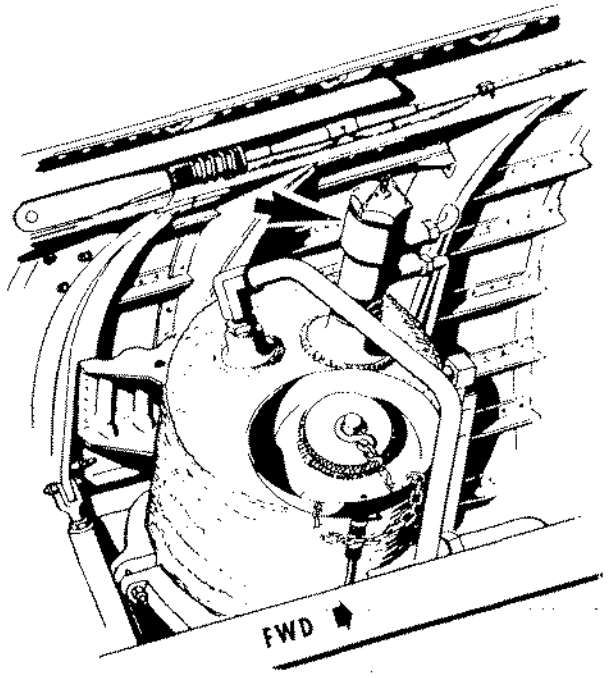
a. Coat hydraulic pump male and female splines with lubricant, MIL-G-21164 or Plastilube Number 3.

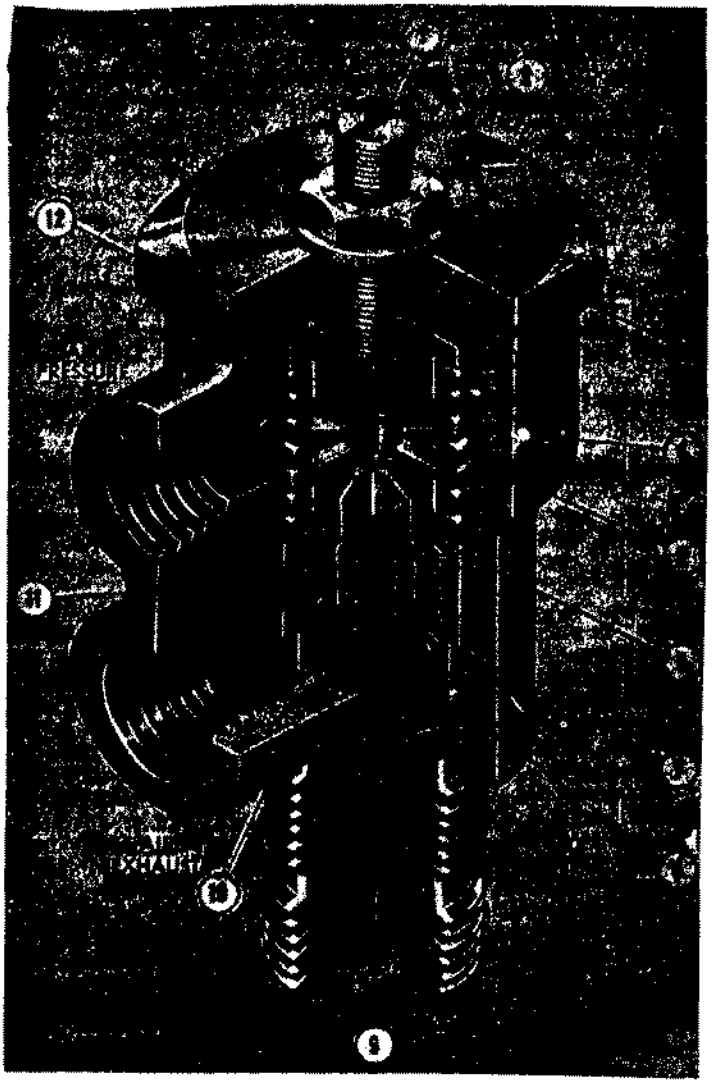
b. Reverse removal procedure.

c. Check suction line for possible air leaks.

Note

Be sure pump pressure regulating valve has been adjusted for the required pressure. In





1.	ADJUSTING SCREW
2.	LOCK NUT
3.	CAP
4.	BODY
5.	RELIEF VALVE SPRING
6.	AIR PRESSURE CHECK VALVE
7.	CHECK VALVE SPRING
8.	SEAT ("O" RING PACKING)
9.	TANK CONNECTION
10.	GASKET
11.	AIR PRESSURE RELIEF VAIVE
12.	SPRING RETAINER

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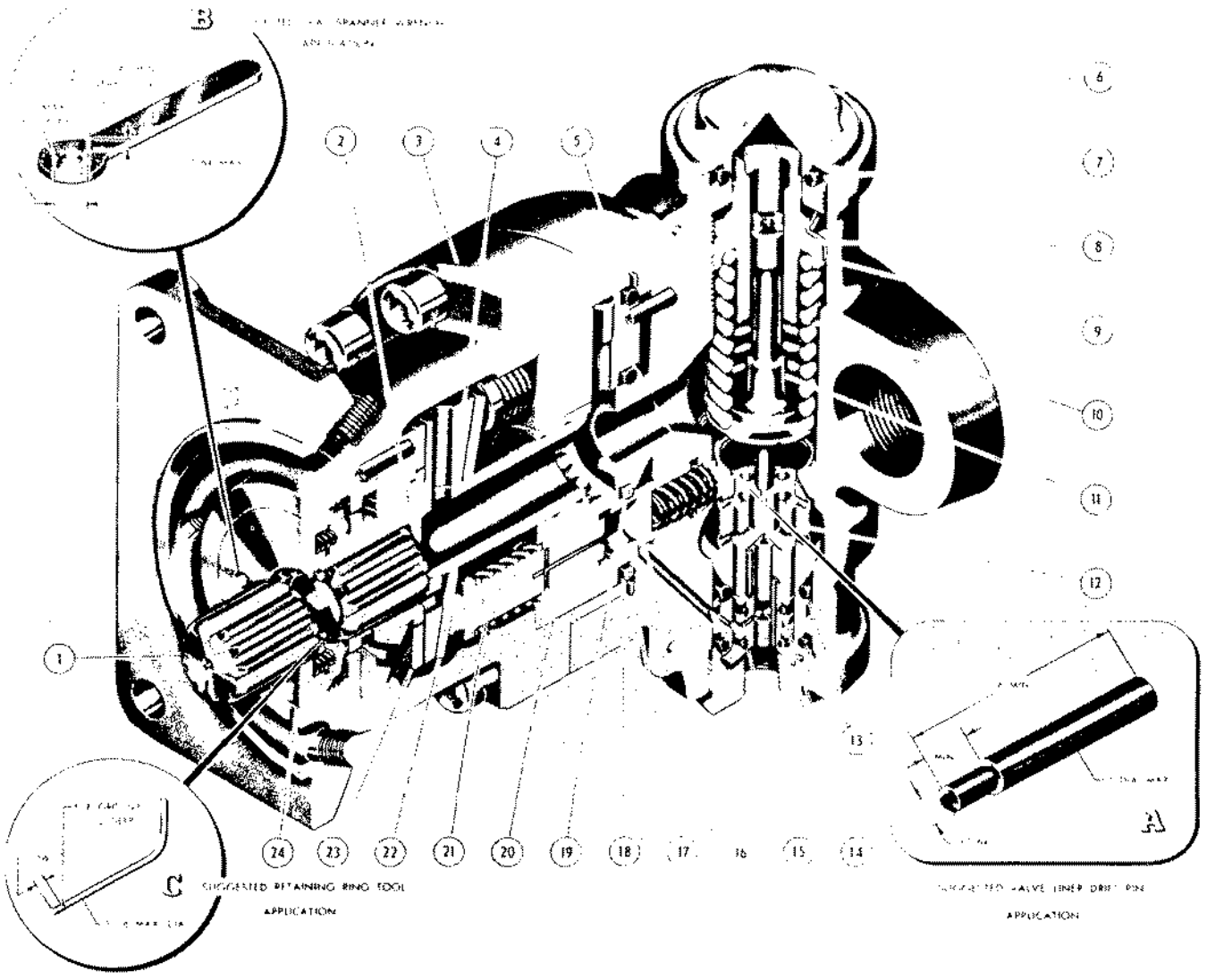
Figure 4-131. Hydraulic Reservoir Air Pressure Regulator

the event that a new pump is received for installation which is not properly adjusted, remove sealnut (see figure 4-132), O-ring (7) and lockwire (9). Turn spring adjusting nut (8) as required to obtain proper setting. Lock spring adjustment nut (8) with lockwire (9) and replace O-ring (7) and seal nut (8). This adjustment, if required, should be accomplished only at initial installation.

4-682. HYDRAULIC SYSTEM RELIEF VALVE. *(See figure 4-133.)* The system relief valve is located on the left side of the engine compartment adjacent to the



1.	SPLINE	13	"O" RING
2	SHAFT ASSEMBLY	14.	"O" RING
3.	HOUSING ASSEMBLY	15	PILOT PISTON LINER
4.	DRIVE CAM	16	CHECK VALVE
5.	COVER	17	GASKET
6	SEAL NUT	18	"O" RING
7.	"O" RING	19	"O" RING
8.	SPRING ADJUSTING NUT	20	CYLINDER BLOCK
9	LOCK WIRE	21	PISTON ASSEMBLY
10.	SPRING	22	REAR CREEP PLATE
11.	SPRING GUIDE	23	FRONT CREEP PLATE
12.	VALVE LINER	24.	SEAL ASSEMBLY

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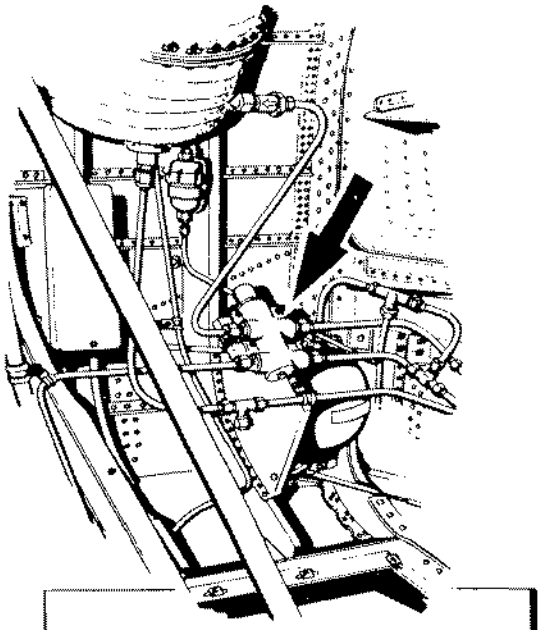
Figure 4-132. Hydraulic Pump



1.	CAP
2.	ADJUSTING SCREW
3.	WASHERS
4.	CHECK NUT
5.	SPRING
6.	SPRING SPACER
7.	PISTON
8.	"O" RING SEAL
9.	SEAT
10.	WASHER
11.	NUT
12.	BODY

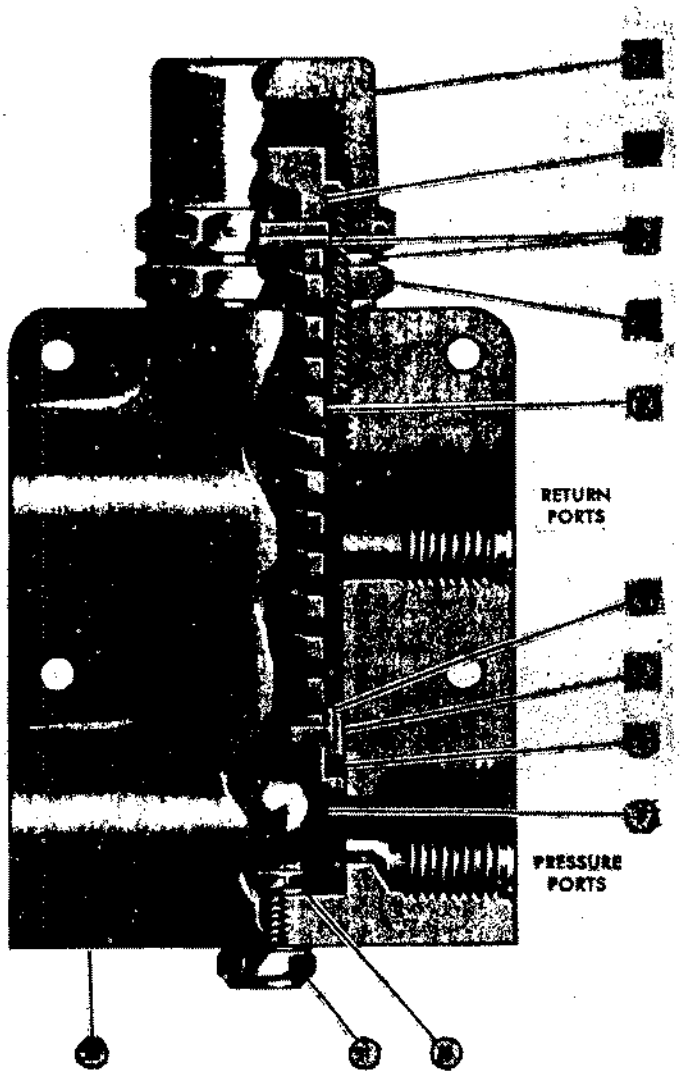


Figure 4-133. Main Hydraulic System Relief Valve

hydraulic reservoir, and it is adjusted to relieve at 1250 (±25) psi on airplanes prior to AF Serial No. 56-1624 and at 1350 (+50, —0) on airplanes AF Serial No. 56-1624 and subsequent. Adjustment is made by removing the cap and turning the spring-adjusting screw clockwise to increase relief pressure or counterclockwise to reduce relief pressure. This valve, AN6200-8-AB, meets the specification with or without cap (1).

4–683. HYDRAULIC SYSTEM ACCUMULATOR. *(See figure 4-134.)* A 7½-inch spherical accumulator is mounted in brackets on the left side of the engine compartment near the left intake duct.

4–684. The accumulator shell contains a synthetic rubber bladder which separates the air and fluid compartments. When the accumulator is charged with air against no hydraulic pressure, the bladder is fully extended against the walls of the shell. As fluid is admitted through the fluid port, the top hemisphere of the bladder is forced toward the bottom, further compressing the air in the bladder. When actuation of a hydraulic cylinder allows the accumulator to discharge into the system, the compressed air forces the fluid out of the accumulator until all of the fluid is expelled. An accumulator air-pressure gage is mounted on the structure aft of the accumulator.

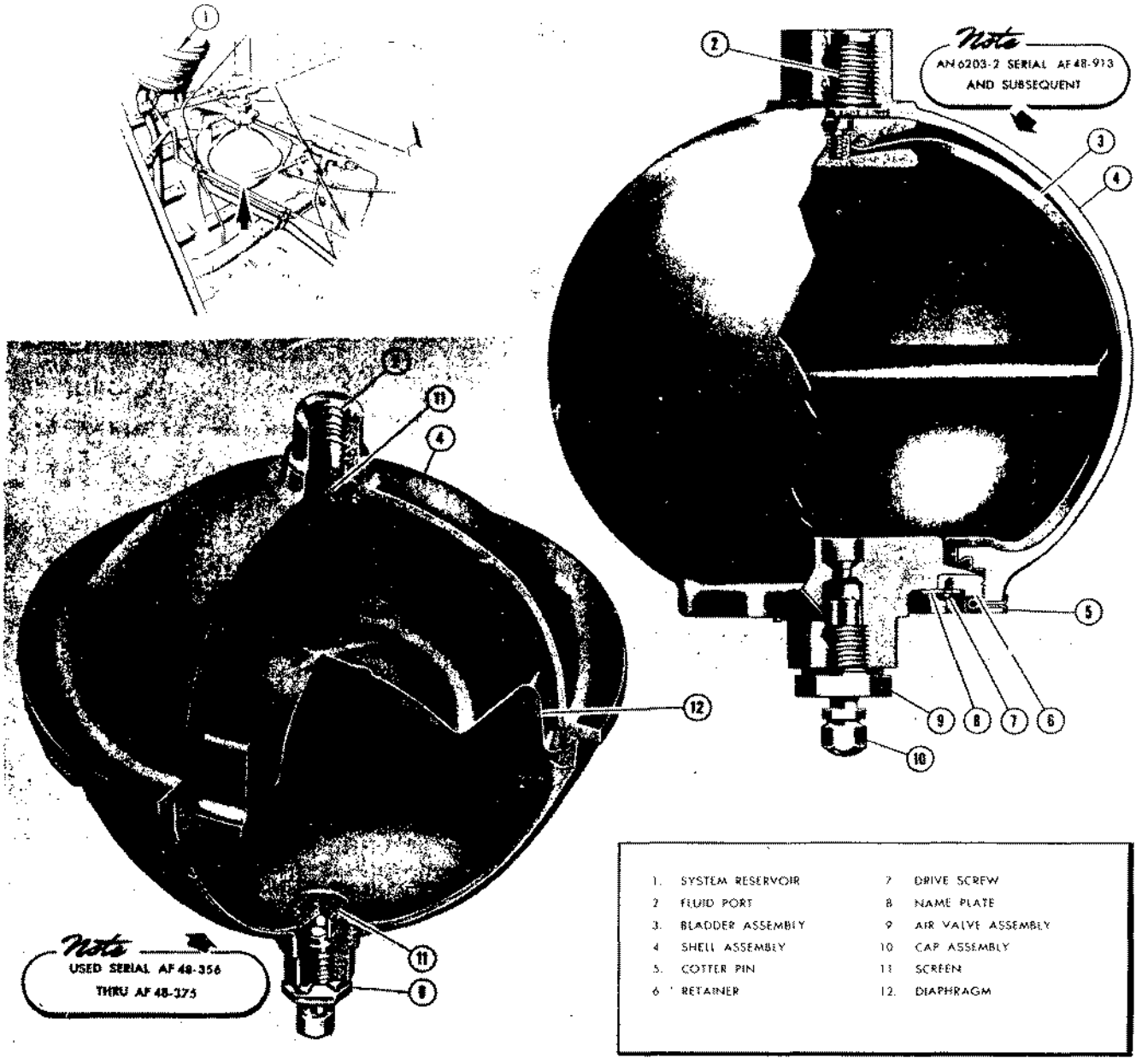


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Figure 4-134. Hydraulic Accumulator

4–685. SERVICING THE HYDRAULIC ACCUMULATOR.

a. Relieve hydraulic system pressure by operating the aileron booster.

b. Charge accumulator with air to 500 (25) psi.

4–686. REMOVAL OF HYDRAULIC ACCUMULATOR.

a. Relieve hydraulic system pressure by operating aileron booster.

b. Disconnect line at top of accumulator.

c. On accumulators using AN6287-1 valve assembly, discharge air pressure by loosening 3/8-inch hex nut on air valve assembly one-half to one complete turn and depressing valve stem.

d. On accumulators using MS28889-1 valve assembly, loosen valve cap about one turn to allow escape of any pressure trapped between metal to metal seal of valve and cap. Remove valve cap and loosen upper 3/4-inch hex nut to permit air within accumulator to escape.

WARNING

MS28889-1 valve assembly does not contain a valve core AN809-1, therefore rapid loosening of valve cap may cause cap to fly off, injuring personnel.

e. Disconnect line to air valve.

f. Remove clamps at top and bottom of unit.

g. Lift out accumulator.

4–687. TROUBLE SHOOTING OF HYDRAULIC ACCUMULATOR.

Trouble	*Probable Cause*	*Remedy*
Fluid or air leak.	Retainer not tightened sufficiently.	Remove cotter (5), tighten outer shell assembly with spanner wrench.
Loss of cushion effect and extreme pressure drops when system is operated.	Loss of air from accumulator.	Check for leaks.
	Insufficient air pressure in accumulator.	Charge air chamber to 500 (±25) psi.
Loss of air in air chamber.	Punctured or torn bladder; air leakage about air fittings.	Check for air leakage at air valve core and air valve gaskets.

4–688. HYDRAULIC SYSTEM EXTERNAL PRESSURE AND SUCTION CONNECTIONS. The fittings for connection of external pressure and suctions lines are mounted on a bracket in the engine compartment on the left side below the hydraulic tank. To connect the system to an external pump, disconnect hoses from engine-driven pump at the AN6242 quick disconnect on the bracket. Use of these fittings for an external pump utilizes fluid supply from the airplane hydraulic reservoir. Access to the fittings is through the engine compartment lower left access door, No. 66.

CAUTION

Tighten hydraulic quick disconnect fittings by hand. Do not use tools on the union nut.

4–689. HYDRAULIC SYSTEM FUSE. *(See figures 4-128 and 4-135.)* Prior to AF Serial No. 51-6819, an hydraulic fuse is installed in the basic system pressure and return lines, just downstream of the aileron booster system. Its function is to prevent complete loss of hydraulic fluid in case of line breakage downstream of the fuse. The fuse is mounted at the forward end of the wing station 0 rib in the left wheel well.

4–690. OPERATION OF THE HYDRAULIC FUSE. *(See figure 4-135.)* When dive flap or alighting gear selector valve is operated, flow in basic system pressure line is temporarily checked by poppet (9) but acts upon sampling piston (7), causing small volume behind piston to flow to actuating cylinder. This small volume of fluid causes a like amount of fluid to flow out of actuating cylinder, through return line to act upon piston (4). This opens poppet (9), allowing basic system pressure to flow directly through fuse. If line to or from actuating cylinder has been broken, original sample fluid would have been lost and not available to act upon piston (4), thus leaving poppet (9) closed and preventing any further loss of fluid. A reset handle on cockpit left shelf acts as an override control for the fuse. If either alighting gear or dive flap system should fail to operate due to "fusing," selector valve should be returned to opposite position, and reset handle pushed down momentarily to reset fuse. Then it may be possible, depending upon location and extent of line damage, to make use of other system. Reset handle must be held in reset position through several cycles in order to bleed system after any unit has been replaced, or any lines of the system opened.

CAUTION

Make certain that 0.0625 steel lockwire, is used to lockwire the hydrofuse and that the fuse is wired in the full reset "OPEN" position.

Note

Airplanes with hydraulic fuses installed must have the fuse wired in the reset "OPEN" position, making the fuse inoperative. The hydraulic fuse return spring, 178716, is removed and stored in the armament compartment.

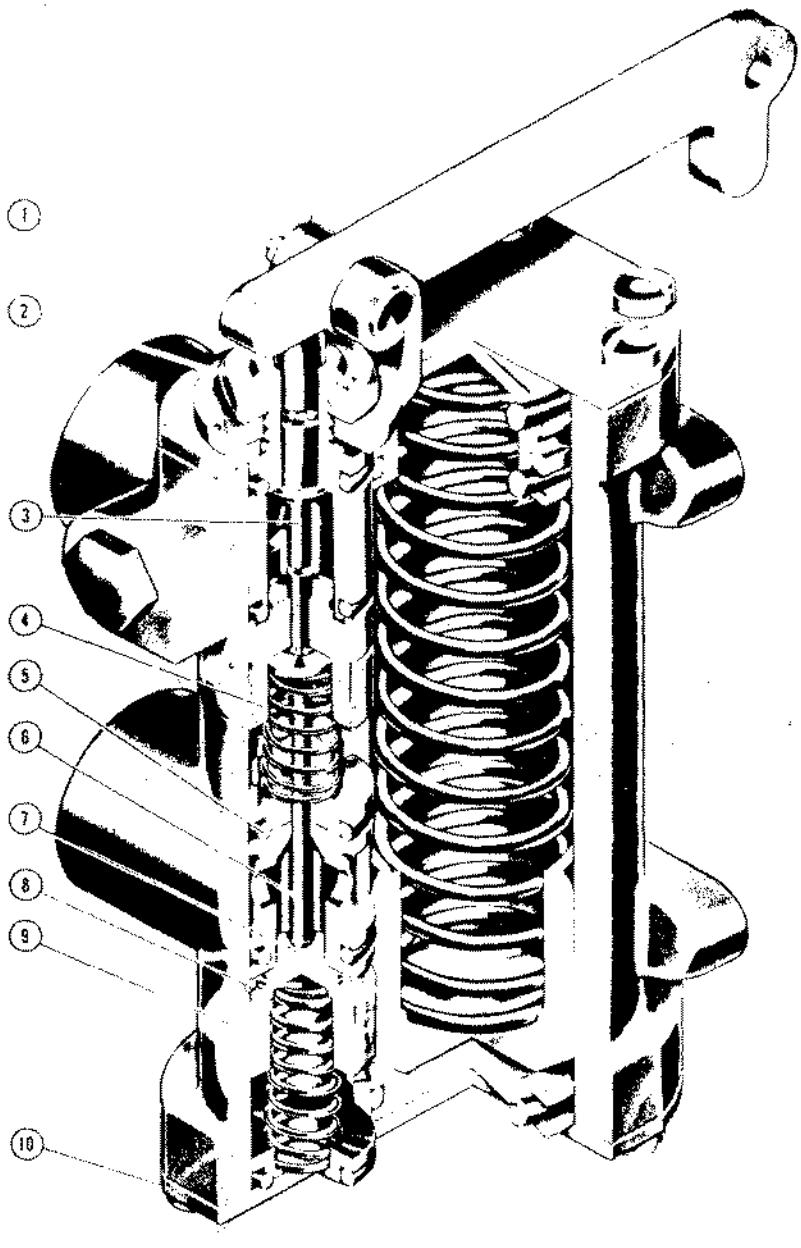
4–691. REMOVAL OF HYDRAULIC FUSE.

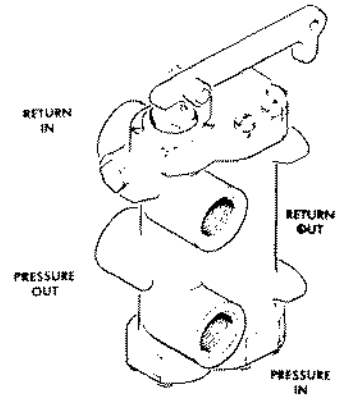
a. Disconnect the cable control at the reset lever on the fuse.

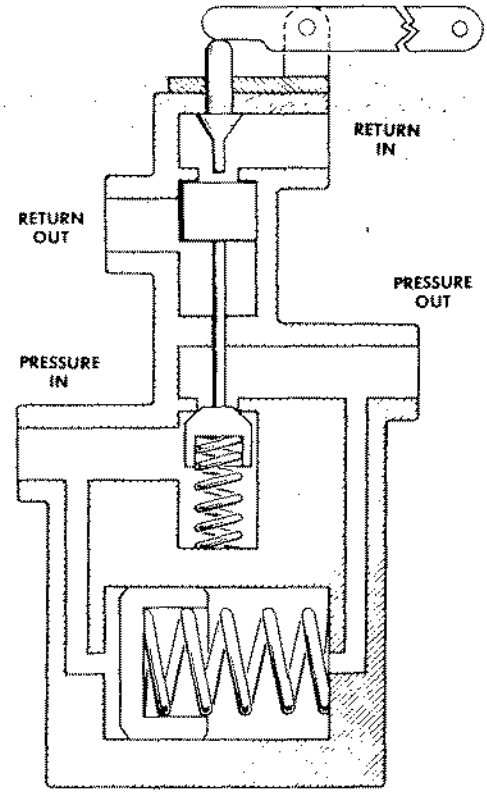
b. Disconnect and cap the plumbing lines.

c. Remove the four mounting bolts, and remove the unit.

4–692. SERVICING THE HYDRAULIC FUSE. This part is not repairable in the field, and must be replaced when found to be defective.







1.	RESET LEVER	6.	PUSH ROD
2.	LOCK NUT	7.	SAMPLING PISTON
3.	RESET STEM	8.	SNAP RING
4.	PISTON	9.	POPPET
5.	"O" RING PACKING	10.	END PLATE

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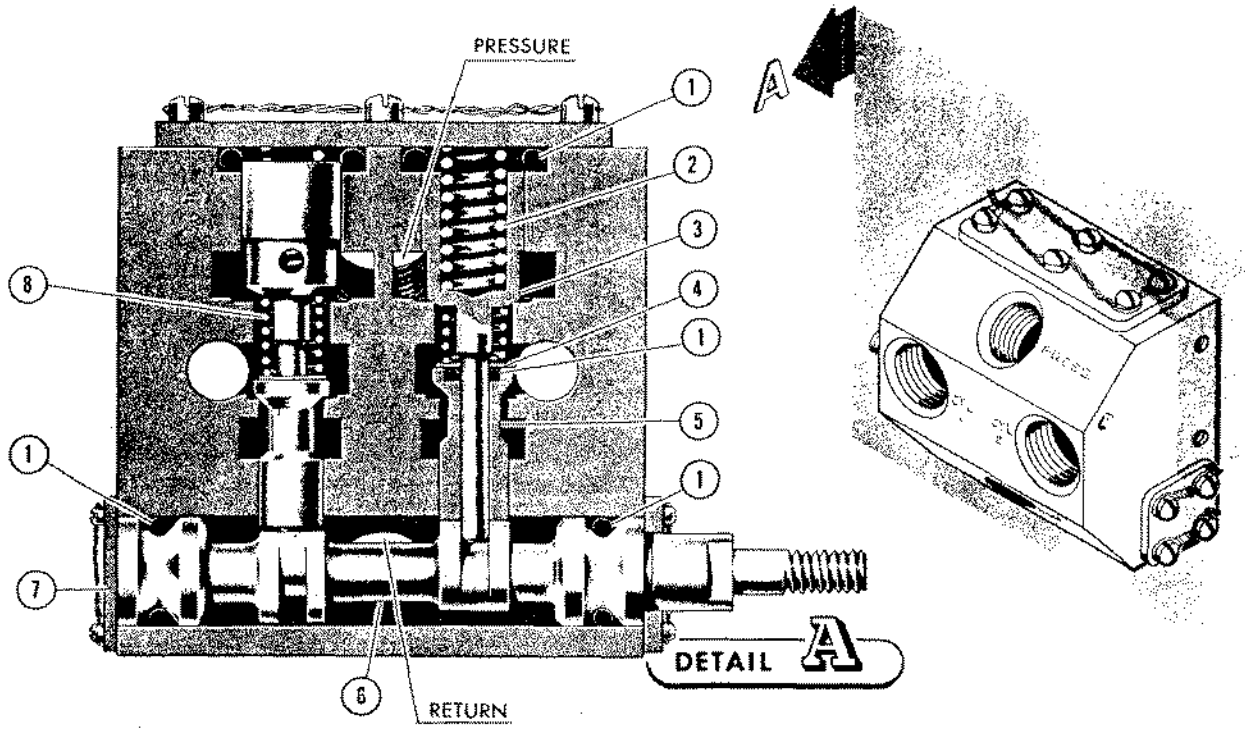
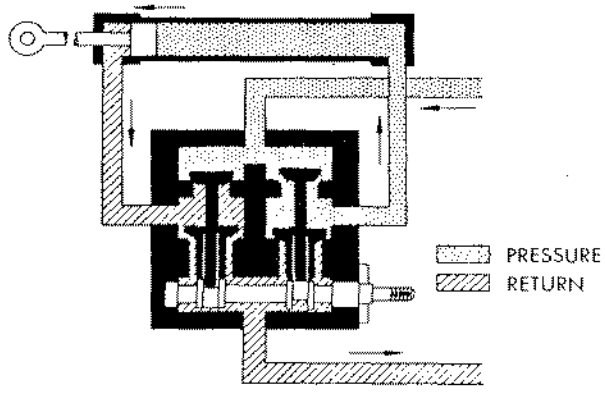
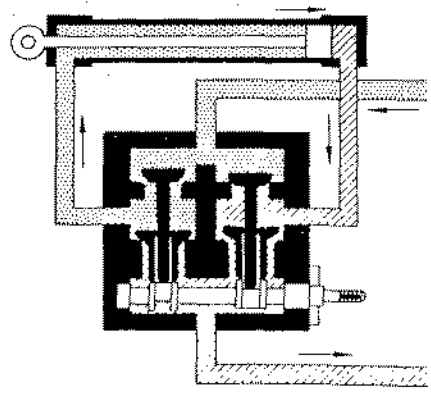
Figure 4-135. Hydraulic Fuse, Prior to AF Serial No. 51-6819





SCHEMATIC OF VALVE IN GEAR "DOWN" POSITION



SCHEMATIC OF VALVE IN GEAR "UP" POSITION

1.	"O" RING PACKING
2.	UPPER POPPET SPRING
3.	UPPER POPPET
4.	SPRING RETAINING WASHER
5.	LOWER POPPET
6.	CAM SHAFT
7.	END CAP (CONTAINS STOP)
8.	LOWER POPPET SPRING

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Figure 4-136. Alighting Gear Selector Valve

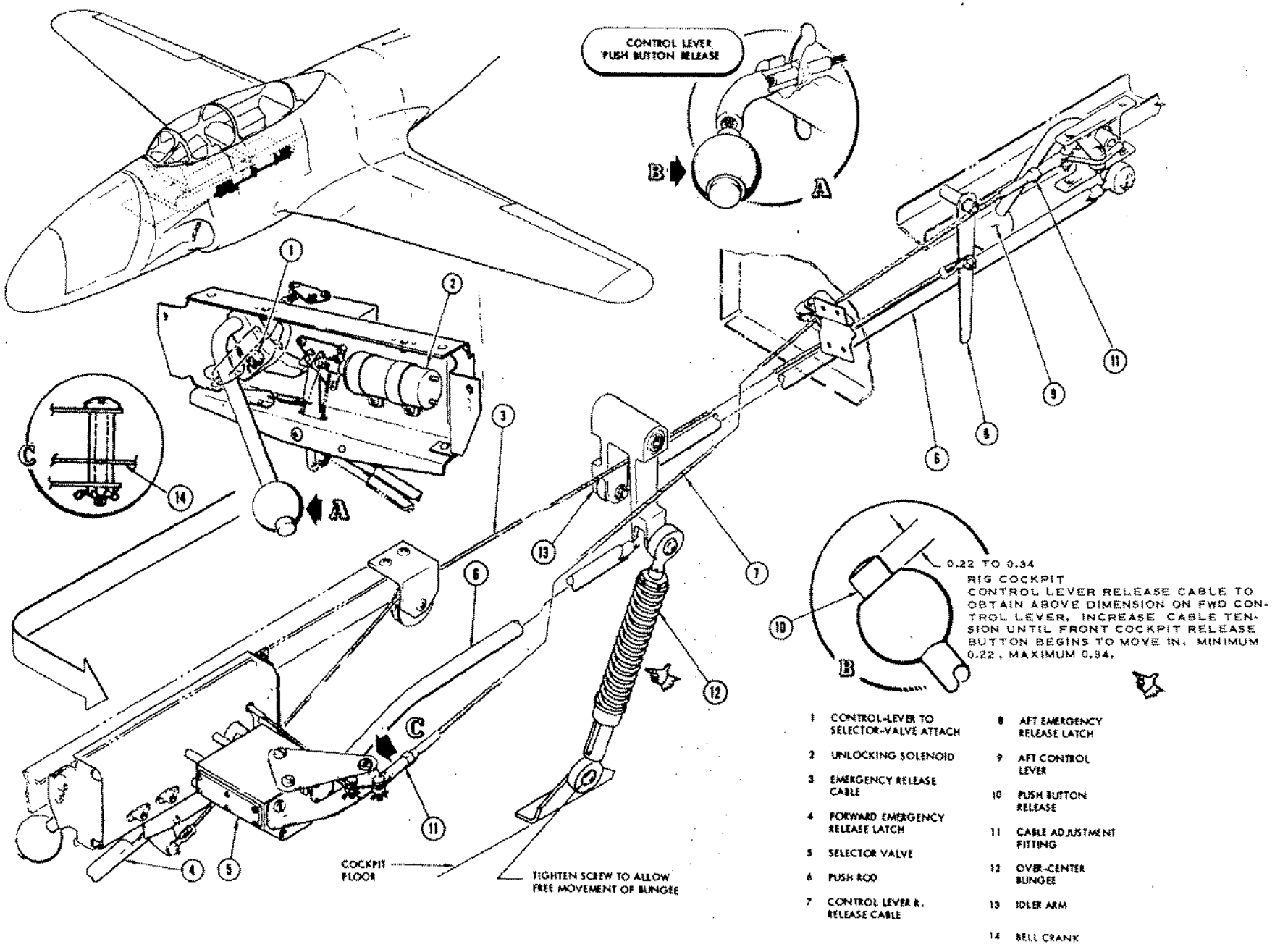


Figure 4-137. Alighting Gear Selector Valve Lock

4-693. ALIGHTING GEAR HYDRAULIC SYSTEM. The alighting gear system consists of the alighting gear selector valve, located in the forward cockpit on the left side, the three alighting gear actuating cylinders, a nose gear uplock cylinder, and on each main gear, an inboard door actuating cylinder and emergency release cylinder. The gear-up line from each actuating cylinder incorporates a manual shut-off valve. All units pertaining to the alighting gear system are located in their respective wheel wells.

4-694. ALIGHTING GEAR SELECTOR VALVE. (See figures 4-136 and 4-137.) The alighting gear selector valve has two pairs of coaxial spring-loaded poppet valves operated by a cam shaft connected to the selector valve lever. The valve body has a pressure port, a return port and two cylinder ports. Rotation of the cam shaft connects the pressure port to a cylinder port, and the return port to the other cylinder port. Return of the cam to its original position reverses the cylinder ports to which the pressure and return ports are connected. The poppets are arranged in such a manner that hydraulic pressure helps to keep them closed.

4-695. The alighting gear selector valve handle in the forward cockpit is connected by cables and pushrods to a duplicate handle in the aft cockpit. A safety device is incorporated in the selector valve installation which prevents inadvertent movement of the control lever to "UP" position when the airplane is on the ground. The device consists of a solenoid-released latch which engages with an arm attached to the control lever shaft. A switch mounted on the torque arm of the left main gear controls the electric current which energizes the solenoid. When the shock strut is compressed (airplane on ground) the solenoid is deenergized, as the torque arm switch is open. The switch is closed by the torque arms when the weight of the airplane is off the shock strut, and the solenoid then energized, releases the latch so that the control lever can be moved to "UP" position. An overcenter bungee is installed between a bracket on the cockpit floor and the idler arm of the selector valve linkage system. The over-center bungee insures that the control handles of the landing gear selector valve remain in the selected position. If the handle fails to lock in the "up" position, check the push button on the selector control handle for measurements in accordance with item 10, Figure 4-137. Adjust the cable at the cable adjustment fitting as shown in item 11, Figure 4-137, to obtain proper measurements. If the handle still fails to lock in the "up" position with the push button properly rigged, disassemble the mechanism and inspect the cable for proper routing, obstruction and swedge damage. Also inspect support assembly Part No. 177713 for misalignment, burrs or other damage which would cause the cable to bind. Replace defective items.

4-696. REMOVAL OF ALIGHTING GEAR SELECTOR VALVE.

a. Remove cockpit left shelf trim panel. Disconnect plumbing from valve and from floor. Remove tubes.

b. Disconnect push-pull tubes and cables.

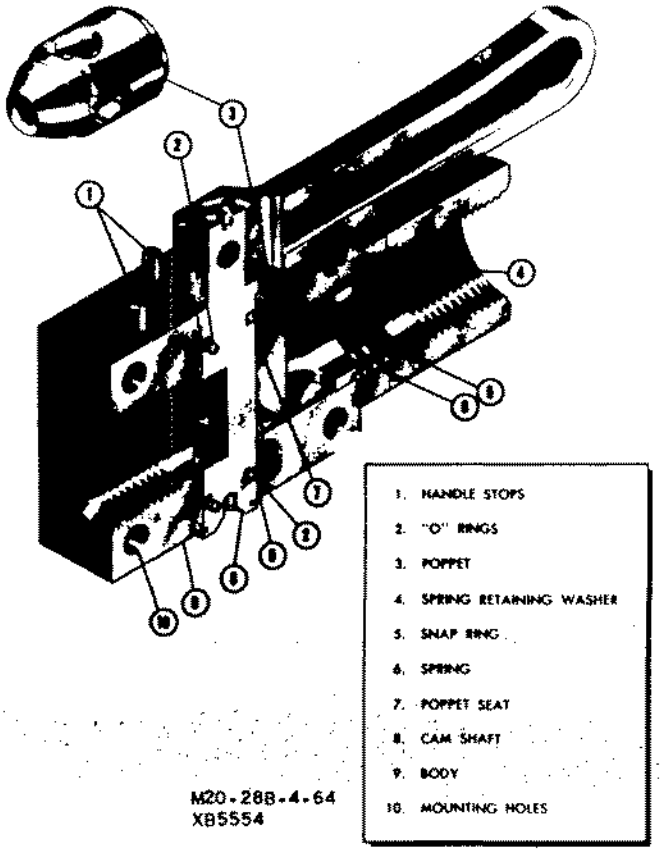


Figure 4-138. Manual Shutoff Valve

c. Remove two screws from top of left shelf into selector valve support assembly.

d. Remove two screws from inboard side of shelf and remove support assembly and valve.

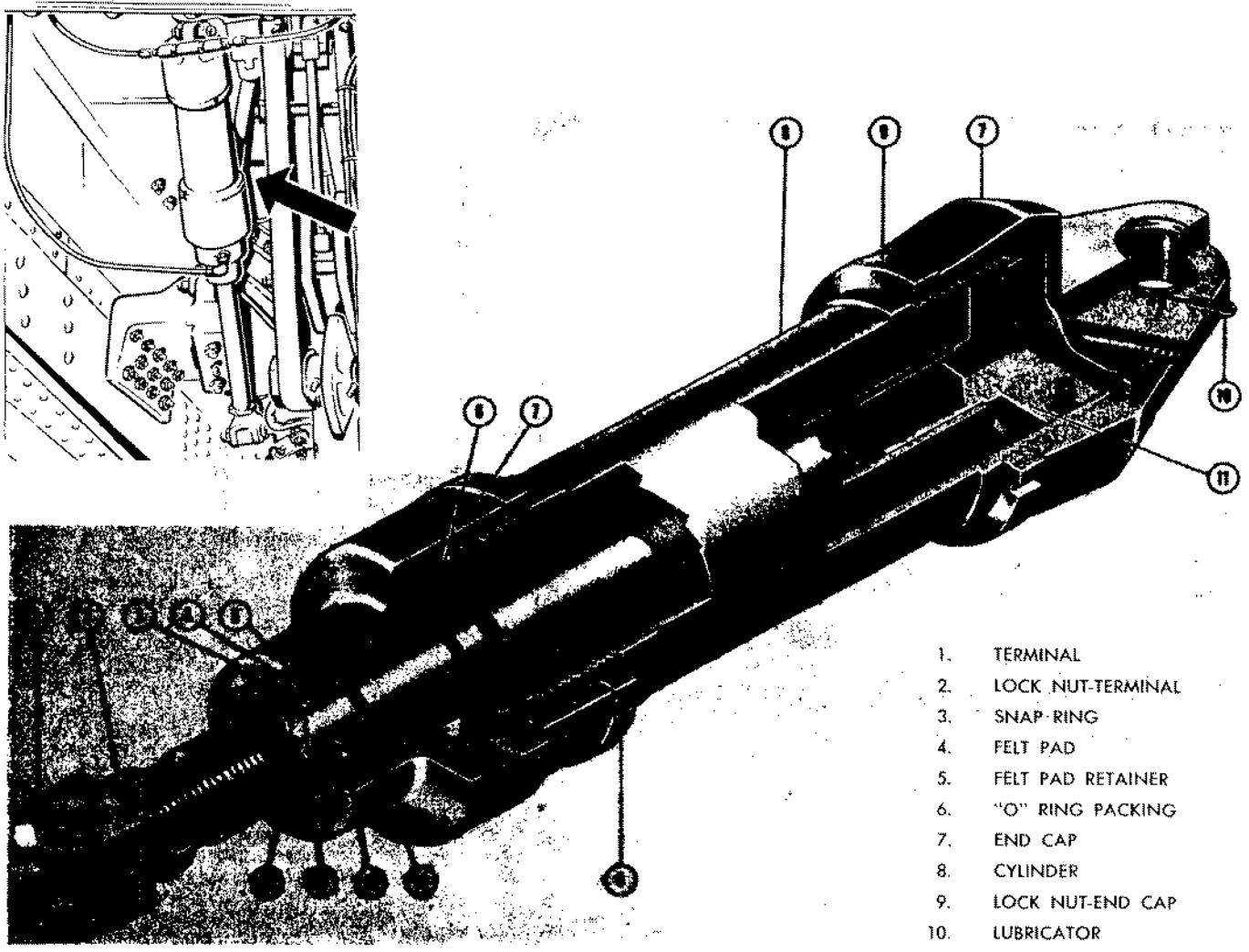
e. Remove nut to disengage lever from valve.

f. Remove three screws attaching valve to support assembly, and remove the valve.

4-697. ALIGHTING GEAR MANUAL SHUTOFF VALVES. *(See figure 4-138.)* These are normally open, manually operated, cam-actuated; poppet-type manual-check valves, with an aluminum alloy body and steel cam. One is located in each wheel well in the alighting gear up line. When closed, the valve operates as a check valve, and will permit alighting gear to be extended, but not retracted.

CAUTION

Before flight, safety all manual check valves in the open position.



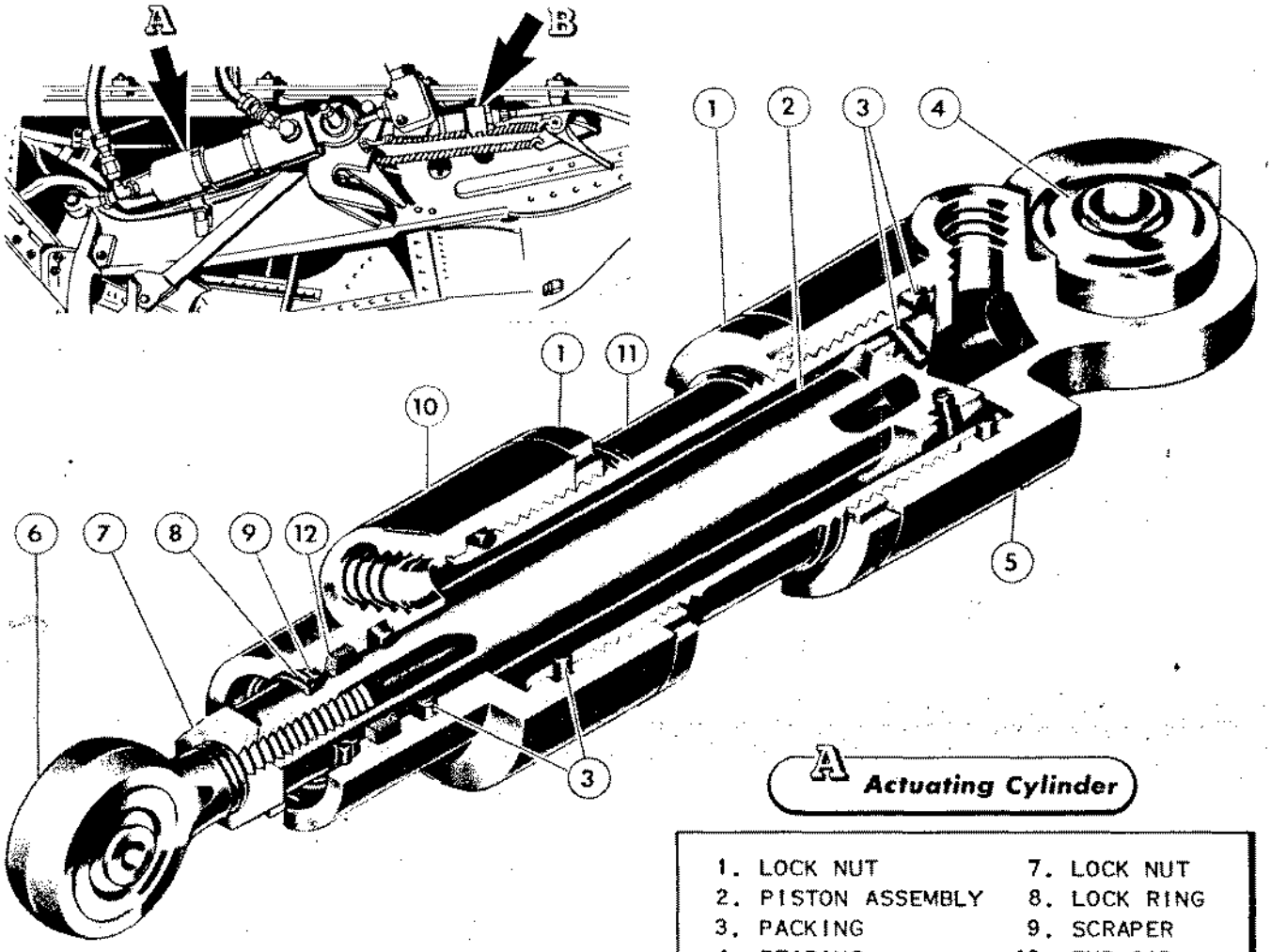
1. TERMINAL
2. LOCK NUT-TERMINAL
3. SNAP RING
4. FELT PAD
5. FELT PAD RETAINER
6. "O" RING PACKING
7. END CAP
8. CYLINDER
9. LOCK NUT-END CAP
10. LUBRICATOR
11. PISTON ASSEMBLY
12. OIL HOLE
13. SCRAPER RETAINER
14. WIPER RING
15. WASHER

Figure 4-139. Main Gear Actuating Cylinder

4–698. ALIGHTING GEAR RESTRICTORS. Three restrictor valves are installed in the alighting gear hydraulic system to regulate fluid flow to "UP" lines on the nose gear actuating cylinder and main gear door actuating cylinders. The restrictors for the main gear door actuating cylinders are located in main gear wheel wells adjacent to the wing center rib. The nose gear restrictor is located to the left of the up lock cylinder on the rear face of fuselage station 103 bulkhead.

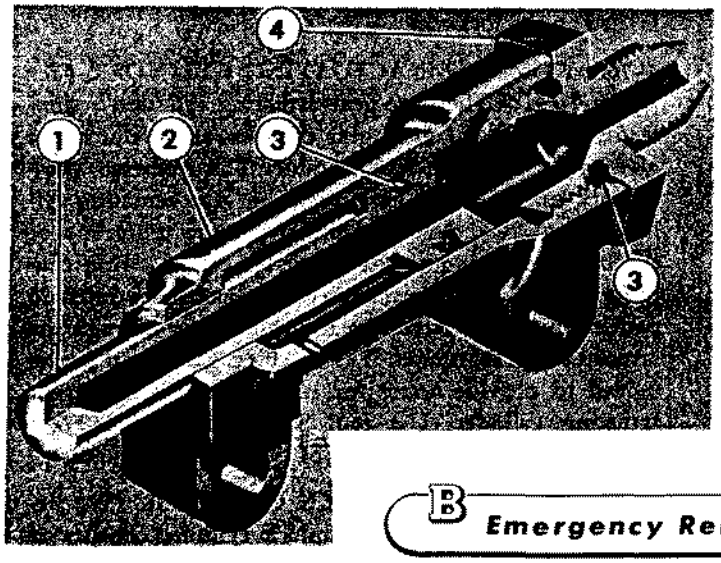
4–699. RESTRICTOR CHECK VALVE. Check valves with a No. 55 (.052) hole drilled through the poppet are installed in each main gear up line to restrict flow during the gear "DOWN" cycle. The restrictor check valves incorporate a screened orifice.

4–700. MAIN GEAR ACTUATING CYLINDER. *(See figure 4-139.)* The cylinder consists of a piston assembly, a barrel, and two end caps. The cylinder has provisions for ⅛-inch overtravel so that the piston is not bottomed against the cap when the gear is up. This insures a firm contact between the gear doors and wing structure before the piston has reached the end of its stroke. When the gear is down, the piston causes the downlock to engage. Refer to paragraph 4–157 for details on adjustment. Access to the actuating cylinder is through the main gear wheel well.



A Actuating Cylinder

1. LOCK NUT	7. LOCK NUT
2. PISTON ASSEMBLY	8. LOCK RING
3. PACKING	9. SCRAPER
4. BEARING	10. END CAP
5. END CAP	11. BARREL
6. ROD END	12. FELT WIPER



1. PISTON
2. CYLINDER
3. PACKING
4. END CAP

B Emergency Release Cylinder

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Figure 4-140. Main Gear Door Emergency Release and Actuating Cylinders

4–701. REMOVAL AND DISASSEMBLY OF MAIN GEAR ACTUATING CYLINDER. *(See figure 4-139.)* Special tool required: S20814-20 or S20614-20 hook spanner wrench.

a. Jack the airplane. (Refer to paragraph 3–19.)

b. Relieve hydraulic pressure by operating aileron booster.

c. Disconnect hydraulic lines from cylinder, and cap the openings.

d. Disconnect piston rod from shock strut by removing terminal fitting which extends vertically through lugs of the fulcrum.

e. Detach upper cylinder end at crank assembly, and remove cylinder.

f. With piston bottomed, measure accurately and record the distance between hole in terminal and hole in end cap. Also measure and record the distance between the two caps. These measurements will enable maintenance of proper stroke and piston rod length upon reassembly of the cylinder.

g. With tool S20814-20 or S20614-20 (figure 3-28), loosen locknuts from end caps.

h. With strap wrenches, remove both caps from the cylinder barrel.

i. Loosen locknut and remove clevis terminal from piston rod. Slide cap off piston rod.

j. Remove snapring (3), washer (15), wiper ring (14), scraper retainer (13), felt pad (4), and retainer (5) from cap.

k. Remove all O-ring packings.

l. Thoroughly clean all parts.

4–702. INSPECTION OF, AND REPLACEMENTS FOR MAIN GEAR ACTUATING CYLINDER.

a. Inspect cylinder bore for scoring, worn spots, or roughness. Inspect piston rod for continuity of plating and for pitted condition. Remove small scratches or roughness with crocus cloth.

b. Replace all O-ring packings.

4–703. ASSEMBLY, TEST, AND INSTALLATION OF MAIN GEAR ACTUATING CYLINDER.

a. Lubricate all O-ring packings, cylinder bore, and piston rod with hydraulic fluid, Specification MIL-H-5606.

b. Assemble end caps on piston rod and cylinder barrel.

c. Assemble piston rod and end cap on cylinder.

d. Tighten end cap on cylinder barrel until barrel is bottomed in cap. Adjust piston stroke with other cap to length recorded in paragraph 4–701, step f. Piston will not bottom on down stroke.

e. Tighten locknuts snugly against caps.

f. Assemble clevis terminal on piston rod, and with piston bottomed, adjust over-all length to dimension recorded in paragraph 4–701, step f. This distance should be 15.250 (+0.000, −0.060) inches.

Note

When adjusting clevis terminal, be sure threads of clevis are showing in witness hole of piston rod to ensure sufficient threads are engaged. Tighten locknut when adjustment is complete.

g. Install cylinder and test for leaks by operating the alighting gear.

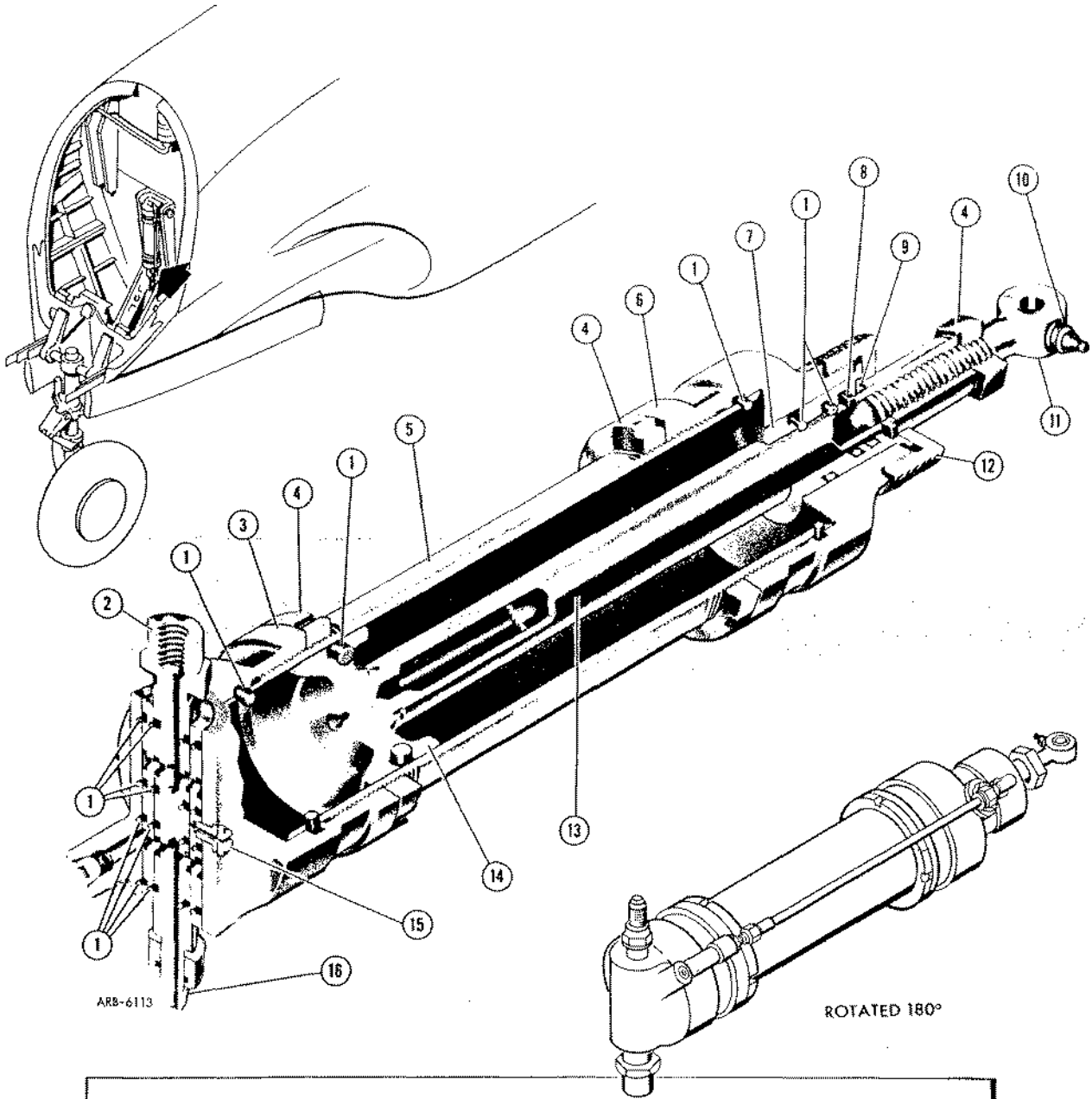
h. After adjustments and tests, safety the lock nuts together.

4–704. MAIN GEAR DOOR ACTUATING CYLINDER. *(See figure 4-140.)* Access to the cylinder is through the main gear wheel well. The cylinder is mounted on the wing front beam; its function is to close the inboard door and lock the trigger mechanism when the gear is in up position, and to open the door when the gear is extended. (See figure 4-42.) The cylinder is connected to the door and door mechanism by sealed anti-friction bearings, one at each end of the cylinder. One bearing is pressed in a lug which extends from the end cap; the other bearing is incorporated in the piston rod end fitting. The cylinder end caps are removable from the barrel for complete disassembly of the unit. A scraper is provided at the piston rod bearing to exclude foreign matter from the cylinder. O-ring packings are used throughout.

4–705. Maintenance operations for the door cylinder are similar to those for the main gear actuating cylinder, except that wrench S20608-6 or S20808-6 (figure 3-28) is used on the locknuts.

4–706. NOSE GEAR ACTUATING CYLINDER. *(See figure 4-141.)* The nose gear actuating cylinder is similar in design to the main gear cylinder, and maintenance given for the latter is applicable. The retracted (bottomed) length of the nose alighting gear actuating cylinder is 11.81 inches measured from the centerline of the rod end fitting to the centerline of the swing coupling shaft. For information on adjustments refer to paragraph 4–242. Access to the cylinder is through the armament compartment. The machine guns must be removed to provide access for removal of the nose gear actuating cylinder. Use tool S20617-21 or S20817-21 (figure 3-28) for disassembly of the end cap locknuts.

4–707. NOSE GEAR UPLOCK CYLINDER. *(See figure 4-142.)* The nose gear uplock cylinder consists of a body with integral mounting lugs, end caps, two pistons, and two springs. One piston is spring-loaded, and



1.	PACKING	9.	SCRAPER RING
2.	SWING COUPLING DOWN PORT	10.	GREASE FITTING
3.	CYLINDER END BLOCK	11.	END FITTING, PISTON ROD
4.	JAM NUT	12.	NUT, BUSHING RETAINER
5.	CYLINDER	13.	PISTON ROD
6.	CYLINDER END FITTING	14.	PISTON
7.	BUSHING	15.	LOCK SCREW
8.	FELT WIPER RING	16.	SWING COUPLING, UP PORT

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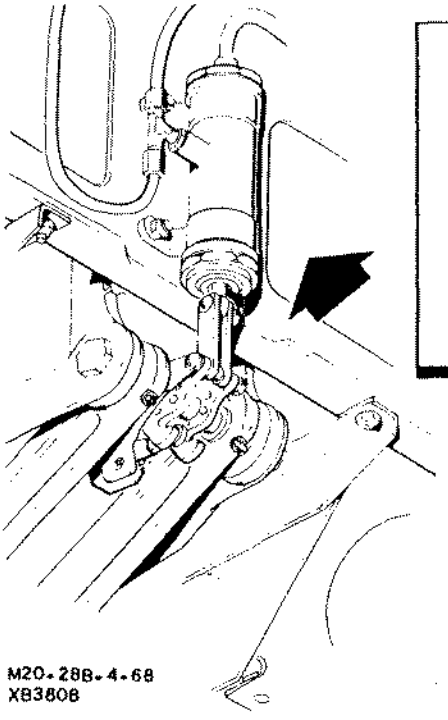
Figure 4-141. Nose Gear Actuating Cylinder



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1.	PISTON	6.	PISTON ROD
2.	PORT	7.	BEARING
3.	PACKING	8.	CYLINDER BODY
4.	SPRING	9	PISTON
5.	END CAP	10.	WASHER

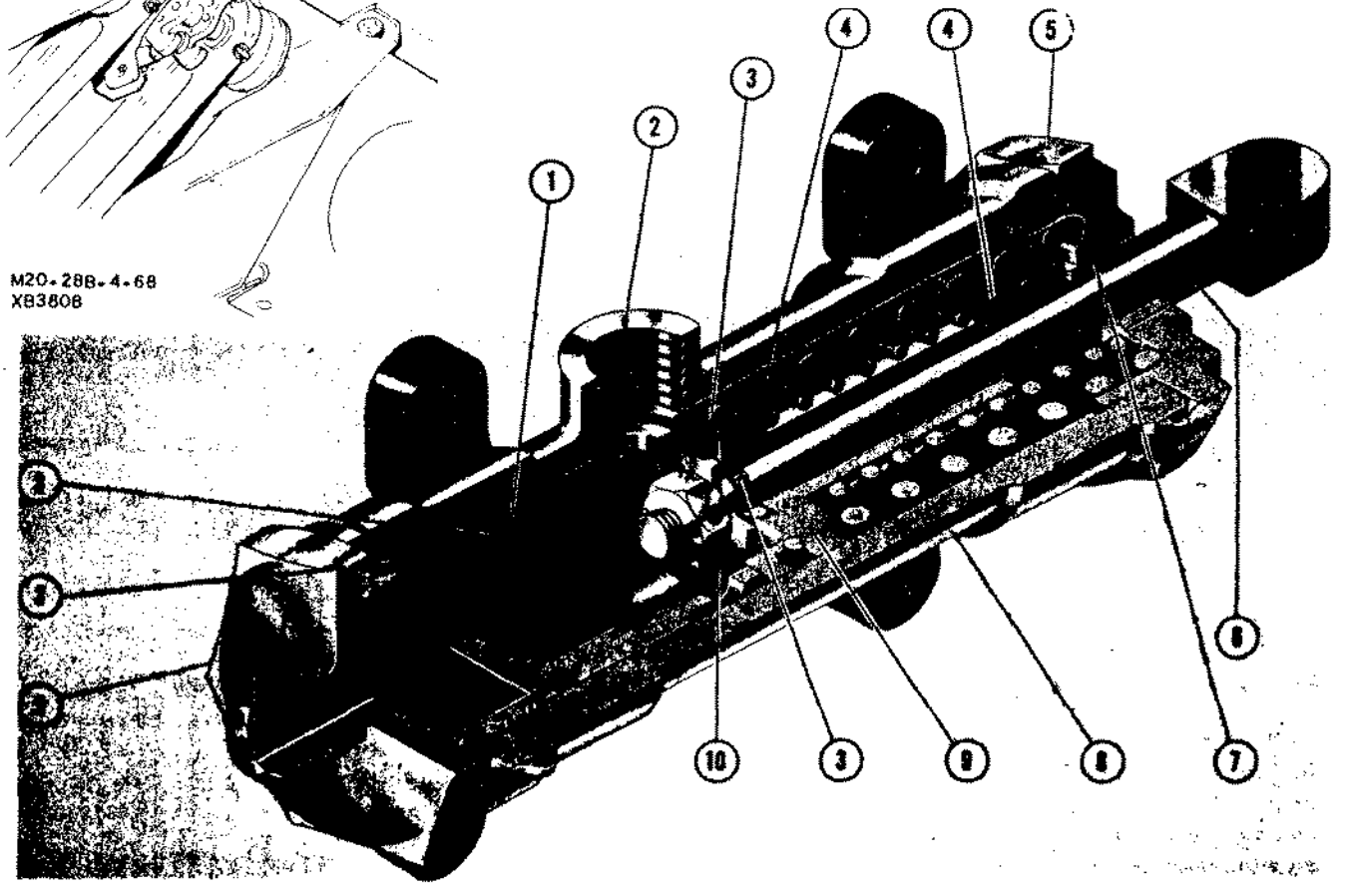


Figure 4-142. Nose Gear Uplock Cylinder

the other rides against it. The function of the cylinder is to lock the nose gear in the retracted position. Access to the cylinder is through the nose gear wheel well.

4–708. OPERATION OF NOSE GEAR UPLOCK CYLINDER. When the gear is extended, fluid forces the piston against the spring, and the piston rod travels down to release the uplock hooks. Main system fluid enters the side port and acts upon the bottom piston only. During emergency operation, the emergency fluid enters the top port. The fluid acts upon the top piston which forces the bottom piston down against the spring to release the uplock hooks.

4–709. REMOVAL OF NOSE GEAR UPLOCK CYLINDER.

a. Disconnect piston rod.

b. Relieve hydraulic pressure by operating aileron booster.

c. Disconnect hydraulic lines.

d. Remove attaching bolts, and remove cylinder.

4–710. DISASSEMBLY OF NOSE GEAR UPLOCK CYLINDER.

a. Remove both end caps.

b. Remove two pistons.

c. Loosen internal nut and remove two springs.

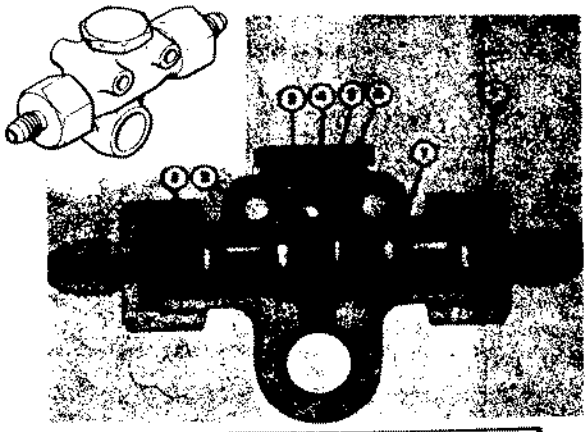


Figure 4-143. Shuttle Valve

4-715A. EMERGENCY SYSTEM PUMP CHECK (See figure 4-140).

a. Normal system hydraulic pressure zero (0).

b. Disconnect emergency system lines from left and right main gear door emergency cylinders and connect hydraulic gage to the supply lines.

c. Check that landing lever is down and locked.

d. Position emergency hydraulic system selector lever to EMERGENCY.

e. Actuate emergency hydraulic pump switch and check pressure build up to minimum of 1075 psi, and then turn switch to OFF. Close switch guard.

f. Position emergency hydraulic system selector lever to NORMAL.

g. Remove hydraulic pressure gages. Reinstall hydraulic lines to main gear door emergency cylinders; bleed lines and check for leaks.

h. Perform alighting gear emergency operations in accordance with paragraphs 4-716 and 4-717.

4-716. OPERATION OF ALIGHTING GEAR EMERGENCY EXTENSION SYSTEM. *(See figure 4-128.)* Place the alighting gear selector valve lever in "DOWN" position and the alighting gear emergency selector valve lever in "EMERGENCY" (gear extension) position, making certain that it engages the catch. (The ground test selector valve should already be safetied in flight position.) Operate emergency pump switch until the alighting gear indicator lights show the gear to be down and locked. When the pump is operated, fluid is drawn from the emergency reservoir and is directed to the actuating cylinders through the alighting gear emergency selector valve.

4-717. RETURN OF ALIGHTING GEAR SYSTEM TO NORMAL OPERATION AFTER EMERGENCY EXTENSION. When the alighting gear has been extended by the emergency hydraulic system, and after the cause of the main system failure has been determined and removed, it is not necessary to jack the airplane to return the alighting gear system to the control of the main hydraulic system. Switch to main pressure by the following procedure:

WARNING

Check to see that stiff-knee pins are in place.

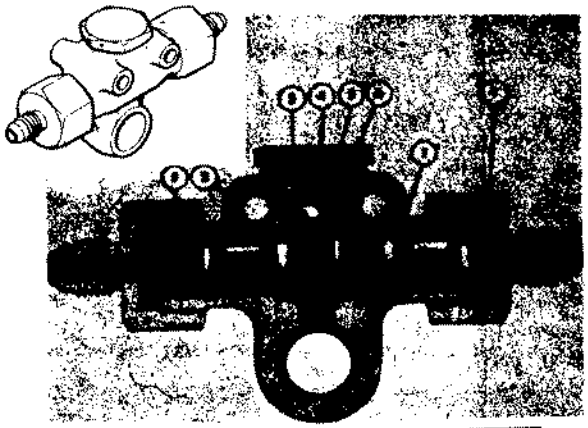
a. Turn the alighting gear emergency selector valve handle to normal position and safety both handles with breakaway wire.

b. Pressurize the main hydraulic system and place the alighting gear main system selector valve handle in "DOWN" position, thus "kicking" the shuttle valve over and closing off the emergency system.

Note

The emergency reservoir hydraulic fluid which originally entered the alighting gear cylinders will now be returned to the main reservoir whenever the gear is retracted. Therefore, drain any excess fluid from the main reservoir, and refill the emergency reservoir to the correct level.

4-718. EMERGENCY SYSTEM HYDRAULIC RESERVOIR. The emergency hydraulic reservoir is welded to a scupper which is attached to the airplane structure with screws. A vent line from the top part of the reservoir



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f. Position emergency hydraulic system selector lever to NORMAL.

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WARNING

Check to see that stiff-knee pins are in place.

a. Turn the alighting gear emergency selector valve handle to normal position and safety both handles with breakaway wire.

b. Pressurize the main hydraulic system and place the alighting gear main system selector valve handle in "DOWN" position, thus "kicking" the shuttle valve over and closing off the emergency system.

Note

The emergency reservoir hydraulic fluid which originally entered the alighting gear cylinders will now be returned to the main reservoir whenever the gear is retracted. Therefore, drain any excess fluid from the main reservoir, and refill the emergency reservoir to the correct level.

4–718. EMERGENCY SYSTEM HYDRAULIC RESERVOIR. The emergency hydraulic reservoir is welded to a scupper which is attached to the airplane structure with screws. A vent line from the top part of the reservoir

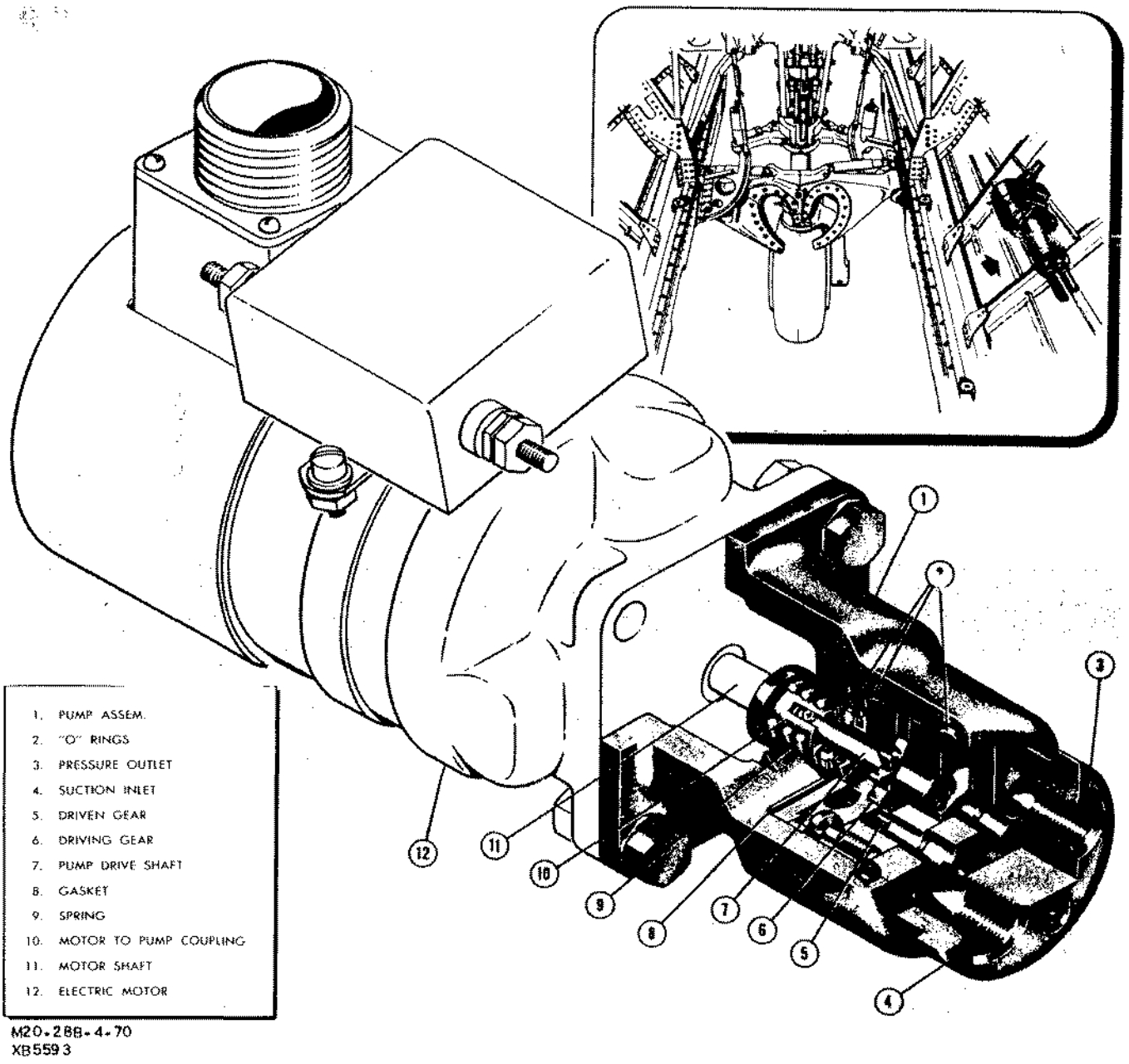


Figure 4-144. Emergency Hydraulic Pump

and connected to the filler well scupper is routed overboard. A screen to strain fluid as it enters the reservoir is located under the filler well. On airplanes AF Serial No. 53-5286 and subsequent, a short standpipe on the suction port forms a small water trap in the bottom of the reservoir. To remove water, use a syringe or siphon hose.

4–719. The reservoir is under the aft end of the forward cockpit right shelf. Access to the filler well is through access door No. 26 (figure 3-1) on right side of the airplane. Access to the tank is through the cockpit trim panel.

4–720. REMOVAL OF EMERGENCY SYSTEM RESERVOIR.

a. Remove pilots seat. (Refer to paragraphs 4–1142 or 4–1156.)

b. Remove trim panel aft of map case on right side of forward cockpit.

c. Disconnect plumbing from altimeter.

d. Disconnect wiring from temperature bulb and indicator.

e. Disconnect vent line (line that comes up through floor) at tee connection.

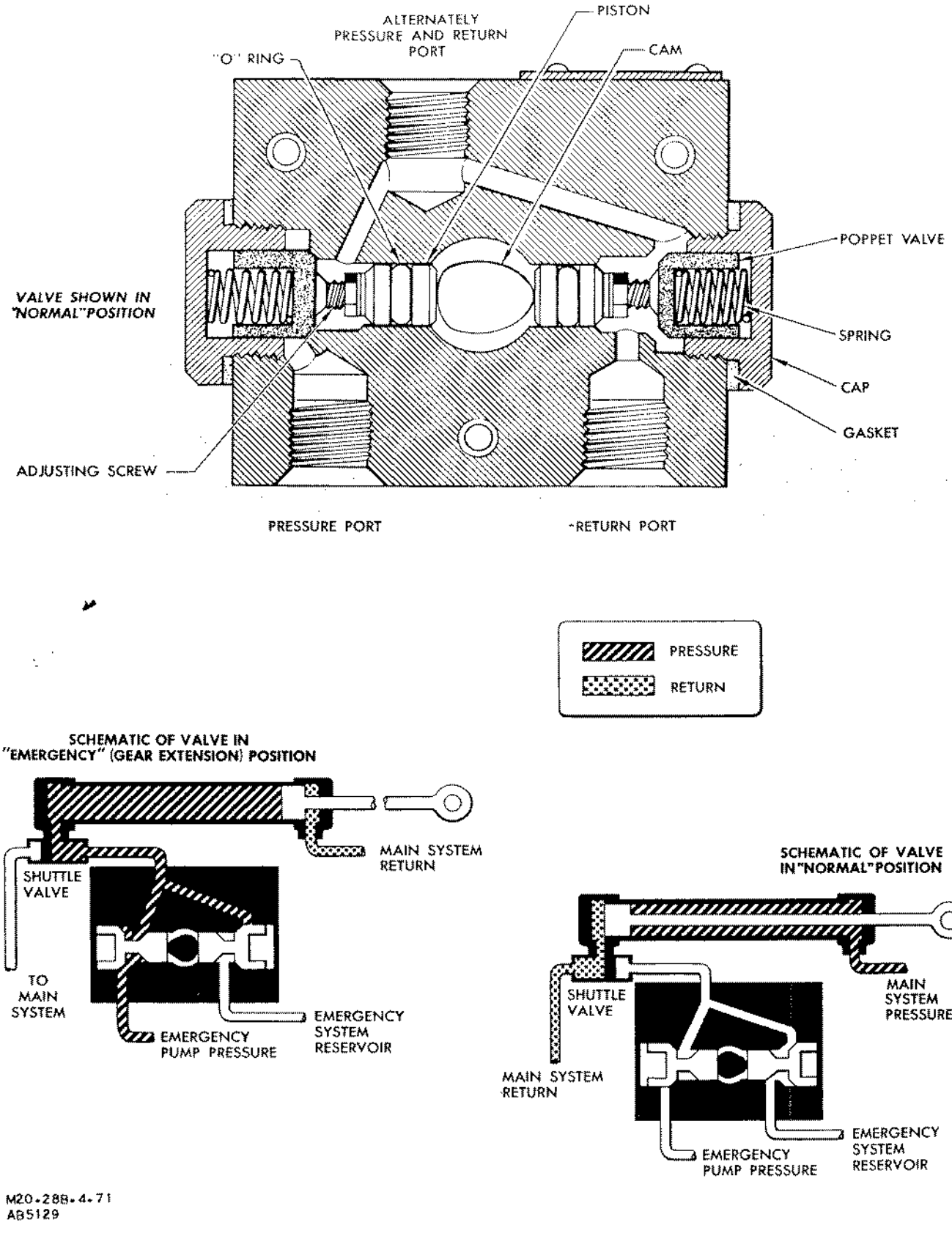


Figure 4-145. Alighting Gear Emergency Selector Valve

f. Disconnect emergency pump suction line at bottom of reservoir.

g. From outside of airplane, remove 24 screws from around reservoir filler well.

h. From inside cockpit, remove screws from bottom of reservoir.

i. Disconnect canopy forward flexible drive shaft from canopy external crank mechanism.

j. Pull flexible drive shaft forward and remove reservoir.

4–721. EMERGENCY SYSTEM ELECTRIC PUMP. *(See figure 4-144.)* The emergency hydraulic system is operated by an electric motor-driven gear-type pump, with a capacity of ½ gallon per minute. The pump is mounted in the nose wheel well on the right side. On airplanes AF Serial Nos. 50-402 and subsequent, a pump seal drain line is routed overboard. For information on the motor circuit, refer to paragraph 4–854.

CAUTION

Do not operate motor for more than 3 minutes in any 25 minute period.

4–722. ALIGHTING GEAR EMERGENCY SELECTOR VALVE. *(See figure 4-145.)* This two-position, three-port, poppet-type selector valve is under the right shelf in the forward cockpit. It is accessible through a removable panel forward of the map case, and is operated by a lever in each cockpit. The lever in the aft cockpit is connected to the valve by a push-pull rod.

4–723. REMOVAL OF ALIGHTING GEAR EMERGENCY SELECTOR VALVE. Remove forward valve lever, and trim panel forward of map case. Disconnect push-pull rod, and plumbing from back of valve. Remove attaching screws, and remove valve.

4–724. ADJUSTMENT OF ALIGHTING GEAR EMERGENCY SELECTOR VALVE. Install the valve lever so that the lever is pointing directly opposite a $\frac{1}{16}$-inch notch in the cam shaft. The notch indicates the position of the cam lobe.

4–725. ALIGHTING GEAR DOOR EMERGENCY RELEASE CYLINDER. *(See figure 4-140.)* The emergency release cylinders are located one in each main wheel well, along the wing front beam, and are accessible through the main wheel wells. Their function is to unlock the inner door segments when the hydraulic emergency system is used. They are hydraulically operated in one direction only, and are returned to their normal position by the door mechanism when the door closes.

4–726. EMERGENCY SYSTEM RELIEF VALVE (PRIOR TO AF SERIAL NO. 53-4886). This valve is identical to the main system relief valve (figure 4-133) except for size. It is under the forward cockpit right shelf, adjacent to the alighting gear emergency selector valve. The body contains a restricted passage, normally closed by a spring-loaded steel ball. Hydraulic pressure in excess of 1225 (±25) psi forces the ball off its seat and permits hydraulic oil to bypass to the emergency pump intake line. The relief setting may be raised by removing the end cap and turning the adjustment screw clockwise, or lowered by turning the screw counterclockwise.

4–727. EMERGENCY SYSTEM RELIEF VALVE (AF SERIAL NO. 53-4886 AND SUBSEQUENT). This valve is under the forward cockpit right shelf, adjacent to the alighting gear emergency selector valve. This valve is set to open at a minimum pressure of 1225 psi, and reseat at a minimum pressure of 1075 psi.

4–728. HYDRAULIC GROUND TEST SYSTEM. The emergency system pump is connected to the main hydraulic reservoir and to the main hydraulic system by the ground test selector valve to facilitate ground testing of the units of the main system.

4–729. HYDRAULIC GROUND TEST SELECTOR VALVE. *(See figure 4-146.)* This valve is a five-port, two-position, poppet-type selector valve with a two-lobe cam. The function of the valve is to connect the hydraulic emergency system pump to the main hydraulic system. Access to the valve and handle is through the forward cockpit trim panel aft of the map case.

4–730. OPERATION OF GROUND TEST SELECTOR VALVE. *(See figure 4-146.)* With the valve lever turned up for ground testing of hydraulic units, the emergency hydraulic pump is connected into the main system, drawing fluid from the main system reservoir and supplying pressure for operation of all units. The aileron booster must be shut off due to its high volume requirements, and the alighting gear emergency selector valve must be in the aft, or normal, position. Return fluid from all units enters the main system reservoir.

4–731. With the ground test valve lever in the down (flight) position, the emergency pump is disconnected from the main system and is connected into the alighting gear emergency system.

4–732. REMOVAL OF GROUND TEST SELECTOR VALVE.

a. Remove cockpit trim panel aft of the map case.

4–711. INSPECTION OF, AND REPLACEMENTS FOR NOSE GEAR UPLOCK CYLINDER.

a. Inspect cylinder for corrosion, wear, and scoring. Inspect piston rod for discontinuity of plating, wear, or other damage.

b. Replace O-ring packing and gasket with new parts.

4–712. ALIGHTING GEAR SHUTTLE VALVES. *(See figure 4-143.)* Each alighting gear shuttle valve consists of a body with three ports and a shuttle held in position by a spring-loaded ball.

4–713. The function of the shuttle valves is to prevent the emergency hydraulic system fluid from entering the main system when the emergency system is operating, and vice versa. The shuttle valves are mounted on the alighting gear actuating cylinders on the extension side.

4–714. DISASSEMBLY OF ALIGHTING GEAR SHUTTLE VALVES.

a. Remove cap and take out spring and ball.

b. Disconnect plumbing and remove end fittings. Push shuttle out.

4–715. ALIGHTING GEAR EMERGENCY EXTENSION SYSTEM. The alighting gear emergency extension system consists of an auxiliary reservoir, an electric motor-driven hydraulic pump, an emergency selector valve, a ground test selector valve, door emergency release cylinders, a pressure relief valve, and check valves. The door release cylinders are in the main gear wheel wells near the inner door mechanism.

CAUTION

The motor is an intermittent-duty type, and must not be operated for more than three minutes in any 25 minute period.

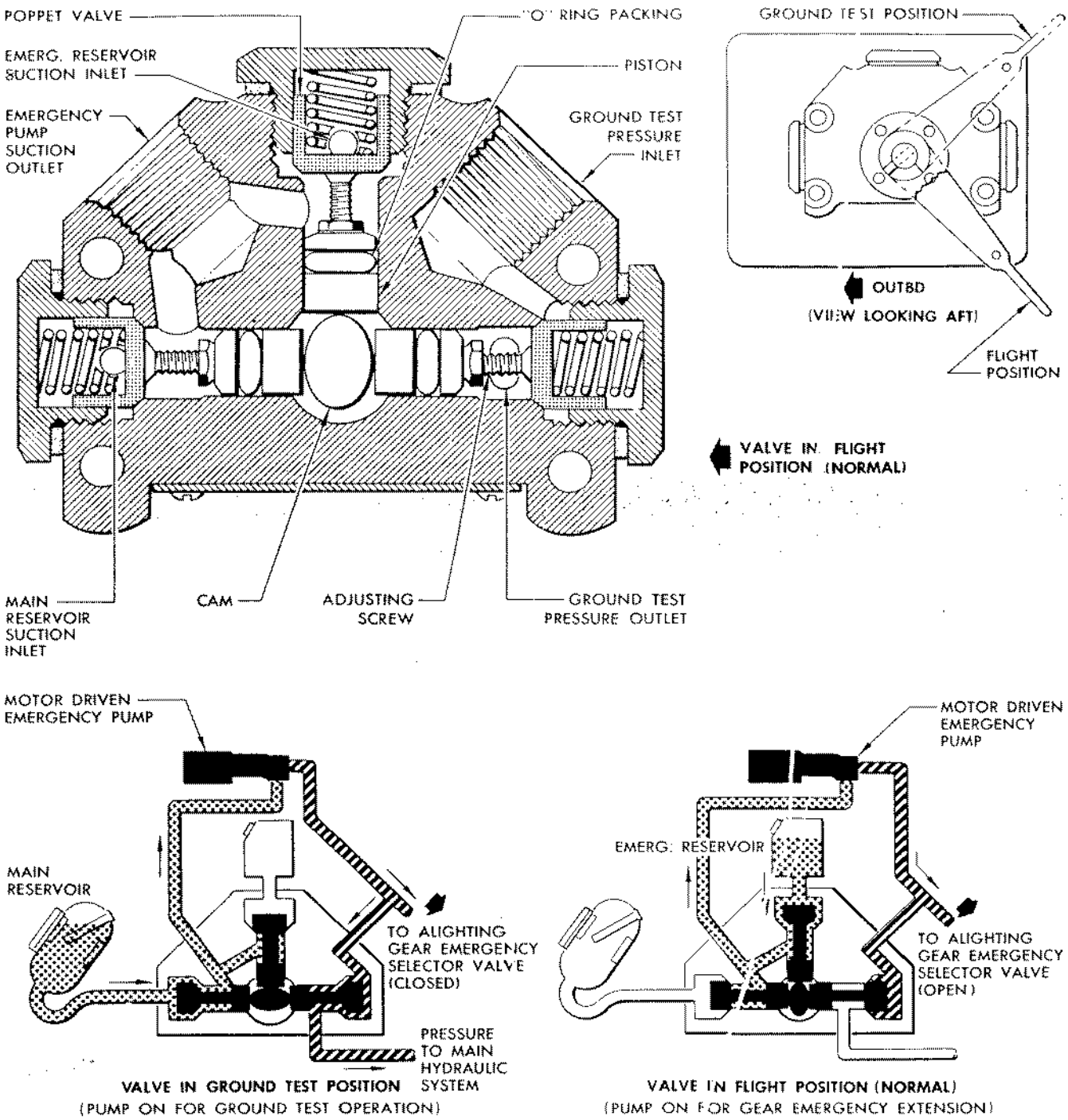


Figure 4-146. Ground Test Selector Valve

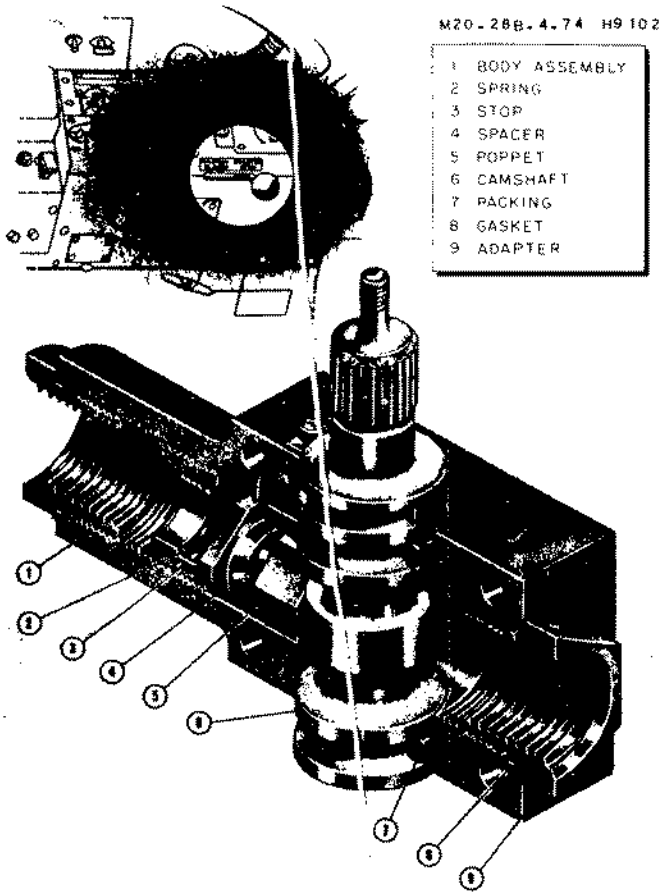


Figure 4-147. Aileron Booster Manual Shutoff Valve

b. Disconnect plumbing from valve.

c. Remove screws attaching valve to structure, and remove valve.

WARNING

After installation, the ground test selector valve handle must be safetied in the down (flight) position and the trim panel installed before the airplane is flown.

4–733. AILERON BOOSTER SYSTEM. The aileron booster system utilizes main system hydraulic pressure to supplement manual pressure on the aileron control. Operation is such that the pilot retains feel of the control, yet is able through servo action to produce a much greater force at the control surface than is applied at the control stick. A manual shutoff valve is installed on the cockpit left shelf. For information on the booster unit, refer to paragraph 4–597.

4–734. AILERON BOOSTER MANUAL SHUTOFF VALVES. *(See figure 4-147.)* Aileron booster manual check-valve type shutoff valves are provided. One valve is located in each cockpit left shelf. The valves are in series so that either one will shut off pressure to the booster.

4–735. DIVE RECOVERY FLAPS SYSTEM. *(See figures 4-27 and 4-128.)* The two dive recovery flaps are actuated by individual hydraulic cylinders which are controlled by one selector valve. The selector valve in turn is operated by an electrical actuator (prior to AF Serial No. 53-5286) controlled by a switch in each cockpit. A manual shutoff valve is in the hydraulic pressure line to the selector valve.

4–736. The selector valve, the shutoff valve, and the dive flaps actuating cylinders are in the hydraulic compartment, and are accessible through the dive flap opening.

4–737. OPERATION OF DIVE RECOVERY FLAPS (PRIOR TO AF SERIAL NO. 53-5286). The dive flaps are operated by means of the dive flaps switch on the engine control lever in each cockpit. The two-position switch does not have an off position. Thus the flaps can be operated only to the flaps up or flaps down position, with no intermediate positions.

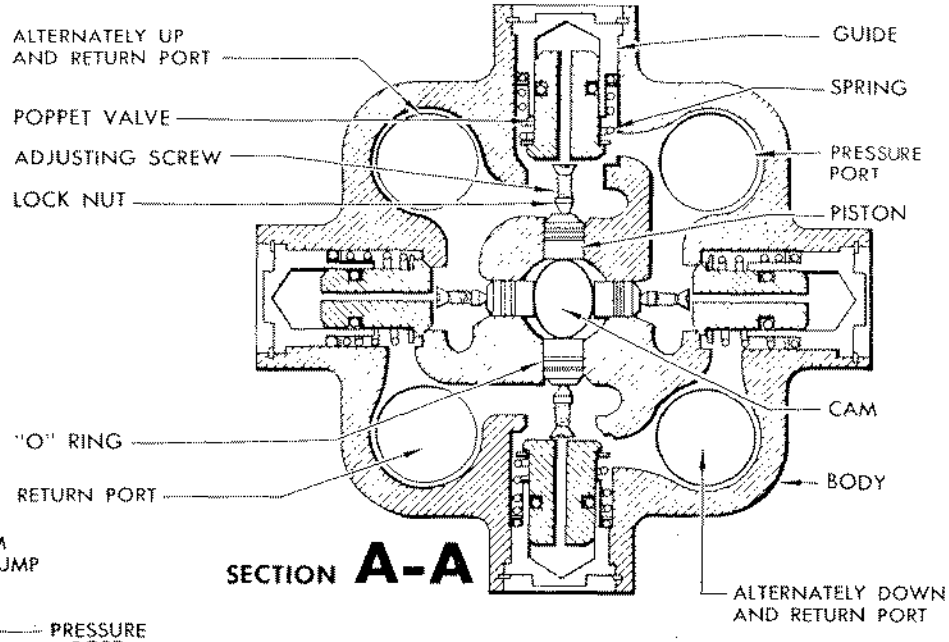
4–738. OPERATION OF DIVE RECOVERY FLAPS (AF SERIAL NO. 53-5286 AND SUBSEQUENT). The dive flaps are controlled by a serrated knob on the top of each engine control lever. A three-position switch is inside the control lever. As the knob is moved aft ("DOWN") the switch operates the selector valve and moves the flaps to the down position. As the knob is moved forward ("UP") the flaps retract full up. To move the flaps to any intermediate position, move the knob in the desired direction and, when the desired angle is obtained, move the knob to the center position.

4–739. DIVE RECOVERY FLAPS SHUTOFF VALVE. *(See figure 4-138.)* A manual check-valve-type shutoff valve is in the pressure line to the selector valve for use when making ground checks. Valve should be shut off when work is being done through dive flap opening, to prevent inadvertent operation of flaps.

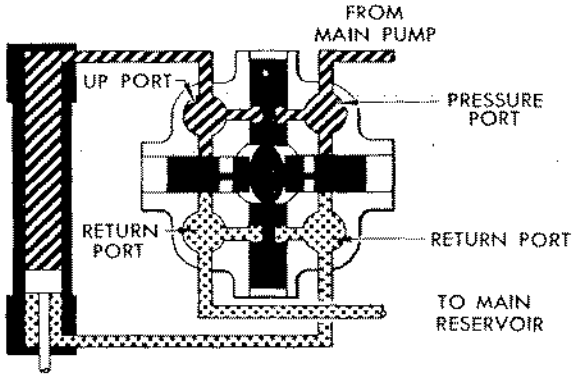
CAUTION

The shutoff valve must be safetied in the open position before flight.

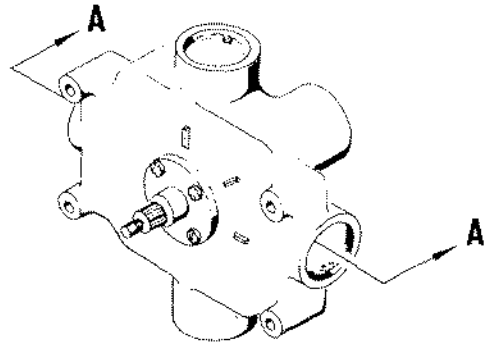
4–740. DIVE RECOVERY FLAPS SELECTOR VALVE (PRIOR TO AF SERIAL NO. 53-5286). *(See figure 4-148.)* The dive flap selector valve has four spring-loaded poppet valves spaced radially around a cam shaft.

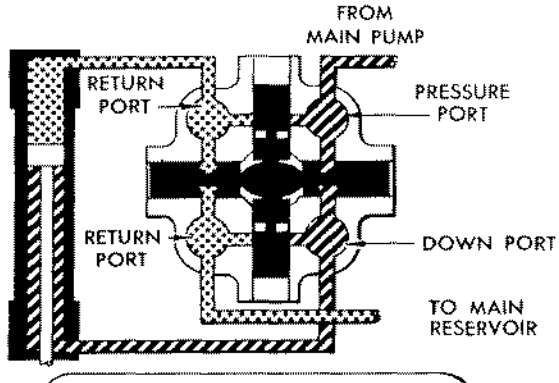


VALVE SHOWN IN UP POSITION



SCHEMATIC OF VALVE IN DIVE FLAP "UP" POSITION





SCHEMATIC OF VALVE IN DIVE FLAP "DOWN" POSITION

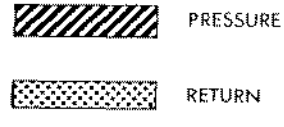


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Figure 4-148. Dive Flap Selector Valve, Prior to AF Serial No. 53-5286

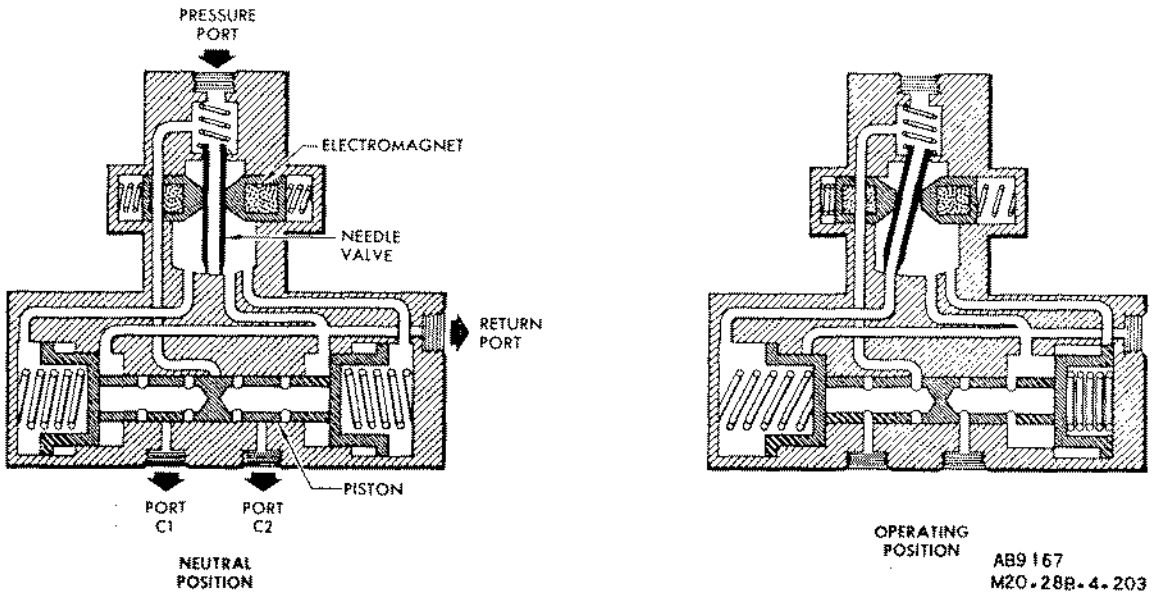

Figure 4-149. Dive Flaps Selector Valve, AF Serial No. 53-5286 and Subsequent

The valve body has a pressure port, a return port, and two cylinder or alternate pressure and return ports. Rotation of the cam shaft opens two of the valves and closes the other two. This connects the pressure to one or the other cylinder ports. At the same time, the return port is connected to the other cylinder port. Access to the selector valve is through the dive flaps.

4–741. DIVE RECOVERY FLAPS SELECTOR VALVE (AF SERIAL NO. 53-5286 AND SUBSEQUENT). *(See figure 4-149.)* This electromagnetic four-way valve has a pressure port, return port, and two cylinder or alternating pressure and return ports. Energizing one of the magnets moves the needle valve which connects the pressure to one or the other cylinder ports on each actuating cylinder. At the same time, the return port is connected to the other cylinder port. This valve incorporates a thermal relief valve which is set to open at 1900 (+50, —100) psi and reseat at a minimum of 1650 psi.

4–742. REMOVAL OF DIVE RECOVERY FLAPS SELECTOR VALVE.

a. Place dive flaps in down position, and close the manual ground check shutoff valve.

b. Prior to AF Serial No. 53-5286, disconnect electrical wiring from actuator. On AF Serial No. 53-5286 and subsequent, disconnect electrical connector from valve.

c. Disconnect and immediately cap all hydraulic lines to valve.

d. Remove 4 screws and remove valve. Prior to AF Serial No. 53-5286, remove valve with actuator.

4–743. DIVE RECOVERY FLAPS ACTUATING CYLINDER. *(See figure 4-150.)* The dive flap actuating cylinder consists principally of a piston, cylinder barrel, and two end caps. The piston-rod end is fitted with an adjustable clevis terminal. O-rings are employed for all packings. The clevis terminal is fitted with a lubricator to provide lubrication for the clevis bushing. A scraper ring on the piston rod bearing area excludes foreign matter from the cylinder.

4–744. REMOVAL OF DIVE RECOVERY FLAPS ACTUATING CYLINDERS. (Refer to paragraph 4–140.

4–745. DISASSEMBLY OF DIVE RECOVERY FLAPS ACTUATING CYLINDER. Special tool required: Locknut wrench S20618-20 or S20818-20.

a. With piston bottomed, measure accurately and record the distance between the clevis attaching hole and the mounting hole on the end cap opposite the clevis.

b. Measure and record the full stroke of the piston.

c. Loosen the end-cap locknuts with wrench S20618-20 or S20818-20.

d. With a strap wrench, remove both end caps from the cylinder barrel.

e. Loosen clevis locknut and remove clevis from piston rod.

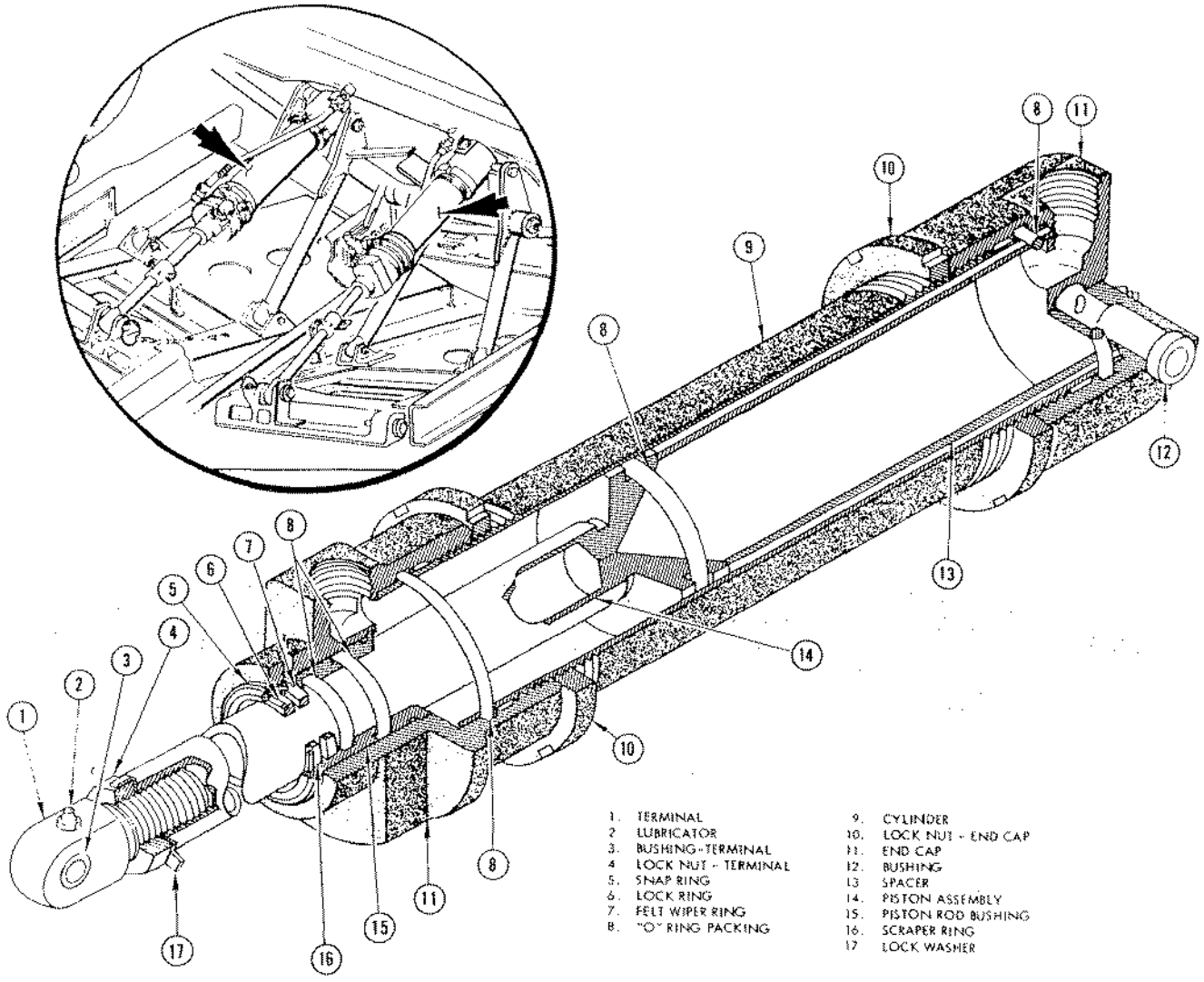

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Figure 4-150. Dive Flaps Actuating Cylinder

f. Slide end cap off piston rod.

g. Remove lockring and scraper from end caps.

h. Remove all O-ring packings and gaskets.

i. Thoroughly clean all parts.

4–746. INSPECTION OF AND REPLACEMENTS FOR DIVE RECOVERY FLAPS ACTUATING CYLINDER.

a. Inspect cylinder bore for scoring, worn spots, or roughness. Inspect piston rod for discontinuity of plating or for pitted condition.

b. Replace all O-ring packings and gaskets.

4–747. ASSEMBLY, TEST, AND INSTALLATION OF DIVE RECOVERY FLAPS ACTUATING CYLINDER.

a. Lubricate all O-ring packings, cylinder bore, and piston rod with hydraulic fluid, Spec MIL-O-5606.

b. Assemble two end caps on piston rod and cylinder barrel.

c. Tighten end cap opposite the clevis so that cylinder barrel bottoms in end cap. Adjust piston stroke with other end cap to length recorded in paragraph 4–745.

d. Tighten two end-cap locknuts with wrench S20618-20 or S20818-20.

e. Assemble clevis and locknut on piston rod.

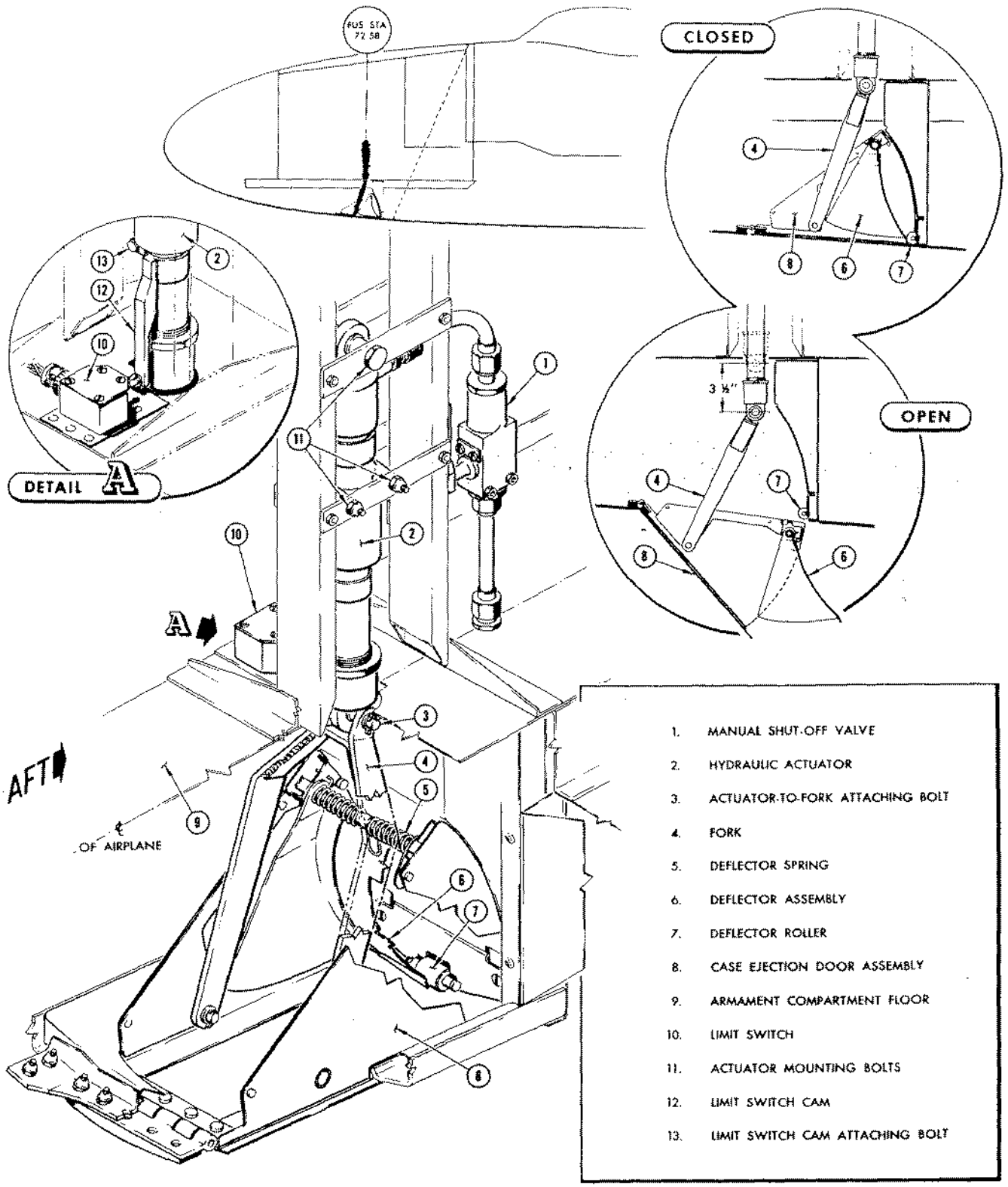


Figure 4-151. Case Ejection Door Mechanism, T-33A-1 Airplanes

f. With piston bottomed, adjust clevis for an over-all length as recorded in paragraph 4–745.

g. Tighten clevis locknut.

Note

Prior to installing bolt through aft end of actuating cylinder, lubricate bolt with grease, Specification MIL-G-23827A.

h. Install cylinder and test for leaks by operating dive flaps.

Note

Adjust elbows on dive flap cylinders to assure maximum clearance between hydraulic hose and air flow control valve, when dive flaps are up.

4–748. CASE EJECTION DOOR SYSTEM (T-33A-1 AIRPLANES). *(See figures 4-128 and 4-151.)* The case ejection door system consists of a solenoid-operated control valve in the nose wheel well on the left side, a manual shutoff valve, and a hydraulic actuating cylinder in the ammunition compartment. The control valve is operated by trigger switches on the control stick grips, and a ground test switch on the armament compartment junction box.

4–749. A restrictor in the return line forces most of the fluid from the control valve to the actuating cylinder when the valve is open. When the valve is closed, the restrictor checks the return fluid and slows the retracting cycle of the actuating cylinder. When it becomes necessary to work in this area, close the manual shutoff valve adjacent to the actuating cylinder. Open the door with the ground operating switch, and release the switch. This will hold the door open.

4–750. CASE EJECTION DOOR ACTUATING CYLINDER (T-33A-1 AIRPLANES). *(See figure 4-152.)* The case ejection door actuating cylinder is in the armament compartment forward of the electrical junction box. It consists of a cylinder and a spring-loaded piston assembly. The piston consists of a sleeve with a spring retainer attached with a snap ring at one end and the end cap screwed into the other end. Hydraulic pressure forces the piston out of the cylinder until the spring retainer strikes the piston stop. The piston is returned to its original position by the spring. The cylinder body has one port which is used for both pressure and return. O-ring packings seal the cylinder, preventing fluid leaks. A cam to operate a limit switch in the control valve circuit is clamped to the side of the actuator. A hole to oil the felt wiper is located at the lower end of the cylinder.

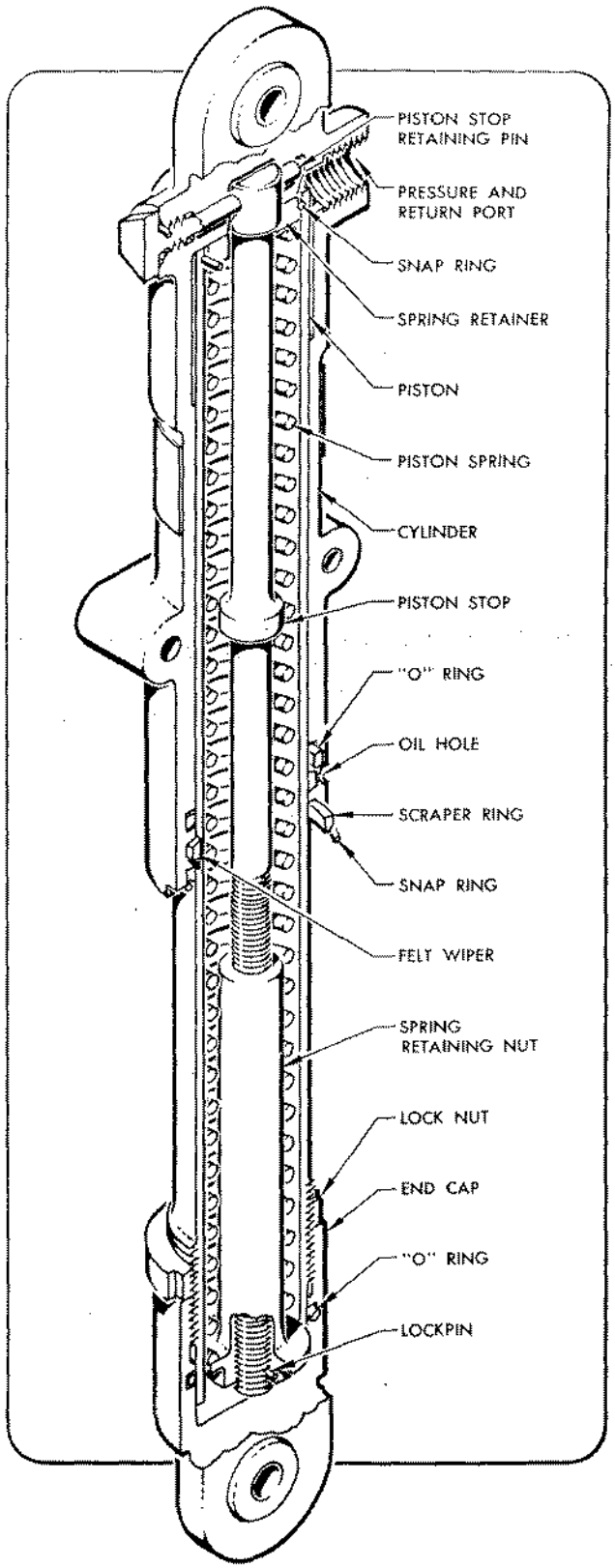


Figure 4-152. Case Ejection Door Actuator, T-33A-1 Airplanes

4–751. REMOVAL OF CASE EJECTION DOOR ACTUATING CYLINDER.

a. Open armament compartment doors.

b. Remove ammunition trays.

c. With the control valve closed, disconnect and immediately cap hydraulic lines.

d. Remove limit switch cam.

e. Remove three bolts holding cylinder, and allow it to drop through hole in floor.

f. Disconnect case ejection door fork from lower end of cylinder. Retain spacers from around bolt.

g. Lift cylinder up through hole in floor, and remove cylinder.

4–752. DISASSEMBLY OF CASE EJECTION DOOR ACTUATING CYLINDER. *(See figure 4-152.)*

a. With a spanner wrench, loosen the locknut and unscrew end cap from piston sleeve. Use a strap wrench to hold piston sleeve.

b. Remove the retaining nut lockpin, and remove spring retaining nut and spring.

c. Remove piston-stop retaining pin.

d. Remove piston stop and piston.

e. Remove snapring and remove spring retainer from piston sleeve.

4–753. REPAIRING CASE EJECTION DOOR ACTUATING CYLINDER.

a. Inspect cylinder bore and external surface of piston sleeve for scoring, worn spots, or roughness. Inspect inside of piston sleeve for scoring and roughness. Remove small scratches or roughness with crocus cloth.

b. Replace badly worn parts.

c. Replace all O-ring packings.

4–754. ASSEMBLY, INSTALLATION, AND ADJUSTMENT OF CASE EJECTION DOOR ACTUATING CYLINDER. *(See figure 4-152.)*

a. Install spring retainer in piston sleeve. Fasten with snapring.

b. Install piston in cylinder.

c. Install piston stop, and insert piston-stop retaining pin.

d. Insert spring, and install spring retaining nut. Insert retaining nut lockpin.

e. With locknut on threads of piston, screw end cap on piston until distance between centers of upper and lower attachment holes is 13.5 (±0.03) inches.

f. Through the hole provided for it in the armament compartment cylinder, lower the cylinder as far as it will go.

g. Install bolt attaching cylinder to case ejection door fork.

h. Pull cylinder back through the hole and fix it in place with its three mounting bolts.

i. If necessary, loosen locknut and adjust door by turning piston sleeve with a strap wrench until door is closed and tight against structure. Tighten locknut against the end cap.

j. Connect hydraulic line to cylinder.

k. Attach limit switch cam to cylinder end cap so that switch will remain closed until cylinder is at end of its stroke, at which time it must open. Test by means of ground operating switch.

l. Reinstall guns and ammunition trays.

4–755. CASE EJECTION DOOR CONTROL VALVE (T-33A-1 AIRPLANES). *(See figure 4-153.)* This solenoid-operated normally closed, poppet-type shutoff valve is located on the left side of the nose wheel well.

4–756. TROUBLE SHOOTING CASE EJECTION DOOR CONTROL VALVE.

Trouble	*Probable Cause*	*Remedy*
Fluid does not flow when valve is "OPEN."	Excessive clearance between poppet and lever.	Readjust to obtain 0.005 to 0.010 inch clearance.
	Shutoff poppet jammed or locked in seated position.	Disassemble and inspect poppet seat, O-rings, and spring. Replace damaged parts and if necessary relap poppet to seat.
	Lever jammed, failing to force poppet from seat.	Inspect lever, washers, and pivot pin. Lubricate if necessary.
Flow does not shut off when valve is "CLOSED."	Dirt or grit lodged on seat of poppet, holding poppet open.	Flush valve thoroughly. If necessary, disassemble and clean poppet and seat.

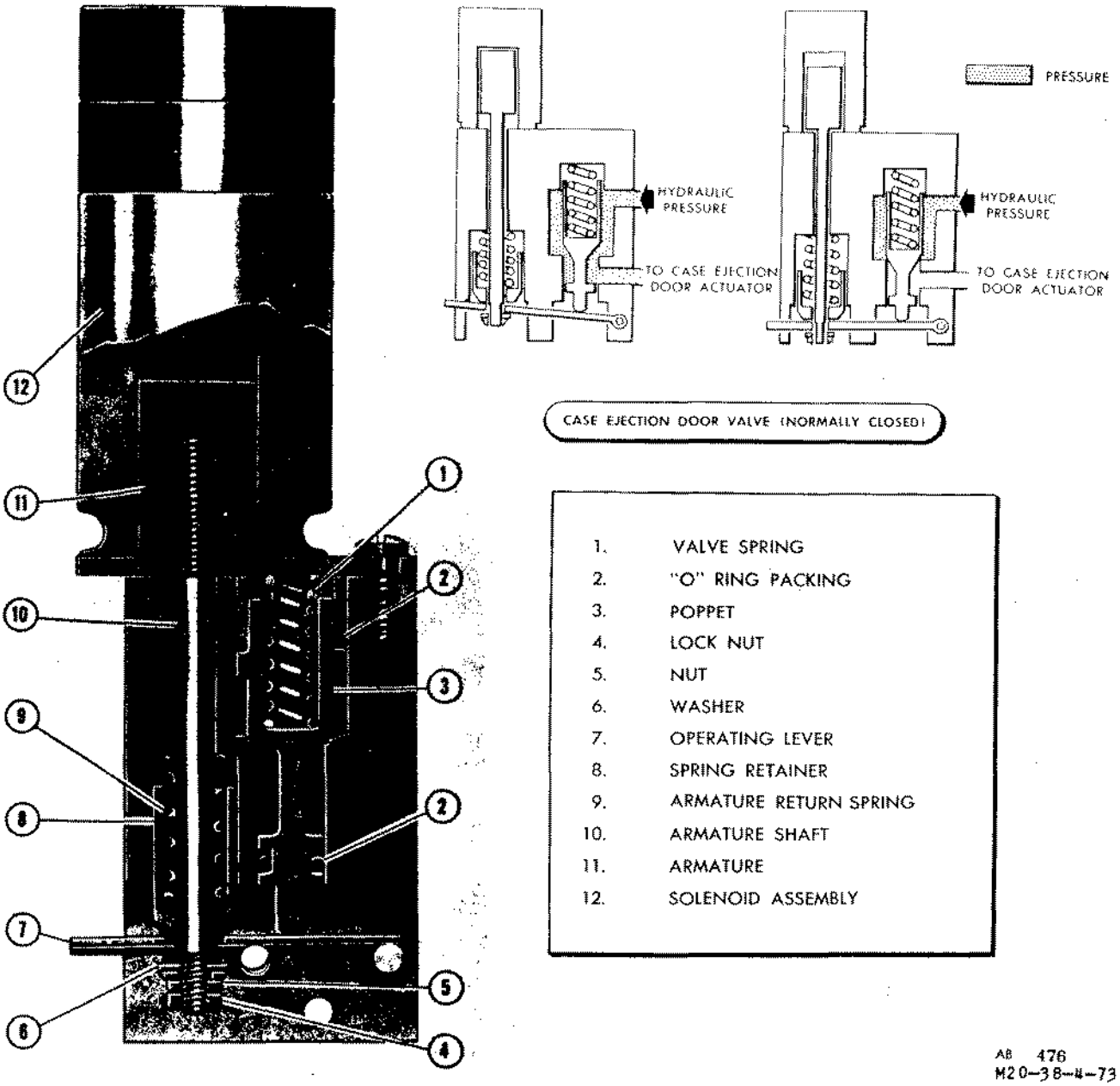
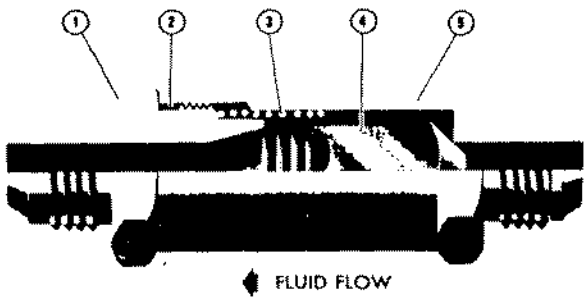


Figure 4-153. Case Ejection Door Control Valve, T-33A-1 Airplanes

Trouble	*Probable Cause*	*Remedy*
	Shutoff poppet or seat is badly scored or scratched.	Replace valve.
	Shutoff poppet is held open by faulty adjustment of solenoid plunger nut.	Adjust to obtain 0.005 to 0.010 inch clearance between lever and poppet.
Fliud leaks from top of valve body when valve is "CLOSED."	O-ring above poppet is in poor condition.	Replace O-ring.
Fluid leaks from bottom of valve body.	O-ring above poppet is in poor condition.	Replace O-ring.



1.	END FITTING	4.	POPPET
2.	PACKING	5.	BODY
3.	SPRING		

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Figure 4-154. Check Valve

Trouble	*Probable Cause*	*Remedy*
Solenoid plunger does not move when control switch is operated.	Loose electrical connections.	See that terminal post wires are secure.
	Corroded plunger.	Clean plunger.
	Defective solenoid.	Replace solenoid.
Valve is open, and closes when solenoid is energized.	Pivot pin installed in wrong hole.	Place pin in center hole.

4–757. CASE EJECTION DOOR MANUAL SHUTOFF VALVE (T-33A-1 AIRPLANES). *(See figure 4-138.)* This poppet-type manual check valve is mounted in the armament compartment aft of the case ejection door cylinder. When closed the valve operates as a check valve and will permit ejection door to be extended, but not retracted.

CAUTION

Valve handle must be safetied in the open position for flight.

4–758. HYDRAULIC SYSTEM CHECK VALVES. *(See figure 4-154.)* Check valves are installed at various points in the hydraulic system to prevent reverse flow of fluid. An arrow stamped on the body of each valve indicates direction of flow.

4–759. HYDRAULIC SYSTEM CHECKOUT PREPARATIONS.

Note

All hydraulic gigs shall have micronic filters. Relief valves on gigs shall be set to bypass at 1000 (±50) psi.

a. Inflate accumulators on hydraulic gig and on airplane with air to 500 (±25) psi.

b. Fill main and emergency reservoirs to the proper level with hydraulic fluid Specification MIL-H-5606.

c. Jack the airplane. (Refer to paragraph 3–19.)

d. Connect hydraulic gig to pressure and return lines at ground test connections. Connect electrical power to airplane through external power receptacle.

e. Be sure alighting gear emergency selector valve handle is in "NORMAL" position.

4–760. HYDRAULIC FUSE CHECKOUT (PRIOR TO AF SERIAL 51-6819).

a. With the lever on cockpit left shelf, shut off the aileron booster.

b. Operate dive flaps at least five times. Allow 30 seconds between each two operations.

c. Operate alighting gear up and down at least five times. Allow 30 seconds between each two operations.

d. When steps b and c are accomplished with no hydraulic fuse lockout, the hydraulic fuse checkout is satisfactory.

Note

If hydraulic fuse locks, requiring excessive resetting, check for air in system or for internal leakage at valves.

4–761. ALIGHTING GEAR MAIN SYSTEM CHECKOUT.

a. Check shock struts for proper inflation. (Refer to paragraphs 4–159 and 4–231.)

b. Be sure doors and gear are free of obstructions such as ladders, tape, bumpers, and stiff knees.

c. With the alighting gear down, close all gear manual shutoff valves and then move the alighting gear selector handle to the "up" position. Particular attention should be given to freedom of movement of the alighting gear selector handle; no binding is allowed. Observe the response of the alighting gear selector as pressure is applied to operate the overcenter bungee during the upward movement. The handle must lock securely in the "up" position once the upward movement of the handle has stopped. If any gear moves up, the corresponding manual shut-off valve is leaking. Depress the push button release and return the alighting gear selector handle to the "down" position. Observe the response of the alighting gear selector handle as pressure is applied to operate the overcenter bungee during the downward movement. The handle must lock firmly in the "down" position once the downward movement of the handle has stopped.

d. Open only one alighting gear manual shutoff valve at a time, and observe for proper operation of gear and door mechanism through at least six cycles.

e. After individual operations have proved satisfactory, open all alighting gear manual shutoff valves and run all gears simultaneously. Check operation time with a stop watch. All gears shall retract and doors shall close and lock in a maximum of five seconds. With gear in retract position turn off hydraulic gig and deplete aircraft hydraulic pressure by actuating aileron boost. Place selector handle in "DOWN" position. Turn on gig and permit pressure to build up to BUT NOT TO EXCEED 600 PSI. Make sure that gear comes down and locks.

Note

Failure of gear to meet above tolerances indicates marginally rigged units, worn parts, improper lubrication, or defective hydraulic units.

f. Check gear down lock latch assembly to see that the lock is fully seated in notch on the side strut cam.

g. Check main gear inboard door for premature operation. With stiff knees in place, operate alighting gear selector valve to "UP" and "DOWN" positions. Inboard door should remain open. The door should not close when subjected to vibration or manual force.

h. With hydraulic pressure off, check breakover adjustment on main gear inboard door brace. Push on the brace at the knee joint separating the surfaces of the upper and lower brace. Insert an 0.020 thickness gage and push door back to open position. The brace shall hold the door rigidly open. File off the surface of the upper brace if necessary to obtain proper adjustment.

4–762. ALIGHTING GEAR EMERGENCY SYSTEM CHECKOUT.

a. With alighting gear in up position, shut off hydraulic pressure, open aileron booster shutoff valve, and operate aileron booster to relieve hydraulic pressure.

b. Place alighting gear selector valve in "DOWN," emergency selector valve in "EMERGENCY," ground test selector valve in "FLIGHT" (normal).

c. Switch on emergency pump. Gear should extend and lock down.

d. Operate emergency pump until emergency relief valve bypasses. This can be determined by placing the ear near the valve and listening for the vibration of the spring when the valve unseats.

Note

Do not operate emergency pump for more than three minutes in any 25-minute period.

e. Allow system to stand for five minutes. Clean off all fittings in emergency system.

f. Visually check for any external leakage in the emergency system. Allowable leakage from each actuating cylinder is one drop during 25 cycles.

g. Relieve pressure by placing emergency selector valve handle in "NORMAL" position. Leave alighting gear selector valve handle in "DOWN" position and turn on hydraulic pressure to move shuttle valves to their normal positions. Move the alighting gear selector valve handle to "UP" position and retract alighting gear. Operate gear through two or three cycles. Place container under main hydraulic reservoir to catch overflow.

h. Refill emergency hydraulic reservoir with fluid Specification MIL-H-5606.

4–763. ALIGHTING GEAR MAIN SYSTEM LEAKAGE TEST.

a. Place alighting gear selector valve handle in "DOWN," and close aileron booster and dive flap manual shut-off valves.

b. Wipe all fittings in the alighting gear system.

c. Apply hydraulic pressure at 1000 (±50) psi for five minutes.

d. Shut off pressure and check for visible leaks in the alighting gear system.

e. Put alighting gear selector valve handle in "UP" position. Apply hydraulic pressure to retract gear. Maintain same pressure on system for five minutes.

f. Put alighting gear selector valve handle in the "DOWN" position. Shut off pressure and check system for visible leaks.

g. Allowable leakage for each actuating cylinder is one drop in 25 cycles.

4–764. AILERON BOOSTER OPERATIONAL CHECKOUT.

a. Close dive flap and alighting gear manual shutoff valves.

b. With hydraulic pressure on, actuate control stick several times to bleed air from aileron booster system.

c. After bleeding operation is complete, continue to move stick through entire range. Operation shall be smooth and free from rough spots.

Note

Slightly higher pressure on control stick may be required at reversal of direction due to presence of dash pots in booster control valve.

d. When control stick is placed in neutral, it shall remain there. Slight creepage is allowed if control stick is placed in any other position. To check degree of creepage, measure pressure on trailing edge at inner rib of aileron. Restraining force must not exceed 10 pounds as measured by creep meter. (See figure 4-155.) If a force of more than 10 pounds is necessary to restrain the aileron creep, adjust linkage in booster assembly to reduce the creep.

4–765. AILERON BOOSTER LEAKAGE CHECK. Apply 1000 (±50) psi to aileron booster system. Operate booster through several cycles and observe for leaks. The allowable leakage for actuating cylinder and booster control valve is one drop in 25 cycles for each.

4–766. AILERON BOOSTER BYPASS VALVE CHECKOUT.

a. Close booster shutoff valve.

b. Move stick through 15 cycles. Movement should be free with no evidence of hydraulic lock.

c. Open booster shutoff valve.

d. Turn on hydraulic test gig.

e. Move stick through 5 cycles of complete travel.

f. Turn off hydraulic gig.

g. Close booster shutoff valve.

h. Move stick through 5 cycles of complete travel. Movement should be free with no evidence of a hydraulic lock.

4–767. DIVE FLAP OPERATIONAL CHECKOUT.

WARNING

The dive flaps move very rapidly, and every precaution should be taken to avoid injury to personnel.

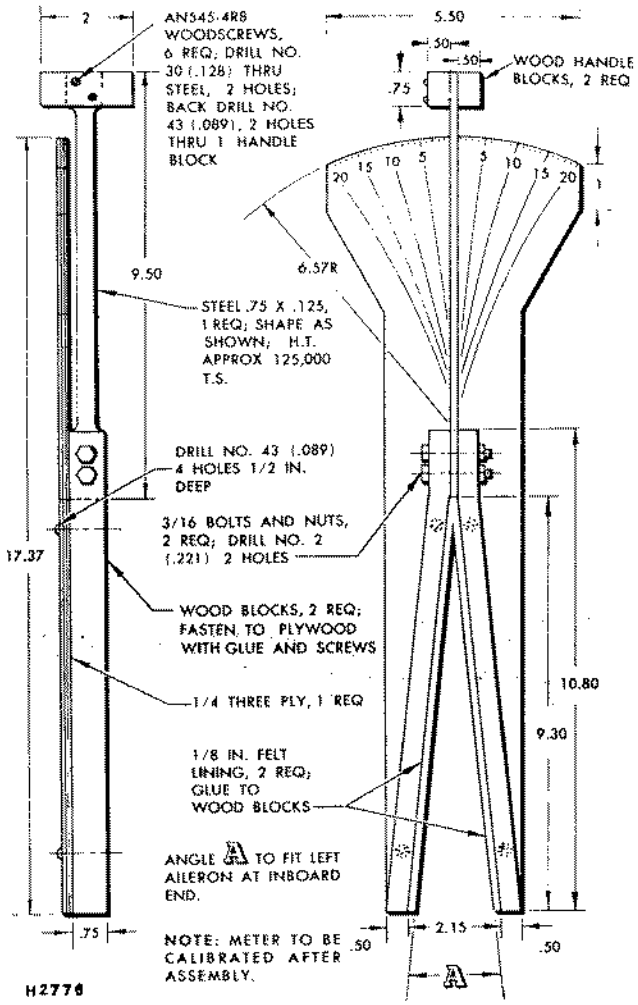


Figure 4-155. Creep Meter

a. Close aileron booster and alighting gear manual shut-off valves.

b. Open dive flaps and close manual shutoff valve. Be sure that dive flaps are free of obstructions such as loose screws, nuts, and bolts in the flap tracks. Check cylinder shaft pin for proper installation and safety.

c. Check hydraulic reservoir to be sure it has been filled to proper level.

d. Shut off hydraulic pressure and electrical power. Open dive flap manual shutoff valve.

e. Turn on hydraulic pressure and electrical power. Operate flaps through several cycles.

4–768. DIVE FLAP SYSTEM LEAKAGE TEST.

a. Clean all fittings and units in dive flap system.

b. Retract flaps and hold a pressure of 1000 (±50) psi for five minutes.

c. Extend flaps and look for leaks.

d. Maintain same pressure for five minutes with flaps extended. Look for leaks.

e. Actuating cylinder is permitted one drop leakage in 25 cycles.

4–769. CASE EJECTION DOOR OPERATIONAL CHECK (T-33A-1 AIRPLANES).

CAUTION

Nose alighting gear must be directly in line with the airplane centerline. Any movement of the gear from parallel with the airplane centerline will cause the door to strike the lens of the light.

a. Be sure there is no obstruction under case ejection door.

b. Close manual shutoff valve adjacent to actuating cylinder. Open the door with the ground operating switch on the armament compartment junction box, and release the switch. The door must not drift closed.

c. Open the manual shutoff valve. The door must take a minimum of five seconds to close. If more than one minute is necessary for the closing cycle, remove the restrictor in the line and clean screen and orifice.

d. Permissible leakage of cylinder is one drop in 25 cycles.

4–770. GENERAL MAINTENANCE OF HYDRAULIC SYSTEM.

a. Relieve hydraulic pressure by operating aileron booster before disconnecting any hydraulic line.

b. Cap all hydraulic tubes after disconnecting to prevent entrance of dust or other foreign matter.

c. Clean disassembled units with kerosene or solvent, Federal Specification P-D-680, and coat with hydraulic oil, Specification MIL-H-5606.

d. Before installing any tube, clean it thoroughly with solvent and compressed air. Check for obstruction by rolling a steel ball through the tube.

e. Tighten tubing connections and aluminum fittings according to torque listed in table 6–5.

4–771. ELECTRICAL SYSTEM.

(See figure 8-2.)

4–772. DESCRIPTION OF ELECTRICAL SYSTEM. The electrical system is a 28-volt, single-wire system, with the negative return for all circuits grounded to the airplane structure. Alternating current at 115 volts, 400 cycles, 3 phase, for the electrical instruments is supplied by an inverter, which in turn receives power from the 28-volt d-c system. Single-phase, 115-volt, 400-cycle alternating current is supplied to the AN/APX-6 identification radar. (Refer to paragraph 4–900.)

4–773. Protection against electrical overloads is effected by circuit protectors and fuses.

4–774. The following parts and equipment are electrically operated:

Engine starter
Ignition dynamotor and exciter
Fuel booster pumps
Fuel transfer valves
Fuel quantity gage
Fuel de-icing
Emergency fuel control
Main fuel control
Starting fuel control
Dual fuel pump solenoid valve
Air solenoid valve
Tachometer indicator
Wing flaps
Elevator trim tabs
Aileron tab
Aileron booster control
Pitot head heater
Gyrosyn compass
Turn and bank indicator
Attitude indicator
Alighting gear warning system
Tail cone temperature indicator
Cockpit temperature indicator
Navigation lights
Landing lights
Warning lights
Gun heaters
Case ejection door valve
Guns
Gun sight camera
Gun sight

Bomb racks
Dive flap selector valve
Overheat warning switches
Fluid injection pump
Windshield auxiliary defroster
Jato ignition
Canopy actuator
Air flow control
Emergency hydraulic pump

4–775. In removing the aft section of the fuselage, the electrical wiring is disconnected at the disconnect plugs contained within the wing-fuselage fillet. The plugs are accessible through an access door.

4–776. All wiring is suspended by rigid clips or clamps attached to the aircraft structure. The electrical switches and most of the circuit protectors are on the cockpit side panels.

4–777. Disconnect plugs mounted on the cockpit pressurization panels are sealed to prevent loss of cockpit pressure, and treated to prevent corrosion.

4–778. Radio noise filters are installed in all electric motor circuits.

4–779. Switches on the forward cockpit are duplicated in the aft cockpit except for emergency fuel and inverter check switches, pitot head heater switch, armament switches except the trigger switch, and fuel booster pump switches except the fuselage tank pump switch.

4–780. ELECTRICAL BONDING. *(See figure 4-156.)* All electrical units must be securely bonded to the airplane structure to reduce radio interference. All inspection doors are bonded to the airplane structure with bonding strips. Be certain that grounded equipment makes good electrical contact.

4–781. SOLDERING ELECTRICAL CONNECTIONS. When making a soldered connection, the parts must be thoroughly clean and the soldering iron hot enough to cause the solder to flow into the joint. Solder which has been applied with insufficient heat will not make a good electrical connection, nor will the joint have the proper strength. Use solder, Federal Specification QQ-S-571. Use a noncorrosive flux, such as resin. Do not use an acid flux or an acid-core solder.

4–782. CLEANING ELECTRICAL EQUIPMENT. *(See table 4-8.)* Clean parts such as antenna insulators with a clean dry cloth. Clean generator armatures with a solvent as noted in the cleaning chart. If a solvent is used, it must be completely removed before the part is put in service. To dry, warm the part in a well ventilated oven, or blow dry compressed air over it at low pressure.

WARNING

Great care must be taken to prevent fire when using benzine, gasoline, or other petroleum distillates as cleaning agents. Cleaning with any type of solvent must be done in a location where there is good ventilation.

4–783. REMOVAL OF POTTED ELECTRICAL CONNECTORS.

a. After separating connectors from equipment tag the harness end of each wire and sever the wires approximately 4-½ to 5-½ inches from potted end of connector.

Note

Upon severing the wires make certain that each wire is staggered approximately 1 to 1-½ inches to provide sufficient splicing area upon reassembly.

b. Dispose of severed connector.

4–784. POTTING AND REPLACEMENT OF ELECTRICAL CONNECTORS.

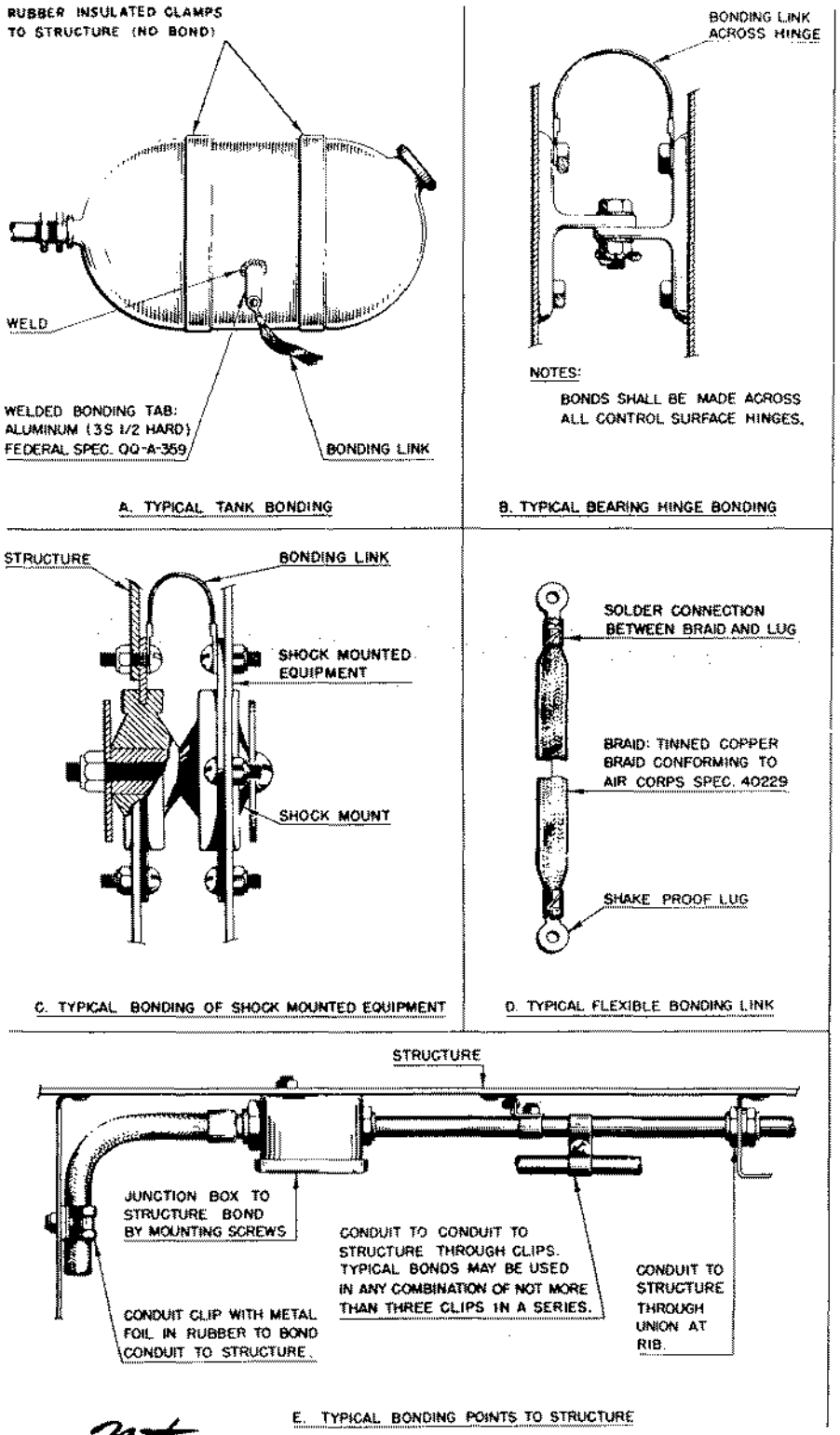
a. Connect and solder pigtails to new connector, making certain that the tagged wires of the harness correspond to wires and pins of the connector.

Note

Perform the soldering and potting process on a work bench.

b. Prepare the connector for potting by cleaning all surfaces of the connector, including pins and wires, to which the sealing compound must adhere by using one part of a mixture of cleaner No. 657, manufactured by Turco Products Co., and one part of cleaner, petroleum base, KUL, manufactured by Kelite Products Co. This can be accomplished by use of brush or forced flush spray from an air pressure gun.

c. Form a potting shell around the connector with either polyethylene tape (500 Gauge) manufactured by Dupont, or formed shells.



Note

WHEN ELECTRICAL ITEMS ARE REMOVED AND REPLACED, IT IS IMPERATIVE THAT THE FAYING SURFACES BE CLEANED FOR GOOD BONDING FOR RADIO NOISE REQUIREMENTS.

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Figure 4-156. Electrical Bonding

TYPICAL BONDING PROCEDURE

1. Metal parts of the airplane which do not make good electrical contact with the airplane structure shall be bonded to structure. See examples A, B, C, and E.

2. Other bonding requirements:

a. Engine-to-engine mounts shall be bonded adequately to carry the power current return.

b. Fuel lines and fittings need not be bonded if the combination is less than 3 inches in longest dimension; neither need they be bonded if their resistance to structure is less than one-half megohm.

c. Metal-to-metal connections shall be so installed that vibration, expansion or contraction, or relative movement incident to normal service use will not break the bonding connection nor loosen them to such an extent that the resistance will vary during the movement or increase above the permissible maximum value.

Bonding requirements are considered as being met inherently by permanent metal-to-metal joints made by welding, brazing, sweating, or swaging or by semi-permanent metal-to-metal joints of machined metal surfaces held together by lock-threaded devices, riveted joints, tie rods, or structural wires under heavy tension, pinned fittings normally permanent and immovable after installation if all insulating finishes are removed from the contact area before assembly.

Insulating finishes need not be removed to comply with paragraph 5, if resistance requirement is met without such removal.

3. When tubular or cylindrical members are bonded, the bonding jumper shall be fastened to the member to be bonded by means of a plain clamp. Cushion clamps are not acceptable.

4. Metallic conduit carrying electrical wiring shall have a low resistance bond of less than one ohm to structure at each terminating and break point. Bonding path may be through the equipment at which the conduit terminates.

5. All isolated conducting items (except antennas) having any linear dimension greater than 3 inches, shall have a mechanically secure electrical connection to the aircraft structure having a resistance of less than one-half megohm to prevent accumulation of static charge.

6. Control surfaces and flaps shall have a bonding jumper across each hinge, and in any case, shall not be less than two jumpers.

7. Large nonconducting projections essential to flight or housing of personnel, such as vertical stabilizers, wing tips, and canopies, shall have a suitable lightning path externally disposed over their exposed area and leading to the aircraft skin.

Note

Make sure that the inside of the mold area is free of grease, oil, etc.

d. Secure the taped shell in place with masking tape, Federal Specification UU-T-106, Type I. Allow the polyethylene tape or shells to extend approximately ⅜ inch above the exposed solder joints of the wire to the pins.

Note

If preshaped molds or shells are used, masking tape is not required. Talc or soapstone may be used for mold or shell release.

Molds or shells with provisions for electric bonding shall be potted after bonding device is securely installed.

e. Prepare to pot the mold or shell by mixing the brown accelerator supplied with the Potting Compound Kit, No. PR8001K, Type I, manufactured by Products Research Co. Mix the basic compound thoroughly and slowly to prevent entrapping air bubbles, and until a uniform color is obtained.

f. Pour the mixed sealant into the molds or shells. While pouring or forcing the sealant into the mold, work the wires to enable the sealant to flow around each wire and electrical connection. The mold shall be filled with sealant to a minimum of ¼ inch above the soldered joints ($\frac{3}{16}$ inch minimum insulation coverage).

Note

Where necessary to prevent entry of the sealing compound into the unpotted section of the connector, small quantities of Specification MIL-S-7124 putty may be applied to small holes before filling the mold.

Where connectors, such as right angle connectors without cable clamps, are potted, the mold or shell shall be filled to provide support for the wires at the point of exit from the shell.

g. Potting Compound No. PR8001K, Type I, manufactured by Products Research Co., has a pour time of one hour ±30 minutes, and a cure time of 24 hours at 25°C (77°F). However, a sufficient cure of the sealant can be obtained in approximately one hour of hot air curing at 38° – 49°C (100° – 120°F) provided that the relative humidity can be above 40 percent.

Note

Before heat curing allow the compound to air dry for ½ hour in the mold. Sealant is cured enough to be removed from heat when the surface of the compound no longer sticks to a dry finger.

Reduction of the temperature or the humidity requires increased curing time.

If it is necessary to make a quick sealing of the connector use Potting Compound No. PR-8101K, Type II, "fast cure", manufactured by Products Research Co. by following the procedure as outlined in step e and h.

h. Potting Compound No. PR8101K, Type II, "fast cure" has a pour time of 15 minutes minimum, and a cure time of eight hours at a temperature of 25°C (77°F). However, the cure time can be reduced to ½ hour of hot air curing 38° – 49°C (100° – 120°F) provided that relative humidity can be above 40 percent.

Note

Before heat curing, allow the compound to air dry for 15 minutes minimum in the mold. Sealant is cured enough to be removed from heat when the surface of the compound no longer sticks to a dry finger.

Reduction of the temperature or the humidity requires increased curing time.

i. If the connector is to be installed in the airplane, remove the masking tape and polyethylene tape when potting has thoroughly cured, otherwise leave tape on connector for handling and storage purposes.

Note

If potted connectors are to be placed in storage, dead end the exposed wire ends.

j. Wires leading out of potted connector shall be tied in a bundle using twine, Specification JAN-T-713, as close to the connector as practicable, and in any event within 4 inches.

k. Splice wires corresponding to tagged harness wires and potted connector pins wires using proper wire size two-way connector and using prescribed tool for permanent crimping.

Note

All spliced wires using the permanent two-way connector splice shall be covered with proper size flexible plastic tube, tube ends extending over the insulated part of the wire not less than ½ inch and tied over the middle of the tubing and the middle of the permanent splice connector using twine, Specification JAN-T-713.

l. Make a complete harness assembly of wiring and perform a continuity check of circuit.

4-785. DESCRIPTION OF ELECTRICAL WIRING. Individual circuit diagrams of all electrical circuits are shown in Section VIII. Included with each diagram is an item list, and a sketch of the airplane showing location of units and wire routing. Items are cross-referenced between the wiring diagram, the perspective inset, and the item list.

4-786. INSTALLATION OF DISCONNECT PLUGS. Lock-wire all AN connectors attached to engine and engine mounted equipment with 0.020 to 0.032-inch steel wire. Lock-wire all others with the exception of those connectors attached to shock mounted equipment and panels. Lock-wire the drilled screw-heads of the adjustable, square flange type, the split-shell type, and the cable clamp type connectors; undrilled screws will require the use of AN936, type A, lockwashers under the screw heads. All AN connectors not having provisions in the coupling ring for lock-wiring shall be secured by wrapping two turns of wire around the connector shell in back of the coupling nut and securing the wire to a drilled screw-head or safety lug.

4-786A. CONNECTING ELECTRICAL POWER TO AIRCRAFT.

WARNING

Perform the following before connecting electrical power to aircraft either from aircraft batteries or an external power source.

a. Check the AFTO Form 781 or other applicable forms.

b. Advise other personnel working on aircraft that the electrical system is about to be energized.

c. Check to insure that the fuel booster pump switches in both cockpits are set in the "OFF" positions.

WARNING

Continuous operation of booster pumps when fuel tanks are empty could result in grave danger to personnel and equipment.

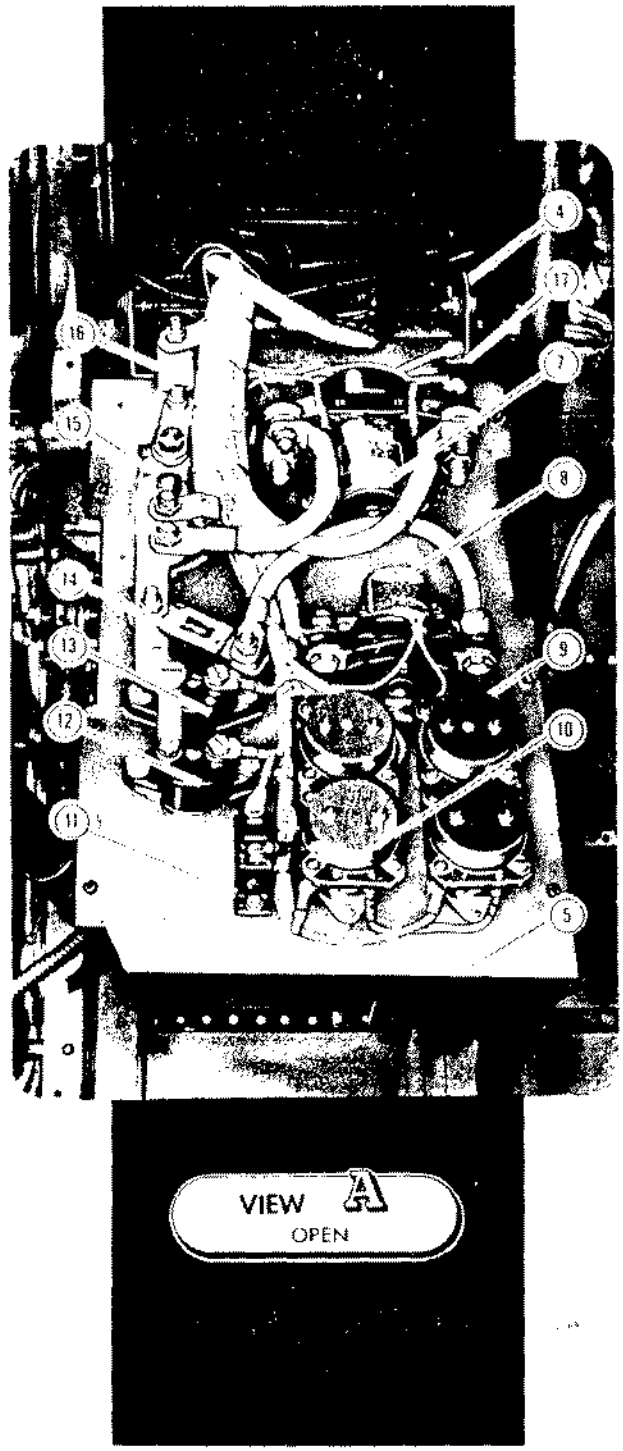
d. Check all other switches and controls for "OFF" or "SAFE" positions. Do not allow inverters or other equipment to operate unless specifically required for maintenance or engine run-up purposes. Needless operation of electrical and electronic equipment and instruments will shorten their useful service life.

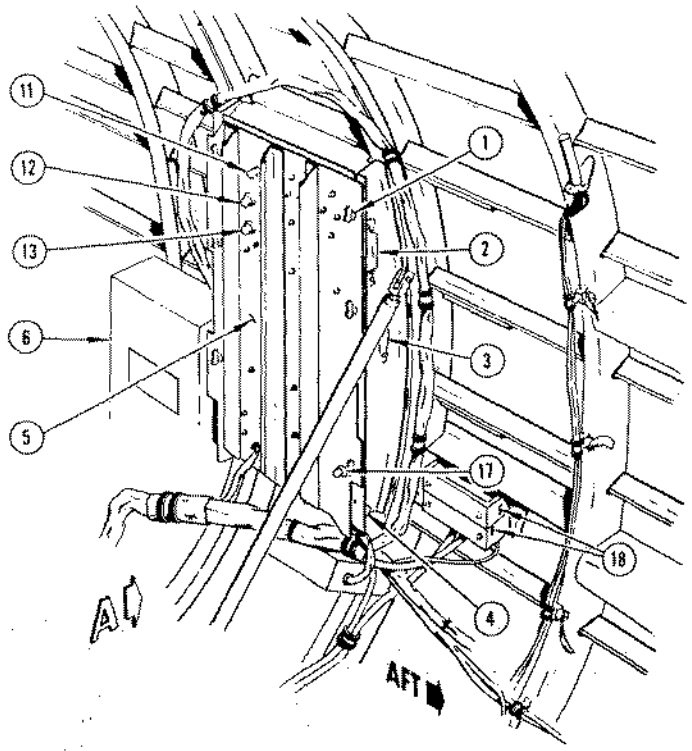
4-787. BATTERY AND GENERATOR CIRCUIT (AIRPLANES NOT INCORPORATING T.O. 1T-33A-577.) *(See figures 8-5 through 8-13.)* Power for the airplane direct-current electrical system is supplied by a 300-ampere, 30-volt generator. In addition to the generator, two 12-volt batteries in series supply power when the generator is not operating, or when generator voltage drops below 26 volts. Accessory equipment in the battery and generator circuit includes a voltage regulator, reverse current relay, generator fuse-type circuit protector, battery relay, ammeter, and ammeter shunt. Two external power receptacles at the right wing-fuselage junction provide for connection of battery carts for engine starting or for ground checking of electrical apparatus. These receptacles are wired in parallel and either or both may be used. External power potential must not exceed 30 volts. When available, both DC cables from ground power units will be connected to the external power receptacles during engine starting operations.

CAUTION

Constant current jet engine starting units should not be plugged into these external receptacles because of possible damage to electrical and electronic equipment. Only those variable units incorporating oval plugs should be utilized. On AF Serial No. 52-9635 and subsequent, an external shield is attached to each external power receptacle to preclude use of constant-current plugs.

4-788. The battery is connected to the 24-volt bus through a type B-14 relay in the armament compartment aft of the batteries. The relay is controlled by a battery switch on the forward cockpit right shelf and a battery-generator switch on the aft cockpit right shelf. The canopy external switches are wired to this relay so that





1. JUNCTION BOX FASTENERS
2. SPARE GENERATOR CURRENT LIMITER
3. SPARE FLUID INJECTION CIRCUIT CURRENT LIMITER
4. JUNCTION BOX HINGE
5. ENGINE COMPARTMENT JUNCTION BOX COVER
6. STARTER RELAY PANEL
7. EXTERNAL POWER RECEPTACLE RELAY
8. FLUID INJECTION RELAY
9. R.H. FLAP RELAY
10. L.H. FLAP RELAY
11. GENERATOR FIELD COIL CIRCUIT PROTECTOR
12. L.H. FLAP CIRCUIT PROTECTOR
13. R.H. FLAP CIRCUIT PROTECTOR
14. FLUID INJECTION CIRCUIT CURRENT LIMITER
15. AMMETER SHUNT
16. GENERATOR CIRCUIT CURRENT LIMITER
17. DYNAMOTOR CIRCUIT PROTECTOR
18. EXTERNAL POWER RECEPTACLES

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Figure 4-157. Engine Compartment Junction Box

they connect the battery to the bus. Thus the canopy circuit may be operated whether the battery switch is OFF or ON.

4–789. The generator is controlled through the reverse current relay by the generator switch on the forward cockpit right shelf and the battery-generator switch on the aft cockpit right shelf. The reverse current relay also disconnects the generator from the bus in the event of a reverse current flow. Constant generator voltage is maintained by the voltage regulator.

4–790. Two ammeters used in conjunction with an ammeter shunt, give continuous indication of generator load. The ammeter shunt is in the engine junction box. (See figure 4-157.)

4–790A. BATTERY AND GENERATOR CIRCUIT (AIRPLANES INCORPORATING T.O. 1T-33A-577). *(See figures 8-13A through 8-13E.)* Aircraft direct-current power requirements are supplied by either a 400-ampere generator or by two series connected 12-volt batteries. Additional components of the system are a voltage regulator, a reverse current relay, external power receptacles, loadmeters, shunt and associated relays and circuit protectors. The system has been wired to prevent complete failure of the electrical system in the event the generator is disabled. When available, both DC cables from ground power units will be connected to the external power receptacles during engine starting operations.

4–790B. Power is supplied from the power source to the dc buses. During normal operation the batteries and generator are connected in parallel to the dc buses. For this type of operation the battery-generaor switches in both cockpits must be in the BATT & GEN position. In the event of generator failure, the batteries supply power to the dc buses.

4–790C. BATTERY AND GENERATOR CIRCUIT (AIRPLANES INCORPORATING T.O. 1T-33A-577 AND 1T-33A-628). *(See figure 8-13A sheets 1 through 5.)* The BATTERY-GENERATOR switch, installed in accordance with T.O. 1T-33A-577, is replaced with an SPST switch labeled GENERATOR. The BATTERY switch is installed in the location of the FUEL CHECK-OUT switch removed in compliance with T.O. 1T-33A-515. The BATTERY-GENERATOR switch provides the pilot with a means of disconnecting the battery without disconnecting the generator from the DC bus in the event a battery becomes shorted.

Table 4-8. Electrical Cleaning Chart

EQUIPMENT TO BE CLEANED	DISASSEMBLED PARTS	CLEANING AGENT TO BE USED	SPECIFICATION OF CLEANING AGENT	PROCEDURE FOR CLEANING PARTS	SPECIAL CONSIDERATIONS
1. Motors Generators Starters Dynamotors Inverters Etc.	A. Armature	Solvent Benzene Naphtha	Fed Spec P-S-661 Fed Spec VV-B-231 Fed Spec TT-N-97	With air gun, spray agent on armature winding and scrub thoroughly with stiff non-wire brush. If spray gun is not available, armature may be dipped into agent, BUT NOT SOAKED. After all dirt has been removed, bake armature two to four hours at 93° C (200° F) in an open or circulating air oven, or if oven is not available, compressed air under low pressure (25 lb) may be blown into winding until thoroughly dry.	CAUTION Extreme care must be taken while spraying an inflammable solvent. Spraying must be done under open air conditions. The use of solvents such as carbon tetrachloride or trichlorethylene should be avoided for cleaning the armature as they are somewhat corrosive to the commutator.
	B. Field Windings and Housings	Naphtha	Fed Spec TT-N-97		
	C. Commutator	See above		After drying armature, check commutator.	
	D. Brushes	Benzene	Fed Spec VV-B-231	Wipe brushes with cleaning fluid.	Do not soak brushes in cleaning agent.
	E. Ball Bearings	Naphtha	Fed Spec TT-N-97	Spray bearings with cleaning agent. Dry in open air. Do not use compressed air to dry as dust particles may enter bearings. For lubrication see maintenance instructions for the unit.	CAUTION Never hold bearings between thumb and forefinger and revolve outer race by compressed air.
	F. Clutch (Starter)	Naphtha	Fed Spec TT-N-97	If not disassembled, wipe surfaces with cleaning agent. If disassembled, wipe each part.	Do not dip clutch assembly in cleaning agent.
2. Condensers Dielectrics Surfaces Electrode Surfaces Insulators		Acetone	Fed Spec O-A-51	Acetone is the best cleaning agent for dielectric parts in removing nitric acid precipitate caused by corona and arcing. It will attack rubber insulation, however, therefore all high tension wires should be removed from the part before cleaning. Wipe —DO NOT IMMERSE—surfaces of part with clean rag dampened with acetone. When the red color characteristic of the nitric acid precipitate no longer comes off on the cleaning rag, the part is clean.	Acetone is extremely explosive and toxic, and requires utmost care in handling. It should always be used in the open air or in a well ventilated room to prevent the fumes from becoming dangerously concentrated.
3. Induction Coils		Benzene	Fed Spec VV-B-231	Wipe coil with clean rag dampened with cleaning agent. DO NOT SOAK. Blow out with dry compressed air.	Do not use non-petroleum agents on coils insulated with varnish as these solvents cause insulation failure.
4. Antenna Insulators		Naphtha	Fed Spec TT-N-97	Wipe parts with rag moistened with cleaning agent.	
5. Magnetos	A. Breaker Points	Naphtha	Fed Spec TT-N-97		
	B. Pole Shoes, Housing Gears, etc.	Naphtha	Fed Spec TT-N-97		
6. Switches	Contacts	Naphtha	Fed Spec TT-N-97		
7. Miscellaneous Electrical Metal Parts (External)	Housing, Nuts and Bolts, Painted Exteriors	See 1, A above			
8. Batteries—Wet Cell	Outside Case and Terminals	A Creamy Solution of Baking Soda ($NaHCO_3$) and Hot Water Dilute Solution of Ammonia		Remove corrosion with a wire brush after which solution should be applied. When bubbling has stopped, wash off with plain water.	Do not let any solution get into the battery cells.

4–791. DESCRIPTION OF GENERATOR. *(See figure 4-66.)* The 30-volt generator is mounted on the accessory case of the engine. Connections to the generator are made at a terminal block on the side of the generator housing. The terminals are identified as follows:

Terminal	*Circuit*
A	Field Positive
B	Generator Positive
D	Equalizer (Not used)
E	Generator Negative

4–792. A failure warning light on each instrument panel is tied into the generator system through a relay. The relay is energized during generator operation. Failure of the generator deenergizes the relay and connects the warning lights to power.

4–793. REMOVAL OF GENERATOR.

a. Loosen two hose clamps securing generator cooling air shroud, and push hose back on rear tube.

b. Remove generator radio noise filter, and disconnect generator electrical cables.

c. Remove cooling shroud from rear of generator.

d. Remove six nuts and washers holding generator to case. Remove generator forward.

e. If another generator is to be installed, remove flame arrestor.

4–793A. PREPARATION OF ENGINE FOR INSTALLATION OF 300-AMPERE GENERATOR. This paragraph is applicable to engines which show compliance with T.O. 2J-J33-540 only.

a. Remove front upper half of air intake screen assembly. This assembly will have an enlarged generator blast tube opening.

b. Install generator cooling air tube assembly, Part No. 6803366, on front guide vane assembly using four washers, Part No. 6714977, and four bolts, AN103706. Safety each bolt with lock-wire AN995C32.

c. Install generator cooling air tube rubber grommet, Part No. 6807884, on removed screen assembly at generator cooling air tube opening.

d. Reinstall screen assembly, using removed attaching parts.

4–794. INSTALLATION OF 300 AMPERE GENERATOR. Reverse removal procedure. Use torque values shown in section VI.

Note

Liberally coat the male drive splines and pack the female spline shaft two thirds full of grease, Specification MIL-G-21164A FSN 9150-754-2595 or alternate lubricant Plastilube Number 3. Flame arrestor will not be installed.

4–794A. INSTALLATION OF 400 AMPERE GENERATOR ON J33-A-35 ENGINE. This paragraph is applicable to engines modified in accordance with T.O. 2J-J33-540 (airplanes incorporating T.O. 1T-33A-577). (See figure 4-157A.)

a. Remove front upper half of air intake screen.

b. Install generator cooling air tube assembly, Part No. 6807002, using four washers, Part No. 6714977, and four bolts, AN103706. Safety each bolt with lock-wire, AN995C32.

c. Install generator cooling air tube rubber grommet, Part No. 6807122, on removed screen assembly at generator cooling air tube opening.

d. Reinstall screen assembly, using removed attaching parts.

e. Remove two nuts, Part No. 365-524, and two washers, AN960C516, from two bottom tachometer generator adapter mounting studs.

f. Install generator upper leg support assembly, Part No. 6807173, on two bottom studs and secure this assembly with two thin washers, Part No. 960C516L, and two nuts, Part No. JL65-524B (6749115-524). (See figure 4-157A.)

g. Install generator low leg support assembly, Part No. 6807084, and secure its lower end by removing bolt, AN75-10, and washer, AN960C516. Safety bolt with lock-wire. (See figure 4-157A.)

h. Secure generator end of both upper and lower leg support assemblies in the following manner.

i. On eyebolt, Part No. 6807085, install in sequence: nut, Part No. 6749289-2; washer, AN960C516; generator cradle support assembly, Part No. 6807082; washer, AN960C516; and check nut, Part No. 6749185. Run nuts on eyebolt so that cradle will be positioned toward lower end of eyebolt threads. (See figure 4-157A.)

j. Install generator support pad, Part No. 6807110, on generator cradle support assembly, Part No. 6807082.

k. Install eyebolt subassembly between upper ends of generator upper leg support, Part No. 6807183, and generator lower leg support assembly, Part No. 6807084, by installing bolt, Part No. 101211, from aft side through upper leg support, eyebolt, and lower leg support. Secure with washer, Part No. AN960C516, and self-locking nut, Part No. 6739949-054. (See figure 4-157A.)

l. Adjust nuts on eyebolt so that cradle support pad will be in contact with bottom of generator and lower nut will be finger tight. Then tighten lower nut one full turn, and tighten upper nut to lock assembly in this position.

4–795. MAINTENANCE OF GENERATOR.

a. Remove generator from airplane and place it on workbench, preferably on wooden V-blocks.

aA. Check generator male splines for excessive wear or damage. If any tooth is worn in excess of 25 percent of original dimension on shaft spline, replace generator.

aB. Check commutator for burned bars. A slightly darkened appearance is normal under good operating conditions. Check for grooves with a depth gage or suitable substitute. If grooves have reached a depth of $\frac{1}{32}$ inch or more, replace the generator with a serviceable generator.

Note

If grooves are present but have not reached a depth of $\frac{1}{32}$ inch, do not remove the generator as this condition is not detrimental to the generator operation.

aC. If generator passes the above checks, proceed with the brush spring tension check.

b. Use spring scale QB80004-3 and measure tension of brush springs.

Note

Place the hook under spring where it rests on brush. Pull on scale should be in line with point where finger rests on brush and parallel to sides of brush. Scale should be jiggled up and down as pull is exerted to minimize effects of friction. When spring is raised to position where it would normally be when resting on a new brush, scale should register a spring tension within tolerances specified in table 4-9. The above procedure may be followed for all generators except Jack & Heintz part No. G300-4B. For this particular generator, check brush spring tension by using a new brush with a narrow groove cut vertically around it. With a wire located in the groove and a scale attached, raise brush until it is flush with bottom of brush holder assembly. The new brush with the groove cut on its side will not be considered serviceable. If spring tension in any generator is not as specified in table 4-9 replace generator.

c. Remove defective brushes and clean brush boxes and commutator as necessary. Slide a strip of No. 0000 or finer sandpaper (not emery cloth) around commutator, abrasive outward, lap it for direction of rotation of generator, and secure temporarily with string. Do not use adhesive (glue or varnish) to secure sandpaper. To do so may cause irreparable damage to brushes, commutator, or both. If commutator is so worn that sandpaper will not lie smoothly, generator shall be replaced.

d. Obtain a new set of brush assemblies. Place brushes in brush holders. Do not snap them down on sandpaper. Secure brush terminals to brush holders. Make certain that sandpaper is wrapped smoothly around commutator and that all brushes are in place. Rotate armature assembly turning it slowly counterclockwise (looking at drive end) so as not to dislodge sandpaper. From time to time lift brushes for inspection. Wearing face of each brush should be hollowed out from edge to edge. Do not sand any more than necessary to obtain this fit on all brushes. When sanding-in is completed, remove all brushes. Remove sandpaper. Blow out commutator end of generator. Return brushes to their holders. To settle brushes, again rotate armature assembly counterclockwise (looking at drive end). Once more blow out commutator end of generator.

e. Brushes which have been sanded must be "run-in," that is, they must be seated to the contour of commutator. Brushes may be "run-in" by operating generator at 3000 to 5000 rpm and with 90 to 120 amperes load current until each brush is seated to the degree specified in table 4-9. At intervals during "run-in" commutation should be observed. If excessive arcing takes place and inspection reveals that brushes are properly contour-sanded, replace generator.

f. A varidrive or other variable speed unit of 20 horsepower or more is required to drive generator. Cooling air must be supplied at rate of 115 cubic feet per minute (minimum) at a pressure equal to six inches of water in a three inch diameter blast tube. Provide a transparent cover band for observing commutation during test, and provide a means of loading generator from 0 to 300 amperes at 30 volts direct current. Unless facilities are available as described above, brush replacement shall not be accomplished.

4–796. FLASHING GENERATOR FIELD.

a. Occasionally it is found that a generator that operated satisfactorily during a previous flight will not develop any output during engine run-up in preparation for next mission. Such a condition should not be readily accepted as an indication that residual magnetism of

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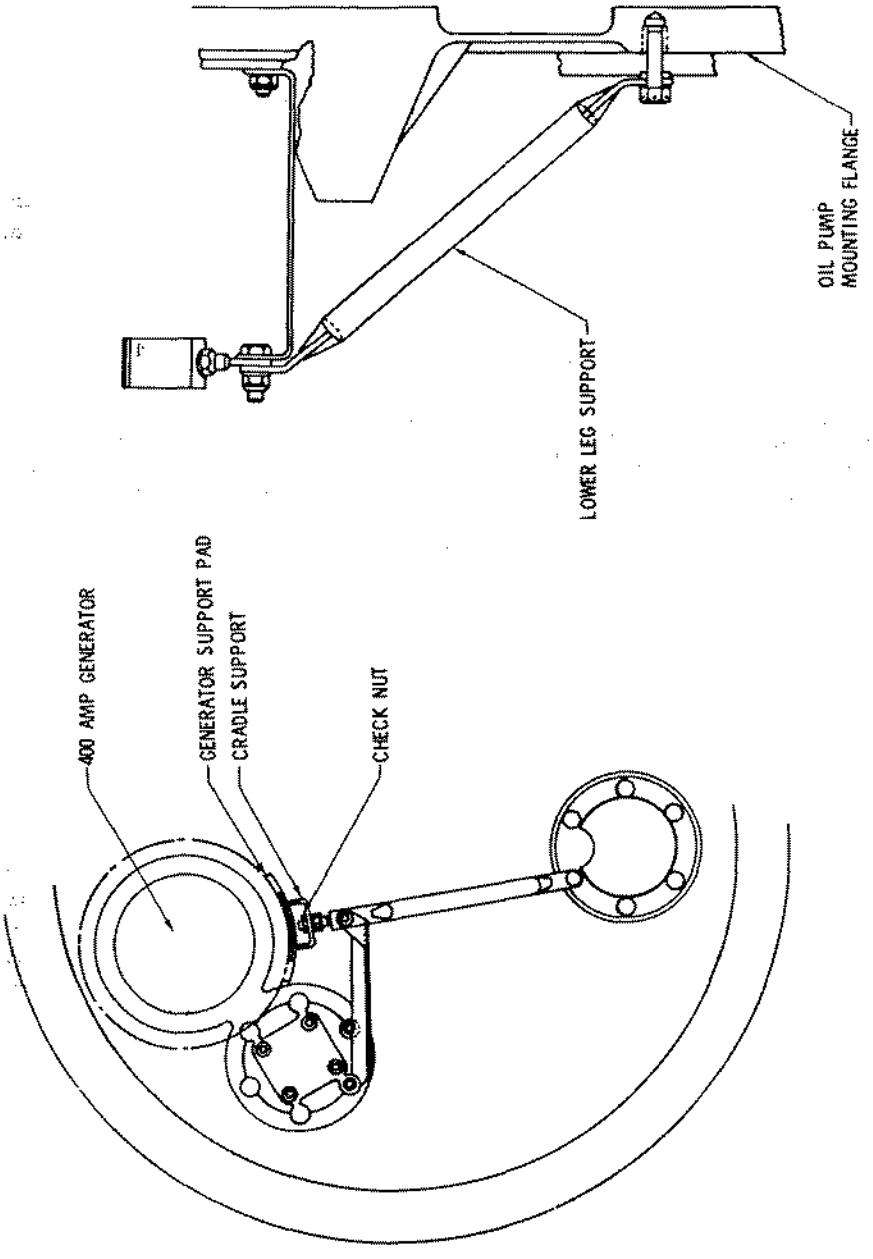


Figure 4-157A. Generator Support Installation

generator is weak or nonexistant. In most of these instances, other defects are responsible for the apparent inability of generator to function properly for lack of residual magnetism. A peculiar characteristic that often serves to strengthen the theory of lost residual magnetism is the fact that flashing the field of a generator will restore its output in a majority of cases in which the generator was inoperative due to other causes. For this reason it is essential that a thorough inspection be made prior to flashing the field of a generator that appears in normal condition but is not capable of self-excitation. Laxity in this respect will invariably result in the need to flash the generator field at every engine run-up. This is undesirable as continuous flashing of the generator field can cause permanent damage to generator. Furthermore, conditions will undoubtedly be overlooked that can only become progressively worse and may eventually lead to failure of generator in flight. To ascertain that flashing the field is accomplished only when failure of generator is due to a loss of residual magnetism, inspect affected generator and associated voltage regulator for the following conditions:

Brushes excessively worn.

Brush spring tension too low.

Brushes binding in brush holders.

Commutator, dirty, rough, pitted, or eccentric.

Regulator base contacts are corroded.

Connections in circuit between generator and voltage regulator dirty or corroded.

b. In the absence of all possibilities listed above, it is reasonable to assume that generator inability to develop voltage is due to a loss of residual magnetism. This discrepancy may be corrected by flashing the field of the affected generator in the following manner:

Turn battery switch "ON" and leave generator switch "OFF."

Remove voltage regulator from mounting base.

Place a jumper from a convenient battery voltage source to "A" terminal on voltage regulator base, for approximately one second.

If necessary, repeat above operation two or three times. Should generator fail to develop output after third application of voltage to its field, replace generator.

WARNING

Do not flash field by closing reverse circuit relay contacts. Such action may result in serious damage to relay, electrical system, or to personnel by heavy current drawn from batteries.

Note

A jumper assembly, consisting of a switch and No. 16 gage wire, should be used to apply battery voltage. The switch is necessary in order to prevent sparking and damage to terminals.

4–797. TROUBLE SHOOTING OF GENERATOR.

Trouble	*Probable Cause*	*Remedy*
Low voltage output.	Voltage regulator out of adjustment.	Adjust voltage regulator.
	Worn or damaged brushes.	Replace brushes.
	Loss of residual magnetism.	Flash generator field. Refer to paragraph 4–796.
High voltage output.	Regulator out of adjustment.	Adjust or replace voltage regulator.
	Defective generator.	Replace generator.
Generator housing overheated, broken, cracked, or other structural defects.	Generator overloaded. Construction flaw.	Replace generator.

Trouble	*Probable Cause*	*Remedy*
Air blast tube broken or cracked. Stripped threads in holes that accommodate cap retaining screws.	Air blast tube misaligned or too rigid.	Replace generator if threads in blast cap retaining screws are stripped. If above defect is not found to exist and all damage is confined to blast cap only replace blast cap.
Mounting flange cracked, broken, or other structural defects. Elongated holes in nonbutton type hole mounting flange. Worn or elongated recess in narrow part of mounting holes in button type hole mounting flange.		Replace generator.
Radio noise filter condenser. Loose connections. Broken mounting brackets. Loose condenser. Loose mounting bracket. Dents in outer case of condenser.	Lead not properly tightened. Bracket not securely attached to generator.	Repair filter condenser mounting attachments as necessary. Any component with damaged threads must be replaced including screws. Loose filter condensers may be reused except when dents or other physical damage is evident or in cases where filter is found to have become separated from generator and is recovered after having been lodged in some part of the engine.
Terminal block connections loose. Post bent, loose, cracked, broken, overheated, or burned damaged threads on terminal block mounting screws or in matching holes in field frames. Burned external leads.	Leads not properly tightened at time of generator installation. Insufficient slack in leads. Generator overloaded.	Tighten all loose connections, terminal blocks and terminal block mounting screws. Replace generator if evidence of overheating is apparent. If any of terminal block components or connections indicate having been subjected to heat or if threads in field frame are damaged and if burned insulation is found on cables connecting "B" and "E" posts, replace generator.
Brush coverband cracked, holes, dents, or dirty.	Improper handling. Arcing to brush leads.	Tap out small dents and clean as required. If other defects worse than minor dents are present, install a new brush coverband.
Armature, oil soaked, burned commutator.	Defective engine drive seal. Weak brush springs. Poor commutation.	Replace generator.
Brushes worn, burned, cracked, chipped, binding loose rivets, corroded, burned or broken leads, loose terminals on brush leads.	Weak brush springs, improper handling, corrosion in brush boxes.	Brushes that are not burned or binding may be replaced. Measure brush length and refer to table 4-9 for minimum permissible length. Replace brushes that are not worn to the maximum wear limit but which are likely to wear below minimum permissible length prior to next anticipated inspection. Replacing brushes necessitates removal of generator. Replacement of brushes will be accomplished in accordance with paragraph 4–795.

Table 4-9. Generator Component Maintenance Limits

Generators			*Brush Spring Tension (Ounces)*	*Minimum Brush Length (Inches)*	*Minimum Contact Area Between Commutator and Brushes When Seating New Brushes*
Mfgr	*Type*	*Part No.*			
G. E.	R-1	2CM73B3	15 to 23	1/4 inch from brush lead rivet.	Properly seated brushes must show contact 100 percent across brush thickness in direction of rotation and for at least 70 percent of brush width in direction parallel to shaft. This insures proper commutation without arcing, which is desirable since arcing is one of the primary causes of rapid wear of brushes.
G. E.	R-1	2CM73B6	15 to 23	1/4 inch from brush lead rivet.	
J & H	R-1	2000-3	22 to 28	9/16 inch from top of brush.	
WH	DF-30	A24A9315-2A	24 to 32	5/8 inch from top of brush.	
G. E.	DF-30	2CM75C10	24 to 36	1/4 inch from brush lead rivet.	
G. E.	DF-30	2CM75D2	24 to 36	1/4 inch from brush lead river.	
WH	E-30	A28A8584(1)	28 to 36	3/4 inch from top of brush.	
G. E.	E-30	2CM75D6	30 to 47	Maximum wear slot is cut in side of brush.	
J & H	E-30	G330-4B	45 to 57	11/16 inch from top of brush.	
LX		30B43-1A	46 to 50	Maximum wear slot is cut in side of brush.	

4–798. VOLTAGE REGULATOR. Constant generator output voltage is maintained by the voltage regulator mounted in the left wing fillet. The regulating resistance is wired in series with the shunt field of the generator and maintains a constant generator output voltage by automatically controlling the generator field current. The equalizing coil of the voltage regulator is not used in this installation, since only a single generator is used.

4–799. ADJUSTMENT OF VOLTAGE REGULATOR. *(See figure 4-158.)*

a. Start engine and allow to warm up. The generator and voltage regulator should be at operating temperature before making adjustments.

b. Turn generator switch to the OFF position.

c. Connect a 30-volt precision voltmeter to terminals B and G of voltage regulator base.

d. Drive generator at rated speed at no load.

e. Adjust regulator by means of the rheostat adjusting screw so that voltmeter reads 28.0 volts.

f. Turn generator switch to the ON position.

g. Apply highest available load by turning on inverters, radios, and lighting equipment, and check that voltage equals 28.50 (±0.5) volts.

h. Turn switches to the OFF position, and stop engine.

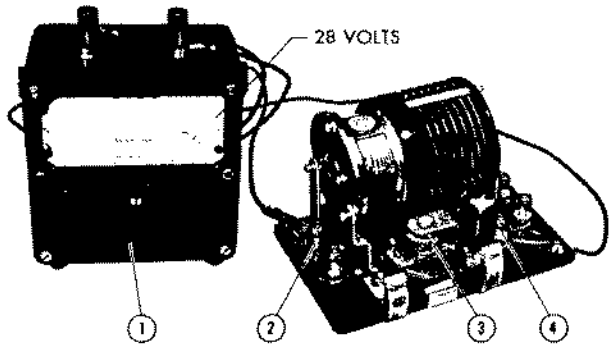
i. Disconnect and remove precision voltmeter.

4–800. REVERSE CURRENT RELAY. *(See figure 4-159.)* The reverse current relay, in the right wing fillet is accessible when the flaps are extended. It prevents the battery from discharging into the generator at low engine speeds.

Note

Do not attempt adjustment, replace if defective.

4–801. BATTERY. *(See figures 4-160 and 4-161.)* Two 12-volt, series connected, high-discharge rate batteries are located in the armament compartment. Current from the batteries is impressed upon the power bus through the battery power relay which is controlled by switches in the cockpit. Either battery switch disconnects the battery from all circuits except the canopy actuator circuit,



1. PORTABLE PRECISION VOLTMETER
2. "G" TERMINAL (VOLTMETER NEGATIVE)
3. THUMB SCREW ADJUSTMENT
4. "B" TERMINAL (VOLTMETER POSITIVE)

ECLIPSE VOLTAGE REGULATOR SHOWN OTHER CARBON PILE TYPES SIMILAR.

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Figure 4-158. Voltage Regulator Adjustment

prior to AF Serial No. 49-922. On AF Serial No. 49-922 through 51-4140, the canopy actuator and bomb and chemical tank circuits are independent of the battery switches. On AF Serial No. 51-4141 and subsequent the canopy actuator and centerline tip tank circuits are independent. Do not use batteries for starting except in an emergency.

Note

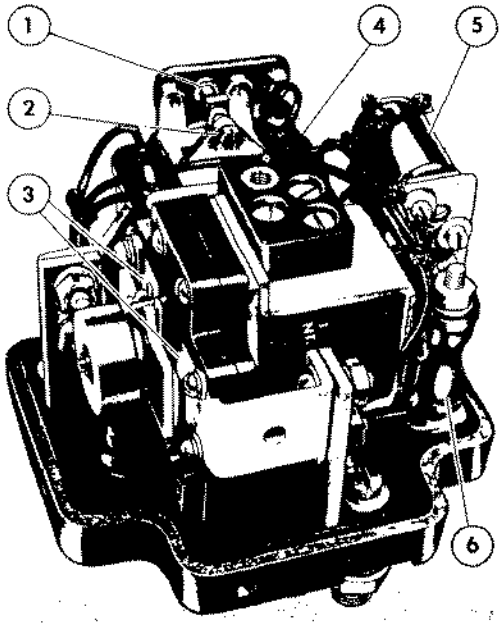
Operation and maintenance instructions for nickel-cadmium batteries are outlined in T.O. 8D2-3-1.

Operation and maintenance instructions for K-1 lead-acid batteries in MAP T-33A aircraft are outlined in T.O. 8D2-1-31.

4–802. Two battery sumps are installed below the batteries. The sumps contain pads saturated with a solution of sodium bicarbonate and water when lead-acid-batteries are installed and a 3 percent by weight solution of boric acid and water when nickel-cadmium batteries are used. The sumps are vented overboard.

CAUTION

Check and adjust the electrolyte level only after a nickel-cadmium battery has been recharged. Do not use implements that have been used to service lead-acid batteries.



1. CONTACT SCREW
2. STOP SCREW
3. MAIN CONTACTS
4. POLARIZED RELAY
5. AUXILIARY RELAY ASSEMBLY
6. 82 OHM RESISTOR

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Figure 4-159. AN3025-1 Reverse Current Relay

4–802A. On airplanes incorporating T.O. 1T-33A-607A, an upward vent system (figure 4-159A) is installed on nickel-cadmium batteries. The upward vent system serves to vent the explosive gases generated by the batteries into the atmosphere.

4–803. ARCTIC OPERATION OF BATTERIES. The power output of a storage battery decreases as the temperature drops. At −29° C (−20° F) a battery will deliver only about one-sixth of its rated power, and conversely, the charging time will be greatly increased. Nickel-cadmium batteries are not adversely affected by cold weather.

4–804. Keep storage batteries fully charged at all times. The electrolyte in a fully charged battery has a lower freezing point than that in a partly discharged battery.

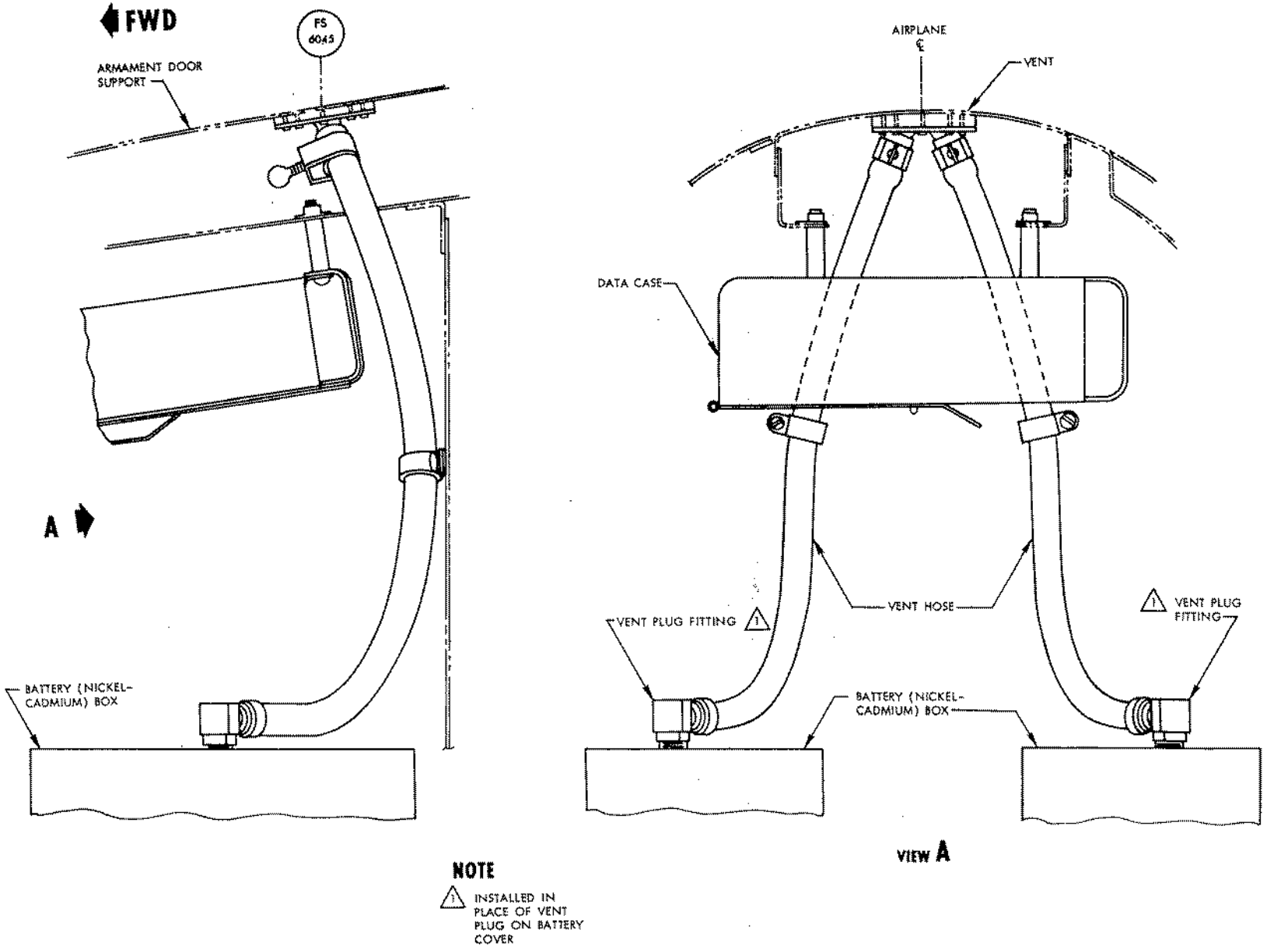


Figure 4-159A. Battery Upward Vent System Installation, Airplanes Incorporating T.O. 1T-33A-607A

Whenever the airplane is to be grounded for an appreciable time in sub-zero weather, remove the batteries and store them in a relatively warm room. If this is not possible, warm the batteries with a hot-air heater for about a half hour before starting.

4-805. REMOVAL OF BATTERY.
(See figures 4-159A, 4-160 and 4-161.)

a. Turn battery switch "OFF."

b. Disconnect battery drain tubes from acid vents on batteries.

c. Remove acid vent fittings from battery, and retain with drain tubes.

cA. On airplanes incorporating T.O. 1T-33A-607A, disconnect upward vent hoses and fittings from battery covers.

d. At forward end of battery, unscrew fiber nuts from battery forward connector, and remove connector.

e. Unscrew fiber nuts (left-hand threads) at aft end of battery, and remove power cable from left battery and ground cable from right battery.

WARNING

Do not pry cable connectors from battery terminals without loosening nuts; to do so may damage connector leads.

f. Break lockwire, lift hold-down clamp, and unscrew it.

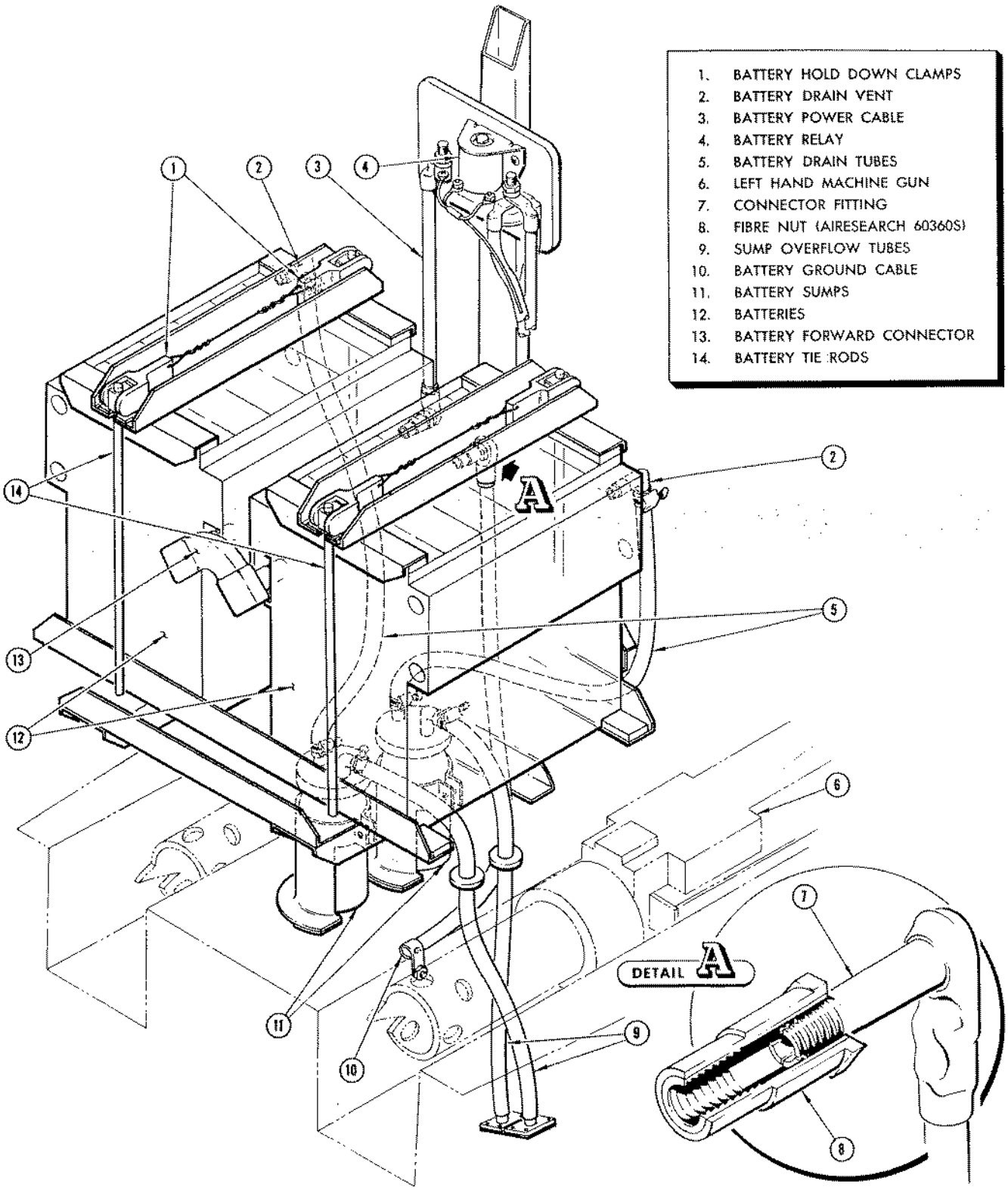


Figure 4-160. Battery Installation, Prior to AF Serial No. 49-967

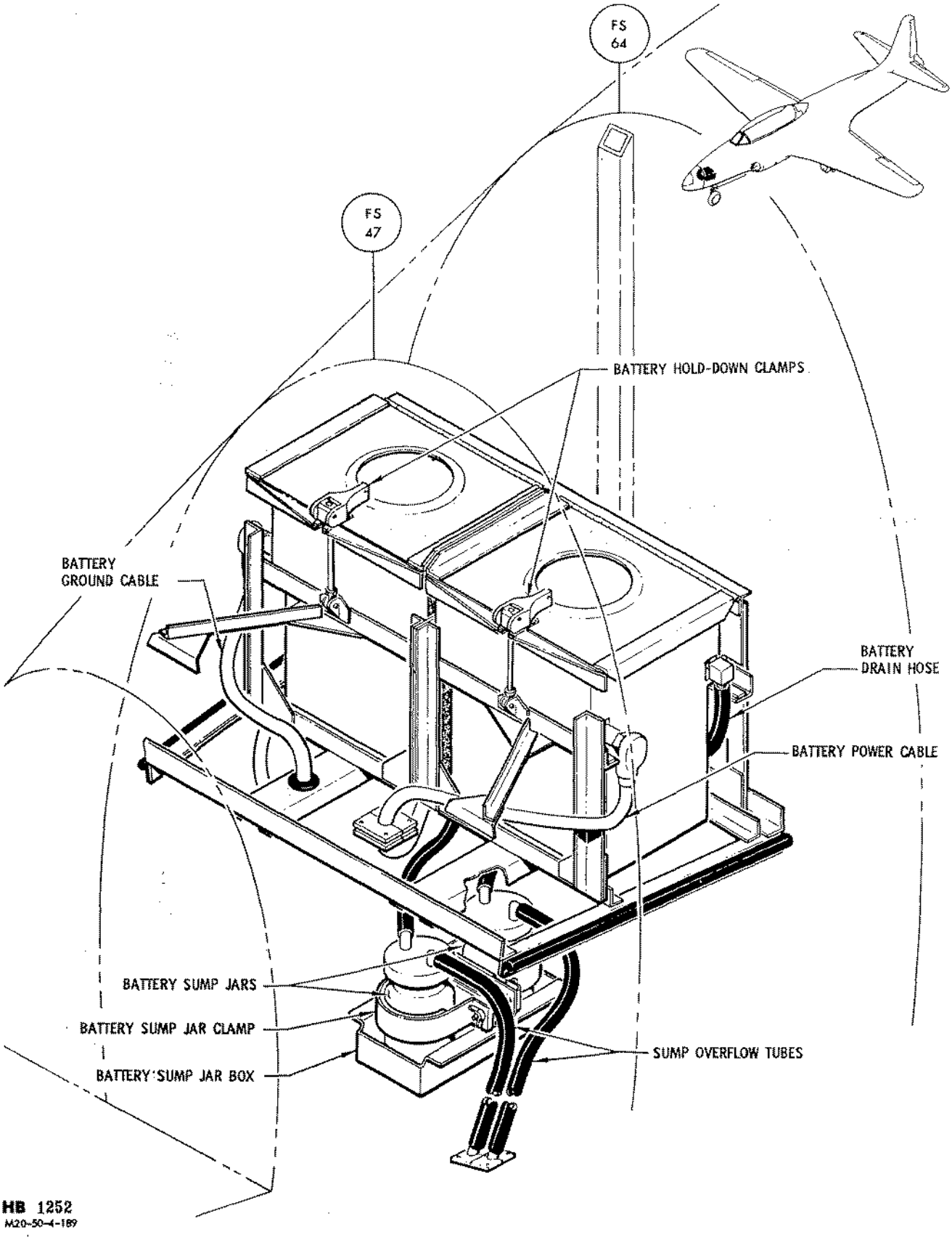


Figure 4-161. Battery Installation, AF Serial 49-967

g. Remove clamps and lift out battery. Batteries weigh approximately 76 pounds each.

Note

The battery cases are of transparent plastic and care should be exercised in handling batteries.

4–806. INSTALLATION OF BATTERY. Reverse removal procedure.

Note

End wrenches should be used to tighten the fiber nuts on battery connectors to adequately secure battery leads. Maximum torque for fiber nut is 150 lb in.

Fiber nuts are loosened by turning in a clockwise direction and tightened by turning them counterclockwise.

4–807. BATTERY AND EXTERNAL POWER RELAY. *(See figures 4-157, 4-160, 4-161, and 8-5 through 8-13.)* The battery and external power relays are single-pole, single throw, type B-14, 400-ampere continuous duty relays with normally open contacts. The relay has a pick-up voltage of 18.0 volts, and a dropout voltage of between 7 and 1.5 volts. The coil draws a maximum of 0.6 ampere at 29.0 volts.

Note

Do not lubricate this relay. Minute quantities of grease promote pitting and burning of the contacts.

4–808. The battery relay on airplanes prior to AF Serial No. 49-967 is located in the armament compartment on a structural member aft of and above the batteries. On airplanes AF Serial Nos. 49-967 and subsequent, the battery relay is in the armament compartment junction box.

4–809. The external power relay is in the engine compartment junction box.

4–810. REPLACEMENT OF B-14 RELAY CONTACTS. The relay contacts must be replaced before the contact material has entirely worn away. Replace contacts if they are badly pitted or burned, or if the following test shows replacement to be necessary. Disassemble relay as shown in figure 4-162, and replace both movable and stationary contacts. Reassemble relay.

4–811. TEST FOR B-14 RELAY CONTACT WEAR. The silver alloy contacts do not require filing, cleaning, or adjusting during their life. To determine when contacts should be replaced, disconnect wires from main contact terminals. Remove plastic cover from movable contacts. Operate battery switch. If a definite click is heard when contacts close, contacts have sufficient material and do not need replacing. If no click can be heard, replace both movable and stationary contacts.

4–812. STUDENT LOCKOUT CIRCUIT (PRIOR TO AF SERIAL NO. 53-5286.) *(See figures 8-14 through 8-18.)* The student lockout system is removed on airplanes incorporating T.O. 1T-33A-638. The circuit consists of fore and aft lockout relays, individual circuit lockout relays, amber indicator lights, lockout-, and lockout-release switches. The fore and aft lockout relays are in the aft cockpit right relay panel, and eight individual lockout relays are in the aft cockpit left relay panel. An amber indicator light is on each instrument panel to show that the cockpit without the telltale box is locked out. The lockout switch is in the telltale light box, and locks the trim tabs, dive flaps, and starting fuel switch circuits. Prior to AF Serial No. 50-385, the wing flaps circuit was controlled by the lockout switch. When the telltale light box is installed in the forward cockpit, the switch locks out the circuits in the aft cockpit; with the box installed in the aft cockpit, the switch locks out the forward cockpit circuits. The lockout-release switches on the left shelf of each cockpit are wired in series, and either one can unlock the circuit.

4–813. TELLTALE LIGHTS CIRCUIT (PRIOR TO AF SERIAL NO. 53-5286.) *(See figures 8-19 through 8-30.)* The telltale light box may be connected to either instrument panel. The box contains seven amber lights and the student lockout switch. The lights indicate that switches are being operated to elevator tab nose-up or nose-down, wing flap extend or retract, aileron tab left or right, or dive flap extended. These indications prevent application of power to both coils of a reversible motor.

4–814. STUDENT LOCKOUT SYSTEM (AF SERIAL NO. 53-5286 AND SUBSEQUENT). *(See figures 8-31 through 8-33.)* The student lockout system is removed on airplanes incorporating T.O. 1T-33A-638. A complete telltale indicator light system and lockout of the aileron and elevator trim tab circuit are incorporated as permanent installations in both the forward and aft cockpits. The student lockout box (refer to paragraphs 4-812 and 4-813) together with provisions for lockout of aileron trim tab, dive flaps and fuel sequence circuits are not installed.

4–815. The elevator trim tab lockout switch in the forward cockpit is under the left sill. In the aft cockpit it is on the lower left side of the instrument panel to the right of the emergency bomb salvo release button. These switches in addition to locking out the elevator tab circuit also lock out the aileron tab circuit due to the manner in which the two circuits are wired.

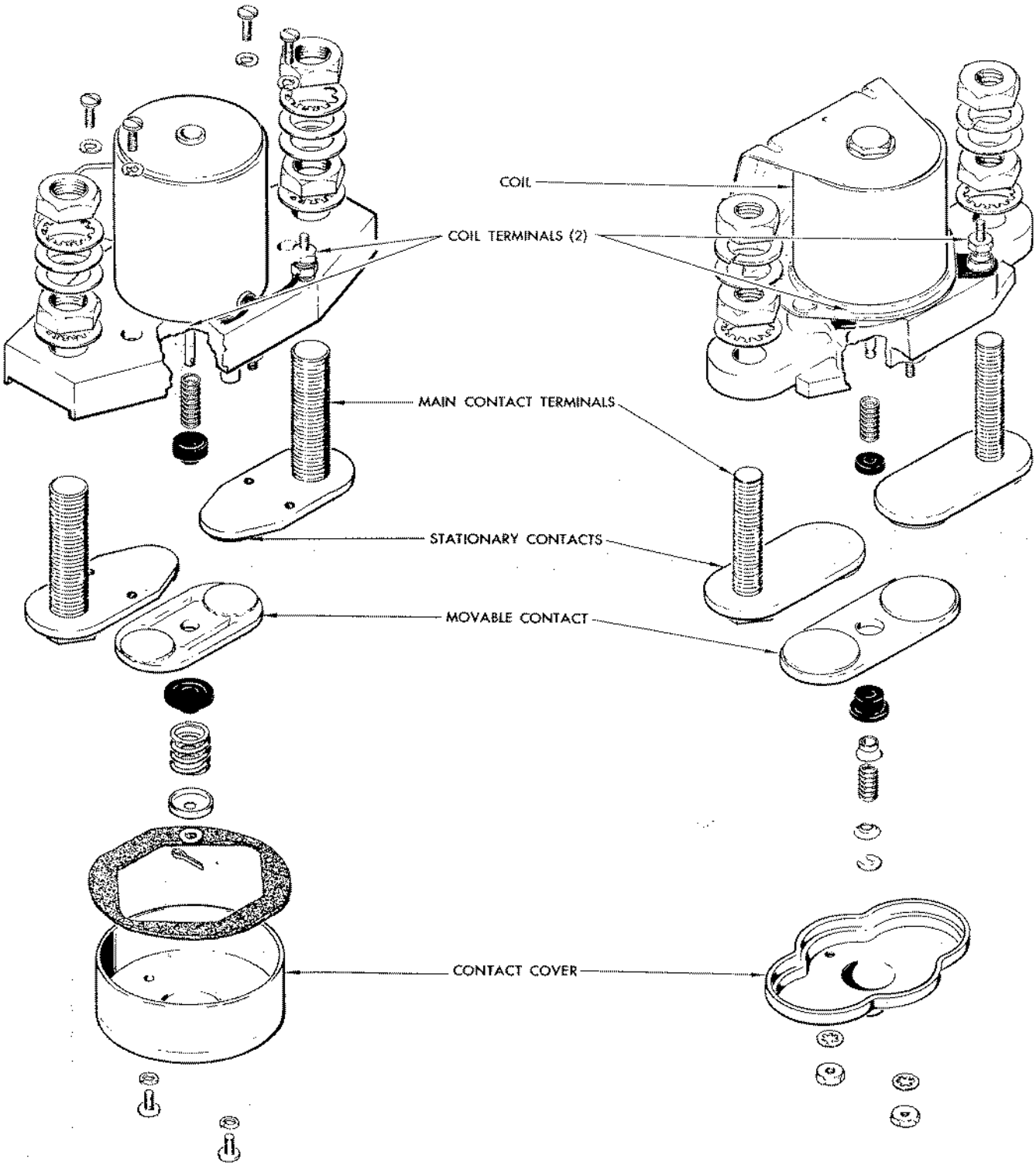


Figure 4-162. Replacement of Battery and External Power Relay Contacts

The eight indicator lights and a "DIM-BRIGHT" switch are on the left side of each instrument panel. The lock-out release switches are on the left shelf of each cockpit.

4–816. FUEL PUMPS CIRCUIT. *(See figures 8-37 through 8-53.)* The flow of fuel from the droppable tanks, wing leading edge tanks, and wing inboard tanks to the fuselage tank is controlled electrically from the fuel system switch panel on the left side of the forward cockpit. (See figures 4-78 through 4-80 for fuel system schematic diagram.)

4–817. A solenoid-actuated air shutoff valve controls the air pressure to the droppable tanks, which in turn controls the flow of fuel to the fuselage tank. The valve is controlled by a two-position toggle switch, and the circuit is protected by a 5-ampere push-to-reset circuit protector.

4–818. The wing leading edge tanks employ electrically driven fuel booster pumps to transfer fuel into the fuselage tank. Both pumps are operated simultaneously by a two-position toggle switch. The circuit is protected by a 35-ampere push-to-reset circuit protector.

4–819. The wing inboard tanks are provided with electrically driven fuel booster pumps mounted inside the aft inboard tanks. (See figure 4-85.) These pumps transfer fuel from the inboard tanks to the fuselage tank. Both pumps are operated simultaneously by a single two-position toggle switch. The circuit is protected by a 35-ampere push-to-reset circuit protector.

4–820. Fuselage fuel tank booster pump circuit and bypass and transfer valves circuits are controlled by a three-position switch on forward cockpit left shelf and a two-position switch on aft cockpit left shelf. Circuit between bus and switches is protected with a 15-ampere push-to-reset circuit protector. Circuit to transfer and bypass valves from forward cockpit switch is protected by a 10-ampere circuit protector, and circuit to fuselage fuel booster pump is protected by a 25-ampere push-to-reset circuit protector. Aft fuselage-tank-pump switch is wired to forward one so that it can override the forward switch when forward switch is in pump "ON" position, but cannot override when forward switch is in "BYPASS." On airplanes AF Serial No. 49-879 and subsequent, fuselage fuel tank booster pump is controlled through a relay in sub-cockpit junction box. Relay control circuit is protected by a 10-ampere push-to-reset circuit protector on aft cockpit left shelf. Power circuit to pump is protected by a 35-ampere push-to-reset circuit protector on forward cockpit left shelf. During normal operation, fuel is supplied to fuselage tank by wing tanks through transfer valves and fuselage tank float valves. Fuselage tank booster pump delivers fuel to engine fuel system.

4–821. The fuel flow from leading edge tanks and wing outboard tanks is controlled further by solenoid shut-off transfer valves. Two valves are used, one for the two leading edge tanks, and another for the four inboard tanks. The valves are installed in fuel system upstream of their respective fuselage tank float valves. The solenoid valves are wired in parallel, and are controlled by fuselage tank switches, one on each cockpit left shelf. Also a solenoid bypass valve is installed to allow fuel from the leading edge and inboard tanks to bypass around fuselage tank. This valve is wired in parallel with transfer valves in such a way that bypass valve is open when transfer valves are closed, and closed when transfer valves are open.

4–822. With the fuselage fuel tank switch "ON," fuselage tank pump is operating, transfer valves are open, and bypass valve is closed. With the fuselage tank switch in "BYPASS," bypass and transfer valve circuit is energized, closing transfer valves and opening bypass valve. In the "OFF" position, transfer valves are open and bypass valve is closed. The fuselage tank pump and its warning light are off. An amber indicator light directly above the fuselage tank booster pump switch glows whenever the fuselage tank pump circuit is energized.

4–823. On AF Serial No. 52-9635 and subsequent, except 52-9876 through 52-9905 and on airplanes incorporating T. O. 1T-33A-576, a fuel pump override toggle switch is installed on the aft cockpit left shelf to enable the instructor to turn on the wing and leading edge tank fuel pumps in the event the student fails to do so.

4–824. FUEL PUMPS. The fuel pumps are driven by 24-volt, direct-current, series-wound motors. For further information on pumps, refer to paragraph 4–430.

4–825. TRANSFER AND BYPASS VALVES. *(See figures 4-97 and 4-98.)* The three solenoid valves are in the fuselage mid-section hydraulic compartment. The transfer valves are normally open, and the bypass valve is normally closed. Continued application of electric power is necessary to hold the transfer valves closed and the bypass valve open. For further information on the operation of the valves, refer to paragraphs 4–450 and 4–453.

4–826. DROP TANK AIR SHUTOFF VALVE. *(See figure 4-207.)* The drop tank air shutoff valve is in the hydraulic compartment. The valve is solenoid-operated through a switch on the cockpit left shelf. The valve is normally open, and closes when system voltage is maintained across the terminals.

4–827. REMOVAL OF DROP TANK AIR SHUTOFF VALVE. Remove electrical disconnect plug. Disconnect and immediately cap two air lines. Remove four screws mounting valve to bracket, and remove valve.

4–828. MAIN FUEL SHUTOFF VALVE CIRCUIT. *(See figure 8-54.)* The main fuel shutoff valve in the hydraulic compartment is electrically operated. A single pole double throw switch on the left shelf of each cockpit operates the valve. When the valve is open, it may be closed by throwing either switch. Both switches have to be in the OPEN position for the valve to open. The circuit receives its power from the forward cockpit left switch box bus and is protected by a 5-ampere push-to-reset circuit protector in the aft cockpit left shelf.

4–829. MAIN FUEL SHUTOFF VALVE MOTOR. The main fuel shut-off valve actuator is a 24 volt shunt wound motor with a permanent magnet field. It is designed for intermittent duty and includes two limit switches.

4–830. FUEL PRESSURE WARNING CIRCUIT. *(See figures 8-55 through 8-60.)* The fuel pressure warning system consists of three pressure switches, one in the hydraulic compartment in the droppable-tank line, one in the wing leading-edge tank line, and one in the engine compartment in the inboard-tank line. The pressure switches turn on red lights on the fuel-system switch panel when the pressure in the lines drops, to indicate that all fuel has been delivered from the respective tanks. Switches adjacent to the lights control the warning lights, the fuel pumps, and the air-pressure shut-off valve.

4–831. ENGINE FUEL SYSTEM CIRCUIT (PRIOR TO AF SERIAL NO. 58-671). *(See figures 8-61 through 8-68.)* The engine fuel system is controlled from either cockpit by the starting fuel switch, the emergency fuel switch, and the engine control lever which actuates a switch in the main fuel control unit. An emergency fuel check switch is on the forward cockpit left shelf. The starting fuel switch on the left auxiliary switch panels has three positions, "AUTO," "OFF," and "MAN." With this switch in "AUTO," and the engine control lever "OFF," solenoid-operated valves in the emergency fuel control and starting fuel control units admit fuel to combustion chambers No. 7 and No. 14 only. With the switch in "MAN" fuel is diverted through the main fuel control unit to all combustion chambers.

4–832. The emergency fuel switch, on each cockpit subinstrument panel, has three positions: "EMERG," "OFF," and "TAKEOFF & LANDING." With the switch in "EMERG," the solenoid-actuated valve in the dual fuel pump bypasses the main pump pressure back to the suction side of the pump, and closes the bypass in the emergency fuel control, forcing fuel to the engine. With the switch in "TAKEOFF & LANDING," the system is placed in a standby condition so that a pressure drop to 35 (+1, —0) psi at the fuel pressure switch automatically performs the same function as placing the switch in "EMERG."

4–833. Deleted.

4–834. Red, green, and amber emergency fuel indicator lights are on both instrument panels. The amber light glows when the emergency system is operating. The green light glows when the emergency system is in a standby or "TAKEOFF & LANDING" condition. The red light glows only when the emergency fuel switch is in the "OFF" position and the alighting gear is not up and locked. Both amber and green lights will glow on pressure below (35 +1, —0) psi with:

a. Emergency switch in "TAKEOFF AND LANDING" position.

b. Emergency switch in "EMERGENCY" position.

c. Starting fuel control switch in "MANUAL" position.

d. Starting fuel control switch in "AUTO" position and main fuel control switch in "OFF" position.

Note

The green light will not turn on when the switch positions called for in steps b, c and d are used if an emergency fuel pressure switch part No. 555-3604 is installed.

4–835. The check-out relay, the emergency fuel relay, and the warning lights relay are all in the forward cockpit left switch box.

4–835A. ENGINE FUEL SYSTEM CIRCUIT (AF SERIAL NO. 58-671). *(See figure 8-68A.)* The engine fuel system is controlled from either cockpit by the starting fuel switch, the emergency fuel switch, and the engine control lever which actuates a switch in the main fuel control unit. The starting fuel switch on the left auxiliary switch panels has three positions, "AUTO," "OFF," and "MAN." With this switch in "AUTO," and the engine control lever "OFF," solenoid-operated valves in the emergency fuel control and starting fuel control units admit fuel to combustion chambers No. 7 and No. 14 only. With the switch in "MAN" fuel is diverted through the main fuel control unit to all combustion chambers.

4–835B. The emergency fuel switch, on each instrument sub-panel, has two positions: "NORM." and "EMERG." With the switch in "EMERG." the solenoid-actuated valve in the dual fuel pump bypasses the main pump pressure back to the suction side of the pump, and closes the bypass in the emergency fuel control, forcing fuel to the engine. With the switch in the "NORM." position, the emergency fuel system is inoperative by itself.

4–835C. An amber indicator light adjacent to each emergency fuel switch glows when the switch is placed in the "EMERG." position.

4–836. ENGINE AUXILIARY ELECTRICAL HARNESS. The engine auxiliary electrical harness conducts electrical current to the main fuel control, emergency fuel control, emergency fuel pressure switch, starting fuel control, dual fuel pump, tachometer generator, and the generator field.

4–837. REMOVAL OF AUXILIARY ELECTRICAL HARNESS.

a. Disconnect airplane cable from engine disconnect bracket.

b. On early-model main fuel controls, remove four recessed-head screws securing main fuel control throttle switch cover to switch housing. Lift off cover. Lift switch assembly off location dowels. Move wires through elbow sufficiently to free the switch. Remove screws securing leads "E" and "F" to switch, and pull wires out of switch housing. On late-model main fuel controls, remove waxed linen thread from around lead wires, slide tubes back from connections, and disconnect short control leads from harness leads.

c. Remove attaching nut and cover on emergency fuel control. Disconnect wire "F" at control.

d. Remove electrical connector from fuel pressure switch on airplanes prior to AF Serial No. 58-671.

e. Remove two screws and terminal cover from starting fuel control. Disconnect wire "G" from control.

f. Remove fillister-head screws and clamps securing wires to dual fuel pump, main fuel control, accessories housing vent tube, and starting system check valve to starting fuel control hose.

g. Remove nut securing wire "L" to generator, and lift off wire.

h. Remove electrical connector from dual fuel pump.

i. Remove screw and clamp securing electrical leads to accessories housing vent-tube clamp.

j. Remove electrical connector from tachometer generator.

k. Remove four screws and nuts securing auxiliary electrical harness connector to main connector bracket. Carefully remove harness from engine. If harness is to be replaced by another, remove parts which are necessary for installation of replacement harness.

4-838. INSTALLATION OF AUXILIARY ELECTRICAL HARNESS.

a. Install harness on engine.

b. Secure auxiliary harness connector to main connector bracket with fillister-head screws and nuts.

c. Connect wire "L" to generator.

d. Install electrical connector on dual fuel pump.

e. Secure electrical leads to accessories-housing vent tube.

f. Install electrical connector on tachometer generator.

g. On early-model main fuel controls, thread wires "E" and "F" through elbow on main fuel control throttle switch housing. Connect wires to switch, and carefully push switch into location on its mounting dowels. Install throttle-switch cover. On late-model fuel controls, telescope vinylite tubes on harness leads. Connect lead clasps, and slide tubes into position, covering connections. Wrap at least three turns of waxed linen thread around each end of each set of tubes, and tie securely.

h. Install wire "F" in emergency fuel control. Install cover and secure with nut.

i. Install electrical connector on fuel pressure switch on airplanes prior to AF Serial No. 58-671.

j. Connect wire "G" to starting fuel control. Put cover in place, and secure with two screws.

k. Using fillister-head screws, secure harness clamps on hose between starting system check valve and starting fuel control, on accessories-housing vent tube, on main fuel control, and dual fuel pump.

l. Connect aircraft cable to auxiliary harness connector at engine disconnect bracket.

4-839. GENERAL DESCRIPTION OF FUEL QUANTITY CIRCUITS. *(See figures 8-69 through 8-75.)* The fuel quantity circuits consist of the fuselage-tank quantity indicator circuit, and a flowmeter cricuit. Both circuits receive their power from the forward-cockpit right shelf bus through the same 5-ampere push-to-reset circuit protector. The fuel low-level light receives its power through the warning lights 5-ampere circuit protector on the forward-cockpit right shelf.

4-840. On AF Serial No. 58-580 and subsequent, a float switch and indicator lights are installed in the airplane to warn the pilot when fuel is being dumped overboard through the fuselage tank vent line.

4-841. FUSELAGE TANK FUEL QUANTITY INDICATOR AND TRANSMITTER. The fuel quantity system indicates only the quantity of fuel contained in the fuselage tank. A remote indicating system is used, employing a Liquidometer gage on each instrument panel and a transmitter mounted on top of the fuselage fuel tank. The transmitter incorporates a switch to indicate a fuel low-level condition when approximately 80 gallons of fuel remain in the fuselage tank.

4–842. INSPECTION OF FUSELAGE TANK FUEL QUANTITY TRANSMITTER. Inspect resistance strip and wiper arm shoe for wear and damage. The wiper arm shoe should press against the resistance strip with a tension of 1 to 1½ ounces. Use gage assembly 7CAD-335915 to determine the tension. If necessary, it is permissible to bend the contact arm to obtain the correct tension.

4–843. ADJUSTMENT OF FUSELAGE TANK FUEL QUANTITY TRANSMITTER. *(See figure 4-163.)*

CAUTION

Remove sufficient fuel from fuselage tank, to prevent spillage, prior to removal of transmitter.

a. Remove transmitter from tank.

b. Straighten float arm if bent.

c. Loosen hex head float arm stop screws.

d. Set up stop by adjusting float arm so that it just makes contact with adapter.

Note

Adapter 412498-1 must be inverted for this adjustment.

e. Set down-stop so that bottom corner of float on EA565-W-1339 transmitter and bottom of horizontally positioned float on EA565-W-553 transmitter is 16.062 inches below a line projected horizontally from the float arm hinge.

f. Install transmitter in tank.

g. Hold float arm of EA565-W-553 transmitter gently against up-stop and with float in a vertical position check for 1 to 1½-inches clearance between float and ends of filler well ring nuts.

h. Adjustments must be made with transmitter and indicator in place and wired as shown in figures 8-69 through 8-75.

CAUTION

Do not damage transmitter resistor when making adjustments. Do not overtighten screws when replacing cover plate.

i. Align slots in adjustment screws (full and empty).

j. With voltage applied to system, raise float through its full range of travel and note travel of indicator pointer. If movement of pointer is not symmetrical about "FULL" and "EMPTY" marks of indicator, it may be centralized by moving shoe about its point of attachment. Shoe is attached to the bakelite with a friction fit.

k. If after adjustment, indicator pointer does not indicate "EMPTY" and "FULL" within 0.06 inch, make further adjustment. If pointer moves past "EMPTY" and "FULL" marks, adjust within 0.06 inch of each mark by moving linkage adjustment screw away from central molded part. To do this, back off linkage screw just enough to permit movement in slotted arm. Insert and turn a screw driver between screw and molded part

l. For final adjustment, rest float on bottom stop and turn "empty" adjustment screw until pointer is directly over EMPTY mark. With float held tightly at its top position, turn full adjustment screw until pointer is directly over the 88-gallon position.

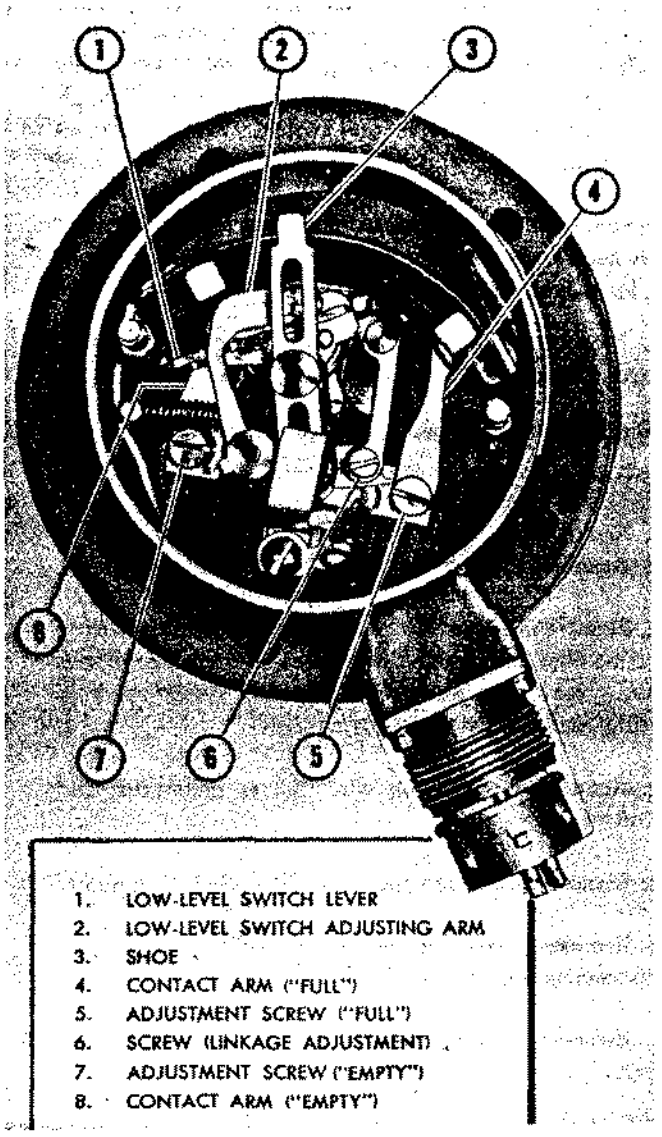


Figure 4-163. Fuel Quantity Transmitter Adjustment

m. Adjustment of low-level warning light switch.

CAUTION

To avoid damaging low-level warning switch, do not adjust low-level switch adjusting arm 2 while it is directly over the warning switch. Raise or lower float to move switch adjusting arm 2 , away from low-level switch lever 1 , while making adjustment.

The low-level warning lights in each cockpit will illuminate when 80 (±5) gallons point is reached in fuel tank, as noted on fuel quantity indicator. If necessary, adjust low-level warning switch setting by pivoting switch adjusting arm 2 . After setting position at which lights illuminate (80 (±5) gallons), raise and lower float to insure that the warning lights remain illuminated until float touches bottom of tank. If they do not, bend low-level switch adjusting arm 2) slightly downward, observing the caution note above. Place 80 (±5) gallons of fuel in tank. Recheck setting of low-level warning light. Adjust if necessary.

4–844. FUEL VENTED OVERBOARD FLOAT SWITCH. A float actuated switch is mounted on the fuselage fuel tank float valve plate to provide an indication when fuel is being vented overboard through the fuselage fuel tank vent line. A ceramic magnet in the float causes the follower magnet in the sealed switch capsule to rotate about its axis making the switch operate.

4–844A. FUEL VENTED OVERBOARD FLOAT SWITCH GROUND CHECKOUT PROCEDURE.

WARNING

Insure that the aircraft is properly grounded in accordance with existing directives. All electrical power must be disconnected from the aircraft and safe fuel handling practices employed while performing this checkout procedure. The supervisor will insure that the involved specialist(s) are familiar with the following directives regarding safety precautions, refueling and defueling operations:

AFM 127-101, T.O.s 00-25-172, 00-25-212, 1T-33A-2CL-2 and applicable paragraphs in this manual.

a. Temporarily remove the fuel venting overboard warning light lens and bulbs from their respective sockets in both forward and aft panels in applicable aircraft.

b. Connect a continuity meter (AN/PSM-6 Multimeter or equivalent) between the center pin (No. 2) and ground of fuel low level warning light sockets in both cockpits.

c. With an approved grounded container (5 gallon minimum capacity) positioned under the saber drain, slowly add fuel to the fuselage fuel tank. As the fuel level reaches its maximum height (without overflowing at filler opening), fuel will vent from the saber drain.

CAUTION

Do not permit fuel to spill over the sides of the fuselage.

Note

Fuel may vent for a short time before the switch closes due to a three second delay designed into the switch.

d. The electrical circuit through the fuel venting overboard warning light sockets will both indicate continuity, (approximately 1 OHM simultaneously), Set multimeters off, disconnect and remove them from aircraft.

Note

If multimeters fail to indicate continuity, check the circuit for opens from indicator lights to terminal post nearest to float switch. Refer to wiring diagram entitled "Fuel Quantity Circuit" in Section VIII. Replace float switch if circuit is not at fault.

e. Drain any excess fuel that remains in the fuselage tank after the saber drain stops draining.

f. Remove fuel container from vicinity of aircraft to a safe distance.

g. Replace the light bulbs and lens in both foward and aft fuel venting overboard warning light sockets.

h. Connect external electrical power to aircraft and check both fuel venting overboard warning lights for proper push to test operation and for correct operation of lens dimmer feature. Leave the lens dimmer set to full bright.

i. Disconnect external electrical power from aircraft if not required for other functions.

4-845. REMOVAL OF FUEL VENTED OVERBOARD FLOAT SWITCH.

a. Remove fuselage tank cover (refer to paragraph -404, steps a through f).

b. Disconnect float switch electrical leads from tank orward bulkhead terminal strip.

c. Remove screws attaching float valve plate assembly o tank.

d. Remove screws attaching tank upper liner to aircraft structure and remove tank liner and float valve plate support as a unit.

e. Displace mounting plate assembly sufficiently to unfasten float-valve elbow connections and remove assembly.

f. Remove nut holding float switch to mounting plate assembly and remove switch.

4-846. INSTALLATION OF FUEL VENTED OVERBOARD FLOAT SWITCH. Reverse removal procedure.

Note

Position switch on float valve plate assembly so that it is perpendicular to tank floor. Torque switch attaching nut to between 58 and 64 lb in.

4-847. FUEL FLOWMETER CIRCUIT. *(See figures 8-69 through 8-75.)* A fuel flowmeter is installed on the engine. This instrument is of the positive displacement type, and measures the amount of fuel which has passed from the tanks to the engine. (Refer to paragraph 4-461.) A remote subtracting type fuel counter on each instrument panel registers the number of gallons of fuel remaining in the system. The counters are connected electrically to a cam-operated micro switch in the flowmeter. The flowmeter circuit is protected by the five-ampere push-to-reset circuit protector in the fuel quantity circuit.

4-848. FUEL DE-ICING CIRCUIT. *(See figures 8-107 through 8-113.)* The fuel de-icing circuit consists of the fluid injection pump on airplanes prior to AF Serial No. 53-5083 and on airplanes AF Serial No. 53-5083 and subsequent, a fuel de-icing fluid pump, the fuel de-icing differential pressure switch, and a solenoid shutoff valve. The pressure switch is wired to an amber warning light installed on each main instrument panel, the sub-panel or the left shelf. When the pressure differential between the inlet and outlet sides of the micronic filter reaches 2 (±0.25) psi, the differential pressure switch closes causing the warning light to glow. The switch will open when the differential pressure drops to 1 (±0.25) psi. A momentary contact switch, on the forward and aft cockpit left shelves, controls the fuel de-icing pump and energizes the de-icing solenoid valve. Power for the pump circuit and the differential pressure switch comes from the forward left switch box bus through a 5-ampere push-to-reset circuit protector.

4-848A. On airplanes incorporating T.O. 1T-33A-622, the fuel de-icing circuit is deactivated. Wiring from the airplane electrical power source is disconnected, taped and stowed. The solenoid shutoff valve and differential pressure switch are removed and wiring to these components is taped and stowed.

4-849. FUEL DE-ICING CIRCUIT COMPONENTS. The series wound fluid injection pump motor is rated at 27 volts for intermittent duty only. The differential pressure switch consists of a bellows and a relay. The fuel line from the downstream side of the filter is plumbed into a chamber which surrounds the bellows. Fuel pressure inside the bellows of 2 (±0.25) psi greater than the fuel pressure of the chamber around it will expand the bellows to a point where it contacts a ground to the warning light in the cockpit. A reduction in pressure inside the bellows to 1 (±0.25) psi is necessary for the bellows to contract, breaking the warning light ground connection. The alcohol shutoff valve is a normally closed continuous duty solenoid type valve.

CAUTION

Do not attempt to adjust this relay.

Do not operate pump continuously for more than 1½ minutes.

4-850. FLUID INJECTION CIRCUIT (PRIOR TO AF SERIAL NO. 53-5083.) *(See figures 8-103 through 8-105.)* Units in the fluid injection circuit are: fluid injection pump, fluid injection relay, engine control-lever switch, a toggle switch in each cockpit, and circuit protectors. The relay, in the engine compartment junction box (figure 4-157), is operated by the control circuit through the two-position toggle switches on the cockpit left shelf. The control circuit is protected by a five-ampere push-to-reset circuit protector on the forward shelf. The engine control-lever switch in the control circuit is on the forward bulkhead of the engine compartment and allows the control circuit to operate the relay only when the engine control lever is fully advanced. The power circuit to the pump through the relay is protected by a 200-ampere fuse-type current limiter in the engine compartment junction box. A spare fuse is mounted on the junction box cover.

4–851. ADJUSTMENT OF CONTROL LEVER FLUID INJECTION SWITCH. *(See figure 4-166.)*

a. Start engine and move control lever to point where engine rpm stabilizes at 90 (+2, —0) percent. Mark edge of slot with pencil at this point. Shut off engine, then move control lever back to pencil mark.

b. On limit switch (5), to which "QW" wires are attached, turn adjusting screw (4) until switch just clicks.

4–852. FLUID INJECTION PUMP MOTOR. The fluid injection pump motor is series-wound, and for intermittent duty only, and will draw approximately 135 amperes under normal operating conditions. It has a safe operating range up to 160 amperes. The motor is on the floor of the engine compartment, and access to it is through the engine compartment lower access doors.

4–853. TACHOMETER CIRCUIT. *(See figures 4-66 and 8-76 through 8-80.)* The tachometer circuit employs a tachometer generator in the engine accessory case and an indicator on each instrument panel. The system operates independently of the airplane electrical system. The tachometer generator is geared to the engine and rotates at a speed proportional to rotor speed, generating alternating current. The indicator is basically an electric motor, rotating at a speed proportional to the frequency of the tachometer generator output. The fore and aft indicators must not vary more than one percent at 90 percent rpm.

4–854. EMERGENCY HYDRAULIC PUMP CIRCUIT. *(See figures 8-76 through 8-80.)* The emergency hydraulic pump circuit operates the motor through a relay in the aft cockpit right-shelf relay panel. Power to the pump motor through the relay comes from the aft cockpit right-shelf bus through a 35-ampere push-to-reset circuit protector. The relay control circuit originates at the aft cockpit right shelf, and is protected by the 5-ampere push-to-reset circuit protector for the emergency pump relay. A switch on the right shelf in each cockpit controls the relay. Either switch connects power to the relay.

4–855. EMERGENCY HYDRAULIC PUMP AND MOTOR. *(See figure 4-144.)* This assembly is mounted in the nose wheel well, and consists of a shunt-wound intermittent duty motor and a gear-type pump. A radio noise filter is mounted on the motor.

CAUTION

Prior to airplanes AF Serials 55-2996, except 53-5994, through 53-6152, each three-minute period of operation must be followed by a 20-minute cooling period. The cooling period can be shortened by using an air blast on the motor.

On airplanes AF Serials 53-5994 through 53-6152 and 55-2996 and subsequent, each ten-minute period of operation must be followed by a 20-minute cooling period. The cooling period can be shortened by using an air blast on the motor.

4–856. WING FLAP ACTUATOR CIRCUIT. *(See figures 4-8 and 8-81 through 8-84.)* On airplanes prior to AF Serial Nos. 50-385, the wing flap actuators are controlled through relays by a switch on the left shelf in each cockpit. The circuit from the forward cockpit left-switch-box bus is protected by a 5-ampere push-to-reset circuit protector. The circuit to the aft switch is routed through the wing-flap aft lockout relay, and the circuit to the forward switch is routed through the wing flap forward lockout relay. On airplanes AF Serial Nos. 50-385 and subsequent, the lockout relays are replaced by a mechanical interlock. (See figure 4-164.) Individual levers are located on each shelf and are connected by push rods to a torque tube. A cam shaft with two lobes and detents for three positions is located on the torque tube. The forward lobe operates the up switch and the aft lobe operates the down switch. The three positions of the levers are forward, "UP"; center "OFF"; and aft "DOWN."

4–856A. ADJUSTMENT OF WING FLAP SWITCHES MECHANICAL INTERLOCK INSTALLATION. *(See figures 4-164 and 8-82 through 8-84.)*

a. To adjust "up" switch, connect an ohmmeter between terminals 12 and 21 of aft terminal panel, located on aft left hand relay panel, with power off. Ohmmeter will read between 10 and 20 ohms when "up" switch is open. Ohmmeter will read continuity when "up" switch is closed.

b. With flap control lever in UP flap position, loosen "up" switch (forward micro-switch) and position to upper limit of its travel.

c. Move "up" switch down approximately 1/32 inch beyond point where ohmmeter first indicates continuity. Secure switch in this position.

d. Slowly move flap control lever to OFF position while watching ohmmeter. "Up" switch should open as control lever leaves UP position.

e. To adjust "down" switch, connect an ohmmeter between terminals 12 and 22 of aft terminal panel, located on aft left hand relay panel, with power off.

Ohmmeter will read between 3 and 10 ohms when "down" switch is open. Ohmmeter will read continuity when "down" switch is closed.

f. With flap control lever in DOWN flap position, loosen "down" switch (aft micro-switch) and position to upper limits of its travel.

g. Move "down" switch down approximately 1/32 inch beyond point where ohmmeter first indicates continuity. Secure switch in this position.

h. Slowly move flap control lever to OFF position while watching ohmmeter. "Down" switch should open as control lever leaves DOWN position.

4–857. A double relay is provided for each motor to control the current to the motors. The relays also reverse the direction of rotation of the motors. Both flap relays are in the engine junction box. (See figure 4-157.)

4–858. The two actuators are interconnected mechanically by flexible shafts and a gear box. This permits operation of both flaps in the event of failure of either actuator. The rotation of the actuator motors is converted to linear motion by the jack screws. The jack screws act on the push-pull tube assemblies which actuate the linkages to operate the flaps. (See figure 4-8.) A switch box containing the limit switches is mounted on the gear box which is located directly forward of the engine lower mount. (See figure 4-165.)

4–859. On airplanes prior to AF Serial No. 50-385 not incorporating T. O. 1T-33A-567, a mechanical position indicator is provided which consists of a Bowden cable connected to linkage at the inboard end of the left flap, and to an indicator on each cockpit left shelf. (See

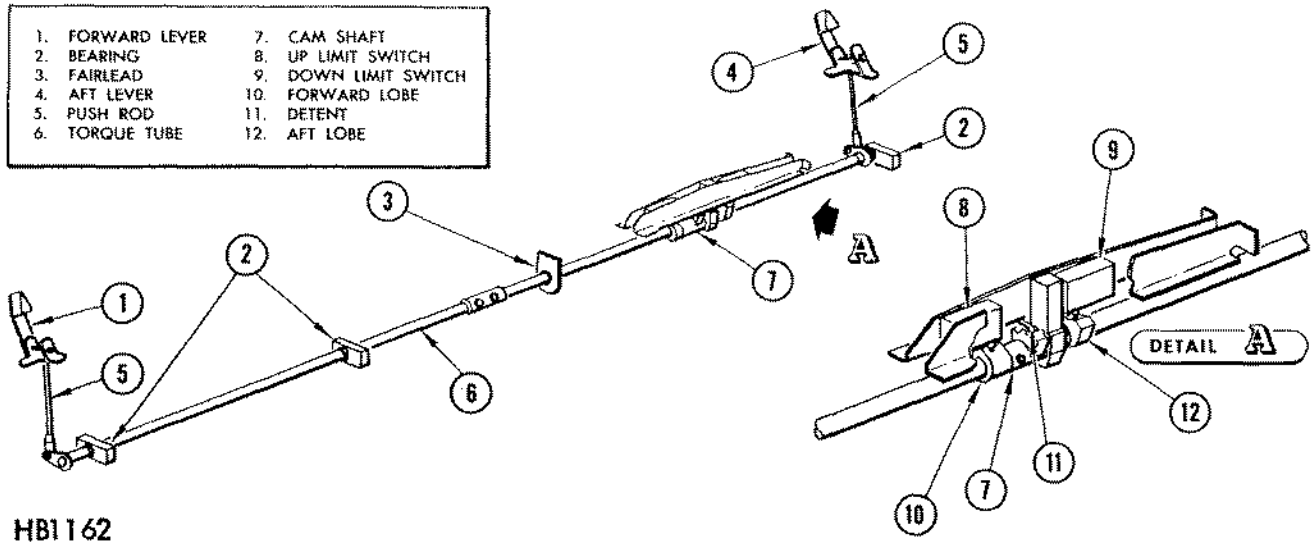


Figure 4-164. Wing Flap Switches Mechanical Interlock Installation

figure 4-11.) On airplanes AF Serial No. 50-385 and subsequent and on airplanes incorporating T. O. 1T-33A-567, an electrically operated d-c selsyn position-indicating system is used.

4–860. OPERATION OF WING FLAPS. For flap operation, refer to paragraph 4–31.

4–861. WING FLAP ACTUATOR. *(See figure 4-8.)* The wing flap actuator employs a series-wound, reversible intermittent duty motor, with an electro-magnetic clutch and brake. The flap actuators are mounted on brackets on each side of the engine compartment, and extend through cut-outs in the fuselage skin into the wing. The actuator shaft bolts to the flap push-pull rod in the wing. The cut-outs in the fuselage are closed against the air pressure in the engine compartment by canvas boots. The boots contain draw strings which pull tight around the actuators.

CAUTION

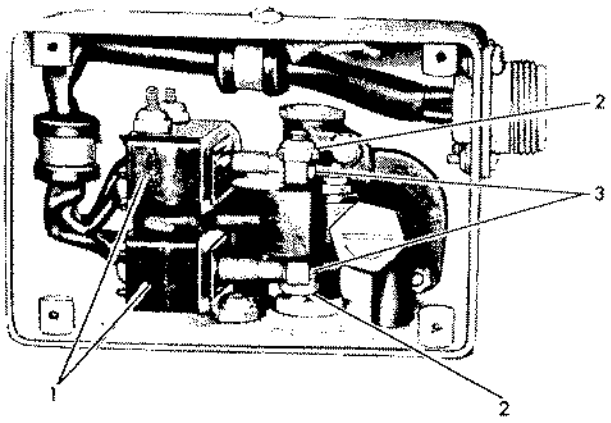
Actuators must be permitted to cool at least one minute after each cycle.

4–862. REMOVAL OF WING FLAP ACTUATOR. Refer to paragraph 4–37.

4–863. ADJUSTMENT OF WING FLAP ACTUATING MECHANISM. Refer to paragraph 4–42.

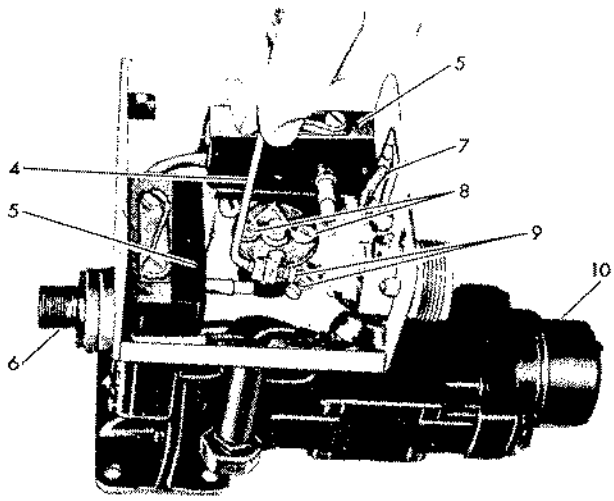
4–864. WING FLAP POSITION INDICATOR CIRCUIT (AF SERIAL NO. 50-385 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-567). *(See figures 8-85 through 8-87.)* The wing flap position indicating circuit consists of the selsyn-type position transmitter linked to the inboard end of the left wing flap, and an indicator on each instrument panel. The circuit operates from the airplane 28-volt system and is protected by a 5-ampere, push-to-reset circuit protector in the forward cockpit left switch box. A 45-degree movement of the flap will induce a 180-degree movement of each indicator pointer. For information on the indicators refer to paragraph 4–1120.

4–865. ELEVATOR TAB ACTUATOR CIRCUIT. *(See figures 4-122 and 8-88 through 8-96.)* The two elevator trim tabs are controlled through a flexible drive shaft by a single electrical actuator. The actuator is controlled through two relays by a switch on each control stick grip. The power to the switches comes from the forward-cockpit left shelf bus through a 15-ampere push-to-reset circuit protector. The circuit to the forward control-stick switch is routed through the trim-tab forward lockout relay, and the circuit to the aft control-stick switch is routed through the trim-tab aft lockout relay. Forward movement of the switch raises the tab (nose down); aft movement of the switch lowers the tab (nose up). A green push-to-test indicator light on each instrument sub-panel glows when the elevator tabs are in neutral. The light will remain on for all positions of the control stick until



WING FLAPS

1 WING FLAP LIMIT SWITCHES
2 ADJUSTMENT NUT
3 ADJUSTMENT SCREW



AILERON TAB

4 ADJUSTING WRENCH
5 AILERON TAB LIMIT SWITCHES
6 FLEXIBLE SHAFT CONNECTION
7 ADJUSTING WRENCH HOLDER
8 ADJUSTMENT SCREW (COARSE)
9 ADJUSTMENT SCREW (FINE)
10 ACTUATOR MOTOR

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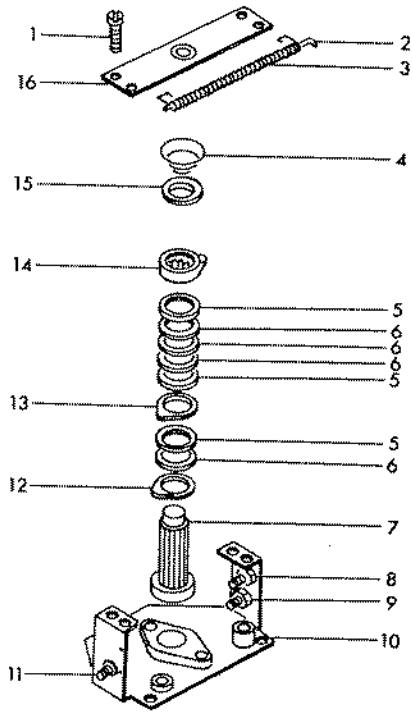
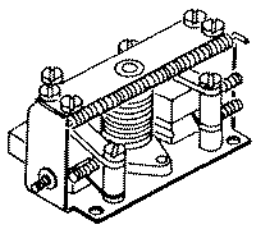
Figure 4-164A. Elevator Tab Actuator Limit Switch Installation





1 TOP PLATE RETAINING SCREW
2 WRENCH
3 WRENCH HOLDING SPRING
4 CONICAL SPRING
5 CAM SPACER (INTERNALLY SPLINED)
6 CAM SPACER
7 SWITCH SHAFT
8 NEUTRAL LIMIT SWITCH ADJUSTING SCREW
9 NOSE UP LIMIT SWITCH ADJUSTING SCREW
10 LIMIT SWITCH FRAME ASSEMBLY
11 NOSE DOWN LIMIT SWITCH ADJUSTING SCREW
12 NOSE DOWN LIMIT SWITCH CAM
13 NOSE UP LIMIT SWITCH CAM
14 NEUTRAL LIMIT SWITCH CAM
15 WASHER
16 TOP PLATE

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Figure 4-165. Aileron Tab and Wing Flap Actuator Limit Switch Adjustment

such time as elevator tabs are trimmed away from neutral. Rheostats are added to both the tab-up and tab-down circuits to decrease overtravel of the actuator. The rheostats are in the aft section of the airplane, near the actuator. Circuit protection is provided by a push-to-reset circuit protector on the cockpit left shelf.

4–866. Some aircraft have four-position elevator trim override switches installed on the left consoles in each cockpit. Each switch is placarded NORMAL, EMERG, NOSE UP and NOSE DOWN and is spring loaded to the EMERG position from momentary NOSE UP and NOSE DOWN positions. When both switches are safety-wired to the NORMAL position, dc power is applied to the control stick grip trim switches for normal operation. When the aft override switch is in NORMAL and the forward override switch is placed in EMERG position, control stick grip trim for elevator tabs will be inoperative in both cockpits and aileron trim will be inoperative in front cockpit only. When the aft override switch is placed in EMERG (forward switch NORMAL) control-stick grip trim for the elevator and aileron trim tabs will be inoperative in the aft cockpit only. When either override switch is in the EMERG position, control of the elevator trim tab from that cockpit is accomplished by moving the elevator trim override switch from the EMERG position to either the momentary NOSE UP or NOSE DOWN position.

Note

Safety toggle switch in NORMAL position using 0.020-inch soft copper lock wire from base of switch toggle to shank of outboard switch guard mounting screw.

4–867. ELEVATOR TAB ACTUATOR. The elevator tab actuator employs a series-wound, reversible, intermittent duty motor, with an electromagnetic clutch and

brake. A thermal switch, mounted on the end of the motor housing and wired in series with the motor armature and clutch coil, protects the motor against overheating. A switch box on the actuator contains the motor limit switches, the tab neutral switch, and the electrical disconnect plug.

4–868. ADJUSTMENT OF ELEVATOR TAB NEUTRAL LIGHT SWITCH (MODEL 157P3, 157P3A AND 157P3A1). *(See figure 4-164A.)* Operate tab switch until tab reaches neutral. Neutral light should be on. If neutral light is not on, reposition switch cam until light comes on. Operate tab in up direction, in small increments, until light goes off. Tab should travel 2 (±½) degrees. Operate tab toward down position in small increments. Light must remain on for 4 (±1) degrees of tab travel. Light band adjustments are to be accomplished by adjusting the switch adjustment screw with an allen wrench. When setting is completed seal adjustment screw with glyptal.

4–869. Deleted.

4–870. ADJUSTMENT OF ELECATOR TAB ACTUATOR LIMIT SWITCHES (MODEL 157P3, 157P3A AND 157P3A1). Refer to paragraph 4–650.

Note

Adjustment of the actuator limit switch to obtain the proper actuator travel must be accomplished by repositioning the limit switch cam. DO NOT ADJUST SCREWS PROTRUDING FROM ACTUATOR CONTROL BOX.

Elevator trim tab actuators that incorporate control limit switch arrangement require adjustment of the cams to obtain the desired travel. To adjust, lift cam and rotate cam lobe toward limit switch to decrease travel, rotate cam lobe away from switch to increase travel.

Small adjustment changes may be made with limit switch adjustment screws. After adjustments are completed, seal adjustment screws with glyptal.

4–871. REMOVAL OF ELEVATOR TAB ACTUATOR.

a. Run tab to full down position until the limit switch operates.

b. Remove electrical disconnect plug.

c. Disconnect flexible shaft from actuator.

d. Remove four bolts and nuts, and remove actuator.

4–872. INSTALLATION AND ADJUSTMENT OF ELEVATOR TAB ACTUATOR. Reverse removal procedure. Refer to paragraph 4–650 for adjustment of tabs.

4–873. AILERON TAB ACTUATOR CIRCUIT. *(See figures 4-120 and 8-97 through 8-102.)* The left aileron is equipped with an electrically operated tab, controlled from both cockpit control sticks. The aileron-tab jack screw is driven through a flexible shaft by the actuator. The actuator is mounted near the inboard end of the aileron, immediately aft of the wing rear beam. The aileron tab actuator circuit consists of the actuator, two radio noise filters, two aileron tab relays, and two trim-tab lockout relays. The relays are controlled by a switch on each control stick. Both control and power circuits are protected by the same 15-ampere push-to-reset circuit protector on the forward cockpit left shelf. The aileron tab relays are in the aft-cockpit right relay panel. The lockout relays are in the aft-cockpit left relay panel. Filters are wired into the circuit adjacent to the actuator.

4–874. An elevator trim tab override switch is installed in each cockpit. When an override switch is placed in the "OFF" position, the aileron tabs cannot be controlled from that particular cockpit as all power is removed from the trim tab switch in the cockpit involved.

4–875. AILERON TAB ACTUATOR. The actuator for driving the aileron tab is the same general type as that used for controlling the elevator tab, except that the switch box does not incorporate a neutral position switch. Access to the actuator is through access panel No. 10 in the wing.

4–876. ADJUSTMENT OF AILERON TAB ACTUATOR. *(See figure 4-165.)*

a. Set actuator limit switches to obtain 160 to 164 revolutions of output shaft. If additional adjustments are needed, comply with steps b and c.

b. Run the tab up and turn the up adjusting screw in the limit switch box until the up limit switch operates.

c. Run the tab down and turn the down adjusting screw in the limit switch box until the down limit switch operates.

d. Seal the screws with Glyptal No. 1201, manufactured by General Electric Company, to ensure better locking in position and to indicate any change of setting.

4–877. ADJUSTMENT OF AILERON TAB ACTUATOR LIMIT SWITCHES. *(See figure 4-165.)* Aileron trim tab actuators that incorporate camtrol limit switch arrangement require adjustment of the cams to obtain the desired travel. To adjust, lift cam and rotate camlobe toward limit switch to decrease travel, rotate camlobe away from limit switch to increase travel.

4–878. REMOVAL OF AILERON TAB ACTUATOR MOTOR.

a. Remove access panel No. 10 (figure 3-1) from wing, and perform balance of operation through this opening if the aileron is installed. If aileron is not installed, perform the operation through the opening left in the aft edge of the wing.

b. Remove electrical terminal panel from its clips, and push it aside.

c. Loosen aileron cables at the turnbuckles, if the aileron is installed.

d. Remove four bolts attaching actuator to wing rib. If aileron is installed, remove the limit switch cover, as shown in view B of figure 4-154, to reach the two upper bolts.

e. Remove actuator, either through aft edge of wing or through panel No. 10.

4–879. WINDSHIELD AUXILIARY DEFROSTER CIRCUITS. *(See figures 8-103 through 8-106.)* Two auxiliary defroster circuits, one installed in each cockpit, are functionally identical except that the circuit in the aft cockpit is dead-ended at the heater-blower end of the wire, and no heater-blower unit is installed in this cockpit. The windshield defroster heater-blower unit is operated through a power circuit by a control circuit. The control circuits operate a relay under each cockpit left shelf. A 10-ampere switch-type circuit breaker on each cockpit right shelf controls the relay. The power circuit to the windshield defroster unit is protected by a 50-ampere push-to-reset circuit protector on each cockpit right shelf. Power is controlled by the relay in the control circuit.

4–880. AUXILIARY DEFROSTER HEATER-BLOWER UNIT. The windshield defroster heater-blower unit is an electrically operated fan which blows air over a heater coil wired in parallel with the motor. The heater unit draws 38 amperes at 28 volts. The blower motor is rated at 0.1 horsepower at 12,000 rpm and 27 volts. The unit is mounted on the forward cockpit front bulkhead and is connected to the windshield defroster tubes by a flexible hose. Electrical provisions are made in the aft cockpit for an identical unit. For removal of units in the auxiliary defroster system other than the heater-blower unit, refer to paragraph 4–1203.

4–881. REMOVAL OF AUXILIARY DEFROSTER HEATER-BLOWER UNIT.

a. Disconnect electrical wiring from aft side of unit.

b. At inboard end, remove hose clamp, and disconnect flexible hose.

c. Remove two screws and two nuts from bottom of unit.

d. Remove unit aft, and retain clamp bolts.

4–882. INSTALLATION OF AUXILIARY DEFROSTER HEATER-BLOWER UNIT. Reverse the removal procedure. Do not tighten bolt of inboard clamp in excess of 15 lb in. torque, or interference between impeller blades and casing may result. After installation, check impeller for freedom of rotation.

4–883. DIVE RECOVERY FLAPS CIRCUIT. *(See figures 4-27 and 8-114 through 8-116.)* The dive recovery flaps circuit consists of an actuator with a limit switch and a selector switch, both integral with the actuator, and lockout relays. A dive recovery flap switch is in each cockpit on the engine control lever. The circuit is protected with a 10-ampere push-to-reset circuit protector on the forward cockpit left shelf. Two lockout relays in the aft cockpit left-shelf relay panel lock out the circuits.

4–884. (Deleted)

4–885. On AF Serial No. 53-5286 and subsequent, a serrated thumb-operated switch on top of the engine control lever permits incremental positioning of the dive flaps intermediate to the fully retracted and fully extended positions.

4–886. DIVE FLAP SELECTOR VALVE ACTUATOR. The dive flap selector valve is operated by an electric actuator. The actuator is started by either dive flap switch, and is stopped by limit switches in the actuator. Prior to AF Serial No. 53-5286 there are no intermediate positions for the flaps. The actuator for the

dive flap selector valve has a cam, an integral limit and selector switch, and radio noise filter. Adjustment of the limit switch is not necessary. The motor comes up to top speed under no load, then engages the cam and maintains maximum load past the breakaway position, after which the actuator opens a limit switch and operates a selector switch. The actuator is on the hydraulic selector valve and actuates the valve. Access is through the dive flap openings.

4–887. GENERAL DESCRIPTION OF FLIGHT INSTRUMENT CIRCUITS. The flight instruments consist of gyrosyn compass indicators, universal attitude indicators, and turn and bank indicators. The 115-volt, 400-cycle alternating current for the gyrosyn compass and attitude gyro indicator is furnished by the instrument inverters. The instruments and inverters are connected to the bus so that they operate whenever the cockpit right shelf bus is energized. There are no controls for any of the flight instruments.

4-888. GYROSYN COMPASS CIRCUIT. (See figures 8-126 through 8-136.) On airplanes AF Serial Nos. 50-320 and subsequent, a J-2 gyrosyn compass system is installed. consisting of a C-2 transmitter in the fuselage aft section, an S-3 directional control unit, an A-2 amplifier on the left side of the engine compartment, and a V-3 indicator on each instrument panel. The a-c circuits to the indicators are protected by two 2-ampere fuses on the forward cockpit right shelf. Spare fuses are adjacent to the active one. To prevent damage to the amplifier, its 28-volt d-c supply is run through the inverter relays. Prior to AF Serial No. 51-4328, the d-c circuit is protected by the 5-ampere push-to-reset "compass amplifier" circuit protector on the cockpit right shelf. On AF Serial NO. 51-4328 and subsequent, the d-c circuit is protected by the 20-ampere push-to-reset inverter power circuit protector.

CAUTION

If gyrosyn compass does not respond within 20 seconds after battery switch is turned on, shut it off.

Note

The turn-and-bank indicator, push-to-reset circuit breaker, must be pushed in to supply 28 volt, d-c power for the gyrosyn compass circuit.

4–889. ATTITUDE GYRO INDICATOR CIRCUIT. *(See figures 8-124 through 8-136.)* The attitude indicators are gyroscopic instruments using alternating current. The 115-volt, 400-cycle, three-phase a-c circuit is protected by two 2-ampere fuses on the forward cockpit left shelf. Spare fuses are adjacent to the active ones. A red flag, marked "OFF," on the face of each instrument is visible when the 115-volt circuit to the instrument is off. Access to the rear of the forward instrument is gained by removal of the forward instrument panel. (Refer to paragraph 4–1069.)

4–890. TURN AND BANK INDICATOR CIRCUIT. *(See figures 8-117 through 8-121.)* The turn and bank indicator is essentially a motor-driven gyroscope which operates from the airplane 28-volt system. A red warning light on each instrument panel glows when the power to the turn and bank indicator on that panel fails. The circuits for the two instruments are functionally identical, and are independent of each other. When the circuit to the instrument is energized, it operates a relay which disconnects the light circuit from the ground. The circuit is protected by a 5-ampere push-to-reset circuit protector which also protects the 28 volt, d-c power circuit for the gyrosyn compass. The warning lights receive power from same source as the instrument inverter warning lights, and are protected by the same 5-ampere push-to-reset protector. Relays for the two circuits are in their respective switch boxes.

4–891. INSTRUMENT INVERTERS CIRCUIT. *(See figures 8-137 through 8-146C.)* Two inverters, one of which is a standby, furnish alternating current to the electrical instruments through the inverter relays. The inverter relay and compass amplifier circuits are protected by 5-ampere push-to-reset circuit protectors on the forward cockpit right shelf.

4–892. Prior to AF Serial No. 52-9335, the relays are wired in such a way that if the first inverter fails, the second inverter is automatically cut in after a delay of approximately 3 seconds. Power for the inverters comes from the armament-compartment junction-box bus through one 35-ampere protector for each inverter. Inverters are in the armament compartment, the No. 1 inverter on the right side, and the No. 2 (standby) on the left. The 115-volt, 400-cycle, 3-phase a-c circuit between inverters and relay unit is protected by 5-ampere fuses. Circuit protectors and fuses are in the armament compartment junction box, with spare fuses adjacent to active ones. A two-position momentary-contact switch marked "TEST ONLY" is mounted on the cockpit right shelf for testing the standby inverter. With the switch held in test position, the No. 1 inverter is disconnected, and the No. 2 inverter connected. If neither inverter is operating, a red warning light on each instrument panel glows. If one phase of the 3-phase inverter fails while instruments are operating, and does not short out to airplane structure, relay unit will not switch over to standby inverter. Flight instruments will continue to operate at reduced speed, giving accurate indication within 2 degrees. When power is turned off, then on, relay unit will immediately switch over to standby inverter.

4–893. The relays are pressurized in a Stratopak mounted in the nosewheel well, on the left side. The thermal time delay relay is sealed in a glass tube and mounted under a detachable cover on top of the Stratopak. To remove the thermal time delay relay, remove two screws, remove the cover, and lift out the glass case in the same manner as removing a radio tube.

Note

Do not attempt any repair of the change-over relays other than replacement of thermal time delay relay. Inverter changeover relays are hermetically sealed, and any malfunction is cause for replacement.

4–894. On AF Serials 51-17487 through 51-17556, 52-9335 through 52-9759, 52-9876 through 52-9940 and 53-2687 through 53-2726, not incorporating T. O. 1T-33A-194, no visual indication for inverter failure is provided and inverter warning lights are placarded "INOPERATIVE." On those airplanes incorporating T. O. 1T-33A-194, the inverter circuit is modified by removal of one relay and installation of a toggle switch on the instrument panel which allows manual changeover of the inverter circuit. The inverter warning lights are operative and the inoperative placard is removed.

4–894A. On T-33A-5LO airplanes incorporating T. O. 1T-33A-577, No. 2 inverter is removed and replaced by a 750-VA inverter. The automatic bus monitoring system is disabled by jumpering between terminals A1 and A2 of bus tie relay 3380-1.

4–894B. On T-33A-15LO airplanes, incorporating T. O. 1T-33A-613, the No. 1 (main) 750 VA inverter is replaced by a single-phase, 115-volt, 400-cps, 2500-VA inverter (MS17404), and a polyphase mesh (496437-1). See figure 8-146C.

4–894C. The 2500-VA main inverter provides single-phase, 115-volt, 400-cps, ac power for the AN/ARN-21, AN/ARN-18 or AN/ARN-31, AN/APX-25, and ME-1 or C-1 amplifier. Three-phase, 115-volt, 400-cps, ac power is supplied through the polyphase mesh for the J-8 attitude gyros and the J-2 gyrosyn compass.

4–895. TESTING INSTRUMENT INVERTERS.

a. Apply electrical power to the bus either through the external power receptacle, the battery, or generator. Be sure the potential does not exceed 26 to 29 volts.

b. When power enters the bus, the inverter warning lights will flash on for approximately three seconds, then be extinguished.

c. Allow inverters to run for one-half minute.

d. Push inverter test switch to "TEST ONLY." Lights should flick on and off once rapidly, indicating standby inverter is operating. Continuous glowing of lights is indication that standby inverter is not operating.

e. Release the switch. If the standby inverter was operating, the lights should flick on and then off to indicate that the No. 1 inverter is operating. If the lights go on for approximately three seconds and then go off, the No. 1 inverter is inoperative and the relay has switched back to the standby inverter.

f. Continuous illumination of the red warning lights indicates that both inverters are inoperative or that both lines from the relays to the instruments are open.

g. Continued blinking of the warning lights indicates a short circuit in one phase of the a-c circuit between the relays and the instruments. Cut off inverter power by pulling out circuit protector on cockpit right shelf marked "COMPASS AMPLIFIER."

4–896. MAINTENANCE OF BENDIX 250VA INVERTERS.

a. Remove control box cover and the two end frame covers.

b. Check all brushes for proper length.

Note

All brushes are 1/2 inch long when new. Dc brushes have a maximum allowable wear of 1/4 inch. Ac and governor brushes have a maximum allowable wear of 5/32 inch.

c. Rotate rotor to check condition of bearings.

d. Check condition of commutator and slip rings. A slight discoloration or brownish tint indicates a satisfactory commutating film and should not be removed.

e. Reinstall brushes in their original position and check for free movement in brush boxes.

f. Check all other electrical connections and wiring to make sure they are satisfactory.

Note

If a-c field wire (white with red tracers) is routed between the regulator and cover retaining post, reroute this wire on opposite side of post to prevent chafing.

g. Remove all dust or foreign material from control box, rotor section and governor assembly. Clean governor contacts with dry lintless cloth.

h. Replace d-c end frame cover to avoid injury to personnel when operating unit.

i. Connect inverter to a suitable test stand (type L1-A or equal).

j. Start inverter and check for proper output voltage and frequency (refer to paragraph 4–898).

4–897. ADJUSTMENT OF BENDIX 250VA INVERTER GOVERNOR.

a. Remove both end frame covers.

b. Inspect fan and governor assembly for wear and damage. Be sure that governor contacts are securely fastened.

c. Inspect inner surface of contacts. Under normal usage the pitted area should enlarge evenly and the surface should be free of erosion and cracks. Pitting should not cover more than 50% of surface of contacts. Replace fan and governor assembly if more than 50% of surface is pitted.

d. If contact points are lightly pitted, rough, dirty or burned, dress with a clean platinum point file. Finish cleaning operation with a dry lintless cloth.

e. Reposition frequency adjusting screw (inner contact adjusting screw) so that the same number of threads show above stock as show through nut.

f. Measure tension of contact springs by first placing the scale hook on inner contact spring. Position hook toward butt end of spring immediately adjacent to contact. The tension should be 2 pounds. If spring tension is more than 2 pounds, use a slotted tool to apply pressure to inner contact forcing spring approximately three-quarters of the distance to the armature shaft.

g. Release forcing action and recheck for desired tension. This procedure may have to be repeated to obtain desired tension. The inner spring should be horizontal and under tension.

h. Measure tension of outer spring. Place hook of scale adjacent to contact toward stationary side of spring butt end and lift until contacts open. The tension should be 1 to 1-¼ pounds. Adjust if necessary. The outer spring contact should have a wiping action on inner contact when inner contact is moved approximately ⅛ inch from adjusting screw.

i. Check spring leaves for cracks or damage. If damaged, replace governor assembly.

4–898. OPERATION CHECK OF BENDIX 250VA INVERTERS.

a. Connect inverter to a suitable test stand.

b. Start inverter and apply a 50% load.

c. Check frequency. If adjustment is necessary, switch off inverter and adjust frequency to 400 cycles by use of adjusting screw.

Note

Small increments of adjustment to both stop screws may be necessary to give the most practical operation of governor to maintain frequency within the narrowest limits.

d. The frequency must remain steady from no load to full load.

e. Lock adjustment when final setting is made.

f. Apply full load to inverter and check for proper voltage after a 30 minute warmup period with 27.5 volt d-c input.

g. Set voltage at 118 volts a-c output with minimum droop or flat characteristic.

Note

In order to stabilize voltage, it may be necessary to replace carbon piles and carbon button contacts in the regulator. Parts replacement and testing will be accomplished in accordance with applicable technical order.

4–899. TROUBLE SHOOTING OF BENDIX 250VA INVERTER.

Trouble	*Probable Cause*	*Remedy*
Inverter fails to operate or operates at slow speed.	Low input voltage.	Check power sources and test equipment connections.
	Faulty electrical connector plug.	Check plug, make sure it is clean and tight.
	Binding worn or improperly seated brushes.	Service as directed by applicable technical order.
	Rough, pitted or badly scored commutators.	*Service as directed by applicable technical order.
	Internal connections to series or shunt field loose or open circuited.	Check all wiring, resolder or tighten all connections as necessary.
	Armature coils shorted.	*Replace rotor assembly.
	Worn and rough turning ball bearings.	*Replace ball bearing.
	Faulty governor.	Replace or readjust per paragraph 4–897.
No effect on output voltage when potentiometer adjusting screw is turned.	Faulty potentiometer.	Replace potentiometer.
	Regulator or exciting coil or 1250 ohm resistor shorted or open circuit.	Check rectifier connections at terminal board and resistor.
		*Replace regulator coil assembly rectifier or resistor.
	Regulator faulty or not properly adjusted.	*Service as directed by applicable technical order and readjust regulator.
No a-c output voltage with unit operating.	Voltage regulator carbon pile or contact plugs faulty or not properly adjusted.	*Service as directed by applicable technical order or readjust regulator.
	Condenser in output circuit open.	*Replace condenser.
	A-c winding shorted or open.	*Replace rotor.
A-c output too low.	Speed too low.	Adjust governor per paragraph 4–897.
		Replace brushes and clean commutator.
		Check power source and equipment connections.
		*Replace ball bearings.
	Regulator faulty.	*Service as directed by applicable technical order.
A-c output too high.	Faulty potentiometer.	Adjust or replace potentiometer.
	Governor brushes open.	Repair or replace.
	Connections to carbon pile, potentiometer or 1250 ohm resistor shorted.	Repair or replace.
	Connections to regulator exciting coil or rectifier open.	Repair as necessary.
		*Replace defective part.
A-c voltage does not remain constant under varying load conditions.	Regulator faulty or not properly adjusted.	*Service as directed by applicable technical order.
		Adjust as necessary.
Frequency will not stabilize.	Governor faulty or not properly adjusted.	*Replace governor.
		Readjust governor per paragraph 4–897.

NOTE: * Repairs should be made only by activities authorized depot level overhaul.

4–900. 250VA INVERTER CIRCUIT (PRIOR TO AF SERIAL NO. 52-9760). *(See figures 8-300 through 8-303.)* The 250va inverter supplies 115-volt, 400-cycle, single-phase alternating-current to the AN/APX-6 identification radar equipment through the inverter starter relay in the nose section. It is protected by a 20-ampere push-to-reset inverter control circuit breaker and a 5-ampere push-to-reset inverter power circuit breaker in the armament junction box. Six-volt power for the AN/APX-6 destructors is supplied directly from the batteries through the battery relay (also in the armament junction box), through the inertia switch in the nose wheel well to the destructors in the AN/APX-6 transmitter-receiver.

4–901. REMOVAL OF 250VA INVERTER.

a. Remove safety wire securing knurled nuts of the AN/ARC-27 transmitter-receiver at left side of upper rear nose section.

b. Loosen knurled nuts and fold downward to clear front of AN/ARC-27 transmitter-receiver.

c. Disconnect 2 connectors on front of AN/ARC-27 transmitter-receiver and slide outward until the 250va inverter on the upper right section of the forward bulkhead is cleared.

d. Remove one connector at 250va inverter.

e. Remove 4 bolts attaching inverter to bulkhead and remove inverter.

f. Replace AN/ARC-27 transmitter-receiver by reversing steps a, b, and c.

4–902. 250VA INVERTER CIRCUIT. *(See figures 8-145 and 8-146.)* On AF Serial No. 52-9760 and subsequent (excluding AF Serial No. 52-9876 through 52-9940 and 53-2687 through 53-2726), two 250VA inverters are installed in lieu of installations described in paragraphs 4–868 through 4–872 and 4–875. These two inverters run all the time, one supplying three-phase instrument power and the other supplying single-phase power to the AN/APX-6 identification radar. Alternating-current relays are installed in lieu of the Stratopak on the left side of the nose wheel well to sense failure of instrument power only. In case of failure, actuation of the manual switch on the forward instrument panel will transfer the three-phase instrument load to the other inverter, connecting the AN/APX-6 to the failed inverter, thus rendering the AN/APX-6 inoperative.

4–902A. 750-VA INVERTER CIRCUIT. (See figures 8-146 and 8-146B.) One 750VA, 3 phase inverter replaces one 250-VA inverter by T.O. 1T-33A-577. Circuitry is modified accordingly to accommodate the increased capacity with improved provisions for monitoring of the electrical power system.

4–903. ALIGHTING GEAR WARNING CIRCUIT. *(See figures 8-147 through 8-156.)* Alighting geat circuits provide for the following functions: To indicate all gears locked in down position; to indicate all gears locked in up position; to prevent operation of the alighting gear operating lever to "GEAR UP" position until weight of airplane is off the gears; and to give visual and audible warning when the engine control lever is closed before all gears are down and locked.

4–904. ALIGHTING GEAR DOWNLOCK SWITCHES. Three green lights for down lock indication are mounted on each instrument panel. The lights are actuated by the down lock switches, one on each alighting gear. The lights receive power from the forward cockpit right-shelf bus through a 10-ampere push-to-reset circuit protector. The down lock switches are single-pole double-throw. The nose-gear switch is on the drag strut, and the main-gear switches are on the side struts. When the gears are all down and locked, the circuit from each pair of green lights is completed to ground through a switch.

4–905. ADJUSTMENT OF NOSE LANDING GEAR DOWNLOCK SWITCH. *(See figure 4-47.)*

4–906. ADJUSTMENT OF MAIN LANDING GEAR DOWNLOCK SWITCH.

a. Install linkage as shown in figure 4-35.

b. Adjust linkage length to provide a gear down-and-locked indication after latch block (5) has engaged lower side strut a minimum of 0.25 inch. Dimension "A" should be approximately 2.30 inches.

c. Make any additional fine adjustment by means of adjusting screw on switch.

4–907. ALIGHTING GEAR POSITION INDICATORS. On AF Serial Nos. 51-6587 and subsequent, three type AN 5839-1 position indicators are installed in lieu of lights. These indicators clearly show the word "UP" when gear is up and locked, a wheel in "DOWN" position when gear is down and locked, and bright red diagonal lines if any individual gear is in a dangerous position.

4–908. ALIGHTING GEAR UPLOCK SWITCHES. Uplock switches, one at each gear, are wired in parallel. Until the three gears are up and locked, a red warning light on each instrument panel indicates an unlocked condition.

4–909. The nose-gear uplock switch is actuated by the uplock engagement fitting on the strut. This switch also operates a relay which opens the circuit to the emergency fuel system red indicator light. (Refer to paragraph 4–830.) The main-gear uplock switches are actuated by the inner-door operating mechanism.

4–910. ADJUSTMENT OF NOSE GEAR UPLOCK SWITCH.

a. Install linkage as shown in figure 4-49 so that dimension "A" is approximately 2.6 inches for switch B2376 and 2.8 inches for switch 9135.

b. Adjust linkage length to provide a gear up- and-locked indication after anchor bolt, which is attached to fork, is fully engaged in uplock hooks (3).

c. Make any additional fine adjustment by means of adjusting screw on switch P/N B2376 or by repositioning linkage on switch shaft of switch 9135.

d. Make certain circuit is broken immediately after hook disengagement.

4–911. ADJUSTMENT OF MAIN LANDING GEAR UPLOCK SWITCH.

a. Install linkage as shown in figure 4-41 so that dimension "A" is approximately 4.00 inches on left gear installation and approximately 3.75 inches on right gear installation.

b. Adjust linkage length to provide a gear up-and-locked indication after roller has engaged hook, with a maximum distance of 0.25 inch from bottom of slot, as shown.

c. Make any additional fine adjustment by means of adjusting screw on switch B2376 or by repositioning linkage on switch shaft of switch 9135.

4–912. ALIGHTING GEAR TORQUE ARM SWITCH AND SELECTOR VALVE LOCK SOLENOID. *(See figure 4-137.)* Operation of the alighting-gear control lever to the "GEAR UP" position when the weight of the airplane is on the gears, is prevented by the emergency release latch. An unlocking solenoid, behind the forward cockpit left shelf and connected to the alighting-gear emergency release latch, unlocks the selector valve when the weight of the airplane is off the gears.

4–913. The solenoid receives its power from the forward cockpit right shelf bus and is grounded at the nose gear down lock switch. This switch is wired in series with the scissors switch on the left main gear. When the airplane is on the ground, the torque arm "scissors" switch is open. When the weight of the airplane is removed from the struts, the scissors on the left main gear moves and closes the switch in the circuit to the nose gear down lock switch. This energizes the solenoid which releases the emergency release latch, permitting operation of the alighting-gear control lever to "GEAR UP" position.

4–914. ADJUSTMENT OF LANDING GEAR TORQUE ARM SWITCH.

a. Install linkage as shown on figure 4-34 so that dimension "A" is approximately 2.375 inches.

b. Adjust linkage length so that switch closes when piston assembly is 0.50 inch from fully extended position.

c. Additional fine adjustment is made by means of adjusting screw "B" on switch B2376 or by repositioning linkage on switch shaft of switch 9135.

4–915. ALIGHTING GEAR WARNING HORN CIRCUIT. *(See figures 8-147 through 8-156.)* A warning horn on the structure between the two cockpits gives an audible warning if any of the alighting gears are not locked in down position when the engine control lever is moved near idle position during flight. The warning circuit includes the horn, the engine control lever switch assembly, and the down lock switches. A red indicator light on each instrument panel gives a visual warning of the same condition. The lights are actuated by the engine control lever switch assembly, and are grounded through the down lock switches when the switches are in up position.

4–916. The engine control lever switch assembly consists of two switches mounted in the engine compartment (figure 4-166) on the forward bulkhead. The switches are operated by cams which are bolted to a crank. The right switch is the alighting gear warning switch, and is set so the horn will sound when the engine control lever switches operate. If it is desired to cut out the audible horn warning, press the button on the cockpit left shelf adjacent to the engine control lever. The circuit to the red indicator light is not affected by the horn cut-out button. To reset the switch it is necessary only to advance the engine control lever.

4–917. ADJUSTMENT OF ALIGHTING GEAR WARNING HORN SWITCH.
(See figure 4-166.)

a. Disconnect the nose gear down lock switch linkage (see figure 4-43) and place switch in the gear unsafe position. With power "ON" in the airplane, the red warning light will indicate landing gear unsafe and the warning horn will sound.

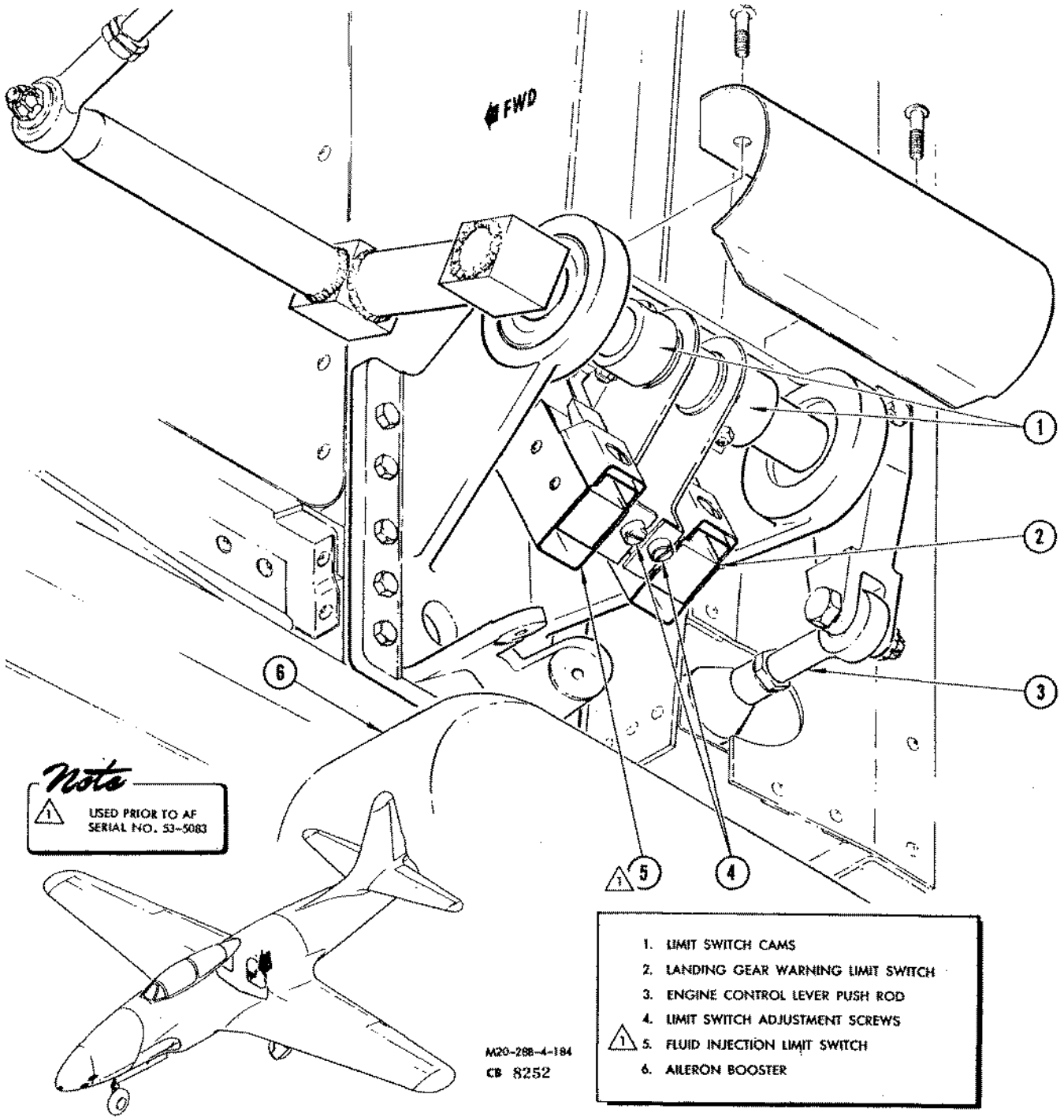


Figure 4-166. Engine Control Lever Switch Adjustment

b. Depress the horn cutout switch to stop sound of horn.

c. Clamp engine compartment lower access doors open.

d. Station one man in the cockpit to operate the engine, and one man (wearing ear plugs and preferably ear muffs,) below the lower left engine access door.

e. Start engine using prescribed starting procedure.

f. Operate engine above 65 percent rpm, then reduce to 65 (+0, —5) percent rpm.

g. Working through the lower left engine access door, adjust the alighting gear warning horn switch until the alighting gear warning horn sounds. At this time the man in the cockpit will communicate this information to the adjuster and at the same time depress the horn cutout switch.

h. The man in the cockpit will then operate the engine again to above 65 percent rpm and reduce to 65 (+0, —5) percent rpm. This will release the horn cutout relay to the ready position.

i. For adjustment of the fluid injection switch (left limit switch) refer to paragraph 4–846.

4–917A. ALTERNATE METHOD FOR ADJUSTMENT OF ALIGHTING GEAR WARNING SWITCH.

a. Start engine using prescribed starting procedures.

b. Operate engine at 65 percent RPM and mark throttle plate in two places with a grease pencil. Once even with the rear of the throttle handle and once even with the front of the throttle handle.

c. Shut the engine down in accordance with prescribed procedures.

d. Close the main fuel shutoff valve to prevent the engine from venting fuel.

e. Advance throttle to full open, depress gear horn cutout switch and retard throttle until gear warning light illuminates.

f. If throttle handle is not centered within the marks on throttle plate, adjust limit switch and recheck setting. Repeat step until throttle is correctly positioned.

g. Return throttle to full close position and open main fuel shutoff valve and resafety wire the fuel shutoff valve switch guard.

4–918. TAIL CONE TEMPERATURE CIRCUIT. *(See figure 8-167.)* A circuit employing three thermocouples in the engine exhaust cone is provided to indicate exhaust gas temperature. Indicators on the instrument panels register temperature at these thermocouples.

4–919. The tail cone temperature circuit generates its own current and is therefore independent of the airplane electrical system. The thermocouple circuit employs a fixed resistor mounted in the sub-cockpit compartment. The leads from the thermocouple units (hot junction) to the indicator (cold junction) are of specific length, resistance, and material, and must not be altered in any way.

4–920. ADJUSTMENT OF TEMPERATURE CIRCUIT.

a. Connect a jumper across the terminals of both tail pipe temperature indicators. Disconnect lead at one end of the series resistor in the sub-cockpit compartment, and insert the test instrument in the circuit.

b. Adjust resistor to obtain a circuit resistance value of 4.0 (±0.05) ohms as follows: Remove cover and unwind resistance wire from spool (coil) until the desired resistance value is obtained. Cut off surplus wire and solder end of remaining wire to lug provided for that purpose.

Note

The second coil of resistance wire is for service replacement only and should not be used unless resistance is less than 4.0 ohms.

c. Disconnect test instrument, reconnect lead to resistor, and remove jumper from terminals of indicator.

4–921. EXHAUST TEMPERATURE INDICATING SYSTEM CALIBRATION CHECK. Check the temperature indicating system calibration using a BH-112G-15 Jet Cal Tester as follows:

a. With voltage regulator in tester at zero, connect tester to 110 volt alternating current, 50 to 400 cycle power source.

b. Connect a junction box to tester and connect one heater probe to junction box.

c. Set and check potentiometer in tester per instructions for tester.

d. Place range switch at 300-1000°C (red scale) position, and turn voltage regulator to maximum to bring heater probe to approximately 700°C.

CAUTION

Never allow heater probe to exceed 900°C.

e. Place hot heater probe over each of tail cone thermocouples. Have a crew member check that exhaust temperature indicator in cockpit shows a rise as each thermocouple is heated. Any dead thermocouple must be replaced before proceeding with calibration check.

f. Turn voltage regulator to zero.

g. Connect remaining heater probes to tester junction box and place probes over each thermocouple in tail cone.

h. Turn voltage regulator to maximum and as heater probe temperature comes up, adjust voltage regulator as necessary to obtain and hold 715°C indicated on tester potentiometer.

i. When tester probe temperature has stabilized at 715°C, read cockpit temperature indicators. Cockpit indicators must read within ±15°C of tester reading.

j. If cockpit indicators do not read within ±15° C of tester reading, locate and correct fault and then repeat calibration check.

4–922. OVERHEAT WARNING CIRCUIT.

a. (Refer to wiring diagrams in Section VIII.) Most aircraft incorporate 9 overheat detector switches in the engine area and 9 overheat detectors in the aft section.

b. The overheat detector switches in the engine area are wired to operate a red push-to-test fire warning light in both cockpits. The overheat detector switches in the aft section are wired to operate an amber push-to-test overheat warning light in both cockpits. The overheat detector switches in the engine and aft section are the same part numbers (17343–16–450) and are set at 450° F by the manufacturer.

c. A test switch on the forward cockpit instrument panel adjacent to the indicator lights, is provided for power on checking of both the fire warning and overheat circuit simultaneously.

4–923. (Deleted)

4–924. MAINTENANCE OF OVERHEAT WARNING CIRCUIT.

a. The wiring used in the fire and overheat wiring circuits in the engine and aft section areas is type MIL-W-25038 (MS 27125–16) size 16.

b. Use high temperature terminals part Nos. YAV14G-88, 322338, or equivalent for connecting high temperature wire to overheat detector switches. Use varglass #46 or MIL–T–43435 type IV finish F lacing and tying tape for securing wires together in high temperature areas. Wire support clamps should be part Nos. MS 21105–( ), MS 21919WDG–( ) or high temperature strap clamps part No. 668–3–6FR. (Refer to T.O. 8S6–3–2–1.)

CAUTION

Do not dent, distort or otherwise damage the overheat detector switch as the shell forms a part of the circuit and could result in false indications.

c. Always use a torque wrench on terminal nut when making electrical connection to overheat detector switch.

d. A maximum of 20 inch-pounds torque can be applied when insulator is constructed of porcelain material.

e. A maximum of 15 inch-pounds can be applied when insulator is constructed of fiberglass.

f. After the overheat detector switch has been placed into operation, it should be kept free from oil, grease or any foreign substances which may accummulate on it and change the amount of heat required to actuate the switch.

4–925. THERMAL SWITCHES.

a. The overheat detector switches are set at 232 °C (450° F ±250°F) by the manufacturer. Check all overheat detector switches prior to installation using the procedures and equipment specified in T.O.s 8S6–3–2–1 or 33D4–6–18–21 and 33D4–6–18–24.

Note

The operating range of overheat detectors must be between 225° C and 246.2 °C. Do not use overheat detector switches that are set below 225 °C, (437 °F).

4–926. THERMAL SWITCH CALIBRATION CHECK.

WARNING

Observe all the safety precautions noted in existing directives and applicable equipment technical orders in the use of test sets employing potentially dangerous voltages.

a. Equipment required for functional testing of overheat detector switches used in the fire and overheat warning circuits when they are installed in aircraft.

b. Model BH112J or BH112JA Jet engine analyzer or equivalent and multimeter AN/PSM–6 or equivalent.

c. Refer to technical manuals, T.O. 33D4–6–18–21 and T.O. 33D4–6–18–24 for functional test procedures and for tables listing the components and accessories required. The operating range of all overheat detector switches used in the fire and overheat warning circuits is between 225° C and 246.2 °C.

(1) Temporarily remove the fire and overheat warning light lens and lamps from both cockpits. Check that the five ampere warning light circuit breaker located in forward cockpit right hand switch panel is closed (in).

Note

The following continuity checks must be made with all electrical connector plugs in this circuit, including engine and aft section plugs connected.

(2) Using multimeter AN/PSM–6 or equivalent, check for resitance between system and ground by connecting one test lead on an overheat detector switch terminal in the aft section, and the other test lead on a clean metal portion of aircraft structure. Multimeter reading must be 1 megohn or higher.

(3) Using multimeter AN/PSM–6 or equivalent, check for resistance between system and ground by connecting one test lead on an overheat detector switch terminal (fire warning) in the plenum chamber area, and the other test lead on a clean metal portion of fuselage structure. Multimeter reading must be 1 megohm or higher.

(4) Upon completion of resistance test, reinstall lamps and lens removed in step a. above. The red lens must be attached to the fire warning lights, and the amber lens must be attached to the overheat warning lights.

(5) Power on check for fire and overheat warning circuits. With external electrical power connected to aircraft, temporarily ground one overheat detector in aft section. Only the amber overheat light in each cockpit should illuminate. Remove temporary ground, both lights should extinguish. Perform the same test with the plenum chamber fire warning circuit also, noting only the red fire warning light in each cockpit illuminates. Operate forward cockpit test switch. Both lights in each cockpit should illuminate and then be extinguished when test switch is released. Above check will ensure that wiring is not crossed at connectors, terminal boards, indicator lights or test at switch.

4–927. COCKPIT LIGHTS CIRCUIT. (See figure 8-168 through 8-193.) Individual shielded red lights illuminate each instrument in both forward and aft cockpits, and red flood lights are provided on each side of each cockpit. An emergency system is also provided, consisting of additional red lights pointing to each instrument panel and a white pencil-type map light on the right sill in each cockpit. Controls for each system are installed on the forward and aft right switch boxes.

4-928. NAVIGATION, POSITION, AND ANTI-COLLISION LIGHTS CIRCUIT. (See figures 8-196 through 8-201.) A C-2 or MS24577-2 flasher, wingtip, tiptank, tail and fuselage upper and lower light installations make up the navigation and position lights system. On airplanes incorporating T.O. IT-33A-42, installation of the wingtip tanks disconnects the wingtip lights from the circuit through switches mounted in the wingtips.

4-929. The flasher is controlled by the position light switch and flashes the wingtip, tiptank and tail lights. The position light switch is a double-throw switch with STEADY, FLASH, and OFF positions. With the switch on STEADY, both wingtip lights, a yellow and a white taillight are on continuously. The yellow taillight lens is changed to white when MS24577-2 flasher, which supersedes C-2, is used. The fuselage position lights are controlled from the single-pole, double-throw fuselage switch, prior to AF Serial No. 51-4127 except on aircraft having complied with T.O. 1T-33-536. The three positions are BRIGHT, DIM, and OFF. The wingtip and taillights may be dimmed by means of the navigation light switch marked DIM and BRIGHT. On AF Serial No. 51-4127 and subsequent and those early aircraft having complied with T.O. 1T-33-536, the navigation light switch controls the dimming provisions for all the lights.

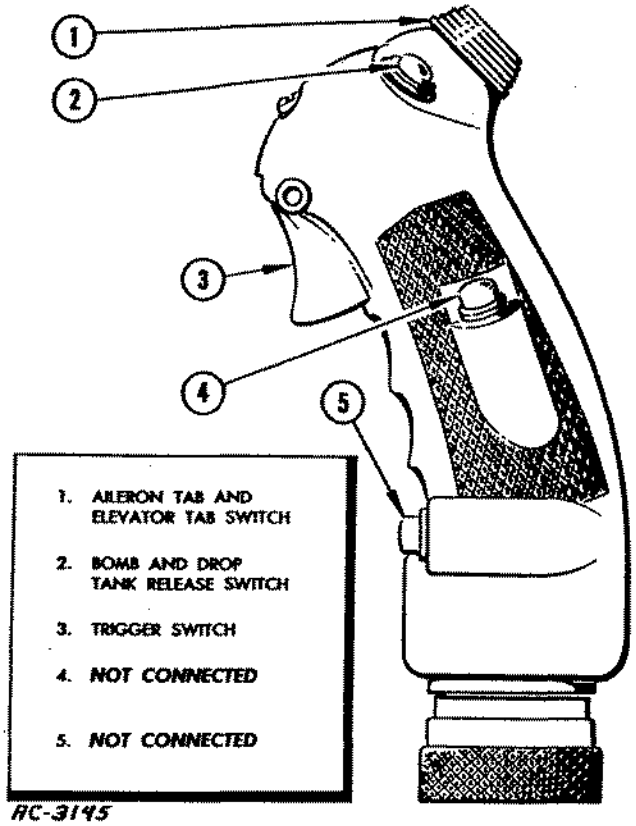


Figure 4-167. Control Stick Grip

4-929A. ANTI-COLLISION LIGHTS. Two anti-collision light beacons (MS25277-1) are installed on tail section adjacent to existing fuselage lights. The upper light must contain a baffle (Part No. D-8916 or equivalent) to prevent the beacon from flashing on cockpit canopy. Insure the bulbs do not contact the baffle when rotating. The lower beacon drain plug must be removed from lens to provide for proper drainage. Upper and lower beacon lens must be cleaned periodically to insure optimum visibility by other aircraft. Refer to T.O. 8D3-8-17-13 for additional information on beacons.) A single on-off switch is located in the forward cockpit right-hand switch panel for controlling both beacons simultaneously. The beacon circuit is protected by a 10-ampere circuit breaker located in the same panel. When necessary to replace beacons, reseal using MIL-S-8802 or RTV-106 sealant. Two MS25338-7079 bulbs are required in each beacon. The electrical connector plugs to beacons shall be safety-wired as noted in T.O. 1-1A-14. When necessary to replace the contacts in beacon electrical disconnect plugs CV8E10SL-3S-C50 or CV10SL-3S-C50, use socket contact Part No. 031-3114-006 or equivalent. Use MS3191-1 or -3 or CCT1612 crimping tool and the combination insertion extraction tool, Part No. CIET-16.

Note

Lamp replacement on some beacons will require loosening of rotating clamp end screw. Lamp may then be removed by rotating counterclockwise and pulling straight out.

CAUTION

On above noted beacons, it is important to tighten the clamp screw until the lamp cannot be turned in the socket. This will insure longer lamp fire.

CAUTION

Those aircraft equipped with nose guns and utilized for gun firing missions will require a shield, P/N 7040520-01, over the forward part of lower anti-collision light beacon. This shield was designed to prevent damage to lower beacon from expended shell casings during certain flight conditions. The shield is easily attached to the lower beacon mounting nutplates with five MS35207-267 screws. The shield may be removed when aircraft is not utilized for gunnery missions and reinstalled when required.

4–930. LANDING LIGHTS CIRCUIT. *(See figures 8-194 and 8-195.)* Two landing lights are mounted on the nose alighting gear and turn with the gear. These lights are not adjustable. Control of the lights is through switches mounted on each cockpit right shelf. The switches have three positions: LANDING LIGHT, OFF, and TAXI LIGHT. With switches in LANDING LIGHT position both lights are on. In the TAXI LIGHT position, only one light is on. On airplanes prior to AF Serial No. 49-901, the left light is the taxi light. On airplanes AF Serial Nos. 49-901 and subsequent, the right light is the taxi light.

CAUTION

The landing lights must not be left on for longer than five minutes at any time when the airplane is on the ground or lights can burn out.

4–931. LANDING LIGHT. *(See figure 4-44.)* The landing lights are sealed-beam units. A bracket mounted on the shimmy damper supports holds the two lights in a fixed position with relation to the wheel. Either light may be removed independently of the other by removing the seven screws around the lamp.

4–932. CONTROL STICK GRIP. *(See figure 4-167.)* The control stick grip in the forward and aft cockpits incorporates switches for controlling the following electrical circuits:

a. Aileron tab and elevator tab switch (refer to paragraphs 4–865 and 4–873).

b. Bomb and drop tank release switch (refer to paragraph 4–942).

c. Trigger switch (refer to paragraph 4–935).

CAUTION

When entering or leaving airplane, take extreme care not to use control stick as a step, and be careful not to kick or hit the trim tab button.

4–933. PITOT HEATER CIRCUIT. *(See figures 8-202 and 8-203.)* The pitot head employs an integral heater to prevent or remove the accumulation of ice. This ensures

correct operation of the air-speed indicator. The pitot head is under the fuselage nose. Control of the heater is by a 10-ampere switch-type circuit breaker on the forward cockpit right shelf.

4–934. GUN HEATERS CIRCUIT (T-33A-1 AIRPLANES). *(See figures 8-202 and 8-203.)* A gun heater in a spring-type housing is attached to each gun. The heaters are wired in parallel and are controlled by a switch on the forward cockpit left shelf. The circuit is protected by a 15-ampere push-to-reset circuit protector in the forward cockpit left shelf, and two 5-ampere push-to-reset circuit protectors in the armament compartment junction box.

4–935. DESCRIPTION OF GUNNERY CIRCUITS (T-33A-1 AIRPLANES). The gunnery circuits are controlled by the armament master switch in the forward cockpit left shelf, and the trigger switch on each control stick. A 10-ampere switch type circuit breaker on the aft cockpit left shelf protects the circuit through the trigger switches and the armament master switch to the control circuits for the case ejection door, the gun firing solenoids, and the gun camera circuits. The armament master switch is a three-position switch with "GUNS," "OFF," and "SIGHT AND CAMERA" positions. The trigger switch is on the forward side of each control stick as an integral part of the control stick grip. Operation of the armament master switch to "GUNS" position affects four circuits: The gun-sight circuit is energized, turning on the gun-sight light; the case ejection door control valve circuit, the gun-firing solenoid circuit, and the gun camera circuit are connected to the trigger switches. Operating the armament master switch to "SIGHT AND CAMERA" energizes the camera and gun sight. The "OFF" position disconnects all gunnery circuits. A switch guard protects the armament master switch from accidental operation in its closed position.

Note

The rear cockpit gun firing trigger and camera circuits have been disabled on those aircraft having T.O. 1T–33–537 complied with.

4–935A. On those aircraft having T.O. 1T–33–537 complied with, the first position of the control stick grip trigger switch (Figure 4–167, item 3) operates the camera when the armament master switch is in the "GUNS" or "SIGHT AND CAMERA" position. The second position of the control stick grip trigger switch operates the guns, case ejection door control valve circuit and gun camera when the armament master switch is placed in the "GUNS" position. On aircraft prior to 50–402, the second position of the forward cockpit stick grip trigger switch will also fire the JATO units when the "GUNS – JATO" switch is in the "GUNS" position.

4–936. GUN FIRING SOLENOIDS CIRCUIT (T-33A-1 AIRPLANES). The machine gun firing solenoids are operated simultaneously through a type B-5B relay, located in the armament compartment junction box. The relay is controlled by the trigger switches and the armament master switch. The master switch must be in the "GUNS" position to fire the guns. Circuit protection is afforded the gun firing solenoids by one 15-ampere push-to-reset circuit protector in the armament compartment junction box.

4–937. CASE EJECTION DOOR CONTROL VALVE CIRCUIT (T-33A-1 AIRPLANES). *(See figures 4-151, 8-204, 8-208 and 8-209.)* Operation of the trigger switches, when the armament master switch is in the "GUNS" position, opens the case ejection door control valve. The valve is controlled through two relays. The first relay applies power through the second relay. The second relay is wired in such a way that current will be supplied to the control valve until the hydraulic actuator is fully extended, at which time a cam on the actuator operates a limit switch to open the second relay. This breaks the circuit to the valve if the trigger switch has been released. If it has not, the solenoid valve will continue to be energized. A switch to operate the case ejection door control valve on the ground is at the forward end of the armament junction box. Circuit protection is provided by a 10-ampere switch-type circuit breaker in the trigger switch circuit, and a 15-ampere push-to-reset circuit protector in the actuator power circuit. For hydraulic information on the actuator and valve refer to paragraph 4–748.

CAUTION

The nose gear on which landing lights are installed must be centered when the case ejection door is operated on the ground to prevent door from striking landing light.

4–938. GUNSIGHT CIRCUIT (T-33A-1 AIRPLANES). *(See figures 8-205 through 8-207.)* The lights on the gun sight are controlled by the armament master switch with the switch in either "GUNS" or "SIGHT AND CAMERA" position. The gyroscope in the sight is not controlled by any switch, but is energized whenever the forward cockpit left-shelf bus is energized. The equipment consists of the type K-14B gun sight, the sight selector, the reticle dimmer, the voltage regulator, the range control, a radio noise filter, and two sets of voltage regulator test jacks. Accurate operation of the sight requires that the voltage supply be maintained at 22

(±0.5) volts. The sight selector and the reticle dimmer are on the forward cockpit instrument sub-panel. The voltage regulator is mounted on the left side of the radio rack in the armament compartment. One set of voltage regulator test jacks is on the forward instrument sub-panel, and the other on the left side of the radio rack in the armament compartment. Spare lamps for the gun sight are held by rubber grommets inside the gun sight support casting.

4–939. ADJUSTMENT OF GUN SIGHT VOLTAGE REGULATOR. To adjust the voltage regulator, a warm-up period of 10 minutes must be allowed with the sight "ON," selector at "FIXED," and dimmer at "BRIGHT." To check the input voltage, connect the leads of a portable voltmeter (range 0-30 volts) to the input terminals (marked with blue dots). The input voltage should be between 24 and 29 volts. If the voltage does not fall within this range, check the source of supply. With the correct input voltage, connect the portable voltmeter to the voltage test jacks. With the sight still operating, the output voltage must be between 21.5 and 22.5 volts. If the output is within 1.1 volts of being correct, adjust to the correct value by the following procedure: Loosen the two core screw locking screws one-half turn. The core screw is the large screw above the terminal board. While carefully observing the voltmeter reading, adjust the output voltage by turning the core screw very slowly and carefully (clockwise to increase voltage). Tighten the core screw locking screws, and again check the output voltage to be sure the locking operation has not disturbed the voltage setting. If output voltage is less than 20.4 or higher than 23.6, replace the regulator.

4–940. GUN CAMERA CIRCUIT (T-33A-1 AIRPLANES). Two circuits are necessary to operate the gun camera, the camera relay circuit and the camera operating circuit. A relay inside the camera, operated by the camera relay circuit, connects the camera operating circuit to the camera motor. The camera relay circuit is operated through another relay located under the forward cockpit left shelf, by the trigger switches, when the armament master switch is in either "GUNS" or "SIGHT AND CAMERA" position. The camera operating circuit is always energized, but cannot operate the camera until it is connected to the camera motor by the camera internal relay. The camera operating circuit is protected by a 10-ampere push-to-reset circuit protector in the cockpit left shelf. A receptacle for a lens heater is on the front of the camera, and is energized whenever the airplane battery switch is "ON."

Note

On those aircraft having T.O. 1T–33–537 complied with, the rear cockpit stick grip trigger switch has been disabled.

4–941. JATO IGNITION CIRCUIT. *(See figures 8-204, 8-210 through 8-212.)* On airplanes prior to AF Serial No. 50-402, the jato ignition circuit is energized from the aft cockpit left-shelf bus through a 10-ampere switch-type circuit breaker on the left shelf, a jato switch on the forward instrument panel, and the control stick trigger switch. A red light on each instrument panel glows when the switch is placed in "JATO" position. Closing either trigger switch fires the jato units.

Note

The rear cockpit trigger switch is disabled on those aircraft having T.O. 1T–33–537 complied with. On aircraft prior to 50-402, the second position of the forward cockpit stick grip trigger switch will also fire the JATO units when the "GUNS – JATO" switch is in the "GUNS" position.

Connectors for the jato units are mounted flush with the outside skin, one on each side of the airplane center line under the engine compartment. On airplanes AF Serial Nos. 50–402 and subsequent, the jato ignition circuit is separated from the gunnery circuit. A push-button jato firing switch is located on the left shelf in each cockpit. An arming switch is located on the forward cockpit left shelf. A jato-ready indicator light is located on each instrument panel. Closing the arming switch energizes indicator lights.

4–942. BOMB AND DROP TANK CIRCUIT (PRIOR TO AF SERIAL NO. 51-4141). *(See figures 4-5 and 8-213.)* This circuit employs a type S-1 or S-2 bomb rack in each wing tip. The rack contains the release unit as an integral part. The wing tip also contains a toggle switch to be operated only when chemical tanks are used. The rack is controlled by three switches on the armament switch panel of the forward cockpit left shelf, the bomb release switch on each control stick grip, and on airplanes AF Serial No. 48-364 through 51-4140, a salvo switch on each instrument panel. The three switches on the left switch panel are the bomb arming, bomb selector, and chemical-tank operating switches. The arming switch is a 3-position switch, and bombs may be dropped safe, tail armed, or nose and tail armed. The bomb selector switch permits the pilot to choose between dropping both bombs together, or dropping them separately. With the bomb selector switch "OFF," bombs or tanks cannot be dropped electrically, but can be dropped manually. Bombs are normally dropped by use of the bomb-release push-button switch.

Note

On AF Serial No. 57-1744 and subsequent and airplanes incorporating T. O. 1T-33A-557, the bomb and drop tank circuit is rendered inoperative to prevent jettison of tip tanks by accidental actuation of stick grip bomb and drop tank release switch.

- On aircraft having T. O. 1T-33-543 accomplished, the tip tank auto-drop switch is an ON-OFF type with the ARM position eliminated. Bombs can be dropped using the bomb release button on the control stick when other switches and circuit breakers are set as noted in applicable munitions loading handbook.

4—943. The drop-tank salvo switch is installed on each instrument sub-panel adjacent to the gun sight controls. The circuit to this switch is wired around the trigger and bomb selector switches. The circuit through the drop-tank salvo switch is protected by a 20-ampere push-to-reset circuit protector in the sub-cockpit right junction box. The switch is operated to jettison both tanks simultaneously in case of emergency.

4–944. When chemical tanks are used, the toggle switch in the wing tip is turned to "CHEMICAL" upon installation of the tanks. To operate the chemical tanks, move the chemical switch on the armament switch panel to whichever tank is selected. If the toggle switch in the wing tip has been left on "BOMBS," both chemical tanks can be operated together, but not separately, by operating the arming switch to "NOSE" or "NOSE AND TAIL." The bomb arming circuit is protected by a 10-ampere switch-type circuit breaker. The bomb release and chemical operating circuit is protected by a 10-ampere switch-type circuit breaker. Both circuit breakers are on the aft cockpit left shelf.

4–945. CENTERLINE TIP TANK CIRCUIT. *(See figures 8-214 through 8-219.)* (Refer to paragraphs 4-415, 4–416, and figure 4-91.) The circuit employs a solenoid in each wing tip to release the jettisonable tanks, and wiring provisions up to the mid-wing terminal strips for bomb pylon installation. The tank dropping solenoid is controlled through relays in the sub-cockpit by the jettison switches on the lower instrument panels in both the forward and aft cockpits. The tip tank auto-drop system is controlled by an ON-OFF switch in each cockpit. The auto-drop circuit is protected by a ten ampere circuit breaker located in the aft cockpit LH switch panel labeled "bomb release and auto-drop."

4–946. On aircraft with T.O. 1T-33-543 accomplished, the tip tank release circuit is designed so that both tank dropping solenoids are energized when the selector switch in either cockpit is in the "AUTO-DROP" position. This will automatically jettison the remaining tip tank in the event of accidental loss of one tip tank.

4–947. FLOW CONTROL VALVE CIRCUIT. *(See figures 8-220 through 8-225.)* The flow control valve circuit on airplanes prior to AF Serial No. 49-967 includes the flow control valve and motor assembly, the flow control valve micropositioning relay, and a temperature control rheostat. The flow control valve is in the sub-cockpit, and controls the temperature of the air entering the cockpit. The flow control valve micropositioning relay is a polarized single-pole double-throw relay, inside the forward cockpit left switch box. A rheostat on the forward cockpit left shelf controls this relay. The circuit to the flow control valve is protected by a 5-ampere push-to-reset circuit protector. A 150-ohm resistor is installed in the line between the control rheostat and ground. A 50-ohm resistor in the sub-cockpit junction box is installed in the motor rheostat ground line. On airplanes AF Serial No. 49-967 and subsequent, the micropositioning relay, the resistors, and two additional relays are mounted in one unit in the sub-cockpit compartment.

4–948. FLOW CONTROL VALVE MOTOR. The flow control valve motor is in the sub-cockpit compartment. The motor is reversible, with built-in limit switches and a follow-up rheostat. The rheostat is keyed directly to the actuating shaft, and turns through an arc of 90 degrees. The limit switches are preset at the factory to stop the motor when the 90-degree limit has been reached, and need no adjustment. The motor turns clockwise to increase cockpit temperature, and counterclockwise to decrease temperature.

4–949. FLOW CONTROL VALVE RELAY. The flow control valve positioning relay is controlled through a bridge circuit arranged so that any unbalance caused by changing the position of the control rheostat energizes the micropositioner coil, causing one or the other set of contacts to close, depending upon the polarity of control current. With no voltage on the coil, the contacts float between the two terminals.

4–950. SOLENOID AIR SHUTOFF VALVE AND COCKPIT PRESSURE RELIEF VALVE CIRCUITS(AF SERIAL NO. 53-5814 THROUGH 53-6152, AND 54-5144 AND SUBSEQUENT). *(See figures 8-224 and 8-225.)* The solenoid air shutoff valve and cockpit pressure relief valve circuits are protected by the cockpit flow control valve circuit breaker, located in the forward left switch box and controlled by the cabin air pressure switch (see figure 4-209) located in the forward cockpit on the left shelf. Interconnected on the dump side of the switch are the circuits to the solenoid air shutoff valve and the cockpit pressure relief valve. Depressurization is accomplished by placing the cabin air pressure switch in the dump position. This action energizes the solenoid of the air shutoff valve, triggering the valve to the closed position and at the same time energizing the solenoid of the cockpit pressure relief valve to the open position, thus dumping cabin pressure.

Note

The solenoid air shutoff valve must be manually reset to the open position after each dumping procedure (refer to paragraph 4–1180).

4–951. CANOPY ACTUATOR CIRCUIT. *(See figures 8-226 through 8-230.)* This circuit consists of the actuator, two relays, and up lock solenoid, a canopy seal air solenoid, five limit switches, indicator lights, switches, and circuit protectors. The power circuit to the actuator is protected by a 35-ampere push-to-reset circuit protector in the aft cockpit right shelf. To retard the closing cycle, a two-ohm adjustable resistor is located in the line between the canopy closing relay and the actuator. The relay control circuit is protected by a 5-ampere push-to-reset circuit protector on the aft cockpit right shelf. This circuit is routed to six control switches. An opening switch is in each cockpit and in the external switch box. The internal switches are push-button type, and the external switch is a double-pole, single-throw momentary

contact switch. One pole of the relay grounds the battery relay coil, connecting the battery to the bus. The other pole operates the actuator opening relay and is grounded through one of the canopy lock limit switches. The up lock solenoid is also energized. A canopy closing switch is in each cockpit and in the external switch box. The cockpit switches are single-pole double-throw momentary contact switches. The external switch is a double-pole double-throw momentary contact switch. The extra pole is to ground the battery relay coil. The two positions are "PART CLOSE" and "FULL CLOSE," with a center off position. To close the canopy, hold one of the switches in "PART CLOSE" position. This operates the canopy up lock relay and energizes the up lock solenoid to release the up lock. The actuator is operated through the closing relay until the part-closed limit switch on the sloping bulkhead of the airplane is opened by the descending canopy. To finish the closing cycle, the closing switch must be moved to "FULL CLOSE" position, upon which the canopy will close until stopped by the down limit switch mounted on the cockpit right sill adjacent to the actuator. Two limit switches are mounted in the forward left canopy latch. One opens the actuator circuit so that the canopy cannot be lowered until the hooks are opened. The other energizes the canopy seal solenoid when the hooks are latched, and energizes the red indicator lights on each cockpit instrument panel when the hooks are unlocked.

4–955. REMOVAL OF CANOPY ACTUATOR.

a. Raise canopy to full "OPEN" position and support canopy forward of the canopy yoke.

b. Remove forward cockpit seat. (Refer to paragraphs 4–1142 or 4–1156.)

c. Remove two bolts at right and left idler sprockets and remove sprockets.

d. Remove chains from right and left drive sprockets.

e. Remove two snap rings and one pin from each drive sprocket, and remove drive sprockets.

CAUTION

Be sure to mark pin locations on actuator bracket mount so that alignment may be made at installation.

f. Unlatch rear cockpit instrument panel and tilt toward rear cockpit seat.

g. Disconnect canopy actuator electrical wiring at terminal block forward of rear instrument panel.

h. Remove three bolts attaching actuator assembly to supporting bracket.

i. Support actuator assembly while removing two bolts holding left side of actuator bracket, and remove bracket side and actuator assembly.

4–953. INSTALLATION OF CANOPY ACTUATOR. Reverse removal procedure.

Note

Make certain that drive sprockets are aligned with each other. Do not cut the wire leads to the actuator during installation of serviceable unit. Secure and stow the excess wire away from the sprocket and chain assembly. Rig canopy chain mechanism as outlined in paragraph 4–94.

4–954. OIL PRESSURE INDICATING CIRCUIT. *(See figures 8-231 through 8-236.)* The oil pressure indicating circuit consists of an autosyn transmitter mounted on the engine and connected to an indicator on each instrument panel. Power for this circuit is furnished by a 400 cycle inverter mounted on the radio rack. The power circuit to the inverter is protected by a 5-ampere push-to-reset circuit protector in the sub-cockpit junction box.

4–955. OIL PRESSURE INDICATING SYSTEM INVERTER. The oil pressure system inverter has an input of one ampere at 27.5 volts. The output is 6 volt-amperes at 26 volts, 400 cycles, single phase. The inverter is located on the radio rack in the fuselage nose section. Refer to paragraph 4–958 for maintenance of 6VA inverter.

4–956. FUEL PRESSURE INDICATING CIRCUIT. *(See figures 8-232 through 8-236.)* On airplanes AF Serial Nos. 50-385 and subsequent, the fuel pressure gage is operated electrically. The units of the fuel pressure circuit consist of an autosyn transmitter on the engine connected to an indicator on each instrument panel. Power for this circuit comes from the same inverter that powers the oil pressure circuit.

4–957. Prior to AF Serial No. 51-8843, the push-to-reset circuit breaker for the fuel and oil pressure inverter is located on the sub-cockpit junction box. On AF Serial Nos. 51-8843 and subsequent, the circuit breaker is on the forward cockpit right shelf.

4–958. MAINTENANCE OF 6VA INVERTER.

a. Remove commutator end cover.

b. Clean and repair all wiring and connections as necessary.

c. Unscrew brush caps and remove brush assemblies.

d. Mark brushes so that they will be positioned properly in their respective brush guides when reassembled.

e. Replace brushes worn to less than 5/32-inch. This is important to insure continuous operation until next scheduled inspection period.

Note

Worn, distorted or corroded brush springs must be replaced with new brush assemblies.

f. Check brush springs for tension, compress springs 15/32-inch, the load required must be two ounces, if less, spring is weak and a new brush assembly must be installed.

g. If commutator is dirty, polish with clean dry lint-free cloth. Should commutator need additional work, replace inverter.

Note

Inverters with new brushes installed must be run-in in accordance with applicable technical orders.

4–959. SEAT ACTUATOR CIRCUIT. *(See figures 8-237 and 8-238.)* On AF Serial No. 51-4040 and subsequent, and on some prior airplanes modified by Lockheed Aircraft Service, Inc., electrically operated seat actuators are provided for adjusting the seats in the vertical direction only. The circuit for each actuator consists of the actuator, a double-pole double-throw control switch, and a circuit breaker. A control switch is on the right lower portion of each seat, and the circuit breakers are on the forward right switch-box panel. The actuator allows 4.00 (±0.25) inches of travel.

4–960. ADJUSTMENT OF SEAT ACTUATOR LIMIT SWITCHES.

a. Remove limit switch cover.

b. Adjust bottom screw so that extended length (center line of gear-to-seat attachment hole to center line of actuator support) is 15.25 (+0.00, —0.25) inches prior to AF Serial No. 51-4522; 15.00 (±0.125) inches on AF Serial Nos. 51-4522 and subsequent.

c. Adjust top screw so that retracted length is 10.50 (+0.25, —0.00) inches prior to AF Serial No. 51-4522; 11.00 (±0.125) inches on AF Serial Nos. 51-4522 and subsequent.

d. Replace cover.

4–961. REMOVAL OF SEAT ACTUATOR. Refer to paragraph 4–1136.

4–962. INSTALLATION OF SEAT ACTUATOR. Refer to paragraph 4–1137.

4–963. ELECTRONICS SYSTEM.

4–964. DESCRIPTION OF ELECTRONICS SYSTEM. The electronics system of the airplane consists of the AN/ARC-3, AN/ARC-27, AN/ARC-34 or AN/ARC-49 command radio, RC-193-A marker beacon receiving equipment, AN/AIC-2A interphone equipment, and an AN/ARN-6 radio compass. On airplanes AF Serial No. 49-942 through 56-3694, the RC-193-A marker beacon is replaced by an AN/ARN-12 radio. On airplanes AF Serial No. 57-530 and subsequent, the AN/ARN-12 radio is replaced by the AN/ARN-32 radio. On airplanes AF Serial Nos. 51-9236 and subsequent, the AN/AIC-10 interphone system replaces the AN/AIC-2. AN/APX-6 identification radar equipment is installed on airplanes AF Serial No. 50-402 through 58-503 except airplanes incorporating T. O. 1T-33A-571. The RT-82/APX-6 receiver-transmitter and its controls are not installed in MDAP airplanes. AN/APX-25 identification radar equipment is installed on airplanes AF Serial No. 58-504 and subsequent and airplanes incorporating T. O. 1T-33A-571 and T. O. 1T-33A-580. An AN/ARN-14 VHF omnirange and localizer receiver and an AN/ARN-18 glide slope receiver are installed in T-33A-5 airplanes. On airplanes AF Serial No. 57-530 and subsequent, the AN/ARN-31 receiver is installed in place of the AN/ARN-18. On airplanes incorporating T. O. 1T-33A-585, the AN/ARN-14 radio and the AN/ARN-18 or AN/ARN-31 radio are replaced by the AN/ARN-21 radio navigation system (TACAN). On T-33A-15LO airplanes (airplanes incorporating T. O. 1T-33A-613), the AN/ARN-21 radio navigation system (TACAN) is installed, with the AN/ARN-14 VHF omnirange and localizer receiver system and the AN/ARN-18 or AN/ARN-31 glide slope receiver system retained, and the AN/ARN-6 radio compass system is removed. On airplanes AF Serial No. 51-4143 and subsequent, certain airplanes incorporating T. O. 1T-33A-554 (those airplanes coded X107 in T. O. 1T-33A-4 that have been designated by the Command Headquarters) are provided with the AN/ALE-2 chaff dispenser equipment. These airplanes are equipped with a C-1616/ALE chaff dispenser control panel and with modified mid-wing bomb pylons containing MA-4A bomb racks for carrying two CY-1440/ALE-2 chaff dispensers. These airplanes may be converted to an ECM (electronic countermeasures) pod configuration by installing two C-6175/ALQ ECM pod control panels in lieu of the C-1616/ALE chaff dispenser control panel and by installing two AN/ALQ(-71) ECM pods in lieu of the two CY-1440/ALE-2 chaff dispenser pods. The same airplane wiring is utilized for the chaff dispenser system or the ECM pod system. For detailed information concerning the various items of equipment, consult the applicable handbooks as listed in the current issue of the List of Applicable Publications for USAF Series T-33A Aircraft and Equipment, T. O. 1T-33A-01.

Note

No transmission will be made on emergency (distress) frequency channels except for emergency purposes. For testing, demonstration, or drill purposes, radio equipment will be operated into a nonradiating dummy load instead of an antenna. Emergency (distress) frequencies are 500 kilocycles, 8364 kilocycles, 121.5 megacycles and 243.0 megacycles.

4–965. For information on the current drain for all electronic equipment, see table 4-10.

4–966. REPAIR OF COAXIAL CABLES.

a. High and low temperature cable with damaged outer braid only, may be repaired as follows:

Thoroughly clean damaged area of all foreign matter and lap-wrap with fiber glass tape, Specification

MIL-G-1140B or equal, overlap to be ½ width of tape and extended one inch beyond each side of damaged area.

Spot-tie ends and at 3 inch intervals and coat with silicone varnish Finch No. 381, manufactured by Finch Paint and Varnish Co., Los Angeles, Calif., or equal.

b. Low temperature cable only with more severe damage may be repaired as follows:

Cut out damaged portion of cable and install matching plugs, jacks and patch cable section of proper type and size.

Splicing to be done only when aircraft must be dismantled to remove damaged cable assembly.

No splices are permitted in high temperature areas and only one splice is permissible in any one coaxial circuit.

When replacing connectors or portions of coaxial cable, the same type or equal must be used.

Table 4-10. Electronic Equipment Power Input

Radio Equipment	*Primary Power Supply*	*D.C. Input Voltage Range*	*Maximum Amperes*	*Maximum D.C. Power (Watts)*
AN/ARC-3 RCVR	A	22-32	6.3	201.6
AN/ARC-3 TRANS	A	22-32	13.5	432.0
AN/ARC-27	A	27.5	25.5	701.25
AN/ARC-34	A	27.5	18	495.0
BC-193A	A	24-28	.31	8.7
AN/ARN-12	A	24-29	1.7	49.3
AN/ARN-32	A	27.5	0.60	16.50
AN/AIC-2A	A	28	1.7	47.6
AN/AIC-10	A	27-28	2.63	72.2
AN/ARN-6	A	21-32	4.0	128.0
AN/APX-6	A B	28	1.8	50.4
AN/APX-6B	A B	24-29	1.5	43.5
AN/APX-25	A B	28	1.8	50.4
AN/ARN-14	A B	27.5	15.0	412.5
AN/ARN-18	A C	26.5	1.0	26.5
AN/ARN-31	A D	26.5	0.15	3.98
AN/ARC-49 RCVR	A	27.5	6.15	172.2
AN/ARC-49 TRANS	A	27.5	13.75	383.0
AN/ARN-21	A E	28	1.8	50.0

A — Battery and Generator System.
B — Also 220 Watts AC Power
C — Also 33.0 Watts AC Power
D — Also 56-64 Watts AC Power
E — Also 470VA AC Power

4-967. AN/ARC-3 COMMAND RADIO (AIRPLANES NOT INCORPORATING T. O. 1T-33A-556). *(See figures 8-239 through 8-244.)* The command radio is an AN/ARC-3 multi-channel aircraft radio with receiving and transmitting equipment. The receiver, transmitters and dynamotor are mounted in the nose section of the airplane. The antenna is built into the plastic tip of the fin, and is connected by a coaxial cable to the command radio. Transmitter and receiver controls are on the right shelf in the aft cockpit. Circuit protectors for the AN/ARC-3 radio and control circuits are mounted on the forward right switch box. Microphone buttons are located on each engine control lever. Control may be shifted from one panel to the other by changing the position of either AN/ARC-3 control switch. An indicator light glows on which ever panel has control. The "MIC" selector switch light will be extinguished when the microphone and headset relays are in proper position for AN/ARC-3 operation.

4-968. The equipment is started by operating any one of the eight red selector buttons on the control panel. The equipment is turned off by the black "OFF" button and the small black lock button plug. The button plug and switch assembly prevents accidental turning off of the equipment and prevents failures of the set as the result of continuous operation of its tuning motors when all channel buttons are released with power "ON." On the shelf adjacent to the push-buttons are a volume control rheostat and a tone control switch. The tone control switch may be used when "MCW" operation is desired.

4-969. The equipment operates over a "line of sight" distance on an all-frequency range of 100 to 156 megacycles. Average communicating distances are approximately 30 miles at an altitude of 1,000 feet, and 135 miles at 10,000 feet. The frequency is controlled by eight selector buttons on top of the control box. The control box is coordinated with the receiver and transmitter in such a way that they both operate on preset frequency channels in combination with other radios similarly set. The radio is wired for high impedance.

WARNING

Do not change tubes or make adjustments inside the radio with the high-voltage supply on.

4-970. REMOVAL OF COMMAND RADIO ANTENNA.

a. Remove eight screws from around base of fin tip.

b. Lift fin tip up and disconnect the coaxial cable from the base of the antenna in the tip.

c. Remove six screws from each side of the fin tip, and remove the antenna.

4–971. GROUND OPERATIONAL CHECK OF AN/ARC-3 COMMAND RADIO.

a. Inspect the following for completeness of installation: Cables, plugs, power junction box, and receiver and transmitter.

b. See that crystals in the transmitter are of proper frequency and in the correct channels.

c. See that crystals and thumb wheels are on their proper frequency and in the correct channels.

d. Connect headset and throat microphone to their respective jacks in the cockpit.

e. Connect external power to the airplane if possible; if not, turn on the battery switch.

f. Start the equipment by depressing any one of the eight channel-selection buttons on the AN/ARC-3 control panel. This action turns on both transmitter and receiver which automatically tune to the selected channel.

g. Allow 30 to 45 seconds for the tubes in the equipment to reach operating temperature. During the latter portion of this warm-up period, an audio tone will be heard in the headset. When this tone stops, the receiver and transmitter have been tuned to the selected channel. The receiver output should be heard in the headset immediately afterward. The VHF audio knob is used to control the audio level.

h. Push the "MIC" button on the engine control lever and talk with the microphone in place on the throat. Speech (side tone) which modulates the transmitter should be audible in the headset. If none is heard, check to make sure a crystal has been inserted for that channel of the transmitter. Release the "MIC" button to restore receiver operation.

i. Establish two-way radio communication with an aircraft in flight or with the control tower, as a final check on the operation of the equipment.

j. Through the sliding panel on the receiver, marked "SQUELCH" located just to the right of the frequency indicating dial on the front panel, adjust the squelch control for the desired background noise level consistent with the operating conditions.

k. Check the "MCW" operation by pressing the "TONE" button on the control panel. A tone should be audible in the headset.

l. Check all channels as above. Approximately two seconds are required to select channels. An audio tone will be heard in the headset while equipment is tuning.

m. Turn equipment off by first pressing the small black button on the control panel, then press "OFF" button.

WARNING

The T-67/ARC-3 and T-67B/ARC-3 transmitters are NOT interchangeable, and the switch marked "MIC-INTERCOM," which is disclosed when the button plug on the underside of the T-67B/ARC-3 transmitter aft of the access door is removed, MUST be set in the "INTERCOM" position for proper functioning of the equipment.

Note

Prior to AF Serial No. 51-9236, the T-67/ARC-3 transmitter is installed for use with the AN/AIC-2 interphone system. On AF Serial No. 51-9236 and subsequent, the T-67B/ARC-3 transmitter is installed for use with the AN/AIC-10 interphone system. (Refer to paragraphs 4–1004 through 4–1028.)

4–972. AN/ARC-49 COMMAND RADIO (AIRPLANES NOT INCORPORATING T. O. 1T-33A-556). *(See figure 8-245.)* The command set is an AN/ARC-49 multi-channel (48 frequency channels) aircraft radio with receiving and transmitting equipment. The receiver and transmitters are mounted in the nose section of the airplane. Transmitter and receiver controls are located in the left switch box in the forward cockpit and in the right radio panel in the aft cockpit. Circuit protectors for the AN/ARC-49 radio and control circuits are mounted on the forward right switch box. Microphone buttons are located on each engine control lever. Control may be shifted from one panel to the other by changing the position of either C-1400/ARC-49 control switch. An indicator light glows to show which panel has control. The "MIC" selector switch light will be extinguished when the microphone and headset relays are in proper position for AN/ARC-49 operations.

4–973. The equipment is started by operating the "ON-OFF" switch to the "ON" position and setting the channel selector switches to desired channel. To operate the equipment to the "OFF" positions, place switch to "OFF."

4–974. Radio set AN/ARC-49 has forty eight frequency channels. Remote operation of the set is accomplished by the use of control, Radio Set, C-1400/ARC-49. The equipment operates in a frequency range of 100 to 156 megacycles. Frequencies of this range are characterized by line of sight distances. Average, communicating distances are approximately 30 miles at an altitude of 1,000 feet and 135 miles at 10,000 feet. These distances may be increased or decreased, depending on atmospheric conditions.

4–975. GROUND OPERATIONAL CHECK OF THE AN/ARC-49 COMMAND RADIO.

a. Inspect the following for completeness of installation: Cables, plugs, power junction box, and receiver and transmitter.

b. Connect external power to airplane if possible, if not, turn on the battery switch.

c. Connect headset and throat microphone to their respective jacks in the cockpit.

d. See that crystals and thumb wheels are on their proper frequency and in the correct channels.

e. Check the VHF circuit breaker for "IN" position, start the equipment by placing the C-1400/ARC-49 power switch to "ON" position.

c. Check Inter-communication system for operation with headset and microphone plugged in.

g. Insert the respective crystals in receiver and transmitter channels.

h. Set the associated receiver thumbwheel to desired position.

i. Perform squelch adjustment in the following manner: Rotate squelch adjust (front of receiver) counterclockwise until hash is at a tolerable level. Some hash must be heard or weak signals will not come through.

j. Perform a transmission check in the following manner: Establish two way radio communication with an aircraft in flight or with the control tower, perform an MCW check by pressing the "TONE" button on the C-1400 control box.

k. Shut down equipment by actuating control box switch to "OFF."

4–976. AN/ARC-27 COMMAND RADIO (AF SERIAL NO. 51-6752 THROUGH 56-3694 AND AIRPLANES INCORPORATING T.O. 1T-33A-143 AND 1T-33A-556.) *(See figures 8-246 through 8-255.)* This equipment operates in the 225.00 to 339.90 megacycle frequency range between aircraft, or between aircraft and ground installations. It consists of a transmitter-receiver unit mounted in the nose section in lieu of the AN/ARC-3 equipment, a master control unit in the upper right nose section mounted above the AN/APX-6 transponder and remote control units on the forward cockpit right shelf, and the aft cockpit left shelf. An ultra-high frequency antenna for the AN/ARC-27 command radio is mounted in the vertical fin tip. On airplanes incorporating T.O. 1T-33A-611A, the existing uhf antenna in the vertical fin tip is disabled by disconnecting its coaxial cable at AN/ARC-27 receiver-transmitter and stowed, and a new uhf stub antenna (AT-256-A/ARC) is installed aft of the nosewheel doors with its coaxial cable assembly connected to the receiver-transmitter. The new uhf stub antenna installation improves the reliability and performance of the uhf system. A total of 1750 frequency channels are provided in the entire range, plus a guard channel. A screw-driver operated control for adjustment of sensitivity of the receiver and the threshold of squelch operation, a rotary switch for connecting a test meter to various circuits of the unit, and a non-locking switch for disabling the squelch circuit of the receiver are provided on the right side of the transmitter-receiver. On AF Serial No. 51-9236 through 56-3694 incorporating T.O. 1T-33-517, the audio output level and the side tone level of the AN/ARC-27 command receiver-transmitter are changed by adjusting the levels to 200 milliwatts and 325 (±25) milliwatts, respectively, to increase the reliability of the command set when used with the AN/AIC-10 interphone system. A decal is installed on the receiver-transmitter to inform personnel of the audio level change.

CAUTION

This set is pressurized to between 3 and 5 psi. Pressure must be maintained within these limits for maximum effectiveness.

4–977. The AN/ARC-27 command transmitter-receiver employs several of its circuits bilaterally to permit its operation both as a receiver and a transmitter, the signal passing through them in one direction while receiving, and in the opposite direction while transmitting. The excitation system is entirely crystal controlled and allows adjustment over the entire frequency range in increments of 0.1 megacycle. A second fixed tuned receiver monitors the guard channel.

4–978. Any one of 1750 freqency channels of AN/ARC-27 may be selected using the controls on the master control unit C-626/ARC-27, and any one of eighteen preset channels or the guard frequency may be selected on the remote control units in either cockpit.

4-979. REMOVAL OF AN/ARC-27 COMMAND TRANSMITTER-RECEIVER.

a. Gain access to AN/ARC-27 command transmitter-receiver through left side armament compartment door.

b. Disconnect antenna and electrical connectors P-1401 and P-1403.

c. Remove safety wire, loosen and swing off two hold-down nuts.

d. Use attaching hand grip of transmitter-receiver and pull unit from mounting rack.

4-980. INSTALLATION OF AN/ARC-27 COMMAND TRANSMITTER-RECEIVER. Reverse removal procedure.

Note

Make certain that aligning pins at opposite lower end of transmitter-receiver unit are properly inserted in mounting rack pilot holes before securing unit with wing hold-down nuts.

4-981. PRESSURIZATION OF AN/ARC-27 COMMAND TRANSMITTER-RECEIVER CASING.

a. Remove valve core assembly from either one of valve stems on transmitter-receiver unit front casing.

b. Connect an MK-20A/UP pressurizing unit or equivalent to second valve stem.

c. Turn on radio equipment (refer to operating instructions). Heat generated within case during operation will aid in driving off any moisture. Pump clean dry air into case for several minutes.

d. Replace valve core assembly that was removed in step a. Continue pumping until case pressure is 13 to 15 psi as indicated by a Schrader 3715 pressure gage. Turn off radio equipment.

e. After 2 hours, gage pressure must not drop more than 1 psi.

f. Reduce pressure to 3-5 PSI.

g. Remove pressurizing unit from transmitter-receiver unit.

CAUTION

Use extreme care during repressurization since large physical forces are involved. Do not force air pressure inside the case above limits indicated.

4-982. GROUND OPERATIONAL CHECK OF AN/ARC-27 COMMAND RADIO.

a. Test receiver-transmitter by connecting thruline wattmeter, Bird Model 43, at point A of figure 4-168. Turn wattmeter plug-in element so that arrow points toward transmission line leading to antenna. Key transmitter and read transmitter power.

b. Reverse wattmeter plug-in element so that arrow points toward transmission line leading to transmitter. Key transmitter and read reflected power.

c. Compute power ratio by dividing transmitter power by reflected power. If ratio is ten or greater and transmitter power is less than eight watts, replace receiver-transmitter unit. Power output specifications for receiver-transmitter is nine watts, eight watts is established to allow for input voltage variations, reflected antenna troubles, etc.

d. If power ratio is ten or greater, antenna system is satisfactory. If less, proceed to check antenna and cable assembly to isolate defects.

e. Insert wattmeter at antenna, point D, figure 4-168, using test cable and read transmitter power, arrow pointing to antenna. Make test on unused frequencies in the range of 350 to 400 mc. If power delivered is less than values listed below, a portion of cable is defective. Other readings at various disconnects will determine defective portion.

Length of Cable RG-8A/U, RG-87A/U or RG-115A/U	*Percent Power Delivered as Compared to Reading at Point A, Figure 4-168*
100 ft	25%
50 ft	50%
25 ft	75%
10 ft	90%

f. Test antenna by inserting wattmeter at point D of figure 4-168, using test cable connected to antenna. Key transmitter and read transmitter power, arrow pointed at antenna; reflected power, arrow pointed at

receiver-transmitter unit. Compute ratio and if over seven, antenna is satisfactory. If less, antenna is defective.

g. Place cockpit selector switch to front cockpit and place C-1904/ARC-27 control in TR & G position.

h. DELETED.

i. DELETED.

j. Check operation of the receiver by operation of the squelch switch on the front panel of the transmitter-receiver unit. If the receiver is operating normally, the "hiss" characteristic of set noise should be heard in the headset.

k. With the function selector in TR & G, operation of the guard channel should be checked in the same manner as the receiver channel described in step j, depressing the guard receiver squelch switch.

l. Check operation of the transmitter by observing the antenna current while the transmitter is being operated. With the meter switch in position 6, a milliammeter (TS-80/U or equivalent) plugged into the meter jack should be deflected two or more divisions on all channels.

m. Operation of the transmitter should operate the side tone which will be heard in the headset.

n. Repeat the above procedures on each of the preset frequencies.

o. Check of complete system should be made by establishing two-way communication with ground station or another aircraft, when time permits.

Note

All checks should be made with battery cart capable of maintaining voltage, since transmitter power output will vary with battery voltage.

4–983. AN/ARC-34 COMMAND RADIO (USAF SERIAL NO. 57-530 AND SUBSEQUENT). *(See figure* 8-256.) This system operates in the 225.00 to 399.90 megacycle frequency range between aircraft, or between aircraft and ground installations. It consists of a receiver-transmitter mounted in the left side of the nose section and control units on the forward cockpit left shelf and aft cockpit right shelf. A total of 1750 frequency channels are provided, plus a guard channel. Any one of the 1750 frequency channels may be selected using the manual controls. In the PRESET position of the control units, any one of twenty preset channels may be chosen. When the control unit is switched to the GUARD position, the guard receiver which is a part of the ARC-34 system is energized.

4–984. On airplanes USAF Serial No. 58-450 and subsequent, a C-1057A/ARC-34 control panel and an ID-572/ARC remote channel indicator are installed in each cockpit. The remote channel indicator is mounted on the instrument panel in each cockpit and presents a number in the indicator window corresponding to the channel which is selected on the control panel.

4–985. The C-1057A/ARC-34 control panel can be used on airplanes which do not have a remote channel indicator installed. However, the C-1057/ARC-34 control panel cannot be used on airplanes incorporating a remote channel indicator as this control panel does not include a connector for hooking up the indicator.

4–985A. On airplanes incorporating T.O. 1T-33A-611A, the existing uhf antenna in the vertical fin tip is disabled by disconnecting its coaxial cable at AN/ARC-34 receiver-transmitter and stowing, and a new uhf stub antenna (AT-256-A/ARC) is installed aft of the nosewheel doors with its coaxial cable assembly connected to the receiver-transmitter. The new uhf stub antenna installation improves the reliability and performance of the uhf system.

4–986. REMOVAL OF AN/ARC-34 COMMAND RECEIVER-TRANSMITTER.

a. Gain access to receiver-transmitter through left armament compartment door.

b. Disconnect antenna.

c. Remove safety wire, loosen and swing off two wing hold-down nuts.

d. Use hand grip of receiver-transmitter and pull unit from mounting rack.

4–987. INSTALLATION OF AN/ARC-34 COMMAND RECEIVER-TRANSMITTER. Reverse removal procedure.

Note

Make certain that aligning pins at opposite lower end of receiver-transmitter are properly inserted in mounting rack pilot holes before securing unit with wing hold-down nuts.

4–988. GROUND OPERATIONAL CHECK OF AN/ARC-34 COMMAND RADIO.

a. Perform steps a through f of paragraph 4–982.

b. Perform steps m through o of paragraph 4–982.

c. On airplanes USAF Serial No. 58-450 and subsequent, make certain that the numbers appearing in the window of remote channel indicator ID-572/ARC, are identical to those selected on the control panels.

4–989 through 4–996. (Deleted)

receiver-transmitter unit. Compute ratio and if over seven, antenna is satisfactory. If less, antenna is defective.

g. Place cockpit selector switch to front cockpit and place C-1904/ARC-27 control in TR & G position.

h. DELETED.

i. DELETED.

j. Check operation of the receiver by operation of the squelch switch on the front panel of the transmitter-receiver unit. If the receiver is operating normally, the "hiss" characteristic of set noise should be heard in the headset.

k. With the function selector in TR & G, operation of the guard channel should be checked in the same manner as the receiver channel described in step j, depressing the guard receiver squelch switch.

l. Check operation of the transmitter by observing the antenna current while the transmitter is being operated. With the meter switch in position 6, a milliammeter (TS-80/U or equivalent) plugged into the meter jack should be deflected two or more divisions on all channels.

m. Operation of the transmitter should operate the side tone which will be heard in the headset.

n. Repeat the above procedures on each of the preset frequencies.

o. Check of complete system should be made by establishing two-way communication with ground station or another aircraft, when time permits.

Note

All checks should be made with battery cart capable of maintaining voltage, since transmitter power output will vary with battery voltage.

4–983. AN/ARC-34 COMMAND RADIO (USAF SERIAL NO. 57-530 AND SUBSEQUENT). *(See figure* 8-256.) This system operates in the 225.00 to 399.90 megacycle frequency range between aircraft, or between aircraft and ground installations. It consists of a receiver-transmitter mounted in the left side of the nose section and control units on the forward cockpit left shelf and aft cockpit right shelf. A total of 1750 frequency channels are provided, plus a guard channel. Any one of the 1750 frequency channels may be selected using the manual controls. In the PRESET position of the control units, any one of twenty preset channels may be chosen. When the control unit is switched to the GUARD position, the guard receiver which is a part of the ARC-34 system is energized.

4–984. On airplanes USAF Serial No. 58-450 and subsequent, a C-1057A/ARC-34 control panel and an ID-572/ARC remote channel indicator are installed in each cockpit. The remote channel indicator is mounted on the instrument panel in each cockpit and presents a number in the indicator window corresponding to the channel which is selected on the control panel.

4–985. The C-1057A/ARC-34 control panel can be used on airplanes which do not have a remote channel indicator installed. However, the C-1057/ARC-34 control panel cannot be used on airplanes incorporating a remote channel indicator as this control panel does not include a connector for hooking up the indicator.

4–985A. On airplanes incorporating T.O. 1T-33A-611A, the existing uhf antenna in the vertical fin tip is disabled by disconnecting its coaxial cable at AN/ARC-34 receiver-transmitter and stowing, and a new uhf stub antenna (AT-256-A/ARC) is installed aft of the nosewheel doors with its coaxial cable assembly connected to the receiver-transmitter. The new uhf stub antenna installation improves the reliability and performance of the uhf system.

4–986. REMOVAL OF AN/ARC-34 COMMAND RECEIVER-TRANSMITTER.

a. Gain access to receiver-transmitter through left armament compartment door.

b. Disconnect antenna.

c. Remove safety wire, loosen and swing off two wing hold-down nuts.

d. Use hand grip of receiver-transmitter and pull unit from mounting rack.

4–987. INSTALLATION OF AN/ARC-34 COMMAND RECEIVER-TRANSMITTER. Reverse removal procedure.

Note

Make certain that aligning pins at opposite lower end of receiver-transmitter are properly inserted in mounting rack pilot holes before securing unit with wing hold-down nuts.

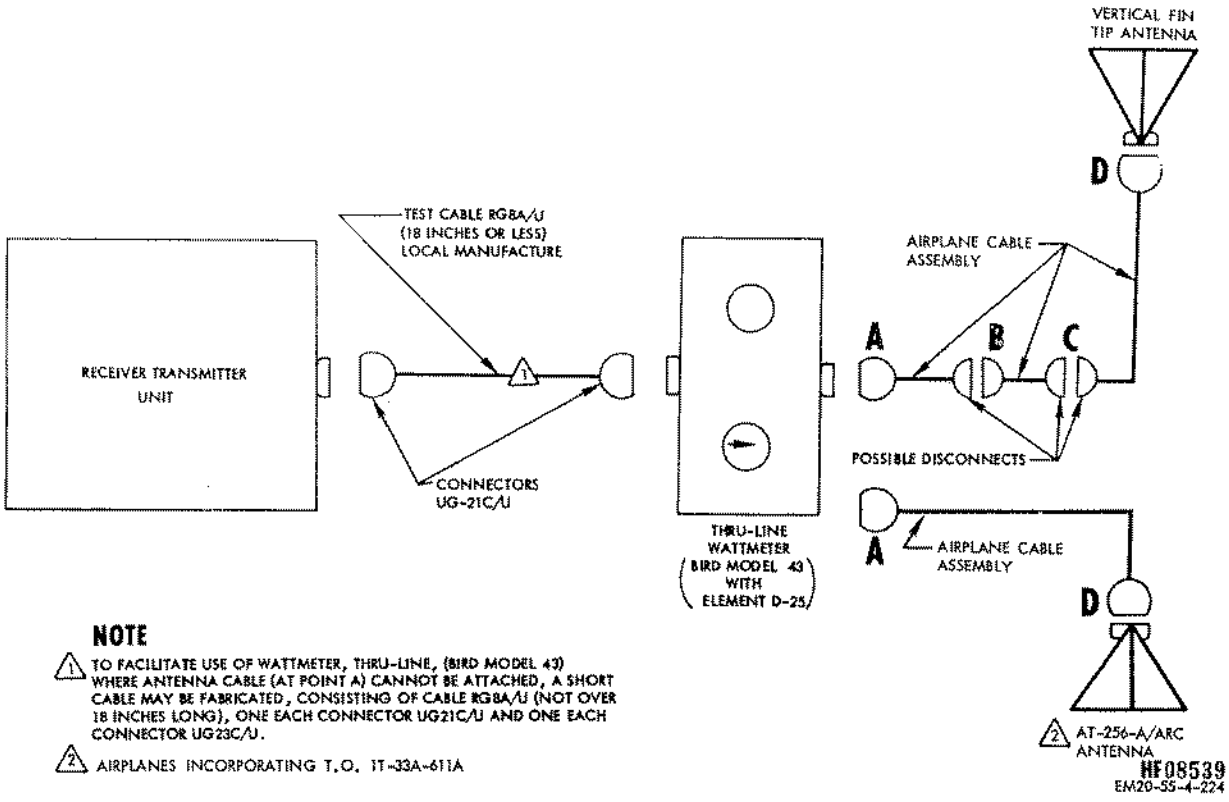
4–988. GROUND OPERATIONAL CHECK OF AN/ARC-34 COMMAND RADIO.

a. Perform steps a through f of paragraph 4–982.

b. Perform steps m through o of paragraph 4–982.

c. On airplanes USAF Serial No. 58-450 and subsequent, make certain that the numbers appearing in the window of remote channel indicator ID-572/ARC, are identical to those selected on the control panels.

4–989 through 4–996. (Deleted)



NOTE

1. TO FACILITATE USE OF WATTMETER, THRU-LINE, (BIRD MODEL 43) WHERE ANTENNA CABLE (AT POINT A) CANNOT BE ATTACHED, A SHORT CABLE MAY BE FABRICATED, CONSISTING OF CABLE RG8A/U (NOT OVER 18 INCHES LONG), ONE EACH CONNECTOR UG21C/U AND ONE EACH CONNECTOR UG23C/U.
2. AIRPLANES INCORPORATING T.O. 1T-33A-611A

Figure 4-168. AN/ARC-27 Antenna Test Points

4–997. MARKER BEACON RECEIVING EQUIPMENT. *(See figures 8-259 and 8-287 through 8-292.)* Airplanes prior to AF Serial No. 49-942 have RC-193-A marker beacon receivers. Airplanes AF Serial No. 49-942 through 56-3694 have AN-ARN-12 marker beacon receivers. On AF Serial No. 57-530 and subsequent, an AN/ARN-32 marker beacon receiver is installed. The marker beacon receiver is energized when the battery switch is on, or when external power is connected to the airplane. The marker beacon receiving equipment consists primarily of an ultra-high frequency receiver mounted on a rack in the nose section of the airplane. A half-wave antenna which receives the marker beacon signal is located within the lower fuselage forward of the right dive flap. A coaxial cable conducts the signals from the antenna to the receiver. Prior to AF Serial No. 53-5086 and on airplanes not incorporating T. O. 1T-33A-218, a dehydrator for the marker beacon is mounted in the sub-cockpit. On AF Serial No. 53-5086 and subsequent and on airplanes incorporating T. O. 1T-33A-218, the dehydrator is installed on two brackets in the right dive flap well. A dehydrator hose connects the dehydrator to the antenna. The marker beacon receiver circuit is protected by a 5-ampere push-to-reset circuit protector on the forward left switch box. The receiver is automatically turned on when the battery switches are closed.

4–998. The marker beacon equipment may be used as a navigation or landing aid, in that a visual and an aural indication are given the pilot when the airplane passes over a 75-megacycle marker beacon transmitter. The presence of such a signal is indicated by the glowing of an indicator lamp and by an aural tone. On T-33A-1 airplanes, the indicator lamps are mounted directly on each instrument panel. On T-33A-5 airplanes, the indicator lamps are a part of the ID-249 or ID-351 course indicators.

4–999. On T-33A-5 airplanes which have been assigned to MDAP countries the ID-249 or ID-351 course indicators are removed. A marker beacon indicator light is installed in the instrument panel and the course indicator wire harness is connected to the light.

4–1000. REMOVAL OF MARKER BEACON RECEIVER.

a. Disconnect one antenna cable and connector plug at receiver front end.

b. Remove safety wire from nuts holding clamps to receiver front end, and loosen clamp.

c. Raise receiver front end to clear clamps, and slide receiver outboard to remove.

4–1001. REMOVAL OF MARKER BEACON ANTENNA.

a. Disconnect dehydrator hose.

b. Remove 24 screws attaching cover plate to fuselage skin.

c. Tilt and withdraw cover and antenna.

d. Disconnect coaxial cable connector at antenna.

4–1002. GROUND OPERATIONAL CHECK OF AN/ARN-12 MARKER BEACON RECEIVER.

a. Check all parts and connectors for security of mounting.

b. Connect external power to the airplane, if possible: if not, close the battery switch.

c. Check the push-to-test lamps on the instrument panels.

d. Using test set I-76, check the light relay as follows:

Insert plug PL-55, which terminates test indicator BE-67 (part of test set I-76), into the relay current jack

marked "RELAY" on the receiver panel. Move the toggle switch on the test indicator to "ADJUST RELAY" position. Rotate the adjustable control on the test indicator panel to the left as far as it will go. Then, slowly rotate the control until the indicator lamps light, indicating that relay has closed. This closing point should fall between 0.75 and 1.00 milliampere on the indicator meter.

Slowly rotate the control to the left (counterclockwise) until the indicator lamp goes out, indicating that the relay has opened. The current value at the time the relay opens should be approximately 0.5 milliampere.

e. Using test set I-76, check tuning of the receiver as follows:

Set 75-megacycle test oscillator (part of test set I-76) on the ground approximately 15 feet from the airplane. Extend the test oscillator antenna to its full length, parallel to the fore-and-aft axis of the airplane.

Turn the test oscillator switch to the "ON" position and set the modulation switch at the "1300 CPS" position. Check to see that indicator light glows.

Move the toggle switch on the test indicator panel to the "TUNE RECEIVER" position. Insert plug PL-55, which terminates test indicator BE-67, into the "RELAY" current pack on the receiver panel.

With a suitable screwdriver, adjust tuning capacitor labeled "ANT" for maximum reading on test indicator. Should the meter reading go off scale, reduce the signal strength of the test oscillator by collapsing its antenna, or by moving it farther away from the airplane.

f. After the receiver has been properly tuned, make an audio check of the receiver as follows:

Remove the plug from the audio output connector marked "AN3108-12S-3P."

Connect the output meter to the connector AN3108-12S-3P. Make certain the impedance control on the output meter is set on the 300 ohms position. Normally, the audio output connector is connected to the 300-ohm tap (terminal No. 2) of the output transformer. In the event the high impedance tap (terminal C) is used, the output meter should be set in the 4000-ohm position.

With an input signal set as described in step e preceding, adjust the "VOLUME" control to the level desired.

Remove test indicator and reconnect plug to AN3108-12S-3P connector.

g. Perform final check on marker beacon reception by making an actual flight test over instrument landing markers.

4–1003. FLIGHT TEST OF MARKER BEACON RECEIVER. In flight, as convenient to the purpose of the flight, comply with one of the following tests:

a. Fly over a standard fan marker 20,000 feet above ground altitude. If indicator light does not operate at normal check altitude, recheck at 15,000 feet, and if no light there check at 10,000 feet.

b. Fly over a "Z" marker or low power fan marker at 4000 feet above ground altitude. If indicator light does not operate at normal check altitude, recheck at 3000 feet, and if no light there check at 2000 feet. Record altitude at which operation was normal. Reject only if indicator light does not operate at 10,000 feet in (a), or 2000 feet in (b), or if audio signal is not normal.

4–1004. INTERPHONE EQUIPMENT. *(See figures 8-259 through 8-286.)* The AN/AIC-2A interphone system is installed on airplanes prior to AF Serial No. 51-9236. This is a low impedance system composed of a AM-26A/AIC or AM-300/AIC (with dynamotor) amplifier incorporating automatic gain control, mounted on the left side of the rear cockpit, C-696/AIC control panels on the forward left shelf and the aft right shelf, two AM-142/AIC mixer amplifiers behind the aft cockpit seat, and a BC-1366-M jack box on the radio rack in the fuselage nose section. A "MIC SELECTOR SWITCH," which controls the microphone control relay and the headset control relay is mounted on the left shelf of each cockpit. A push-to-reset indicator light, mounted near each "MIC" control switch, glows when the microphone and headset circuits are connected to the interphone equipment. The 28-volt direct current is fed to the amplifier and to the interphone indicator lights from the forward left switch box bus. This circuit is protected by a 5-ampere push-to-reset circuit protector mounted on the forward switch box.

4–1005. On airplanes AF Serial No. 50-419 through 51-9235, a "hot microphone" interphone circuit is used. (See figure 8-264.) The units of this circuit consist of the interphone amplifier in the aft cockpit; two mixer amplifiers in the aft cockpit on the left side; a control panel on the aft right shelf and another on the forward

left shelf; a relay panel under the forward right shelf and a mechanics jack box on the radio rack in the fuselage nose section. The circuit is wired so that it is not necessary to push the MIC button to carry on a conversation between the two cockpits when the selector switch is in COMMAND AND MIXED SIGNALS with the INTERPHONE switch closed. The MIC switch must be pressed to talk on the command radio.

Note

The filter switch must always be in NORMAL.

4–1006. The three double-pole, double-throw relays in the forward right relay panel are: the call relay, which transfers the headphones to interphone; and the fore and aft command-radio-relays. The latter two relays operate together when either selector switch is pressed.

4–1007. INTERPHONE AMPLIFIER (AN/AIC-2). The following list shows the interphone amplifiers used:

Prior to AF Serial No. 50-419
AM-26A/AIC amplifier, AN/AIC-2A.

AF Serial No. 50-419 through 51-6795
AM-300/AIC amplifier, AN/AIC-2A.

AF Serial No. 51-8518 through 51-9235
AM-26A/AIC amplifier, AN/AIC-2A.

4–1008. The AM-26A/AIC amplifier is a four-tube, two-stage, audio amplifier. It incorporates an automatic gain control which automatically compensates for acoustic variations caused by changes in altitude. An additional manually operated four-position gain control on the front panel of the amplifier is for emergency use. This gain control, as well as the ON-OFF switch adjacent to it are safety wired; the gain control in position 1 and the switch ON. A dynamotor is mounted on the back of the amplifier. The AM-300/AIC interphone amplifier is similar to the AM-26A/AIC except that it is smaller and has additional input circuits.

4–1009. MIXER AMPLIFIER, AM-142/AIC. *(Refer to paragraph 4–1004.)* Two mixer amplifiers are used, one for each headset. Each is used to mix the output of other audio circuits with the command radio audio to five audion channels simultaneously. No gain control is provided and no adjustment is required.

4–1010. CONTROL PANEL, C-383/AIC. *(Refer to paragraph 4–1004.)* This unit consists of a panel upon which is mounted four toggle switches for mixed signals, a six-position rotary selector switch, a volume control, and a three-position filter switch. The filter switch must be left in NORMAL at all times.

4–1011. GROUND OPERATIONAL CHECK OF AN/AIC-2A INTERPHONE EQUIPMENT.

a. Check amplifier mounting and connectors for security and for tightness.

b. Attach an external source of dc power.

c. Make certain amplifier ON-OFF switch is safetied in ON position, and manual gain control is safetied in position 1.

d. On airplanes prior to AF Serial No. 50-385, check the push-to-test interphone lights and move either MIC SELECTOR switch to a position at which the interphone lights glow, indicating that the headsets and microphones are on the interphone circuits.

e. On airplanes AF Serial No. 50-385 and subsequent, turn filter switch to NORMAL, and with all radios operating, perform the following checks:

(1) Turn selector switch to COMPASS. Check to see that AN/ARN-6 compass reception is normal with satisfactory audio level.

(2) Turn selector switch to LIAISON. Check to see that the proper transmission and reception are obtained from the command radio.

(3) Turn selector switch to MIXED SIGNALS AND COMMAND. Close and open all toggle switches and check to be sure that all signals are received at a similar noise level and interphone is received at opposite station.

(4) Turn selector switch to interphone and check reception and transmission.

(5) Turn selector switch to CALL. Check to be sure that the audio signal from the microphone call is audible in both headphones.

f. Disconnect the external power source.

4–1012. INTERPHONE EQUIPMENT (AN/AIC-10 TUBE TYPE). On T-33A-1, T-33A-5 and T-33A-10 airplanes, AF Serial No. 51-9239 through 57-633, and on T-33A-15 airplanes, AF Serial No. 51-9236 through 55-4369, the AN/AIC-10 interphone system consists of a DY 77( )/AIC-10 dynamotor, an RE-94/AIC-10 relay and two C-824/AIC-10 control panels.

4–1013. INTERPHONE EQUIPMENT (AN/AIC-10 TRANSISTOR TYPE). On T-33A-1, T-33A-5 and T-33A-10 airplanes, AF Serial No. 57-634 and subsequent, and on T-33A-15 airplanes, AF Serial No. 55-4370 and subsequent, the AN/AIC-10 interphone system consists of an RE-94A/AIC-10 relay and two C-824A/AIC-10 control panels.

4–1014. INTERCHANGEABILITY OF COMPONENTS. Transistorized control panel C-824A/AIC-10 can replace tube type control panel C-824/AIC-10, and transistorized relay RE-94A/AIC-10 can replace tube type relay RE-94/AIC-10 in an AN/AIC-10 system which incorporates a dynamotor. Tube type components cannot replace transistorized components in an AN/AIC-10 system which does not incorporate a dynamotor because there is no plate voltage available to operate the tubes.

4–1015. CONTROL PANELS (C-824/AIC-10 AND C-824A/AIC-10). Control panel C-824/AIC-10 (refer to paragraph 4–1012 for application) contains an AM476/AIC-10 plug-in tube type amplifier. Control panel C-824A/AIC-10 (refer to paragraph 4–1013 for application) contains an AM476B/AIC-10 plug-in transistor type amplifier. Two control panels, one installed in the forward cockpit left switch box, and one in the aft cockpit right switch panel, provide talking and listening facilities on any one of five channels by means of five toggle switches and a six-position rotary switch. A NORMAL/AUX LISTEN switch at the lower right of the control panel is safety-wired in the NORMAL position. A VOL (volume) control is at the lower left. The engraved skirt of the selector switch is indirectly illuminated. When the selector switch on the control panel is in the COMM position, speech places a signal on the interphone line without further talk switch action. When the MIC button on top of the engine control lever is depressed, the signal is placed on the command radio AUDIO OUT line.

4–1016. REMOVAL OF CONTROL PANELS (C-824/AIC-10 AND C-824A/AIC-10).

a. Turn four fasteners at outer edges of control panel ¼ turn counterclockwise.

b. Lift control panel, and disconnect two cannon plugs at rear recess.

c. Remove control panel.

4–1017. RELAY ASSEMBLIES (RE94/AIC-10 AND RE94A/AIC-10). The purpose of the RE-94/AIC-10 and RE-94A/AIC-10 relays is to allow free use of communications between cockpits without switching. Relay RE-94/AIC-10 (refer to paragraph 4–1012 for application) contains an AM476/AIC-10 plug-in tube type amplifier. Relay RE-94A/AIC-10 (refer to paragraph 4–1012 for application) contains an AM476B/AIC-10 plug-in transistor type amplifier. On T-33A-1, T-33A-5, T-33A-10 and T-33A-15 airplanes, AF Serial No. 51-9236 through 55-4369, the relay is normally mounted on a shelf on the centerline of the airplane behind the aft cockpit seat. On some of these aircraft the relay is mounted on a bracket above the left console in the aft cockpit. On T-33A-1, T-33A-5 and T-33A-10 airplanes, AF Serial No. 55-4370 and subsequent, the relay is mounted on the right forward side of bulkhead 103 of the nose section. On T-33A-15 airplanes, AF Serial No. 55-4370 and subsequent, the relay is mounted inside of the right console in the aft cockpit.

4–1018. REMOVAL OF RELAY ASSEMBLY (RE94/AIC-10 AND RE94A/AIC-10).

a. Refer to paragraph 4–1017 for location of relay.

b. On airplanes with the relay located behind the aft cockpit seat, gain access to the relay through a cutout in the seat. If there is no cutout in the seat, remove the canopy (refer to paragraph 4–91) and remove the aft seat (refer to paragraphs 4–1142 or 4–1156).

c. On airplanes with the relay located inside of the right console in the aft cockpit, gain access to the relay on AF Serial No. 55-4370 through 56-3694, by removing panel assembly, 457746-8 from shelf, 179683-11; and on AF Serial No. 57-530 and subsequent, by removing panel assembly, LS4174 from the aft cockpit right console.

d. On airplanes with the relay located in the nose section, gain access to the relay by opening the right armament door.

e. On airplanes with the relay located above the left hand console in the rear cockpit gain access to the relay by opening the canopy.

f. Remove the relay assembly as follows:

(1) Disconnect cannon plug.

(2) Unfasten two camloc fasteners on relay cover.

(3) Remove relay assembly with attached components.

4–1019. INTERPHONE AMPLIFIERS (AM-476/AIC-10 AND AM-476B/AIC-10). The interphone amplifiers are utilized for either talking or listening, depending upon control panel switch positions. Automatic gain control compresses the range of the output levels due to varying inputs. A peak clipping circuit is employed to limit the maximum output voltage and prevent excessive sound pressures from reaching the ear of the listener, and yet permit operation (refer to paragraphs 4–1016 and 4–1018 for removal instructions).

4–1020. INTERPHONE DYNAMOTOR DY77( )/AIC-10). On all airplanes prior to AF Serial No. 55-4370, the dynamotor is mounted on a support bracket on the right side of the airplane behind the aft cockpit

seat. On T-33A-5 and T-33A-10 airplanes, AF Serial No. 55-4370 through 57-633, the dynamotor is mounted in the right side of the nose section forward of bulkhead 103. The dynamotor, which also contains dual radio frequency filters, supplies 100 milliamperes current at 170-volts dc for the plate supply of the AN/AIC-10 interphone tube type amplifiers. The radio frequency filters, one in the 27.5 volt line and the other in the 170 volt line are incorporated to eliminate noise, radio frequency interference and hash. A low frequency filter smooths the pulsating dc and eliminates hum.

4–1021. REMOVAL OF DYNAMOTOR (DY77( )/AIC-10).

a. The dynamotor is located near the RE-94/AIC-10 relay (refer to paragraph 4–108 to gain access to the dynamotor).

b. Remove dynamotor as follows:

(1) Remove cannon plug.

(2) Remove safety wire from right and left pairs of camloc fasteners on top of dynamotor dust cover.

(3) Turn camloc fasteners counterclockwise and remove dynamotor assembly.

4–1022. TROUBLE SHOOTING OF AN/AIC-10 INTERPHONE.

Trouble	*Probable Cause*	*Remedy*
Entire system inoperative. No illumination at either panel	Blown fuses or open circuit in main power line. Open power cable to interphone	Check that main power is on. Check fuses, circuit breakers and cable
System inoperative	*Defective dynamotor or shorted 170-volt dc line	*Check dynamotor; remove dynamotor interconnecting plug to check line shorts
One station fails to operate on talking or listening but operates on AUX LISTEN	Defective A.F. amplifier, AM-476/AIC-10 or AM-476B/AIC-10	Substitute spare amplifier
System operates properly but illuminated panels are brighter on one side that the other	Incandescent lamps	Replace lamps as required
Station fails to operate on a particular facility	Open wires in cables to control panels. Faulty selector or mixing switch	Check continuity of cables. Replace panel

*T-33A-1, T-33A-5 and T-33A-10 airplanes prior to AF Serial No. 57-634.

T-33A-15 airplanes prior to AF Serial No. 55-4370.

4-1023. OPERATIONAL CHECKOUT OF INTERPHONE SET AN/AIC-10.

a. Start equipment by connecting external power source to airplane or by closing the battery switch.

b. To turn off the plate supply power to an individual amplifier, turn the NORMAL/AUX LISTEN switch to AUX LISTEN.

c. Normal operation of the control panels containing audio frequency amplifier AM-476/AIC-10 indicates that the dynamotors are supplying the required power.

Note

The noise-cancelling, close-talking microphones used in this system, should be used with the moisture barrier just touching the lips. Maximum output signal level is dependent on talkers microphone technique and voice volume.

d. Checking control panel C-824/AIC-10 and C-824A/AIC-10:

(1) To check transmit facility, select the desired channel with the rotary selector switch, close the microphone talk switch, and speak into the microphone. Sidetone should be heard in the operators headset.

(2) To check receiver facility, turn the selector to the desired channel. Adjust the VOL control. Signals from the selected facility should be heard.

Note

The receiver volume control setting has no effect when CALL signals are being received.

(3) To check LISTEN simultaneously with various signals available at the mixing switches (interphone, compass, etc.), turn the mixing switch for the desired signal ON (switch-handle up). Signals from the mixing lines should be heard when the microphone talk switch is open. Mixed signals are available for listening regardless of the setting of the channel selector switch (except CALL position).

(4) To check CALL, turn and hold the rotary selector switch in CALL and speak into the microphone. On CALL position it is not necessary to close the microphone talk switch when using hand free or oxygen mask microphones. The CALL signal should be heard on all selector switch positions of the other panel.

Note

Since CALL intercepts all radio facilities, it should be used to arrange for interphone conversation or for emergencies.

(5) To talk on the hot-mic facility, set the selector switch to position 4 and turn the INTER mixing switch ON (up). To talk on interphone, speak into the microphone without closing the talk switch. To talk on the transmitter, close the talk switch and speak into microphone. The operation of the hot-mic facility checks relay assembly RE-94/AIC-10 and RE-94A/AIC-10.

(6) To check AUX listen, turn the NORMAL/AUX LISTEN switch to AUX LISTEN. Turn the mixing switch to the channel on which a check is desired with all other mixing switches off. To check a channel available only on the rotary selector, set the selector switch to the desired channel and turn all mixing switches off. Talk on the selected channel is heard at line level.

Note

A priority exists on the mixing switches. The priority is from left to right and has precedence over the rotary selector switch.

(7) Stop the equipment by disconnecting external power source or opening the battery switch.

(8) Lock-wire the NORMAL/AUX LISTEN switch in the NORMAL position.

4-1024 through 4-1028. (Deleted)

4-1029. RADIO COMPASS. *(See figures 8-293 through 8-299.)* The AN/ARN-6 radio compass operates from the airplane 28-volt electrical system. Basically, the radio compass consists of a radio receiver using a superheterodyne circuit and additional circuits necessary for radio compass operation. The radio compass has a frequency range from 100 to 1750 kilocycles divided over four bands. Power for the equipment comes from the cockpit right-hand switch-box bus through a five-ampere push-to-reset circuit protector. The compass is wired for low impedance (300 ohms). The AN/ARN-6 radio compass is not installed in T-33A-15LO airplanes, incorporating T.O. 1T-33A-613.

4-1030. The radio compass can receive radio signals, guide the airplane to a transmitting station at its destination, or give bearings on a transmitting station. At all times, the indicators show whether the airplane is headed to the right of, to the left of, or toward the transmitting station. While the equipment is acting as a radio compass, weather reports or other flight information can be received.

4-1031. On airplanes prior to AF Serial No. 58-504, a remote control unit for operation of the radio compass is located on the centerstand in each cockpit. On AF Serial No. 58-504 and subsequent, the forward remote control unit is located on the right shelf and the aft control unit is installed in the centerstand. The director indications are on the instrument panels. The radio compass unit is in the armament compartment below the command radio. The loop antenna is in the nose of the airplane under a section of plastic skin. Compensator bars for the loop antenna are located

one on each side of the loop and are adjusted by bending them inboard or outboard. The shortest perpendicular distance between the glass housing of the loop and the compensator bars shall be equal on both sides within 0.031-inch. The nondirectional sense antenna is mounted on the inside surface of the canopy. On T-33A-1 airplanes, this antenna is connected to the AN/ARN-6 receiver; while on T-33A-5 airplanes, the antenna serves as a sense antenna for the AN/ARN-6 as well as an antenna for the AN/ARN-14 receiver (refer to paragraph 4–1058).

4–1032. OPERATION OF RADIO COMPASS. To start the equipment, turn the function switch on the "live" control box to "COMP," "ANT," or to "LOOP." To stop the equipment, turn the function switch "OFF." The "live" control box is the one on which the dials are illuminated when the light control knob is turned fully clockwise. Deflection of the tuning meter pointer after a 15-second warmup period also indicates that a control box is "live." To gain control of the compass, push the "CONTROL" button on the tuning knob.

4–1033. To take a bearing on a transmitting station, switch the equipment to "COMP" and tune in the station. The direction indicator and loop will rotate until they show the heading of the airplane in relation to the position of the transmitting station. After a few seconds have been allowed for the indicator pointer to reach a stable position, read that bearing directly from the indicator. Within two miles of the home station, time radio compass to other stations 70 to 125 miles away and check bearings. Readings should check to 2.5 degrees of 0° and 180° bearings, and 7.5 degrees on all other bearings. To establish definitely the position of the airplane, take several different bearings rapidly in this manner.

4–1034. To fly the airplane toward a transmitting station, use the equipment as a homing radio compass. For this purpose, fly airplane so that the indicator pointer is always at the index. Whenever airplane goes off course, indicator pointer shows the deviation in degrees.

4–1035. REMOVAL OF AN/ARN-6 RADIO COMPASS RECEIVER.

a. Disconnect three electrical connectors on front of receiver. Make certain that connector at the left is disconnected from the balun, leaving balun mounted on receiver.

b. Disconnect bonding jumper from front of receiver.

c. Break lockwire holding two knurled thumb nuts in place, and unscrew thumb nuts until safety pins on receiver lower front are exposed. Fold thumb nuts and attached bolts downward.

d. Gently pull receiver outward on mounting rack until electrical contact pins release from mounting rack plugs at rear of rack. Receiver may then be slid outward and upward for removal.

4–1036. INSTALLATION OF AN/ARN-6 RADIO COMPASS RECEIVER. Reverse removal procedure.

CAUTION

Great care must be used in installing AN/ARN-6 receiver as the electrical contact pins must be carefully aligned with mounting rack plugs. "Feel" for proper alignment before exerting any force on receiver.

Note

Insert potting compound, Specification MIL-S-8516, in rear of connector to cover soldered connections. Fill rear connector shell completely to provide support for wires. Do not reinstall AN3057 adapter.

4–1037. REMOVAL OF AN/ARN-6 LOOP ANTENNA.

a. Remove screws around the plastic nose cover, and remove the cover.

b. Disconnect electrical wires from the aft end of the loop casing.

c. Remove 10 screws that hold the loop to the shock mount, and remove the loop.

Note

Do not bend the compensator bars. Bars must be symmetrical about the loop within $\frac{1}{32}$ inch. If loop other than the one originally installed in the airplane is used, it must be compensated as described below.

4–1038. COMPENSATION FOR A NEW AS313B LOOP.

a. Remove the loop from the airplane as instructed in paragraph 4–1037.

b. With the loop connected to its power supply and to an indicator, and with the loop in operation, use a screwdriver to adjust the 12 adjustment screws as outlined below.

c. Rotate the loop until the loop pointer is exactly at the degree which is to be compensated on the black scale. Turn the screw next to the point to be compensated until the indicator shows that the correct number

of degrees has been added or subtracted, as shown in Tables 4-11 and 4-12.

CAUTION

Never turn any of the compensating screws more than three complete revolutions at a time, to avoid putting a permanent bend in the cam strip.

d. If large errors are to be corrected, or the rate of change per 30-degree sector is rapid, it may be necessary to set up one-half or one-third of the required correction on all screws. Proceed around the circle once or twice more until all screws have been satisfactorily adjusted.

e. Replace the compensator adjustment cover and install the loop in the airplane.

Note

Prior to AF Serial No. 52-9695, check that loop antenna is stamped:

CORRECTED
T. O. No. 12-3-3
Data Line No. 60

On AF Serial No. 52-9695 and subsequent, check to see that loop antenna is stamped:

CORRECTED
T. O. No. 12-3-3
Data Line No. 162

4–1039. GROUND OPERATIONAL CHECK OF RADIO COMPASS.

Note

Battery cart voltage should be adjusted so that the voltage at the ARN-6 control box is from 27.0 to 27.5 volts when performing check-out.

a. Turn the function switch to "COMP" and momentarily press "CONTROL" button in the center of the band switch.

b. Using a headset, check the operation of the audio (volume) control to see that it controls the headset volume properly.

c. While listening with the headset, jar the radio compass unit R-101 (on the radio rack) to check possible noise or intermittent reception.

Table 4-11. Compensation Table for New AS313B Loop, Prior to AF Serial No. 52-9695

Azimuth Degrees	*Compensation Degrees*	*Azimuth Degrees*	*Compensation Degrees*
0	+1.0	165	—3.0
15	+4.0	195	+6.0
45	+9.0	225	+10.0
75	+5.0	255	+6.0
105	—3.0	285	—1.0
135	—8.0	315	—6.0
		345	—3.0

Table 4-12. Compensation Table for New AS313B Loop, AF Serial No. 52-9695 and subsequent

Azimuth Degrees	*Compensation Degrees*	*Azimuth Degrees*	*Compensation Degrees*
0	0.0	165	—3.0
15	+3.0	195	+3.0
45	+8.0	225	+8.0
75	+5.0	255	+5.0
105	—5.0	285	—5.0
135	—8.0	315	—8.0
		345	—3.0

d. With the function switch on "ANT" check operation of all equipment on all four bands. Set the "CW-VOICE" switch to "CW" and check operation of the beat frequency oscillator.

e. Switch to "LOOP" and check reception on all bands. Check operation of the "LOOP L-R" switch. Direction and speed of loop rotation, as indicated by the indicator pointers, are controlled by direction and amount of "LOOP L-R" switch rotation respectively.

Note

Speed of rotation is continuously variable from 0 to 55 degrees per second, depending on the magnitude of displacement of the "LOOP L-R" switch.

f. Place the airplane in an area at least 200 feet away from any metallic frame building, hills, power lines, railroads, or other large electrically conductive objects. Swing the nose of the airplane so it points exactly toward a transmitting station. Turn the function switch to "COMP" and tune the equipment to this station. The indicator pointer should swing to the zero index within two degrees. The accuracy of this zero bearing will depend upon the accuracy with which the fore-and-aft line of the airplane is aligned with the direction of the trans-

mitting station, and on the accuracy with which the loop mounting base is aligned with the fore and aft line of the airplane. Distortion in the direction of arrival of the radio waves will cause errors in the accuracy of the zero bearing.

g. Swing the heading of the aircraft approximately 15 degrees to the right of the original reading. The indicator pointer should swing to about 345 degrees. A reading of 15 degrees instead of 345 degrees indicates improper connection of components for the location of the loop and antenna in this installation.

4–1039A. AN/ARN-21 TACAN RADIO NAVIGATION SYSTEM (AIRPLANES INCORPORATING T. O. 1T-33A-585 AND T-33A-15LO AIRPLANES, INCORPORATING T. O. 1T-33A-613).

4–1039B. The AN/ARN-21 radio navigation system includes the following components, located as noted:

Name	*No. Per Airplane*	*Location*	*Type or Part No.*
Receiver-Transmitter	1	Nose section	RT-220C/ARN-21
Mounting	1	Nose section	MT-928/ARN-21
Control, TACAN (Radio Set)	2	Fwd and aft cockpit subpanels	C-1763/ARN-21A
Indicator, Azimuth	1	Nose section	ID-307/ARN
Indicator, Range	2	Fwd and aft instrument panels	ID-310A/ARN
Detector, Phase	1	Nose section	CV-279/ARN
*Indicator, Course	2	Fwd and aft instrument panels	ID-249/ARN, ID-351A/ARN, or ID-387/ARN
*Indicator, Course	2	Fwd and aft instrument panels	ID-250/ARN
Antenna	1	Nose section	AT-741/A
**Box, TACAN Relay	1	Nose section	496419-1
**Display Coupler, Dual Distance	1	Nose section	HLI-117A
**Panel, Control	1	Fwd cockpit right console	496405-1
**Panel, Control	1	Aft cockpit centerstand	496405-5

*Component is integrated with, but not part of, AN/ARN-21 TACAN system.
**Component is part of AN/ARN-21 TACAN system provided by T. O. 1T-33A-613.

4–1039C. The TACAN Radio Set AN/ARN-21 is an airborne navigation interrogator-responder designed to operate in conjunction with a surface navigation beacon transponder such as Radio Set AN/URN-3. These two sets comprise a radio navigation system which enables the aircraft to obtain continuous indications of distance and bearing from any selected beacon station within a line of sight distance from the aircraft up to 195 nautical miles. Navigational information is presented visually by indicators located on the forward and aft instrument panels and aurally through the interphone system. The operation of the system is controlled by C-1763/ARN-21A Radio Set Controls located on the forward and aft cockpit subpanels.

4–1039D. POWER INPUT. Direct current power for the AN/ARN-21 radio navigation set is supplied through the AN/ARN-21 XFER circuit breaker in the left hand forward switch box. Alternating current power for the AN/ARN-21 radio navigation set is supplied through two separate fuses in the left hand forward switch box.

4–1039E. RT-220C/ARN-21 RECEIVER-TRANSMITTER. The RT-220C/ARN-21 receiver-transmitter transmits distance interrogation signals. It receives, in return, distance reply signals, variable bearing signals and reference bearing signals, and prepares the received information for display on the indicators. The transmitter section transmits pulse modulated signals in the frequency range of 1025 to 1150 mc. The receiver section operates in the frequency range of 962 to 1024 and 1151 to 1213 mc. There are 126 frequency channels, any one of which may be selected by setting the proper controls on Radio Set Control C-1763/ARN-21.

4–1039F. DISTANCE INFORMATION. The transmitter section, a part of the Radio Receiver-Transmitter RT-221C/ARN-21, initiates the interrogation process by radiating pulse signals. These signals, known as distance interrogation pulses, are detected by the AN/URN-3 receiver and cause the AN/URN-3 transmitter to respond with pulses known as the distance reply pulses. The distance reply pulses are detected by the receiver portion of the RT-220C/ARN-21 receiver-transmitter,

where special range circuits measure the elapsed time between transmission of the interrogation pulses and the reception of reply pulses. Other range circuits then convert the time difference into nautical miles which are displayed on the Range Indicator ID-310A/ARN.

4–1039G. BEARING INFORMATION. In addition to the reply pulses, the AN/URN-3 transmitter continuously transmits a series of coded and modulated radio frequency pulses to provide a reference bearing signal and a variable bearing signal. These pulses are detected by the receiver section of the RT-220C/ARN-21 receiver-transmitter, where special azimuth circuits measure the phase difference between the reference bearing signal and the variable bearing signal. Other azimuth circuits then convert this phase difference into degrees which are displayed on the ID-250/ARN and ID-249/ARN, ID-351A/ARN, or ID-387/ARN course indicators.

4–1039H. TONE IDENTIFICATION INFORMATION. At regular intervals the AN/URN-3 transmitter also transmits a series of pulse signals which are keyed with identifying International Morse Code characters. When these signals are received by the receiver section of the RT-220C/ARN-21 receiver-transmitter, they are detected by a circuit which reproduces the code as a keyed audio tone.

4–1039J. C-1763/ARN-21A RADIO SET CONTROL. The C-1763/ARN-21A radio set controls, marked "NAV," are located in the forward and aft cockpit instrument subpanels and contain the channel selector knobs, marked "CHAN"; identity tone level control, marked "VOL"; and the "OFF-REC-T/R" switch for energizing the equipment. Channel selection is accomplished by turning the two knobs marked "CHAN." The setting of the right hand knob determines the unit figure of the channel number, while the left knob determines the tens and hundreds figure of the channel number. The toggle switch to the left of the channel selector knob has three positions. The bottom position, marked "OFF" turns the equipment off. The center position, marked "REC," turns on the receiving equipment so that only bearing information is displayed. The top position marked "TR," operates the transmitting and receiving equipment so that both bearing and distance information are displayed. When the audio output from the equipment is connected to the pilots headphones, the control marked "VOL" is used to regulate the level of the audio signal, which is coded to identify the surface beacon to which the equipment has been tuned.

4–1039K. CV-279/ARN PHASE DETECTOR. The CV-279/ARN phase detector, located on the left side forward face of the F.S. 103 bulkhead, is a small cylinder-encased unit that has a connector at one end and a screwdriver control at the other. This network is employed, in conjunction with Azimuth Indicator ID-307/ARN, to relay the AN/ARN-21 bearing signals to the ID-249/ARN, ID/351A-ARN, or ID-387/ARN course indicators. It is done in such a manner that deviation of the aircraft course to the left or right of the AN/URN-3 beacon will be indicated by the vertical cross pointer of Course Indicator ID-249/ARN, ID-351A/ARN, or ID-387/ARN.

4–1039L. ID-307/ARN AZIMUTH INDICATOR. The azimuth indicator ID-307/ARN is mounted in the left side of the nose section. The visual function of the instrument is not used but the other functions are used as part of the radio navigation system.

4–1039M. ID-310A/ARN RANGE INDICATOR. A range indicator ID-310A/ARN is mounted in the forward and aft instrument panels. It has a single window which indicates distance in nautical miles between the aircraft and the surface beacon. The numerals in the window are electronically controlled by the RT-220C/ARN-21 Receiver-Transmitter circuits, and serve to display the results computed by these circuits. The maximum range of the ID-310/ARN indicator is 195 nautical miles. While the indicator is "searching" for the correct range, the rapidly rotating numbers are partially covered by a red flag which warns the operator against reading incorrect indications.

4–1039M-1. HLI-117A DUAL DISTANCE DISPLAY COUPLER (T-33A-15 AIRPLANES, INCORPORATING T. O. 1T-33A-613). The HLI-117A dual distance display coupler provides simultaneous channeling of distance information to both the forward (master) ID-310A/ARN and aft (slave) ID-310A/ARN range indicators. The HLI-117A coupler features a potentiometer which is used to adjust the range reading of the slave indicator to within 1 mile of the reading of the master indicator.

4–1039N. SYSTEM OPERATION. The operators can observe course, azimuth, and range information on the indicators located in the forward and aft instrument panels. The operation of the system is automatic except that the operator may select the frequency channel; receive function, where only bearing information is displayed; or the transmit-receive function, where both bearing and range information are displayed. The operator can also adjust the level of the tone identification signal.

4-1039P. CAPABILITIES AND LIMITATIONS. Satisfactory operation of the AN/ARN-21 system is dependent upon the satisfactory operation of Radio Set AN/URN-3. Therefore, both the air-to-surface transmission and the surface-to-air transmission must be effective for the realization of the capabilities of the system. The system has 126 frequency channels and will provide full service for over 100 aircraft on each channel. The large number of channels makes the arrangement of surface beacons flexible without producing signal interference, thereby allowing for both extensive and intensive coverage in any area.

4-1039Q. The coverage of a surface beacon, however, is limited to line of sight distances due to the operating frequency. Bearing information, limited to the power output of the surface beacon, and the sensitivity of the Receiver-Transmitter RT-220C/ARN-21, extends to over 200 nautical miles. Distance information, limited by the range circuits and Range Indicator ID-310A/ARN, extends from sero to 195 nautical miles. The Receiver-Transmitter, RT-220C/ARN-21, permits operation at full power up to altitudes of 60,000 feet. This altitude is assured by the manufacturer's test at full power at 70,000 feet for 10 minutes. The RT-220A and RT-220B are interchangeable, however, neither can be substituted for the RT-220C without loss of altitude and power capability.

4-1039R. In airplanes incorporating T. O. 1T-33A-585, the AN/ARN-14 omnirange receiver equipment and the AN/ARN-18 or AN/ARN-31 glide slope receiver equipment is not installed. In T-33A-15LO airplanes, incorporating T. O. 1T-33A-613, the AN/ARN-21 TACAN equipment is installed along with the AN/ARN-14 omnirange receiver equipment and the AN/ARN-18 or AN/ARN-31 glide slope receiver equipment. The TACAN (AN/ARN-21) equipment or the VOR/ILS (AN/ARN-14 and AN/ARN-18 or AN/ARN-31) equipment is selected for use by means of the VOR/ILS — TACAN switch on the 496405-1 (forward cockpit) or 496405-5 (aft cockpit) control panel. The ID-250/ARN and ID-249/ARN (or ID-351A/ARN or ID-387/ARN) course indicators are used in common for the TACAN or VOR/ILS equipment, as selected. Control of the TACAN or VOR/ILS equipment, as selected, is transferred from the controls in one cockpit to the controls in the other cockpit by means of the COCKPIT SHIFT switch on the 496405-1 and 496405-5 control panels. When control has been shifted to a cockpit, the LIGHT ON WITH CONTROL light on the control panel in that cockpit becomes lit, indicating that control is in that cockpit.

4-1040. IDENTIFICATION RADAR EQUIPMENT. *(See figures 8-350 through 8-357.)* The RT-82/APX-6 receiver-transmitter and its controls are not installed in MDAP, TV-2, or RCAF airplanes. (Refer to "Introduction" for serial numbers). On airplanes incorporating T. O. 1T-33A-580, the RT-82/APX-6 has been replaced with RT-279/APX-25.

4-1041. The function of the radar equipment is to enable the airplane in which it is installed to identify itself automatically as friendly whenever it is properly challenged. The AN/APX-6 equipment, installed prior to AF Serial No. 58-504, consists of the transponder, the indicator box (prior to AF Serial No. 51-9236) and the inverter located in the fuselage nose section on the right side of the radio rack; the inertia switch in the subcockpit; the control panel on the forward right shelf; and the antenna mounted flush with the skin on the bottom of the airplane forward of the dive flaps. Access to the transponder is through the armament compartment right door. On airplanes prior to AF Serial No. 51-9236, the indicator box shows by red indicator lights when the destructor switch in the forward cockpit is in the ON position. Prior to AF Serial No. 52-9760, single-phase, 115-volt, 400-cycle power is supplied to the transponder through a control relay by an inverter mounted on the rack above the transponder. (Refer to paragraph 4-894). On AF Serial No. 52-9760 and subsequent, 115-volt, 400-cycle ac is supplied to the transponder from one of the instrument inverters.

Note

On AF Serial Nos. 51-8508 through 51-8990, Type XJ-3D destructors are installed in the RT-82/APX-6 receiver-transmitter. Type MK2, Mod. O destructors are installed on AF Serial No. 51-8991 through 53-2780. No destructors are installed on AF Serial No. 53-4886 and subsequent.

4-1042. On airplanes AF Serial No. 58-504 and subsequent and airplanes incorporating T. O. 1T-33A-571, T. O. 1T-33A-580, AN/APX-25 identification radar equipment is installed. This equipment consists of a receiver-transmitter, a coder, a receiver-transmitter control and a keyer control. The transmitter-receiver is supplied dc power from the radio junction box bus and its ac power from the instrument inverters circuit. The command radio and the AN/APX-25 are interconnected by

a relay which is actuated when the microphone switch is pressed. Operation of the microphone switch shifts the AN/APX-25 from Mode 1 to Mode 2 operation to assist in aircraft identification. The AN/APX-25 controls are mounted on the forward cockpit centerstand. The KY-95/APX-25 coder is installed in the right side of the nose section on the floor below the command radio receiver-transmitter. The RT-279/APX-25 receiver-transmitter is located in the right side of the nose section forward of the command radio receiver-transmitter. An F-245/APX-25 noise filter is mounted underneath the mount for the RT-279/APX-25. If an RT-279/APX-25 receiver-transmitter is installed, the power supply to the unit must be routed through the filter. If an RT-279A/APX-25 receiver-transmitter is installed, the power supply harness is connected directly to the receiver-transmitter and the filter harness is connected back to the filter to provide wire stowage.

4-1043. GROUND OPERATIONAL CHECK OF IDENTIFICATION RADAR. Refer to the applicable Technical Order for this information.

4-1044. REMOVAL OF THE RT-82/APX-6 TRANSPONDER.

a. Disconnect four electrical connectors.

b. Break lockwire and unscrew clamp at top of unit.

c. Break lockwire between the two clamping collars, and unscrew clamping collars.

d. Pull unit outboard to disengage the pins on back and clear clamp at top.

NOTE

When AT-234 antenna is not available for identification radar, use AT-741/A with mounting plate 67D38437.

WARNING

Prior to Serial No. 53-4886, immediately after the RT-82/APX-6 transponder is removed from the airplane, all three destructors must be removed from their receptacles and stored in accordance with existing regulations governing destructors.

4–1045. INSTALLATION OF RT-82/APX-6 TRANSPONDER, PRIOR TO AF SERIAL NO. 52-9760).

CAUTION

Prior to installation of the transponder in the airplane, check the continuity of the destructor receptacle wiring of the transponder. MAKE SURE ALL THREE DESTRUCTORS ARE REMOVED. Check, using an ohmmeter, the continuity between the center contact of the "DESTRUCT" jack "J-405" and the center contacts of each of the three "DESTRUCTOR" receptacles "J-406," "J-407" and "J-408." Check to see that the ohmmeter reads infinity between the center contacts and ground.

a. Inspect transponder to determine that all dust covers, wrap-around, and front panel are secured properly.

WARNING

Properly secured covers protect personnel from injury in the event a destructor explodes. Make sure all cables are disconnected from the transponder.

b. Install destructors in each of the three destructor jacks "J-406," "J-407," and "J-408" on the transponder front panel, and secure.

c. Install transponder, complete with destructors, on mounting base. Reverse procedures outlined in steps b, c, and d in paragraph 4–1044.

d. Connect cables W-701, W-709A, and W-703 to transponder but DO NOT connect cable W-704 to jack labeled "DESTRUCT."

e. Connect all interconnecting cables EXCEPT plug P-405.

f. On AN/APX-6 control panel, check to see that MASTER switch S-501 is in "OFF" position. Remove safety wire on "DESTRUCT" guard, raise guard and turn "DESTRUCT" switch S-504 to "ON" position. Check d-c voltage between center contact of P-405 and ground. Voltmeter should read approximately 28 volts.

Note

The center contact is positive.

g. Turn "DESTRUCT" switch on control panel to "OFF" position. Lockwire "DESTRUCT" guard in down position. Check to see that voltage at P-405 center contact is zero. Be sure that the positive voltmeter test clip is making contact.

Note

Set the voltmeter at its lowest range to assure that the reading is zero.

h. Check impact switch SA-3/A. Trip switch by removing safety wire and plastic cap, and displacing pendulum arm until a sharp snap is heard. The loose swinging of the pendulum arm indicates that switch is tripped and contacts closed. Check for a reading of approximately 28 volts at plug P-405.

i. Reset impact switch by rotating sunken screw on right side of case counterclockwise as far as it will go.

j. Allow spring inside case to rotate screw driver SLOWLY clockwise until it catches.

k. Notice that pendulum is now set firmly at about center of opening.

l. If switch is not in its normal vertical position, hold pendulum in place while resetting with screw driver.

m. Check setting for resistance to minor jars and vibration by giving side of case a hard blow with the hand. The switch should not trip.

n. If switch trips when struck with the hand, repeat steps h through m.

o. If switch appears unduly sensitive or has lost its calibration, replace it. Do not attempt repair.

p. If replacing switch does not correct trouble, check mounting installation.

q. When action is satisfactory, replace plastic cap and lockwire. Check to see that cap is screwed on tightly to prevent entry of moisture.

r. Check with voltmeter to prove absence of voltage on destructor plug P-405, using successively more sensitive voltmeter ranges to be positive that no voltage is present.

s. Connect P-405 to "DESTRUCT" jack "J-405."

WARNING

Regardless of the setting of the "MASTER" control S-501, destructors will be fired if the "DESTRUCT" switch S-504 is turned on, or if the impact switch is tripped.

All handling, testing, and storing of destructors must be done outside the airplane by qualified ordnance personnel. Destructors should always be carried in a closed metal box and never exposed to high-intensity r-f fields, such as prevail around radar equipment.

Never, under any circumstances, connect plug P-405 to "DESTRUCT" jack "J-405" on front panel of transponder until destructor firing circuits have been tested as described in this paragraph.

IMMEDIATELY after transponder is removed from airplane all three destructors MUST be removed from their receptacles and stored in accordance with existing regulations.

All three "DESTRUCT" receptacles are wired in parallel so that if a single destructor is left in place it will explode when voltage is applied to the firing circuit. All three destructors must be removed.

4–1046. INSTALLATION OF RT-82/APX-6 TRANSPONDER (AF SERIAL NO. 52-9760 AND SUBSEQUENT).

a. Push unit inboard. Make sure guide pins are engaged and unit clears top clamp.

b. Tighten clamping collars, and lockwire in place.

c. Tighten clamp at top of unit, and lockwire in place.

d. Connect four electrical connectors, and safety-wire in place.

4–1046A. INSTALLATION OF AIMS EQUIPMENT (T–33A–15 AIRCRAFT). The AIMS equipment is installed on T–33A–15 aircraft modified in accordance with T.O. 1T–33A–658. The major components in the system are as follows:

COMPONENT TYPE	NOMENCLATURE
RT–859/APX–72	Receiver-Transmitter
C–6280( )/APX Transponder	Transponder Set Control Panel
TS–1843/APX	Transponder Airborne Test Set
KIT–1A/TSEC	Transponder Computer
CPU–46/A–11	Altitude Computer
AAU–19/A	Servoed Altimeter
SA–1474/A	Antenna Switching Unit
AT–741/A	Antenna

The AIMS system automatically provides identification of a target airplane and its altitude through a multiple pulse coded reply, transmitted in response to an appropriately coded interrogation. The coded reply, processed by the interrogation equipment provides a visual indication on a radarscope of target airplane identification (in modes 1, 2, 3/A, 4 and test) and altitude (in mode C). Since the system has the mode 4 (encrypted) IFF capability, it is designated as a Mark XII system. The system's auxiliary functions are identification-of-position (I/P), emergency, and mode C special position identification (SPI). In the I/P function, the pilot initiates a modified reply code which allows the interrogating station to identify his airplane in a group of airplanes. The emergency function is also initiated by the pilot and provides a coded reply to an interrogation which readily identifies the airplane as being in distress. The emergency function is initiated automatically if the pilot ejects from the airplane. The SPI function in mode C automatically provides an indication which allows an air traffic controller to quickly identify all airplanes above or below a specific altitude. The AIMS system is capable of self-test in modes 1, 2, 3/A, and C. External inputs to the system are provided by the TACAN system and by the microphone and tone control circuits in the UHF radio system. AIMS system operation is inhibited in all modes by blanking pulses provided by the TACAN system during transmission.

CONTROL PANEL

The control panel, located in the sub-instrument panel in the forward cockpit, provides controls and indications for operation, monitoring, and in-flight testing of the system. Controls on the panel include a MASTER switch; mode select and test switches for modes 1, 2, 3/A and C; and an identifier pulse switch. Mode 4 enable and code select switches are also on the control panel. The MASTER switch controls system turn-on, receiver sensitivity (normal or low) and emergency operation. The mode and test select switches (M–1, M–2, M–3/A and M–C) provide a means of selecting the mode of operation by placing the appropriate switch at ON. These switches also provide a means of initiating a self-test of each mode by placing and holding the appropriate switch at TEST. The TEST light provides an indication of proper system performance in each mode. Mode 4 is selected by placing the MODE 4 switch at ON. The mode 1 and mode 3/A code selectors

are thumbwheel-type switches. The two mode 1 code selectors provide for 32 code selections, and the four mode 3/A code selectors provide for 4096 code selections. The mode 2 code selectors are on the front panel of the receiver-transmitter. Mode 4 codes are set in the mode 4 computer using a code changer key. The mode 4 code selector, on the control panel, provides a means of enabling either code A or B, a means of retaining the code for an additional flight (code is automatically returned to zero when power is removed after landing), as well as providing a means of manually zeroizing the mode 4 code. The RAD-TEST-OUT-MON switch, when placed at MON, provides a means of monitoring receiver-transmitter replies to external interrogations in modes 1, 2, 3/A, or C. When the switch is held at TEST, the two test modes are enabled and will reply to external interrogations. The IDENT-OUT-MIC (identifier pulse) switch enables transmission of aircraft I/P signals for about 30 seconds when switch is momentarily placed at IDENT or when switch is at MIC position and the MIC button on the throttle is momentarily depressed. This allows the interrogation station to identify a specific airplane in a group. The AUDIO-OUT-LIGHT switch completes the group for the mode 4 REPLY light when positioned at AUDIO or LIGHT. The mode 4 audio function of the switch is not used.

AIRBORNE TRANSPONDER TEST SET TS–1843A/APX.

Test sets TS–1843A/APX permanently installed in the aircraft provides a self test function for the transponder RT–859/APX–72. Two basic functions are used in performing system checks, these are test and monitor. In the test function modes 1, 2, 3A and C are checked individually by holding the corresponding mode select switch, M–1, M–2, M–3/A or M–C on the control panel at TEST. If system is within tolerance the TEST light on the control panel comes on. System performance evaluation includes receiver sensitivity and frequency, transmitter power output and frequency decoding, reply framing pulse spacing, and antenna VSWR. In the monitor mode, the RAD-TEST-OUT-MON switch is placed at MON and the test set monitors receiver-transmitter replies to an external interrogation. Again if the system performance is within tolerance the TEST light comes on.

ANTENNAS.

Two vertically polarized omnidirectional L-band antennas (upper and lower) are utilized in the AIMS system. The upper antenna is located at F.S.53. The lower antenna is located at F.S.164.

*Required for mode 4 and automatic emergency checks only.

ANTENNA SWITCHING UNIT.

The antenna switching unit, located in the nose compartment is a solid state unit which allows selection of the upper, lower or both antennas.

OPERATIONAL CHECK-OUT.

Operational check-out of the system should be performed periodically and whenever a system component is replaced and/or a circuit is repaired. The following equipment is required for system check-out:

TS–1809 AN/APM–123( ) 3 transponder test set.
KIR–1A–TSEC interrogator computer.*
KIK–18/TSEC code changer key and keying data.*
MODE 4 computer (must be installed in airplane).*

TEST SET PRELIMINARY PROCEDURE.

1. Place test set 40 to 50 feet from airplane upper antenna so that line-of-sight path between test set and airplane is free of obstructions.

2. Remove test set cover. Raise test set antenna and point arrow on antenna directly at airplane upper antenna. Lock antenna in this position.

3. Connect CG-3308/APM coaxial cable (provided with test set) between test set antenna and PROBE receptacle.

4. If mode 4 and/or automatic emergency checks are to be performed, connect cable (provided with test set) between test set MODE 4 receptacle and KIR-1A/TSEC interrogator computer.

5. Place test set as follows:

CONTROL	POSITION
FUNCTION switch	SELF TEST
MODE switch	1
CODE selectors	0000
ISLS switch	OFF
PUSH TO TEST switch	Unlocked
MODE 4 CODE	A
MODE 4 VER BIT 1 switch	OFF
MODE 4 VER BIT 2 switch	OFF
MODE 4 DIR-RAD switch	RAD
28 VDC ON-OFF-115 VAC ON switch	OFF
PANEL LIGHT switch	OFF

6. Connect source of 28-volt dc or 115 ac (50 – 420 cycles) to test set POWER receptacle, using appropriate cable provided with test set.

7. Place test set 28 VDC ON-OFF-115 VAC ON switch at position corresponding to source of power used. The POWER light should come on. Allow 2 minute warmup period.

8. Momentarily depress REJECT and ACCEPT lights. Each light should come on while it is depressed.

9. Depress and hold PUSH TO TEST switch. The ACCEPT light should come on.

Note

If REJECT light comes on in step 9 or 10, the test set is defective.

10. Place ISLS switch at ON. The accept light should remain on.

11. Place ISLS switch at OFF.

AIRPLANE PRELIMINARY PROCEDURE:

1. Check that following aircraft circuit breakers are pushed in:

FRONT COCKPIT RIGHT HAND CONSOLE
IFF 115 VAC
IFF 28 VDC
CPU–46/A 115 VAC
AAU–19/A 28 VDC

2. Place front cockpit and receiver-transmitter control as follows:

CONTROL	POSITION
AIMS CONTROL PANEL	
CODE switches	A
MASTER switch	OFF
All toggle switches	OUT
MODE 1 code selectors	00
MODE 3/A code selectors	0000
IFF ANTENNA SELECT switch	TOP

3. Connect external sources of ac and dc electrical power in accordance with applicable directives.

4. On AIMS control panel, place MASTER switch at standby. Allow a 1 minute warmup period.

5. Place AUDIO-OUT-LIGHT switch at LIGHT. Momentarily depress REPLY and TEST lights on AIMS control panel. Each light should come on while it is depressed. Place AUDIO-OUT-LIGHT switch at OUT.

6. Place MASTER switch at NORM.

7. Assuming test set preliminary procedure has been completed, place test set FUNCTION switch at SYSTEM.

8. Place M–1 switch on AIMS control panel at ON.

9. Depress and place test set PRESS TO TEST switch at LOCK. The ACCEPT light should come on. If the REJECT light comes on, check that test set antenna is still pointed directly at aircraft antenna; then move test set closer (not closer than 25 feet) to aircraft antenna.

CAUTION

Test set must never be closer than 25 feet from aircraft antenna during radiation checks or damage to test set may result.

10. Place M–1 switch at OUT. The ACCEPT light should go off, and the reject light should come on.

11. At this point, the test set and aircraft controls are in their initial operating position for any of the functional checks in the paragraphs that follow. These checks can be performed in any sequence desired.

MODE 1 CHECK.

Note

Either the test set ACCEPT or REJECT light will be on as long as the PUSH TO TEST switch is at the LOCK position. When one light comes on, the other goes off. Therefore, to simplify this procedure only the light that comes on will be specified.

All aircraft controls are on the AIMS control panel unless otherwise specified.

1. Perform test set and aircraft preliminary procedures, if not already accomplished. Make certain that all controls are in their initial operating position, as indicated in the last step of aircraft preliminary procedure.

2. Place aircraft M–1 switch at ON (test set MODE switch should already be at 1). The test set ACCEPT light should come ON.

3. Place test set CODE selectors at 7300. The REJECT light should come ON.

4. Place aircraft MODE 1 code selectors at 73. The ACCEPT light should come ON.

5. Place test set ISLS switch at ON. The REJECT light should come ON.

6. Place test set ISLS switch at OFF. The ACCEPT light should come ON.

7. Place test set FUNCTION switch at I/P. The REJECT light should come ON.

8. Momentarily place aircraft INDENT-OUT-MIC switch at IDENT (hold for about 1 second). The test set ACCEPT light should come ON for 15 to 30 seconds after release of switch.

9. Place aircraft IDENT-OUT-MIC switch at MIC. Momentarily depress microphone button on throttle (hold for about 1 second). The test set ACCEPT light should come ON for about 15 to 30 seconds after release of switch.

10. Place aircraft IDENT-OUT-MIC switch at out.

11. Place test set FUNCTION switch at EMER.

12. Place aircraft MASTER switch at EMER. The test set ACCEPT light should come on. Immediately place MASTER switch at NORM. The test set REJECT light should come ON.

CAUTION

Do not leave MASTER switch at EMER for more than 5 seconds.

13. Place test set FUNCTION switch at SYSTEM. The test set ACCEPT light should come ON.

14. Place aircraft RAD TEST-OUT-MON switch at MON. The aircraft TEST light should come ON.

15. Place aircraft RAD TEST-OUT-MON switch at OUT. The aircraft TEST light should go OFF.

16. Place aircraft M–1 switch to TEST test light should come ON.

17. Place aircraft MODE 1 code and test set CODE selectors at zero.

MODE 2 CHECK

Note

Either the test set ACCEPT or REJECT light will be on as long as the PUSH TO TEST switch is at the LOCK position. When one light comes on, the other goes off. Therefore, to simplify this procedure, only the light that comes on will be specified.

*All aircraft controls are on the AIMS control panel unless otherwise specified.

1. Perform test set and airplane preliminary procedures, if not already accomplished. Make certain that all controls are in their initial operating position, as indicated in last step of aircraft preliminary procedure.

2. Place aircraft M–2 switch at ON.

3. Place test set MODE switch at 2. The test set ACCEPT light should come ON.

4. Place test set CODE selectors at 7777. The reject light should come ON.

5. Place aircraft receiver-transmitter mode 2 code selectors at 7777. The ACCEPT light should come ON.

6. Perform steps 5 through 13 of mode 1 check. If airborne test set is installed, perform steps 14 and 15 also.

7. Place aircraft M–2 switch at OUT.

8. Place aircraft receiver-transmitter code and test set code selectors at zero.

MODE 3/A CHECK.

CAUTION

Do not check mode 3/A in code 7600 and 7700. Code 7600 signifies a communication failure and code 7700 signifies an aircraft in distress.

Note

Either the test set ACCEPT or REJECT light will be on as long as the PUSH TO TEST switch is at the LOCK position. When one light comes on the other goes off. Therefore, to simplify this procedure only the light that comes on will be specified.

*All aircraft controls are on the AIMS control panel.

1. Perform test set and aircraft preliminary procedures, if not already accomplished. Make certain that all controls are in their initial operating position, as indicated in the last step of the aircraft preliminary procedures.

2. Place aircraft M–3/A switch at ON.

3. Place test set MODE switch at M–3/A. The test set ACCEPT light should come ON.

4. Place test set CODE selectors at 7777. The REJECT light should come ON.

5. Place aircraft MODE 3/A code selectors at 7777. The test set ACCEPT light should come ON.

6. Place aircraft M–3/A at OUT. The test set REJECT light should come ON.

7. Place test set FUNCTION switch at TEST.

8. Place and hold aircraft RAD TEST-OUT-MON switch at RAD TEST. The test set ACCEPT light should come on. Release RAD TEST-OUT-MON switch. The test set REJECT light should come on.

9. Place aircraft M–3/A switch at ON.

10. Place test set MODE switch at 3/A. The test set ACCEPT light should come ON.

11. Perform steps 5 through 14 of MODE 1 check. If airborne test set is installed perform steps 14 and 15 also.

12. Place test set CODE selectors at 7700.

13. Place test set FUNCTION switch at EMER.

14. Place aircraft MASTER switch at EMER. The test set ACCEPT light should come on. Immediately place MASTER switch at NORM. The test set REJECT light should come ON.

CAUTION

Do not leave MASTER switch at EMER for more than 5 seconds.

Note

During mode 3/A emergency operation, the test set ACCEPT light remains on regardless of position of aircraft MODE 3/A code selectors.

15. Place aircraft M–3/A switch at OUT.

16. Place aircraft MODE 3/A code and test set CODE selectors at zero.

MODE C CHECK

Note

Either the test set ACCEPT or REJECT light will be on as long as the PUSH TO TEST switch is at the LOCK position. When one light comes on, the other goes off. Therefore, to simplify this procedure, only the light that comes on will be specified.

*All aircraft controls are on the AIMS control panel unless otherwise specified.

1, Perform test set and aircraft preliminary procedures, if not already accomplished. Make certain that all controls are in their initial operating position, as indicated in the last step of aircraft preliminary procedure.

2. Place aircraft M–C switch at ON.

3. Place test set MODE switch at C.

4. Using barometric pressure scale adjust knob, on aircraft servoed altimeter, set barometric pressure at 29.22 inches of Mercury. Note altimeter indication.

5. On aircraft servoed altimeter, momentarily place RESET-STBY switch at RESET. The STBY flag should move out of view, the vibrator should stop, and the altimeter should indicate about the same as noted in the preceeding step. The test set REJECT light should come ON.

6. Using altitude/code conversion computer (provided with test set) or the altitude/code conversion data, Table 1, place test set CODE selectors at indicated field elevation

code. The test set ACCEPT light should come ON. If the ACCEPT light does not come on, place test set CODE selectors at code corresponding to 100 or 200 feet above or below indicated field elevation. The ACCEPT light must come on at one of these five possible codes.

7. Perform steps 5 and 6 of mode 1 check. If airborne test set is installed, perform steps 14 and 15 also.

8. Place aircraft M–C switch at OUT.

9. Place test set CODE selectors at zero.

MODE 4 CHECK.

Note

Either the test set ACCEPT or REJECT light will be on as long as the PUSH TO TEST switch is at the LOCK position. When one light comes on, the other goes off. Therefore, to simplify this procedure, only the light that comes on will be specified.

*All aircraft controls are on the AIMS control panel unless otherwise specified.

1. Perform test set and aircraft preliminary procedures, if not already accomplished. Make certain that all controls are in their initial operating position, as indicated in last step of aircraft preliminary procedure.

2. Using KIK–18/TSEC code changer Key, set up same codes (A and B) in the mode 4 computer and in the KIR–1A/TSEC interrogator computer. Close code changer access door on mode 4 computer. The aircraft IFF CAUTION light, on the indicator light panel should go OFF.

3. Place aircraft AUDIO-OUT-LIGHT switch at LIGHT and MODE 4 switch at ON.

4. Place test set MODE switch at 4. The test set ACCEPT and aircraft REPLY lights should come ON.

5. Place aircraft AUDIO-OUT-LIGHT switch at AUDIO. The aircraft REPLY light should remain ON. The audio function of this switch is not used.

6. Place aircraft CODE switch at B. The test set REJECT light should come on and the aircraft REPLY light should go OFF.

7. Place test set CODE switch at B. The test set ACCEPT and aircraft REPLY light should come ON.

8. Place both test set and aircraft CODE switches at A. The test set ACCEPT and aircraft REPLY lights should remain ON.

9. Place aircraft LH main landing gear scissor switch at airborne for a minimum of 15 seconds and then place switch at ground position.

10. Momentarily place aircraft CODE switch at HOLD.

11. Place aircraft MASTER switch at OFF. The aircraft REPLY light should go off and the test set REJECT light should come ON.

12. After a minimum of 30 seconds, place aircraft MASTER switch at NORM. In about 20 seconds, the aircraft REPLY and test set ACCEPT light should come ON.

13. Place aircraft LH main landing gear scissor switch at airborne position.

14. Place aircraft MASTER switch at OFF. The aircraft REPLY light should go off and the test set REJECT light should come ON.

15. After a minimum of 30 seconds, place MASTER switch at NORM. The aircraft IFF CAUTION light should come on.

16. Using code changer key, set up codes in mode 4 computer. The IFF CAUTION light should go off. In about 20 seconds, the aircraft REPLY and test set ACCEPT light should come ON.

17. Pull out and place aircraft CODE switch at zero; then, place switch at A. The aircraft REPLY light should go off and the aircraft IFF CAUTION and test set REJECT lights should come ON.

18. Place aircraft AUDIO-OUT-LIGHT and MODE 4 switches at OUT.

19. Place aircraft LH main landing gear scissor switch at ground position.

4—1047. AN/ARN-14 OMNIRANGE RECEIVER (T-33A-5 AIRPLANES NOT INCORPORATING T.O. 1T-33A-585.) *(See figures 8-307 and 8-310.)* The AN/ARN-14 receiver provides all of the radio aids to navigation available in the VHF range. This reception range includes both military and commercial communication channels, omnidirectional range channels, tone localizer service and VHF visual-aural range service. The system consists of a dynamotor, receiver, C-1 amplifier and an ID-251 radio indicator control mounted in the nose section; a control panel and control shifting switch mounted below each main instrument panel; an ID-249A course indicator, an ID-250 course indicator and control indicator lights on each main instrument panel; and a combination omnirange and AN/ARN-6 radio compass sense antenna attached to the canopy.

4—1048. The frequency range covered by the AN/ARN-14 receiver is from 108.0 to 135.9 megacycles. Two-hundred-eighty crystal controlled communication-navigation channels are provided, spaced 100 kilocycles apart in this frequency range. Frequencies are allocated so that the ground stations operate only on even 100-kilocycle frequencies spaced 100 kilocycles apart. Different types of services or ground stations are allocated to respective bands of frequencies. An exception to this is the case of tone localizers and omniranges which share portions of their bands. The receiver automatically selects the required receiving function whenever it is tuned to a frequency assigned to that function. See table 4-13 for frequency assignments and their uses.

Table 4-13. AN/ARN-14 Frequency Assignments

Frequency in Megacycles	*Use*
Odd 0.1 mc from 108.1 to 111.9 mc	Tone Localizer
Even 0.1 mc from 108.1 to 111.9 mc	Omnirange
112.0 to 117.9 mc	

4—1049. The frequency range from 118.0 to 135.9 megacycles is not used in this installation as a vertically polarized antenna is required. The combination antenna used is a horizontally polarized unit and will not receive these frequencies.

4—1050. Control of the AN/ARN-14 and AN/ARN-18 or AN/ARN-31 receivers may be transferred from one cockpit to the other by the "VHF NAV CONTROL SHIFT" switch on each insturment sub panel. When the switch is actuated to place control in one cockpit, a green light on the main instrument panel lights indicating that particular cockpit has control of the system. At the same time the green light in the other cockpit goes out and two amber lights come on. These amber lights illuminate a placard reading "OBTAIN COURSE SETTING FROM OTHER COCKPIT." This informs the pilot that the course setting on his ID-249 indicator is not necessarily the same as that set into the ID-249 indicator in the other cockpit. In all other respects, the indicator readings in the non-controlling cockpit are identical with those in the governing cockpit.

Note

Do not attempt to install control panel C-760/A in conjunction with C-996/A receiver control. If control panel C-760/A is to be installed, installation of control panel C-760/A must be accomplished in both cockpits, also it is necessary that receiver crystals be changed to the "Military" position, as the AN/ARN-14 and the AN/ARN-18 or AN/ARN-31 receivers as installed and using the C-996/A control have the

crystals in the AN/ARN-18 or AN/ARN-31 receiver in the "Commercial" position.

When new or replacement radio receiver R-322/ARN-18 or R-626/ARN-31 is made up, the crystals are in the "Military" position. Prior to installing the set, the crystals should be placed in the "Commercial" position for aircraft which have the C-996/A control in both cockpits. Reference should be made to Specification MIL-R-7263 for crystal placement.

On USAF Serial No. 48-356 through 56-3694 and 57-530 and subsequent incorporating T.O. 1T-33A-614A, additional instrument landing system wiring is installed between R-322/ARN-18 or R-626/ARN-31 receiver and C-996/A receiver control, and the crystals in the receiver are relocated, to eliminate any restriction to the instrument landing system operation when new frequencies are to be assigned.

4–1051. GROUND OPERATIONAL CHECK OF AN/ARN-14 SYSTEM. Special equipment required: signal generator (479A-2 or equivalent). All indicator readings described in the following procedure are for use with the 479T-2 signal generator. If a SG-13/ARN signal generator is used to perform this ground operational check, airplane indicator readings will be 180° apart from those described.

a. Connect external power to airplane.

b. Push in MAIN INVERTER circuit breaker.

c. Push in ARN-14 and ARN-18 or ARN-31 circuit breakers.

d. Place system control switch in ON position.

e. Place signal generator approximately 20 feet in front of airplane nose and in line-of-sight with AN/ARN-14 antenna.

f. Set system channel selector switch to 110.3 MC.

g. Turn signal generator to 90/150 LOC BLUE. The vertical needle of the ID-249 indicator should deflect left one or two dots.

h. Turn signal generator to 90/150 LOC YELLOW. The vertical needle of the ID-249 indicator should deflect right one or two dots.

i. Repeat steps g and h while observing indicator in other cockpit.

j. Set channel selector switch at 112.1 MC.

k. Turn signal generator to VOR 0°.

l. Both ID-250 indicator dials should read within three degrees of the gyrosyn compass reading.

m. Turn the course SET knob on the ID-249 indicator to the zero heading. The ID-250 indicator course should read the same as the gyrosyn compass. The No. 2 pointer of the ID-250 indicator should read 0 (±3) degrees.

n. Turn the course SET knob of the ID-249 to read 10 degrees. The vertical needle should deflect to the right.

o. Adjust SET knob to center vertical needle. The course reading on the ID-249 indicator should be 0 (±3) degrees and the To-From flag should read FROM. The ID-251 indicator and the No. 2 pointer of the ID-250 indicator should read 180 (±3) degrees. The LOC-RANGE flag should be out of sight.

p. Set signal generator to VOR 315°. The ID-251 indicator and the No. 2 needle of the ID-250 indicator should read 135 (±5) degrees.

q. Adjust ID-249 indicator SET knob to center the vertical needle. The course reading on the ID-249 indicator should be 315 (±3) degrees and the To-From flag should read TO. The LOC-RANGE flag should remain out of sight.

r. Switch system control to the other cockpit and repeat steps j through q.

4–1052. REMOVAL OF AN/ARN-14 RECEIVER.

a. Open right nose section access door.

b. Disconnect antenna cable from receiver.

c. Remove safety wire, release latches holding receiver to mount.

d. Raise receiver slightly and slide it outboard, being careful not to bend pins on receiver connector which mate with receiver mount connector.

4–1053. C-1 AMPLIFIER (T-33A-5 AIRPLANES PRIOR TO USAF SERIAL NO. 57-530.) The C-1 amplifier is installed in the AN/ARN-14 and AN/ARN-18 systems to provide enough amplification of the received signals to operate the five system indicators and to provide a source of 26.5 volt, 400 cycle alternating current to drive the indicator synchros. The amplifier is installed on the right side of the nose section forward of nose section canted bulkhead.

4–1054. ME-1 AMPLIFIER (T-33A-5 AIRPLANES USAF SERIAL NO. 57-530 AND SUBSEQUENT). The ME-1 amplifier is a miniaturized version of the C-1 amplifier and is installed in the AN/ARN-14 and AN/ARN-31 systems to provide enough amplification of the received signals to operate the five system indicators. The unit also provides a source of 26.5 volt, 400 cycle alternating current to drive the indicator synchros. The amplifier is installed on the right side of the nose section forward of the nose section canted bulkhead.

4–1055. ID-251/ARN RADIO INDICATOR CONTROL (T-33A-5 AIRPLANES NOT INCORPORATING T.O. 1T-33A-585). The radio indicator control

provides continuous mixing of magnetic compass and omnirange information for display on the ID-250 course indicator. It is not essential for the information presented on the dial of the radio indicator control to be seen by the pilot, therefore, the control is mounted in the right side of the nose section above the AN/ARN-14 receiver.

4–1056. ID-249A/ARN COURSE INDICATOR (T-33A-5 AIRPLANES). The ID-249 course indicator has a vertical bar, a horizontal bar and a needle on the face of the instrument. The vertical bar, actuated by signals from the AN/ARN-14 receiver, indicates flight to the left or right of the course while the horizontal bar, which is actuated by signals from the AN/ARN-18 or AN/ARN-31 receiver, indicates flight above or below the glide path. The needle indicates the difference between the relative and desired headings of the aircraft. A course window indicates the course that is set into the instrument and a "TO-FROM" window indicates whether the course flown is to or from the omnirange station. A marker beacon indicator light is mounted in the upper right corner of the instrument and receives its signal from the AN/ARN-12 receiver.

4–1057. ID-250/ARN COURSE INDICATOR (T-33A-5 AIRPLANES). The ID-250 course indicator pointer supplies the magnetic bearing to the omnirange station and the rotating card indicates the magnetic heading of the aircraft.

4–1057A. ID-250/ARN COURSE INDICATOR (T-33-15 AIRPLANES INCORPORATING T.O. 1T-33A-613 AND T.O. 1T-33A-629). The number 1 needle indicates TACAN and the number 2 needle indicates VOR.

4–1058. AN/ARN-6 AND AN/ARN-14 ANTENNA SYSTEM (T-33A-5 AIRPLANES NOT INCORPORATING T.O. 1T-33A-585). The AN/ARN-6 sense antenna and the AN/ARN-14 receiver antenna are a common unit mounted on the inner surface of the canopy. The antenna performs both of its functions simultaneously without benefit of switching. An rf-choke in the lead to the AN/ARN-6 receiver rejects all signals in the 108.1 to 117.9 megacycle band while permitting reception of signals in the 100 to 1750 kilocycle band. A balun in the AN/ARN-14 lead rejects all signals in the 100 to 1750 kilocycle band while passing signals in the 108.1 to 117.9 megacycle band. An additional function of the balun is to convert the 95 ohm antenna impedance to a 52 ohm impedance which is acceptable to the AN/ARN-14 receiver. The balun is of conventional non-adjustable coil and capacitor design. See figure 8-358 for a wiring diagram of the balun. On T-33A-15LO airplanes, incorporating T.O. 1T-33A-613, the AN/ARN-6 radio compass system is removed.

4–1059. AN/ARN-18 RECEIVER (T-33A-5 AIRPLANES PRIOR TO AF SERIAL NO. 57-530 NOT INCORPORATING T.O. 1T-33A-585). The AN/ARN-18 glide path receiver is mounted in the nose section above the ARN-14 dynamotor and forward of the instrument inverters. The receiver is a 20 channel unit, one of which is automatically selected upon the selection of the proper localizer frequency using the AN/ARN-14 control panel. The frequency range is between 329.3 and 335.0 megacycles with 0.3 megacycles separating the channels. The output of the receiver operates the horizontal bar of the ID-249 course indicator. The antenna is mounted in the nose section under a plastic enclosure which is beneath the AN/ARN-6 loop antenna.

4–1060. AN/ARN-31 RECEIVER (T-33A-5 AIRPLANES AF SERIAL NO. 57-530 AND SUBSEQUENT NOT INCORPORATING T.O. 1T-33A-505). Refer to paragraph 4–1059 for receiver description as functionally this unit is identical to the AN/ARN-18 receiver.

4–1061. MN-92A ANTENNA. A tunable glide slope antenna is mounted in the nose of the airplane, just below the AN/ARN-6 loop antenna. The antenna tuning adjustment is accessible through a hole on the left side of the nose section and aft of the antenna plastic housing.

4–1062. TUNING OF MN-92A ANTENNA. The tuning procedure in paragraph 4–1063 is preferred to that procedure listed in paragraph 4–1064. However, due to field conditions and lack of equipment it may be necessary to perform the less desirable procedure.

4–1063. TUNING OF MN-92A ANTENNA—PREFERRED METHOD. Special equipment required: signal generator (TS-170 or equivalent) and remote indicator (microammeter or multimeter with a plug which connects pins "C" and "D" and leads of sufficient length to see that meter is visible from the nose section).

a. Connect external power to airplane.

b. Push in "ARN-14" and "ARN-18" or "ARN-31" circuit breakers.

c. Place system control switch in "ON" position.

d. Place signal generator approximately 20 feet in front of airplane nose and in line-of-sight with antenna.

e. Set system channel selector switch to "110.3 MC."

f. Turn signal generator power "ON." Turn channel selector switch to position "Z." Set modulation to "150."

g. Replace ID-249 indicator with remote indicator.

h. Adjust length of signal generator antenna until remote indicator reads from 25 to 50 microamperes.

i. Adjust MN-92A antenna for maximum indication on remote indicator.

WARNING

Tuning adjustment must be made with a non-metallic screwdriver, such as a long sharpened wooden dowel and operator must move aft and to one side, out of antenna range, to eliminate possible interference.

CAUTION

If remote indicator reads above 100 microamperes, shorten signal generator antenna to reduce received signal. At maximum, indicator should not read over 50 microamperes.

j. After a maximum reading is obtained, put Glyptal, No. 1201, manufactured by General Electric Co., Lockheed Specification 1-214, on screwhead to prevent further rotation.

k. Turn all power "OFF" and disconnect test equipment. Reconnect ID-249 indicator.

4–1064. TUNING OF MN-92A ANTENNA-ALTERNATE METHOD. Special equipment required: signal generator (TS-170 or equivalent).

a. Have an observer seated in cockpit to monitor horizontal needle of ID-249 indicator and relay needle movements to equipment operator.

b. Connect external power to airplane.

c. Push in "ARN-14" and "ARN-18" or "ARN-31" circuit breakers.

d. Place system control switch in "ON" position.

e. Place signal generator approximately 20 feet in front of airplane nose and in line-of-sight with antenna.

f. Set system channel selector switch to "110.3 MC."

g. Turn signal generator power "ON." Turn channel selector switch to position "Z." Set modulation to "150."

h. Adjust output of signal generator until indicator horizontal needle shows any indication of movement.

i. Adjust antenna adjusting screw until needle reaches a peak position.

WARNING

Tuning adjustment must be made with a non-metallic screwdriver, such as a long sharpened wooden dowel and operator must move aft and to one side, out of antenna range, to eliminate possible interference.

CAUTION

If indicator needle deflection exceeds one dot, shorten signal generator antenna to reduce received signal. At maximum, needle should not deflect more than one dot.

j. After a maximum reading is obtained, put Glyptal No. 1201, manufactured by General Electric Co., Lockheed Specification 1-214, on screwhead to prevent further rotation.

k. Turn all power "OFF."

4–1065. GROUND OPERATIONAL CHECK OF AN/ARN-18 or AN/ARN-31 SYSTEM. Special equipment required: signal generator (TS-170 or equivalent).

a. Connect external power to airplane.

b. Push in "ARN-14" and "ARN-18" or "ARN-31" circuit breakers.

c. Place system control switch in "ON" position.

d. Place signal generator approximately 20 feet in front of airplane nose and in line-of-sight with antenna.

e. Set system channel selector switch to "110.3 MC."

f. Turn signal generator power "ON." Turn channel selector switch to position "Z." Set modulation to "150."

g. Horizontal needle on ID-249 indicator should be deflected upward and flag should be out of sight.

h. Set modulation on signal generator at "90."

i. Horizontal needle should be deflected downward and flag should be out of sight.

j. Turn all power "OFF."

4–1065A. AN/ALE-2 CHAFF DISPENSERS AND AN/ALQ-71 or AN/ALQ-72 or QRC160-9 ECM PODS (AIRCRAFT INCORPORATING T.O. 1T-33A-554 or T.O. 1T-33A-636 and T.O. 1T-33A-635) *(See Figures 4-168A or 4-168B).*

a. The AN/ALE-2 chaff dispenser consists of a case assembly (streamlined pod) which contains a hopper for packages of tape-mounted chaff (radar re-

flective material), an intervalometer, and a stripper unit. When in operation, the stripper separates the chaff packages from the tape and directs the opened packages to a chute where they are ejected into the airstream by ram air passing through the case. The control unit in the forward cockpit provides the pilot with either direct control of the stripper or programmed control by means of the intervalometer.

NOTE

Operation, servicing and maintenance of AN/ALE-2 chaff dispensing equipment is contained in the 12P3-2ALE2 series technical orders.

b. The AN/ALQ-71 and AN/ALQ-72 ECM pods each consist of a case which contains electronic countermeasure components, a generator to provide electrical power for the components, and a ram air turbine for driving the generator. A multiple blade type antenna system is mounted on the bottom of the case.

NOTE

Operation, servicing and maintenance of AN/ALQ-71 and AN/ALQ-72 ECM equipment is contained in the 12P3-2ALQ series technical orders.

c. A pylon containing a MA-4A bomb shackle is installed under each wing for carrying a chaff dispenser or an ECM pod. Removal panels are provided in the pylon side fairings for access to electrical disconnects and MA-4A shackle cocking slide and release lever. Cocking of the shackles is accomplished by pulling on a cable fitting that projects from the pylon aft fairing.

CAUTION

On some MA-4A bomb shackles, the ring on the cocking slide is round and will not pass through the space between the pylon attaching brackets. If this is the case, the ring on the cocking slide must be squeezed into a triangular shape to allow its passage between the pylon bracket assemblies when the cocking cable is pulled. (See figure 4-168A.)

d. Controls for the ECM pods or chaff dispensers are located on the left side of the forward cockpit under the canopy rail. Circuit breakers to protect the aircraft wiring for the ECM pods or chaff dispensers are located in the right side of the nose electronic compartment on airplanes with T.O. 1T-33A-554 accomplished, and on the right side of the nose wheel well on airplanes with T.O. 1T-33A-636 accomplished.

CAUTION

The pylon external stores jettison system must be disabled to preclude jettisoning of stores when carrying ECM pods or chaff dispensers. The mechanical jettison system is disabled by coiling and securing bomb release cable, part number 176514-4, inside of wing. The electrical jettison system is disabled by disconnecting wire AB21E16 from the right hand emergency bomb release terminal board and wire AB24E16 from the left hand emergency bomb release terminal board and by disconnecting and stowing the MA-4A bomb rack electrical connector. (See Chaff Dispenser and ECM Pod wiring diagram in Section VIII of this manual and figure 4-168A.)

4-1065B. Conventional external stores hanger fittings provide a means of suspending the case assembly from the MA-4A bomb rack located in each wing pylon. Removable panels are provided in the pylon side fairings for access to electrical disconnects and MA-4A shackle release levers. Cocking of the shackles is accomplished by pulling on a cable fitting that projects from the pylon aft fairing. Two inspection holes have been provided in the mid wing bomb pylon fairings by T.O. 1T-33-539. These inspection holes are located on the inboard side of the left hand wing pylon and on the outboard side of the right hand wing pylon. After cocking the shackles, inspect through the holes in the pylon fairings to check the engagement of the bomb rack release lever arm and solenoid locking pin for 50 percent minimum engagement. Also inspect the engagement of the tumbler and link lock. These two points must be checked to assure a safe cocked and locked bomb rack when any external stores are carried on the mid wing pylons.

Table 4-13a. Chaff Dispenser and ECM Pod Installations.

	Installation No. 1	Installation No. 2	Installation No. 3
Left Pylon	Part No. 67E40434-1 or Part No. 410347-3	Part No. 67E40434-1 or Part No. 410347-3	Part No. 67E40434-1 or Part No. 410347-3
Right Pylon	Part No. 67E40434-2 or Part No. 410347-4	Part No. 67E40434-2 or Part No. 410347-4	Part No. 67E40434-2 or Part No. 410347-4
Left Pod	AN/ALE-2 Chaff Dispenser	AN/ALQ-71 ECM Pod or AN/ALQ-72 ECM Pod or QRC160-9ECM Pod	AN/ALQ-71 ECM Pod or AN/ALQ-72 ECM Pod or QRC160-9ECM Pod
Right Pod	AN/ALE-2 Chaff Dispenser	AN/ALQ-71 ECM Pod or AN/ALQ-72 ECM Pod or QRC160-9ECM Pod	AN/ALE-2 Chaff Dispenser
Control	C-1616/ALE (See Note 1 below)	C-6175/ALQ (See Note 2 below)	C-6631/ALQ
Mount			MT-3475

NOTES:

1. Two C-6918/ALE controls and one MT-3475 mount can be substituted for a C-1616/ALE control.
2. The C-6175/ALQ control consists of two C-6631/ALQ controls and one MT-3475 mount.

4-1065C. CHAFF DISPENSER/ECM POD INSTALLATION. (See Figures 4-168A and 168B and Table 4-13a.)

A. AEROSPACE GROUND EQUIPMENT REQUIRED

1. MJ-1 bomb lift or MF-9 trailer
2. Stand assembly, ECM Pod, WRAMA Drawing Number 67E46347.
3. Adapter Assembly, QRC160-9, WRAMA Drawing Number 68F34482.

B' PREDISPATCH PROCEDURES.

CAUTION

Maximum trailer towing speed 5 MPH.

1. Check MF-9 trailer or MJ-1 bomb lift for serviceability.
2. Check pitch control and travel locks for proper position prior to loading.
3. Check that trailer/bomb lift is chocked.
4. (QRC160-9) Install ECM Pod loading adapter on trailer/lift.
5. Load pod and secure to trailer/bomb lift with loadibinding straps.

C. AIRCRAFT PREPARATION.

1. Check that the aircraft main wheels are chocked fore and aft and the aircraft is properly grounded. (See Figure 4-169.)
2. Check that the main and nose ladning gear ground safety pins are installed.
3. Check that both tip tank safety pins are installed properly. (See Figure 4-169A.)
4. Check that adequate firefighting equipment is available.
5. Position ground support equiopment in proper location.
6. Check AFTO Form 781 for status of aircraft.
7. Check that the Egress safety pins are installed in the pilot's seats and canopy. (See Figure 4-169B.)
8. Check that flaps are raised to the full up position.
9. Disconnect external power and check that aircraft BATTERY switch is at OFF.
10. Check that all switches, in both the fore and aft cockpit, are at SAFE or OFF.
11. Remove pylon access panels required for accessibility.

WARNING

Failure to disconnect the MA--4A bomb racks electrical connector could result in inadvertent release of chaff dispensers/ECM pods.

12. Disconnect pylon/rack electrical plugs, stow MA-4A electrical plug (see figures 4-168A and 4-169C) (plug has 10 contacts).
13. Disconnect manual release cable from bomb rack and stow with sufficient slack to permit tip tank jettison. (See figures 4-168A and 4-169C.)
14. Loosen pylon sway-brace locknuts and retract sway-braces to maximum position.
15. Unlock rack and, with 0.032-inch safety wire,

safety wire manual release lever in full-down position. *(See Figure 4-169D.)*

16. Check that CHAFF/ECM circuit breakers are pulled OUT.

D. POD LOADING PROCEDURES.

1. Ensure that pod preparation has been accomplished by Electronic Warfare Systems (EWS) personnel and ECM/CHAFF Pod is serviceable.

CAUTION

Be sure that aircraft has settled on landing gear shock struts.

Note

Approach aircraft from the front for loading CHAFF/ECM Pod.

2. (MF-9) Remove rear guard from trailer.
3. Approaching aircraft from the front, position pod below pylon and chock lift/trailer.
4. Remove load binders.
5. Raise pod sufficiently to permit alignment of pod lugs with pylon rack hooks.
6. Connect pod receptacle to pylon electrical plug. *(See Figure 4-169E.)*

CAUTION

Do not use excessive cradle pressure as damage to ECM Pod or aircraft may result.

7. Raise pod slowly until pylon rack hooks can be engaged with pod suspension lugs. Cock rack hooks by pulling MA-4A rack cocking cable. Ensure that cocking strap returns to normal position.
8. Visually check bomb rack for proper engagement of tumbler and link lock to ensure rack is fully cocked. Check engagement of rack release lever locking arm and solenoid stud (minimum engagement 50%) to ensure rack is fully locked. *(See Figure 4-169F.)*
9. Lower cradle one inch until rack hooks support pod.
10. Shake pod to check that store is securely attached.
11. Install sway-brace pads, if necessary. *(See Figure 4-169G.)*
12. Tighten lower sway-brace nuts finger tight, then apply torque by 1/2 turn increments (front sway-braces first) to each nut, in turn, to a torque value of 100-125-inch-pounds. Torque top locknuts on sway-brace studs to 100-125-inch-pounds.
13. Install pylon access panels.
14. (ALQ-72/QRC160-2) Remove omniantenna cover, if installed.
15. Lower lift until clear of pod, and remove lift from immediate area.
16. Check that ECM/CHAFF circuit breaker is pushed IN.
17. Remove all unnecessary tools and equipment from the immediate area.
18. Make AFTO Form 781 entry.

4-1065D. ECM POD/CHAFF DISPENSER REMOVAL.

A. PREUNLOADING

1. Check that the aircraft main wheels are chocked fore and aft and the aircraft is properly grounded.
2. Check that the main and nose landing gear ground safety pins are installed.
3. Check that both tip tank safety pins are installed properly.
4. Check that adequate firefighting equipment is available.
5. Position ground support equipment in proper position.
6. Check AFTO Form 781 for status of aircraft.
7. Check that the Egress safety pins are installed in the pilot's seats and canopy.
8. Check that the flaps are raised to the full up position.
9. Disconnect electrical power and check that aircraft BATTERY switch is at OFF.
10. Check that all switches, in both the fore and aft cockpits, are at SAFE or OFF.
11. Check that ECM/CHAFF circuit breaker is pulled OUT.

B. POD UNLOADING PROCEDURES.

CAUTION

Be sure that aircraft has settled on landing gear shock struts.

1. (MF-9) Remove rear guard from trailer.
2. (ALQ-72/QRC160-2) Install omniantenna cover, if required.
3. (QRC160-9) Install ECM Pod loading adapter on lift, if required.
4. Approaching aircraft from the front, position cradle directly under pod and chock lift/trailer.
5. Raise cradle until pod is securely supported.
6. Remove pylon access panels.

7. Remove safety wire from rack manual release lever.
8. Loosen locknuts and retract sway-brace studs sufficiently to relieve tension on pod.
9. Raise bomb rack manual release lever until pod is released.
10. Install load binder securing pod to bomb lift cradle.
11. Lower lift sufficiently to permit access to electrical connection. Disconnect pod electrical plug.
12. Remove lift/trailer with pod to clear aircraft.
13. (MF-9) Set travel locks and lower inner frame until it rests on travel locks.
14. Replace nose and/or tail cones if removed.
15. (MF-9) Replace rear guard on trailer.
16. Manually cock/lock MA-4A bomb rack.
17. Connect manual release cable to manual release lever, if required.
18. Stow plug and reinstall pylon access panels.
19. Make the proper entries in AFTO Form 781.

CAUTION

Maximum trailer towing speed 5 MPH.

20. Clean up area and remove all tools and equipment from the immediate area.

4–1066. INSTRUMENTS.

4–1067. INSTRUMENT PANEL. *(See figures 4-169 through 4-178C.)* Each instrument panel consists of two

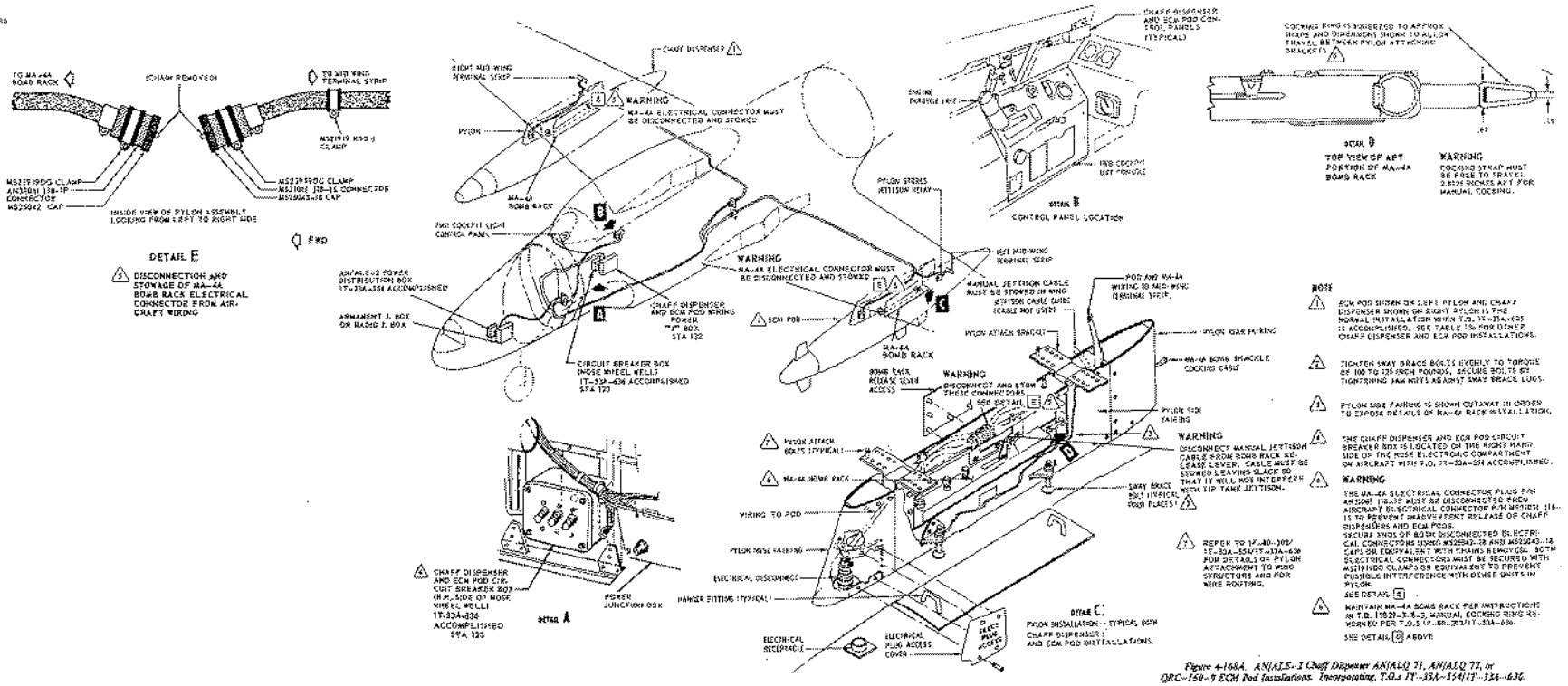


Figure 4-168A. AN/ALE-1 Chaff Dispenser AN/ALQ 71, AN/ALQ 72, or QRC-160-9 ECM Pod Installations. Incorporating, T.O.s 1F-33A-554/1F-33A-636.

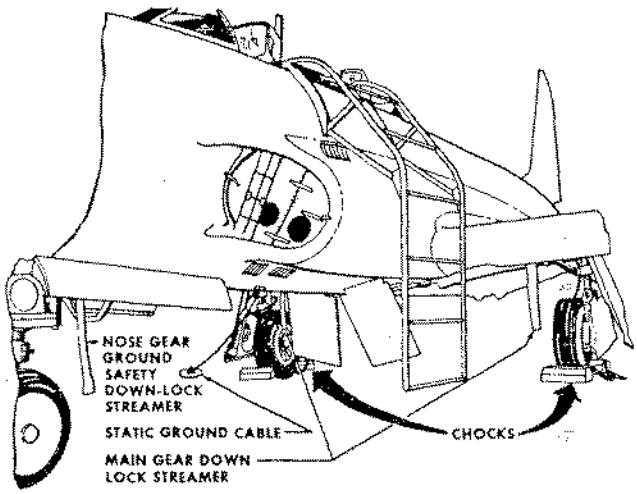


Figure 4-169. Aircraft Chocked; Landing Gear Ground Safety

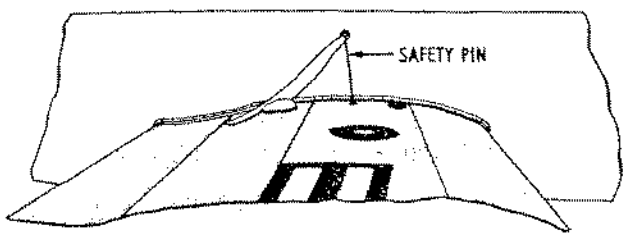
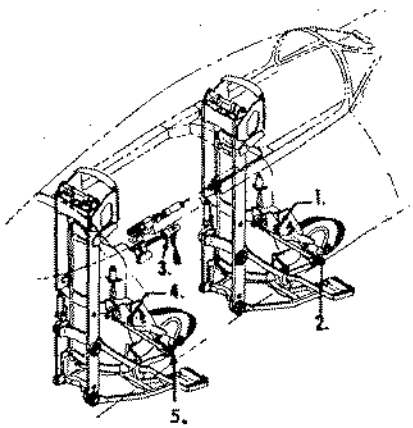


Figure 4-169A. Tip Tank Safety



1. FORWARD SEAT CATAPULT INITIATOR
2. FORWARD SEAT TRIGGER SAFETY PIN
3. EXTERNAL CANOPY JETTISON INITIATOR
4. AFT SEAT CATAPULT INITIATOR
5. AFT SEAT TRIGGER SAFETY PIN

Figure 4-169B. Seat and Canopy Safety

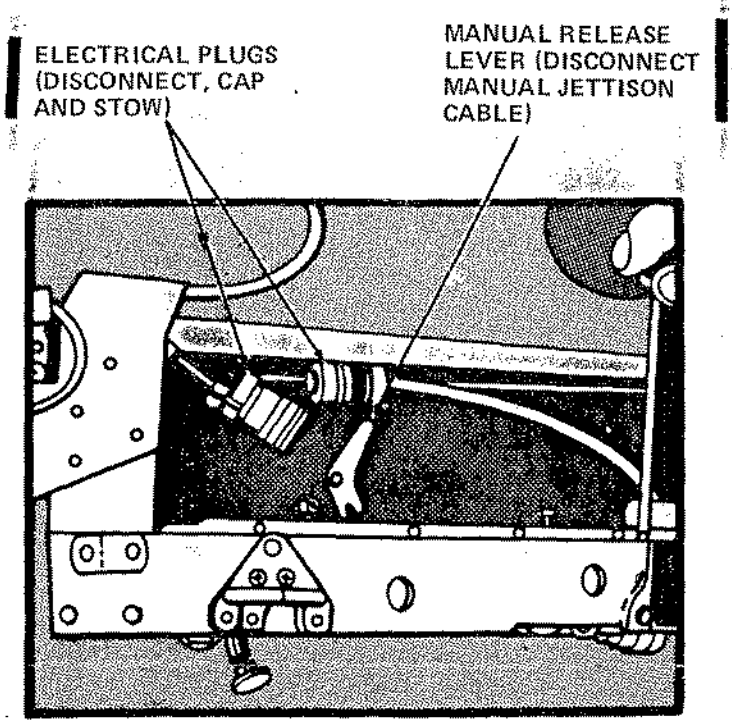


Figure 4-169C. Pylon/Rack Electrical Cable Connection. See figure 4-168A, detail E for method of securing disconnected MA-4A bomb rack electrical connectors.

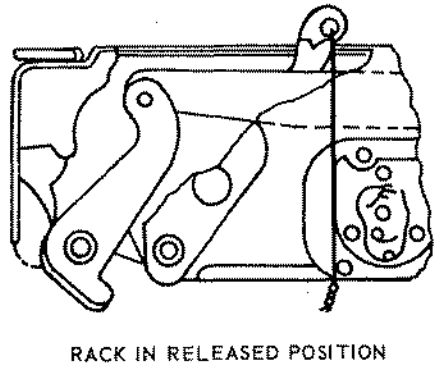


Figure 4-169D. Manual Release Lever (Safety Wired)

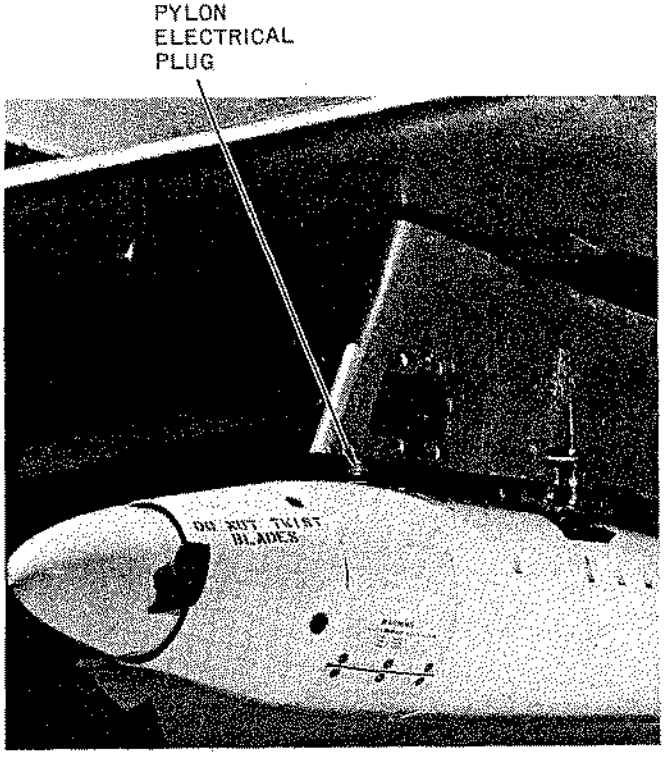


Figure 4-169E. Pod and Pylon Alignment

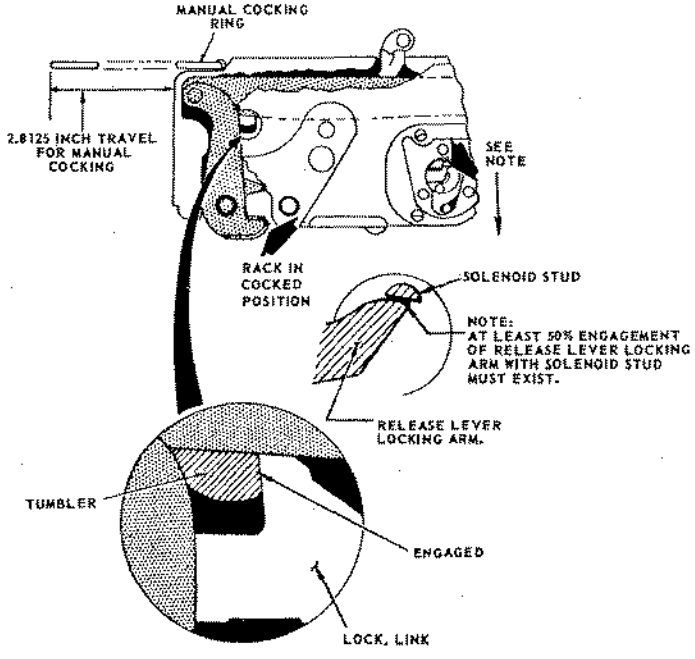


Figure 4-169F. Manual Release Lever; Cocked and Released Rack

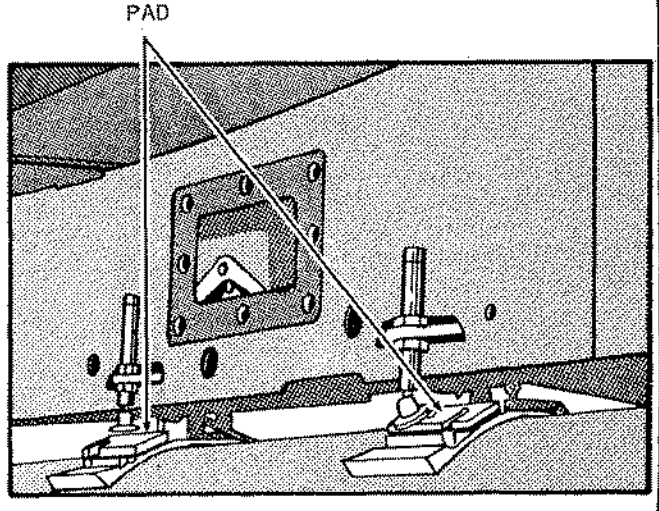


Figure 4-169G. Sway-Brace Pads

All data on pages 412 through 417, including figures 4–171, 4–172, 4–173, 4–174, 4–175, and 4–176, deleted.

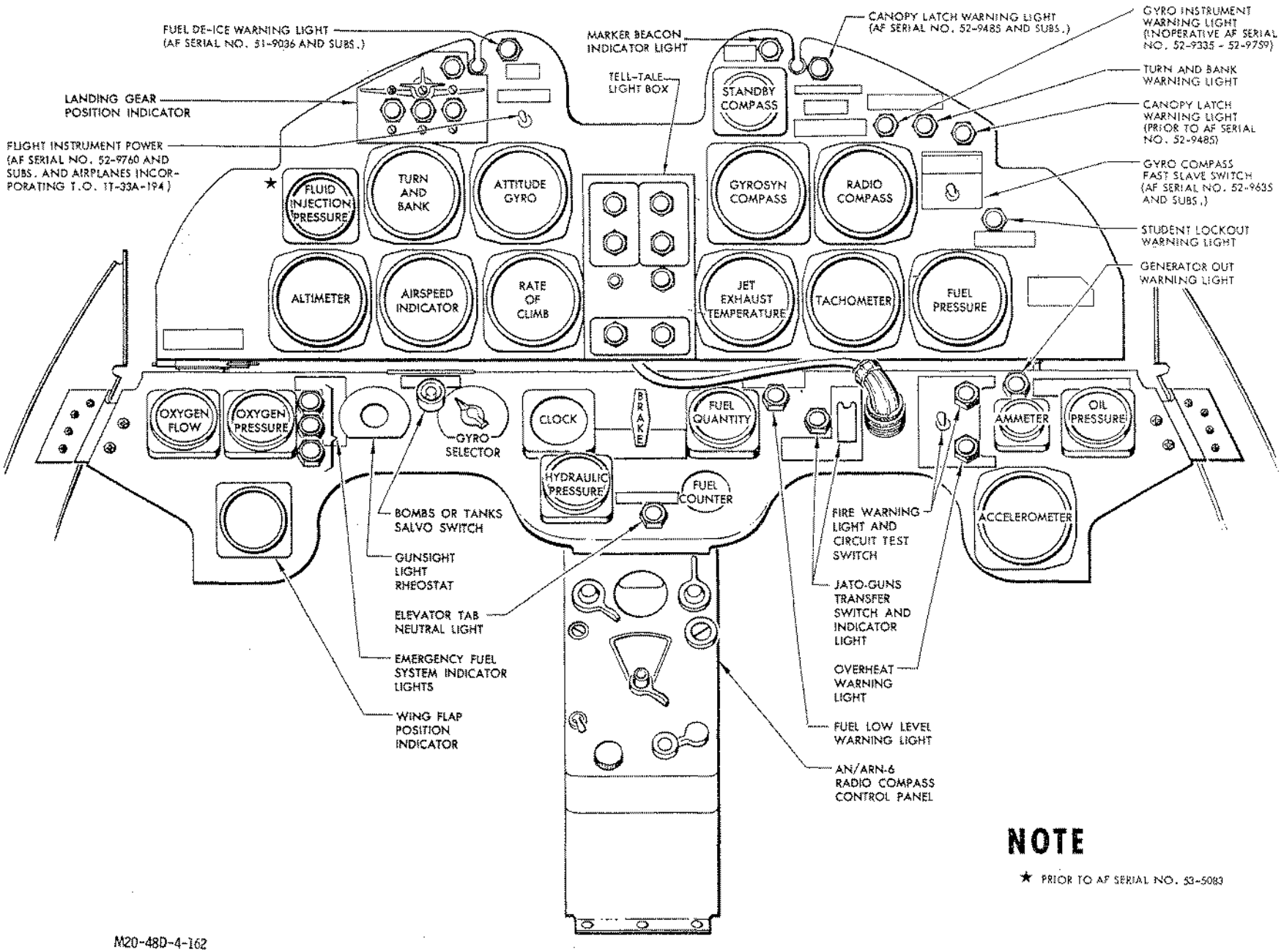
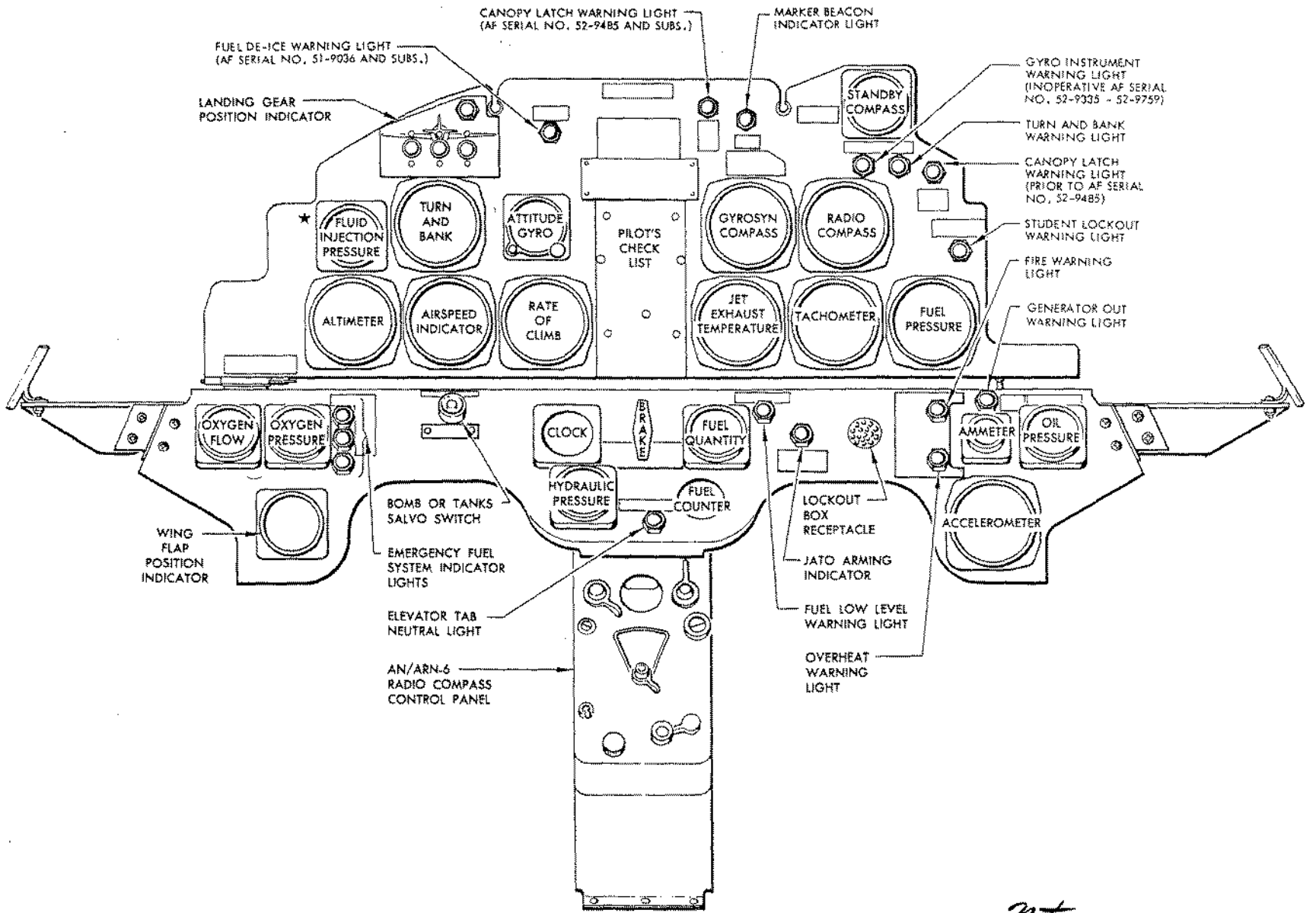


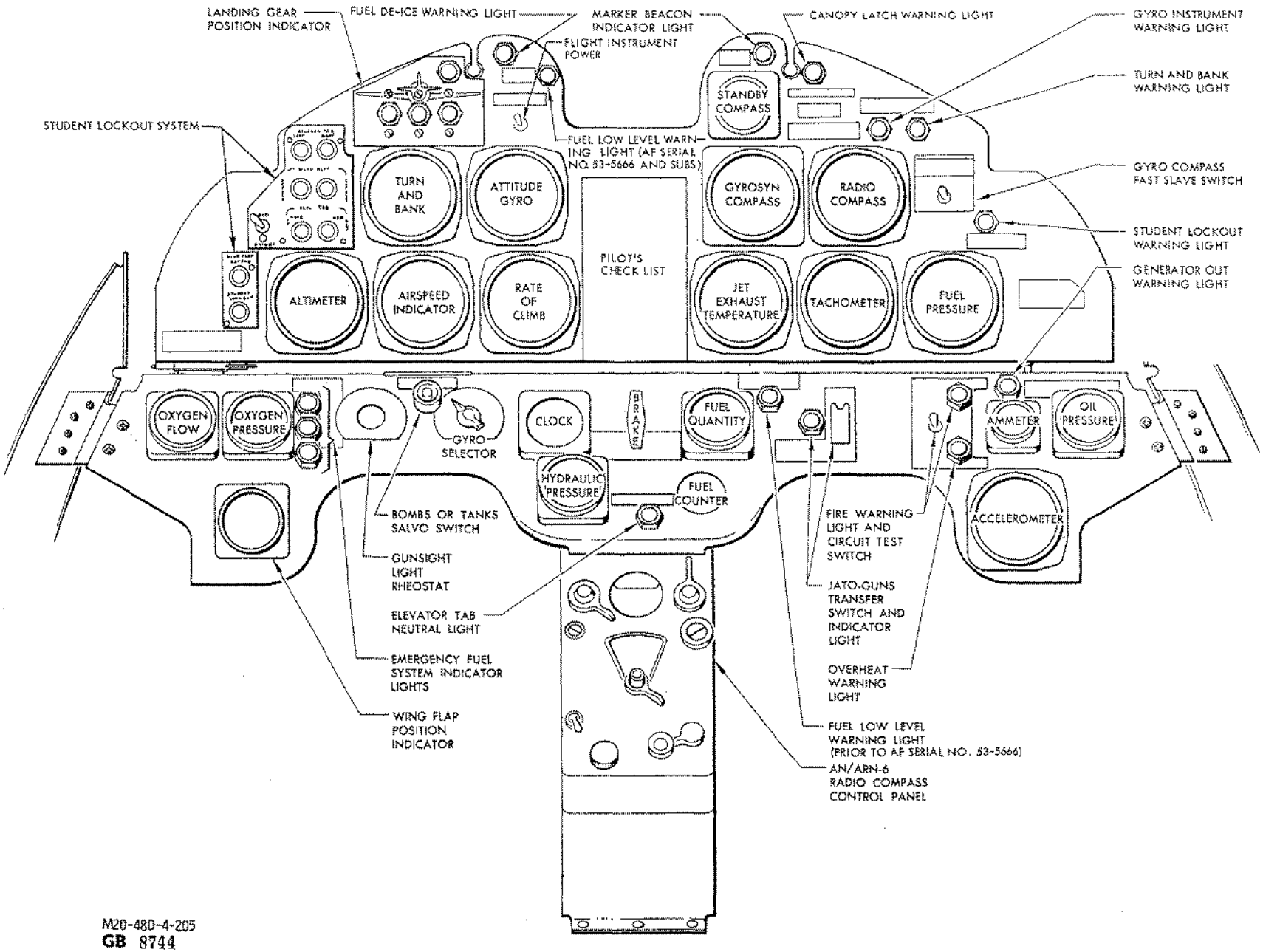
Figure 4-172. Forward Instrument Panel, AF Serial No. 51-6588 through 53-5285



Note

★ PRIOR TO AF SERIAL NO. 53-5083

Figure 4-173. Aft Instrument Panel, AF Serial No. 51-6588 through 53-5285



M20-480-4-205
GB 8744

Figure 4–174. Forward Instrument Panel, AF Serial No. 53-5286 and Subsequent, T-33A-1

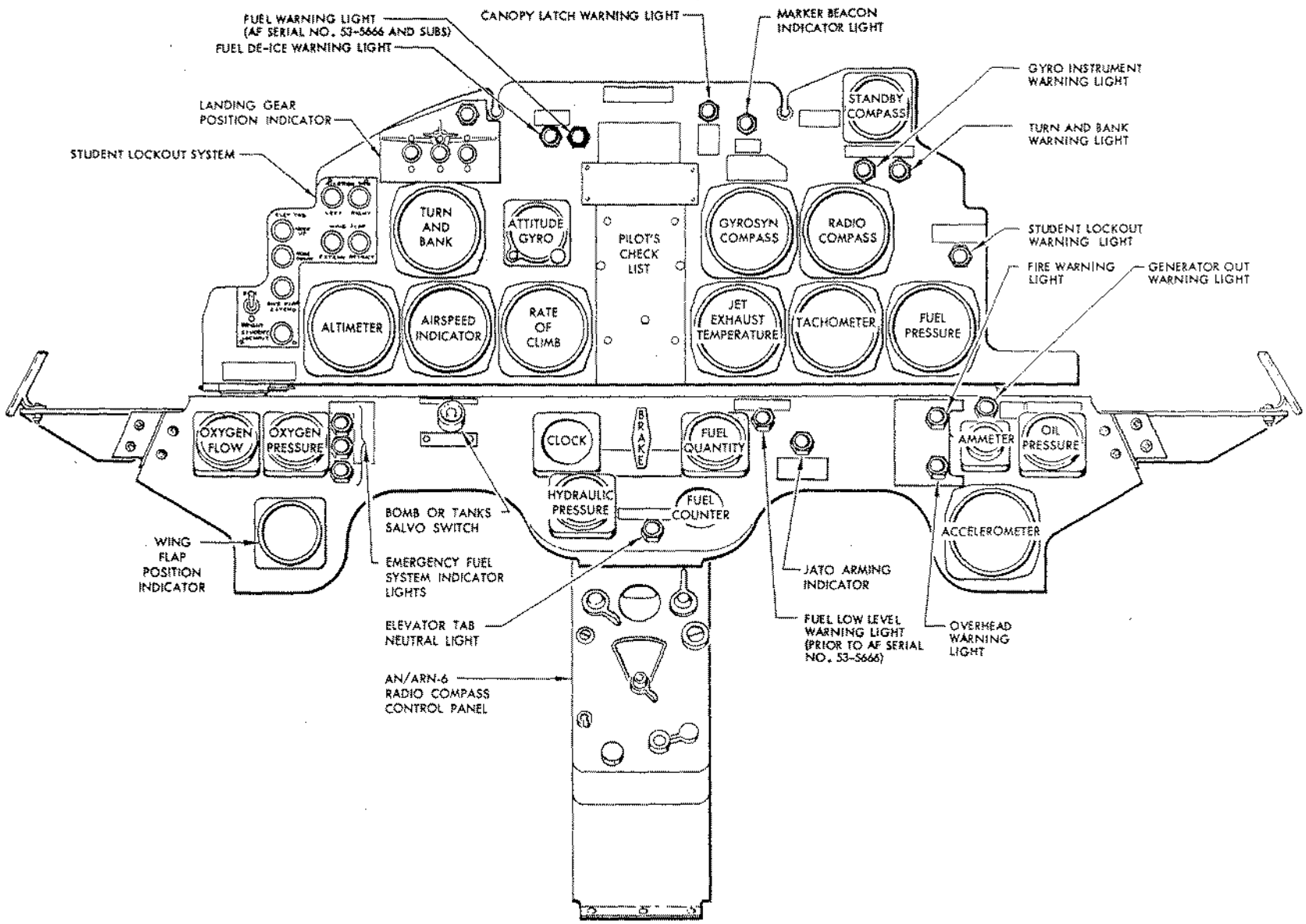
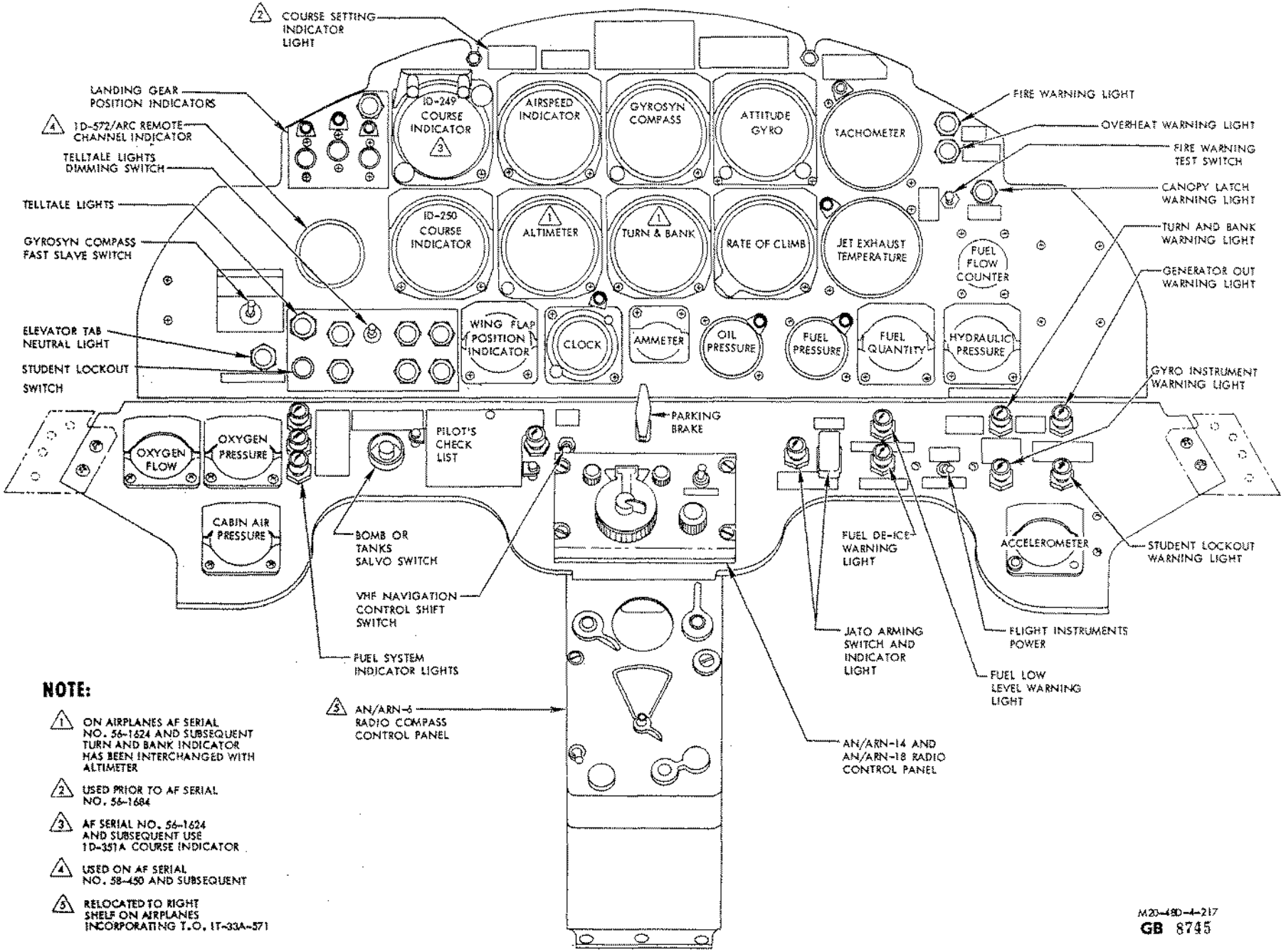


Figure 4-175. Aft Instrument Panel, AF Serial No. 53-5286 and Subsequent, T-33A-1 Airplanes

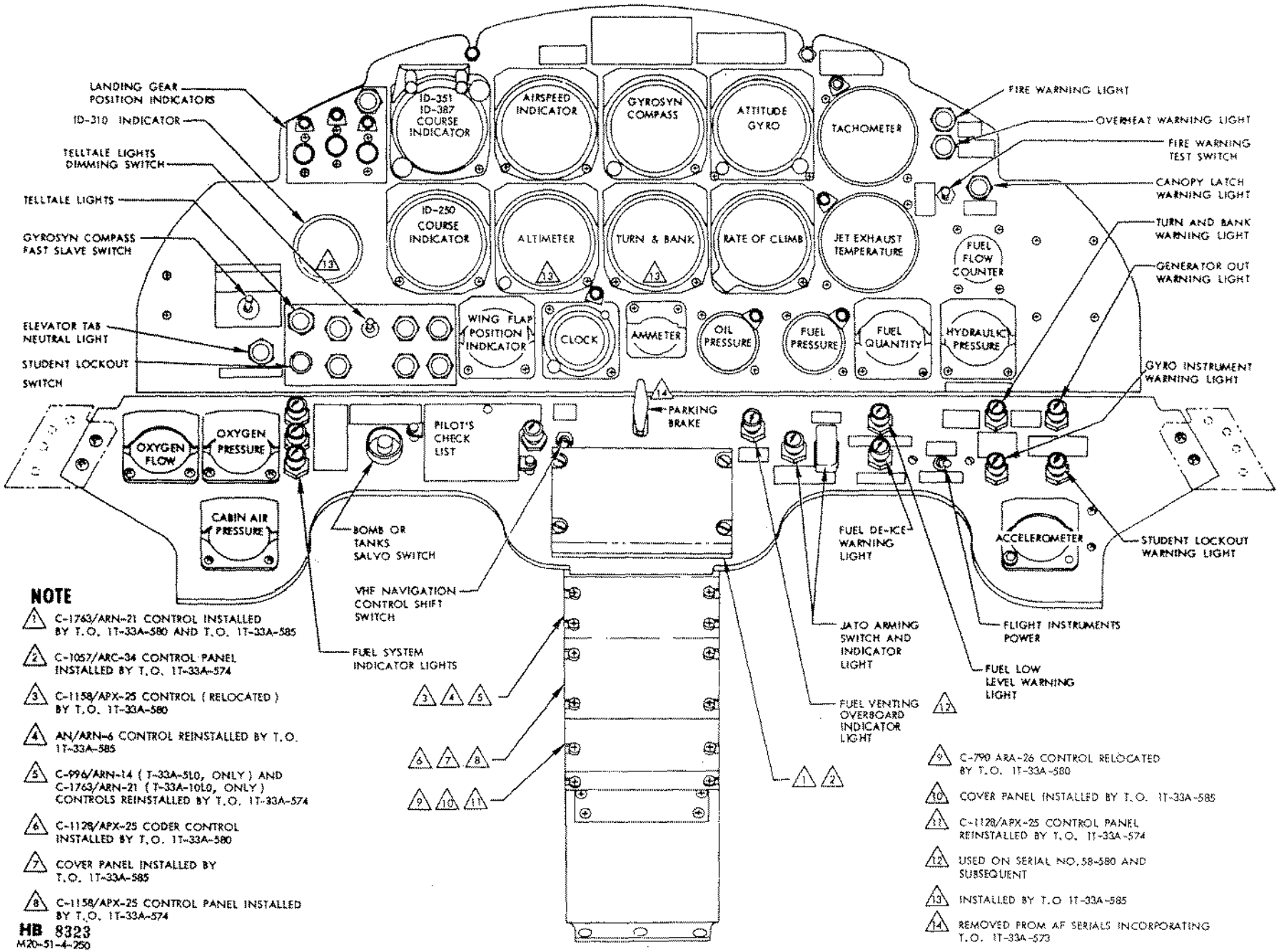


NOTE:

1. ON AIRPLANES AF SERIAL NO. 56-1624 AND SUBSEQUENT TURN AND BANK INDICATOR HAS BEEN INTERCHANGED WITH ALTIMETER
2. USED PRIOR TO AF SERIAL NO. 56-1684
3. AF SERIAL NO. 56-1624 AND SUBSEQUENT USE 1D-351A COURSE INDICATOR
4. USED ON AF SERIAL NO. 58-450 AND SUBSEQUENT
5. RELOCATED TO RIGHT SHELF ON AIRPLANES INCORPORATING T.O. 1T-33A-571

M20-48D-4-217
GB 8745

Figure 4-176. Forward Instrument Panel, T-33A-5 Airplanes Prior to AF Serial No. 58-504



NOTE

1. C-1763/ARN-21 CONTROL INSTALLED BY T.O. 1T-33A-580 AND T.O. 1T-33A-585
2. C-1057/ARC-34 CONTROL PANEL INSTALLED BY T.O. 1T-33A-574
3. C-1158/APX-25 CONTROL (RELOCATED) BY T.O. 1T-33A-580
4. AN/ARN-6 CONTROL REINSTALLED BY T.O. 1T-33A-585
5. C-996/ARN-14 (T-33A-510, ONLY) AND C-1763/ARN-21 (T-33A-1010, ONLY) CONTROLS REINSTALLED BY T.O. 1T-33A-574
6. C-1128/APX-25 CODER CONTROL INSTALLED BY T.O. 1T-33A-580
7. COVER PANEL INSTALLED BY T.O. 1T-33A-585
8. C-1158/APX-25 CONTROL PANEL INSTALLED BY T.O. 1T-33A-574
9. C-799 ARA-26 CONTROL RELOCATED BY T.O. 1T-33A-580
10. COVER PANEL INSTALLED BY T.O. 1T-33A-585
11. C-1128/APX-25 CONTROL PANEL REINSTALLED BY T.O. 1T-33A-574
12. USED ON SERIAL NO. 58-580 AND SUBSEQUENT
13. INSTALLED BY T.O 1T-33A-585
14. REMOVED FROM AF SERIALS INCORPORATING T.O. 1T-33A-573

HB 8323
M20-51-4-250

Figure 4-177. Forward Instrument Panel, T-33A-5 Airplanes, AF Serial No. 58-504 and Subsequent

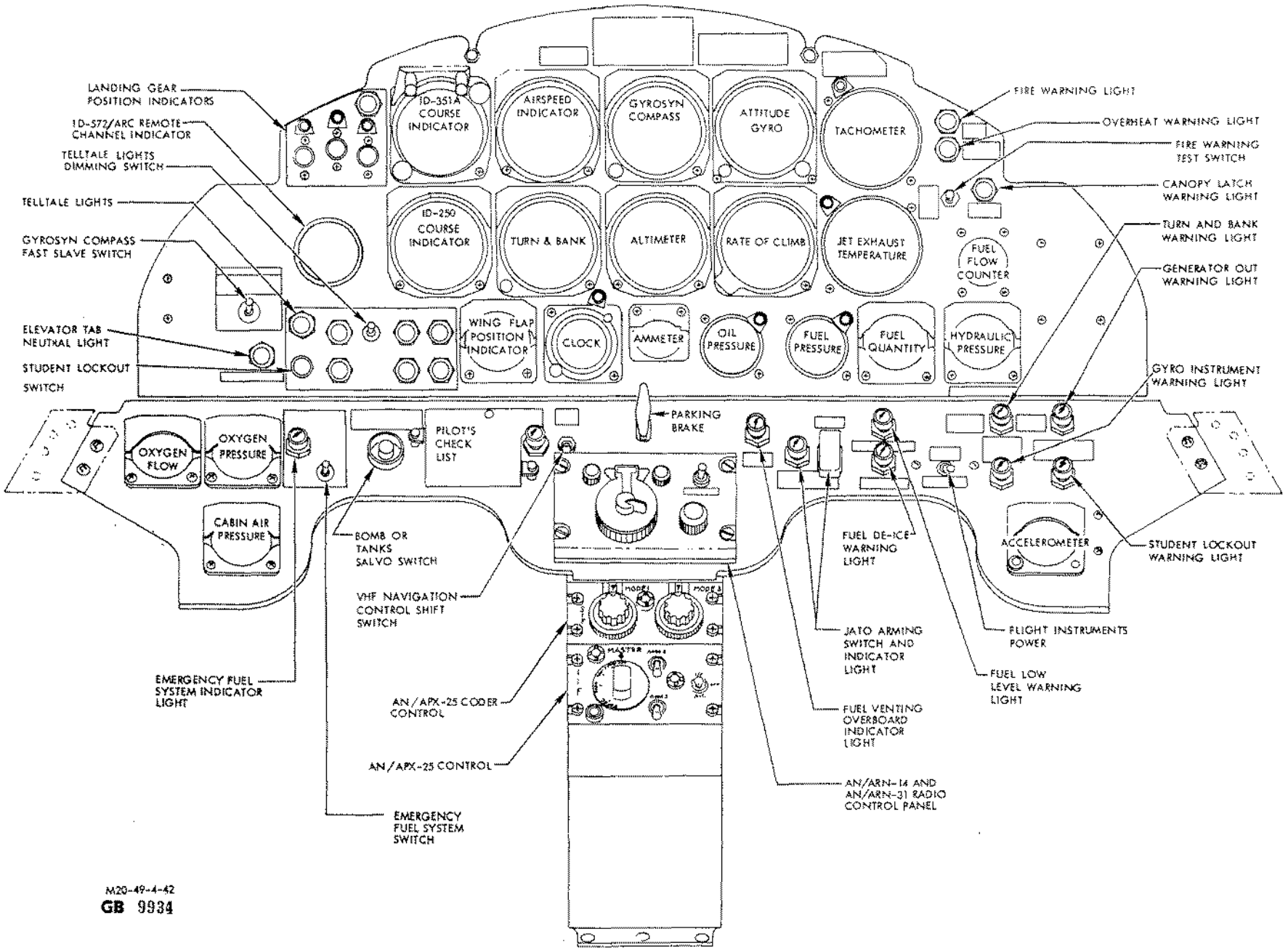


Figure 4-177A. Forward Instrument Panel, T-33A-5 Airplanes, AF Serial No. 58-671 and Subsequent

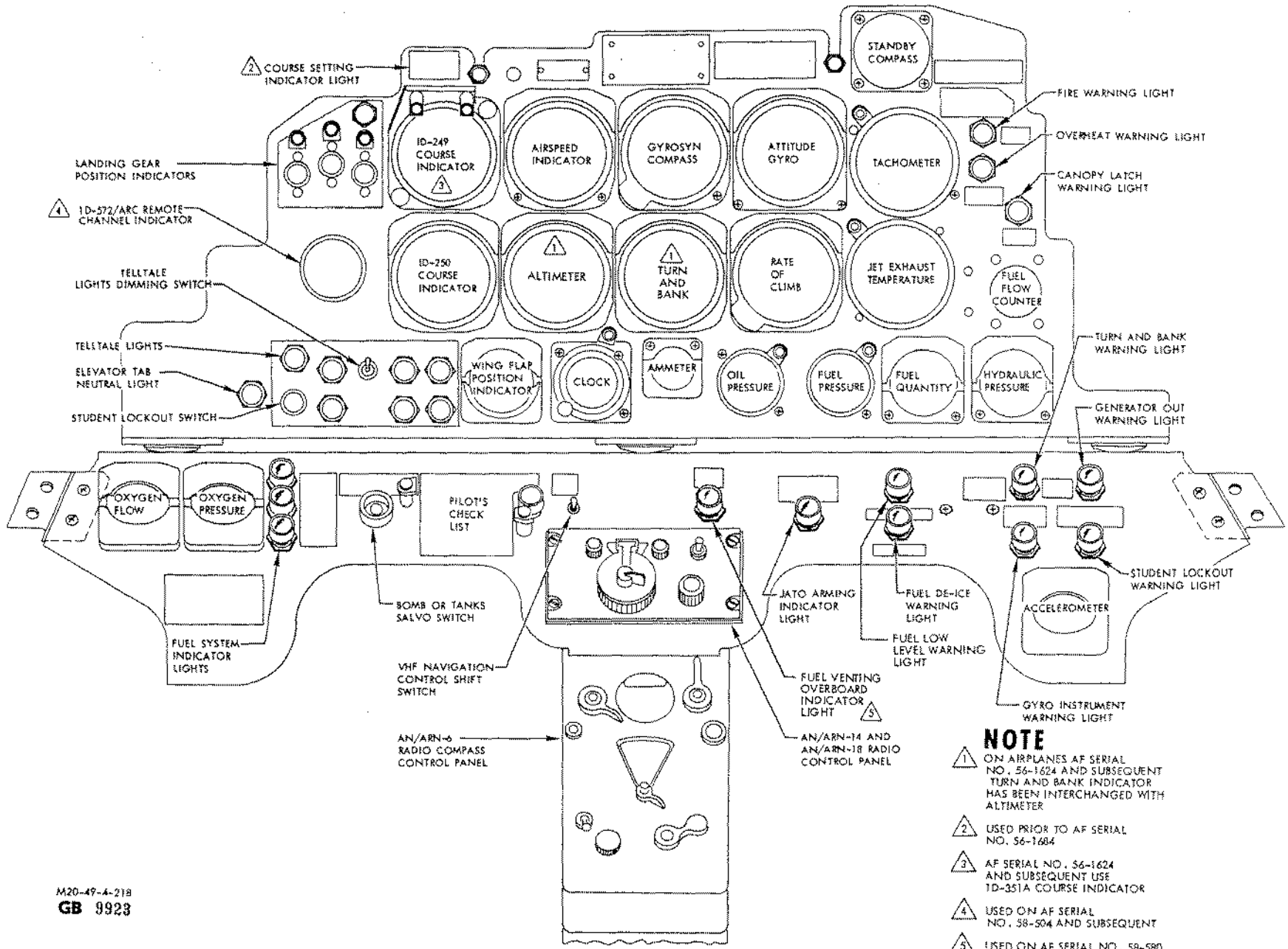


Figure 4-178. Aft Instrument Panel, T-33A-5 Airplanes, Prior to AF Serial No. 58-671

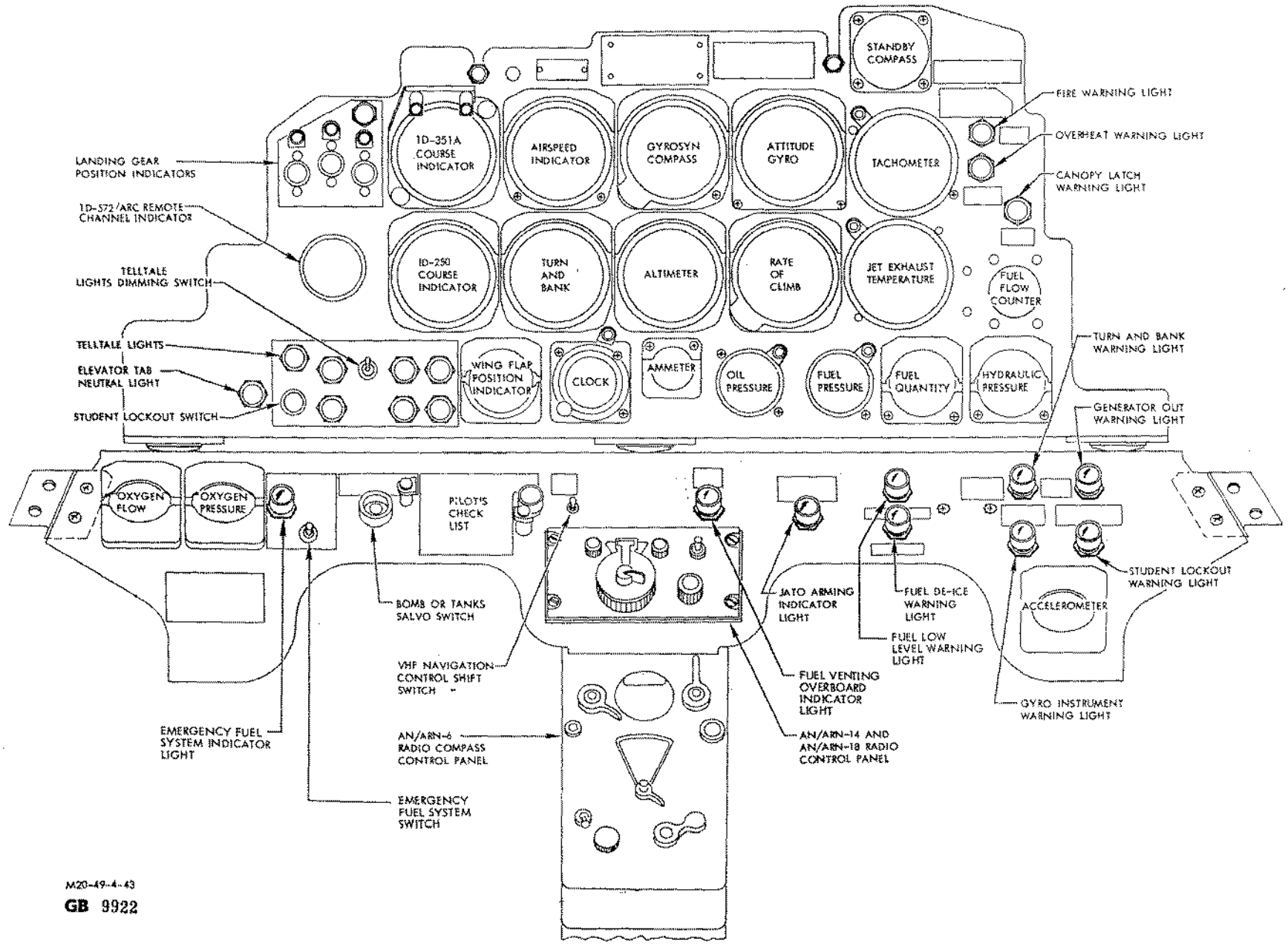


Figure 4-178A. Aft Instrument Panel, T-33A-5 Airplanes, AF Serial No. 58-671 and Subsequent

separate panel assemblies. The upper or main instrument panel is attached to the structure by vibration absorbing mounts. To facilitate instrument maintenance, the bottom of the panel is hinged and the top is supported by rod assemblies.

4–1068. Each sub-panel, immediately below the main instrument panel, is bolted to the airplane structure. A radio compass remote control box is located below each sub-panel.

4–1069. REMOVAL OF INSTRUMENT MAIN PANEL. Remove gyrosyn compass indicator, and nuts at top of panel on each side of gunsight mounting, and allow panel to swing outward. Disconnect safety chain on AF Serial Nos. 51-6819 and subsequent. Disconnect electrical or plumbing connections of all instruments, and bonding between main panel and subpanel near fuselage pressure indicator. Remove hinge pins at bottom of panel. Lift out panel.

4–1070. REMOVAL OF INSTRUMENT SUB-PANEL. Disconnect electrical or plumbing connections of all instruments, and parking brake at back side of panel. Detach radio compass remote-control box support from sub-panel. Remove cockpit trim panels at ends of sub-panel, three bolts at each end, and four bolts at center of panel. Lift out panel.

4–1071. ACCELEROMETER. An accelerometer, type AN5745-T2A or B-6, or MS28025-1, has three pointers arranged to move concentrically on the face of the instrument, to show accelerations on a common scale. The outer or main pointer records instantaneous acceleration. The middle pointer records positive acceleration, while the one nearest the dial records negative acceleration. Until reset, the middle and inner pointers indicate and remain at the maximum positive or negative reading for any particular maneuver. Instrument range markings consist of two red bars; one at positive 7.33 and the other at negative 3.00 G's.

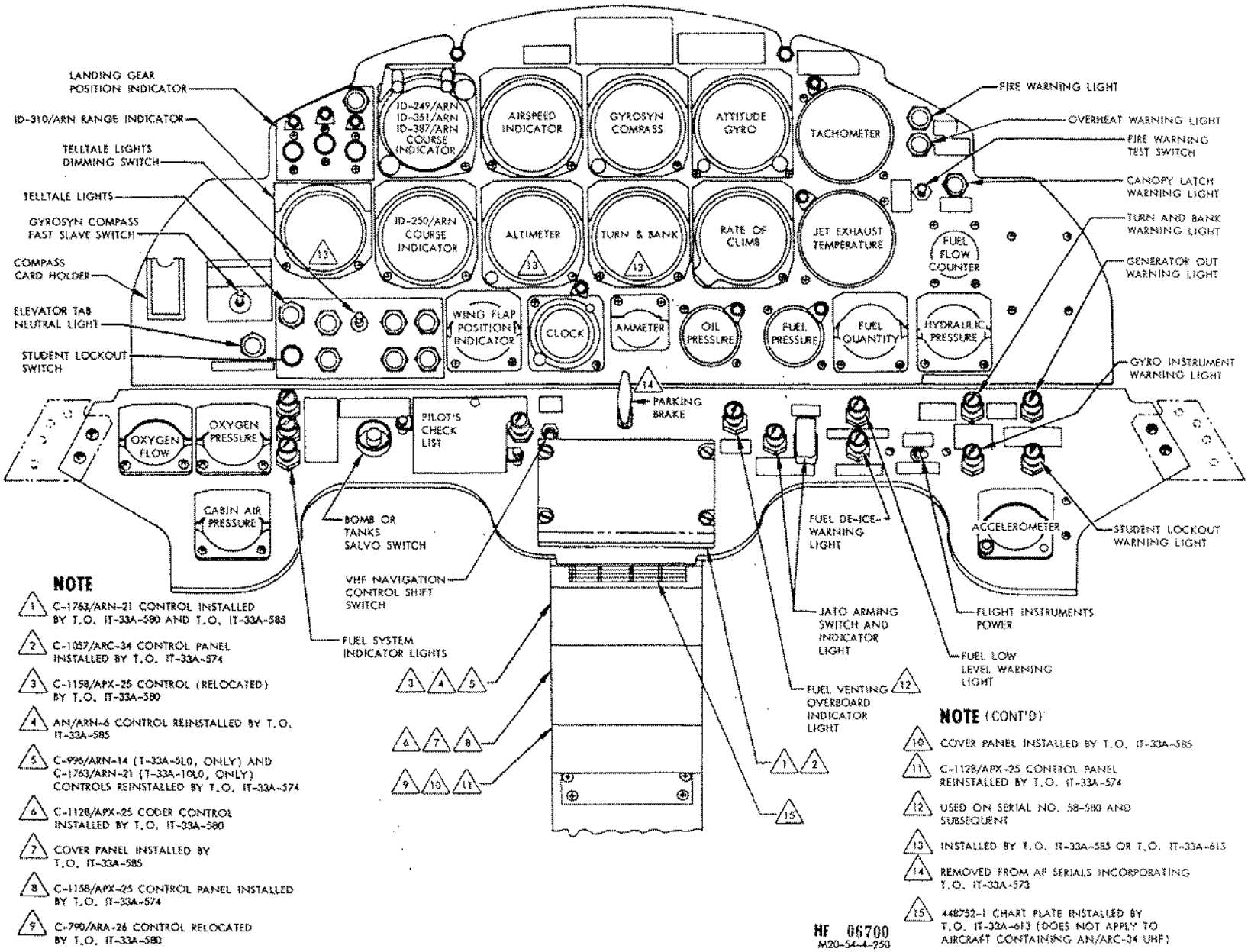
4–1072. There is very little maintenance or repair that can be made other than checking the security of instrument mounting. If accelerometer does not function correctly, replace it. No lubrication is required in service.

4–1073. AIRSPEED INDICATOR. The Mach number type air speed indicator is connected to the pitot static lines, and indicates the speed of the airplane in relation to the body of air in which it is traveling. Instrument range markings consist of a yellow bar at 174 knots and an adjustable red pointer. The adjustable, red, critical Mach number limit pointer is preset at the proper value for this airplane. If an instrument must be replaced, refer to T.O. No. 1T-33A-1, "Handbook of Flight Operating Instructions," and adjust the red pointer to the proper Mach value. At zero airspeed pressure, the indicating drum should read 30 to 35 knots. Refer to T.O. 33D2-6-9-1 for operation and service instructions for type MB-1 pitot static system tester.

4–1074. TROUBLE SHOOTING OF AIR SPEED INDICATOR.

Trouble	*Probable Cause*	*Remedy*
Pointers do not move.	Pitot or static pressure connection not connected properly.	Check tubing and connections for leaks.
	Pitot or static pressure line clogged.	Disconnect pitot and static pressure lines from all instruments. Drain at lowest point of each tube line. Blow through tubing to remove obstructions.
	Defective indicator mechanism.	Replace indicator.
Inaccurate reading.	Leak in tubing from pitot or static pressure fittings.	Check lines to external fittings for leaks.
	Leak in indicator case.	Replace indicator.
	Defective indicator.	Replace indicator.
Pointers oscillate.	Leak in tubing from pitot or static pressure fittings.	Disconnect lines from indicator. Check lines for leaks.
	Leak in indicator case.	Replace indicator.
	Leak in rate of climb indicator or altimeter installations.	Check lines for leaks. If an instrument is at fault, replace instrument.

4–1075. ATTITUDE GYRO INDICATOR. Each type J-8 attitude gyro indicator is an electrically driven flight instrument providing visual indication of pitch and roll flight attitude with respect to the earth. The indicator provides horizon bar sensing and manual caging for quick erection of the gyro.



NOTE

1. C-1763/ARN-21 CONTROL INSTALLED BY T.O. 1T-33A-580 AND T.O. 1T-33A-585
2. C-1057/ARC-34 CONTROL PANEL INSTALLED BY T.O. 1T-33A-574
3. C-1158/APX-25 CONTROL (RELOCATED) BY T.O. 1T-33A-580
4. AN/ARN-6 CONTROL REINSTALLED BY T.O. 1T-33A-585
5. C-996/ARN-14 (T-33A-9L0, ONLY) AND C-1763/ARN-21 (T-33A-10L0, ONLY) CONTROLS REINSTALLED BY T.O. 1T-33A-574
6. C-1128/APX-25 CODER CONTROL INSTALLED BY T.O. 1T-33A-580
7. COVER PANEL INSTALLED BY T.O. 1T-33A-585
8. C-1158/APX-25 CONTROL PANEL INSTALLED BY T.O. 1T-33A-574
9. C-790/ARA-26 CONTROL RELOCATED BY T.O. 1T-33A-580

NOTE (CONT'D)

10. COVER PANEL INSTALLED BY T.O. 1T-33A-585
11. C-1128/APX-25 CONTROL PANEL REINSTALLED BY T.O. 1T-33A-574
12. USED ON SERIAL NO. 58-580 AND SUBSEQUENT
13. INSTALLED BY T.O. 1T-33A-585 OR T.O. 1T-33A-613
14. REMOVED FROM AF SERIALS INCORPORATING T.O. 1T-33A-573
15. 448752-1 CHART PLATE INSTALLED BY T.O. 1T-33A-613 (DOES NOT APPLY TO AIRCRAFT CONTAINING AN/ARC-34 UHF)

Figure 4-178B. Forward Instrument Panel, Incorporating T.O. 1T-33A-574, T.O. 1T-33A-580, and T.O. 1T-33A-585 (MDAP), or T.O. 1T-33A-613 (USAF)

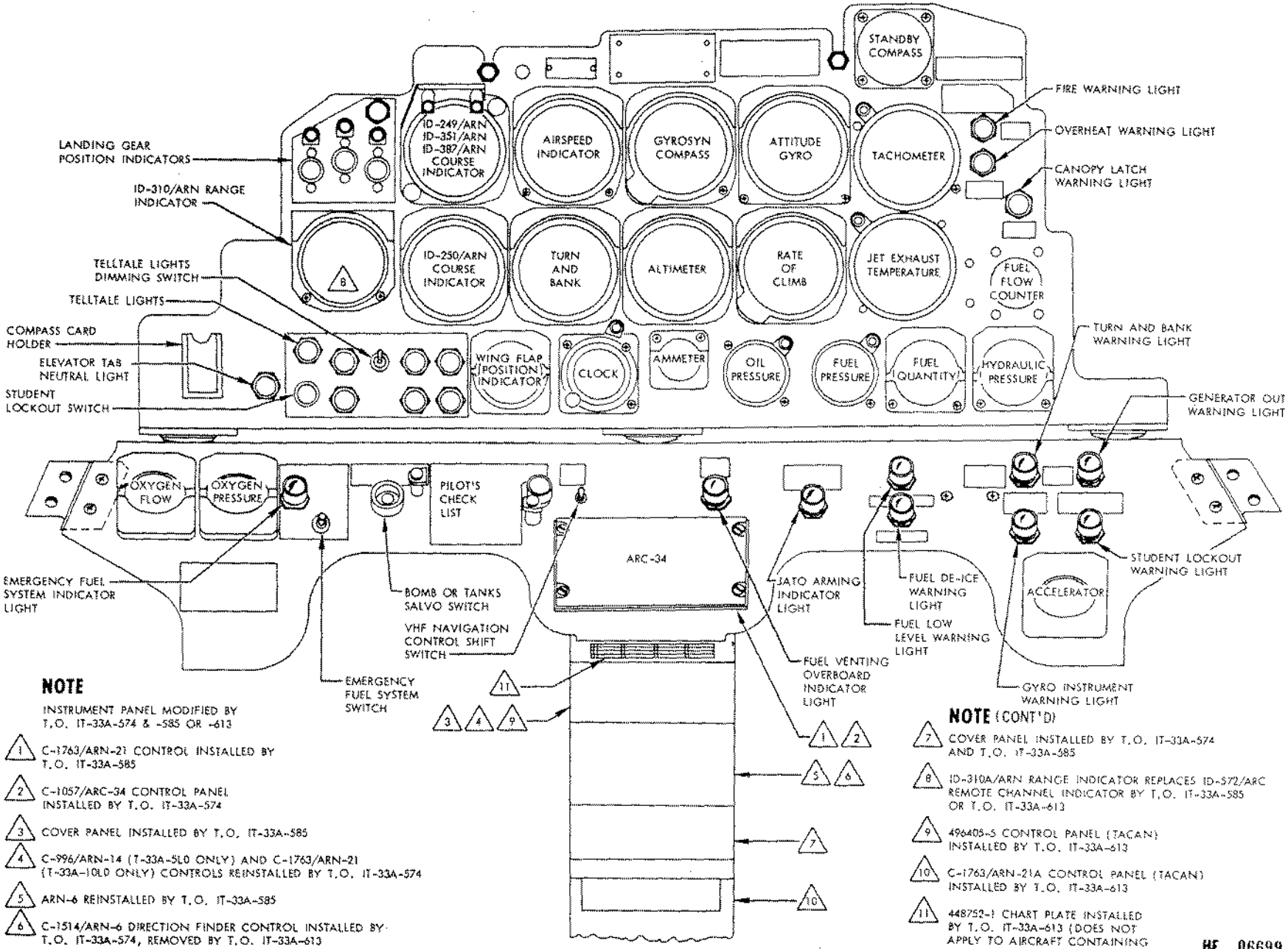


Figure 4-178C. Aft Instrument Panel, Incorporating T.O. 1T-33A-574, T.O. 1T-33A-580, and T.O. 1T-33A-585 (MDAP), or T.O. 1T-33A-613 (USAF)

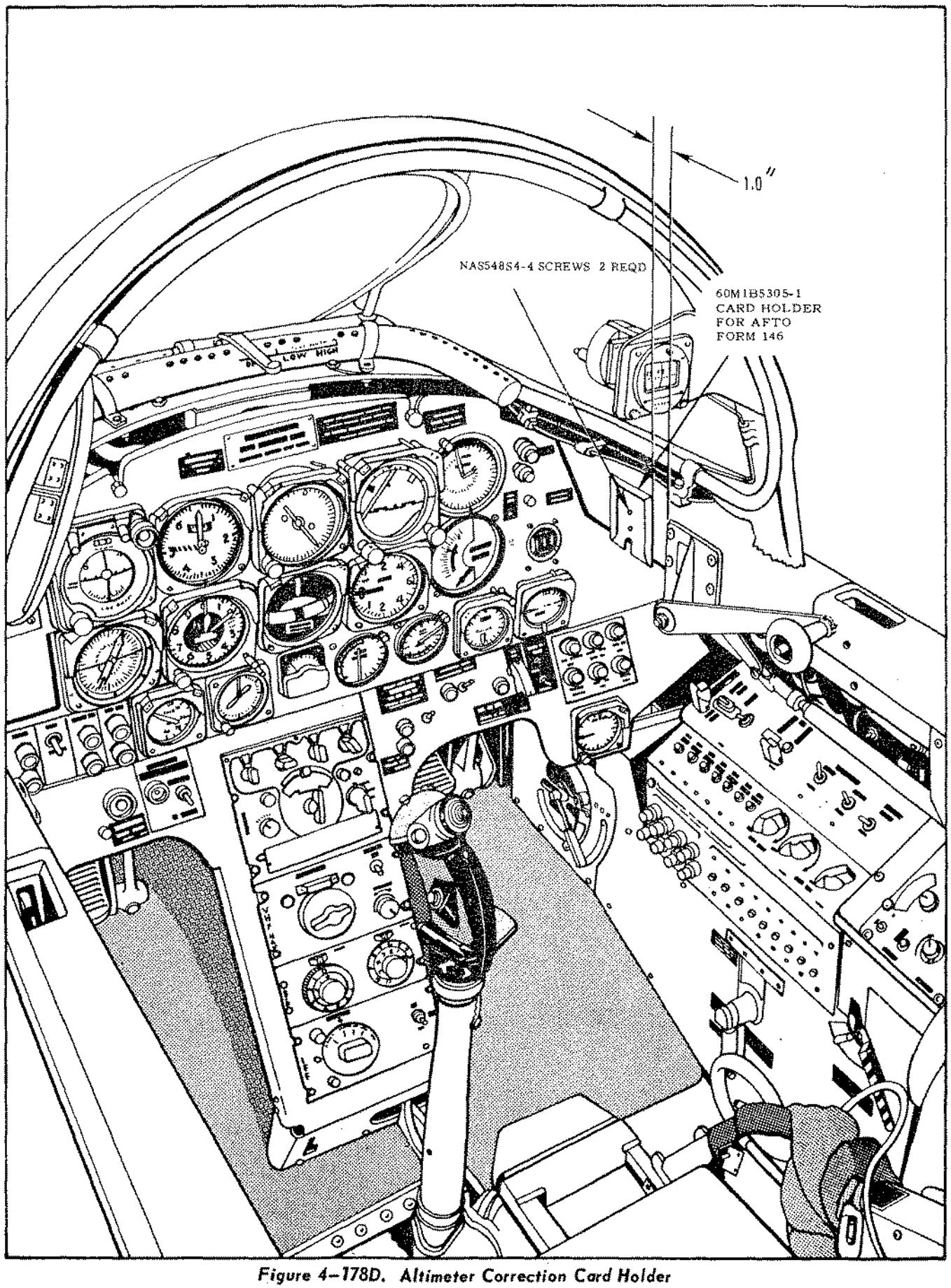


Figure 4–178D. Altimeter Correction Card Holder

AIRCRAFT:	CONFIGURATION:	WEIGHT:
T-33A	LANDING GEAR AND FLAPS RETRACTED	ALL

DESIRED ALTITUDE	INDICATED ALTITUDE		
	HOLD SPEED	CRUISE SPEED	MAXIMUM SPEED
45000	45030	45110	45140
40000	40050	40120	40210
35000	35080	35120	35280
30000	30060	30090	30330
25000	25050	25070	25380
20000	20045	20075	20450
15000	15040	15090	15470
10000	10035	10125	10505
5000	5030	5140	5510
Sea Level	25	155	520

Figure 4-178E. Altimeter Position Error Table

ALTIMETER SCALE ERROR			(SEE NOTE ON REVERSE SIDE)		
NOMENCLATURE			SERIAL NO.		
TEST PT (FT)	INDICATOR READINGS AT +25 °C	TEST PT (FT)	INDICATOR READINGS AT +25 °C	TEST PT (FT)	INDICATOR READINGS AT +25 °C
0 0		8000		30,000	
500		10,000		35,000	
1000		12,000		40,000	
1500		14,000		45,000	
2000		15,000		50,000	
2500		16,000		55,000	
3000		18,000		60,000	
4000		20,000		70,000	
5000		22,000		80,000	
6000		25,000			

AFTO FORM MAR 59 139

AFLC-WPAFB-JUL 66 46800

NOTE: THIS FORM IS NOT FOR INSTALLATION IN THE AIRCRAFT. THE FORM WILL BE USED IN THE COMPUTATION OF AIRCRAFT TOTAL STATIC SYSTEM ERROR. SEE APPLICABLE AIRCRAFT (-1) FLIGHT AND OPERATION HANDBOOK FOR SPECIFIC INSTRUCTIONS. TEST POINTS FOR ALL ALTIMETERS WILL BE DETERMINED BY APPLICABLE OVERHAUL HANDBOOKS.

Figure 4-178F. Altimeter Correction Card, AFTO Form 139

TYPE		EXT CONFIG	
ALTIMETER SERIAL NO.			
ASSIGNED ALTITUDE	INDICATED ALTITUDE		
	HOLD AIRSPEED	CRUISE AIRSPEED	MAX AIRSPEED
50,000			
45,000			
40,000			
35,000			
30,000			
25,000			
CHANGE TO 29.92 AT 18,000			
20,000			
15,000			
10,000			
5000			

AFTO FORM 146, FEB 63

ALTIMETER CORRECTION

Figure 4-178G. Altimeter Correction Card, AFTO Form 146

ALTIMETER CORRECTION WORKSHEET		
AIRCRAFT	EXTERNAL CONFIGURATION	GROSS WEIGHT

NOTE: Enter numbers in lines marked "Round to Nearest 100 Feet" on AFTO 146.

	HOLD A/S	CRUISE A/S	MAXIMUM A/S
50000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
45000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
40000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
35000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
30000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
25000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
20000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
15000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
10000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			
5000 Altimeter error from AFTO 139			
Algebraic sum			
Round to nearest 100 feet			

AFTO FORM MAY 60 156

Figure 4–178H. Altimeter Correction Worksheet, AFTO Form 156

4–1076. Power is supplied through electrical receptacles on the rear of the instrument. Two power supplies are required: 115-volt, 400-cycle, 3-phase alternating current, and 28-volt direct current. The 115-volt alternating current supply is provided by an inverter, and the 28-volt direct current supply is taken directly from the regular power supply system.

4–1077. TROUBLE SHOOTING OF ATTITUDE GYRO INDICATOR.

Trouble	*Probable Cause*	*Remedy*
Instrument does not start. (Dial fails to respond.)	Source of power or faulty connections.	Check power supply, cable, plug, and receptacle.
	Faulty internal wiring.	Replace instrument.
Dial does not settle properly.	Faulty connections.	Check connections.
	Faulty internal wiring.	Replace instrument.
	Voltages and frequency of power incorrect.	Check voltages and frequency.
	Instrument mechanism defective.	Replace instrument.
Dial does not respond when airplane maneuvers.	Faulty power supply, connections, or wiring.	Check.
Dial indicates large error due to turning.	Phase rotation of alternating current power supply reversed.	Check phase rotation.
Power supply warning indicator remains in view constantly after power is applied.	Faulty alternating current power supply.	Check power supply at source.
	Defective instrument.	Replace instrument.

4–1078. CLOCK. Prior to AF Serial No. 53-4886, the clock is an eight-day AN5743-T1A instrument mounted on the subpanel. The dial face is graduated in hours, minutes, and seconds.

4–1079. On AF Serial No. 53-4886 and subsequent, an elapsed time clock, type A-13A, is installed. This instrument, in addition to the standard hands, incorporates an elapsed time hand and associated mechanism for manual setting by means of a knob in the upper right corner. The elapsed time may be set for a maximum of one hour.

4–1080. TROUBLE SHOOTING OF CLOCK.

Trouble	*Probable Cause*	*Remedy*
Incorrect time.	Improperly set.	Reset with master clock.
Gain or loss of time.	Improperly adjusted.	Adjust or replace instrument.
Clocks fail to start when wound.	Excessive friction or congealed oil.	Jar slightly; if trouble persists, replace instrument.
Winding knob will not turn.	Wound too tight.	Replace instrument.
Loose or cracked glass.	Excessive vibration or sudden jar.	Replace glass.
Dull or discolored luminous markings.	Age.	Replace instrument.
Winding knob turns freely.	Broken main spring.	Replace instrument.
Hands do not move when clock is running.	Hands loose on shaft.	Reset and tighten hands.

4–1081. EXHAUST TEMPERATURE INDICATOR. Temperature in the tail cone is sensed by thermocouples and is shown on a type A-6, K-3, K-7, K-8 or MJ-4 temperature indicator. Instrument range markings consist of a green arc from 275° to 715° C, (the range for continuous operation of the engine) and two red bars; one at 715° C (maximum temperature for flight) and the other at 900° C (maximum temperature for starting).

4–1082. FUEL COUNTER. A subtracting type fuel counter is electrically connected to a fuel flowmeter. Upon filling the tanks with fuel, the counter is set to the correct number of gallons. As the fuel supply is used, the counter indicates the quantity of fuel remaining in the fuel system.

4–1083. FUEL PRESSURE INDICATOR. The fuel pressure indicator is a direct indicating differential type pressure gage with a range of from 0 to 600 psi. Instrument range markings consist of a red bar at 38 psi, a green arc from 38 to 200 psi, and another red bar at 200 psi.

4–1084. On AF Serial No. 50-385 through 51-8835, a type C-30 fuel pressure indicator is installed. On AF Serial No. 51-8836 and subsequent, a type C-34 fuel pressure indicator is installed. This is a remote indicating autosyn type instrument designed to operate from a 26-volt, 400-cycle, single-phase power source. The indi-

cator is electrically connected to a transmitter mounted on the engine. The electrical construction of the transmitter is identical to that of the indicator, except for the manner in which current is supplied to the rotor.

4–1085. Fuel pressure at the engine fuel manifold causes deflection of a pressure sensing diaphragm in the transmitter. This deflection is converted by linkage and a rocking shaft assembly into rotary deflection of the transmitter rotor. The rotary deflection of the transmitter rotor is reflected at the indicator as deflection of the pointer.

4–1086. TROUBLE SHOOTING OF FUEL PRESSURE INDICATOR AND TRANSMITTER.

Trouble	*Probable Cause*	*Remedy*
Slight or no movement of pointer.	Clogged or dirty pressure sensing line.	Check and clean line.
	Corroded or dirty bearing, broken or damaged parts.	Return to instrument repair depot.
	Short circuit between stator leads.	Check for short between A and C or D, or between C and D.
Sluggish pointer movement.	At low temperature, cold oil in the bearings.	Preheat instrument panel.
	Worn or dirty bearing, burned slip rings, or damaged brushes.	Return to instrument repair depot.
Pointer spins.	Mechanical defects in brushes, dirty slip rings, or brushes.	Return to instrument repair depot.
Pointer 180 degrees in error.	No power on one rotor.	Check power at terminal B.
Pointer oscillates in limited arc.	Open transmitter or indicator lead A.	Check and connect A lead to terminal.
	Open stator lead.	Check and connect C and D lead.
	Short circuit between power lead and stator lead.	Check and correct possible short between B and C or D.
	Reverse connection.	Check B reversal with C or D.
Pointer makes complete rotation in reverse direction.	Reversed stator leads.	Check and correct reversal between A and C or D, or between C and D.

4–1087. FUEL QUANTITY INDICATOR. The Liquidometer type fuel gage indicates contents of the fuselage tank only, no gages being installed for the wing tanks. Maintenance includes only such items that do not involve disassembly of units, such as tightening connections to eliminate leaks, or replacement of the entire installation. For information on the electrical circuit, refer to paragraph 4–841.

4–1088. ALTIMETER. Three altimeters are installed on the airplane, one on each instrument panel to indicate airplane altitude, and one on the right forward shelf to indicate cabin pressure in terms of altitude.

Note

When necessary to replace front cockpit instrument panel altimeter, the AFTO Form 146 (figure 4–178G) must be reworked in accordance with the computations described in this paragraph.

a. Altimeter correction card AFTO Form 146 (figure 4–178G) is located in a holder on the front cockpit RH sill, forward of the canopy lock handle (see figure 4–178D). The purpose of the altimeter correction card AFTO Form 146 is to provide the pilot with corrected altitude information in order to maintain adequate vertical separation of aircraft. The properly completed correction card corrects for errors in sensing true static pressure (aircraft position error) and the scale errors of the altimeter. Following are the instructions for completing the altimeter correction card AFTO Form 146 (figure 4–178G).

Note

The card holder is installed in an inverted position so correction card AFTO Form 146 (figure 4–178G) may be inserted from the bottom.

b. Using the altimeter correction worksheet, AFTO Form 156 (figure 4–178H), calculate the altimeter system error in the following manner.

c. Remove the AFTO Form 139 (figure 4–178F) from the altimeter. If the AFTO Form 139 is not available it will be necessary to locally calibrate the altimeter to determine the scale error in accordance with the applicable 5F3 series technical order.

d. Refer to figure 4–178E. On altimeter correction worksheet AFTO Form 156 (figure 4–178H) enter the altimeter position error for hold, cruise and maximum speeds for all altitudes from 5000 feet through 45000 feet inclusive in the hold, cruise and maximum airspeed columns.

e. Enter altimeter scale error data (including plus or minus signs) from AFTO Form 139 (figure 4–178F) to AFTO Form 156 (figure 4–178H) worksheet in the hold, cruise and maximum airspeed columns on each line marked "Altimeter Error from AFTO Form 139".

f. Algebraically add the altimeter scale error to the altimeter position error figure immediately above it and enter the result in column marked "Algebraic Sum".

Note

If the scale error figure entered is positive (+), add this figure immediately above it and enter the total in column marked "Algebraic Sum". If the scale error figure entered is negative (–), subtract this figure from the altimeter position error figure immediately above it and enter the difference in the column marked "Algebraic Sum".

g. Round off the algebraic sum obtained to the nearest 100 feet and enter this figure on the line marked "round to nearest 100 feet".

h. Enter the figures in the lines marked "round to nearest 100 feet" in the corresponding hold a/s, cruise a/s and maximum a/s blocks on the altimeter correction chart AFTO Form 146 (figure 4–178G).

i. Complete the AFTO Form 146 (figure 4–178G) as follows:

(1) In block marked "type", enter: T–33.

(2) In block marked "ext. config", enter: clean.

(3) In block marked "altimeter serial no.", enter the serial number of altimeter.

j. Insert the completed correction card AFTO Form 146 (figure 4–178G) in the correction card holder (see figure 4–178D).

Note

Retain the AFTO Form 139 (figure 4–178F) so replacement of the AFTO Form (figure 4–178G) can be accomplished if the original altimeter correction form is lost or defaced.

4–1089. TROUBLE SHOOTING OF ALTIMETER.

Trouble	*Probable Cause*	*Remedy*
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Defective mechanism.	Replace instrument.
High reading.	Improper venting.	Eliminate leak in static pressure system and check alignment of air speed tube.
Setting knob bind.	Wrong lubrication or lack of lubrication.	Replace instrument.
Setting-knob lock screw loose or missing.	Excessive vibration; careless maintenance.	Tighten screw if loose. Replace instrument if screw is missing.
Reference markers fail to move when setting knob is turned.	Out of engagement.	Replace instrument.
Cracked or loose cover glass.	Excessive vibration.	Replace instrument.
Dull or discolored luminous markings.	Age.	Replace instrument.
Barometric scale and reference markers not synchronized.	Slippage in mating parts.	Replace instrument.
Barometric scale and reference markers not synchronized with pointers.	Drift in mechanism or carless maintenance.	Reset pointers.

4–1089A. INSTALLATION OF AIMS EQUIPMENT (T-33A-15 AIRCRAFT).

CHECKING SERVOED ALTIMETER SYSTEMS (AIMS)

The check that follows should be performed whenever a servoed altimeter or the altitude computer is replaced. The following test equipment is required for checking the system:

TTU–205B/E pressure/temperature
TS–1809 AN/APM–123(V)3 transponder test set
TTU–229/E

TTU–205 TEST SET PRELIMINARY PROCEDURE.

Note

In case of test set power interruption or an abnormal pressure condition, indicated by one of the three test set warning lights (ALTITUDE HIGH, ALTITUDE LOW & AIRSPEED LOW) coming on, refer to TTU–205 Test Set Shutdown Procedure.

*All controls and indications are on the test set unless otherwise specified.

1. Place controls as follows:

INDEX	CONTROL	POSITION
3–	Ps EQUALIZER	Open (rotate CCW)
5–	Pt EQUALIZER	Open (rotate CCW)
36–	MACH LIMIT helidial	1.5
32–	ALT RATE control	2
10–	AS RATE control	100
29–	ALTITUDE control	0 Sea Level
30–	Altitude TRIM control	Centered (5 turn pot.)
20–	AIRSPEED control	50
19–	Airspeed TRIM control	OFF
28–	FREQUENCY control	0
25–	ALTITUDE AMPLITUDE control	0
A	All toggle switches TEMP SIMULATOR	OFF or down

2. Install pitot and static test adapters on aircraft pitot heads.

3. Connect test set to pitot and static test adapters, using hoses provided with test set. Note that hose and test set couplings are colorcoded to facilitate connection.

WARNING

To prevent damage to the AAU–19 altimeter, both pitot tubes must be connected to the TTU–205 test set and the altimeter should be in the standby position preceeding all tests or leak checks. Observe standby flag before commencing test.

4. Connect source of 115 volts, 400 cycle, single phase power to test set POWER INPUT receptacle using appropriate cable provided with test set.

5. Place POWER switch at ON. The CONTROL and PUMP lights should come on.

6. Close Ps EQUALIZER and Pt EQUALIZER valves (rotate full clockwise).

7. Place ALTITUDE control at 10. The ALTITUDE counter and aircraft servoed altimeter indications should increase to about 10,000 feet. Adjust altitude TRIM control to point at which ALTITUDE counter indicates 10,000 feet.

8. With ALTITUDE counter stabilized at 10,000 feet, place and hold altitude LEAK TEST switch at ON and check number of feet ALTITUDE counter indication decreases within a 1 minute period. Release switch. A leakage rate of more than 100 feet per minute is excessive and must be corrected before continuing with system checks.

9. Place ALTITUDE control at field altitude. The test set ALTITUDE and aircraft servoed altimeter indications should decrease to field altitude.

10. Place AIRSPEED control at 505. The test set AIRSPEED counter and aircraft airspeed indicator indications should increase to about 505 knots. Adjust airspeed TRIM control to point at which AIRSPEED counter indicates 650 knots.

11. With AIRSPEED counter indication stabilized at 505 knots, place and hold airspeed LEAKTEST switch at ON and check number of knots AIRSPEED counter indication decreases within a 1 minute period. Release switch. A leakage rate of more than 5 knots per minute is excessive and must be corrected before continuing checks.

12. Place AIRSPEED control at 50. The test set AIRSPEED counter and aircraft indicator indications should decrease to about 50 knots.

SUPPLEMENT I

INPUT TEST POINTS					COMPUTER OUTPUT AND TOLERANCES				
A ALTITUDE	B Psi	C A/S	D Pt	MACH NO.	E ALTI-TUDE	F AAU-19/A STANDBY ±TOL.	G BENCH ±TOL.	H FLIGHT LINE ±TOL.	I MODE C CODE
(FT.)	(IN. HG)	(KTS)	(IN. HG)	(REF)	(FT.)	(FT.)	(FT.)	(FT.)	(OUT-PUTS)
0	29.9213	59	29.9213	0	0	60	35	45	0660 0620 0630
1000	28.8557	260	32.2188	.40	1000	70	35	45	0360 0320 0330
10000	20.5769	277	24.4085	.50	10000	160	35	45	6560 6520 6530
15000	16.8858	303	21.5378	.60	15000	210	55	70	3060 3020 3030
20000	13.7501	324	19.0728	.70	20000	260	70	90	7760 7720 7730
30000	8.8854	283	12.9041	.75	30000	360	105	135	1460 1420 1430
35000	7.0406	291	11.2919	.85	35000	410	125	160	5144 5164 5124 5134 5114
45000	4.3550	200	6.3247	.75	45000	510	160	205	3244 3264 3224 3234 3214

TABLE 4-1 (Cont)

ALTITUDE CODE CHART

ALTITUDE	AN/APM–123(V) MODE C CODE OUTPUTS	ALTITUDE	AN/APM–123(V) MODE C CODE OUTPUTS	ALTITUDE	AN/APM–123(V) MODE C CODE OUTPUTS
–1 000	0020	2 800	4140	6 800	6040
– 900	0030	2 900	4160	6 900	6060
– 800	0010	3 000	4120	7 000	6020
– 700	0410	3 100	4130	7 100	6030
– 600	0430	3 200	4110	7 200	6010
– 500	0420	3 300	4510	7 300	6410
– 400	0460	3 400	4530	7 400	6430
– 300	0440	3 500	4520	7 500	6420
		3 600	4560	7 600	6460
– 200	0640	3 700	4540	7 700	6440
– 100	0660				
0	0620	3 800	4740	7 800	6640
100	0630	3 900	4760	7 900	6660
200	0610	4 000	4720	8 000	6620
300	0210	4 100	4730	8 100	6630
400	0230	4 200	4710	8 200	6610
500	0220	4 300	4310	8 300	6210
600	0260	4 400	4330	8 400	6230
700	0240	4 500	4320	8 500	6220
		4 600	4360	8 600	6260
800	0340	4 700	4340	8 700	6240
900	0360				
1 000	0320	4 800	4240	8 800	6340
1 100	0330	4 900	4260	8 900	6360
1 200	0310	5 000	4220	9 000	6320
1 300	0710	5 100	4230	9 100	6330
1 400	0730	5 200	4210	9 200	6310
1 500	0720	5 300	4610	9 300	6710
1 600	0760	5 400	4630	9 400	6730
1 700	0740	5 500	4620	9 500	6720
		5 600	4660	9 600	6760
1 800	0540	5 700	4640	9 700	6740
1 900	0560				
2 000	0520	5 800	4440	9 800	6540
2 100	0530	5 900	4460	9 900	6560
2 200	0510	6 000	4420	10 000	6520
2 300	0110	6 100	4430		
2 400	0130	6 200	4410		
2 500	0120	6 300	4010		
2 600	0160	6 400	4030		
2 700	0140	6 500	4020		
		6 600	4060		
		6 700	4040		

13. Place POWER switch at OFF. The CONTROL and PUMP lights should go OFF.

14. Open Ps EQUALIZER and Pt EQUALIZER valves rotate (counterclockwise).

AN/APM–123 TEST SET PRELIMINARY PROCEDURE.

1. Place test set 40 to 50 feet from aircraft upped antenna so that line-of-upper-sight path between test set and aircraft antenna is free of obstructions.

2. Remove test set cover. Raise test set antenna, and point arrow on antenna directly at aircraft upper antenna (vertical polarization). Lock antenna in this position.

3. Connect CG-3308/APM coaxial cable (provided with test set) between test set antenna and PROBE receptacles.

4. Place test set controls as follows:

CONTROL	POSITION
FUNCTION switch	SELF TEST
MODE switch	1
CODE selectors	0000
ISLS switch	OFF
PUSH TO TEST switch	Unlocked
MODE 4 CODE switch	A
MODE 4 VER BIT 1 switch	OFF
MODE 4 VER BIT 2 switch	OFF
MODE 4 DIR-RAD switch	RAD
28 VDC ON-OFF–115 VAC ON	OFF
PANEL LIGHT switch	OFF

5. Connect source of 28-volt dc or 115 volt ac (50 to test set POWER receptacle, using appropriate cable provided with test set.

6. Place test set 28 VDC ON-OFF–115 VAC ON switch at position corresponding to source of power used. The POWER light should come ON. Allow a 2 minute warmup period.

7. Momentarily depress REJECT and ACCEPT lights. Each light should come on while it is depressed.

8. Press and hold PUSH TO TEST switch. The ACCEPT light should come on.

Note

If REJECT light comes on in step 8 or 9, the test is defective.

9. Place ISLS switch at on. The ACCEPT light should remain on (the PUSH TO TEST switch depressed).

10. Release PUSH TO TEST switch. The ACCEPT light should go OFF.

11. Place ISLS switch at OFF.

Note

During system checks, if an incorrect indication occurs, perform a self test of the test set to eliminate a defective test set. A self test is accomplished by placing the test set FUNCTION switch at SELF TEST, with the PUSH TO TEST switch either depressed or at the LOCK position. If the test set is functioning correctly, the ACCEPT light comes on.

AIRPLANE PRELIMINARY PROCEDURE.

1. Check the following aircraft circuit breakers are pushed in:

FRONT COCKPIT RIGHT HAND CONSOLE
IFF 115 VAC
IFF 28 VDC
CPU–46/A 115 VAC
AAU–19/A 28 VDC

2. Place front cockpit and receiver-transmitter controls as follows:

CONTROL	POSITION
AIMS CONTROL PANEL	
CODE switches	A
MASTER switch	OFF
All toggle switches	OUT
MODE 1 code selectors	00
MODE 3/A code selectors	0000
IFF ANTENNA SELECT switch	TOP
INSTRUMENT PANEL (FRONT & REAR COCKPITS)	
Altimeter Baro set knob	29.92hg

3. Connect external sources of ac and dc electrical power to aircraft in accordance with existing handbooks. The aircraft servoed altimeter vibrator should start operating.

4. On AIMS control panel, place MASTER switch at STBY. If mode 4 computer is installed and mode 4 codes are zeroized, the IFF CAUTION light on the indicator

light panel should come on. Allow a 1 minute warmup period.

5. On AIMS control panel place MASTER switch at NORM and M—1 switch at ON.

6. Depress and place test set PRESS TO TEST switch at LOCK. The ACCEPT light should come on. If REJECT light comes on, check that test set antenna is still pointing directly at aircraft antenna; then move test set closer (not closer than 25 feet) to aircraft antenna.

7. Place aircraft M—1 switch at out. The ACCEPT light should go off and the reject light should come on.

SYSTEM CHECK-OUT PROCEDURE.

Note

The TTU—205 ALTITUDE and AIRSPEED controls are used for a coarse setting of altitude and airspeed. The corresponding TRIM control is used for a fine adjustment.

All aircraft controls are on the AIMS control panel.

1. Perform TTU—205 test set, AN/APM—123 test set, and aircraft preliminary procedures, unless already accomplished.

2. Place aircraft M—C switch at ON, and AN/APM—123 test set MODE switch at C.

3. Place TTU—205 test set POWER switch at ON. The CONTROL and PUMP light should come ON.

4. Close TTU—205 test set Ps EQUALIZER and Pt EQUALIZER valves (full clockwise).

5. Perform sea level check as follows:

a. Adjust TTU—205 test set controls for test set counter indications of zero altitude and 50 knots airspeed. The aircraft front and rear cockpit servoed altimeter indications, after stabilizing, should be 0 (±45) feet.

b. Momentarily place aircraft front cockpit servoed altimeter RESET STBY switch at RESET. The STBY flag should move out of view, the vibrator should stop, and the altimeter should indicate 0 (±55) feet. Place switch at STBY. The STBY flag should move into view and the vibrator should start operating.

c. Repeat step 5.b. using rear cockpit servoed altimeter.

d. Place AN/APM—123 test set CODE selectors at 0620 (0 feet code ±100 feet). The ACCEPT light should come on at one of these three possible codes. Use altitude/code conversion computer, provided with test set, or altitude/code conversion data in table 1 for the two additional codes indicated by tolerance.

6. Perform 1000 foot check as follows:

a. Adjust TTU—205 test set controls for test set counter indications of 29,378 feet altitude and 308 knots airspeed. The aircraft front and rear cockpit servoed altimeter indications, after stabilizing, should be 29,378 (±360) feet.

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET-STBY switches at RESET. The altimeters should indicate 30,000 (±135) feet. Place switches at STBY.

c. Place AN/APM—123 test set CODE selectors at 0320 (1000 feet code ±100 feet). The ACCEPT light should come on at one for these three possible codes.

7. Perform 10,000 foot check as follows:

a. Adjust TTU—205 test set controls for test set counter indications of 10,000 feet altitude and 277 knots airspeed. The aircraft front and rear cockpit servoed altimeter indications, after stabilizing should be 10,000 (±160 feet.

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET STBY switches at RESET. The altimeters should indicate 10,000 (±45) feet. Place switches at STBY.

c. Place AN/APM—123 test set CODE selectors at 6520 (10,000 feet code ±feet). The ACCEPT light should come on at one of these three possible codes.

8. Perform 20,000 foot check as follows:

a. Adjust TTU—205 test set controls for test set counter indications of 20,000 feet altitude and 324 knots airspeed. The aircraft front and rear cockpit servoed altimeter indications, after stabilizing should be 20,000 (±260) feet.

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET-STBY switches at RESET. The altimeters should indicate 20,000 (±90). Place switches at STBY.

c. Place AN/APM–123 test set CODE selectors at 7720 (20,000 feet code ±200 feet). The ACCEPT light should come on at one of these five possible codes.

9. Place aircraft M–C switch at OUT, and place MASTER switch at OFF.

10. Perform TTU–205 TEST SET SHUT DOWN PROCEDURE.

11. Place AN/APM–123 test set 28 VDC ON-OFF-115 VAC ON switch at OFF. Disconnect test set power cable from power source and from test set.

12. Disconnect CG–3308/APM coaxial cable test set antenna and PROBE receptacles.

13. Stow cables in test set cover and secure test set.

TTU–205 TEST SET SHUT DOWN PROCEDURES.

To shut down test set after performing system check-out or test procedures or after an abnormal condition occurs (power interruption or ALTITUDE HIGH, ALTITUDE LOW, or AIRSPEED LOW warning light ON) proceed as follows:

1. Place ALTITUDE control at field altitude and place AIRSPEED control at 50. The test set and aircraft indications should decrease to corresponding indications.

2. Open Ps EQUALIZER and Pt EQUALIZER valves.

3. If shutdown procedure is being performed due to an abnormal condition repeat TTU–205 TEST SET PRELIMINARY PROCEDURE and then continue with check out or test procedures as applicable. Otherwise, continue with steps that follow.

4. Place POWER switch at OFF. The CONTROL and PUMP lights should go OFF.

5. Disconnect pitot and static hoses from test set.

6. Disconnect electrical power cable from power source and from test set.

7. Stow electrical power and hoses in test set.

TESTING SERVOED ALTIMETER SYSTEM (AIMS)

The following test equipment is required for testing the system.

TTU–205B/E pressure/temperature test set.
TTU–229/E automatic altitude reporting encoders and altimeter test set.

TEST SET PRELIMINARY PROCEDURE.

Note

All controls and indications are on the TTU–229 test set unless otherwise specified.

1. Place controls as follows:

CONTROL	POSITION
VOLUME control	Centered
LAMP TEST switch	Down
NORM-DIODE TEST-SELF TEST	Normal
SYNCHRO SELECTOR switch	Self Test
SYNCHRO RESET switch	Normal
ALTIMETER LIGHTING switch	OFF
ALTIMETER SERVO switch	Normal
ALTIMETER VIBRATOR switch	Disable
COMPUTER switch	Normal
POWER ON-OFF switch	OFF
INDUCED ERROR control	0 (zero)

2. Connect test set to source of 115–volt ac, 400–cycle, single-phase power.

3. Place POWER ON-OFF switch at ON. Check for the following indications:

LIGHT OR INDICATOR	INDICATION
POWER light	ON
PILOT light	ON
CO-PILOT light	ON
Altimeter	0 (±10) feet
ENCODER READOUT indicator	0 (±100) feet

4. Place and hold LAMP TEST switch at up position. The 11 binary code lights should come ON. Release switch. The lights should go OFF.

5. Place NORMAL-DIODE TEST-SELF TEST switch at SELF TEST. The ENCODER READOUT indicator should indicate +40,000 feet and the D_4, A_1, A_2, A_4, B_2, B_4 and C_2 binary code light should come ON.

6. Place NORMAL-DIODE TEST-SELF-TEST switch at NORMAL. The ENCODER READOUT indicator 0 (±10) feet and the binary code lights should go OFF.

7. Place SYNCHRO SELECTOR switch at PILOT.

8. Place POWER ON-OFF switch at OFF.

9. Connect test set to aircraft system.

10. Perform TTU–205 TEST SET PRELIMINARY PROCEDURE.

SYSTEM TEST PROCEDURE.

The TTU–229 test set provides two simultaneous indications of the altitude computer encoder output. One is provided by the binary code lights, and the other is provided by the ENCODER READOUT indicator, which gives the altitude in decimal form. Only the latter indication will be specified.

- In this procedure, if all indications are within tolerance except the aircraft servoed altimeter, the altimeter or related aircraft wiring is defective. If test set indications are out of tolerance, altitude computer or related wiring is defective.

1. Perform TEST SET PRELIMINARY PROCEDURE unless previously accomplished.

2. Connect source of ac and dc electrical power to aircraft. (Refer to applicable aircraft Technical Orders.)

3. Check that aircraft IFF, AAU–19, and CPU–46A circuit breakers on right console, are pushed in. The aircraft servoed altimeter vibrator should start operating.

4. Perform sea level check as follows:

a. Adjust TTU–205 test set controls for test set counter indications of zero feet altitude and 50 knots airspeed. The aircraft servoed altimeter indications should be 0 (±60) feet.

b. Place TTU–229 test set POWER ON/OFF switch at ON. The test set altimeter should indicate 0 (±55) feet. The ENCODER READOUT indicator should indicate 0 (±100) feet.

c. Momentarily place aircraft front cockpit servoed altimeter RESET STBY switch at RESET. The STBY flag should move out of view, the vibrator should stop, and the altimeter should indicate within ±30 feet of the TTU–229 test set altimeter indication. Place switch at STBY. The STBY flag should move into view and the vibrator should start operating.

d. Repeat step 4.c. using rear cockpit servoed altimeter.

Note

In the steps that follow, it will be assumed that the front and rear cockpit altimeter STBY flags are visible and the vibrator is operating only during stand-by operation.

5. Perform 1000 foot check as follows:

a. Adjust TTU–205 test set controls for test set counter indications of 1000 feet altitude and 260 knots airspeed. Check for the following indications after stabilizing:

INDICATOR	INDICATION (FEET)
TTU–229 altimeter	1000 (±45)
TTU–229 ENCODER READOUT	1000 (±100)
Aircraft front and rear Cockpit servoed altimeter	1000 (±70)

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET-STBY switches at RESET. The altimeters should indicate within ±30 feet of the TTU–229 test set altimeter indication.

6. Perform 10,000 foot check as follows:

a. Adjust TTU–205 test set controls for test set counter indications of 10,000 feet altitude and 277 knots airspeed. Check for the following indications after stabilizing:

INDICATOR	INDICATION (FEET)
TTU–229 altimeter	10000 (±45)
TTU–229 ENCODER READOUT	10000 (±100)
Aircraft front and rear cockpit Servoed altimeters	10000 (±160)

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET-STBY switches at RESET. The altimeter should indicate within ±30 feet of the TTU–229 test set altimeter indication.

7. Perform 20,000 foot check as follows:

a. Adjust TTU–205 test set controls for test set counter indication of 20,000 feet and 324 knots airspeed. Check for the following indications after stabilizing:

INDICATOR	INDICATION (FEET)
TTU–229 altimeter	20000 (±90)
TTU–229 ENCODER READOUT	20000 (±100)
Aircraft front and rear Servoed altimeter	20000 (±260)

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET-STBY switches at RESET. The altimeters should indicate within ±30 feet of the TTU–229 test set altimeter indication.

8. Perform 30,000 foot check as follows:

a. Adjust TTU–205 test set controls for test set counter indicationsoof30,000 feet altitude and 283 knots airspeed. Check for the following indications after stabilizing.

INDICATOR	INDICATION (FEET)
TTU–229 altimeter	30,000 (±135)
TTU–229 ENCODER READOUT	30,000 (±100)
Aircraft front and rear Cockpit altimeters	30,000 (±360)

b. Momentarily place aircraft front and rear cockpit servoed altimeter RESET STBY switches at RESET. The altimeters should indicate within 30 feet of the TTU–229 test set altimeter indication.

4–1090. AMMETER. Two type J-1 ammeters measure currents up to 300 amperes, direct-current. Each unit operates as a shunted millivoltmeter in connection with a separately mounted resistor which serves as a shunt. The scale is calibrated to indicate the electrical load in terms of the rated capacity of the generator. The instrument does not require lubrication.

4–1091. TROUBLE SHOOTING OF AMMETER.

Trouble	*Probable Cause*	*Remedy*
No reading.	External wiring open.	Test and repair break.
	Bearing friction.	Replace instrument.
	Open circuit inside meter.	Replace instrument.
High reading.	Resistance shorted inside meter.	Replace instrument.
Low reading.	Coil shorted inside meter.	Replace instrument.
Pointer sticks.	Friction.	Replace instrument.
Pointer off zero.	Button shifted.	Reset to zero.
Irregular or jerky action.	Loose external connection.	Test terminals and wiring. Tighten where necessary.
Pointer rubs against glass.	Static on glass.	Blot glass with damp cloth.
Other defects.	Mechanical.	Replace instrument.

4-1092. SLAVED GYROSYN MAGNETIC COMPASS SYSTEM TYPE J-2. Refer to T.O. 5N3-3-7-1 for operation and service instructions. The gyrosyn compass installation consists of one electrically driven setable dial indicator in each cockpit, a directional gyro control and an amplifier in the engine compartment, and a remote compass transmitter in the tail section. The system operates on 28 volt dc. and 115 volt, 400 cycle, 3 phase ac. For information on the electrical circuit, refer to paragraph 4-888.

4–1093. FLUX VALVE. *(See figure 4-179.)* The magnetic flux valve is installed in a box between stations 352 and 364. It is mounted with flange calibrations in a forward position. Lettered cable leads are attached to correspondingly lettered lugs on the valve.

4-1094 thru 4-1098 Deleted.

4-1099. COMPASS SWING. Refer to T.O. 5N3-3-7-1 for compass swinging instructions. DD Form 1613 (Compass Correction Card) may be used for recording data obtained from compass swinging. Detach the compass card and insert it in the compass card holder in the aircraft. Place the remainder of the form in the permanent file.

Note

Compensate the gyrosyn compass and record readings on DD Form 1613 at each change of engine, guns, or electrical equipment likely to affect the compass or when known deviations are in excess of tolerances.

4-1100 Deleted.

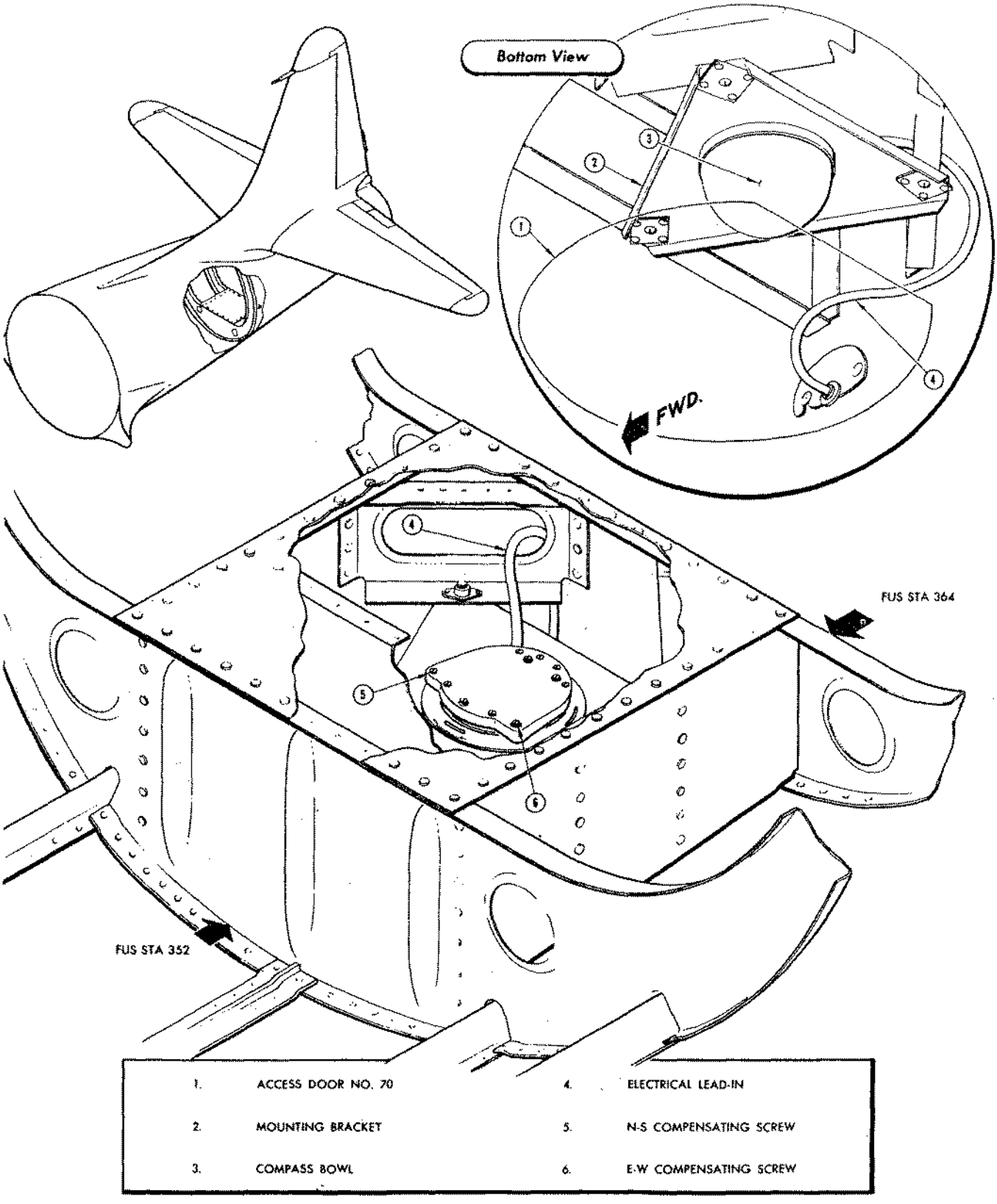


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Figure 4-179. Gyrosyn Compass Flux Valve Installation

All data on pages 425 and 426, including figure 4-180 deleted.

d. Using the recorded deviations, calculate coefficients A, B, and C, according to the formulas shown below, (also on AF Form No. 57) using the deviations obtained for the cardinal headings.

$$\text{Coeff. C} = \frac{N - S}{2}$$

$$\text{Coeff. B} = \frac{E - W}{2}$$

$$\text{Coeff. A} = \frac{N + E + S + W}{4}$$

All additions and subtractions are algebraic.

Note

See figure 4-180, steps 1 through 5, for steps in filling out compensation cards.

e. With the aircraft heading on magnetic north, add coefficient C to the compass reading by adjusting the N-S compensation screw on the compass transmitter flux valve, (see figure 4-179, reference 5).

f. With the heading on magnetic east add coefficient B algebraically to the compass reading by adjusting the E-W compensating screw on the compass transmitter flux valve, (see figure 4-179, reference 6).

g. With the aircraft heading the same as in the preceding step, add coefficient A algebraically by rotating the compass transmitter bodily clockwise if coefficient A is positive, or counterclockwise if coefficient A is negative.

4-1099. RESIDUAL SWING OF GYROSYN COMPASS.

a. With the aircraft heading on magnetic east, note the reading and enter in Column 4. Enter the actual rose heading in Column 3. Repeat for each of the eight cardinal and quadrantal magnetic headings.

b. Complete AF Form No. 57 by filling in the remaining two columns (in black ink) from data obtained in the residual swing. The entries for the left-hand column (C to M) are obtained by subtracting Column 4 from Column 3 for each heading. The entries in the right hand column (M to C) are obtained by subtracting Column 3 from Column 4.

c. Detach the compass card and insert it in the compass card holder in the aircraft. Place the remainder of the form in a permanent file.

Note

Compensate the gyrosyn compass and record readings on AF Form No. 57 at each change of engine, guns, armor plate, or electrical equipment likely to affect the compass, or when known deviations are in excess of tolerances.

4-1100. TROUBLE SHOOTING OF GYROSYN COMPASS.

Trouble	*Probable Cause*	*Remedy*
Instrument does not start.	Failure of power supply.	Check power supply at instrument.
	Faulty connections.	Check cables, plugs, and receptacles.
	Faulty gyrosyn indicator.	Replace instrument.

CAUTION

If gyro does not start within 20 seconds, turn off power and investigate. If *single phase* power is supplied to gyro, it will burn out.

Annunciator shows dot, cross, or black continuously upon 360 degree rotation of pointer.	Proper power not supplied to instrument.	If gyro has started, it is only necessary to check direct current supply.
	Short or open in excitation circuit to flux valve.	Check continuity at receptacle on indicator end of cable.

CAUTION

DO NOT use a direct-current ohmmeter across any coils of the flux valve. Check indicator circuit with ohmmeter at indicator receptacle. If faulty, replace indicator.

	Defective tube.	Replace amplifier.
	Faulty gyrosyn indicator.	Replace indicator.
Annunciator shows dot or cross continuously after proper alignment procedure.	Faulty circuit between gyrosyn indicator and flux valve.	Check for open or short circuit.

	Compensating Swing			Residual Swing		Aircraft Comp.		Date
	Actual Head (M)	Aircraft Comp.	Dev's	Actual Head (M)	Aircraft Comp.	C to M		M to C
N 000	005	001					000	
NE 045	X	X					045	
E 090	087	090					090	
SE 135	X	X					135	
S 180	176	180½					180	
SW 225	X	X					225	
W 270	265	273					270	
NW315	X	X					315	
	(1)	(2)	(1)–(2)	(3)	(4)	(3)–(4)		(4)–(3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2}$ = $\frac{(\ )-(\ )}{2}$ =

Coeff. B = $\frac{E-W}{2}$ = $\frac{(\ )-(\ )}{2}$ =

Coeff. A = $\frac{N+E+S+W}{4}$ = $\frac{(\ )+(\ )+(\ )+(\ )}{4}$ =

XB1133

Step 1

	Compensating Swing			Residual Swing		Aircraft Comp.		Date
	Actual Head (M)	Aircraft Comp.	Dev's	Actual Head (M)	Aircraft Comp.	C to M		M to C
N 000	005	001	+4				000	
NE 045	X	X					045	
E 090	087	090	−3				090	
SE 135	X	X					135	
S 180	176	180½	−4½				180	
SW 225	X	X					225	
W 270	265	273	−8				270	
NW315	X	X					315	
	(1)	(2)	(1)–(2)	(3)	(4)	(3)–(4)		(4)–(3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2}$ = $\frac{(+4)-(-4\frac{1}{2})}{2}$ = $+\frac{8\frac{1}{2}}{2}$ = $+4\frac{1}{4}$ OR $+4$

Coeff. B = $\frac{E-W}{2}$ = $\frac{(-3)-(-8)}{2}$ = $+\frac{5}{2}$ = $+2\frac{1}{2}$

Coeff. A = $\frac{N+E+S+W}{4}$ = $\frac{(+4)+(-3)+(-4\frac{1}{2})+(-8)}{4}$ = $-\frac{11\frac{1}{2}}{4}$ = -3

XB1134

Step 3

	Compensating Swing			Residual Swing		Aircraft Comp.		Date
	Actual Head (M)	Aircraft Comp.	Dev's	Actual Head (M)	Aircraft Comp.	C to M		M to C
N 000	005	001	+4				000	
NE 045	X	X					045	
E 090	087	090	−3				090	
SE 135	X	X					135	
S 180	176	180½	−4½				180	
SW 225	X	X					225	
W 270	265	273	−8				270	
NW315	X	X					315	
	(1)	(2)	(1)–(2)	(3)	(4)	(3)–(4)		(4)–(3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2}$ = $\frac{(+4)-(-4\frac{1}{2})}{2}$ = $+\frac{8\frac{1}{2}}{2}$ = $+4\frac{1}{4}$ OR $+4$

Coeff. B = $\frac{E-W}{2}$ = $\frac{(-3)-(-8)}{2}$ = $+\frac{5}{2}$ = $+2\frac{1}{2}$

Coeff. A = $\frac{N+E+S+W}{4}$ = $\frac{(+4)+(-3)+(-4\frac{1}{2})+(-8)}{4}$ = $-\frac{11\frac{1}{2}}{4}$ = -3

XB1133

Step 2

	Compensating Swing			Residual Swing		Aircraft Comp.		Date
	Actual Head (M)	Aircraft Comp.	Dev's	Actual Head (M)	Aircraft Comp.	C to M		M to C
N 000	005	001	+4	002½	001		000	
NE 045	X	X		040	043		045	
E 090	087	090	−3	095	094		090	
SE 135	X	X		136	134		135	
S 180	176	180½	−4½	185	184		180	
SW 225	X	X		222	225		225	
W 270	265	273	−8	275	276		270	
NW315	X	X		317	316		315	
	(1)	(2)	(1)–(2)	(3)	(4)	(3)–(4)		(4)–(3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2}$ = $\frac{(+4)-(-4\frac{1}{2})}{2}$ = $+\frac{8\frac{1}{2}}{2}$ = $+4\frac{1}{4}$ OR $+4$

Coeff. B = $\frac{E-W}{2}$ = $\frac{(-3)-(-8)}{2}$ = $+\frac{5}{2}$ = $+2\frac{1}{2}$

Coeff. A = $\frac{N+E+S+W}{4}$ = $\frac{(+4)+(-3)+(-4\frac{1}{2})+(-8)}{4}$ = $-\frac{11\frac{1}{2}}{4}$ = -3

XB1134

Step 4

	Compensating Swing			Residual Swing		Aircraft Comp.		Date
	Actual Head (M)	Aircraft Comp.	Dev's	Actual Head (M)	Aircraft Comp.	C to M		M to C
N 000	005	001	+4	002½	001	+1½	000	−1½
NE 045	X	X		040	043	−3	045	+3
E 090	087	090	−3	095	094	+1	090	−1
SE 135	X	X		136	134	+2	135	−2
S 180	176	180½	−4½	185	184	+1	180	−1
SW 225	X	X		222	225	−3	225	+3
W 270	265	273	−8	275	276	−1	270	+1
NW315	X	X		317	316	+1	315	−1
	(1)	(2)	(1)–(2)	(3)	(4)	(3)–(4)		(4)–(3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2}$ = $\frac{(+4)-(-4\frac{1}{2})}{2}$ = $+\frac{8\frac{1}{2}}{2}$ = $+4\frac{1}{4}$ OR $+4$

Coeff. B = $\frac{E-W}{2}$ = $\frac{(-3)-(-8)}{2}$ = $+\frac{5}{2}$ = $+2\frac{1}{2}$

Coeff. A = $\frac{N+E+S+W}{4}$ = $\frac{(+4)+(-3)+(-4\frac{1}{2})+(-8)}{4}$ = $-\frac{11\frac{1}{2}}{4}$ = -3

XB1135

Step 5

Figure 4-180. Compass Compensation

Trouble	*Probable Cause*	*Remedy*
	Defective tube.	Replace amplifier.
	Defective indicator.	Replace indicator.
Annunciator sticky or sluggish.	Faulty frequency and voltage supplies.	Check tolerances.
	Improper shielding of flux valve cable.	Check signal leads shielding.
	Defective indicator.	Replace indicator.
Deviation exceeds 1 degree during compensation check.	Flux valve not properly compensated.	Check compensation. Refer to paragraph 4-1069.
	Faulty cable between gyrosyn indicator and flux valve.	Check continuity at receptacle on the indicator end of the cable. Repair or replace defective leads.
	Defective flux valve or indicator.	Replace defective unit.
Erratic movement of indicator.	Insufficient fluid in flux valve.	Remove and replace flux valve.
Compass settles on approximately 30, 90, 150 degrees or reciprocals regardless of ships heading.	One signal lead between flux valve and indicator open, shorted to ground, or two leads shorted together.	Check circuit.
	Open signal selsyn data circuit in indicator.	Check circuit.

4-1101. HYDRAULIC PRESSURE INDICATOR. The AN5771-T4B hydraulic pressure gage has a range of from zero to 2000 psi, with scale graduation in units of 200 psi, and colored range markings on the dials as follows: green arc from 850 to 1150 psi and a red arc from 1150 to 1200 psi.

4-1102. TROUBLE SHOOTING OF HYDRAULIC PRESSURE INDICATOR.

Trouble	*Probable Cause*	*Remedy*
No reading on gage.	Pressure line plugged.	Remove foreign matter.
	Pressure line broken.	Repair or replace.
	Fractured Bourdon tube.	Replace socket assembly.
	Broken endpiece.	Replace socket assembly.
	Pointer loose on shaft.	Reset pointer.
	Movement damaged or corroded.	Replace movement assembly.
Pointer fails to return to zero.	Foreign matter in line.	Remove foreign matter.
	Foreign matter in Bourdon tube.	Replace socket assembly.
	Bourdon tube stretched.	Reset pointer.
Does not register properly.	Faulty mechanical adjustment.	Readjust.
Gage fails to register full dial reading.	Broken line.	Repair.
Sticky action.	Worn or bent movement.	Replace movement assembly.
	Scale or foreign matter in Bourdon tube.	Replace socket assembly.
	Dirt in movement.	Clean.
	Corroded movement.	Clean or replace.
	Pointer bent so it rubs on dial, dial screw, or glass.	Straighten pointer.

4-1103. (Deleted)

4-1104. OIL PRESSURE INDICATOR. On AF Serial No. 49-922 and subsequent, an autosyn oil pressure indicator is installed. The type B-18 or B-20 gage is a remote-indicating autosyn type instrument operating on 26-volt, 400-cycle power. The indicator is electrically connected to a type F-2 transmitter mounted on the engine. The two units are electrically identical, except for the manner in which current is supplied to the rotor of the transmitter.

4-1105. Engine oil pressure causes deflection of a pressure sensing diaphragm in the transmitter. This deflection is converted by linkage and a rocking shaft assembly into rotary deflection of the transmitter rotor. The rotary deflection of the transmitter rotor is reflected at the indicator as deflection of the pointer. Instrument range markings consist of two red bars; one at 7 psi and the other at 50 psi. A green arc covers the range from 7 psi to indicate the desirable oil pressure range.

4–1106. TROUBLE SHOOTING OF OIL PRESSURE INDICATOR AND TRANSMITTER.

Trouble	*Probable Cause*	*Remedy*
Slight or no movement of pointer.	Clogged or dirty pressure sensing line.	Check and clean line.
	Corroded or dirty bearing, broken or damaged parts.	Return to instrument repair depot.
	Short circuit between stator leads.	Check for short between A and C or D, or between C and D
Sluggish pointer movement.	At low temperature, cold oil in the bearings	Preheat instrument panel.
	Worn or dirty bearings, burnt slip rings, or damaged brushes.	Return to instrument repair depot.
Pointer spins.	Mechanical defects in brushes, dirty slip rings or brushes.	Return to instrument repair depot.
Pointer 180 degrees in error	No power on one rotor.	Check power at terminal B.
Pointer oscillates in limited arc.	Open transmitter or indicator lead A.	Check and connect A lead to terminal.
	Open stator lead.	Check and connect C or D lead.
	Short circuit between power lead and stator lead.	Check and correct possible short between B and C or D.
	Reversed connection.	Check B reversal with C or D.
Pointer makes complete rotation in/reverse direction.	Reversed stator leads.	Check and correct reversal between A and C or D, or between C and D.

4–1107. OXYGEN FLOW INDICATOR. Refer to paragraph 4–1251.

4–1108. OXYGEN PRESSURE INDICATOR. The type K-1 oxygen pressure gages indicate the pressure in the oxygen cylinders. Satisfactory operation of the gage requires from 100 to 425 psi pressure in the system. No maintenance is required on these gages. If an instrument does not function properly, replace it.

WARNING

Never use oil on an oxygen gage.

4–1109. RATE OF CLIMB INDICATOR. The rate of climb indicator is used to indicate the vertical component of the airplane speed, based on the rate of change of atmospheric pressure.

4–1110. TROUBLE SHOOTING OF RATE OF CLIMB INDICATOR.

Trouble	*Probable Cause*	*Remedy*
Pointer off the zero position.	Mechanism shift.	Return pointer to zero by means of zero adjusting shaft.
Pointer off zero and cannot be brought back by adjusting shaft.	Broken pivot.	Replace instrument.
Pointer fails to respond.	Obstruction in static line.	Disconnect all instruments connected to static line. Blow line clear.
Instrument indicates less than actual rate of climb.	Case leak.	Replace instrument.
Sticky pointer action.	Dirty pivots and jewels.	Replace instrument.
	Broken jewels.	Replace instrument.
	Improper clearances.	Replace instrument.
Pointer oscillates.	Leaks in static line.	Disconnect all instruments connected to static line. Check line and repair leaks. Check individual instruments for case leaks.

4–1111. RADIO COMPASS INDICATOR (T-33A-1 AIRPLANES). This indicator is used with the AN/ARN-6 radio compass. The indicator shows any deviation from the heading set for the radio compass.

4-1112. STANDBY COMPASS. The standby compass is designed as an emergency compass to be used in the event the Gyrosyn compass system fails, or as a check on the operation of the gyrosyn compass. It is a short-period magnetic compass and is intended to indicate continuously the heading of the aircraft with reference to the earth's magnetic field. No lubrication is required. Refer to T.O. 5N3-3-1-101 for compass swinging information. DD Form 1613 "Pilot's Compass Correction Card" shall be used for recording data obtained from compass swinging. Upon completion of magnetic compass swinging, detach applicable portion of compass cards and insert them in the compass holders in the aircraft. Place the remaining portions of DD Form 1613 in the office file.

4-1113. TROUBLE SHOOTING OF STANDBY COMPASS (Refer to T.O. 5N3-3-1-101.)

4-1114. TACHOMETER INDICATOR. The tachometer indicator is a remote indicating instrument with a range of from zero to 110 percent speed of the engine turbine. The indicator incorporates a logarithmic scale dial and two indicator hands. The short hand indicates from zero to 50 percent of engine rpm, and the larger hand, overlapping the small hand, indicates from 50 to 110 percent of engine rpm. This arrangement provides a wider scale at higher percentages to permit easier setting and reading of the higher power ratings.

4-1115. TURN AND BANK INDICATOR. The turn and bank indicator is a combination of two flight instruments, the turn indicator and the bank indicator. The turn indicator unit consists of an electrically driven gyroscope and registers not only a turn, but also the rate at which the turn is being made. The bank indicator unit is a ball type inclinometer. The ball rolls in a curved glass tube filled with damping liquid, and gives an indication of the lateral stability of the airplane in straight flight and in turns.

4-1116. TROUBLE SHOOTING OF TURN AND BANK INDICATOR.

Trouble	*Probable Cause*	*Remedy*
Gyro does not operate.	Poor electrical connections.	Check plug and external wiring for loose or broken connection.
	Worn brushes.	Replace instrument.
	Low input voltage due to discharged battery.	Check battery.
	Insufficient tension on brush springs.	Replace instrument.
Intermittent gyro operation.	Poor electrical connections.	Check plug and external wiring for loose or broken connection.
	Worn brushes.	Replace instrument.
	Intermittent contact in housing and frame connection.	Replace instrument.
	Insufficient tension on brush springs.	Replace instrument.
Radio interference.	Poor electrical connections.	Check plug and external wiring.
	Dirty or rough commutator.	Replace instrument.
	Worn or pitted contacts.	Replace instrument.
	Filter defective.	Replace instrument.
Hand fails to respond.	Hand touches glass.	Replace instrument.
	Gyro does not rotate.	See troubles and remedies preceding.
	Damper springs have slipped from posts.	Replace instrument.
	Dirt in armature bearings.	Replace instrument.
	Dirt in damping cylinder.	Replace instrument.
Incorrect sensitivity.	Misadjustment of centralized spring and damping cylinder.	Adjust centralizing spring with a screwdriver by turning the screw on right side of the frame and adjust the cylinder.
Pointer does not set on zero.	Gyro assembly out of balance.	Replace instrument.
	Hand incorrectly sets on the staff.	Replace instrument.
	Adjustment of centralizing spring and piston assembly pulls hand off zero.	Replace instrument.

Trouble	*Probable Cause*	*Remedy*
	Damper springs have slipped from posts.	Replace instrument.
Vibrating pointer.	Excessive vibration.	Inspect instrument panel mounting.
	Damper springs out of adjustment.	Replace instrument.
Sluggish deflection of hand at low temperature.	Grease in bearings becomes too thick.	Replace instrument.
	Insufficient clearance of housing bearings.	Replace instrument.

4–1117. LANDING GEAR POSITION INDICATORS. Prior to AF Serial No. 51-6588, red warning lights are installed on the upper left edge of each instrument panel to indicate an unsafe condition when the landing gear control handle is placed in the down and locked position. On AF Serial No. 51-6588 and subsequent, three position indicators are installed which show a wheel when the gear is down and locked, a "barber pole" of alternate red and white stripes to indicate an unsafe condition, and the word "UP" when each gear is up and locked.

4–1118. WING FLAP POSITION INDICATOR. *(See figure 4-11.)* Prior to AF Serial No. 50-385, the mechanically operated indicator is linked to the left flap and indicates flap position at all times.

4–1119. ADJUSTMENT OF WING FLAP POSITION INDICATOR. Prior to AF Serial No. 50-385, adjust the indicator by repeated trials as follows:

a. Adjust bracket on the flap to a forward position.

b. With flap down, attach a flexible shaft to the bracket so the indicator shows "FLAPS DOWN."

c. Run flap through full travel and check for agreement of indicator with flap position.

d. Repeat steps a, b, and c until proper readings are obtained on the indicator.

4–1120. WING FLAP POSITION INDICATOR. On AF Serial No. 50-385 and subsequent, a wing flap position indicator is electrically connected to a position transmitter. The position transmitter is mechanically linked to the left wing flap at the inboard point of attachment. As the flaps change position, the transmitter shaft is rotated, and an indication of this rotation is transmitted electrically to the indicator.

4–1121. ADJUSTMENT OF WING FLAP POSITION INDICATOR. On AF Serial No. 50-385 and subsequent, adjust the indicator as follows:

a. Extend flaps to full down (45°) position.

b. By means of the adjusting screw at the rear of the indicator, move the scale plate so that the down position is at "45."

c. Loosen setscrew, and adjust shaft of position transmitter until needle on position indicator is at "45."

d. Tighten setscrew, and retract flaps to the full up position. Check position indicator for zero.

e. If indication is incorrect, readjust transmitter shaft by splitting the difference between the up position indication and zero.

4–1122. TROUBLE SHOOTING OF WING FLAP POSITION INDICATOR.

Trouble	*Probable Cause*	*Remedy*
Off calibration.	Unbalanced rotor or pointer.	Rebalance or replace parts.
	Dirt in bearings or air gap.	Clean and check parts.
	Loose pointer.	Reset pointer on shaft.
	Indicator coils unbalanced on resistance.	Replace coils to match resistance.
	Under-voltage.	Correct voltage supply.
	Over-voltage.	Correct voltage supply.
Sticky indicator operation.	Dirt in bearings.	Clean rotor shaft and bearings.
	Dirt in air gap.	Clean rotor and damping cylinder.
	Top and bottom bearings out of line.	Relocate or replace to bridge.
	Interference with dial.	Clean and straighten dial. Check clearance.
	Bent rotor shaft.	Straighten shaft or replace part.
	Insufficient end play.	Readjust end play.
	Pointers rubbing on each other.	Straighten pointers and check clearance.

Trouble	*Probable Cause*	*Remedy*
	Weak rotor.	Remagnetize or replace magnet.
	Under voltage.	Correct voltage supply.
Poor pull-off.	Weak pull-off magnet.	Remagnetize or replace magnet.
	Magnet incorrectly located.	Relocate magnet.
	Sticky indicator.	See Sticky Indicator Operation.
Sluggish operation.	Weak rotor.	Remagnetize or replace rotor.
	Under-voltage.	Correct voltage supply.
	Sticky indicator.	See Sticky Indicator Operation.

Trouble	*Probable Cause*	*Remedy*
No indication.	Poor connections.	Check internal and external connections.
	Sticky indicator.	See Sticky Indicator Operations.
	Open or shorted indicator coil.	Replace coil. Check connections.
	Open or shorted transmitter coil.	Replace coil. Check connections.
	Under-voltage or no voltage.	Correct voltage supply.
Erratic readings.	Poor connections.	Check internal and external connections.
	Dirty transmitter coil.	Clean coil and check for wear.
	Sticky indicator.	See Sticky Indicator Operation.
	Loose or uneven wires on transmitter coil.	Replace coil.

4–1123. PITOT SYSTEM. *(See figure 4-181.)* Three external fittings for the pitot-static system are installed on the airplane.

4–1124. The type G-2 air speed pitot tube is mounted under the nose. The pitot tube employs a heater to prevent or remove accumulations of ice. For information on the heater circuit, refer to paragraph 4–933.

4–1125. Two flush static-pressure fittings are located, one on each side, in the forward end of the nose. The lines from the two external-opening fittings run inboard to a "T" connection or cross and then to the rate of climb indicator, the air speed indicator, and the altimeter on each main instrument panel. A ground test gage connection is located at the cross.

CAUTION

Leakage tests outlined in paragraphs 4–1126 and 4–1127 should be performed after any component of the pitot system has been removed or replaced. Leakage tests outlined in paragraphs 4–1126 and 4–1127 should be performed with Type MB-1A, Tester.

4–1126. STATIC PRESSURE LEAK TEST.

a. Tape over static pressure openings.

b. Connect a suitable source of vacuum to the static system.

c. Slowly apply vacuum (not to exceed the range of the rate of climb indicator) until the altimeter reads 10,000 feet above field elevation, and close valve of vacuum source.

d. The altimeter must not change indication more than 100 feet for a period of one minute. Tap instrument case to keep pointer free.

Note

Do not apply pressure to static lines.

4–1127. PITOT PRESSURE LEAK TEST.

a. Tape over pitot tube drain holes.

b. Connect a suitable source of pressure to the system.

c. Slowly apply pressure until aircraft's airspeed indicator reads three-fourths full scale, and close valve of pressure source.

d. For a period of one minute, the indicated air speed shall not have decreased more than five knots or 5 MPH.

Note

Do not apply vacuum to pitot lines.

4–1128. FUSELAGE EQUIPMENT.

(See figures 4-182 through 4-200.)

WARNING

Medium pressure teflon flexible hoses that are locally manufactured for use in canopy and seat ejection systems must be manufactured and inspected in strict adherence with T.O. 42E1-1-1.

- Ballistic hoses not having gap clearances as shown in Figure 4-180A, will not be used in the canopy or seat ejection system. (Refer to T.O. 42E1-1-1.)

CAUTION

Whenever a replacement ejection seat is installed or any of the seat ejection system hoses, tubing, check valves, fittings, adapters, connectors, or elbows are removed or replaced, an inspection for obstructions shall be made prior to installation. Purge with dry nitrogen at 50 psig through openings or visually inspect with a light to assure obstructions do not exist. Check valves shall be checked in both directions to assure free flow in one direction and no flow in the opposite direction. Assure that check valves are correctly installed to provide proper direction of flow.

4–1129. JETTISONABLE SEATS (PRIOR TO AF SERIAL NO. 53-5286). (See figures 4-197 and 4-198.) The seats are formed from sheet metal and are mounted on a tubular frame. The jettison trigger is on the right arm rest. A seat catapult is located at the back of the seat. A shoulder harness and safety belt, are included with each seat assembly. An inertial lock is provided in connection with the shoulder harness. A cable, reel, and ratchet assembly is attached to the back of the seat. The cable is attached to the shoulder harness and reels in or out as the pilot moves forward or backward. When the airplane is pulling out of a dive with a minimum of 2½Gs, the ratchet engages, stopping further release of the cable and preventing forward movement of the pilot. A handle to the left of each pilots seat permits the pilot to unlock the ratchet mechanism.

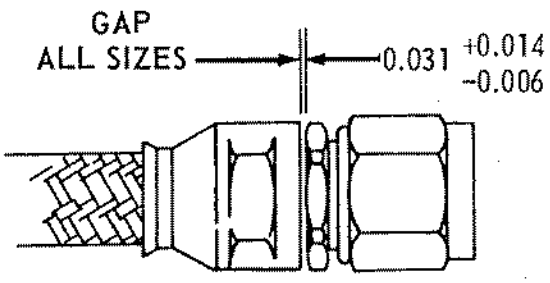


Figure 4-180A. Ejection System Hoses

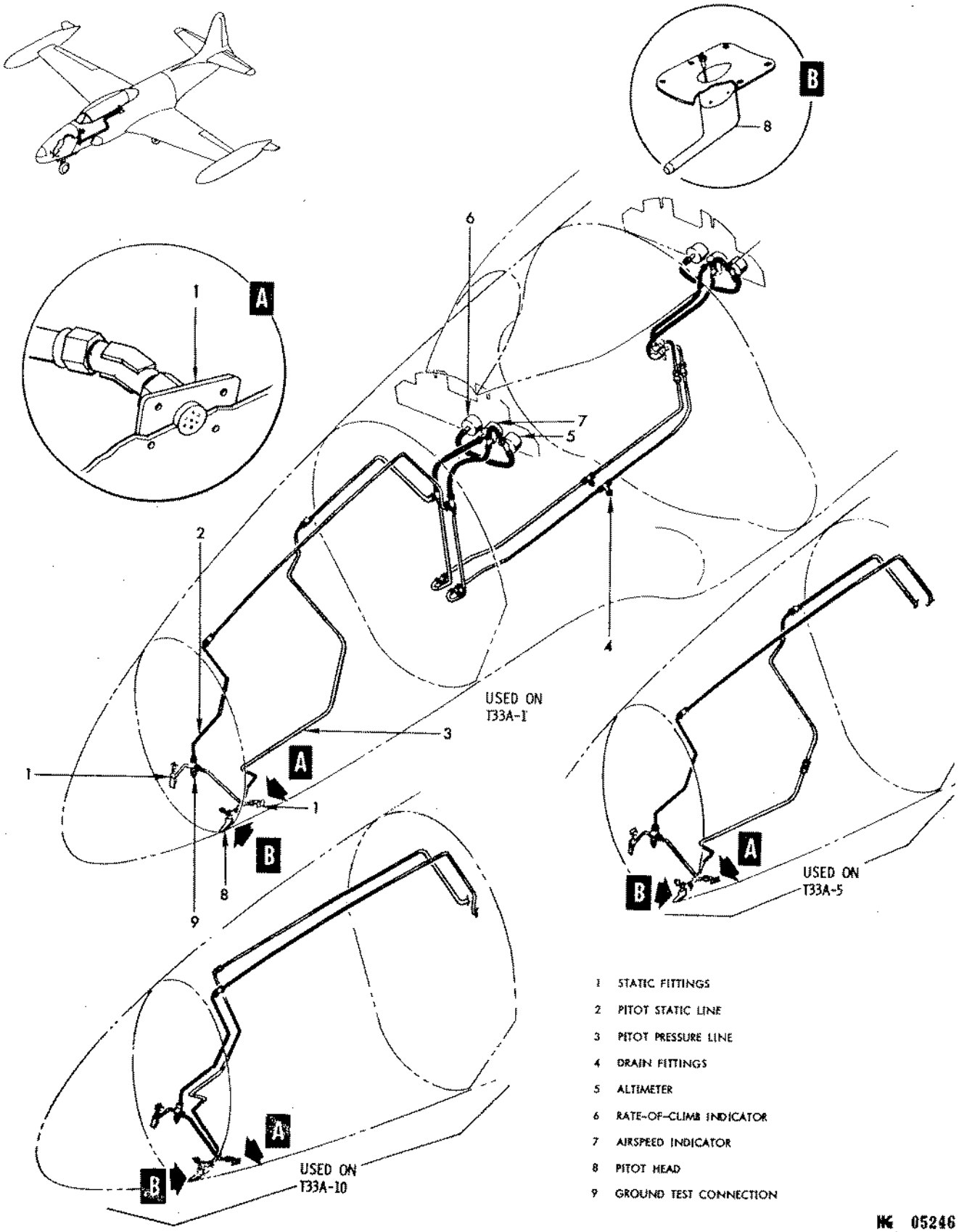
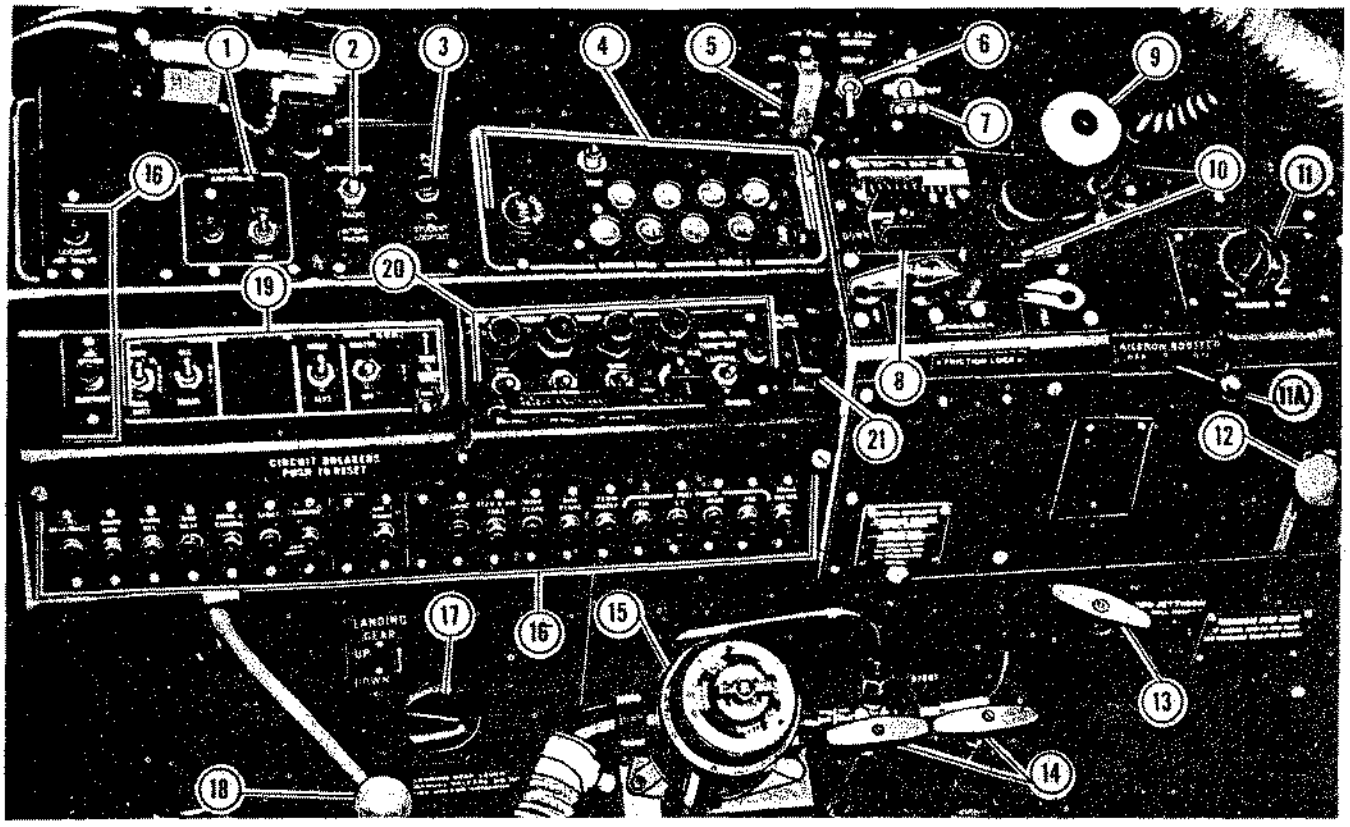


Figure 4-181. Pitot Static System



1.	MARKER BEACON RECEIVER CONTROLS	11A.	AILERON BOOST SHUT-OFF VALVE
2.	INTERPHONE CONTROL SWITCH	12.	HYDRAULIC FUSE RESET HANDLE
3.	STUDENT LOCKOUT SWITCH	13.	JATO JETTISON HANDLE
4.	COMMAND RADIO CONTROLS	14.	DROP TANK MANUAL RELEASE HANDLES
5.	STARTING FUEL SYSTEM SWITCH	15.	OXYGEN REGULATOR
6.	AIR START IGNITION SWITCH	16.	CIRCUIT BREAKERS
7.	LANDING LIGHT SWITCH	17.	LANDING GEAR MANUAL RELEASE
8.	WING FLAP CONTROL	18.	LANDING GEAR CONTROL LEVER
9.	GUN-SIGHT RANGE CONTROL	19.	ARMAMENT SWITCHES
10.	DIVE FLAP SWITCH	20.	FUEL SWITCHES
11.	PRESSURIZED AIR CONTROL	21.	FLUID INJECTION SWITCH

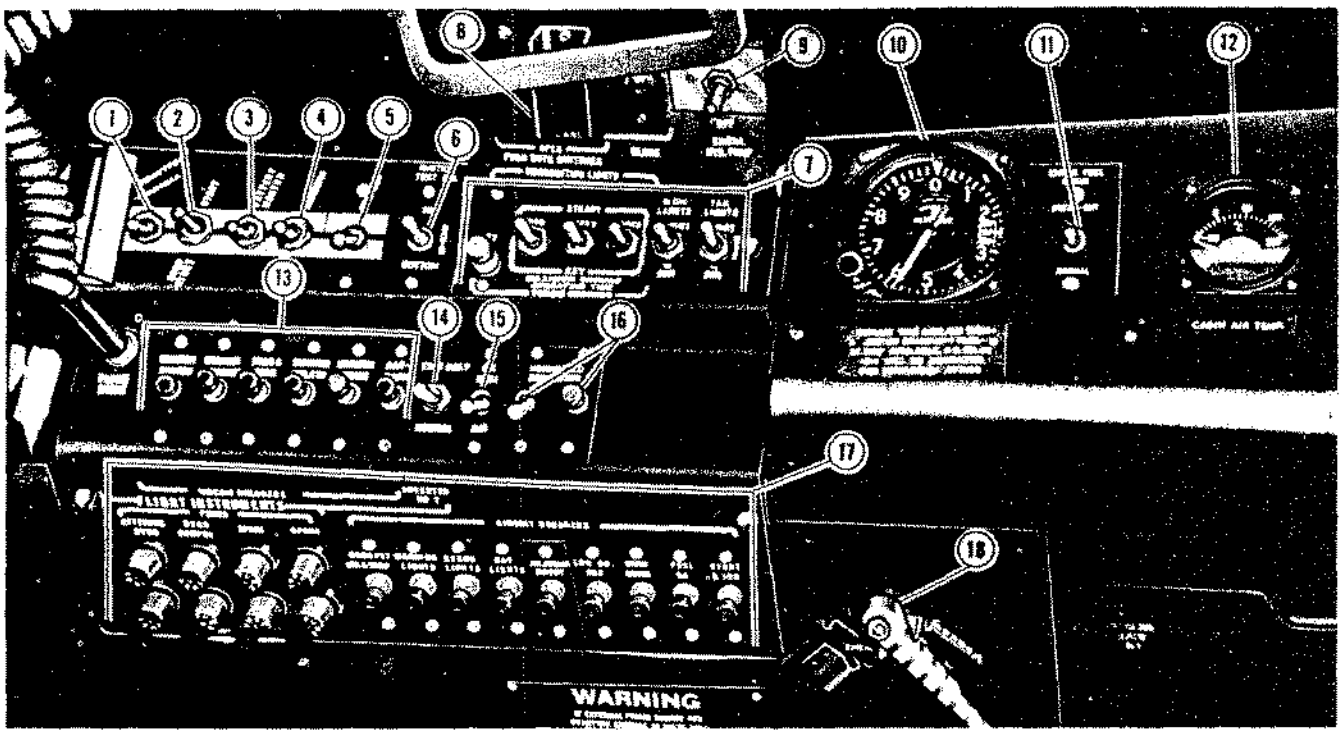
AB 9023
M20-38-4-167

Figure 4-182. Forward Cockpit, Left Side, Prior to AF Serial No. 49-901

CAUTION

Make sure that the two halves of the pilots personal leads disconnect assembly are retained by the cable ends passing through two pins of disconnect assembly. The cable is located under the seat and is attached to the cockpit floor. This requirement applies only to seats which have the disconnect assembly located on the forward face of the seat.

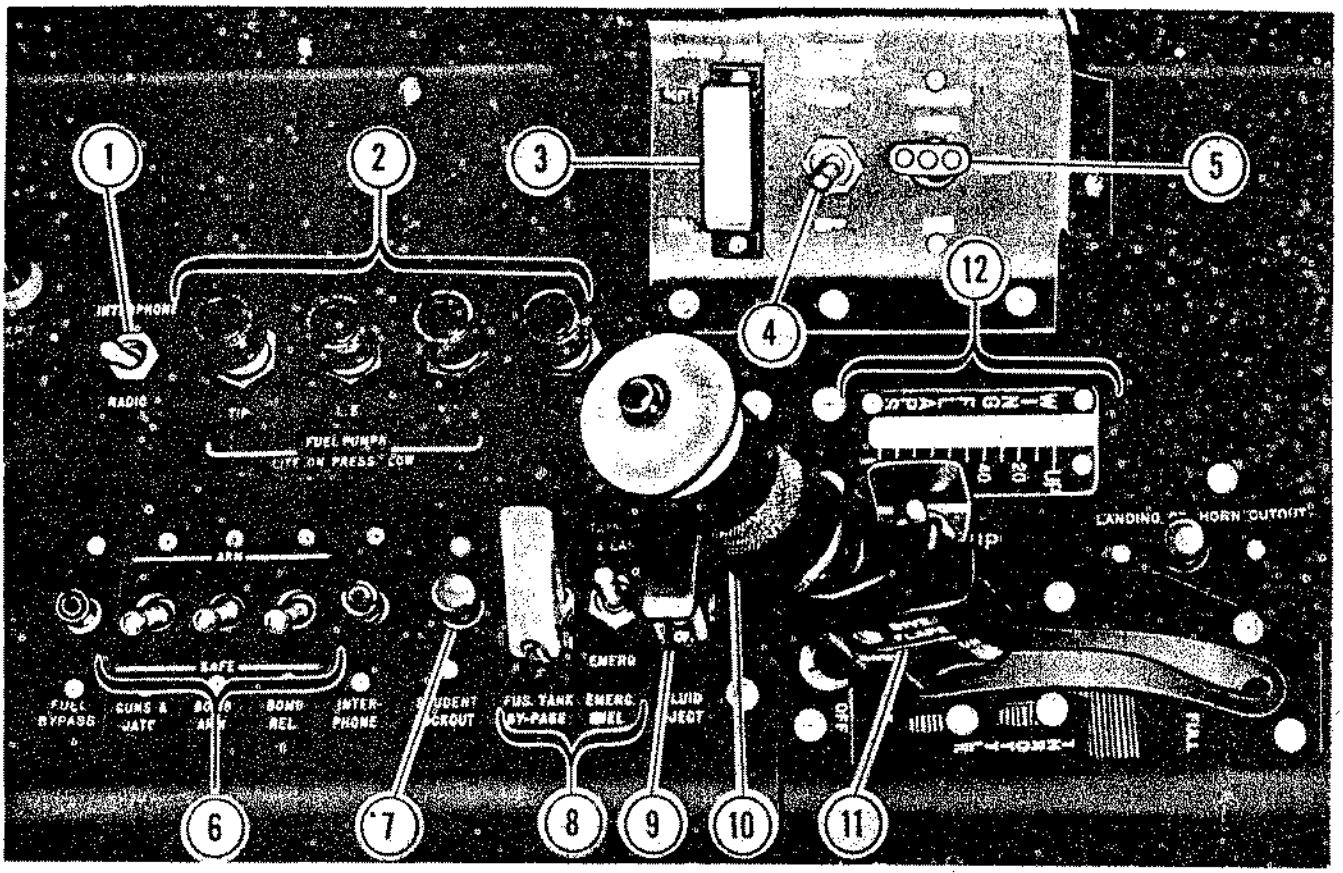
4-1130. An initiator (with explosive charge) is on the back of each seat above the inertia reel. The firing



1.	IGNITION SWITCH	11.	EMERGENCY FUEL SYSTEM CHECK SWITCH
2.	STARTER SWITCH	12.	CABIN AIR TEMPERATURE INDICATOR
3.	BATTERY MASTER SWITCH	13.	CIRCUIT BREAKERS
4.	GENERATOR SWITCH	14.	INVERTER TEST SWITCH
5.	PITOT HEATER SWITCH	15.	OIL HEATER SWITCH
6.	IGNITION TEST SWITCH	16.	WINDSHIELD DEFROST SWITCH AND CIRCUIT BREAKER
7.	RECOGNITION AND NAVIGATION LIGHT SWITCHES	17.	CIRCUIT BREAKER PANEL
8.	CANOPY SWITCHES	18.	ALIGHTING GEAR EMERGENCY SELECTOR VALUE
9.	EMERGENCY HYDRAULIC PUMP SWITCH		
10.	ALTIMETER		

M20-41-4-188
GB 30

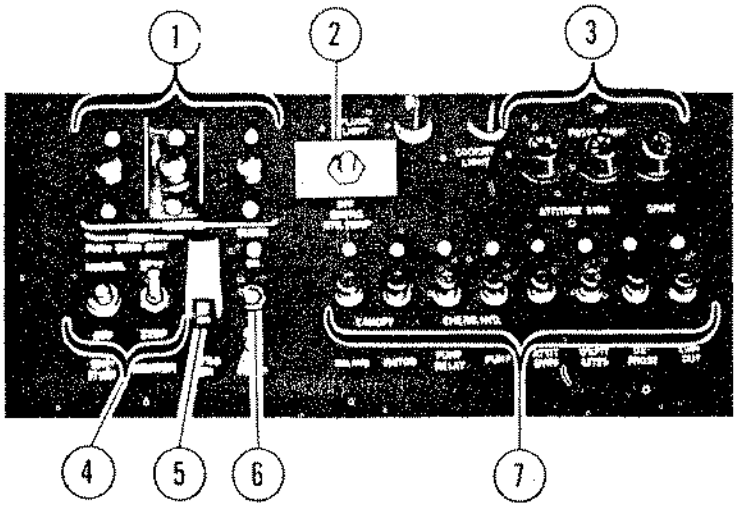
Figure 4-183. Forward Cockpit, Right Side, Prior to AF Serial No. 49-901



1.	INTERPHONE SWITCH	7.	STUDENT LOCKOUT SWITCH
2.	FUEL SYSTEM WARNING LIGHTS	8.	FUEL SYSTEM SWITCHES
3.	STARTING FUEL SYSTEM SWITCH	9.	FLUID INJECTION SWITCH
4.	AIR START IGNITION SWITCH	10.	ENGINE CONTROL LEVER
5.	LANDING LIGHT SWITCH	11.	DIVE FLAP CONTROL
6.	ARMAMENT SWITCHES	12.	WING FLAP INDICATOR

M20-17-4-207
CB 8188

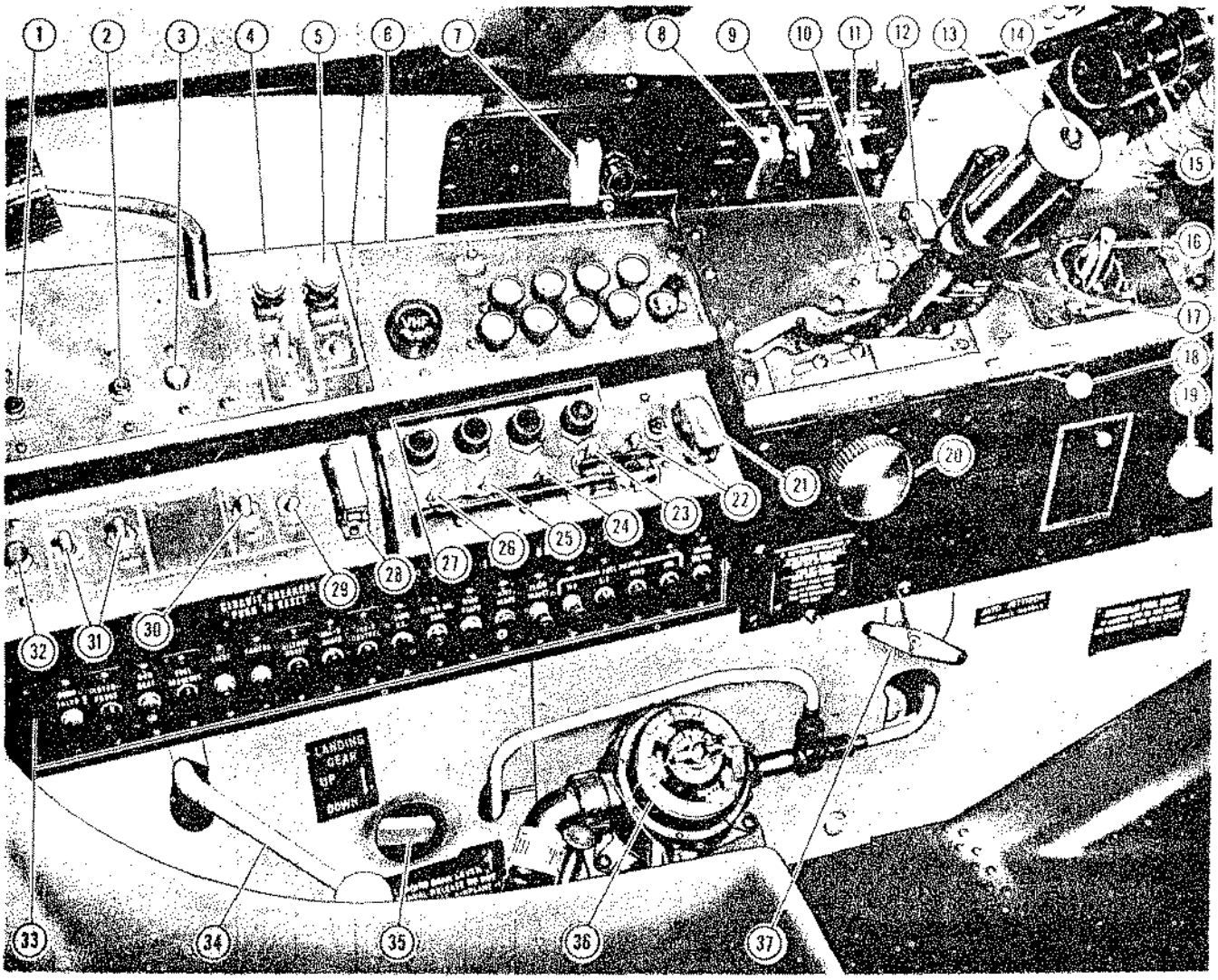
Figure 4-184. Aft Cockpit, Left Side, Prior to AF Serial No. 49-901



1	CANOPY SWITCHES
2	EMERGENCY HYDRAULIC SWITCH
3	FUSES
4	IGNITION AND STARTER SWITCHES
5	BATTERY GENERATOR SWITCH
6	WINDSHIELD DEFROSTER SWITCH
7	CIRCUIT BREAKERS

M20-41-4-211
FB 9877

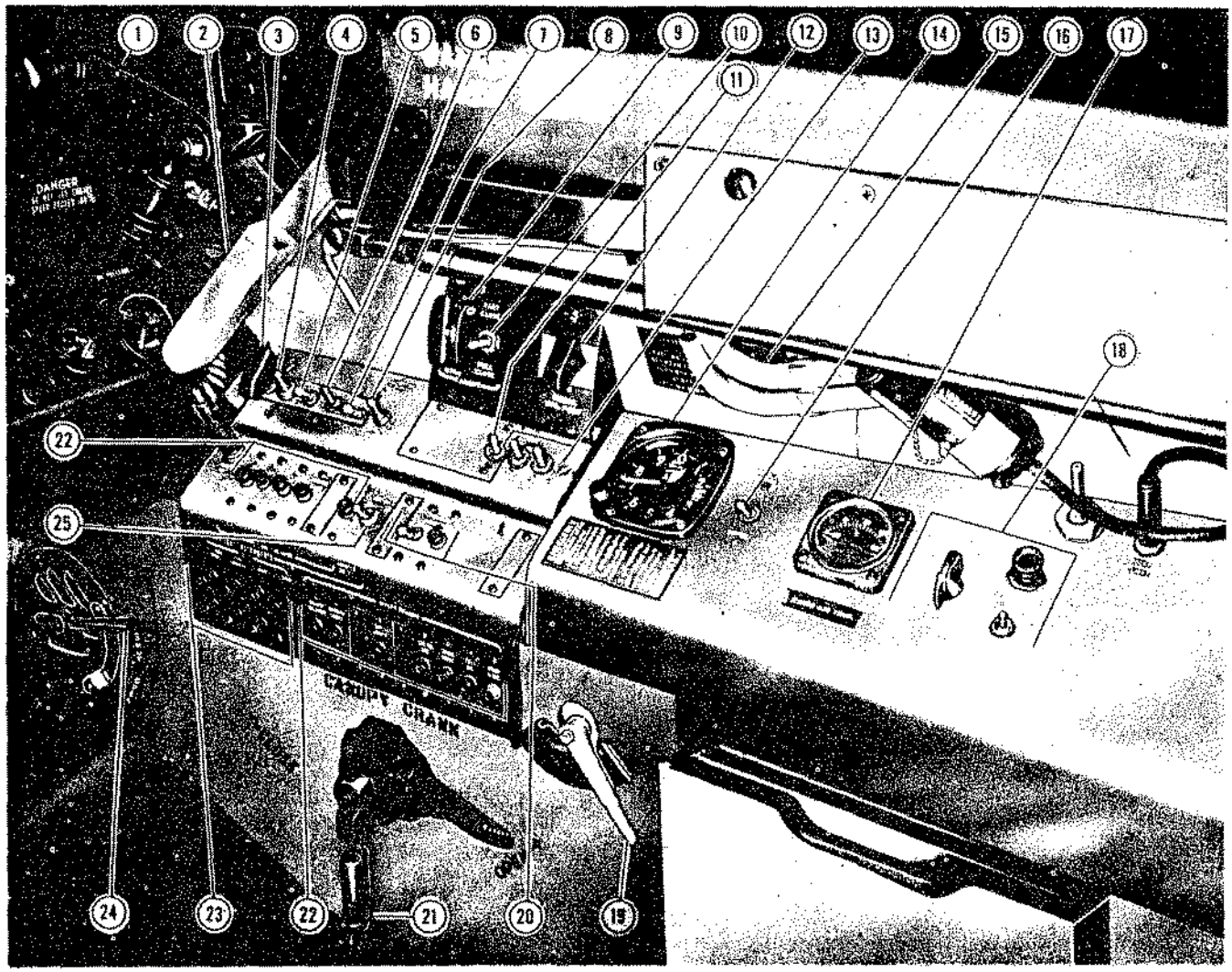
Figure 4-185. Aft Cockpit, Right Side, Prior to AF Serial No. 49-901



1. CIRCUIT BREAKER - COCKPIT AIR VALVE
2. CIRCUIT BREAKER - MARKER BEACON RECEIVER
3. STUDENT LOCKOUT RELEASE
4. INTERPHONE - AN/ARC-3 SELECTOR
5. AN/ARC-3 RADIO CONTROL SWITCH AND INDICATOR
6. AN/ARC-3 RADIO CONTROLS
7. FUEL FILTER DEICER SWITCH
8. STARTING FUEL SEQUENCE SWITCH
9. AIR START IGNITION SWITCH
10. LANDING GEAR HORN CUTOUT
11. LANDING - TAXI LIGHT SWITCH
12. MAIN FUEL VALVE SHUT-OFF SWITCH
13. THROTTLE
14. MICROPHONE BUTTON
15. FLUORESCENT LIGHT
16. COCKPIT HEAT CONTROL
17. DIVE FLAP SWITCH
18. AILERON BOOST SHUT-OFF LEVER
19. HYDROFUSE RESET KNOB
20. THROTTLE FRICTION CONTROL
21. FUEL INJECTION SWITCH
22. EMERGENCY FUEL SWITCH AND CIRCUIT BREAKER
23. FUSELAGE TANK AND BY-PASS SWITCH
24. WING FUEL TANKS SWITCH
25. LEADING EDGE FUEL TANK SWITCH
26. DROP TANKS FUEL SWITCH
27. FUEL TANK INDICATOR LIGHTS
28. GUNS - CAMERA SWITCH
29. GUN HEATER SWITCH
30. CHEMICAL TANKS SWITCH
31. BOMB ARMING AND SELECTOR SWITCHES
32. AIR START IGNITION CIRCUIT BREAKER
33. CIRCUIT BREAKER PANEL
34. LANDING GEAR CONTROL LEVER
35. LANDING GEAR DOWNLOCK RELEASE
36. OXYGEN REGULATOR
37. JATO JETTISON CONTROL

CB 6652
M-20-26-4-168 (1)

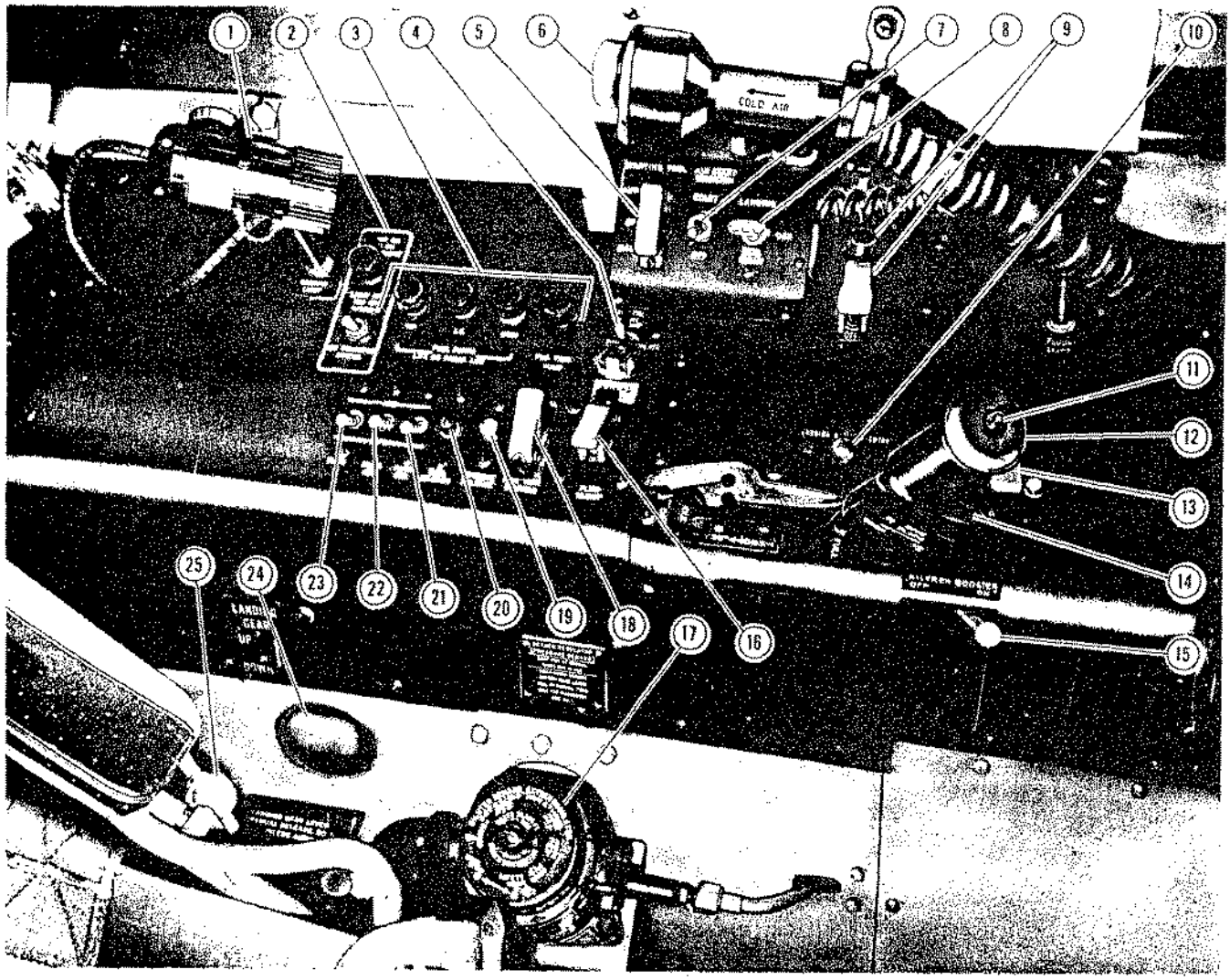
Figure 4-186. Forward Cockpit, Left Side, AF Serial No. 49-901 through 50-384



1. CANOPY LOCKING HANDLE
2. CANOPY JETTISON LEVER
3. IGNITION SWITCH
4. STARTER SWITCH
5. BATTERY SWITCH
6. GENERATOR SWITCH
7. PITOT HEATER SWITCH
8. IGNITION TEST SWITCH
9. CANOPY "OPEN" BUTTON
10. CANOPY "CLOSE" SWITCH
11. FUSELAGE LIGHTS SWITCH
12. EMERGENCY HYDRAULIC PUMP
13. NAVIGATION LIGHTS SWITCHES.
14. CABIN ALTIMETER
15. SURFACE CONTROLS LOCK (STOWED)
16. EMERGENCY FUEL CHECKOUT SWITCH
17. CABIN AIR TEMPERATURE GAGE
18. CODE SELECTOR AND SIGNAL LIGHT SWITCH
19. EMERGENCY HYDRAULIC SYSTEM SELECTOR
20. AUXILIARY WINDSHIELD DEFROSTER SWITCH AND CIRCUIT BREAKER
21. CANOPY MANUAL HANDCRANK
22. CIRCUIT BREAKERS
23. FLIGHT INSTRUMENT AND SPARE FUSES
24. CABIN PRESSURIZATION GRILL
25. INVERTER TEST SWITCH

AB 3599
M20-28B-4-92

Figure 4-187. Forward Cockpit, Right Side, AF Serial No. 49-901 through 50-401

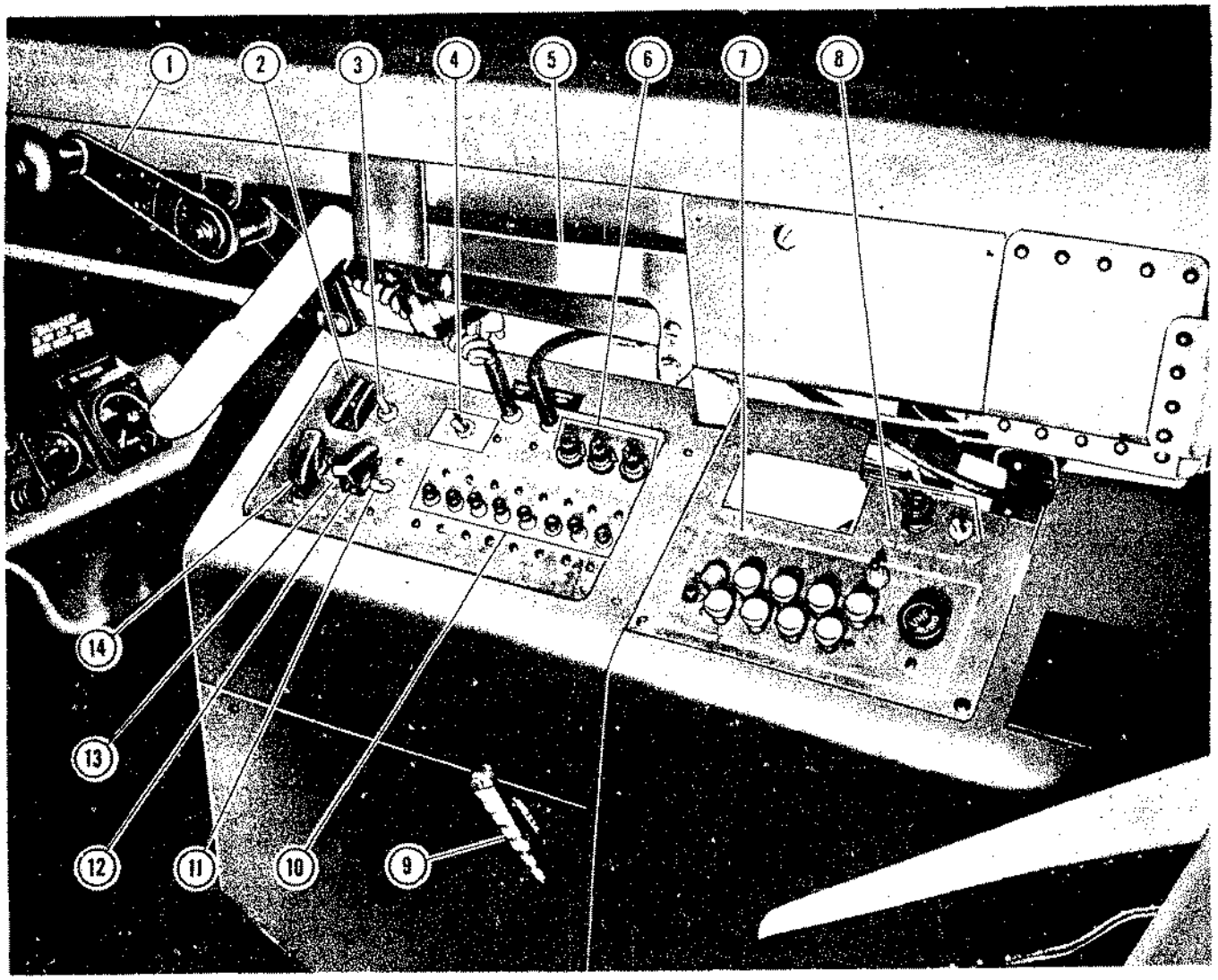


1. COCKPIT LIGHT
2. INTERPHONE AN/ARC-3 RADIO SWITCH AND INDICATOR LIGHT
3. FUEL TANK INDICATOR LIGHTS
4. EMERGENCY FUEL SWITCH
5. STARTING FUEL SEQUENCE SWITCH
6. COCKPIT VENTILATOR
7. AIR START IGNITION SWITCH
8. LANDING TAXI LIGHT SWITCH
9. FUEL FILTER DEICER AND WARNING LIGHT
10. LANDING GEAR HORN CUTOUT
11. MICROPHONE BUTTON
12. THROTTLE
13. MAIN FUEL VALVE SHUT-OFF SWITCH
14. DIVE FLAP SWITCH
15. AILERON BOOST SHUT-OFF LEVER
16. FLUID INJECTION SWITCH
17. OXYGEN REGULATOR
18. FUEL TANK AND BY-PASS MASTER SWITCH
19. STUDENT LOCKOUT RELEASE
20. FUEL BY-PASS CIRCUIT BREAKER
21. BOMB SELECTOR MASTER SWITCH
22. BOMB ARMING MASTER SWITCH
23. GUNS MASTER SWITCH
24. LANDING GEAR DOWNLOCK RELEASE
25. LANDING GEAR CONTROL LEVER

A8 22316

M20-28B-4.169

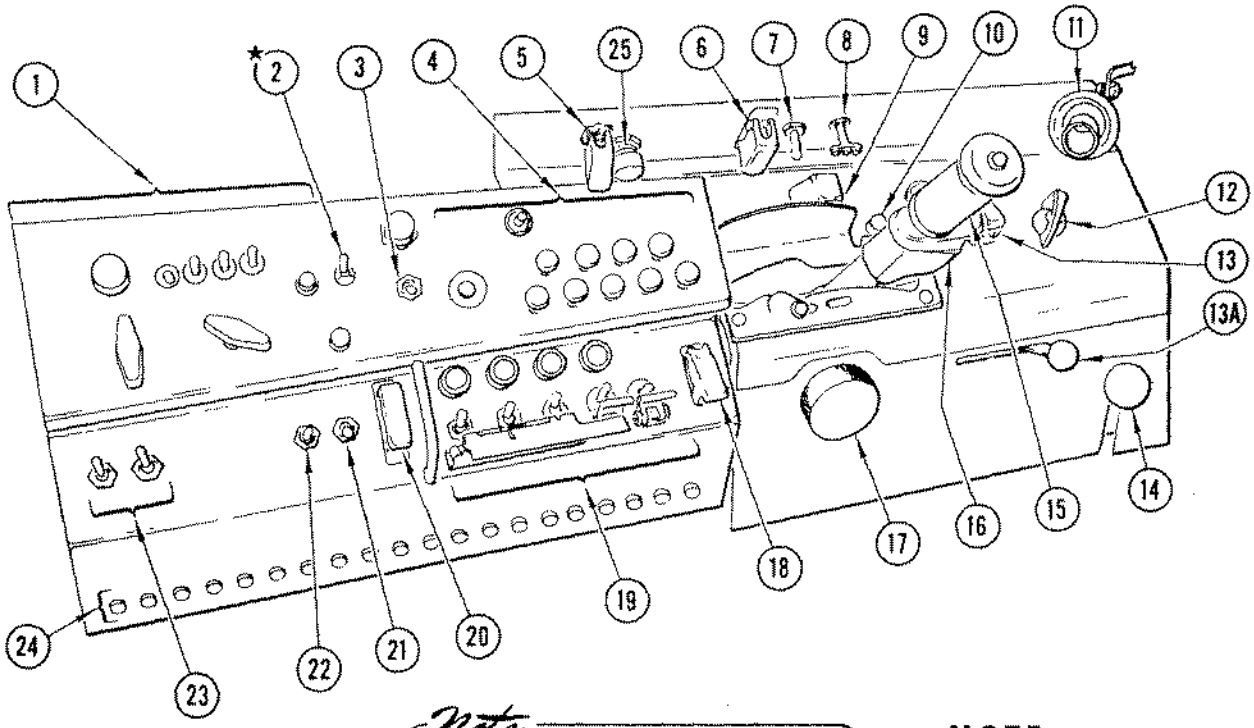
Figure 4-188. Aft Cockpit, Left Side, AF Serial No. 49-901 through 50-384



1. CANOPY LOCKING HANDLE
2. CANOPY "OPEN" BUTTON
3. CANOPY "CLOSE" SWITCH
4. EMERGENCY HYDRAULIC PUMP SWITCH
5. CANOPY JETTISON LEVER
6. GYRO INSTRUMENT AND SPARE FUSES
7. AN/ARC-3 RADIO CONTROL PANEL
8. AN/ARC-3 RADIO CONTROL SWITCH AND INDICATOR LIGHT
9. EMERGENCY HYDRAULIC SYSTEM SELECTOR
10. CIRCUIT BREAKERS
11. AUXILIARY DEFROSTER SWITCH
12. BATTERY AND GENERATOR SWITCH
13. STARTER SWITCH
14. IGNITION NORMAL-OFF SWITCH

AB 2237
M20-28B-4-115

Figure 4-189. Aft Cockpit, Right Side, AF Serial No. 49-901 through 50-401



Note

AN/ARC-27 RADIOS ARE INSTALLED ON AF SERIAL NOS. 51-6751 AND SUBSEQUENT EXCEPT MDAP AIRPLANES

NOTE

★ USED ON AF SERIAL NO. 51-4141 AND SUBSEQUENT

1. INTERPHONE CONTROLS
★2. TIP TANK AUTO - DROP SWITCH
3. RADIO CONTROL SWITCH AND LIGHT
4. RADIO CONTROLS
5. FUEL DE-ICER SWITCH
6. STARTING FUEL SEQUENCE SWITCH
7. AIR START IGNITION SWITCH
8. LANDING-TAXI LIGHT SWITCH
9. WING FLAP CONTROL LEVER
10. LANDING GEAR HORN CUTOUT
11. FLUORESCENT LIGHT
12. COCKPIT HEAT CONTROL
13. MAIN FUEL VALVE SHUT-OFF SWITCH
13A. AILERON BOOST SHUT-OFF LEVER
14. HYDROFUSE RESET KNOB (DELETED ON AF SERIAL NOS. 51-6819 AND SUBSEQUENT)
15. THROTTLE
16. DIVE FLAP SWITCH
17. THROTTLE FRICTION CONTROL
18. FLUID INJECTION SWITCH
19. FUEL TANK LIGHTS AND SWITCHES
20. GUNS—CAMERA SWITCH
21. GUN HEATER SWITCH
22. CHEMICAL TANKS SWITCH
23. BOMB ARMING AND SELECTOR SWITCHES
24. CIRCUIT BREAKERS
25. FUEL DE-ICER WARNING LIGHT

Figure 4-190. Forward Cockpit, Left Side, AF Serial No. 50-385 through 51-9235

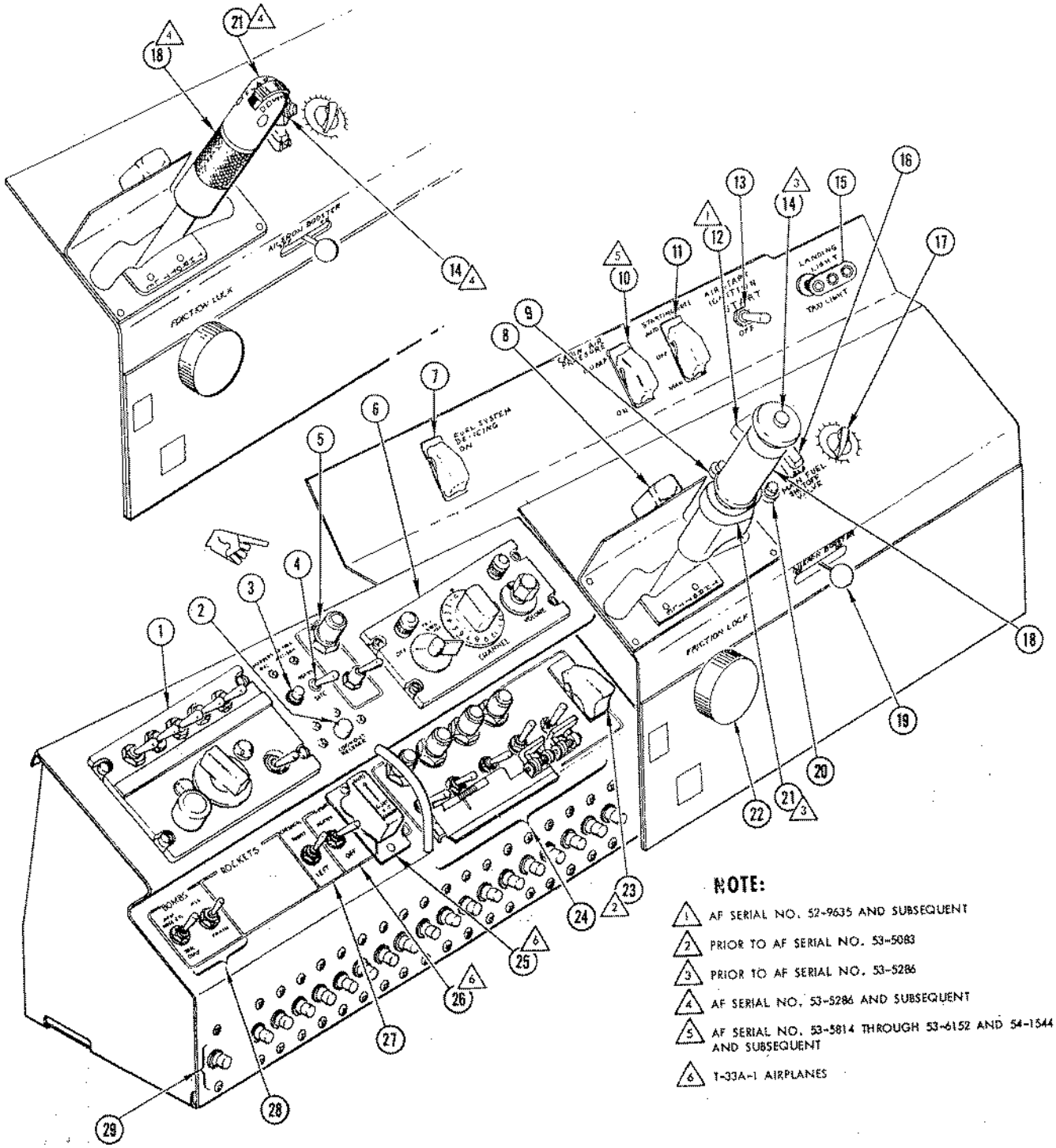
trigger, on the right hand-grip, is connected through rods and levers, to the initiator. The initiator is connected through tubing to the type M5A-1 catapult. (See figure 4-198.)

WARNING

Since canopy and seat jettison systems are not interconnected, seats can be jettisoned with the canopy installed.

4–1131. On AF Serial No. 56-1573 and subsequent, and airplanes incorporating T.O. 1T-33A-222, there is an automatic release type seat belt, type MA-6, on each seat. A hose is installed between the seat belt buckle and an initiator, type M-4. The initiator is on the back of the seat on the left side. A telescopic tube assembly is installed between the initiator sear pin and the cockpit floor.

4–1132. On AF Serial No. 51-17537 through 51-17556 and on 52-9466 through 53-5730, except on airplanes



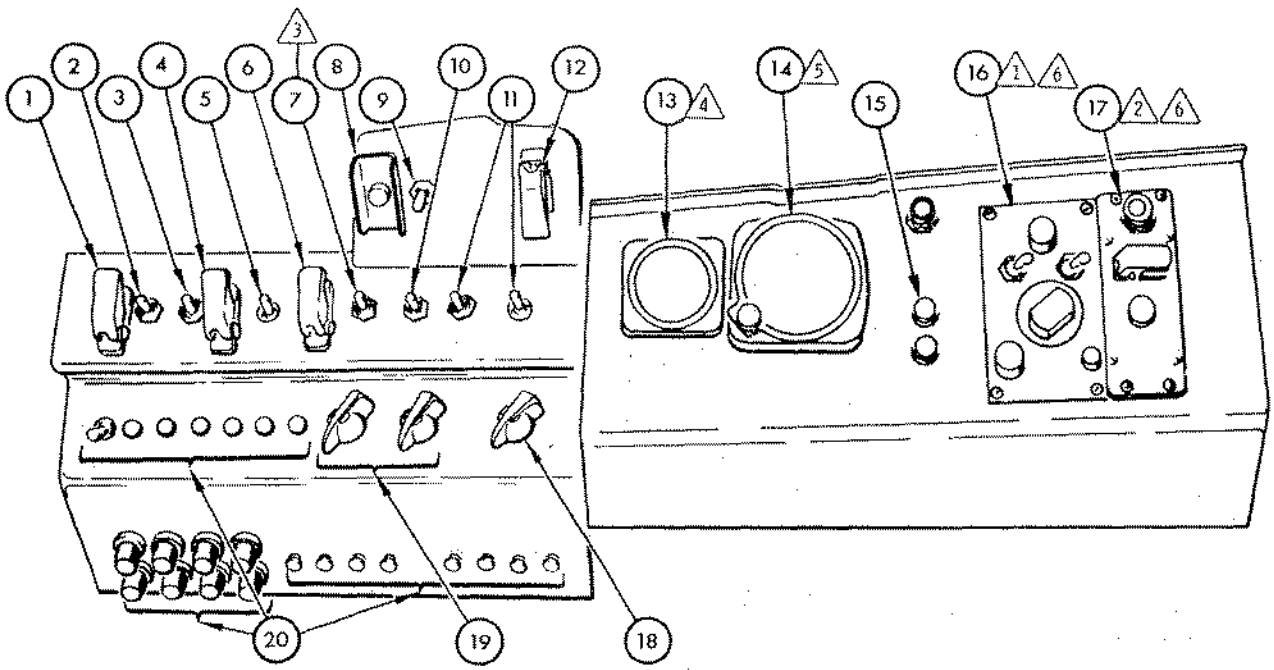
NOTE:

1. AF SERIAL NO. 52-9635 AND SUBSEQUENT
2. PRIOR TO AF SERIAL NO. 53-5083
3. PRIOR TO AF SERIAL NO. 53-5286
4. AF SERIAL NO. 53-5286 AND SUBSEQUENT
5. AF SERIAL NO. 53-5814 THROUGH 53-6152 AND 54-1544 AND SUBSEQUENT
6. T-33A-1 AIRPLANES

1. INTERPHONE CONTROL PANEL
2. LOCKOUT RELEASE SWITCH
3. MARKER BEACON CIRCUIT BREAKER
4. TIP TANK AUTO-DROP SWITCH
5. COMMAND RADIO CONTROL
6. COMMAND RADIO PANEL
7. FUEL DE-ICE SWITCH
8. WING FLAP CONTROL LEVER
9. LANDING HORN CUTOUT SWITCH
10. CABIN AIR PRESSURE SWITCH
11. STARTING FUEL SEQUENCE SWITCH
12. FUEL PUMP OVERRIDE SWITCH
13. AIR START IGNITION SWITCH
14. MICROPHONE SWITCH
15. LANDING-TAXI LIGHT SWITCH
16. MAIN FUEL SHUTOFF VALVE SWITCH
17. COCKPIT HEAT CONTROL
18. THROTTLE LEVER
19. AILERON BOOST SHUTOFF LEVER
20. JATO SWITCH
21. DIVE FLAP SWITCH
22. THROTTLE FRICTION LOCK
23. FLUID INJECTION SWITCH
24. FUEL TANK SWITCHES AND WARNING LIGHTS
25. ARMAMENT MASTER SWITCH
26. GUN HEATERS SWITCH
27. CHEMICAL TANKS SWITCH
28. BOMB ARMING AND SELECTOR SWITCHES
29. CIRCUIT BREAKERS

M20-48D-4-196
GB 8749

Figure 4-191. Forward Cockpit, Left Side, AF Serial No. 51-9236 and Subsequent



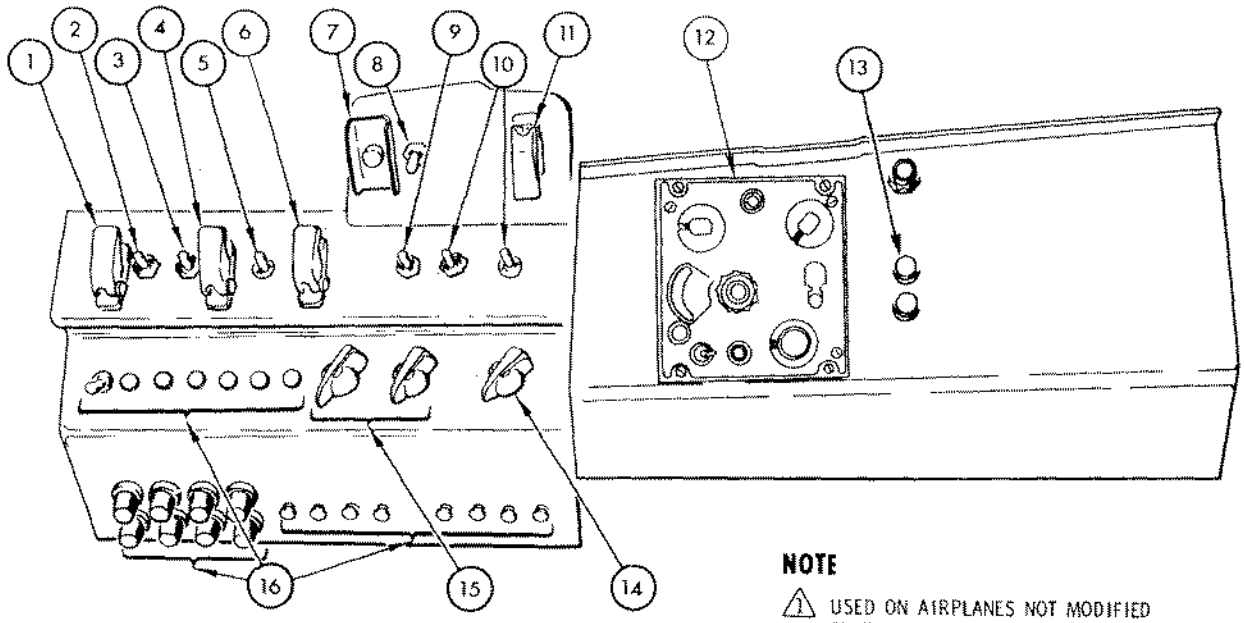
1 IGNITION SWITCH
2 STARTER SWITCH
3 BATTERY SWITCH
4 GENERATOR SWITCH
5 PITOT HEATER SWITCH
6 EMERGENCY FUEL CHECKOUT SWITCH △7
△3 7 INVERTER TEST SWITCH
8 CANOPY "OPEN" SWITCH
9 CANOPY "CLOSE" SWITCH
10 FUSELAGE LIGHTS SWITCH
11 NAVIGATION LIGHT SWITCHES
12 EMERGENCY HYDRAULIC PUMP SWITCH
△4 13 CABIN AIR TEMPERATURE GAGE
△5 14 CABIN ALTIMETER
15 SEAT ACTUATOR CIRCUIT BREAKERS
△1 16 RECOGNITION RADAR CONTROLS
△2 17 AN/ARA-26 CONTROL KEYER
18 SIDE PANEL LIGHTS CONTROLS
19 INSTRUMENT PANEL LIGHTS CONTROLS
20 FUSES AND CIRCUIT BREAKERS

NOTE

△1 NOT INSTALLED ON MDAP AIRPLANES.
△2 USED ON AF SERIAL NO. 51-9236 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-531 AND 1T-33A-556.
△3 PRIOR TO AF SERIAL NO. 52-9760 AND AIRPLANES NOT INCORPORATING T.O. 1T-33A-194.
△4 PRIOR TO AF SERIAL NO. 53-4886
△5 T-33A-1 AIRPLANES
△6 RELOCATED TO CENTERSTAND ON AIRPLANES INCORPORATING T.O. 1T-33A-571.
△7 AIRPLANES NOT MODIFIED BY T.O. 1T-33A-628, T.O. 1T-33A-515, T.O. 1T-33A-577 AND T.O. 1T-33A-585.

HF 08706
M20-57-4-171

Figure 4-192. Forward Cockpit, Right Side, USAF Serial No. 50-402 through 58-503



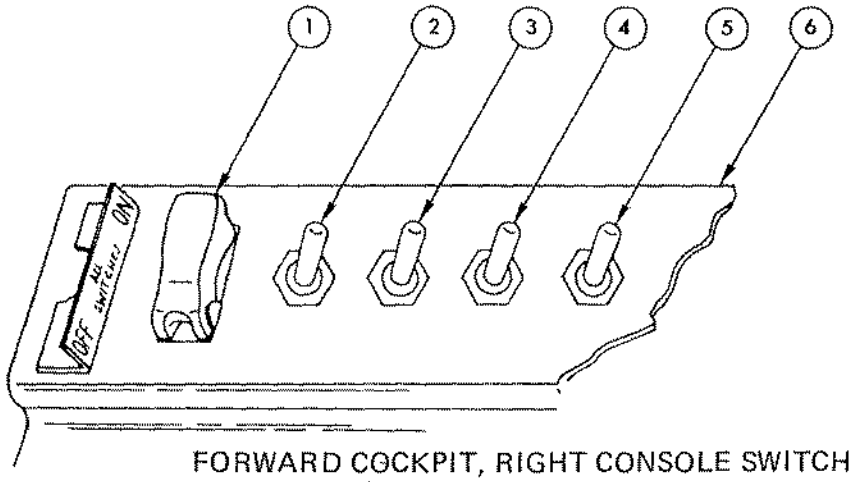
NOTE

△1 USED ON AIRPLANES NOT MODIFIED BY T.O. 1T-33A-515

1 IGNITION SWITCH
2 STARTER SWITCH
3 BATTERY SWITCH
4 GENERATOR SWITCH
5 PITOT HEATER SWITCH
6 EMERGENCY FUEL CHECKOUT SWITCH △1
7 CANOPY "OPEN" SWITCH
8 CANOPY "CLOSE" SWITCH
9 FUSELAGE LIGHTS SWITCH
10 NAVIGATION LIGHT SWITCHES
11 EMERGENCY HYDRAULIC PUMP SWITCH
12 AN/ARN-6 RADIO COMPASS CONTROL
13 SEAT ACTUATOR CIRCUIT BREAKERS
14 SIDE PANEL LIGHTS CONTROLS
15 INSTRUMENT PANEL LIGHTS CONTROLS
16 FUSES AND CIRCUIT BREAKERS

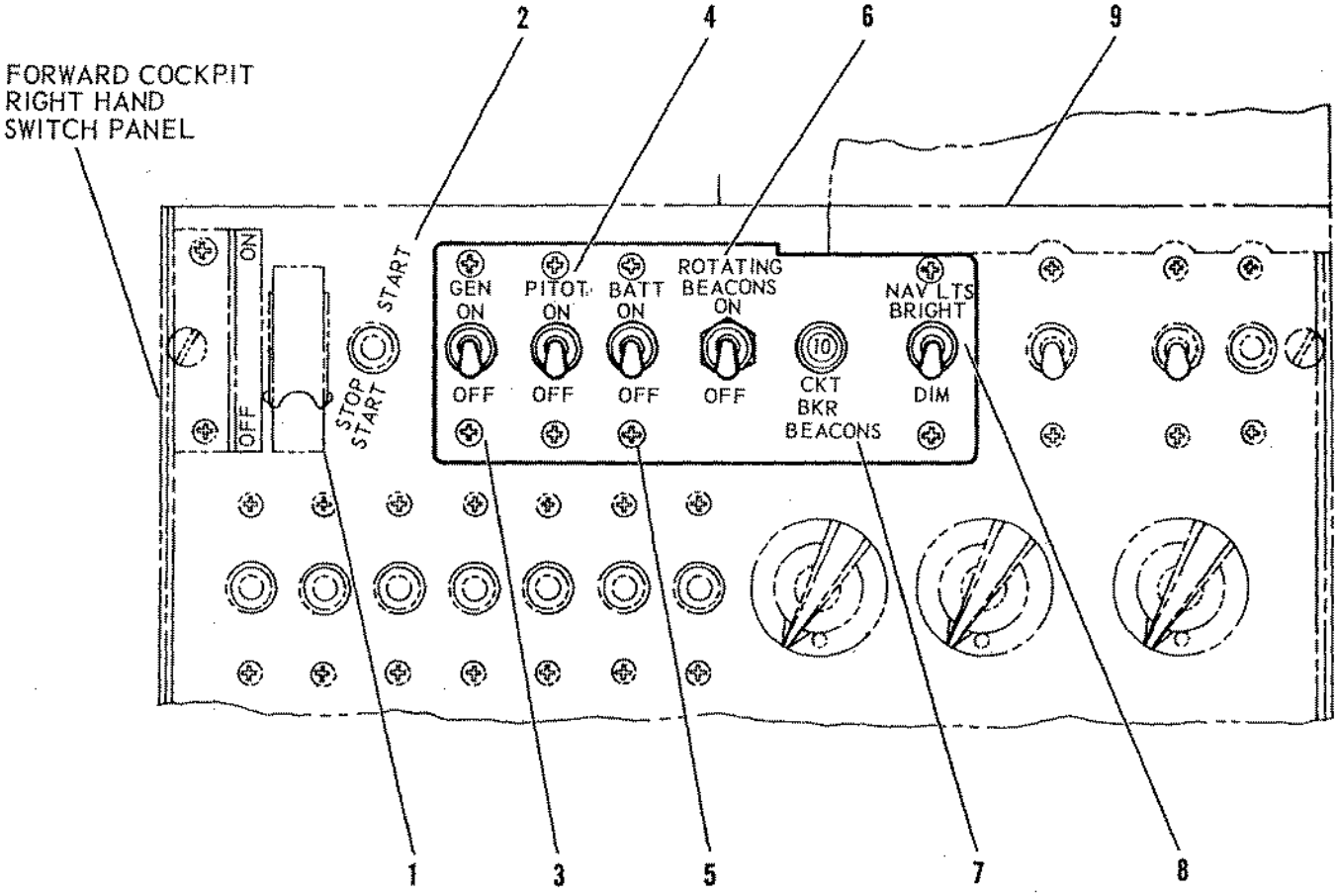
NF 08703
M20-57-4-185

Figure 4-193. Forward Cockpit, Right Side, USAF Serial No. 58-504 and Subsequent



1 IGNITION SWITCH
2 STARTER SWITCH
3 GENERATOR-SWITCH
4 PITOT HEATER SWITCH
5 BATTERY SWITCH
6 FWD COCKPIT RIGHT CONSOLE SWITCH BOX

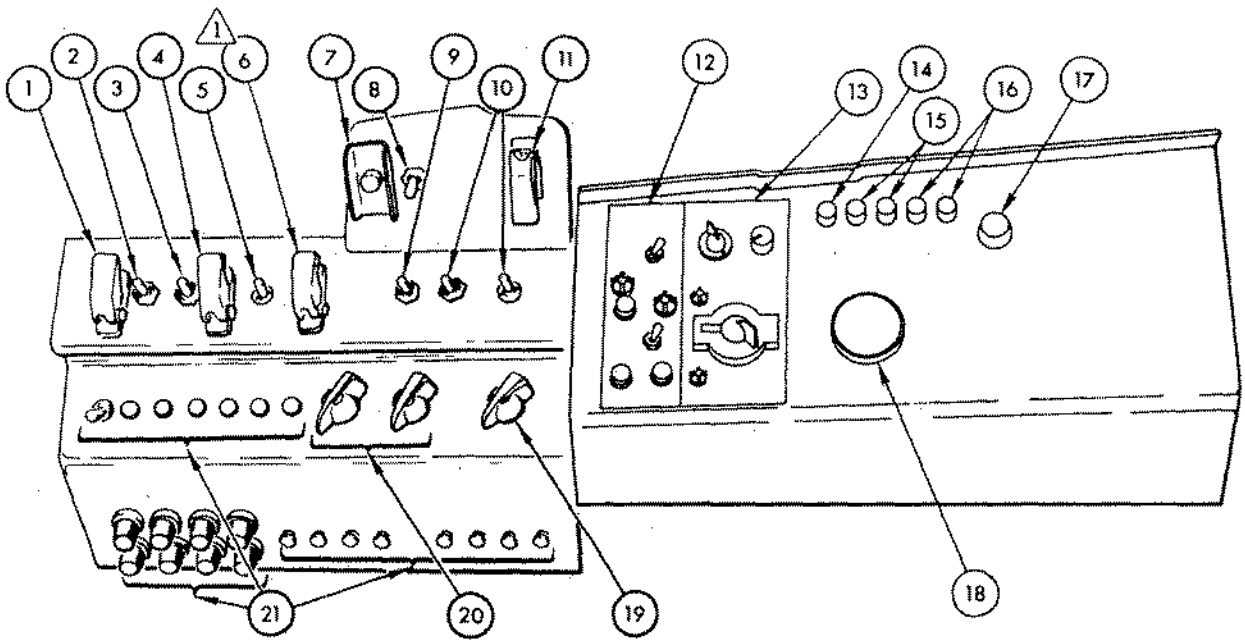
FORWARD COCKPIT, RIGHT CONSOLE SWITCHBOX, T33A-5 AND T33A-10 AIRPLANES INCORPORATING T.O. 1T-33A-628



1. IGNITION SWITCH
2. STARTER SWITCH
3. GENERATOR SWITCH
4. PITOT HEATER SWITCH
5. BATTERY SWITCH
6. ROTATING BEACONS SWITCH
7. BEACONS CIRCUIT BREAKER
8. NAVIGATION LIGHTS
9. FORWARD COCKPIT RIGHT CONSOLE SWITCH BOX

FORWARD COCKPIT RIGHT CONSOLE SWITCH BOX ON AIRCRAFT HAVING COMPLIED WITH T.O. 1T-33-536

Figure 4-193A. Forward Cockpit, Right Console Switchbox



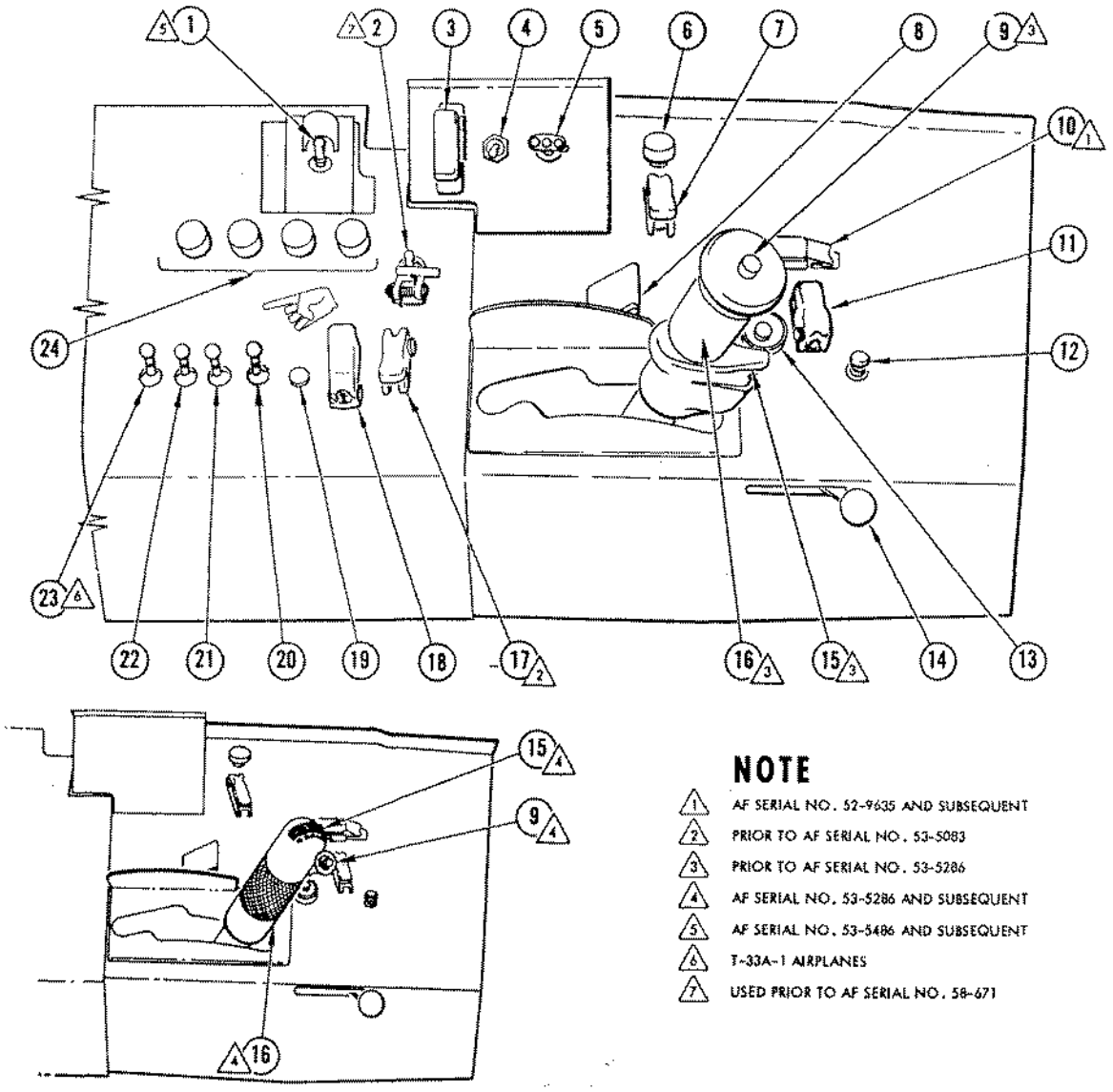
NOTE

1 USED PRIOR TO AF SERIAL NO. 58-671

1 IGNITION SWITCH
2 STARTER SWITCH
3 BATTERY SWITCH
4 GENERATOR SWITCH
5 PITOT HEATER SWITCH
1 6 EMERGENCY FUEL CHECKOUT SWITCH
7 CANOPY "OPEN" SWITCH
8 CANOPY "CLOSE" SWITCH
9 FUSELAGE LIGHTS SWITCH
10 NAVIGATION LIGHT SWITCHES
11 EMERGENCY HYDRAULIC PUMP SWITCH
12 496405-1 CONTROL PANEL (TACAN)
13 C1763/ARN-21A CONTROL PANEL (TACAN)
14 28V DC TACAN CIRCUIT BREAKER
15 FORWARD AND AFT SEAT ACTUATORS CIRCUIT BREAKERS
16 115V AC TACAN CIRCUIT BREAKERS
17 MAIN INVERTER POWER CIRCUIT BREAKER
18 CABIN AIR TEMPERATURE GAGE
19 SIDE PANEL LIGHTS CONTROLS
20 INSTRUMENT PANEL LIGHTS CONTROLS
21 FUSES AND CIRCUIT BREAKERS

HF 06698
M20-54-4-316

Figure 4-193A. Forward Cockpit, Right Side, Incorporating T.O. 1T-33A-613



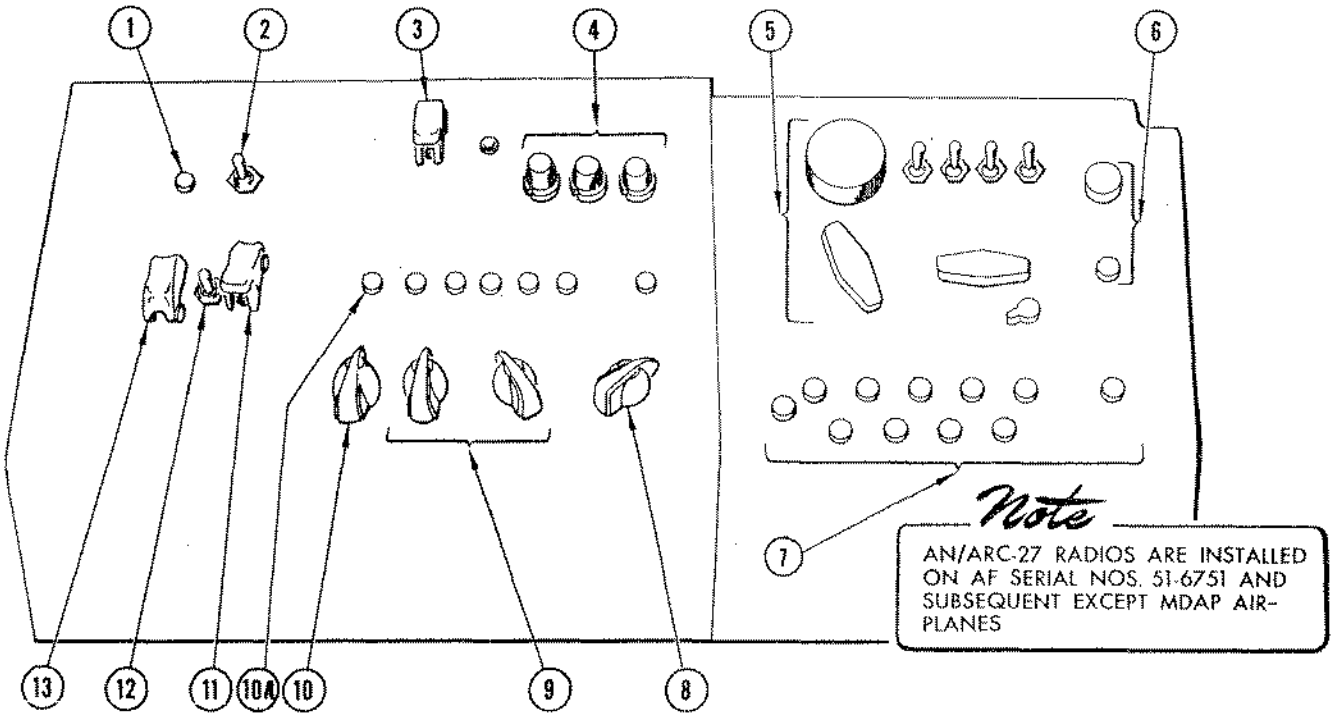
NOTE

1. AF SERIAL NO. 52-9635 AND SUBSEQUENT
2. PRIOR TO AF SERIAL NO. 53-5083
3. PRIOR TO AF SERIAL NO. 53-5286
4. AF SERIAL NO. 53-5286 AND SUBSEQUENT
5. AF SERIAL NO. 53-5486 AND SUBSEQUENT
6. T-33A-1 AIRPLANES
7. USED PRIOR TO AF SERIAL NO. 58-671

1. ELEVATOR TAB OVERRAIL SWITCH
2. EMERGENCY FUEL SWITCH
3. STARTING FUEL SEQUENCE SWITCH
4. AIR START IGNITION SWITCH
5. LANDING-TAXI LIGHT SWITCH
6. FUEL DE-ICER WARNING LIGHT
7. FUEL DE-ICER SWITCH
8. WING FLAP CONTROL LEVER
9. MICROPHONE SWITCH
10. FUEL PUMP OVERRIDE SWITCH
11. MAIN FUEL SHUTOFF VALVE SWITCH
12. MAIN FUEL SHUTOFF VALVE CIRCUIT BREAKER
13. LANDING HORN CUTOUT SWITCH
14. AILERON BOOST SHUTOFF LEVER
15. DIVE FLAP SWITCH
16. THROTTLE LEVER
17. FLUID INJECTION SWITCH
18. FUSELAGE TANK SWITCH
19. LOCKOUT RELEASE SWITCH
20. TIP TANK AUTO - DROP SWITCH
21. BOMB SELECTOR SWITCH
22. BOMB ARMING SWITCH
23. GUNS SWITCH
24. FUEL WARNING LIGHTS

GB 9938
M20-49-4-172

Figure 4-194. Aft Cockpit, Left Side, AF Serial No. 50-385 and Subsequent



1.	CANOPY "OPEN" BUTTON	8.	SIDE PANEL LIGHT CONTROL
2.	CANOPY "CLOSE" SWITCH	9.	INSTRUMENT PANEL LIGHT CONTROL
3.	EMERGENCY HYDRAULIC PUMP SWITCH	10.	RADIO PANEL LIGHT CONTROL
4.	GYRO INSTRUMENT AND SPARE FUSES	10A.	CIRCUIT BREAKERS
5.	INTERPHONE CONTROL PANEL	11.	BATTERY AND GENERATOR SWITCH
6.	RADIO CONTROL SWITCH AND INDICATOR LIGHT	12.	STARTER SWITCH
7.	RADIO CONTROL PANEL	13.	IGNITION SWITCH

AB 9593
M-20-18-4-173

Figure 4-195. Aft Cockpit, Right Side, AF Serial No. 50-402 through 51-9235

incorporating T.O. 1T-33A-222, a type MB-1 shoulder harness is installed in lieu of the type G-2 shoulder harness.

WARNING

Shoulder harnesses, types MB-3 and MB-4, shall be used with automatic lap belts, types MA-1, MA-2, MA-3 and MA-4. Shoulder harnesses, types MB-1A and MB-2A, shall be used with automatic lap belts, types MA-5 and MA-6. (MA-5 belts are interchangeable with MA-6 and can be used.)

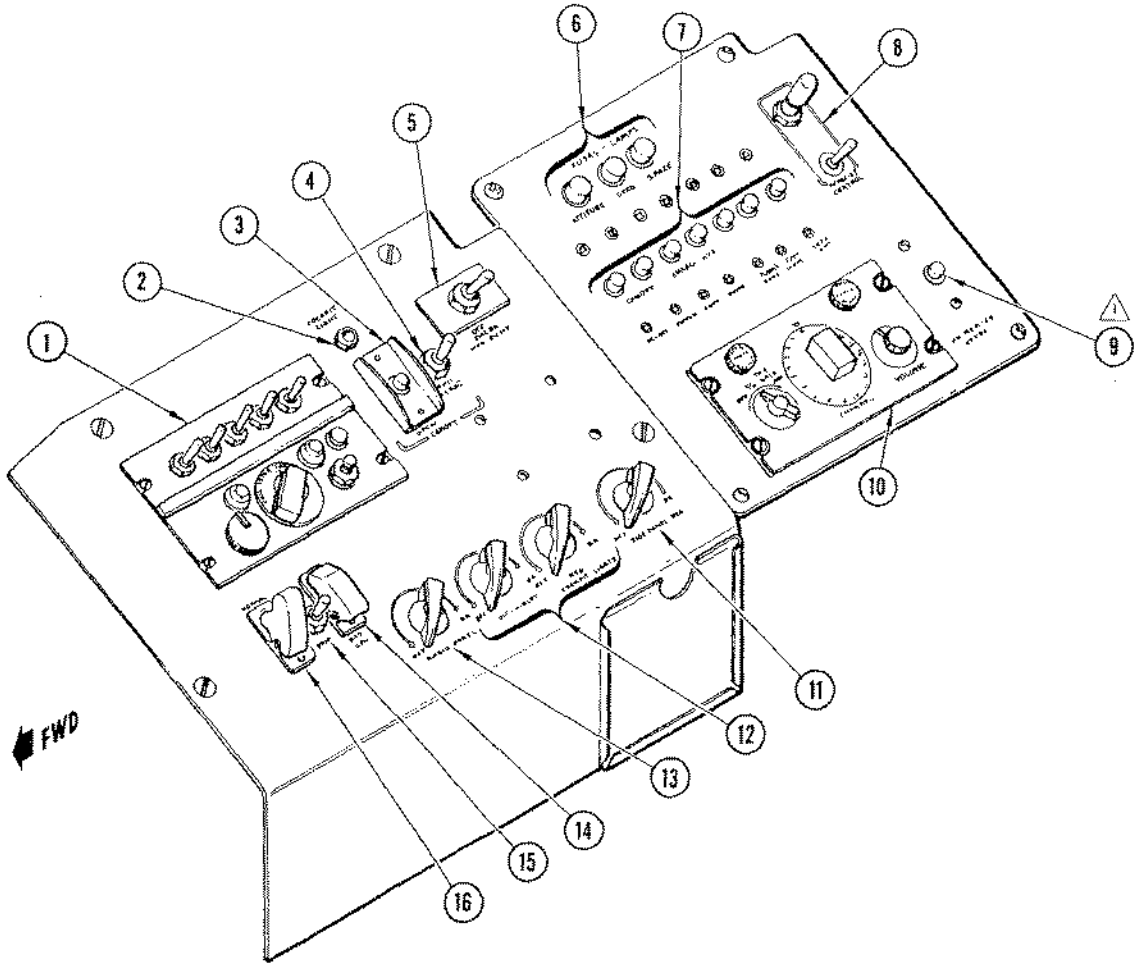
4–1133. On airplanes incorporating T. O. 1T-33A-246, a steel headrest is on the seat. This headrest will fracture the canopy plastic when jettisoning the seat if the canopy cannot be jettisoned.

4–1134. OPERATION OF SEAT EJECTION MECHANISM (PRIOR TO AF SERIAL NO. 53-5286). Raising the right armrest exposes a trigger that is connected to the initiator through rods and levers. Squeezing this trigger fires the explosive charge in the initiator. The explosive pressure travels through the tubing to the catapult, fires the catapult, and ejects the seat (and the occupant).

Note

If the right armrest is raised, lower the armrest as outlined in figure 4-197.

When on the ground, a red-flagged safety pin should be inserted through the right armrest strut.



NOTE

△1 USED PRIOR TO AF SERIAL NO. 58-601

HB 61'
M20-49-4-197

1. INTERPHONE CONTROL PANEL
2. COCKPIT LIGHT JACK
3. CANOPY "OPEN" BUTTON
4. CANOPY "CLOSE" SWITCH
5. EMERGENCY HYDRAULIC PUMP SWITCH
6. GYRO INSTRUMENT AND SPARE FUSES
7. CIRCUIT BREAKERS
8. COMMAND RADIO CONTROL
△1 9. EMERGENCY KEYER CIRCUIT BREAKER
10. COMMAND RADIO PANEL
11. SIDE PANEL LIGHT CONTROL
12. INSTRUMENT PANEL LIGHT CONTROLS
13. RADIO PANEL LIGHT CONTROL
14. BATTERY AND GENERATOR SWITCH
15. STARTER SWITCH
16. IGNITION SWITCH

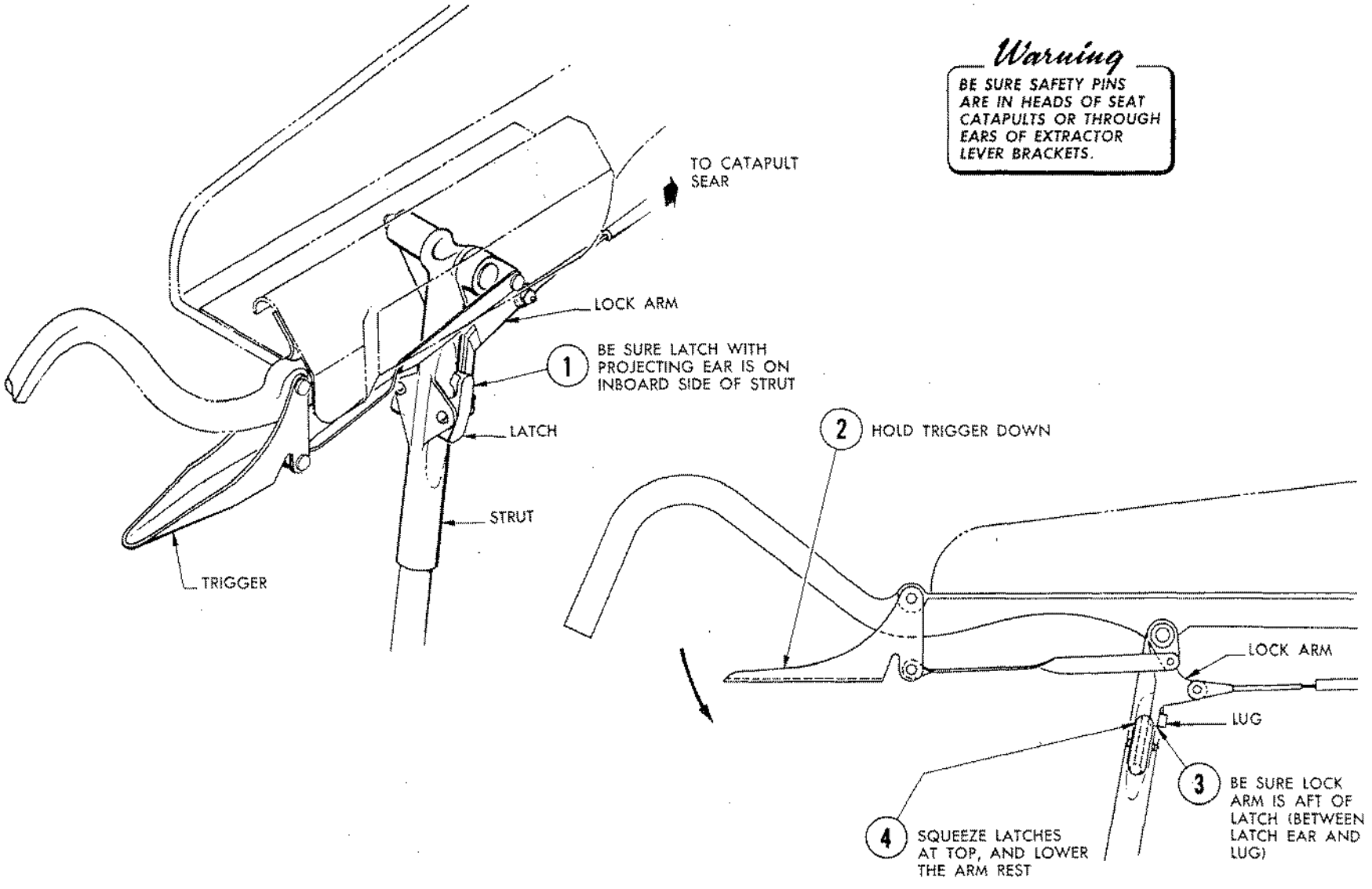
Figure 4-196. Aft Cockpit, Right Side, AF Serial No. 51-9236 and Subsequent

Note

FOLLOW NUMERICAL STEPS FOR LOWERING OF RIGHT ARM REST.

Warning

BE SURE SAFETY PINS ARE IN HEADS OF SEAT CATAPULTS OR THROUGH EARS OF EXTRACTOR LEVER BRACKETS.



CB3292
M20-28B-4-198

RIGHT ARM REST
(SHOWN IN FULL UP POSITION)

Figure 4-197. Lowering of Jettisonable Seat Right Armrest, Prior to AF Serial No. 53-5286

4–1135. On AF Serial No. 51-17537 through 51-17556 and on 52-9485 and subsequent, as the seat is ejected from the cockpit, a telescopic tube pulls the sear pin in the seat belt initiator. A time delay feature in the initiator (for the seat belt) allows the seat (and the occupant) to be at a safe distance from the airplane before the explosive charge in the seat belt initiator is fired. The explosive pressure travels through the hose to the seat belt buckle and automatically unlocks the seat belt.

4–1136. REMOVAL OF SEAT ACTUATOR (PRIOR TO AF SERIAL NO. 53-5286).

WARNING

- Be certain that safety pin (0.080-inch diameter music wire) is installed in catapult initiator.
- On AF Serial No. 51-17537 through 51-17556 and on 52-9485 and subsequent, be certain safety pin is installed in seat belt initiator.
- Be certain safety pin is installed in right armrest strut.

a. Lower seat to full down position.

b. Disconnect electrical receptacle on top of seat actuator.

c. Remove bolt and nut at jackscrew-to-seat attachment point.

d. Remove two cotter pins and two washers at actuator support points.

e. Remove support rod, two spacers and actuator.

4–1137. INSTALLATION OF SEAT ACTUATOR (PRIOR TO AF SERIAL NO. 53-5286). Reverse removal procedure.

WARNING

Keep body clear of ejection path as much as possible.

CAUTION

Do not operate seat adjustment mechanism unless seat is occupied or mechanism will be damaged.

4–1138. SEAT CATAPULT (PRIOR TO AF SERIAL NO. 53-5286). The neck of the M5A-1 catapult has a hose connection, no sear lever, and no safety pins. The only safety pin in the system is installed in the neck of the initiator.

4–1139. INITIATOR (PRIOR TO AF SERIAL NO. 53-5286). *(See figure 4-198.)* The initiator is above the inertia reel on the back of the seat. The initiator is a small cylindrical container incorporating a pressure outlet with a standard pressure fitting, a sear pin, a firing pin, and an explosive cartridge. When the sear pin is pulled, the cartridge delivers an initial maximum pressure of 5200 psi at the pressure outlet.

4–1140. Deleted.

4–1141. SAFETY PRECAUTIONS WHEN HANDLING INITIATOR AND CATAPULT.

a. Visually inspect initiator to assure that no more than four threads are showing between initiator chamber and the initiator cap. If more than four threads are showing, replace initiator with a like serviceable unit.

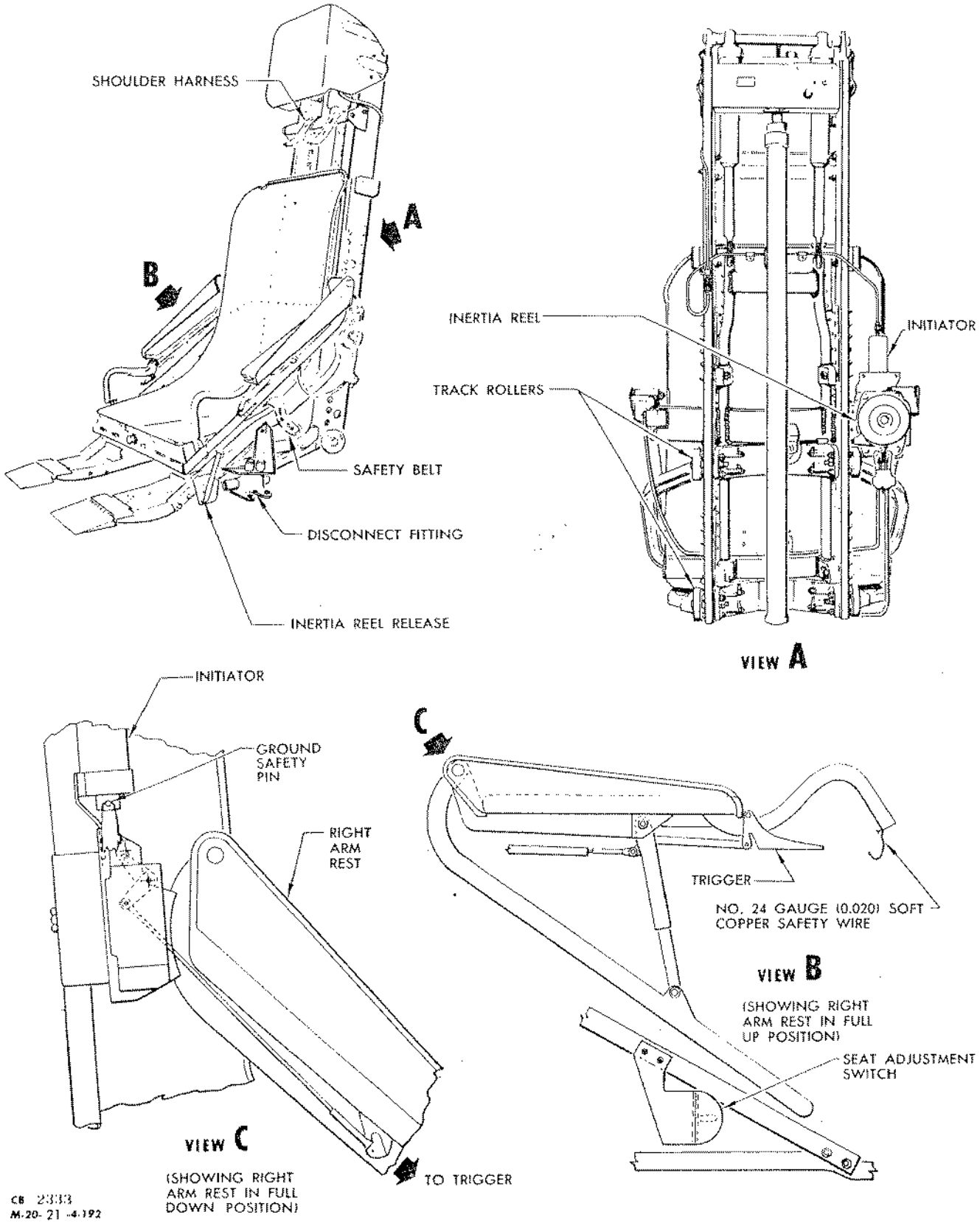


Figure 4-198. Jettisonable Seats, Prior to AF Serial No. 53-5286

b. If a malfunction of initiator or catapult is known or suspected, safety and tag initiator, hose, tubing, and turn over to Base Ordnance Officer for disposition.

4–1142. REMOVABLE OF JETTISONABLE SEAT AND CATAPULT (PRIOR TO AF SERIAL NO. 53-5286). *(See figure 4-198.)*

a. Remove canopy. (Refer to paragraph 4–91.)

WARNING

Be certain safety pin (0.080-inch diameter music wire) is installed in catapult initiator.

Make certain that sear pin is bottomed in initiator and that safety pin is in groove of sear pin and not behind shoulder of sear pin. If safety pin is not in groove of sear pin, the initiator is in armed position.

On AF Serial No. 51-17487 through 51-17556, on 52-9335 and subsequent, and airplanes incorporating T. O. 1T-33A-162, be sure safety pin is installed in canopy initiator. On AF Serial No. 51-17537 through 51-17556 and on 52-9485 and subsequent, be sure safety-pin is installed in seat belt initiator. Be sure red-flagged safety pin is installed in right armrest strut.

b. Disconnect hose from neck of catapult.

c. On AF Serial No. 51-17537 through 51-17556 and on 52-9485 and subsequent and airplanes incorporating T.O. 1T-33A-222, disconnect seat-belt-initiator telescopic tube at initiator.

d. On seats which have the pilots personal leads quick-disconnect assembly located on forward face of seat, remove cable ends from two pins of disconnect assembly.

e. Remove snap ring and washer from one end of pin that connects seat to female trunnion of catapult. Support seat firmly and remove pin. Do not allow seat to drop.

f. Raise and remove seat.

g. Remove bolt attaching catapult mounting bracket to airplane structure and carefully disconnect catapult from airplane structure at lower trunnion.

WARNING

Place catapult in shipping container for storage. Do not store catapults inside any building. Loaded catapults must be stored and handled as live ammunition.

4–1143. SAFETY PRECAUTIONS AND PRE-INSTALLATION CHECK OF CATAPULT AND INITIATOR.

The following inspections must be made and the precautionary measures adhered to before installation of an initiator or catapult.

a. Check the catapult lower cap and the upper trunnion ring to make sure that proper staking has been accomplished.

b. Be sure safety pin (0.080-inch diameter music wire) is installed in neck of initiator. Make certain that sear pin is bottomed in initiator and that safety pin is in groove of sear pin and not behind shoulder of sear pin.

WARNING

If safety pin is not in groove of sear pin, the initiator is in armed position.

c. Be sure initiator cap is staked to initiator cylinder.

d. Check to see that initiator linkage is in proper adjustment.

4–1144. INSTALLATION OF SEAT CATAPULT (PRIOR TO AF SERIAL NO. 53-5286). Install catapult with lower trunnion through mounting brackets. Bolt mounting bracket to airplanes structure.

WARNING

When installing the airfired catapult, movement of aircraft to an open area is not required if initiator hoses are not reconnected until aircraft is removed from hanger.

4–1145. INSTALLATION OF JETTISONABLE SEAT (PRIOR TO AF SERIAL NO. 53-5286). The catapult must be installed before installing jettisonable seat (refer to paragraph 4-1144).

WARNING

Keep body clear of ejection path as much as possible.

Note

On AF Serial No. 51-4076 and subsequent, a retaining strap is stretched between the tracks in the forward cockpit to prevent the catapult tube from pivoting freely when seat is out of the aircraft.

a. Move inertia reel control to the unlocked (aft) position. Verify that when left arm is raised to the latched position, inertia reel is locked. Check by pulling slightly on shoulder harness while simultaneously pulling up on left arm rest.

b. Check adjustment of seat vertical actuator and then verify that all clamps holding cable assemblies to seat are positioned properly and are securely tightened.

c. Lower seat on tracks with care, and make sure that sufficient clearance exists between the seat and catapult, as well as between the seat and fuselage structure, before any attachments are made. Check to see that foot ramps are forward of foot rests as seat approaches cockpit floor. Check to see that male connectors of upper personal-leads-disconnect enter the female connectors of lower personal-leads-disconnect without binding.

WARNING

Do not drop seat. On seats which have the quick-disconnect assembly located on the forward face of the seat be certain that the two halves of the disconnect assembly are retained by passing the cable ends through a drilled hole in two pins of the disconnect assembly. The cable is located under the seat and is attached to the cockpit floor.

d. Attach female trunnion of catapult to ejection seat yoke. Insert spacer washers, one on each side of trunnion, if space is available. Care must be taken to see that spacers do not cause binding.

WARNING

When attaching seat to catapult, exercise extreme care in order to prevent striking any part of catapult, especially the sear (firing lever).

e. Attach hose to neck of catapult.

f. On AF Serial No. 51-17537 through 51-17556 and on 52-9485 and subsequent and airplanes incorporating T.O. 1T-33A-222, connect seat-belt-initiator telescopic tube to initiator.

Note

There must be a minimum of 0.12-inch travel remaining in telescopic tube assembly when seat is in full up position. If the above dimension cannot be obtained, it will be necessary to elongate slot of inner tube, being careful not to increase original diameter of slot.

g. Perform seat jettison check. (Refer to paragraph 4–1146).

4–1146. SEAT JETTISON CHECK (PRIOR TO AF SERIAL NO. 53-5286).

WARNING

Be sure safety pin (0.080-inch diameter music wire) is installed in catapult initiator and seat belt initiator at all times during seat jettison check.

a. Check security of cable housing to seat. No motion is allowed between cable housing and mounting clamps.

b. Raise right arm rest to full up and locked position.

c. Disconnect bell crank link from seat initiator.

d. Attach spring scale to bell crank link.

e. While maintaining a pull of 30 pounds on bell crank link, squeeze trigger on right arm rest and measure distance that bell crank has traveled. Distance must be a minimum of ¾ inch. Remove spring scale.

f. Lower right arm rest to full down position (figure 4-197) and safety with one strand of 0.020-inch diameter soft copper wire.

g. Reconnect link to seat initiator.

4–1147. SAFETY PRECAUTIONS AND INSPECTION AFTER INSTALLATION OF CATAPULT AND JETTISONABLE SEAT (PRIOR TO AF SERIAL NO. 53-5286). The following precautions must be taken and inspections made after installing the catapult and the jettisonable seat.

a. Make sure that a warning placard is stenciled on the exterior of the fuselage between the seats. (See figure 3-2.)

b. Allow only trained personnel to enter cockpit.

c. Check to see that arm rests are full down (figure 4-198) and safetied with one strand of 0.020-inch diameter soft copper wire. Be sure red-flagged safety pin is installed in right armrest strut.

d. Record lot number and serial number of catapult and date of installation on AF form 263A or 263C.

e. Check to see that safety pin (0.080-inch diameter music wire) is installed in initiator. Make certain that sear pin is bottomed in initiator and that safety pin is in groove of sear pin and not behind shoulder of sear pin.

WARNING

If safety pin is not in groove of sear pin, the initiator is in armed position.

f. Check to see that initiator linkage is in proper adjustment.

4–1148. JETTISONABLE SEATS (AF SERIAL NO. 53-5286 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-258). An initiator (with explosive charge) is in the right armrest. The firing trigger, on the right handgrip, is connected through links to the initiator. The initiator is connected through tubing to the type M5A-1 catapult. (See figure 4-199.) For further information on these seats, refer to paragraph 4–1129.

WARNING

On AF Serial No. 53-5286 through 53-5878, 54-1522 through 54-1583 and 54-2689 through 54-2728, the canopy and seat jettison systems are not interconnected. The seats can be jettisoned with the canopy installed. On AF Serial No. 53-5879 through 53-6152 and 54-1584 and subsequent, except 54-2689 through 54-2728, the canopy and seat jettison systems are interconnected. The seat cannot be jettisoned with the canopy installed.

4–1149. On AF Serial No. 53-5486 and subsequent and on airplanes incorporating T.O. 1T-33A-246, a steel headrest is on the seat. This headrest will fracture the canopy plastic panel when jettisoning the seat if the canopy can not be jettisoned.

4–1150. On AF Serial No. 53-5731 through 57-710, and on airplanes incorporating T.O. 1T-33A-222, a type MB-4 shoulder harness is installed instead of a type MB-1.

4–1151. On AF Serial No. 53-5994 through 53-6152 and 55-3017 through 55-4962 except on airplanes incorporating T.O. 1T-33A-222, a type MA-4 seat safety belt is installed instead of a type MA-1. On AF Serial No. 56-1573 and subsequent, and on airplanes incorporating T.O. 1T-33A-222, a type MA-6 seat safety belt is installed instead of a type MA-4. On AF Serial No. 57-711 and subsequent, a type MB-1A shoulder harness is used in lieu of type MB-4.

WARNING

Shoulder harnesses, types MB-3 and MB-4, shall be used with automatic lap belts, types MA-1, MA-2, MA-3 and MA-4. Shoulder harnesses, types MB-1A and MB-2A shall be used with automatic lap belts, types MA-5 and MA-6. Mismatched equipment may cause malfunction and injury to personnel.

4–1152. OPERATION OF SEAT EJECTION MECHANISM (AF SERIAL NO. 53-5286 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-258). Refer to paragraphs 4–1134 and 4–1135.

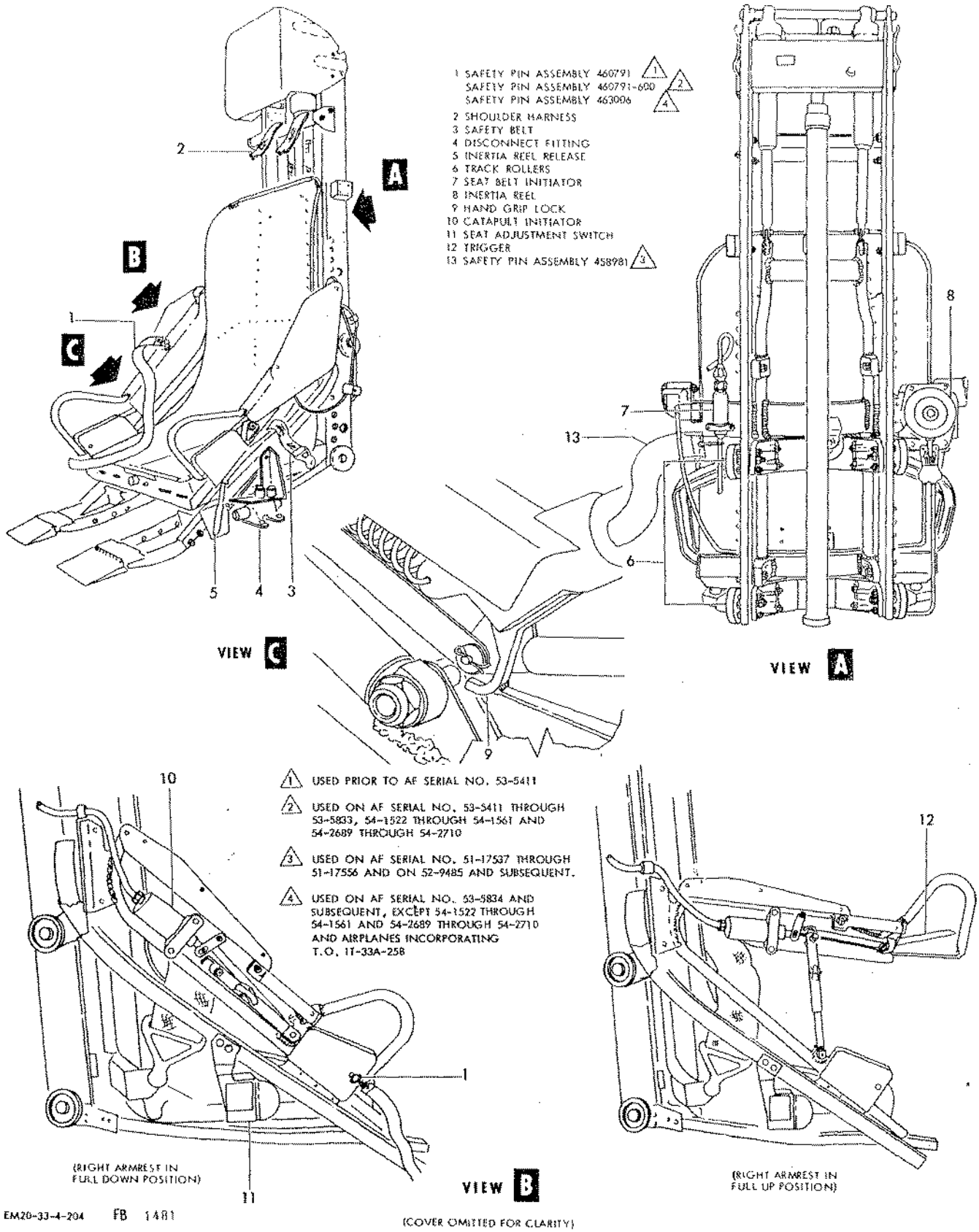


Figure 4-199. Jettisonable Seats, AF Serial No. 53-5286 and Subsequent and Airplanes Incorporating T. O. 1T-33A-258, Except Airplanes Incorporating T. O. 1T-33A-548

4–1153. REMOVAL AND INSTALLATION OF SEAT ACTUATOR (AF SERIAL NO. 53-5286 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-258). Refer to paragraph 4–1136.

4–1154. SEAT CATAPULT (AF SERIAL NO. 53-5286 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-258). Refer to paragraph 4–1138.

4–1155. INITIATOR (AF SERIAL NO. 53-5286 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-258). The initiator is in the right armrest. For further information, refer to paragraphs 4-1139 through 4-1141. For removal and installation of the M3A1 seat catapult initiator see paragraphs 1163AM and 1163AN.

4–1156. REMOVAL OF JETTISONABLE SEAT AND CATAPULT (AF SERIAL NO. 53-5286 AND SUBSEQUENT AND AIRPLANES INCORPORATING T. O. 1T-33A-258). Refer to paragraph 4–1142. On airplanes AF Serial No. 53-5879 and subsequent, except 54-2689 through 54-2728, disconnect canopy jettison lever from thruster initiator (see figure 4-200).

WARNING

Make sure safety pin assembly is installed before removing seat. On AF Serial No. 53-5286 through 53-5410, a 460791 safety pin assembly is installed. On AF Serial No. 54-5411 through 53-5833, 54-1522 through 54-1561 and 54-2689 through 54-2710, a 460791-600 safety pin assembly is installed. On AF Serial No. 53-5834 and subsequent, except 54-1522 through 54-1561 and 54-2689 through 54-2710, a 463006 safety pin assembly is installed.

4–1157. INSTALLATION OF JETTISONABLE SEAT AND CATAPULT (AF SERIAL NO. 53-5286 AND SUBSEQUENT). Refer to paragraphs 4–1143 through 4–1145. On AF Serial No. 53-5879 and subsequent, except 54-2689 through 54-2728, connect canopy jettison lever to thruster initiator (see figure 4-200).

Note

On AF Serial No. 51-4076 and subsequent, a retaining strap is stretched between the tracks in the forward cockpit; on AF Serial No. 57-634 and subsequent, the retaining strap is used in both cockpits. The purpose of the retaining strap is to prevent the catapult tube from pivoting freely when the seat is out of the aircraft.

The armrest pip pin of the safety pin assembly must be removed by a ground crewman before pilot enters airplane. After pilot is seated and is ready for flight, pilot must remove catapult initiator safety pin of the safety pin assembly. On AF Serial No. 53-5286 through 53-5410, a 460791 safety pin assembly is installed. On AF Serial No. 53-5411 through 53-5833, 54-1522 through 54-1561 and 54-2689 through 54-2710, a 460791-600 safety pin assembly is installed. On AF Serial No. 53-5834 and subsequent, except 54-1522 through 54-1561 and 54-2689 through 54-2710, a 463006 safety pin assembly is installed.

On AF Serial No. 56-1624 and subsequent, the aft seat must be adjusted to the up position before installation, to eliminate interference between cable casing and head warmer tube.

4–1158. SEAT JETTISON CHECK (AF SERIAL NO. 53-5286 AND SUBSEQUENT).

WARNING

Make sure safety pin (0.080-inch diameter music wire) is installed in catapult initiator and seat belt initiator at all times during seat jettison check.

a. On AF Serial No. 53-5879 and subsequent, except 54-2689 through 54-2728, disconnect cable between seat arming lever (right armrest) and thruster initiator.

b. Raise right armrest to full up-and-locked position.

c. Disconnect link from seat initiator.

d. Squeeze trigger on right armrest and measure distance that link has traveled. Distance must be a minimum of ¾ inch.

e. Reconnect link to seat initiator.

f. Lower right armrest to full down position.

g. On AF Serial No. 53-5879 and subsequent, except 54-2689 through 54-2728, connect cable between seat arming lever (right armrest) and thruster initiator.

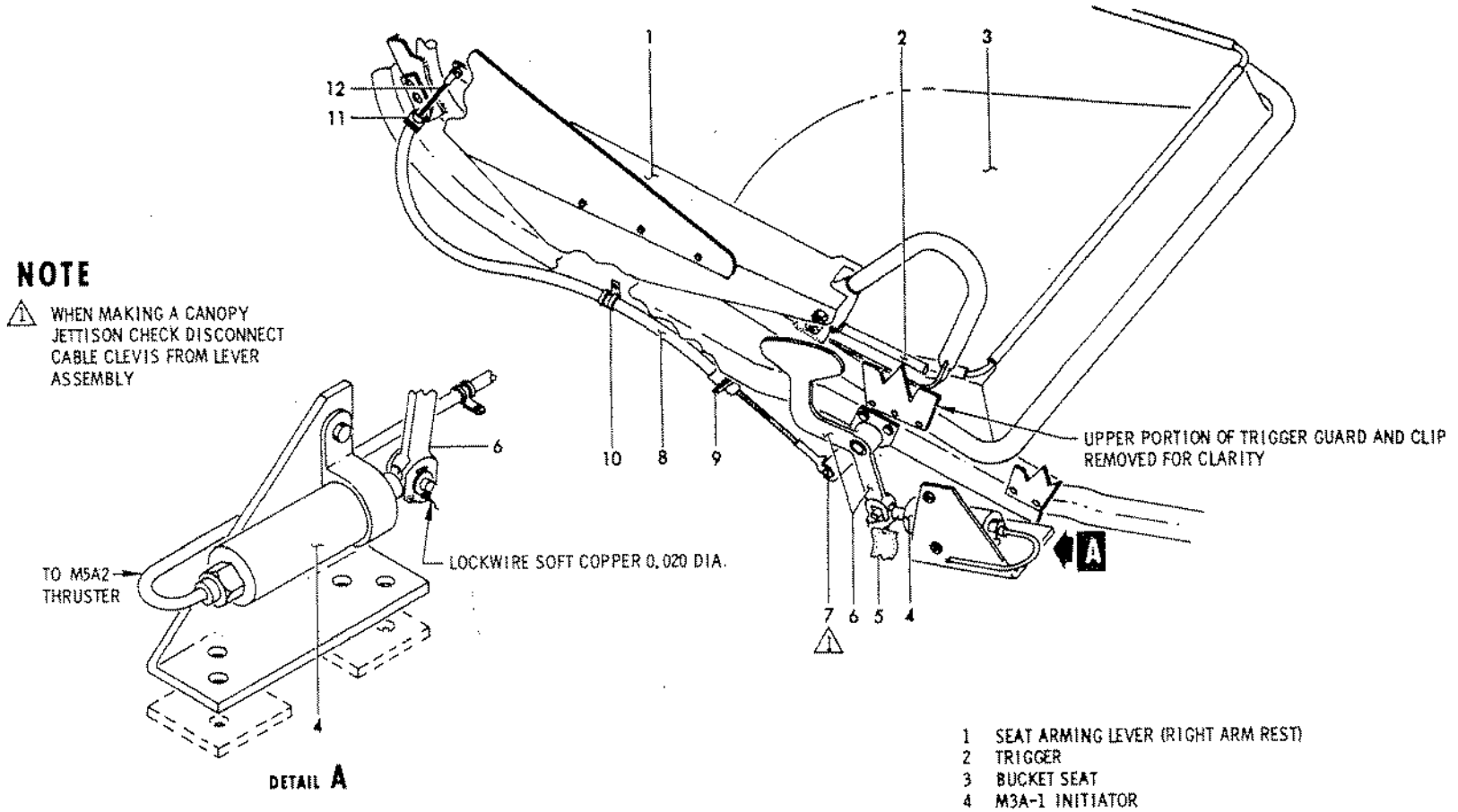


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Figure 4-200. Right Armrest Installation, AF Serial No. 50-5879 and Subsequent, and Airplanes Incorporating T.O. 1T-33A-548 except Serial No. 54-2689 through 54-2728

4–1159. SHOULDER HARNESS INERTIA LOCKING REEL, MODELS 0-3903NN AND 0-4600. The shoulder harness take-up inertia locking reel is mounted on the rear of the seat and is used as a safety device to restrain the forward movement of the occupant from the seat during a crash or any deceleration of an aircraft in excess of 2G's. A complete unit consists of two assemblies, an inertia locking reel assembly and a manual control assembly used to lock or unlock the reel.

4–1160. REMOVAL OF INERTIA LOCKING REEL.

a. Reels that have a swaged type manual control cable will be removed from the manual control by cutting the cable between cable stop and manual control mechanism.

b. Reels that have a terminal end fitting will be removed from manual control by removing terminal nut.

c. Remove reel from seat and pull manual control cable through cable housing. Leave manual control and cable housing attached to seat.

4–1161. INSTALLATION OF INERTIA LOCKING REEL.

a. When installing serviceable reel, thread manual control cable through cable housing and manual control lever fitting.

b. To obtain proper actuation of reel assembly, make necessary adjustments to manual control cable adjusting screw.

4–1162. ADJUSTMENT OF INERTIA LOCKING REEL.

a. If reel will not unlock properly (or if additional travel is required on control handle, armrest or hand grips), adjust as follows:

Loosen screws on cable housing clamp at either end of control cable housing.

Push cable housing into cable clamp slightly.

Tighten clamp screw and check reel for proper operation. Repeat this operation if further adjustment is required.

b. If reel will not lock properly (or if less travel is required on control handle, armrest or hand grip), adjust as follows:

Loosen screws on cable housing clamp at either end of control cable housing.

Pull cable housing out of clamp slightly.

Tighten clamp screws and check reel for proper operation. Repeat this operation if further adjustment is required.

4–1163. OPERATION CHECK OF INERTIA LOCKING REEL. To assure positive manual locking, inertia reels will be checked as follows:

a. With manual control in unlocked position, fully extend harness cable. When manual control is placed in locked position, cable should retract into case.

b. Slowly move control handle two-thirds of way to locked position. When harness cable is extended, teeth will make contact and lock.

c. Pull harness, cable out approximately ten inches. Place manual control in locked position. Pull harness against lock and hold pressure while moving manual control back to unlocked position. Harness cable should remain locked in extended position until manual control is moved to locked position and back to unlocked position.

4-1163A. EMERGENCY ESCAPE SYSTEM (AIRPLANES INCORPORATING T. O. 1T-33A-615). (See figures 4-200A through 4-200L.) The emergency escape system provides safe seat ejection, automatic pilot seat separation and parachute deployment when it becomes necessary for the flight crew to leave the airplane under emergency conditions.

4–1163B. The emergency escape system incorporates the following design features:

a. A rocket catapult for each seat which will ensure safe ejection from the aircraft at ground level at an airspeed of 120 knots.

b. An inertia reel and shoulder harness system.

c. An automatic lap belt release.

d. An automatic pilot-seat separator device which insures positive separation of the pilot from the seat during ejection.

e. Right armrest linkage which permits positive actuation of the primary canopy jettison system and triggering of the seat ejection system.

f. A secondary canopy jettison system which is independent of and a true back-up for the primary canopy jettison system.

g. An ejection sequencing system which allows ejection of the aft seat first and the forward seat one-half second later.

4–1163C. The canopy jettison system forms a part of the emergency escape system. For information concerning description and maintenance of this system, refer to paragraph 4-120A.

4–1163D. EJECTION SEATS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-200A.)* The ejection seats are formed from sheet metal and are mounted on a tubular frame. Seat guide rails, which guide the seat upwards during ejection, are permanently attached to the airplane. Rollers on the seat ride on the rails. The basic components of the ejection seat system consist of the following:

a. Canopy breaker.

b. Headrest.

c. Seat adjustment actuator.

d. Inertia reel and shoulder harness.

e. MA-6 lap belt.

f. Pilot-seat separator system.

g. Right armrest (trigger mechanism).

h. (Deleted)

i. Airplane and ejection seat disconnects.

j. Rocket catapult.

k. Initiator panel.

l. M3A-1 pin-fired initiators (2 each seat).

m. M32 pin-fired initiators (1 each seat).

n. M72 gas-fired initiators (2-initiator panel, forward seat).

o. M28 gas-fired initiators (2-initiator panel, forward seat).

p. Safety pins.

q. Tubing and hoses.

4–1163E. CANOPY BREAKER. *(See figure 4-200A.)* The canopy breaker is part of the basic structure of the seat and is at the extreme top of the seat (above and aft of the headrest). The breaker is designed to break the canopy plastic on impact in the event the canopy cannot be jettisoned.

4–1163F. HEADREST. *(See figure 4-200A.)* The headrest is located immediately below and forward of the canopy breaker and serves to support the pilots head.

4–1163G. SEAT ADJUSTMENT ACTUATOR. *(See figure 4-200A.)* The seat adjustment actuator, which provides for vertical adjustment of the seat, is an electrically-driven unit incorporating limit switches, an electrical receptacle, and twin screw jacks. The actuator is installed behind the headrest on the right side. The screw jacks are diametrically opposite each other. The actuator provides 4.00 (±0.25) inches of seat adjustment measured parallel to the seat rails. A double-pole double-throw control switch is located on the right lower side of the seat. When the switch is held in the down position, the seat will be lowered. When the switch is held in the up position, the seat will be raised. When the switch is released, it will return to the OFF (center) position.

CAUTION

To avoid jamming the seat in the up position, do not operate the seat adjustment switch unless the seat is occupied.

4–1163H. REMOVAL OF SEAT ADJUSTMENT ACTUATOR. Refer to paragraph 4–1136.

4–1163J. INSTALLATION OF SEAT ADJUSTMENT ACTUATOR. Refer to paragraph 4–1137.

4–1163K. ADJUSTMENT OF SEAT ADJUSTMENT ACTUATOR LIMIT SWITCHES. Refer to paragraph 4–960.

4–1163L. INERTIA REEL AND SHOULDER HARNESS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-200C.)* An inertial reel and shoulder harness is installed on each seat. The inertia reel consists primarily of a case, a spring-loaded spool on which a high strength strap winds or unwinds, an inertia locking mechanism, and a manual cable-operated locking mechanism. The inertia reel is mounted on a bracket which closes the underside of the seat headrest and the seat back structure. An extension shaft is attached to the inertia reel and is connected to a lever and control cable to the inertia reel lock lever. The inertia reel lock lever is located on the lower left side of the seat. The lock lever is also attached to the left armrest of the seat through a cable, so that when the armrest is raised the inertia reel is automatically locked. The lock lever has two positions: "LOCKED"

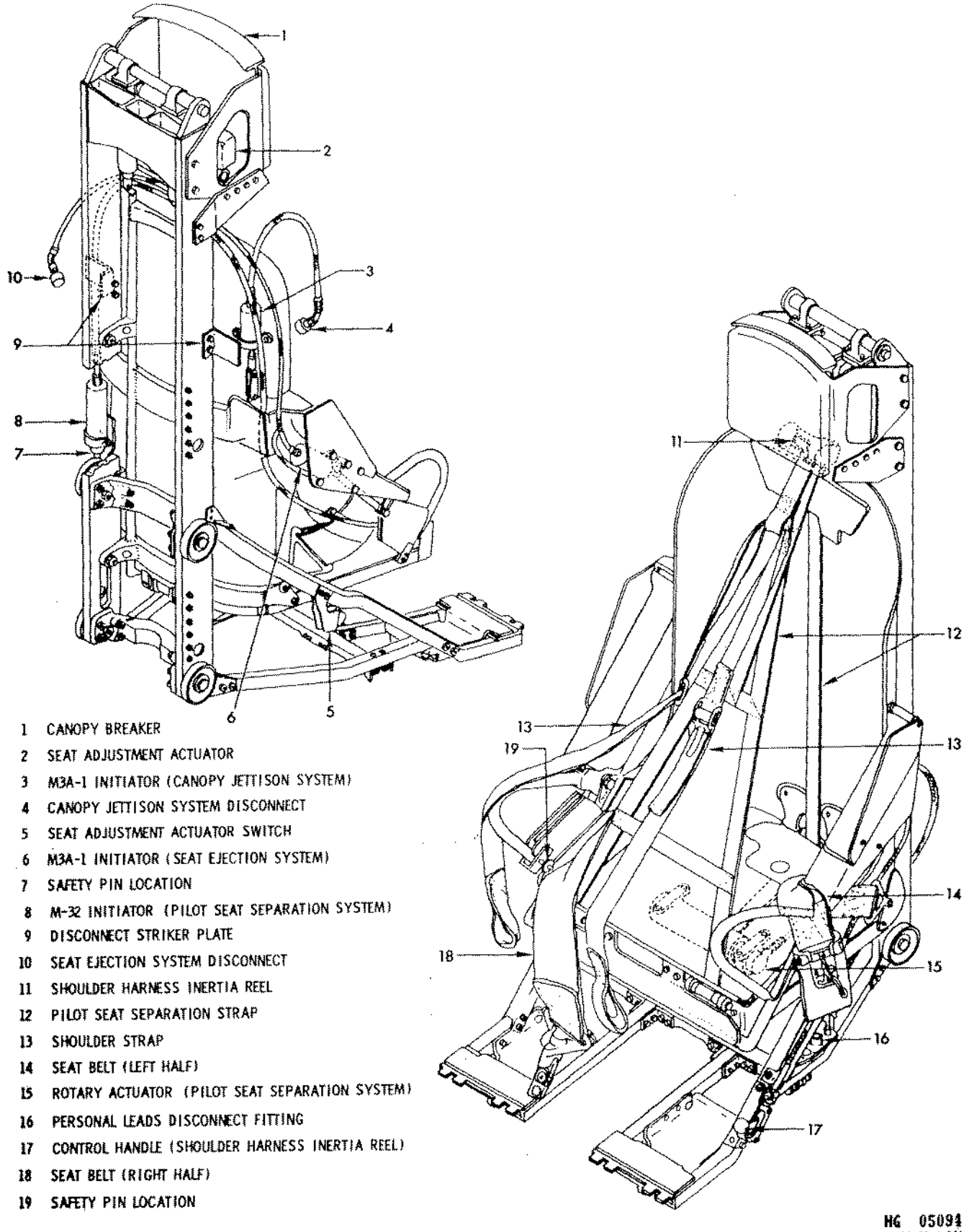

Figure 4-200A. Ejection Seat, Airplanes Incorporating T.O. 1T-33A-615

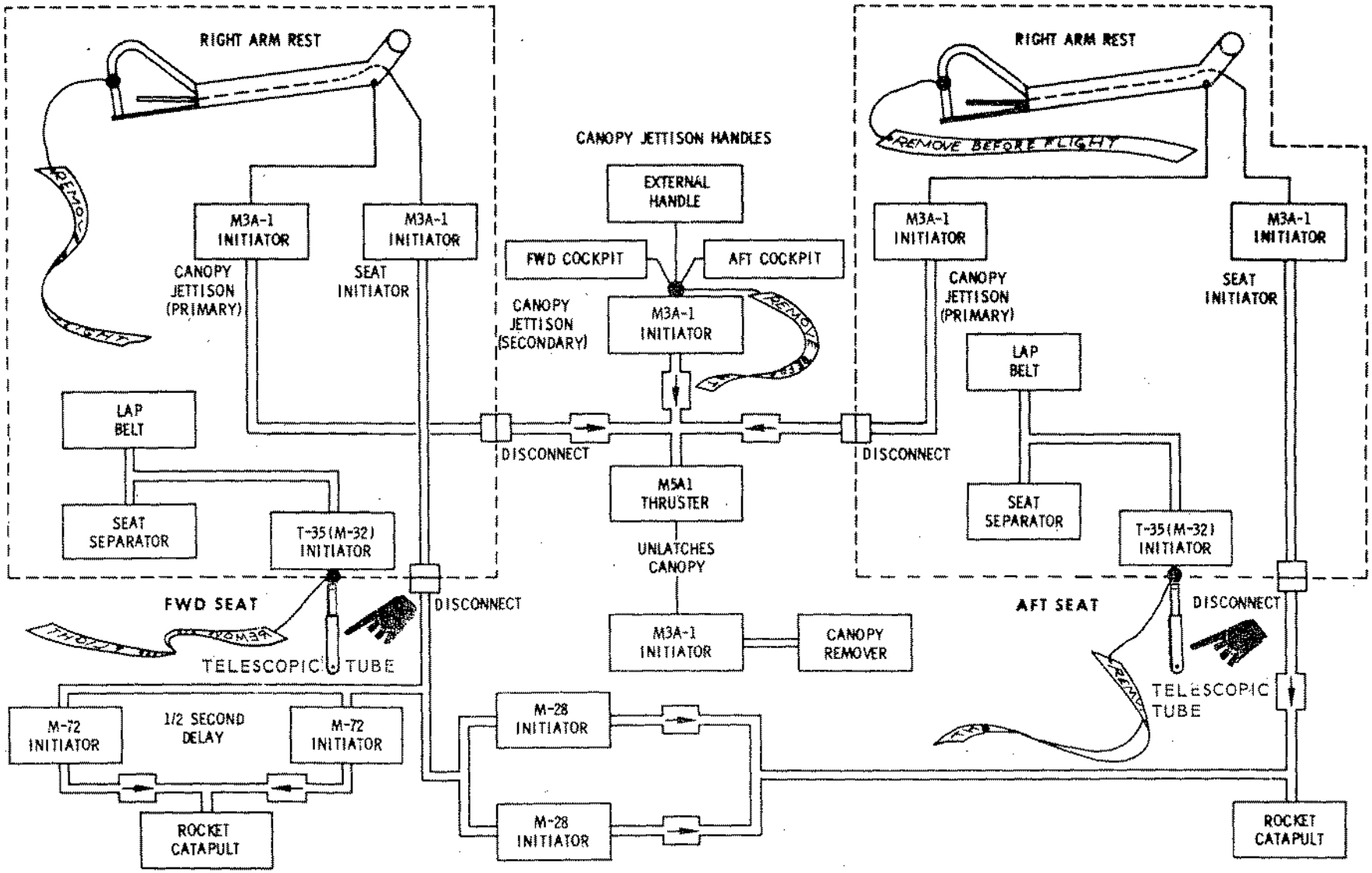

Figure 4-200B. Escape System Schematic Airplanes Incorporating T.O. 1T-33A-615

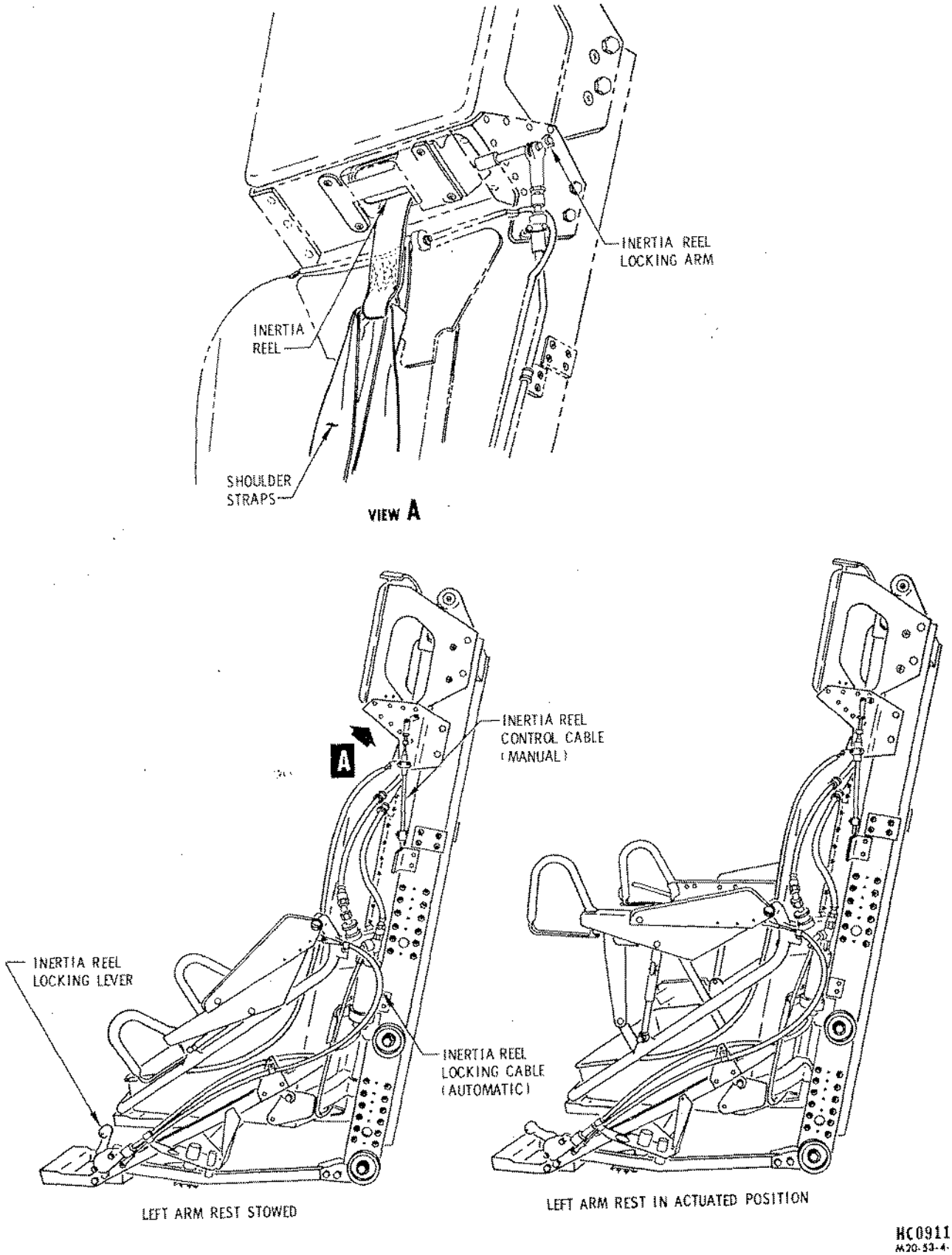

Figure 4-200C. Inertia Reel and Shoulder Harness, Airplanes Incorporating T. O. 1T-33A-615

and "UNLOCKED." When the lever is in the UNLOCKED position, the pilots shoulders may be moved forward, backward, or to the side at will. Under this condition, the reel will simply wind and unwind as the shoulders move. However, with any sudden unwinding of the reel strap equivalent to 2 to 3 G's, the reel will lock automatically, thus restraining the pilot. When the reel is locked in this manner, it will remain locked until the lock lever is moved to the "LOCKED" position and then returned to the "UNLOCKED" position. When the lock lever is in the "LOCKED" position, the reel harness cable is manually locked so that the pilot is prevented from bending forward.

4–1163M. REMOVAL OF INERTIA REEL (AIRPLANES INCORPORATING T. O. 1T-33A-615).

a. Disconnect control cable from inertia reel extension shaft lever.

b. Remove the four screws that attach the inertia reel to the bracket on the underside of the headrest.

4–1163N. INSTALLATION OF INERTIA REEL (AIRPLANES INCORPORATING T. O. 1T-33A-615). Reverse the removal procedure.

4–1163P. INERTIA REEL AND SHOULDER HARNESS TEST PROCEDURE (AIRPLANES INCORPORATING T. O. 1T-33A-615).

a. Place the inertia reel lock lever in the "UNLOCKED" position (aft).

b. Pull the shoulder harness slowly forward from the inertia reel to its full travel. The harness shall move freely against the inertia reel spring. Allow the harness to re-wind on the reel with a controlled movement. Operation shall be free and smooth with no evidence of binding or stopping. Repeat this cycle a minimum of five times.

c. Pull the shoulder harness to approximately half travel of the inertia reel. Apply a sudden hard pull (jerk) to the harness. The inertia reel shall lock, preventing further forward travel.

d. Relieve the load on the harness and allow it to re-wind on the reel with a controlled movement.

e. Place the inertia reel lock lever in the "LOCKED" position (forward) and then back to the "UNLOCKED" position. This action is necessary to unlock the inertia reel.

f. Repeat steps c, d, and e twice, using two different starting positions of shoulder harness extension.

g. Pull the left armrest to its full up position and apply a hard forward pull to the shoulder harness. The harness shall be locked, allowing no forward travel.

h. Re-stow the left armrest.

i. Place the inertia reel lock lever in the "LOCKED" position and apply a hard forward pull to the shoulder harness. The harness shall be locked, allowing no forward travel.

j. Repeat step i twice, using two different starting positions of shoulder harness extension.

Note

The inertia reel lock lever must be placed in the "UNLOCKED" position to move the harness to different starting points. Place the lock lever in the "LOCKED" position for each starting point before proceeding with test.

k. Upon completion of the test, place the inertia reel lock lever in the "UNLOCKED" position.

4–1163Q. MA-6 LAP BELT (AIRPLANES INCORPORATING T. O. 1T-33A-615). *(See figures 4-200A and 4-200D.)* The MA-6 lap belt is an automatic opening belt which is actuated by gas pressure from an M32 initiator installed on the aft left side of the seat. A pressure hose from the initiator attaches to a fixture in the buckle assembly of the belt. Manual release of the belt is also provided by operation of a manual release lever on the buckle assembly. The fittings on each end of the belt are permanently attached to the basic structure of the seat by bolts. The buckle has a swivel link on which the pilots parachute lanyard anchor and the two loop ends of the shoulder harness are inserted. When the lap belt is separated by gas pressure, the shoulder harness loop ends are released; however, the parachute lanyard anchor is retained by a shoulder on the swivel link. When the lap belt is separated by the manual release lever, both the shoulder harness loop ends and the parachute lanyard anchor are released. The parachute lanyard anchor can be installed on the swivel link only by use of the manual release lever.

4–1163R. PILOT-SEAT SEPARATOR SYSTEM (AIRPLANES INCORPORATING T. O. 1T-33A-615). *(See figures 4-200A and 4-200D.)* This system consists of a rotary actuator which is mounted on the underside of the seat. A separator strap extends from the actuator, over a roller mounted in the lower aft side of the seat bucket, up the forward side of the seat bucket, over another roller at the top of the bucket, back down the seat bucket, along the seat pan, and finally to the front of the seat bucket where it is attached. The rotary actua-

tor is a cartridge-operated device which is initiated by the same M32 initiator that releases the lap belt. The actuator contains a piston, screw jack, and reel. The gas pressure from the initiator fires the cartridge in the actuator causing the piston to move along its stroke. This action causes the screw jack to turn the reel which winds up the separator strap. The strap is then drawn tight diagonally across the seat bucket, forcibly separating the pilot from the seat. The actuator provides a stroke of approximately 15 inches, which is more than adequate to deploy the strap across the seat bucket. The strap is divided to form a Y to insure even distribution of load to the pilot during operation of the system.

4–1163S. REMOVAL OF PILOT-SEAT SEPARATOR STRAP AND ROTARY ACTUATOR (AIRPLANES INCORPORATING T.O. 1T-33A-615).

WARNING

Make certain that the safety pin is properly installed in the M-32 initiator before disconnecting the hose from the rotary actuator.

Note

The ejection seat must be removed from the airplane before the separator strap and rotary actuator can be removed.

a. Remove the two screws that attach the two segments of the strap to the forward edge of the seat bucket.

b. Remove the six bolts from the bracket that attaches the strap and roller to the top of the seat bucket.

c. Slide the strap assembly through the opening at the lower aft side of the seat bucket.

d. Disconnect the initiator hose from the rotary actuator.

e. Remove the four bolts from the mounting lugs that attach the rotary actuator to the bottom of the seat structure.

4–1163T. INSTALLATION OF PILOT-SEAT SEPARATOR STRAP AND ROTARY ACTUATOR (AIRPLANES INCORPORATING T.O. 1T-33A-615).

a. Attach the rotary actuator to the bottom of the seat structure by installing the four bolts in the mounting lugs.

b. Slide the strap assembly over the lower roller and through the opening in the lower aft side of the seat bucket.

c. Secure the top roller and strap to the top of the seat bucket by installing the bracket and six bolts that hold the roller and strap in place.

d. Install the two screws that secure the two segments of the strap to the forward edge of the seat bucket.

e. Connect the M32 initiator hose to the rotary actuator.

WARNING

Make certain that the safety pin is properly installed in the M32 initiator before connecting the hose to the rotary actuator.

4–1163U. RIGHT ARMREST (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-200E.)* The right armrest is the primary control for initiating the entire ejection sequence. The armrest consists of a lever and handle arrangement and a trigger mechanism. The armrest lever is connected, through linkage, to an M3A-1 initiator which is provided to actuate the canopy release mechanism (see paragraph 4–120B). The trigger mechanism is connected, through linkage, to an M3A-1 initiator which is provided to actuate the seat ejection system. This initiator is located in the right armrest. When the armrest is raised, the canopy jettison initiator is fired and the canopy is jettisoned. Raising the armrest also cocks the trigger mechanism and exposes the trigger handle. Squeezing the trigger handle fires the seat ejection initiator to eject the seat.

4–1163V. An ejection sequencing system is incorporated to prevent the aft seat occupant from being subjected to rocket blast and heat from the forward seat rocket during ejection. (See figure 4-200B.) The forward seat ejection system is interconnected with the aft seat ejection system so that when the forward seat trigger handle is squeezed, the M3A-1 seat ejection system initiator in the forward seat armrest is fired. Gas pressure from this initiator then fires two M28 initiators which in turn fire the aft seat rocket catapult to eject the aft seat. The gas pressure from the M3A-1 seat ejection initiator simultaneously fires two M72 0.5 second delay initiators which fire the forward seat rocket catapult. This action ejects the forward seat one-half second after the aft seat is ejected. Dual initiators are incorporated in the sequencing system to provide increased reliability. Check valves are installed to prevent interconnecting the dual systems. Squeezing the aft seat trigger handle fires the

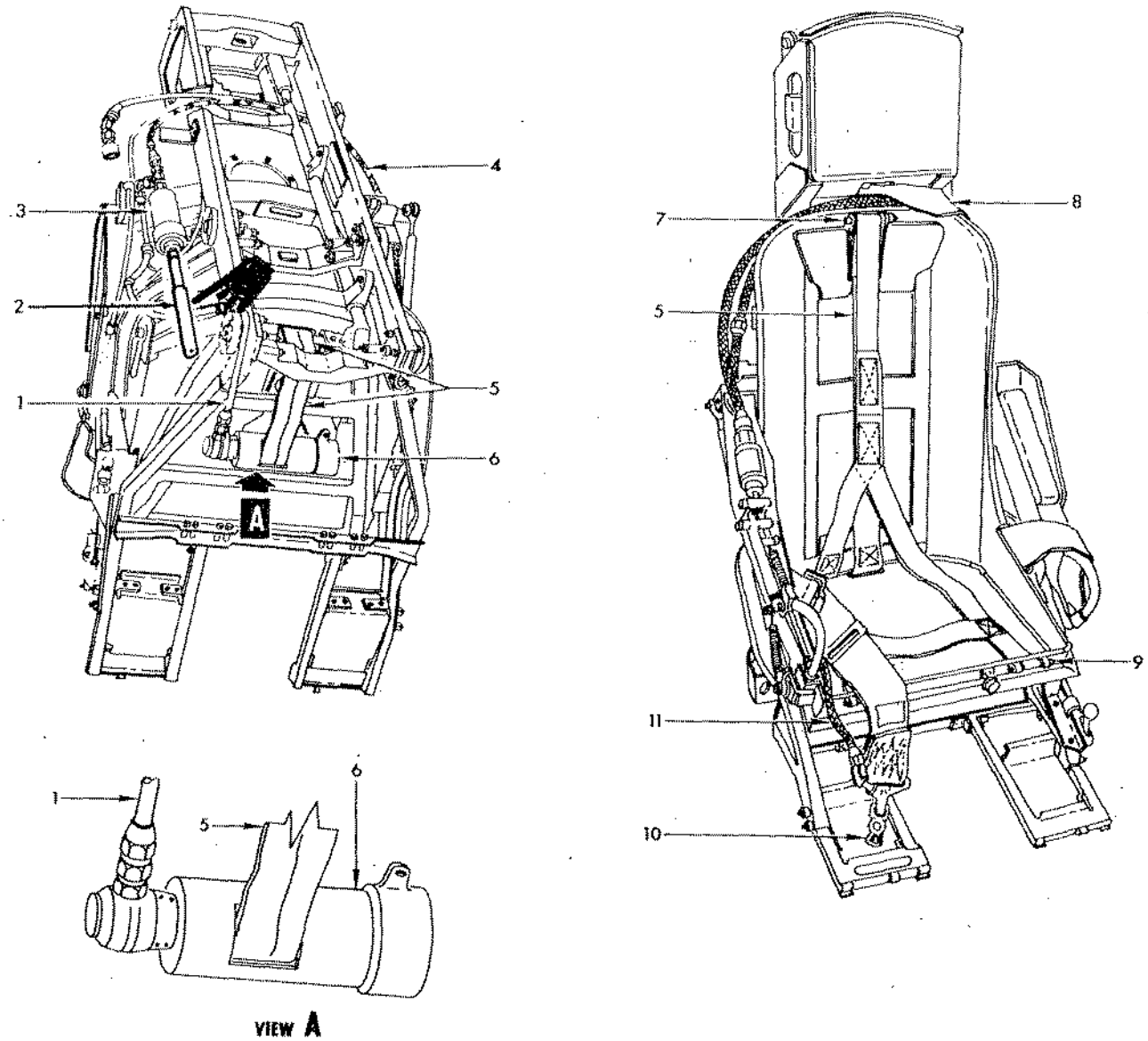

Figure 4-200D. Pilot-Seat Separator System, Airplanes Incorporating T. O. 1T-33A-615

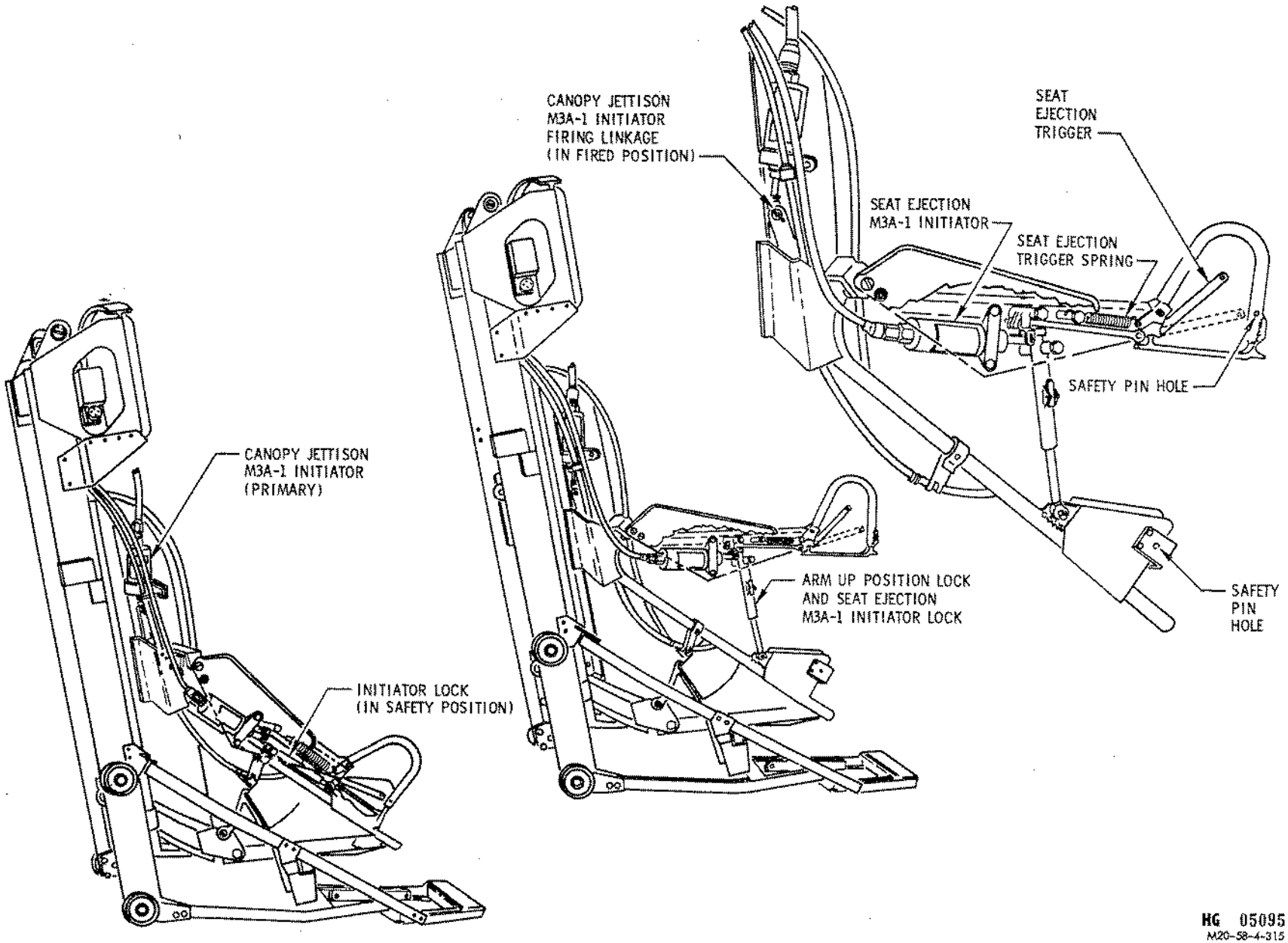

Figure 4-200E. Installation and Actuation of Right Arm of Ejection Seat, Airplanes Incorporating T.O. 1T-33A-615

M3A-1 initiator in the aft seat armrest. The gas from this initiator is routed directly to the aft seat rocket catapult to fire and eject the aft seat only.

Note

The canopy can be jettisoned from either cockpit.

4–1163W through 4–1163X. (Deleted)

4–1163Y. AIRPLANE AND EJECTION SEAT DISCONNECTS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figures 4-200A and 4-200G.)* Two disconnects are located on each seat, one for the primary canopy jettison system and one for the seat ejection system. The disconnect for the canopy jettison system is located on the right side of the seat and the disconnect for the seat ejection system is located on the left side of the seat. The airplane half of the disconnects (male fittings) are attached to the seat rails. The seat half of the disconnects (female fittings) are attached to the seat bucket. The female fitting for the canopy jettison system is attached through a hose to an M3A-1 initiator located on the right side of the seat bucket. The male fitting for this system is attached to the canopy jettison mechanism. (See paragraph 4–120B.) The female fitting for the ejection seat system is attached through a hose to an M3A-1 initiator located in the right armrest. The male fitting is attached to the rocket catapult cartridge housing. During ejection, a striker plate on each side of the seat trips a lever in each disconnect, automatically disconnecting the hoses. A multiple unit quick-disconnect fitting is also located on the left lower side of each seat to automatically disconnect oxygen, radio, and G-suit lines when the seats are ejected.

4–1163Z. ROCKET CATAPULT (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figures 4-200G and 4-200H.)* A rocket catapult is attached to the backside of each seat. The cylinder of the catapult is attached to the airplane structure. The rocket nozzle is located in such a way that the centerline of thrust is approximately one inch below the cg of the ejected seat. This will insure against tumbling of the seat during rocket firing. The rocket catapult consists of a rocket motor which is sealed at the nozzle end by a cap to form a piston, a cylinder, and a cartridge housing which is attached to the side of the cylinder. During normal installation, the rocket motor (piston) is locked to the cylinder barrel by a lock installed in the base of the cartridge housing. The cartridge is fired by gas pressure from initiators located on the seat. (See figures 4-200B and 4-200J.) A minimum of 500 psi in the inlet port is required to release the firing pin to fire the cartridge. When the cartridge fires, the gas pressure relieves the piston lock and causes the piston to move up a stroke. Near the end of the piston stroke, the rocket motor sealing cap contacts a shoulder in the cylinder barrel which causes the cap to strip off, permitting gas from the catapult cartridge to enter the rocket nozzle. The hot gases from the catapult cartridge fires an igniter (at the base of the rocket motor) which ignites the propellant. An igniter is also installed in the upper end of the rocket motor to insure uniform ignition of the propellant. Separation of the rocket motor from the cylinder barrel takes place as the seat leaves the seat rails. The catapult portion of the operation takes place in 0.15 seconds. The rocket motor burns with a maximum thrust of 6000 pounds and 15G's acceleration.

4–1163AA. REMOVAL OF ROCKET CATAPULT (AIRPLANES INCORPORATING T.O. 1T-33A-615). Refer to paragraph 4–1163AH.

4–1163AB. INSTALLATION OF ROCKET CATAPULT (AIRPLANES INCORPORATING T.O. 1T-33A-615). Refer to paragraph 4–1163AJ.

4–1163AC. M3 INITIATORS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-200A.)* Two M3A-1 initiators are installed on each seat. One is provided to supply gas pressure to the canopy jettison system and is located on the right side of the seat bucket. The other provided to supply gas pressure to the seat ejection system and is located in the right armrest. The initiators are pin-fired and are instantaneous.

4–1163AD. M32 INITIATORS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figures 4-200A and 4-200D.)* An M32 initiator is installed on each seat to provide gas pressure to release the lap belt and to simultaneously actuate the rotary actuator in the pilot-seat separator system. The initiator is a pin-fired 1 ($\pm$0.2) second delay unit and is fired during seat ejection by a telescopic tube attached to the firing pin and to the eye bolt on the cockpit floor.

4–1163AE. M72 INITIATORS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-200J.)* Two M72 initiators are installed on an initiator panel located on the backside of the forward seat. The initiators are provided to supply gas pressure to the forward seat rocket catapult to eject the forward seat. The initiators are gas-fired, 0.5 second delay units and are fired by the seat ejection system M3A-1 initiator on the forward seat.

4–1163AF. M28 INITIATORS (AIRPLANES INCORPORATING T.O. 1T-33A-615). *(See figure 4-200J.)* Two M28 initiators are installed on the initiator panel located on the backside of the forward seat. The initiators are provided to supply gas pressure to the aft seat rocket catapult to eject the aft seat. The initiators are gas-fired, instantaneous units and are fired by the seat ejection system M3A-1 initiator on the forward seat.

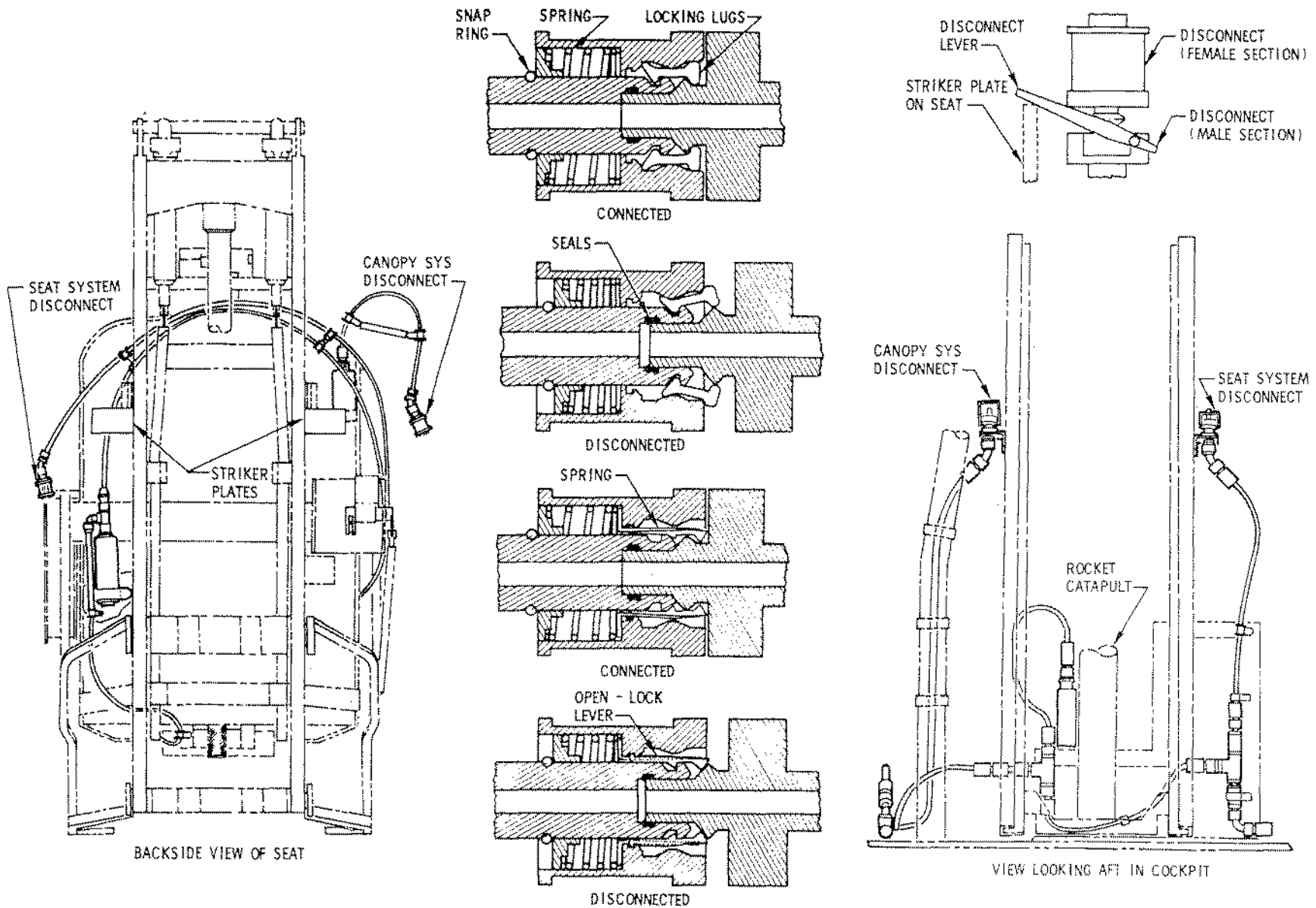

Figure 4-200G. Airplane and Ejection Seat Disconnects, Airplanes Incorporating T.O. 1T-33A-615

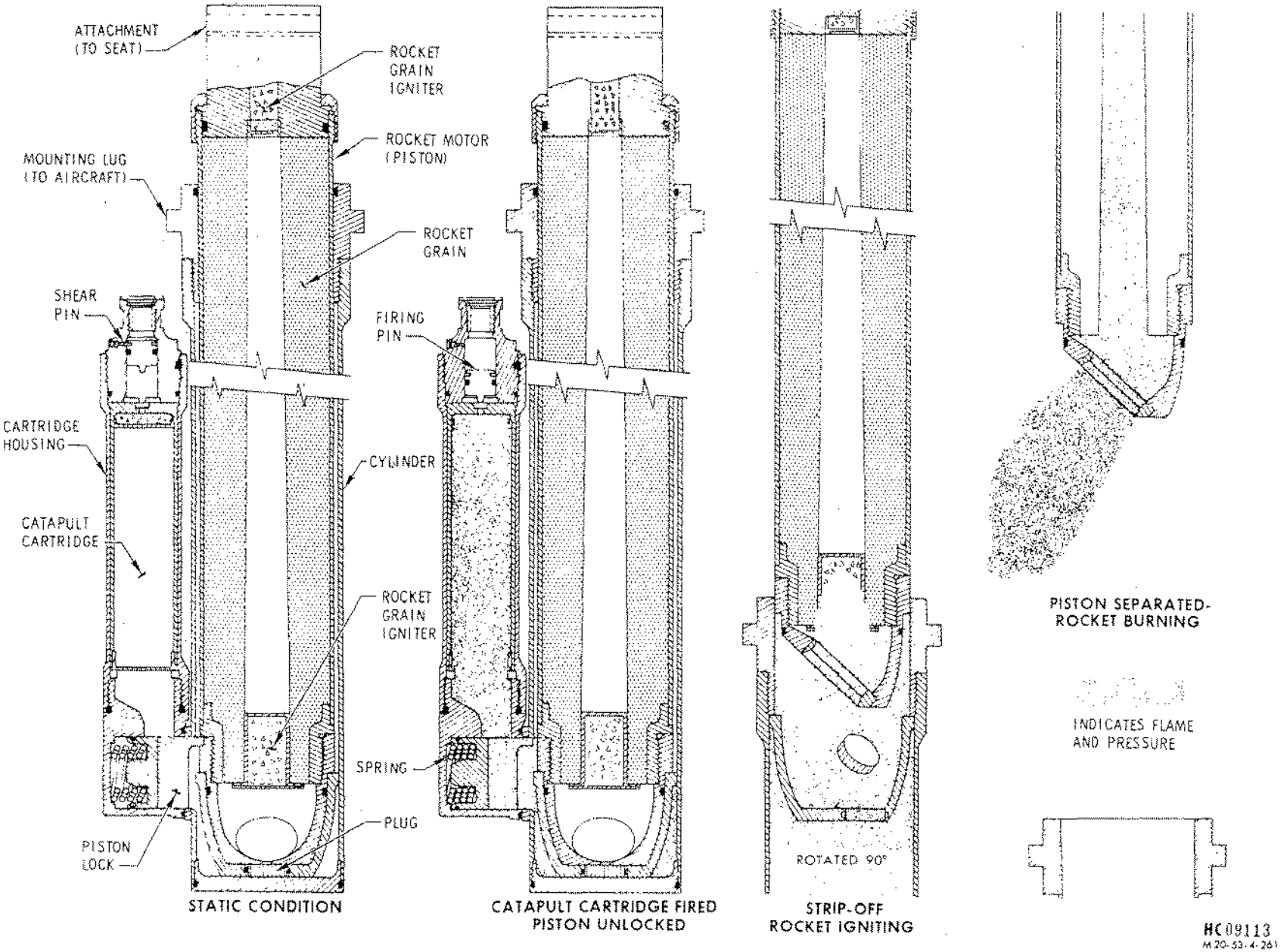

Figure 4-200H. Rocket Catapult, Airplanes Incorporating T. O. 1T-33A-615

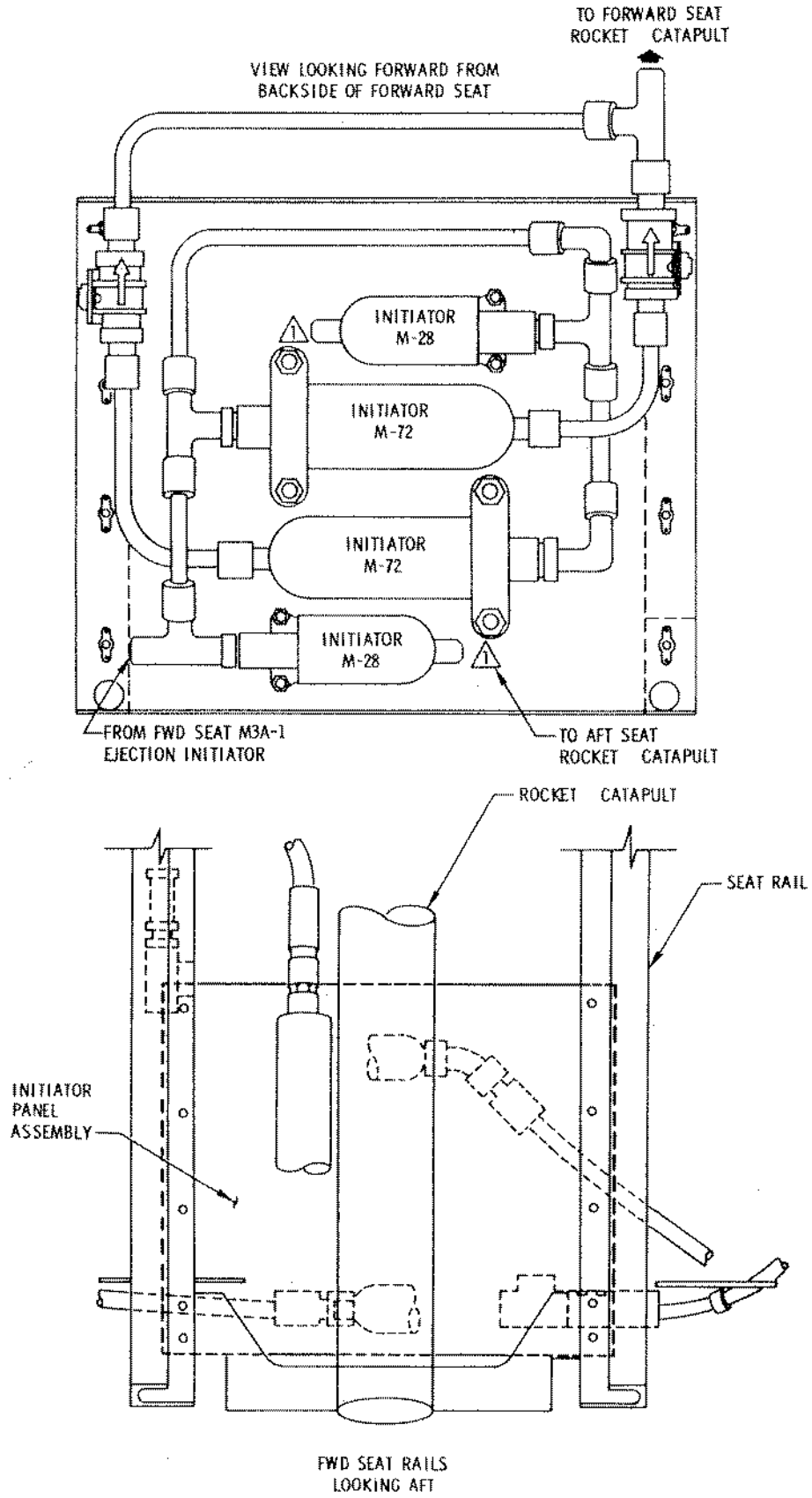

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Figure 4-200J. Ejection Seat Initiator Panel Installation, Airplanes Incorporating T.O. 1T-33A-615

4-1163AG. Provisions for installation of safety pins are located at the M3A1 seat catapult initiators in the right hand armrests, in the lower forward ends of the right hand armrests in both cockpits and at the secondary M3A1 canopy jettison initiator on the right hand side of the rear cockpit. These are flight status safety pins and are to be removed by the pilot and crew member prior to flight. Additional ground handling safety pin provisions are located at the M-32 lap belt/pilot/seat separator initiators and at the M3A1 primary canopy jettison initiators on the back of each seat, as well as at the M3A1 canopy remover initiator on the right hand canopy sill. Ground handling safety pins are removed by ground personnel prior to releasing the aircraft to the flight crew.

WARNING

Make sure that all initiator safety pins are installed in the correct manner as shown in figure 4-200L.

Note

The safety pin engages an annular groove in the initiator firing pin when properly installed and practically no motion of the shaft is possible. However, if the initiator firing pin is pulled out slightly from the initiator, the safety pin can be installed with no protection gained, as the initiator can be fired with the safety pin installed in this manner. If this condition is found to exist, preload on the initiator pin is indicated and should be corrected before proceeding further.

4-1163AH. REMOVAL OF EJECTION SEAT AND ROCKET CATAPULT (AIRPLANES INCORPORATING T.O. 1T-33A-615).

a. Remove canopy. (Refer to paragraph 4-92.)

WARNING

Make sure that all safety pins, as shown in figure 4-200K, are installed and remain installed during removal procedure. Make sure that all initiator safety pins are installed in the correct manner as shown in figure 4-200L.

b. Adjust seat full up and disconnect the pilot-seat separator telescopic tube from the initiator firing pin.

c. Disconnect electrical quick disconnect plug at floor on left side of seat.

d. Disconnect the canopy and seat ejection system quick disconnect fittings on each side of the seat at the seat rails.

e. (Deleted)

f. Remove snapring and washer from one end of pin that connects seat to female trunnion of catapult. Support seat firmly and remove pin. Do not allow seat to drop.

g. (Deleted)

h. Remove seat from aircraft. Cover oxygen disconnect fitting (do not use tape). Disconnect canopy and seat ejection system hoses at female quick disconnect sockets. Install caps on sockets and plugs in hoses. Reinstall quick disconnect sockets on nipples at the seat rails.

hA. Disconnect the initiator hose assembly from the rocket catapult cartridge housing. Cap openings.

i. Remove bolts that attach catapult mounting bracket to aircraft structure and carefully disconnect catapult from airframe structure at lower trunnion. Remove catapult.

j. Remove initiator panel from forward seat rails - cap/plug openings. Remove initiators from seat-cap/plug openings.

WARNING

Place catapult in shipping container for storage. Do not store catapults inside any building. Loaded catapults must be stored and handled as live ammunition.

4-1163AJ. INSTALLATION OF ROCKET CATAPULT AND EJECTION SEAT (AIRPLANES INCORPORATING T.O. 1T-33A-615).

a. (Deleted)

b. (Deleted)

c. Install catapult in the airplane with lower trunnion through mounting bracket, making certain that the rocket nozzle is facing aft. Connect initiator hose assembly to the rocket catapult cartridge housing.

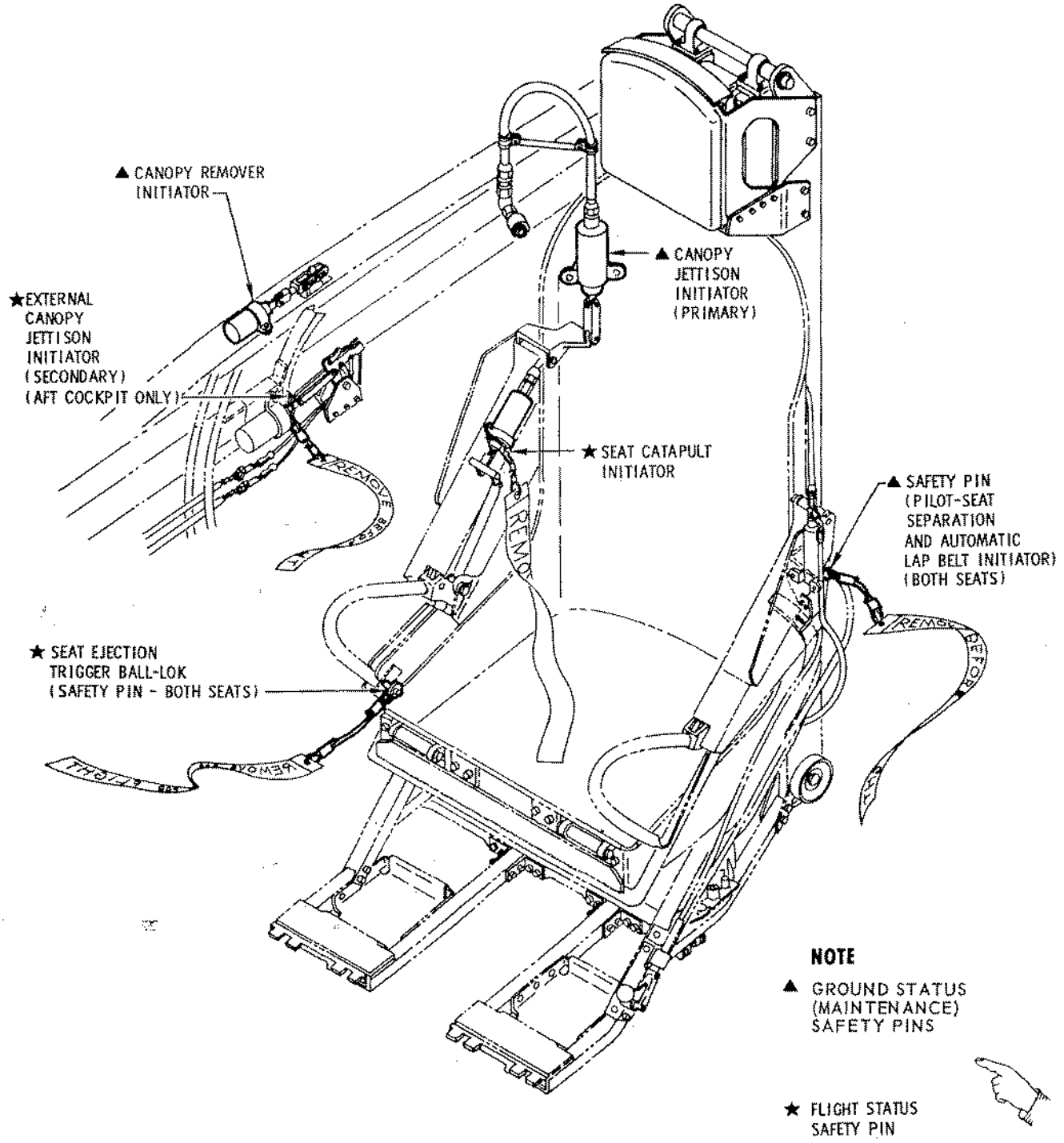


Figure 4-200K. Escape System Safety Pin Positions, Airplanes Incorporating T.O. 1T-33A-615

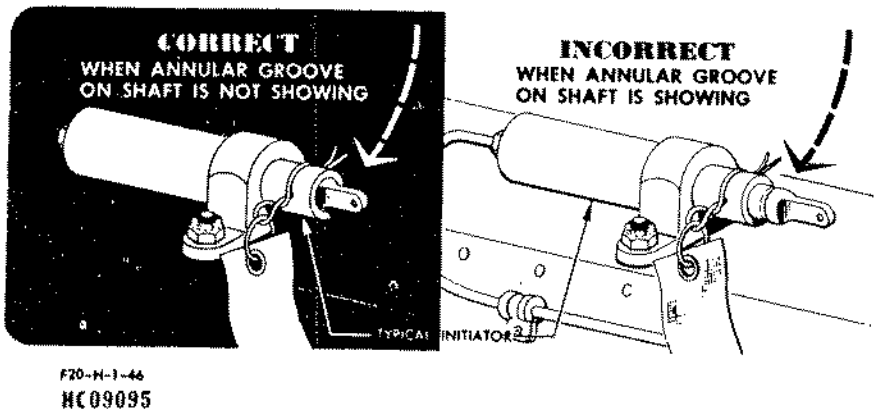


Figure 4-200L. Safety Pin Installation

d. Install live initiators at the primary canopy jettison system, seat ejection system, and pilot-seat separator positions on the seat. Also, install initiator panel on backside of forward seat.

WARNING

Prior to installing live initiators, make certain that safety pin is installed in right armrest of each seat, also, after installing initiators make certain safety pins are installed as shown in figures 4-200K and 4-200L.

e. Check seat adjustment actuator limit switch adjustments. (Refer to paragraph 4–960.) Verify that all clamps holding cables and hoses to seat are secure.

f. Remove canopy and seat ejection quick disconnect sockets from the seat rails. Remove dust cover oxygen quick disconnect fitting on cockpit floor and check condition of oxygen fitting "O" ring seal. Raise quick disconnect release levers to the up position. Lower seat slowly down the rails until the seat rests on the floor. Assure that foot ramps are forward of foot rests as seat approaches cockpit floor. Install canopy and seat ejection female quick disconnect sockets on nipples at seat rails. Make certain that sufficient clearance exists between the seat and catapult as well as between the seat and fuselage structure before any seat attachments are made. Check to see that male connectors of upper half of the personal leads disconnect enter the female connectors of the lower half of the personal leads disconnect without binding. Connect hoses to female ends of quick disconnect sockets. Torque fittings 70 to 120 inch pounds.

CAUTION

To avoid damage, do not drop seat. Make certain that the two halves of the personal leads disconnect assembly are retained by passing the cable ends through the drilled hole in two pins of the disconnect assembly. The cable is located under the seat and is attached to the cockpit floor.

g. Attach female trunnion of catapult to ejection seat yoke. Insert spacer washers, one on each side of trunnion, if space is available. Care must be taken to assure that spacers do not cause binding. Install snapring on each end of catapult trunnion pin.

CAUTION

When attaching seat to catapult, extreme care should be exercised to prevent striking any part of the catapult and damaging equipment.

h. Connect pilot-seat separator system telescopic tube to M32 initiator firing pin. Make certain that opposite end of tube is secured to eye bolt on cockpit floor. Check electrical operation of seat.

i. Perform MH-2 oxygen leak test in accordance with T.O. 15X15-4-1-101.

Note

When safetying the clevis pin which secures the telescoping tube (Part No. 458877 or Part No. 61B40380) to the initiator firing pin, use a cotter pin, Part No. AN380-2-5. This pin is 1-¼ inches long and should not be trimmed after installation since the added length allows this pin to be installed and removed without the use of tools.

j. through k. (Deleted)

4-1163AK. INITIAL EJECTION SEAT PREINSTALLATION CHECK FOLLOWING INCORPORATION OF T.O. 1T-33A-615.

a. With both armrests in the stowed position, install a dummy M3A-1 initiator in the seat ejection system initiator position in the right armrest and connect the linkage to the firing pin.

b. Install a dummy M3A-1 initiator in the primary canopy jettison system initiator location on the back right side of the seat bucket and connect the linkage to the initiator firing pin.

c. Pull up on the right armrest. The extreme forward end of the armrest shall move a minimum of one inch before the canopy jettison system initiator firing pin is pulled. Continue pulling up on the armrest until full travel is reached. Check the initiator firing pin travel. The travel shall be 0.75 inch minimum.

d. Squeeze the trigger on the right armrest and check that the seat ejection system initiator is pulled. Measure the distance that the link has traveled. The travel shall be 0.75 inch minimum.

e. Perform an inertial reel and shoulder harness test in accordance with the procedure contained in paragraph 4–1163P.

f. Restow the armrests by rotating the lever assembly on the forward end of the armrest upward, while exerting a downward pressure on the armrest. Return the lever assembly to the down position while still keeping a downward pressure on the armrest.

4-1163AL. INITIAL SEAT EJECTION SYSTEM INSTALLATION CHECK FOLLOWING INCORPORATION OF T.O. 1T-33A-615.

a. Install a dummy M32 initiator on the forward and aft ejection seats at the lap belt and pilot-seat separator initiator location.

Note

A dummy M12 initiator can be used in lieu of a dummy M32 initiator for this check.

b. (Deleted)

c. Install the forward seat on the ejection seat rail without the rocket catapult. Lower the seat slowly down on the rails until the seat rests on the floor.

d. Connect the telescopic tubing to the dummy M32 initiator firing pin. Connect the canopy jettison system and the seat ejection system hose disconnects. Connect the pilots personal leads quick-disconnect.

e. Repeat steps c and d above, for the aft ejection seat.

f. Pull up on the forward seat right armrest. The armrest shall move through its full travel.

g. Restow forward seat right armrest by rotating lever assembly on forward end of armrest upward while exerting a downward pressure on armrest, return the lever assembly to the down position while still keeping downward pressure on the armrest.

h. (Deleted)

i. Exert an upward pull on the forward seat right armrest. The armrest shall not move from its stowed position.

j. Raise both armrests of the aft seat to full travel. Check that the inertia reel has locked and remains locked.

k. Slowly raise the aft seat up the seat rails. The canopy jettison system and seat ejection system disconnects shall disconnect as the striker plates on the seat strike the disconnect levers. The personal leads quick-disconnects shall separate. The telescopic tube shall pull the dummy M32 initiator firing pin.

l. Continue to raise the aft seat up the rails. Check for hang-up of the pilot-seat separator hose and the inertia reel automatic lock cable on the left side of the seat. Check that the canopy jettison initiator hose and the seat ejection system hose do not hang up on the fuselage structure.

m. Remove the aft seat from the airplane.

n. (Deleted)

o. Pull up on the forward seat right armrest. The armrest shall move through its full travel.

p. Raise the forward seat left armrest to its full travel. The inertia reel shall lock and remain locked.

q. Raise the forward seat slowly up the seat rails and repeat the checks outlined in steps k and l, above.

r. Remove the forward seat from the airplane.

s. Restow the armrests on both seats as outlined in step g above, and remove the dummy initiators.

4-1163AM. REMOVAL OF M3A1 SEAT CATAPULT INITIATOR IN RIGHT-HAND ARM REST, FORWARD AND AFT SEAT.

a. Install safety pins in all initiators (see figure 4-200K) both seats.

b. Disconnect ballistic hoses at left and right quick disconnect fittings on back of seat.

c. Disconnect linkage from primary canopy jettison initiator on back of seat by removing clevis pin.

d. Disconnect hose from M3A1 initiator in right hand arm rest. Install dust caps.

e. Remove safety pin from front end of right hand arm rest lever and raise arm rest to full up position.

f. Disconnect linkage from M3A1 initiator sear pin in right hand arm rest by removing clevis pin.

g. Remove two mounting bolts and remove initiator.

4-1163AN. INSTALLATION OF M3A1 SEAT CATAPULT INITIATOR IN RIGHT HAND ARM REST FORWARD AND AFT SEAT.

a. Check to see that all ground and flight safety pins are installed in both seats (see figure 200–K) except for the M3A1 initiator in the right hand arm rest and the safety pin in the front end of the arm rest lever which were removed in accordance with paragraph 4–1163AM.

b. With right arm rest in up position install the M3A1 initiator with two attach bolts. Be sure that initiator safety pin is installed.

c. Connect linkage from trigger to M3A1 initiator by installing clevis pin and cotter pin.

d. Remove dust caps and install hose to M3A1 initiator.

e. Lower right hand arm rest, hold arm rest down, rotate hand grip upward and back down. Assure that arm rest lever is down and latched. (Under roller.) Install safety pin in arm rest lever.

f. Connect linkage to primary canopy initiator on back of seat by installing clevis pin and cotter pin.

g. Reconnect two ballistic hoses on back of seat at quick disconnect fittings.

4-1163AO. FLOW CHECK OF COMPLETE EJECTION SYSTEM. The following flow check procedures are to be used for periodic check of egress systems for foreign objects, obstructions, or corroded check valves which might prevent successful operation of the ejection system:

WARNING

Do not apply pressure to inlet ports of gas fired explosives or gas operated units. All M32, M3A1, M28 and M72 initiators, M5A1 thruster, 2400-15 rocket catapults, M3 canopy removers and rotary actuators must be disconnected from fittings being checked prior to application of gas pressure.

Note

- A dry nitrogen servicing hand truck, model B064, Part No. 796356-1, FSN 4770-072-5174 or equivalent may be used to perform this check.
- A dry nitrogen bottle, pressurized to 1500-2200 PSIG equipped with a regulator capable of regulating the gas pressure to 50 PSIG, sufficient hose length to reach fittings and hoses in the cockpits, and a valve to turn the gas on or off, is sufficient to perform this test.
- New "O" rings, Part No. MS28778-4 will be installed on all removed fittings, elbows, unions and tees.
- Fittings removed from gas fired explosives, or gas operated components may be checked with dry nitrogen separately, or with the balance of their respective lines.
- All connections shall be torqued in accordance with T.O. 1-1A-8.
- If check valves leak at inlet ports when reverse pressure is applied to outlet ports, adjust pressure to 1000 PSI and recheck. If still leaking, remove check valves and check in accordance with the "Check Valve Leak Test Set-Up and Test Procedure" Figure 4-200 Q. Check valves which cannot pass the leak test will be rejected. Serviceable check valves drawn from supply will be tested for free flow and no flow. If new check valves leak they will also be subjected to the "Check Valve Leak Test Set-Up and Test Procedure." For other defective parts found during testing, replace defective parts and repeat the flow check only on the affected system.

a. Ejection System, Fuselage - For all aircraft modified in accordance with T.O. 1T-33A-615 (refer to figure 4-200M.)

(1) Assure that all ground and flight safety pins are installed in ejection seat and canopy initiators.

(2) Remove canopy and forward and rear seats from aircraft in accordance with existing instructions.

(3) Disconnect hose assembly from rocket catapult Part No. 2400-15 in front seat (refer to figure 4-200M④).

(4) Remove rocket catapult from front cockpit, remove union from catapult cartridge, install plug. Purge union with 50 PSI dry nitrogen, install new "O" ring Part No. MS28778-4, reinstall union in catapult cartridge and cap union.

(5) Disconnect teleflex drive cable from canopy actuator motor.

(6) Disconnect hose assemblies at ①②③⑤⑥⑦⑧ and ⑨, install caps/plugs.

(7) Remove panel assembly Part No. 412994-101 from aircraft.

(8) Remove all tube assemblies, M28 and M72 initiators, tees, and elbows from Part No. 412994-101 panel assembly, cap openings in M28 and M72 initiators. Apply 50 PSI nitrogen pressure to all tube assemblies, tees, elbows, and check valves to assure no foreign objects are restricting flow and that all openings are clear. Pressurize check valves from both sides to assure proper direction of flow and seating of valves in their closed positions.

(9) Remove caps from initiators, reassemble panel assembly, Part No. 412994-101 using new "O" rings. Torque connections 90-120 in lbs, cap open fittings. Retain panel for later installation.

CAUTION

When installing check valves make certain the flow is in the proper direction.

(10) Apply nitrogen pressure at ⑤, there shall be free flow at ①. Apply pressure at ① there shall be no flow at ⑤.

(11) Apply pressure at ②, there shall be free flow at ⑥.

(12) Apply pressure at ⑦, there shall be free flow at ⑥

(13) Apply pressure at ③, there shall be free flow at ⑥.

(14) Apply pressure at ⑥, there shall be no flow at ⑦, ②, or ③

(15) Remove union from rear seat rocket catapult cartridge, purge, install new "O" ring and reinstall.

(16) Reinstall panel assembly Part No. 412994-101.

(17) Connect teleflex drive cable to canopy actuator motor.

(18) Reinstall hose assemblies at ①, ②, ③, ⑤, ⑥, ⑦, ⑧, and ⑨. Torque connections.

b. Canopy Remover System (refer to figure 4-200N). All A/C modified T.O. 1T-33A-615.

(1) Disconnect hose assemblies at ①, ②, and ③. Remove plug at ④

(2) Apply pressure at ②, there shall be free flow at ④.

(3) Apply pressure at ①, there shall be free flow at ④.

(4) Apply pressure at ③, there shall be free flow at ④.

(5) Apply pressure at ④, there shall be no flow at ①, ②, and ③.

(6) Remove elbow from top of canopy remover at ⑤. Apply pressure to elbow, there shall be free flow. Reinstall elbow and cap.

(7) Reconnect hose assemblies at ①, ②, and ③.

(8) With canopy removed, disconnect line at ⑥.

(9) Remove spotlight.

(10) Remove wire bundle from sill.

(11) Disconnect linkage at aft end of M3A1 initiator.

(12) Disconnect hose from fwd end of M3A1 initiator at (8). Apply pressure, there shall be free flow at (9). Plug hose.

(13) With thruster line removed at bulkhead fitting in canopy (6), apply pressure to bulkhead fitting, there shall be free flow.

(14) Remove M3A1 initiator.

(15) Remove bulkhead fitting and bracket from canopy rail.

(16) Remove screws from angle cover over thruster and remove angle cover.

(17) Remove line from canopy thruster elbow at (7).

(18) Remove canopy thruster.

(19) Remove elbow from canopy thruster, replace "O" ring, install elbow on line and apply pressure, there shall be free flow at opposite end (6).

(20) Remove elbow from line and reinstall on thruster.

(21) Connect line and torque (7).

(22) Reinstall thruster, angle cover, bulkhead fitting, and bracket assembly, and M3A1 initiator.

(23) Install thruster line to bulkhead fitting at (6) and torque.

(24) Install hose on fwd end of M3A1 at (8) and torque.

(25) Install thruster linkage, wire bundle and spotlight.

c. Ejection Seats (refer to figure 4-200P). All A/C modified to T.O. 1T-33A-615.

Note

These instructions apply to both front and rear seats.

(1) Disconnect hose assembly from M32 initiator at (1), and (2), remove tee (3), install caps/plugs.

(2) Disconnect hose assembly from rotary actuator at (4), remove fitting install new "O" ring, install plug in rotary actuator, reconnect fitting to hose.

(3) Disconnect hose assembly from M3A1 initiator on back of seat at (5) install cap.

(4) Disconnect hose assembly from M3A1 initiator in RH arm rest at (6) install cap.

(5) Remove hose assembly at lap belt elbow fitting (7), remove elbow and connect to hose. Install plug in lap belt.

(6) Apply pressure to hose assembly at (2), there shall be free flow at (7).

(7) Apply pressure to hose assembly at (6), there shall be free flow at (8).

(8) Apply pressure at (5), there shall be free flow at (9).

(9) Apply pressure at (1), there shall be free flow at (4).

(10) Apply pressure to tee fitting (3), there shall be free flow at other two openings. Reinstall tee fittings in M32 initiator and connect hose assemblies at (1) and (2), torque connections.

(11) Connect hose assemblies at (5), (6), and (7), torque connections.

(12) Install fitting in rotary actuator, connect hose (4), and torque connection.

(13) Reinstall forward rocket catapult, connect hose and torque connector.

(14) Install seats and canopy in accordance with existing instructions.

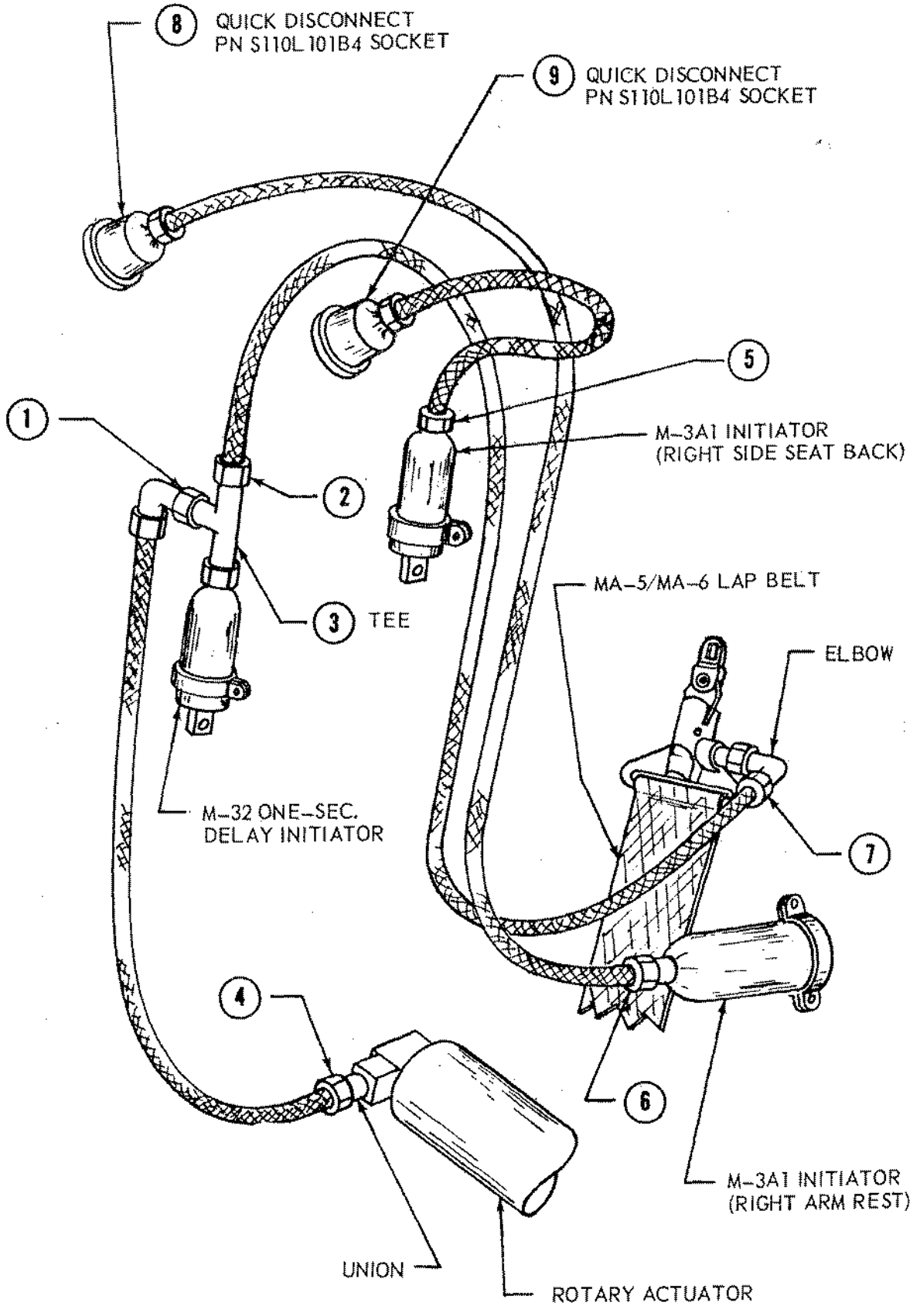


Figure 4-200P. Ejection Seats, T-33A Aircraft

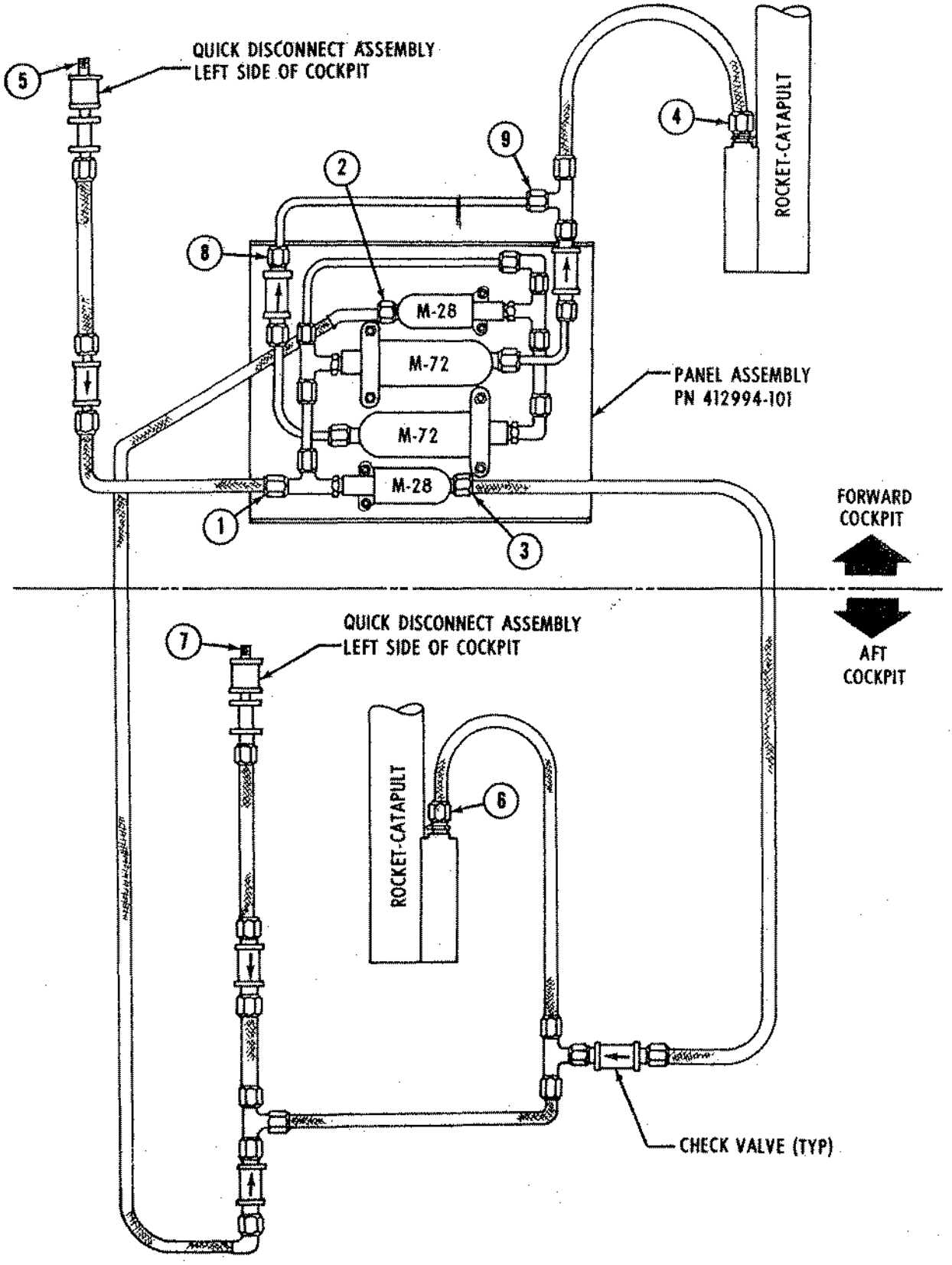


Figure 4-200M. Ejection System Fuselage, T-33A Aircraft

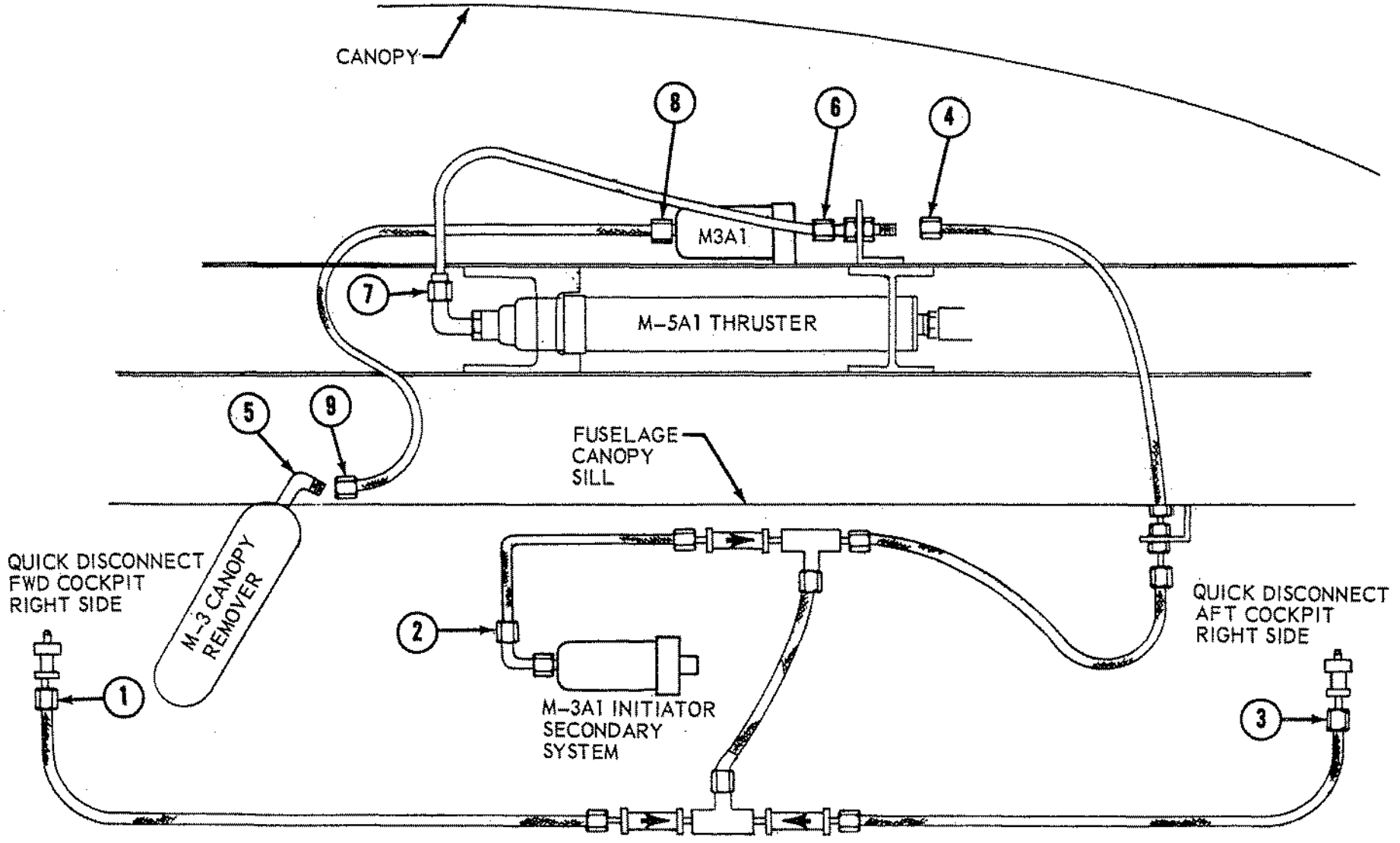
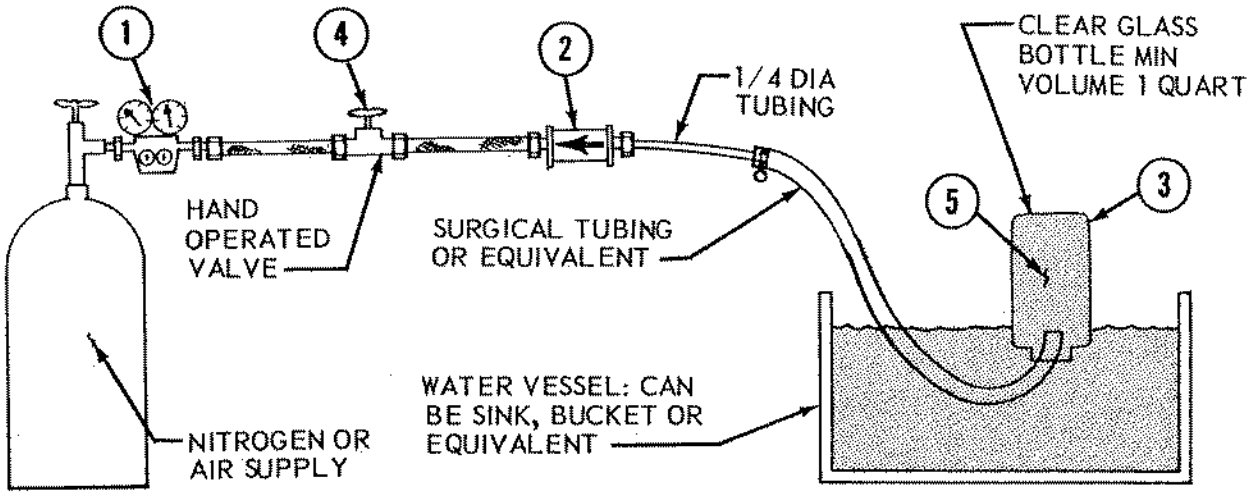


Figure 4-200N. Canopy Remover System, T-33A Aircraft



LEAK TEST PROCEDURE

(1) REGULATE PRESSURE SUPPLY TO 1000 POUNDS PER SQUARE INCH.

(2) INSTALL CHECK VALVE WITH OUTLET PORT FACING THE PRESSURE SOURCE.

NOTE

FILL THE GLASS BOTTLE WITH ONE QUART OF WATER AND MARK THE ONE QUART LEVEL ON THE SIDE OF THE BOTTLE.

(3) SUBMERGE AND FILL THE BOTTLE. INVERT THE BOTTLE AS SHOWN. INSERT THE END OF THE SURGICAL TUBING INTO THE BOTTLE.

(4) APPLY PRESSURE TO THE CHECK VALVE.

(5) GAS LEAKAGE THROUGH THE CHECK VALVE WILL DISPLACE THE WATER FROM THE BOTTLE. MEASURE THE ELAPSED TIME REQUIRED TO DISPLACE ONE QUART OF WATER. THE ELAPSED TIME SHALL BE 30 SECONDS OR LONGER. REPLACE CHECK VALVES REQUIRING LESS THAN 30 SECONDS TO DISPLACE ONE QUART OF WATER.

Figure 4-200Q. Check Valve Leak Test Set-Up and Test Procedure

4–1164. RELIEF TUBE. A specially designed horn is held in a bracket under the right front corner of each pilot's seat. A manually controlled valve in the horn prevents loss of cockpit pressure when the equipment is not in use. Rubber tubing extends under the seat, through the cockpit floor, and connects to an aluminum alloy tube which vents overboard.

4–1165. MAP CASE. A case for stowage of maps and flight report holder is built into the right side shelf.

WARNING

A shock cord must be around the map case at all times to permit complete operation of the canopy internal forward jettison handle.

4–1166. COCKPIT TRIM PANELS. The trim panels are fastened to airplane structure with screws. Two panels which fair into the ends of the instrument panel are Alclad sheet. The remaining panels above and below the cockpit side shelves are 1/32-inch phenolic resin sheet. Removal of panels gives access to plumbing lines and wiring routed along the sides of the cockpit.

4–1167. INSTRUMENT GLARE SHIELD. For night flying, a shield of waterproof duck, dyed black is pro-

vided for glare protection on each instrument panel. The forward shield is installed directly over the gun-sight mounting bracket forward of the gun sight, and attaches to the fuselage aft of the bullet-resistant glass at four points, and to four points on each side of the fuselage directly below the windshield defroster tube. The aft shield is attached in approximately the same manner.

4–1168. REAR VIEW MIRROR. A curved glass mirror enclosed in a metal case is mounted in the forward cockpit and is adjustable in vertical and horizontal directions.

4–1169. BLIND FLYING HOOD. On AF Serial No. 51-4140 through 52-9635 and 52-9876 through 52-9905, a hood (five amber plastic shields) is provided for blind flying training. When in use, each shield is held inside the windshield and canopy by spring clips. On AF Serial No. 53-5286 and subsequent, a white nylon hood is provided in the aft cockpit. Two snap fasteners at the forward end of the curtain hold the forward flaps together when the curtain is in use. When not in use, the curtain can be pushed aft on its rods.

4–1170. DATA CASE. A case for stowing acceptance forms, and similar material, is installed in the nose section of the airplane. Prior to AF Serial No. 51-6751 the case is on the armament compartment right door; on AF Serial No. 51-6751 through 51-6791, on the armament compartment left door; and on AF Serial No. 51-6792 and subsequent, in the top of the armament compartment on the center line of the airplane.

4–1171. HEATING, COOLING, AND PRESSURIZATION SYSTEM.

(See figures 4-201 through 4-205A.)

4–1172. DESCRIPTION. This system provides heated air from the engine compressor section for windshield defrosting, heating and pressurizing the cockpit and for pressurizing the droppable fuel tanks, canopy seal tube, hydraulic reservoir, and pressurized suit valves. Prior to AF Serial No. 53-5083, this air is cut off by two shutoff valves mounted on the engine compressor section whenever the fluid injection system is operating.

4–1173. On AF Serial No. 53-5814 through 53-6152 and 54-1544 and subsequent, and on airplanes incorporating T.O. 1T-33A-513 the air for cabin heating and pressurization passes through a solenoid air shutoff valve (manual reset type) upstream and adjacent to the flow control valve (refer to paragraph 4–1180).

4–1174. Air for cabin heating and pressurization passes through a flow control valve and an air mixing chamber, both located in the hydraulic compartment forward of the dive flaps. The flow control valve diverts some of the air through the turbine and cooler for cooling before routing it to the mixing chamber. In each cockpit, a valve at head level admits air for defrosting the canopy, another valve at the forward end of a ring mounted around the edge of the windshield controls the air flow for defrosting the windshield. Valves adjacent to the rudder pedals admit warming air for the pilots feet. A blast tube in each cockpit is connected to the left air intake duct to provide cooling air. These tubes incorporate butterfly valves and swivel joints in their discharge ends. The temperature of the cabin air is controlled by manually setting a rheostat switch located just forward of the engine control lever in the forward cockpit.

4–1175. TROUBLE SHOOTING HEATING, COOLING, AND PRESSURIZATION SYSTEM.

Trouble	*Probable Cause*	*Remedy*
Pressurized air supply insufficient.	Duct leak.	Check ducts and repair.
	Hot air shut-off valve stuck partially closed.	Check shut-off valve and control circuit.
Cockpit pressure too low.	Excessive cabin leakage.	Check canopy seal pressure. Check cockpit sealing.
	Faulty pressure regulator.	Replace regulator.
	Pressurized air insufficient.	See "Pressurized Air Insufficient."
	Faulty pressure relief valve.	Replace relief valve.
	Defective flow control valve.	Clean or replace.
Cockpit pressure too high.	Pressure regulator shut-off valve closed.	Open valve, and safety-wire in open position.
	Defective pressure regulator.	Replace regulator.
	Defective flow control valve.	Clean or replace.
Cockpit temperature too high.	Inoperative cooler turbine.	Replace turbine.
	Flow control valve stuck open.	Replace flow control valve.
	Faulty temperature control rheostat.	Replace rheostat.
	Clogged, broken, or leaking tubes in heat exchanger.	Clean or replace unit.

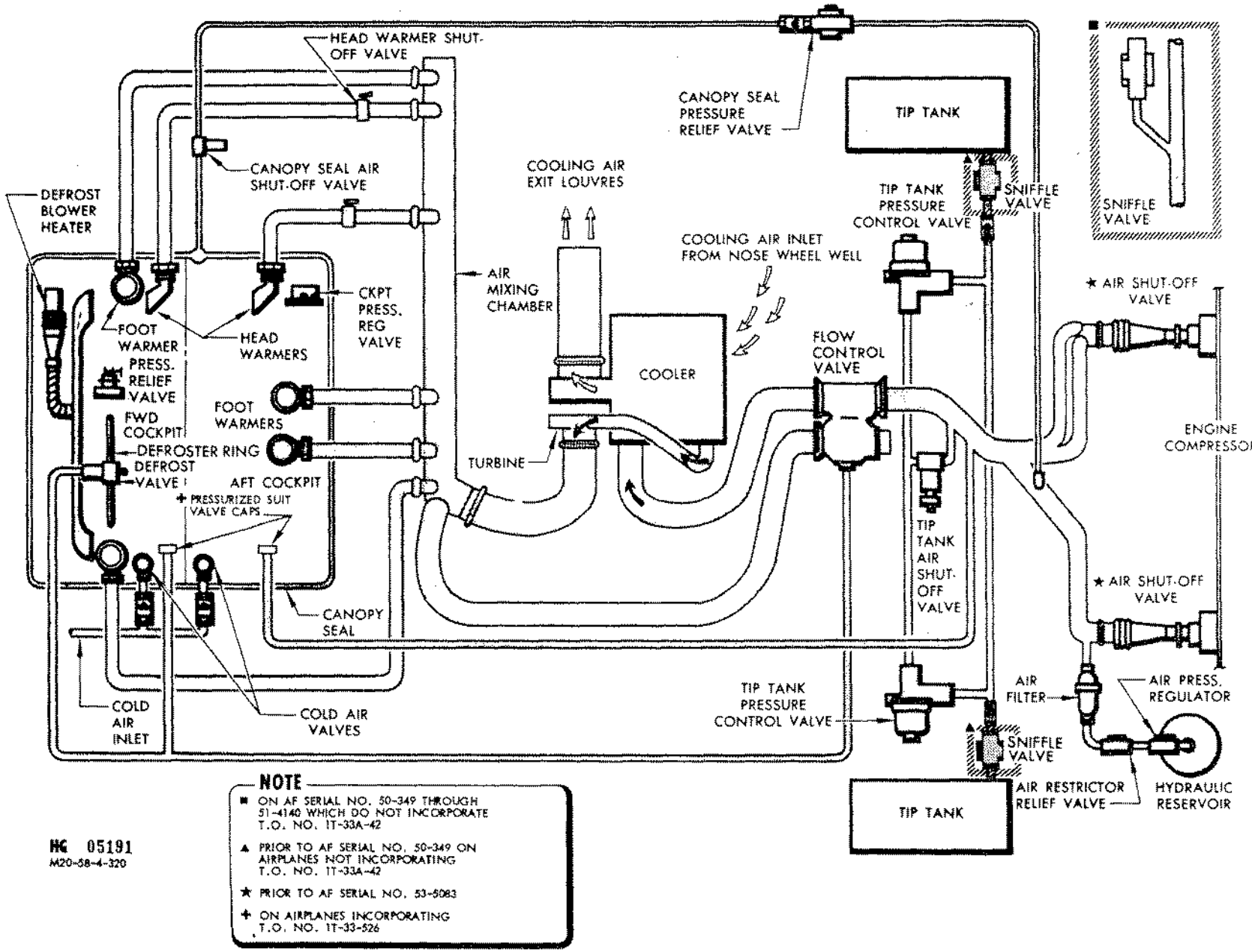
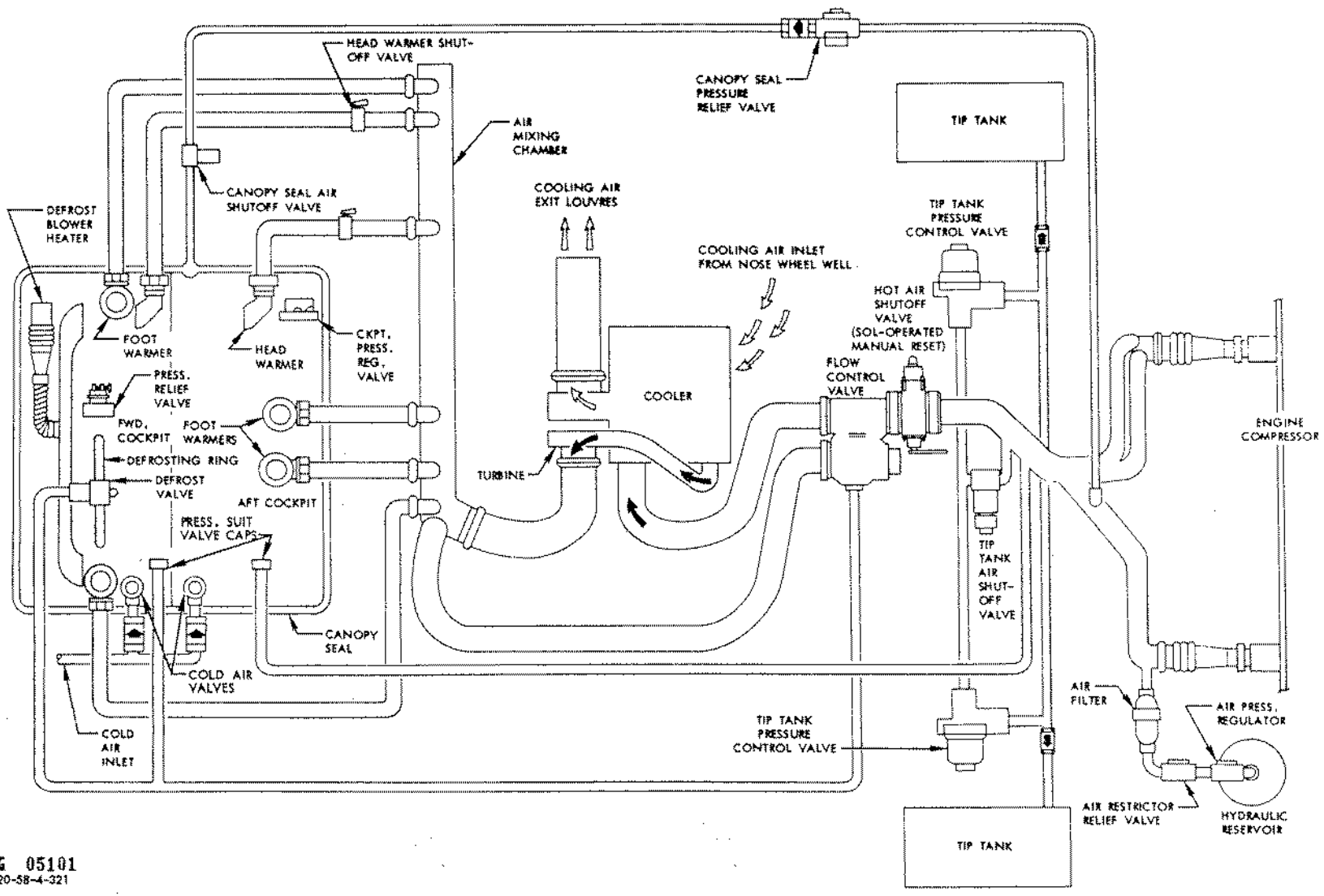


Figure 4-201. Heating, Cooling and Pressurization System Schematic, on Airplanes Incorporating T.O. 1T-33-526



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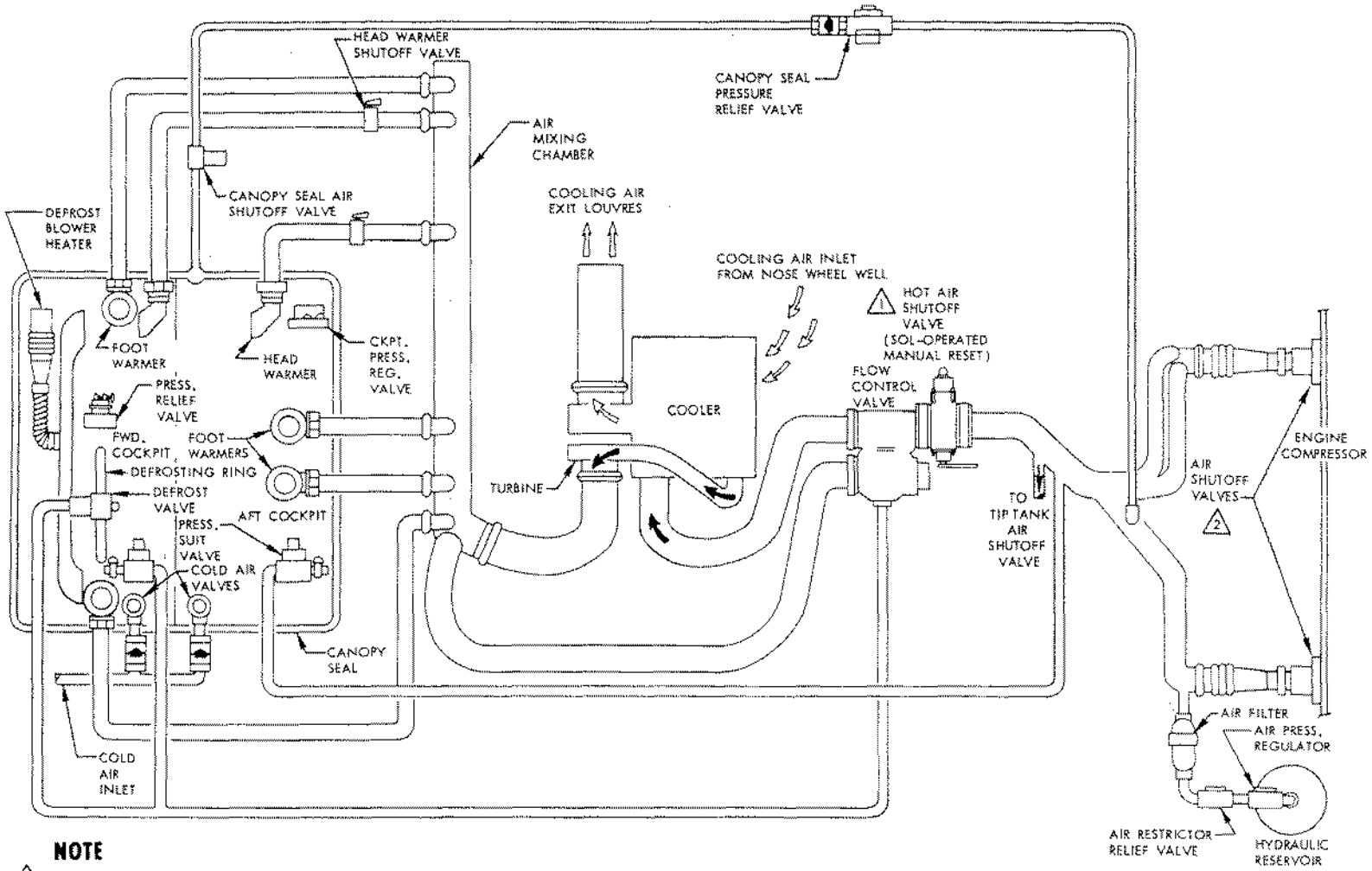
M20-58-4-321

Figure 4-202. Heating, Cooling and Pressurization Schematic, AF Serial No. 53-5814 through 53-6152 and 54-1544 through 55-4339, and on Airplanes Incorporating T.O. 1T-33A-513 and 1T-33-526



NOTE

1. ON AF SERIAL NO. 53-5814 THROUGH 53-6152, 54-1544 AND SUBSEQUENT, AND AIRPLANES INCORPORATING T.O. 1T-33A-513
2. PRIOR TO AF SERIAL NO. 53-5083

NF 08831
M20-55-4-222

Figure 4-203. Heating, Cooling, and Pressurization System Schematic

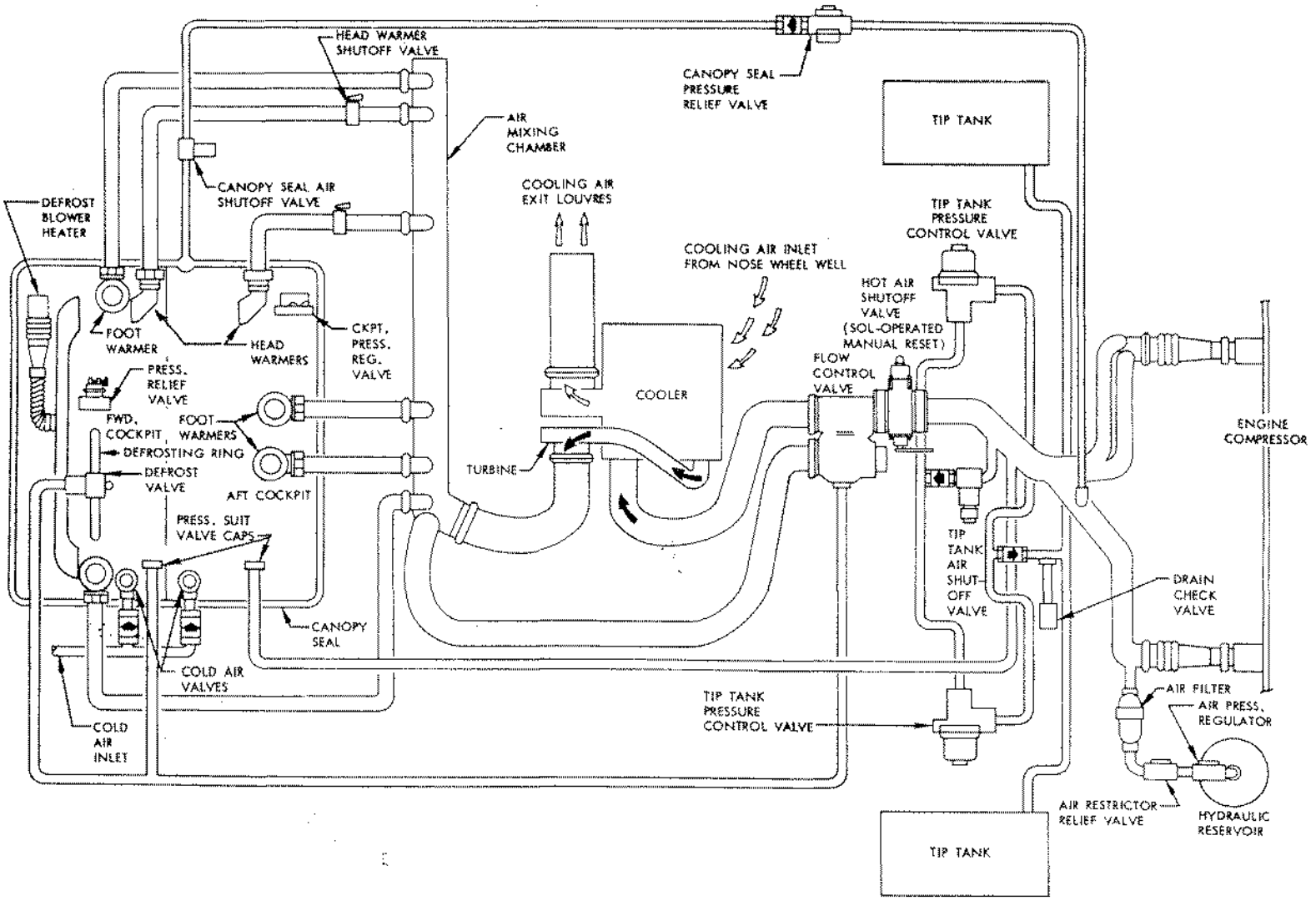


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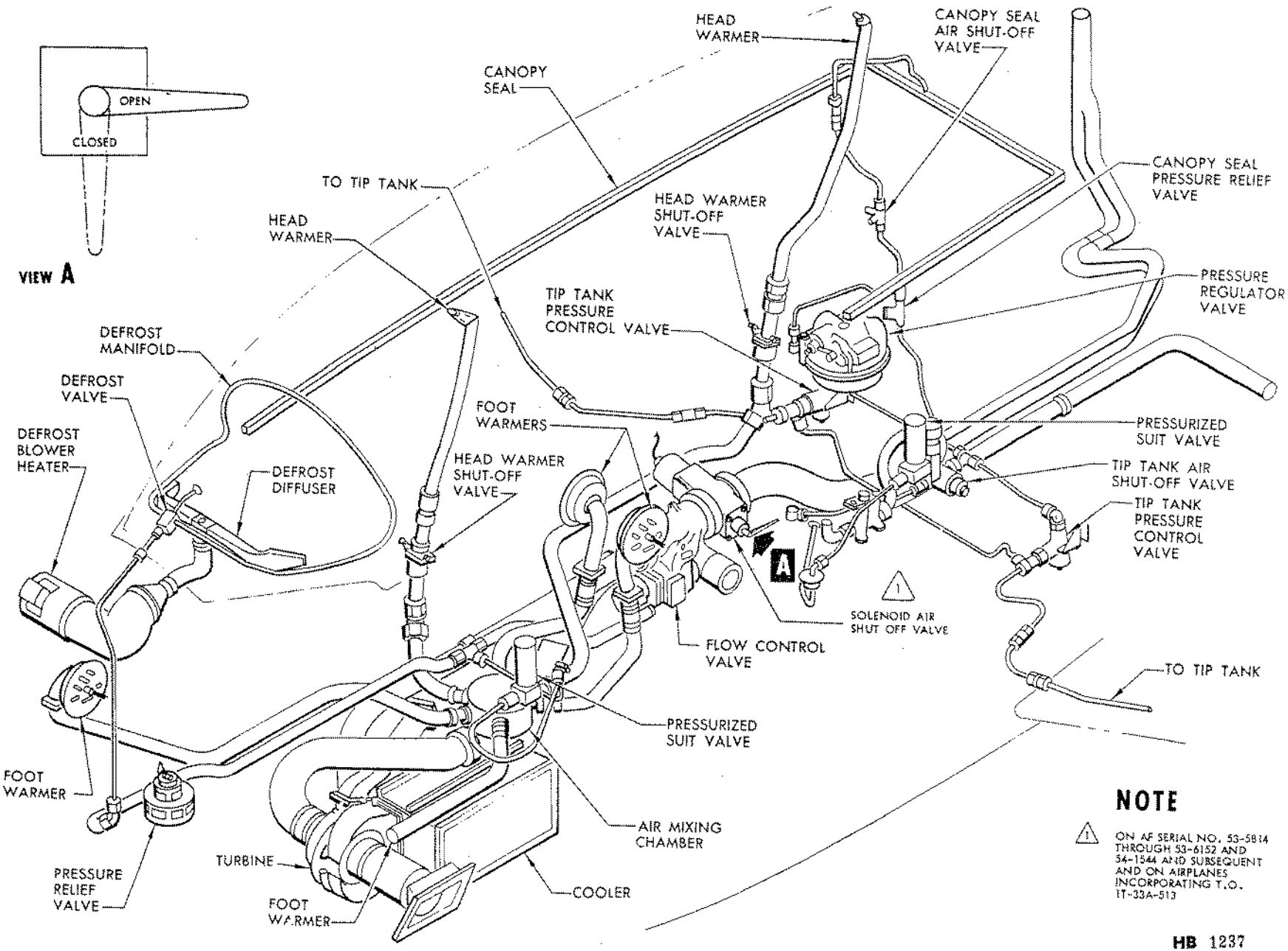
Figure 4-203A. Heating, Cooling, and Pressurization System Schematic, AF Serial No. 55-4340 and Subsequent, Incorporating T.O. 1T-33-526



NOTE

1 ON AF SERIAL NO. 53-5814 THROUGH 53-6152 AND 54-1544 AND SUBSEQUENT AND ON AIRPLANES INCORPORATING T.O. 1T-33A-513

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M20-50-4-193

Figure 4-204. Heating, Cooling and Pressurization System, Prior to AF Serial No. 55-4410

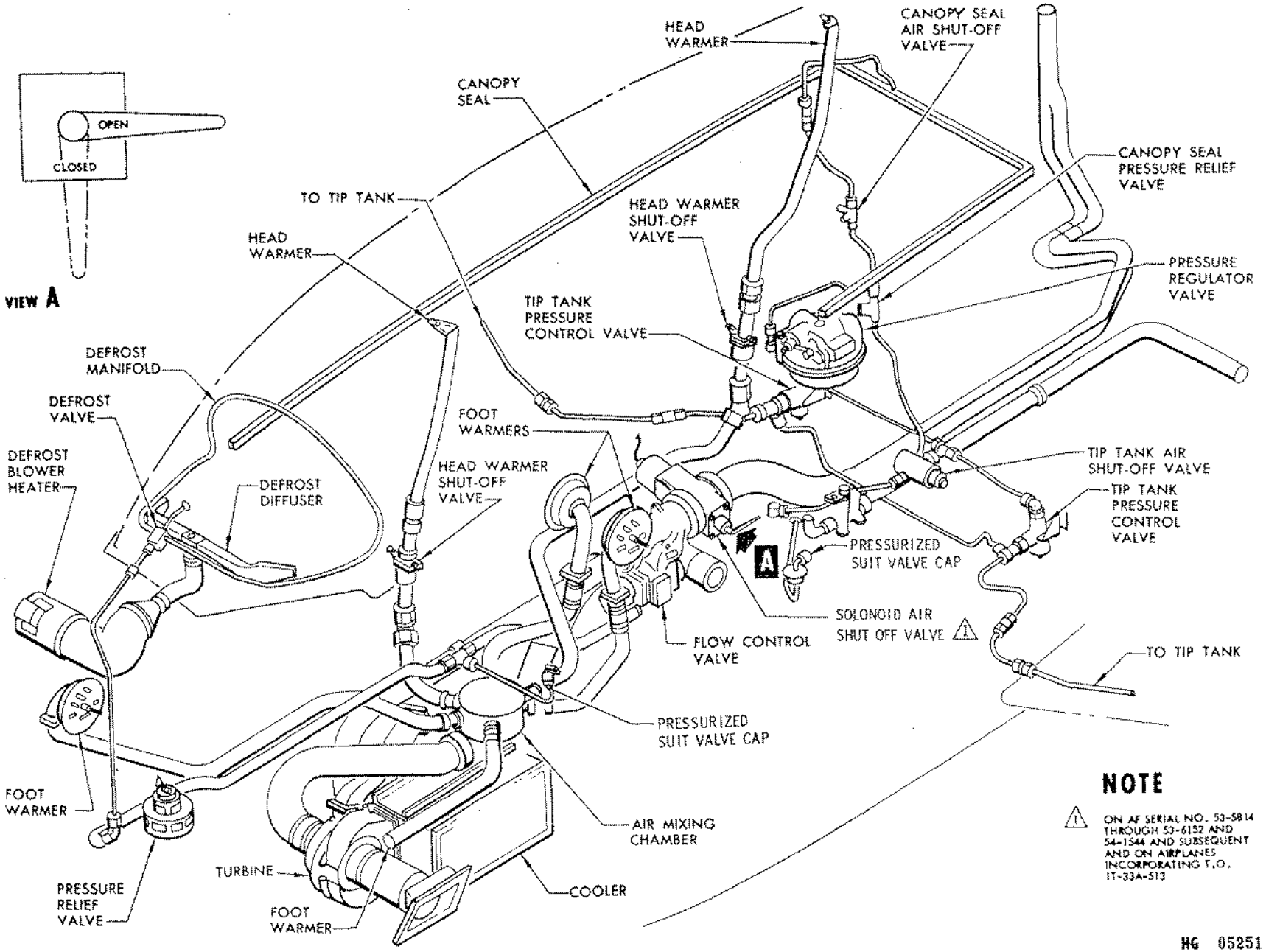


Figure 4-204A. Heating, Cooling and Pressurization System Prior to AF Serial No. 55-4410, Incorporating T.O. 1T-33A-526

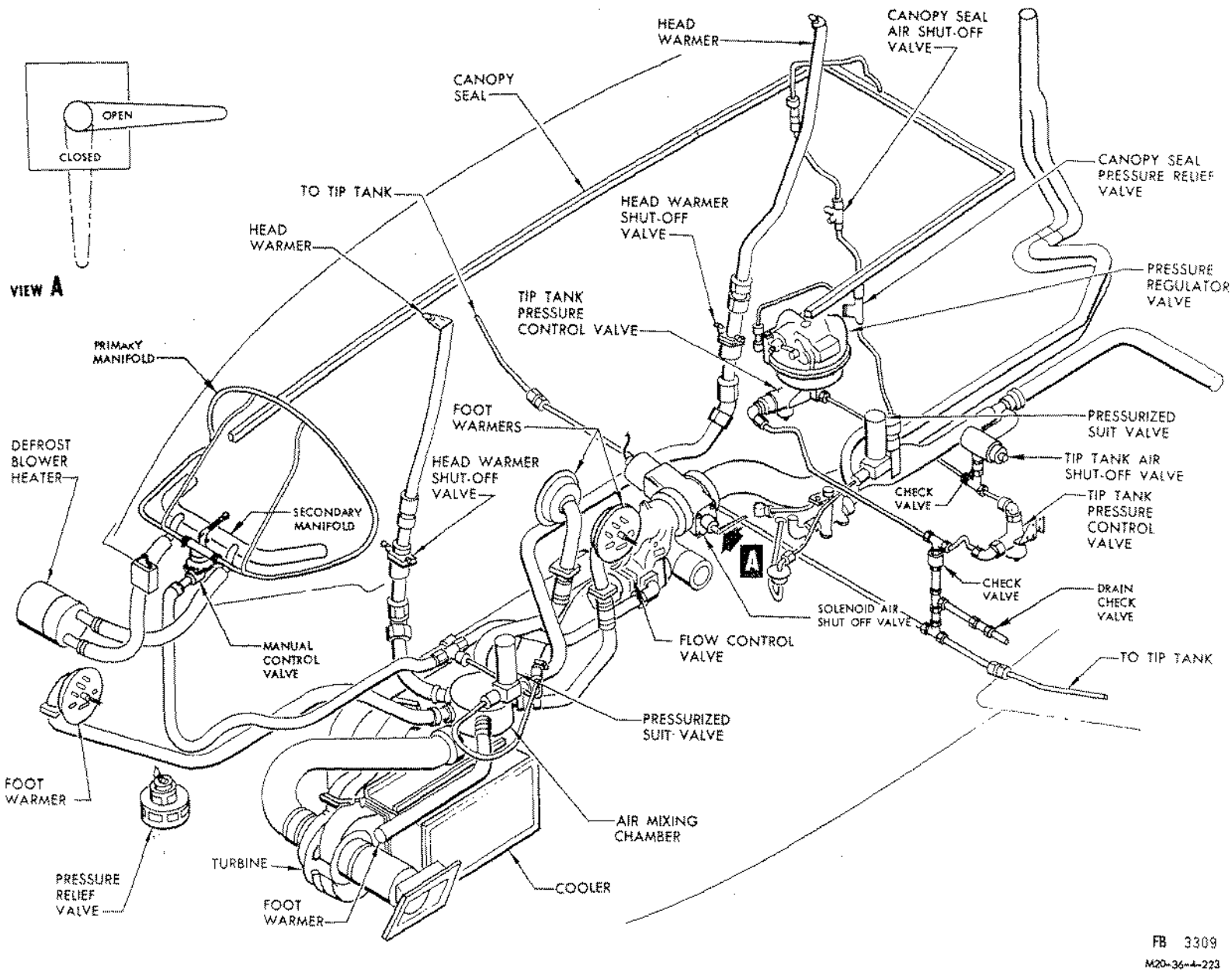


Figure 4-205. Heating, Cooling, and Pressurization System, AF Serial No. 55-4410 and Subsequent

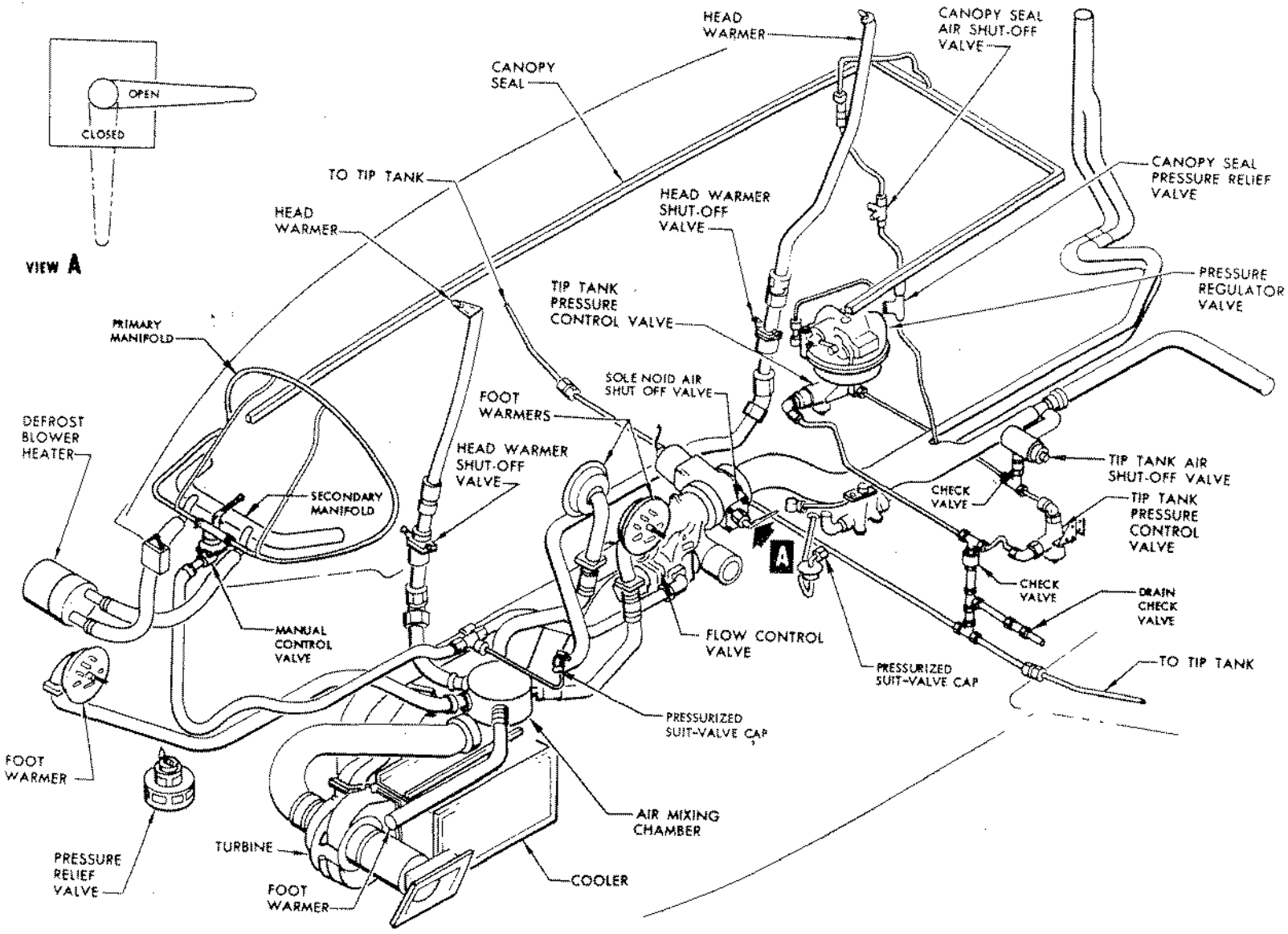


Figure 4-205A. Heating, Cooling and Pressurization System, Prior to AF Serial No. 55-4410, Incorporating T.O. 1T-33-526

Trouble	*Probable Cause*	*Remedy*
Cockpit temperature too low.	Insufficient hot air supply.	See "Pressurized Air Supply."
	Flow control valve stuck closed.	Replace flow control valve.
	Faulty temperature regulator.	Replace regulator.
	Faulty temperature control rheostat.	Replace rheostat.
	Faulty cockpit temperature control switch.	Check switch and circuit.
Insufficient cooling air.	Ram air intake blocked.	Remove obstruction.
	Hot air shut-off valve stuck open.	Check hot air shut-off valve, switch, and circuit.
Auxiliary windshield defrost unsatisfactory.	Circuit protector tripped.	Reset circuit protector.
	Heater-blower inoperative.	Replace heater-blower unit.

4–1176. AIR SHUTOFF VALVE ACTUATOR (PRIOR TO AF SERIAL NO. 53-5083). Refer to figure 4-109 and paragraph 4–558.

4–1177. AIR SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 53-5083). This valve consists of two aluminum cases, a gate assembly, a carbon seat, and a shaft. The gate assembly slides against the carbon seat which is installed on the outflow side of valve. The gate is moved through an arc of 46 degrees by the serrated shaft. When the gate is in the closed position, a slot on the end of the shaft is in line with the centerline of the valve port. Upon being actuated, the gate in the valve shuts off all air flow from the engine compressor to the heating, cooling, and pressurization system. The two shut-off valves are on the upper portion of the engine compressor casing.

4–1178. REMOVAL OF AIR SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 53-5083).

a. Disconnect air outlet line.

b. Loosen and remove valve actuating arm from valve shaft.

c. Loosen jam nut on valve adapter.

d. Remove air shut-off valve and adapter from engine compressor casing as a unit.

4–1179. INSTALLATION OF AIR SHUTOFF VALVE (PRIOR TO AF SERIAL NO. 52-5083). Reverse removal procedure.

Note

Screw the adapter into the compressor casing with the O-ring installed, applying anti-seize compound, Specification MIL-C-5544, to the threads of the adapter and compressor casing threads. Tighten the adapter, applying a torque of 18 to 30 lb ft.

4–1180. SOLENOID AIR SHUTOFF VALVE (AF SERIAL NO. 53-5814 THROUGH 53-6152 AND 54-1544 AND SUBSEQUENT AND ON AIRPLANES INCORPORATING T.O. 1T-33A-513). *(See figure 4-203.)* A solenoid-operated air shutoff valve (manual reset) is mounted adjacent to and upstream of the flow control valve. The valve is normally in the open position admitting air from the engine compressor section to the cabin for pressurization, heating, and cooling. The air shutoff valve is electrically-operated to the shutoff position only. This necessitates the repositioning (manually) of the valve to the "OPEN" position. This is accomplished by gaining access through the opened right dive flap and resetting valve control handle to "OPEN."

4–1181. REMOVAL OF SOLENOID AIR SHUTOFF VALVE.

a. Remove marker beacon antenna (refer to paragraph 4–1001).

b. Remove valve forward attaching clamp through marker beacon access opening.

c. Remove right dive flap (refer to paragraph 4–140) and disconnect valve electrical connection.

d. Loosen and slide valve rear attaching clamp aft over connecting tubing. Remove valve.

4–1182. HYDRAULIC RESERVOIR AIR FILTER. A filter is installed in the hydraulic reservoir pressurization line upstream of the reservoir. The capacity of the filter is three cubic feet of air per minute at a pressure of four inches of water.

4–1183. REMOVAL OF HYDRAULIC RESERVOIR AIR FILTER. Remove retaining clip holding filter in place. Disconnect air pressure lines from units, and remove filter.

4–1184. HYDRAULIC RESERVOIR AIR RESTRICTOR RELIEF VALVE. The valve is mounted adjacent to the reservoir, and delivers air at 2.8 to 5.5 psi.

4–1185. REMOVAL OF HYDRAULIC RESERVOIR AIR RESTRICTOR RELIEF VALVE. Disconnect the lines from both ends of the valve, and remove the valve.

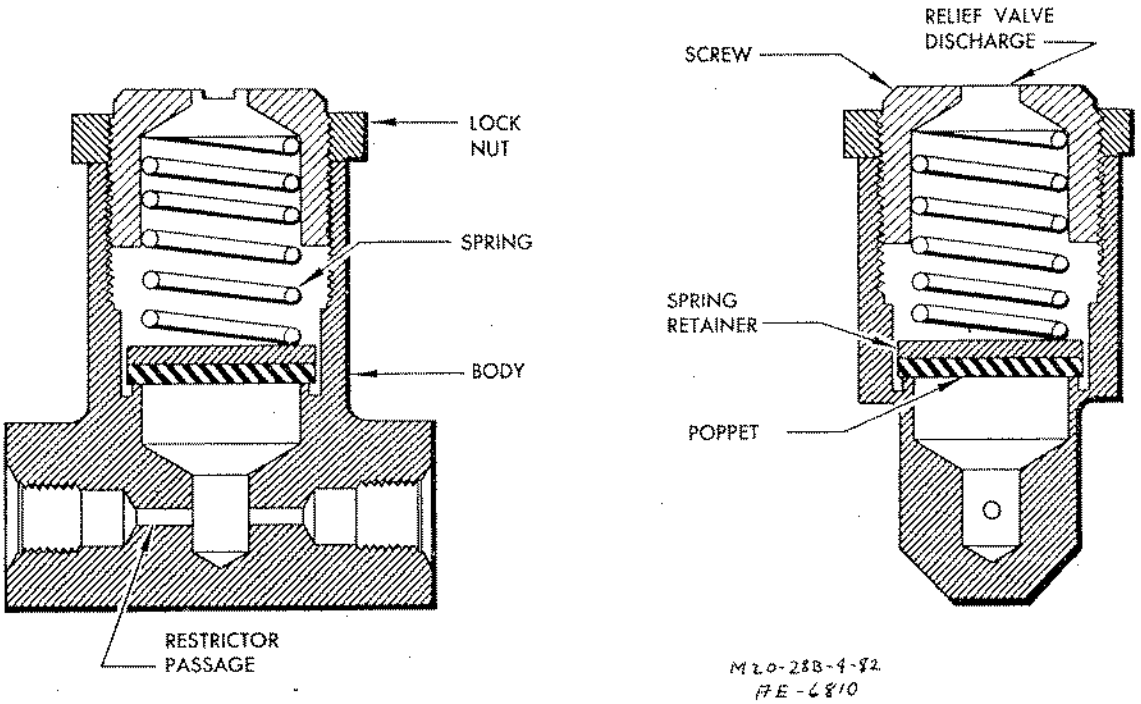


Figure 4-206. Canopy Pressure Seal Relief Valve

4–1186. INSTALLATION OF HYDRAULIC RESERVOIR AIR-RESTRICTOR RELIEF VALVE. Reverse removal procedure.

Note

Mount valve with reservoir line connected to port indicated by arrow on valve.

4–1187. CANOPY PRESSURE-SEAL RELIEF VALVE. *(See figure 4-206.)* This valve is forward of the cockpit aft bulkhead, atop the air-seal box behind the aft jettisonable seat. The valve is adjustable and is set to crack open at from 15 to 19 psi. The valve incorporates a restrictor which limits air flow to 0.4 cubic foot per minute at a pressure of 60 psi applied at either port. Under low-temperature conditions, water or moisture will cause binding or freezing. Remove water droplets by washing valve in alcohol and then drying the valve.

4–1188. REMOVAL OF CANOPY PRESSURE-SEAL RELIEF VALVE.

a. Remove air-seal box cover.

b. Disconnect air line in air-seal box.

c. Remove jam nut on under side of air-seal box.

d. Disconnect line above check valve.

e. Remove relief valve and check valve as a unit.

4–1189. CANOPY SEAL AIR SHUTOFF VALVE. A solenoid operated shut-off valve is installed in the canopy seal air lines between the canopy seal relief valve and the canopy seal. The valve is on the right-track support rail of the aft jettisonable seat. When the canopy is open, the valve shuts off the air supply to the canopy seal, and with the canopy closed, turns on the supply.

4–1190. REMOVAL OF CANOPY SEAL AIR SHUTOFF VALVE.

a. Disconnect electrical wiring at valve.

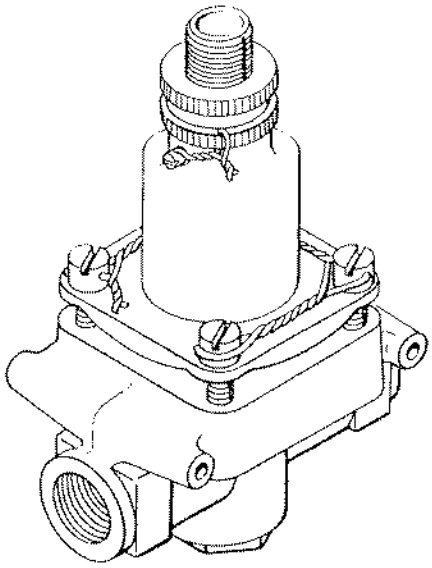
b. Disconnect air pressure lines at valve.

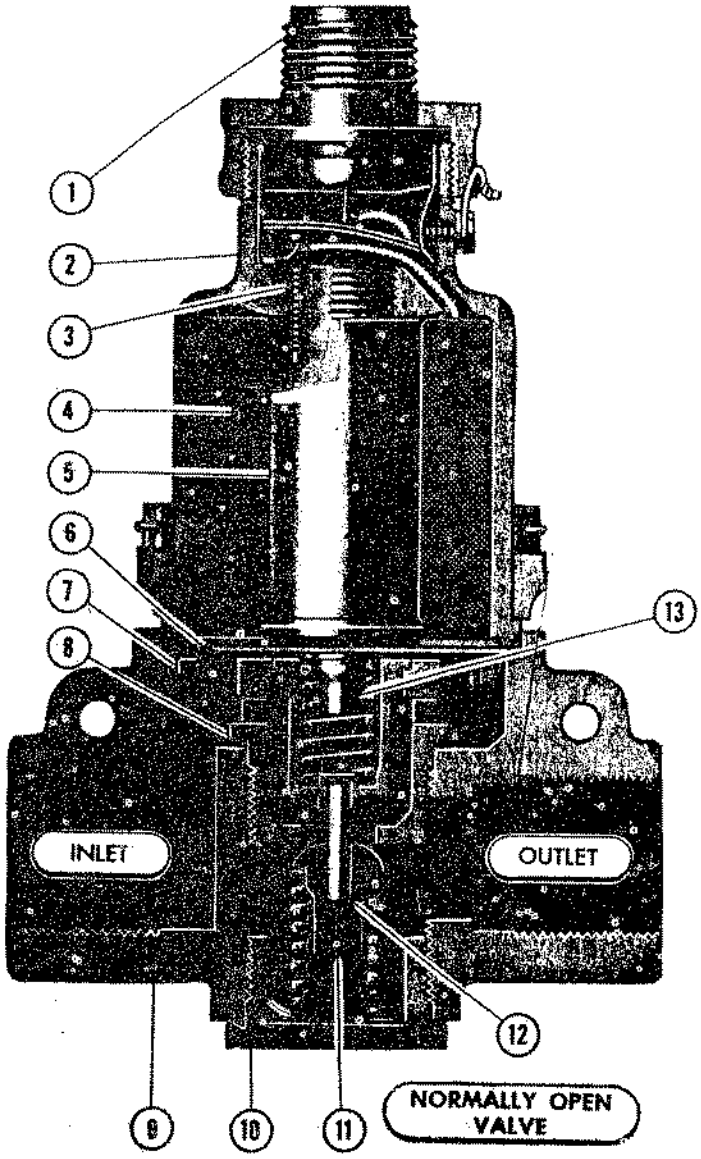
c. Remove valve mounting bolts, and remove valve.

4–1191. DROP TANK AIR SHUTOFF VALVE. *(See figure 4-207.)* The electrically operated air shutoff valve is in the hydraulic compartment. A single valve controls the air flow to both drop tanks. The valve is controlled by the drop tank switches of the fuel-tank selector panels on the cockpit left shelf. For further information on this valve, refer to paragraph 4–826.

4–1192. DROP TANK PRESSURE CONTROL VALVE. *(See figure 4-208.)* Two pressure control valves are located, one on each side of the hydraulic compartment. The valves obtain air from the engine compressor at pressures varying from 6 to 60 psi, and reduce the pressure to 5.25 (±0.50) psi above atmospheric pressure. The valves are vented to the atmosphere.

4–1193. OPERATION OF DROP TANK PRESSURE CONTROL VALVE. Air from the engine compressor passes through the poppet in the valve. The differential





1.	ELECTRICAL CONNECTOR
2.	COIL HOUSING
3.	CORE LOCK SCREW
4.	COIL
5.	COIL CORE
6.	DIAPHRAGM
7.	ARMATURE
8.	VALVE SEAT
9.	VALVE BODY
10.	BOTTOM CAP
11.	POPPET
12.	OPERATING STEM
13.	SPRING GUIDE

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Figure 4-207. Drop Tank Air Shutoff Valve

pressure across the diaphragm controls the position of the poppet. One side of the diaphragm is vented to the atmosphere and the other side contains tip tank system air. When the pressure in the tip tank system drops below the valve setting of 5.25 (±0.50) psi the diaphragm is deflected upward, opening the poppet. When the tip tank system air pressure increases to the valve setting the diaphragm is deflected downward, closing the poppet.

4–1194. REMOVAL OF DROP TANK PRESSURE CONTROL VALVE.

a. Disconnect dive flaps from actuating cylinders.

b. Disconnect and cap lines leading to valve.

c. Remove four bolts holding valve to support bracket.

d. Slide valve forward to remove it.

4–1195. FUEL DRAIN CHECK VALVE (AF SERIAL NO. 55-4410 AND SUBSEQUENT). *(See figure 4-205.)* A fuel drain check valve is teed into the tip tank pressurization line downstream of the paralleled tip tank pressure control valve. The valve prevents fuel from draining into the engine compressor through the tip tank pressurization line when the airplane is being fueled. The valve is normally open and closes to prevent loss of air pressure between 1 and 3 psi.

4–1196. SNIFFLE VALVE (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42.) *See figure 4-209.)* A double acting valve is installed in the wing tip in each drop

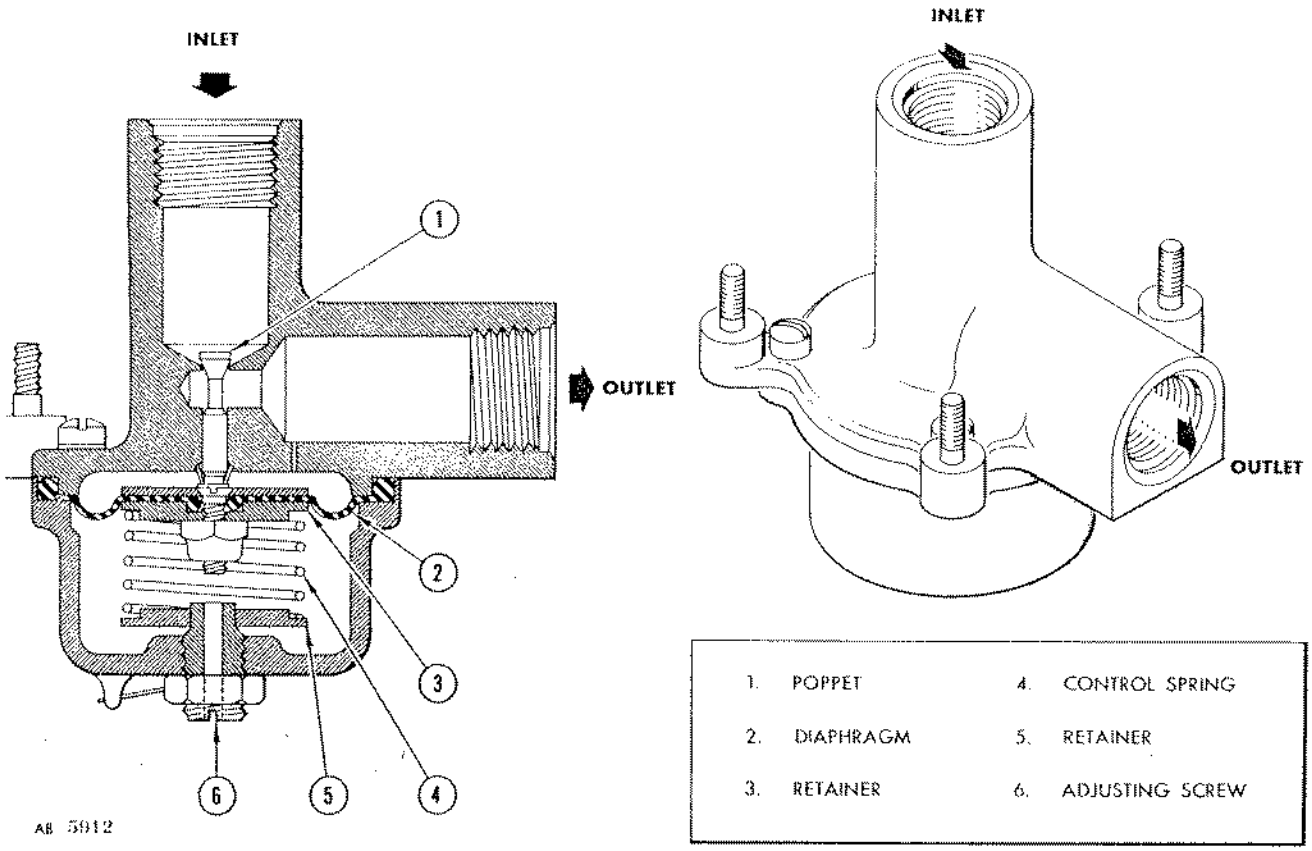


Figure 4-208. Drop Tank Pressure Control Valve

tank air line to prevent excessive air pressure or the formation of a vacuum in the droppable tank.

CAUTION

The suction relief portion of the valve is a simple flapper-type valve and is held closed by gravity. When installing the valve, be sure that the pressure relief adjustment is up (toward the top surface of the wing tip). Make certain that neither the pressure relief nor vacuum relief openings of the sniffle valve are restricted during installation.

4–1197. REMOVAL OF SNIFFLE VALVE (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42).

a. Remove access panels No. 2 and 5. (See figure 3-1.)

b. On airplanes prior to AF Serial No. 50-349 disconnect lines from inlet and outlet ports. On airplanes AF Serial Nos. 50-349 through 51-4140 disconnect line from valve inlet port.

c. Remove valve retaining clips, and remove valve.

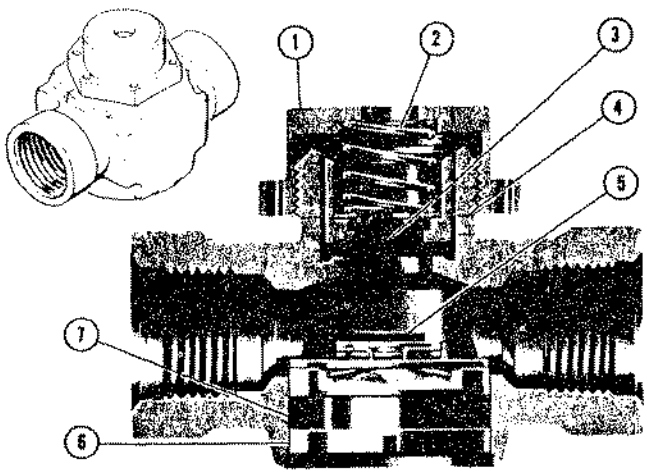
4–1198. FLOW CONTROL VALVE. An electrically operated flow control valve is installed on the right side of the hydraulic compartment forward of the dive flaps, to control all heating air to the cockpit. When warm air is desired, the cabin air rheostat is set in "HOT" position. This causes the flow control valve to divert more engine compressor air directly through the mixing chamber to the cockpit. If cooler air is desired, the valve directs more compressor air through the turbine and cooler and air mixing chamber to the cockpit. Incorporated in the flow control valve is a compensating valve. The valve functions to maintain a constant air pressure at the inlet port of the flow control valve.

4–1199. REMOVAL OF FLOW CONTROL VALVE.

a. Remove right dive flap. (Refer to paragraph 4–140.)

b. Remove wiring from valve unit.

c. Disconnect four air lines leading to valve.



1. CAP	
2. SPRING	5. FLAPPER VALVE
3. RELIEF VALVE	6. FLAPPER BODY
4. AIR ESCAPE SLOT	7. "O" RING

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Figure 4-209. Sniffle Valve, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T.O. 1T-33A-42

d. Remove two bolts holding valve to structure, and move unit aft to remove it.

4-1200. PRESSURIZED SUIT VALVE. On aircraft not incorporating T.O. 1T-33-526, a "G" suit valve is installed on the left side of each cockpit at the floor level. The "G" suit valve receives air under pressure from the engine compressor, and meters it to the pilot's pneumatic suit during positive "G" accelerations. At the high setting, suit pressurization begins at 1.75 "G" and increases at a rate of 1.4 psi per "G". At the low setting, suit pressurization begins at 1.75 "G" and increases at the rate of 1 psi per "G".

4-1201. REMOVAL OF PRESSURIZED SUIT VALVE.

a. Disconnect air inlet line in cockpit.

b. Remove three nuts and bolts holding "G" valve to mounting bracket, and remove valve.

4-1202. WINDSHIELD DEFROSTER. The defroster ring is mounted around the edge of the windshield, inside the cockpit. The ring is perforated to blast air on the windshield. A valve at the forward end of the ring controls the air flow.

4-1203. REMOVAL OF WINDSHIELD DEFROSTER.

a. Remove forward instrument panel. (Refer to paragraph 4-1069.)

b. Disconnect defroster ring from air pressure line on right side of gunsight mount.

c. Remove defroster ring retaining clips, and remove defroster.

CAUTION

Do not bump gun sight with defroster ring as glass in sight may be broken.

4-1204. TURBINE AND COOLER ASSEMBLY. *(See figure 4-210.)* This assembly is located on the fuselage keelson aft of the nose gear wheel well. The assembly consists of a cross-flow heat exchanger (cooler) and a radial type expansion turbine. Hot pressurized air from the engine compressor enters the heat exchanger and passes through it to the turbine. The air entering the turbine impinges upon the turbine wheel blades, driving the turbine wheel at high speed. The cabin air passing through the turbine wheel is discharged at low temperature and pressure. The power from the turbine wheel is absorbed by the fan mounted on the opposite end of the shaft. The fan turning at high speed draws cooling air through the heat exchanger. The cooling air is obtained from the nose gear wheel well and provides a means for absorbing the heat from the engine compressor air. Ambient air is discharged on the left side of the fuselage.

4-1205. REMOVAL OF TURBINE AND COOLER ASSEMBLY.

a. Disconnect cooling-air inlet and outlet lines.

b. Disconnect ambient air outlet line.

c. Remove bolts holding unit to shock mounts.

d. Move turbine and cooler forward to remove it.

4-1206. INSTALLATION OF TURBINE AND COOLER.

a. Place unit in normal operating position, and fill sump about half full of oil, Specification MIL-L-6085A.

CAUTION

Exercise caution when using oil, Specification MIL-L-6085A, to see that it does not come in contact with and soften paint, natural rubber, neoprene, and electrical insulating materials.

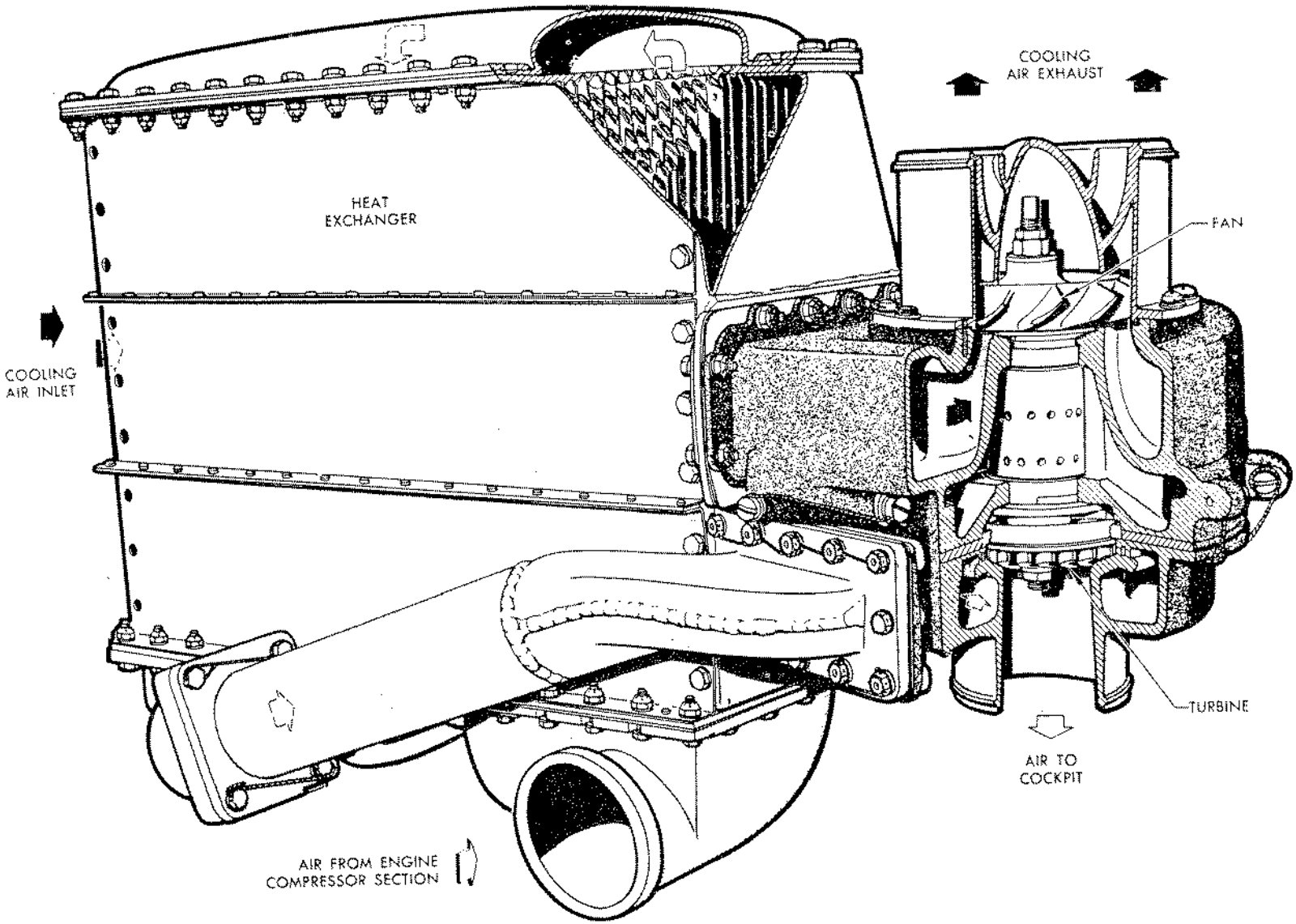

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Figure 4-210. Turbine and Cooler

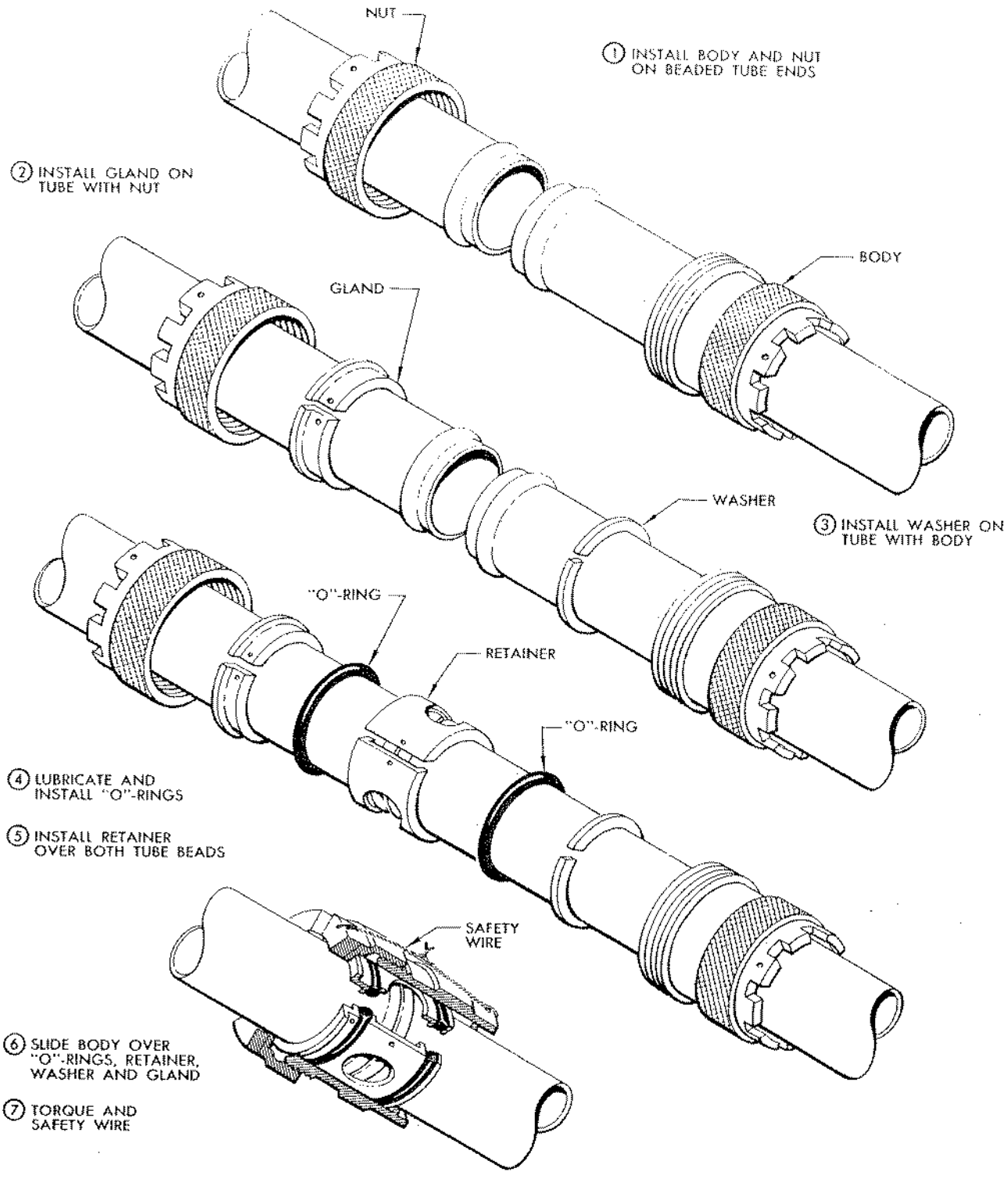

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Figure 4-211. Installation Instructions for Wiggins Couplings (Sheet 1 of 2)

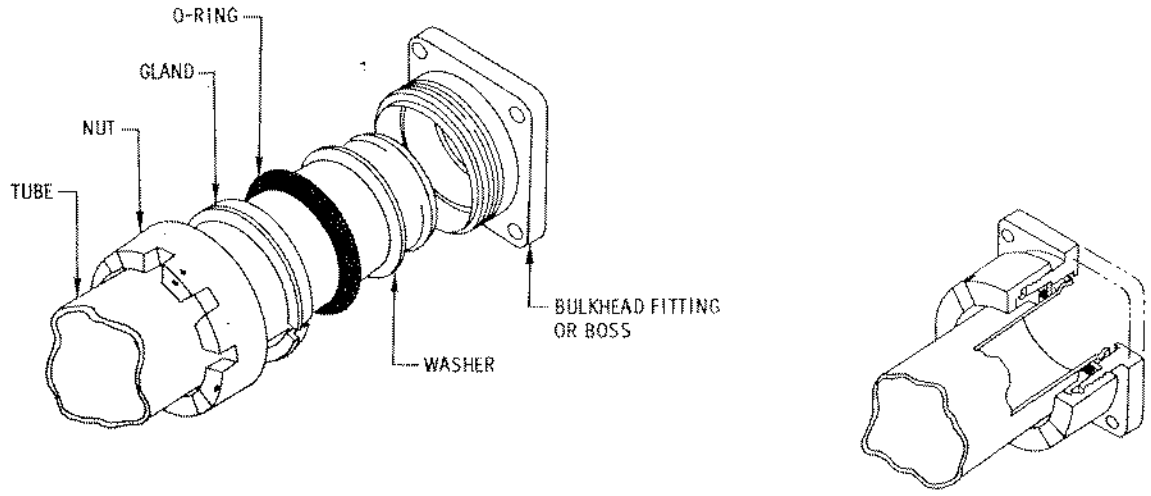


Figure 4-211. Installation Instructions for Wiggins Couplings (Sheet 2 of 2)

b. Install turbine filler screw.

c. Shake the turbine, turning it frequently about both axes to allow oil to penetrate seals and bearings and thoroughly saturate wicks.

d. Drain the oil.

e. Return unit to normal attitude, and reverse removal procedure.

Note

Upon reinstallation of heating, cooling and pressurization units, make certain that all Wiggins couplings are not torqued in excess of 50 to 60 lb in. (See figure 4-211.)

f. After unit is installed on airplane, fill sump to top level of filler screw with oil, Specification MIL-L-6085A.

4–1207. LUBRICATION OF TURBINE AND COOLER ASSEMBLY.

a. To fill turbine and cooler assembly, remove filler screw, and fill sump to level of opening.

Note

When filling turbine and cooler following a complete draining, leave drain screw out until oil flows from drain opening.

b. To drain turbine and cooler assembly, remove filler and drain-screws.

4–1208. FOOT WARMER VALVE. Two foot warmer valves are located in each cockpit. The valves are outboard of the rudder pedals in the forward cockpit and inboard of the rudder pedals in the aft cockpit. These valves serve to deliver warm air in quantity desired by pilot, and to shut off air supply completely.

4–1209. REMOVAL OF FOOT WARMER VALVE.

a. Remove valve-handle retaining nut and handle.

b. Remove four screws and nuts which hold lower plates, handle stops, and valve in position.

c. Remove four mounting screws which fasten valve to air pressure line.

d. Remove unit from behind mounting panel.

4–1210. HEAD WARMER VALVE. A head warmer valve is on the end of a tube projecting up from the floor to the right and behind each pilots seat. This unit, in addition to assisting in the provision of warm air for heating the cockpit, also aids in defrosting the canopy due to the angle at which the valve is set.

4–1211. REMOVAL OF HEAD WARMER VALVE. Remove four screws and nuts which hold valve to hot air tube, and remove valve.

4–1212. COCKPIT PRESSURE REGULATOR VALVE. The cockpit pressure regulator valve is on the cockpit floor to the right and aft of the aft pilots seat. The valve is automatic and non-adjustable, and is set at the factory to give the following conditions. From zero to 8000 feet, no pressurization is provided; from 8000 to 15,300 feet, the cockpit pressure is maintained at 10.9 psi absolute; above 15,300 feet the cockpit pressure is maintained at 2.75 psi above atmospheric pressure.

4–1213. A shutoff valve is provided which may be used to make the entire pressure regulator valve inoperative. The shutoff valve is normally lockwired in open position, but may be closed to shut off air flow during pressure testing operations in the cockpit.

4–1214. REMOVAL OF COCKPIT PRESSURE REGULATOR VALVE.

a. On airplanes AF Serial Nos. 50-385 and subsequent, remove interphone amplifier.

b. At the point where it enters the floor, disconnect static line that leads to the valve.

c. Working through right dive flap opening perform the following:

WARNING

Shut off the hydraulic pressure to the dive-flaps selector valve. Accidental operation of dive-flaps may cause serious injury to personnel.

On airplanes prior to AF Serial No. 51-6751 remove 12 screws fastening valve to floor.

On airplanes AF Serial Nos. 51-6751 and subsequent, remove 12 bolts fastening valve to floor.

d. Lift unit and move it forward taking care not to damage mounting gasket.

4–1215. INSTALLATION OF COCKPIT PRESSURE REGULATOR VALVE. Reverse removal procedure. Use sealant MIL-S-7502 between valve mounting and airplane structure to preserve cockpit pressure sealing.

CAUTION

Exercise caution to prevent warpage of the base mount when tightening bolts fastening valve to cockpit floor.

4–1216. TROUBLE SHOOTING THE COCKPIT PRESSURE REGULATOR VALVE.

Trouble	*Probable Cause*	*Remedy*
Pressure regulator inoperative.	Ruptured diaphragm.	Replace regulator.
	Shutoff valve in "OFF."	Lockwire valve in "ON."
	Obstruction on outflow valve seat preventing complete closing.	Clean outflow valve.
	Filter clogged.	Remove and clean filter.
Regulator fails to provide cockpit pressure control in isobaric range.	Shutoff valve in "OFF."	Lockwire valve in "ON."
	Filter clogged.	Remove and clean filter.
	Isobaric (evacuated) bellows ruptured or faulty.	Replace regulator.
Regulator fails to provide cockpit pressure control in differential range.	Differential bellows ruptured.	Replace regulator.
Regulator maintains improper cockpit pressure in isobaric range.	Isobaric control system out of calibration.	Replace regulator.
Operation of regulator unstable in isobaric range.	Faulty isobaric bellows or needle valve.	Replace regulator.
Regulator maintains improper cockpit pressure in differential range.	Differential control system out of calibration.	Replace regulator.

Trouble	*Probable Cause*	*Remedy*
Operation of regulator unstable in differential range.	Faulty differential bellows or needle valve.	Replace regulator.

4-1217. COCKPIT VACUUM RELIEF AND DUMP VALVE (PRIOR TO AF SERIAL NO. 54-1544, EXCEPT 53-5814 THROUGH 53-6152). *(See figure 4-212.)* A cockpit vacuum relief and dump valve is on the floor of the forward cockpit between the rudder pedals. At the base and to the left of the radio compass mounting panel is a foot lever which actuates the pressure dumping mechanism of the valve.

4-1218. OPERATION OF COCKPIT VACUUM RELIEF AND DUMP VALVE. The valve is a combination pressure relief, vacuum relief, and dump valve.

4-1219. Cockpit pressure in excess of 3.5 psi above atmospheric pressure causes bellows (5) to contract, lifting piston (6) from valve seat (11), and opening the chamber below diaphragm (9) to atmospheric pressure. This permits cockpit pressure to force diaphragm (9) from its seat against valve housing (4), allowing cockpit pressure to drop to the point where the bellows expands and the cycle reverses.

4-1220. Cockpit air pressure may be dumped manually by actuating the foot lever. This compresses bellows (5) and initiates the cycle described above, except that air will be released through the valve as long as the foot lever is actuated.

4-1221. Atmospheric pressure in excess of cockpit pressure by approximately one inch of water on airplanes prior to AF Serial No. 51-4397, and 1.5 inches of water on airplanes AF Serial No. 51-4397 and subsequent will force diaphragm (9) from its seat and permit the pressures to equalize.

4-1222. REMOVAL OF COCKPIT VACUUM RELIEF AND DUMP VALVE.

a. Remove cotter key holding foot-lever actuating rod to relief valve arm.

b. Remove screws which hold relief valve and relief valve cover plate to cockpit floor, and remove unit.

4-1223. COCKPIT VACUUM RELIEF AND DUMP VALVE (AF SERIAL NO. 53-5814 THROUGH 53-6152 AND 54-1544 AND SUBSEQUENT). *(See figure 4-213.)* A cockpit vacuum relief and dump valve is on the floor of the forward cockpit between rudder pedals. The valve is dumped by a solenoid which is wired into the same circuit as the hot air shutoff valve.

4-1224. OPERATION OF COCKPIT VACUUM RELIEF AND DUMP VALVE. *(See figure 4-213.)* The valve is a combination pressure relief, vacuum relief, and dump valve. Cockpit pressure in excess of 3.5 psi above atmospheric pressure causes bellows (4) to contract, lifting piston (5) from valve seat (12) and opening the chamber below diaphragm (8) to atmospheric pressure. This permits cockpit pressure to force diaphragm (8) from its seat against valve housing (3), allowing cockpit pressure to drop to the point where the bellows expand and the cycle reverses.

4-1225. Cockpit pressure may be dumped by energizing solenoid valve (16). Solenoid plunger raises poppet (14) off its seat permitting air pressure below the diaphragm to escape. This action allows the diaphragm to be forced from its seat relieving cockpit pressure.

4-1226. Atmospheric pressure in excess of cockpit by 2.5 inches of water will force diaphragm (8) from its seat and permit the pressures to equalize.

4-1227. REMOVAL OF COCKPIT VACUUM RELIEF AND DUMP VALVE.

a. Remove screws holding relief valve and relief valve cover plate to cockpit floor.

b. Remove ground wire from ground stud on stringer No. 11 in nose wheel well on left side of fuselage.

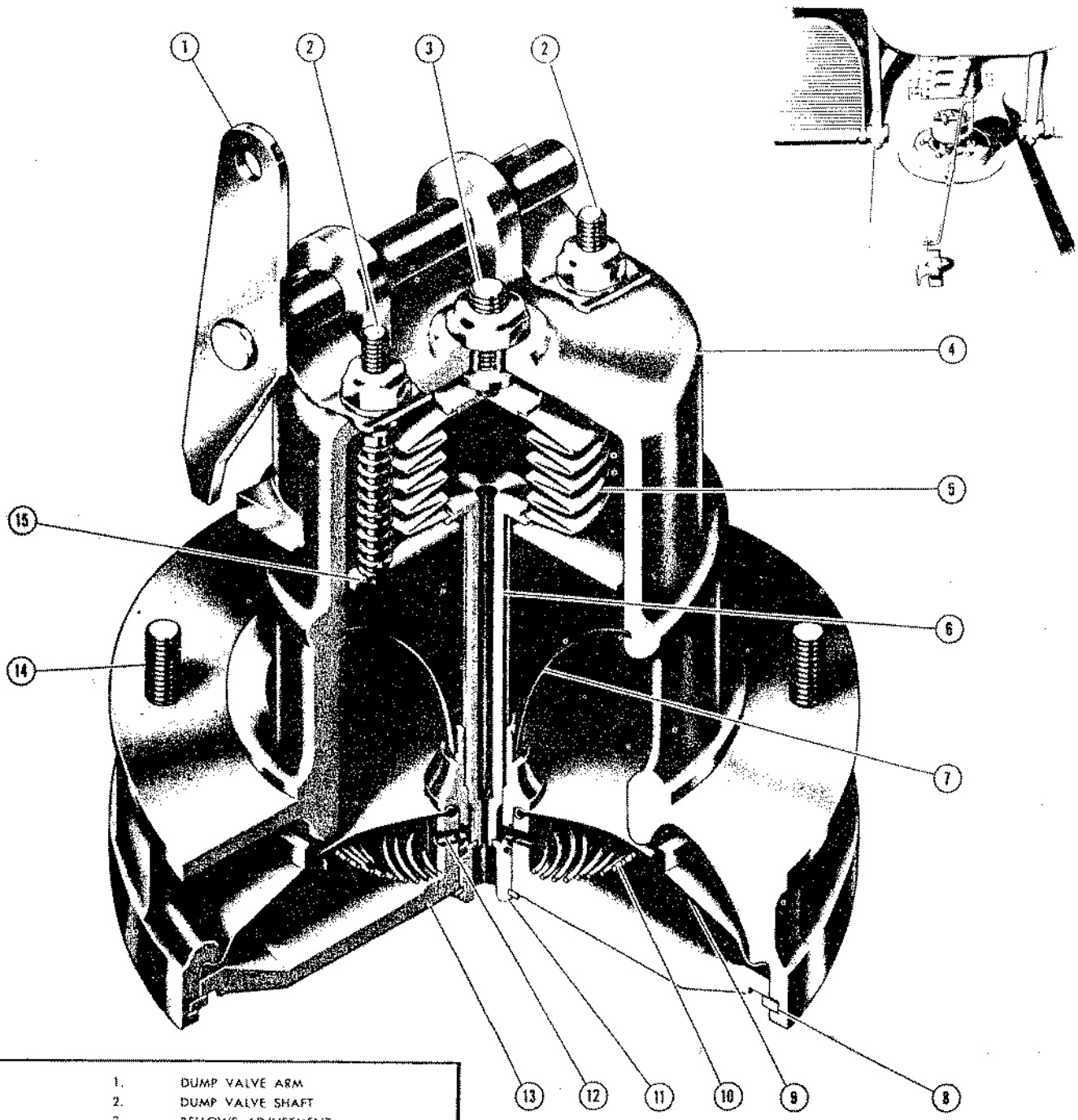
c. Remove power wire from terminal strip, terminal No. 2.

d. Remove relief valve.

4-1228. INSTALLATION OF COCKPIT VACUUM RELIEF AND DUMP VALVE. Reverse removal procedure.

WARNING

To prevent interference with nose wheel tire, proper position of valve solenoid is at the



1.	DUMP VALVE ARM
2.	DUMP VALVE SHAFT
3.	BELLOWS ADJUSTMENT
4.	VALVE HOUSING
5.	BELLOWS
6.	PISTON
7.	BELLOWS COVER
8.	SNAP RING
9.	DIAPHRAGM
10.	DIAPHRAGM RETURN SPRING
11.	VALVE SEAT
12.	BLEED PORT
13.	COVER PLATE
14.	MOUNTING STUD
15.	DUMP VALVE PLATE

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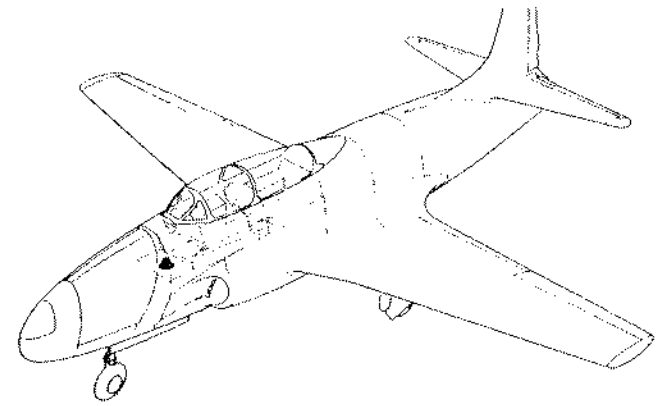
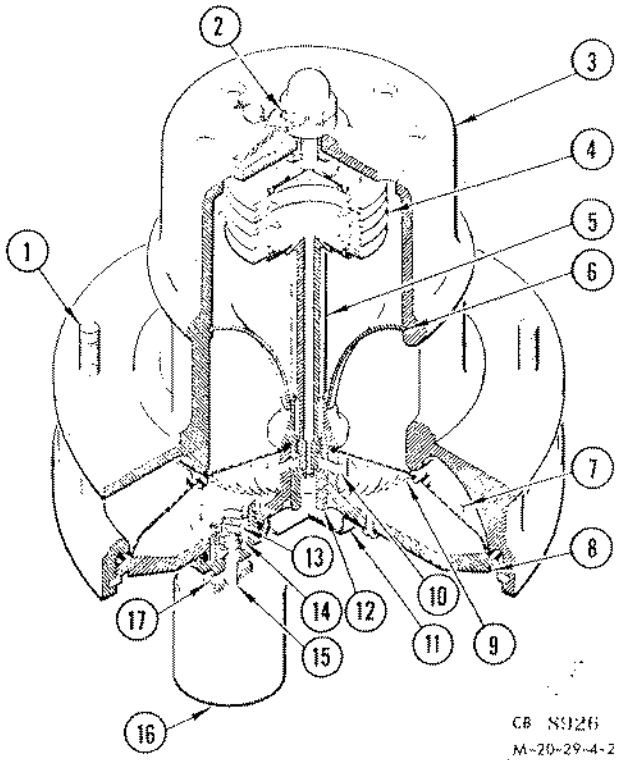
Figure 4-212. Cockpit Vacuum Relief and Dump Valve, Prior to AF Serial No. 54-1544, Except 53-5814 through 53-6152





1.	MOUNTING STUD
2.	BELLOWS ADJUSTMENT NUT
3.	FRAME ASSEMBLY
4.	BELLOWS ASSEMBLY
5.	PISTON
6.	BELLOWS COVER
7.	DIAPHRAGM
8.	BASE
9.	DIAPHRAGM SPRING
10.	BLEED PORT
11.	VALVE GUARD
12.	VALVE SEAT
13.	POPPET RETURN SPRING
14.	SPRING RETAINER
15.	SOLENOID PLUNGER
16.	SOLENOID ASSEMBLY
17.	DUMPING PORT

Figure 4-213. Cockpit Vacuum Relief and Dump Valve, AF Serial No. 53-5814 through 53-6152 and 54-1544 and Subsequent

10 o'clock position and wiring must be secured in the wire bundle clamp located at left side of nose gear uplock cylinder.

Note

Make certain pressure plate gasket is in place.

4–1229. AUXILIARY DEFROSTER HEATER-BLOWER UNIT. This unit is forward of the instrument panel. The unit heats cockpit air and blows it against the windshield through the defroster outlet tubes as an alternate to engine compressor defrosting air. For detailed information, refer to paragraph 4–880.

4–1230. AUXILIARY DEFROSTER DIFFUSER. An aluminum diffuser is installed just inside the forward edge of the windshield to distribute air from the heater-blower unit over the windshield.

Note

On AF Serial No. 55-4410 and subsequent, and aircraft incorporating T.O. 1T-33A-558, the vane type diffuser is replaced by a perforated tube type defroster.

4–1231. REMOVAL OF AUXILIARY DEFROSTER DIFFUSER.

a. Remove windshield defroster.

b. Prior to AF Serial No. 55-4410 on airplanes not incorporating T.O. 1T-33A-558, loosen clamping nut on diffuser, and remove diffuser.

c. On AF Serial No. 55-4410 and subsequent, and aircraft incorporating T.O. 1T-33A-558, remove two clamps which attach defroster to armor plate. Remove two clamps which attach two hoses to defroster, and remove defroster.

4–1232. COCKPIT PRESSURE TESTING. *(See figure 4-203.)*

a. Fill the turbine and cooler sump with oil, Specification MIL-L-6085A.

CAUTION

Exercise caution when using oil, Specification MIL-L-6085A, to see that it does not come in contact with and soften paint, natural rubber, neoprene, and electrical insulating materials.

b. Cut safety wire from shutoff valve handle on cockpit pressure regulator. Turn handle 180 degrees to "ALL OFF" position.

Note

After pressure check, be sure to return valve handle to its original position, and resafety it.

c. Make certain all instruments using airplane static and pitot system are either connected to their respective lines or that instruments and lines are plugged. Failure to comply will result in damage to instruments.

d. Remove cabin altimeter.

e. Disconnect canopy seal line in hydraulic compartment at left main duct and connect a pressure line from tester compressor to seal line. Cap fitting in left main duct.

f. Connect a line between static pressure connection on tester and small fitting on right side of F.S. 103 bulkhead.

g. Disconnect both cockpit pressurization lines at clamps forward of engine flexible ducts. Cap one pressurization line and connect flexible hose from tester to other pressurization line.

h. Connect external source of electrical power to airplane and place drop tank switch in OFF.

i. On AF Serial No. 53-5814 through 53-6152 and 54-1544 and subsequent, place cabin pressure switch in OFF position prior to beginning of test.

Note

Make certain that solenoid air shutoff valve handle is in OPEN position.

j. Place cockpit heat control in HOT to prevent air pressure from operating the turbine and cooler.

k. Open cabin air inlet valves on cockpit floor near rudder pedals.

l. Make certain that cabin pressure relief valve in floor between rudder pedals is closed.

m. Close and lock canopy and fasten safety strap to canvas webbing around fuselage.

WARNING

Be sure safety straps are used to prevent canopy from causing injury in event that canopy mechanism should fail. Do not open canopy during test unless cockpit air pressure is relieved.

n. Apply air pressure to canopy seal until seal relief valve opens. This should occur at between 15 and 19 psi. Do not increase air pressure after relief valve opens.

o. When sufficient seal pressure is obtained, apply air pressure to cockpit gradually, by slowly cracking valve on tester. Watch tester cabin pressure gage and rate of pressure change gage and when cockpit pressure reaches 2.75 (+0.00, −0.02) psi and rate of pressure change drops to zero, the volume of air input shown on the flowmeter shall not exceed 65.0 cubic feet per minute (i.e., 65 cubic feet per minute of free air at 2.75 psi pressure over atmospheric).

p. After leakage requirements have been met, place ground test selector valve handle on cockpit pressure regulator in DIFF ON position. Gradually increase tester air pressure. Note that pressure regulator relieves at 2.75 psi. If regulator fails to relieve, replace regulator. Place regulator handle in ALL OFF position.

q. Turn off air supply to canopy seal and hold a tester input of 2.75 psi at 65 cfm. If cockpit pressure falls after turning off air supply to canopy seal, leakage is present in either the canopy seal or in the canopy seal check valve. Restore canopy seal air pressure.

r. After leakage requirements have been met, increase pressure to 3.5 (±0.1) psi to check operation of relief valve.

s. Place flow control valve in COLD position to check air turbine and cooler operation. Shut off flow control valve as soon as possible.

WARNING

Relieve cabin air pressure by turning shutoff valve handle on cockpit pressure regulator to ALL ON position. Safety handle in this position, or personnel may be injured.

t. Connect lines after completion of test.

u. Inspect cabin altimeter for open vent and reinstall.

4–1233. OXYGEN SYSTEM.

WARNING

Take every precaution when working with oxygen to see that all clothing, lines, fittings, and equipment are free from oil and grease. Fire or explosion may result when slight traces of oil or grease come in contact with oxygen under pressure. Do not open valves where there is an open flame or an electric arc.

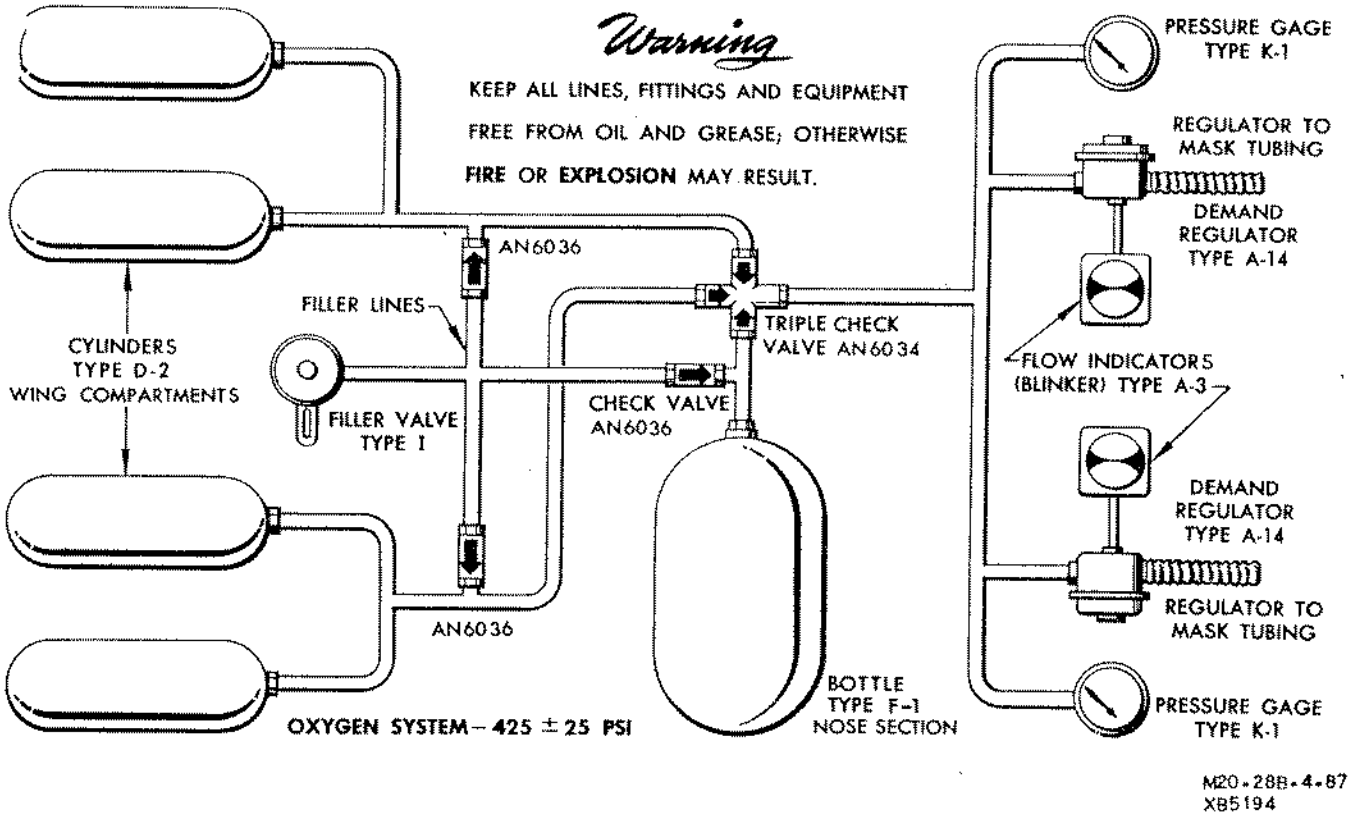


Figure 4-214. Oxygen System

4–1234. DESCRIPTION OF OXYGEN SYSTEM. *(See figure 4-214.)* The oxygen installation is a pressure breathing, demand system built into the airplane. All units are connected by $\frac{5}{16}$-inch OD, 0.035 gage aluminum alloy tubing. The regulators are connected to the masks by flexible tubing.

4–1235. OPERATION OF OXYGEN SYSTEM. The oxygen system provides the pilots with proper amounts of oxygen at all altitudes and under all conditions. Oxygen under a maximum pressure of 450 psi is supplied by the cylinders to the demand regulator, which in turn supplies oxygen to the pilot as he breathes through the mask.

4–1236. The pressure gage indicates the supply of oxygen remaining in the cylinders. The flow indicator shows that oxygen is flowing from the regulator. Check valves are installed in the filler lines between the filler valve and each cylinder location, and a cross-triple check valve is installed in the supply line between the cylinders and demand regulators. Valves are marked to show direction of flow.

4–1237. MAINTENANCE OF OXYGEN SYSTEM.

a. Keep oxygen units and tubing free from oil, grease, and other foreign matter.

CAUTION

Do not use a grease or oil-base soap in performing step b or equipment will deteriorate.

b. To check for leaks, charge the system to 425 (±25) psi and check tubing, fittings, and cylinders with a NEUTRAL soap solution.

WARNING

- When performing step c, use tape on tapered pipe threads only.
- In no instance shall this tape be used on fittings which have flared ends or cone ends.
- Before applying new tape, remove all remnants of old tape from threads.

c. Seal all pipe thread connections with tetrafluorethylene (Teflon) tape, MIL-T-27730, apply to oxygen line threads in accordance with T.O. 15X-1-1. Wrap tape in direction of thread spiral of male pipe thread, beginning with second thread. In no case shall the tape be permitted to extend beyond the first thread. Encircle the threads and join together with a very slight overlap, using care not to contaminate the tape.

d. Use a torque wrench to tighten fittings. Do not exceed 50 lb in. torque on plastic regulator fittings; do not exceed 100 lb in. torque on aluminum alloy fittings.

e. Before removing any unit from the oxygen system, slowly discharge pressure by loosening inlet fitting at the regulator or by turning regulator control to SAFETY.

f. Return defective units of oxygen system to instrument repair department of control depot.

g. Make certain that flex hose is properly installed over bead of tubing prior to installation of clamp and that clamp is not installed over circumference of tube bead.

4–1238. FILLING OXYGEN SYSTEM. Before filling oxygen system, thoroughly clean all dirt, oil, or grease from the filler box. Be sure a drier cartridge and a pressure reducing regulator are used on the recharger. Never fill a low-pressure system from a storage cylinder without a pressure reducer to lower the high pressure to the safe working pressure of the airplane system. After attaching filling cylinder to system line, open regulator valve on cylinder slowly until approximately 425 psi pressure is registered on the gage. Do not charge the system to a pressure in excess of 450 psi.

WARNING

The oxygen system pressure should not be allowed to become completely depleted. An empty oxygen system will allow moisture to enter the system which may cause freezing of equipment or obstruction of system during low temperature operations. On airplanes that have returned from missions with oxygen system pressure completely depleted or with pressure below 50 psi, system must be refilled within a period of two hours after airplane lands. If oxygen system is not filled within two hours after airplane lands, it will be necessary to purge the system. If oxygen cylinder pressure drops below 50 psi while airplane is on the ground, the system must be purged.

4–1239. During the filling process, oxygen becomes heated, and increasing temperature of the cylinders installed on the airplane is an indication that replenishing oxygen is entering the cylinders. After filling, the gage pressure may drop as much as 30 psi as the oxygen cools. This pressure drop does not necessarily indicate a leak in the system.

4–1240. PURGING OXYGEN SYSTEM. Purge the oxygen system by filling and depleting the system at least three times. It will be necessary to purge the oxygen system should foreign matter or moisture enter the system. This may occur if lines or fittings are not plugged when disconnected.

4–1241. OXYGEN MAST. The A-13A oxygen mask used with the demand system is a special mask that requires very careful selection of size and test of fit. It contains two inlet ducts which direct the flow of oxygen from the inlet tube to the inhalation ports located on each side of the mask. Each inhalation port contains an inlet check valve which allows a fresh supply of oxygen to flow to the interior of the mask only when it is needed by the user. During exhalation the check valves are closed. An exhalation valve located at the base of the mask in the exhalation port dispels the exhaled air through the expiratory chamber. During the inhaling process the exhalation valve remains closed. If the mask does not fit, the user will draw some air from the rarefied atmosphere instead of drawing the correct amount of oxygen from the regulator, and will suffer from the effects of too little oxygen. Extreme care must be taken, therefore, in fitting the mask. A flexible corrugated tube connects the mask to the demand system.

CAUTION

Stow flexible tube carefully to prevent crushing or kinking. Be sure fittings between tube and regulator and between tube and mask are tight.

4–1242. MAINTENANCE OF OXYGEN MASK. No attempt should be made to repair defective valves. If the mask is damaged and is to be replaced, turn the mask over to the Personal Equipment Officer for disposition. While not in use, masks must be kept in a clean, dry place away from sunlight and heat as much as possible. Particular attention should be given to the exhalation valve to see that the valve seat and flap are kept clean.

4–1243. For ordinary cleaning, wash the mask with a pure soap solution and rinse it well with clean water. If

a microphone is installed, use a clean swab instead of running water, in order to keep the microphone from getting wet. To disinfect an oxygen mask swab it carefully and thoroughly with a gauze solution of merthiolate (1 gram merthiolate, Medical Supply Stock No. 1-285-675, to 1000 CC of water). Spray the inner crevices to make certain that the disinfectant penetrates thoroughly. Wipe the mask with a clean cloth and let it dry before it is used.

Note

No lubrication or grease of any kind is required or should be used in this equipment.

4–1244. OXYGEN DEMAND REGULATOR. *(See figures 4-215 and 4-216.)* The type A-14 diluter-demand oxygen regulator is essentially a diaphragm-operated flow valve which opens when the user inhales and shuts when he exhales. It is of the two stage reduction type, consisting of two main sections or stages and a mixing chamber. The low pressure chamber contains a relief valve which will "crack" at a minimum of 1.1 inch of mercury. In addition to furnishing oxygen on demand the A-14 regulator mixes air with oxygen in varying quantities according to existing altitudes. Two manual controls, the diluter control and the pressure breathing knob are provided. The two positions of the diluter control are labeled NORMAL OXYGEN and 100% OXYGEN. The pressure breathing knob calibrations show as SAFETY pressure and in altitudes reading 41M, 43M, 45M, and ABOVE 45M.

4–1245. OPERATION OF OXYGEN DEMAND REGULATOR. *(See figure 4-216.)* Each time the pilot inhales the pressure drop is sufficient to deflect the diaphragm which is connected to valve (4), causing the valve to open and oxygen to flow into the mask. As soon as inhalation stops, a spring returns the diaphragm to its original position and valve (4) closes.

4–1246. When the diluter control handle is in the NORMAL position the regulator automatically provides the required amount of oxygen. This is accomplished by an aneroid within the regulator which controls an oxygen port and an air port. As altitude increases, the aneroid expands, gradually closing the air port while opening the oxygen port, so that at approximately 30,000 feet the air port is completely closed and the oxygen port wide open. When the diluter control handle is turned to 100% OXYGEN position, the regulator still functions as a demand regulator, but the air port is closed and 100 percent pure oxygen is supplied at all altitudes. The pressure breathing knob must be turned to the successive positions as altitude is increased above 30,000 feet. The knob should be set to SAFETY at altitudes between 30,000 and 40,000 feet. The regulator will then supply oxygen to the mask at a pressure very slightly above that of the cockpit air.

4–1247. REMOVAL OF OXYGEN DEMAND REGULATOR.

a. Discharge oxygen system pressure slowly by turning regulator pressure breathing knob to SAFETY.

b. Remove regulator-to-mask tubing and plug regulator outlet.

c. Disconnect supply line and line to the flow indicator.

d. Remove mounting screws and lift regulator from mounting bracket. Plug remaining openings.

4–1248. REPAIRS AND ADJUSTMENTS OF OXYGEN DEMAND REGULATOR. Return defective regulator to instrument repair depot.

4–1249. INSTALLATION OF OXYGEN DEMAND REGULATOR (Replacement Regulator).

a. Remove shipping plug from oxygen inlet fitting.

b. Remove plastic dust plug from outlet elbow.

WARNING

- When performing step c, use tape on tapered pipe threads only.
- In no instance shall this tape be used on fittings which have flared ends or cone ends.
- Before applying new tape, remove all remnants of old tape from threads.

c. Seal all pipe thread connections with tetrafluorethylene (Teflon) tape, MIL-T-27730, apply to oxygen line threads in accordance with T.O. 15X-1-1. Wrap tape in direction of thread spiral of male pipe thread, beginning with the second thread. In no case shall the tape be permitted to extend beyond the first thread. Encircle the threads and join together with a very slight overlap, using care not to contaminate the thread.

WARNING

Do not use oil, or any material containing oil, on threads, since fire or explosion might occur when such material contacts oxygen under pressure.

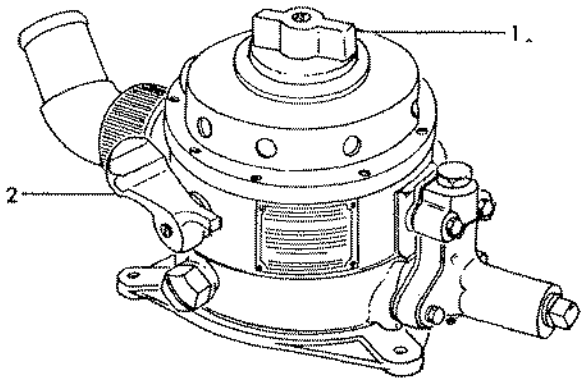
d. Set regulator in position on mounting bracket, and attach $\frac{5}{16}$-inch aluminum alloy tubing from oxygen source to nipple. Be sure tubing is free of obstructions, and that it is attached securely and in such a manner as to protect against breakage.

e. Remove brass plug from flow-indicator connection.

WARNING

- When performing step f, use tape on tapered pipe threads only.
- In no instance shall this tape be used on fittings which have flared ends or cone ends.
- Before applying new tape, remove all remnants of old tape from threads.

f. Seal the flow-indicator line nipple with tetrafluorethylene (Teflon) tape, MIL-T-27730, apply to oxygen line threads in accordance with T.O. 15X-1-1.



1. PRESSURE CONTROL KNOB
2. DILUTER CONTROL

M20-41-4-240
FB 9878

Figure 4-215. Oxygen Regulator

Wrap tape in direction of thread spiral of male pipe thread, beginning with the second thread. In no case shall the tape be permitted to extend beyond the first thread. Encircle the threads and join together with a very slight overlap, using care not to contaminate thread. Tighten nipple carefully; do not exceed torque of approximately 50 lb in.

Note

When replacing oxygen regulators be sure to use the outlet elbow supplied with the new regulator. The Bendix design A-12 and AN6004-1 regulators have a screen type baffle installed inside the outlet elbow which prevents oxygen syphoning. The elbow with the baffle installed must not be used with any other type or design regulator as it will restrict the oxygen flow of these regulators.

g. Attach $\frac{5}{16}$-inch aluminum alloy tubing from flow indicator to the nipple. Hold nipple securely with a wrench.

h. Attach regulator to bracket with its mounting screws.

i. Attach mask-to-regulator tubing to the oxygen-air outlet with hose clamp supplied with the tubing.

Note

The outlet elbow is serrated, and mated with serrations in the regulator body. If it is necessary to change the position of the outlet elbow, remove outlet gland nut from outlet of regulator and remove elbow from regulator. Select desired position of elbow and reinsert serrations into mating serrations of regulator outlet, being sure rubber sealing gasket is in place. Tighten outlet gland nut securely.

4–1250. TEST OF OXYGEN DEMAND REGULATOR INSTALLATION.

a. Charge oxygen system to 425 (±25) psi.

b. Place diluter control in 100% OXYGEN and pressure control knob in NORMAL. Apply a small amount of neutral soap solution to regulator case at seams and around connections. Change regulator if any leak is evident.

c. Disconnect regulator-to-mask tubing and place a soap film across elbow opening. There must be no swelling of soap film. Wipe regulator, connections and tube, clean of soap solution.

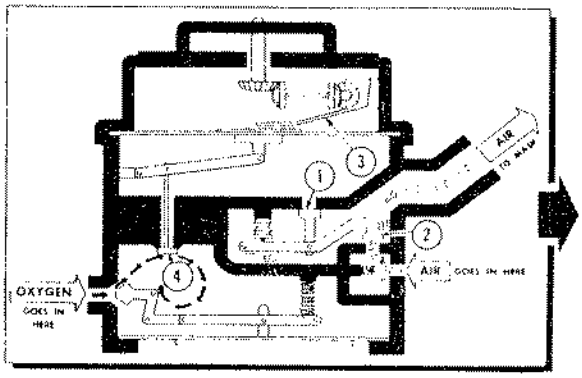
d. With diluter control still at 100% OXYGEN, open trap-door dust cover of the mask-to-regulator tubing on end opposite to that connected to regulator. Place mouth over tube opening and inhale through the tube. A good flow of oxygen should pass through tubing with negligible resistance. Close cover.

e. Place pressure breathing knob in SAFETY setting. A steady flow of oxygen through regulator-to-mask tubing indicates correct operation.

f. With the diluter control in 100% OXYGEN and pressure control knob at NORMAL, place open end of mask-to-regulator hose against your mouth and blow gently into it for about five seconds (blowing too hard will cause regulator relief valve to vent). There should be a positive and continued resistance to blowing. If there is only slight or no resistance, the second stage breathing diaphragm may be faulty or the mask-to-regulator hose or connections may be leaking. Repeat this blow back test with diluter control in NORMAL and pressure knob in NORMAL. There should be a positive and continued resistance to blowing. If there is only a slight or no resistance, the air metering check valve, mask-to-regulator hose or mask-to-regulator hose connection may be leaking.

Note

A normal person can create a maximum of approximately 2 psi by blowing.

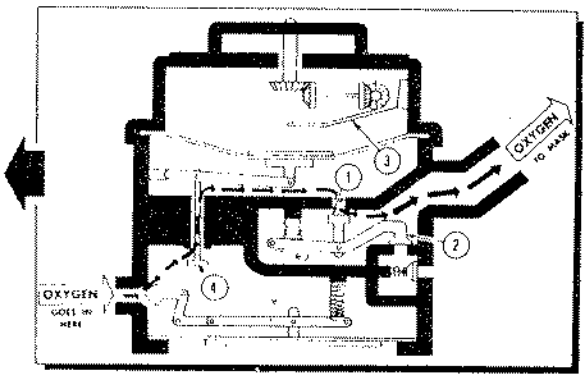


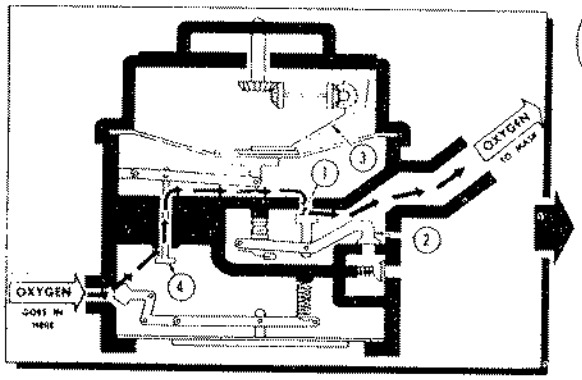
A

A-14 REGULATOR OPERATION DURING INHALATION AT SEA LEVEL. OXYGEN DILUTER VALVE (1) IS CLOSED, AIR DILUTER VALVE (2) IS OPEN, AND YOU BREATH AIR ONLY

B

REGULATOR OPERATION DURING INHALATION AT 30,000 FEET. AIR DILUTER VALVE (2) IS CLOSED, OXYGEN DILUTER VALVE (1) IS OPEN, AND YOU BREATH 100 PERCENT OXYGEN



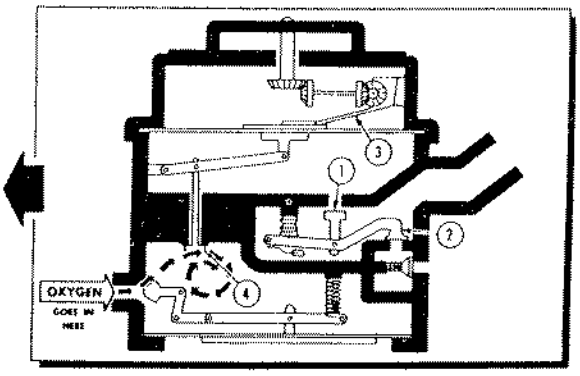


C

REGULATOR OPERATION DURING INHALATION WITH PRESSURE BREATHING. SPRING (3) PRESSES DOWN ON DIAPHRAGM, OPENING DEMAND VALVE (4) AND FORCING OXYGEN INTO THE MASK UNDER PRESSURE.

D

REGULATOR OPERATION DURING EXHALATION WITH PRESSURE BREATHING. AS YOU EXHALE YOU MOMENTARILY RAISE THE PRESSURE IN THE MASK ABOVE THE OXYGEN SUPPLY PRESSURE, FORCING THE DIAPHRAGM UP AGAINST THE SPRING TENSION. THE DEMAND VALVE (4) CLOSES AND NO OXYGEN FLOWS.



ARB 8017

Figure 4-216. Oxygen Regulator Schematic

g. Turn pressure breathing knob to "NORMAL" position and check all line connections for leakage by applying a small amount of NEUTRAL soap solution.

h. Apply a small amount of NEUTRAL soap solution to regulator case at seams and around connections.

Note

If a line leak is indicated, make necessary adjustments, but do not tamper with the regulator.

i. Disconnect regulator-to-mask tubing and place a soap film across elbow opening. There must be no swelling of the soap film.

j. Wipe regulator and connections clean of soap solution after tests are complete.

k. Install an oxygen mask to the regulator hose and a water manometer to the bail-out bottle connection. With the mask held tightly against the face to prevent leakage of oxygen, set the diluter lever at "NORMAL OXYGEN" and take a deep breath. While holding the breath, turn pressure breathing knob to each position and note the manometer readings. The minimum allowable pressure reading at each setting is listed below. The maximum allowable pressure is 17 inches of water pressure.

Dial Setting	*Pressure Delivered Inches of Water*
Normal	Same as Ambient
Safety	1.25
41 M	3.5
43 M	5.5
45 M	7.5
Above 45 M	11.0

4–1251. OXYGEN FLOW INDICATOR. The flow indicator blinks with each breathing cycle of the user, and thus gives visual indication that oxygen is flowing from the regulator when the pressure breathing knob is in "NORMAL" position. It does not indicate that sufficient oxygen is flowing. Should blinker fail to move while system is in normal operation at altitude, it may be an indication of failure in the demand mechanism of the regulator, and the regulator control should be turned to "SAFETY" position immediately. The flow indicator is mounted at the left end of the instrument sub-panel.

Note

With the diluter in normal position, it is possible the blinker will only partially open, or will not open at all. It is also possible that a shallow breather may not breathe at a sufficient rate to actuate the blinker. This condition does not indicate a faulty blinker or a no flow of oxygen. Blinker should be checked with the diluter lever in the 100% position. A normal breathing cycle should be sufficient to actuate the blinker. If the blinker does not operate in the 100% position, it will be considered faulty.

4–1252. REMOVAL OF OXYGEN FLOW INDICATOR.

a. Discharge oxygen system pressure slowly by turning regulator pressure breathing knob to "SAFETY."

b. Disconnect and plug tubing connections.

c. Remove four mounting bolts and remove indicator.

4–1253. INSTALLATION OF OXYGEN FLOW INDICATOR. Reverse removal procedure.

Note

If tape was used for sealing tubing, clean all adhesive from surfaces.

CAUTION

Care must be taken to prevent oil, grease, moisture, or other foreign material from entering the indicator, fittings, or tubing.

4–1254. OXYGEN PRESSURE GAGE. The oxygen gage indicates pressure in pounds per square inch of oxygen in the supply cylinders. This gage is adjacent to the flow indicator on the instrument sub-panel.

4–1255. REMOVAL OF OXYGEN PRESSURE GAGE.

a. Discharge oxygen system pressure slowly by turning regulator control dial to "SAFETY."

b. Disconnect and plug tubing.

c. Remove mounting bolts and lift gage from bracket.

4–1256. INSTALLATION OF OXYGEN PRESSURE GAGE. Reverse removal procedure.

WARNING

Be sure all parts of the gage and all tubing are free from oil, grease, or other foreign matter.

4–1257. OXYGEN CYLINDERS. *(See figure 4-214.)* The oxygen supply is contained in shatter-proof cylinders. Four cylinders are mounted in the wing, two on each side of the airplane between wing stations 34 and 63. Access to the wing cylinders is through removable panel No. 20 (figure 3-1). One cylinder is mounted in the nose, and is accessible through the armament compartment doors.

4–1258. REMOVAL OF OXYGEN CYLINDERS.

a. Discharge oxygen system pressure slowly by turning regulator pressure breathing knob to SAFETY.

b. Remove access panel No. 20 to reach wing cylinders, or open armament compartment doors to reach nose cylinder.

c. Disconnect and plug lines at tube fittings.

d. Install pipe plugs in cylinder fittings to prevent entrance of dust, moisture, or other foreign matter.

e. Loosen cylinder support straps by unscrewing trunnion bolts, and remove cylinders.

4–1259. MAINTENANCE OF OXYGEN CYLINDERS.

a. Maintain at least 50 psi oxygen pressure in the cylinders at all times. If the pressure falls much below this value, moisture is very likely to accumulate in the cylinders.

b. Keep cylinders clean and dry, inside and outside.

c. Paint outside surface with zinc chromate primer, Specification MIL-P-6889A, as protection against corrosion.

d. For maintenance repairs requiring disassembly, return cylinders to repair depot.

e. Protect oxygen cylinders from excessive heat and from the direct rays of the sun.

f. Cylinders depleted to a pressure approaching 50 psi are to be marked EMPTY and segregated from other cylinders.

4–1260. INSTALLATION OF OXYGEN CYLINDERS. Reverse removal procedure, but perform step a.

WARNING

- When performing step a, use tape on tapered pipe threads only. In no instance shall this tape be used on fittings which have flared ends or cone ends.
- Before applying new tape, remove all remnants of old tape from threads.
- Do not use red lead or paint.

a. Seal all pipe thread connections with tetrafluorethylene (Teflon) tape, MIL-T-27730, apply to oxygen line threads in accordance with T.O. 15X-1-1. Wrap tape in direction of thread spiral of male pipe thread, beginning with the second thread. In no case shall the tape be permitted to extend beyond the first thread. Encircle the threads and join together with a very slight overlap, using care not to contaminate thread.

4–1261. OXYGEN FILLER VALVE. A filler valve is provided which will fit all cylinders and all filler hose on oxygen-supply equipment. A plug with a rubber washer fits into the filler valve to keep it clean when not in use. The filler valve is located on the left side of the airplane forward of the air intake duct and is accessible through panel No. 57 (figure 3-1).

4–1262. TROUBLE SHOOTING OF OXYGEN SYSTEM.

Trouble	*Probable Cause*	*Remedy*
Loss of system pressure.	Leak in system. (Refer to paragraph 4–1263.)	Check tubing, fittings, and connections.
	Leaking or damaged cylinder.	Replace cylinder.
	Check valves not closing or are installed backward.	Inspect check valves and reverse or replace.
Oxygen duration too short.	Leak in system.	Check system tubing.
	Faulty check valve.	Replace valve.
	Faulty cylinder.	Replace cylinder.
	Check valve sticking or installed backward preventing filling a cylinder (cylinder does not heat during filling.)	Inspect filler lines and check valves. Reverse or replace check valve.
	Check valve sticking or installed backward preventing flow to regulator.	Inspect supply lines and valve; reverse or replace valve.
Pilot receives insufficient oxygen at high altitudes.	Regulator functioning improperly.	Replace regulator.
	Mask does not fit.	Refit or replace mask.
	Flapper valve in mask not operating properly.	Check mask exhaust valve.
	Flexible tubing to mask crushed or kinked.	Replace tubing if necessary.

Note

When airplane ascends from warm temperatures of ground level to low temperatures of high altitudes, the gage will show a drop in cylinder pressure. This does not indicate a loss of oxygen but only that drop in temperature has caused volume of gas to decrease in pressure.

4–1263. LEAKAGE TEST OF OXYGEN SYSTEM.

a. With oxygen regulators removed and lines capped, charge oxygen system to a pressure between 425 and 450 psi. Permit system to cool for one hour.

b. Make a record of oxygen pressure and air temperature of an enclosed wing compartment. Cockpit pressure gage must read within ±35 psi of gage on service cart.

c. After a 24-hour period, record air temperature again. If temperature has changed, note change in degrees, and whether it has increased or decreased. Refer to table 4-14 and convert this temperature change into a pressure correction.

d. Correct the first pressure reading by adding the correction if the temperature has risen, or subtracting the correction if the temperature has fallen. This will give the corrected pressure.

e. Compare the corrected pressure with the actual pressure reading taken 24 hours after the first reading. If the actual pressure has dropped in excess of 5 psi below the corrected pressure, a dangerous leakage is indicated and must be corrected.

f. Install one oxygen regulator leaving other regulator line capped.

g. Charge system to between 425 and 450 psi. Permit system to cool for one hour.

h. Make a record of oxygen pressure and air temperature of an enclosed wing compartment.

i. After a 6-hour period, record air temperature again. Note temperature change and convert this change into a pressure correction.

j. Correct the initial pressure reading by adding or subtracting the pressure correction to obtain the corrected pressure.

k. Compare the corrected pressure with the actual pressure taken 6 hours after the first reading. If a pressure drop in excess of 10.5 psi is found, replace the installed oxygen regulator.

l. If the pressure drop noted in step k is not exceeded, install the second regulator in the system and repeat steps g through k. The pressure drop with two regulators installed shall not exceed 10.5 psi for a 6 hour period after subtracting the pressure drop of the one regulator recorded in step k.

m. If the system leakage test shows leakage is within limits, charge the system to 425 psi.

4–1264. LEAKAGE TEST OF FILLER LINE CHECK VALVES. Inspect the filler line check valves for leakage by charging the system to at least 50 psi; then seat check valves in the filling manifold by inserting the AN6027-1 filler valve adapter into the filler valve. After allowing sufficient time for the filler line to drain, draw a film of pure soap solution over the open end of the adapter. If the film is broken within 10 seconds a leaky check valve is indicated, and the faulty check valve must be located and replaced.

Table 4-14. Pressure Correction for Oxygen Leak Test

Change in Temperature	*Pressure Correction*	*Change in Temperature*	*Pressure Correction*
5° F	4 psi	30° F	23.5 psi
10° F	7.5 psi	35° F	27 psi
15° F	11 psi	40° F	31 psi
20° F	15.5 psi	45° F	35 psi
25° F	19 psi	50° F	39 psi

4–1265. BOMBING EQUIPMENT.

4–1266. DESCRIPTION OF BOMBING EQUIPMENT. *(See figures 4-217 and 4-221.)* Prior to AF Serial No. 51-4141 on airplanes not incorporating T.O. No. 1T-33A-42, provisions are made in each wing tip to carry a bomb weighing from 100 to 1000 pounds by a type S-1 or S-2 bomb rack installed in the wing-tip fitting assembly. The bomb racks are also used to carry 165-gallon drop tanks, or M-10 or M-33 chemical tanks. The rack has chemical-release terminals which are wired into the nose arming circuit. Automatically retractable sway braces built into each wing-tip fitting assembly are used to stabilize the bombs or tanks. Normally, bombs or tanks are released electrically by a button switch on each control stick; however, there are manual release handles for emergency use. On airplanes AF Serial Nos. 51-4141 and subsequent, provisions for bomb pylons are installed. (Refer to paragraph 4–1281.)

Note

On AF Serial No. 57-1744 and subsequent, and airplanes incorporating T. O. 1T-33A-557, the

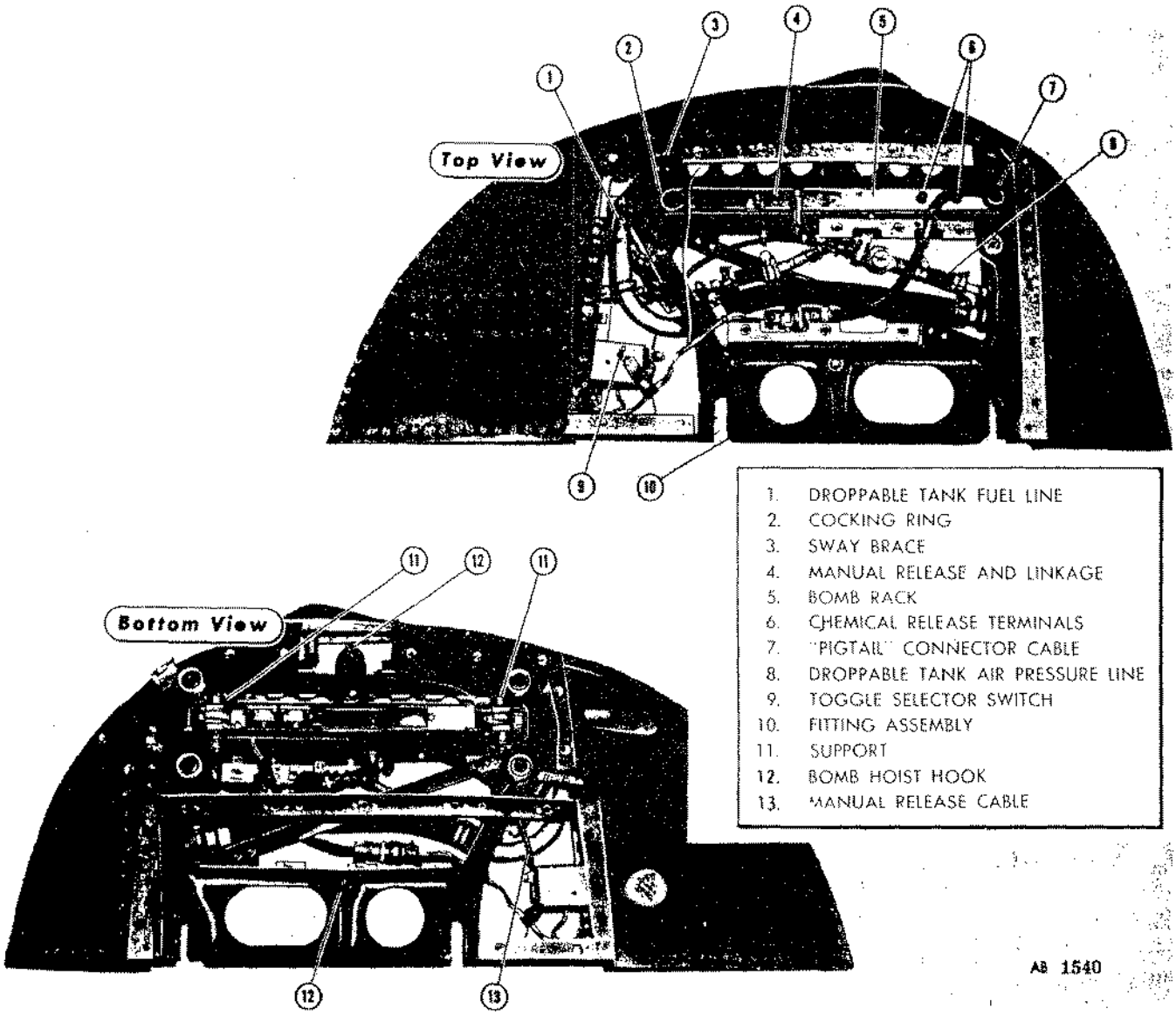


Figure 4-217. Bomb and Drop Tank Carrying Equipment, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T. O. 1T-33A-42

bomb and drop tank circuit is rendered inoperative to prevent jettison of tip tanks by accidental actuation of stick grip bomb and drop tank release switch.

4–1267. BOMB RACK (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42.) *(See figure 4-217.)* The bomb rack is an all-electric self-contained unit and is installed in each wing-tip fitting assembly by two bolts passing through at the bomb-carrying hook pivot points. The rack is enclosed by a removable fairing on the bottom of the wing tip. Openings in the fairing permit the lugs on the bombs or fuel tanks to engage the bomb-carrying hooks.

4–1268. To load the rack it is merely necessary to hoist the bomb into place. In most cases the bomb lugs will automatically cock the rack as the bomb is hoisted into position. However, the use of the cocking ring will expedite the cocking of the rack. The cocking ring is accessible by removing the large access panel No. 1 on top of the wing tip. No maintenance or adjustment of the rack is necessary under normal use. The rack is so designed that one side plate can be removed to accomplish cleaning or replacement of parts as necessary.

4–1269. REMOVAL OF BOMB RACK.

a. Remove access panel No. 1. (See figure 3-1.)

b. Disconnect link from rack manual release lever.

c. Disconnect "pigtail" connector cable at quick disconnect.

d. Remove large access panel No. 5 from bottom of wing tip

e. Remove two bolts passing through bomb-carrying hook pivots, and remove rack.

4–1270. BOMB AND DROP TANK SWAY BRACES (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42). *(See figure 4-218.)* Four automatically retractable sway braces are built into each wing-tip fitting assembly. When the bomb or tank is released, the braces retract into internally threaded sleeves in the fitting assembly.

4–1271. Each brace assembly consists of a plunger attached by a plunger pin to a split nut assembly. In addition, a large spring assembly fits around the plunger. The plunger pin passes through the split nut assembly cap, a small spring, and is fastened into the body of the plunger by a small pin. The small spring around the plunger pin keeps the split nut assembly slightly separated from the plunger. The split nut pivots about two pins extending part way into the cap, which fits over one end of the split nut. The springs inside the cap, between the two halves of the split nut, keep the threaded ends of the nut together so that the threads do not engage the threads of the sleeve when the brace is in the retracted position. The entire brace assembly is held into the sleeve by a plug.

4–1272. When the sway brace is in place against a bomb or tank, the split nut assembly is forced down over the plunger, spreading the nut apart so that the threads engage the threads in the sleeve. When the bomb or tank is released, the small spring around the plunger pin separates the plunger from the split nut, and the small springs between the two halves of the split nut in the cap force the ends of the split nut together, disengaging the threads from the sleeve threads. The large spring assembly around the plunger then pushes the whole brace assembly into the sleeve until the split nut assembly cap bottoms at the end of the bore in the fitting assembly.

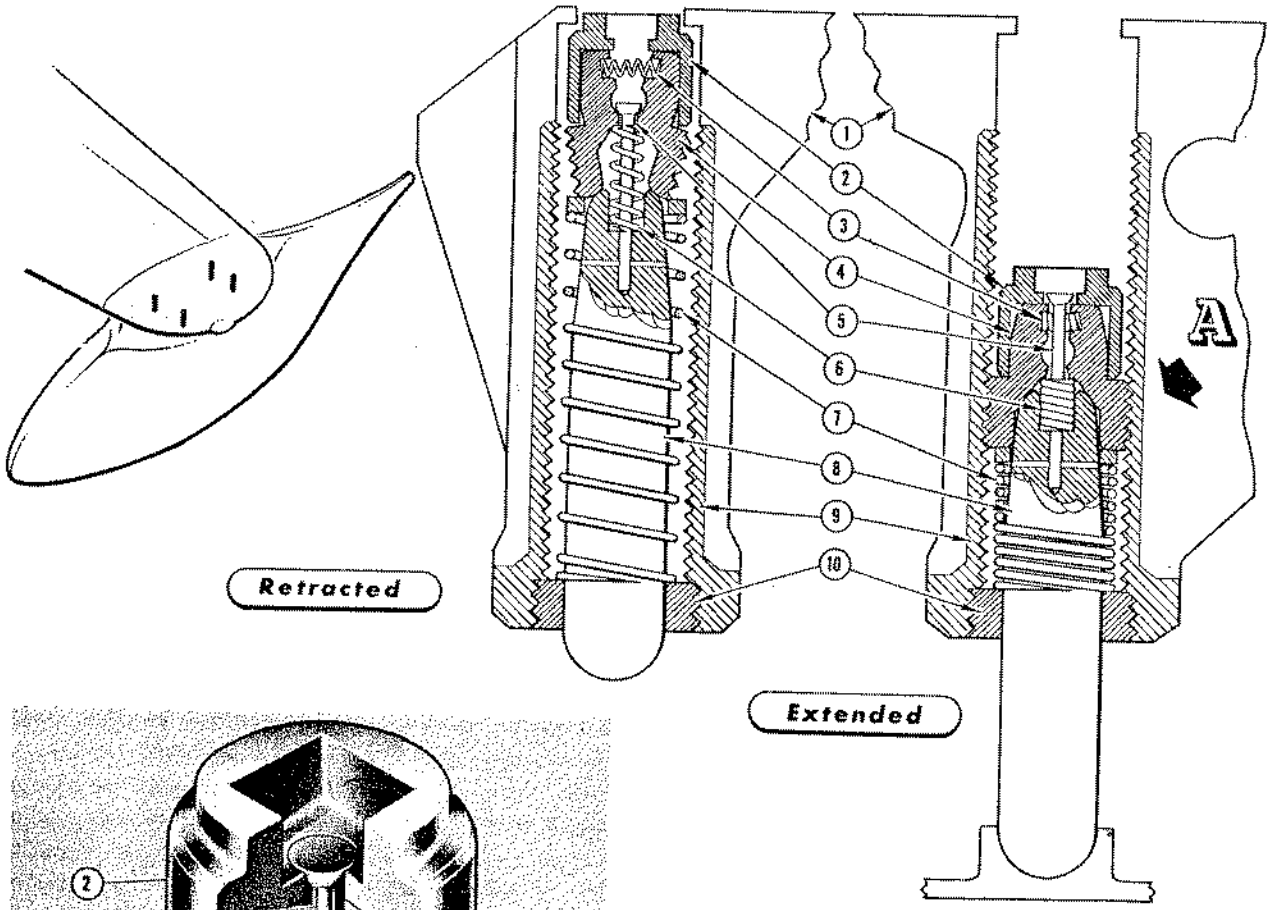
4–1273. OPERATION AND ADJUSTMENT OF SWAY BRACES (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-42). The split-nut assembly cap is designed to accommodate a standard ⅜-inch drive wrench extension for adjustment. To engage the sway brace, insert the wrench extension through the top of the bore in the wing-tip fitting assembly and push on the split-nut assembly cap. Continue pushing down on the cap until it bottoms. This is an indication that the split nut has engaged the threads of the sleeve. Turn the nut assembly with the tool until the brace is tight. Torque to 90 to 100 lb in. with tanks full.

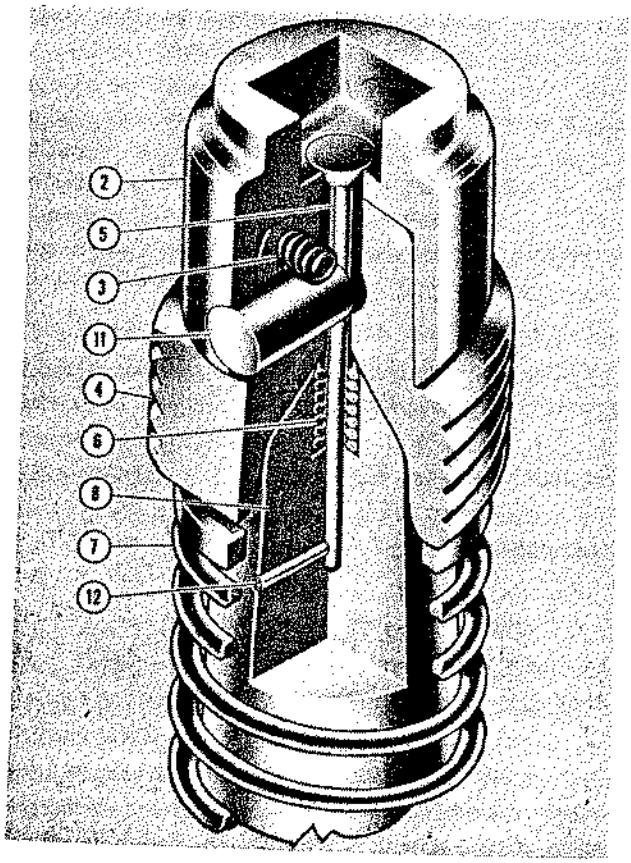
4–1274. BOMB AND DROP TANK RELEASE EQUIPMENT (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-42). Release of bombs or tanks is controlled electrically by switches on the armament control panels on the cockpit right shelves, and on the control sticks.

4–1275. Switches on the forward and aft cockpit armament control panels, and push-button switches on the control sticks control the bomb racks in the wing tips. Bomb arming, bomb selector, and chemical tank switches are located in the forward cockpit. The aft cockpit contains a bomb arming and a bomb selector switch. Bombs can be dropped "SAFE," "TAIL ARMED ONLY," or "NOSE AND TAIL ARMED." Bombs can be dropped in train or in salvo. When chemical tanks are installed, the toggle switch in the wing tip is placed in "CHEMICAL" position. If this toggle switch is placed in "BOMBS" position, both chemical tanks will be operated simultaneously when the bomb arming switch is operated.

4–1276. BOMB AND DROP TANK JETTISON PROVISIONS. A push-button switch on the forward cockpit instrument panel can be used to jettison both drop tanks (or bombs and chemical tanks) simultaneously in an emergency. On AF Serial No. 48-364 and subsequent, a jettison switch is also provided on the aft cockpit instrument panel.

4–1277. BOMB AND DROP TANK MANUAL RELEASE MECHANISM (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42.) *(See figure 4-219.)* Two handles located on the floor to the left of the pilot can be used to release the bombs or tanks in case of failure of the electrical release system. A cable fastened to each handle is routed to the bomb rack in each wing tip where it is connected to the rack manual release lever.





M20-28B-4-45
ARB9851

DETAIL A

1.	WING TIP FITTING ASSEMBLY	7.	PLUNGER SPRING ASSEMBLY
2.	CAP	8.	PLUNGER
3.	SPLIT NUT SPRING	9.	SLEEVE
4.	SPLIT NUT	10.	SLEEVE PLUG
5.	PLUNGER PIN	11.	SPLIT NUT PIVOT
6.	PLUNGER PIN SPRING	12.	PIN

Figure 4-218. Sway Brace, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T. O. 1T-33A-42

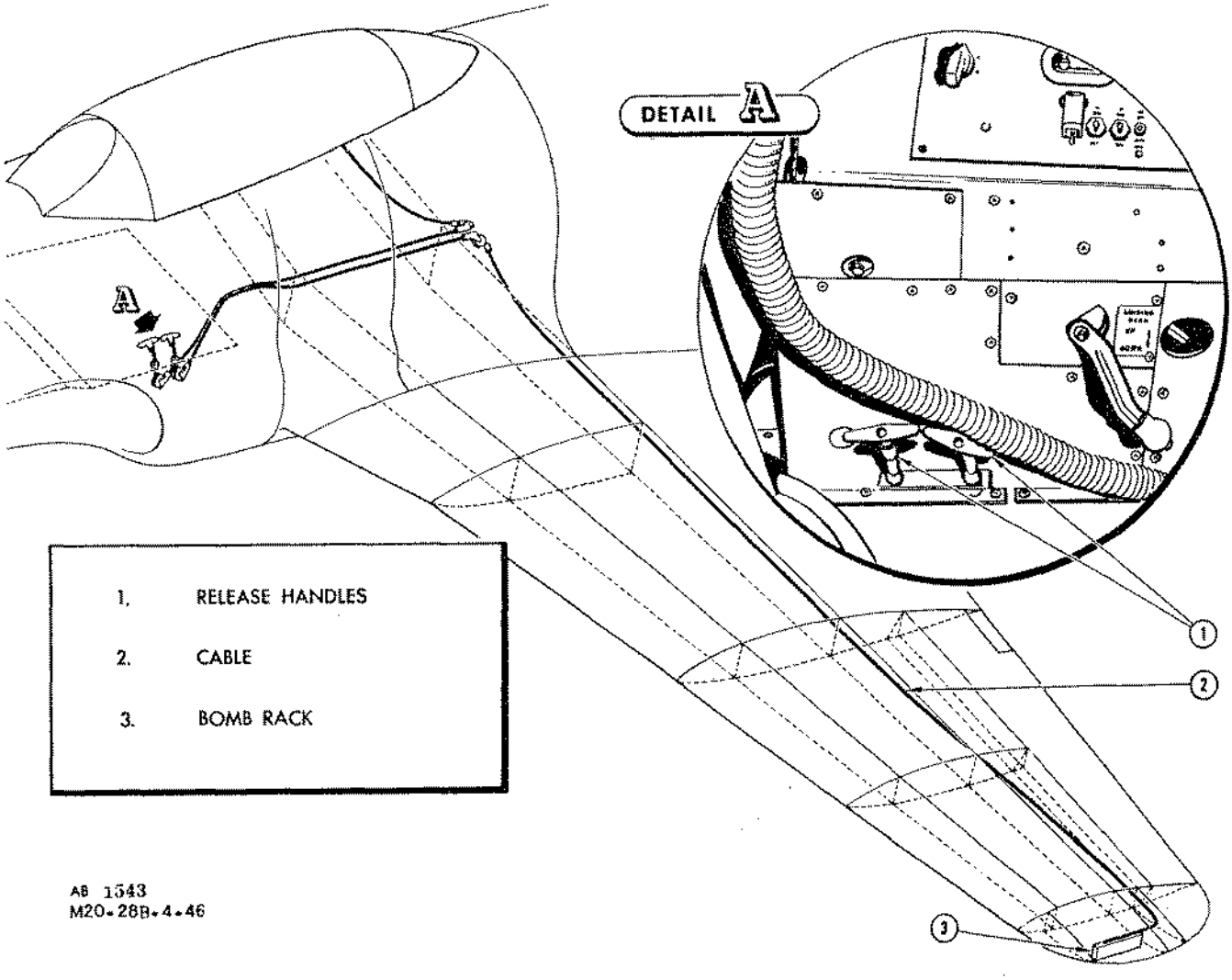


Figure 4-219. Manual Control, Drop Tanks and Bombs, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T. O. 1T-33A-42

4–1278. ADJUSTMENT OF MANUAL RELEASE MECHANISM. See that release handles are fully depressed. Cock rack and see that the wing-tip cable and linkage are securely fastened to the rack release lever. Take up all the slack in the cable from the cockpit at the point where the cable joins the wing-tip cable, and tighten cable connector.

4–1279. BOMB DEFLECTOR ASSEMBLY (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42). *(See figure 4-220.)* This consists of a support arm, a deflector, and attaching parts. The assembly is supplied as an item of loose equipment, and is installed when 250-pound bombs are to be carried. When 500-pound or larger bombs are carried, the deflector arm should be removed. No part of the deflector assembly is installed when drop tanks are to be carried.

4–1280. INSTALLATION OF BOMB DEFLECTOR. Secure the support to aft end of rack and wing tip casting by two NAS145-DH-50 bolts, AN960-516 washers, and AN365-524 nuts. Attach deflector arm to support by two AN4-15A bolts, AN960-416 washers, and AN365-428 nuts.

Note

When drop tanks are carried, use one NAS145-DH-44 bolt to secure aft end of rack to wing tip casting in place of one NAS145-DH-50 bolt used to install bomb deflector support arm.

4–1281. BOMB PYLONS (AF SERIAL NO. 51-4141 AND SUBSEQUENT). *(See figure 4-221.)*

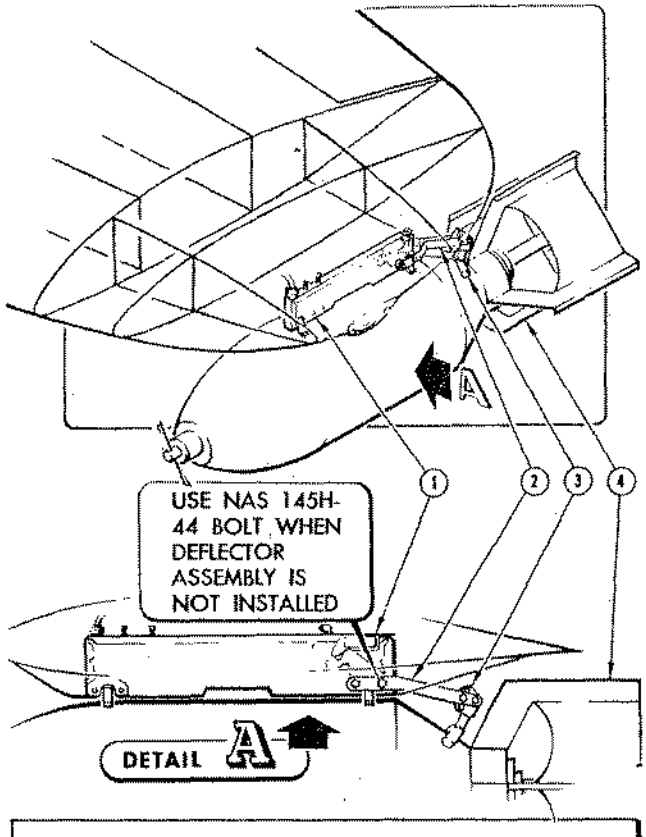


Figure 4-220. Bomb Deflector Assembly, Prior to AF Serial No. 51-4141 on Airplanes Not Incorporating T. O. 1T-33A-42

4–1282. Structural, mechanical, and electrical provisions are contained in the wing for the installation of two bomb-carrying pylons. An electrical harness and a control cable are routed into the pylon and connected to the bomb rack which is contained therein. Hinged doors in the pylon fairing provide access to the bomb rack and electrical disconnect plug.

4–1283. REMOVAL OF BOMB PYLON.

a. Remove pylon detachable fairings.

b. Disconnect jettison cable and electrical connector and wires from rack and bomb-chemical switch.

c. Remove forward supporting bolt and two aft bolts.

4–1284. BOMB RACK (AF SERIAL NO. 51-4141 AND SUBSEQUENT). This is an all-electric self-contained unit incorporating provisions for carrying bombs and releasing them singly or in salvo, either tail-armed, or nose-armed or nose- and tail-armed, or safe. In addition to the electrical release mechanism, a cable-actuated jettison mechanism is also provided.

4–1285. BOMB LOADING (AF SERIAL NO. 51-4141 AND SUBSEQUENT).

a. Open hinged door in plylon fairing by driving forward the catch lever which projects from the bottom of the fairing, and unfastening the door locking studs.

b. If a bomb hoist is to be used, release catch and swing out the bomb hoist hook.

c. Hoist the bomb up into position under release rack. Guide the arming wires into the opening in the under surface of the rack.

Note

Normally, this will cock the rack. If the rack does not cock easily, pull the cocking handle which is clipped to the pylon and attached by a cable to the rack-cocking slide ring.
Be sure arming wires are fully inserted into rack.

d. Tighten the anti-sway braces only finger-tight.

e. Close and fasten the pylon access doors.

4–1286. BOMBING CONTROLS (AF SERIAL NO. 51-4141 AND SUBSEQUENT). Bomb arming and bomb selector switches on the armament control panel, and a push-button switch on the control stick control the bomb racks. Bombs can be dropped "SAFE," "TAIL ARMED ONLY," or "NOSE AND TAIL ARMED." Bombs can be dropped singly or in salvo.

4–1287. BOMB AND DROP TANK MANUAL JETTISON CONTROL (AF SERIAL NO. 51-4141 AND SUBSEQUENT). *(See figure 4-221.)* Two handles on the floor to the left of the forward seat can be used to release bombs or tanks in case of electrical failure. Cables are routed to the pylons and wing tips, where they are connected to manual release levers.

Note

Mechanical and electrical jettisoning provisions of pylon mounted stores is deactivated in airplanes equipped for AN/ALE-2 chaff dispensing or AN/ALQ(-71) ECM operations.

4–1288. ADJUSTMENT OF MANUAL JETTISON MECHANISM. See that release handle is fully de-

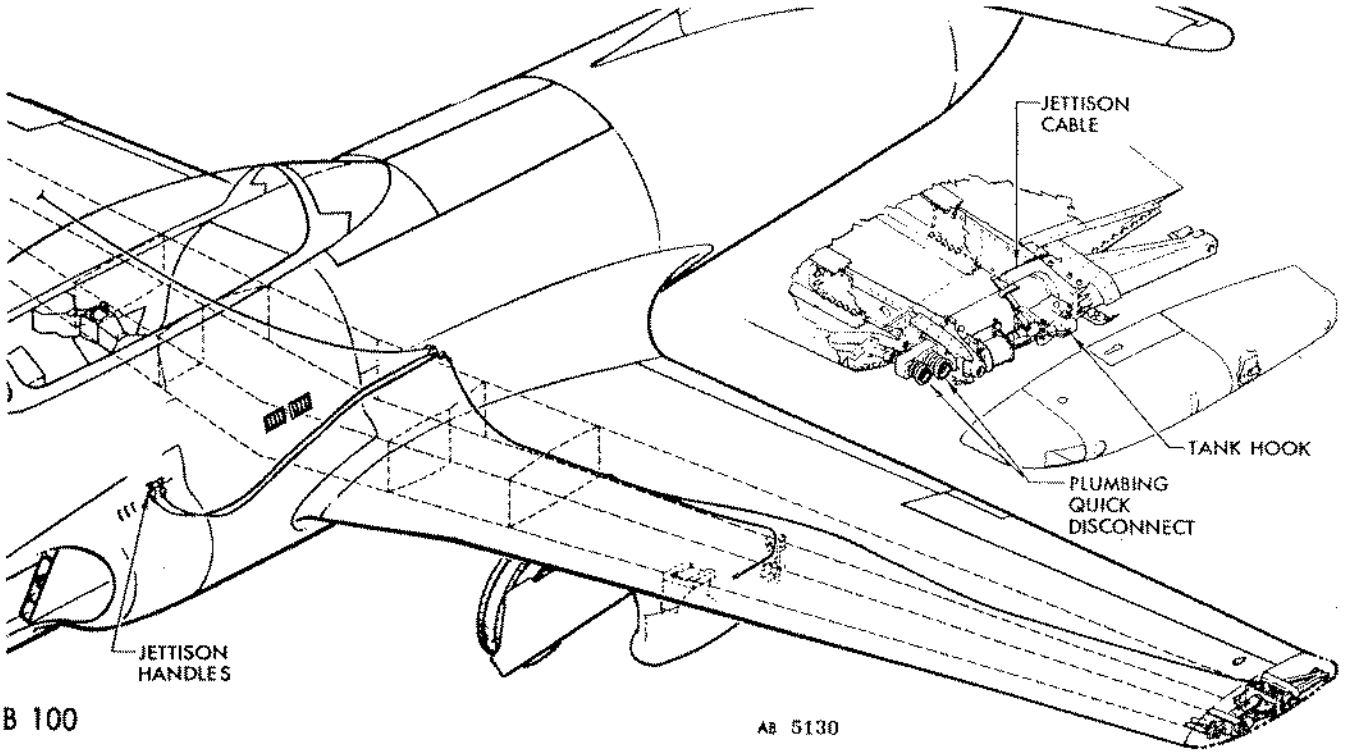


Figure 4-221. Bomb and Drop Tank Manual Jettison Control, AF Serial No. 51-4141 and Subsequent and Airplanes Incorporating T. O. 1T-33A-42

pressed. Cock rack and see that the release cable and linkage are securely fastened to the rack release lever. Take up all but approximately ½ inch slack in the cable from the cockpit at the point where the cable joins the release lever, and tighten the cable connector. The cable connector must be located so that the rack will trip before the connector contacts the cable sheath.

4–1289. SAFETY SWITCH ADJUSTMENT AND OPERATIONAL CHECKOUT OF TIP TANK JETTISON SYSTEM. (AIRCRAFT INCORPORATING AN AUTO-DROP SYSTEM) (1T–33–545).

Note

On AF Serial No. 57-1744 and subsequent and airplanes incorporating T.O. 1T-33A-557, the bomb and drop tank circuit is rendered inoperative to prevent jettison of tip tanks by accidental actuation of stick grip bomb and drop tank release switch. On aircraft having T.O. 1T-33-543 accomplished, the auto-drop switch is an ON-OFF type with the ARM position eliminated. Bombs can be dropped using the bomb release button on control stick when other switches and circuit breakers are set as noted in applicable munitions loading handbook. For aircraft having TCTO 1T-33-543 accomplished and not having TCTO 1T-33-545 accomplished, use steps a through m for wing tip switch adjustment and inspection, and steps v through aaa for power on checks. These aircraft will incorporate the unsealed wing tip safety switches part No. DT-2R-A7. (MS 25008-1) and switch actuators, part No. AN3168-1. For aircraft having TCTO 1T-33-545 accomplished, use steps n through u for safety switch adjustment and inspection, and steps v through aaa for power on checks. These aircraft incorporate sealed wing tip safety switches, part No. 1EN61-6B, which are connected to circuit with permanent splices.

For aircraft with TCTO 1T-33-543 accomplished, use steps a through m for wing tip switch adjustments, and v through aaa for power on checks. Remove left and right hand wing tip fairing part number 207038-3L or -3R for inspection of wing tip microswitches and microswitch actuators. It is important to insure that the microswitch actuators part number AN3168-1 are fully bottomed in wing tip fitting part number 207026 to prevent loss of tip tanks. Inspect the tip tank rear shear ball stud fitting part number ST25-230-0081 for condition. A flattened ball stud could cause inadvertent actuation of microswitch. Inspect microswitches and microswitch actuators for corrosion, for loose connections on switch, for security of mounting, and for freedom of movement. Correct any discrep-

ancies noted. Procedure for Installation and Adjustment of Left Hand and Right Hand Wing Tip Sensitive Switches and Extended Plunger Type Switch Actuators with DC Power Off.

a. Remove wing tip fairing, Part Number 207038-3L or -3R and tip tanks from aircraft in accordance with IT-33A-2.

b. Install tip tank and temporarily torque in place in accordance with IT-33A-2.

c. Install DPDT sensitive switch Part Number MIL-S-8805/31 (MS25008-1) into extended plunger type switch actuator Part Number AN3168-1. Insure that DPDT sensitive switch is securely mounted in switch actuator using hardware provided.

CAUTION

If the microswitch MIL-S-8805/31 (MS25008-1) is forced toward the actuator plunger while microswitch mounting screws are being tightened, the microswitch will not operate when the actutor plunger is released.

d. Check microswitches after installation in actuators for proper operation of all contacts using an AN/PSM-6 multimeter or equivalent.

e. Connect multimeter to one common and one normally open terminal of microswitch. Inspect hole in wing tip fitting Part Number 207026-4L or -4R for obstructions. Clean as required. Connect wires to switch as shown in wiring diagram. Carefully insert switch actuator into wing tip fitting Part Number 207026-4L or -4R until switch actuates as noted on multimeter.

f. Place a metal ruler against the inboard face of tip tank support fitting Part Number 207026-4L or -4R near switch actuator hole and measure the distance to rear edge of the microswitch actuator housing when the switch is actuated.

g. Continue inserting switch actuator into its hole in tank support fitting until the shoulder of switch actuator bottoms on centerline tip tank support bushing Part Number 207027-3. Measure the distance to reference points noted above to check for overtravel of actuator plunger after the microswitch is actuated.

h. The difference (overtravel) between these two readings taken shall be between 1/16 to 3/16 of an inch.

i. After overtravel is within tolerance noted, secure the switch actuator with mounting nuts and locknuts provided.

j. Remove tip tank.

k. Depress microswitch actuator plunger a number of times to insure freedom of movement.

l. Check area for foreign objects.

m. Reinstall wing tip fairing Part Number 207038-3L or -3R.

CAUTION

During the following power on checks the tip tank release solenoids Part Number 18488 will be operated. Actuations of these solenoids must be limited to brief periods to prevent burn out of coils.

CAUTION

Failure of the auto-drop system to function properly during takeoff with full fuel load in the tip tanks could result in pilot's inability to control the aircraft due to an extremely severe wing heavy condition should only one tip tank separate from the aircraft.

(1) Insure that the battery switch is OFF. Turn off all electrical equipment except as noted. Connect batteries to aircraft.

(2) Set the forward and aft cockpit auto-drop switches to OFF position.

(3) Set tip tank auto-drop and bomb release circuit breaker MS25017-10 located in rear cockpit left hand switch panel to OFF position.

(4) Set tip tank jettison circuit breaker to OFF position. This 20 AMP circuit breaker is located in right hand sub-cockpit junction box aft of nose gear curtain.

(5) Set both 25 AMP tip tank solenoid circuit breakers located in right hand nose wheel well area junction box to OFF position. This junction box is forward of nose gear curtain.

WARNING

Insure that no external stores are connected to aircraft during the following steps and that both bomb rack electrical connector plugs are temporarily disconnected on applicable aircraft.

Note

Correct any discrepancy noted during power on checks before proceeding with succeeding steps.

(6) Momentarily depress forward cockpit external stores jettison switch (panic button). The tip tank jettison

relay in RH nose gear junction box (forward of nose gear curtain) shall not operate.

(7) Close ON the 20 AMP tip tank jettison circuit breaker located in right hand sub-cockpit junction box aft of nose gear curtain.

(8) Momentarily depress forward cockpit external stores jettison switch. One tip tank jettison relay in right hand nose gear junction box will actuate. Tank release solenoids at both wing tips must not be energized.

(9) Close ON the 25 AMP LH tip tank circuit breaker located in right hand nose wheel well area junction box.

(10) Momentarily depress forward cockpit external stores jettison switch. Left hand tip tank solenoid will now operate.

(11) Close ON the 25 AMP right hand tip tank circuit breaker located in right hand nose wheel well area junction box.

(12) Momentarily depress forward cockpit external stores jettison switch. Both the left hand and right hand wing tip tank release solenoids will operate.

(13) Momentarily depress rear cockpit external stores jettison switch. Both the left and right hand wing tip tank release solenoids will operate.

(14) Disconnect batteries. Connect external electrical power to aircraft.

(15) Momentarily depress forward cockpit external stores jettison switch. There shall be no actuation of tip tank jettison relay or the left hand and right hand tip tank release solenoids. Jettison circuit is open with external electrical power connected and aircraft batteries disconnected.

(16) Repeat above test step 15 using rear cockpit external stores jettison switch. Again there shall be no actuation of tip tank jettison relay or the left hand and right hand tip tank release solenoids.

(17) Depress both left hand and right hand wing tip microswitches to simulate installed tip tanks. Place position light switch to steady bright. Wing tip lights shall not illuminate. Tail light will illuminate. Release left hand wing tip microswitch actuator to simulate loss of left hand tip tank. Tip tank solenoids shall not operate. Top and bottom left hand red wing tip position light and tail light will illuminate.

(18) Close ON forward cockpit auto-drop switch and again release the left hand wing tip microswitch actuator. Tip tank solenoids shall not operate. Top and bottom left hand red wing tip position lights and tail light will illuminate.

(19) Close ON rear cockpit tip tank bomb release and auto-drop circuit breaker. Release left hand wing tip microswitch actuator. Both left hand and right hand wing tip tank release solenoids shall operate. Top and bottom left hand red wing tip position lights and tail lights will illuminate.

(20) Depress left hand wing tip tank microswitch actuator and release right hand microswitch actuator. Again both left hand and right hand wing tip tank release solenoids shall operate. Top and bottom right hand green wing tip position lights and tail light will illuminate.

(21) Set forward cockpit auto-drop switch to OFF position. Set rear cockpit bomb release and auto-drop circuit breaker to OFF position.

(22) Repeat steps 17 through 21 for rear cockpit. (Where reference is made to forward cockpit auto-drop switch, substitute rear cockpit auto-drop switch.)

(23) Depress left hand and right hand wing tip microswitch actuators to simulate installed tip tanks. With bomb release and auto-drop circuit breaker ON and bomb arming circuit breaker ON actuate the forward cockpit stick grip bomb release button with auto-drop switch on and off. Tip tank release solenoids must not operate. Again depress forward cockpit stick grip bomb release button while positioning the chemical tanks switch from left to right setting the bomb selector switch in ALL and TRAIN, and the bomb arming switch to TAIL AND NOSE and TAIL. During all checks in this paragraph, the wing tip tank solenoids shall not operate. Repeat this test using rear cockpit stick grip on applicable aircraft. This test will insure that the tip tank release circuit is not erroneously connected to the bomb release circuit. Perform an operational checkout of bomb and rocket release circuits on applicable aircraft in accordance with existing munitions loading procedures.

(24) Set all switches to OFF or NORMAL position. Disconnect external electrical power from aircraft. Batteries should have been disconnected from previous steps. Reconnect aircraft batteries before engine operation or as otherwise directed.

WARNING

Make certain that TIP TANK SOLENOID circuit protectors are not pulled. If these circuit protectors are pulled, tanks cannot be dropped electrically.

(25) Cock hooks on both wing tips. Pull one of the two manual release handles located on floor to left of forward seat. Corresponding jettison mechanism shall operate satisfactory. Pull second release handle and check the operation of the opposite hook.

(26) After tip tanks have been installed and ground safety pins properly inserted, set the navigation light

switches to flashing bright positions. Check that both the left and right tip tank lights flash as required.

WARNING

If any of the four upper or lower wing lights illuminate instead of the tip tank lights, this is a possible indication of misaligned aft tank ball socket with microswitch actuator. Operation of cockpit auto-drop switches under these conditions will jettison both tip tanks when ground safety pins are removed.

Note

Only aircraft with 1T-33-545 accomplished, use steps n through u.

n. Remove tip tanks and wing tip fairing, part No. 207038-3L/3R in accordance with 1T-33A-2.

o. Inspect the tip tank rear shear ball stud fitting, part No. ST25-230-0081 for general condition. A flattened ball stud could cause inadvertent actuations of microswitch. Inspect switch for corrosion, loose splices, for security of mounting, for correct safety wiring of mounting nuts, for freedom of plunger operation, for excessive wear at switch plunger tip and for general condition of accessible wiring. Correct any discrepancies noted.

p. Wing tip safety switch, part No. 1EN61-6B, will be installed by removing lock washer and key washer supplied with new switch. Install switch using 2 each, part No. AN960-1016, flat washers and 2 each nuts supplied with switch. Install switch in wing tip support fitting until it bottoms.

q. Measure the distance from tip of switch plunger to face of tank support fitting. Dimension shall be 1/4 inch + 1/32 inch -1/16 inch or may be expressed as between 6/32 and 9/32 of an inch.

r. After ensuring that adjustment is correct, tighten both nuts securely and safety wire them together with MS20995F32 lock wire per MS33540.

s. Operate switch plunger through at least five cycles to ensure freedom of movement. On initial installation of switch, (before splicing to aircraft wiring) check all contacts using an AN/PSM-6 multimeter or equivalent.

t. Check area for foreign objects and remove as necessary.

u. Reinstall wing tip fairing.

Substitute the following checkout procedure for existing items (1) through (26), including preceding caution note and the ending warning note.

v. Perform the following power on checks on all aircraft incorporating an auto-drop system after inspection and adjustment noted above has been completed on wing tip safety switches.

WARNING

Failure of the auto-drop system to function properly during take-off with full fuel load in the tip tanks could result in pilot's inability to control the aircraft due to an extremely severe wing heavy condition should only one tip tank separate from the aircraft.

CAUTION

During the following power-on checks, the tip tank release solenoids, part No. 18488, will be operated. Actuations of these solenoids must be limited to brief periods to prevent overheating accompanied by possible burn-out of coils. The maximum duty cycle is one second on and thirty seconds off.

Note

The checkout procedure for RT-33A aircraft will be the same as the T-33A steps indicated below, with the exception of those items calling for rear cockpit checkout. The bomb release and auto-drop circuit breaker is located in forward cockpit left-hand switch panel in RT-33A aircraft.

w. Ensure that the battery switch is "OFF". Turn off all electrical equipment except as noted. Connect batteries to aircraft. Do not connect external electrical power at this time.

x. Set the forward and aft cockpit auto-drop switches to "OFF" position.

y. Set tip tank auto-drop and bomb release circuit breaker located in rear cockpit left-hand switch panel to "OFF" position.

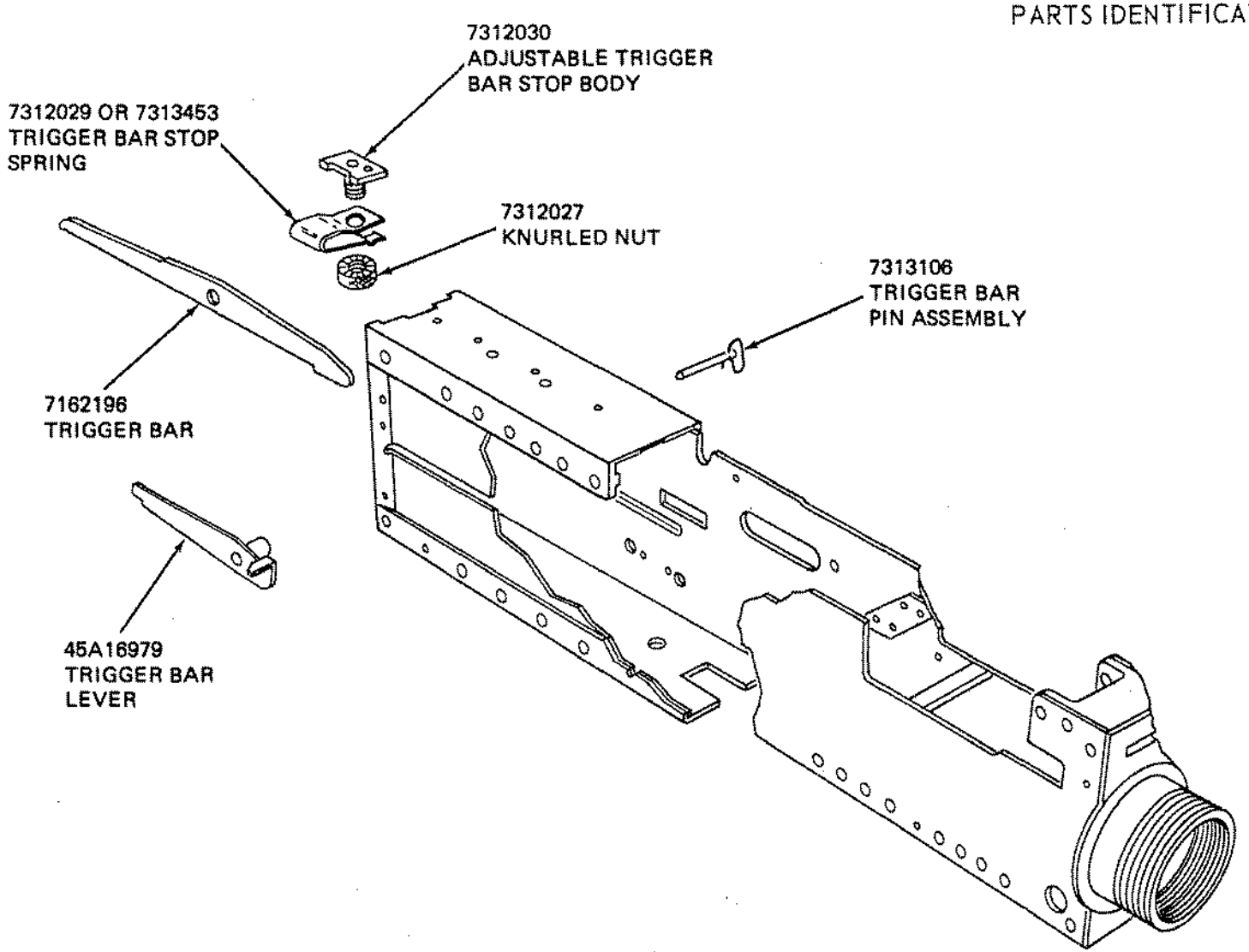
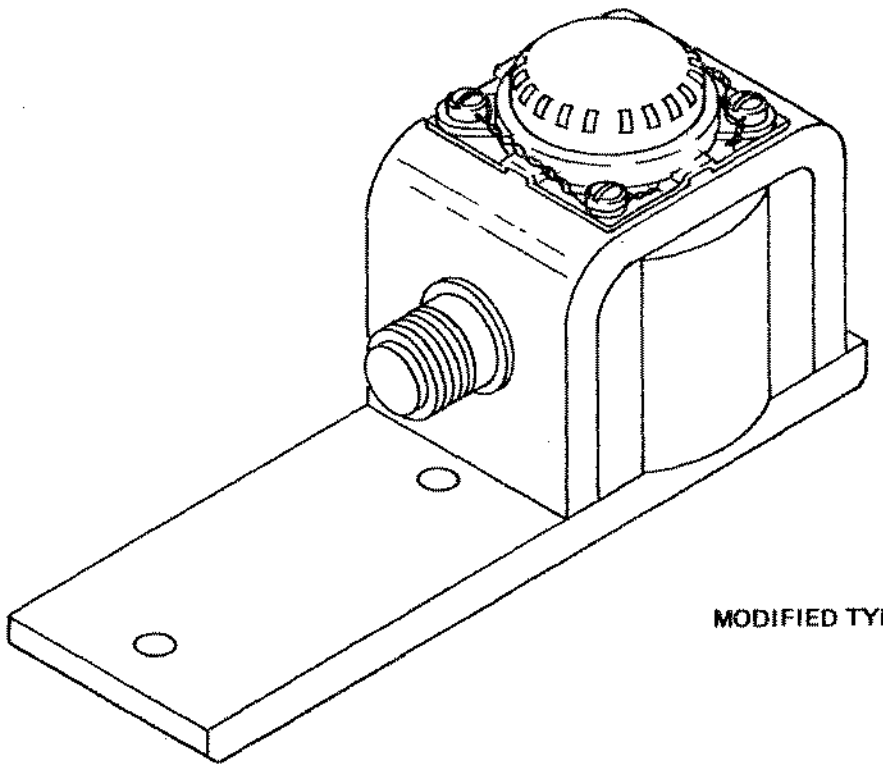
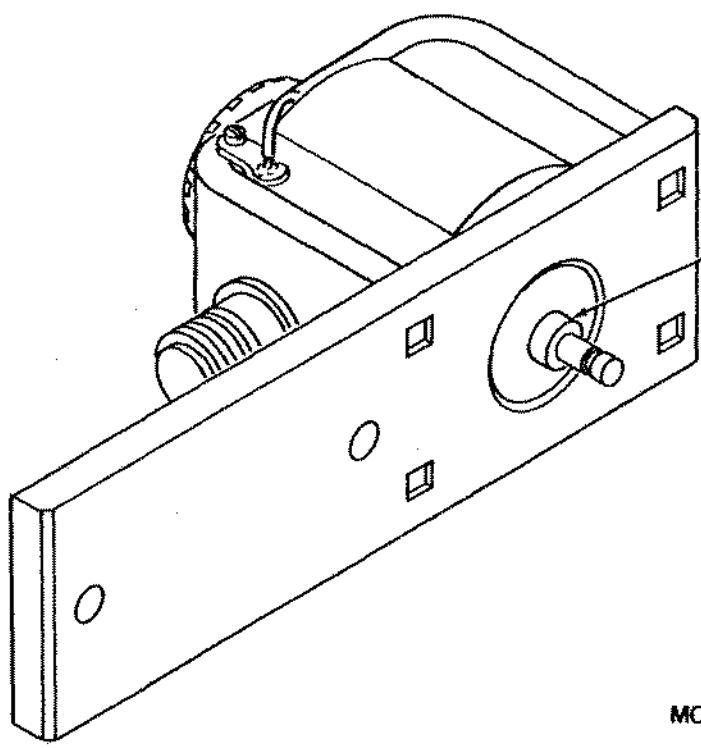


Figure 4-221A. Modified G-22 and G-22A Gun Firing Solenoids (Sheet 1 of 3)

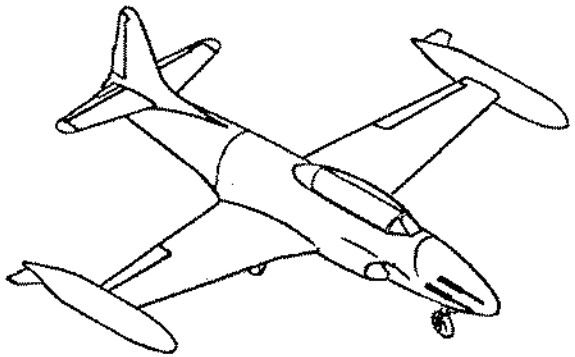


MODIFIED TYPE G-22A



MODIFIED TYPE G-22A

Figure 4-221A. Modified G-22 and G-22A Gun Firing Solenoids (Sheet 2 of 3)



1T-33A-1 AND
AT-33A-20 AIRCRAFT

REMOVAL OF COVER PLATE
6008939 AND INSTALLATION
OF G-22A GUN FIRING SOLENOID.

REMOVE SCREW
7131208 REPLACE
WITH SPECIAL
SCREW 45A16987

REMOVE SCREW
5153191 REPLACE
WITH BOLT AN74-4
OR MS20073-04
TORQUE SOLENOID
MOUNTING SCREW
AND BOLT TO 60-65
IN. LB. AND SAFETY
WIRE.

Figure 4-221A. Modified G-22 and G-22A Gun Firing Soldnoids (Sheet 3 of 3)

(2) Inspect to see that approximately 0.005-inch clearance exists between mounting bolts and the 17/64-inch diameter holes in the solenoid mounting plate. If the proper tolerance does not exist, the two 17/64-inch diameter holes in the solenoid base plate will be reamed out to 9/32-inch diameter.

4-1291E. INSTALLATION OF G-22 AND G-22A SOLENOIDS. Prior to installation, inspect the solenoid in accordance with the instructions contained in paragraph 4-1291D.

a. Remove top plate cover, part No. 6008939, from the gun by removing top plate cover screw, part No. 5153191 and 7312028.

b. Install the solenoid assembly on the top plate of the machine gun with the solenoid connector pointing to the rear of the gun. The solenoid plunger shaft shall be located in the 0.308-inch diameter jig hole which is approximately 3-5/8 inches to the rear of the forward edge of the top plate on the gun centerline.

c. Fasten the solenoid to the top plate with one drilled head aircraft bolt, part No. AN74-4 or MS20073-04, and solenoid mounting screw, part No. 45A16987, furnished as a part of the solenoid assembly. The solenoid mounting screw will be used to hold the solenoid to the top plate of the gun in place of the screw, part No. 7312028. Torque bolt and screw to 60-65 in. lb. Secure the bolt and screw in place with safety wire in accordance with T.O. 1-1A-8.

d. Remove trigger bar pin assembly, part No. 7313106, and trigger bar, part No. 7162196 (M-3 guns). Remove trigger bar stop adjusting nut, part No. 7312027, and trigger bar stop adjusting nut spring, part No. 7313453 or 7312029. The force required by the solenoid to consistently sear off the gun at 0.116-inch out of battery with the backplate off, trigger bar stop adjusting nut spring, part No. 7313453, in place, is normally 190 pounds. When properly adjusted to sear off the gun, the solenoid will have an air gap setting between 0.010 and 0.025-inch. Since the solenoid only develops 165 pounds at the 0.025-inch air gap setting, it is necessary to modify the trigger bar stop adjusting nut spring, part No. 7313453, by removing the center leaf which contacts the trigger bar, this reducing the force required to sear off the gun from 190 to 165 pounds.

e. Remove the center leaf of trigger bar stop adjusting nut spring, part No. 7313453, by gripping the leaf with pliers and bending it back until it breaks at the base. (See figure 4-221B.) No modification is necessary if the gun is equipped with trigger bar stop adjusting nut spring, part No. 7312029. (See figure 4-221C.)

f. If not present, install trigger bar stop adjusting nut spring, part No. 7312029, or the modified trigger bar stop adjusting nut spring, part No. 7313453, and replace trigger bar stop adjusting nut, part No. 7312027.

g. Place solenoid trigger bar lever, part No. 45A16979, in position and insert trigger bar pin assembly to hold it in position. The solenoid trigger bar lever is installed so that the forward end is positioned on top of the gun trigger bar and under the solenoid plunger. Place gun trigger bar in position and complete installation of the trigger bar pin to retain both the gun trigger bar and the solenoid trigger bar lever.

4-1291F. ADJUSTMENT OF G-22 AND G-22A SOLENOIDS. Check the headspace using the "GO" and "NO-GO" headspace gage, part No. 5351211. This gage is a part of the headspace and timing gages assembly, part No. 5351217. To check and adjust the headspace of .50-caliber aircraft guns, proceed as directed in T.O. 11W1-13-3-34 (machine gun AN/M2), 11W1-13-122 and 11W1-13-3-124 (machine gun AN/M3).

a. Rotate trigger bar stop adjusting nut in counterclockwise direction, as viewed from top of gun, to maximum upward position.

b. Rotation of the adjustment cap in a clockwise direction to the limit of travel provides minimum plunger extension.

c. Cock the gun and insert the "NO-FIRE" (0.116-inch) gage of the assembly, part No. 5351217, between barrel extension and the trunnion block.

d. Allow the barrel extension to close slowly on the gage.

e. Attach electrical test cable or connect aircraft electrical connector to solenoid. Release the firing mechanism by operating the solenoid. The firing pin should not be released.

f. Adjust the solenoid plunger protrusion by turning the solenoid adjusting cap in counterclockwise direction, one notch at a time, until the point is reached where the firing mechanism is just consistently released with the "NO-FIRE" gage inserted between the trunnion block and the barrel extension. The adjustment MUST be made with the driving spring assembled in the gun. The gun must be charged each time the solenoid is energized whether the firing mechanism is released or not.

g. Turn trigger bar stop adjusting nut in a clockwise direction as viewed from the top of the gun, one notch at a time, until the firing mechanism just consistently fails to release when the solenoid is energized and the 0.116-inch "NO-FIRE" gage is in place. Charge gun and energize solenoid after each notch change in adjustment.

h. Turn trigger bar stop adjusting nut seven notches in a clockwise direction.

i. Rotate solenoid adjusting cap one notch in clockwise direction.

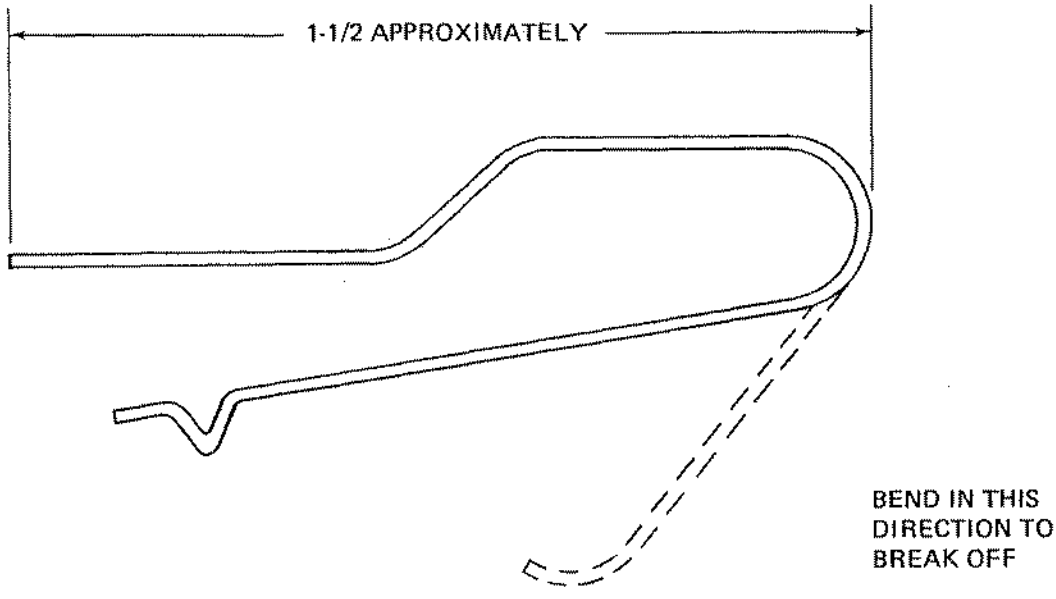


Figure 4-221B. Trigger Bar Stop Adjusting Nut Spring, Part No. 7313453

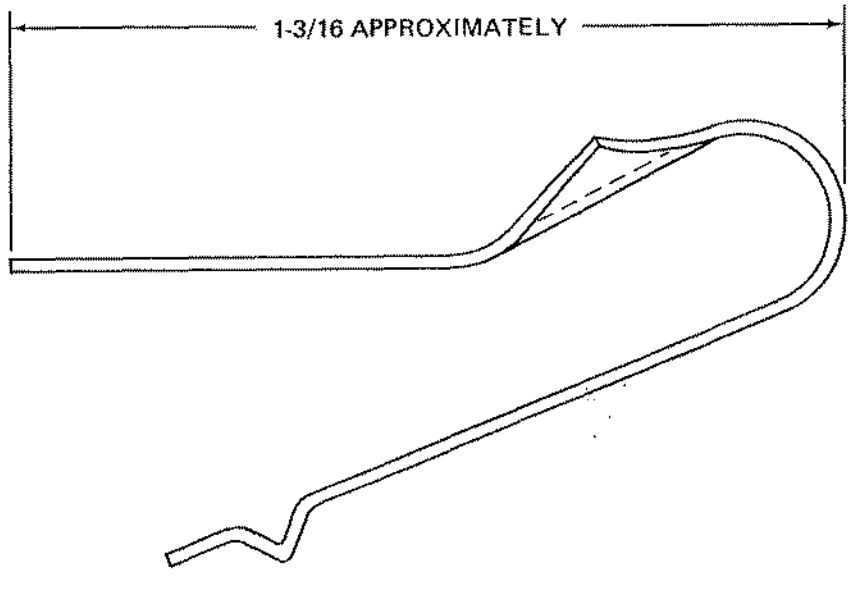


Figure 4-221C. Trigger Bar Adjusting Nut Spring, Part No. 7312029

j. With this setting, the trigger bar clearance will be in excess of 0.010-inch, and the gun will not fire at 0.115-inch out of battery position and may be checked with the "FIRE" (0.020-inch) and "NO-FIRE" (0.116-inch) gages. THIS FINAL CHECK WILL BE MADE WITH THE BACKPLATE ASSEMBLED ON THE GUN.

k. Disconnect electrical test cable if attached.

4-1291G. LUBRICATION OF G-22 AND G-22A SOLENOIDS. No lubrication is required for the G-22 and G-22A gun firing solenoids.

4-1291H. SPECIAL SERVICE TOOLS FOR G-22 AND G-22A SOLENOIDS. No special tools are required to service this equipment.

4-1291J. MAINTENANCE OF G-22 AND G-22A SOLENOIDS.

4-1291K. DISASSEMBLY OF G-22 AND G-22A SOLENOIDS. The detailed procedure described herein will be followed in sequence.

a. Remove safety wire.

b. Exert pressure on top of solenoid adjusting cap. Remove four fillister head screws and gradually release tension from the adjusting cap until the adjusting cap spring has extended its full length.

c. Remove adjusting cap retaining clamps, retaining flange, retaining spring, spring tension retainer, solenoid plunger assembly and solenoid plunger assembly spring.

d. Check all parts for wear, cracks, burrs and for cleanliness.

Note

If the solenoid is found to be defective in any manner, it shall be tagged for disposition as administratively condemned property.

4-1291L. REASSEMBLY OF G-22 AND G-22A SOLENOIDS.

a. Wash all parts with the exceptions of solenoid coil assembly in PS-661 specification MIL-C-25769. After cleaning, thoroughly dry all parts with compressed air prior to reassembly in solenoid body, utilizing authorized safety procedures.

b. Clean out inside of cylinder and plunger operating hole with cloth wet with PS-661. DO NOT submerge coil in cleaning fluid.

CAUTION

Do not allow fluid to enter the solenoid coil. In the event fluid enters the solenoid coil, dry with compressed air utilizing authorized safety procedures.

c. Place solenoid plunger assembly and spring in solenoid coil.

d. Place spring tension retainer on top of plunger beveled side up.

e. Install adjusting cap.

f. Place retaining flange on top of adjusting cap. Rotate retaining flange until slot in retaining flange lines up with safety wire hole in solenoid body.

g. Rotate adjusting cap until adjuster enters slot in solenoid plunger, start two fillister head screws leaving out the two screws that fasten the adjusting cap clamps.

h. Rotate spring tension retainer until the four protruding lugs align with the indentation on the bottom side of the retaining flange.

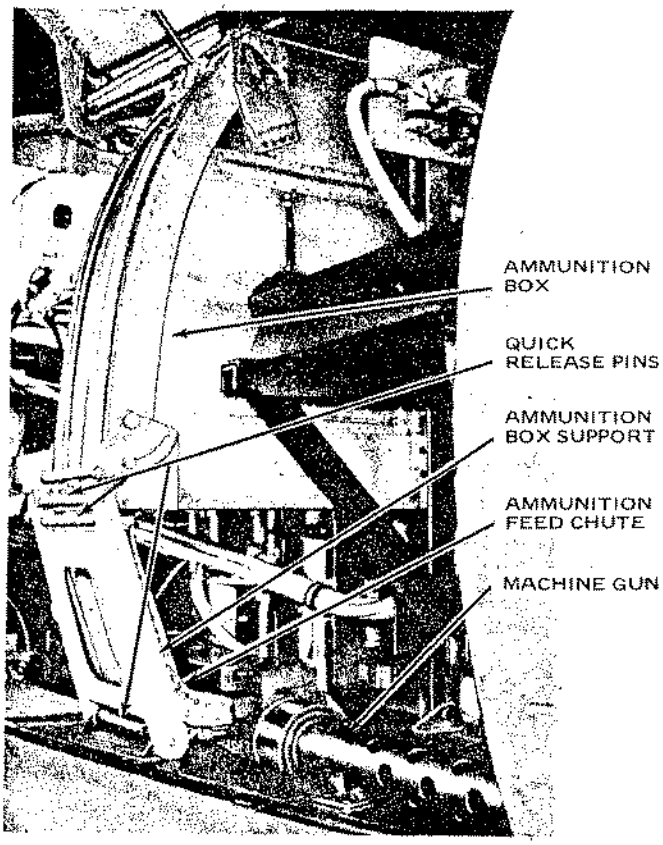
i. Tighten the two fillister head screws and safety wire.

j. Place the two adjusting cap clamps in slots in retaining flange. Tighten and safety wire fillister head screws.

Note

In the event solenoid is to be immediately installed on the gun, clamp and fillister head screws may be left out until solenoid is installed on the gun.

4-1292. MACHINE GUN INSTALLATION. *(See figure 4-222.)* The machine guns are mounted on the gun compartment structure by quick-release fittings. The rear mount of each gun can be adjusted horizontally and vertically to permit boresighting. A 300-round ammunition box is mounted above the feed chute of each gun. The boxes hook over fittings at the top and are fastened to the feed-chute supports at the bottom by quick-release fittings. The feed chutes and supports are fastened to the guns and to the structure by quick-release fittings. Expended links and cartridge cases are discharged through chutes into the space below the guns, from which they are discharged overboard through a hydraulically-operated door in the skin. To alleviate overheating and to facilitate maintenance, the gun barrel jacket sleeve and clamp have been removed from the guns.



K4307
M20-38-4-49

Figure 4-222. Machine Gun Installation

CAUTION

During gunfiring tests on the ground, pad the nose-gear torque arms with cloth or other suitable material. This will prevent a live shell (dropped from the ejection chute after a jam has been cleared or during initial injection of the belt) from being fired by striking unpadded torque arms. In addition, the nose alighting gear must be centered to prevent the case ejection door deflector plate from striking the lens of the landing lights.

4–1293. Guns are charged manually by handles located in the gun compartment. Each gun is supplied with an electric heater controlled from the cockpit.

z. Set tip tank jettison circuit breaker to "OFF" position. This 20 AMP circuit breaker is located in right-hand sub-cockpit junction box aft of nose gear curtain.

aa. Set both 25 AMP tip tank solenoid circuit breakers located in right-hand nose wheel well area junction box to "OFF" positions. This junction box is forward of nose gear curtain.

WARNING

Ensure that no external stores are connected to aircraft during the following steps and that bomb rack electrical connector plugs are temporarily disconnected on applicable aircraft.

Note

Correct any discrepancy noted during power-on checks before continuing with following steps.

ab. Momentarily depress forward cockpit external stores jettison switch. The tip tank jettison relay in right-hand nose gear junction box (forward of nose gear curtain) will not operate.

ac. Close (on) the 20 AMP tip tank jettison circuit breaker located in right-hand subcockpit junction box aft of nose gear curtain.

ad. Momentarily depress forward cockpit external stores jettison switch. One tip tank jettison relay in right-hand nose gear junction box will actuate. Tank release solenoids at both wing tips will not be energized.

ae. Close (on) the 25 AMP left-hand tip tank circuit breaker located in right-hand nose wheel well area junction box.

af. Momentarily depress forward cockpit external stores jettison switch. Left-hand tip tank solenoid will now operate. (Limit the operation of external stores jettison switches to one second followed by a thirty second cooling period to prevent burn-out of tank release solenoids.)

ag. Close (on) the 25 AMP right-hand tip tank circuit breaker located in right-hand nose wheel well area junction box.

ah. Momentarily depress forward cockpit external jettison switch. Both the left-hand and right-hand wing tip tank release solenoids will operate.

ai. Momentarily depress rear cockpit external stores jettison switch. Both the left and right-hand wing tip tank release solenoids will operate.

aj. Momentarily depress forward cockpit external stores jettison switch. There shall be no actuation of tip tank jettison relay or the left-hand and right-hand tip tank release solenoids. (Jettison circuit is open with external electrical power connected and aircraft batteries disconnected).

ak. Repeat above test (item aj) using rear cockpit external stores jettison switch. There shall be no actuation of tip tank jettison relay or the left-hand and right-hand tip tank release solenoids.

al. Depress both left-hand and right-hand wing tip switch plungers to simulate installed tip tanks. Place position switch to steady bright. Wing tip lights will not illuminate. Tail light will illuminate. Release left-hand wing tip switch plunger to simulate loss of left-hand tip tank. Tip tank solenoids shall not operate. Top and bottom left-hand red wing tip position light and tail light will illuminate.

am. Depress left-hand wing tip switch plunger again and hold. Close (on) forward cockpit auto-drop switch and again release the left-hand wing tip switch plunger. Tip tank solenoids shall not operate. Top and bottom left-hand red wing tip position lights and tail light will illuminate.

an. Depress left-hand wing tip switch plunger again and hold. Close (on) rear cockpit tip tank bomb release and auto-drop circuit breaker. Momentarily release left-hand wing tip switch plunger. Both left-hand and right-hand wing tip tank release solenoids shall operate. Top and bottom left-hand red wing tip position lights and tail lights will illuminate.

ao. Momentarily release right-hand wing tip switch plunger. Again both left-hand and right-hand wing tip tank release solenoids shall operate. Top and bottom right-hand green wing tip position lights and tail light will illuminate.

ap. Set rear cockpit bomb release and auto-drop circuit breaker to OFF position. Set forward cockpit auto-drop switch to OFF position. Release both wing tip switch plungers.

aq. Repeat steps al through ap for rear cockpit. (Where reference is made to forward cockpit auto-drop switch, substitute rear cockpit auto-drop switch.)

ar. Depress left-hand and right-hand wing tip switch plungers. With bomb release and auto-drop circuit breaker ON, actuate the forward cockpit stick grip bomb release button with auto drop switch set first on ON and then to OFF positions. Tip tank release solenoids must not operate. Again depress forward cockpit stick grip bomb release button while positioning the chemical tanks switch from left to right, setting the bomb selector switch in ALL and TRAIN and the bomb arming switch to TAIL and NOSE and TAIL on applicable aircraft. During all checks in this paragraph, the wing tip tank solenoids shall not operate. Repeat this test using rear cockpit stick grip on applicable aircraft. Release wing tip switch plungers. This test will ensure that the tip tank release circuit is not erroneously connected to the bomb release circuit. Perform an operational checkout of bomb and rocket release circuits on applicable aircraft in accordance with existing munitions loading procedures.

as. Set all switches to OFF or NORMAL positions. Disconnect external electrical power from aircraft. Batteries should have been disconnected from previous steps.

WARNING

Make certain that all tip tank solenoid circuit breakers in nose gear area not pulled. If these circuit breakers are pulled, tip tanks cannot be dropped electrically.

at. Cock hooks on both wing tips. Pull one of the two manual release handles located on floor to left of forward seat. Corresponding jettison mechanism shall operate satisfactorily. Pull second release handle and check the operation of the opposite hook. Ensure that the safety release levers at wing tips and both cockpit tank release handles are safety wired with 0.020 "breakaway" wire.

au. Remove any debris caused by this checkout procedure.

av. Secure all panels, covers and other components disturbed by this checkout procedure.

aw. Refer to figure 4-221A. Install plastic seal over the red cylindrical switch guards of external stores jettison switches in both cockpits as follows:

WARNING

Ensure that batteries are disconnected and electrical power is not connected to aircraft when installing plastic seal. This is required to prevent inadvertent jettisoning of tip tanks and/or other external stores.

(1) Form a piece of wire as shown.

(2) Cut a 1-1/8 inch diameter hole in the center of a piece of scratch paper. Place paper over external stores jettison switch guard flush with panel to prevent possible spillage of liquid plastic to settle on instrument subpanel or other parts of aircraft.

(3) Momentarily dip wire loop into open jar of liquid plastic number 1411 or equivalent and withdraw. Allow excess liquid to drain back into jar.

(4) Slowly place wire loop with clear plastic attached, over the red switch guard until it nearly bottoms on paper. Carefully withdraw wire loop from around switch guard. Plastic film will remain over the open end of switch guard if it is not disturbed. If plastic fails to adhere to the switch guard, wipe guard clean to remove possible contaminents, and reapply plastic film.

Note

Do not touch newly installed plastic film as this will destroy its effectiveness.

(5) Remove paper from around switch guard by tearing so as not to disturb the fresh plastic film. Check to ensure that the drain hole (located at the 6 o'clock position) in the guard is not obstructed.

(6) Repeat above steps for sealing external stores jettison switch guard in opposite cockpit on applicable aircraft.

ax. Reconnect other external stores and bomb racks as required on applicable aircraft in accordance with existing manuals and checklists.

ay. After both tip tanks have been installed and tip tank ground safety pins properly inserted, set the navigation light switches to flashing bright positions. Check that both the left and right tip tank lights and tail lights flash as required using external electrical power.

WARNING

If any of the four upper or lower wing lights illuminate instead of the tip tank lights, this is a possible indication of a misaligned aft tank ball socket with the wing tip switch actuator plunger. Operation of either cockpit auto-drop switch with bomb release and auto-drop circuit breaker "ON", under these conditions, will jettison both tip tanks when ground safety pins are removed.

az. Set navigation lights switches to "OFF" positions. Disconnect electrical power from aircraft.

aaa. Perform a final check for debris and tools in aircraft resulting from this operational checkout procedure.

4-1289A. EXTERNAL STORES JETTISON SWITCH GUARD SEALING. External stores jettison switches will be sealed with part No. 1311 Flag Red liquid translucent plastic. The seal will be replaced as needed and after performing operational checks which require actuation of external stores jettison switches. The plastic seal will be installed as follows:

WARNING

Insure that batteries are disconnected, and electrical power is not connected to aircraft when installing plastic seal over external stores jettison switch guards. This is required to prevent inadvertent jettisoning of tip tanks and/or other external stores.

a. Form a piece of wire approximately as shown in figure 4-221A. Wire diameter may be between 1/32 to 3/32 inches.

b. Cut a 1-1/8 inch diameter hole in the center of an 8X10 inch piece of scrap paper. Place paper over external stores jettison switch guard flush with panel to prevent possible spillage of liquid plastic on instrument subpanel or other parts of aircraft.

c. Open container and stir contents slowly. Momentarily dip wire loop into open container of liquid plastic Formafilm part No. 1311N, or equivalent, and withdraw. Allow excess liquid to drain back into jar.

d. Slowly place wire loop with clear plastic attached, over the red switch guard until it nearly bottoms on paper. Carefully withdraw wire loop from around switch guard. Plastic film will remain over the open end of switch guard if it is not disturbed. If plastic fails to adhere to the switch guard, wipe guard clean to remove possible contaminents, and reapply plastic film.

Note

Do not touch newly installed plastic film as this will destroy its effectiveness.

e. Remove paper from around switch guard by tearing so as not to disturb the fresh plastic film. Check to insure that the drain hole (located at the 6 o'clock position) in the switch guard is not obstructed.

f. Repeat above steps for sealing external stores jettison switch guard in opposite cockpit on applicable aircraft.

Note

The external stores jettison switch, part No. 7041298-05, was made from switch, part No. D407W3RS2R, by drilling a 1/8 inch diameter hole in cylinderical switch guard 1/4 inch from base. This hole provides venting when the plastic seal is installed. The hole must be located at the 6 o'clock position.

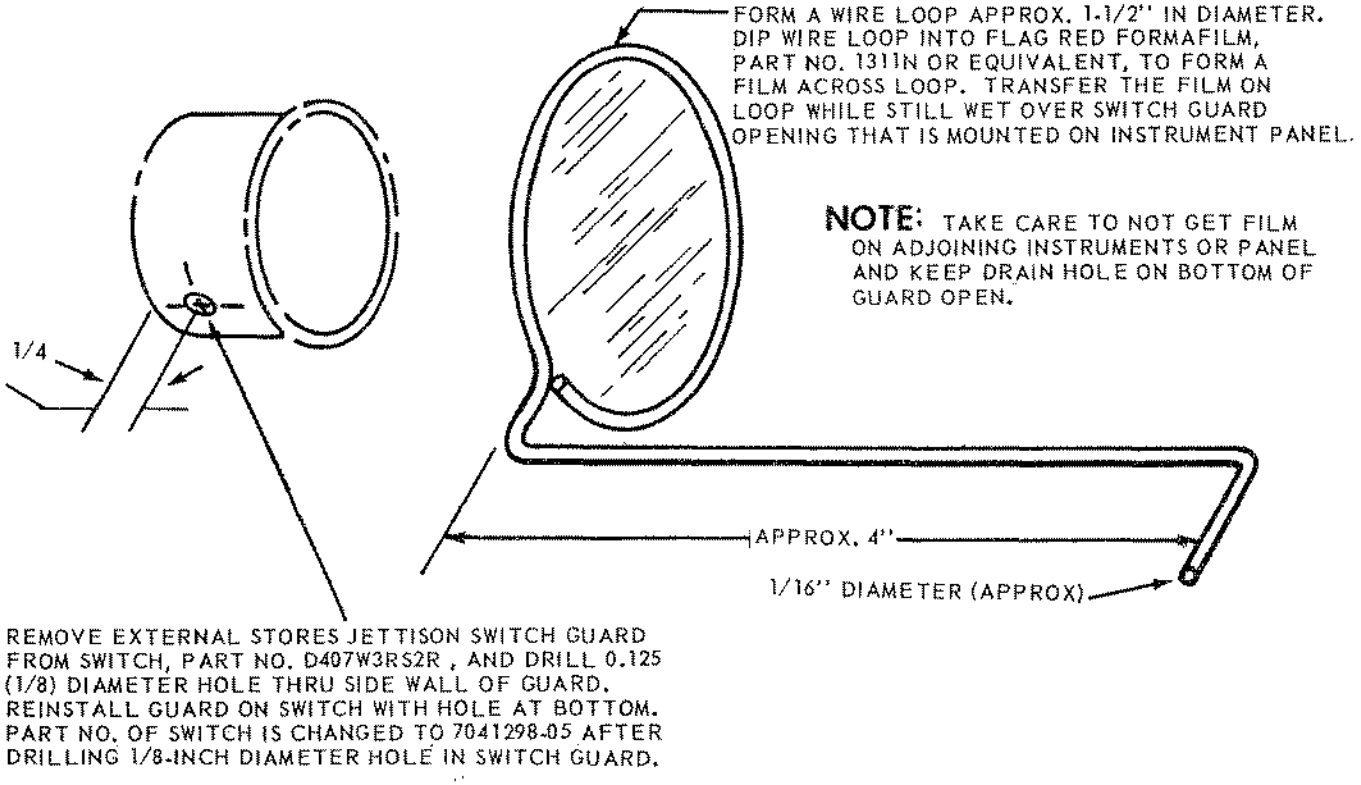


Figure 4–221A. Installation of External Stores Jettison Switch Guard Seal.

4-1290. GUNNERY EQUIPMENT (T-33A-1 AIRPLANES).

4-1291. DESCRIPTION OF GUNNERY EQUIPMENT. The gunnery equipment consists of the machine gun installation, the gun sight, and the gun camera. The fixed, .50-caliber M-3 machine guns are mounted in the gun compartment in the upper forward part of the fuselage nose section. Ammunition boxes, one for each gun, are also in the gun compartment. A computing gun sight is installed in the cockpit, directly behind the bulletproof windshield, on the center line of the airplane. A gun camera is installed in the leading edge of the right-hand engine air intake duct.

4-1291A. MAINTENANCE AND INSTALLATION INSTALLATION INSTRUCTIONS FOR MODIFIED G-22 AND G-22A GUN FIRING SOLENOIDS.

a. The G-22 and G-22A gun firing solenoids are presently used on T-33A-1 and -20 aircraft utilizing the .50-caliber, M-3 machine guns.

b. Type G-22 solenoids have been modified in accordance with Safety TCTO 8R-1-506, indicated by a 1/4-inch yellow dot (paint) in the center of the adjustment manufactured to the revised drawing.

WARNING

Type G-22 solenoids will not be used in T-33A aircraft unless Safety TCTO 8R-1-506 has been accomplished.

4-1291B. DESCRIPTION OF G-22 AND G-22A SOLENOIDS.

a. The gun firing solenoid, part No. 49C4267, is an electrically operated and electrically controlled device designed to remotely fire .50-caliber, M-3 machine guns.

b. The solenoid incorporates a single winding which is energized as long as the firing switch is closed and draws approximately 4.5 amperes at 24 volts. When mounted on a gun, the solenoid grounds through the gun into the aircraft structure.

4-1291C. PRINCIPLES OF OPERATION FOR G-22 AND G-22A SOLENOIDS.

a. The G-22 and G-22A gun firing solenoids are used for electrical trigger control of free-firing .50-caliber machine guns. Both incorporate a movable plunger in a coil and actuate the sear of the trigger mechanism.

b. When the solenoid is energized by pressing the firing switch, magnetic forces in the core of the solenoid coil attract the plunger, release the sear, and fire the gun. Release of the firing switch opens the circuit, and a spring returns the plunger to its original position causing the gun to cease firing.

WARNING

Insure that guns are properly cleared of all ammunition before performing inspection and/or other maintenance on them.

4-1291D. INSPECTION OF G-22 AND G-22A SOLENOIDS. All G-22 and G-22A gun firing solenoids will be inspected prior to installation as follows:

a. Perform electrical bench check by attaching an MS3106R10S-2S electrical connector to G-22A receptacle. Connect DC (+) to connector plug. Connect DC (-) to solenoid base plate with suitable hardware. Energize the solenoid with 28-volts DC to extend the plunger out of the plunger guide. The solenoid plunger must move freely and return to its starting position immediately when the solenoid is deenergized. If it does not move freely, the solenoid will be tagged for disposition as administratively condemned property. Disconnect bench check cable.

b. Refer to figure 4-221B. Each type G-22 and G-22A gun firing solenoid will be checked for proper alignment between the mounting holes of the solenoid and the top plate of the gun as follows:

(1) Insert the plunger guide into the 0.308-inch diameter hole in the plate of the gun. Insert the mounting screw and bolt, Part No. 45A16987 and AN74-4, or MS20073-04, approximately two or three threads deep into the tapped holes in the top plate of the gun.

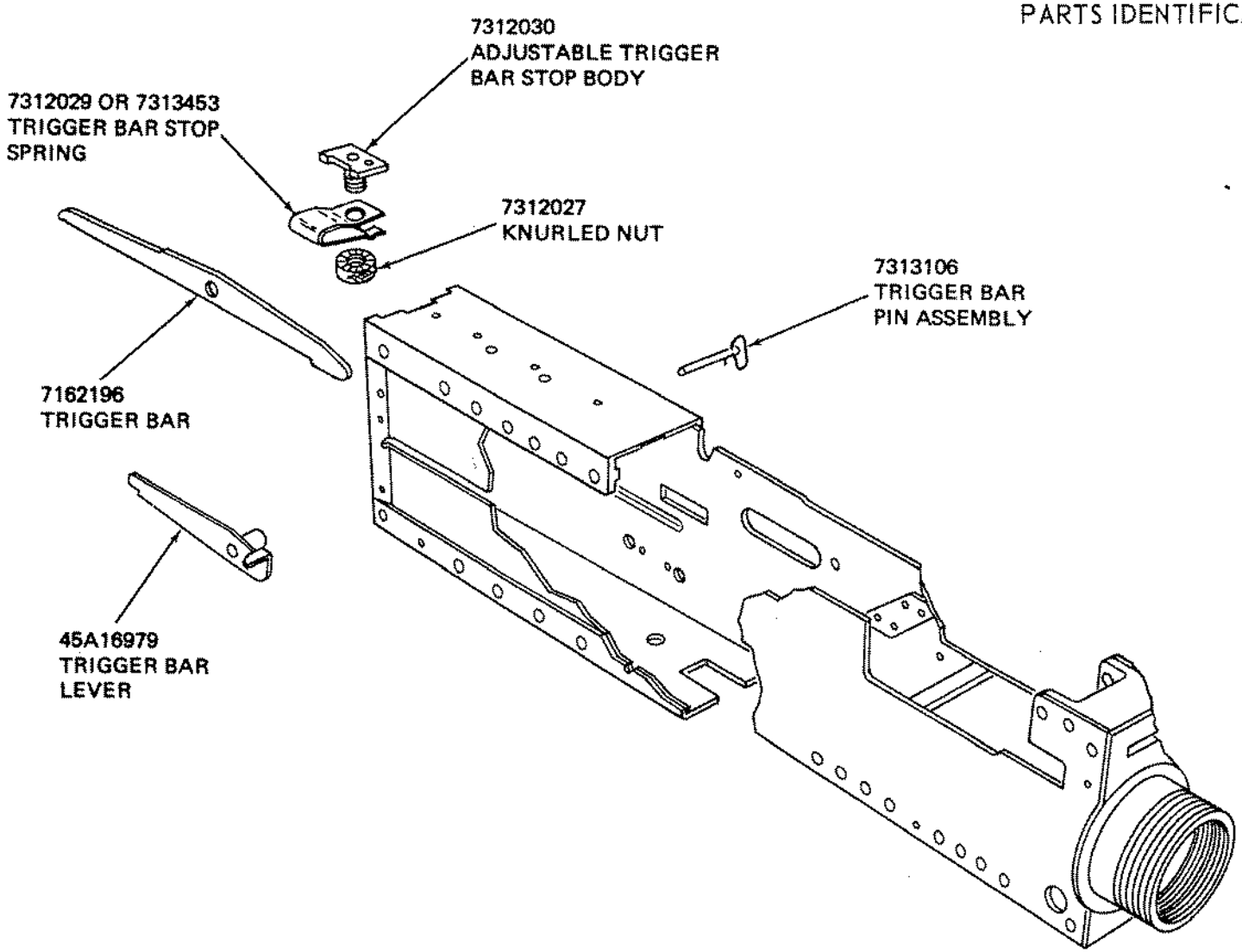
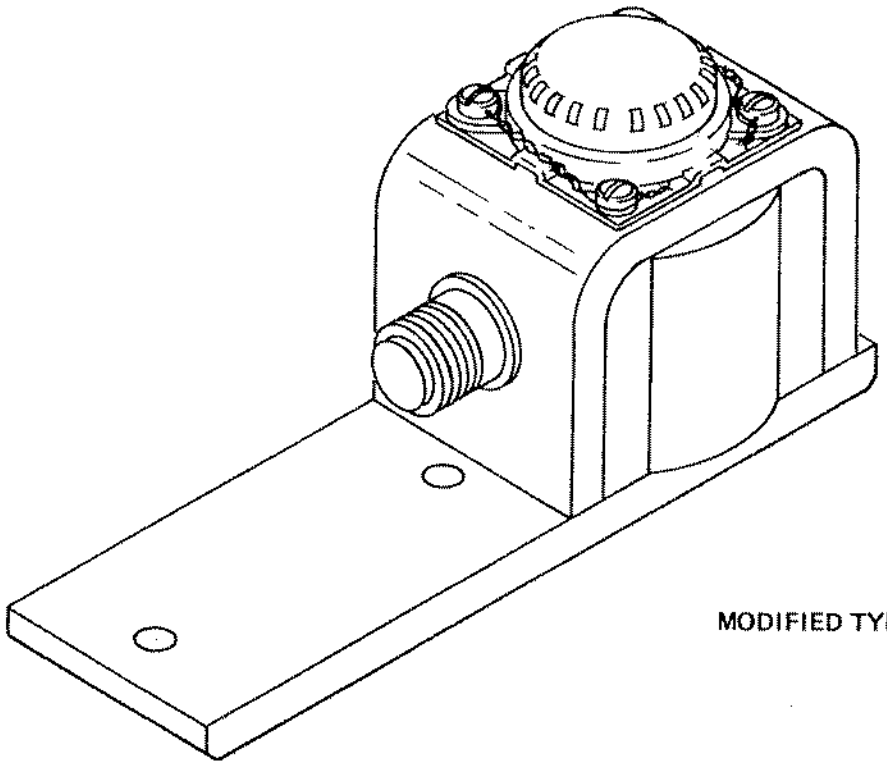
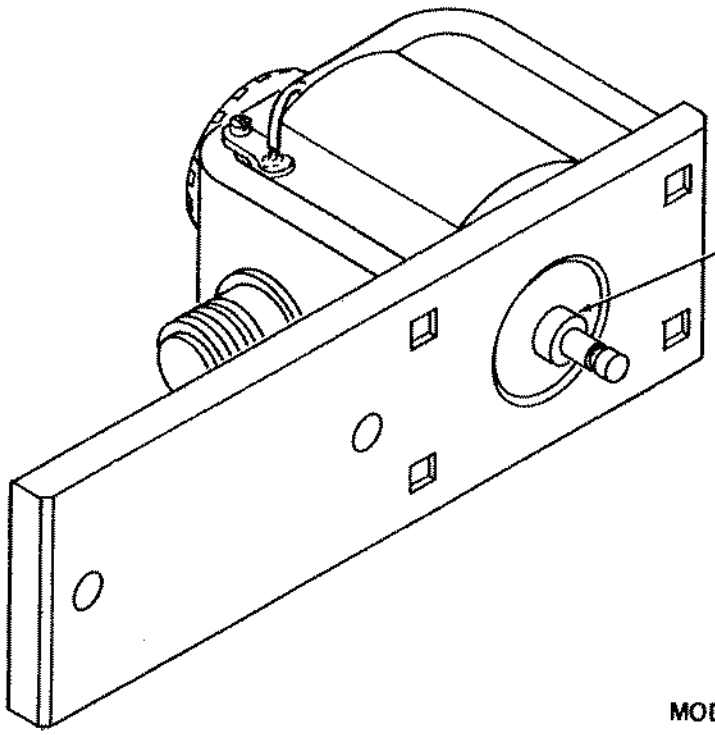


Figure 4-221B. Modified G-22 and G-22A Gun Firing Solenoids (Sheet 1 of 3)

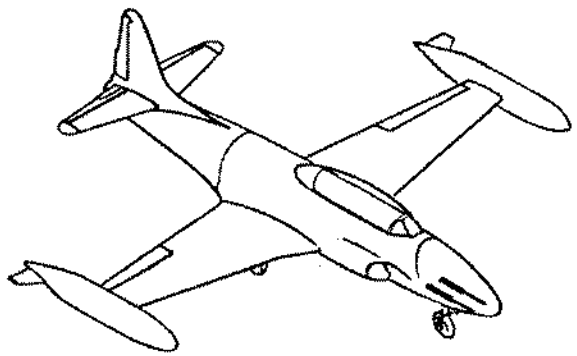


MODIFIED TYPE G-22A



MODIFIED TYPE G-22A

Figure 4–221B. Modified G-22 and G-22A Gun Firing Solenoids (Sheet 2 of 3)



1T-33A-1 AND
AT-33A-20 AIRCRAFT

REMOVAL OF COVER PLATE
6008939 AND INSTALLATION
OF G-22A GUN FIRING SOLENOID.

REMOVE SCREW
7131208 REPLACE
WITH SPECIAL
SCREW 45A16987

REMOVE SCREW
5153191 REPLACE
WITH BOLT AN74-4
OR MS20073-04
TORQUE SOLENOID
MOUNTING SCREW
AND BOLT TO 60-65
IN. LB. AND SAFETY
WIRE.

Figure 4–221B. Modified G-22 and G-22A Gun Firing Solenoids (Sheet 3 of 3)

(2) Inspect to see that approximately 0.005-inch clearance exists between mounting bolts and the 17/64-inch diameter holes in the solenoid mounting plate. If the proper tolerance does not exist, the two 17/64-inch diameter holes in the solenoid base plate will be reamed out to 9/32-inch diameter.

4-1291E. INSTALLATION OF G-22 AND G-22A SOLENOIDS. Prior to installation, inspect the solenoid in accordance with the instructions contained in paragraph 4-1291D.

a. Remove top plate cover, part No. 6008939, from the gun by removing top plate cover screw, part No. 5153191 and 7312028.

b. Install the solenoid assembly on the top plate of the machine gun with the solenoid connector pointing to the rear of the gun. The solenoid plunger shaft shall be located in the 0.308-inch diameter jig hole which is approximately 3-5/8 inches to the rear of the forward edge of the top plate on the gun centerline.

c. Fasten the solenoid to the top plate with one drilled head aircraft bolt, part No. AN74-4 or MS20073-04, and solenoid mounting screw, part No. 45A16987, furnished as a part of the solenoid assembly. The solenoid mounting screw will be used to hold the solenoid to the top plate of the gun in place of the screw, part No. 7312028. Torque bolt and screw to 60-65 in. lb. Secure the bolt and screw in place with safety wire in accordance with T.O. 1-1A-8.

d. Remove trigger bar pin assembly, part No. 7313106, and trigger bar, part No. 7162196 (M-3 guns). Remove trigger bar stop adjusting nut, part No. 7312027, and trigger bar stop adjusting nut spring, part No. 7313453 or 7312029. The force required by the solenoid to consistently sear off the gun at 0.116-inch out of battery with the backplate off, trigger bar stop adjusting nut spring, part No. 7313453, in place, is normally 190 pounds. When properly adjusted to sear off the gun, the solenoid will have an air gap setting between 0.010 and 0.025-inch. Since the solenoid only develops 165 pounds at the 0.025-inch air gap setting, it is necessary to modify the trigger bar stop adjusting nut spring, part No. 7313453, by removing the center leaf which contacts the trigger bar, this reducing the force required to sear off the gun from 190 to 165 pounds.

e. Remove the center leaf of trigger bar stop adjusting nut spring, part No. 7313453, by gripping the leaf with pliers and bending it back until it breaks at the base. (See figure 4-221C.) No modification is necessary if the gun is equipped with trigger bar stop adjusting nut spring, part No. 7312029. (See figure 4-221D.)

f. If not present, install trigger bar stop adjusting nut spring, part No. 7312029, or the modified trigger bar stop adjusting nut spring, part No. 7313453, and replace trigger bar stop adjusting nut, part No. 7312027.

g. Place solenoid trigger bar lever, part No. 45A16979, in position and insert trigger bar pin assembly to hold it in position. The solenoid trigger bar lever is installed so that the forward end is positioned on top of the gun trigger bar and under the solenoid plunger. Place gun trigger bar in position and complete installation of the trigger bar pin to retain both the gun trigger bar and the solenoid trigger bar lever.

4-1291F. ADJUSTMENT OF G-22 AND G-22A SOLENOIDS. Check the headspace using the "GO" and "NO-GO" headspace gage, part No. 5351211. This gage is a part of the headspace and timing gages assembly, part No. 5351217. To check and adjust the headspace of .50-caliber aircraft guns, proceed as directed in T.O. 11W1-13-3-34 (machine gun AN/M2), 11W1-13-122 and 11W1-13-3-124 (machine gun AN/M3).

a. Rotate trigger bar stop adjusting nut in counterclockwise direction, as viewed from top of gun, to maximum upward position.

b. Rotation of the adjustment cap in a clockwise direction to the limit of travel provides minimum plunger extension.

c. Cock the gun and insert the "NO-FIRE" (0.116-inch) gage of the assembly, part No. 5351217, between barrel extension and the trunnion block.

d. Allow the barrel extension to close slowly on the gage.

e. Attach electrical test cable or connect aircraft electrical connector to solenoid. Release the firing mechanism by operating the solenoid. The firing pin should not be released.

f. Adjust the solenoid plunger protrusion by turning the solenoid adjusting cap in counterclockwise direction, one notch at a time, until the point is reached where the firing mechanism is just consistently released with the "NO-FIRE" gage inserted between the trunnion block and the barrel extension. The adjustment MUST be made with the driving spring assembled in the gun. The gun must be charged each time the solenoid is energized whether the firing mechanism is released or not.

g. Turn trigger bar stop adjusting nut in a clockwise direction as viewed from the top of the gun, one notch at a time, until the firing mechanism just consistently fails to release when the solenoid is energized and the 0.116-inch "NO-FIRE" gage is in place. Charge gun and energize solenoid after each notch change in adjustment.

h. Turn trigger bar stop adjusting nut seven notches in a clockwise direction.

i. Rotate solenoid adjusting cap one notch in clockwise direction.

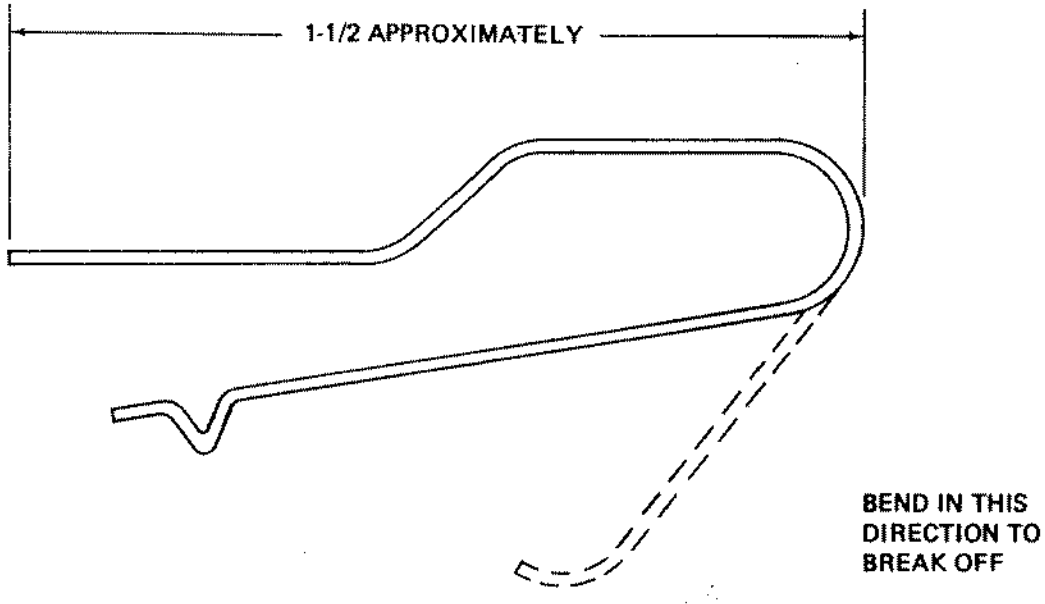


Figure 4-221C. Trigger Bar Stop Adjusting Nut Spring, Part No. 7313453

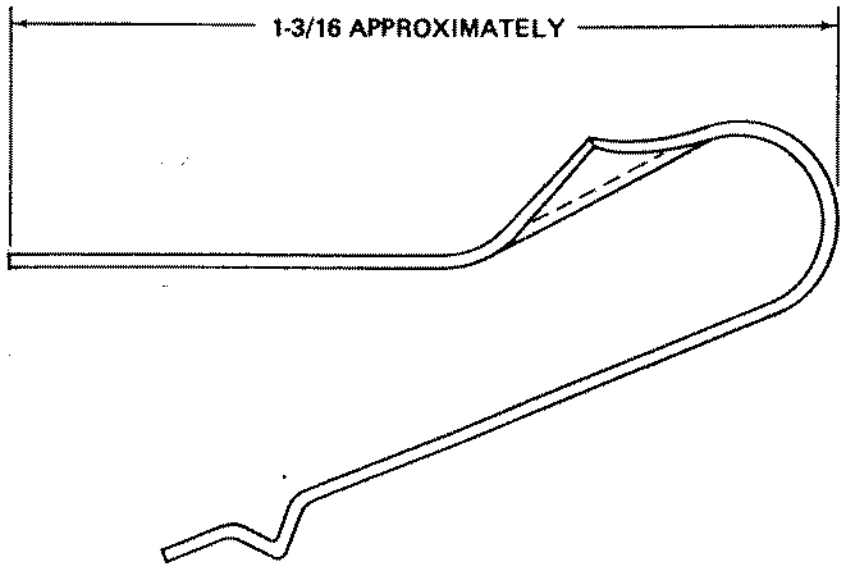


Figure 4-221D. Trigger Bar Adjusting Nut Spring, Part No. 7312029

j. With this setting, the trigger bar clearance will be in excess of 0.010-inch, and the gun will not fire at 0.115-inch out of battery position and may be checked with the "FIRE" (0.020-inch) and "NO-FIRE" (0.116-inch) gages. THIS FINAL CHECK WILL BE MADE WITH THE BACKPLATE ASSEMBLED ON THE GUN.

k. Disconnect electrical test cable if attached.

4-1291G. LUBRICATION OF G-22 AND G-22A SOLENOIDS. No lubrication is required for the G-22 and G-22A gun firing solenoids.

4-1291H. SPECIAL SERVICE TOOLS FOR G-22 AND G-22A SOLENOIDS. No special tools are required to service this equipment.

4-1291J. MAINTENANCE OF G-22 AND G-22A SOLENOIDS.

4-1291K. DISASSEMBLY OF G-22 AND G-22A SOLENOIDS. The detailed procedure described herein will be followed in sequence.

a. Remove safety wire.

b. Exert pressure on top of solenoid adjusting cap. Remove four fillister head screws and gradually release tension from the adjusting cap until the adjusting cap spring has extended its full length.

c. Remove adjusting cap retaining clamps, retaining flange, retaining spring, spring tension retainer, solenoid plunger assembly and solenoid plunger assembly spring.

d. Check all parts for wear, cracks, burrs and for cleanliness.

Note

If the solenoid is found to be defective in any manner, it shall be tagged for disposition as administratively condemned property.

4-1291L. REASSEMBLY OF G-22 AND G-22A SOLENOIDS.

a. Wash all parts with the exceptions of solenoid coil assembly in PS-661 specification MIL-C-25769. After cleaning, thoroughly dry all parts with compressed air prior to reassembly in solenoid body, utilizing authorized safety procedures.

b. Clean out inside of cylinder and plunger operating hole with cloth wet with PS-661. DO NOT submerge coil in cleaning fluid.

CAUTION

Do not allow fluid to enter the solenoid coil. In the event fluid enters the solenoid coil, dry with compressed air utilizing authorized safety procedures.

c. Place solenoid plunger assembly and spring in solenoid coil.

d. Place spring tension retainer on top of plunger beveled side up.

e. Install adjusting cap.

f. Place retaining flange on top of adjusting cap. Rotate retaining flange until slot in retaining flange lines up with safety wire hole in solenoid body.

g. Rotate adjusting cap until adjuster enters slot in solenoid plunger, start two fillister head screws leaving out the two screws that fasten the adjusting cap clamps.

h. Rotate spring tension retainer until the four protruding lugs align with the indentation on the bottom side of the retaining flange.

i. Tighten the two fillister head screws and safety wire.

j. Place the two adjusting cap clamps in slots in retaining flange. Tighten and safety wire fillister head screws.

Note

In the event solenoid is to be immediately installed on the gun, clamp and fillister head screws may be left out until solenoid is installed on the gun.

4-1292. MACHINE GUN INSTALLATION. *(See figure 4-222.)* The machine guns are mounted on the gun compartment structure by quick-release fittings. The rear mount of each gun can be adjusted horizontally and vertically to permit boresighting. A 300-round ammunition box is mounted above the feed chute of each gun. The boxes hook over fittings at the top and are fastened to the feed-chute supports at the bottom by quick-release fittings. The feed chutes and supports are fastened to the guns and to the structure by quick-release fittings. Expended links and cartridge cases are discharged through chutes into the space below the guns, from which they are discharged overboard through a hydraulically-operated door in the skin. To alleviate overheating and to facilitate maintenance, the gun barrel jacket sleeve and clamp have been removed from the guns.

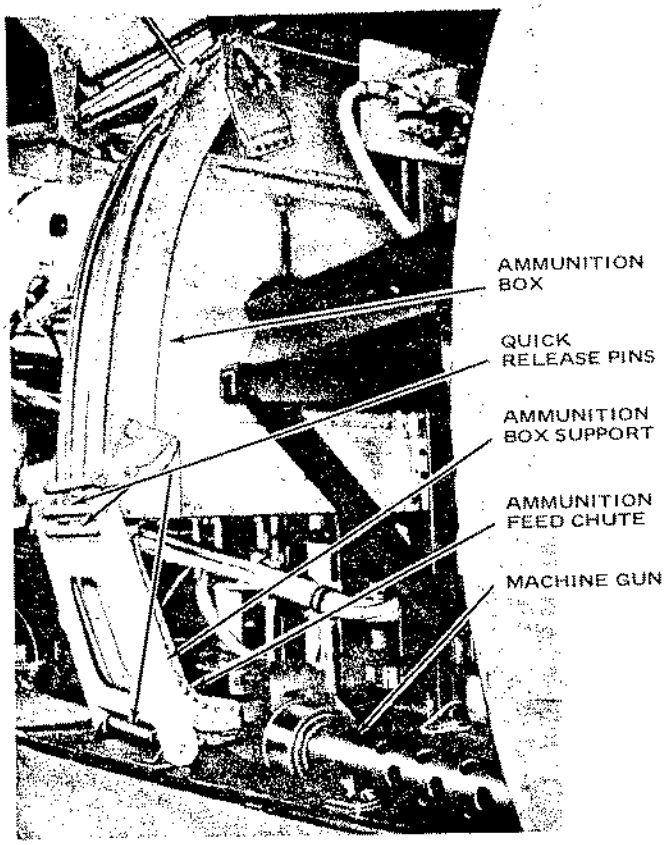


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Figure 4-222. Machine Gun Installation

CAUTION

During gunfiring tests on the ground, pad the nose-gear torque arms with cloth or other suitable material. This will prevent a live shell (dropped from the ejection chute after a jam has been cleared or during initial injection of the belt) from being fired by striking unpadded torque arms. In addition, the nose alighting gear must be centered to prevent the case ejection door deflector plate from striking the lens of the landing lights.

4–1293. Guns are charged manually by handles located in the gun compartment. Each gun is supplied with an electric heater controlled from the cockpit.

4–1294. The guns and gun camera are fired electrically by a trigger switch on the control stick. In order for the trigger switch to be operative, the master armament switch on the forward cockpit left shelf must be turned to either the "GUNS," or "SIGHT AND CAMERA" position and the switch type circuit breaker on the aft cockpit left shelf must be turned to the "ON" position. Operation of the master armament switch to the "GUNS" position turns on the gun sight. The case ejection door is opened by the trigger switch when the master armament switch is in the "GUNS" position. Operation of the switch to the "SIGHT AND CAMERA" position turns on the gun sight, and energizes the gun camera circuit. A switch adjacent to the master switch controls the gun heaters.

Note

Those aircraft having T.O. 1T–33–537 complied with have the forward cockpit control stick grip trigger wired to operate the camera on the first position of the trigger when the armament master switch is in the "SIGHT AND CAMERA" position. The second position of the control stick grip trigger switch operates the guns, camera and case ejection door circuit when the armament master switch is in the "GUNS" position. In addition, T.O. 1T–33–537 disables the rear cockpit stick grip trigger switch.

4–1295. LOADING OF GUNS.

a. Enter the double-looped end of the cartridge belt into the machine gun through the feed opening until the first cartridge is beyond the belt-holding pawl.

Note

If cartridge will not slip past belt-holding pawl, open gun cover sufficiently to allow cartridge to enter. Close cover.

b. Charge the gun twice (or until the first link is ejected with the gun charger). The action and cover must be fully closed and the extractor must grip the cartridge in the feedway.

4–1296. CHARGING OF GUNS.

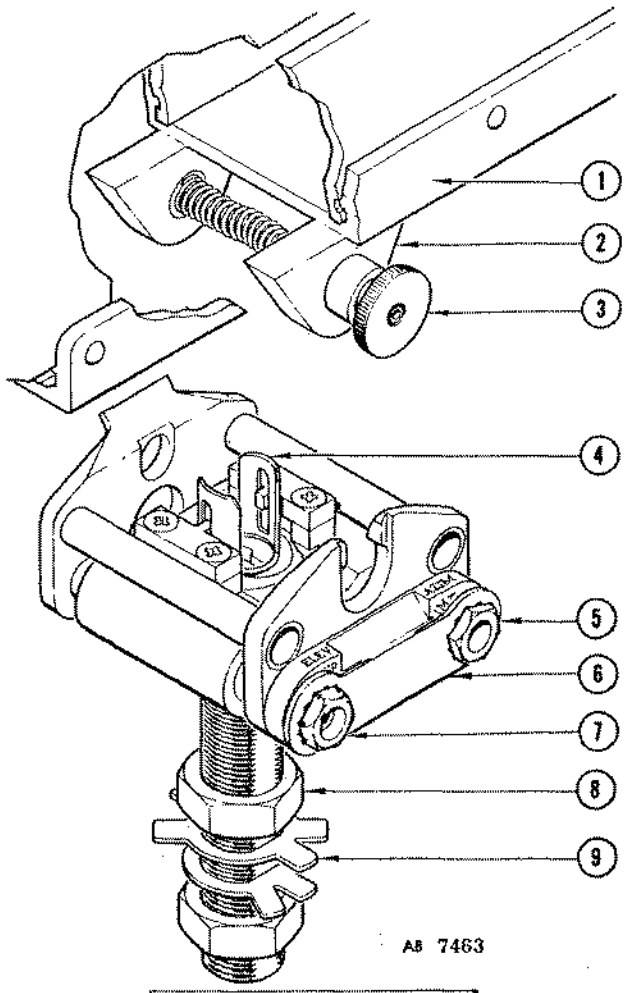
a. Remove gun charger handle from stowage clip and pull out until charger trigger engages beveled shoulder on outer slide, thus holding gun bolt in rear position.

b. Allow handle to return to its original position, and replace it in the clip.

c. To release gun bolt, trip trigger lever.

4–1297. UNLOADING OF GUNS.

a. Lift cover and remove belt.



1.	MACHINE GUN
2.	MOUNTING FLANGE
3.	SPRING-LOADED PIN
4.	GUN POST
5.	AZIMUTH ADJUSTMENT
6.	LOCKING PLATE
7.	ELEVATION ADJUSTMENT
8.	NUT
9.	LOCKWASHER

Figure 4-223. Rear Gun Mount

Note

In case belt is stuck and it is necessary to open the cover, remove one shell at the top end of the feed chute to split the belt, and remove the ammunition box.

b. Retract bolt with gun charger handle and make visual inspection of feedway, "T" slot, and chamber to be sure that gun is unloaded.

c. Release bolt and close the cover.

d. Release tension on firing pin spring by pressing trigger lever.

4-1298. REMOVAL OF GUNS.

a. Remove ammunition boxes.

b. Remove electrical disconnect plug from gun solenoid and gun heater.

c. Remove the link ejection and ammunition feed chutes by releasing the quick-release fittings attaching them to the gun.

d. Pull spring-loaded pin knob out approximately 1/4 inch. Raise aft end of gun and release knob, leaving pin in the gun mounting flanges. (See figure 4-223.)

e. Withdraw the spring-loaded pin in the front mounting trunnion about 1/4 inch. Raise gun just clear of trunnion and release the pin.

f. Lift gun slightly off its mountings. Any tendency for it to stick may be overcome by striking the gun sharply with the hand. Move the gun aft until the muzzle clears the blast tube. Remove gun from the airplane.

CAUTION

As each gun is removed, place ballast equal to weight of gun in nose of airplane.

g. Remove the trunnion and rear mount pin and spring from the gun by taking out the cotter pin.

Note

If the gun is to be left out of the airplane, remove the detachable parts of the trunnion and rear mount, and reinstall them in the airplane.

4-1299. MACHINE GUN BARREL REMOVAL WITH GUN INSTALLED. To remove the barrel from a machine gun, remove the ammunition box and slip off the backplate of the gun. Prior to AF Serial No. 51-17536 and on 52-9129 through 52-9484, use tool S10802 to actuate the oil-buffer spring lock. Remove the barrel.

4-1300. INSTALLATION OF GUNS. Reverse removal procedure.

CAUTION

Be sure both front and rear attachments are properly seated and locked, otherwise guns may jump mountings and cause serious damage.

4-1301. AMMUNITION BOXES AND FEED CHUTES. Each gun is rovided with a 300-round ammunition box located above the gun feedway. Ammunition boxes are easily removable, and are supported at the top rear by fittings which rest on hooks attached to vertical support posts. A feed chute is attached between each ammunition box and gun. When installed, the lip of the chute should be even with or slightly above the bottom surface of the gun feedway. A flanged opening in the floor extends down from each gun breech and leads to the case ejection door in the fuselage skin.

4-1302. GUNSIGHT. *(See figure 4-224.)* A type K-14 gunsight is mounted on a casting aft of the windshield. The sight works on the gyroscopic principle, and is designed to provide the proper lead for fighter deflection gunnery. The sight is effective at all ranges between 200 and 800 yards, at any angle, as long as the target is tracked for not less than one second and the span lever has been set properly. The greatest effectiveness is obtained at ranges between 300 and 500 yards. The gunsight is not installed on airplanes as delivered from the factory.

4-1303. When the gunsight is not installed, remove and store as loose equipment, gunsight bracket 178044, and gunsight support 178046. These parts are not installed on AF Serial No. 53-5436 and subsequent, when they are delivered from the manufacturer, but are supplied as loose equipment.

4-1304. GUNSIGHT HEAD. This is located just aft of the windshield, in the pilots line of vision. It consists of two reflector sights mounted integrally side by side. The left sight is fixed, and its line of sight is always parallel to the flight line of the airplane. The right sight is the gyro sight and contains the automatic computing mechanism. On the face of the sight just forward of the crash pad are the span lever and scale. A lever on the left side of the head operates a mask which blanks out part of the fixed-sight reticle pattern. An access door is provided on the face of the sight for replacing burned-out lamps.

4-1305. GUNSIGHT SELECTOR SWITCH AND RETICLE DIMMER RHEOSTAT. The selector switch determines whether the fixed sight alone is to be used, the fixed and gyro sights together, or the gyro sight only. The rheostat increases or decreases the brightness of the sight reticle. These switches are located on the left side of the instrument sub-panel.

4-1306. GUNSIGHT RADIO NOISE FILTER. This item is included to reduce the level of the radio-frequency noise generated by the series-wound, direct-current motor in the sight.

4-1307. GUNSIGHT VOLTAGE REGULATOR. This is a carbon pile regulator, and is included for maintaining the potential of 22 (±.5) volts required by the sight for accurate calibration.

4-1308. GUNSIGHT RANGE CONTROL TWIST GRIP. *(See figure 4-71.)* This is part of the engine control lever, and enables the pilot to keep the target framed continually in the ring formed by the inner points of the diamonds of the gyro-sight reticle, while flying the airplane.

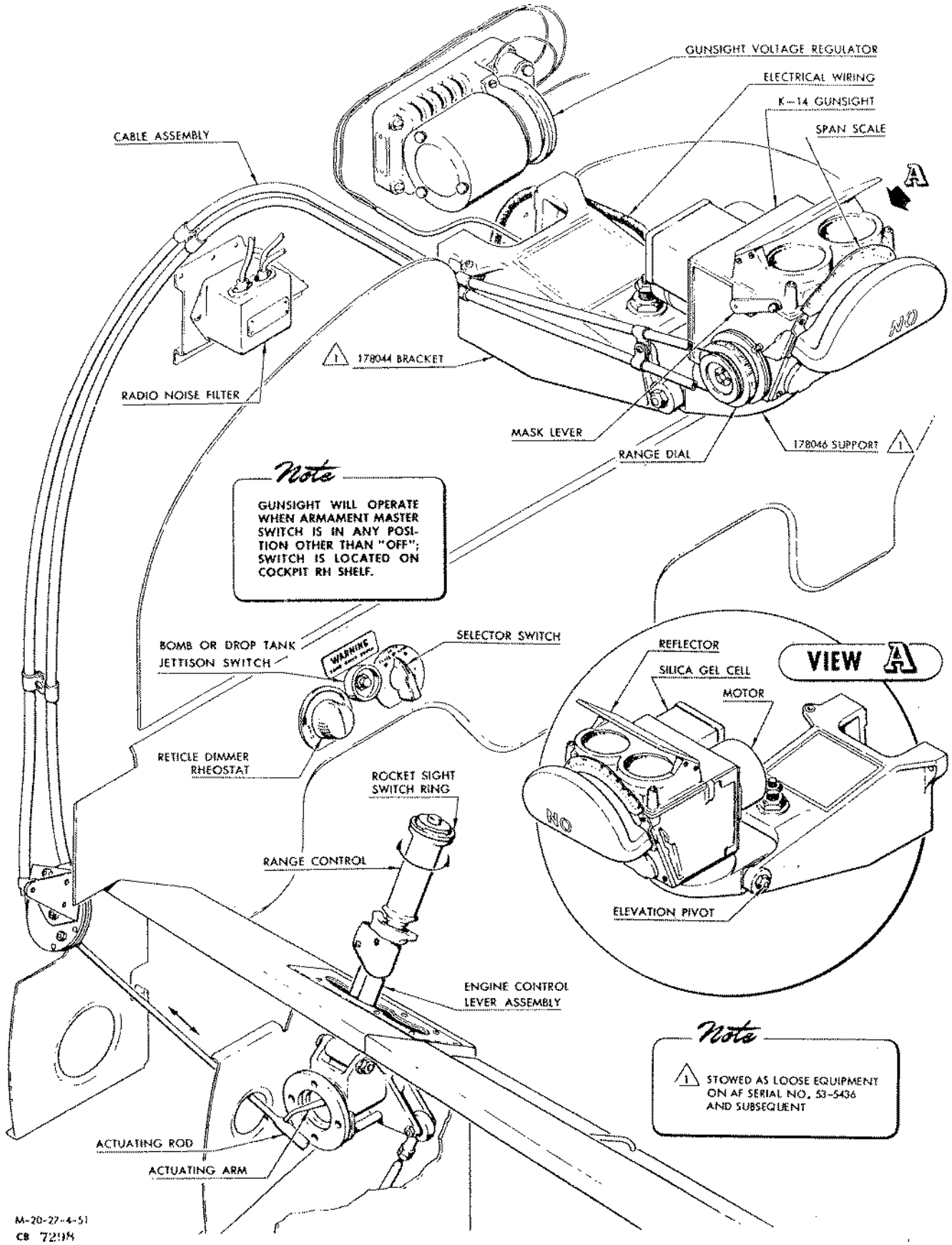


Figure 4-224. Gunsight Installation

Note

Lubricate throttle lever upper bearing with oil, Specification MIL-L-7870, through hole below grip. Prior to reassembly, lubricate throttle lever with oil, Specification MIL-L-7870, and bearings with grease, Specification MIL-G-23827. Top and bottom bearings must have a clearance of 0.004 inch.

CAUTION

Exercise caution when using grease, Specification MIL-G-23827, to see that it does not come in contact with and soften paint, natural rubber, neoprene, and electrical insulating materials.

4–1309. OPERATION OF GUNSIGHT. The gunsight automatically compensates for range and deflection by enabling the pilot to fly the airplane so the guns lead the target by the required distance. To operate the sight, turn the battery switch "ON" and turn the armament master switch either to "GUNS" or to "SIGHT AND CAMERA."

4–1310. Turn selector switch to the desired sight: "FIXED," "FIXED AND GYRO," or "GYRO." Turn rheostat to give the desired illumination. Set the span lever to the proper index for the target. Range the target by turning the range control twist grip with a smooth continuous movement, keeping the target framed by the inner points of the diamonds. The target must be tracked in this manner for at least one second.

4–1311. GROUND CHECK OF GUNSIGHT.

a. Turn battery switch "ON."

b. Turn armament master switch to "GUNS."

c. Turn rheostat to "BRIGHT."

d. Turn sight selector switch to "FIXED AND GYRO."

e. See that both reticles light up.

f. Turn armament master switch to "SIGHT AND CAMERA." See that reticles light up again.

g. Move sight selector switch to "FIXED" and then to the "GYRO" positions and observe that each reticle lights properly.

h. Reset the selector at "FIXED AND GYRO" and dim the reticles as desired.

i. Test throttle twist grip for free operation without excessive stiffness, binding, or jumpiness from maximum to minimum range at various throttle positions. See that the gyro sight reticle movements correspond to the movements of the twist grip.

4–1312. FLIGHT CHECK OF GUNSIGHT.

a. Turn the sight on and allow it to warm up for 15 minutes.

b. Set selector switch at "FIXED AND GYRO," the fixed reticle mask lever up, and the range at 800 yards.

c. Cage the direction gyro at zero degrees.

d. Establish a steady turn at a rate which will deflect the dot of the gyro sight reticle to the circumference of the fixed reticle ring, that is, one rad or 35 mils deflection.

e. Hold this rate of turn constant and uncage the directional gyro when the second hand of the clock passes zero seconds.

f. Maintain the constant rate of turn by keeping the dot at the 35-mil deflection ring for 60 seconds.

g. Cage the gyro after exactly 60 seconds have elapsed, and read the number of degrees turns from the directional gyro.

h. Repeat the above procedure for a turn in the opposite direction.

Note

The correct amount of turn should be 130 ($\pm$10) degrees.

There should not be more than 10 degrees difference between the right and left turn. A greater difference indicates misalignment of the reticle.

i. If the amount of turn is greater than 140 degrees and the electrical circuit reveals no fault, the gyro pivot friction is probably too high, and the sight should be sent to a qualified depot for overhaul.

j. If the amount of turn is less than 120 degrees, check the electrical circuits to see that the proper resistances are in the range circuit. If no high-resistance connections, or no improper resistances are found, the sight should be sent to a qualified depot for overhaul.

4–1313. BORESIGHTING. Boresighting is the process of aligning the guns with the flight line of the airplane for a given speed. At approximately 390 miles per hour indicated air speed, dependent upon the weight of the airplane, the fuselage reference line is parallel to the flight line. Below that speed the airplane flies "nose up." Above that speed, the airplane flies "nose down."

4–1314. SPECIAL TOOLS.

a. Boresight target.

b. Steel measuring tape, 100 feet long.

c. Two plumb lines and plumb bobs.

d. Transit, surveyor's; AF Stock No. 7800-866815, or wye level.

e. Spirit level.

f. Steel scale (preferably narrow).

4–1315. POSITIONING THE AIRPLANE FOR BORESIGHTING.

a. Place airplane on jacks as described in paragraph 3–19. (See figure 3-10.)

b. Place a spirit level across lateral leveling pads in nose wheel well (figure 3-12) and adjust one of the wing jacks until spirit level shows airplane to be level laterally.

c. Place spirit level on gun-leveling pads in armament compartment and level airplane longitudinally.

Note

The gun-leveling pads are parallel with fuselage reference line.

When airplane is leveled with respect to these points, or fuselage longitudinal leveling pads in the nose wheel well (figure 3-12), airplane is in the flight attitude, assumed at approximately 383 miles per hour indicated air speed. For boresighting at various air speeds, loading and acceleration conditions, see figure 4-226, and use nose wheel well leveling pads. For each mil change in attitude indicated on figure 4-226, install one 0.018-inch shim between forward leveling pad and spirit level if flight attitude moves "nose down," or at aft leveling pad if flight attitude moves "nose up."

4–1316. POSITIONING THE BORESIGHTING TARGET. Place a target, made in accordance with figure 4-226, 1000 inches (83 feet, 4 inches) in front of the mean center line of the front gun trunnions. The target must be mounted so that it can be moved both vertically and horizontally.

4–1317. HORIZONTAL ADJUSTMENT OF BORESIGHTING TARGET. *(See figure 4-225.)*

a. Drop plumb lines from plumb-line points at nose and mid-wing positions of airplane.

b. Place center of a surveyor's transit (AF Stock No. 7800-866815) or wye level even with aft plumb line and 36 inches to the left. Level the instrument.

c. Place a steel scale on the ground with one end against forward plumb bob and the other end extending to the left.

d. Swing instrument (transit or wye level) onto steel scale and adjust instrument until vertical cross hair is on the scale and 36 inches to left of plumb bob.

e. Focus instrument on boresight target. Move target horizontally until line, which is 36 + 5 or 41 inches, to left of the target center aligns with cross hair of the instrument.

4–1318. VERTICAL ADJUSTMENT OF BORESIGHTING TARGET. *(See figure 4-225.)*

a. Place a surveyor's transit (AF Stock No. 7800-866815) or wye level on left wing near fuselage at a height of from 2 to 10 inches below reticle image on gun sight reflector. Level the instrument.

b. Hold a steel scale against left side of gun sight so that one end of scale is at the same height as the reticle image on the reflector, and the other end extends downward.

c. Focus instrument on the steel scale and record distance of horizontal cross hair below reticle image.

d. Swing instrument onto target. Raise target until sight mark on target is the same distance above the cross hair as the reticle image.

Note

The target may also be positioned with relation to the airplane by using a type A-2 sight line level indicator.

4–1319. GUN ADJUSTMENT. Adjust each gun to its individual mark on the boresight target. Adjustment for

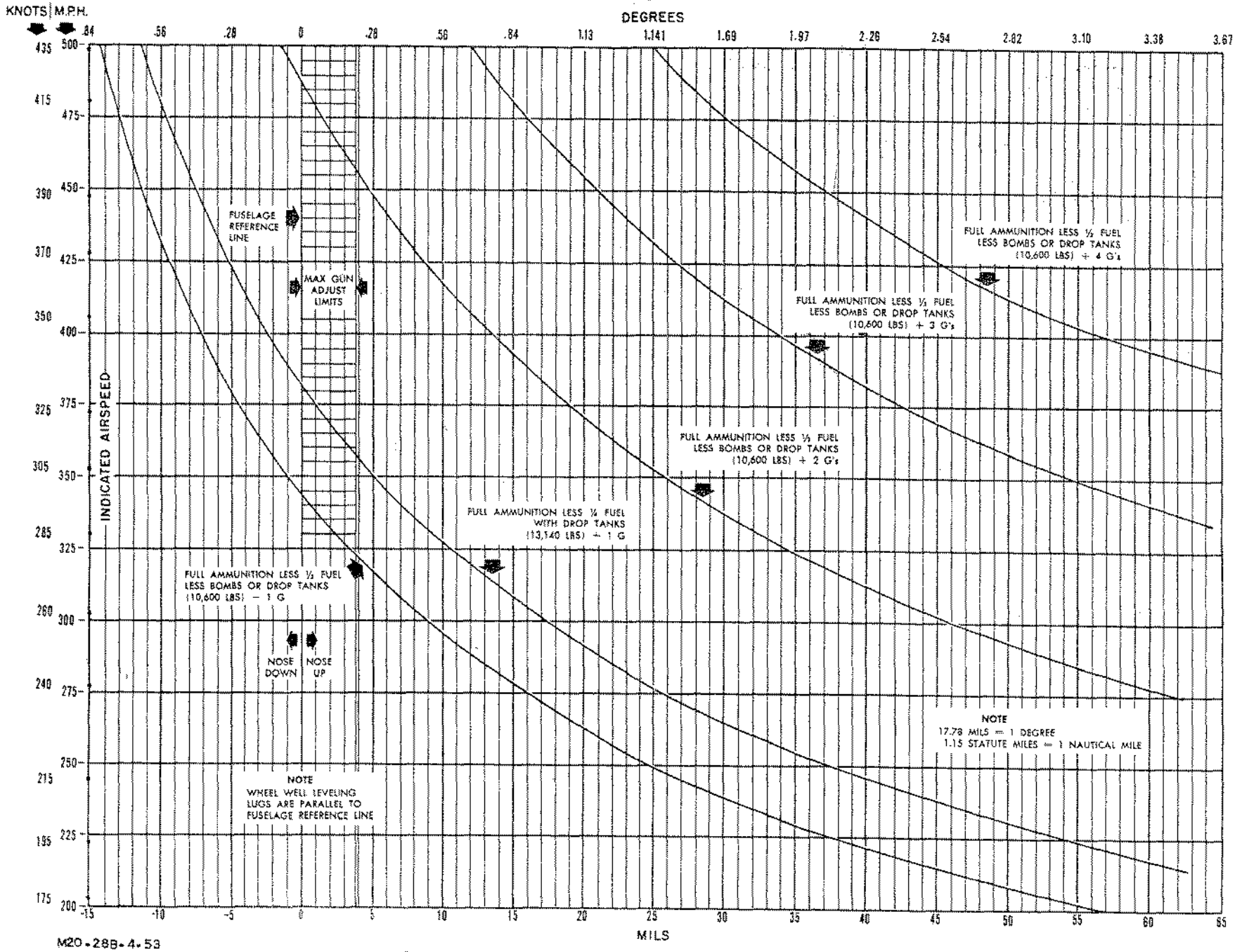


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Figure 4-226. Gunsight Alignment Chart

4–1321. GUN CAMERA. *(See figure 4-227.)* A type N-6 gun camera is mounted in the outboard leading edge of the right-hand air intake scoop. A hinged panel inside the scoop provides access to the camera and its adjustable mount. The camera has an internal overrun device, which allows the camera to operate for two seconds after the trigger switch has been released. A heater and a receptacle for a lens heater are built into the camera. When the armament master switch is in either "GUNS" or "SIGHT AND CAMERA" position, the camera can be operated.

4–1322. REMOVAL AND LOADING OF GUN CAMERA.

a. Disconnect fasteners in camera access door. Raise door until brace engages its stop.

b. Loosen knurled bolt at bottom of mounting bracket and remove camera with its mounting bracket. The adjustable mount need not be removed.

c. Open magazine cover at aft end of camera by pressing latch knobs toward lens-end of camera.

d. Move the magazine latch out of the way to allow for magazine loading. This also retracts the magazine driving spline.

e. Insert type A-6 film magazine into camera with aperture toward lens and footage indicator toward mount-side of camera. Note footage on magazine and set indicator in camera to agree.

f. Move magazine latch over magazine as far as it will go.

g. Close magazine cover.

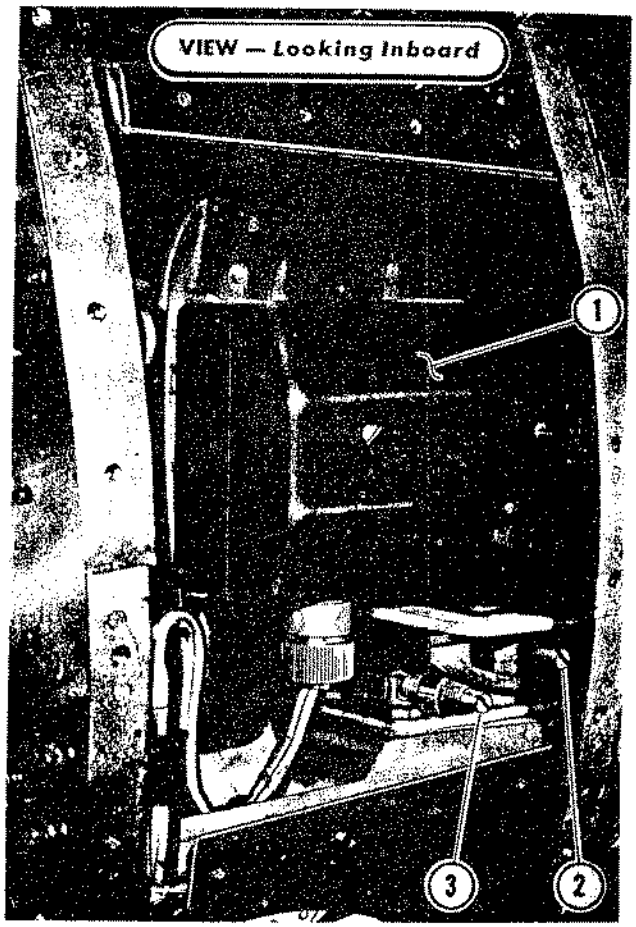
Note

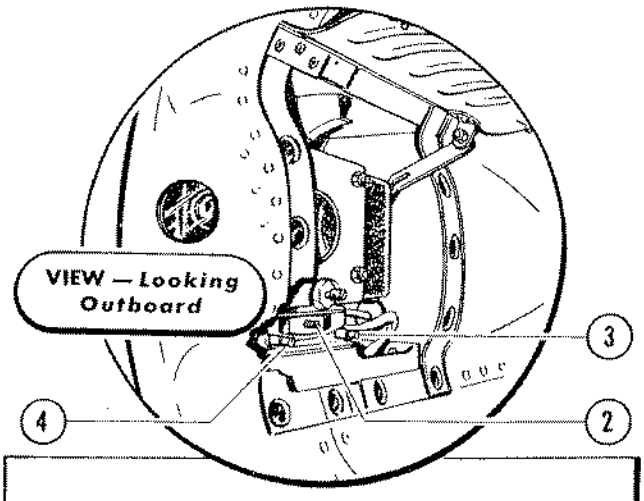
The magazine cover will not close unless the magazine latch has been moved down as far as it will go.

4–1323. GUN CAMERA SHUTTER AND LENS. The shutter speeds are 16, 32, and 64 exposures per second, and are controlled by the shutter-speed knob on the camera body. A minus-blue filter having approximately the transmission characteristics of Wratten No. 12 is provided with each lens assembly. The calibrations on the lens diaphragm are corrected for use with the filter, therefore the filter should not be removed from the lens except for cleaning.

CAUTION

Never change shutter speeds while camera is operating. Keep index marks on shutter-speed knob and on top cover aligned.





1.	GUN SIGHT AIMING POINT CAMERA
2.	ELEVATION ADJUSTMENT LOCK SCREW
3.	AZIMUTH ADJUSTMENT SCREW
4.	ELEVATION ADJUSTMENT SCREW

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Figure 4-227. Gun Camera Installation

4-1324. ADJUSTMENT OF GUN CAMERA. The gun-camera mount is adjustable both horizontally and vertically through the camera access door. Three adjustment screws are located at the base of the mount. The forward screw adjusts the camera vertically, the center screw locks the mount in position, and the aft screw adjusts the mount horizontally. Adjust gun camera with the aid of a magazine-type camera sight to align with the camera sighting mark on the target. (See figure 4-225.)

Note

The gun camera must be realigned whenever the gun sight is changed or resighted, or if the camera becomes loose in its mount.

4-1324A. INSTALLATION OF 30—CALIBER MACHINE GUN PODS T—33A—1 AND TT—33A—5 AIRCRAFT.

a. Description of 30-caliber gunnery equipment (applicable to following MAP aircraft); T-33A-1 aircraft, AF Serial Nos. 51-9199, 52-9190 and 51-9281 and T-33A -5 aircraft, AF Serial Nos. 53-4906 and 51-5197. In addition to the 50-Caliber guns described in paragraph 4-1291, two gun pods have been provided for each aircraft listed above, in accordance with T.O. 1T-33-529. The GPU-1/A 30-Caliber gun pods are installed at the left and right mid-wing pylons and are suspended from MA-4A bomb racks.

Note

T-33A-5 aircraft do not have 50-caliber guns, electrical gun sights, or gun cameras.

Each gun pod contains two modified M37 30-caliber guns, two electric gun chargers, two 1000-round capacity ammunition boxes. No gun heaters are used. A new relay box has been provided in the nose wheel well. A rotary selector switch, a gun charger switch, and a circuit breaker have been added on the pilot's instrument panel. On T-33A-1 aircraft the master armament switch in the front cockpit left hand switch box is removed by 1T-33-529. Mid-wing pylons have been installed on the T-33A-5 aircraft to carry the 30-caliber gun pods. The ammunition cans have a simplified feed system and are easily installed on tracks. Large access doors provide maximum access to the guns and are hinged so they cannot be removed. Misfired rounds, casings and links are ejected overboard from the lower part of the pod. The gun pods can be jettisoned in flight manually, but not electrically, since the electrical cable is not connected to the bomb rack. Each gun pod weighs 155 lbs. empty, and 289.4 loaded with two M37 30-caliber guns, gun chargers, two 1000-round ammunition cans and 2000 rounds of ammunition. The pods are 86.44 inches long and 15 inches in diameter. Center of gravity shift (expending ammunition) is 10.37 inches. There is no ammunition cookoff hazard when bolt is opened with gun charger. Vent openings are provided to prevent gas concentration. Pods can be installed or removed in approximately ten minutes by two men. No special tools or ground support equipment is required. Electrical power requirements are 15 amps, 28V DC. Firing of guns is initiated from the stick trigger (28 volts). Chargers operate on six amps per pod, 28 V DC, and are protected with a special four amp slo blo fuse located on the junction box in each gun pod. This fuse should be replaced only with a like item. A higher amperage fuse will damage the gun charger motor if a gun jam occurs due to a defective cartridge or link. Push button switches are also provided on the gun pod junction box for operating the gun chargers during ground maintenance. The modified M37 gun weigh 26 lbs. each, and are 41-5/8 inches long. Weight of gun barrel is 4.44 lbs., rate of fire 950-1100 SPM, weight of solenoid and bracket 1-¼ lbs. Type of mechanism: short recoil; feeding device; disentegrating metallic link; cooling; air; ammunition types; ball, armor piercing, tracer, incendiary. Charger type: electric, weight: four lbs. Gun barrel life is approximately 10,000 rounds.

b. Access Panels. The guns can be serviced by removing the nose cone, tail cone, or side access panels. Access to the electrical gun charger can be made through an access panel on each side of the pod.

c. Removal of Guns. To remove the guns from the pod it is necessary to actuate two quick release pins, release the flexible ammunition feed belt, and disconnect the electric gun chargers. The ammunition cans can be removed after removing the tail cone.

d. Gun Chargers. The chargers hold the gun bolts in the open position when the gun charging switch is in the SAFE position. this prevents accidental firing if the trigger on the gun is inadvertently depressed. The open bolt system also precludes ammunition cookoffs.

WARNING

If the gun charger switch is moved from the Safe position to the Ready position, the gun bolts complete the charge cycle and the guns are ready to fire.

e. Installation of 30-Caliber Gun Pods.

WARNING

The bomb arming switch in the forward cockpit must be in the SAFE position while the 30-caliber guns are installed. If the bomb arming circuit breaker switch in the aft cockpit is in the ARM position, and the bomb arming switch in the forward cockpit is actuated to the TAIL ONLY or NOSE and TAIL position, it will provide power for charging the 30-caliber guns and they will be ready to fire.

To install gun pods on the MA-4A bomb racks at each mid-wing pylon, unlatch the bomb rack hooks with the manual release lever at top of bomb rack, and raise pod until attach lugs on the gun pod engage the bomb rack hooks. This normally causes the hooks to latch. Pull cocking cable on aft end of bomb pylon all the way out, and release. On mid-wing pylons with T.O. 1T-33A-539 incorporated, sight through the inspection holes on the inboard side of the left-hand pylon, and the outboard side of the right hand pylon. Check the engagement of bomb rack release lever arm and solenoid locking pin for a 50 per cent minimum engagement as well as the engagement of the tumbler and link lock. Run the four pylon sway brace bolts down against the gun pods finger tight. Torque lower sway brace jam nuts to 20/25 inch-pounds, torque upper jam nuts to 100/125 inch-pounds. Disconnect the bomb rack electrical cable from the pylon receptacle and tie it down to prevent the cable from swinging loosely in pylon. Connect the gun pod electrical cable to the pylon receptacle. Gun pods cannot be jettisoned electrically in-flight, however, they can be jettisoned manually by pulling the jettison manual release handles in the forward cockpit. Pulling the handles will release the tip tanks and the gun pods simultaneously.

CAUTION

Before installing or removing gun pods from the aircraft make certain tip tank safety pins are installed and release handles in forward cockpit are down and safety wired.

f. Gunsight. The K-14C gun sight is used on T-33A-1 aircraft. For T-33A-5 aircraft, a fixed gun sight is mounted on the forward instrument panel to line up the aircraft with the intended target.

4–1325. ARMOR PLATE AND BULLETPROOF GLASS INSTALLATION.

4–1326. DESCRIPTION OF ARMOR PLATE AND BULLETPROOF GLASS INSTALLATION. The pilot is protected from forward and aft gun fire by the armor plate and bulletproof glass installation.

4–1327. Forward armor protection consists of an armored skin panel of 1/4-inch hard clad aluminum alloy on the top of the fuselage mid section forward of the windshield, and the bulletproof glass that forms the forward part of the windshield.

4–1328. Prior to AF Serial No. 51-4040, on airplanes not modified by Lockheed Aircraft Service, Inc. head armor protection consists of one piece of steel plate behind the pilots head rest. This plate is of 3/8-inch face-hardened steel and is attached to the jettisonable seat frame.

4–1329. REMOVAL OF BULLETPROOF GLASS. Refer to paragraph 4–131.

4–1330. INSTALLATION OF BULLETPROOF GLASS. Refer to paragraph 4–133. Seal and pressure-test the windshield. (Refer to paragraph 4–1232.)

4–1331. REMOVAL OF ARMORED SKIN PANEL.

a. Remove the windshield. (Refer to paragraph 4–131.)

b. Remove the hose and hose clamp attaching the auxiliary defroster line to the defroster diffuser adapter in the armored skin panel.

c. Remove the recessed-head screws holding the skin in place, and remove the skin panel.

4–1332. INSTALLATION OF ARMORED SKIN PANEL.

a. Replace and secure the panel with recessed-head screws.

b. Replace the windshield. (Refer to paragraph 4–133.)

c. Seal and pressure-test the windshield. Refer to paragraph 4–1232.)

4–1333. REMOVAL OF HEAD ARMOR PLATE.

Note

This paragraph applies to airplanes prior to AF Serial No. 51-4040, which have not been modified by Lockheed Aircraft Service, Inc.

a. Remove the jettisonable seat.

b. Remove the clevis pins attaching the head rest to the armor plate.

c. Remove the binding wires.

d. Remove the trigger-cable retaining clip and pulley.

e. Remove the armor plate retaining bolts, and remove the plate.

SECTION V

USEFUL OR MILITARY LOAD

5–1. .50 CALIBER MACHINE GUNS (T-33A-1 AIRPLANES).

5–2. The ammunition for each machine gun is carried in a drawer-type tray located above each gun feed mechanism. Each tray holds 300 rounds of ammunition.

5–3. LOADING GUN AMMUNITION TRAYS. Ammunition loading procedure is placarded on the outside of each tray and is as follows:

a. Disconnect quick-disconnect fitting at bottom front of ammunition tray, and remove tray.

b. Open door on top of tray by disconnecting latch.

c. Feed the ammunition belt into the tray beginning on the bottom of the sloping end. Place cartridges so they will be pointing forward when trays are installed.

d. Feed belt toward straight end of tray, then reverse direction and lay second layer of belt over first layer. Continue building up layers until the required capacity is reached.

e. Feed balance of belt into lower end of feed chute and lock belt in place with belt lock at top of feed chute.

f. Close and latch door on top of tray.

g. Install trays in tracks and fasten with fittings at bottom of feed chutes.

h. Release belt lock and feed the belt from the chute into the machine gun. For loading guns, refer to paragraph 4–1295.

Note

Belt lock must be released, or ammunition will not feed into gun, and armament compartment doors will not close properly.

5–4. BOMBS.

5–5. A type S-1 or S-2 bomb rack capable of supporting a 100- to 1000-pound bomb is installed in each wing tip or pylon. Two AN-MK-4 bomb hoists with bomb slings may be used to lift a bomb in place. Hooks in the wing-tip fitting assembly are used to support the bomb hoists.

5–6. LOADING BOMBS (PRIOR TO AF SERIAL NO. 51-4141 ON AIRPLANES NOT INCORPORATING T. O. 1T-33A-42.) *(See figure 4-217.)*

a. Remove access panel No. 1. (See figure 3-1.)

b. Remove two small access panels No. 2 on bottom of wing tip marked "MOOR HERE" to provide access to bomb hoist hooks.

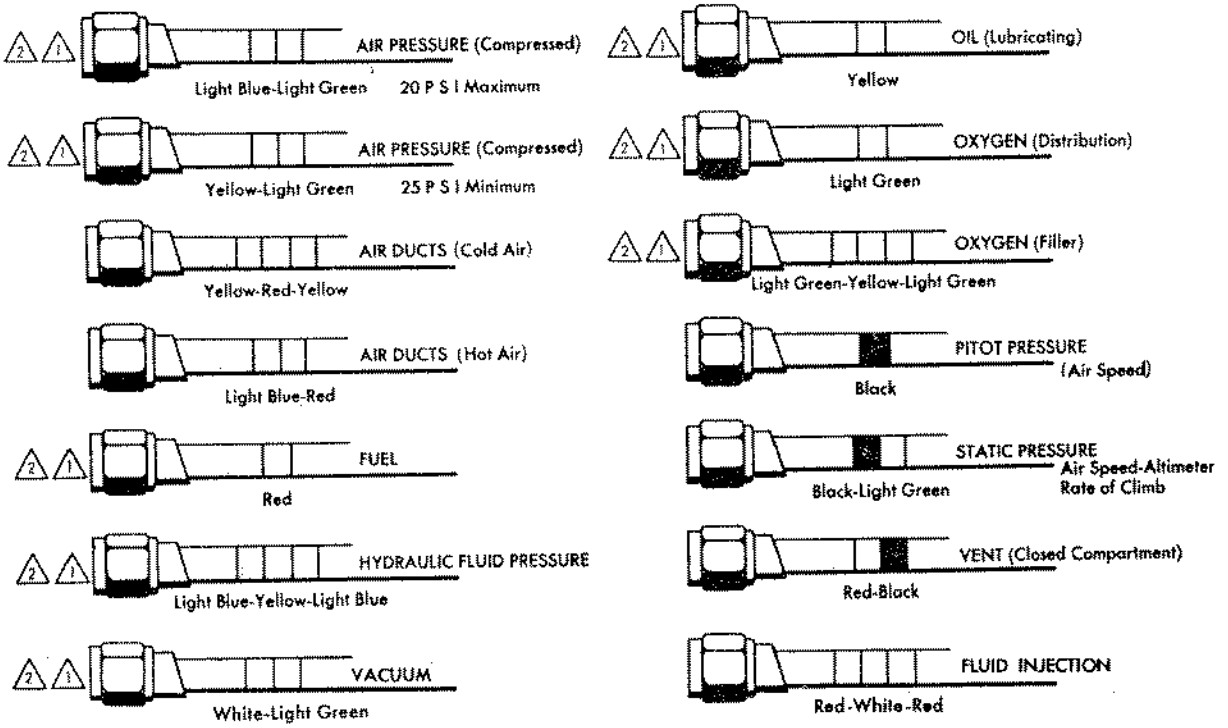
c. Attach bomb to bomb hoist with sling, and attach bomb hoist to hooks in wing tip.

d. Hoist bomb into place and cock rack with cocking ring. The arming wires can be engaged to the rack arming solenoids after the bomb has been loaded.

e. Check to be sure the manual release cable is connected.

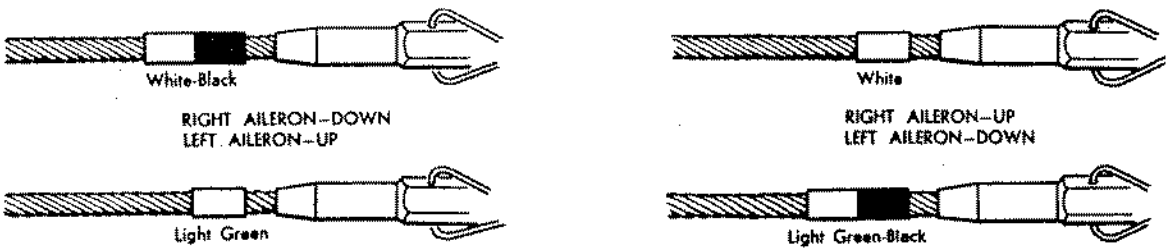
5–7. LOADING BOMBS (AF SERIAL NO. 51-4141 THROUGH 51-4265). Refer to paragraph 4–1285.

SECTION VI
CHARTS AND TABLES



All control cables are identified by encircling bands of colored cellulose tape at the turnbuckles according to the following code.

In case a single continuous cable is used in the flight control system to operate a surface in both directions the cable will be marked with alternate red bands with the middle band being the first color shown below.

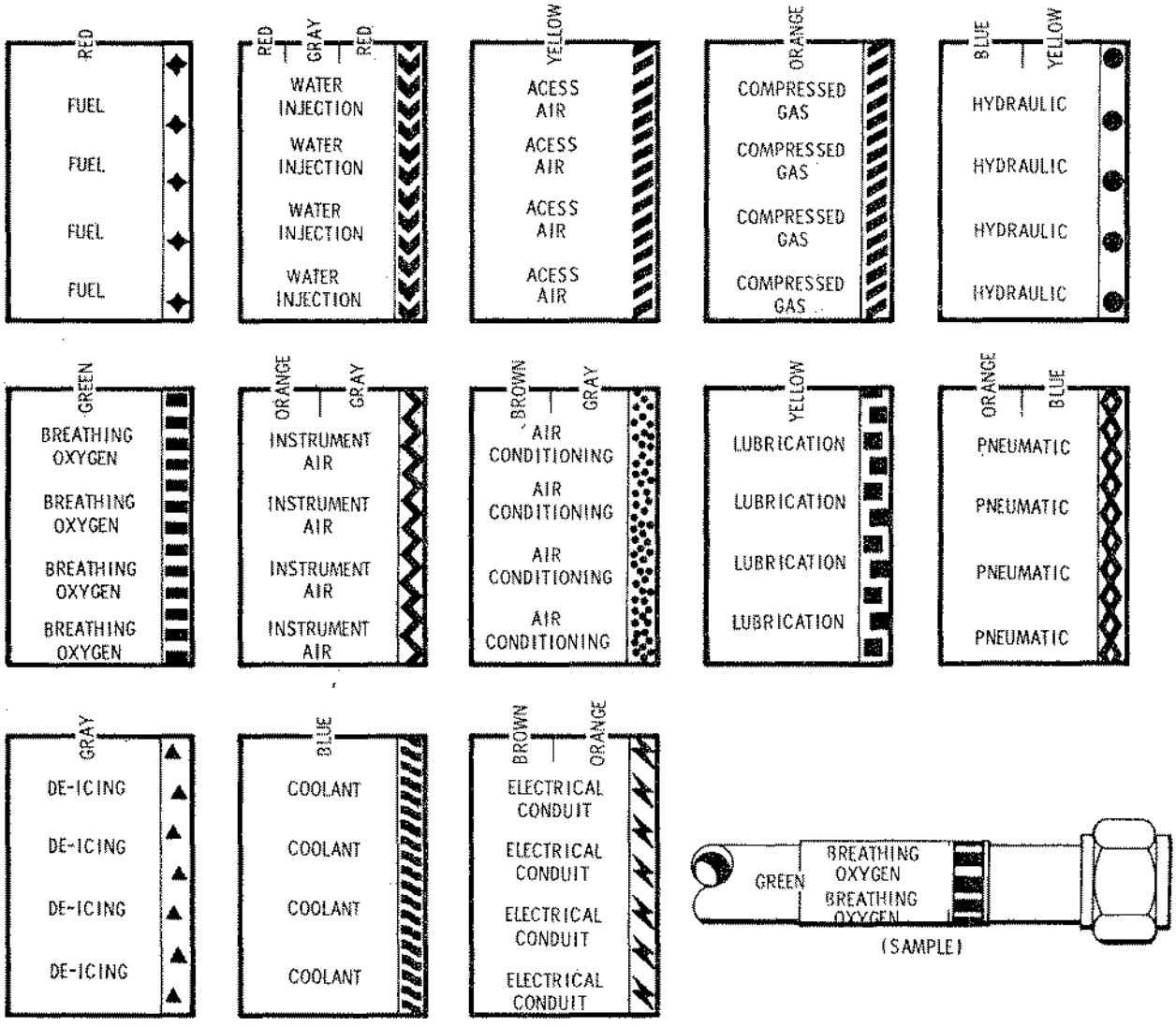


M20-55-6-1
HF 08827

△1 COLOR CODING NOT COMPATIBLE WITH T.O. 1-1-4

△2 FOR COLOR CODING COMPATIBLE WITH T.O. 1-1-4, (SEE FIGURE 6-2)

Figure 6-1. Color Codes



NOTE

THE ABOVE COLOR CODES REPRESENT DESIGNATION FOR SYSTEMS ONLY. FOR CODING LINES WHICH DO NOT FALL INTO ONE OF THESE SYSTEMS THE CONTENTS SHALL BE DESIGNATED BY BLACK LETTERING ON A WHITE TAPE.

SUBSIDIARY FUNCTIONS OR IDENTIFICATION OF LINE CONTENT MAY BE INDICATED BY THE USE OF ADDITIONAL WORDS OR ABBREVIATIONS WHICH SHALL BE CARRIED ON A SECOND TAPE ADJACENT TO THE FIRST OR ALTERNATIVELY, INTERPOSED BETWEEN THE WORDS DESCRIPTIVE OF THE MAIN FUNCTION.

WARNING SYMBOL TAPES, 3/8-INCH WIDE, SHALL BE APPLIED TO THOSE LINES WHOSE CONTENTS ARE CONSIDERED TO BE DANGEROUS TO MAINTENANCE PERSONNEL. WARNING TAPES ARE TO BE PLACED ADJACENT TO SYSTEM IDENTIFICATION TAPES.

ONE BAND SHALL BE LOCATED ON EACH TUBE SEGMENT, 24 INCHES OR SHORTER. ONE BAND SHALL BE LOCATED AT EACH END OF EACH TUBE SEGMENT LONGER THAN 24 INCHES. ADDITIONAL BANDS SHALL BE APPLIED WHEN THE TUBE SEGMENT PASSES THROUGH MORE THAN ONE COMPARTMENT OR BULKHEAD. AT LEAST ONE BAND SHALL BE VISIBLE IN EACH COMPARTMENT OR ON EACH SIDE OF THE BULKHEAD.

PRESSURE TRANSMITTER LINES SHALL BE IDENTIFIED BY THE SAME COLORS AS THE LINES FROM WHICH THE PRESSURE IS BEING TRANSMITTED.

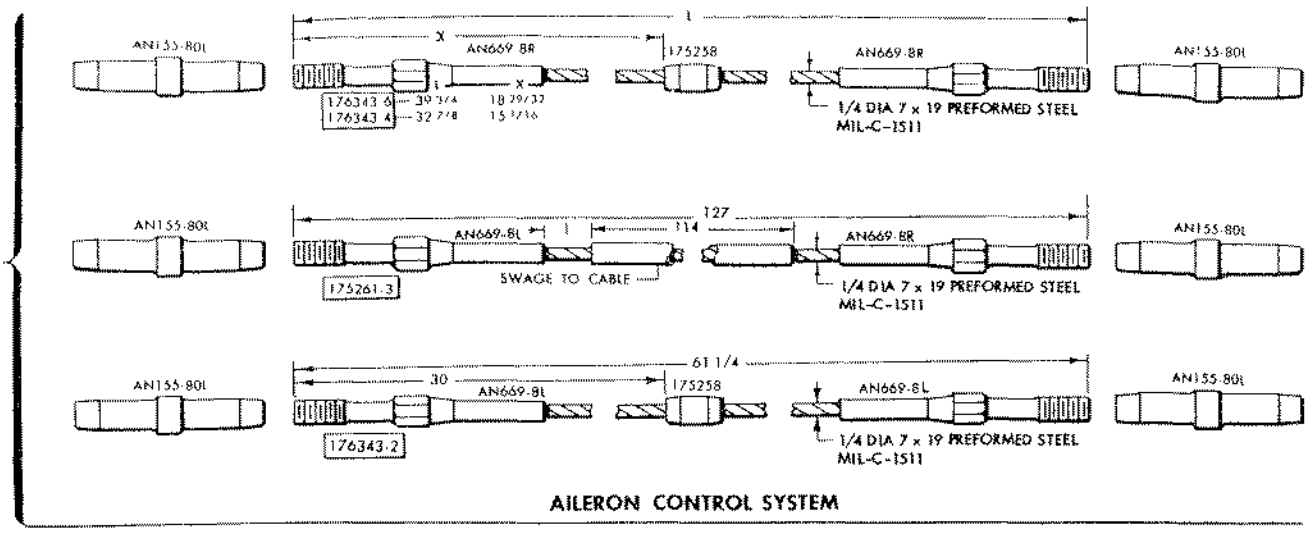
FILLER LINES, VENT LINES, AND DRAIN LINES OF A SYSTEM SHALL BE IDENTIFIED BY THE SAME COLORS AS THE RELATED SYSTEM.

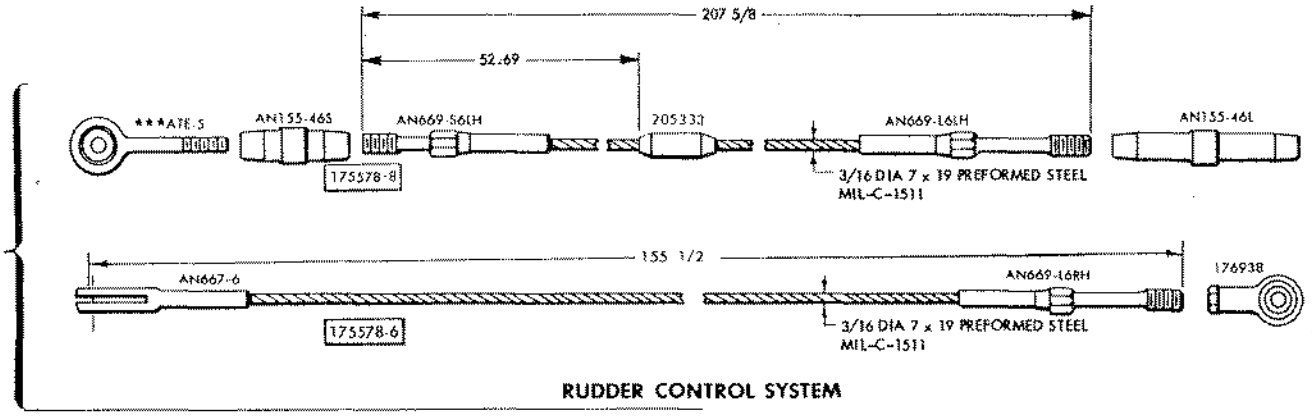
TAPES SHALL NOT BE USED ON FLUID LINES IN THE ENGINE COMPARTMENT WHERE THERE IS A POSSIBILITY OF THE TAPE BEING DRAWN INTO THE ENGINE INTAKE. FOR SUCH LOCATIONS, SUITABLE PAINTS, CONFORMING TO THIS COLOR CODE, AND WHICH HAVE NO DELETERIOUS EFFECT ON THE MATERIAL USED FOR THE LINES, SHALL BE USED FOR IDENTIFICATION PURPOSES. IN THESE CASES THE GEOMETRICAL SYMBOLS MAY BE OMITTED.

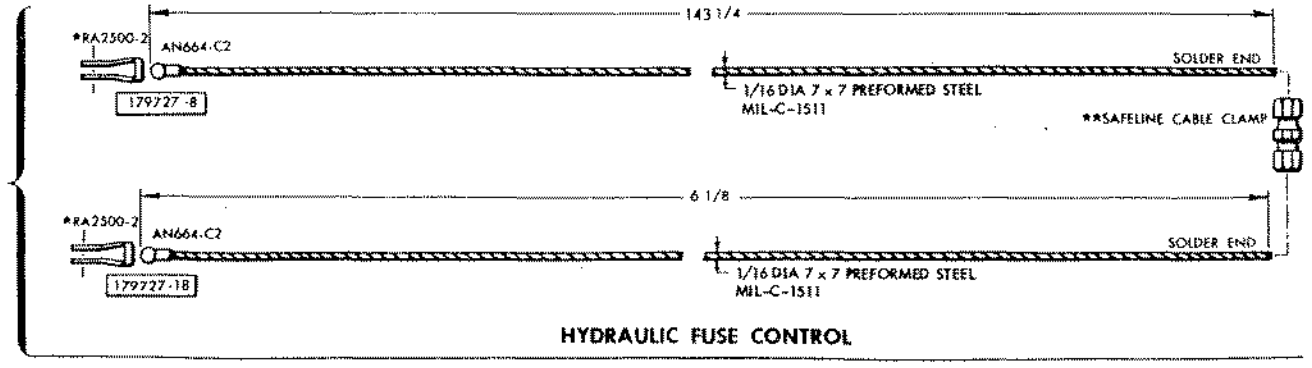
IF DECALS ARE NOT AVAILABLE, USE IDENTIFICATION TAPE OR PAINT SUITABLY COLORED STRIPES ON THE TUBE TO DESIGNATE SYSTEM. PROTECT WHEN DRY WITH A COAT OF LACQUER, SPEC AN-L-29.

HF 08890
M20-55-6-2

Figure 6-2. Color Coded Functional Identification Tapes (Compatible with T.O. 1-1-4)



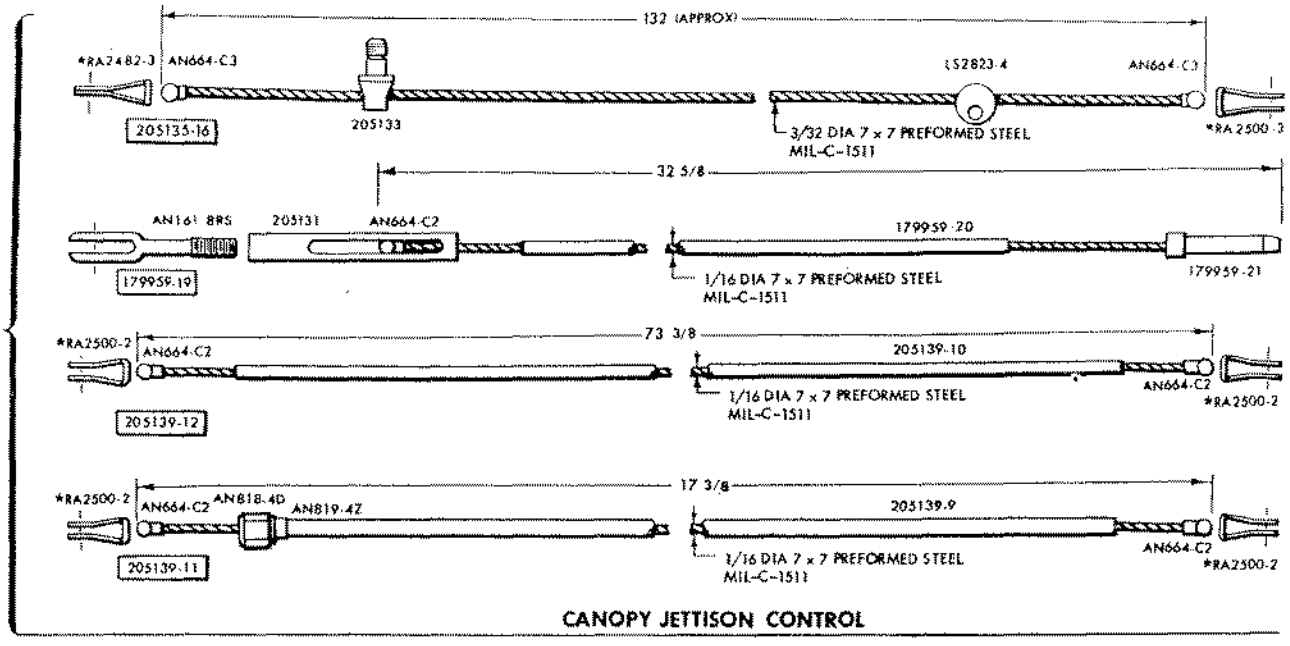




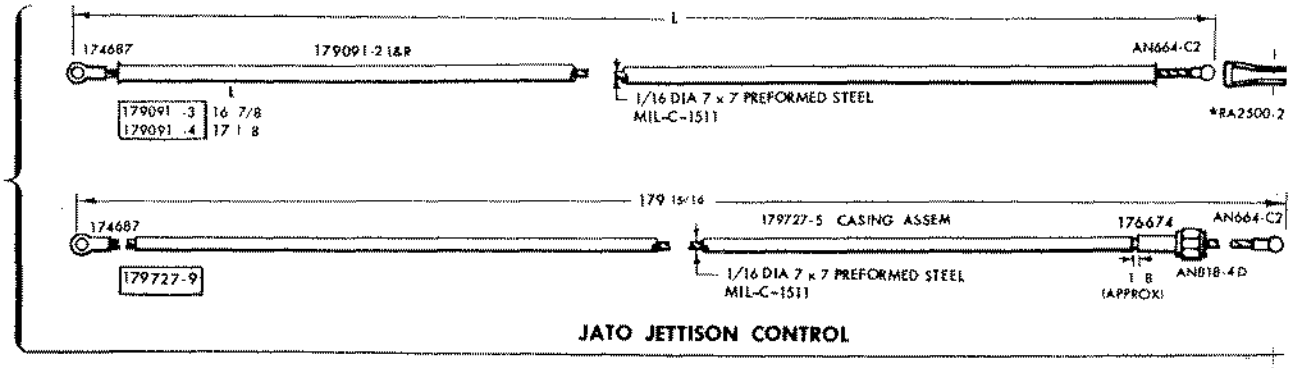
NOTE: *MFD. BY AMERICAN CHAIN AND CABLE CO., BRIDGEPORT, CONN.
**MFD. BY NATIONAL PRODUCTION CO., DETROIT, MICH.
***MFD. BY SHAFER BEARING CO., CHICAGO, ILL.

M20-48D-6-3(1)
GB 8746

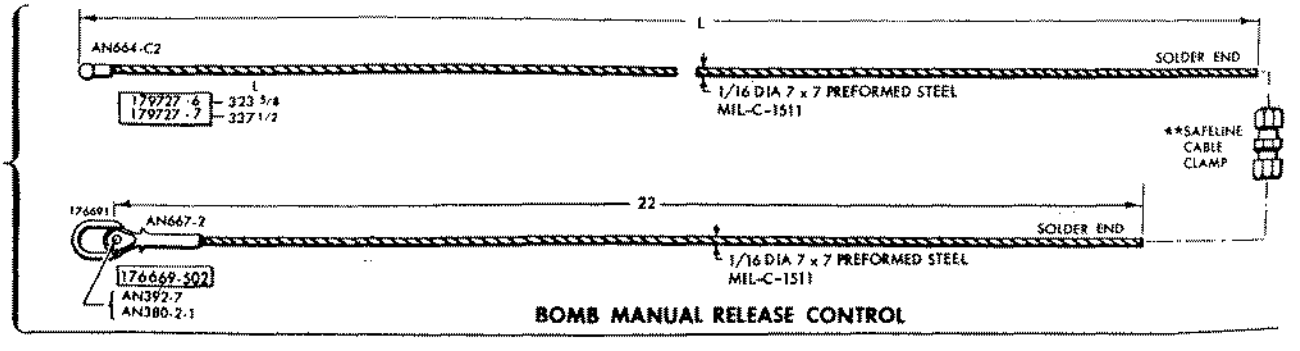
Figure 6 – 3. Cable Chart (Sheet 1 of 3)



CANOPY JETTISON CONTROL



JATO JETTISON CONTROL

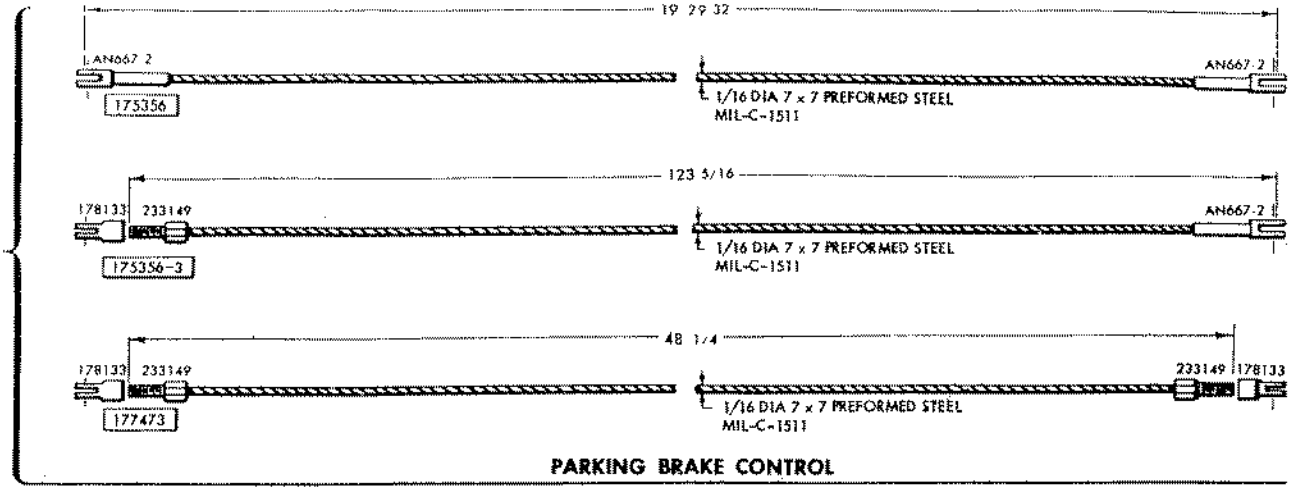


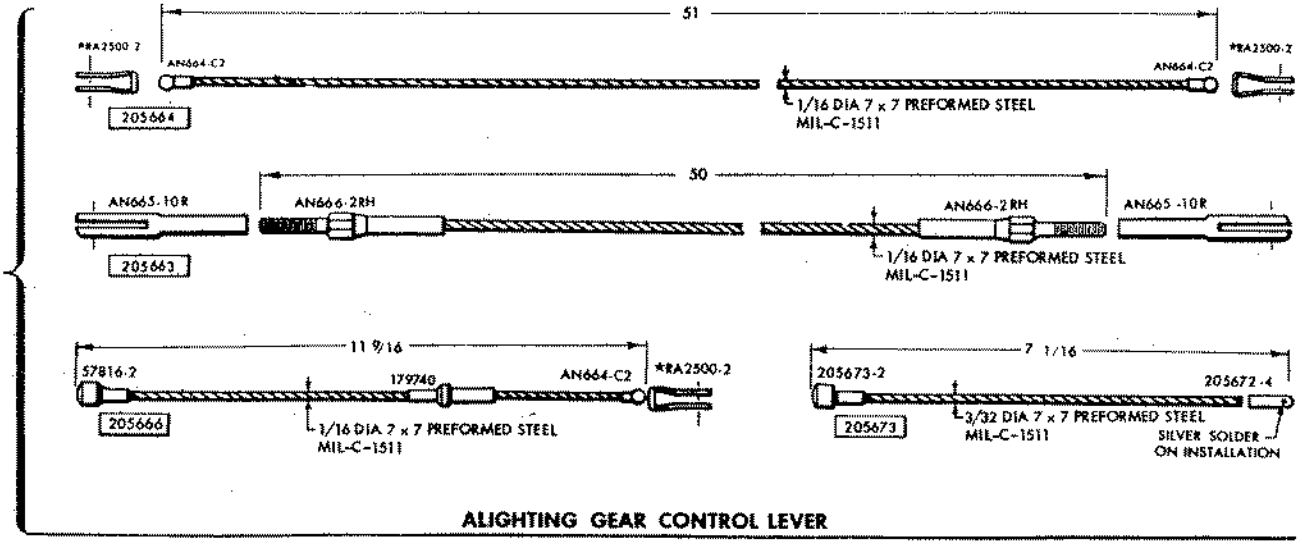
BOMB MANUAL RELEASE CONTROL

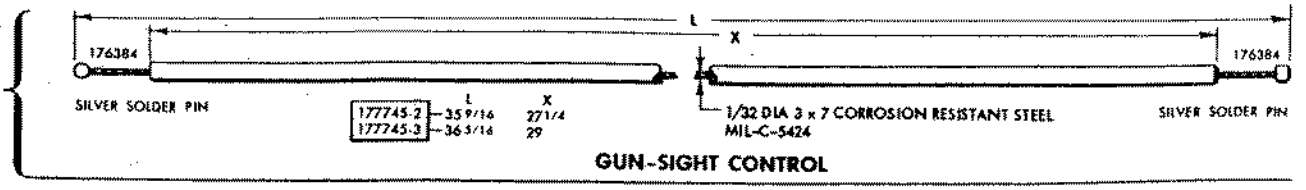
NOTE: *MFD. BY AMERICAN CHAIN AND CABLE CO., BRIDGEPORT, CONN.
**MFD. BY NATIONAL PRODUCTION CO., DETROIT, MICH.

M20-43-6-3 (2)
GB 2549

Figure 6—3. Cable Chart (Sheet 2 of 3)







NOTE: *MFD. BY AMERICAN CHAIN AND CABLE CO., BRIDGEPORT, CONN.

GB 2550
M20-43-6-3 (3)

Figure 6—3. Cable Chart (Sheet 3 of 3)

Table 6-1 — Wrench Torque Table

TORQUE VALUES IN INCH-POUNDS					
Standard Nuts, Bolts, and Screws			*High Shear Nuts, Bolts, and Screws*	*Maximum Allowable Tightening Torque*	
Bolt, Stud or Screw Size	*Tension-Type Nuts AN310 and AN365 (40,000 psi in Bolt)*	*Shear-Type Nuts AN320 and AN364 (60% of Column 2)*	*Tension-Type Nuts*	*Tension-Type Nuts AN310 and AN365 (90,000 psi in Bolt)*	*Shear-Type Nuts AN320 and AN364 (60% of Column 5)*
Column 1	*Column 2*	*Column 3*	*Column 4*	*Column 5*	*Column 6*
Fine Thread Series					
8-36	12-15	7-9	15-18	20	12
10-32	20-25	12-15	25-35	40	25
1/4-28	50-70	30-40	70-90	100	60
5/16-24	100-140	60-85	140-203	225	140
3/8-24	160-190	95-100	190-351	390	240
7/16-20	450-500	270-300	500-756	840	500
1/2-20	480-690	290-410	690-990	1,100	660
9/16-18	800-1,000	480-600	1,000-1,440	1,600	960
5/8-18	1,100-1,300	660-780	1,300-2,160	2,400	1,400
3/4-16	2,300-2,500	1,300-1,500	2,500-4,500	5,000	3,000
7/8-14	2,500-3,000	1,500-1,800	3,000-6,300	7,000	4,200
1-14	3,700-5,500	2,200-3,300	5,500-9,000	10,000	6,000
1 1/8-12	5,000-7,000	3,000-4,200	7,000-13,500	15,000	9,000
1 1/4-12	9,000-11,000	5,400-6,600	11,000-22,500	25,000	15,000
Coarse Thread Series					
8-32	12-15	7-9	15-18	20	12
10-24	20-25	12-15	25-35	35	21
1/4-20	40-50	25-30	50-68	75	45
5/16-18	80-90	48-55	90-144	160	100
3/8-16	160-185	95-110	185-248	275	170
7/16-14	235-255	140-155	255-428	475	280
1/2-13	400-480	240-290	480-792	880	520
9/16-12	500-700	300-420	700-990	1,100	650
5/8-11	700-900	420-540	900-1,350	1,500	900
3/4-10	1,150-1,600	700-950	1,600-2,250	2,500	1,500
7/8-9	2,200-3,000	1,300-1,800	3,000-4,140	4,600	2,700
1-8	3,700-5,000	2,200-3,000	5,000-6,840	7,600	4,500
1 1/8-8	5,500-6,500	3,300-4,000	6,500-10,800	12,000	7,200
1 1/4-8	6,500-8,000	4,000-5,000	8,000-14,000	16,000	10,000

Use the preceding wrench torques (given in inch-pounds) for installing castellated and self-locking steel nuts on AN3, AN23, AN42, and AN73 series steel bolts and on AN525, CT204, NAS220, and AN502 series steel screws. Threads are assumed to be medium fit, cadmium plated, and clean. If threads are lubricated, use the lower torque value.

TIGHTENING HOSE CLAMPS, TORQUE REQUIREMENT. Hose clamps installed on fuel, alcohol, and fluid injection system hose shall be tightened to a torque value of 25 inch-pounds. An alternate procedure for use when torque wrenches are not available is to tighten worm screw type clamps finger-tight plus 1¼ complete turns and radial type clamps finger-tight plus 2 complete turns. Hose clamps used on blast tubes, air ducts, vacuum lines, de-icer lines, and drain and vent lines shall be tightened to a torque of 15 lb in. Hose clamps installed on fuel cell fittings shall be torqued to 15 lb in. The finger-tight plus turns method will not be used on these installations. Hose clamps which are in service may be tightened ¼ turn to stop leakage.

CAUTION: Do not loosen hose clamps to inspect them.

S-1 and S-2 Bomb rack attaching bolts — Finger-tight.

PIPE THREAD FITTINGS

Thread Size	*Torque in Pound-Inches*	
	Minimum	*Maximum*
⅛	40	250
¼	70	450
⅜	100	650
½	160	900
¾	300	1600
1.0	400	2200
1¼	500	2500

Use the preceding wrench torques (given in pound-inches) for tightening aircraft pipe thread fittings.

CAUTION: A-1 pressure transmitter and associated gages, and lines carrying oxygen require special lubricants. For all other applications use only lubricant Specification JAN-A-669 Anti-Seize, white lead base, general purpose (for threaded fittings). Do not apply anti-seize to female fittings, nor to the first two threads of male fittings. Anti-Seize is strictly a lubricant, not a filler, no sealing compound is required.

TIGHTENING. Pipe threaded fittings torque starts at zero torque which is the initial torque to make a thread engagement, the torque increases abruptly, indicating the starting point of thread loading. This abrupt torque build-up, which must continue smoothly and progressively, is characteristic of aircraft pipe-threaded fittings. Tighten beyond the point of zero torque to the following number of turns:

Thread Size	*Minimum*	*Optimum*	*Maximum*
1¼	¾	1¼	1¾
1 and ¾	1	1½	2
½ and under	1	2	3

POSITIONING TEES AND ELBOWS. First screw together to the minimum, ¾ turn for 1¼ size, 1 turn for all others, then turn carefully until fitting line up, which will require less than one additional turn. Never back off on a fitting if the proper position is passed, but disassemble and start over. With sizes 1 and 1¼, it is good practice to select fittings that will be about ½ turn out of line at point of zero torque.

NOTE: Pipe threaded joints should be considered permanent and should not be disassembled in servicing if this is avoidable.

Table 6-2. Materials Specifications

Spec.	Use	Type	Grade
AF3560 (Med)	Grease	High Melting Point	
AF3607	Grease	High Melting Point with 5% graphite	
AF3580D	Hydraulic Fluid	Petroleum Base	
MIL-A-6091	Fluid Injection	Alcohol	
MIL-C-6708	Rust Preventive Exterior	I II	
JAN-A-669	Anti-seize Threaded Fitting	White Lead Base	
MIL-T-27730	Tetrafluoroethylene (Teflon) tape		
MIL-C-5020	Aircraft Compass	Petroleum Base	One
MIL-C-5544	Anti-seize Compound	Graphite Petroleum	
MIL-F-5616	Fuel	Kerosene	JP-1
MIL-F-5624	Fuel		JP-3
MIL-F-5572	Starting Fuel	Gasoline	100/130
MIL-L-3545	Grease	High Temp. Water-resistant	
MIL-G-7187	Grease	Graphite Med.	
MIL-G-23827A	Grease	Aircraft and Instrument, Gear and Actuator Screw	
MIL-L-7711 (May use AF3560F Med in Place of)	Grease	High Temp.	
MIL-G-6711	Lubricant	Graphite	Powdered
MIL-O-6086	Lubricating Oil	Low Temp., Gear	
MIL-L-7870	Lubricating Oil	Low Temp.	
MIL-L-6082A	Engine Oil	Petroleum Base SAE 60	1120
MIL-O-6081	Lubricating Oil	Petroleum Base	1010
USA 2-36-D	Oil, Recoil		Light
MIL-P-6889A	Paint	Zinc Chromate	
AN-VV-C-566	Anti-seize	Mica Base	One

Table 6-2. Materials Specifications (Continued)

Spec.	Use	Type	Grade
AN-VV-C-576	Rust Preventive, Interior	1120 II	
MIL-H-5606	Hydraulic Fluid	Petroleum Base	
USA 4-33	Lubricant	Talc	
MIL-L-644A	Preservative	Lubricating Oil	
USA 4-1035	Sodium Silicate (Hydraulic Tank Lagging)		

Table 6-3. Decimal Equivalents

Fraction	Decimal	Fraction	Decimal
1/64	.0156	33/64	.5156
1/32	.0312	17/32	.5312
3/64	.0468	35/64	.5468
1/16	.0625	9/16	.5625
5/64	.0781	37/64	.5781
3/32	.0937	19/32	.5937
7/64	.1093	39/64	.6093
1/8	.1250	5/8	.6250
9/64	.1406	41/64	.6406
5/32	.1562	21/32	.6562
11/64	.1718	43/64	.6718
3/16	.1875	11/16	.6875
13/64	.2031	45/64	.7031
7/32	.2187	23/32	.7187
15/64	.2343	47/64	.7343
1/4	.25	3/4	.75
17/64	.2656	49/64	.7656
9/32	.2812	25/32	.7812
19/64	.2968	51/64	.7968
5/16	.3125	13/16	.8125
21/64	.3281	53/64	.8281
11/32	.3437	27/32	.8437
23/64	.3593	55/64	.8593
3/8	.3750	7/8	.8750
25/64	.3906	57/64	.8906
13/32	.4062	29/32	.9062
27/64	.4218	59/64	.9218
7/16	.4375	15/16	.9375
29/64	.4531	61/64	.9531
15/32	.4687	31/32	.9687
31/64	.4843	63/64	.9843
1/2	.5	1	1.0

6–1. TUBING DATA.

6–2. TUBE SIZES AND GAGES.

All non-structural tubing material is 5052 aluminum alloy, as follows:

Outside Diameter	Inside Diameter	Wall Thickness (Inches)	Cockpit Pressurization	Fuel System	Hydraulic System		Instruments	Oxygen System	Fluid Injection
					Low Press.	High Press.			
1/4	.180	.035		x	x	x	x		x
5/16	.242	.035			x	x		x	
3/8	.305	.035			x	x			
1/2	.430	.035			x		x		x
1/2	.402	.049				x			
3/4	.680	.035			x				
1	.930	.035		x	x				x
1	.902	.049							x
1 1/4	1.152	.049	x	x	x				

6–3. TUBE LENGTHS. In replacing a damaged tube select a tube of the same size and gage as that of the damaged tube. Cut the piece of tubing approximately 10 percent longer than the length of the tube to be replaced. After required bends have been made, and allowance made for the flaring operation, cut off the amount of tubing in excess of the required dimensions.

6–4. TUBE IDENTIFICATION. The tubing of each system is identified by color bands at the ends of each tube. (See figures 6-1 and 6-2.)

6-5. Place identification tape on tube in conspicuous place. Place tapes in the following manner:

a. Clean and dry the surfaces.

b. Wrap cellulose tape around the tube; overlap the tape 1/4 turn.

c. Brush tape with a coat of clear lacquer, Specification AN-L-29, to prevent deterioration. Be sure edges of tape are covered.

d. Store tape in a cool, dry place.

e. If identification tape is not available, paint suitable colored stripes on the tube to designate the system. Protect when dry with a coat of clear lacquer. If paint is not available. mark the tube by gluing a piece of white paper, on which the name of the line is printed clearly, around the tube. Protect the paper with a coat of clear lacquer.

6–6. TUBE TEMPLATE. If the old tube is intact and the bends have not been changed, use it as a template or pattern from which to bend a new tube.

6–7. If a new model or template must be made, select a soft iron wire or a 1/8-inch tube, either of which may be bent easily by hand. Place the material selected for use as a template in one of the fittings where the tube is to be connected. Form the necessary bends in order to place the opposite end of the template in the other connection. When the template is properly formed to span the area between the two fittings, remove it and use the pattern for bending the new tube.

Note

If new supports are required, place them as close to bends as possible to minimize the amount of overhang of the tube from a straight line between supports.

6–8. TUBE CUTTING. Use a standard cutting tool and cut the tube at right angles to the surface. Be careful to avoid forcing the tube out of round. Use a hack saw if a standard cutting tool is not available.

6–9. After the tube has been cut off, file the end square using a fine-toothed flat file. Hold the tube in a vise or flaring block while filing. If a hack saw was used for cutting, file the tube ends until all hack saw marks are removed.

6–10. After filing, remove all burrs from the inside and outside of the tube. A burnishing spoon is suitable for this purpose.

6–11. TUBE BENDING. Tube bending may be accomplished with any one of a variety of hand-bending tools or power production bending tools. Take care to avoid bending in smaller radius than the limits of the tube will allow. Avoid flattened, kinked, or wrinkled bends. The permissible bend radii are given on AND-10111.

6–12. FLARING TUBE ENDS. *(See table 6-4.)* Select the proper flaring tool and vise for the tube to be worked. With a hammer-type tool, tap the pin lightly first, then use more force. Do not crack tube ends or overflare. In the event a flaring pin and block are not available, a ball peen hammer can be substituted in the flaring operation. Secure the tube and form the flange by placing the round end of the hammer against the

end of the tube, tapping the opposite end of the hammer with another hammer. This method is not a recommended shop practice.

6–13. Check the flare by placing a T-square over the tube. The outside diameter of the flare should extend beyond the toe of the sleeve but not beyond the outside diameter of the sleeve. Flares made too long will stick and jam on the threads and are likely to seat on the bottom of the coupling rather than on the tapered seat. Flares made too short may be squeezed thin on installation and prevent full utilization of the clamping area.

Table 6-4 — Tubing Flare Dimensions

Tube	*Flare*	*Angle*	*Recommended Flare Dia.*	
OD	*OD*	*ID*	*Max.*	*Min.*
1/4	33°	37°	.359	.349
5/16	33°	37°	.421	.411
3/8	33°	37°	.484	.474
1/2	33°	37°	.656	.646
3/4	33°	37°	.937	.927
1	33°	37°	1.187	1.172
1 1/4	33°	37°	1.500	1.485

6–14. INSTALLING A TUBE.

a. Attach a piece of clean cloth as large as can be pulled through the tube to a wire six inches longer than the tube. Thread the wire through the tube and pull the cloth through as many times as is necessary to clean out oil, grease, or other foreign matter.

b. Inspect flares to see that the inside is clean.

c. Place the tube in position and take up the nut finger-tight.

d. With an end wrench or a crescent wrench hold the fitting in position while taking up the nut to the proper torque with a torque wrench. (See table 6-5 for recommended torque.)

CAUTION

Use a torque wrench to avoid over-tightening and consequent system failure.

e. Test the installation for tightness by applying pressure to the system.

Table 6-5 — Recommended Torque for Tubing Fittings

Tube OD (Inch)	*Torque (Inch-Pounds)*
1/4	40- 65
5/16	60- 80
3/8	75-125
1/2	150-250
3/4	300-500
1	500-700
1 1/4	700-900

6–15. TUBING LEAKS AND FAILURES. Trouble in a tubing system may be broadly classified into two groups, namely leaks and failures.

6–16. LOCATING TUBING LEAKS. Wipe the system clean and track the flow of liquid to source of leak. For leaks in oxygen or air lines, apply solution of neutral soap and watch for bubbles. Leaks generally occur at joints, around shafts or seals, and infrequently at pinhole leaks in unit bodies.

6–17. CAUSES OF TUBING LEAKS AT JOINTS:

a. Poor flare; rough surface, cracks, splits.

b. Improper wrench torque.

c. Foreign material under flares.

d. Damaged fitting.

e. Mismated parts.

f. Threads seized or galled; damaged threads; threads crossed.

g. Sealing compound used improperly or washed out.

h. Wrong size gaskets; wrong type gasket; no gasket.

i. Re-use of gasket.

j. Improper positioning of gasket.

k. Insufficient wrench torque to squeeze gasket and make seal.

l. Improper positioning of fitting boss.

6–18. TUBING FAILURES. If a tube bursts, it is usually because of faulty material, since the tubing is designed to withstand several times the operating pressure to which it is subjected. Vibration resulting from chattering or insufficient support is also a common cause of failure.

Table 6-6 — Engine Fuel and Oil Lines Torque Limits

Size	Torque (In.-lb.)	Torque (Ft.-lb.)
FLEXIBLE HOSE, ALUMINUM COUPLE NUTS ON ALUMINUM FITTINGS:		
7/16-20	40—65	
9/16-18	80—120	
3/4 -16	150—200	
7/8 -14	200—350	
1 1/16-12	300—500	
1 5/16-12		60—80
FLEXIBLE HOSE, STEEL COUPLE NUTS ON STEEL FITTINGS:		
7/16-20	125—175	
9/16-18	200—250	
3/4 -16	325—420	
SOLID STEEL TUBE, STEEL OR ALUMINUM COUPLE NUTS ON ALUMINUM FITTINGS:		
7/16-20	65—100	
9/16-18	125—175	
3/4 -16	250—325	
SOLID STEEL TUBE, STEEL OR ALUMINUM COUPLE NUTS ON STEEL FITTINGS:		
7/16-20	80—120	
9/16-18	200—250	
3/4 -16	325—420	
ALUMINUM TUBING AND ALUMINUM COUPLE NUTS ON ALUMINUM FITTINGS:		
7/8 -14	200—350	
FLEXIBLE HOSE, ALUMINUM COUPLE NUTS ON STEEL FITTINGS OR STEEL COUPLINGS ON ALUMINUM FITTINGS:		
7/16-20	65—100	
9/16-18	125—175	
3/4 -16	250—325	
UNIVERSAL FITTING LOCK NUTS:		
7/16-20	55—80	
9/16-18	100—150	
3/4 -16 (Starting Fuel Control Inlet)	150—200	
3/4 -16	200—300	
7/8 -14	420 —600	
1 1/16-12		50—70
1 5/16-12		65—85
1 5/8 -12		60—80
1 7/8 -12		
UNIONS:		
7/16-20	55—80	
9/16-18	100—150	
3/4 -16	200—300	
1 1/16-12	420—600	
1 5/16-12		50—70
MISCELLANEOUS:		
9/16-18 (Fluid Injection Nozzles)	175—200	
5/16-24 (Plug)	10—16	
7/16-20 (Plug or Cap)	40—65	
9/16-18 (Cap)	80—120	

Note

Do not apply full torque at the first drawdown. Such a procedure may produce uneven tension and overstressing of parts with resultant warped or distorted split line surfaces. Tighten unit in staggered sequence until parts are firmly seated at the split line, then tighter finally in a series of gradually increased torque applications until required tension is obtained.

Table 6-7 — Engine Structural Torque Limits

Unit	Torque (Lb in.)	Torque (Lb in.)
10-32 self-locking nuts on hex-head bolts	30—40	
10-32 self-locking nuts on round-head and fillister-head screws, manifold and ignition cable clamps	20—25	
10-32 bolts, retaining air adapter brackets and inner air baffle sectors to tube flange	30—40	
10-32 bolts, screwed into normal threads	30—40	
1/4-inch-20 liner bolts	45—60	
1/4-inch-20 bolts	70—85	
1/4-inch-28 bolts, general	80—100	
1/4-inch-28 bolts retaining tachometer generator to adapter pad	35—45	
1/4-inch-28 bolts retaining spark plugs	70—85	
1/4-inch-28 self-locking nuts, general	80—100	
1/4-inch-28 fillister-head screws	40—60	
5/16-inch-18 trunnion spindle set screw	100—110	

Unit	*Torque (In.-lb.)*	*Torque (Ft.-lb.)*
5/16-inch–24 bolts retaining front support ball seats and ball cap	160—200	
5/16-inch–24 bolts, general	140—180	
5/16-inch–24 self-locking nuts:		
Boots type	110—140	
Klincher type	90—110	
5/16-inch–24 oil filter element nut	25—30	
5/16-inch–24 oil filter cover nut	80—100	
3/8-inch–24 bolts, general	240—300	
3/8-inch–24 self-locking nuts:		
Boots type	240—325	
3/8-inch–24 Klincher type nuts (exhaust cone) measured torque	225—250	
3/4-inch–16 scavenge tube oil filter assembly	360—540	
3/4-inch–16 trunnion spindle		100—110
Tail pipe adapter to exhaust cone bolts (castle nuts)	50—150	
Compressor attaching nuts	240—324	
Dome-to-air adapter nuts:		
a. Tighten with a torque of 40 inch-pounds to seat parts.		
b. Loosen until dome is free to move.		
c. Center the dome in the air adapter.		
d. Tighten to a measured torque of 35 to 45 lb in.		
e. When checked at three points approximately 120° apart, clearance between air adapter ID and dome OD must be equal within 0.010 inch.		
Pal nuts: Tighten finger-tight; then one extra flat.		
5/8-inch–14 filter plug in air adapter		60—80
7/16-inch–20 instrumentation bolt in air adapter	100—125	
Fuel nozzle in air adapter		80—90
Fuel filter tube nut on stack assembly	60—80	
Fuel filter stack assembly in head	100—110	
Fuel filter sump on head		35—40
1/4-inch–28 bolts retaining air adapters and spacers to compressor diffuser:		
a. Draw down evenly and lightly to obtain contact with gasket, tightening locating bolts on sides first.		
b. Apply increased tension with a wrench force equivalent to approximately 30 lb in.		
c. Apply final tension with a torque equivalent to 50—60 lb in. measured on bolts that are accessible to torque wrench.		

Table 6-8 — Engine Lubricants and Compounds

Location	*Lubricant or Compound*
Front support assembly:	
Ball seat, concave surface	AN-P-51
Ball caps, concave surface	AN-P-51
Female support threads	Oildag
Trunnion spindle	Oildag
Turbine shroud, exhaust cone, and reinforcing ring bolts	Ab-lube (Allison Part No. S-6718529)
Fuel nozzle male threads and shoulder	Oildag
Filter plug in-air adapter	Oildag
Filter plug gasket	Permatex No. 2
Air adapter fuel inlet elbows	Permatex No. 3
Air adapter drain fittings	Permatex No. 3
Plugs in air adapter	Permatex No. 3
High-tension shielded lead sleeve and contact spring	AN-C-128
Straight threaded connections, male threads, when either part is aluminum	JAN-A-669
Straight threaded connections, male threads, when both parts are steel	Oildag
Taper threaded connections	Permatex No. 3
Rubber tubing, ID where it fits over metal tubing	MIL-O-6081 (Grade 1010)
Exhaust cone thermocouple nuts	Ab-lube (Allison Part No. S-6718529)

SECTION VII
MAINTENANCE INSPECTION

For information relating to this section, refer to Inspection Requirements Handbook for T-33A Airplane, T.O. 1T-33A-6.

SECTION VIII

ELECTRICAL AND ELECTRONIC WIRING DIAGRAMS

8-1. CIRCUIT DIAGRAMS.

8-2. The wire numbers used in the individual circuit diagrams agree with those used in the master electrical wiring diagrams included with each airplane. Each wire is identified with numbers printed at intervals along its entire length. The wire numbers on the airplane correspond with the numbers assigned on the wiring diagram. All wire numbers are in accordance with electrical Specification AN-W-14a. Wire identification consists of the circuit function and designation letters followed by the cable number, cable segment letter and wire size. For information on the circuit function and designation letters, refer to paragraph 8-3.

8-3. CIRCUIT FUNCTION AND CIRCUIT DESIGNATION CODE. The first letter of the following code designates the function of the circuit, and the second letter designates the circuits in which the wire is located.

A—ARMAMENT AND BOMBING CIRCUITS.
- AB—Bombing
- AC—Camera
- AG—Guns
- AK—Chemical
- AR—Rockets
- AS—Sights

C—FLIGHT CONTROL CIRCUITS
- CB—Diving Brakes
- CF—Landing Flaps
- CT—Trim Tabs

D—DE-ICING OR ANTI-ICING CIRCUITS
- DH—Windshield Heat Defroster
- DP—Pitot Heater

E—ENGINE INSTRUMENT CIRCUITS
- EF—Fuel Quantity
- EG—Oil Pressure
- ES—Tachometer
- EU—Fuel Pressure

F—FLIGHT INSTRUMENT CIRCUITS
- FB—Bank and Turn Indicator
- FE—Cockpit Temperature
- FH—Gyro Horizon
- FL—Flap Position
- FY—Directional Gyro

G—ALIGHTING GEAR CIRCUITS
- GA—Actuation and Retraction
- GS—Ground Safety

H—HEATING AND VENTILATING CIRCUITS
- HC—Cabin Heater
- HG—Gun Heater

J—IGNITION CIRCUITS
- JB—Ignition Booster

K—ENGINE CONTROL CIRCUITS
- KS—Starter

L—LIGHTING CIRCUITS
- LC—Communications
- LJ—Instrument
- LL—Landing
- LN—Navigation
- LR—Recognition
- LS—Spot Extension

M—MISCELLANEOUS CIRCUITS
- M—Seat Actuator
- ME—Ejector Equipment
- MR—Enclosure Operation (Canopy)

N—GROUND NETWORK WIRING
- NA—Ground, Armament
- NC—Ground, Flight Control
- ND—Ground, De-icing
- NE—Ground, Engine Instruments
- NF—Ground, Flight Instruments
- NG—Ground, Emergency Hydraulic Pump
- NH—Ground, Heating and Ventilating
- NJ—Ground, Ignition
- NK—Ground, Engine Control
- NL—Ground, Lighting
- NM—Ground, Miscellaneous
- NP—Ground, Power
- NQ—Ground, Fuel and Oil
- NR—Ground, Radio
- NV—Ground, Inverter
- NW—Ground, Warning Devices

P—POWER (All direct current wiring for more than one circuit shall be identified by the letter "P" with no additional circuit designation letter.)
- PA—Power, Armament
- PF—Power, Flight Instruments
- PP—Power, Generator and Battery Control
- PV—Power, Inverter
- PW—Power, Warning Devices

Q—FUEL AND OIL CIRCUITS
- QF—Fuel Transfer Pump Motor and Control
- QJ—Jettison Fuel Tanks
- QW—Fluid Injection

R—RADIO NAVIGATIONAL AND COMMUNICATION EQUIPMENT
- RA—Instrument Landing
- RM—Marker Beacon
- RN—Navigation
- RU—Command
- RV—Command
- RZ—Interphone

S—RADAR OPERATED EQUIPMENT
- SX—Identification Radar

T—SPECIAL ELECTRONIC
- TA—Adapters
- TM—Electronic Countermeasures

W—WARNING DEVICES CIRCUITS
- WA—Armament
- WC—Flight Controls
- WE—Engine Instruments
- WF—Flight Instruments
- WG—Alighting Gear Warning
- WM—Miscellaneous
- WP—Power
- WQ—Fuel and Oil
- WR—Radio

X—ALTERNATING CURRENT POWER CIRCUITS
- XA—"A" Phase of 3-phase Power
- XB—"B" Phase of 3-phase Power
- XC—"C" Phase of 3-phase Power
- XV—Single Phase Power

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 1 of 8)

Title	*Model*	*Effective Serials*	*Incorporating T.O.*	*Fig. No.*	*Page No.*
Aileron Tab Motor		48-356—51-4328		8-97	667
		51-4329—51-6818		8-98	668
		G		8-99	669
		R		8-100	670
		53-5286—53-5485		8-101	671
		53-5486 & up		8-102	672
	T-33A-5 & T-33A-15	50-385—51-4328	1T-33A-638	8-102A	672A
	T-33A-5 & T-33A-15	51-4329—51-6818	1T-33A-638	8-102B	672B
	T-33A-5 & T-33A-15	51-6819—52-9634 & 52-9876—52-9905	1T-33A-638	8-102C	672C
	T-33A-5 & T-33A-15	52-9635—53-5285 (except 52-9876—52-9905)	1T-33A-638	8-102D	672D
	T-33A-5 & T-33A-15	53-5286 & up	1T-33A-638	8-102E	672E
Alighting Gear Warning		48-356—51-4328		8-147	717
		48-356—51-4328	1T-33A-567	8-147A	718
		51-4329—51-6586		8-148	718B
		51-4329—51-6586	1T-33A-567	8-148A	720
	T-33A, MDAP	51-6587—51-6818		8-149	720B
	T-33A, MDAP	51-6587—51-6818	1T-33A-567	8-149A	722
		G		8-150	722B
		G	1T-33A-567	8-150A	722D
		U		8-151	724
		53-4936—53-5083		8-152	726
		53-5084—53-5665		8-153	728
	T-33A-1	53-5666 & up		8-154	730
	T-33A-5	56-1675—56-3694	AN	8-155	732
	T-33A-5	57-530—58-670		8-156	734
	T-33A-5	58-671 & up		8-156A	734B
Attitude Gyro		48-917—49-2772		8-124	694
		48-356—49-2772	1T-33A-507	8-125	695
		50-320—50-367		8-126	696
	T-33A, MDAP	50-368—51-4328		8-127	697
	T-33A, MDAP	51-4329—51-6818		8-128	698
	T-33A, MDAP	51-6819—51-9235		8-129	699
	T-33A, MDAP	N		8-130	700
	T-33A, MDAP	W		8-131	701
	T-33A, MDAP	W	1T-33A-194	8-132	702
	T-33A-1	AA		8-133	703
	T-33A-5	Prior to 55-4954	AN	8-134	704
	T-33A-5	55-4954—56-3694		8-135	705
	T-33A-5	57-530 & up		8-136	706

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 2 of 8)

Title	Model	Effective Serials	Incorporating T.O.	Fig. No.	Page No.
Battery and Generator (Cont.)		H		8-10	573
		AF		8-11	575
	T-33A-1	53-5086 & up		8-12	577
	T-33A-5		AN	8-13	579
	T-33A-5	48-356—50-384	1T-33A-577 & 628	8-13A	580A
	T-33A-5	50-385—51-4328	1T-33A-577 & 628	8-13B	580B
	T-33A-5	51-4329—51-6818	1T-33A-577 & 628	8-13C	580C
	T-33A-5	51-6819—56-3694	1T-33A-577 & 628	8-13D	580D
	T-33A-5	53-5610, 53-5919 & up	1T-33A-577 & 628	8-13E	580E
	T-33A-5	57-530—58-2106	1T-33A-577 & 628	8-13E	580E
	T-33A-5	50-385—51-4328	1T-33A-628, 638 & 639	8-13F	580F
	T-33A-5	51-4329—51-6818	1T-33A-628, 638 & 639	8-13G	580G
	T-33A-5	51-6819—53-5918	1T-33A-628, 638 & 639	8-13H	580H
	T-33A-5	53-5919—56-3694	1T-33A-628, 638 & 639	8-13I	580J
	T-33A-5	57-530—58-2106	1T-33A-628, 638 & 639	8-13J	580K
	T-33A-15	51-6819—53-5918	1T-33A-628, 638, 639 & 640	8-13K	580L
	T-33A-15	53-5919—56-3694	1T-33A-628, 638 639 & 640	8-13L	580M
	T-33A-15	57-530—58-2106	1T-33A-628, 638 639 & 640	8-13M	580N
Bombs and Chemical Tanks		48-356—51-4140		8-213	792
Canopy Actuator		48-356—51-4328		8-226	805
		51-4329—51-6818		8-227	806
		51-6819—51-9235		8-228	807
	T-33A-1	51-9236 & up		8-229	808
	T-33A-5		AN	8-230	809
Centerline Tip Tank		48-356—51-4140	1T-33A-42	8-214	793
		48-356—51-4140	1T-33A-42 & -567	8-214A	794
		51-4141—51-4395		8-215	794A
		51-4141—51-4395	1T-33A-567	8-215A	794B
		51-4396—51-6818		8-216	795
		51-4396—51-6818	1T-33A-567	8-216A	796
		G		8-217	796A
		G	1T-33A-567	8-217A	796B
	T-33A-1	Q		8-218	797
	T-33A-5		AN	8-219	798
Chaff Dispenser, AN/ALE-2		51-4143 & up (X107)	1T-33A-554	8-238A	817
	T-33A	51-4141 & up	1T-33A-535 & 636	8-238A	817
Chemical Tanks, Bombs and		48-356—51-4040		8-213	792
Cockpit Air Shutoff Valve	T-33A-1, TV-2	AH	1T-33A-513	8-224	803
	T-33A-5		AN	8-225	804
Cockpit Lights, Aft		48-356—50-401		8-182	761
		50-402—51-4048		8-183	762
		51-4049—51-6818		8-184	763
		51-6819—51-9235		8-185	764
		M		8-186	765
		AFA		8-187	766
	T-33A-1	53-5086—55-4435		8-188	767
	T-33A-5	Prior to 55-4332		8-189	768
	T-33A-1	55-4436—55-4962		8-190	769
	T-33A-5	55-4332—55-4953	AN	8-191	770
	T-33A-5	55-4954—56-3694		8-192	771
	T-33A-5	57-530 & up		8-193	772

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 3 of 8)

Title	Model	Effective Serials	Incorporating T. O.	Fig. No.	Page No.
Cockpit Lights, Forward	T-33A	48-356—50-401		8-168	747
	T-33A	50-402—51-4048		8-169	748
	T-33A	51-4049—51-6818		8-170	749
	T-33A	51-6819—51-9235		8-171	750
	T-33A	MA		8-172	751
	T-33A	AFA		8-173	752
		53-5086—53-5285		8-174	753
		53-5286—53-5665		8-175	754
	T-33A-1	AGA		8-176	755
	T-33A-5	Prior to 55-4332		8-177	756
	T-33A-1	55-4436—55-4962		8-178	757
	T-33A-5	55-4332—55-4953	AN	8-179	758
	T-33A-5	55-4954—58-503		8-180	759
	T-33A-5	58-504 & up		8-181	760
Cockpit Pressure Dump Valve	T-33A-1	AH	1T-33A-513	8-224	803
	T-33A-5		AN	8-225	804
Command Radio, AN/ARC-3		48-356—50-384		8-239	818
		50-385—51-4039		8-240	819
		51-4040—51-6750		8-241	820
	MDAP	G		8-242	821
	MDAP	S		8-243	822
	MDAP	53-5086—54-2955		8-244	823
Command Radio, AN/ARC-27		48-356—51-6750	1T-33A-143 & -556	8-246	825
		48-356—51-6750	1T-33A-143 & -531	8-247	826
		51-6751—51-6818		8-248	827
		51-6751—51-6818	1T-33A-531	8-249	828
	T-33A-1	51-6751—51-6775	1T-33A-556	8-250	829
	T-33A-1	51-6776 & up	1T-33A-556	8-251	830
		51-6819—51-9235		8-252	831
		51-6819—51-9235	1T-33A-531	8-253	832
		NA		8-254	833
		AL		8-255	835
	T-33A-1LO, T33A-5LO, T-33A-10LO, MDAP		1T-33A-573	8-255A	836A
Command Radio, AN/ARC-34	T-33A-5	57-530—57-769		8-256	837
	T-33A-5	58-450—58-503		8-257	839
	T-33A-5	58-504—58-600		8-258	841
	T-33A-5	58-601 & up		8-258A	842A
	T-33-5LO, T-33-10LO MDAP	57-530—58-2106	1T-33A-574	8-258B	842C
Command Radio, AN/ARC-49	T-33A-1	55-2979 & up		8-245	824
Connector Location Diagram	T-33A-1			8-3	560
	T-33A-5			8-4	561
Dive Flap Selector Valve Actuator		A		8-114	684
		R		8-115	685
		53-5286 & up		8-116	686
ECM, AN/ALQ-71		51-4143 & up (X107)	1T-33A-554	8-238A	817
ECM, AN/ALQ-71 & -72	T-33A	51-4141 & up	1T-33A-535 & -636	8-238A	817
Electrical Diagram Simplified				8-2	527
Electrical Symbols				8-1	526
Elevator Trim Tab Actuator		48-356—49-900		8-88	658
		49-901—51-4328		8-89	659
		51-4329—51-6818		8-90	660
		G		8-91	661
		R		8-92	662
		53-5286—53-5485		8-93	663
		53-5486—53-5665		8-94	664
	T-33A-1	53-5666 & up		8-95	665
	T-33A-5		AN	8-96	666

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 4 of 8)

Title	Model	Effective Serials	Incorporating T.O.	Fig. No.	Page No.
Emergency Hydraulic Pump		48-356—51-4328		8-76	646
		51-4329—51-6818		8-77	647
		51-6819—51-9235		8-78	648
	T-33A-1	51-9236 & up		8-79	649
	T-33A-5			8-80	650
Engine Fuel System		48-356—51-6818		8-61	631
		G		8-62	632
		W		8-63	633
		AD		8-64	634
		AJ		8-65	635
	T-33A-1	AK		8-66	636
	T-33A-5	Prior to 57-530	AN	8-67	637
	T-33A-5	57-530—58-670		8-68	638
	T-33A-5	58-671 & up		8-68A	638A
	T-33A-1	58-671 & up	1T-33A-515	8-68B	638B
Flow Control Valve		48-356—49-966		8-220	799
		48-356—49-966	1T-33A-143 & -236	8-221	800
		49-967—51-6818		8-222	801
		AG		8-223	802
	T-33A-1	AH	1T-33A-513	8-824	803
	T-33A-5		AN	8-225	804
Fluid Injection		48-356—51-4328		8-103	673
		51-4329—51-6818		8-104	674
		51-6819—53-5082		8-105	675
Fuel De-icing		48-356—49-900	1T-33A-622	8-107	677
		49-901—51-6818	1T-33A-622	8-108	678
		51-6819—51-9035	1T-33A-622	8-109	679
		L	1T-33A-622	8-110	680
		T	1T-33A-622	8-111	681
	T-33A-1	53-5083 & up	1T-33A-622	8-112	682
	T-33A-5		1T-33A-622, AN	8-113	683
Fuel Pressure		48-385—51-4328		8-232	811
		51-4329—51-6818		8-233	812
		51-6819—51-8835		8-234	813
	T-33A-1	51-8836 & up		8-235	814
	T-33A-5		AN	8-236	815
Fuel Pressure Warning Lights		48-356—48-920		8-55	625
		49-879—51-6528		8-56	626
		51-6529—51-6818		8-57	627
		G		8-58	628
	T-33A-1	Q		8-59	629
	T-33A-5		AN	8-60	630
Fuel Pumps		48-356—48-920		8-37	607
		48-356—48-920	1T-33A-245 & -576	8-38	608
		49-879—49-966		8-39	609
		49-879—49-966	1T-33A-245 & -576	8-40	610
		49-967—51-6528		8-41	611
		49-967—51-6528	1T-33A-245 & -576	8-42	612
		51-6529—51-6818		8-43	613
		51-6529—51-6818	1T-33A-245 & -576	8-44	614
		51-6819—51-9035		8-45	615
		51-6819—51-9035	1T-33A-245 & -576	8-46	616
		L		8-47	617
		L	1T-33A-245 & -576	8-48	618
		V		8-49	619
		V	1T-33A-245	8-50	620
		53-4886—53-5665		8-51	621
		53-4886—53-5665	1T-33A-245	8-52	622
		53-5666 & up		8-53	623
Fuel Quantity		48-356—51-4328		8-69	639
		51-4329—51-6819		8-70	640
		F		8-71	641
		AC		8-72	642
	T-33A-1, TV-2	53-5666 & up		8-73	643
	T-33A-5	Prior to 58-580	AN	8-74	644
	T-33A-5	58-580 & up	1T-33A-584	8-75	645

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 5 of 8)

Title	Model	Effective Serials	Incorporating T.O.	Fig. No.	Page No.
Fuel Shut-off Valve		48-356 & up		8-54	624
Generator, Battery and		48-356—49-966		8-5	563
		49-967—51-4089		8-6	565
		51-4090—51-4328		8-7	567
		51-4329—51-6818		8-8	569
		51-6819—51-8835		8-9	571
		H		8-10	573
		AF		8-11	575
	T-33A-1	53-5086 & up		8-12	577
	T-33A-5		AN	8-13	579
	T-33A-5	48-356—50-384	1T-33A-577 & 628	8-13A	580A
	T-33A-5	50-385—51-4328	1T-33A-577 & 628	8-13B	580B
	T-33A-5	51-4329—51-6818	1T-33A-577 & 628	8-13C	580C
	T-33A-5	51-6819—56-3694	1T-33A-577 & 628	8-13D	580D
	T-33A-5	53-5610, 53-5919 & up	1T-33A-577 & 628	8-13E	580E
	T-33A-5	57-530—58-2106	1T-33A-577 & 628	8-13E	580E
	T-33A-5	50-385—51-4328	1T-33A-628, 638 & 639	8-13F	580F
	T-33A-5	51-4329—51-6818	1T-33A-628, 638 & 639	8-13G	580G
	T-33A-5	51-6819—53-5918	1T-33A-628, 638 & 639	8-13H	580H
	T-33A-5	53-5919—56-3694	1T-33A-628, 638 & 639	8-13I	580J
	T-33A-5	57-530—58-2106	1T-33A-628, 638 & 639	8-13J	580K
	T-33A-15	51-6819—53-5918	1T-33A-628, 638, 639 & 640	8-13K	580L
	T-33A-15	53-5919—56-3694	1T-33A-628, 638, 639 & 640	8-13L	580M
	T-33A-15	57-530—58-2106	1T-33A-628, 638, 639 & 640	8-13M	580N
Gun Camera	T-33A-1	48-356—50-401		8-204	783
Gun Heaters	T-33A-1	48-356—51-6818		8-202	781
	T-33A-1	51-6819 & up		8-203	782
Gunnery	T-33A-1(MAP)	51-9199, 51-9281 and 52-9190	1T-33-529	8-209A	788A
	T-33A-5(MAP)	51-4906 and 51-5197	1T-33-529	8-209B	788B
Gun Sight	T-33A-1	48-356—51-6818		8-205	784
	T-33A-1	F		8-206	785
	T-33A-1	AB		8-207	786
	T-33A-1(MAP)	51-9199, 51-9281 and 52-9190	1T-33-529	8-207A	786A
Gyrosyn Compass		48-356—48-916		8-122	692
		48-356—48-916	1T-33A-194	8-123	693
		48-917—49-2272		8-124	694
		48-356—49-2272	1T-33A-507	8-125	695
		50-320—50-367		8-126	696
	T-33A, MDAP	50-368—51-4328		8-127	697
	T-33A, MDAP	51-4329—51-6818		8-128	698
	T-33A, MDAP	51-6819—51-9235		8-129	699
	T-33A, MDAP	N		8-130	700
	T-33A, MDAP	W		8-131	701
	T-33A, MDAP	W	1T-33A-194	8-132	702
	T-33A-1	AA		8-133	703
	T-33A-5	Prior to 55-4954	AN	8-134	704
	T-33A-5	55-4954—56-3694		8-135	705
	T-33A-5			8-136	706

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 5A of 8)

Title	Model	Effective Serials	Incorporating T. O.	Fig. No.	Page No.
Ignition, Emergency Airstart Starter			1T-33A-593	8-36A	606A
Identification Radar, AN/APX-6		48-356—50-401		8-300	903
		50-402—51-8635		8-301	904
		J		8-302	905
	T-33A, MDAP	W		8-303	906
	T-33A-1	Z		8-304	907
	T-33A-5	Prior to 58-504	AN	8-305	908
Identification Radar, AN/APX-25	T-33A-5	58-504 & up	1T-33A-571	8-306	909
Ignition, Starter and Instrument Inverters		48-356—51-6818		8-34	604
		51-6819—53-5085		8-35	605
		53-5086 & up		8-36	606
		48-356—51-4328		8-137	707
	T-33A, MDAP	48-356—51-4328	1T-33A-194	8-138	708
	T-33A, MDAP	51-4329—51-6818		8-139	709
	T-33A, MDAP	51-4329—51-6818	1T-33A-194	8-140	710
	T-33A, MDAP	E		8-141	711
	T-33A, MDAP	P		8-142	712
	T-33A, MDAP	X		8-143	713
	T-33A, MDAP	D	1T-33A-194	8-144	714
	T-33A-1	AA		8-145	715
	T-33A-5		AN	8-146	716
	T-33A-5LO	48-356—53-2726	1T-33A-577 & -628	8-146A	716A
	T-33A-5LO	52-9760—56-3694	1T-33A-577 & -628	8-146B	716B
	T-33A-10	57-530—57-769 & 58-540—58-579	1T-33A-585C & -628	8-146C	716C
	T-33A-10	56-1573—56-1792 & 56-3659—56-3694	1T-33A-585C & -628	8-146D	716D
	T-33A-15LO		1T-33A-613	8-146E	716E
	T-33A-15LO		1T-33A-613	8-146F	716F
Interphone, AN/AIC-2A		48-356—49-941		8-259	843
		49-942—50-384		8-260	844
		48-356—50-384	1T-33-236	8-261	845
		50-385—50-418		8-262	846
		50-385—50-418	1T-33A-143	8-263	847
		50-419—51-4040		8-264	848
		50-419—51-4040	1T-33A-143	8-265	849
		51-4141—51-6750		8-266	850
		51-4141—51-6750	1T-33A-143	8-267	851
	MDAP	51-6751—51-6818		8-268	852
	T-33A	51-6751—51-6818		8-269	853
	MDAP	51-6819—51-9235		8-270	854
	T-33A	51-6819—51-9235		8-271	856

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 6 of 8)

Title	*Model*	*Effective Serials*	*Incorporating T.O.*	*Fig. No.*	*Page No.*
Ignition, Emergency Airstart Starter			1T-33A-593	8-136A	606A
Identification Radar, AN/APX-6		48-356—50-401		8-300	903
		50-402—51-8635		8-301	904
		J		8-302	905
	T-33A, MDAP	W		8-303	906
	T-33A-1	Z		8-304	907
	T-33A-5	Prior to 58-504	AN	8-305	908
Identification Radar, AN/APX-25	T-33A (all series)	50-385—56-3694	1T-33A-648	8-306	908A
	T-33A (all series)	57-530 & up	1T-33A-648	8-306A	909
Ignition, Starter and Instrument Inverters		48-356—51-6818		8-34	604
		51-6819—53-5085		8-35	605
		53-5086 & up		8-36	606
		48-356—51-4328		8-137	707
	T-33A, MDAP	48-356—51-4328	1T-33A-194	8-138	708
	T-33A, MDAP	51-4329—51-6818		8-139	709
	T-33A, MDAP	51-4329—51-6818	1T-33A-194	8-140	710
	T-33A, MDAP	E		8-141	711
	T-33A, MDAP	P		8-142	712
	T-33A, MDAP	X		8-143	713
	T-33A, MDAP	D	1T-33A-194	8-144	714
	T-33A-1	AA		8-145	715
	T-33A-5		AN	8-146	716
	T-33A-5LO	48-356—53-2726	1T-33A-577 & -628	8-146A	716A
	T-33A-5LO	52-9760—56-3694	1T-33A-577 & -628	8-146B	716B
	T-33A-10	57-530—57-769 & 58-540—58-579	1T-33A-585C & -628	8-146C	716C
	T-33A-10	56-1573—56-1792 & 56-3659—56-3694	1T-33A-585C & -628	8-146D	716D
	T-33A-15LO		1T-33A-613	8-146E	716E
	T-33A-15LO		1T-33A-613, -640 & -648	8-146F	716F
Interphone, AN/AIC-2A		48-356—49-941		8-259	843
		49-942—50-384		8-260	844
		48-356—50-384	1T-33-236	8-261	845
		50-385—50-418		8-262	846
		50-385—50-418	1T-33A-143	8-263	847
		50-419—51-4040		8-264	848
		50-419—51-4040	1T-33A-143	8-265	849
		51-4141—51-6750		8-266	850
		51-4141—51-6750	1T-33A-143	8-267	851
	MDAP	51-6751—51-6818		8-268	852
	T-33A	51-6751—51-6818		8-269	853
	MDAP	51-6819—51-9235		8-270	854
	T-33A	51-6819—51-9235		8-271	856
Interphone, AN/AIC-10	MDAP	N		8-272	858
	T-33A	N		8-273	860
	MDAP	52-9906—52-9940		8-274	862
	T-33A	Y		8-275	864
	MDAP	52-9941—53-5085		8-276	866
	T-33A	AE		8-277	868
	MDAP	53-5086—53-5285		8-278	870
	T-33A	53-5086—53-5285		8-279	872
	MDAP	53-5286—54-2955		8-280	874
	T-33A-1	55-2980 & up		8-281	876
	T-33A-1	53-5286 & up		8-282	878
	T-33A-5	Prior to 55-4370	AN	8-283	880
	T-33A-15LO		1T-33A-613	8-283A	882
	T-33A-5	55-4370—56-3694		8-284	882B
	T-33A-15LO		1T-33A-613	8-284A	882D
	T-33A-5	57-530—57-633		8-285	884
	T-33A-15LO		1T-33A-613	8-285A	886
	T-33A-5	57-634 & up		8-286	886B
	T-33A-15LO		1T-33A-613	8-286A	886C

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 7 of 8)

Title	*Model*	*Effective Serials*	*Incorporating T.O.*	*Fig. No.*	*Page No.*
Jato Ignition		48-356—50-401		8-204	783
		50-402—51-6818		8-210	789
	T-33A-1	51-6819 & up		8-211	790
	T-33A-5		AN	8-212	791
Landing Lights		48-356—51-6818		8-194	773
		51-6819 & up		8-195	774
Marker Beacon, AN/ARN-12		49-942—51-4328		8-260	844
		51-4329—51-6818		8-287	887
		51-6819—51-9235		8-288	888
		M		8-289	889
	T-33A-1	AB		8-290	890
	T-33A-5	Prior to 57-530	AN	8-291	891
Marker Beacon, AN/ARN-32	T-33A-5	57-530 & up		8-292	892
Marker Beacon, RC-193A		48-356—49-941		8-259	843
Navigation, Position and Anti-Collision Lights		48-536-51-4126	1T-33A-42 1T-33-536	8-197	776
		51-4127-51-4140	1T-33A-42 1T-33-536		
		C	1T-33-536	8-200	779
		Q	1T-33-536	8-201	780
Oil Pressure Indicating		48-356—50-384		8-231	810
		50-385—51-4328		8-232	811
		51-4329—51-6818		8-233	812
		51-6819—51-8835		8-234	813
	T-33A-1	51-8836 & up		8-235	814
	T-33A-5		AN	8-236	815
Overheat Warning		48-356—49-900		8-157	736
		49-901—51-4328		8-158	737
		50-338—51-4328	1T-33A-180	8-159	738
		51-4329—51-6818		8-160	739
		51-4329—51-6818	1T-33A-180	8-161	740
		51-6819—51-9035		8-162	741
		51-6819—51-9035	1T-33A-180	8-163	742
		K		8-164	743
	T-33A-1	AB		8-165	744
	T-33A-5		AN	8-166	745
Pitot Heater		48-356—51-6818		8-202	781
		51-6819 & up		8-203	782
Position Lights		48-356—51-4126		8-196	775
		48-356—51-4126	1T-33A-42	8-197	776
		51-4127—51-4140		8-198	777
		51-4127—51-4140	1T-33A-42	8-199	778
		C		8-200	779
		Q		8-201	780
Radio Compass, AN/ARN-6		48-356—51-4048		8-293	893
		51-4049—51-9235		8-294	894
		M		8-295	895
	T-33A-1	AB		8-296	896
	T-33A-5	Prior to 58-504		8-297	897
	T-33A-5		1T-33A-571	8-298	899
	T-33A-5	58-504 & up		8-299	901
	T-33A-10LO, T-33A-10LO MDAP	48-356—56-3694	1T-33A-580	8-299A	902A
Radio, AN/ARN-14	T-33A-5	Prior to 55-4954	1T-33A-186, AN	8-307	910
	T-33A-5	55-4954—56-1683		8-308	912
	T-33A-5	56-1684—56-3694		8-309	914
	T-33A-15LO		1T-33A-613	8-309A	916
	T-33A-5	57-530—57-633		8-310	916B
	T-33A-5	57-634 & up	1T-33A-585	8-311	918
Radio, AN/ARN-18	T-33A-5	Prior to 55-4954	1T-33A-186, AN	8-307	910
	T-33A-5	55-4954—56-1683		8-308	912
	T-33A-15LO				
	T-33A-5	56-1684—56-3694	1T-33A-585	8-309	914
	T-33A-15LO		1T-33A-613	8-309A	916

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 7A of 8)

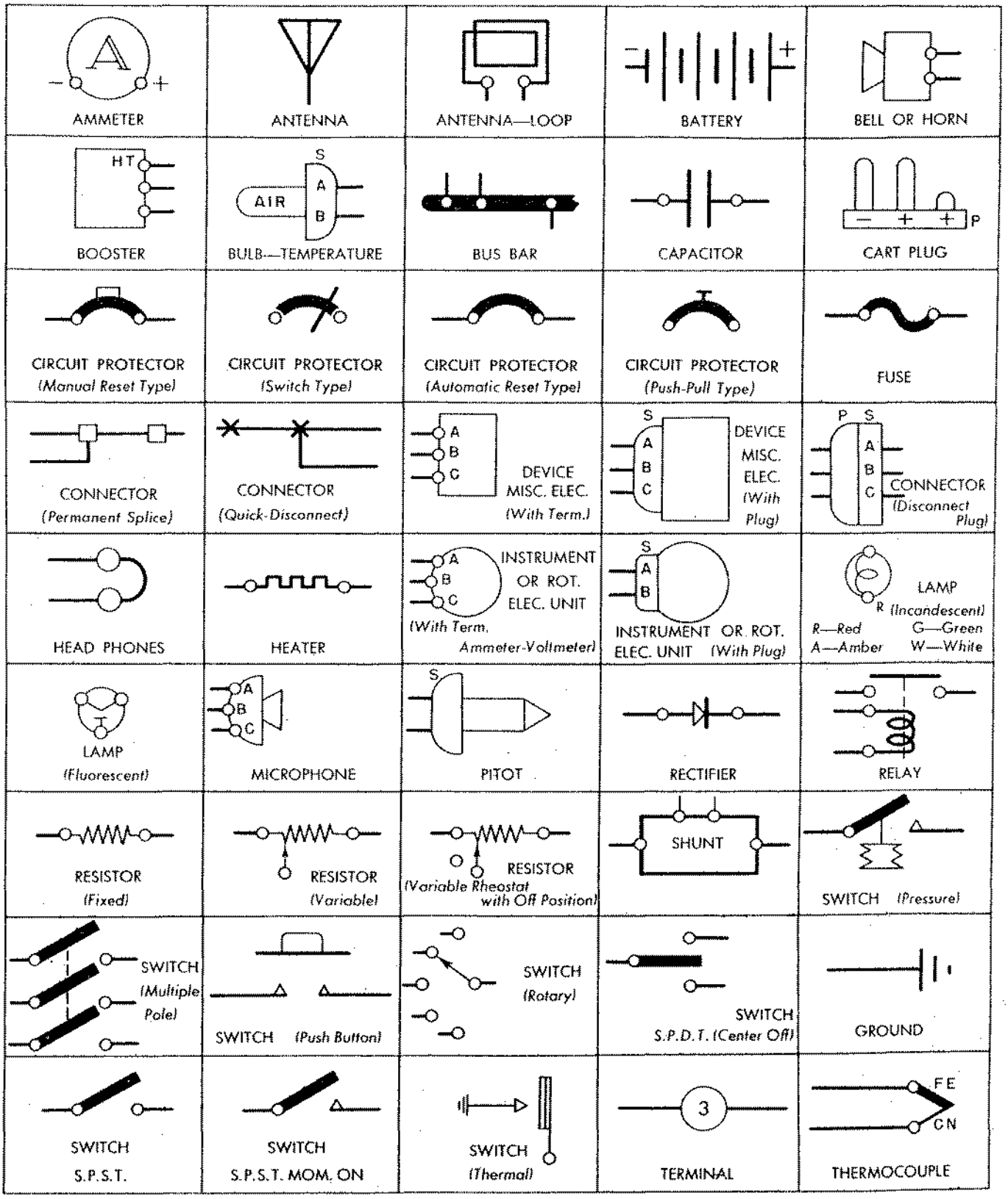
Title	*Model*	*Effective Serials*	*Incorporating T.O.*	*Fig. No.*	*Page No.*
Radio, AN/ARN-31	T-33A-5	57-530—57-633		8-310	916B
	T-33A-15LO		1T-33A-613	8-310A	916D
	T-33A-5	57-634 & up		8-311	918
			1T-33A-613	8-310A	916D
Navigation System, AN/ARN-21	T-33A-1LO & MDAP	48-356—55-4962	1T-33A-585	8-311A	918B
	T-33A-5LO & MDAP	56-1573—56-3694	1T-33A-585	8-312	918D
	T-33A-15LO	57-530—58-579	1T-33A-613	8-313	918F
Simplified Electrical Diagram				8-2	527
Seat Position Actuator		B		8-237	816
		Q		8-238	816A
Starter and Ignition		48-356—51-6818		8-34	604
		51-6819—53-5085		8-35	605
		53-5086 & up		8-36	606
Student Lockout		48-356—50-384		8-14	581
		50-385—51-4328		8-15	582
		51-4329—51-6818		8-16	583
		51-6819—51-9235		8-17	584
		51-9236—53-5285		8-18	585
		53-5286—53-5485		8-31	601
	T-33A-1	53-5486 & up		8-32	602
	T-33A-5			8-33	602A
	T-33A-15LO		1T-33A-613	8-33A	602B
	T-33A-5 & T-33A-15	50-385—51-4328	1T-33A-638	8-33B	602C
	T-33A-5 & T-33A-15	51-4329—51-6818	1T-33A-638	8-33C	602D
	T-33A-5 & T-33A-15	51-6819—51-9235	1T-33A-638	8-33D	602E
	T-33A-5 & T-33A-15	51-9236—52-9634 & 52-9876—52-9905	1T-33A-638	8-33E	602F
	T-33A-5 & T-33A-15	52-9635—53-5085 & 52-9876—52-9905		8-33F	602G
	T-33A-5 & T-33A-15	53-5086—53-5285		8-33G	602H
	T-33A-5 & T-33A-15	53-5286 & up	1T-33A-638	8-33H	603
Tachometer		48-356—51-4328		8-76	646
		51-4329—51-6818		8-77	647
		51-6819—51-9235		8-78	648
	T-33A-1	51-9236 & up		8-79	649
	T-33A-5			8-80	650
Tail Cone Temperature		48-356 & up		8-167	746
Telltale Lights		48-356—50-384		8-19	586
		48-356—50-384	1T-33A-195	8-20	587
		50-385—51-4023		8-21	588
		50-385—51-4023	1T-33A-195	8-22	589
		51-4024—51-4328		8-23	590
		51-4024—51-4328	1T-33A-195	8-24	592
		51-4329—51-6818		8-25	593
		51-4329—51-6818	1T-33A-195	8-26	595
	MDAP	51-6819—52-9634	1T-33A-195	8-27	596
	T-33A	52-9876—52-9905	1T-33A-195	8-28	597
		S	1T-33A-195	8-29	598
		53-5086—53-5285		8-30	599
		53-5286—53-5485		8-31	601
	T-33A-1	53-5486 & up		8-32	602
	T-33A-5			8-33A	602B
	T-33A-5 & T-33A-15	50-385—51-4328	1T-33A-638	8-33B	602C
	T-33A-5 & T-33A-15	51-4329—51-6818	1T-33A-638	8-33C	602D
	T-33A-5 & T-33A-15	51-5819—51-9235	1T-33A-638	8-33D	602E
	T-33A-5 & T-33A-15	51-9236—52-9634 & 52-9876—52-9905	1T-33A-638	8-33E	602F
	T-33A-5 & T-33A-15	52-9635—53-5085 & 52-9876—52-9905		8-33F	602G
	T-33A-5 & T-33A-15	53-5086—53-5285		8-33G	602H
	T-33A-5 & T-33A-15	53-5286 & up	1T-33A-638	8-33H	603
Turn and Bank Indicator		48-356—51-4328		8-117	687
		51-4329—51-6818		8-118	688
		51-6819—51-9235		8-119	689
	T-33A-1	51-9236 & up		8-120	690
	T-33A-5			8-121	691

Table 8-1. Alphabetical Index of Wiring Diagrams (Sheet 8 of 8)

Title	Model	Effective Serials	Incorporating T. O.	Fig. No.	Page No.
Warning Lights, Fuel Pressure		48-356—48-920		8-55	625
		49-879—51-6528		8-56	626
		51-6529—51-6818		8-57	627
		G		8-58	628
	T-33A-1	Q		8-59	629
	T-33A-5			8-60	630
Windshield Defrosting, Auxiliary		48-356—51-4328		8-103	673
		51-4329—51-6818		8-104	674
		51-6819—53-5082		8-105	675
		53-5083 & up		8-106	676
Wing Flap Actuator		48-356—50-384		8-81	651
		50-385—51-6818		8-82	652
		GA		8-83	653
		AM		8-84	654
Wing Flap Position Indicating		48-356—50-384	1T-33A-567	8-84A	654A
		50-385—51-6818		8-85	655
	T-33A-1	51-6819 & up		8-86	656
	T-33A-5			8-87	657

NOTE:

A	48-356—52-9634 & 52-9876—52-9905
B	51-4040—52-9634, 52-9876—52-9905 & 22 airplanes modified by Lockheed Aircraft Service
C	51-4141—52-6234 & 52-9876—52-9905
D	51-6819—51-17556 & 52-9129—52-9940
E	51-6819—51-17486 & 52-9129—52-9334
F	51-6819—52-9759, 52-9876—52-9940 & 53-2687—53-2726
G	51-6819—52-9634 & 52-9876—52-9905
GA	51-6819—53-5066 & 54-1522—55-3098
H	51-8836—52-9759, 52-9876—52-9940 & 53-2687—53-2726
J	51-8836—52-9634 & 52-9876—52-9905
K	51-9036—52-9759, 52-9876—52-9940 & 53-2687—53-2726
L	51-9036—52-9634 & 52-9876—52-9905
M	51-9236—52-9759, 52-9876—52-9940 & 53-2687—53-2726
MA	51-9236—52-9759 & 52-9876—52-9940
N	51-9236—52-9634 & 52-9876—52-9905
NA	51-9236—55-3028, except 53-6038—53-6152
P	51-17487—51-17556, 52-9335—52-9634 & 52-9876—52-9905
Q	52-9635 & up, except 52-9876—52-9905
R	52-9635—53-5285, except 52-9876—52-9905
S	52-9635—53-5085, except 52-9876—52-9905
T	52-9635—53-5082, except 52-9876—52-9905
U	52-9635—53-4935, except 52-9876—52-9905
V	52-9635—53-2780, except 52-9876—52-9905
W	52-9635—52-9759, 52-9906—52-9940 & 53-2687—53-2726
X	52-9635—52-9759 & 52-9906—52-9940
Y	52-9635—52-9759 & 53-2687—53-2726, except 52-9876—52-9905
Z	52-9760 & up, except 52-9906—52-9940
AA	52-9760 & up, except 52-9906—52-9940 & 53-2687—53-2726
AB	52-9760 & up, except 52-9876—52-9940 & 53-2687—53-2726
AC	52-9760—53-5665, except 52-9876—52-9940 & 53-2687—53-2726
AD	52-9760—53-5285, except 52-9906—52-9940 & 53-2687—53-2726
AE	52-9760—53-5085, except 53-2687—53-2726
AF	52-9760—53-5085, except 52-9876—52-9940 & 53-2687—53-2726
AFA	52-9760—53-5085, except 52-9876—52-9940
AG	51-6819—53-5813, except 54-1522—54-1539
AGA	53-5666—53-6152 & 54-1522—55-3115
AH	53-5814—53-6152 & 54-1544 & up
AJ	53-5286—53-5878, 54-1522—54-1583 & 54-2689—54-2728
AK	53-5879—53-6152 & 54-1584 & up, except 54-2689—54-2728
AL	53-6038—53-6152 & 55-3029—56-3694
AM	53-6067—53-6152 & 55-3100 & up
AN	Airplanes incorporating the intent of T. O. 1T-33A-186



XB3267

Figure 8-1. Electrical Symbols

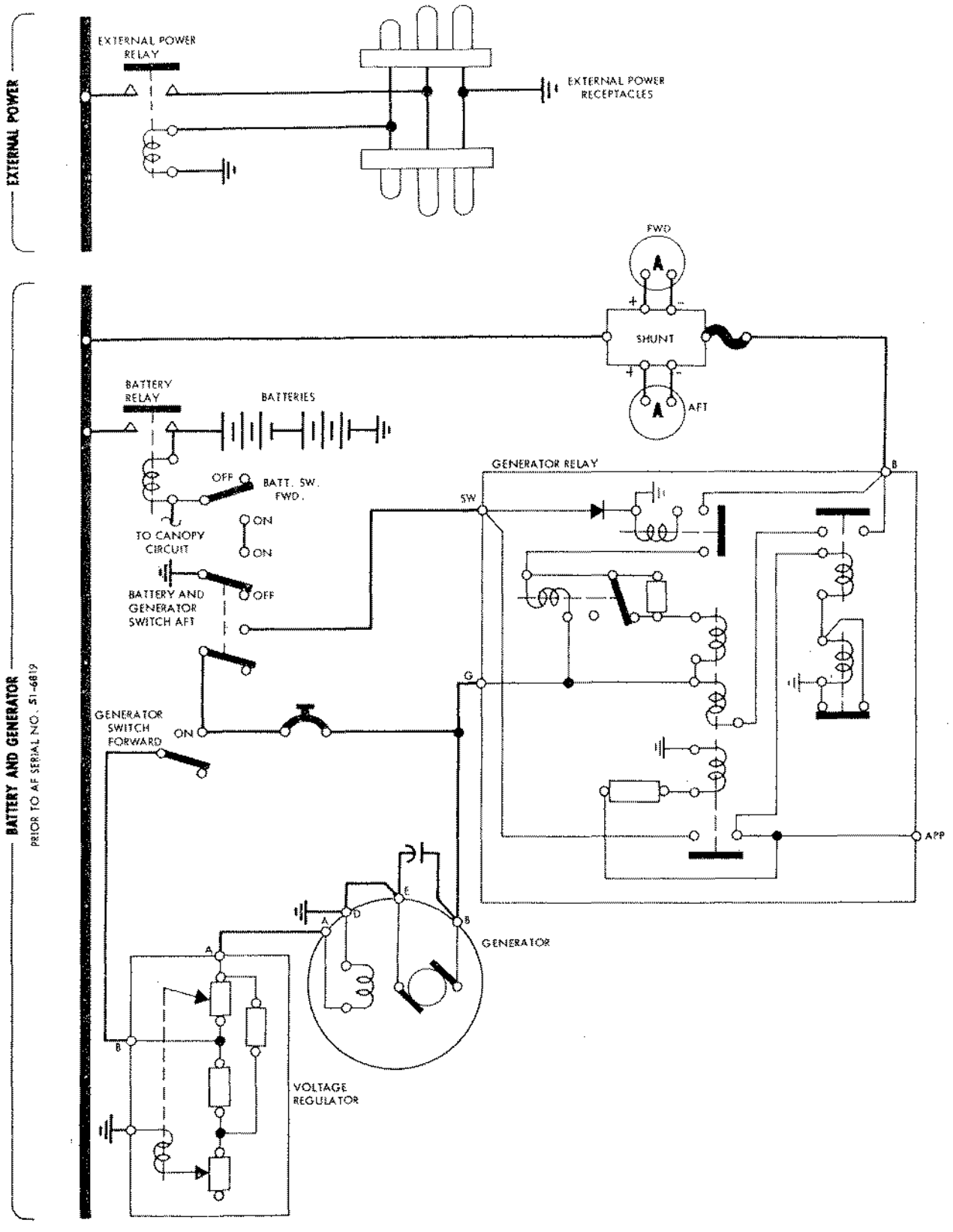


Figure 8-2. Simplified Electrical Diagrams (Sheet 1 of 34)

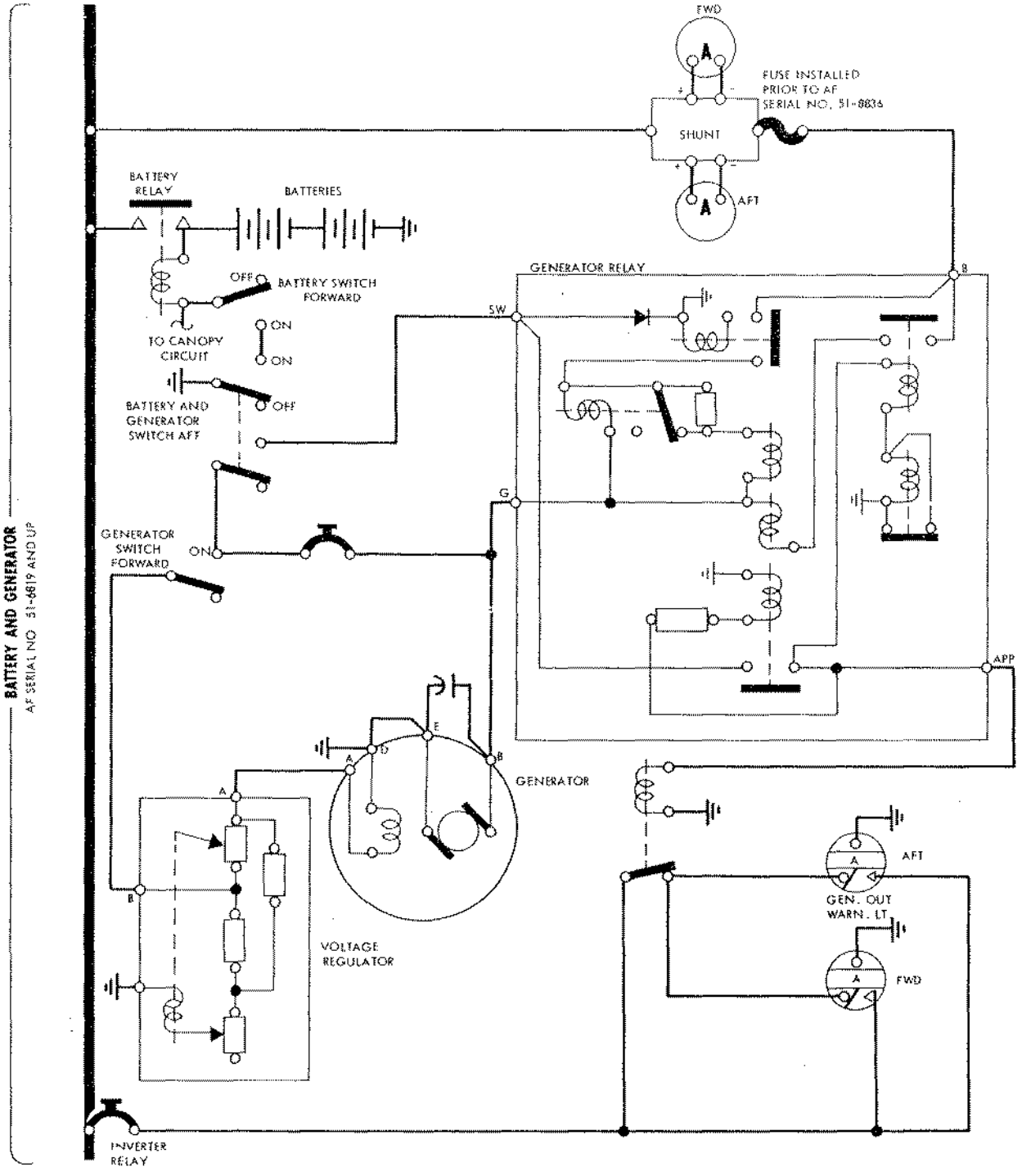


Figure 8-2. Simplified Electrical Diagrams (Sheet 2 of 34)

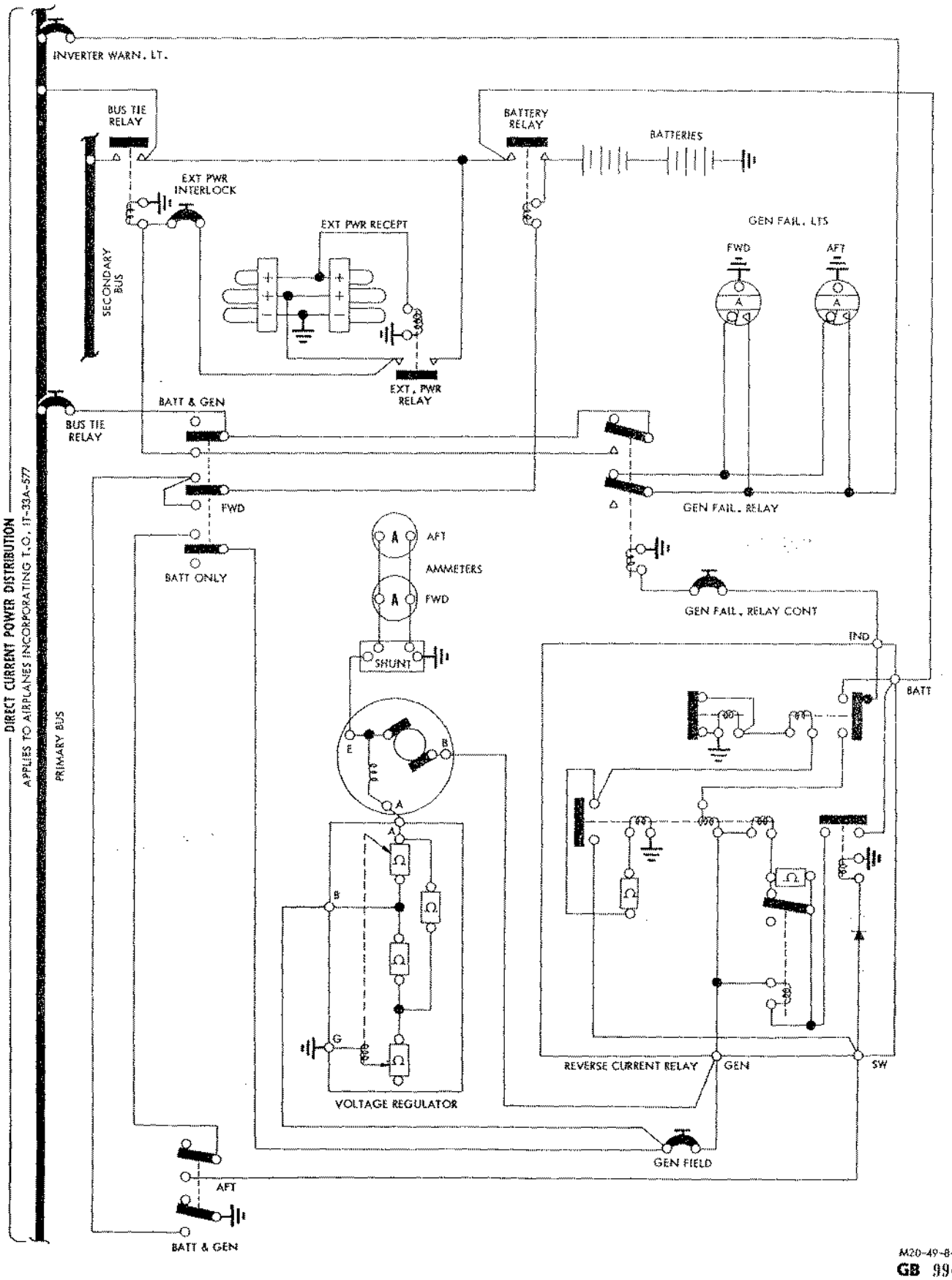


Figure 8-2. Simplified Electrical Diagram (Sheet 2A of 34)

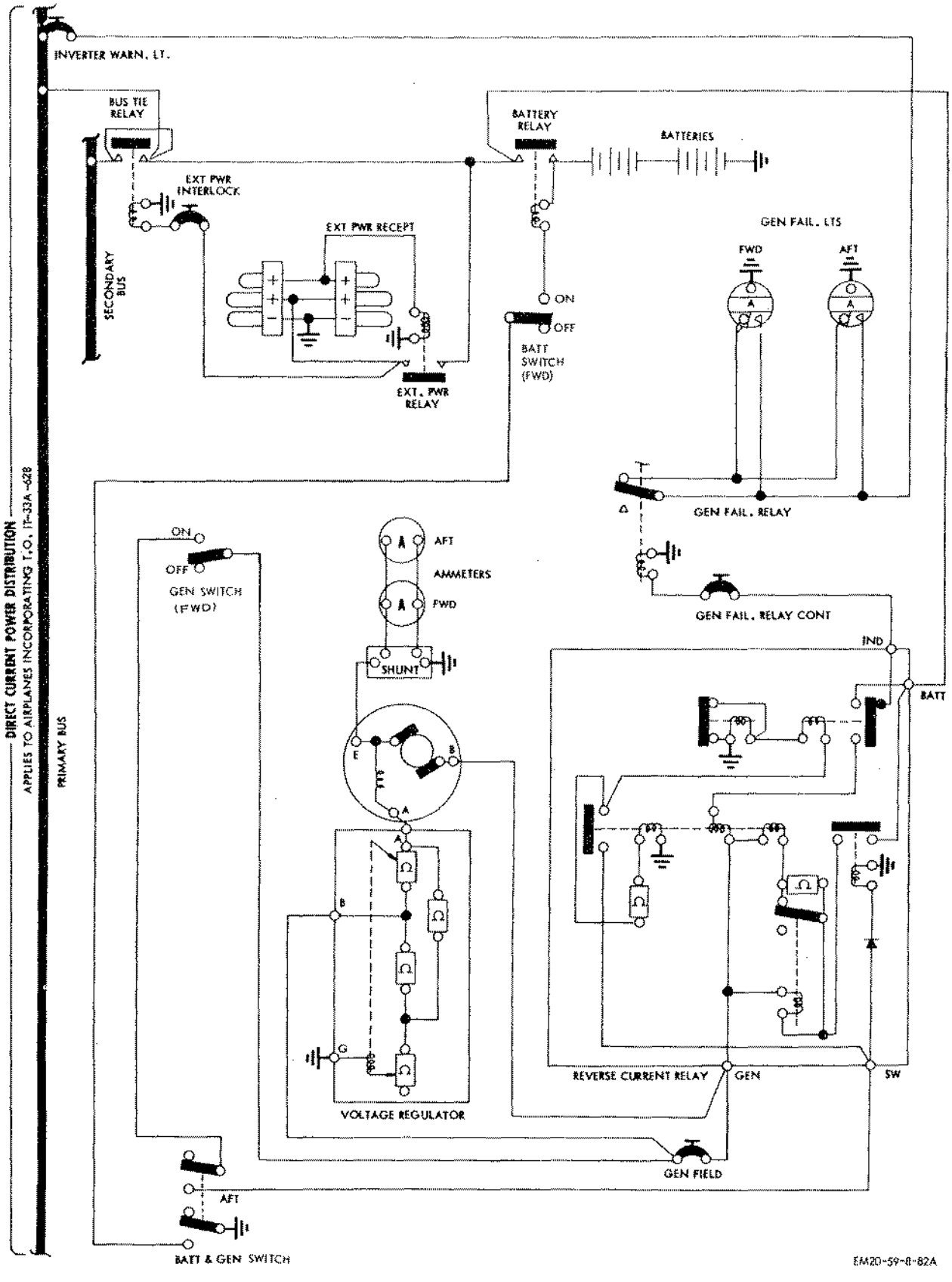


Figure 8-2. Simplified Electrical Diagram (Sheet 2B of 34)

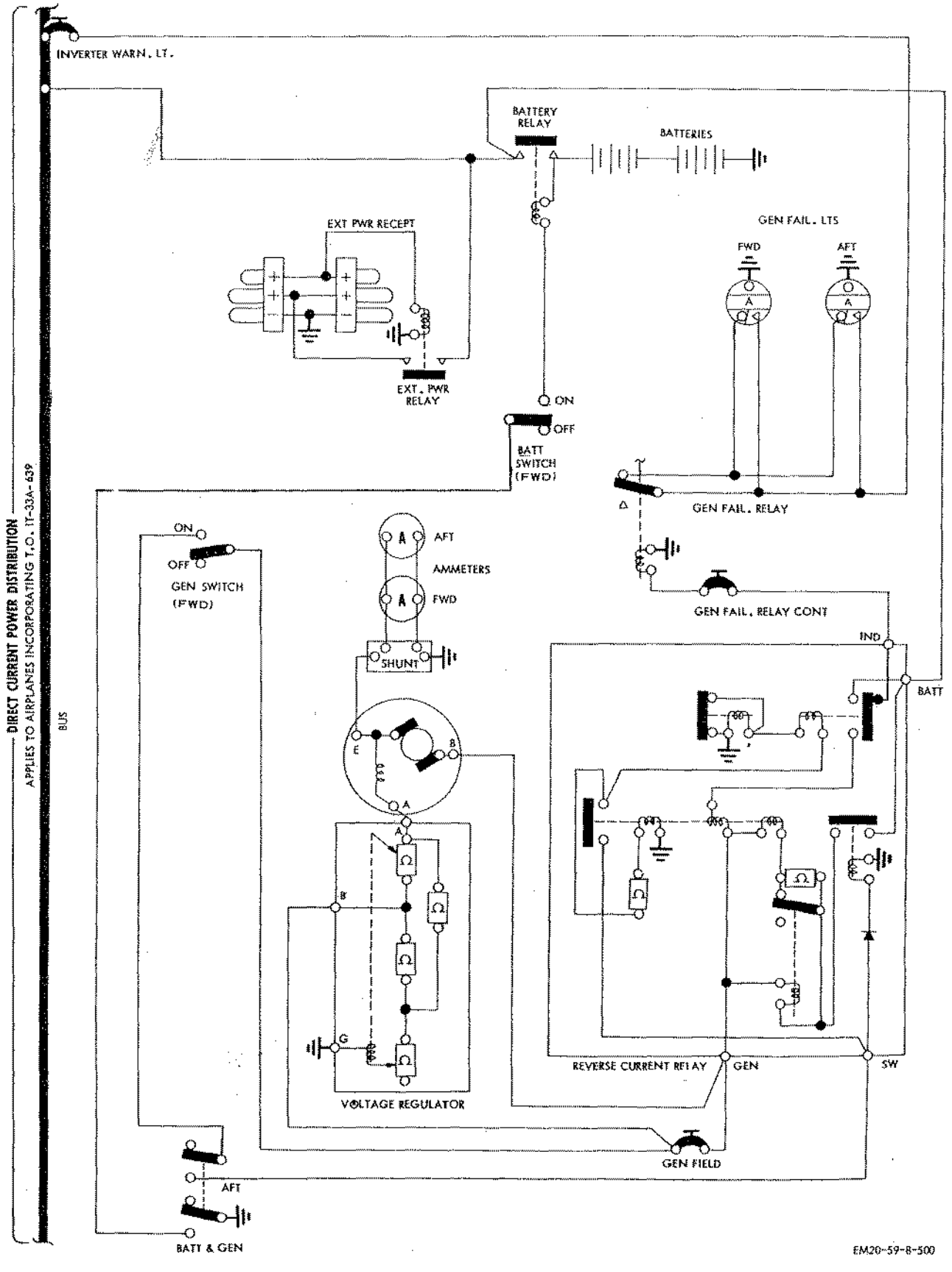


Figure 8-2. Simplified Electrical Diagram (Sheet 2C of 34)

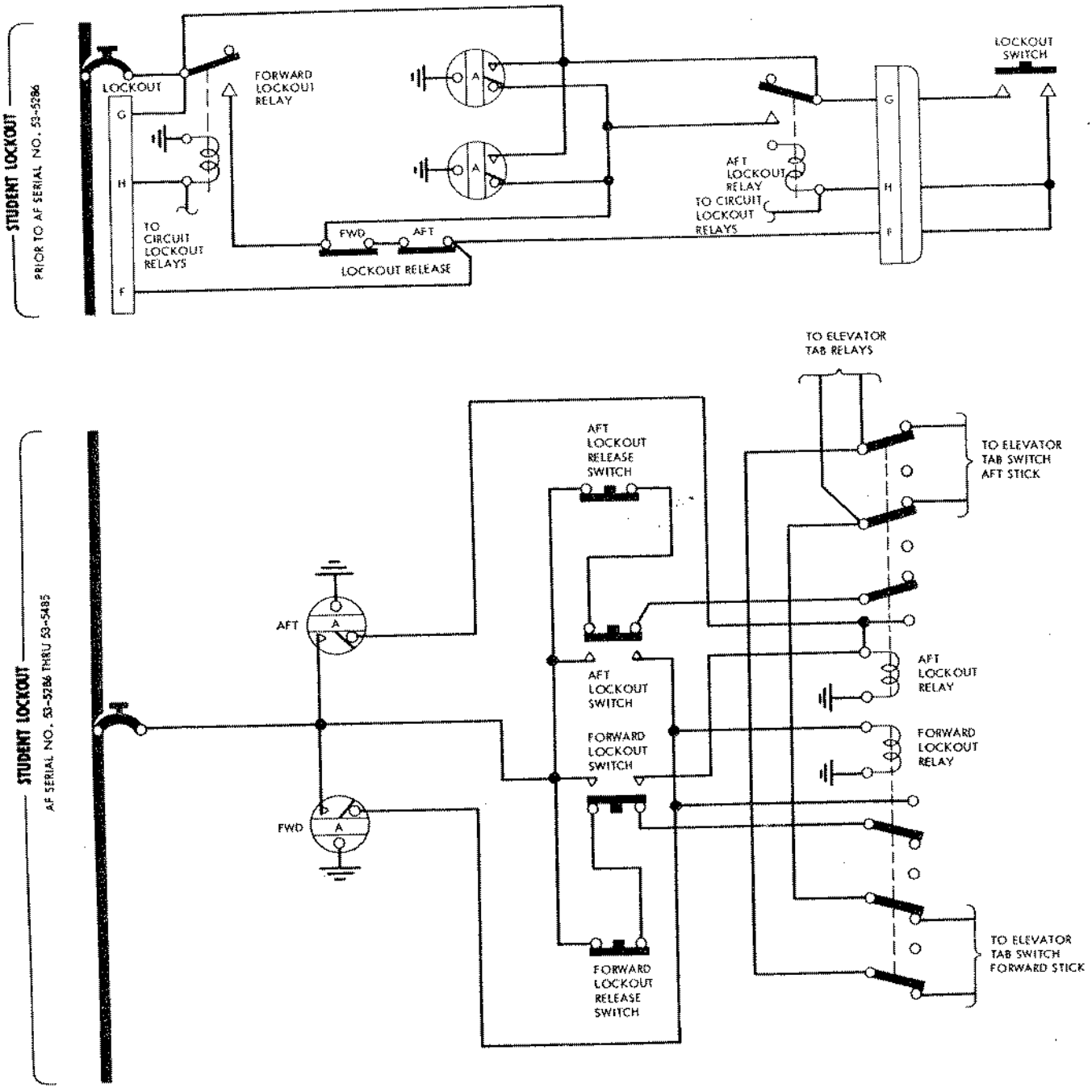
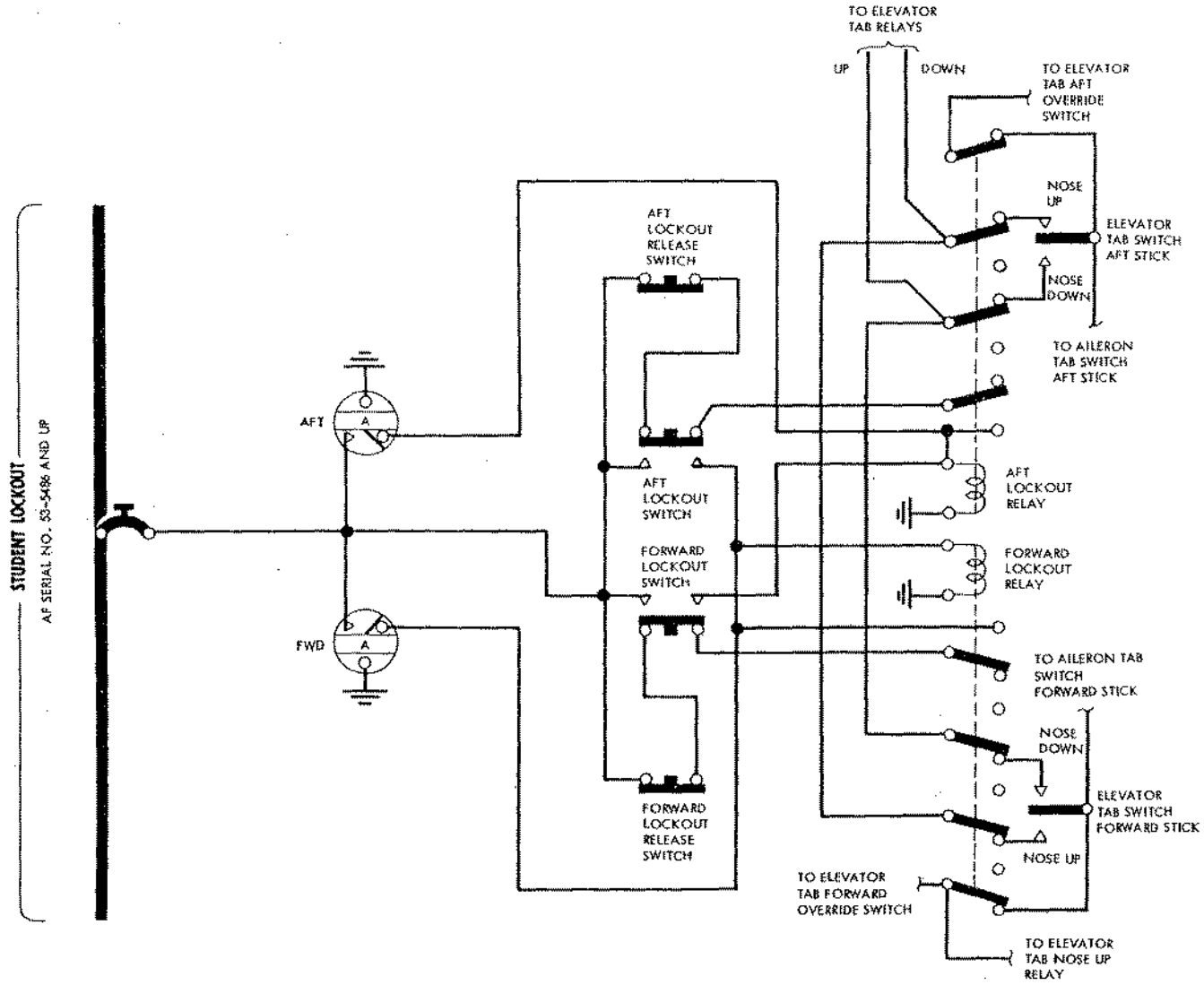


Figure 8-2. Simplified Electrical Diagrams (Sheet 3 of 34)



NOTE:
STUDENT LOCKOUT SYSTEM
IS REMOVED FROM AIRPLANES
INCORPORATING T.O. 1T-33A-638.

EM20-59-8-327

Figure 8-2. Simplified Electrical Diagrams (Sheet 4 of 34)

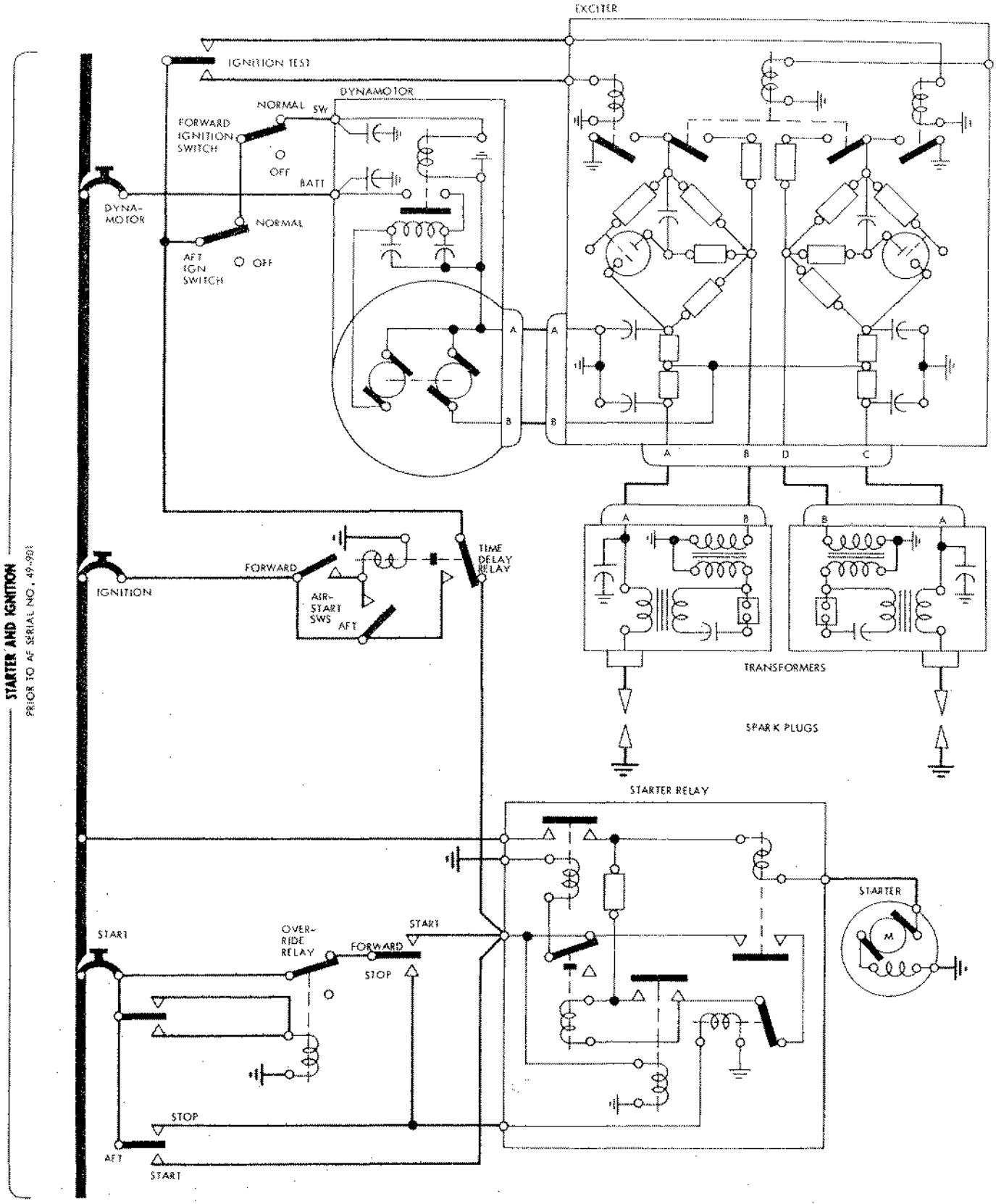


Figure 8-2. Simplified Electrical Diagrams (Sheet 5 of 34)

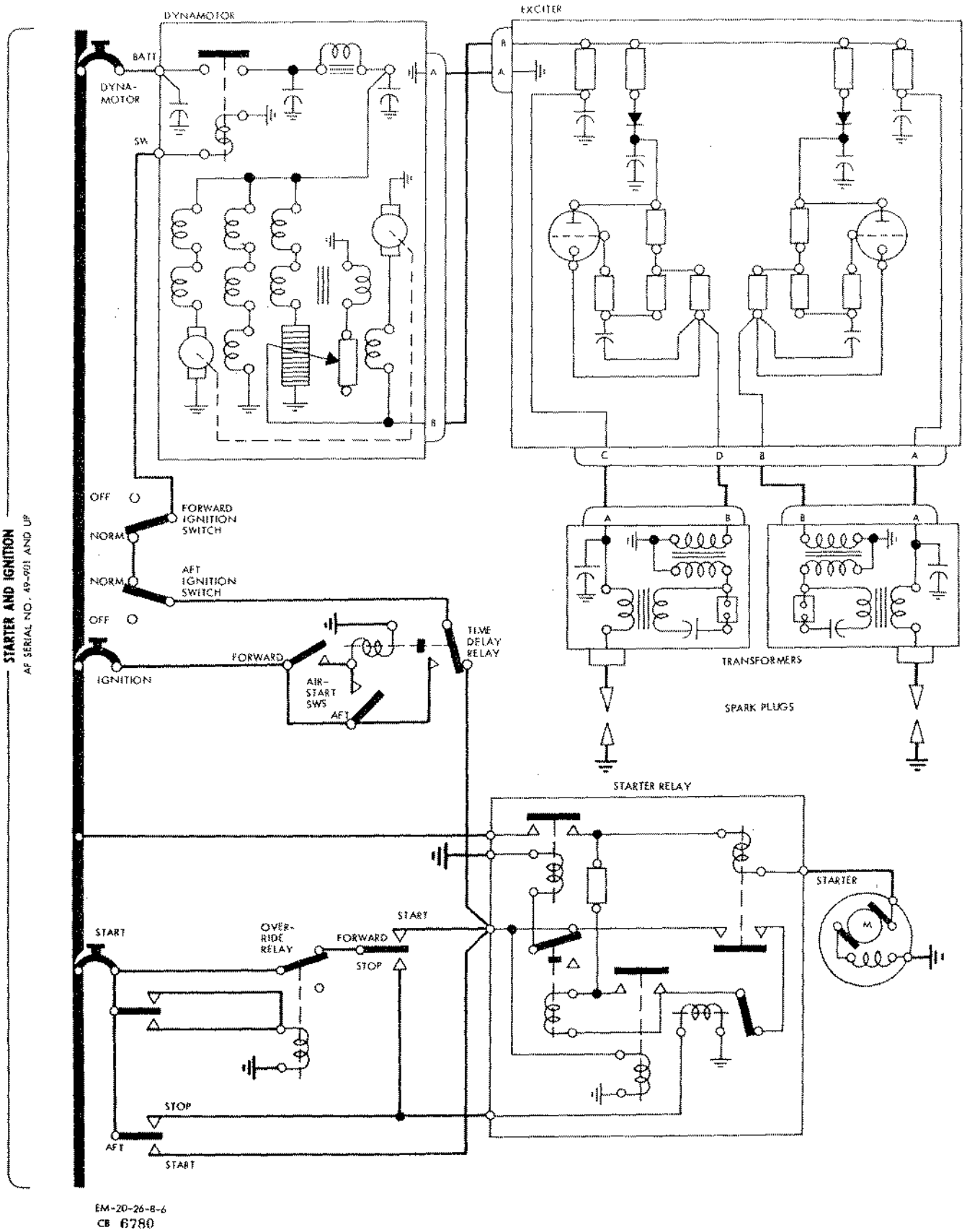


Figure 8-2. Simplified Electrical Diagrams (Sheet 6 of 34)

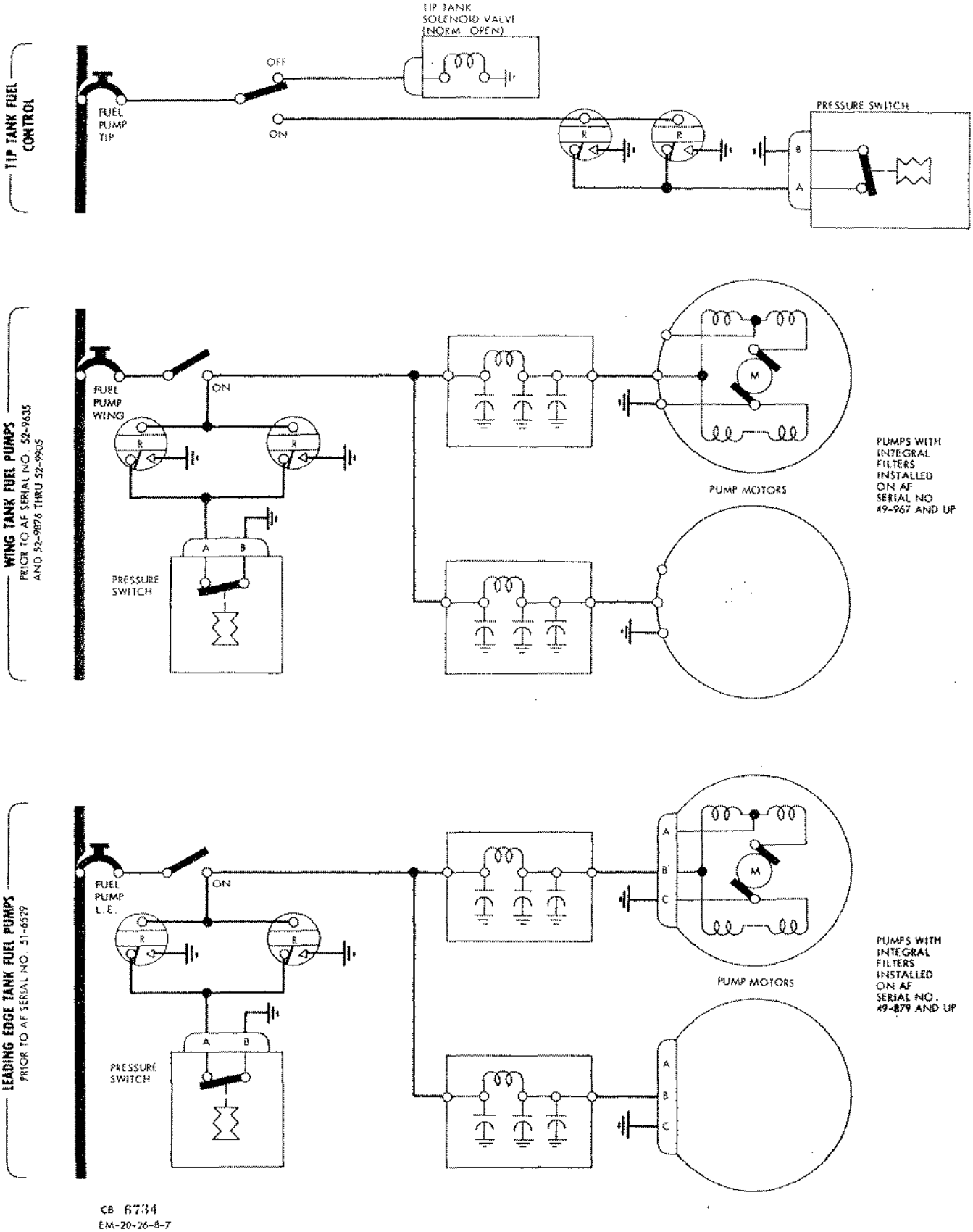
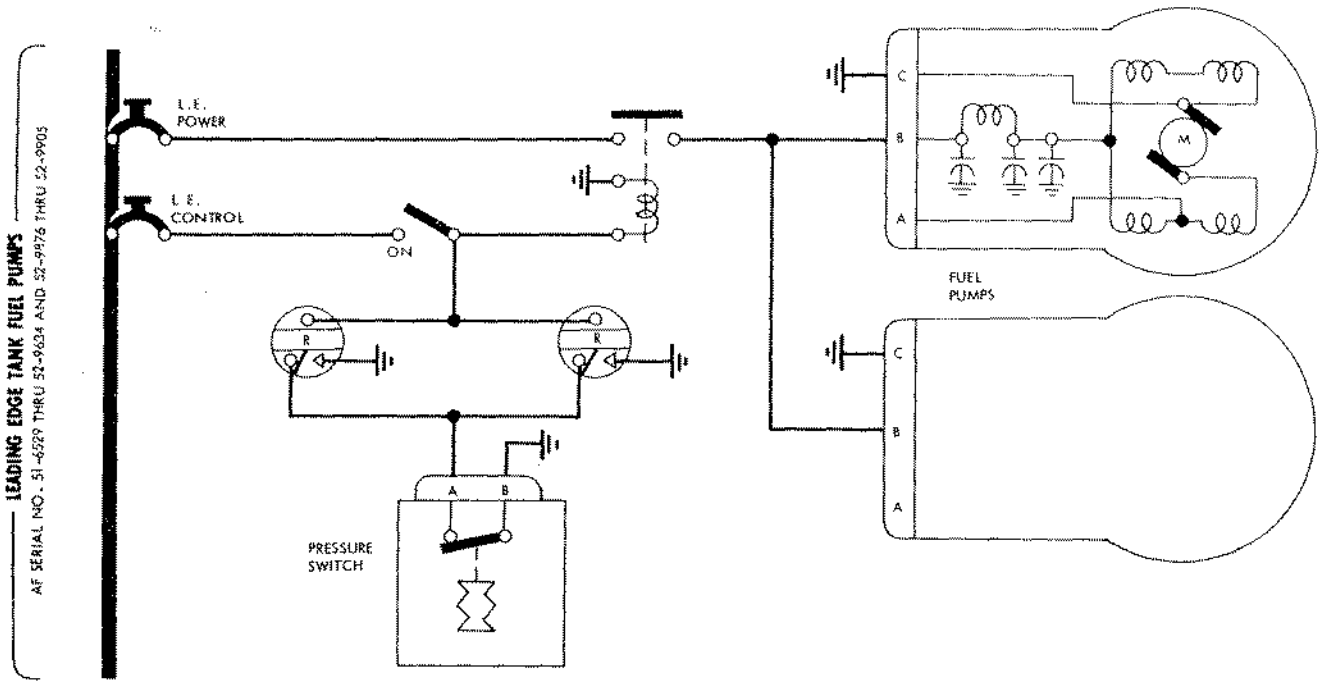


Figure 8-2. Simplified Electrical Diagrams (Sheet 7 of 34)



CB 6735
EM-20-26-8-8

Figure 8-2. Simplified Electrical Diagrams (Sheet 8 of 34)

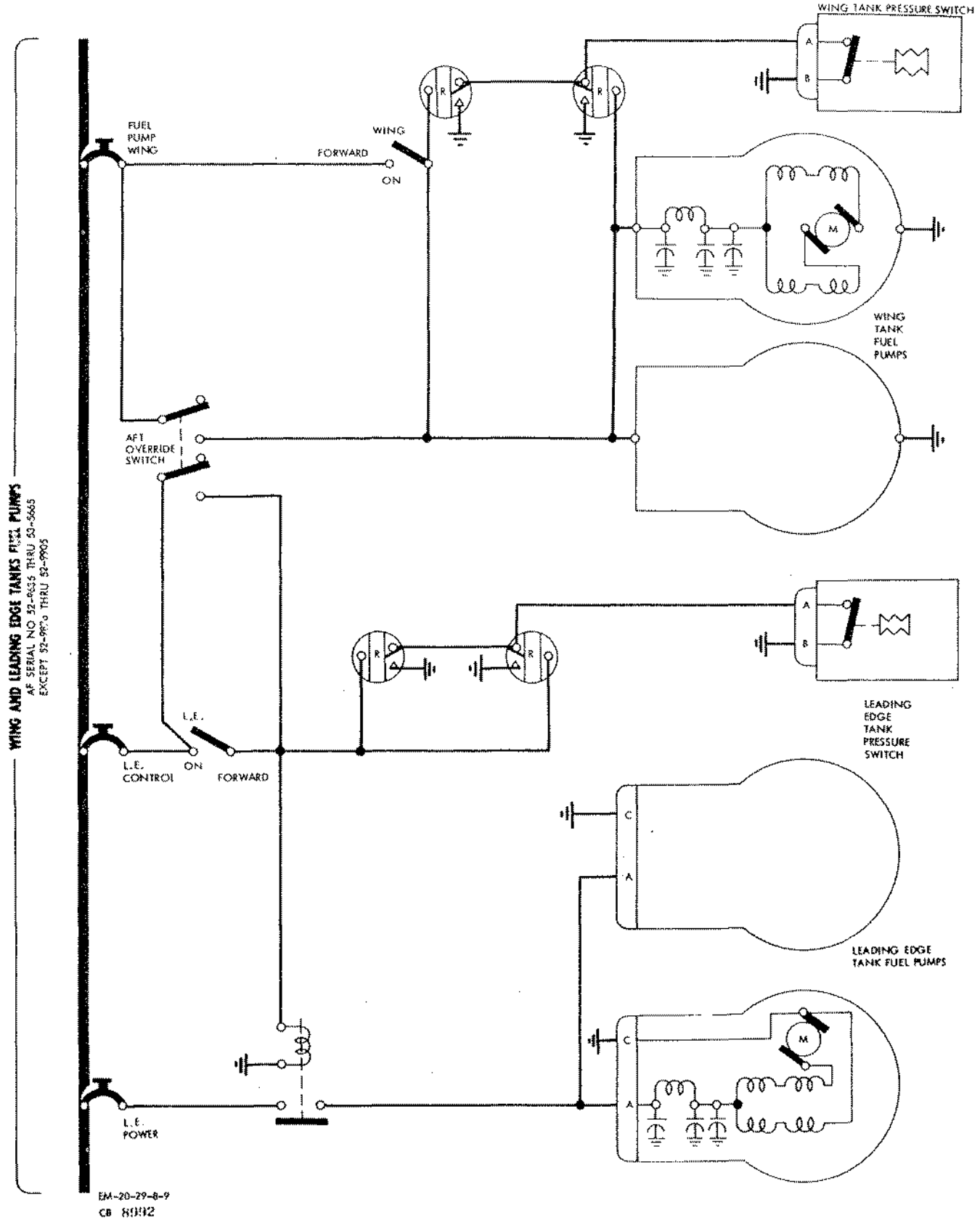


Figure 8-2. Simplified Electrical Diagrams (Sheet 9 of 34)

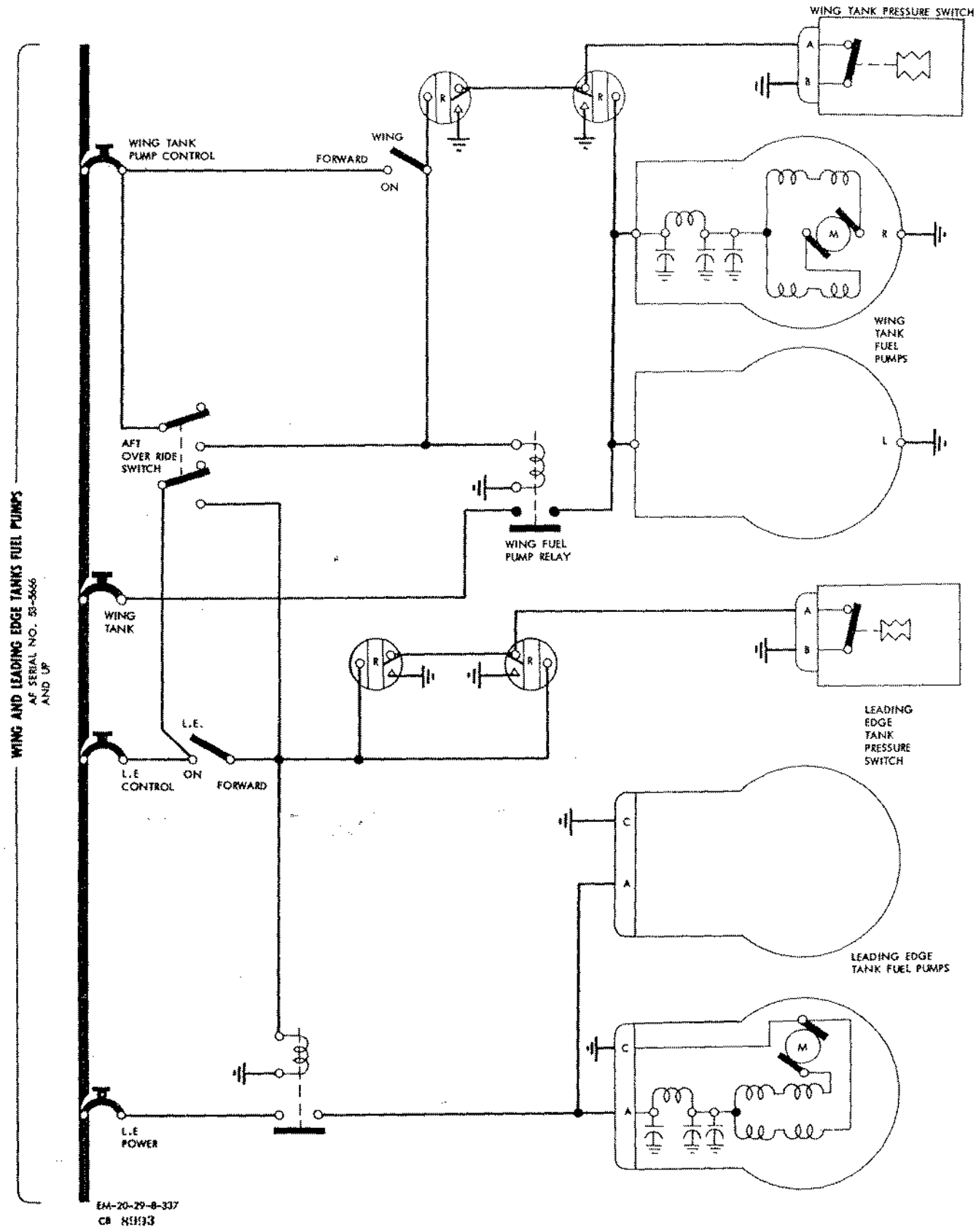


Figure 8-2. Simplified Electrical Diagrams (Sheet 10 of 34)

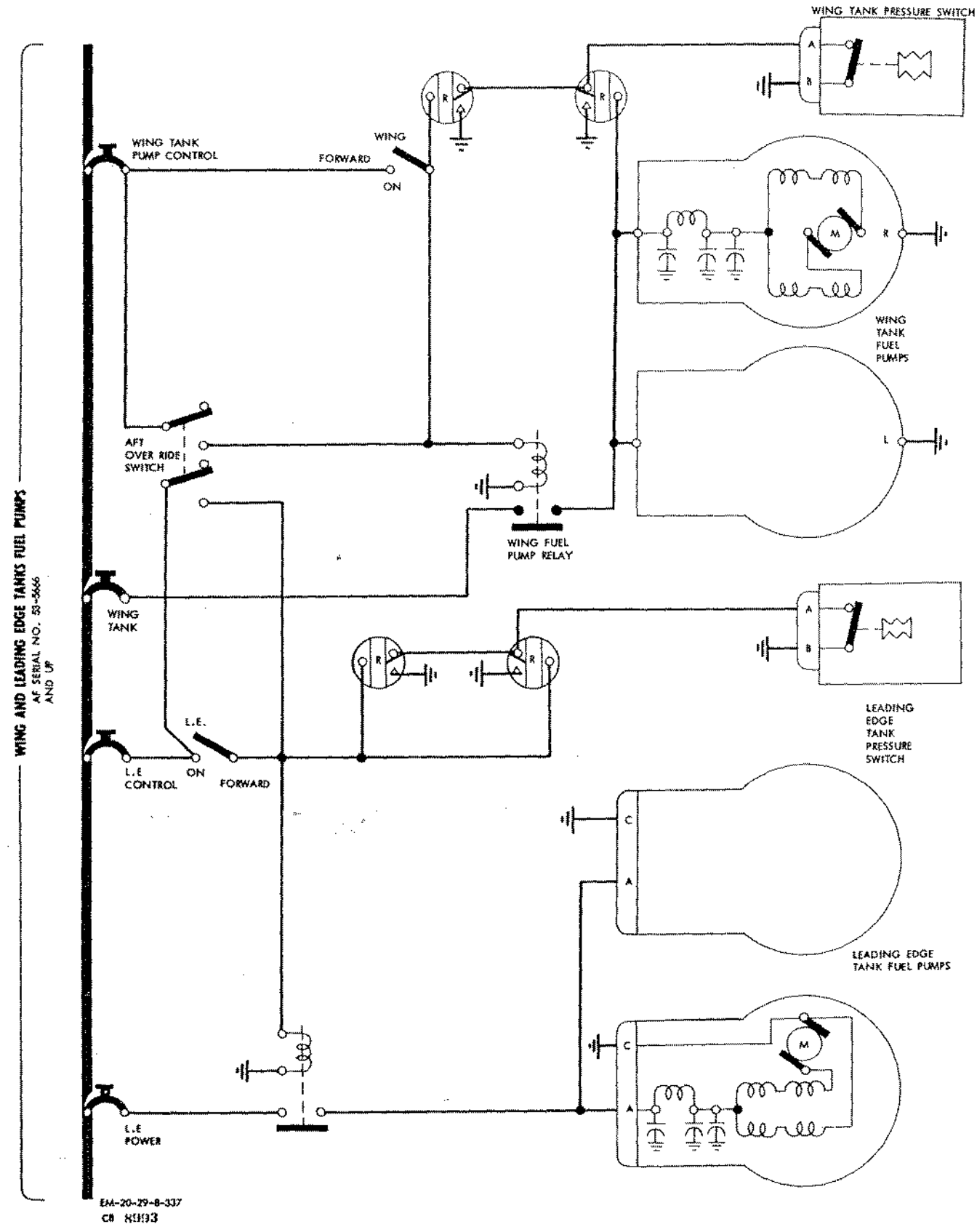


Figure 8-2. Simplified Electrical Diagrams (Sheet 10 of 34)

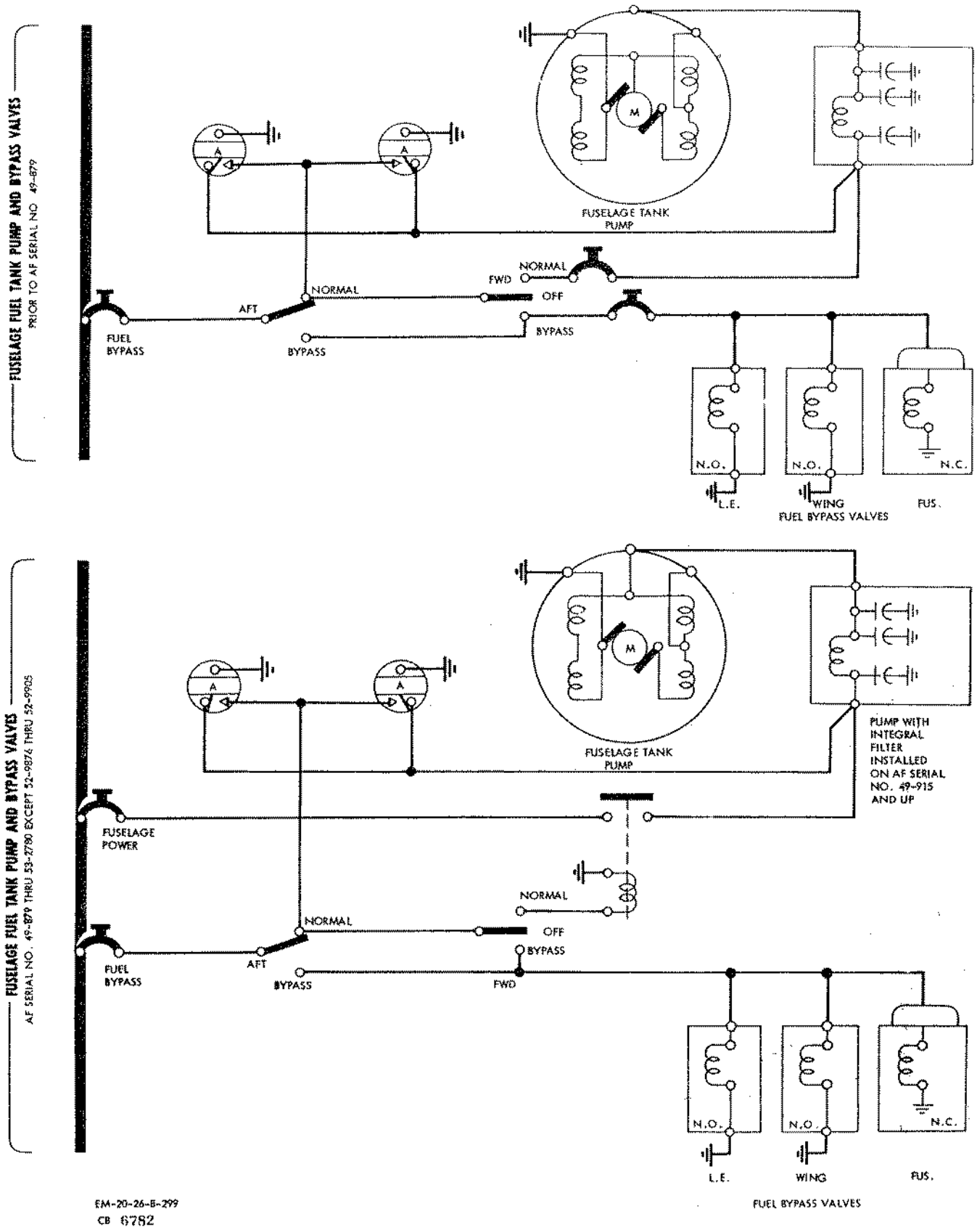
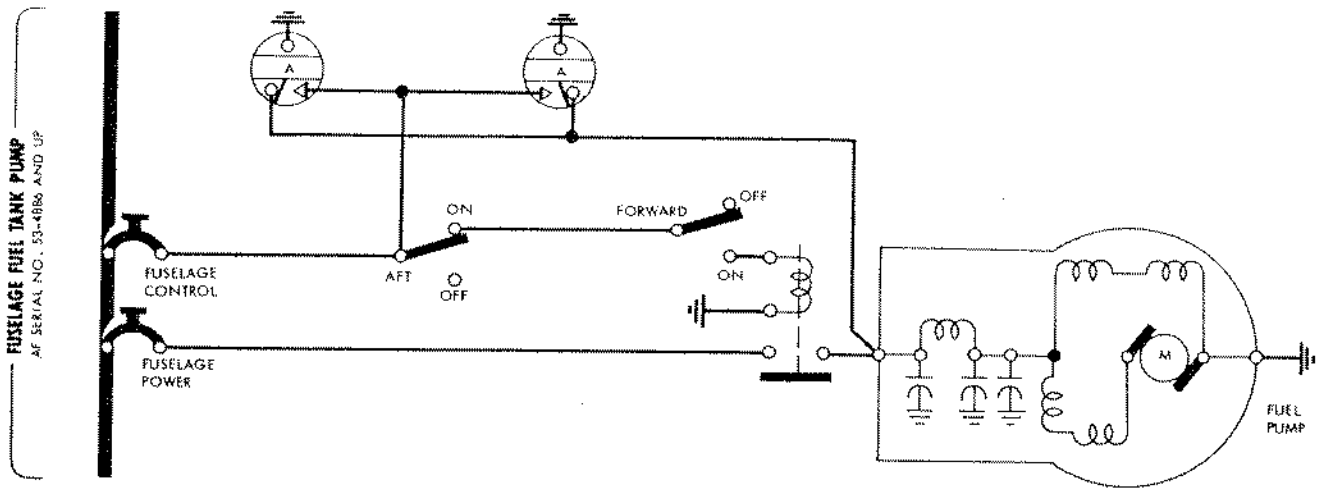


Figure 8-2. Simplified Electrical Diagrams (Sheet 11 of 34)



C8 67736
EM-20-26-8-300

Figure 8-2. Simplified Electrical Diagrams (Sheet 12 of 34)

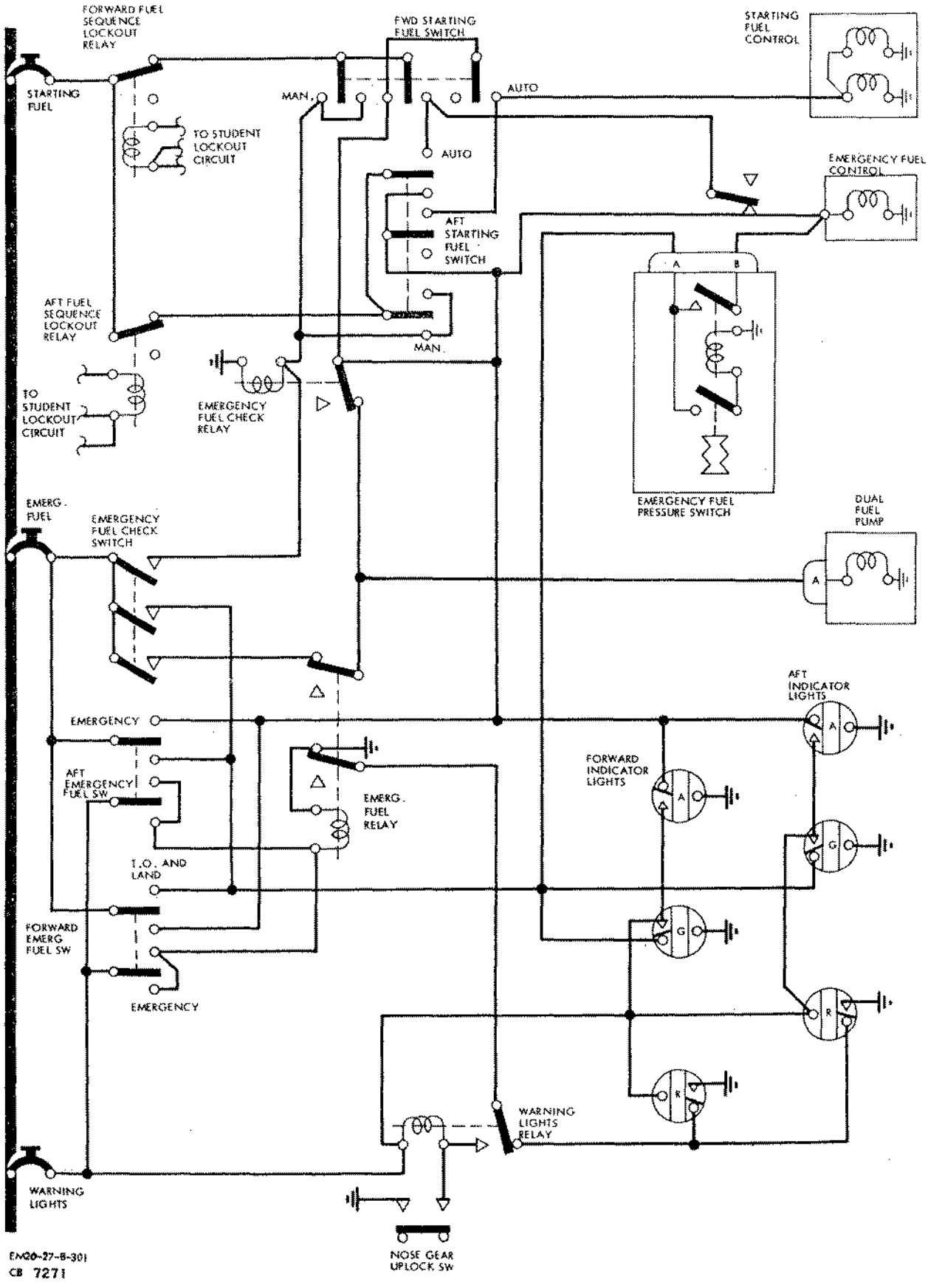


Figure 8-2. Simplified Electrical Diagrams (Sheet 13 of 34)

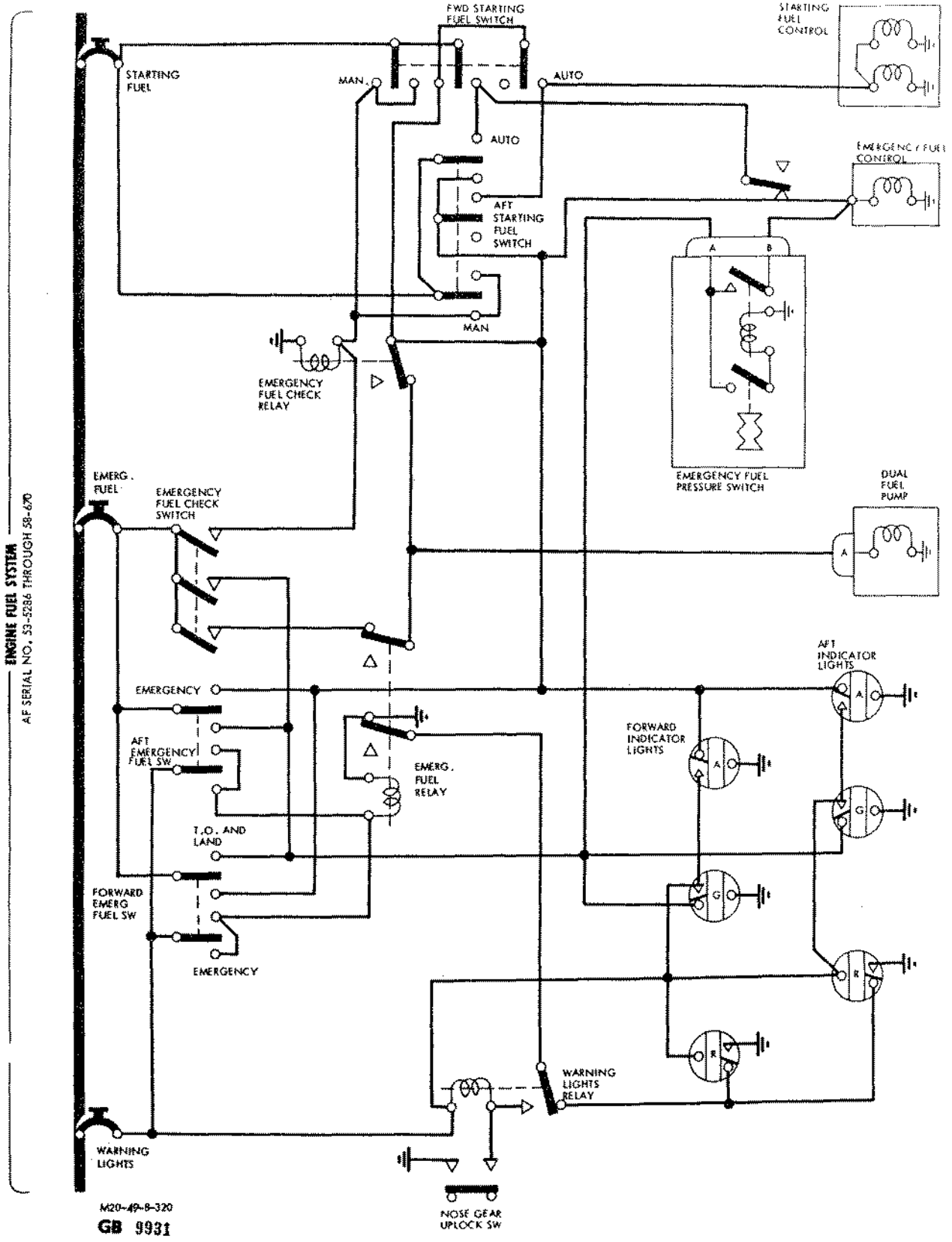


Figure 8-2. Simplified Electrical Diagram (Sheet 14 of 34)

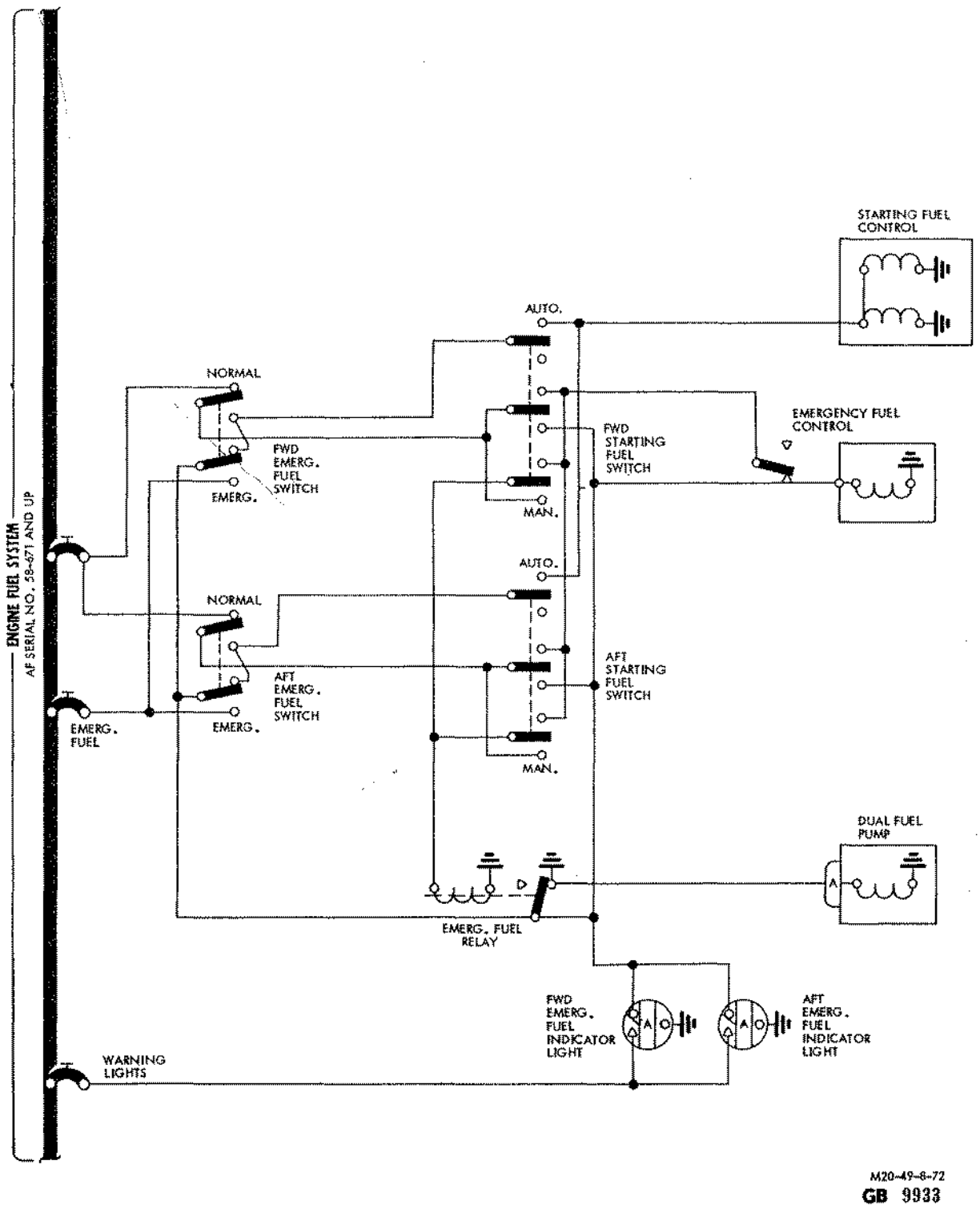
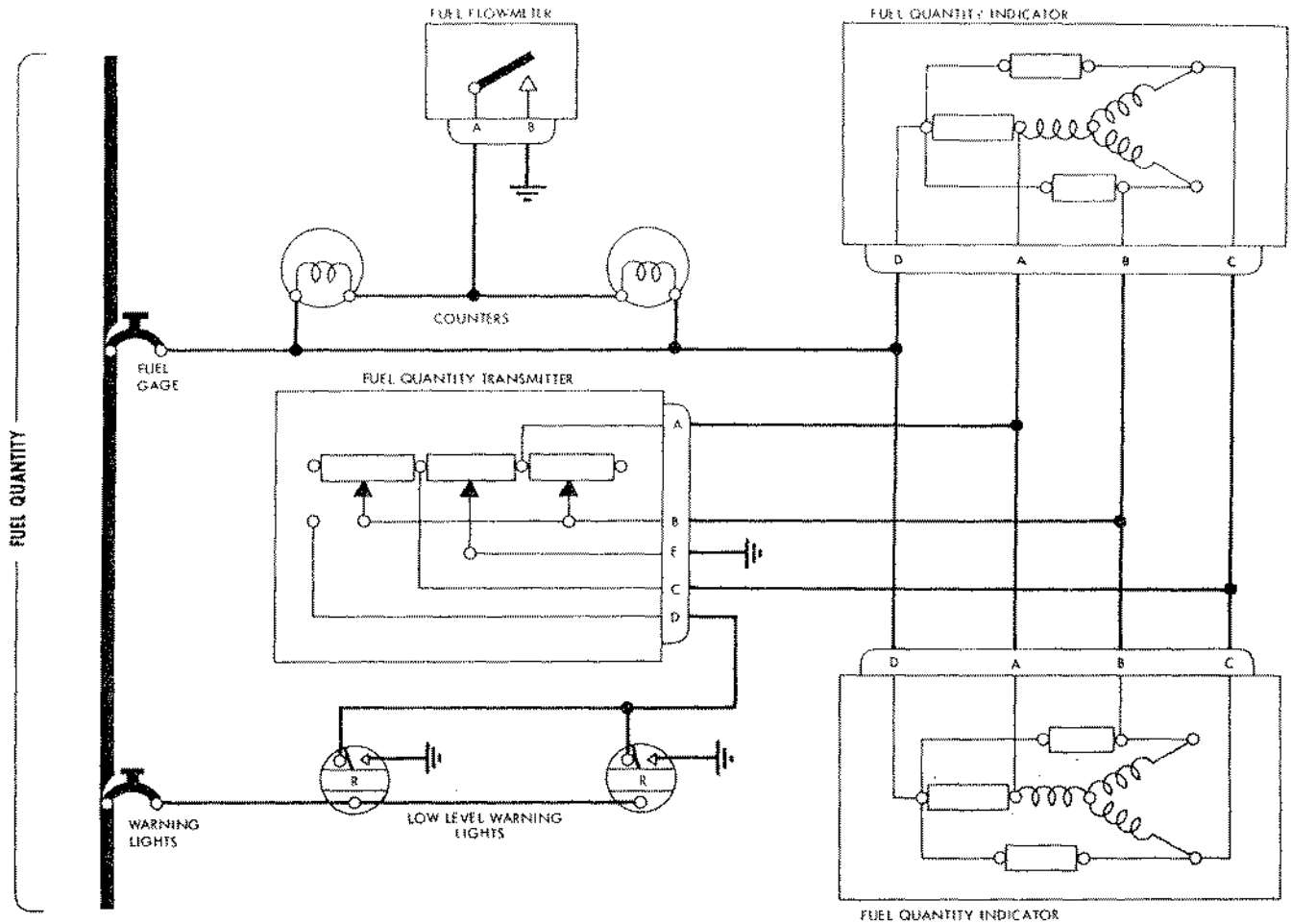


Figure 8-2. Simplified Electrical Diagrams (Sheet 14A of 34)



CB 6737
EM-20-26-8-302

Figure 8-2. Simplified Electrical Diagrams (Sheet 15 of 34)

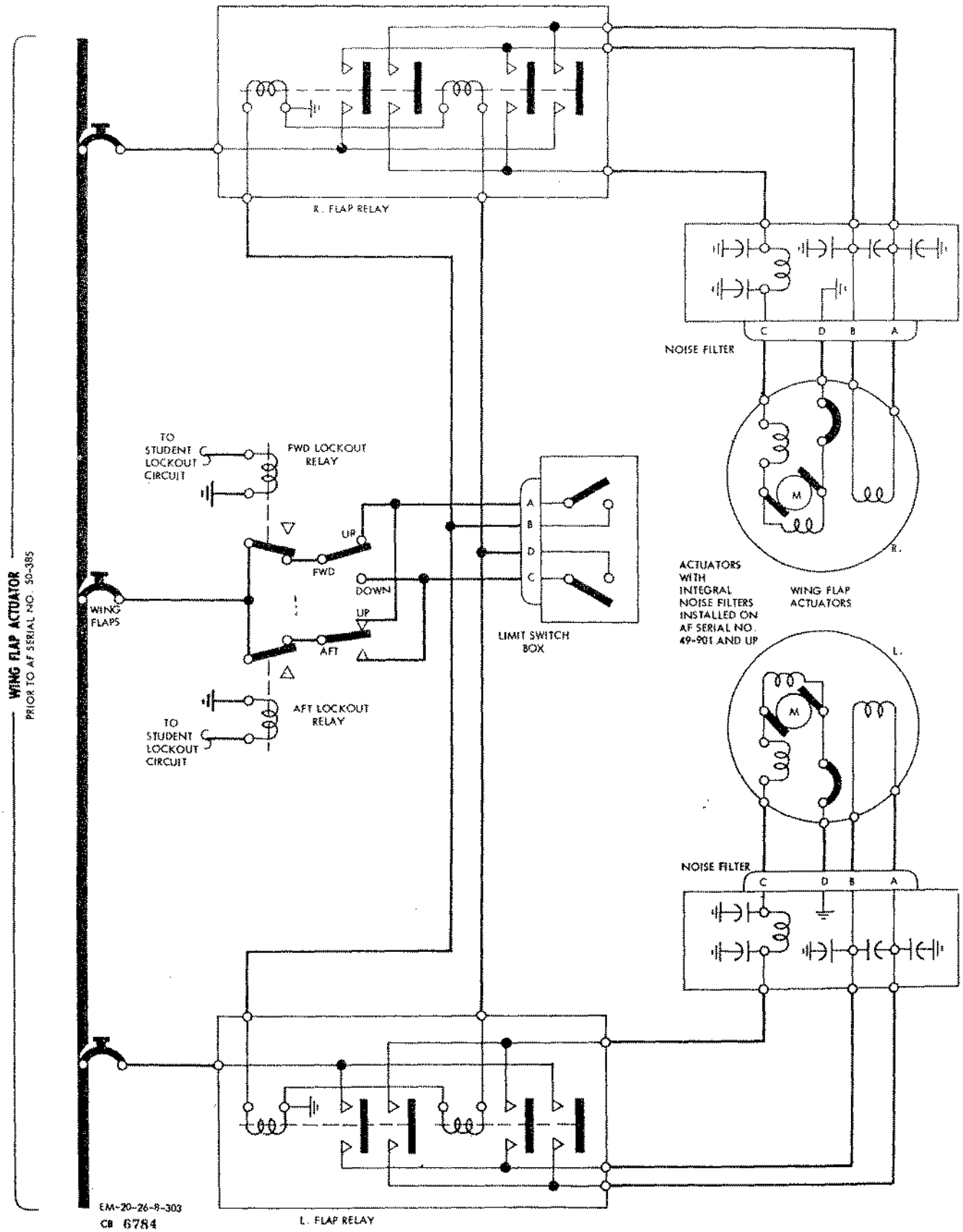
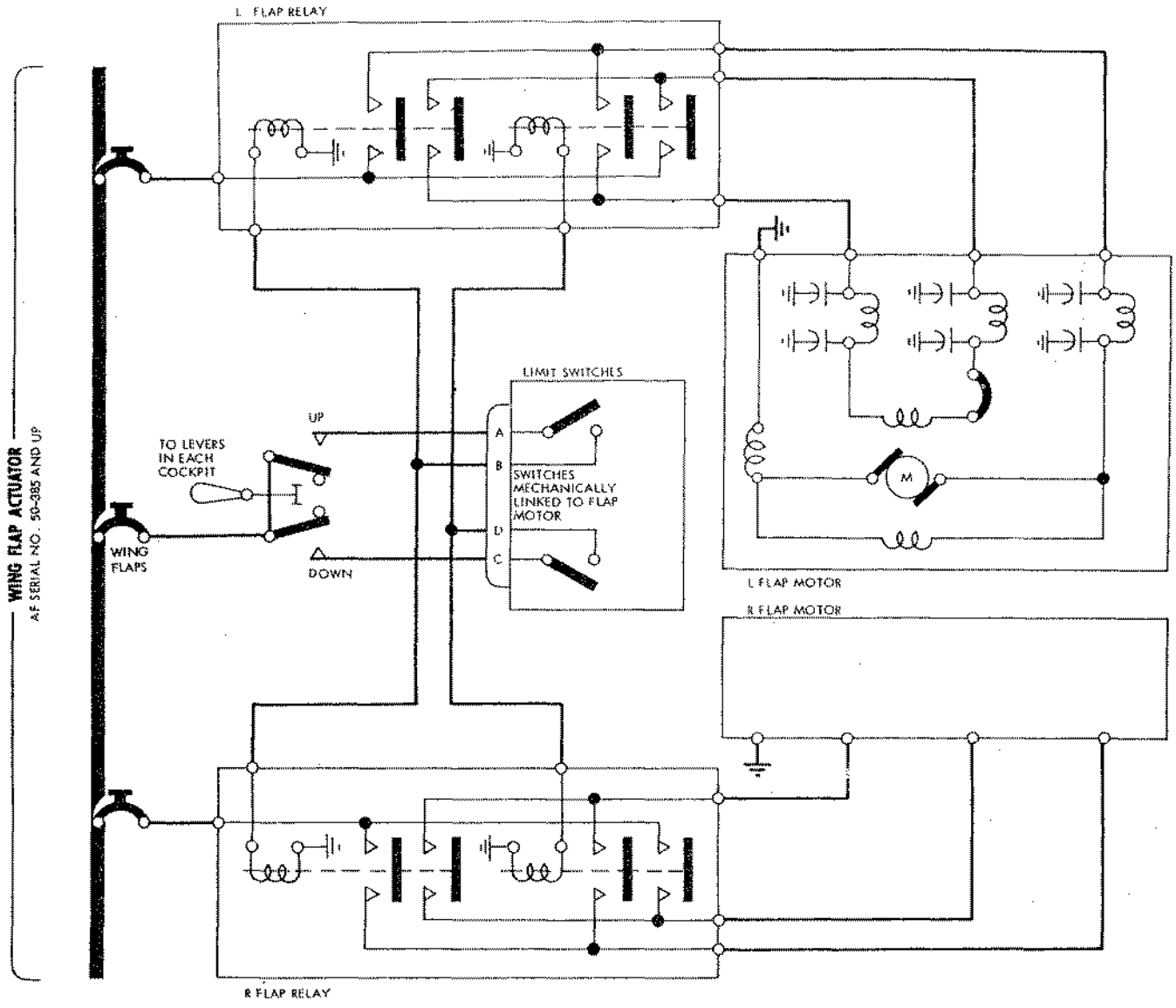


Figure 8-2. Simplified Electrical Diagrams (Sheet 16 of 34)



CB 6785
EM-20-26-8-304

Figure 8-2. Simplified Electrical Diagrams (Sheet 17 of 34)

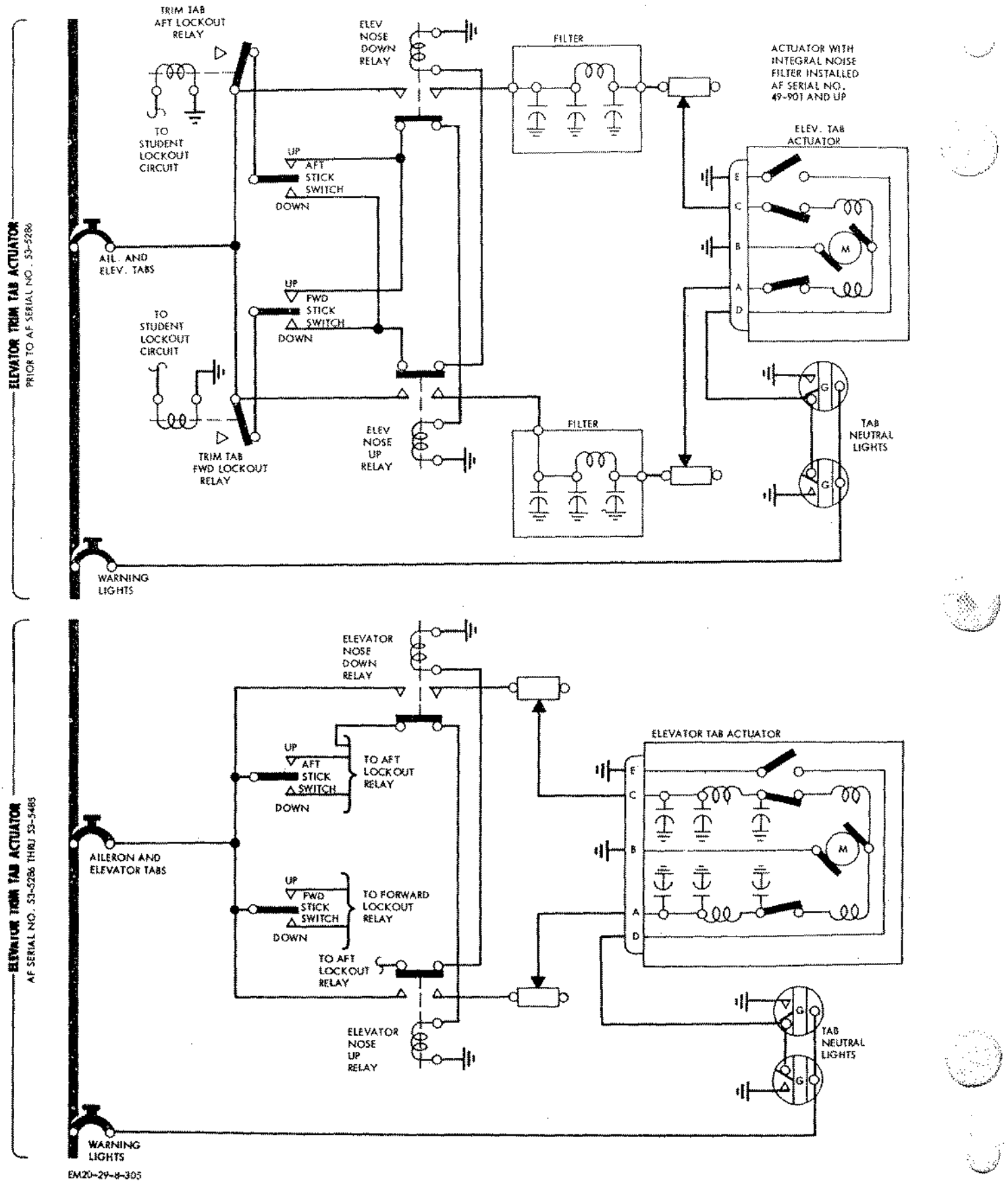


Figure 8-2. Simplified Electrical Diagrams (Sheet 18 of 34)

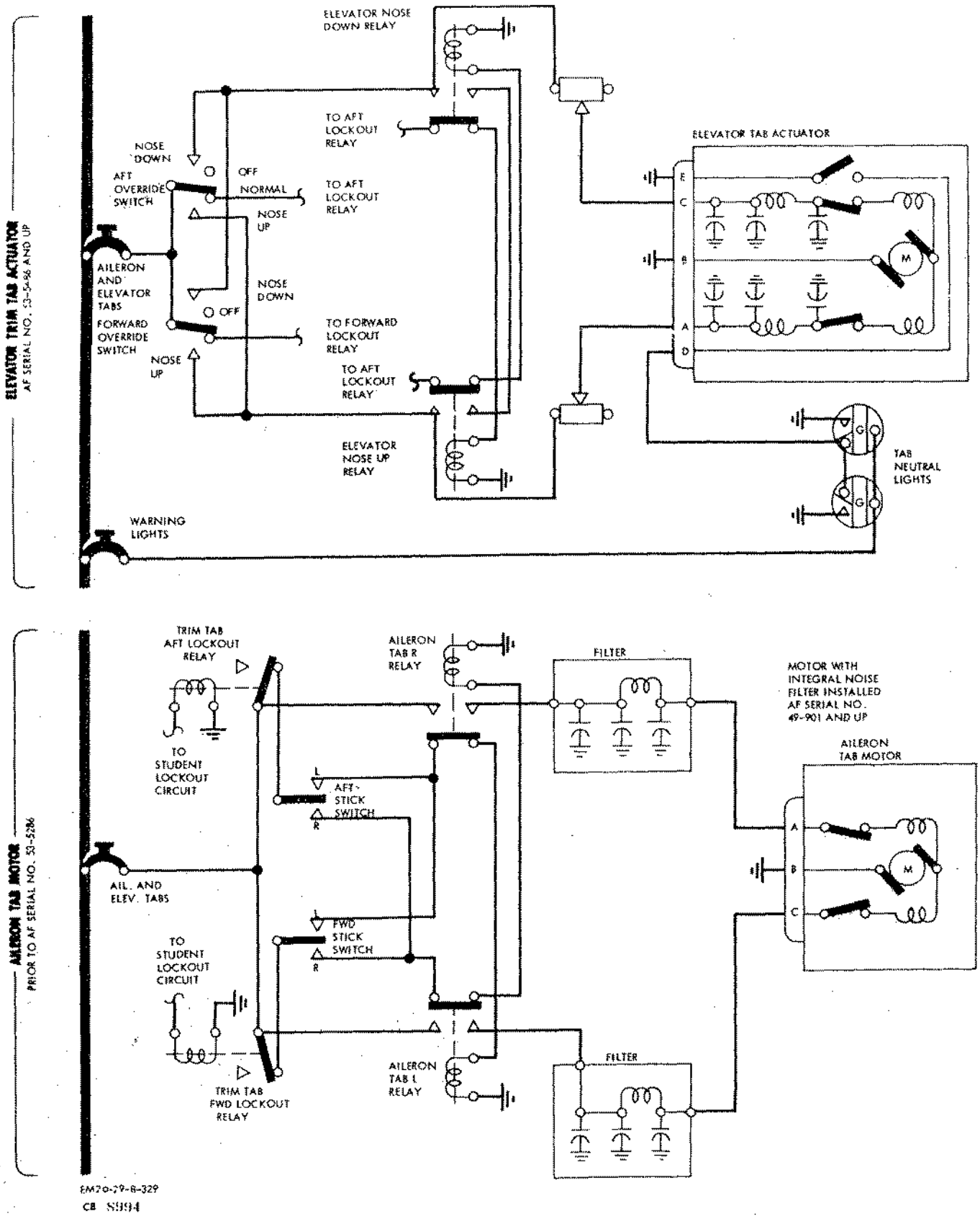
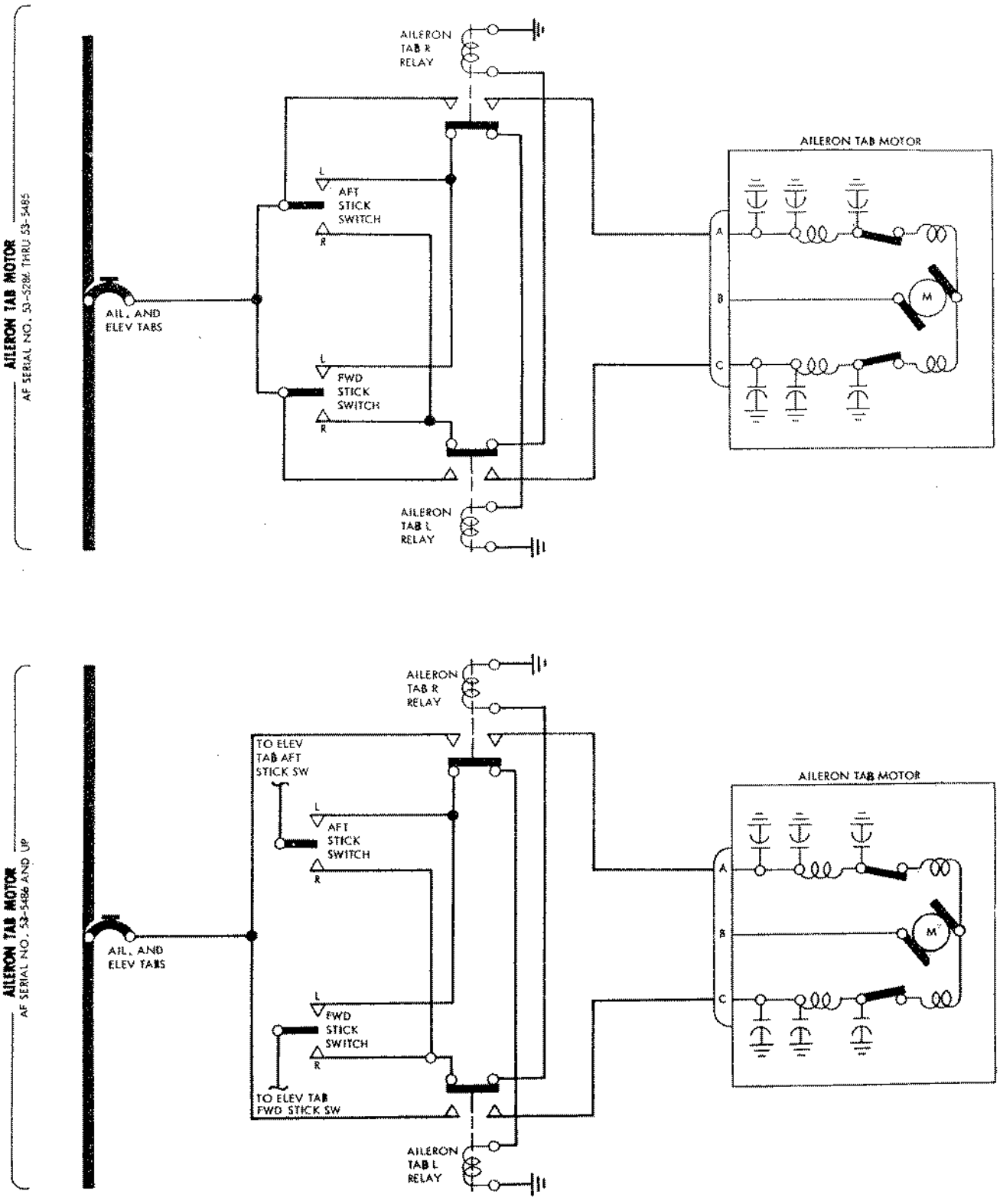
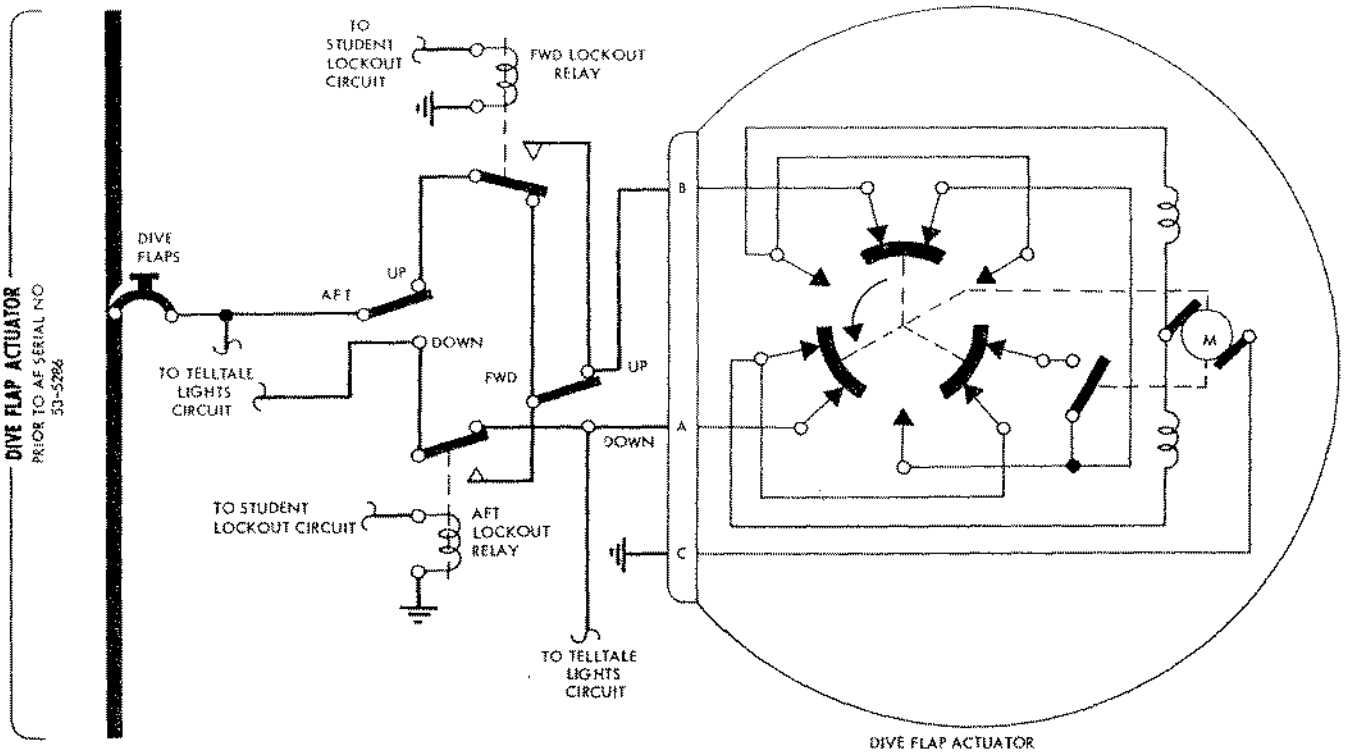


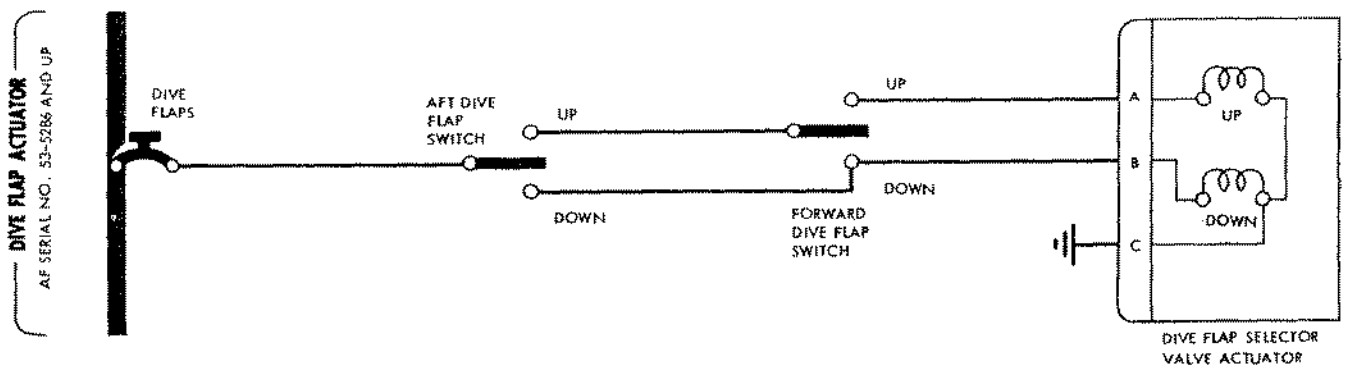
Figure 8-2. Simplified Electrical Diagrams (Sheet 19 of 34)



EM20-2BB-8-330
CB 8-134

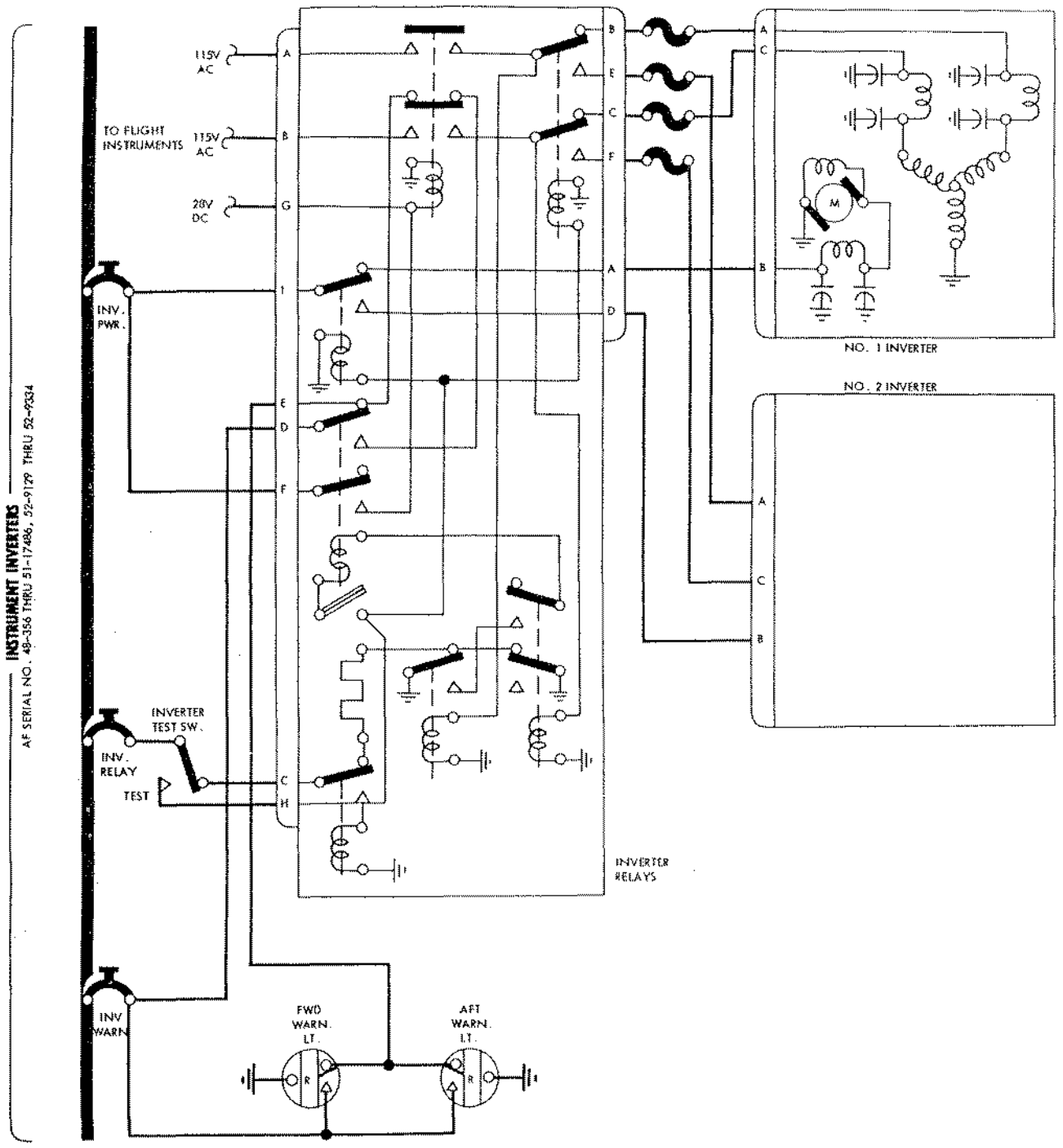
Figure 8-2. Simplified Electrical Diagrams (Sheet 20 of 34)





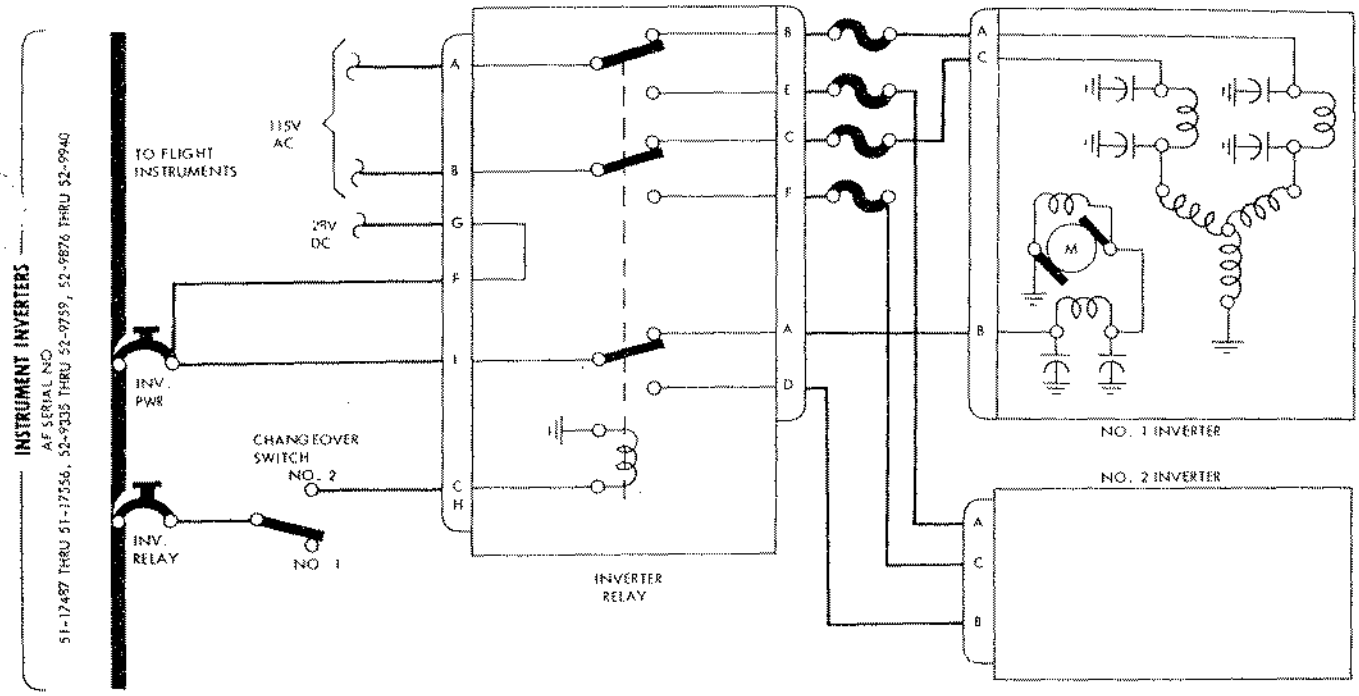
CB 7272
EM-20-27-8-306

Figure 8-2. Simplified Electrical Diagrams (Sheet 21 of 34)



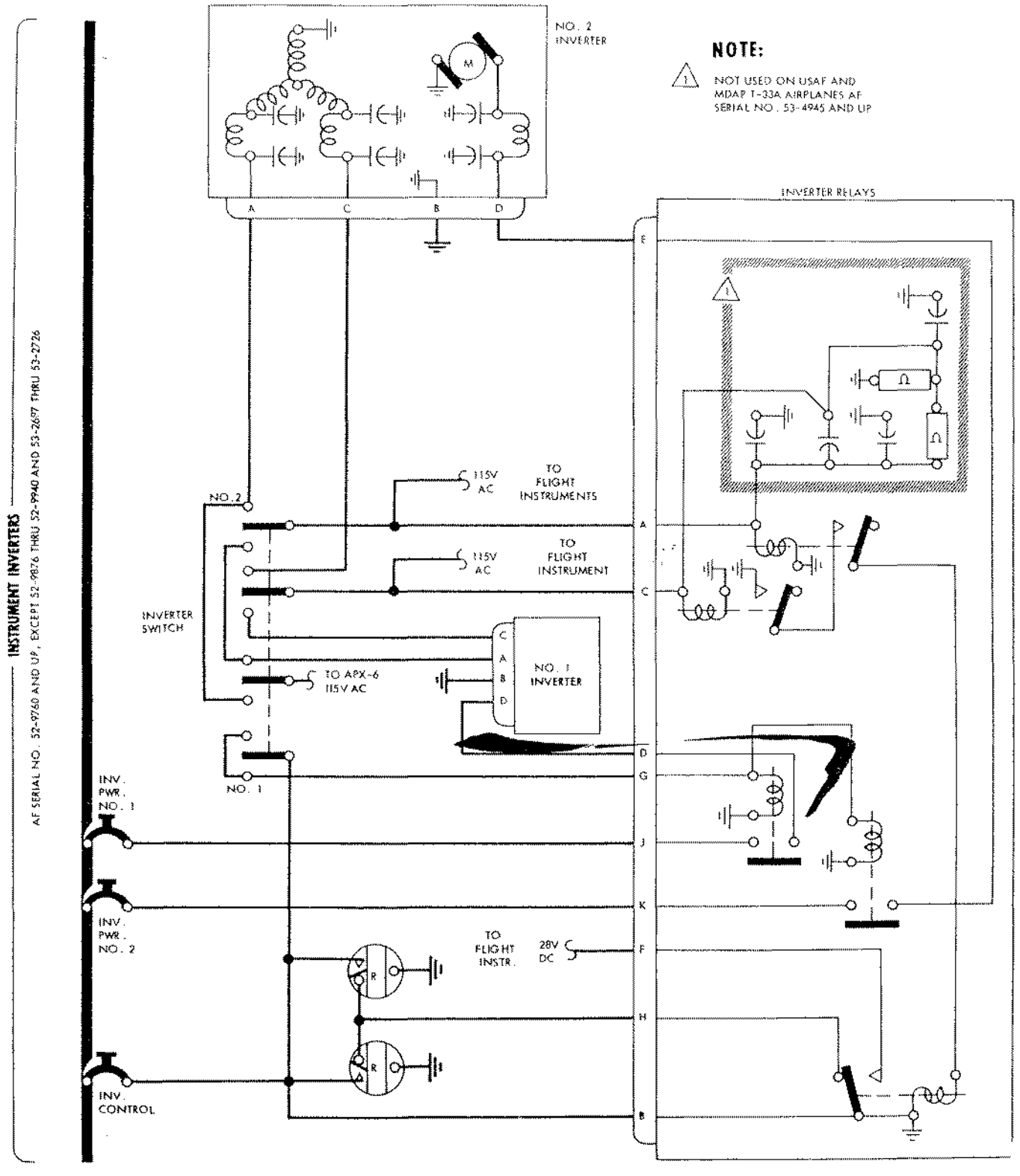
GB 8874
M20-48D-8-307

Figure 8-2. Simplified Electrical Diagrams (Sheet 22 of 34)



CB 6788
EM-20-26-8-30B

Figure 8-2. Simplified Electrical Diagrams (Sheet 23 of 34)



CB 6840
EM-20-26-B-309

Figure 8-2. Simplified Electrical Diagrams (Sheet 24 of 34)

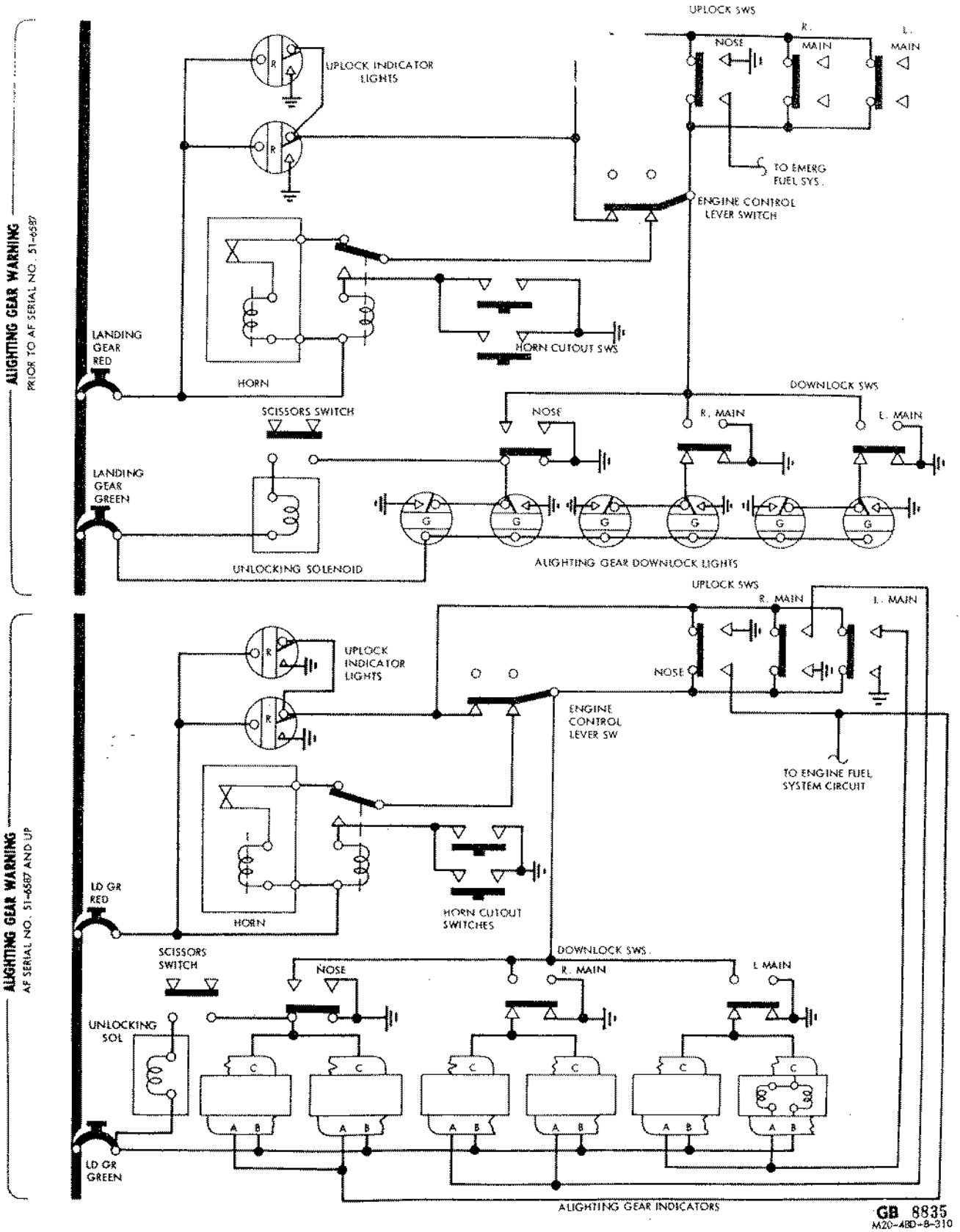
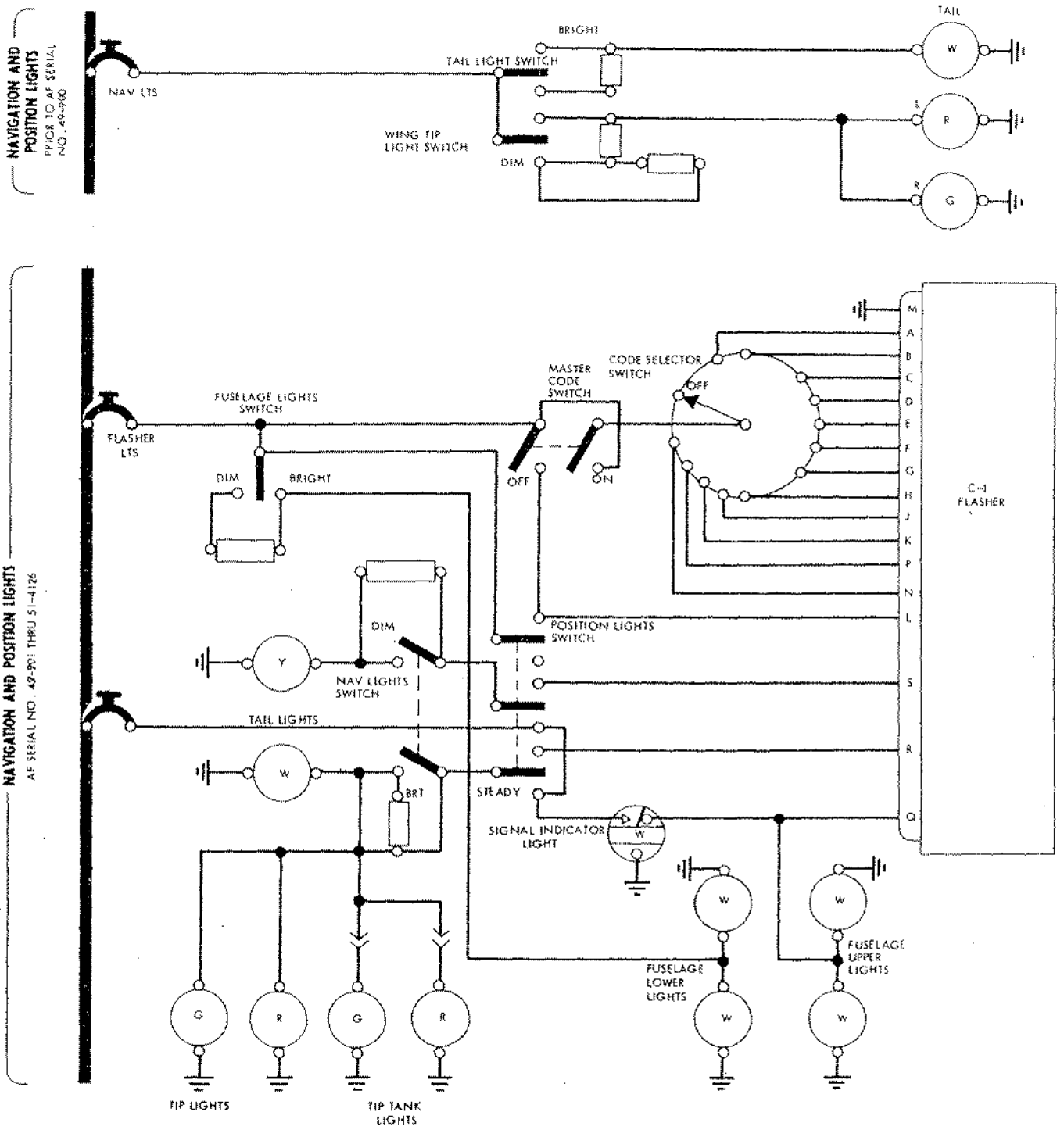
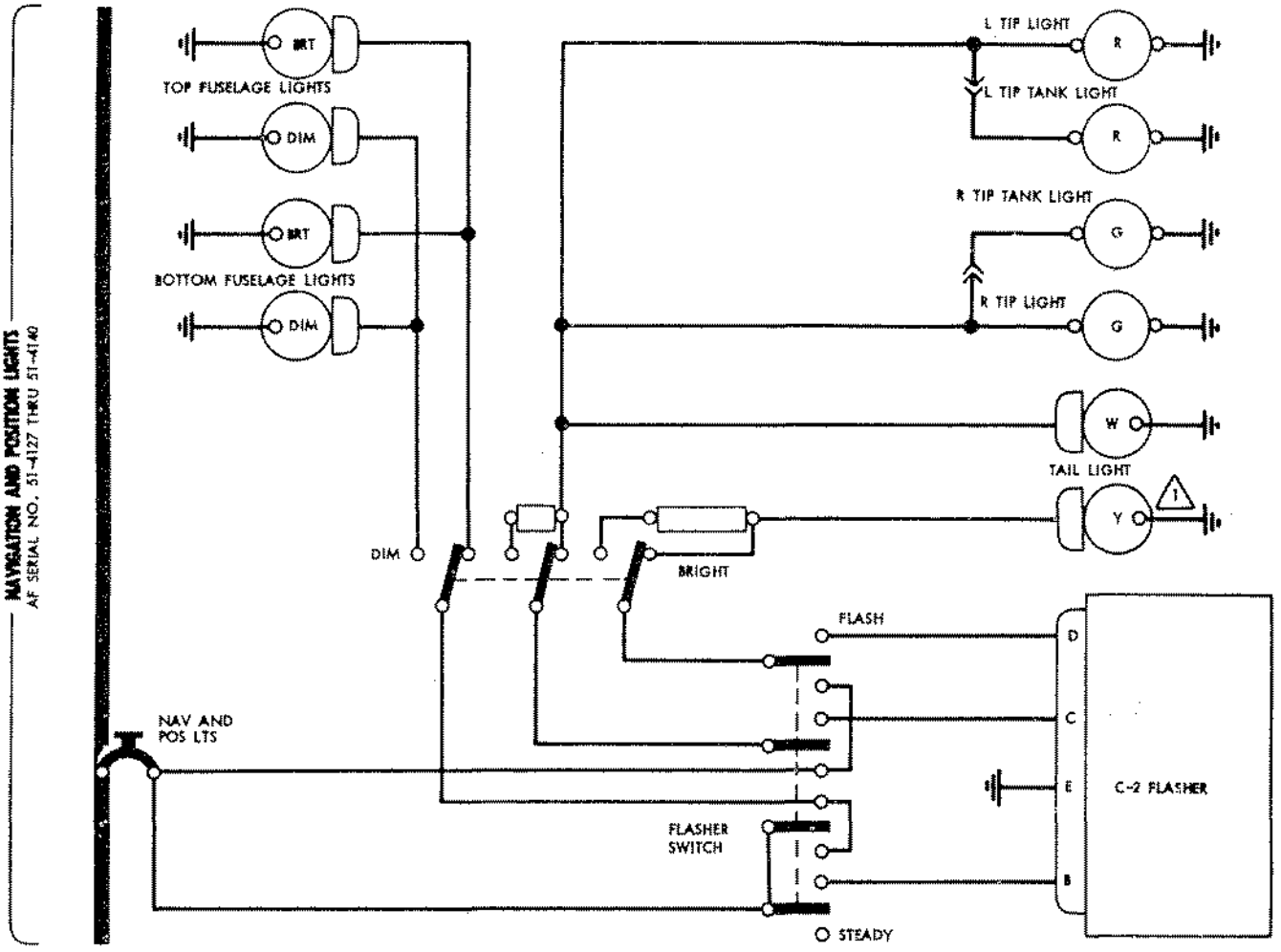


Figure 8-2. Simplified Electrical Diagrams (Sheet 25 of 34)



CB 6841
EM-20-26-8-311

Figure 8-2. Simplified Electrical Diagrams (Sheet 26 of 34)

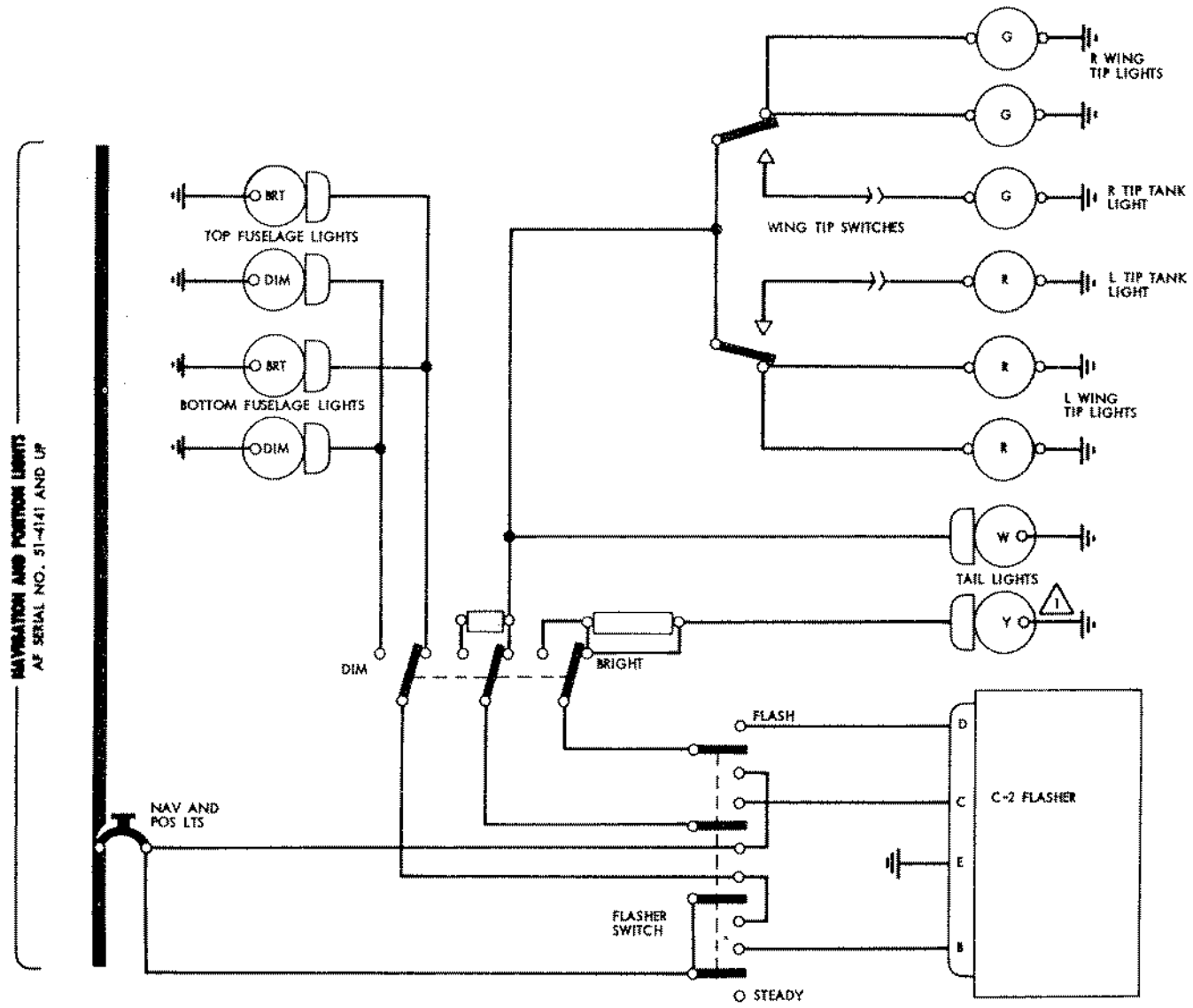


NOTE

1 WHEN ALTERNATE MOTOR-FLASHER, MS-24577-2, IS USED THE YELLOW TAIL LIGHT IS CHANGED TO WHITE

NG 05356
EM20-58-4-312

Figure 8-2. Simplified Electrical Diagrams (Sheet 27 of 34)

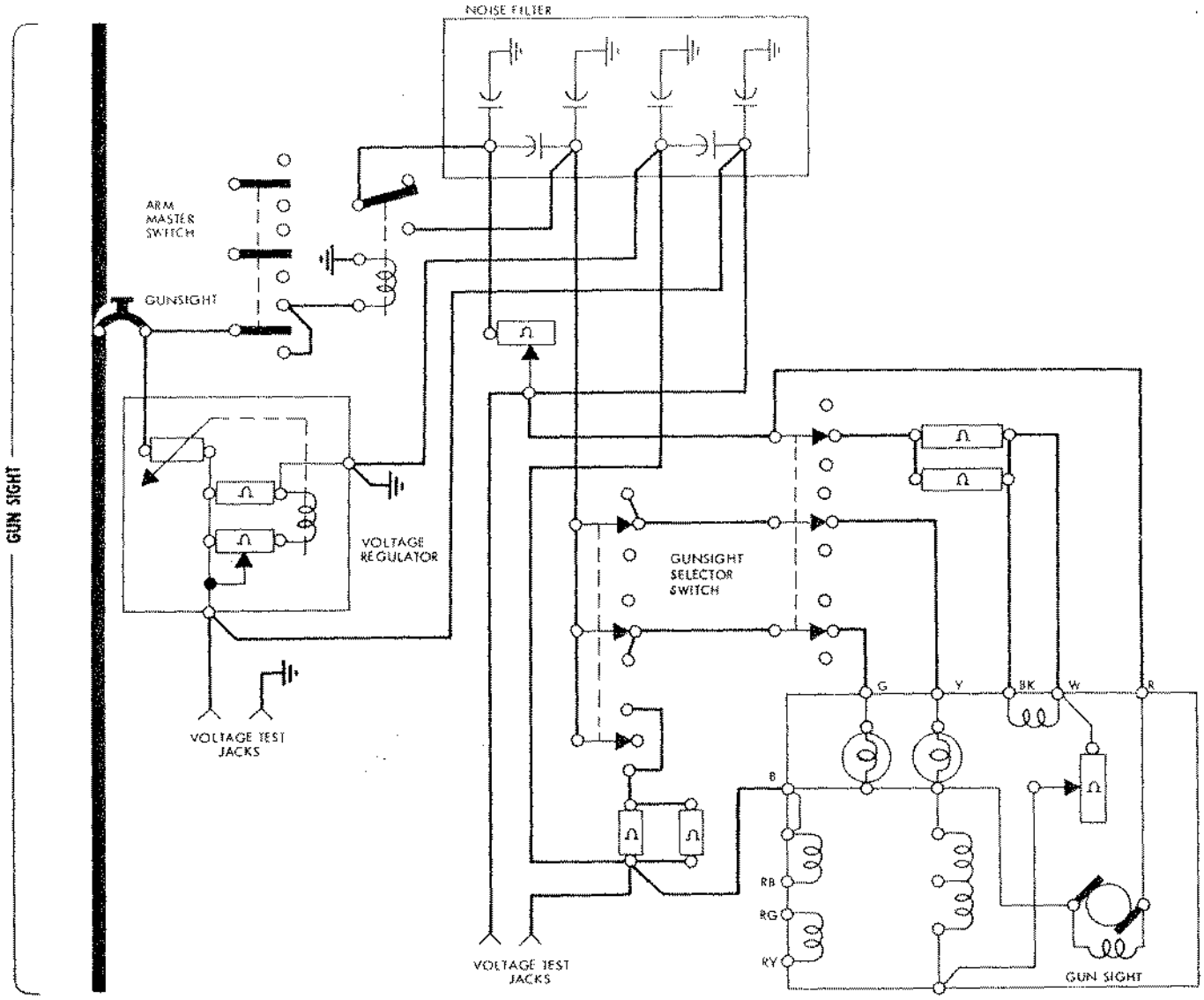


NOTE

1 WHEN ALTERNATE MOTOR-FLASHER, MS-24577-2, IS USED THE YELLOW TAIL LIGHT IS CHANGED TO WHITE

HG 05355
EM20-58-8-313

Figure 8-2. Simplified Electrical Diagrams (Sheet 28 of 34)



CB 6790
EM-20-26-8-314

Figure 8-2. Simplified Electrical Diagrams (Sheet 29 of 34)

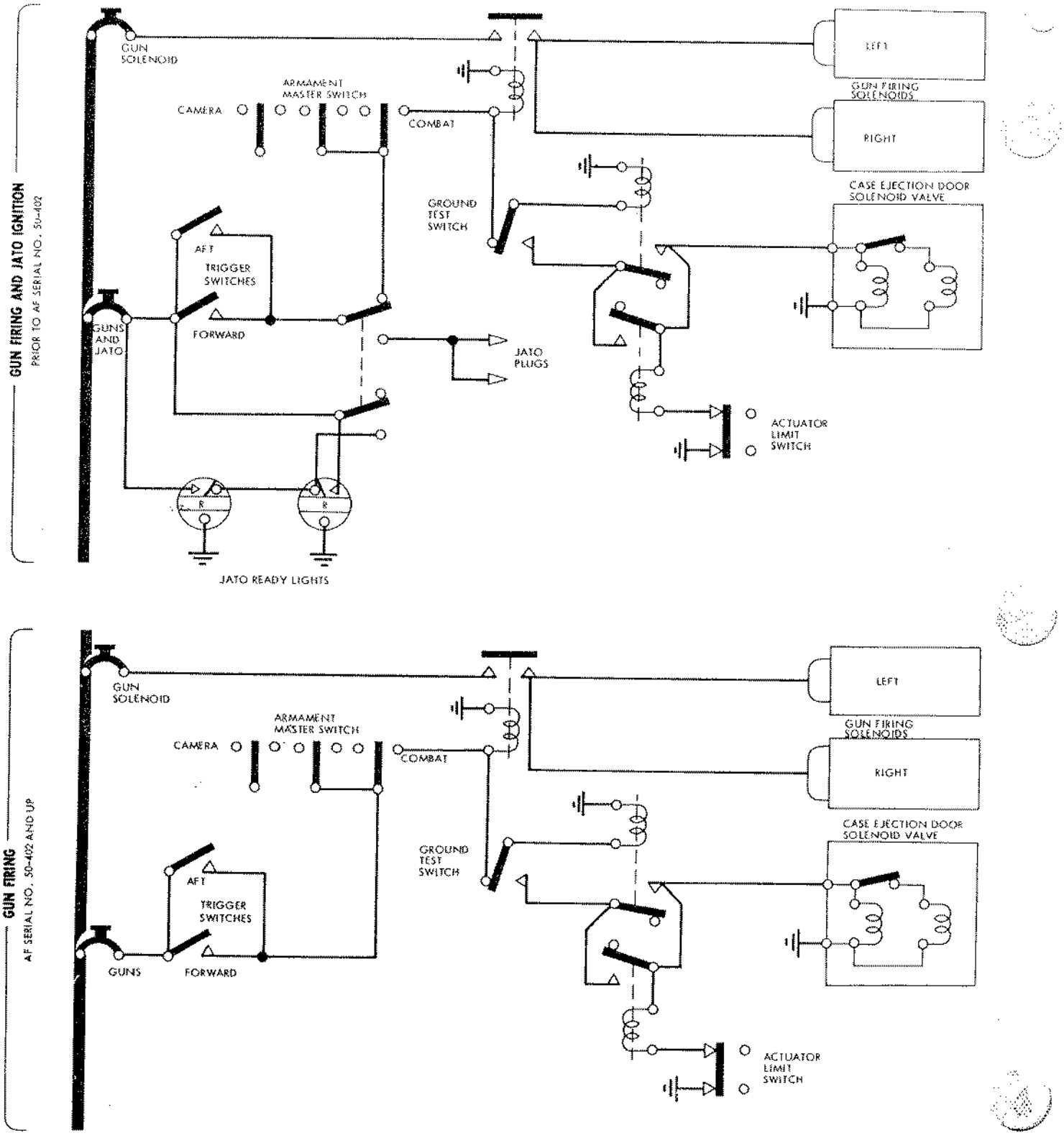
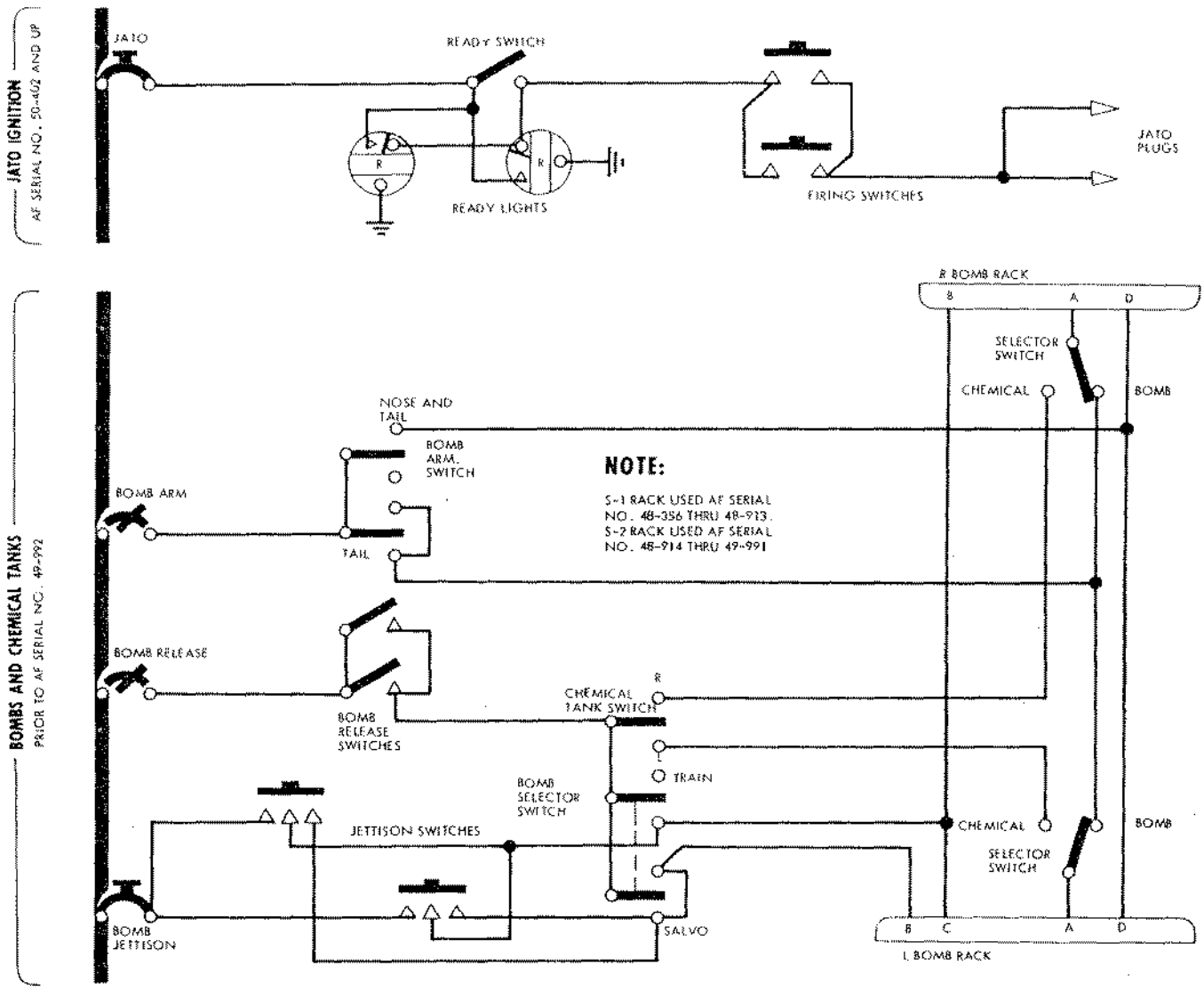


Figure 8-2. Simplified Electrical Diagrams (Sheet 30 of 34)



CB 6791
EM-20-26-8-316

Figure 8-2. Simplified Electrical Diagrams (Sheet 31 of 34)

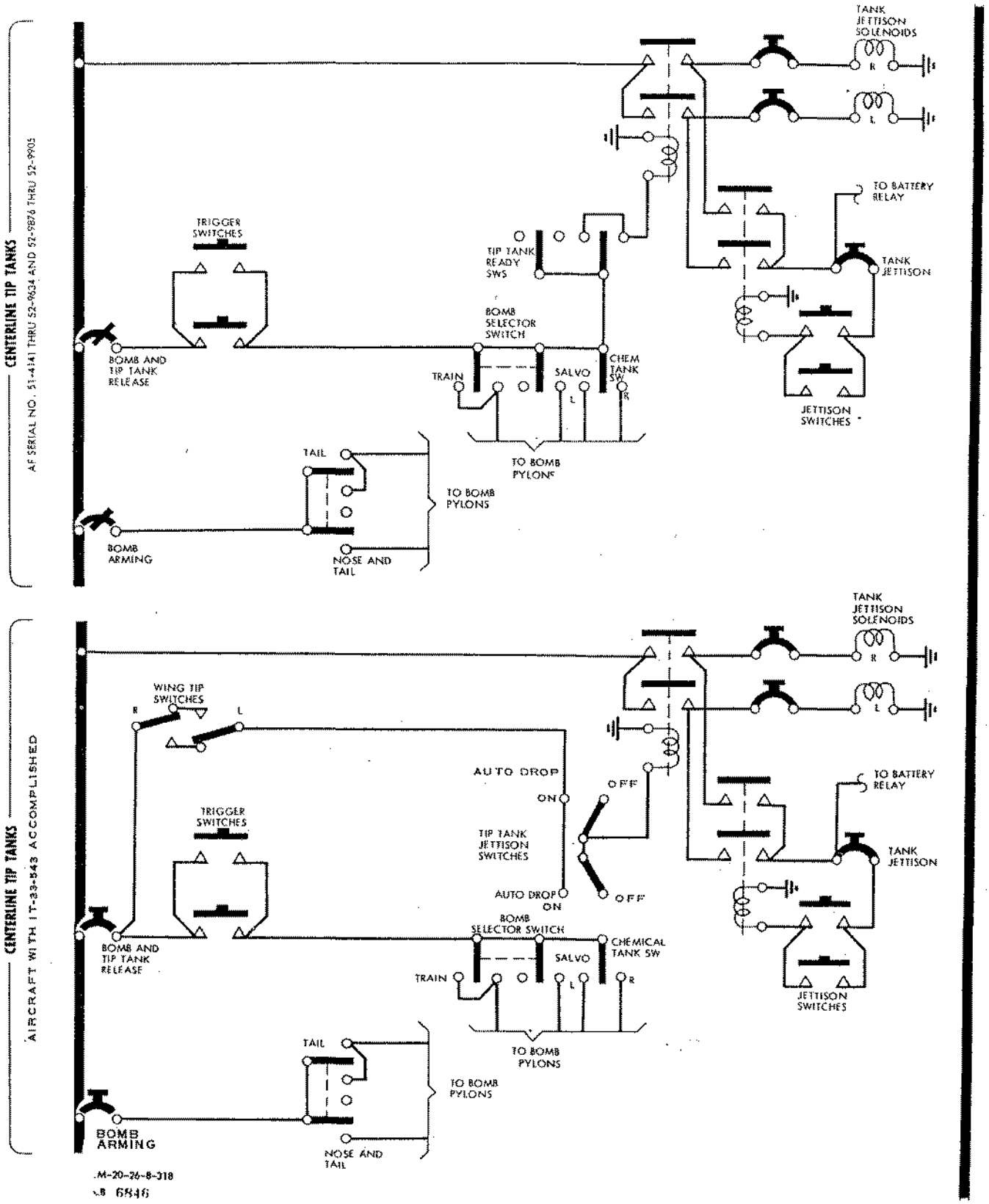
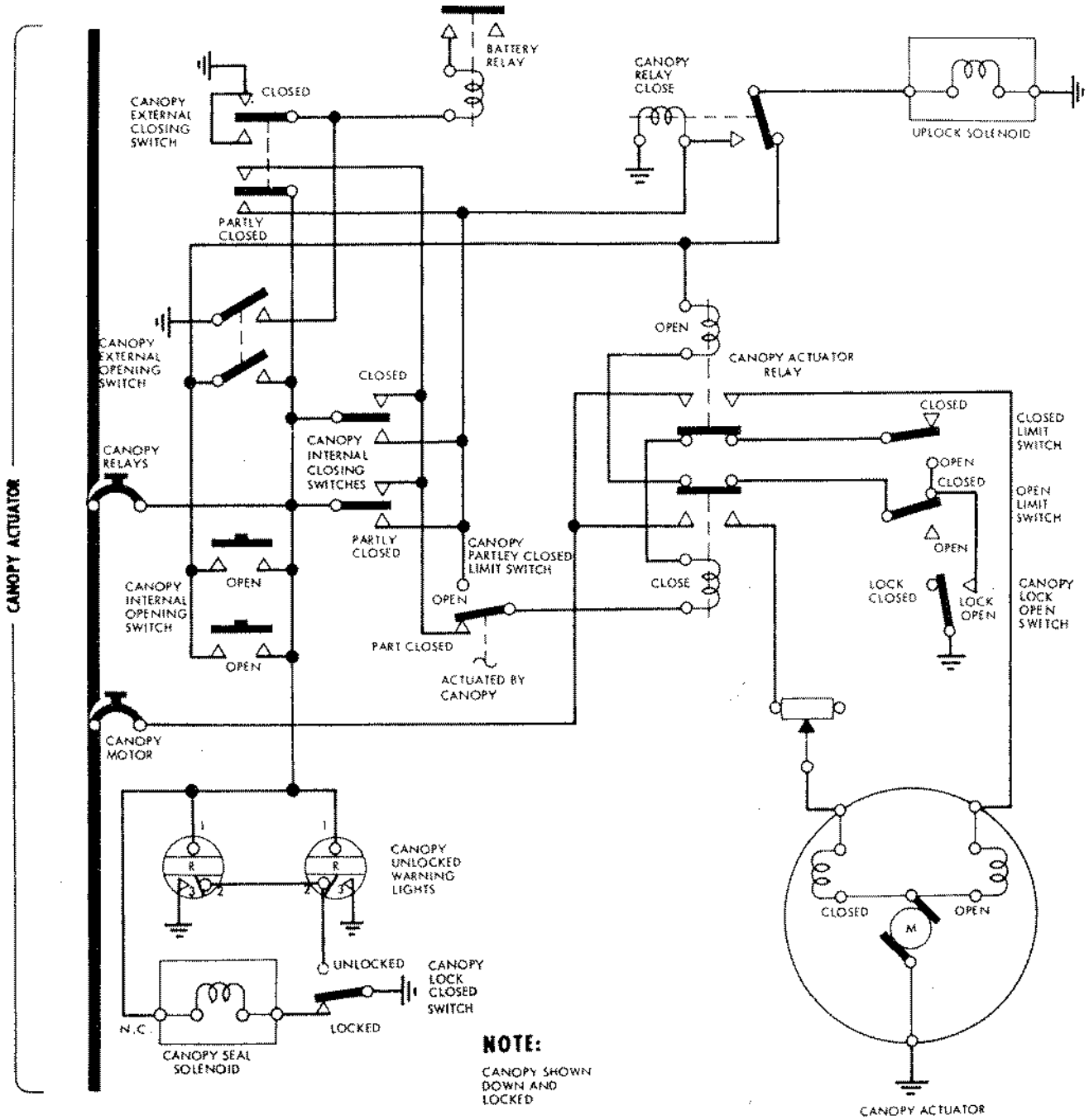
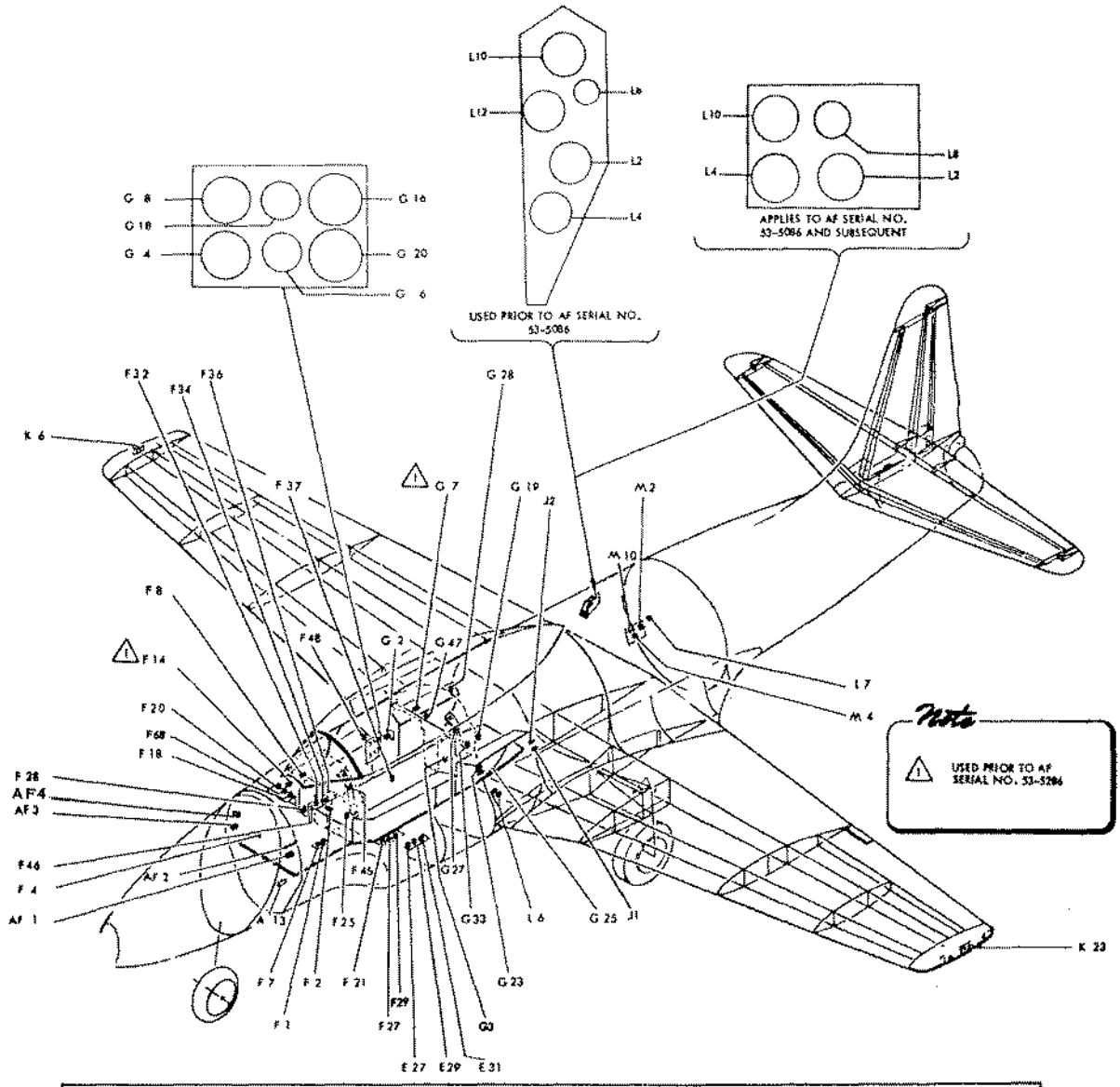


Figure 8-2. Simplified Electrical Diagrams (Sheet 33 of 34)



GB 3546
EM20-44-8-319

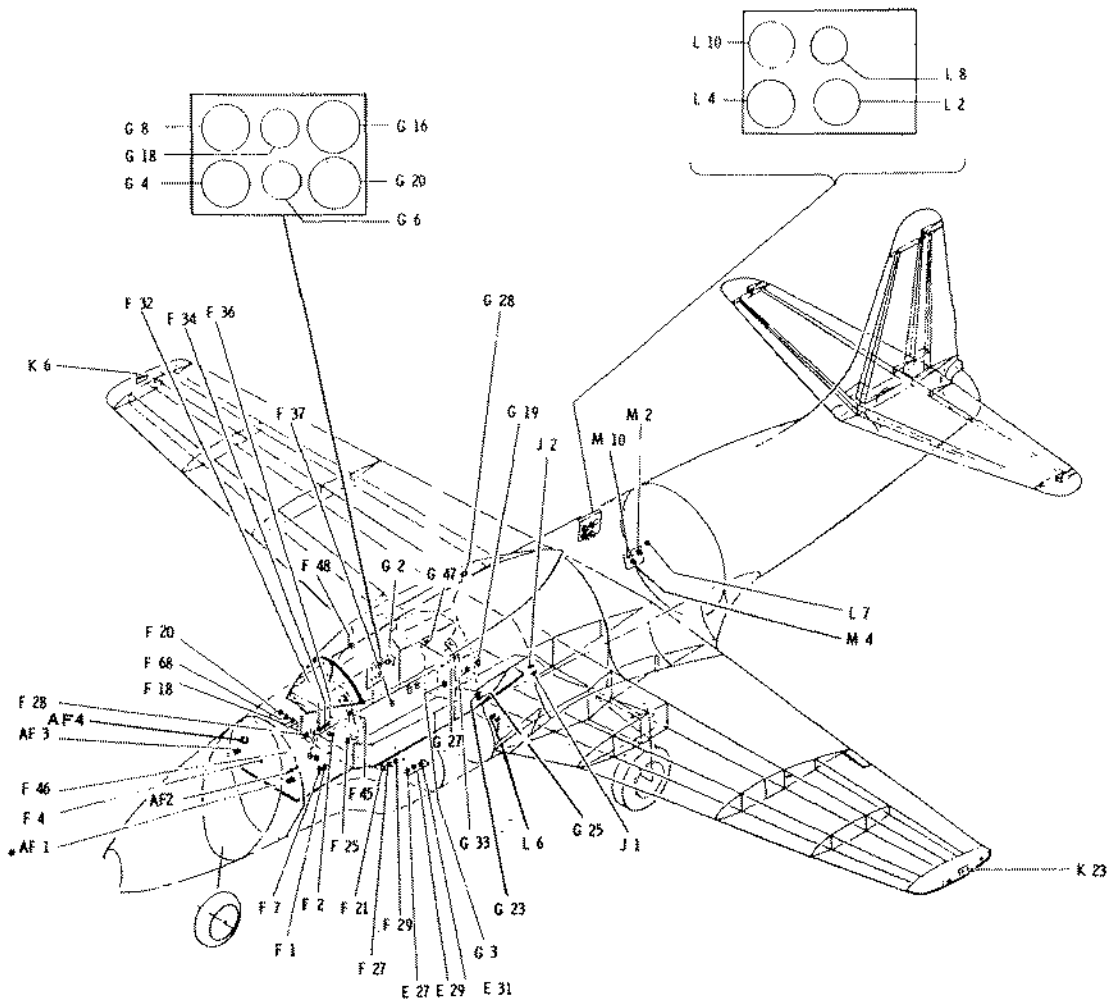
Figure 8-2. Simplified Electrical Diagrams (Sheet 34 of 34)



REF.	LOCATION	REF.	LOCATION	REF.	LOCATION
A13	GUN SIGHT VOLTAGE TEST	F36	R FLOOR—F.S. 136—AFT	G18	CROSS SHIP—F.S. 163+9—CENTER UPPER
AF1	LEFT F.S. 103	F37	FWD SEAT	G19	AFT SEAT
AF2	ARN-6, F.S. 103	F45	FWD CONTROL STICK	G20	CROSS SHIP—F.S. 163+9—AFT LOWER
AF3	RIGHT F.S. 103	F46	THERMOCOUPLE	G23	AFT UPPER SWITCH PANEL
AF4	RIGHT F.S. 103	F48	FWD SPOT LIGHT	G25	AFT LOWER SWITCH PANEL
F1	L UPPER INSTR PANEL—F.S. 111—AFT	F68	R UPPER INSTR. PANEL—F.S. 119.5—CENTER	G27	AFT CONTROL STICK
F2	R FWD CENTER STAND	E27	SUB-COCKPIT CROSS SHIP—F.S. 152—FWD	G28	AFT SPOT LIGHT
F4	R FWD FLOOR—F.S. 108	E29	SUB-COCKPIT CROSS SHIP—F.S. 152—CENTER	G33	AFT SUB-INSTR. PANEL
F7	L SUB INSTR PANEL—F.S. 111—FWD	E31	SUB-COCKPIT CROSS SHIP—F.S. 152—AFT	G47	AFT RADIO PANEL
F8	GUN SIGHT	G2	RELAY—F.S. 163+13	J1	L WING—R WHEEL WELL
⚠1 F14	FWD TELLTALE LIGHTS	G3	AFT STICKWELL	J2	R WING—R WHEEL WELL
F18	R UPPER INSTR PANEL—F.S. 119.5—INBD	G4	CROSS SHIP—F.S. 163+9—FWD LOWER	K6	R TIP TANK
F20	R SUB INSTR PANEL—F.S. 119.5—OUTBD	G6	CROSS SHIP—F.S. 163+9—CENTER LOWER	K23	L TIP TANK
F21	L FLOOR—F.S. 136—FWD	⚠1 G7	AFT TELLTALE LIGHTS	L2	ENGINE SECTION—CENTER
F25	FWD STICKWELL	G8	CROSS SHIP—F.S. 163+9—FWD UPPER	L4	ENGINE SECTION—LOWER
F27	L FLOOR—F.S. 136—CENTER	G16	CROSS SHIP—F.S. 163+9—AFT UPPER	L6	ENGINE SEAL THERMOCOUPLE
F28	GYROSYN COMPASS, R FWD FLOOR			L7	ENGINE
F29	L FLOOR—F.S. 136—AFT			L8	FLUX VALVE
F32	R FLOOR—F.S. 136—FWD			L10	ENGINE SECTION—UPPER
F34	R FLOOR—F.S. 126—CENTER			M2	AFT FUSELAGE
				M4	GYROSYN COMPASS
				M10	THERMOCOUPLE

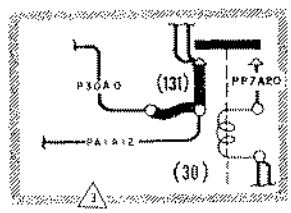
M20-480-8-183
GB 8836

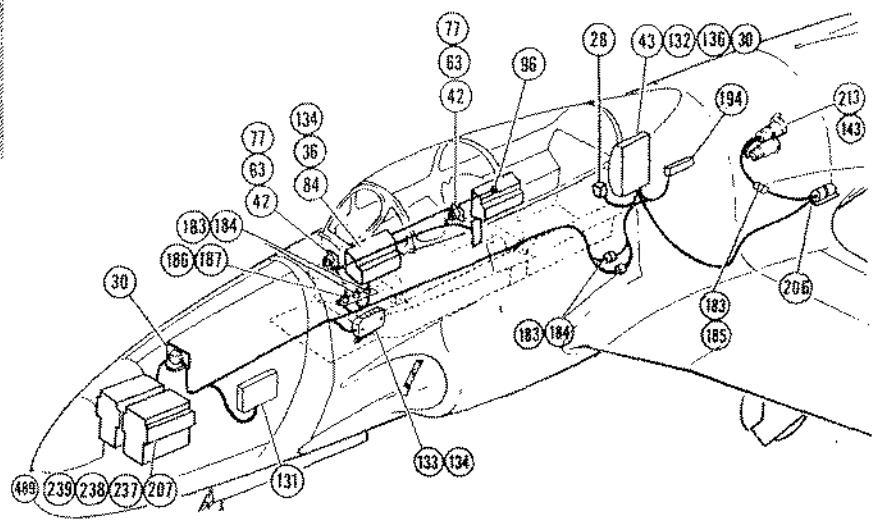
Figure 8-3. Connector Location Diagram, T-33A-1.



REF.	LOCATION	REF.	LOCATION	REF.	LOCATION	REF.	LOCATION
AF1	LEFT F.S. 103	F34	R FLOOR - F.S. 126 - CENTER	G6	CROSS SHIP - F.S. 163 + 9 - CENTER LOWER	G57	AFT SUB INST L DISC
AF2	ARN-6, F.S. 103	F36	R FLOOR - F.S. 136 - AFT	G7	AFT LWR INST PANEL DISC	J1	L WING - R WHEEL WELL
AF3	RIGHT F.S. 103	F37	FWD SEAT	G8	CROSS SHIP - F.S. 163 + 9 - FWD UPPER	J2	R WING - R WHEEL WELL
AF4	RIGHT F.S. 103	F45	FWD CONTROL STICK	G16	CROSS SHIP - F.S. 163 + 9 - AFT UPPER	K6	R TIP TANK
F1	L UPPER INSTR PANEL - F.S. 111 - AFT	F46	THERMOCOUPLE	G18	CROSS SHIP - F.S. 163 + 9 - CENTER UPPER	K23	L TIP TANK
F2	R FWD CENTER STAND	F48	FWD SPOT LIGHT	G19	AFT SEAT DISC.	L2	ENGINE SECTION - CENTER
F4	R FWD FLOOR - F.S. 108	F68	R UPPER INSTR. PANEL - F.S. 119.5 - CENTER	G20	CROSS SHIP - F.S. 163 + 9 - AFT LOWER	L4	ENGINE SECTION - LOWER
F7	L SUB INSTR PANEL - F.S. 111 - FWD	F81	L FWD FLOOR DISC F.S. 106	G23	AFT UPPER SWITCH PANEL	L6	ENGINE SEAL THERMOCOUPLE
F14	FWD LWR INST PANEL DISC	F82	L FWD FLOOR DISC F.S. 108	G25	AFT LOWER SWITCH PANEL	L7	ENGINE
F18	R UPPER INSTR PANEL - F.S. 119.5 - INBD	F85	FWD RH UPPER INST PANEL DISC	G27	AFT CONTROL STICK	L8	FLUX VALVE
F20	R SUB INSTR PANEL - F.S. 119.5 - OUTBD	E27	SUB-COCKPIT CROSS SHIP - F.S. 152 - FWD	G28	AFT SPOT LIGHT	L10	ENGINE SECTION - UPPER
F21	L FLOOR - F.S. 136 - FWD	E29	SUB-COCKPIT CROSS SHIP - F.S. 152 - CENTER	G33	AFT SUB-INSTR. PANEL	M2	AFT FUSELAGE
F25	FWD STICKWELL	E31	SUB-COCKPIT CROSS SHIP - F.S. 152 - AFT	G47	AFT RADIO PANEL	M4	GYROSYN COMPASS
F27	L FLOOR - F.S. 136 - CENTER	G2	RELAY - F.S. 163 + 13	G55	AFT STICKWELL FWD DISC	M10	THERMOCOUPLE
F28	GYROSYN COMPASS, R FWD FLOOR	G3	AFT STICKWELL	G56	AFT STICKWELL AFT DISC		
F29	L FLOOR - F.S. 136 - AFT	G4	CROSS SHIP - F.S. 163 + 9 - FWD LOWER				
F32	R FLOOR - F.S. 136 - FWD						

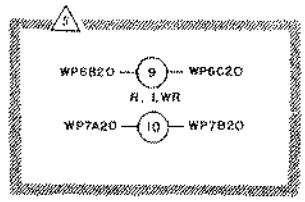
Figure 8-4. Connector Location Diagram, T-33A-5 Airplanes.

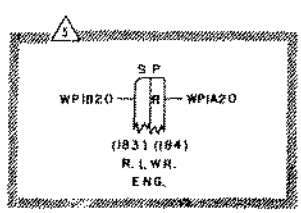




Notes

1. USED ON AF SERIAL NO. 49-922 THROUGH 49-966
2. USED ON AF SERIAL NO. 48-356 THROUGH 49-943
3. BATTERY RELAY LOCATED IN ARMAMENT COMPARTMENT JUNCTION BOX ON AF SERIAL NO. 49-942 THROUGH 49-966
4. USED ON AF SERIAL NO. 48-356 THROUGH 49-900
5. USED ON AF SERIAL NO. 49-901 THROUGH 49-966
6. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586





ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
28	GENERATOR RELAY	GFAE		AN3025-1
30	BATTERY RELAY	GFAE	B-14	AN3380-1
36	RELAY	ELEC. PROD		NB-57C
42	AMMETER	GFAE	J-1	MIL-A-5125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
131	CURRENT LIMITER	BURNDY	200A	FELF
132	CURRENT LIMITER	BURNDY	275A	FLLR
133	CIRCUIT PROTECTOR	SPENCER		PLM105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	CAPACITOR	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
194	EXTERNAL PWR RECPT	KERWOOD		121-0 (45A6343)
206	VOLTAGE REGULATOR	GFAE	1	37R21
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	R-1	2CM7386
237	BATTERY CONNECTOR	AIRESEARCH		60822-2
238	BATTERY CONNECTOR	AIRESEARCH		60822-1
239	BATTERY CONNECTOR	AIRESEARCH		60823A
4 489	BATTERY		MA-2	

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 49-966

HB 1413
EM20-50-8-254

Figure 8-5. Battery and Generator Circuit (Sheet 1 of 2)

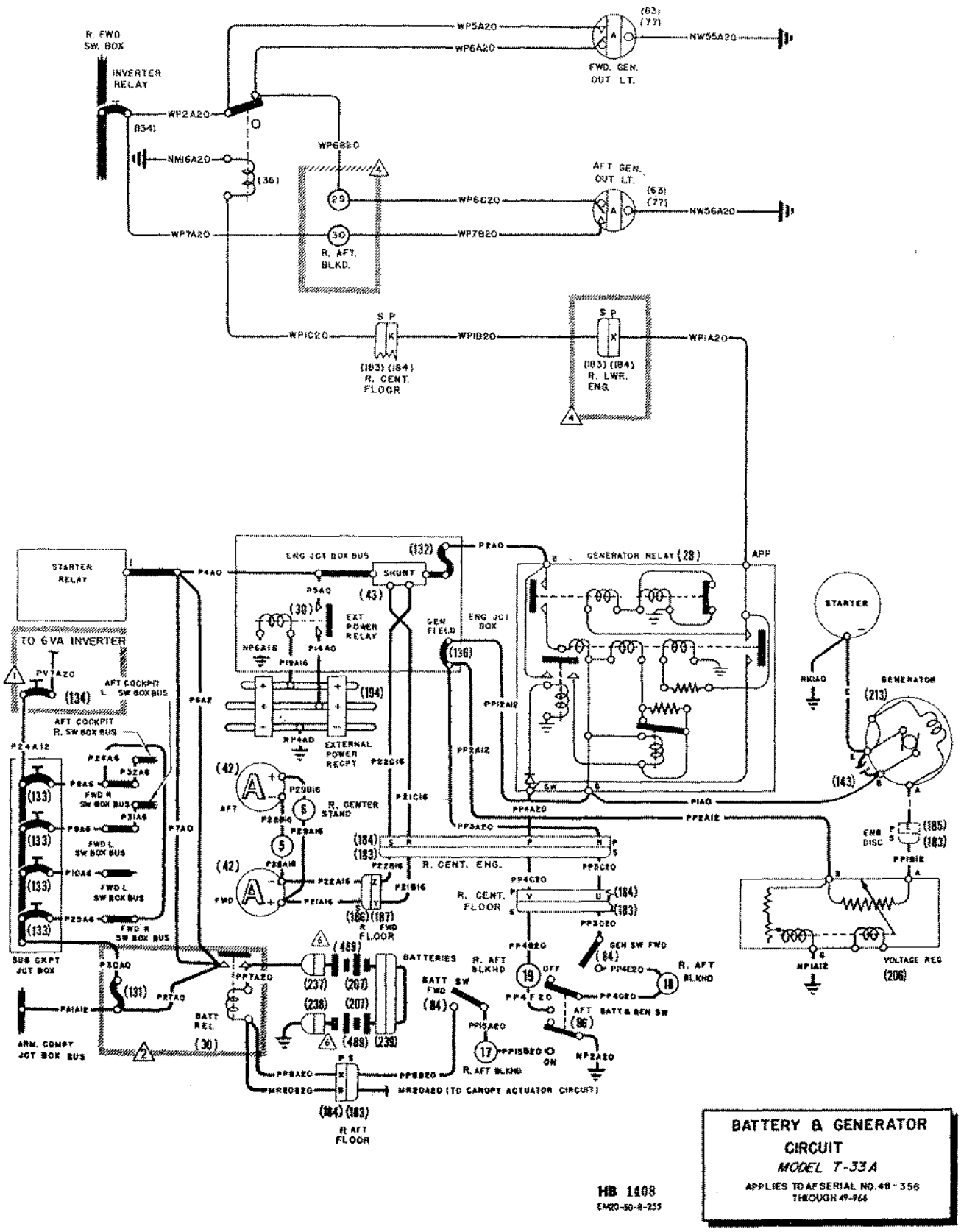
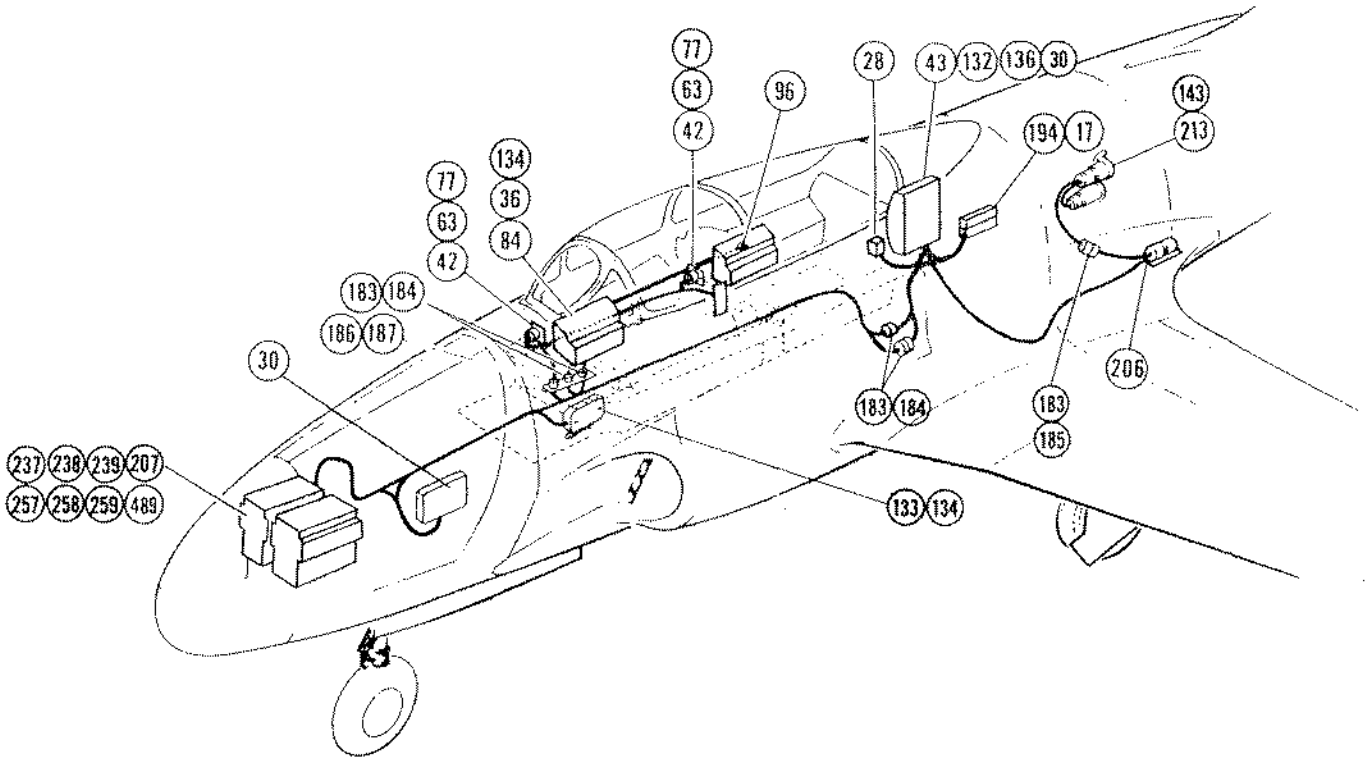


Figure 8-5. Battery and Generator Circuit (Sheet 2 of 2)



Note

1. USED ON AF SERIAL NO. 49-992 THROUGH 51-4089
2. USED PRIOR TO AF SERIAL NO. 49-992
3. NOT GFAE ON AF SERIAL NO. 50-328 THROUGH 51-4089
4. THIS ITEM IS GFAE PRIOR TO AF SERIAL NO. 50-347
5. MFR FOR THIS ITEM IS WESTON ON AF SERIAL NO. 50-368 THROUGH 51-4089
6. USED PRIOR TO AF SERIAL NO. 51-4040
7. USED ON AF SERIAL NO. 51-4040 THROUGH 51-4089
8. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

ITEM	DESCRIPTION	MFR.	TYPE	DWG. OR SPEC.
7 17	EXTERNAL PWR. RECEPT.			AN2552-A3A
28	GENERATOR RELAY	GFAE		AN3025-1
30	BATTERY RELAY	GFAE 4	B-14	AN3390-1
36	RELAY	ELEC. PROD		NB-57C
42	AMMETER	GFAE 5	J-1	MIL-A-5125
3 43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
132	CURRENT LIMITER	BURNDY	275A	FLLH
133	CURRENT LIMITER	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	CAPACITOR	SOLAR	4 MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
6 194	EXTERNAL PWR. RECEPT.	KERWOOD	121-0	45A6343
206	VOLTAGE REGULATOR	GFAE	1	17R21
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	R-1 OR 3633-1	2CM73B6
2 237	BATTERY CONNECTOR	AIRESEARCH		60822-2
2 238	BATTERY CONNECTOR	AIRESEARCH		60822-1
2 239	BATTERY CONNECTOR	AIRESEARCH		60823A
1 257	BATTERY CONNECTOR	BURTON		175-0
1 258	BATTERY CONNECTOR	AIRESEARCH		60851-1
1 259	BATTERY CONNECTOR	AIRESEARCH		60851-3
8 489	BATTERY		MA-2	

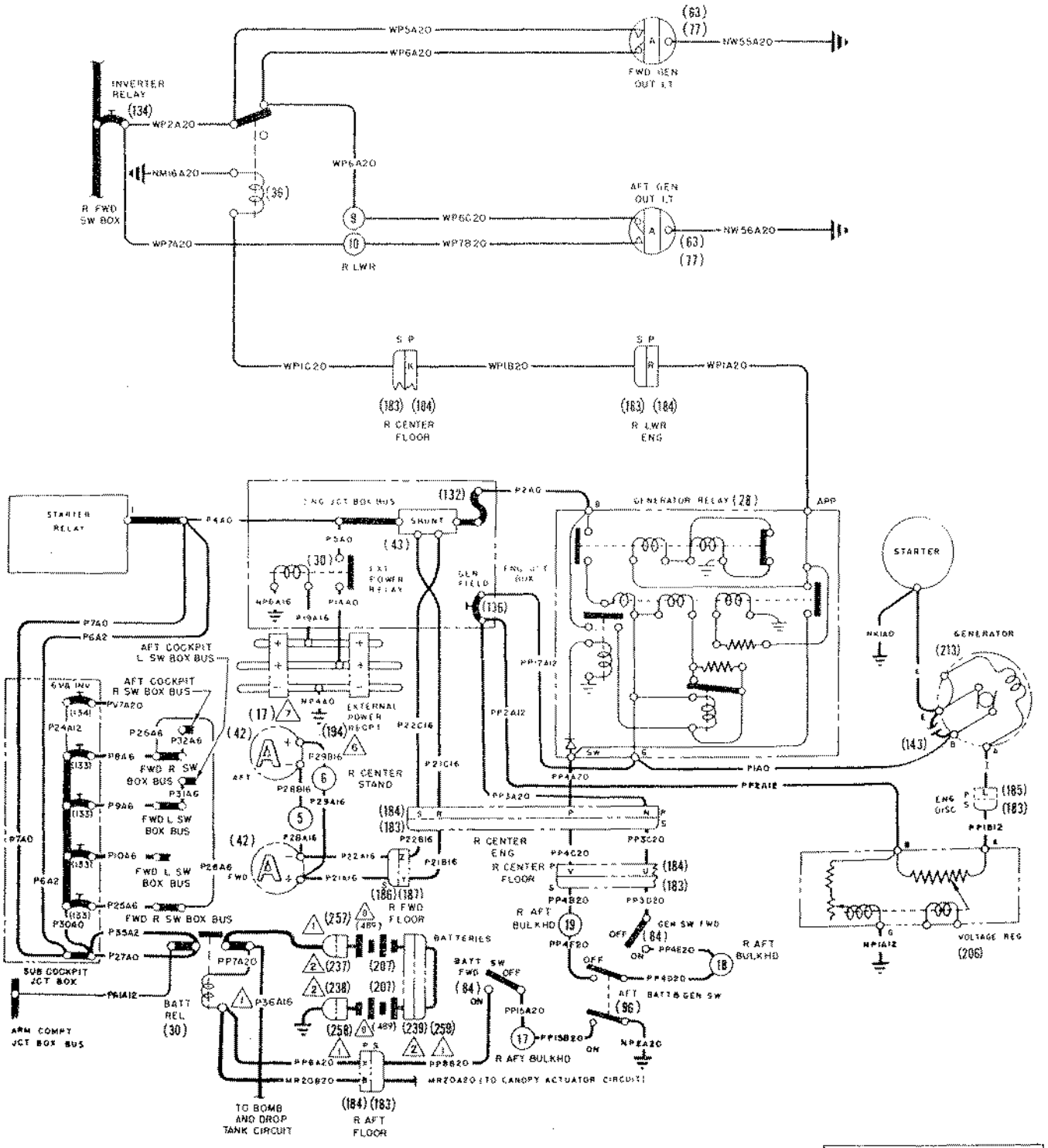
BATTERY AND GENERATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 49-967 THROUGH 51-4089

HB 1538
M20-50-8-256

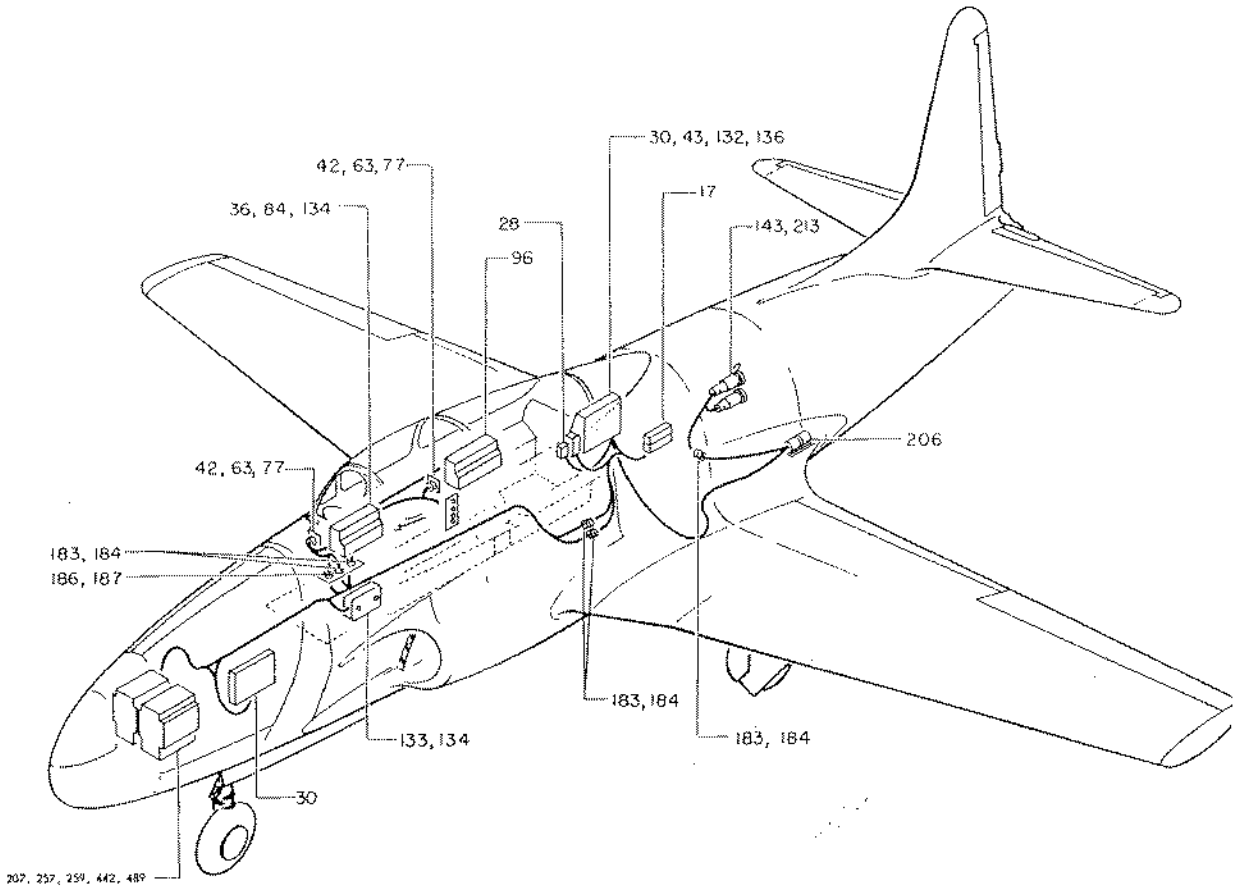
Figure 8-6. Battery and Generator Circuit (Sheet 1 of 2)



BATTERY AND GENERATOR CIRCUIT
MODEL T33A
APPLIES TO AF SERIAL NO. 49-967 THROUGH 51-4089

M20-50-B-257
HB 1644

Figure 8-6. Battery and Generator Circuit (Sheet 2 of 2)



NOTE

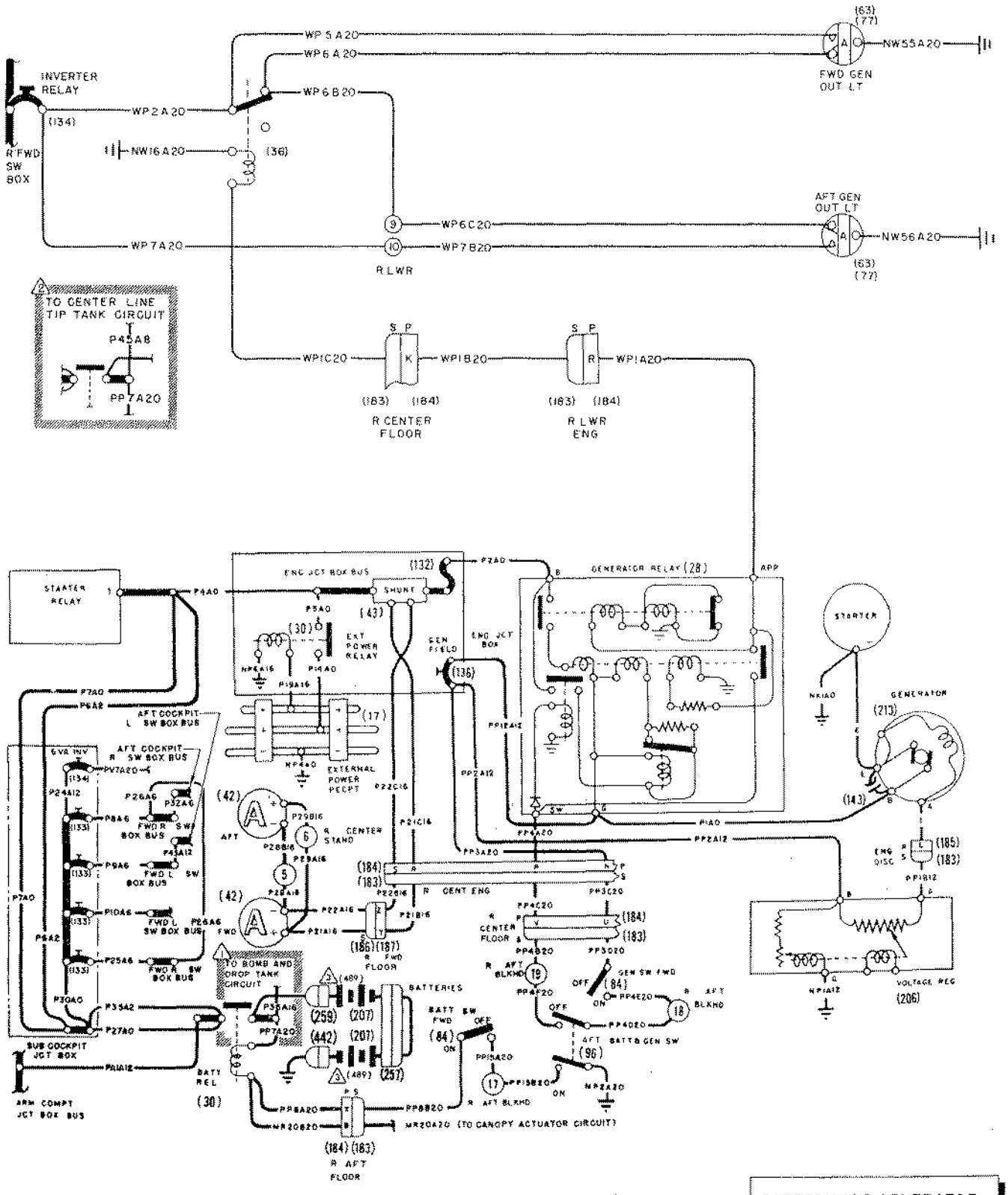
1. USED PRIOR TO AF SERIAL NO. 51-4141
2. USED ON AF SERIAL NO. 51-4141 THROUGH 51-4328
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT.			AN2552-A3A
28	GENERATOR RELAY			AN3025-1
30	BATTERY RELAY		B-14	AN3380-1
36	RELAY	ELEC. PROD.		NB-57C
42	AMMETER		J-1	MIL-A-5125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
132	CURRENT LIMITER	BURNDY	275A	FELH
133	CIRCUIT PROTECTOR	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	CAPACITOR	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
206	VOLTAGE REGULATOR	GFAE	1	17825
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	R-1	2CM7386
257	BATTERY CONNECTOR	BURTON		175-0
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
442	BATTERY CONNECTOR	AIRESEARCH		60851-5
2 489	BATTERY		MA-2	

HB 1410
M20-50-8-258

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4090 THROUGH 51-4328

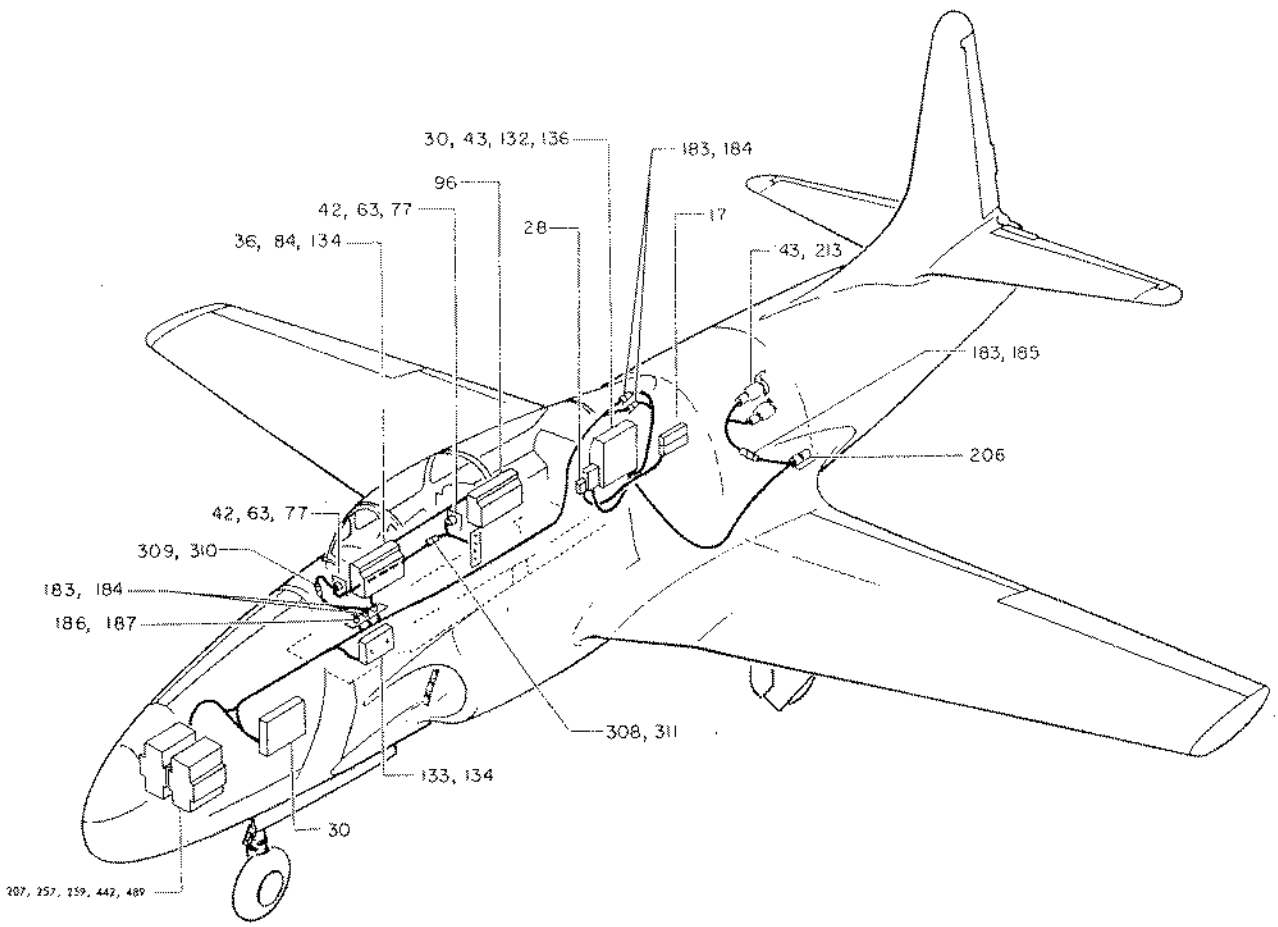
Figure 8-7. Battery and Generator Circuit (Sheet 1 of 2)



BATTERY AND GENERATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4090 THROUGH 51-4328

MB 1407
M20-50-8-259

Figure 8-7. Battery and Generator Circuit (Sheet 2 of 2)



NOTE

⚠1 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT			AN2552-A3A
28	GENERATOR RELAY			AN3025-1
30	RELAY		B-14	AN3380-1
36	RELAY	ELEC. PROD.		NB-57C
42	AMMETER		J-1	MIL-A-5325
43	SHUNT	GFAE		AN5200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-3E3
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
132	CURRENT LIMITER	BURNDY	275A	FLLH
133	CIRCUIT PROTECTOR	SPENCER		PLA6-10S
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	CAPACITOR	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
206	VOLTAGE REGULATOR	GFAE	1	17R21
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	B-1	2GA7386
257	BATTERY CONNECTOR	BURTON		175-6
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
⚠1 442	BATTERY CONNECTOR	AIRESEARCH		60851-5
⚠1 489	BATTERY		MA-2	

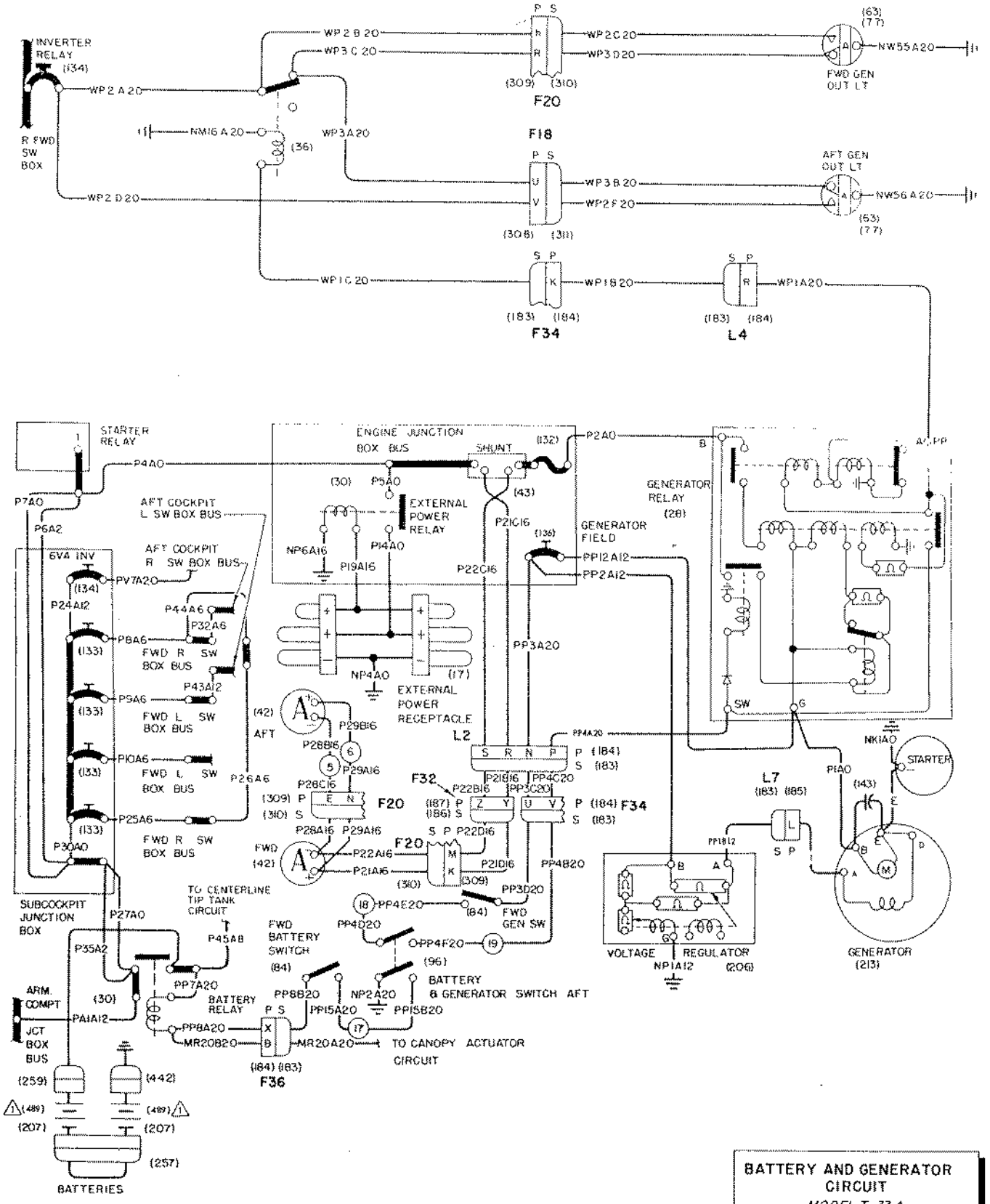
BATTERY AND GENERATOR CIRCUIT

MODEL T-33 A

APPLIES TO AF SERIAL NO. 51-4329 THROUGH 51-6818

HB 1411
M20-50-8-260

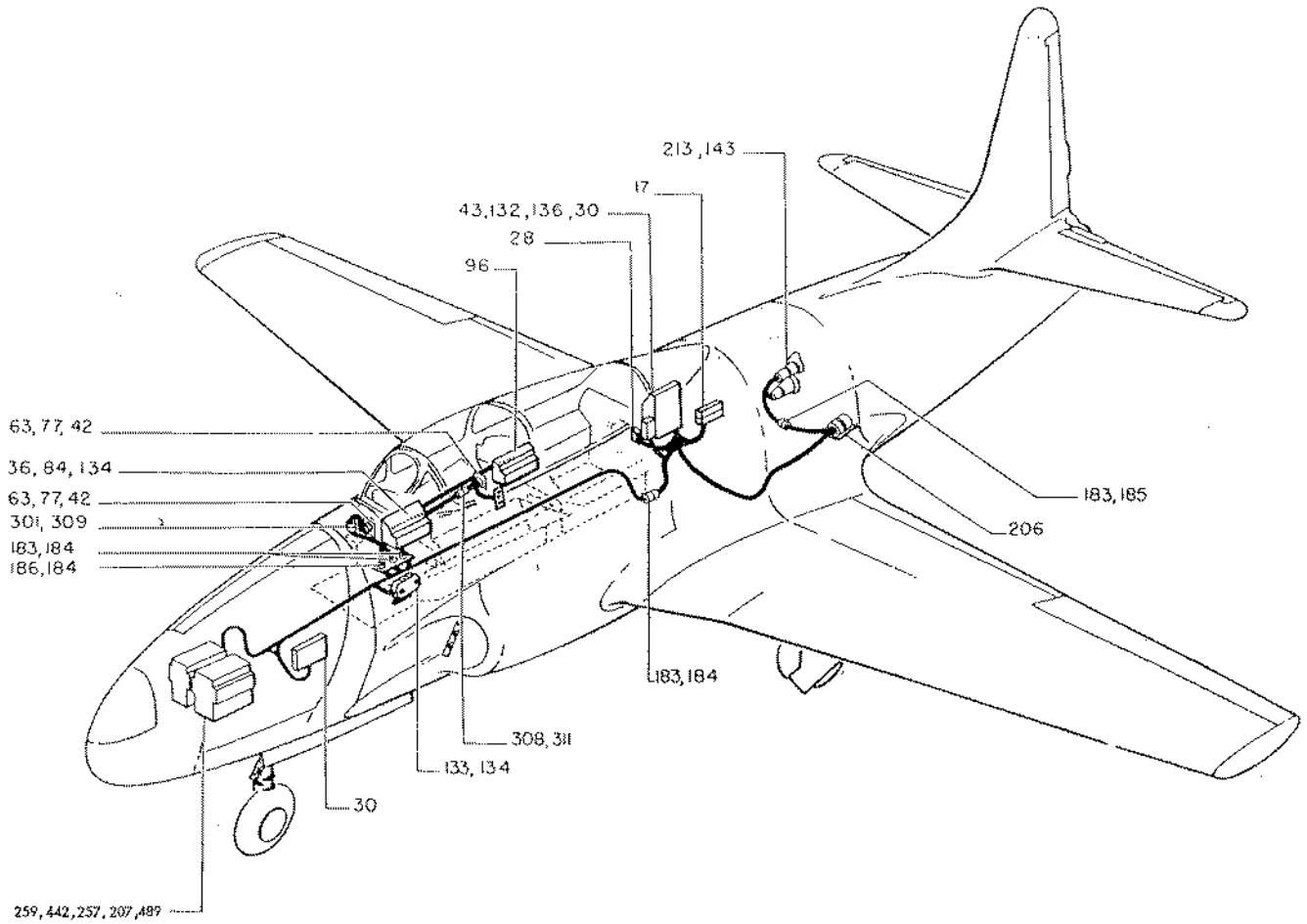
Figure 8-8. Battery and Generator Circuit (Sheet 1 of 2)



BATTERY AND GENERATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4329 THROUGH 53-6818

HB 1414
M20-50-6-261

Figure 8-8. Battery and Generator Circuit (Sheet 2 of 2)



NOTE

⚠1 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT			AN2552-A3A
28	GENERATOR RELAY			AN3025-1
30	RELAY		B-14	AN3380-1
36	RELAY	EL PROD		NB-57C
42	AMMETER		J-1	MIL-A-5125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
132	CIRCUIT PROTECTOR	BURNDY	275A	PLLH
133	CIRCUIT PROTECTOR	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	FILTER	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
206	VOLTAGE REGULATOR	GFAE	1	17821
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	R-1	95-32362
257	BATTERY CONNECTOR	BURTON		175-0
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
442	BATTERY CONNECTOR	AIRESEARCH		60851-5
⚠1 489	BATTERY		MA-2	

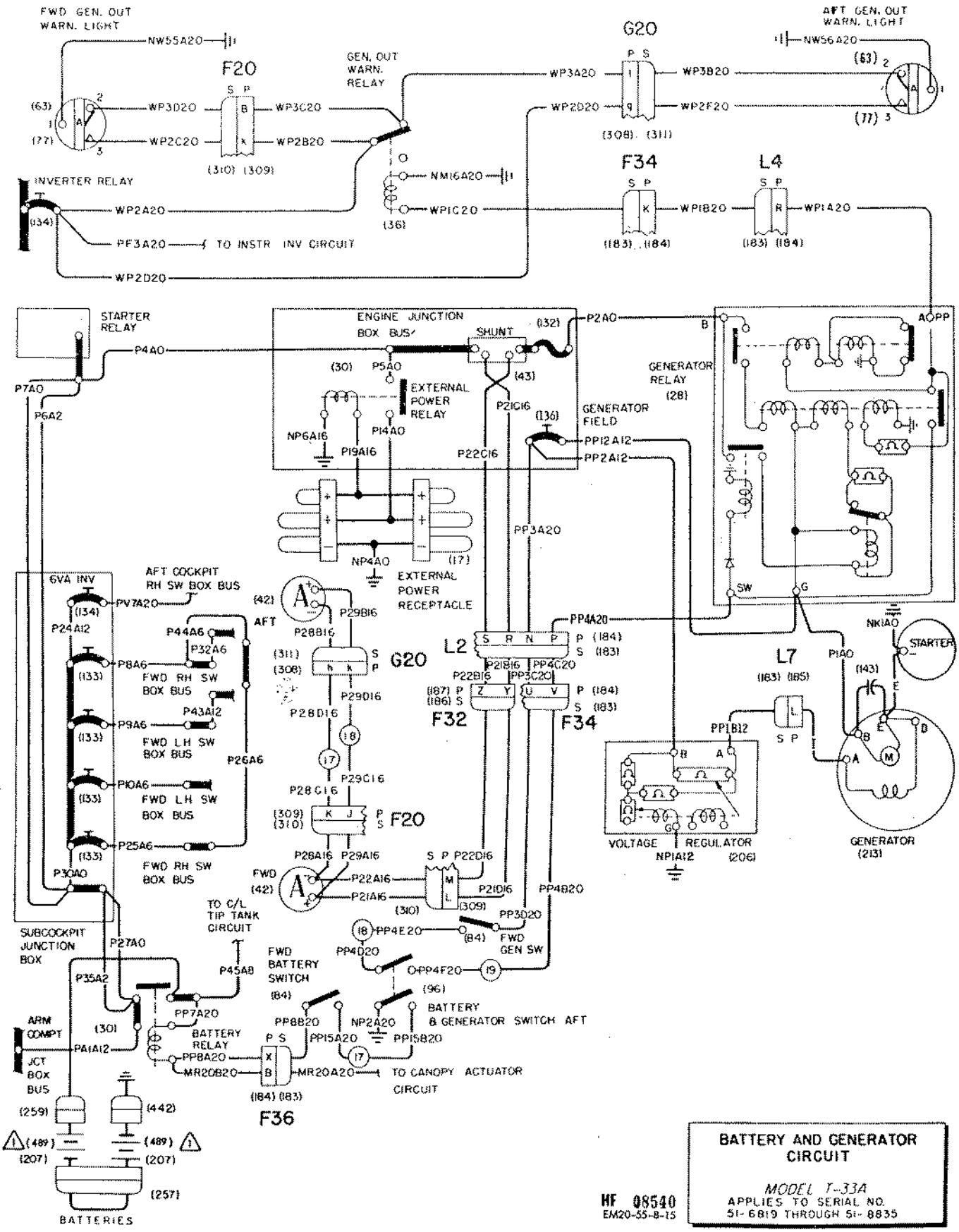
HB 615
M20-50-8-14

BATTERY AND GENERATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-8835

Figure 8-9. Battery and Generator Circuit (Sheet 1 of 2)

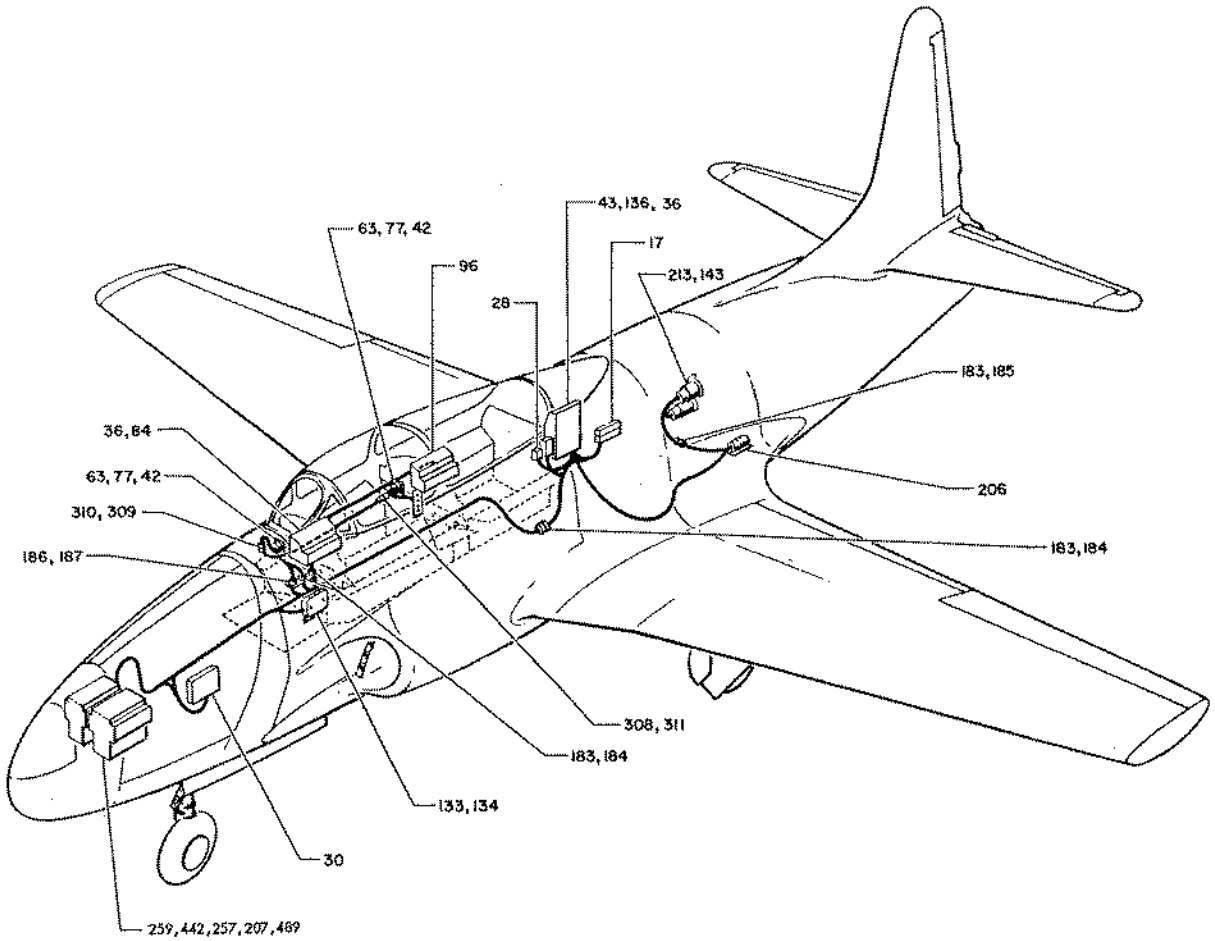


BATTERY AND GENERATOR CIRCUIT

MODEL T-33A
APPLIES TO SERIAL NO.
51-6819 THROUGH 51-8835

HF 08540
EM20-55-8-15

Figure 8-9. Battery and Generator Circuit (Sheet 2 of 2)



NOTE

⚠ USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT			AN2552-A3A
28	GENERATOR RELAY			AN3025-1
30	RELAY		B-14	AN3380-1
36	RELAY	EL PROD		NB-57C
42	AMMETER		J-1	MIL-A-5125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
133	CIRCUIT PROTECTOR	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	FILTER	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
206	VOLTAGE REGULATOR	GFAE	1	17821
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	R-1	95-32362
257	BATTERY CONNECTOR	BURTON		175-0
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
442	BATTERY CONNECTOR	AIRESEARCH		60851-5
⚠1 489	BATTERY		MA-2	

HB 608
M20-50-8-16

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-8836 THROUGH 52-9759, 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-10. Battery and Generator Circuit (Sheet 1 of 2)

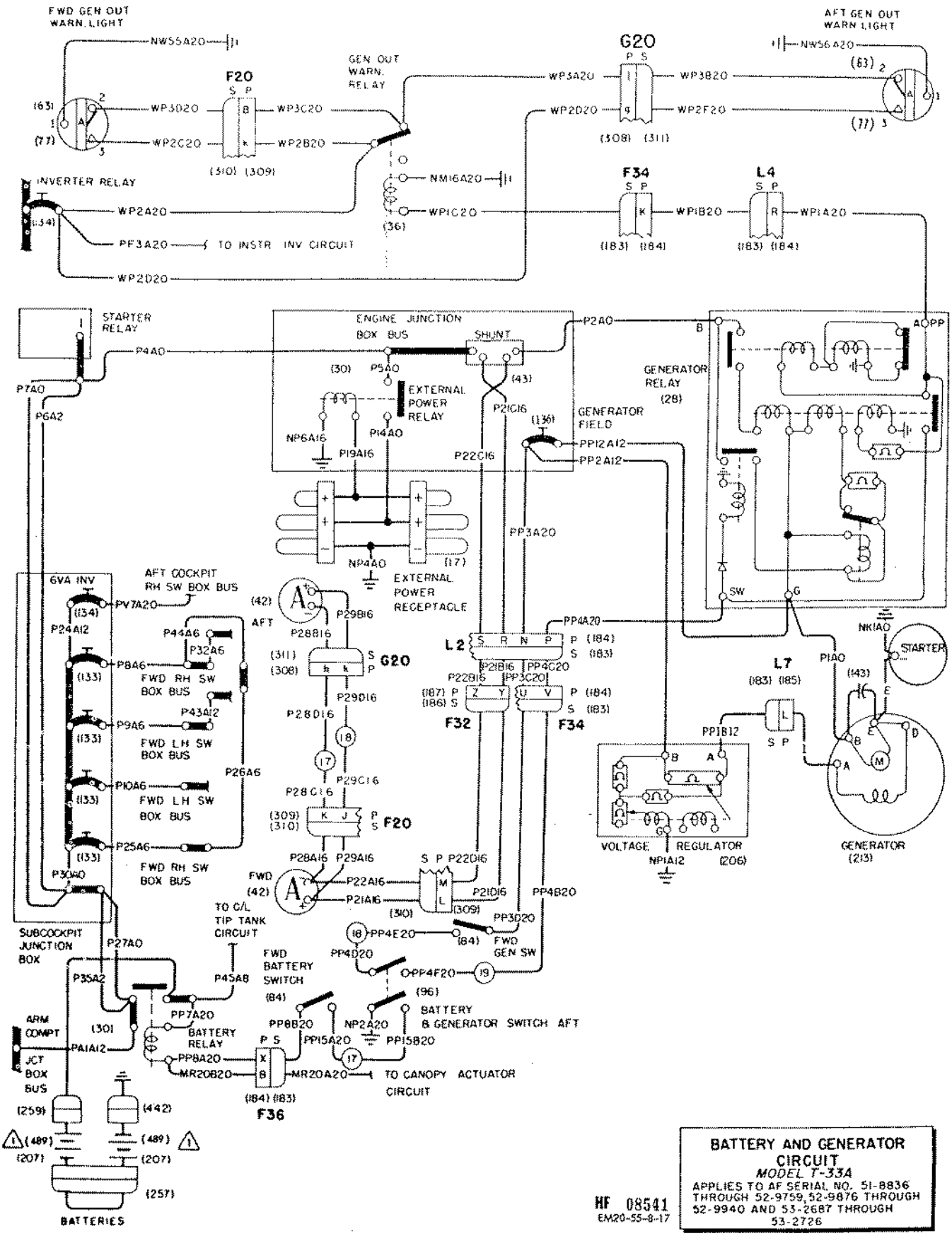
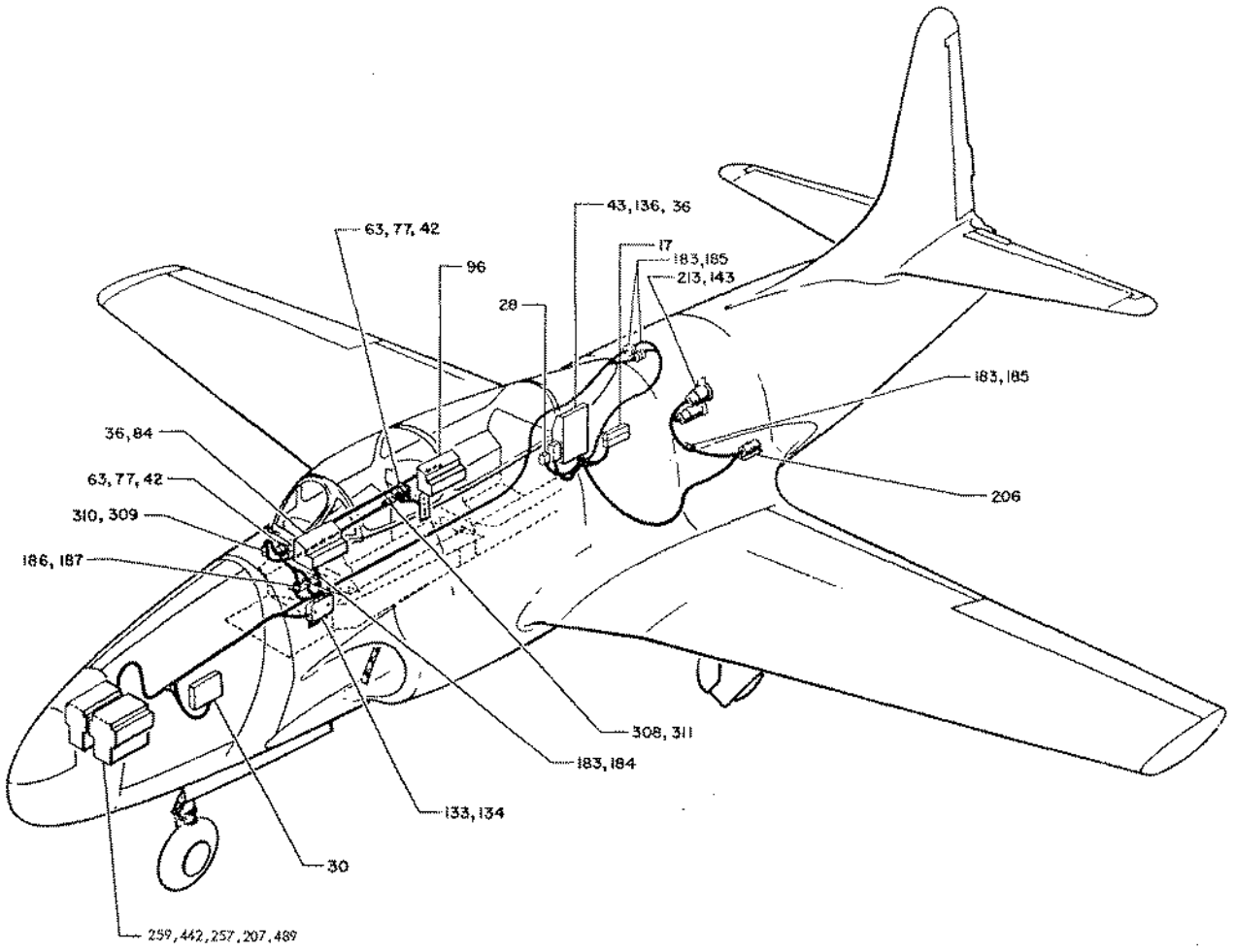


Figure 8-10. Battery and Generator Circuit (Sheet 2 of 2)



NOTE

⚠1 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT			AN2552-A3A
28	GENERATOR RELAY			AN3025-1
30	RELAY		B-14	AN3380-1
36	RELAY	EL PROD		NB-57C
42	AMMETER		J-1	MIL-A-5125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
133	CIRCUIT PROTECTOR	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	FILTER	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
206	VOLTAGE REGULATOR	GFAE	1	17921
207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	R-1	95-32362
257	BATTERY CONNECTOR	BURTON		175-8
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
442	BATTERY CONNECTOR	AIRESEARCH		60851-5
⚠1 489	BATTERY		MA-2	

HB 614
M20-50-8-220

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9760 THROUGH 53-5085 EXCEPT 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-11. Battery and Generator Circuit (Sheet 1 of 2)

Changed 23 September 1959

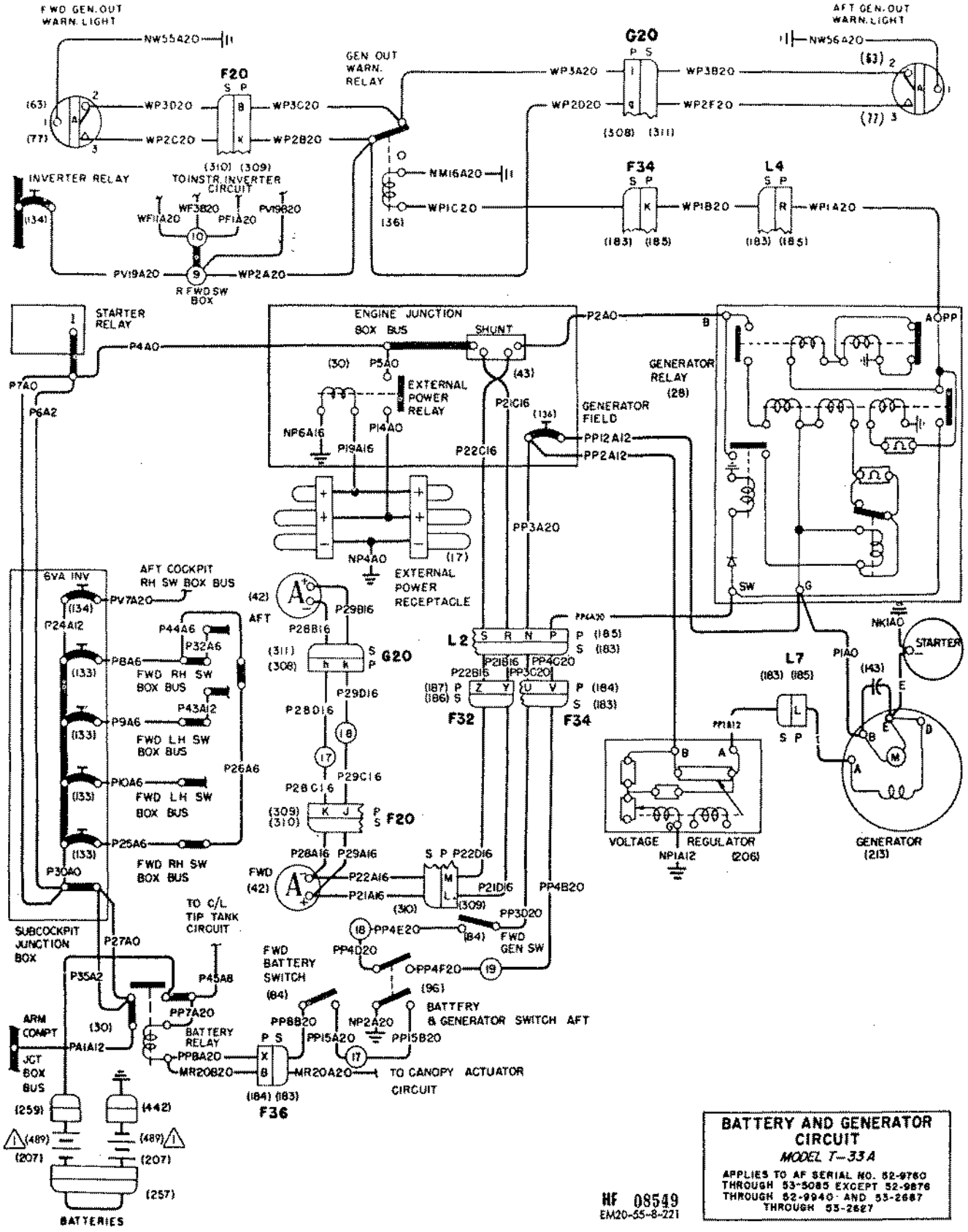
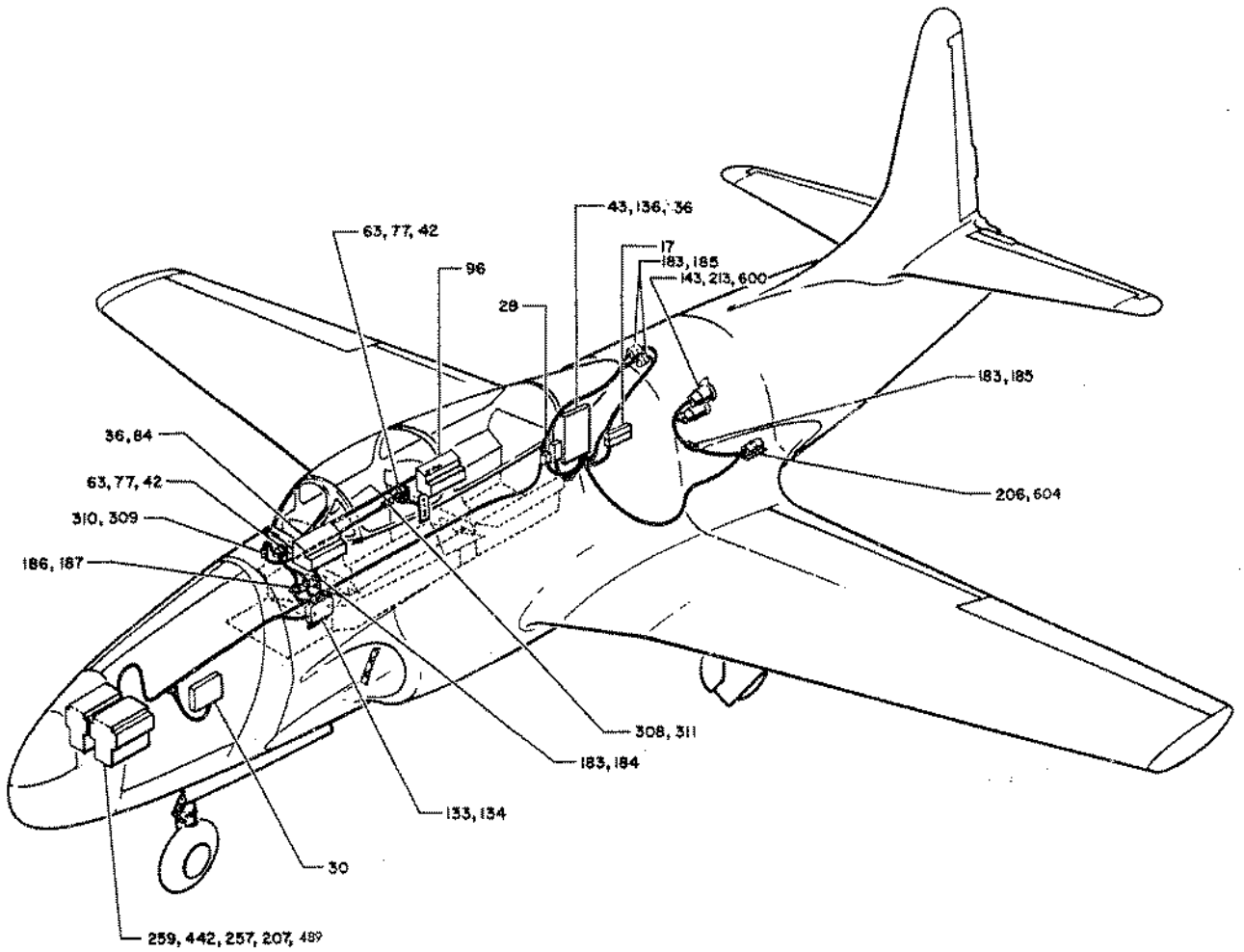


Figure 8-11. Battery and Generator Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT			AN2552-A3A
5 28	GENERATOR RELAY			AN3025-1
30	RELAY		B-14	AN3380-1
36	RELAY	EL PROD		NB-67C
42	AMMETER		J-1	MIL-A-8125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
133	CIRCUIT PROTECTOR	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	FILTER	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
2 206	VOLTAGE REGULATOR	GFAE	1	17821
1 207	BATTERY	GFAE	K-1	MIL-B-9225
213	GENERATOR	GFAE	B-1	95-32262
257	BATTERY CONNECTOR	BURTON		175-0
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102B-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
442	BATTERY CONNECTOR	AIRESEARCH		60851-5
5 489	BATTERY		MA-2	
4 600	GENERATOR	GFAE		AN3633-1
1 604	VOLTAGE REGULATOR	ECLIPSE		1589-1C

NOTE

1. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 54-1525 AND SUBSEQUENT
2. USE ON USAF T-33A AIRCRAFT ONLY
3. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 55-2979 AND SUBSEQUENT
4. EQUIPMENT IS GFAE ON ALL MDAP T-33A AIRCRAFT FROM AF SERIAL NO. 55-2979 THROUGH 55-2983 AND 55-3029 THROUGH 55-3049 AND 55-3074 THROUGH 55-3117
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

HB 596
M20-50-8-262

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 53-5086 AND SUBSEQUENT

Figure 8-12. Battery and Generator Circuit (Sheet 1 of 2)

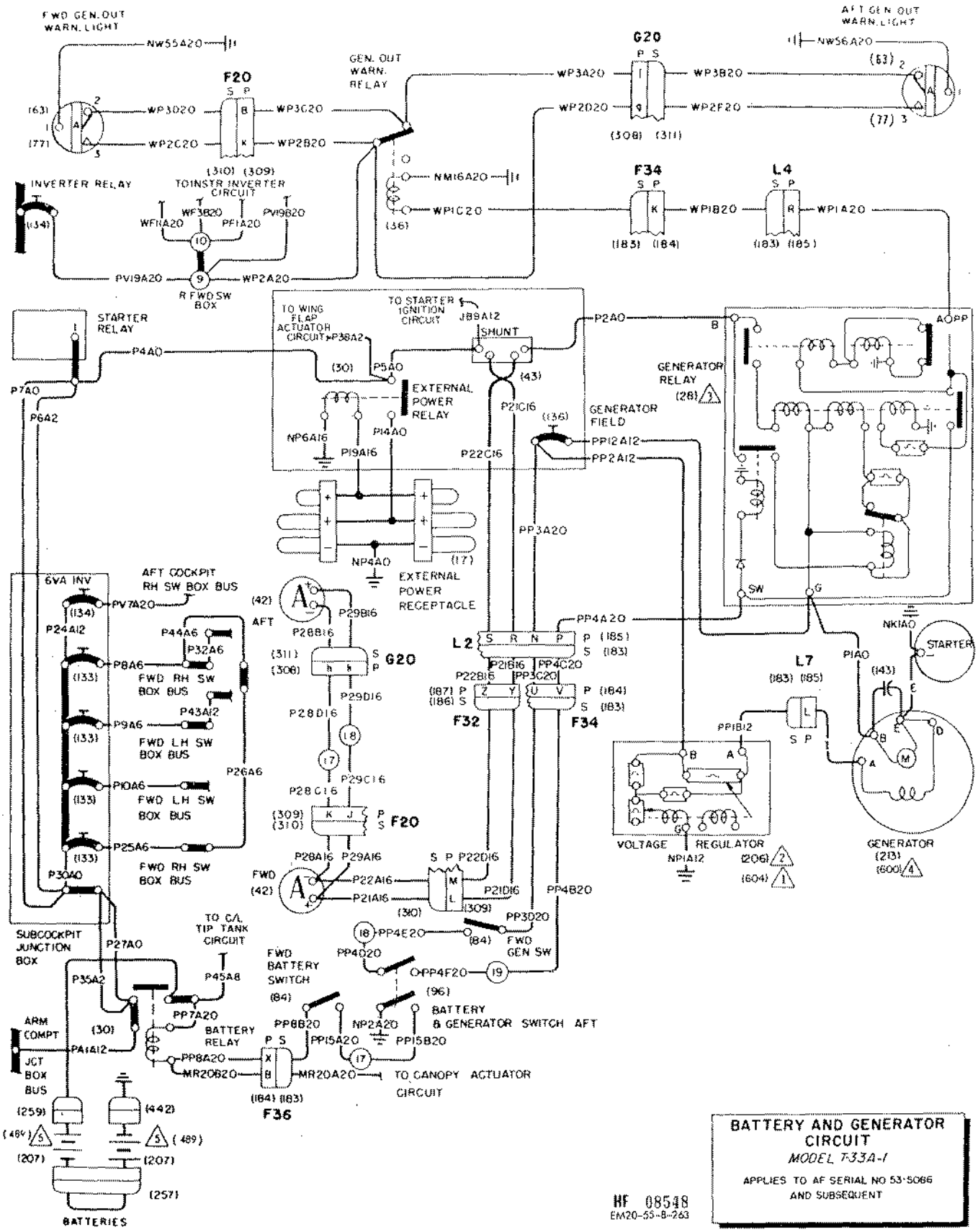
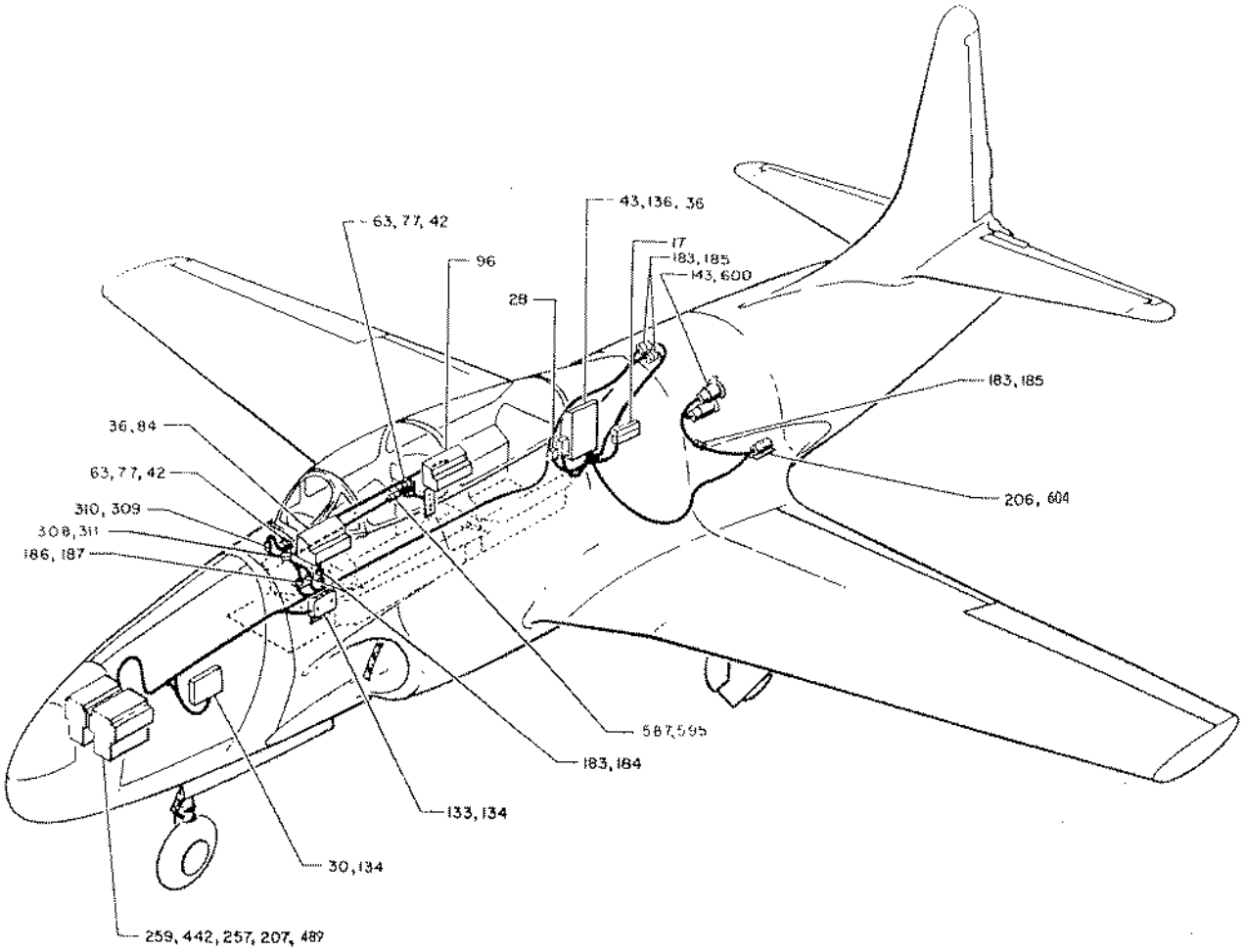


Figure 8-12. Battery and Generator Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
17	EXTERNAL POWER RECEPT			AN2552-A3A
28	GENERATOR RELAY			AN3025-1
30	RELAY		B-14	AN3380-1
36	RELAY	EL PROD		NB-57C
42	AMMETER		J-1	MIL-A-5125
43	SHUNT	GFAE		AN3200-300
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
96	SWITCH			AN3027-2
T33	CIRCUIT PROTECTOR	SPENCER		PLM-105
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
143	FILTER	SOLAR	4MFD	EA173
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
⚠1 206	VOLTAGE REGULATOR	GFAE	1	17R21, 94-32276A
207	BATTERY	GFAE	K-1	MIL-B-9225
257	BATTERY CONNECTOR	BURTON		175-0
259	BATTERY CONNECTOR	AIRESEARCH		60851-3
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
442	BATTERY CONNECTOR	AIRESEARCH		60851-5
⚠6 489	BATTERY		MA-2	
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
600	GENERATOR	GFAE		AN3633-1
⚠2 604	VOLTAGE REGULATOR	ECLIPSE		⚠5 AN3633-1A 1589-1C

NOTE

⚠1 USED PRIOR TO AF SERIAL NO. 55-3116

⚠2 USED ON AF SERIAL NO. 55-3116 AND SUBSEQUENT

⚠3 USED PRIOR TO AF SERIAL NO. 57-634

⚠4 USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

⚠5 ALTERNATE 5

⚠6 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-586

HB 602
M20-50-8-389

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A-5

Figure 8-13. Battery and Generator Circuit (Sheet 1 of 2)

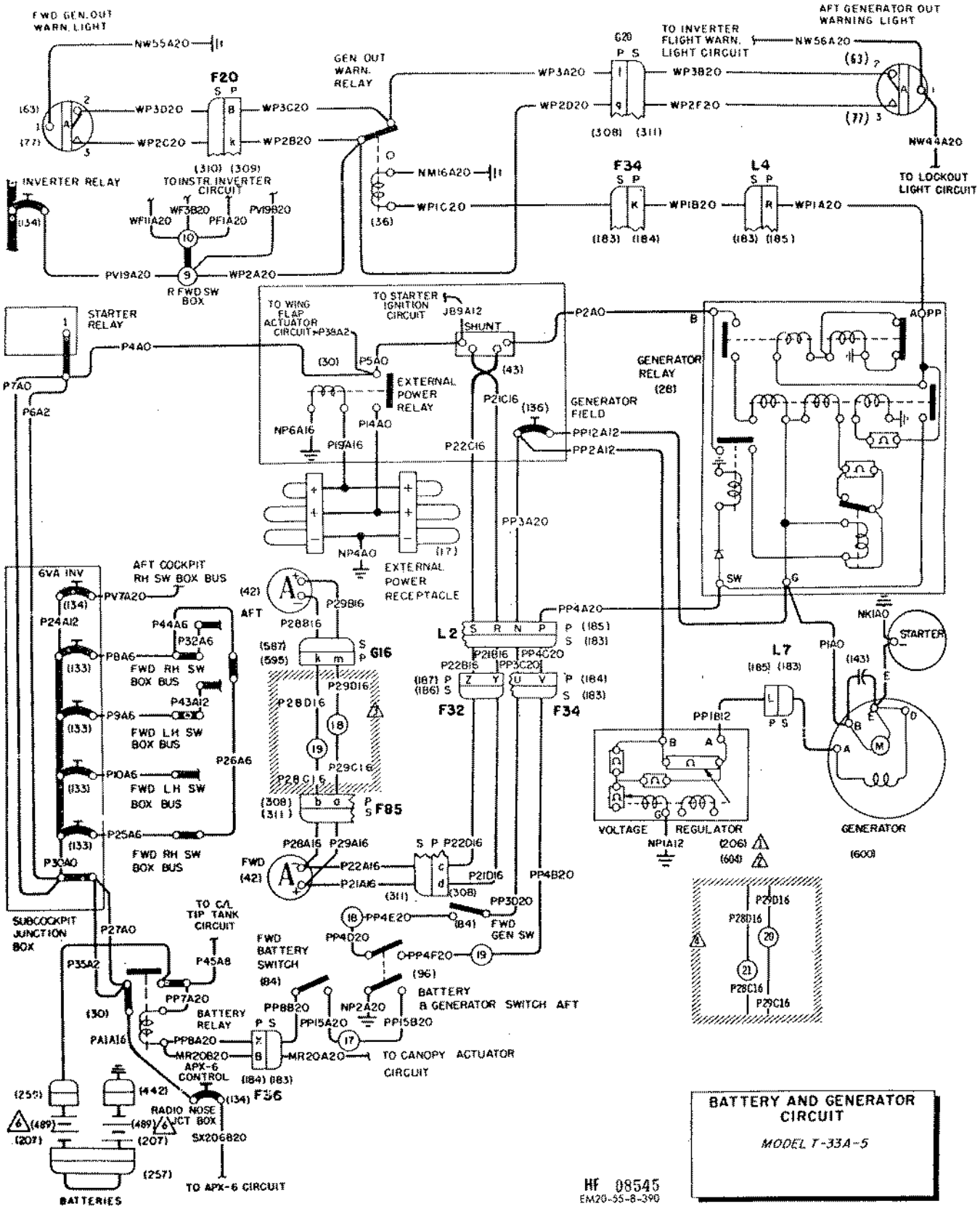


Figure 8-13. Battery and Generator Circuit (Sheet 2 of 2)

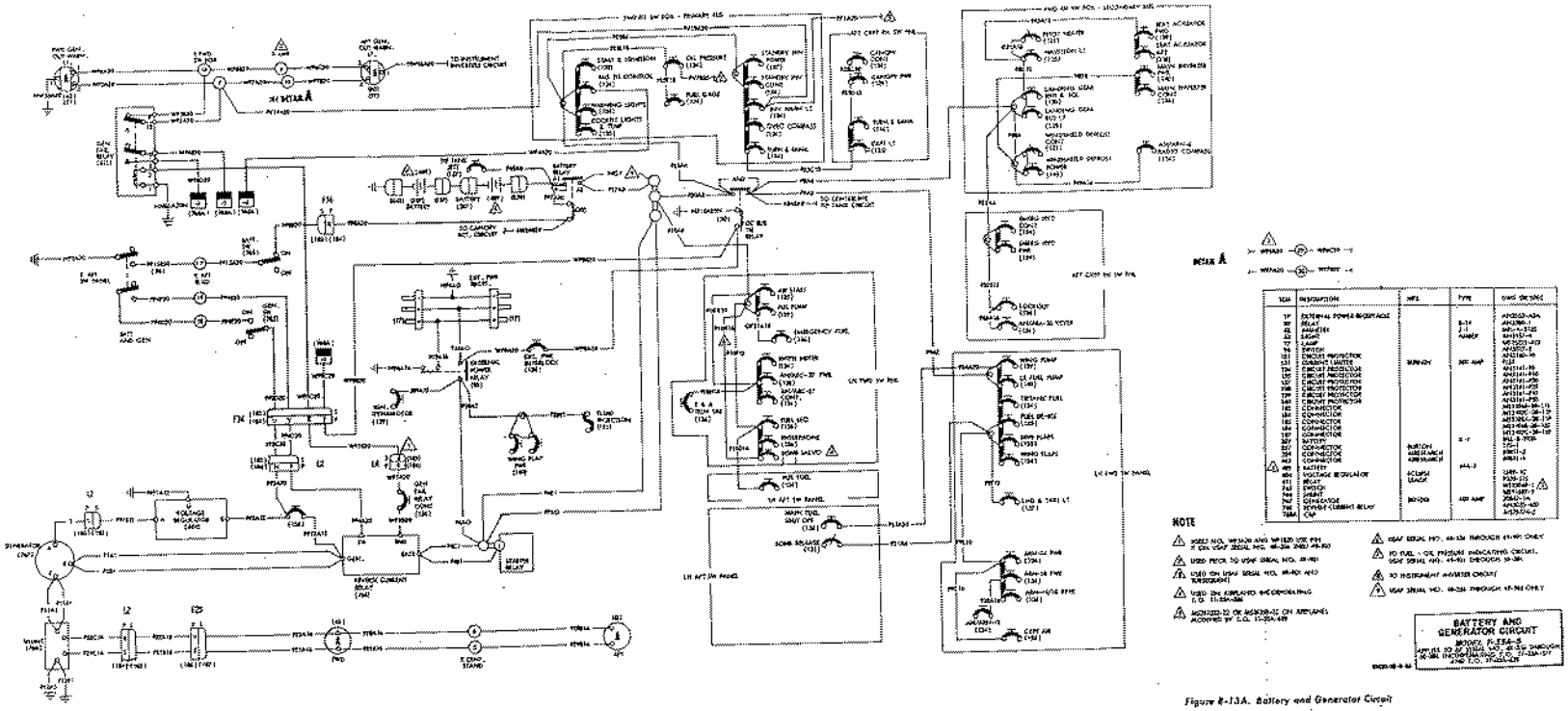


Figure 8-13A. Battery and Generator Circuit

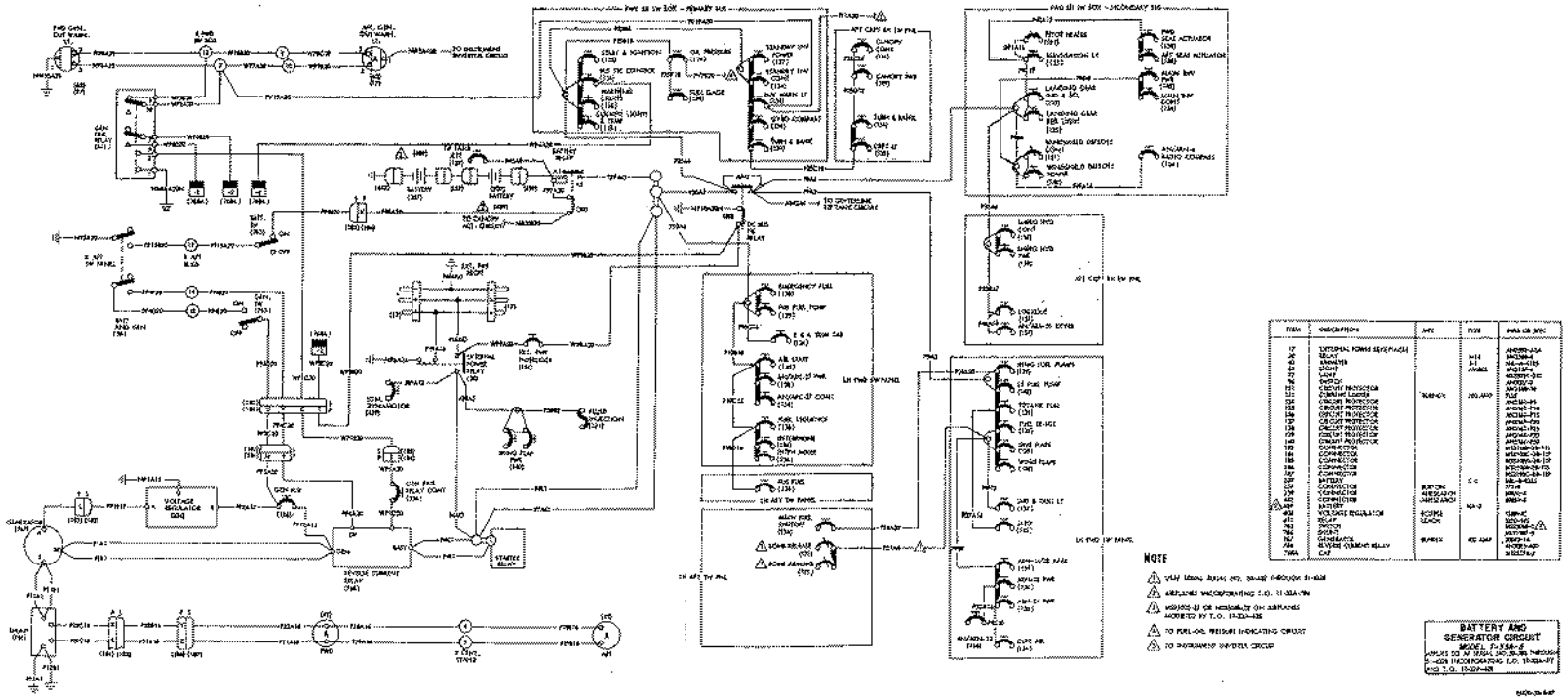
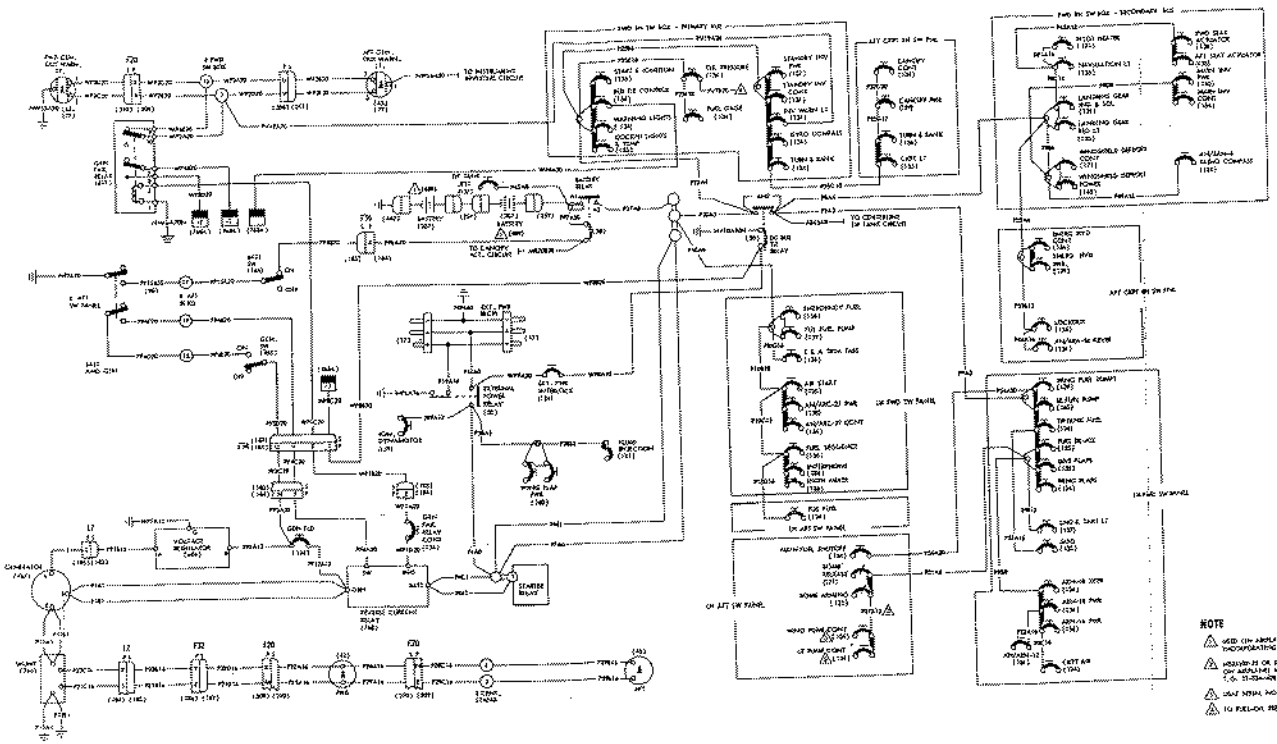


Figure 8-132. Battery and Generator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
	CENTRIFUGAL SENSING MECHANISM			AN3050-45A
	RELAY		4-CO	AN3148A-1
	AMMETER		2-1 RANGE	AN5115-1
	LIGHT			AN3159-2
	LAMP			MS25241-313
	SWITCH			AN3027-2
	CIRCUIT PROTECTOR			AN3146-30
	CURRENT LIMITER			FCLI
	CIRCUIT PROTECTOR			AN3141-25
	CIRCUIT PROTECTOR			AN3141-710
	CIRCUIT PROTECTOR			AN3141-715
	CIRCUIT PROTECTOR			AN3141-720
	CIRCUIT PROTECTOR			AN3141-725
	CIRCUIT PROTECTOR			AN3141-730
	CIRCUIT PROTECTOR			AN3141-735
	CIRCUIT PROTECTOR			AN3141-740
	CIRCUIT PROTECTOR			AN3141-750
	CONNECTOR			MS27484-16-13S
	CONNECTOR			MS27484-24-11P
	CONNECTOR			MS27484-24-11S
	CONNECTOR			MS27484-28-15P
	CONNECTOR			MS27484-28-15S
	CONNECTOR			MS27484-32-17P
	CONNECTOR			MS27484-32-17S
	CONNECTOR			MS27484-36-15S
	CONNECTOR			MS27484-36-22S
	CONNECTOR			MS3112E-14S
	BATTERY	EXIDE/GLOBE ACCUMULATOR	12-1	12CE-9
	CONNECTOR			AN3101-3
	CONNECTOR			MS3102A-28-15P
	CONNECTOR			MS3102A-28-19P
	CONNECTOR			MS3106A-32-17S
	CONNECTOR			MS3106A-36-22S
	CONNECTOR			MS3112E-14S
	CONNECTOR			MS3112E-14S
	CONNECTOR	NEWMARK	MM-3	MM3-1
	BUSBAR			1288-2C
	VOLTAGE REGULATOR	DELCO-REMY		1929-2G
	RELAY			MS3240B-1
	SWITCH			AN3150-1
	VALVE			28B12-1A
	SEPARATOR	BENDIX	400 AMP	AN4582A-400
	REVERSE CURRENT RELAY			MS3207A-2
	CAP			AN3050-45A

NOTE

1. USED ON AIRPLANES INCORPORATING T.O. 1F-33A-506.
2. MS3109-12 OR MS3108B-12 ON AIRPLANES MODIFIED BY T.O. 1F-33A-509.
3. SEAT SERIAL NOS. 51-4879 THROUGH 51-4914.
4. TO FUEL-OIL PRESSURE INDICATING CIRCUIT.

BATTERY AND GENERATOR CIRCUIT
MODEL F-33A-5
APPLIES TO AF SERIAL NO. 51-4329 THROUGH 51-4613 INCORPORATING T.O. 1F-33A-509 AND T.O. 1F-33A-508

Figure 8-13C. Battery and Generator Circuit

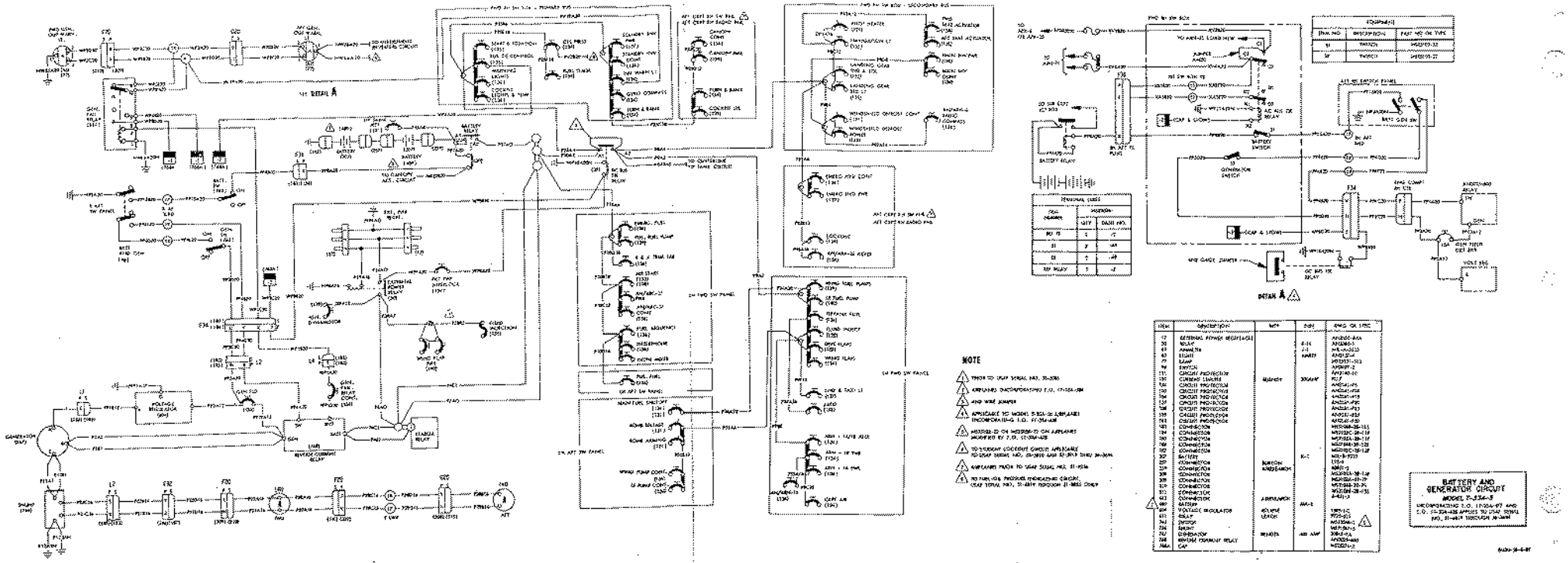


Figure 8-13D. Battery and Generator Circuit

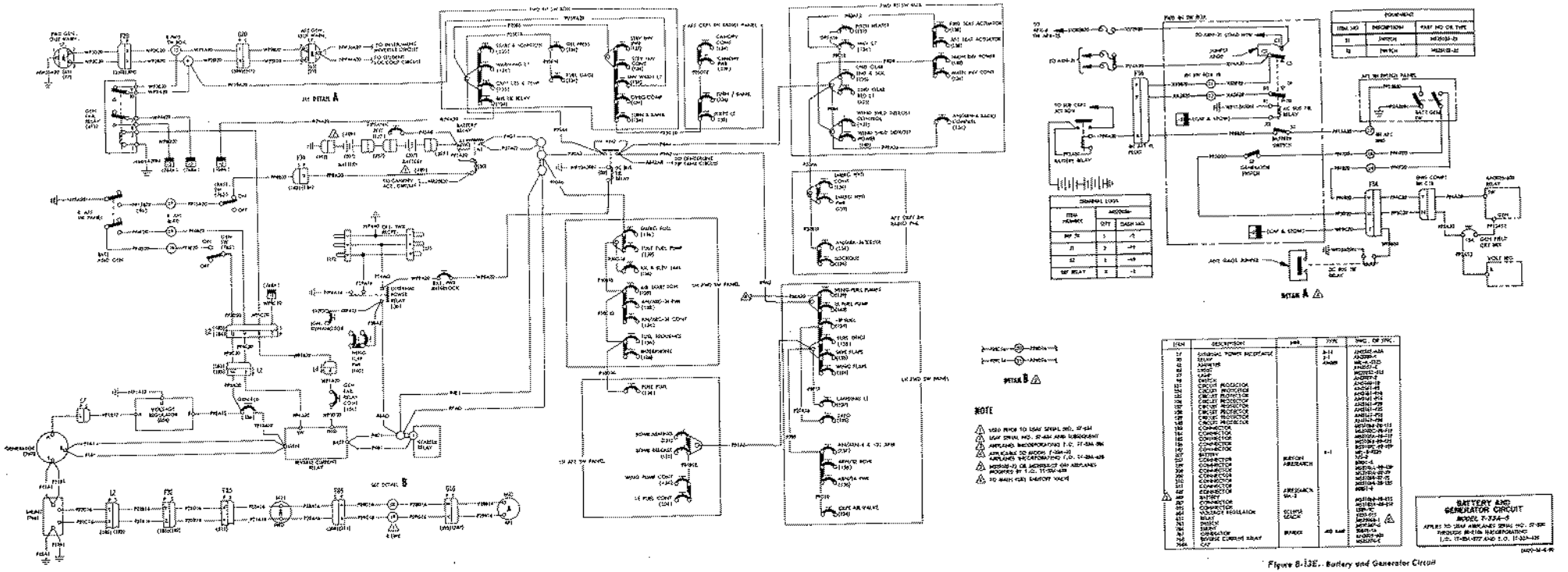
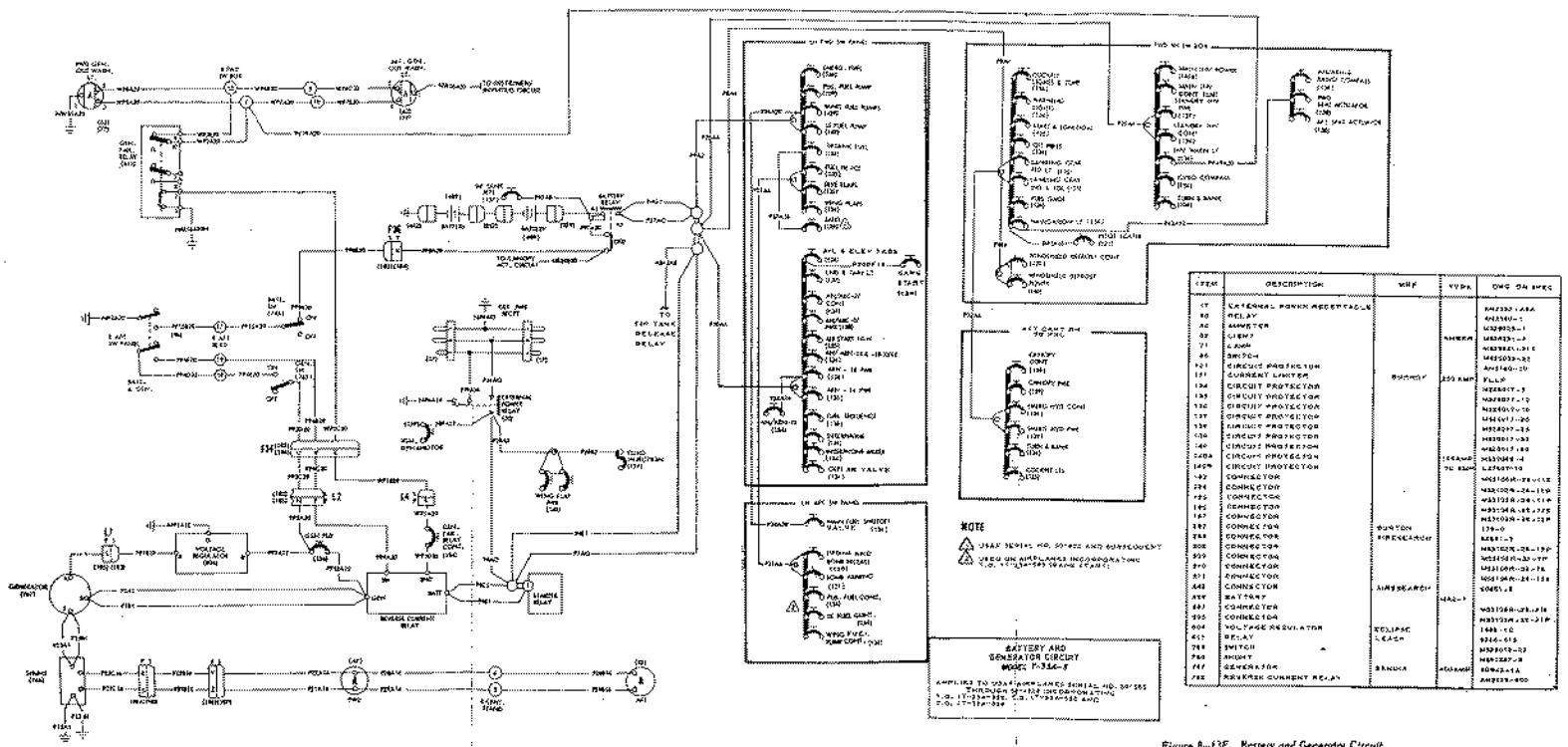


Figure 8-13E. Battery and Generator Circuit



ITEM	DESCRIPTION	WIRE	TYPE	DWG OR SPEC
A1	EXTERNAL POWER RECEPTACLE			AN3330-1AR4
A2	RELAY			MS25180-1
A3	AMMETER			MS29058-1
A7	LIGHT		NUMBER	MS25237-328
A11	DIODE			MS27641-1E1
A6	SWITCH			MS25033-353
A21	CIRCUIT PROTECTOR			AN3160-20
A31	CURRENT LIMITER	BUSSMAN	250 AMP	FLL-250
A34	CIRCUIT PROTECTOR			MS25237-5
A35	CIRCUIT PROTECTOR			MS25237-10
A36	CIRCUIT PROTECTOR			MS26574-10
A37	CIRCUIT PROTECTOR			MS25237-355
A38	CIRCUIT PROTECTOR			MS25237-353
A40	CIRCUIT PROTECTOR			MS25237-180
A40A	CIRCUIT PROTECTOR		1 BREAKER	MS25237-4
A40B	CIRCUIT PROTECTOR		70 BREAKER	LA7A0710
A42	CONNECTOR			MS27656-22-22
A24	CONNECTOR			MS27029-24-11P
A25	CONNECTOR			MS27028-24-11P
A45	CONNECTOR			MS27656-22-22P
A47	CONNECTOR			MS27656-22-22P
A52	CONNECTOR	BURTON		139-0
A58	CONNECTOR	NORTHCRAFT		6881-5
A60	CONNECTOR			MS27029-24-19P
A59	CONNECTOR			MS27656-22-19P
A70	CONNECTOR			MS27656-22-7S
A51	CONNECTOR			MS27656-24-13S
A48	CONNECTOR	AIRESEARCH		50451-8
A55	BATTERY		NEAR-T	
A61	CONNECTOR			MS27656-22-22P
A65	CONNECTOR			MS27029-22-21P
A04	VOLTAGE REGULATOR	ECLIPSE		14A-10
A11	RELAY	LEACH		9346-015
A8	SWITCH			MS25032-53
A68	MOUNT			MS25237-3
A67	GENERATOR			30962-14A
A62	REVERSE CURRENT RELAY	BENDIX	AIRFRAME	AN2510-400

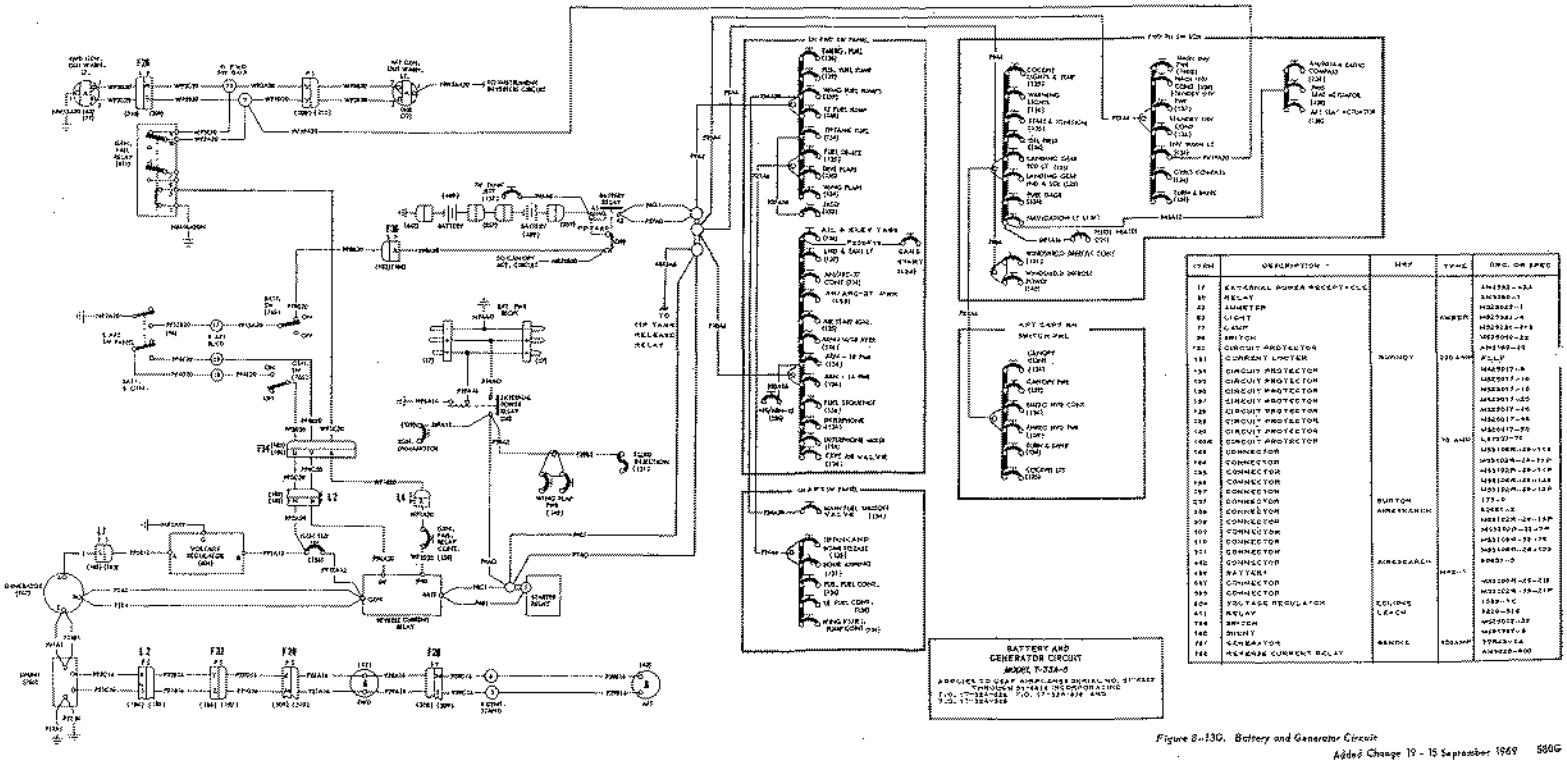
NOTE

1. USAF SERIAL NO. 59-455 AND SUBSEQUENT
2. WIRING ON AIRPLANES INCORPORATING T.O. 1F-33A-549 IS AN ADD (DASH)

BATTERY AND GENERATOR CIRCUIT MODEL F-33A-5

AIRPLANES TO USAF AIRPLANES SERIAL NO. 59-455 INCLUSIVE SEE FOR DESIGNATION T.O. 1F-33A-554, C.I. (1959-560 AIR)

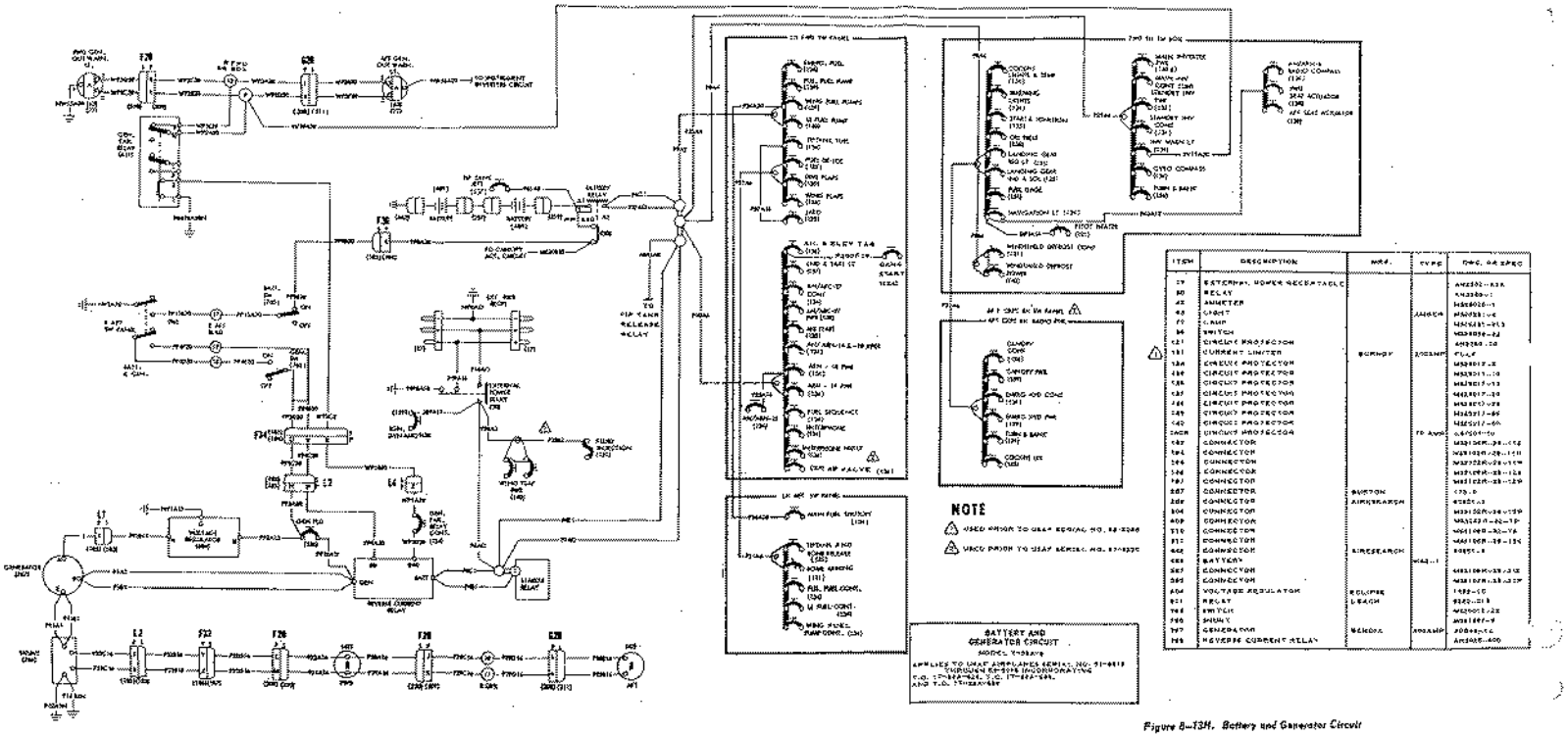
Figure 8-13F. Battery and Generator Circuit



ITEM	DESCRIPTION	MFR	TYPE	MFG. OR SPEC
1F	EXTERNAL POWER RECEPTACLE			AN4158-33A
2K	RELAY			5N5386-1
4Z	AMMETER			M28868-1
6Q	LIGHT		AMBER	M25783-4
7T	CLAMP			M20926-PP3
9W	SWITCH			M27406-33
10Z	CIRCUIT PROTECTOR			AN3150-15
11J	CURRENT LIMITER	ROTHDY	220 AMP	KCLP
12H	CIRCUIT PROTECTOR			MA25017-A
13G	CIRCUIT PROTECTOR			MS25017-10
13K	CIRCUIT PROTECTOR			MS25017-16
13Y	CIRCUIT PROTECTOR			MS25017-45
14B	CIRCUIT PROTECTOR			MS25017-46
15B	CIRCUIT PROTECTOR			MS26017-4A
15C	CIRCUIT PROTECTOR			MS26017-5A
15DE	CIRCUIT PROTECTOR		70 AMP	CLP1527-7A
16A	CONNECTOR			MS3106R-28-11S
16H	CONNECTOR			MS3102A-2A-11P
16S	CONNECTOR			MS3102R-28-11P
16X	CONNECTOR			MS3106R-28-11S
16Y	CONNECTOR			MS3102R-28-12P
17F	CONNECTOR	BURTON		173-0
18B	CONNECTOR	AIRCRAFT		ROBERT-E
20F	CONNECTOR			MS3102R-32-15P
20Y	CONNECTOR			MS3102R-32-17P
21Y	CONNECTOR			MS3106R-32-17S
21Z	CONNECTOR			MS3106R-28-12S
22Z	CONNECTOR	AIRCRAFT		89031-0
23F	BATTERY		MAC-1	
24T	CONNECTOR			MS3106R-16S-1P
24Y	CONNECTOR			MS3102A-10SL-3P
25Y	VOLTAGE REGULATOR	ROLLINS		1582-1C
26J	RELAY	LEACH		9829-516
27A	SWITCH			MS27007-3F
28E	SWITCH			MS27007-6
29Y	GENERATOR	BENDIX	400AMP	109426-6A
31E	REVERSE CURRENT RELAY			AN3420-400

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A-5
APPLIES TO USAF AIRPLANES SERIAL NO. 51-17557 THROUGH 51-17616 INCORPORATING T.O. 1T-33A-524, T.O. 1T-33A-526 AND T.O. 1T-33A-528

Figure 8-130. Battery and Generator Circuit



ITEM	DESCRIPTION	MFR.	TYPE	MFG. OR SPEC
C9	RECEPTACLE, POWER			AN3102-16A
K1	RELAY			1N3289-1
M1	AMMETER			MS16026-1
S3	SWITCH		JA4001A	MS90351-14
P1	CLAMP			MS90387-1013
S6	SWITCH			MS90356-22
CB1	CIRCUIT PROTECTOR			AN3320-20
VR1	CURRENT LIMITER	WORTHY	JOCAMP	CL-4
CB2	CIRCUIT PROTECTOR			MS90317-2
CB4	CIRCUIT PROTECTOR			MS90317-10
CB5	CIRCUIT PROTECTOR			MS90317-13
CB7	CIRCUIT PROTECTOR			MS90317-19
CB8	CIRCUIT PROTECTOR			MS90317-22
CB9	CIRCUIT PROTECTOR			MS90317-25
CB10	CIRCUIT PROTECTOR			MS90317-28
CB28	CIRCUIT PROTECTOR		TO AMP	8-929041-10
J22	CONNECTOR			MS3106R-28-11S
J24	CONNECTOR			MS3108R-28-11S
J26	CONNECTOR			MS3122R-28-11S
J28	CONNECTOR			MS3108R-28-11S
J37	CONNECTOR			MS3122R-28-11S
J38	CONNECTOR	BURTON		4262-A3
J39	CONNECTOR	AIRESEARCH		MS3106R-28-11P
J40	CONNECTOR			MS3107R-32-7P
J70	CONNECTOR			MS3108R-32-7S
J72	CONNECTOR			MS3108R-28-15S
J45	CONNECTOR	AIRESEARCH		8055-8
K28	BATTERY		M48-1	
J67	CONNECTOR			MS3108R-32-2S
J68	CONNECTOR			MS3108R-32-22P
K24	VOLTAGE REGULATOR	ELECTRIC LEAGH		1492-10
K21	RELAY			8262-011
T48	SWITCH			MS25081-22
F90	SHUNT			MS1189-9
T47	GENERATOR	NEWCOA	400AMP	30866-10
M6	REVERSE CURRENT RELAY			AR2048-400

NOTE

△ USED PRIOR TO USAF SERIAL NO. 52-3048

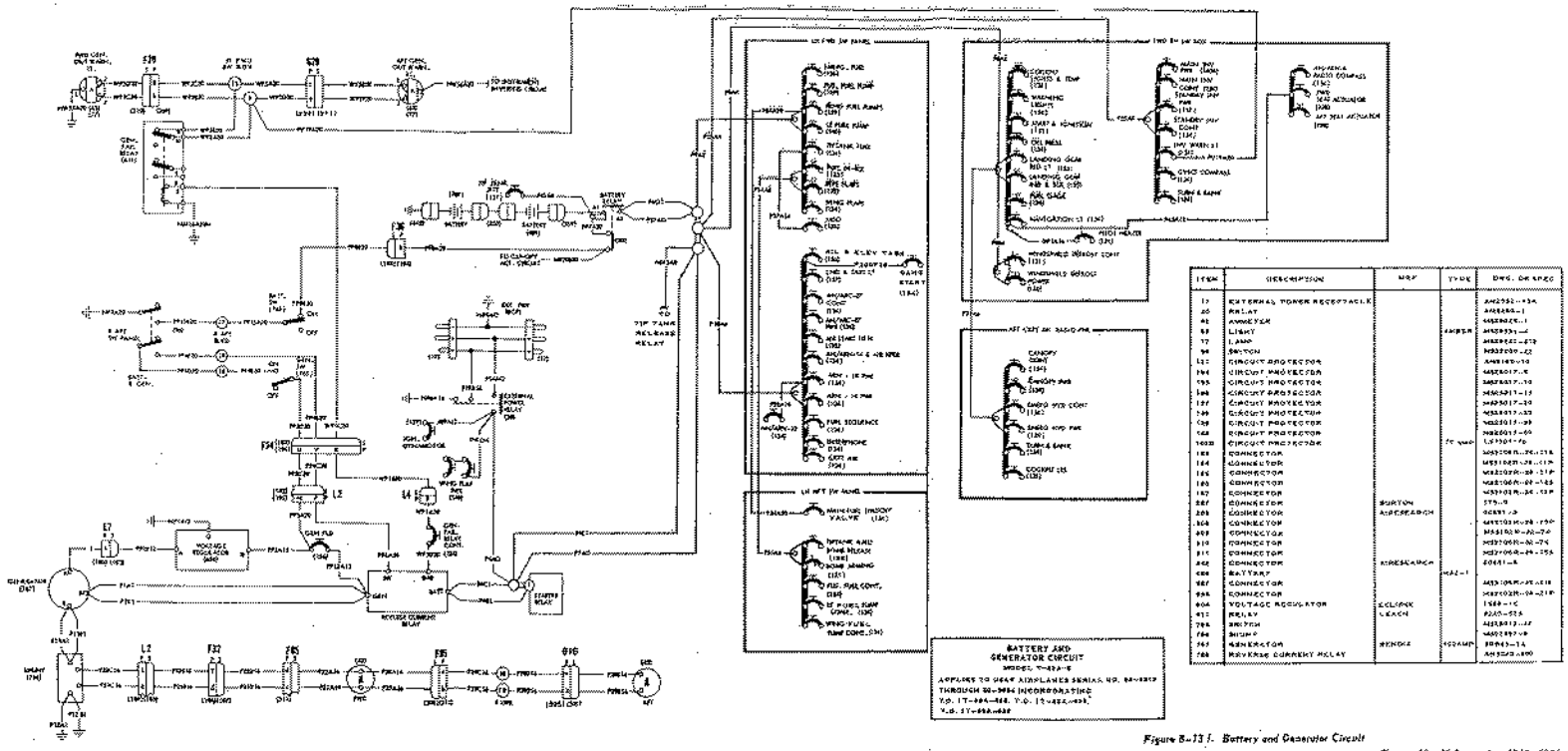
△ USED PRIOR TO USAF SERIAL NO. 53-4030

BATTERY AND GENERATOR CIRCUIT

APPLIES TO USAF AIRPLANES SERIAL NO. 51-4018 THROUGH 52-3048 (NONCONFORMING T.O. 1T-33A-2, T.O. 1T-33A-2-1, AND T.O. 1T-33A-2-2)

Figure 8-13H. Battery and Generator Circuit

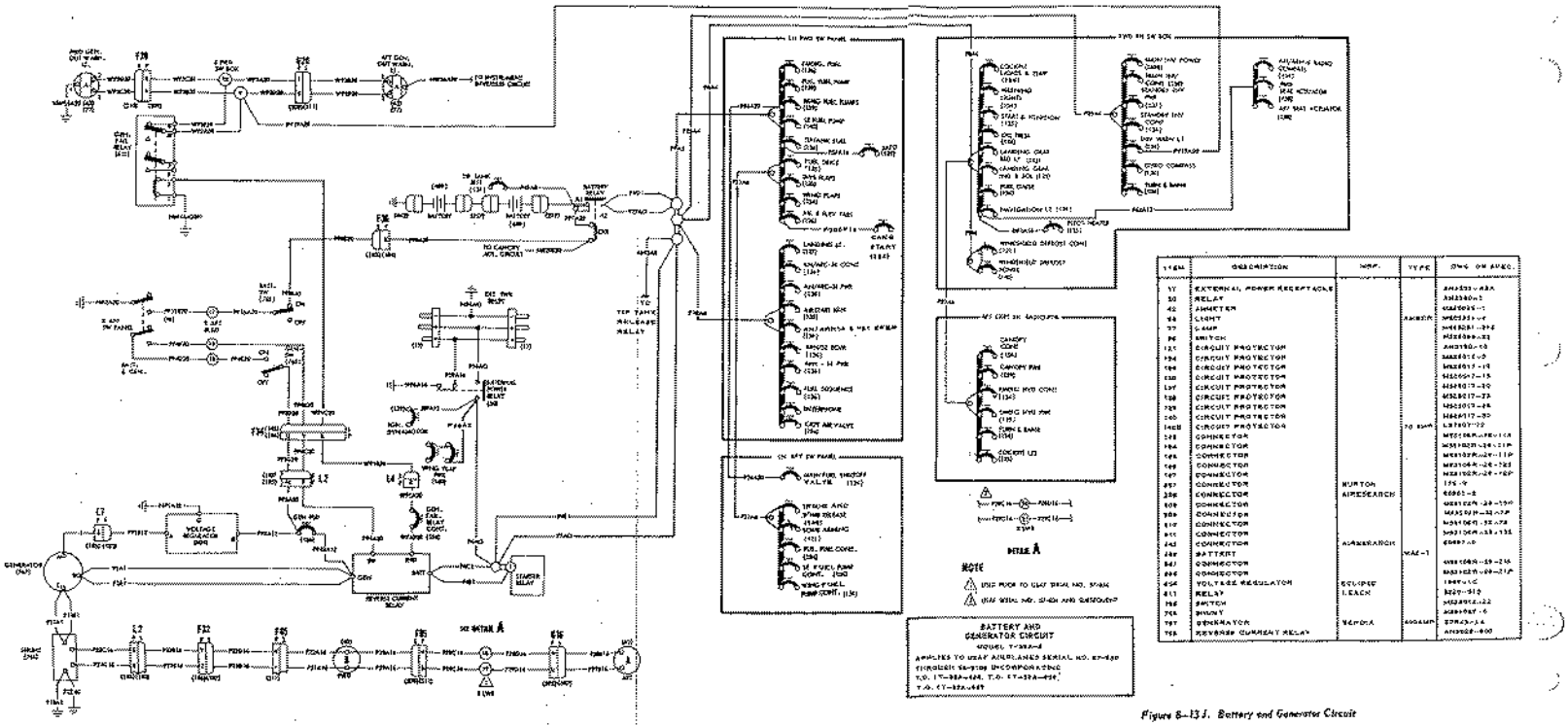
580H Added Change 19 - 15 September 1959



ITEM	DESCRIPTION	MFR	TYPE	DWG. OR SPEC
13	EXTERNAL POWER RECEPTACLE			AN6252-13A
20	RELAY			AN4484-1
41	AMMETER			6458842K-1
53	LIGHT		AMBER	AN3591-2
57	LAMP			AN3829-57
98	SWITCH			8938030-22
121	CIRCUIT PROTECTOR			AN3155-10
194	CIRCUIT PROTECTOR			6458017-5
195	CIRCUIT PROTECTOR			3458017-10
196	CIRCUIT PROTECTOR			3458017-15
197	CIRCUIT PROTECTOR			3458017-20
199	CIRCUIT PROTECTOR			3458017-30
198	CIRCUIT PROTECTOR			3458017-35
164	CIRCUIT PROTECTOR			3458017-50
1000	CIRCUIT PROTECTOR		70 VOLT	1A7341-70
183	CONNECTOR			3459108-24-21S
184	CONNECTOR			MS3102R-28-21P
186	CONNECTOR			MS3102R-28-21P
185	CONNECTOR			MS3106R-24-19S
187	CONNECTOR			MS3101R-24-19P
287	CONNECTOR	BURTON		575-0
288	CONNECTOR	AIRCRAFT		6001-0
308	CONNECTOR			MS3103R-24-19P
309	CONNECTOR			MS3102R-24-19P
310	CONNECTOR			MS3106R-24-19S
311	CONNECTOR			MS3106R-24-25S
312	CONNECTOR	KINGSBRIDGE		60681-4
600	BATTERY		24V-1	
287	CONNECTOR			MS3106R-24-21S
288	CONNECTOR			MS3102R-24-21P
604	VOLTAGE REGULATOR	ECLIPSE LEACH		1568-1C
412	RELAY			A265-556
786	SWITCH			6458812-27
786	SHUNT			6460287-8
767	GENERATOR	WINCO	400AMP	8894S-1A
788	REVERSE CURRENT RELAY			AN3565-1000

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A-1
APPLIES TO USAF AIRPLANES SERIAL NO. 54-1372 THROUGH 56-3956 INCORPORATING T.O. 1T-33A-468, T.O. 1T-33A-469, T.O. 1T-33A-482

Figure 8-13 f. Battery and Generator Circuit



ITEM	DESCRIPTION	MFR.	TYPE	DWG OR MFR'S
V1	EXTERNAL POWER RECEPTACLE			AN4333-4BA
K1	RELAY			AN3320-1
A1	AMMETER			4041003-1
L1	LIGHT		AMBER	MS25237-14
F7	S-AMP			MS25281-3P5
S6	SWITCH			MS24659-X21
CB1	CIRCUIT PROTECTOR			AN3320-10
CB2	CIRCUIT PROTECTOR			MS25237-9
CB4	CIRCUIT PROTECTOR			MS25237-19
CB5	CIRCUIT PROTECTOR			MS25237-15
CB7	CIRCUIT PROTECTOR			MS25237-30
CB8	CIRCUIT PROTECTOR			MS25237-23
CB9	CIRCUIT PROTECTOR			MS25237-28
CB5	CIRCUIT PROTECTOR			MS25237-30
CB10	CIRCUIT PROTECTOR		70 AMP	L37207-70
J28	CONNECTOR			MS3106R-24-21P
J24	CONNECTOR			MS3102R-24-21P
J25	CONNECTOR			MS3102R-24-11P
J26	CONNECTOR			MS3106R-24-7S
J27	CONNECTOR			MS3102R-24-7P
J37	CONNECTOR	BURTON		1PS-9
J38	CONNECTOR	AIRESEARCH		60865-8
J39	CONNECTOR			4031024-24-19P
J40	CONNECTOR			MS3501W-24-7P
J41	CONNECTOR			MS3106R-24-19S
J42	CONNECTOR	AIRESEARCH		60487-8
J43	BATTERY		WAE-1	
J47	CONNECTOR			4031024-24-21S
J48	CONNECTOR			MS3102R-24-21P
K54	VOLTAGE REGULATOR	DELCO-REM		1117-1C
K11	RELAY	I. EACH		5629-919
S26	SWITCH			MS24659-22
T25	SHUNT			4001047-6
T27	GENERATOR	LEECE-N	400AMP	5PM24-24
T28	REVERSE CURRENT RELAY			AN3322-400

NOTE

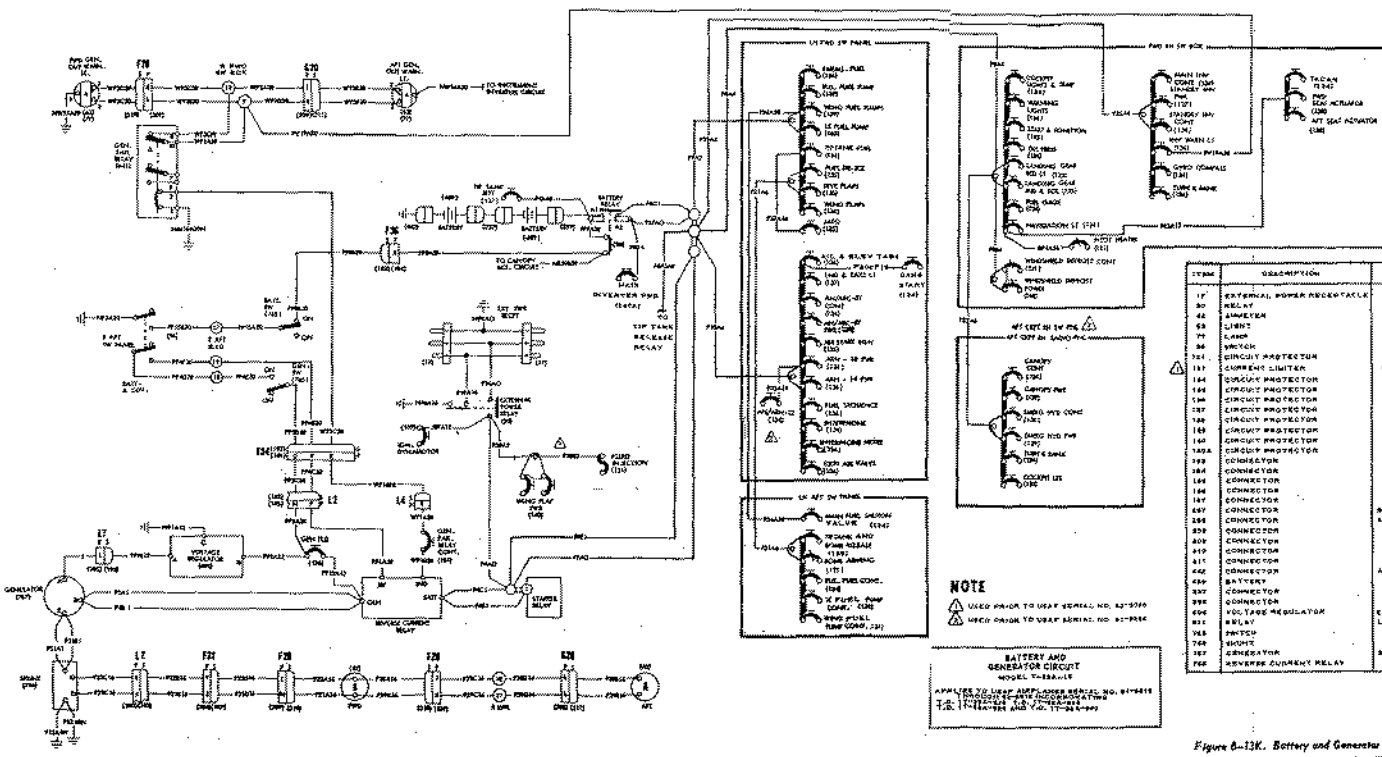
1. USE PER TO USAF SERIAL NO. 51-4564
2. USE WIRE NO. 51-4564 AND SUBSEQUENT

DETAIL A

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A-5

APPLIES TO USAF AIRPLANES SERIAL NO. 51-4564 THROUGH 53-5750 INCORPORATING T.O. 1T-33A-424, T.O. 1T-33A-436, T.O. 1T-33A-447

Figure 8-13 J. Battery and Generator Circuit



ITEM	DESCRIPTION	MFR.	TYPE	DWG. OR SPEC.
17	EXTERNAL POWER RECEPTACLE			AN3682-4A
30	RELAY			AN2960-1
42	AMMETER			MS28028-1
63	LIGHT		AMBER	MS25237-4
77	CLAMP			AN3420-413
86	SWITCH			MS25988-22
121	CIRCUIT PROTECTOR			AN3498-1C
137	CURRENT LIMITER	SUNDT	20C AMP	PLLF
164	CIRCUIT PROTECTOR			MS25437-5
165	CIRCUIT PROTECTOR			MS25437-74
166	CIRCUIT PROTECTOR			MS25437-48
167	CIRCUIT PROTECTOR			MS25437-30
168	CIRCUIT PROTECTOR			MS25437-28
169	CIRCUIT PROTECTOR			MS25437-25
170	CIRCUIT PROTECTOR			MS25437-80
170A	CIRCUIT PROTECTOR		125AMP	MS25998-6
183	CONNECTOR			MS27498-24-11B
184	CONNECTOR			MS27484-3B-11P
185	CONNECTOR			MS27484-24-11P
186	CONNECTOR			MS27484-24-11S
187	CONNECTOR			MS27529-24-12P
697	CONNECTOR	BURTON		1914
698	CONNECTOR	AIRESEARCH		60981-3
808	CONNECTOR			MS27529-24-13P
809	CONNECTOR			MS27497-20-7P
810	CONNECTOR			MS27484-22-7S
811	CONNECTOR			MS27484-22-14S
845	CONNECTOR	AIRESEARCH		40822-9
859	BATTERY		6AH	
897	CONNECTOR			MS27656-22-2P
898	CONNECTOR			MS27656-22-21P
906	VOLTAGE REGULATOR	ECLIPSE LEACH		1586-1C
911	RELAY			8730-819
968	SWITCH	-		MS25032-22
969	SHUNT			1469195-9
987	GENERATOR	BENDIX	40KVA	5984-4
988	REVERSE CURRENT RELAY			AN3015-600

NOTE

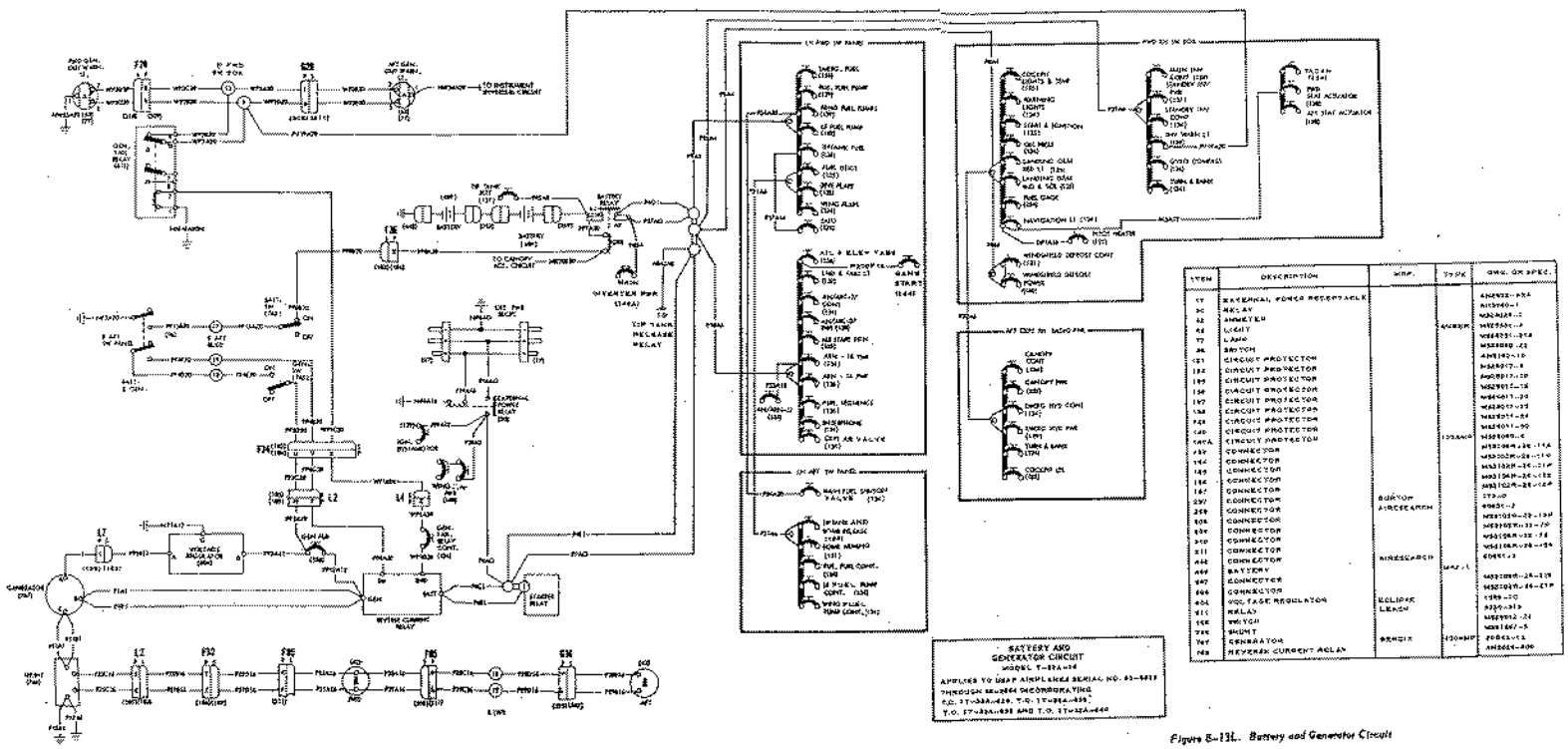
1. USED PRIOR TO USAF SERIAL NO. 52-5040
2. USED PRIOR TO USAF SERIAL NO. 52-5026

BATTERY AND GENERATOR CIRCUIT
MODEL T-33A-1,5

APPLIES TO USAF AIRPLANES SERIAL NO. 51-4419 THROUGH 52-5040 AND USN AIRPLANES WITH T.O. 1T-33A-1,5 AND T.O. 1T-33A-5,9

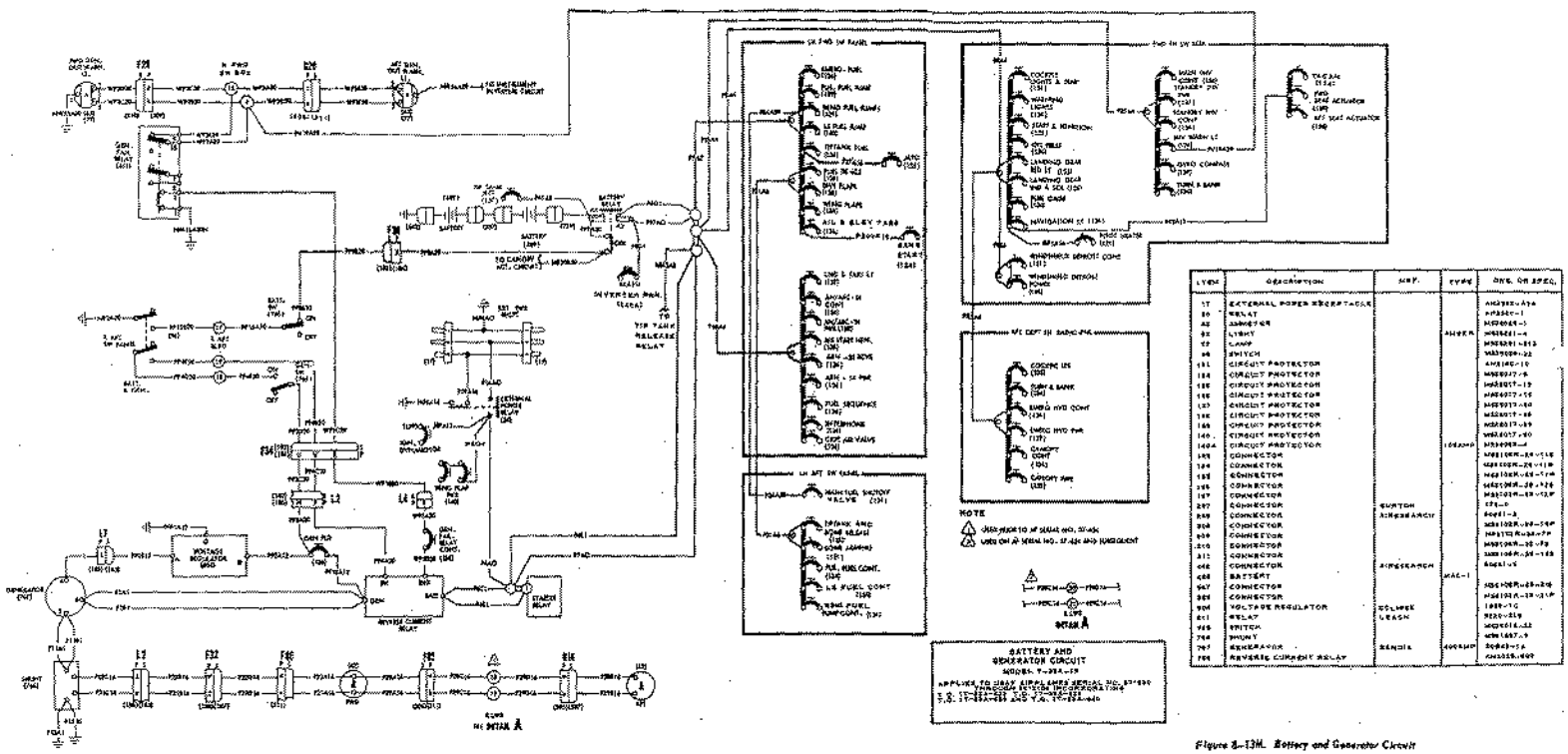
Figure 8-13K. Battery and Generator Circuit

Added Change 19 - 15 September 1969 5801



SATTERY AND GENERATOR CIRCUIT
MODEL T-33A-1-1
APPLIES TO USAF AIRPLANES SERIAL NO. 53-5818 THROUGH 53-5864 INCORPORATING O.C. 1T-33A-429, T.O. 1T-33A-439, T.O. 1T-33A-438 AND T.O. 1T-33A-440

Figure 8-13L. Battery and Generator Circuit



ITEM	DESCRIPTION	MFR.	TYPE	MIL SPEC.
17	EXTERNAL POWER RECEPTACLE			MS3322-A14
80	RELAY			MS352C-1
82	AMMETER			MS18068-5
83	LIGHT		AN4EK	MS35221-4
92	LAMP			MS35221-1813
98	SWITCH			MS27029-22
181	CIRCUIT PROTECTOR			AN3320-15
184	CIRCUIT PROTECTOR			MS25077-5
185	CIRCUIT PROTECTOR			MS25077-12
186	CIRCUIT PROTECTOR			MS25077-15
187	CIRCUIT PROTECTOR			MS25077-20
188	CIRCUIT PROTECTOR			MS25077-25
189	CIRCUIT PROTECTOR			MS25077-30
189A	CIRCUIT PROTECTOR		100AMP	MS25077-4
193	CONNECTOR			MS21029C-24-41S
194	CONNECTOR			MS21029C-24-41P
195	CONNECTOR			MS21042L-24-41S
196	CONNECTOR			MS21042L-24-41P
197	CONNECTOR			MS21029C-28-42S
197	CONNECTOR	BURTON		ETS-D
198	CONNECTOR	AIRESEARCH		600E1-3
204	CONNECTOR			MS3102R-24-54P
209	CONNECTOR			MS3112E-24-7P
210	CONNECTOR			MS3106R-28-7S
212	CONNECTOR			MS3106R-24-16S
402	CONNECTOR	AIRESEARCH		600E1-6
402	BATTERY		MAE-1	
403	CONNECTOR			MS3106R-28-20S
404	CONNECTOR			MS3101A-28-21P
404	VOLTAGE REGULATOR	ELDRED		1488-10
411	RELAY	LEASH		9230-219
418	SWITCH			MS27016-22
704	SHUNT			MIL-1667-9
707	GENERATOR	BENDIX	400AMP	30843-10
708	REVERSE CURRENT RELAY			AN3328-400

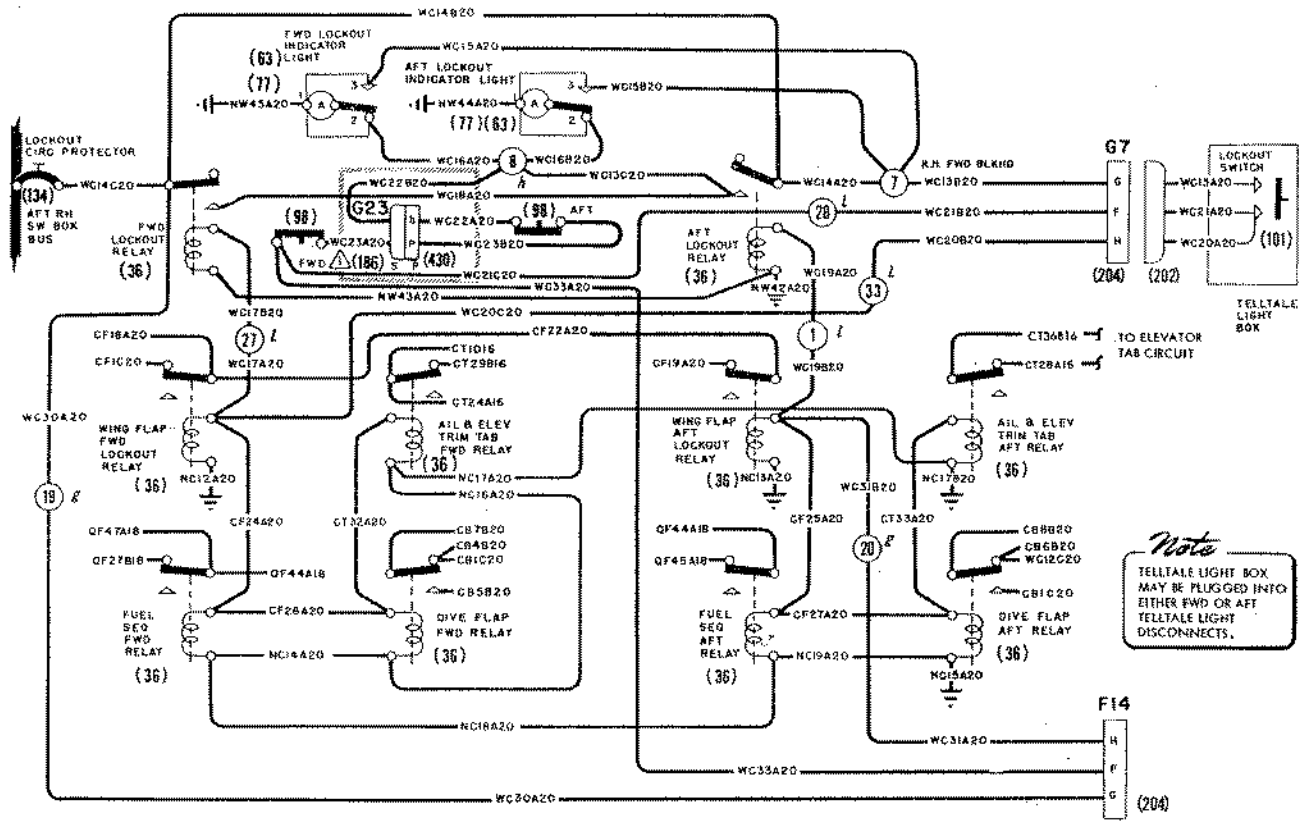
NOTE

1. USED PRIOR TO AF SERIAL NO. 57-456
2. USED ON AF SERIAL NO. 57-456 AND SUBSEQUENT

BATTERY AND GENERATOR CIRCUIT

APPLIES TO USAF AIRPLANES SERIAL NO. 57-590
T.O. 1T-33A-1-1 AND T.O. 1T-33A-1-1A

Figure 8-13H. Battery and Generator Circuit

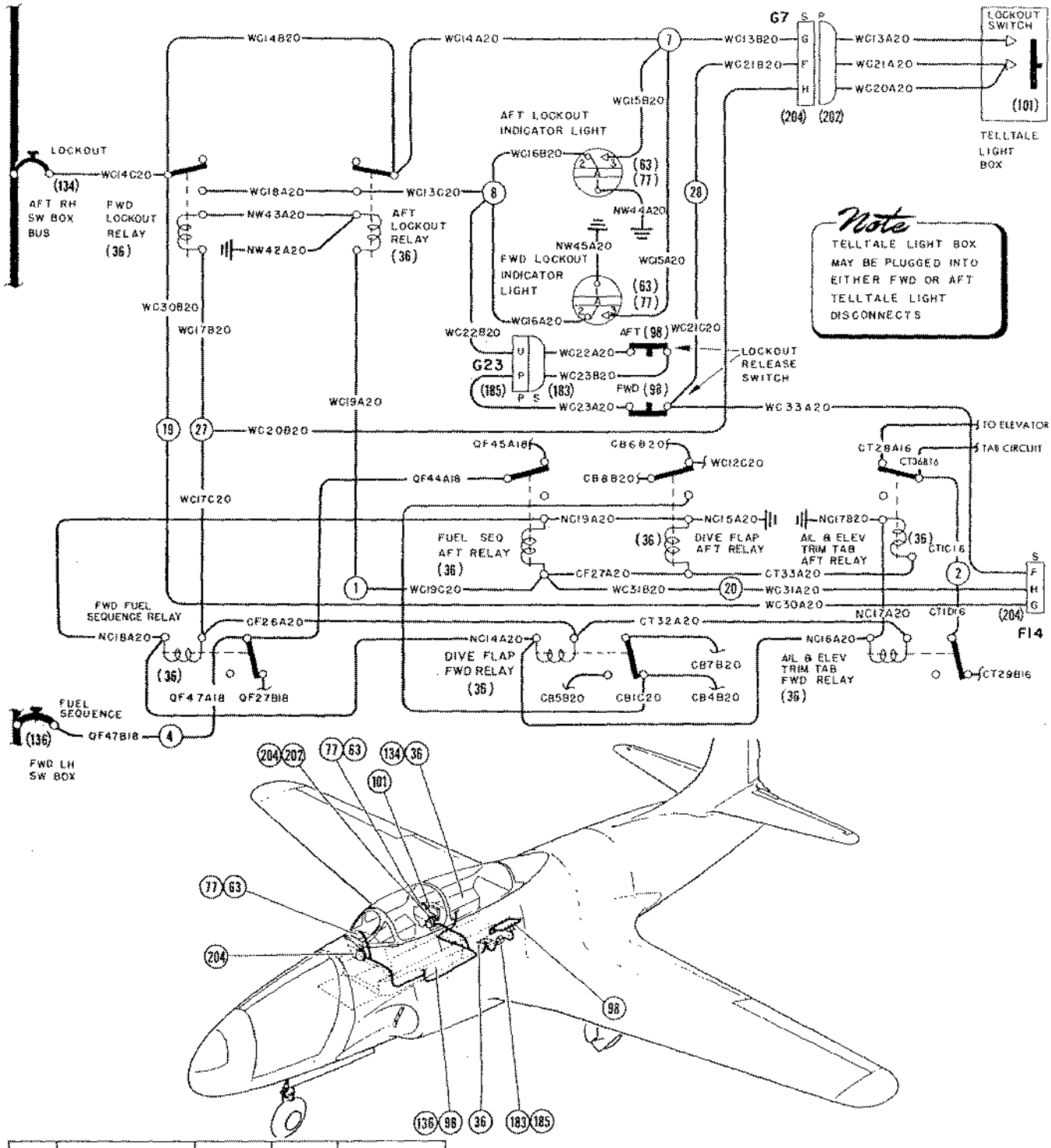


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD.		NB-57-C
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
98	SWITCH LOCKOUT RELEASE	C-H		8873
101	SWITCH	C-H		8872
134	CIRCUIT PROTECTOR			AN3161-P5
1 183	CONNECTOR			AN3106B-28-11S
2 185	CONNECTOR			AN3102A-28-11P
1 186	CONNECTOR			AN3106B-28-12S
202	CONNECTOR			AN3108B-20-29P
204	CONNECTOR			AN3102A-20-29S
1 430	CONNECTOR			AN3102A-28-12P

GB1444
EM20-42-8-18

STUDENT LOCKOUT CIRCUIT
MODEL T-33A
USED PRIOR TO AF SERIAL NO. 50-385

Figure 8-14. Student Lockout Circuit

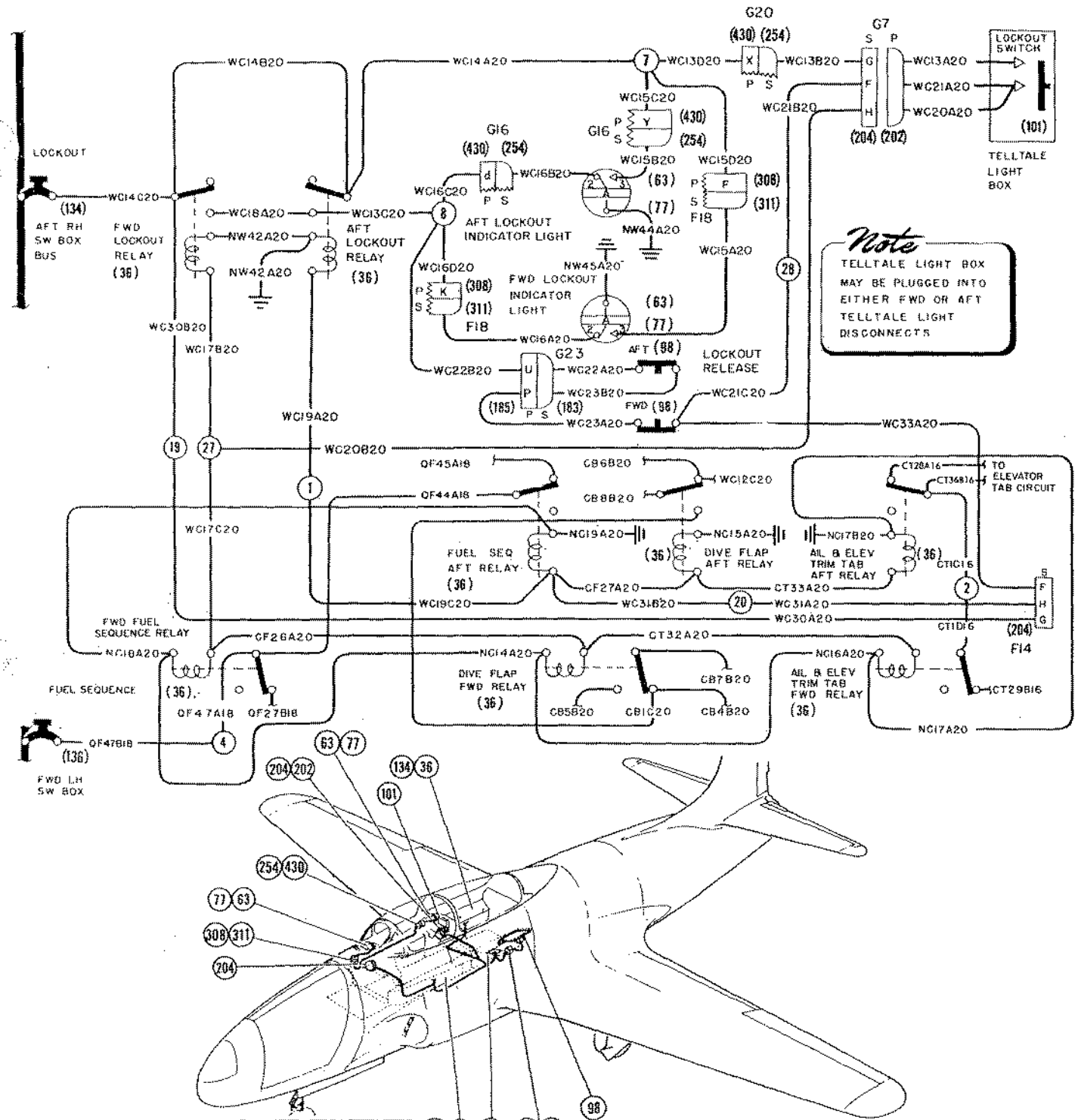


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
98	SWITCH	C-H		8873
101	SWITCH	C-H		8872
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
202	CONNECTOR			AN3108B-20-29P
204	CONNECTOR			AN3102A-20-29S

GB1443
EM20-42-8-19

STUDENT LOCKOUT CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 50-385 THROUGH 51-4328

Figure 8-15. Student Lockout Circuit

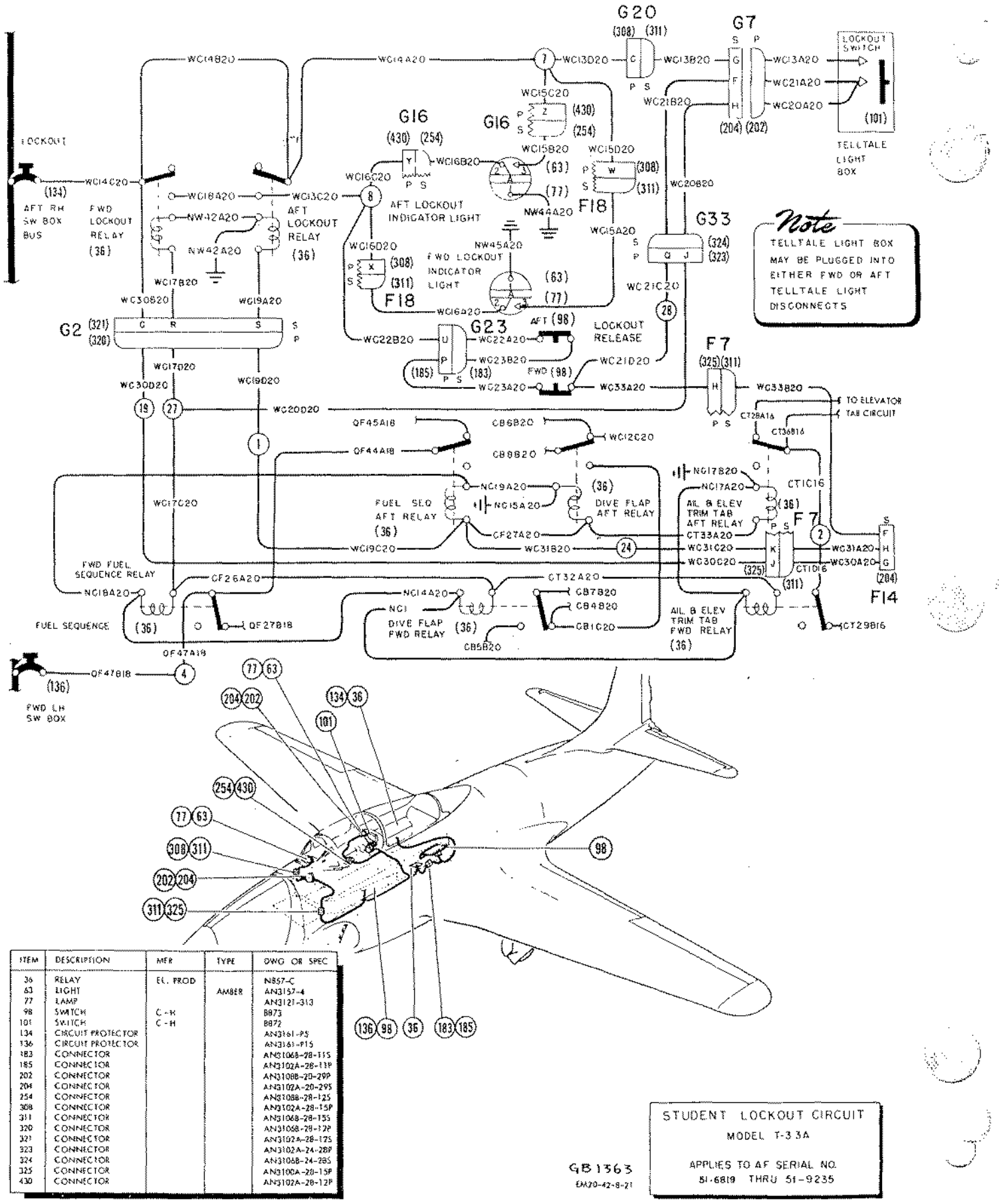


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
98	SWITCH	C-H		8873
101	SWITCH	C-H		8872
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106A-28-11S
185	CONNECTOR			AN3102A-28-11P
202	CONNECTOR			AN3108-20-29P
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106A-24-15S
430	CONNECTOR			AN3102A-28-12P

68/1995
EM20-42-8-20

STUDENT LOCKOUT CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4329 THRU 51-6818

Figure 8-16. Student Lockout Circuit

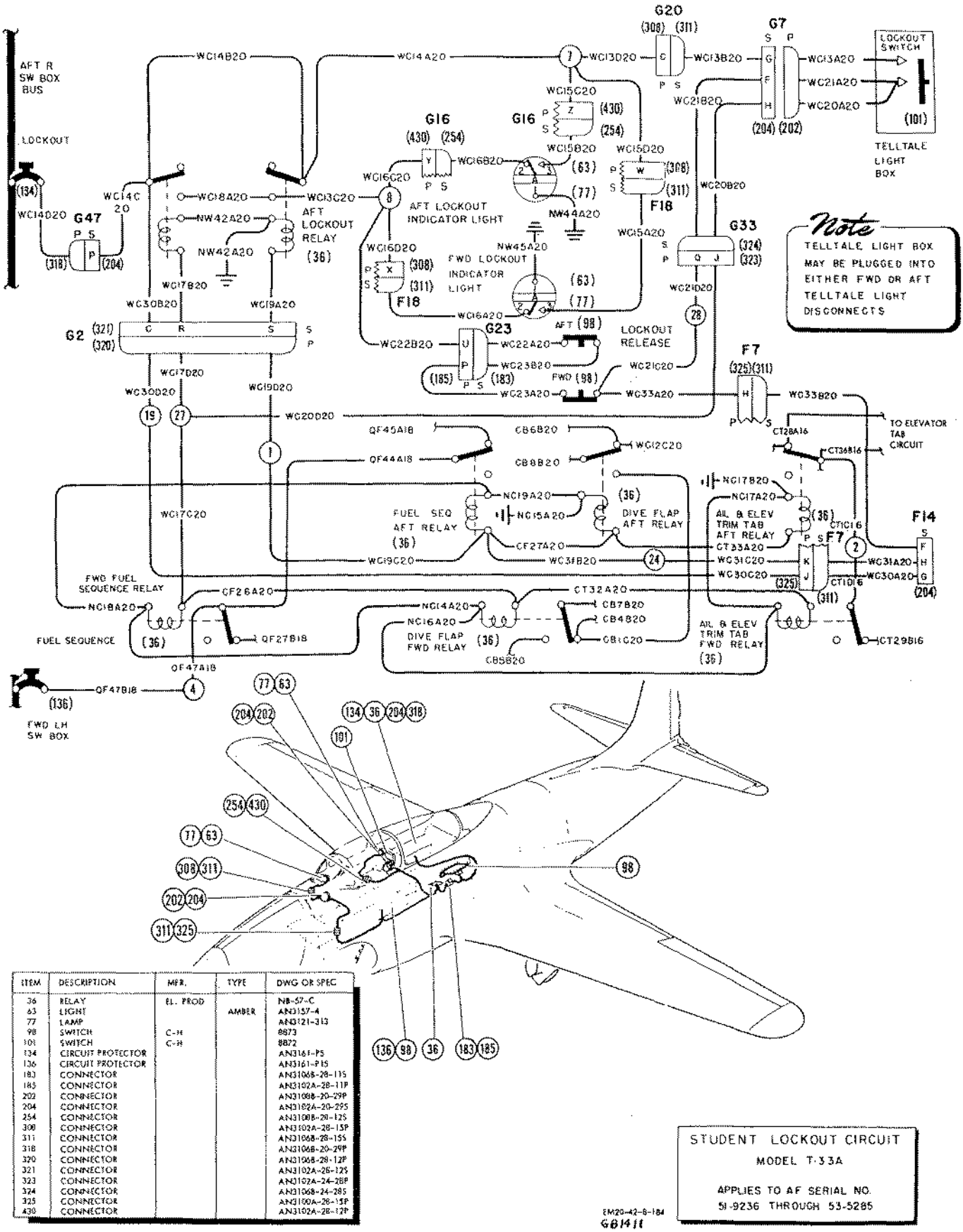


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		N857-C
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
98	SWITCH	C-H		B873
101	SWITCH	C-H		B872
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN51068-28-T5S
185	CONNECTOR			AN3102A-28-11P
202	CONNECTOR			AN3108B-20-29P
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN3108B-28-12S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN51068-28-T5S
320	CONNECTOR			AN51068-28-12P
321	CONNECTOR			AN3102A-28-12S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
325	CONNECTOR			AN3100A-20-15P
430	CONNECTOR			AN3102A-28-12P

GB1563
EM20-42-8-21

STUDENT LOCKOUT CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THRU 51-9235

Figure 8-17. Student Lockout Circuit

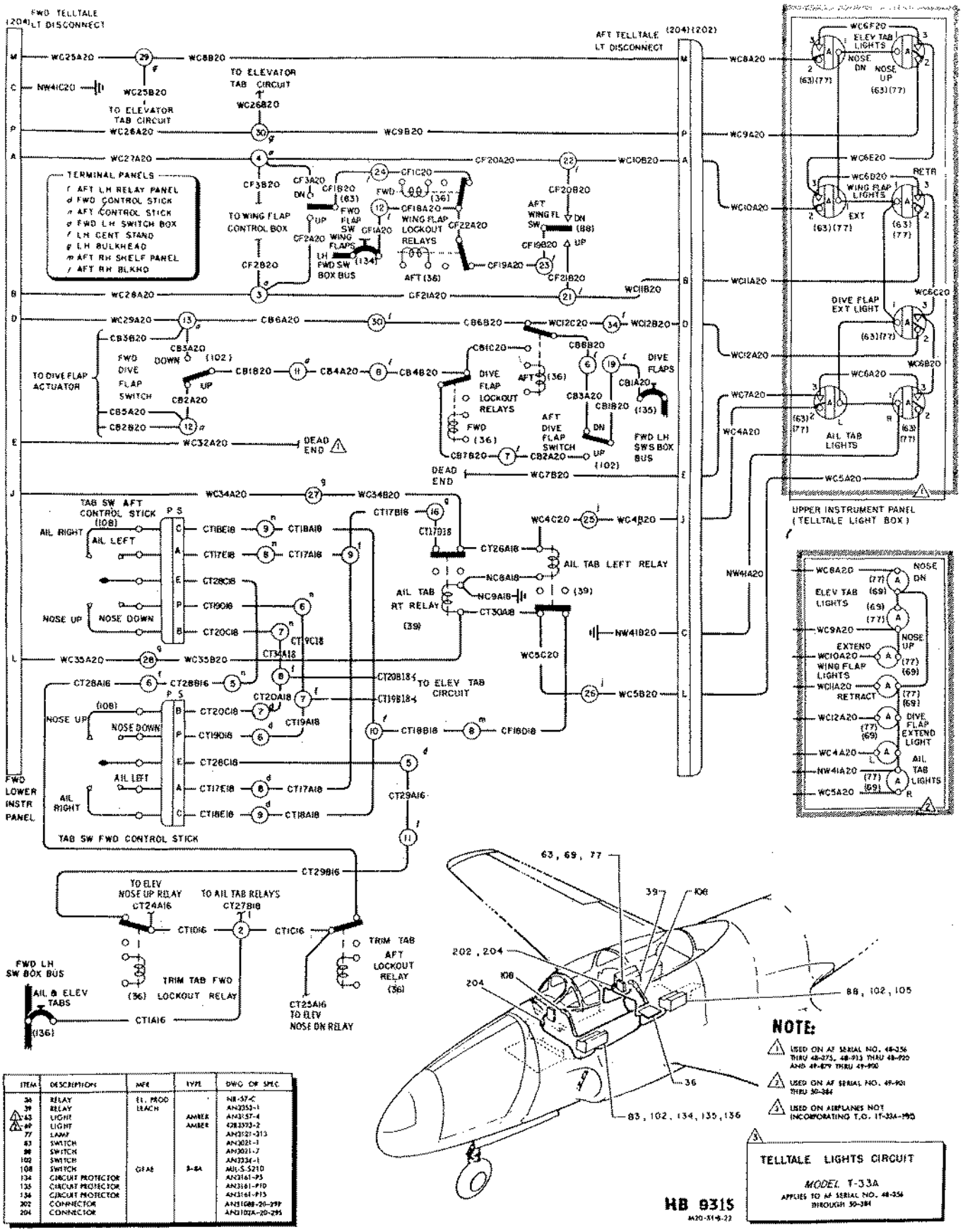


ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		NB-57-C
63	LIGHT		AMBER	AN3157-A
77	LAMP			AN3121-313
98	SWITCH	C-H		8873
101	SWITCH	C-H		8872
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN31068-28-11S
185	CONNECTOR			AN3102A-28-11P
202	CONNECTOR			AN31068-20-29P
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN31068-20-12S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN31068-28-15S
318	CONNECTOR			AN31068-20-29P
320	CONNECTOR			AN31068-28-12P
321	CONNECTOR			AN3102A-26-12S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN31068-24-28S
325	CONNECTOR			AN3100A-26-15P
430	CONNECTOR			AN3102A-28-12P

STUDENT LOCKOUT CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-9236 THROUGH 53-5285

EM20-42-8-184
GB1411

Figure 8-18. Student Lockout Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
39	RELAY	ELECTRO PRODUCTS LABORATORIES		NB-57-C
39	RELAY	LEACH		AN3353-1
43	LIGHT		AMBER	AN3157-4
69	LIGHT		AMBER	6813393-2
77	LAMP			AN3523-313
83	SWITCH			AN3021-1
88	SWITCH			AN3021-7
102	SWITCH			AN3234-1
108	SWITCH	GRAS	B-8A	MIL-S-5210
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
202	CONNECTOR			AN3108B-20-29P
204	CONNECTOR			AN3102A-20-29S

Figure 8-19. Telltale Lights Circuit

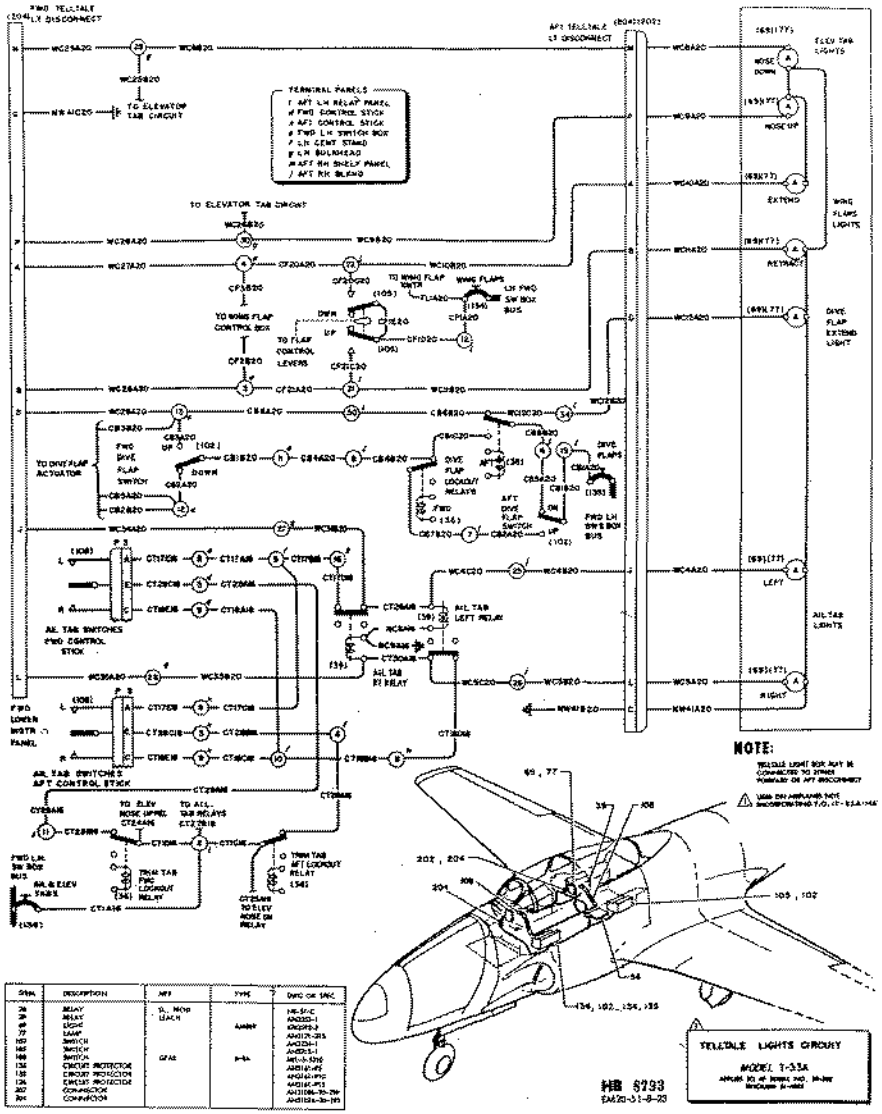
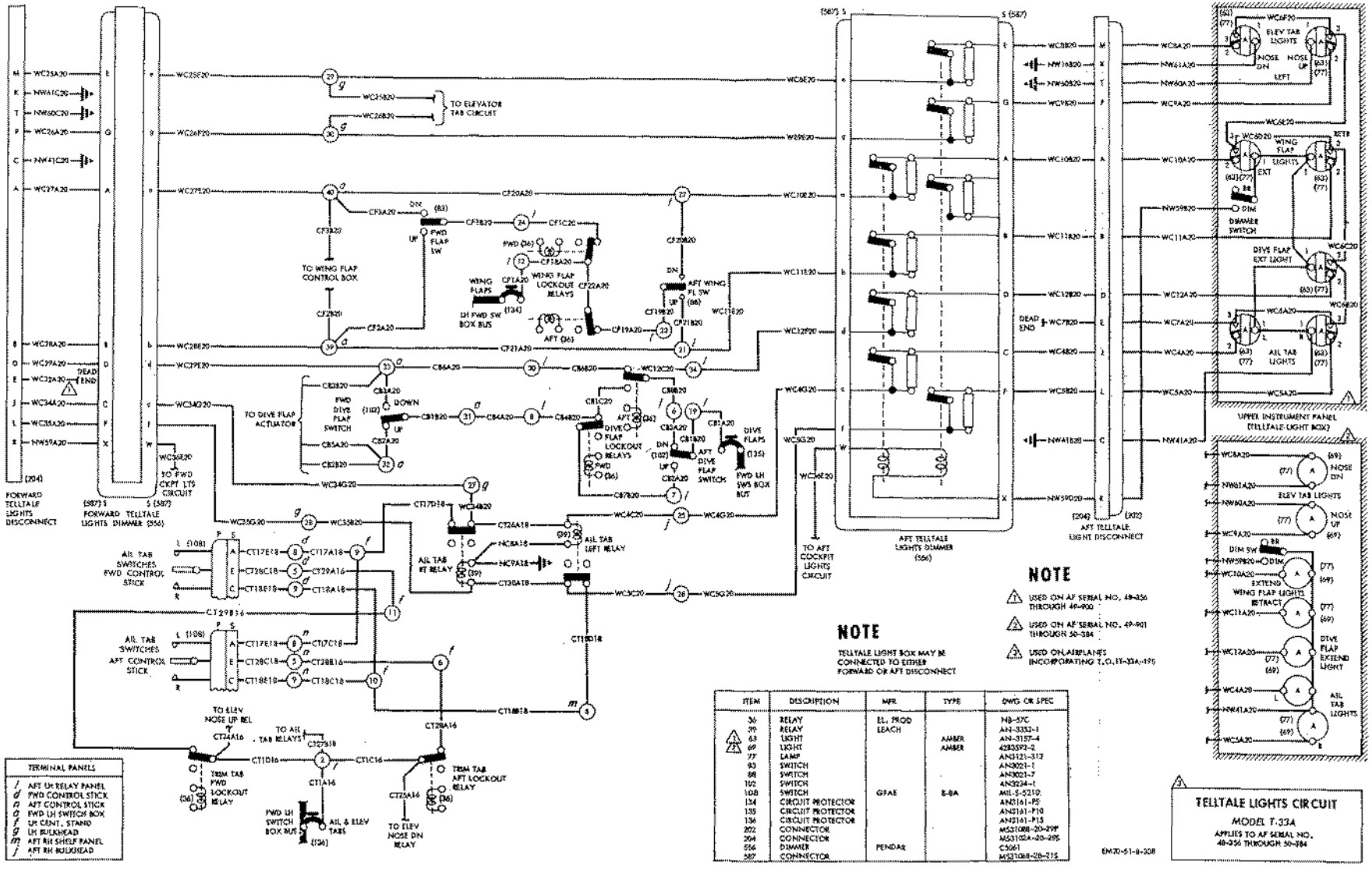
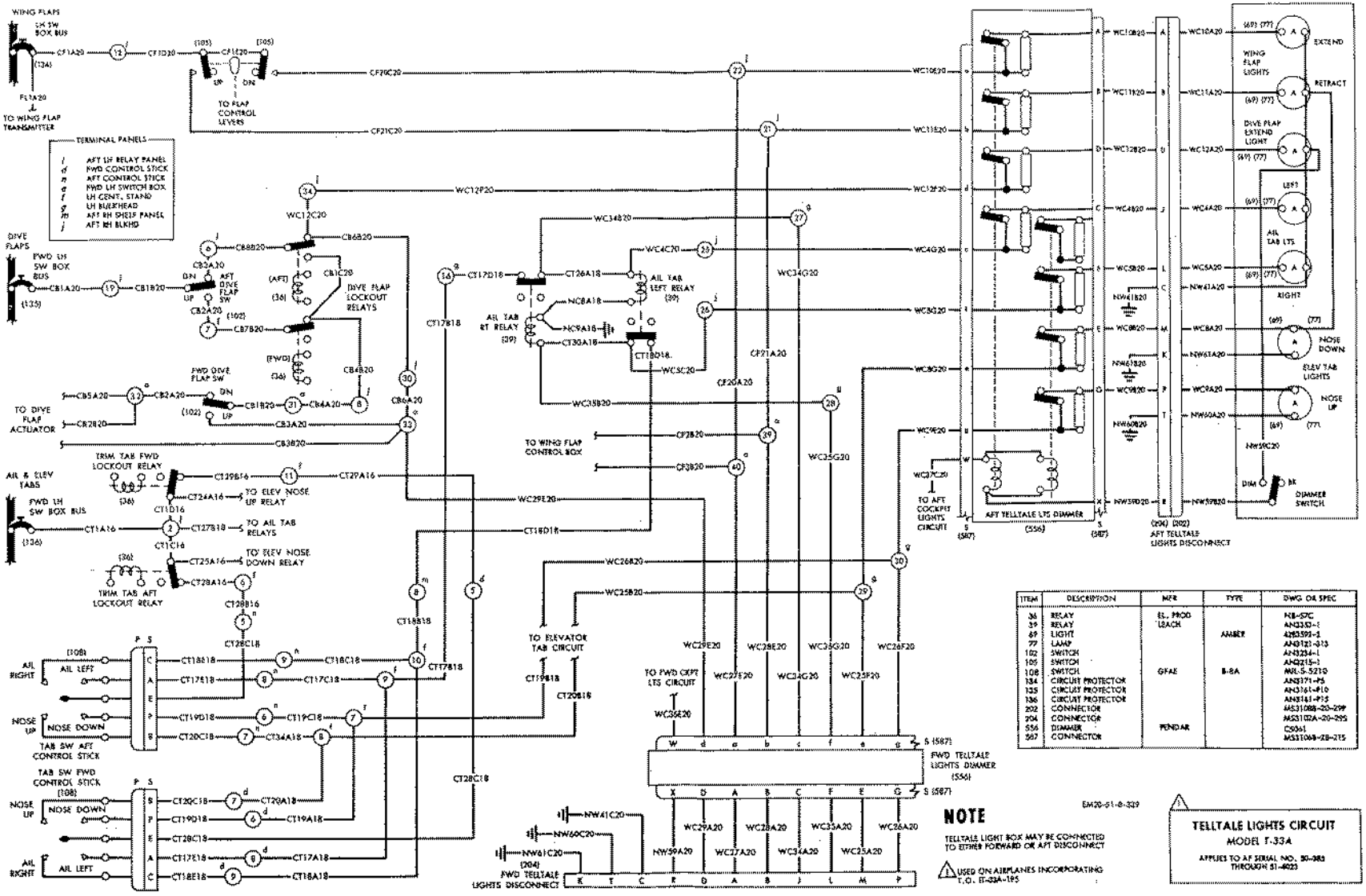


Figure 8-21. Telltale Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		MB-57C
39	RELAY	LEACH		AN-3332-1
2 63	LIGHT		AMBER	AN-3157-4
69	LIGHT		AMBER	4283592-2
77	LAMP			AN3121-333
83	SWITCH			AN3021-1
88	SWITCH			AN3021-7
102	SWITCH			AN3234-1
108	SWITCH	GFAE	8-8A	MIL-S-5210
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
202	CONNECTOR			MS35058-20-29P
204	CONNECTOR			MS3102A-20-29S
556	DIMMER	PENDAR		C5061
587	CONNECTOR			MS35058-28-21S

Figure 8-20. Telltale Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
34	RELAY	EL. PROD LEACH		MIL-SPEC
39	RELAY			AN3332-1
69	LIGHT		AMBER	4253593-1
77	LAMP			AN3123-313
102	SWITCH			AN3234-1
105	SWITCH			AN4215-1
108	SWITCH	GPAE	B-8A	MIL-S-5210
134	CIRCUIT PROTECTOR			AN3371-P5
135	CIRCUIT PROTECTOR			AN3361-P10
136	CIRCUIT PROTECTOR			AN3361-P15
202	CONNECTOR			MS31088-20-29P
204	CONNECTOR			MS3102A-20-29S
556	DIMMER	PENDAR		C5056
567	CONNECTOR			MS3106B-28-21S

EM20-51-8-329

NOTE

TELLTALE LIGHT BOX MAY BE CONNECTED TO EITHER FORWARD OR AFT DISCONNECT

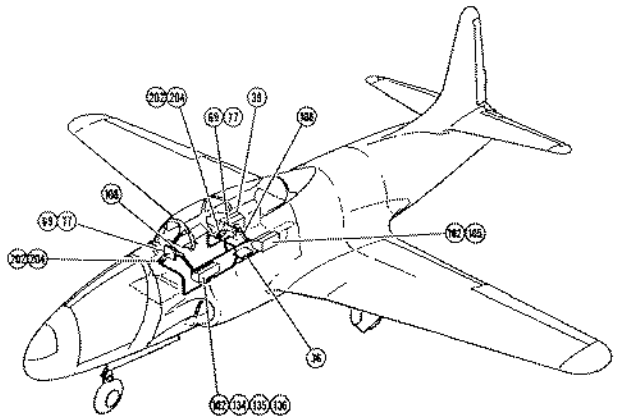
⚠ USED ON AIRPLANES INCORPORATING T.O. 1T-33A-185

⚠

TELLTALE LIGHTS CIRCUIT
MODEL T-33A

APPLIES TO AF SERIAL NO. 50-383 THROUGH 51-6023

Figure 8-22. Telltale Lights Circuit



NOTE:

1 USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-195

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	ES PROD		MS-27-C
38	RELAY	LEACH		AN2550-1
69	LIGHT		AMBER	6265975-9
77	LAMP			AN3151-313
102	SWITCH			AN3234-1
105	SWITCH			AN3235-1
108	SWITCH	GPI	5-8	MS-5-52106
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3167-P10
136	CIRCUIT PROTECTOR			AN3167-P15
202	CONNECTOR			AN3108R-20-29P
204	CONNECTOR			AN3102A-20-29S

BM30-51-8-24

TELLTALE LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4024 THRU 51-4328

Figure 8-23. Telltale Lights Circuit (Sheet 1 of 2)

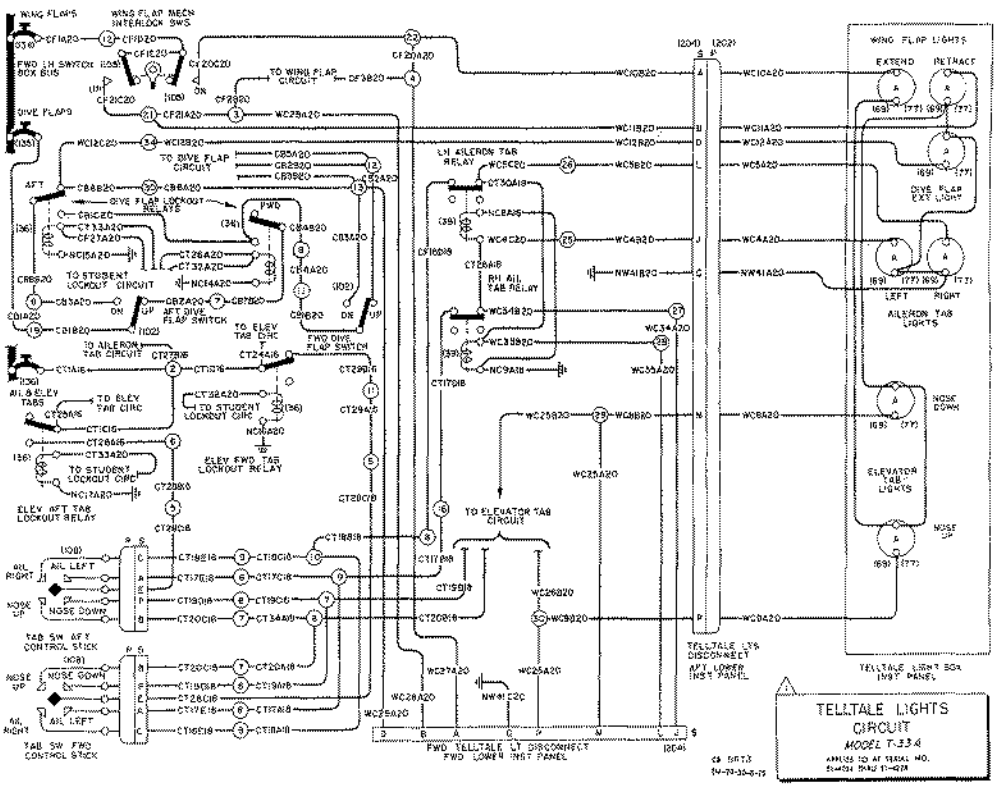
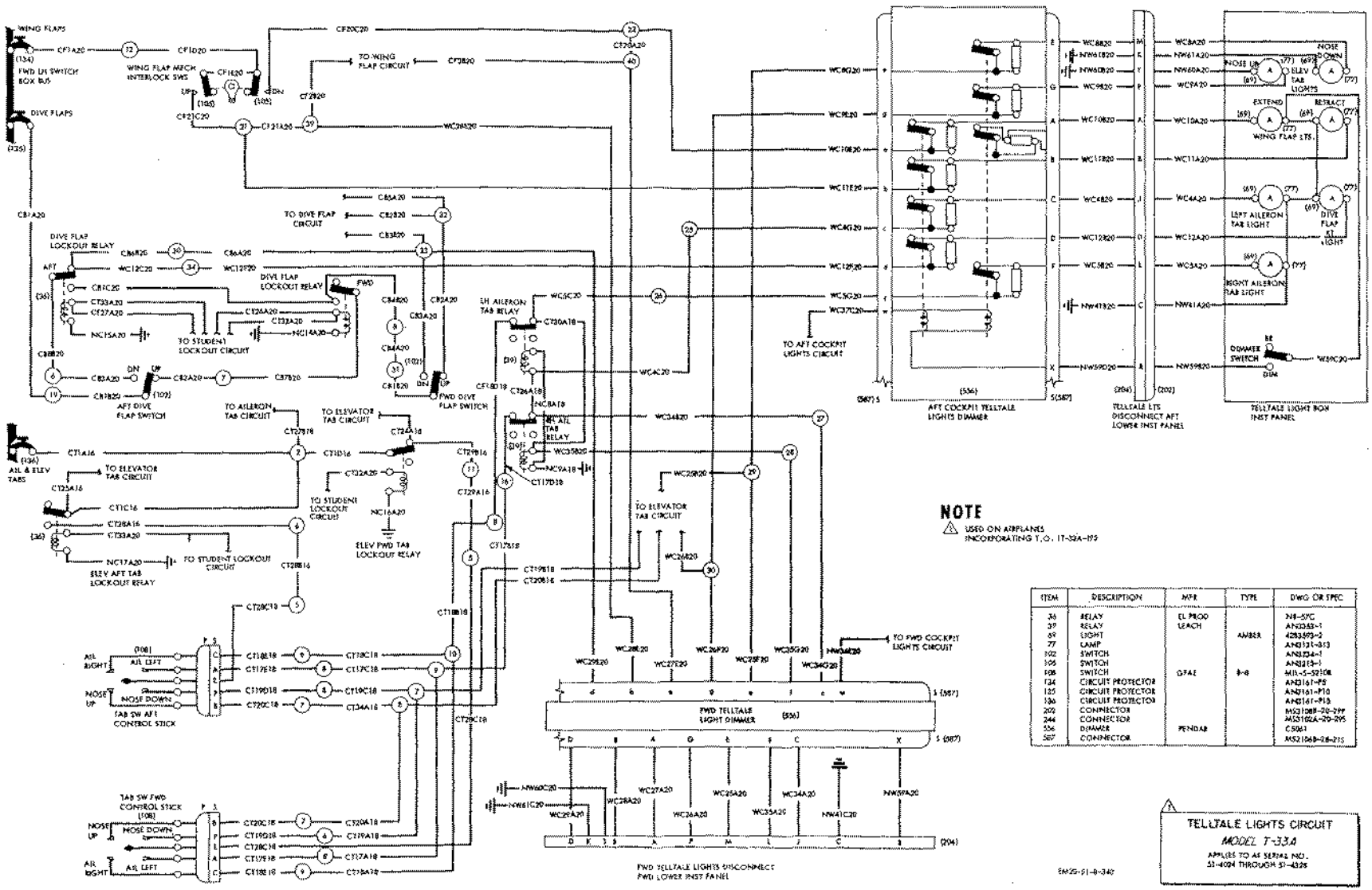


Figure 8-23. Telltale Lights Circuit (Sheet 2 of 2)



NOTE

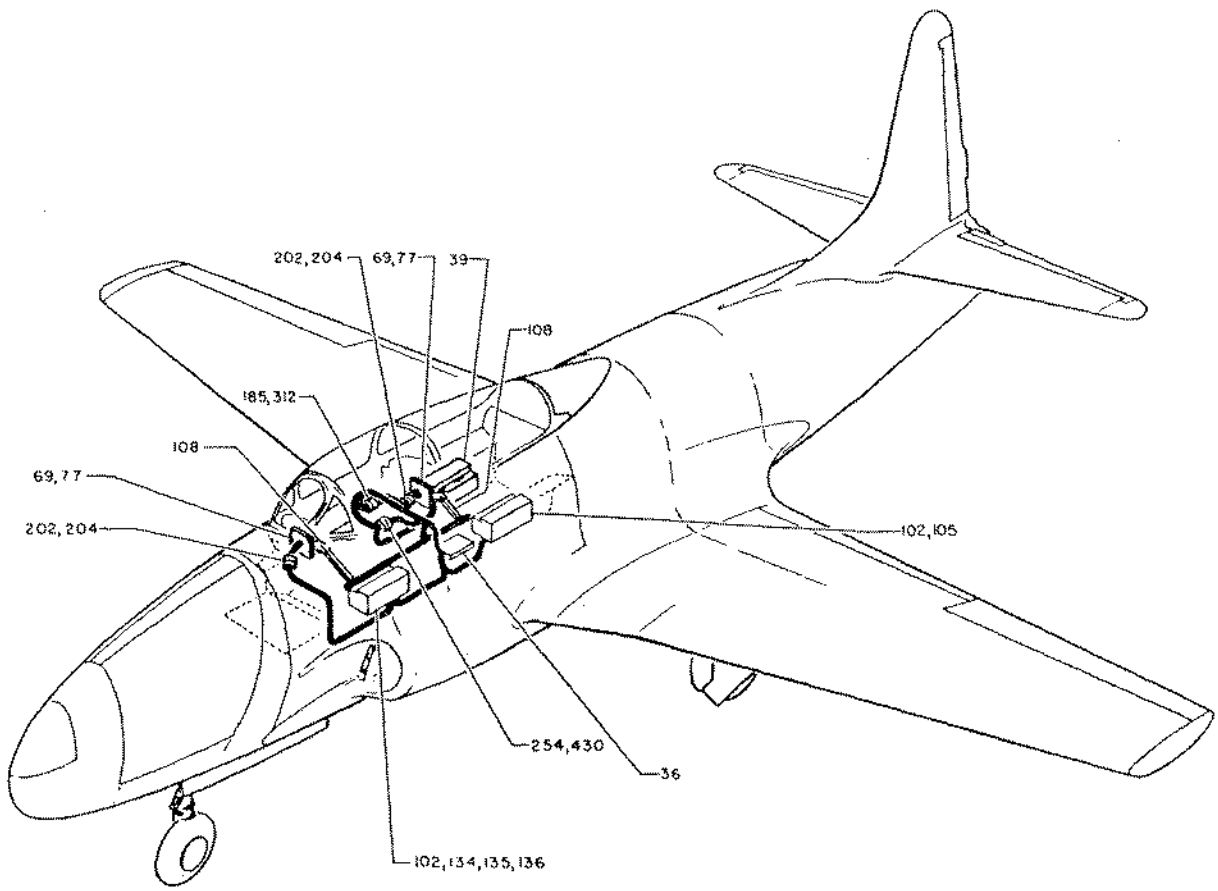
⚠ USED ON AIRPLANES INCORPORATING T.O. 1T-33A-195

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NR-57C
39	RELAY	LEACH		AN3653-1
69	LIGHT		AN3828	4283393-2
77	LAMP			AN3121-313
102	SWITCH			AN3234-1
105	SWITCH			AN3233-1
108	SWITCH	GFAE	9-B	MIL-S-5210B
124	CIRCUIT PROTECTOR			AN3161-P5
125	CIRCUIT PROTECTOR			AN3161-P10
126	CIRCUIT PROTECTOR			AN3161-P15
202	CONNECTOR			MS21088-20-29P
244	CONNECTOR			MS3102A-20-29S
556	DIMMER	PENDAR		C-5061
587	CONNECTOR			MS21068-28-21S

⚠ TELLTALE LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO.
51-4094 THROUGH 51-4326

EM2G-51-8-340

Figure 8-24. Telltale Lights Circuit



NOTE

1 USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-195

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		NB-57-C
39	RELAY	LEACH		AN3353-1
69	LIGHT		AMBER	4283593-2
77	LAMP			AN3121-313
102	SWITCH			AN3234-1
105	SWITCH			AN3215-1
108	SWITCH	GFAE	B-8	MIL-S-5210B
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
185	CONNECTOR			AN3102A-28-11P
202	CONNECTOR			AN3108B-20-29P
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN3108B-28-12S
312	CONNECTOR			AN3108B-28-11S
430	CONNECTOR			AN3102A-28-12P

1

TELLTALE LIGHTS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4329 THRU 51-6818

HB 8790
EM20-51-8-26

Figure 8-25. Telltale Lights Circuit (Sheet 1 of 2)

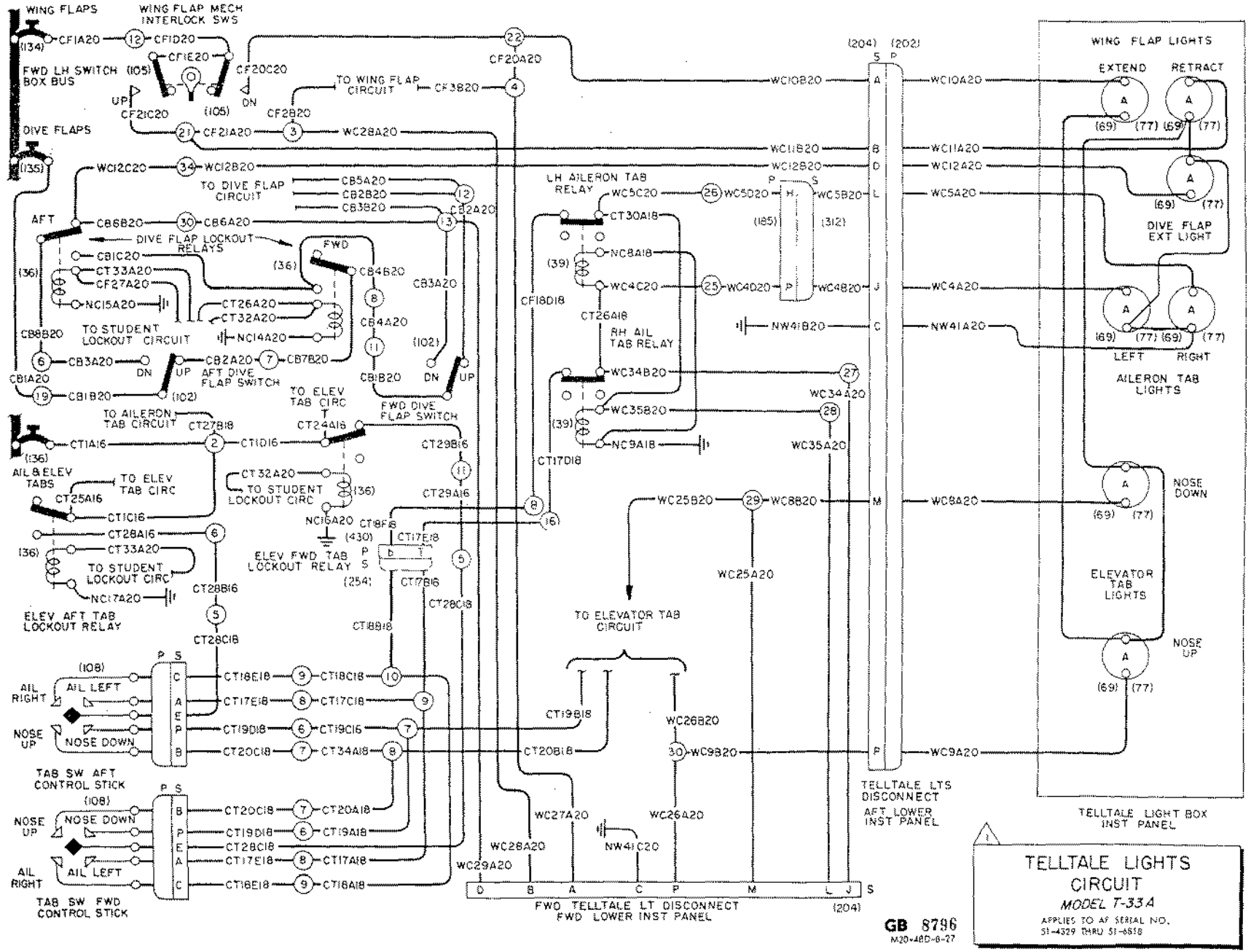
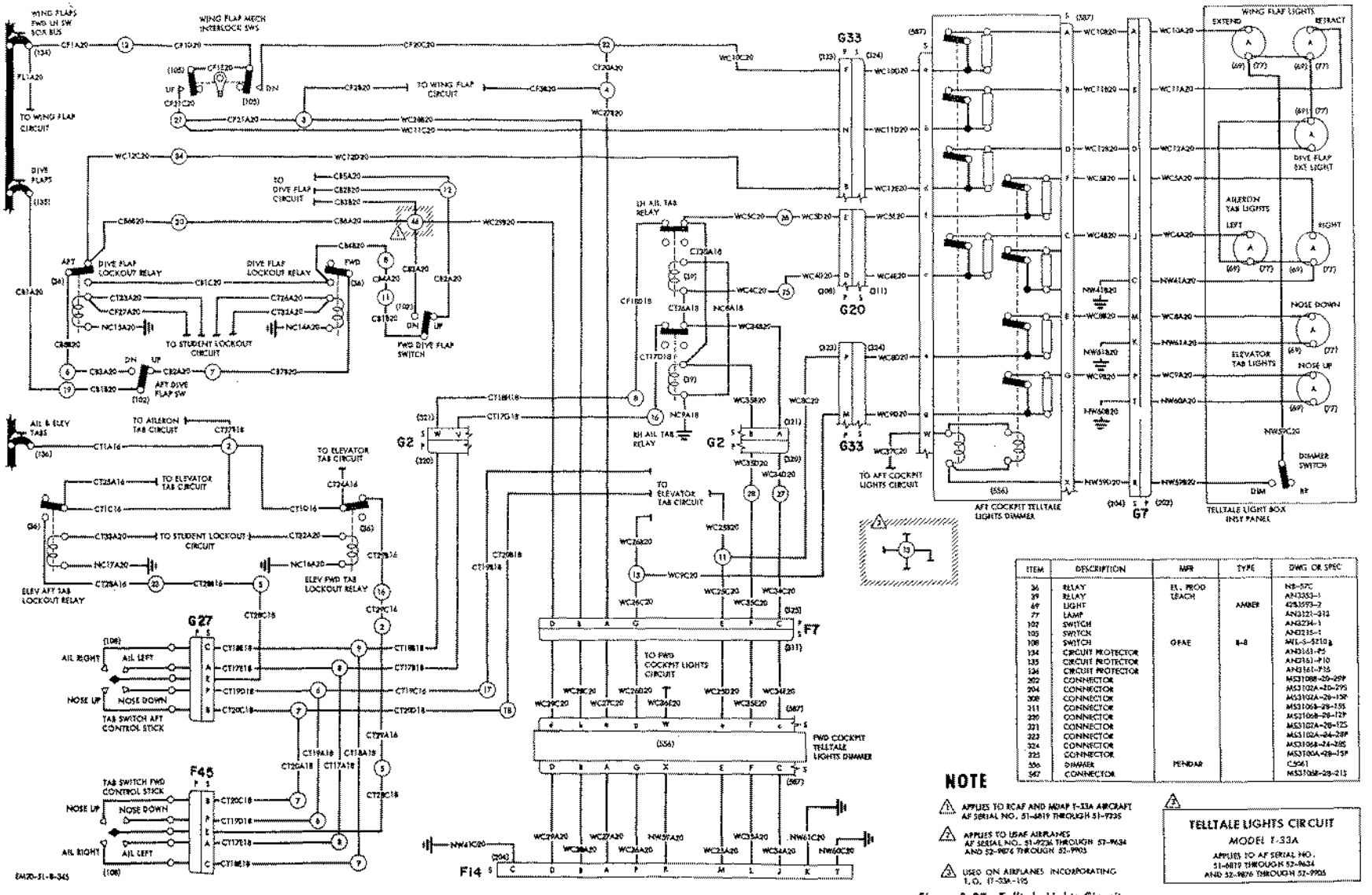


Figure 8–25. Telltale Lights Circuit (Sheet 2 of 2)



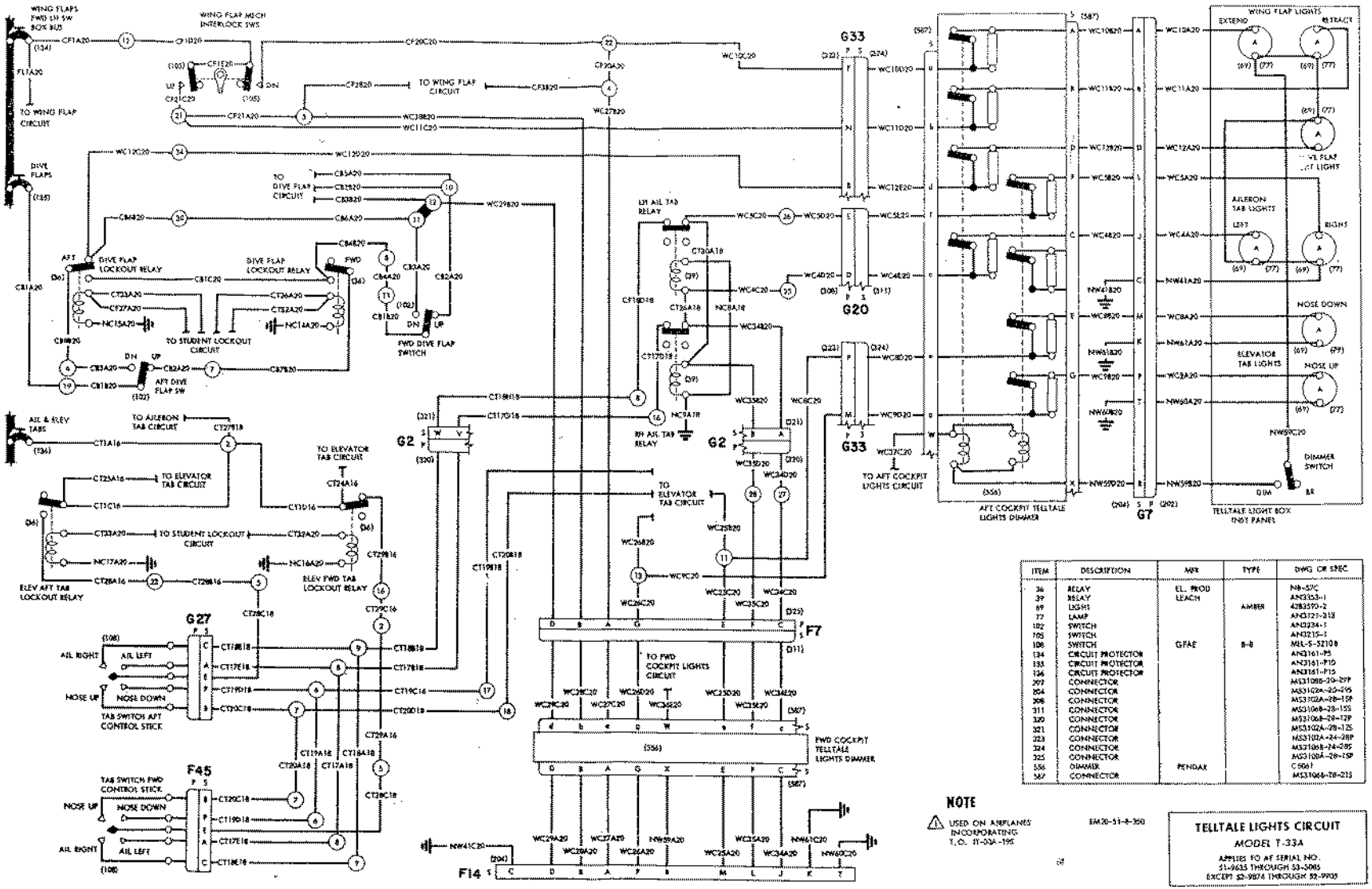
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		NB-57C
39	RELAY	TEACH		AN3350-1
69	LIGHT		AMBER	4053595-2
77	LAMP			AN3121-313
102	SWITCH			AN3234-1
105	SWITCH			AN3235-1
108	SWITCH	GRAE	8-8	MTL-S-3210 g
134	CIRCUIT PROTECTOR			AN3163-M5
135	CIRCUIT PROTECTOR			AN3163-M10
136	CIRCUIT PROTECTOR			AN3163-M15
202	CONNECTOR			MS31088-20-29P
204	CONNECTOR			MS3102A-20-29S
308	CONNECTOR			MS3102A-20-15P
311	CONNECTOR			MS31068-28-15S
320	CONNECTOR			MS31068-28-12P
321	CONNECTOR			MS3102A-28-12S
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS31068-24-28S
325	CONNECTOR			MS3100A-28-15P
556	DIMMER	PENDAR		CA561
567	CONNECTOR			MS31068-28-21S

NOTE

1. APPLIES TO RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9735
2. APPLIES TO USAF AIRPLANES AF SERIAL NO. 51-9736 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-195

TELLTALE LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

Figure 8-27. Telltale Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD LEACH		NR-67C
39	RELAY			AN3353-1
69	LENS		AMBER	428359-2
77	LAMP			AN3121-313
102	SWITCH			AN3234-1
105	SWITCH			AN3215-1
108	SWITCH	GFAE	B-8	MIL-S-5210B
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
207	CONNECTOR			MS3108B-20-29P
304	CONNECTOR			MS3102A-20-29S
308	CONNECTOR			MS3102A-28-15P
311	CONNECTOR			MS3106B-28-15S
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106B-24-28S
325	CONNECTOR			MS3108A-28-15P
556	DIMMER	PENDAR		C-5061
587	CONNECTOR			MS3106B-28-21S

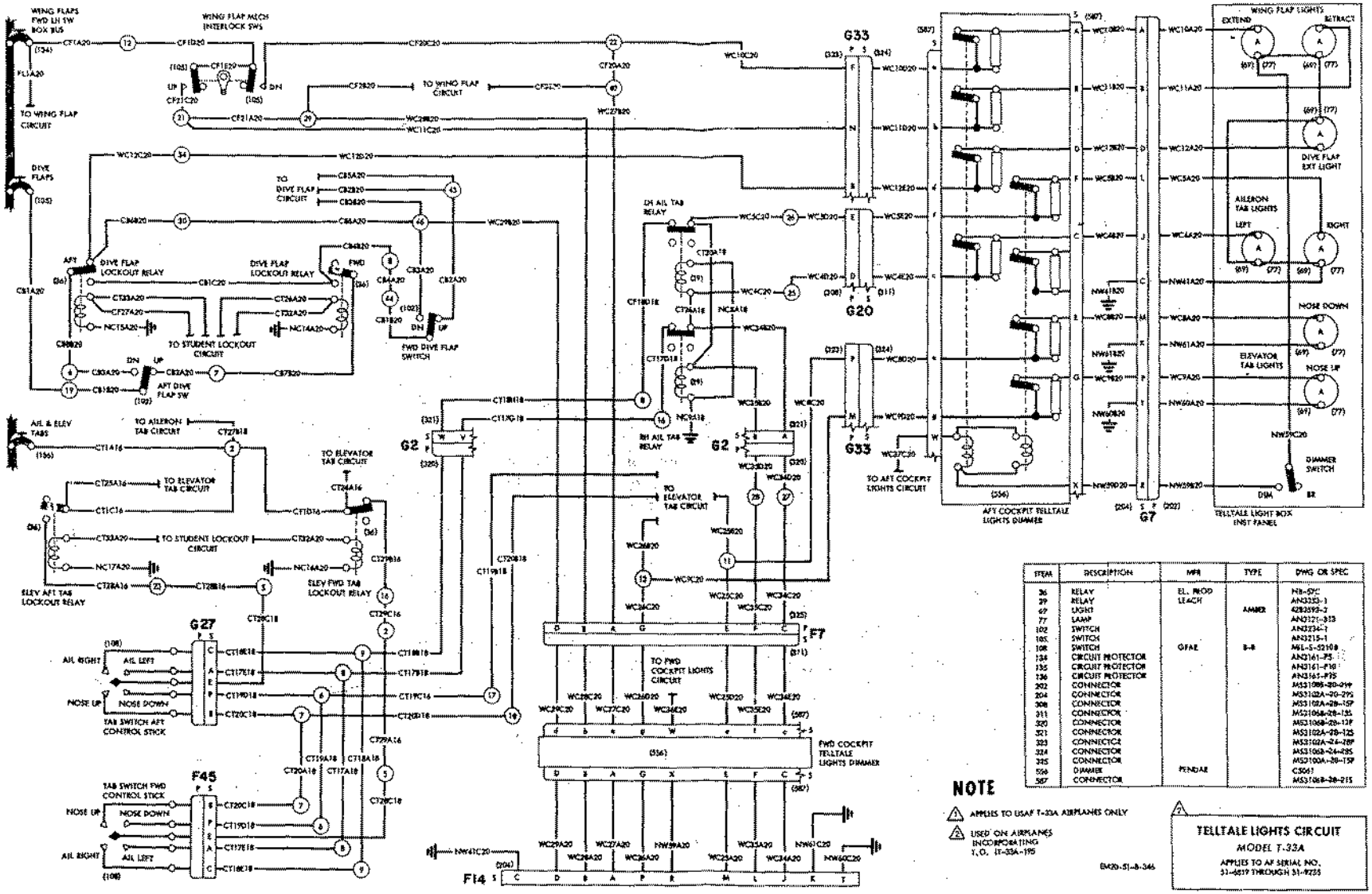
NOTE

⚠ USED ON AIRPLANES INCORPORATING T.O. 1T-33A-195

EM20-51-8-350

TELLTALE LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-9635 THROUGH 53-5085 EXCEPT 52-9874 THROUGH 52-9905

Figure 8-29. Telltale Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		NR-5YC
39	RELAY	LEACH		AN3333-1
69	LIGHT		AMBER	6S8395-2
77	LAMP			AN3121-313
102	SWITCH			AN3234-1
105	SWITCH			AN3215-1
108	SWITCH	GFAE	B-8	MSL-5-5210B
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3165-P7S
202	CONNECTOR			MS3108B-20-01P
204	CONNECTOR			MS3102A-20-29S
308	CONNECTOR			MS3108A-28-15P
311	CONNECTOR			MS3106B-28-13S
320	CONNECTOR			MS3106B-20-12P
321	CONNECTOR			MS3102A-20-12S
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106B-24-28S
325	CONNECTOR			MS3100A-28-15P
556	DIMMER	PENDAR		C5061
587	CONNECTOR			MS3106B-38-21S

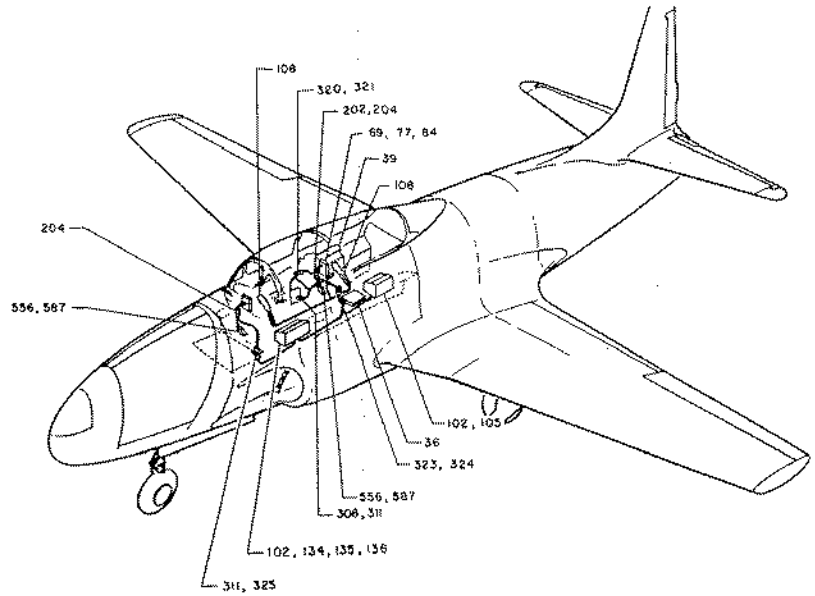
NOTE

1. APPLIES TO USAF T-33A AIRPLANES ONLY
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-195

EM20-51-8-346

TELLTALE LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4019 THROUGH 51-9235

Figure 8-28. Telltale Lights Circuit



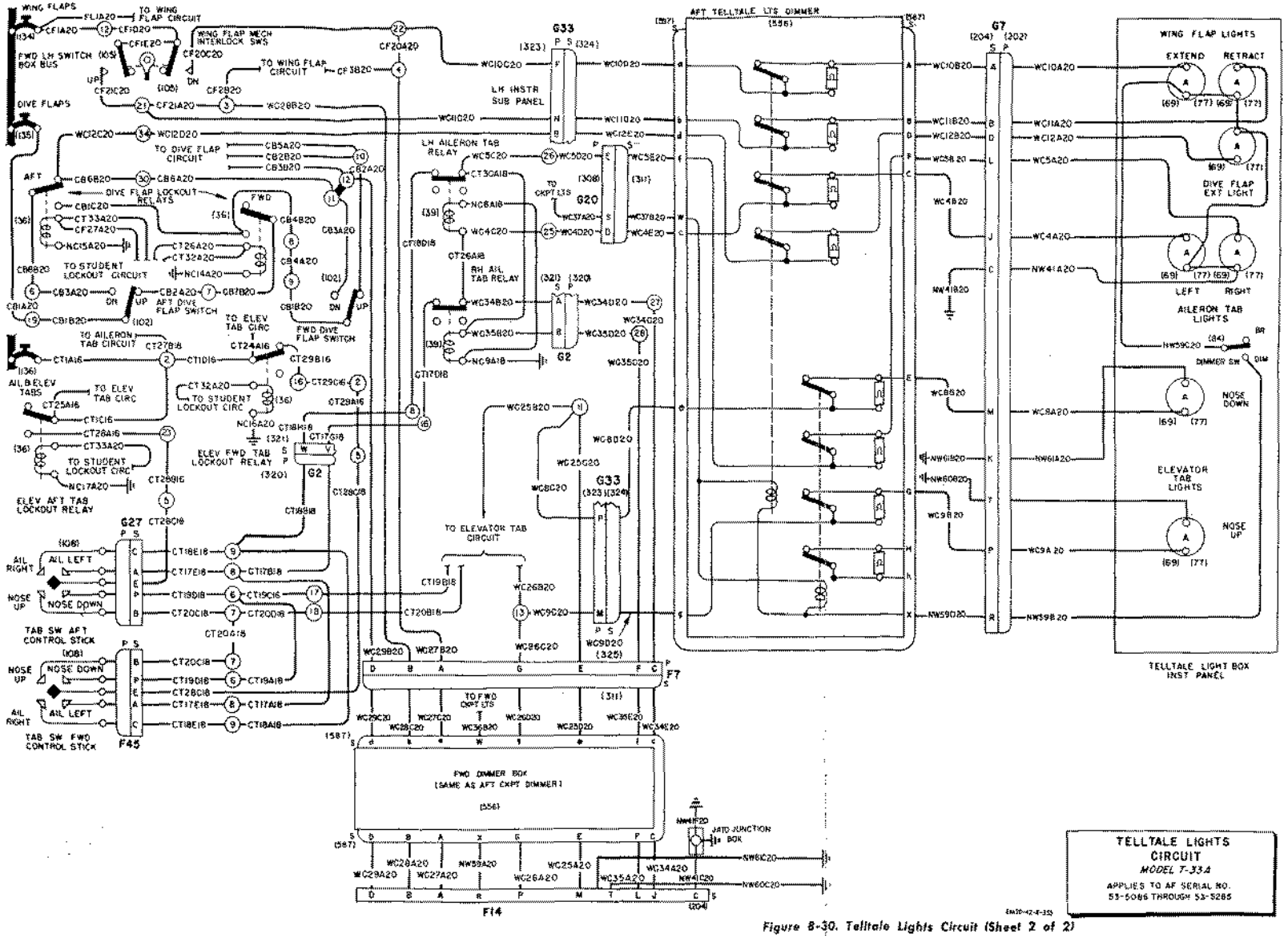
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		MR-57-C
39	RELAY			AN3655-1
69	LIGHT		AMBER	42B3393-3
77	LAMP			AN3751-555
84	SWITCH		SPST	AN3021-2
102	SWITCH			MS3524-1
105	SWITCH			AN3021-1
108	SWITCH	OHIO	8-4	MS-5-32108
134	CIRCUIT PROTECTOR			AN3161-P3
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
202	CONNECTOR			AN3109B-2C-29P
204	CONNECTOR			AN3102A-20-29S
308	CONNECTOR			AN3126A-18-13P
311	CONNECTOR			AN3106B-28-15S
321	CONNECTOR			AN3106A-28-15P
323	CONNECTOR			AN3102A-20-29S
325	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-19S
556	CONNECTOR			AN3100A-36-19P
558	RELAY DYNAMIC	PENCAR		C-1067
587	CONNECTOR			AN3106B-28-21S

681399
EM20-42-4-332

TELLTALE LIGHTS CIRCUIT

MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5085 THROUGH 53-5283

Figure 8-30. Telltale Lights Circuit (Sheet 1 of 2)



TELLTALE LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5086 THROUGH 53-5285

Figure 8-30. Telltale Lights Circuit (Sheet 2 of 2)

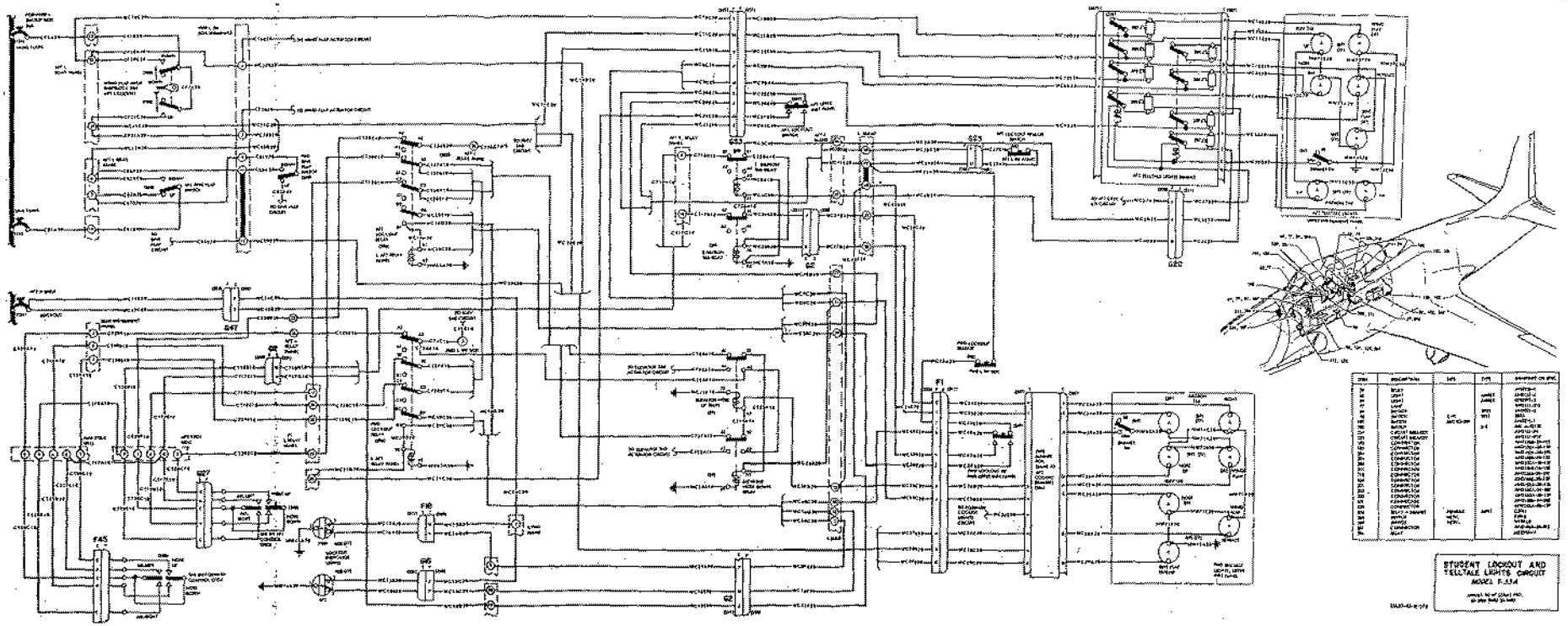


Figure 8-31. Student Lockout and Telltale Lights Circuit

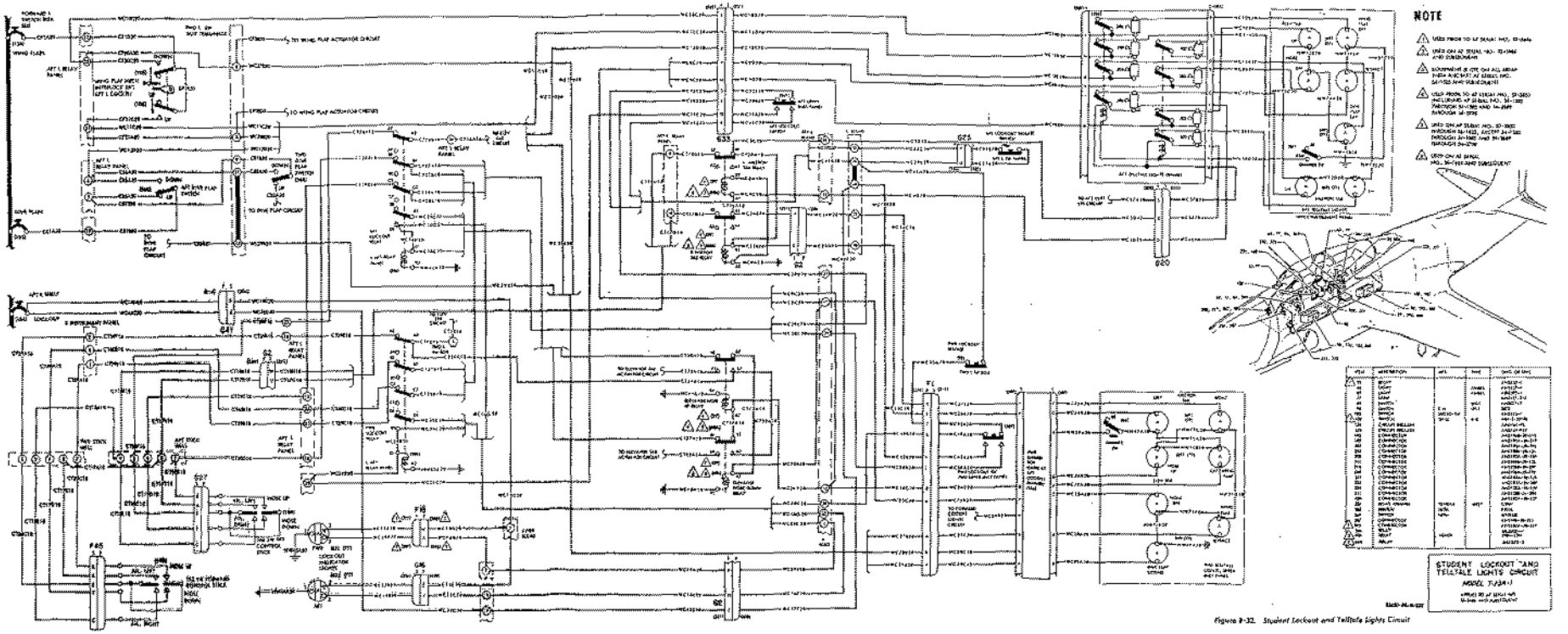


Figure 8-32. Student Lockout and Telltale Lights Circuit

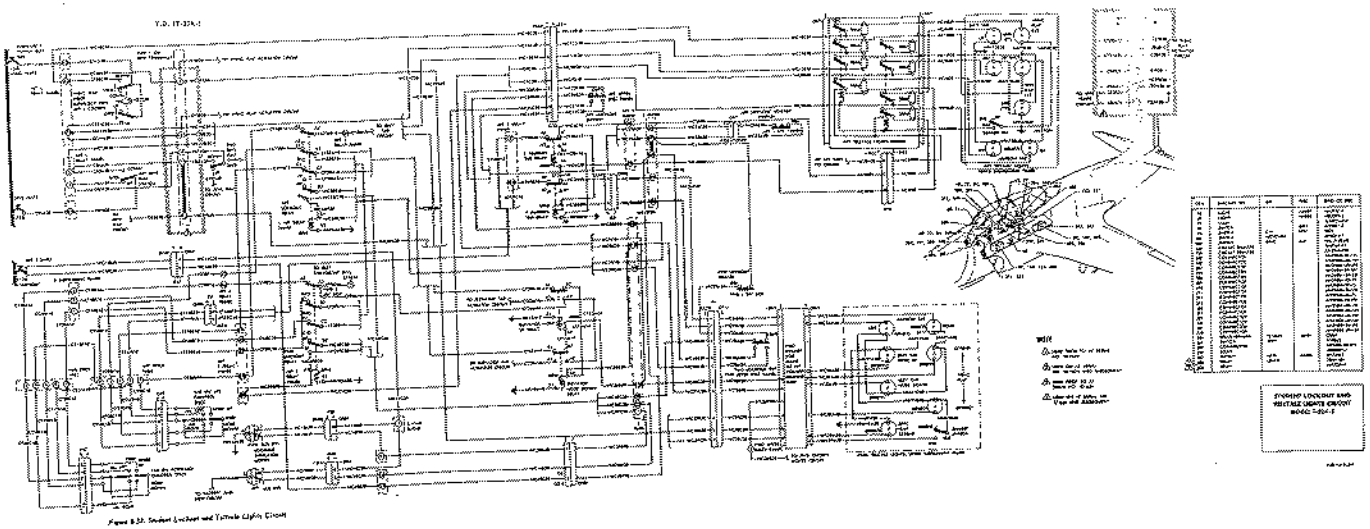


Figure 8.33. Student Lockout and Ventmate Lights Circuit

Changed 15 December 1986

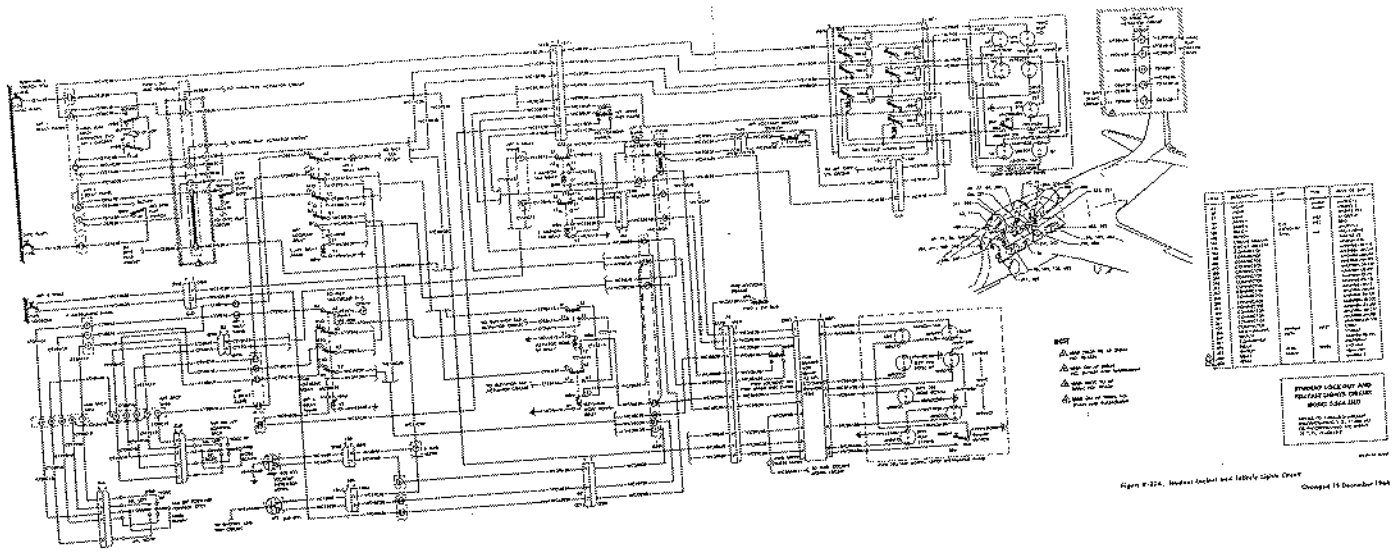


Figure 8-324. Headrest Ancient and Tattered Lights Circuit

Changed 15 December 1944

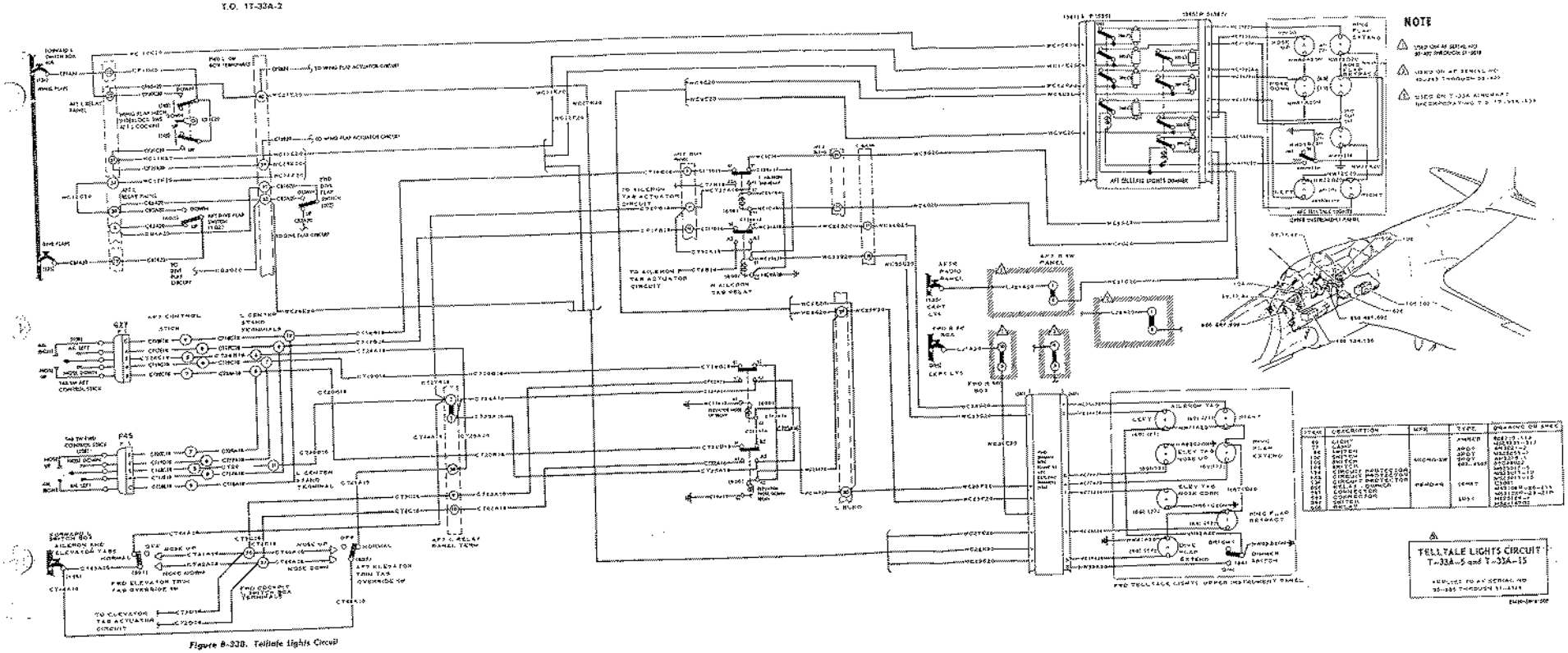
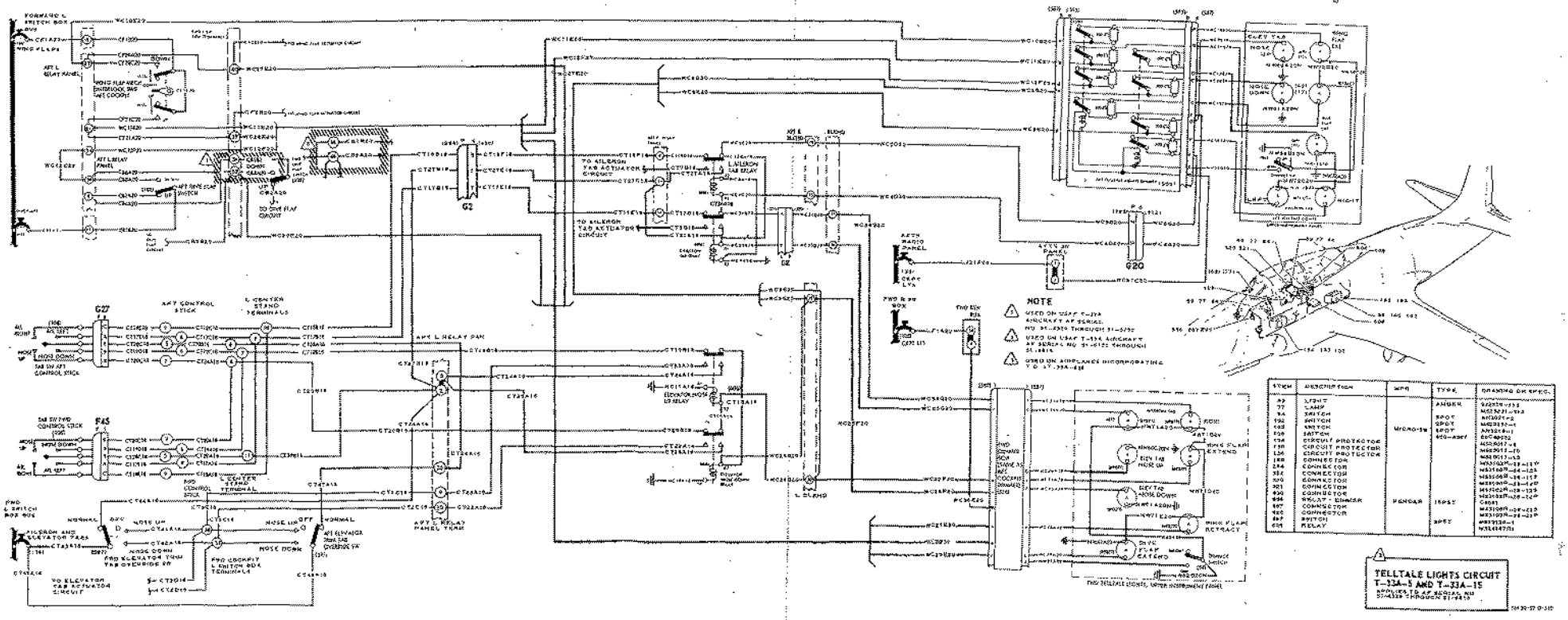
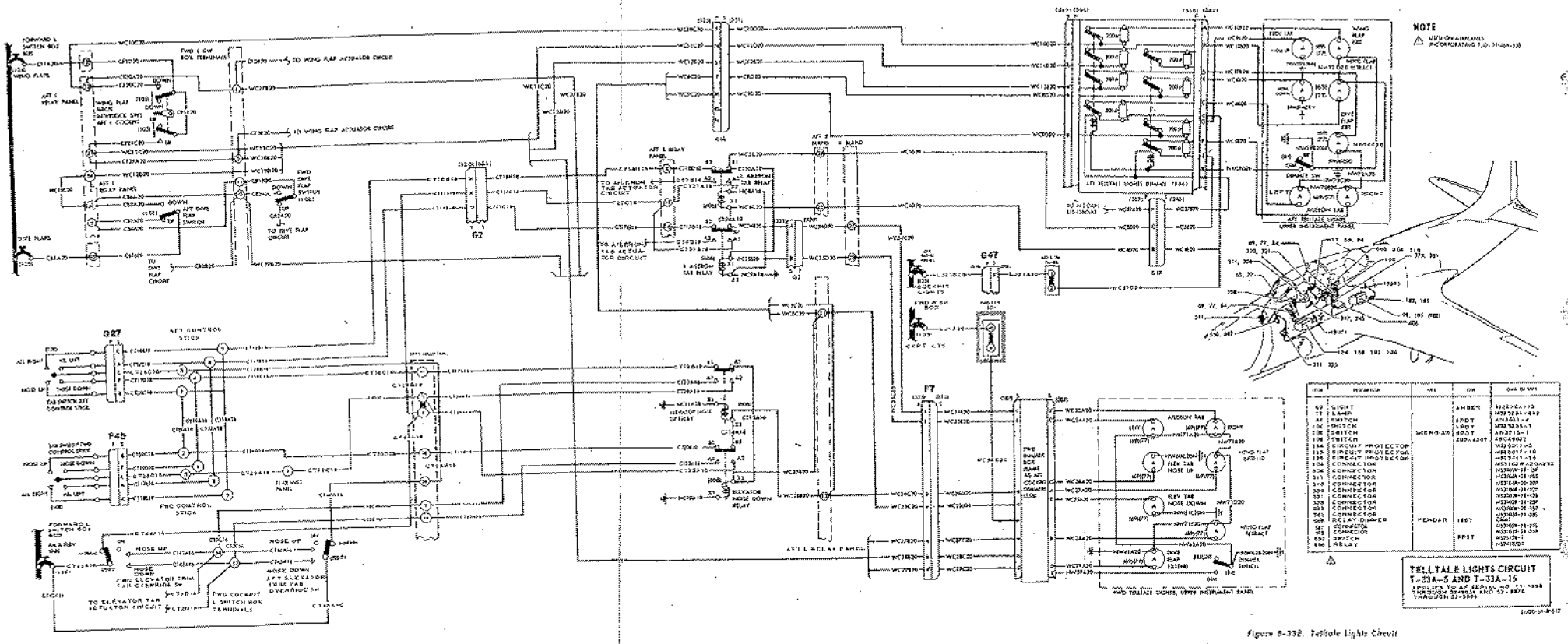


Figure 8-33B. Telltale Lights Circuit



SYMBOL	DESCRIPTION	MFR'S	TYPE	DRAWING OR SPEC.
A9	LIGHT		AMBER	622250-103
A7	LAMP			MS25231-333
B4	SWITCH		SPOT	AN3027-2
B22	SWITCH		SPOT	MS27032-2
B23	SWITCH		SPOT	MS27032-1
B26	SWITCH		SPOT	AN3026-1
B34	SWITCH		60D-A3E1	60D-A3E1
F31	CIRCUIT PROTECTOR			AN3320-7
F31	CIRCUIT PROTECTOR			MS25237-5
F26	CIRCUIT PROTECTOR			MS25237-10
J188	CONNECTOR			MS27467T13B35S
J24	CONNECTOR			MS27484T14B19P
J25	CONNECTOR			MS27484T14B35P
J20	CONNECTOR			MS27484T14B97P
J21	CONNECTOR			MS27484T14B97S
J30	CONNECTOR			MS27484T16B26P
J99	CONNECTOR			MS27484T16B26S
K9	RELAY - ELEVATOR			C6081
J87	CONNECTOR			MS3106R-18F-4S
J25	CONNECTOR			MS3108R-24-22P
S67	SWITCH			MS27032-4
K59	RELAY			MS24477-1

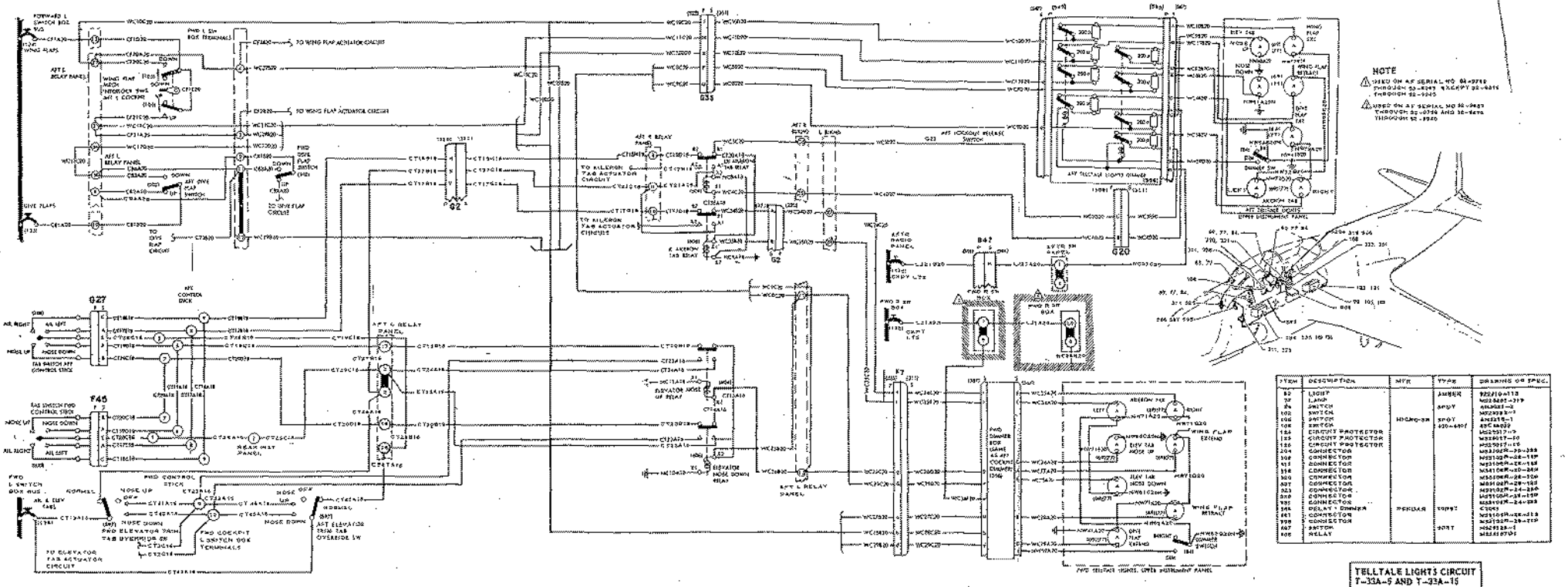
Figure 8-33C. Telltale Lights Circuit



ITEM	DESIGNATION	WIRE	DIM	MIL STD NUMBER
G9	LIGHT		AMBER	AN3052-A-313
G7	LAMP			MS25237-329
A2	SWITCH		SPDT	AN3021-4
C102	SWITCH		SPDT	MS27039-1
C105	SWITCH		SPDT	AN3015-1
109	SWITCH		2NO-4CO	AN5490D2
134	CIRCUIT PROTECTOR			1623-5017-5
135	CIRCUIT PROTECTOR			MS25017-10
136	CIRCUIT PROTECTOR			MS25017-15
304	CONNECTOR			MS3106R-20-20P
306	CONNECTOR			MS3106R-28-7P
311	CONNECTOR			MS3106R-18-1S
318	CONNECTOR			MS3106R-20-20P
319	CONNECTOR			MS3106R-28-7P
321	CONNECTOR			MS3106R-24-12S
323	CONNECTOR			MS3106R-24-28P
333	CONNECTOR			MS3106R-28-15P
361	CONNECTOR			MS3106R-24-28S
368	RELAY DWELL			Cont
GR	CONNECTOR			MS3106R-24-27S
588	CONNECTOR			MS3106R-24-30S
592	SWITCH		SPST	MS25178-1
106	RELAY			MS24107-1
		MEDIUM	18GY	

⚠

Figure 8-33E. Telltale Lights Circuit

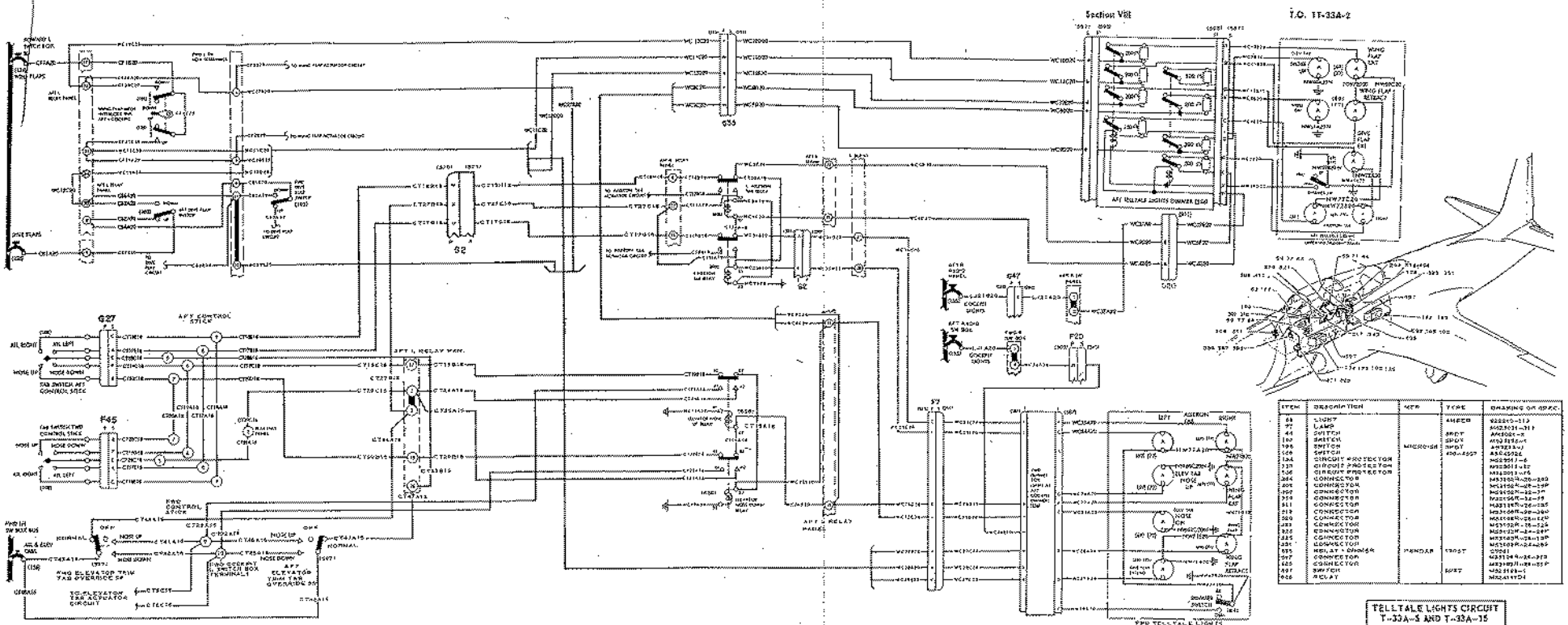


ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC.
B2	LIGHT		AMBER	9221104113
B7	LAMP			MS25237-327
B4	SWITCH		ARMY	AN3023-2
K02	SWITCH			MS2988-3
K06	SWITCH		SPDT	AN3015-1
K08	SWITCH	HONG-SW	400-600F	49C6A09
K24	CIRCUIT PROTECTOR			MS25037-3
K25	CIRCUIT PROTECTOR			MS25037-10
K26	CIRCUIT PROTECTOR			MS25037-15
P04	CONNECTOR			MS3102R-20-28S
P07	CONNECTOR			MS3102R-22-19P
P15	CONNECTOR			MS3106R-22-14S
P16	CONNECTOR			MS3106R-20-24S
P20	CONNECTOR			MS3106R-24-10S
P27	CONNECTOR			MS3102R-28-12S
P23	CONNECTOR			MS3102R-24-24S
P30	CONNECTOR			MS3106R-24-19S
P31	CONNECTOR			MS3102R-24-28S
P45	RELAY + DIMMER	HONEY	28PDT	C1004
P47	CONNECTOR			MS3106R-22-21S
P99	CONNECTOR			MS3102R-28-21P
R47	SWITCH		3PST	MS24519-1
R05	RELAY			MS24519-3

TELLTALE LIGHTS CIRCUIT
T-33A-5 AND T-33A-15
APPLIES TO AF SERIAL NO. 53-5615 THROUGH 53-5942 EXCEPT 52-4976 THROUGH 52-4982

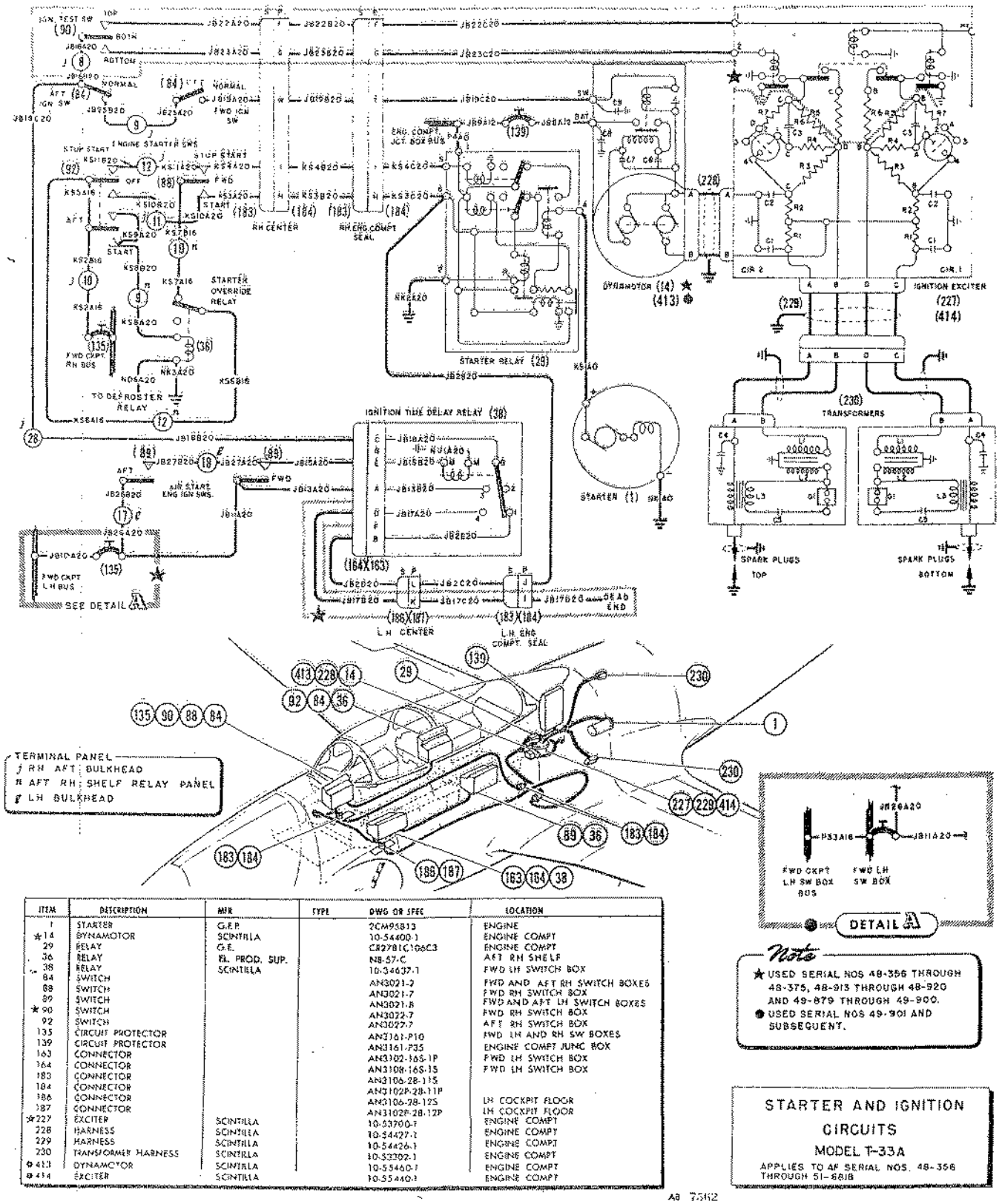
EA33A-37-2-2-2

Figure 8-33F, Telltale Lights Circuit



ITEM	DESCRIPTION	REF	TYPE	DRAWING OR SPEC
88	LIGHT		4MEER	9225X5-313
97	LAMP			9602X31-311
44	SWITCH		8RDT	AN3021-K
150	SWITCH		5PDT	AN3151-4
196	SWITCH	MICROSWITCH	5PDT	AN3233-1
106	SWITCH		4PDT-MOM	AN3450-2E
184	CIRCUIT PROTECTOR			MS25057-6
331	CIRCUIT PROTECTOR			AN3320-1-4Z
136	CIRCUIT PROTECTOR			AN3320-1-4
264	CONNECTOR			MS3106R-20-29S
208	CONNECTOR			MS3102R-28-19P
192	CONNECTOR			MS3102R-32-3P
314	CONNECTOR			MS3106R-32-1S
311	CONNECTOR			MS3116R-36-23S
213	CONNECTOR			MS3106R-20-29S
309	CONNECTOR			MS3106R-24-22S
283	CONNECTOR			MS3102R-16-10S
326	CONNECTOR			MS3102R-24-28P
225	CONNECTOR			MS3102R-24-13P
291	CONNECTOR			MS3102R-24-28S
595	RELAY - DIODE	MINDER	12DST	270511
247	CONNECTOR			AN3124-4-24-21S
525	CONNECTOR			AN3102R-14-18S-P
497	SWITCH		6PST	MS25181-1
466	RELAY			MS24197-D4

Figure 8-33G. Telltale Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC	LOCATION
1	STARTER	G.E.P.		2CM9381B	ENGINE
★14	DYNAMOTOR	SCINTILLA		10-54400-1	ENGINE COMPT
29	RELAY	G.E.		CR2781C106C3	ENGINE COMPT
36	RELAY	EL. PROD. SUP.		N8-57-C	AFT RH SHELF
38	RELAY	SCINTILLA		10-54637-1	FWD LH SWITCH BOX
84	SWITCH			AN3021-2	FWD AND AFT RH SWITCH BOXES
88	SWITCH			AN3021-7	FWD RH SWITCH BOX
89	SWITCH			AN3021-8	FWD AND AFT LH SWITCH BOXES
★90	SWITCH			AN3022-7	FWD RH SWITCH BOX
92	SWITCH			AN3022-7	AFT RH SWITCH BOX
135	CIRCUIT PROTECTOR			AN3161-P10	FWD LH AND RH SW BOXES
139	CIRCUIT PROTECTOR			AN3161-P35	ENGINE COMPT JUNC BOX
163	CONNECTOR			AN3102-16S-1P	FWD LH SWITCH BOX
164	CONNECTOR			AN3108-16S-1S	FWD LH SWITCH BOX
183	CONNECTOR			AN3106-28-11S	
184	CONNECTOR			AN3102P-28-11P	
186	CONNECTOR			AN3106-28-12S	LH COCKPIT FLOOR
187	CONNECTOR			AN3102P-28-12P	LH COCKPIT FLOOR
★227	EXCITER	SCINTILLA		10-53700-1	ENGINE COMPT
228	HARNESS	SCINTILLA		10-54427-1	ENGINE COMPT
229	HARNESS	SCINTILLA		10-54426-1	ENGINE COMPT
230	TRANSFORMER HARNESS	SCINTILLA		10-53202-1	ENGINE COMPT
●413	DYNAMOTOR	SCINTILLA		10-54460-1	ENGINE COMPT
●414	EXCITER	SCINTILLA		10-55440-1	ENGINE COMPT

AB 75412

Note

★ USED SERIAL NOS 48-356 THROUGH 48-375, 48-913 THROUGH 48-920 AND 49-879 THROUGH 49-900.

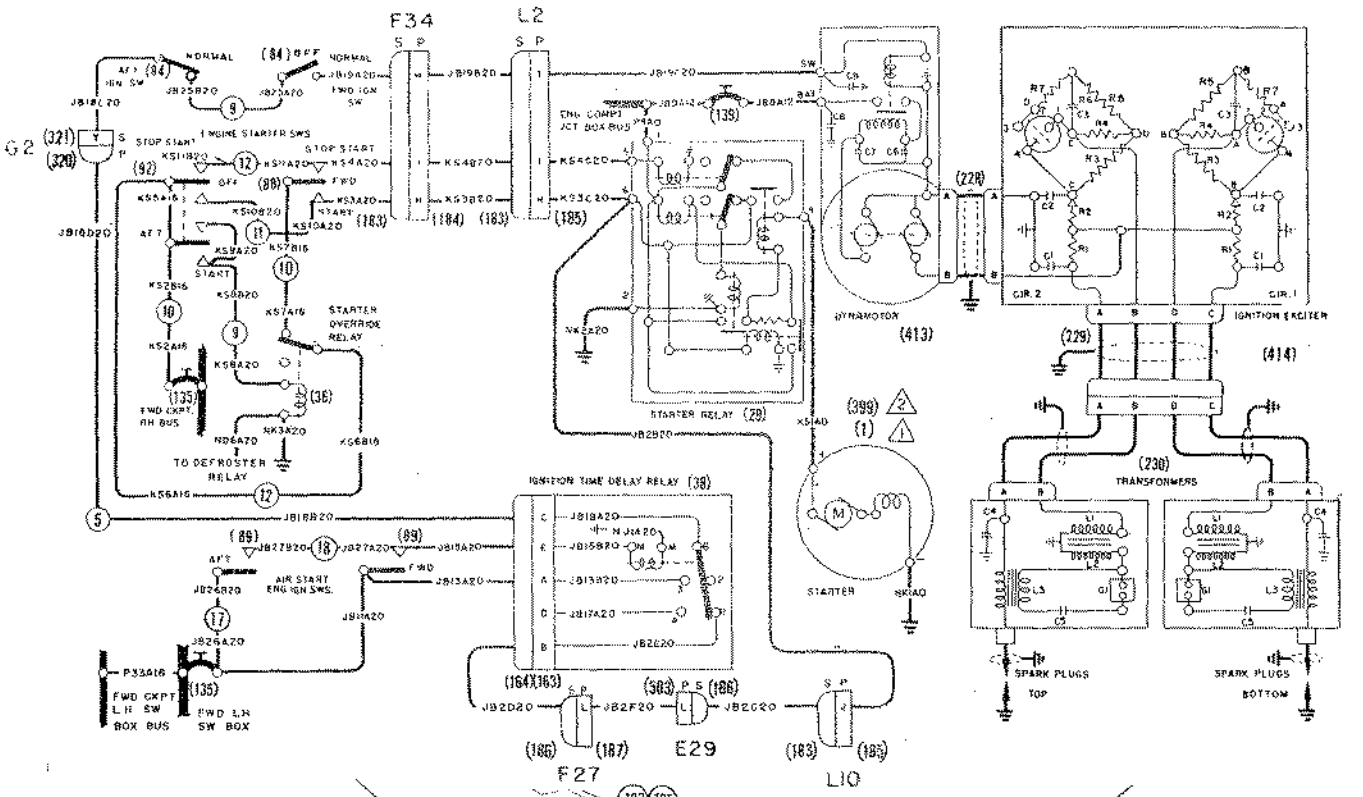
● USED SERIAL NOS 49-901 AND SUBSEQUENT.

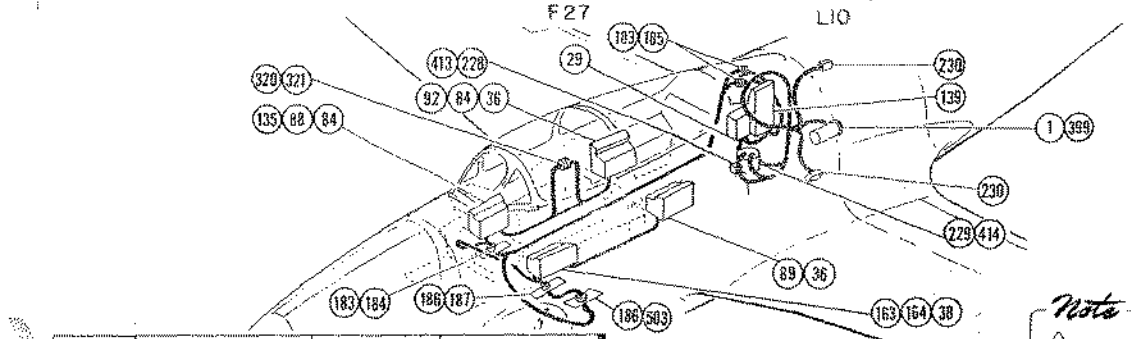
STARTER AND IGNITION CIRCUITS

MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-6818

Figure 8-34. Starter and Ignition Circuit





ITEM	DESCRIPTION	MFR	TYPE DWG OR SPEC
⚠1 1	STARTER	G.F.A.E.	2CM95B13
29	RELAY	G.E.	CR2791C106C3
36	RELAY	EL. PROD. SUP.	NB-57-C
38	RELAY	SCINTILLA	10-34637-1
84	SWITCH		AN3021-2
88	SWITCH		AN3021-7
89	SWITCH		AN3021-8
92	SWITCH		AN3027-2
135	CIRCUIT PROTECTOR		AN3161-P10
139	CIRCUIT PROTECTOR		AN3161-P35
163	CONNECTOR		AN3102-16S-1P
164	CONNECTOR		AN3108-16S-1S
183	CONNECTOR		AN3106-28-11S
184	CONNECTOR		AN3102C-28-11P
185	CONNECTOR		AN3102-28-11P
186	CONNECTOR		AN3106-28-12S
187	CONNECTOR		AN3102P-28-12P
228	HARNESS	SCINTILLA	10-54427-1
229	HARNESS	SCINTILLA	10-54426-1
230	TRANSFORMER HARNESS	SCINTILLA	10-53302-1
320	CONNECTOR		AN-3106R-28-12P
321	CONNECTOR		AN-3102A-28-12S
⚠2 399	STARTER	G.E.	2CM95B19
413	DYNAMOTOR	SCINTILLA	10-55460-1
414	EXCITOR	SCINTILLA	10-55440-1
503	CONNECTOR		AN3100A-28-12P

Note

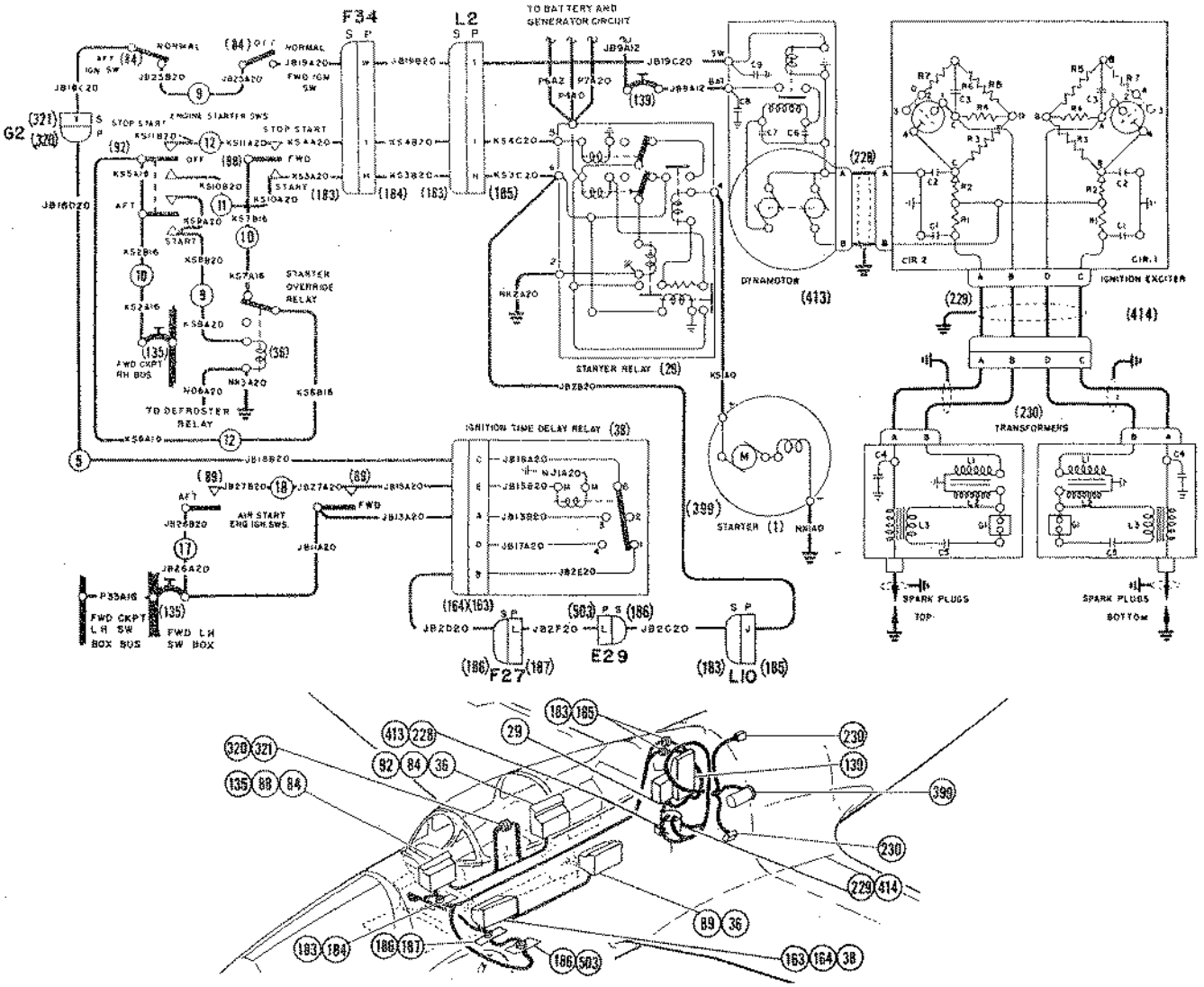
⚠1 USED PRIOR TO AF SERIAL NO. 53-4886

⚠2 USED ON AF SERIAL NO. 53-4886 THROUGH 53-5085

EM20-25-8-31
CB 0017

STARTER AND IGNITION CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NOS. 53-6819 AND THROUGH 53-5085

Figure 8-35. Starter and Ignition Circuit

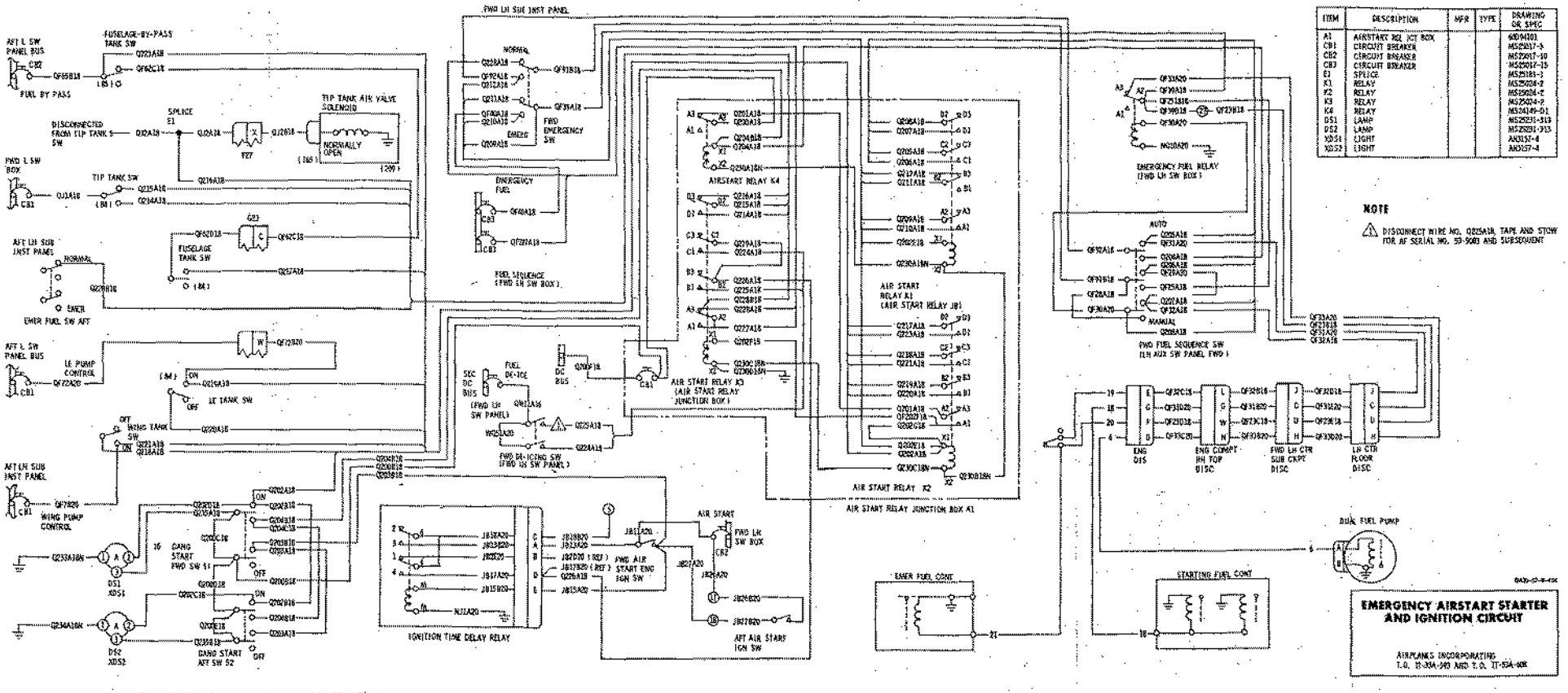


ITEM	DESCRIPTION	MFR	TYPE DWG OR SPEC
29	RELAY	G.E.	CR2781C106G3
36	RELAY	EL PROD SUP	NB-57-C
38	RELAY	SCINTILLA	10-34637-1
84	SWITCH		AN3021-2
88	SWITCH		AN3021-7
89	SWITCH		AN3021-8
92	SWITCH		AN3022-7
135	CIRCUIT PROTECTOR		AN3161-P10
139	CIRCUIT PROTECTOR		AN3161-P25
163	CONNECTOR		AN3102-16S-1P
164	CONNECTOR		AN3108-16S-1S
183	CONNECTOR		AN3106-28-11S
184	CONNECTOR		AN3102C-28-11P
185	CONNECTOR		AN3102-28-11P
186	CONNECTOR		AN3106-28-12S
187	CONNECTOR		AN3102P-28-12P
228	HARNESS	SCINTILLA	10-54427-1
229	HARNESS	SCINTILLA	10-54426-1
230	TRANSFORMER HARNESS	SCINTILLA	10-53302-1
320	CONNECTOR		AN-3106A-28-12P
321	CONNECTOR		AN-3102A-28-12S
399	STARTER	G.E.	2CM95B19
413	DYNAMOTOR	SCINTILLA	10-55460-1
414	EXCITOR	SCINTILLA	10-55440-1
503	CONNECTOR		AN3106A-28-12P

EM00-25-8-266
CB 6138

STARTER AND IGNITION CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5086 AND SUBSEQUENT

Figure 8-36. Starter and Ignition Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
A1	AIRSTART REL K3,K4 BOX			6010-1103
CB1	CIRCUIT BREAKER			MS25017-5
CB2	CIRCUIT BREAKER			MS25017-10
CB3	CIRCUIT BREAKER			MS25017-15
E1	SPLICE			MS25181-2
K1	RELAY			MS25024-2
K2	RELAY			MS25024-2
K3	RELAY			MS25024-2
K4	RELAY			MS24149-D1
DS1	LAMP			MS25251-313
DS2	LAMP			MS25252-313
XDS1	LIGHT			AN3157-4
XDS2	LIGHT			AN3157-4

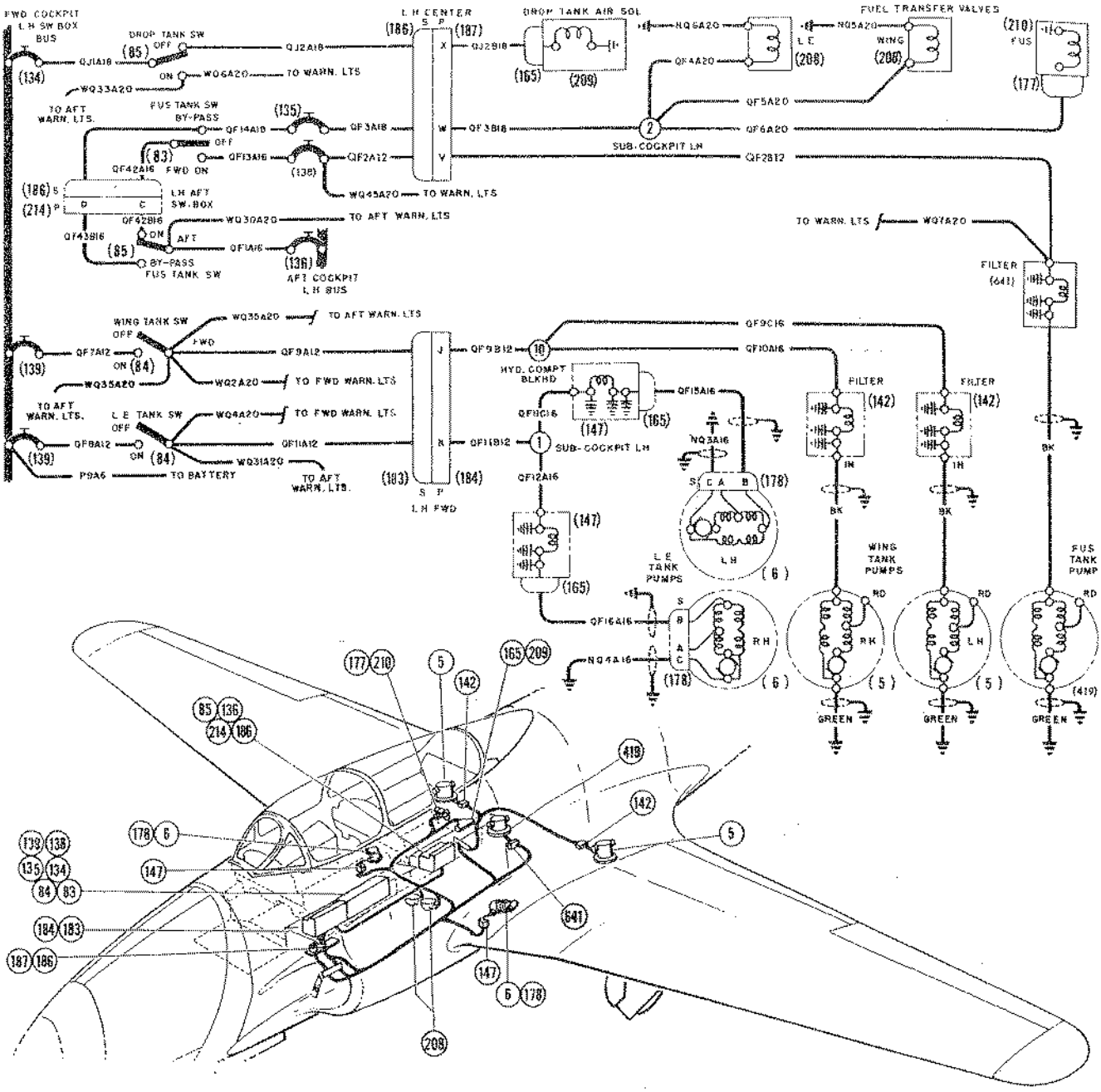
NOTE

⚠ DISCONNECT WIRE NO. Q225A18, TAPE AND STOW FOR AF SERIAL NO. 53-5083 AND SUBSEQUENT

EMERGENCY AIRSTART STARTER AND IGNITION CIRCUIT

AIRPLANES INCORPORATING T.O. 1T-33A-540 AND T.O. 1T-33A-40R

Figure 8-36A. Emergency Airstart and Ignition Circuit



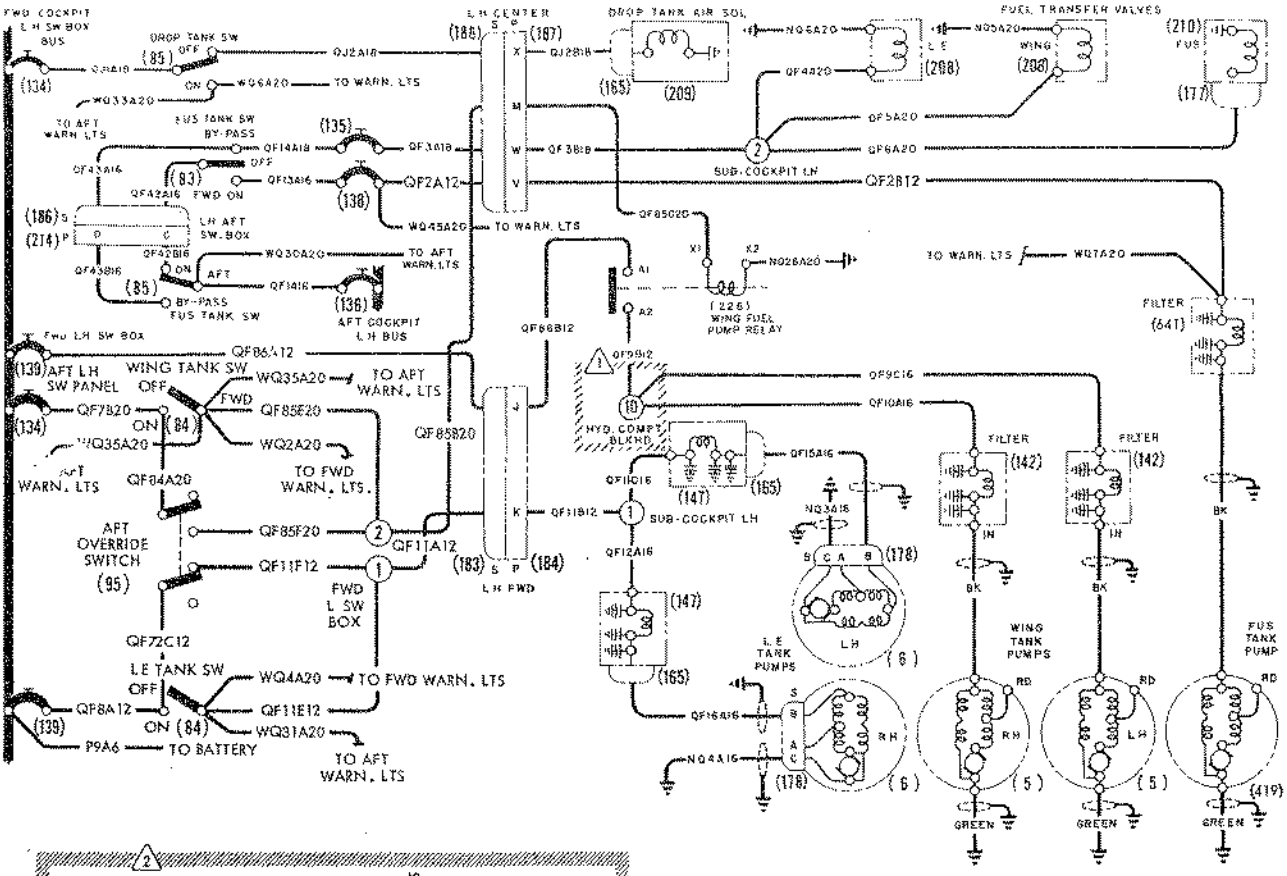
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
5	PUMP	PESCO	B-19	121041-020-02
6	PUMP	PESCO	B-78	2E-V763-A
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
138	CIRCUIT PROTECTOR			AN3161-P25
139	CIRCUIT PROTECTOR			AN3161-P35
142	FILTER	POTTER	20A	B-120
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
208	VALVE	SAVAL		5120
209	VALVE	GEN. CONT.		40R-721
210	VALVE	GEN. CONT.		40R-733
214	CONNECTOR			AN3102-28-12P
419	PUMP	PESCO	B-18A	121071-010-01
641	FILTER	PESCO		22-2013

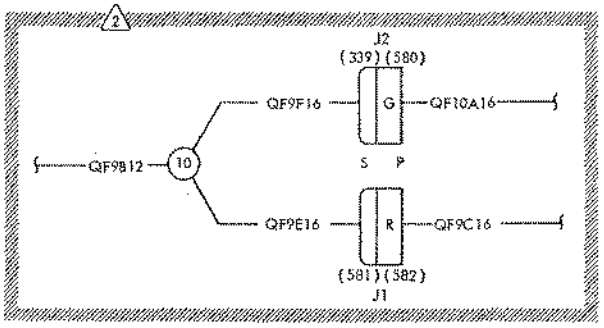
GB 9929
M20-49-8-32

FUEL PUMPS CIRCUIT
MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 48-920 NOT INCORPORATING T.O. 1T-33A-245 AND -576

Figure 8-37. Fuel Pumps Circuit





ITEM	DESCRIPTION	MFR.	TYPE	DWG. OR SPEC.
5	PUMP	PESCO	B-19	121041-020-02
6	PUMP	PESCO	B-7B	2E-V763-A
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
95	SWITCH			AN3027-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P15
138	CIRCUIT PROTECTOR			AN3161-P25
139	CIRCUIT PROTECTOR			AN3161-P35
142	FILTER	POTTER	20A	B-120
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
208	VALVE	SAVAL		5120
209	VALVE	GEN CONT		40R-721
210	VALVE	GEN CONT		40R-733
214	CONNECTOR			AN3102-28-12P
226	RELAY			AN3350-2
339	CONNECTOR			MS3106M-28-11SW
419	PUMP	PESCO	B-18A	121071-010-01
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P
641	FILTER	PESCO		22-2013

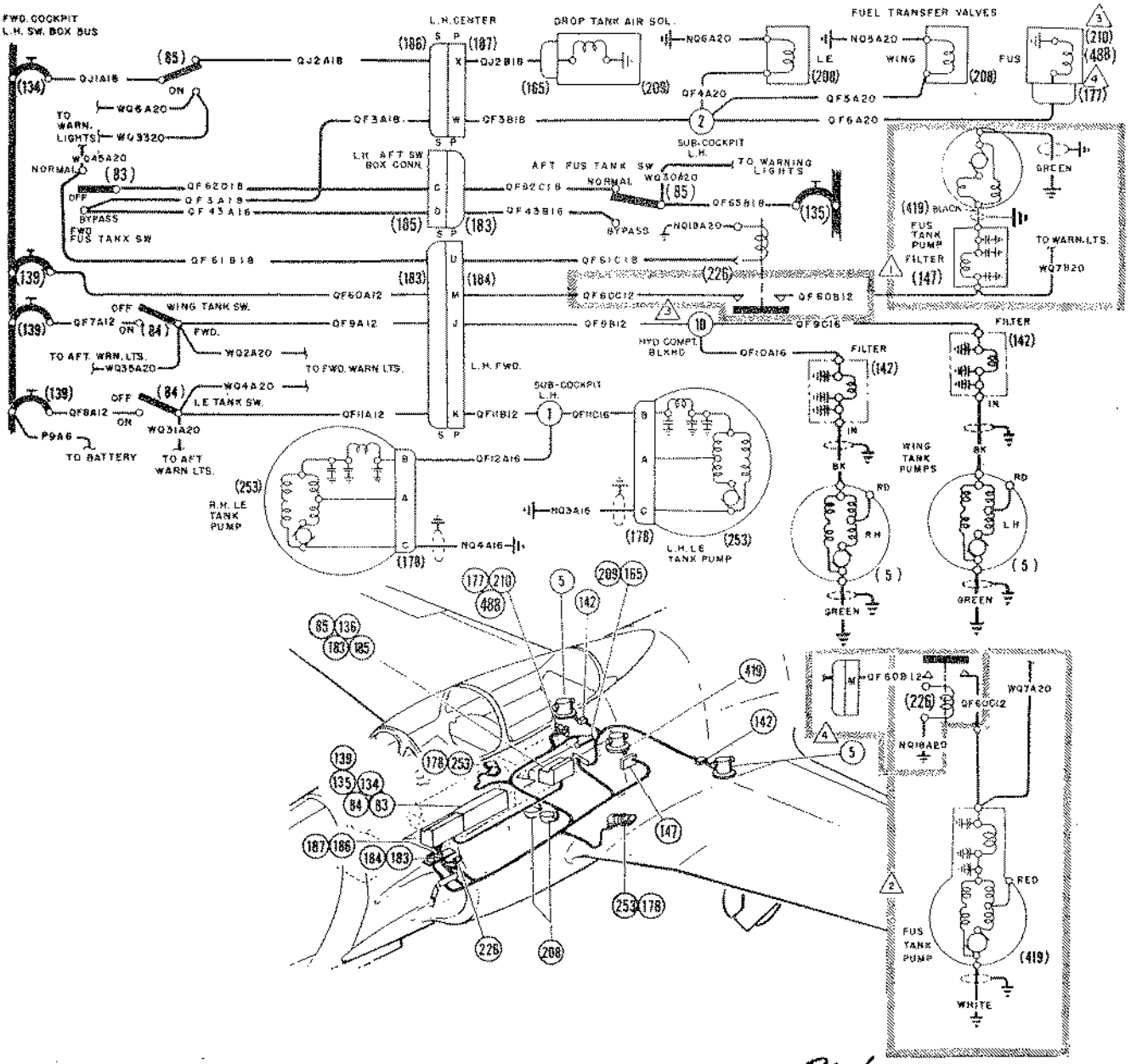
NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

HB 1238
M20-50-8-415

FUEL PUMPS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 48-920 INCORPORATING T.O. 1T-33A-245 AND -576

Figure 8-38. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
5	PUMP	PESCO	B-19	121041-020-02
83	SWITCH			AN3121-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
142	FILTER	POTTER		B-120
△1 147	FILTER	POTTER		B-120
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
208	VALVE	SAVAL		5120
209	VALVE	GEN. CONT.		40R-721
△3 210	VALVE	GEN. CONT.		40R-733
226	RELAY			AN3350-2
253	PUMP MOTOR	PESCO		121812-010-01
△2 419	PUMP MOTOR	PESCO	B-18A	121071-016-02
△3 △4 419	PUMP MOTOR	PESCO	B-18A	121071-014-01
488	VALVE	SAVAL		5898

Note

△1 USED ON SERIAL 49-879 THROUGH 49-914

△2 USED ON SERIAL 49-915 AND SUBSEQUENT

△3 USED ON SERIAL 49-879 THROUGH 49-900

△4 USED ON SERIAL 49-901 AND SUBSEQUENT

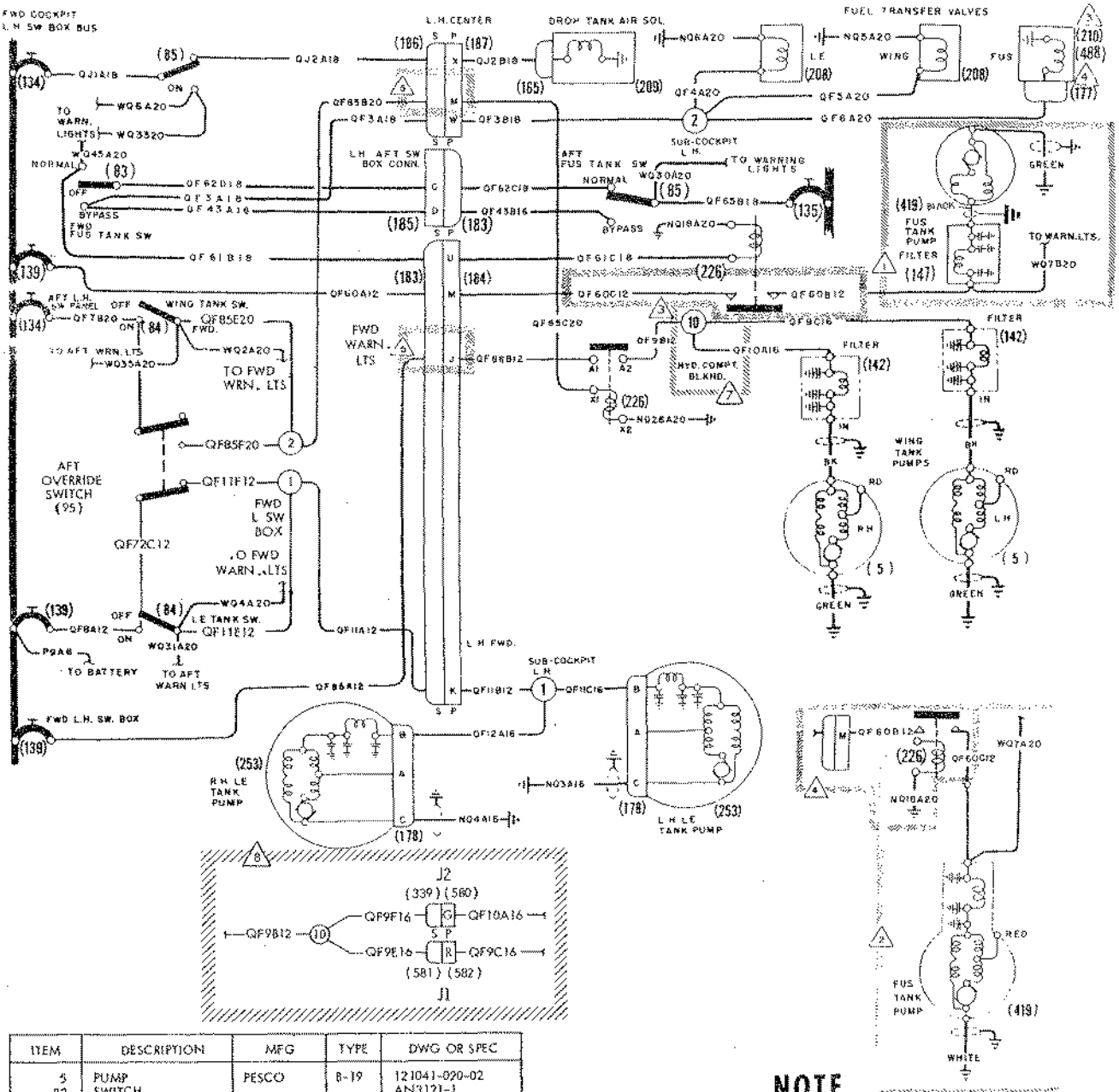
FUEL PUMPS CIRCUIT

MODEL T-33A

APPLIES TO SERIAL NO. 49-879 THROUGH 49-966 NOT INCORPORATING T.O. 1T-33A-245 AND -526

HB 55
M20-49-8-33

Figure 4-39. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
5	PUMP	PESCO	B-19	121041-020-02
83	SWITCH			AN3121-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
95	SWITCH			AN3027-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
142	FILTER	POTTER		B-120
1 147	FILTER	POTTER		B-120
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
208	VALVE	SAVAL		5120
209	VALVE	GEN CONT		40R-721
3 210	VALVE	GEN CONT		40R-733
226	RELAY			AN3350-2
253	PUMP MOTOR	PESCO		121812-010-01
339	CONNECTOR			MS3106M-28-11SW
2 419	PUMP MOTOR	PESCO	B-18A	121071-016-02
1 419	PUMP MOTOR	PESCO	B-18A	121071-014-01
4 488	VALVE	SAVAL		5898
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

NOTE

1. USED ON SERIAL 49-879 THROUGH 49-914
2. USED ON SERIAL 49-915 AND SUBSEQUENT
3. USED ON SERIAL 48-879 THROUGH 49-900
4. USED ON SERIAL 49-901 AND SUBSEQUENT
5. USED ON SERIAL 49-879 THROUGH 49-921
6. USED ON SERIAL 49-922 THROUGH 49-966
7. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
8. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

FUEL PUMPS CIRCUIT

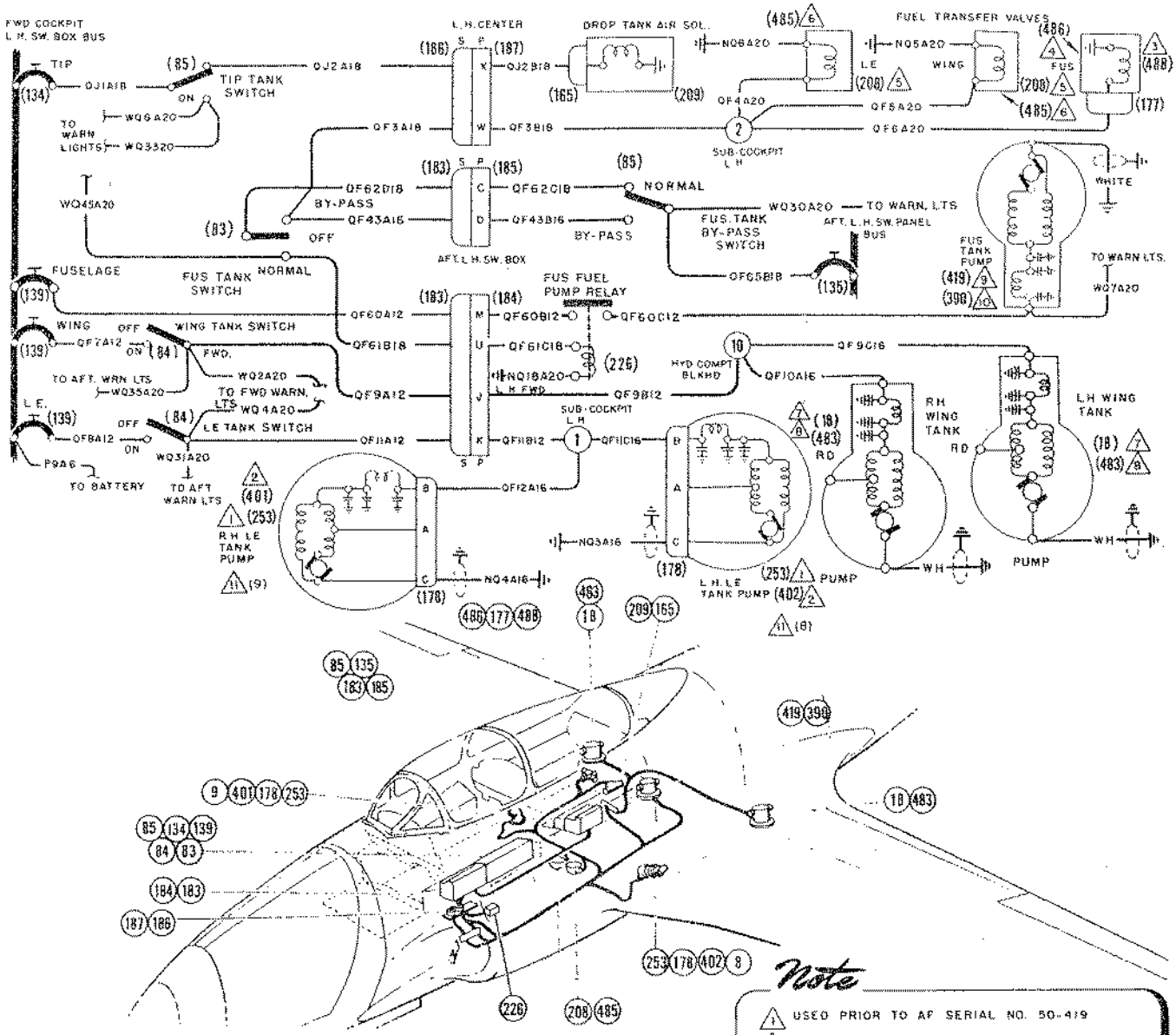
MODEL T-33A

APPLIES TO AF SERIAL NO. 49-879 THROUGH 49-966 INCORPORATING T.O. 1T-33A-245 AND -576

M20-50-8-416

HB 863

Figure 8-40. Fuel Pumps Circuit



	ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
11	8	PUMP MOTOR	PESCO		121812-041-01
11	9	PUMP MOTOR	PESCO		121812-040-01
7	18	PUMP	PESCO	8-19	121041-023-01
	83	SWITCH			AN3021-1
	84	SWITCH			AN3021-2
	85	SWITCH			AN3021-3
	134	CIRCUIT PROTECTOR			AN3161-P5
	135	CIRCUIT PROTECTOR			AN3161-P10
	139	CIRCUIT PROTECTOR			AN3161-P35
	165	CONNECTOR			AN3106-10S-2S
	177	CONNECTOR			AN3106-16S-3S
	178	CONNECTOR			AN3106-16S-5S
	183	CONNECTOR			AN3106-28-11S
	184	CONNECTOR			AN3102P-28-11P
	185	CONNECTOR			AN3102-28-11P
	186	CONNECTOR			AN3106-28-12S
	187	CONNECTOR			AN3102P-28-12P
5	208	VALVE	SAVAL		5120
	209	VALVE	GEN CONT		408-721
	226	RELAY			AN3350-2
10 1	253	PUMP MOTOR	PESCO		121812-010-01
	390	PUMP MOTOR	THOMPSON		TF29600-1
2	401	PUMP MOTOR	PESCO	8-18A	121812-012-01
2	402	PUMP MOTOR	PESCO	8-18A	121812-013-03 121812-013-01
8 9	419	PUMP MOTOR	PESCO	8-18A	121041-016-01
	483	PUMP	PESCO		122289-010-01
4 6	485	VALVE	SAVAL		6924
	486	VALVE	SAVAL		7248
3	488	VALVE	SAVAL		5898

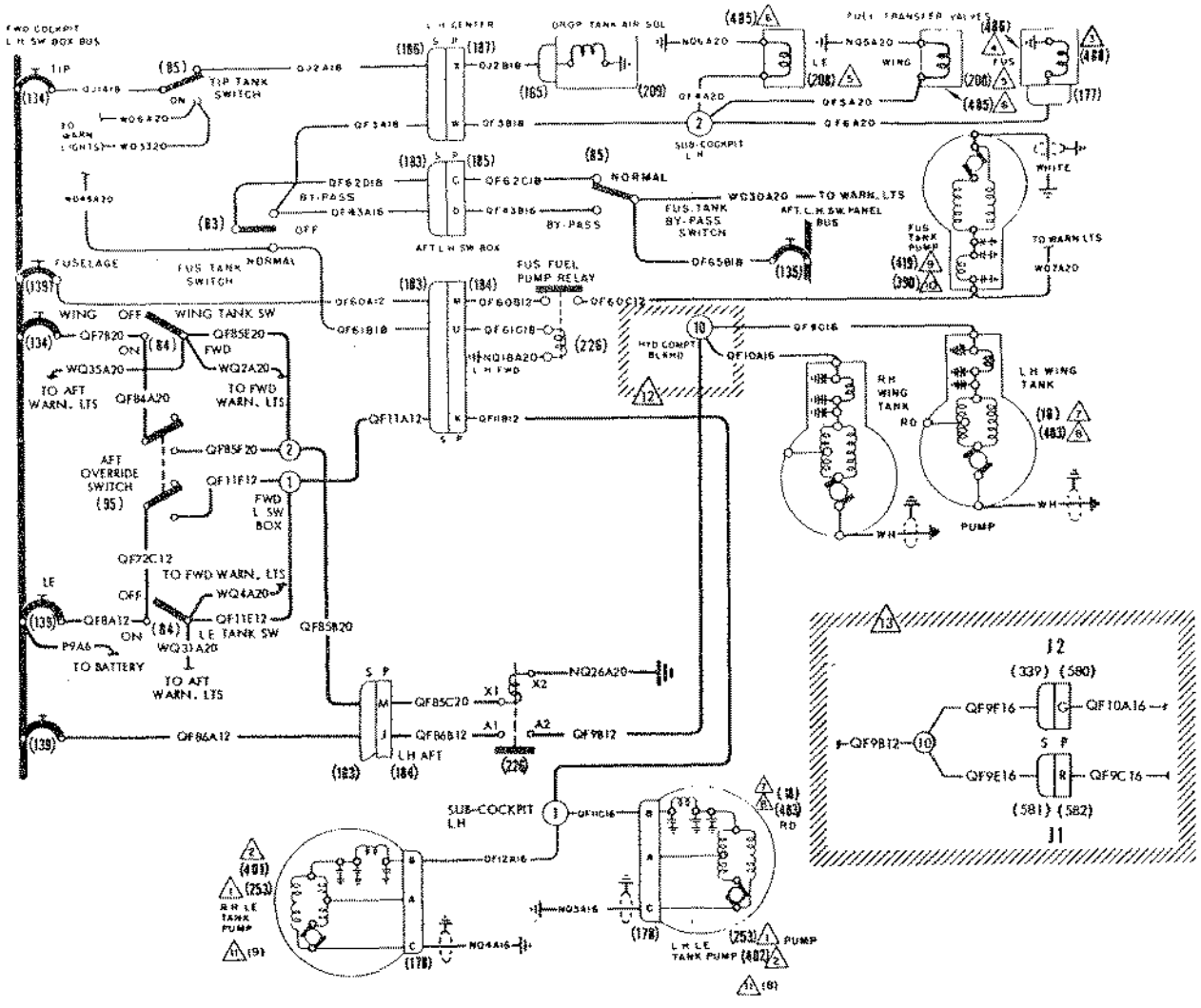
Note

1. USED PRIOR TO AF SERIAL NO. 50-419
2. USED ON AF SERIAL NO. 50-419 THRU 51-4532
3. USED PRIOR TO AF SERIAL NO. 50-454
4. USED ON AF SERIAL NO. 50-1272 & SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 50-350
6. USED ON AF SERIAL NO. 50-350 & SUBSEQUENT
7. USED PRIOR TO AF SERIAL NO. 50-436
8. USED ON AF SERIAL NO. 50-436 & SUBSEQUENT
9. USED PRIOR TO AF SERIAL NO. 51-4141
10. USED ON AF SERIAL NO. 51-4141 & SUBSEQUENT
11. USED ON AF SERIAL NO. 51-4533 & SUBSEQUENT

HB 56
M20-49-8-34

FUEL PUMPS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 49-967 THROUGH 51-6529 NOT INCORPORATING T.O. 1T-33A-245 AND -576

Figure 8-41. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC.
1, 8	PUMP MOTOR	PESCO		121812-041-01
1, 9	PUMP MOTOR	PESCO		121812-040-01
2, 18	PUMP	PESCO	B-19	121041-023-01
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
95	SWITCH			AN3027-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
5, 208	VALVE	SAVAL		5120
209	VALVE	GEN CONT		40R-721
226	RELAY			AN3350-2
1, 253	PUMP MOTOR	PESCO		121812-010-01
339	CONNECTOR			MS3106M-28-11SW
10, 390	PUMP MOTOR	THOMPSON		YF29600-1
4, 401	PUMP MOTOR	PESCO	B-18A	121812-010-03
4, 402	PUMP MOTOR	PESCO	B-18A	121812-011-03
4, 419	PUMP MOTOR	PESCO	B-18A	121041-016-01
8, 483	PUMP	PESCO		122289-010-01
6, 485	VALVE	SAVAL		6924
4, 486	VALVE	SAVAL		7248
3, 488	VALVE	SAVAL		5898
580	CONNECTOR			MS3109M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

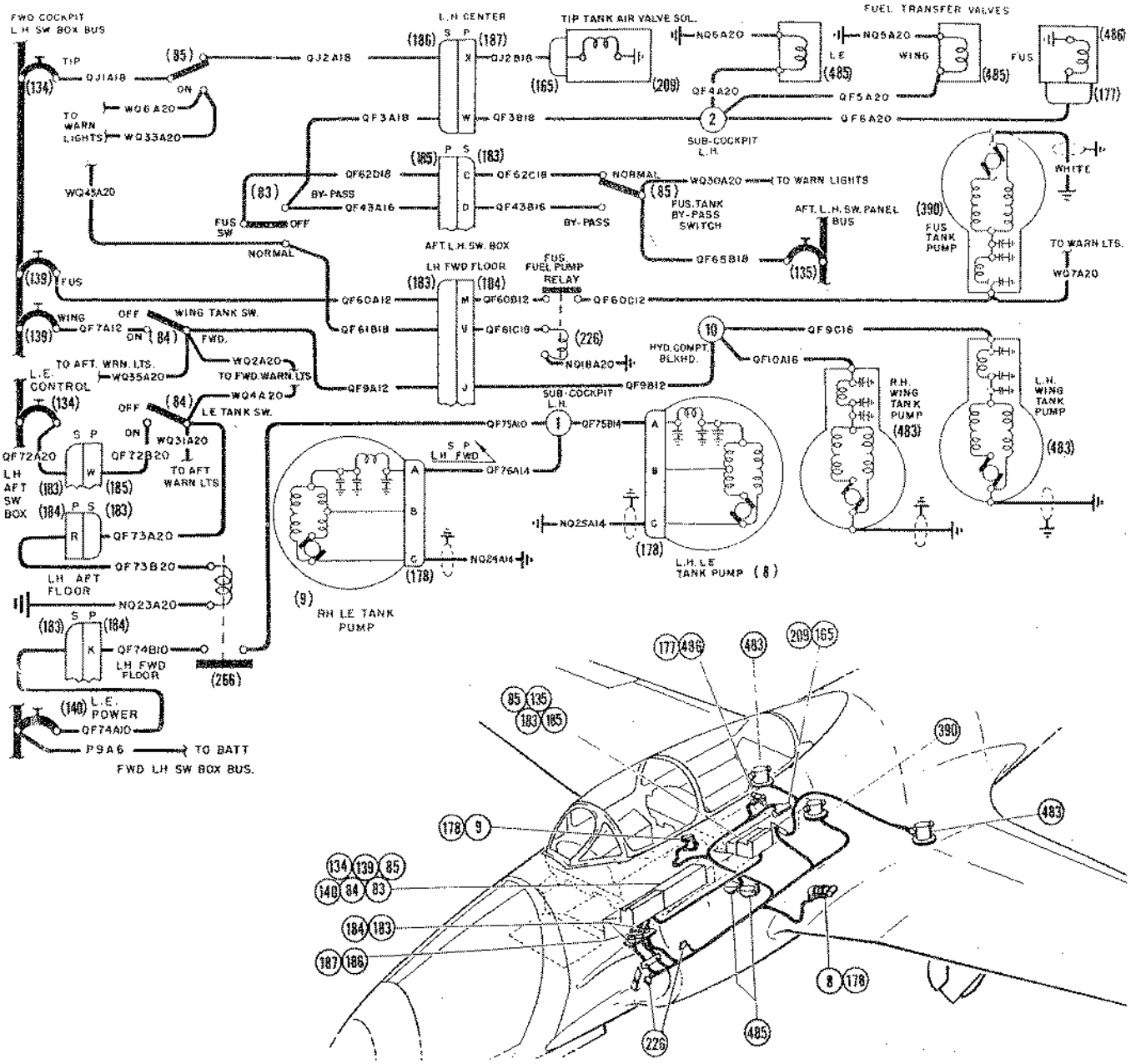
NOTE

1. USED PRIOR TO AF SERIAL NO. 50-419
2. USED ON AF SERIAL NO. 50-419 THRU 51-4532
3. USED PRIOR TO AF SERIAL NO. 50-454
4. USED ON AF SERIAL NO. 50-1272 & SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 50-350
6. USED ON AF SERIAL NO. 50-350 & SUBSEQUENT
7. USED PRIOR TO AF SERIAL NO. 50-436
8. USED ON AF SERIAL NO. 50-436 & SUBSEQUENT
9. USED PRIOR TO AF SERIAL NO. 51-4141
10. USED ON AF SERIAL NO. 51-4141 & SUBSEQUENT
11. USED ON AF SERIAL NO. 51-4533 & SUBSEQUENT
12. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
13. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

HB 8792
E M20-5E-8-417

FUEL PUMPS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-967 THROUGH 51-6528 INCORPORATING T.O. 1T-33A-245 AND -576

Figure 8-42. Fuel Pumps Circuit



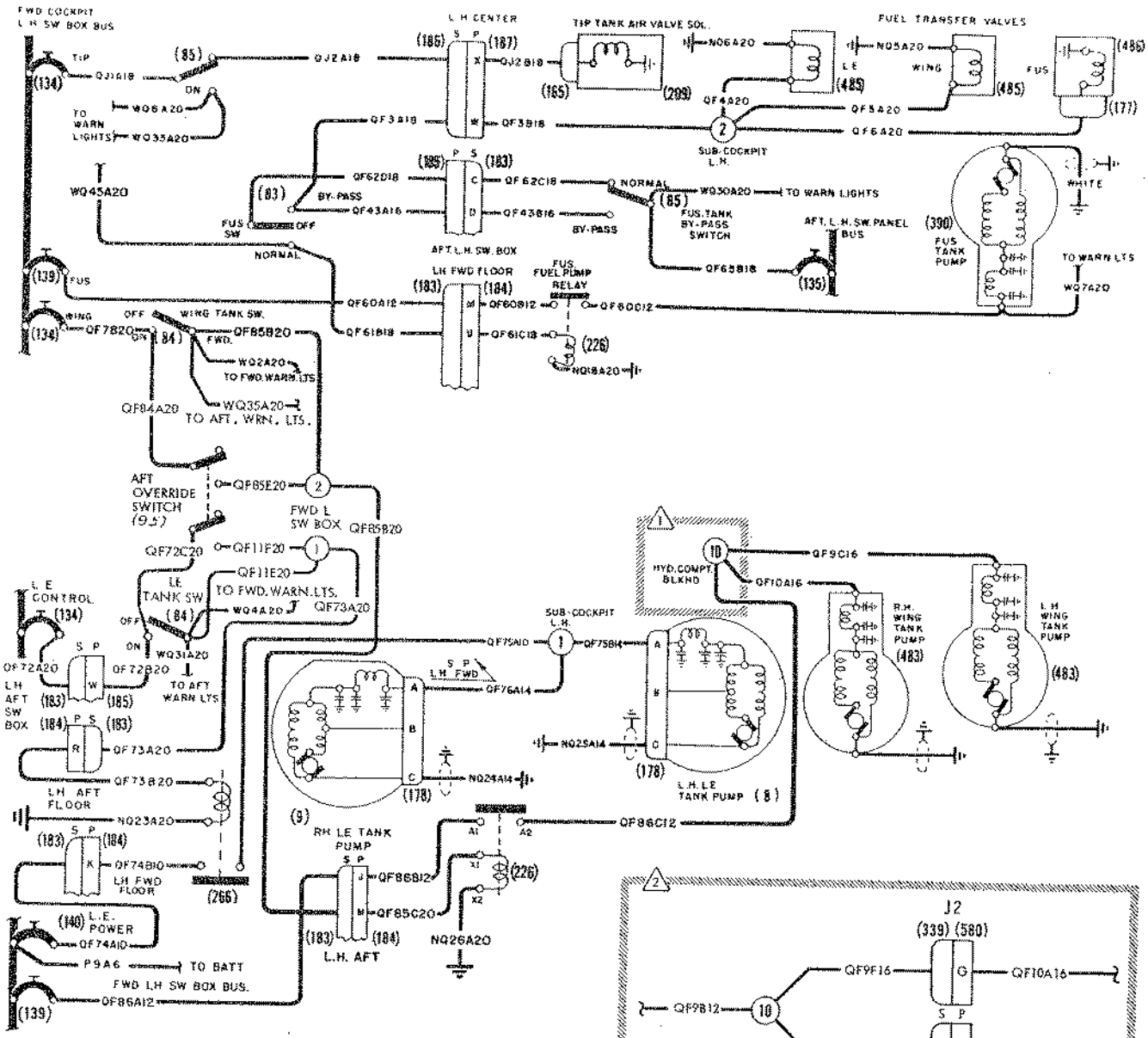
ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
8	PUMP MOTOR	PESCO		121812-041-01
9	PUMP MOTOR	PESCO		121812-040-01
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
140	CIRCUIT PROTECTOR			AN3161-P35
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
209	VALVE	GEN CONT		40R-721
226	RELAY			AN3350-2
390	FUS. TANK PUMP	THOMPSON		TF29600-1
483	PUMP	PESCO		122209-010-01
485	VALVE	SAVAL		6924
486	SOLENOID VALVE	GEN CONT		7248-1

FUEL PUMPS CIRCUIT
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6529 THROUGH 51-6818 NOT INCORPORATING T.O. 1T-33A-245 AND -576

HB 54
M20-49-8-3a

Figure 8-43. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
8	PUMP MOTOR	PESCO		121812-041-01
9	PUMP MOTOR	PESCO		121812-040-01
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
95	SWITCH			AN3027-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
140	CIRCUIT PROTECTOR			AN3161-P35
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
209	VALVE	GEN CONT		40R-721
226	RELAY			AN3350-2
339	CONNECTOR			MS3106M-28-11SW
390	FUS. TANK PUMP	THOMPSON		TF29600-1
483	PUMP	PESCO		122289-010-01
485	VALVE	SAVAL		6924
486	SOLENOID VALVE	GEN CONT		7248-1
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

FUEL PUMPS CIRCUIT

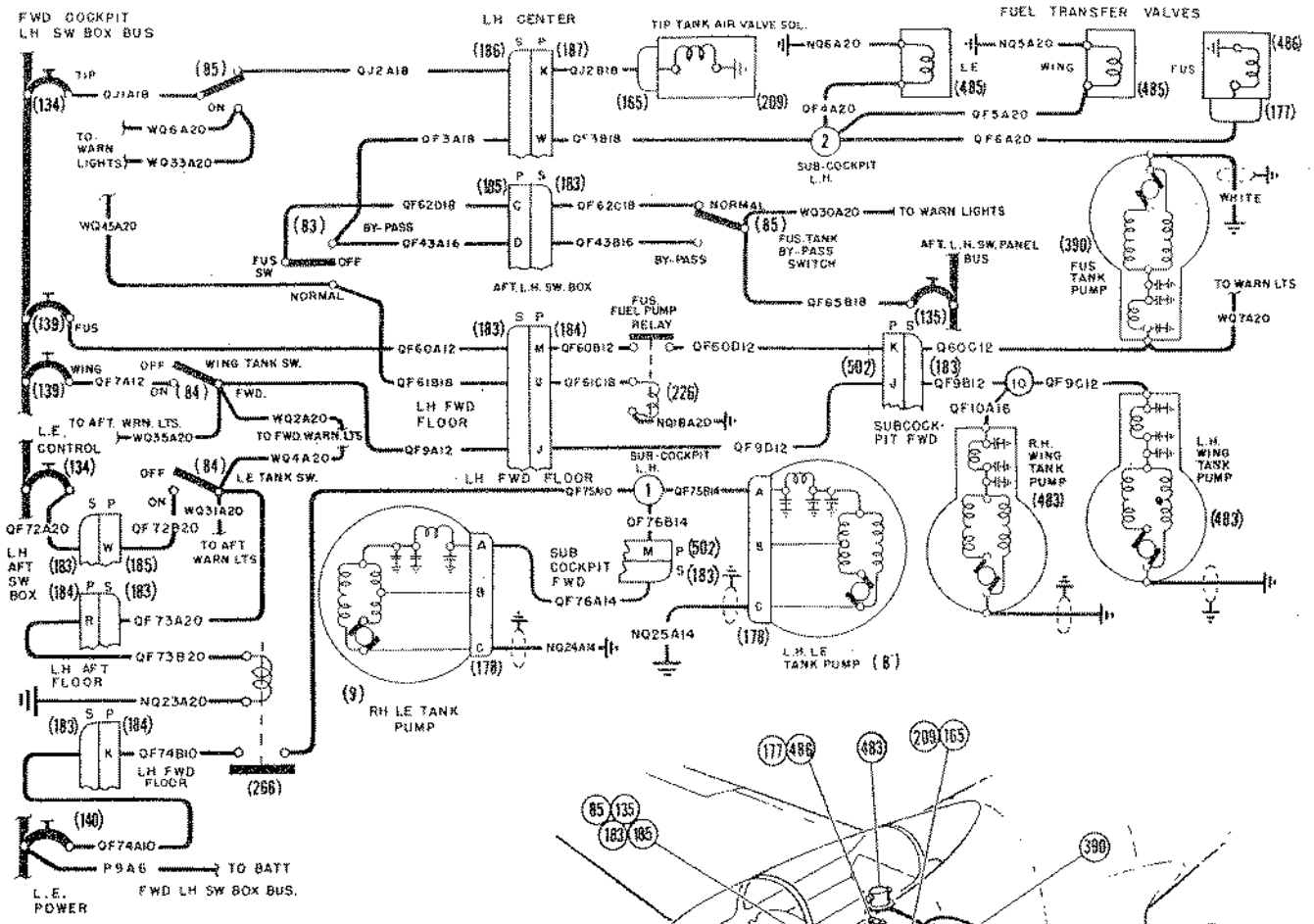
MODEL T-33A

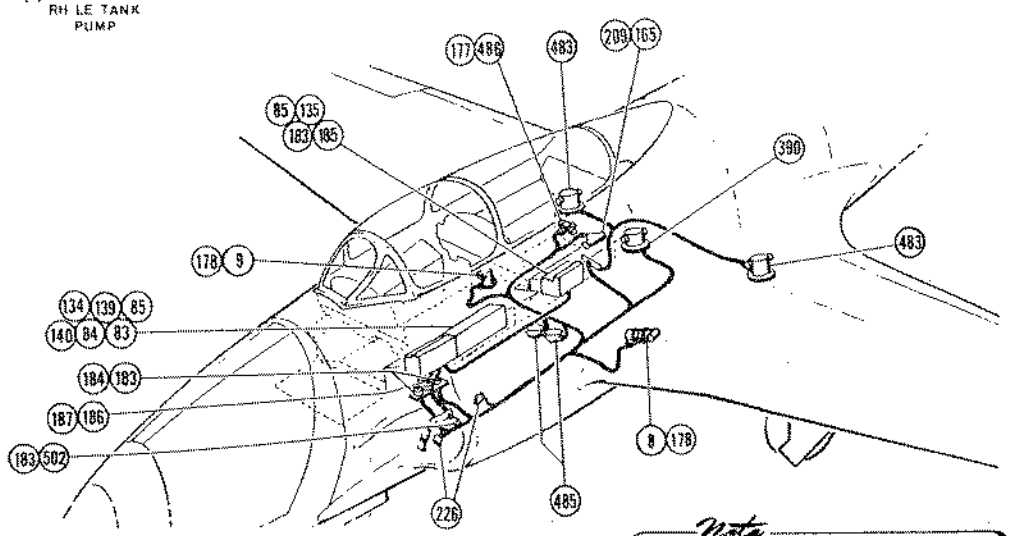
APPLIES TO AF SERIAL NO. 51-6529 THROUGH 51-6818 INCORPORATING T.O. 1T-33A-245 AND - 576

HB 616

M20-50-8-418

Figure 8-44. Fuel Pumps Circuit





ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
1 4	8 PUMP MOTOR	PESCO		121812-041-01
4	8 PUMP MOTOR	PESCO		121812-041-02
1 3	9 PUMP MOTOR	PESCO		121812-040-01
4	9 PUMP MOTOR	PESCO		121812-040-02
	83 SWITCH			AN3021-1
	84 SWITCH			AN3021-2
	85 SWITCH			AN3021-3
	134 CIRCUIT PROTECTOR			AN3161-P5
	135 CIRCUIT PROTECTOR			AN3161-P10
	139 CIRCUIT PROTECTOR			AN3161-P35
	140 CIRCUIT PROTECTOR			AN3161-P50
	165 CONNECTOR			AN3106-10S-2S
	177 CONNECTOR			AN3106-16S-3S
	178 CONNECTOR			AN3106-16S-5S
	183 CONNECTOR			AN3106-28-11S
	184 CONNECTOR			AN3102P-28-11P
	185 CONNECTOR			AN3102-28-11P
	186 CONNECTOR			AN3106-28-12S
	187 CONNECTOR			AN3102P-28-12P
	209 VALVE	GEN CONT		408-221
	226 RELAY			AN3350-2
	390 FUS. TANK PUMP	THOMPSON		TF29600-1
1 3	483 PUMP	PESCO		122289-010-01
2 3	483 PUMP	THOMPSON		29800-1
	485 VALVE	SAVAL		6924
	486 SOLENOID VALVE	GEN CONT		7248-1
	502 CONNECTOR			AN3160A-28-11P

Note

1. USED PRIOR TO AF SERIAL NO. 51-8636
2. USED ON AF SERIAL NO. 51-8636 THROUGH 51-9035
3. USED PRIOR TO AF SERIAL NO. 51-8935
4. USED ON AF SERIAL NO. 51-8935 THROUGH 51-9035

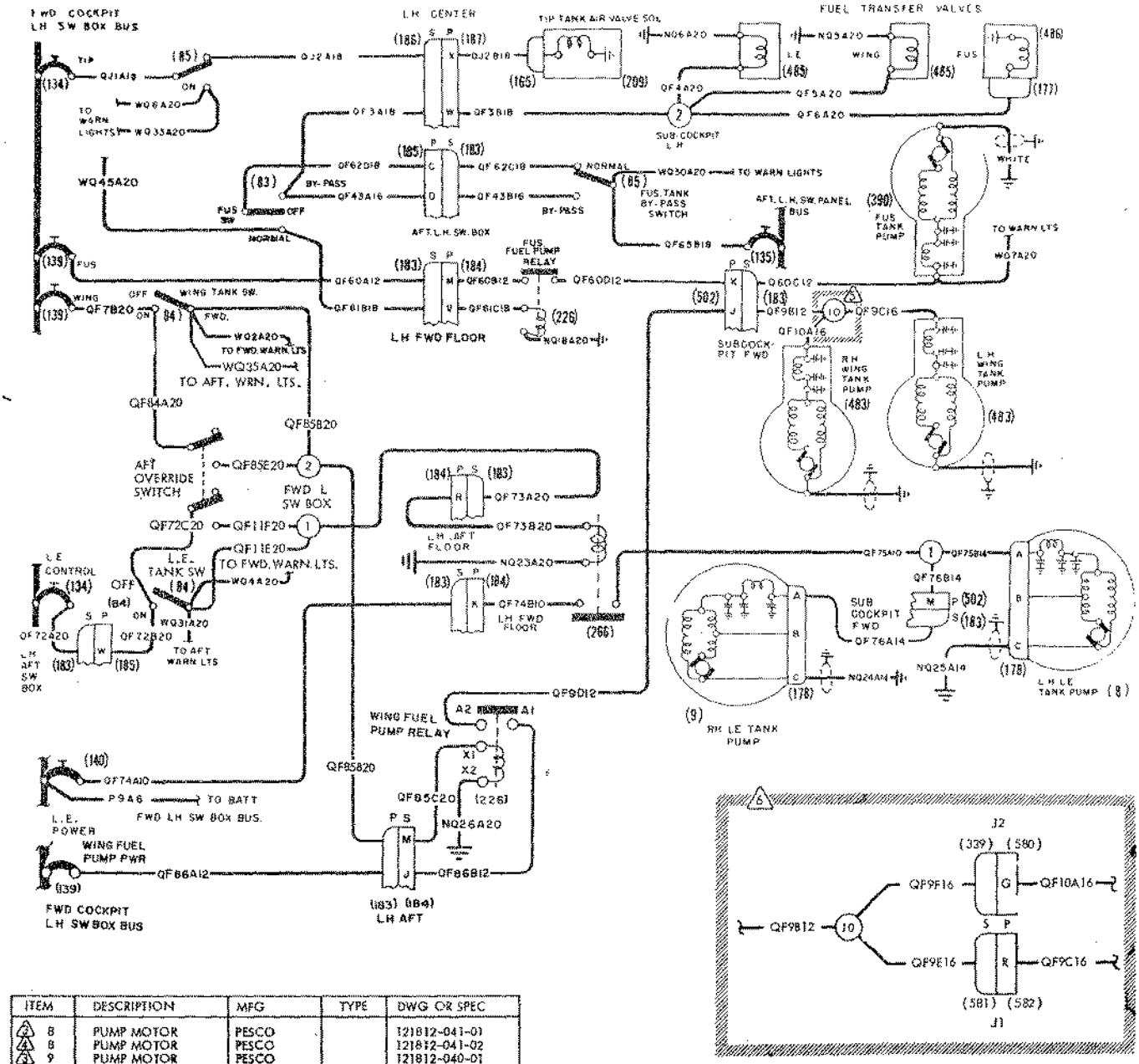
FUEL PUMPS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9035 NOT INCORPORATING T.O. 1T-33A-245 AND -576

HB 64
M20-49-8-36

Figure 8-45. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
4 8	PUMP MOTOR	PESCO		121812-041-01
4 8	PUMP MOTOR	PESCO		121812-041-02
3 9	PUMP MOTOR	PESCO		121812-040-01
4 9	PUMP MOTOR	PESCO		121812-040-02
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
95	SWITCH			AN3027-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
140	CIRCUIT PROTECTOR			AN3161-P50
165	CONNECTOR			AN3106B-10S-2S
177	CONNECTOR			AN3106B-16S-3S
178	CONNECTOR			AN3106B-16S-5S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
209	VALVE	GEN CONT		40R-721
226	RELAY			AN3350-2
339	CONNECTOR			MS3106M-28-11SW
390	FUS. TANK PUMP	THOMPSON		TF29600-1
1 4 83	PUMP	PESCO		122289-010-01
2 4 83	PUMP	THOMPSON		29800-1
485	VALVE	SAVAL		6924
486	SOLENOID VALVE	GEN CONT		7248-1
502	CONNECTOR			AN3100A-28-11P
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

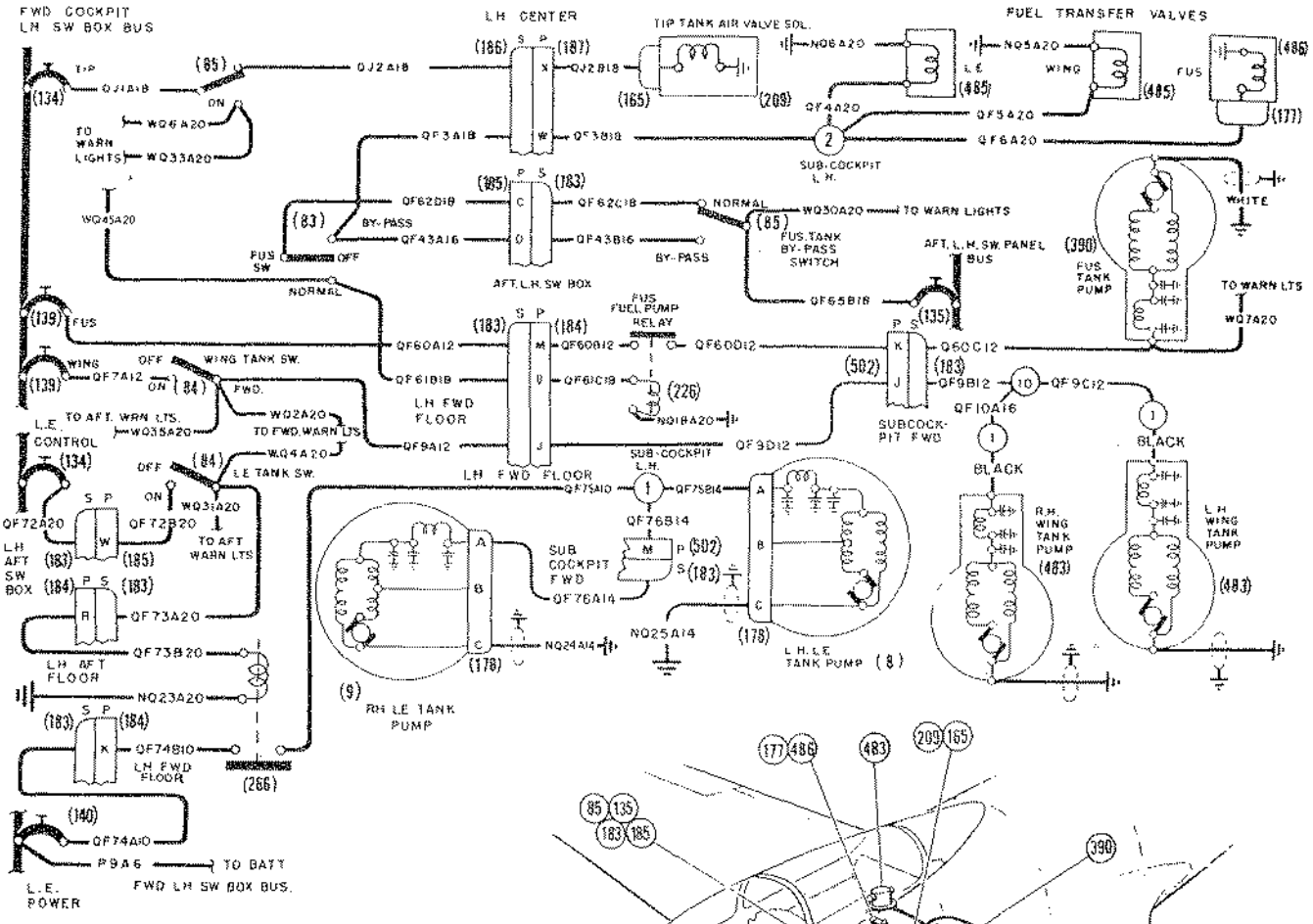
NOTE

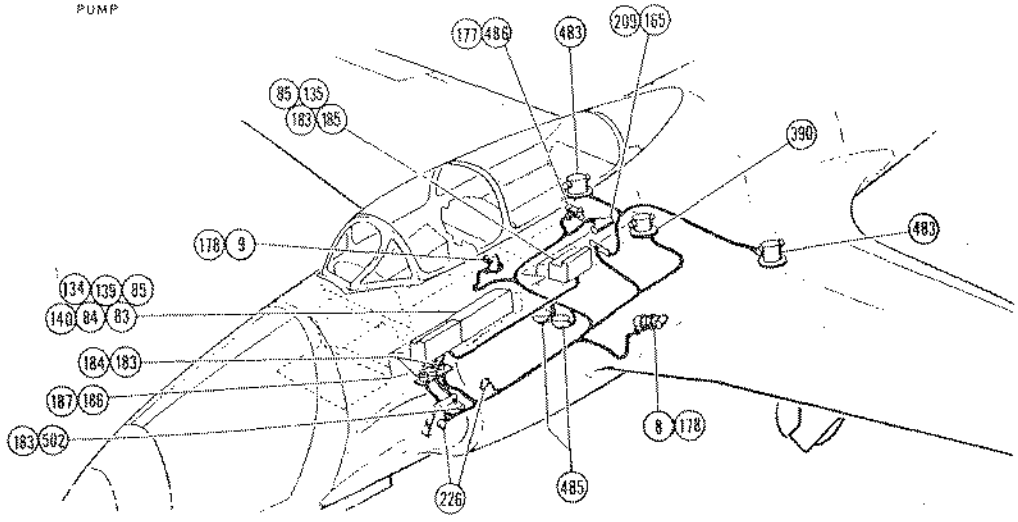
1. USED PRIOR TO AF SERIAL NO. 51-8636
2. USED ON AF SERIAL NO. 51-8636 THROUGH 51-9035
3. USED PRIOR TO AF SERIAL NO. 51-8935
4. USED ON AF SERIAL NO. 51-8936 THROUGH 51-9035
5. USED ON AIRPLANES NOT INCORPORATING T.O 1T-33A-567
6. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

HB 617
M20-56-8-419

FUEL PUMPS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THRU 51-9035 INCORPORATING T.O. 1T-33A-245 AND -576

Figure 8-46. Fuel Pumps Circuit





ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
8	PUMP MOTOR	PESCO		121812-041-02
9	PUMP MOTOR	PESCO		121812-040-01
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-A5
135	CIRCUIT PROTECTOR			AN3161-B10
139	CIRCUIT PROTECTOR			AN3161-B35
140	CIRCUIT PROTECTOR			AN3161-B50
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102F-28-12P
209	VALVE	GEN CONT		408-721
226	RELAY			AN3350-2
390	FUS. TANK PUMP	THOMPSON		TF29A00-1
483	PUMP	THOMPSON		29B00-1
485	VALVE	SAVAL		6924
486	SOLENOID VALVE	GEN CONT		7248-1
502	CONNECTOR			AN3106A-28-11P

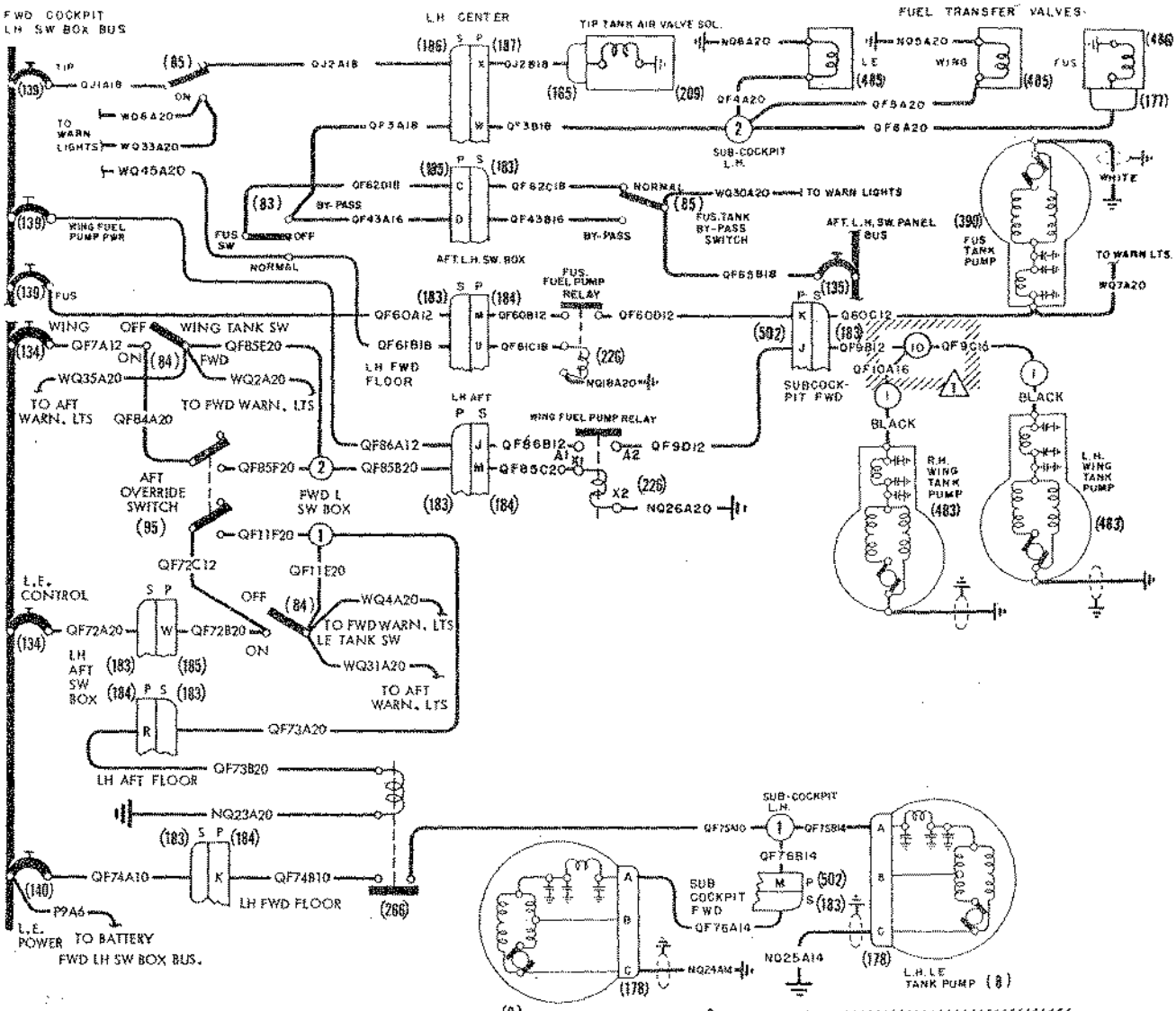
HB 66
M20-69-8-100

FUEL PUMPS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-9036 THROUGH 53-9634 AND 52-9876 THROUGH 52-9905 NOT INCORPORATING T.O. 1T-33A-245 AND -576

Figure 8-47. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC.
8	PUMP MOTOR	PESCO		121812-041-02
9	PUMP MOTOR	PESCO		121812-040-01
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3121-3
95	SWITCH			AN3027-3
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
140	CIRCUIT PROTECTOR			AN3161-P50
165	CONNECTOR			AN3106-10S-2S
177	CONNECTOR			AN3106-16S-3S
178	CONNECTOR			AN3106-16S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
209	VALVE	GEN CONT		40R-721
226	RELAY			AN3350-2
339	CONNECTOR			MS3106M-28-11SW
390	FUS. TANK PUMP	THOMPSON		TF29600-1
483	PUMP	THOMPSON		29600-1
485	VALVE	SAVAL		6924
486	SOLENOID VALVE	GEN CONT		7248-1
502	CONNECTOR			AN3100A-28-11P
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

FUEL PUMPS CIRCUIT

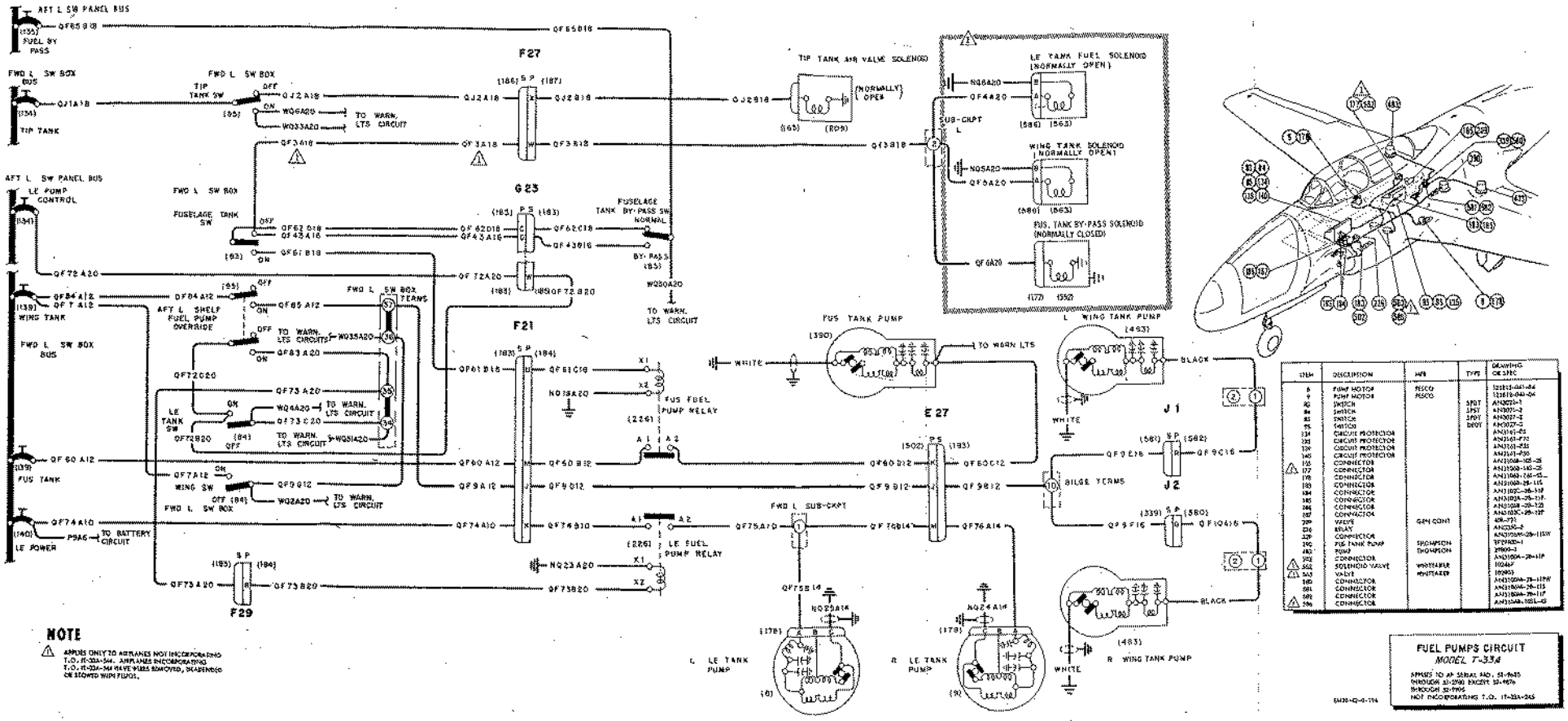
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9036 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905 INCORPORATING T.O. 1T-33A-245 AND -576

HB 603

M20-50-8-420

Figure 8-48. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
6	PUMP MOTOR	PESCO		122813-041-04
9	PUMP MOTOR	PESCO		122813-041-04
80	SWITCH		3PST	AN3027-1
84	SWITCH		1PST	AN3021-2
85	SWITCH		3PDT	AN3027-2
95	SWITCH		DPDT	AN3027-2
124	CIRCUIT PROTECTOR			AN3161-05
130	CIRCUIT PROTECTOR			AN3160-P30
134	CIRCUIT PROTECTOR			AN3160-P35
140	CIRCUIT PROTECTOR			AN3160-P50
155	CONNECTOR			AN3106B-16S-2S
177	CONNECTOR			AN3126B-16S-2S
178	CONNECTOR			AN3106B-24S-4S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-16-1P
185	CONNECTOR			AN3102A-28-21P
186	CONNECTOR			AN3106B-20-22S
192	CONNECTOR			AN3102C-28-21P
209	VALVE	GEN CONT		408-731
216	RELAY			AN2256-2
229	CONNECTOR			AN3126A-28-11SW
390	FUS TANK PUMP	THOMPSON		TP29B3-1
483	PUMP	THOMPSON		3P8B3-1
502	CONNECTOR			AN3106A-28-11P
552	SOLENOID VALVE	WHITTAKER		102467
563	VALVE	WHITTAKER		102823
580	CONNECTOR			AN3126A-28-11SW
581	CONNECTOR			AN3106A-24-11S
582	CONNECTOR			AN3106A-28-11P
586	CONNECTOR			AN3126A-10SL-6S

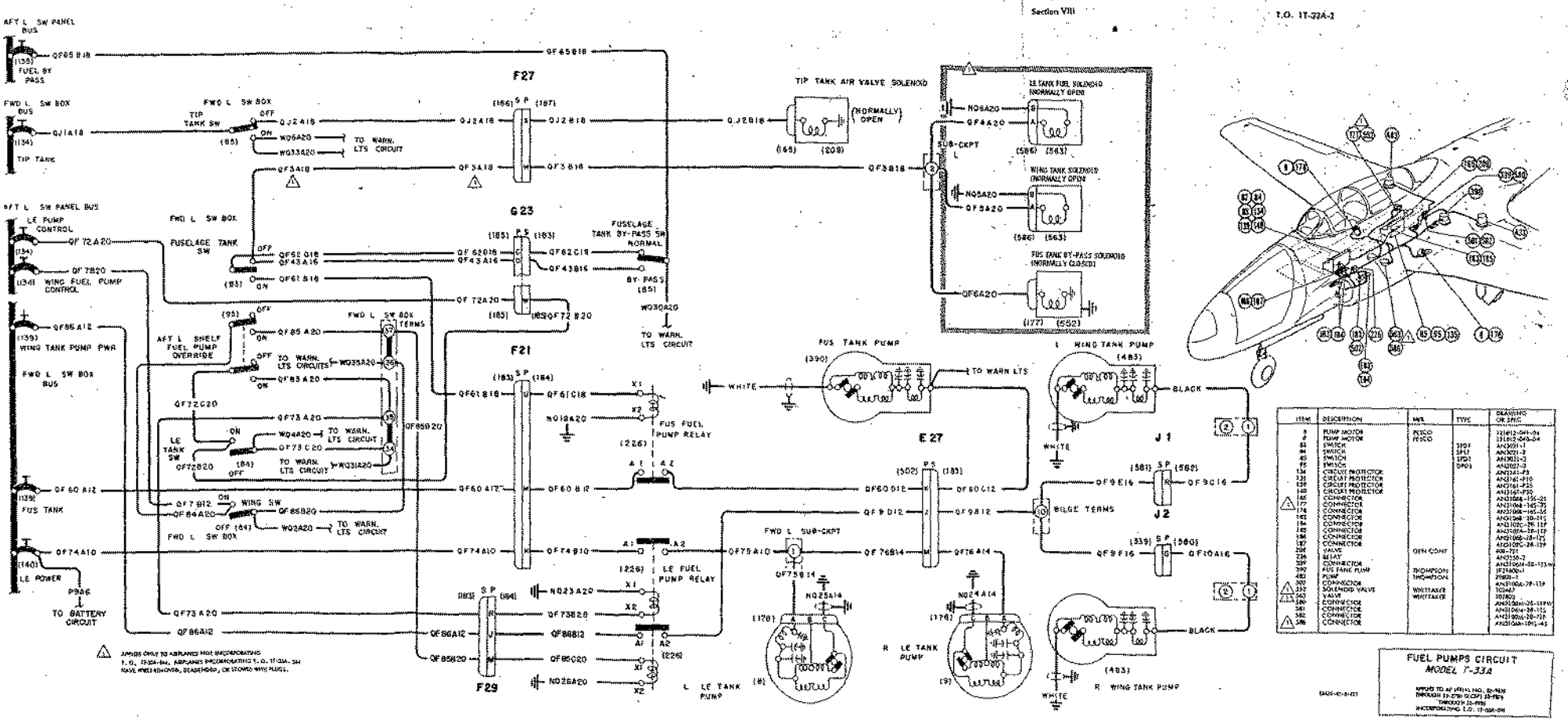
NOTE

⚠ APPLIES ONLY TO AIRPLANES NOT INCORPORATING T.O. 1T-33A-546. AIRPLANES INCORPORATING T.O. 1T-33A-546 HAVE WIRES REMOVED, DISABLED OR SECURED WITH FUSES.

FUEL PUMPS CIRCUIT
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9645 THROUGH 53-3790 EXCEPT 53-4979 THROUGH 53-5905 NOT INCORPORATING T.O. 1T-33A-545

Figure 8-17. Fuel Pumps Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
3	PUMP MOTOR	PESCO		121612-049-04
4	PUMP MOTOR	PESCO		121612-049-04
83	SWITCH		3PDT	AN3021-1
84	SWITCH		5PST	AN3021-2
85	SWITCH		3PDT	AN3021-3
95	SWITCH		DPDT	AN3021-4
134	CIRCUIT PROTECTOR			AN3361-P3
135	CIRCUIT PROTECTOR			AN3361-P10
139	CIRCUIT PROTECTOR			AN3361-P25
140	CIRCUIT PROTECTOR			AN3361-P30
165	CONNECTOR			AN3106A-165-3S
174	CONNECTOR			AN3106A-165-3S
176	CONNECTOR			AN3106A-165-5S
181	CONNECTOR			AN3106A-10-2S
184	CONNECTOR			AN3102E-2S-1P
185	CONNECTOR			AN3102A-2S-1P
186	CONNECTOR			AN3106B-2S-1P
187	CONNECTOR			AN3102C-2S-3P
204	VALVE	GEN CONT		608-751
236	RELAY			AN3150-2
339	CONNECTOR			AN3106A-20-33S
390	AUX TANK PUMP	THOMPSON		[P23600-1
483	PUMP	THOMPSON		P2600-1
502	CONNECTOR			AN3100A-28-11P
563	SOLENOID VALVE	WHITTAKER		302443
580	VALVE	WHITTAKER		302803
580	CONNECTOR			AN3100A-20-19PW
581	CONNECTOR			AN3106A-28-11S
582	CONNECTOR			AN3100A-20-7S
586	CONNECTOR			AN3106A-10S-6S

FUEL PUMPS CIRCUIT
MODEL F-33A

APPLIES TO AF (AFAL) NO. 52-1826 THROUGH 53-3790 (OLCAP) 53-3826 THROUGH 53-3930 INCORPORATING T.O. 1F-33A-2M

Figure 8-36. Fuel Pumps Circuit

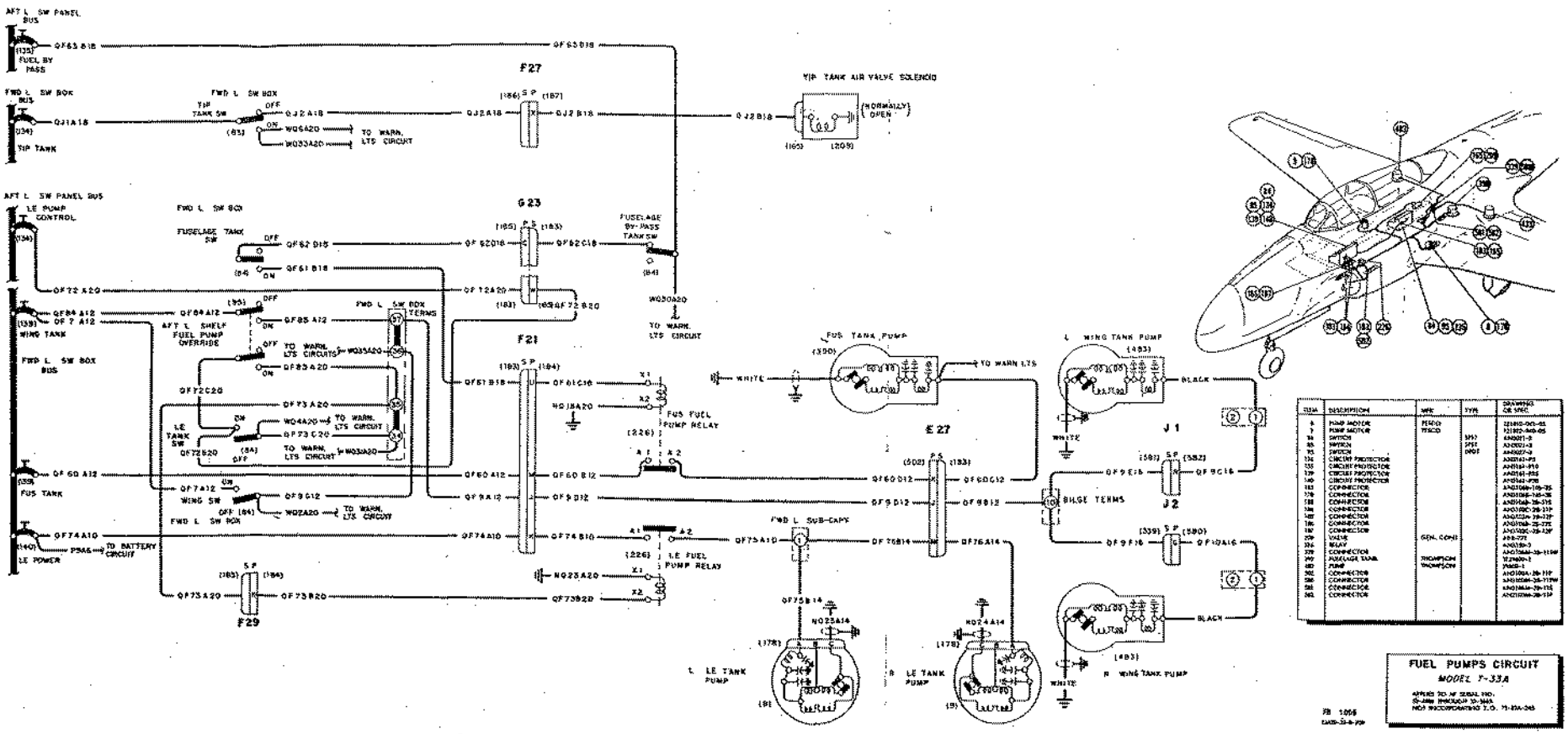


Figure 8-51. Fuel Pumps Circuit

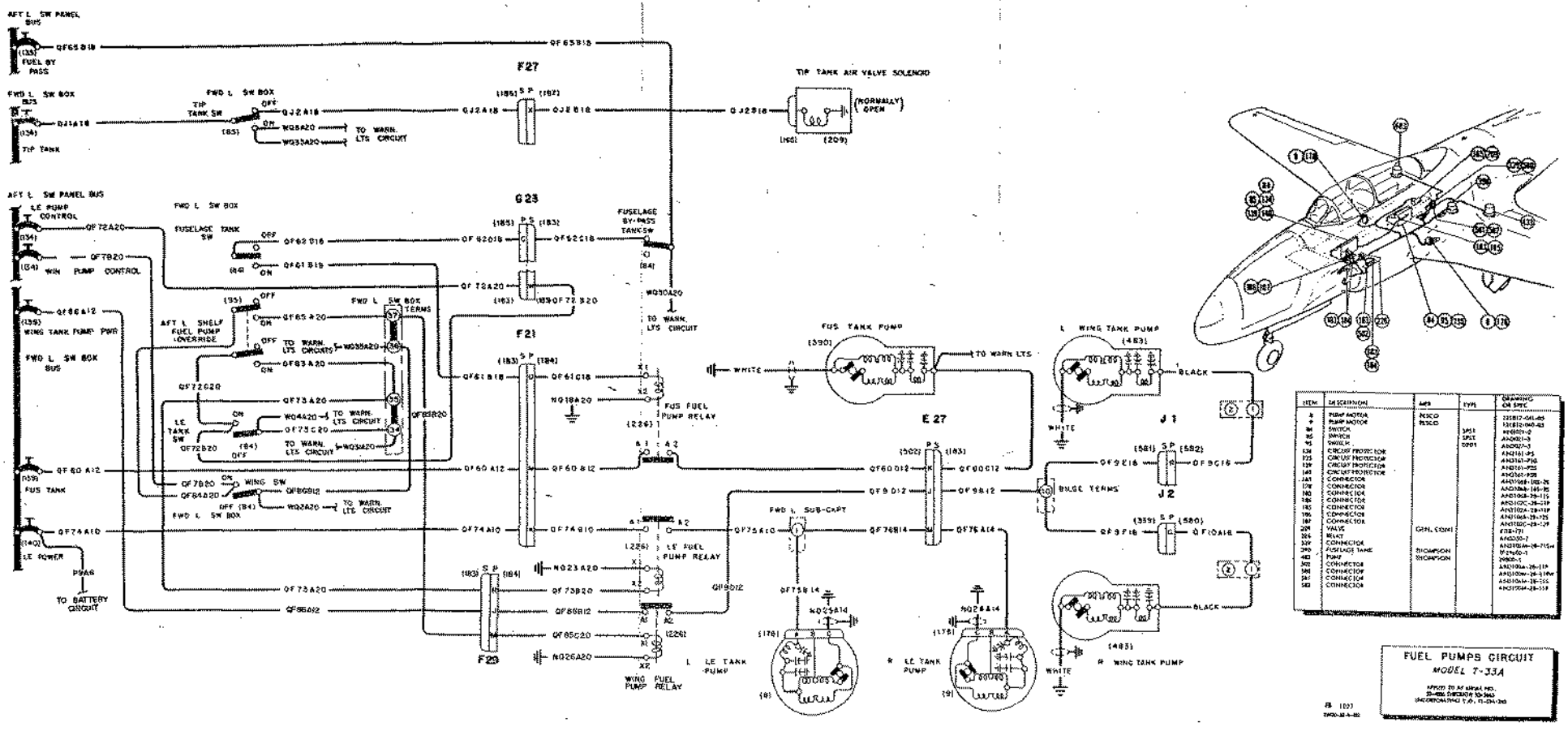
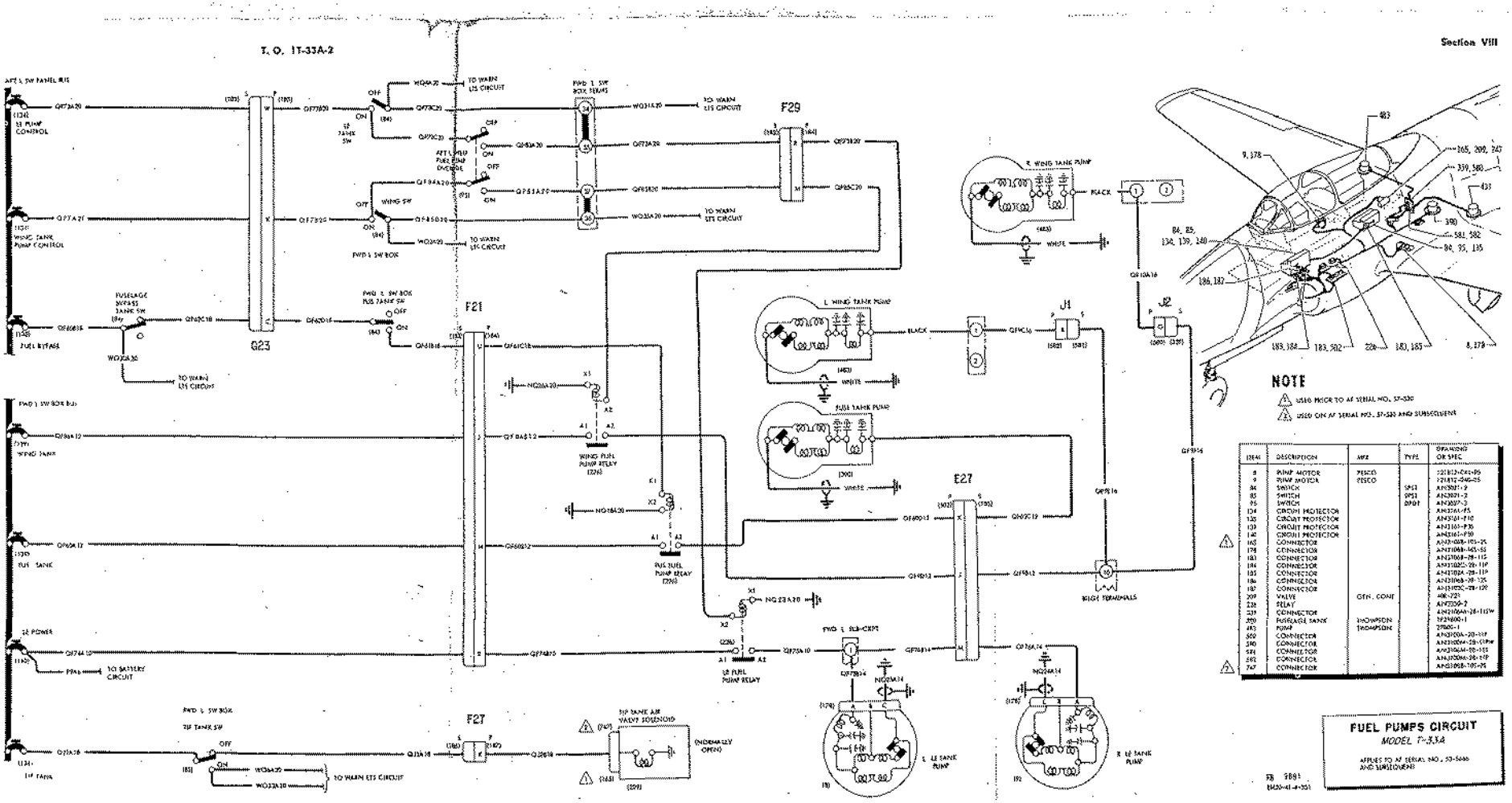


Figure 8-52. Fuel Pumps Circuit

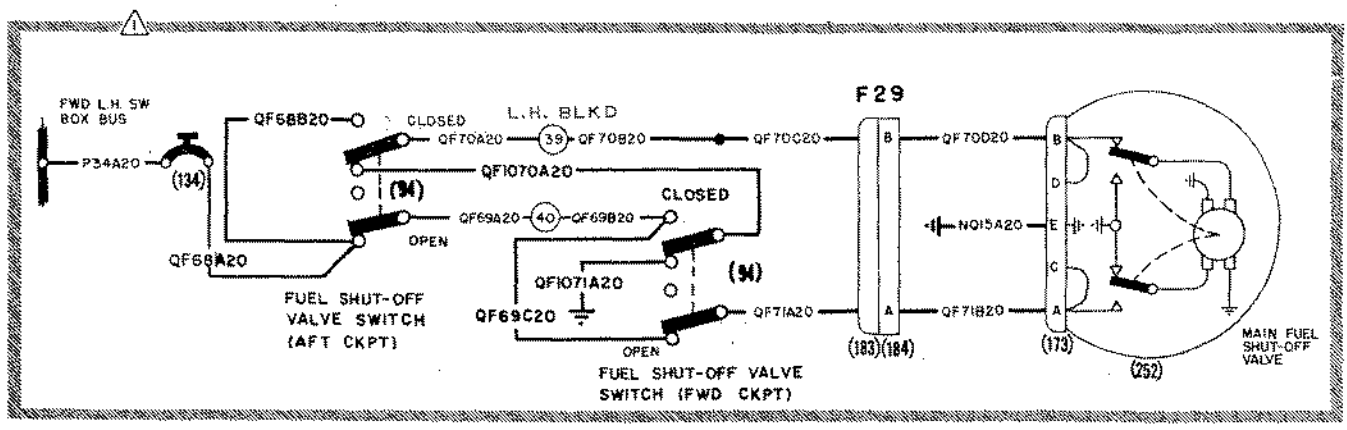


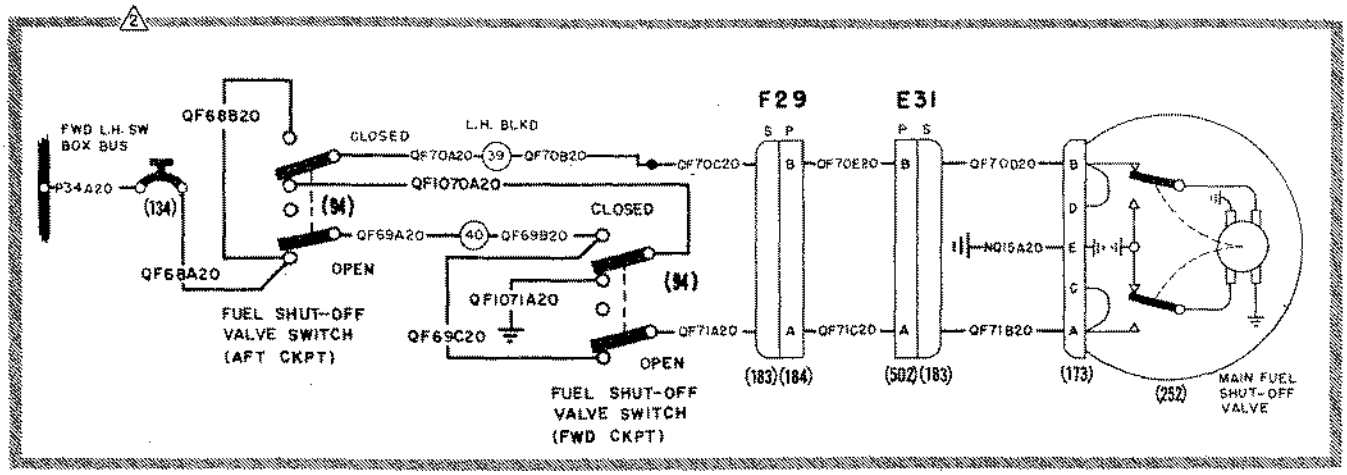
ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
8	PUMP MOTOR	PESCO		221812-C42-P9
9	PUMP MOTOR	PESCO		221812-C46-P5
84	SWITCH		SPST	AN3021-2
85	SWITCH		SPST	AN3021-2
95	SWITCH		DPDT	AN3027-2
104	CIRCUIT PROTECTOR			AN3361-P5
126	CIRCUIT PROTECTOR			AN3361-P10
130	CIRCUIT PROTECTOR			AN3361-P35
140	CIRCUIT PROTECTOR			AN3361-P50
165	CONNECTOR			AN2108B-10S-2S
178	CONNECTOR			AN2108B-16S-5S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3108A-28-11S
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
209	VALVE	GEN. COAT		AIR-7221
226	RELAY			AN2506-2
239	CONNECTOR			AN2108A4-26-11SW
260	FUSELAGE TANK	THOMPSON		3P29600-1
263	PUMP	THOMPSON		29600-1
569	CONNECTOR			AN3102A-20-15P
590	CONNECTOR			AN3106A-28-15PW
591	CONNECTOR			AN3106A-20-15S
592	CONNECTOR			AN3102A-20-15P
747	CONNECTOR			AN3106B-10S-9S

FUEL PUMPS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5666 AND SUBSEQUENT

FB 9881
B4A0-41-A+353

Figure 8-53. Fuel Pumps Circuit





MAIN FUEL SHUT-OFF VALVE CIRCUIT

APPLIES TO T-33A-1, T-33A-5, T-33A-10, T-33A-15, AT-33A-20, AND DT-33A

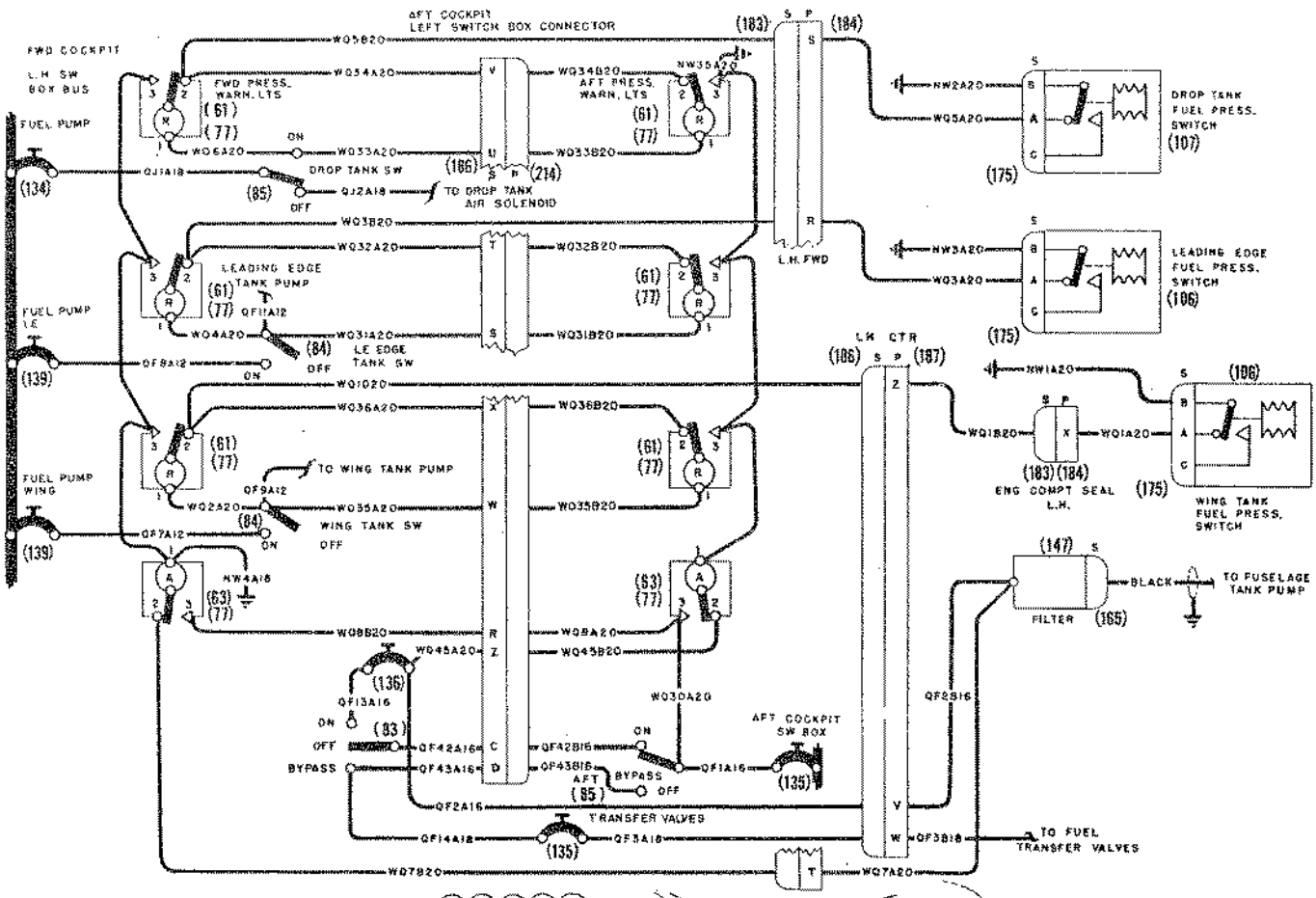
NOTE:

1. USED PRIOR TO AF SERIAL NO. 51-6819
2. USED ON AF SERIAL NO. 51-6819 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
94	SWITCH			MS24524-23
134	CIRCUIT PROTECTOR			MS25017-5
173	CONNECTOR			MS3106R-14S-5S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
252	VALVE	WHITTAKER		W7951-1-1/4D W7955-1-1/4D WE451-1-1/4D 101913
502	CONNECTOR			MS3100R-28-11P

Figure 8-54. Main Fuel Shutoff Valve Circuit

AFLC SMAMA JAN 70 6600

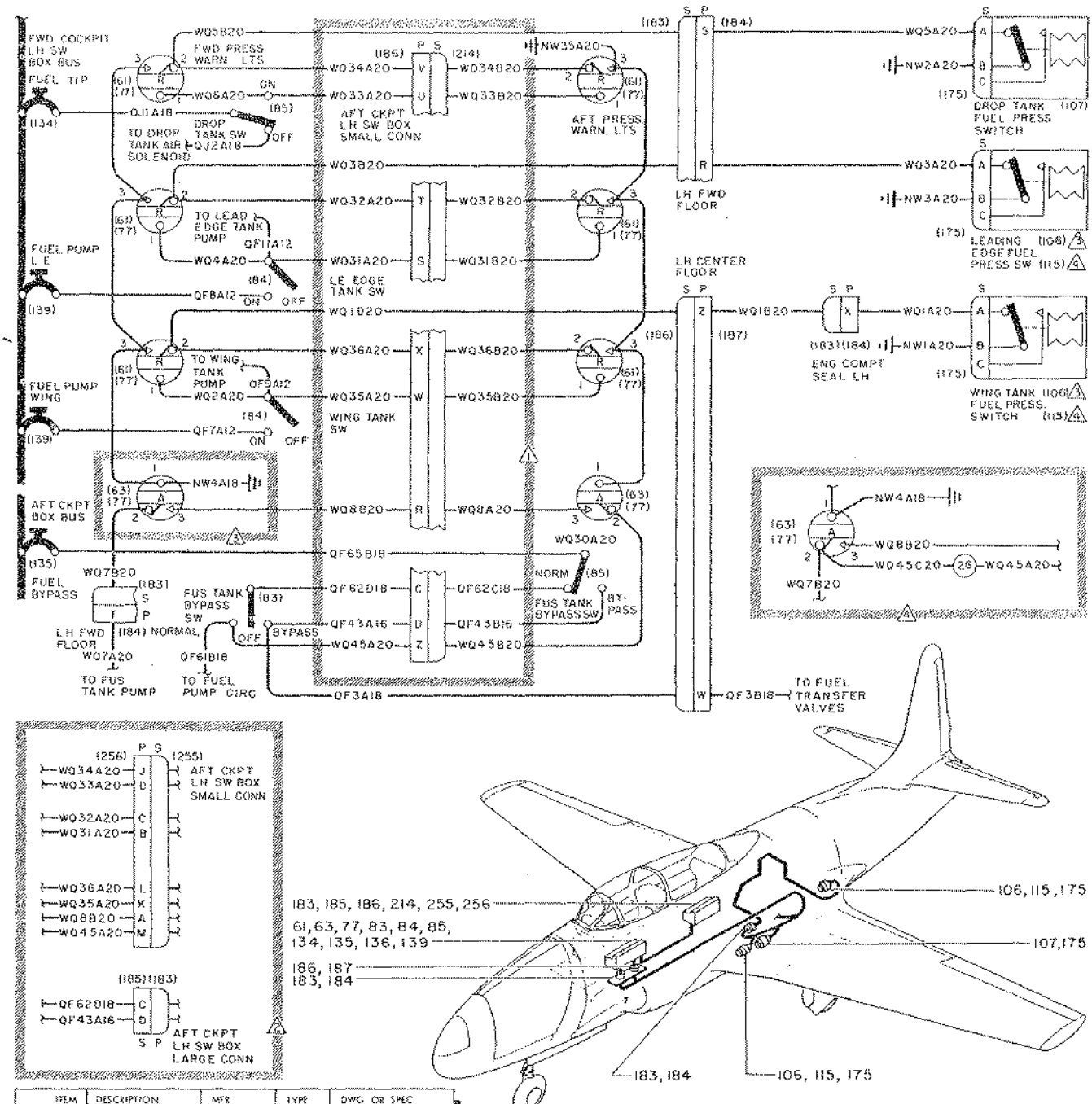


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
106	PRESS. SWITCH	MELETRON		610-10L-3
107	PRESS. SWITCH	MELETRON		610-10L-2
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P15
136	CIRCUIT PROTECTOR			AN3161-P15
139	CIRCUIT PROTECTOR			AN3161-P35
147	FILTER	POTTER		B-135
165	CONNECTOR			AN3106-10S-2S
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
214	CONNECTOR			AN3102-28-12P

FUEL PRESSURE WARNING LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO SERIAL 48-356 THROUGH 48-375, AND 48-913 THROUGH 48-920

AS 6810

Figure 8-55. Fuel Pressure Warning Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
1 106	PRESSURE SWITCH	MEL-E-TRON		410-306-3
107	PRESSURE SWITCH	MEL-E-TRON		410-306-2
4 115	PRESSURE SWITCH	MEL-E-TRON		410-306-13
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
136	CIRCUIT PROTECTOR			AN3161-P25
139	CIRCUIT PROTECTOR			AN3161-P35
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
1 214	CONNECTOR			AN3102-28-12P
2 255	CONNECTOR			AN3106-20-1S
2 256	CONNECTOR			AN3102-20-1P

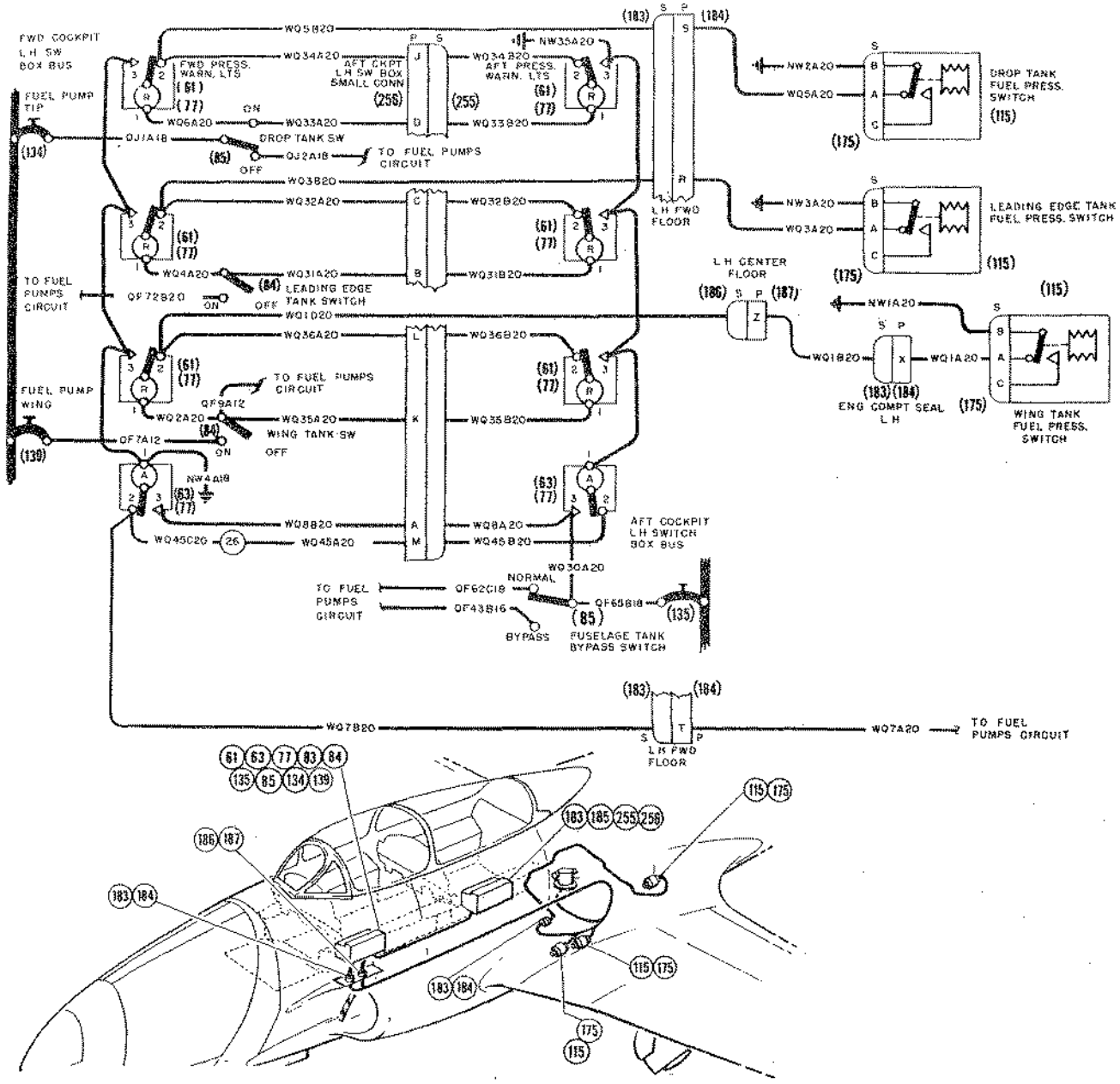
Note

1. USED ON AF SERIAL NOS. 49-879 THRU 49-900
2. USED ON AF SERIAL NOS. 49-901 THRU 51-6528
3. USED PRIOR TO AF SERIAL NO. 51-4094
4. USED ON AF SERIAL NOS. 51-4094 THRU 51-6528

FUEL PRESSURE WARNING LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 49-879 THROUGH 51-6528

EM20-18-8-39
AB 10330

Figure 8-56. Fuel Pressure Warning Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3152-2
63	LIGHT		AMBER	AN3152-4
77	LAMP			AN3121-313
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
115	PRESSURE SWITCH	MELETRON		430-10L-13
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
187	CONNECTOR			AN3102P-28-12P
255	CONNECTOR			AN3106-28-1S
256	CONNECTOR			AN3102-20-1P

EM-20-1B-8-160

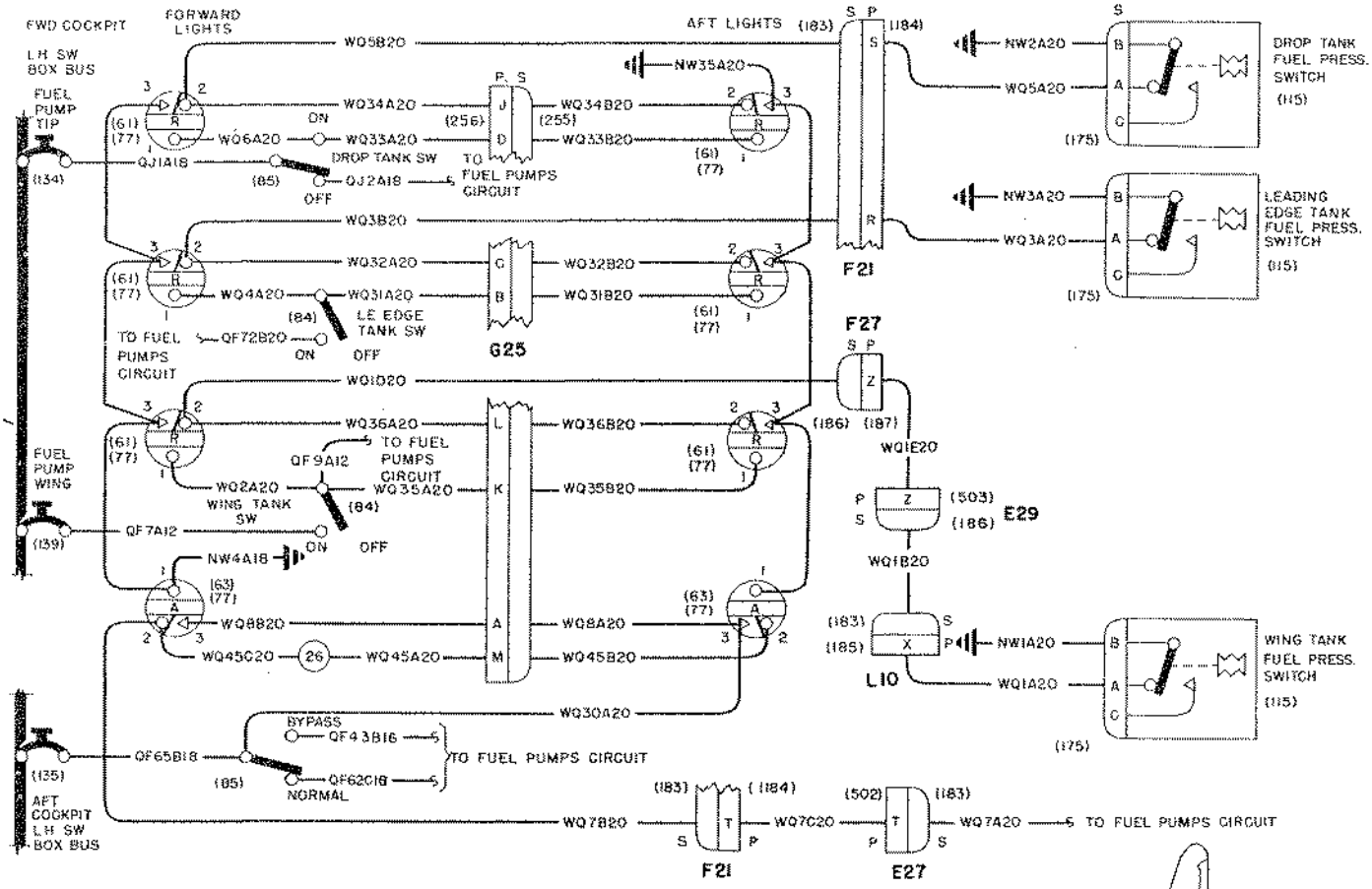
AB 9810

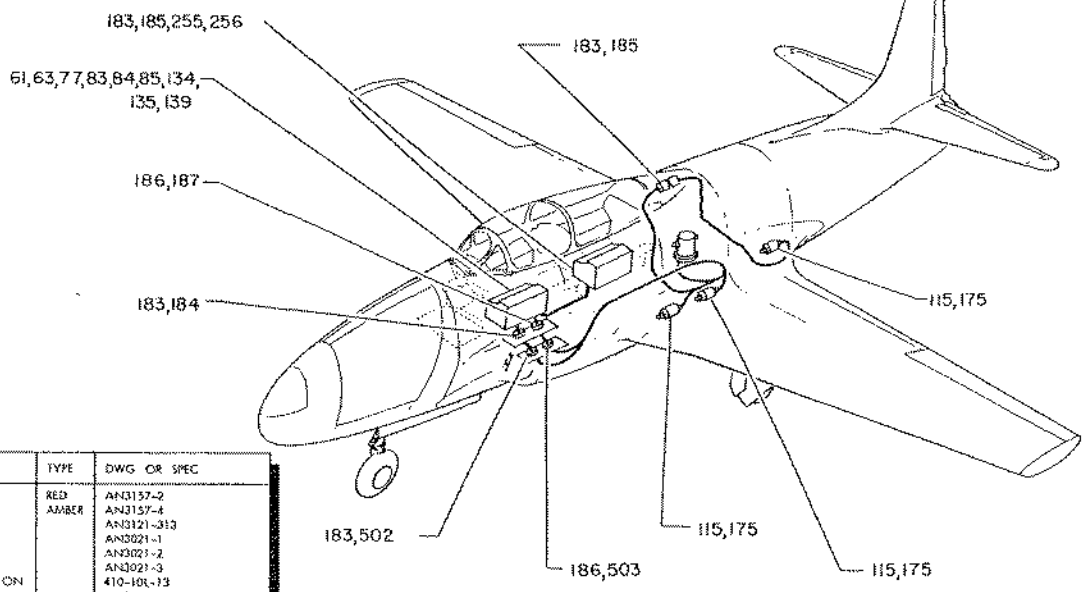
FUEL PRESSURE WARNING LIGHTS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-6529 THROUGH 51-6818

Figure 8-57. Fuel Pressure Warning Lights Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
115	PRESSURE SWITCH	MELETRON		410-101-13
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
255	CONNECTOR			AN3106-20-3S
256	CONNECTOR			AN3102-20-3P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P

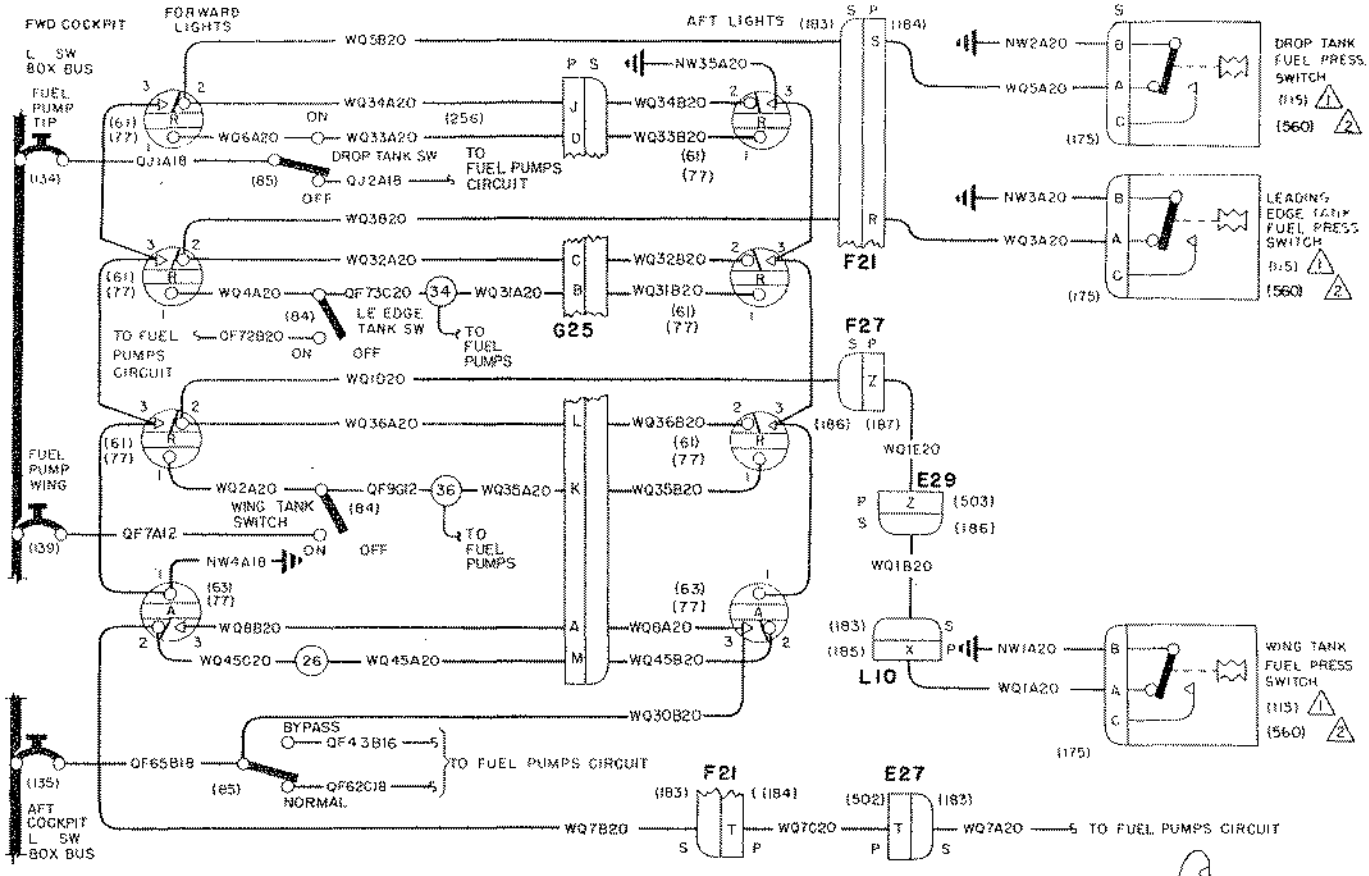
FUEL PRESSURE WARNING LIGHTS CIRCUIT

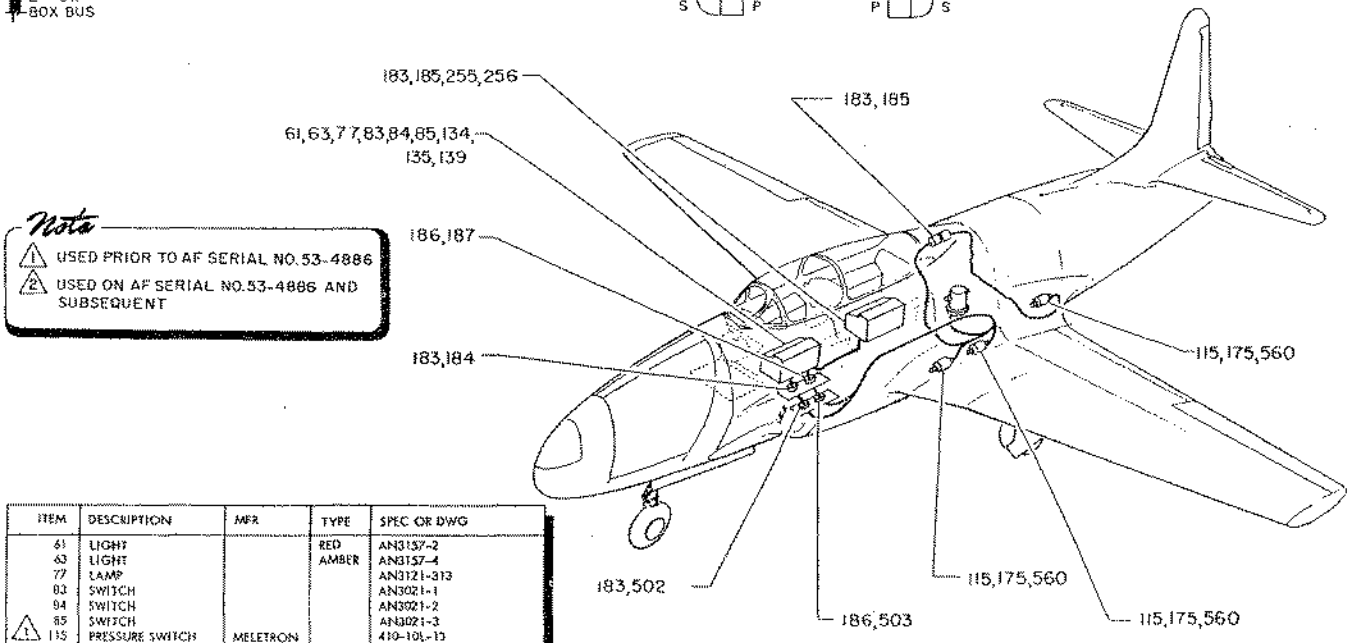
MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9903

EM-20-22-8-40
CB 3850

Figure 8-58. Fuel Pressure Warning Lights Circuit





Note

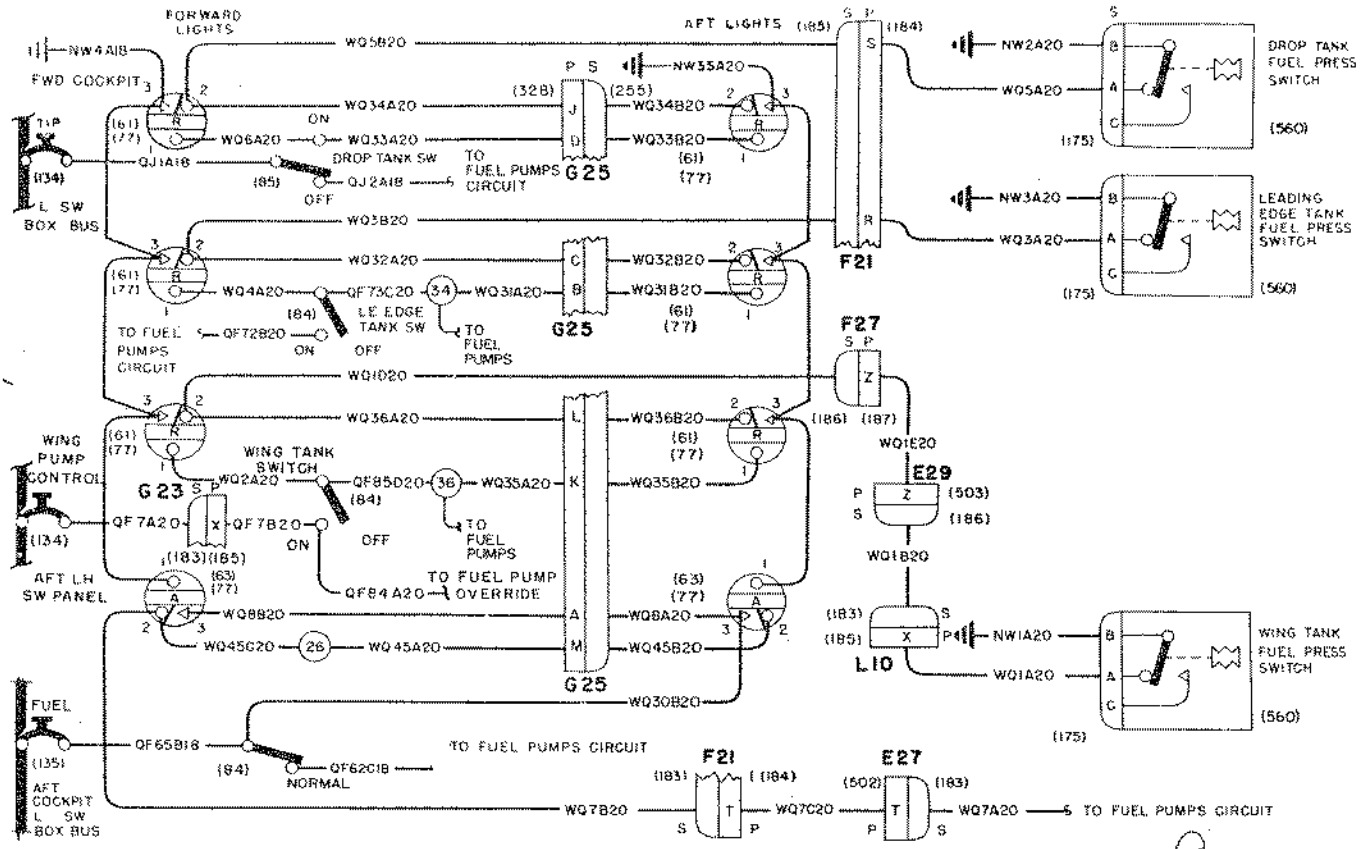
1. USED PRIOR TO AF SERIAL NO. 53-4886
2. USED ON AF SERIAL NO. 53-4886 AND SUBSEQUENT

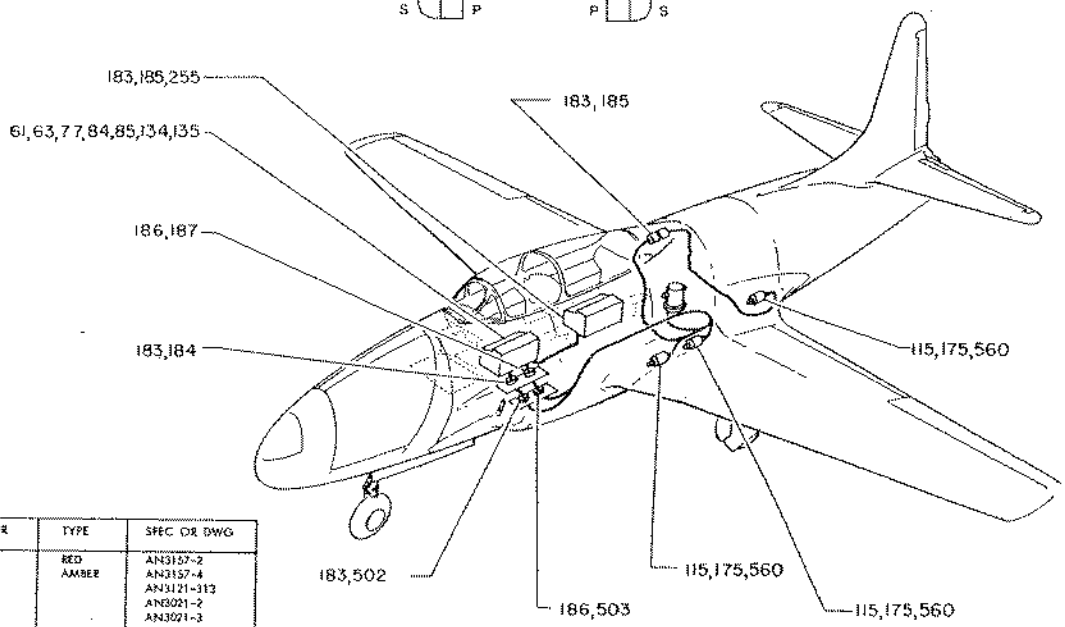
ITEM	DESCRIPTION	MFR	TYPE	SPEC OR DWG
61	LIGHT		RED	AN3157-2
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
83	SWITCH			AN3021-1
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
1 115	PRESSURE SWITCH	MELETRON		410-10L-13
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
139	CIRCUIT PROTECTOR			AN3161-P35
175	CONNECTOR			AN3106-14S-7S
180	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
255	CONNECTOR			AN3106-20-1S
256	CONNECTOR			AN3102-20-1P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
2 560	PRESSURE SWITCH	HYDRA		33100-3

GB 8804
M20-A8D-8-195

FUEL PRESSURE WARNING LIGHTS CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 52-9635 AND SUBSEQUENT, EXCEPT 52-9876 THROUGH 52-9905

Figure 8-59. Fuel Pressure Warning Lights Circuit



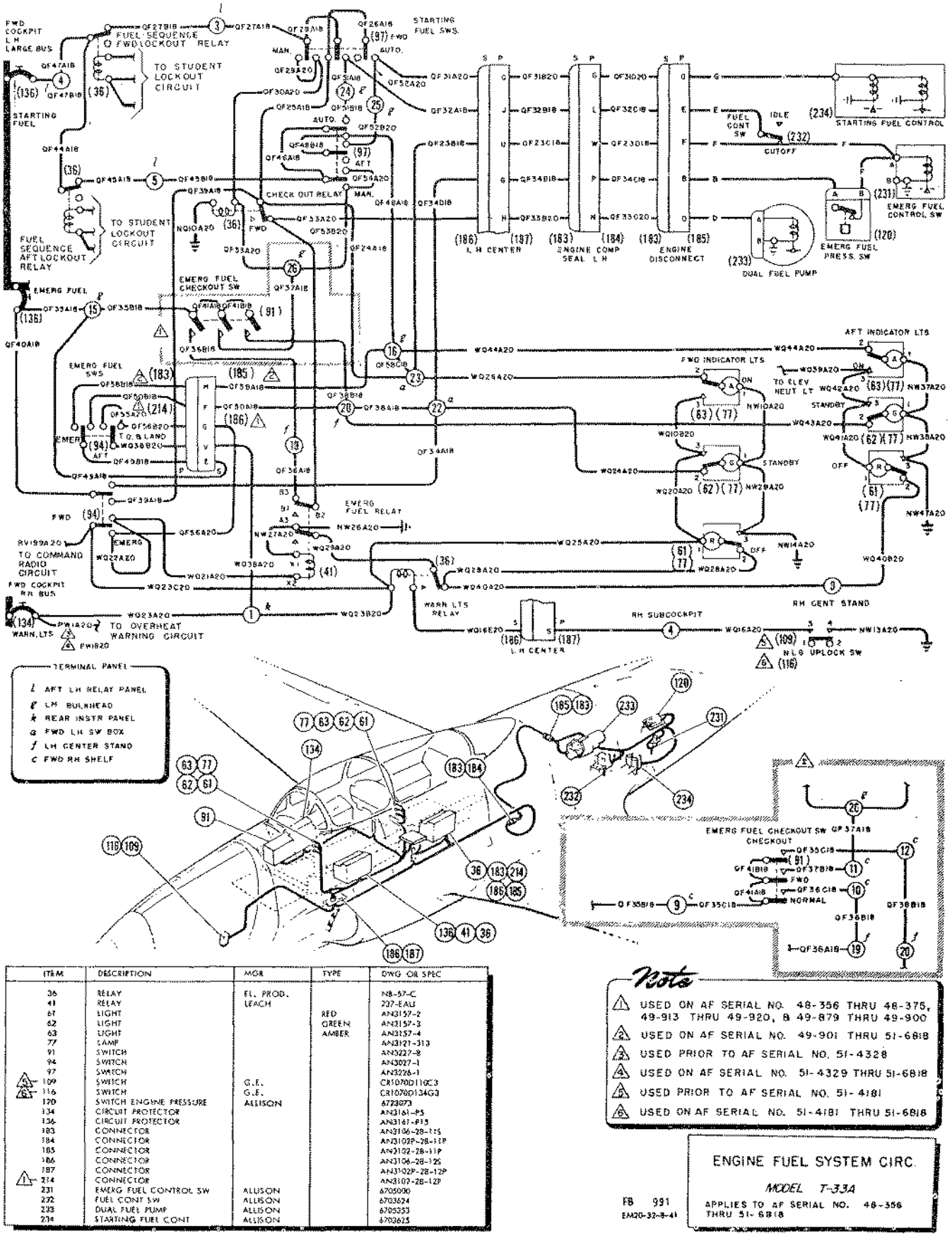


ITEM	DESCRIPTION	MFR	TYPE	SPEC OR DWG
61	LIGHT		RED	AN3157-2
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-#5
135	CIRCUIT PROTECTOR			AN3161-#10
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102-28-12P
255	CONNECTOR			AN3106-20-15
328	CONNECTOR			AN3102A-20-19P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
560	PRESSURE SWITCH	HYDRA		23100-3

FUEL PRESSURE WARNING LIGHTS CIRCUIT
MODEL T-33A-5

FB 412
EM-20-31-8-292

Figure 8-60. Fuel Pressure Warning Lights Circuit



ITEM	DESCRIPTION	MGR	TYPE	DWG OR SPEC
	36 RELAY	EL. PROD.		NB-57-C
	41 RELAY	LEACH		237-EAU
	61 LIGHT		RED	AN3157-2
	62 LIGHT		GREEN	AN3157-3
	63 LIGHT		AMBER	AN3157-4
	77 LAMP			AN3121-313
	91 SWITCH			AN3227-8
	94 SWITCH			AN3027-1
	97 SWITCH			AN3226-1
5	109 SWITCH	G.E.		CR1070D110C3
6	116 SWITCH	G.E.		CR1070D134G3
	120 SWITCH ENGINE PRESSURE	ALLISON		6723873
	134 CIRCUIT PROTECTOR			AN3161-P5
	136 CIRCUIT PROTECTOR			AN3161-P15
	183 CONNECTOR			AN3106-28-11S
	184 CONNECTOR			AN3102P-28-11P
	185 CONNECTOR			AN3102-28-11P
	186 CONNECTOR			AN3106-28-12S
	187 CONNECTOR			AN3102P-28-12P
1	214 CONNECTOR			AN3102-28-12P
	231 EMERG FUEL CONTROL SW	ALLISON		6705000
	232 FUEL CONT SW	ALLISON		6703624
	233 DUAL FUEL PUMP	ALLISON		6705353
	234 STARTING FUEL CONT	ALLISON		6703625

Note

1. USED ON AF SERIAL NO. 48-356 THRU 48-375, 49-913 THRU 49-920, & 49-879 THRU 49-900
2. USED ON AF SERIAL NO. 49-901 THRU 51-6818
3. USED PRIOR TO AF SERIAL NO. 51-4328
4. USED ON AF SERIAL NO. 51-4329 THRU 51-6818
5. USED PRIOR TO AF SERIAL NO. 51-4181
6. USED ON AF SERIAL NO. 51-4181 THRU 51-6818

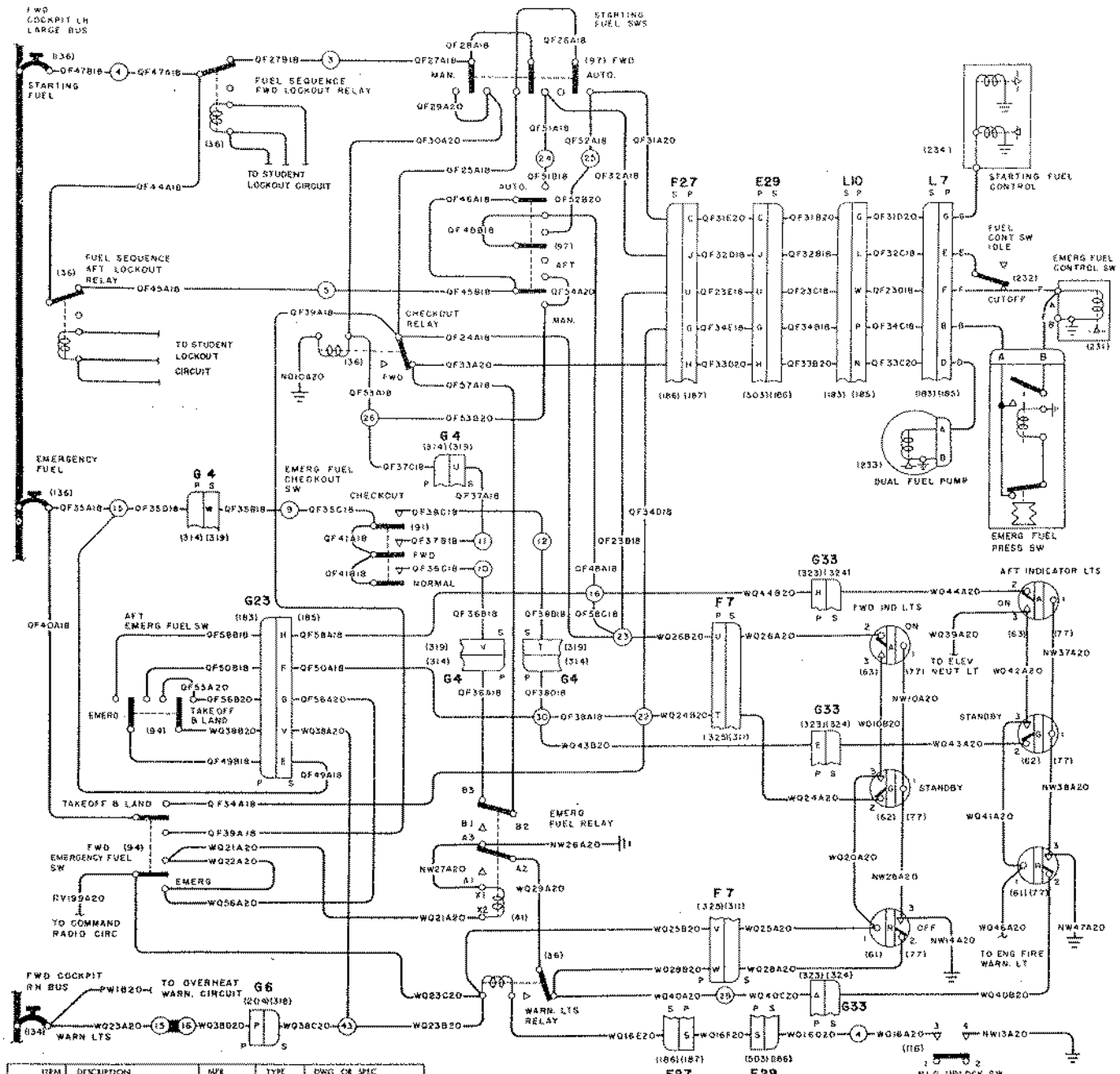
ENGINE FUEL SYSTEM CIRC.

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THRU 51-6818

FB 991
EM20-32-8-41

Figure 8-61. Engine Fuel System Circuit

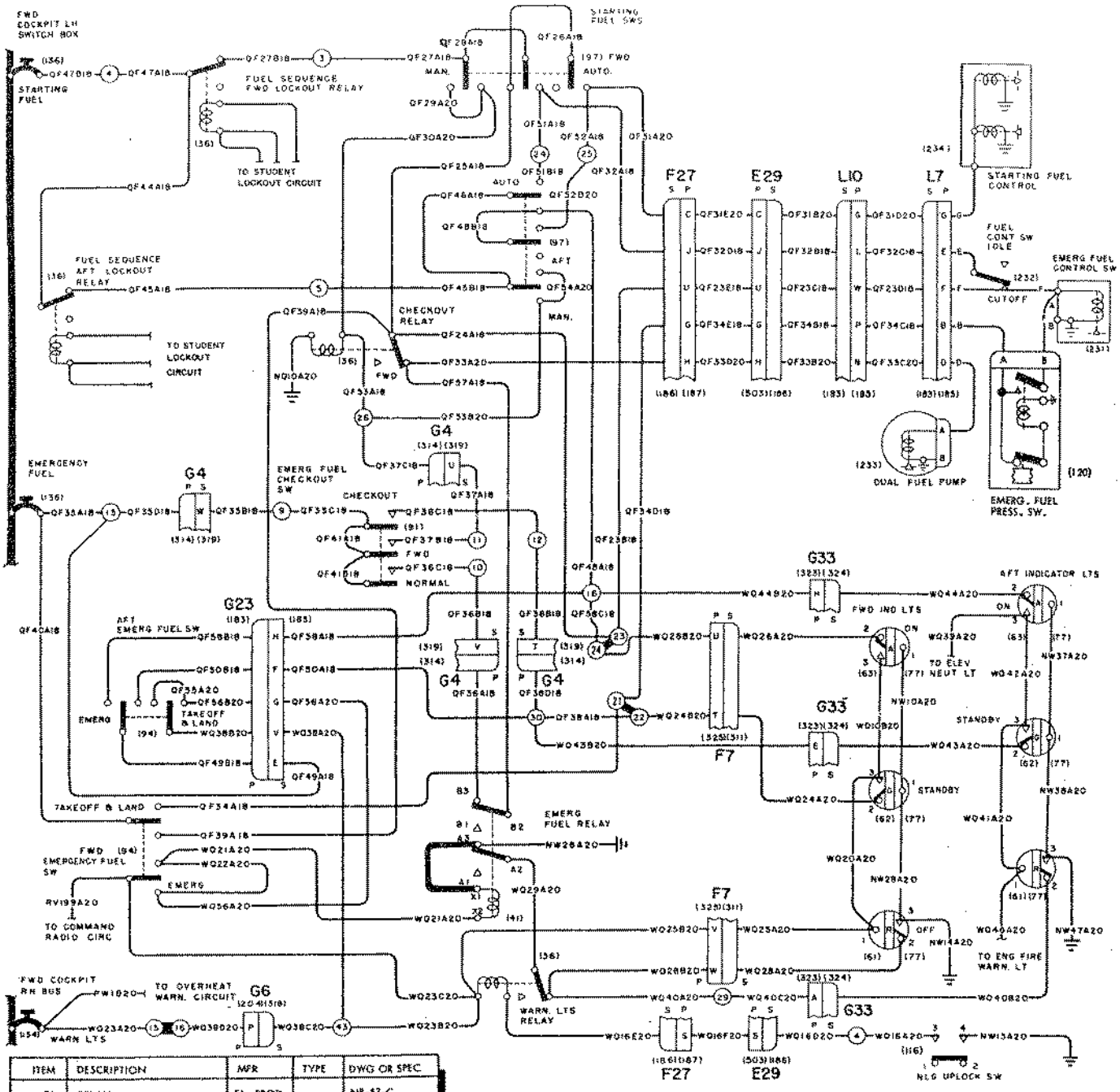


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD.		NK-57-C
41	RELAY	LEACH		257-EAA1
61	LIGHT		RED	AN3157-7
62	LIGHT		GREEN	AN3157-3
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3727-313
91	SWITCH			AN3227-8
94	SWITCH			AN3027-1
97	SWITCH			AN3226-1
116	SWITCH	G.E.		CR101(X)134F3
120	SWITCH, ENGINE PRESSURE	GEAR		555-3604
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106-28-19S
185	CONNECTOR			AN3102-28-19P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3029-28-12P
204	CONNECTOR			AN3102-20-29S
234	EMERG FUEL CONTROL SW	ALLISON		6705000
232	FUEL CONTROL SW	ALLISON		6703624
233	DUAL FUEL PUMP	ALLISON		6705353
234	STARTING FUEL CONT	ALLISON		6700625
311	CONNECTOR			AN3106-28-15S
314	CONNECTOR			AN3106A-24-28P
318	CONNECTOR			AN3106A-20-29P
319	CONNECTOR			AN3102-24-29S
323	CONNECTOR			AN3102-24-28P
324	CONNECTOR			AN3106A-24-29S
325	CONNECTOR			AN3106A-28-15P
503	CONNECTOR			AN3106A-28-12P

ENGINE FUEL SYSTEM CIRCUIT
MODEL F-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

FB 8016
M20-39-8-42

Figure 8-62. Engine Fuel System Circuit

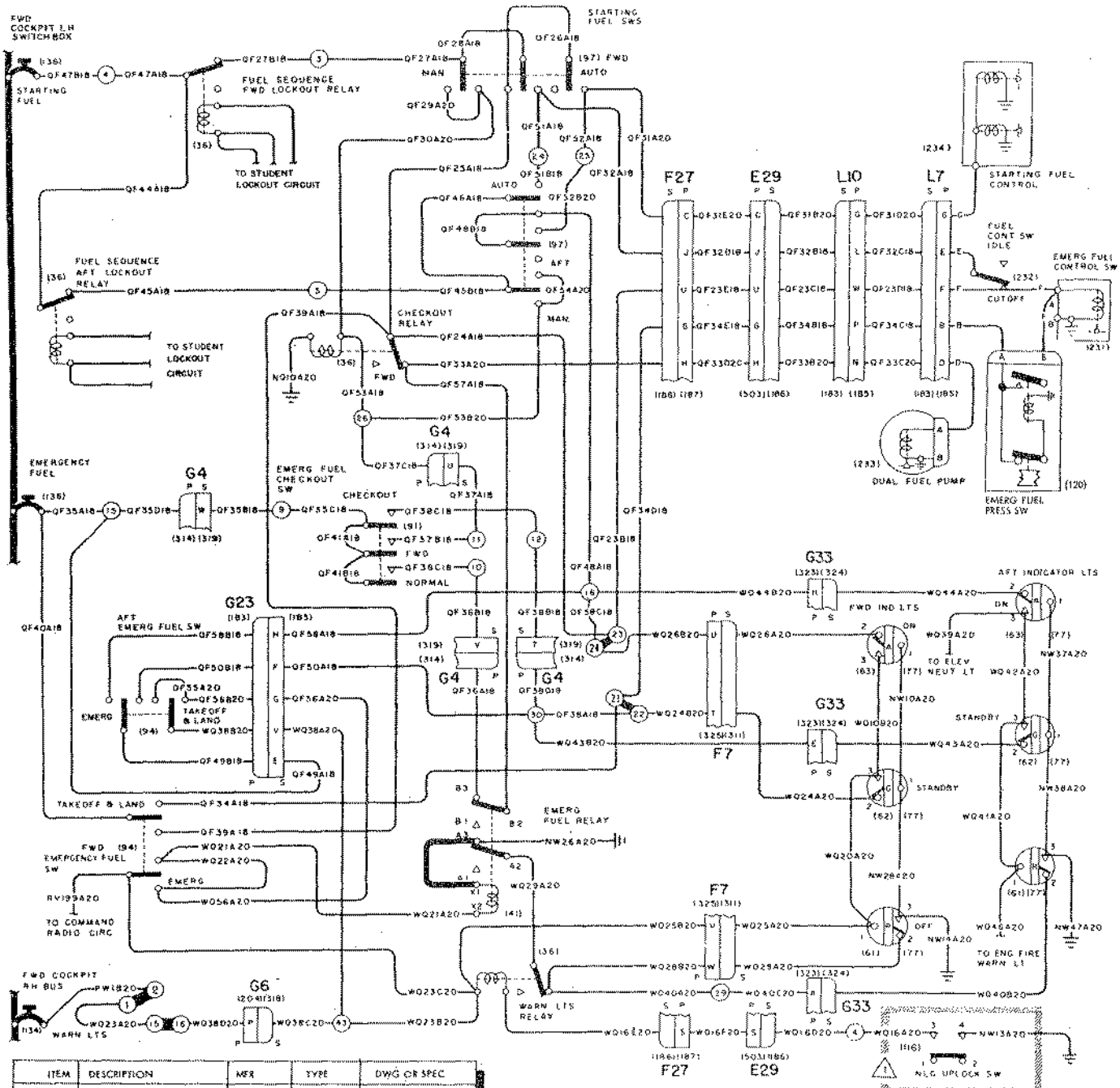


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD.		NB-57-C
41	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
91	SWITCH			AN3227-8
94	SWITCH			AN3027-1
97	SWITCH			AN3226-1
116	SWITCH	G.E.		CR1070D134E3
120	SWITCH, ENGINE PRESSURE	GFAE		555-3604
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
231	EMERG FUEL CONTROL SW	ALLISON		6705000
232	FUEL CONTROL SW	ALLISON		6703624
233	DUAL FUEL PUMP	ALLISON		6705353
234	STARTING FUEL CONT	ALLISON		6703625
311	CONNECTOR			AN3106-28-15S
314	CONNECTOR			AN3106B-24-28P
318	CONNECTOR			AN3106B-20-29P
319	CONNECTOR			AN3102-24-28S
323	CONNECTOR			AN3102-24-28P
324	CONNECTOR			AN3106B-24-28S
325	CONNECTOR			AN3100A-28-15P
393	CONNECTOR			AN3100A-28-12P

ENGINE FUEL SYSTEM CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO.
52-9835 THROUGH 52-9959,
52-9906 THROUGH 52-9940 AND
53-2687 THROUGH 53-2726

FB 8081
M20-39-8-196

Figure 8-63. Engine Fuel System Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		MB-57-C
45	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
93	SWITCH			AN3227-8
94	SWITCH			AN3027-1
97	SWITCH			AN3226-1
1 116	SWITCH	G.E.		CR1070D134F3
120	SWITCH, ENGINE PRESSURE	GFAE		555-360 4
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
231	EMERG FUEL CONTROL SW	ALLISON		6705090
232	FUEL CONTROL SW	ALLISON		6703624
233	DUAL FUEL PUMP	ALLISON		6705053
234	STARTING FUEL CONT	ALLISON		6703625
311	CONNECTOR			AN3106-28-15S
314	CONNECTOR			AN3106B-24-28P
318	CONNECTOR			AN3106B-20-29P
319	CONNECTOR			AN3102-24-28S
323	CONNECTOR			AN3102-24-28P
324	CONNECTOR			AN3106B-24-28S
325	CONNECTOR			AN3100A-28-15P
503	CONNECTOR			AN3100A-28-12P
2 561	SWITCH	ALLOY IND.		908140

Note

1 USED PRIOR TO AF SERIAL NO. 53-5086

2 USED ON AF SERIAL NO. 53-5086 AND SUBSEQUENT

ENGINE FUEL SYSTEM CIRCUIT

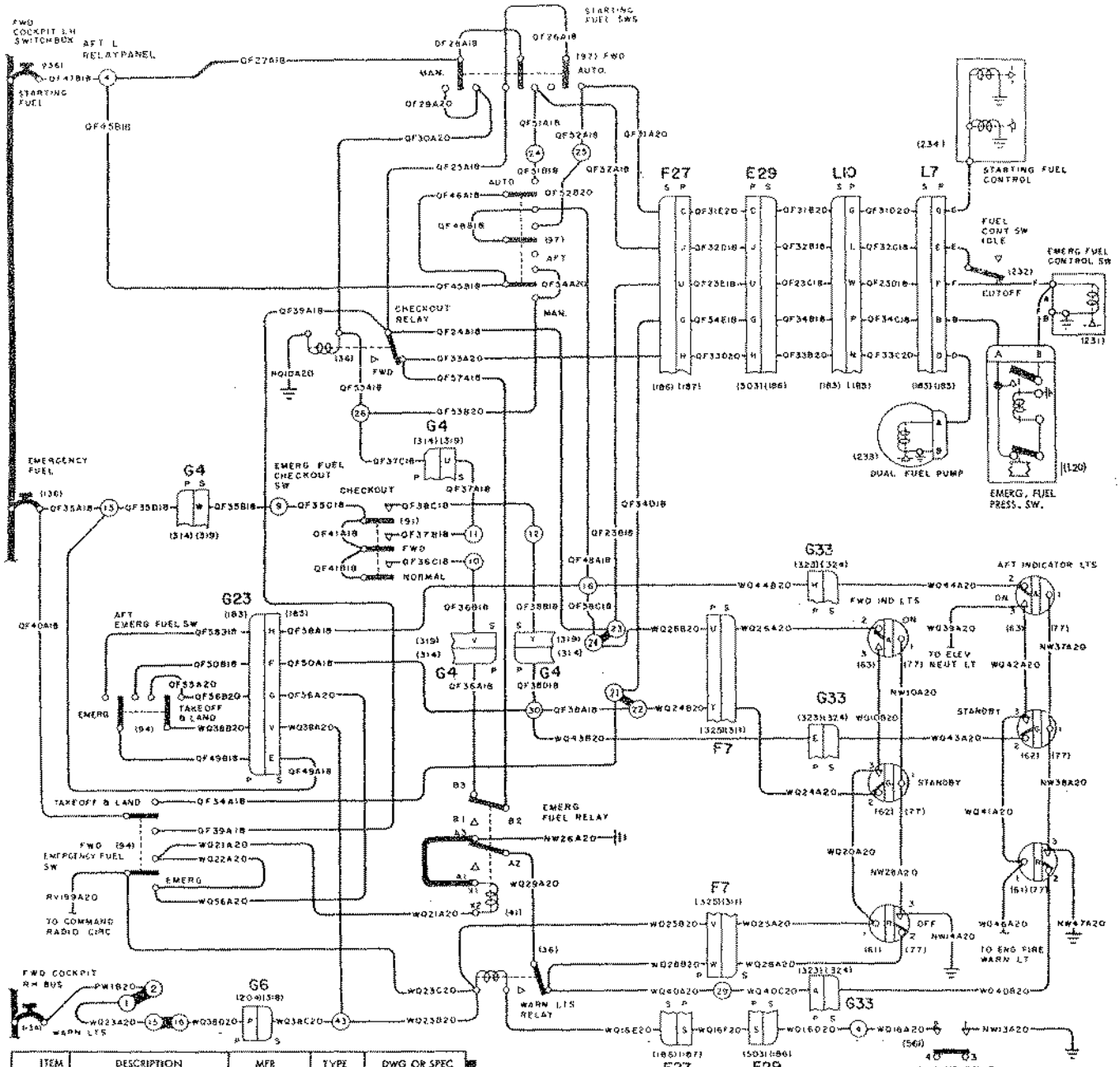
MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9760 THROUGH 53-5285, EXCEPT 52-9906 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

F8 8082

M20-39-8-267

Figure 8-64. Engine Fuel System Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
41	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
91	SWITCH			AN3227-8
94	SWITCH			AN3027-1
97	SWITCH			AN3226-1
120	SWITCH, ENGINE PRESSURE	GFAE		555-3504
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
231	EMERG FUEL CONTROL SW	ALLISON		6705000
232	FUEL CONTROL SW	ALLISON		6703624
233	DUAL FUEL PUMP	ALLISON		6705353
234	STARTING FUEL CONT	ALLISON		6703625
315	CONNECTOR			AN3106-28-15S
314	CONNECTOR			AN3106B-24-28P
318	CONNECTOR			AN3106B-20-29P
319	CONNECTOR			AN3102-24-28S
323	CONNECTOR			AN3102-24-28P
324	CONNECTOR			AN3106B-24-28S
325	CONNECTOR			AN3100A-28-15P
503	CONNECTOR			AN3100A-28-12P
561	SWITCH	ALLOY IND.		808140

ENGINE FUEL SYSTEM CIRCUIT

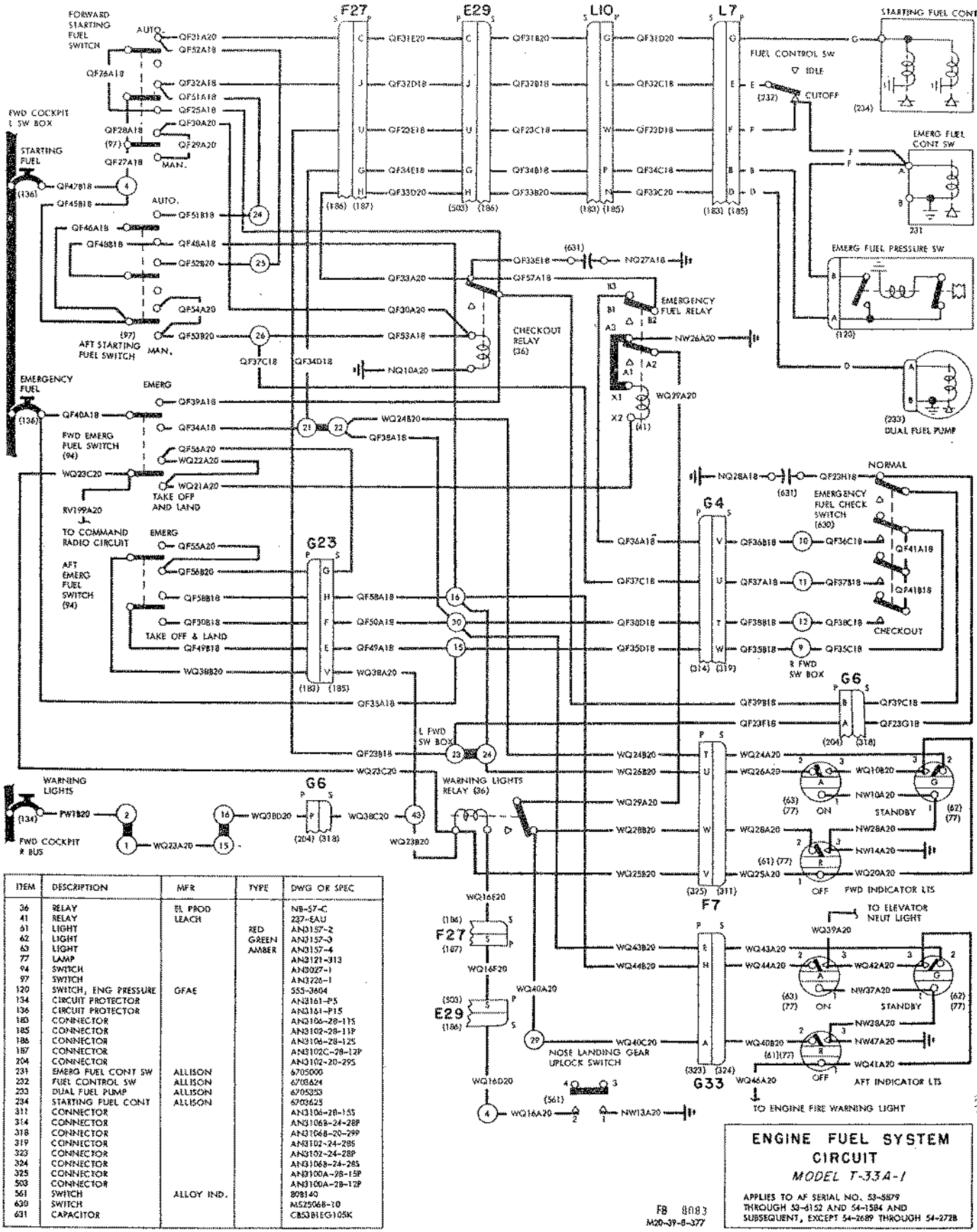
MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5286 THROUGH 53-5878, 54-1522 THROUGH 54-1561 AND 54-2689 THROUGH 54-2728

GB 8807

M20-480-8-280

Figure 8-65. Engine Fuel System Circuit



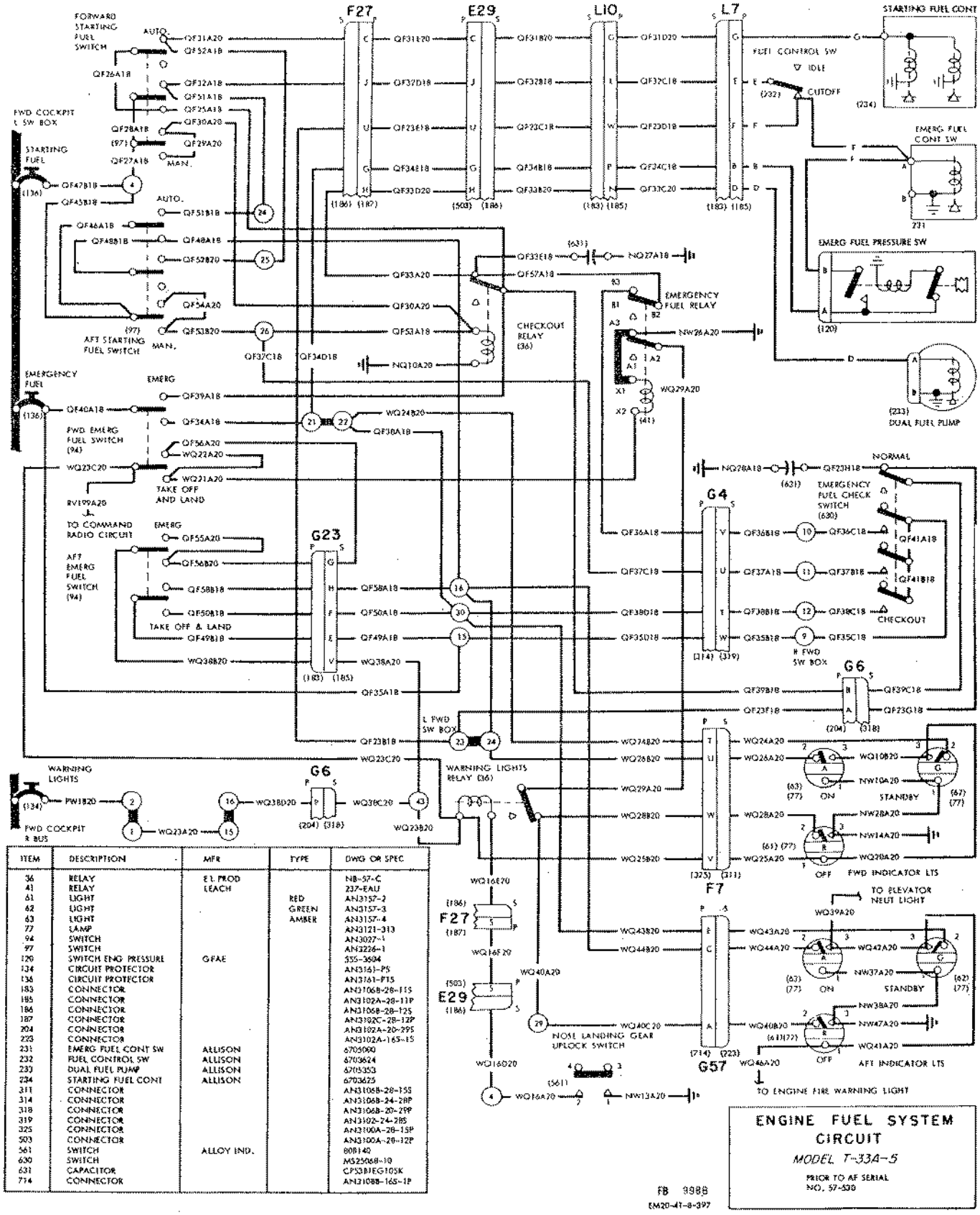
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
41	RELAY	LEACH		237-6AU
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
94	SWITCH			AN3027-1
97	SWITCH			AN3726-1
120	SWITCH, ENG PRESSURE	GFAE		555-3604
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
231	EMERG FUEL CONT SW	ALLISON		6705000
232	FUEL CONTROL SW	ALLISON		6705824
233	DUAL FUEL PUMP	ALLISON		6705353
234	STARTING FUEL CONT	ALLISON		6703625
311	CONNECTOR			AN3106-28-15S
314	CONNECTOR			AN3106A-24-28P
318	CONNECTOR			AN3106B-20-29P
319	CONNECTOR			AN3102-24-28S
323	CONNECTOR			AN3102-24-28P
324	CONNECTOR			AN3106B-24-28S
325	CONNECTOR			AN3100A-28-15P
503	CONNECTOR			AN3100A-28-12P
561	SWITCH	ALLOY IND.		808140
630	SWITCH			MS25068-10
631	CAPACITOR			CB53B1EG105K

FB 8083
M20-39-8-377

ENGINE FUEL SYSTEM CIRCUIT
MODEL T-33A-1

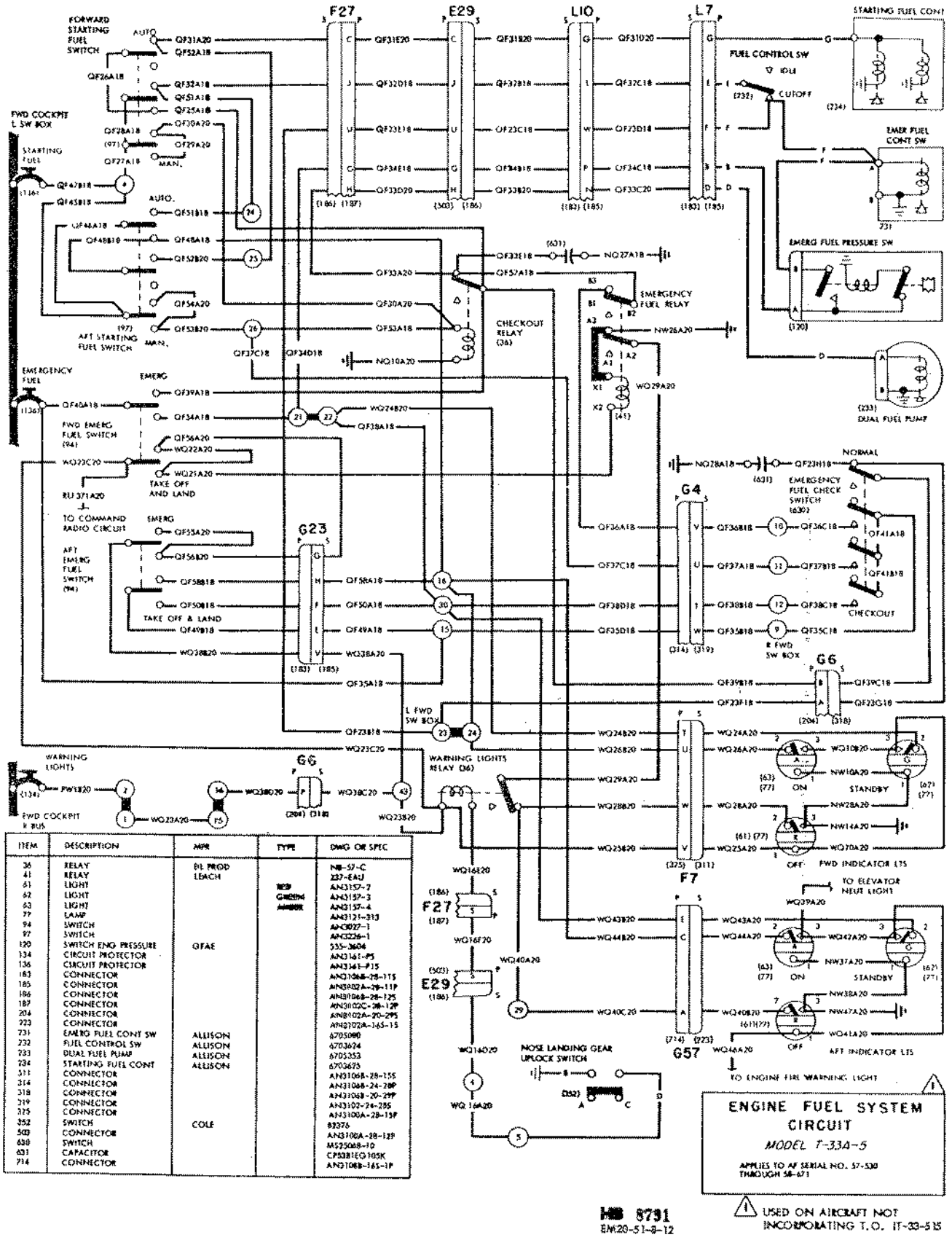
APPLIES TO AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1584 AND SUBSEQUENT, EXCEPT 54-2689 THROUGH 54-2728

Figure 8-66. Engine Fuel System Circuit



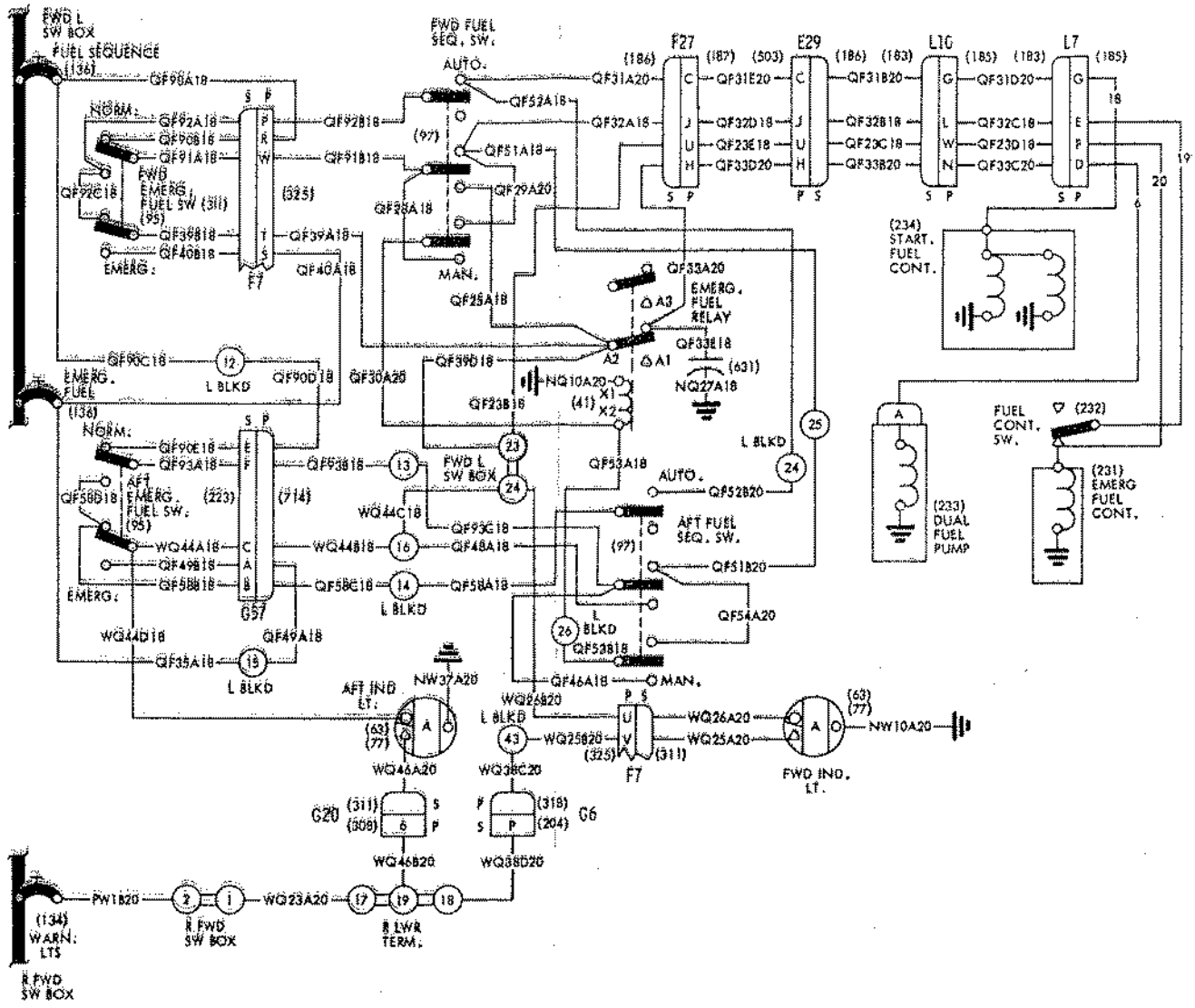
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	ELPROD		NB-57-C
41	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
94	SWITCH			AN3027-1
97	SWITCH			AN3226-1
120	SWITCH ENG PRESSURE	GFAE		555-3604
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
223	CONNECTOR			AN3102A-165-1S
231	EMERG FUEL CONT SW	ALLISON		6703090
232	FUEL CONTROL SW	ALLISON		6703624
233	DUAL FUEL PUMP	ALLISON		6705353
234	STARTING FUEL CONT	ALLISON		6703625
311	CONNECTOR			AN3106B-28-15S
314	CONNECTOR			AN3106B-24-28P
318	CONNECTOR			AN3106B-20-29P
319	CONNECTOR			AN3102-24-28S
325	CONNECTOR			AN3100A-28-15P
503	CONNECTOR			AN3100A-20-12P
561	SWITCH	ALLOY IND.		80B140
630	SWITCH			MS25068-1B
631	CAPACITOR			CP53B1EG105K
714	CONNECTOR			AN3108B-165-1P

Figure 8-67. Engine Fuel System Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	BE PROD		MB-57-C
41	RELAY	LEACH		237-EAU
61	LIGHT			AN3157-7
62	LIGHT			AN3157-3
63	LIGHT			AN3157-4
77	LAMP			AN3121-313
94	SWITCH			AN-3027-1
97	SWITCH			AN-3226-1
120	SWITCH ENG PRESSURE	GFAE		535-3604
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
223	CONNECTOR			AN4102A-165-1S
231	EMERG FUEL CONT SW	ALLISON		6705090
232	FUEL CONTROL SW	ALLISON		6703624
233	DUAL FUEL PUMP	ALLISON		6705353
234	STARTING FUEL CONT	ALLISON		6700675
311	CONNECTOR			AN3106B-28-15S
314	CONNECTOR			AN3106B-24-28P
318	CONNECTOR			AN3106B-20-29P
319	CONNECTOR			AN3102-24-28S
325	CONNECTOR			AN3100A-28-15P
352	SWITCH	COLE		82376
503	CONNECTOR			AN3100A-28-12P
630	SWITCH			MS25068-10
631	CAPACITOR			CP5381EG105K
714	CONNECTOR			AN3106B-16S-1P

Figure 8-68. Engine Fuel System Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
41	RELAY	LEACH		237-EAU
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
95	SWITCH			AN3027-3
97	SWITCH			AN3226-1
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
183	CONNECTOR			MS3106B-28-11S
185	CONNECTOR			MS3102A-28-11P
186	CONNECTOR			MS3106B-28-12S
187	CONNECTOR			MS3102C-28-12P
204	CONNECTOR			MS3102A-20-29S
223	CONNECTOR			MS3102A-16S-1S
231	CONTROL, EMERG. FUEL	ALLISON		6705000
232	SWITCH, FUEL CONTROL	ALLISON		6703624
233	PUMP, DUAL FUEL	ALLISON		6705353
234	CONTROL, START. FUEL	ALLISON		6703625
308	CONNECTOR			MS3102A-28-15P
311	CONNECTOR			MS3106B-28-15S
318	CONNECTOR			MS3106B-20-29P
325	CONNECTOR			MS3100A-28-15P
503	CONNECTOR			MS3100A-28-12P
631	CAPACITOR			CPS2B1EG105K
714	CONNECTOR			MS3108B-16S-1P

HB 8899
EM20-51-8-77

ENGINE FUEL SYSTEM CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 58-671 AND SUBSEQUENT

Figure 8-68A. Engine Fuel System Circuit

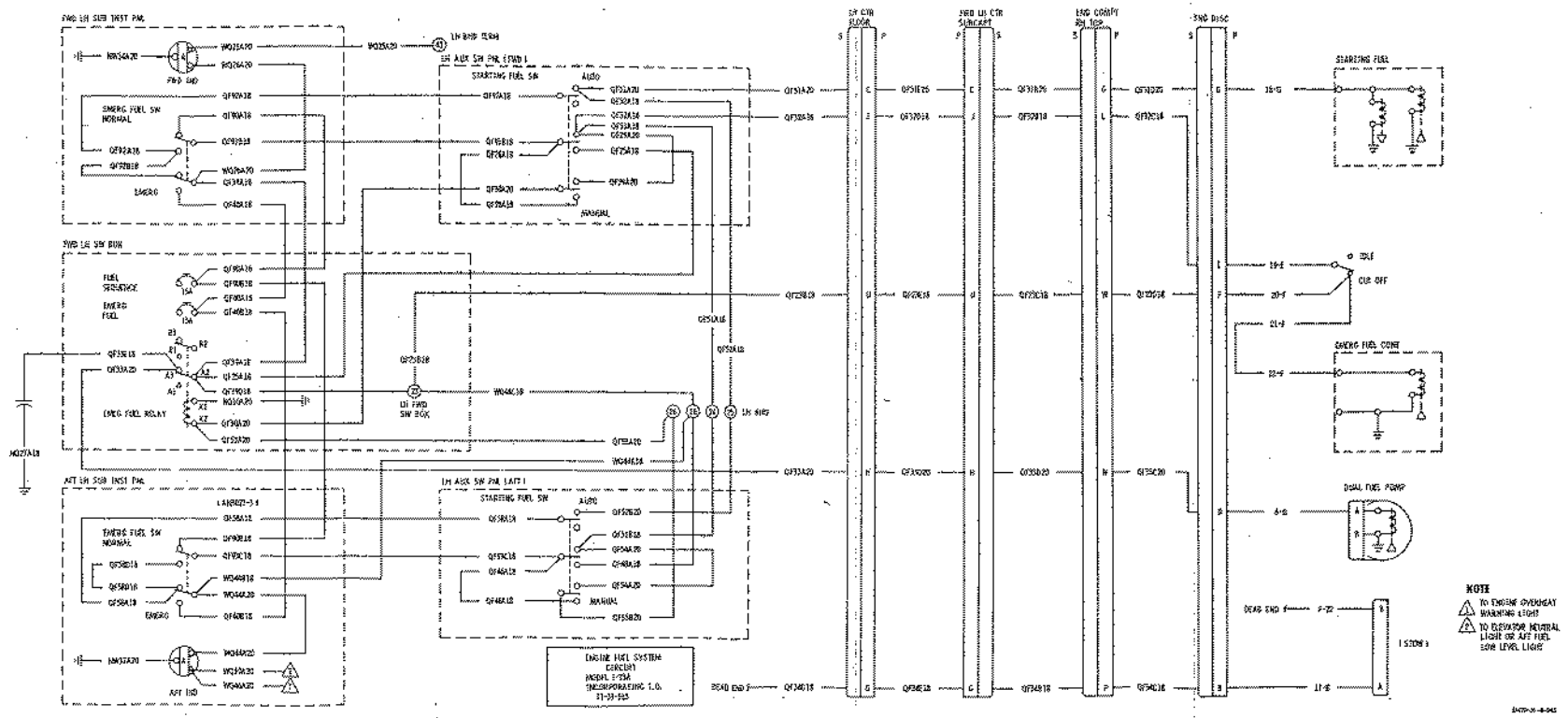
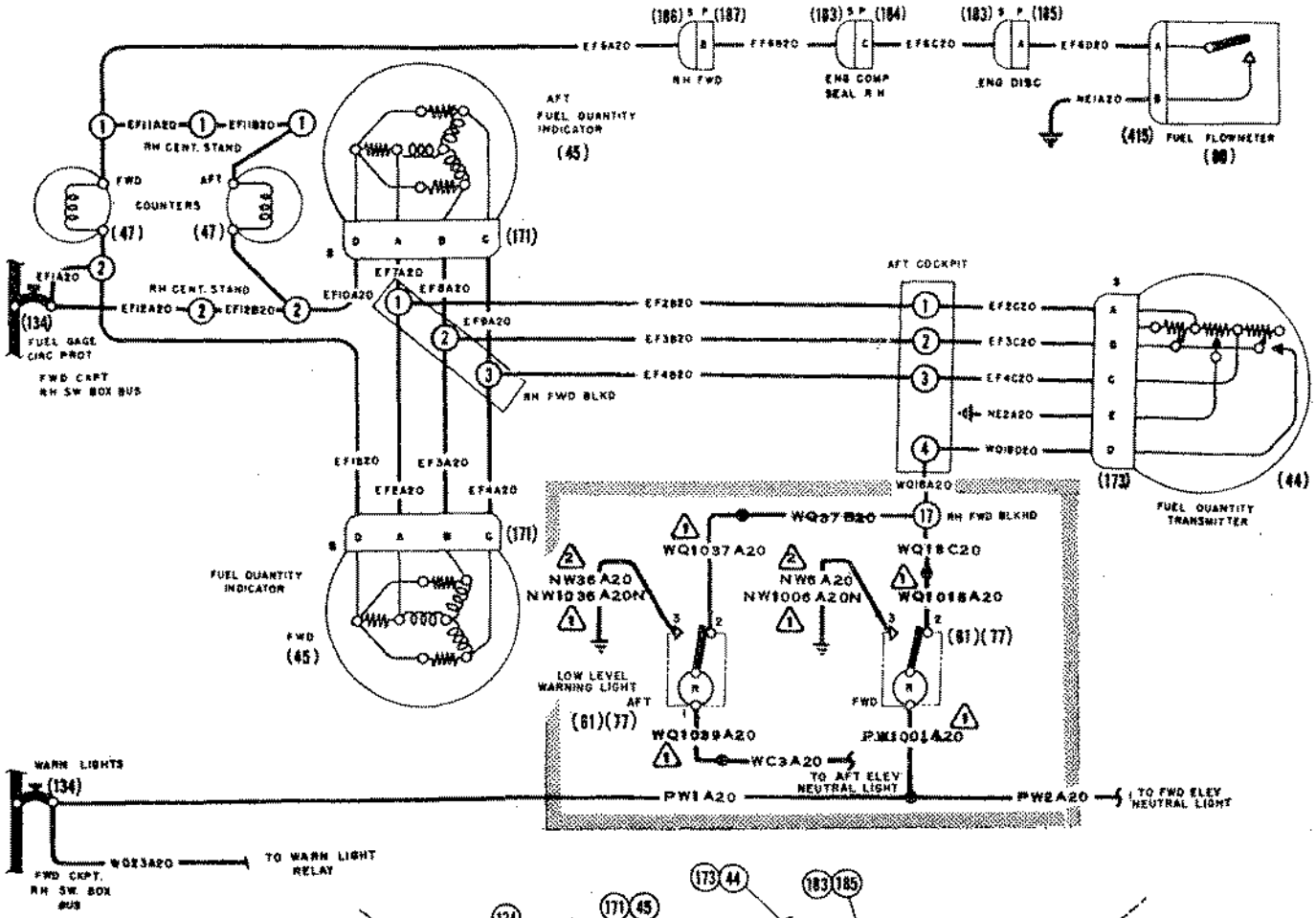
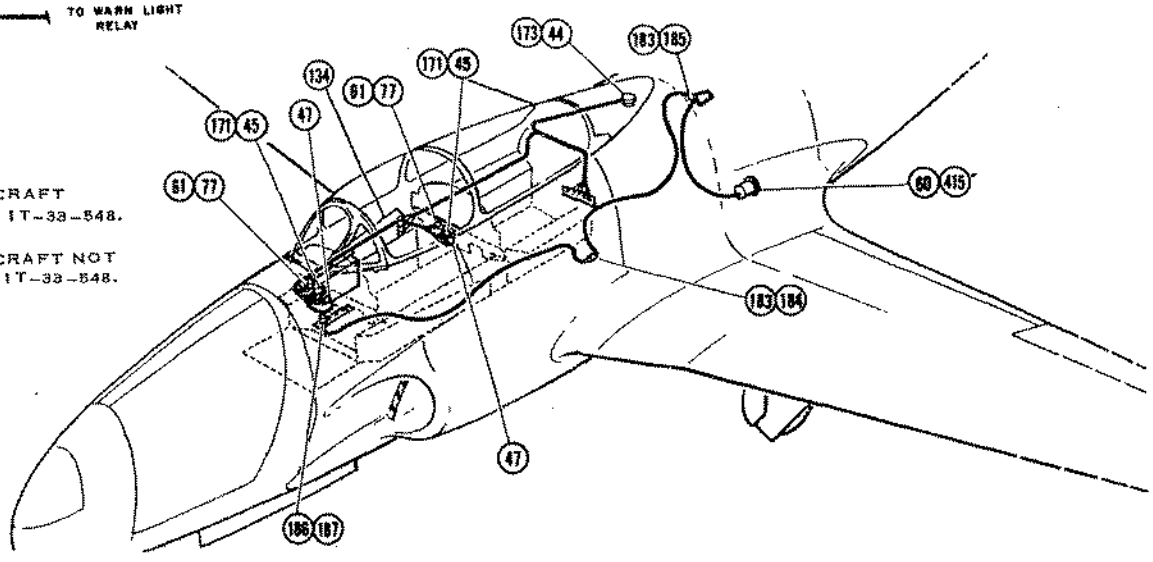


Figure 8-66B. Engine Fuel System Circuit



NOTE

1. USED ON AIRCRAFT MODIFIED BY 1T-33-548.
2. USED ON AIRCRAFT NOT MODIFIED BY 1T-33-548.



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC	LOCATION
44	FUEL QTY TRANSMITTER	LIQUIDOMETER		EA-565W-553	FUSELAGE TANK
45	FUEL QTY INDICATOR	LIQUIDOMETER		EA-100AN-53	INSTRUMENT PANELS
47	FUEL FLOW COUNTER	VEEDER-ROOT		AY-62803-3	INSTRUMENT PANELS
60	FLOWMETER	REVERE	H-1	R-862-D4	ENGINE
61	LIGHT		RED	AN3157-2	INSTRUMENT PANELS
77	LAMP			AN3121-313	INSTRUMENT PANELS
134	CIRCUIT PROTECTOR			AN3161-P5	FWD RH SWITCH BOX
171	CONNECTOR			AN3106-14S-2S	QUANTITY INDICATORS
173	CONNECTOR			AN3106-14S-5S	QUANTITY XMTR
183	CONNECTOR			AN3106-28-11S	
184	CONNECTOR			AN3102P-28-11P	REAR BEAM
185	CONNECTOR			AN3102-28-11P	ENGINE
186	CONNECTOR			AN3106-28-12S	RH FLOOR
187	CONNECTOR			AN3102P-28-12P	RH FLOOR
415	CONNECTOR			AN3108-12S-3S	FLOWMETER

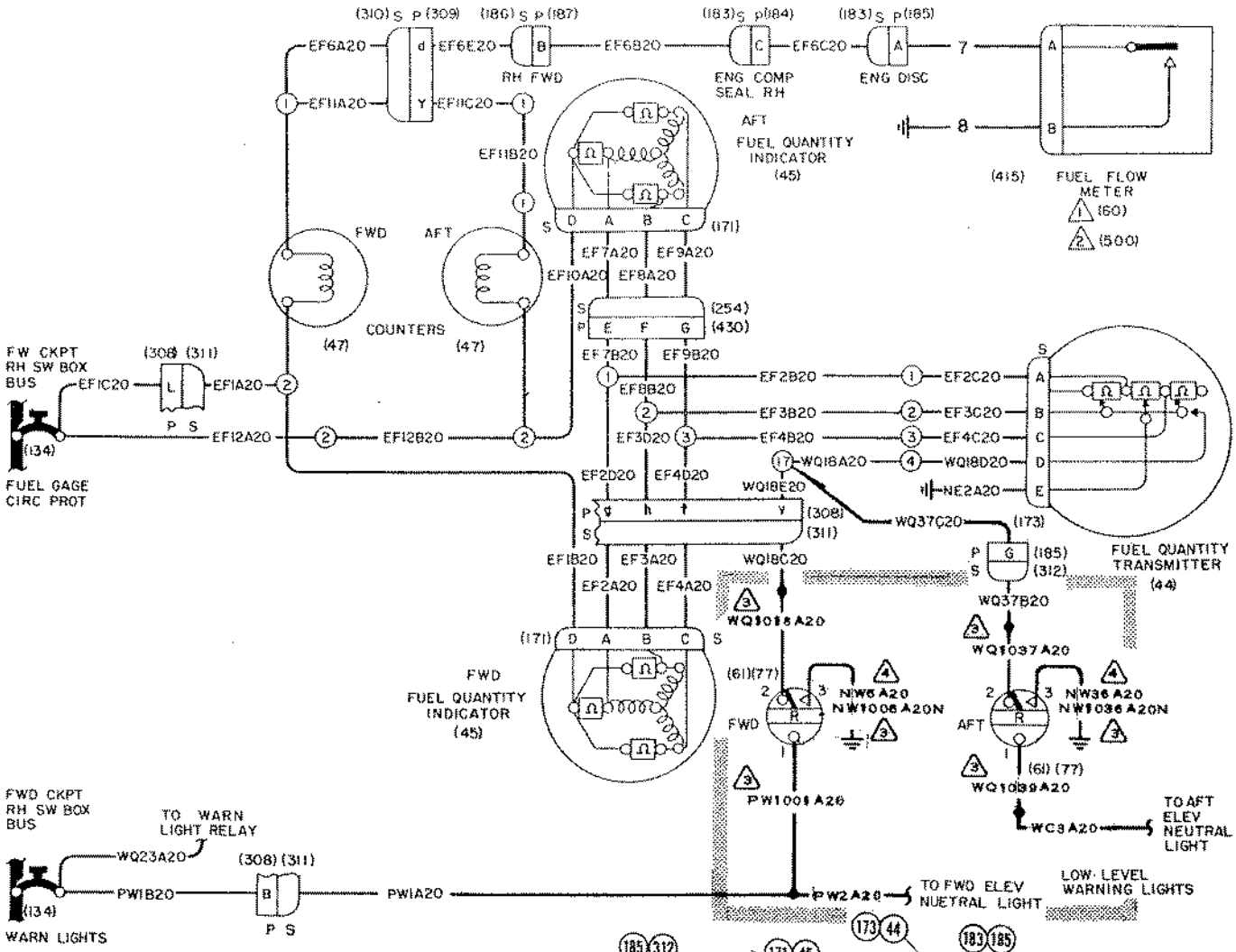
AB 8483

FUEL QUANTITY CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-4328

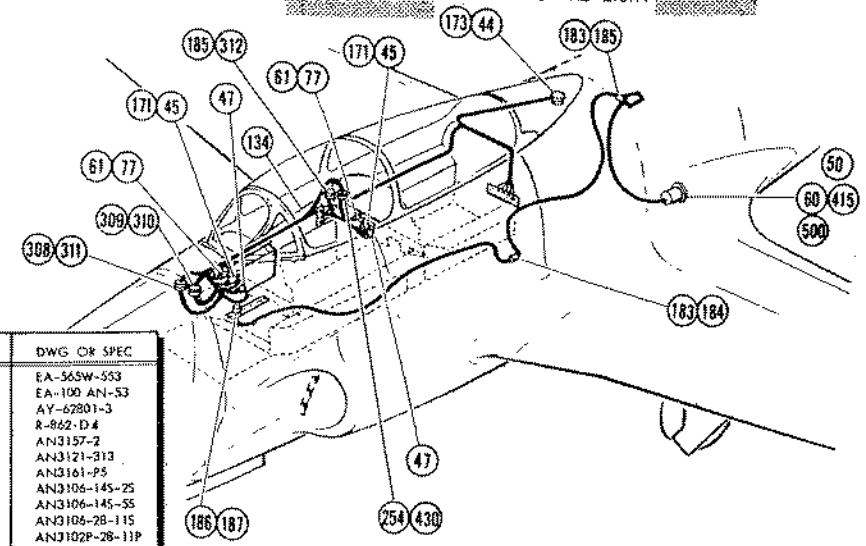
Figure 8-69. Fuel Quantity Circuit



NOTE

1. USED PRIOR TO AF SERIAL NO. 51-4533
2. USED ON AF SERIAL NOS. 51-4533 THRU 51-6818
3. USED ON AIRCRAFT MODIFIED BY 1T-33-548.
4. USED ON AIRCRAFT NOT MODIFIED BY 1T-33-548.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
44	TRANSMITTER	LIQUIDOMETER		EA-565W-553
45	INDICATOR	LIQUIDOMETER		EA-100 AN-53
47	COUNTER	VEEDER-ROOT		AY-62801-3
1 60	FLOWMETER	REVERE	H-1	R-862-D4
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
171	CONNECTOR			AN3106-14S-2S
173	CONNECTOR			AN3106-14S-5S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
312	CONNECTOR			AN3108-28-11S
415	CONNECTOR			AN3108-12S-3S
430	CONNECTOR			AN3102-28-12P
2 500	FLOWMETER	REVERE		R-876-D



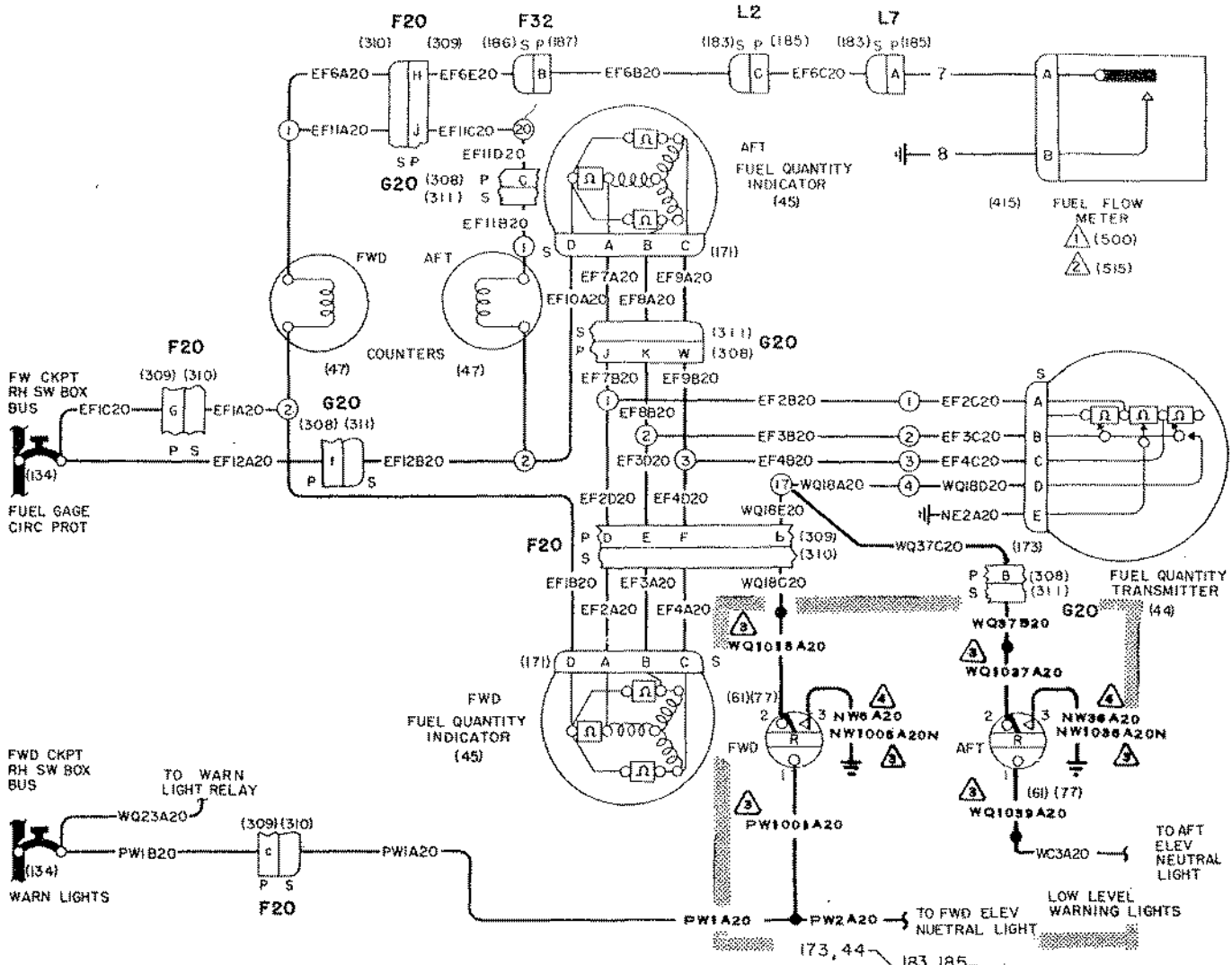
CB 37774
EM-20-22-8-44

FUEL QUANTITY CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS 51-4329 THRU 51-6818

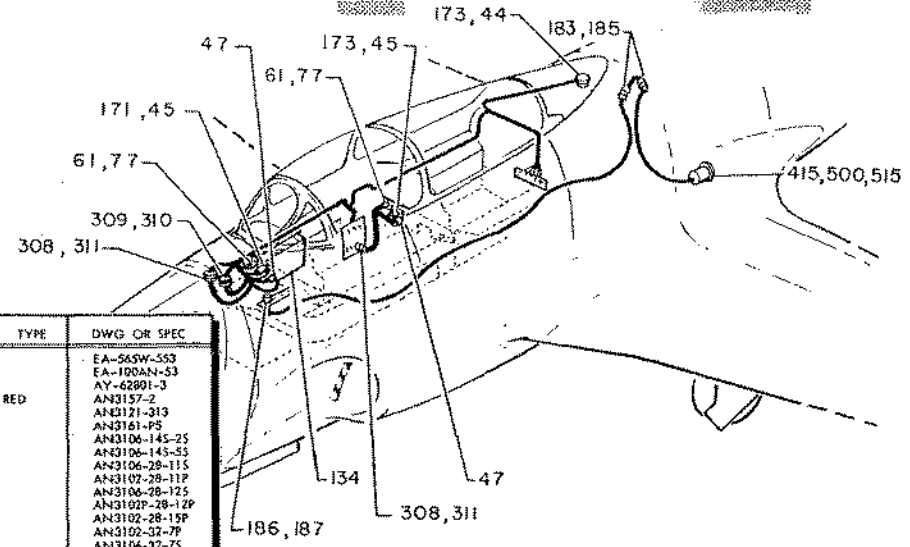
Figure 8-70. Fuel Quantity Circuit



NOTE

1. USED PRIOR TO AF SERIAL NO. 51-8506
2. USED ON AF SERIAL NOS. 51-8506 AND SUBSEQUENT
3. USED ON AIRCRAFT MODIFIED BY 1T-33-548.
4. USED ON AIRCRAFT NOT MODIFIED BY 1T-33-548.

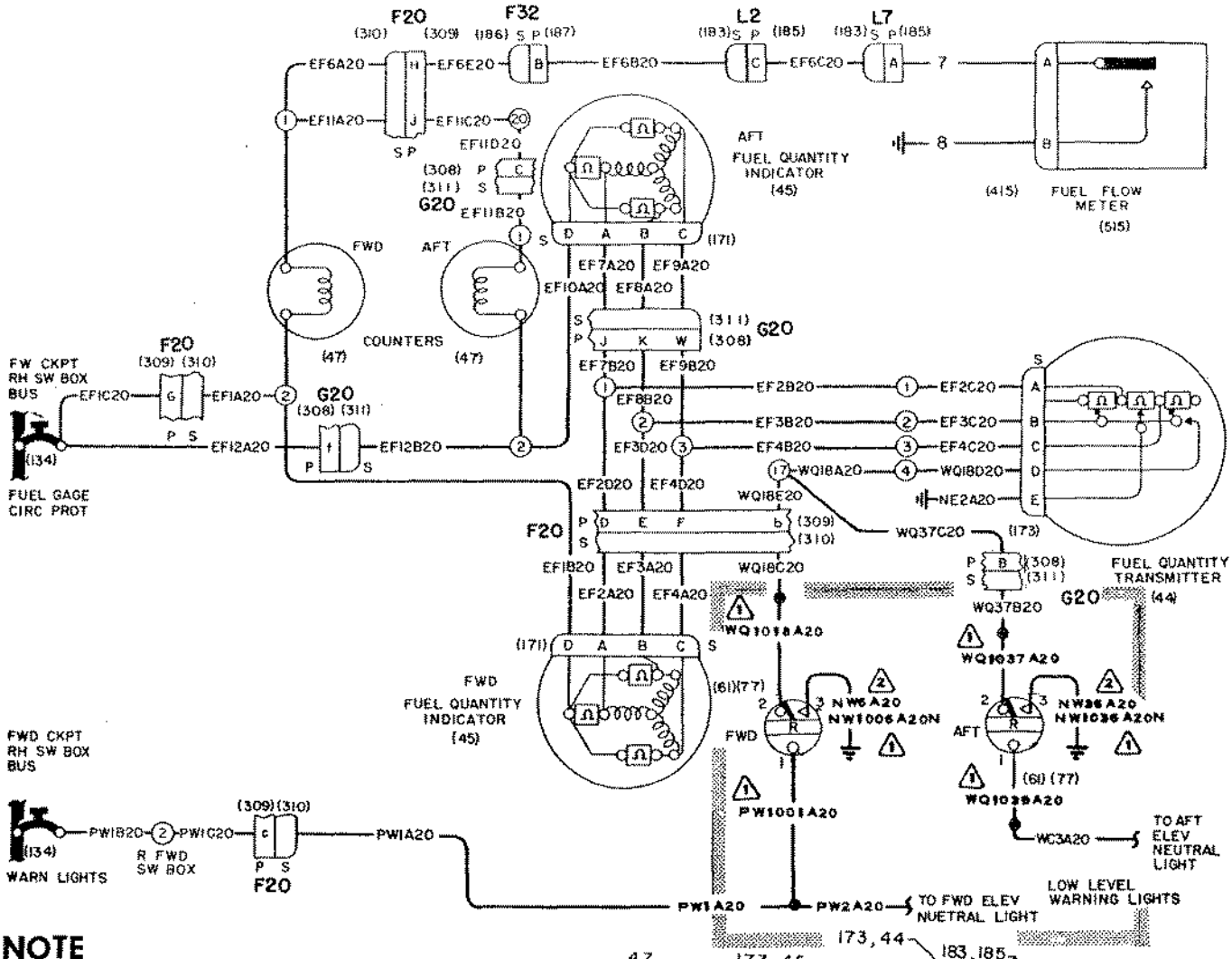
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
44	TRANSMITTER	LIQUIDOMETER		EA-56SW-553
45	INDICATOR	LIQUIDOMETER		EA-190AN-53
47	COUNTER	VEEDER-ROOT		AY-62801-3
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
171	CONNECTOR			AN3106-14S-2S
173	CONNECTOR			AN3106-14S-5S
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
312	CONNECTOR			AN3106-28-11S
415	CONNECTOR			AN3108-12S-3S
1 500	FLOWMETER	REVERE	R-876-D4	F-2077
2 515	FLOWMETER	REVERE	R-876-D4	F-2077-1500G-360



FUEL QUANTITY CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-6819 THROUGH 52-9759, 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

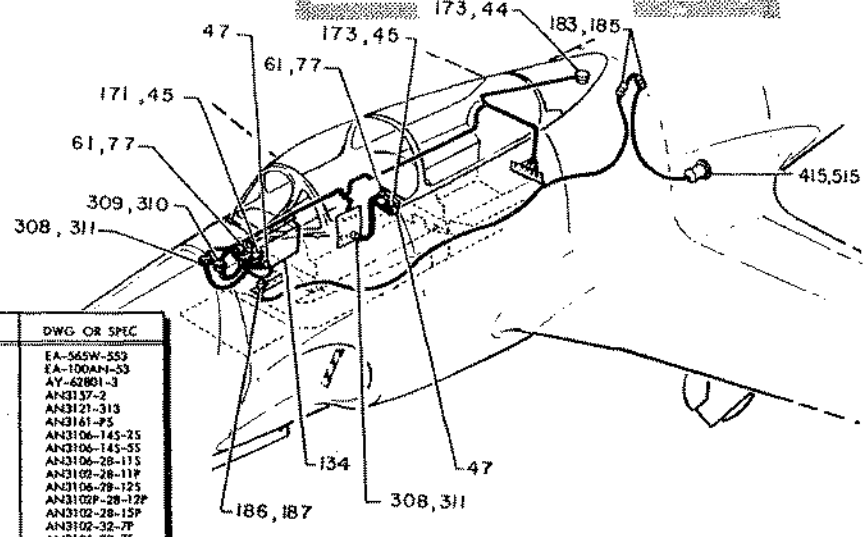
CB 4329
EM-20-23-8-45

Figure 8-71. Fuel Quantity Circuit



NOTE

1. USED ON AIRCRAFT MODIFIED BY 1T-33-548.
2. USED ON AIRCRAFT NOT MODIFIED BY 1T-33-548.



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
44	TRANSMITTER	LIQUIDOMETER		EA-565W-553
45	INDICATOR	LIQUIDOMETER		EA-100AM-53
47	COUNTER	VEEDER-ROOT		AY-62881-3
61	LIGHT		RED	AN3137-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
171	CONNECTOR			AN3106-145-2S
173	CONNECTOR			AN3106-145-5S
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
312	CONNECTOR			AN3106-28-11S
415	CONNECTOR			AN3108-12S-3S
515	FLOWMETER	REVERE	R-876-04	F-2077-1500G-360

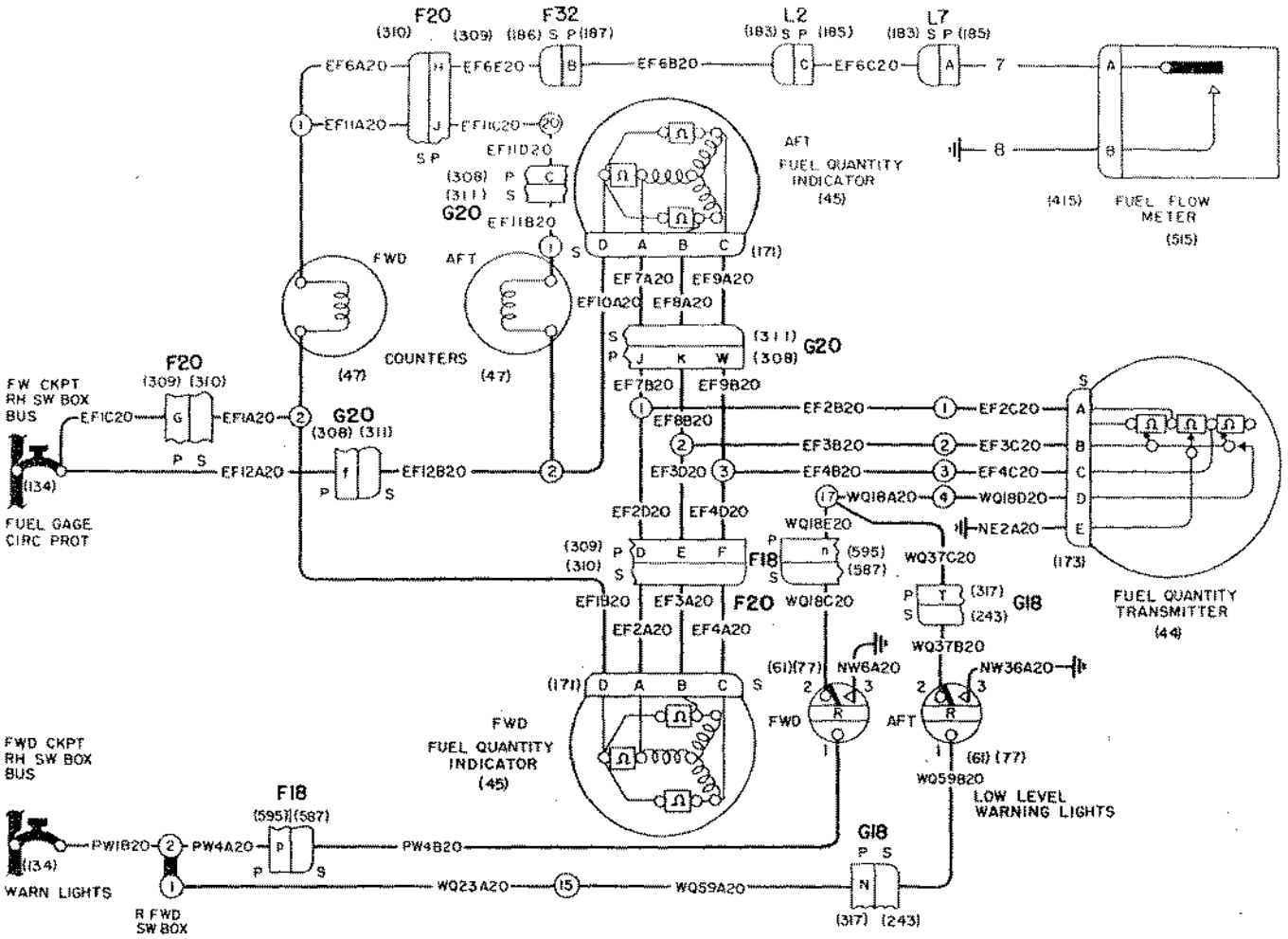
FUEL QUANTITY CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9760 THROUGH 53-5665, EXCEPT 53-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

EM-20-28B-8-222
CB 8427

Figure 8-72. Fuel Quantity Circuit

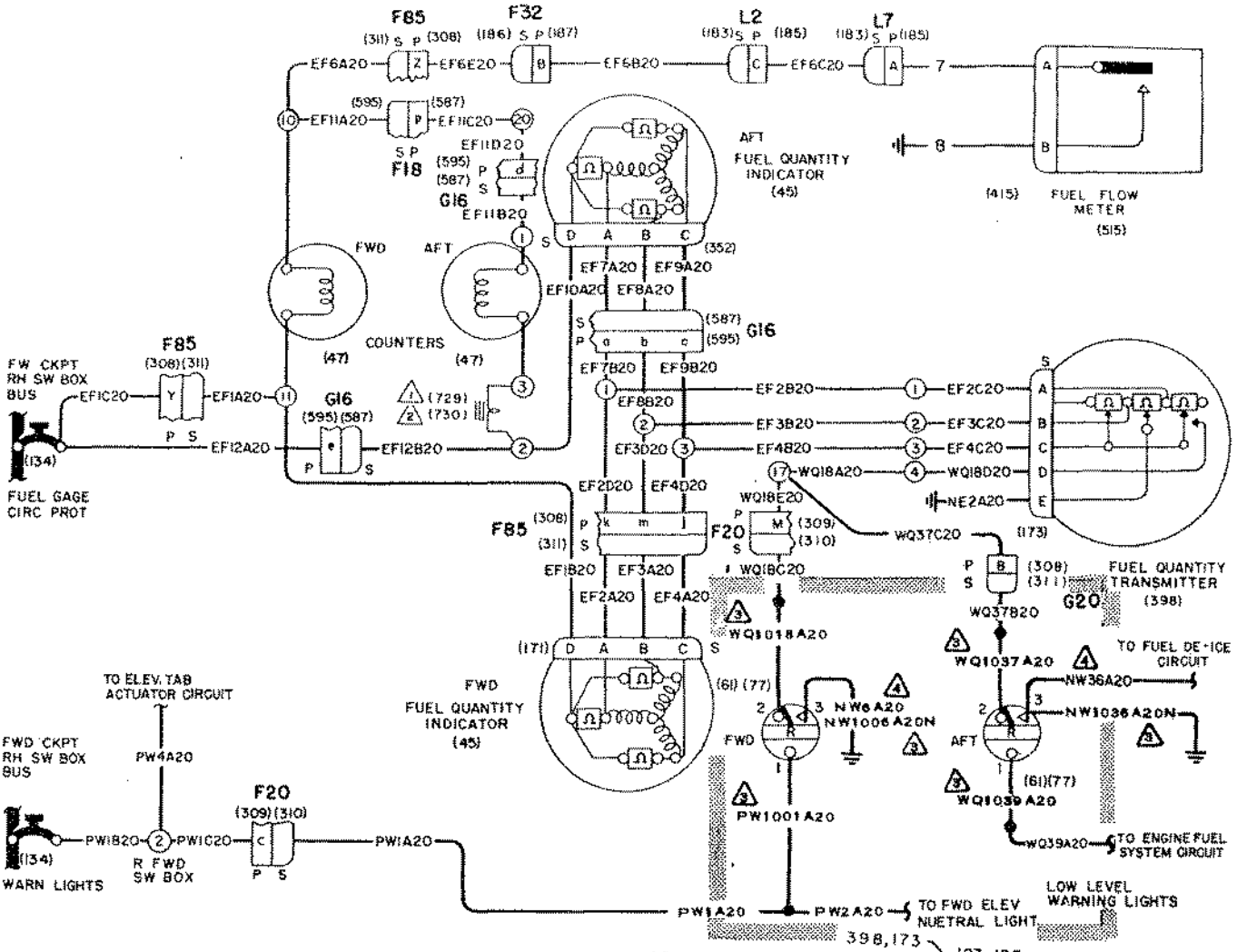


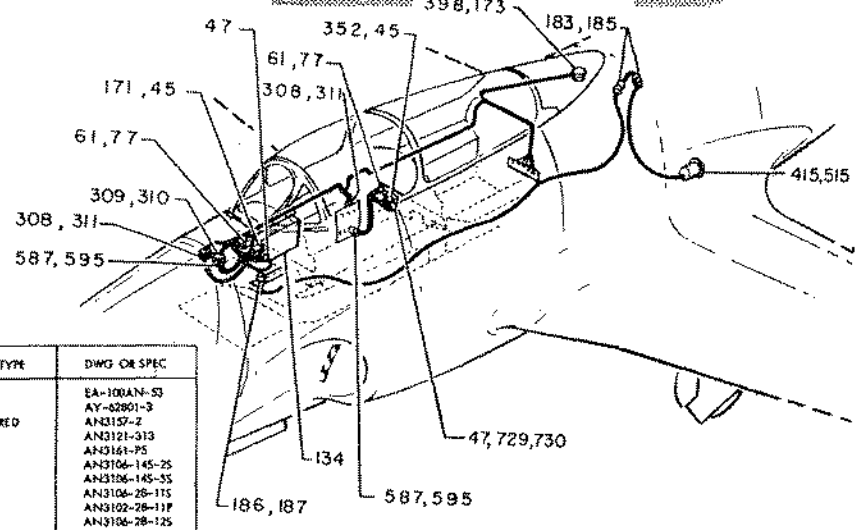
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
44	TRANSMITTER	LIQUIDOMETER		EA-565W-553
45	INDICATOR	LIQUIDOMETER		EA-100AN-53
47	COUNTER	VEEDER-ROOT		AY-62801-3
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-PS
171	CONNECTOR			AN3106B-145-2S
173	CONNECTOR			AN3106B-145-5S
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102P-28-12P
243	CONNECTOR			AN3106B-20-29S
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
312	CONNECTOR			AN3106B-28-11S
317	CONNECTOR			AN3102A-20-29P
415	CONNECTOR			AN3106B-125-3S
515	FLOWMETER	REVERE	R-876-D4	F-2077-1500G-360
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

M20-48D-8-332
GB 8968

FUEL QUANTITY CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 53-5666 AND SUBSEQUENT

Figure 8-73. Fuel Quantity Circuit





NOTE

1. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 53-6038
2. USED ON AIRPLANES AF SERIAL NO. 53-6039 & SUBSEQUENT
3. USED ON AIRCRAFT MODIFIED BY 1T-33-548.
4. USED ON AIRCRAFT NOT MODIFIED BY 1T-33-548.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
45	INDICATOR	LIQUIDOMETER		EA-100AN-53
47	COUNTER	VEEDER-ROOT		AY-62801-3
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
171	CONNECTOR			AN3106-14S-2S
173	CONNECTOR			AN3106-14S-5S
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
352	CONNECTOR			AN3108B-14S-2S
398	FUEL QUANTITY TRANSMITTER	LIQUIDOMETER		EA-565W-1329
415	CONNECTOR			AN3106-12S-3S
515	FLOWMETER	REVERE	F-2077	F-2077-1500G-360
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
1 729	MAGNET, COMPASS COMPENSATOR	LOCKHEED		464526
2 730	MAGNET, COMPASS COMPENSATOR	PENDAR		A-6190

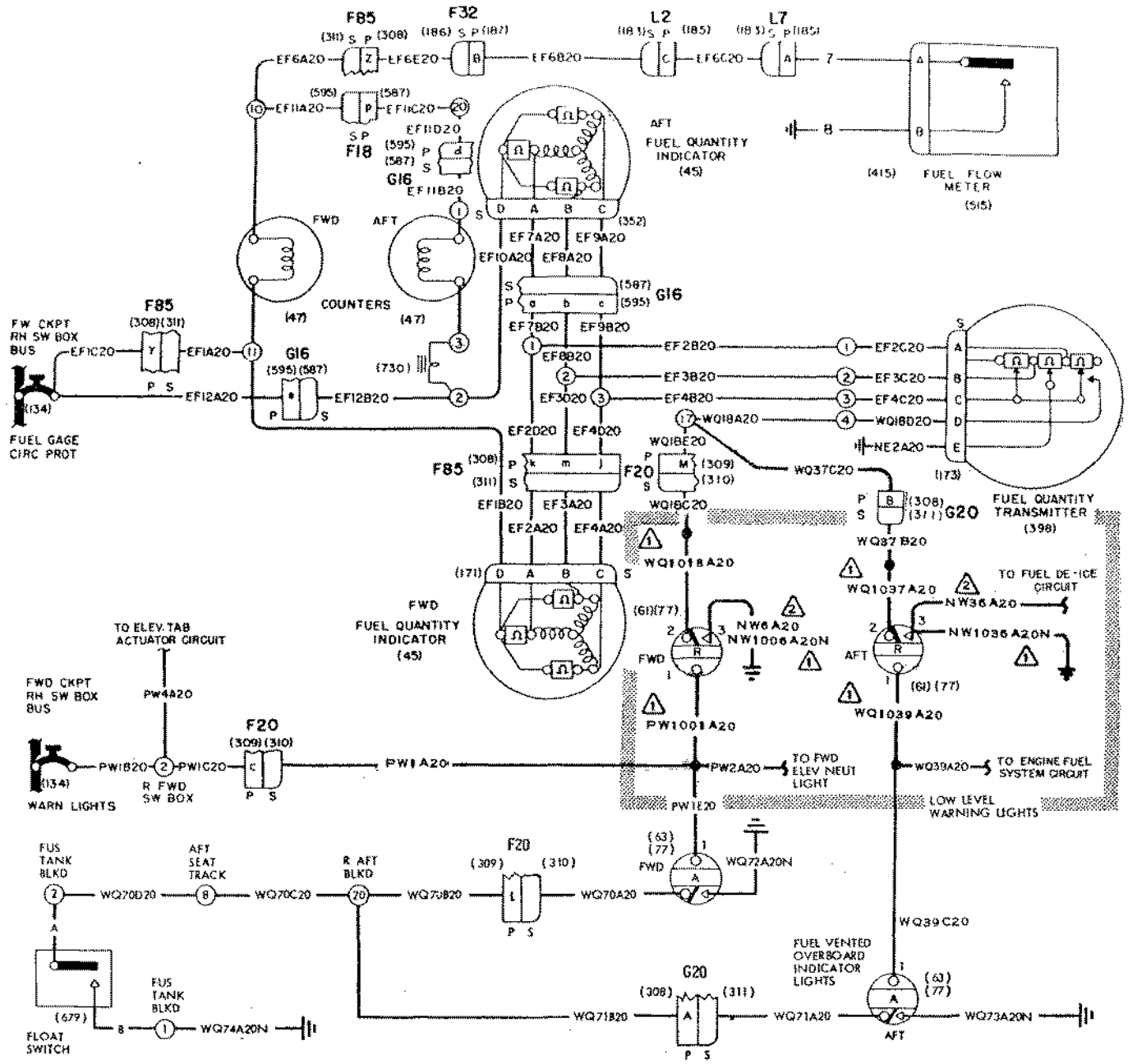
M20-47-8-393
GB 7701

FUEL QUANTITY CIRCUIT

MODEL T-33A-5

APPLIES PRIOR TO AF SERIAL NO. 58-580

Figure 8-74. Fuel Quantity Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
45	INDICATOR	LIQUIDOMETER		EA-100AN-53
47	COUNTER	VEEDER-ROOT		AY-62801-3
61	LIGHT		RED	AN3157-2
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN316)-P5
171	CONNECTOR			AN3106-14S-2S
173	CONNECTOR			AN3106-14S-5S
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
352	CONNECTOR			AN3108B-14S-2S
398	FUEL QUANTITY TRANSMITTER	LIQUIDOMETER		EA-366W-1339
415	CONNECTOR			AN3108-12S-3S
515	FLOWMETER	REVERE	F-2077	F-2077-1500G-360
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
679	FLOAT SWITCH	REVERE		F-71805
730	MAGNET, COMPASS COMPENSATOR	PENDAR		A-6190

NOTE

1. USED ON AIRCRAFT MODIFIED BY 1T-33-548.
2. USED ON AIRCRAFT NOT MODIFIED BY 1T-33-548.

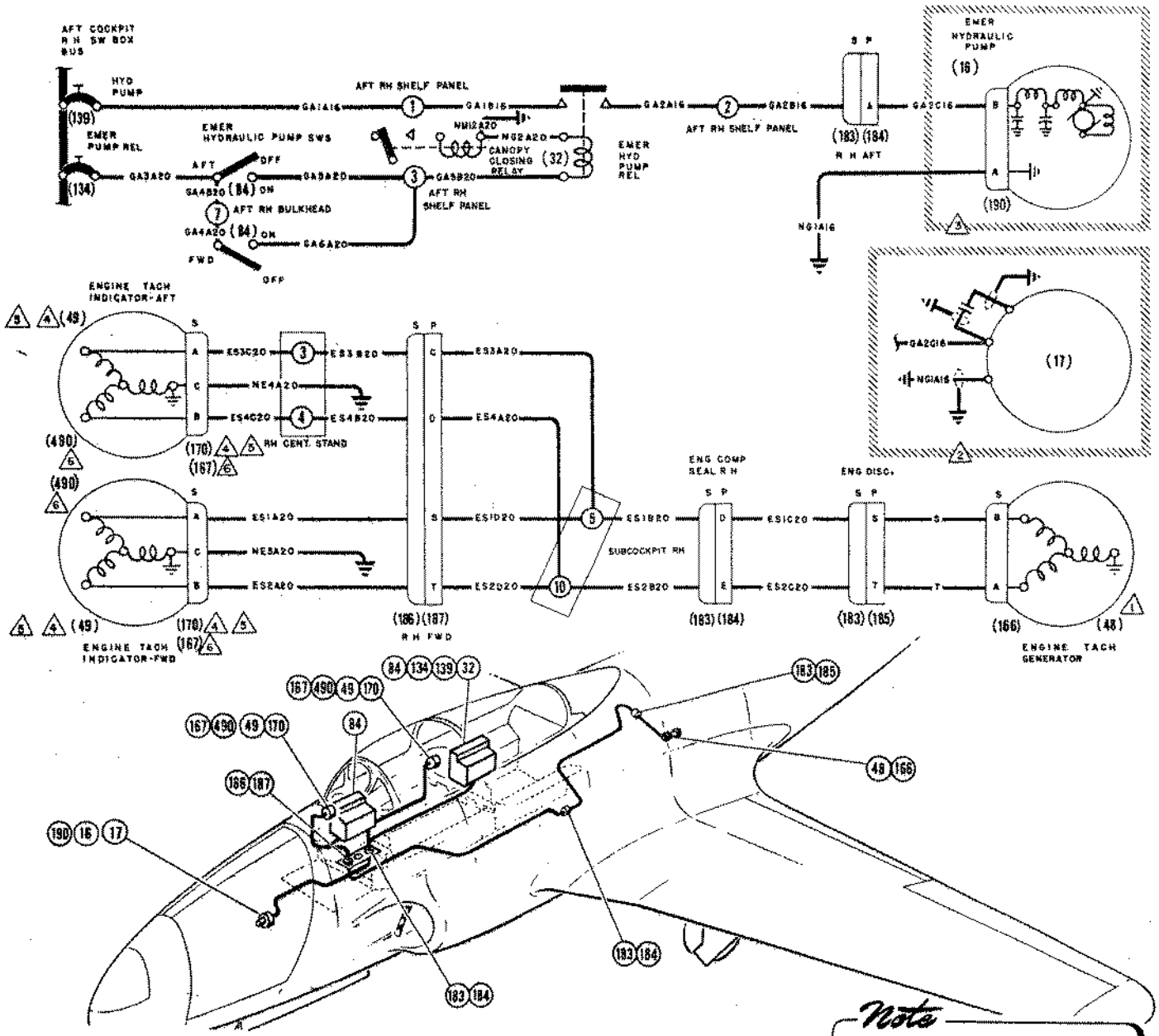
FUEL QUANTITY CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 58-580 AND SUBSEQUENT AND AF SERIALS INCORPORATING T.O. 1T-33A-548B

HB 8799 EM20-51-8-57

Figure 8-75. Fuel Quantity Circuit



	ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2 3	16	EMER HYD PUMP MOTOR	ADEL		NE9417
2 3	17	EMER HYD PUMP MOTOR	ADEL		20908
	32	RELAY			AN3350-1
4 1	48	TACHOMETER GEN	GFAE	A	27539
4 5	49	TACHOMETER IND	GFAE	E-21	27540(X708P1)
4 5	49	TACHOMETER IND	GFAE	E-21A	27540A
	84	SWITCH			AN3021-2
	134	CIRCUIT PROTECTOR			AN3161-P5
	139	CIRCUIT PROTECTOR			AN3161-P35
6	166	CONNECTOR			AN3106-12S-3S
4 5 6	167	CONNECTOR			AN3108-10SL-3S
4 5	170	CONNECTOR			AN3108-14S-15
	183	CONNECTOR			AN3106-28-11S
	184	CONNECTOR			AN3102P-28-11P
	185	CONNECTOR	GFAE		AN3102-28-11P
	186	CONNECTOR			AN3106-28-12S
	187	CONNECTOR			AN3102P-28-12P
3	190	CONNECTOR			AN3106-18-3S
6	490	TACHOMETER IND	GFAE	E-32	27144

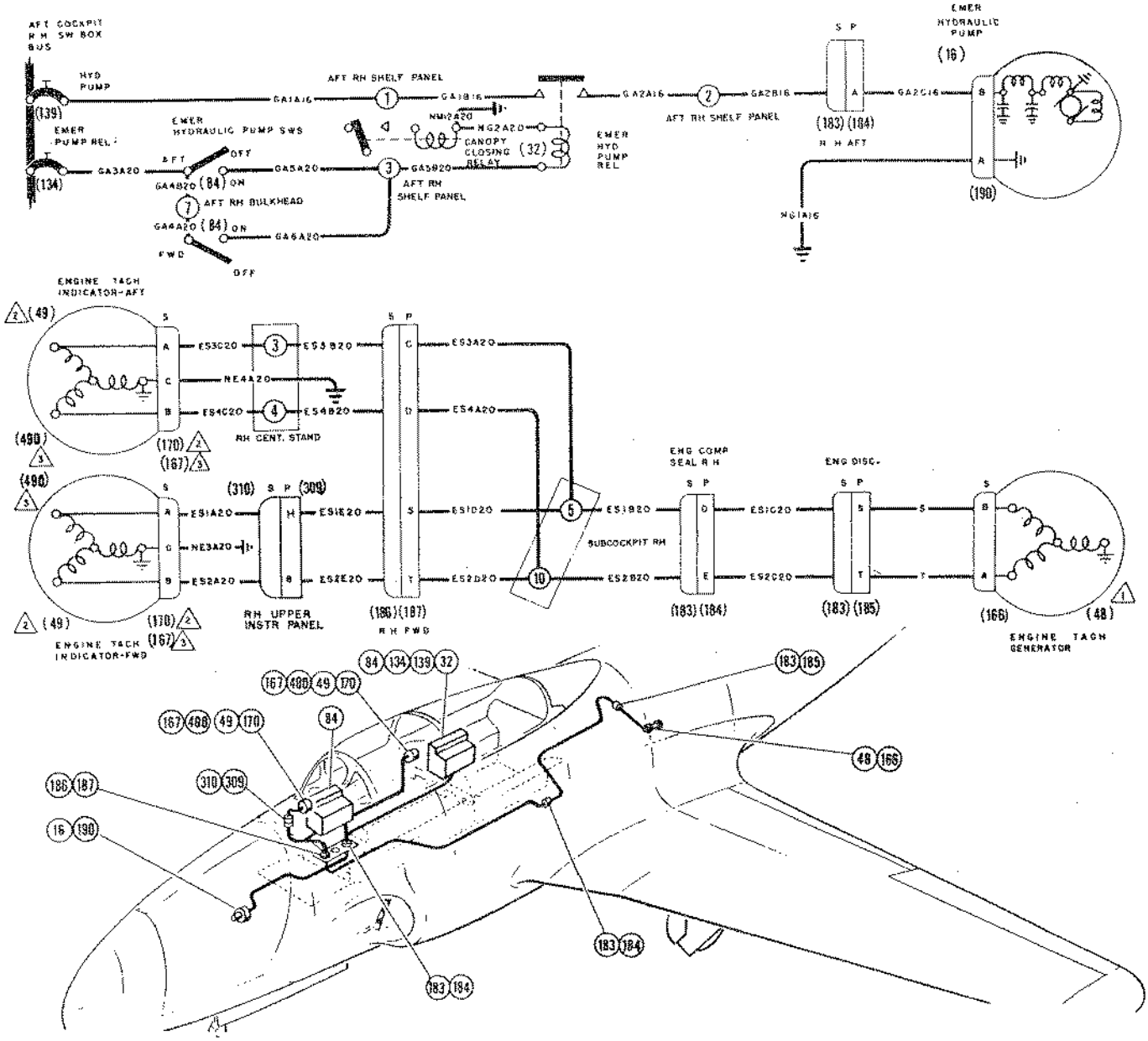
EM-20-18-8-46
CB 2545

Note

1. AN 5544-2 MOD OR AN 5544-3
2. USED SERIAL NOS. 48-356 THROUGH 48-360
3. USED SERIAL NOS. 48-361 AND SUBSEQUENT
4. USED PRIOR TO SERIAL NOS. 49-901
5. USED SERIAL NOS. 49-901 THROUGH 49-1006, 49-2757 THROUGH 49-2772 AND 50-320 THROUGH 50-391
6. USED SERIAL NOS. 50-392 THROUGH 50-454, 50-1272 THRU 50-1275, AND 51-4019 THROUGH 51-4328

ENGINE TACHOMETER & EMERG HYDRAULIC PUMP CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-4328

Figure 8-76. Engine Tachometer and Emergency Hydraulic Pump Circuits



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
16	MOTOR	ADEL		N19417
32	RELAY			AN3350-1
1 48	TACH GENERATOR	G.F.A.E.	A	27539
2 49	INDICATOR	G.F.A.E.	E-21A	27540 A
84	SWITCH			AN3021-2
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
166	CONNECTOR			AN3106-12S-3S
3 167	CONNECTOR			AN3108-10SL-3S
2 170	CONNECTOR			AN3108-14S-1S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
185	CONNECTOR	G.F.A.E.		AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102F-28-12P
190	CONNECTOR			AN3106-18-3S
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
3 490	INDICATOR		E-32	27144

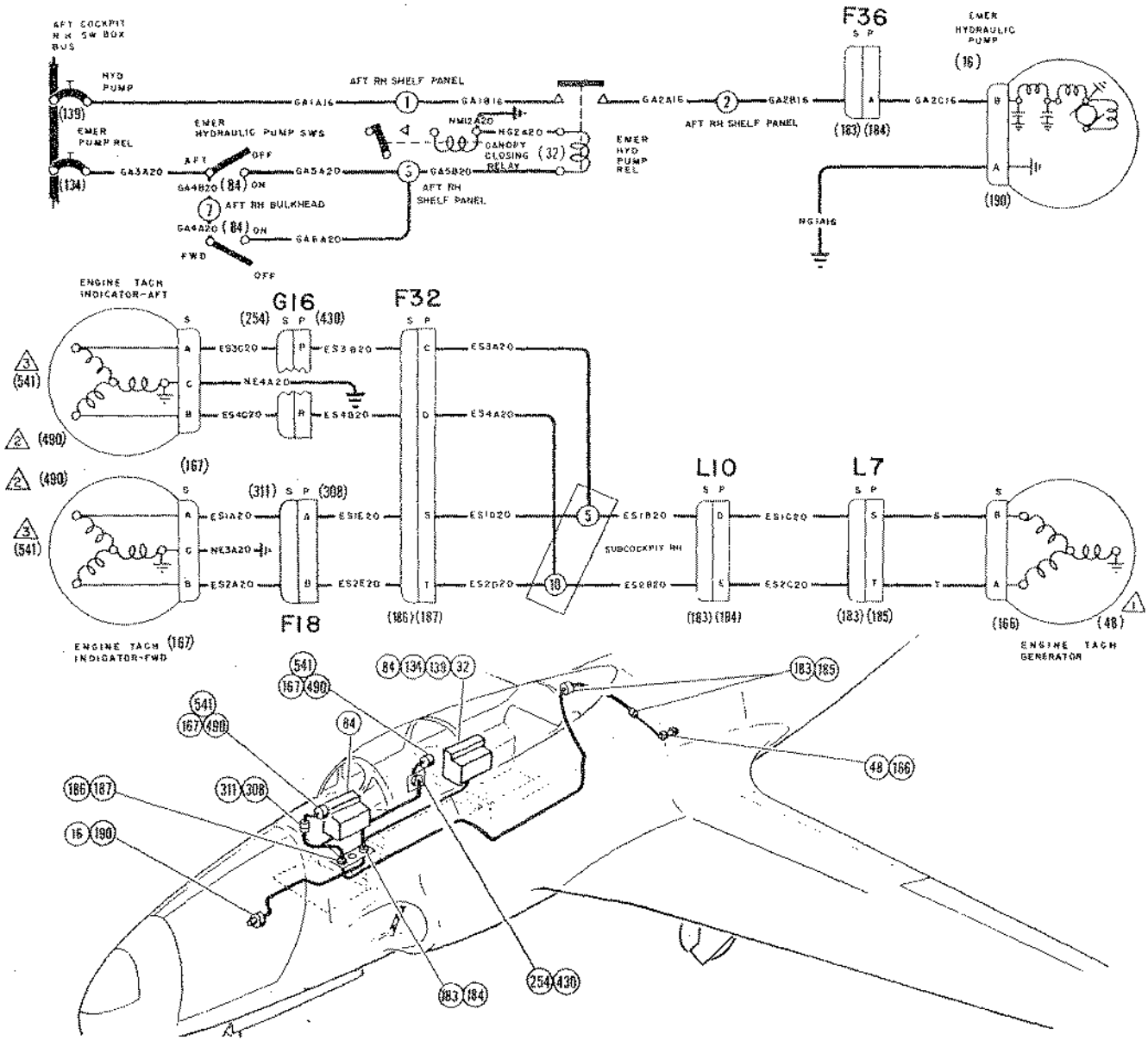
Note

1. AN 5544-2 MOD OR AN 5544-3
2. USED SERIAL NOS. 51-4500 THROUGH 51-4514
3. USED PRIOR TO AF SERIAL NOS. 51-4499 AND 51-4515 AND SUBSEQUENT

CB 8887
EM-20-29-8-47

ENGINE TACHOMETER & EMERG HYDRAULIC PUMP CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-4329 THRU 51-6818

Figure 8-77. Engine Tachometer and Emergency Hydraulic Pump Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
16	MOTOR	ADEL		N19417
32	RELAY			AN3350-3
1 48	TACH GENERATOR	GFAE		27539
84	SWITCH			AN3021-2
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
166	CONNECTOR			AN3106-12S-3S
167	CONNECTOR			AN3108-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
190	CONNECTOR			AN3106-18-3S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P
2 3 490	INDICATOR		E-32	27144
2 3 541	INDICATOR		E-34	MIL-I-6470

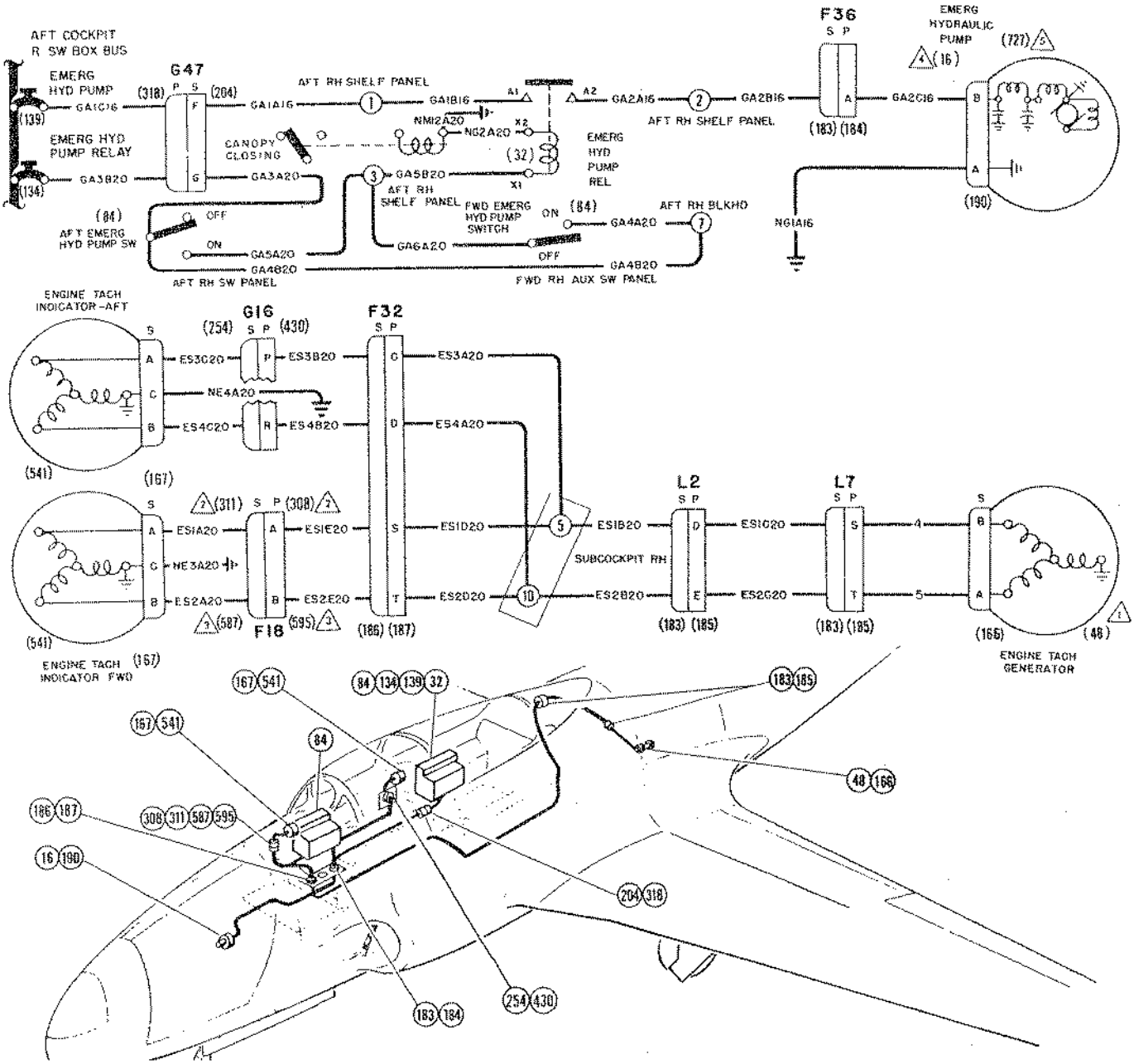
EM-20-21-8-48
CS 2473

Note

1. AN5544-2 MOD OR AN5544-3.
2. USED PRIOR TO AF SERIAL NO. 51-8836.
3. USED ON AF SERIAL NOS. 51-8836 THRU 51-9235.

ENGINE TACHOMETER & EMERG HYDRAULIC PUMP CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-6819 THRU 51-9235

Figure 8-78. Engine Tachometer and Emergency Hydraulic Pump Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
4 16	MOTOR	ADEL		N19417
32	RELAY			AN3350-1
1 48	TACH GENERATOR	GFAE		27539
84	SWITCH			AN3021-2
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
166	CONNECTOR			AN3106-12S-3S
167	CONNECTOR			AN3108-10SL-3S
183	CONNECTOR			AN3106-2B-11S
184	CONNECTOR			AN3102P-2B-11P
185	CONNECTOR			AN3102-2B-11P
186	CONNECTOR			AN3106-2B-12S
187	CONNECTOR			AN3102P-2B-12P
190	CONNECTOR			AN3106-18-3S
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN3108-2B-12S
2 308	CONNECTOR			AN3102-2B-15P
2 311	CONNECTOR			AN3106-2B-15S
318	CONNECTOR			AN3106B-20-29S
430	CONNECTOR			AN3102-2B-12P
541	INDICATOR		E-34	MIL-I-6470
3 587	CONNECTOR			AN3106B-2B-21S
3 595	CONNECTOR			AN3102A-2B-21P
5 727	MOTOR	PESCO		111920-030

NOTE:

1. AN5544-2 MOD OR AN5544-3
2. USED PRIOR TO AF SERIAL NO. 53-5666
3. USED ON AF SERIAL NO. 53-5666 AND SUBSEQUENT
4. PRIOR TO AF SERIAL NO. 55-2996
5. ON AIRPLANES AF SERIAL NO. 55-2996 AND SUBSEQUENT

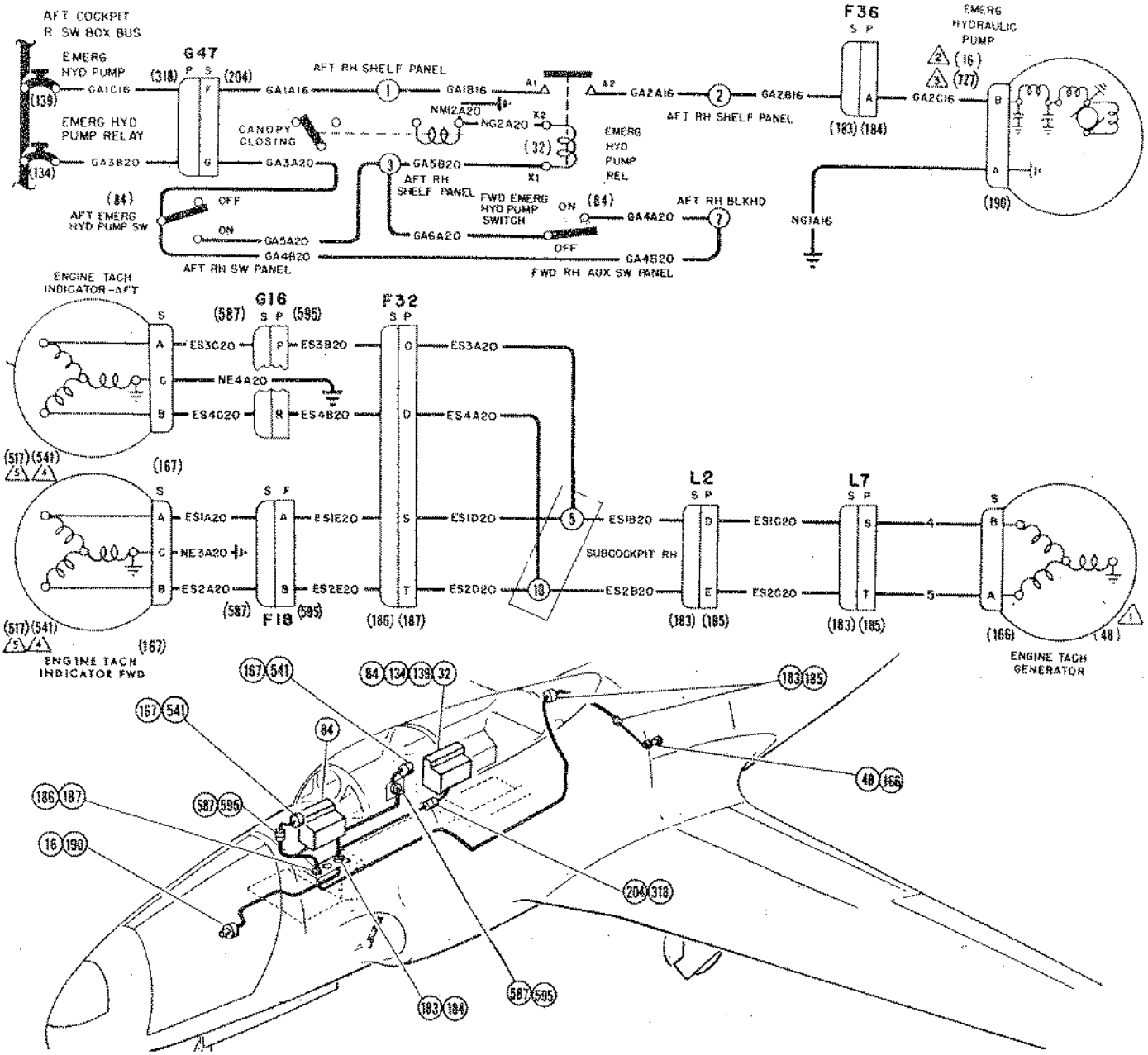
ENGINE TACHOMETER & EMERG HYDRAULIC PUMP CIRCUITS

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 51-9236 AND SUBSEQUENT

GB 8873
M20-48D-8-382

Figure 8-79. Engine Tachometer and Emergency Hydraulic Pump Circuits



	ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	16	MOTOR	ADEL		N19417
	32	RELAY			AN3350-3
1	48	TACH GENERATOR	GFAE		27539
	84	SWITCH			AN3021-2
	134	CIRCUIT PROTECTOR			AN3161-P5
	139	CIRCUIT PROTECTOR			AN3161-P35
	166	CONNECTOR			AN3106-12S-3S
	167	CONNECTOR			AN3108-10SL-3S
	183	CONNECTOR			AN3106-28-11S
	184	CONNECTOR			AN3102P-28-11P
	185	CONNECTOR			AN3102-28-11P
	186	CONNECTOR			AN3106-28-12S
	187	CONNECTOR			AN3102P-28-12P
	190	CONNECTOR			AN3106-18-3S
	204	CONNECTOR			AN3102A-20-29S
	318	CONNECTOR			AN3108-20-29S
5	517	INDICATOR		ERU/2A	
4	541	INDICATOR		6-34	MIL-I-6470
	587	CONNECTOR			AN3106B-28-21S
	595	CONNECTOR			AN3102A-28-21P
3	727	MOTOR	PESCO		1E1920-030

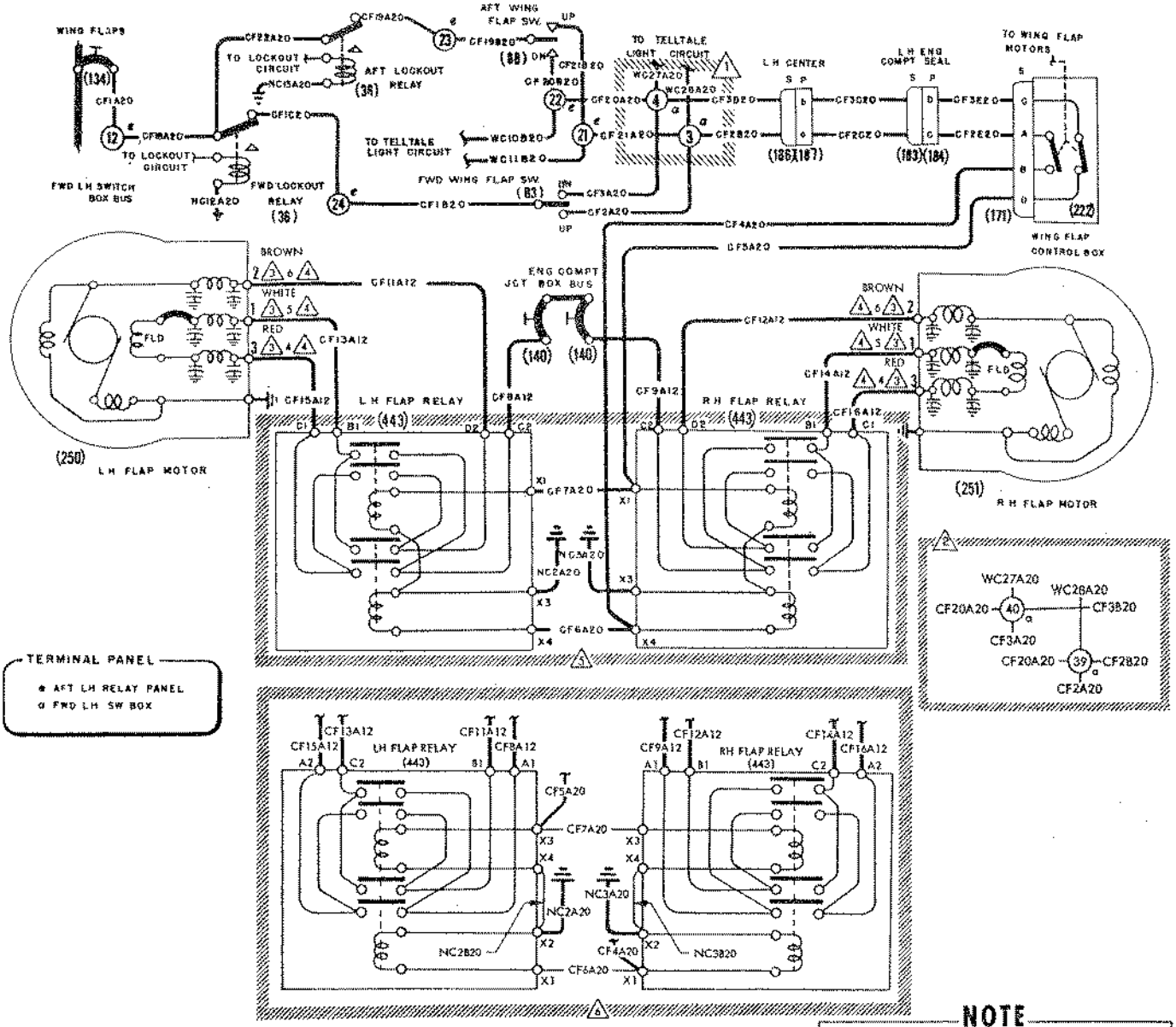
NOTE:

1. AN5544-2 MOD OR AN5544-3
2. PRIOR TO AF SERIAL NO. 53-3017, EXCEPT 53-5494 THROUGH 53-6152
3. ON AIRPLANES AF SERIAL NO. 53-5994 THROUGH 53-6152 AND 55-3017 AND SUBSEQUENT
4. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 57-565
5. USED ON AIRPLANES AF SERIAL NO. 57-565 AND SUBSEQUENT

ENGINE TACHOMETER & EMERG HYDRAULIC PUMP CIRCUITS
MODEL T-33A-5

EM20-43-8-394
GB 2506

Figure 8-80. Engine Tachometer and Emergency Hydraulic Pump Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD.		NB-57C
83	SWITCH			MS25026-1
88	SWITCH			MS25026-7
130	CIRCUIT BREAKER	SPENCER		PDLM-50
134	CIRCUIT BREAKER			AN3161-P5
171	CONNECTOR			MS3106B-14S-2S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
186	CONNECTOR,			MS3106B-28-12S
187	CONNECTOR			MS3102C-28-12P
222	SWITCH BOX, LIMIT	LEAR		790A
250	L FLAP MOTOR	LEAR		423D-2-L OR 423D-3-L OR 423D-4-L OR 103175-02
251	R FLAP MOTOR	LEAR		423D-2-R OR 423D-3-R OR 423D-4-R OR 103175-01
443	RELAY			AN3354-1 OR AN3354-2

NOTE

1. USED ON AIRCRAFT NOT INCORPORATING T.O. NO. 1T-33A-143
2. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-143
3. TERMINAL ARRANGEMENT WHEN USING PARTS NUMBERED 423D-2-L, 423D-2-R, 423D-3-L, 423D-3-R, 423D-4-L AND 423D-4-R
4. TERMINAL ARRANGEMENT WHEN USING PARTS NUMBERED 103175-01 AND 103175-02.
5. TERMINAL ARRANGEMENT WHEN USING AN3354-1 RELAY.
6. TERMINAL ARRANGEMENT WHEN USING AN3354-2 RELAY.

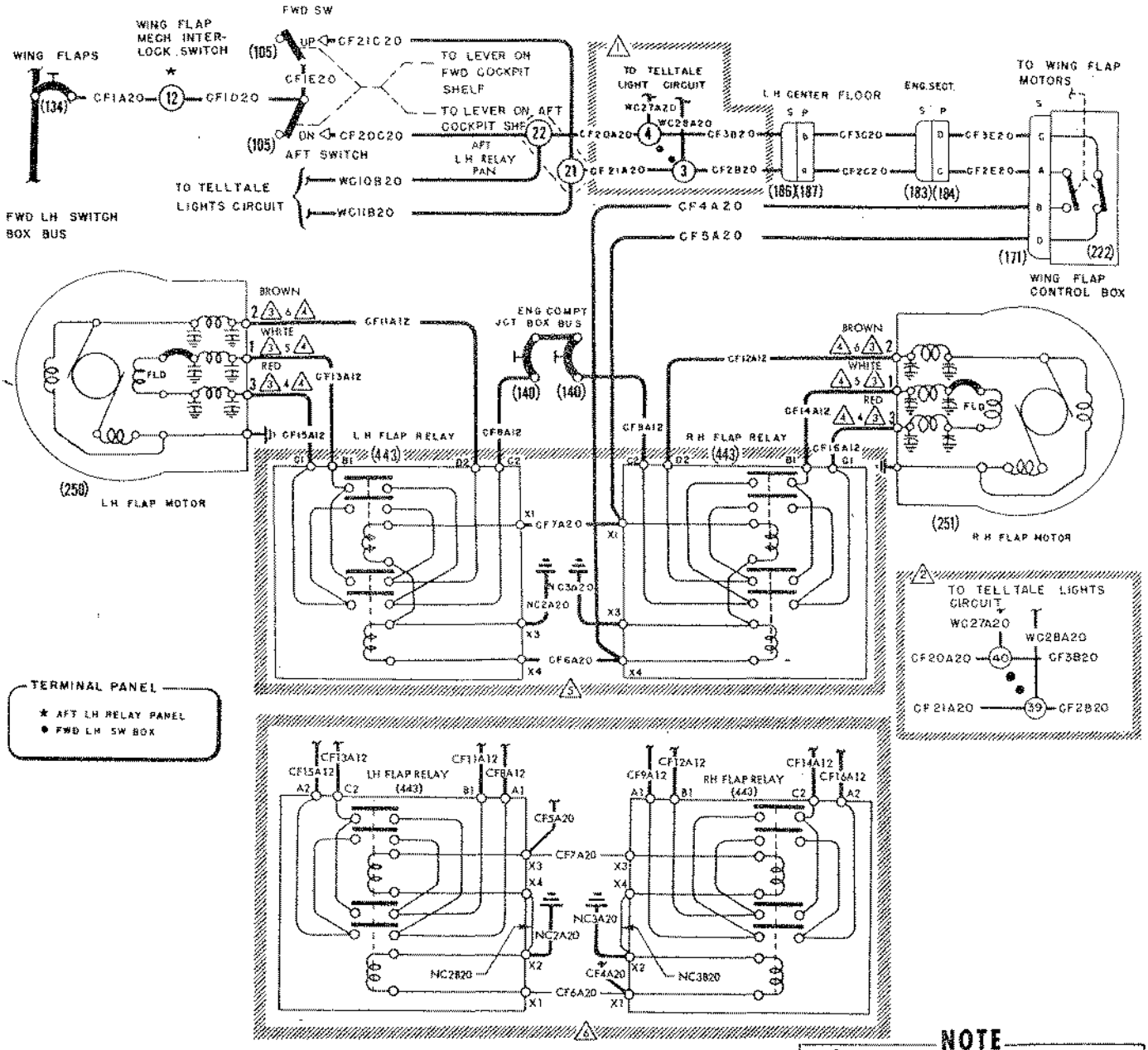
WING FLAP ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AIRPLANES PRIOR TO 50-385

M20-45-8-49
GB 4534

Figure 8-81. Wing Flap Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
105	SWITCH			AN3215-1
134	CIRCUIT PROTECTOR			AN3161-P5
140	CIRCUIT PROTECTOR			AN3161-P50
171	CONNECTOR			MS31068-14S-2S
183	CONNECTOR			MS31068-28-11S
184	CONNECTOR			MS3102C-28-11P
186	CONNECTOR			MS31068-28-12S
187	CONNECTOR			MS3102C-28-12P
222	FLAP CONTROL BOX	LEAR		790A
250	LH FLAP MOTOR	LEAR		423D-2-L OR 423D-3-L OR 423D-4-L OR 103175-02
251	RH FLAP MOTOR	LEAR		423D-2-R OR 423D-3-R OR 423D-4-R OR 103175-01
443	FLAP RELAY			AN3354-1 OR AN3354-2

NOTE

1. USED PRIOR TO AF SERIAL NO. 51-6751 AND ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6751 THROUGH 51-6818 AND ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-143.
2. USED ON USAF T-33A AND BUAER TV-2 AIRCRAFT AF SERIAL NO. 51-6751 THROUGH 51-6818 AND ON AIRCRAFT INCORPORATING T.O. 1T-33A-143.
3. TERMINAL ARRANGEMENT WHEN USING PARTS NUMBERED 423D-2-L, 423D-2-R 423D-3-L, 423D-3-R, 423D-4-L AND 423D-4-R.
4. TERMINAL ARRANGEMENT WHEN USING PARTS NUMBERED 103175-01 AND 103175-02.
5. TERMINAL ARRANGEMENT WHEN USING AN3354-1 RELAY.
6. TERMINAL ARRANGEMENT WHEN USING AN3354-2 RELAY.

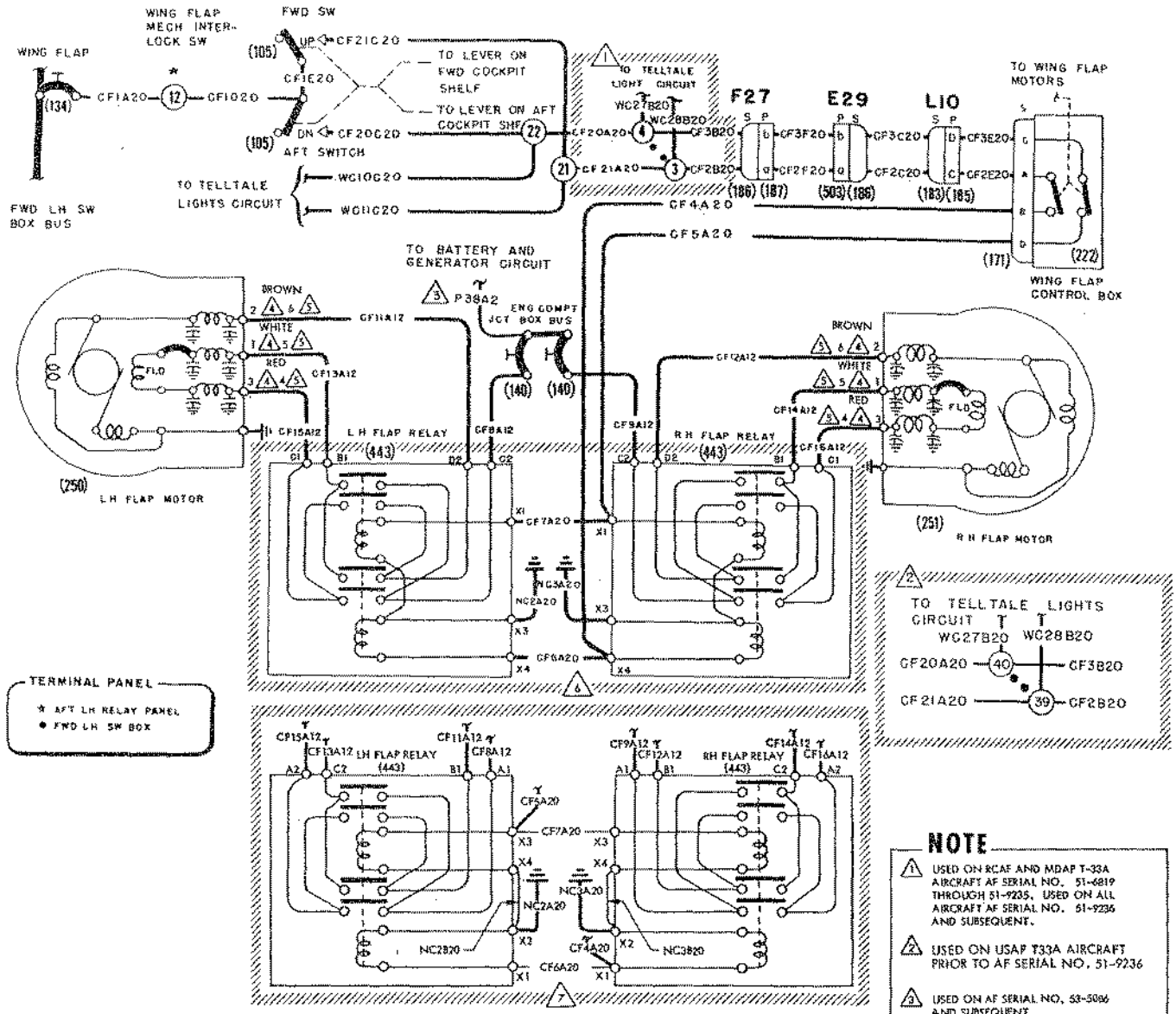
WING FLAP ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 50-385 THROUGH 51-6818

M20-45-8-50
GB 4115

Figure 8-82. Wing Flap Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
105	SWITCH			AN3235-1
134	CIRCUIT PROTECTOR			AN3161-P5
140	CIRCUIT PROTECTOR			AN3161-P50
171	CONNECTOR			MS3106B-14S-2S
183	CONNECTOR			MS3106B-28-11S
185	CONNECTOR			MS3102A-28-11P
186	CONNECTOR			MS3106B-28-12S
187	CONNECTOR			MS3102C-28-12P
222	FLAP CONTROL BOX	LEAR		790A
250	LH FLAP MOTOR	LEAR		423D-2-L OR 423D-3-L OR 423D-4-L OR 103175-02
251	RH FLAP MOTOR	LEAR		423D-2-R OR 423D-3-R OR 423D-4-R OR 103175-01
443	FLAP RELAY			AN3354-1 OR AN3354-2
503	CONNECTOR			MS3100A-28-12P

GB 8806

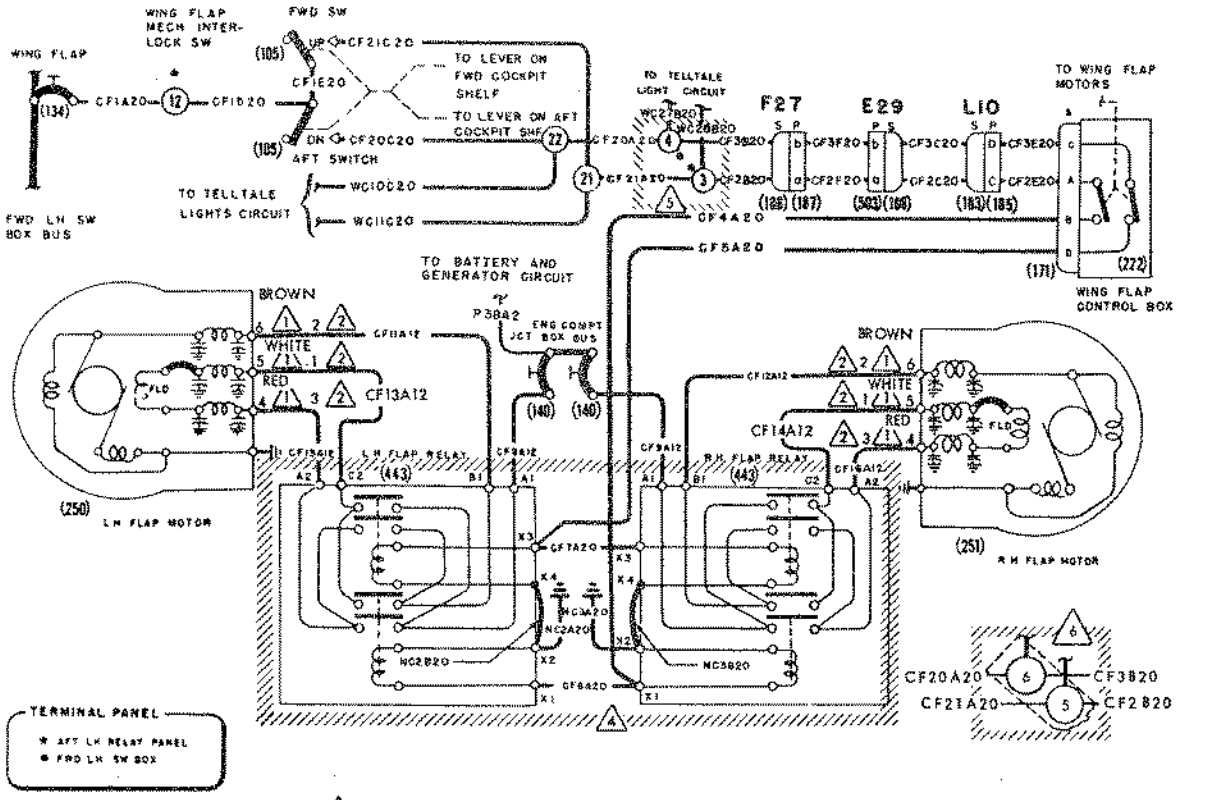
M20-48D-8-51

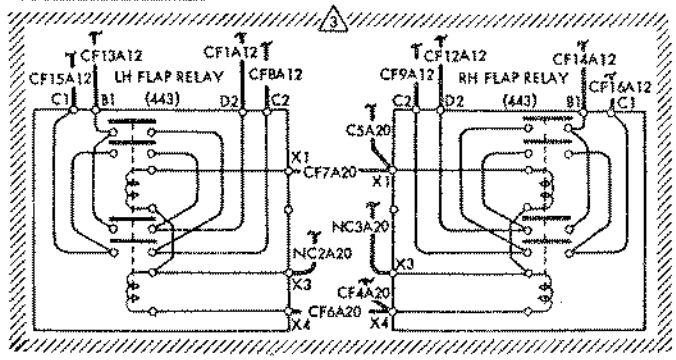
WING FLAP ACTUATOR CIRCUIT

MODEL T-33A

AF SERIAL NO. 51-6819 THROUGH 53-5066 AND 54-1522 THROUGH 55-3098

Figure 8-83. Wing Flap Actuator Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC.
105	SWITCH			AN3215-1
134	CIRCUIT PROTECTOR			AN3161-P5
140	CIRCUIT PROTECTOR			AN3161-P50
171	CONNECTOR			MS3106B-14S-2S
183	CONNECTOR			MS3106B-28-11S
185	CONNECTOR			MS3102A-28-11P
186	CONNECTOR			MS3106B-28-12S
187	CONNECTOR			MS3102C-28-12P
222	FLAP CONTROL BOX	LEAR		790A
250	LH FLAP MOTOR	LEAR		423D-2L OR 423D-3L OR 423D-4L OR 103175-02
251	RH FLAP MOTOR	LEAR		423D-2-R 423D-3-R OR 423D-4-R 103175-01
443	FLAP RELAY			AN3354-1 OR AN3354-2
503	CONNECTOR			MS3100A-28-12P

Note

1. TERMINAL ARRANGEMENT WHEN USING PARTS NUMBERED 423D-L-2, 423D-R-2 423D-L-3 423D-R-3, 423D-4-L AND 423D-4-R
2. TERMINAL ARRANGEMENT WHEN USING PARTS NUMBERED 103175-01 AND 103175-02
3. TERMINAL ARRANGEMENT WHEN USING PART NUMBER AN3354-1
4. TERMINAL ARRANGEMENT WHEN USING PART NUMBER AN3354-2
5. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 57-634
6. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

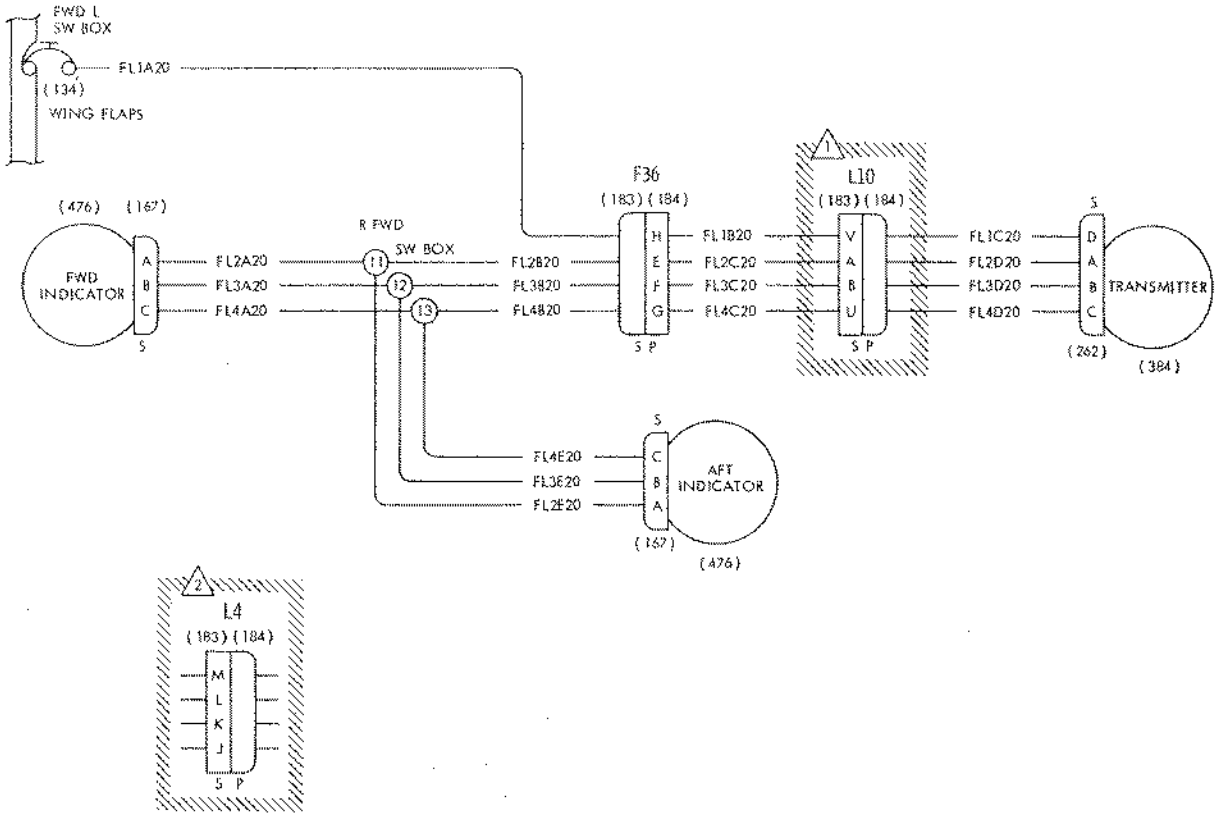
WING FLAP ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-6067 THROUGH 53-6152 AND 55-3100 AND SUBSEQUENT

M20-45-8-425
GB 4535

Figure 8-84. Wing Flap Actuator Circuit



NOTE

1. USED ON AF SERIAL NO. 48-356 THROUGH 49-900
2. USED ON AF SERIAL NO. 49-901 THROUGH 50-384

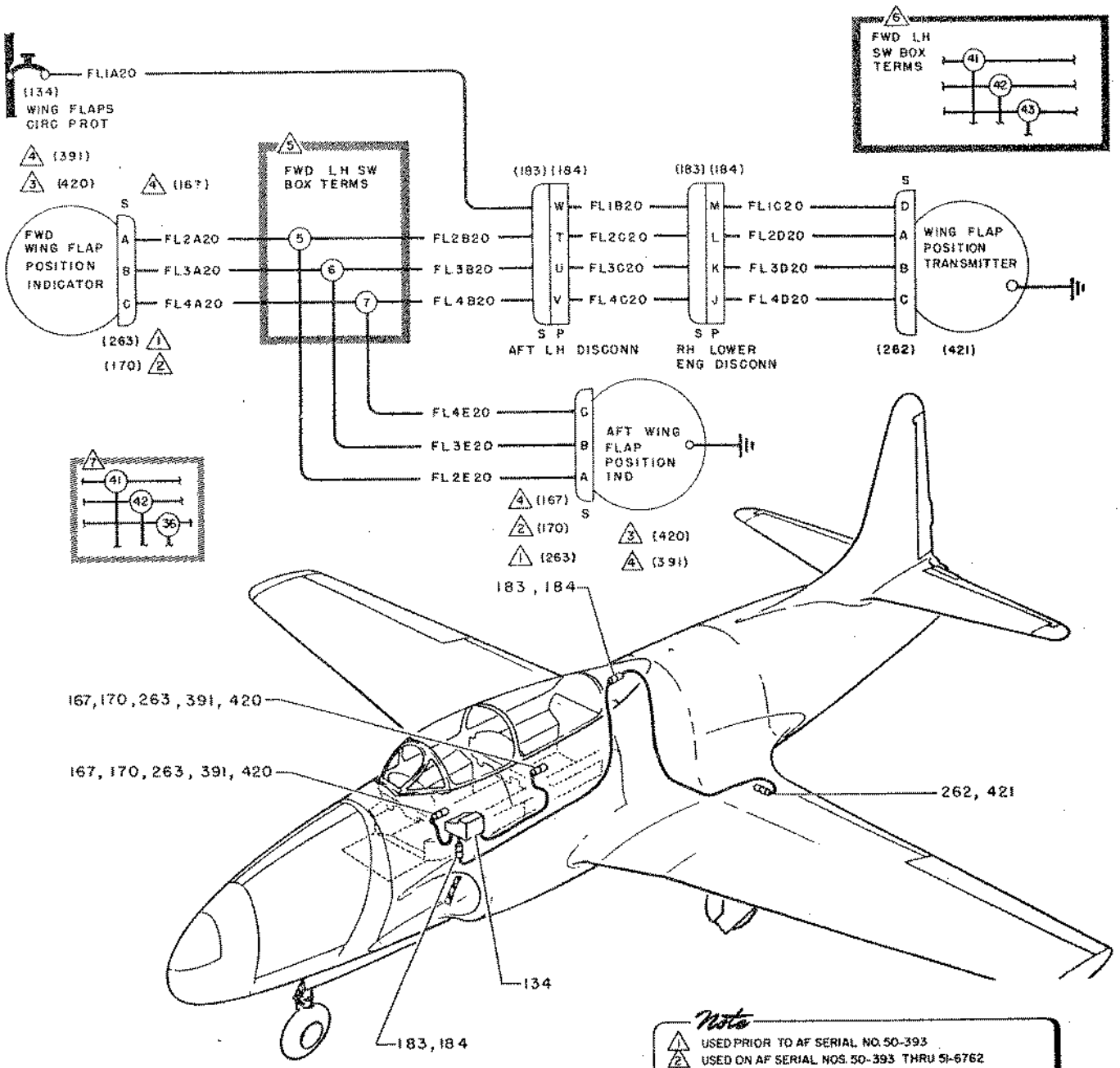
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT BREAKER			AN3161-P5
167	CONNECTOR			MS3108B-10SL-3S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
262	CONNECTOR			MS3108B-14S-2S
384	TRANSMITTER			AN5786-1
476	INDICATOR			MS28023-1

HB 1243
M20-50-B-91

WING FLAP POSITION INDICATOR CIRCUIT

MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 50-384 INCORPORATING T.O. 1T-33A-567.

Figure 8-84A. Wing Flaps Position Indicator Circuit



Notes

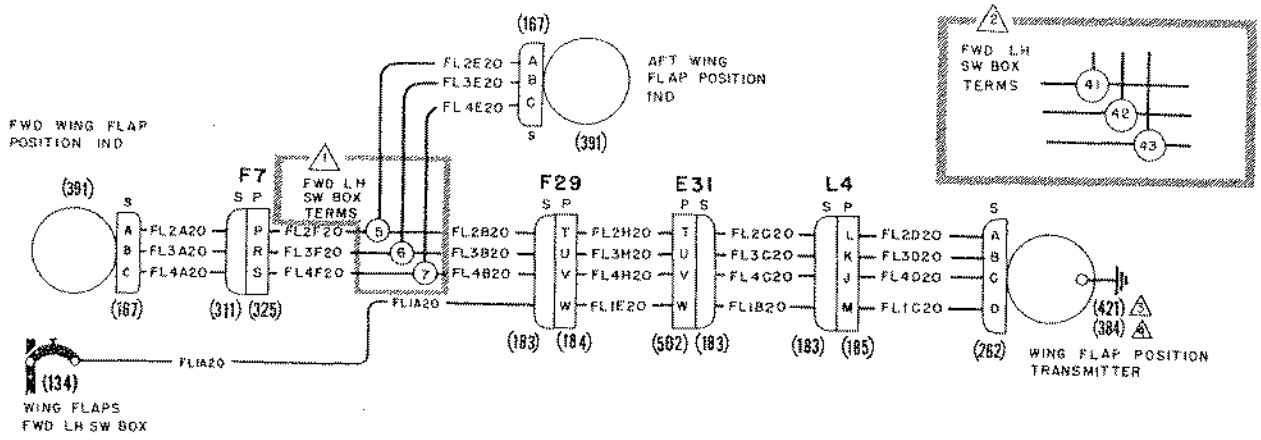
1. USED PRIOR TO AF SERIAL NO. 50-393
2. USED ON AF SERIAL NOS. 50-393 THRU 51-6762
3. USED PRIOR TO AF SERIAL NO. 51-6763
4. USED ON AF SERIAL NOS. 51-6763 THRU 51-6818
5. USED PRIOR TO AF SERIAL NO. 51-6751 AND ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NOS. 51-6751 THRU 51-6818 AND ON AIRCRAFT NOT INCORPORATING T.O. NO. 1T-33A-143
6. USED ON USAF T-33A AIRCRAFT AF SERIAL NOS. 51-6751 THRU 51-6818
7. USED ON AIRCRAFT INCORPORATING T.O. NO. 1T-33A-143

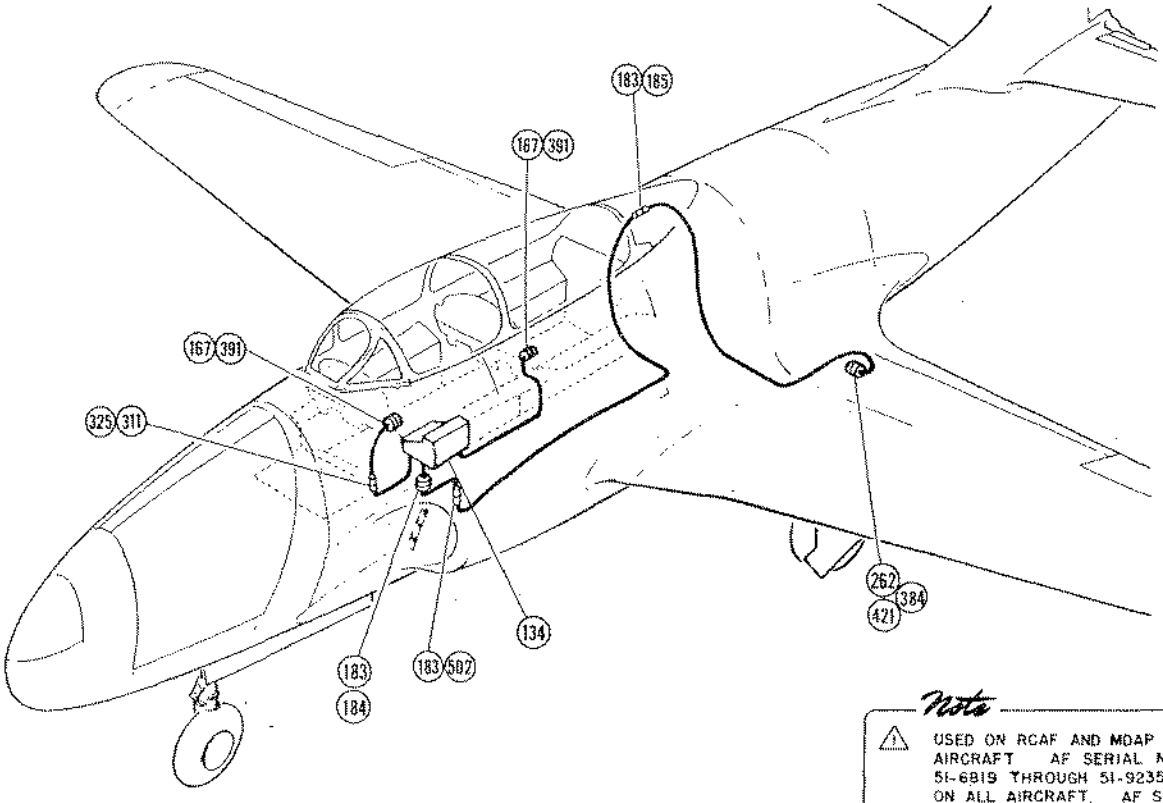
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
4 167	CONNECTOR			AN3108B-10SL-3S
2 170	CONNECTOR			AN3106-14S-1S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
1 262	CONNECTOR			AN3106-14S-2S
4 263	CONNECTOR			AN3106-14S-1S
391	INDICATOR	USAF		MS28003
3 420	INDICATOR	GE	A-4	8D,J11PKA
421	TRANSMITTER	GE	TJ-9	8Y,J9YF9

GB 8815
M20-48D 8-52

WING FLAP POSITION INDICATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 50-585 THRU 51-6818

Figure 8-85. Wing Flap Position Indicator Circuit





ITEM	DESCRIPTION	AFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
167	CONNECTOR			AN3108B-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102A-28-17P
262	CONNECTOR			AN3106-14S-2S
311	CONNECTOR			AN3106-28-19S
325	CONNECTOR			AN3100A-28-19P
4 384	TRANSMITTER			AN5786-1
391	INDICATOR		USAF	MS28003
2 421	TRANSMITTER	GE	TJ-9	BT39PFE
502	CONNECTOR			AN3100A-28-11P

GB 8797
M20-480-8-53

Note

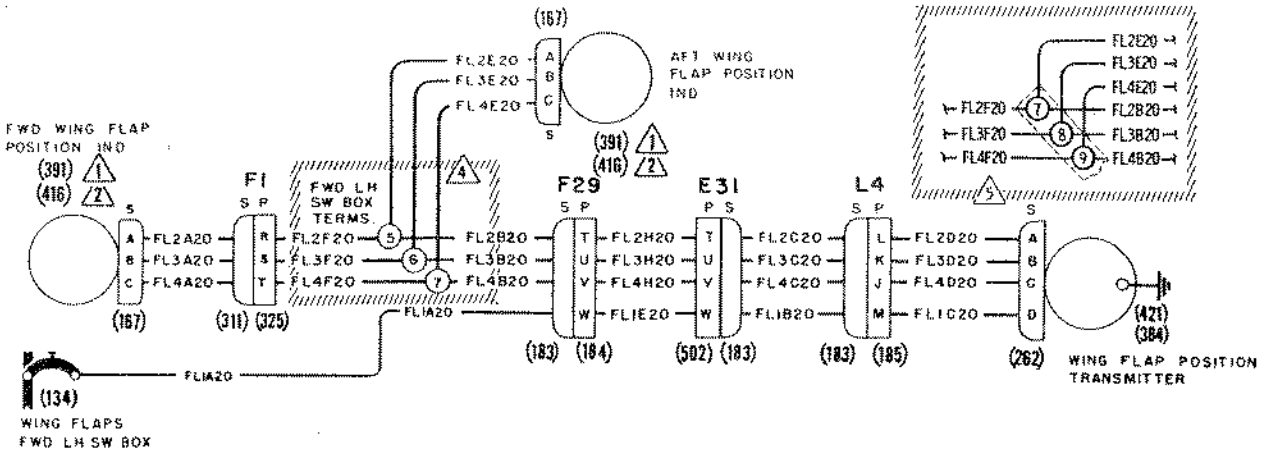
1. USED ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235. USED ON ALL AIRCRAFT, AF SERIAL NO. 51-9236 AND SUBSEQUENT
2. USED ON USAF T-33A AIRCRAFT PRIOR TO AF SERIAL NO. 51-9236
3. USED PRIOR TO AF SERIAL NO. 52-9445
4. USED ON AF SERIAL NO. 51-17512 THROUGH 51-17556 AND ON 52-9445 AND SUBSEQUENT.

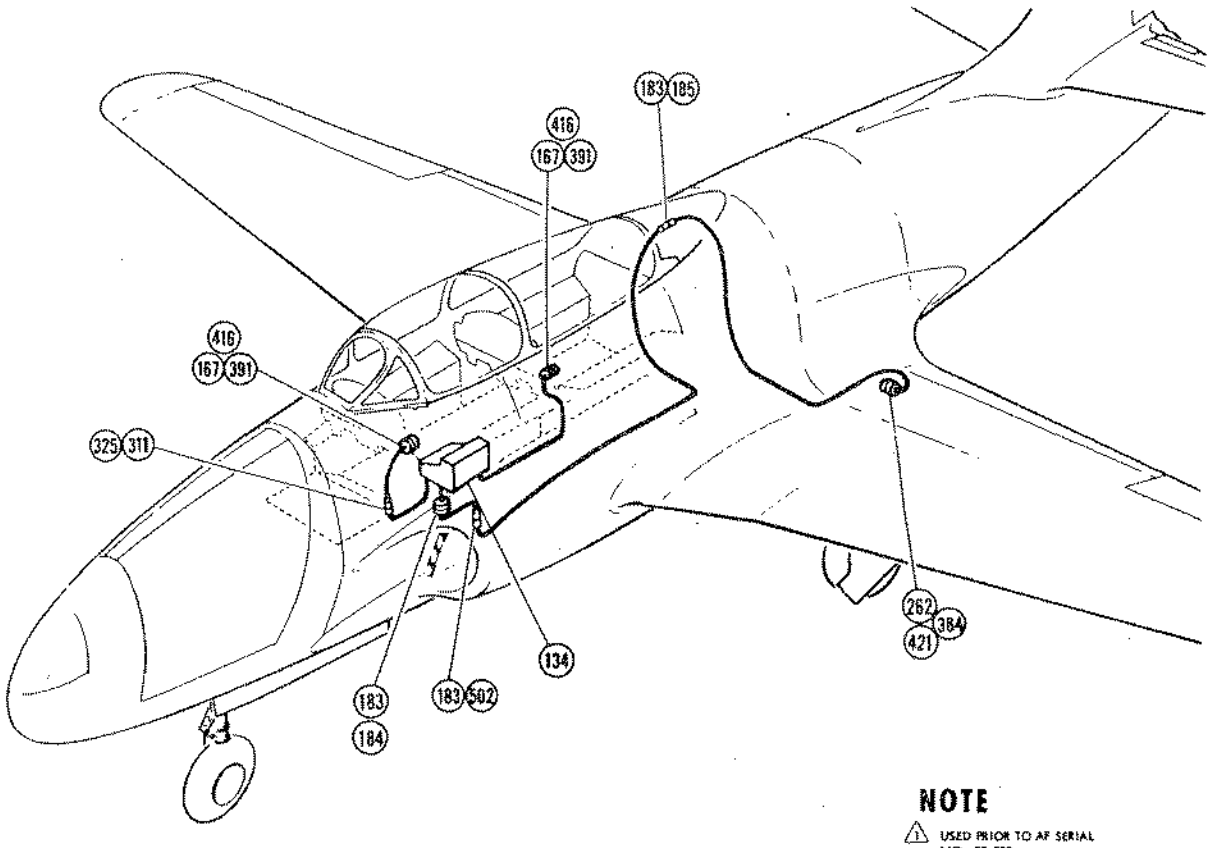
WING FLAP POSITION INDICATOR CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 51-6819 AND SUBSEQUENT

Figure 8-86. Wing Flap Position Indicator Circuit





NOTE

1. USED PRIOR TO AF SERIAL NO. 57-582
2. USED ON AF SERIAL NO. 57-582 AND SUBSEQUENT
4. USED PRIOR TO AF SERIAL NO. 57-634
5. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

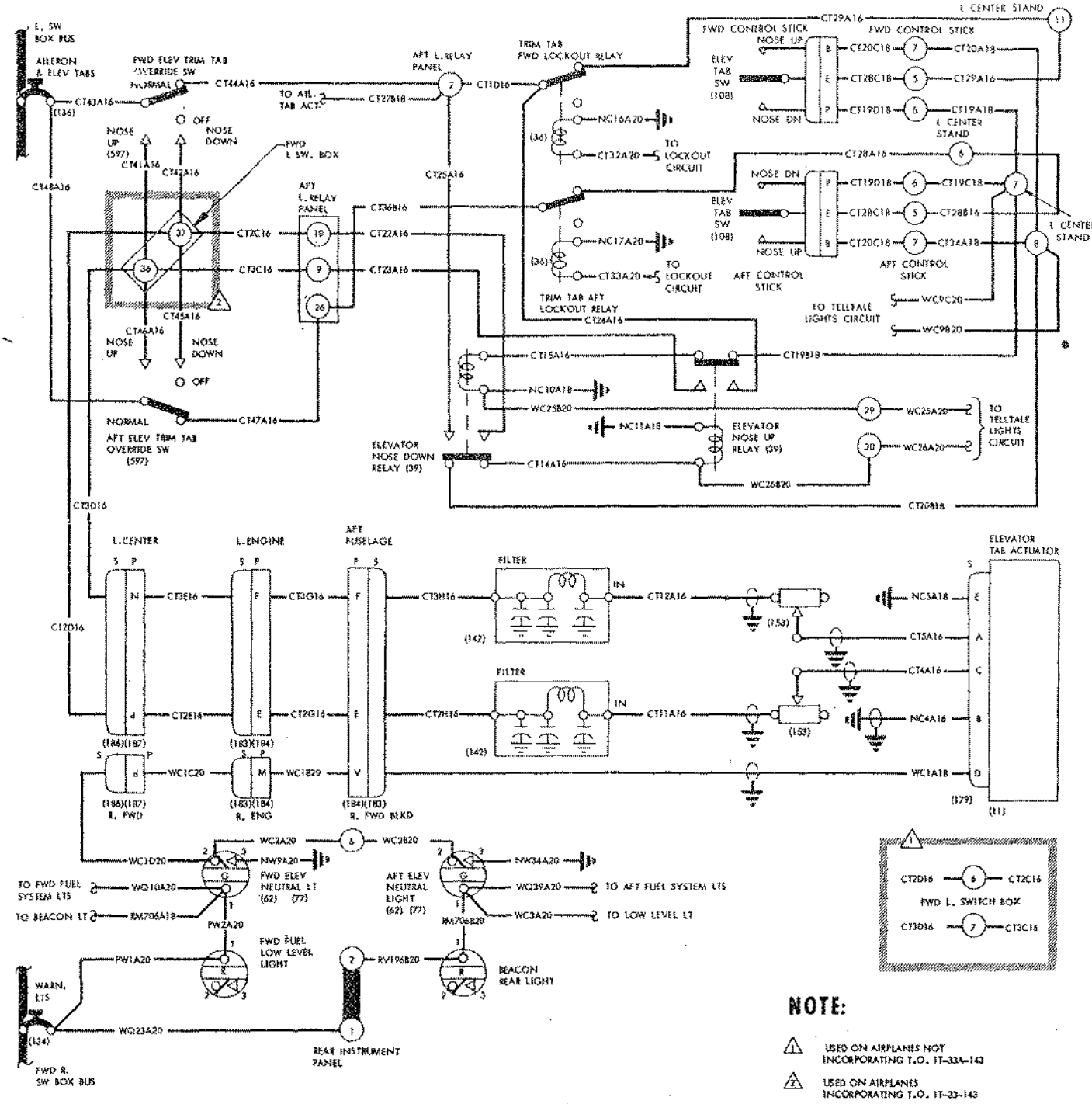
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
167	CONNECTOR			AN3108B-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
185	CONNECTOR			AN3102A-28-11P
262	CONNECTOR			AN3108-14S-2S
311	CONNECTOR			AN3106-28-15S
325	CONNECTOR			AN3100A-28-15P
384	TRANSMITTER			AN5786-1
1 391	INDICATOR		USAF	MS28003-1
2 5 416	INDICATOR			MS28003-2
421	TRANSMITTER	GE	TJ-9	81J9PFF
502	CONNECTOR			AN3100A-28-11P

EM-20-44-8-595
GB 3679

WING FLAP POSITION INDICATOR CIRCUIT

MODEL T-33A-5

Figure 8-87. Wing Flap Position Indicator Circuit



NOTE:

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-143
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33-143

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
11	ELEV. TAB MOTOR	LEAR		1579
36	RELAY	EL. PROD.		NB-57-C
39	RELAY			AN3352-1
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
108	SWITCH	OPAE	B-8A	MIL-S-5210
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
142	FILTER	FOTTER	20A	B-320
153	RHEOSTAT	OHMITE		0442 2Ω 100W
179	CONNECTOR			AN3106B-16S-8S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102F-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C28-12P
597	SWITCH	C-H	SPDT	8749

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

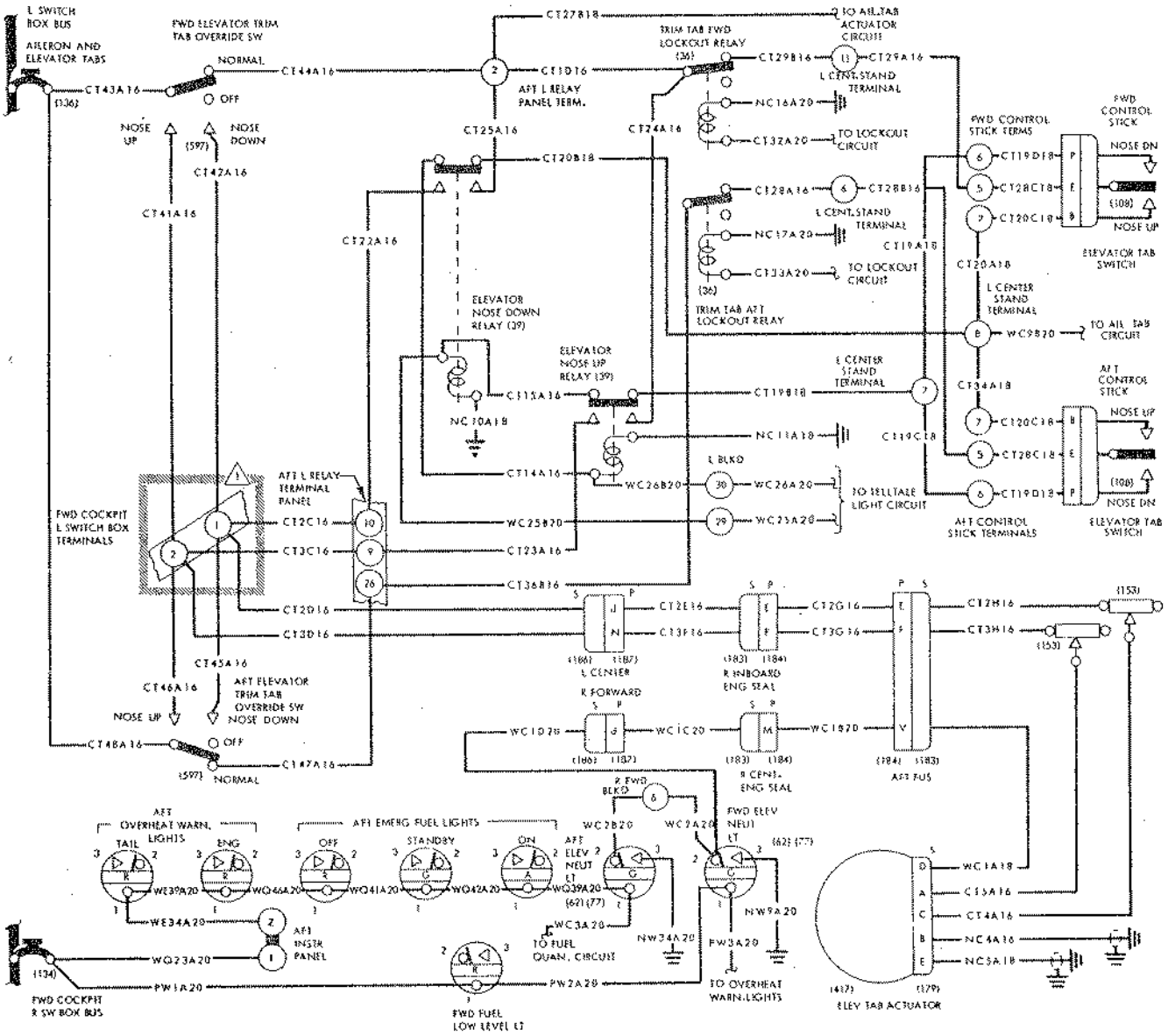
MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THRU 49-900

GB 3813

EM20-42-8-354

Figure 8-88. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
36	RELAY	EL. PROD.		NB-57-C
39	RELAY			AN3353-1
62	LIGHT		GREEN	AN3152-3
77	LAMP			AN3121-313
198	SWITCH	GFAE	B-BA	MIL -S-5210B
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
153	RHEOSTAT	OHMITE	2Ω100W	3 0442 4 2120B
179	CONNECTOR			AN3106B-16S-8S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR	LEAR		AN3102C-28-12P
417	ELEVATOR TAB MOTOR			1577P-3
597	SWITCH	C-H	5PST	8749

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-143
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-143
3. USED PRIOR TO AF SERIAL NO. 50-491
4. USED ON AF SERIAL NO. 50-491 AND SUBSEQUENT

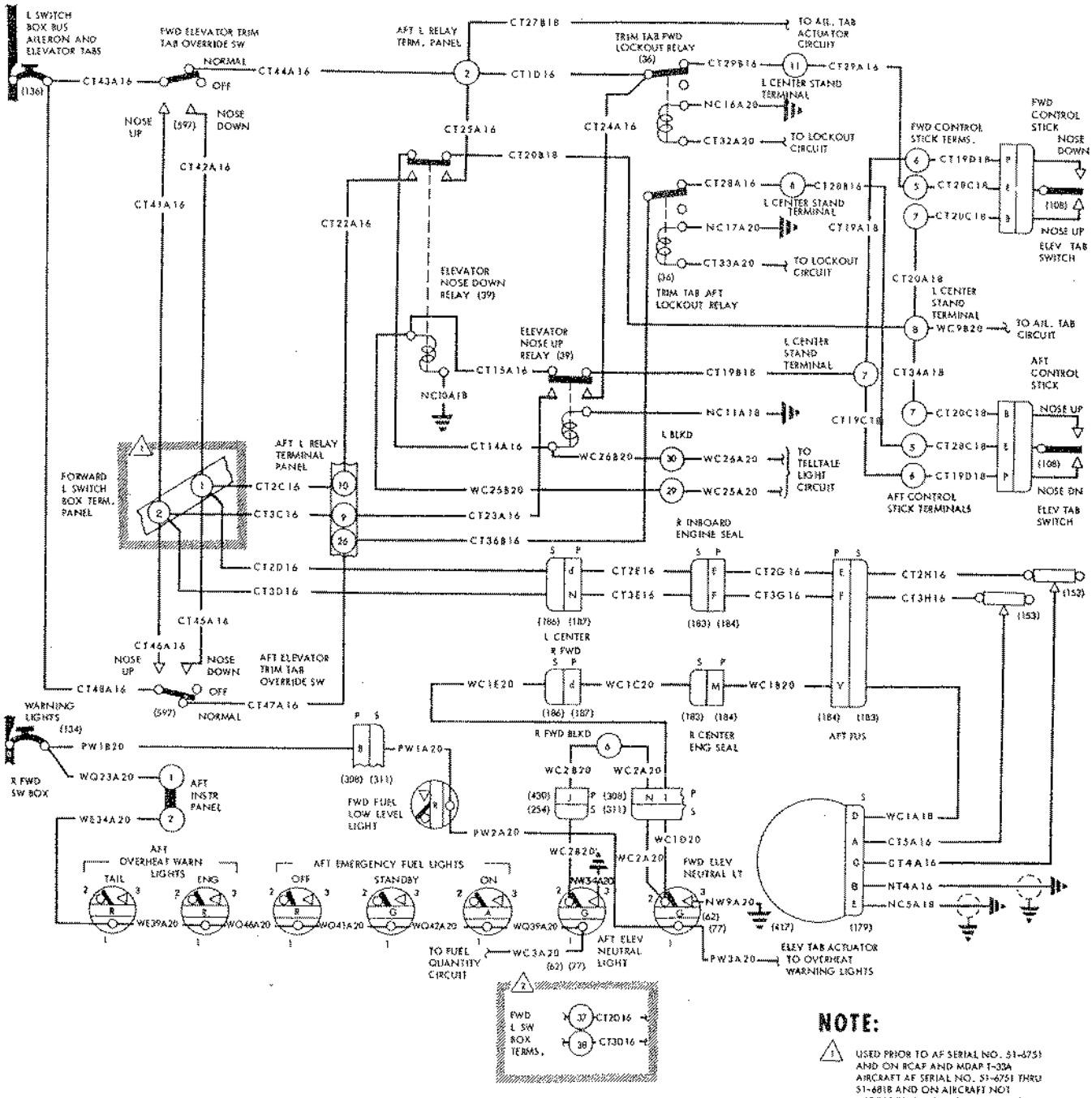
ELEVATOR TRIM TAB ACTUATOR CIRCUIT

MODEL T-33A

USED ON SERIAL NO. 49-991 THROUGH 51-4328

M20-44-B-35S
GB 3680

Figure 8-89. Elevator Trim Tab Actuator Circuit



NOTE:

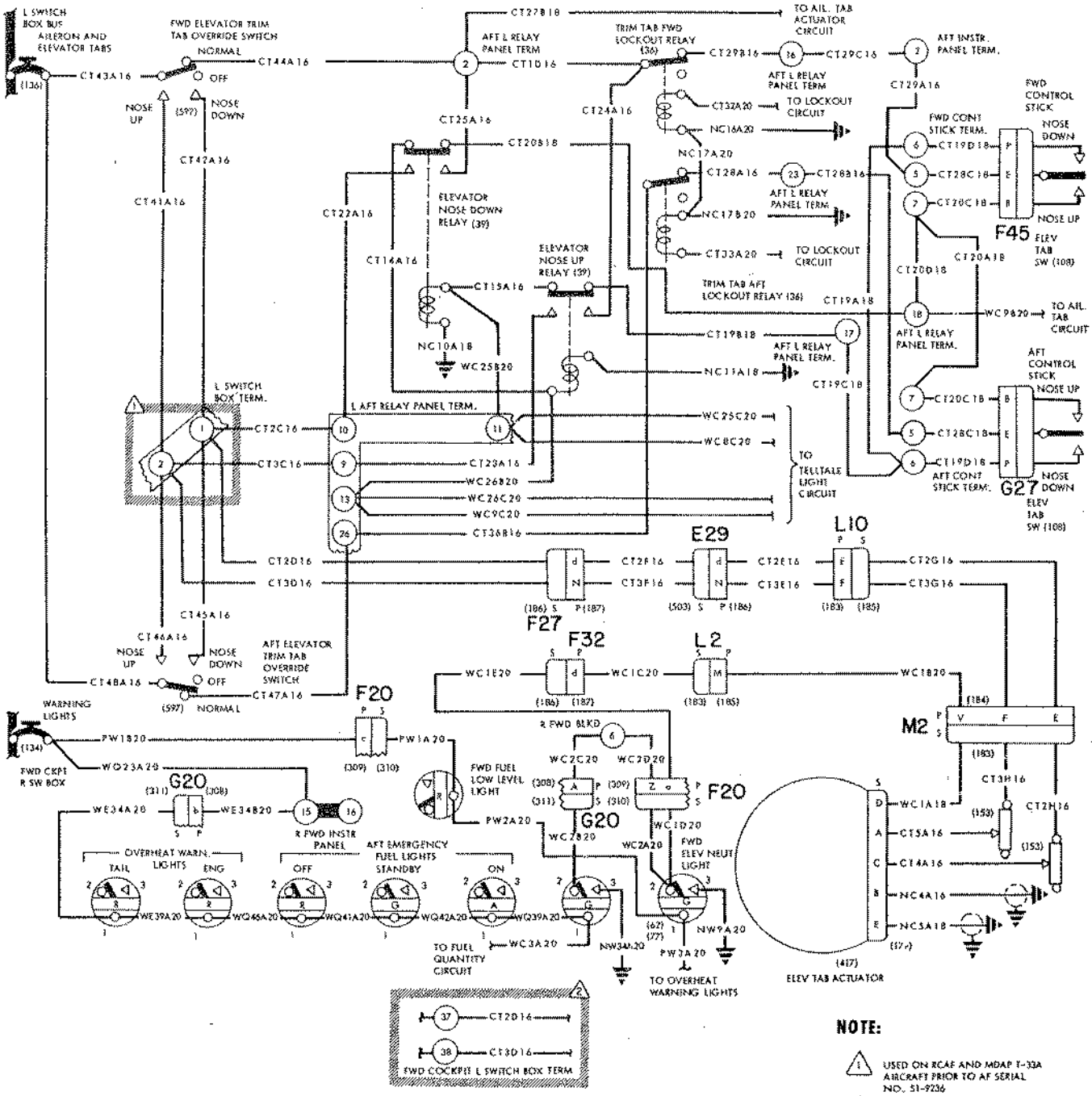
1. USED PRIOR TO AF SERIAL NO. 51-6751 AND ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6751 THRU 51-6818 AND ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-143
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NO. 51-6751 THRU 51-6818 AND ON AIRCRAFT INCORPORATING T.O. 1T-33A-143

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-97-C
39	RELAY			AN3352-1
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
108	SWITCH	GFAP	B-8 OR 8-8 A	MR-5-5230B
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN2161-P15
153	RHEOSTAT	OHMITE	2 Ω 100W	2120B
179	CONNECTOR			AN31068-16S-8S
183	CONNECTOR			AN31068-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN31068-28-12S
187	CONNECTOR			AN3102C-28-12P
254	CONNECTOR			AN31068-28-22S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN31068-28-15S
417	MOTOR	LEAR		157P-3
430	CONNECTOR			AN3102A-28-12P
597	SWITCH	C-H	SP3T	8749

GB 8810
M20-480-8-356

ELEVATOR TRIM TAB ACTUATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4329 THRU 51-6818

Figure 8-90. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
39	RELAY			AN3353-1
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
108	SWITCH	GFAE	B-8 OR B-8A	MIL-S-5210B
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
153	RHEOSTAT	OHMITE	2.2Ω 100W	2120B
179	CONNECTOR			AN3106B-16S-8S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-9P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
417	MOTOR	LEAR		157P-3
503	CONNECTOR			AN3100A-28-12P
597	SWITCH	C-H	SP3T	B749

NOTE:

1. USED ON RCAF AND MDAP T-33A AIRCRAFT PRIOR TO AF SERIAL NO. 51-9236
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NO. 51-6819 THRU 51-9235. USED ON ALL AIRCRAFT AF SERIAL NO. 51-9236 AND SUBSEQUENT

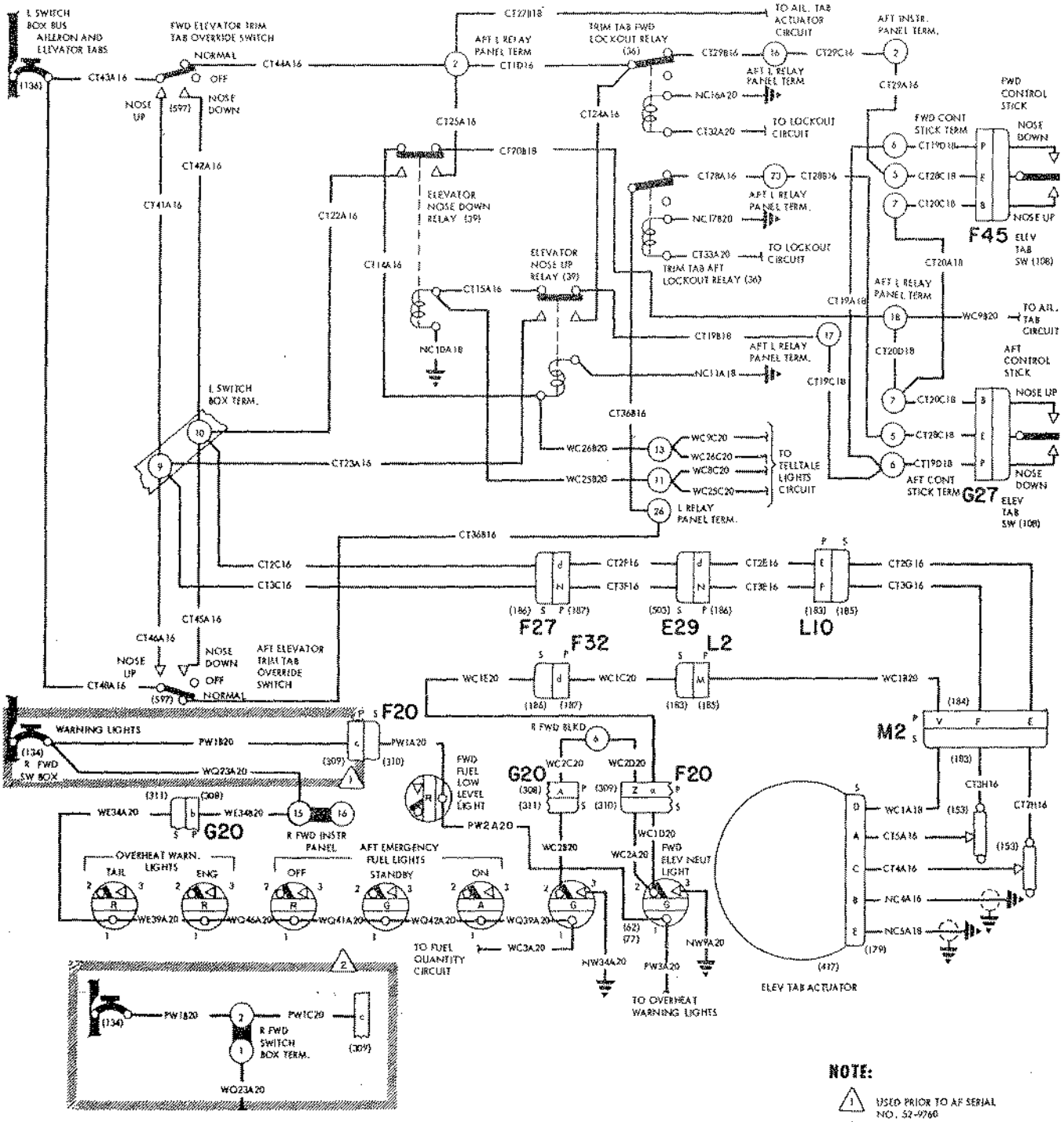
ELEVATOR TRIM TAB ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

GB 8814
M20-480-8-357

Figure 8-91. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-c
39	RELAY			AN3353-1
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-373
108	SWITCH	GEAF	8-8	MIL-S-5210
134	CIRCUIT PROTECTOR			AN3163-P5
136	CIRCUIT PROTECTOR			AN3161-P15
153	RHEOSTAT	OHMITE	2 Ω, 90W	21208
179	CONNECTOR			AN3106-16S-8S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
[illegible]	CONNECTOR			AN3102A-28-11P
6	CONNECTOR			AN3106-28-12S
67	CONNECTOR			AN3021-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-22-7S
311	CONNECTOR			AN3106-28-15S
417	MOTOR	LEAR		T57P-3
503	CONNECTOR			AN3100A-28-12P
597	SWITCH	C-H	SPST	8745

GB1402
EM20-42-8-358

NOTE:

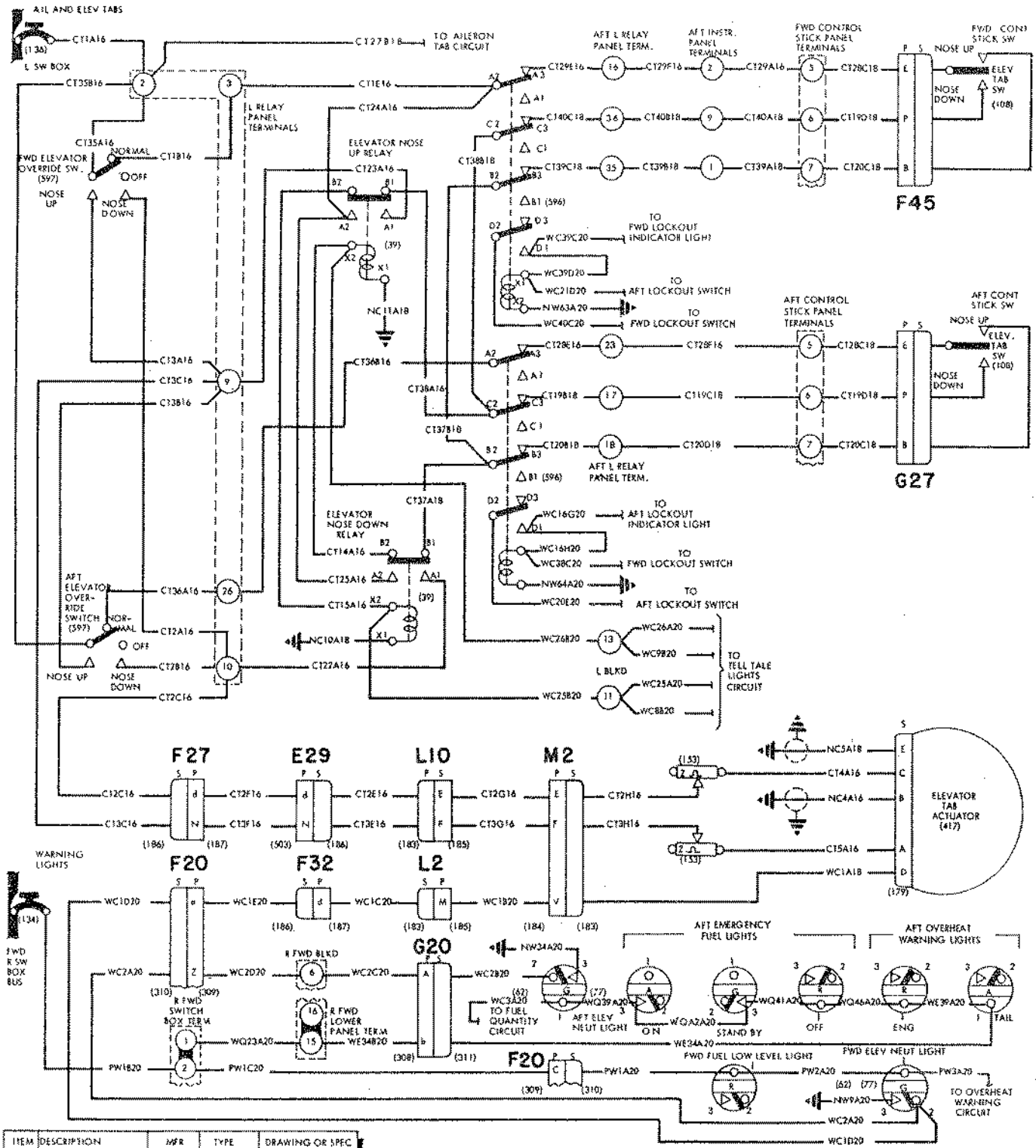
1. USED PRIOR TO AF SERIAL NO. 52-9760
2. USED ON AF SERIAL NO. 52-9760 AND SUBSEQUENT

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9635 THROUGH 53-5285 EXCEPT 52-9876 THROUGH 52-9905

Figure 8-92. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
39	RELAY	LEACH		AN3353-1
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
108	SWITCH	GFAE	8 - 8	MIL-S-6528/8
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
153	RESISTOR	OHMITE	2/3100W	71208
379	CONNECTOR			AN31068-16S-8S
183	CONNECTOR			AN31068-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN31068-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN31068-32-7S
311	CONNECTOR			AN31068-28-15S
417	ACTUATOR ELEV TAB	LEAR		157P-3
503	CONNECTOR			AN31006-28-12P
596	RELAY			MS25024
597	SWITCH	C-H	3P3T	8749

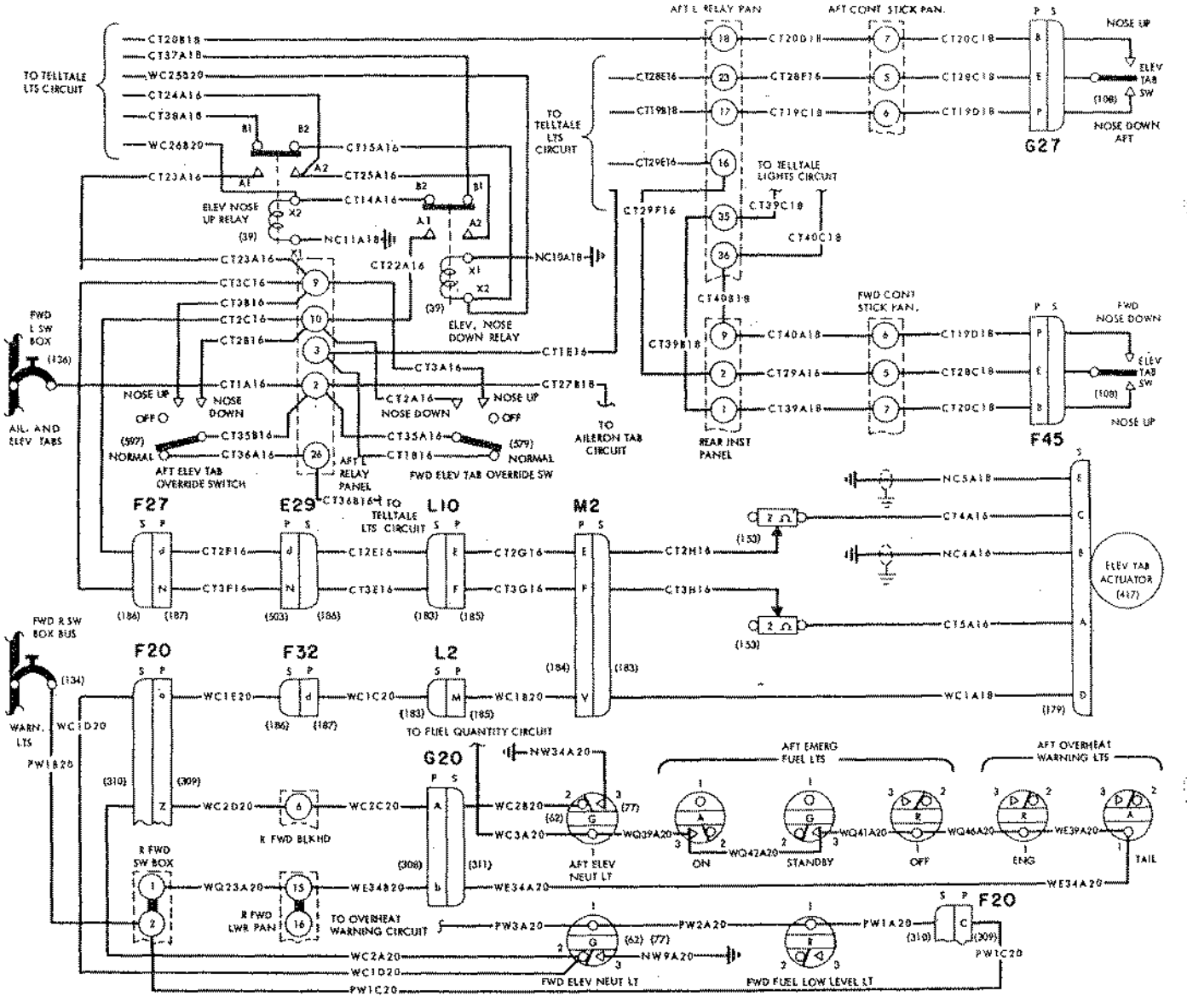
EM20-42-8-359
GB1404

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5286 THROUGH 53-5485

Figure 8-93. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
39	RELAY	LEACH		AN3353-1
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
108	SWITCH	GFAE	8-8	MIL-S-5210B
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3163-P15
153	RESISTOR	OHMITE	2 Ω 100W	21208
179	CONNECTOR			AN3106B-16S-8S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102A-28-12P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
417	ACTUATOR ELEV TAB	LEAR		157F-3
503	CONNECTOR			AN3100A-28-12P
597	SWITCH	C-H	SPST	8749

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

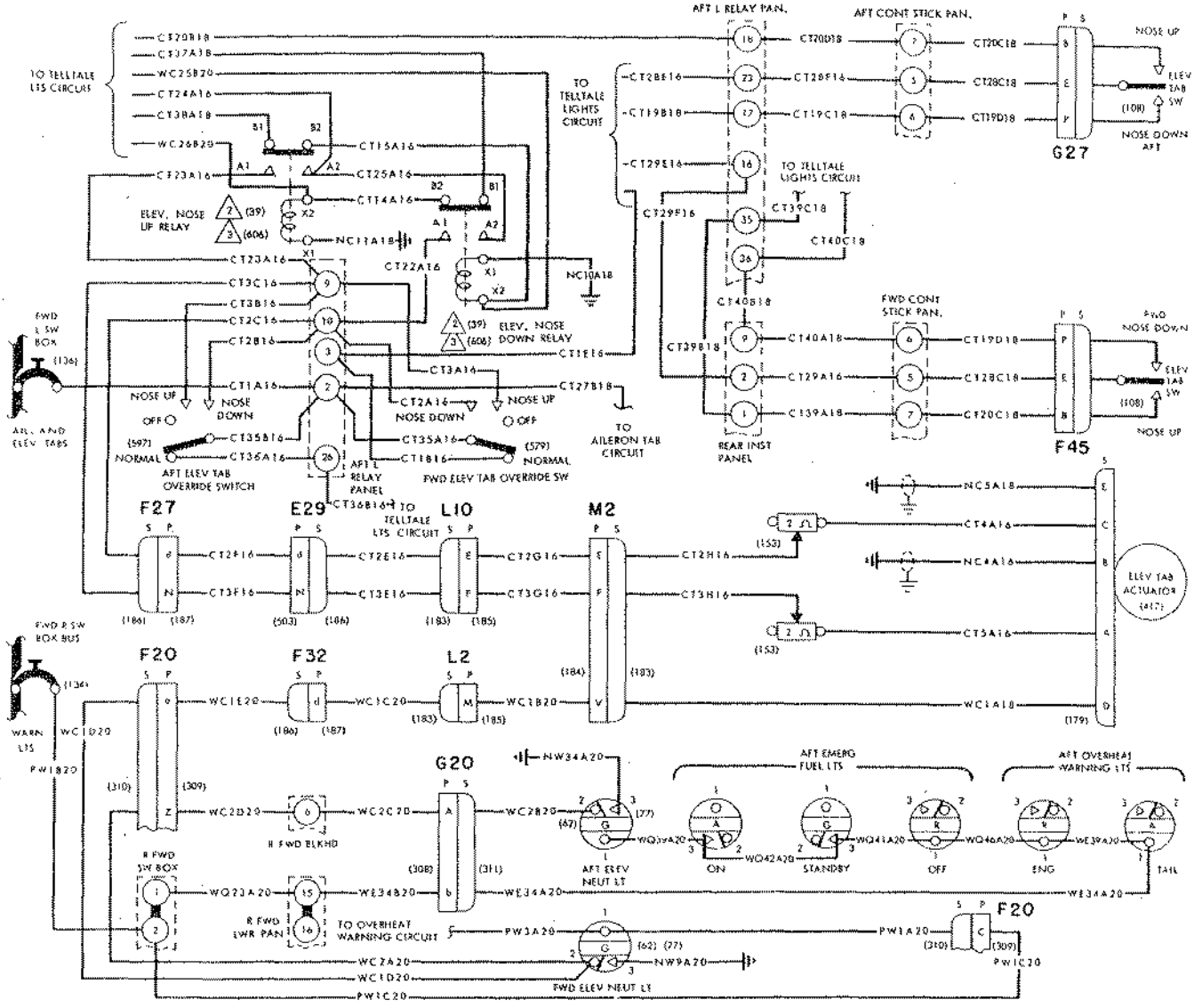
MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5486 THROUGH 53-5665

GB 8813

M20-48D 8-324

Figure 8-94. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
2 3	39 RELAY	LEACH		AN3353-1
	62 LIGHT		GREEN	AN3157-3
	77 LAMP			6N3121-313
1	108 SWITCH	GFAE	B-8	MIL-S-5210B
	134 CIRCUIT PROTECTOR			AN3161-P5
	136 CIRCUIT PROTECTOR			AN3161-P15
	153 RESISTOR	OHMITE	2 5% 100W	21208
	179 CONNECTOR			AN3106B-16S-8S
	183 CONNECTOR			AN3106B-28-11S
	184 CONNECTOR			AN3102C-28-11P
	185 CONNECTOR			AN3102A-28-11P
	186 CONNECTOR			AN3106B-28-12S
	187 CONNECTOR			AN3102C-28-12P
	308 CONNECTOR			AN3102A-28-12P
	309 CONNECTOR			AN3102A-32-7P
	310 CONNECTOR			AN3106B-32-7S
	331 CONNECTOR			AN2106B-28-15S
4	417 ACTUATOR ELEV TAB	LEAR		157P-1
6	417 ACTUATOR ELEV TAB	LEAR		157P-3A
	503 CONNECTOR			AN3100A-28-12P
3 5	597 SWITCH	C-H	SPST	8749
3	606 RELAY	LEACH		7064-15N
5	606 RELAY			AN3353-2

NOTE

1. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 54-1525 AND SUBSEQUENT
2. USED PRIOR TO AF SERIAL NO. 53-5853 INCLUDING NO. 54-1523 THROUGH 54-1583, AND 54-2689 THROUGH 54-2728
3. USED ON AF SERIAL NO. 53-5853 THROUGH 54-7423 EXCEPT 54-1523 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728
4. USED PRIOR TO AF SERIAL NO. 56-1624
5. USED ON AF SERIAL NO. 56-1624 AND SUBSEQUENT
6. USED ON AF SERIAL NO. 56-1684 AND SUBSEQUENT

GB 8812

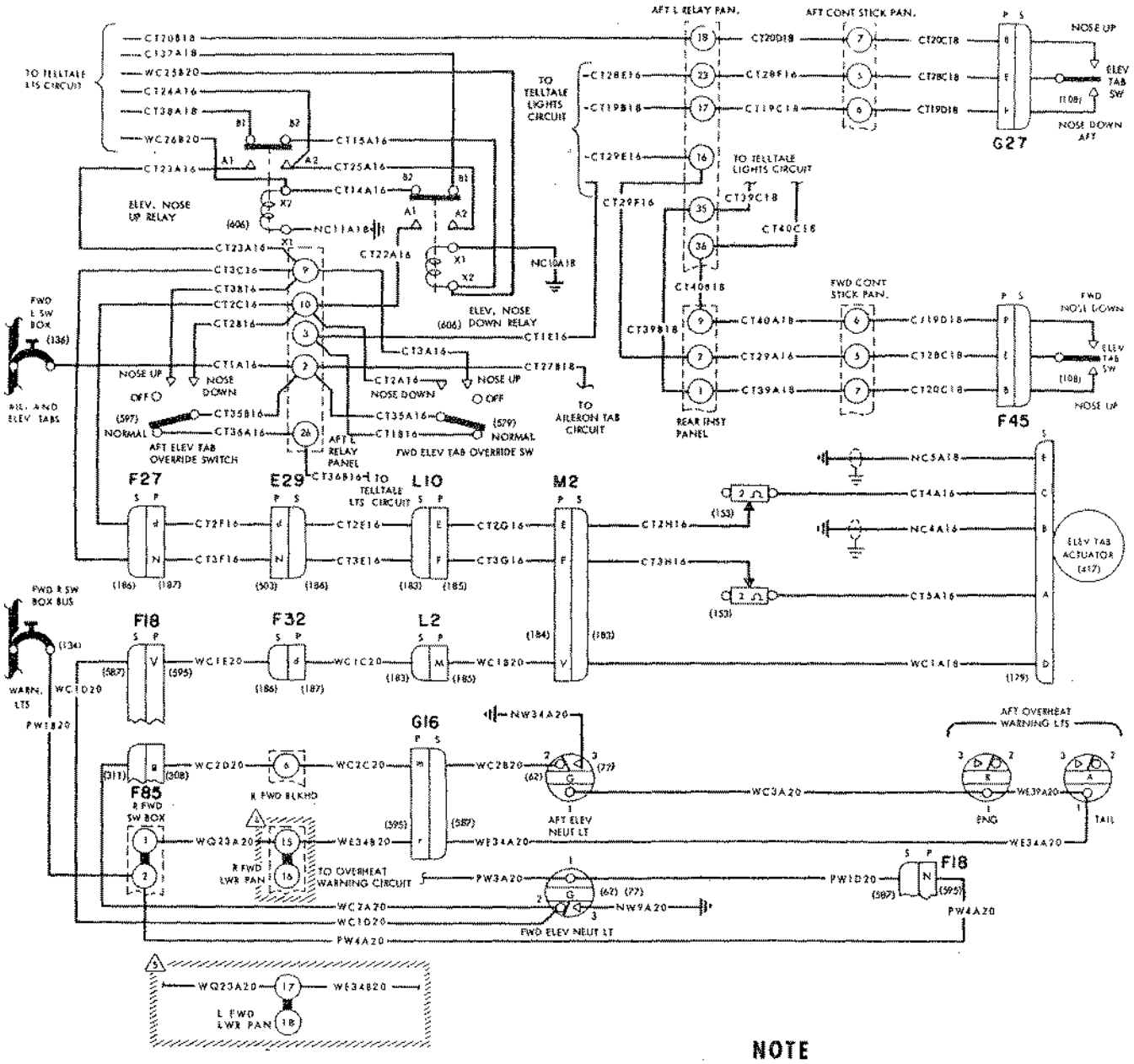
A620-ABD-A-338

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 53-5666 AND SUBSEQUENT

Figure 8-95. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
108	SWITCH	GFAE	B-B	MIL-S-52108
134	CIRCUIT PROTECTOR			AN3161-P5
136	CIRCUIT PROTECTOR			AN3161-P15
153	RESISTOR	OHMITE	2 100W	21208
179	CONNECTOR			AN3106B-16S-8S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102A-28-15P
313	CONNECTOR			AN3106B-28-15S
1 2 417	ACTUATOR ELEV TAB	LEAR		1579-3
3 417	ACTUATOR ELEV TAB	LEAR		1579-3A
503	CONNECTOR			AN3100A-28-12P
587	CONNECTOR			AN3102A-20-21P
595	CONNECTOR			AN3106B-28-21S
597	SWITCH	C-H	SP3T	8749
1 606	RELAY	LEACH		7064-15N
2 606	RELAY			AN3333-2

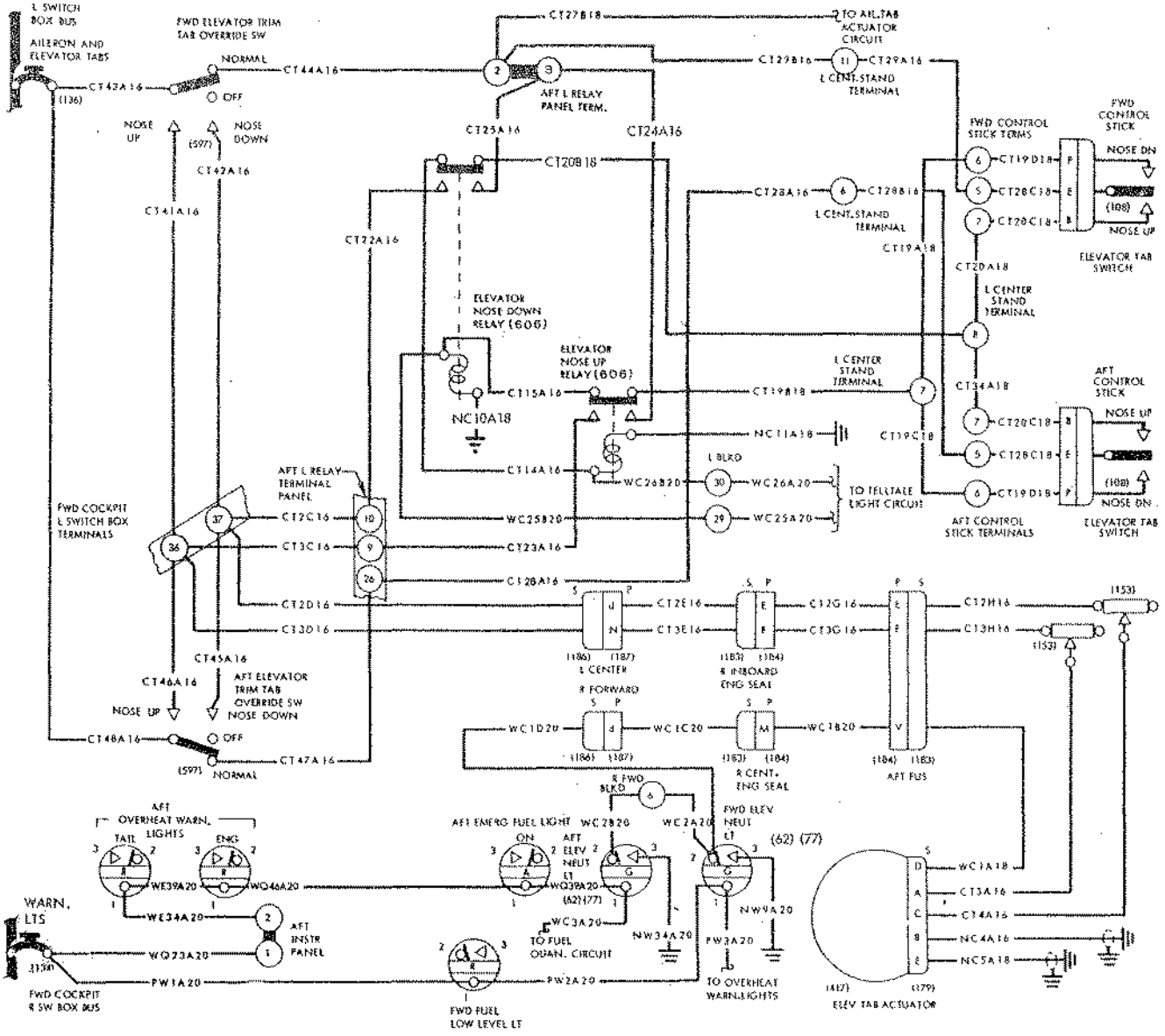
NOTE

1. USED PRIOR TO AF SERIAL NO. 56-1624
2. USED ON AF SERIAL NO. 56-1624 AND SUBSEQUENT
3. USED ON AF SERIAL NO. 56-1684 AND SUBSEQUENT
4. USED PRIOR TO AF SERIAL NO. 58-673
5. USED ON AF SERIAL NO. 58-673 AND SUBSEQUENT

HB 63
M20-49-8-396

ELEVATOR TRIM TAB ACTUATOR CIRCUIT
MODEL T-33-5

Figure 8-96. Elevator Trim Tab Actuator Circuit



NOTE

1 USED ON AIRCRAFT INCORPORATING T O 1T-33A-638

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC.
62	LIGHT		GREEN	MS25331-3
77	LAMP			MS25231-313
108	SWITCH			65C47022
134	CIRCUIT PROTECTOR			MS25017-5
136	CIRCUIT PROTECTOR			MS25017-15
153	RESISTOR	OHMITE	2-100W	21208
179	CONNECTOR			MS3106R-165-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
186	CONNECTOR			MS3106R-28-12S
187	CONNECTOR			MS3102R-28-12P
417	ACTUATOR ELEV. TAB	LEAR		157P-3A
597	SWITCH		SPST	MS25228-1
606	RELAY			MS24187-D3

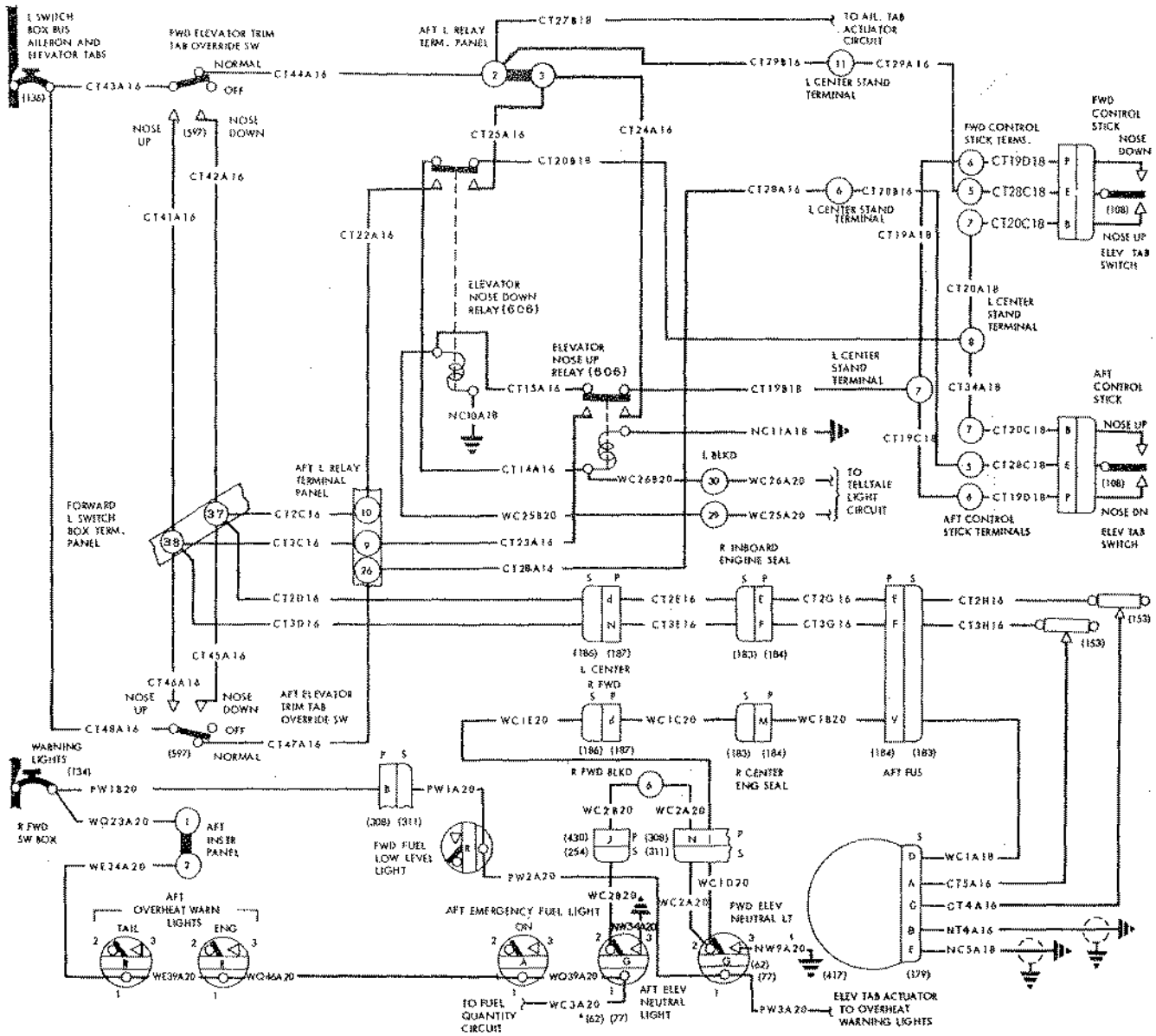
1

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

T-33A-5 AND T-33A-15
S/N 50-385 THRU 51-4328

EM20-59-8-516

Figure 8-96A. Elevator Trim Tab Actuator Circuit



NOTE

1 USED ON AIRCRAFT INCORPORATING T O 1T-33A-638

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC.
62	LIGHT		GREEN	MS25331-3
77	LAMP			MS25231-313
108	SWITCH			65C47022
134	CIRCUIT PROTECTOR			MS25017-5
136	CIRCUIT PROTECTOR			MS25017-15
153	RESISTOR	OHMITE	2-100W	21208
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
186	CONNECTOR			MS3106R-28-12S
187	CONNECTOR			MS3102R-28-12P
254	CONNECTOR			MS3106R-28-12S
308	CONNECTOR			MS3102R-28-15P
311	CONNECTOR			MS3106R-28-15S
417	ACTUATOR ELEV. TAB	LEAR		157P-3A
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187-D1

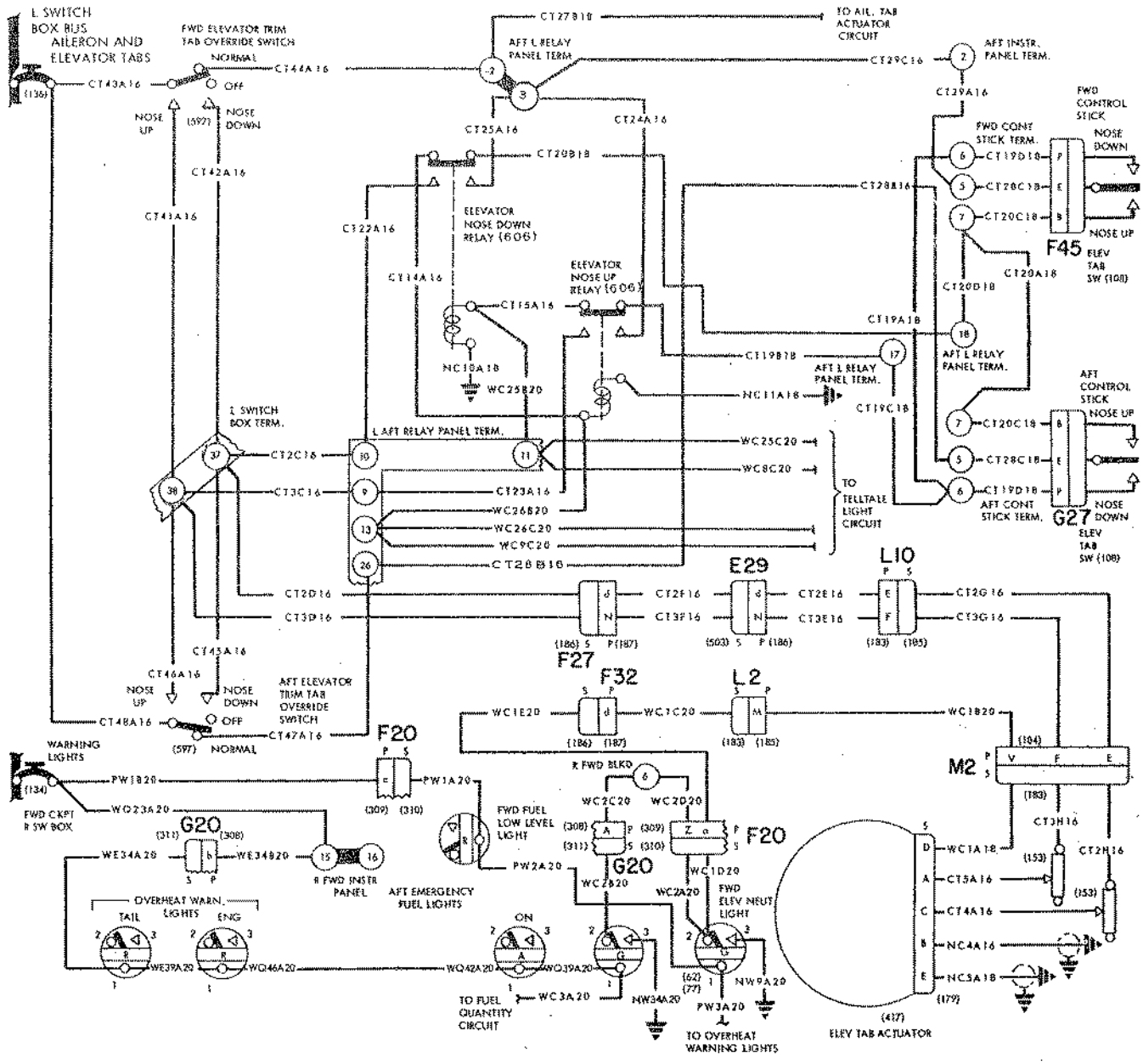
1

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

T-33A-5 AND T-33A-15 S/N 51-4329 THRU 51-6818

EM20-59-8-517

Figure 8-96B. Elevator Trim Tab Actuator Circuit



NOTE:

1 USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-638

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
62	LIGHT		GREEN	MS25331-3
77	LAMP			MS25231-319
108	SWITCH			55C47022
134	CIRCUIT PROTECTOR			MS25017-5
136	CIRCUIT PROTECTOR			MS25017-15
153	RESISTOR	OHMITE	2A100W	21208
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
185	CONNECTOR			MS3102R-28-11P
186	CONNECTOR			MS3106R-28-12S
187	CONNECTOR			MS3102R-28-12P
308	CONNECTOR			MS3102R-28-15P
309	CONNECTOR			MS3102R-32-7P
310	CONNECTOR			MS3106R-32-7S
311	CONNECTOR			MS3106R-28-15S
417	ACTUATOR ELEV. TAB	LEAR		157P-3A
503	CONNECTOR			MS3100R-28-12P
597	SWITCH		SPST	MS25128-1
606	RELAY			MS24187-D1

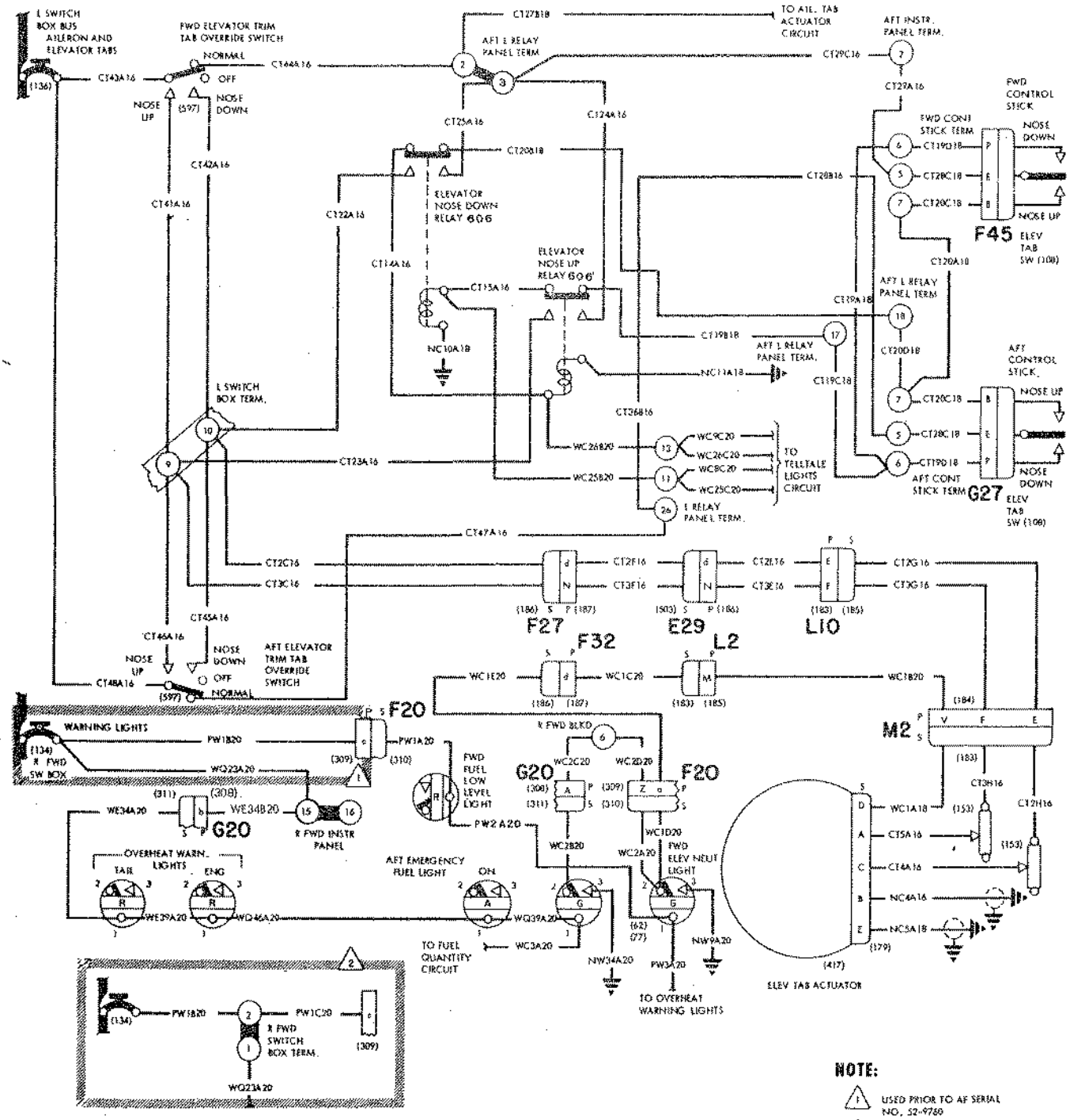
1 ELEVATOR TRIM TAB ACTUATOR CIRCUIT

T-33A-5 AND T-33A-15

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

EM20-59-8-518

Figure 8-96C. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC.
62	LIGHT		GREEN	MS25331-3
77	LAMP			MS25231-313
100	SWITCH			65C47022
134	CIRCUIT PROTECTOR			MS25017-5
136	CIRCUIT PROTECTOR			MS25017-15
153	RESISTOR	OHMITE	2A100W	21208
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
185	CONNECTOR			MS3102R-28-11P
186	CONNECTOR			MS3106R-28-12S
187	CONNECTOR			MS3102R-28-12P
308	CONNECTOR			MS3102R-28-19P
309	CONNECTOR			MS3102R-32-7P
310	CONNECTOR			MS3106R-32-7S
311	CONNECTOR			MS3106R-28-15S
417	ACTUATOR ELEV. TAB	LEAR		157P-3A
503	CONNECTOR			MS3108R-28-12P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187-D3

NOTE:

1. USED PRIOR TO AF SERIAL NO. 52-9760
2. USED ON AF SERIAL NO. 52-9760 AND SUBSEQUENT
3. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-638

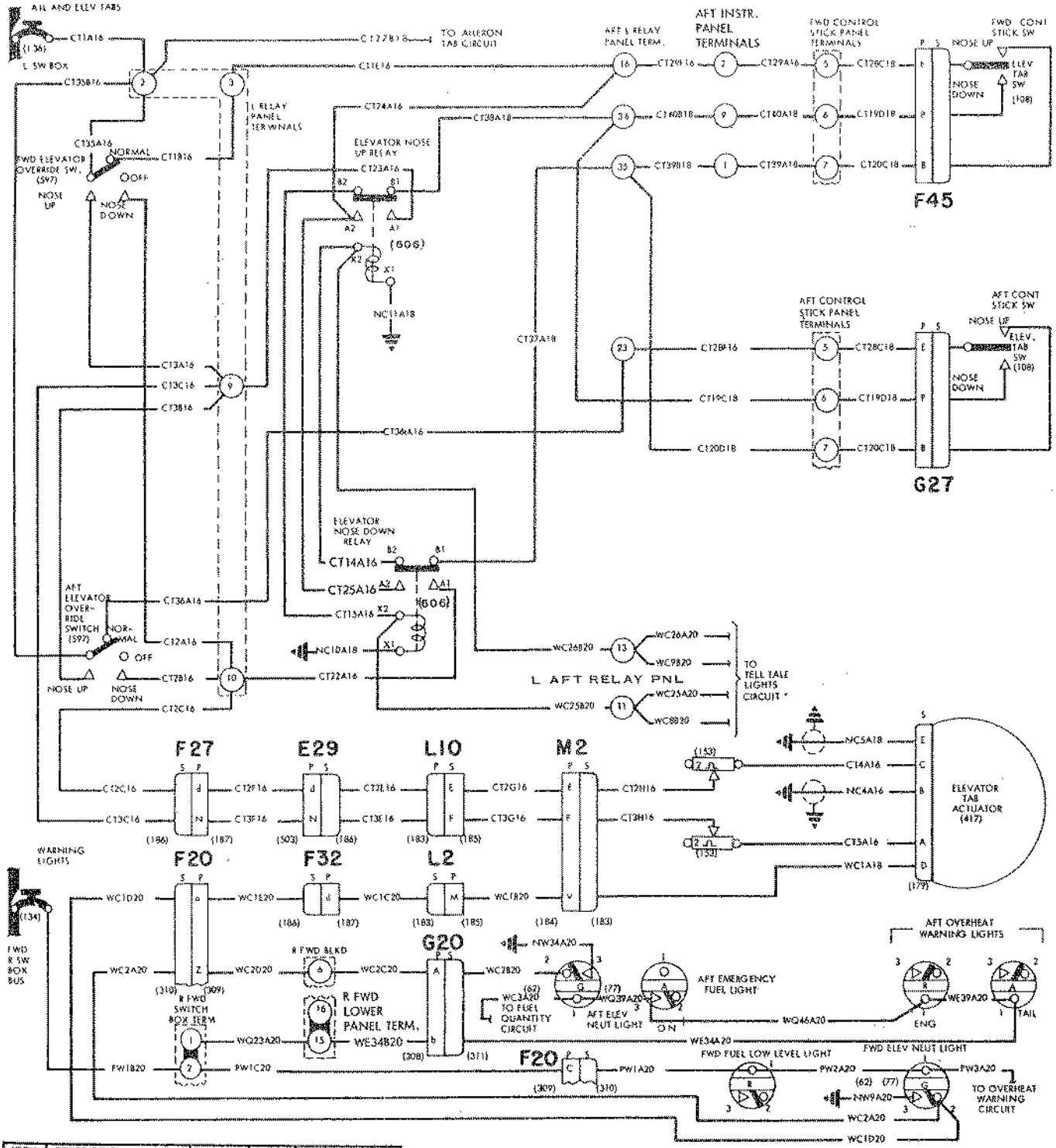
3

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

T-33A-5 and T-33A-15
S/N 52-9635 thru 53-5285
EXCEPT 52-9876 thru 52-9905

EM20-59-8-519

Figure 8-96D. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC.
62	LIGHT		GREEN	MS25331-3
77	LAMP			MS25237-313
108	SWITCH			6SCA7022
134	CIRCUIT PROTECTOR			MS25017-5
136	CIRCUIT PROTECTOR			MS25017-15
153	RESISTOR	OHMITE	2A100W	21208
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
185	CONNECTOR			MS3102R-28-11P
186	CONNECTOR			MS3106R-28-12S
187	CONNECTOR			MS3102R-28-12P
308	CONNECTOR			MS3102R-28-15P
309	CONNECTOR			MS3102R-32-7P
310	CONNECTOR			MS3106R-32-7S
311	CONNECTOR			MS3106R-28-15S
417	ACTUATOR ELEV. TAB	LEAR		157P-3A
503	CONNECTOR			MS3100R-28-12P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187-D1

NOTE

1 USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-638

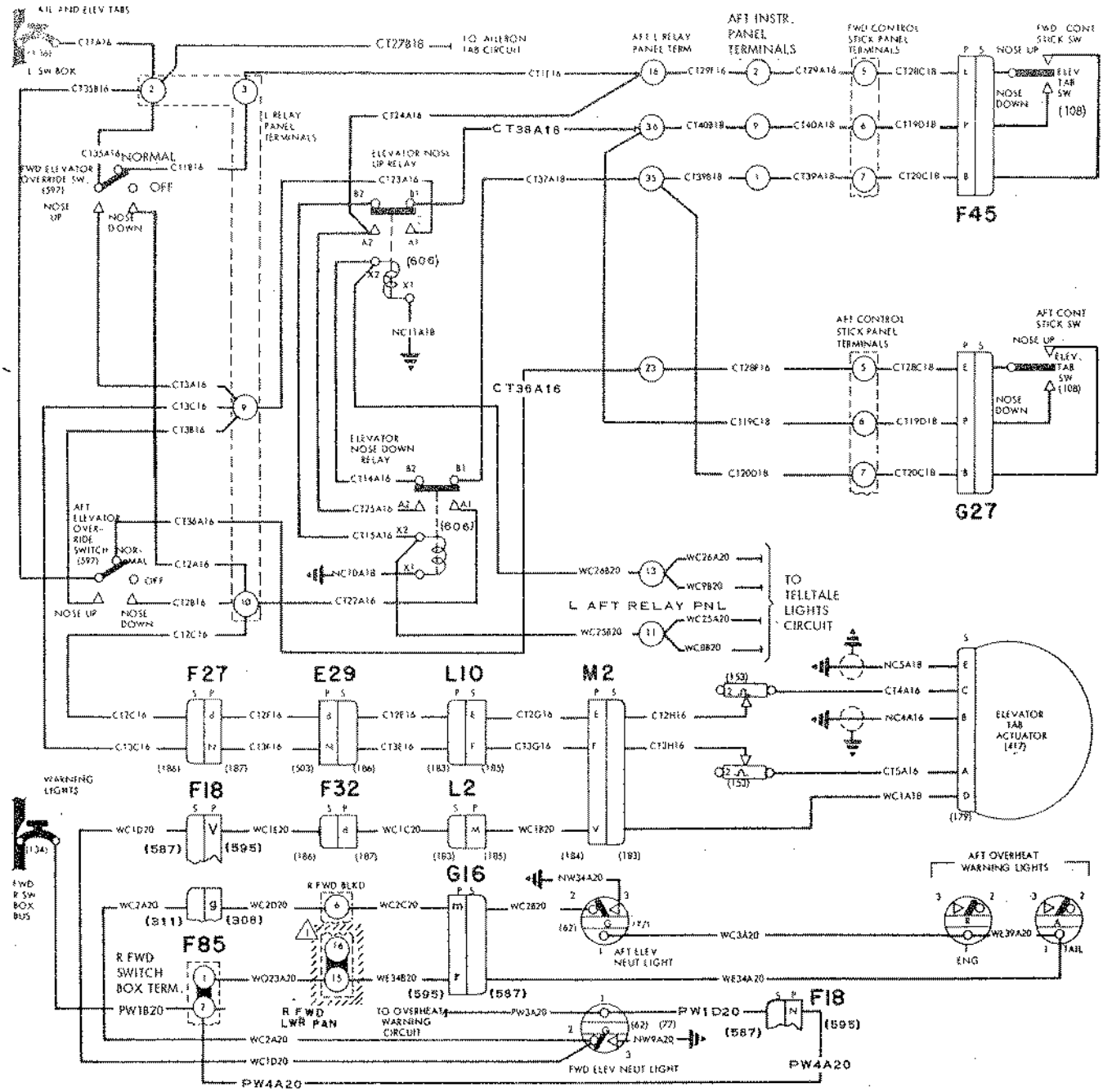
1

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

T-33A-5 and T-33A-15
S/N 53-5286 thru 53-5665

Figure 8-96E. Elevator Trim Tab Actuator Circuit

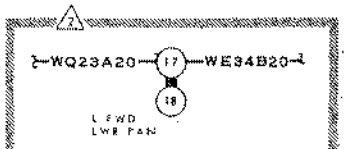
EM20-59-8-520



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
62	LIGHT		GREEN	MS25331-3
77	L AMP			MS25231-313
108	SWITCH			6SC47022
134	CIRCUIT PROTECTOR			MS25017-5
136	CIRCUIT PROTECTOR			MS25017-15
153	RESISTOR	OHMITE	2.2/100W	71208
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
185	CONNECTOR			MS3102R-28-11P
186	CONNECTOR			MS3106R-28-12S
187	CONNECTOR			MS3102R-28-12P
308	CONNECTOR			MS3102R-28-15P
311	CONNECTOR			MS3106R-28-15S
417	ACTUATOR ELEV. TAB	LEAR		1579P-3A
503	CONNECTOR			MS3100R-28-12P
587	CONNECTOR			MS3102R-28-21P
595	CONNECTOR			MS3106R-28-21S
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187-D1

NOTE

1. USED PRIOR TO AF SERIAL NO. 58-671
2. USED ON AF SERIAL NO. 58-671 AND SUBSEQUENT
3. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-638



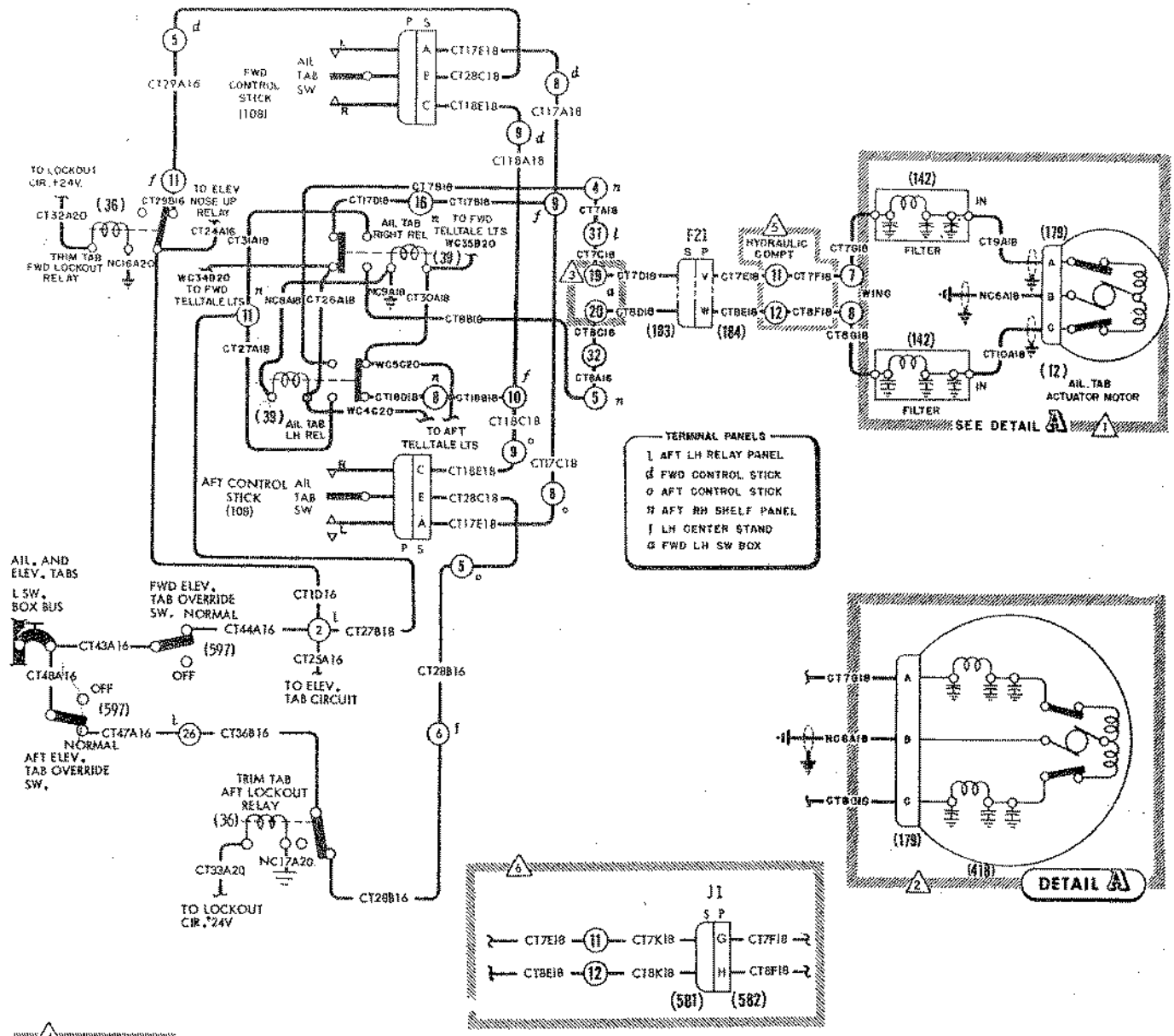
3

ELEVATOR TRIM TAB ACTUATOR CIRCUIT

T-33A-5 and T-33A-15
S/N 53-5666 and SUBSEQUENT

EM20-59-8-521

Figure 8-96F. Elevator Trim Tab Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
△1 12	MOTOR	LEAR		157V
36	RELAY	EL. PROD.		NB-57C
39	RELAY			AN3353-1
108	SWITCH	GFAE	6-BA	MIL-S-5210
136	CIRCUIT PROTECTOR			AN3161-P15
△1 142	FILTER	POTTER	20A	8-120
179	CONNECTOR			MS3106B-16S-8S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
△2 418	MOTOR	LEAR		157V-2
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P
597	SWITCH	C-H	SPST	8749

NOTE

△1 USED ON SERIAL NO. 48-356 THROUGH 49-900.

△2 USED ON SERIAL NO. 49-901 AND SUBSEQUENT

△3 USED ON AIRCRAFT NOT INCORPORATING T.O. NO. 1T-33A-143

△4 USED ON AIRCRAFT INCORPORATING T.O. NO. 1T-33A-143

△5 USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567

△6 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

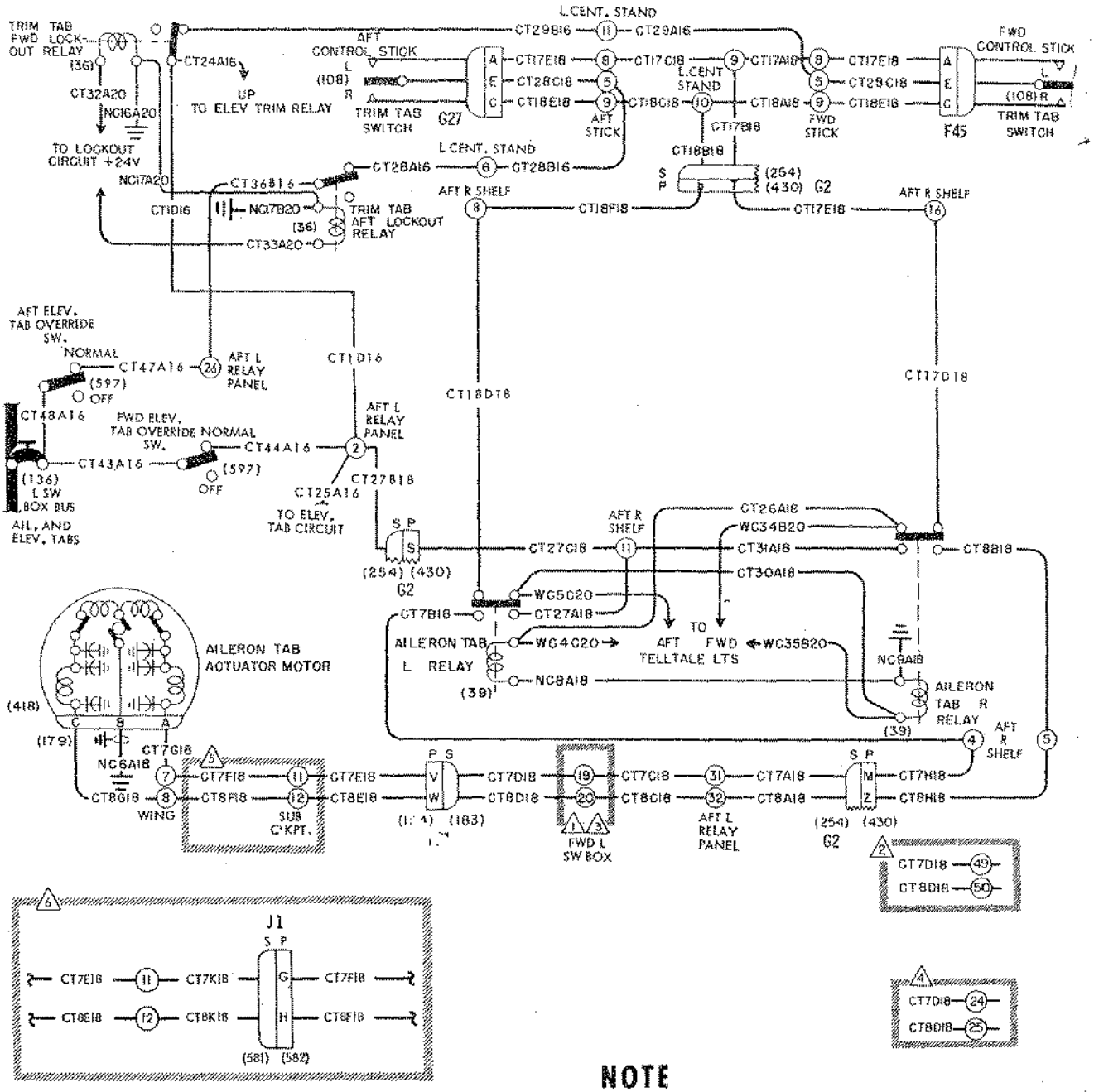
AILERON TAB MOTOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4328

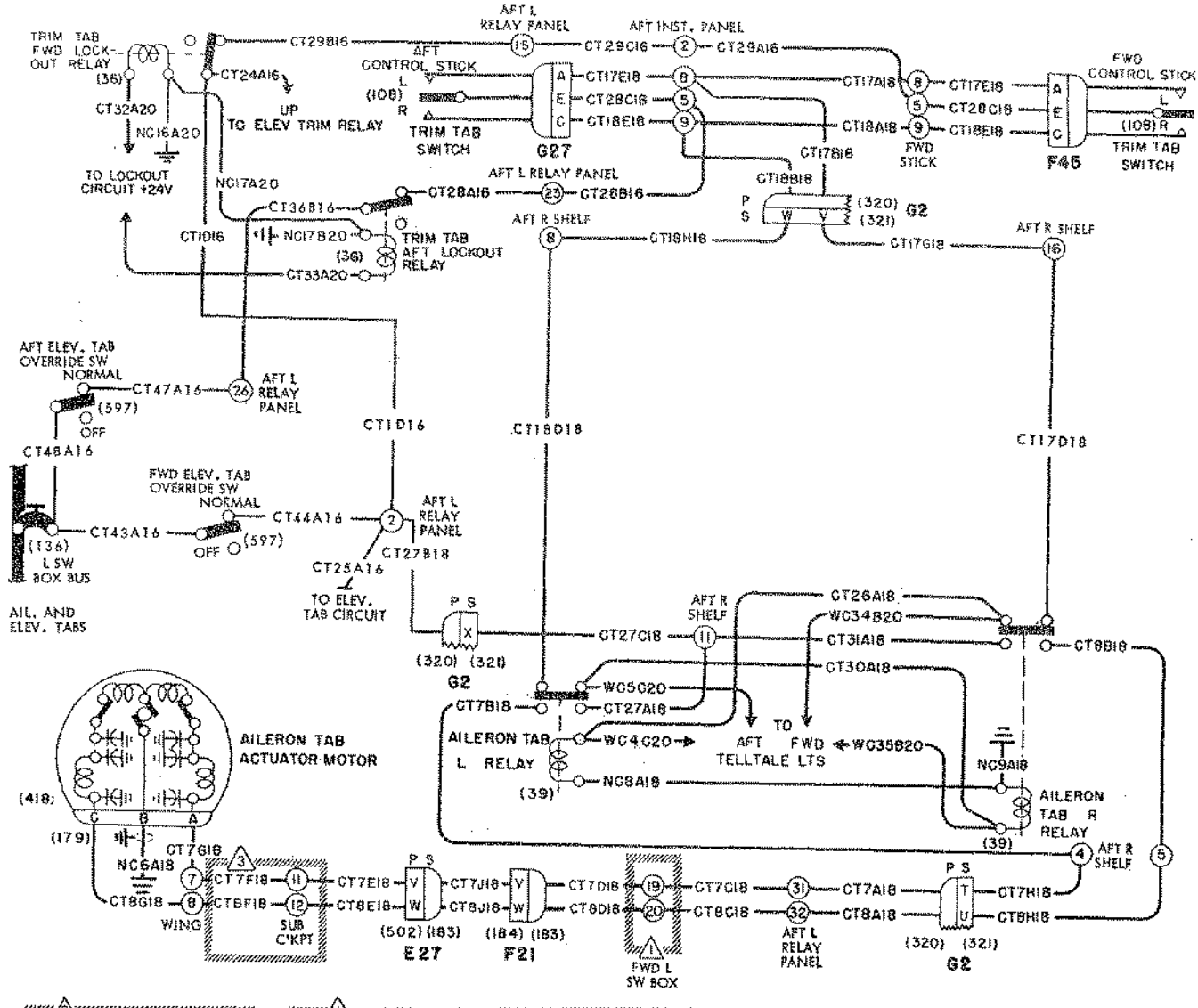
HB 610
M20-50-8-58

Figure 8-97. Aileron Tab Motor Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57C
39	RELAY			AN3353-1
108	SWITCH	GFAE	B-8A	MIL-S-5210
136	CIRCUIT PROTECTOR			AN3161-P15
179	CONNECTOR			MS3106B-16S-8S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
254	CONNECTOR			MS3108B-28-12S
418	MOTOR	LEAR		157V-2
430	CONNECTOR			MS3102A-28-12P
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P
597	SWITCH	C-H	SP3T	8749

Figure 8-98. Aileron Tab Motor Circuit



NOTE

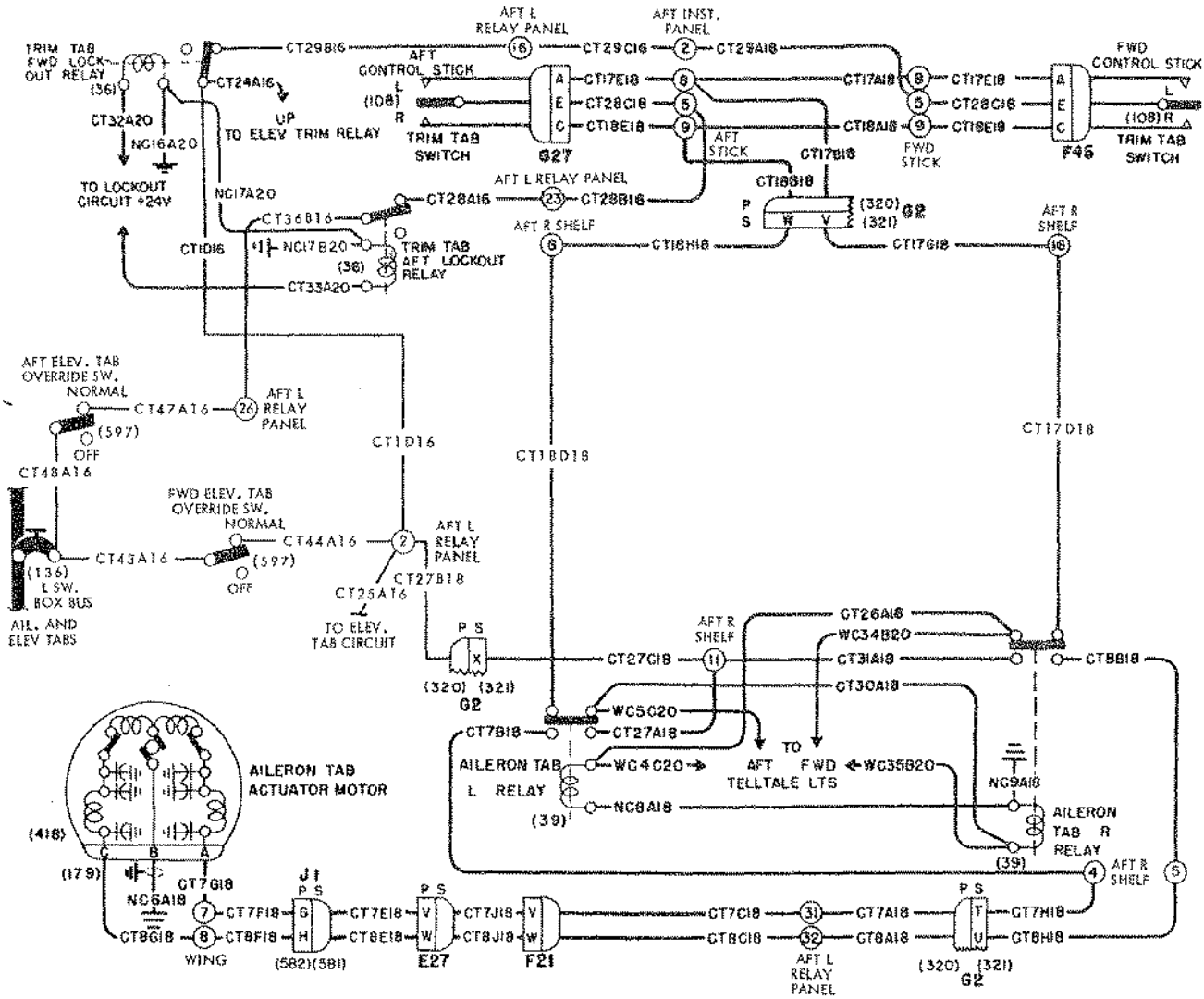
1. USED ON RCAF & MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235. USED ON ALL AIRCRAFT AF SERIAL NO. 51-9236 AND SUBSEQUENT
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57C
39	RELAY			AN3353-1
108	SWITCH	GFAE	B - 8A	MIL-S-5210
136	CIRCUIT PROTECTOR			AN3361-P15
179	CONNECTOR			MS3106B-16S-8S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
418	MOTOR	LEAR		157V-2
502	CONNECTOR			MS3100A-28-11P
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P
597	SWITCH	C-H	5P3T	8749

HB 612
M20-50-8-60

AILERON TAB MOTOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

Figure 8-99. Aileron Tab Motor Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD.		NB-57C
39	RELAY			AN3353-1
108	SWITCH	GFAE	8-8A	MIL-S-5210
136	CIRCUIT PROTECTOR			AN3161-P1S
179	CONNECTOR			MS3106B-16S-8S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
418	MOTOR	LEAR		157V-2
502	CONNECTOR			MS3100A-28-11P
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P
597	SWITCH	C-H	SP3T	8749

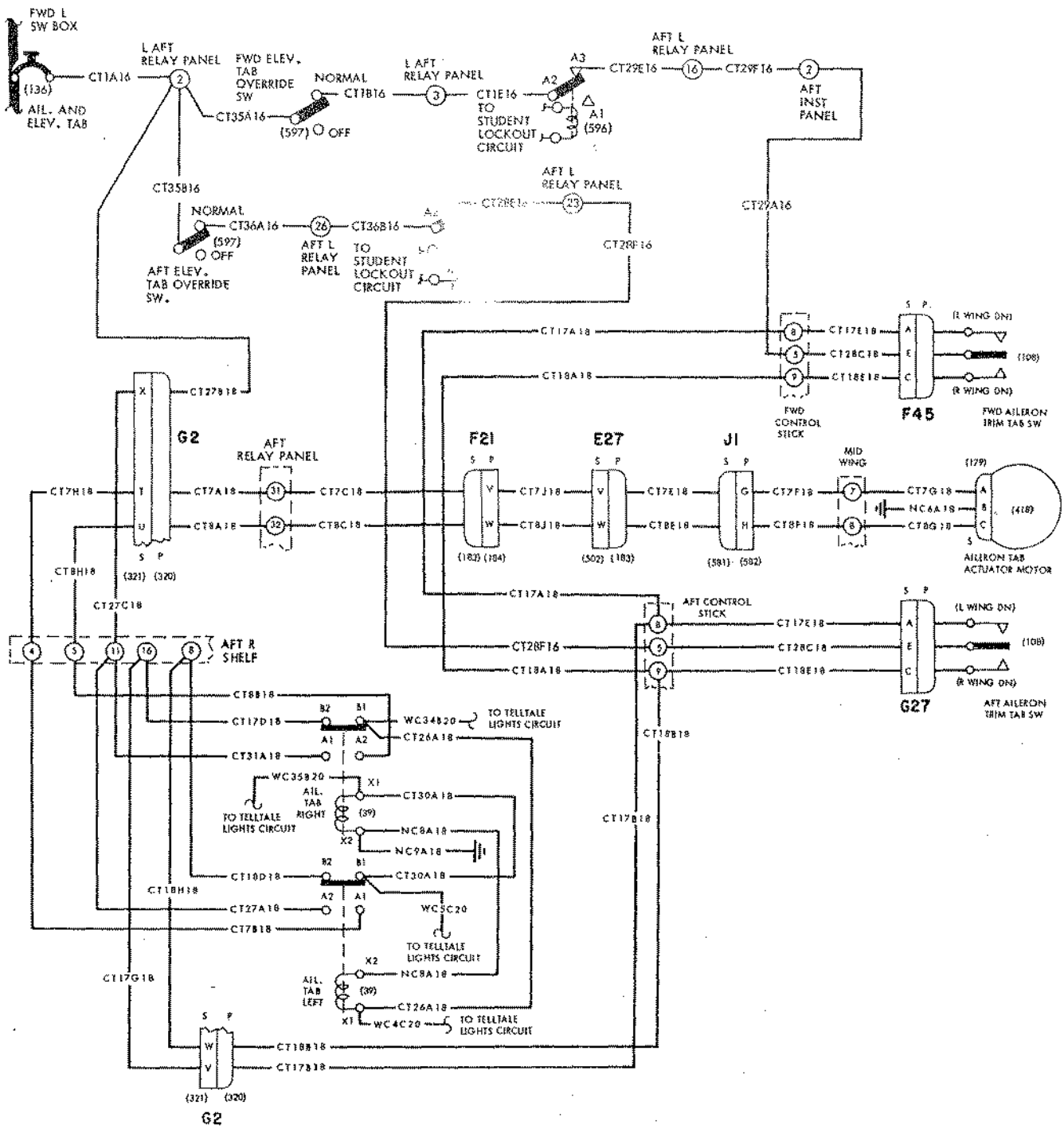
M20-45-8-198
GB 4878

AILERON TAB MOTOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIALS NO. 52-9635 THROUGH 53-5285, EXCEPT 52-9876 THROUGH 52-9905

Figure 8-100. Aileron Tab Motor Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
39	RELAY			AN3353-1
108	SWITCH	GFAE	B-8A	MIL-S-52108
136	CIRCUIT PROTECTOR			AN3161-P15
179	CONNECTOR			MS3106B-16S-8S
183	CONNECTOR			MS3106B-28-11S
184	CONNECTOR			MS3102C-28-11P
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
418	MOTOR	LEAR		157V-2
502	CONNECTOR			MS3100A-28-11P
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P
596	RELAY			MS25024-1
597	SWITCH	C-H	SP3T	8749

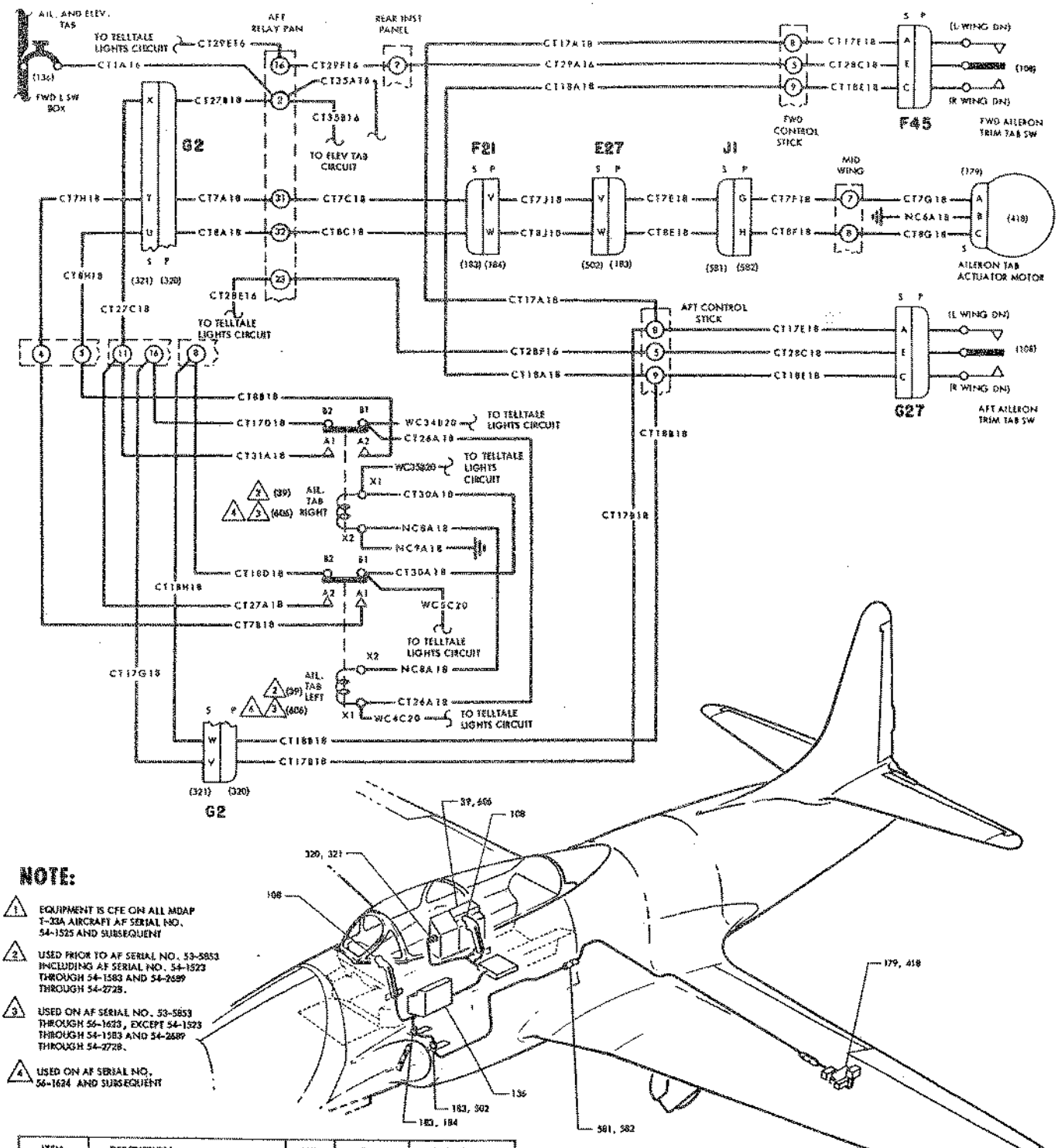
M20-45-8-283
GB 4576

AILERON TAB MOTOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5286 THROUGH 53-5485

Figure 8-101. Aileron Tab Motor Circuit



NOTE:

1. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 54-1525 AND SUBSEQUENT
2. USED PRIOR TO AF SERIAL NO. 53-5853 INCLUDING AF SERIAL NO. 54-1523 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728.
3. USED ON AF SERIAL NO. 53-5853 THROUGH 56-1623, EXCEPT 54-1523 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728.
4. USED ON AF SERIAL NO. 56-1624 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2, 3 39	RELAY	GFAE	B-8 OR B-9A	AN3353-1
1 108	SWITCH			MIL-S-52108
136	CIRCUIT PROTECTOR			AN3161-P15
179	CONNECTOR	LEAR		AN3106B-165-6S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102A-28-12S
418	MOTOR			157-V-2
502	CONNECTOR			AN3100A-28-11P
581	CONNECTOR			AN3106A-28-11S
582	CONNECTOR			AN3100A-28-11P
3, 4 606	RELAY	LEACH		7066-15N
606	RELAY			AN3353-2

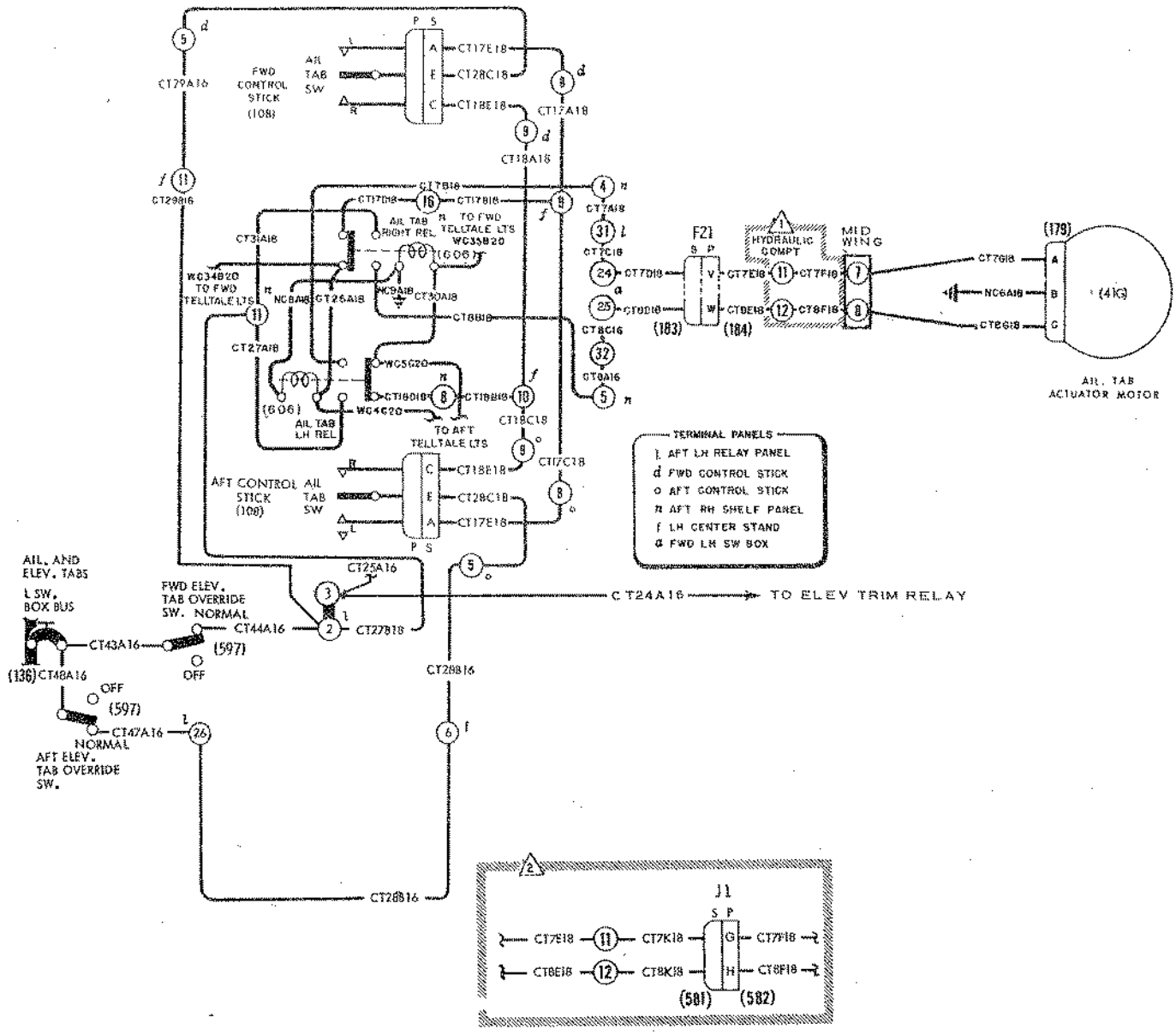
GB 8801
M20-18D-8-325

AILERON TAB MOTOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5406 AND SUBSEQUENT

Figure 8-102. Aileron Tab Motor Circuit



NOTE:

1. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-567
3. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-698

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
108	SWITCH		400-4307	65C47022
136	CIRCUIT PROTECTOR			MS25017-15
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
418	MOTOR	LEAR		157V-2
581	CONNECTOR			MS3106R-28-11S
582	CONNECTOR			MS3100R-28-11P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187D1

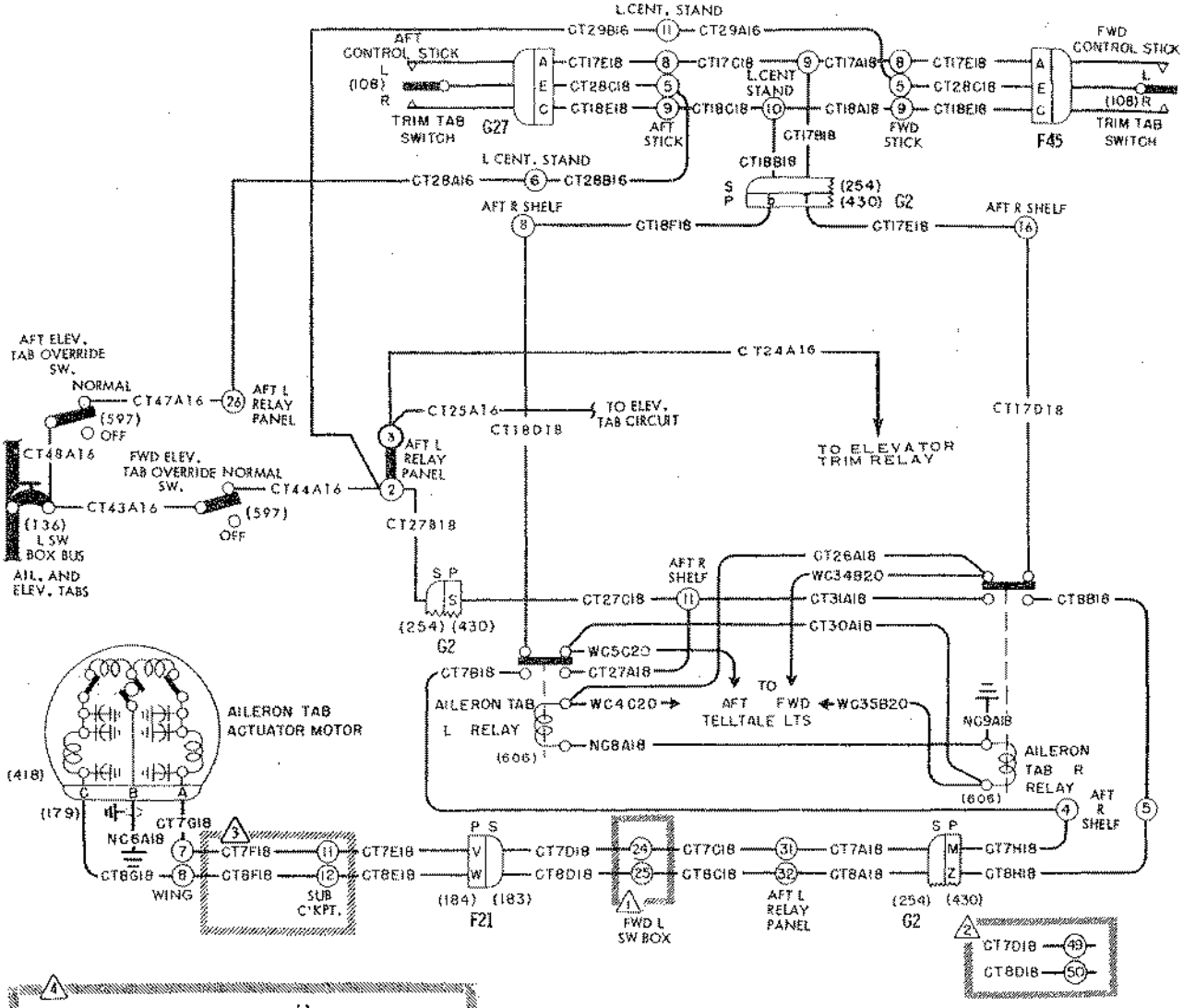
3

AILERON TAB MOTOR CIRCUIT
T-33A-5 AND T-33A-15

APPLIES TO AF SERIAL NO. 50-385 THROUGH 51-4328

EM20-59-8-522

Figure 8-102A. Aileron Tab Motor Circuit



NOTE

1. USED ON AF SERIAL NO. 51-4329 THROUGH NO 51-6751
2. USED ON AF SERIAL NO. 51-6751 THROUGH 51-6818
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-638

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
108	SWITCH	LEAR	400-4307	65C47022
136	CIRCUIT PROTECTOR			MS25017-15
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
254	CONNECTOR			MS3108R-28-12S
418	MOTOR			157V-2
430	CONNECTOR			MS3102R-28-12P
531	CONNECTOR			MS3106R-28-11S
582	CONNECTOR			MS3100R-28-11P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187D1

5

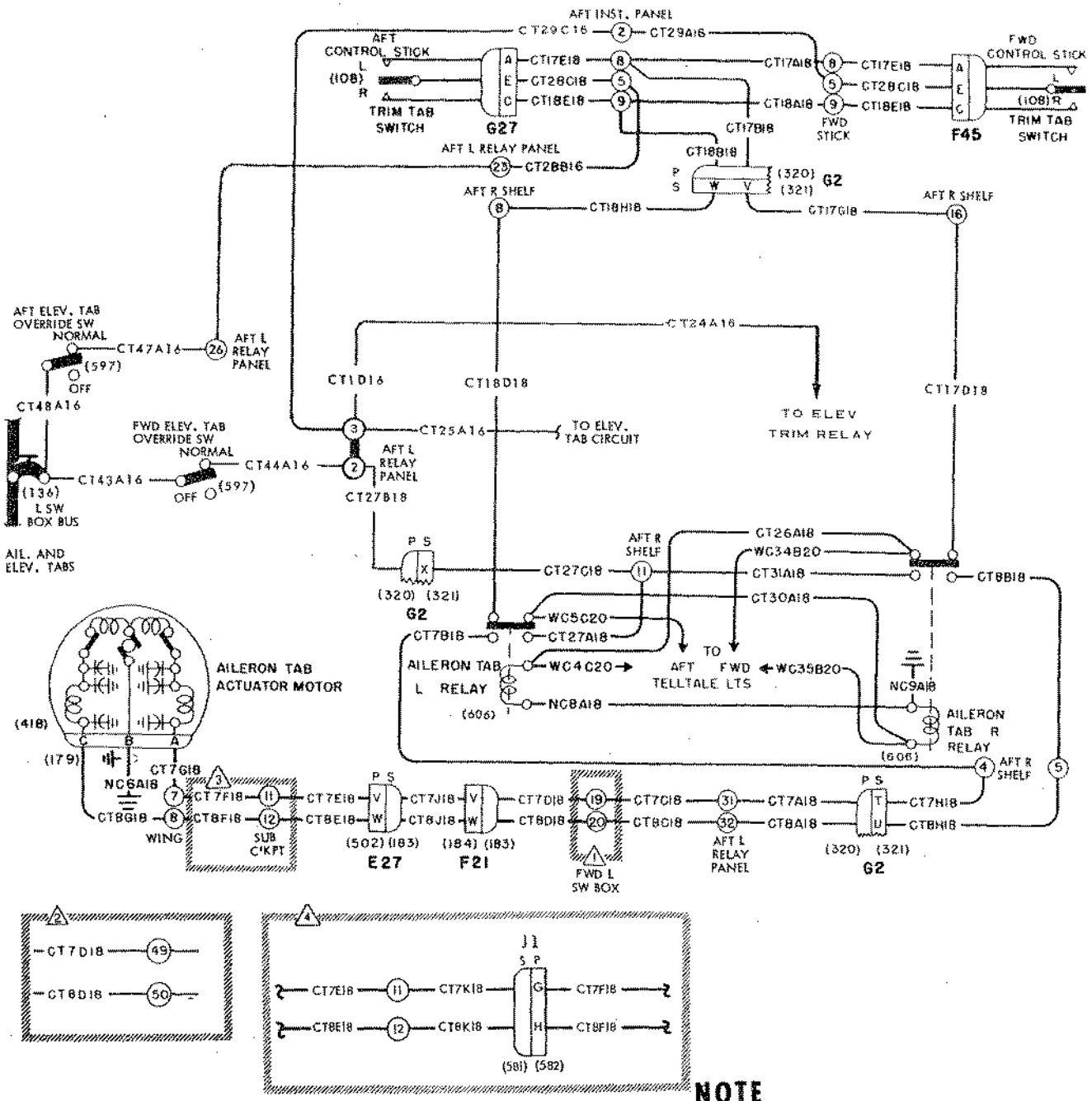
AILERON TAB MOTOR CIRCUIT

T-33A-5 AND T-33A-15

APPLIES TO AF SERIAL NO. 51-4329 THRU 51-6818

EM20-59-8-523

Figure 8-102B. Aileron Tab Motor Circuit



NOTE

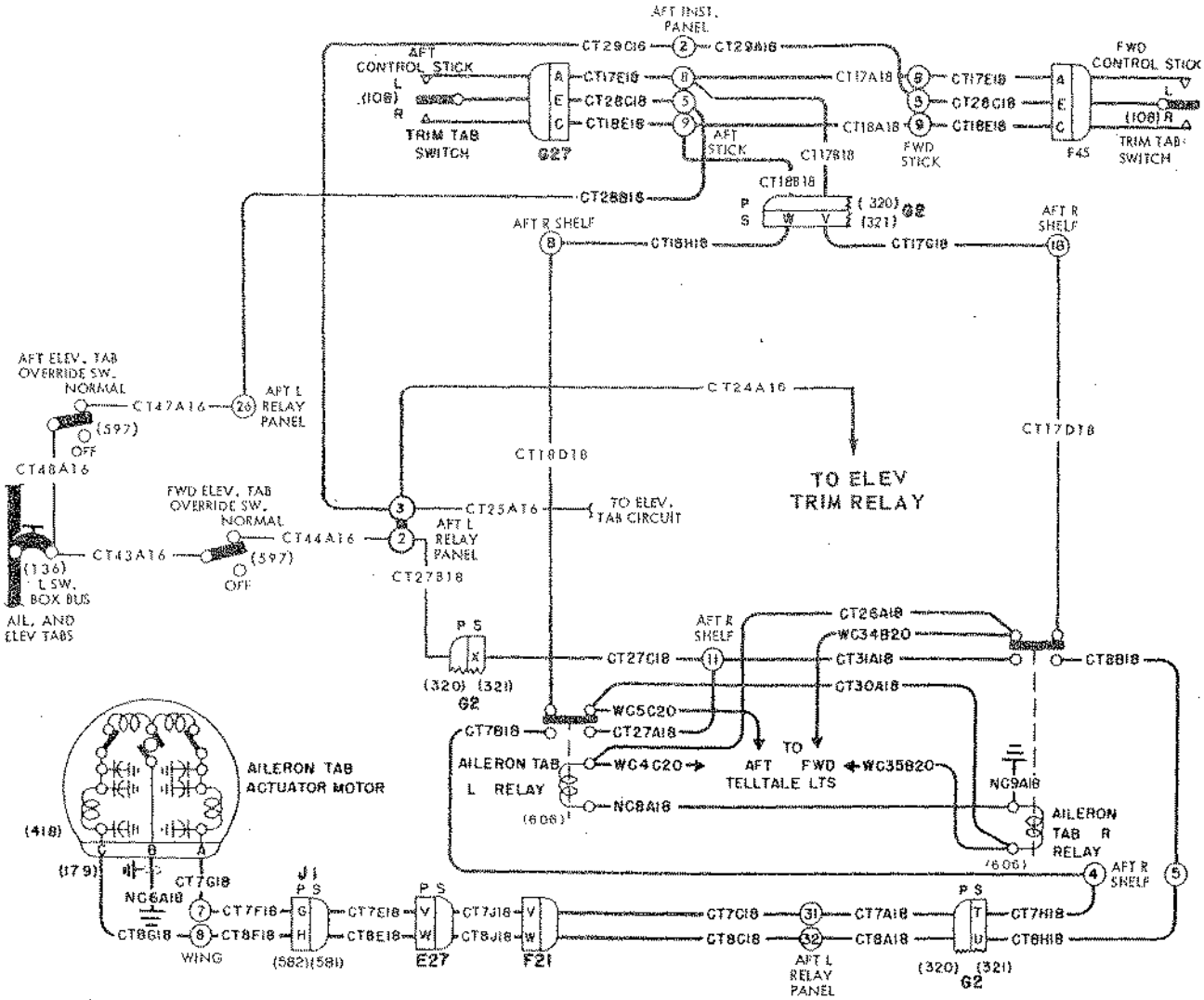
1. USED ON AF SERIAL NO. 51-9236 AND SUBSEQUENT
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-638

5 AILERON TAB MOTOR CIRCUIT
T-33A-5 AND T-33A-15
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
103	SWITCH		400-4307	65C47022
136	CIRCUIT PROTECTOR			MS25017-15
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
320	CONNECTOR			MS3106R-28-12P
321	CONNECTOR			MS3102R-28-12S
418	MOTOR	LEAR		157V-2
502	CONNECTOR			MS3100R-28-11P
581	CONNECTOR			MS3106R-28-11S
582	CONNECTOR			MS3100R-28-11P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187D1

EM20-59-8-S24

Figure 8-102C. Aileron Tab Motor Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
108	SWITCH		400-4307	55C47022
136	CIRCUIT PROTECTOR			MS25017-15
179	CONNECTOR			MS3106R-16S-6S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
320	CONNECTOR			MS3106R-28-12P
321	CONNECTOR			MS3102R-28-12S
418	MOTOR	LEAR		157V-2
502	CONNECTOR			MS3100R-28-11P
581	CONNECTOR			MS3106R-28-11S
582	CONNECTOR	"		MS3100R-28-11P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187D1

NOTE:

(1) USED ON AIRPLANES INCORPORATING T.O. 1T-33A-638

△

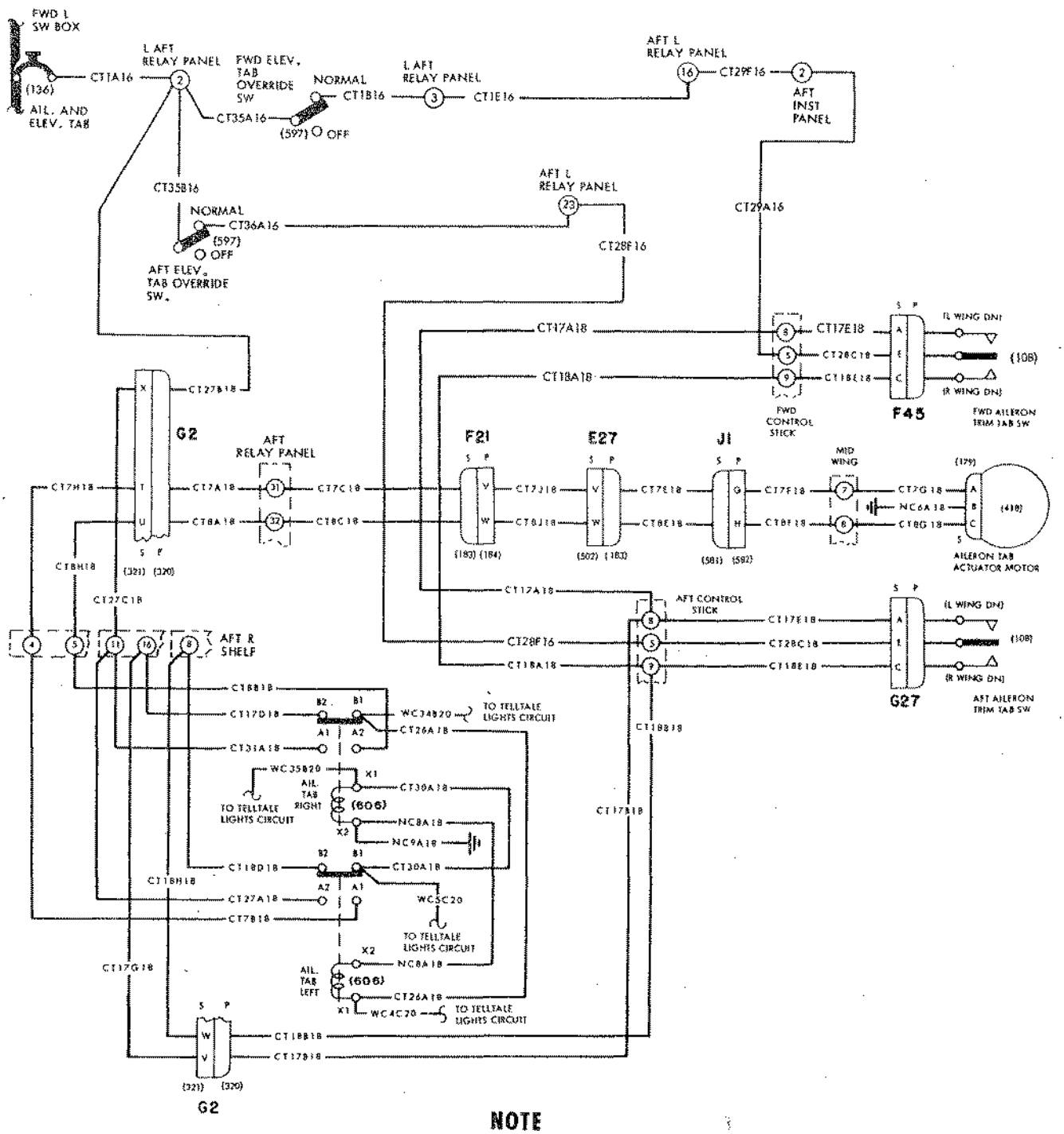
AILERON TAB MOTOR CIRCUIT

T-33A-5 AND T-33A-15

APPLIES TO AF SERIALS NO. 52-9635 THROUGH 53-5285, EXCEPT 52-9876 THROUGH 52-9905

EM20-59-8-525

Figure 8-102D. Aileron Tab Motor Circuit



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC.
108	SWITCH		488-4307	65C47022
136	CIRCUIT PROTECTOR			MS25017-1S
179	CONNECTOR			MS3106R-16S-8S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P
320	CONNECTOR			MS3106R-28-12P
321	CONNECTOR			MS3102R-28-12S
418	MOTOR	LEAR		157V-2
502	CONNECTOR			MS3100R-28-11P
582	CONNECTOR			MS3100R-28-11P
597	SWITCH		SP3T	MS25128-1
606	RELAY			MS24187D1

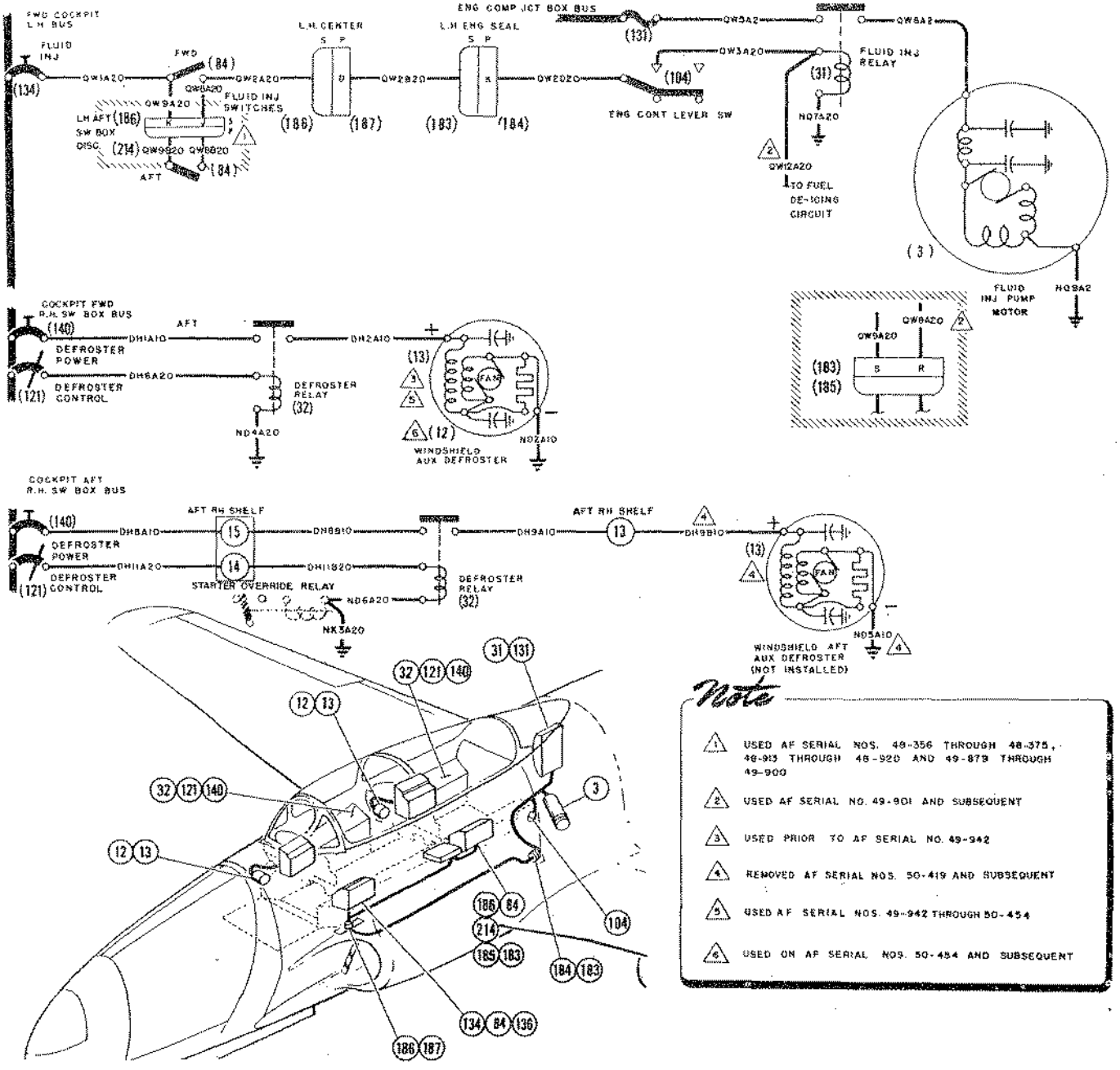
1

AILERON TAB MOTOR CIRCUIT

T-33A-5 and T-33A-15
S/N 53-5286 and SUBSEQUENT

EM20-39-8-526

Figure 8-102E. Aileron Tab Motor Circuit



Note

1. USED AF SERIAL NOS. 48-356 THROUGH 48-375, 48-913 THROUGH 48-920 AND 49-879 THROUGH 49-900
2. USED AF SERIAL NO. 49-901 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 49-942
4. REMOVED AF SERIAL NOS. 50-419 AND SUBSEQUENT
5. USED AF SERIAL NOS. 49-942 THROUGH 50-454
6. USED ON AF SERIAL NOS. 50-454 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP MOTOR	EEMCO		D-289
6 12	WINDSHIELD DEFROSTER	JOY MFG		U-702-24B
4 13	WINDSHIELD DEFROSTER	JOY MFG		U-703-2
5 13	WINDSHIELD DEFROSTER	JOY MFG		U-702-24A
31	RELAY			AN3370-1
32	RELAY			AN3350-1
84	SWITCH			AN3021-2
104	SWITCH	MICROSW		AN3216-1
121	CIRCUIT PROTECTOR			AN3160-10
131	CIRCUIT PROTECTOR	BURNDY		ELLF-200A
134	CIRCUIT PROTECTOR			AN3161-P5
140	CIRCUIT PROTECTOR			AN3161-P50
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
2 185	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
1 214	CONNECTOR			AN3102-28-12P

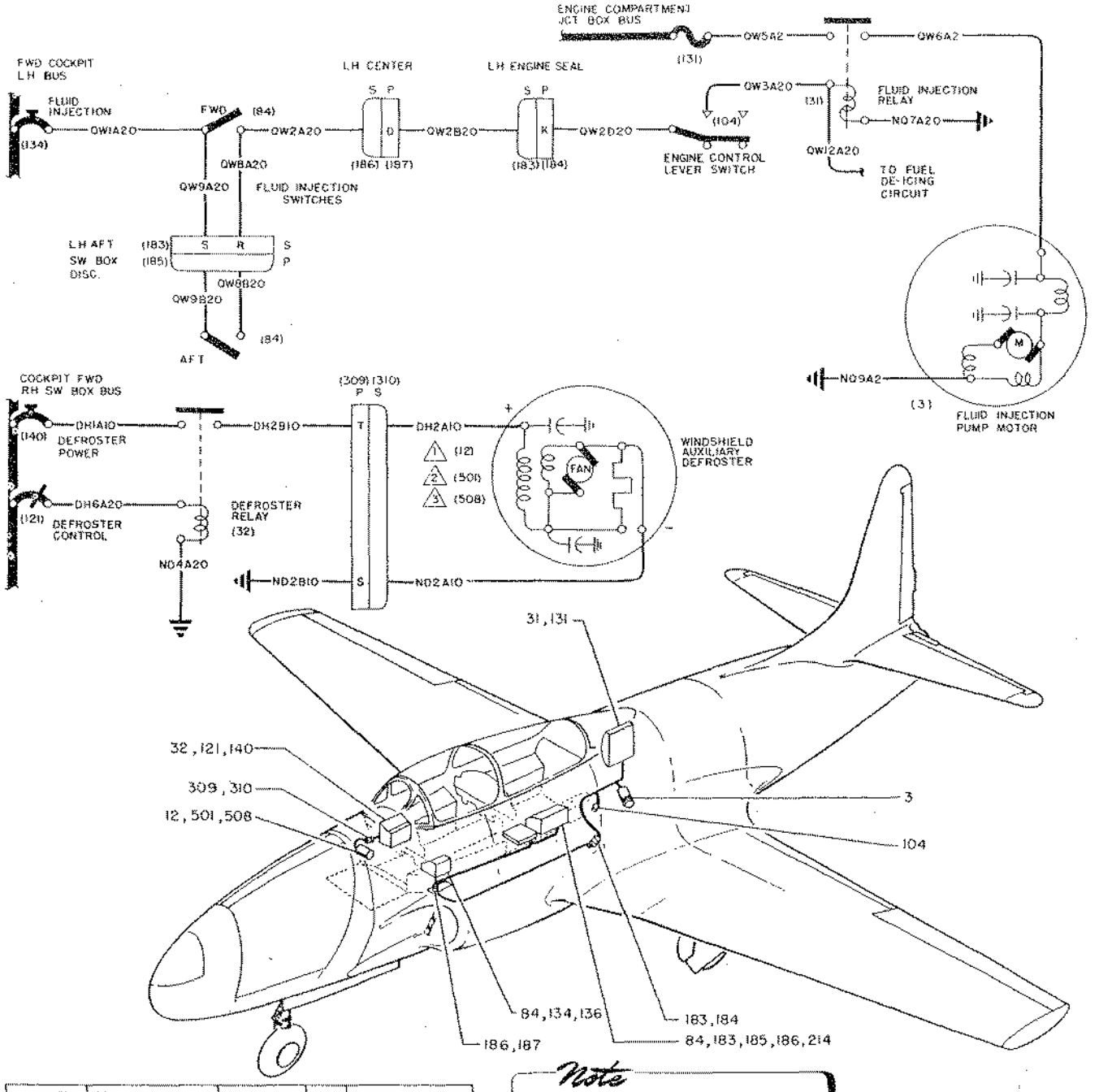
AB 6531

FLUID INJECTION, AND AUX WINDSHIELD DEFROSTER CIRCUITS

MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-4328

Figure 8-103. Fluid Injection and Auxiliary Windshield Defroster Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP MOTOR	EEMCO		D289
12	WINDSHIELD DEFROSTER	JOY MFG CO		U-702-248
31	RELAY			AN3379-1
32	RELAY			AN3358-3
84	SWITCH			AN3021-2
104	SWITCH	MICROSW		AN3216-1
121	CIRCUIT PROTECTOR			AN3169-10
131	CIRCUIT PROTECTOR	BURNDY		FLU-200A
134	CIRCUIT PROTECTOR			AN3161-P5
140	CIRCUIT PROTECTOR			AN3161-P50
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
501	WINDSHIELD DEFROSTER	JOY MFG CO		U-702-240
508	WINDSHIELD DEFROSTER	JOY MFG CO		U-702-24E

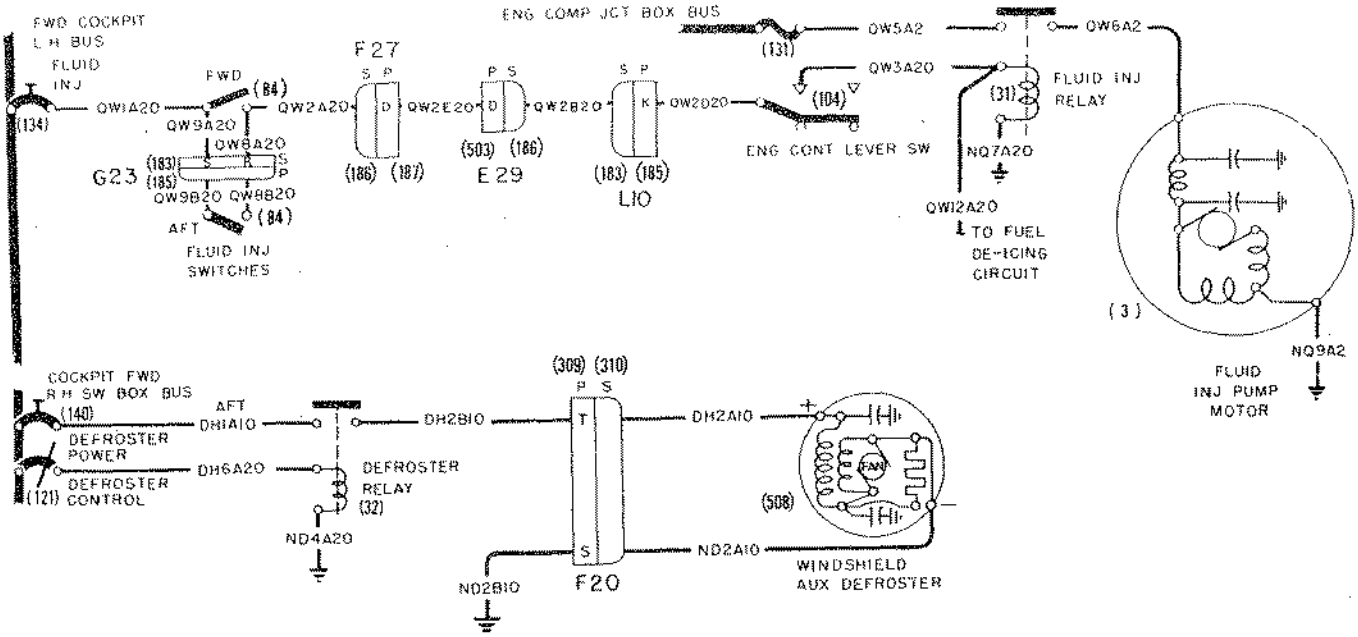
Note

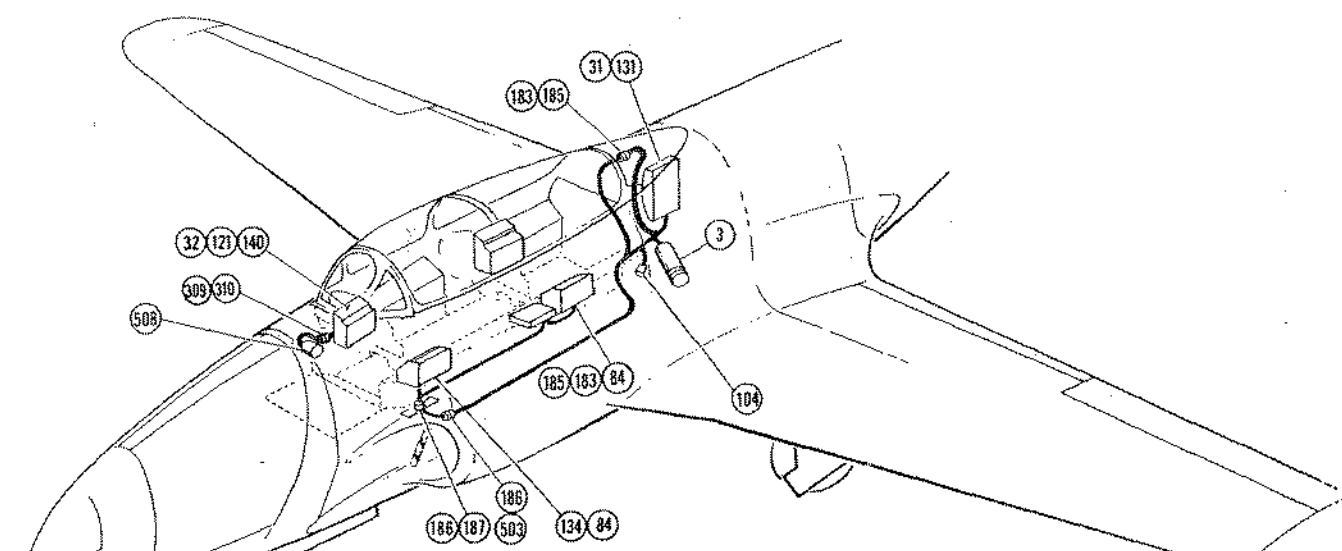
1. USED PRIOR TO AF SERIAL NO. 51-4408
2. USED ON AF SERIAL NOS. 51-4408 THROUGH 51-6792
3. USED ON AF SERIAL NOS. 51-6793 THROUGH 51-6818

EM-20-18-8-62
AB 0501

FLUID INJECTION, AND AUX WINDSHIELD DEFROSTER CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-4329 THROUGH 51-6818

Figure 8-104. Fluid Injection and Auxiliary Windshield Defroster Circuits





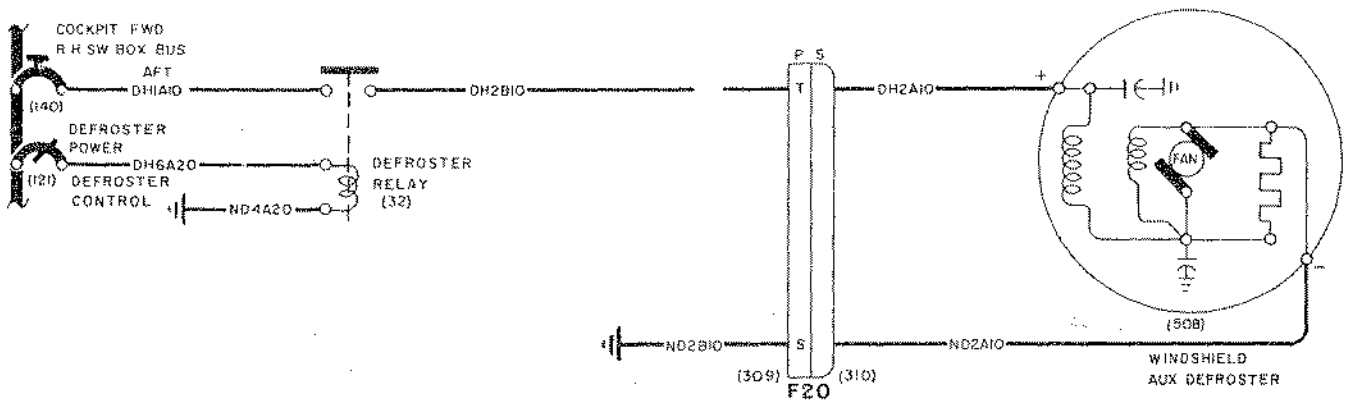
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID IN PUMP MOTOR	EEMCO		D289
31	RELAY			AN3370-1
32	RELAY			AN3350-1
84	SWITCH			AN3021-2
104	SWITCH			AN3216-1
121	CIRCUIT PROTECTOR			AN3160-10
131	CIRCUIT PROTECTOR	BURNDY		FLLF-200A
134	CIRCUIT PROTECTOR			AN3161-P5
140	CIRCUIT PROTECTOR			AN3161-P50
183	CONNECTOR			AN3106-28-11S
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
503	CONNECTOR			AN3100A-28-12P
508	WINDSHIELD DEFROSTER	JOY MFG. CO.		U-702-24G

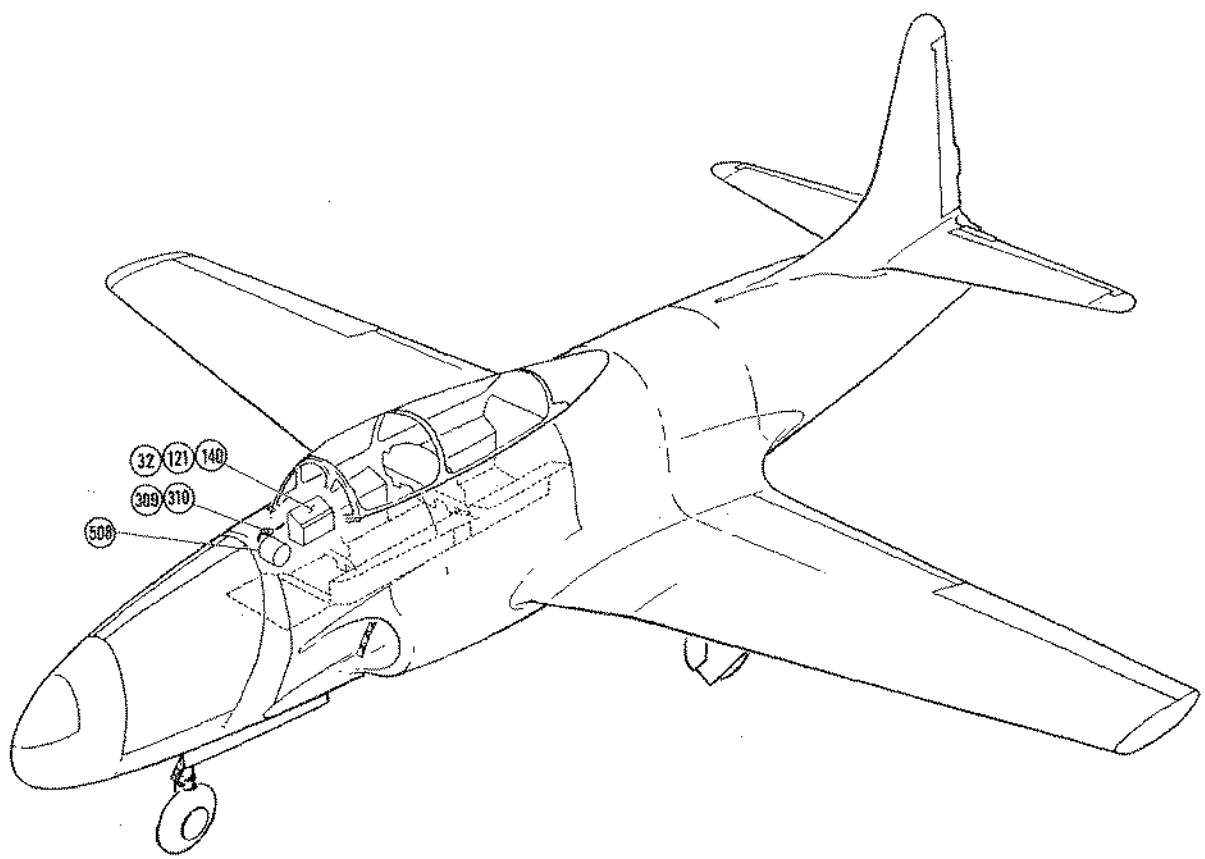
CB 6591
EM20-26-8-63

FLUID INJECTION, AND AUX WINDSHIELD DEFROSTER CIRCUITS

MODEL T-33A
APPLIES TO AF SERIAL NOS 51-6819 THROUGH 53-5082

Figure 8-105. Fluid Injection and Auxiliary Windshield Defroster Circuits



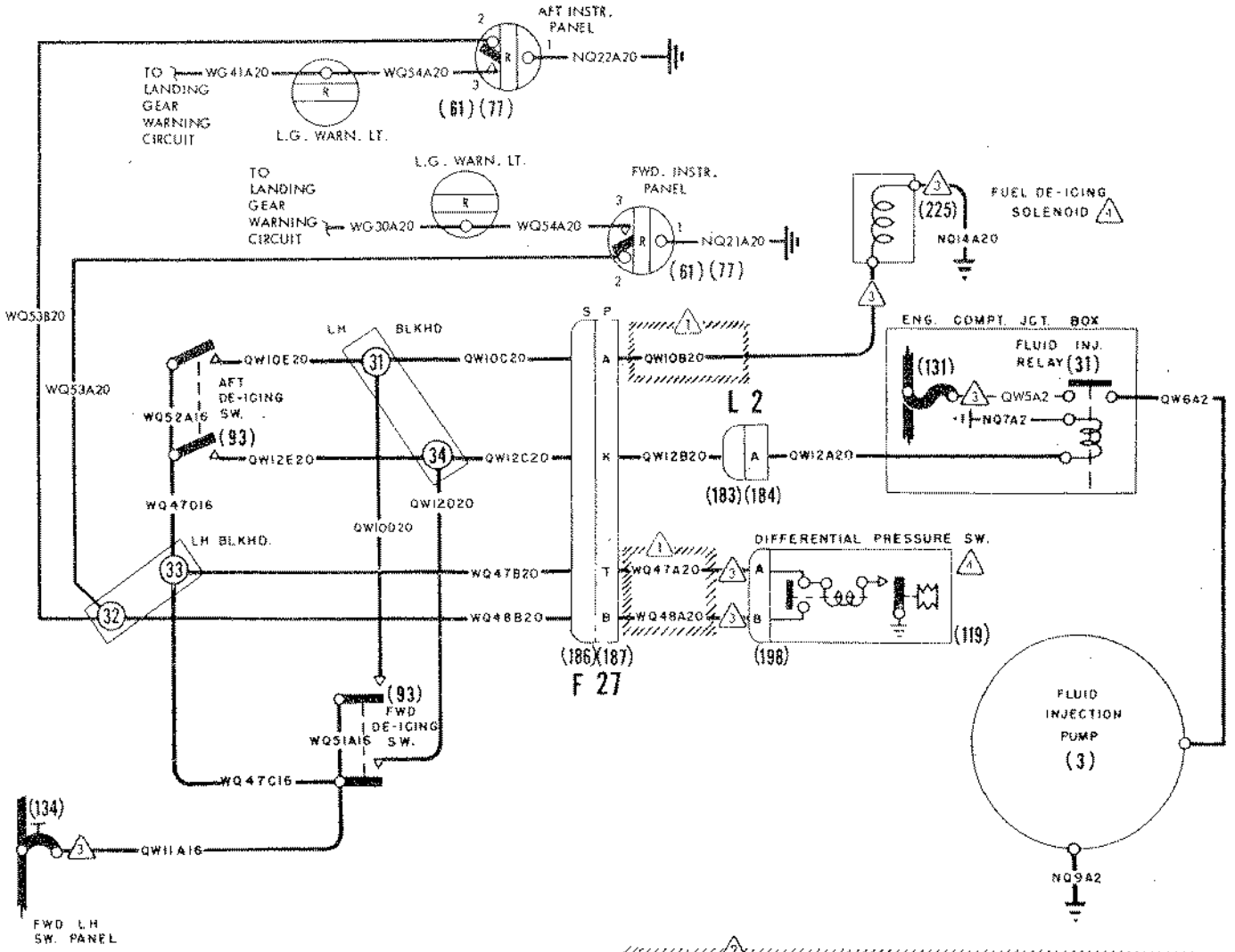


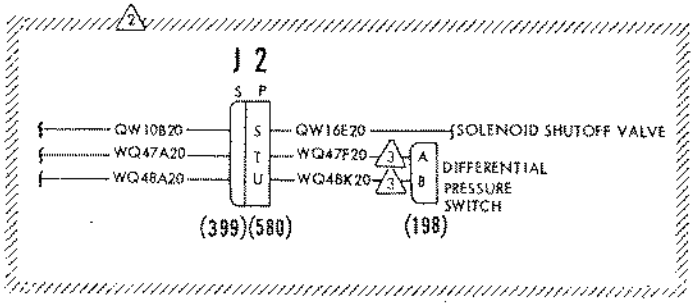
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
32	RELAY			AN3350-1
121	CIRCUIT PROTECTOR			AN3160-10
140	CIRCUIT PROTECTOR			AN3161-P50
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
508	WINDSHIELD DEFROSTER	JOY MFG CO.		J-702-24G

CR 6582
EM20-26-8-268

WINDSHIELD AUXILIARY
DEFROSTER CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL
NOS 53-5083 AND SUBSEQUENT

Figure 8-106. Windshield Auxiliary Defroster Circuit





NOTE

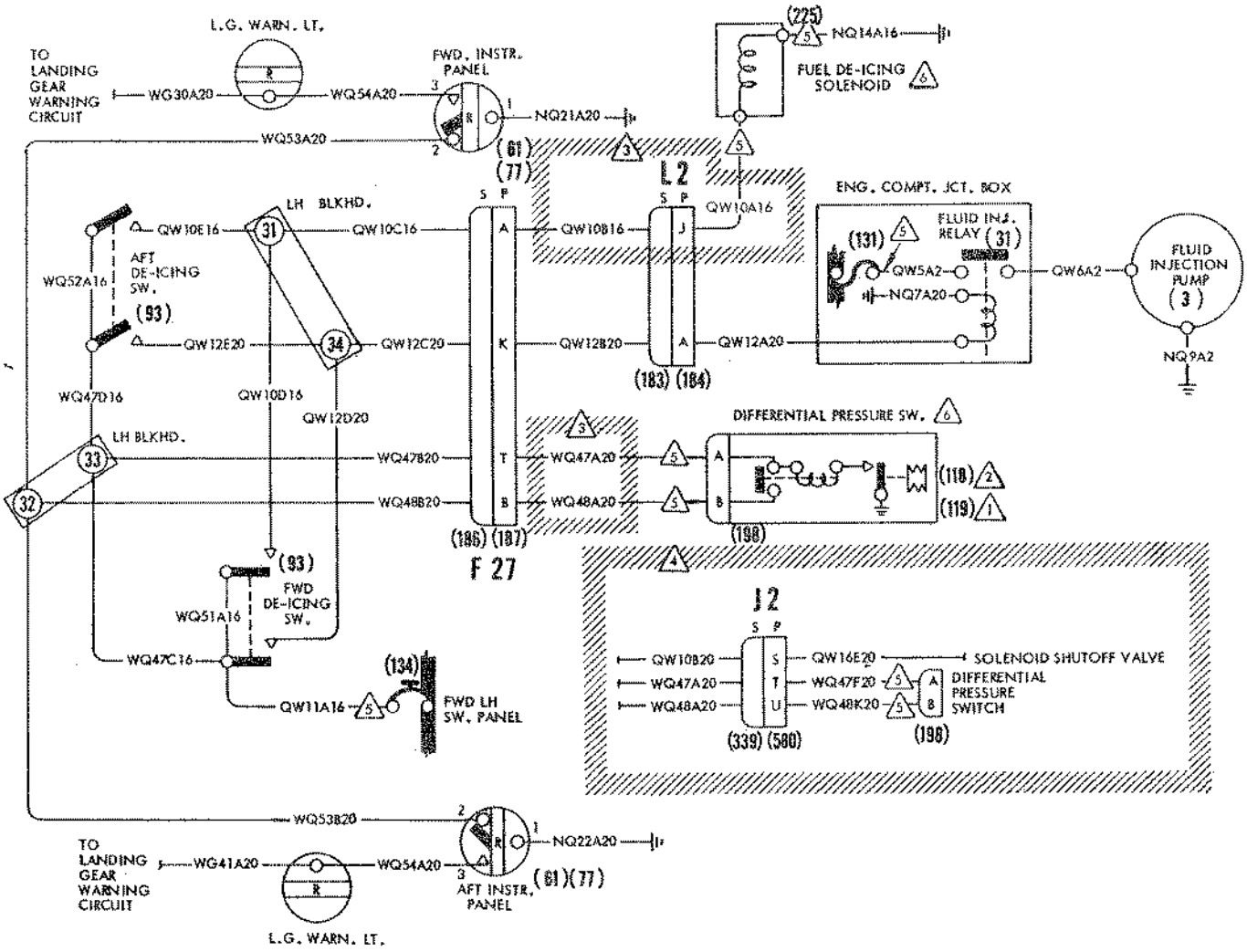
1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
3. TAPE AND STOW WIRES ON AIRPLANES INCORPORATING T.O. 1T-33A-622
4. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP	EEMCO		D289
31	FLUID INJ RELAY			AN3370-1
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
93	SWITCH			AN3027-5
4 119	DIFFNTL PRESS. SW	M H		G-20A4
131	CIRCUIT PROTECTOR	BURNDY	200A	FLLF
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
198	CONNECTOR			AN3108-14S-9S
4 225	SOLENOID VALVE	ADEL		12257-25
339	CONNECTOR			MS3106M-28-11 SW
580	CONNECTOR			MS3100M-28-11 PW

HF 08547
EM20-55-8-64

FUEL DE-ICING CIRCUIT
MODEL T-33A
APPLIES PRIOR TO AF SERIAL NO. 49-901

Figure 8-107. Fuel De-Icing Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP	EEMCO		D289
31	FLUID INJ RELAY			AN3370-1
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
93	SWITCH			AN3027-5
6 2	DIFFNTL PRESS SW	MH		G-20A14
6 1	DIFFNTL PRESS SW	MH		G-20AX10
131	CIRCUIT PROTECTOR	BURNDY	200A	FLLF
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
198	CONNECTOR			AN3108-14S-9S
6 225	SOLENOID VALVE	ADEL		12257-25
339	CONNECTOR			MS3106M-28-11SW
580	CONNECTOR			MS3100M-28-11PW

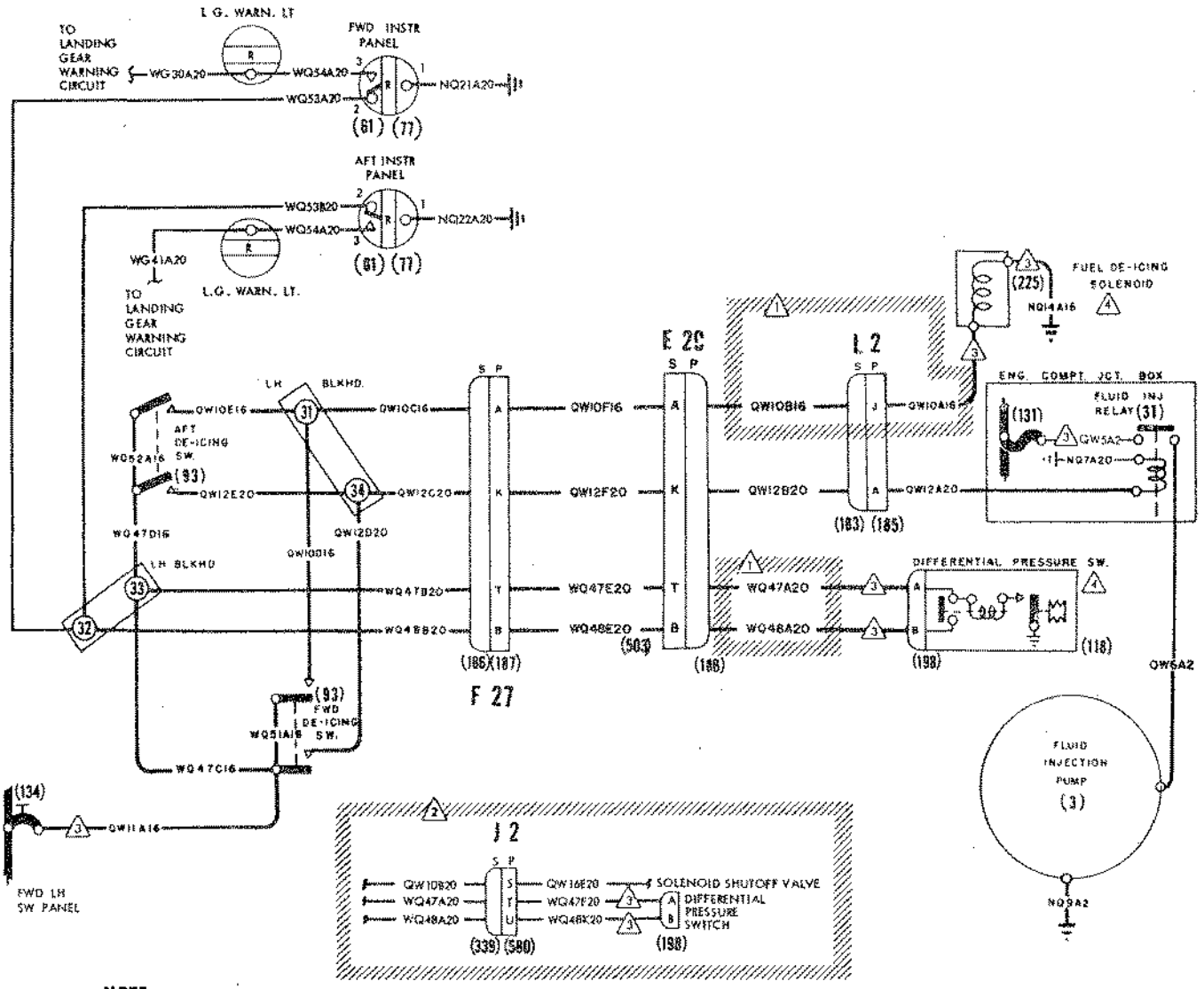
NOTE

1. USED PRIOR TO AF SERIAL NO. 51-6562
2. USED ON AF SERIAL NO. 51-6562 THROUGH 51-6818
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
5. WIRES TAPED AND STOWED ON AIRPLANES INCORPORATING T.O. 1T-33A-622
6. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

HF 08546
EM20-55-8-65

FUEL DE-ICING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 49-901 THROUGH 51-6818

Figure 8-108. Fuel De-Icing Circuit



NOTE

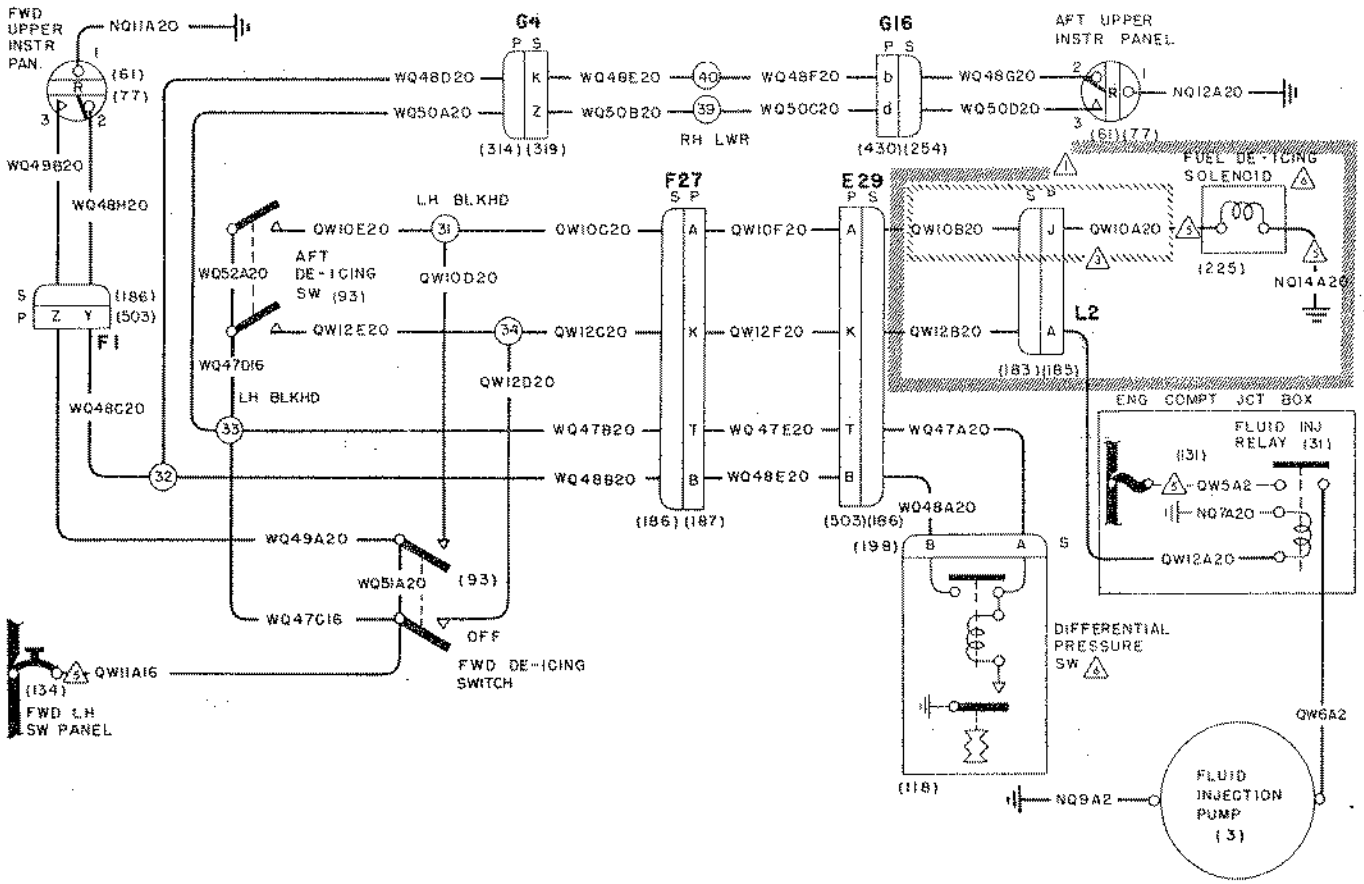
1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
3. WIRES TAPED AND STOWED ON AIRPLANES INCORPORATING T.O. 1T-33A-622
4. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

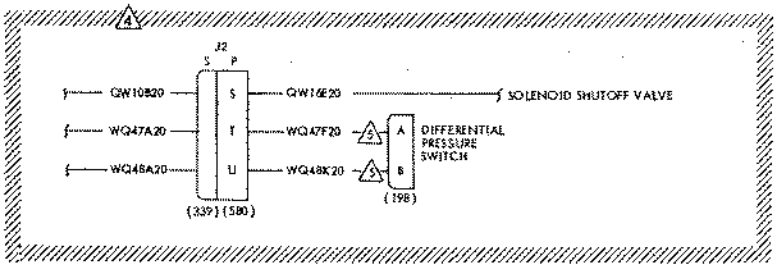
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP	EEMCO		D289
31	FLUID INJ RELAY			AN3370-1
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
93	SWITCH			AN3027-5
4 118	DIFFNTL PRESS. SW	MH		G-20A14
131	CIRCUIT PROTECTOR	BURNDY	200A	FLLF
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-2B-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-2B-12S
187	CONNECTOR			AN3102P-28-12P
198	CONNECTOR			AN3108-14S-9S
4 225	SOLENOID VALVE	ADEL		12257-25
339	CONNECTOR			MS3106M-28-11SW
503	CONNECTOR			AN3100A-28-12P
580	CONNECTOR			MS3100M-28-11PW

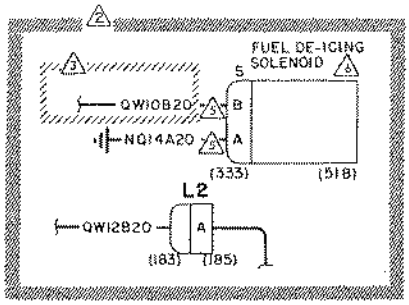
HF 08794
EM20-55-8-66

FUEL DE-ICING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9035

Figure 8-109. Fuel De-Icing Circuit







ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP	EEMCO		0288C
31	FLUID INJ RELAY			AN3370-1
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
93	SWITCH			AN3027-3
6 118	DIFF'NT'L PRESS SW	M H		G20A18
131	CIRCUIT PROTECTOR	BURNDY	200A	FLLE
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
198	CONNECTOR			AN3108B-14S-9S
6 1 225	SOLENOID VALVE	ADEL		12257-25
254	CONNECTOR			AN3108B-28-12S
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
2 333	CONNECTOR			AN3108B-10SL-4S
339	CONNECTOR			MS3106M-28-11SW
430	CONNECTOR			AN3102A-28-12P
502	CONNECTOR			AN3100A-28-12P
6 2 518	SOLENOID VALVE	VALCOR		V-200-12A
580	CONNECTOR			MS3100M-28-11PW

NOTE

1. USED ON AF SERIAL NO. 51-9036 THROUGH 51-17455 AND 52-9129 THROUGH 52-9165
2. USED ON AF SERIAL NO. 51-17456 THROUGH 51-17556 AND ON 52-9166 AND SUBSEQUENT
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567.
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
5. WIRES TAPED AND STOWED ON AIRPLANES INCORPORATING T.O. 1T-33A-622
6. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

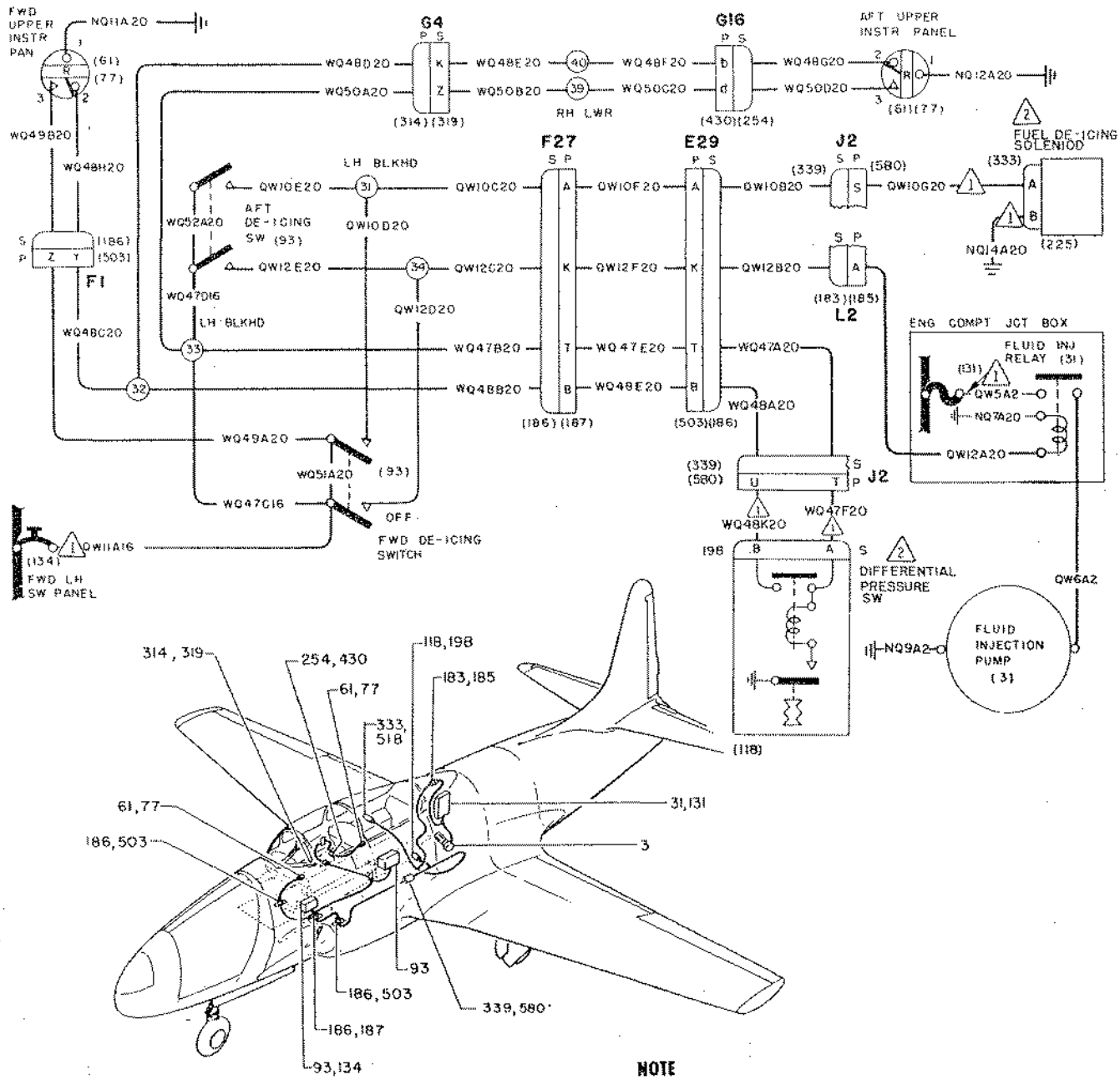
FUEL DE-ICING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9036 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

HF 08528 EM20-55-8-11T

Figure 8-110. Fuel De-Icing Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
3	FLUID INJ PUMP	EEMCO		D289C
31	FLUID INJ RELAY			AN3370-1
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
93	SWITCH			AN3027-5
2 118	DIFF'NT'L PRESS. SW	MH		G20A1B
131	CIRCUIT PROTECTOR	BURNDY	200A	FLLF
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11S
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
198	CONNECTOR			AN3108B-14S-9S
2 225	SOLENOID VALVE	ADEL		12257-25
254	CONNECTOR			AN3106B-28-12S
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28P
333	CONNECTOR			AN3108B-10SL-4S
339	CONNECTOR			AN3106M-28-11SW
430	CONNECTOR			AN3102A-28-12P
503	CONNECTOR			AN3100A-28-12-0
518	CONNECTOR	VALCOR		V-200-12A
580	CONNECTOR			AN3108M-28-11PW

NOTE

1. WIRES TAPED AND STOWED ON AIRPLANES INCORPORATING T.O. 1T-33A-622
2. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

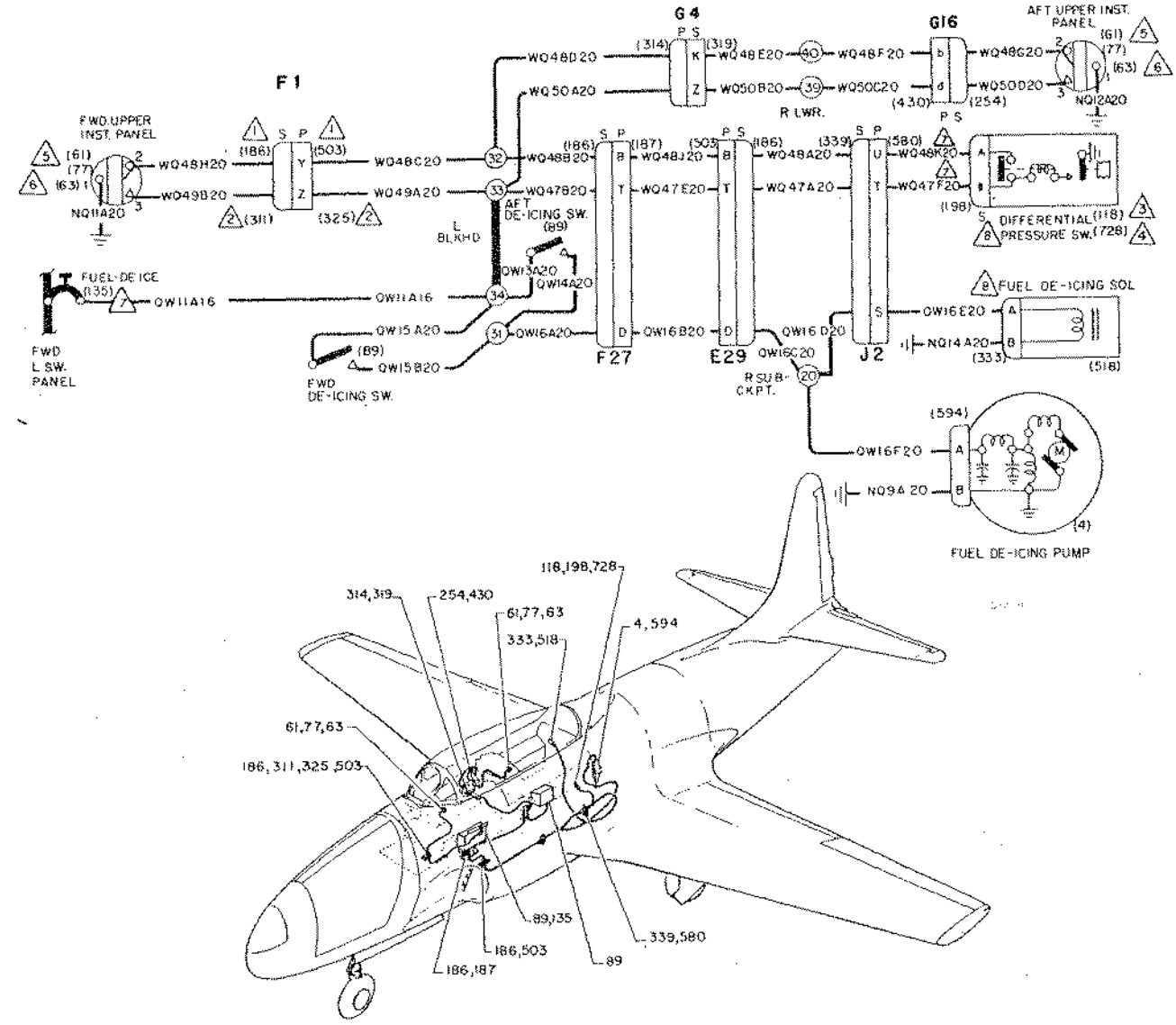
MF 08745
EM20-55-8-199

FUEL DE-ICING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL 52-9635 THROUGH 53-5082 EXCEPT 52-9876 THROUGH 52-9905

Figure 8-111. Fuel De-Icing Circuit



NOTE

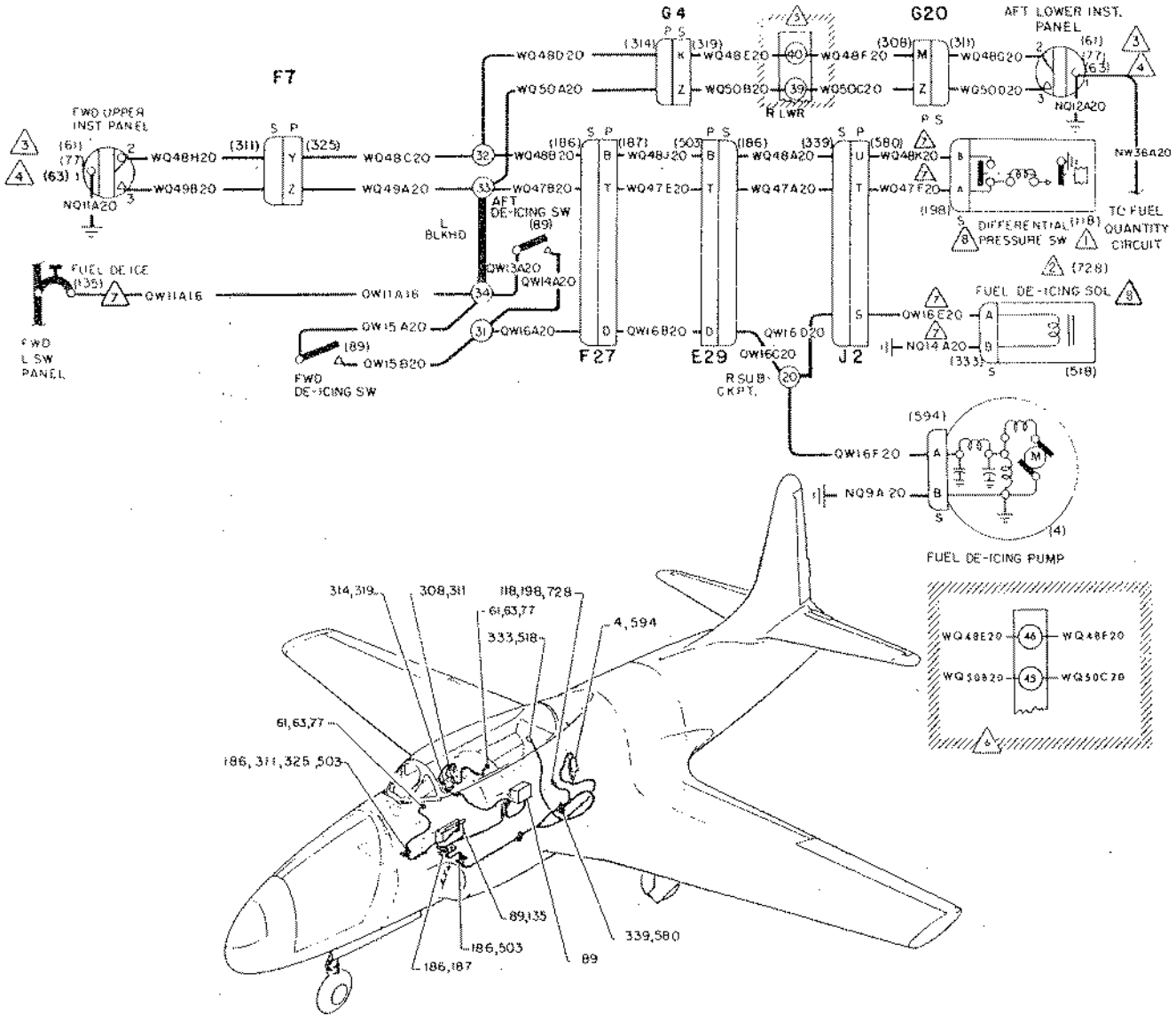
1. USED PRIOR TO AF SERIAL NO. 53-5286
2. USED ON AF SERIAL NO. 53-5286 AND SUBSEQUENT
3. ON AIRPLANES PRIOR TO AF SERIAL NO. 55-4332
4. ON AIRPLANES AF SERIAL NO. 55-4332 AND SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 56-3670
6. USED ON AF SERIAL NO. 56-3670 AND SUBSEQUENT
7. WIRES TAPED AND STOWED ON AIRPLANES INCORPORATING T.O. 1T-33A-622
8. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
4	FUEL DEICING PUMP	ROMEC		RG5490E
5 61	LIGHT		RED	AN3157-2
6 63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
89	SWITCH			AN3021-8
8 3 118	DIFF'N'T'L PRESS SW	M-H		G20A18
135	CIRCUIT PROTECTOR			AN3161-P10
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
198	CONNECTOR			AN3108B-14S-9S
254	CONNECTOR			AN3108B-28-12S
311	CONNECTOR			AN3106B-28-15S
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
325	CONNECTOR			AN3100A-28-15P
333	CONNECTOR			AN3108B-10SL-4S
339	CONNECTOR			AN3106M-28-11SW
430	CONNECTOR			AN3102A-28-12P
503	CONNECTOR			AN3100A-28-12P
8 518	SOLENOID VALVE	VALCOR		V-200-12A
580	CONNECTOR			AN3100M-28-11PW
594	CONNECTOR			AN3106B-16-11S
8 4 728	DIFF'N'T'L PRESS SW	HYD ELEC		33000-3

HF 08543
EM20-5S-8-269

FUEL DE-ICING CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 53-5083 AND SUBSEQUENT

Figure 8-112. Fuel De-Icing Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
4	FUEL DEICING PUMP	ROMEC		RG54908
3 61	LIGHT		RED	AN3157-2
4 63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
89	SWITCH			AN3021-8
1 8 118	DIFF'N'T'L PRESS SW	M-H		G20A18
135	CIRCUIT PROTECTOR			AN3161-P10
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
198	CONNECTOR			AN3108B-14S-9S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
325	CONNECTOR			AN3100A-28-15P
333	CONNECTOR			AN3108B-10SL-4S
339	CONNECTOR			AN3106M-28-11SW
503	CONNECTOR			AN3100A-28-12P
8 518	SOLENOID VALVE	VALCOR		V-200-12A
580	CONNECTOR			AN3100M-28-11PW
594	CONNECTOR			AN3108B-16-11S
2 8 728	DIFF'N'T'L PRESS SW	HYD-ELEC		33000-3

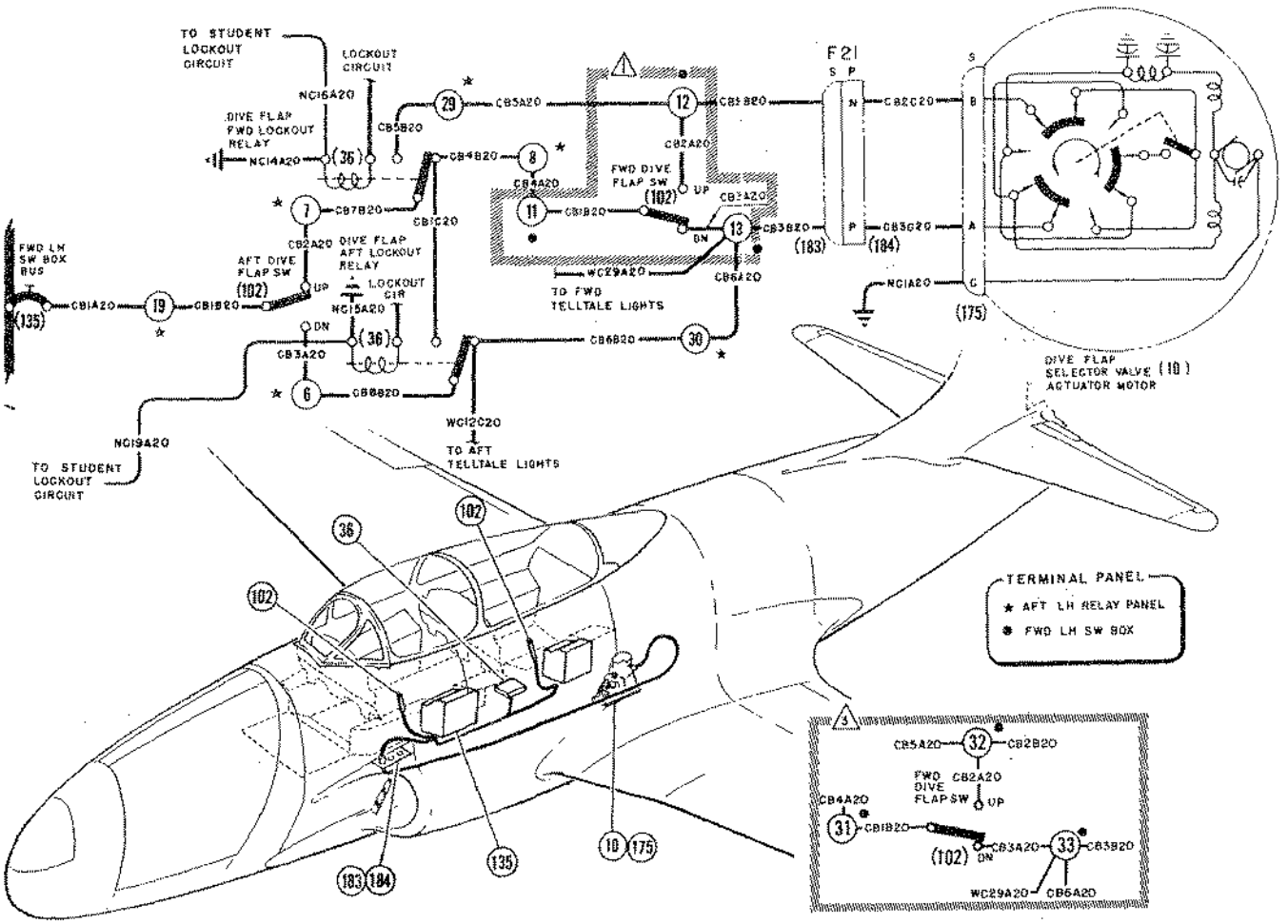
NOTE

1. ON AIRPLANES PRIOR TO AF SERIAL NO. 55-4332
2. ON AIRPLANES AF SERIAL NO. 55-4332 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 56-3670
4. USED ON AF SERIAL NO. 56-3670 AND SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 57-634
6. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT
7. WIRES TAPED AND STOWED ON AIRPLANES INCORPORATING T.O. 1T-33A-622
8. REMOVED ON AIRPLANES INCORPORATING T.O. 1T-33A-622

HF 08544
EM20-55-8-399

FUEL DE-ICING CIRCUIT
MODEL T33A-5

Figure 8-113. Fuel De-Icing Circuit



Note

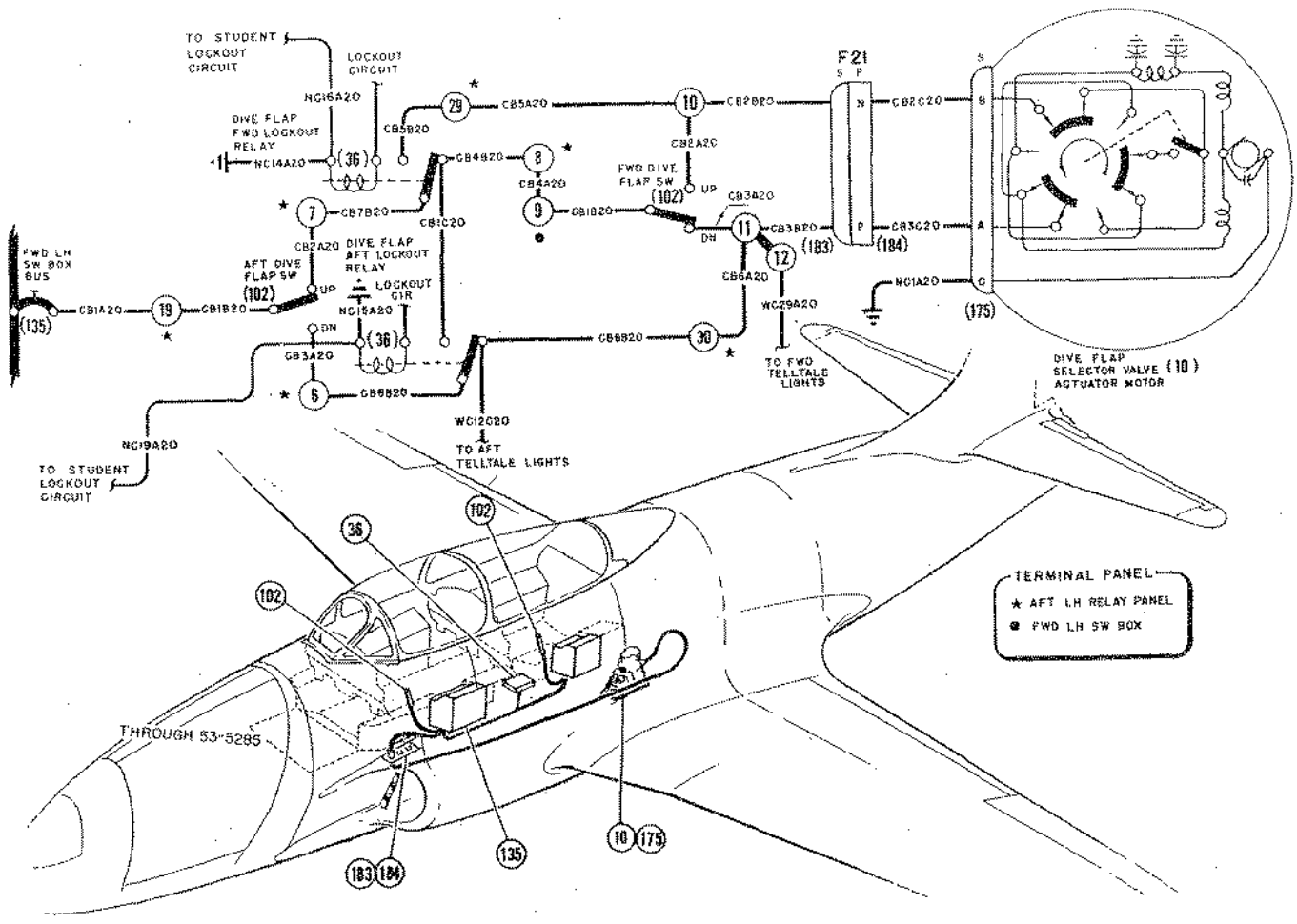
1. USED ON ALL AIRCRAFT PRIOR TO AF SERIAL NO.51-6751, USED ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NOS.51-6751 THROUGH 51-9235, USED ON ALL AIRCRAFT AF SERIAL NOS. 51-9236 AND SUBSEQUENT AND AIRCRAFT NOT INCORPORATING T.O. NO.1T-33A-143
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NOS.51-6751 THROUGH 51-9235.
3. USED ON AIRCRAFT INCORPORATING T.O. NO. 1T-33A-143

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
10	DIVE FLAP VALVE	BENDIX EL. PROD.		405381-4
36	RELAY			NB-57-C
102	SWITCH			AN3234
135	CIRCUIT PROTECTOR			AN3361-P10
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-2B-11S
184	CONNECTOR			AN3102P-2B-11P

GB 8819
M20-48D-8-67

DIVE FLAP SELECTOR VALVE ACTUATOR CIRCUIT
MODEL T-33A
APPLIES TO SERIAL 48-356 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

Figure 8-114. Dive Flap Selector Valve Actuator Circuit

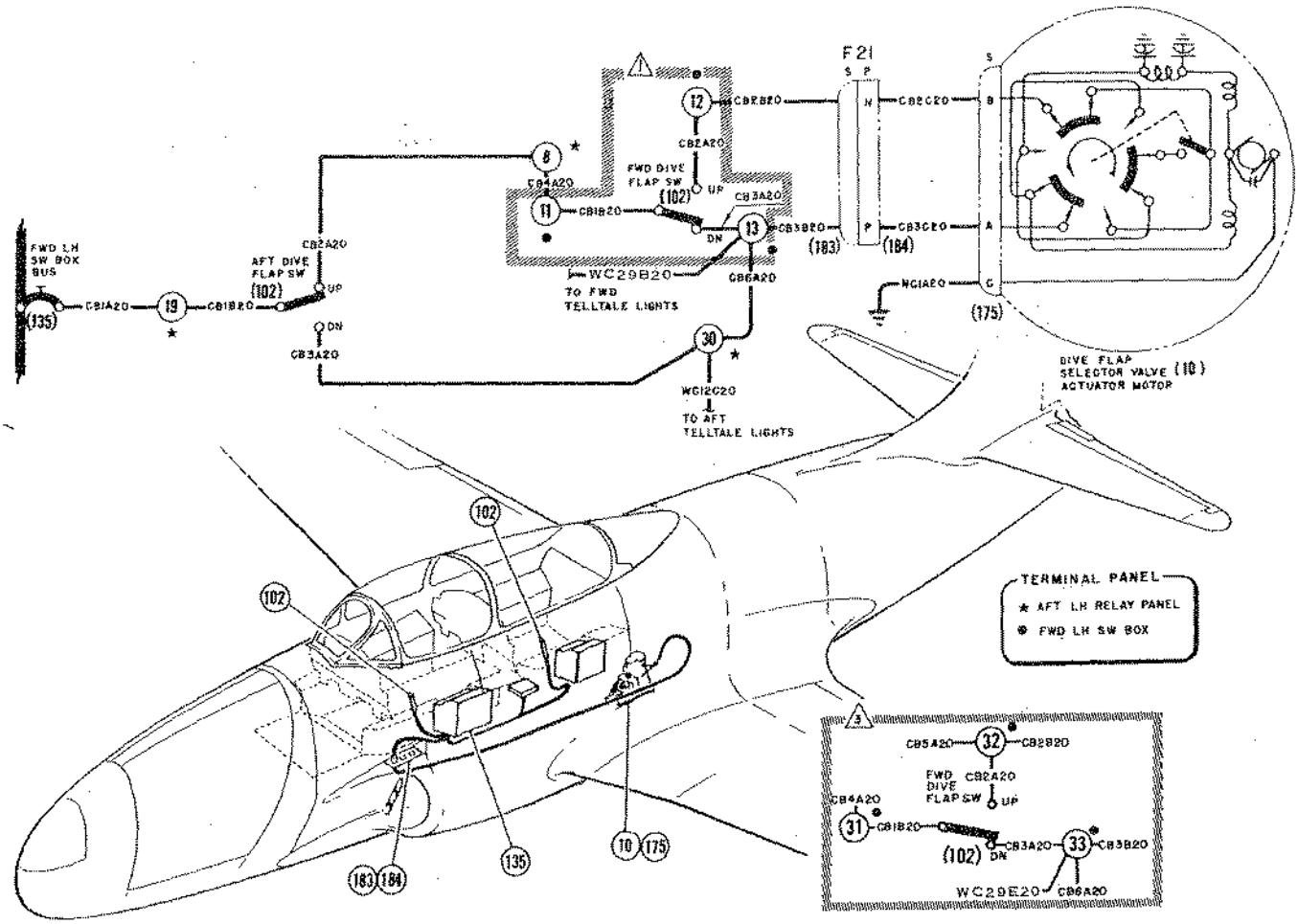


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
10	DIVE FLAP VALVE	BENDIX . EL. PROD.		4053B1-4
36	RELAY			NB-57-C
102	SWITCH			AN3234
135	CIRCUIT PROTECTOR			AN3161-P10
175	CONNECTOR			AN3106-14S-7S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P

CB 6586
EM-28-26-B-200

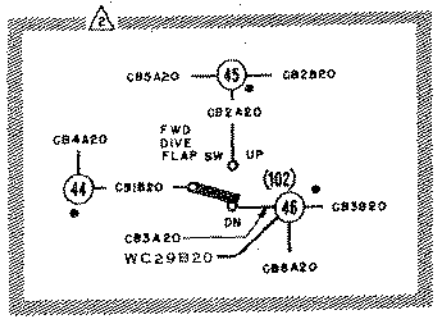
DIVE FLAP SELECTOR VALVE ACTUATOR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9635 THROUGH 53-5285 EXCEPT 52-9876 THROUGH 52-9905

Figure 8-115. Dive Flap Selector Valve Actuator Circuit



NOTE

1. USED ON T-33A AIRCRAFT SERIAL NO. 51-9236 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905
2. USED ON T-33A AIRCRAFT SERIAL NO. 51-6751 THROUGH 51-9235
3. USED ON T-33A AIRCRAFT SERIAL NO. 50-385 THROUGH 51-6750
4. USED ON T-33A AIRCRAFT INCORPORATING T.O. 1T-33A-638



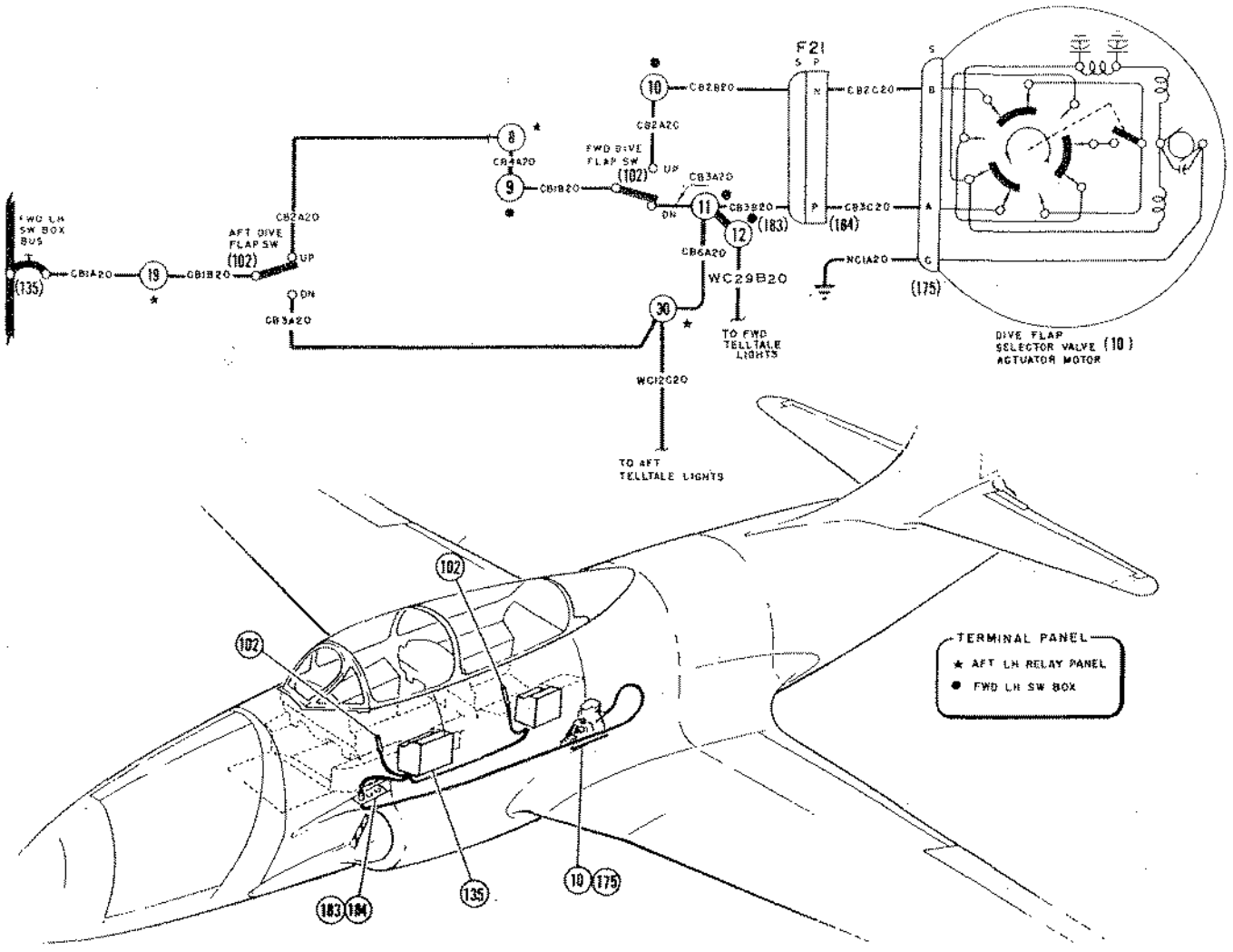
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
10	DIVE FLAP VALVE	BENDIX		405381-4
102	SWITCH			AN3234
135	CIRCUIT PROTECTOR			MS26017-10
175	CONNECTOR			MS3106R-14S-7S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P

4

DIVE FLAP SELECTOR VALVE ACTUATOR CIRCUIT
T-33A-5 and T-33A-15
APPLIES TO SERIAL 50-385 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

EM20-59-8-527

Figure 8-115A. Dive Flap Selector Valve Actuator Circuit



NOTE

⚠1 USED ON T-33A AIRCRAFT INCORPORATING T.O. 1T-33A-638

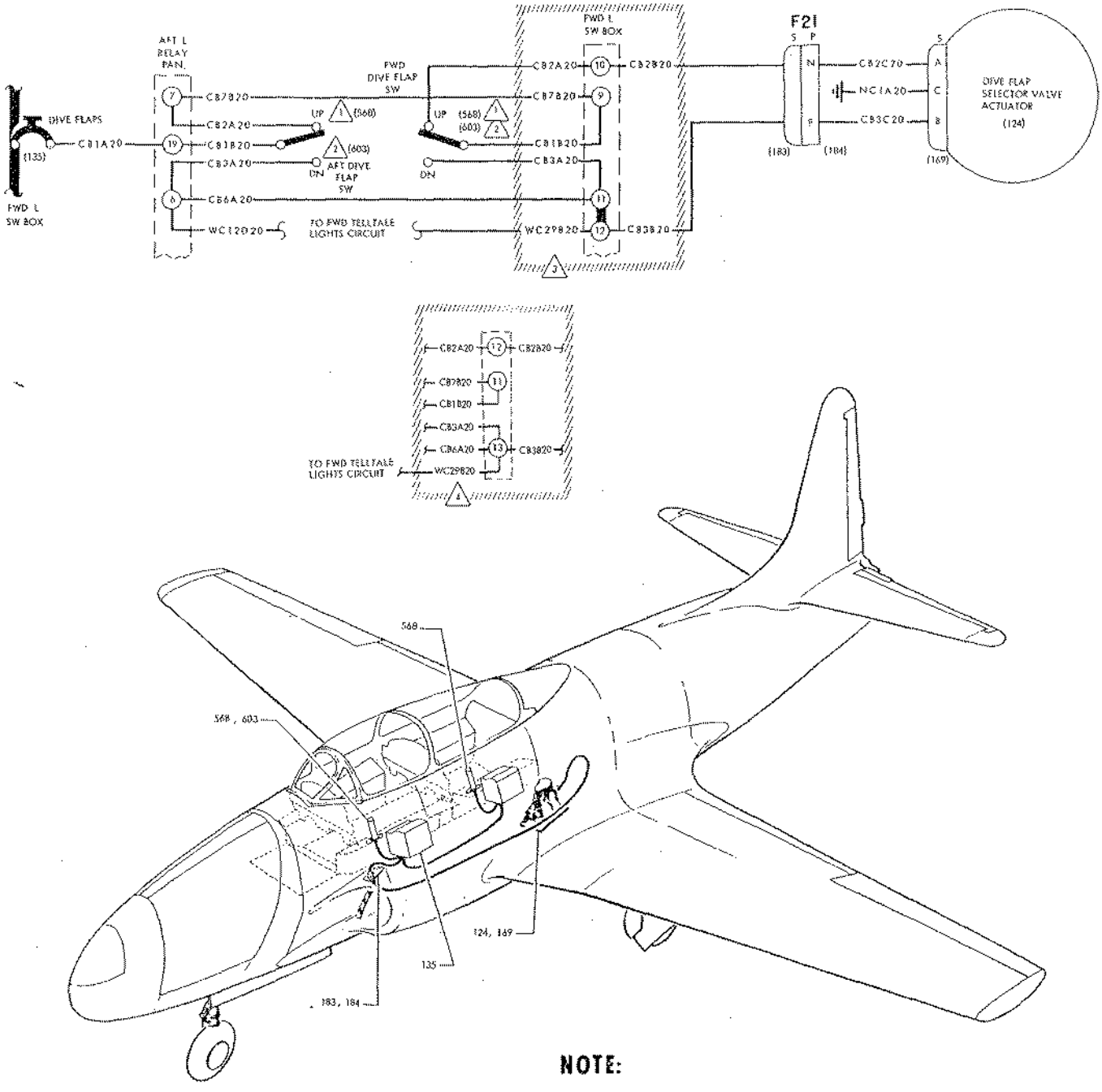
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
10	DIVE FLAP VALVE	BENDIX		405381-4
102	SWITCH			AN3234
135	CIRCUIT PROTECTOR			MS25017-10
175	CONNECTOR			MS3106R-145-7S
183	CONNECTOR			MS3106R-28-11S
184	CONNECTOR			MS3102R-28-11P

⚠1

DIVE FLAP SELECTOR VALVE ACTUATOR CIRCUIT
T-33A-5 and T-33A-15
APPLIES TO AF SERIAL NO. 52-9635 THROUGH 53-5285 EXCEPT 52-9876 THROUGH 52-9905

EM20-59-8-528

Figure 8-115B. Dive Flap Selector Valve Actuator Circuit



NOTE:

1. USED PRIOR TO AF SERIAL NO. 53-5666
2. USED ON AF SERIAL NO. 53-5666 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 57-634
4. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
124	DIVE FLAP VALVE	GEN. CONT.		AV-14B32A0
135	CIRCUIT PROTECTOR			AN3361-A10
169	CONNECTOR			AN3106B-10SL-3S
183	CONNECTOR			AN3106B-20-41S
184	CONNECTOR			AN3107C-28-21P
1 568	SWITCH	HETHER'GT'N		P201B
2 603	SWITCH	HETHER'GT'N		E610A

DIVE FLAP SELECTOR VALVE ACTUATOR CIRCUIT

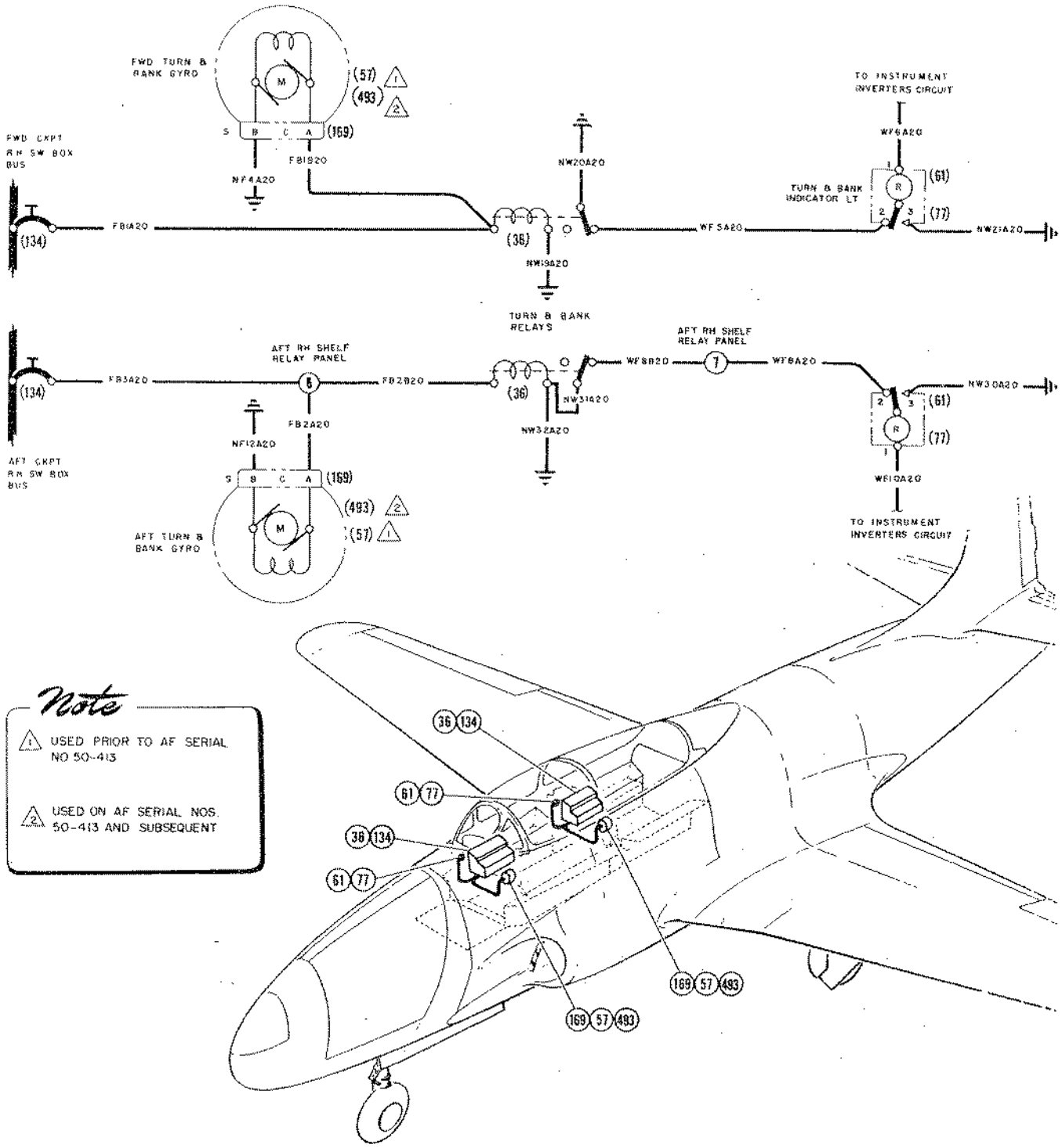
MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5286 AND SUBSEQUENT

EM-20-44-8-284

GB 3682

Figure 8-116. Dive Flap Selector Valve Actuator Circuit



Note

1. USED PRIOR TO AF SERIAL NO 50-413
2. USED ON AF SERIAL NOS. 50-413 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC	LOCATION
36	RELAY	EL-PROD.		NB-57-C	RH SWITCH BOXES
1 57	TURN & BANK GYRO	G.F.P.	C-5	21106	INSTRUMENT PANELS
61	LIGHT		RED	AN3157-2	INSTRUMENT PANELS
77	LAMP			AN3121-313	INSTRUMENT PANELS
134	CIRCUIT PROTECTOR			AN3161-P5	RH SWITCH BOXES
169	CONNECTOR			AN3106-10SL-3S	TURN & BANK GYROS
2 493	TURN & BANK GYRO	G.F.P.	C-6	21328	INSTRUMENT PANELS

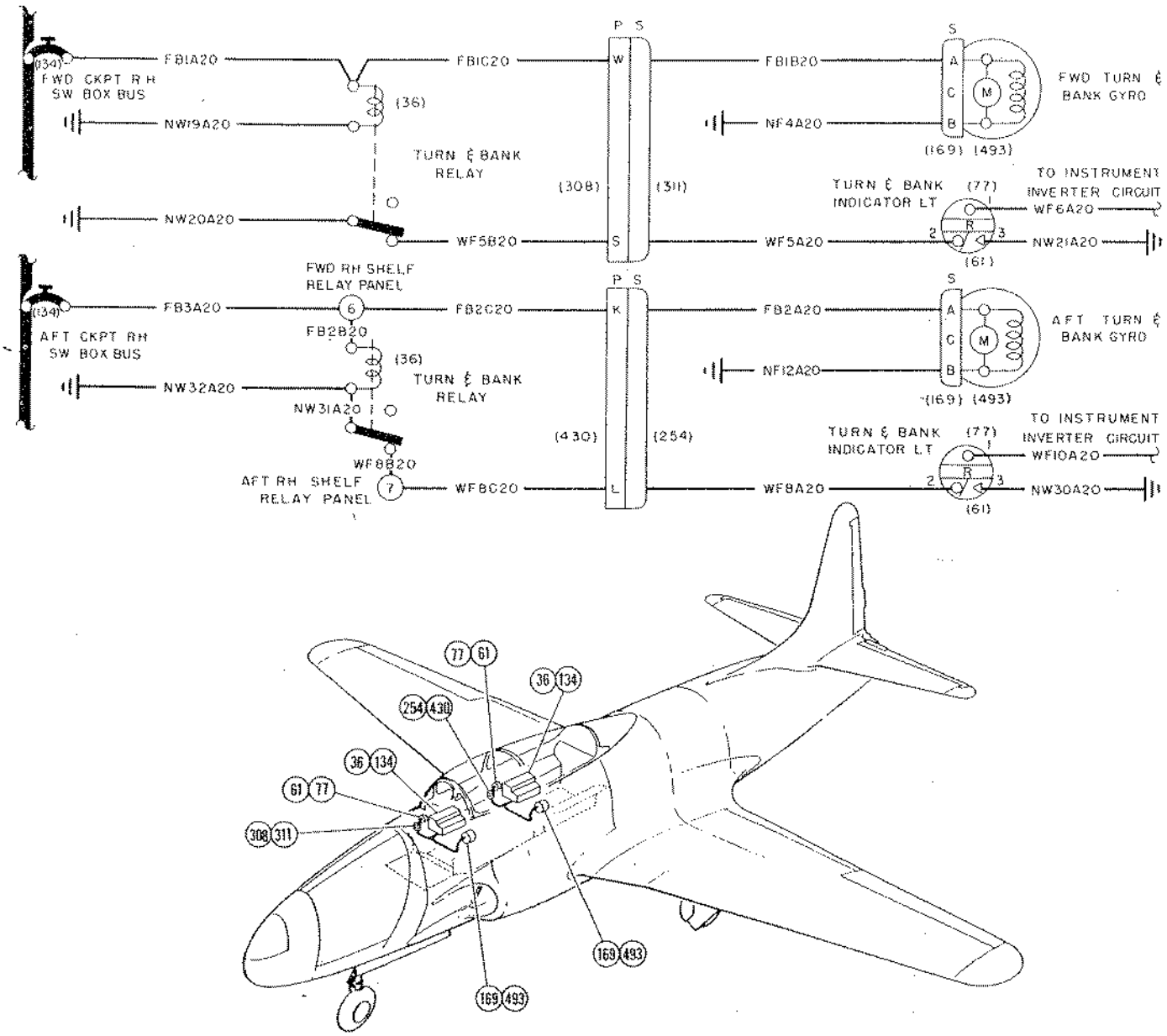
AB 6536

TURN AND BANK INDICATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-4328

Figure 8-117. Turn and Bank Indicator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106-10SL-3S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P
493	TURN & BANK GYRO	GEP	C-6	21028

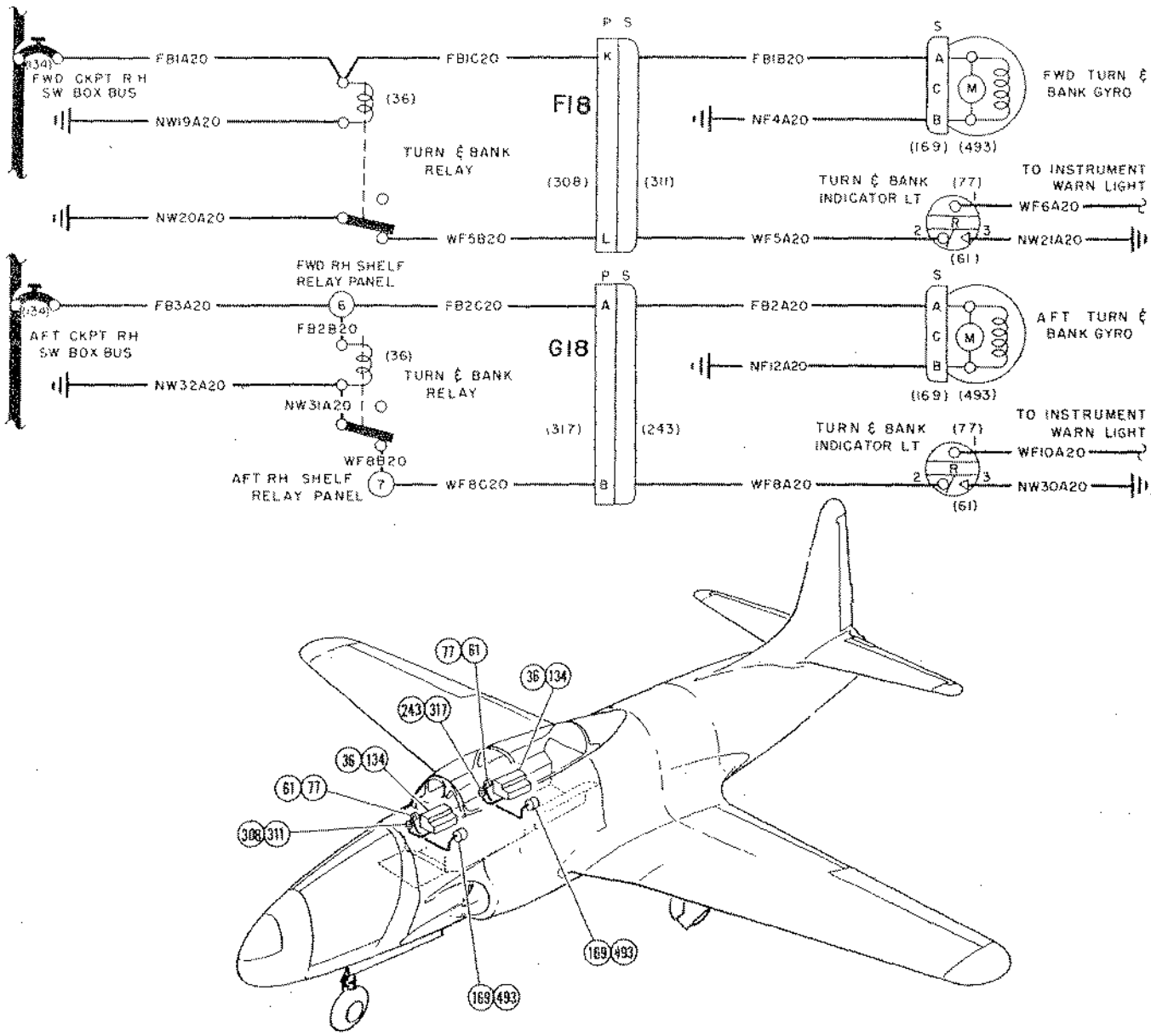
A8 75191

TURN AND BANK INDICATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS 51-4329 THROUGH 51-6818

Figure 8-118. Turn and Bank Indicator Circuit



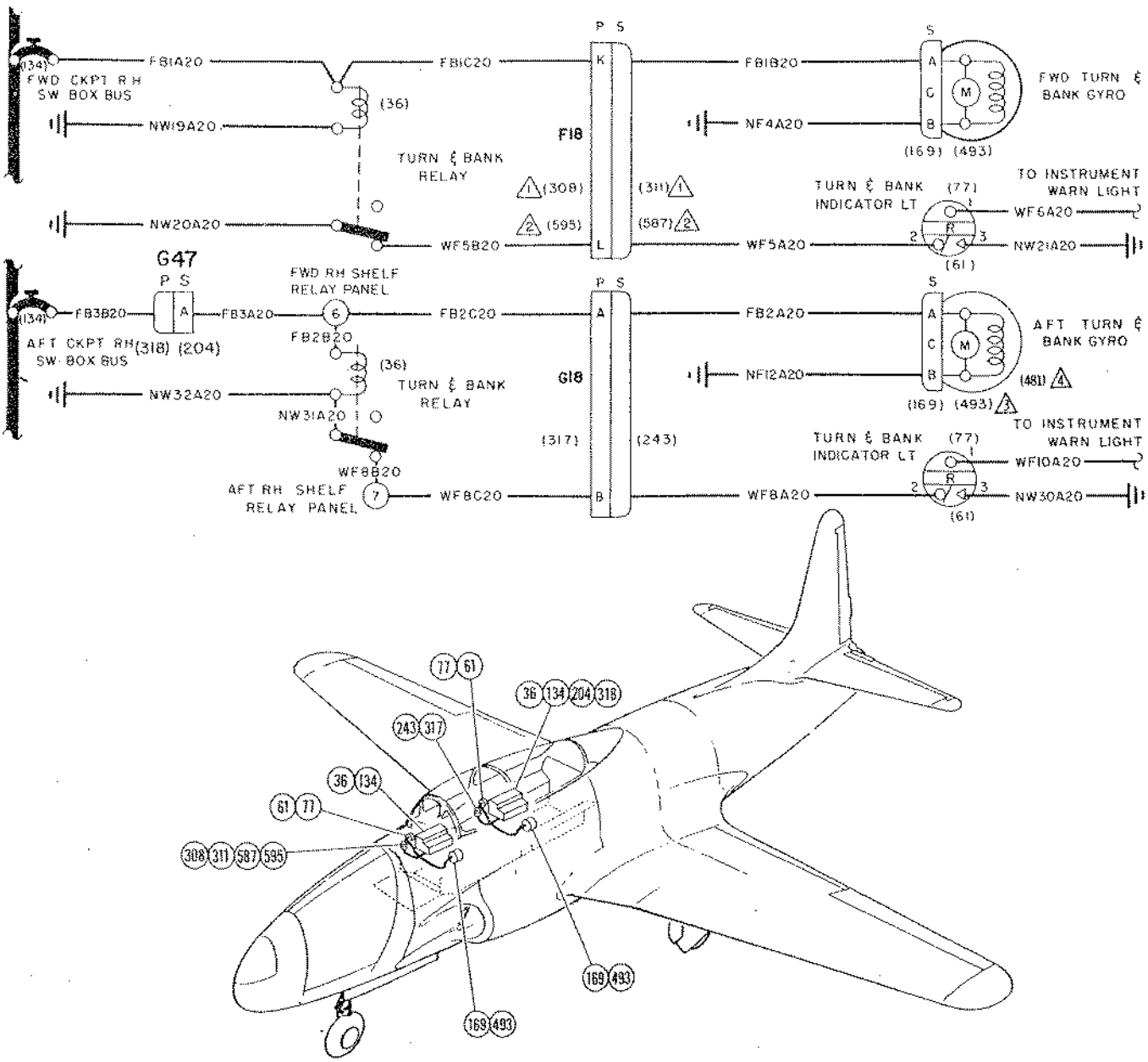
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		N8-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106-10SL-3S
243	CONNECTOR			AN3106--20-29S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102A-20-29P
493	TURN & BANK GYRO	GRAE	C-6	21328

EM-20-21-8-70
C8 23-11

TURN AND BANK INDICATOR CIRCUIT

MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-6819 THRU 51-9235

Figure 8-119. Turn and Bank Indicator Circuit



NOTE

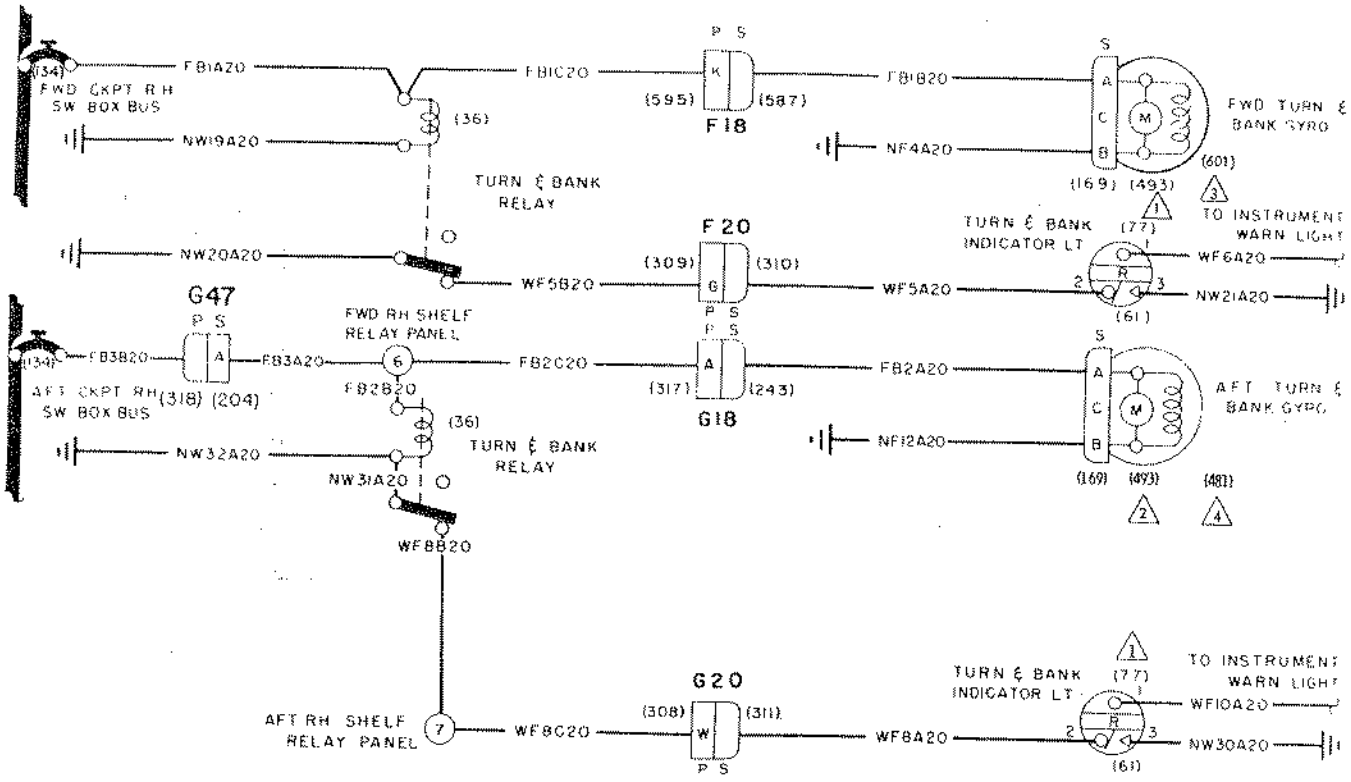
1. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 53-5666
2. USED ON AF SERIAL NO. 53-5666 AND SUBSEQUENT
3. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 56-1624
4. USED ON AF SERIAL NO. 56-1624 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106-10SL-3S
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106-20-29S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN2102A-20-29P
318	CONNECTOR			AN3108-20-29P
481	TURN AND BANK GYRO	GEAE	MD-1A	MS28043-1
493	TURN AND BANK GYRO	GEAE	C-6	21328
587	CONNECTOR			AN3108-28-21S
595	CONNECTOR			AN3102A-28-21P

GB 8818
M20-48D-8-188

TURN AND BANK INDICATOR CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 51-9236 AND SUBSEQUENT

Figure 8-120. Turn and Bank Indicator Circuit



NOTE

1. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 57-608
2. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 56-1624
3. USED ON AIRPLANES AF SERIAL NO. 57-608 AND SUBSEQUENT
4. USED ON AIRPLANES AF SERIAL NO. 56-1624 AND SUBSEQUENT

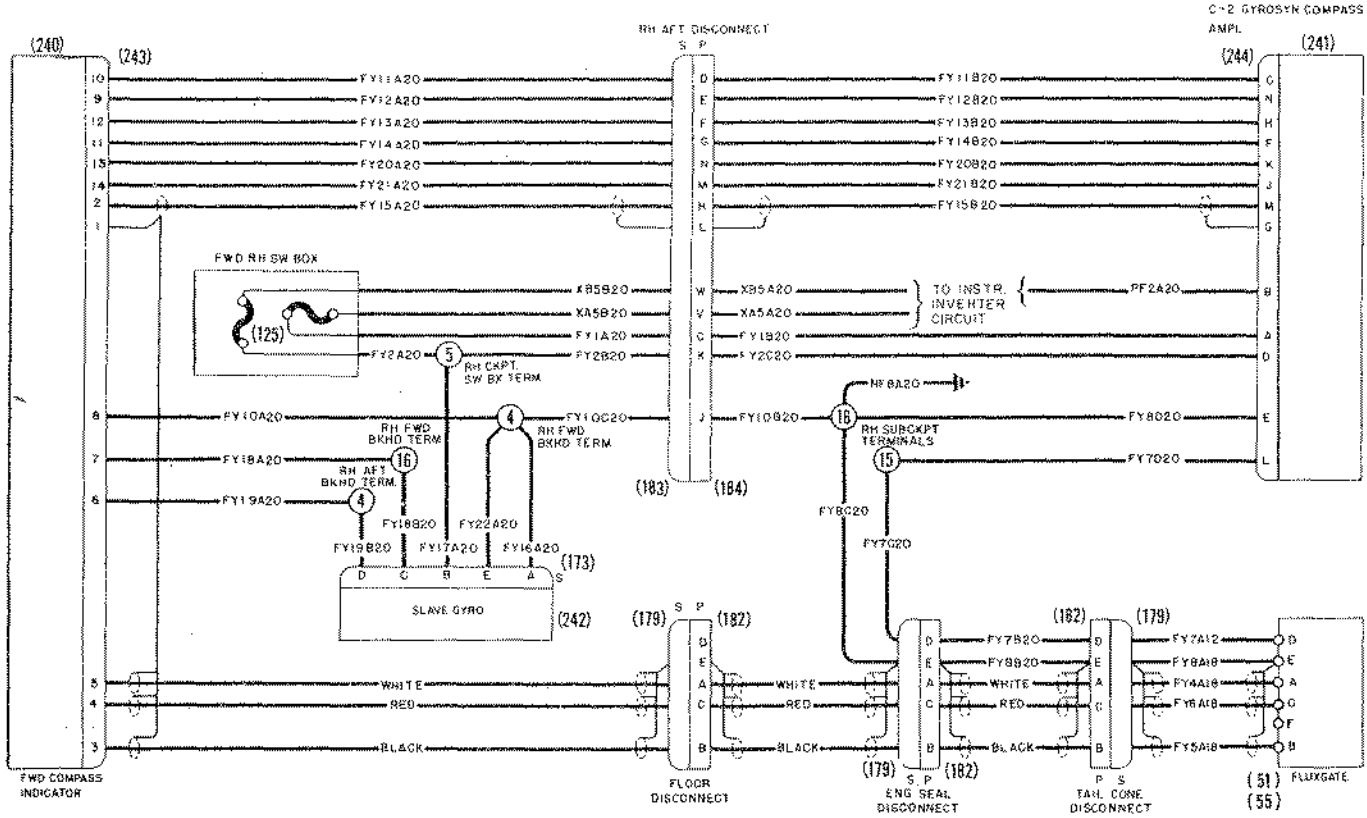
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106-10SL-3S
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106-20-29S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102A32-7P
310	CONNECTOR			AN3106B32-7S
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-29-29P
4 481	TURN AND BANK GYRO	GFAE	MD-1A	MS28041-1
2 493	TURN AND BANK GYRO	GFAE	C-6	21328 OR MS28024-1
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
3 601	TURN AND BANK GYRO	GFAE	MD-8	MS28024-3

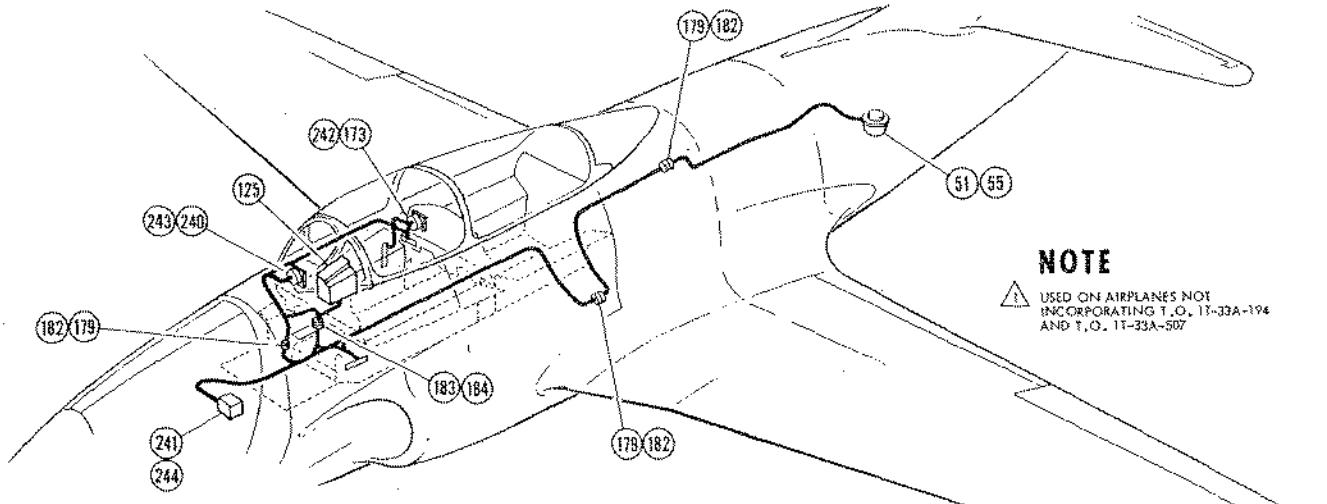
GB 3549
EM20-44-8-398

TURN AND BANK INDICATOR CIRCUIT

MODEL T-33A-5

Figure 8-121. Turn and Bank Indicator Circuit





NOTE

1 USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-194 AND T.O. 1T-33A-507

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC	LOCATION
51	FLUXGATE	GFAE	C-2	27635	TAIL CONE
55	COMPENSATOR	GFAE		656767	TAIL CONE
125	FUSE	LITTELFUSE	2 AMP	413002	RH SWITCH BOXES
173	CONNECTOR			AN3106-14S-5S	AFT COMPASS INDICATOR
179	CONNECTOR			AN3106-16S-8S	
182	CONNECTOR			AN3102P-16S-8P	
183	CONNECTOR			AN3106-28-11S	COCKPIT FLOOR
184	CONNECTOR			AN3102P-28-11P	COCKPIT FLOOR
240	GYROSYN COMPASS	GFAE	C-2	664106-2	FWD INSTRUMENT PANEL
241	COMPASS AMPLIFIER	GFAE	C-2	664256-1	RADIO RACK
242	GYROSYN COMPASS	GFAE	C-2	665264-2	AFT INSTRUMENT PANEL
243	CONNECTOR	GFAE	C-2	815582	FWD COMPARTMENT BND.
244	CONNECTOR			AN3106-20-11S	AMPLIFIER

FB 9053
EM20-40-8-71

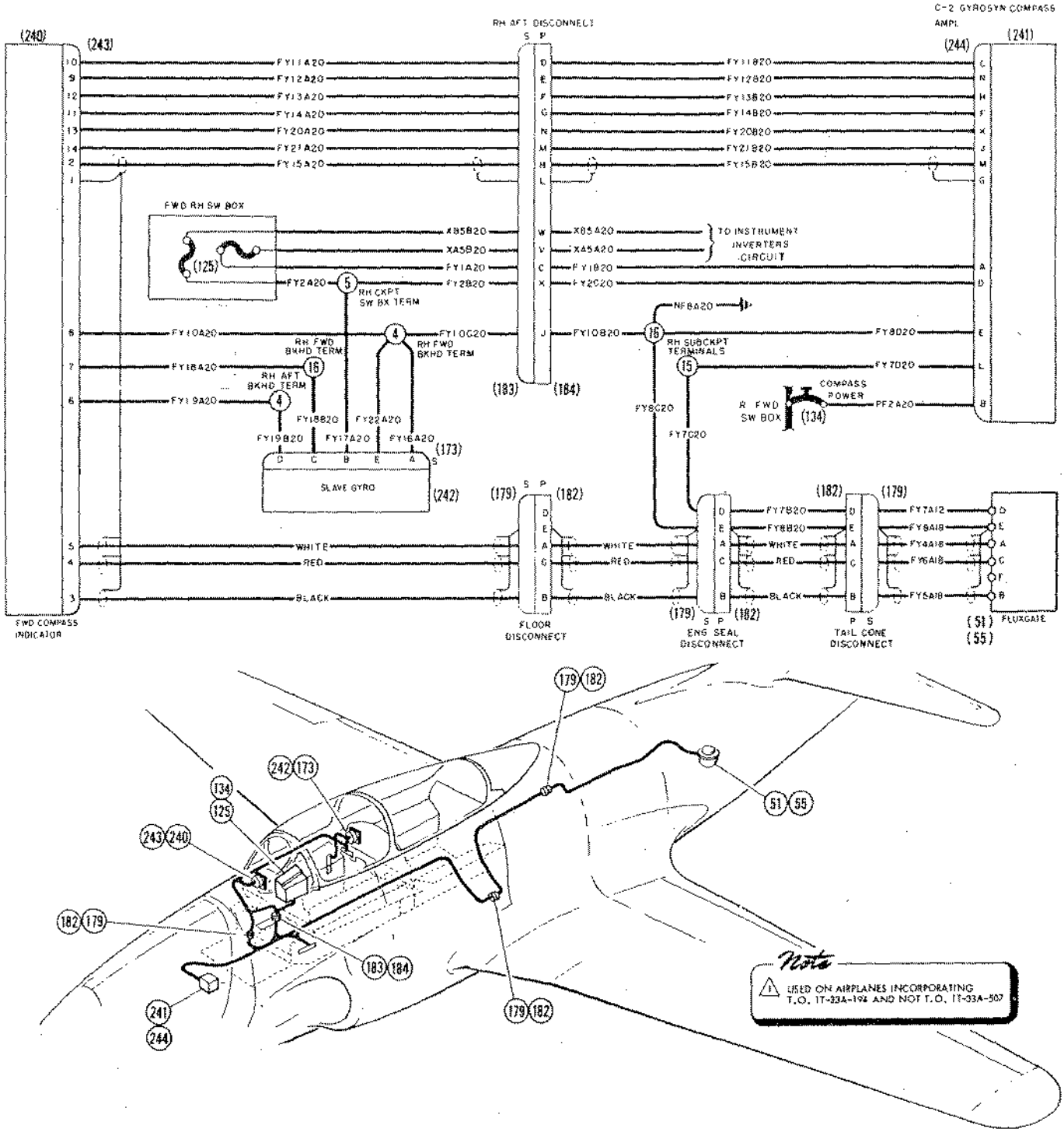
1

GYROSYN COMPASS CIRCUIT

MODEL T-33A

USED ON AF SERIAL NO 48-356 THROUGH 48-375, AND 48-913 THROUGH 48-996

Figure 8-122. Gyrosyn Compass Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUXGATE	GFAE	C-2	29635
55	COMPENSATOR	GFAE		656767
125	FUSE	LITTELFUSE	2 AMP	413002
134	CIRCUIT PROTECTOR			AN3161-95
173	CONNECTOR			AN3106-14S-5S
179	CONNECTOR			AN3106-16S-8S
182	CONNECTOR			AN3102P-16S-8P
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
240	GYROSYN COMPASS	GFAE	C-2	664306-2
241	COMPASS AMPLIFIER	GFAE	C-2	664256-1
242	GYROSYN COMPASS	GFAE	C-2	665264-2
243	CONNECTOR	GFAE	C-2	815582
244	CONNECTOR			AN3106-20-11S

FB9301

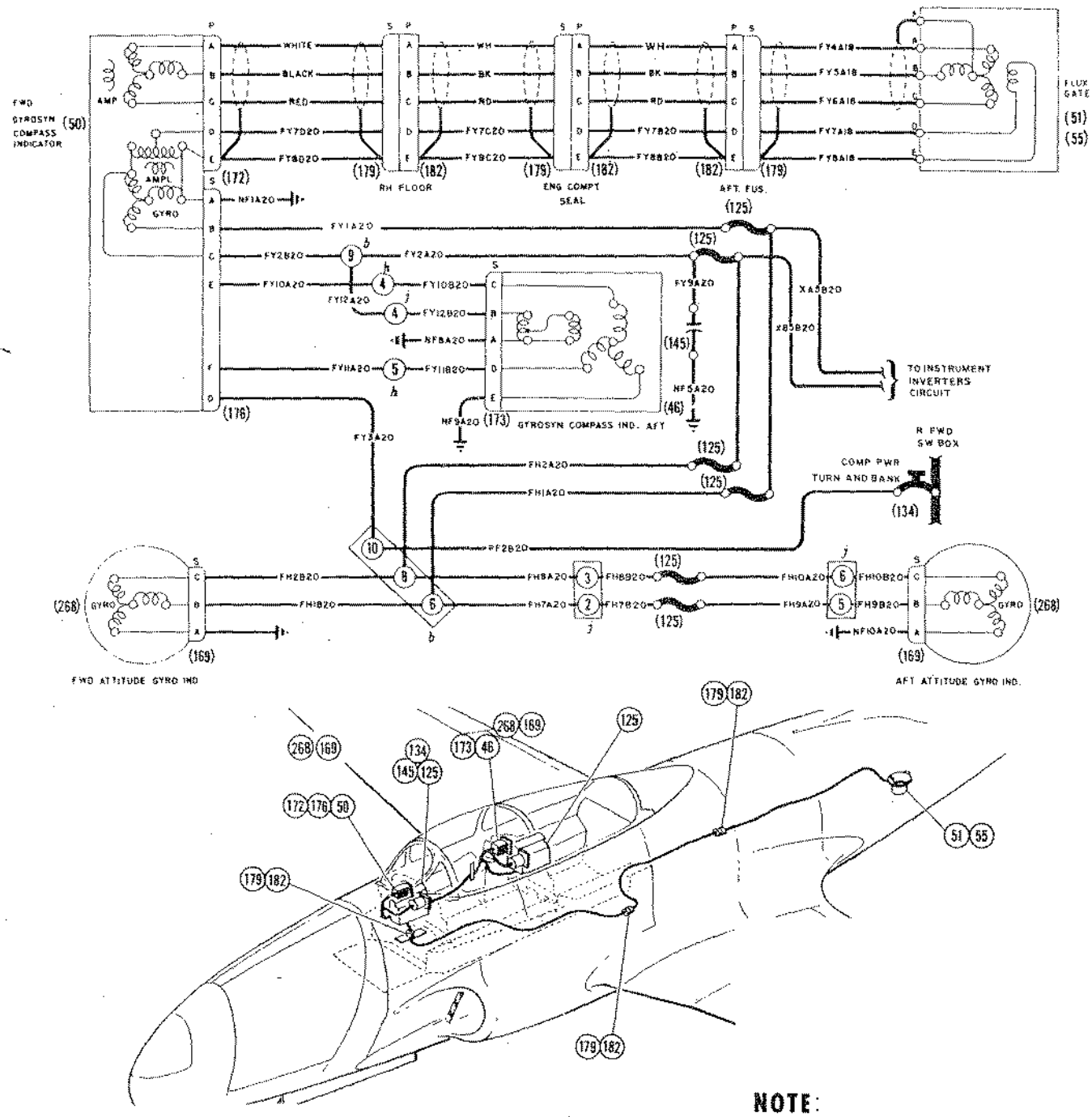
EM20-40-8-292

GYROSYN COMPASS CIRCUIT

MODEL F-33A

USED ON AF SERIAL NO. 48-356 THROUGH 48-375, AND 48-913 THROUGH 48-996

Figure 8-123. Gyrosyn Compass Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
46	GYROSYN COMPASS	GFAE	V-2	21123
50	GYROSYN COMPASS	SPERRY	V-1	656528
51	FLUX GATE	GFAE	C-2	27635
55	COMPENSATOR	SPERRY		656767
125	FUSE	LITTELFUSE	2 AMP	413002
134	CIRCUIT PROTECTOR			AN3161-P5
145	CONDENSER	SPRAGUE		P8TS-364
169	CONNECTOR			MS3106B-10SL-3S
172	CONNECTOR			MS3106B-14S-5P
173	CONNECTOR			MS3106B-14S-5S
176	CONNECTOR			MS3106B-14S-6S
179	CONNECTOR			MS3106B-16S-8S
182	CONNECTOR			MS3102C-16S-8P
268	ATTITUDE GYRO	GFAE	J-8	MIL-I-5133

NOTE:

1. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-507
- b FW RH SW BOX
- h FW RH BLKHD
- j AFT RH BLKHD

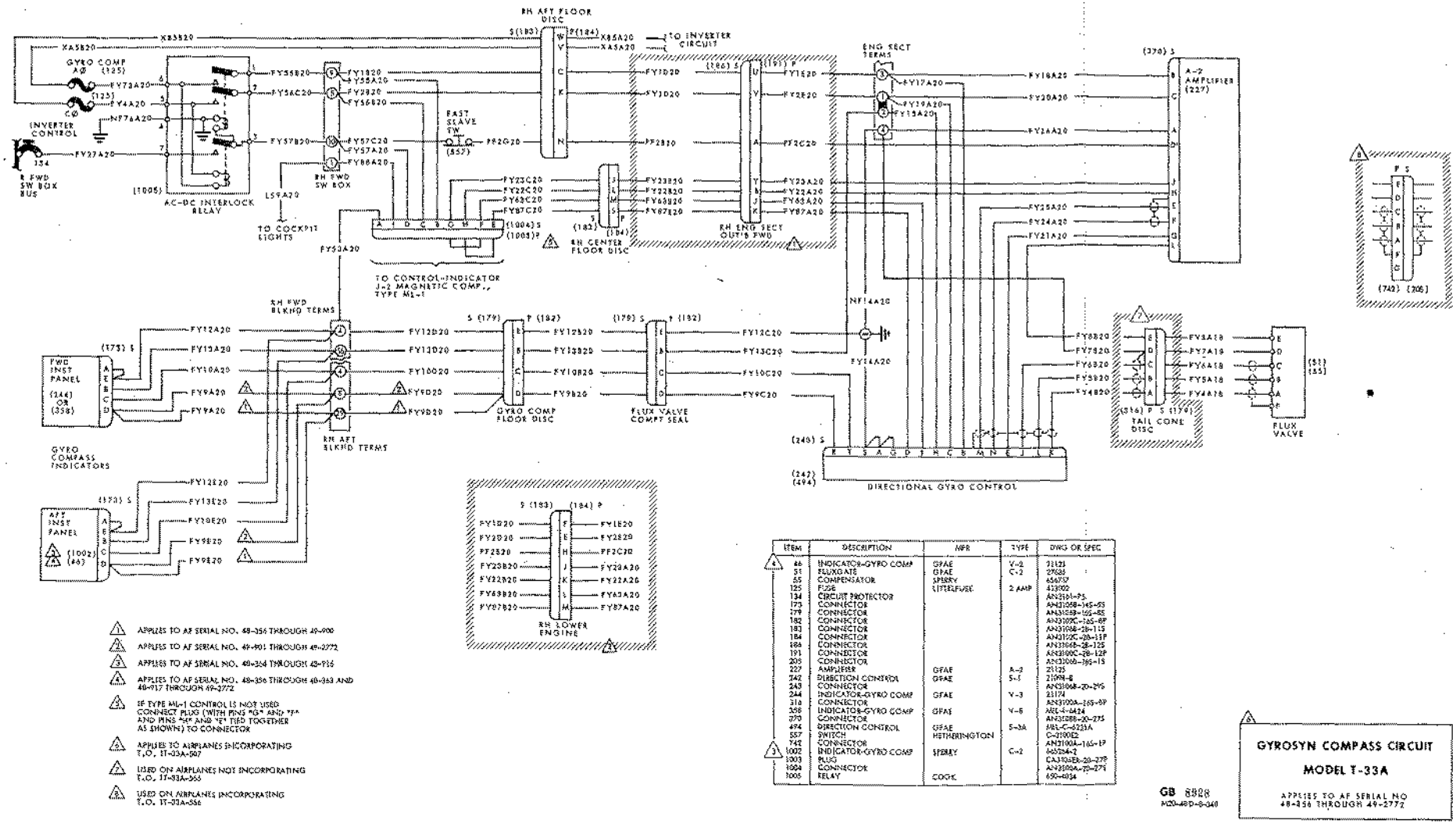
GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-917 THROUGH 49-2772

M20-45-8-293
GB 9412

Figure 8-124. Gyrosyn Compass and Altitude Gyro Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
4	INDICATOR-GYRO COMP	GFAE	V-2	21121
51	FLUXGATE	GFAE	C-2	27026
55	COMPENSATOR	SPERRY		656757
125	FUSE	LITTELFUSE	2 AMP	413002
134	CIRCUIT PROTECTOR			AN3151-2-5
173	CONNECTOR			AN3106B-14S-6S
179	CONNECTOR			AN3459B-16S-8S
182	CONNECTOR			AN3102C-16S-6P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-20A-3P
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
206	CONNECTOR			AN3106A-16S-1S
227	AMPLIFIER	GFAE	A-2	23125
242	DIRECTION CONTROL	GFAE	S-1	21094-B
243	CONNECTOR			AN3106B-20-29S
244	INDICATOR-GYRO COMP	GFAE	V-3	21174
310	CONNECTOR			AN3102A-16S-6P
358	INDICATOR-GYRO COMP	GFAE	V-6	MEL-4-6424
370	CONNECTOR			AN3106B-20-27S
494	DIRECTION CONTROL	GFAE	S-3A	MEL-C-6223A
557	SWITCH	HETHERINGTON		C-219052
743	CONNECTOR			AN3100A-16S-1P
1002	INDICATOR-GYRO COMP	SPERRY	C-2	6652564-2
1003	PLUG			DA3106B-20-27P
1004	CONNECTOR			AN3390A-20-27S
1005	RELAY	COGK		650-4034

1. APPLIES TO AF SERIAL NO. 48-356 THROUGH 49-900
2. APPLIES TO AF SERIAL NO. 49-901 THROUGH 49-2772
3. APPLIES TO AF SERIAL NO. 48-356 THROUGH 48-916
4. APPLIES TO AF SERIAL NO. 48-356 THROUGH 48-363 AND 48-917 THROUGH 49-2772
5. IF TYPE ML-1 CONTROL IS NOT USED CONNECT PLUG (WITH PINS "G" AND "F" AND PINS "M" AND "E" TIED TOGETHER AS SHOWN) TO CONNECTOR
6. APPLIES TO AIRPLANES INCORPORATING T.O. 1T-33A-507
7. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-555
8. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-556

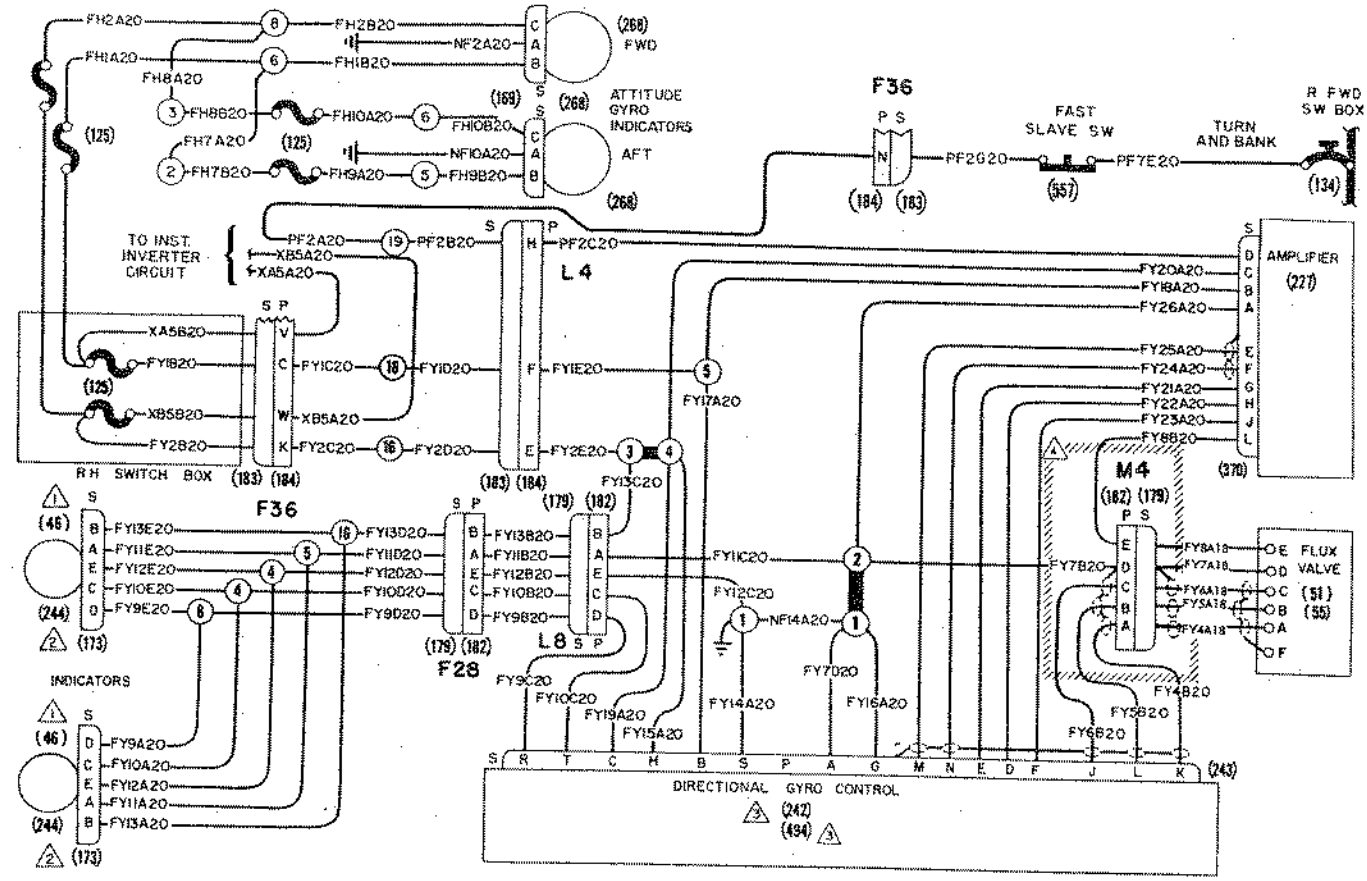
GYROSYN COMPASS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO 48-356 THROUGH 49-2772

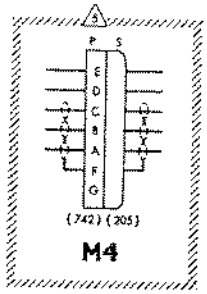
GB 6908
M20-48D-8-340

Figure 8-125. Gyrosyn Compass Circuit



NOTE

1. USED ON AF SERIAL NO. 50-320 THROUGH 50-348
2. USED ON AF SERIAL NO. 50-349 AND SUBSEQUENT
3. ALTERNATES
4. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
1 46	GYROSYN COMPASS	GFAE	V-2	21123
51	FLUXGATE	GFAE	C-2	27635
55	COMPENSATOR	SPERRY		656767
125	FUSE	LITTEL.	2A	413002
134	CIRCUIT PROTECTOR			AN3161-P3
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER			21125
3 242	DIRECTION CONTROL	GFAE	A-2	21125
243	CONNECTOR	GFAE	S-1	210988
2 244	INDICATOR			AN3106B-20-29S
268	ATTITUDE GYRO	GFAE	V-3	21174
370	CONNECTOR	GFAE	J-8	MIL-I-5133
3 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	AN3108B-20-27S MIL-C-6231A
557	SWITCH	HETH.		C-3100E2
742	CONNECTOR			AN3100A-16S-1P

GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

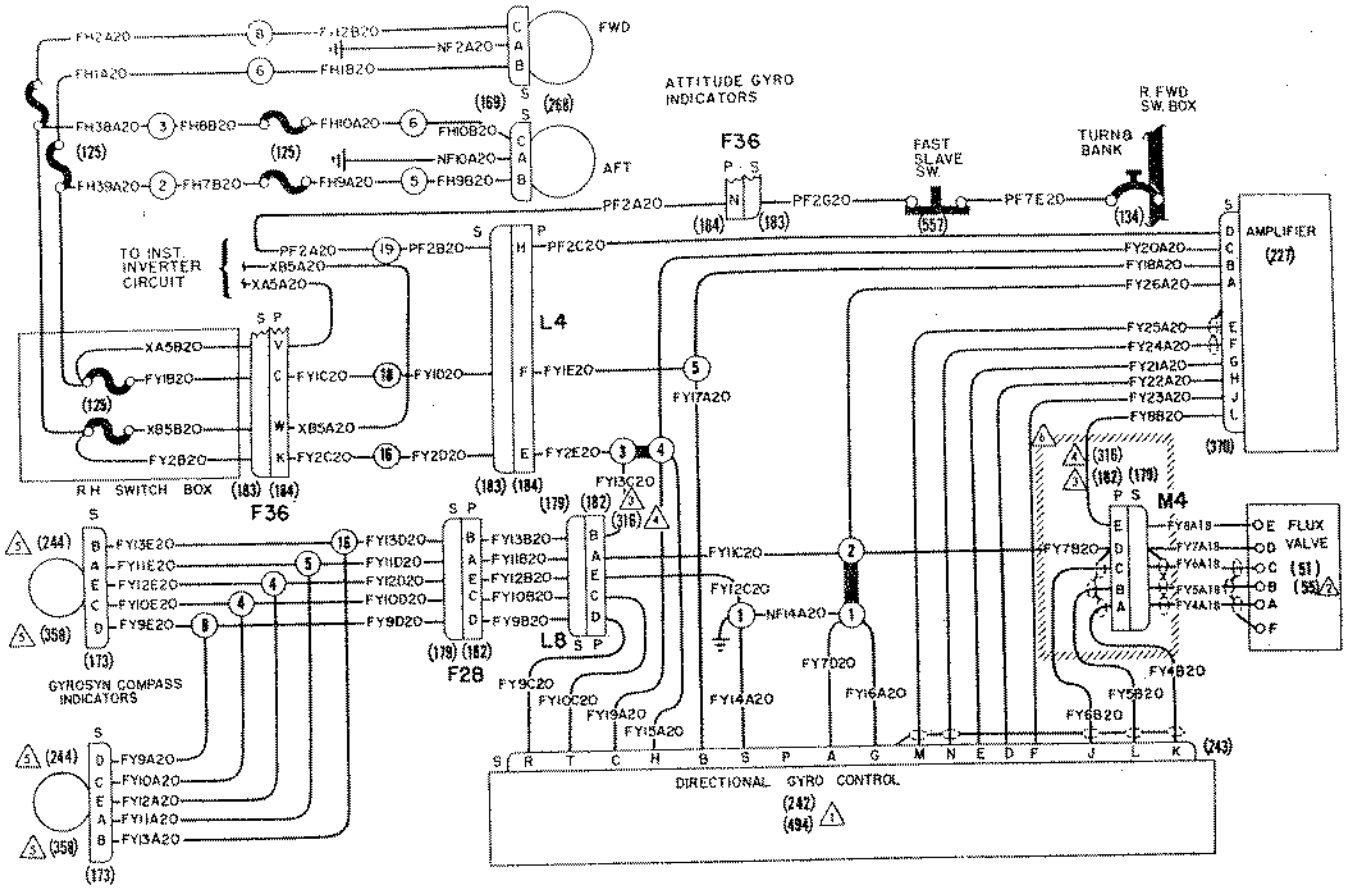
MODEL T-33A

APPLIES TO AF SERIAL NO. 50-320 THROUGH 50-367

GB 8808

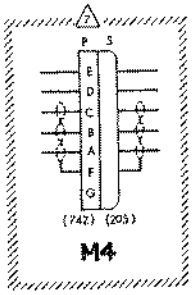
M20-48D-8-285

Figure 8-126. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. COMPENSATOR IS FURNISHED WITH FLUX VALVE ON AF SERIAL NO. 51-4019 THRU 51-4328
3. USED PRIOR TO AF SERIAL NO. 51-4266
4. USED ON AF SERIAL NO. 51-4266 THRU 51-4328
5. ALTERNATES ON AF SERIAL NO. 51-4318 THRU 51-4328
6. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
7. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27635
2 55	COMPENSATOR	SPERRY		656767
129	FUSE	LITTELFUSE	2A	413002
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
1 242	DIRECTION CONTROL	GFAE	S-1	21098-8
243	CONNECTOR			AN3106B-20-29S
3 244	GYROSYN COMPASS	GFAE	V-3	21174
268	ATTITUDE GYRO	GFAE	J-8	MIL-I-5133
4 316	CONNECTOR			AN3100A-16S-8P
5 358	GYROSYN COMPASS	GFAE	V-8	MIL-I-6424
370	CONNECTOR			AN3106B-20-27S
1 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	HETHERINGTON		C-3100E2
742	CONNECTOR			AN3100A-16S-1P

GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

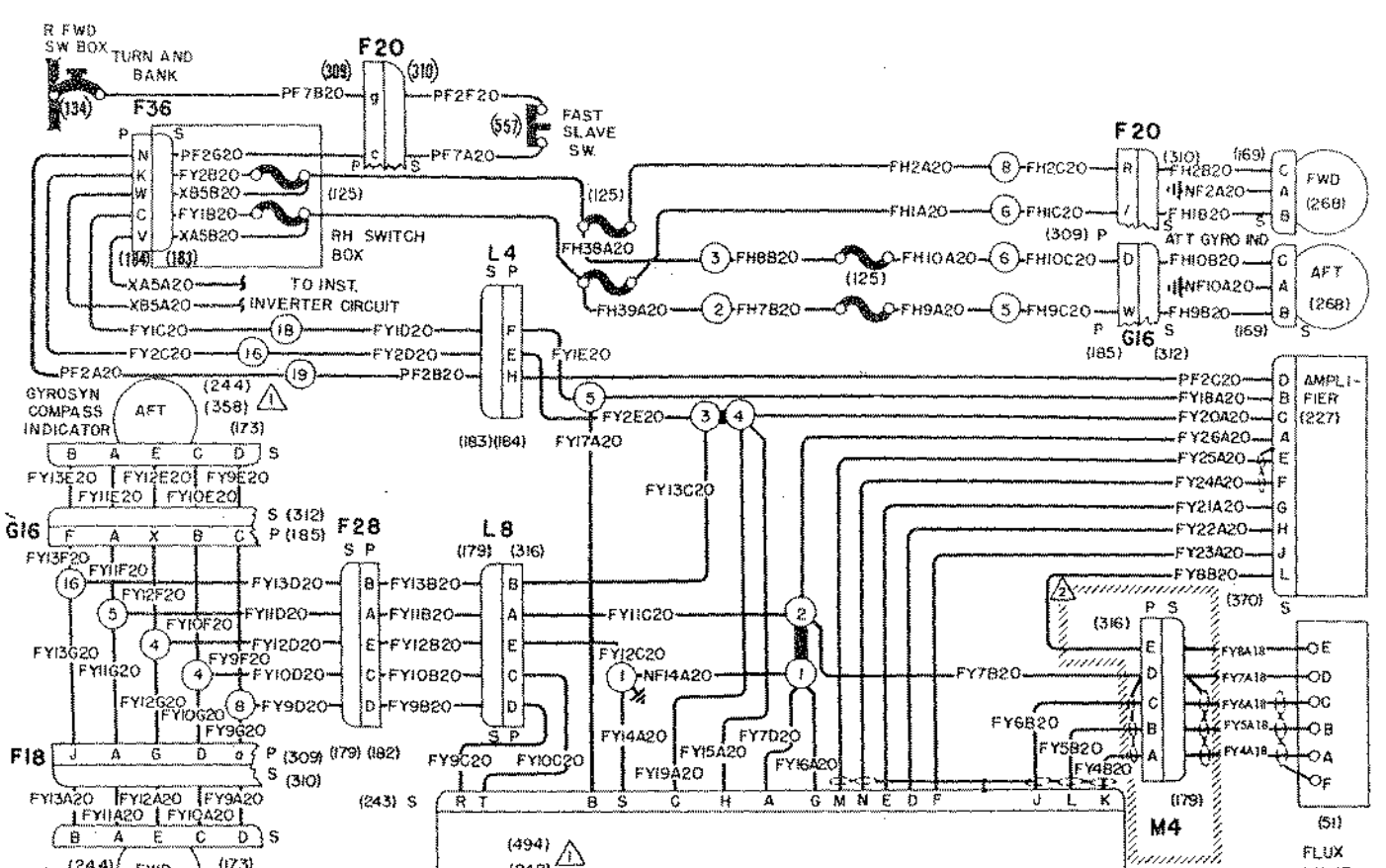
MODEL T-33A

APPLIES TO AF SERIAL NO. 50-368 THROUGH 51-4328

GB 8784

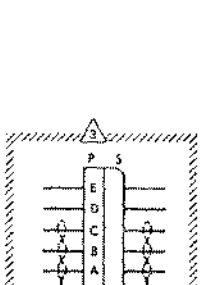
M20-480-8-286

Figure 8-127. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27635
125	FUSE	LITTELFUSE	2A	413002
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
1 242	DIRECTION CONTROL	GFAE	S-1	21098-8
243	CONNECTOR			AN3106B-20-29S
1 244	GYROSYN COMPASS	GFAE	V-3	21174
269	ATTITUDE GYRO	GFAE	J-8	MIL-I-5133
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
312	CONNECTOR			AN3108B-28-11S
316	CONNECTOR			AN3100A-16S-8P
1 358	GYROSYN COMPASS	GFAE	V-8	MIL-C-6424
370	CONNECTOR			AN3108B-20-27S
1 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	HETH.		C-3100E2
742	CONNECTOR			AN3100A-16S-1P

GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

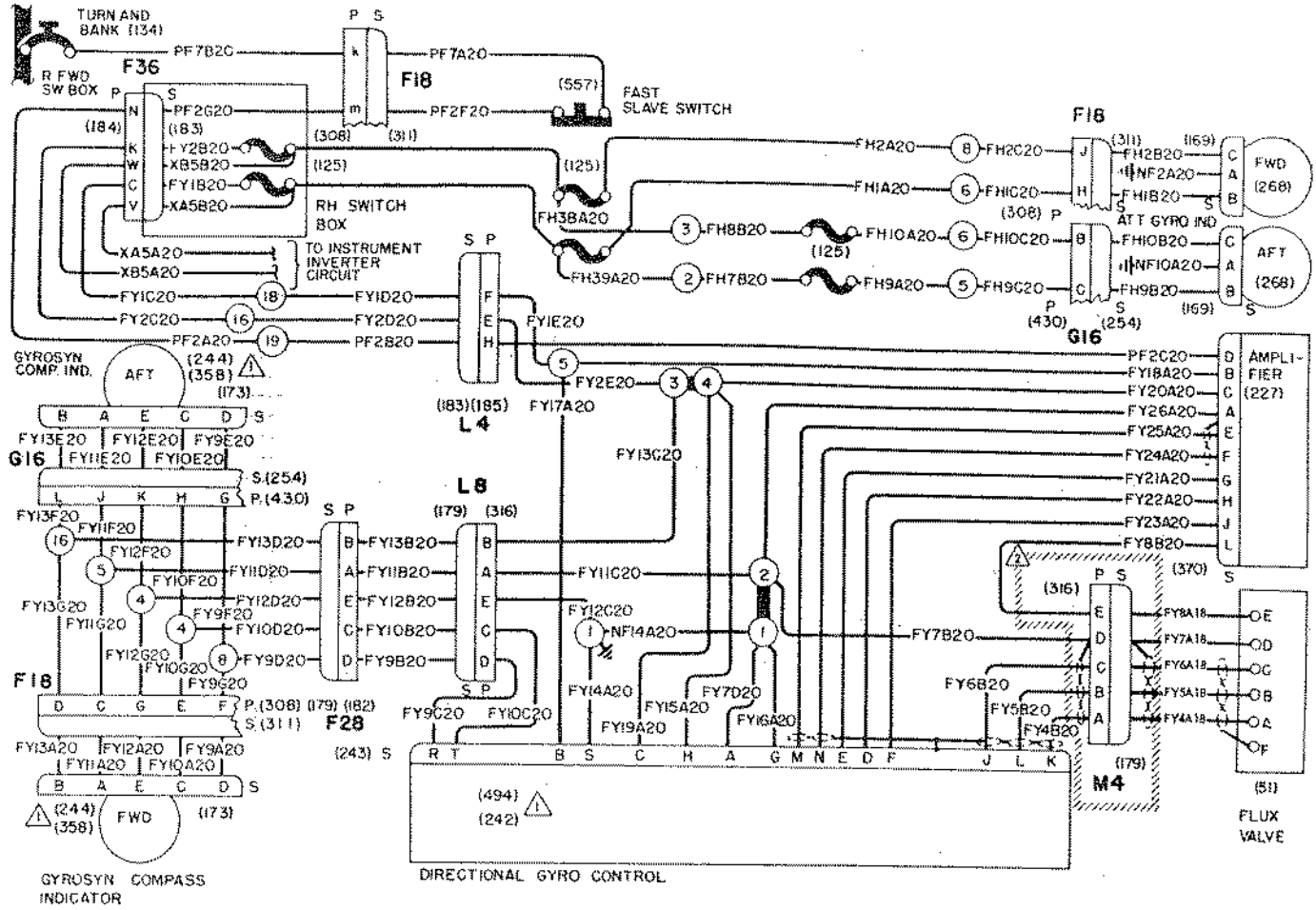
MODEL T-33A

APPLIES TO AF SERIALS NO. 51-4329 THRU 51-6818

GB 8792

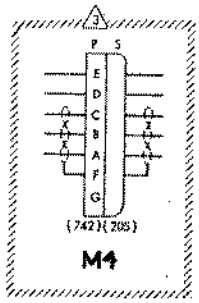
M20-48D-8-287

Figure 8-128. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566

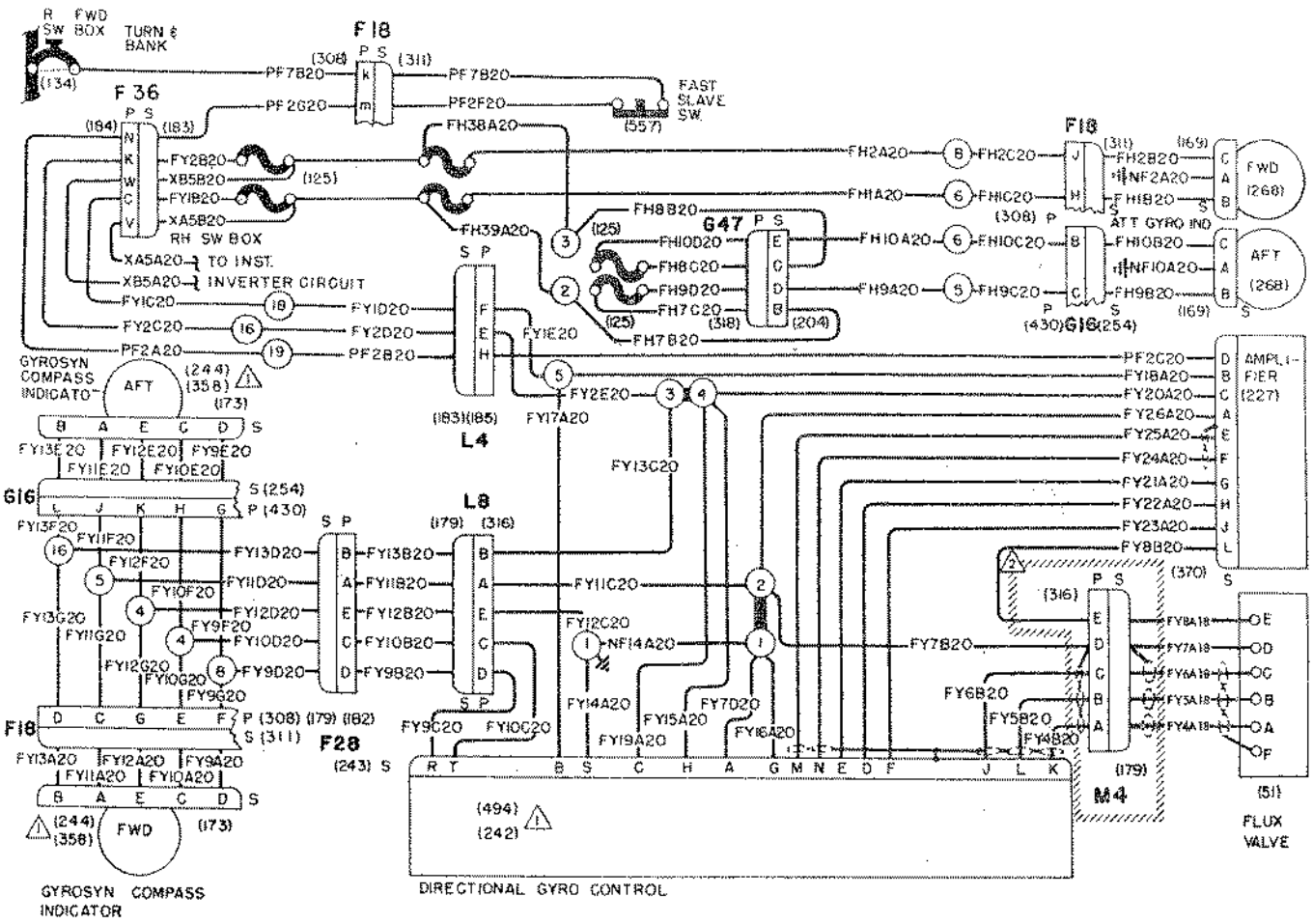


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27035
125	FUSE	LITTELFUSE	2A	413002
134	CIRCUIT PROTECTOR			AN3161-P5
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
206	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
⚠1 242	DIRECTION CONTROL	GFAE	S-1	21098-8
⚠1 243	CONNECTOR	GFAE		AN3106B-20-29S
⚠1 244	GYROSYN COMPASS	GFAE	V-3	21174
254	CONNECTOR			AN3108B-28-12S
268	ATTITUDE GYRO	GFAE	J-8	MIL-I-5123
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-35S
316	CONNECTOR			AN3100A-16S-8P
⚠1 358	GYROSYN COMPASS	GFAE	V-8	MIL-C-6424
370	CONNECTOR			AN3108B-20-27S
430	CONNECTOR			AN3102A-28-12P
⚠1 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	HETHERINGTON		C-3100E2
742	CONNECTOR			AN3100A-16S-1P

GB 8785
M28-48D-8-288

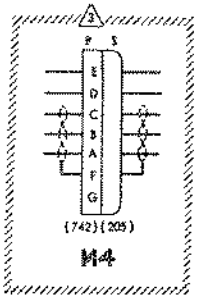
GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THRU 51-9235

Figure 8-129. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27435
125	FUSE	LITTELFUSE	2A	413002
134	CIRCUIT PROTECTOR			AN3161-PS
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
204	CONNECTOR			AN3102A-20-29S
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
1 242	DIRECTION CONTROL	GFAE	S-1	21098-8
243	CONNECTOR			AN3106B-20-29S
1 244	GYROSYN COMPASS IND	GFAE	V-3	21174
254	CONNECTOR			AN3108B-28-12S
268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5133A
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
316	CONNECTOR			AN3100A-16S-8P
318	CONNECTOR			AN3106B-20-29P
1 358	GYRO COMP. INDIC.	SPERRY	V-8	MIL-I-6424
370	CONNECTOR			AN3106B-20-27S
430	CONNECTOR			AN3102A-28-12P
1 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	HETHERINGTON		C-3100E2
742	CONNECTOR			AN3100A-16S-1P

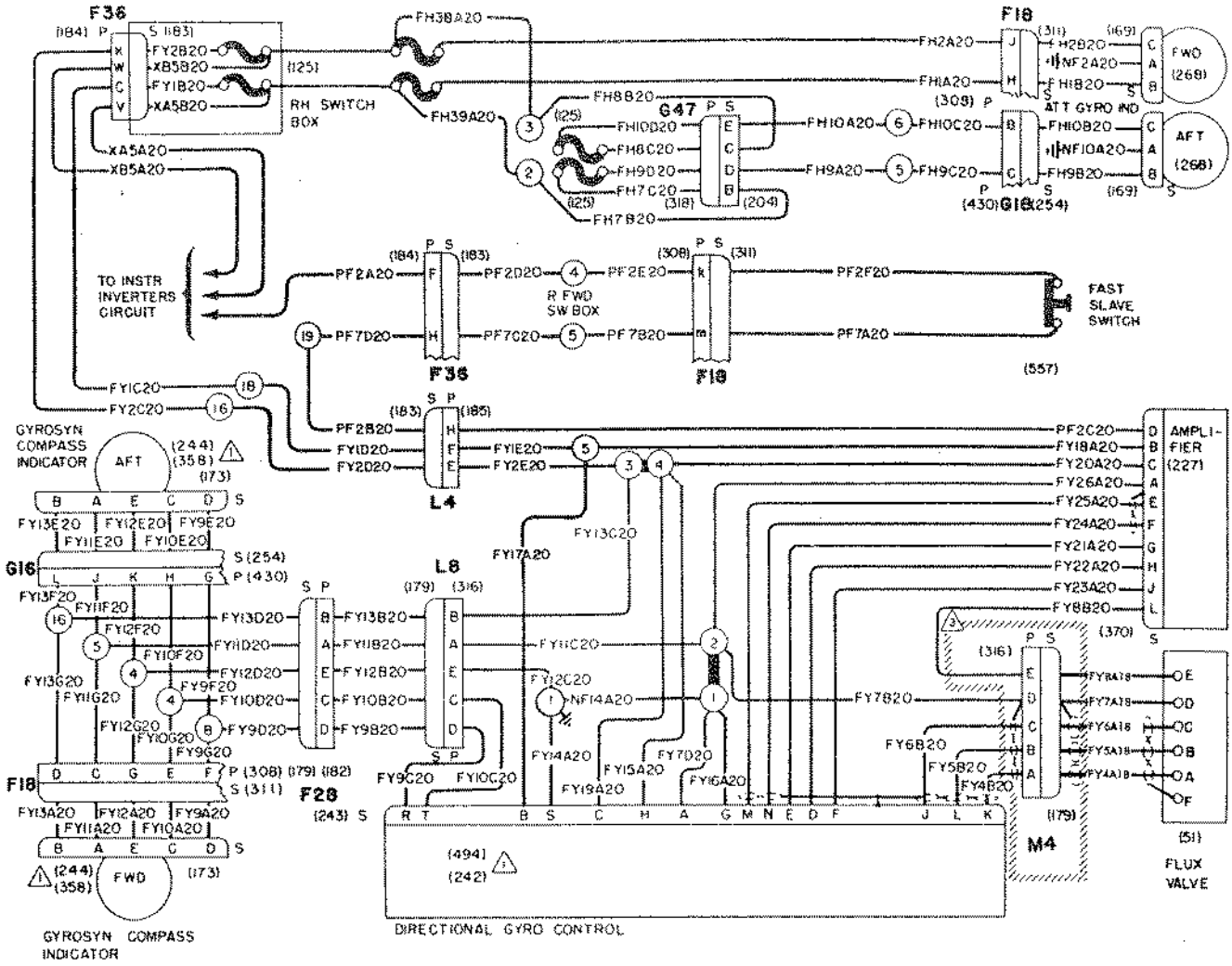
GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9236 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905.

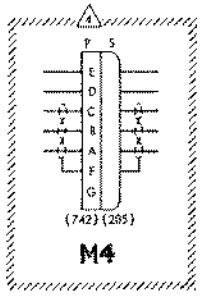
GB 8786
M20-48D-8-289

Figure 8-130. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-194
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	G-2	27635
125	FUSE	LITTELFUSE	2A	413002
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
204	CONNECTOR			AN3102A-20-29S
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
⚠1 242	DIRECTION CONTROL	GFAE	S-1	21098-8
243	CONNECTOR			AN3106B-20-29S
⚠1 244	GYROSYN COMPASS IND	GFAE	V-3	21174
254	CONNECTOR			AN3108B-28-12S
268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5133A
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106A-28-15S
316	CONNECTOR			AN3109A-16S-8P
318	CONNECTOR			AN3106B-20-29P
⚠1 359	GYRO COMP. INDIC.	SPERRY	V-8	MIL-I-4624
370	CONNECTOR			AN3106B-20-27S
430	CONNECTOR			AN3102A-28-12P
⚠1 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	HETHER-INGTON		C-3100E2
742	CONNECTOR			AN3100A-16S-1P

⚠2 **GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT**

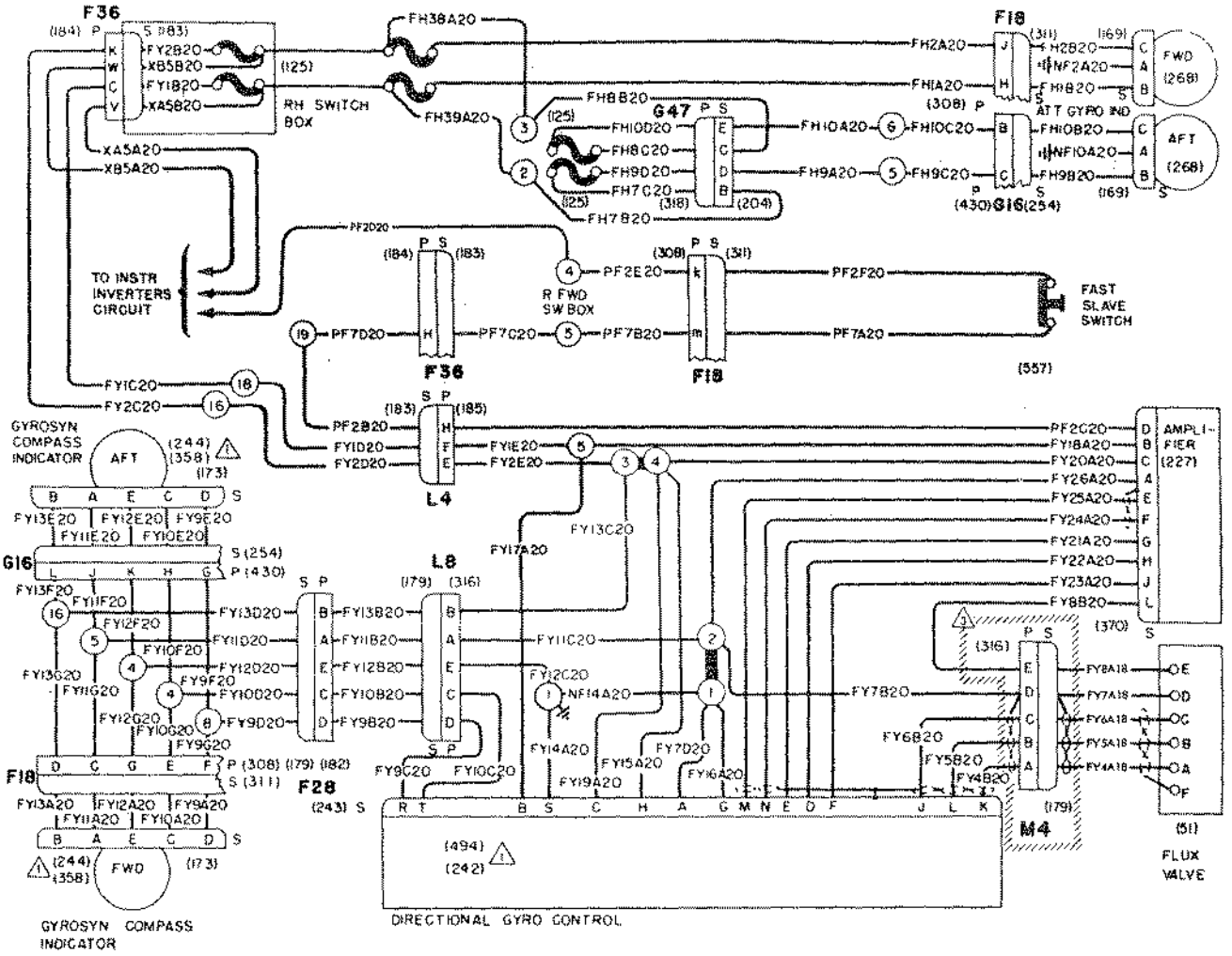
MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9635 THROUGH 52-9759, 52-9906 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

GB 8787

M20-48D-8-201

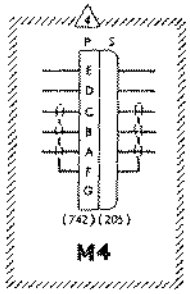
Figure 8-131. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-194
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27635
125	FUSE	LITTELFUSE	2A	413002
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
204	CONNECTOR			AN3102A-20-29S
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21325
242	DIRECTION CONTROL	GFAE	S-1	210988
243	CONNECTOR			AN3106B-20-29S
244	GYROSYN COMPASS IND	GFAE	V-3	21374
254	CONNECTOR			AN3108B-28-12S
268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5393A
308	CONNECTOR			AN3102A-28-13P
311	CONNECTOR			AN3106B-28-15S
316	CONNECTOR			AN3100A-16S-8P
318	CONNECTOR			AN3106B-20-29P
358	GYRO COMP INDIC	SPERRY	V-8	MIL-I-6424
370	CONNECTOR			AN3108B-20-27S
430	CONNECTOR			AN3102A-28-12P
494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	NETHER-LINGTON		C-3100E2
742	CONNECTOR			AN3100A-16S-1P



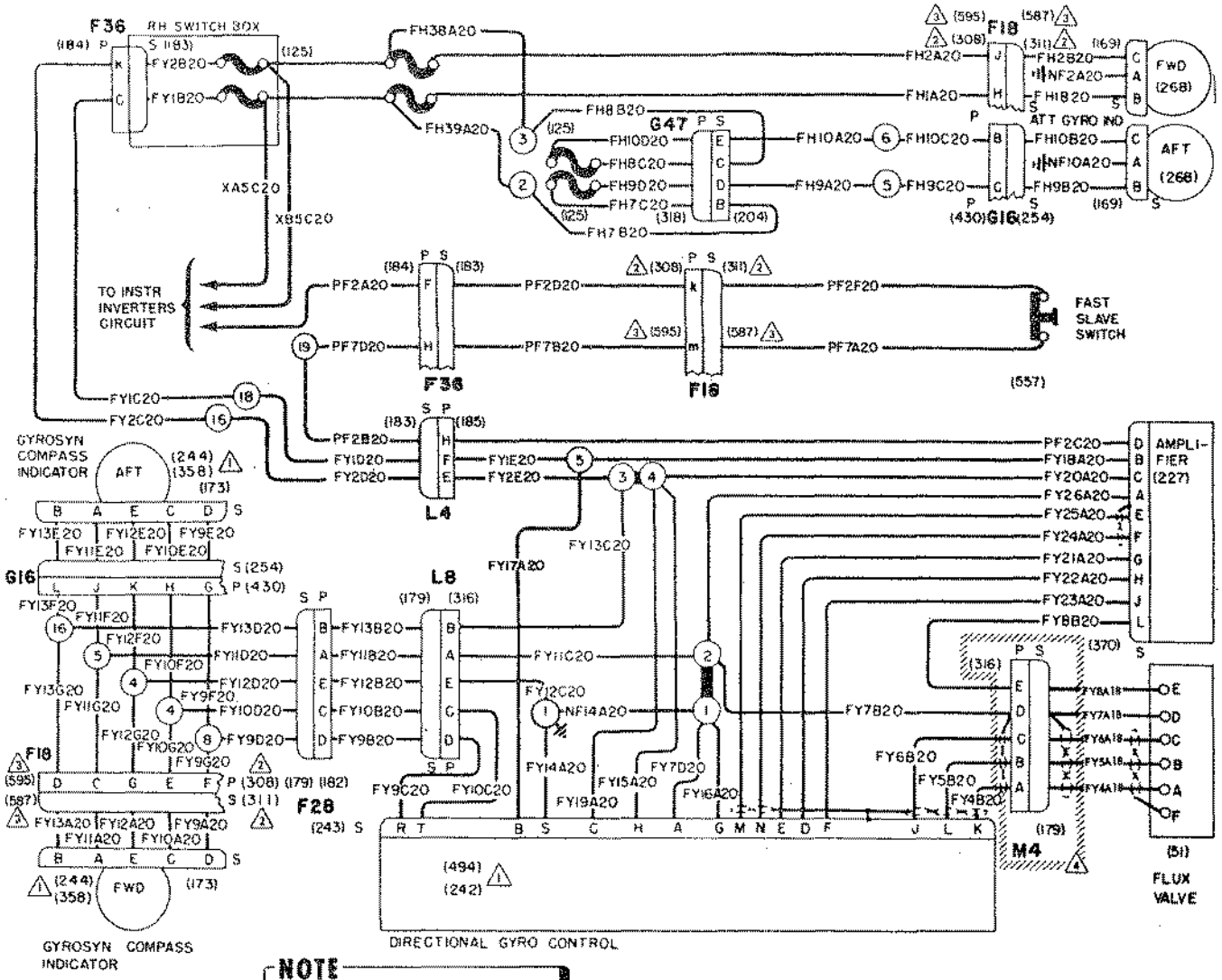
GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9635 THROUGH 52-9759, 52-9905 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

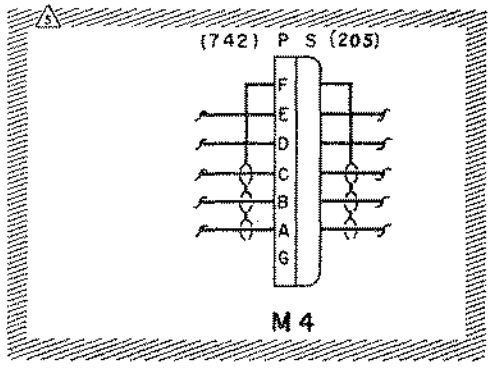
GB 8788
M20-480-8-439

Figure 8-132. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. ALTERNATES
2. USED PRIOR TO AF SERIAL NO. 53-5666
3. USED ON AF SERIAL NO. 53-5666 AND SUBSEQUENT
4. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 56-1684 NOT INCORPORATING T.O. 1T-33A-566
5. USED ON AIRPLANES AF NO. 56-1684 AND SUBSEQUENT AND AIRPLANES INCORPORATING T.O. 1T-33A-566



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27635
125	FUSE	LITTELFUSE	2A	413002
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106A-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
204	CONNECTOR			AN3102A-20-29S
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
242	DIRECTION CONTROL	GFAE	S-1	21098-8
243	CONNECTOR			AN3106B-20-29S
244	GYROSYN COMPASS IND	GFAE	V-3	21174
254	CONNECTOR			AN3106B-28-12S
268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5133A
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
316	CONNECTOR			AN3102A-16S-8P
318	CONNECTOR			AN3106B-20-29P
358	GYRO COMP. INDIC.	SPERRY	V-8	MIL-I-4424
370	CONNECTOR			AN3106B-20-27S
430	CONNECTOR			AN3102A-28-12P
494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6213A
557	SWITCH	HETHER-INGTON		C-3100E2
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-25-23P
742	CONNECTOR			AN3100A-16S-1P

GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

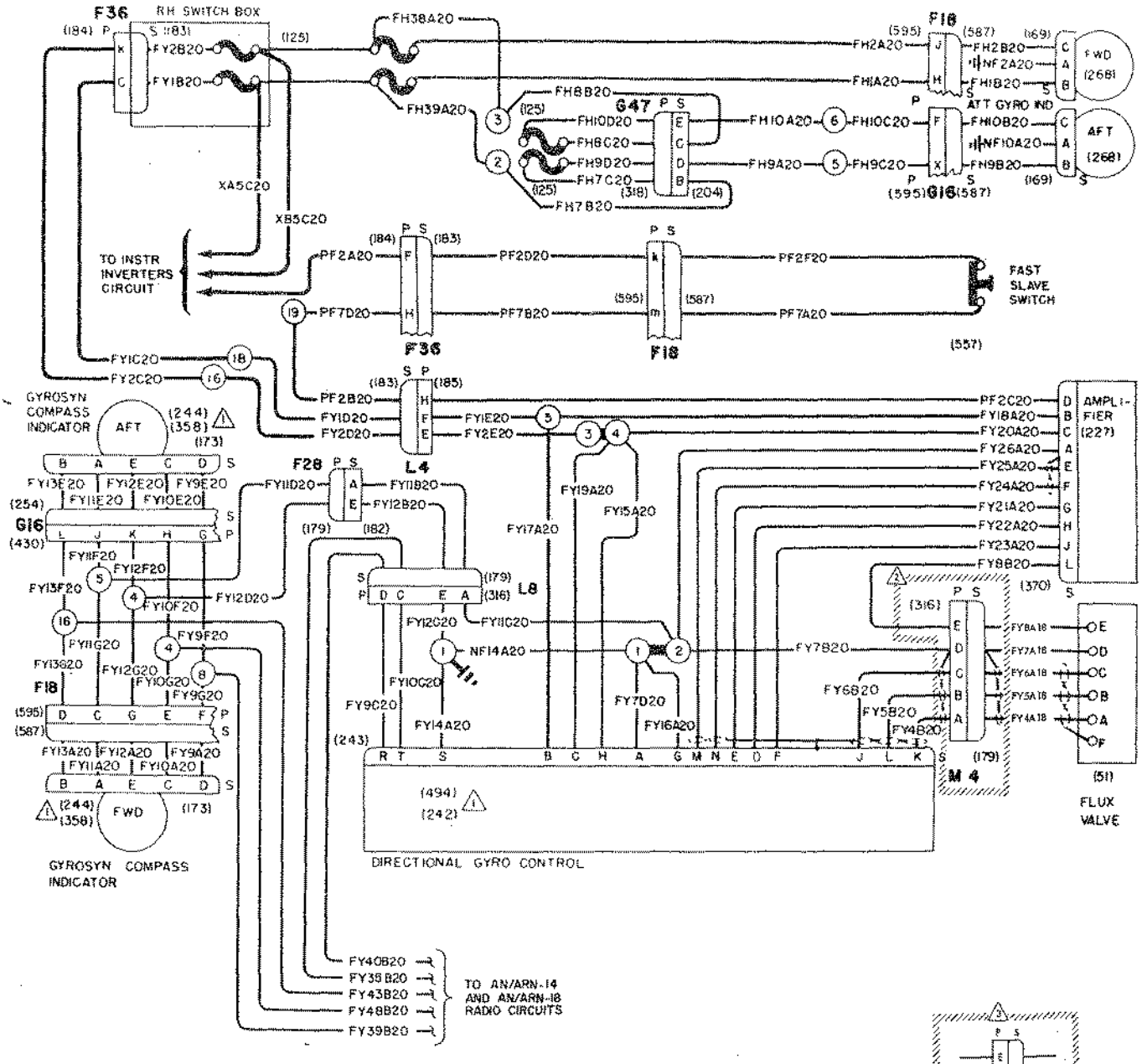
MODEL T-33A-1

APPLIES TO AF SERIAL NO. 52-9760 AND SUBSEQUENT, EXCEPT 52-9906 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

GB 8789

M20-48D-9-223

Figure 8-133. Gyrosyn Compass and Attitude Gyro Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27635
125	FUSE	LITTELFUSE	2A	413002
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
204	CONNECTOR			AN3102A-20-29S
205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	21125
① 242	DIRECTION CONTROL	GFAE	S-3	23098-8
243	CONNECTOR			AN3106B-20-29S
① 244	GYROSYN COMPASS IND	GFAE	V-3	23174
254	CONNECTOR			AN3108B-28-12S
268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5133A
316	CONNECTOR			AN3100A-16S-8P
318	CONNECTOR			AN3106B-20-29P
① 358	GYRO COMP. INDIC.	SPERRY	V-8	MIL-I-5424
370	CONNECTOR			AN3108B-20-27S
430	CONNECTOR			AN3102A-28-12P
① 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
557	SWITCH	NETHER-LINGTON		C-3100F2
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
742	CONNECTOR			AN3100A-16S-1P

NOTE

① ALTERNATES

② USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-566

③ USED ON AIRPLANES INCORPORATING T.O. 1T-33A-566

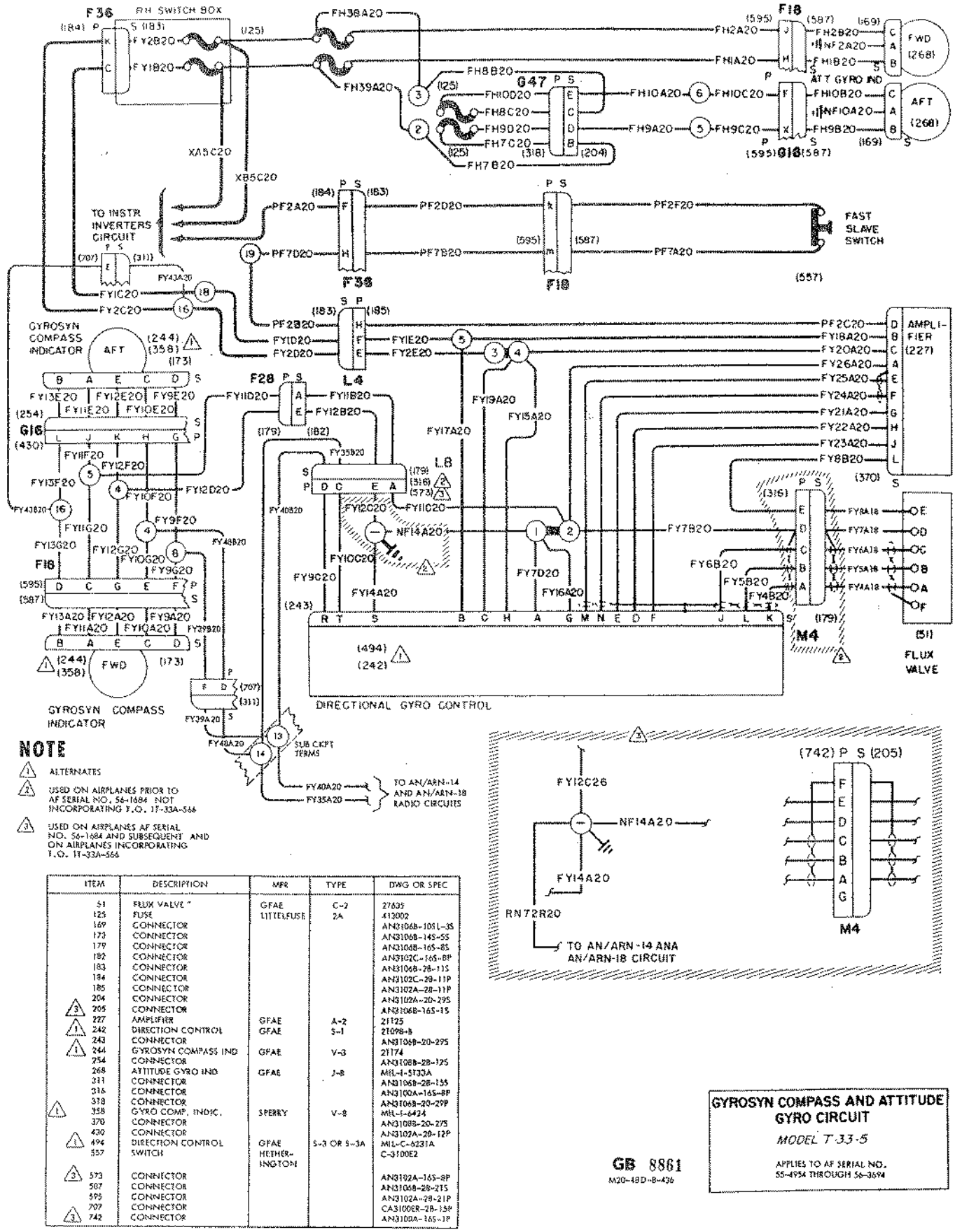
GB 8790
M20-ABD-8-383

GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

MODEL T-33-5

PRIOR TO AF SERIAL NO. 55-4954

Figure 8-134. Gyrosyn Compass and Attitude Gyro Circuit

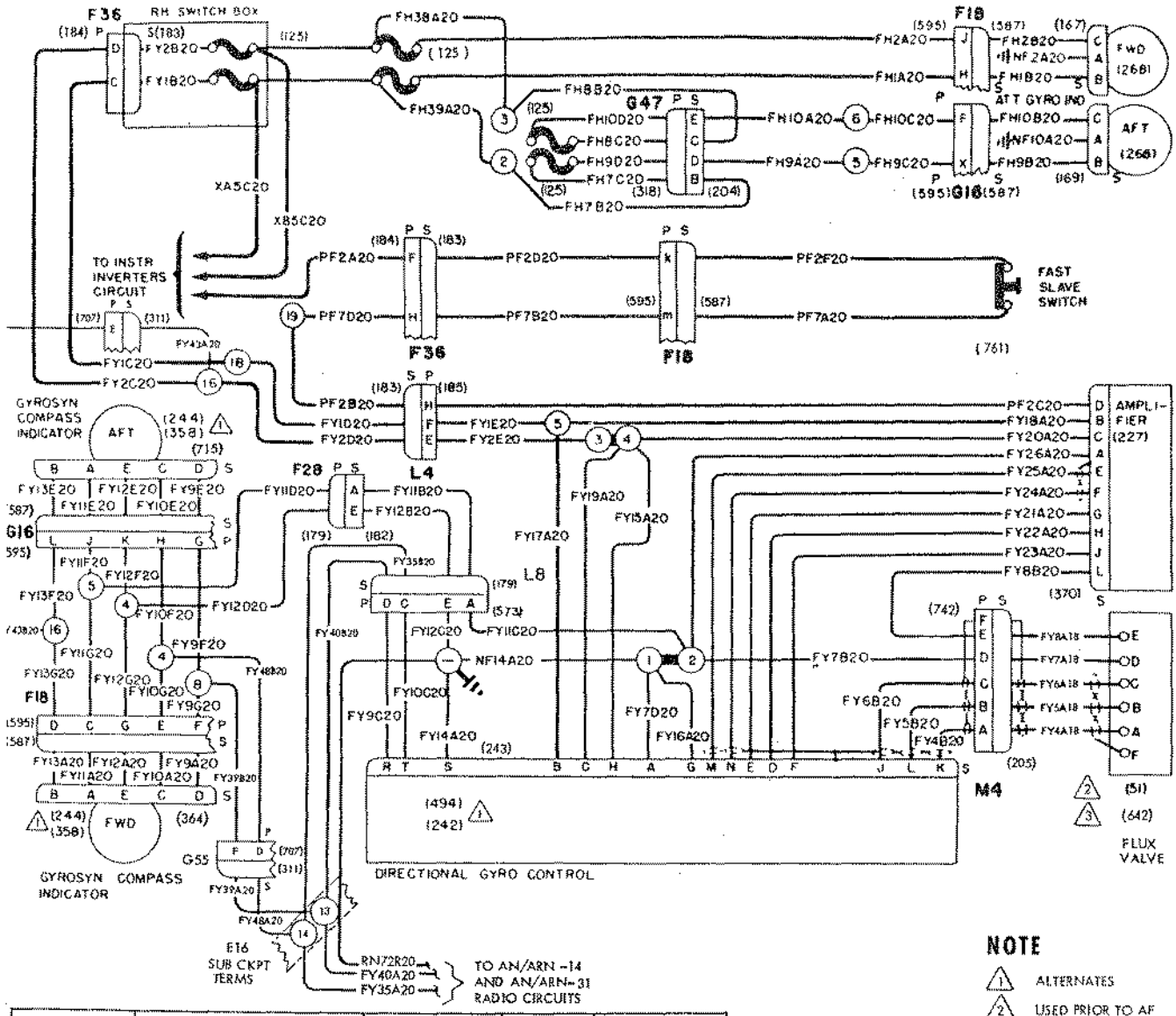


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
51	FLUX VALVE	GFAE	C-2	27635
125	FUSE	LITTELFUSE	2A	413002
169	CONNECTOR			AN3106B-10SL-3S
173	CONNECTOR			AN3106B-14S-5S
179	CONNECTOR			AN3106B-16S-8S
182	CONNECTOR			AN3102C-16S-8P
183	CONNECTOR			AN3106B-28-21S
184	CONNECTOR			AN3102C-28-21P
185	CONNECTOR			AN3102A-28-11P
204	CONNECTOR			AN3102A-20-29S
3 205	CONNECTOR			AN3106B-16S-1S
227	AMPLIFIER	GFAE	A-2	2F125
1 242	DIRECTION CONTROL	GFAE	S-1	2F098-8
243	CONNECTOR			AN3106B-20-29S
1 244	GYROSYN COMPASS IND	GFAE	V-3	2F174
254	CONNECTOR			AN3108B-28-12S
268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5133A
311	CONNECTOR			AN3106B-28-15S
316	CONNECTOR			AN3100A-16S-8P
378	CONNECTOR			AN3106B-20-29P
1 358	GYRO COMP. INDIC.	SPERRY	V-8	MIL-I-6424
370	CONNECTOR			AN3108B-20-27S
430	CONNECTOR			AN3102A-28-12P
1 494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6213A
557	SWITCH	HEATHER-INGTON		C-3100E2
3 573	CONNECTOR			AN3192A-16S-8P
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
707	CONNECTOR			CA3100ER-28-15P
3 742	CONNECTOR			AN3100A-16S-1P

GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT
MODEL T-33-5
APPLIES TO AF SERIAL NO. 55-4954 THROUGH 56-3694

GB 8861
M20-48D-8-436

Figure 8-135. Gyrosyn Compass and Attitude Gyro Circuit



	ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	51	FLUX VALVE	GFAE	C-2	27635
	125	FUSE	LITTELFUSE	2A	413002
	167	CONNECTOR			AN3108B-10SL-3S
	169	CONNECTOR			AN3106B-10SL-3S
	173	CONNECTOR			AN3106B-14S-5S
	179	CONNECTOR			AN3106B-16S-8S
	182	CONNECTOR			AN3102C-16S-8P
	183	CONNECTOR			AN3106B-28-11S
	184	CONNECTOR			AN3102C-28-11P
	185	CONNECTOR			AN3102A-28-11P
	264	CONNECTOR			AN3102A-20-29S
	205	CONNECTOR			AN3106B-16S-1S
	227	AMPLIFIER	GFAE	A-2	21125
1	242	DIRECTION CONTROL	GFAE	S-1	21098-8
1	243	CONNECTOR			AN3106B-20-29S
1	244	GYROSYN COMPASS IND	GFAE	V-3	21174
	268	ATTITUDE GYRO IND	GFAE	J-8	MIL-I-5133A
	311	CONNECTOR			AN3106B-28-15S
	318	CONNECTOR			AN3106B-20-29P
1	358	GYRO COMP. INDIC.	SPERRY	V-8	MIL-I-6424
	364	CONNECTOR			AN3108B-14S-5S
	370	CONNECTOR			AN3108B-20-27S
1	494	DIRECTION CONTROL	GFAE	S-3 OR S-3A	MIL-C-6231A
	557	SWITCH	HETHERINGTON		C-3100F2
	573	CONNECTOR			AN3102A-16S-8P
	587	CONNECTOR			AN3106B-29-2TS
	595	CONNECTOR			AN3102A-28-2EP
3	642	DETECTOR, MAG. AZ.	GFAE	DT-173/AJN	MIL-D-2552IA
	707	CONNECTOR			CA3100ER-28-15P
	715	CONNECTOR			CA3106ER-14S-5S
	742	CONNECTOR			AN3100A-16S-1P
	761	SWITCH			MS25089-5C

NOTE

1. ALTERNATES
2. USED PRIOR TO AF SERIAL NO. 58-450
3. USED ON AF SERIAL NO. 58-450 AND SUBSEQUENT

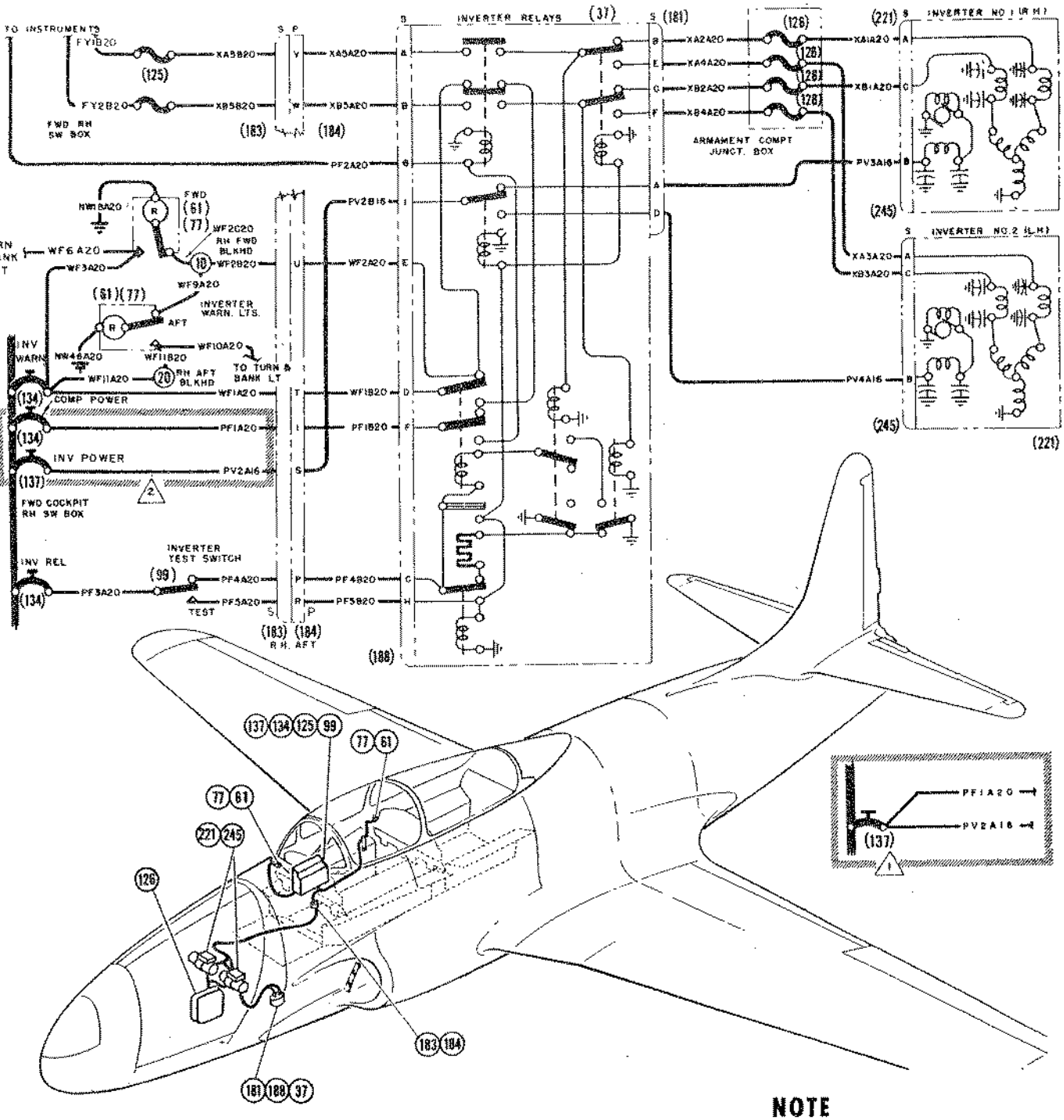
GYROSYN COMPASS AND ATTITUDE GYRO CIRCUIT

MODEL T-33-5

APPLIES TO AF SERIAL NO. 57-530 AND SUBSEQUENT

M20-45-8-13
GB 4536

Figure 8-136. Gyrosyn Compass and Attitude Gyro Circuit



NOTE

1. USED ON AF SERIAL NO. 49-901 AND SUBSEQUENT.
2. USED ON AF SERIAL NO. 48-356 THROUGH 48-375, 48-913 THROUGH 48-920, AND 49-879 THROUGH 49-900.
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-194

ITEM	DESCRIPTION	MFR.	TYPE	DWG. OR SPEC.
37	RELAY	COOK		650-1099
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
99	SWITCH	C-H		8804
125	FUSE	LITTELFUSE	2 AMP	413002
126	FUSE	LITTELFUSE	3 AMP	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
188	CONNECTOR			AN3106-20-16S
221	INVERTER	GPAE		AN3187-1
245	CONNECTOR			AN3108-14S-7S

GB 8805
M20-4BD-9-83

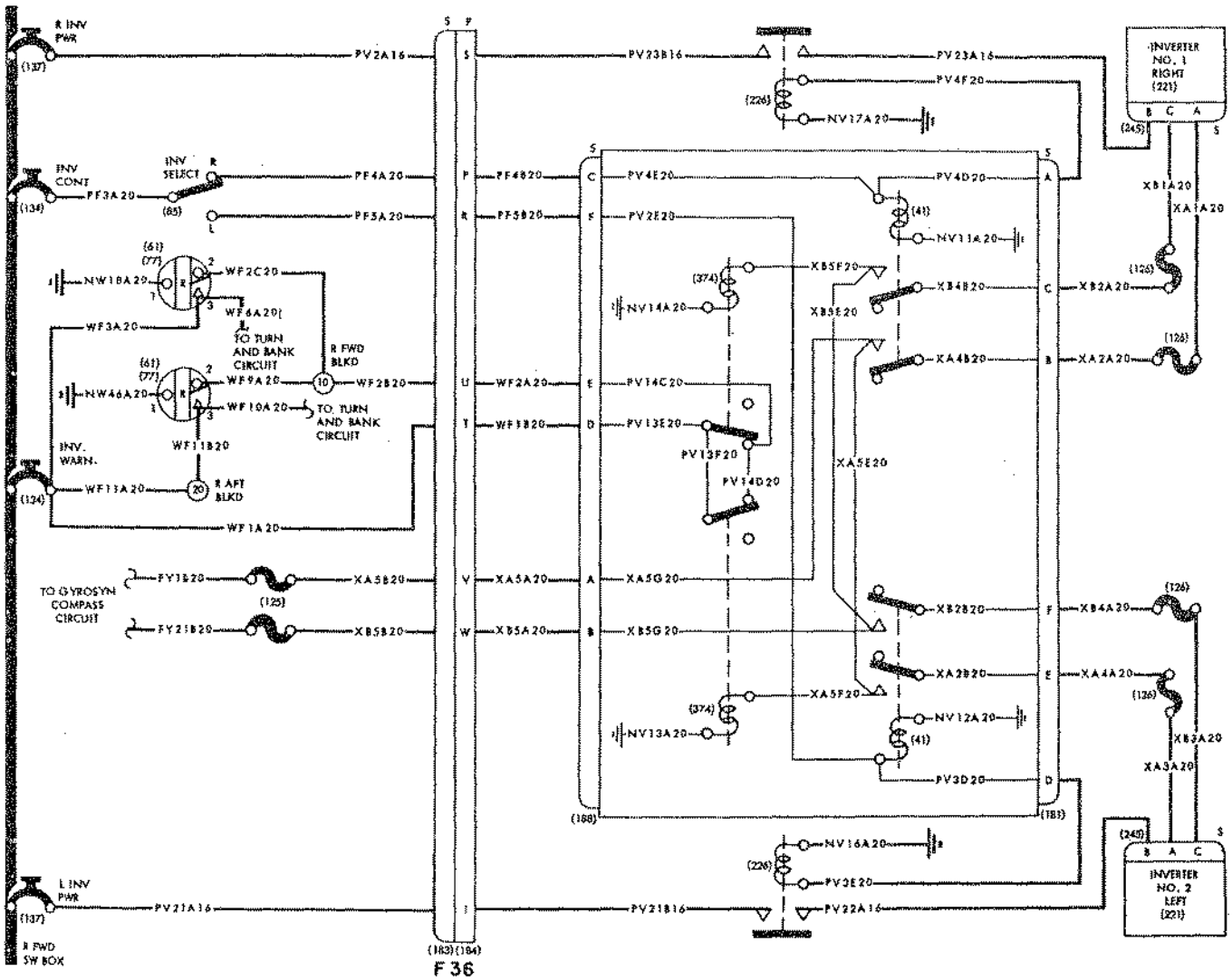
3

INSTRUMENT INVERTERS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4328

Figure 8-137. Instrument Inverters Circuit



NOTE:

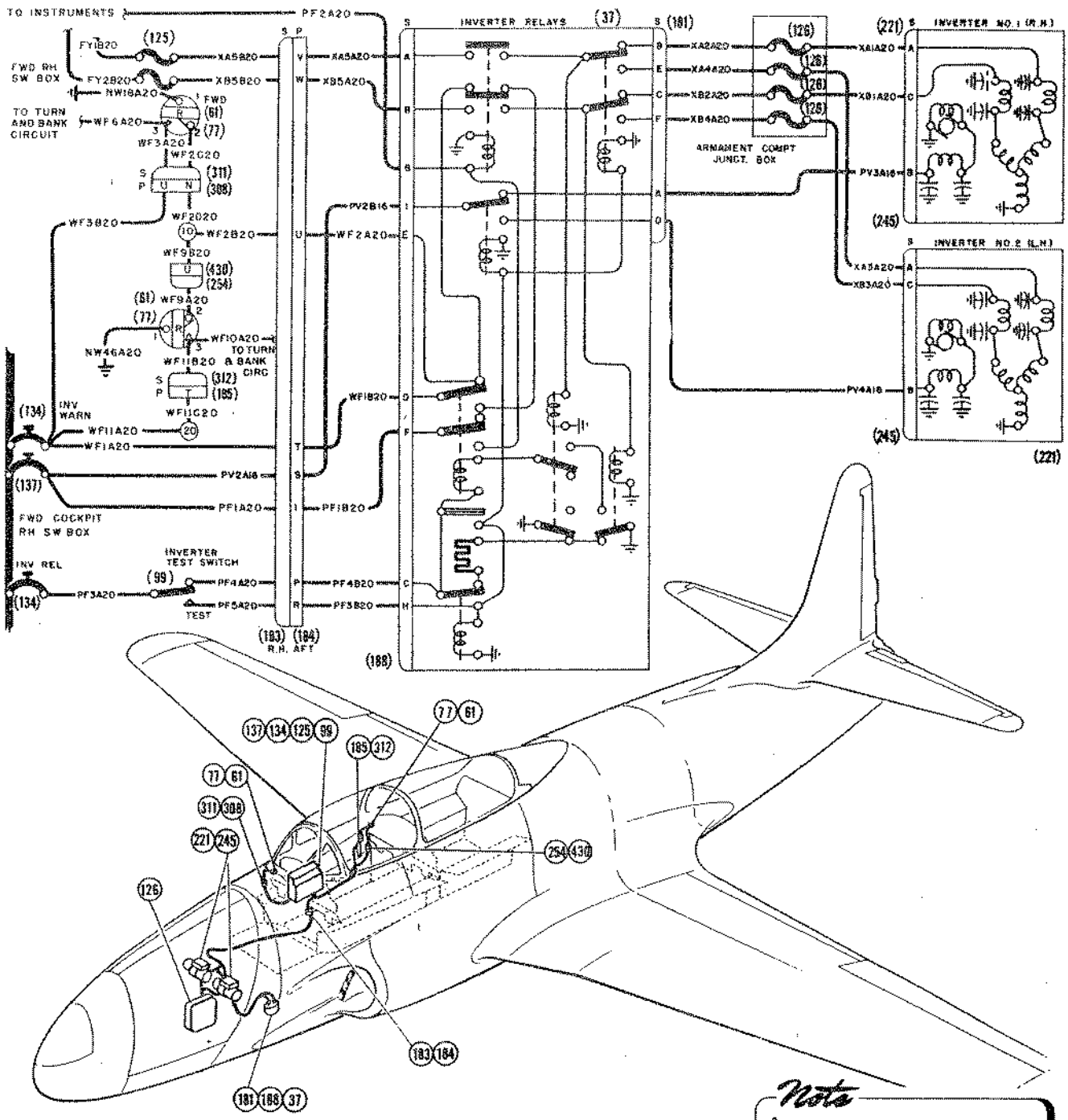
⚠ USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-194

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
41	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
125	FUSE	LITTELFUSE	2A	413002
126	FUSE	LITTELFUSE	3A	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106B-18-9S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
188	CONNECTOR			AN3106B-20-16S
221	INVERTER	GEAE		AN2187-1
226	RELAY			AN3350-2
245	CONNECTOR			AN3108B-14S-7S
374	RELAY	AERO INST		A372-400

GB 8827
M20-48D-9-290

⚠ INSTRUMENT INVERTERS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4328

Figure 8-138. Instrument Inverters Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
37	RELAY	COOK		650-1099
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
99	SWITCH	C-H		8804
125	FUSE	LITTELFUSE	2 AMP	413002
126	FUSE	LITTELFUSE	3 AMP	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
18[illegible]	CONNECTOR			AN3029-28-11P
185	CONNECTOR			AN3102-28-11P
188	CONNECTOR			AN3106-20-16S
221	INVERTER	GFAE		AN3187-1
245	CONNECTOR			AN3108-14S-7S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
312	CONNECTOR			AN3108-28-11S
430	CONNECTOR			AN3102-28-12P

GB 8825
M20-4B1-8-54

Note

(1) USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-194

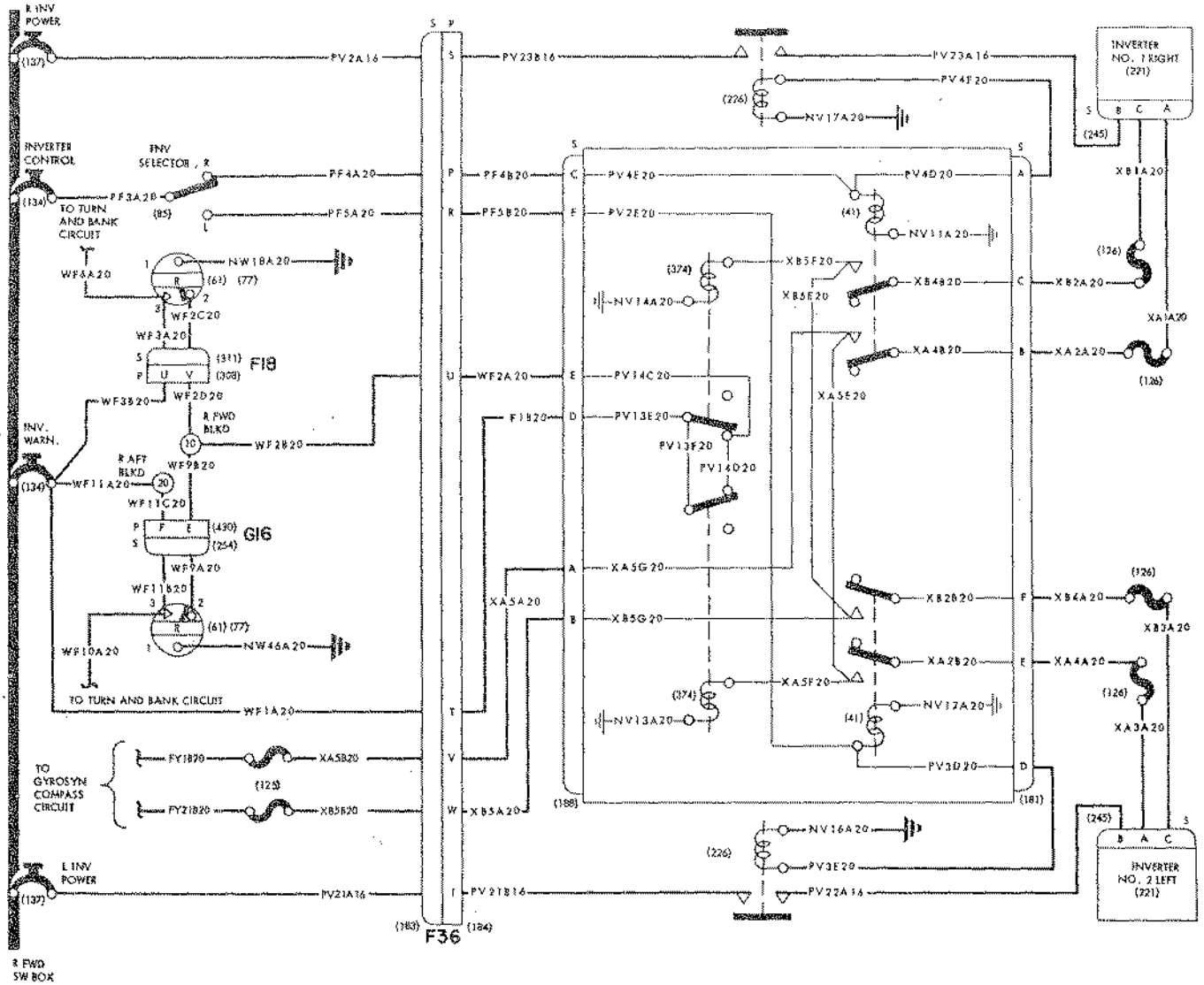
(1)

INSTRUMENT INVERTERS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-4329 THROUGH 51-6818

Figure 8-139. Instrument Inverters Circuit



NOTE:

⚠1 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-194

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
41	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
85	SWITCH			AN2023-3
125	FUSE	LITTELFUSE	2A	413002
126	FUSE	LITTELFUSE	3A	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106B-18-9S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
188	CONNECTOR			AN3106B-20-16S
221	INVERTER	GFAE		AN3187-1
226	RELAY			AN3350-2
245	CONNECTOR			AN3108B-14S-7S
254	CONNECTOR			AN3108B-28-12S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
374	RELAY	AERO INST		A132-460
430	CONNECTOR			AN3102A-28-12P

⚠1

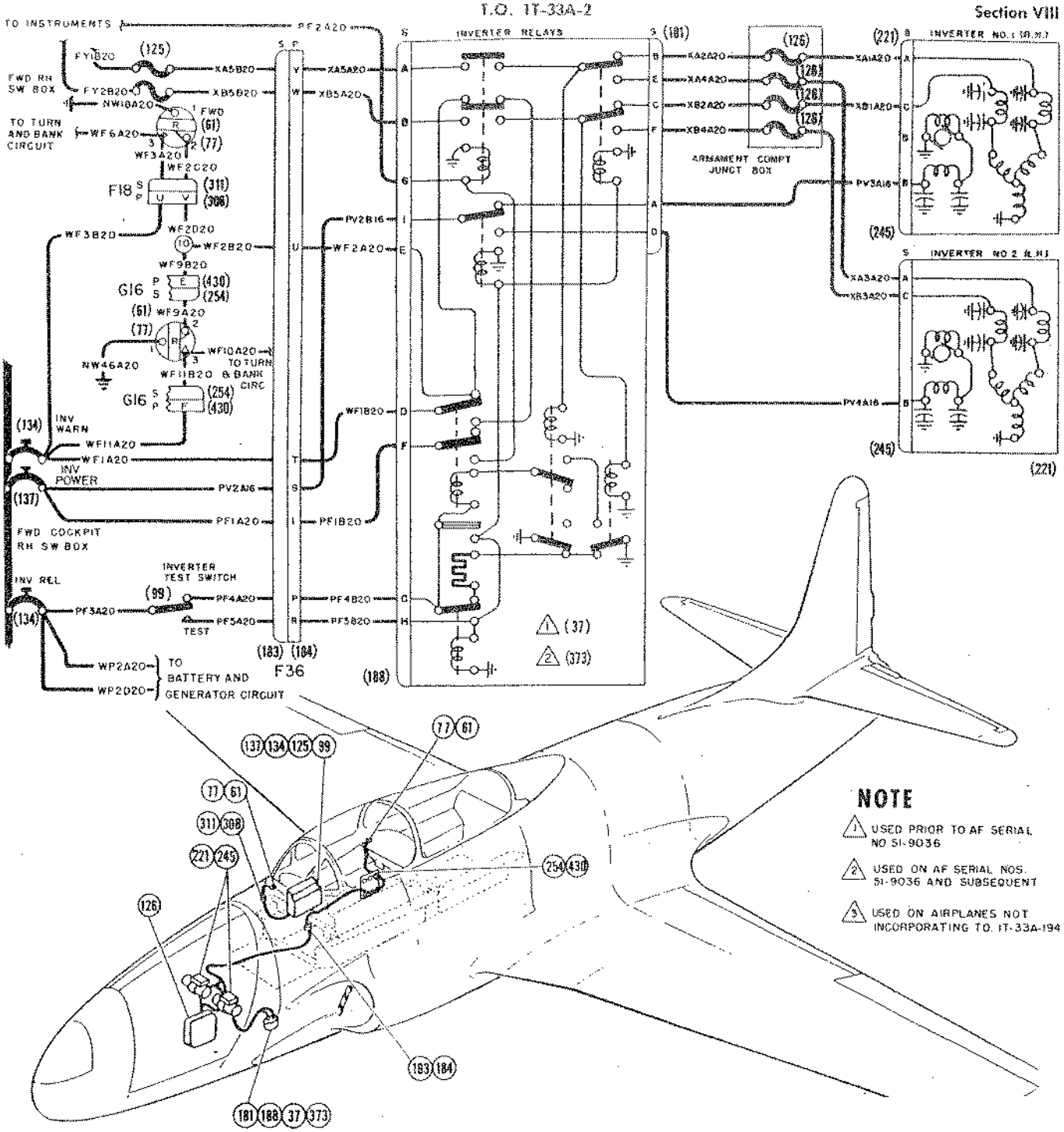
INSTRUMENT INVERTERS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4329 THROUGH 51-6818

GB 8822
M20-480-8-291

Figure 8-140. Instrument Inverters Circuit

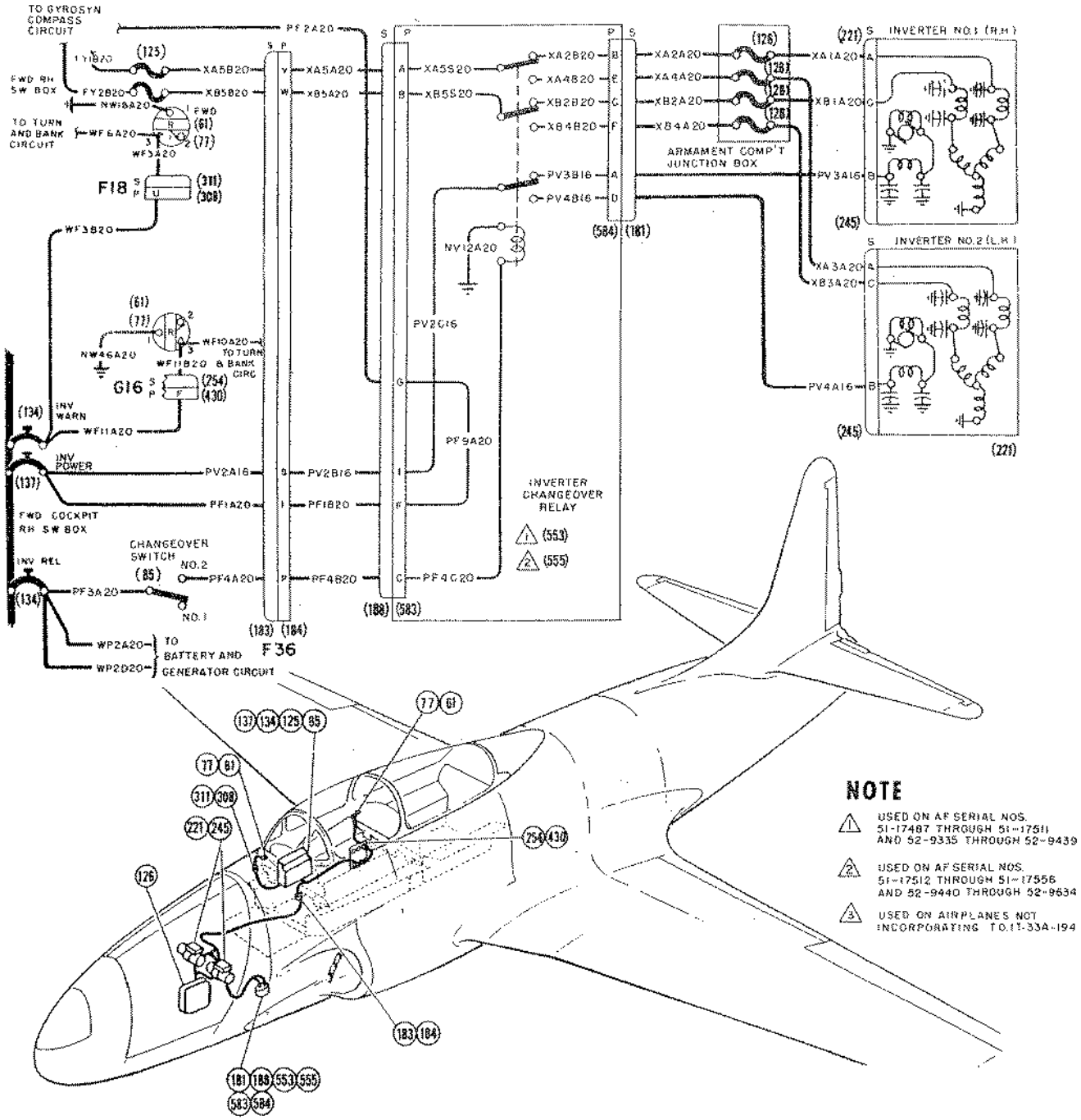


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
1 37	RELAY	COOK		650-1099
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
99	SWITCH	C-H		8804
125	FUSE	LITTELFUSE	2 AMP	413002
126	FUSE	LITTELFUSE	3 AMP	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
188	CONNECTOR			AN3106-20-16S
221	INVERTER	GFAE		AN3187-1 OR AN3499-1
245	CONNECTOR			AN3108B-14S-7S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
2 373	RELAY	COOK		650-1740
430	CONNECTOR			AN3102-28-12P

GB 8980
M20-4RD-8-85

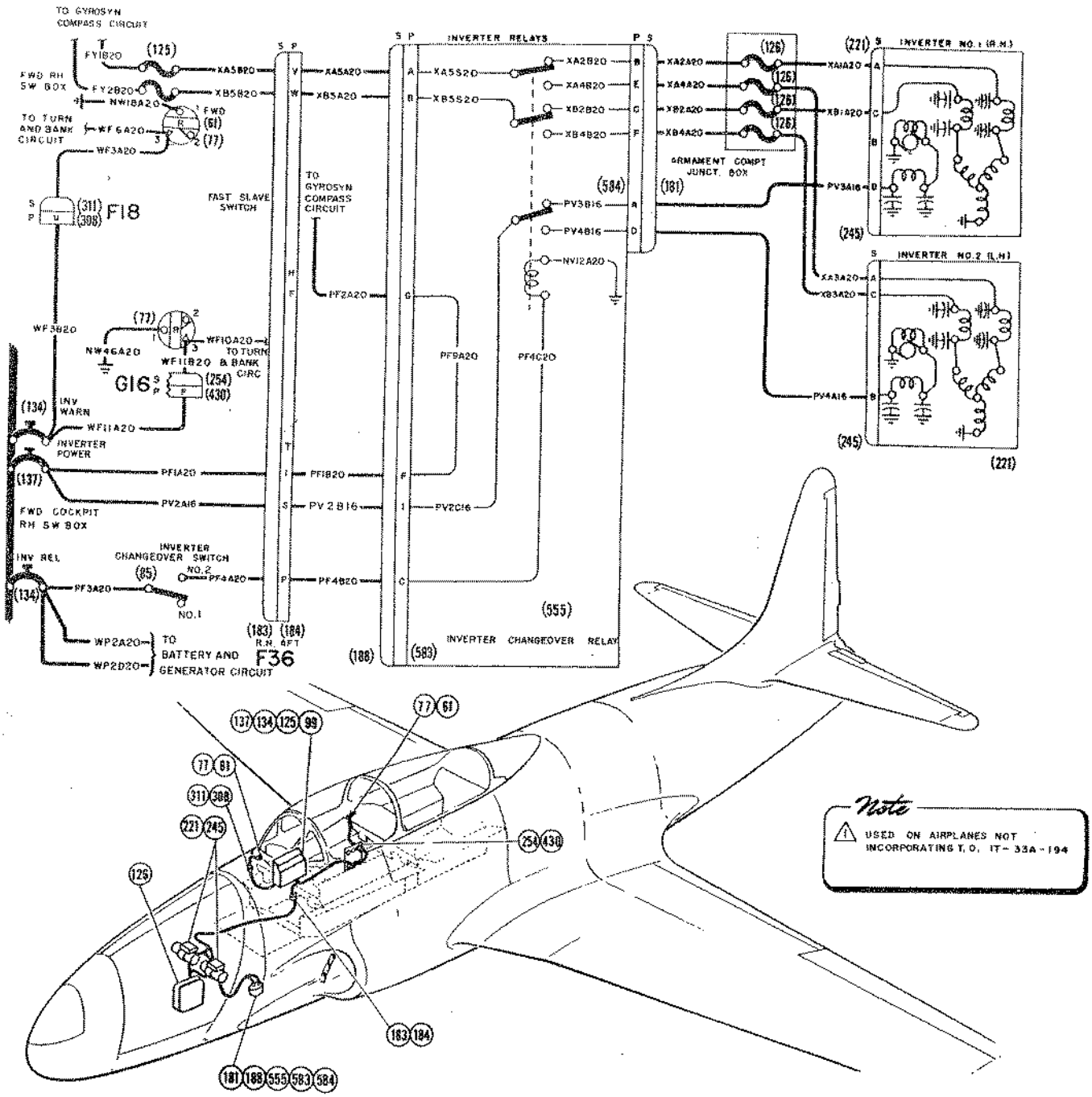
3 INSTRUMENT INVERTERS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-6819 THROUGH 51-17466, AND 52-9129 THROUGH 52-9334

Figure 8-141. Instrument Inverters Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
125	FUSE	LITTELFUSE	2 AMP	413002
126	FUSE	LITTELFUSE	3 AMP	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
188	CONNECTOR			AN3106-20-16S
221	INVERTER	GFAE		AN3187-1
245	CONNECTOR			AN3108-14S-7S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-82-15P
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P
553	RELAY			AN3312-1
555	RELAY	LEACH		2069-900
583	CONNECTOR			AN3102A-20-16P
584	CONNECTOR			AN3102A-18-9P

Figure 8-142. Instrument Inverters Circuit

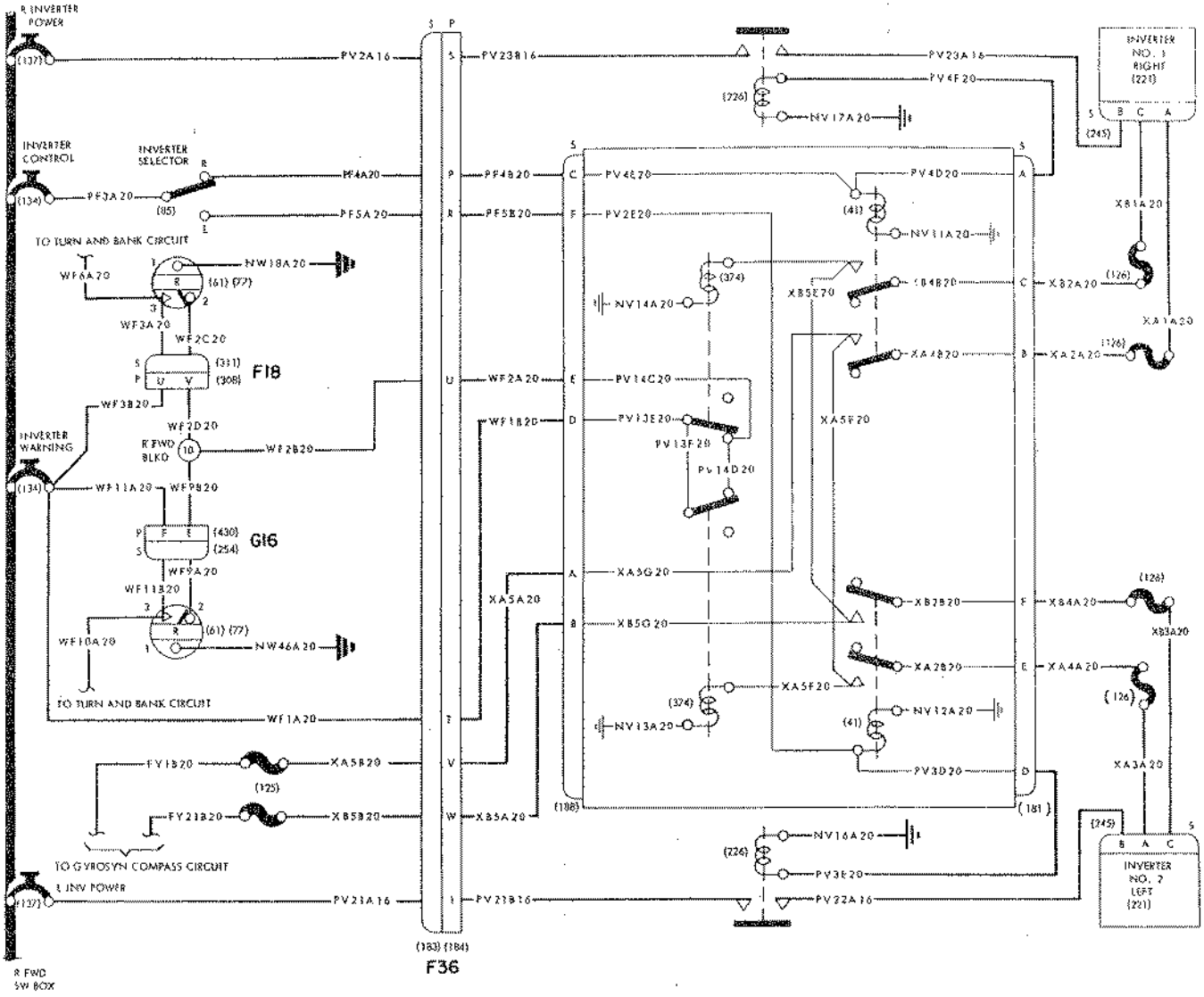


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
125	FUSE	LITTELFUSE	2 AMP	413002
126	FUSE	LITTELFUSE	3 AMP	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
188	CONNECTOR			AN3106-20-16S
221	INVERTER	GFAE		AN197-1
245	CONNECTOR			AN3108-14S-7S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P
555	RELAY	LEACH		2069-900
583	CONNECTOR			AN3102A-20-16P
584	CONNECTOR			AN3102A-18-9P

GB 8824
M29-48D-8-204

INSTRUMENT INVERTERS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9635 THROUGH 52-9759, 52-9906 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-143. Instrument Inverters Circuit



NOTE:

1 USED ON AIRPLANES INCORPORATING T.O. 1T-33A-194

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
49	RELAY	LEACH		237-EAU
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
125	FUSE	LITTELFUSE	2A	413002
126	FUSE	LITTELFUSE	3A	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106B-18-9S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN3106B-20-16S
221	INVERTER	GFAE		AN3187-1
226	RELAY			AN3350-2
245	CONNECTOR			AN3108B-14S-7S
254	CONNECTOR			AN3108B-28-12S
308	CONNECTOR			AN3102A-28-15P
331	CONNECTOR			AN3106B-28-15S
374	RELAY	AERO INST		A332-400
439	CONNECTOR			AN3102A-28-12P

1 INSTRUMENT INVERTERS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-17556, AND 52-9129 THROUGH 52-9940

GB 8803

M20-4BD-8-294

Figure 8-144. Instrument Inverters Circuit

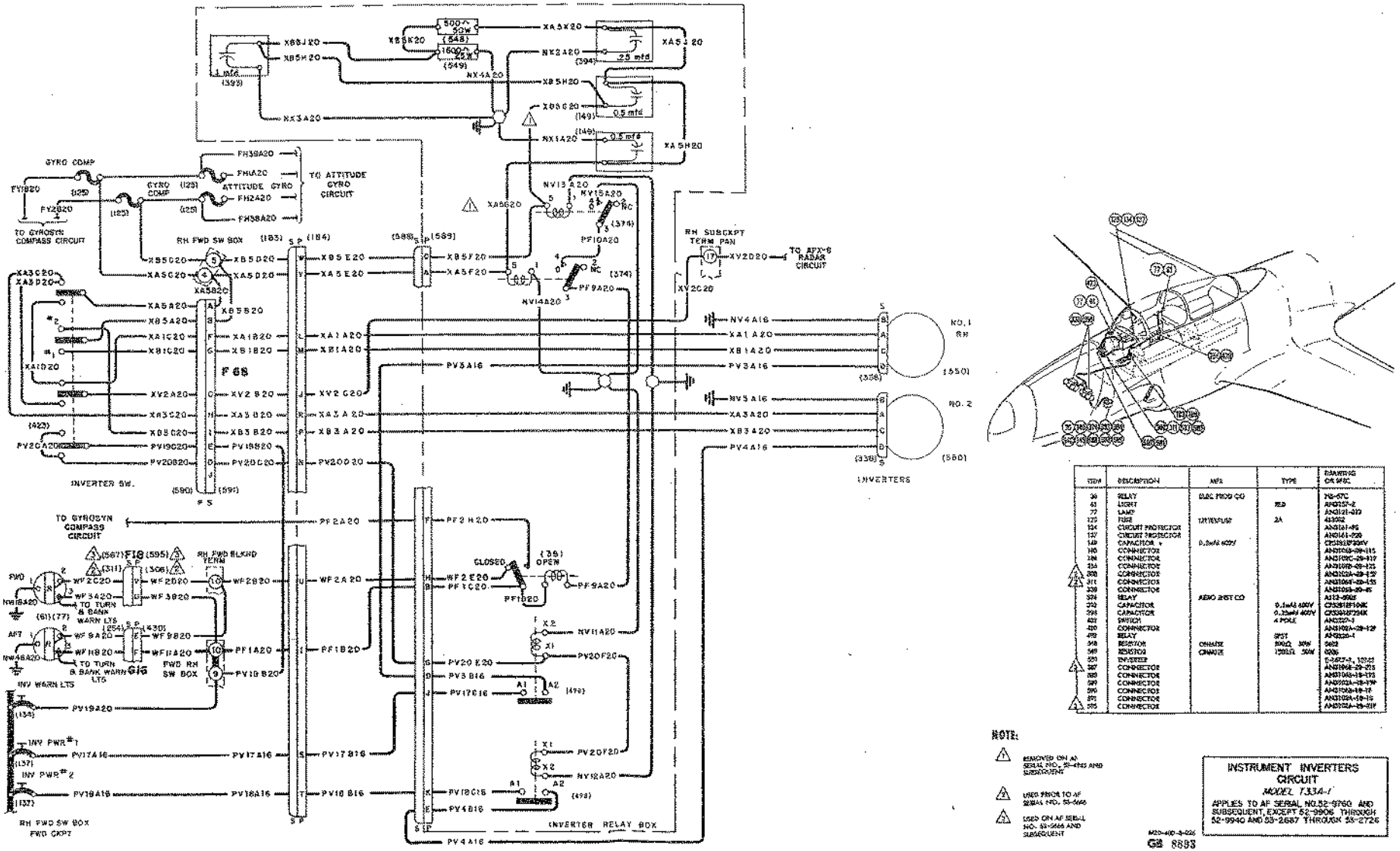


Figure 8-145. Instrument Inverters Circuit

ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
56	RELAY	GUIDE PROD CO		MS-67C
61	LIGHT		RED	AN3121-2
72	LAMP			AN3121-419
123	FUSE		2A	413052
134	CIRCUIT PROTECTOR			AN3321-95
137	CIRCUIT PROTECTOR			AN3321-220
149	CAPACITOR			CD35B1F304V
195	CONNECTOR			AN3106A-28-11S
196	CONNECTOR			AN3106C-28-11P
256	CONNECTOR			AN3108B-28-12S
308	CONNECTOR			AN3102A-28-12P
311	CONNECTOR			AN3106A-28-11S
339	CONNECTOR			AN3102A-28-4S
374	RELAY	AERO REST CO		A12-0505
392	CAPACITOR			CD35B1F104K
398	CAPACITOR			CD35B1F204K
402	SWITCH		4 POLE	AN3327-3
420	CONNECTOR			AN3102A-28-12P
478	RELAY		SPST	AN3220-1
548	RESISTOR	OHMITE	500Ω 50W	5602
549	RESISTOR	OHMITE	1600Ω 25W	0206
555	INVERTER			C-2627-3, 10262
567	CONNECTOR			AN3106A-28-21S
568	CONNECTOR			AN3106A-18-17S
569	CONNECTOR			AN3102A-18-17P
596	CONNECTOR			AN3102A-18-1P
571	CONNECTOR			AN3102A-18-1S
595	CONNECTOR			AN3102A-18-21P

NOTE:

1. REMOVED ON AF SERIAL NO. 53-4985 AND SUBSEQUENT
2. USED PRIOR TO AF SERIAL NO. 53-3666
3. USED ON AF SERIAL NO. 53-3666 AND SUBSEQUENT

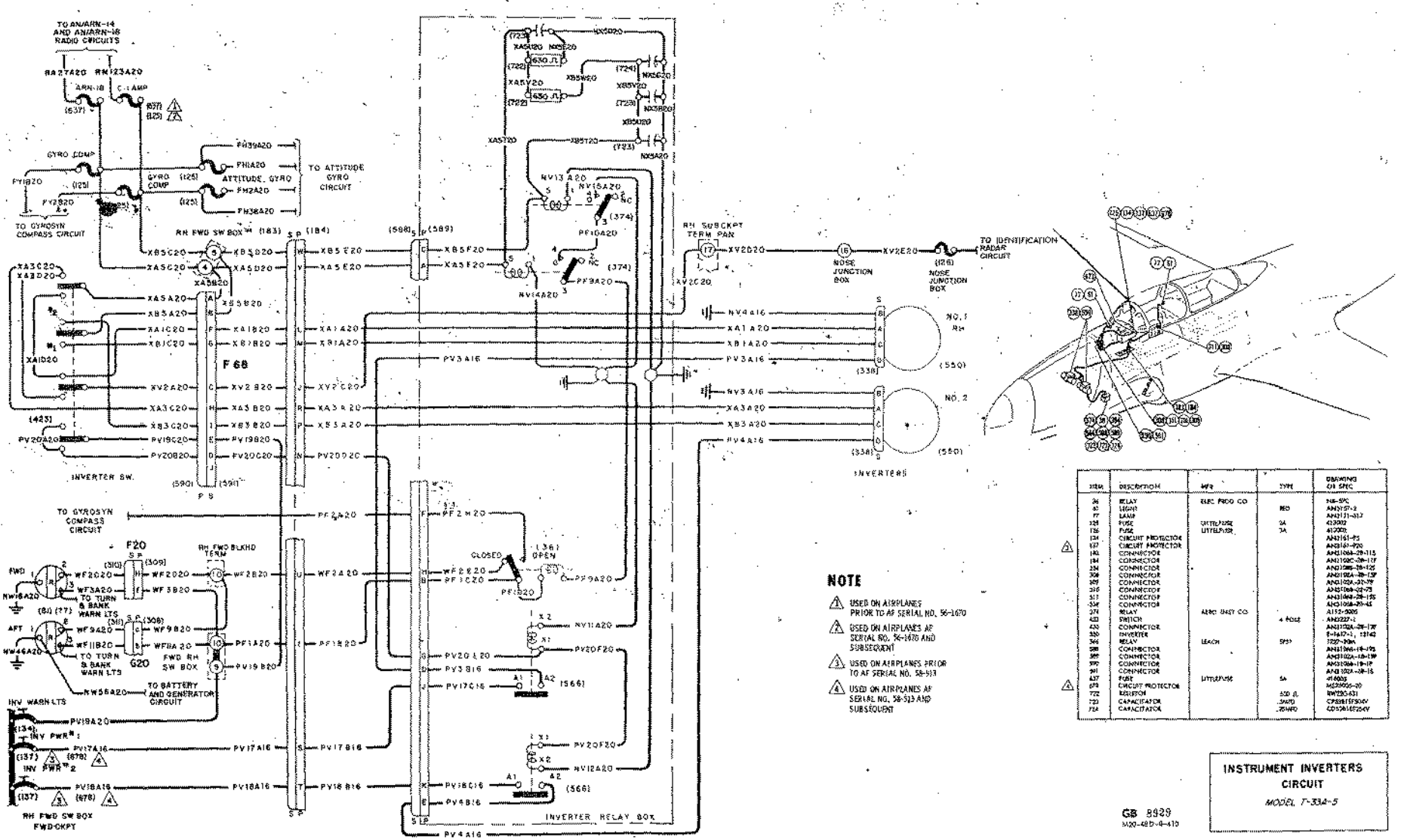
INSTRUMENT INVERTERS CIRCUIT

MODEL 7334-1

APPLIES TO AF SERIAL NO. 52-5760 AND SUBSEQUENT, EXCEPT 52-9906 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

M20-400-8-026

GE 8893



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
26	RELAY	ELEC. PROD CO		MIL-SPEC
67	LIGHT		RED	AN3157-2
77	LAMP			AN3171-327
125	FUSE	LITTELFUSE	5A	412005
126	FUSE	LITTELFUSE	7A	412007
134	CIRCUIT PROTECTOR			AN3161-75
137	CIRCUIT PROTECTOR			AN3161-200
180	CONNECTOR			AN3106A-28-11S
184	CONNECTOR			AN3108C-20-17P
284	CONNECTOR			AN3126E-18-12S
308	CONNECTOR			AN3102A-18-13P
309	CONNECTOR			AN3102A-22-19P
310	CONNECTOR			AS3450-02-7S
317	CONNECTOR			AN3106A-24-19S
334	CONNECTOR			AN3106A-20-4S
374	RELAY	AERO DEV CO		A152-5005
403	SWITCH		4 POLE	AN3227-1
430	CONNECTOR			AN3102A-28-12P
550	INVERTER			5-1617-1, 13142
566	RELAY	LEACH	5PST	3237-2001
588	CONNECTOR			AN3106A-18-1PS
589	CONNECTOR			AN3102A-18-1SW
590	CONNECTOR			AN3106A-18-1P
591	CONNECTOR			AN3102A-18-1S
637	FUSE	LITTELFUSE	5A	412005
678	CIRCUIT PROTECTOR			MS25055-20
722	RESISTOR		500 Ω,	RW22S-631
723	CAPACITATOR		.2MFD	CP35E1EF504V
724	CAPACITATOR		.25MFD	CP35A1EF254V

NOTE

1. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 56-1670
2. USED ON AIRPLANES AF SERIAL NO. 56-1670 AND SUBSEQUENT
3. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 56-513
4. USED ON AIRPLANES AF SERIAL NO. 56-513 AND SUBSEQUENT

INSTRUMENT INVERTERS CIRCUIT

MODEL T-33A-5

GB 8929
3420-48D-4-410

Figure 8-146. Instrument Inverters Circuit

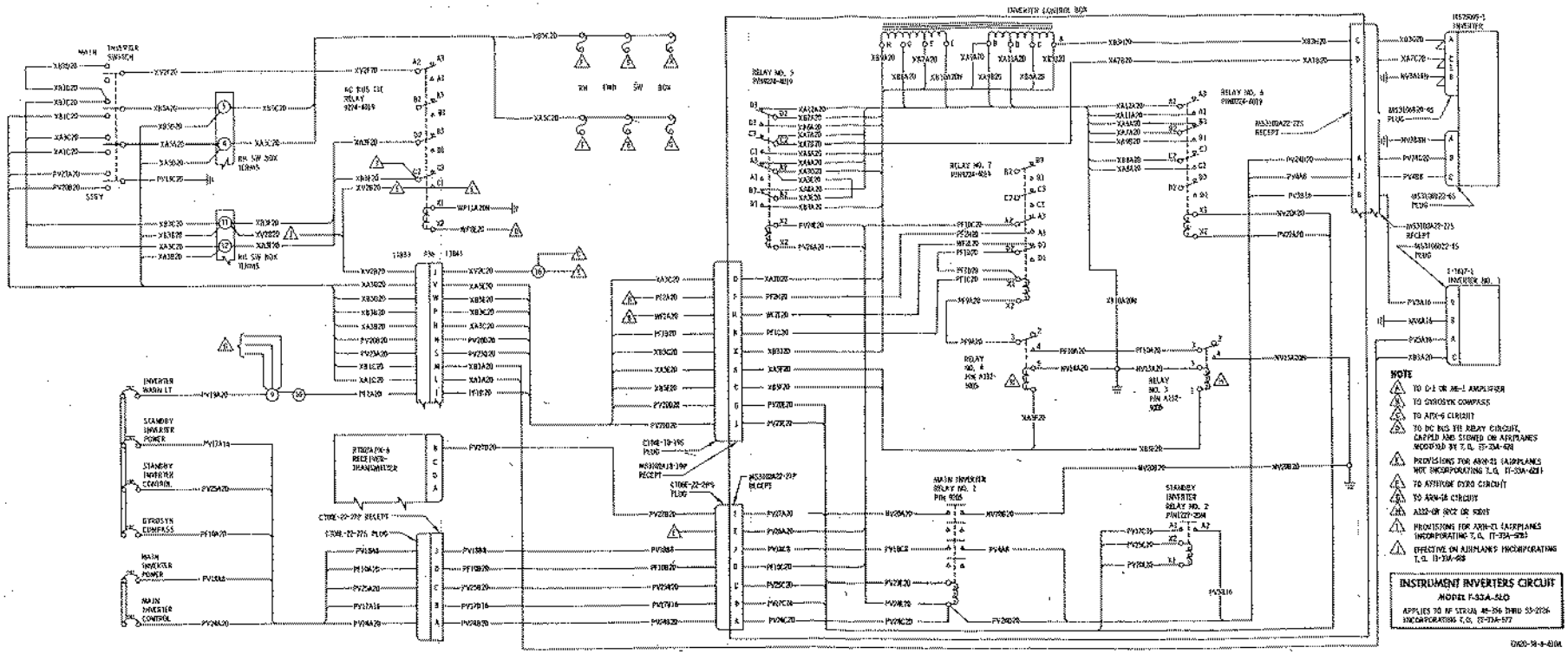
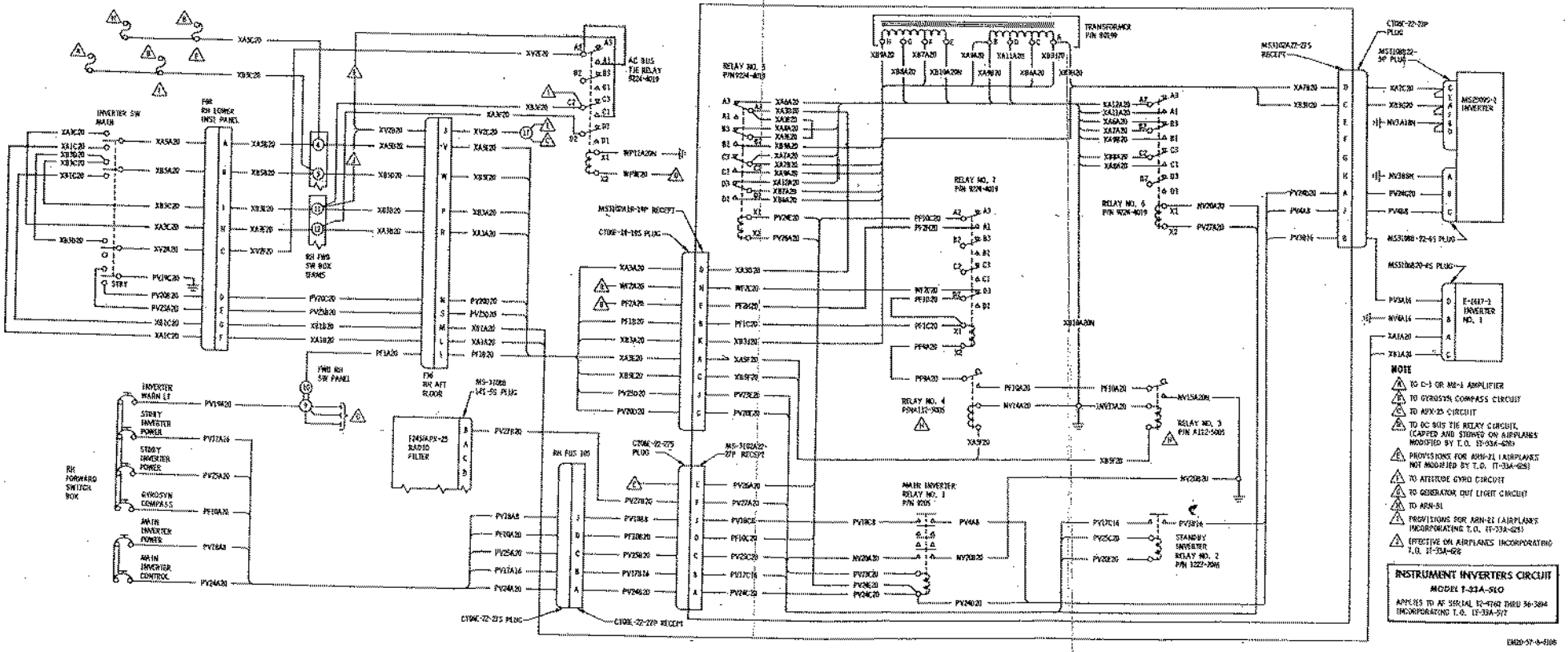


Figure 8-146A. Instrument Inverters Circuit


INSTRUMENT INVERTERS CIRCUIT
MODEL T-33A-5LO
APPLIES TO AF SERIAL 52-4762 THRU 56-3894 INCORPORATING T.O. 1F-33A-572
NOTE
TO C-1 OR A2-1 AMPLIFIER
TO GYROSYN COMPASS CIRCUIT
TO AUX-25 CIRCUIT
TO DC BUS TIE RELAY CIRCUITS, (CAPPED AND STOWED ON AIRPLANES MODIFIED BY T.O. 1F-33A-628)
PROVISIONS FOR ARN-21 (AIRPLANES NOT MODIFIED BY T.O. 1T-33A-628)
TO ATTITUDE GYRO CIRCUIT
TO GENERATOR OUT LIGHT CIRCUIT
TO ARN-5L
PROVISIONS FOR ARN-21 (AIRPLANES INCORPORATING T.O. 1F-33A-628)
EFFECTIVE ON AIRPLANES INCORPORATING T.O. 1F-33A-626
TRANSFORMER P/N 90299
RELAY NO. 3 P/N 9224-4019
RELAY NO. 7 P/N 9224-4019
RELAY NO. 6 P/N 9224-4019
RELAY NO. 4 P/N A112-3005
RELAY NO. 5 P/N A112-5005
MAIN INVERTER RELAY NO. 1 P/N 9205
STANDBY INVERTER RELAY NO. 2 P/N 1222-2561
AC BUS TIE RELAY 9224-4019
INVERTER SW PANEL
RH LOWER INSP PANEL
RH FWD SW BOX TERMS
F36 RH AFT FLOOR
RH FWD SW PANEL
RH FUS 105
RH FORWARD SWITCH BOX
INVERTER WARN LT
STDBY INVERTER POWER
GYROSYN COMPASS
MAIN INVERTER POWER
ARN-5N INVERTER CONTROL
F2454A-PX-25 RADIO FILTER
MS3100A22-27P RECEPT
MS3102A22-27S PLUG
MS3108B22-14P RECEPT
MS3106A22-14S PLUG
C19BE-22-27S PLUG
C19BE-22-27P RECEPT
C19BE-22-22P PLUG
MS3108B22-14P PLUG
MS3108B20-4S PLUG
MS3102A22-27S RECEPT
MS3106B-22-6S PLUG
MS25099-1 INVERTER
E-0687-1 INVERTER NO. 1
XA3C20
XB3C20
XA5C20
XB5C20
XA1C20
XB1C20
XA3B20
XB3B20
XA5B20
XB5B20
XA1B20
XB1B20
XA3A20
XB3A20
XA5A20
XB5A20
XA1A20
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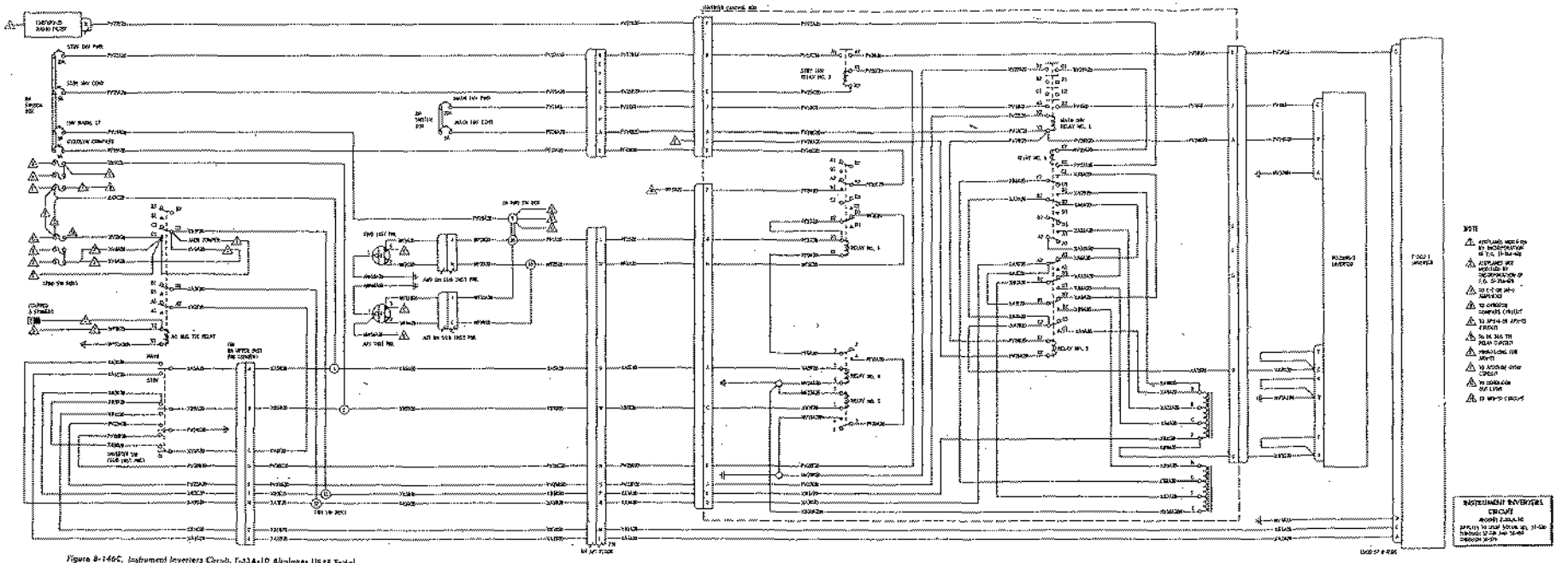


Figure 8-146C. Instrument Inverters Circuit, F-33A-10 Airplanes USAF Serial No. 57-590 through 57-769 and 58-450 through 58-579

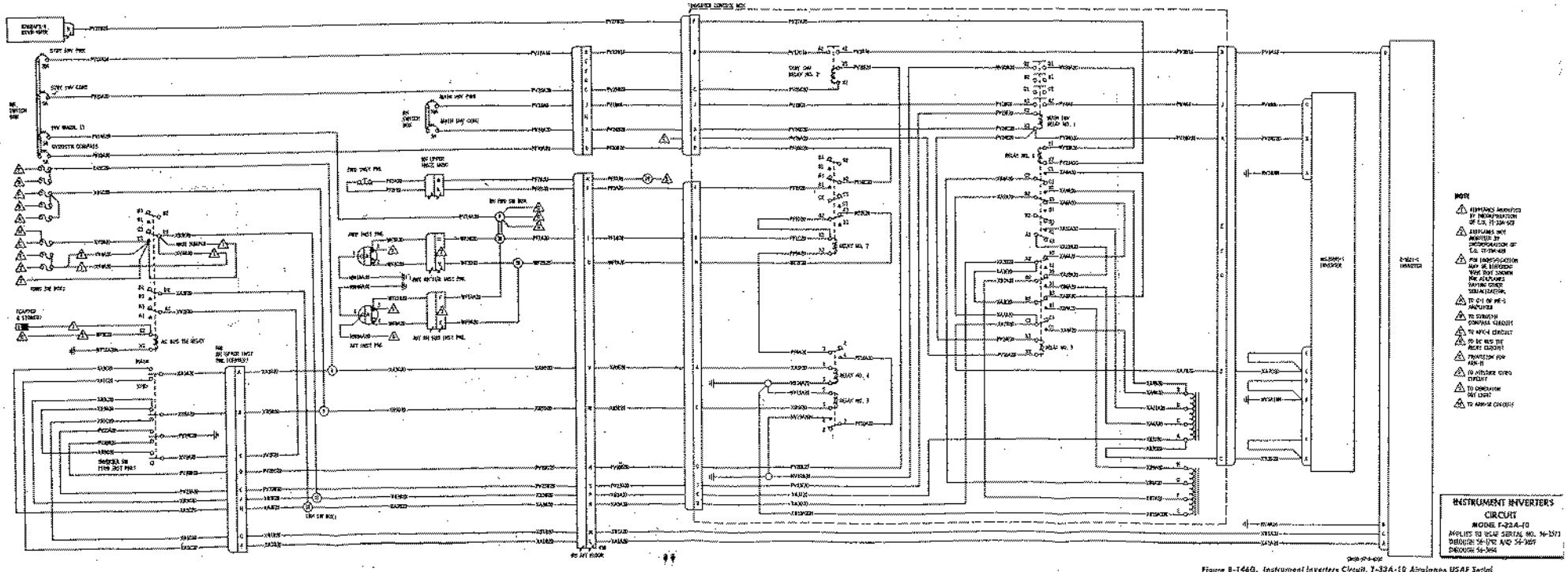


Figure 8-T46B. Instrument Inverters Circuit, T-33A-10 Airplanes USAF Serial No. 56-1573 through 56-1792 and 56-3659 through 56-3694

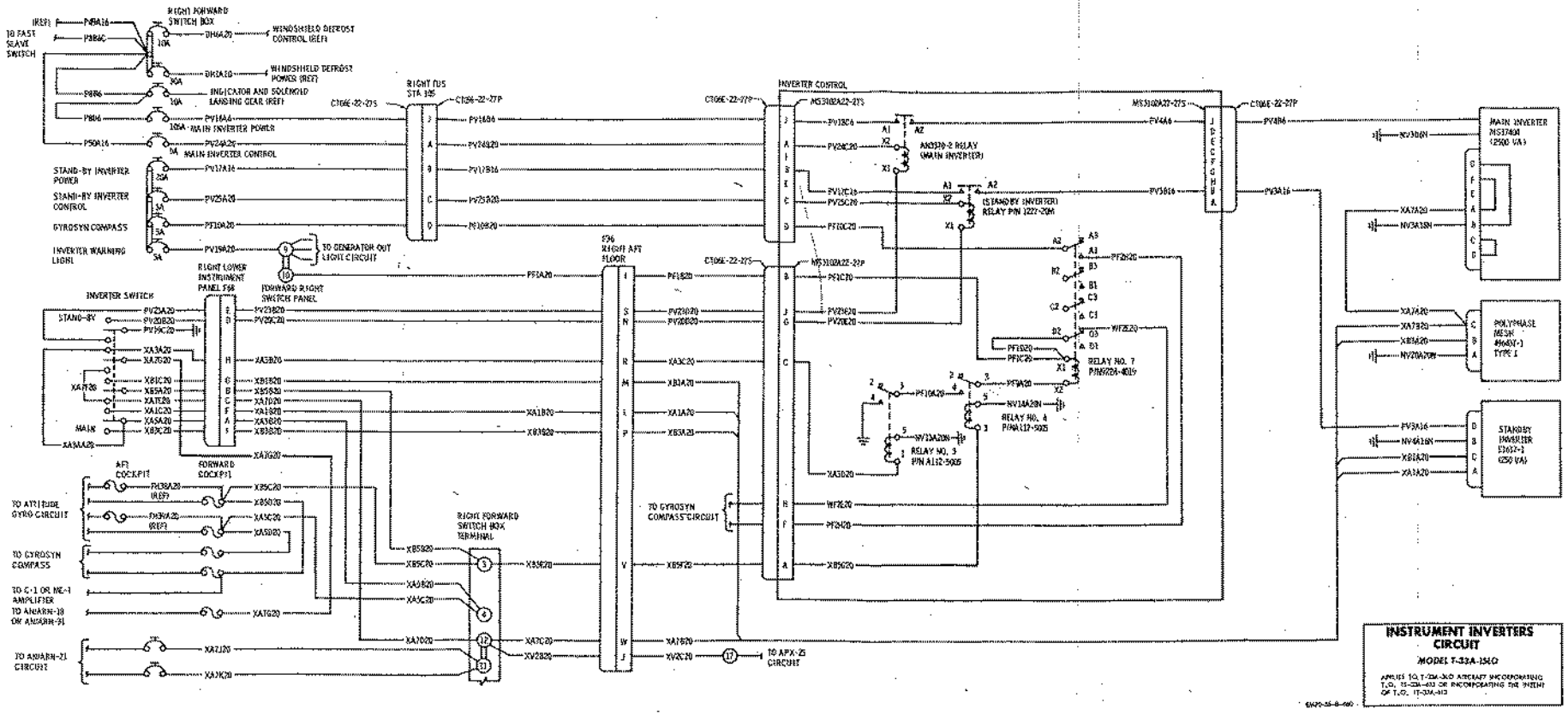


Figure 8-146E. Instrument Inverters Circuit

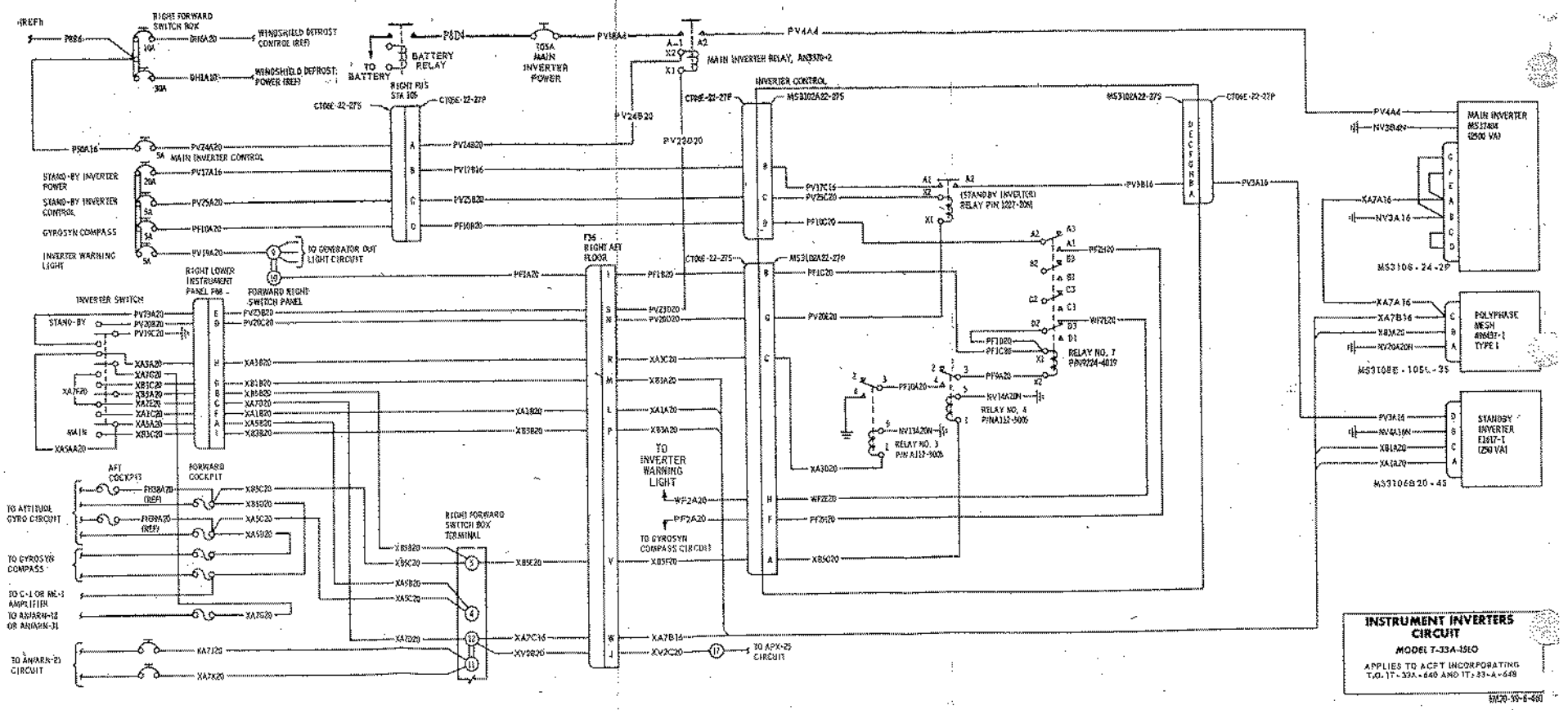
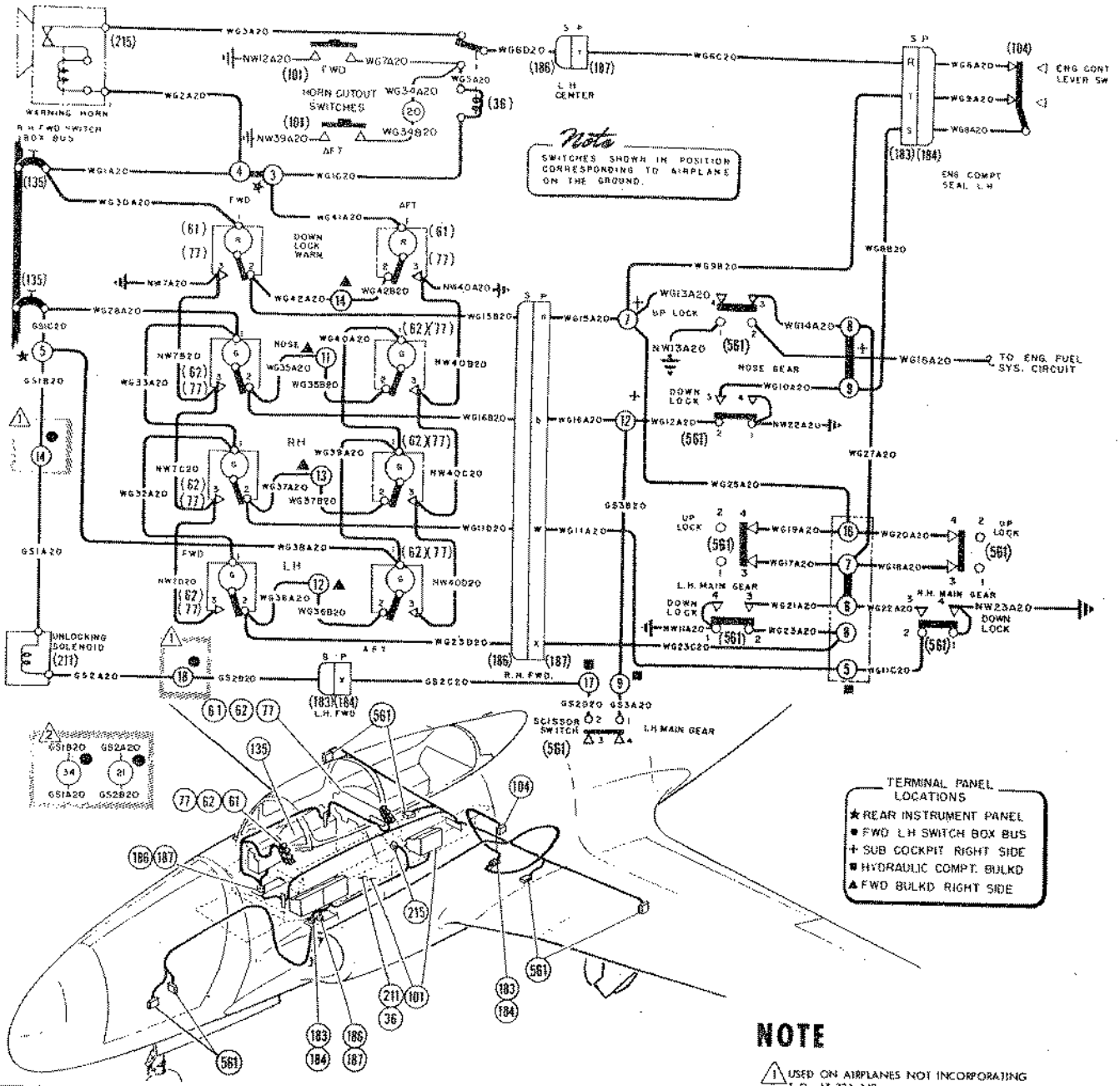


Figure 8-146F. Instrument Inverters Circuit



ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-PTC
183	CONNECTOR			AN3106-2B-11S
184	CONNECTOR			AN3102P-2B-11P
186	CONNECTOR			AN3106-2B-12S
187	CONNECTOR			AN3102P-2B-12P
211	LOCK SOLENOID	CANNON		W-56
215	HORN	EL PROD	3-2	32462
561	SWITCH	ALLOY IND		808140

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-143
2. USED ON AIRPLANES INCORPORATING T.O. NO. 1T-33A-143

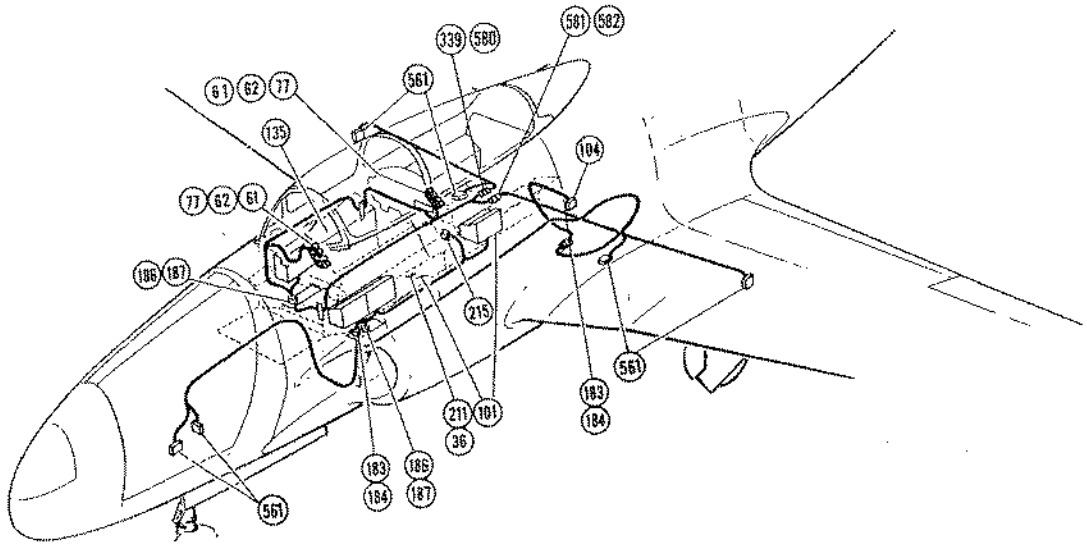
ALIGHTING GEAR WARNING CIRCUIT

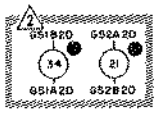
MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4328. NOT INCORPORATING T.O. 1T-33A-567

HB 597
M20-50-8-360

Figure 8-147. Alighting Gear Warning Circuit





ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT	-	RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
183	CONNECTOR			AN3106-2B-11S
184	CONNECTOR			AN3102P-2B-11P
186	CONNECTOR			AN3106-2B-12S
187	CONNECTOR			AN3102P-2B-12P
211	LOCK SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
339	CONNECTOR			MS3106M-2B-11SW
561	SWITCH	ALLOY IND		808140
580	CONNECTOR			MS3100M-2B-11PW
581	CONNECTOR			MS3106M-2B-11S
582	CONNECTOR			MS3100M-2B-11P

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-143
2. USED ON AIRPLANES INCORPORATING T.O. NO. 1T-33A-143

ALIGHTING GEAR
WARNING CIRCUIT

MODEL F-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4328

HB 1236
M20-50-B-92

Figure 8-147A. Alighting Gear Warning Circuit (Sheet 1 of 2)

Changed 23 September 1959

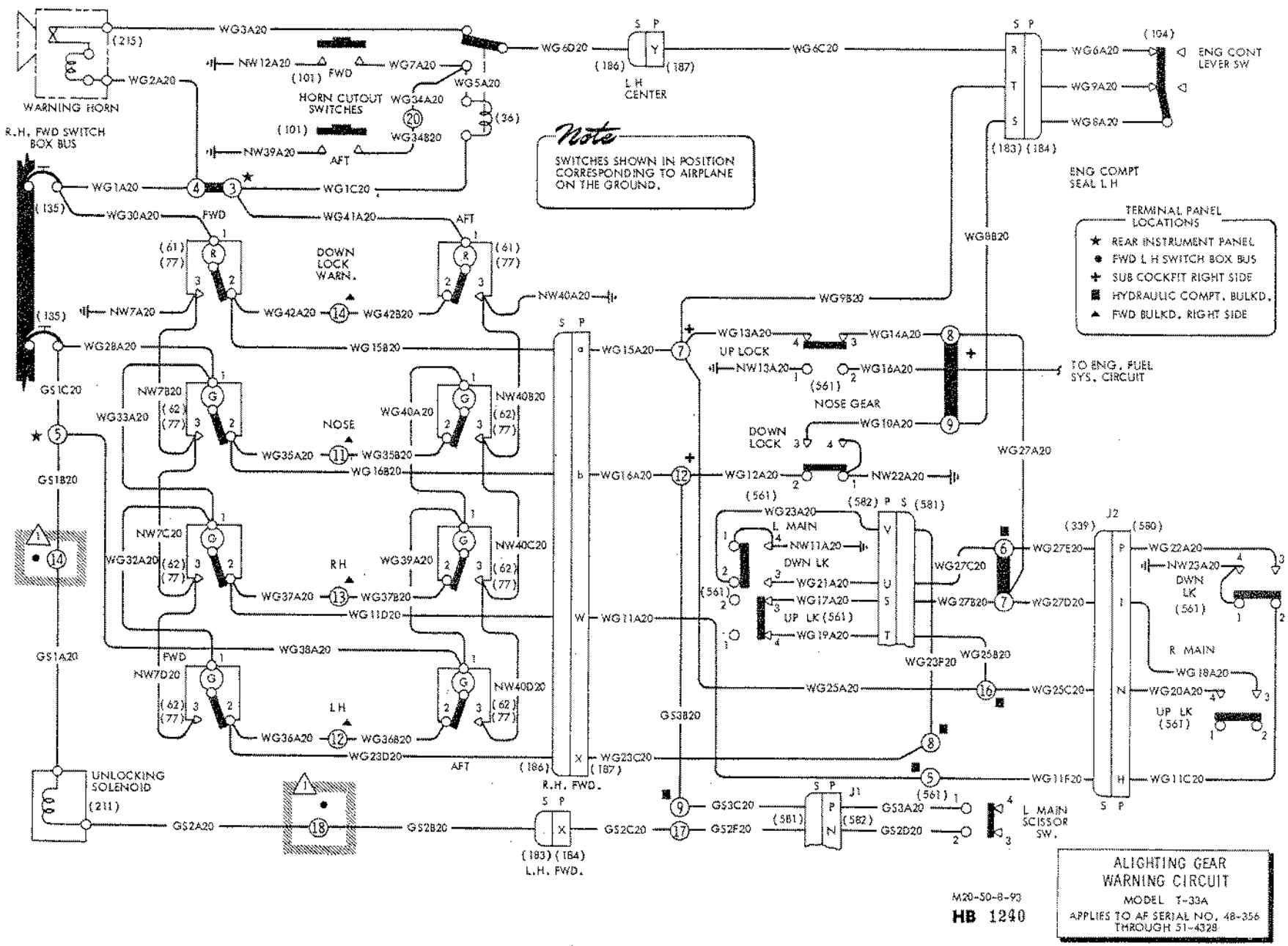
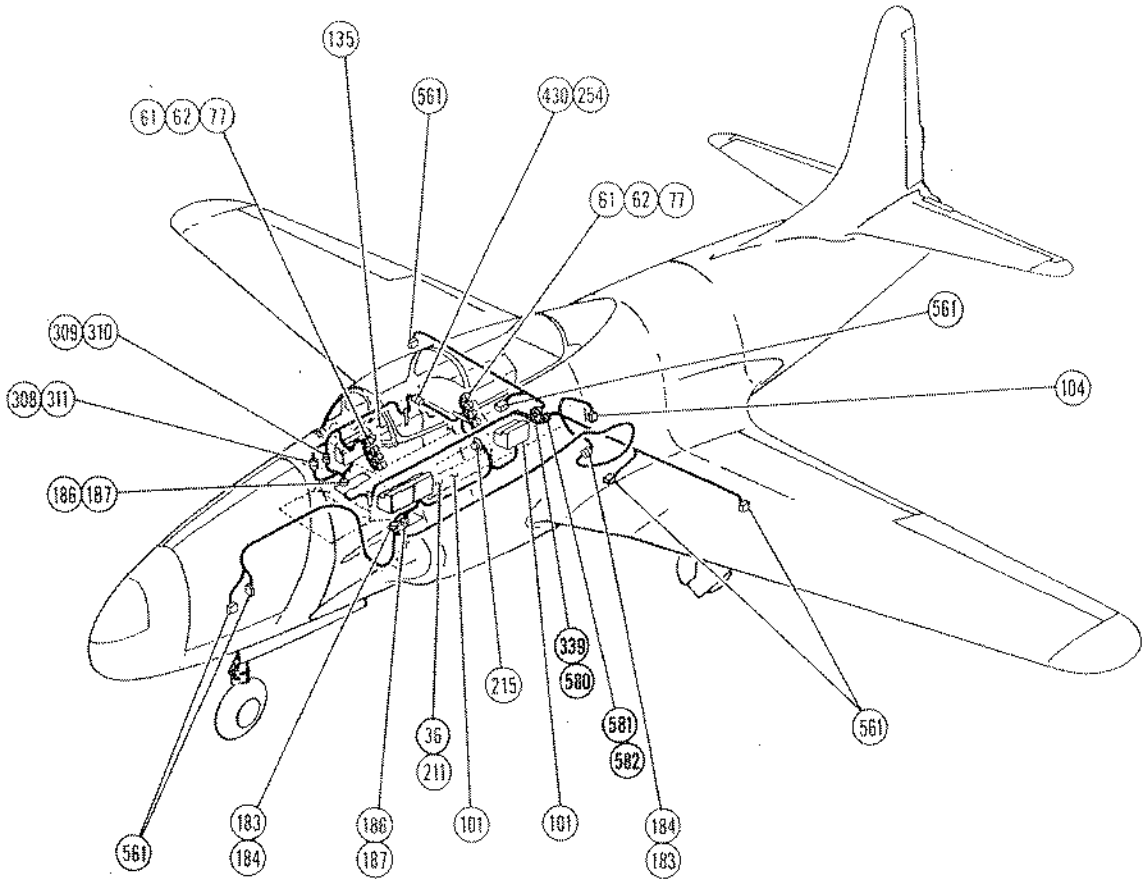
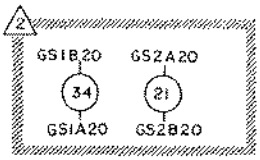


Figure 8-147A. Alighting Gear Warning Circuit (Sheet 2 of 2)





NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-143
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-143

ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P
561	SWITCH	ALLOY IND		808140

ALIGHTING GEAR WARNING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4329 THROUGH 51-6586. NOT INCORPORATING T.O. 1T-33A-567

M20-50-8-361

HB 1692

Figure 8-148. Alighting Gear Warning Circuit (Sheet 1 of 2)

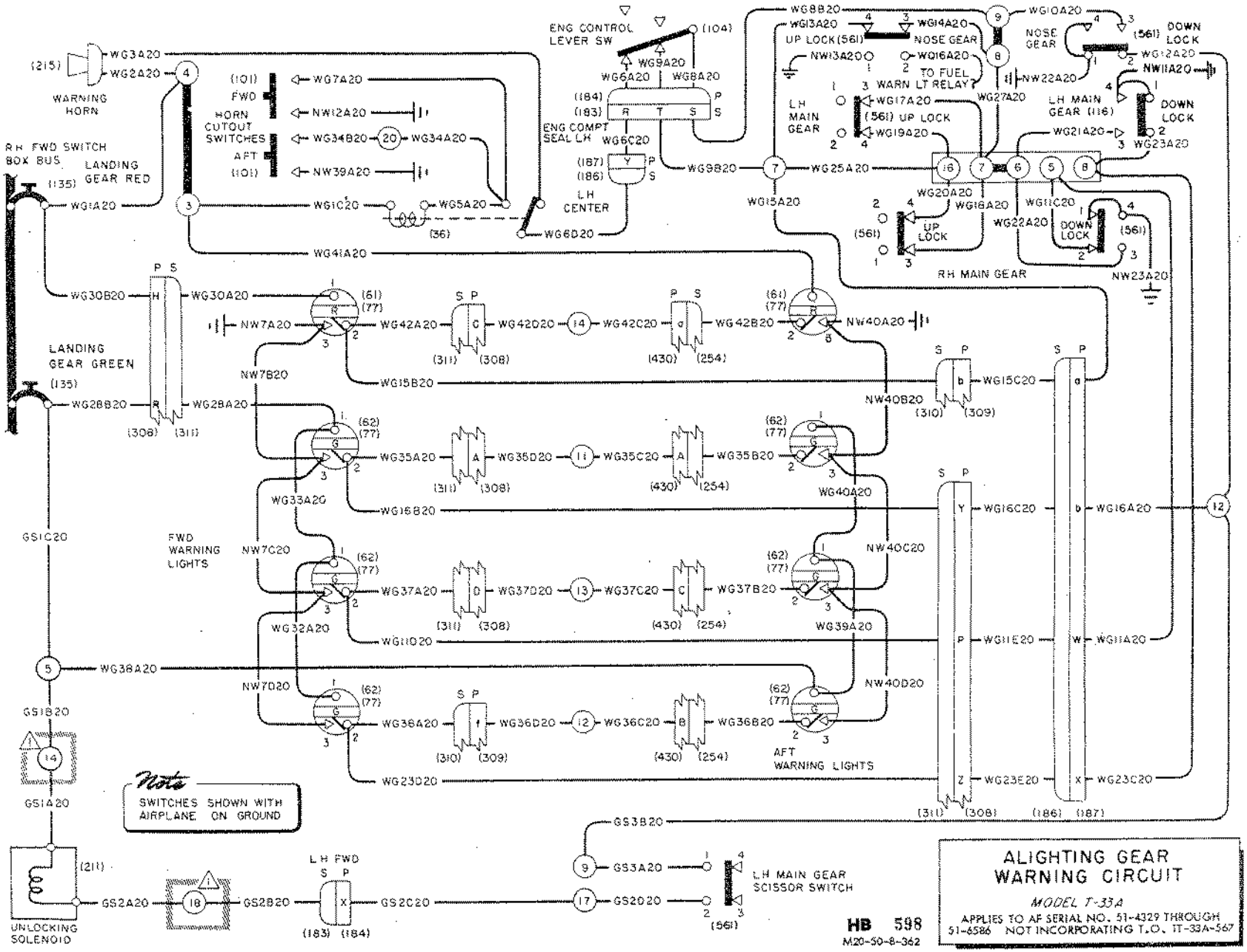
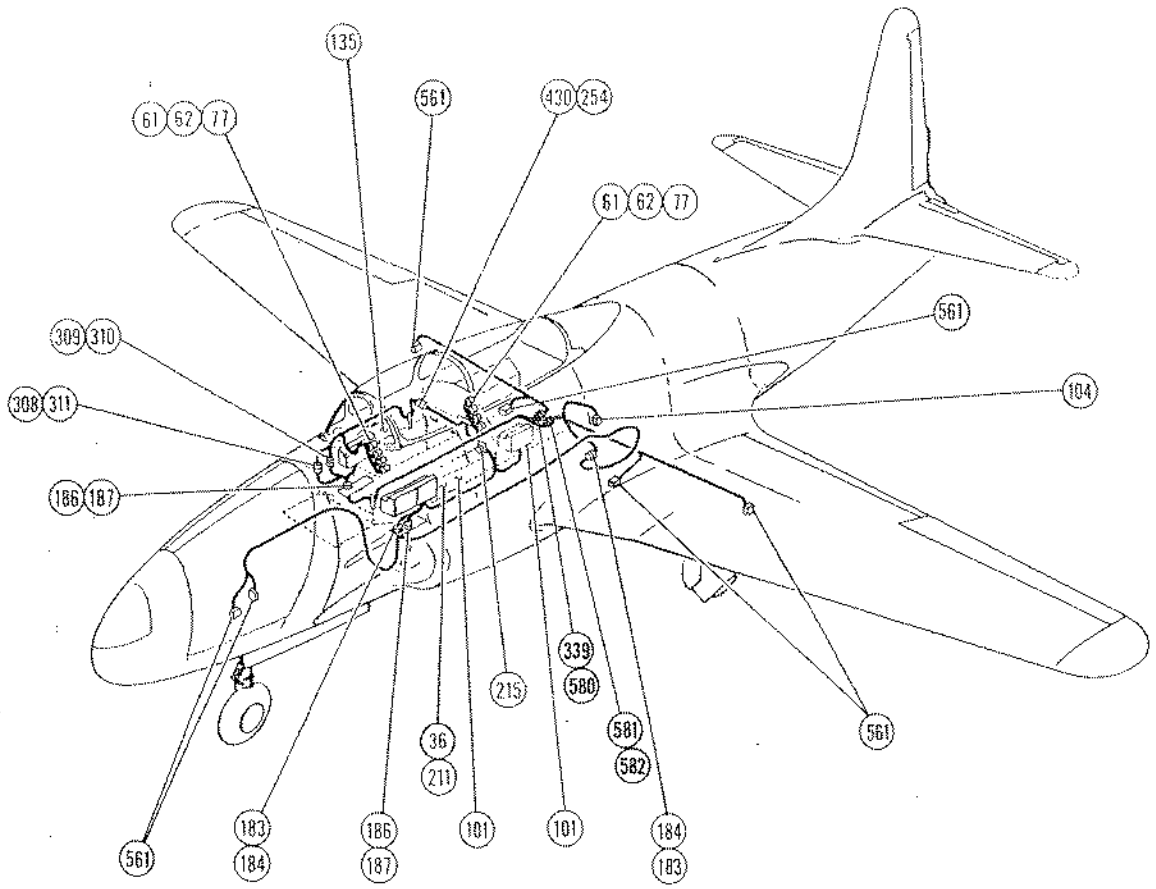
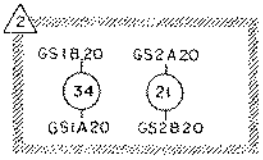


Figure 8-148. Alighting Gear Warning Circuit (Sheet 2 of 2)





NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-143
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-143

ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
339	CONNECTOR			MS3106M-28-11SW
430	CONNECTOR			AN3102-28-12P
561	SWITCH	ALLOY IND		808140
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

HB 1244
M20-50-8-94

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4329 THRU 51-6586 INCORPORATING T.O. 1T-33A-567

Figure 8-148A. Alighting Gear Warning Circuit (Sheet 1 of 2)

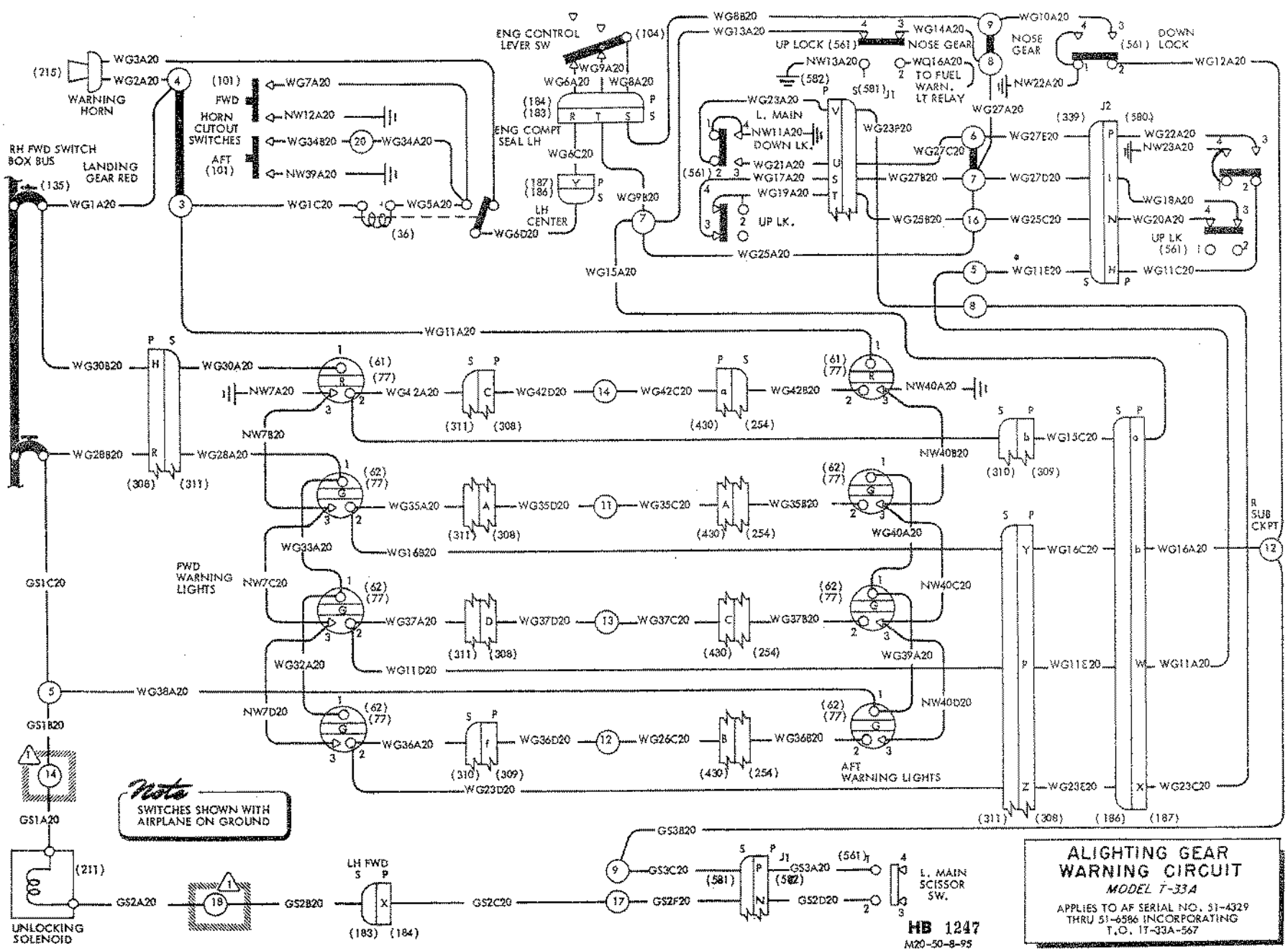
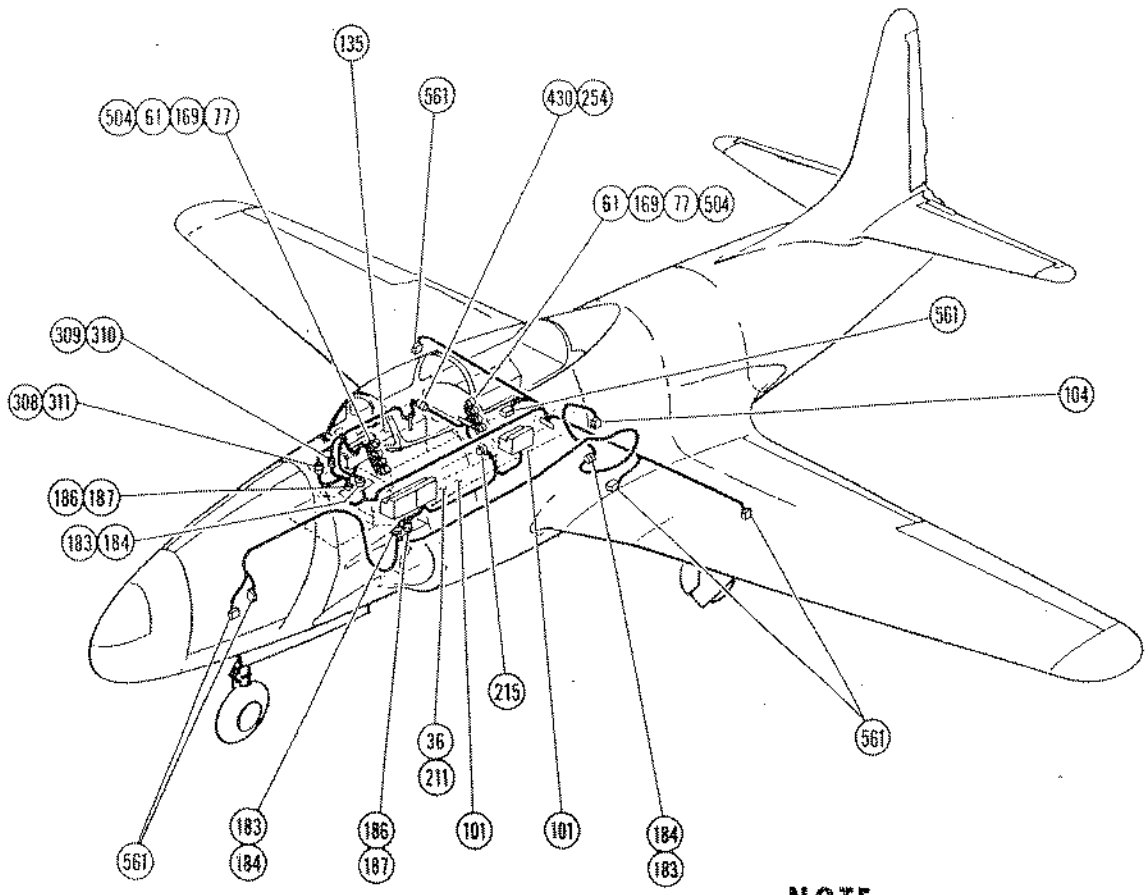
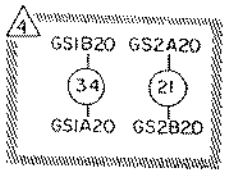


Figure 8-148A. Alighting Gear Warning Circuit (Sheet 2 of 2)





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P
504	INDICATOR	G.E.	C-1	AN5839-1
561	SWITCH	ALLOY IND		808140

NOTE:

1. USED PRIOR TO AF SERIAL NO. 51-6751 AND ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6751 THROUGH 51-6818.
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NO. 51-6751 THROUGH 51-6818.
3. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-143
4. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-143

ALIGHTING GEAR WARNING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6587 THROUGH 51-6818, NOT INCORPORATING T.O. 1T-33A-567

M20-50-8-363
HB 862

Figure 8-149 Alighting Gear Warning Circuit (Sheet 1 of 2)

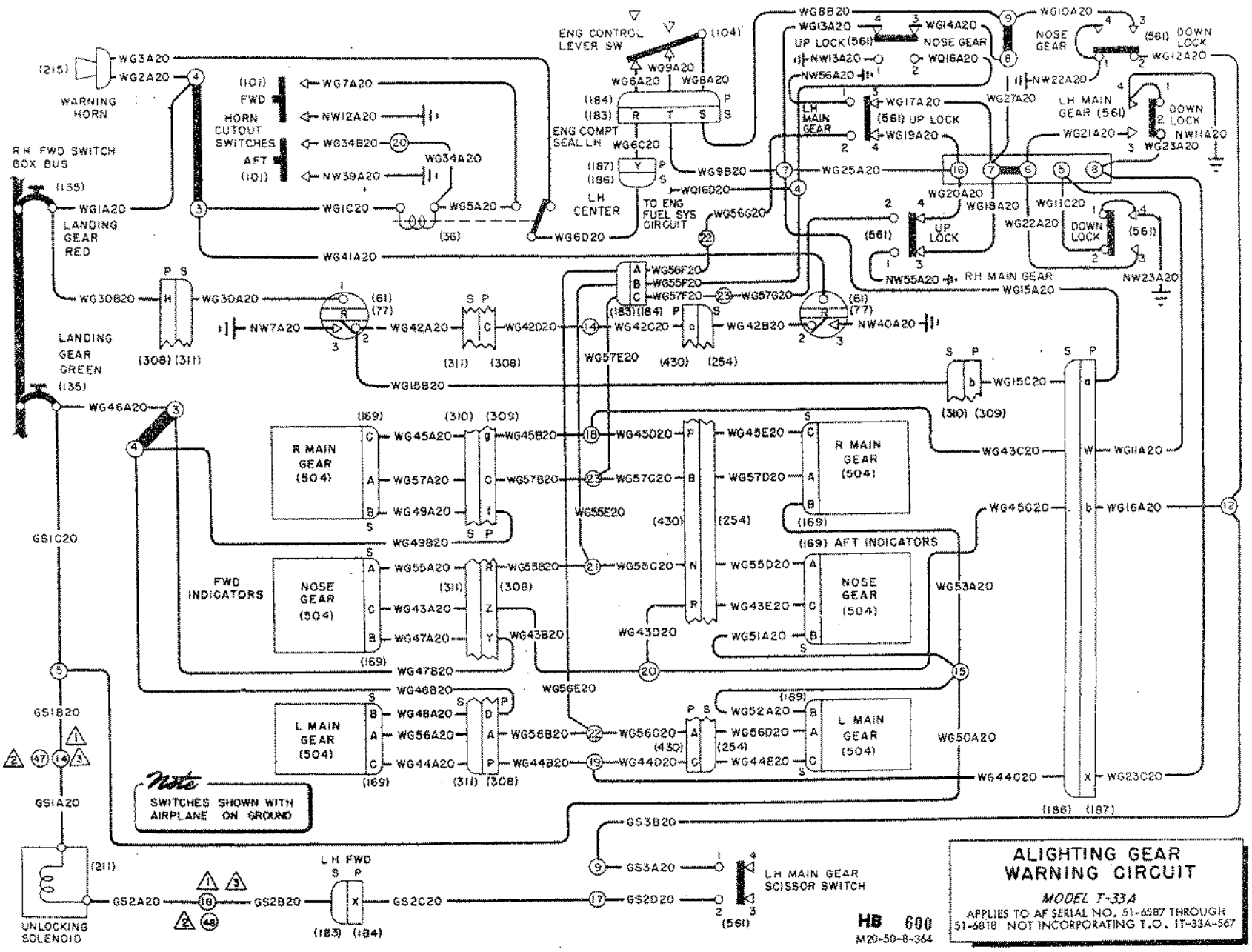
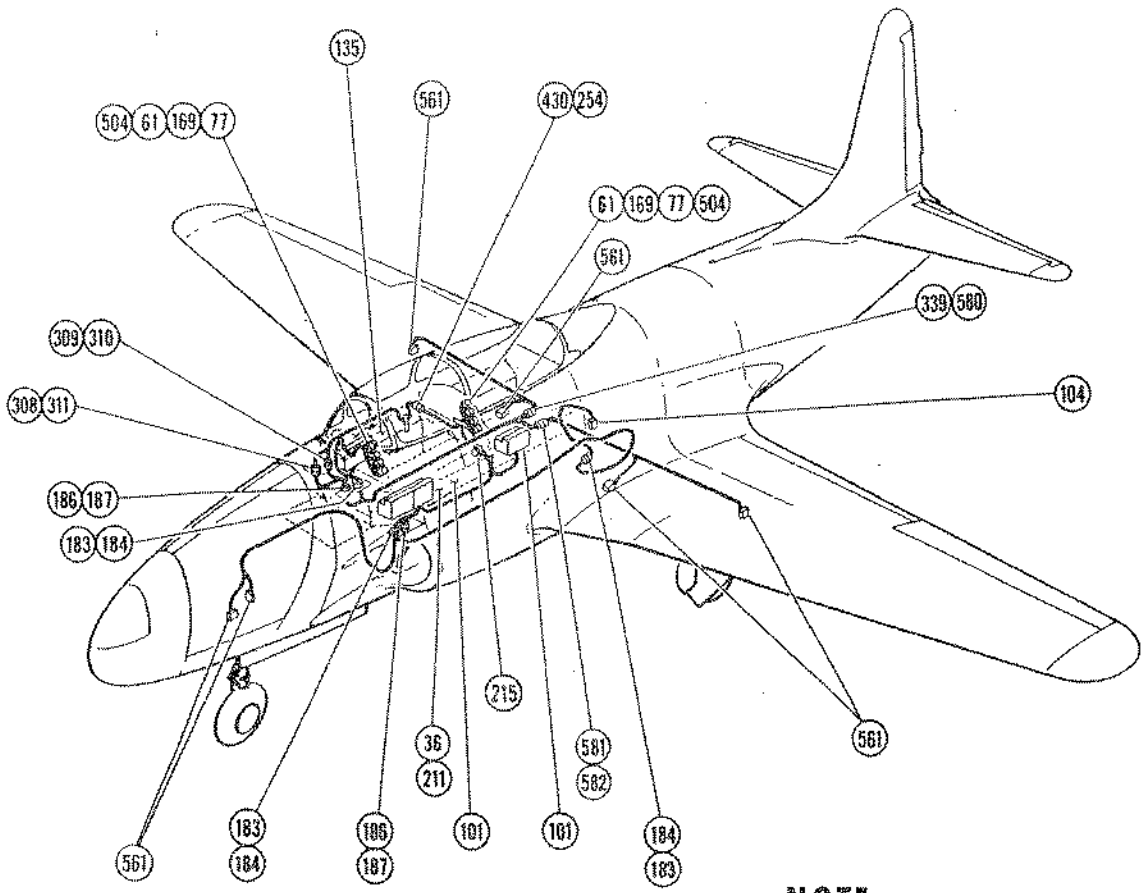
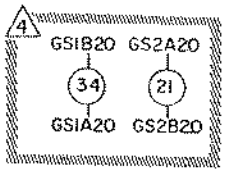


Figure 8-149. Alighting Gear Warning Circuit (Sheet 2 of 2)





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
339	CONNECTOR			MS3106M-28-11SW
430	CONNECTOR			AN3102-28-12P
504	INDICATOR	G.E.	C-1	AN5839-1
561	SWITCH	ALLOY IND		808140
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

NOTE:

1. USED PRIOR TO AF SERIAL NO. 51-6751 AND ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6751 THROUGH 51-6818.
2. USED ON USAF T-33A AIRCRAFT AF SERIAL NO. 51-6751 THROUGH 51-6818.
3. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-143
4. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-143

HB 1241
M20-50-8-96

ALIGHTING GEAR WARNING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6587 THRU 51-6818 INCORPORATING T.O. 1T-33A-567

Figure 8-149A. Alighting Gear Warning Circuit (Sheet 1 of 2)

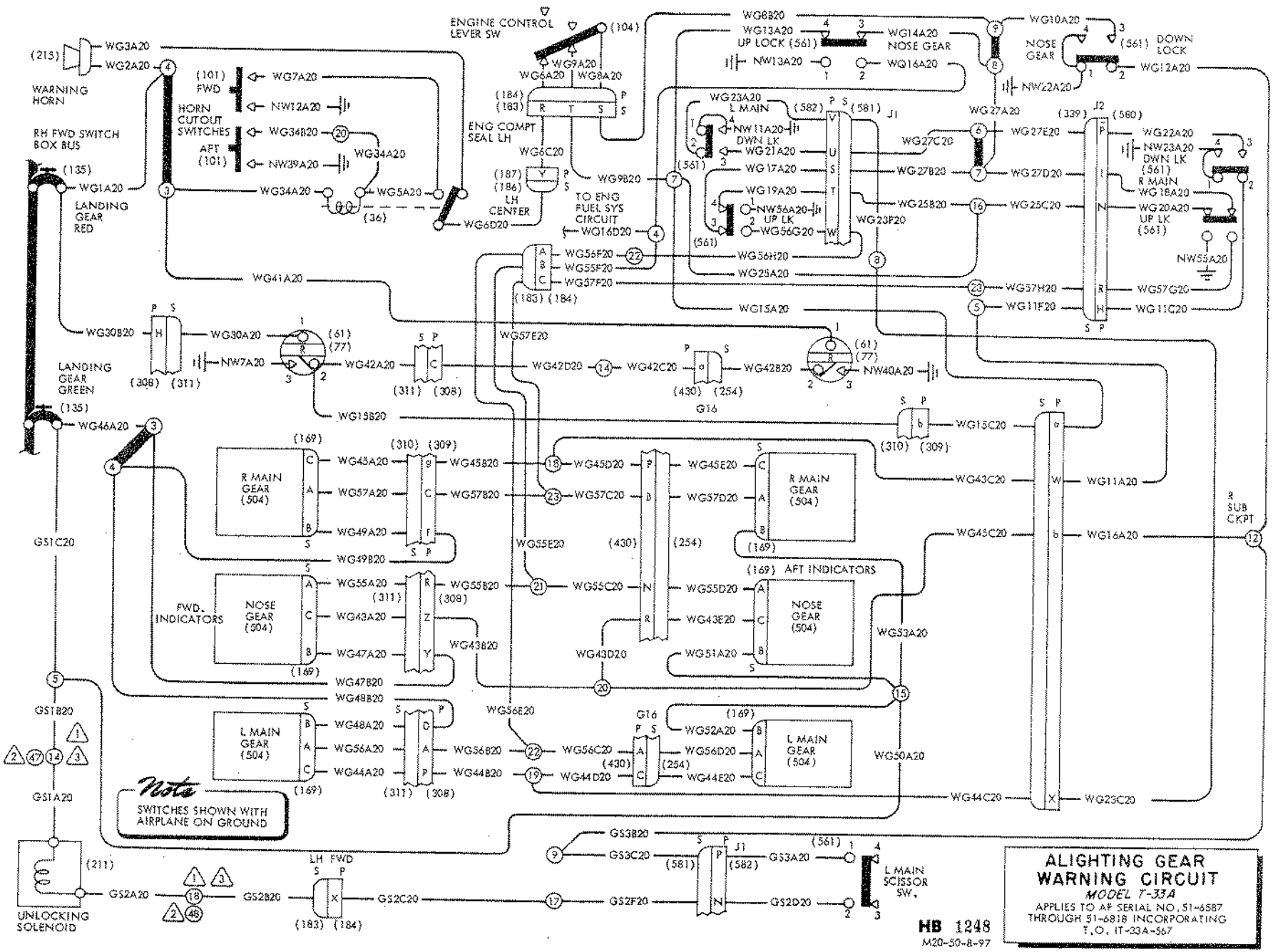
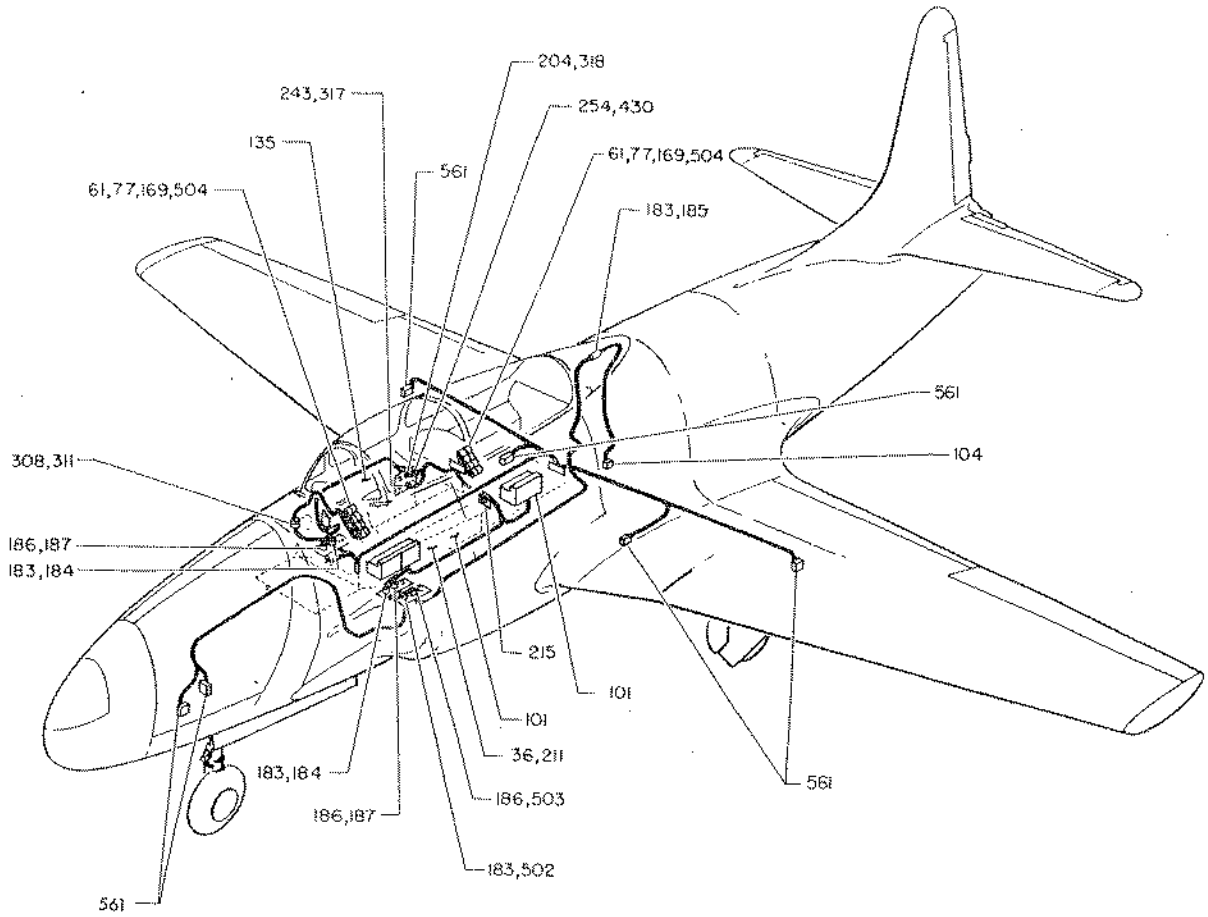


Figure 8-149A. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		N8-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C 28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
215	HORN	EL. PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102-20-29P
318	CONNECTOR			AN3106B-20-29P
430	CONNECTOR			AN3102-28-12P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
504	INDICATOR	G.E.	C-1	AN5839-1
561	SWITCH	ALLOY IND		808140

NOTE

1. USED ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235. USED ON ALL AIRCRAFT AF SERIAL NO. 51-9236 AND SUBSEQUENT
2. USED ON USAF AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905. NOT INCORPORATING T.O. 1T-33A-567

M20-50-8-367
HB 861

Figure 8-150. Alighting Gear Warning Circuit (Sheet 1 of 2)

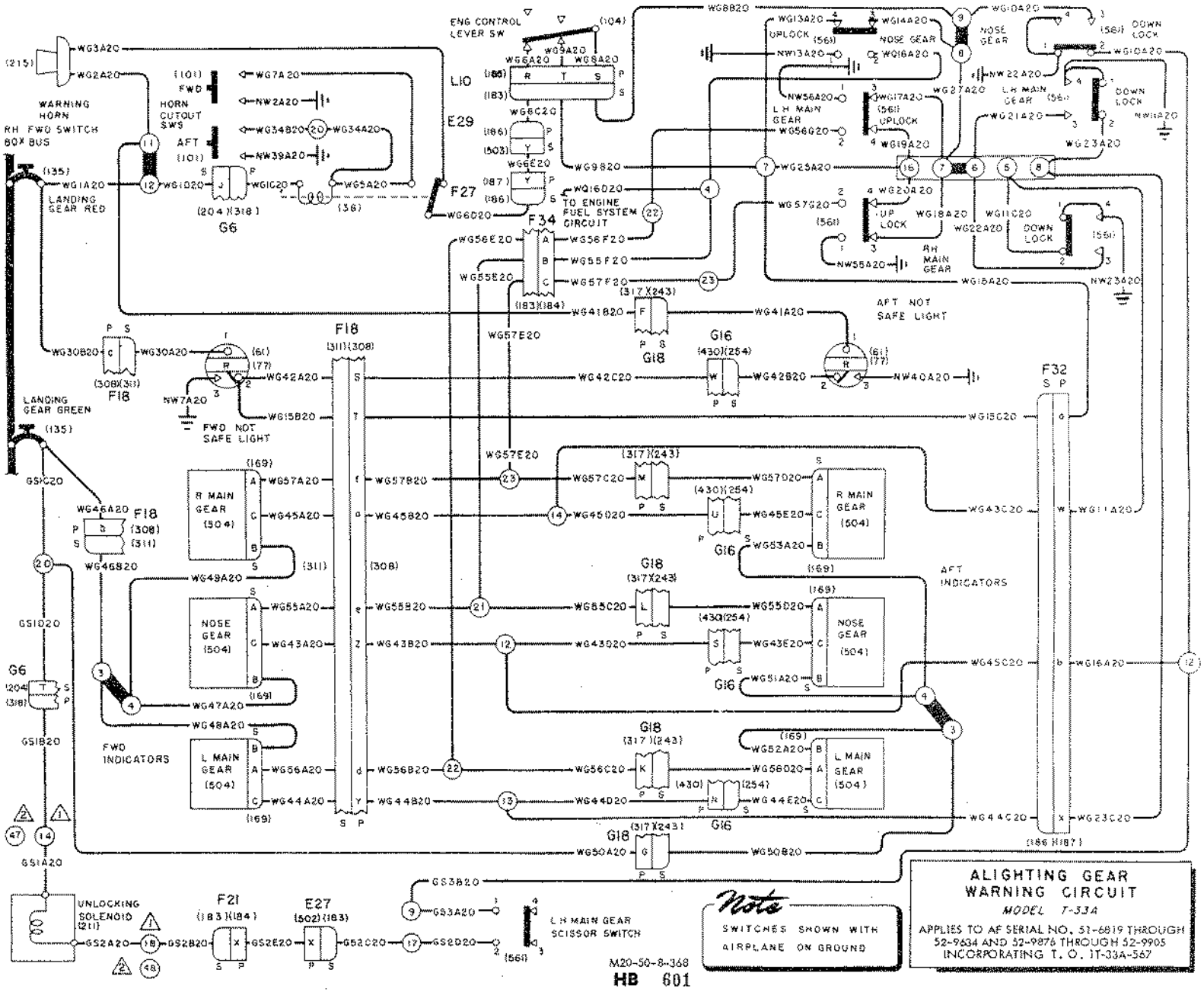
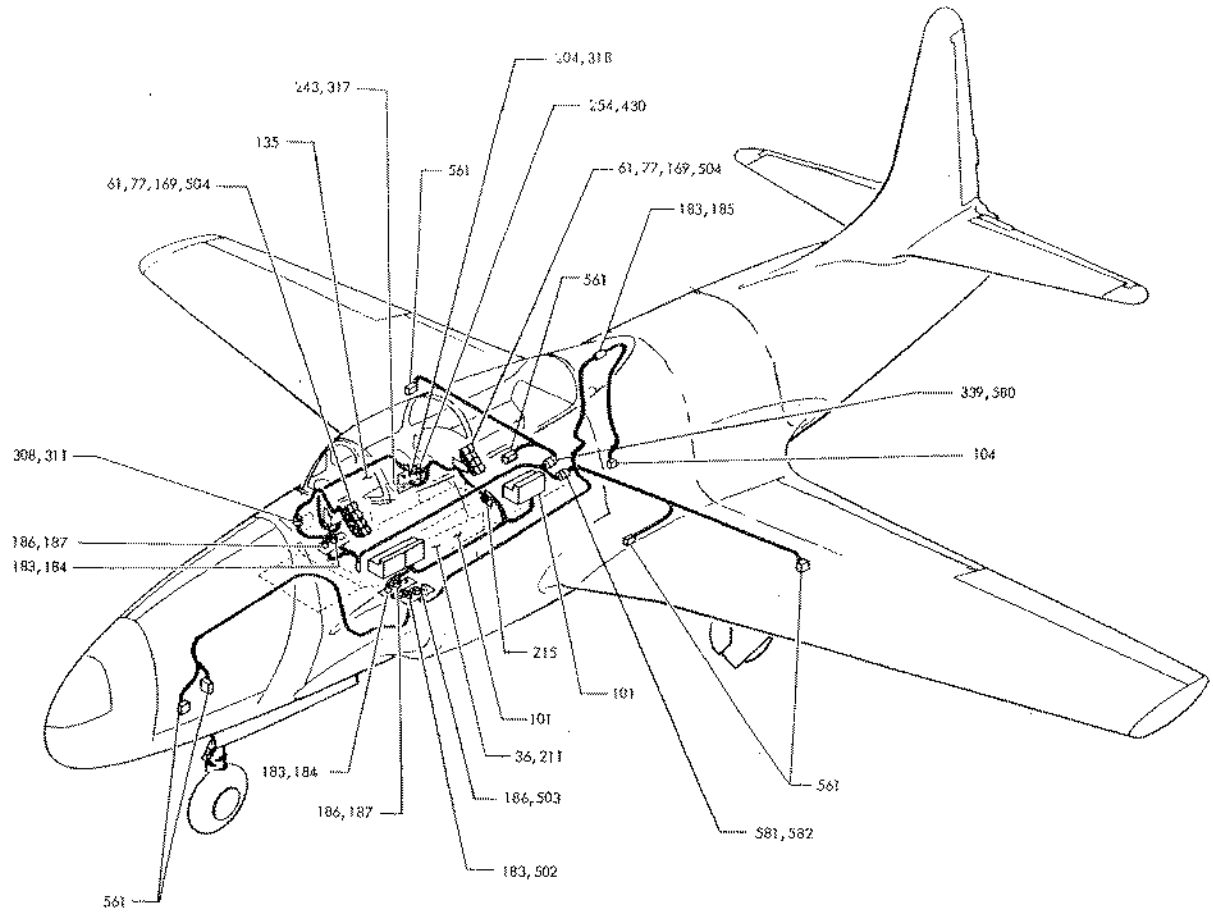


Figure 8-150. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD		N8-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
215	HORN	EL. PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
254	CONNECTOR			AN3106-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			MS3106M-28-11SW
430	CONNECTOR			AN3102-28-12P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
504	INDICATOR	G.E.	C-1	AN5839-1
561	SWITCH	ALLOY IND		808140
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

NOTE

1. USED ON RCAF AND MDAP T-33A AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235. USED ON ALL AIRCRAFT AF SERIAL NO. 51-9236 AND SUBSEQUENT
2. USED ON USAF AIRCRAFT AF SERIAL NO. 51-6819 THROUGH 51-9235

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905 INCORPORATING T.O. 1T-33A-567

HB 1250
M20-50-8-103

Figure 8-150A. Alighting Gear Warning Circuit (Sheet 1 of 2)

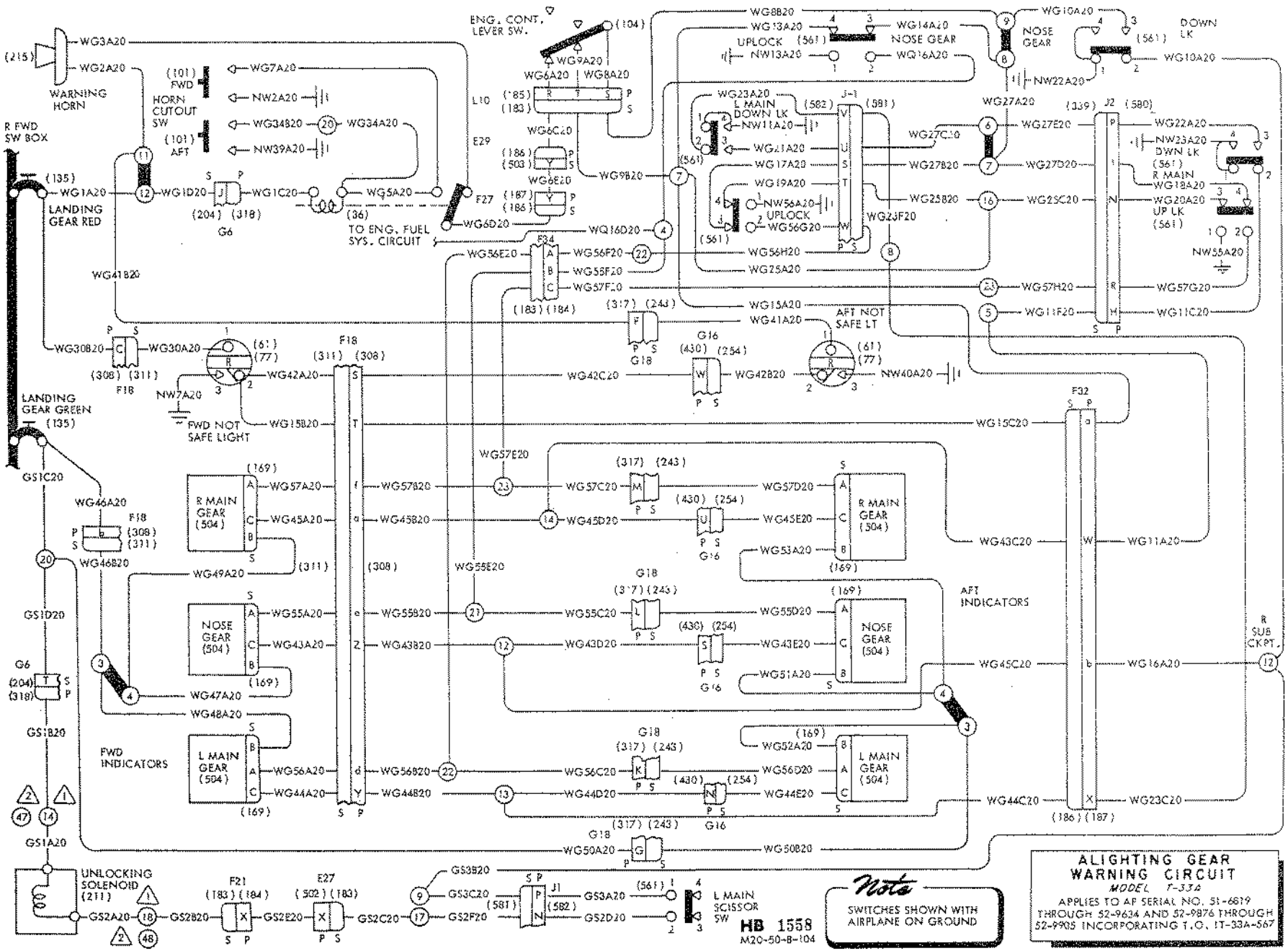
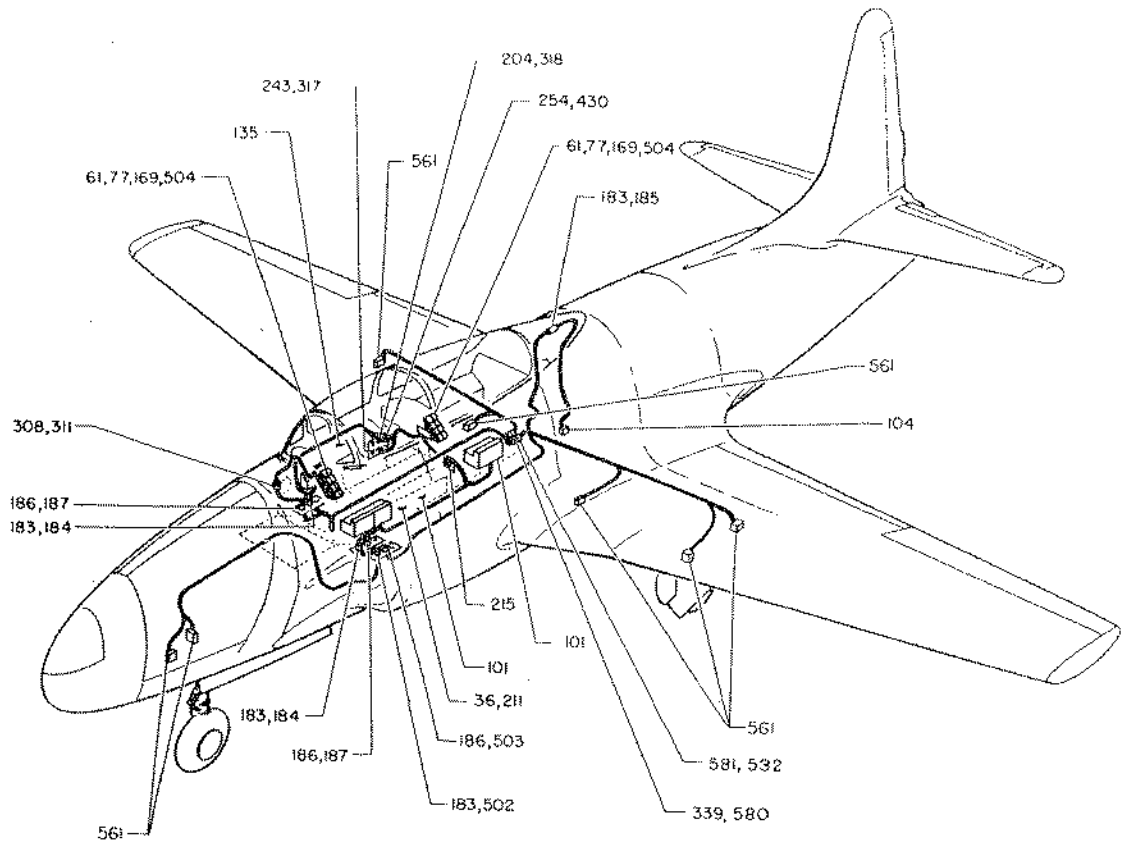


Figure 8-150A. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		N8-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			AN3106M-28-11SW
430	CONNECTOR			AN3102-28-12P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
504	INDICATOR	G.E.	C-8	AN5039-1
561	SWITCH	ALLOY IND		808140
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3106M-28-11P

GB 8809
M20-48D-8-369

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9635 THROUGH 53-4935, EXCEPT 52-9876 THROUGH 52-9905

Figure 8-151. Alighting Gear Warning Circuit (Sheet 1 of 2)

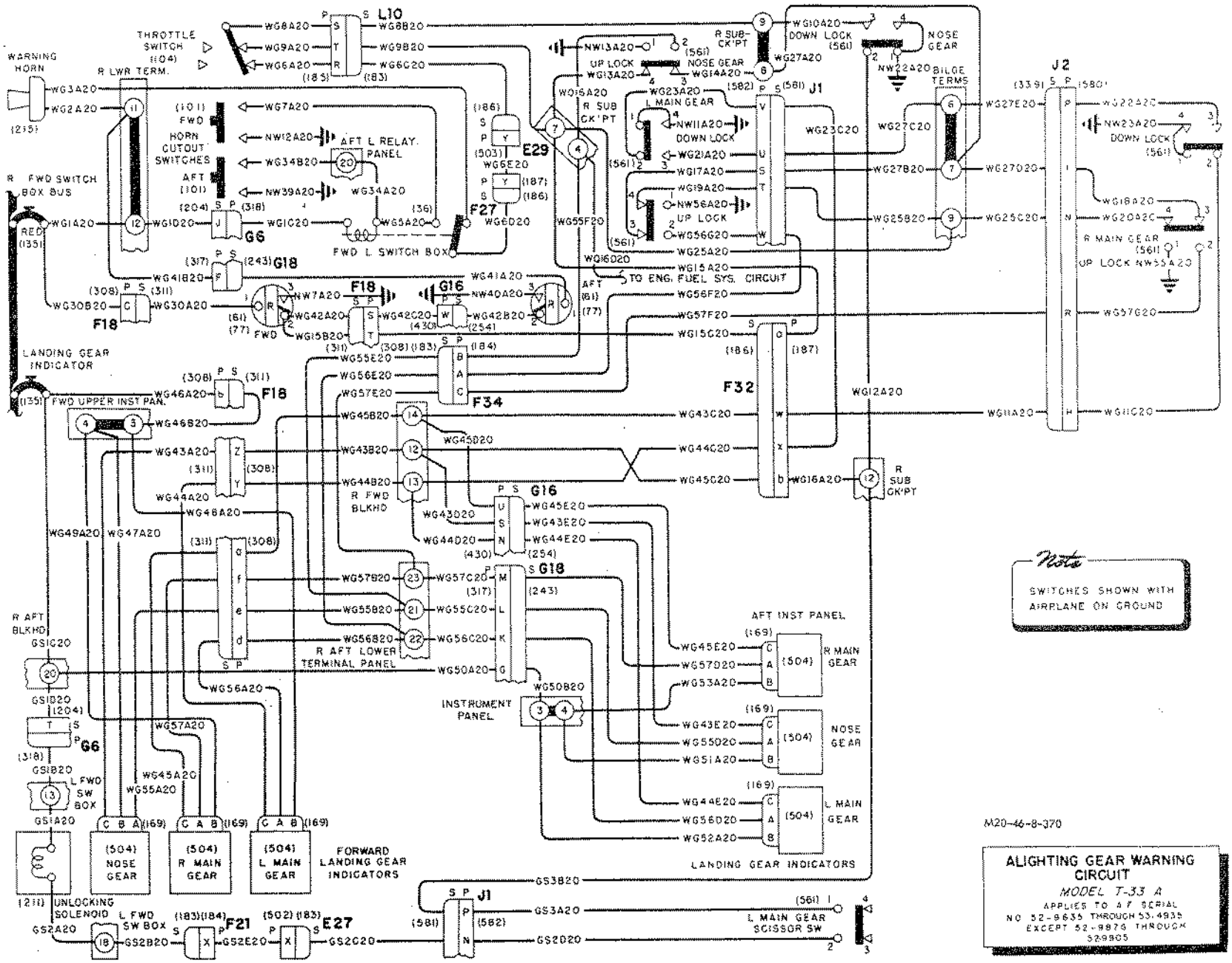
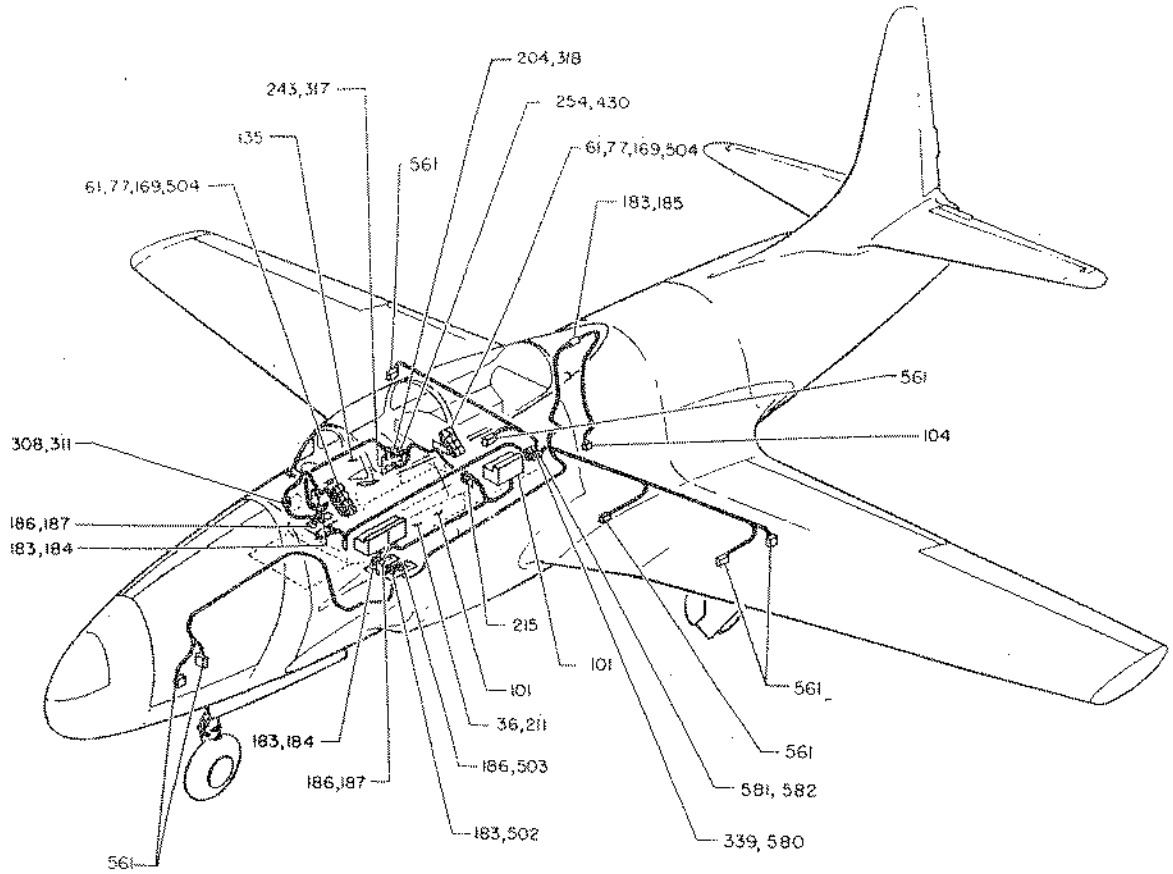


Figure 8-151. Alighting Gear Warning Circuit (Sheet 2 of 2)

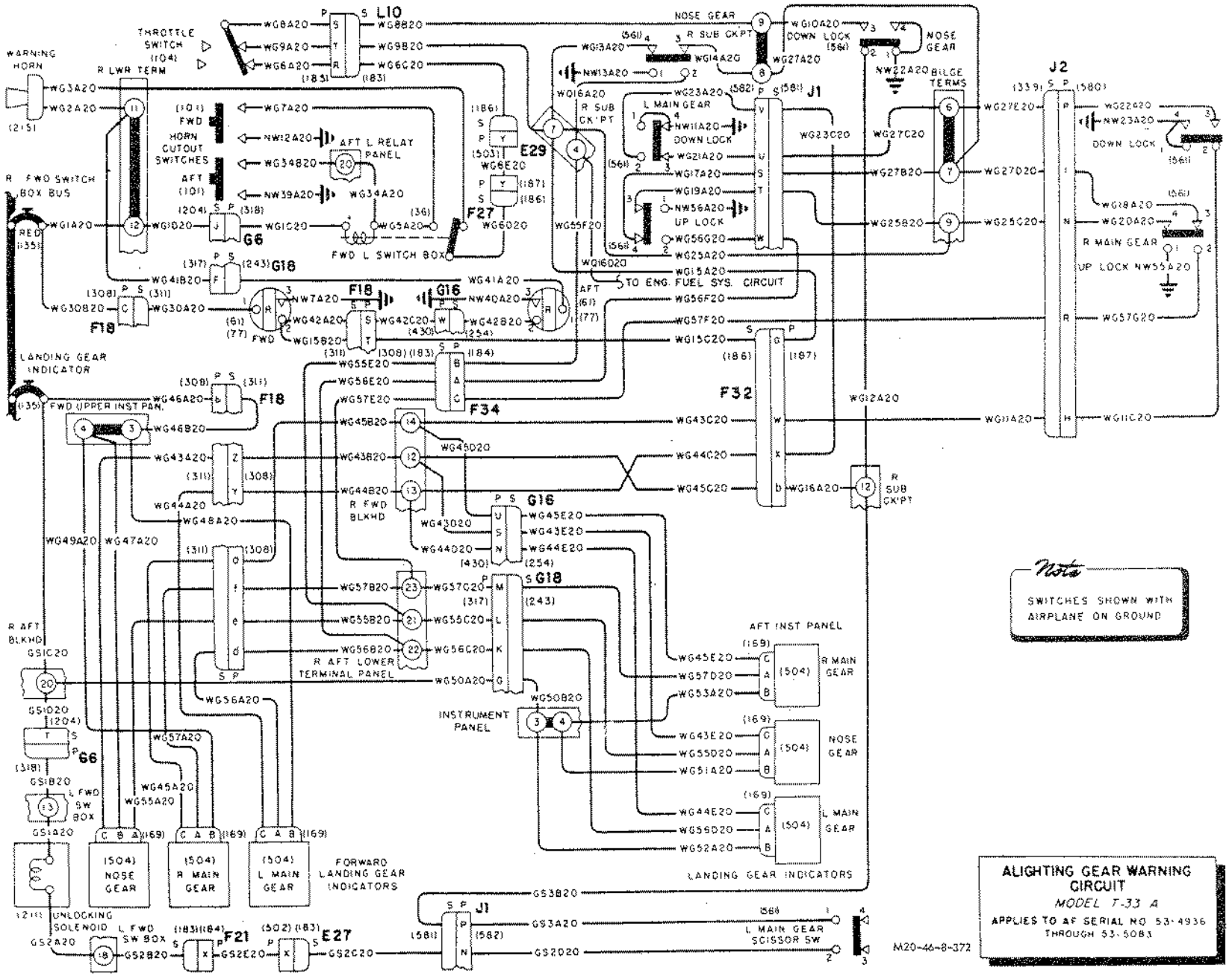


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD.		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROT			AN3161-P10
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD.	J-2	32462
243	CONNECTOR			AN3106B-20-29S
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-16P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			AN3106M-28-11SW
430	CONNECTOR			AN3102-28-12P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
504	INDICATOR	G.E., ALLOY IND	C-1	AN5839-1
561	SWITCH			808160
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3100M-28-11P

GB 8826
M20-48D-8-371

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-4936 THROUGH 53-5083

Figure 8-152. Alighting Gear Warning Circuit (Sheet 1 of 2)



Note

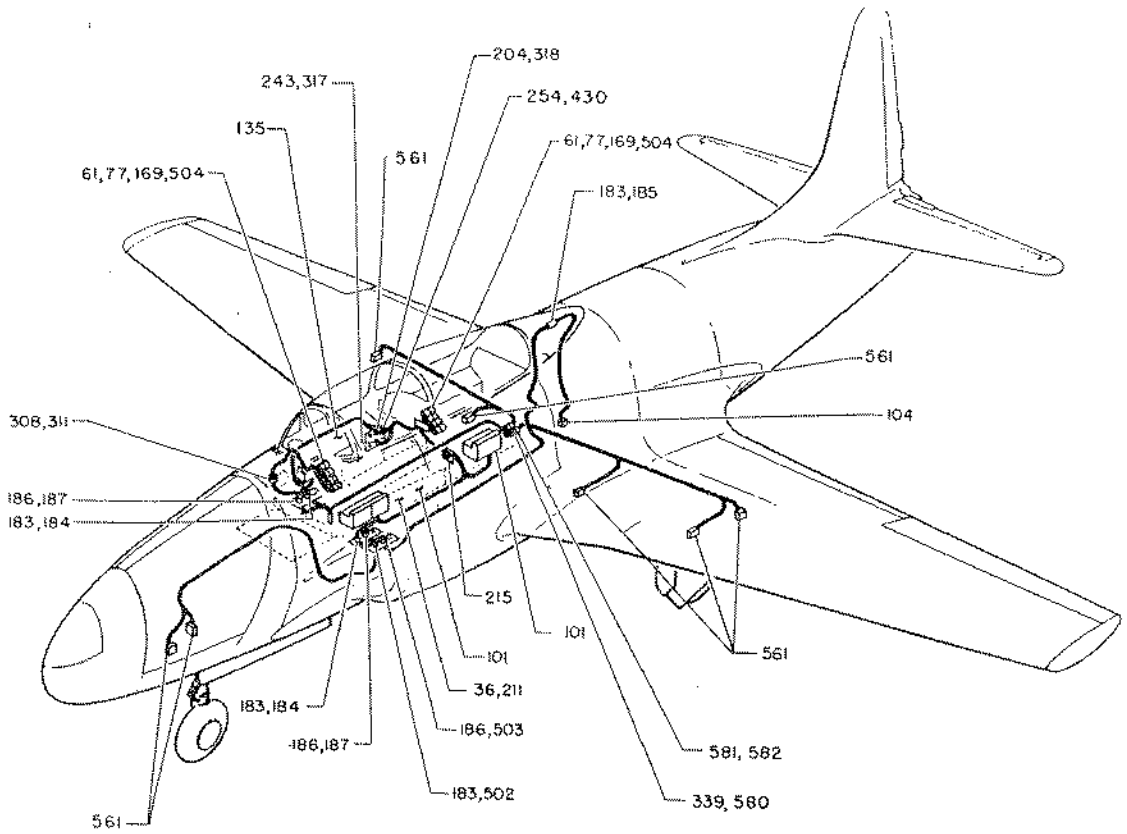
SWITCHES SHOWN WITH AIRPLANE ON GROUND

ALIGHTING GEAR WARNING CIRCUIT

MODEL T-33 A

APPLIES TO AF SERIAL NO 53-4936 THROUGH 53-5083

Figure 8-152. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3159-2
77	LAMP			AN3321-313
101	SWITCH	C-N		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3361-P30
169	CONNECTOR			AN3106-10SL-3S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
254	CONNECTOR			AN3106-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
317	CONNECTOR			AN3102-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			AN3106M-28-21SW
430	CONNECTOR			AN3102-28-12P
502	CONNECTOR			AN3100A-28-13P
503	CONNECTOR			AN3100A-28-12P
504	INDICATOR	G.E. ALLOY IND	C-1	AN5839-1
561	SWITCH			808140
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3100M-28-11P

GB 8834
M20-480-8-270

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5084 THROUGH 53-5665

Figure 8-153. Alighting Gear Warning Circuit (Sheet 1 of 2)

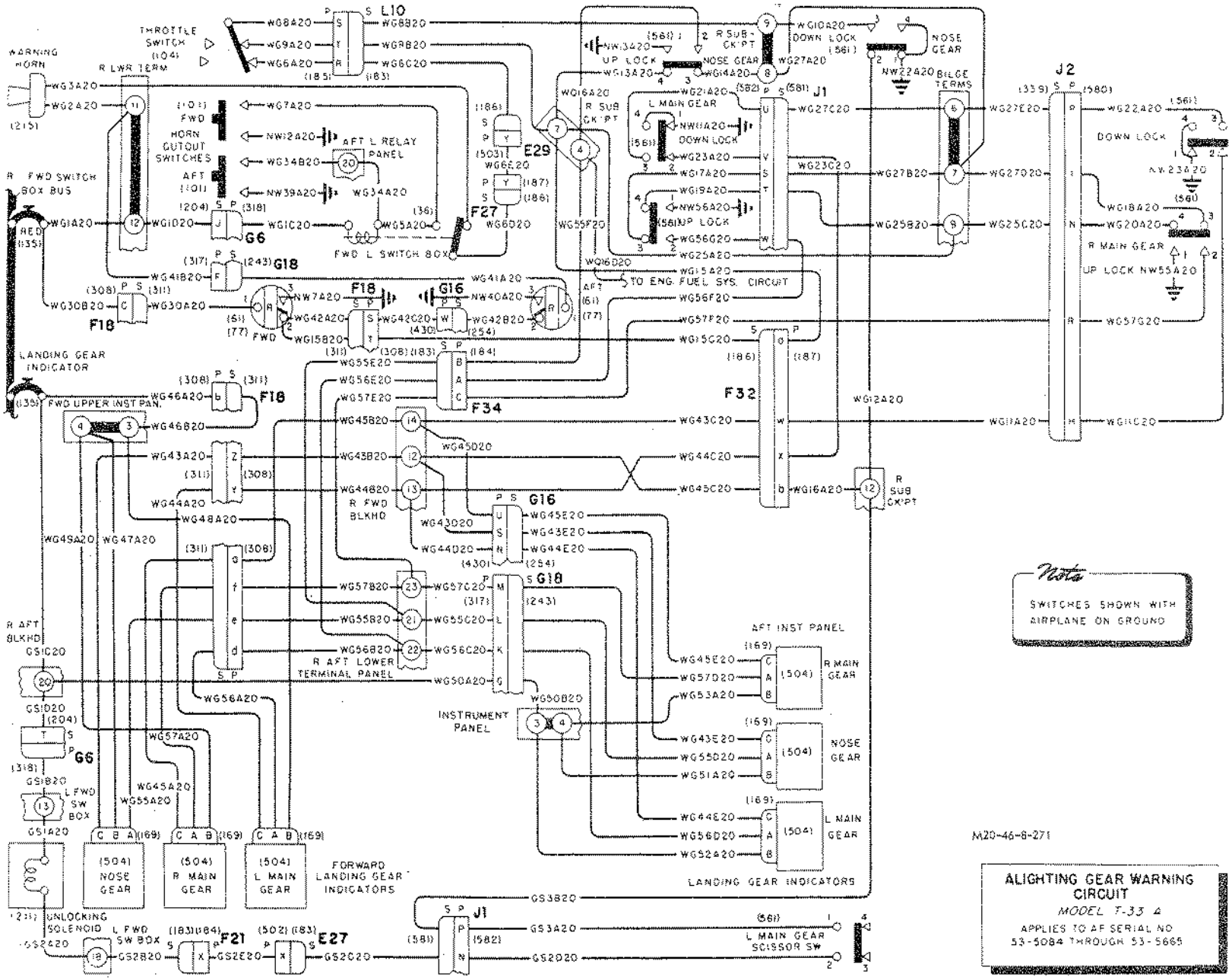
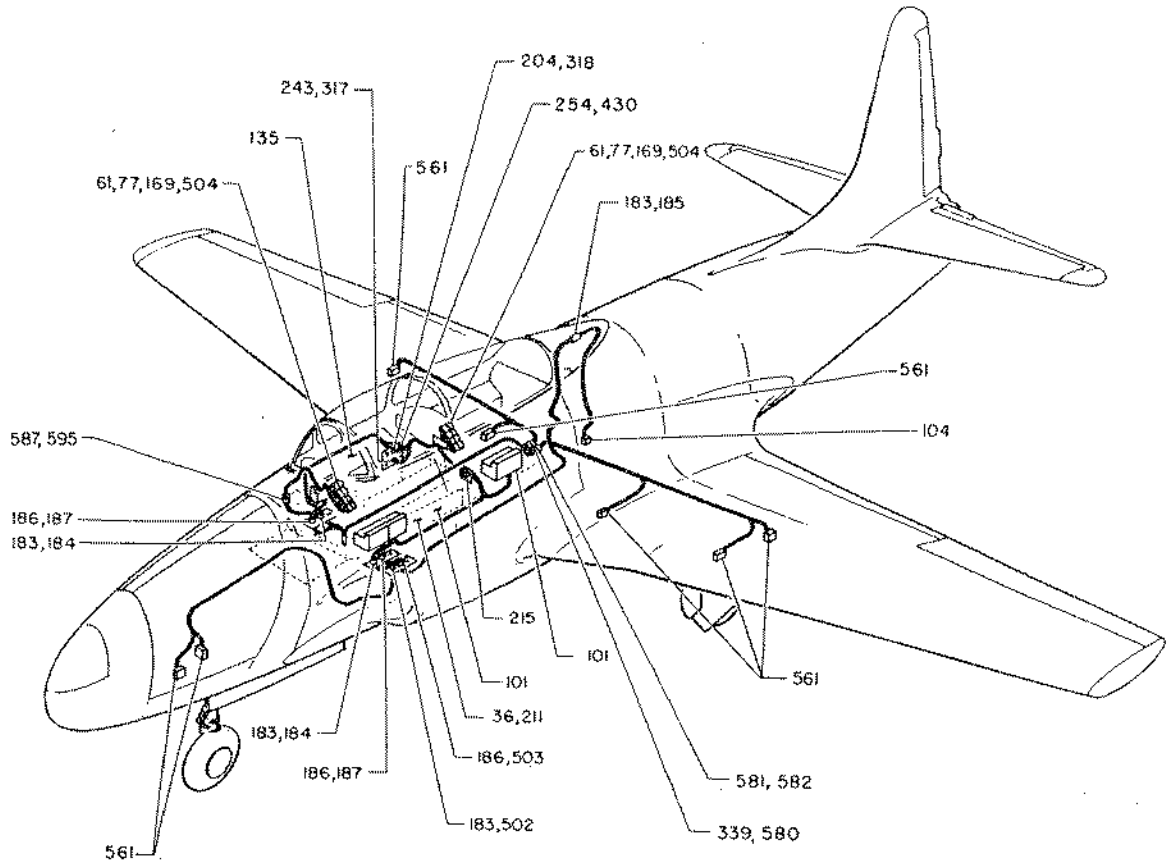


Figure 8-153. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3123-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106B-1051-35
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
211	SOLENOID	CANNON		W-51
215	HORN	EL PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
254	CONNECTOR			AN3108B-28-12S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			AN3106M-28-11SW
430	CONNECTOR			AN3102A-28-12P
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3108A-28-12P
504	INDICATOR	G.E.	C-1	AN5839-1
561	SWITCH	ALLOY IND		808140
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3100M-28-11P
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

GB 8833
AN20-480-8-334

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 53-5666 THROUGH 56-1674

Figure 8-154. Alighting Gear Warning Circuit (Sheet 1 of 2)

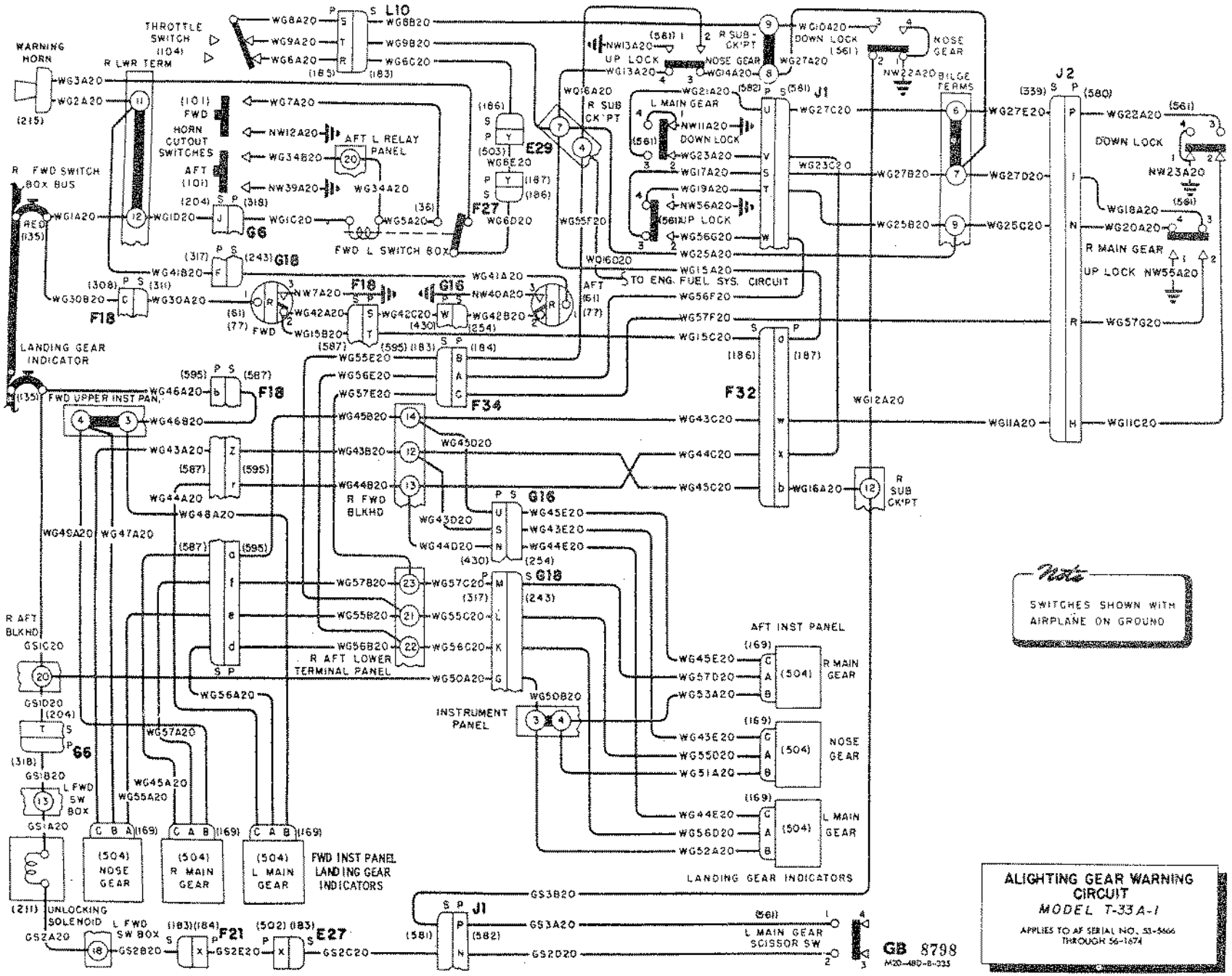
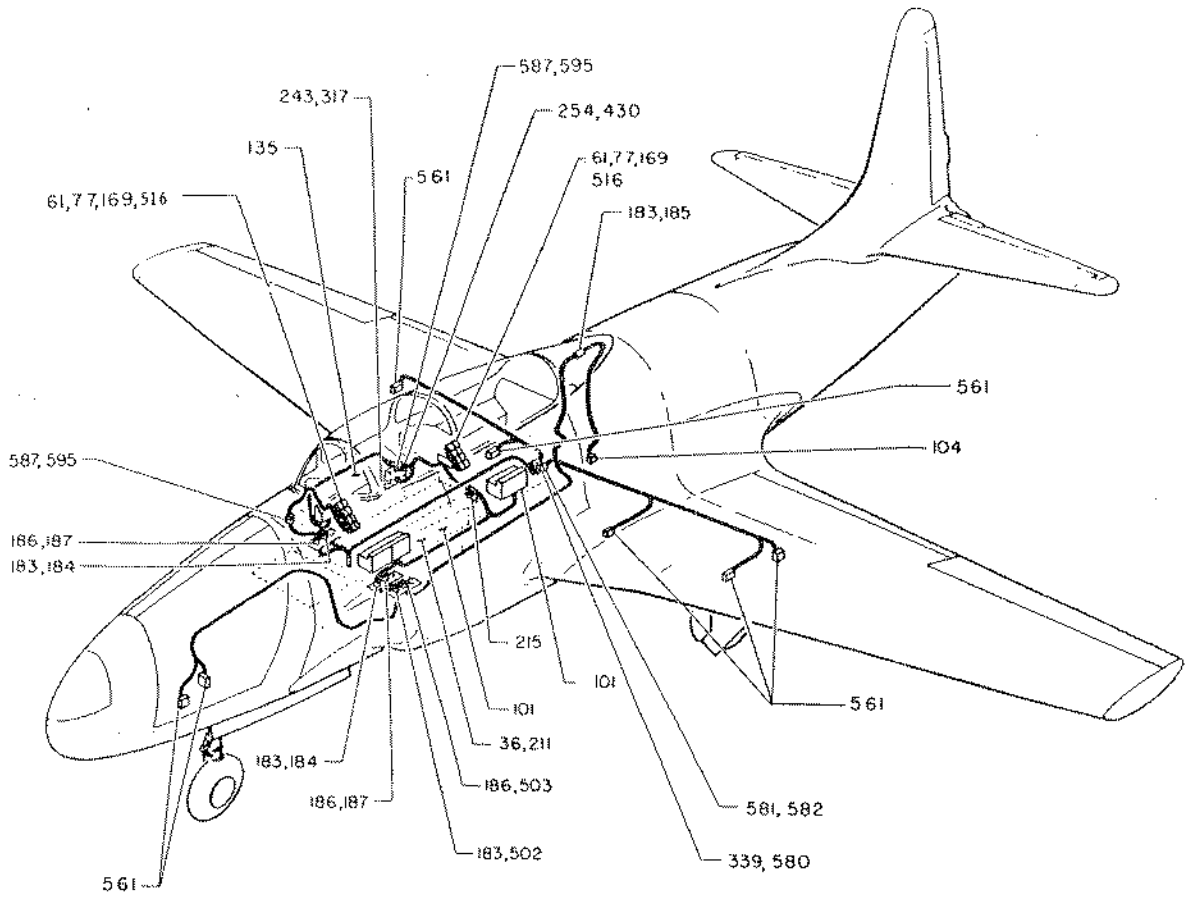


Figure 8-154. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3171-313
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
125	CIRCUIT PROTECTOR			AN3161-P10
169	CONNECTOR			AN3106B-16SE-3S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
211	SOLENOID	CANNON		W-51
215	HORN	EL PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			AN3106M-28-11SW
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
516	INDICATOR			AN5839-2
561	SWITCH	ALLOY END		808140
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3100M-28-11P
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

GB1406
M20-42-8-403

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A-5
APPLIES TO A.F. SERIAL NO. 56-1675 THROUGH 57-529

Figure 8-155. Alighting Gear Warning Circuit (Sheet 1 of 2)

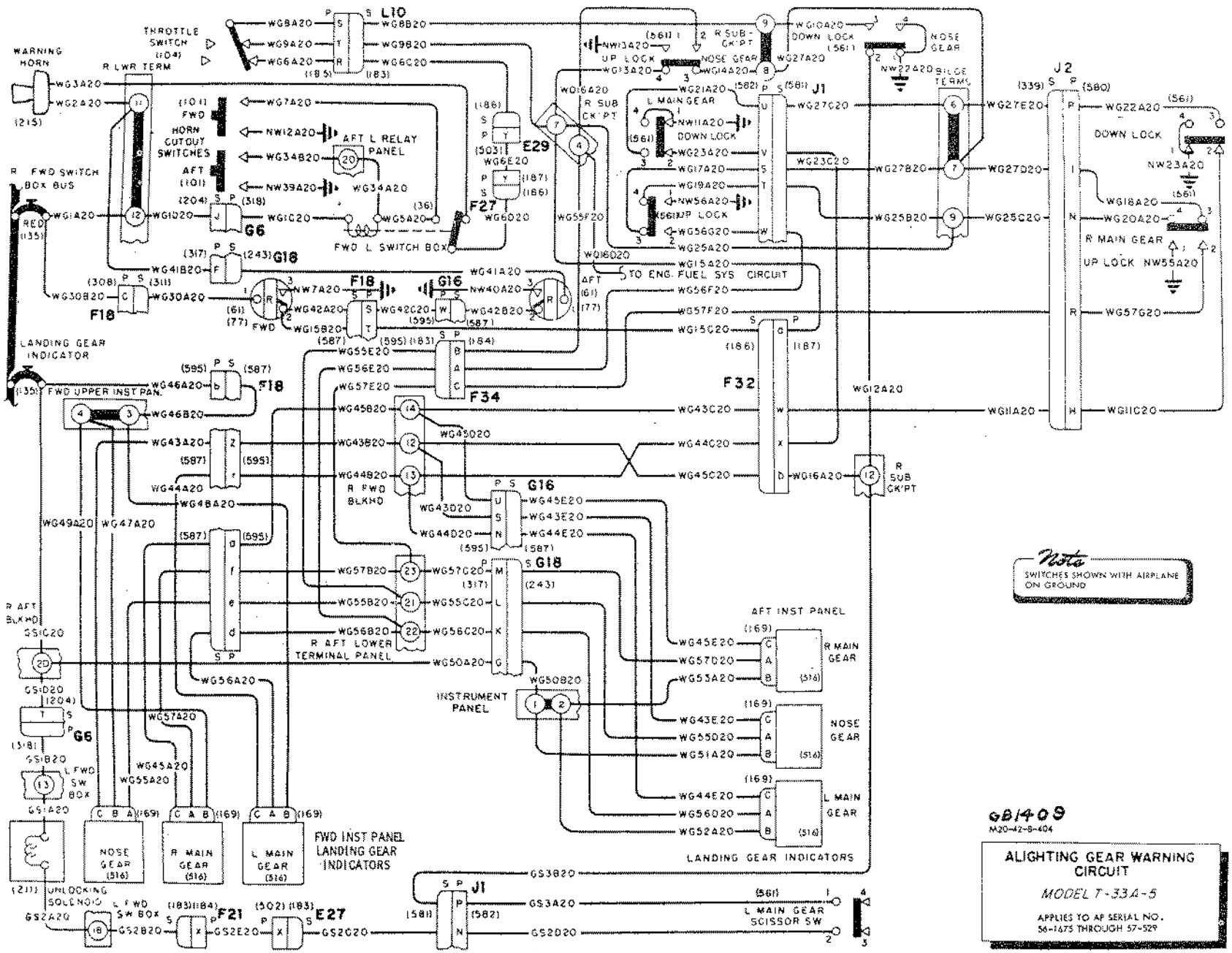
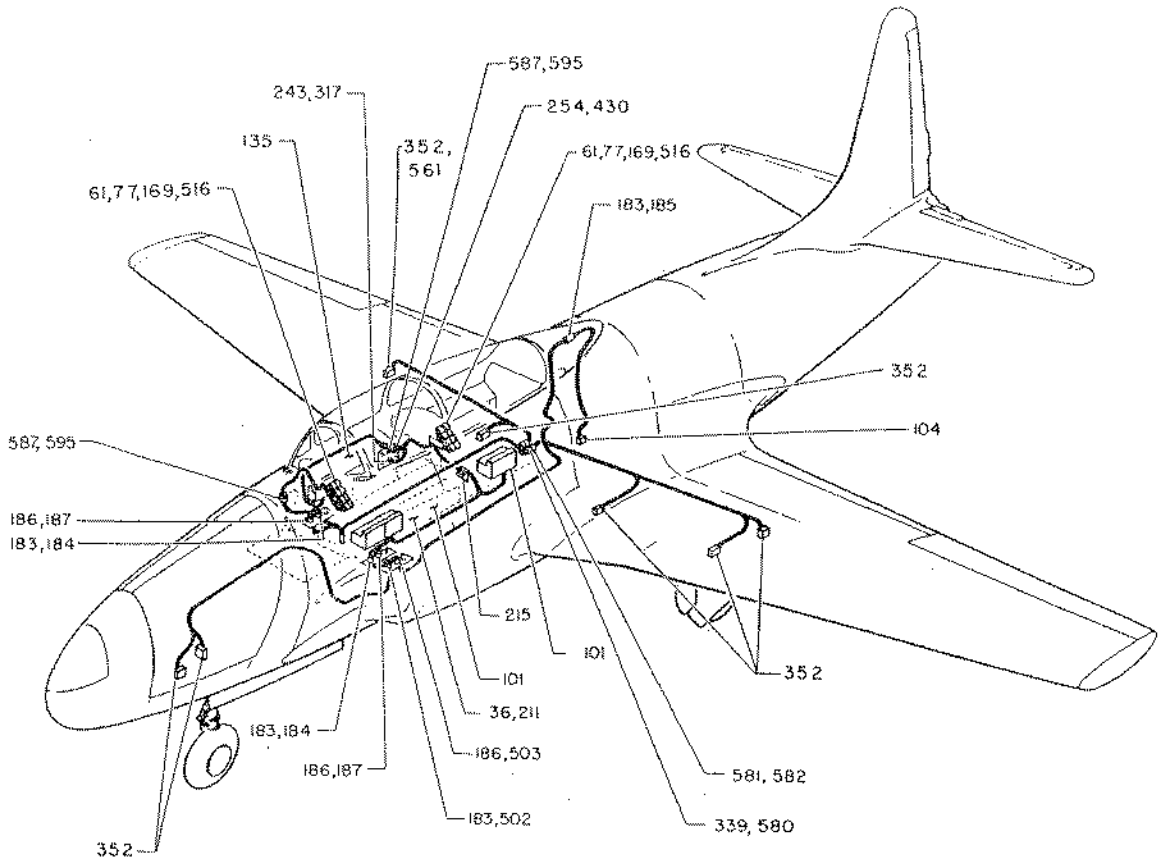


Figure 8-155. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD	*	NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
103	SWITCH	C-H		B872
104	SWITCH			AN3236-1
135	CIRCUIT PROTECTOR			AN3361-P30
169	CONNECTOR			AN3106B-20SL-3S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
211	SOLENOID	CANNON		W-5L
215	HORN	EL PROD	J-2	32462
243	CONNECTOR			AN3106B-20-29S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			AN3106M-28-11SW
352	SWITCH	COLE		B-2376
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
516	INDICATOR	G.E.	C-1	AN5839-2
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3100M-28-11P
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

HB 58
M28-49-8-121

ALIGHTING GEAR WARNING CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. 57-530 THROUGH 58-670

Figure 8-156. Alighting Gear Warning Circuit (Sheet 1 of 2)

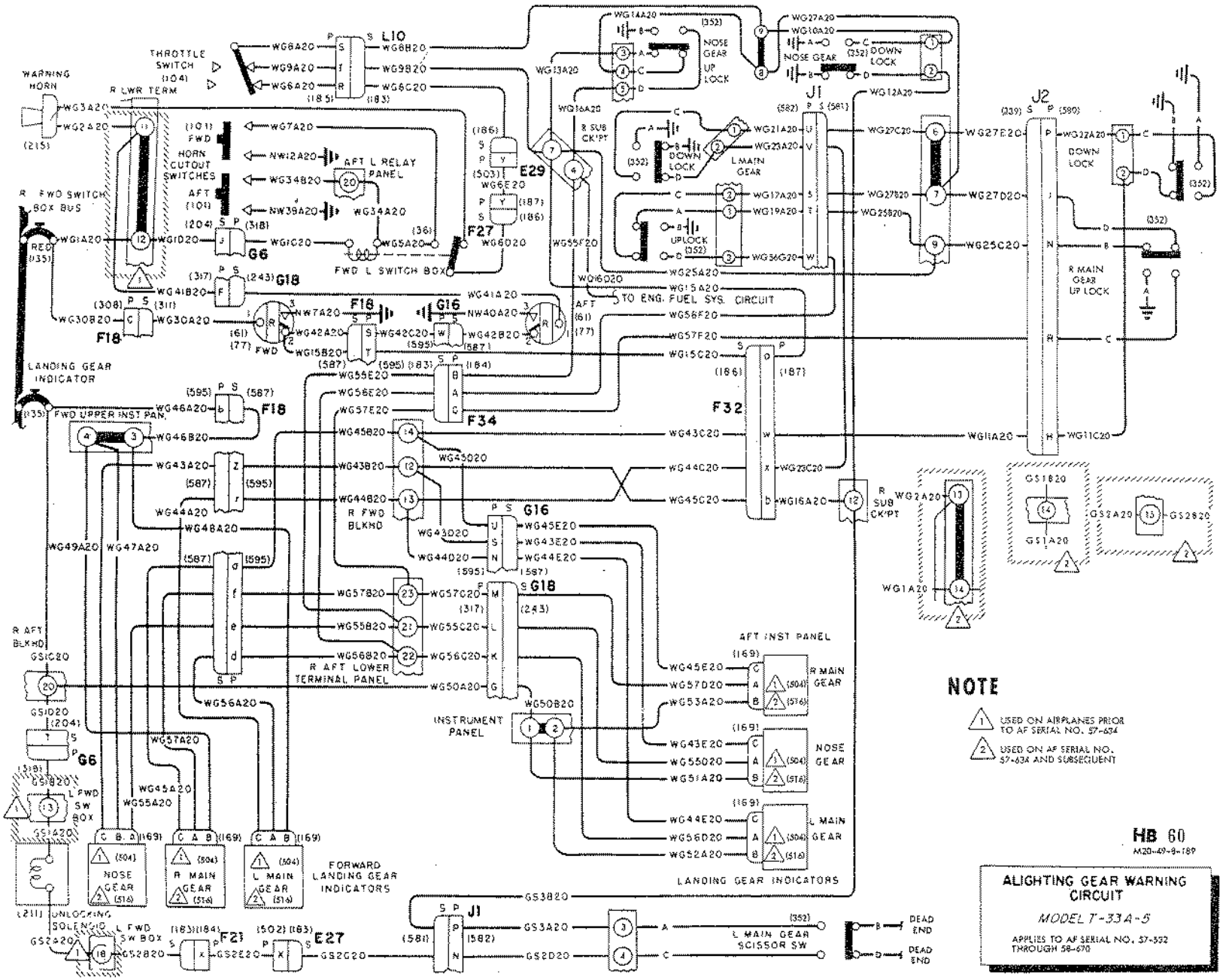
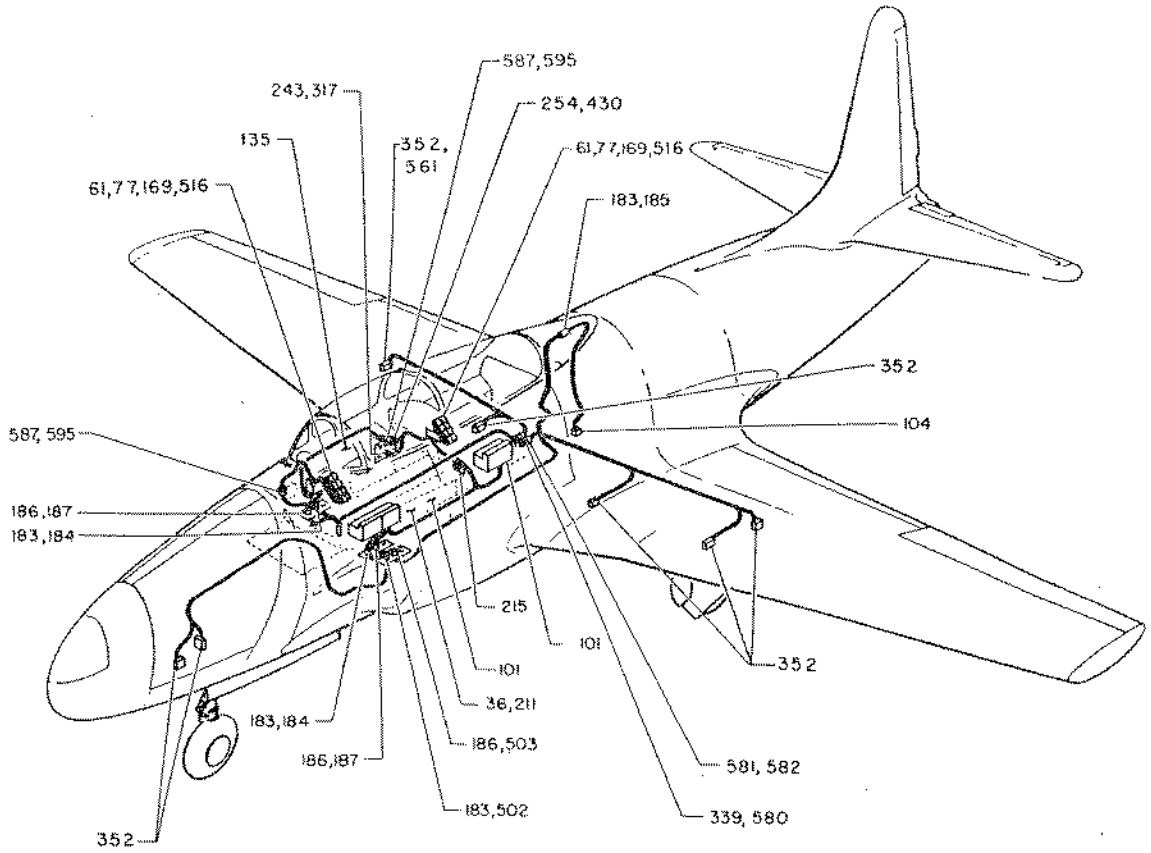


Figure 8-156. Alighting Gear Warning Circuit (Sheet 2 of 2)

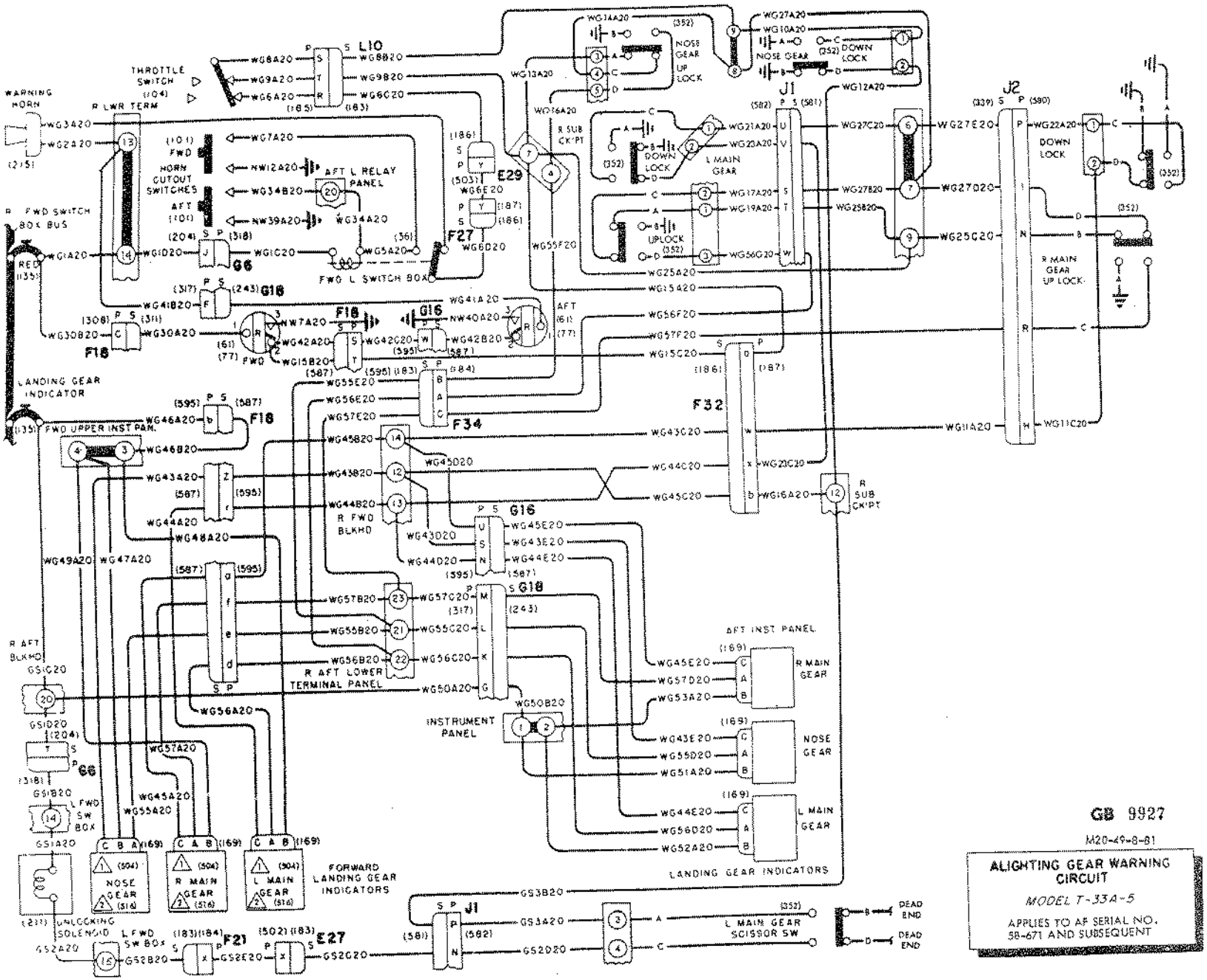


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD		NB-57-C
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-310
101	SWITCH	C-H		8872
104	SWITCH			AN3216-1
135	CIRCUIT PROTECTOR			AN3161-PTO
169	CONNECTOR			AN31068-16SL-3S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
211	SOLENOID	CANNON		W-51
215	HORN	EL PROD	J-2	32467
243	CONNECTOR			AN31068-20-29S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN31068-20-29P
339	CONNECTOR			AN3106A-28-11SW
352	SWITCH	COLE		B-2376
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
516	INDICATOR	G.E.	C-1	AN5839-2
580	CONNECTOR			AN3100M-28-11PW
581	CONNECTOR			AN3106M-28-11S
582	CONNECTOR			AN3100M-28-11P
587	CONNECTOR			AN31068-28-21S
595	CONNECTOR			AN3102A-28-21P

GB 9928
M20-49-8-80

ALIGHTING GEAR
WARNING CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO.
58-671 AND SUBSEQUENT

Figure 8-156A. Alighting Gear Warning Circuit (Sheet 1 of 2)



GB 9927

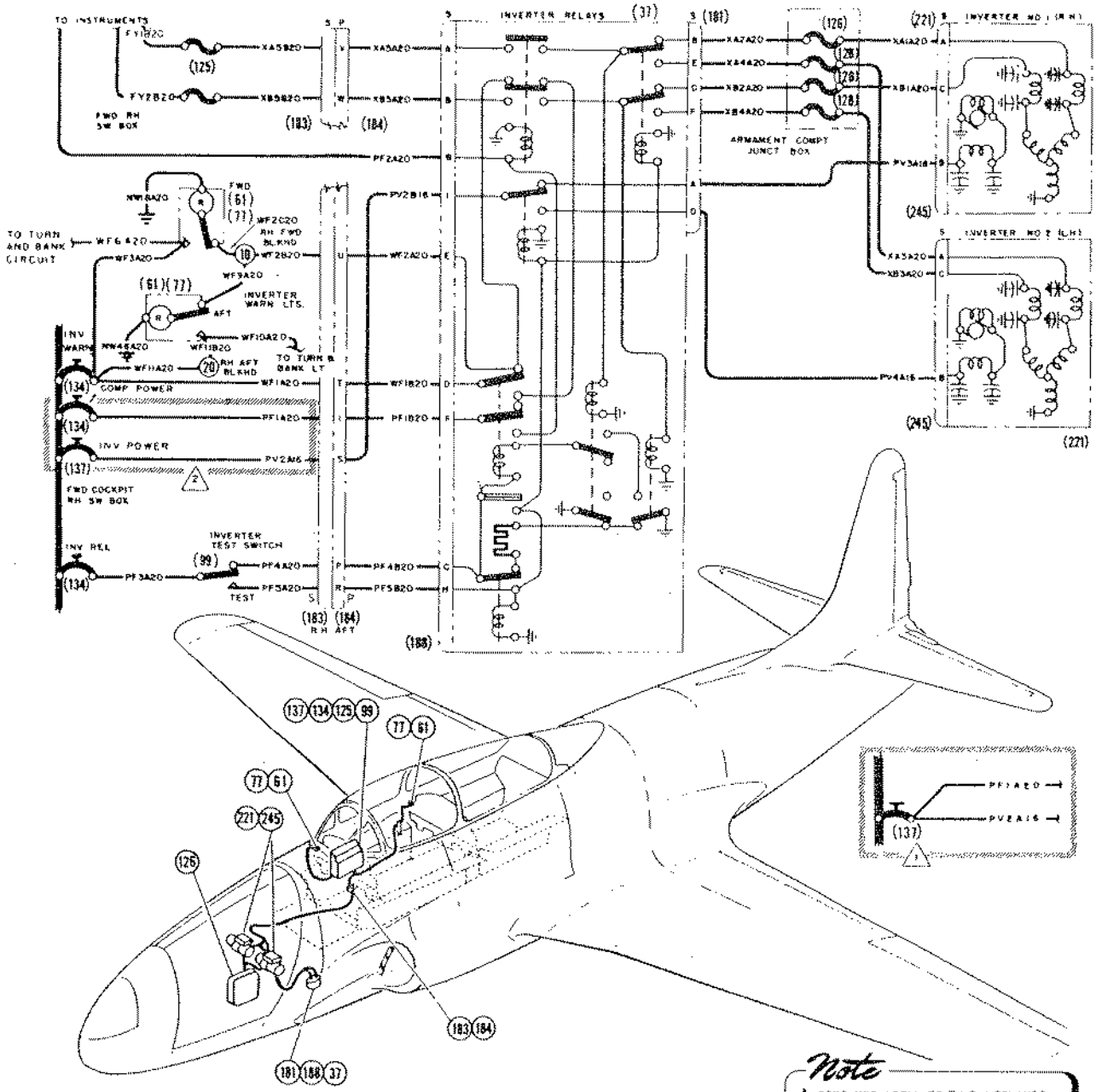
M20-49-8-81

ALIGHTING GEAR WARNING CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 58-671 AND SUBSEQUENT

Figure 8-156A. Alighting Gear Warning Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR.	TYPE	DWG. OR SPEC.
37	RELAY	COOK		650-1899
61	LIGHT		RED	AN3157-2
77	LAMP			AN3521-313
99	SWITCH	C-H		8804
125	FUSE	LITTELFUSE	7 AMP	413002
126	FUSE	LITTELFUSE	3 AMP	413003
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P20
181	CONNECTOR			AN3106-18 9S
183	CONNECTOR			AN3106 28-11S
184	CONNECTOR			AN3102F-28 11P
188	CONNECTOR			AN3106 20-16S
221	INVERTER	GFAE		AN3187-1
245	CONNECTOR			AN3108 14S 7S

Note

★ DOES NOT APPLY TO TV-2 AIRPLANES BUAER SERIAL NO. 126583 AND SUBSEQUENT

△1 USED ON AF SERIAL NO 49-901 AND SUBSEQUENT.

△2 USED ON AF SERIAL NO. 48-356 THROUGH 48-375, 48-913 THROUGH 48-920, AND 49-879 THROUGH 49-900.

△3 USED ON AIRPLANES NOT INCORPORATING TO. 1T-33A-194

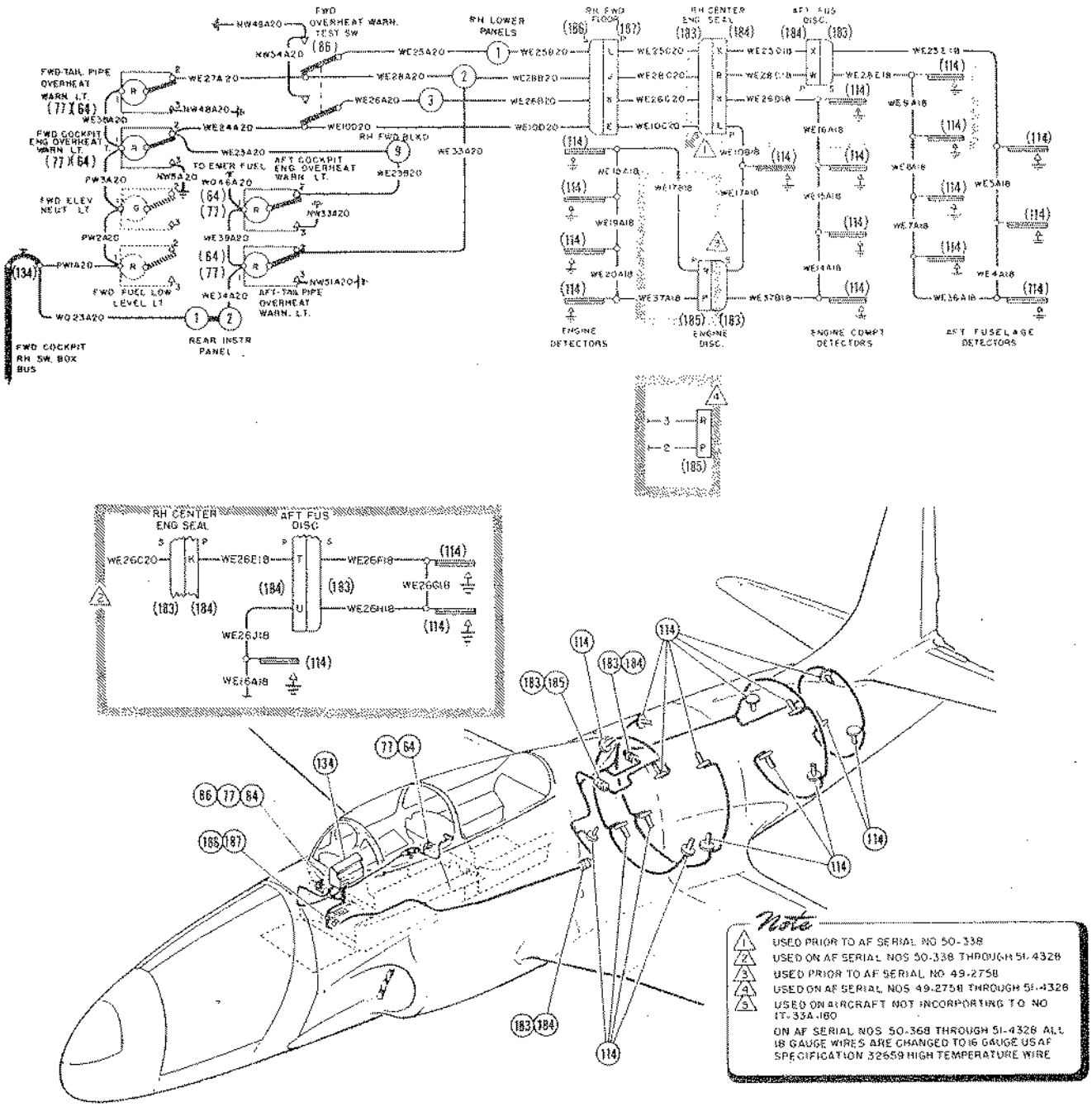
INSTRUMENT INVERTERS CIRCUIT

MODEL T-33A

★ APPLIES TO AF SERIAL NO 48-356 THROUGH 51-4328

HB 8898
EM20-51-8-253

Figure 8-157. Overheat Warning Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
114	SWITCH	FENWAL	450°	17343-6 450
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P

Note

1. USED PRIOR TO AF SERIAL NO 50-338
2. USED ON AF SERIAL NOS 50-338 THROUGH 51-4328
3. USED PRIOR TO AF SERIAL NO 49-2758
4. USED ON AF SERIAL NOS 49-2758 THROUGH 51-4328
5. USED ON AIRCRAFT NOT INCORPORATING T.O. NO 1T-33A-180

ON AF SERIAL NOS 50-368 THROUGH 51-4328 ALL 18 GAUGE WIRES ARE CHANGED TO 16 GAUGE USAF SPECIFICATION 32659 HIGH TEMPERATURE WIRE

5

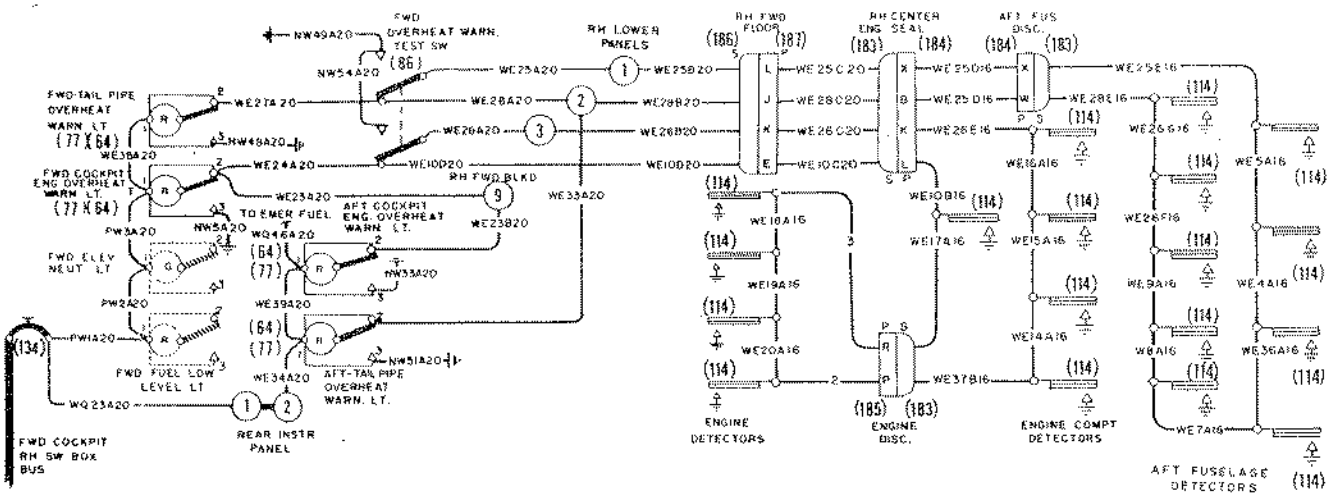
OVERHEAT WARNING CIRCUIT

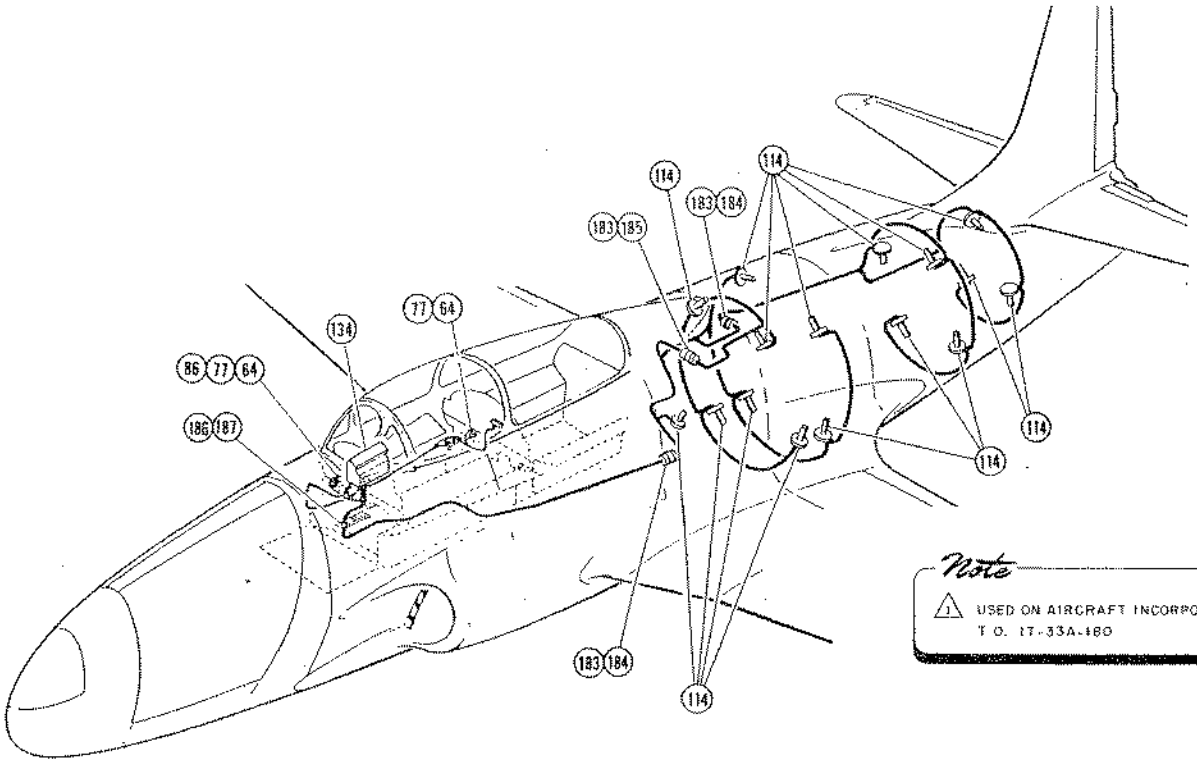
MODEL T-33 A

APPLIES TO AF SERIAL NOS. 49-901 THROUGH 51-4328

EM20-24-8-99
C8 15.52

Figure 8-158. Overheat Warning Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3171-313
86	SWITCH			AN3027-6
114	SWITCH	FENWAL	450°	17343-6-450
134	CIRCUIT PROTECTOR			AN3163-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P

Note

1 USED ON AIRCRAFT INCORPORATING T. O. 1T-33A-180

1

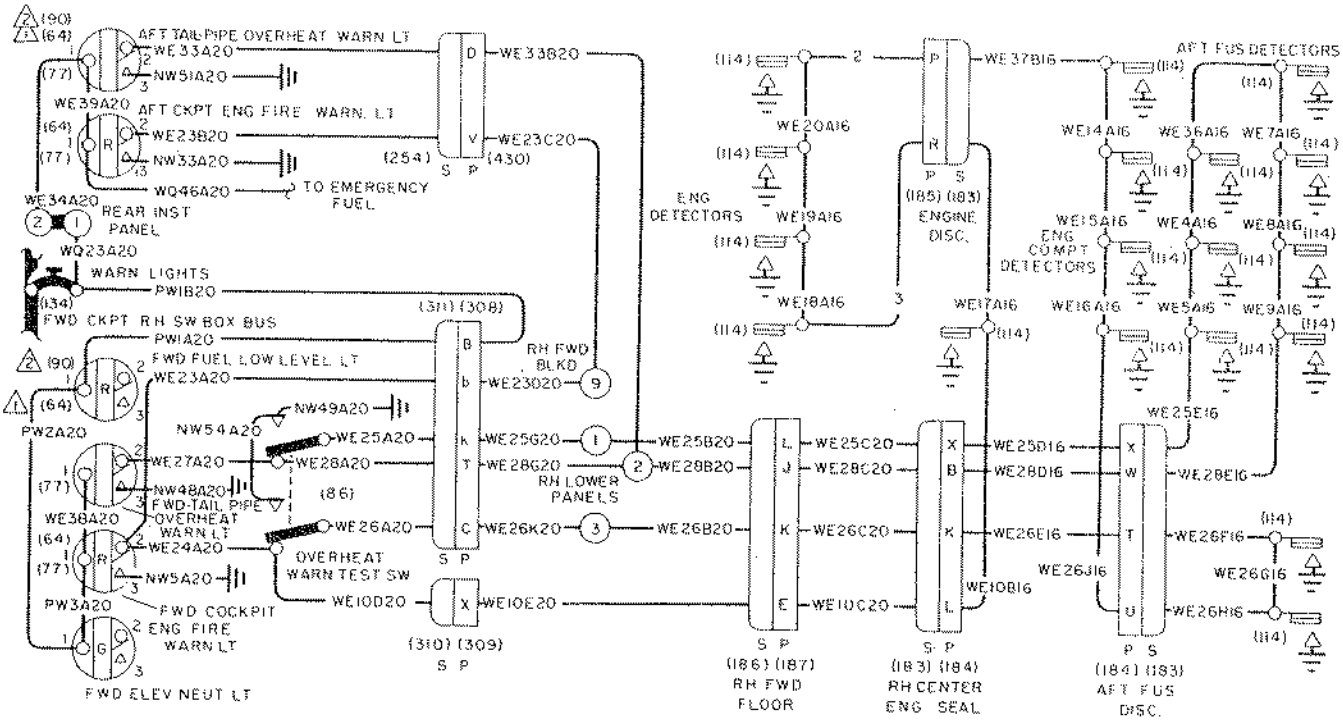
OVERHEAT WARNING CIRCUIT

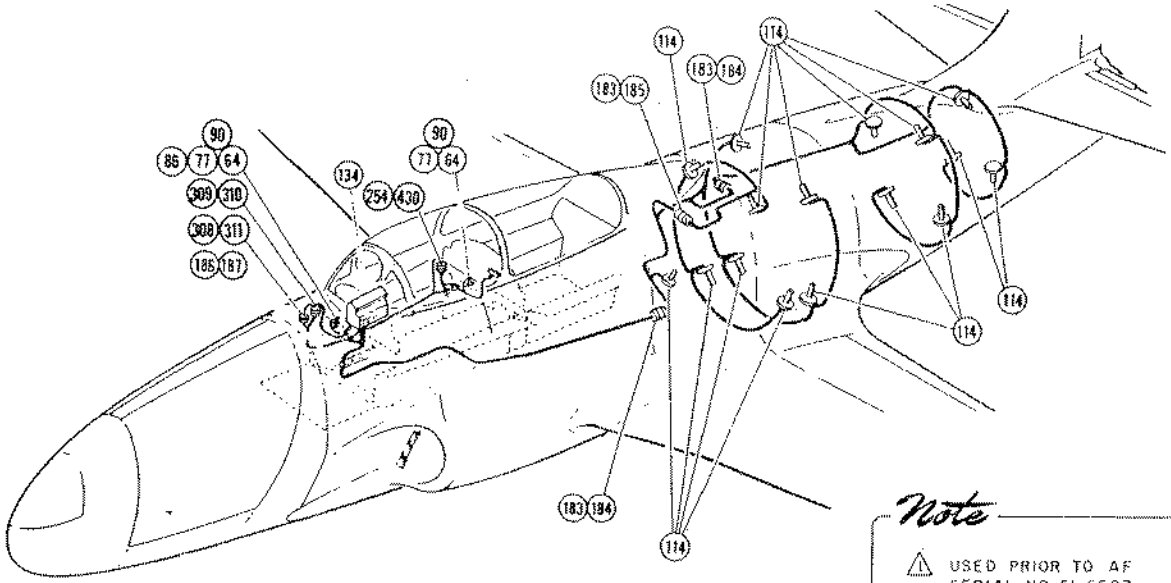
MODEL T33-A

APPLIES TO AF SERIAL NOS 50-338 THROUGH 51-4328

EM-20-780-8-246
CB 8372

Figure 8-159. Overheat Warning Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
90	LIGHT			AN3157-8
114	SWITCH	FENWAL		17343-6-450
134	CIRCUIT PROTECTOR			AN3161-25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102R-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102-28-12P
254	CONNECTOR			AN3108-28-12S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P

Note

1. USED PRIOR TO AF SERIAL NO. 51-6587
2. USED ON AF SERIAL NOS. 51-6587 AND SUBSEQUENT
3. USED ON AIRCRAFT NOT INCORPORATING TO NO. 1T-33A-180

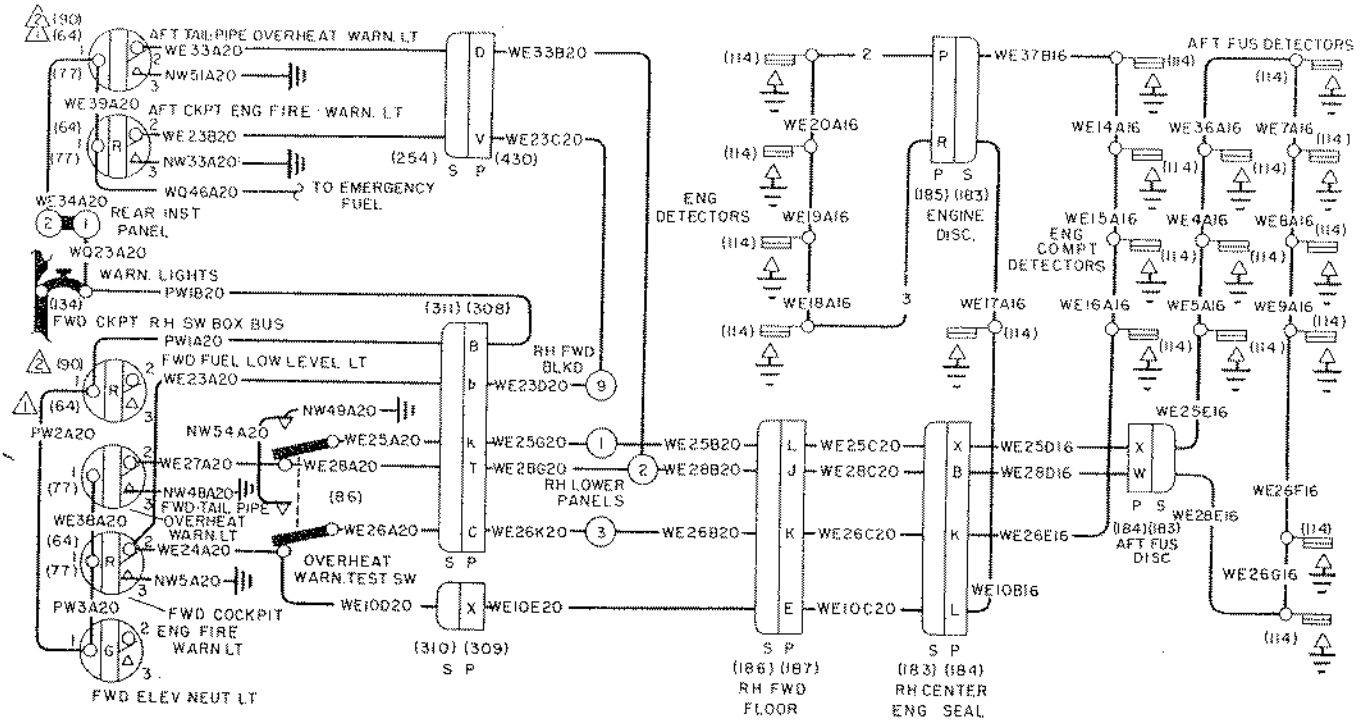
OVERHEAT WARNING CIRCUIT

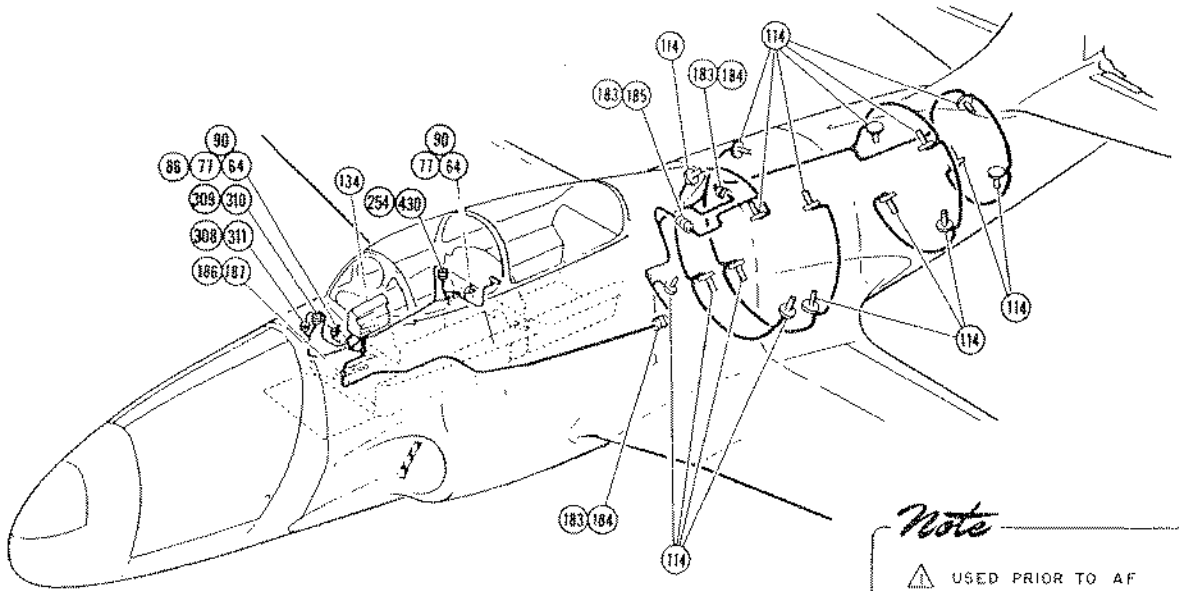
MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-4329 THRU 51-6818

EM20-24-8-100

Figure 8-160. Overheat Warning Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT	FENWAL	RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
90	LIGHT			AN3157-8
311	SWITCH			17343-6-450
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102-28-12P
254	CONNECTOR			AN3108-28-22S
308	CONNECTOR			AN3102-28-22P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S
430	CONNECTOR			AN3102-28-12P

EM20-24-8-247
CB 4849

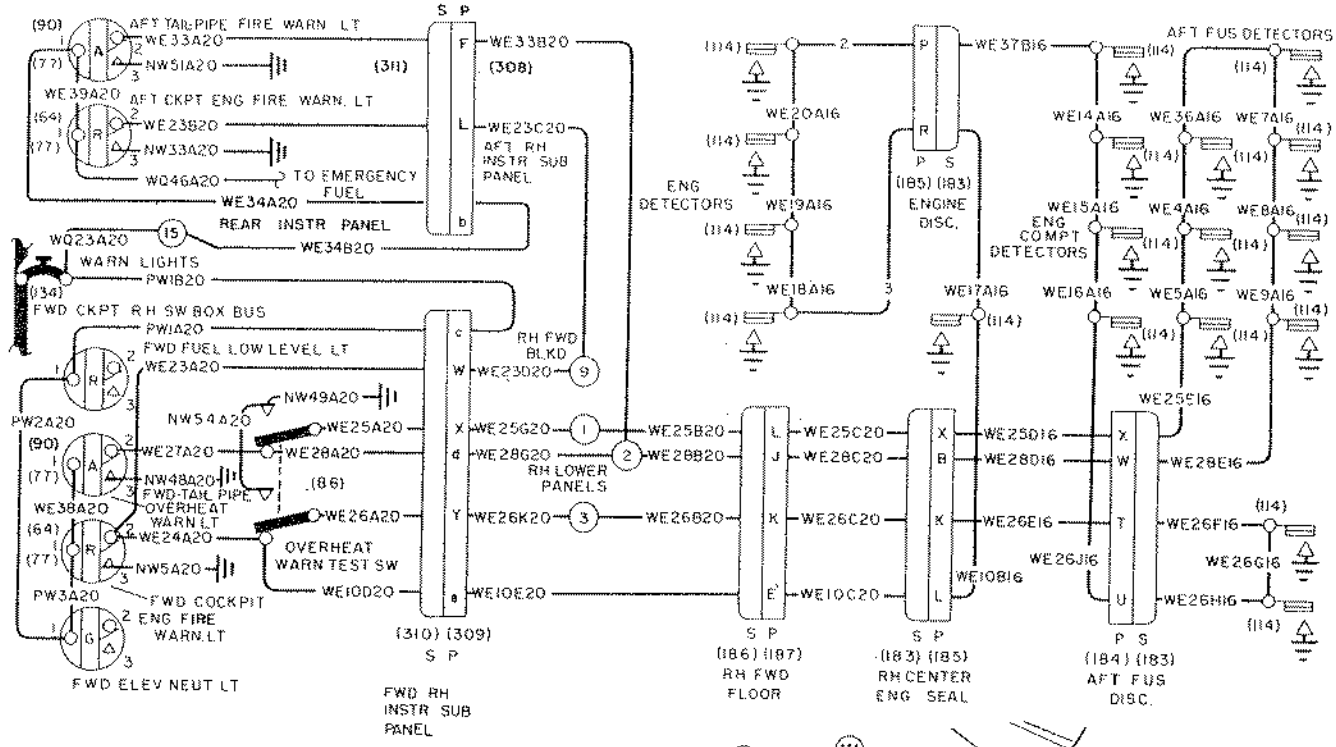
Note

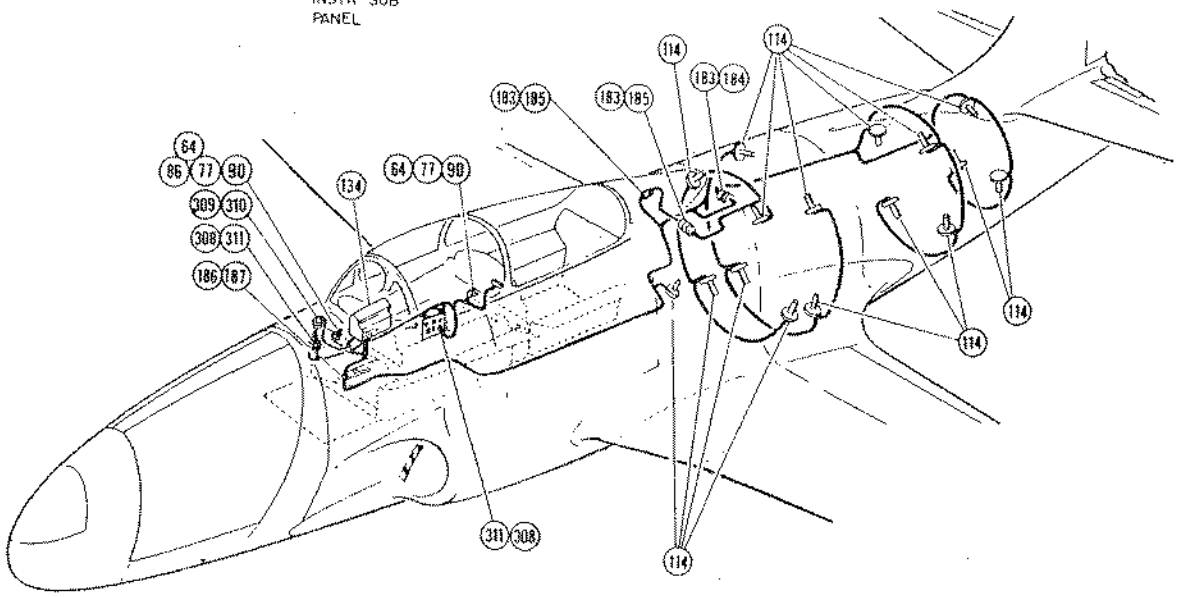
1. USED PRIOR TO AF SERIAL NO. 51-6587
2. USED ON AF SERIAL NOS. 51-6587 AND SUBSEQUENT
3. USED ON AIRCRAFT INCORPORATING T.O. NO 1T-33A-180

3

OVERHEAT WARNING CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-4329 THRU 51-6818

Figure 8-161. Overheat Warning Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
90	LIGHT		AMBER	AN3157-8
114	SWITCH	RENWAL	450	17543-6-450
134	CIRCUIT PROTECTOR			AN3161-75
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S

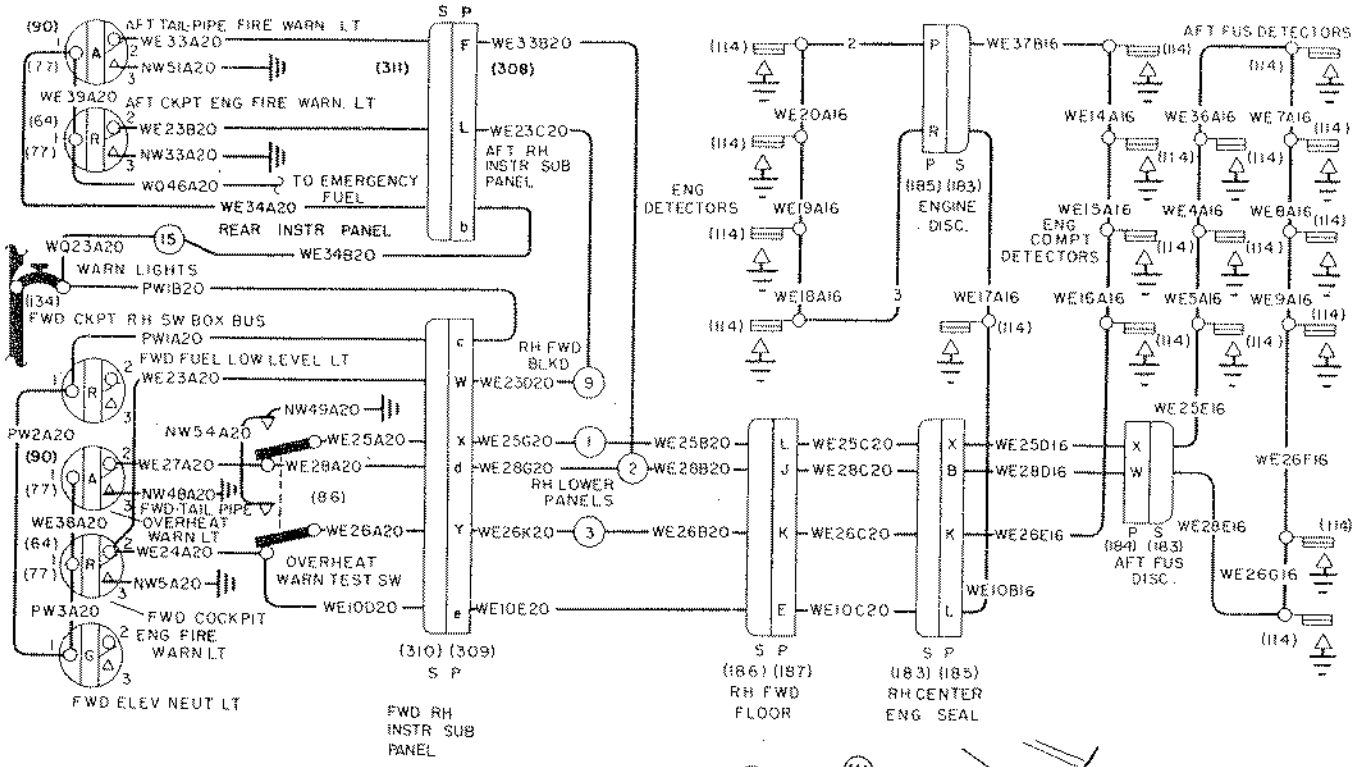
Note

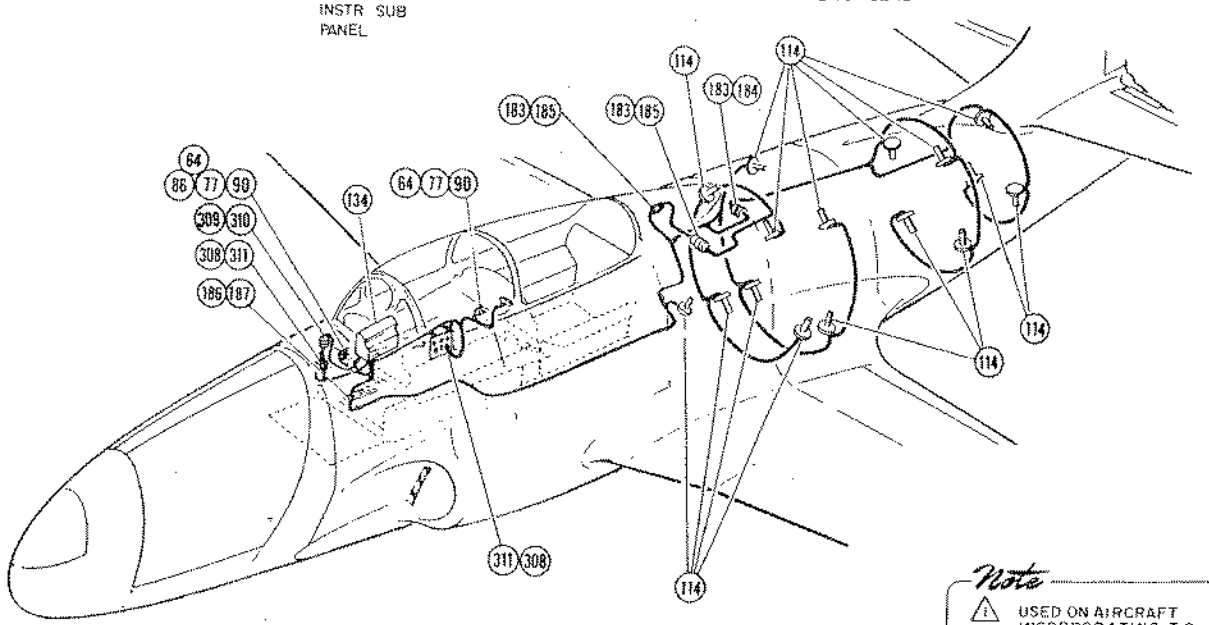
1 USED ON AIRCRAFT NOT INCORPORATING T.O. NO. 1T-33A-180

1 OVERHEAT WARNING CIRCUIT
MODEL T-33A
APLIES TO AF SERIAL NOS. 51-6819 THROUGH 51-9035

EM20-24-8-101
CB 4N53

Figure 8-162. Overheat Warning Circuit





Note

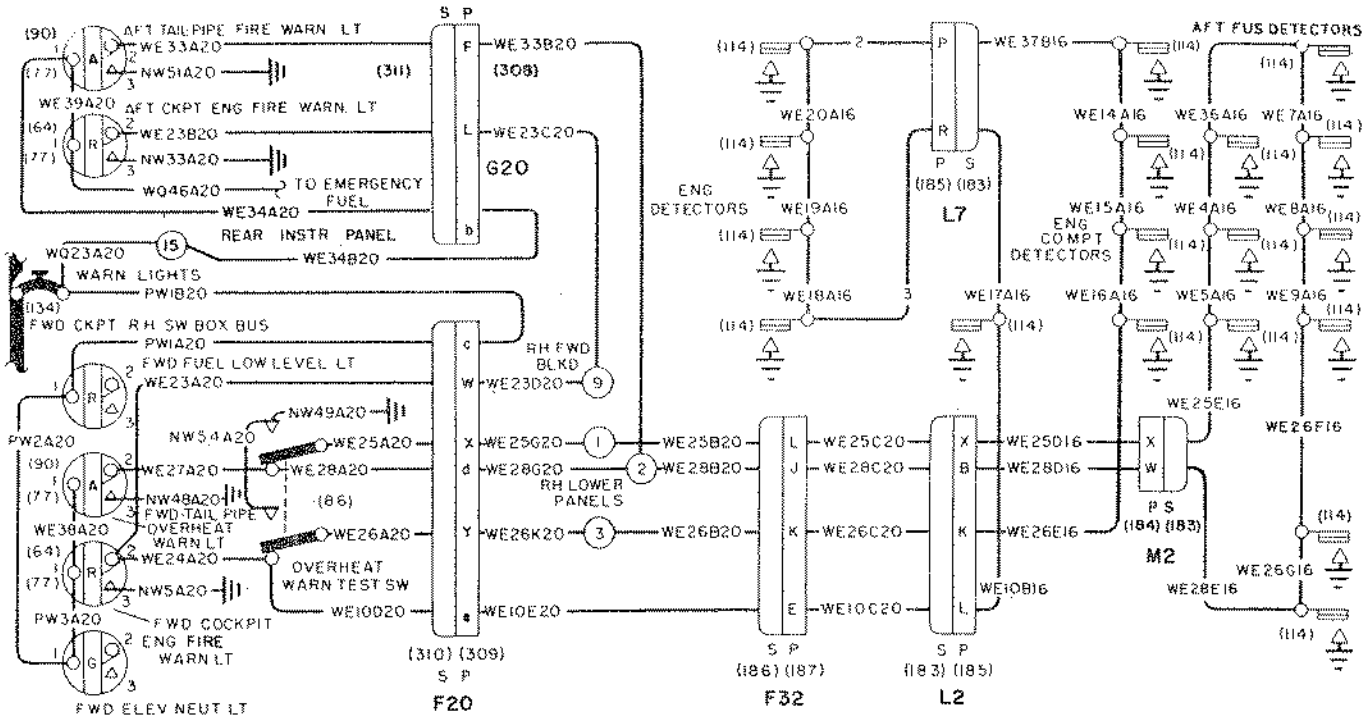
1 USED ON AIRCRAFT INCORPORATING T.O. NO 1T-33A-180

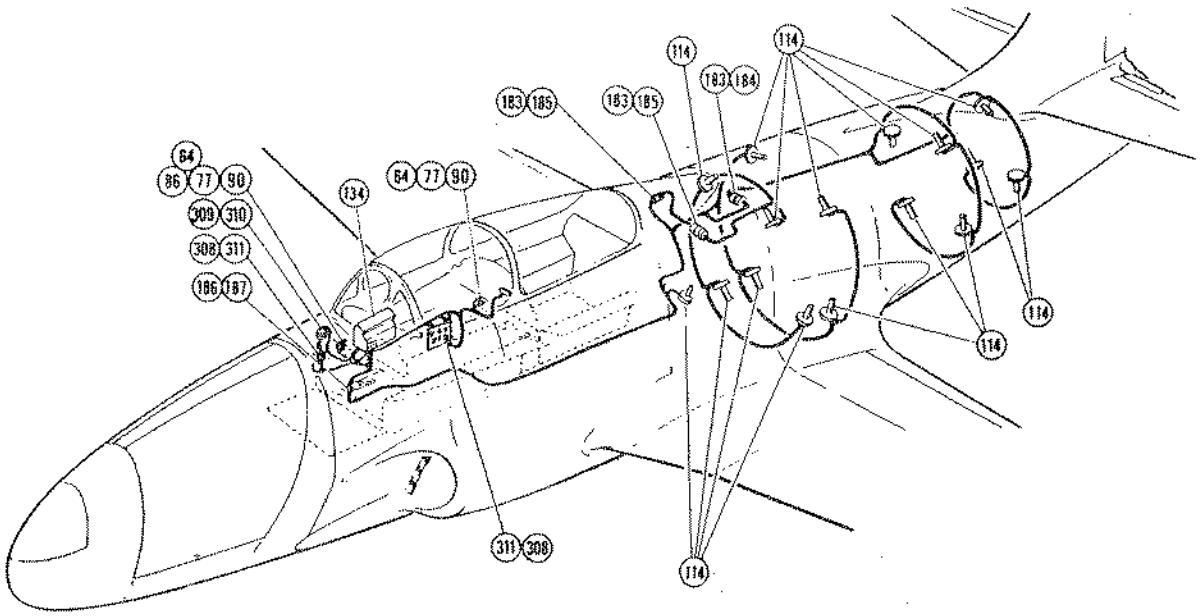
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3123-513
86	SWITCH			AN3027-6
90	LIGHT		AMBER	AN3157-8
114	SWITCH	FENWAL	450	17343-6-450
134	CIRCUIT PROTECTOR			AN3761-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3107-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3107-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S

EM20-24-8-240
CB 4N48

1 OVERHEAT WARNING CIRCUIT
MODEL T-33A
APLIES TO AF SERIAL NOS. 51-6819 THROUGH 51-9035

Figure 8-163. Overheat Warning Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
90	LIGHT		AMBER	AN3157-6
114	SWITCH	FENWAL	450°	17343-6-450
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3107-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3107-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S

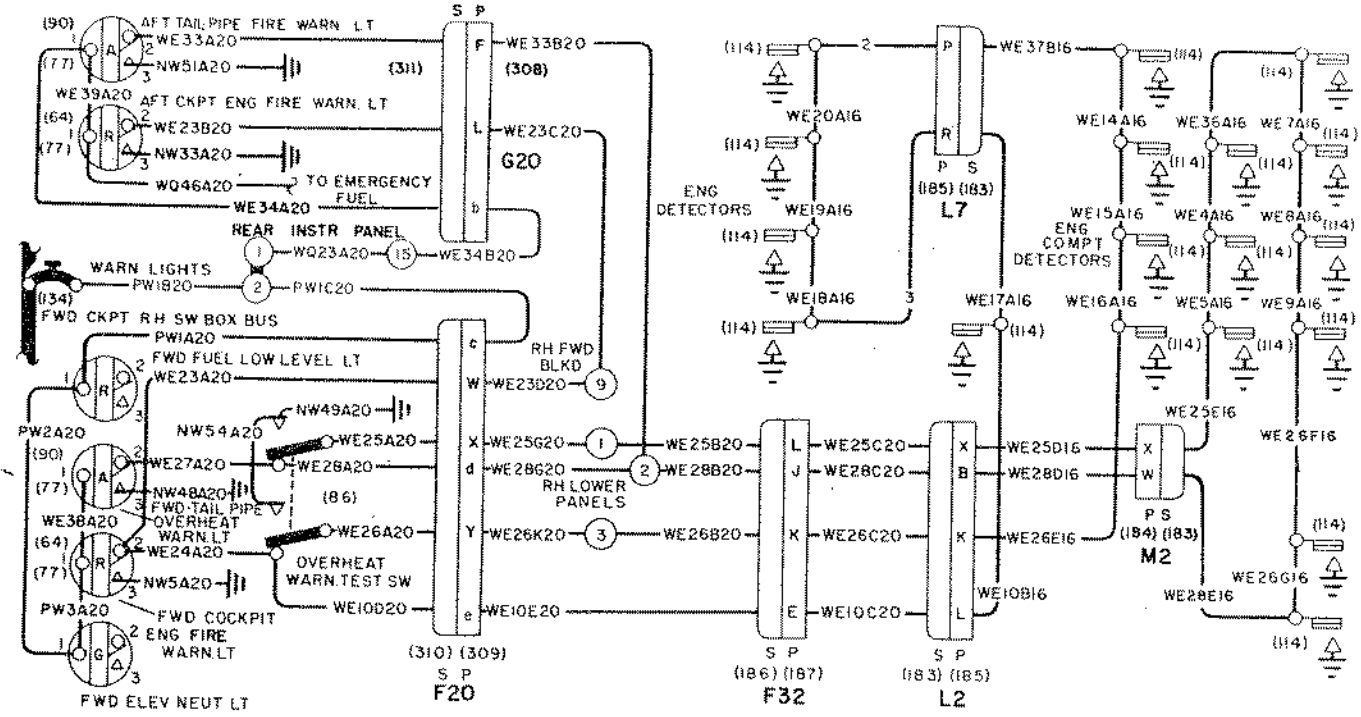
CB 33A16
EM-20-23-8-169

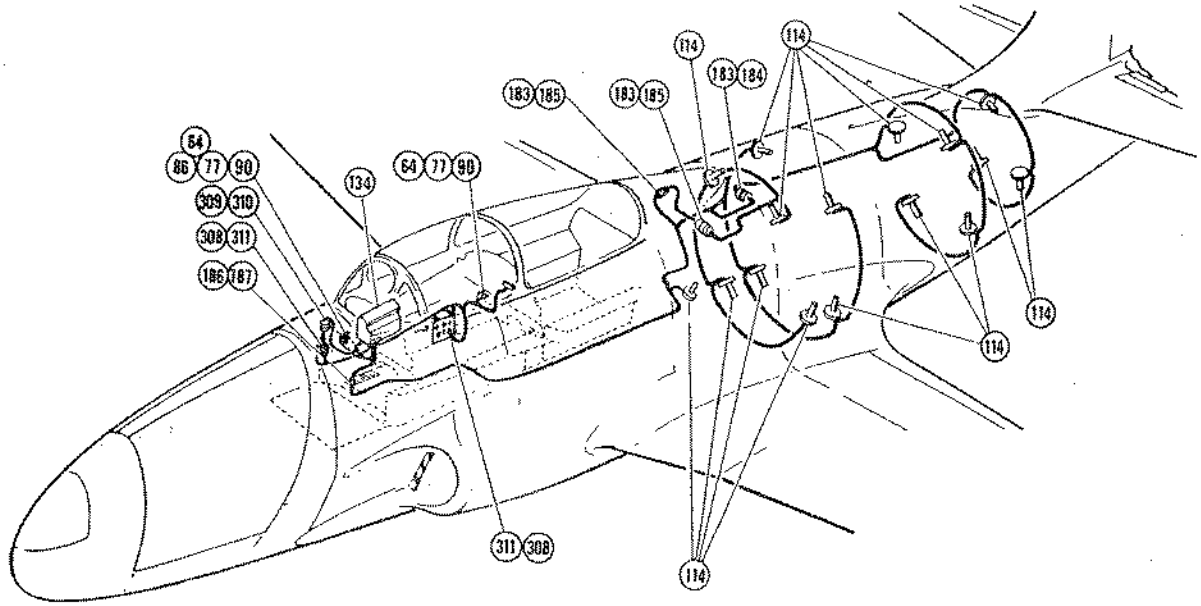
OVERHEAT WARNING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS 51-9036 THROUGH 52-9759; 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-164. Overheat Warning Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT	FENWAL	RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
90	LIGHT		AMBER 450°	AN3157-8
114	SWITCH			17343-6-450
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3182-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106-28-15S

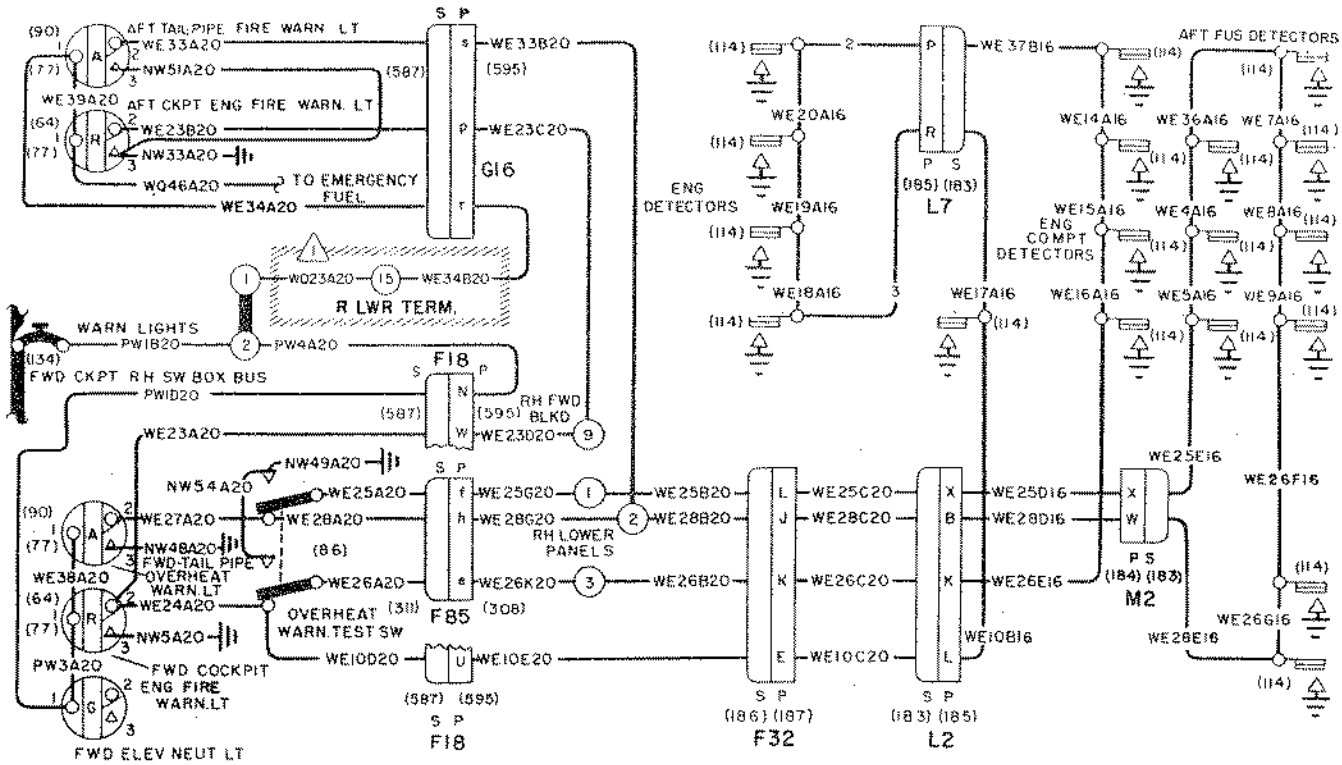
GB 8832
M20-48D-8-727

OVERHEAT WARNING CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 52-9760 AND SUBSEQUENT, EXCEPT 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-165. Overheat Warning Circuit



NOTE

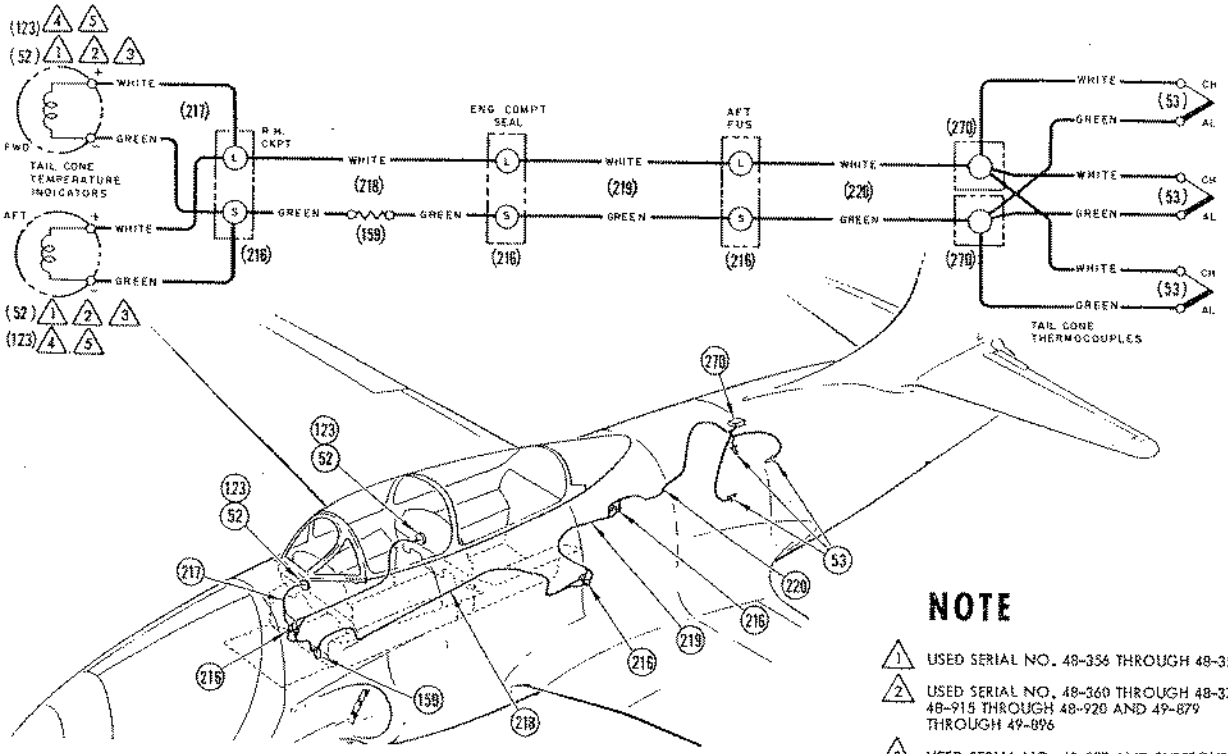
1. USED PRIOR TO AF SERIAL NO. 58-671
2. USED ON AF SERIAL NO. 58-671 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
86	SWITCH			AN3027-6
90	LIGHT		AMBER	AN3157-8
114	SWITCH	FENWAL	450°	17143-6-450
134	CIRCUIT PROTECTOR			AN3161-P3
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

OVERHEAT WARNING CIRCUIT
MODEL T-33A-5

HB 67
AN20-49-8-407

Figure 8-166. Overheat Warning Circuit



ITEM		DESCRIPTION	MFG	TYPE	DWG OR SPEC
1	52	TAIL CONE TEMP IND	GFAE	K-3	21199-A
2	52	TAIL CONE TEMP IND	GFAE	A-6	21073
3	52	TAIL CONE TEMP IND	GFAE	K-7	27332
	53	TAIL CONE THERMOCOUPLE	G.E.		L-894027OG-2
4	123	TAIL CONE TEMP IND	GFAE	K-8	MIL-I-25026
5	123	TAIL CONE TEMP IND	GFAE	MJ-4	MIL-I-25026
	159	RESISTOR			AN5534-1
	216	BULKHEAD	G.E.		4159691-P1
	217	THERMOCOUPLE LEAD	LOCKHEED		204802-2
	218	THERMOCOUPLE LEAD	LOCKHEED		204802-3
	219	THERMOCOUPLE LEAD	LOCKHEED		204802-4
	220	THERMOCOUPLE LEAD	LOCKHEED		204802-5
	270	TERMINAL PANEL	BUCHANAN		8C301CA

NOTE

1. USED SERIAL NO. 48-356 THROUGH 48-359
2. USED SERIAL NO. 48-360 THROUGH 48-375, 48-915 THROUGH 48-920 AND 49-879 THROUGH 49-896
3. USED SERIAL NO. 49-897 AND SUBSEQUENT
4. ALTERNATE ON AF SERIAL NO. 52-9635 THROUGH 53-2780. USED ON AF SERIAL NO. 53-4886 THROUGH 55-4962
5. ALTERNATE ON AF SERIAL NO. 53-5919 THROUGH 55-4962. USED ON AF SERIAL NO. 56-1648 AND SUBSEQUENT

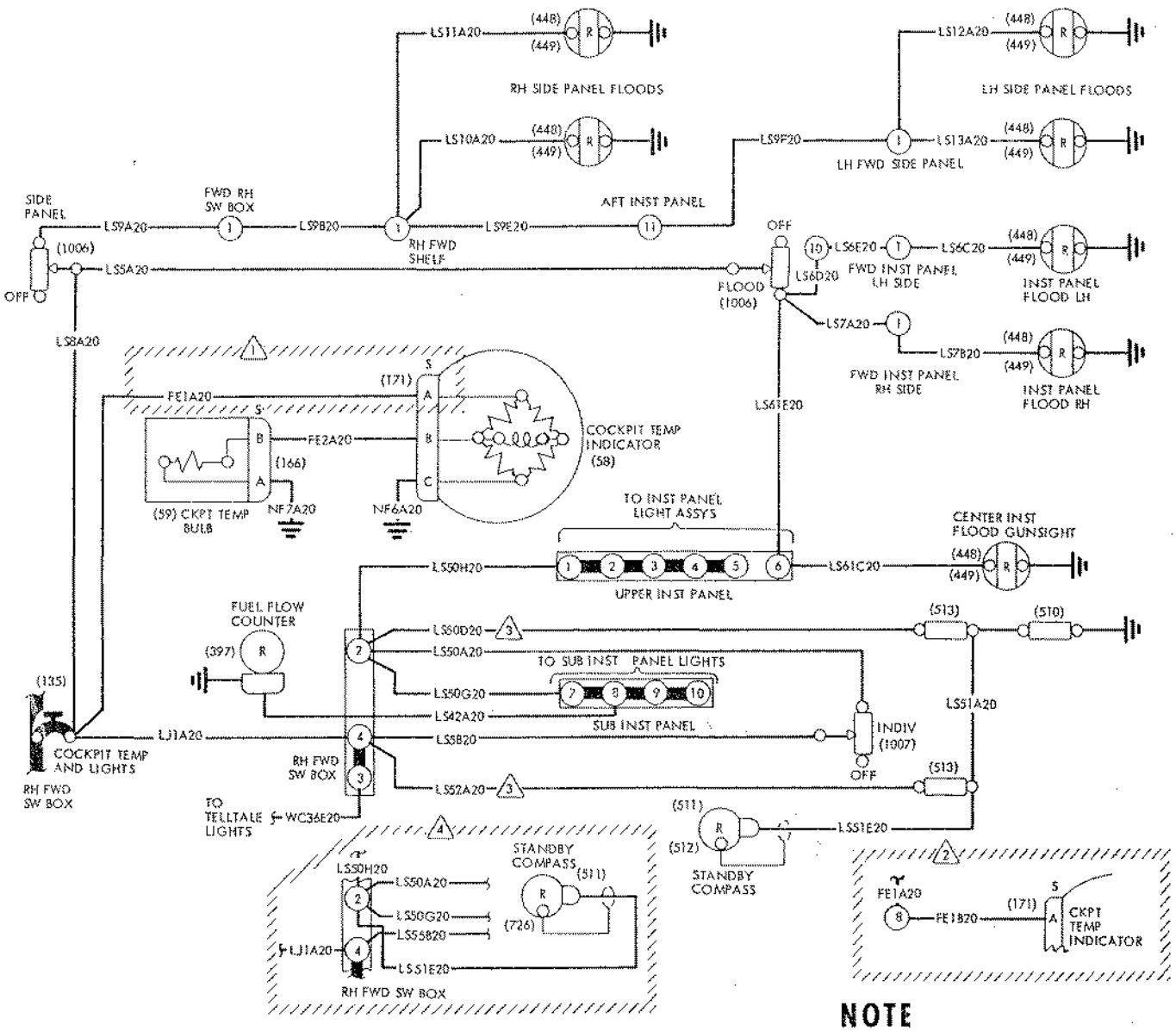
GB 8772

M20-48D-102

TAIL CONE TEMPERATURE CIRCUIT

MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 AND SUBSEQUENT

Figure 8-167. Tail Cone Temperature Circuit



NOTE

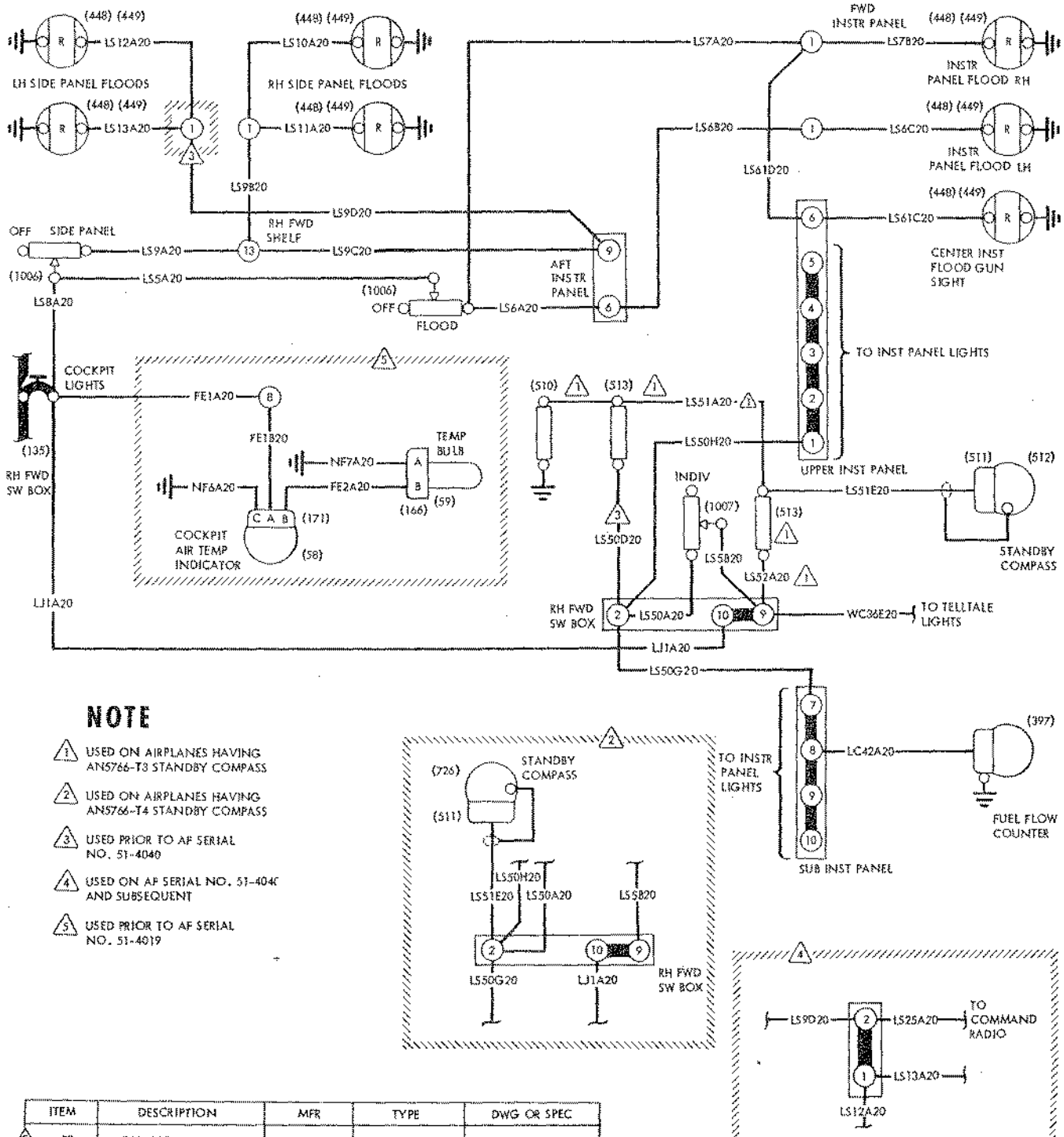
1. USED PRIOR TO SERIAL 49-901
2. USED SERIAL 49-901 AND SUBSEQUENT
3. USED PRIOR ON AIRPLANES HAVING AN5766-T3 STANDBY COMPASS
4. USED ON AIRPLANES HAVING AN5766-T4 STANDBY COMPASS
5. USED ON AIRPLANES AF SERIAL NO. 50-368 AND SUBSEQUENT
6. USED ON AIRPLANES PRIOR TO AF SERIAL NO. 50-368

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
5 6 58	COCKPIT TEMP INDIC	GFAE		AN5790-T7
6 58	COCKPIT TEMP INDIC	GFAE		AN5790-6
59	COCKPIT TEMP BULB	GFAE		AN5525-1
135	CIRCUIT PROTECTOR			AN3161-P10
166	CONNECTOR			MS3106B-12S-3S
171	CONNECTOR			MS3106B-14S-2S
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200Ω 25W	0200H
726	LAMP			AN3140-327
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

GB 4440
M20-45-8-441

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 50-401

Figure 8-168. Forward Cockpit Lights Circuit



NOTE

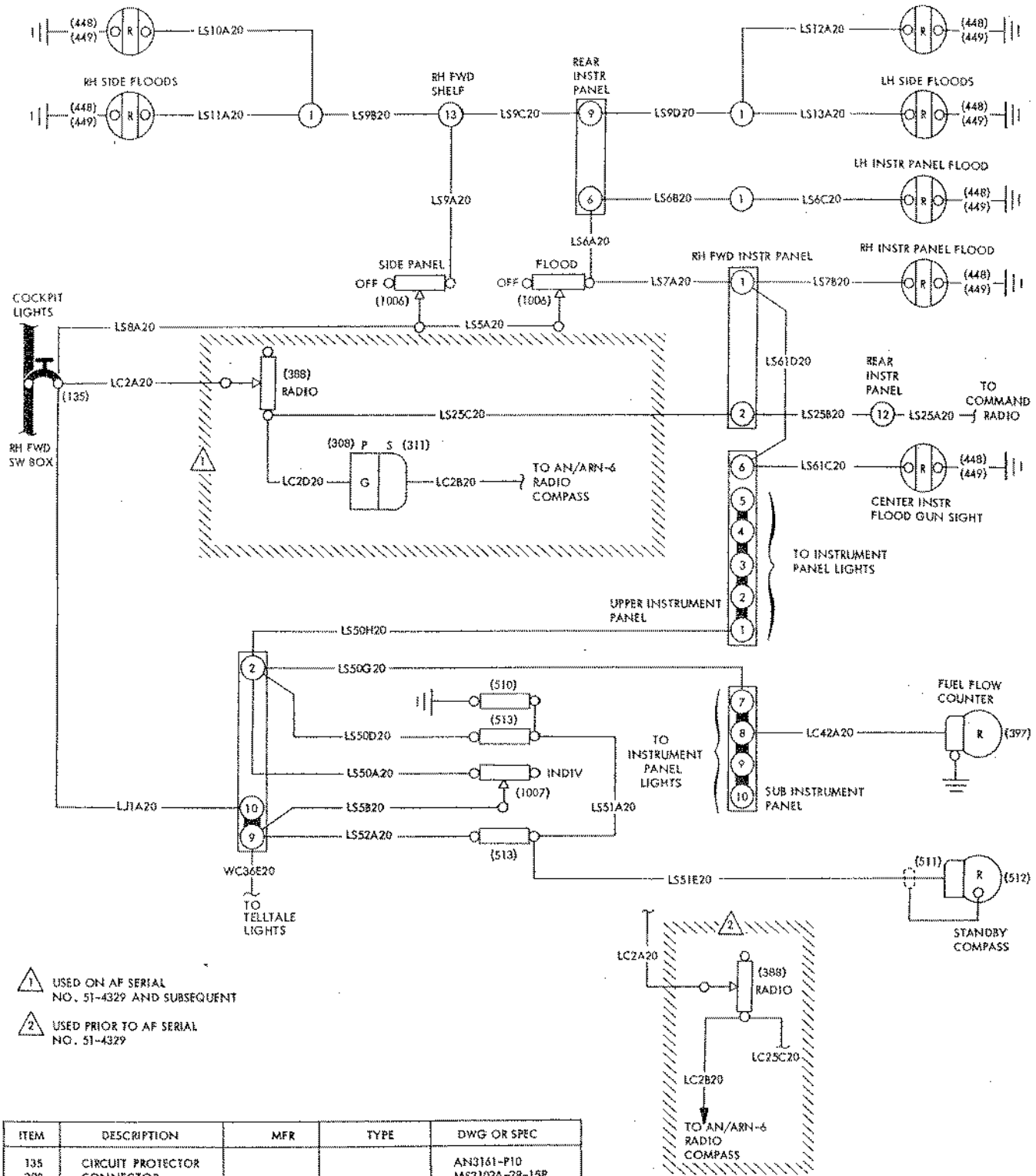
1. USED ON AIRPLANES HAVING AN5766-T3 STANDBY COMPASS
2. USED ON AIRPLANES HAVING AN5766-T4 STANDBY COMPASS
3. USED PRIOR TO AF SERIAL NO. 51-4040
4. USED ON AF SERIAL NO. 51-4040 AND SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 51-4019

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
5 58	INDICATOR	GFAE		AN5790-T6A
5 59	BULB	GFAE		AN5525-1
135	CIRCUIT PROTECTOR			AN3161-P10
166	CONNECTOR			MS3106B-12S-3S
171	CONNECTOR			MS3106B-14S-2S
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
4 510	RESISTOR		47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
4 512	LAMP			AN3136-R323
4 513	RESISTOR	OHMITE	200 Ω 25W	0200H
726	LAMP			AN3140-327
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

GB 8782
M20-48D-8-443

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 50-492 THROUGH 51-4048

Figure 8-169. Forward Cockpit Lights Circuit

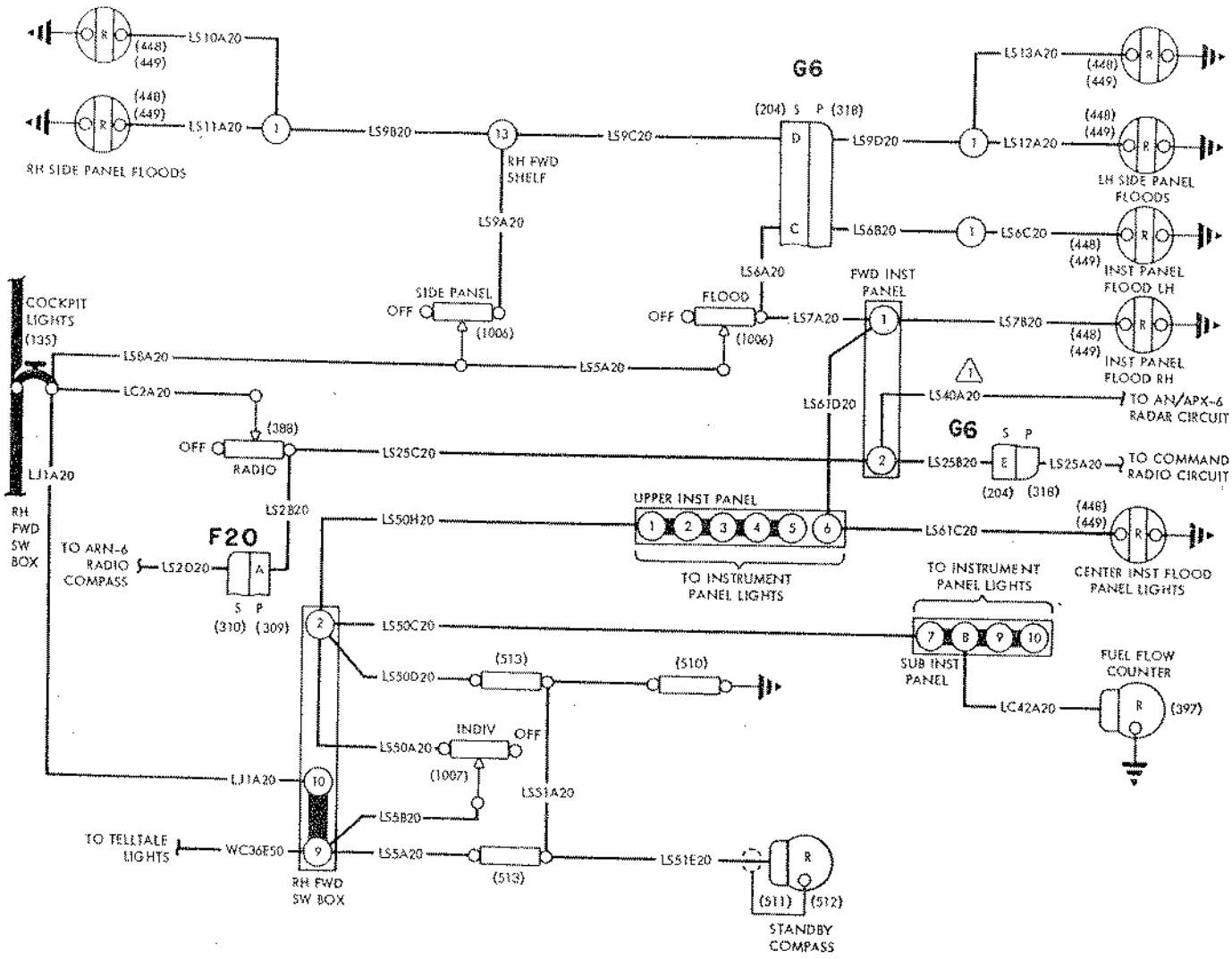


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
308	CONNECTOR			MS3102A-28-15P
311	CONNECTOR			MS3106B-28-15S
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

GB 8783
M20-480-8-445

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4049 THRU 51-6818

Figure 8-170. Forward Cockpit Lights Circuit



NOTE

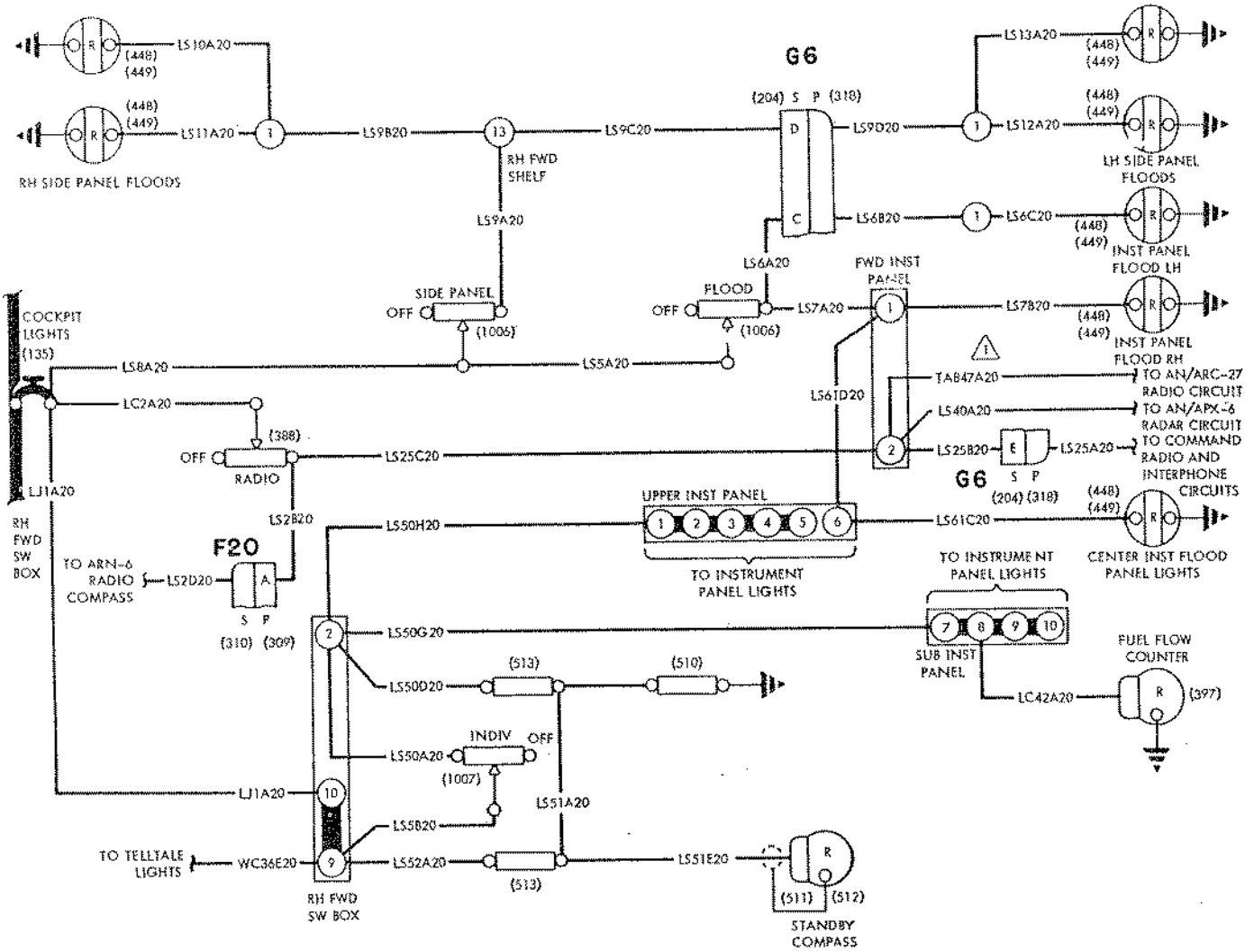
1 USED ON AF SERIAL NO. 51-8636 AND SUBSEQUENT

ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			MS3102A-20-29S
309	CONNECTOR			MS3102A-32-7P
310	CONNECTOR			MS3106B-32-7S
318	CONNECTOR			MS3106B-20-29P
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP			AN3123-301
449	LIGHT			32639
510	RESISTOR		RED A-11 47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

GB 8769
M20-48D-8-447

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9235

Figure 8-171. Forward Cockpit Lights Circuit



NOTE

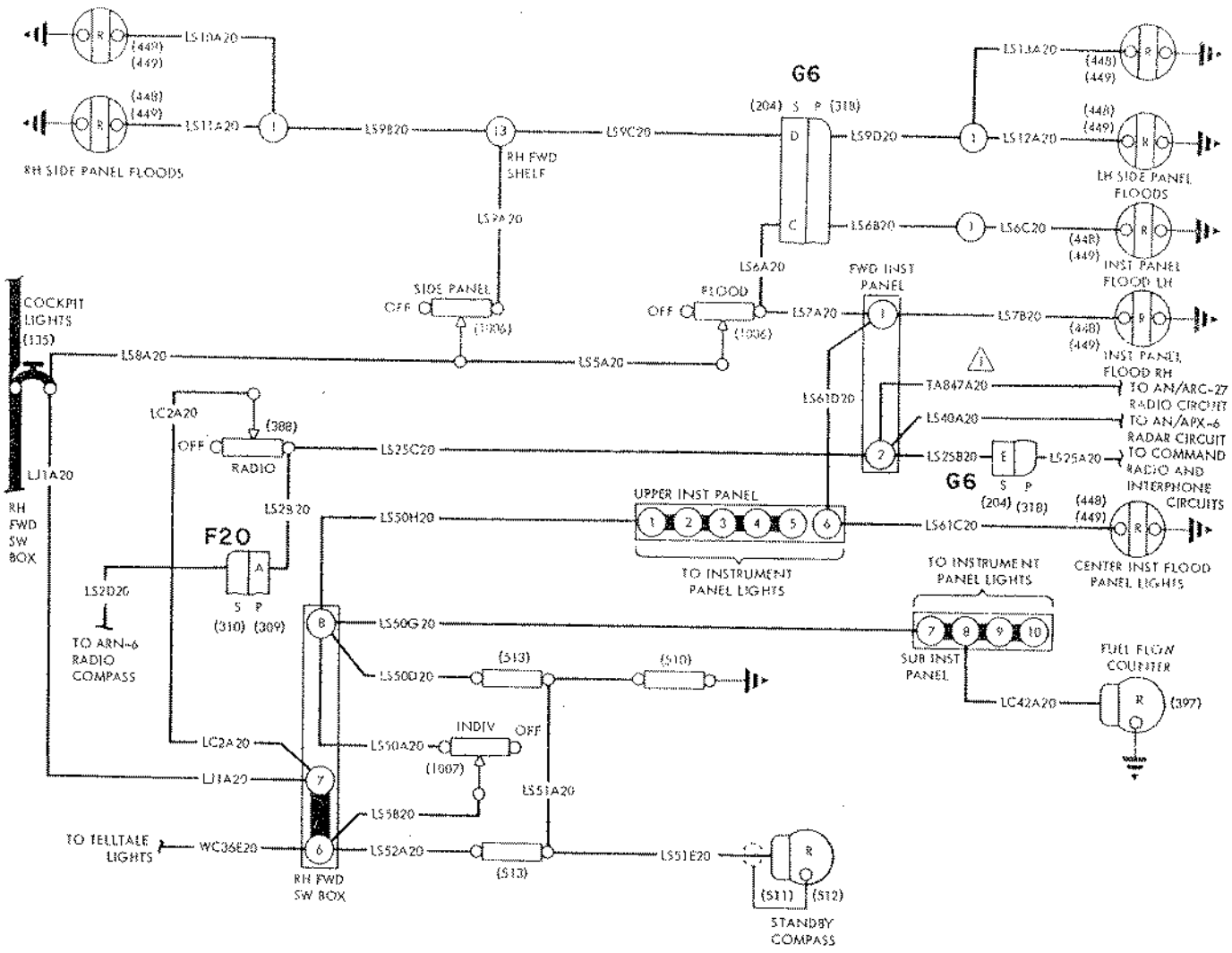
1 USED ON USAF T-33A AIRPLANES ONLY

ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			MS3102A-20-29S
309	CONNECTOR			MS3102A-32-7P
310	CONNECTOR			MS3106B-32-7S
318	CONNECTOR			MS3106B-20-29P
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-3ST
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-381
449	LIGHT		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
1006	RHEOSTAT			H75F2-3S2
1007	RHEOSTAT			J22F2-3S2

GB 8770
MZO-48D-8-450

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-9236 THROUGH 52-9759 AND 52-9876 THROUGH 52-9940

Figure 8-172. Forward Cockpit Lights Circuit



NOTE

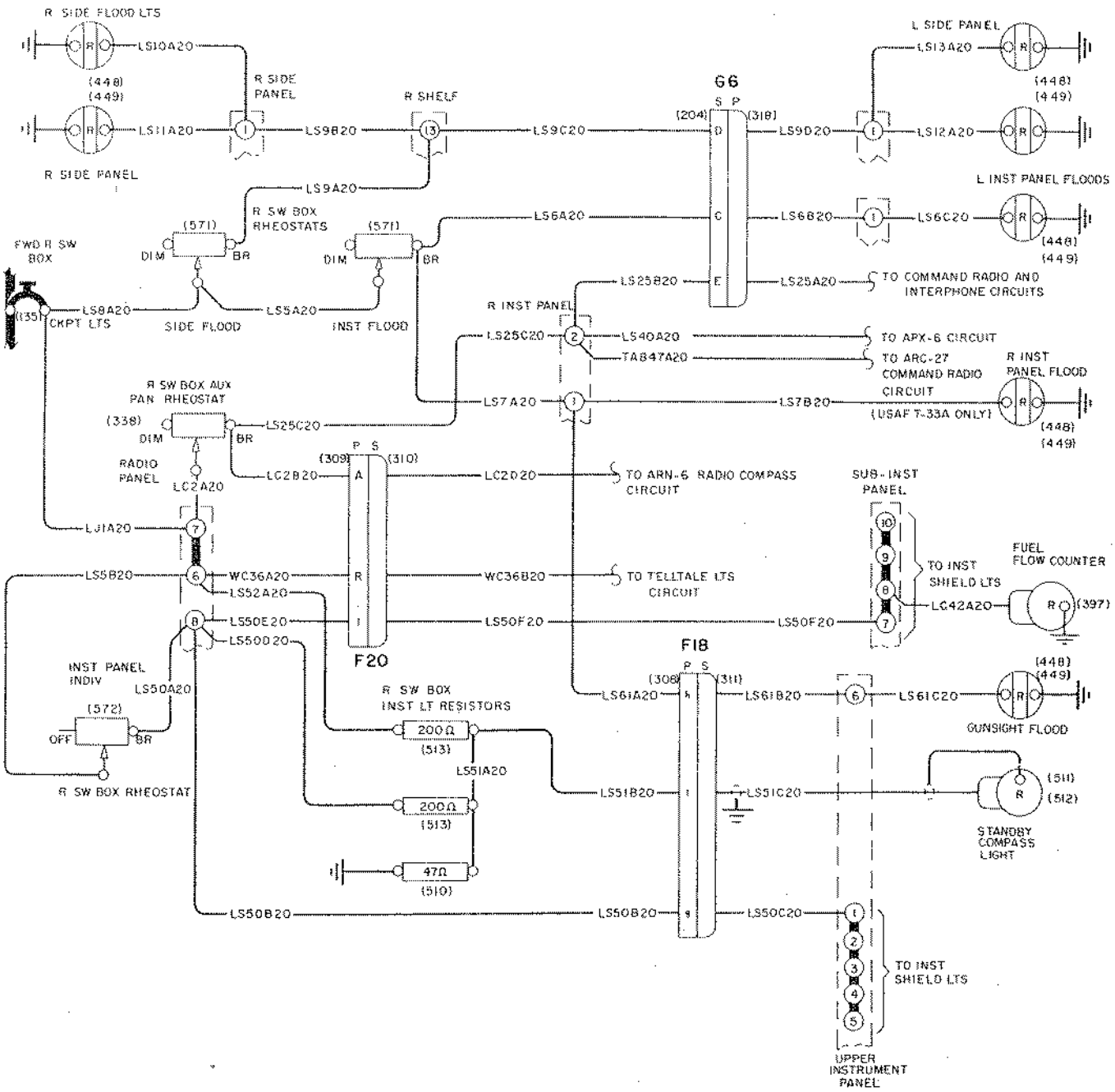
1 USED ON USAF T-33A AIRPLANES ONLY

ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P30
204	CONNECTOR			MS3102A-20-29S
309	CONNECTOR			MS3102A-32-7P
310	CONNECTOR			MS3106B-32-7S
318	CONNECTOR			MS3106B-20-29P
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
1006	RHEOSTAT			M75F2-352
1007	RHEOSTAT			J22F2-352

GB 8771
M20-48D-8-453

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9760 THROUGH 53-5085, EXCEPT 52-9876 THROUGH 52-9940

Figure 8-173. Forward Cockpit Lights Circuit

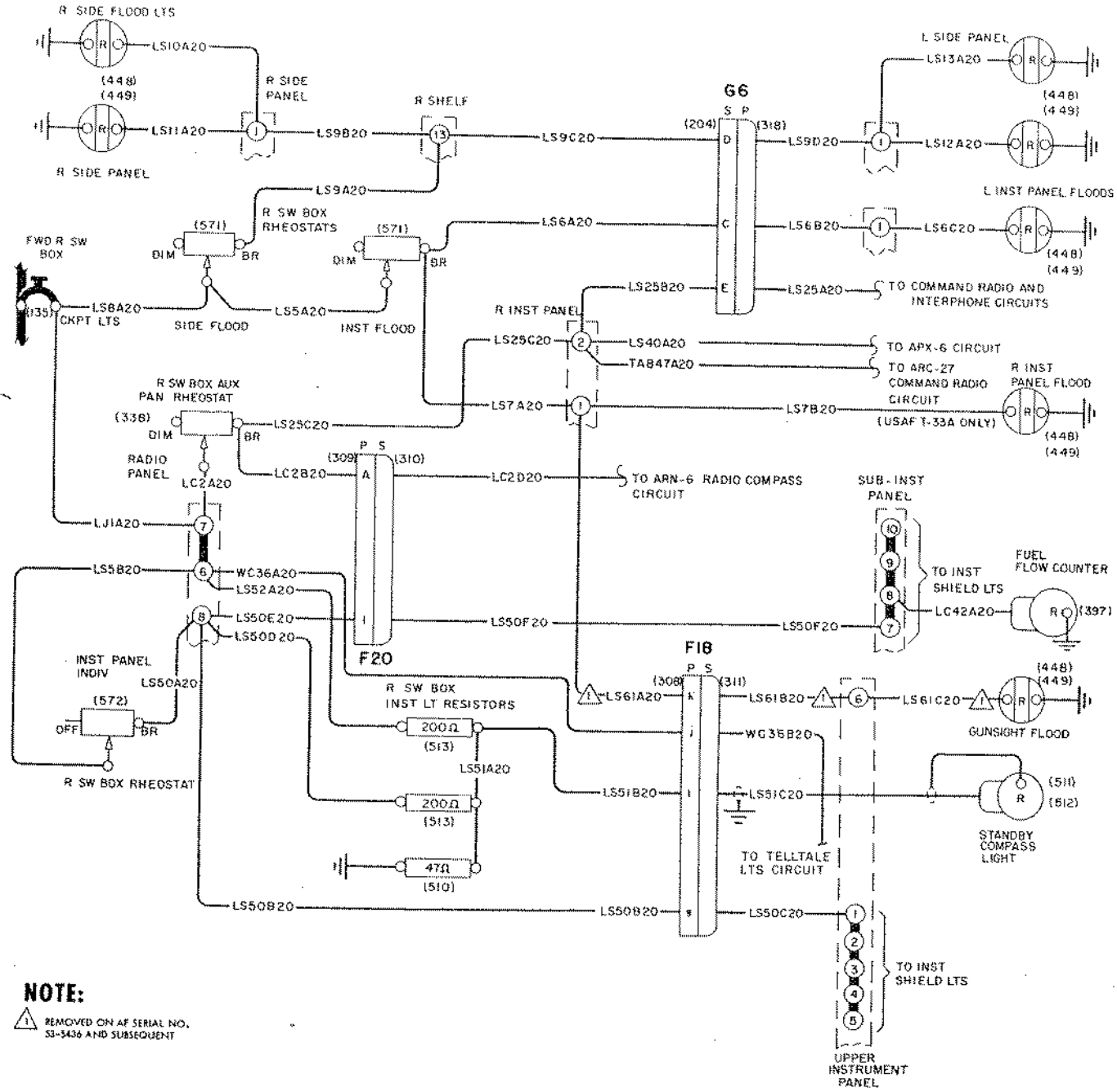


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
335	CIRCUIT PROTECTOR			AN3161-P10
304	CONNECTOR			AN3102A-20-29S
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
318	CONNECTOR			AN3106B-20-29P
338	RHEOSTAT	OHMITE	100Ω25W	0151H
397	LIGHT ASSEMBLY			AN5034-3
448	LAMP		RED	AN3120-301
449	LIGHT ASSEMBLY		A-11	37639
510	RESISTOR		47Ω1W	RC30BF470K
511	CONNECTOR			AN3116-1
512	LAMP		RED	AN3136-R-323
513	RESISTOR	OHMITE	200Ω75W	0200H
571	RHEOSTAT	OHMITE	75Ω25W	0150H
572	RHEOSTAT	OHMITE	22Ω50W	0316J

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5086 THROUGH 53-5285

GB 8831
M20-48D-8-272

Figure 8-174. Forward Cockpit Lights Circuit



NOTE:

1. REMOVED ON AF SERIAL NO. 53-3436 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			AN3102A-20-29S
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
318	CONNECTOR			AN3106B-20-29P
336	RHEOSTAT	OHMITE	100Ω25W	0151H
397	LIGHT ASSEMBLY			AN6034-3
448	LAMP		RED	AN3123-309
449	LIGHT ASSEMBLY		A-11	32639
510	RESISTOR		47Ω1W	RC30BF470K
511	CONNECTOR			AN3116-1
512	LAMP		RED	AN3136-R-323
513	RESISTOR	OHMITE	200Ω25W	0200H
571	RHEOSTAT	OHMITE	75Ω25W	0150H
572	RHEOSTAT	OHMITE	22Ω50W	0316J

FORWARD COCKPIT LIGHTS CIRCUIT

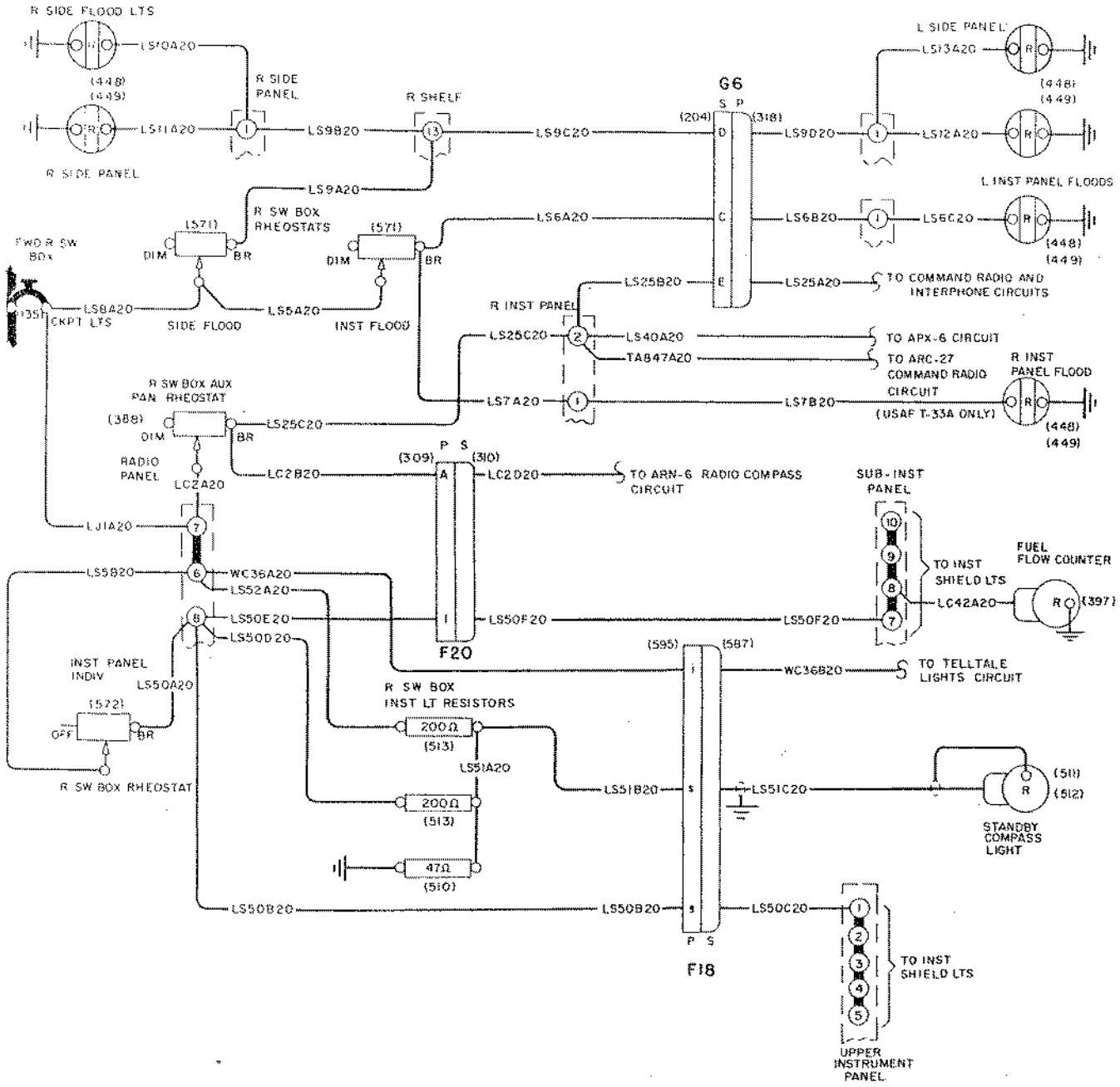
MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5286 THROUGH 53-5665

GB 8830

M20-480-8-411

Figure 8-175. Forward Cockpit Lights Circuit

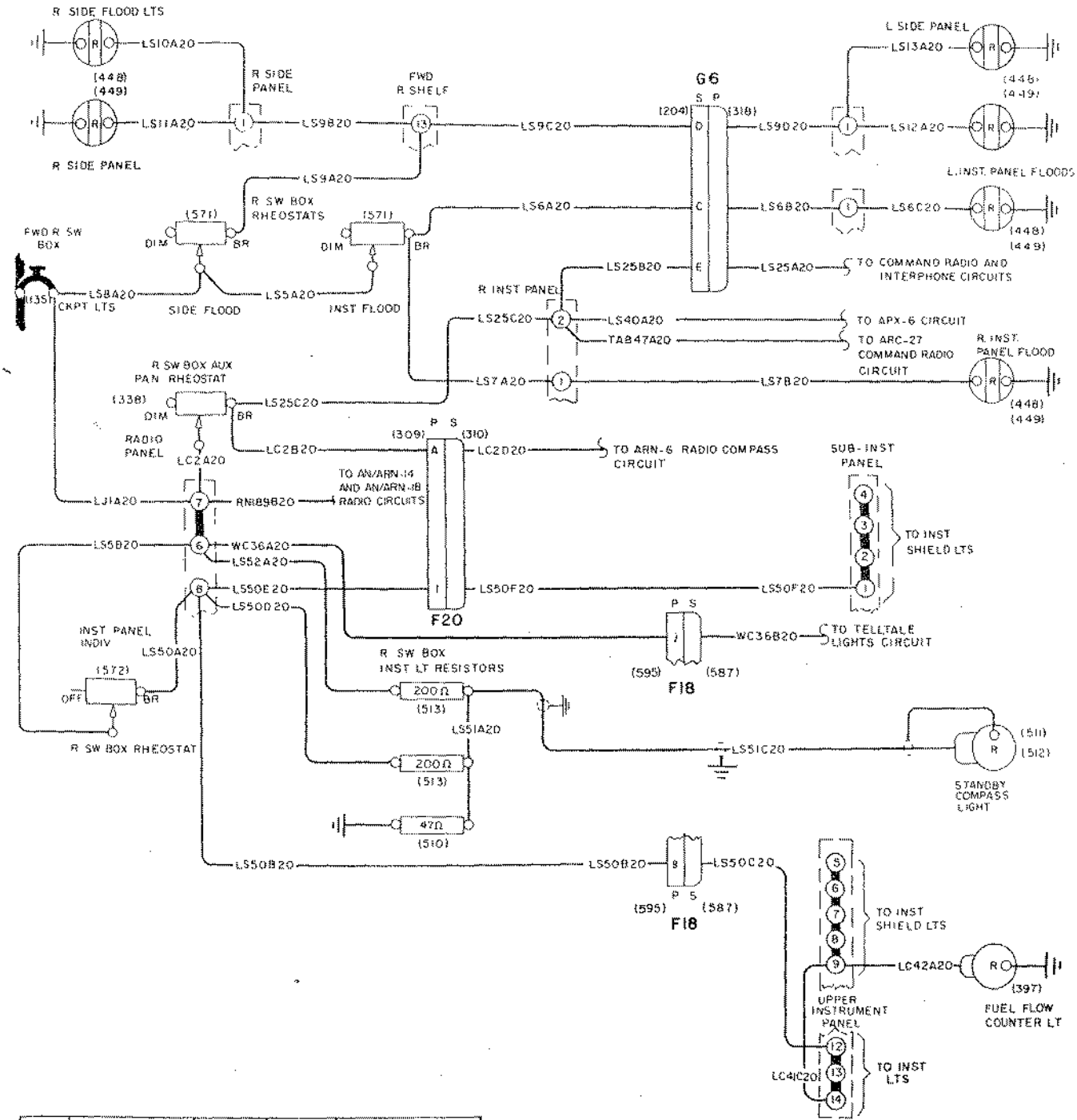


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
335	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			AN3102A-20-29S
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
319	CONNECTOR			AN3106B-20-29P
388	RHEOSTAT	OHMITE	100Ω 25W	0153H
392	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3173-301
449	LIGHT ASSEMBLY		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3136-1
512	LAMP		RED	AN3136-R-323
513	RESISTOR	OHMITE	200Ω 25W	0200H
571	RHEOSTAT	OHMITE	75Ω 25W	0150H
572	RHEOSTAT	OHMITE	22Ω 50W	0316J
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

GB 8829
M20-48D-8-336

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 53-5666 THROUGH 53-6152 AND 54-1522 THROUGH 55-3115

Figure 8-176. Forward Cockpit Lights Circuit

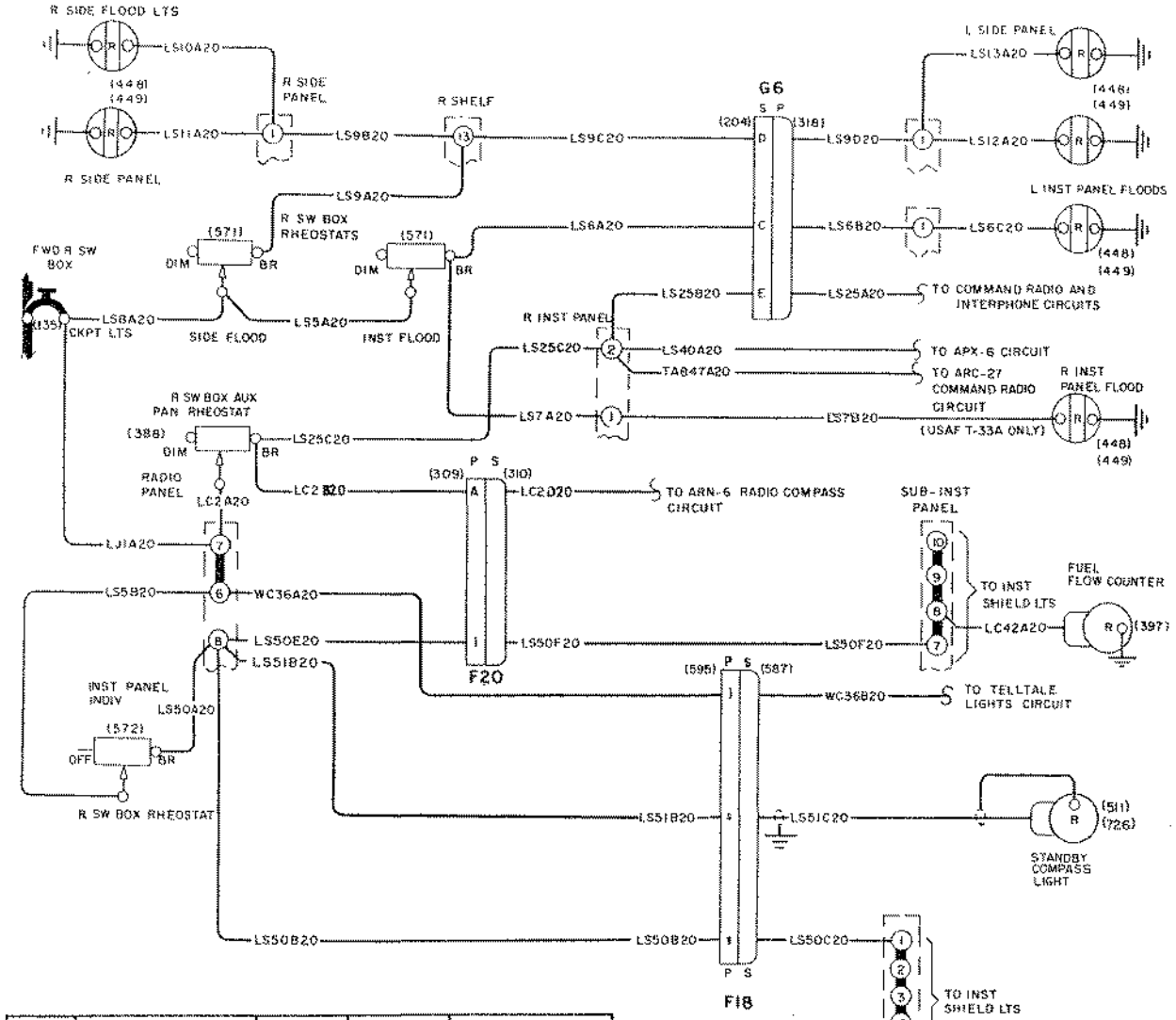


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
335	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			AN3102A-20-29S
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
318	CONNECTOR			AN3106B-20-29P
338	RHEOSTAT	OHMITE	100 Ω 25W	015M
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3120-303
449	LIGHT ASSEMBLY		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-3
512	LAMP		RED	AN3136-R-323
513	RESISTOR	OHMITE	200Ω 25W	0200H
571	RHEOSTAT	OHMITE	75Ω 25W	0150H
572	RHEOSTAT	OHMITE	225Ω 50W	D3167
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

GB 8828
M20-48D-8-408

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A-5
APPLIES PRIOR TO AF SERIAL NO. 53-4332

Figure 8-177. Forward Cockpit Lights Circuit

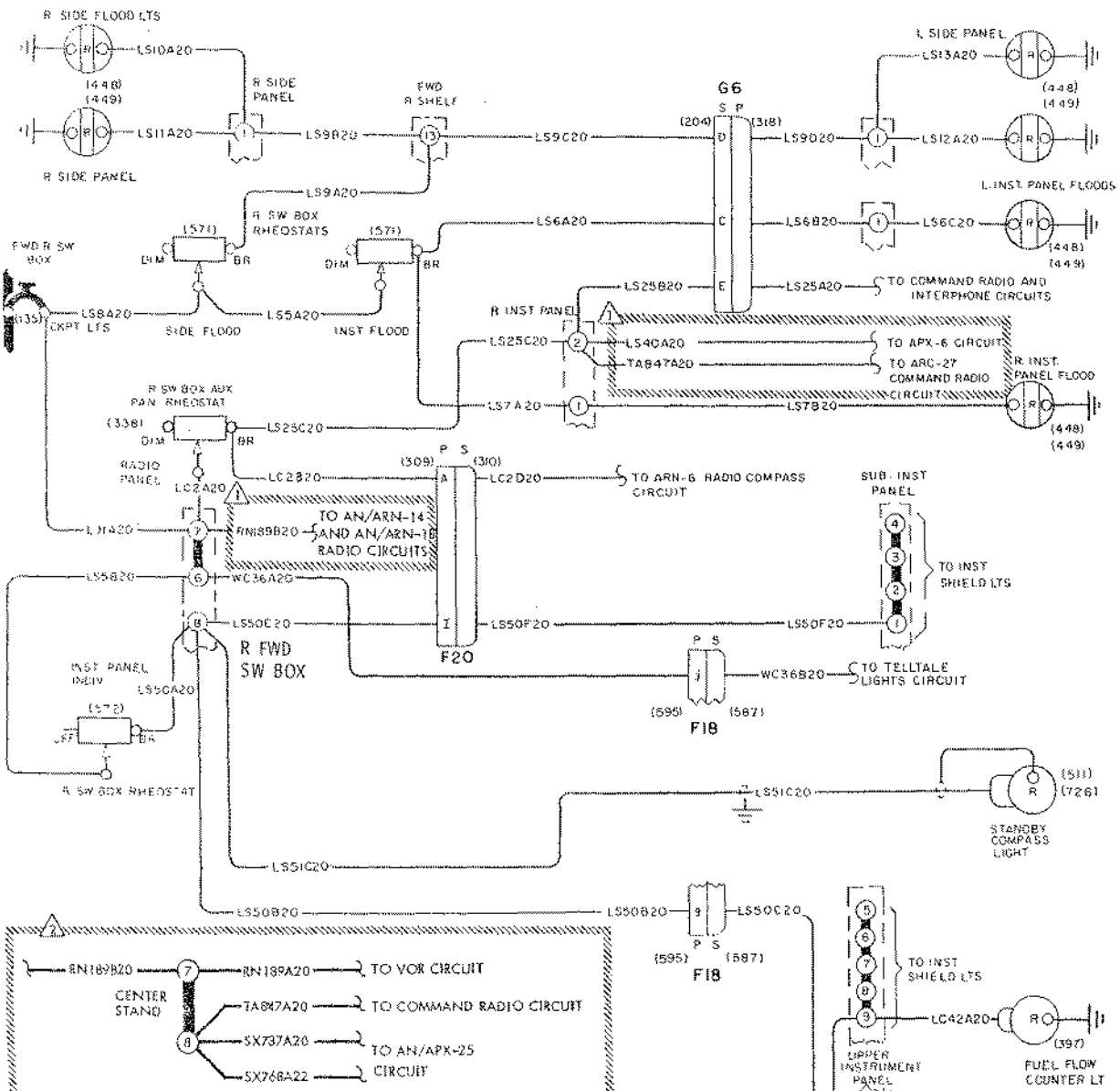


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR-			AN3102A-20-29S
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
318	CONNECTOR			AN3106B-20-29P
388	RHEOSTAT	OHMITE	100Ω25W	0151H
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-1
571	RHEOSTAT	OHMITE	75Ω25W	0150H
572	RHEOSTAT	OHMITE	22Ω50W	0316J
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
726	STANDBY COMPASS			AN5766T4

GB 8773
M20-480-6-428

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 55-4436 THROUGH 55-4962

Figure 8-178. Forward Cockpit Lights Circuit



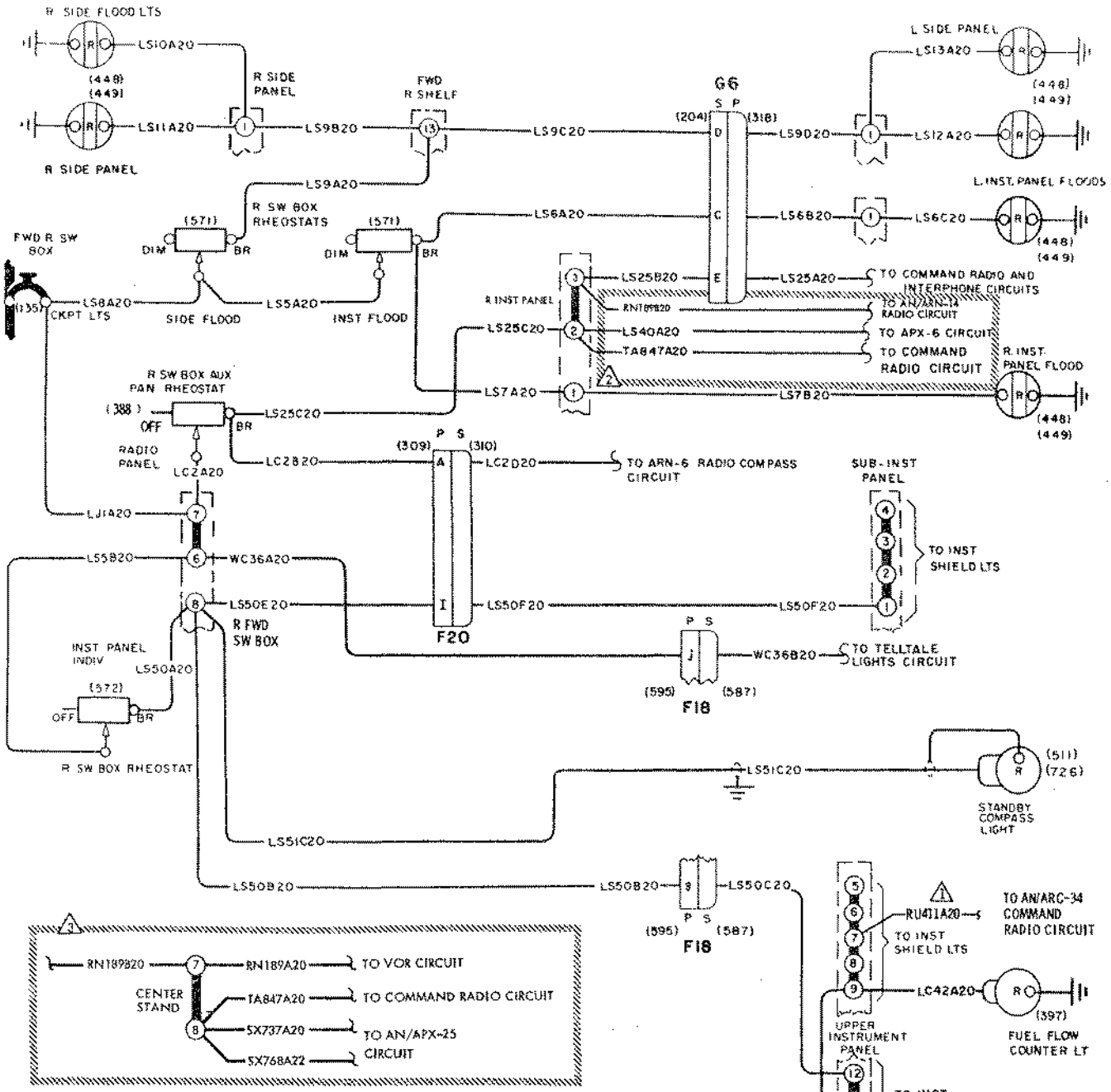
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			AN3102A-20-29S
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
318	CONNECTOR			AN3106B-20-29P
388	RHEOSTAT	OHMITE	100 Ω 25W	0151H
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-1
571	RHEOSTAT	OHMITE	75 Ω 25W	0150H
572	RHEOSTAT	OHMITE	22 Ω 50W	0316J
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
726	STANDBY COMPASS			AN5776Y4

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-571
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-571

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. 55-4032 THROUGH 55-4953

Figure 8-179. Forward Cockpit Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			AN3102A-20-29S
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
318	CONNECTOR			AN3106B-20-29P
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-1
571	RHEOSTAT	OHMITE	75 Ω 25W	0150H
572	RHEOSTAT	OHMITE	22 Ω 50W	0316J
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
726	LAMP			AN3140-327

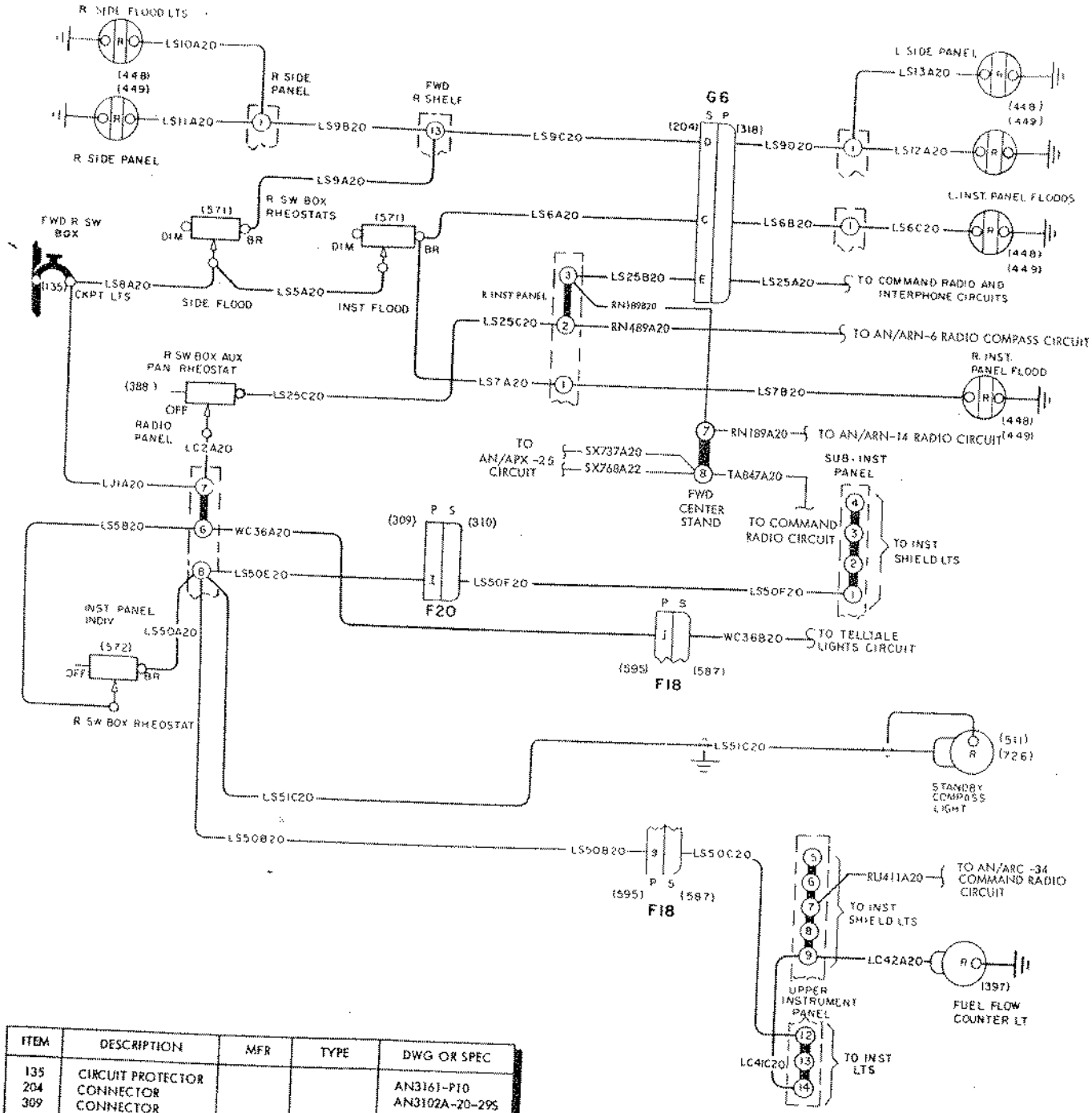
NOTE

1. USED ON AF SERIAL NO. 58-450 AND SUBSEQUENT
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-571
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-571

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. 55-4954 THROUGH 58-503

M20-48D-8-434
GB 8878

Figure 8-180. Forward Cockpit Lights Circuit

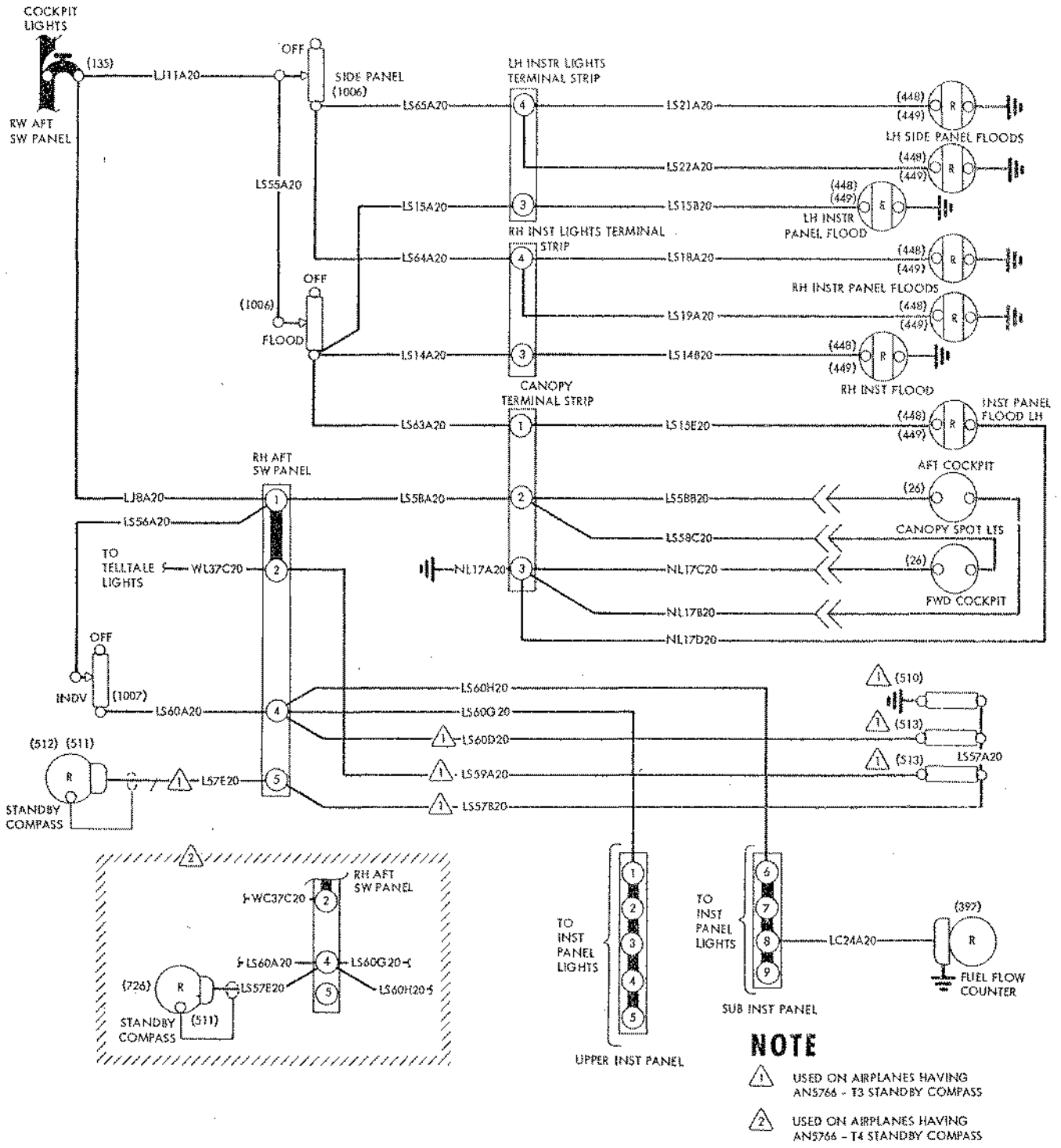


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			AN3102A-20-29S
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
318	CONNECTOR			AN3106B-20-29P
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-35J
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-1
571	RHEOSTAT	OHMITE	75 Ω 25W	0150H
572	RHEOSTAT	OHMITE	22 Ω 50W	0316J
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
726	LAMP			AN3140-327

GB 8879
M20-48D-8-56

FORWARD COCKPIT LIGHTS CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. 58-504 AND SUBSEQUENT

Figure 8-181. Forward Cockpit Lights Circuit



NOTE

1. USED ON AIRPLANES HAVING AN5766 - T3 STANDBY COMPASS
2. USED ON AIRPLANES HAVING AN5766 - T4 STANDBY COMPASS

ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES	B6685	
135	CIRCUIT PROTECTOR			AN3161-P10
392	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200Ω 25W	0200H
726	LAMP			AN3140-327
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

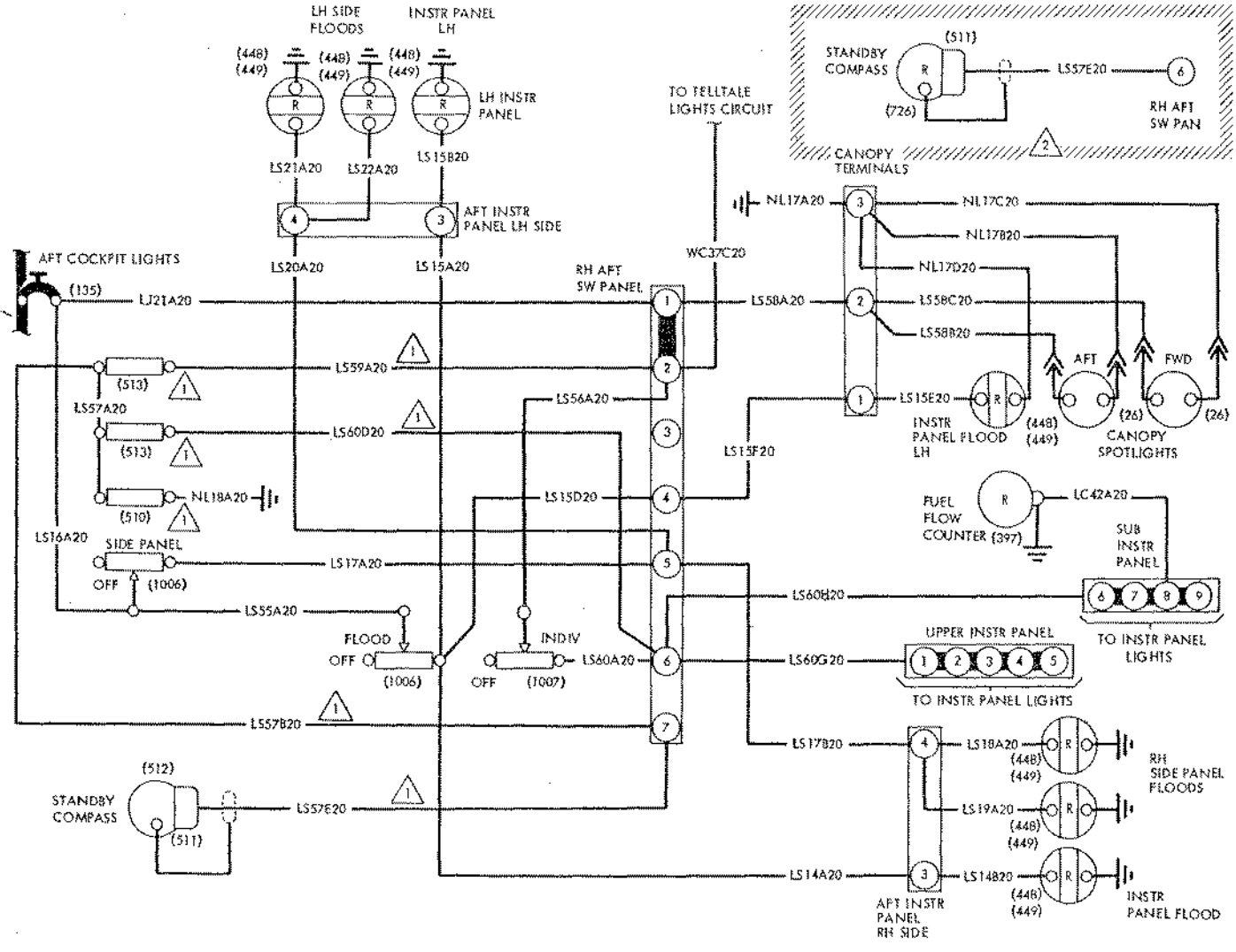
AFT COCKPIT LIGHTS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 50-401

M20-45-8-442
GB 4449

Figure 8-182. Aft Cockpit Lights Circuit



NOTE

1. USED ON AIRPLANES HAVING AN5766-T3 STANDBY COMPASS.
2. USED ON AIRPLANES HAVING AN5766-T4 STANDBY COMPASS.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		86685
135	CIRCUIT PROTECTOR			AN3161-P10
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
726	LAMP			AN3140-327
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

1, 1, 1, 2

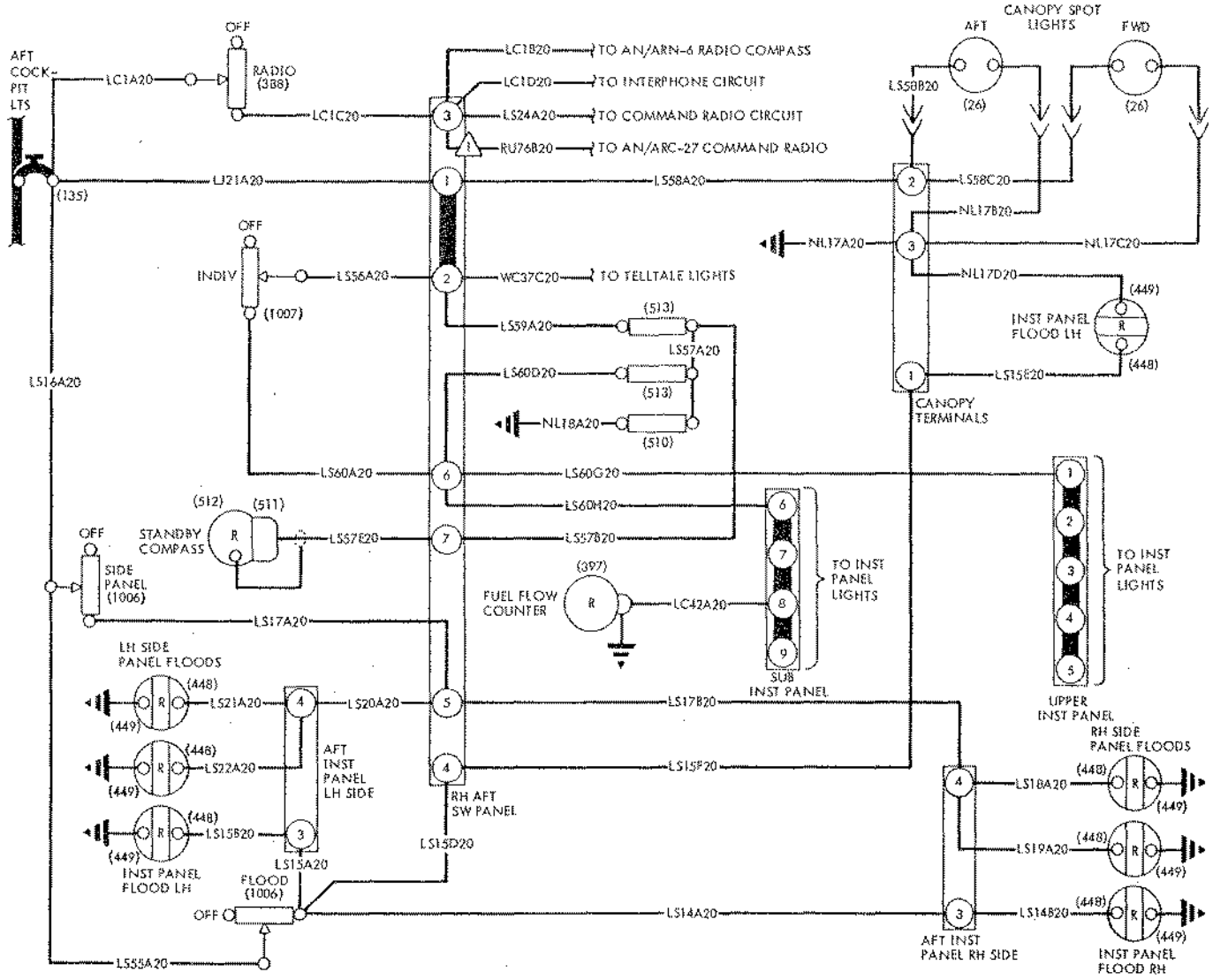
M20-45-8-444
GB 4450

AFT COCKPIT LIGHTS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 50-402 THROUGH 51-4048

Figure 8-183. Aft Cockpit Lights Circuit



NOTE

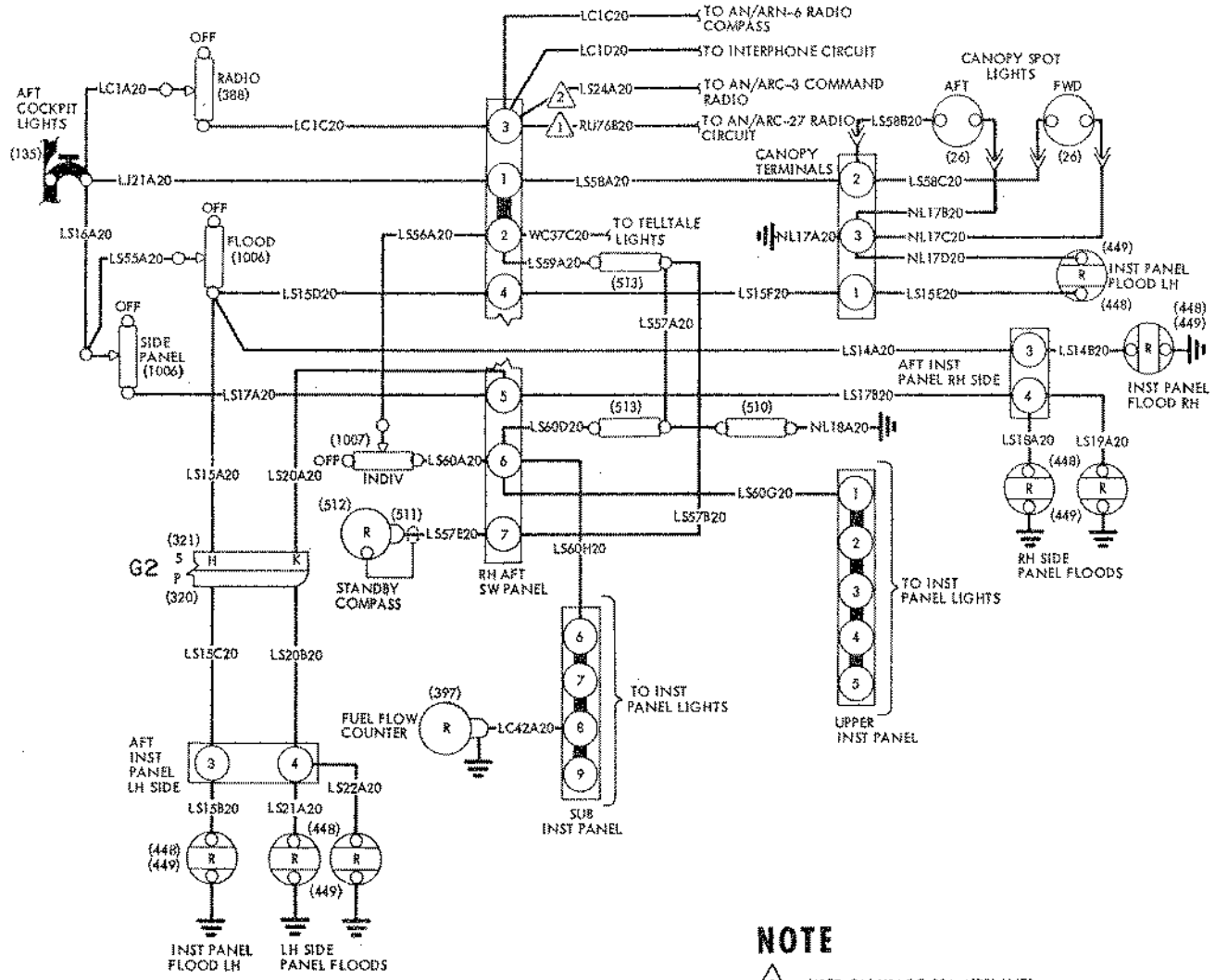
1 USED ON MODEL T-33A ONLY AF SERIAL NO. 51-6587 THROUGH 51-6818

ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		B6685
135	CIRCUIT PROTECTOR			AN3161-P10
388	RHEOSTAT	OHMITE	100Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3024-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200Ω 25W	0200H
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

M20-45-8-446
GB 4451

AFT COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4049 THROUGH 51-6818

Figure 8-184. Aft Cockpit Lights Circuit



NOTE

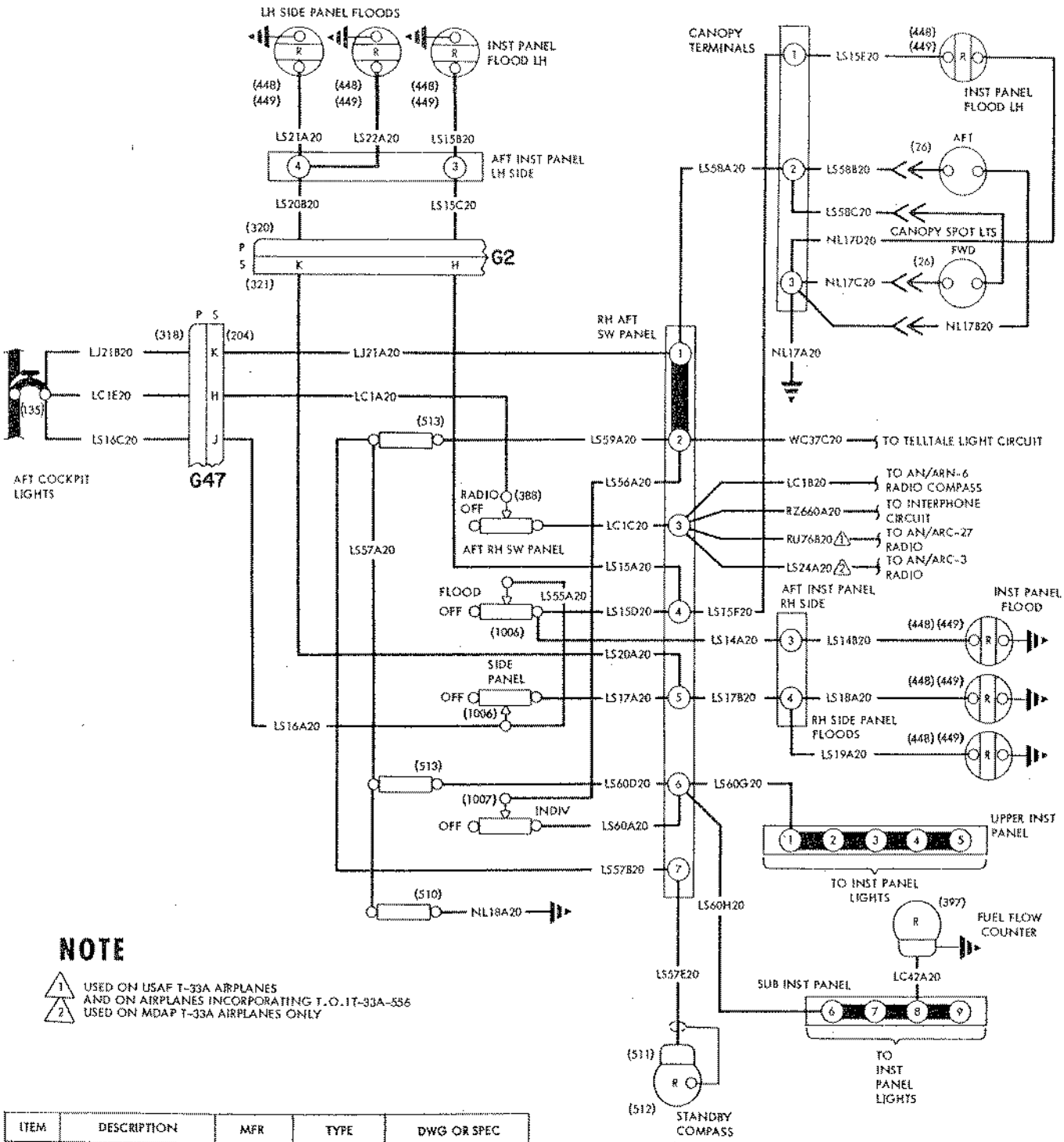
1. USED ON USAF T-33A AIRPLANES AND ON AIRPLANES INCORPORATING T.O. 1T-33A-556
2. USED ON RCAF AND MDAP AIRPLANES ONLY

ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		B6695
135	CIRCUIT PROTECTOR			AN3161-P10
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
388	RHEOSTAT	OHMITE	100 Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

GB 8775
M20-48D-8-488

AFT COCKPIT LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9235

Figure 8-185. Aft Cockpit Lights Circuit



NOTE

1 USED ON USAF T-33A AIRPLANES AND ON AIRPLANES INCORPORATING T.O.1T-33A-556

2 USED ON MDAP T-33A AIRPLANES ONLY

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		B6685
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			MS3102A-20-29S
318	CONNECTOR			MS3106B-20-29P
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
388	RHEOSTAT	OHMITE	100Ω 25W	H-100-F2-351
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47 Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200 Ω 25W	0200H
1006	RHEOSTAT			H75F2-352
1007	RHEOSTAT			J22F2-352

AFT COCKPIT LIGHTS CIRCUIT

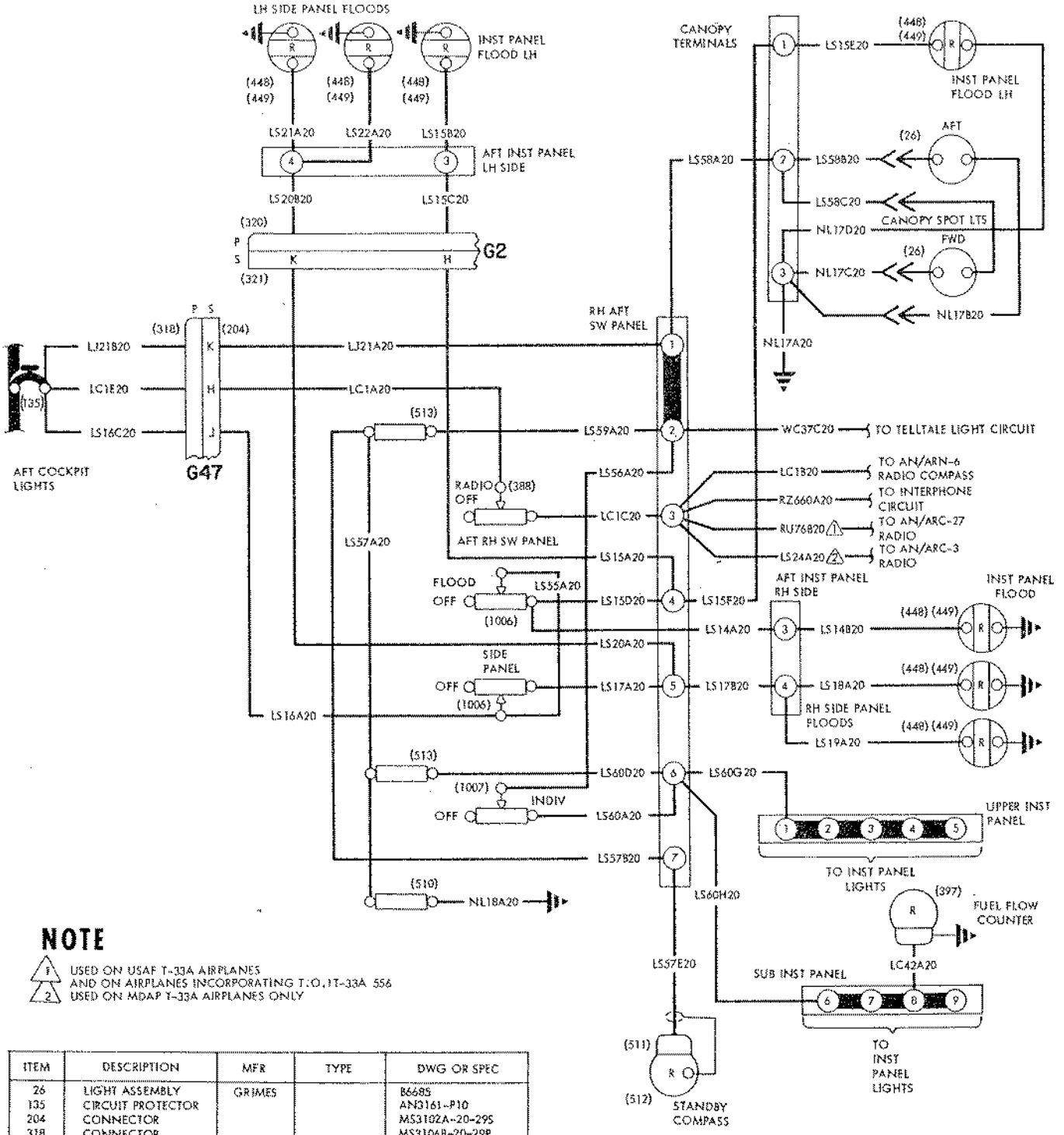
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9236 THROUGH 52-9759, 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

GB 8776

M20-4BD-8-452

Figure 8-186. Aft Cockpit Lights Circuit



NOTE

1 USED ON USAF T-33A AIRPLANES AND ON AIRPLANES INCORPORATING T.O. 1T-33A 556

2 USED ON MDAP T-33A AIRPLANES ONLY

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		B668S
135	CIRCUIT PROTECTOR			AN3161-P10
204	CONNECTOR			MS3102A-20-29S
318	CONNECTOR			MS3106B-20-29P
320	CONNECTOR			MS3106B-28-12P
321	CONNECTOR			MS3102A-28-12S
388	RHEOSTAT	OHMITE	100Ω 25W	H-100-F2-35T
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-2
512	LAMP			AN3136-R323
513	RESISTOR	OHMITE	200Ω 25W	0200H
1006	RHEOSTAT			H75F2-35Z
1007	RHEOSTAT			J22F2-35Z

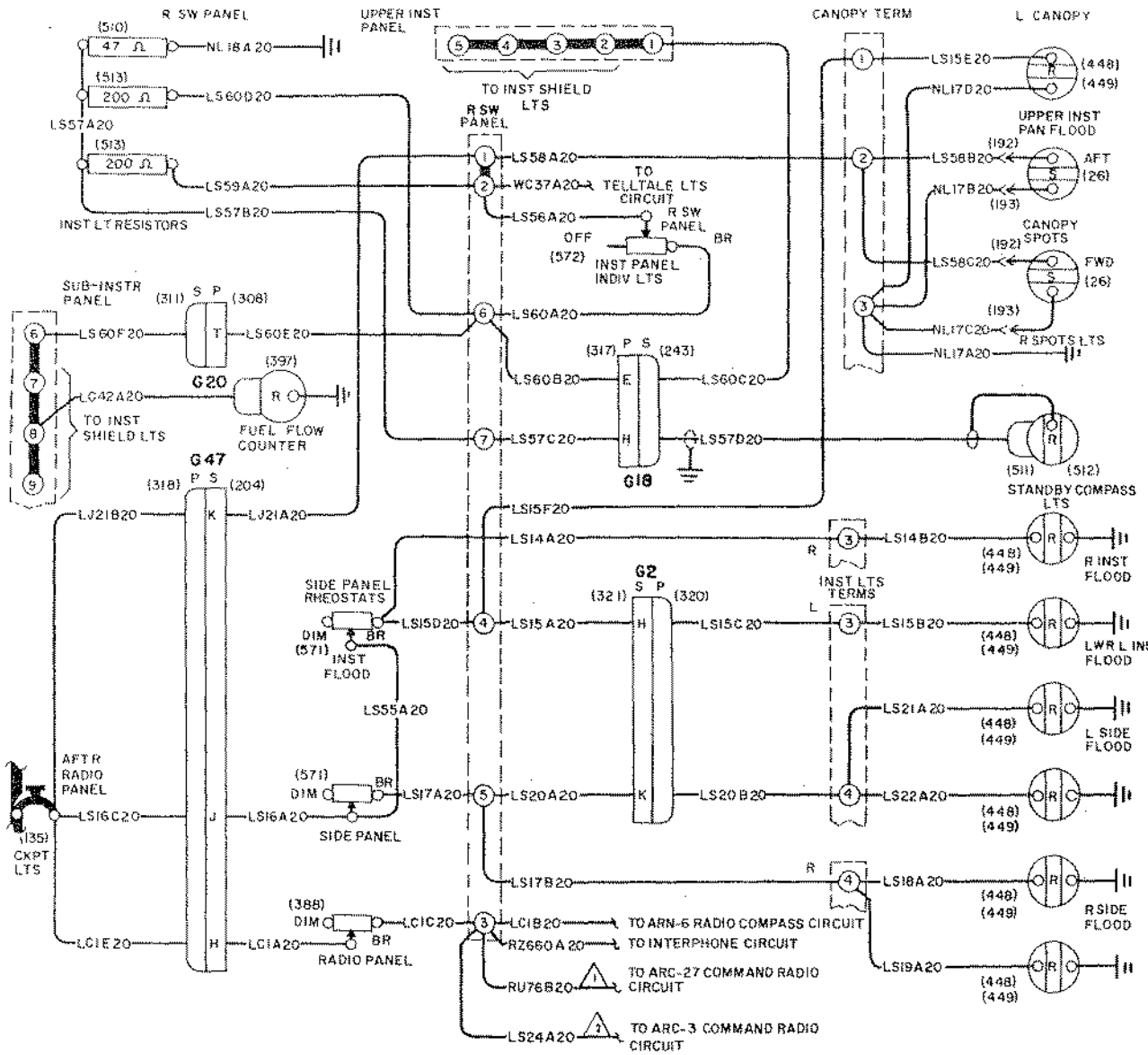
AFT COCKPIT LIGHTS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9760 THROUGH 53-5085, EXCEPT 52-9876 THROUGH 52-9940

GB 8856

Figure 8-187. Aft Cockpit Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
76	LIGHT ASSEMBLY	GRIMES		86685
135	CIRCUIT PROTECTOR			AN3161-P10
192	CONNECTOR			PJ-068
193	CONNECTOR			SCA-28
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3106A-28-12P
321	CONNECTOR			AN3102A-28-12S
388	RHEOSTAT	OHMITE	100Ω 25W	0151H
397	LIGHT ASSEMBLY			AN3034-2
448	LAMP		RED	AN3123-391
449	LIGHT ASSEMBLY		A-11	32639
510	RESISTOR		47Ω 1W	RC30BF470K
511	CONNECTOR			AN3116-1
512	LAMP		RED	AN3136-R-323
513	RESISTOR	OHMITE	200Ω 25W	0200H
571	RHEOSTAT	OHMITE	75Ω 25W	0150H
572	RHEOSTAT	OHMITE	22Ω 50W	0316J

NOTE

1. USED ON USAF T-33A AIRPLANES AND ON AIRPLANES INCORPORATING T.O. 1T-33A-556
2. USED ON MDAP T-33A AIRPLANES ONLY

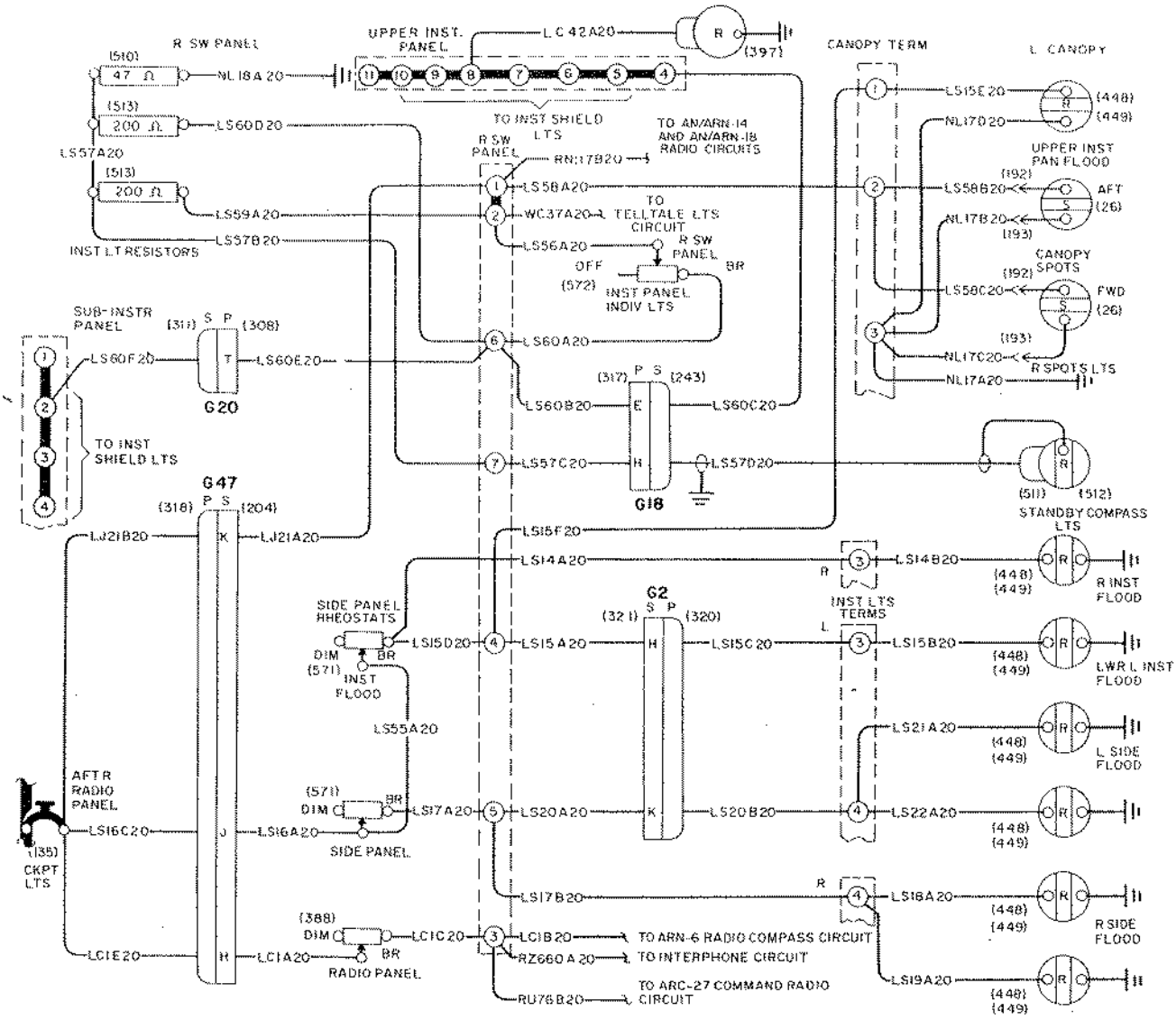
AFT COCKPIT LIGHTS CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 53-5086 THROUGH 55-4435

GB 8852
M20-480-8-273

Figure 8-188. Aft Cockpit Lights Circuit

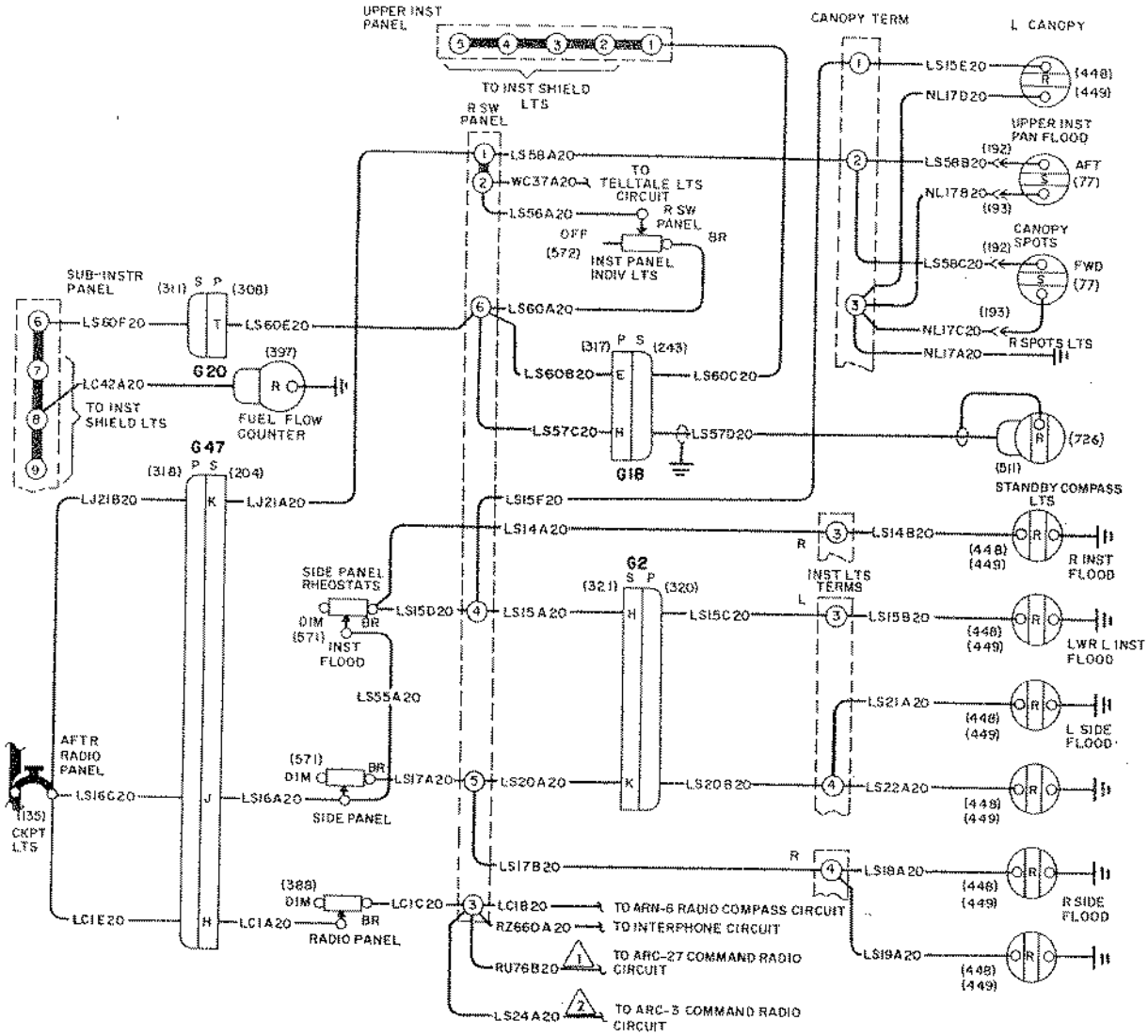


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		86683
135	CIRCUIT PROTECTOR			AN3361-P30
192	CONNECTOR			PJ-068
193	CONNECTOR			SCA-28
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102A-28-12S
388	RHEOSTAT	OHMITE	100Ω 25W	0151R
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3171-R01
449	LIGHT ASSEMBLY		A-11	32639
510	RESISTOR		47Ω 1W	RC30BE470K
511	CONNECTOR			AN3116-1
512	LAMP		RED	AN3136-R-323
513	RESISTOR	OHMITE	200Ω 25W	0200J
571	RHEOSTAT	OHMITE	75Ω 25W	0150R
572	RHEOSTAT	OHMITE	22Ω 50W	0316J

EM-20-34-B-406
FB 2139

AFT COCKPIT LIGHTS CIRCUIT
MODEL T-33A-5
APPLIES PRIOR TO AF SERIAL NO. 55-4332

Figure 8-189. Aft Cockpit Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		B6685
77	LAMP			AN3121-313
135	CIRCUIT PROTECTOR			AN3161-P10
192	CONNECTOR			PJ-068
193	CONNECTOR			SCA-28
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102A-38-12S
388	RHEOSTAT	OHMITE	100 Ω 25W	0151H
397	LIGHT ASSEMBLY			AN3034-3
448	LAMP		RED	AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-3
571	RHEOSTAT	OHMITE	75 Ω 25W	0150H
572	RHEOSTAT	OHMITE	22 Ω 50W	0316J
726	STANDBY COMPASS			AN5766T4

NOTE

1. USED ON USAF T-33A AIRPLANES AND ON AIRPLANES INCORPORATING T.O. 1T-33A-556
2. USED ON MDAP T-33A AIRPLANES ONLY

AFT COCKPIT LIGHTS CIRCUIT

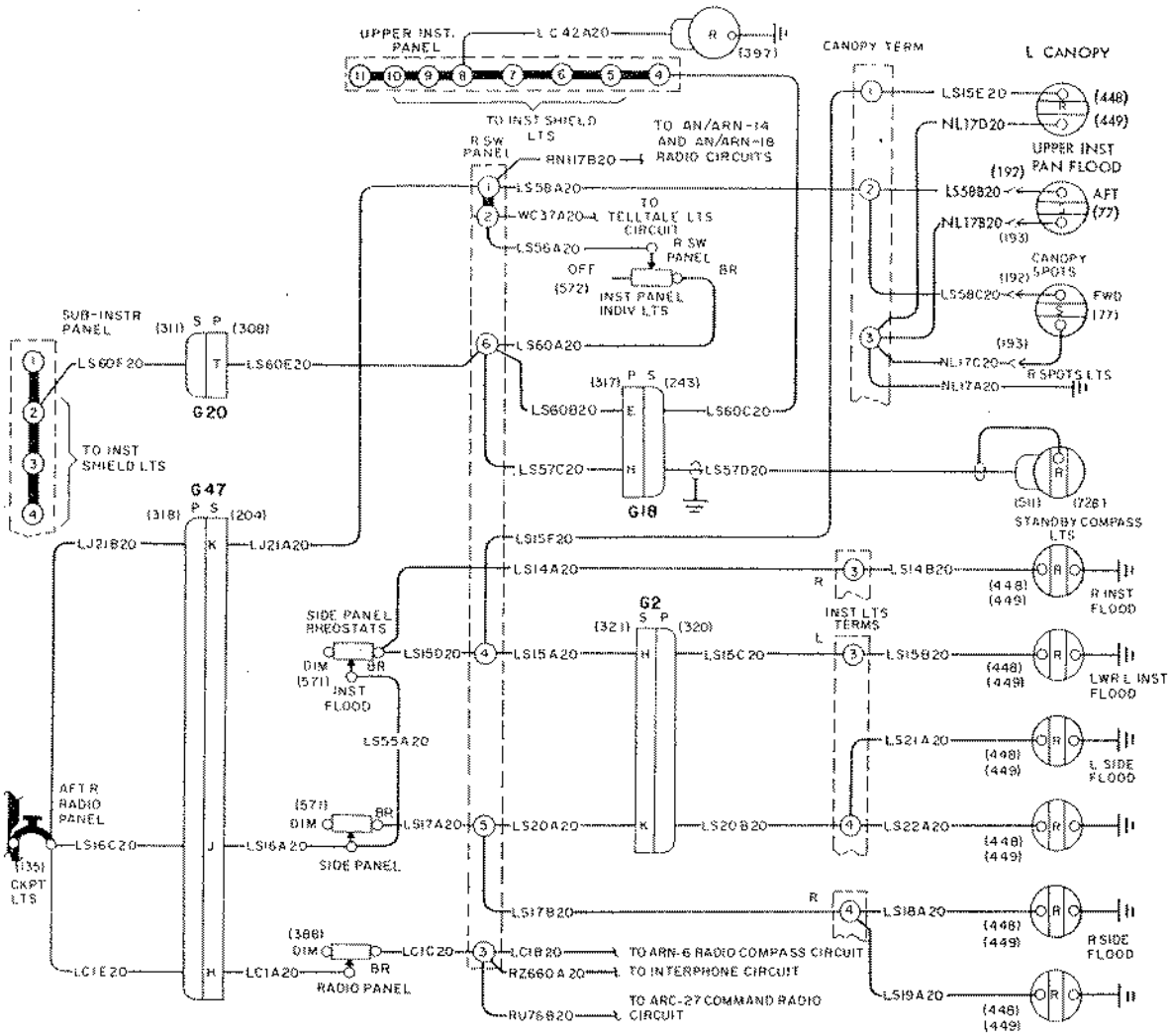
MODEL T33A-1

APPLIES TO AF SERIAL NO. 55-4436 THROUGH 55-4962

GB 8781

M20-480-8-429

Figure 8-190. Aft Cockpit Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		86685
77	LAMP			AN3121-313
135	CIRCUIT PROTECTOR			AN3161-P10
192	CONNECTOR			PJ-068
193	CONNECTOR			SCA-2B
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102A-28-12S
386	RHEOSTAT	OHMITE	100 Ω 25W	0151H
397	LIGHT			AN3034-3
448	LAMP			AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-1
512	LAMP		RED	AN3136-R-323
571	RHEOSTAT	OHMITE	75 Ω 25W	0150H
572	RHEOSTAT	OHMITE	22 Ω 50W	0316J
726	STANDBY COMPASS			AN5766T4

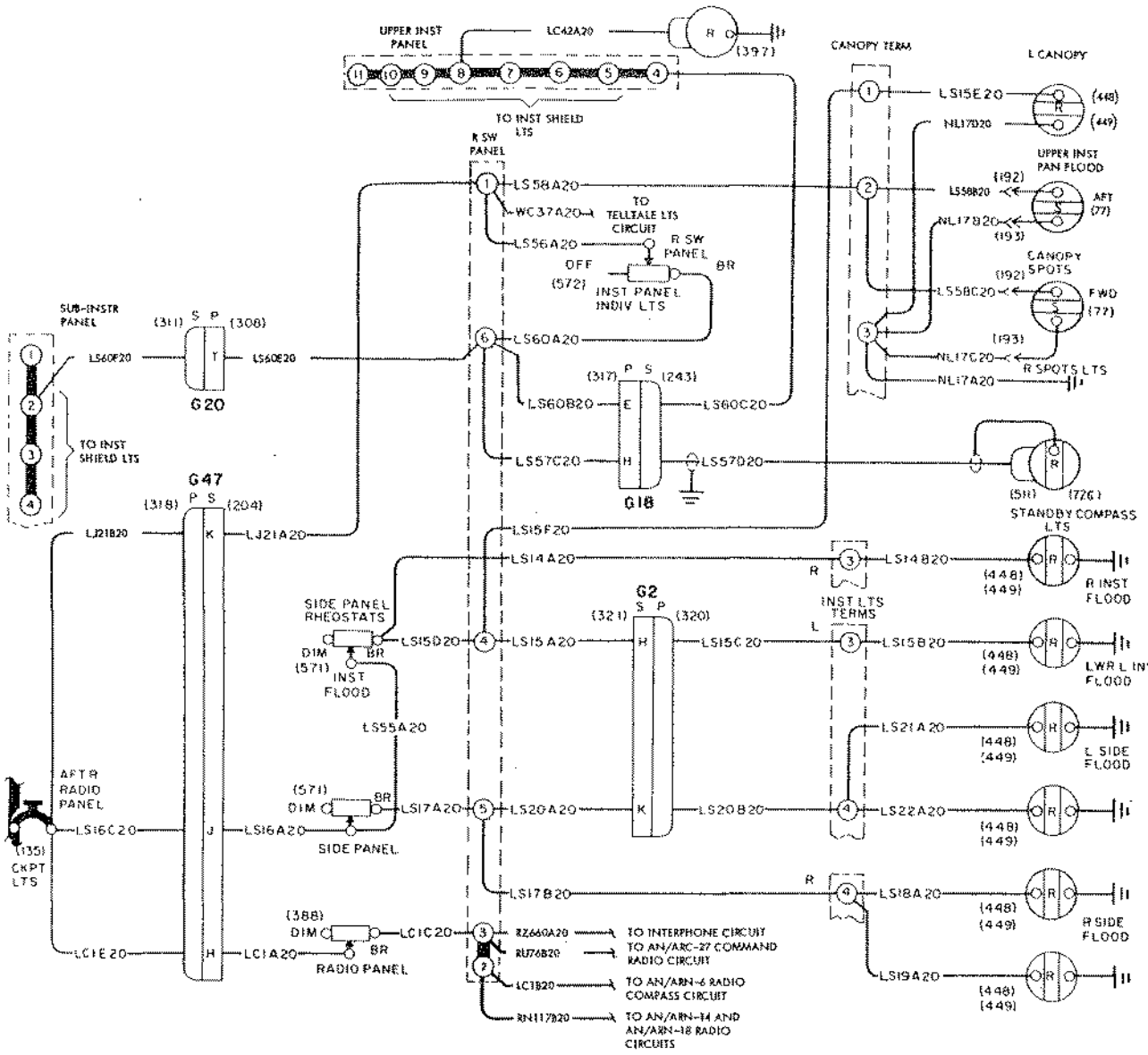
AFT COCKPIT LIGHTS CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 55-4332 THROUGH 55-4953

M20-45-8-430
GB 4455

Figure 8-191. Aft Cockpit Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
26	LIGHT ASSEMBLY	GRIMES		B6685
77	LAMP			AN3121-313
135	CIRCUIT PROTECTOR			AN316I-P10
192	CONNECTOR	MALLORY		PJ-068
193	CONNECTOR	MALLORY		SCA-28
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102A-28-12S
388	RHEOSTAT	OHMITE	100Ω25W	0151H
397	LIGHT			AN3034-3
448	LAMP			AN3123-301
449	LIGHT ASSEMBLY		A-11	32639
511	CONNECTOR			AN3116-1
512	LAMP		RED	AN3136-R-323
571	RHEOSTAT	OHMITE	75Ω25W	0150H
572	RHEOSTAT	OHMITE	220Ω50W	0316J
726	LAMP			AN3140-327

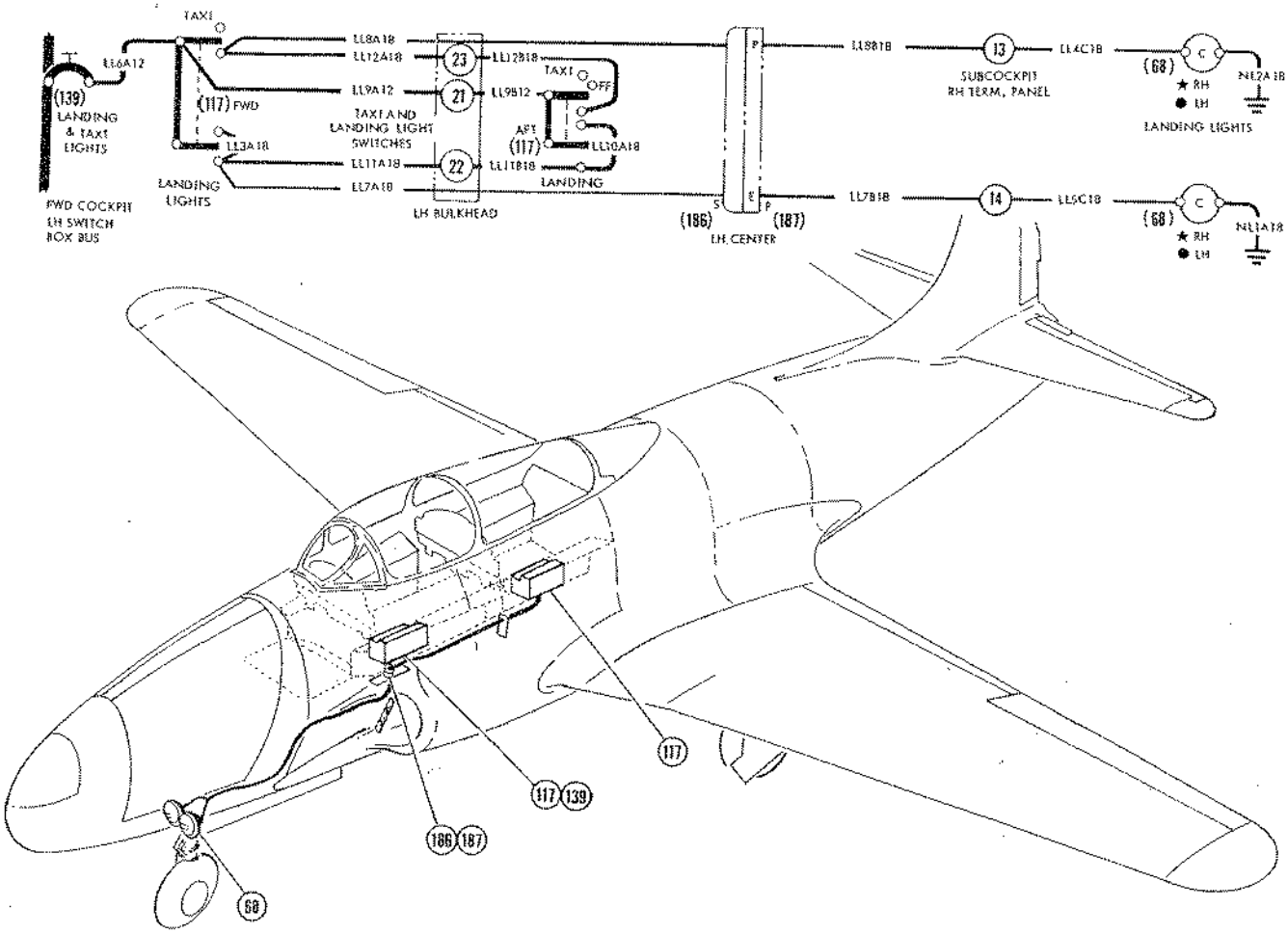
EM20-45-8-435
GB 4439

AFT COCKPIT LIGHTS CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 55-4954 THROUGH 56-3694

Figure 8-192. Aft Cockpit Lights Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
68	LIGHT	C-H		AN3129-4523
117	SWITCH			8905K766
139	CIRCUIT PROTECTOR			AN3161-P35
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P

Note

★ USED PRIOR TO SERIAL NO. 49-901

● USED SERIAL NO. 49-901 AND SUBSEQUENT

FB 9983

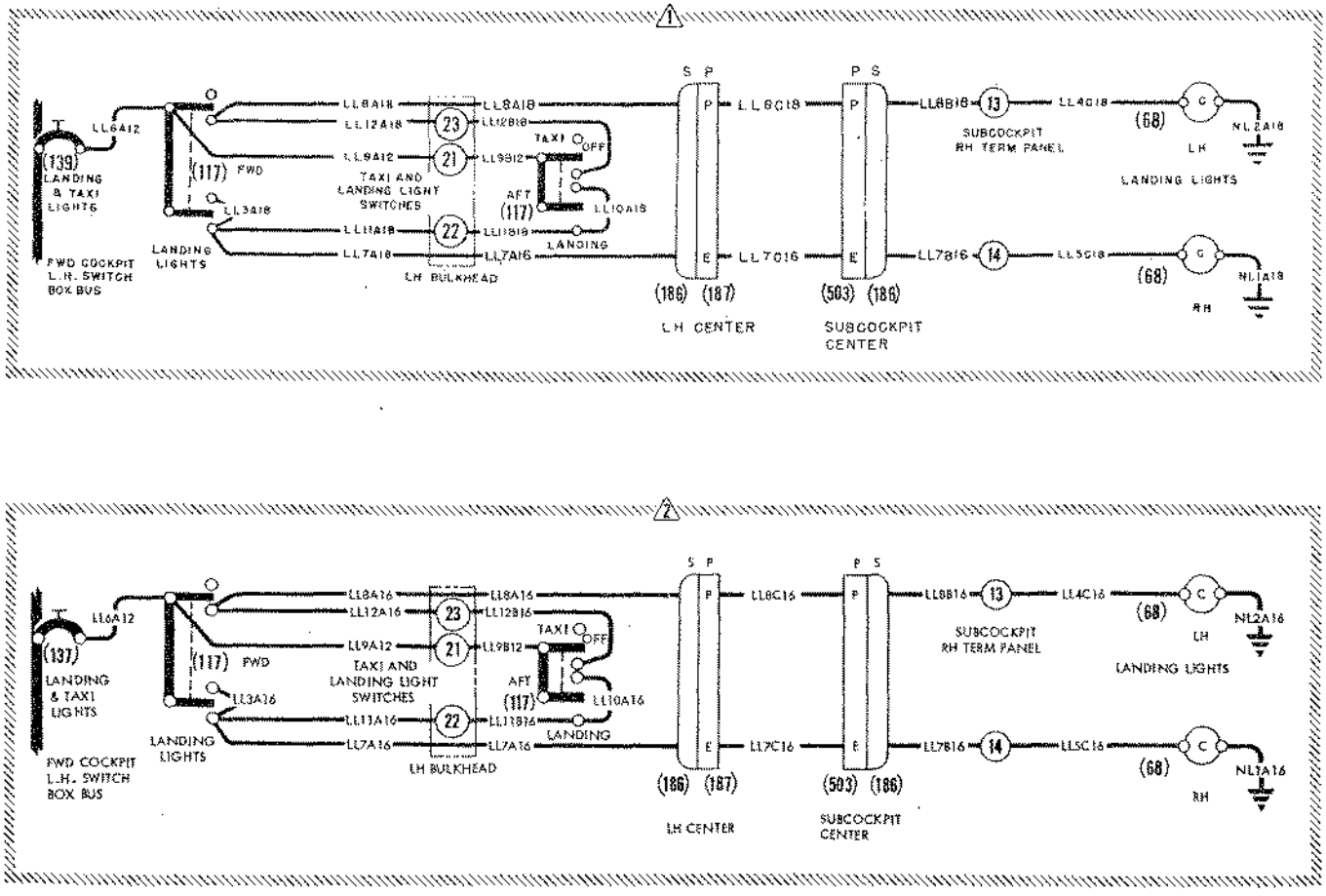
EM20-41-8-107

LANDING LIGHTS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-6818

Figure 8-194. Landing Lights Circuit



NOTE

1. USED ON AIRPLANES AF SERIAL NO. 51-6819 THROUGH 55-4953
2. USED ON AIRPLANES AF SERIAL NO. 55-4954 AND SUBSEQUENT

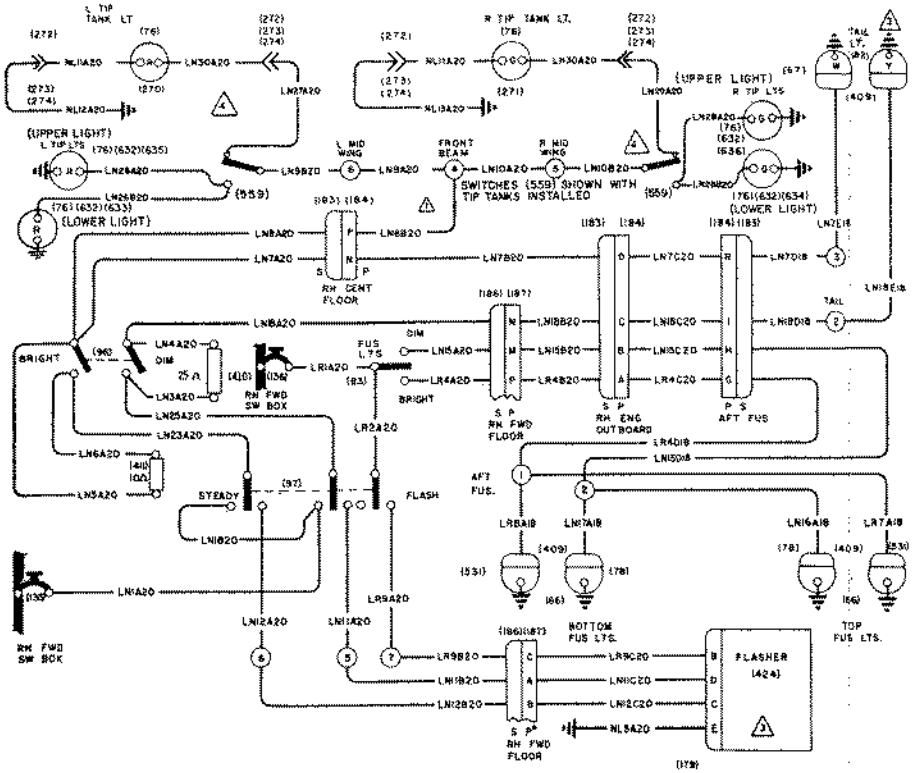
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
68	LIGHT	C-H		AN3129-4523
117	SWITCH			8905K766
1 137 2	CIRCUIT PROTECTOR			AN3161-P20
139	CIRCUIT PROTECTOR			AN3161-P35
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
503	CONNECTOR			AN3100A-28-12P

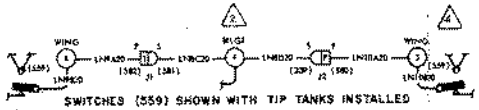
FB 4702
EM20-37-8-108

LANDING LIGHT CIRCUIT

MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-6819 & SUBSEQUENT

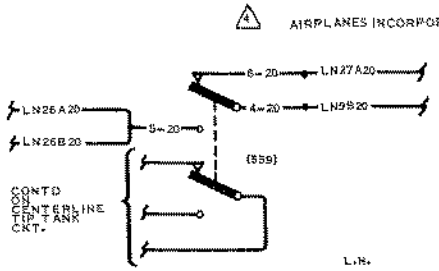
Figure 8-195. Landing Lights Circuit

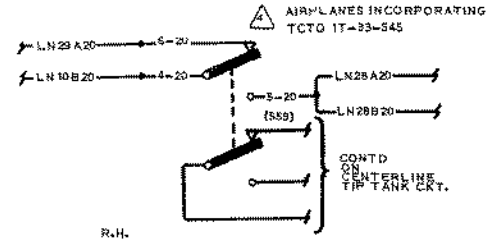




EXTERIOR LIGHTING FOR THOSE AIRCRAFT NOT HAVING COMPLIED WITH T.O. 1T-33-536.

NAVIGATION AND POSITION LIGHTS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4126 (INCORPORATING T.O. 1T-33A-42)
05249 M20-SE-8-252

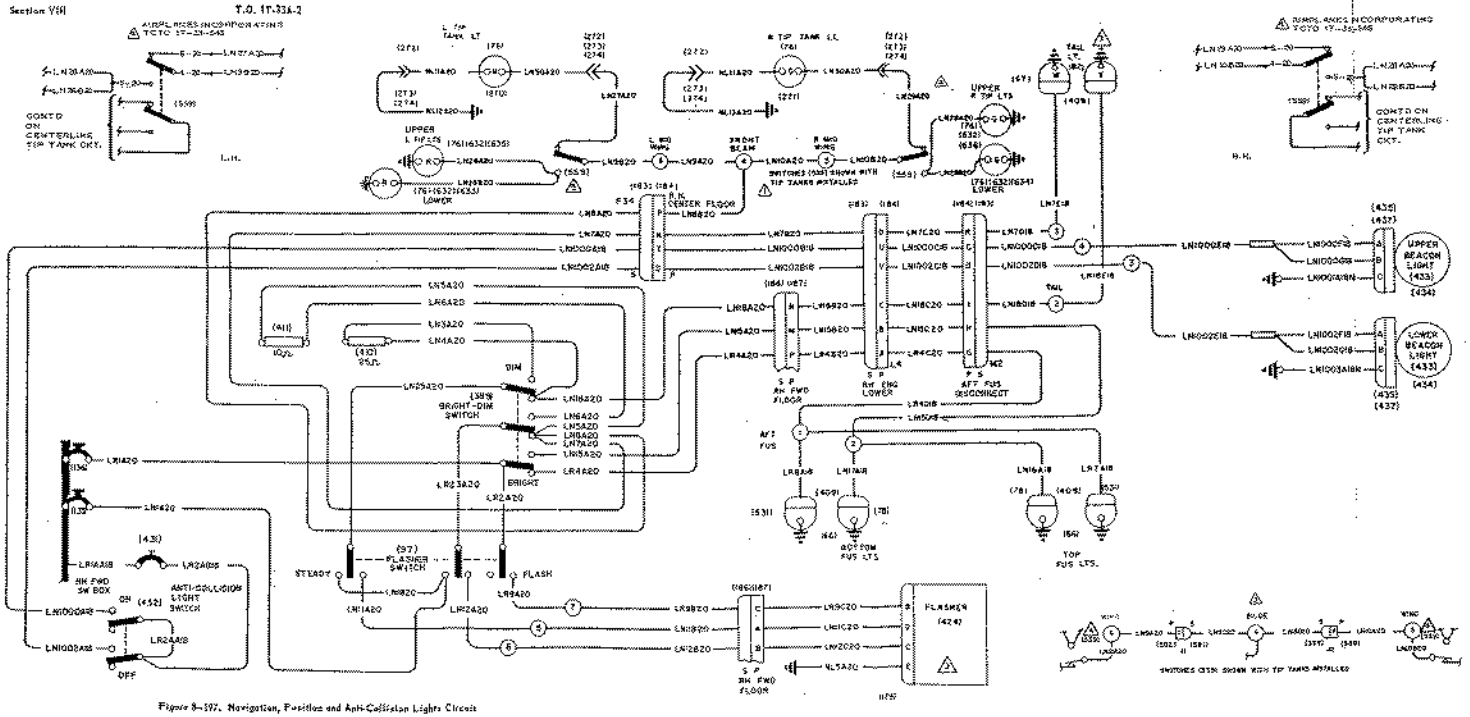




NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
3. YELLOW TAIL LIGHT CHANGED TO WHITE WHEN MS-24577-2A FLASHER, WHICH SUPERCEDES C-2 IS USED
4. SWITCH, ITEM (559) CHANGED TO PART NO. 1EN61-68 AND CONNECTED AS SHOWN ON AIRPLANES INCORPORATING TCTO 1T-33-545

Figure 8-196. Navigation and Position Lights Circuit



ITEM	DESCRIPTION	MANUFACTURER	TYPE	PART OR SPEC
1	LIGHT	CONSOLIDATED ELECTRODYNAMICS		7324-A INDUSTRIES
2	LIGHT			6A6336
3	LAMP		28V	MS25237-333
4	LAMP		28V	MS25237-327
5	SWITCH		5 AMP	MS24659-22
6	SWITCH			MS24659-153
7	CIRCUIT BREAKER			MS25852-10
8	CIRCUIT BREAKER			MS25852-15
9	CONNECTOR			MS3106A18-1S
10	CONNECTOR			MS3106A14-18S
11	CONNECTOR			MS3106A14-18P
12	CONNECTOR			MS3116F14-18S
13	LIGHT			AN3052-1
14	LIGHT			AN3052-2
15	CONTACTOR	THOMAS & BETTS		AN3151-1
16	RELAY	THOMAS & BETTS		AN3151
17	TUP	THOMAS & BETTS	440	AN3151A1
18	CONNECTOR			MS3116F14-19P
19	SWITCH			MS3509-6
20	CONNECTOR	ITT CANNON	51004	AN3106-4
21	RESISTOR	CARBOTE	50 OHM 5 WATTS	53006
22	RESISTOR	CARBOTE	50 OHM 10 WATTS	53006
23	MOTOR-FLASHER ⚠			MS25237-336
24	CIRCUIT BREAKER			MS25852-7
25	SWITCH			MS25852-20
26	BEACON LIGHT			MS25237-341
27	LAMP			MS25237-327
28	CONNECTOR	ITT CANNON		MS3106A18-1S
29	CONNECTOR	ITT CANNON		MS3106A14-18S
30	LAMP	ITT CANNON	28V	MS25237-327
31	LAMP		28V SPOT	MS25237-333
32	SWITCH			MS24659-153
33	CONNECTOR			MS3106A14-18P
34	CONNECTOR			MS3116F14-18S
35	COVER			AN3057-3
36	COVER			AN3057-4
37	COVER			1370785
38	COVER			3107964

NOTE

⚠ USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567

⚠ USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567

⚠ YELLOW TAIL LIGHT CHANGED TO WHITE WHEN MS25577-2A FLASHER, WHICH SUPERSEDES C-2, IS USED

⚠ SWITCH, ITEM (559) CHANGED TO PART NO. 10A51-68 AND CONNECTOR AS SHOWN, ON AIRPLANES INCORPORATING T.O. 1T-33-569

NAVIGATION AND POSITION LIGHTS CIRCUIT MODEL T-33A

APPLIES TO AF SERIAL NO. 49-936 THROUGH 51-423 INCORPORATING F.C.O.'S 33A-40 AND 1T-33-536

Figure 8-197. Navigation, Position and Anti-Collision Lights Circuit

Figure 8-198. Deleted

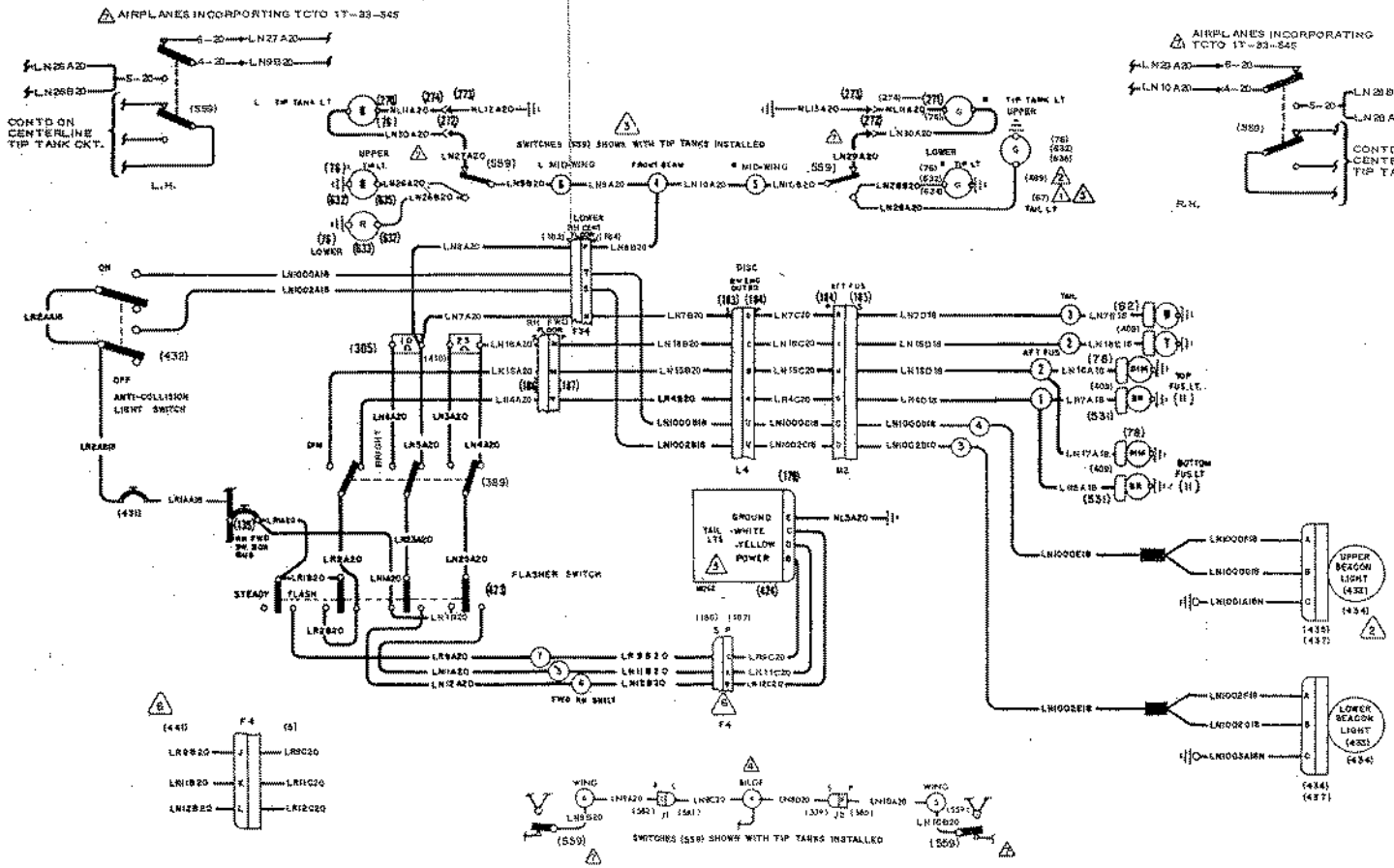


Figure 8-199. Navigation, Position and Anti-Collision Lights Circuit

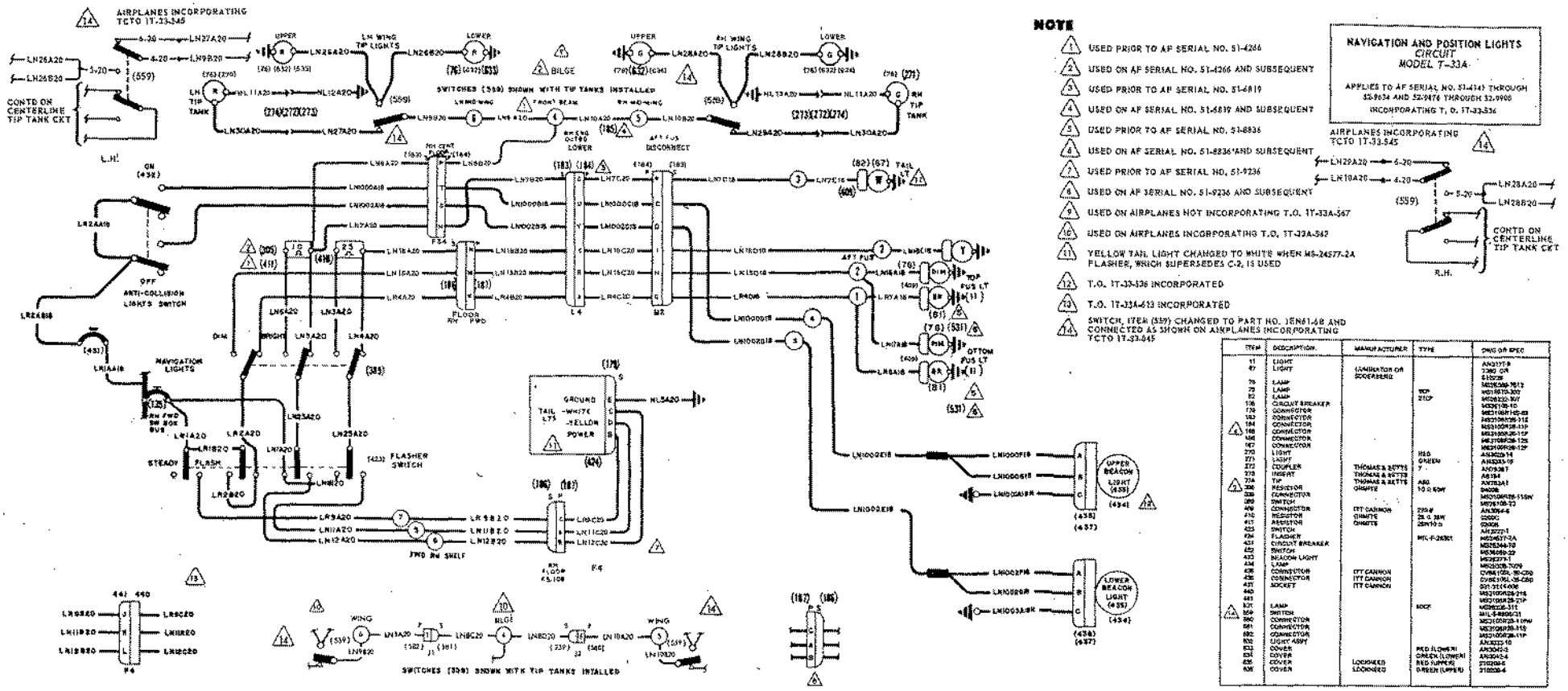
ITEM	DESCRIPTION	MANUFACTURER	TYPE	DWG OR SPEC
1	LIGHT			AN3177-8
47	LIGHT	LUMINATOR OR SODERBERG		T2R5-6T
				S10226
76	LAMP		28V	MS25237-7612
78	LAMP		6CP	MS18670-302
83	LAMP		28CP	MS25322-387
130	CIRCUIT BREAKER			MS25047-10
178	CONNECTOR			MS3106R18-4S
183	CONNECTOR			MS3106R28-11P
184	CONNECTOR			MS3106R28-21P
186	CONNECTOR			MS3106R28-12S
187	CONNECTOR			MS3106R28-12P
270	LIGHT		RED	AN3033-14
271	LIGHT		GREEN	AN3033-15
272	COUPLER	THOMAS & BETTS	7	AN7838E
273	INSERT	THOMAS & BETTS		AB164
274	TIP	THOMAS & BETTS	A50	AA75341
305	RESISTOR	OHMITE	50W10Ω	04009
306	CONNECTOR			MS3106R28-15PW
309	SWITCH			MS25108-20
409	CONNECTOR	ITT CANNON	220A	AN3084-6
410	RESISTOR	OHMITE	25W25Ω	50009
413	SWITCH			AN3227-1
424	FLASHER		MIL-F-6930	MS24677-2A
431	CIRCUIT BREAKER			MS25344-10
432	SWITCH			MS35059-22
433	BEACON LIGHT			MS25271-1
434	LAMP			MS25236-7029
435	CONNECTOR	ITT CANNON		CVB6106L-25-C20
436	CONNECTOR	ITT CANNON		CVB6106L-25-C00
437	SOCKET	ITT CANNON		031-3114-005
440				MS3100R28-21S
441				MS3100R28-21P
480	LIGHT	SODERBERG		S10236
531	LAMP		6CP	MS25238-311
559	SWITCH			MIL-S-5528-22
560	CONNECTOR			MS3100R28-11PW
561	CONNECTOR			MS3100R28-11S
562	CONNECTOR			MS3100R28-11P
610	LIGHT ASSY			AN3005-10
623	COVER		RED (LOWER)	AN3042-2
624	COVER		GREEN (LOWER)	AN3042-3
637	COVER	LOCKHEED	RED (UPPER)	210208-5
638	COVER	LOCKHEED	GREEN (UPPER)	210208-6

NOTE

1. USED PRIOR TO AF SERIAL NO. 51-4140
2. T.O. 1T-33-536 INCORPORATED
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-567
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-567
5. YELLOW TAIL LIGHT CHANGED TO WHITE WHEN MS-24677-2A FLASHER, WHICH SUPERSEDES C-2, IS USED
6. T.O. 1T-33A-613 INCORPORATED
7. SWITCH, ITEM (559) CHANGED TO PART NO. 1EN51-6B AND CONNECTED AS SHOWN, ON AIRPLANES INCORPORATING TCTO 1T-33-545

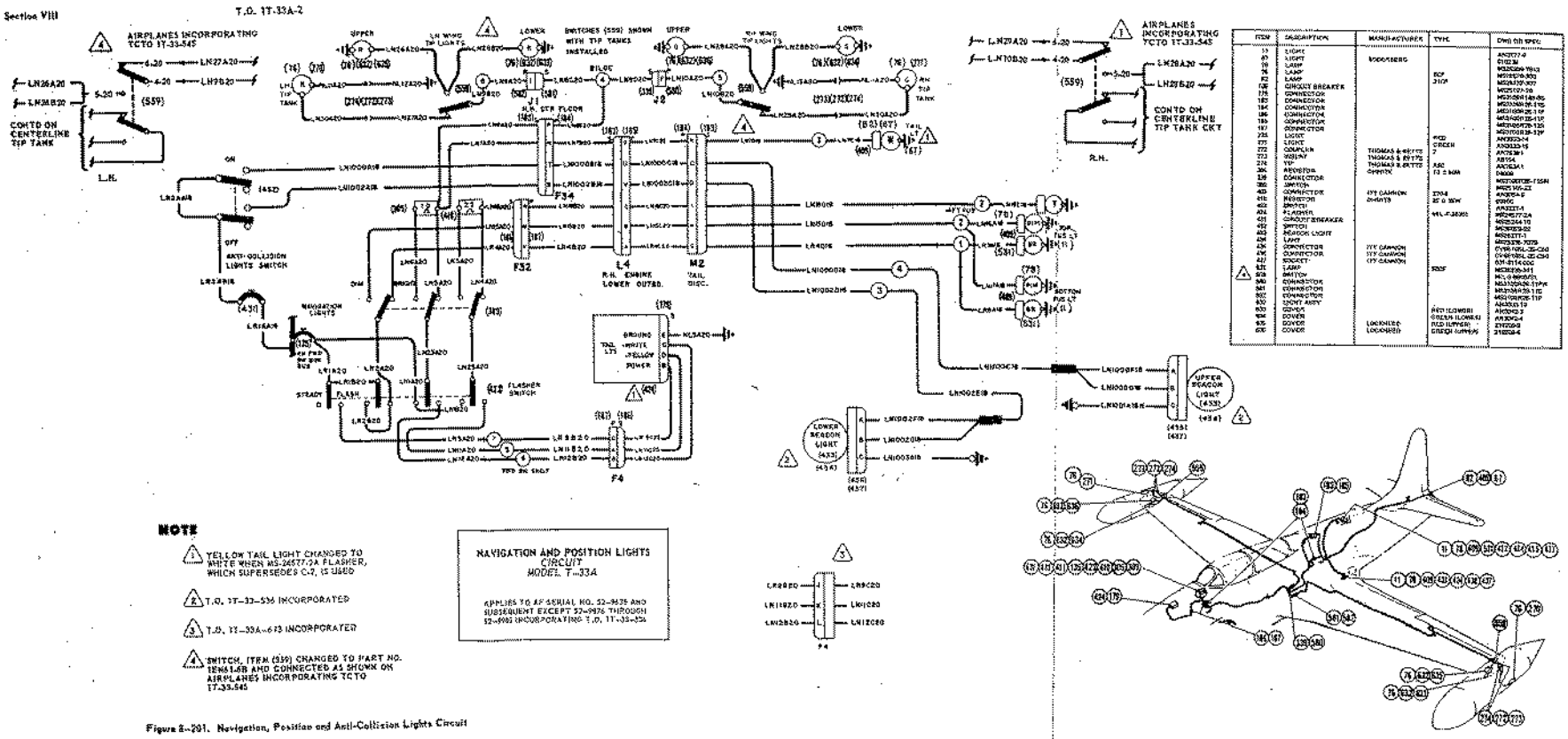
NAVIGATION AND POSITION LIGHTS CIRCUIT MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4127 THROUGH 51-4340 INCORPORATING T.O.'S 1T-33A-42 AND 1T-33-536



ITEM	DESCRIPTION	MANUFACTURER	TYPE	DWG OR SPEC
11	LIGHT			AN3177-8
47	LIGHT	LEAMICATOR OR GOODERSON		1380 OR 615028
78	LAMP			MS25266-7012
79	LAMP			MS25266-7012
82	LAMP		RED 210	MS25266-307
106	CIRCUIT BREAKER			MS25266-307
128	CONNECTOR			5439E106-10
183	CONNECTOR			MS27484T10SB8S
184	CONNECTOR			MS3106F28-21S
185	CONNECTOR			MS3100F28-21P
4 186	CONNECTOR			MS3100F28-21P
188	CONNECTOR			MS3106F28-12S
189	CONNECTOR			MS3100F28-12P
270	LIGHT		RED	MS3106F28-12S
271	LIGHT		GREEN	AN3422-14
272	COUPLER	THOMAS & BETTS	Y	AN3423-15
273	INSERT	THOMAS & BETTS		AC19-087
274	TIP	THOMAS & BETTS		A6184
4 286	RESISTOR	OHMITE	470	AN7832A1
288	CONNECTOR		10 Ω 50W	5M206
289	SWITCH			MS3100A28-15SW
290	CONNECTOR	ITT CANNON		MS27484T10SB8S
410	RESISTOR	OHMITE	220W	MIL-R-26301
415	RESISTOR	OHMITE	25 Ω 25W	5M206-6
423	SWITCH		25W10 Ω	5206C
424	FLASHER			5M206
431	CIRCUIT BREAKER			AN3227-1
432	SWITCH		MIL-F-26301	MS25477-2A
433	BEACON LIGHT			MS25346-10
434	LAMP			MS24659-22
435	CONNECTOR	ITT CANNON		MS3227-1
436	CONNECTOR	ITT CANNON		MS3102R-7S7P
437	SOCKET	ITT CANNON		CVR61061-18-C50
440				CVR61061-18-C50
441				501-3114-006
4 442	LAMP		SOCK	MS3102R28-21P
4 443	SWITCH			MS3102R28-21P
4 12 459	CONNECTOR			MS3106F28-21S
460	CONNECTOR			MIL-S-8805-31
461	CONNECTOR			MS3102R28-10PW
462	CONNECTOR			MS3106F28-21S
505	LIGHT ASSY			MS3102F28-11P
533	COVER			AN3422-10
534	COVER		RED FLOWER	AN3042-5
535	COVER		GREEN FLOWER	AN3042-6
536	COVER	LOCKHEED	RED SUPPORT	2702004-5
537	COVER	LOCKHEED	GREEN SUPPORT	2702004-6

Figure 8-200. Navigation, Position and Anti-Collision Lights Circuit



ITEM	DESCRIPTION	MANUFACTURER	TYPE	DWG OR SPEC
33	LIGHT			AN3777-6
69	LIGHT	MOORESBORO		51B2-N
78	LAMP			MS25264-1943
79	LAMP			MS25264-1820
82	LAMP			MS25237-327
178	CIRCUIT BREAKER		ECP 2101	MS25237-327
178	CONNECTOR			MS25237-10
183	CONNECTOR			MS3106R14S-6S
184	CONNECTOR			MS3106R-28-21S
186	CONNECTOR			MS3106R28-21P
188	CONNECTOR			MS3450W28-21S
193	CONNECTOR			MS3450W28-21P
235	LIGHT			MS3170B28-22P
275	LIGHT			AN3032-14
276	COUPLER	THOMAS & BETTS	2	AN3033-14
303	RELAY	THOMAS & BETTS		AN3156-1
304	TIP	THOMAS & BETTS		AB154
306	RECEPTOR	CANNON	3302	AN3631
308	CONNECTOR		3302	D4606
380	SWITCH			MS27035E-155N
403	CONNECTOR	ITT CANNON	3304	MS25105-22
415	RECEPTOR	CANNON	3302	AN3057-2
422	SWITCH			4NS221-1
424	FLASHER		491-P-28030	MS25277-2A
425	CIRCUIT BREAKER			MS25264-10
426	SWITCH			MS27035-22
428	MOTOR UNIT			MS25277-1
429	LIGHT			6N3036-7079
430	CONNECTOR	ITT CANNON		CVM-16RL-2S-C30
431	CONNECTOR	ITT CANNON		CVM-16RL-2S-C30
432	SOCKET	ITT CANNON		631-814-000
433	LAMP		3302	MS25236-341
434	SWITCH			MS1-9-M6R5P1
440	CONNECTOR			MS3126R-TYPE
441	CONNECTOR			MS3126R-TYPE
442	CONNECTOR			MS3126R-TYPE
450	CONT ASSY			AN3033-10
454	COVER		RECEPTACLE	AN3042-2
455	COVER		GROUND (LOWER)	AN3042-4
456	COVER	LOCKHEED	RED (UPPER)	2N3042-6
458	COVER	LOCKHEED	GREEN (UPPER)	2N3042-8

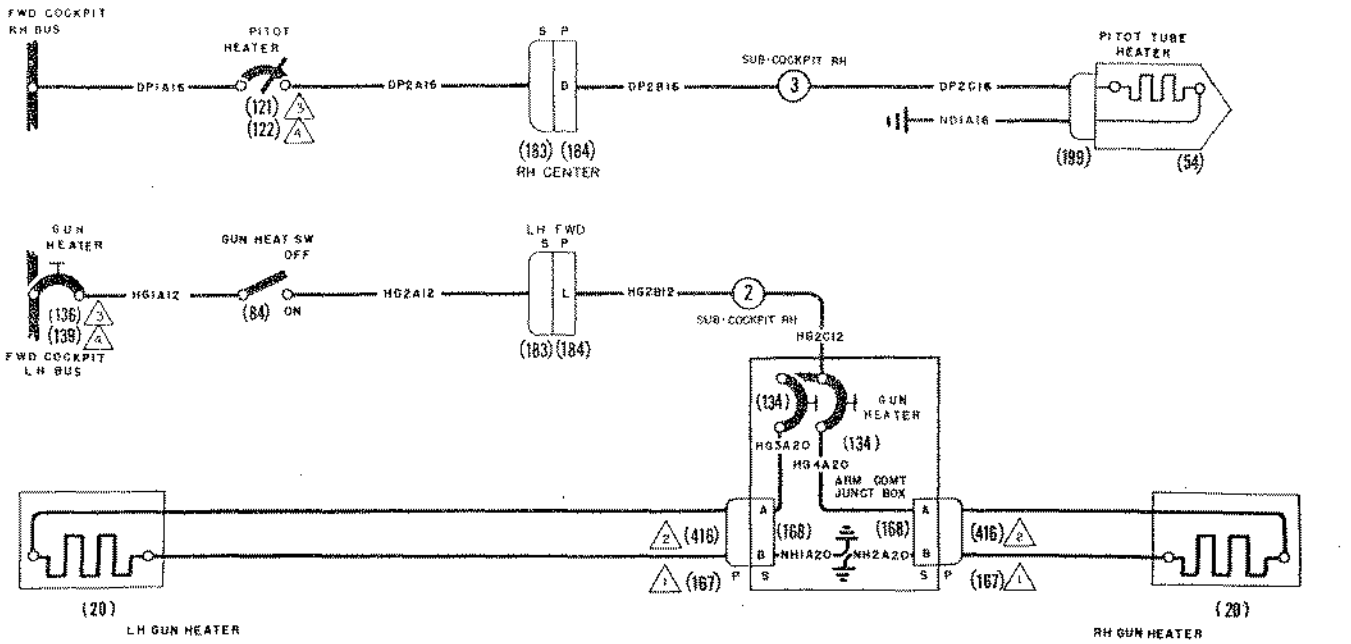
NOTE

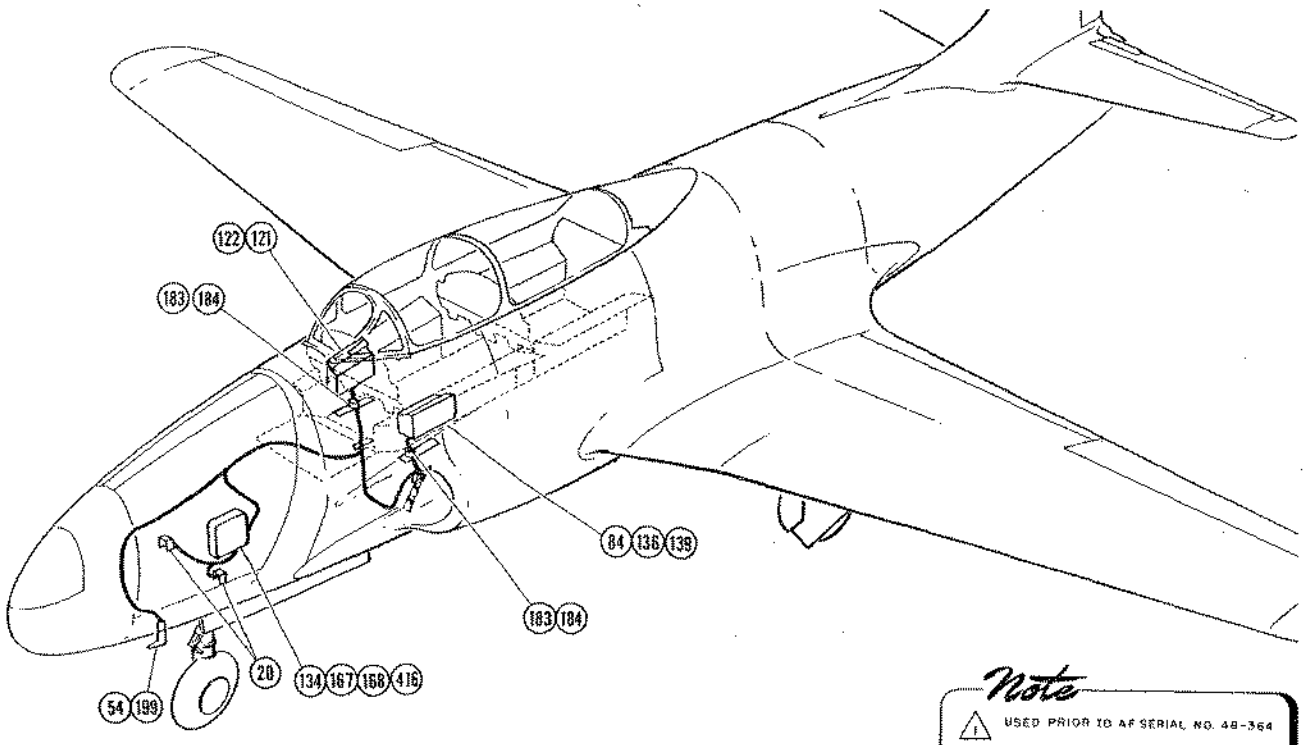
1. YELLOW TAIL LIGHT CHANGED TO WHITE WHEN MS-26577-2A FLASHER, WHICH SUPERSEDES C-2, IS USED
2. T.O. 1T-33-536 INCORPORATED
3. T.O. 1T-33A-673 INCORPORATED
4. SWITCH, ITEM (559) CHANGED TO PART NO. 1ENS14B AND CONNECTED AS SHOWN ON AIRPLANES INCORPORATING TCTO 1T-33-545

NAVIGATION AND POSITION LIGHTS CIRCUIT
MODEL T-33A

AIRPLANES TO AF SERIAL NO. 52-9835 AND SUBSEQUENT EXCEPT 52-9976 THROUGH 52-9982 INCORPORATING T.O. 1T-33-536

Figure 8-291. Navigation, Position and Anti-Collision Lights Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
20	GUN HEATER	GFP	J-4	24946
54	PITOT HEATER	GFP	G-1	AN5812-1
84	SWITCH			AN3021-2
2 121	CIRCUIT PROTECTOR			AN3160-10
4 122	CIRCUIT PROTECTOR			AN3160-15
134	CIRCUIT PROTECTOR			AN3161-P5
3 136	CIRCUIT PROTECTOR			AN3161-P15
4 139	CIRCUIT PROTECTOR			AN3161-P35
1 167	CONNECTOR	GFP		AN3106-12S-3P
168	CONNECTOR			AN3102-12S-3S
183	CONNECTOR			AN3106-2B-11S
184	CONNECTOR			AN3102F-2B-11P
199	CONNECTOR			AN3115-1
2 416	CONNECTOR	GFP		AN3108-12S-3P

Note

1. USED PRIOR TO AF SERIAL NO. 48-364
2. USED ON AF SERIAL NOS. 48-364 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 51-4266
4. USED ON AF SERIAL NOS. 51-4266 AND SUBSEQUENT

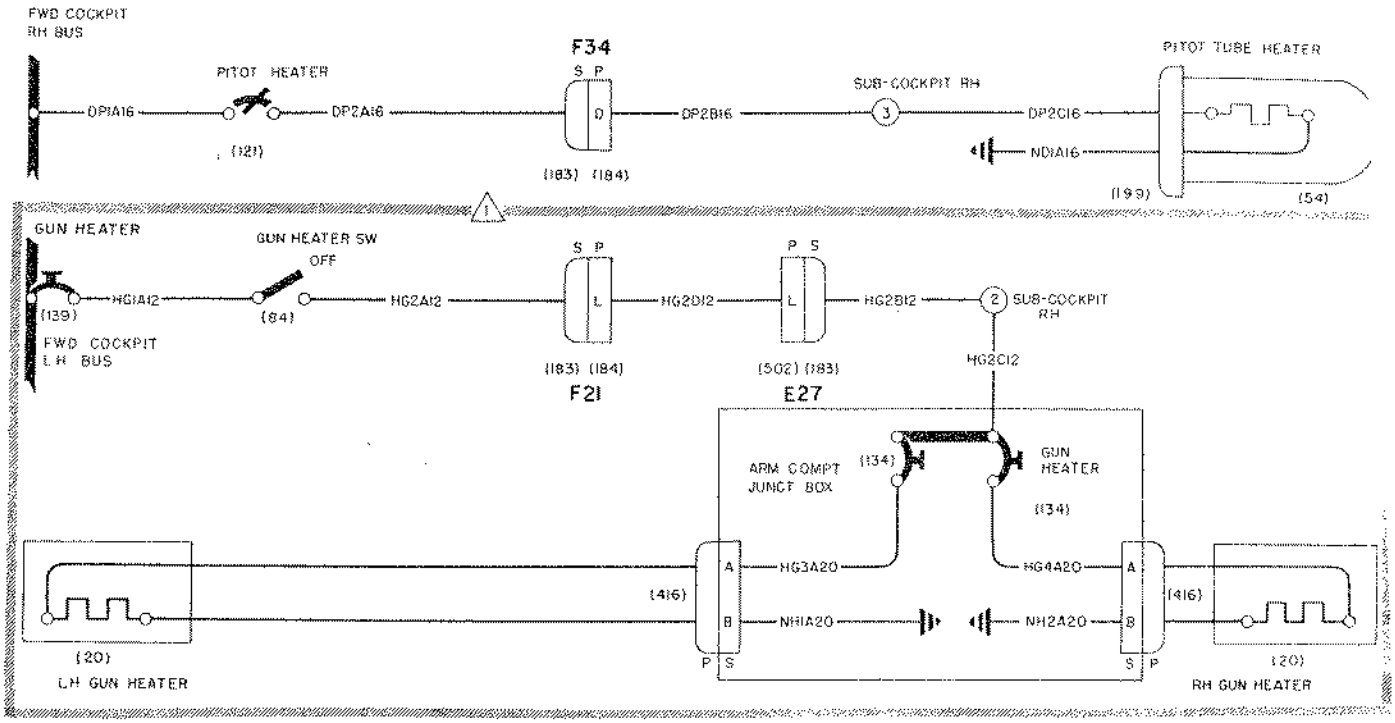
GUN AND PITOT HEATER CIRCUITS

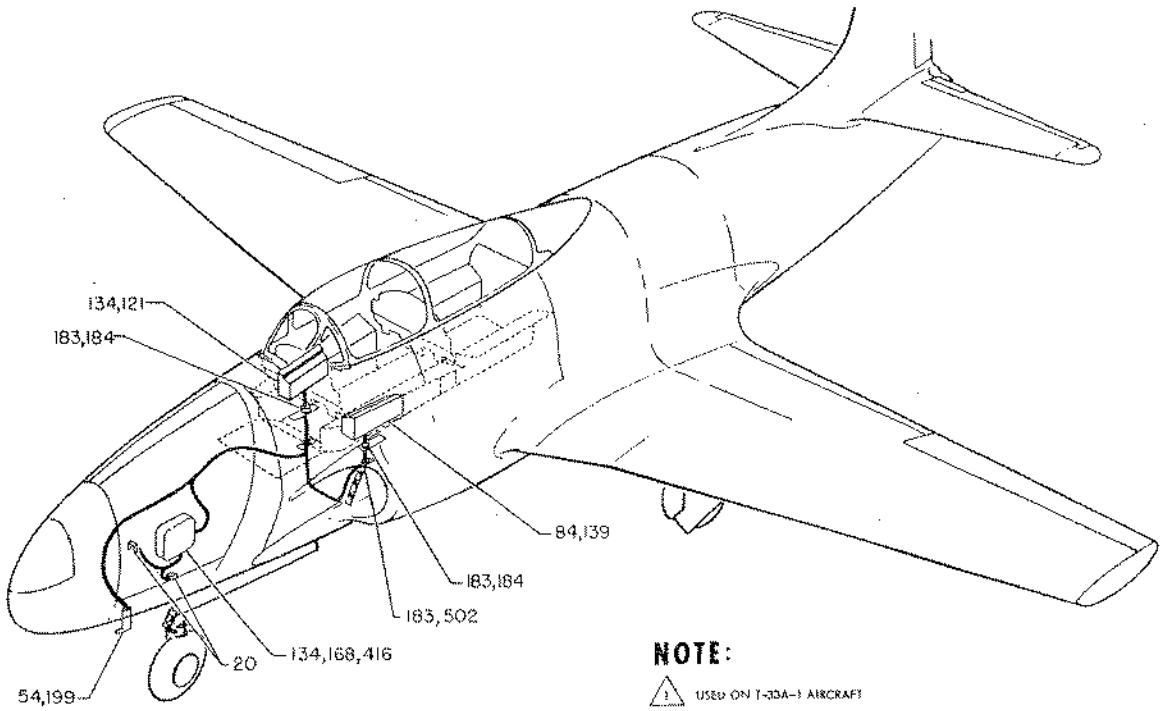
MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THRU 51-6818

AB 7566

Figure 8-202. Gun and Pitot Heater Circuits





NOTE:

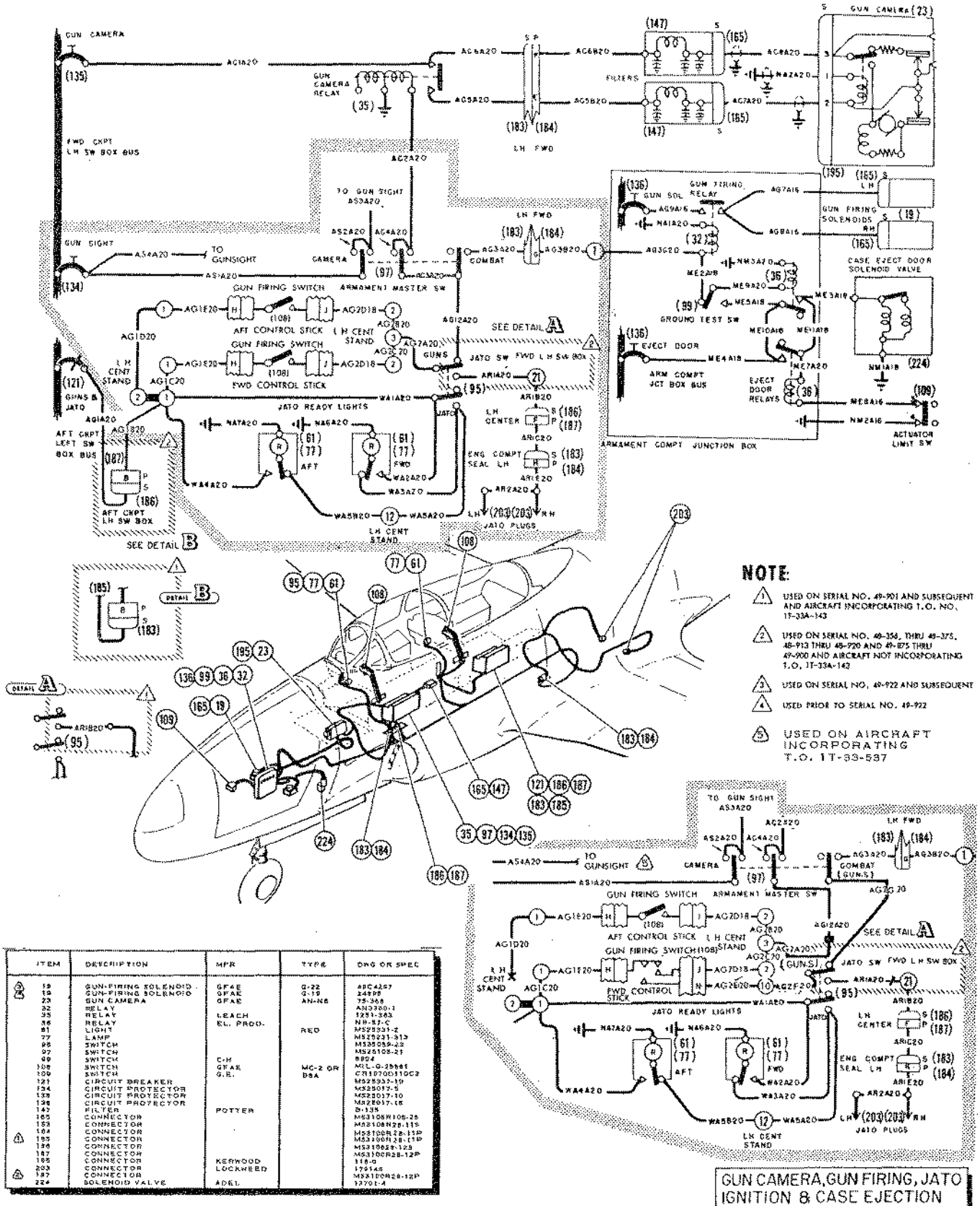
1 USED ON T-33A-1 AIRCRAFT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
20	GUN HEATER	GFAE	J-4	24946
54	PITOT HEATER	GFAE	G-1	AN5812-1
84	SWITCH			AN3021-2
121	CIRCUIT PROTECTOR			AN3160-15
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
168	CONNECTOR			AN3102-12S-3S
183	CONNECTOR			AN3106-20-11S
184	CONNECTOR			AN3102P-28-11P
199	CONNECTOR			AN3115-1
416	CONNECTOR			AN3108-12S-3P
502	CONNECTOR			AN3100A-28-12P

GB 8876
M20-480-8-113

GUN AND PITOT HEATER CIRCUITS
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6819 AND SUBSEQUENT

Figure 8-203. Gun and Pitot Heater Circuits



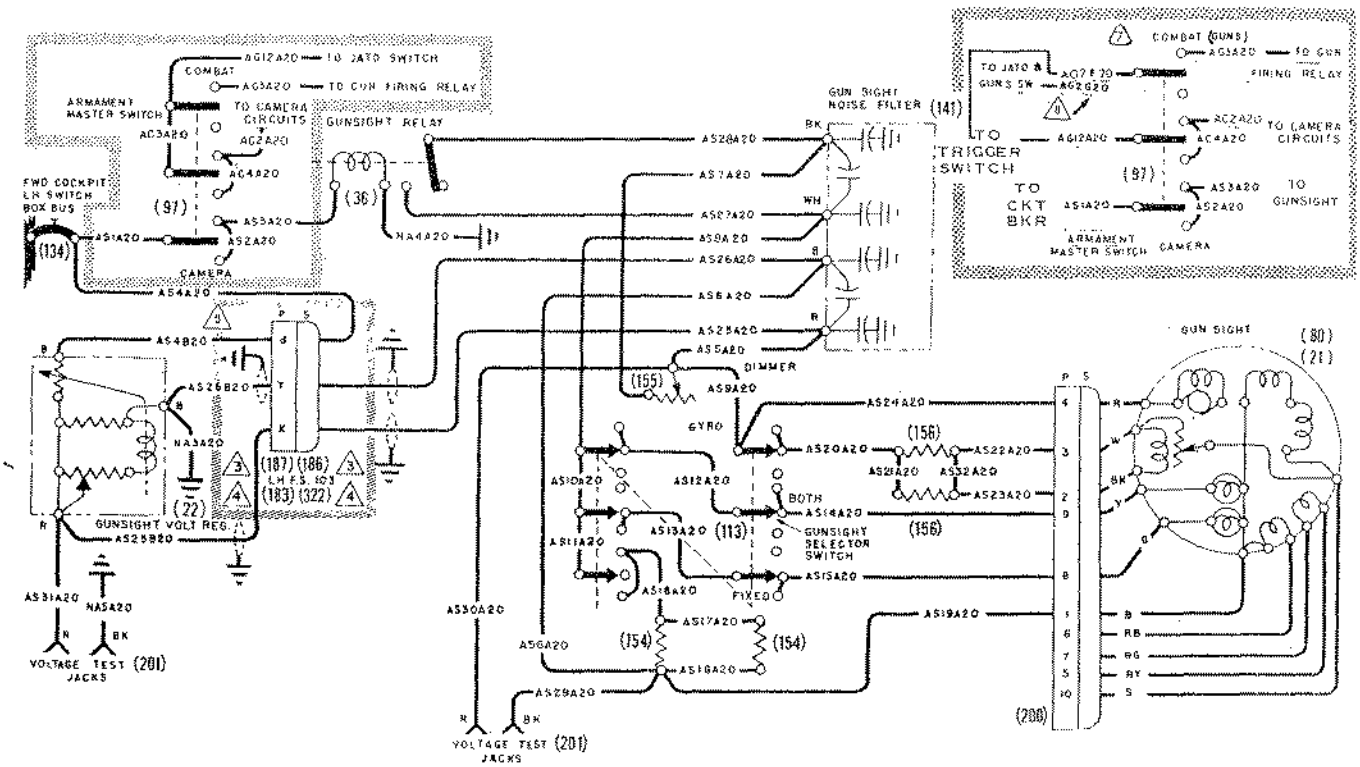
	ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	19	GUN-FIRING SOLENOID	GFAE	G-22	AFC4267
	19	GUN-FIRING SOLENOID	GFAE	G-19	24690
	23	GUN CAMERA	GFAE	AN-N6	35-368
	32	RELAY			AN3320-1
	35	RELAY	LEACH		1291-583
	36	RELAY	EL. PROD.		NR-57-C
	81	LIGHT		RED	MS25231-2
	77	LAMP			MS25231-313
	95	SWITCH			M5350S9-22
	97	SWITCH			MS26108-21
	99	SWITCH	C-H		8804
	108	SWITCH	GFAE	MC-2 OR	MC-G-28681
	109	SWITCH	G.E.	D8A	CR1070D110C2
	121	CIRCUIT BREAKER			MS25333-39
	134	CIRCUIT PROTECTOR			MS25017-5
	135	CIRCUIT PROTECTOR			MS25017-10
	136	CIRCUIT PROTECTOR			MS25017-16
	147	FILTER	POTTER		B-135
	165	CONNECTOR			MS3108W10S-2S
	183	CONNECTOR			MS3108W28-11S
4	184	CONNECTOR			MS3100R28-11P
	185	CONNECTOR			MS3100R28-11P
	186	CONNECTOR			MS3100R28-12S
	187	CONNECTOR			MS3100R28-12P
	195	CONNECTOR	KEYWOOD		316-0
	203	CONNECTOR	LOCKHEED		179146
4	187	CONNECTOR			MS3100R28-12P
	224	SOLENOID VALVE	ADEL		13701-4

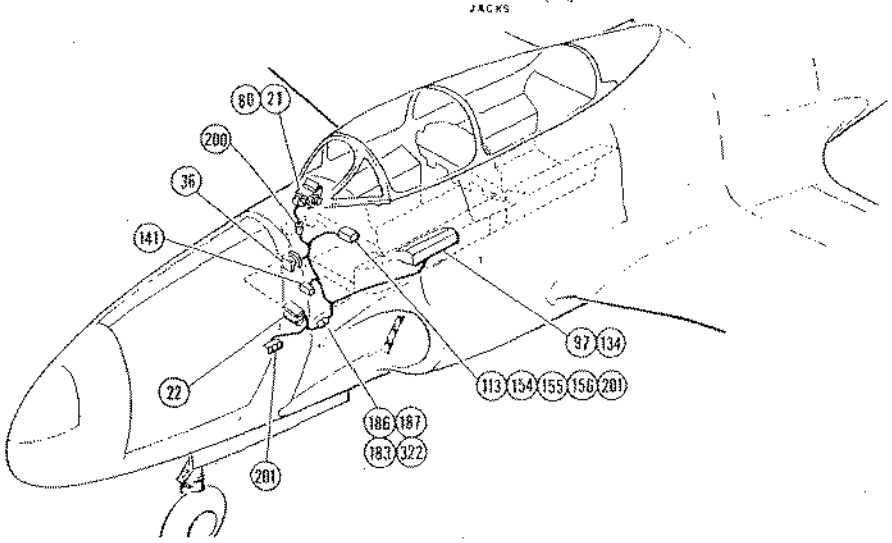
GUN CAMERA, GUN FIRING, JATO IGNITION & CASE EJECTION DOOR CIRCUITS

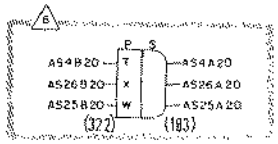
MODEL T-33A

APPLIES TO SERIALS PRIOR TO NO. 50-402

Figure 8-204. Gun Camera, Gun Firing, Jato Ignition and Case Ejection Door Circuits







ITEM	DESCRIPTION	MFR	TYPE	PNG OR SPEC
21	GUNSIGHT	GFAE	K-14B	C-24955-A
22	VOLTAGE REGULATOR	GFAE		8881371
36	RELAY	EL-PROD		MD-67-C
80	LAMP, GUN SIGHT	GFAE		449
97	SWITCH	CIH		MS35109-21
113	SWITCH	CENTRA LAB	HW	28HX7001
134	CIRCUIT PROTECTOR			MS25917-3
141	FILTER	GFAE		MS251841-2
154	RESISTOR	OHMITE	50Ω25W	0356
156	RESISTOR	OHMITE	80Ω25W	0290D
155	RHEOSTAT	OHMITE	80Ω50W	0319
206	RESISTOR	WARD LEONARD		K41924
183	CONNECTOR			MS3106R28-11S
188	CONNECTOR			MS3106R28-12S
187	CONNECTOR			MS3100R28-12P
200	CONNECTOR	GFAE		8381559
201	VOLT TEST JACKS	AMPHENOL		73-1P
322	CONNECTOR			MS3100R28-11P

Note

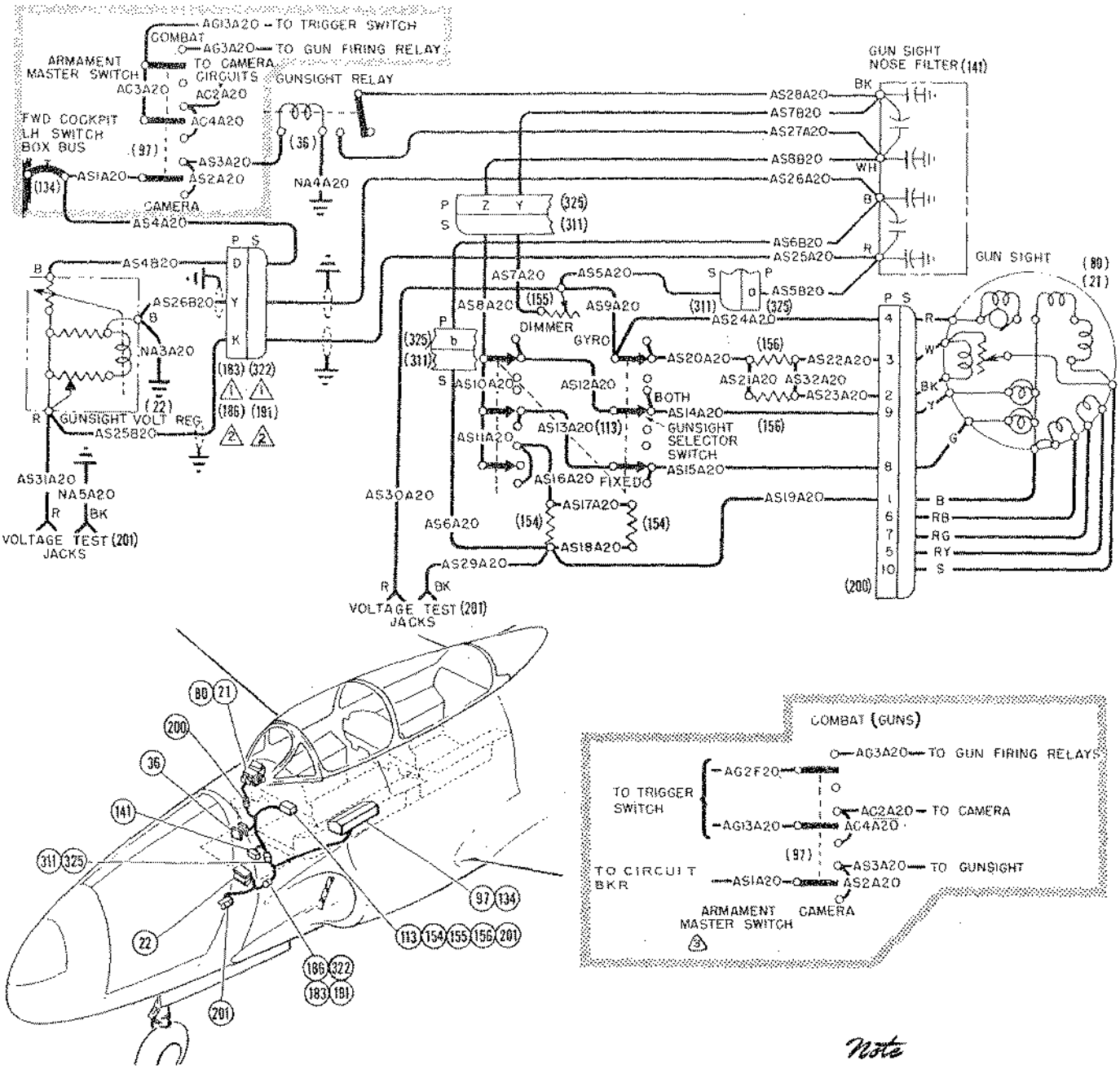
1. USED PRIOR TO AF SERIAL NO 51-4266
2. USED ON AF SERIAL NOS 51-4266 THRU 51-6818
3. USED PRIOR TO AF SERIAL NO 51-6751
4. USED ON AF SERIAL NOS 51-6751 THRU 51-6818
5. USED ON AIRPLANES NOT INCORPORATING T.O. NO 1T-33A-143
6. USED ON AIRPLANES INCORPORATING T.O. NO 1T-33A-143
7. USED ON AIRCRAFT INCORPORATING, T.O. 1T-33-537 CIRCUIT
8. USED ON AIRCRAFT PRIOR TO 50-402

GUN SIGHT CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THRU 51-6818

Figure 8-205. Gun Sight Circuit



Note

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
21	GUNSIGHT	GFAE	K-14B K-14C	C-24955-A MIL-S-6137
22	VOLTAGE REGULATOR	GFAE		SNB1371
36	RELAY	EL-PROD		NB-51-C
80	LAMP, GUNSIGHT	GFAE		480
97	SWITCH	CAE		MS25105-2T
113	SWITCH	CENTRAL LAB	MW	28HX2001
134	CIRCUIT PROTECTOR			MS25012-5
141	FILTER	GFAE		4458116419 SB82189
154	RESISTOR	OHMITE	50025W	0200D
155	RHEOSTAT	OHMITE	50050W	0319
156	RESISTOR	WARD LEONARD		R41R24
183	CONNECTOR			MS3106R28-11S
186	CONNECTOR			MS3106R28-12S
191	CONNECTOR			MS3100R28-12P
200	CONNECTOR	GFAE		5585959
201	VOLT TEST JACKS	AMPHENOL		78-1P
311	CONNECTOR			MS3106R28-15S
322	CONNECTOR			MS3100R28-11P
325	CONNECTOR			MS3100R28-15P

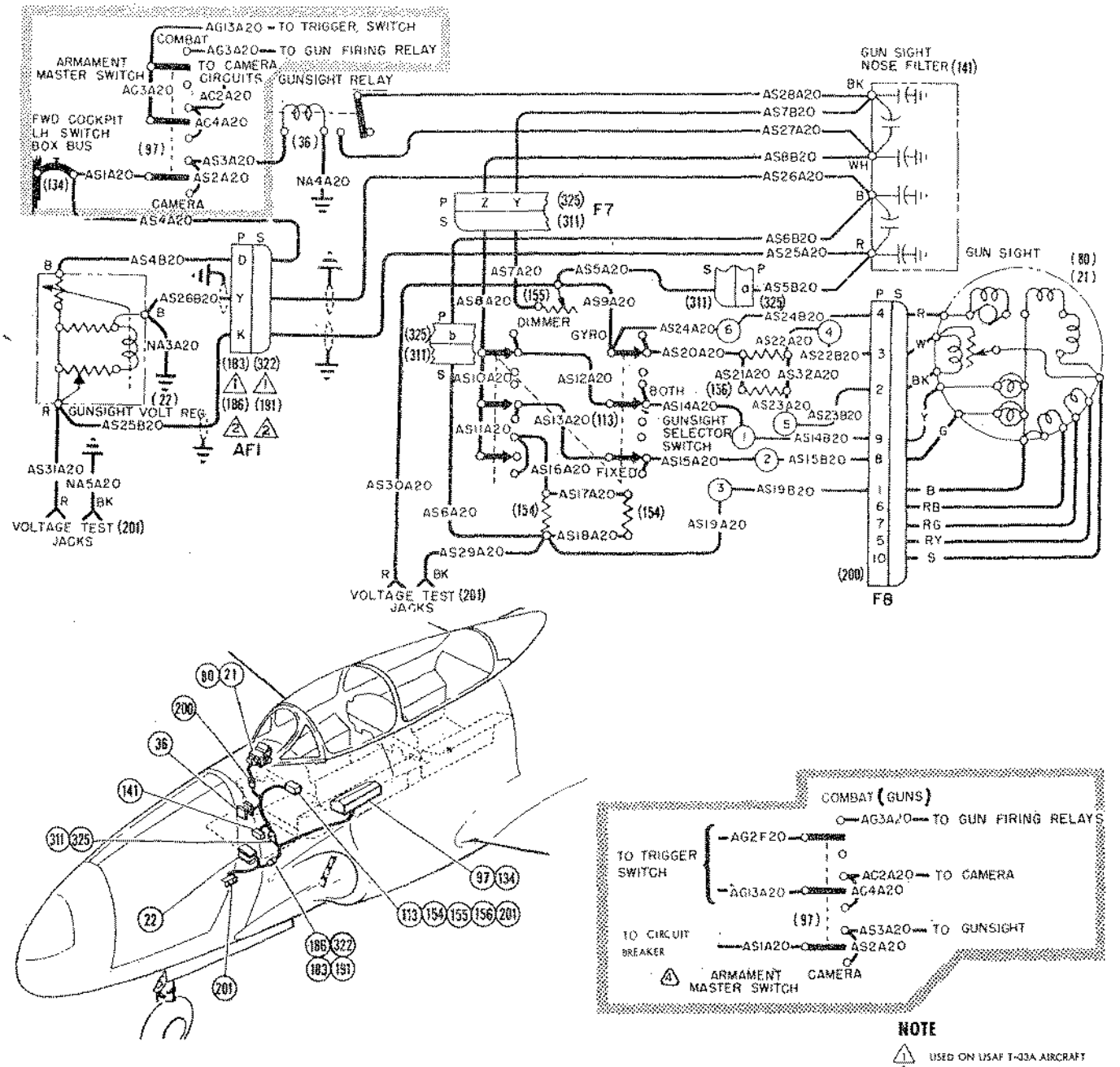
1 USED ON USAF T-33A AIRCRAFT

2 USED ON RCAF AND MDAP T-33A AIRCRAFT

3 USED ON AIRCRAFT INCORPORATING T.O. 1T-33-537

GUN SIGHT CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-6819 THROUGH 52-9759, 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-206. Gun Sight Circuit



NOTE

1. USED ON USAF T-33A AIRCRAFT
2. USED ON RCAF AND MDAP T-33A AIRCRAFT
3. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 54-1525 AND SUBSEQUENT
4. USED ON AIRCRAFT INCORPORATING T.O. 1T-33-537

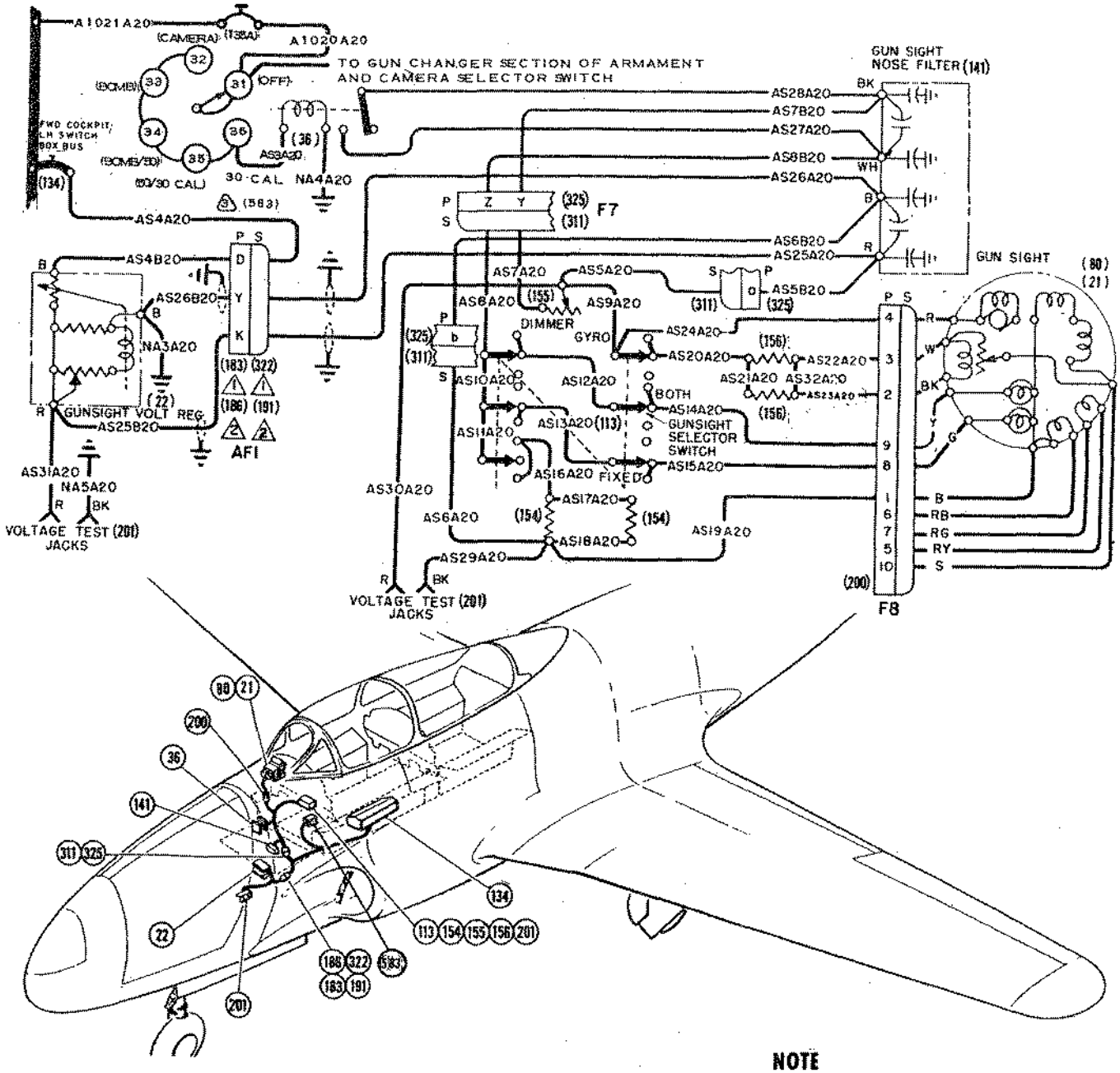
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
21	GUNSIGHT	GFAE	K-14B	C-24985-A
			K-14C	MIL-S-6137
22	VOLTAGE REGULATOR	GFAE		2581271
36	RELAY	ELPROD		ND-57-C
80	LAMP, GUNSIGHT	GFAE		480
97	SWITCH	C. N		MS25106-21
113	SWITCH	CENTRA LAB	HW	28EX3901
124	CIRCUIT PROTECTOR			MS25017-5
4 141	FILTER	GFAE		N45D16419
				5562140
154	RESISTOR	OHMITE	50W±5%	9200D
155	RHEOSTAT	OHMITE	80W±5%	0419
156	RESISTOR	WARD LEONARD		R41724
1 183	CONNECTOR			MS3106R32-11S
2 3 186	CONNECTOR			MS3108R32-12S
1 2 191	CONNECTOR			MS3100R28-12P
200	CONNECTOR	GFAE		5581350
201	VOLT TEST JACKS	AMPHENOL		78-1P
311	CONNECTOR			MS3106R28-15S
1 322	CONNECTOR			MS3100R28-11P
325	CONNECTOR			MS3106R28-15P

GUN SIGHT CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 52-9760 AND SUBSEQUENT, EXCEPT 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 52-2725

Figure 8-207. Gun Sight Circuit



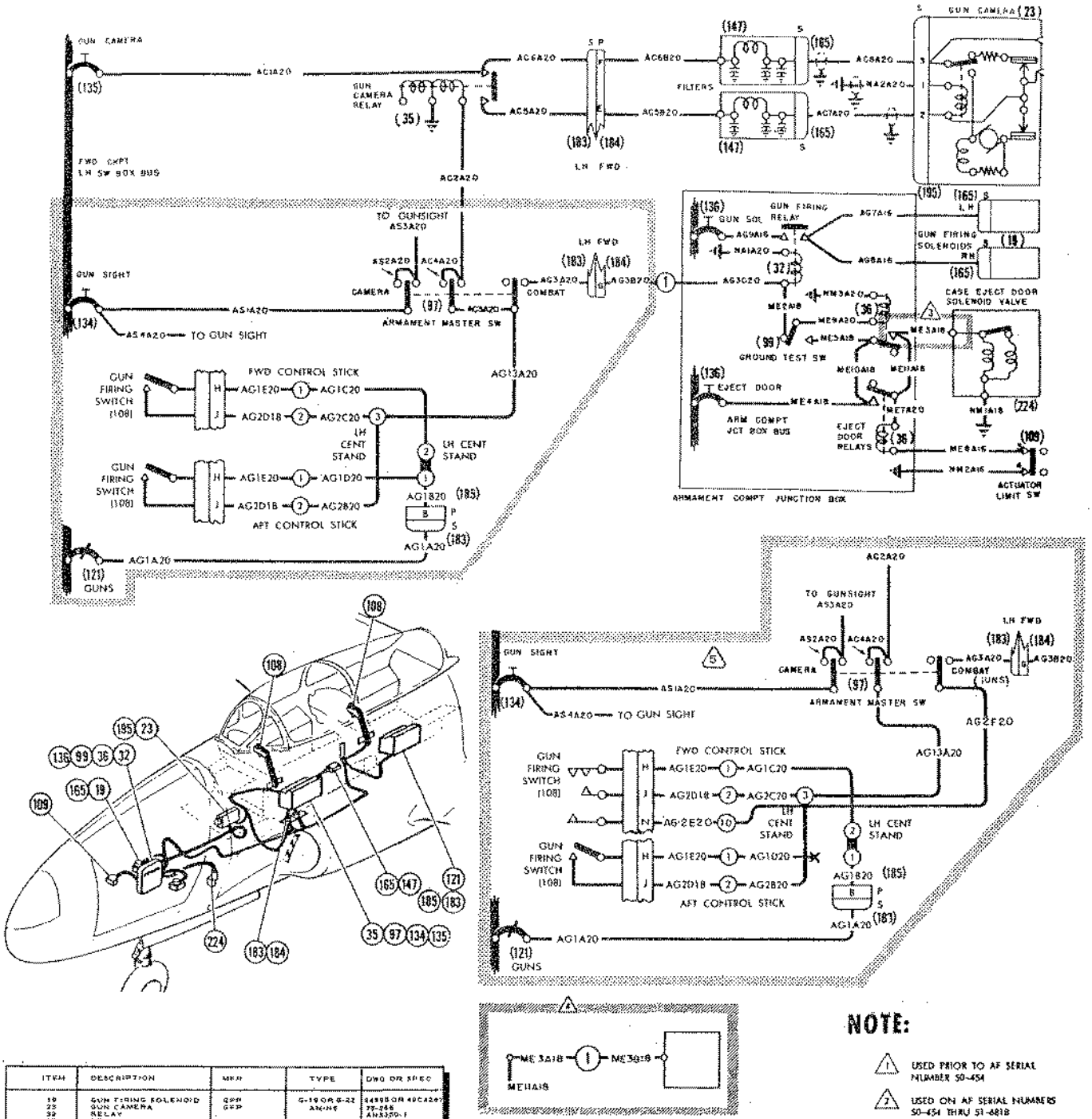
ITEM	DESCRIPTION	MFR	TYPE	DWG OR PART NO.
21	GUNSIGHT		K-14C	48AH297
22	VOLTAGE REGULATOR			5581371
36	RELAY	EL. PROD.		NB-57-C
80	LAMP, GUNSIGHT			5581155
113	SWITCH	CENTRA-LAB		2BHX790T
134	CIRCUIT BREAKER			MS25017-5
136A	CIRCUIT BREAKER			MS25244-1
141	FILTER			5582189
154	RESISTOR	OHMITE	500 25W	0200D
155	RHEOSTAT	OHMITE	85Ω 50W	0319
156	RESISTOR			5581859
183	CONNECTOR			MS3106R-28-11S
186	CONNECTOR			MS3106R-28-12S
191	CONNECTOR			MS3100R-28-12P
200	CONNECTOR			5581559
201	VOLT TEST JACKS	AMPHENOL		78-1P
311	CONNECTOR			MS3106R-28-15S
322	CONNECTOR			MS3100R-28-11P
325	CONNECTOR			MS3100R-28-15P
583	SWITCH			MS25002-6

NOTE

1. USED ON USAF T-33A AIRCRAFT
2. USED ON RCAF AND MDAP T-33A AIRCRAFT
3. THIRD SECTION OF ARMAMENT AND CAMERA SELECTOR SWITCH

GUN SIGHT CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NOS 51-9199 51-9281 AND 52-9150 WITH T.O. 1T-33-529 ACCOMPLISHED

Figure 8-207A. Gun Sight Circuit



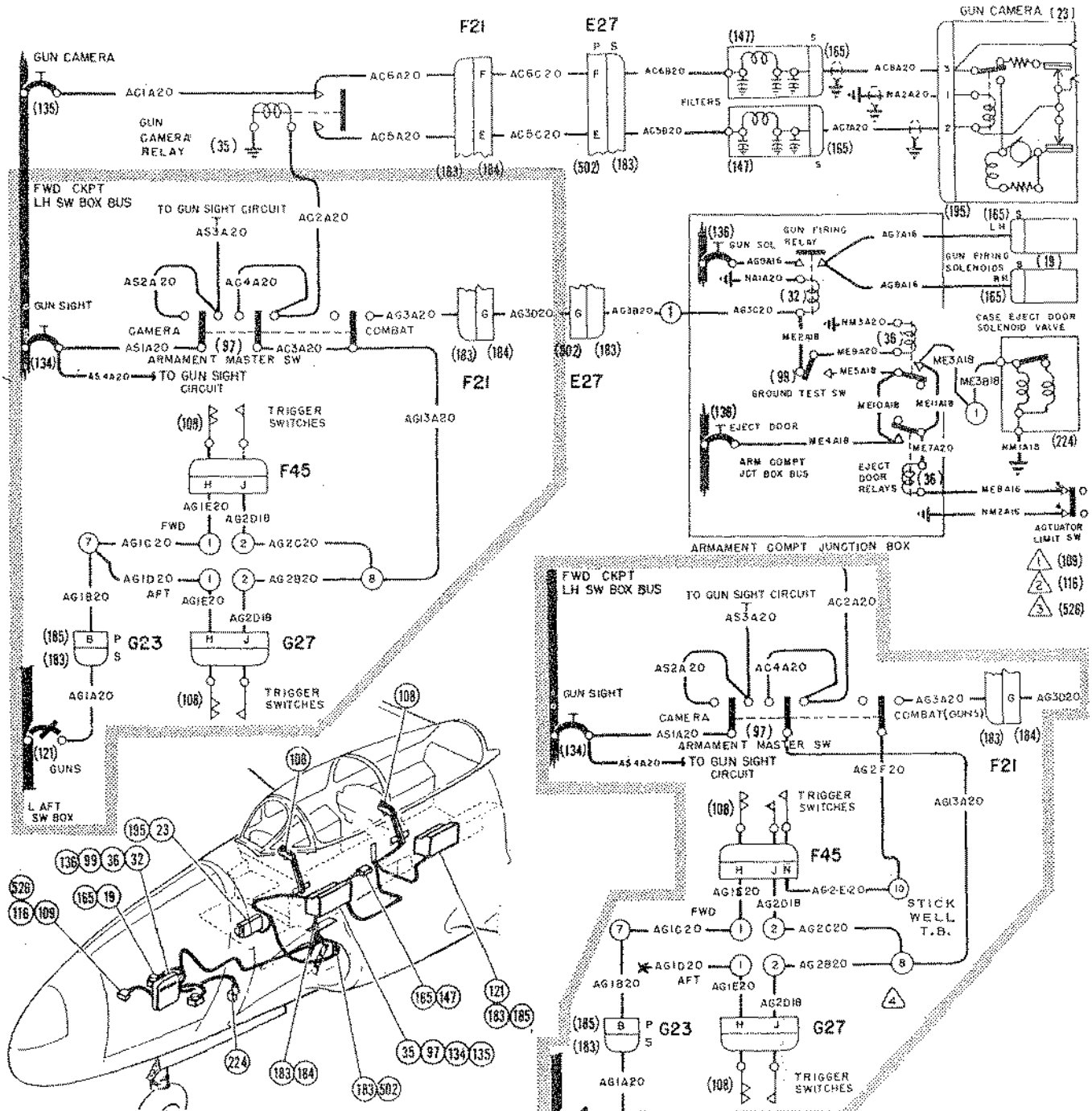
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
19	GUN FIRING SOLENOID	GFP	G-19 OR G-22 AN-M6	84998 OR 40CA267
23	GUN CAMERA	GFP		73-286
32	RELAY			AN3350-1
35	RELAY	LEACH		12E1-953
36	RELAY	EL-PROD		NB-87-C
97	SWITCH			MS27508-21
99	SWITCH	G-E		8904
108	SWITCH	GFP	MC-2 OR 88A	MIL-S-22565
109	SWITCH	G.E.		CR1570D119CA
121	CIRCUIT BREAKER			MS25337-19
134	CIRCUIT PROTECTOR			MS25017-5
135	CIRCUIT PROTECTOR			MS25017-10
136	CIRCUIT PROTECTOR			MS25017-15
147	FILTER	POTTER		B-136
147	FILTER			B-139-B
165	CONNECTOR			MS3106R16-23
183	CONNECTOR			MS3106R10S-2S
184	CONNECTOR			MS3100R28-11P
185	CONNECTOR			MS3100R28-11P
198	CONNECTOR	KENWOOD		115-9
224	SOLENOID VALVE	ADEL		13701-4

GUNNERY CIRCUITS

MODEL T-33A

APPLIES TO AF SERIAL NO. 50-402 THRU 51-6818

Figure 8-208. Gunnery Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
19	GUN FIRING SOLENOID	GFAE	G-19 OR G-22	24898 OR 49C4267
23	GUN CAMERA	GFAE	AN-N6	78-360
32	RELAY			AN3240-1
35	RELAY	LEACH		1251-353
36	EL PROD			780-67-C
97	SWITCH			MS25108-21
99	SWITCH	C-N		8804
108	SWITCH	GFAE	MC2 OR BEX	MIL-A-25661
109	SWITCH	G.E.		CR5170D110C3
116	SWITCH	G.E.		CR5170D313403
121	CIRCUIT BREAKER			MX5397-10
134	CIRCUIT BREAKER			MS25017-9
135	CIRCUIT BREAKER			MS25017-10
136	CIRCUIT BREAKER			MS25017-18
147	FILTER			B-135-B
165	CONNECTOR			MS3106R10S-2S
183	CONNECTOR			MS3108R28-11S
184	CONNECTOR			MS3100R28-11P
185	CONNECTOR			MS3200R28-11P
195	CONNECTOR	KERWOOD		1318-0
224	SOLENOID VALVE	ADEL		13701-4
502	CONNECTOR			MS3108R28-11P
526	SWITCH	ALLOY IND.		808130

Figure 8-209. Gunnery Circuits

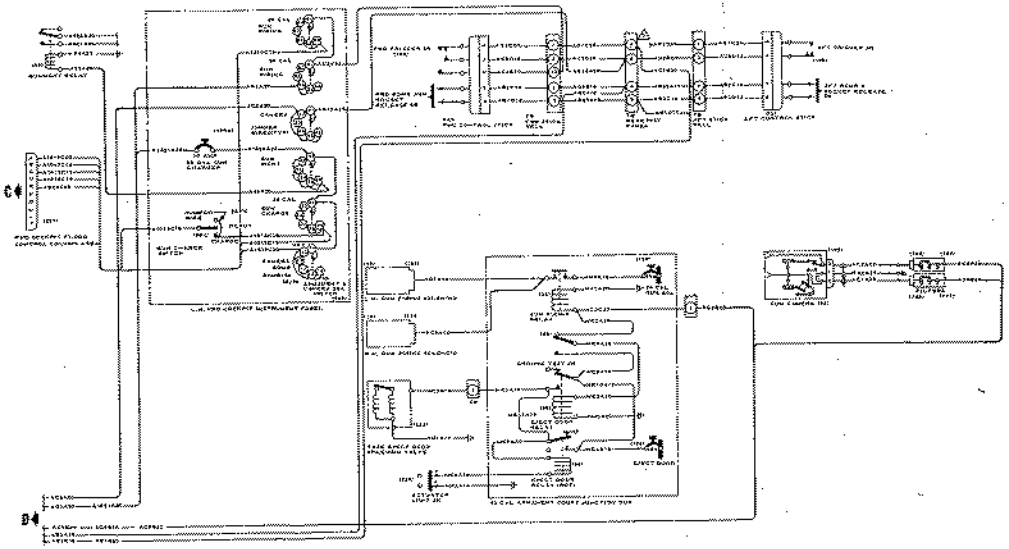
AFLC SHAMA APR 69, 3500

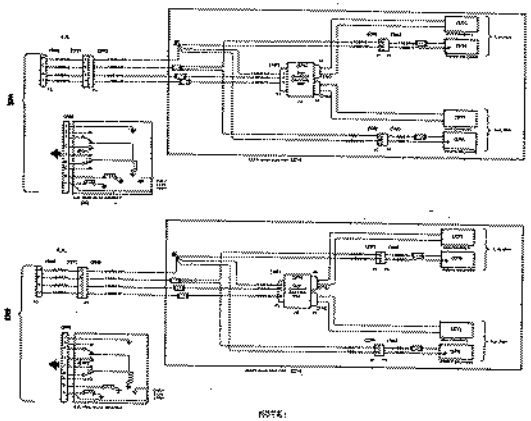
Figure 6-2(9A. Gravity Bomb and Tip Tank Drop Circuit (Sheet 1 of 2)

Change 26 78BA

T.O. 1F-22A-2

September 1988





NOTES:

APPLIES TO F-16A-1 AIRCRAFT WITH T.O.'S 1F-16A-502, 1F-16A-503, 1F-16A-543 AND 1F-16A-545 ACCOMPLISHED

⚠ CONDUCTOR SPLICE AREA IN THE PANEL WELL

⚠ MARK INSTALLATION OF 1J39 AND 1J40 ARE NOT INSTALLED

⚠ WIRE ADJOIN IS DISCONNECTED TO DISABLE THE ART COCKPIT TRIGGER SWITCH IN A/N TU-30 (1F-16A-2-6-1)

⚠ CONDUCTOR SPLICE AREA AT WING ZIP

⚠ SPLICE AREA

NOTE:

THIS CIRCUIT APPLIES TO T-16A-1 AIRCRAFT MODIFIED TO INCORPORATE TYPE CFU-17/A IN CARTRIDGE ELM PROG. T.O. 1F-16A-536

ITEM	DESCRIPTION	MFR. NO.	TYPE	DRAWING OR SPECIFICATION
4	Switch			MS35058-22
19	Wire Fitting Solenoid			MS27058-22
27	Connect		C-22A	AN 929
33	Bomb Rack		AN-26	75-366 (2979)
37	Relay		M4-16	5212-2-2
45	Relay			6482550-3
46	Relay			1351-1053
47	Connector	98828		MCW-82-C
48	Connector			MS3101E-22-19P(60)
49	Clamp			MS3320-7-4(MS3420)
68	Clamp			MS3320-15A16F
69	Switch		TYP	MS3251-1E5146
100	Switch	76526	Semiplug	8804
104	Strip Cap	81649	CT Use	1943M4-05
121	Circuit Breaker		MC-3	MIL-B-25551
122	Circuit Breaker			MS35337-10
131	Circuit Breaker			MS3501-5
134	Circuit Breaker			MS3501-14
134A	Circuit Breaker			MS3501-20
136	Circuit Breaker			MS3501-25
136A	Circuit Breaker			MS3501-35
137	Circuit Breaker			MS3501-37
138	Circuit Breaker			MS3501-30
141	Circuit Breaker			MS3501-25
155	Filter	83668		2-135-B
156	Connector			MS3106A-20-35
194	Connector			MS3106A-20-35
196	Connector			MS3106A-20-35
203	Connector			MS3106A-20-35
204	Connector			MS3106A-20-35
205	Connector			MS3106A-28-21P
206	Connector			MS3106A-28-21P
207	Connector			MS3106A-20-35P
208	Connector			115-8
209	Solenoid Valve	80582		8959-11878-10
210	Connector			12950-4
211	Connector			MS3106A-16-1S
212	Connector			MS3102E-24-2P
213	Connector			MS3102A-18-1P
214	Connector			MS3106A-18-1P
215	Relay			MS3104E-24-11P
216	Solenoid	71468		AS5179-01
217	Connector			78404
218	Connector			MS3106A-18-1S
219	Switch	98814		979-199
220	Switch			MS24523-20
221	Switch	13430		1704-1-28
222	Relay	15435		6042M1-1
223	Relay			MS27027-1-11
224	Shunt		CPU-17A	8459-39
225	Terminal Box	33065		9572
227	Solenoid	22065		9582
228	Solenoid	94982		MS3106A-22-1
229	Connector			MS3106E-24-1P
230	Connector			MS3106E-24-1S
231	Connector			MS3106E-20-15S
232	Switch			MS3500-1
233	Connector			MS3106A-18-1P
234	Connector			MS3106E-24-1P

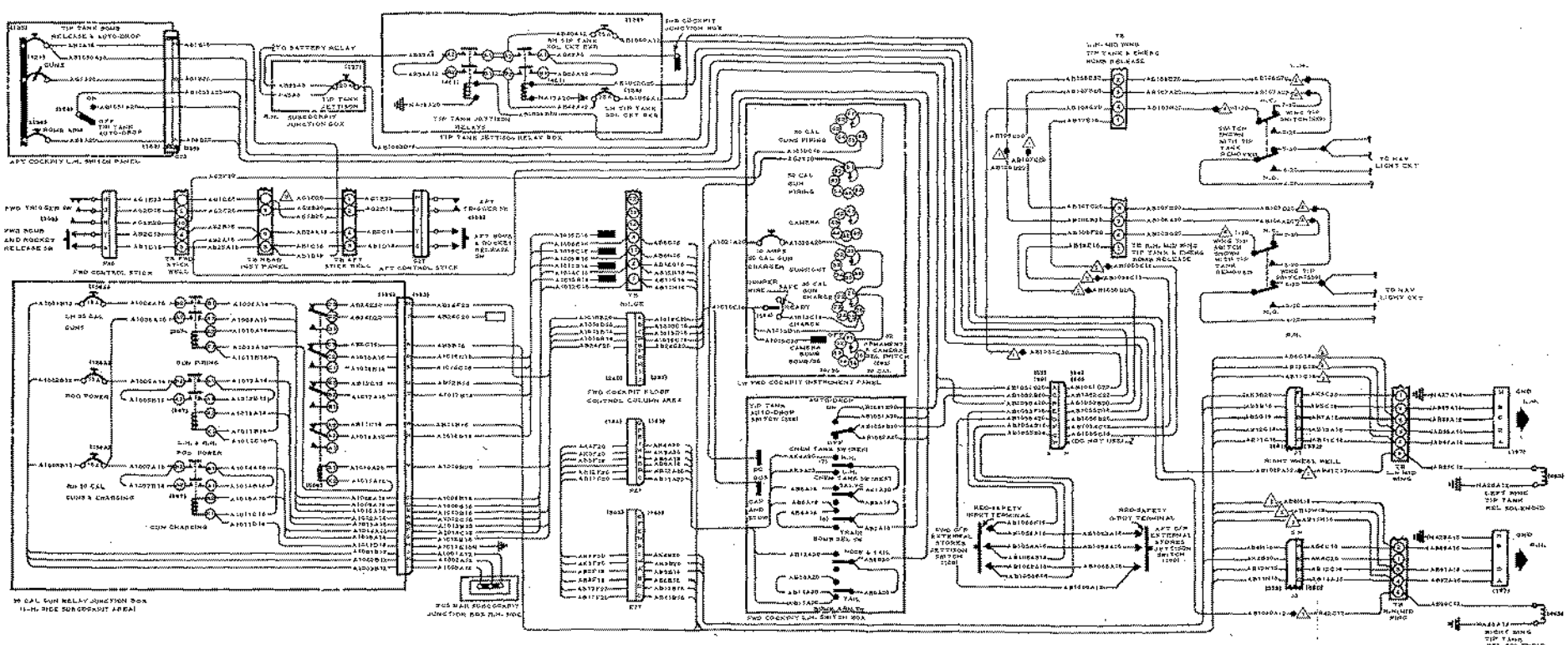
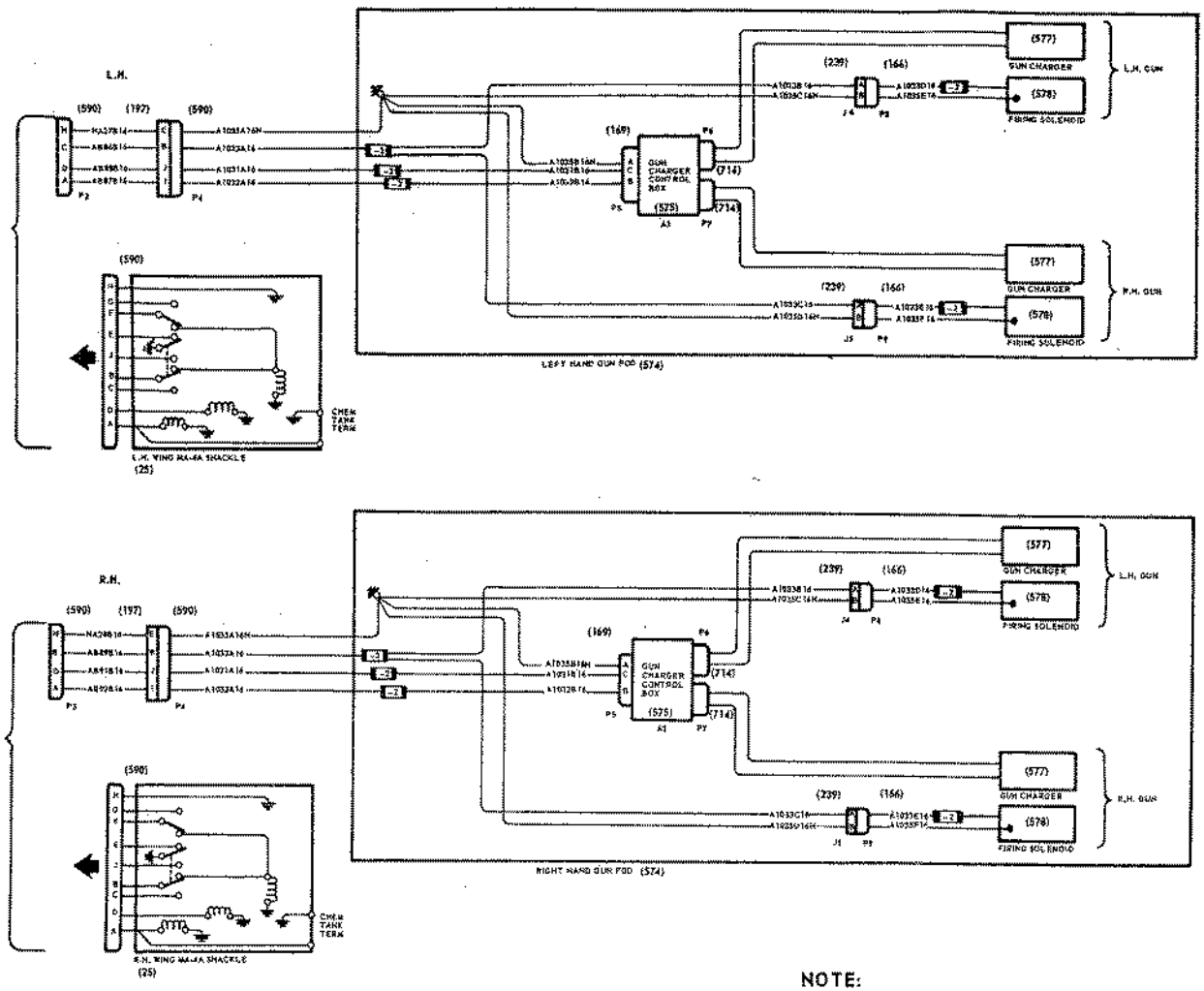


Figure 8-209B. Gunnery, Bomb and Tip Tank Drop Circuit (Sheet 1 of 2)



NOTE:

THIS CIRCUIT APPLIES TO T-33A-5 AIRCRAFT MODIFIED TO INCORPORATE TYPE GPU-1/A 30 CALIBER GUN PODS. (T.O. 1T-33-529)

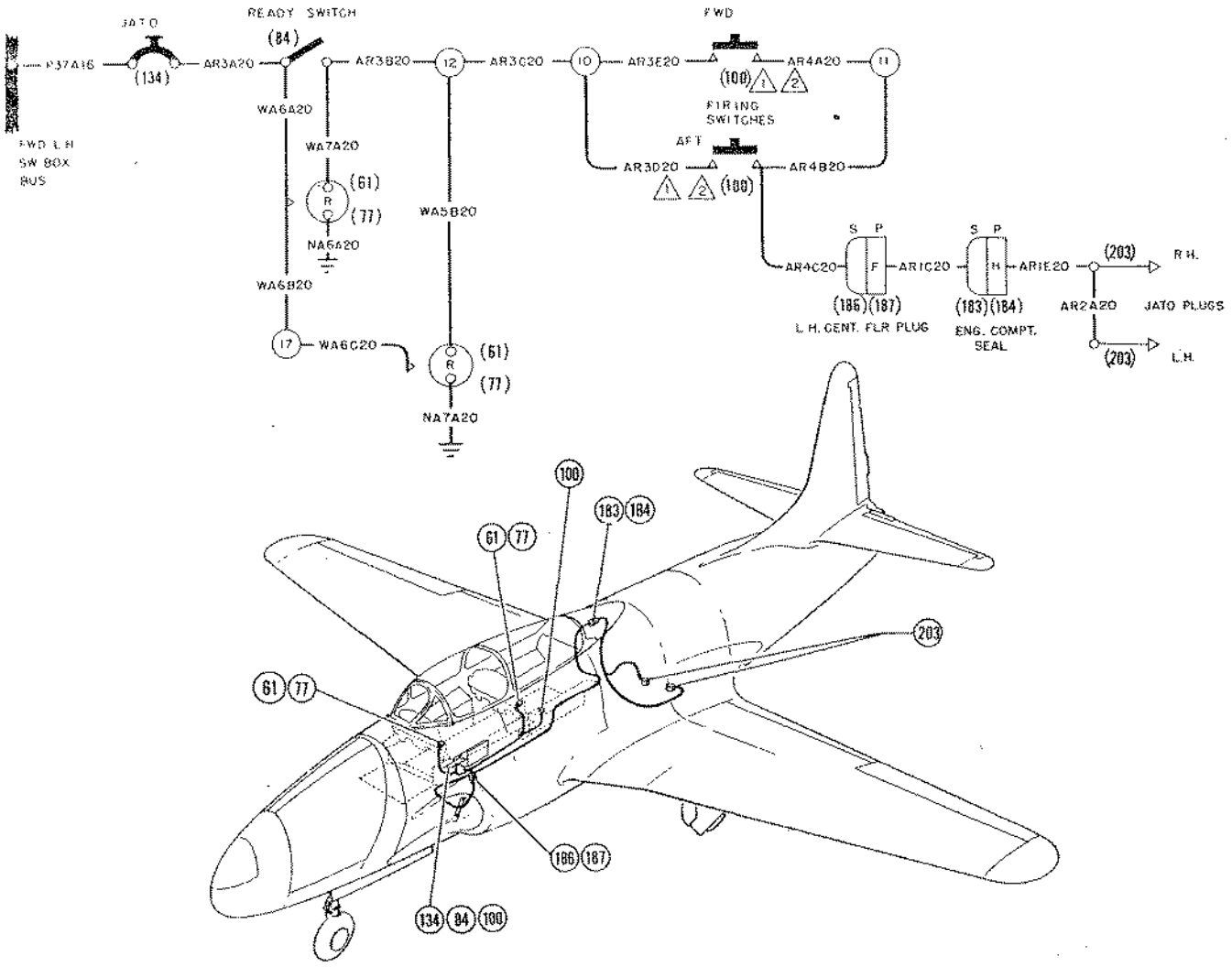
ITEM	DESCRIPTION	MANUFACTURER	TYPE	DRAWING OR SPECIFICATION
6	SWITCH			MS25059-21
7	SWITCH			MS25058-21
25	BOMB RACK		MA-4A	5W4312
57	CONNECTOR			MS3723 - 01F1608N
58	CONNECTOR			MS3723 - 14F1608N
59	CLAMP		90°	MS3723 - 15A16F
60	CLAMP		STRAIGHT	MS3723 - 15916F
100	SWITCH	81640	4 TERM	7041296-05
108	STICK GRIP		MC-2	MIL-G-25561
121	CIRCUIT BREAKER			MS25337-10
135	CIRCUIT BREAKER			MS25017-10
135A	CIRCUIT BREAKER			MS25244-10
136A	CIRCUIT BREAKER			MS25244-15
137	CIRCUIT BREAKER			MS25017-20
138	CIRCUIT BREAKER			MS25017-25
168	CONNECTOR			MS3106R12S-3S
169	CONNECTOR			MS3106R10SL-3S
183	CONNECTOR			MS3106R28-11S
184	CONNECTOR			MS3106R28-11P
185	CONNECTOR			MS3100R28-11P
197	CONNECTOR			MS3101R18-15
237	CONNECTOR			MS3106R18-15
239	CONNECTOR			MS3102R12S-3P
240	CONNECTOR			MS3100R18-1P
259	CONNECTOR			MS3106R28-11SW
461	RELAY			MS24178-D1
463	SOLENOID	71468		18488
502	CONNECTOR			MS3100R28-11P
556	SWITCH			MS24529-22
559	SWITCH	91920		1ENA1-6B
567	RELAY	13605		6042H141
568	RELAY			MS25271-D1
574	GUN POD		GPU-1/A	68D34630
575	CONTROL BOX	32048		90194
577	SOLENOID	32048		90814
578	SOLENOID	98752		68C34603-3
580	CONNECTOR			MS3100R28-11PW
581	CONNECTOR			MS3106R28-11S
582	CONNECTOR			MS3100R28-11P
583	SWITCH			MS25002-6
584	SWITCH			MS24529-31
590	CONNECTOR			MS3100R18-1P
714	CONNECTOR			MS3100R16S-1P

NOTE:

APPLIES TO T-33A-5 AIRCRAFT WITH T.O. 1T-33-529, T.O. 1T-33-537, 1T-33-543 AND 1T-33-545 ACCOMPLISHED.

1. DENOTES SPLICE AREA IN R.H. WHEEL WELL.
2. WIRE INSTALLATION IF "J1" AND "J2" NOT INSTALLED.
3. WIRE AG1D20 IS DISCONNECTED TO MAKE THE AFT TRIGGER SWITCH INOPERATIVE (1T-33-537).
4. DENOTES SPLICE AREA AT WING TIP.
5. R.H. BILGE AREA.

Figure 8-209B. Gunnery, Bomb and Tip Tank Drop Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
△1 100	SWITCH	HETHERINGTON		A34600
△2 100	SWITCH	HETHERINGTON		D204W3RS2R
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102F-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102F-28-12P
203	CONNECTOR	LOCKHEED		179145

AB 5033

Note

△1 USED PRIOR TO AF SERIAL NO. 51-6587

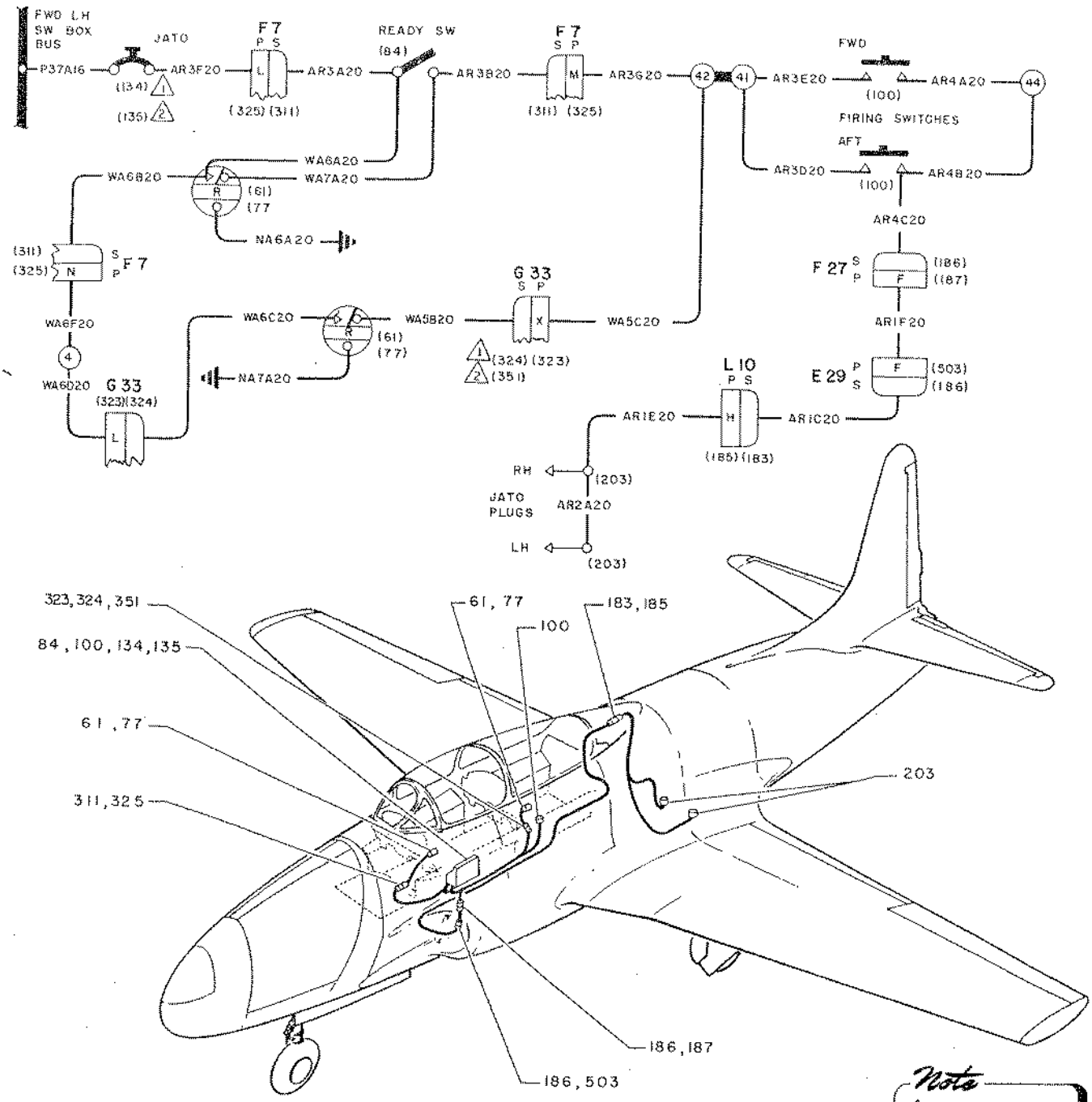
△2 USED ON AF SERIAL NOS. 51-6587 AND SUBSEQUENT

JATO IGNITION CIRCUIT

MODEL T-33A

APPLIES TO AF SERIALS NOS 50-402 THROUGH 51-6818

Figure 8-210. Jato Ignition Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT	HETH.	RED	AN3157-2
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
100	SWITCH			D204W39S2R
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
183	CONNECTOR	LOCKHEED		AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
203	CONNECTOR			179145
311	CONNECTOR			AN3106B-28-15S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
325	CONNECTOR			AN3100A-28-15P
351	CONNECTOR			AN3108B-24-28S
503	CONNECTOR			AN3100A-28-12P

Note

1. USED PRIOR TO AF SERIAL NO. 53-5286
2. USED ON AF SERIAL NO. 53-5286 AND SUBSEQUENT

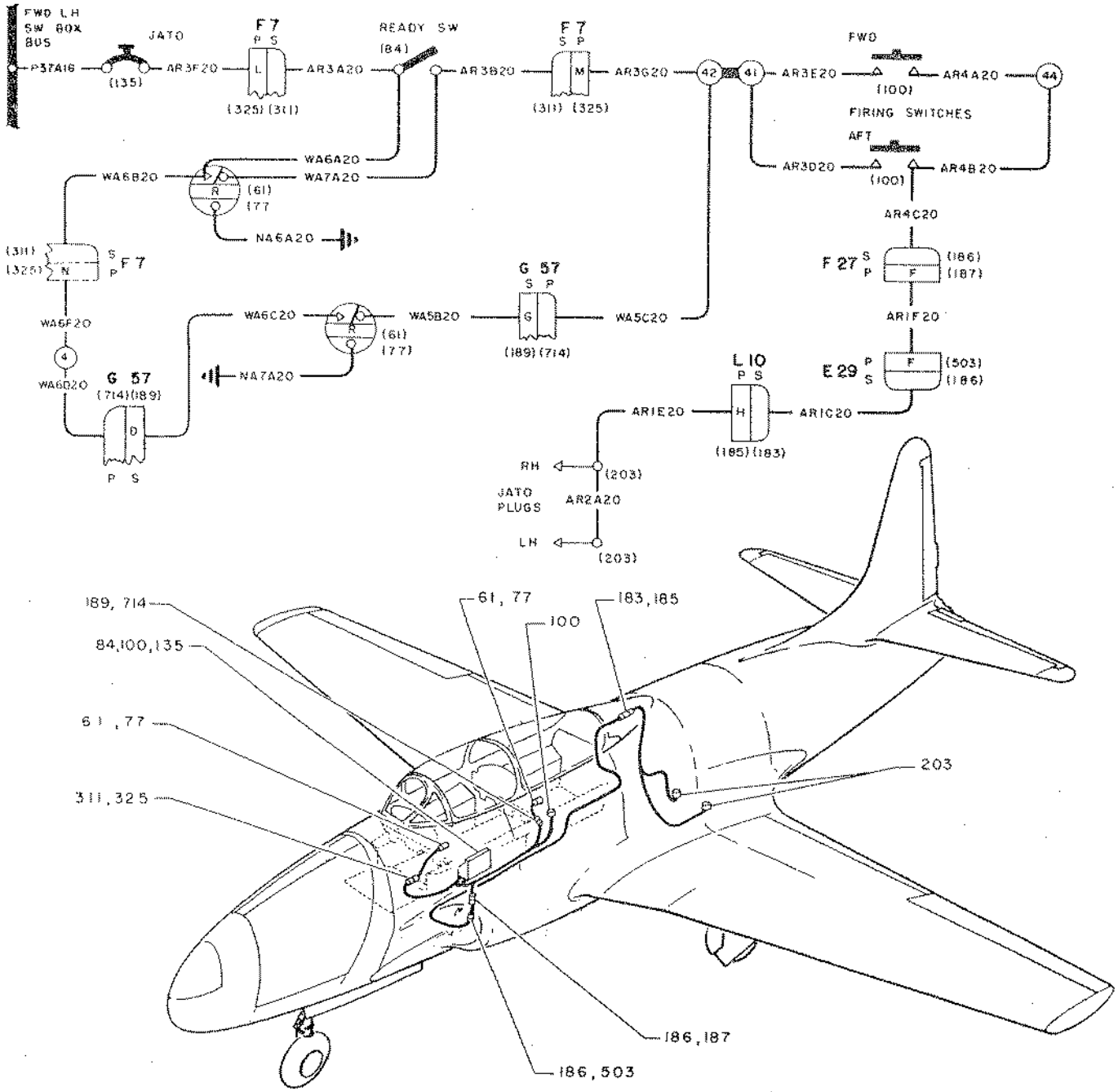
GB 8848
M20-48D-8-120

JATO IGNITION CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 51-6819 AND SUBSEQUENT

Figure 8-211. Jato Ignition Circuit



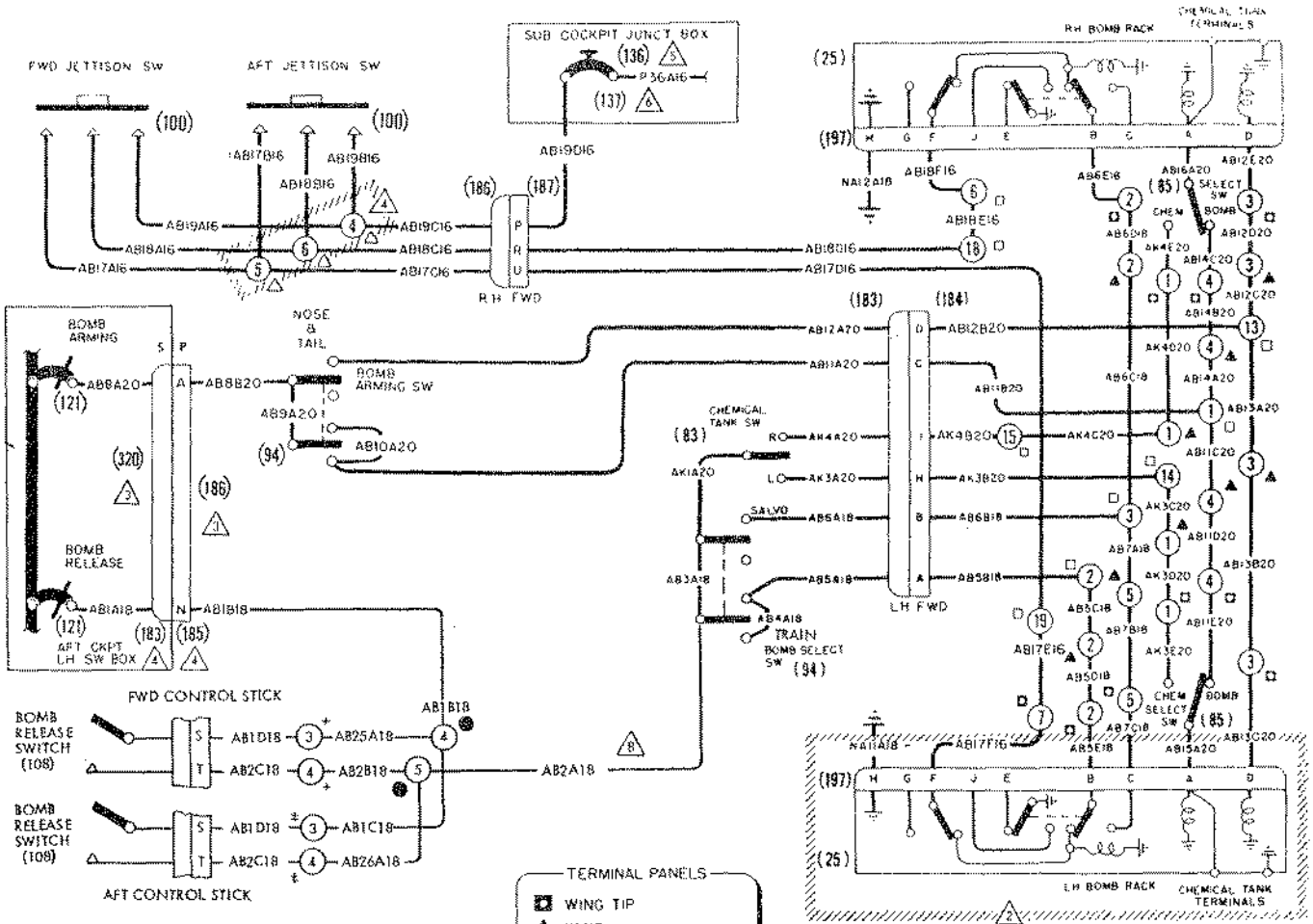
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
61	LIGHT		RED	AN3157-2
77	LAMP			AN3121-313
84	SWITCH			AN3021-2
100	SWITCH	HETH.		D2044V3RS2R
135	CIRCUIT PROTECTOR			AN3161-P10
183	CONNECTOR			AN3106B-28-11S
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
189	CONNECTOR			AN3102A-16S-1S
203	CONNECTOR	LOCKHEED		1779145
311	CONNECTOR			AN3106B-28-15S
325	CONNECTOR			AN3100A-28-15P
503	CONNECTOR			AN3100A-28-12P
714	CONNECTOR			AN3108A-16S-1P

JATO IGNITION CIRCUIT

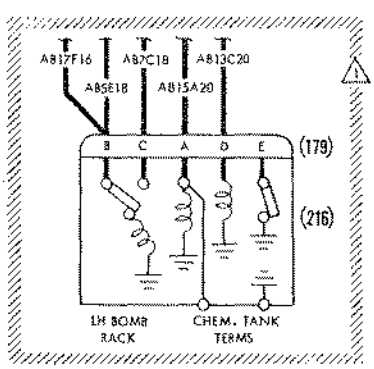
MODEL T-33A-5

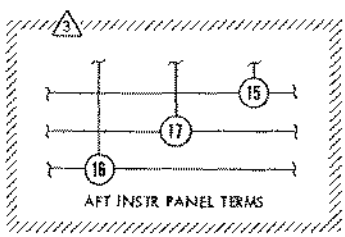
FB 499
EM-20-31-8-401

Figure 8-212. Jato Ignition Circuit



TERMINAL PANELS
- WING TIP
- WING
- HYD COMPT BLKHD
- LH CENTER STAND
- FWD CONTROL STICK
- AFT CONTROL STICK
- RH LOWER





ITEM	DESCRIPTION	MFG	TYPE	DWG OR SPEC
2 25	SHACKLE	GFAE	S-2	24993
83	SWITCH			AN3021-1
85	SWITCH			AN3021-3
94	SWITCH			AN3027-1
108	SWITCH	GFAE	B-8A	MIL-S-5210B
121	CIRCUIT BREAKER			AN3160-10
5 136	CIRCUIT PROTECTOR			AN3161-P15
6 137	CIRCUIT PROTECTOR			AN3161-P20
7 179	CONNECTOR			AN3106B-165-8S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
4 185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
2 197	CONNECTOR			AN3101A-18-1S
1 216	BOMB RACK	GFAE	S-1	24935
3 304	SWITCH	HETHERINGTON		A14600
3 320	CONNECTOR			AN3106B-28-12P

NOTE

1. USED PRIOR TO AF SERIAL NO. 49-914
2. USED ON AF SERIAL NO. 49-914 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 49-901
4. USED ON AF SERIAL NO. 49-901 AND SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 49-992
6. USED ON AF SERIAL NO. 49-992 AND SUBSEQUENT
7. USED ON AIRCRAFT NOT INCORPORATING T.O. NO. 1T-33A-42
8. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-557. ON AIRPLANES INCORPORATING 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 5.

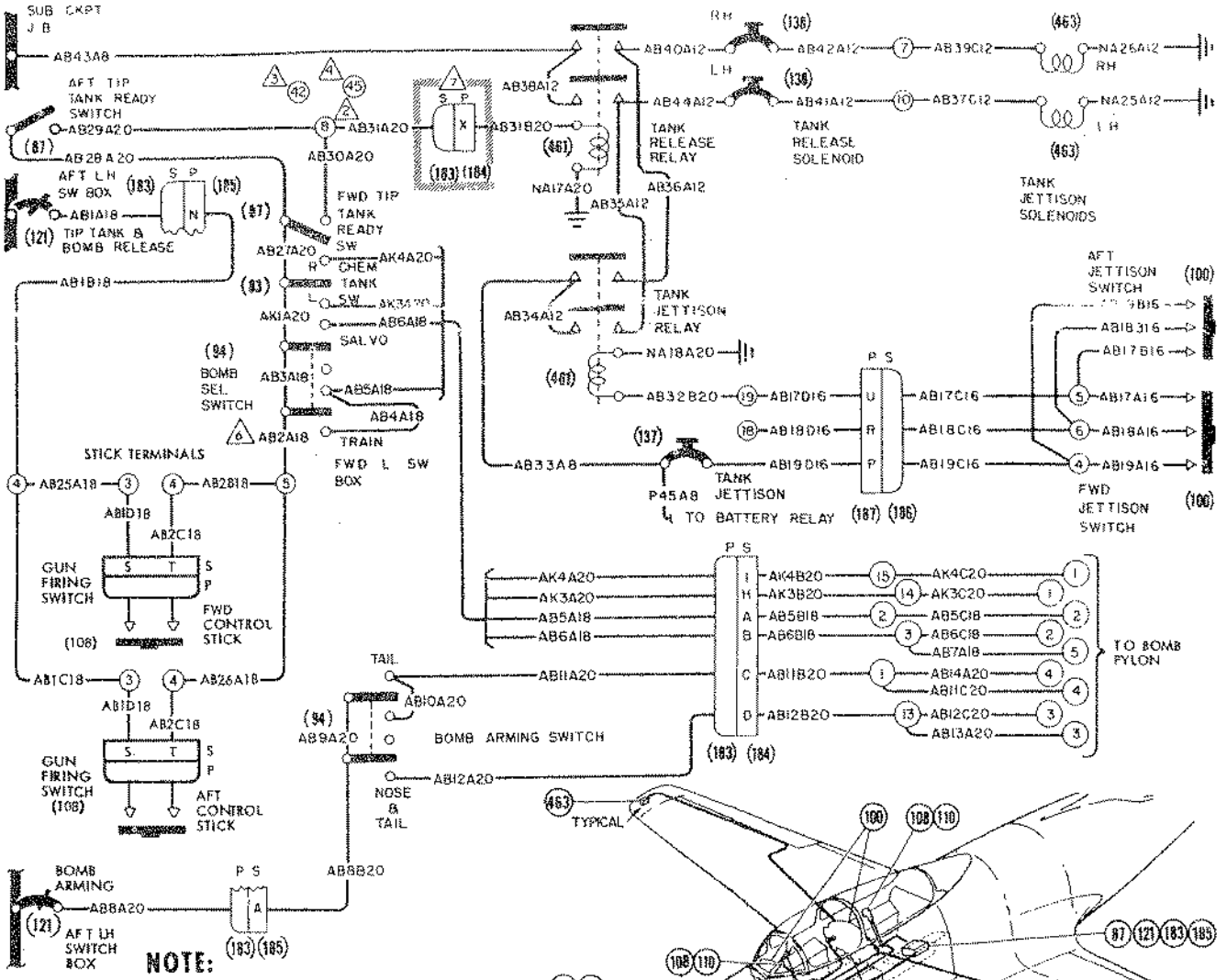
7 BOMBS AND CHEMICAL TANKS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4140

GB 3551
M20-44-8-122

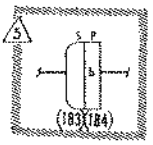
Figure 8-213. Bombs and Chemical Tanks Circuit



NOTE:

1. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-42
2. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-143
3. USED PRIOR TO AF SERIAL NO. 50-385 WHEN AIRCRAFT INCORPORATES T.O. 1T-33A-143
4. USED ON AF SERIAL 50-385 THROUGH 51-4140 WHEN AIRCRAFT INCORPORATES T.O. 1T-33A-143
5. USED PRIOR TO AF SERIAL NO. 49-901
6. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-557. ON AIRPLANES INCORPORATING T.O. 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 5
7. USED ON AF SERIAL NO. 49-901 AND SUBSEQUENT

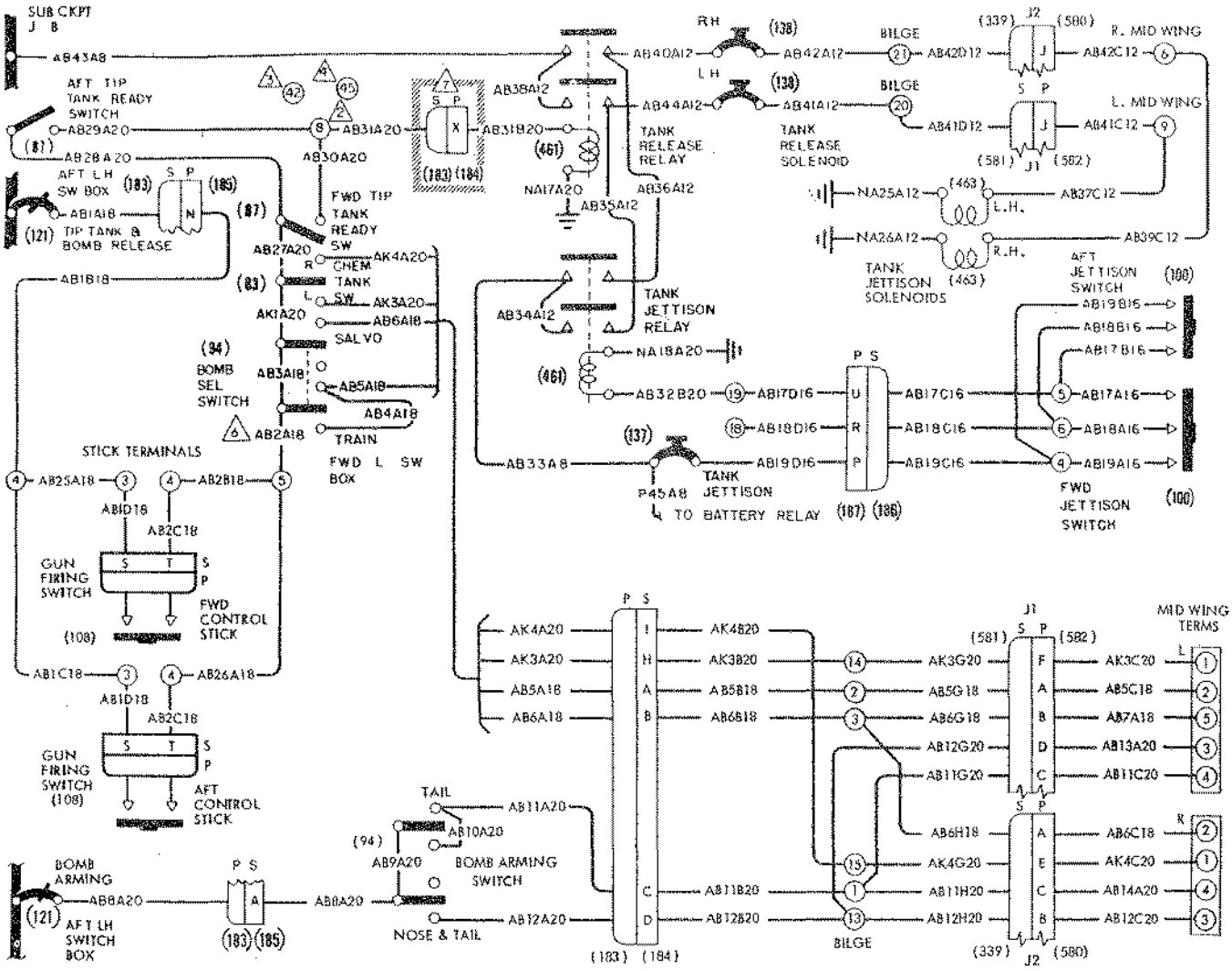
ITEM	DESCRIPTION	MFR	MFR	TYPE	DWG OR SPEC
83	SWITCH				AN3021-1
87	SWITCH				AN3022-2
94	SWITCH				AN3027-1
100	SWITCH	HETHERINGTON			A4600
108	SWITCH	GFAE		B-8A	MIL-S 5210
121	CIRCUIT PROTECTOR				AN3160-18
137	CIRCUIT PROTECTOR				AN3161-P20
138	CIRCUIT PROTECTOR				AN3161-P25
183	CONNECTOR				AN3106-28-11S
184	CONNECTOR				AN3102P-28-11P
185	CONNECTOR				AN3102-28-11P
186	CONNECTOR				AN3106-28-12S
187	CONNECTOR				AN3102P-28-12P
461	RELAY				AN3352-1
463	SOLENOID	CANNON			18488

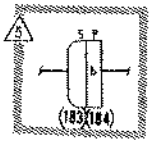


CENTERLINE TIP TANK CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4140 NOT INCORPORATING T.O. 1T-33A-567

HB 595
M20-50-8-249

Figure 8-214. Centerline Tip Tank Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH			AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
100	SWITCH	HETHERINGTON		A4600
108	SWITCH	GFAE	8-8A	MIL-S 5210
121	CIRCUIT PROTECTOR			AN3160-18
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
339	CONNECTOR			MS3106M-28-11SW
461	RELAY			AN3352-1
463	SOLENOID			18488
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR	CANNON		MS3100M-28-11P

NOTE

1. USED ON AIRCRAFT INCORPORATING T.O. 1T-33A-42
2. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-143
3. USED PRIOR TO AF SERIAL NO. 50-385 WHEN AIRCRAFT INCORPORATES T.O. 1T-33A-143
4. USED ON AF SERIAL 50-385 THROUGH 51-4140 WHEN AIRCRAFT INCORPORATES T.O. 1T-33A-143
5. USED PRIOR TO AF SERIAL NO. 49-901
6. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-557. ON AIRPLANES INCORPORATING T.O. 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 5
7. USED ON AF SERIAL NO. 49-901 AND SUBSEQUENT

1

CENTERLINE TIP TANK CIRCUIT

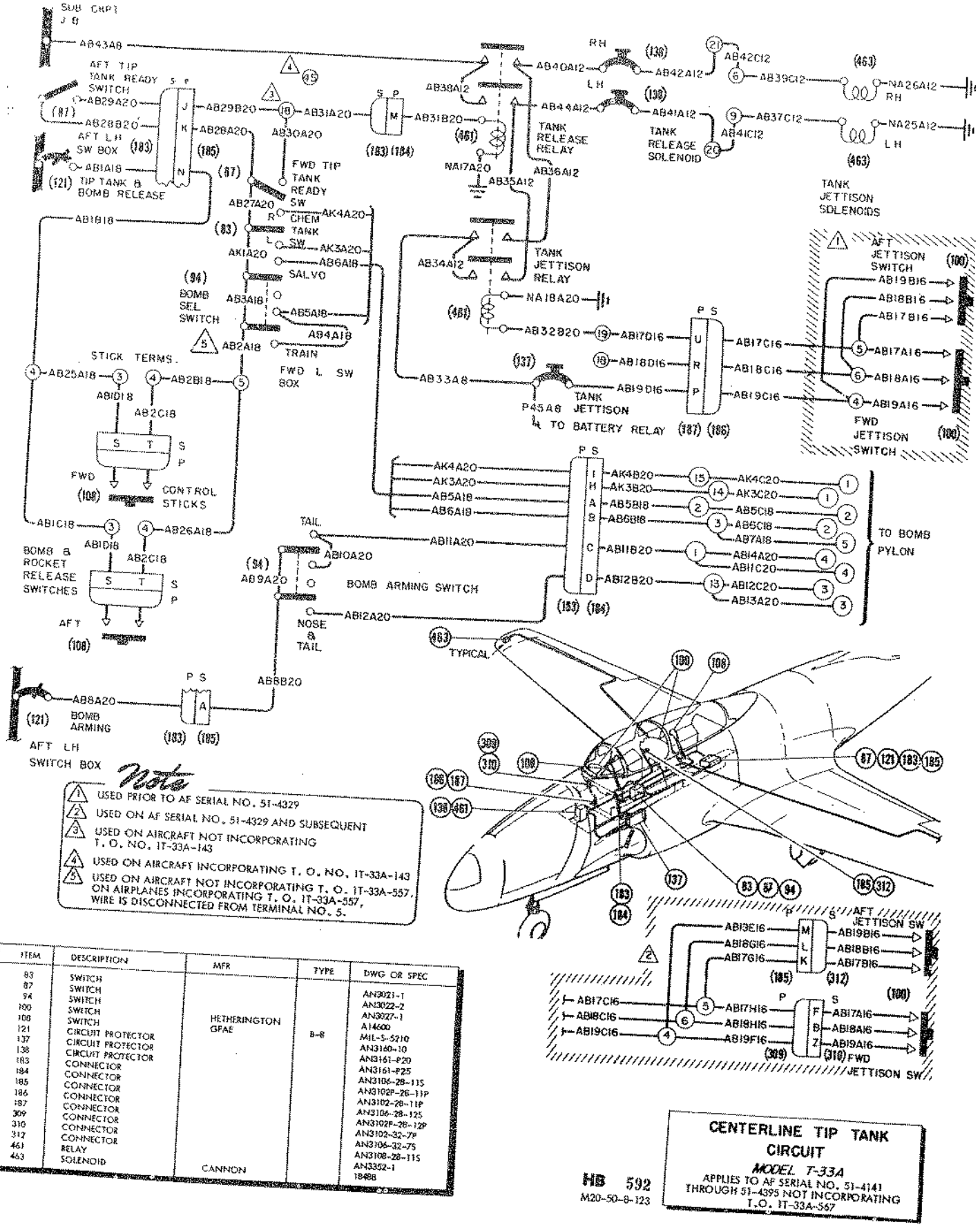
MODEL T-33A

APPLIES TO AF SERIAL NO. 48-356 THROUGH 51-4140 INCORPORATING T.O. 1T-33A-567

HB 1249

M20-50-8-105

Figure 8-214A. Centerline Tip Tank Circuit



Note

1. USED PRIOR TO AF SERIAL NO. 51-4329
2. USED ON AF SERIAL NO. 51-4329 AND SUBSEQUENT
3. USED ON AIRCRAFT NOT INCORPORATING T. O. NO. 1T-33A-143
4. USED ON AIRCRAFT INCORPORATING T. O. NO. 1T-33A-143
5. USED ON AIRCRAFT NOT INCORPORATING T. O. 1T-33A-557, ON AIRPLANES INCORPORATING T. O. 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 5.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH	HETHERINGTON GFAE	B-8	AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
100	SWITCH			A14600
108	SWITCH			MIL-S-5210
121	CIRCUIT PROTECTOR			AN3160-10
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
312	CONNECTOR			AN3108-28-11S
461	RELAY	CANNON		AN3352-1
463	SOLENOID			1848B

CENTERLINE TIP TANK CIRCUIT

MODEL T-33A

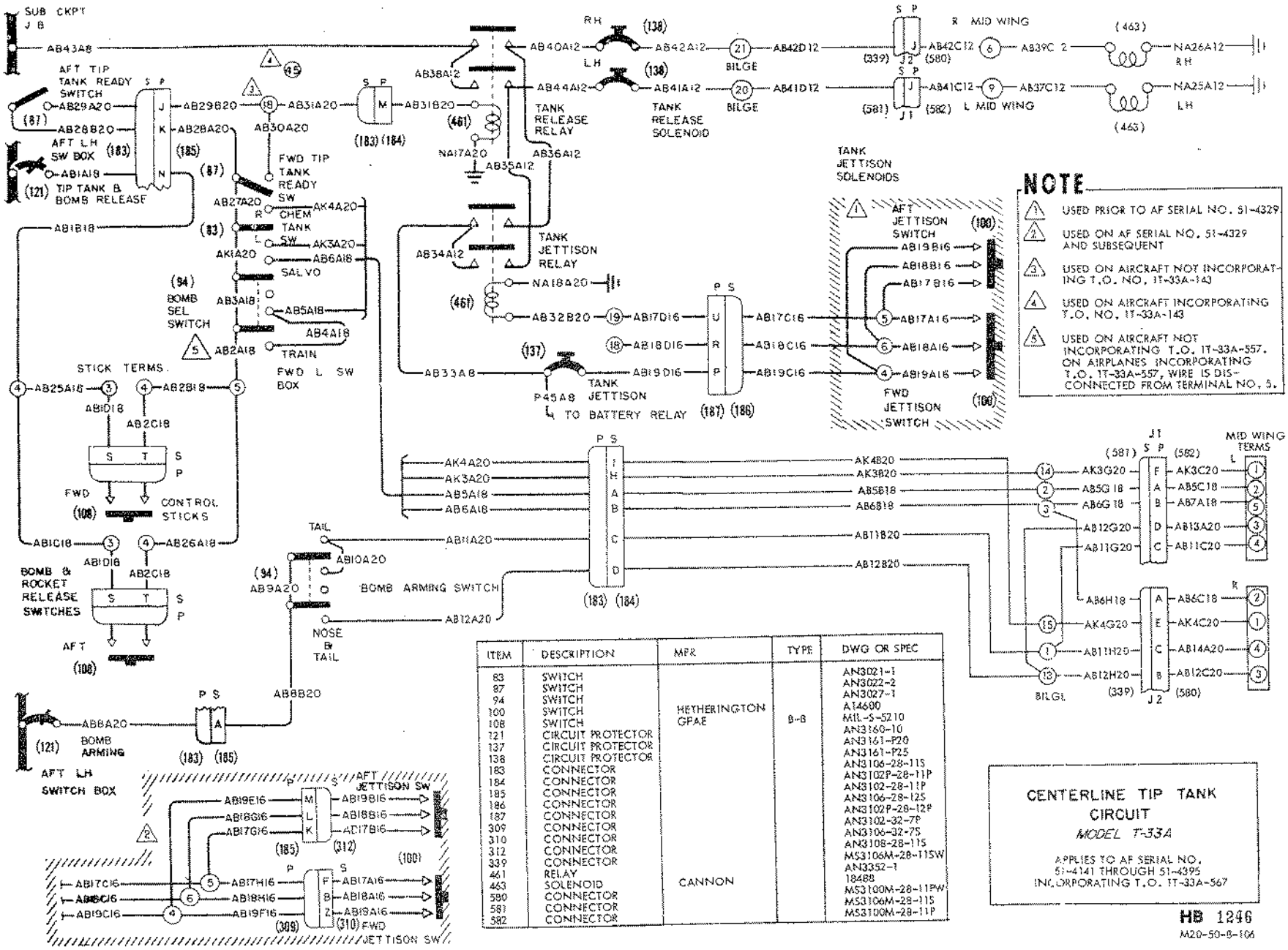
APPLIES TO AF SERIAL NO. 51-4141 THROUGH 51-4395 NOT INCORPORATING T.O. 1T-33A-567

HB 592

M20-50-8-123

Figure 8-215. Centerline Tip Tank Circuit

Changed 23 September 1959



NOTE

1. USED PRIOR TO AF SERIAL NO. 51-4329
2. USED ON AF SERIAL NO. 51-4329 AND SUBSEQUENT
3. USED ON AIRCRAFT NOT INCORPORATING T.O. NO. 1T-33A-143
4. USED ON AIRCRAFT INCORPORATING T.O. NO. 1T-33A-143
5. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-557. ON AIRPLANES INCORPORATING T.O. 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 5.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH	HETHERINGTON GPAE	B-B	AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
100	SWITCH			AE4690
108	SWITCH			MIL-S-5210
121	CIRCUIT PROTECTOR			AN3160-10
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
312	CONNECTOR			AN3108-28-11S
339	CONNECTOR			MS3106M-28-11SW
461	RELAY	CANNON		AN3352-1
463	SOLENOID			18488
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

CENTERLINE TIP TANK CIRCUIT

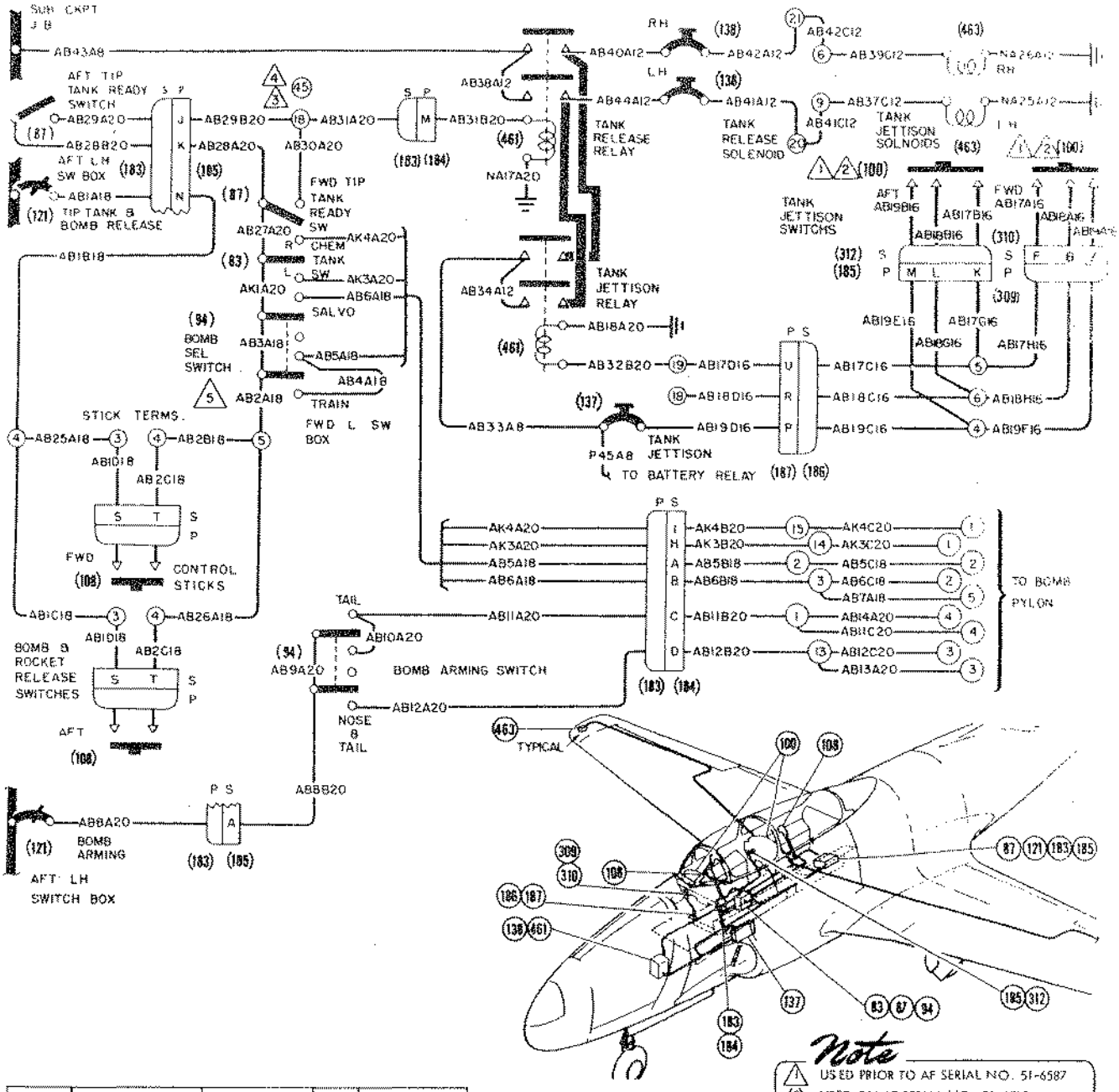
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4141 THROUGH 51-4395 INCORPORATING T.O. 1T-33A-567

HB 1246

M20-50-8-106

Figure 8-215A. Centerline Tip Tank Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH			AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
△1 100	SWITCH	HETHERINGTON		A14606
△2 100	SWITCH	HETHERINGTON		D204W3852R
108	SWITCH	GFAE	B-8	MIL-S-5210
121	CIRCUIT PROTECTOR			AN3160-10
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
312	CONNECTOR			AN3108-28-11S
461	RELAY			AN3352-1
463	SOLENOID	CANNON		18498

Note

△1 USED PRIOR TO AF SERIAL NO. 51-6587

△2 USED ON AF SERIAL NO. 51-6587 AND SUBSEQUENT

3 USED ON AIRCRAFT NOT INCORPORATING T. O. NO. 1T-33A-143

4 USED ON AIRCRAFT INCORPORATING T. O. NO. 1T-33A-143

5 USED ON AIRCRAFT NOT INCORPORATING T. O. 1T-33A-557. ON AIRPLANES INCORPORATING T. O. 1T-33A-557, WIRE IS REMOVED FROM TERMINAL NO. 5.

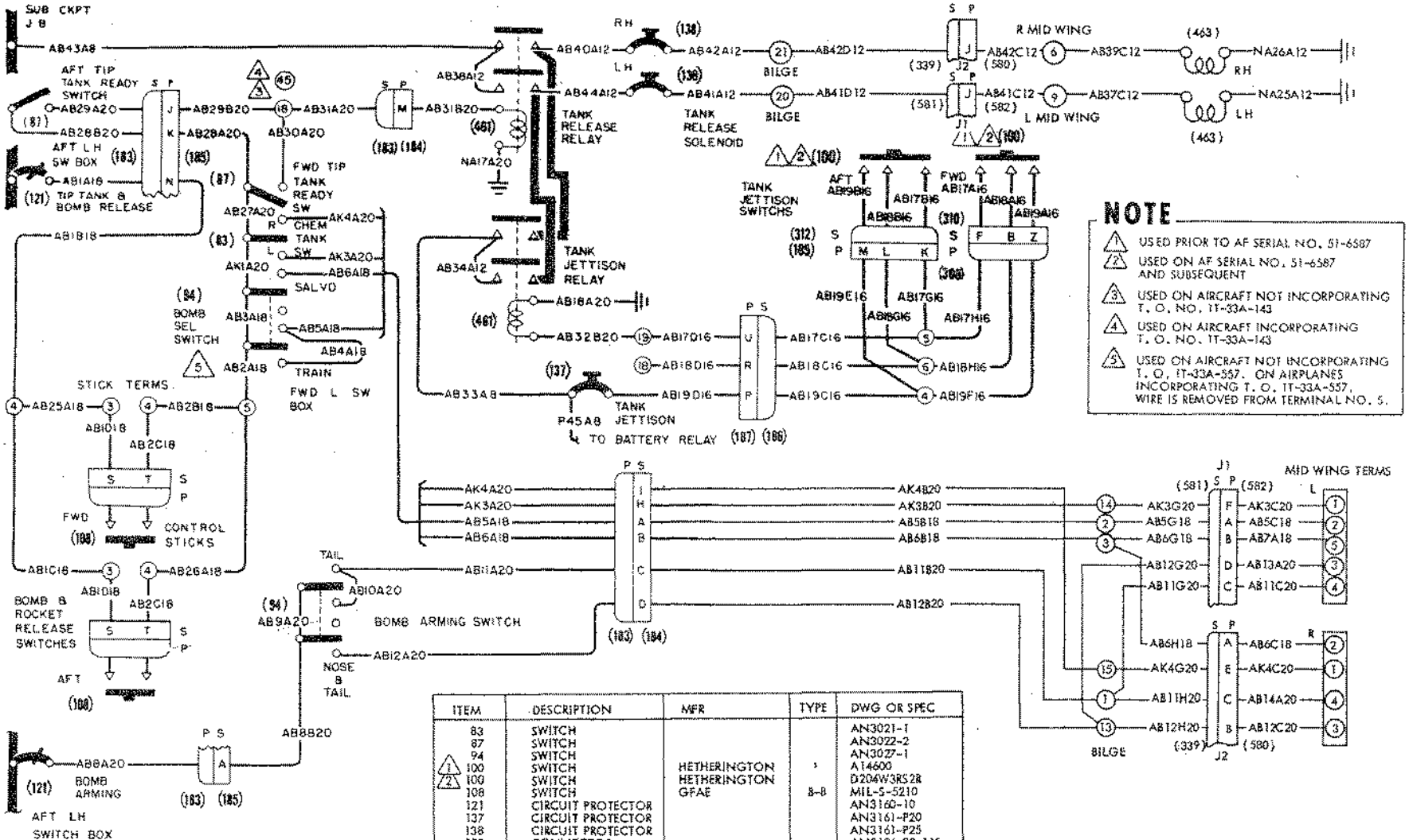
CENTERLINE TIP TANK CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4396 THROUGH 51-6818 NOT INCORPORATING T.O. 1T-33A-567

HB 593
MZO-50-8-124

Figure 8-216. Centerline Tip Tank Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH			AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
1 100	SWITCH	HETHERINGTON	3	A14600
2 100	SWITCH	HETHERINGTON		D204W3RS2R
108	SWITCH	GFAE	8-8	MIL-S-5210
121	CIRCUIT PROTECTOR			AN3160-10
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
312	CONNECTOR			AN3108-28-11S
339	CONNECTOR			MS3106M-28-11SW
461	RELAY			AN3352-1
463	SOLENOID	CANNON		16488
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

CENTERLINE TIP TANK CIRCUIT

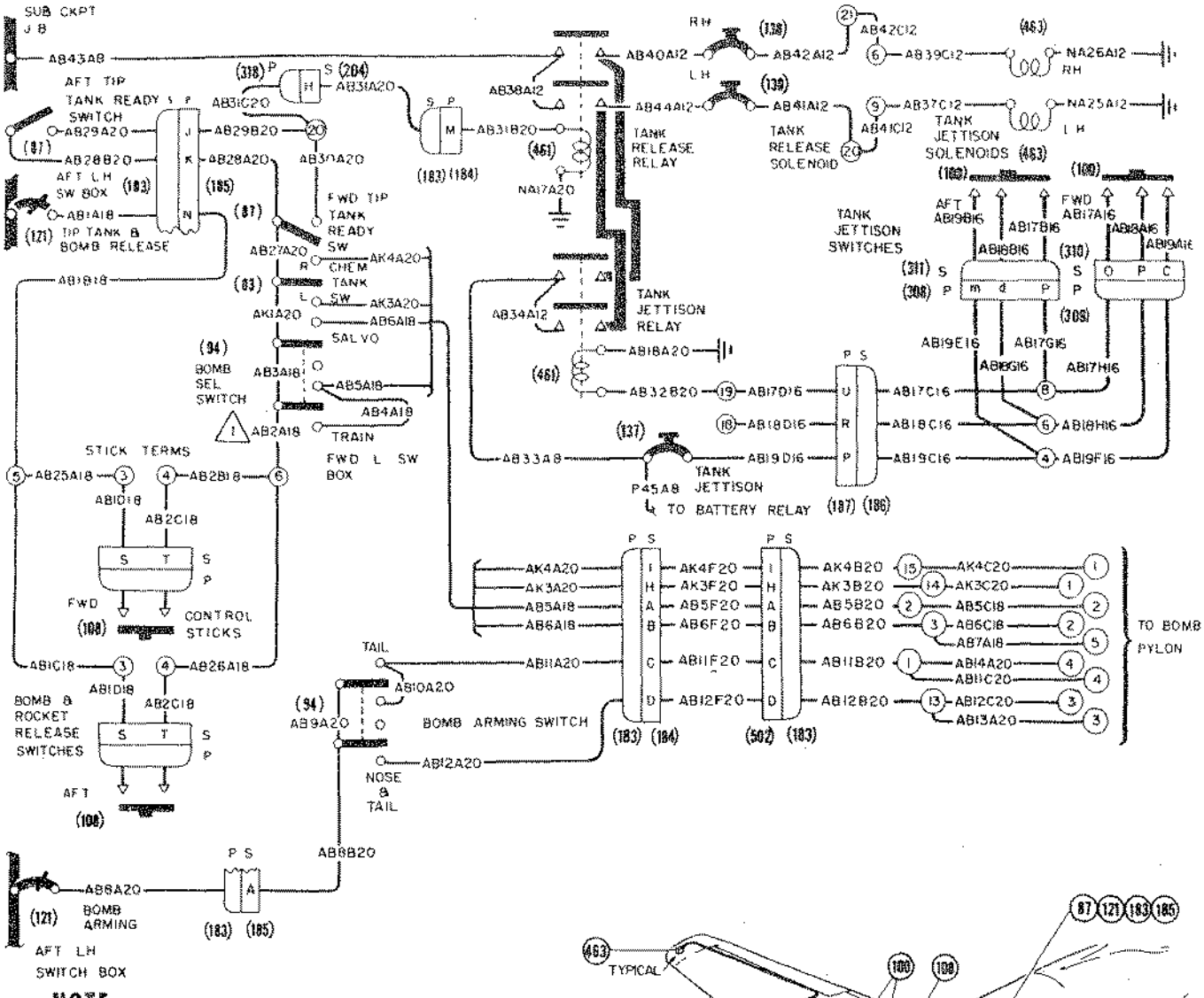
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4396 THRU 51-6818 INCORPORATING T.O. 1T-33A-567

HB 1245

M20-50-8-161

Figure 8-216A. Centerline Tip Tank Circuit



NOTE

1. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-557, ON AIRPLANES INCORPORATING T.O. 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 6.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH			AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
100	SWITCH	HETHERINGTON		D204WRS2R
108	SWITCH	GFAE	B-8	MIL-S-5210
121	CIRCUIT PROTECTOR			AN3160-10
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
204	CONNECTOR			AN3102-20-29S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106B-28-15S
318	CONNECTOR			AN3106B-20-29P
461	RELAY			AN3352-1
463	SOLENOID	CANNON		188488
502	CONNECTOR			AN3100A-28-11P

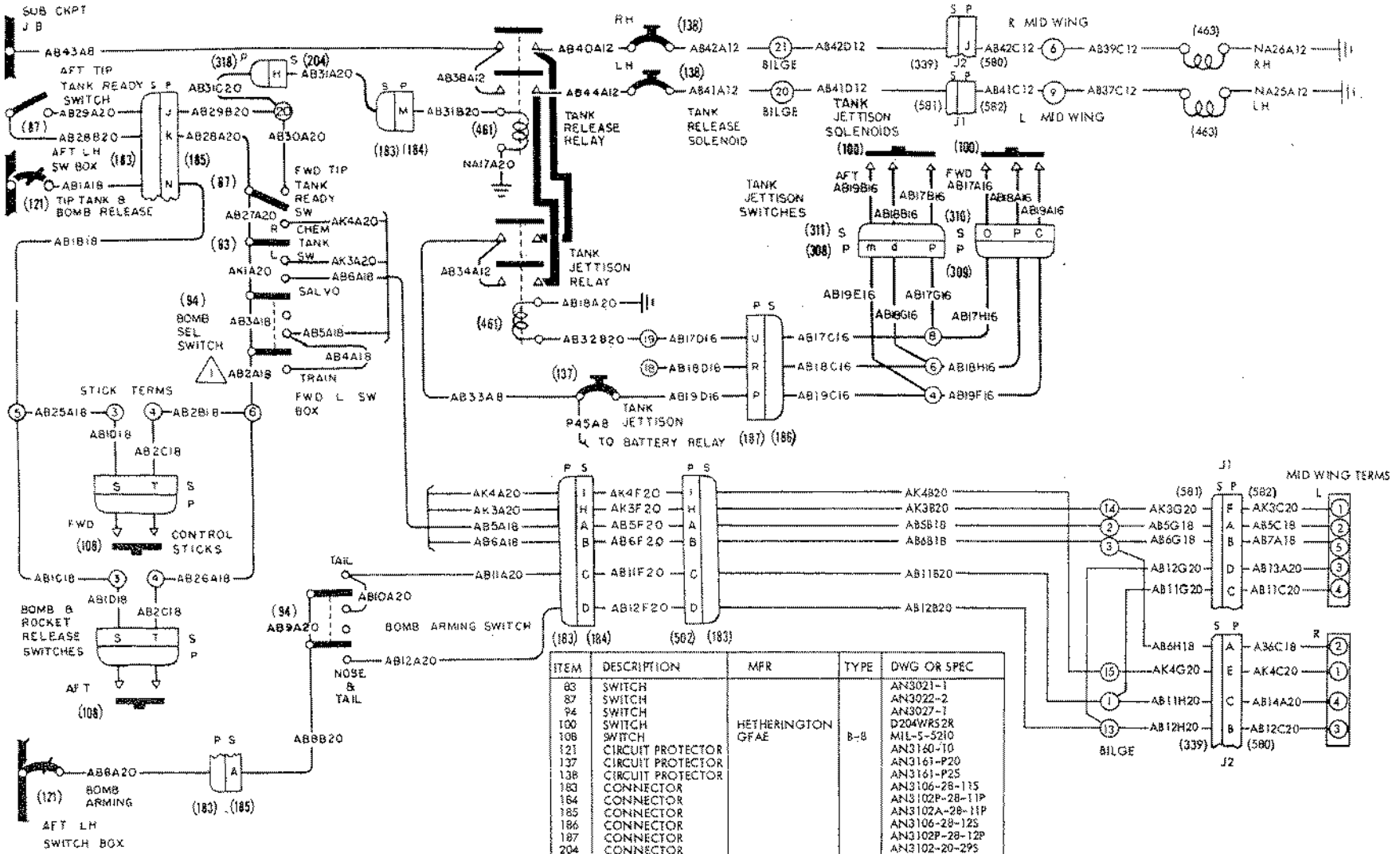
HB 594
M20-50-8-125

CENTERLINE TIP TANK CIRCUITS

MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-6819 THROUGH 52-9905 NOT INCORPORATING T.O. 1T-33A-567

Figure 8—217. Centerline Tip Tank Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
83	SWITCH			AN3021-1
87	SWITCH			AN3022-2
94	SWITCH			AN3027-1
100	SWITCH	HETHERINGTON		D204WRS2R
108	SWITCH	GFAE	B-8	MIL-S-5210
121	CIRCUIT PROTECTOR			AN3160-10
137	CIRCUIT PROTECTOR			AN3161-P20
138	CIRCUIT PROTECTOR			AN3161-P25
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
204	CONNECTOR			AN3102-20-29S
308	CONNECTOR			AN3102-28-15P
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
311	CONNECTOR			AN3106B-28-15S
318	CONNECTOR			AN3106B-20-29P
339	CONNECTOR			MS3106M-28-11SW
461	RELAY			AN3352-1
463	SOLENOID	CANNON		188468
502	CONNECTOR			AN3100A-38-11P
580	CONNECTOR			MS3100M-28-11PW
581	CONNECTOR			MS3106M-28-11S
582	CONNECTOR			MS3100M-28-11P

NOTE

1. USED ON AIRCRAFT NOT INCORPORATING T.O. 1T-33A-557, ON AIRPLANES INCORPORATING T.O. 1T-33A-557, WIRE IS DISCONNECTED FROM TERMINAL NO. 6

CENTERLINE TIP TANK CIRCUITS

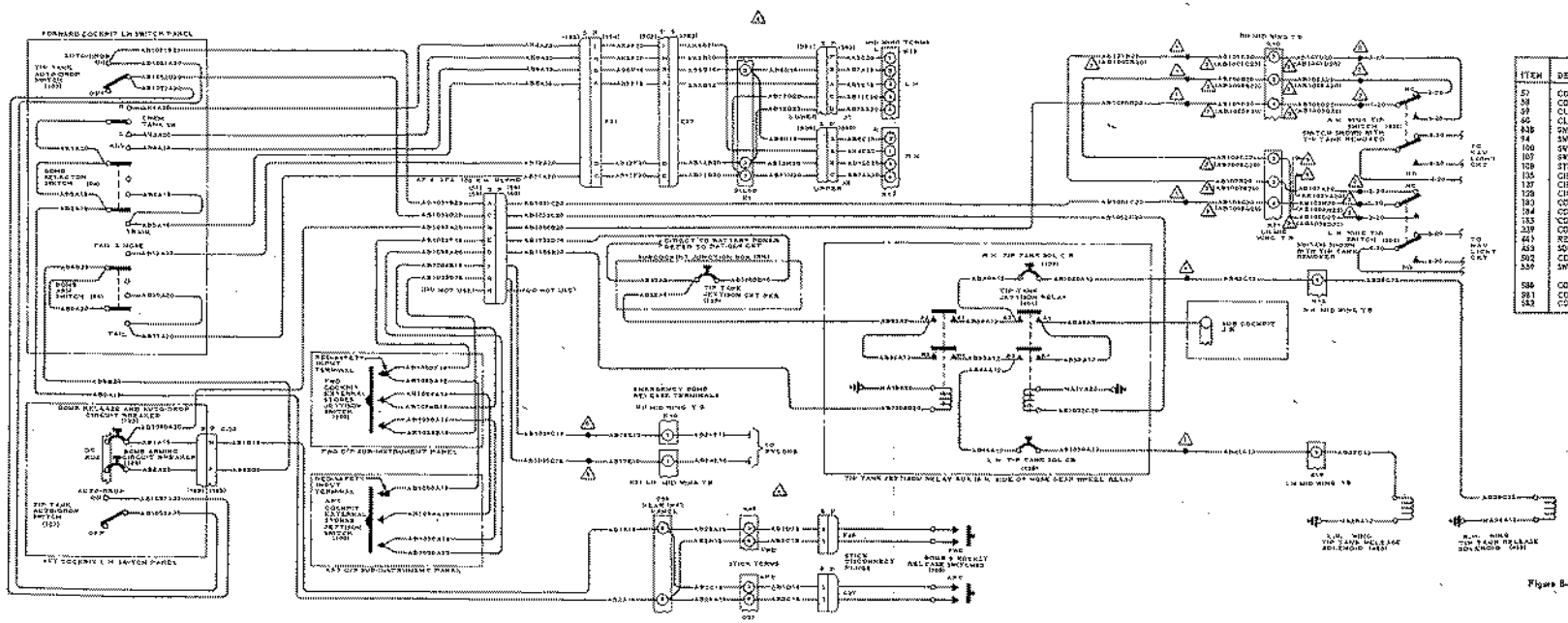
MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-6919 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905 INCORPORATING T.O. 1T-33A-567.

HB 1543

M20-50-8-162

Figure 8-217A. Centerline Tip Tank Circuit



ITEM	DESCRIPTION	MANUFACTURER	TYPE	DRAWING OR SPECIFICATION
57	CONNECTOR			MS3770-24F16SBN
58	CONNECTOR			MS3772-20F16SBN
59	CLAMP		90° STRAIGHT	MS3723-16A16F
60	CLAMP			MS3723-16A16F
83B	SWITCH			MS25059-21
94	SWITCH			MS25059-21
100	SWITCH			7241278-55
107	SWITCH			MS24523-22
109	STICK GRIP		MC-2	MIL-G-----2564
125	CIRCUIT BREAKER			MS25017-3B
127	CIRCUIT BREAKER			MS25017-2B
129	CIRCUIT BREAKER			MS25017-2S
183	CONNECTOR			MS3106R20-41S
184	CONNECTOR			MS3102R20-41P
183	CONNECTOR			MS3102R28-21P
338	CONNECTOR			MS3106R20-41SW
461	RELAY			MS24178R1
483	SOL, 2-WIRE	ITT CANNON		78-484
502	CONNECTOR			MS3100R28-21P
539	SWITCH	93929 MICRO-SWITCH		3E46-1-6B
586	CONNECTOR			MS3106R28-21PW
591	CONNECTOR			MS3106R28-21S
582	CONNECTOR			MS3100R28-21P

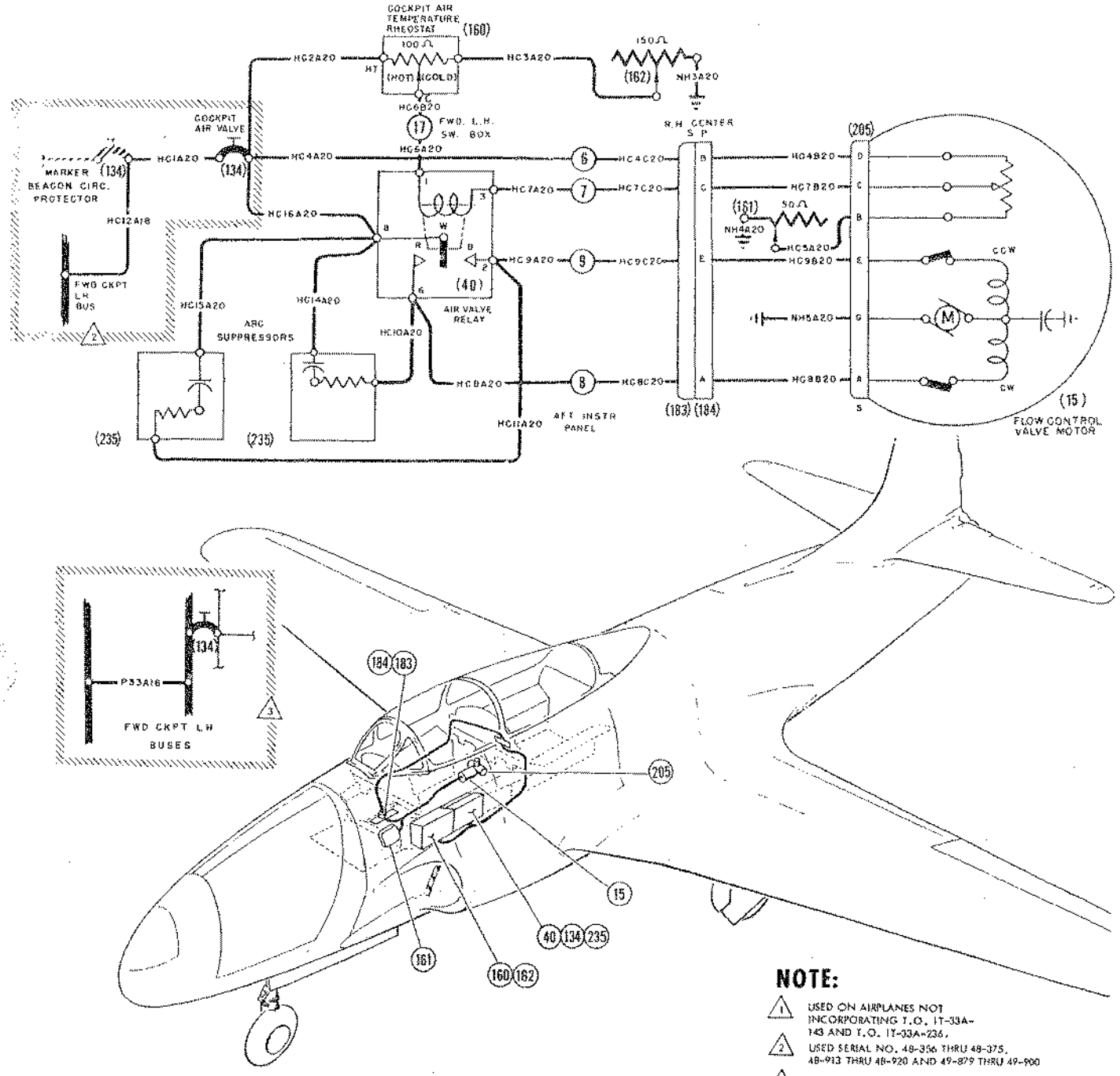
NOTE

EFFECTIVE ONLY ON A/C MODELS -1, -5, AND -10B WITH TCTO 1F-33-568 AND ITT-N-1368 ACCOMPLISHED

1. - DENOTES SPLICE AREA IN W.C. WELL RECT.
2. - DENOTES SPLICE AREA AT JOINT TIP.
3. - DESIGNED AT TERMINATE WIRE NUMBERS USED ON ZONE AIRCRAFT.
4. - DENOTES TYPICAL CIRCUIT SHOWN, REFER TO APPLICABLE CONTINUITY TIP TANK FROM A, TECHNICAL TANK CIRCUITS FOR OTHER CONFIGURATIONS.
5. - DENOTES RH WING AREA.

Figure 8-218. Centerline Tip Tank Circuit

Figure 8-219. Deleted



ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
15	MOTOR	STRATOS		CF125-3
40	RELAY	BAR. COL.		AYLZ25435 OR AYLZ27695
134	CIRCUIT PROTECTOR			AN3161-P5
160	RESISTOR	OHMITE	100Ω25W	0151H
★161	RESISTOR	OHMITE	100Ω10W	1012
▲162	RESISTOR	OHMITE	200Ω10W	1014
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
205	CONNECTOR			AN3106-16S-1S
235	ARC SUPPRESSOR	BAR. COL.		CYZR142

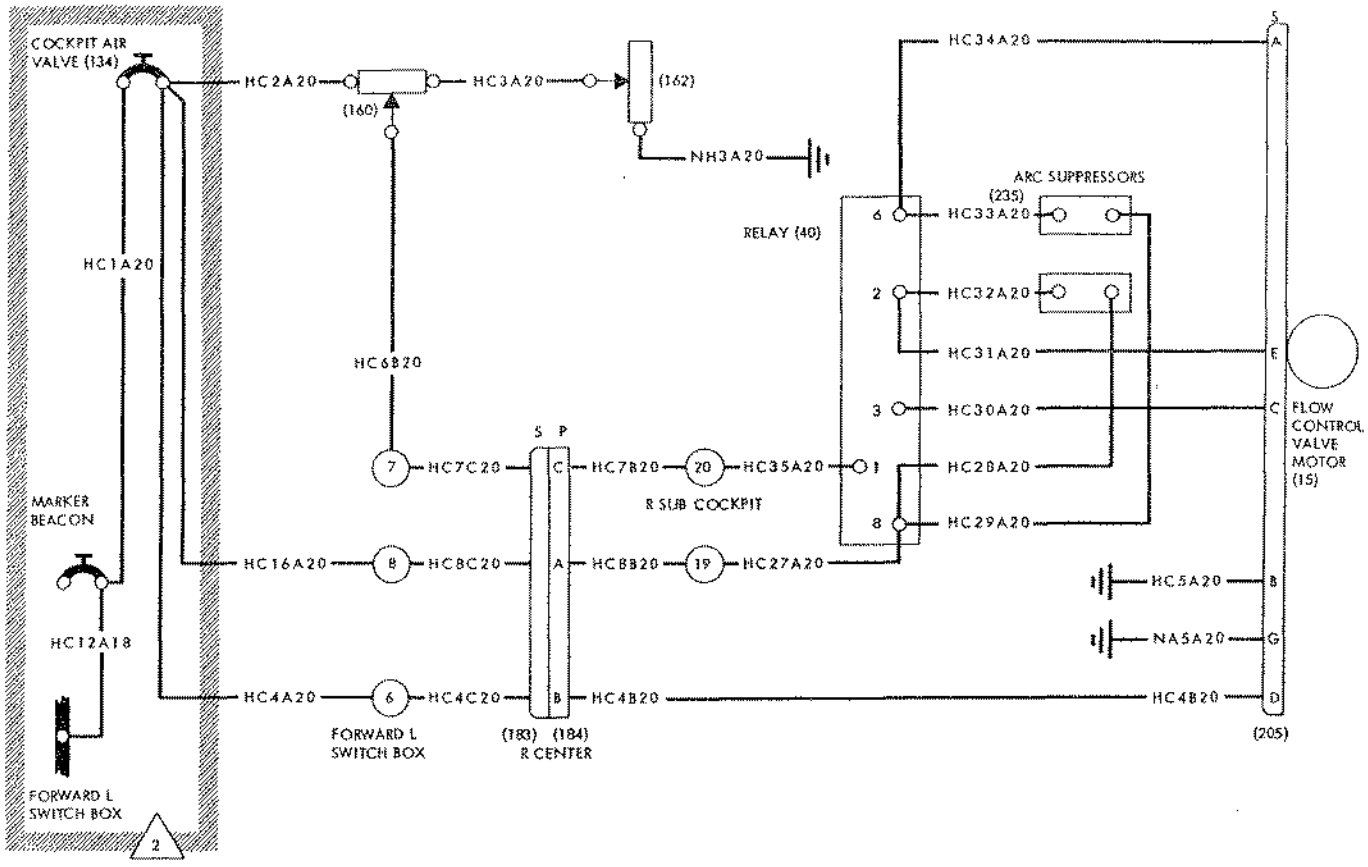
★ REWORK TO 50 Ω
▲ REWORK TO 150 Ω

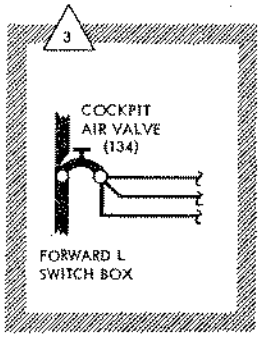
FB 8011
M20-39-8-126

1

FLOW CONTROL VALVE CIRCUIT
T.O. 1T-33A-4
APPLIES TO AIRPLANES PRIOR TO AF SERIAL NO. 49-967

Figure 8-220. Flow Control Valve Circuit





NOTE

1. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-143 AND T.O. 1T-33A-236.
2. USED PRIOR TO AF SERIAL NO. 49-901
3. USED ON AF SERIAL NO. 49-901 THRU 49-966

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
15	MOTOR	STRATOS		CFT25-3
40	RELAY	BAR. COL.		AYLZ25435 OR AYLZ2769S
134	CIRCUIT PROTECTOR			AN3161-P5
160	RESISTOR	OHMITE	100Ω 25W	0151H
162	RESISTOR	OHMITE	200Ω 10W	T014
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
205	CONNECTOR			AN3106B-16S-1S
235	ARC SUPPRESSOR	BAR. COL.		CYZR142

1

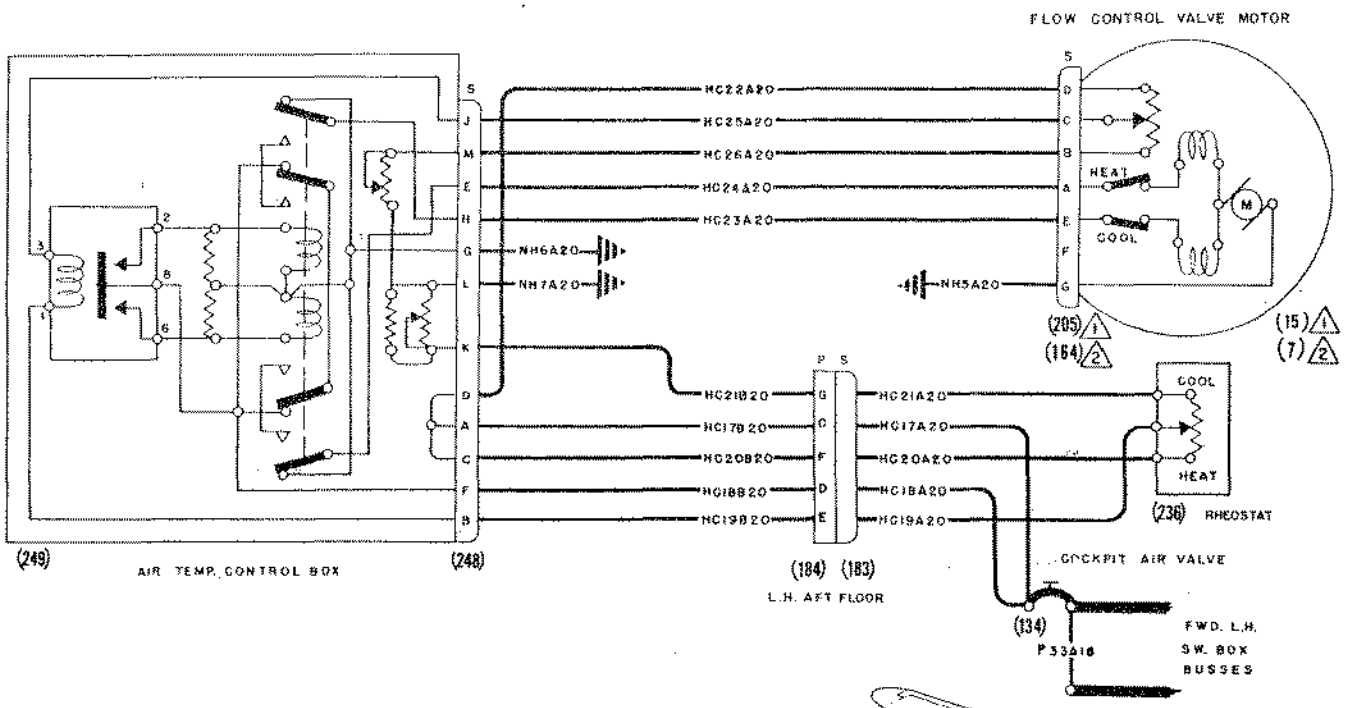
FLOW CONTROL VALVE CIRCUIT

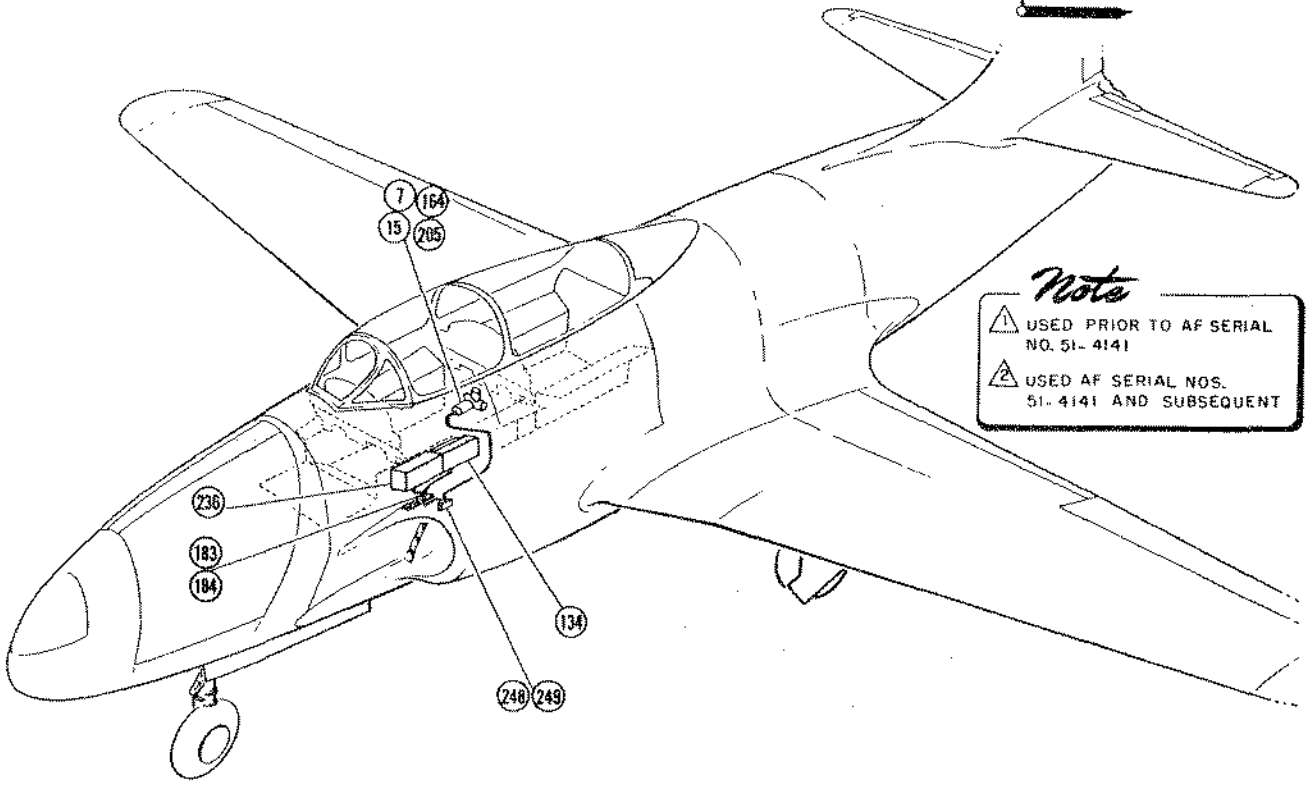
MODEL T-33A

APPLIES PRIOR TO AF SERIAL NO. 49-967

FB 8005
M20-39-8-128

Figure 8-221. Flow Control Valve Circuit





Note

1. USED PRIOR TO AF SERIAL NO. 51-4141
2. USED AF SERIAL NOS. 51-4141 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
1 7	MOTOR	STRATOS		CFT 25-3D
1 15	MOTOR	STRATOS		CFT 25-B
134	CIRCUIT PROTECTOR			AN3161-P5
1 164	CONNECTOR			AN3108-16S-1S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
1 205	CONNECTOR			AN3106-16S-1S
236	RHEOSTAT	OHMITE	15Ω25W	0146H
248	CONNECTOR			AN3106-20-27S
249	CONTROL BOX	BAR.COL.		CYL2 2482

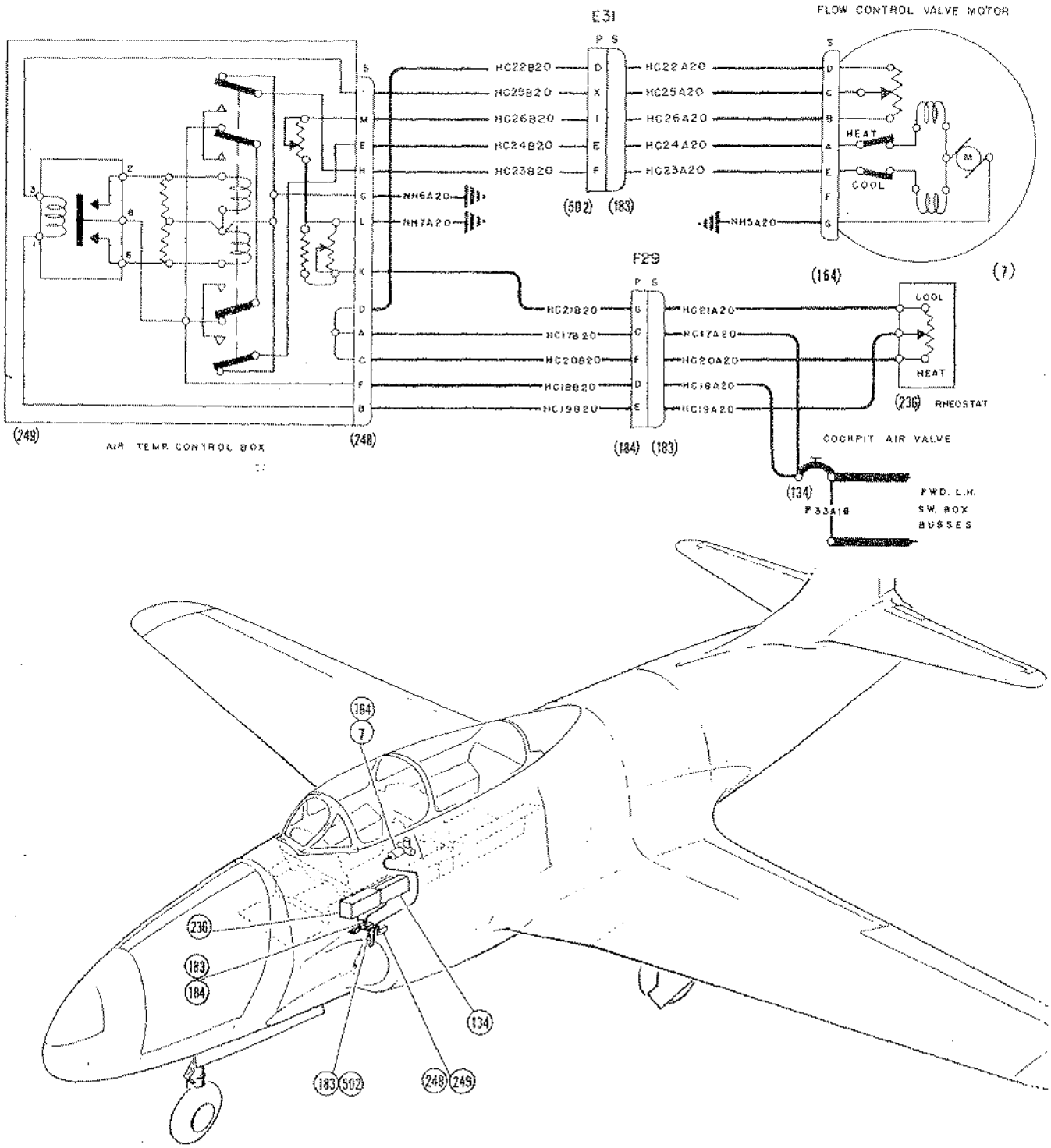
EM20-25-8-127
CB 6128

FLOW CONTROL VALVE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 49-967 THROUGH 51-6818

Figure 8-222. Flow Control Valve Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
7	MOTOR	STRATOS		CF125-3D
134	CIRCUIT PROTECTOR			AN3161-P5
164	CONNECTOR			AN3108-165-1S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
236	RHEOSTAT	OHMITE	150 25W	0146H
248	CONNECTOR			AN3106-20-27S
249	CONTROL BOX	BAR, COL.		CY1Z2482
502	CONNECTOR			AN3100A-28-11P

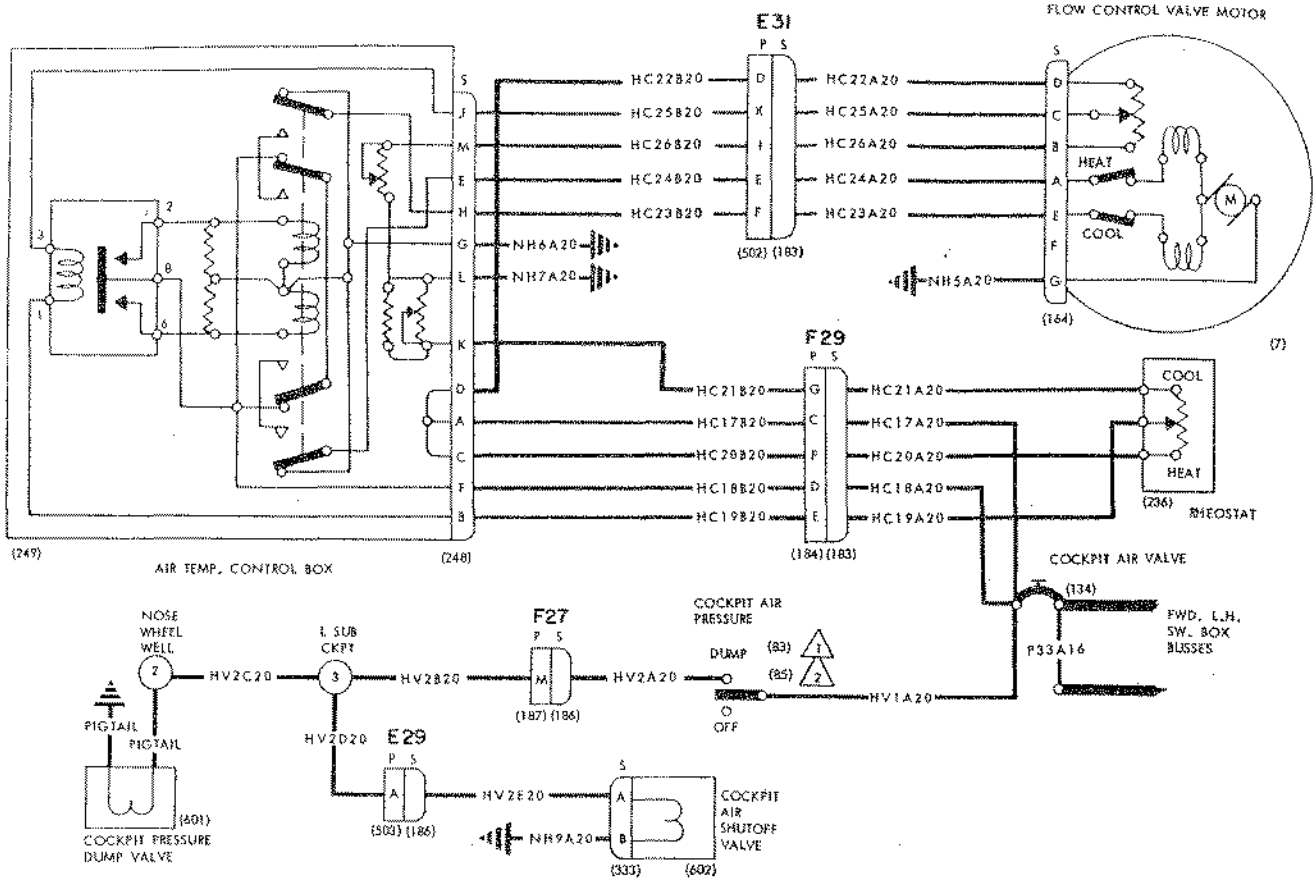
CB 19240
EM20-29-8-129

FLOW CONTROL VALVE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-6819 THROUGH 54-1529, EXCEPT 53-5814 THROUGH 53-5152

Figure 8-223. Flow Control Valve Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
7	MOTOR	STRATOS		CFT25-3D
1 83	SWITCH		SPDT	AN3021-1
2 85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
164	CONNECTOR			AN3108-16S-1S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
236	RHEOSTAT	OHMITE	15Ω,25W	0146H
248	CONNECTOR			AN3106-20-27S
249	CONTROL BOX	BAR. COL.		CYLZ2482
333	CONNECTOR			AN3108B-10SL-4S
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
601	DUMP VALVE	P.A.C.		30150-3.50
601	DUMP VALVE	RAM. STD.		516249
602	SHUTOFF VALVE	VINSON		A20124

NOTE:

1. USED ON AF SERIAL NO. 53-5814 THROUGH 53-5878, 54-1544 THROUGH 54-1583, 54-2689 THROUGH 54-2728.
2. USED ON AF SERIAL NO. 53-5879 THROUGH 53-6152 AND 54-1584 AND SUBSEQUENT.
3. USED ON AIRPLANES INCORPORATING TF-33A-513

3

FLOW CONTROL VALVE, COCKPIT AIR SHUTOFF VALVE AND PRESSURE DUMP VALVE CIRCUITS

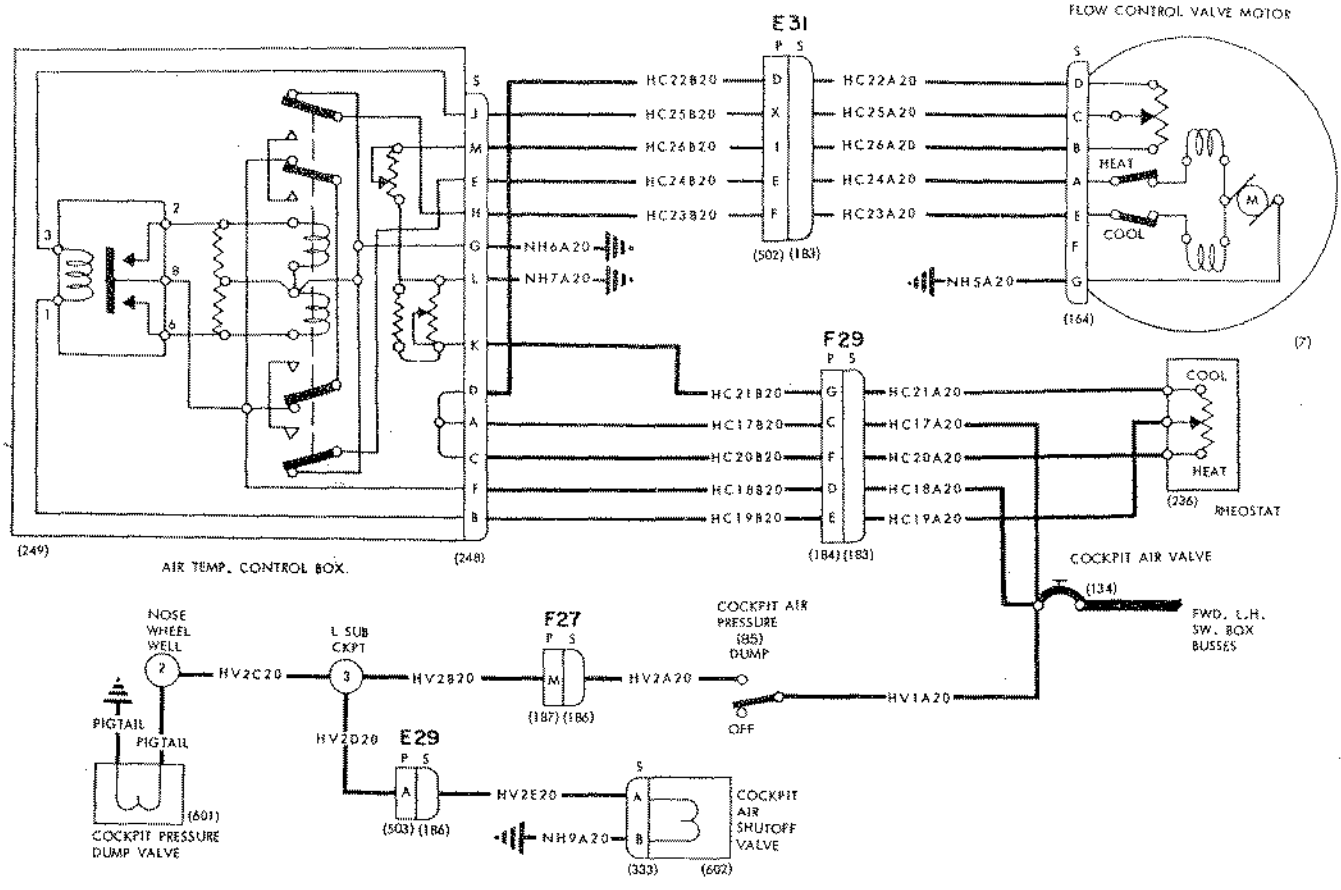
MODEL T-33A-1

APPLIES TO AF SERIAL NO. 53-5814 THROUGH 53-6152 AND 54-1544 AND SUBSEQUENT

GB 8847

M20-48D-8-375

Figure 8-224. Flow Control Valve, Cockpit Air Shutoff Valve and Pressure Dump Valve Circuits

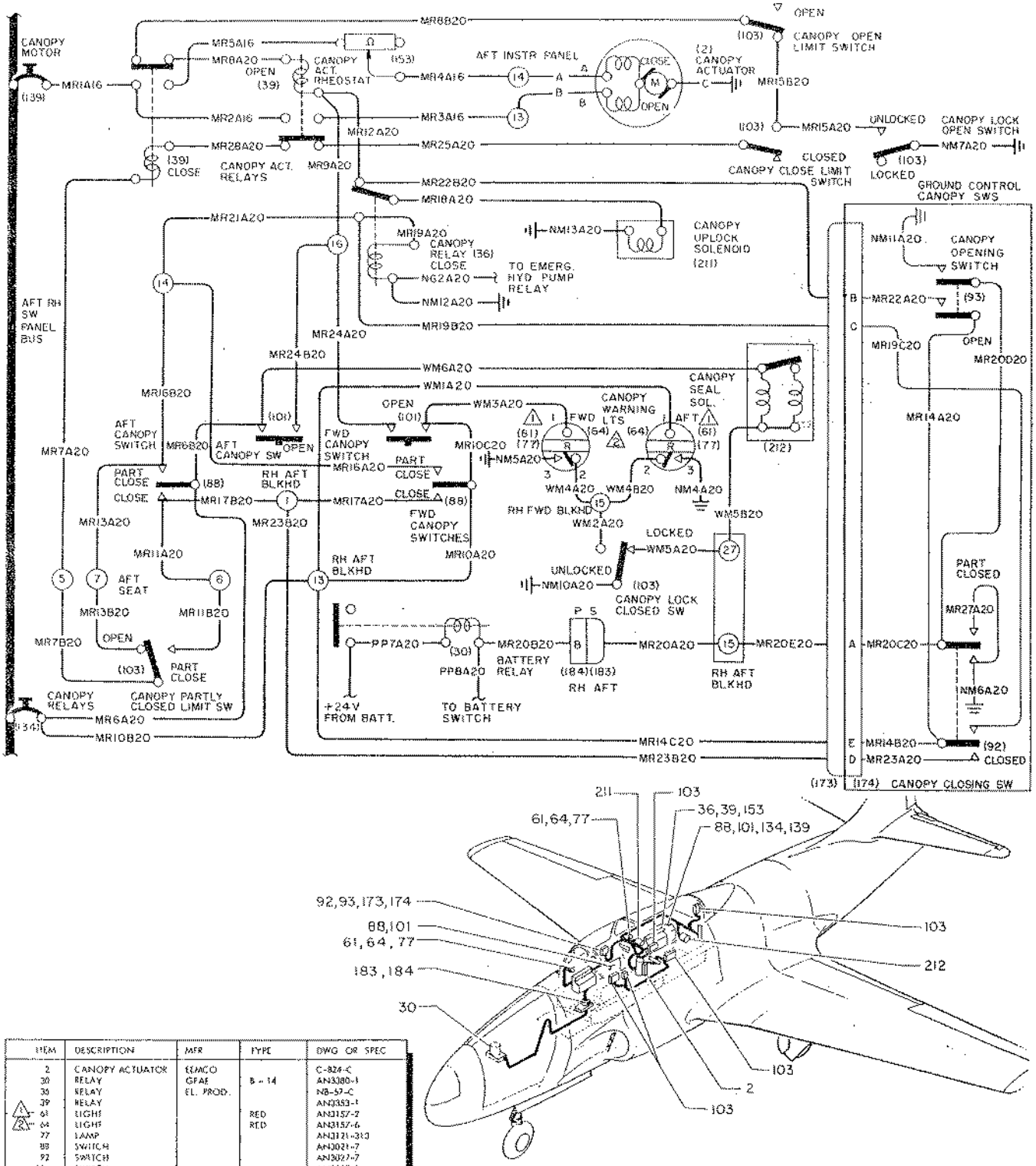


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
7	MOTOR	STRATOS		CFT25-3D
85	SWITCH		SPDT	AN3021-3
134	CIRCUIT PROTECTOR			AN3161-F5
164	CONNECTOR			AN3108-16S-1S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102C-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
236	RHEOSTAT	OHMITE	15Ω25W	0146H
248	CONNECTOR			AN3106-20-27S
249	CONTROL BOX	BAR. COL.		CYL22482
333	CONNECTOR			AN3108B-10SL-4S
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
601	DUMP VALVE	P.A.C.		30150-3.50
601	DUMP VALVE	HAM. STD.		5H6249
602	SHUTOFF VALVE	VINSON		A20124

FLOW CONTROL VALVE, COCKPIT AIR SHUTOFF VALVE AND PRESSURE DUMP VALVE CIRCUITS
MODEL T-33A-5

FB 8164
M20-39-B-412

Figure 8-225. Flow Control Valve, Cockpit Air Shutoff Valve and Pressure Dump Valve Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	CANOPY ACTUATOR	EMCO		C-826-C
30	RELAY	GFAE	B - 14	AN3380-1
36	RELAY	EL. PROD.		NB-57-C
39	RELAY			AN3353-1
61	LIGHT		RED	AN3157-2
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
88	SWITCH			AN3021-7
92	SWITCH			AN3027-7
93	SWITCH			AN3027-5
101	SWITCH	C - H		8872
103	SWITCH			AN3210-1
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
153	RHEOSTAT	OHMITE	2 Ω, 100W	0442
173	CONNECTOR			AN3106-14S-5S
174	CONNECTOR			AN3102F-14S-5P
183	CONNECTOR			AN3106-20-11S
184	CONNECTOR			AN3102F-20-11P
211	SOLENOID	CANNON		W-5L
212	SOLENOID	ADEL		12257-29

Note

1. USED PRIOR TO AF SERIAL NO. 49-992
2. USED ON AF SERIAL NOS. 49-992 AND SUBSEQUENT

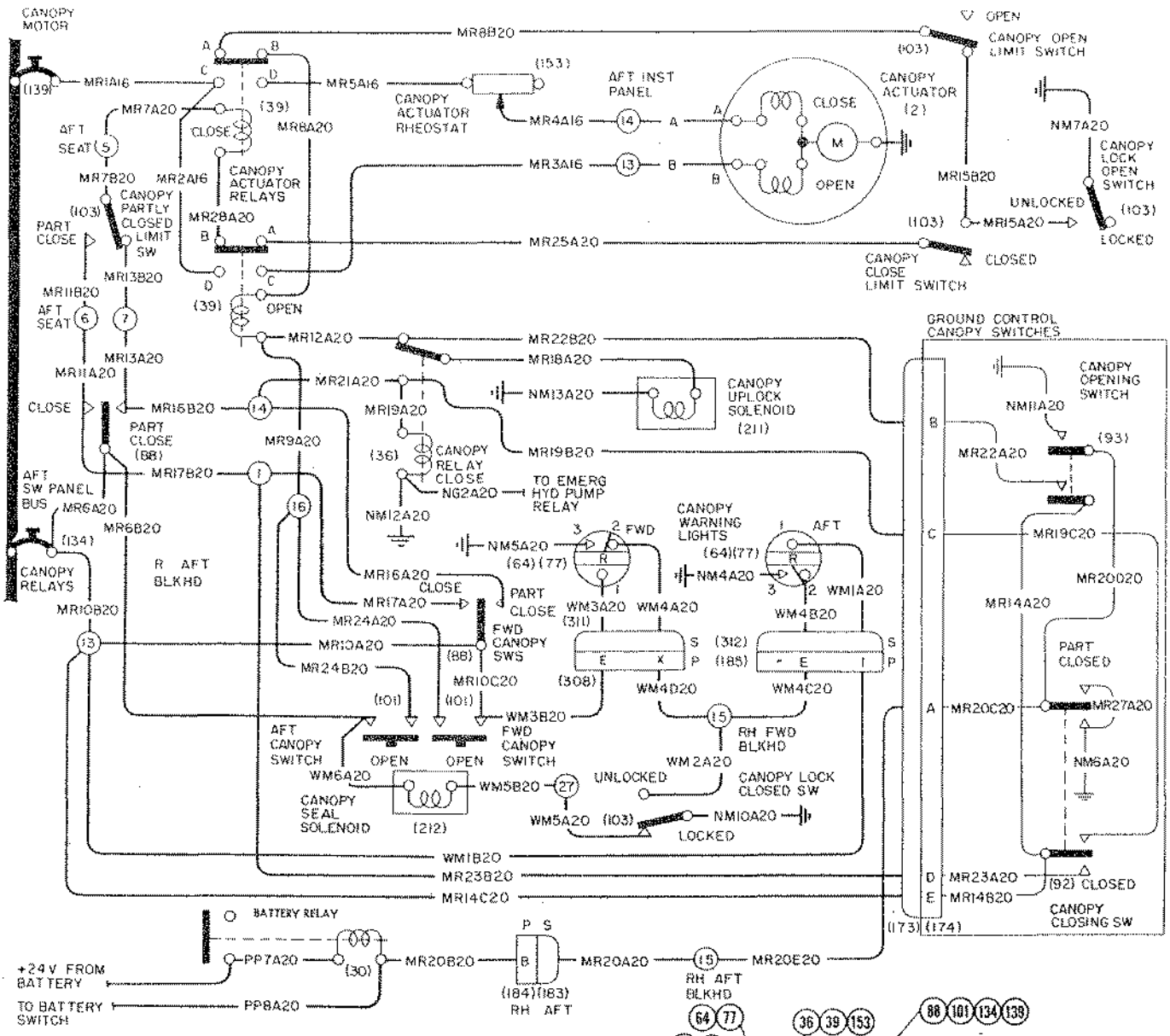
CANOPY ACTUATOR CIRCUIT

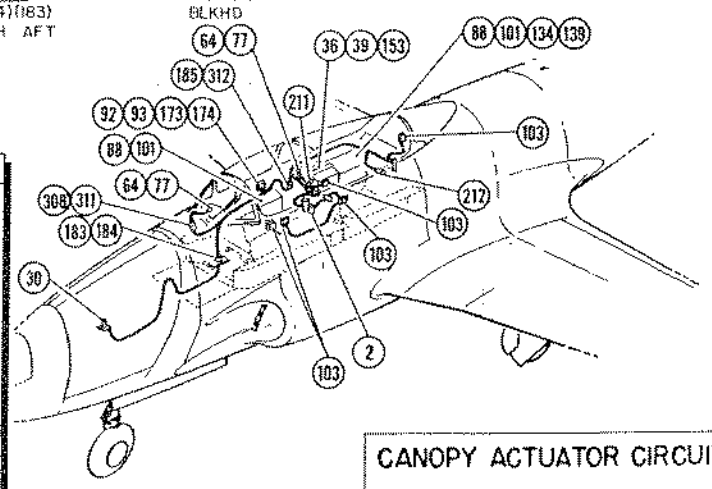
MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-4328

AB S93S

Figure 8-226. Canopy Actuator Circuit





ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	CANOPY ACTUATOR	BEMCO		C-824-C
30	RELAY	GPAE	R-14	AN3380-1
36	RELAY	EL PROD		N8-57-C
39	RELAY			AN3353-1
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
88	SWITCH			AN3023-7
92	SWITCH			AN3027-7
93	SWITCH			AN3027-5
101	SWITCH	C-H		8872
103	SWITCH			AN3210-1
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
153	RHEOSTAT	OHMITE	25Ω 100W	0442
173	CONNECTOR			AN3106-14S-5S
174	CONNECTOR			AN3102P-14S-5P
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
185	CONNECTOR			AN3102-28-11P
211	SOLENOID	CANNON		W-5L
212	SOLENOID	ADEL		12257-29
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
312	CONNECTOR			AN3108-28-11S

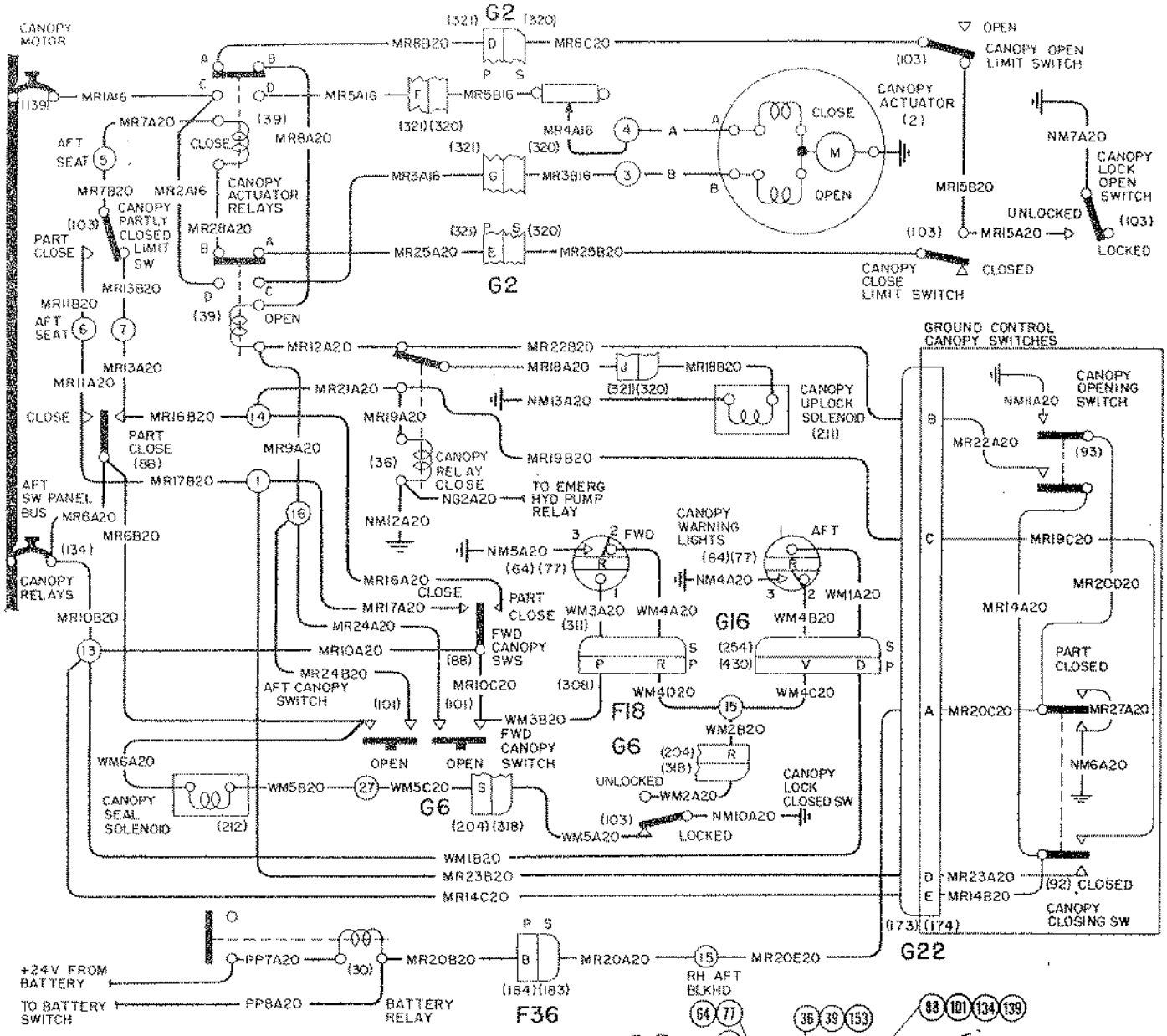
CANOPY ACTUATOR CIRCUIT

MODEL T-33A

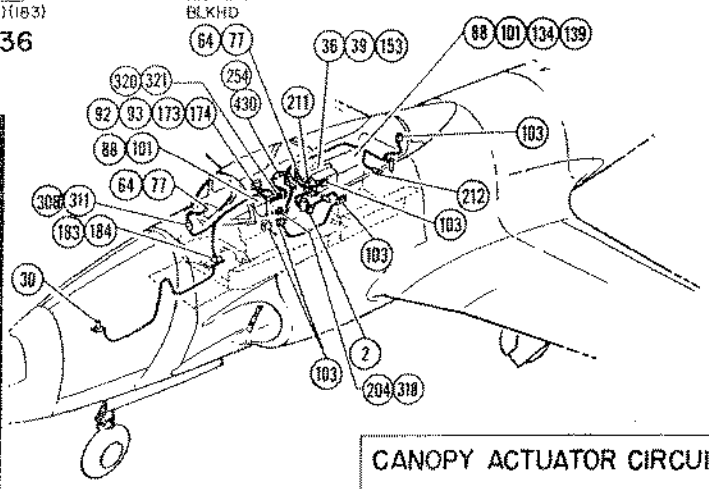
APPLIES TO AF SERIAL NO. 51-4329 THRU 51-6818

EM20-38-8-131
FB 5790

Figure 8-227. Canopy Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	CANOPY ACTUATOR	EEMCO		C-824-C
30	RELAY	GFAE	B-14	AN3380-1
36	RELAY	EL PROD		NB-57-C
39	RELAY			AN3353-1
64	LIGHT		RED	AN3167-6
77	LAMP			AN3121-313
88	SWITCH			AN3027-7
92	SWITCH			AN3027-7
93	SWITCH			AN3027-5
101	SWITCH	C-H		8872
103	SWITCH			AN3210-1
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
153	RHEOSTAT	OHMITE	2Ω/100W	0442 OR 21208
170	CONNECTOR			AN3106-145-5S
174	CONNECTOR			AN3102P-145-5P
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
212	SOLENOID	ADEL		12257-29
254	CONNECTOR			AN3108B-28-12S
308	CONNECTOR			AN3102-20-15P
311	CONNECTOR			AN3106-28-15S
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3108A-28-12P
321	CONNECTOR			AN3102-28-12S
430	CONNECTOR			AN3102-28-12P



FB 5787

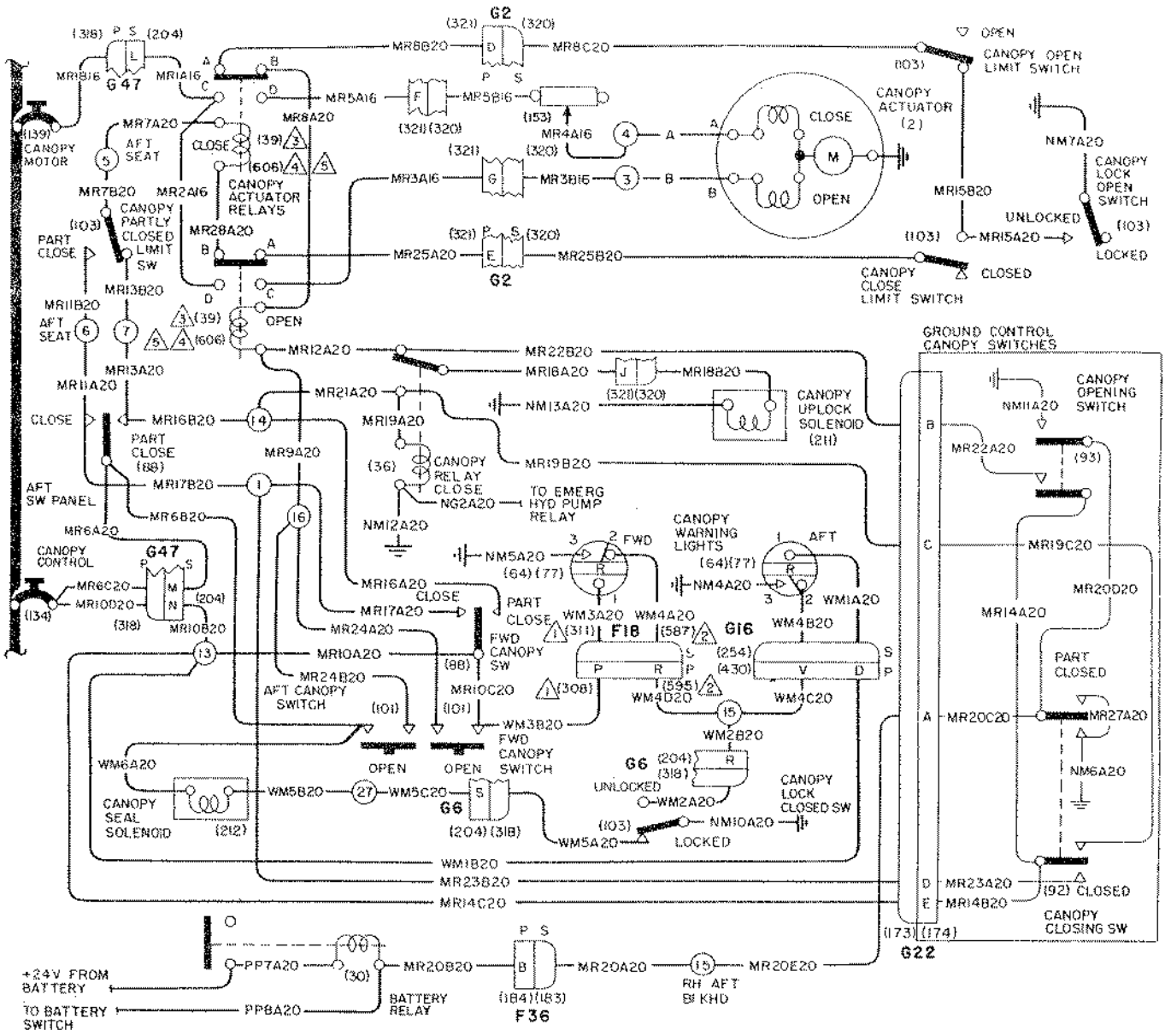
EM20-38-8-102

CANOPY ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THRU 51-9235

Figure 8-228. Canopy Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	CANOPY ACTUATOR	EEMCO		C-824-C
10	RELAY	GFAE	B-14	AN3380-1
36	RELAY	EL PROD		NB-57-C
39	RELAY			AN3353-1
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
80	SWITCH			AN3021-7
92	SWITCH			AN3027-7
93	SWITCH			AN3027-5
101	SWITCH	C-H		8872
103	SWITCH			AN3210-1
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-F35
153	RHEOSTAT	OHMITE	2Ω±100W	21208
173	CONNECTOR			AN3106-14S-5S
174	CONNECTOR			AN3102P-14S-5P
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5E
212	SOLENOID	ADEL		12257-29
254	CONNECTOR			AN3106B-28-12S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
318	CONNECTOR			AN3106B-20-29P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102-28-12S
430	CONNECTOR			AN3102-28-12P
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
606	RELAY	LEACH		7064-1SR2
606	RELAY			AN3353-2

NOTE

1. USED PRIOR TO AF SERIAL NO. 53-5666
2. USED ON AF SERIAL NO. 53-5666 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 53-5853 INCLUDING AF SERIAL NO. 54-1523 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728
4. USED ON AF SERIAL NO. 53-5853 THROUGH 56-1623 EXCEPT 54-1523 THROUGH 54-1583 AND 54-2689 THROUGH 54-2728
5. USED ON AF SERIAL NO. 56-1624 AND SUBSEQUENT

CANOPY ACTUATOR CIRCUIT

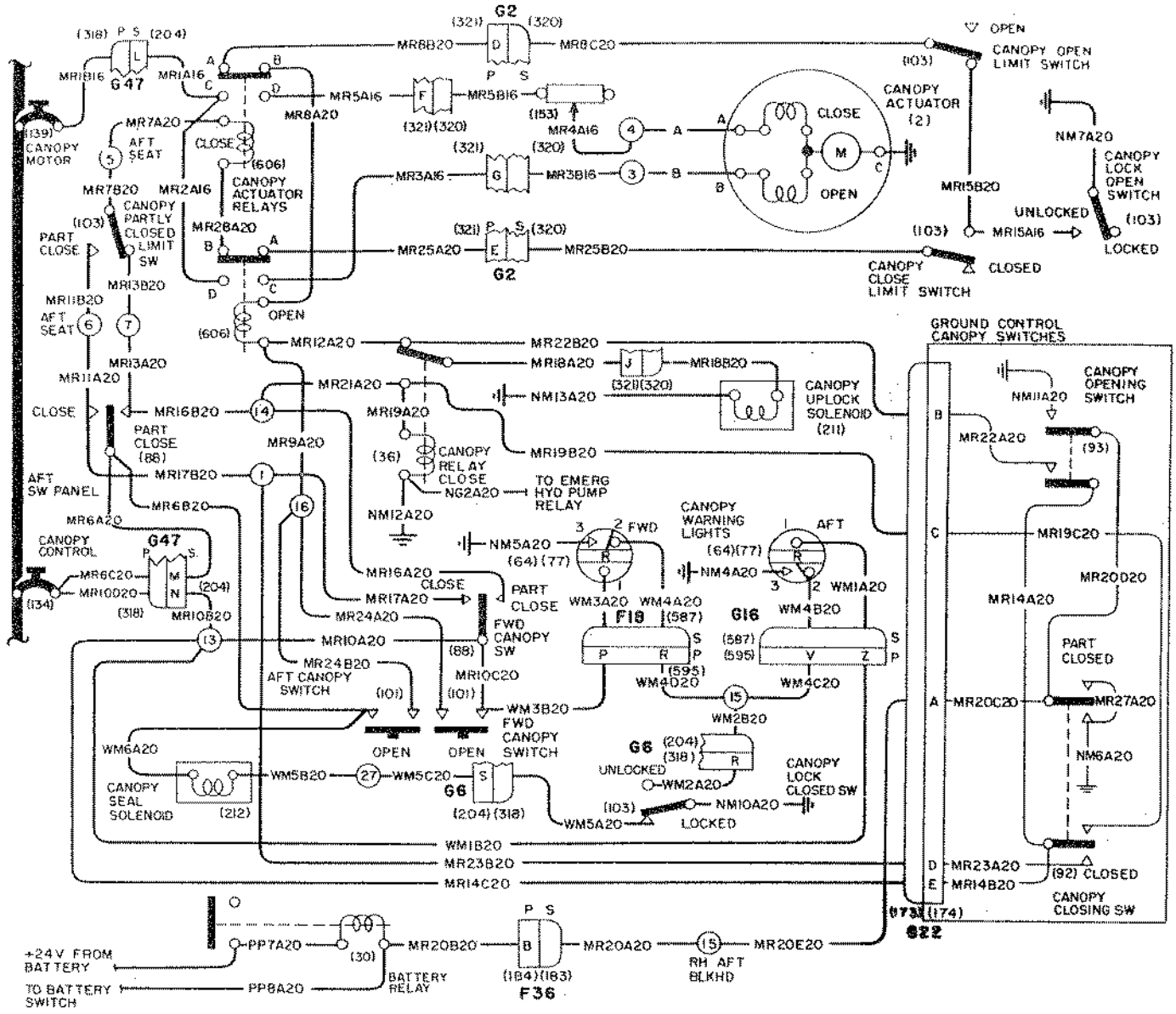
MODEL T-33A-1

APPLIES TO AF SERIAL NO. 51-9236 AND SUBSEQUENT

GB 8846

M28-480-8-190

Figure 8-229. Canopy Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
2	CANOPY ACTUATOR	BEMCO		C-824-C
30	RELAY	GFAE	B-14	AN3380-1
36	RELAY	EL PROD		NB-57-C
64	LIGHT		RED	AN3157-6
77	LAMP			AN3121-313
88	SWITCH			AN3021-7
92	SWITCH			AN3027-7
93	SWITCH			AN3027-5
101	SWITCH	C-H		8872
103	SWITCH			AN3210-1
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P35
153	RHEOSTAT	OHMITE	2Ω, 100W	21208
173	CONNECTOR			AN3106-14S-5S
174	CONNECTOR			AN3102P-14S-5P
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
204	CONNECTOR			AN3102-20-29S
211	SOLENOID	CANNON		W-5L
212	SOLENOID	ADEL		12257-29
318	CONNECTOR			AN3106B-20-29-P
320	CONNECTOR			AN3106B-28-12P
321	CONNECTOR			AN3102-28-12S
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P
⚠1 606	RELAY	LEACH		7964-15N
⚠2 606	RELAY			AN3353-2

NOTE

⚠1 USED PRIOR TO AF SERIAL NO. 56-1624

⚠2 USED ON AF SERIAL NO. 56-1624 AND SUBSEQUENT

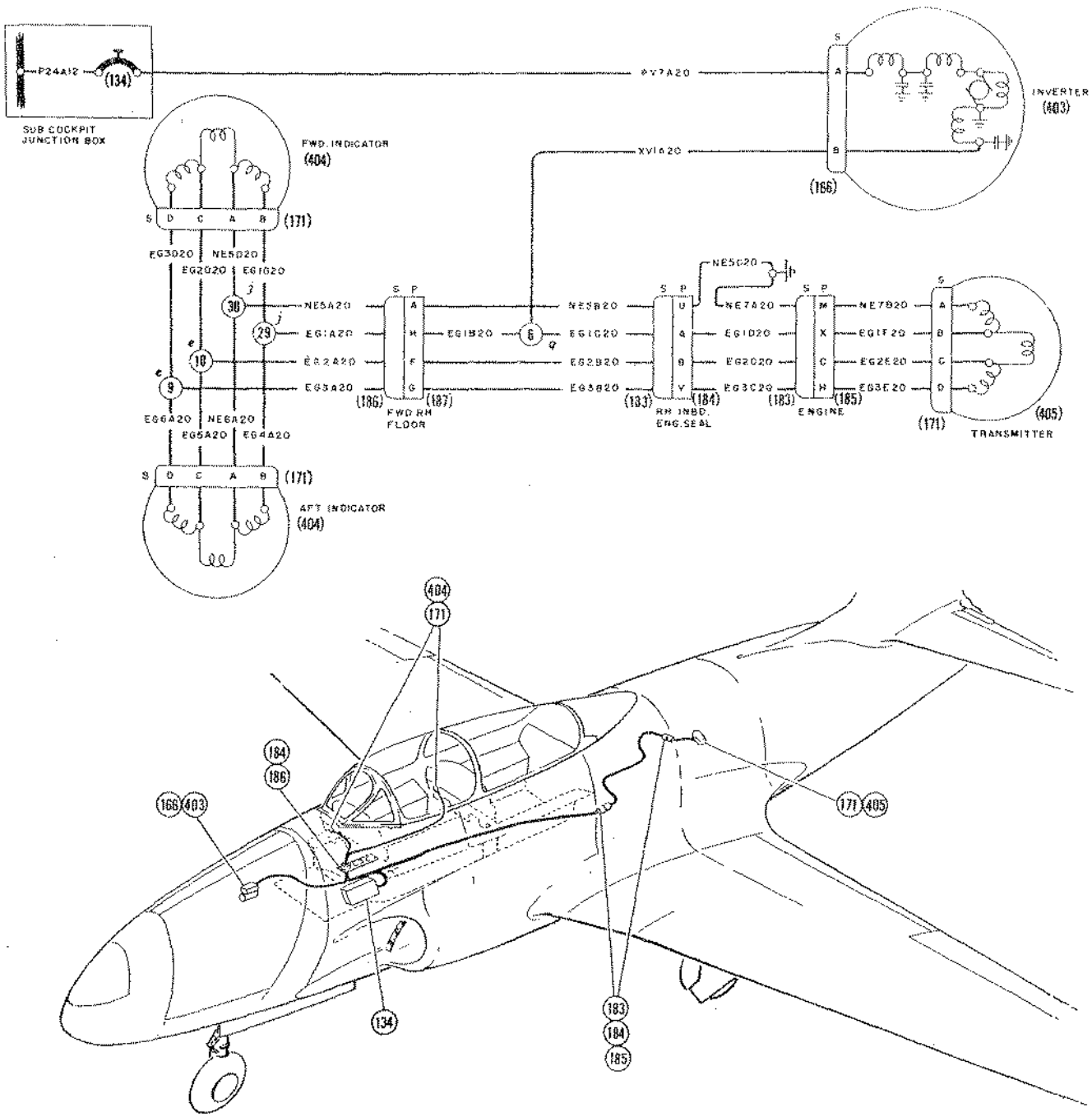
CANOPY ACTUATOR CIRCUIT

MODEL T-33A-5

FB 5788

EM20-38-8-400

Figure 8-230. Canopy Actuator Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC	LOCATION
134	CIRCUIT PROTECTOR			AN3161-P5	SUB-COCKPIT JCT BOX
166	CONNECTOR			AN3106-12S-3S	INVERTER PLUG
171	CONNECTOR			AN3106-14S-2S	
183	CONNECTOR			AN3106-28-11S	
184	CONNECTOR			AN3102P-28-11P	RH INBD ENGINE SEAL
185	CONNECTOR	GFP		AN3102-28-11P	ENGINE SECTION
186	CONNECTOR			AN3106-28-12S	FWD RH FLOOR
187	CONNECTOR			AN3102P-28-12P	FWD RH FLOOR
403	INVERTER	PIONEER	6VA	32270	RADIO RACK
404	INDICATOR	GFP	B-18	2123B	FWD & AFT INSTR PANEL
405	TRANSMITTER	GFP	P-2	21117	ENGINE SECTION

AB 33004

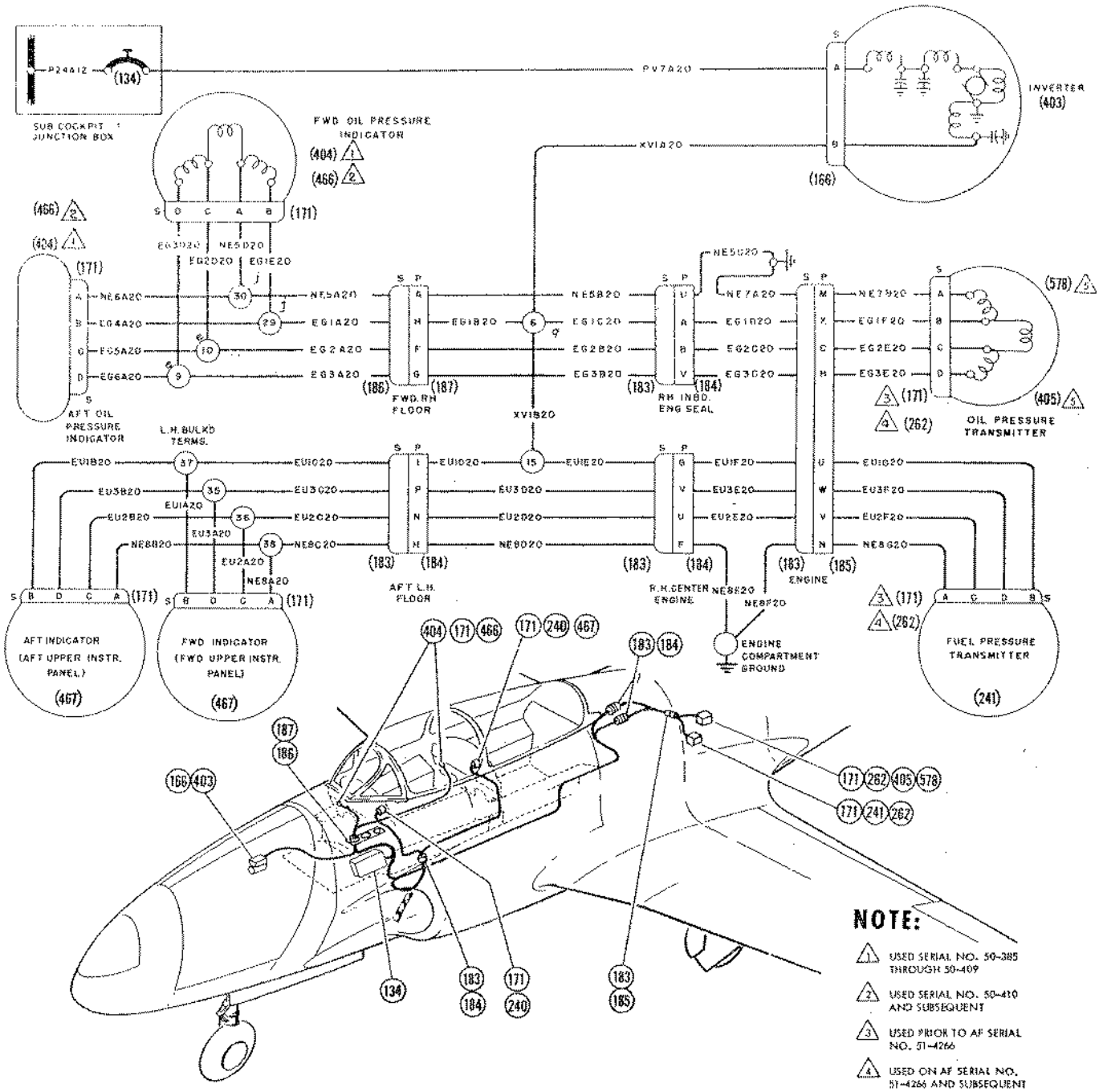
Notes

q SUB-COCKPIT
j R.H. AFT BULKHEAD
e R.H. CENTER STAND

OIL PRESSURE INDICATING SYSTEM CIRCUIT
MODEL T33-A

APPLIES TO SERIAL NOS 49-922 THROUGH 49-1006, 49-2757 THROUGH 49-2772 AND 50-320 THROUGH 50-384

Figure 8-231. Oil Pressure Indicating Circuit



	ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
	134	CIRCUIT PROTECTOR			AN3161-P5
	166	CONNECTOR			AN3106-12S-3S
	171	CONNECTOR			AN3106-14S-2S
	183	CONNECTOR			AN3106-28-11S
	184	CONNECTOR			AN3102P-28-11P
	185	CONNECTOR			AN3102-28-11P
	186	CONNECTOR			AN3106-28-12S
	187	CONNECTOR			AN3102P-28-12P
	241	TRANSMITTER		E5	21163
4	262	CONNECTOR			AN3108-14S-2S
	403	INVERTER	PIONEER	6VA	32270
1	404	INDICATOR	GFAE	B1B	21238
5 2	405	TRANSMITTER	GFAE	E-2	21117
	466	INDICATOR	GFAE	B2D	21319
	467	INDICATOR		C-30	21308
5	578	TRANSMITTER	GFAE	MS28093-2	MIL-T-5796

CB 7487
EM20-27-8-134

NOTE:

1. USED SERIAL NO. 50-385 THROUGH 50-409
2. USED SERIAL NO. 50-410 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 51-4266
4. USED ON AF SERIAL NO. 51-4266 AND SUBSEQUENT
5. ALTERNATES

q SUB-COCKPIT

j R.H. AFT BUCKHEAD

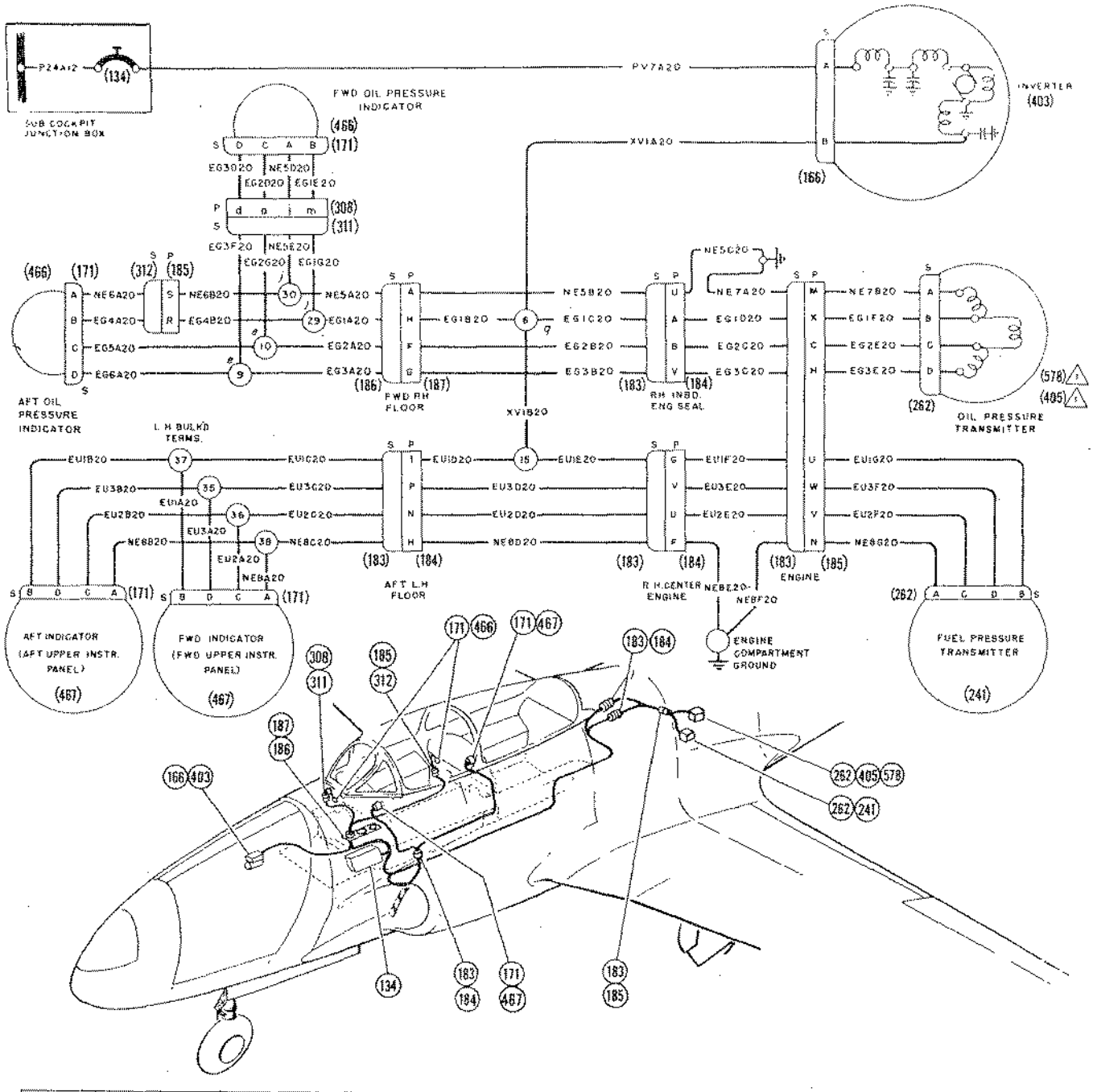
e R.H. CENTERSTAND

OIL AND FUEL PRESSURE INDICATING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 50-385 THROUGH 51-4328

Figure 8-232. Oil and Fuel Pressure Indicating Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P3
166	CONNECTOR			AN3106-12S-3S
171	CONNECTOR			AN3106-14S-2S
183	CONNECTOR			AN3106-20-11S
184	CONNECTOR			AN3102P-20-11P
185	CONNECTOR			AN3102-20-11P
186	CONNECTOR			AN3106-20-12S
187	CONNECTOR			AN3102P-20-12P
241	TRANSMITTER		E-5	21163
262	CONNECTOR			AN3108-14S-2S
308	CONNECTOR			AN3102-20-15P
311	CONNECTOR			AN3106-20-15S
312	CONNECTOR			AN3108-20-11S
403	INVERTER	PIONEER	6VA	32270
1 405	TRANSMITTER	GFAE	F-2	21137
466	INDICATOR	GFAE	A-20	21319
467	INDICATOR	GFAE	C-30	21308
1 578	TRANSMITTER	GFAE	MS28005-2	MIL-T-5996

NOTE:

1 ALTERNATES
g SUB-COCKPIT
j RH AFT BULKHEAD
e RH CENTER STAND

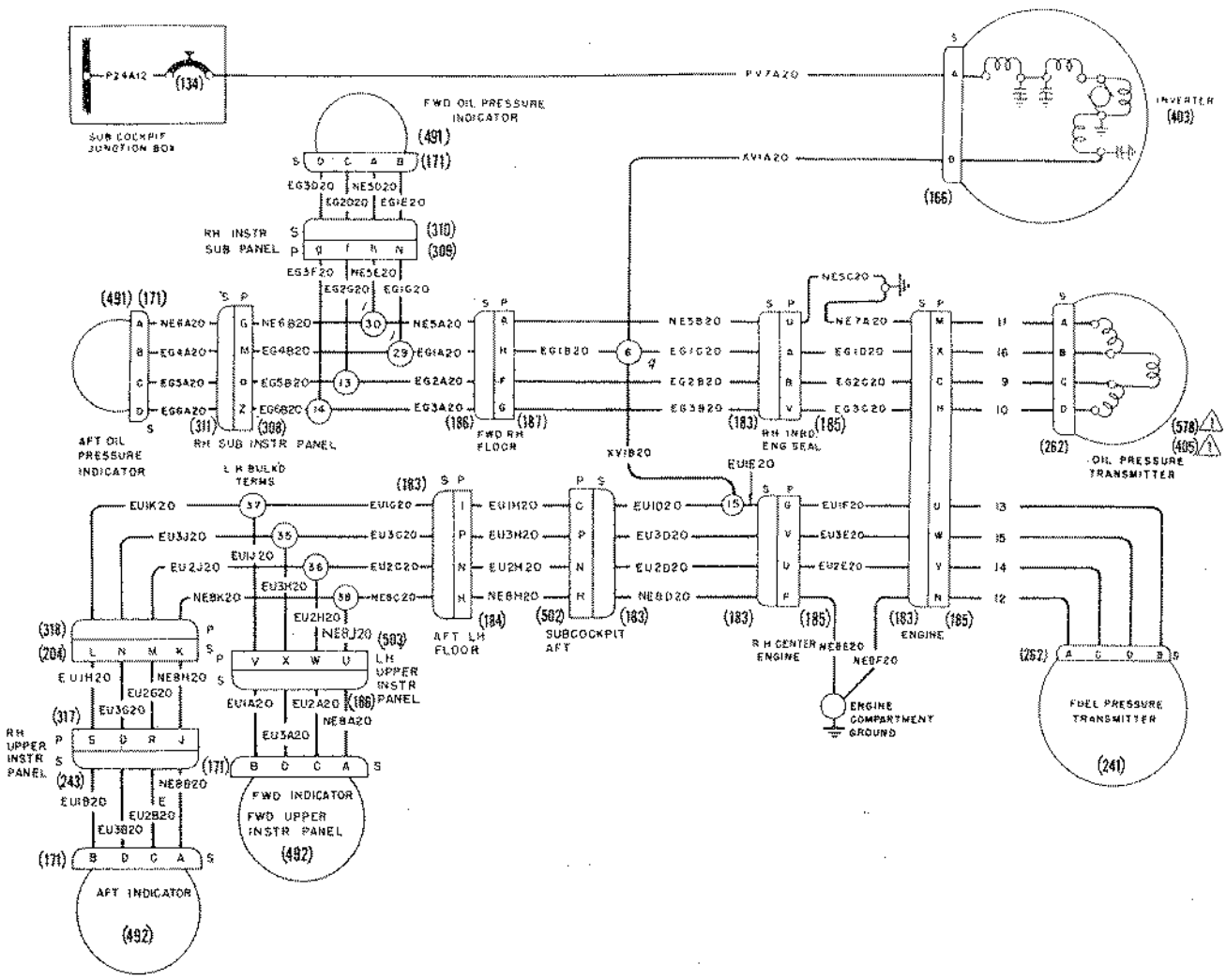
CB 7408
EM20-27-8-135

OIL AND FUEL PRESSURE INDICATING CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NUMBERS 51-4329 THROUGH 51-6818

Figure 8-233. Oil and Fuel Pressure Indicating Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
166	CONNECTOR			AN3106B-12S-3S
171	CONNECTOR			AN3106B-14S-2S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
241	TRANSMITTER	GFAE	E-5	27163
243	CONNECTOR			AN3106B-20-29S
262	CONNECTOR			AN3108B-14S-2S
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
403	INVERTER	PIONEER	6 VA	32270
⚠1 405	TRANSMITTER	GFAE	F-2	21117
491	INDICATOR	GFAE	B-20	21319
492	INDICATOR	GFAE	C-30	21308
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
⚠1 578	TRANSMITTER	GFAE	MS28005-2	MIL-T-5796

NOTE:

⚠1 ALTERNATES

q SUB-COCKPIT

j RH AFT BULKHEAD

OIL AND FUEL PRESSURE INDICATING CIRCUIT

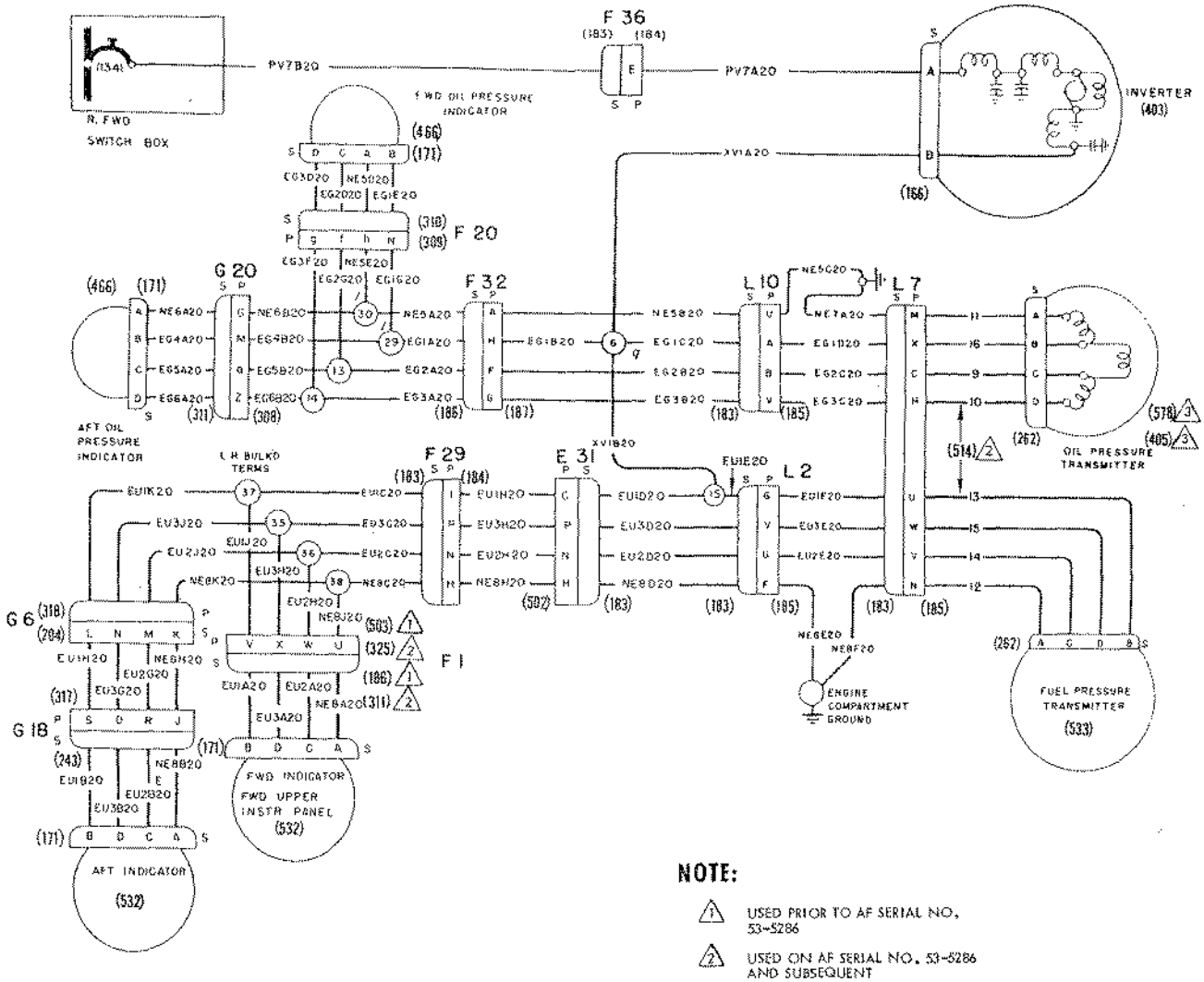
MODEL T-33A

APPLIES TO AF SERIAL NUMBERS 51-6819 THROUGH 51-8855

GB 8875

M20-48D-8-136

Figure 8-234. Oil and Fuel Pressure Indicating Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
166	CONNECTOR			AN3106B-12S-3S
171	CONNECTOR			AN3106B-14S-2S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
262	CONNECTOR			AN3108B-14S-2S
308	CONNECTOR			AN3102A-28-15P
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
2 325	CONNECTOR			AN3100A-28-15P
403	INVERTER	PIONEER	6 VA	12129-3
3 405	TRANSMITTER	GFAE	F - 2	21117
491	INDICATOR	GFAE	B - 20	21319
502	CONNECTOR			AN3100A-28-11P
503	CONNECTOR			AN3100A-28-12P
2 514	HARNESS ASSY	ALLISON		6719074
532	INDICATOR	GFAE	MS28010-7	MIL-I-6301A
533	TRANSMITTER	GFAE	MS28005-7	MIL-T-7086
3 578	TRANSMITTER	GFAE	MS28005-2	MIL-T-5796

NOTE:

1. USED PRIOR TO AF SERIAL NO. 53-5286
2. USED ON AF SERIAL NO. 53-5286 AND SUBSEQUENT
3. ALTERNATES

Note

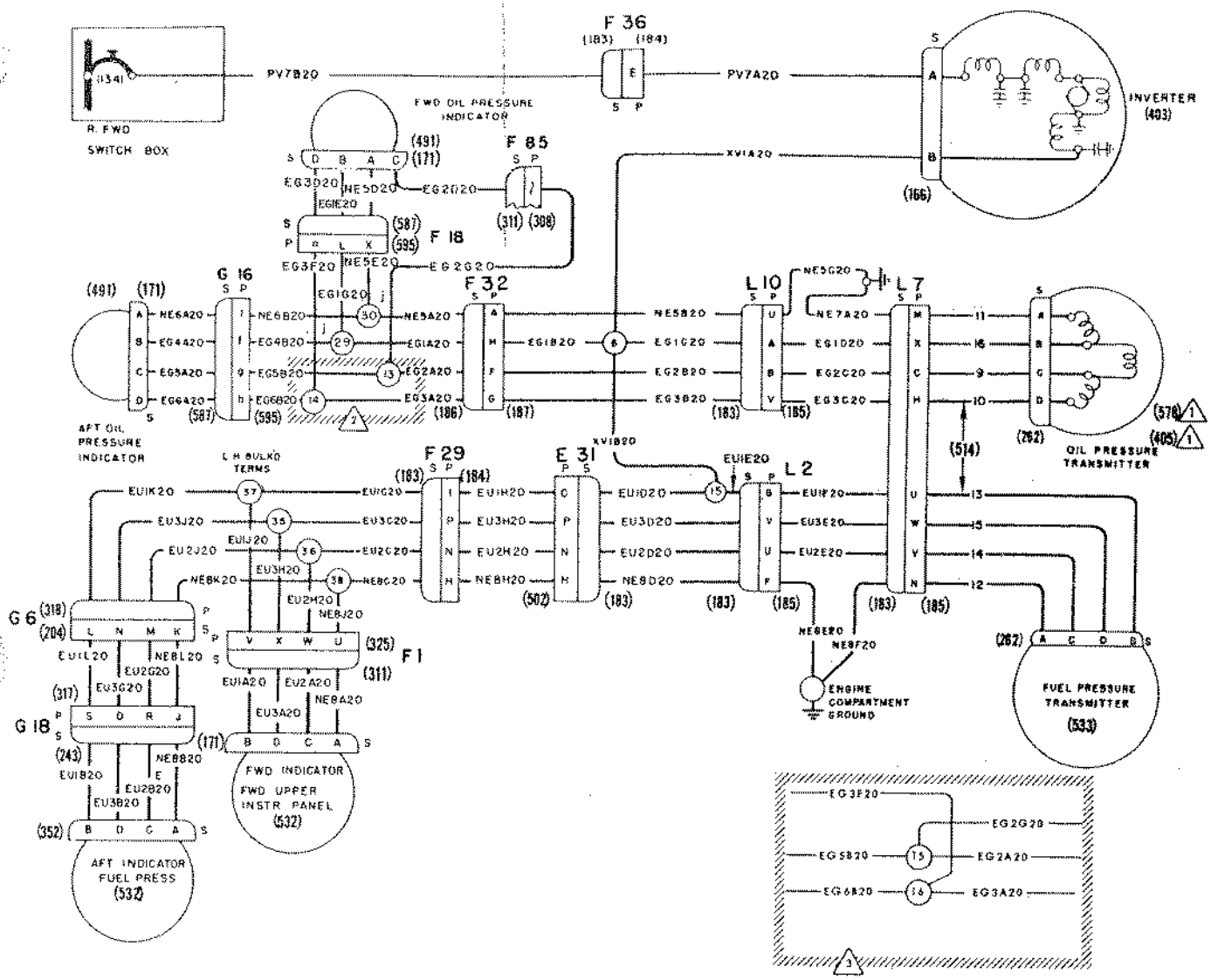
ø SUB- COCKPIT
/ R.H. AFT BULKHEAD

M20-48D-B-137

GB 8979

OIL AND FUEL PRESSURE INDICATING CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 51-8836 AND SUBSEQUENT

Figure 8-235. Oil and Fuel Pressure Indicating Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
166	CONNECTOR			AN3106B-12S-3S
171	CONNECTOR			AN3106B-14S-2S
183	CONNECTOR			AN3106B-28-11S
184	CONNECTOR			AN3102C-28-11P
185	CONNECTOR			AN3102A-28-11P
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
262	CONNECTOR			AN3108B-14S-2S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
325	CONNECTOR			AN3100A-28-15P
352	CONNECTOR			AN3108B-14S-2S
403	INVERTER	PIONEER	6 VA	12128-3
405	TRANSMITTER	GFAE	F-2	21817
491	INDICATOR	GFAE	B-20	25319
502	CONNECTOR			AN3100A-28-11P
514	HARNESS ASSY	ALLISON		6719874
532	INDICATOR	GFAE	MS28010-7	MIL-I-6301A
533	TRANSMITTER	GFAE	MS28005-7	MIL-T-7086
578	TRANSMITTER	GFAE	MS28005-2	MIL-T-5796
587	CONNECTOR			AN3106B-28-21S
595	CONNECTOR			AN3102A-28-21P

NOTE:

1. ALTERNATES
2. USED PRIOR TO AF SERIAL NO. 57-634
3. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

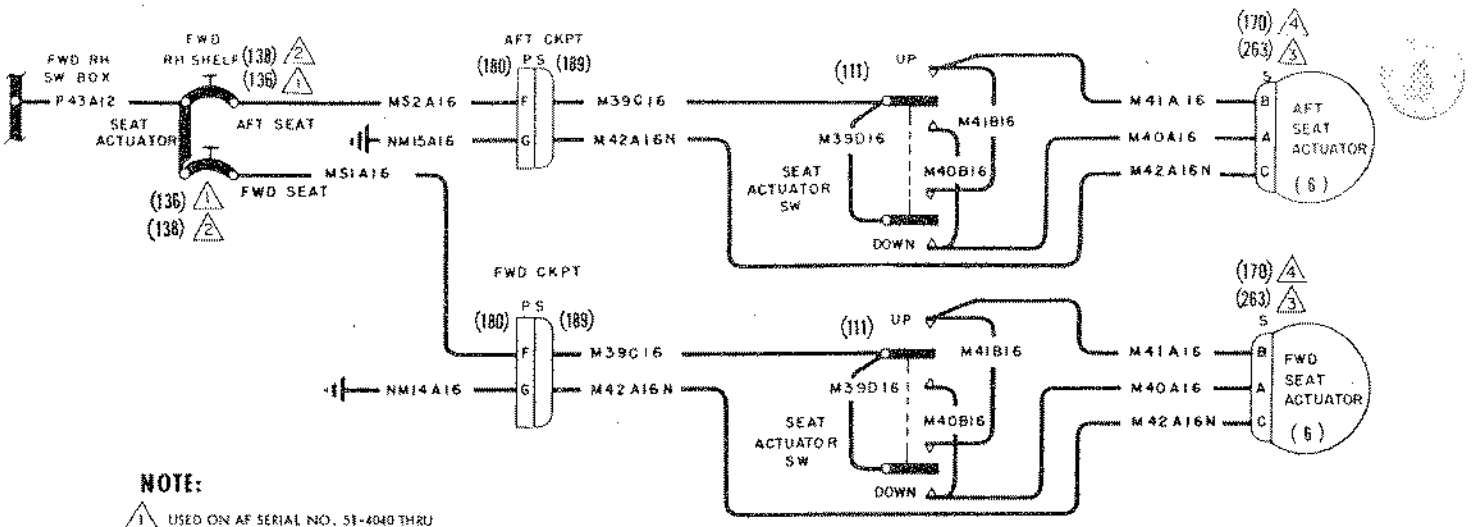
g SUBCOCKPIT

J RH AFT BULKHEAD

M20-44-8-402
GB 3685

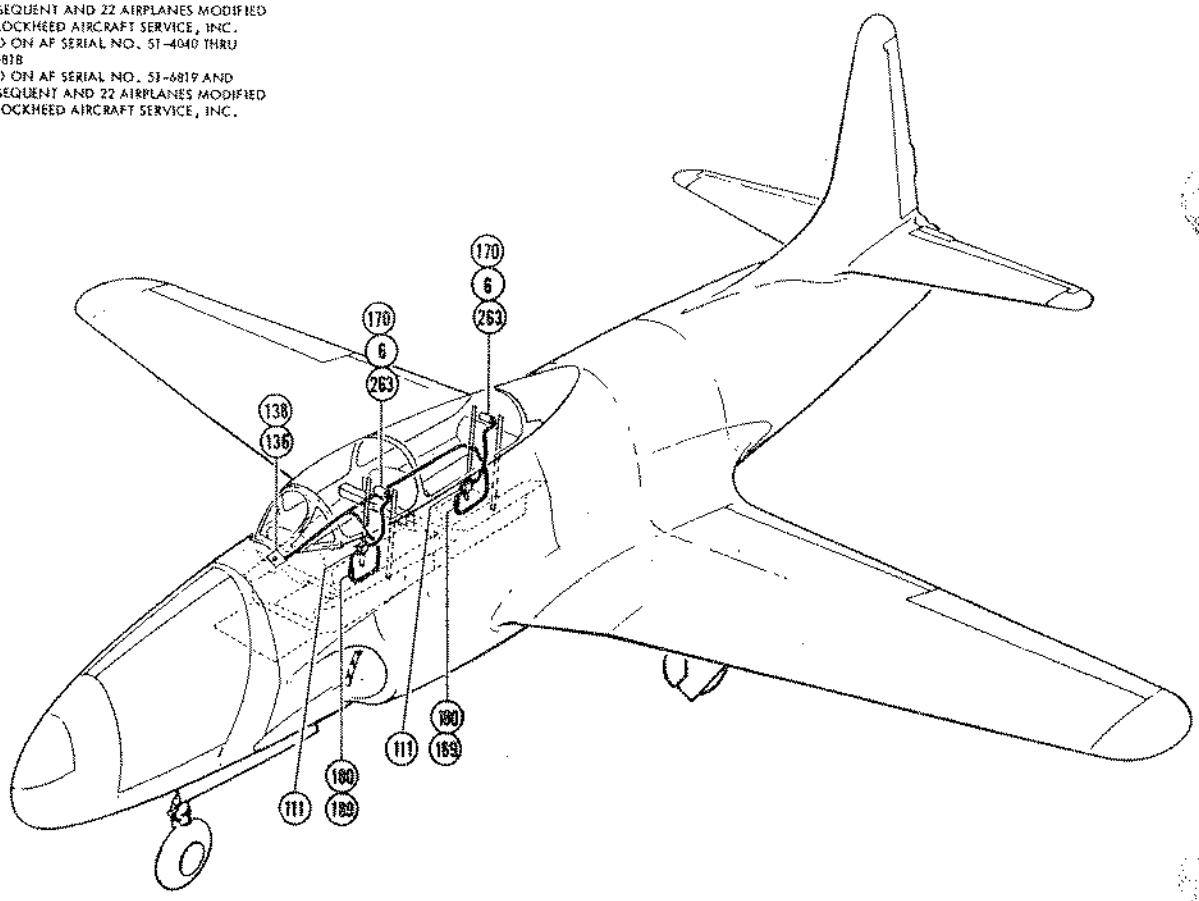
OIL AND FUEL PRESSURE INDICATING CIRCUIT
MODEL T-33A-5

Figure 8-236. Oil and Fuel Pressure Indicating Circuits



NOTE:

1. USED ON AF SERIAL NO. 51-4040 THRU 51-4089
2. USED ON AF SERIAL NO. 51-4090 AND SUBSEQUENT AND 22 AIRPLANES MODIFIED BY LOCKHEED AIRCRAFT SERVICE, INC.
3. USED ON AF SERIAL NO. 51-4040 THRU 51-6818
4. USED ON AF SERIAL NO. 51-6819 AND SUBSEQUENT AND 22 AIRPLANES MODIFIED BY LOCKHEED AIRCRAFT SERVICE, INC.



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
6	ACTUATOR - EJECT SEAT	GILFILLAN		48029
1 131	SWITCH - SEAT ACTUATOR		DPDT	AN3023-7
1 136	CIRCUIT BREAKER		15A	AN3161-P15
2 138	CIRCUIT BREAKER		25A	AN3161-P25
4 170	CONNECTOR			AN3108-14S-1S
180	CONNECTOR		MOD	AN3102A-16S-1P
189	CONNECTOR		MOD	AN3102A-16S-1S
3 263	CONNECTOR			AN3108-14S-1S

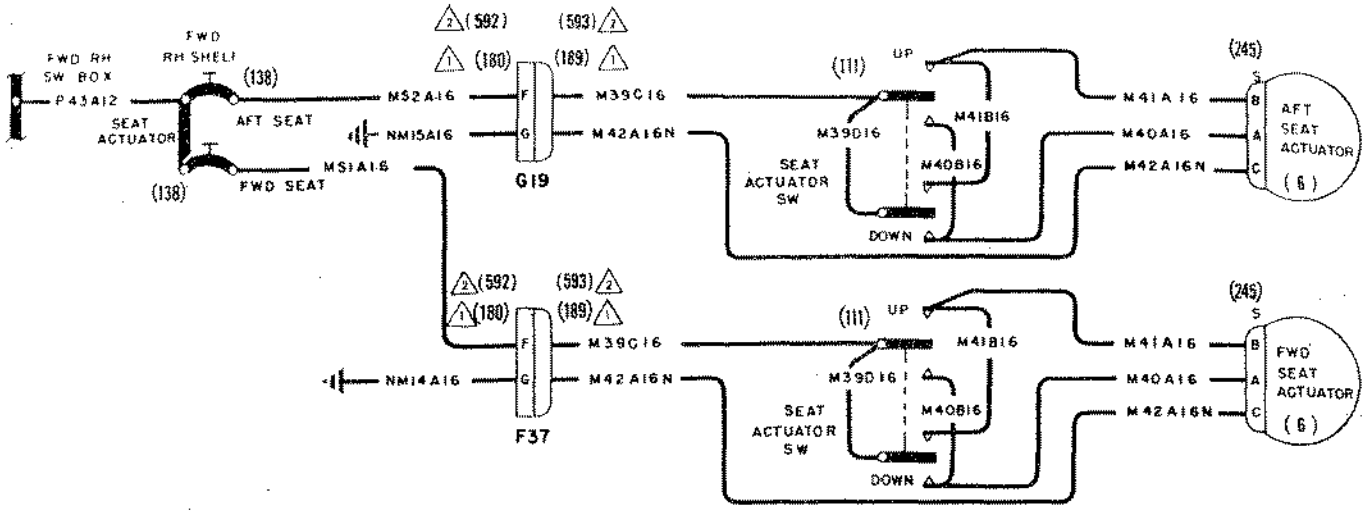
GB 3582
M20-44-8-138

SEAT POSITION ACTUATOR CIRCUIT

MODEL T-33A

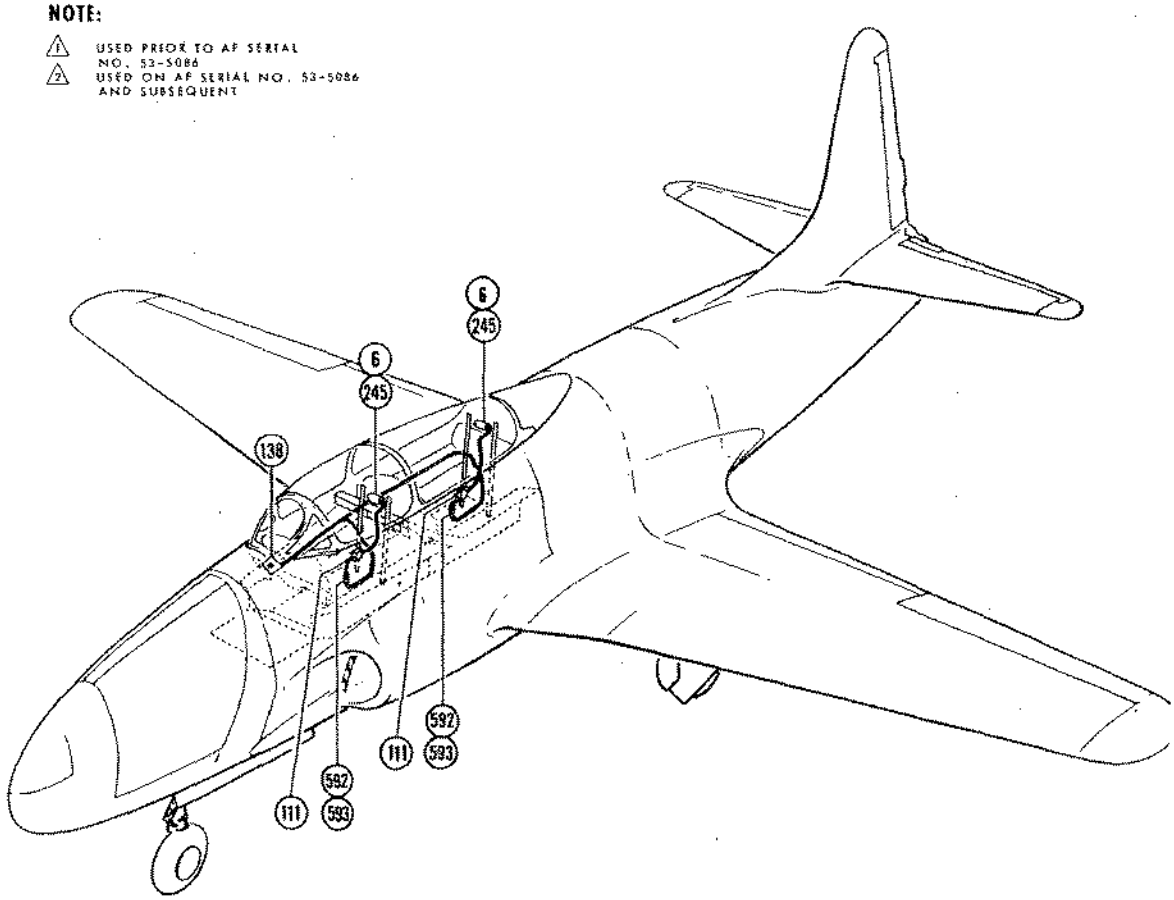
APPLIES TO AF SERIAL NO. 51-4040 THROUGH 52-9634, 52-9876 THROUGH 52-9905, AND 22 AIRPLANES MODIFIED BY LOCKHEED AIRCRAFT SERVICE, INC.

Figure 8-237. Seat Position Actuator Circuit



NOTE:

△1 USED PRIOR TO AF SERIAL NO. 53-5086
△2 USED ON AF SERIAL NO. 53-5086 AND SUBSEQUENT



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
6	ACTUATOR - EJECT SEAT	GILFILLAN		48029
111	SWITCH-SEAT ACTUATOR		DPDT	AN3023-7
138	CIRCUIT BREAKER		25A	AN3161-P25
△1 180	CONNECTOR		MOD	AN3102A-16S-1P
△1 189	CONNECTOR		MOD	AN3102A-16S-1S
245	CONNECTOR			AN31068-14S-7S
△2 592	CONNECTOR		MOD	AN3102A-16S-1S
△2 593	CONNECTOR		MOD	AN31068-16S-1P

GB 3583
M20-44-8-210

SEAT POSITION ACTUATOR CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9835 AND SUBSEQUENT, EXCEPT 52-9876 THROUGH 52-9905

Figure 8-238. Seat Position Actuator Circuit

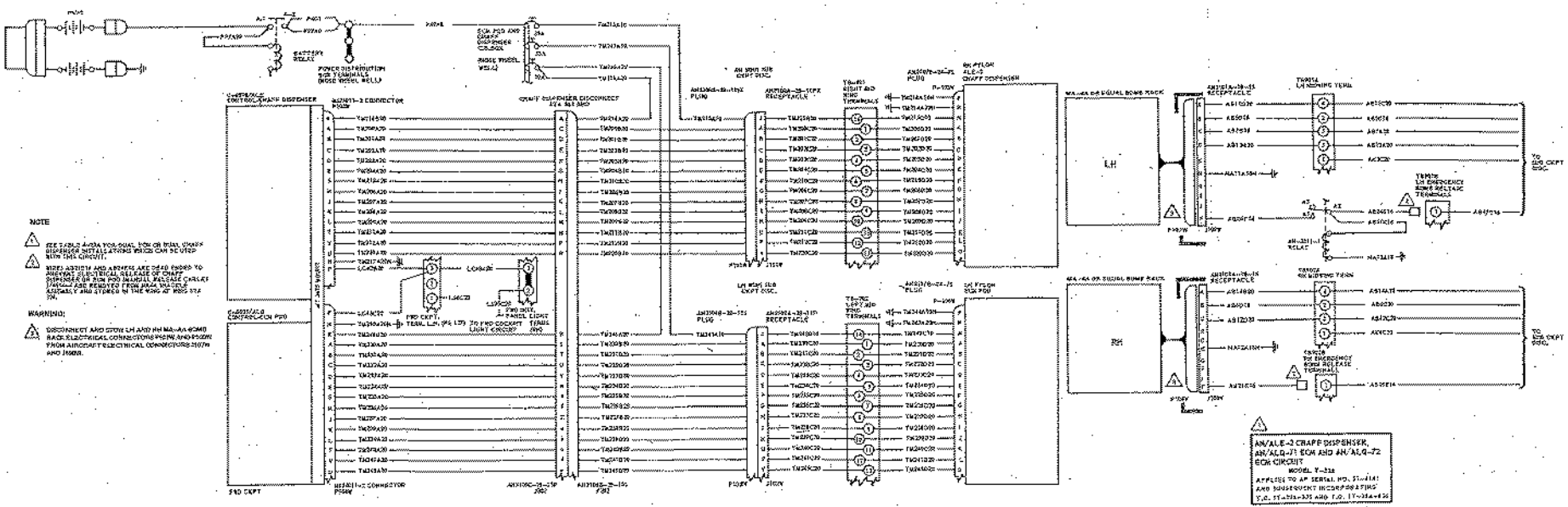
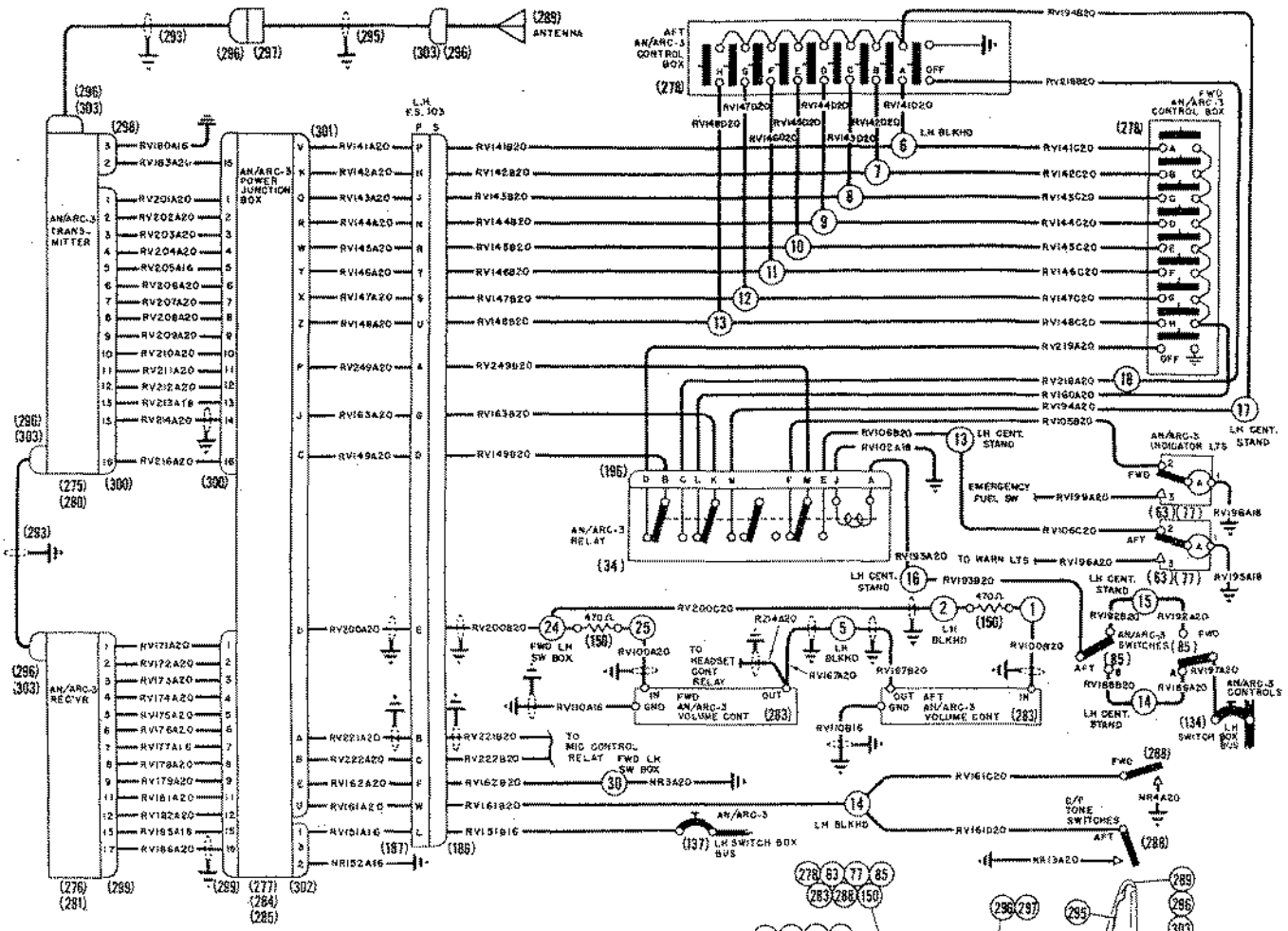
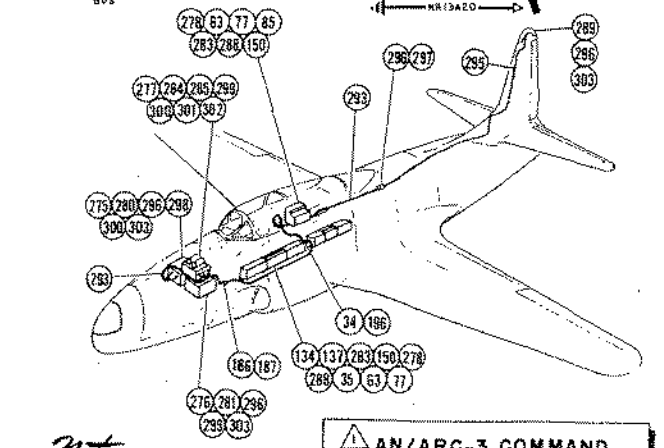


Figure 8-29A. AN/ALE-2 Chaff Dispenser, AN/ALQ-71 ECM and AN/ALQ-72 ECM Circuit.



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
34	RELAY	ADVANCE		A8609-1
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
137	CIRCUIT PROTECTOR			AN3161-P2U
150	RESISTOR	ERIE	1/2W	470Ω
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102P-28-12P
196	CONNECTOR			AN3106-20-1P
275	TRANSMITTER	GFAE		T-67/ARC-3
276	RECEIVER	GFAE		R-77/ARC-3
277	POWER JUNCTION BOX	GFAE		J-68/ARC-3
278	CONTROL BOX	GFAE		C-1118A/ARC-3
280	MOUNTING TRANSMITTER	GFAE		MT-238A/ARC-3
281	MOUNTING RECEIVER	GFAE		MT-237A/ARC-3
283	VOLUME CONTROL	GFAE		C197/ARC-3
284	DYNAMOTOR	GFAE		DY-21/ARC-3
285	DYNAMOTOR	GFAE		DY22/ARC-3
288	TONE CONTROL	GFAE		SE-256
289	ANTENNA	LAC		177250
293	CABLE, COAXIAL	GFAE		RG-8/U
295	CABLE, COAXIAL	ROCKBESTOS		LRD-1
296	PLUG, COAXIAL CABLE	GFAE		PL-259A
297	PLUG, COAXIAL CABLE	GFAE		SO-239
298	PLUG, TONE CONTROL	GFAE		PL-151A
299	PLUG, RECEIVER	GFAE		PL-153A
300	PLUG, TRANSMITTER	GFAE		U-15/U
301	PLUG, POWER JUNCTION BOX	GFAE		U-16/U
302	PLUG, POWER	GFAE		PL-148A
303	ADAPTER	GFAE		M-359



Note

⚠ REMOVED PER T.O. 1T-33A-143 AND 1T-33A-556

⚠ AN/ARC-3 COMMAND RADIO CIRCUIT

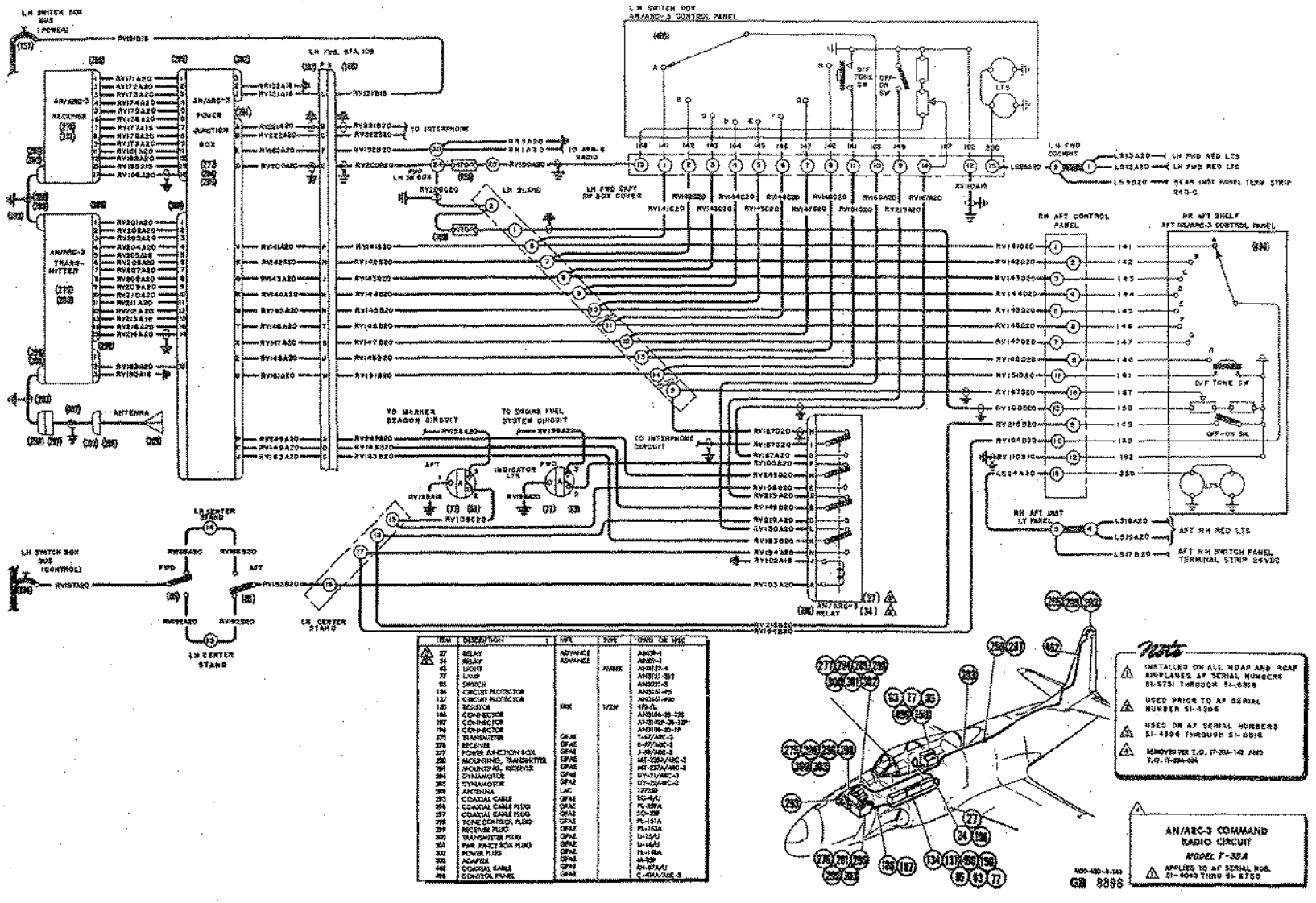
MODEL T-33A

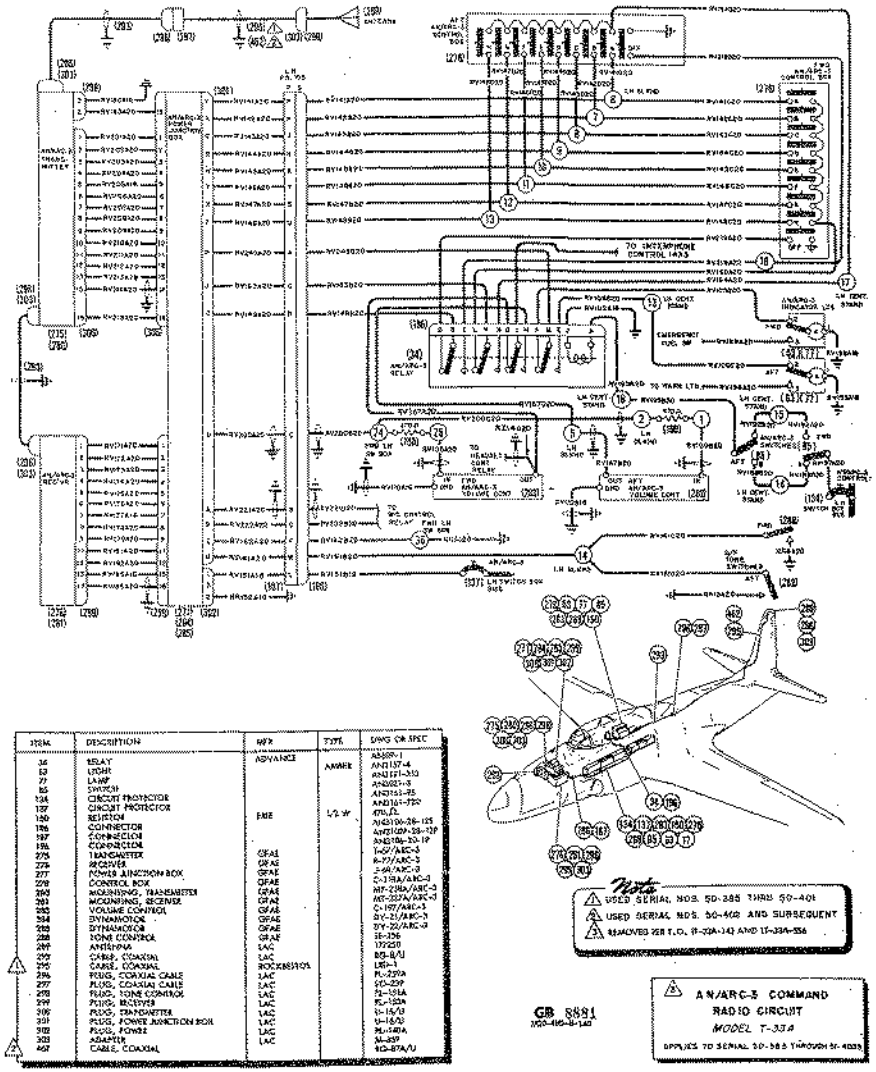
APPLIES TO AIRPLANES PRIOR TO 50-395

M20-4BD-8-139

GB 8880

Figure 8-239. AN/ARC-3 Command Radio Circuit


LH SWITCH BOX AN/ARC-3 CONTROL PANEL
AN/ARC-3 RECEIVER
AN/ARC-3 POWER JUNCTION BOX
AN/ARC-3 TRANSMITTER
TO INTERPHONE
TO ARN-6 RADIO
LH FWD CKPT
LH FWD RED LTS
BEAM INST PANEL TERM STRIP 263-C
LH FWD SAFT SW BOX COVER
RH AFT CONTROL PANEL
RH AFT SHELF AFT AN/ARC-3 CONTROL PANEL
DIF TONE SW
OFF-ON SW
LTS
RH AFT INST LT PANEL
AFT RH RED LTS
AFT RH SWITCH PANEL TERMINAL STRIP 24VDC
TO MARKER BEACON CIRCUIT
TO ENGINE FUEL SYSTEM CIRCUIT
TO INTERPHONE CIRCUIT
INDICATOR LTS
ANTENNA
LH SWITCH BOX AN/ARC-3 CONTROL
LH CENTER STAND
AN/ARC-3 RELAY
RV1A20
RV2A20
RV3A20
RV4A20
RV5A20
RV6A20
RV7A20
RV8A20
RV9A20
RV10A20
RV11A20
RV12A20
RV13A20
RV14A20
RV15A20
RV16A20
RV17A20
RV18A20
RV19A20
RV20A20
RV21A20
RV22A20
RV23A20
RV24A20
RV25A20
RV26A20
RV27A20
RV28A20
RV29A20
RV30A20
RV31A20
RV32A20
RV33A20
RV34A20
RV35A20
RV36A20
RV37A20
RV38A20
RV39A20
RV40A20



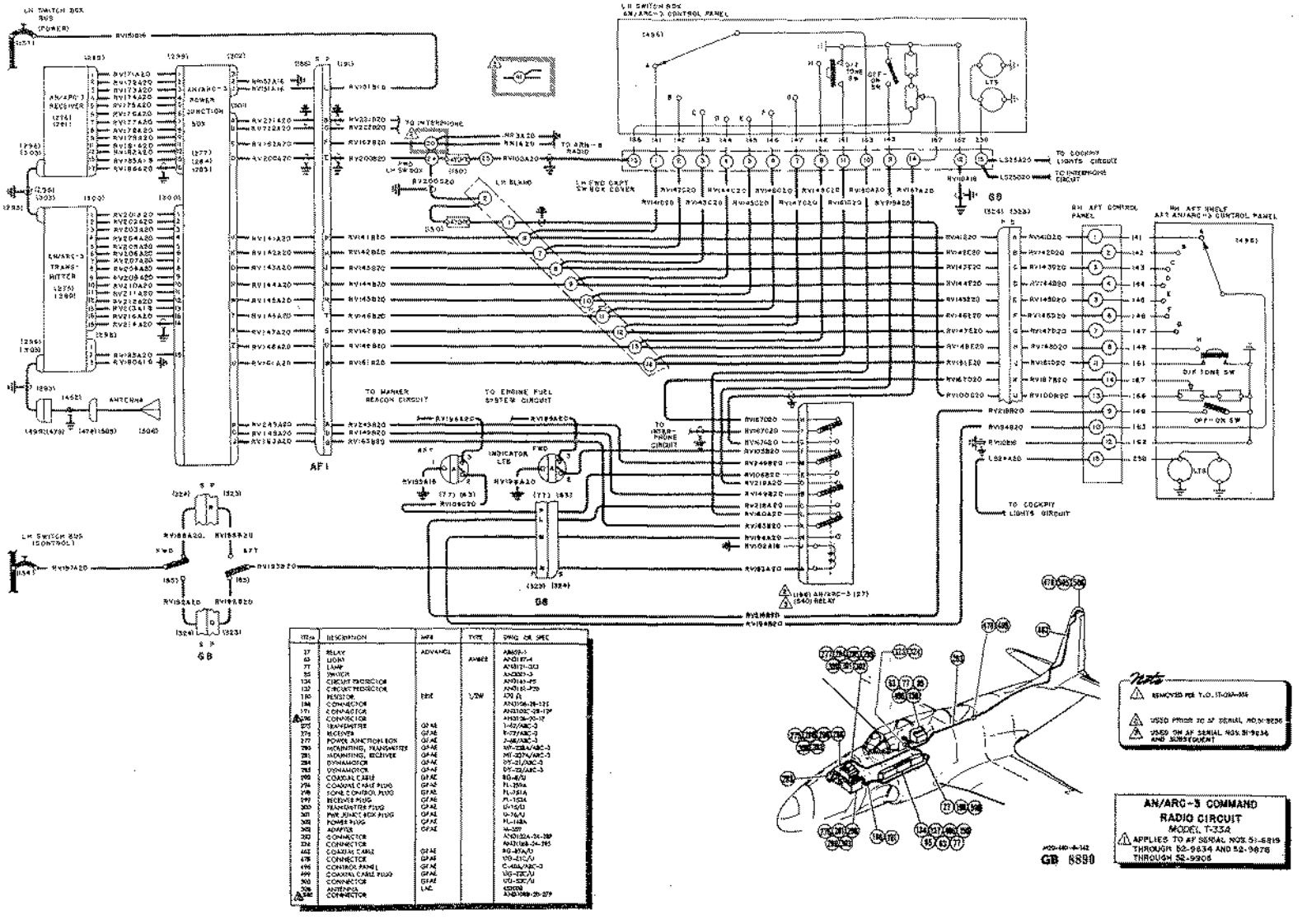
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	ADVANCE		AN3659-1
53	LIGHT		AN#ARE	AN1157-4
77	LAMP			AN1371-310
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-25
137	CIRCUIT PROTECTOR			AN3161-730
150	RESISTOR	ERIE	1/2 W	470Ω
186	CONNECTOR			AN3100-28-12S
187	CONNECTION			AN3102P-22-19P
196	CONNECTION			AN3106-22-19
274	TRANSMITTER	GFAE		T-69/ARC-3
275	TRANSMITTER	GFAE		R-77/ARC-3
276	RECEIVER	GFAE		R-69/ARC-3
277	POWER JUNCTION BOX	GFAE		C-1318/ARC-3
278	CONTROL BOX	GFAE		C-1317/ARC-3
280	MOUNTING, TRANSMITTER	GFAE		MT-2378/ARC-3
281	MOUNTING, RECEIVER	GFAE		MT-2377A/ARC-3
282	VOLUME CONTROL	GFAE		C-197/ARC-3
284	DYNAMOTOR	GFAE		DY-21/ARC-3
285	DYNAMOTOR	GFAE		DY-22/ARC-3
288	TONE CONTROL	GFAE		SE-126
289	ANTENNA	SAC		177250
292	CABLE, COAXIAL	SAC		RG-8/U
295	CABLE, COAXIAL	ROCKBESTOS		LBT-1
296	PLUG, COAXIAL CABLE	SAC		PL-259A
297	PLUG, COAXIAL CABLE	SAC		SO-239
298	PLUG, TONE CONTROL	SAC		PL-155A
299	PLUG, RECEIVER	SAC		PL-153A
300	PLUG, TRANSMITTER	SAC		M-14/U
301	PLUG, POWER JUNCTION BOX	SAC		M-16/U
302	PLUG, POWER	SAC		PL-548A
303	ADAPTER	SAC		M-359
407	CABLE, COAXIAL			RG-57A/U

Notes
1. USED SERIAL NOS. 50-385 THRU 50-401
2. USED SERIAL NOS. 50-402 AND SUBSEQUENT
3. REMOVED PER T.O. 1F-33A-143 AND 1T-33A-556

GB 8881

AN/ARC-3 COMMAND RADIO CIRCUIT
MODEL T-33A
APPLIES TO SERIAL 50-385 THROUGH 50-402

Figure 8-248. AN/ARC-3 Command Radio Circuit



REF	DESCRIPTION	MFR	TYPE	SPEC OR SPEC
17	RELAY	ADVANCE		AN659-1
63	LIGHT			AN3121-4
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
152	CIRCUIT PROTECTOR			AN3161-P20
180	RESISTOR	ERIE	1/2W	470 Ω
184	CONNECTOR			AN3106-28-12S
191	CONNECTOR			AN3102C-28-12P
196	CONNECTOR			AN3106-20-12
275	TRANSMITTER	GFAE		T-42/ARC-3
276	RECEIVER	GFAE		R-27/ARC-3
277	POWER JUNCTION BOX	GFAE		J-48/ARC-3
280	MOUNTING, TRANSMITTER	GFAE		MT-328A/ARC-3
281	MOUNTING, RECEIVER	GFAE		MT-327A/ARC-3
284	DYNAMOTOR	GFAE		DY-21/ARC-3
285	DYNAMOTOR	GFAE		DY-22/ARC-3
288	COAXIAL CABLE	GFAE		RG-8/U
294	COAXIAL CABLE PLUG	GFAE		PL-259A
296	TONE CONTROL PLUG	GFAE		PL-561A
298	RECEIVER PLUG	GFAE		PL-1534
300	TRANSMITTER PLUG	GFAE		U-76/U
301	PWR JUNCT BOX PLUG	GFAE		U-76/U
302	POWER PLUG	GFAE		PL-148A
303	ADAPTOR	GFAE		M-359
310	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-19S
462	COAXIAL CABLE	GFAE		RG-8A/U
478	CONNECTOR	GFAE		UG-21C/U
496	CONTROL PANEL	GFAE		C-434/ARC-3
499	COAXIAL CABLE PLUG	GFAE		UG-12C/U
500	CONNECTOR	GFAE		UG-22C/U
506	ANTENNA	LAC		42008
507	CONNECTOR			AN3106B-20-27S

Parts

1 REMOVED PER T.O. 1T-33A-506

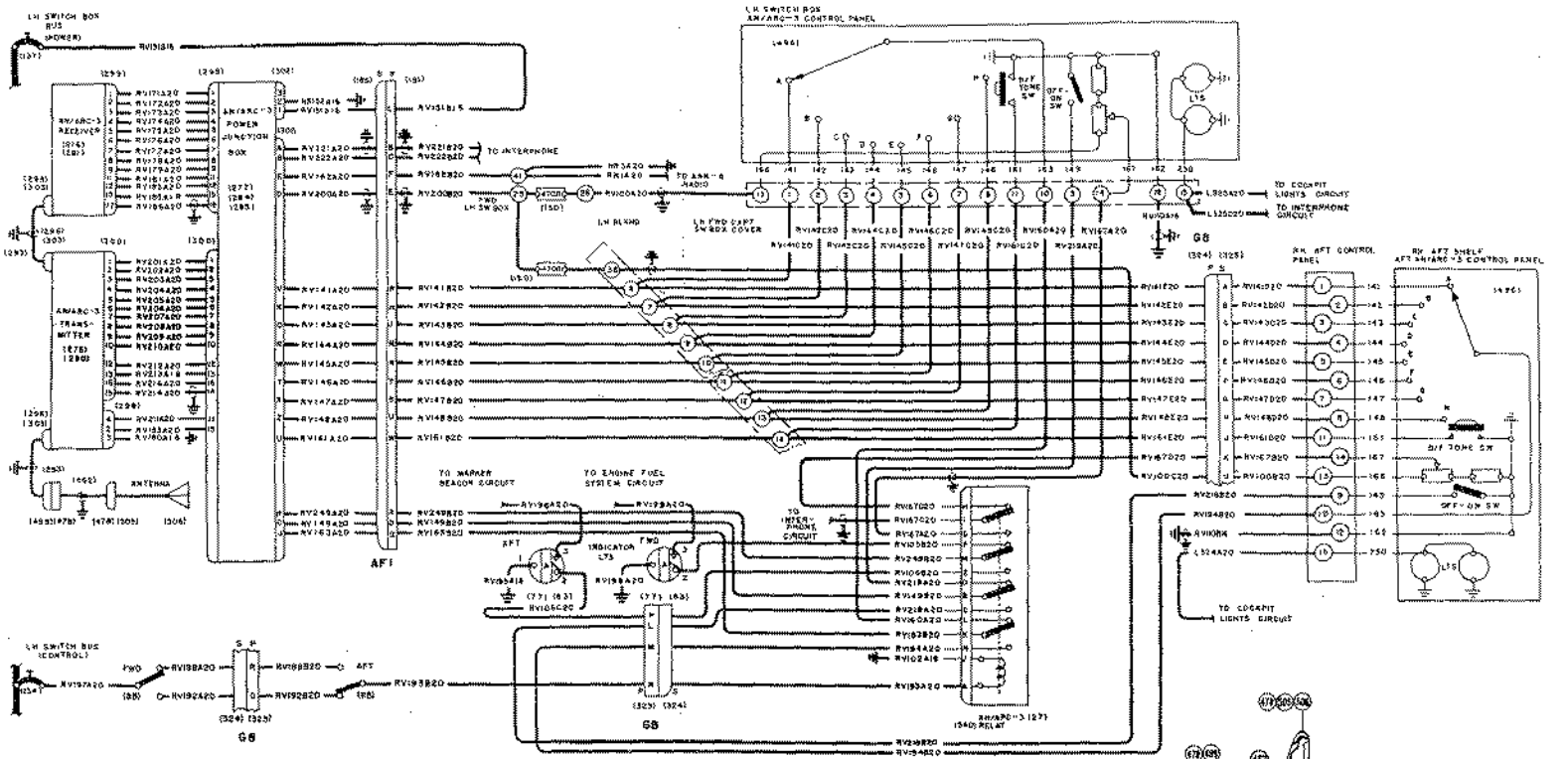
2 USED PRIOR TO AF SERIAL NO. 51-9256

3 USED ON AF SERIAL NOS. 51-9256 AND SUBSEQUENT

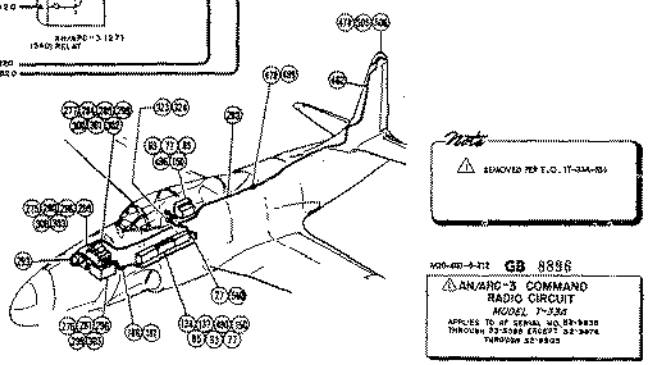
AN/ARC-5 COMMAND RADIO CIRCUIT
MODEL T-33A

1 APPLIES TO AF SERIAL NOS. 51-6819 THROUGH 52-9634 AND 52-9676 THROUGH 52-9905

Figure 8-242. AN/ARC-3 Command Radio Circuit



ITEM	DESCRIPTION	MFR	TYPE	SPEC OR SPEC
21	RELAY	ADVANCE	AN4813	AB639-1
23	LIGHT			AN3157-4
27	LAMP			AN3121-233
35	SWITCH			AN3960-8
124	CIRCUIT PROTECTOR			AN3161-P3
127	CIRCUIT PROTECTOR			AN3161-P20
150	RESISTOR		CPS-A1/PW	RC30BF471K
186	CONNECTOR			AN3106-28-12S
191	CONNECTOR			AN3106-28-12P
225	TRANSMITTER	GFAE		A-47/ARC-3
226	RECEIVER	GFAE		R-77/ARC-3
227	POWER JUNCTION BOX	GFAE		J-48/ARC-3
240	MOUNTING, TRANSMITTER	GFAE		MT-1824/ARC-3
241	MOUNTING, RECEIVER	GFAE		MT-2273/ARC-3
261	DYNAMOTOR	GFAE		DY-22/ARC-3
286	DYNAMOTOR	GFAE		DY-23/ARC-3
293	DYNAMOTOR	GFAE		RG-8/U
272	COAXIAL CABLE	GFAE		PL-259A
274	COAXIAL CABLE PLUG	GFAE		PL-259A
296	TONE CONTROL PLUG	GFAE		PL-155A
297	RECEIVER PLUG	GFAE		PL-155A
299	TRANSMITTER PLUG	GFAE		UG-21/U
301	PWR JUNCT BOX PLUG	GFAE		UG-29/U
302	POWER PLUG	GFAE		PL-148A
303	ADAPTER	GFAE		M-258
323	CONNECTOR			AN3102A-24-2W
324	CONNECTOR			AN3106A-24-2S
460	COAXIAL CABLE	GFAE		RG-62A/U
478	CONNECTOR	GFAE		UG-274/U
496	CONTROL PANEL	GFAE		C-1014/ARC-3
497	COAXIAL CABLE PLUG	GFAE		UG-92C/U
505	CONNECTOR	GFAE		UG-23C/U
506	ANTENNA	LAC		A10000
547	CONNECTOR			AN3108A-20-22P



Note

REMOVED PER T.O. 1T-33A-154

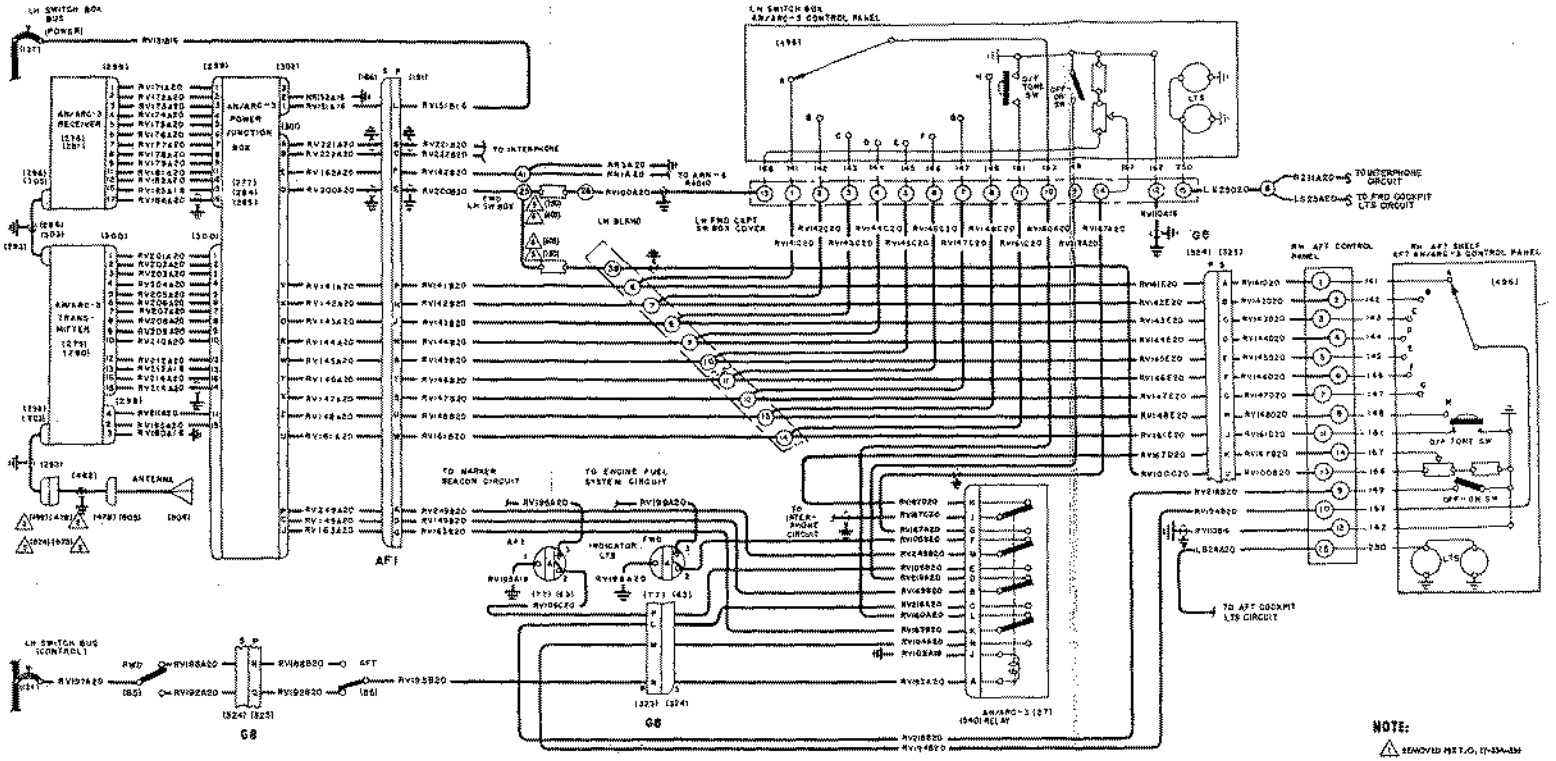
GB 8886

AN/ARC-3 COMMAND RADIO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9838 THROUGH 53-3088 EXCEPT 52-9874 THROUGH 52-9905

Figure 8-243. AN/ARC-3 Command Radio Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
107	RELAY	ADVANCE		AB6M-J
111	LIGHT		AN6V	AN6157-4
117	LAMP		AN6V	AN6151-313
124	SWITCH			AN6977-3
136	CIRCUIT PROTECTOR			AN6161-45
137	CIRCUIT PROTECTOR			AN6160-920
3 138	RESISTOR		470Ω±1/2W	MC08M470K
139	CONNECTOR			AN6106-18R-12S
141	CONNECTOR			AN6106-28-12S
170	TRANSMITTER	GFAE		T-69/ARC-3
225	RECEIVER	GFAE		R-77/ARC-3
227	POWER JUNCTION BOX	GFAE		J-48/ARC-3
4 228	MOUNTING, TRANSMITTER	GFAE		MT-2248 (ARC-3)
4 231	MOUNTING, RECEIVER	GFAE		MT-2251 (ARC-3)
234	DYNAMOTOR	GFAE		DY-87/ARC-3
235	DYNAMOTOR	GFAE		DY-88/ARC-3
272	COAXIAL CABLE	GFAE		RG-8/U
274	COAXIAL CABLE PLUG	GFAE		PL-259A
278	TONE CONTROL PLUG	GFAE		PL-155A
294	RECEIVER PLUG	GFAE		PL-133A
300	TRANSMITTER PLUG	GFAE		CJ-16/U
301	POWER JCT BOX PLUG	GFAE		CJ-16/U
303	POWER PLUG	GFAE		PL-148A
305	ADAPTER	GFAE		M-359
333	CONNECTOR			AN6106A-24-28P
335	CONNECTOR			AN6106A-24-19S
462	COAXIAL CABLE	GFAE		RG-87A/U
476	CONNECTOR			UG-21C/U
488	CONTROL PANEL	GFAE		C-404/ARC-3
4 489	COAXIAL CABLE PLUG			UG-83C/U
4 505	CONNECTOR	UC		UG-83C/U
506	ANTENNA			455900
4 565	CONNECTOR			AN6106B-20-03P
4 574	CONNECTOR			UG-57A/U
4 575	CONNECTOR			UG-57J/U
4 605	RESISTOR		470Ω±1/2W	MC08F470K

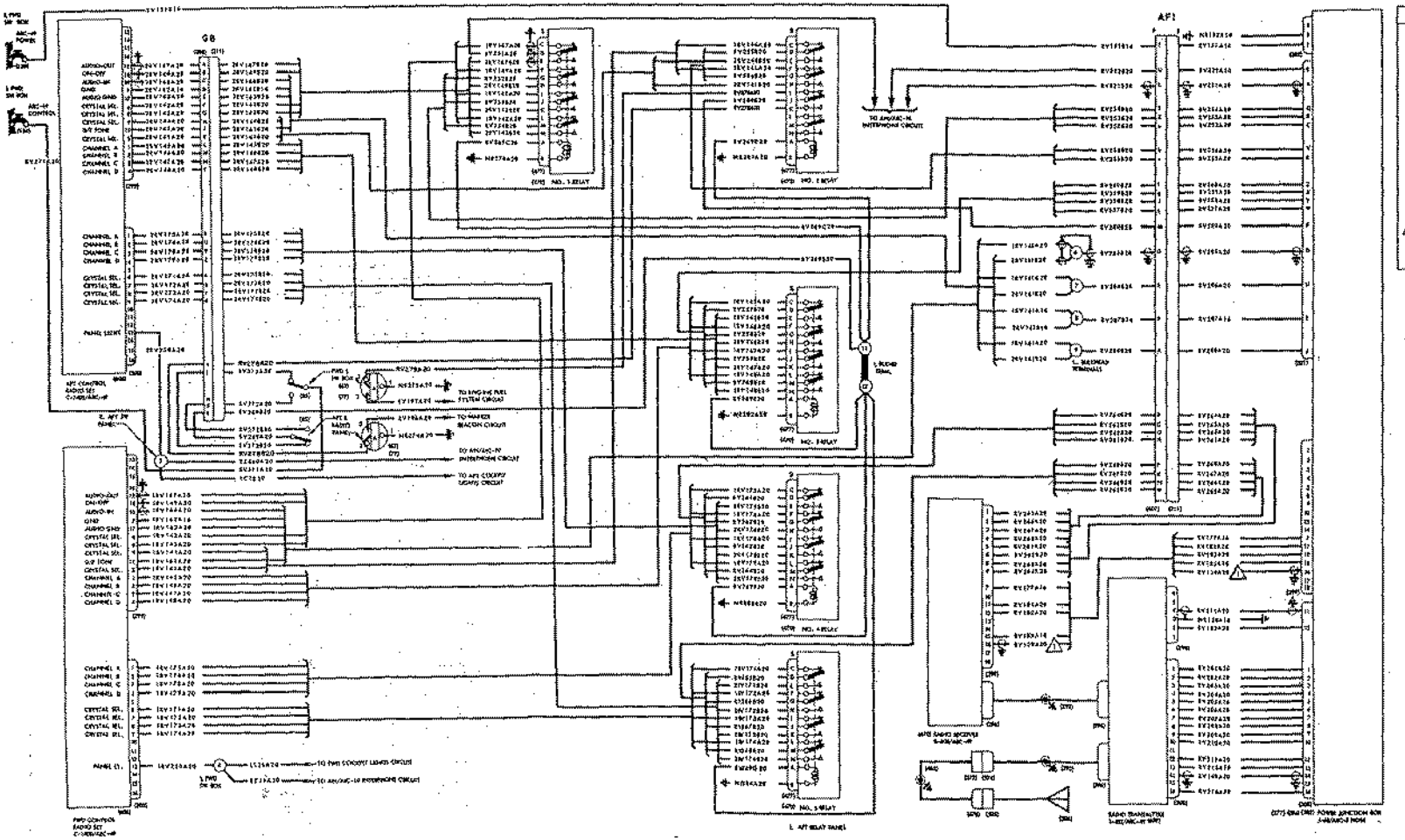
Figure 8-244. AN/ARC-3 Command Radio Circuit

NOTE:

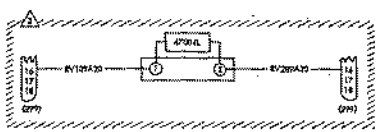
1. REMOVED PER T.O. 1T-33A-4SI
2. USED PRIOR TO AF SERIAL NO. 52-5486
3. USED ON AF SERIAL NO. 52-5486 AND SUBSEQUENT
4. REQUIREMENT IS SEE ON AF SERIAL NO. 54-1285 AND SUBSEQUENT
5. USED PRIOR TO AF SERIAL NO. 53-5339
6. USED ON AF SERIAL NO. 53-5339 AND SUBSEQUENT

MIL-HDBK-6-274 **GB 8895**

AN/ARC-3 COMMAND RADIO CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-5486 THROUGH 54-1285



ITEM	DESCRIPTION	MFR	TYPE	DRAWING OR SPEC
43	LIGHT		AMBER	AN3139-4
77	LAMP			AN3523-612
81	SWITCH		SPDT	AN3021-6
134	CIRCUIT PROTECTOR			AN3565-P5
135	CIRCUIT PROTECTOR			AN3567-P35
277	POWER JUNCTION BOX			J-49/ARC-49
293	COAXIAL CABLE			RG-8/U
296	COAXIAL CABLE PLUG			PL-259A
298	TONE CONTROL PLUG			PL-731A
299	RECEIVER PLUG			PL-732A
300	TRANSMITTER PLUG			U-76/U
301	PWR JUNCT BOX PLUG			U-16/U
302	POWER PLUG			PL-146A
308	CONNECTOR			AN3102A-28-15P
321	CONNECTOR			AN3106A-28-15S
662	COAXIAL CABLE			RG-58A/U
670	RELAY	SEACK	4PDT	AN3230-1
677	CONNECTOR			AN3102A-20-27S
678	CONNECTOR			UG-274/U
505	CONNECTOR			UG-88A/U
506	ANTENNA			420000
574	CONNECTOR			UG-273/U
575	CONNECTOR			UG-271/U
4 576	RESISTOR		1/2W47KΩ	RC20K-470K
607	CONNECTOR			AN3100C-28-15S
608	CONTROL PANEL, ARC-49	GFAE		C-1429/ARC-49
609	TRANSMITTER	GFAE		T-402/ARC-49
610	RECEIVER	GFAE		R-608/ARC-49



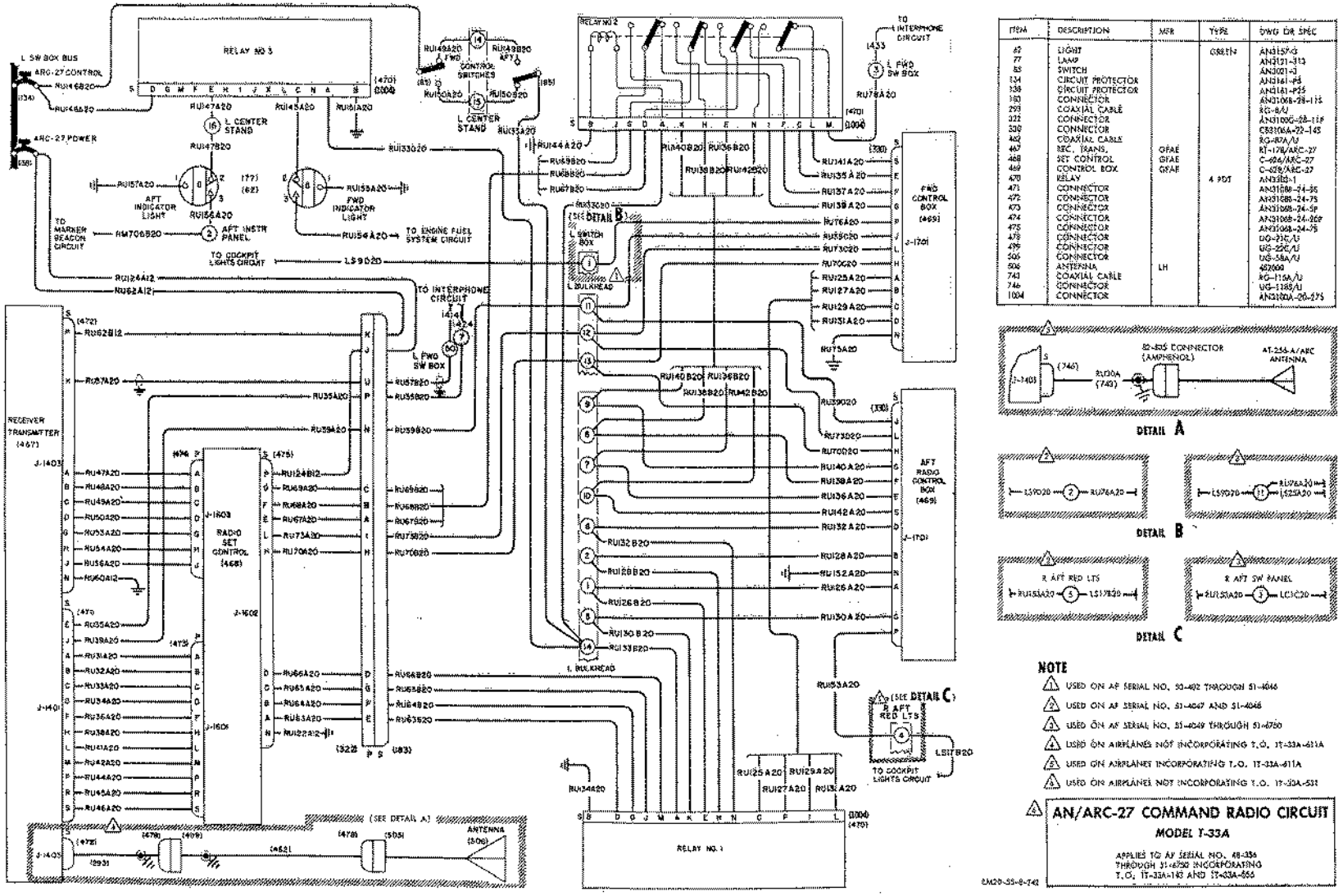
NOTE

1. USED PRIOR TO AF SERIAL NO. 55-4437 AND ON 55-4438 THROUGH 55-4444, 55-4446 AND 55-4447
2. USED ON AF SERIAL NO. 55-4437, 55-4445 AND 55-4448 AND SUBSEQUENT
3. REMOVED PER T.O. 1T-32A-554

AN/ARC-45 COMMAND RADIO CIRCUIT
MODEL T32A-1
APPLIES TO AF SERIAL NO. 55-3979 AND SUBSEQUENT

GB 8927

Figure 8-245. AN/ARC-49 Command Radio Circuit



ITEM	DESCRIPTION	MFR	TYPE	SPEC
62	LIGHT		G28E1N	AN3159-G
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
138	CIRCUIT PROTECTOR			AN3161-P25
193	CONNECTOR			AN3106B-28-11S
293	COAXIAL CABLE			RG-8/U
322	CONNECTOR			AN3106C-22-14S
330	CONNECTOR			CS3106A-22-14S
402	COAXIAL CABLE			RG-87A/U
467	REC. TRANS.	GFAE		RT-178/ARC-27
468	SET CONTROL	GFAE		C-606/ARC-27
469	CONTROL BOX	GFAE		C-629/ARC-27
470	RELAY		4 PDT	AN3365-1
471	CONNECTOR			AN3106B-24-3S
472	CONNECTOR			AN3108B-24-7S
473	CONNECTOR			AN3106B-24-5P
474	CONNECTOR			AN3106B-24-20P
475	CONNECTOR			AN3106B-24-7S
478	CONNECTOR			UG-21C/U
499	CONNECTOR			UG-22C/U
506	CONNECTOR			UG-58A/U
506	ANTENNA	LH		452069
743	COAXIAL CABLE			RG-115A/U
746	CONNECTOR			UG-1185/U
1004	CONNECTOR			AN3100A-20-27S

DETAIL A

DETAIL B

DETAIL C

NOTE

1. USED ON AF SERIAL NO. 50-492 THROUGH 51-4046
2. USED ON AF SERIAL NO. 51-4047 AND 51-4048
3. USED ON AF SERIAL NO. 51-4049 THROUGH 51-4750
4. USED ON AIRPLANES NOT INCORPORATING T.O. 1F-33A-611A
5. USED ON AIRPLANES INCORPORATING T.O. 1F-33A-611A
6. USED ON AIRPLANES NOT INCORPORATING T.O. 1F-33A-531

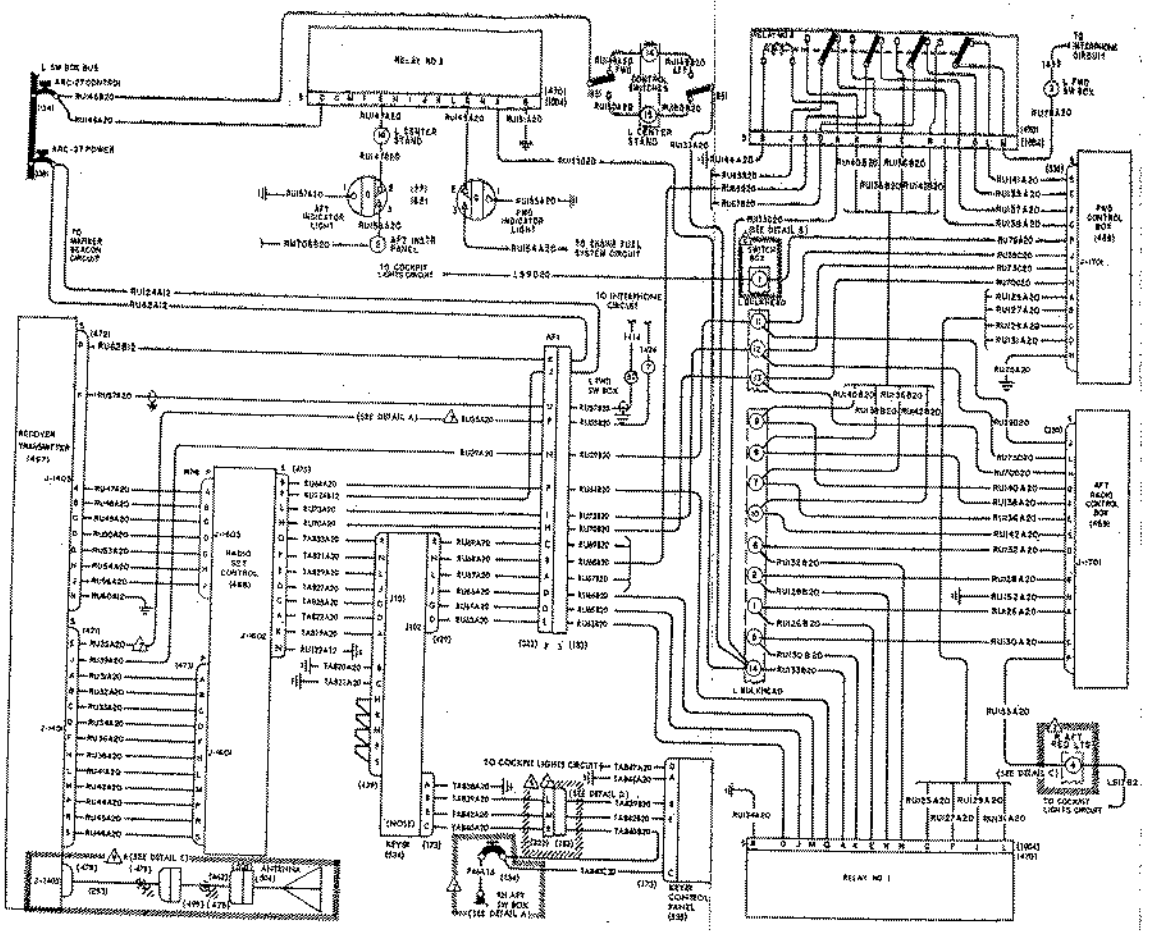
AN/ARC-27 COMMAND RADIO CIRCUIT

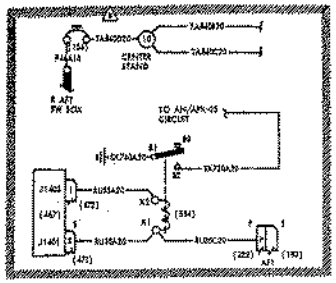
MODEL F-33A

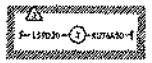
APPLIES TO AF SERIAL NO. 49-356 THROUGH 51-4750 INCORPORATING T.O. 1F-33A-143 AND 1F-33A-555

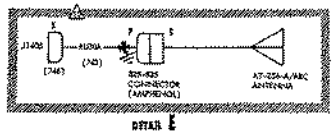
8M20-55-8-743

Figure 8-246. AN/ARC-27 Command Radio Circuit









ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3169-2
77	LAMP - WARNING			AN3123-311
83	SWITCH			AN3021-5
134	CIRCUIT PROTECTOR			AN3162-#5
159	CIRCUIT PROTECTOR			AN3160-#25
172	CONNECTOR			AN3106B-14S-5S
183	CONNECTOR			AN3106B-20-41S
184	CONNECTOR			AN3102C-20-41P
298	COAXIAL CABLE			RG-8/U
330	CONNECTOR			CB3106A-22-14S
332	CONNECTOR			AN3102C-28-11P
427	CONNECTOR			AN3106B-22-14P
439	CONNECTOR			AN3106A-22-14S
440	COAXIAL CABLE			RG-142A/U
447	ARC, 1RA45	GFAE		81-378/ARC-27
466	SET CONTROL	GFAE		C-1605/ARC-27
469	CONTROL BOX	GFAE		C-668/ARC-27
470	RELAY		4PDT	AN3240-2
471	CONNECTOR			AN3106B-24-5S
472	CONNECTOR			AN3106B-14-7S
473	CONNECTOR			AN3106A-24-2P
474	CONNECTOR			AN3106B-24-10P
475	CONNECTOR			AN3106B-24-7S
476	CONNECTOR			MS-21C/U
477	CONNECTOR			MS-20C/U
805	CONNECTOR			MS-48A/U
806	ANTENNA	SIE		452100
834	KEYER	GFAE		KY-46/AIA-26
835	CONTROL, REMOTE	GFAE		C-790/AIA-26
854	RELAY			AN3231-2
859	CONNECTOR			CTOME-3A-12P
871	CONNECTOR			CTOME-28-12P
743	COAXIAL CABLE			RG-316A/U
744	CONNECTOR			UG-1188/U
1034	CONNECTOR			AN3100A-20-27S

NOTE

1. NOT INSTALLED ON AIAP AIRPLANES
2. USED ON AF SERIAL NO. 50-602 THROUGH 51-4596
3. USED ON AF SERIAL NO. 51-4597 AND 51-4668
4. USED ON AF SERIAL NO. 51-4669 THROUGH 51-4750
5. USED ON AF SERIAL NO. 48-556 THROUGH 49-900
6. USED ON AF SERIAL NO. 49-901 THROUGH 51-4750
7. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-577
8. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-575
9. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
10. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

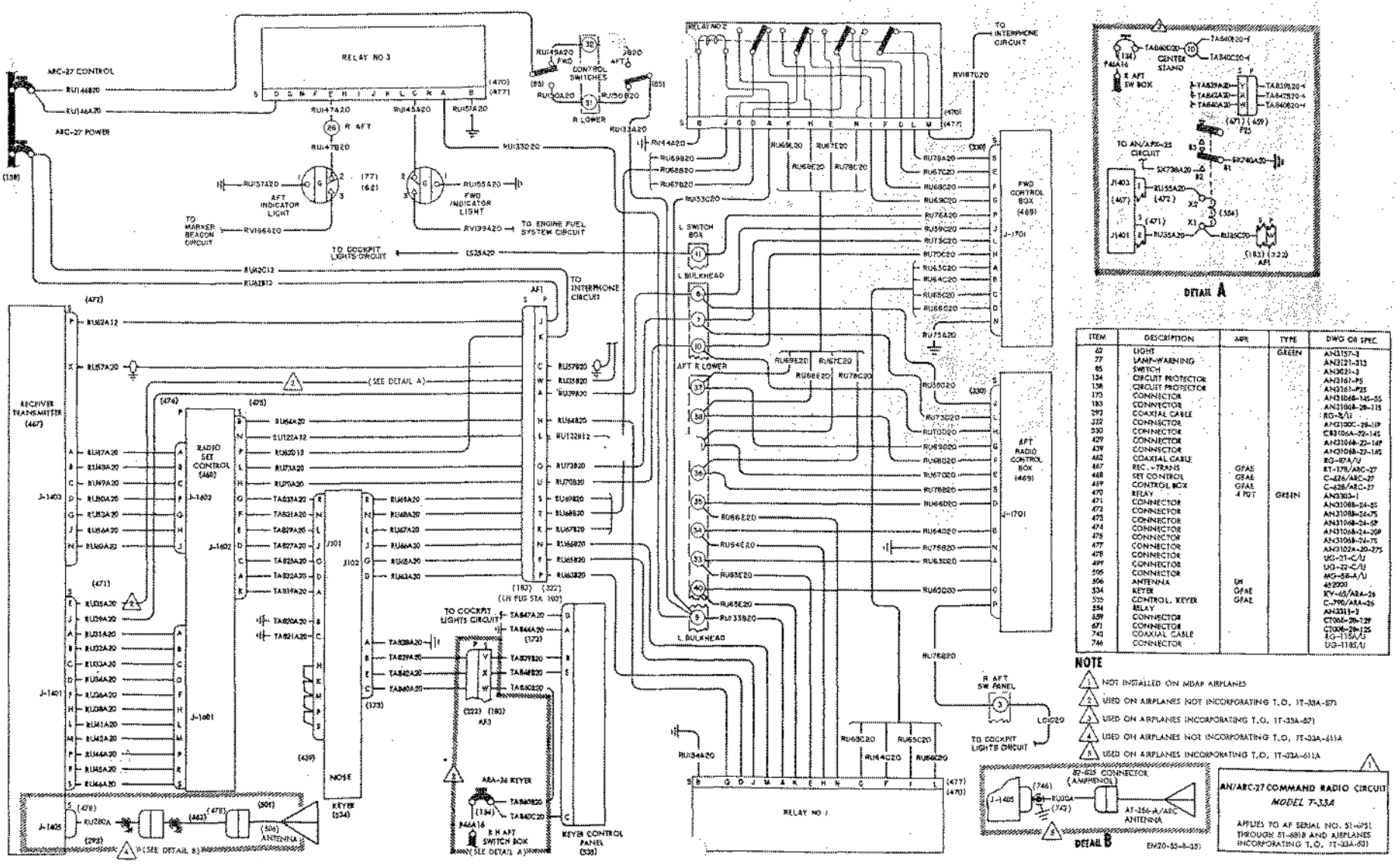
AN/ARC-27 COMMAND RADIO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 48-556 THROUGH 51-4750 INCORPORATING T.O. 1T-33A-142 AND 1T-33A-681

1A2C-33-8-349

Figure 8-247. AN/ARC-27 Command Radio Circuit

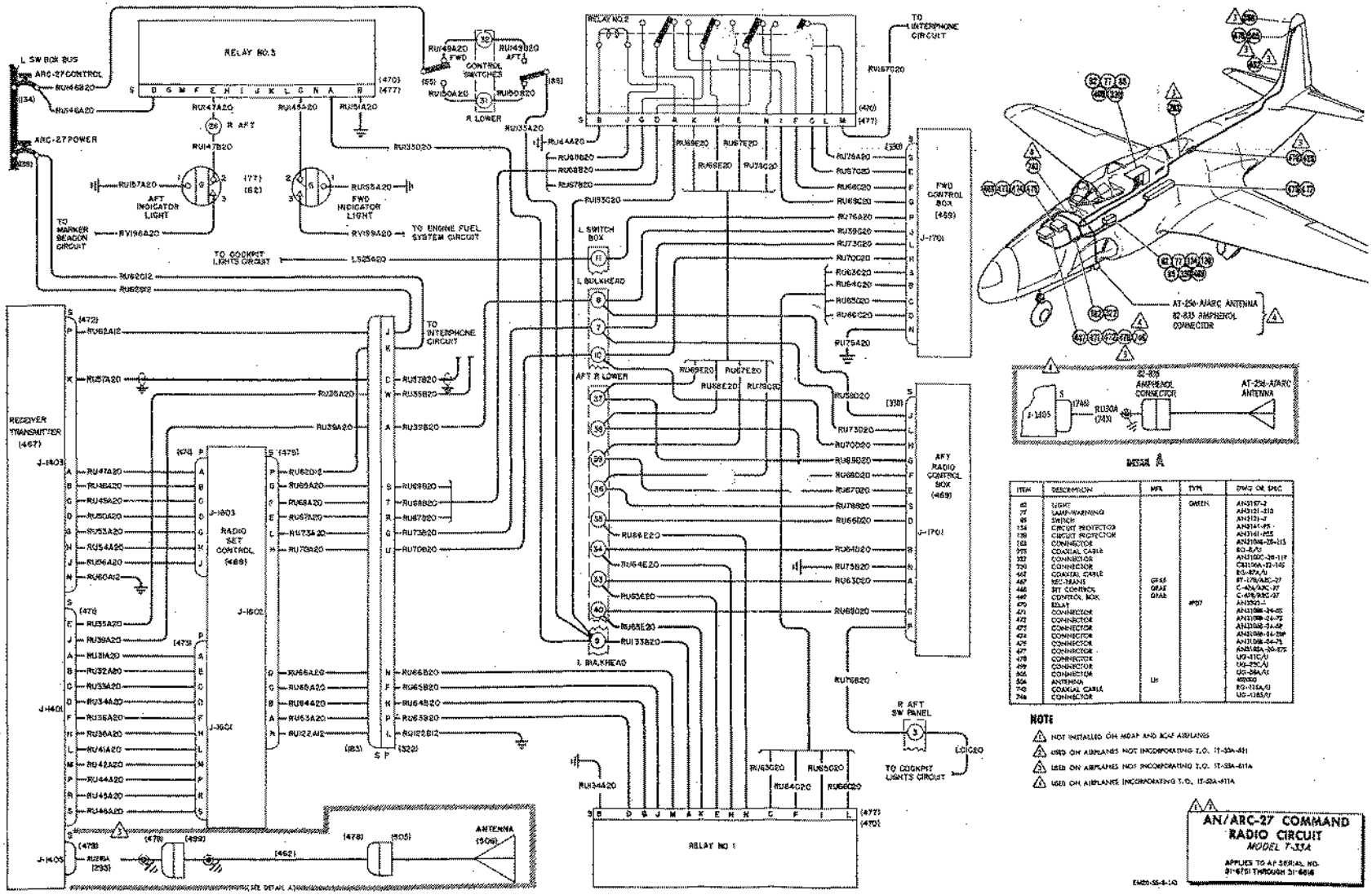


ITEM	DESCRIPTION	APPR	TYPE	DWG OR SPEC
42	LIGHT		GREEN	AN3137-3
77	LAMP-WARNING			AN3121-313
85	SWITCH			AN3023-3
134	CIRCUIT PROTECTOR			AN3167-P5
158	CIRCUIT PROTECTOR			AN3163-P25
175	CONNECTOR			AN3106B-145-5S
183	CONNECTOR			AN3106B-20-17S
292	COAXIAL CABLE			RG-8/U
322	CONNECTOR			AN6100C-20-1P
330	CONNECTOR			C83106A-22-14S
429	CONNECTOR			AN3106B-22-14P
439	CONNECTOR			AN3106B-22-14S
460	COAXIAL CABLE			RG-87A/U
467	REC.-TRANS	GFAE		RT-178/ARC-27
468	SET CONTROL	GFAE		C-626/ARC-27
469	CONTROL BOX	GFAE		C-628/ARC-27
470	RELAY	4 PDT	GREEN	AN3303-1
471	CONNECTOR			AN3108B-24-5S
472	CONNECTOR			AN3108B-24-7S
473	CONNECTOR			AN3106B-24-5P
474	CONNECTOR			AN3106B-24-9P
475	CONNECTOR			AN3106B-24-7S
477	CONNECTOR			AN3102A-20-27S
478	CONNECTOR			UG-21-C/U
499	CONNECTOR			UG-22-C/U
505	CONNECTOR			MC-58-A/U
506	ANTENNA	GH		45200
534	KEYER	GFAE		KY-65/ARA-26
538	CONTROL, KEYER	GFAE		C-990/ARA-26
554	RELAY			AN3311-2
659	CONNECTOR			CT006-20-12P
671	CONNECTOR			CT006-20-12S
742	COAXIAL CABLE			RG-155A/U
746	CONNECTOR			UG-1185/U

NOTE

1. NOT INSTALLED ON MDAP AIRPLANES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-671
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-671
4. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-631A
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-631A

Figure 8-249. AN/ARC-27 Command Radio Circuit



ITEM	DESCRIPTION	MFR.	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3157-2
77	LAMP-WARNING			AN3121-210
95	SWITCH			AN3121-7
134	CIRCUIT PROTECTOR			AN3147-P5
139	CIRCUIT PROTECTOR			AN3161-M5
183	CONNECTOR			AN21006-28-11S
195	COAXIAL CABLE			RG-8/U
203	CONNECTOR			AN3100C-28-11P
230	CONNECTOR			CB3106A-32-14S
462	COAXIAL CABLE			RG-87A/U
467	RECEIVER-TRANSMITTER	GFAE		RT-178/ARC-27
468	RT CONTROL	GFAE		C-424/ARC-27
469	CONTROL BOX	GFAE		C-425/ARC-27
470	RELAY		MS27	AN3320-1
471	CONNECTOR			AN3106B-24-5S
472	CONNECTOR			AN3108B-24-7S
473	CONNECTOR			AN3108B-24-6P
474	CONNECTOR			AN3108B-24-2SW
475	CONNECTOR			AN3108B-24-7S
476	CONNECTOR			AN3106A-20-4S
477	CONNECTOR			UG-417C/U
478	CONNECTOR			UG-274/U
479	CONNECTOR			UG-264/U
505	CONNECTOR			UG-264A/U
506	ANTENNA	US		402330
740	COAXIAL CABLE			RG-316A/U
740	CONNECTOR			UG-1185/U

NOTE

1. NOT INSTALLED ON AD4P AND AD4F AIRPLANES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

AN/ARC-27 COMMAND RADIO CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-6751 THROUGH 51-6816

EM20-35-8-1A

Figure 8-248. AN/ARC-27 Command Radio Circuit

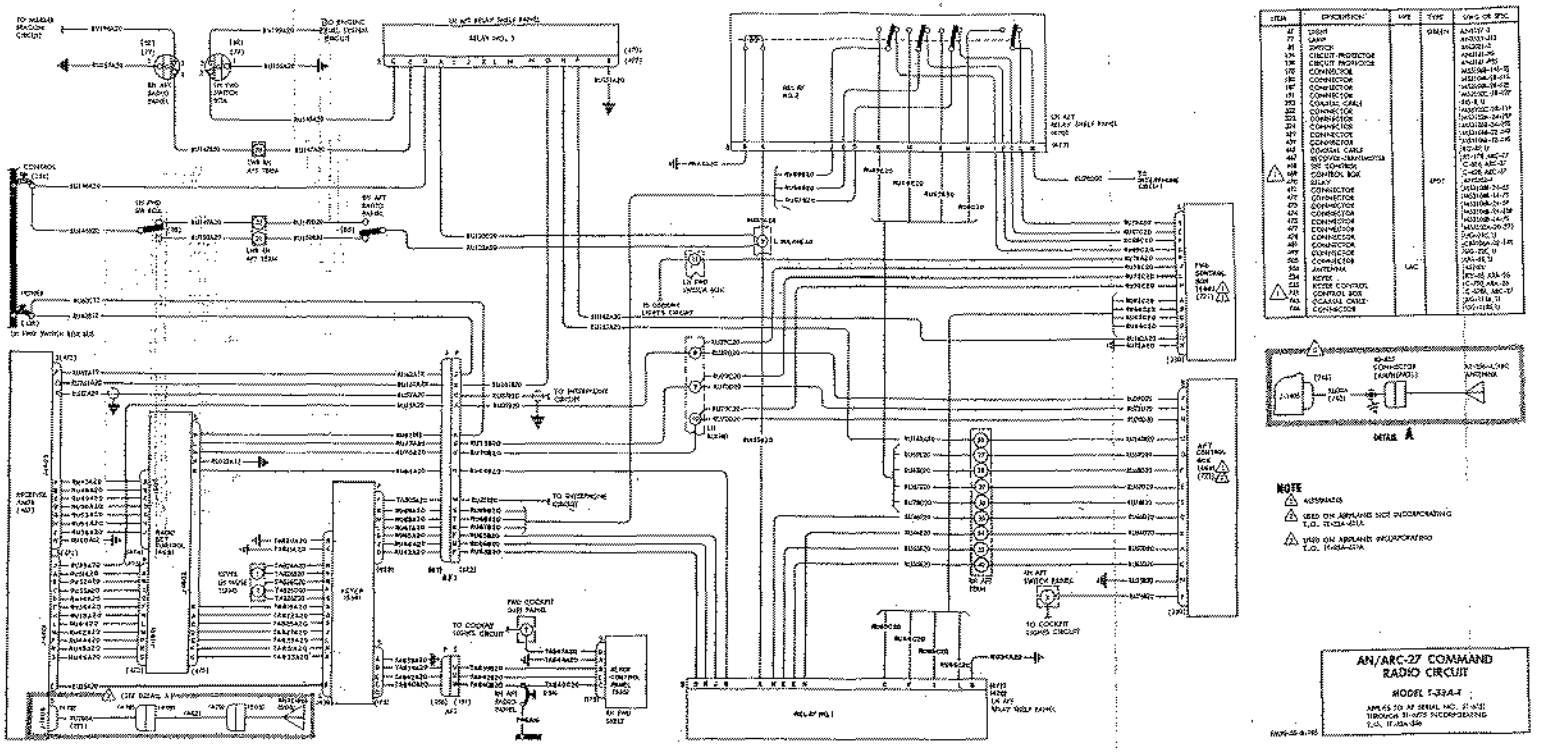
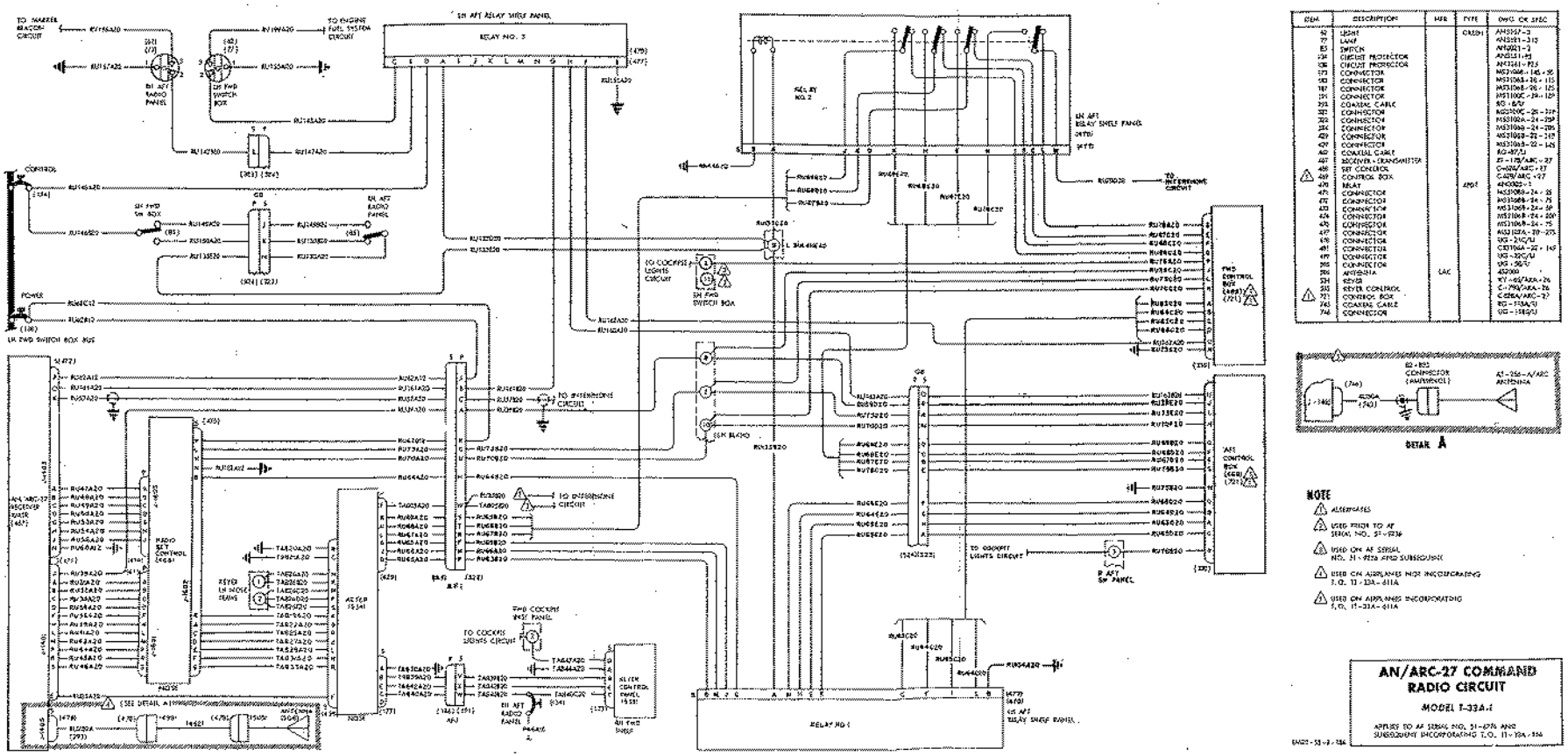


Figure 8-250. AN/ARC-27 Command Radio Circuit



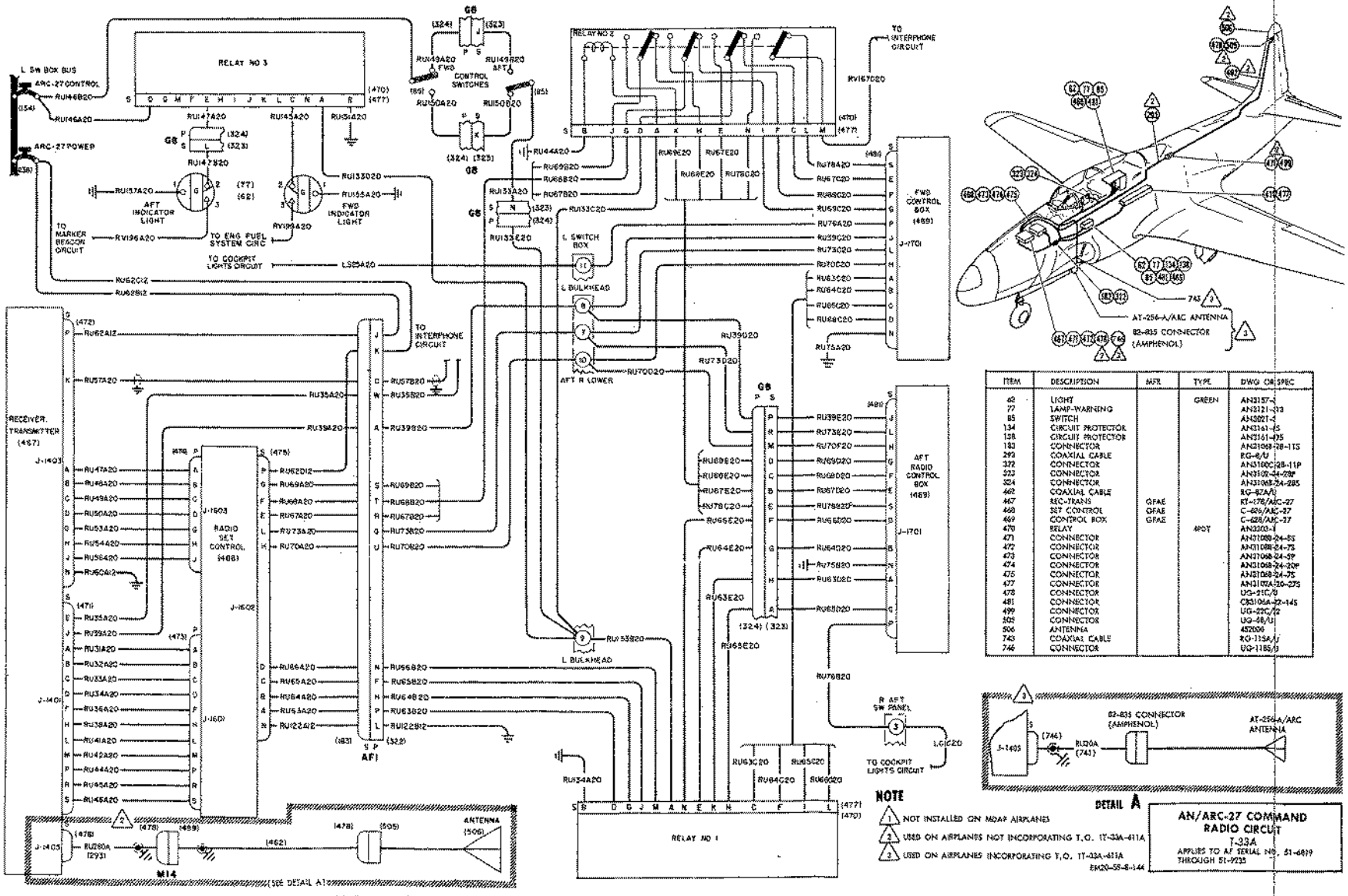
ITEM	DESCRIPTION	MFR	TYPE	CHNG OR SPEC
42	LIGHT		CM504	AN3052-2
77	LAMP			AN3581-313
83	SWITCH			AN3021-2
104	CIRCUIT PROTECTOR			AN3321-5
106	CIRCUIT PROTECTOR			AN3321-7.5
173	CONNECTOR			MS27466-14S-5S
180	CONNECTOR			MS3106A-16-11S
181	CONNECTOR			MS3106A-20-12S
191	CONNECTOR			MS3100C-24-12P
203	COAXIAL CABLE			RG-58/U
207	CONNECTOR			MS3109C-20-27P
209	CONNECTOR			MS3108A-24-22P
224	CONNECTOR			MS3106B-24-28S
429	CONNECTOR			MS3108B-22-14S
437	CONNECTOR			MS3108B-22-14S
469	COAXIAL CABLE			RG-400/U
487	RECEIVER-TRANSMITTER			ER-178/ARC-27
488	SET CONTROL			C-6526/ARC-27
489	CONTROL BOX			C-6529/ARC-27
470	RELAY		AN40	AN3022-1
471	CONNECTOR			MS3108B-24-3S
472	CONNECTOR			MS3106B-24-7S
473	CONNECTOR			MS3106B-24-5P
474	CONNECTOR			MS3106B-24-20P
475	CONNECTOR			MS3106B-24-7S
477	CONNECTOR			MS3108A-20-27S
478	CONNECTOR			UG-21C/U
481	CONNECTOR			CM3196A-22-14P
484	CONNECTOR			UG-22C/U
485	CONNECTOR			UG-306/U
486	ANTENNA	LAC		AS2980
234	XEVER			XY-465/ARA-26
235	XEVER CONTROL			C-756/ARA-26
721	CONTROL BOX			C-2854/ARC-27
745	COAXIAL CABLE			RG-178A/U
746	CONNECTOR			UG-1568/U

AN/ARC-27 COMMAND RADIO CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NOS. 51-4278 AND SUBSEQUENT INCORPORATING T.O. 1T-33A-556

Figure 8-251. AN/ARC-27 Command Radio Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3157-1
77	LAMP-WARNING			AN3121-333
85	SWITCH			AN3021-2
134	CIRCUIT PROTECTOR			AN3161-5
138	CIRCUIT PROTECTOR			AN3161-25
183	CONNECTOR			AN3106B-28-11S
293	COAXIAL CABLE			RG-8/U
322	CONNECTOR			AN3108C-28-11P
323	CONNECTOR			AN3102-24-28P
324	CONNECTOR			AN3106B-24-28S
462	COAXIAL CABLE			RG-87A/U
467	REC-TRANS	GFAE		RT-178/ARC-27
468	SET CONTROL	GFAE		C-826/ARC-27
469	CONTROL BOX	GFAE		C-628/ARC-27
470	RELAY		APDT	AN3203-1
471	CONNECTOR			AN3108B-24-5S
472	CONNECTOR			AN3108B-24-7S
473	CONNECTOR			AN3106A-24-9P
474	CONNECTOR			AN3106A-24-20P
475	CONNECTOR			AN3108B-24-7S
477	CONNECTOR			AN3102A-20-27S
478	CONNECTOR			UG-21C/U
481	CONNECTOR			CB3106A-22-14S
499	CONNECTOR			UG-201C/U
505	CONNECTOR			UG-58/U
506	ANTENNA			452000
743	COAXIAL CABLE			RG-115A/U
746	CONNECTOR			UG-1185/U

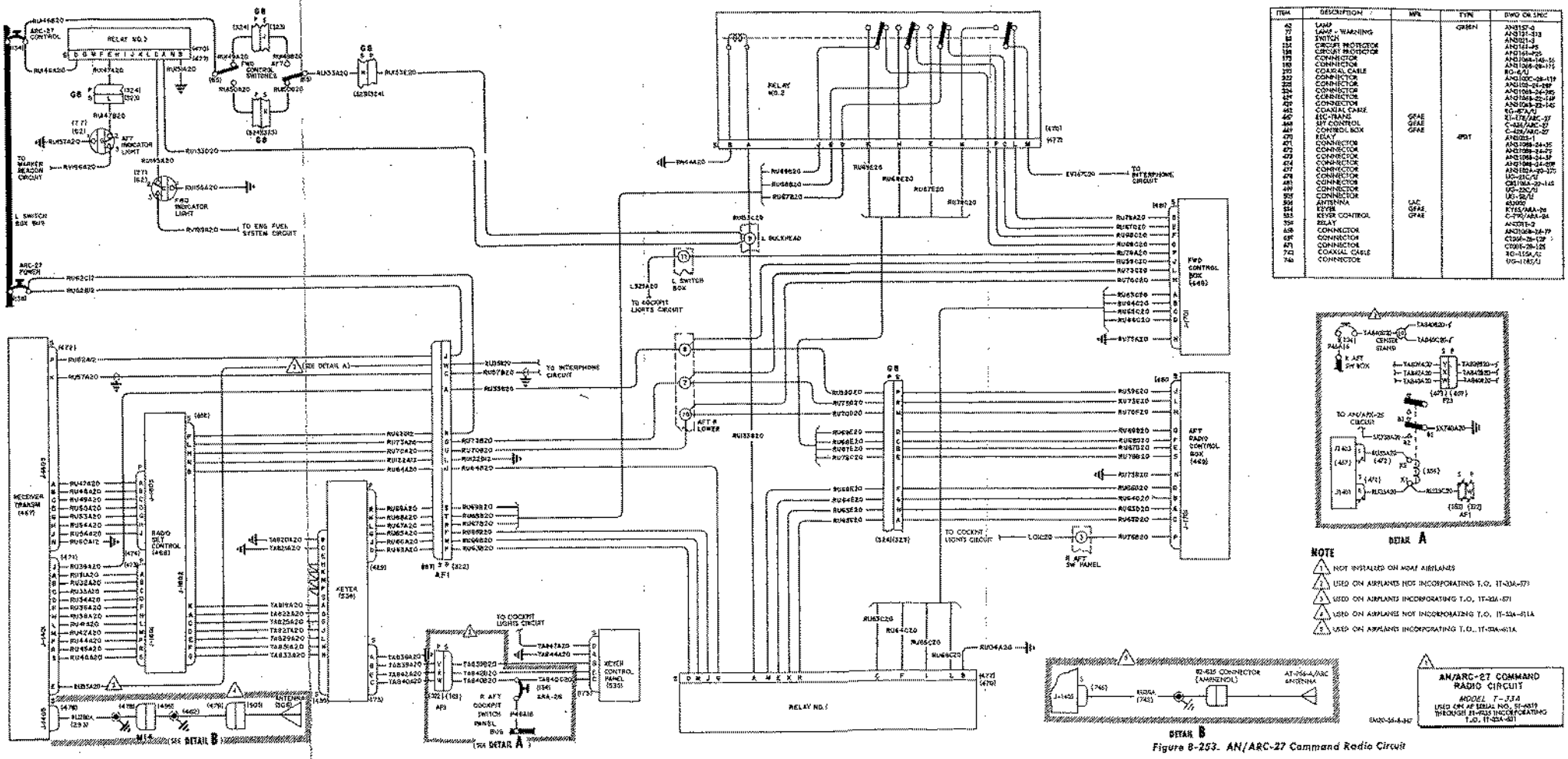
NOTE

1. NOT INSTALLED ON MDAP AIRPLANES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

EM20-55-8-144

AN/ARC-27 COMMAND RADIO CIRCUIT
T-33A
APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9235

Figure 8-252. AN/ARC-27 Command Radio Circuit

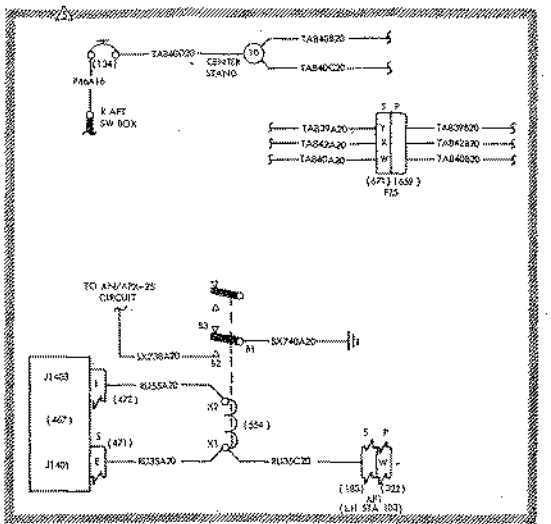


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
42	LAMP		GM28N	2043157-3
43	LAMP - WARNING			AN3121-313
44	SWITCH			AN3021-3
45	CIRCUIT PROTECTOR			AN3161-45
46	CIRCUIT PROTECTOR			AN3161-720
47	CONNECTOR			AN3106A-14S-5S
48	CONNECTOR			AN3106A-20-17S
49	COAXIAL CABLE			RG-6/U
50	CONNECTOR			AN3100C-28-17P
51	CONNECTOR			AN3102-24-19P
52	CONNECTOR			AN3106A-24-2S
53	CONNECTOR			AN3106A-22-14P
54	CONNECTOR			AN3106A-22-14S
55	CONNECTOR			AN3106A-22-5S
56	COAXIAL CABLE			RG-8A/U
57	RELAY	GEAE		ES-17E/ARC-27
58	SPT CONTROL	GEAE		C-426/ARC-27
59	CONTROL BOX	GEAE		C-426/ARC-27
60	RELAY		4PDT	AN2022-1
61	CONNECTOR			AN3106B-24-3S
62	CONNECTOR			AN3108B-24-9S
63	CONNECTOR			AN3106A-24-9P
64	CONNECTOR			AN3106A-24-5P
65	CONNECTOR			AN3108B-24-5PW
66	CONNECTOR			AN3102A-20-27S
67	CONNECTOR			MC-27C/U
68	CONNECTOR			CBS1106A-20-14S
69	CONNECTOR			MC-25C/U
70	CONNECTOR			UG-58/U
71	ANTENNA			45X900
72	KEYER			KY65/ARA-26
73	KEYER CONTROL			C-795/ARA-26
74	RELAY			AN2031-2
75	CONNECTOR			AN3106B-24-19P
76	CONNECTOR			CS3106-28-12P
77	CONNECTOR			CS3101-28-12S
78	COAXIAL CABLE			RG-115A/U
79	CONNECTOR			UG-1185/U

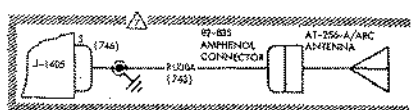
NOTE

1. NOT INSTALLED ON MOAF AIRPLANES
2. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-573
3. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-571
4. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

Figure 8-253. AN/ARC-27 Command Radio Circuit



DETAIL A



DETAIL B

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		CR2229	AN3169-3
77	LAMP-WARNING			AN3121-313
85	SWITCH			AN3021-7
134	CIRCUIT PROTECTOR			AN3361-95
136	CIRCUIT PROTECTOR			AN3161-P25
173	CONNECTOR			AN3106B-14S-5S
183	CONNECTOR			AN3106B-28-11S
187	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
293	COAXIAL CABLE			RG-8/U
322	CONNECTOR			AN3100C-28-11P
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-14-28S
429	CONNECTOR			AN3106B-22A-14P
439	CONNECTOR			AN3106B-22-14S
442	COAXIAL CABLE			RG-87A/U
467	REC-TRANS	GFAE		RT-178/ARC-27
468	SET CONTROL	GFAE		C-626/ARC-27
469	CONTROL BOX	GFAE		C-629/ARC-27
470	RELAY		4 PDT	AN3302-1
471	CONNECTOR			AN3108B-24-5S
472	CONNECTOR			AN3108B-24-7S
473	CONNECTOR			AN3106B-24-5P
474	CONNECTOR			AN3106B-24-5SW
475	CONNECTOR			AN3106B-24-7S
477	CONNECTOR			AN3102A-20-27S
478	CONNECTOR			UG-21C/U
481	CONNECTOR	LAC		C8320AA-22-14S
499	CONNECTOR			UG-22C/U
505	CONNECTOR			UG-58/U
506	ANTENNA	LAC		452000
524	KEYER	GFAE		KY65/ARA-26
525	KEYER CONTROL	GFAE		C-799/ARA-26
554	RELAY			AN3311-2
574	CONNECTOR			UG-573/U
575	CONNECTOR			UG-571/U
659	CONNECTOR			CT106B-38-12P
671	CONNECTOR			CT106B-28-12S
743	COAXIAL CABLE			RG-115A/U
746	CONNECTOR			UG-1185/U

NOTE

1. NOT INSTALLED ON NDAP AIRPLANES
2. USED PRIOR TO AF SERIAL NO. 53-3486
3. USED ON AF SERIAL NO. 53-3486 AND SUBSEQUENT
4. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-571
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-571
6. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
7. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

AN/ARC-27 COMMAND RADIO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9236 THROUGH 55-3028 EXCEPT 53-6038 THROUGH 53-6152

AF 08816
EM20-55-8-175

Figure 8-254. AN/ARC-27 Command Radio Circuit (Sheet 1 of 2)

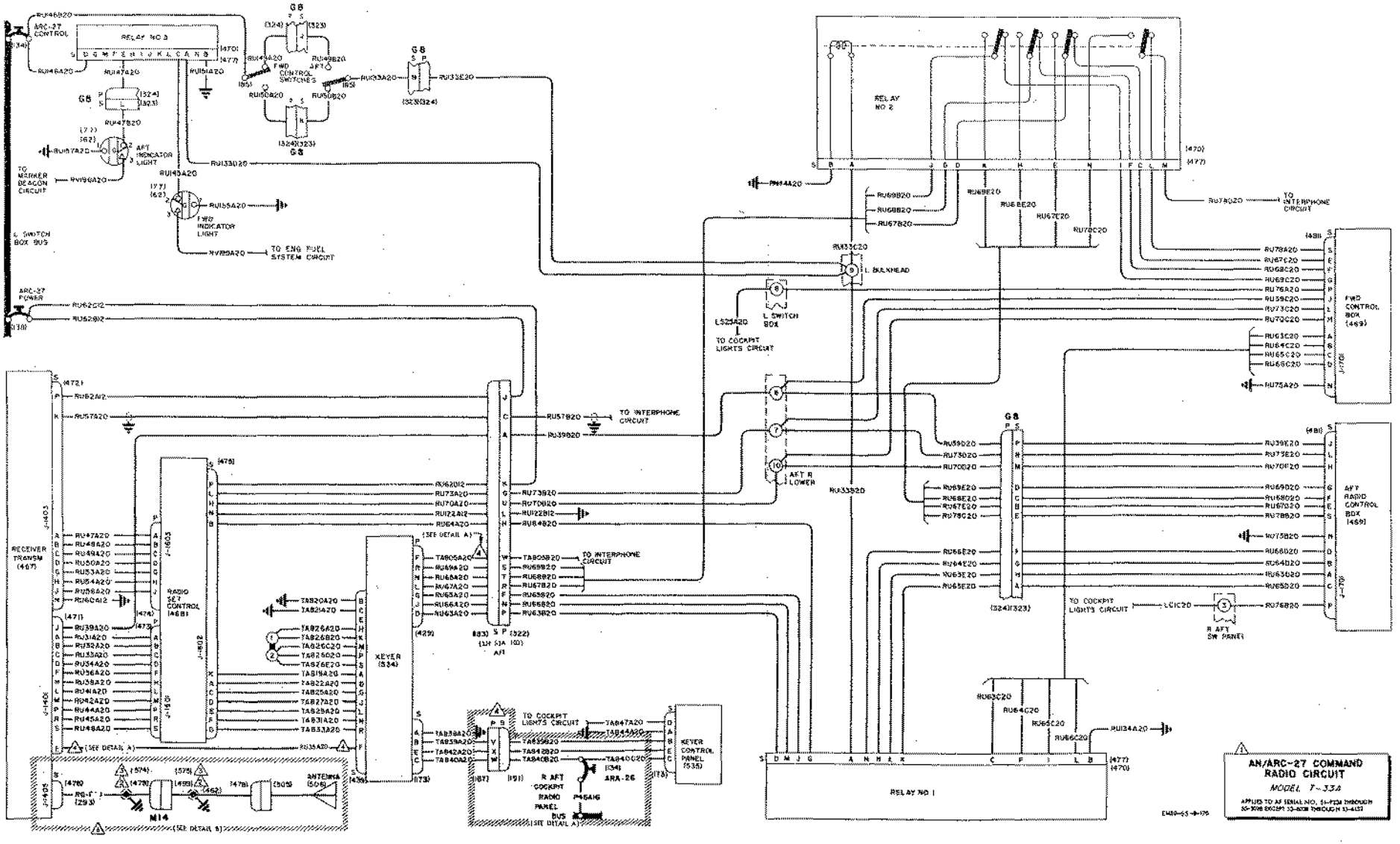


Figure 8-254. AN/ARC-27 Command Radio Circuit (Sheet 2 of 2)

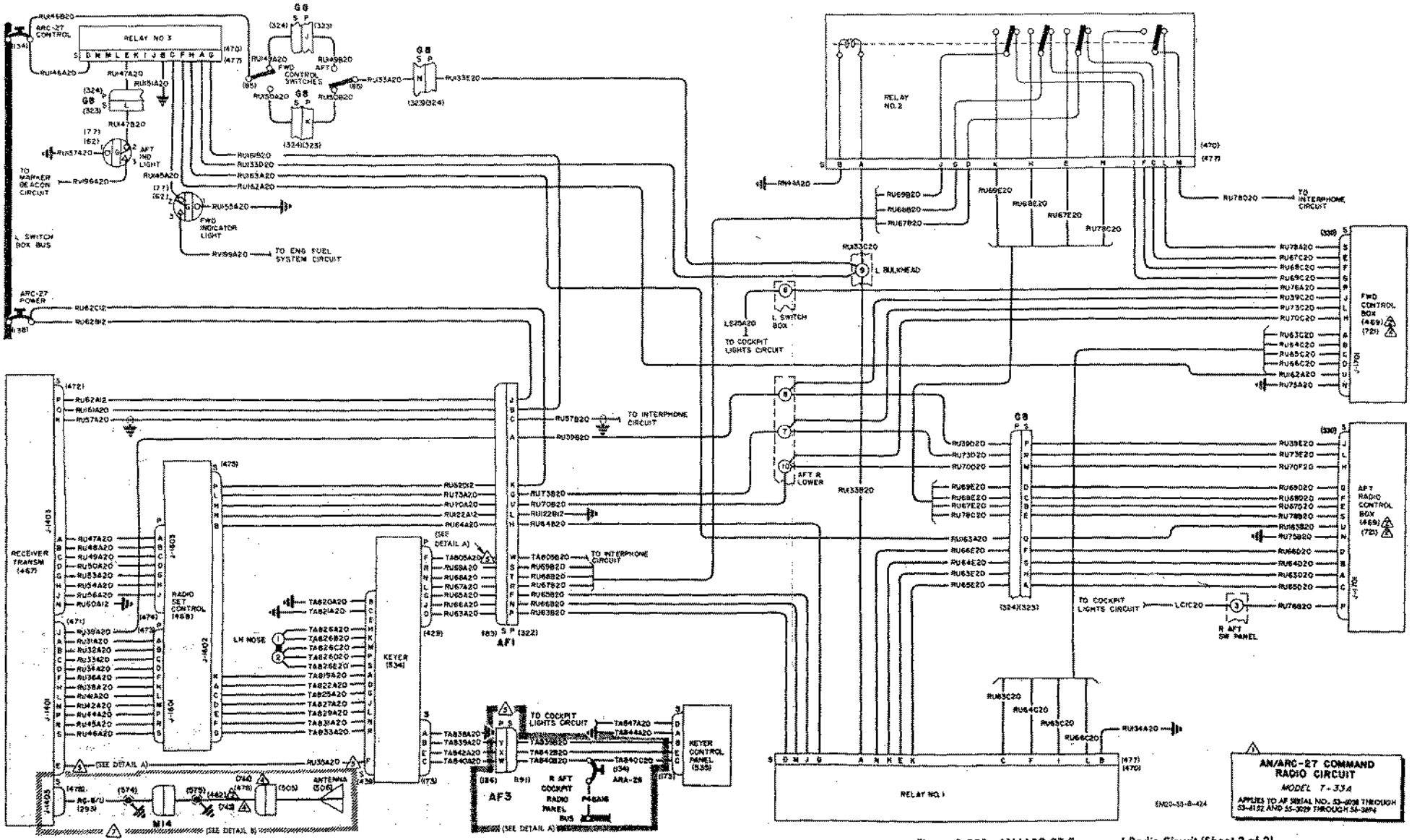
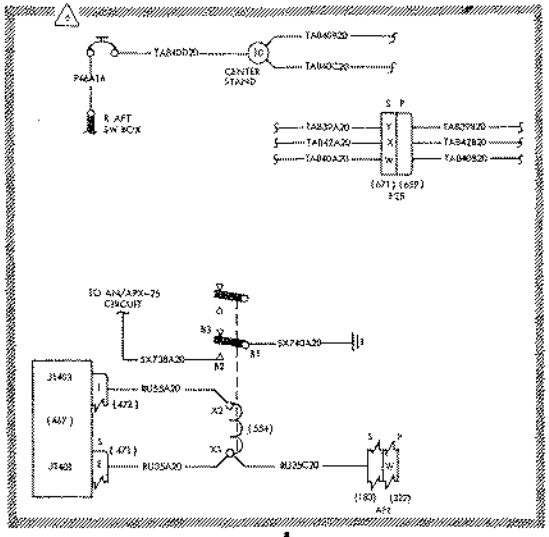
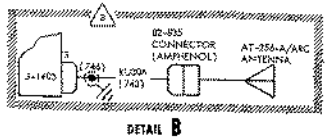


Figure 8-255. AN/ARC-27 Command Radio Circuit (Sheet 2 of 2)



DETAIL A

ITEM	DESCRIPTION	AFPL	TYPE	DWG OR SPEC
52	LIGHT		GREEN	AN3157-3
77	LAMP-WARNING			AN3171-313
82	SWITCH			AN3071-3
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P23
173	CONNECTOR			AN3106B-14S-5S
183	CONNECTOR			AN3106B-28-11S
186	CONNECTOR			AN3106B-20-12S
191	CONNECTOR			AN3109C-28-12P
293	COAXIAL CABLE			RG-8/U
323	CONNECTOR			AN3909C-28-11P
325	CONNECTOR			AN3102A-24-28P
326	CONNECTOR			AN3106B-24-28S
330	CONNECTOR			CB3156A-22-14S
429	CONNECTOR			AN3106B-22-24P
439	CONNECTOR			AN3106B-22-14S
2 662	COAXIAL CABLE			RG-58A/U
467	REC-TRANS	GFAE		R9-578/ARC-27
468	SET CONTROL	GFAE		C-626/ARC-27
469	CONTROL BOX	GFAE		C-628/ARC-27
470	RELAY		4 PDT	AN3350-1
471	CONNECTOR			AN3108B-24-5S
472	CONNECTOR			AN3108B-24-7S
473	CONNECTOR			AN3106B-24-19P
474	CONNECTOR			AN3106B-24-20P
475	CONNECTOR			AN3106B-24-7S
477	CONNECTOR			AN3102A-20-27S
2 478	CONNECTOR			UG-21C/U
505	CONNECTOR			UG-58A/U
506	ANTENNA	EAC		450009
534	KEYER	GFAE		AY-65/ARA-26
535	KEYER CONTROL	GFAE		C-790/ARA-26
584	RELAY			AN3331-2
574	CONNECTOR			UG-573/U
575	CONNECTOR			UG-571/U
659	CONNECTOR			CTD6F-28-12P
671	CONNECTOR			CTD6F-28-12S
731	CONTROL BOX	GFAE		C-628A/ARC-27
743	COAXIAL CABLE			RG-113A/U
4 744	CONNECTOR	AMPHENOL		82-312
746	CONNECTOR			UG-1185/U



DETAIL B

NOTE

1. NOT INSTALLED ON MDAP AIRPLANES
2. ALTERNATES
3. USED PRIOR TO AF SERIAL NO. 56-3670
4. USED ON AF SERIAL NO. 56-3670 THROUGH 56-3694
5. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-573
6. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-573
7. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
8. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

1

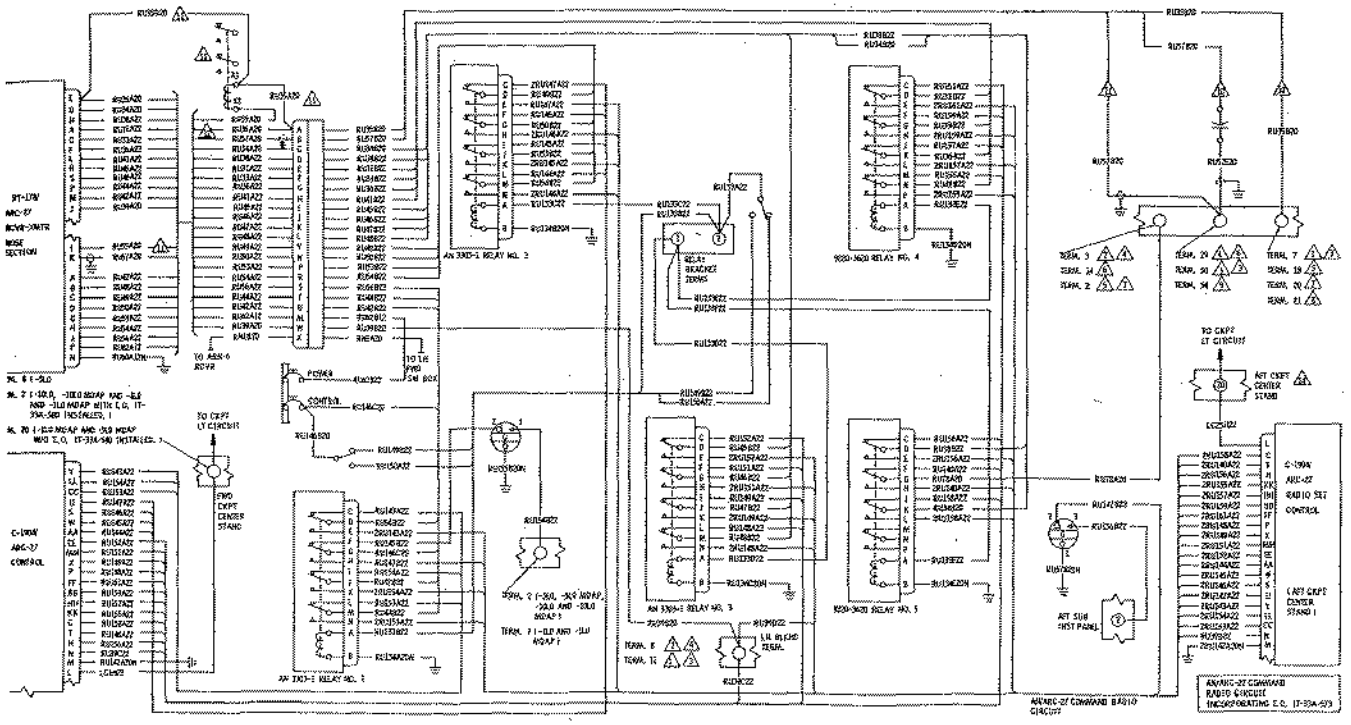
AN/ARC-27 COMMAND RADIO CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-4408 THROUGH 53-4152 AND 55-4029 THROUGH 56-3694

HF 08891
EA620-55-B-423

Figure 8-255. AN/ARC-27 Command Radio Circuit (Sheet 1 of 2)


AN 3303-1 RELAY NO. 2
AN 3303-2 RELAY NO. 3
AN 3303-3 RELAY NO. 4
AN 3303-4 RELAY NO. 5
AN/ARC-27 COMMAND RADIO CIRCUIT
AN/ARC-27 COMMAND RADIO CIRCUIT INCORPORATING T.O. 1T-33A-573
C-1904A ARC-27 RADIO SET CONTROL
CONTROL
POWER
RELAY
TERM. 3
TERM. 29
TERM. 7
TERM. 30
TERM. 19
TERM. 34
TERM. 20
TERM. 21
TERM. 2
TERM. 8
TERM. 9
TERM. 11
TERM. 12
TERM. 13
TERM. 14
TERM. 15
TERM. 16
TERM. 17
TERM. 18
TERM. 22
TERM. 23
TERM. 24
TERM. 25
TERM. 26
TERM. 27
TERM. 28
TERM. 31
TERM. 32
TERM. 33
TERM. 35
TERM. 36
TERM. 37
TERM. 38
TERM. 39
TERM. 40
TERM. 41
TERM. 42
TERM. 43
TERM. 44
TERM. 45
TERM. 46
TERM. 47
TERM. 48
TERM. 49
TERM. 50
TERM. 51
TERM. 52
TERM. 53
TERM. 54
TERM.

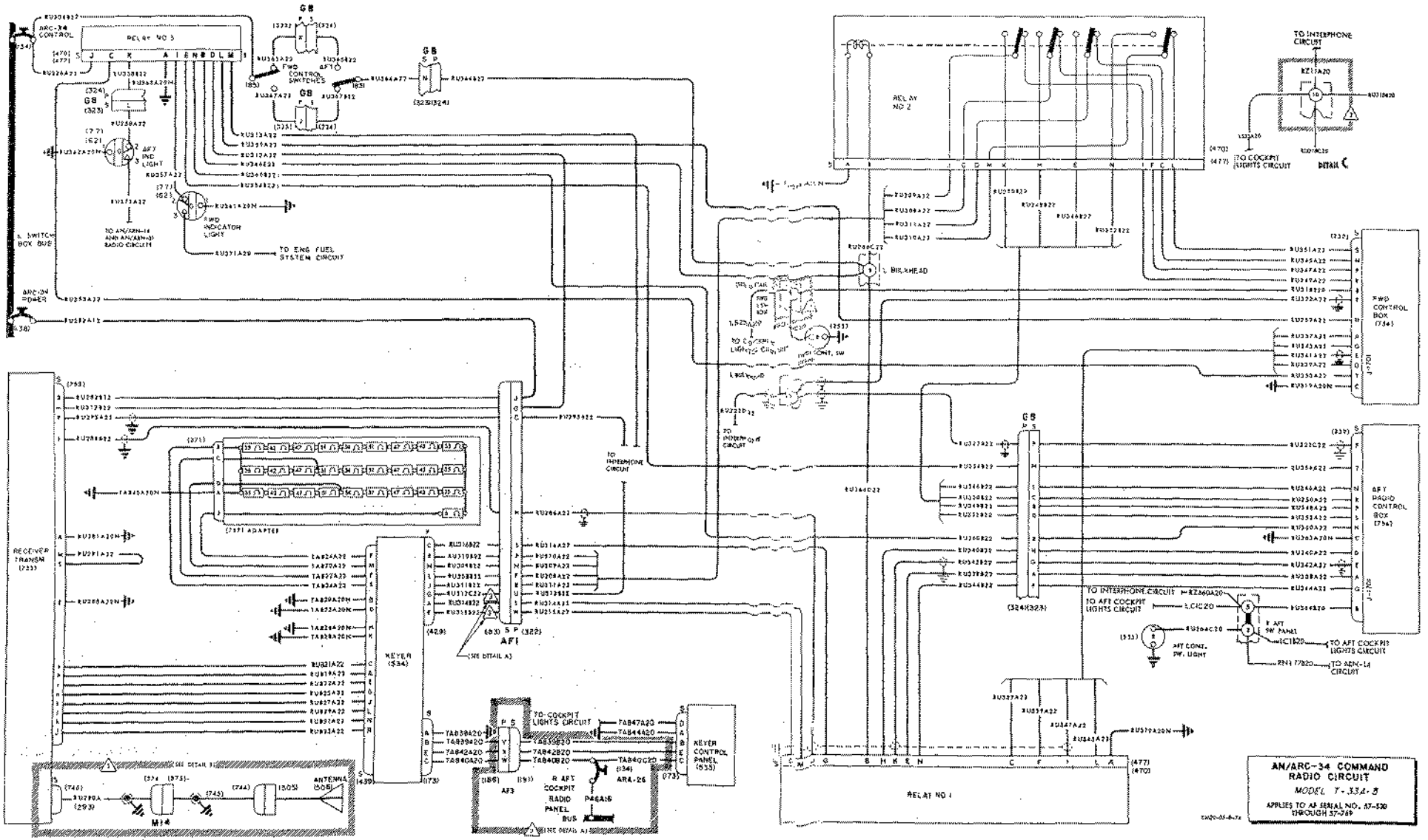
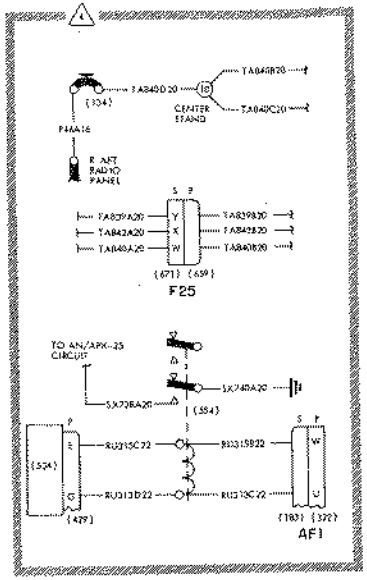
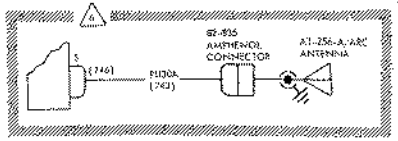


Figure 8-256. AN/ARC-34 Command Radio Circuit (Sheet 2 of 2)



DETAIL A



DETAIL B

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3137-3
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
139	CIRCUIT PROTECTOR			AN3161-P25
173	CONNECTOR			AN3106B-14S-5S
187	CONNECTOR			AN3106B-28-11S
196	CONNECTOR			AN3108B-28-12S
199	CONNECTOR			AN3100C-28-12P
293	COAXIAL CABLE			RG-6/U
322	CONNECTOR			AN3102C-28-11P
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106A-24-28S
330	CONNECTOR			CB3106A-32-14S
353	LIGHT			MS25010-7
371	CONNECTOR			AN3106B-18S-1S
426	CONNECTOR			AN3106B-22-14P
429	CONNECTOR			AN3106B-22-14S
470	RELAY			AN2303-1
477	CONNECTOR			AN3102A-20-29S
505	CONNECTOR			UG-58A/U
506	ANTENNA	LAC		452909
534	KEYER	GFAE		KY-65/ARA-26
537	CONTROL	GFAE		C-790/ARA-26
554	RELAY			AN2211-2
574	CONNECTOR			UG-573/U
575	CONNECTOR			UG-571/U
659	CONNECTOR			CT90E-28-12P
671	CONNECTOR			CT90E-28-12S
743	COAXIAL CABLE			RG-175A/U
744	CONNECTOR	AMPHENOL		82-312
745	CONNECTOR			UG-210/U
746	CONNECTOR			UG-1185/U
752	RECEIVER-TRANS	GFAE		RT-263/ARC-34
753	MOUNT	GFAE		MT-3099/AJ
756	CONTROL	GFAE		C-1059/ARC-34
757	ADAPTER	BARWOOD		MX-1396/ARC-34

NOTE

1. USED PRIOR TO AF SERIAL NO. 57-634
2. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-573
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-573
5. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
6. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

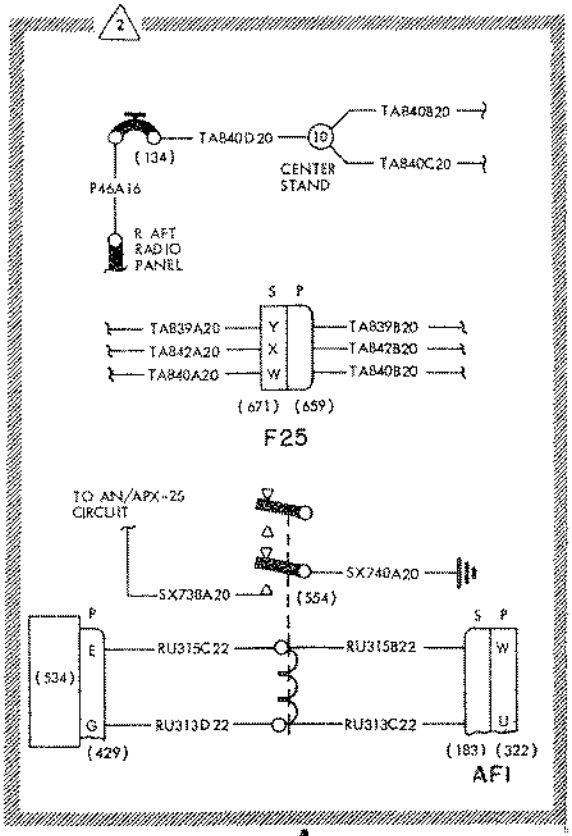
AN/ARC-34 COMMAND RADIO CIRCUIT

MODEL T-33A-5

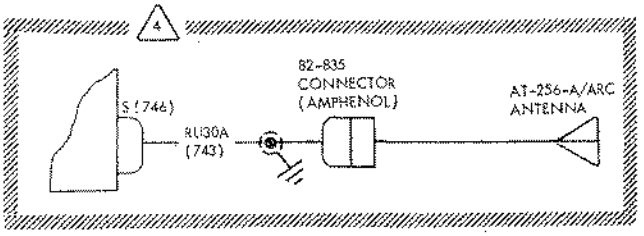
APPLIES TO AF SERIAL NO. 57-590 THROUGH 57-709

HF 08799
EM20-55-A-72

Figure 8-256. AN/ARC-34 Command Radio Circuit (Sheet 1 of 2)



DETAIL A



DETAIL B

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-5
138	CIRCUIT PROTECTOR			AN3161-25
173	CONNECTOR			MS31068-14S-5S
180	CONNECTOR			MS31068-28-11S
186	CONNECTOR			MS31068-28-12S
191	CONNECTOR			MS3100C-28-12P
293	COAXIAL CABLE			RG-8/U
311	CONNECTOR			MS3100A-28-15P
322	CONNECTOR			MS3100C-28-11P
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS31068-24-28S
325	CONNECTOR			MS31068-28-15S
330	CONNECTOR			C83106A-22-14S
353	LIGHT			MS25010-7
371	CONNECTOR			MS31068-18S-1S
429	CONNECTOR			MS31068-22-14P
439	CONNECTOR			MS31068-22-14S
470	RELAY			MS3303-1
477	CONNECTOR			MS3102A-20-27S
505	CONNECTOR			UG-58A/U
506	ANTENNA	LAC		452000
534	KEYER	GFAE		KY-65/ARA-26
535	CONTROL	GFAE		C-790/ARA-26
554	RELAY			AN3311-3
574	CONNECTOR			UG-573/U
575	CONNECTOR			UG-571/U
587	CONNECTOR			MS31068-28-21S
595	CONNECTOR			MS3102A-28-21P
659	CONNECTOR			CT06E-28-12P
671	CONNECTOR			CT00E-28-12S
743	COAXIAL CABLE			RG-115A/U
744	CONNECTOR	AMPHENOL		82-312
746	CONNECTOR			UG-1185/U
752	RECEIVER-TRANS	GFAE		RT-263/ARC-34
753	MOUNT	GFAE		MT-1099/U
757	ADAPTER	BARWOOD		MX-1396/ARC-34
763	CONTROL	GFAE		C-1057A/ARC-34
773	INDICATOR	GFAE		ID-572/ARC
774	CONNECTOR			K03-16-10SN
775	CONNECTOR			CA3106E-18-1S

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-571
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-571
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

AN/ARC-34 COMMAND RADIO CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 58-450 THROUGH 58-503

HF 08826
EM20-55-8-54

Figure 8-257. AN/ARC-34 Command Radio Circuit (Sheet 1 of 2)

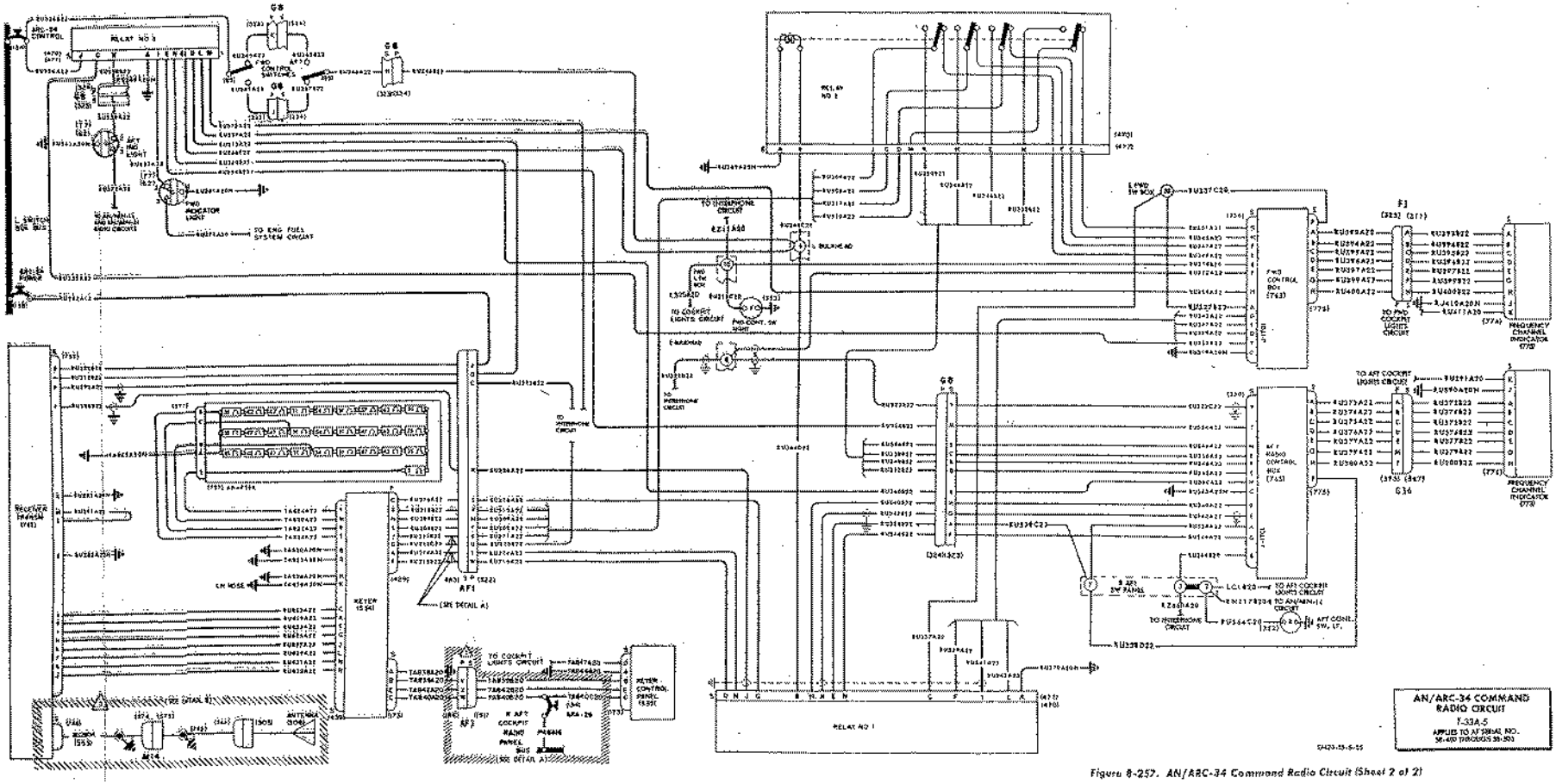
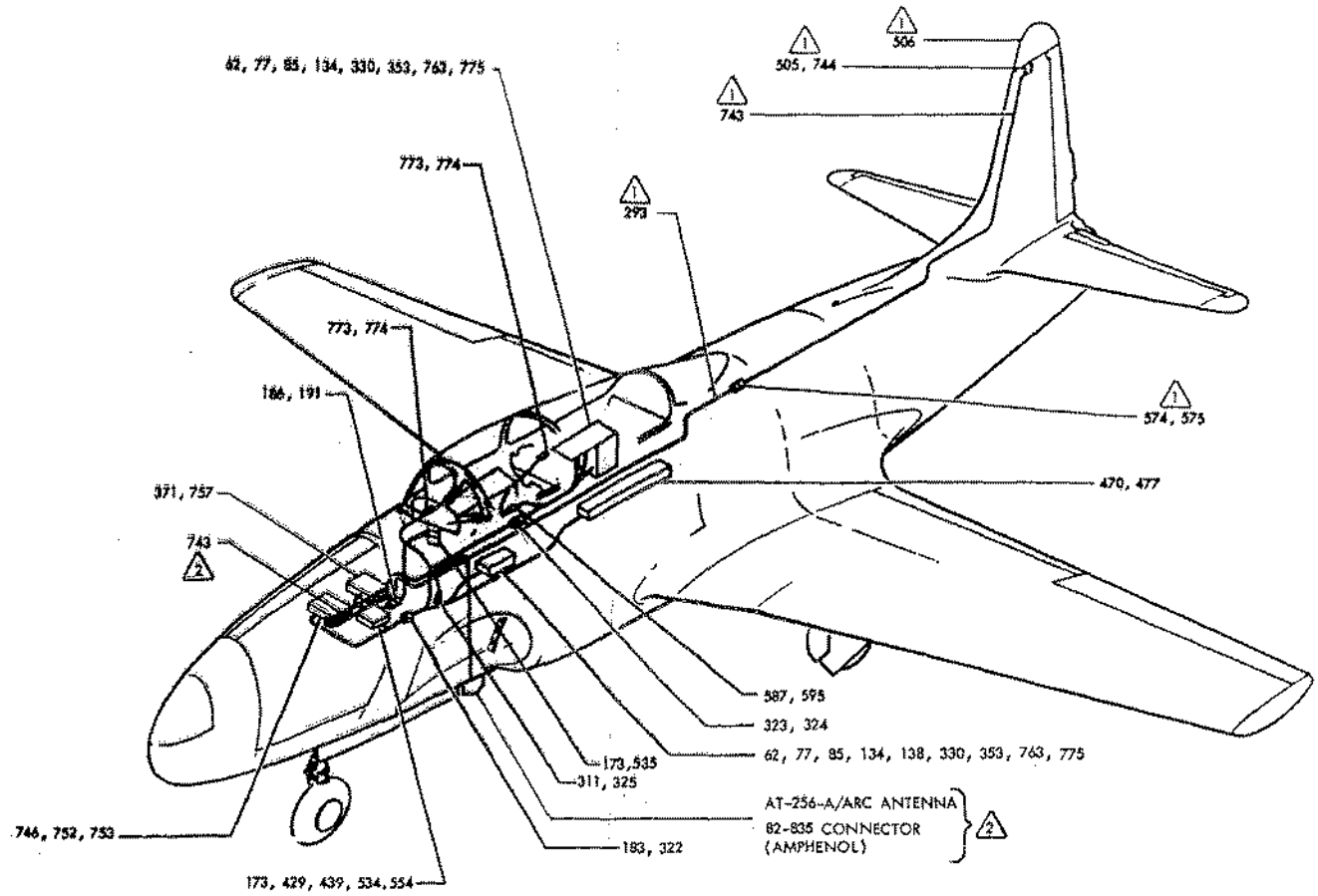


Figure 8-257. AN/ARC-34 Command Radio Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-013
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
138	CIRCUIT PROTECTOR			AN3161-P25
173	CONNECTOR			MS3106B-14S-5S
183	CONNECTOR			MS3106B-28-11S
186	CONNECTOR			MS3106B-28-12S
191	CONNECTOR			MS3100C-28-12P
293	COAXIAL CABLE			RG-8/U
311	CONNECTOR			MS3100A-28-15P
322	CONNECTOR			MS3100C-28-11P
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106B-24-28S
325	CONNECTOR			MS3106B-28-15S
330	CONNECTOR			CB3106A-22-14S
353	LIGHT			MS25010-7
371	CONNECTOR			MS3106B-18S-1S
429	CONNECTOR			MS3106B-22-14P
439	CONNECTOR			MS3106B-22-14S
470	RELAY			MS3303-1
477	CONNECTOR			MS3102A-20-27S
505	CONNECTOR			UG-58A/U
506	ANTENNA	LAC		452000
534	KEYER	GFAE		KY-65/ARA-26
535	CONTROL	GFAE		C-790/ARA-26
554	RELAY			AN3311-2
574	CONNECTOR			UG-573/U
575	CONNECTOR			UG-571/U
587	CONNECTOR			MS3106B-28-21S
595	CONNECTOR			MS3102A-28-21P
743	COAXIAL CABLE			RG-115A/U
744	CONNECTOR	AMPHENOL		82-312
746	CONNECTOR			UG-1185/U
752	RECEIVER - TRANS.	GFAE		RT-263/ARC-34
753	MOUNT	GFAE		MT-1099/U
757	ADAPTER	BARWOOD		MX-1396/ARC-34
763	CONTROL	GFAE		C-1057A/ARC-34
773	INDICATOR	GFAE		ID-572/ARC
774	CONNECTOR			K03-16-10SN
775	CONNECTOR			CA3106ER-18-1S

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

HF 08797
EM20-55-8-145

AN/ARC-34 COMMAND RADIO CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 58-504 THROUGH 58-600

Figure 8-258. AN/ARC-34 Command Radio Circuit (Sheet 1 of 2)

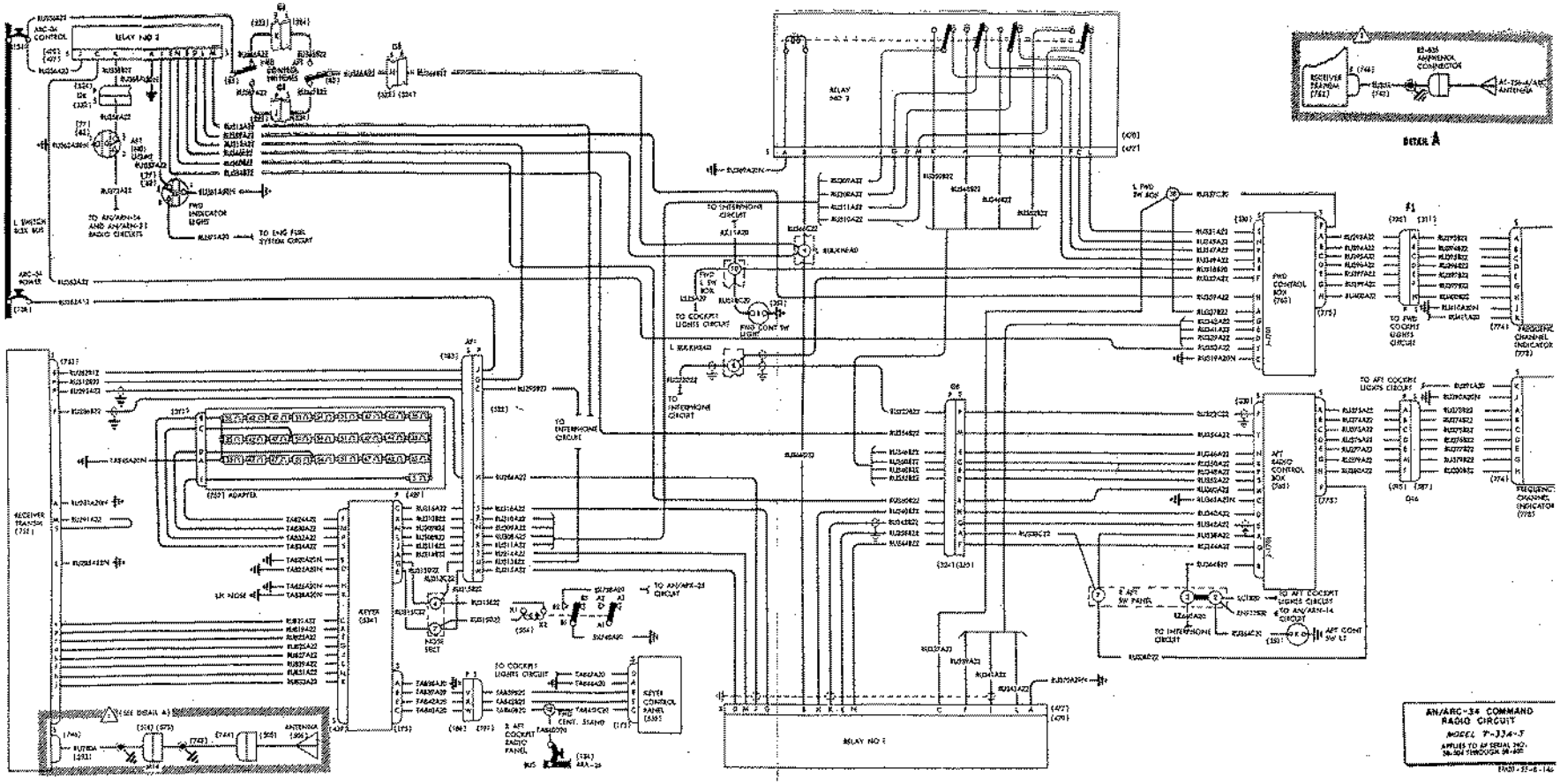
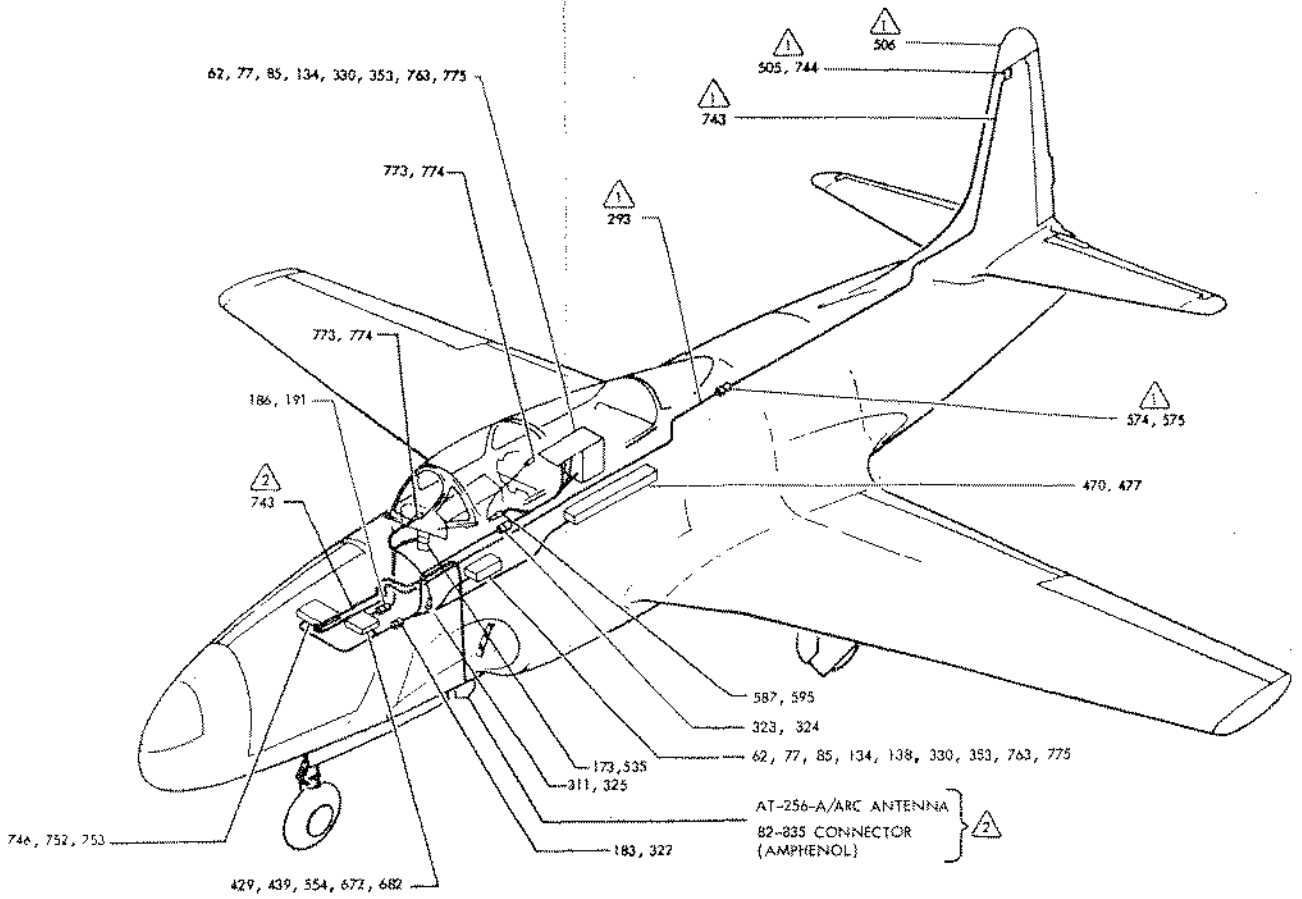


Figure 8-258. AN/ARC-34 Command Radio Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
62	LIGHT		GREEN	AN3157-3
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
134	CIRCUIT PROTECTOR			AN3161-P5
138	CIRCUIT PROTECTOR			AN3161-P25
173	CONNECTOR			MS3106B-14S-5S
180	CONNECTOR			MS3106B-28-11S
186	CONNECTOR			MS3106B-28-12S
191	CONNECTOR			MS3100C-28-12P
293	COAXIAL CABLE			RG-8/U
311	CONNECTOR			MS3100A-28-15P
322	CONNECTOR			MS3100C-28-11P
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106B-24-28S
325	CONNECTOR			MS3106B-28-15S
330	CONNECTOR			CB3106A-22-14S
353	LIGHT			MS25010-7
371	CONNECTOR			MS3106B-18S-1S
429	CONNECTOR			MS3106B-22-14P
439	CONNECTOR			MS3106B-22-14S
470	RELAY			MS3303-1
477	CONNECTOR			MS3102A-20-27S
505	CONNECTOR			UG-58A/U
506	ANTENNA	LAC		452000
554	RELAY			AN3311-2
574	CONNECTOR			UG-573/U
575	CONNECTOR			UG-571/U
587	CONNECTOR			MS3106B-28-21S
595	CONNECTOR			MS3102A-28-21P
672	CONNECTOR			MS3101B-22-14P
682	CONNECTOR			MS3101B-22-14S
743	COAXIAL CABLE			RG-175A/U
744	CONNECTOR	AMPHENOL		82-312
746	CONNECTOR			UG-1185/U
752	RECEIVER-TRANS.	GFAE		RT-263/ARC-34
753	MOUNT	GFAE		MT-1099/U
763	CONTROL	GFAE		C-10574/ARC-34
773	CONTROL	GFAE		1D-572/ARC
774	CONNECTOR			K03-16-10SN
775	CONNECTOR			CA3106ER-18-1S

NOTE

1. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-611A
2. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-611A

AN/ARC-34 COMMAND RADIO CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 58-601 AND SUBSEQUENT

HF 08798
EM20-55-8-2B

Figure 8-258A. AN/ARC-34 Command Radio Circuit (Sheet 1 of 2)

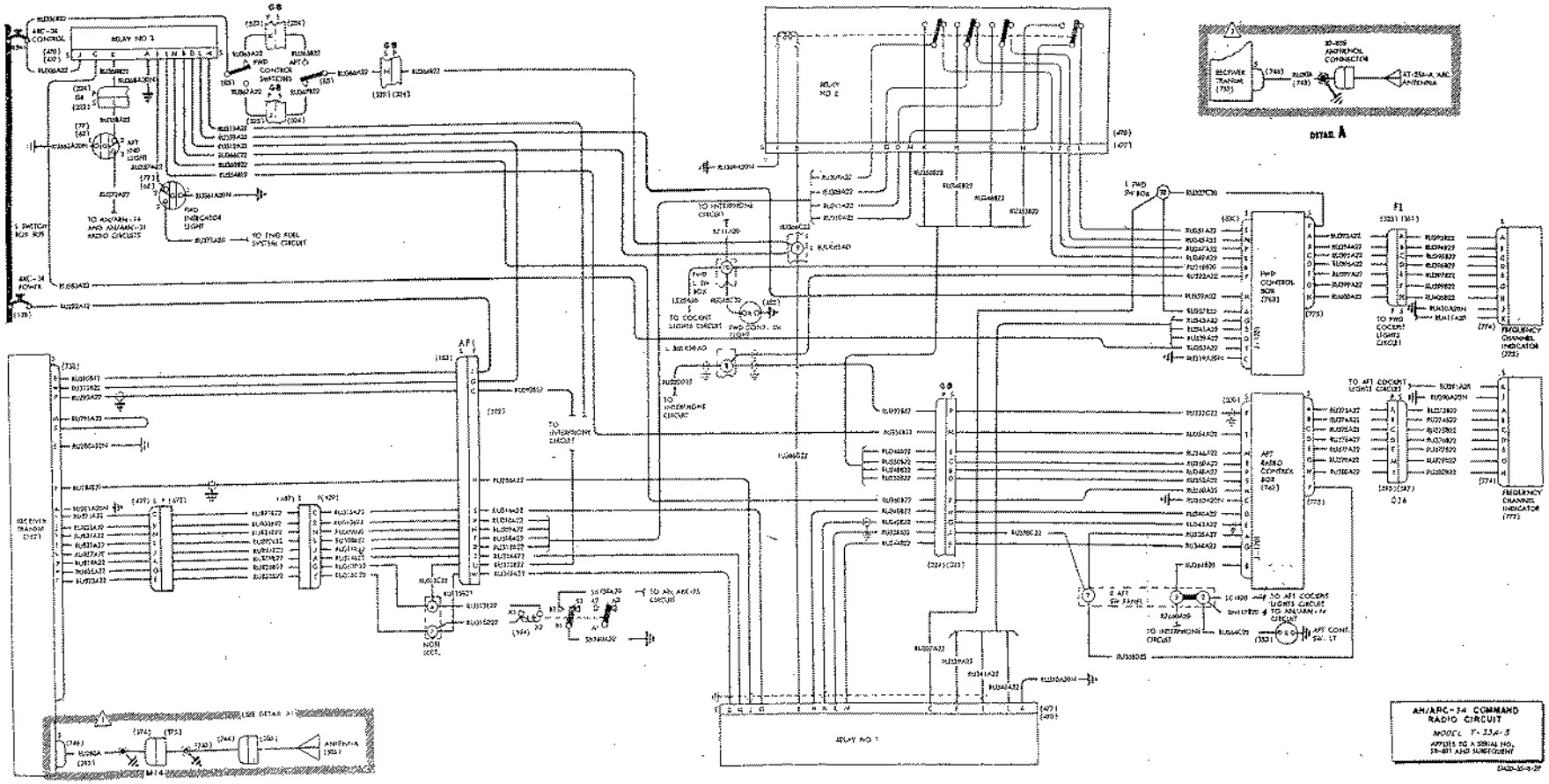


Figure 8-25BA. AN/ARC-34 Command Radio Circuit (Sheet 2 of 2)

Changed 4 June 1965

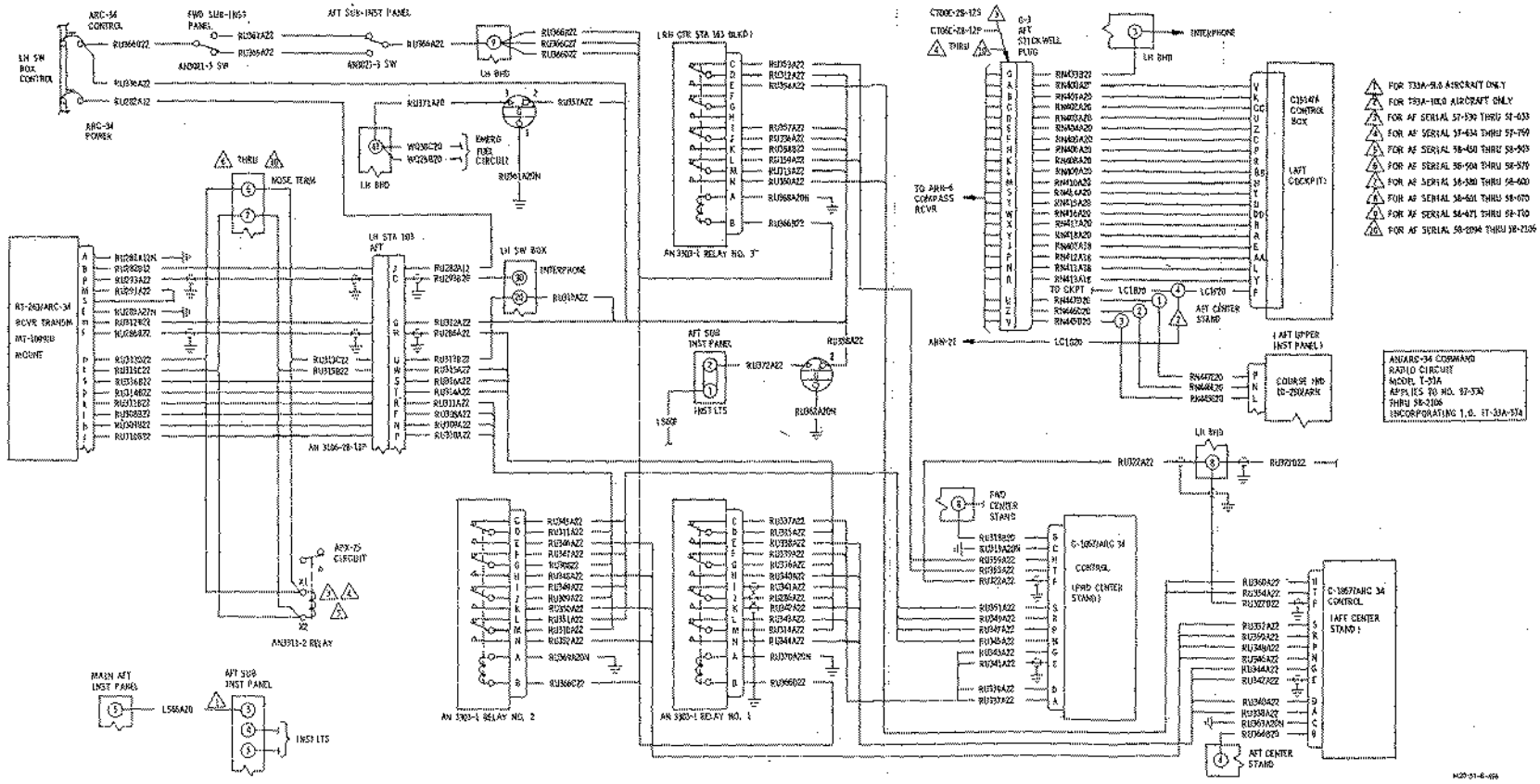
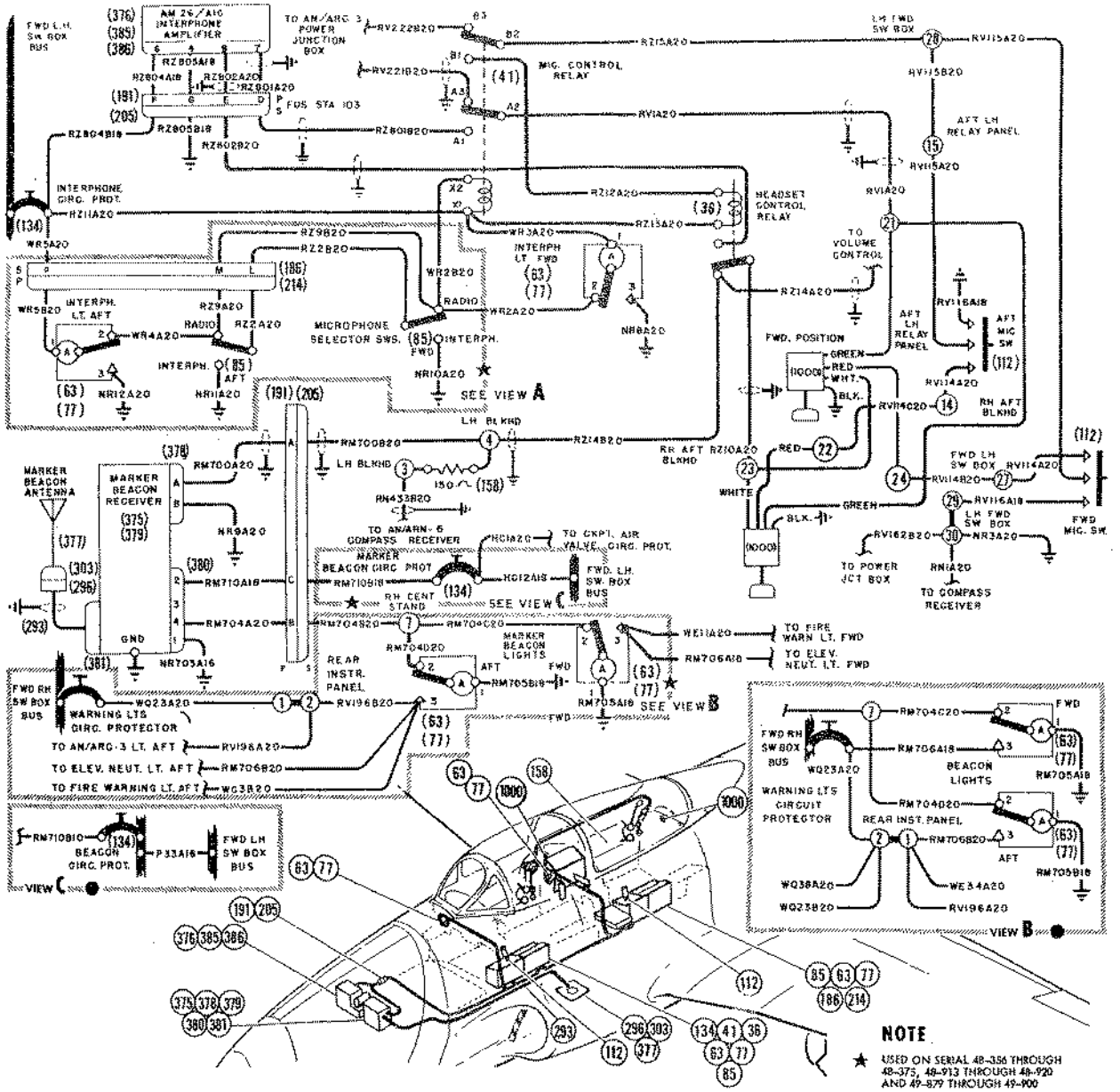


Figure 8-258B. AN/ARC-34 Command Radio Circuit



NOTE

★ USED ON SERIAL 48-356 THROUGH 48-375, 48-913 THROUGH 48-920 AND 49-879 THROUGH 49-900

● USED ON SERIAL 49-901 AND SUBSEQUENT

△1 USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-236

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL. PROD.		NR-57-C
41	RELAY	LEACH		237-EAU
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
112	SWITCH	UCINITE		138165
134	CIRCUIT PROTECTOR			AN3161-P5
158	RESISTOR	ERIE	1/2 W	150 Ω
186	CONNECTOR			AN3106-2B-12S
191	CONNECTOR			AN3102P-16S-1P
205	CONNECTOR			AN3106-16S-1S
214	CONNECTOR			AN3102-2B-12P
293	COAXIAL CABLE	GFAE		RG-8/U
296	PLUG	GFAE		PL-259A
303	ADAPTER	GFAE		M-359
375	RECEIVER	GFAE		BC-1333
376	MOUNT	GFAE		MT-26/ARN-5
377	ANTENNA	GFAE		AT-134/ARN-12
378	CONNECTOR	GFAE		AN3108-12S-3P
379	MOUNT	GFAE		FT-161
380	CONNECTOR	GFAE		PL-108
381	CONNECTOR	GFAE		PL-239
385	AMPLIFIER	GFAE		AM-26/AIC
386	CONNECTOR	GFAE		PL-152A
1000	ADAPTER BOX	GFAE		MX-1646/AIC

AN/AIC-2A INTERPHONE △1 AND RC-193-A MARKER BEACON RADIO

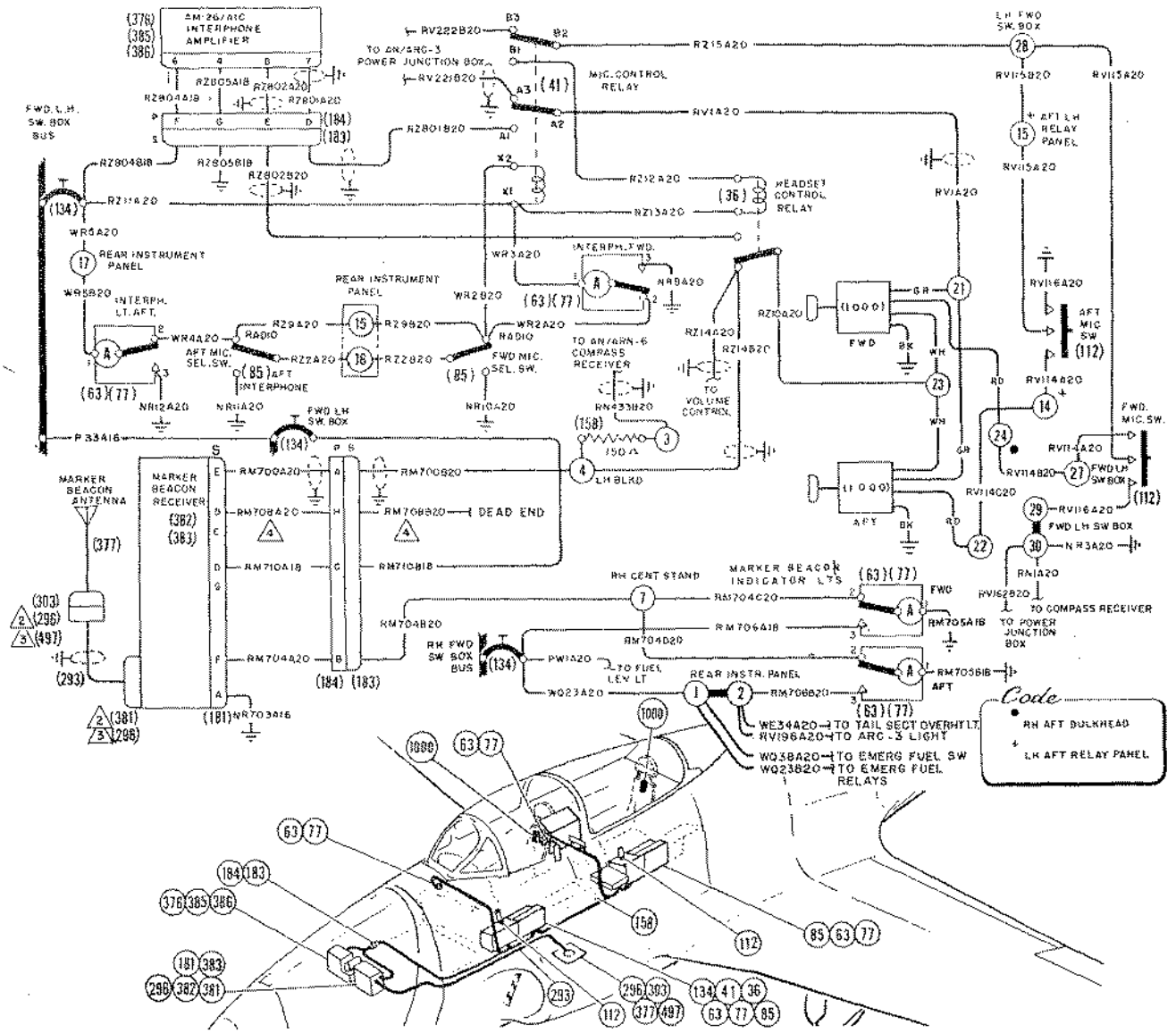
MODEL T33-A

APPLIES TO SERIALS PRIOR TO 49-942

GB 8863

M20-4BD-8-426

Figure 8-259. AN/AIC-2A Interphone and RC-193A Marker Beacon Radio Circuits



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
36	RELAY	EL PROD.		NB-57-C
41	RELAY	LEACH		237-EAU
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
85	SWITCH			AN3021-3
112	SWITCH	UCINITE		138185
134	CIRCUIT PROTECTOR			AN3161-P5
158	RESISTOR	ERIE	1/2 W-150 Ω	
181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
293	COAXIAL CABLE	G F A E		RG-8/U
296	PLUG	G F A E		PL-259
303	ADAPTER	G F A E		M-359
376	MOUNT	G F A E		MT-28/ARN-5
377	ANTENNA	G F A E		AT-134/ARN-12
2 381	CONNECTOR	G F A E		PL-219
382	RECEIVER	G F A E		R-122/ARN-12
383	MOUNT	G F A E		MT-589/ARN-12
385	AMPLIFIER	G F A E		AM-26/AIC
386	CONNECTOR	G F A E		PL-152A
3 497	CONNECTOR			UG-21 B/U
1000	ADAPTER BOX	G F A E		MX-1646/AIC

NOTE:

1. INTERPHONE CIRCUIT USED PRIOR TO AF SERIAL NO. 50-385 NOT INCORPORATING T.O. 1T-33A-236

   MARKER BEACON CIRCUIT USED PRIOR TO AF SERIAL NO. 51-4329

2. USED PRIOR TO AF SERIAL NO. 50-441
3. USED ON AF SERIAL NO. 50-441 AND SUBSEQUENT
4. USED PRIOR TO AF SERIAL NO. 51-4040

AN/AIC-2A INTERPHONE 1 & AN/ARN-12 RADIO CIRCUITS

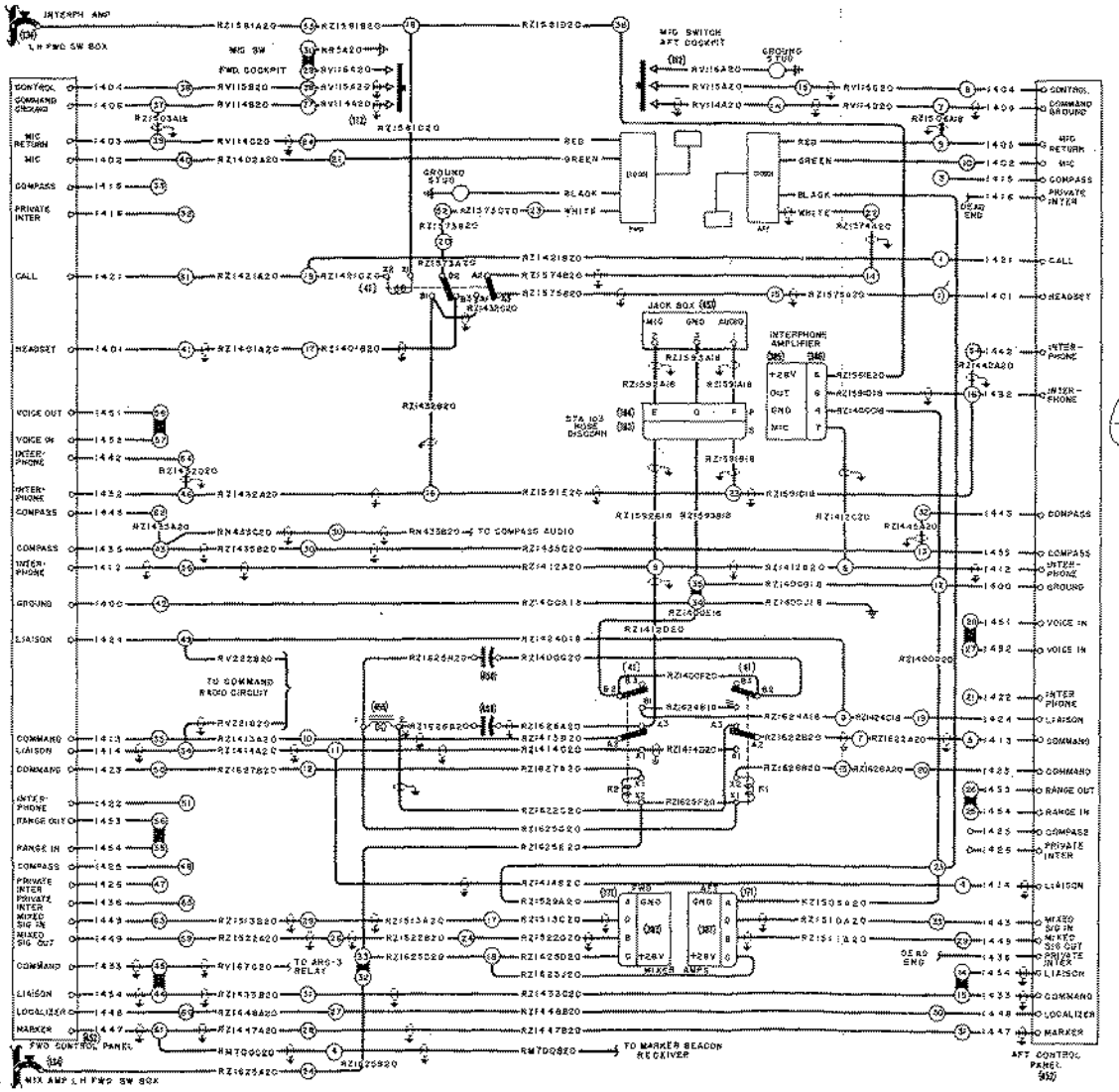
MODEL T-33A

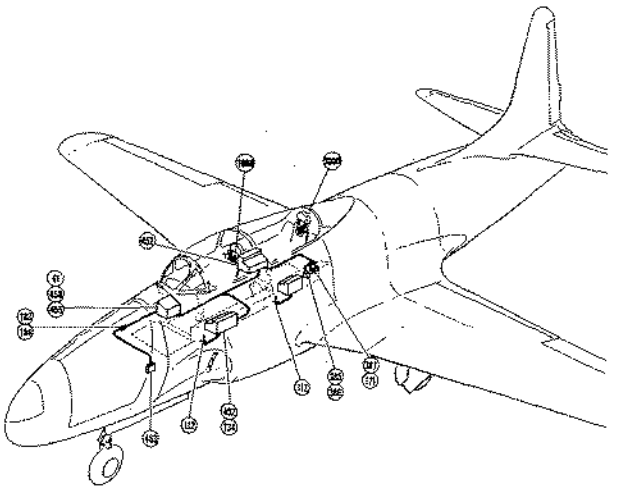
APPLIES TO AF SERIAL NO. 49-942 THROUGH 51-4328

GB 3553

M20-44-8-427

Figure 8-260. AN/AIC-2A Interphone and AN/ARN-12 Radio Circuits





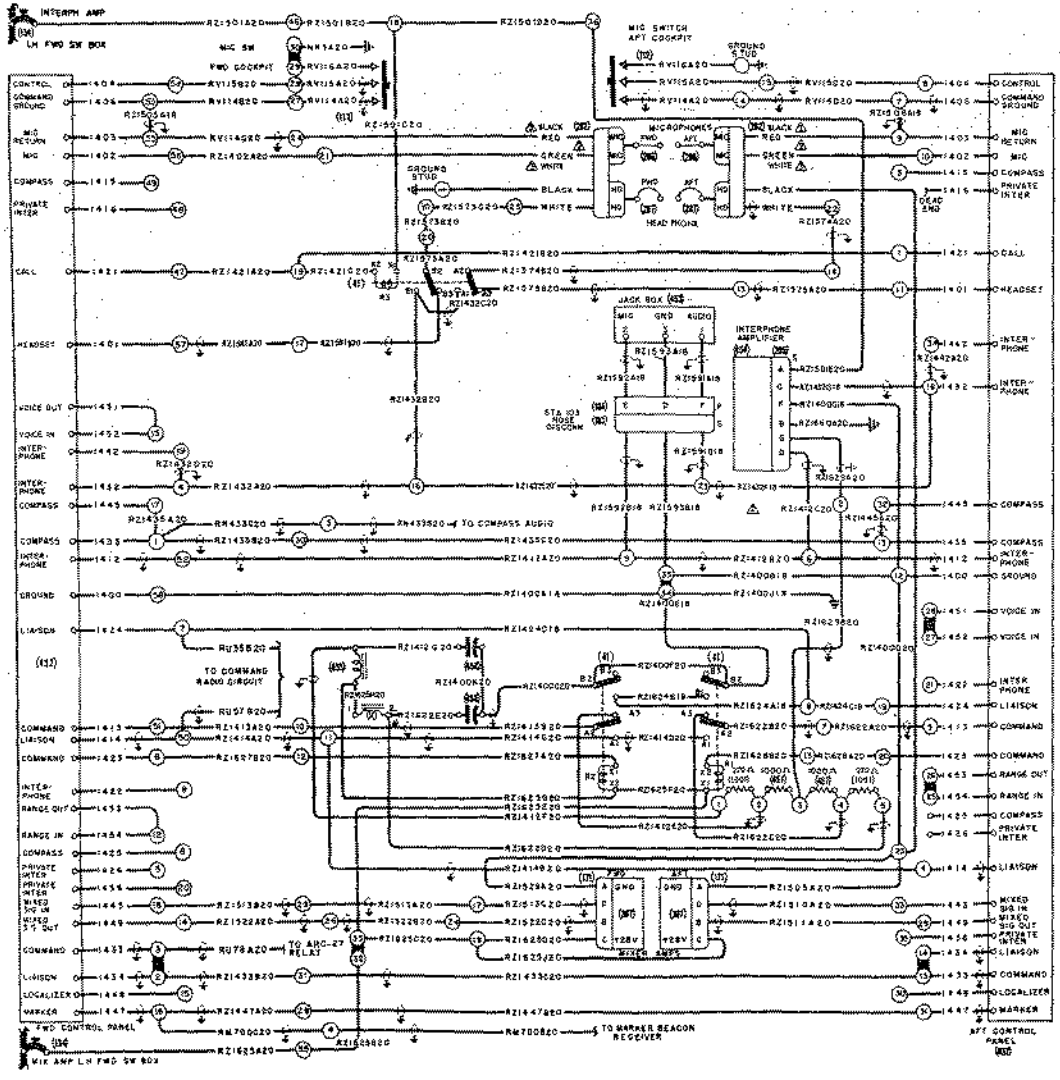
ITEM	DESIGNATION	MFR	TYPE	DWG OR SPEC
K7	RELAY	CRACK VICTREX		207-0A-3
S14	SWITCH			L-22150
F15	CIRCUIT PROTECTOR			AN3151-2.5
J175	CONNECTOR			AN3106-16S-1S
J185	CONNECTOR			AN3106-18-1S
J186	CONNECTOR			AN3106-18-1P
Z262	AMPLIFIER	GFAE		AN-19A/AIC
J69	CONNECTOR			MS3124
A67	AMPLIFIER (MIXER)	GFAE		AN-19A/AIC
A68	CONTROL PANEL	GFAE		C-2182/AIC
A55	JACK BOX	GFAE		J-1077A/AIC
A55	CHOKE - 200 DC	SPRAGUE	MPC-100-A	C-438
E58	CONVERTER - 28V	MALLORY	2P-28-A1	2P-28
1380	REMOTE BOX	GFAE		AN-19A/AIC

NOTE:

⚠ USED ON AIRCRAFT NOS PRIOR INCORPORATING T.O. 1T-33A-143

AN/AIC-2A INTERPHONE CIRCUIT
MODEL 733-A
APPLIES TO AF SERIAL NO. 53-5[illegible] THROUGH 53-[illegible]

Figure 8-262. AN/AIC-2A Interphone Circuit



ITEM	DESCRIPTION	MFR	TYPE	SPEC OR SPEC
41	RELAY	SEACO		22014-6X10
112	SWITCH	LEACH		1581B5
134	CIRCUIT PROTECTOR			AN3161-M3
173	CONNECTOR			AN3106-14S-4S
188	CONNECTOR			AN3106-18-7S
194	CONNECTOR			AN3102-28-11P
195	CONNECTOR			AN3106-10S-1S
202	JACK			S-61/U
218	MICROPHONE	GPAE		T-30M OR LATER
219	HEAD SET	GPAE		H1-33
309	AMPLIFIER (MIXER)	GPAE		AM-142/AIC
405	CONTROL PANEL	GPAE		C-383/AIC
406	JACK BOX	GPAE		J-339A/AIC
454	AMPLIFIER	GPAE		AM309/AIC
456	SPKR	COSLIN		CM-28, 10S-12S
457	RESISTOR			RC20GF100K
458	CONDENSER-309	MALLORY		85-39
459	RESISTOR			RC30BF271K

NOTE

1. USED ON AIRFRAMES INCORPORATING T.O. 1T-33A-243 AND 1T-33A-256
2. USED ON AF SERIAL NO. 49-940 AND SUBSEQUENT
3. USED ON AF SERIAL NO. 48-256 THROUGH 49-941

AN/AIC-2A INTERPHONE CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 48-604 THROUGH 50-384

FB 8303

Figure 8-26E. AN/AIC-2A Interphone Circuit

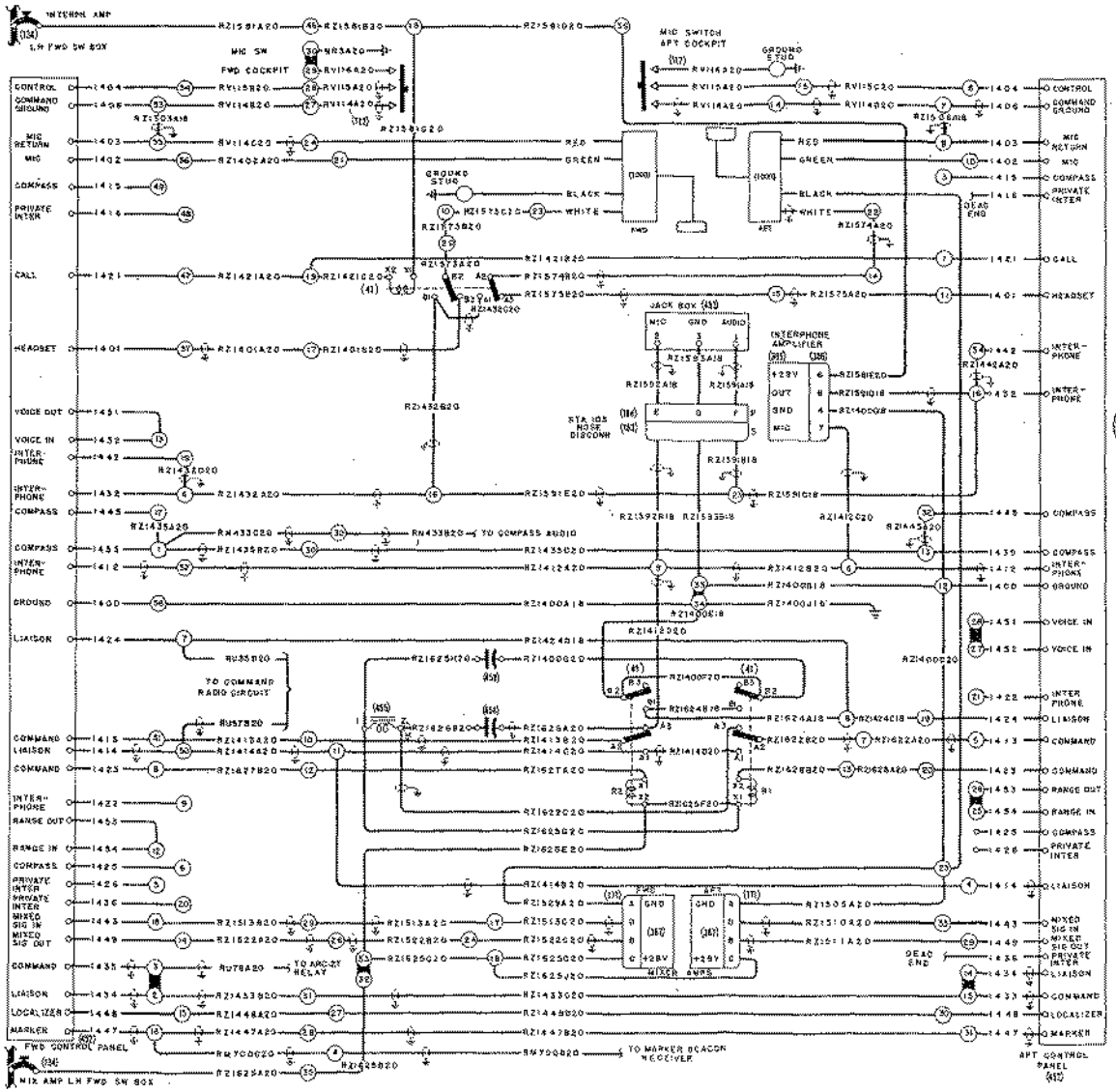
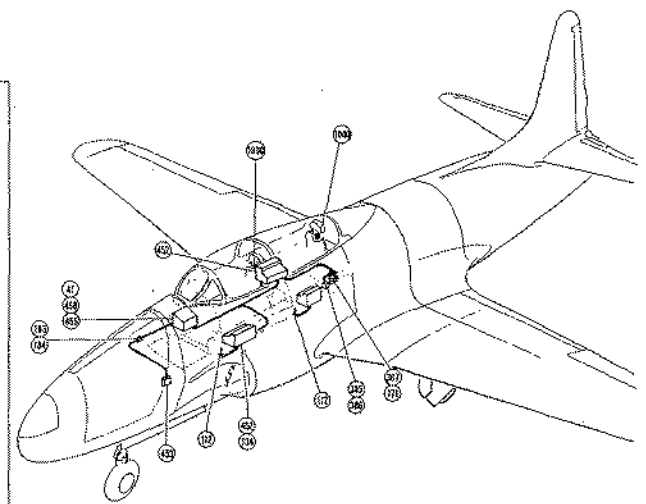


Figure 8-263. AN/AIC-2A Interphone Circuit



NOTE:

⚠ USED ON AIRCRAFT INCORPORATING T.O. NO. 1T-33A-143

ITEM	DESCRIPTION	MFR	TYPE	SPEC OR STOCK
K1	RELAY	LEACH		270-LA61
S10	SWITCH	SCINTRA		1-28195
15A	CIRCUIT PROTECTOR			AN3161-M
97A	CONNECTOR			AN3106-14S-2S
98A	CONNECTOR			AN3450-20-12S
98B	CONNECTOR			AN3102R-20-12P
99A	AMPLIFIER	GPAE		AM-106/AIC
99B	CONNECTOR			PL-112A
99C	AMPLIFIER (MIXER)	GPAE		AM-142/AIC
100	CONTROL PANEL	GPAE		C-360/AIC
101	JACK BOX	GPAE		J-339A/AIC
450	CHOKE - .060 DC	GOSHEN	60MV 50 MA	CC-625 .525 - 715 μh 25-50
458	CONDENSER - 50V	MALLORY		MFC-1648/AIC
1000	ADAPTER BOX	GPAE		

⚠ AN/AIC-2A INTERPHONE CIRCUIT
MODEL T33-A
APPLIES TO AF SERIAL NO. 52-285 THROUGH 53-418

SM20-44-8-263

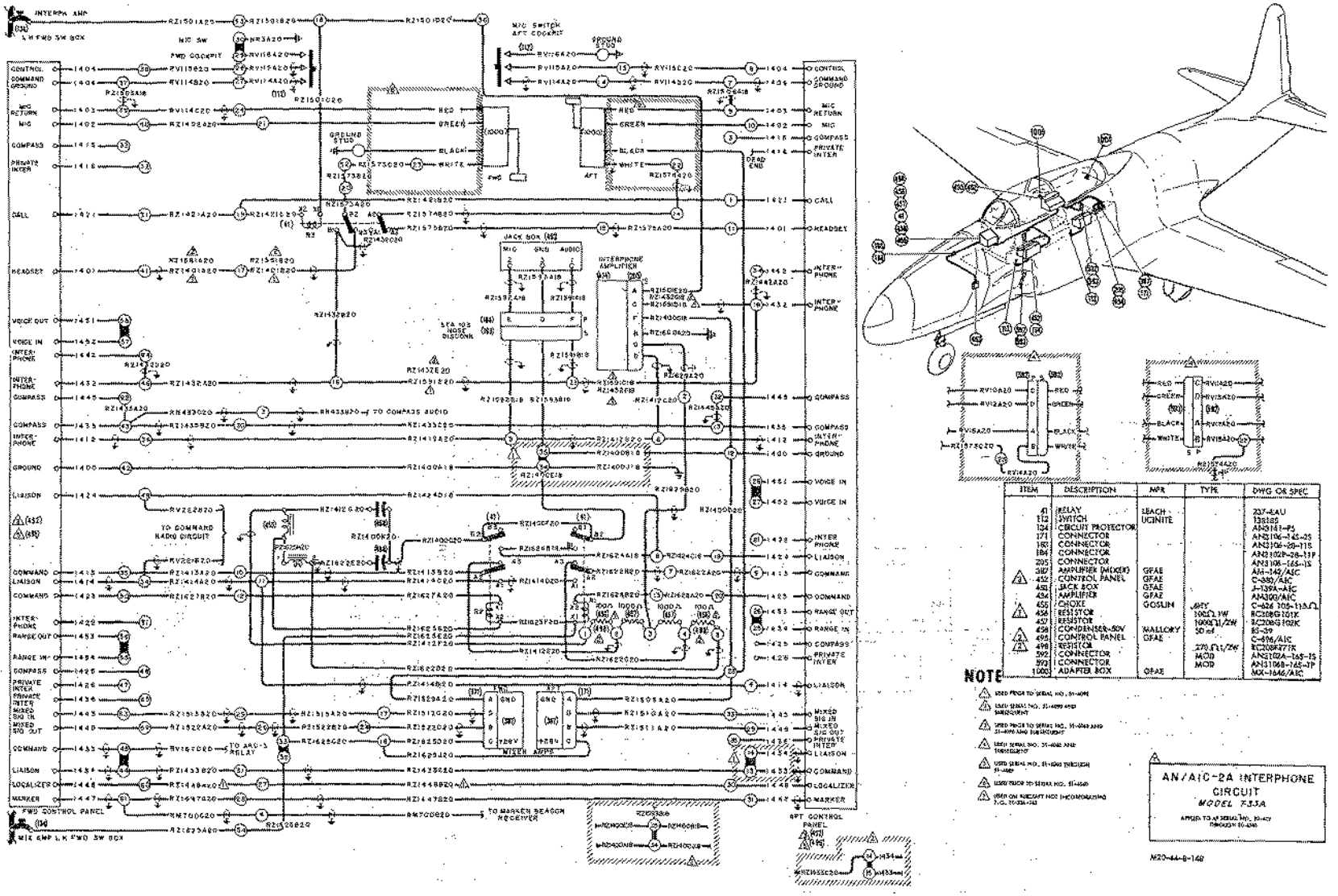
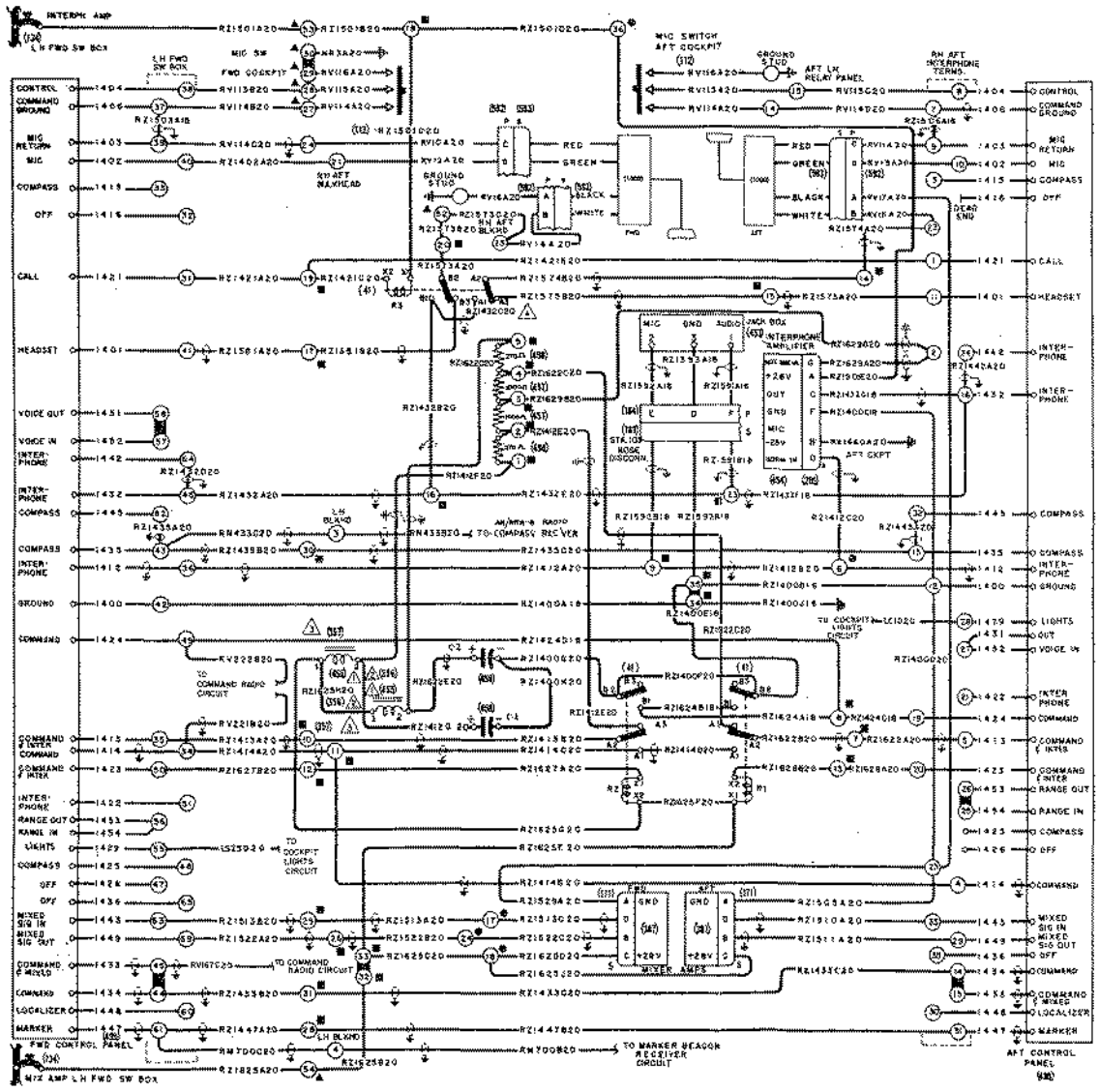
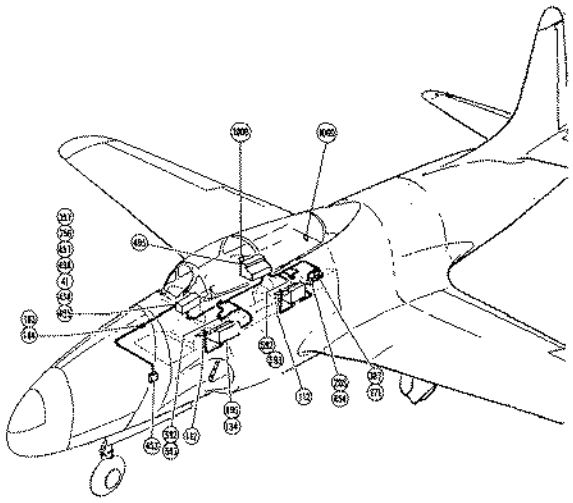


Figure 8-264. AN/AIC-2A Interphone Circuit





Notes
▲ LH FWD SWITCH BOX.
◆ RH AFT INTERPHONE TERMS.
■ FWD INTERPHONE TERMS.

ITEM	DESCRIPTION	MFR	TYPE	DWG. OR SPEC.
	42 RELAY	LEACH		227-EAU
	112 MIC SWITCH	LICINITE		138888
	124 CIRCUIT PROTECTOR			AN3162-P8
	575 CONNECTOR			AN3106-16S-2S
	583 CONNECTOR			AN3106-20-11S
	804 CONNECTOR			AN3102P-28-11P
	205 CONNECTOR			AN3106-16S-1S
▲ 2 3	326 CHOKE - .068 DC	WC ELEC	6HY	210814
23	367 CHOKE - .050 DC	WC ELEC	6 HY	950058
	387 AMPLIFIER (AU XER)	GFAE		AM-142/AIC
	453 JACK BOX	GFAE		J-1394/AIC
	494 AMPLIFIER-INTERPH.	GFAE		AM-1305/AIC
▲ 1	455 CHOKE - .080 DC	GOSLIN	6 HY	C-626135
	457 RESISTOR		100Ω	RC20BG102K
	458 CONDENSER -50V	MALLORY	50 MF	35-39
	493 CONTROL PANEL	GFAE		C-696/AIC
	498 RESISTOR		270Ω	RC20BF271K
	592 CONNECTOR		MOD	AN3102A-16S-1S
	593 CONNECTOR		MOD	AN3106A-16S-1P
	1000 ADAPTER BOX	GFAE		Y X-1844/AIC

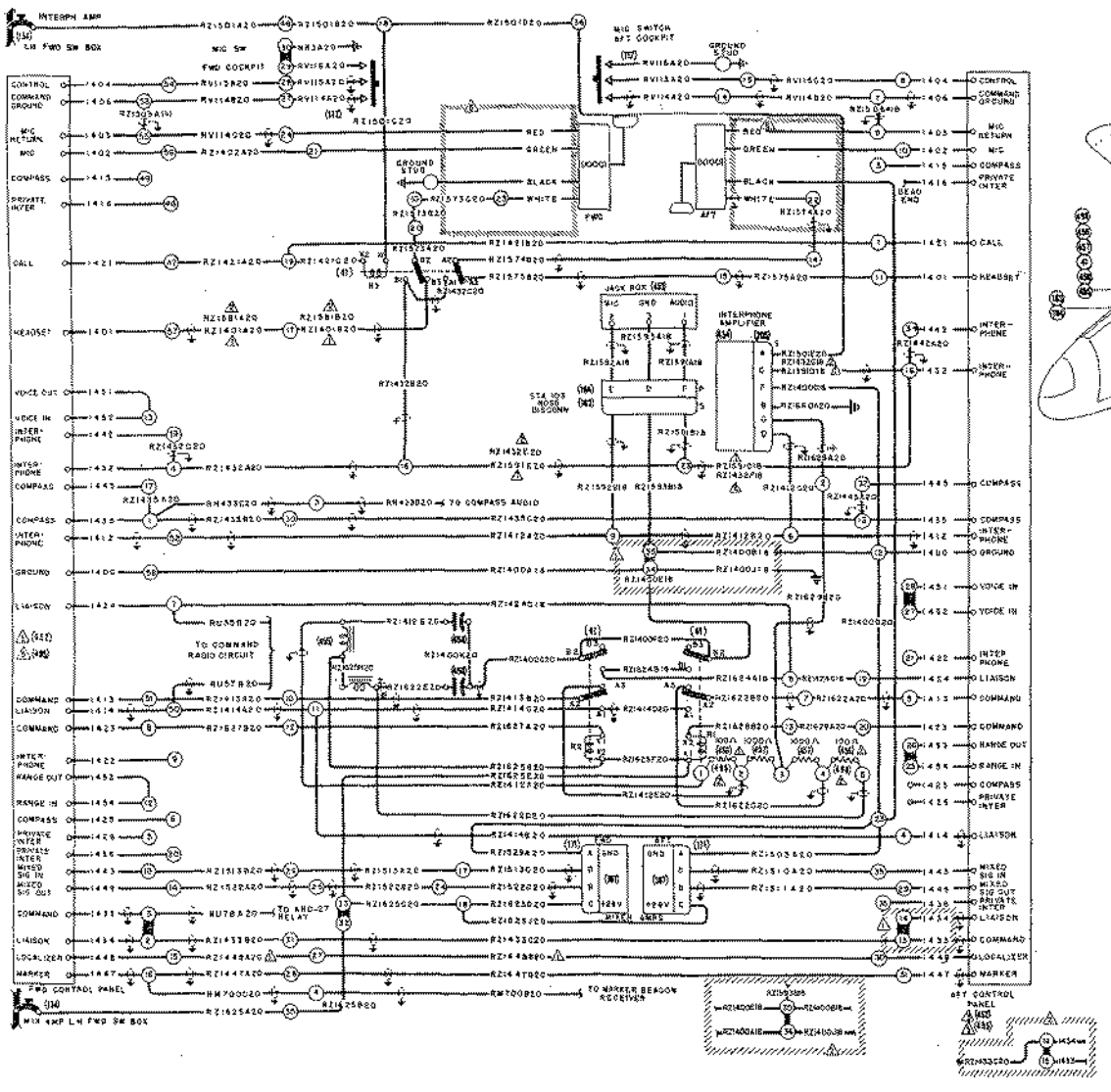
NOTE

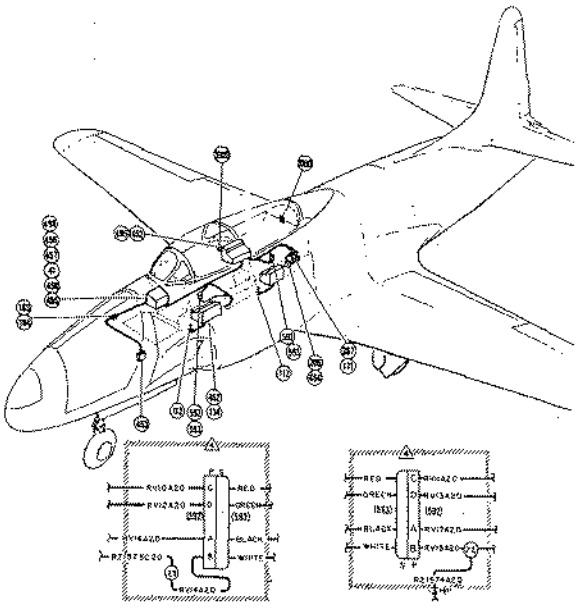
1. USED PRIOR TO AF SERIAL NO. 51-4216
2. USED ON AF SERIAL NO. 51-4216 THROUGH 51-6586
3. USED ON AF SERIAL NO. 51-6587 THROUGH 51-6750
4. RZ1432C20 UNSHIELDED ON AF SERIAL NO. 51-6587 THROUGH 51-6750
5. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-142

▲ AN/AIC-2A INTERPHONE CIRCUIT MODEL T-33A
APPLIES TO AF SERIAL NO. 51-4343 THROUGH 51-6750

AN20-33-1-147

Figure 8-266. AN/AIC-2A Interphone Circuit





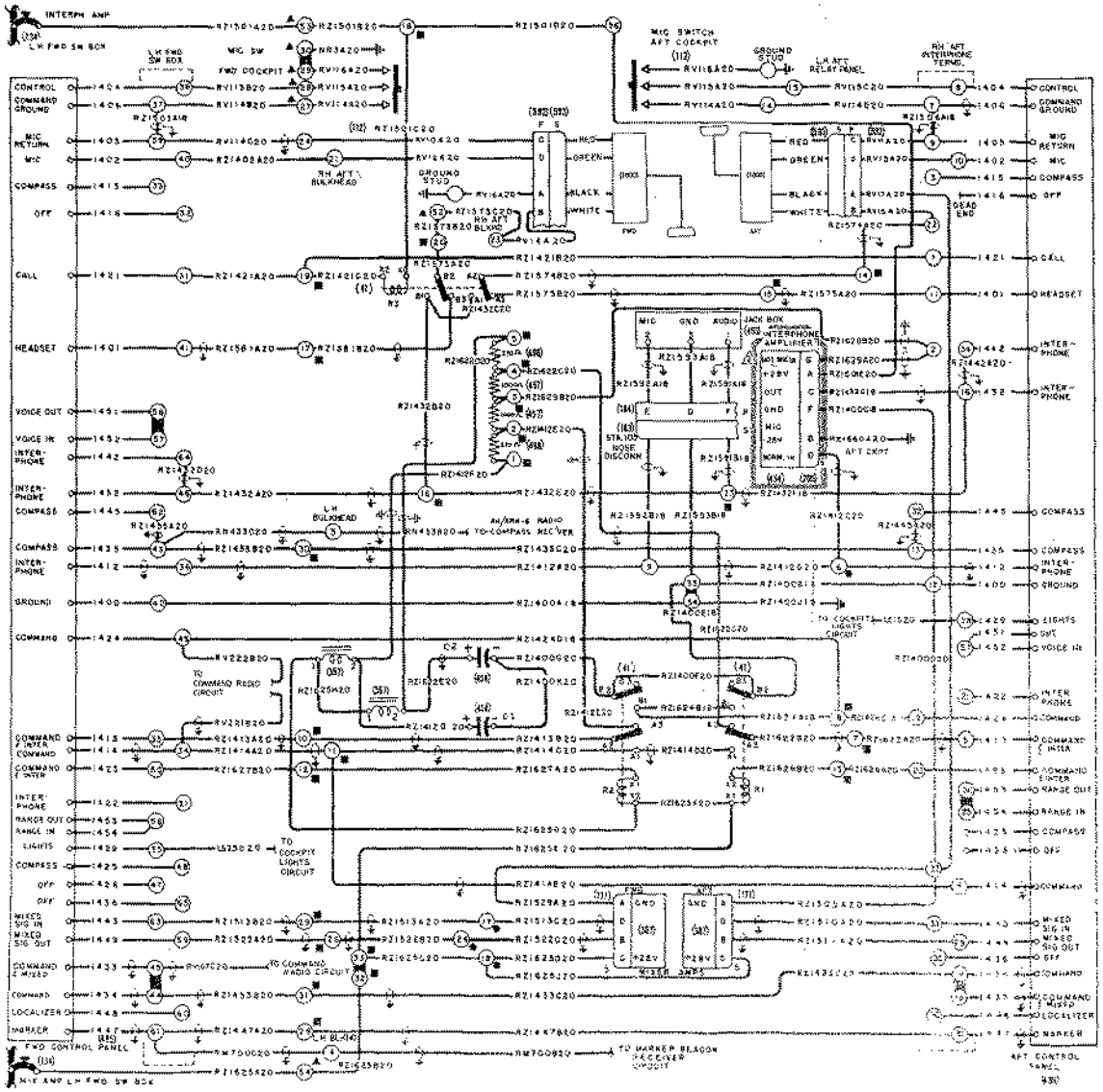
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
	RELAY	LEACH UGINITE		737-EAU
	SWITCH			1D61S3
	CIRCUIT PROTECTOR			AN3320-1HS
	CONNECTOR			AN3106-14S-2S
	CONNECTOR			AN3102A-14S-1P
	CONNECTOR			AN3106A-28-11S
	CONNECTOR			AN3102F-12-3P
	CONNECTOR			AN3102A-16S-1S
	CONNECTOR			AN3106-18S-1S
	AMPLIFIER (MISSILES)	GFAE		AIC-162/AIC
	CONTROL PANEL	GFAE		C-2182/AIC
	JACK BOX	GFAE		J-339A/AIC
	AMPLIFIER	GFAE		AM2050/AIC
	CRICKE	COSUM		C-402-105-(1)
	RESISTOR		1W	RC20BG105K
	RESISTOR		150Ω/1W, 1500Ω/2W	RL20BG151K, RL20BG152K
	CONDENSER-30V	MALLORY	80-40	81-59
	CONTROL PANEL	GFAE		C-2182/AIC
	RESISTOR		10Ω/2-1/2W	RC20BF230K
	CONNECTOR	MOD	MOD	AN3102A-16S-1S
	CONNECTOR	MOD	MOD	AN3106B-16S-1P
	ADAPTER BOX	GFAE		MX-1648/AIC

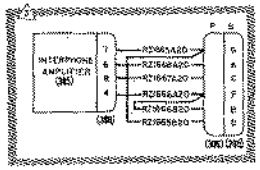
NOTE

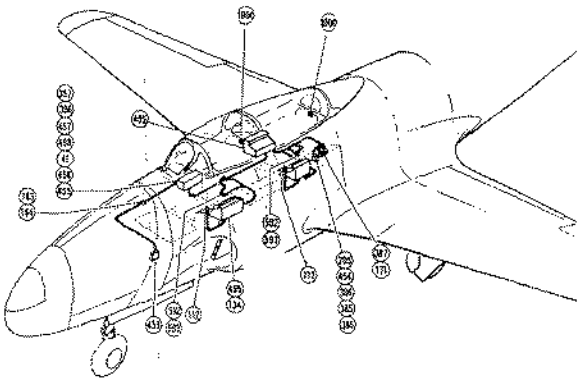
1. USED PRIOR TO AF SERIAL NO. 51-4090
2. USED ON AF SERIAL NO. 51-4090 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 51-4040 AND 51-4090 AND SUBSEQUENT
4. USED ON AF SERIAL NO. 51-4040 AND SUBSEQUENT
5. USED ON AF SERIAL NO. 51-4040 THROUGH 51-4089
6. USED PRIOR TO AF SERIAL NO. 51-4040
7. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-543

AN/AIC-2A INTERPHONE CIRCUIT
MODEL F-33A
APPLIES TO AF SERIAL NO. 50-419 THROUGH 51-4040

Figure 8-265. AN/AIC-2A Interphone Circuit







NOTES

▲ L.H. FWD SW BOX
● R.H. AFT INTERPHONE TERMS.
✱ F.AD. INTERPHONE TERMS.

ITEM	DESCRIPTION	MFR	TYPE	MIL. SPEC. OR SPEC.
	41 RELAY	R.BACH		33T-66A1
	132 MIC SWITCH	LICINITE		33T-95
	134 CIRCUIT PROTECTOR			AN3320-3
	271 CONNECTOR			AN3106-18-2S-2S
	283 CONNECTOR			AN3106-20-4P-1S
	784 CONNECTOR			AN3450-20-20-24P
	205 CONNECTOR			AN3106-16S-1S
	306 CONNECTOR			AN3510-16S-1P
⚠1	357 CHOKE - .069 DC	WC ELEC	6 HY	750308
⚠1	385 AMPLIFIER-INTERPH	GFAE		AM-26-AIC
⚠2	388 CONNECTOR			PL-1826
	389 AMPLIFIER (MIXER)	GFAE		AM-3107-AIC
	410 JACK BOX	GFAE		3139A/AIC
⚠1	434 AMPLIFIER-INTERPH	GFAE		AM-987-AIC
	457 RESISTOR		1000 Ω	RC20GF102K
	456 CONDENSOR-50V	MALLORY	.50 MF	85-50
	495 CONTROL PANEL	GFAE		C-998/AIC
	498 RESISTOR		270 Ω	RC32GF271K
	572 CONNECTOR	MOD	MOD	AN3106A-14S-1S
	573 CONNECTOR	MOD	MOD	AN3108A-14S-1P
	1030 ADAPTER BOX	GFAE		MX-1644/AIC

NOTE

⚠1 USED ON SCAF AND MDAP AIRCRAFT ONLY.

⚠2 USED PRIOR TO AF SERIAL NO., 51-6796

⚠3 USED ON AF SERIAL NO., 51-6798 THROUGH 51-6818

⚠ AN/AIC-2A INTERPHONE CIRCUIT MODEL T-33A

APPLIES TO AF SERIAL NO., 51-6751 THROUGH 51-6818

Figure 8-26ff. AN/AIC-2A Interphone Circuit

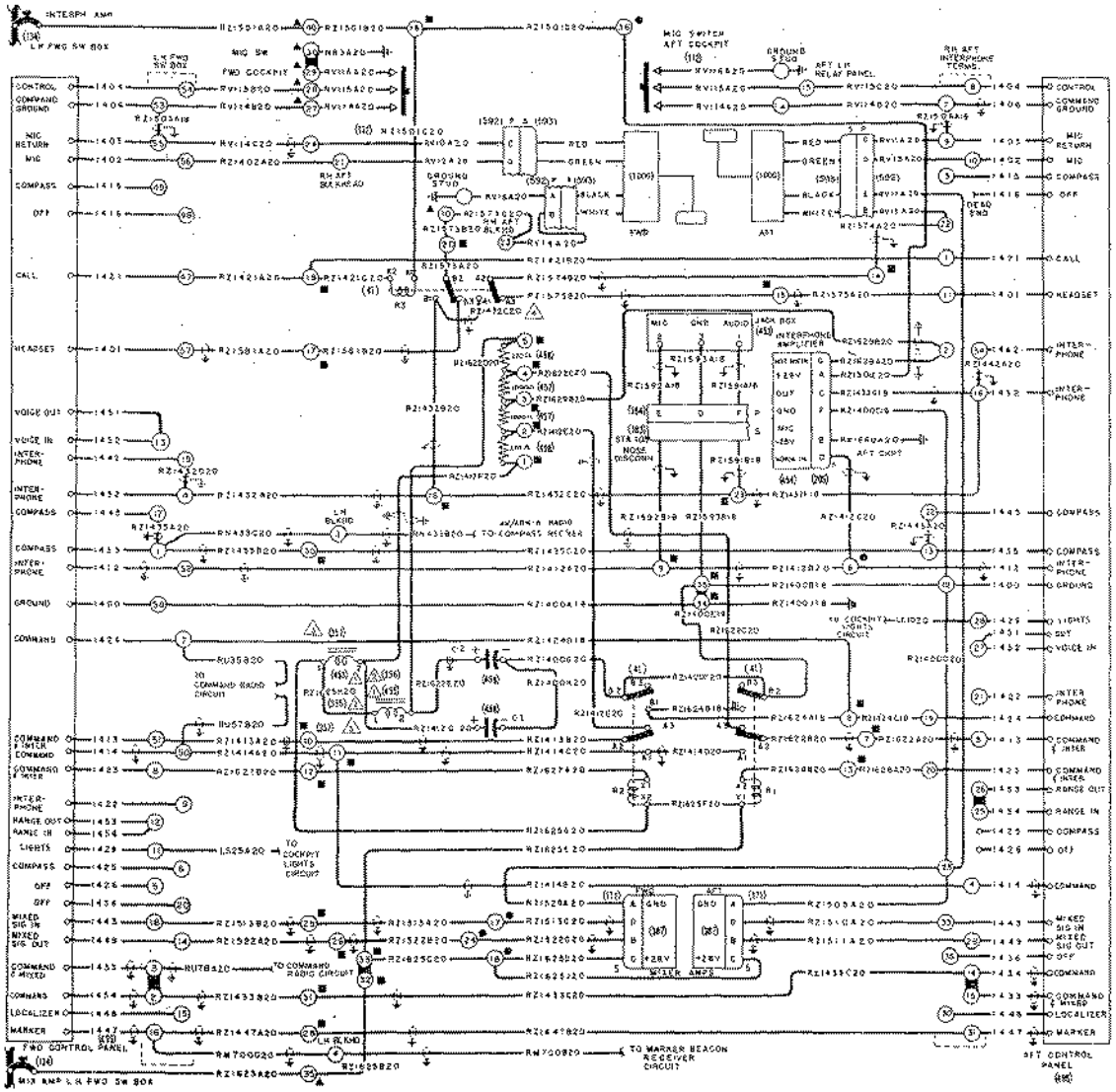
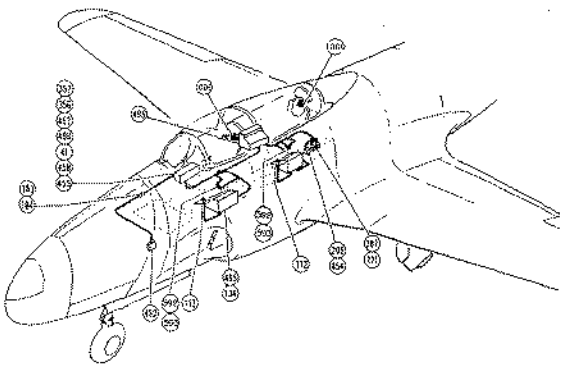


Figure 8-267. AN/AIC-2A Interphone Circuit

NOTE

1. USED PRIOR TO AF SERIAL NO. 51-4216
2. USED ON AF SERIAL NO. 51-4216 THROUGH 51-6586
3. USED ON AF SERIAL NO. 51-6587 THROUGH 51-6759
4. RZ1433C20 UNINSULATED ON AF SERIAL NO. 51-6587 THROUGH 51-6759
5. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-143



ITEM	DESCRIPTION	MFR	TYPE	FWO OR SPEC
49	RELAY	STACKPOLE		227-6440
112	MIC SWITCH	LEONITE		13X185
134	CIRCUIT PROTECTOR			AN3161-05
171	CONNECTOR			AN3106B-14S-2S
180	CONNECTOR			AN3756B-18-11S
184	CONNECTOR			AF3A1027-28-11P
369	CONNECTOR			AN3106B-16S-1S
536	DIODE - .008 DC	WC LVDC	6 KV	2D014
537	DIODE - .008 DC	WC LVDC	6 KV	2D014
539	AMPLIFIER (WATER)	GPAE		750098
435	JACK BOX	GPAE		J139/AIC
454	AMPLIFIER-INTERPH	GPAE		AM2090/AIC
455	DIODE - .060 DC	GOULD	6 KV	G-6D013
457	RESISTOR		1800Ω	RC20BG182K
458	COMPRESSOR-SOV	MALLORY	50 MF	JH-59
495	CONTROL PANEL	GPAE		C-694/AIC
498	RESISTOR		2700Ω	RC20BF272K
592	CONNECTOR		MOD	AN3102A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P
1000	ADAPTER BOX	GPAE		MX-1846/AIC

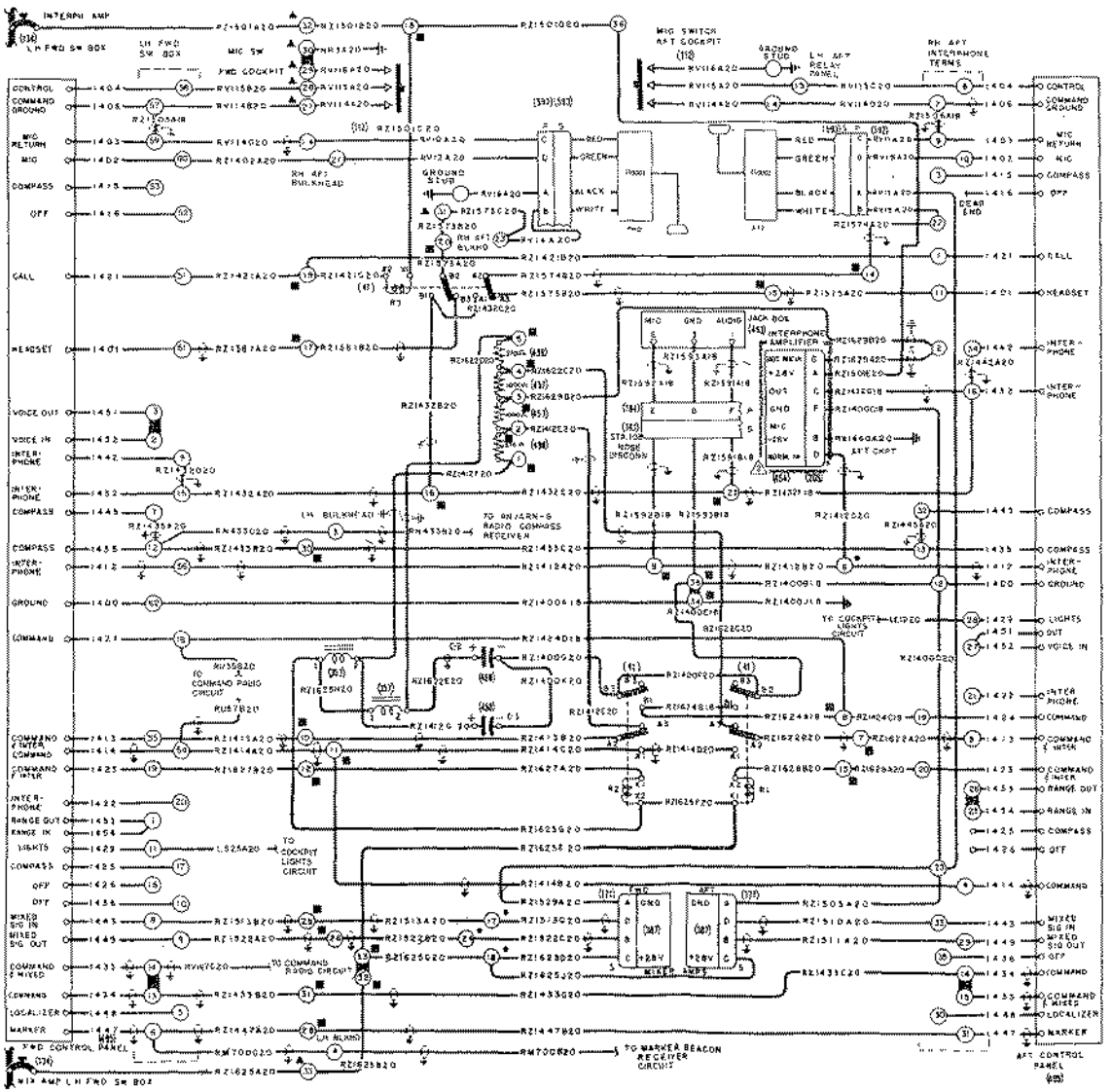
NOTE

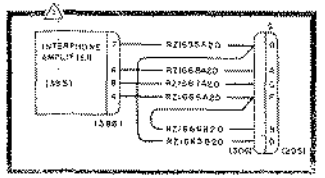
- LH FWD SWITCH BOX
- RH AFT INTERPHONE TERMS.
- FWD INTERPHONE TERMS.

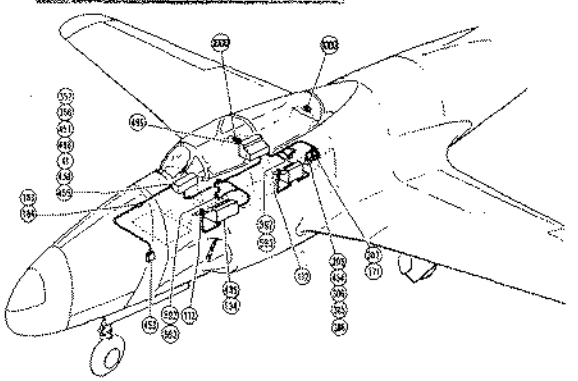
AN/AIC-2A INTERPHONE CIRCUIT MODEL T-33A

APPLIES TO AF SERIAL NO. 51-4141 THROUGH 51-6759

DA20-44-B-245







NOTE

▲ LH FWD SW BOX
★ RH AFT INTERPHONE TERMS
■ FWD INTERPHONE TERMS

ITEM	DESCRIPTION	MFR	TYPE	ORDER ON TYPE
A1	RELAY	SEACOR SECHRON		332-DA2
A2	MIC SWITCH			TB183
A3	CIRCUIT BOARD ASSY			AN3060-1A
J49	CONNECTOR			AN3106A-14S-2S
J49	CONNECTOR			AN3106A-24-22S
J50	CONNECTOR			AN3102R-20-22S
J50	CONNECTOR			AN3106A-16S-1S
J51	CONNECTOR			AN3106A-16S-1P
J51	CONNECTOR			AN3102R-16S-1P
J52	CONNECTOR			T3502B
J52	AMPLIFIER-INTERPHONE	MC DOC CRAIG	6 VDC	AM-1267/AIC
J53	CONNECTOR			PL-1704
J54	AMPLIFIER (MARKER)	CRAIG		AM-1462/AIC
J55	JACK BOX	CRAIG		J141C/AIC
J56	AMPLIFIER-INTERPH	CRAIG		AM-1004/AIC
J57	RELAY			RC3D50J103K
J58	CONDENSER-DEV	MALLORY CRAIG	600 VDC	ML-29
J59	CONTROL PANEL			C-1596/AIC
J60	RESISTOR		2 WATT	RC20GF473K
J61	CONNECTOR	MCDO	MCDO	AN3102A-16S-1S
J62	CONNECTOR			AN3102A-16S-1P
J100	ADAPTER BOX	CRAIG		MX-1486/AIC

NOTE

△1 USED ON USAF T-33A AIRCRAFT ONLY.

△2 USED PRIOR TO AF SERIAL NO. 51-6795

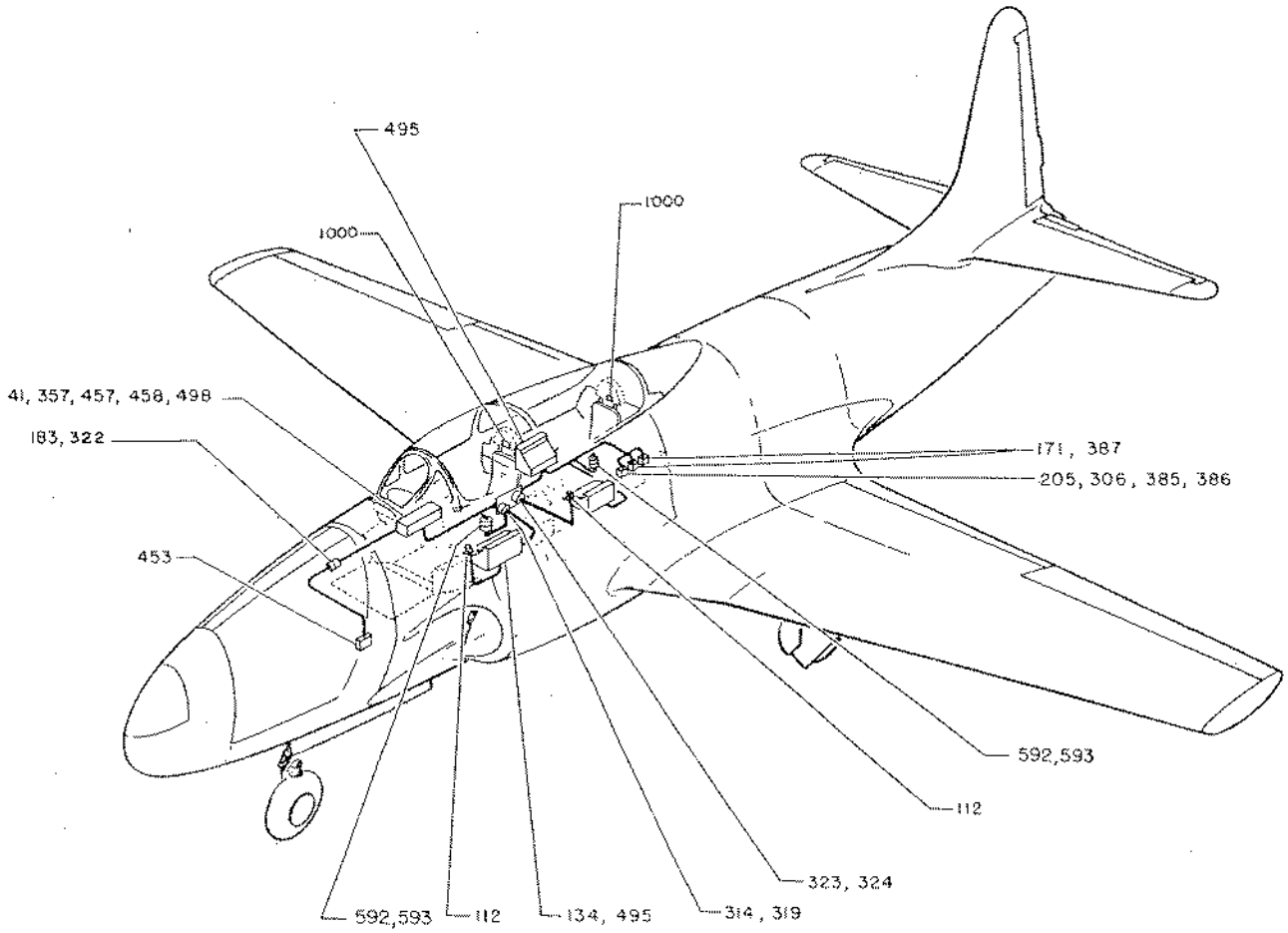
△3 USED ON AF SERIAL NO. 51-6795 THROUGH 51-6878

△ AN/AIC-24 INTERPHONE CIRCUIT MODEL T-33A

APPLIES TO AF SERIAL NO. 52-8425 AND THROUGH 52-8618

GB 8831
20-480-8-5A6

Figure 8-269. AN/AIC-2A Interphone Circuit



NOTE

⚠ USED ON MDAP AND RCAF AIRCRAFT ONLY

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
41	RELAY	LEACH		237-EAU
112	MIC SWITCH	UCINITE		555185
134	CIRCUIT PROTECTOR			AN3161-P5
171	CONNECTOR			AN3106-14S-2S
183	CONNECTOR			AN3106-28-11S
205	CONNECTOR			AN3106-16S-1S
306	CONNECTOR			AN3018-16S-1P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102-24-28S
322	CONNECTOR			AN3100C-28-11P
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
357	CHOKE - .060 DC	WC ELEC	6 HY	750038
385	AMPLIFIER-INTERPH	GFAE		AM-26/AIC
386	CONNECTOR			PL-152A
387	AMPLIFIER (MIXED)	GFAE		AM-142/AIC
453	JACK BOX	GFAE		J-139A/AIC
457	RESISTOR		1000 Ω	RC20BG102K
458	CONDENSOR-50V	MALLORY	50 MF	BS-39
495	CONTROL PANEL	GFAE		C-696/AIC
498	RESISTOR			RC-20BF271K
592	CONNECTOR		MOD	AN3102A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P
1000	ADAPTER BOX	GFAE		MX-1646/AIC

⚠

AN/AIC-2A INTERPHONE CIRCUIT

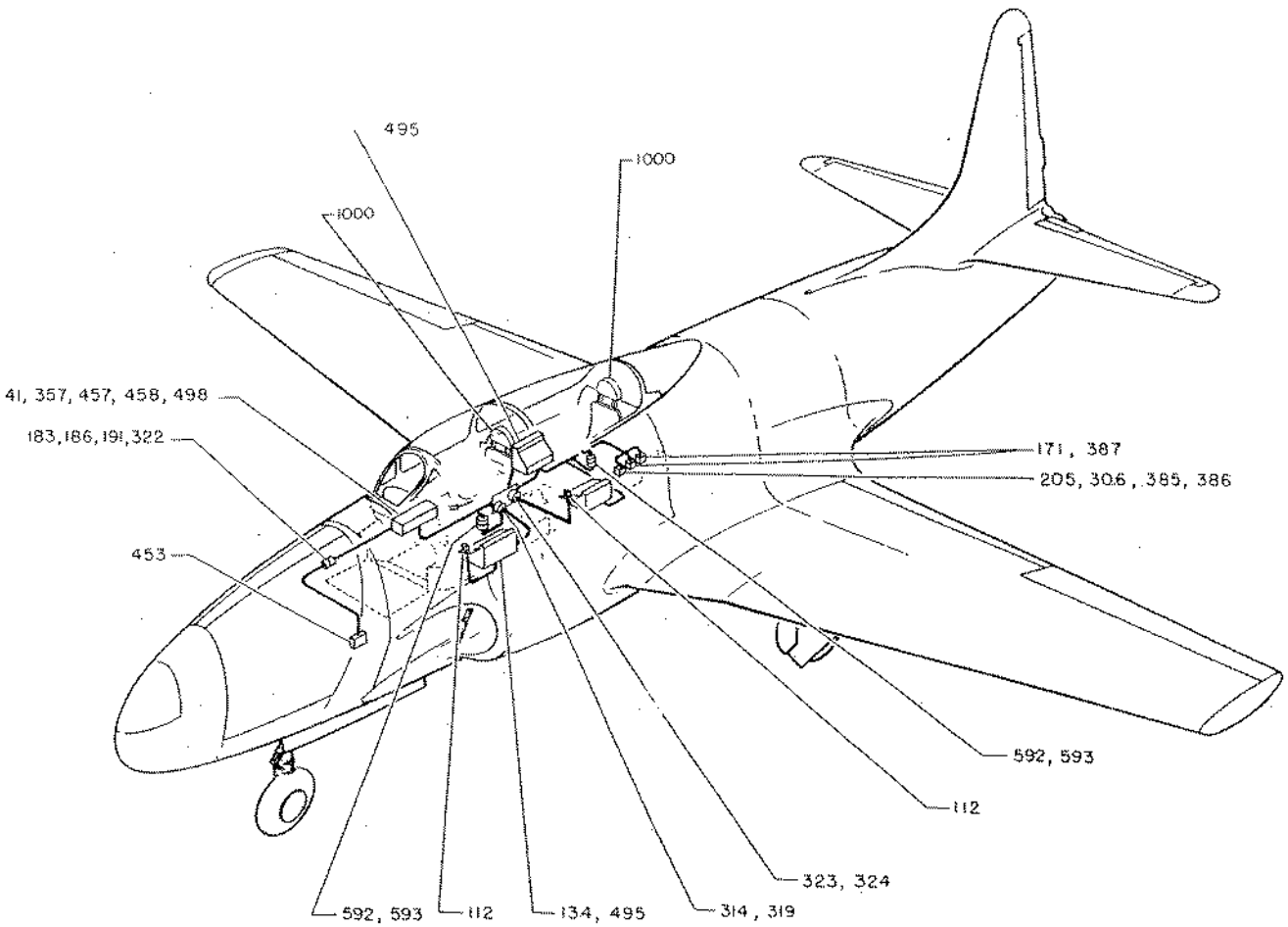
MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9235

EM20-44-8-178

GB 3686

Figure 8-270. AN/AIC-2A Interphone Circuit (Sheet 1 of 2)



NOTE

⚠1 DOES NOT APPLY TO MDAP AIRCRAFT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC.
41	RELAY	LEACH		237-EAU
112	MIC SWITCH	UCINITE		125185
134	CIRCUIT PROTECTOR			AN3161-P5
171	CONNECTOR			AN3106-14S-2S
183	CONNECTOR			AN3106-28-11S
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
205	CONNECTOR			AN3106-16S-1S
306	CONNECTOR			AN3101B-16S-1P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102-24-28S
322	CONNECTOR			AN3100C-28-11P
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
357	CHOKE - .060DC	W C ELEC.	6 HY	750038
385	AMPLIFIER-INTERPH	GFAE		AM-26/AIC
386	CONNECTOR			PL-152A
387	AMPLIFIER (MIXER)	GFAE		AM-142/AIC
453	JACK BOX	GFAE		J-139A/AIC
457	RESISTOR		1000Ω	RC20BG102K
458	CONDENSOR-50V	MALLORY		85-2P
495	CONTROL PANEL	GFAE		C-696/AIC
498	RESISTOR		270Ω	RC20BF271K
592	CONNECTOR		MOD	AN3102A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P
1000	ADAPTER BOX	GFAE		MX-1646/AIC

⚠1

AN/AIC-2A INTERPHONE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-6819 THROUGH 51-9235

GB 8864
M20-48D-8-179

Figure 8-271. AN/AIC-2A Interphone Circuit (Sheet 1 of 2)

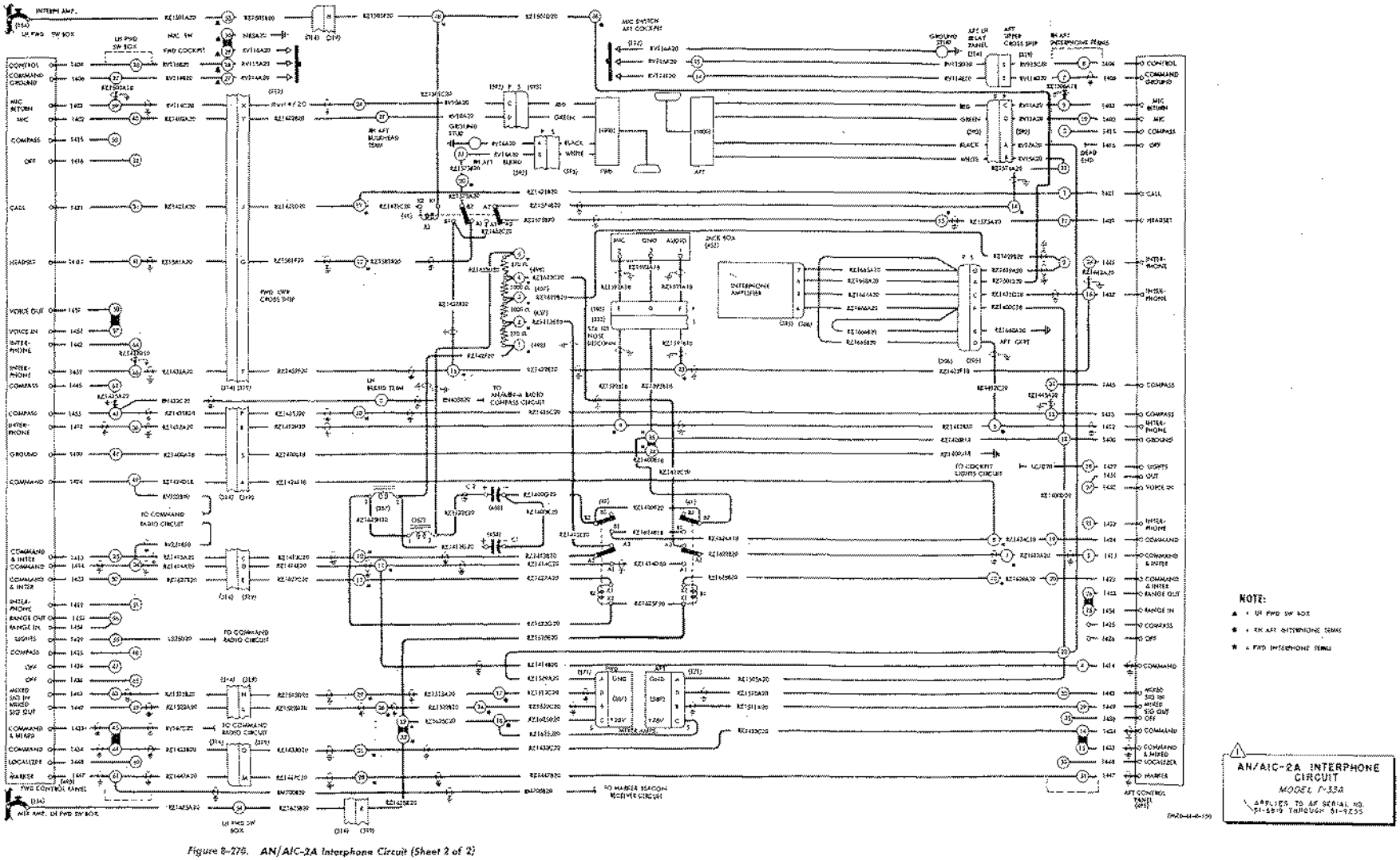


Figure 8-279. AN/AIC-2A Interphone Circuit (Sheet 2 of 2)

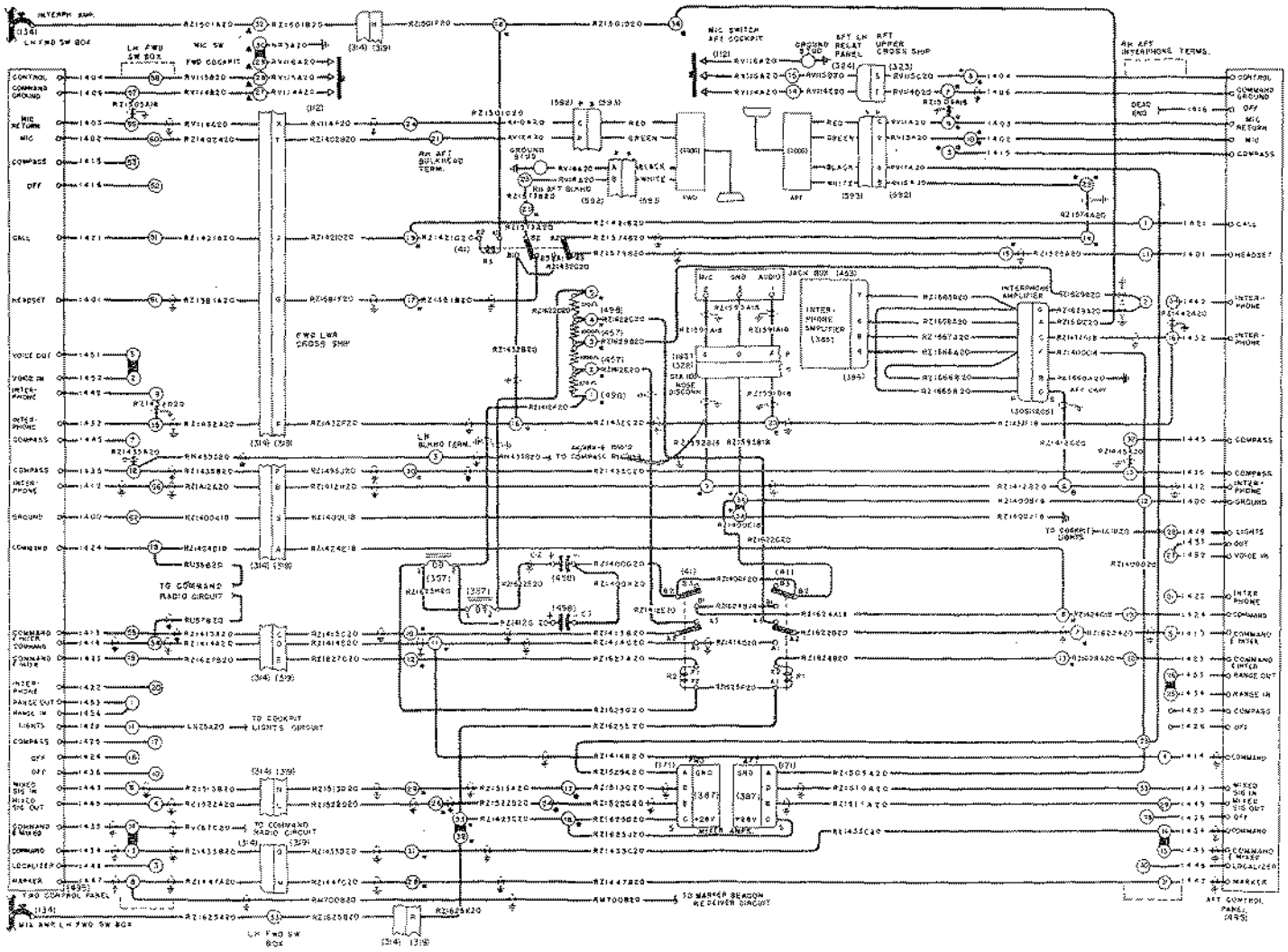
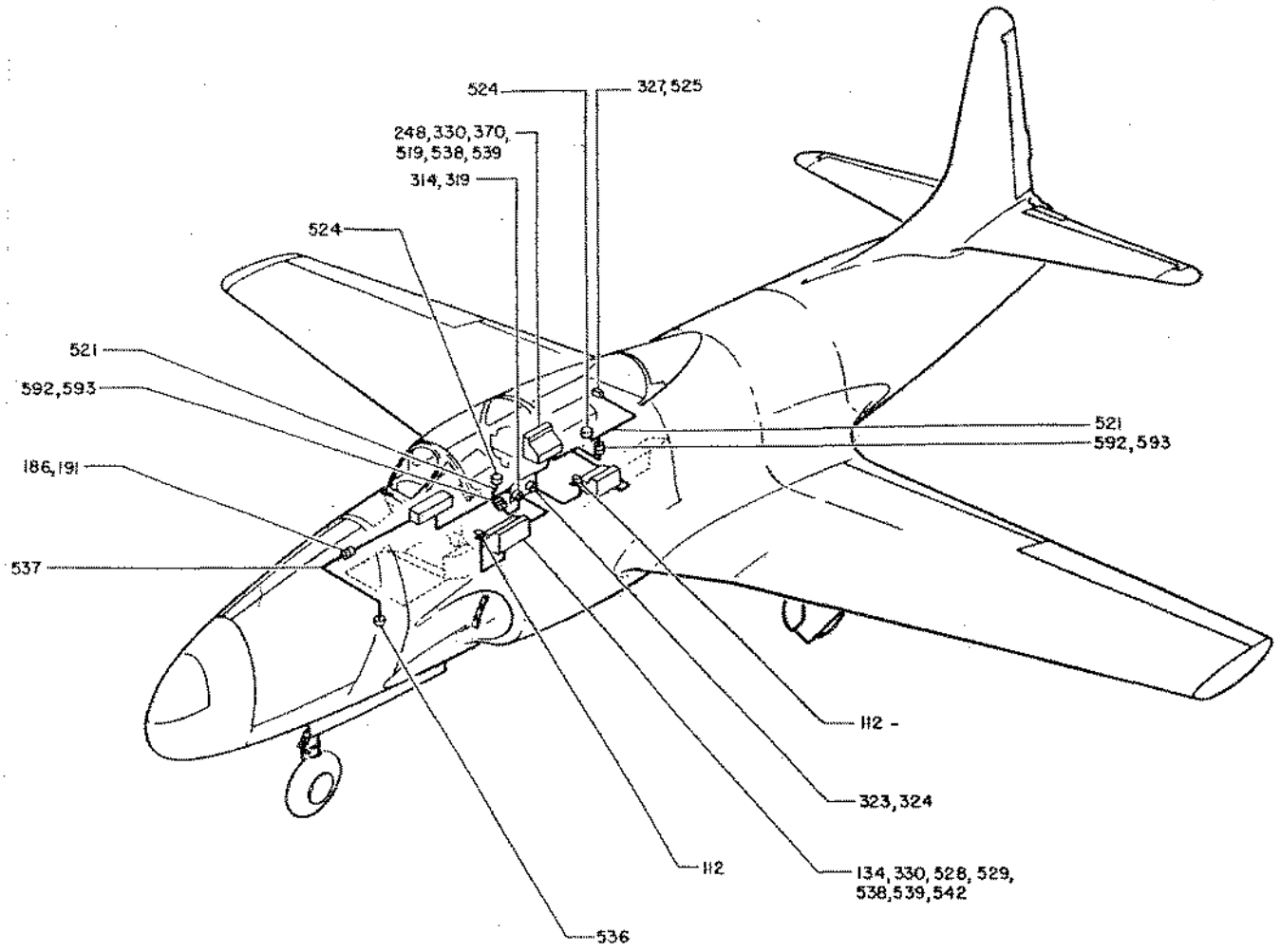


Figure 8-271. AN/AIC-2A Interphone Circuit (Sheet 2 of 2)



NOTE

1 USED ON RCAF AND MDAP T-33A AIRCRAFT ONLY

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		138185
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
193	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			C83106M-22-14S
370	CONNECTOR			AN3108B-20-27S
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
528	RESISTOR		560Ω ±1/2W	RC20BF561K
529	RESISTOR		150Ω ±1/2W	RC20BF151K
536	JACK			U-94/U
537	CABLE			WM-85/U
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			C83106A-24-28S
542	RESISTOR		330Ω ±1/2 W	RC20BF331K
592	CONNECTOR		MOD	AN3102A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

1 AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 51-9236 THROUGH 52-9634 AND 52-9876 THROUGH 52-9905

GB 3586
M20-44-8-176

Figure 8-272. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

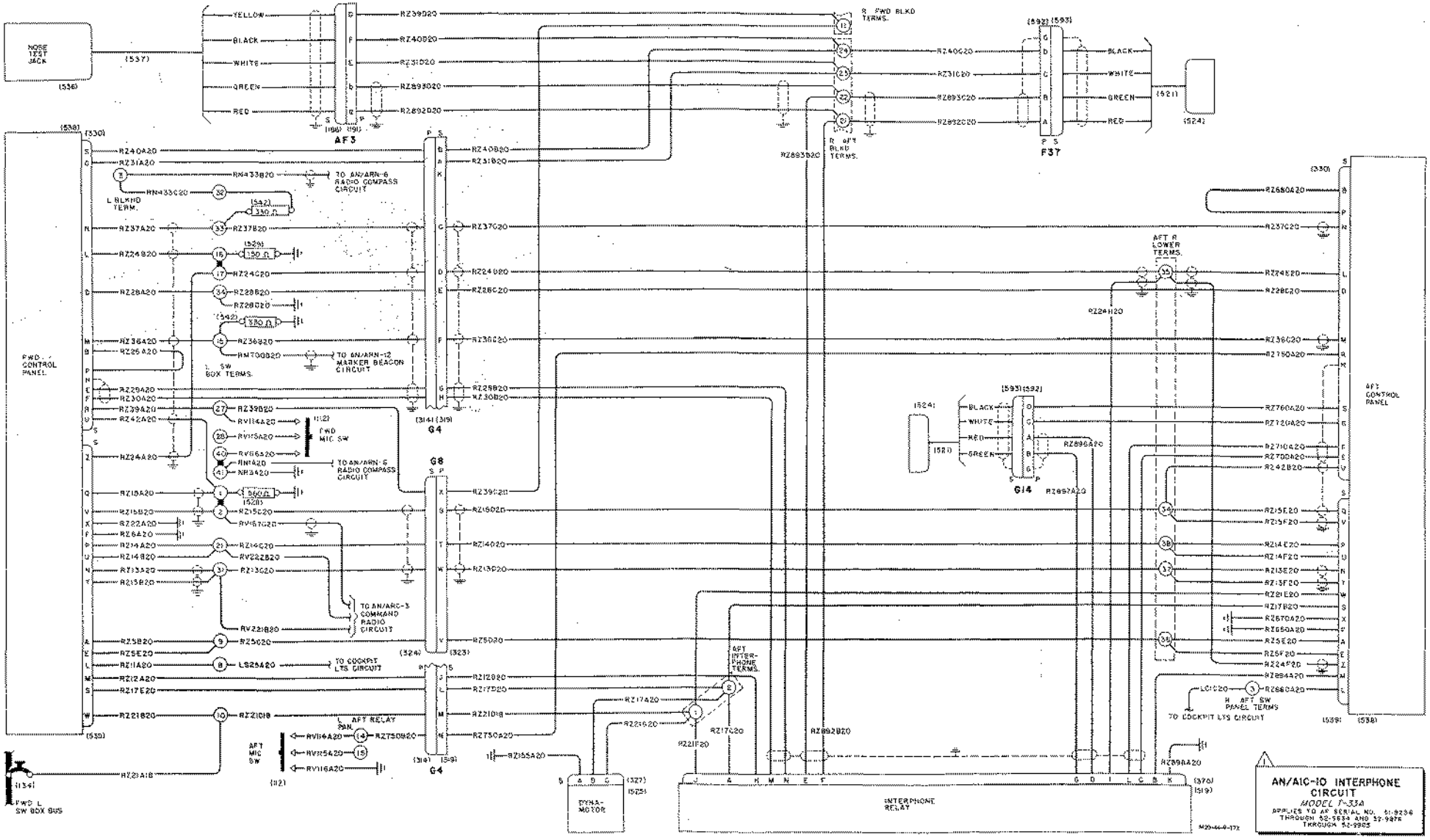
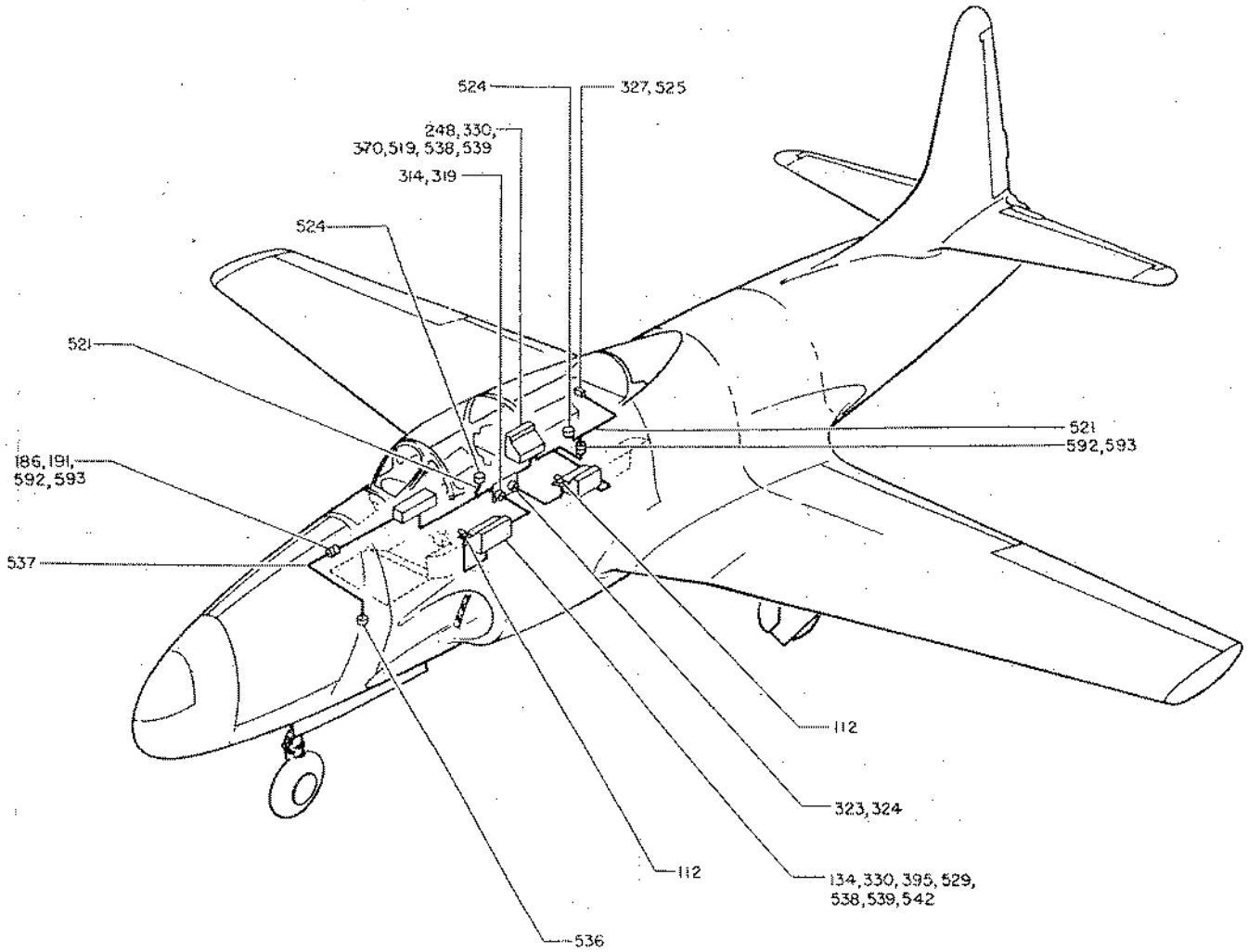


Figure 8-272. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		138185
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-20-12S
191	CONNECTOR			AN3100C-20-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106M-22-14S
370	CONNECTOR			AN3108B-20-27S
395	CAPACITOR	MALLORY	50 MFD	BS-29
519	RELAY	GFAE		RB-94/AIC-10
521	CABLE	GFAE		WF-54/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
529	RESISTOR		150 Ω 1/2W	RC20BF151K
536	JACK			U-94/U
537	CABLE			WM-85/U
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			CB3106A-24-28S
542	RESISTOR		330Ω 1/2 W	RC20BF331K
543	RESISTOR		100 Ω 1/2W	RC20BF101K
547	RESISTOR		220 Ω 1/2W	RC20BF221K
592	CONNECTOR	MOD		AN3102A-16S-1S
593	CONNECTOR	MOD		AN3106B-16S-1P

NOTE

1. NOT USED ON MDAP T-33A AIRCRAFT
2. APPLIES TO AIRPLANES INCORPORATING T.O. 1T-33-517

1

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 51-9236 THROUGH 52-9634 AND 52-9876 THROUGH 52-9965

HF 08704
M20-55-8-177

Figure 8-273. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

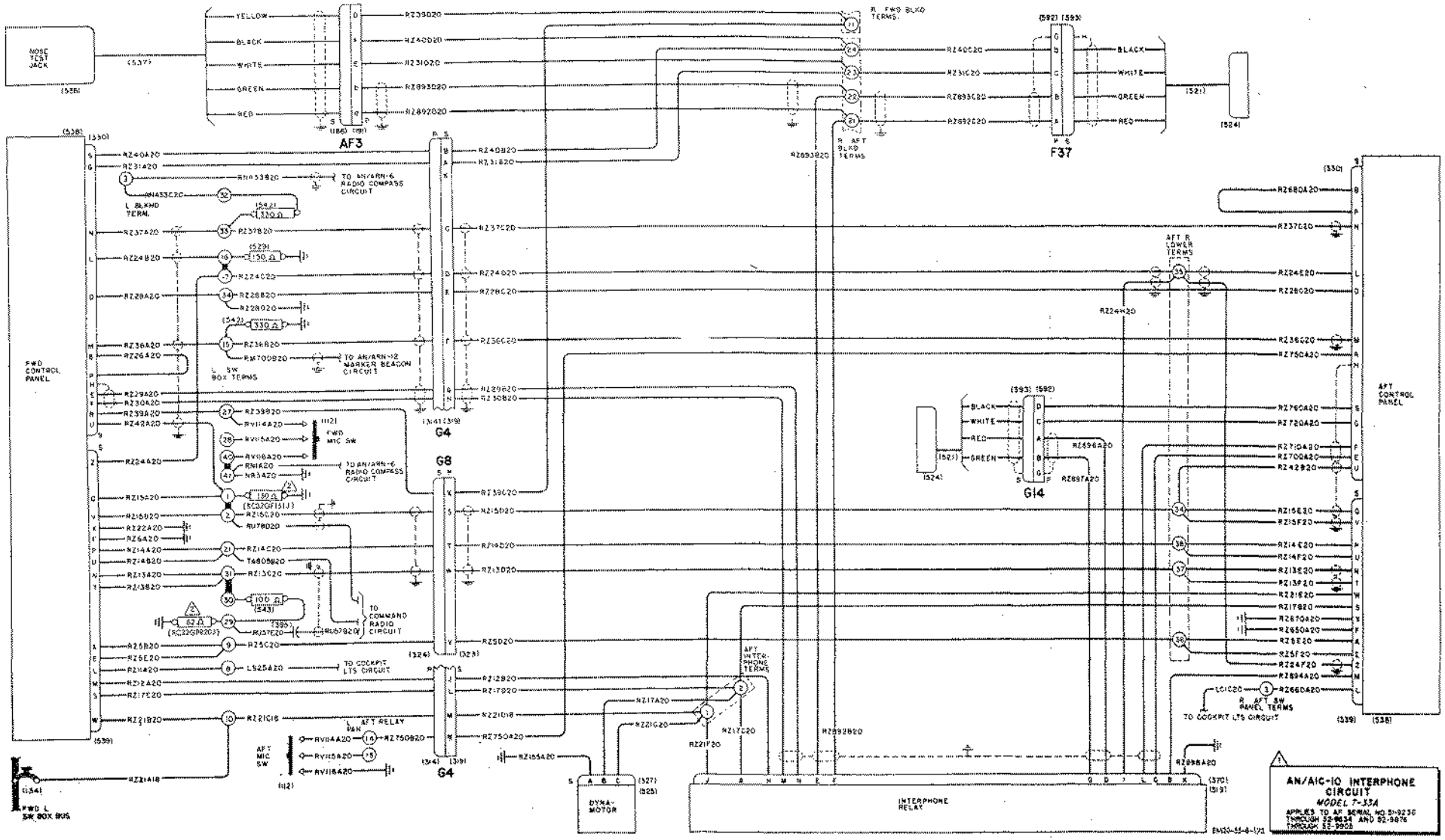
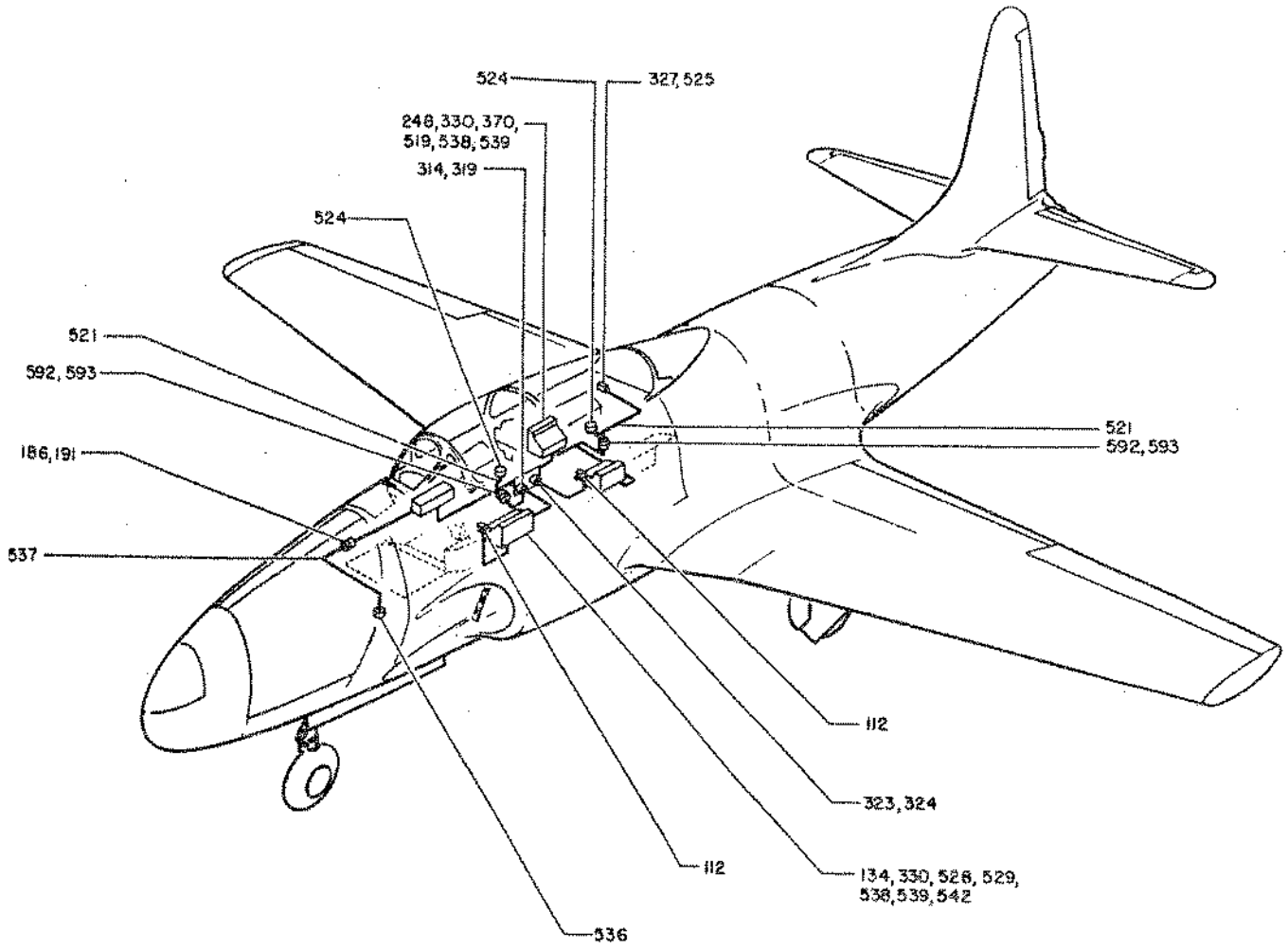


Figure 8-273. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
113	SWITCH	UCINITE		136185
134	CIRCUIT PROTECTOR			AN3161-#5
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CS3106M-22-14S
370	CONNECTOR			AN3102B-20-27S
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		159-34/U
526	JACK			U-92/U
529	DYNAMOTOR	GFAE		DY-72/AIC-10 OR DY-97A/AIC-10
530	RESISTOR		560Ω 1/2W	RC20GF561K
538	RESISTOR		150Ω 1/2W	RC20GF151K
539	JACK			U-94/U
542	CABLE			159-48/U
550	CONTROL PANEL	GFAE		C-624/AIC-10
551	CONNECTOR			CS3102A-24-28S
552	RESISTOR		3300Ω 1/2 W	RC30GF332K
553	CONNECTOR		MOD	AN3106A-16S-1S
575	CONNECTOR		MOD	AN3106B-16S-1P

NOTE

1. USED ON RCAF AND MDAP T-33A AIRCRAFT ONLY

GB 3588

NSS-44-5-314

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9986 THROUGH 53-5960

Figure 8-274. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

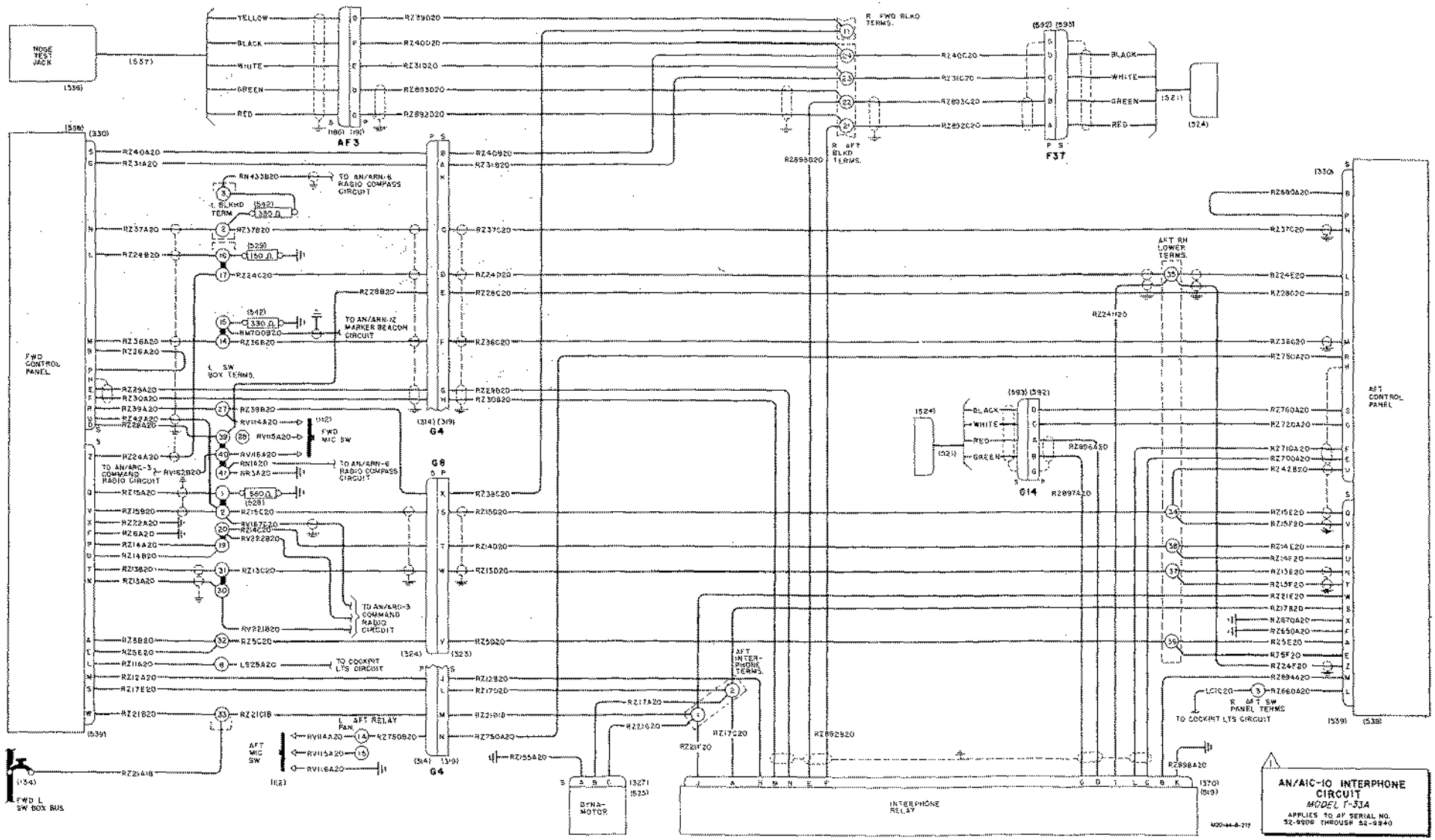
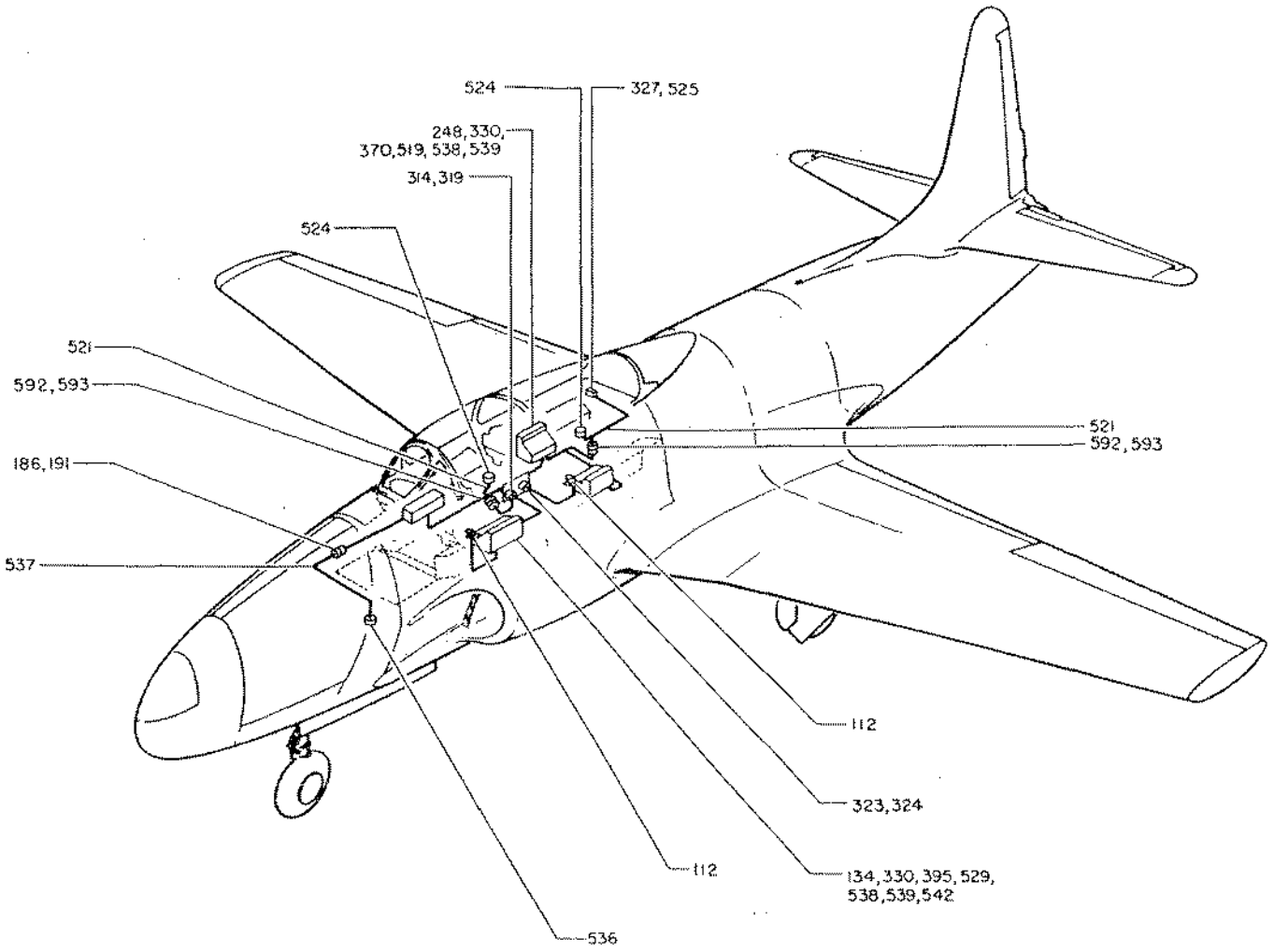


Figure 8-274. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		138185
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			C83106M-22-14S
370	CONNECTOR			AN3108B-20-27S
395	CAPACITOR	MALLORY	50 MFD	BS-39
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
529	RESISTOR		150 Ω 1/2W	RC20BF151K
536	JACK			U-94/U
537	CABLE			WM-85/U
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			C83106A-24-28S
542	RESISTOR		330 Ω 1/2W	RC20BF331K
543	RESISTOR		100 Ω 1/2W	RC20BF101K
547	RESISTOR		220 Ω 1/2W	RC20BF221K
592	CONNECTOR		MOD	AN3102A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

NOTE

1. NOT USED ON MDAP T-33A AIRCRAFT
2. APPLIES TO AIRPLANES INCORPORATING T.O. 1T-33-517

1

AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9635 THROUGH 52-9759 AND 53-2687 THROUGH 53-2726, EXCEPT 52-9676 THROUGH 52-9905

HF 08774
M20-55-8-216

Figure 8-275. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

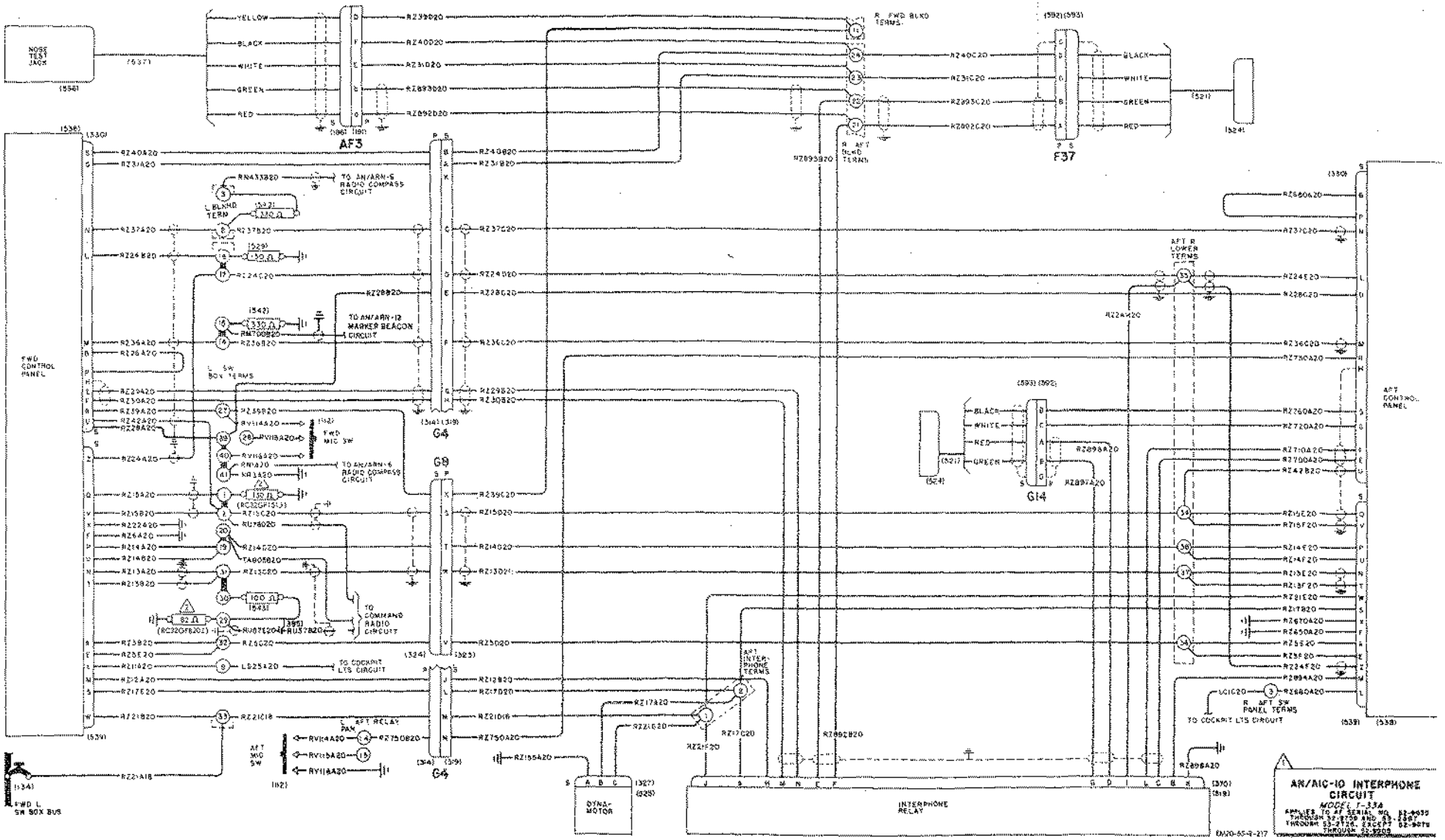
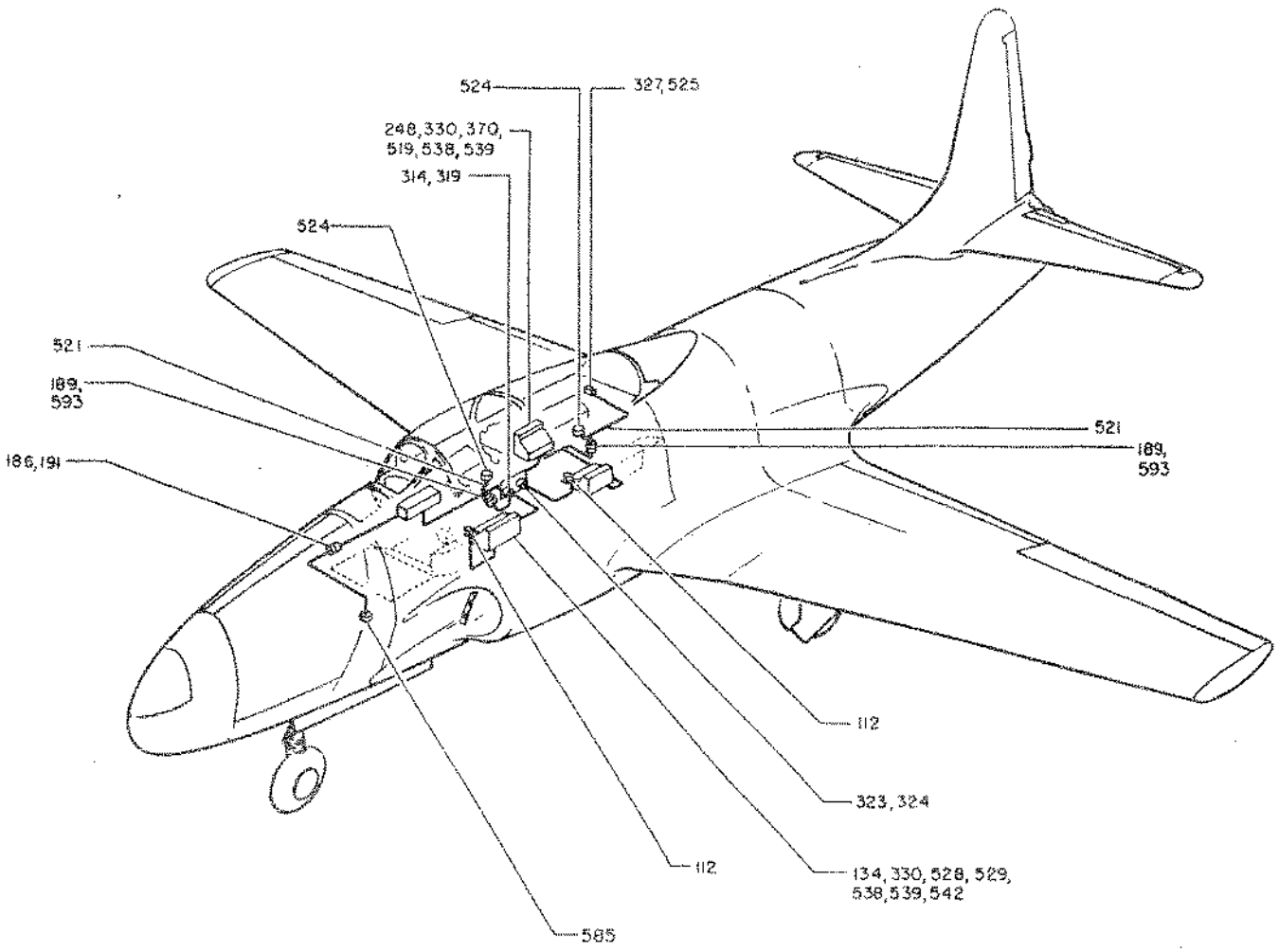


Figure 8-275. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		138183
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3108B-20-27S
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
534	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
528	RESISTOR		560Ω 1/2W	RC20BF561K
529	RESISTOR		150Ω 1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			CB3106A-24-28S
542	RESISTOR		330Ω 1/2W	RC20BF331K
586	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106A-16S-1P

NOTE

⚠ USED ON RCAF AND MDAP T-33A AIRCRAFT ONLY

GB 3590
M20-44-8-231

⚠
AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 52-9941 THROUGH 53-5083
-9839 or -9879

Figure 8-276. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

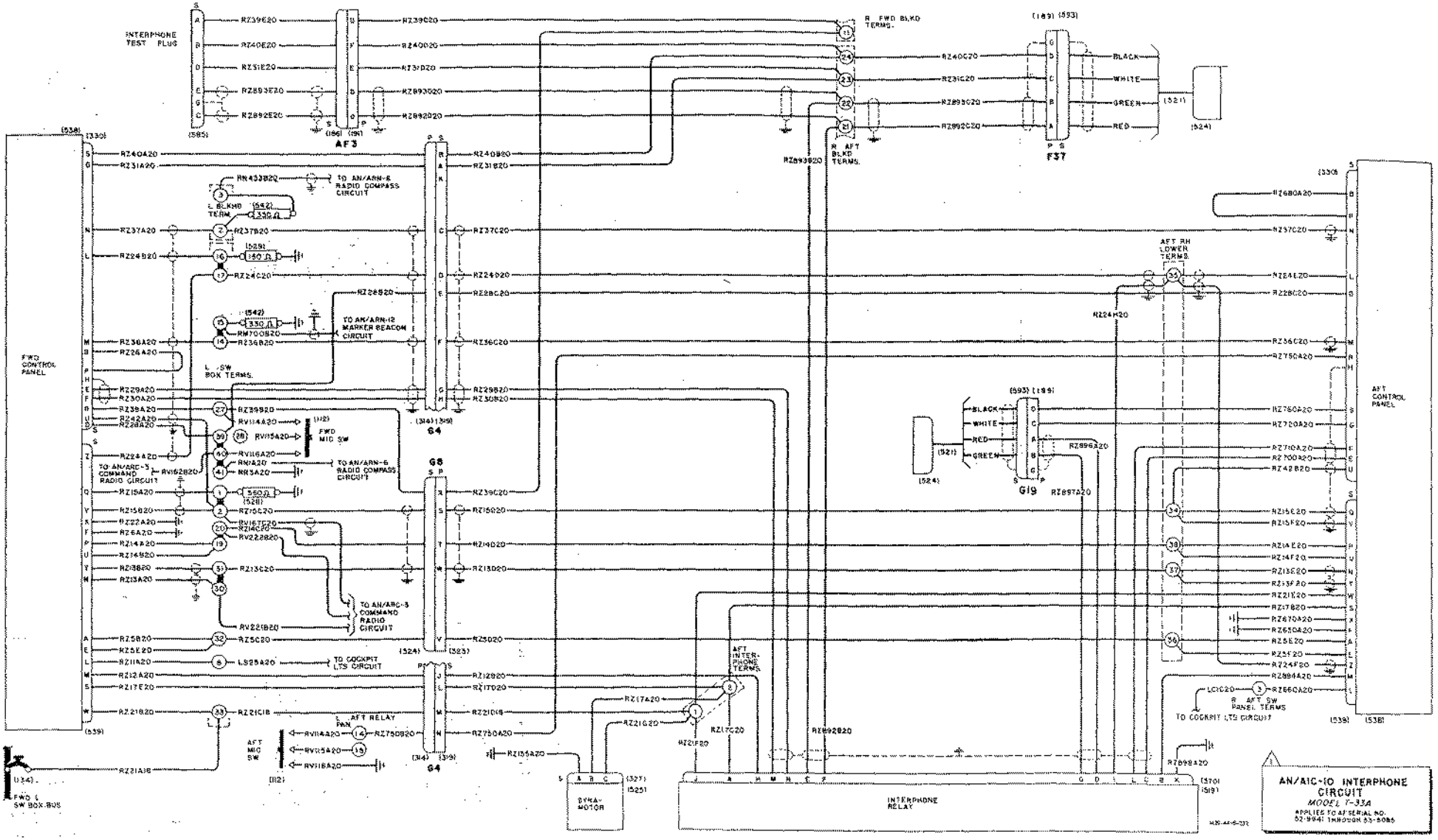
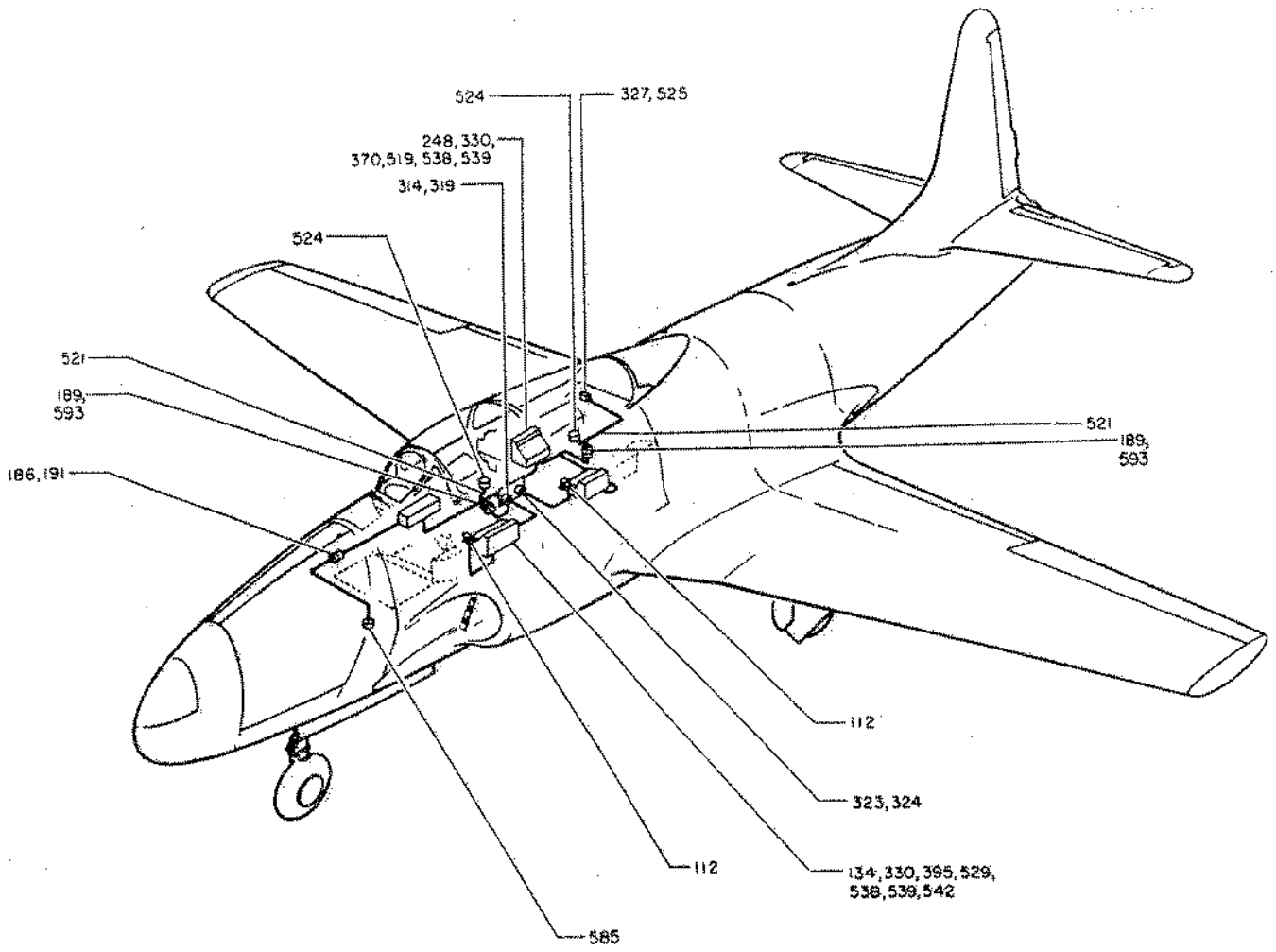


Figure 8-276. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		138165
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR			AN3102A-16S-1S
191	CONNECTOR			AN3102C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3106B-20-27S
395	CAPACITOR	MALLORY	50 MFD	85-39
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
529	RESISTOR		150 Ω±1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			CB3106A-24-28S
542	RESISTOR		330 Ω±1/2W	RC20BF331K
543	RESISTOR		100 Ω±1/2W	RC20BF101K
547	RESISTOR		220 Ω±1/2W	RC20BF221K
585	CONNECTOR			AN3100A-16S-1S
592	CONNECTOR		MOD	AN3106B-16S-1P

NOTE

1. NOT USED ON MDAP T-33A AIRCRAFT
2. APPLIES TO AIRPLANES INCORPORATING T.O. 1T-33-517

1

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 52-9760 THROUGH 53-5085, EXCEPT 53-2687 THROUGH 53-2726

HF 08702
M20-33-8-233

Figure 8-277. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

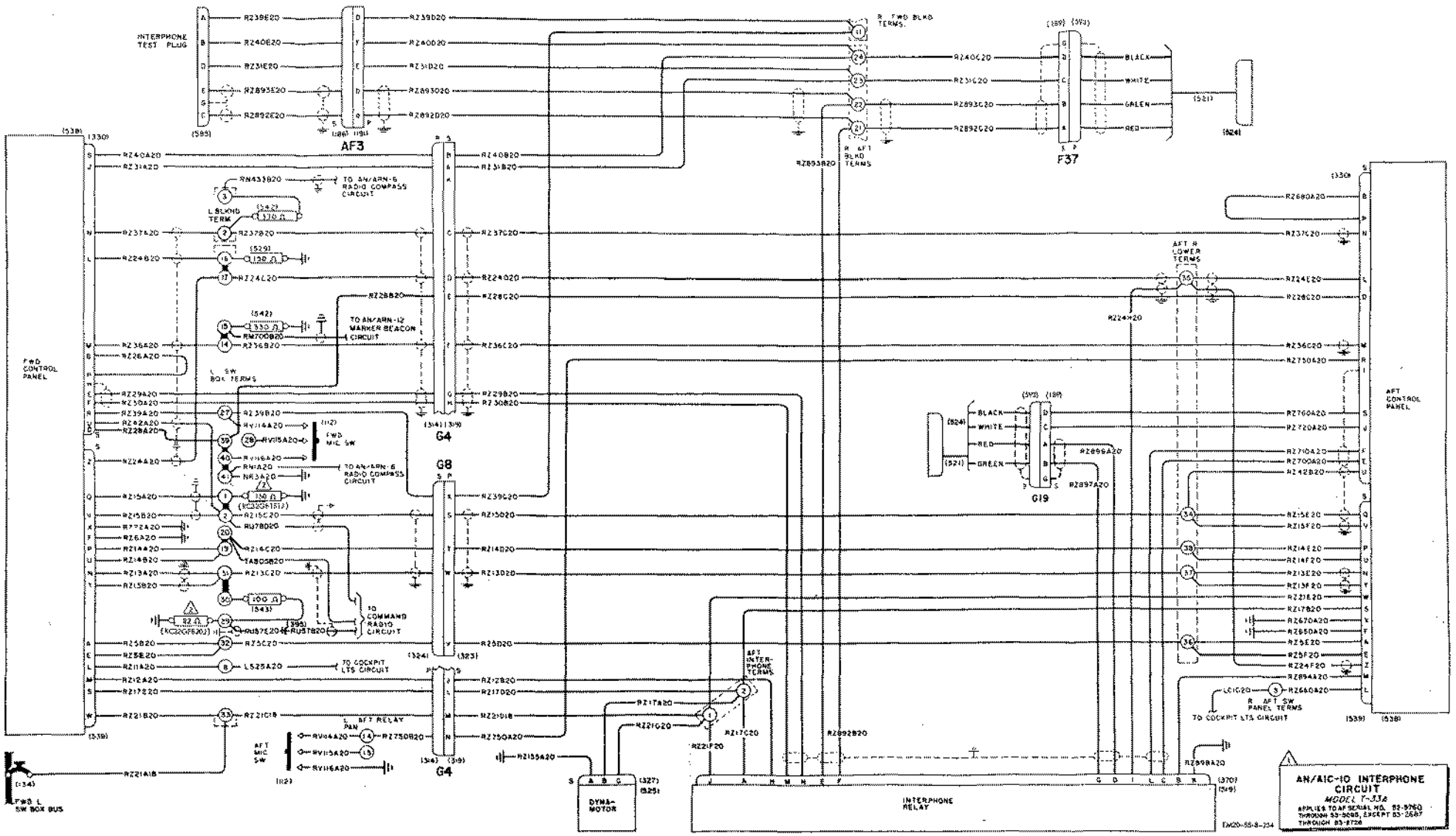
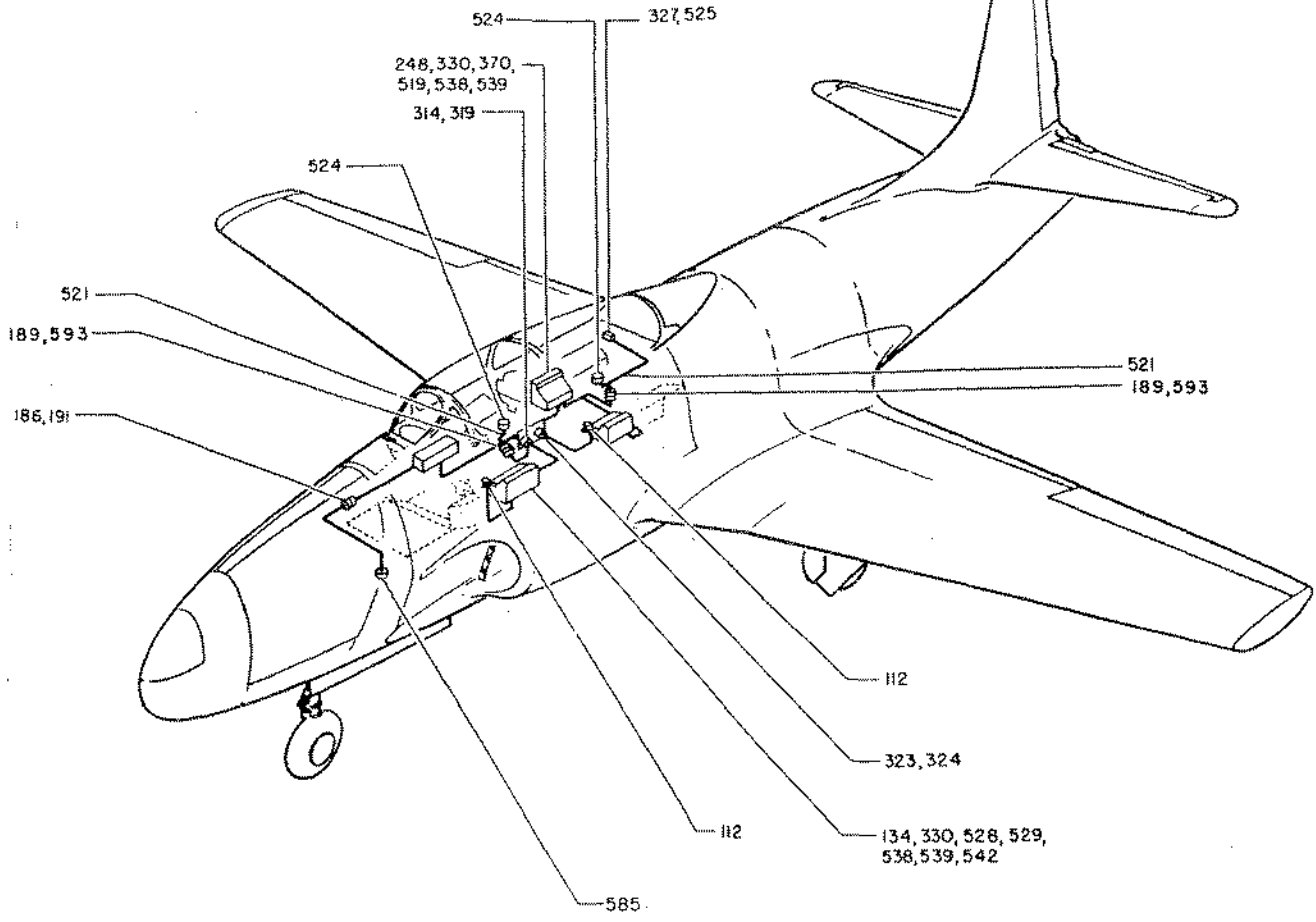


Figure 8-277. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		108185
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3108B-20-27S
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-16/U
524	JACK			J-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
528	RESISTOR		560Ω ±1/2W	RC20BF561K
529	RESISTOR		150Ω ±1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			CB3106A-24-28S
542	RESISTOR		330Ω ±1/2W	RC20BF331K
585	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

NOTE:

1. USED ON RCAF AND MDAP T-33A AIRCRAFT ONLY

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5086 THROUGH 53-5285

GB 3592
EM20-44-8-275

Figure 8-278. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

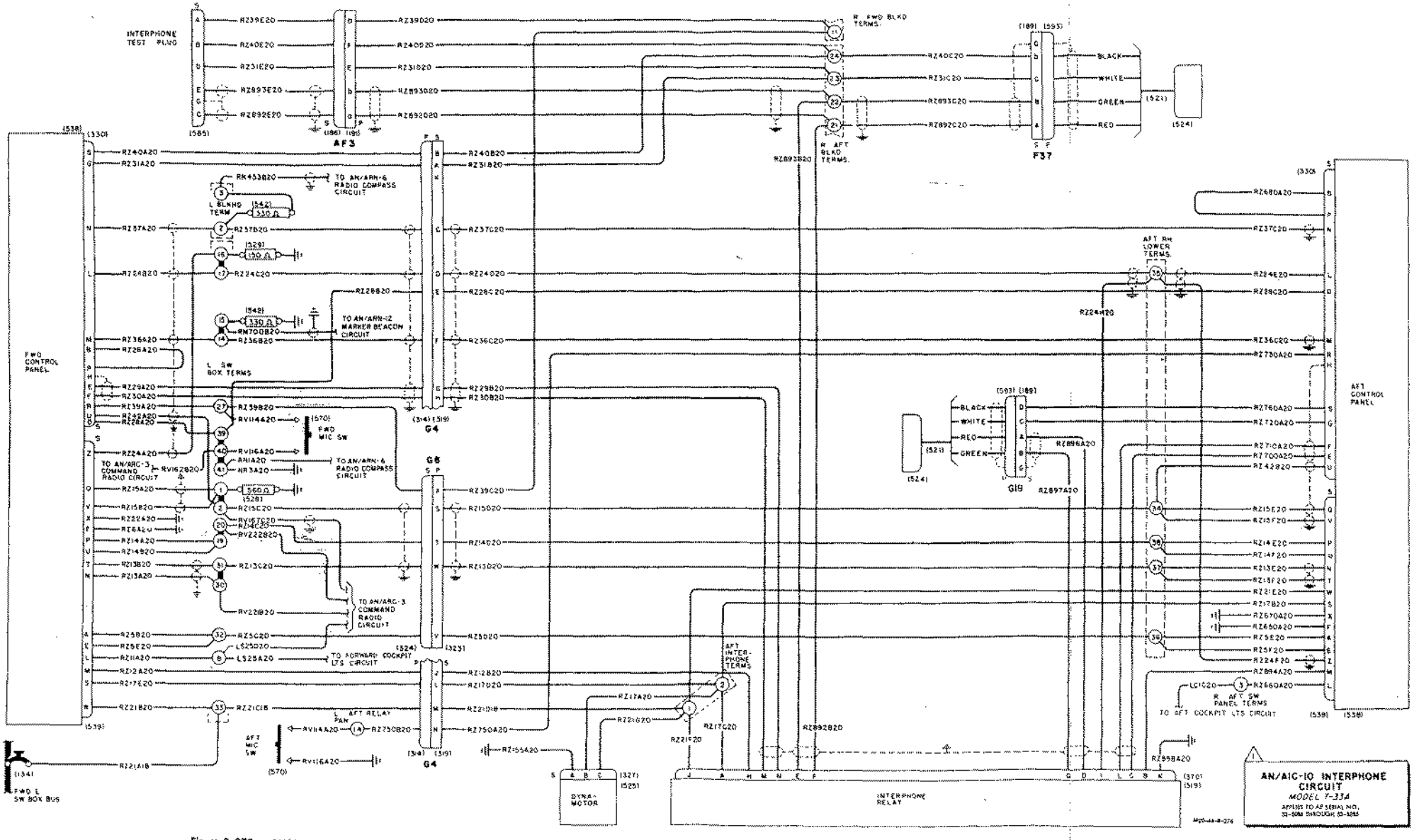
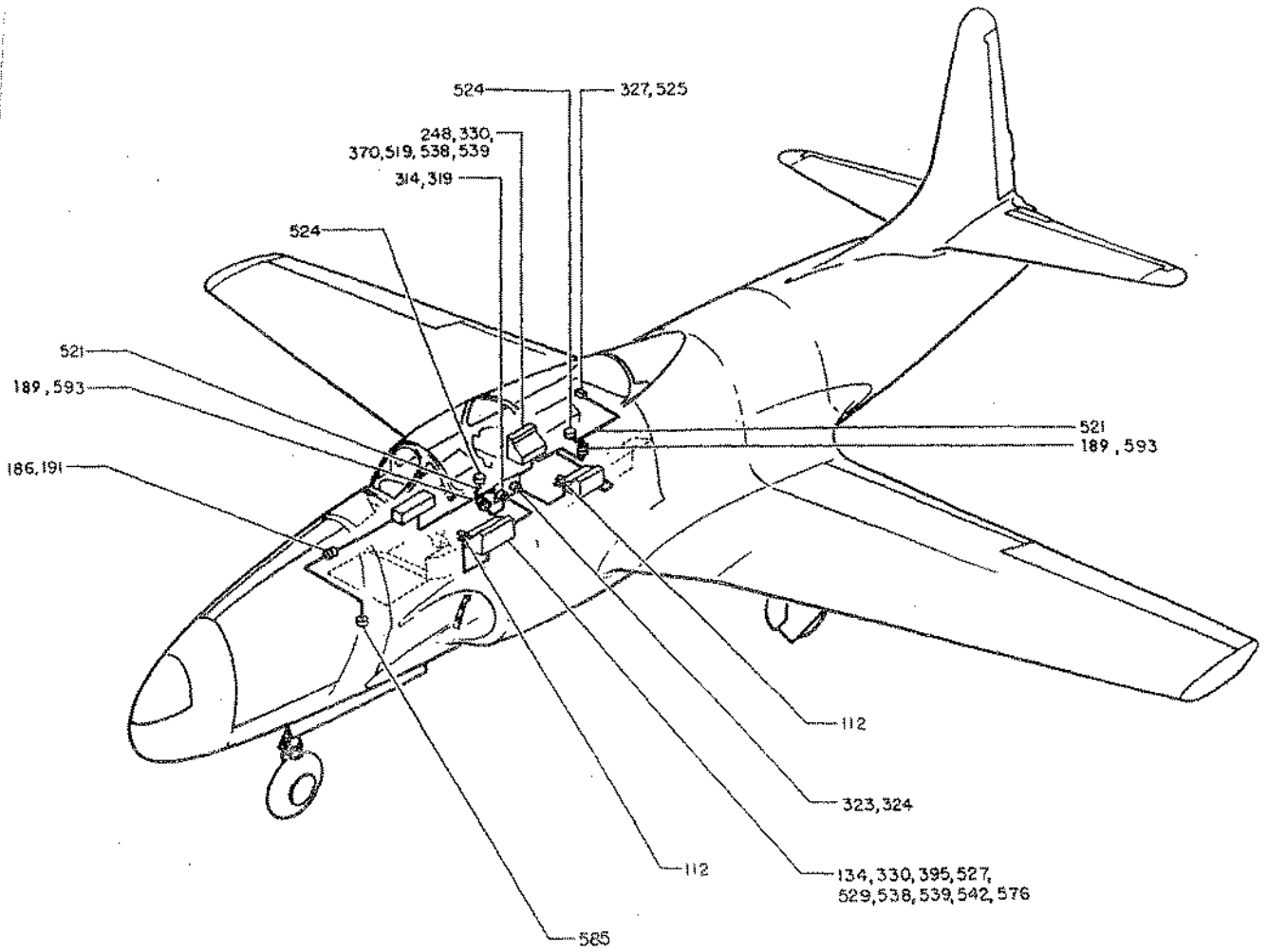


Figure 8-278. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
112	SWITCH	UCINITE		138185
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			C83106A-22-14S
370	CONNECTOR			AN3108B-20-27S
395	CAPACITOR	MALLORY	50 MFD	35-39
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
527	RESISTOR		82 Ω, 1W	RC30BF820K
529	RESISTOR		150 Ω, 1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			C83106A-24-28S
542	RESISTOR		330 Ω, 1/2W	RC20BF331K
543	RESISTOR		100 Ω, 1/2W	RC20BF101K
547	RESISTOR		220 Ω, 1/2W	RC20BF221K
576	RESISTOR		150 Ω, 1W	RC30BF151K
585	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

NOTE

1 NOT USED ON MDAP T-33A AIRCRAFT

GB 8802
M20-480-6-277

1

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NO. 53-5006 THROUGH 53-5285

Figure 8-279. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

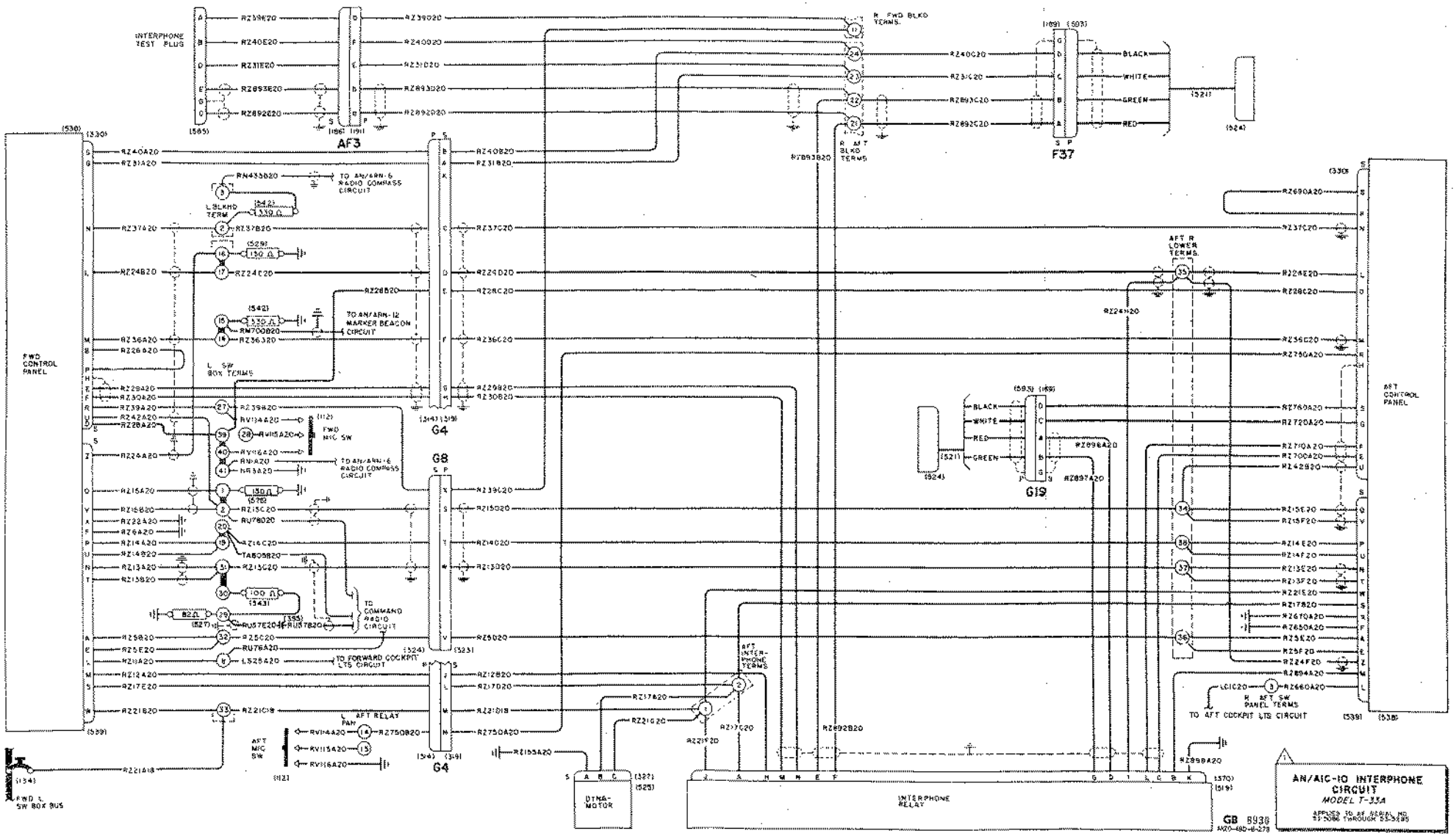
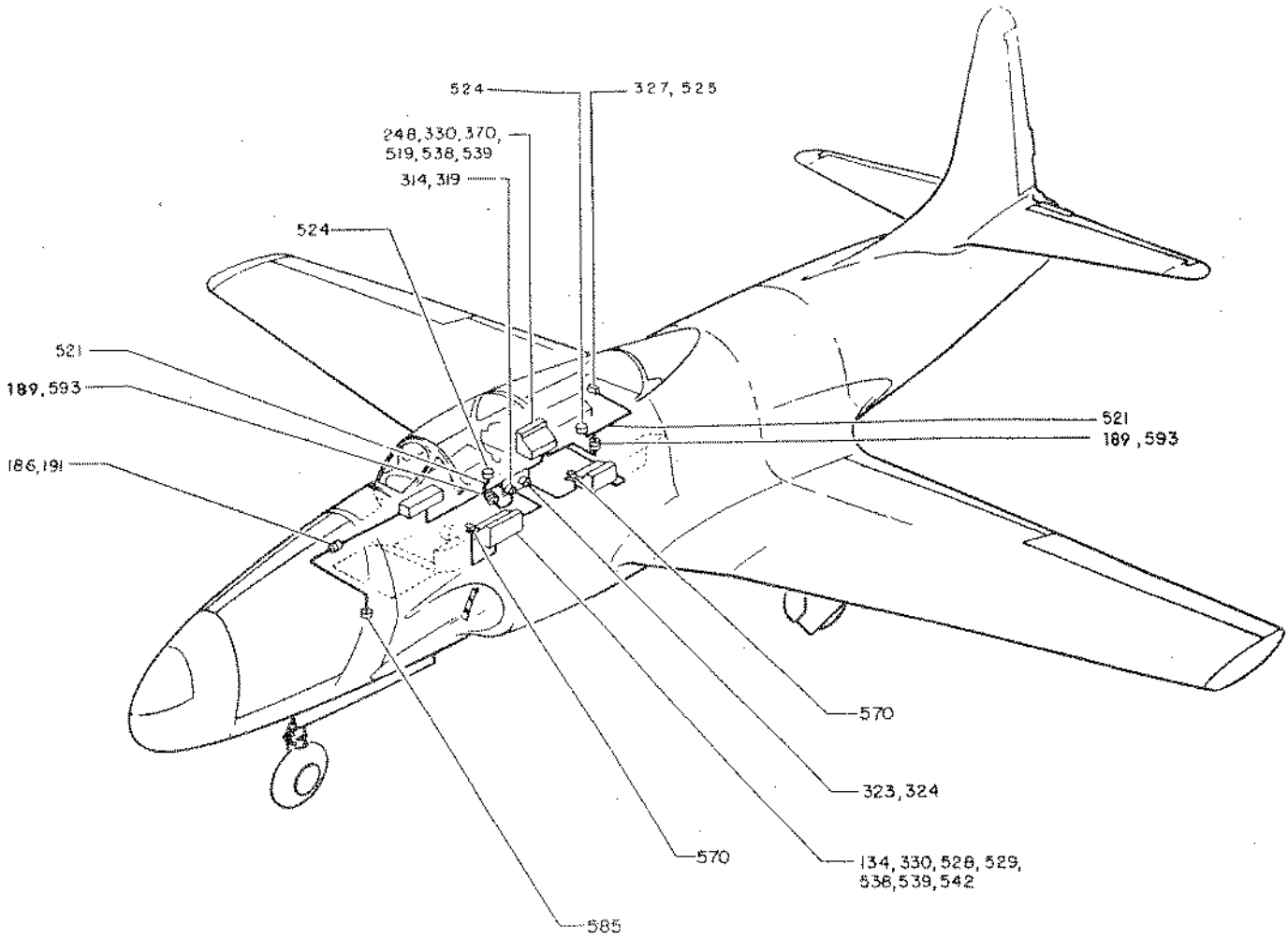


Figure 8-279. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR			AN3102A-16S-1S
191	CONNECTOR			AN3109C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3106B-20-27S
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WP-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
528	RESISTOR		560 Ω ±1/2W	RC20BF561K
529	RESISTOR		150 Ω ±1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-894/AIC-10
539	CONNECTOR			[illegible]6A-24-28S
542	RESISTOR		330 Ω ±1/2W	RC20BF331K
570	SWITCH			W304NB4
585	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

NOTE:
1. USED ON RCAF AND MDAP T-33A AIRCRAFT ONLY

GB 3594
M20-44-8-293

1
AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 53-5286 THROUGH 54-2955

Figure 8-280. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

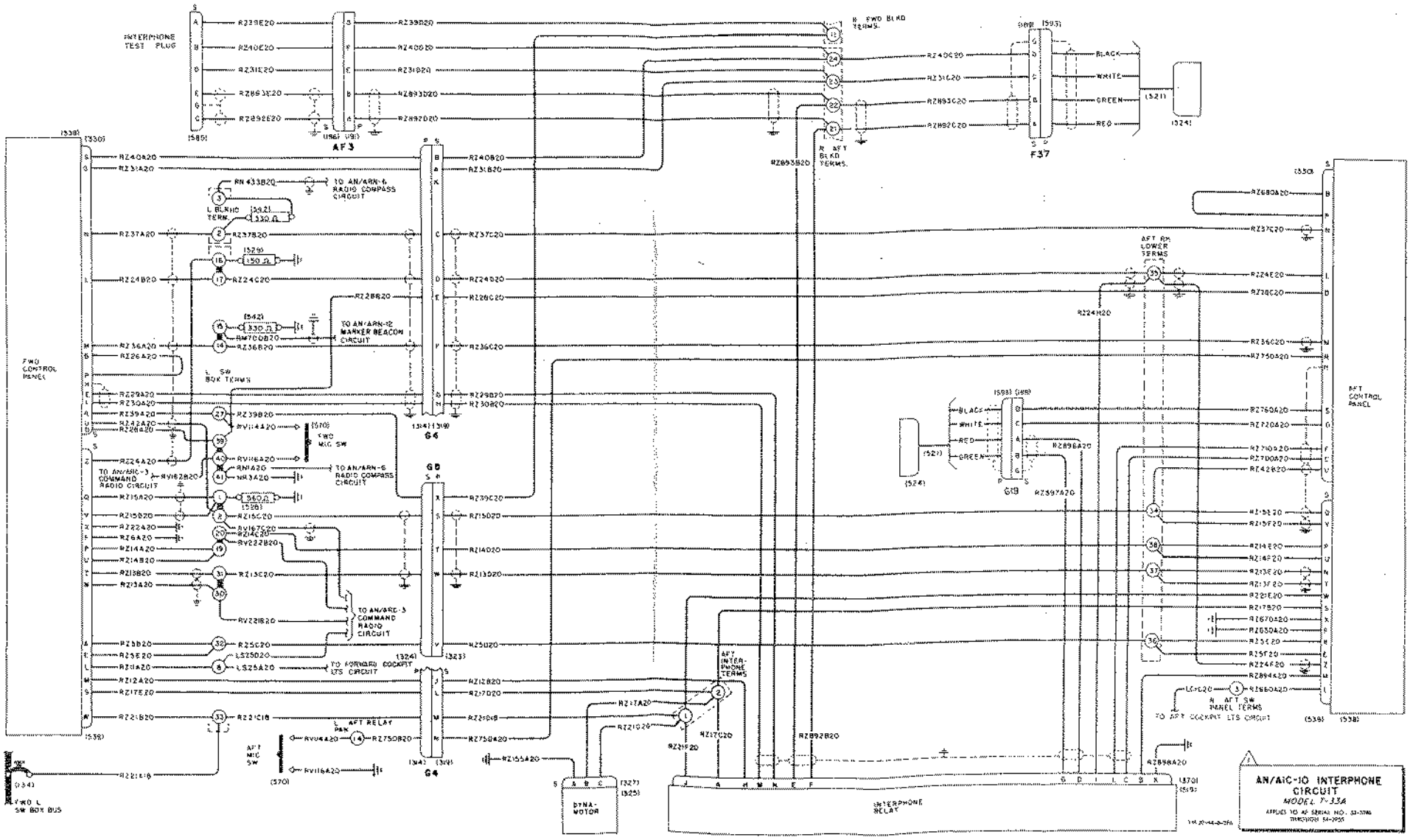
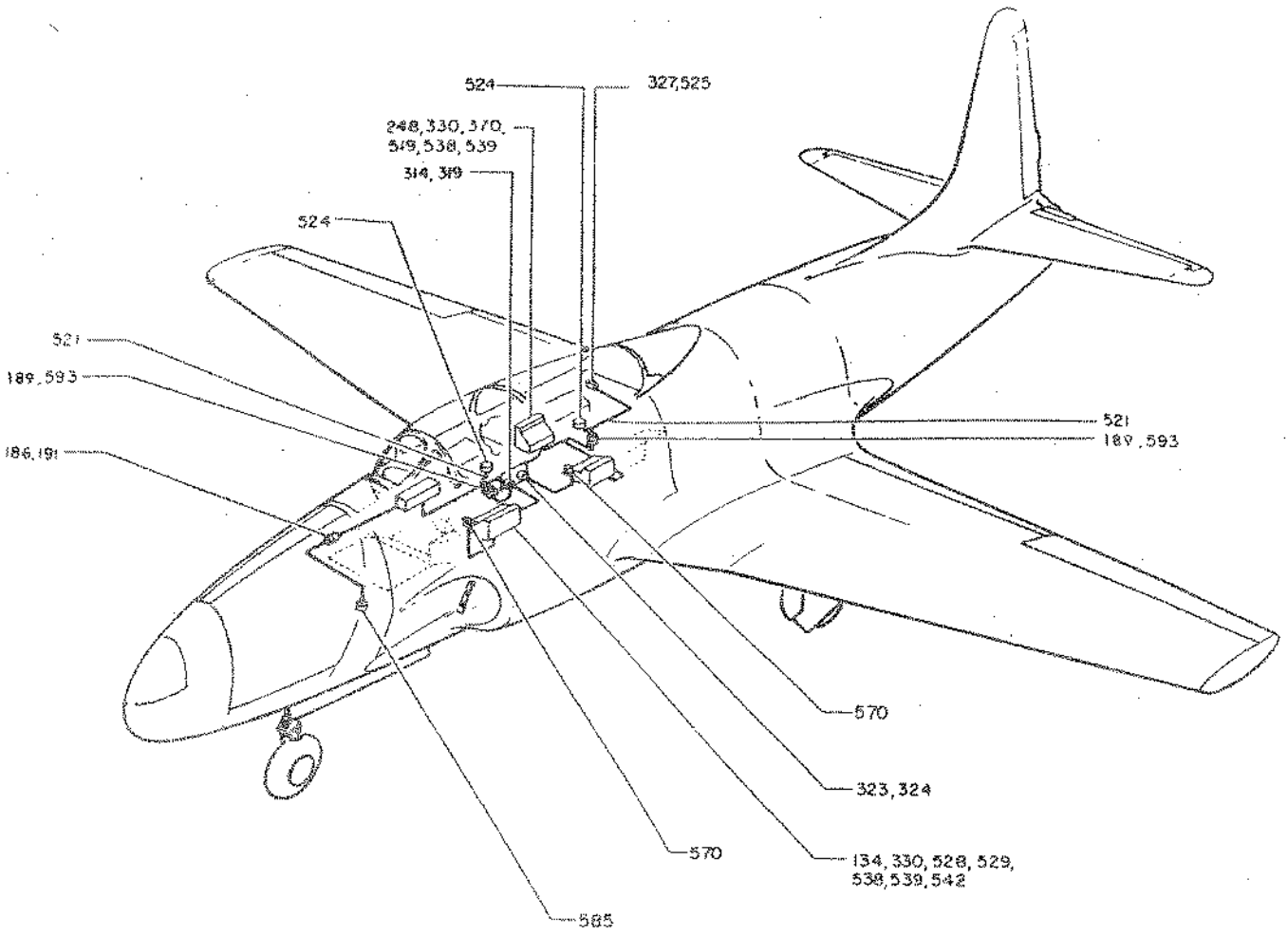


Figure 8-289. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



NOTE

⚠1 USED ON MDAP AIRCRAFT ONLY

ITEM	DESCRIPTION	MFR	TYPE	DWG. OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P3
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR			AN3102A-16S-1S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-20P
319	CONNECTOR			AN3102A-24-28P
323	CONNECTOR			AN3102A-24-28S
324	CONNECTOR			AN3106A-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3108B-20-27S
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		W9-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
528	RESISTOR		560Ω±1%/2W	RC20BF561K
529	RESISTOR		1500Ω±1%/2W	RC20BF152K
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			CB3106A-24-09S
542	RESISTOR		3300Ω±1%/2W	RC20BF332K
570	SWITCH	HETHERINGTON		W106N26
585	CONNECTOR			AN3102A-16S-1S
593	CONNECTOR	MCD		AN3106B-16S-1P

GB 8868
M20-480-8-387

⚠1
AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 55-2920 AND SUBSEQUENT

Figure 8-281. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

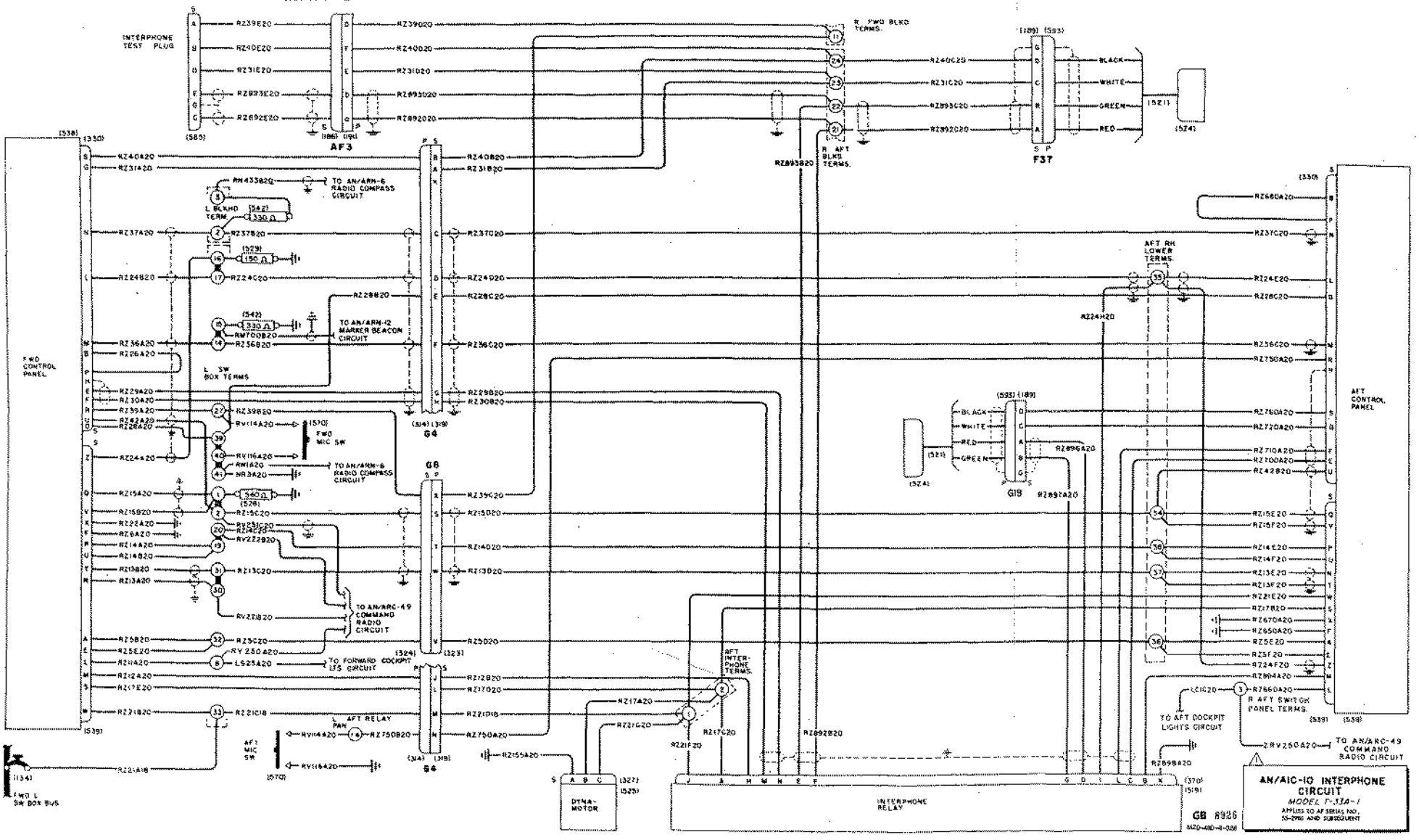
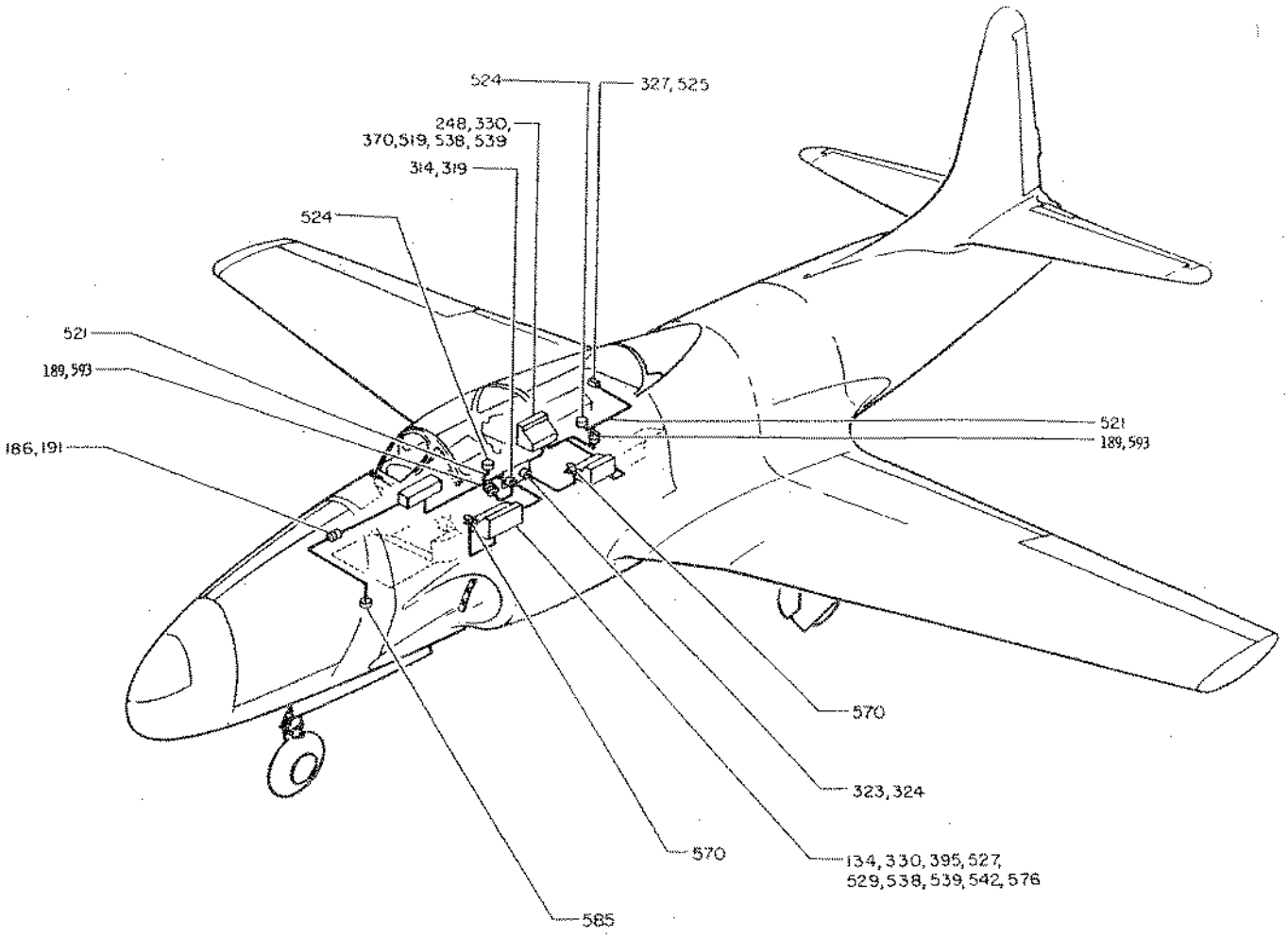


Figure 8 – 281. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3108B-20-27S
395	CAPACITOR	MALLORY	50 MFD	B5-29
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/AJ
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
527	RESISTOR		82Ω 1W	RC30BF820K
529	RESISTOR		150Ω 1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-624/AIC-10
539	CONNECTOR			CB3106A-24-28S
542	RESISTOR		330Ω 1/2W	RC20BF331K
543	RESISTOR		100Ω 1/2W	RC20BF101K
547	RESISTOR		220Ω 1/2W	RC20BF221K
570	SWITCH	HETHERINGTON		W104NB4
576	RESISTOR		150Ω 1W	RC30BF151K
585	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-4P

NOTE

1 NOT USED ON RCAF OR MDAP T-33A AIRCRAFT

1

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A-1

APPLIES TO AF SERIAL NO. 53-5286 AND SUBSEQUENT

GB 8869

M20-48D-8-297

Figure 8-282. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

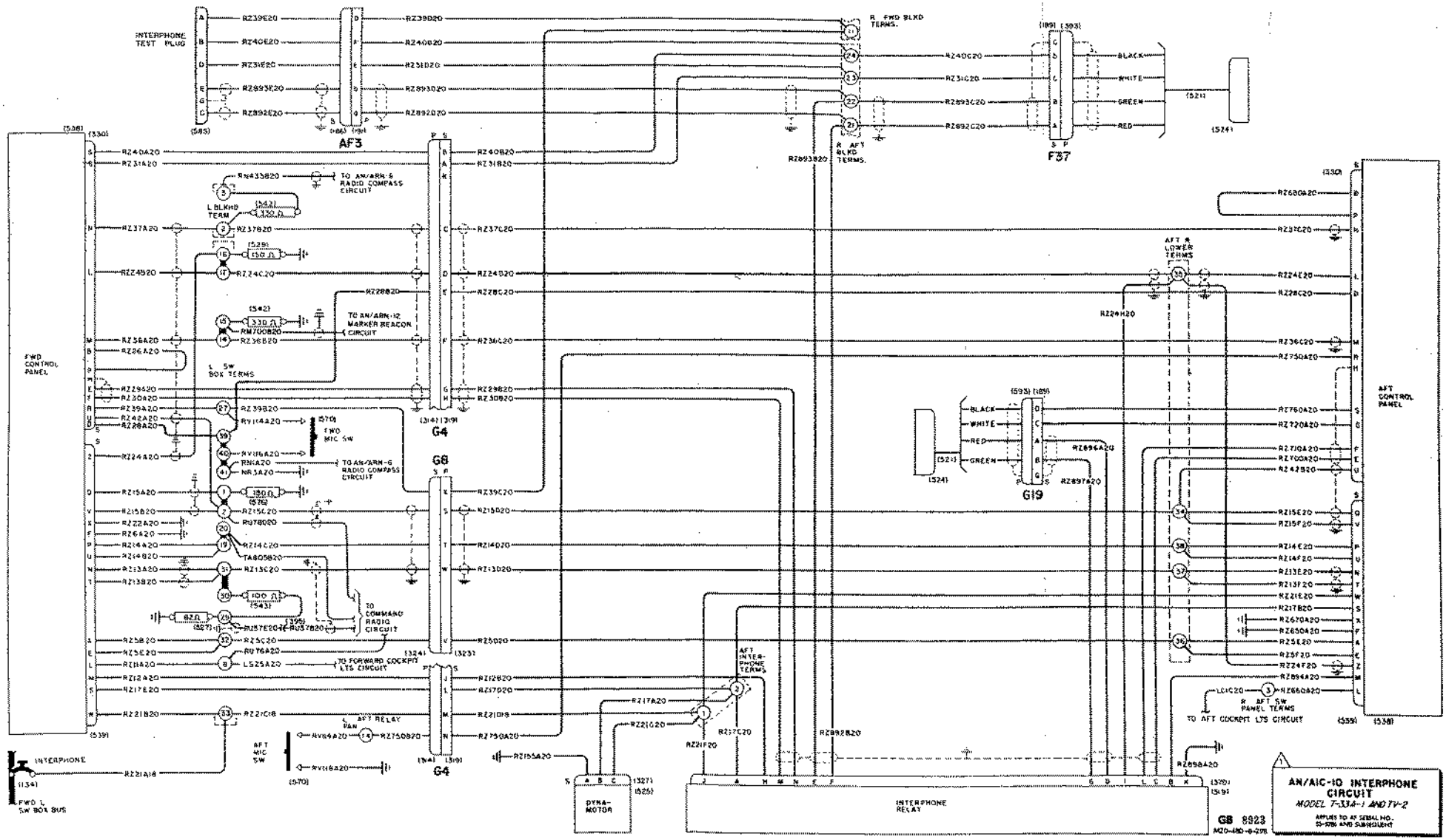
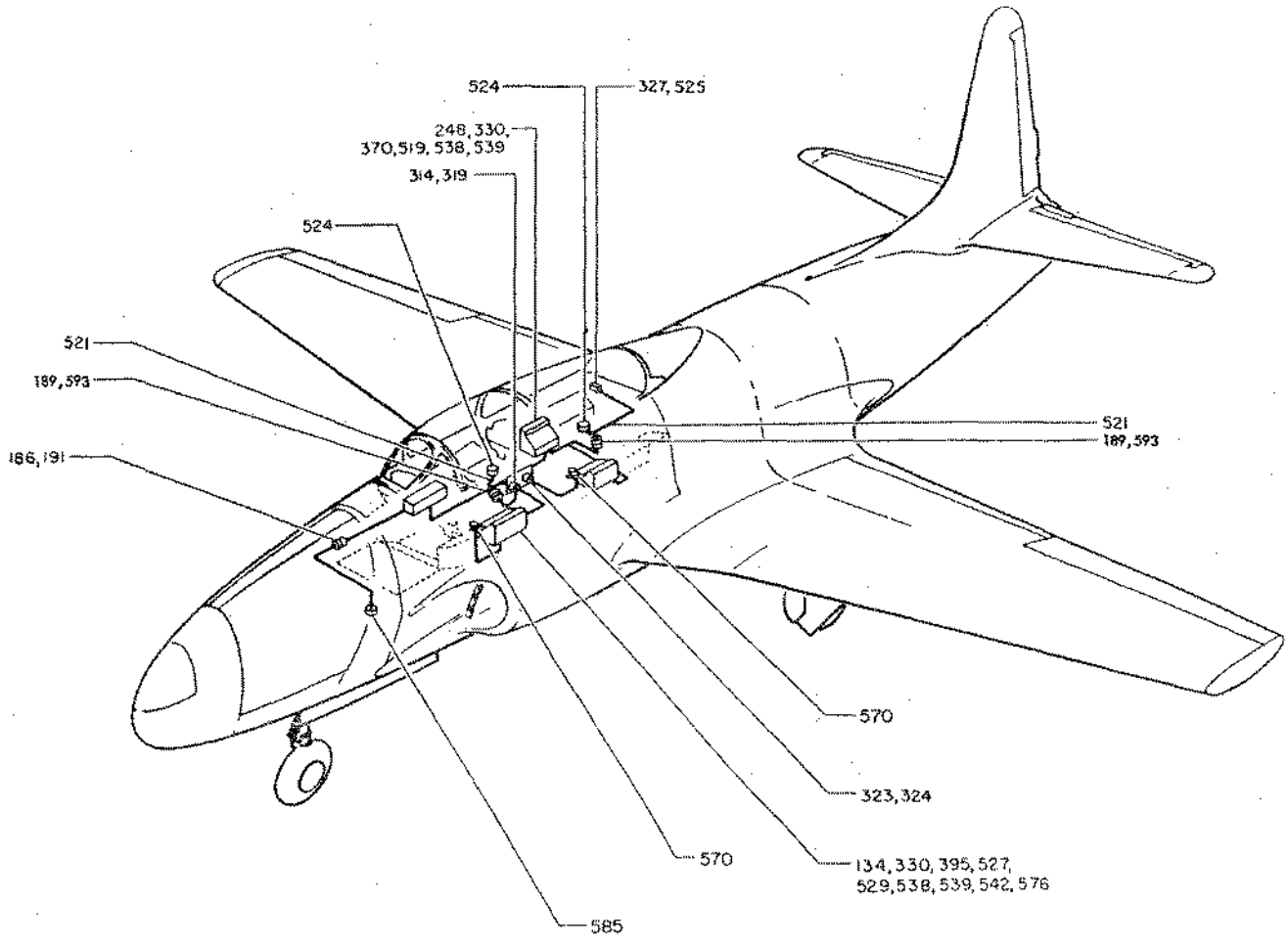


Figure 8-282. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1S
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3108B-20-27S
395	CAPACITOR	MALLORY	50MFD	85-39
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
527	RESISTOR		82 Ω 1W	RC30BF820K
529	RESISTOR		150 Ω 1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			CB3106A-24-28S
542	RESISTOR		330 Ω 1/2W	RC20BF331K
543	RESISTOR		100 Ω 1/2W	RC20BF101K
547	RESISTOR		220 Ω 1/2W	RC20BF221K
570	SWITCH	HETHERINGTON		W104N84
576	RESISTOR		150 Ω 1W	RC30BF151K
585	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

M20-44-8-378
GB 3554

AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. PRIOR TO 55-4370

Figure 8-283. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

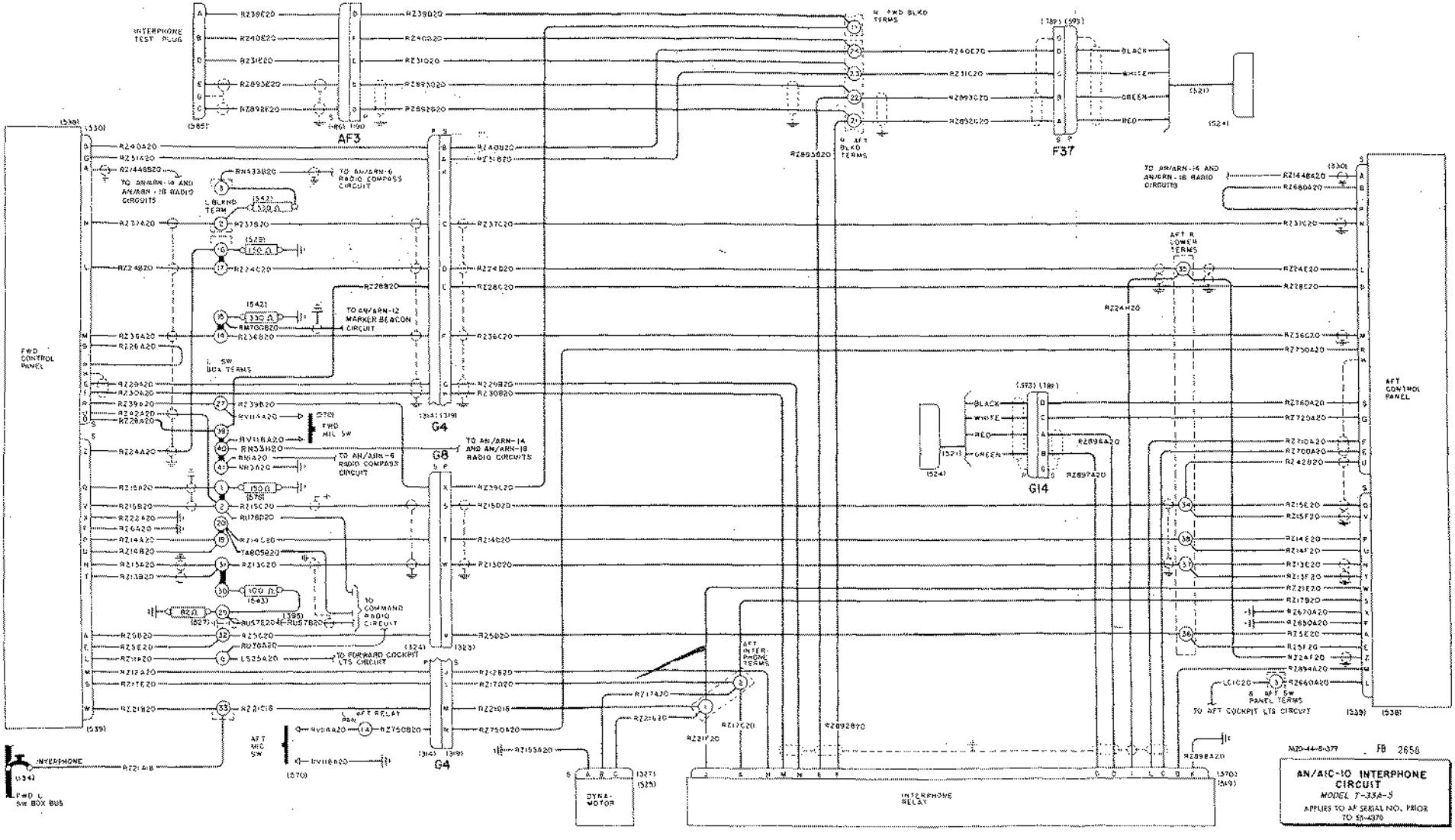
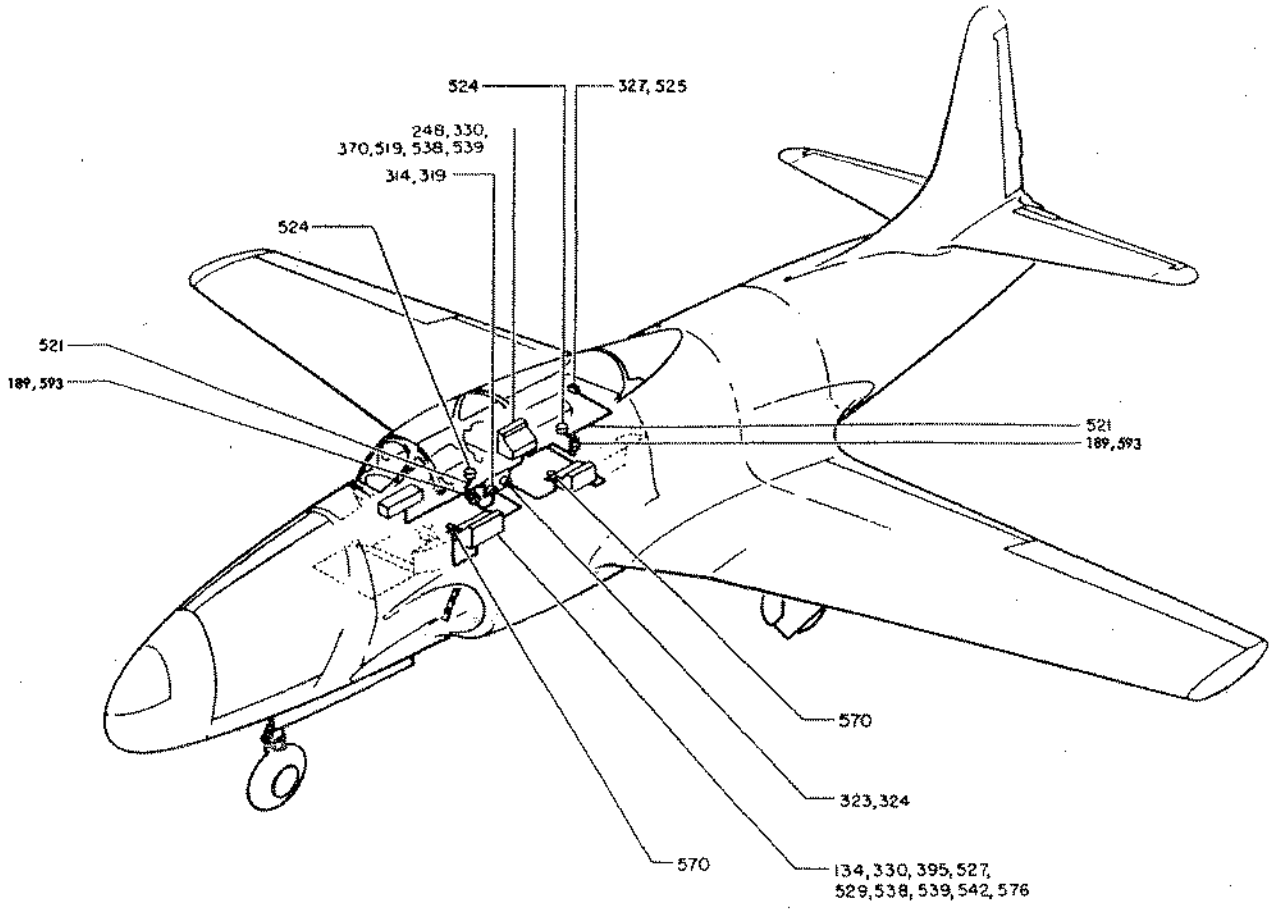


Figure 8-283. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			MS25017-5
189	CONNECTOR			MS3102A-16S-1S
314	CONNECTOR			MS3106A-24-28P
319	CONNECTOR			MS3102A-24-28S
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106A-24-28S
327	CONNECTOR			MS3106A-16-10S
330	CONNECTOR			MS3106R-22-14S
370	CONNECTOR			MS3108B-20-27S
396	CAPACITOR	MALLORY	40MFD	5A 85-48
519	RELAY	GFAE		RE-94/AIC-10
521	CABLE	GFAE		WF-14/U
524	JACK			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10 OR DY-77A/AIC-10
527	RESISTOR		82 Ω 1W	MS35044-75
529	RESISTOR		150 Ω 1/2W	MS35043-67
538	CONTROL PANEL	GFAE		C-824/AIC-10
539	CONNECTOR			MS3106R-24-28S
542	RESISTOR		330 Ω 1/2W	MS35043-75
543	RESISTOR		100 Ω 1/2W	MS35043-63
570	SWITCH	HETHERINGTON		W104NB4
576	RESISTOR		150 Ω 1W	MS35044-81
593	CONNECTOR			MS3106A-16S-1P

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A-15

APPLIES TO AF SERIAL NO. PRIOR TO 55-4070

HG 05247 M20-58-8-470

Figure 8-283A. AN/AIC-10 Interphone Circuit, Modified by T.O. 1T-33A-613G (Sheet 1 of 2)

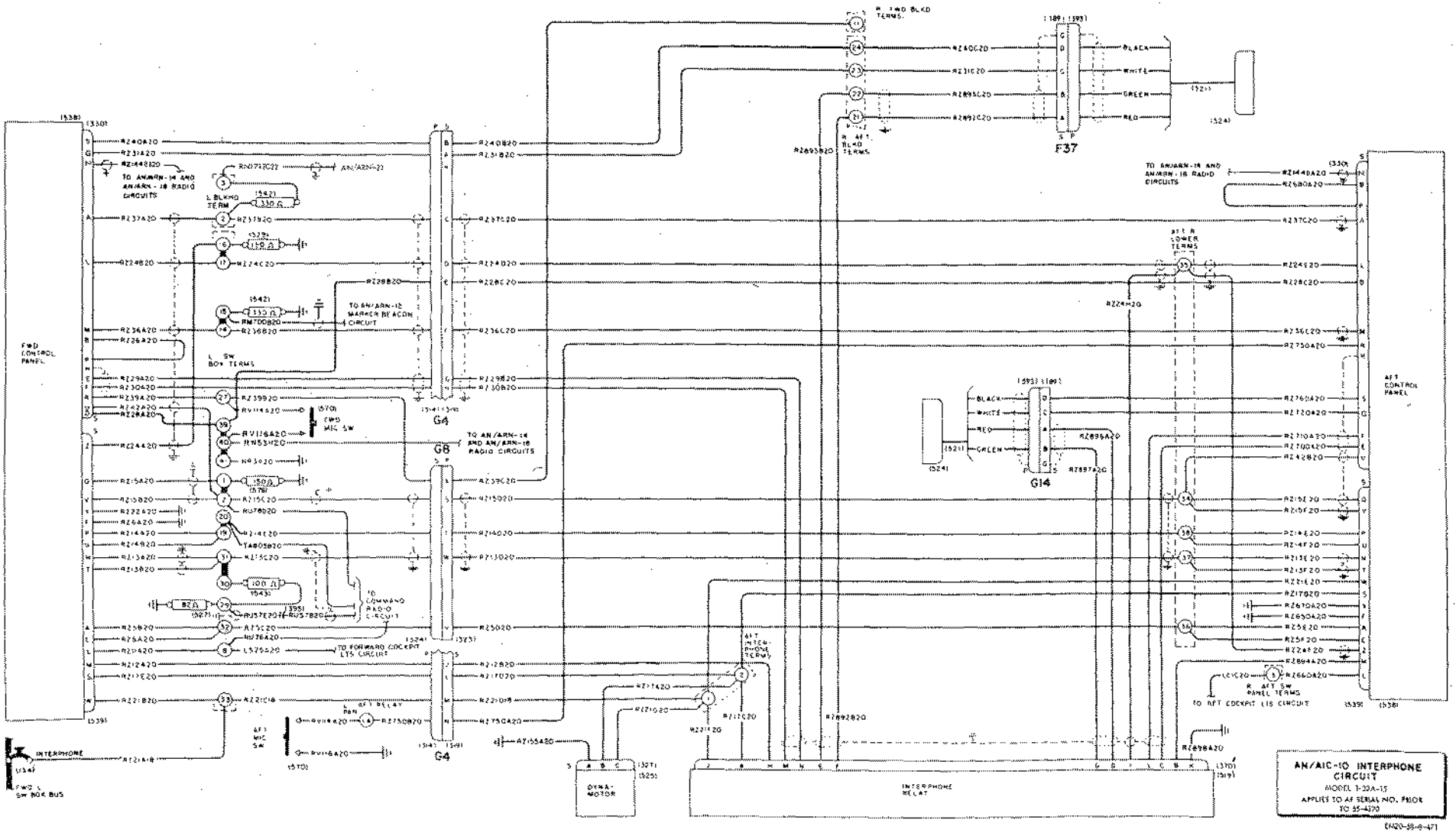
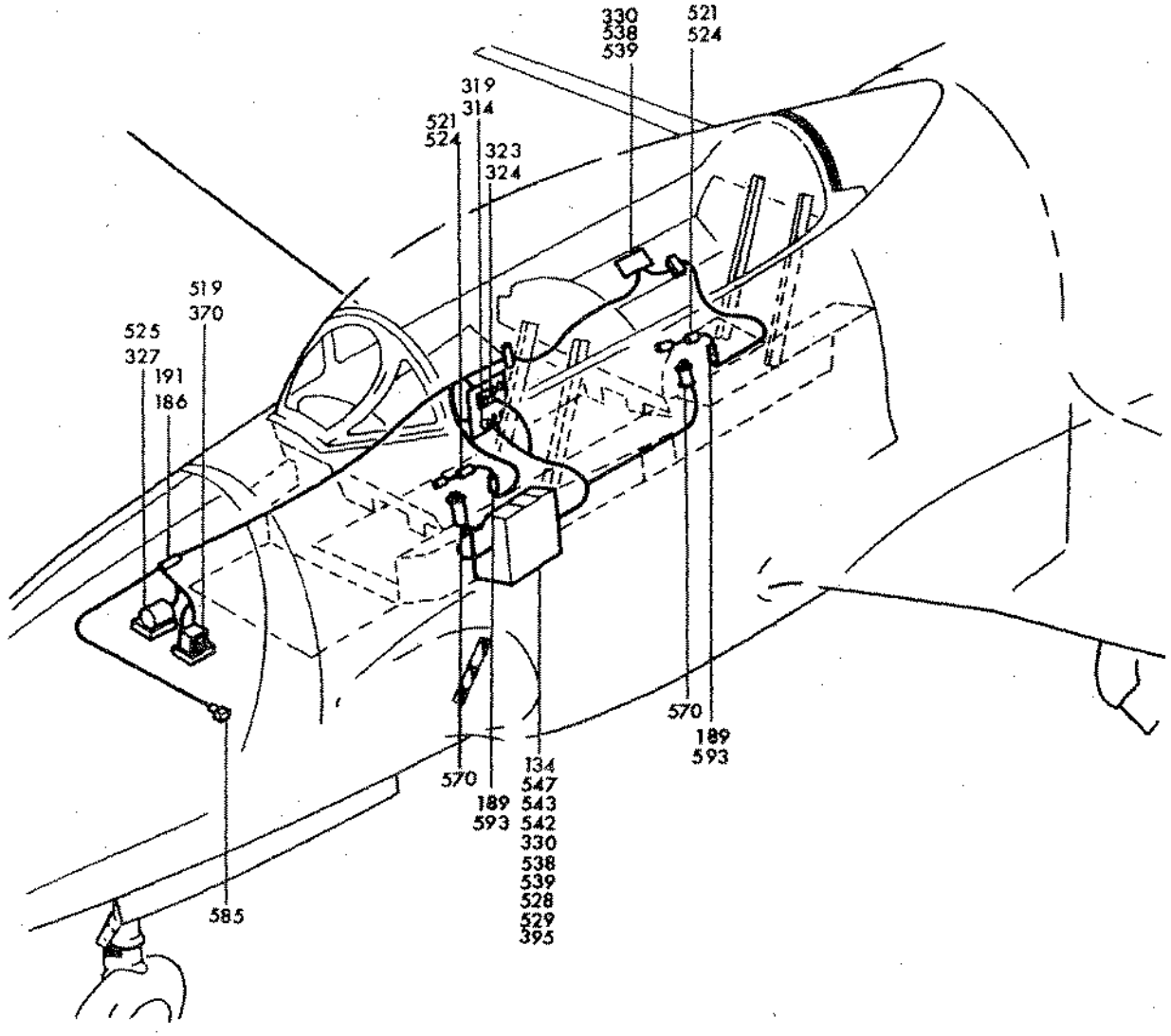


Figure 6-283A. AN/AIC-10 Interphone Circuit, Modified by T.O. 1T-33A-613G (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR.	TYPE	DRWG OR SPEC.
134	CIRCUIT BREAKER			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1P
191	CONNECTOR			AN3108C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			C83106A-22-14S
370	CONNECTOR			AN3108B-20-27S
396	CAPACITOR	MALLORY	40 MFD 150V	BS-48
519	RELAY	GFAE		RE-94/AIC-10
521	CORD			WF-14U
524	JACK BOX	GFAE		J-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10
527	RESISTOR		82Ω 3W	RC30BF820K
529	RESISTOR		150Ω 1/2W	RC20BF151K
538	CONTROL PANEL	GFAE		C824/AIC-10
539	CONNECTOR			C83106A-24-28S
542	RESISTOR		330Ω 1/2W	RC20BF331K
543	RESISTOR	HETHERINGTON	110Ω 1/2W	RC20BF301K
570	SWITCH			W104N84
576	RESISTOR		150Ω 1/2W	RC30BF151K
585	CONNECTOR			AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

GB 3559
M20-44-8-432

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 55-4370 THROUGH 56-3694

Figure 8-284. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

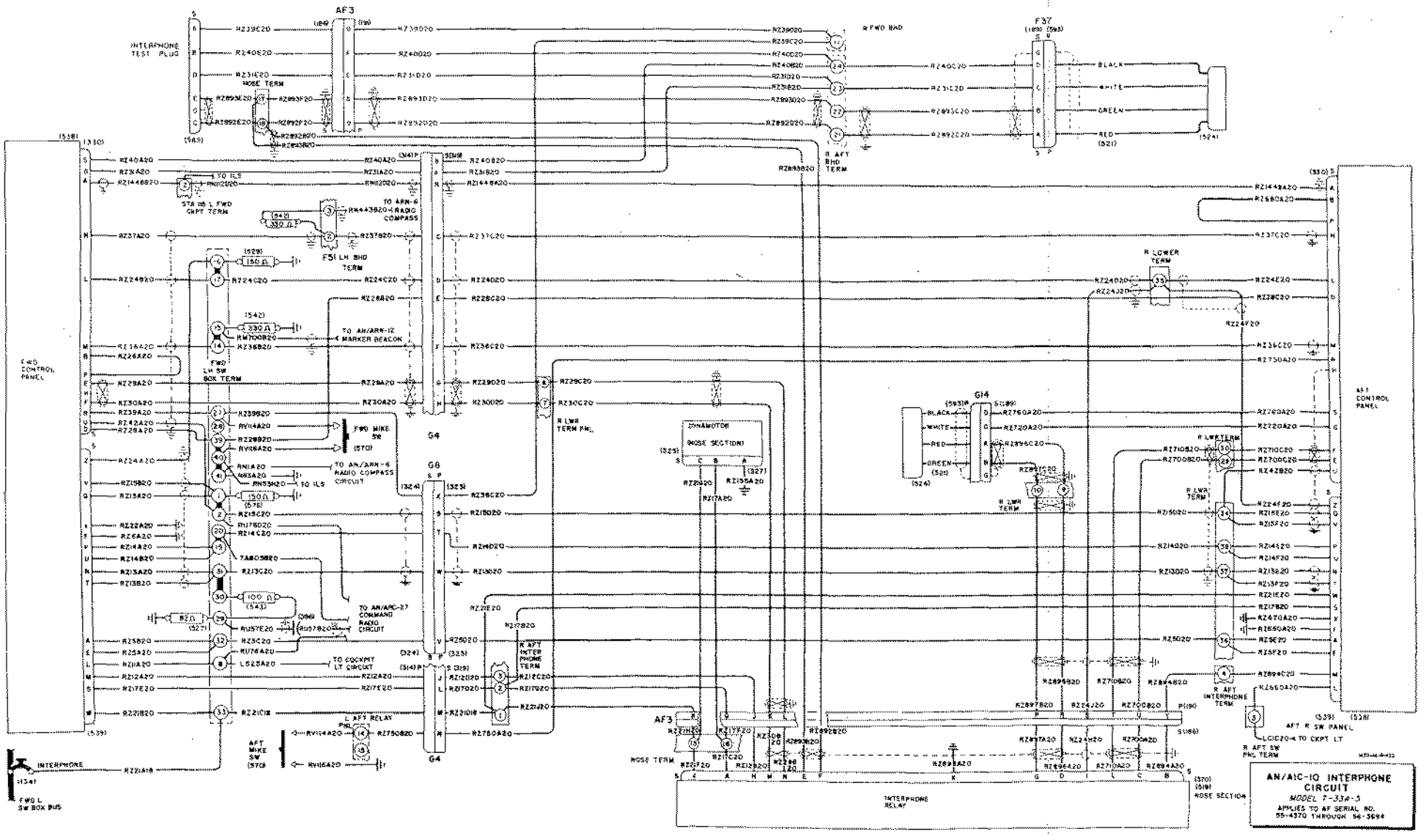
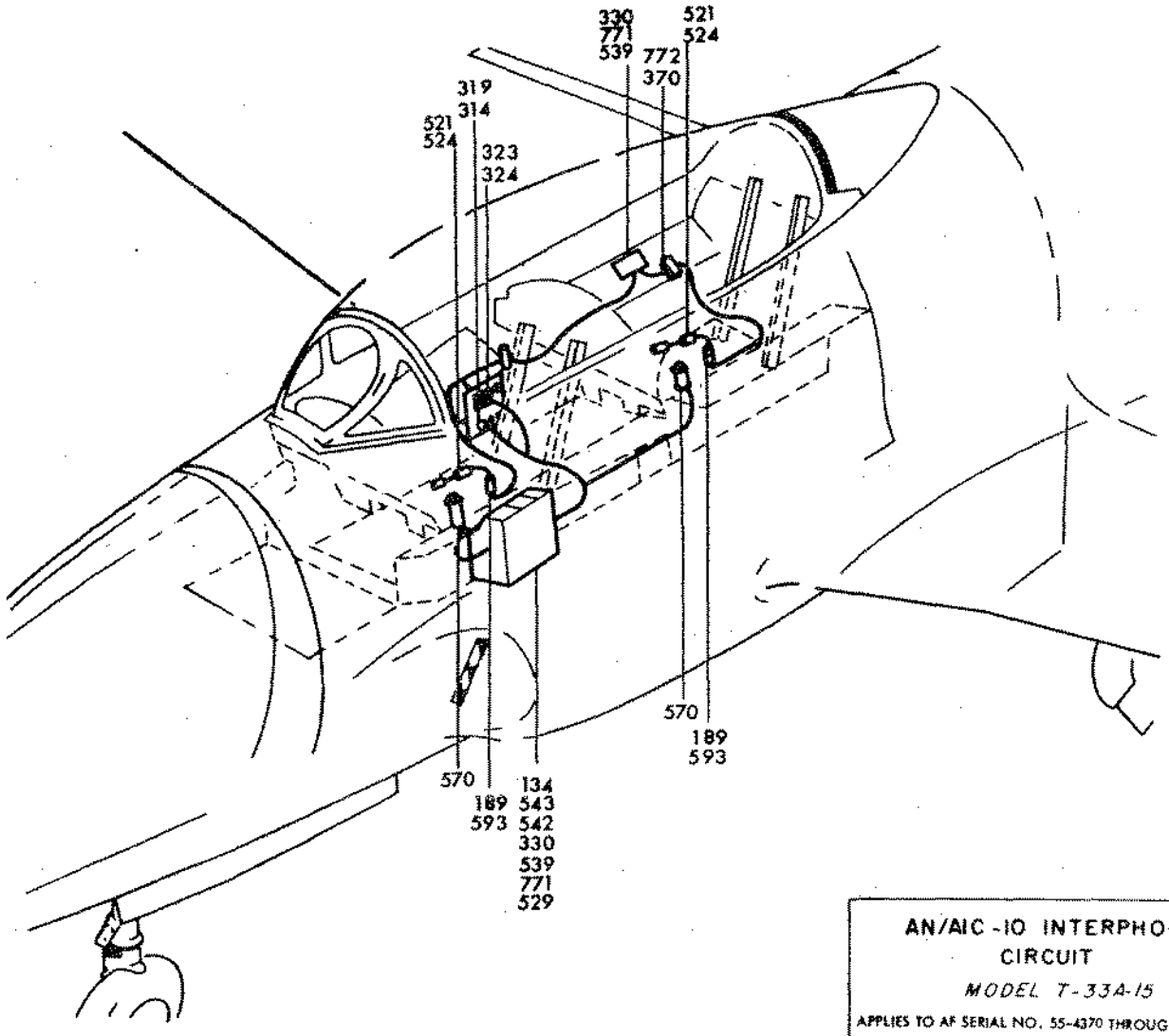


Figure 8-284. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A-15

APPLIES TO AF SERIAL NO. 55-4370 THROUGH 56-3694.

ITEM	DESCRIPTION	MFR	TYPE	DRWG OR SPEC.
134	CIRCUIT BREAKER			MS25017-5
189	CONNECTOR			MS3102A-16S-1P
314	CONNECTOR			MS3106A-24-28P
319	CONNECTOR			MS3102A-24-28S
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106A-24-28S
330	CONNECTOR			MS3106R-22-14S
370	CONNECTOR			MS3108B-20-27S
396	CAPACITOR	MALLORY	40 MFD 150V	SABS-48
521	CORD	GFAE		WF-14U
524	JACK BOX			U-92/U
527	RESISTOR		82 Ω 1W	MS35044-75
529	RESISTOR		150 Ω 1/2W	MS35043-67
539	CONNECTOR			MS3106R-24-28S
542	RESISTOR		330 Ω 1/2W	MS35043-75
543	RESISTOR		100 Ω 1/2W	MS35043-63
570	SWITCH	HETHERINGTON		W104N84
576	RESISTOR		150 Ω 1/2W	MS35044-81
593	CONNECTOR			MS3106A-16S-1P
771	CONTROL PANEL			CB24A/AIC-10
772	RELAY			RE96A/AIC-10

HG 05253
M20-58-8-472

Figure 8-284A. AN/AIC-10 Interphone Circuit, Modified by T.O. 1T-33A-613G (Sheet 1 of 2)

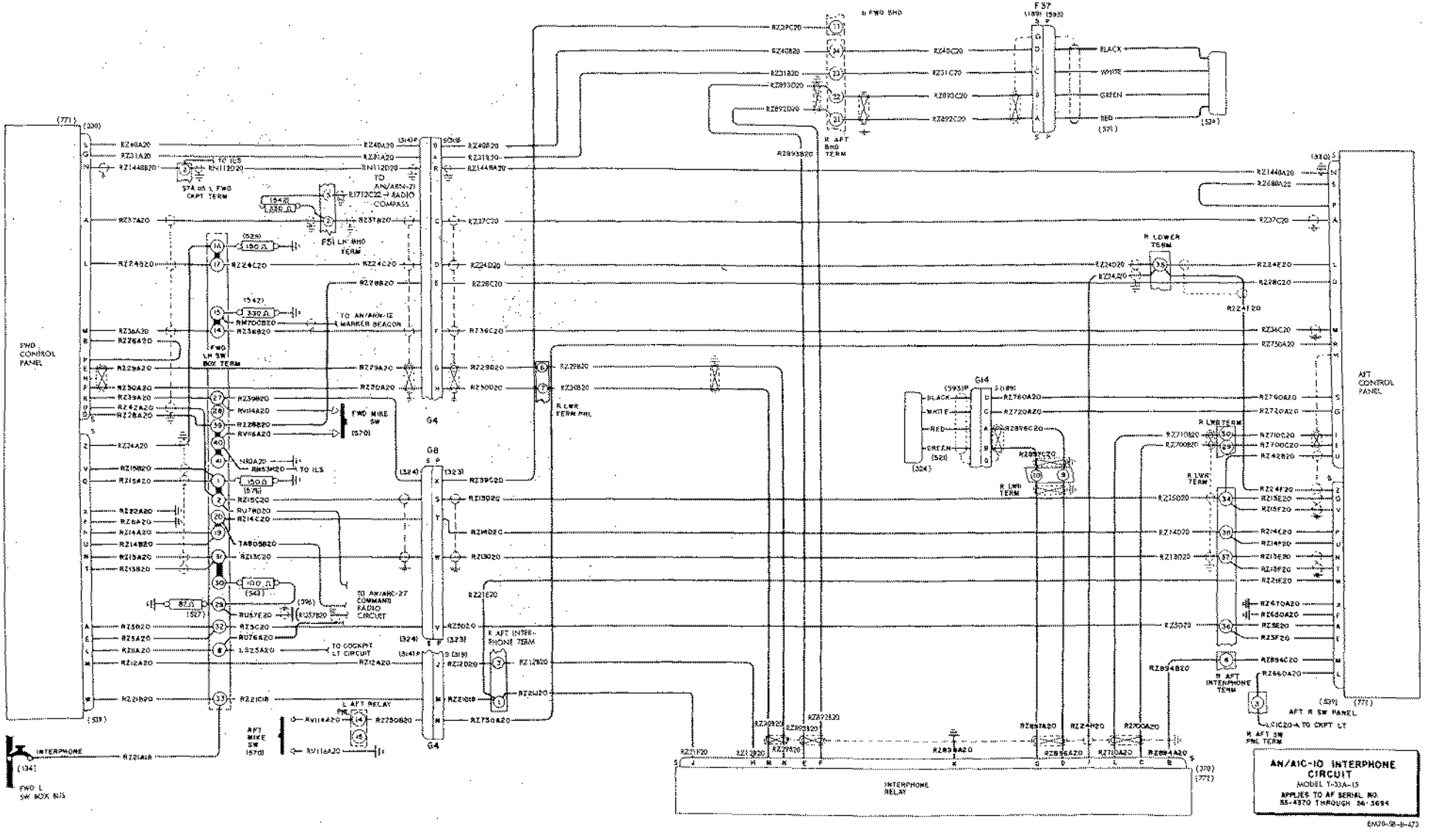
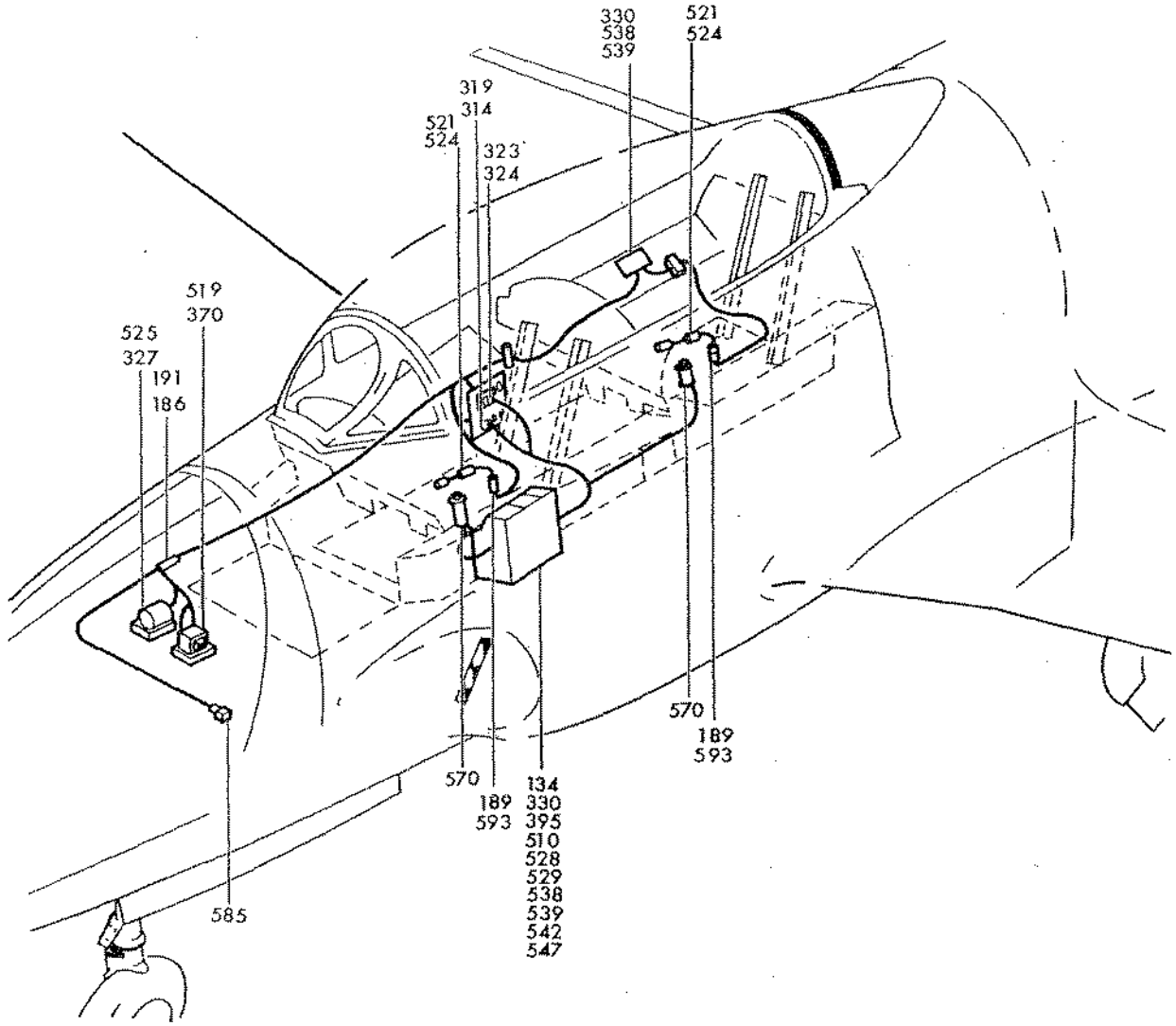


Figure 8-284A. AN/AIC-10 Interphone Circuit, Modified by T.O. 1T-33A-613G (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DRWG OR SPEC
134	CIRCUIT BREAKER			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
189	CONNECTOR		MOD	AN3102A-16S-1P
191	CONNECTOR			AN3100C-28-12P
314	CONNECTOR			AN3106B-24-28P
319	CONNECTOR			AN3102A-24-28S
323	CONNECTOR			AN3102A-24-28P
324	CONNECTOR			AN3106B-24-28S
327	CONNECTOR			AN3106B-16-10S
330	CONNECTOR			CB3106A-22-14S
370	CONNECTOR			AN3108B-20-27S
396	CAPACITOR	MALLORY	40 MFD 150V	BS-48
510	RESISTOR		47 Ω 1W	MS35044-5
519	RELAY			RE-94/AIC-10
521	CORD	GFAE		WF-14U
524	JACK BOX			U-92/U
525	DYNAMOTOR	GFAE		DY-77/AIC-10
529	RESISTOR	GFAE	150 Ω 1/2W	RC20BF151K
538	CONTROL PANEL			C824/AIC-10
539	CONNECTOR	GFAE		CB3106A-24-28S
542	RESISTOR		330 Ω 1/2W	RC20BF331K
570	SWITCH			W104NB4
585	CONNECTOR	HETHERINGTON		AN3100A-16S-1S
593	CONNECTOR		MOD	AN3106B-16S-1P

M20-46-8-10

AN/AIC-10 INTERPHONE CIRCUIT

MODEL T-33A-5

APPLIES TO AF SERIAL NO. 57-530 THROUGH 57-633

GB 6043

73

Figure 8-285. AN/AIC-10 Interphone Circuit (Sheet 1 of 2)

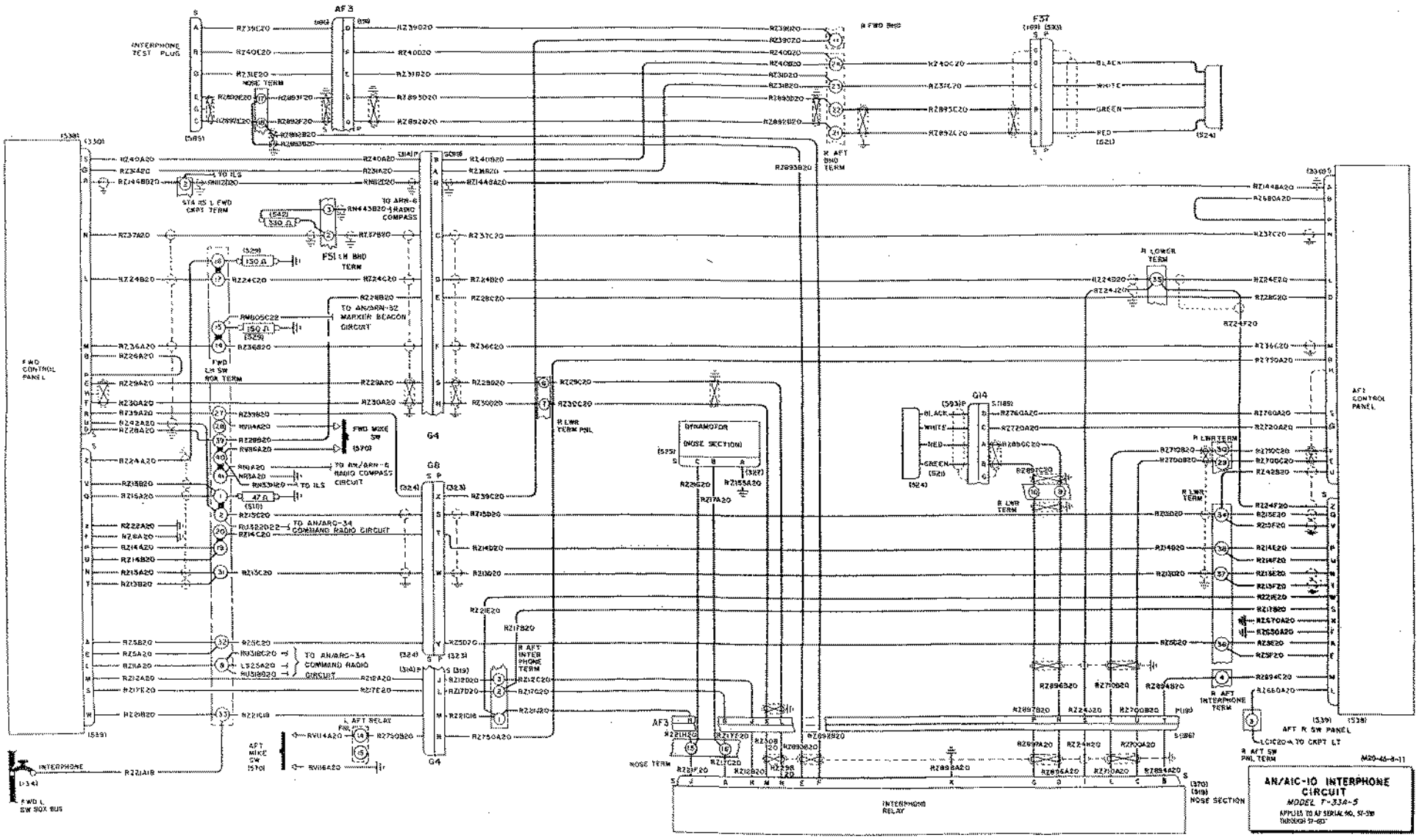
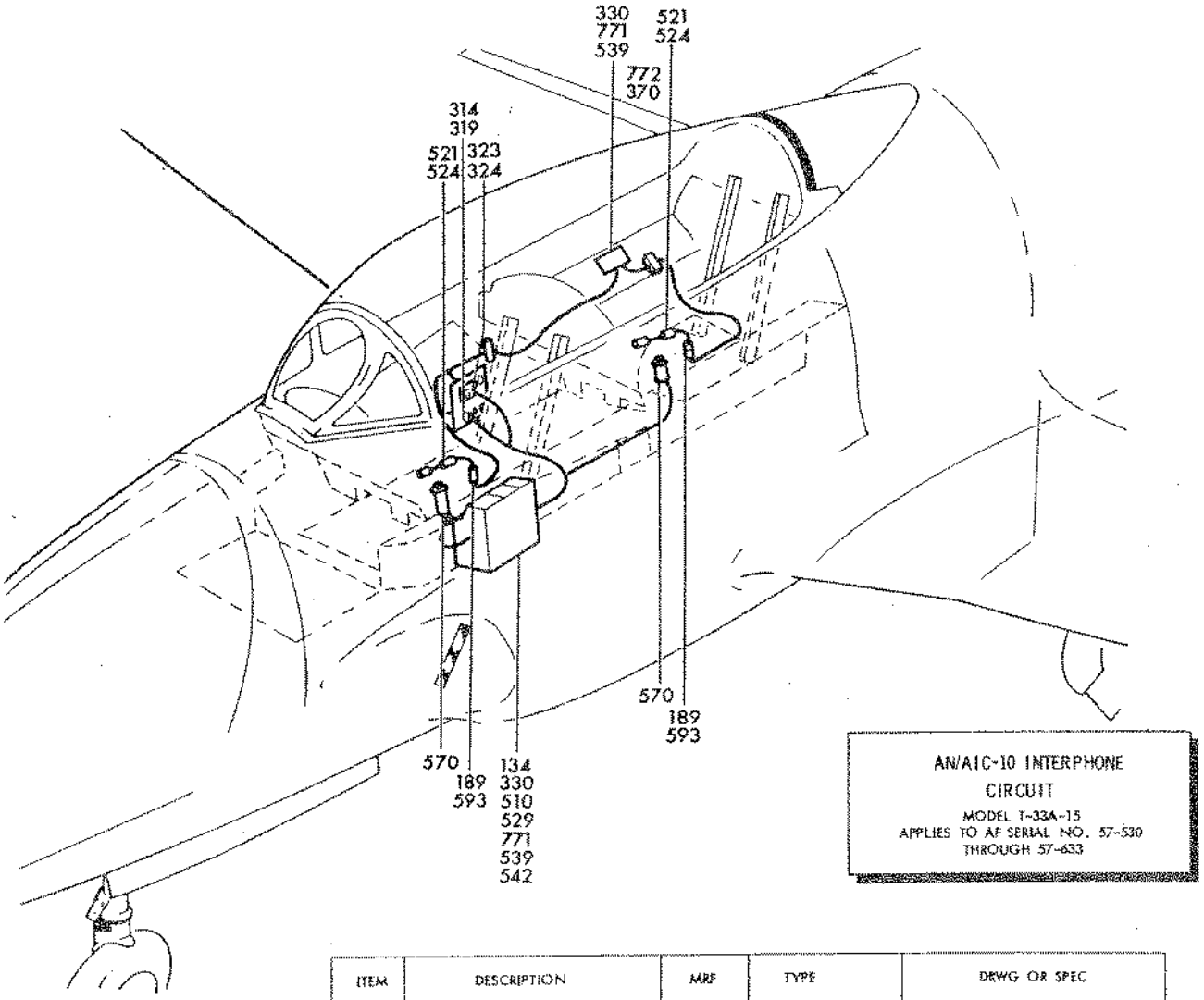


Figure 8— 285. AN/AIC-10 Interphone Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MRF	TYPE	DRWG OR SPEC
134	CIRCUIT BREAKER			MS25017-5
189	CONNECTOR			MS3102A-16S-1P
314	CONNECTOR			MS3106A-24-28P
319	CONNECTOR			MS3102A-24-28S
323	CONNECTOR			MS3102A-24-28P
324	CONNECTOR			MS3106A-24-28S
330	CONNECTOR			MS3108R-22-14S
370	CONNECTOR			MS3108B-20-27S
510	RESISTOR		47 Ω 1W	MS35044-69
521	CORD			WF-14U
524	JACK BOX			U-92/U
529	RESISTOR		150Ω1/2W	MS35043-67
539	CONNECTOR			MS3106R-24-28S
542	RESISTOR		330Ω1/2W	
570	SWITCH			W104N84
593	CONNECTOR			MS3106A-16S-1P
771	CONTROL PANEL			C824A/A1C-10
772	RELAY			R594A/A1C-10

MK 05255
M20-58-8-474

Figure 8-285A. AN/AIC Interphone Circuit, Modified by T.O. 1T-33A-613G (Sheet 1 of 2)

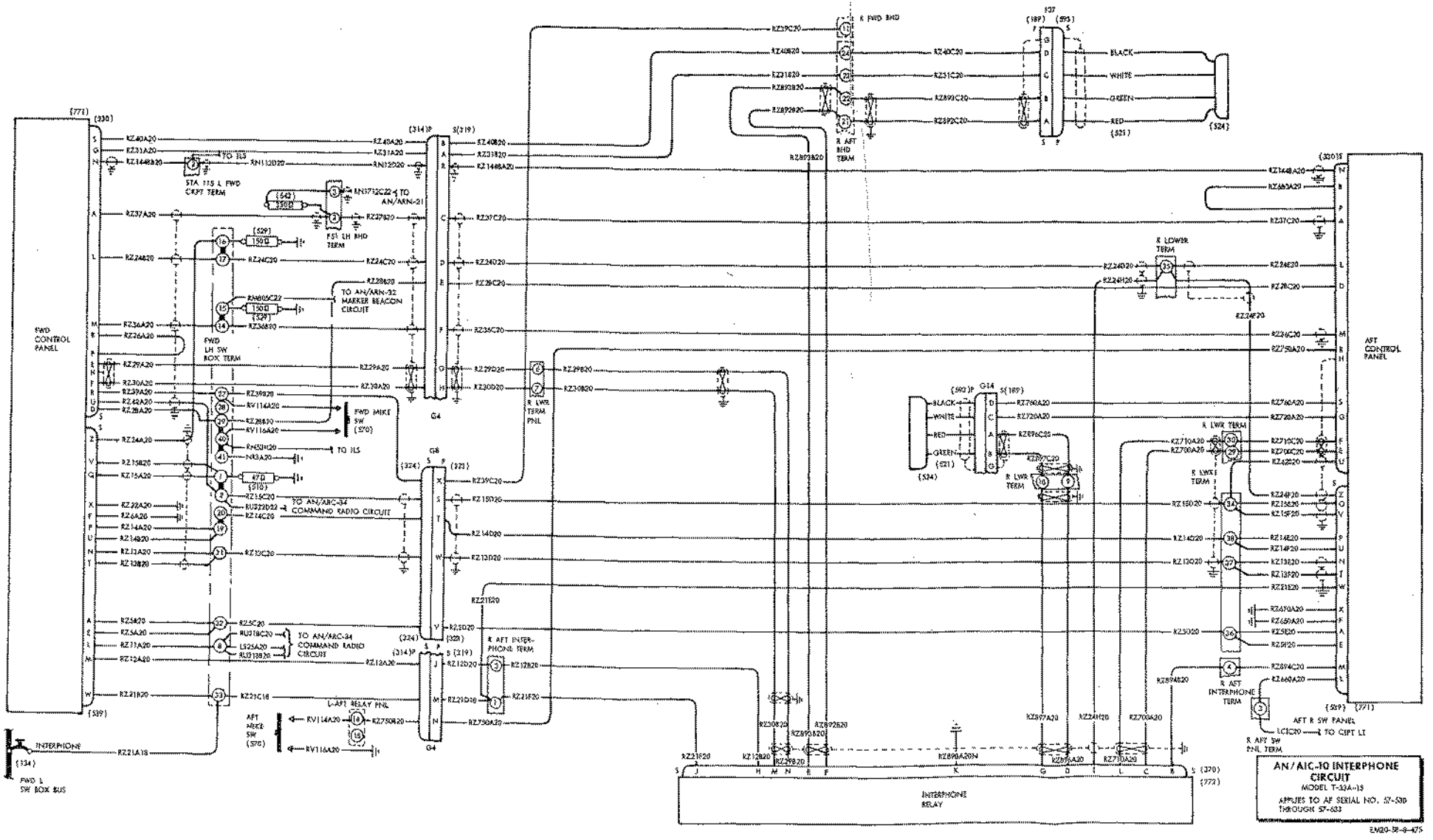
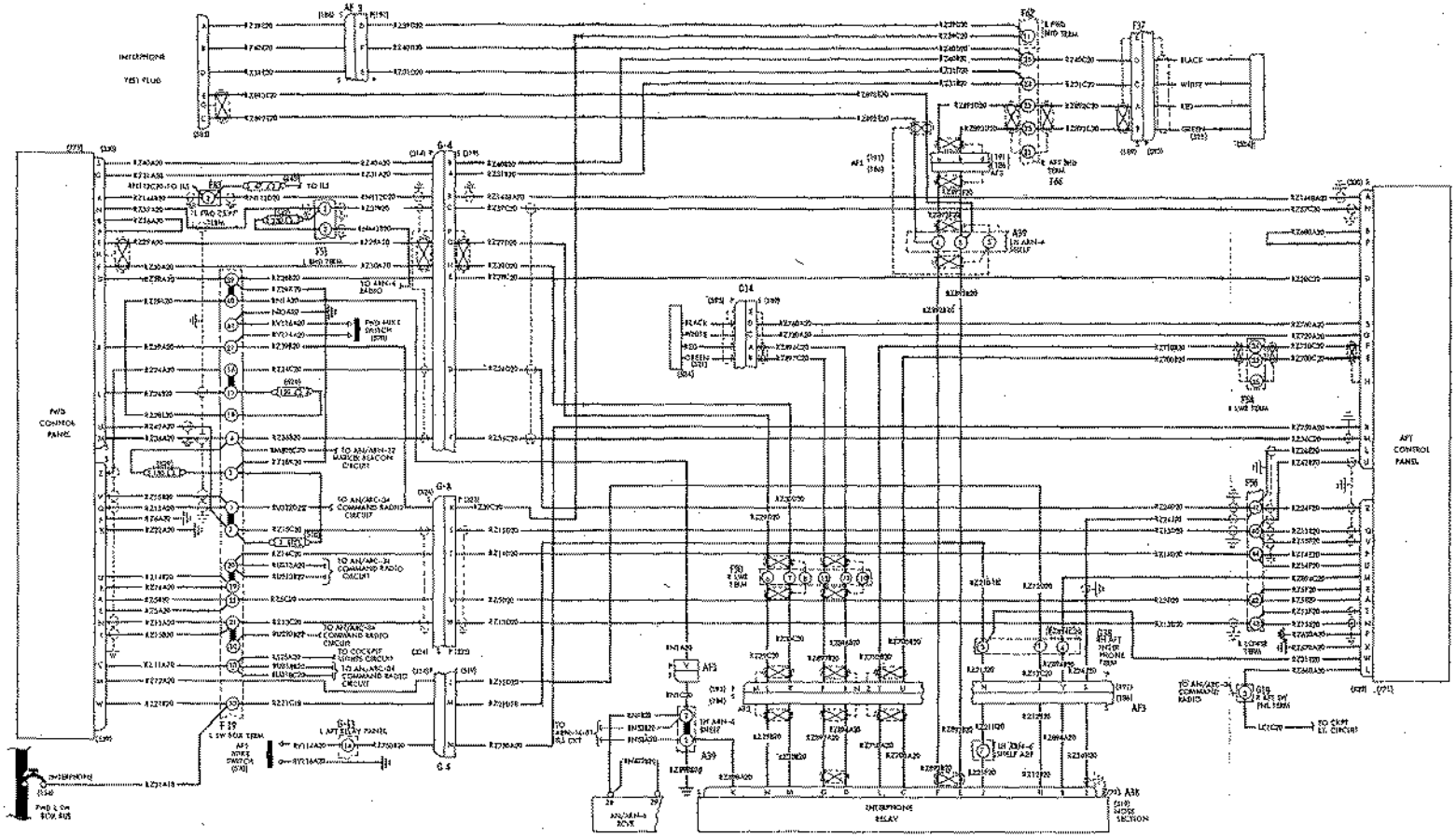


Figure 8-285A. AN/AIC Interphone Circuit, Modified by T.O. 1T-33A-613G (Sheet 2 of 2)

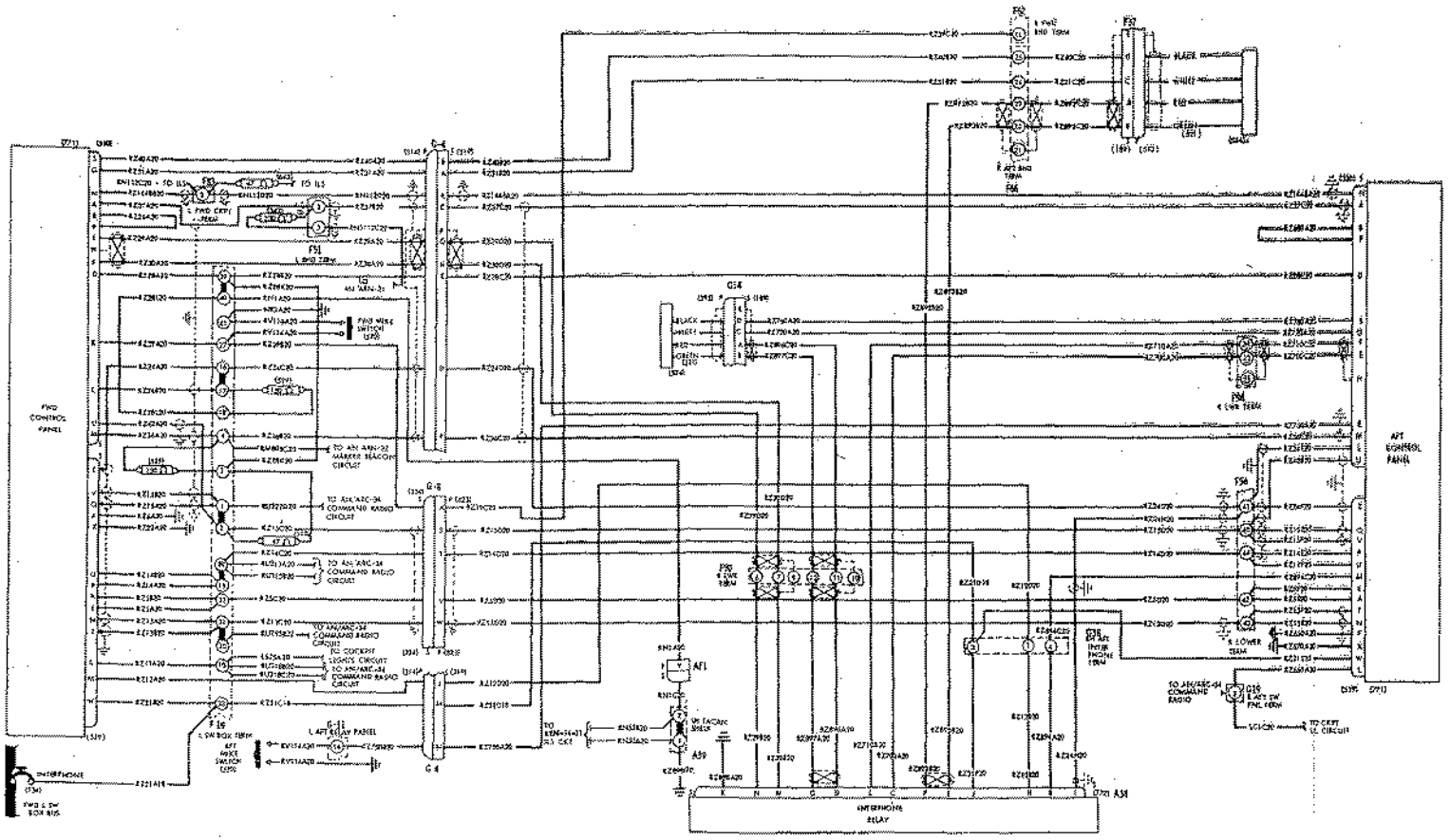
Changed 1 August 1967



ITEM	DESCRIPTION	MFR	TYPE	GRADE OR SPEC
134	CIRCUIT BREAKER			AA51A1-15
150	RESISTOR		400 Ω ± 5% 5 W	MIL-R-39007-15
156	CONNECTOR			AN3106A-24-19S
158	CONNECTOR		AN3101	AN3101A-16S-10
191	CONNECTOR			AN3101C-24-12P
312	CONNECTOR			AN3106A-24-19P
319	CONNECTOR			AN3101A-36-08S
322	CONNECTOR			AN3101A-24-28P
354	CONNECTOR			AN3101A-24-10S
356	CONNECTOR			CD3106A-22-14S
358	CONNECTOR			AN3108B-20-12S
370	RESISTOR		47 Ω, 5 W	MIL-R-39007-5
371	CORD			MIL-C-5020
374	JACK, INTERPHONE	GRAE		CJ-11/AIC
379	RESISTOR		150 Ω, 1/2 W	MIL-R-39007-8
389	CONNECTOR			CD3106A-24-28S
442	RESISTOR		33K Ω, 1/2 W	MIL-R-39007-20
520	SWITCH	WESTINGHOUSE		MS25088-2
586	CONNECTOR			AN3106A-14S-1S
750	CONNECTOR			AN3108B-16S-1P
843	RESISTOR		MOD 47 Ω, 10 W	MIL-R-39007-3
973	CONTROL PANEL	GRAE		CP-11A/AIC-10
975	RELAY	GRAE		CP-894/AIC-10

AN/AIC-10 INTERPHONE CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. 57-1454 AND SUBSEQUENT

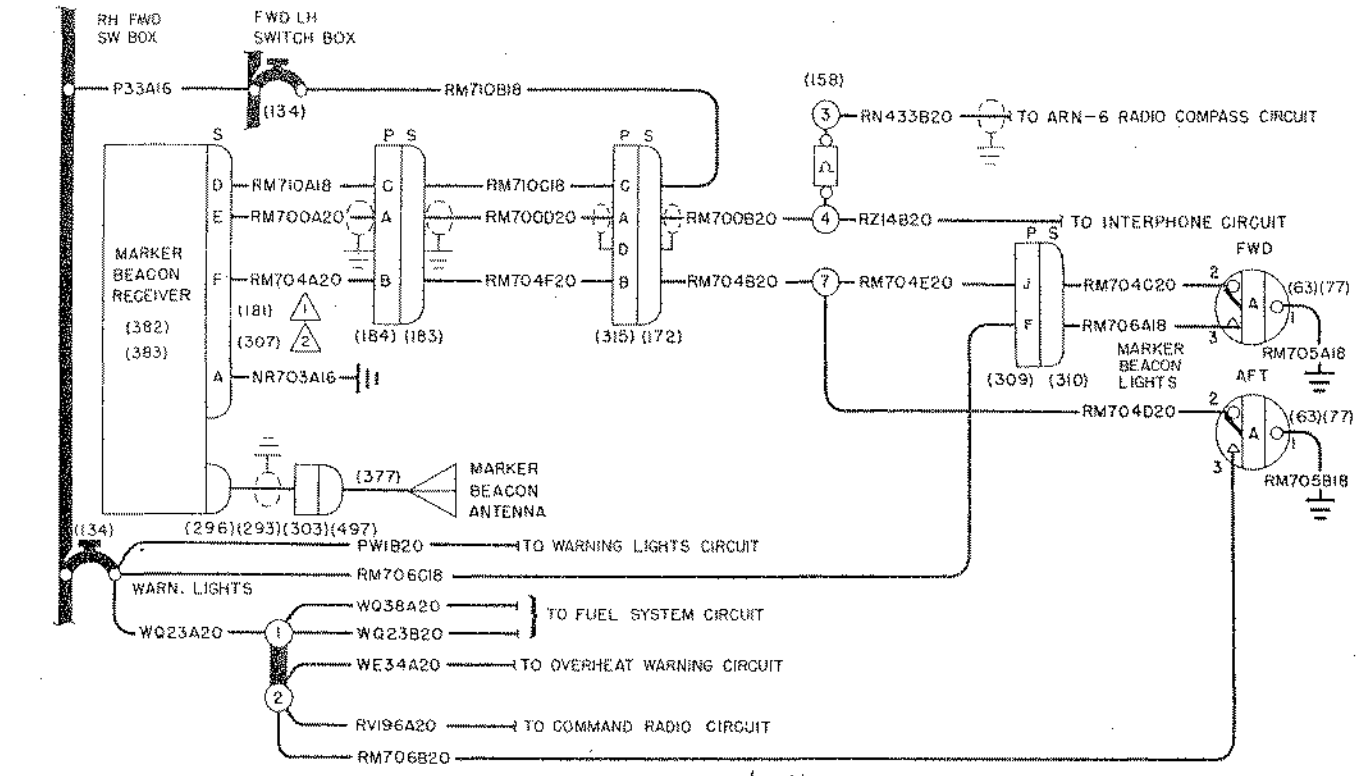
Figure 8-286 AN/AIC-10 Interphone Circuit

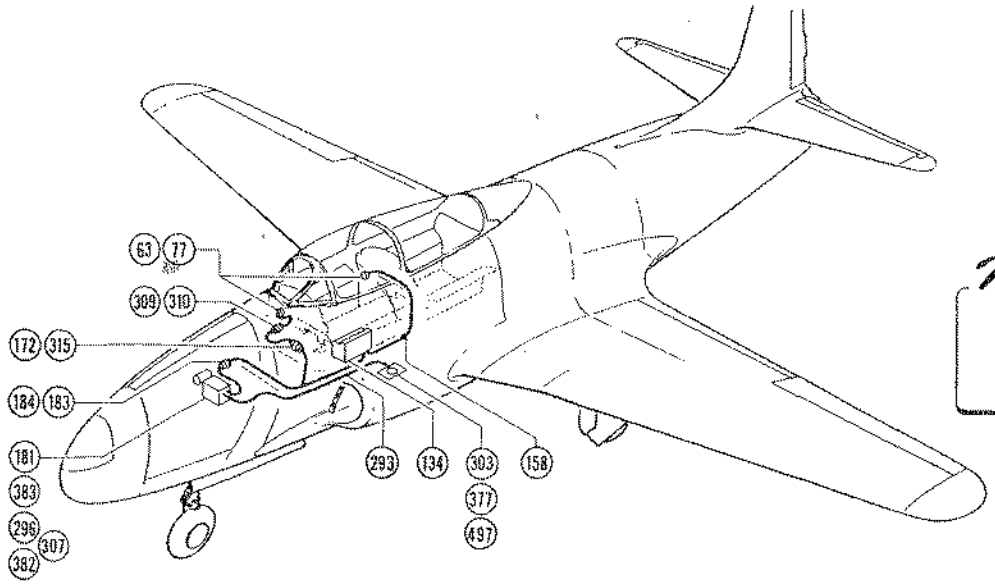


ITEM	DESCRIPTION	MFR	TYPE	DRWG OR SPEC
124	CIRCUIT BREAKER			MS25077-3
189	CONNECTOR			MS3100A-14S-1S
214	CONNECTOR			MS3106A-14-12P
219	CONNECTOR			MS3100A-24-28S
225	CONNECTOR			MS3102A-24-28P
226	CONNECTOR			MS3108A-24-28S
308	CONNECTOR			MS3108B-22-14S
309	CONNECTOR			MS3108B-20-27S
311	RESISTOR		47 Ω 5W	MS20064-49
321	RESISTOR			WW-1/10
324	JACK, ENGINEMASTER	GFAE		12-952-1
329	RESISTOR		150 Ω 1/2W	MS20062-67
339	CONNECTOR			MS3106A-24-28S
340	RESISTOR	INTERMEDIATE	150 Ω 1/2W	MS20069-75
590	SWITCH			WT-9454
595	CONNECTOR			MS3106A-16S-1P
662	RESISTOR		47 Ω 1/2W	MS20062-55
771	CONTROL PANEL	GFAE		GFAE/AIC-10
775	RELAY	GFAE		GFAE/AIC-10

Figure 6-286A. AN/AIC-10 Interphone Circuit, Modified by T.O. 1T-33A-613G

anged 1 August 1967





Note

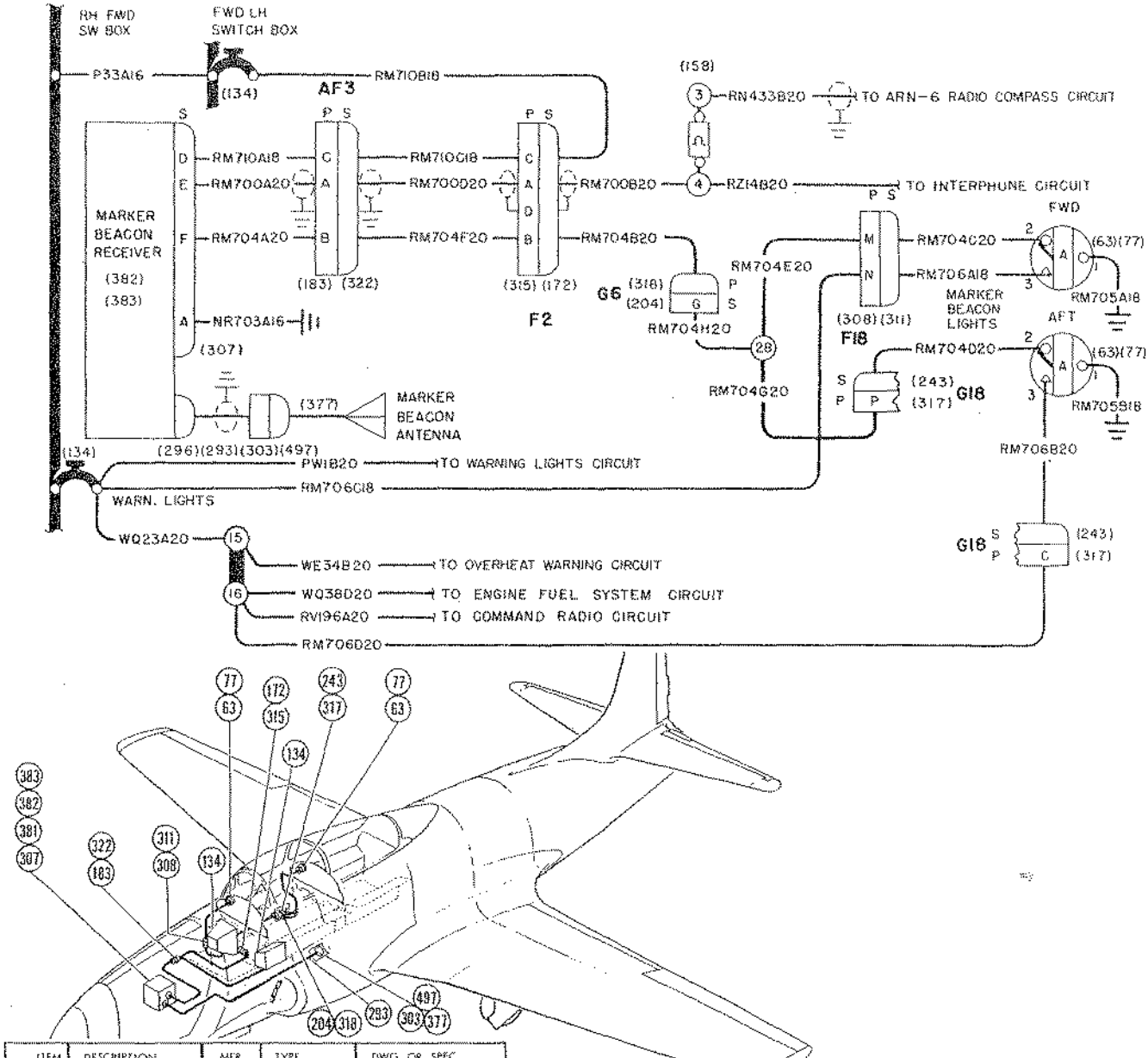
1. USED PRIOR TO AF SERIAL NO. 51-6751
2. USED ON AF SERIAL NO. 51-6751 THRU 51-6818

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
158	RESISTOR	ERIE	150Ω 1/2W	
172	CONNECTOR			AN3106-14S-5P
1 181	CONNECTOR			AN3106-18-9S
183	CONNECTOR			AN3106-28-11S
184	CONNECTOR			AN3102P-28-11P
293	COAXIAL CABLE	GFAE		RG-8/U
296	PLUG	GFAE		PL-259
303	ADAPTER	GFAE		M-359
2 307	CONNECTOR			AN3108-18-9S
309	CONNECTOR			AN3102-32-7P
310	CONNECTOR			AN3106-32-7S
315	CONNECTOR			AN3102-14S-5S
377	ANTENNA	GFAE		AT-134/ARN-12
382	RECEIVER	GFAE		R-122/ARN-12
383	MOUNT	GFAE		MT-589/ARN-12
497	CONNECTOR			UG-238/U

GB 8870
M20-46D-8-15Z

AN/ARN-12
MARKER BEACON CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS.
51-4329 THRU 51-6818

Figure 8-287. AN/ARN-12 Marker Beacon Circuit

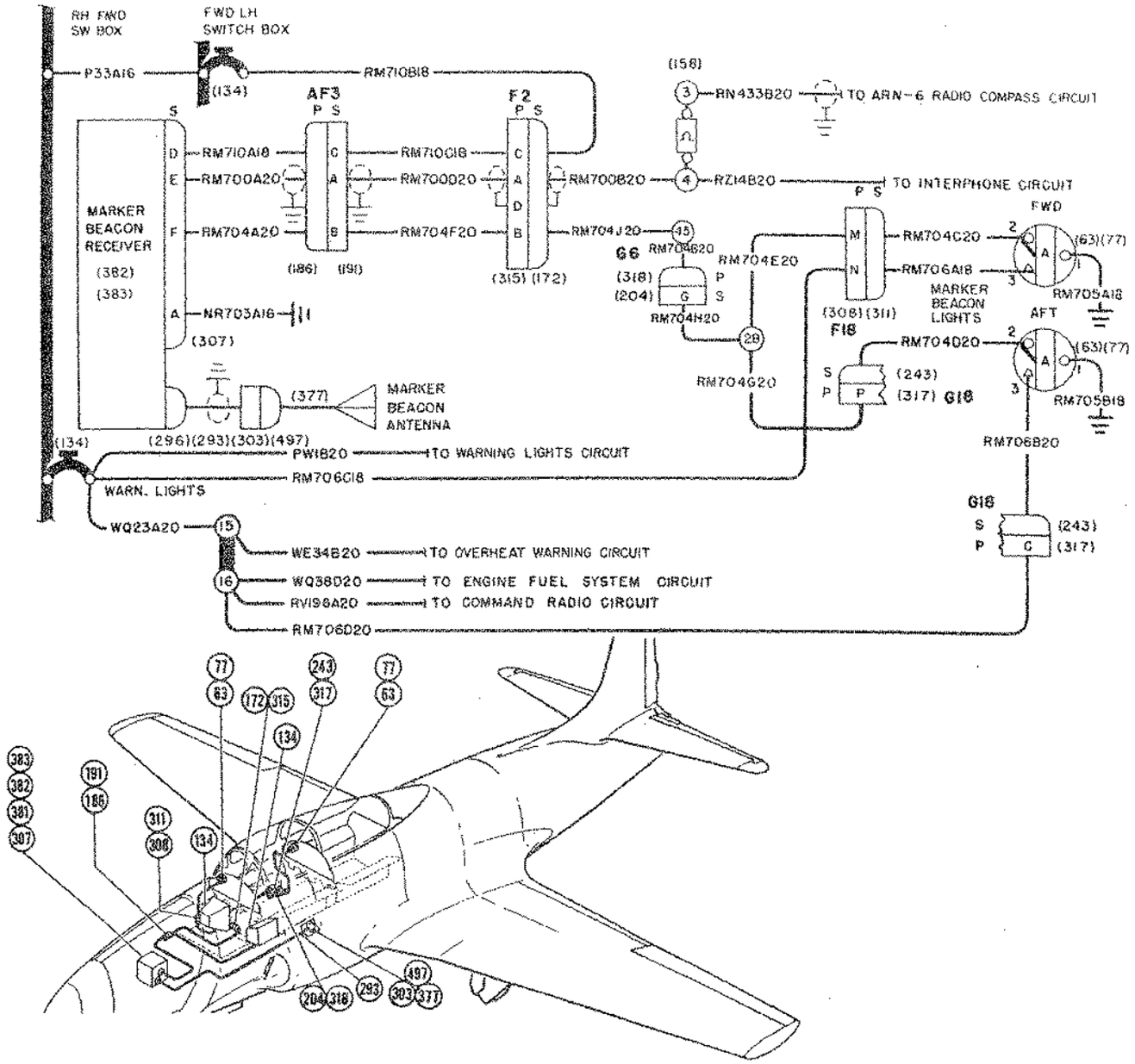


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3323-313
134	CIRCUIT PROTECTOR			AN3161-P5
158	RESISTOR	ERIE	150Ω±1/2W	
172	CONNECTOR			AN3106B-145-5P
183	CONNECTOR			AN3106B-28-11S
204	CONNECTOR			AN3102A-20-29S
243	CONNECTOR			AN3106B-20-29S
293	COAXIAL CABLE	GFAE		RG-8/U
296	PLUG	GFAE		PL-259
303	ADAPTER	GFAE		M-359
307	CONNECTOR			AN3108B-18-9S
308	CONNECTOR			AN3102A-28-15P
311	CONNECTOR			AN3106B-28-15S
315	CONNECTOR			AN3102A-14S-5S
317	CONNECTOR			AN3102A-20-29P
318	CONNECTOR			AN3106B-20-29P
322	CONNECTOR			AN3100C-28-11P
377	ANTENNA	GFAE		AT-134/ARN-12
381	CONNECTOR			PL-239
382	RECEIVER	GFAE		R-122/ARN-12
383	MOUNT	GFAE		MT-589/ARN-12
497	CONNECTOR			UG-238/U

GB 8817
M20-480-8-153

AN/ARN-12
MARKER BEACON CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS
51-6819 AND THRU 51-9235

Figure 8-288. AN/ARN-12 Marker Beacon Circuit

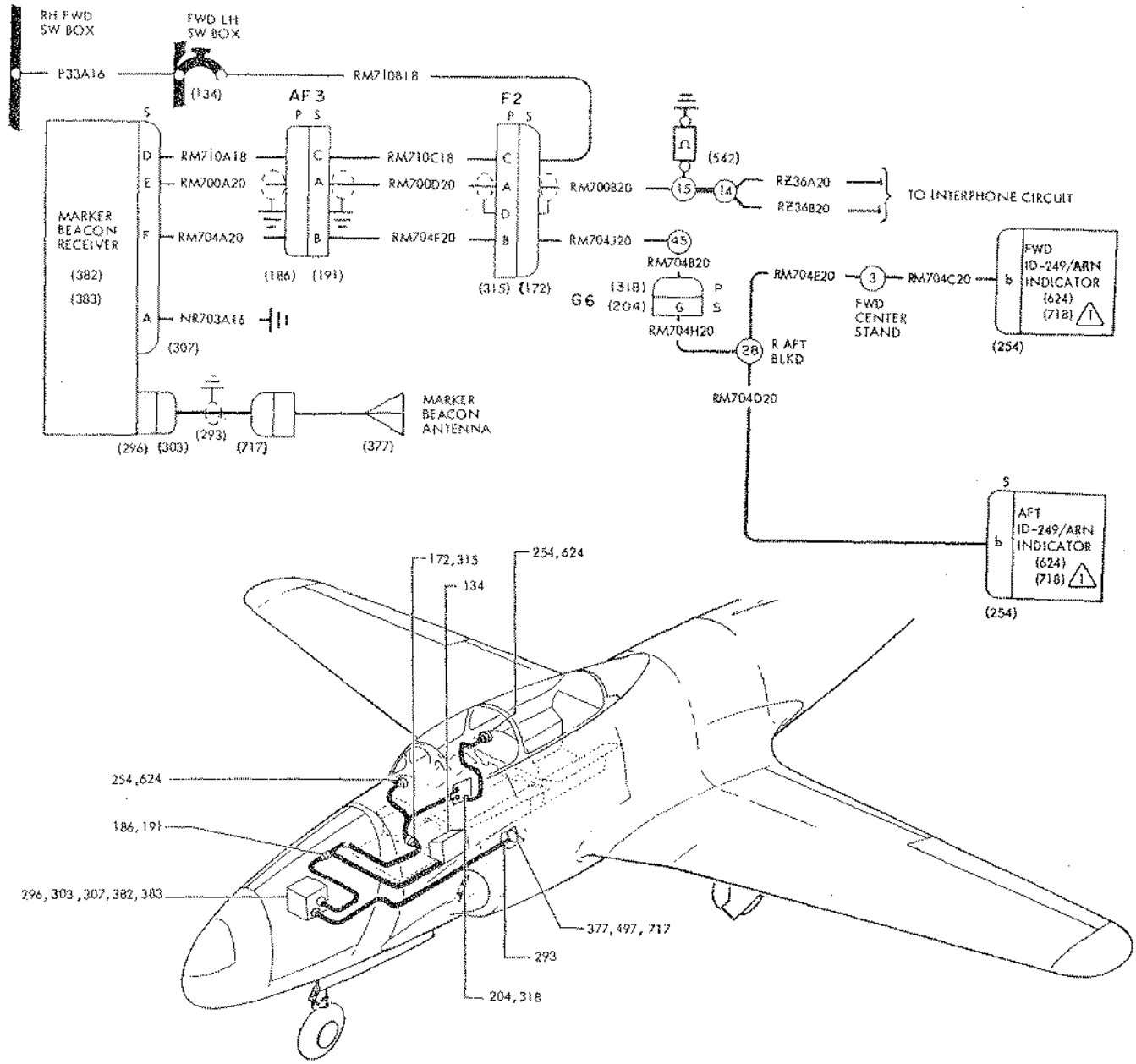


ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
63	LIGHT		AMBER	AN3157-4
77	LAMP			AN3121-313
134	CIRCUIT PROTECTOR			AN3161-P5
158	RESISTOR	ERIE	150 Ω 1/2 W	
172	CONNECTOR			AN3106-14S-5P
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
204	CONNECTOR			AN3102-20-29S
243	CONNECTOR			AN3106-20-29S
293	COAXIAL CABLE	GFAE		RG-8/U
296	PLUG	GFAE		PL-259
303	ADAPTER	GFAE		M-359
307	CONNECTOR			AN3108-18-9S
308	CONNECTOR			AN3102-28-15P
311	CONNECTOR			AN3106-28-15S
315	CONNECTOR			AN3102-14S-5S
317	CONNECTOR			AN3102-20-29P
318	CONNECTOR			AN3106B-20-29P
377	ANTENNA	GFAE		AT-136/ARN-12
381	CONNECTOR			PL-239
382	RECEIVER	GFAE		R-122/ARN-12
383	MOUNT	GFAE		MT-589/ARN-12
497	CONNECTOR			UG-218/U

GB 8871
M2D-480-8-191

AN/ARN-12
MARKER BEACON CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS. 51-9236 THROUGH 52-9759, 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

Figure 8-289. AN/ARN-12 Marker Beacon Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
172	CONNECTOR			AN3106B-14S-5P
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN3108B-28-12S
293	COAXIAL CABLE	GFAE		RG-8/U
296	PLUG	GFAE		PL-259A
303	ADAPTER	GFAE		M-359A
307	CONNECTOR			AN3108B-18-9S
315	CONNECTOR			AN3102A-14S-5S
318	CONNECTOR			AN3106B-20-29P
377	ANTENNA	GFAE		AT-134A/ARN-12
382	RECEIVER	GFAE		R-122/ARN-12
383	MOUNT	GFAE		MT-589A/ARN-12
497	CONNECTOR			UG-218/U
542	RESISTOR		330Ω±1/2W	RC20BF331K
624	INDICATOR	GFAE		ID-249/ARN
⚠1 717	ADAPTER			UG-276/U
⚠1 718	INDICATOR	GFAE		ID-351A/ARN

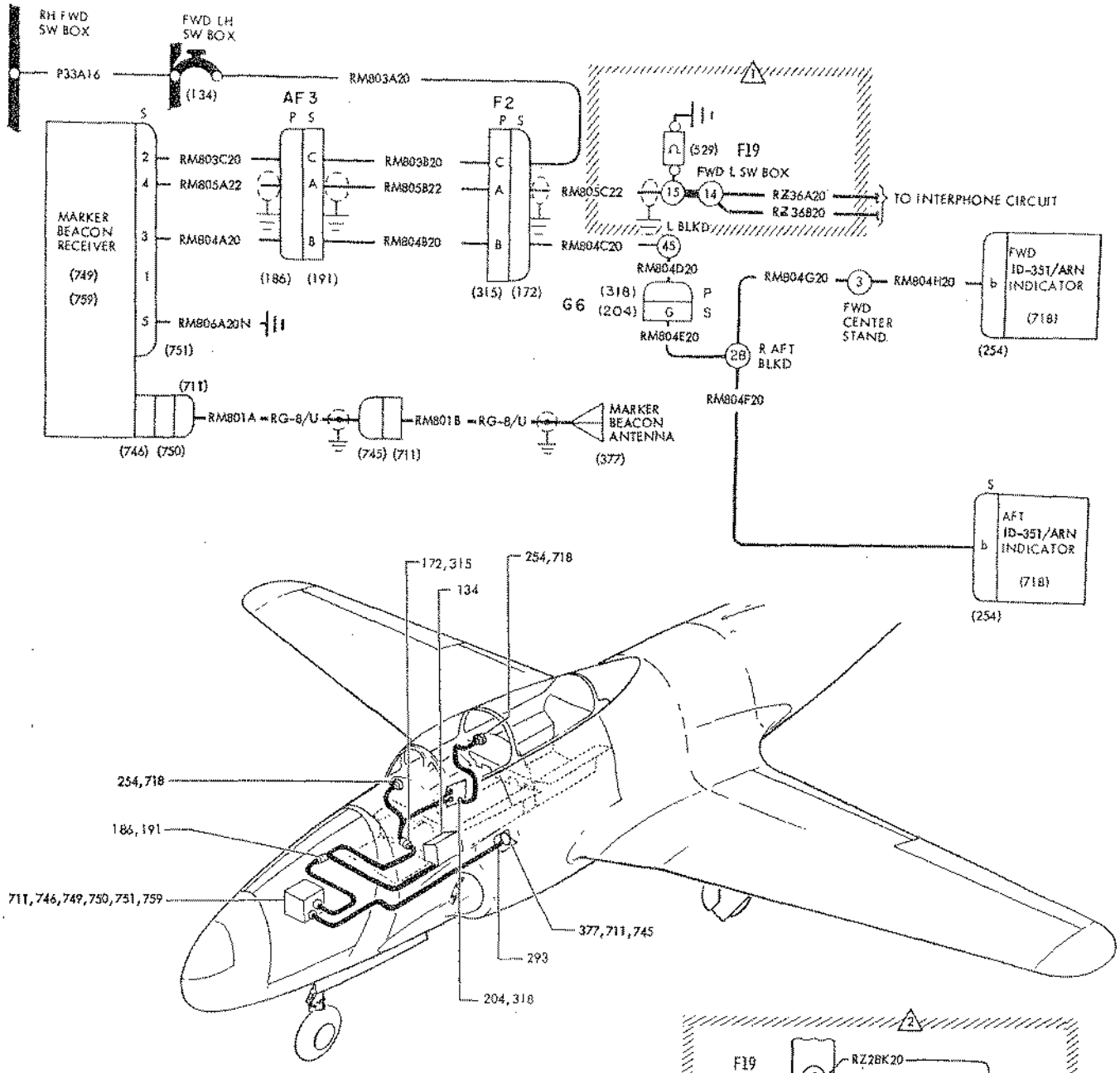
GB 219
EM20-4T-8-380

NOTE

⚠1 USED ON AIRPLANES AF SERIAL NO. 56-1624 AND SUBSEQUENT

AN/ARN-12
MARKER BEACON CIRCUIT
MODEL T-33A-5
PRIOR TO AF SERIAL NO. 57-530

Figure 8-291. AN/ARN-12 Marker Beacon Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
172	CONNECTOR			AN3106B-14S-5P
186	CONNECTOR			AN3106B-28-12S
191	CONNECTOR			AN3100C-28-12P
204	CONNECTOR			AN3102A-20-29S
254	CONNECTOR			AN3108B-28-12S
315	CONNECTOR			AN3102A-14S-5S
318	CONNECTOR			AN3106B-20-29P
377	ANTENNA	GFAE		AT-134A/ARN-12
529	RESISTOR		150Ω 1/2W	RC20BF151K
711	ADAPTER			UG-27C/U
718	INDICATOR	GFAE		ID-351A/ARN
745	CONNECTOR			UG-21D/U
746	CONNECTOR			UG-1185/U
749	MOUNT			MT-1546/ARN-32
750	ADAPTER			UG-349A/U
751	CONNECTOR			MM-5-11
759	RECEIVER			R-666/ARN-32

1 USED PRIOR TO AF SERIAL NO. 57-634

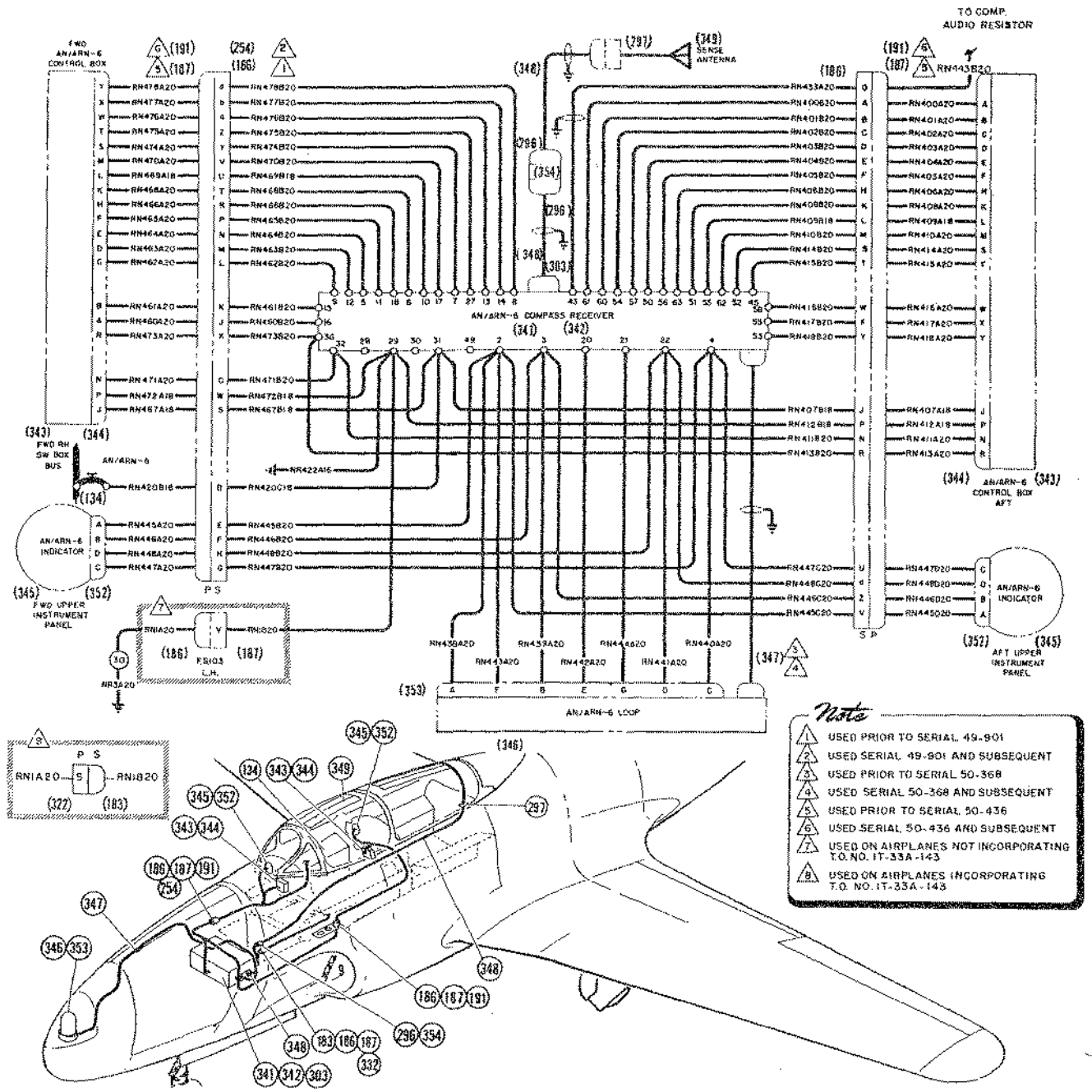
2 USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

AN/ARN-32
MARKER BEACON CIRCUIT
MODEL T-33A-5
APPLIES TO AF SERIAL NO. 57-530 AND SUBSEQUENT

EM20-44-8-109

GB 3556

Figure 8-292. AN/ARN-32 Marker Beacon Circuit



Note

1. USED PRIOR TO SERIAL 49-901
2. USED SERIAL 49-901 AND SUBSEQUENT
3. USED PRIOR TO SERIAL 50-368
4. USED SERIAL 50-368 AND SUBSEQUENT
5. USED PRIOR TO SERIAL 50-436
6. USED SERIAL 50-436 AND SUBSEQUENT
7. USED ON AIRPLANES NOT INCORPORATING T.O. NO. 1T-33A-143
8. USED ON AIRPLANES INCORPORATING T.O. NO. 1T-33A-143

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106B-28-11S
186	CONNECTOR			AN3106-28-12P
187	CONNECTOR			AN3102P-28-12P
191	CONNECTOR			AN3100C-28-12P
254	CONNECTOR			AN3108-28-12S
296	PLUG	GFAE		PL-259A
297	PLUG	GFAE		SO-239
303	ADAPTER	GFAE		M-359
322	CONNECTOR			AN3100C-28-11P
341	COMPASS UNIT	GFAE		R-103(A)/ARN-6
342	MOUNTING	GFAE		MT-273/(A)/ARN-6
343	CONTROL BOX	GFAE		C-349/(A)/ARN-6
344	MOUNTING	GFAE		MT-275A/ARN-6
345	INDICATOR	GFAE		ID-99(A)/ARN-6
346	LOOP	GFAE		AS-313(B)/ARN-6
347	CORD	GFAE		CG-133/ARN-6
348	CORD, COAXIAL	GFAE		CG-133/ARN-6
349	SENSE ANTENNA	LOCKHEED		CG-320/ARN-6
352	PLUG			204675
353	PLUG	GFAE		AN3106-145-2S
354	PLUG	GFAE		AN3104-16-1S
				PL-274

AN/ARN-6

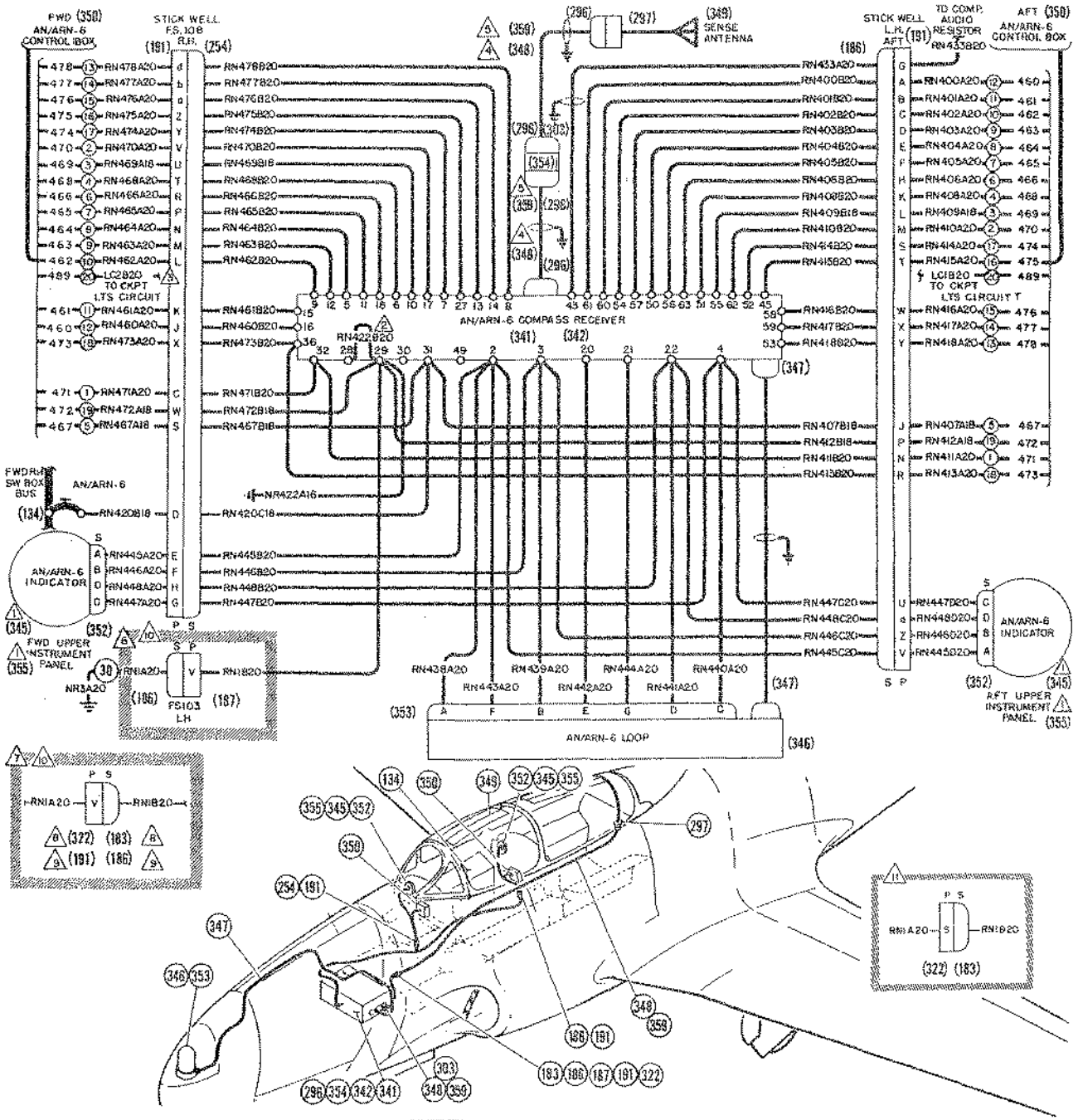
RADIO COMPASS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 48-356 THROUGH 51-4048

EM20-24-6-154
CB 49J2

Figure 8-293. AN/ARN-6 Radio Compass Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106B-28-11S
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102F-28-12P
191	CONNECTOR			AN3100C-28-12P
254	CONNECTOR			AN3106-28-12S
296	CONNECTOR	GFAE		FL-239A
297	CONNECTOR	GFAE		SO-239
303	ADAPTER	GFAE		M-359
322	CONNECTOR			AN3100C-28-11P
341	COMPASS UNIT	GFAE		R-103A/ARN-6
342	MOUNTING	GFAE		MT-273A/ARN-6
1 345	INDICATOR	GFAE		ID-90A/ARN-6
346	LOOP	GFAE		AS-3138/ARN-6
347	CORD			CG-133/ARN-6
4 348	CORD COAXIAL	GFAE		CG-320/ARN-6
349	SENSE ANTENNA	LOCKHEED		204675
350	CONTROL BOX			C-403A/A
352	CONNECTOR			AN3108-14S-2S
353	CONNECTOR	GFAE		AN3106-14-15
354	CONNECTOR	GFAE		FL-274
1 355	INDICATOR	GFAE		ID-91A/ARN-6
5 359	CORD COAXIAL	LOCKHEED		204659

Note

1. ALTERNATES ON AF SERIAL NOS. 51-4090 THROUGH 51-9235
2. USED ON AF SERIAL NOS 51-4167 THROUGH 51-9235
3. WIRE NO. IS LG2B20 ON AF SERIAL NOS. 51-4329 THROUGH 51-9235
4. USED PRIOR TO AF SERIAL NO. 51-6582
5. USED ON AF SERIAL NOS 51-6582 YHROUGH 51-9235
6. USED PRIOR TO AF SERIAL NO. 51-6751
7. USED ON AF SERIAL NOS. 51-6751 THROUGH 51-9235
8. USED ON USAF T-33A AIRCRAFT ONLY
9. USED ON MDAP T-33A AIRCRAFT ONLY
10. USED ON AIRPLANES NOT INCORPORATING T.O. NO 1T-33A-143
11. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-143

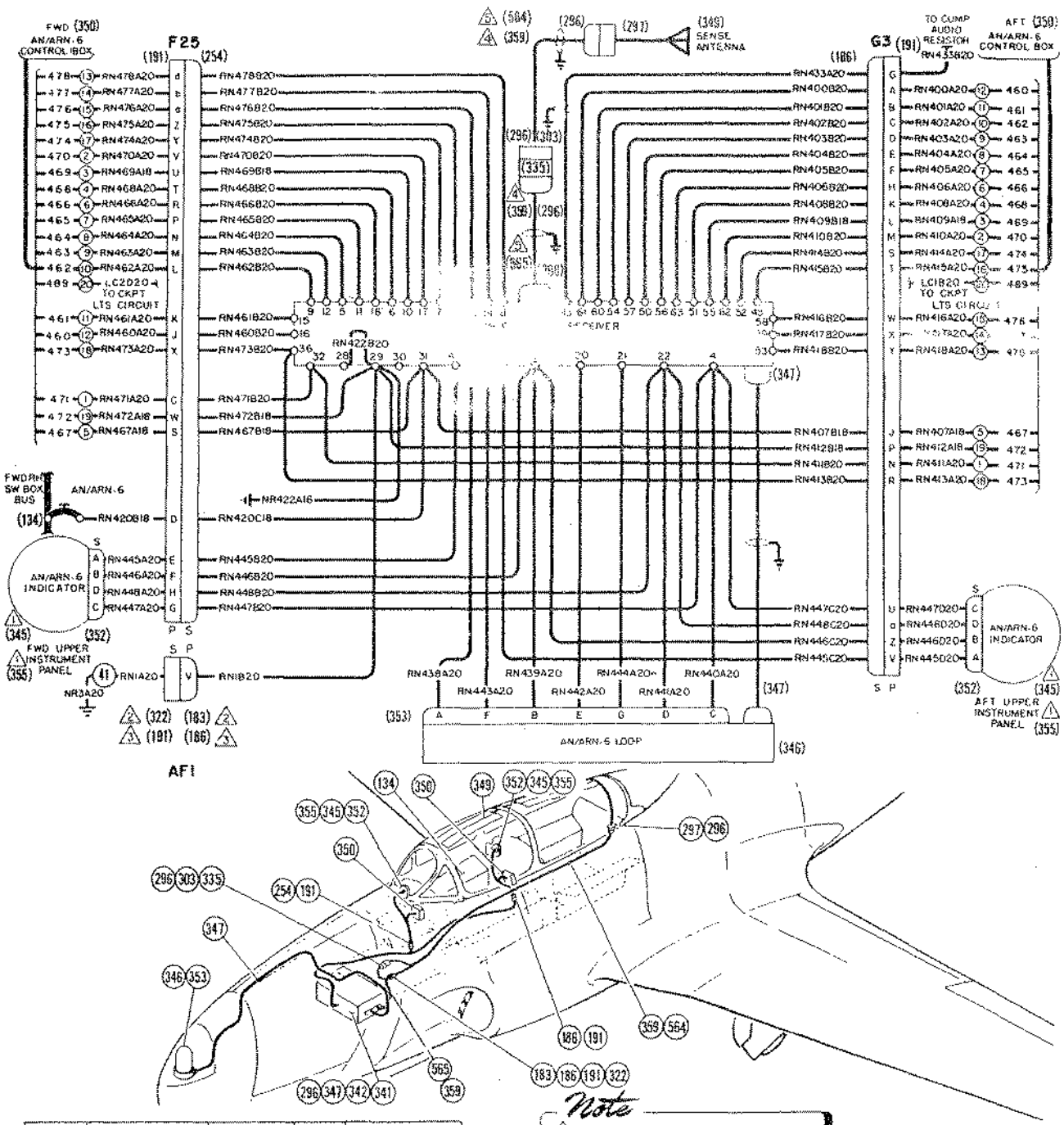
GB 8858
M2048D-8-155

AN/ARN-6 RADIO COMPASS CIRCUIT

MODEL T-33A

APPLIES TO AF SERIAL NOS. 51-4049 THROUGH 51-9235

Figure 8-294. AN/ARN-6 Radio Compass Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106B-28-11S
186	CONNECTOR			AN3106-28-12S
191	CONNECTOR			AN3100C-28-12P
254	CONNECTOR			AN3108-28-12S
296	CONNECTOR			PL-259A
297	CONNECTOR			SO-239
303	ADAPTER			M-359
322	CONNECTOR			AN3100C-28-11P
335	ADAPTER			UG363/U
341	COMPASS UNIT	GFAE		R-505A/ARN-6
342	MOUNTING	GFAE		MT-273/ARN-6
△1 345	INDICATOR	GFAE		ID-90A/ARN-6
346	LOOP	GFAE		AS-3138 ARN-6
347	CORD			CG-133 ARN-6
349	SENSE ANTENNA	LOCKHEED		204675
350	CONTROL BOX			C-4037A
352	CONNECTOR			AN3108-14S-2S
353	CONNECTOR			AN3106-16-1S
△1 355	INDICATOR	GFAE		ID-91A/ARN-6
△3 △4 359	CORD,COAXIAL	LOCKHEED		204650
△3 564	CABLE	UNIVOX		5302
△2 565	CABLE	UNIVOX		5303

Note

△1 ALTERNATES

△2 USED ON USAF T-33A AIRCRAFT ONLY

△3 USED ON MDAP T-33A AIRCRAFT ONLY

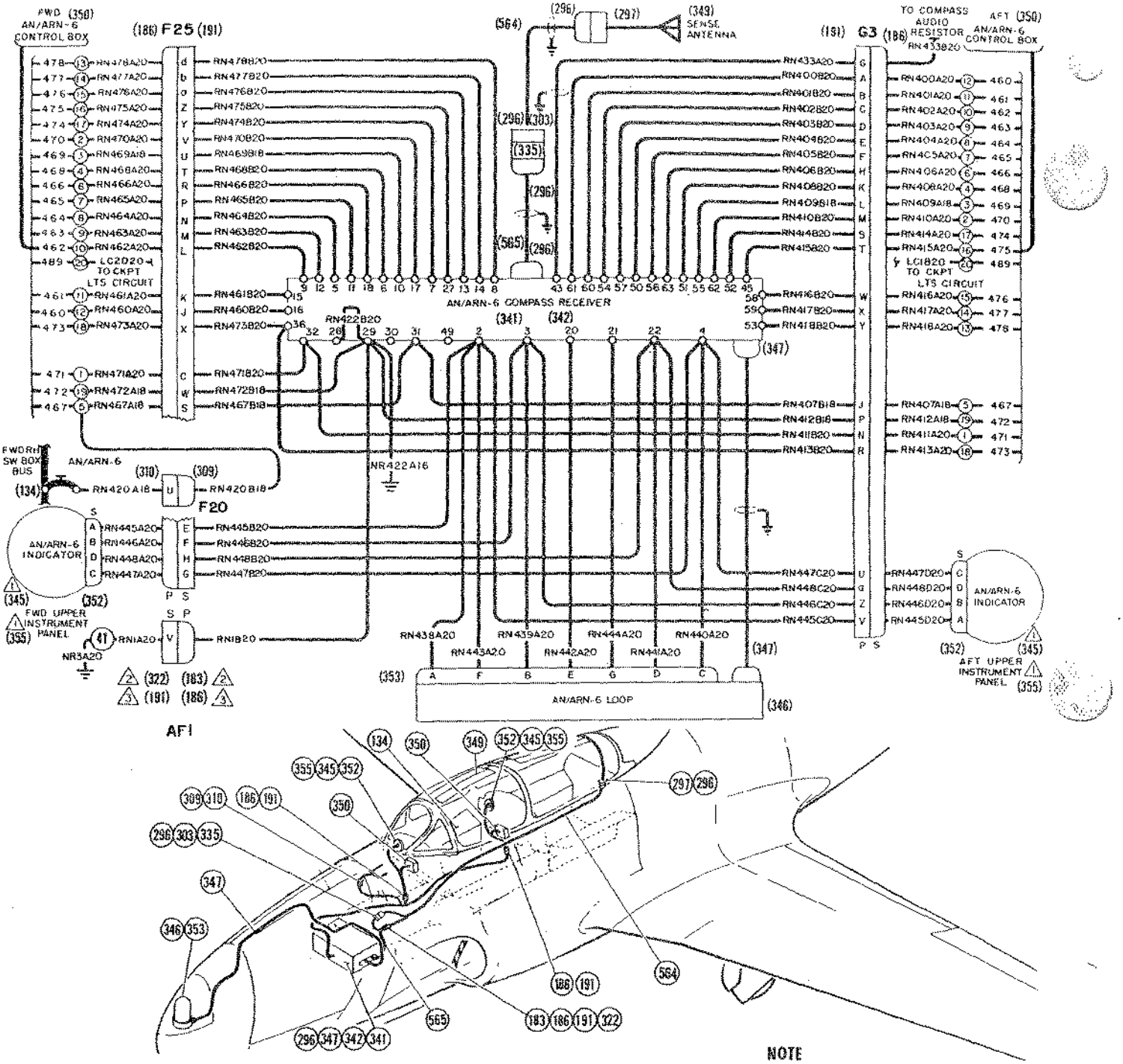
△4 USED PRIOR TO AF SERIAL NO 52-9335 EXCEPT 51-17487 THROUGH 51-17556

△5 USED ON AF SERIAL NO 51-17487 THROUGH 51-17556 AND 52-9335 AND SUBSEQUENT

AN/ARN-6 RADIO COMPASS CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NOS 51-9236 THROUGH 52-9759, 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

GB 8877
M20-ARD-8-174

Figure 8-295. AN/ARN-6 Radio Compass Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			AN3106B-28-11S
186	CONNECTOR			AN3106-28-12S
191	CONNECTOR			AN3100C-28-12P
296	CONNECTOR			PL-259A
297	CONNECTOR			SO-239
303	ADAPTER			M-359
309	CONNECTOR			AN3102A-32-7P
310	CONNECTOR			AN3106B-32-7S
322	CONNECTOR			AN3100C-28-11P
335	ADAPTER			UG363/U
341	COMPASS UNIT	GFAE		R-101A/ARN-6
4 342	MOUNTING	GFAE		MT-273/ARN-6
1 345	INDICATOR	GFAE		ID-90A/ARN-6
346	LOOP	GFAE		AS-3138/ARN-6
347	CORD			CG-133/ARN-6
349	SENSE ANTENNA	LOCKHEED		204675
350	CONTROL BOX			C-403/A
352	CONNECTOR			AN3108-145-2S
353	CONNECTOR			AN3106-16-1S
1 355	INDICATOR	GFAE		ID91A/ARN-6
364	CABLE	UNIVOX		5302
565	CABLE	UNIVOX		5303

NOTE

1. ALTERNATES
2. USED ON USAF T-33A AIRCRAFT ONLY
3. USED ON MDAP T-33A AIRCRAFT ONLY
4. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 54-1525 AND SUBSEQUENT

AN/ARN-6 RADIO COMPASS CIRCUIT

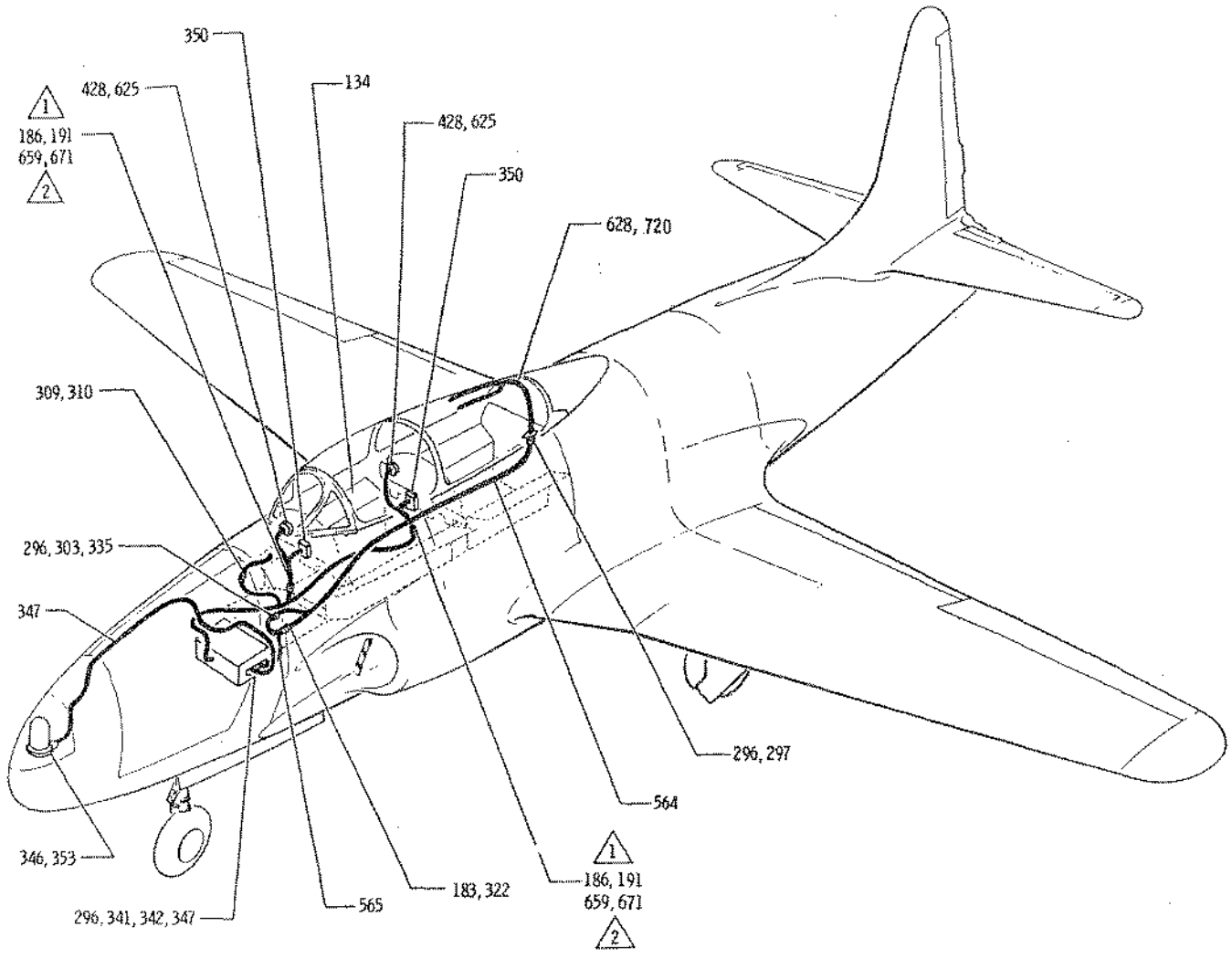
MODEL T-33A-1

APPLIES TO AF SERIAL NO. 52-9760 AND SUBSEQUENT, EXCEPT 52-9876 THROUGH 52-9940 AND 53-2687 THROUGH 53-2726

GB 8981

M20-480-8-236

Figure 8-296. AN/ARN-6 Radio Compass Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			MS3106B-28-11S
1 186	CONNECTOR			MS3106B-28-12S
1 191	CONNECTOR			MS3100C-28-12P
296	CONNECTOR			PL-259A
297	CONNECTOR			SO-239
303	ADAPTER			M-359
309	CONNECTOR			MS3102A-32-7P
310	CONNECTOR			MS3106B-32-7S
322	CONNECTOR			MS3100C-28-11P
335	ADAPTER			UG363/U
341	COMPASS UNIT	GFAE		R-101/ARN-6
342	MOUNTING	GFAE		MT-273( )/ARN-6
346	LOOP	GFAE		AS-313B/ARN-6
347	CORD			CG-122/ARN-6
350	CONTROL BOX			C-403/A
353	CONNECTOR			MS3106B-16-1S
428	CONNECTOR			MS3108B-22-14S
564	CABLE	UNIVOX		5302
565	CABLE	UNIVOX		5303
625	INDICATOR	GFAE		ID-250/ARN
628	ANTENNA ASSY	LOCKHEED		750442
2 659	CONNECTOR			CT06E-28-12P
2 671	CONNECTOR			CT00E-28-12S
720	CHOKE	OHMITE		Z-144

NOTE

1. APPLIES TO AIRPLANES PRIOR TO AF SERIAL NO. 57-634
2. APPLIES TO AIRPLANES AF SERIAL NO. 57-634 AND SUBSEQUENT.
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-571

AN/ARN-6 RADIO COMPASS CIRCUIT

MODEL T-33A-5
PRIOR TO AF SERIAL NO. 58-504

GB 8779
M20-48D-8-381

Figure 8-297. AN/ARN-6 Radio Compass Circuit (Sheet 1 of 2)

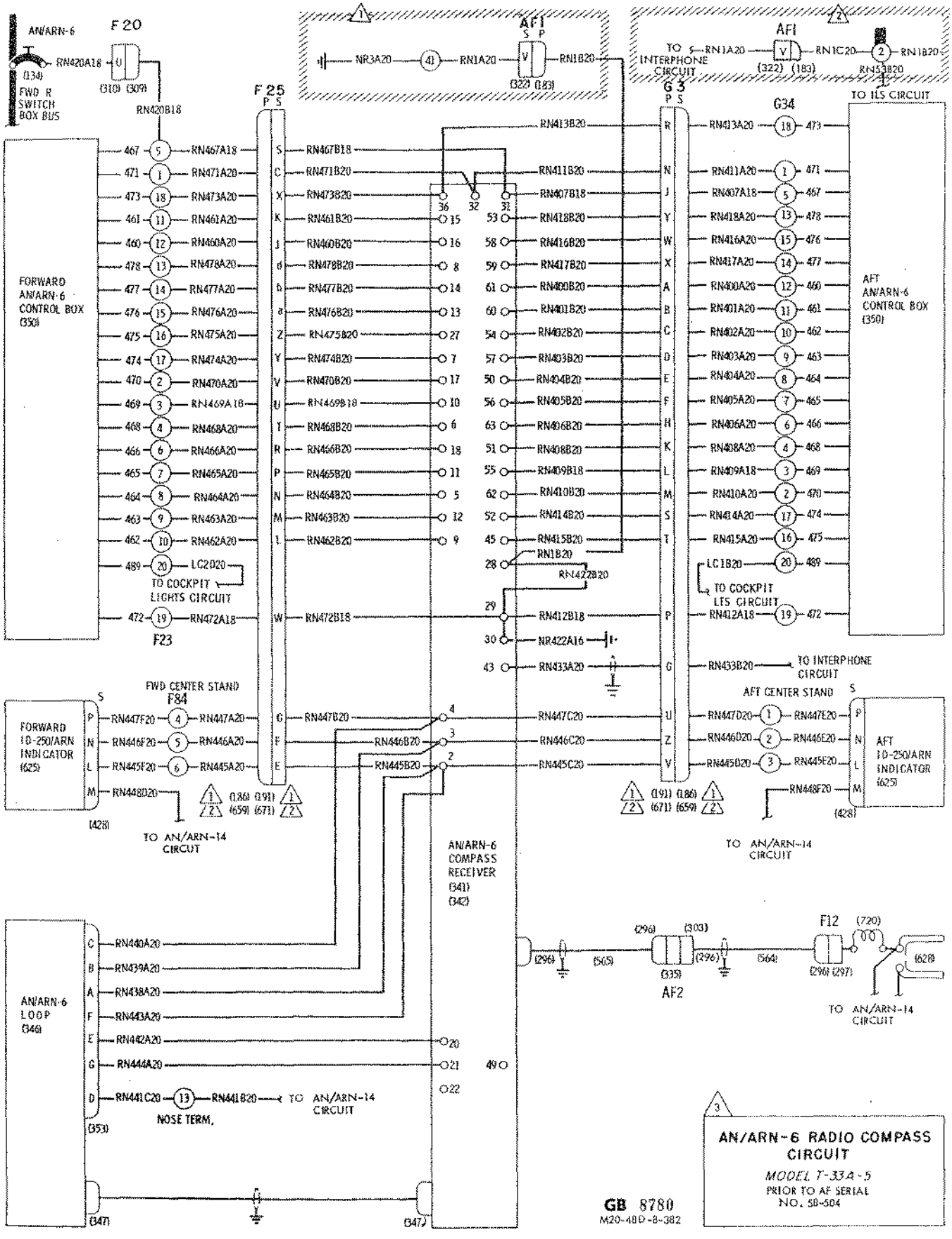
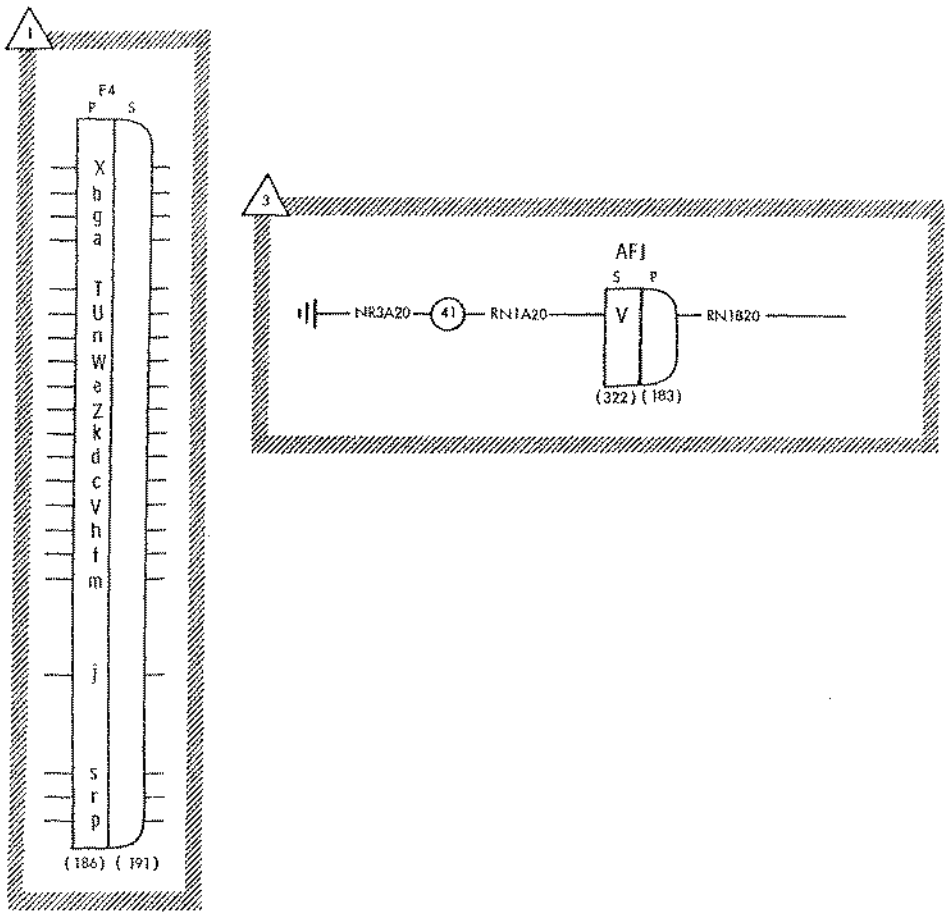


Figure 8-297. AN/ARN-6 Radio Compass Circuit (Sheet 2 of 2)



NOTE

1. USED PRIOR TO AF SERIAL NO. 51-4127
2. USED ON AF SERIAL NO. 51-4127 AND SUBSEQUENT
3. USED PRIOR TO AF SERIAL NO. 57-634
4. USED ON AF SERIAL NO. 57-634 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			MS31068-28-11S
186	CONNECTOR			MS3106B-28-12S
191	CONNECTOR			MS3100C-28-12P
296	CONNECTOR			PL-259A
297	CONNECTOR			SO-239
303	ADAPTER			M-359
322	CONNECTOR			MS3100C-28-11P
335	ADAPTER			UG363/U
341	COMPASS UNIT	GFAE		R-101/ARN-6
342	MOUNTING	GFAE		MT-273 ( ) /ARN-6
346	LOOP	GFAE		AS-3138/ARN-6
347	CORD			CG-122/ARN-6
350	CONTROL BOX			C-403/A
353	CONNECTOR			MS31068-16-1S
428	CONNECTOR			MS31088-22-14S
564	CABLE	UNIVOX		5302
565	CABLE	UNIVOX		5303
625	INDICATOR	GFAE		ID-250/ARN
628	ANTENNA ASSY	LOCKHEED		750442
644	CONTROL			C-1514/A
645	CONNECTOR			MRE345-GHZ
659	CONNECTOR			CT06E-28-12P
671	CONNECTOR			CT00E-28-12S
720	CHOKE	OHMITE		Z-144

GB 8857
M20-48D-8-192

AN/ARN-6 RADIO COMPASS CIRCUIT

MODEL T-33A-5

APPLIES TO AIRPLANES PRIOR TO AF SERIAL NO. 58-504 INCORPORATING T.O. 1T-33A-571

Figure 8-298. AN/ARN-6 Radio Compass Circuit (Sheet 1 of 2)

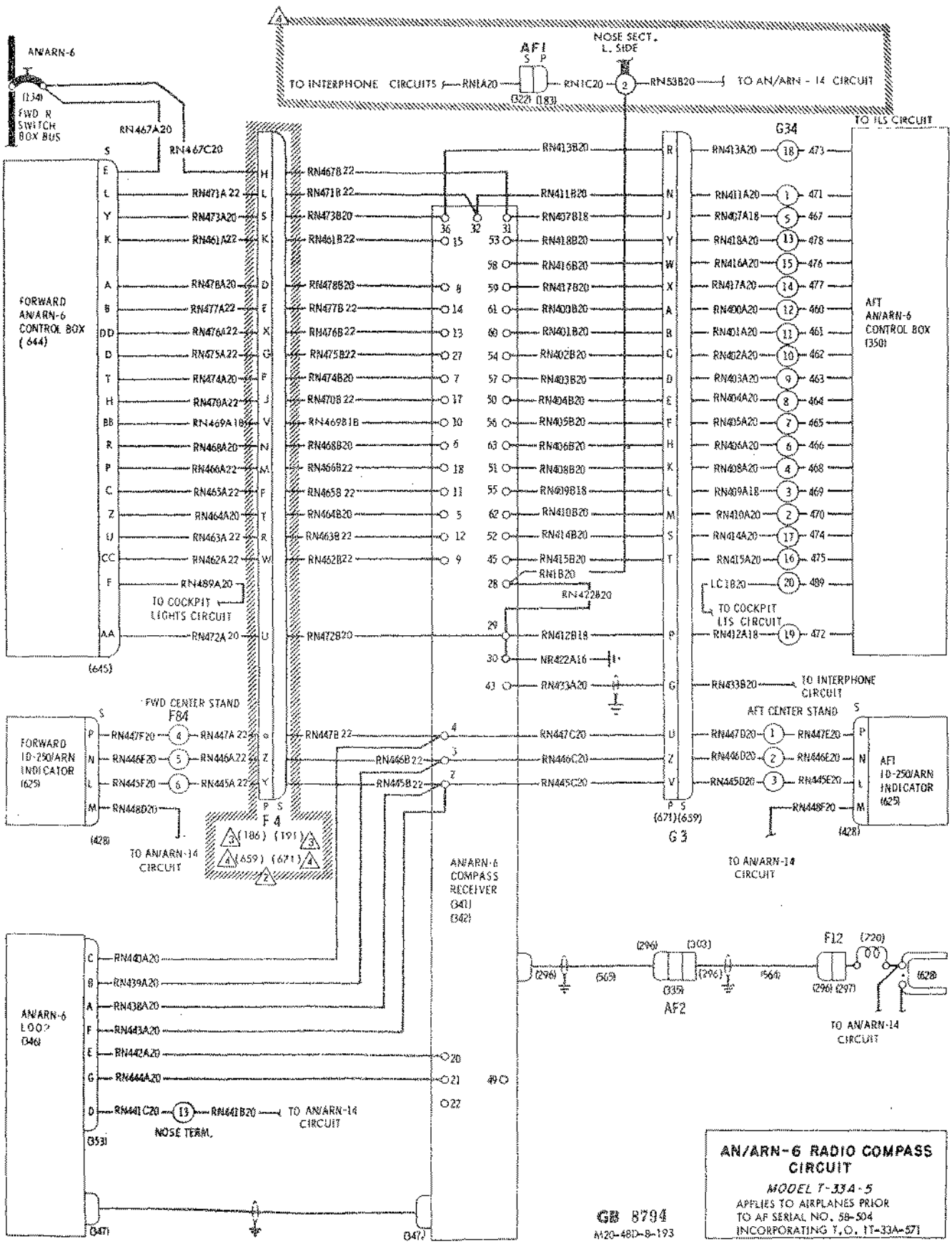
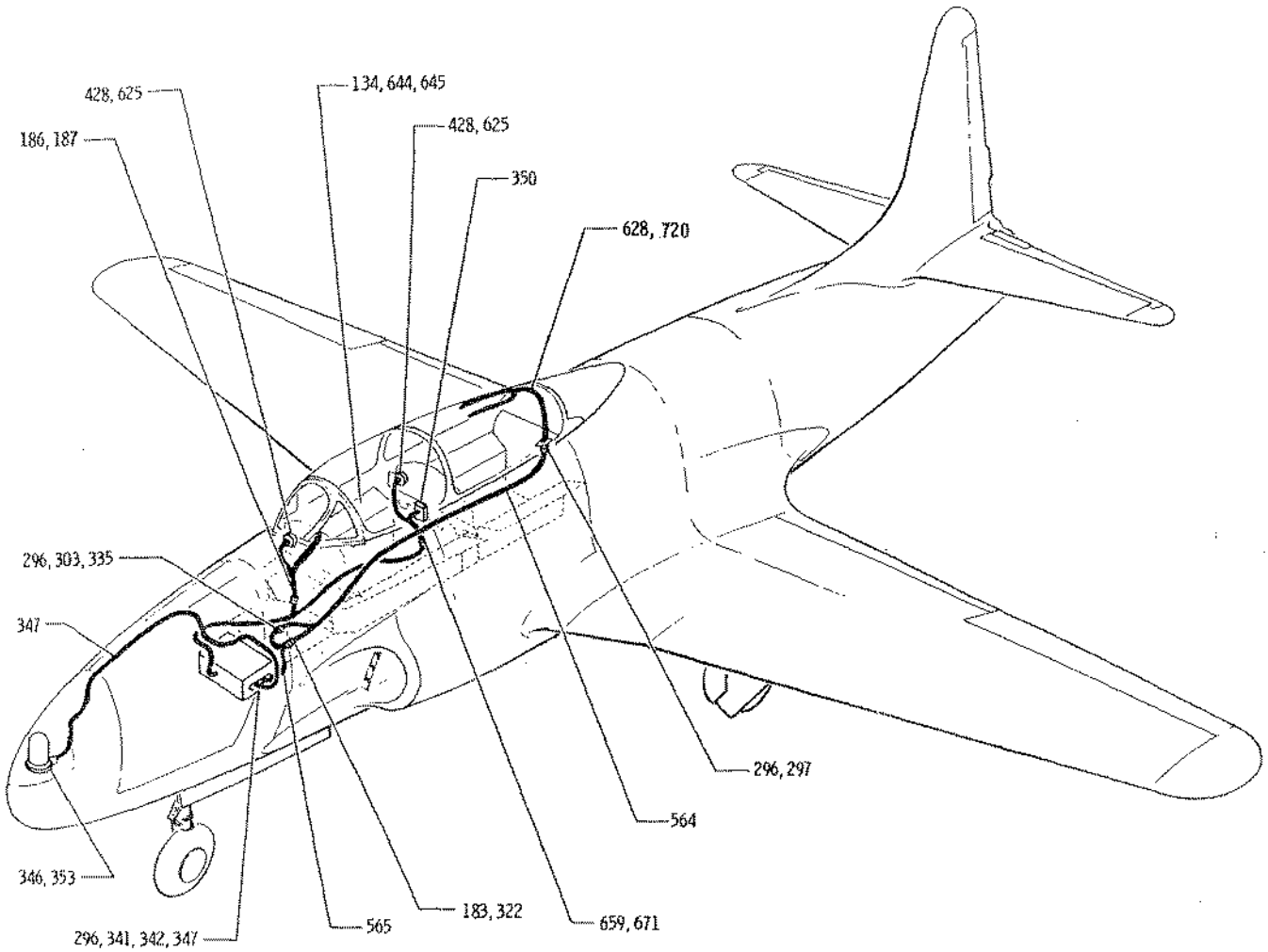


Figure 8-298. AN/ARN-6 Radio Compass Circuit (Sheet 2 of 2)



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
134	CIRCUIT PROTECTOR			AN3161-P5
183	CONNECTOR			MS3106B-28-11S
186	CONNECTOR			MS3106B-28-12S
187	CONNECTOR			MS3102C-28-12P
296	CONNECTOR			PL-259A
297	CONNECTOR			SO-239
303	ADAPTER			M-359
322	CONNECTOR			MS3100C-28-11P
335	ADAPTER			UG363/U
341	COMPASS UNIT	GFAE		R-101/ARN-6
342	MOUNTING	GFAE		MT-273 ( ) /ARN-6
346	LOOP	GFAE		AS-313B/ARN-6
347	CORD			CG-122/ARN-6
350	CONTROL BOX			C-403/A
353	CONNECTOR			MS3106B-16-1S
428	CONNECTOR			MS3108B-22-14S
564	CABLE	UNIVOX		5302
565	CABLE	UNIVOX		5303
625	INDICATOR	GFAE		ID-250/ARN
628	ANTENNA ASSY	LOCKHEED		750442
644	CONTROL			C-1514/A
645	CONNECTOR			MRE34S-GHZ
659	CONNECTOR			CT06E-28-12P
671	CONNECTOR			CT00E-28-12S
720	CHOKE	OHMITE		Z-144

GB 8795
M20-48D-8-158

AN/ARN-6, RADIO COMPASS CIRCUIT

MODEL T-33A-5
APPLIES TO AF SERIAL NO. 58-504 AND SUBSEQUENT

Figure 8-299. AN/ARN-6 Radio Compass Circuit (Sheet 1 of 2)

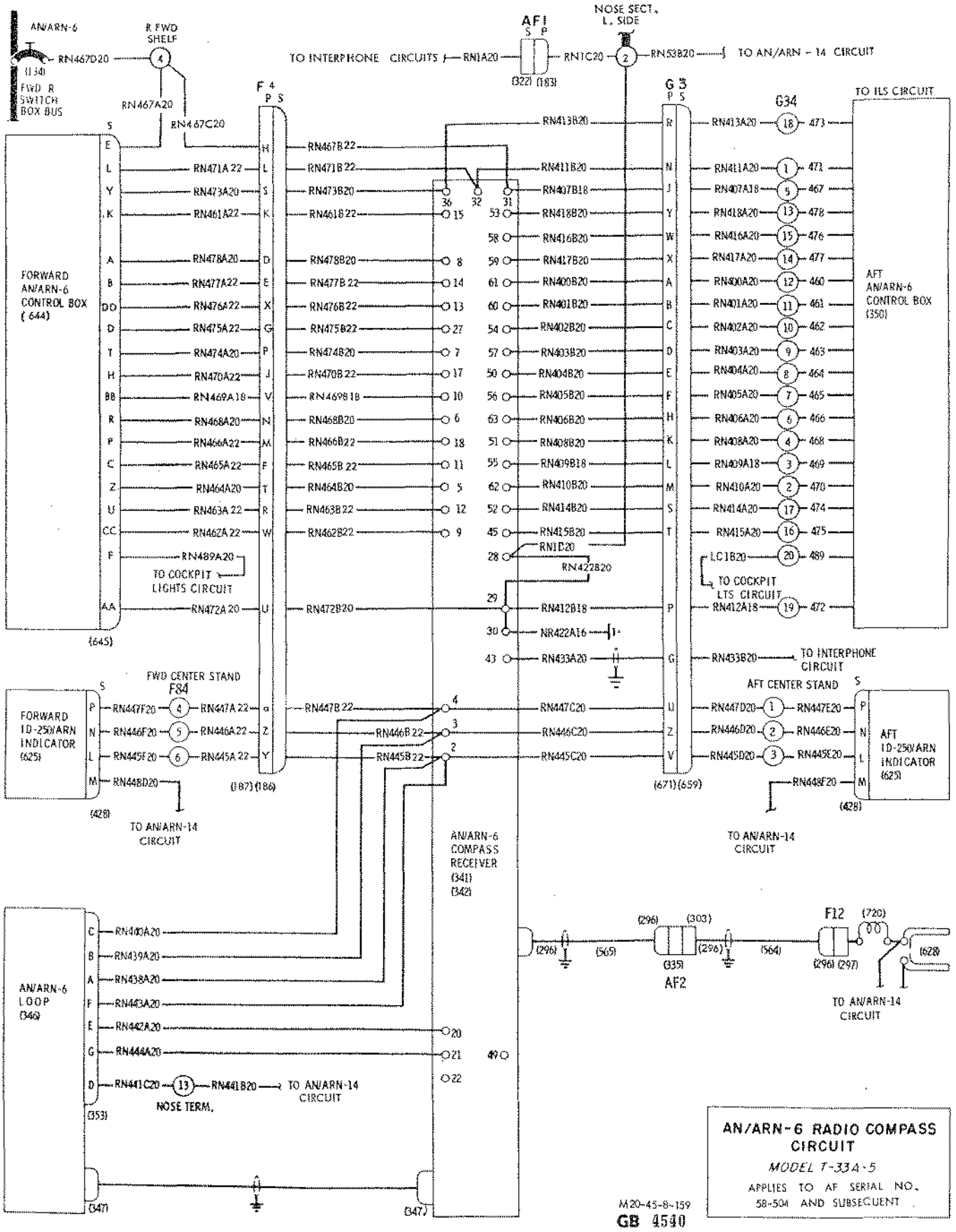


Figure 8–299. AN/ARN-6 Radio Compass Circuit (Sheet 2 of 2)

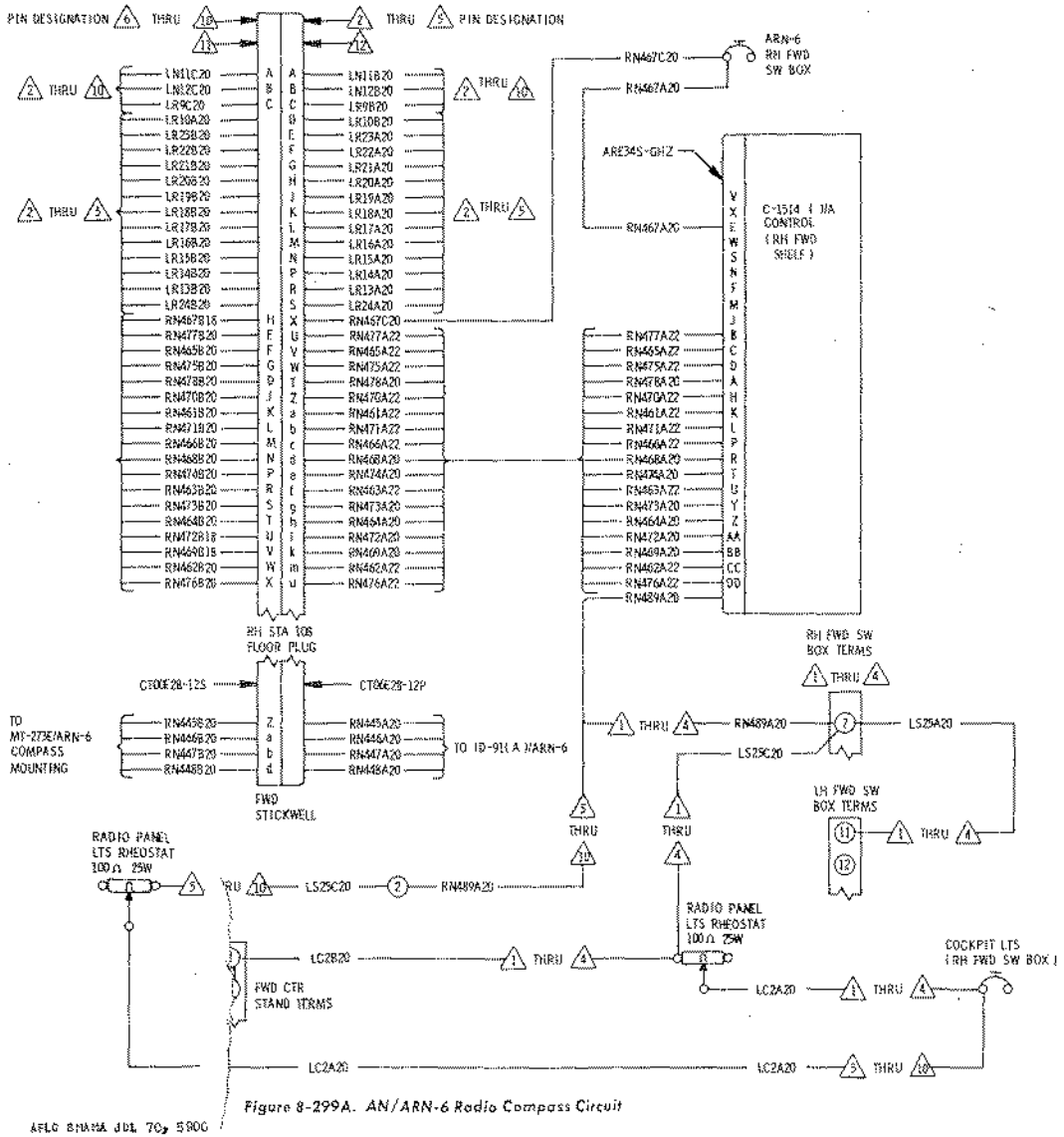


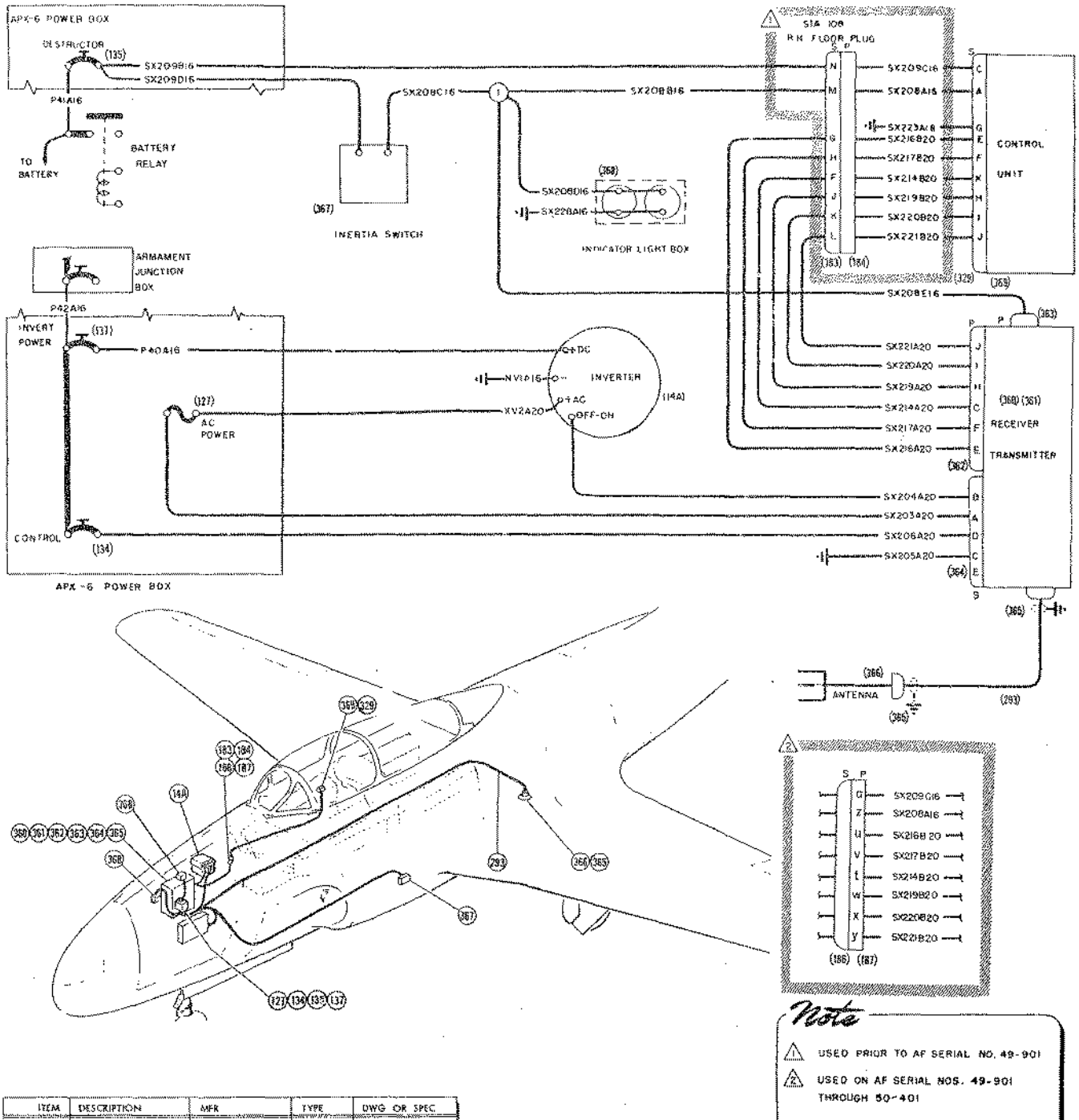
Figure 8-299A. AN/ARN-6 Radio Compass Circuit

NOTES: APPLIES TO:

1. APPLIES TO MODEL T33A-1L0 AIRCRAFT, AF SERIAL NO. 48-356 THRU 48-475, 48-913 THRU 48-920 AND 49-879 THRU 49-900.
2. APPLIES TO MODEL T33A-1L0 AIRCRAFT, AF SERIAL NO. 49-901 THRU 49-1006, 49-2157 THRU 49-2772 AND 50-328 THRU 50-401.
3. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT, AF SERIAL NO. 50-402 THRU 50-431, 50-433 THRU 50-454, 50-1272 THRU 50-1276 AND 51-4019 THRU 51-4046.
4. APPLIES TO MODEL T33A-1L0 AIRCRAFT, AF SERIAL NO. 51-4047 AND 51-4048.
5. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT
6. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT AF SERIAL NO. 50-432, 51-4127 THRU 51-4328
7. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT AF SERIAL NO. 51-4329 THRU 51-4535 AND 51-6497 THRU 51-6838
8. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT, AF SERIAL NO. 51-6839 THRU 51-6957 AND 51-8506 THRU 51-9235
9. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT, AF SERIAL NO. 51-9236 THRU 51-9310 51-16976 THRU 16995, 51-17388 THRU 51-17596, 52-9129 THRU 52-9259, 52-9874 THRU 52-9940 AND 53-2687 THRU 53-2726
10. APPLIES TO MODEL T33A-1L0 AND T33A-1L0 MDAP AIRCRAFT, AF SERIAL NO. 52-9760 THRU 52-9875, 53-2727 THRU 53-2780, 53-4686 THRU 53-6152, 54-1522 THRU 54-1618, 54-2689 THRU 54-2728, 54-2950 THRU 54-2955, 54-4035 AND 54-4036, 55-2979 THRU 55-3117, 55-4332
11. CT06E28-12P RECEPTACLE, 1 REQ 1
CT06E28-21P RECEPTACLE, 1 REQ REPLACES AN3100C28-12P 2 THRU 5
AN3100C28-12P RECEPTACLE - EXISTING 6 THRU 8
AN3106B28-12S PLUG - EXISTING 9 10
12. CT06E28-12S PLUG - 1 REQ 1
CT06E28-21S PLUG - 1 REQ REPLACES AN3106B28-12S 2 THRU 5
AN3106B28-12S PLUG - EXISTING 6 THRU 8
AN3100C28-12P RECEPTACLE - EXISTING 9 10

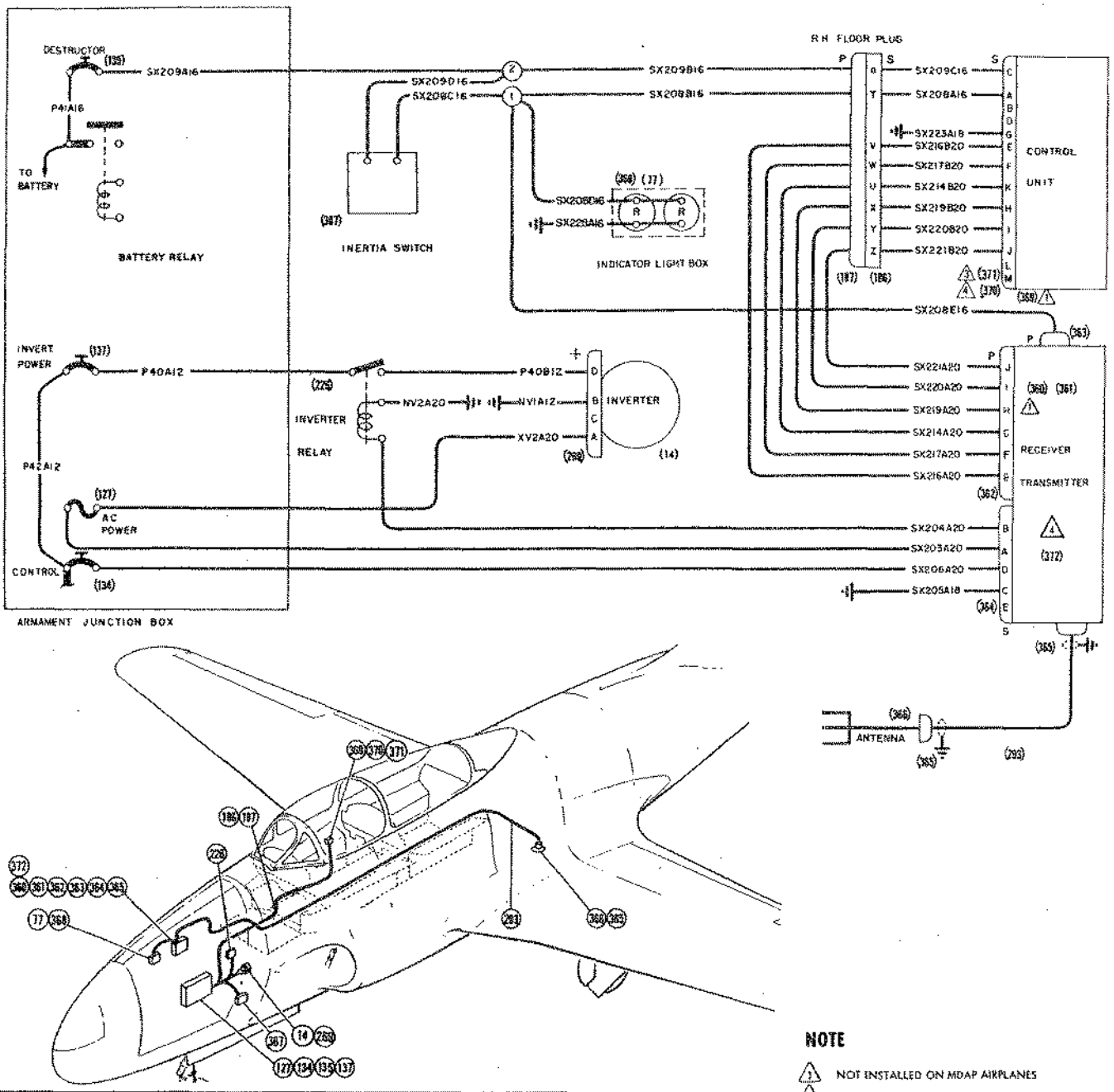
AN/ARN-6 RADIO COMPASS CIRCUIT
MODEL T-33A
INCORPORATING T.O. 1T-33A-580

M20-51-8-457



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
14A	INVERTER	ECLIPSE PIONEER	1 PHASE	3214 6 - 1A
127	FUSE	LITTELFUSE	5A	415005
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
137	CIRCUIT PROTECTOR			AN3161-P20
1 183	CONNECTOR			AN3106-28-11S
1 184	CONNECTOR			AN3102C-28-11P
2 186	CONNECTOR			AN3106-28-12S
2 187	CONNECTOR			AN3102C-28-12P
293	CABLE	GFAE		RG-8/U
329	CONNECTOR	BENDIX		CR3106A-20-27S
360	RECEIVER	GFAE		R1-92/APX-6
361	MOUNTING	GFAE		MT362/A
362	CONNECTOR			AN3108-18-1P
363	CONNECTOR			AN3108-85-1P
364	CONNECTOR			AN3108-145-5S
365	CONNECTOR			UG-59A/U
366	ANTENNA	GFAE		AT-234/APX-6 OR AT-741/A
367	SWITCH BOX	GFAE		SA-3/A
368	LIGHT BOX	GFAE		IC-727
369	CONTROL UNIT	GFAE		C-629

Figure 8-300. AN/APX-6 Identification Radar Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
14	INVERTER	ECLIPSE PIONEER	1 PHASE	12143-2
77	LAMP			AN3121-313
127	FUSE	LITTELFUSE	5A	413005
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
137	CIRCUIT PROTECTOR			AN3761-P20
186	CONNECTOR			AN3106B-2B-12S
187	CONNECTOR			AN3102C-2B-12P
226	RELAY			AN3350-2
269	CONNECTOR			AN3108B-22-4S
293	CABLE	GFAE		RG-8/U
3 ΔΔ	CONNECTOR	SCINTILLA		CB3106A-20-27S
329	RECEIVER TRANSMITTER	GFAE		RT-82/APX-6
360	MOUNTING	GFAE		MT-362A/APX-6
361	CONNECTOR			AN3108B-18-1P
362	CONNECTOR			AN3108B-8S-1P
363	CONNECTOR			AN3108B-14S-5S
364	CONNECTOR			UG-559B/U
365	CONNECTOR			AT-234/APX-6
366	ANTENNA	GFAE		OR AT-741/A
367	SWITCH BOX	GFAE		SA-3/A
368	LIGHT BOX	GFAE		BC-727
1 Δ 2 ΔΔ 4 ΔΔΔΔ	CONTROL UNIT	GFAE		C-629/APX-6
370	CONNECTOR			AN3108B-20-27S
372	DESTRUCTOR	GFAE		X3-3D

NOTE

1 Δ NOT INSTALLED ON MDAP AIRPLANES
2 ΔΔ USED PRIOR TO SERIAL NO. 51-4266
3 ΔΔΔ USED ON SERIAL NO. 51-4266 THROUGH 51-8635
4 ΔΔΔΔ USED ON AF SERIAL NO. 51-6789 AND SUBSEQUENT

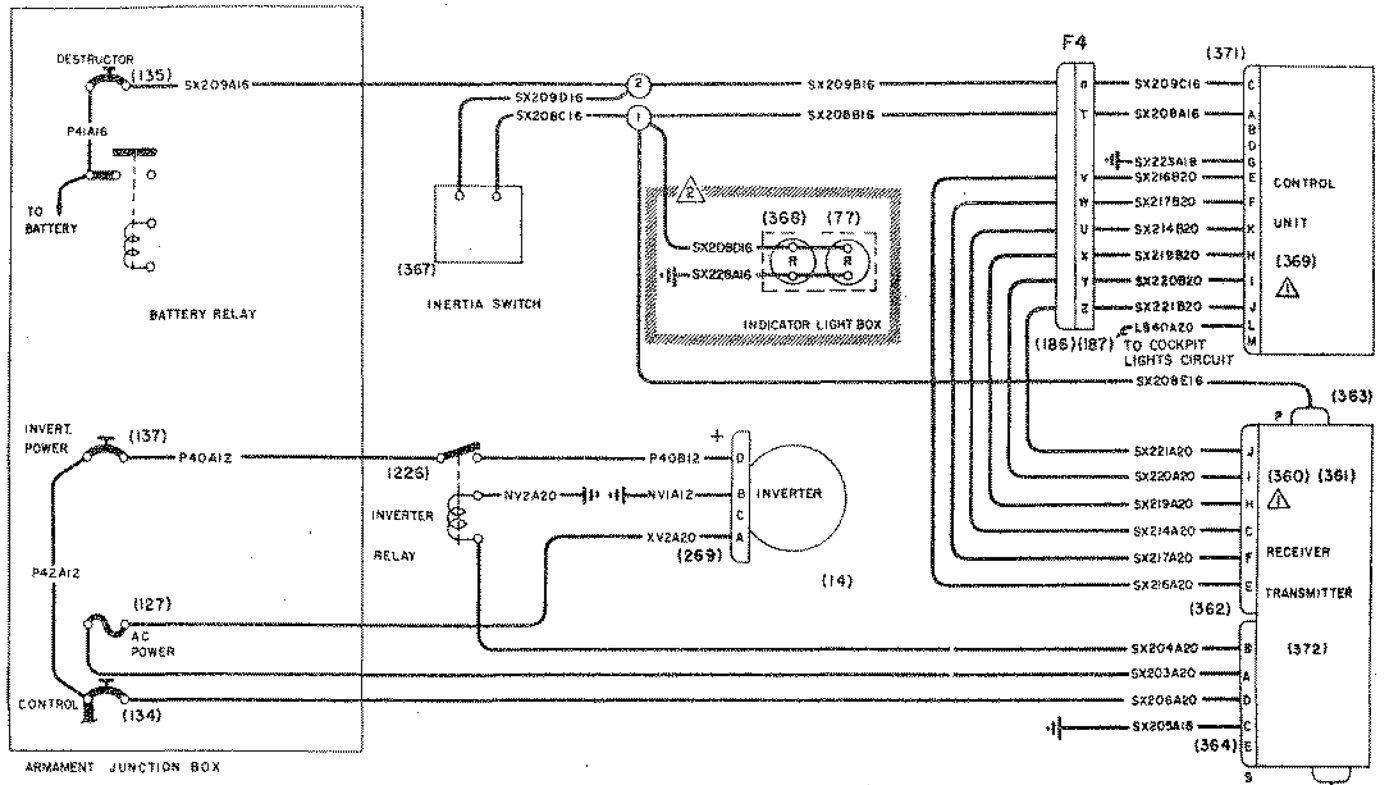
AN/APX-6 IDENTIFICATION RADAR CIRCUIT

MODEL F-33 A

APPLIES TO AF SERIAL NO. 50-402 THROUGH 51-8635

GB 8859
M20-48D-8-156

Figure 8-301. AN/APX-6 Identification Radar Circuit



NOTE

1. NOT INSTALLED ON MDAP AIRPLANES
2. NOT INSTALLED ON AF SERIAL NO. 51-9236 AND SUBSEQUENT

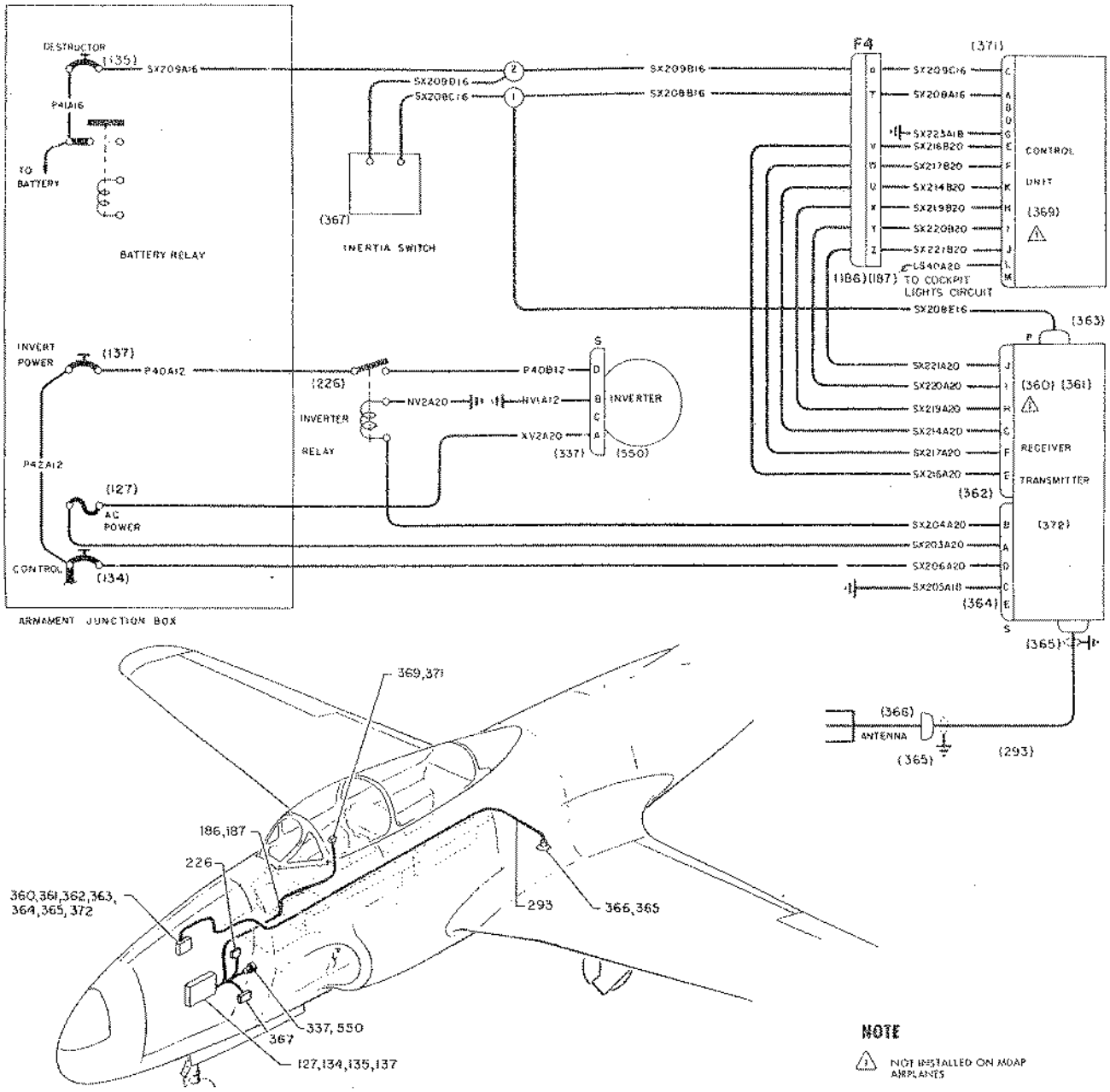
ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
14	INVERTER	ECLIPSE PIONEER	1 PHASE	12143-2
2 77	LAMP			AN3121-333
127	FUSE	LITTELFUSE	5A	413005
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P10
137	CIRCUIT PROTECTOR			AN3161-P20
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
226	RELAY			AN3350-2
269	CONNECTOR			AN3109-22-4S
293	CABLE	GFAE		RG-8/U
1 360	RECEIVER TRANSMITTER	GFAE		RT-82/APX-6
361	MOUNTING	GFAE		MT362/A
362	CONNECTOR			AN3108-18-1P
363	CONNECTOR			AN3108-8S-1P
364	CONNECTOR			AN3108-14S-5S
365	CONNECTOR			UG-59A/U
366	ANTENNA	GFAE		AT-234/APX-6 OR A-1741/A
367	SWITCH BOX	GFAE		SA-3/A
2 368	LIGHT BOX	GFAE		BC-767
1 369	CONTROL UNIT	GFAE		C-629
371	CONNECTOR	SCINTILLA		CB3106A-20-27S
372	DESTRUCTOR	GFAE		XJ-30 OR MK2 MOD O

GB 8860
M20-48D-8-157

AN/APX-6 IDENTIFICATION RADAR CIRCUIT
MODEL F33A

APPLIES TO AF SERIAL NO. 51-8636 THROUGH 53-9634 AND 52-9876 THROUGH 52-9905

Figure 8-302. AN/APX-6 Identification Radar Circuit



NOTE

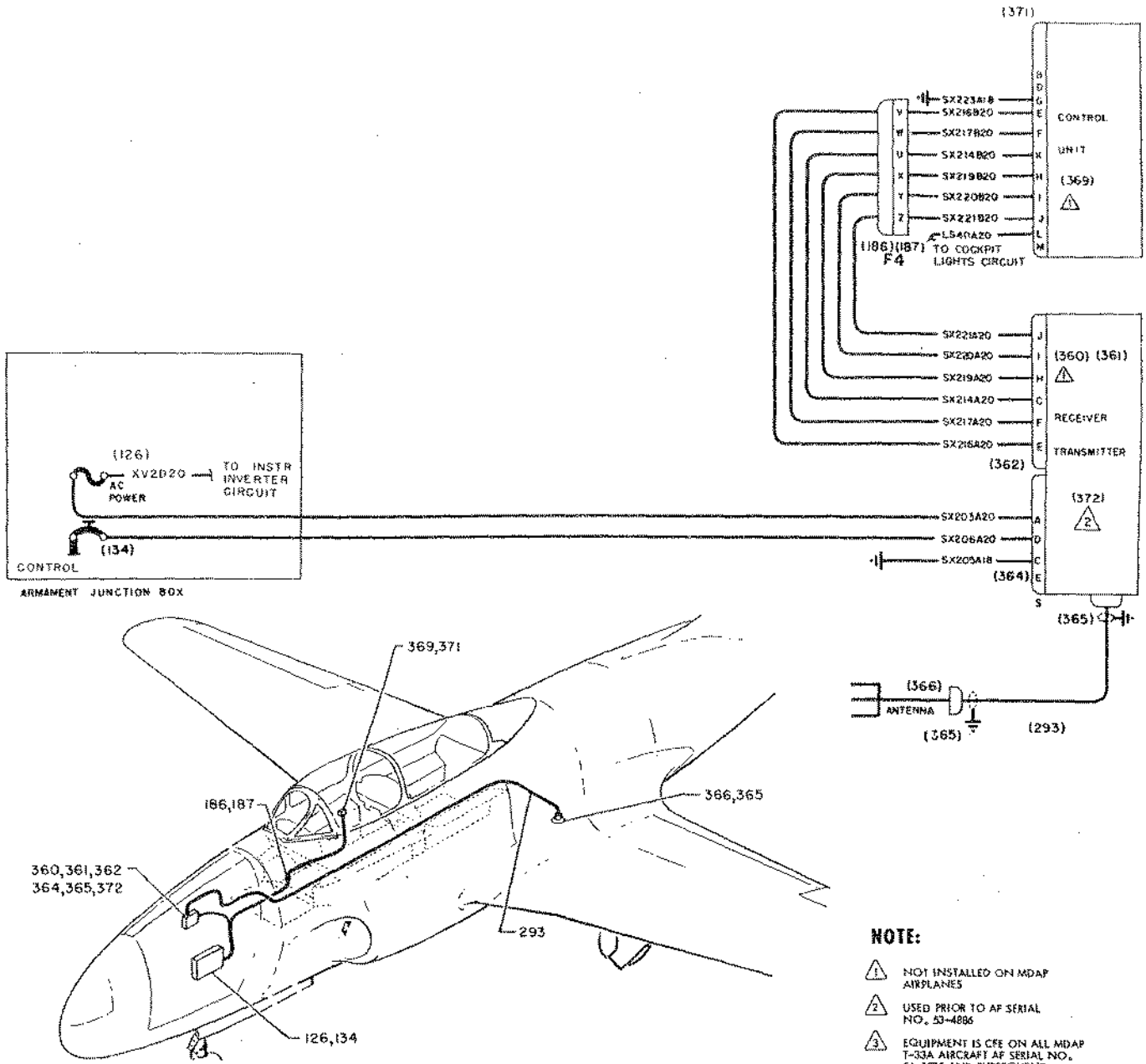
⚠ NOT INSTALLED ON MDAP AIRPLANES

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
127	FUSE	LITTELFUSE	5A	413005
134	CIRCUIT PROTECTOR			AN3161-P5
135	CIRCUIT PROTECTOR			AN3161-P18
137	CIRCUIT PROTECTOR			AN3161-P28
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
226	RELAY			AN3350-2
293	CABLE	GFAE		RG-8/U
337	CONNECTOR			AN3108B-20-4S
⚠ 360	RECEIVER TRANSMITTER	GFAE		RT-82/APX-6
361	MOUNTING	GFAE		MT362/A
362	CONNECTOR			AN3108-18-1P
363	CONNECTOR			AN3108-8S-1P
364	CONNECTOR			AN3108-14S-5S
365	CONNECTOR			UG-59A/U
366	ANTENNA	GFAE		AT-234/APX-6 OR AT-741/A
367	SWITCH BOX	GFAE		SA-3/A
⚠ 369	CONTROL UNIT	GFAE		C-629
371	CONNECTOR	SCINTILLA		DBJ106A-20-27S
372	DESTRUCTOR	GFAE		XJ-3D OR MK2 MOD 0
550	INVERTER	ECLIPSE-PIONEER		E-1617-1

AN/APX-6 IDENTIFICATION RADAR CIRCUIT
MODEL T-33A
APPLIES TO AF SERIAL NO. 52-9635 THROUGH 52-9759 AND 52-9906 THROUGH 52-9940, EXCEPT 52-9876 THROUGH 52-9905

GB 8816
M20-40D-8-210

Figure 8-303. AN/APX-6 Identification Radar Circuit



NOTE:

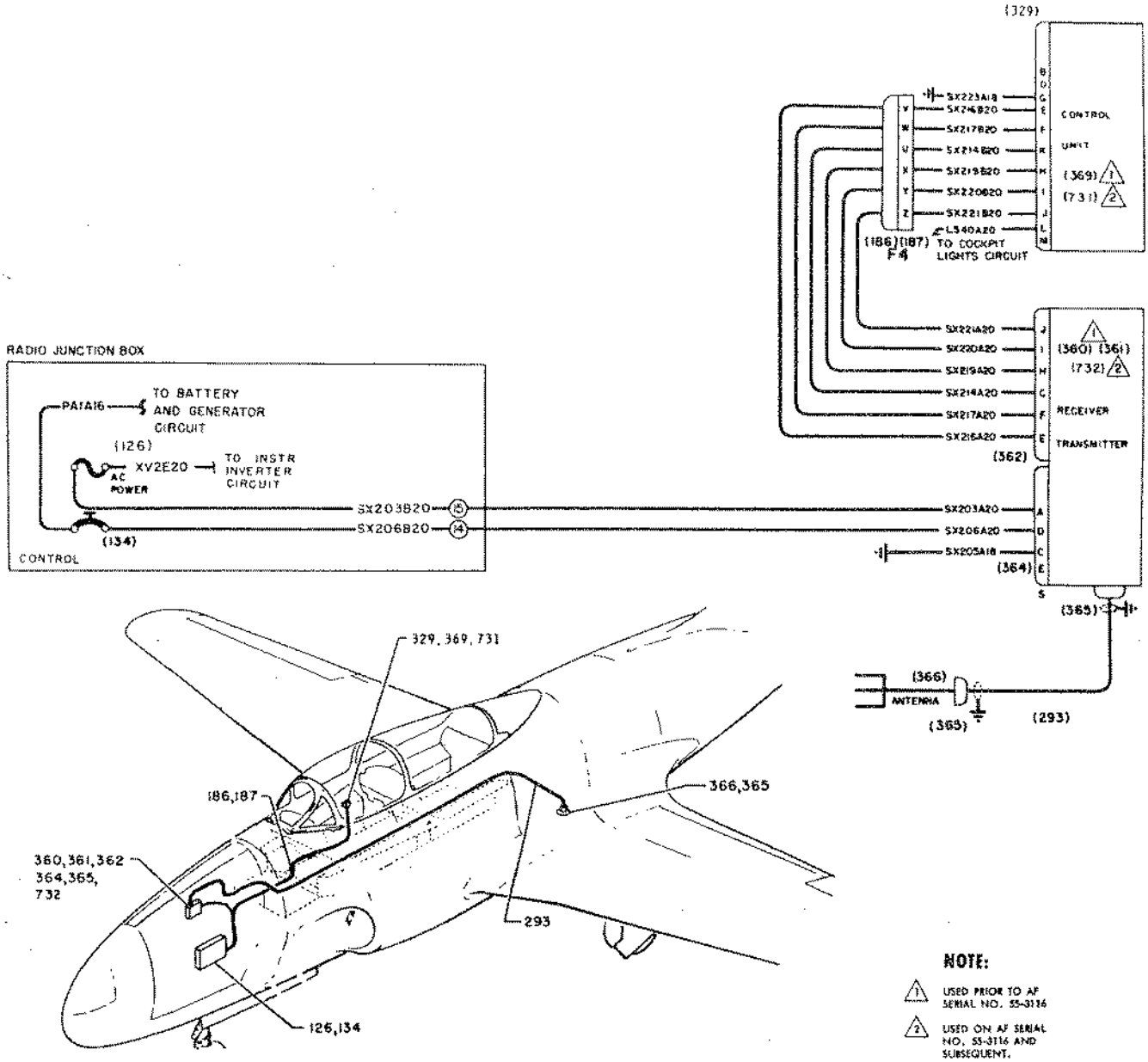
1. NOT INSTALLED ON MDAP AIRPLANES
2. USED PRIOR TO AF SERIAL NO. 53-4886
3. EQUIPMENT IS CFE ON ALL MDAP T-33A AIRCRAFT AF SERIAL NO. 54-1525 AND SUBSEQUENT

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
126	FUSE	LITTELFUSE	3A	413003
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106-28-12S
187	CONNECTOR			AN3102C-28-12P
293	CABLE	GFAE		RG-8/U
3 360	RECEIVER TRANSMITTER	GFAE		RT-82/APX-6
3 361	MOUNTING	GFAE		MT-362/A
362	CONNECTOR			AN3108-18-1P
364	CONNECTOR			AN3108-14S-5S
365	CONNECTOR			UG-59A/U
366	ANTENNA	GFAE		AT-234/APX-6 OR AT-741/A
1 369	CONTROL UNIT	GFAE		C-629
2 371	CONNECTOR	SCINTILLA		CB3106A-20-27S
372	DESTRUCTOR	GFAE		XJ-30 OR MK2 MOD 0

GB 8855
M20-48D-8-237

AN/APX-6 IDENTIFICATION RADAR CIRCUIT
MODEL T-33A-1
APPLIES TO AF SERIAL NO. 52-9760 AND SUBSEQUENT, EXCEPT 52-9906 THROUGH 52-9940

Figure 8-304. AN/APX-6 Identification Radar Circuit



NOTE:

1. USED PRIOR TO AF SERIAL NO. 55-3116
2. USED ON AF SERIAL NO. 55-3116 AND SUBSEQUENT.
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-571 AND T.O. 1T-33A-580

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
126	FUSE	LITTELFUSE	3A	413003
134	CIRCUIT PROTECTOR			AN3161-P5
186	CONNECTOR			AN3106B-28-12S
187	CONNECTOR			AN3102C-28-12P
293	CABLE	GFAE		RG-8/U
329	CONNECTOR	SCINTILLA		C93106A-20-27S
360	RECEIVER TRANSMITTER	GFAE		RT-82/APX-6
361	MOUNTING	GFAE		MT-362/A
362	CONNECTOR			AN3108B-16-1P
364	CONNECTOR			AN3108B-14S-5S
365	CONNECTOR			UG-1213/U
366	ANTENNA	GFAE		AT-234/APX-6 OR AT-748/A
369	CONTROL UNIT	GFAE		C-629
731	CONTROL	GFAE		C-1158 ( )/APX
732	RECEIVER TRANSMITTER	GFAE		RT-279 ( )/APX

3

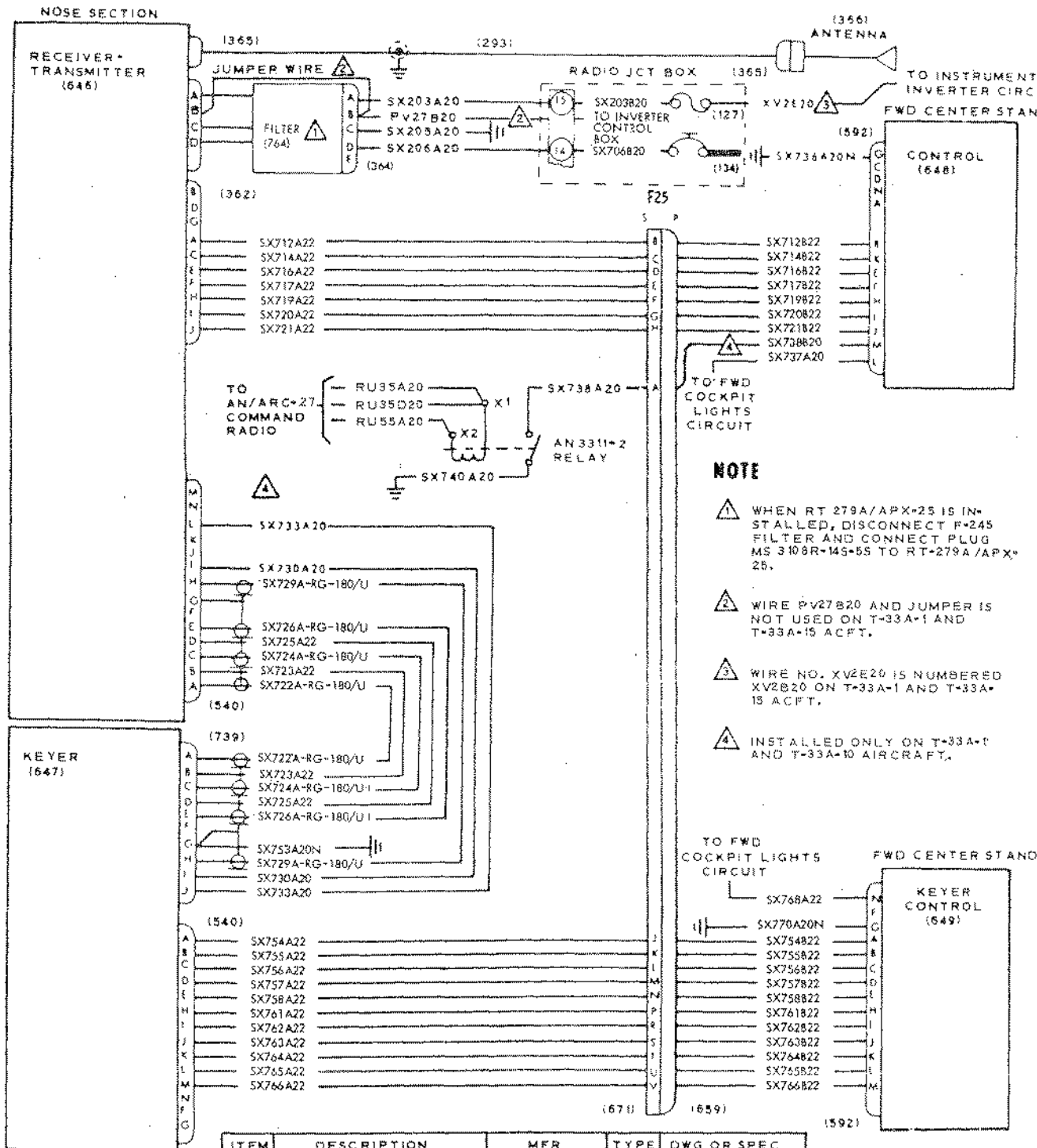
AN/APX-6 IDENTIFICATION RADAR CIRCUIT

MODEL T-33A-5

USED PRIOR TO AF SERIAL NO. 56-304

HB 8794 EM20-61-8-405

Figure 8-305. AN/APX-6 Identification Radar Circuit



ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
127	FUSE	LITTLE FUSE	5A	413005
134	CIRCUIT PROTECTOR			MS25017-5
293	CABLE, COAXIAL			RG-8/U
362	CONNECTOR			MS3108R-18-1P
364	CONNECTOR			MS3108R-14S-5S
365	CONNECTOR			UG-1213/U
366	ANTENNA			AT-234/APX-5 OR AT-741/A
540	CONNECTOR			MS3108R-20-27P
592	CONNECTOR			MS3106R-20-27S
646	RECEIVER-TRANSMITTER			RT-279()/APX-25
647	KEYER			KY95()/APX-25
648	CONTROL			C-1156/APX-25
649	KEYER CONTROL			C-1128/APX-25
659	CONNECTOR			MS3106R-28-12P
671	CONNECTOR			MS3100R-28-12S
739	CONNECTOR			MS3108R-18-1S
764	FILTER			F-243/APX-25

AN/APX-25 IDENTIFICATION RADAR CIRCUIT
MODEL T-33A, ALL SERIES
APPLIES TO AF SERIAL NUMBER 50-385 THRU 56-3694

Figure 8-306. AN/APX-25 Identification Radar Circuit

EM20-59-8-251

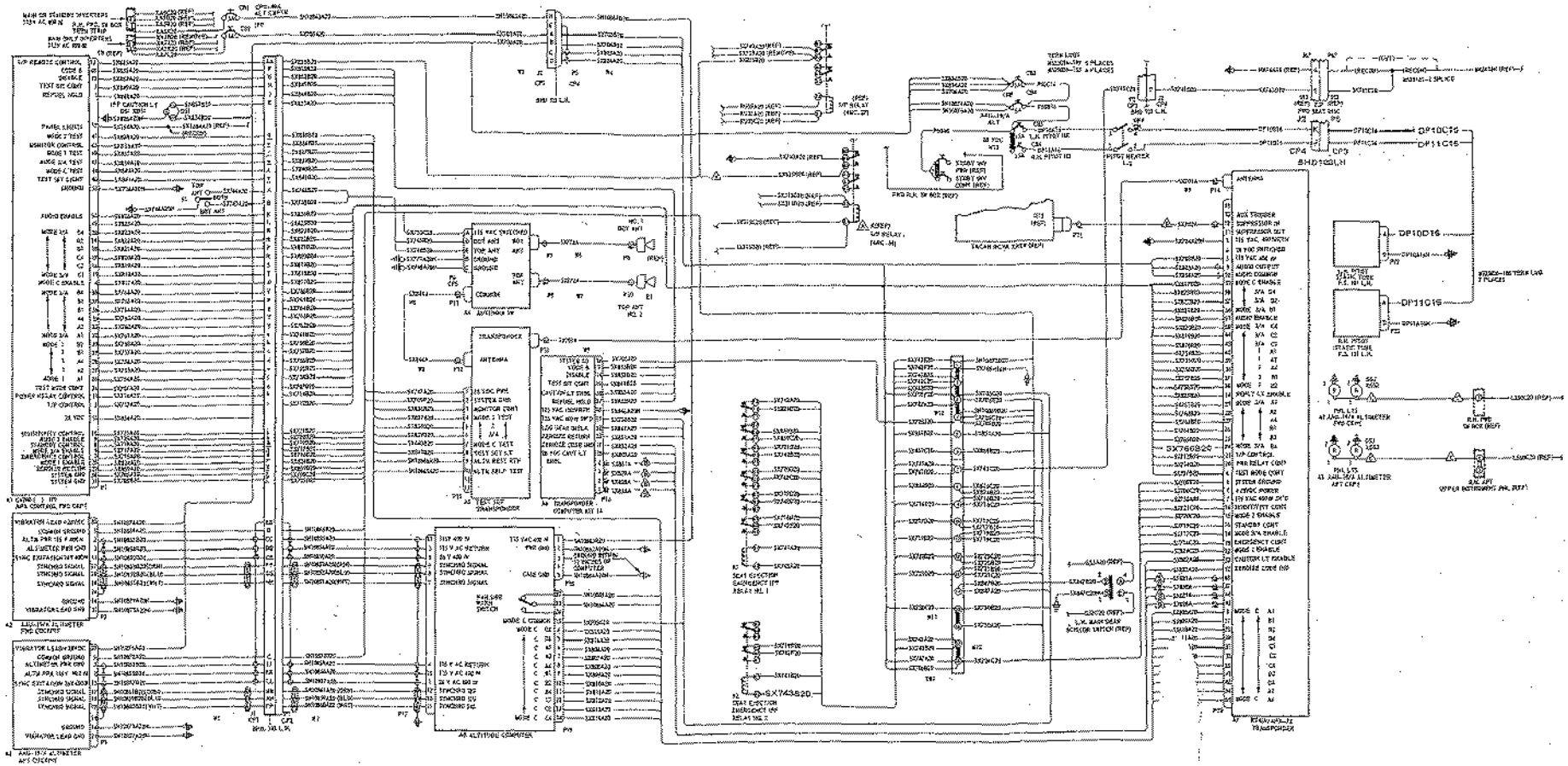
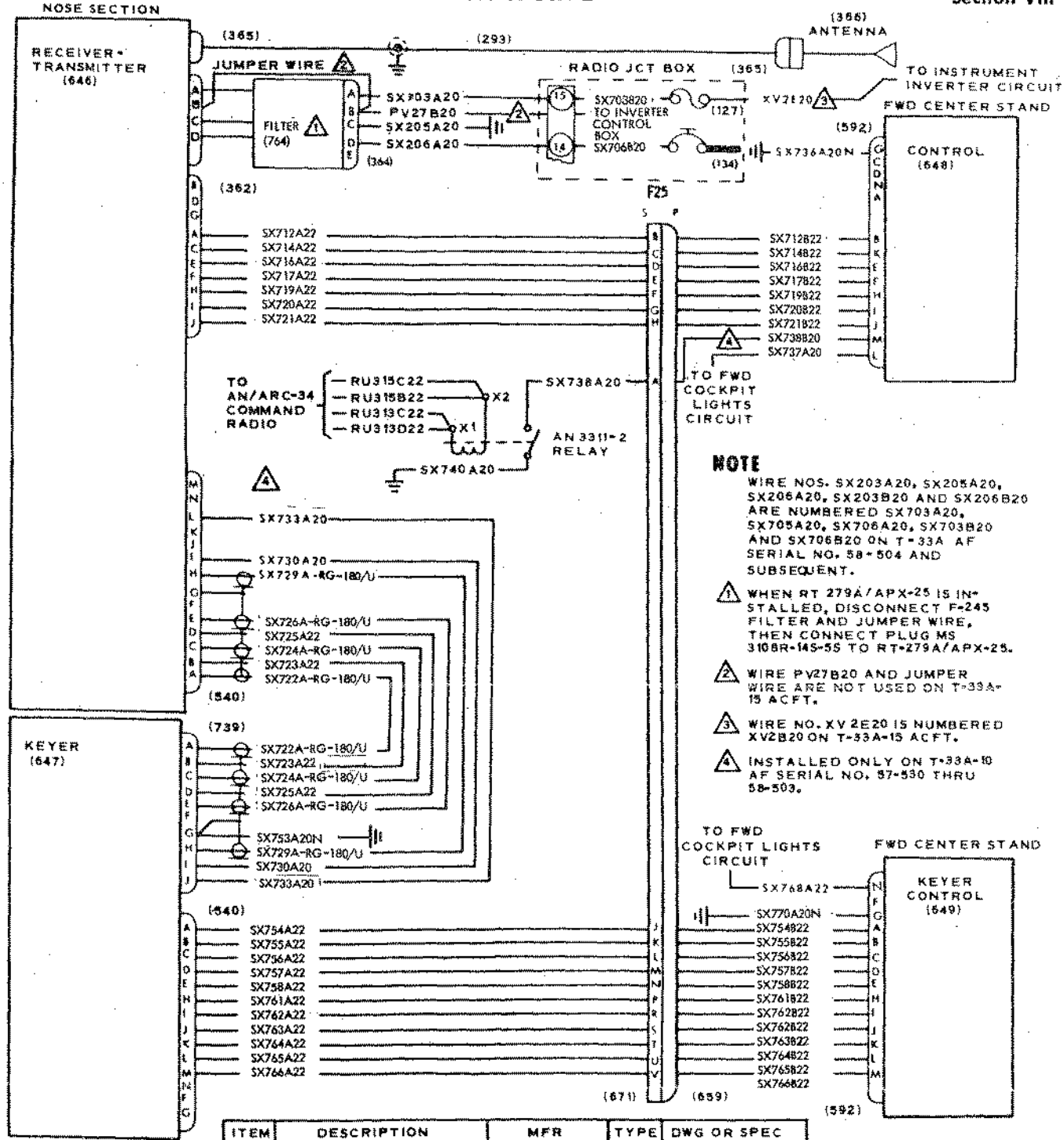


Figure 8-3 Wiring Diagram – AIMS Installation, T-33A-15 Aircraft



NOTE

WIRE NOS. SX203A20, SX205A20, SX206A20, SX203B20 AND SX206B20 ARE NUMBERED SX703A20, SX705A20, SX706A20, SX703B20 AND SX706B20 ON T-33A AF SERIAL NO. 58-504 AND SUBSEQUENT.

1. WHEN RT 279A/APX-25 IS INSTALLED, DISCONNECT F-245 FILTER AND JUMPER WIRE, THEN CONNECT PLUG MS 3108R-14S-5S TO RT-279A/APX-25.
2. WIRE PV27B20 AND JUMPER WIRE ARE NOT USED ON T-33A-15 ACFT.
3. WIRE NO. XV2E20 IS NUMBERED XV2B20 ON T-33A-15 ACFT.
4. INSTALLED ONLY ON T-33A-10 AF SERIAL NO. 57-530 THRU 58-503.

ITEM	DESCRIPTION	MFR	TYPE	DWG OR SPEC
127	FUSE	LITTLE FUSE	5A	413005
134	CIRCUIT PROTECTOR			MS25017-5
293	CABLE, COAXIAL			RG-8/U
362	CONNECTOR			MS3108R-18-1P
364	CONNECTOR			MS3108R-14S-5S
365	CONNECTOR			UG-1213/U
366	ANTENNA			AT-234/APX-6 OR AT-741/A
540	CONNECTOR			MS3108R-20-27P
592	CONNECTOR			MS3106R-20-27S
646	RECEIVER-TRANSMITTER			RT-279()/APX-25
647	KEYER			KY95()/APX-25
648	CONTROL			C-1158/APX-25
649	KEYER CONTROL			C-1128/APX-25
659	CONNECTOR			MS3106R-28-12P
671	CONNECTOR			MS3100R-28-12S
739	CONNECTOR			MS3108R-18-1S
764	FILTER			F-245/APX-25

AN/APX-25 IDENTIFICATION RADAR CIRCUIT
MODEL T-33A, ALL SERIES
APPLIES TO AF SERIAL NUMBER 57-530 AND SUBSEQUENT

EM20-59-8-529

Figure 8-306A. AN/APX-25 Identification Radar Circuit

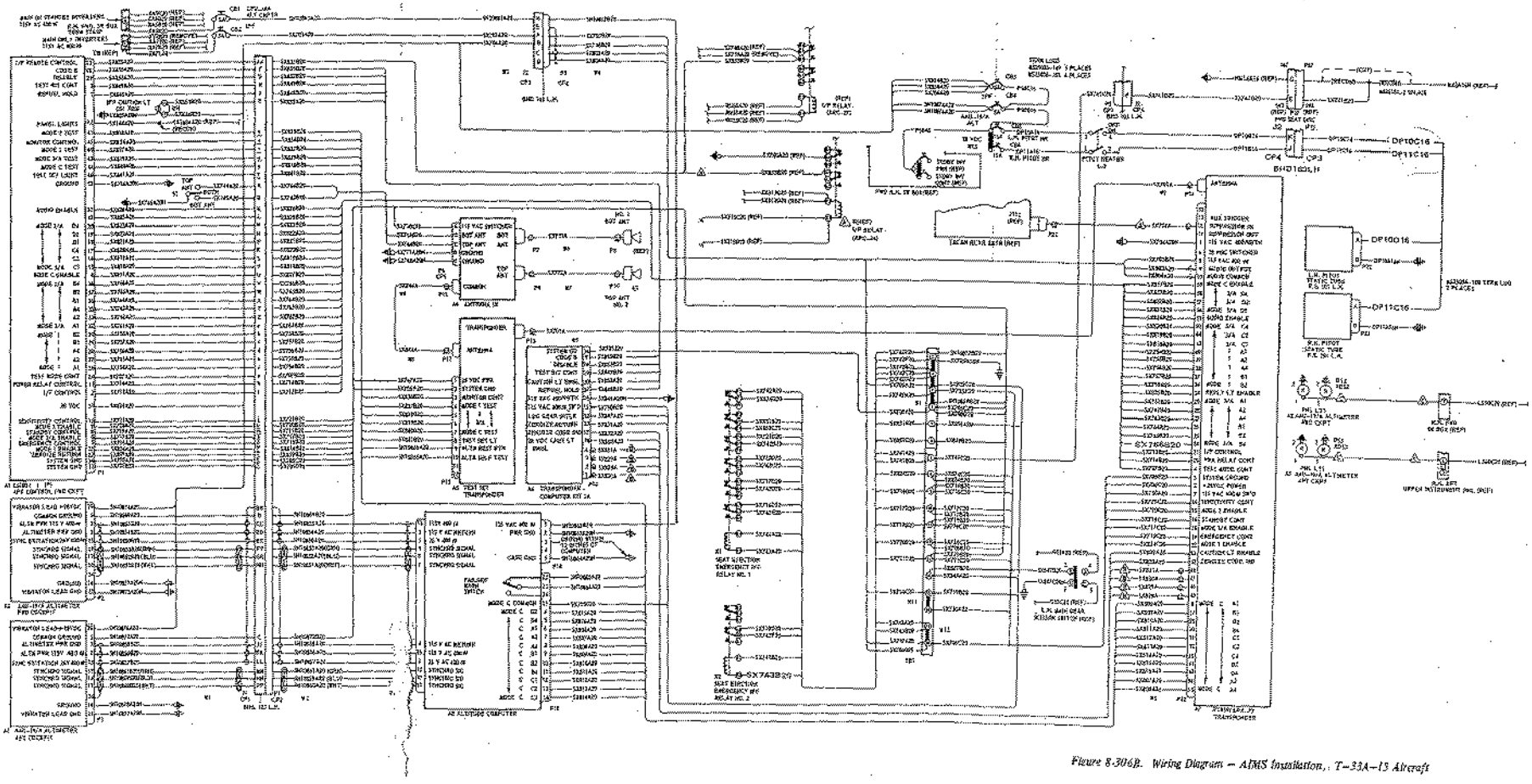
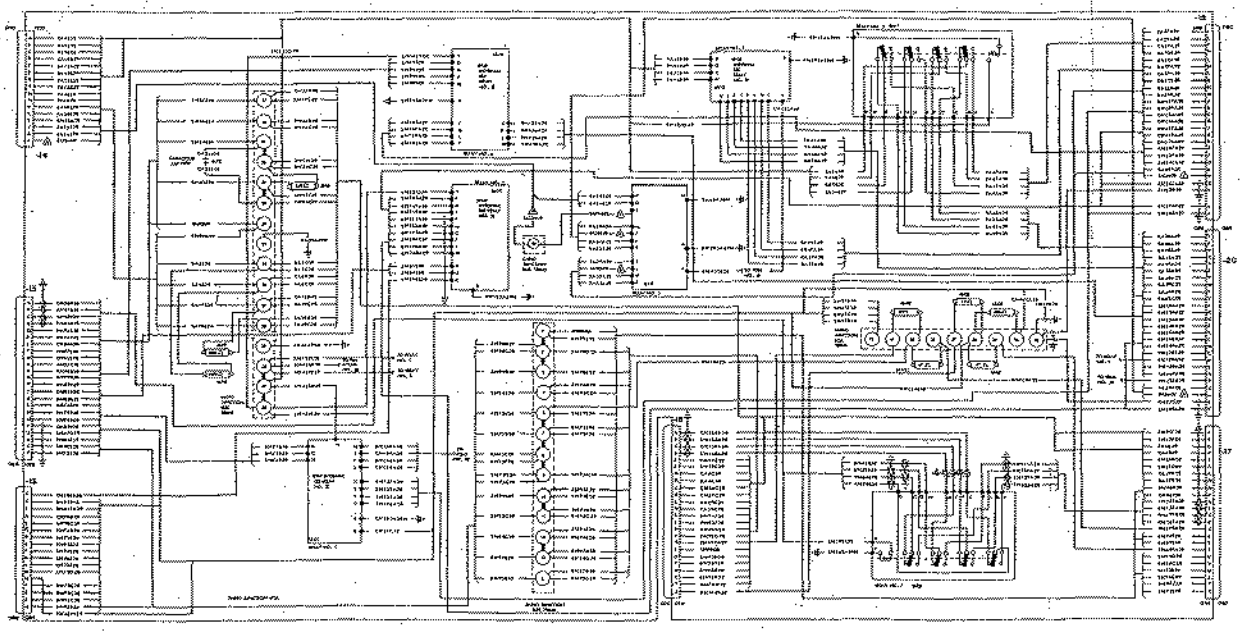
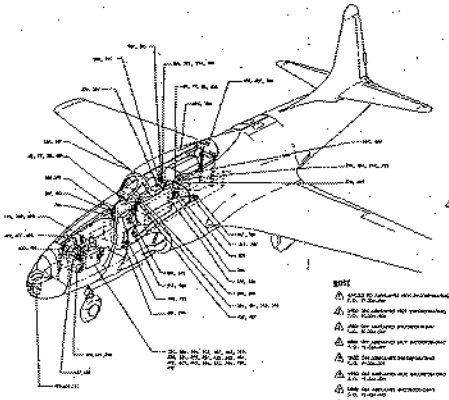


Figure 8-306B. Wiring Diagram — AIMS Installation, T-33A-15 Aircraft





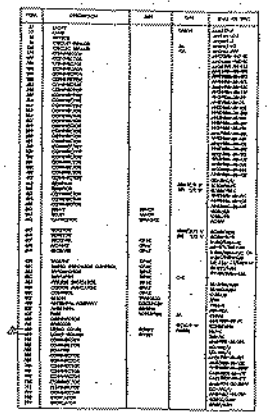
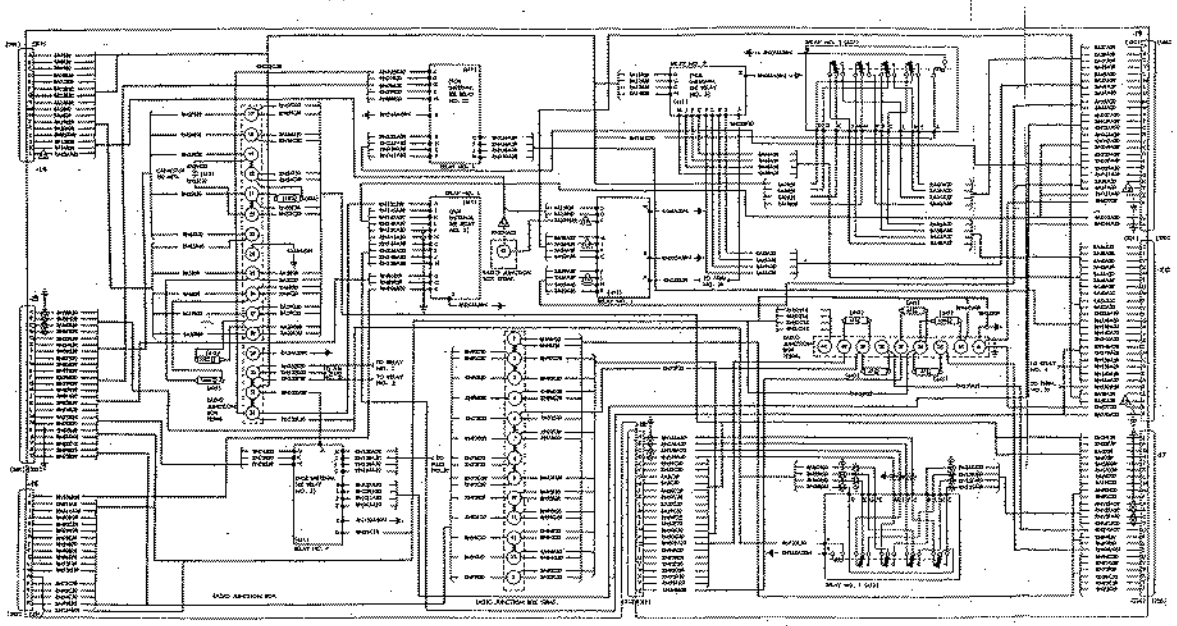


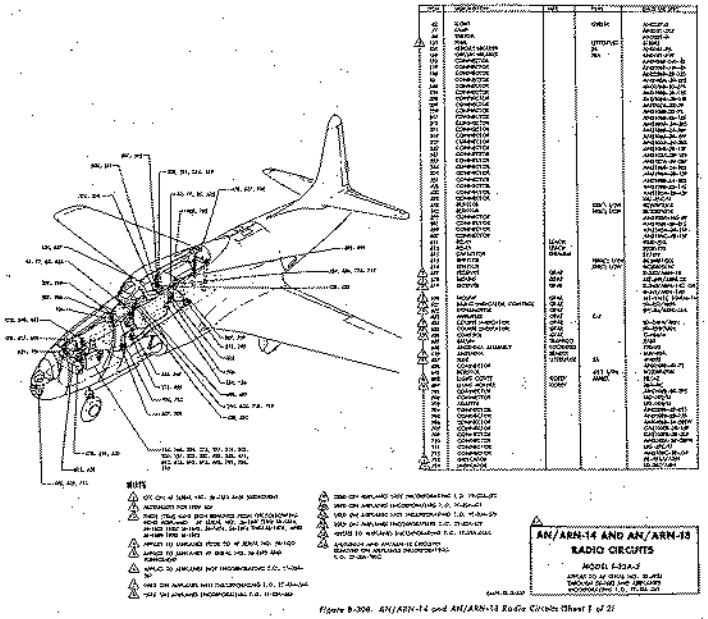
Figure 8-307. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 1 of 2)

Figure 5-207. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 2 of 3)

Changed 4 June 1965

T.O. 1T-29A-2





AN/ARN-14 AND AN/ARN-18
RADIO CIRCUITS
MODEL F-33A-5

Figure 8-308. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 1 of 2)

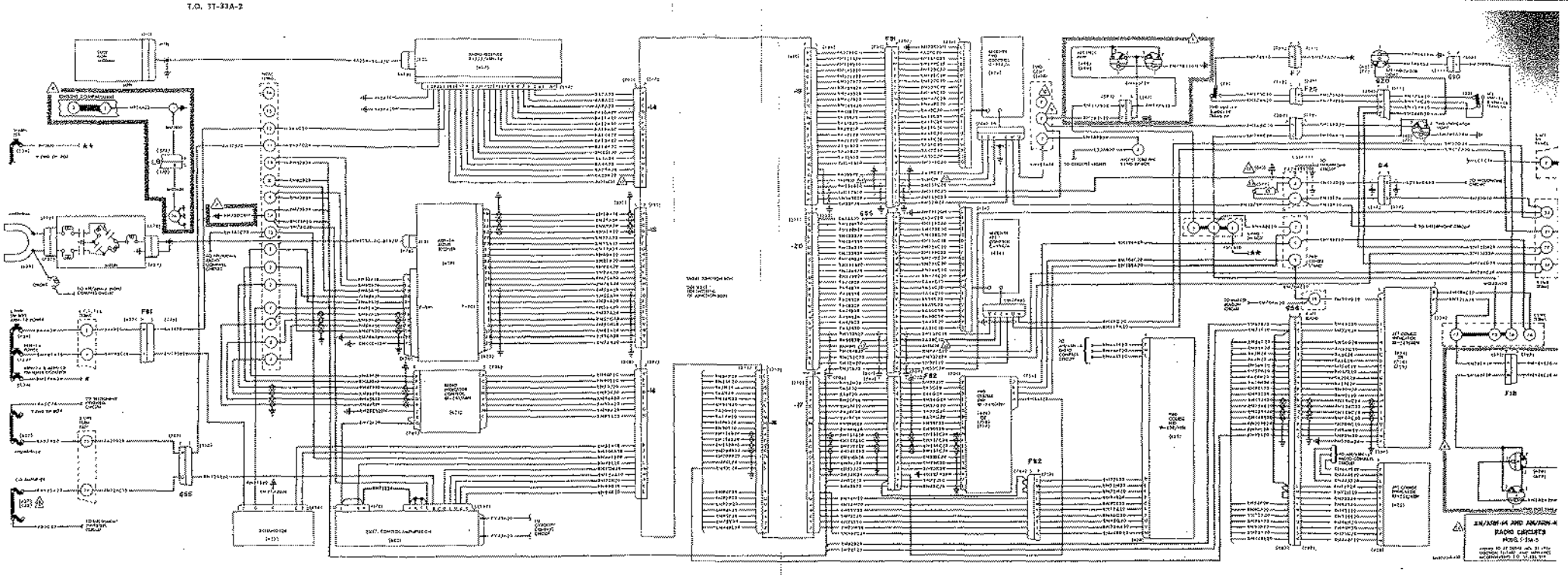
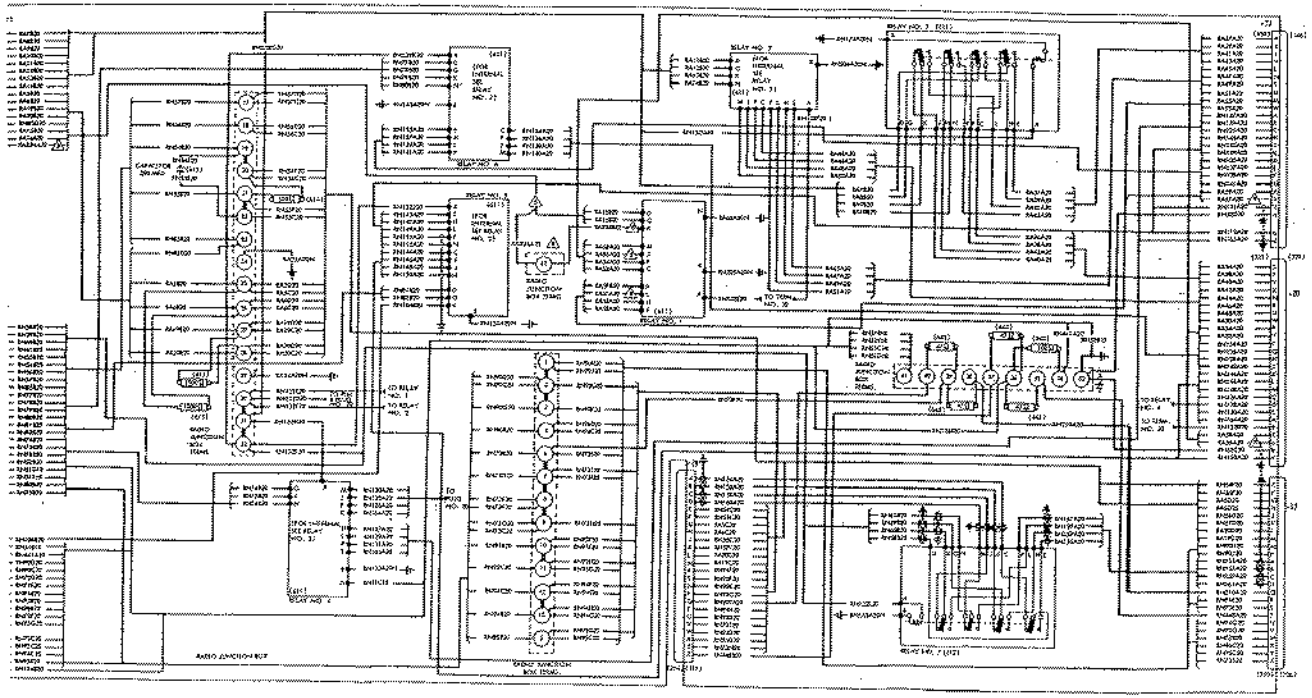
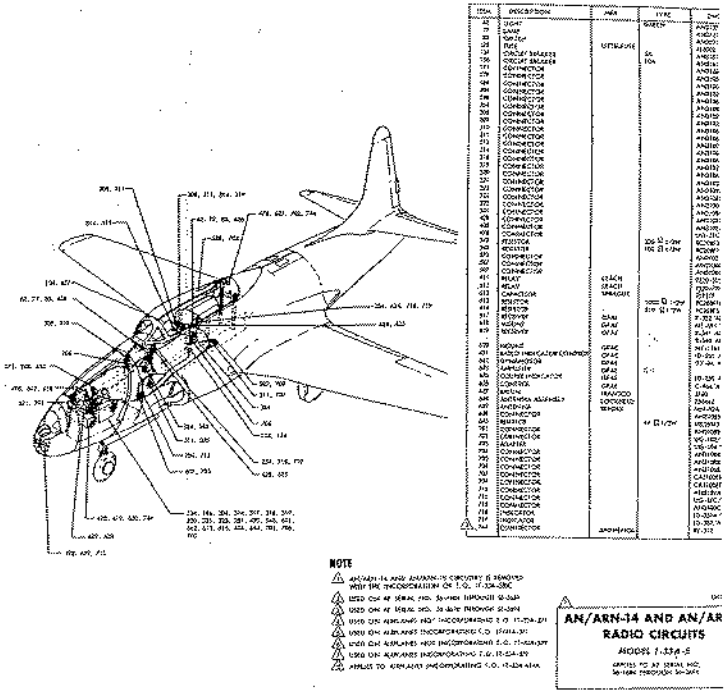


Figure 3-30B. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 2 of 2)





NOTE

1. AN/ARN-14 AND AN/ARN-18 CIRCUITRY IS REMOVED WITH THIS INCORPORATION ON T.O. 1T-33A-20C.
2. USED ON AF SERIAL NOS. SEE NOTE 1 THROUGH SEE NOTE 2
3. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-20
4. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-20
5. USED ON AIRPLANES NOT INCORPORATING T.O. 1T-33A-20
6. USED ON AIRPLANES INCORPORATING T.O. 1T-33A-20
7. APPLIES TO AIRPLANES INCORPORATING T.O. 1T-33A-20A

AN/ARN-14 AND AN/ARN-18 RADIO CIRCUITS

MODEL T-33A-5

APPLIES TO AF SERIAL NOS. 56-1696 THROUGH 56-2049

Figure 8-209. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 1 of 2)

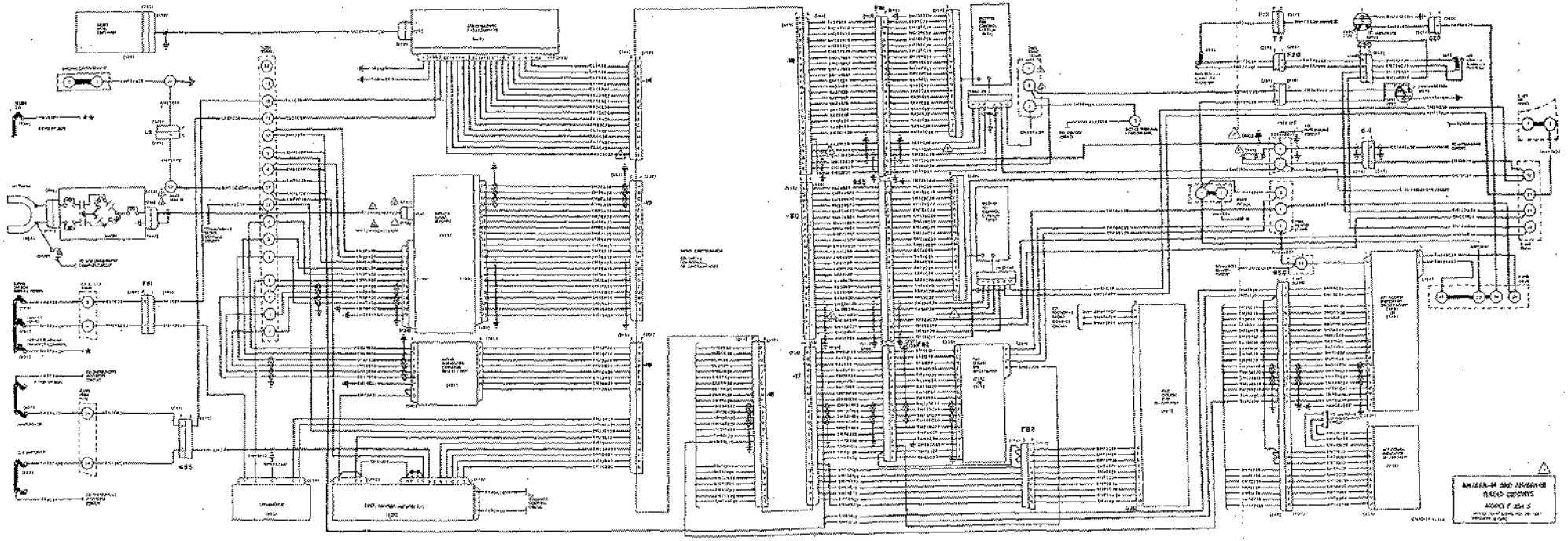
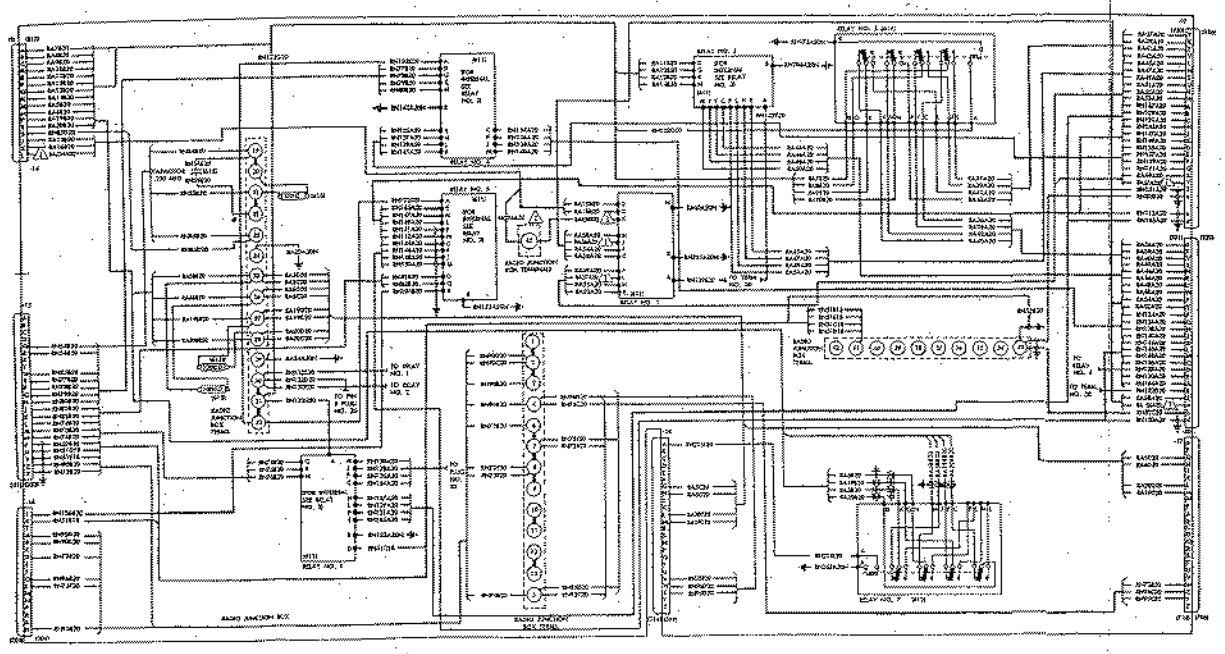
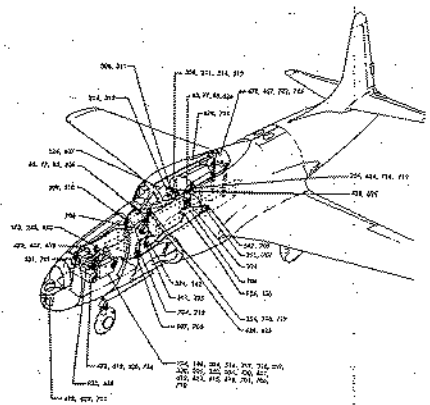


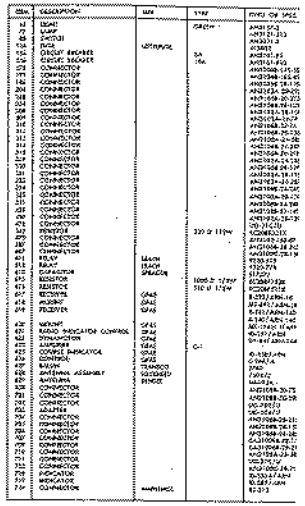
Figure 2-309. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 2 of 2)





NOTE

1. WIRING ON AIRCRAFT INCORPORATING T.O. 1F-33A-514A
2. WIRING ON AIRCRAFT INCORPORATING T.O. 1F-33A-514
3. WIRING ON AIRCRAFT NOT INCORPORATING T.O. 1F-33A-514



AN/ARN-14 AND AN/ARN RADIO CIRCUITS MODEL F-33A-3&C

Figure 8-309A. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 1 of 2)

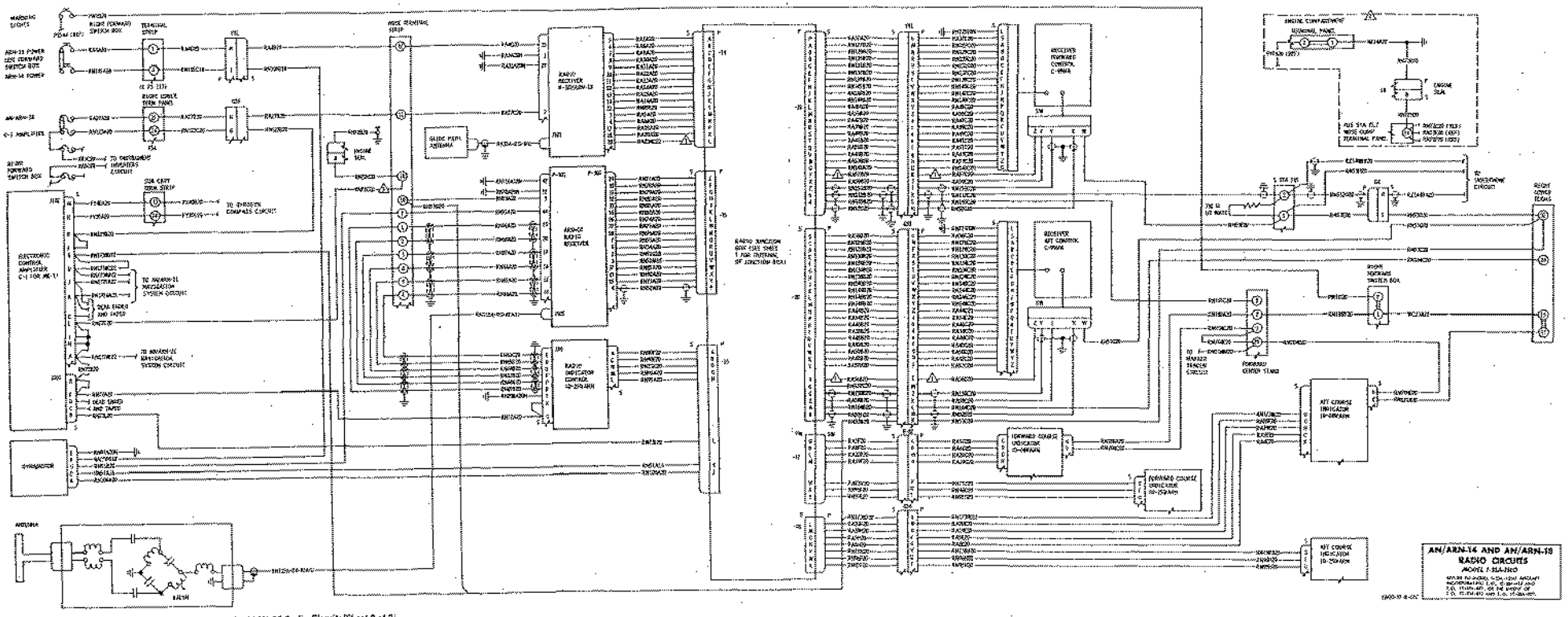
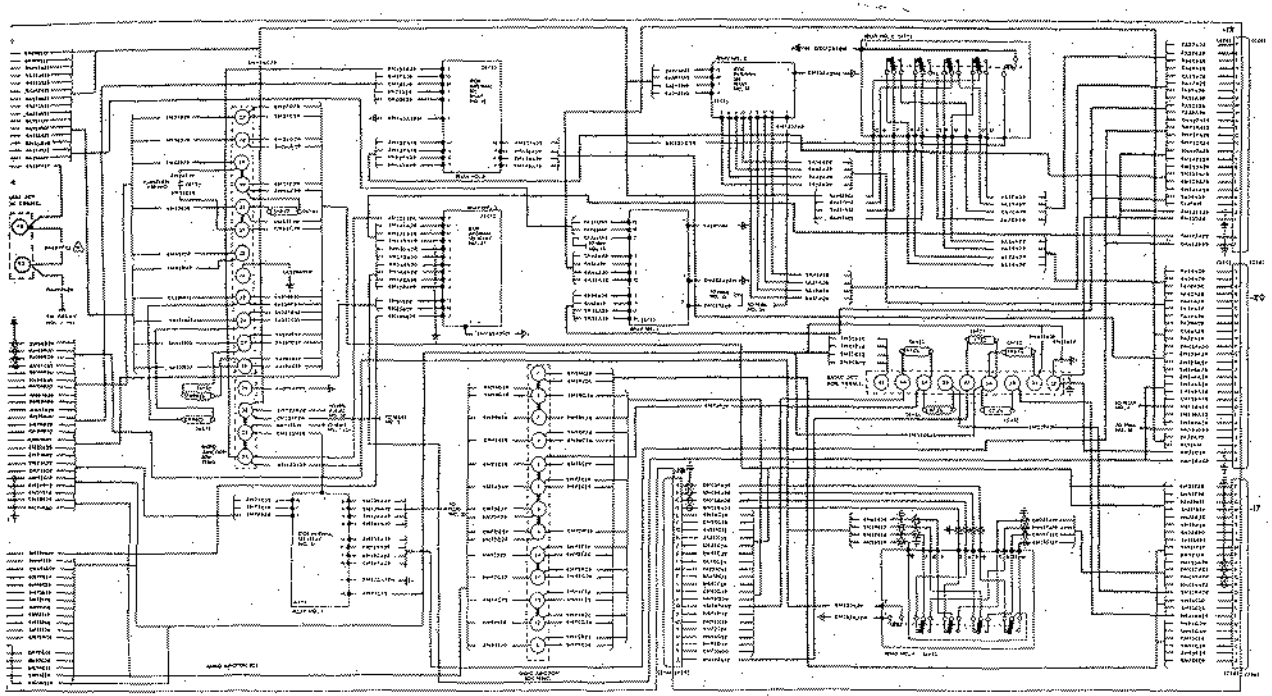
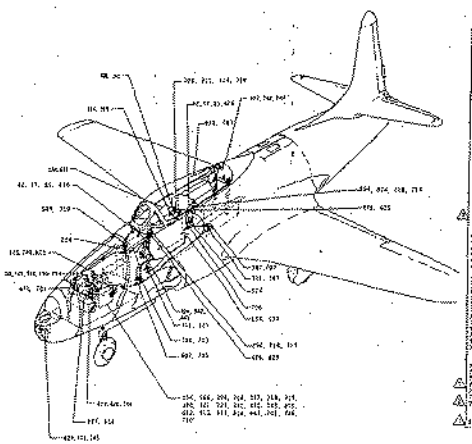


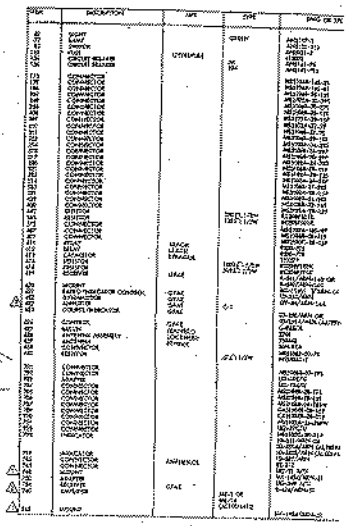
Figure 6-309A. AN/ARN-14 and AN/ARN-18 Radio Circuits (Sheet 2 of 2)





NOTE

1. DELETED.
2. ALSO APPLIES ON AF SERIAL NO. AF-305 AND SUBSEQUENT.
3. ALSO APPLIES ON AF SERIAL NO. AF-304 AND SUBSEQUENT.
4. DELETED.
5. DELETED.
6. APPLIES TO AF SERIAL NO. AF-305 AND SUBSEQUENT.
7. AN/ARN-14 AND AN/ARN-21 CIRCUITRY SHOWN ON AIRCRAFT INCORPORATING T.O. 1F-33A-538.



AN/ARN-14 AND AN/ARN-21 RADIO CIRCUITS MODEL T-33A-5

APPLIES TO AF SERIAL NO. 56-369 THROUGH 57-748

Figure 8-319. AN/ARN-14 and AN/ARN-21 Radio Circuits (Sheet 1 of 2)

AFLC 42A&R 300 69a 2500

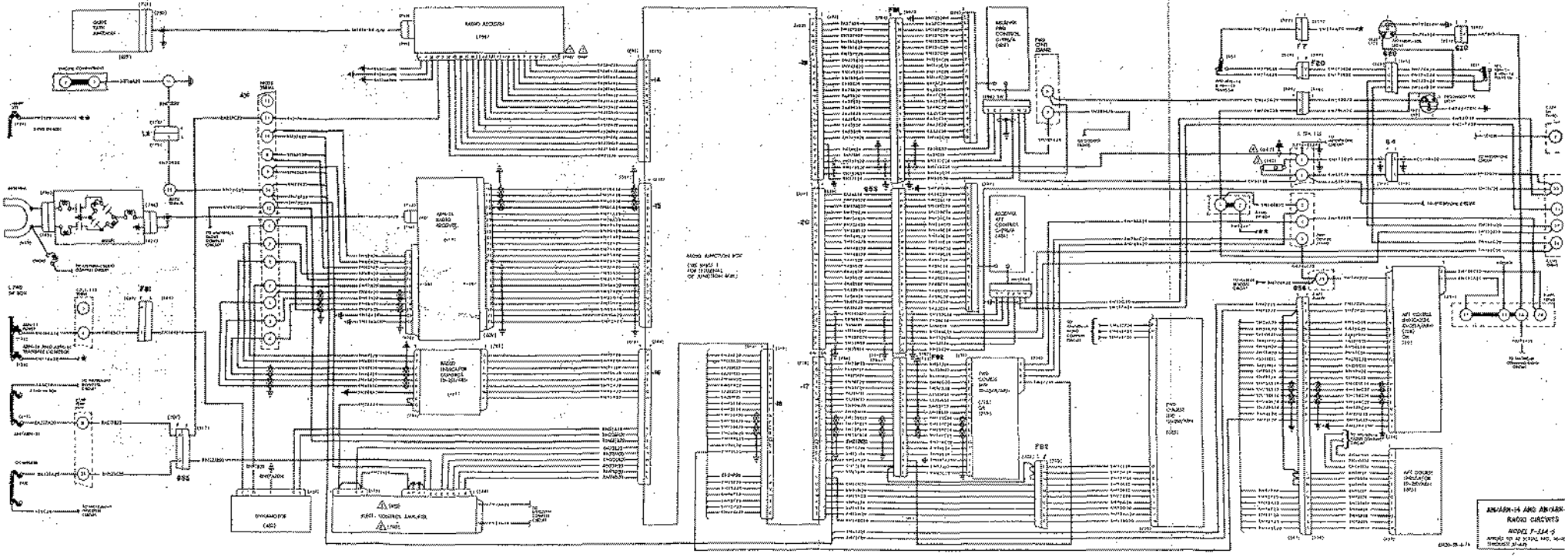
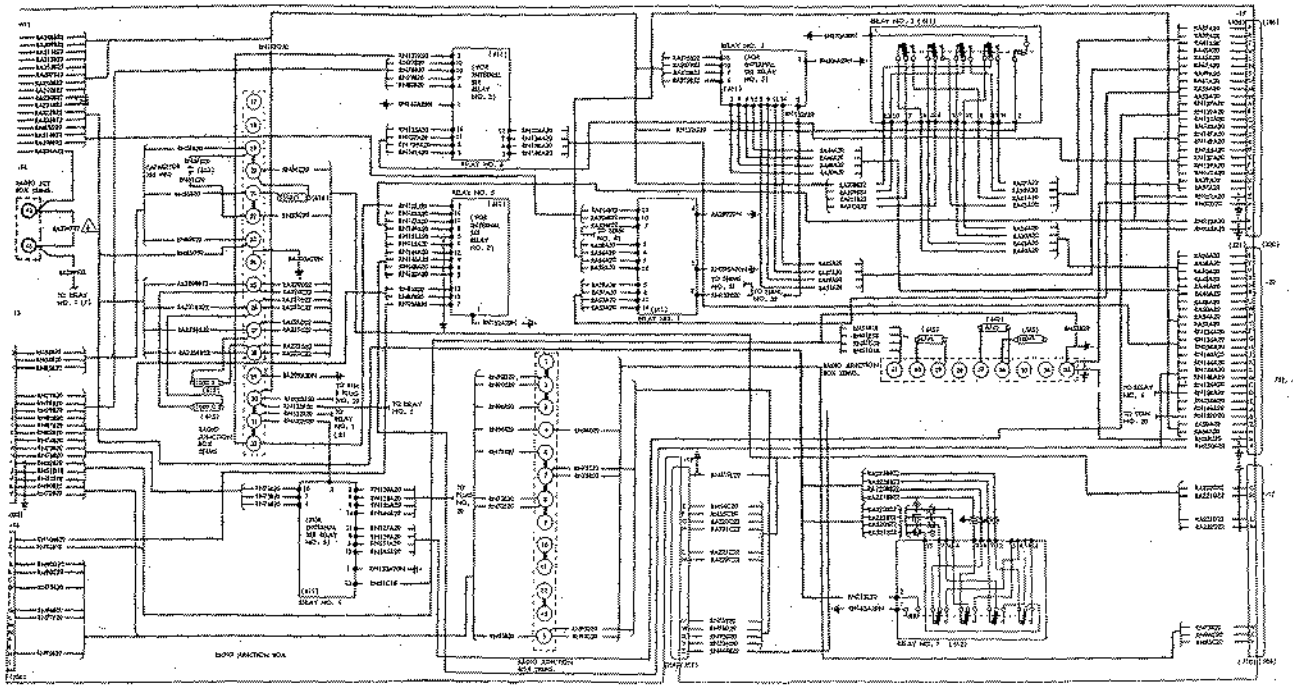
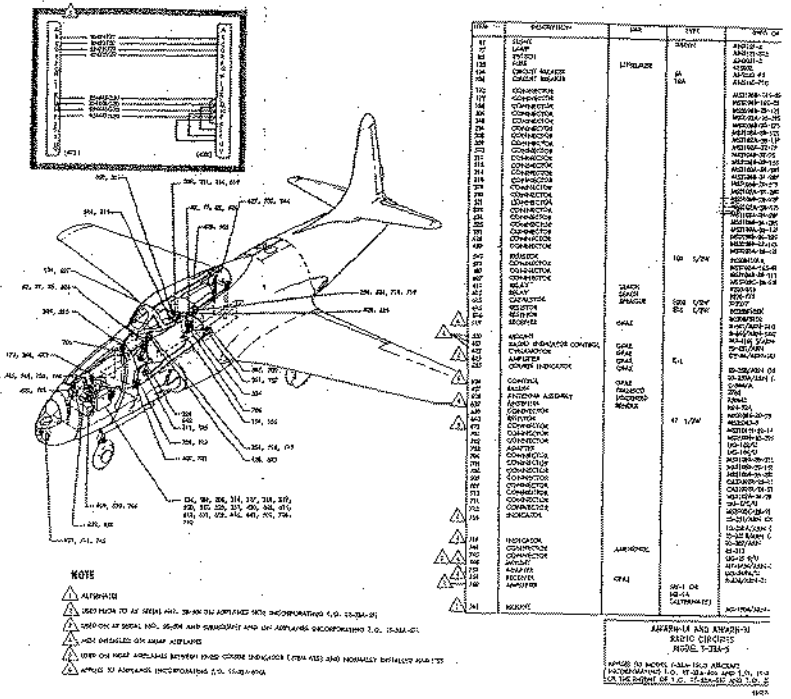


Figure 8-310. AN/ARN-14 and AN/ARN-21 Radio Circuit (Sheet 2 of 2)





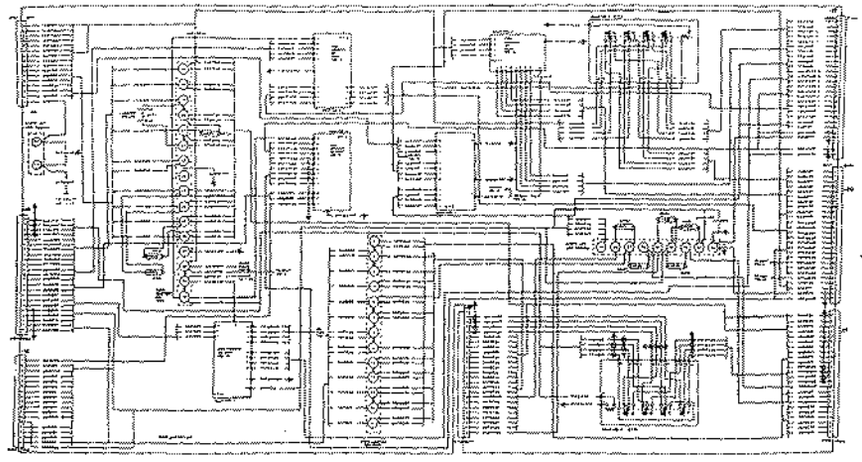
NOTE

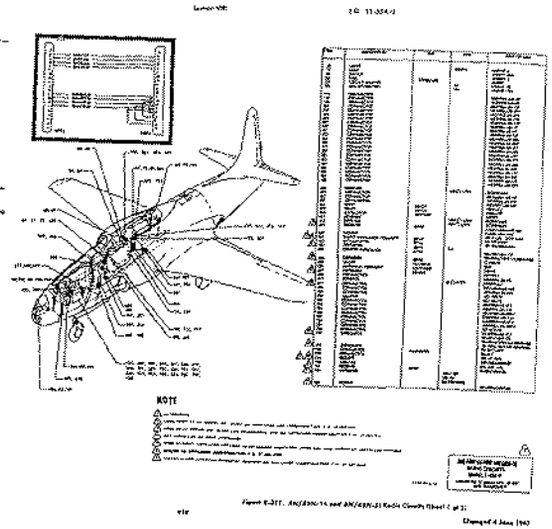
1. AUTOPILOT
2. 0560 MUSN TO AF SERIAL NO. 58-804 INC AIRPLANES NOT INCORPORATING T.O. 1S-33A-1F.
3. 0560 ON AF SERIAL NO. 58-804 AND SUBSEQUENT AND ON AIRPLANES INCORPORATING T.O. 1S-33A-1F.
4. NOT INSTALLED ON ARMY AIRPLANES
5. WIRE ON MOST AIRPLANES BETWEEN CROSS CONDUIT JUNCTION (CJ34 A33) AND NORMALLY INSTALLED ANTENNA
6. APPLIES TO AIRPLANES INCORPORATING T.O. 1S-33A-504A

AN/ARN-14 AND AN/ARN-21 RADIO CIRCUITS MODEL T-33A-5

APPLIES TO MODEL T-33A-5 AIRCRAFT (MCDONNELL) T.O. 1T-33A-20 AND T.O. 1T-33A-20A, THE SUPPLEMENT OF T.O. 1T-33A-12 AND T.O. 1T-33A-12A

Figure 8-350A. AN/ARN-14 and AN/ARN-21 Radio Circuits (Sheet 1 of 2)




NOTE

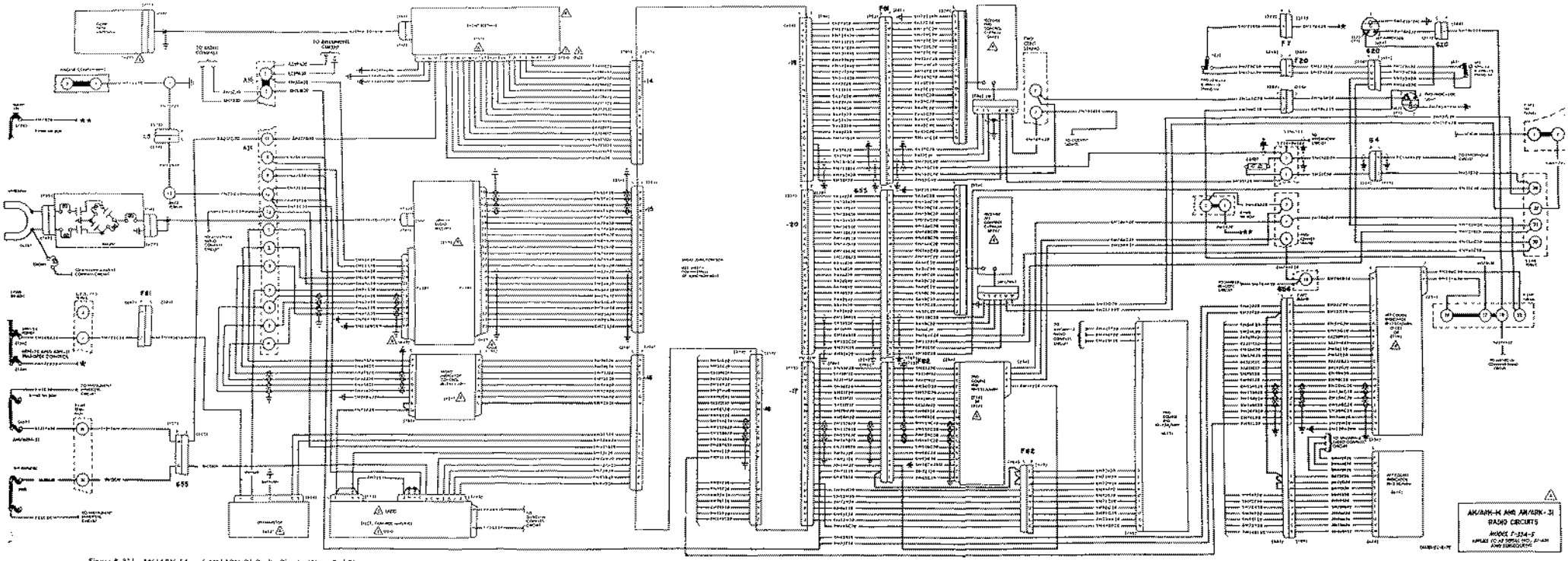


Figure 6-311. AN/ARN-14 and AN/ARN-31 Radio Circuits (Sheet 2 of 2)

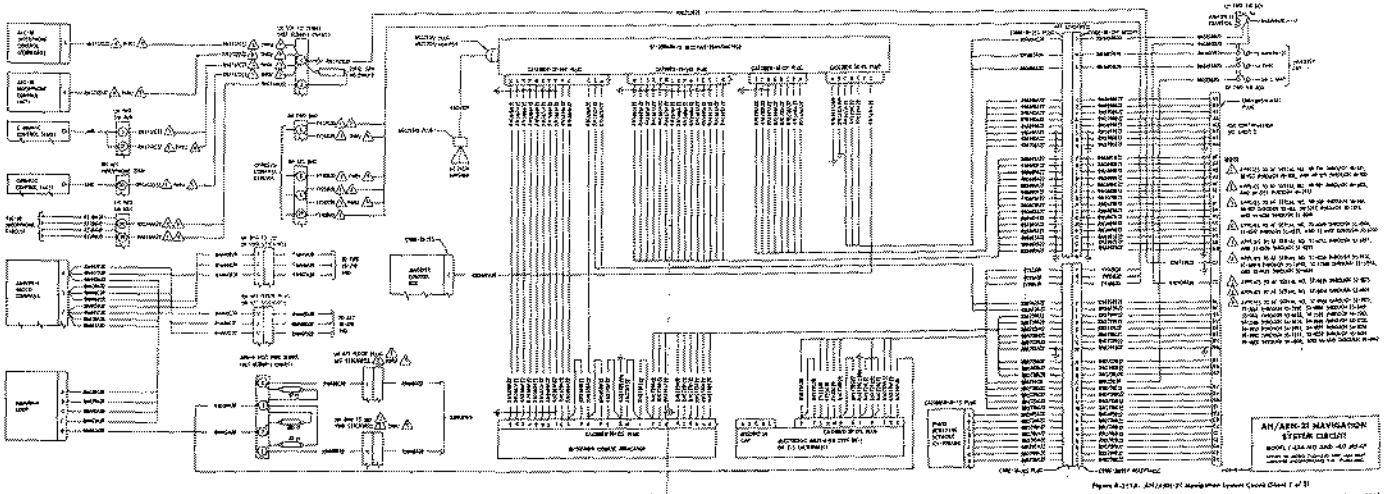


Figure 8-3-11A. AN/ARN-21 Navigation System Circuit (Sheet 1 of 3)

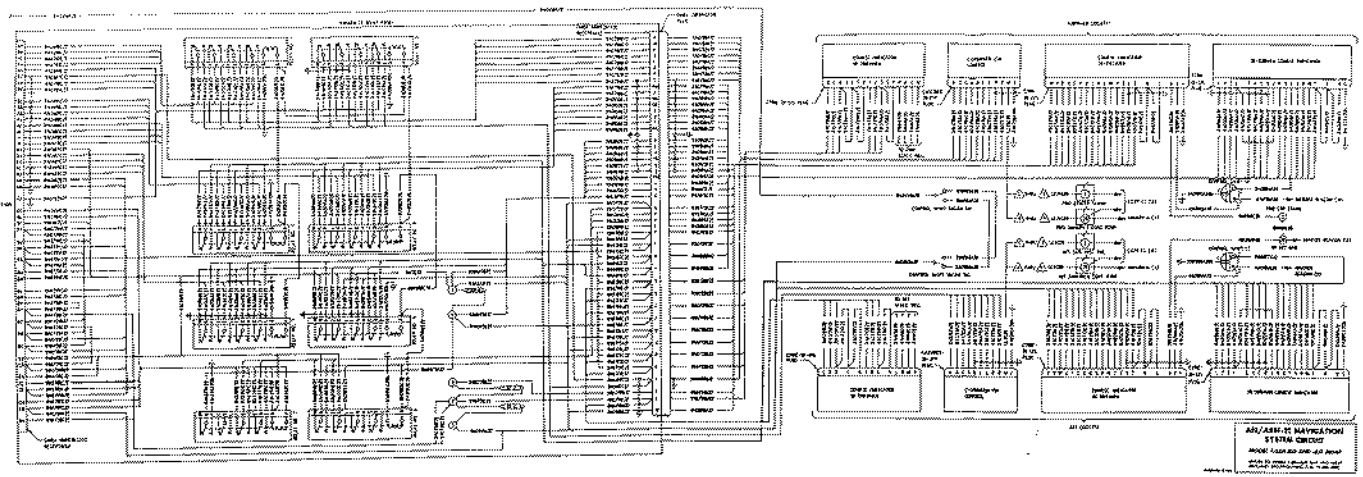
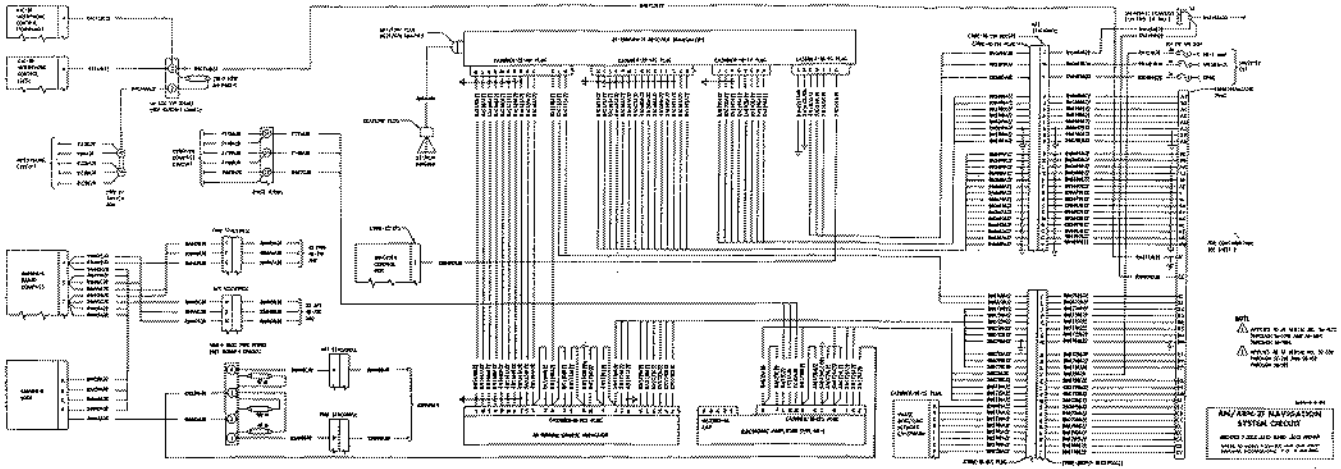


Figure 8-377A. AN/ASN-92 Navigation System Circuit Chart 2 of 2

Changed 4 June 1965

9/8C



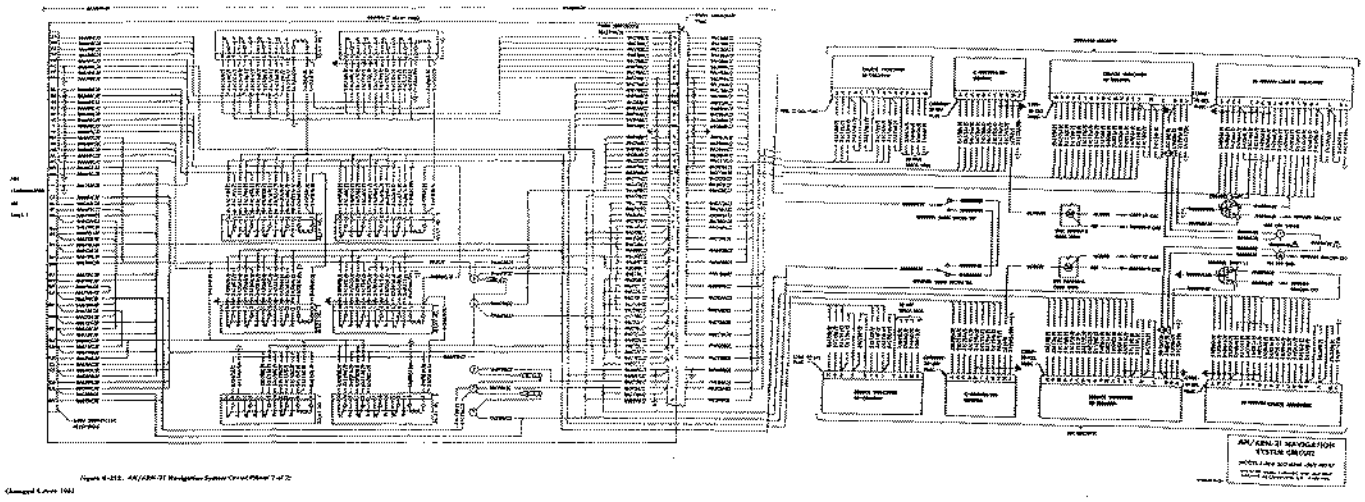
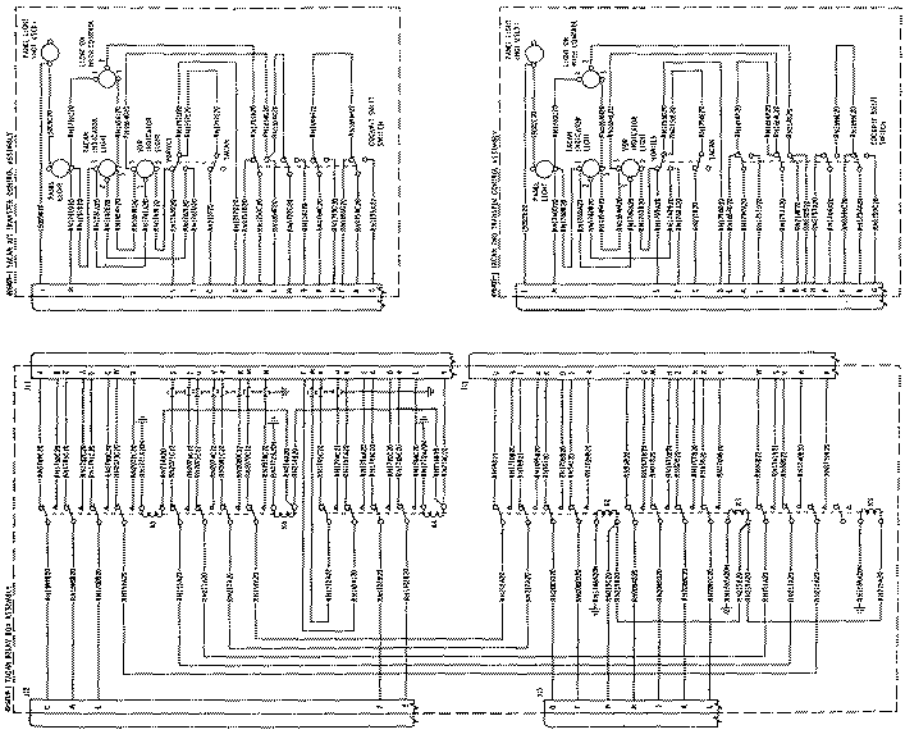
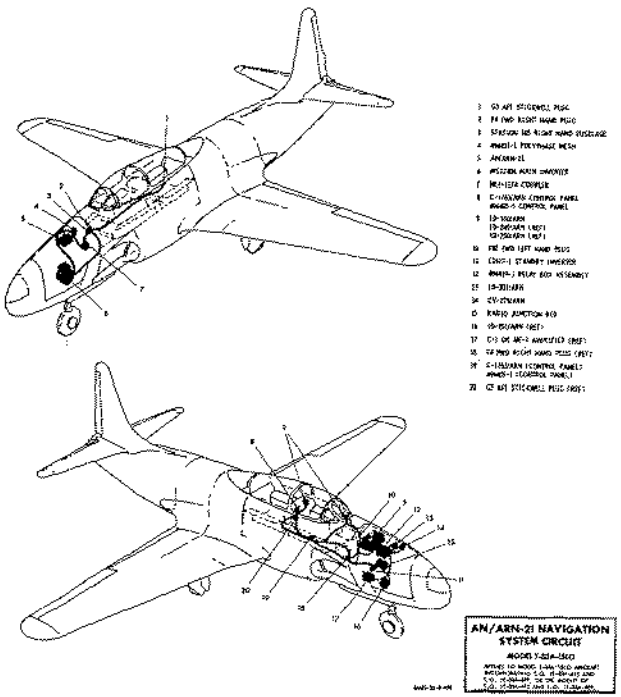


Figure 4-212. AR/ASN-31 Navigation System Circuit (Sheet 2 of 2)

Changed 4 June 1981

7-162

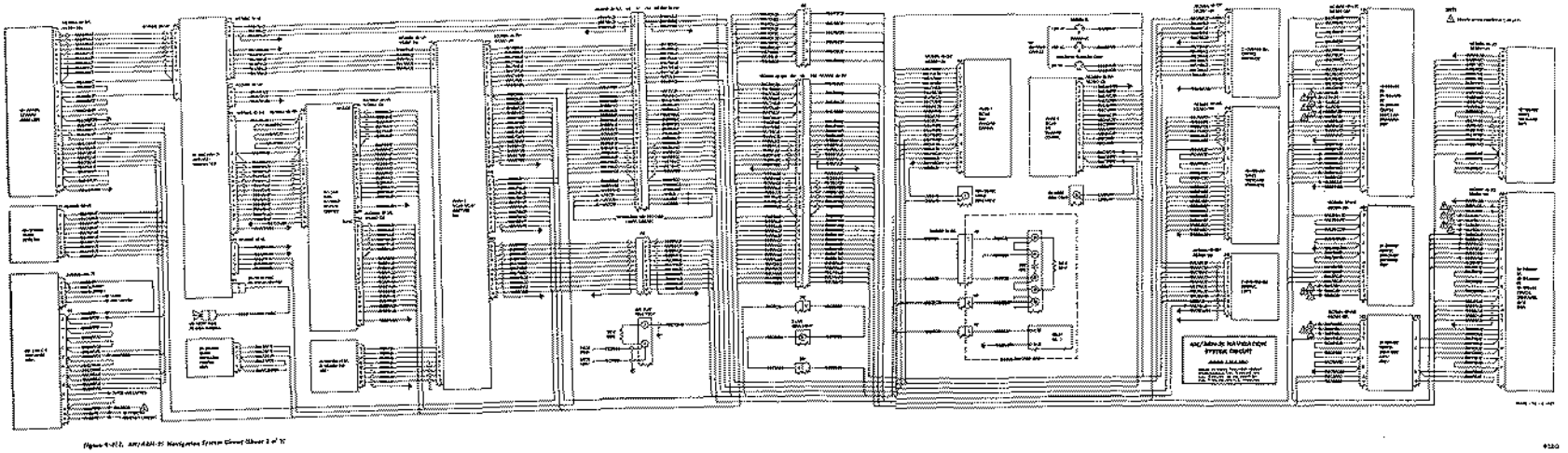




AN/ARN-21 NAVIGATION SYSTEM CIRCUIT

MODELS F-33A-15CO

Figure 8-313. AN/ARN-21 Navigation System Circuit (Sheet 1 of 2)



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(* Denotes Illustration)

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