NAVWEPS 01-40ALF-2

Handbook
Maintenance Instructions

NAVY MODELS

A-1H • A-1J
AIRCRAFT

SECTION VII
ELECTRICAL SYSTEMS

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For information on other available materials and details of distribution refer to NAVSANDA PUBLICATION 2002, SECTION VIII and NAVWEPS 00-500A.

SECTION VII

ELECTRICAL SYSTEMS

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7-1. ELECTRICAL SYSTEMS.

7-2. GENERAL. Major electrical systems, which either produce or operate on dc and/or ac voltage are given below. All electrical and electronic circuit diagrams are presented in section X:

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Cockpit sliding enclosure jettison control system
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Horizontal stabilizer control system
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Auxiliary pressure system pump control circuit
Carburetor air control circuit
Water injection system control circuit
Engine starting system
Cowl flap control circuit
Fuel quantity indicating system
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Gun-sight light control circuit
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Mark 3 Mod 5 bomb director system
Aero 18 A/B armament control system.

7-2A. The Table of Contents preceding this section should be consulted to determine where specific information can be found within the section. The Alphabetical Index at the end of the handbook should also be consulted to determine where specific information is contained within the handbook.

7-3. CIRCUITRY. Open wiring grouped into bundles and/or harnesses is used to facilitate routing and installation wherever possible. Flexible conduit is used as a protection for wiring in the power plant accessory section. Rigid conduit is used as a wiring guide in areas that are not readily accessible, such as fuel cell compartment and certain areas of the wings. Terminal panels and bulkhead connectors are installed throughout the airplane to further facilitate the maintenance of the wiring. The terminal panels are identified and the studs are numbered to facilitate wire connection, circuit tracing and trouble shooting. Terminal panels and wire connections are shown in Section X of this manual. Bulkhead connectors are identified in the airplane by letters engraved on metal plates adjacent to the connector.

7-4. TROUBLESHOOTING. The following general trouble shooting steps are provided as a guide to augment specific trouble shooting information found elsewhere in this manual, and as a basis from which to develop the more detailed procedures required to locate infrequent causes of electrical trouble.

a. Investigate report of trouble at source, when possible to determine certain conditions leading up to and under which trouble occurred and whether failure of mechanical or other electrical system occurred simultaneously. Determine also whether trouble was of a constant or intermittent nature. (Careful analysis of information of this type is often indicative of the nature and most likely the location of the trouble.)

b. Study circuit wiring diagrams covering affected operating system and its related power supply. (A thorough understanding of system functions is necessary before a trouble-shooting procedure can be effectively planned and executed. Combining a knowledge of applicable circuits with information gained from a trouble report usually facilitates identification of the circuit, or section of the circuit, in which the cause of the trouble is located.)

c. Visually check circuitry for open circuit breakers, broken wiring, loose wire connections, loose electrical connectors, evidence of a short circuit or a short to ground. Observe particularly security of ground connections and presence of foreign matter.

d. Perform continuity check, if blown fuse or open circuit breaker or evidence of a short circuit or short to ground indicates that a "power-on" check would create a hazardous condition. With power off, check circuit with continuity tester by isolating defective circuit from airplane electrical system and checking circuit a section at a time until defective section is found.

e. Perform "power-on" check only when it has been determined that such a check cannot create a hazardous condition. With power on, perform operational tests using airplane controls to confirm report of trouble and to determine, if possible, whether cause of trouble is in power supply system, operating circuit, or a section of either. (A voltmeter or 24-volt test light can also be used at various break points in a circuit—terminal panels, relays, and equipment input terminals—to determine the amount of available power at these points.)

f. Replace inoperative equipment. Whenever equipment remains inoperative after proving that power is available at unit and ground connections are secure, replace unit.

7-5. ELECTRICAL EQUIPMENT.

7-6. DESCRIPTION. For descriptive information concerning a particular unit of electrical equipment, reference should be made to the paragraph or wiring diagram covering the system in which the unit is included.

7–7. REMOVAL.

Note

The following is a *general* removal procedure applying to most of the electrical equipment in the airplane. Where special handling of a unit is required, or where danger to personnel or the possibility of damage to equipment exists, a specific removal procedure is given following the descriptive text of the unit concerned.

a. Make certain that aircraft engine is not operating, d-c power control switch is "OFF," and no external power is connected to airplane.

b. Remove any cover, shield or other form of protection for unit being removed.

c. Disconnect all wiring, bonding braid or mechanical linkage attached to unit. (If the unit is to remain out of the airplane for subsequent flights, all wires should be stowed in a manner which will preclude a short circuit or a short to ground.)

d. Remove parts that attach unit to airplane, and remove unit.

7–8. INSTALLATION.

Note

The following is a *general* installation procedure applying to most of the electrical equipment installed in the airplane. Where special handling of equipment is required or where danger to personnel exists, a specific installation procedure is given following the descriptive text of the unit concerned.

a. Make certain that airplane engine is not operating, that d-c power control switch is in "OFF," and that no external power is connected.

b. Make certain that all bonding surfaces of unit and airplane are clean and free of non-conductive materials such as oil, grease, stain, dye, paint, or oxide.

c. Place unit in position and secure with attaching parts.

d. Complete all electrical connections to unit; refer to applicable wiring diagrams for information regarding matching of connections. Before joining threaded connectors, apply anti-seize compound (Specification JAN-A-669) to all external threads.

7–9. ELECTRICAL POWER SUPPLY SYSTEMS.

7–10. DESCRIPTION. The airplane contains three power systems—a d-c supply system, a variable-frequency a-c supply system, and a constant-frequency a-c supply system.

7–11. D-C POWER SUPPLY SYSTEM.

7–12. DESCRIPTION. (See figures 7–1 and 7–2.) The d-c power supply is derived from a 30-volt, 400-ampere, 4-pole generator and its associated equipment. The principal units of the d-c power supply system are as follows:

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7–13. The d-c power supply system utilizes either of two d-c power supply sources: (1) a 24-volt, 34-ampere hour storage battery, and a 30-volt, 400-ampere hour, engine driven d-c generator; (2) an external power supply system which utilizes an auxiliary external source of 28-volt d-c power. This power supply system energizes all the airplane's buses, and is connected for use during ground operation tests.

7–14. D-c power distribution is accomplished by the means of six major buses: battery, primary, secondary, monitor, armament, and radio. Each of these buses, in turn, may have several distribution points or minor buses. (See figure 7–5.)

7–15. When the battery is installed in the airplane, the battery bus is energized. Battery power to the primary bus is controlled by the d-c power control switch, which has three indicated positions: "BAT ONLY," "OFF," and "BAT & GEN."

7–16. Generator power, which is controlled by the generator control (reverse current) relay, is available on the primary bus when the generator is operating and the generator control relay is closed. The generator control relay connects the generator to the primary bus when the generator voltage is at least 0.35 to 0.65 volts greater than the bus or battery voltage. This relay also disconnects the d-c generator from the primary bus when a reverse current of from 25 to 35 amperes flows from the bus to the generator.

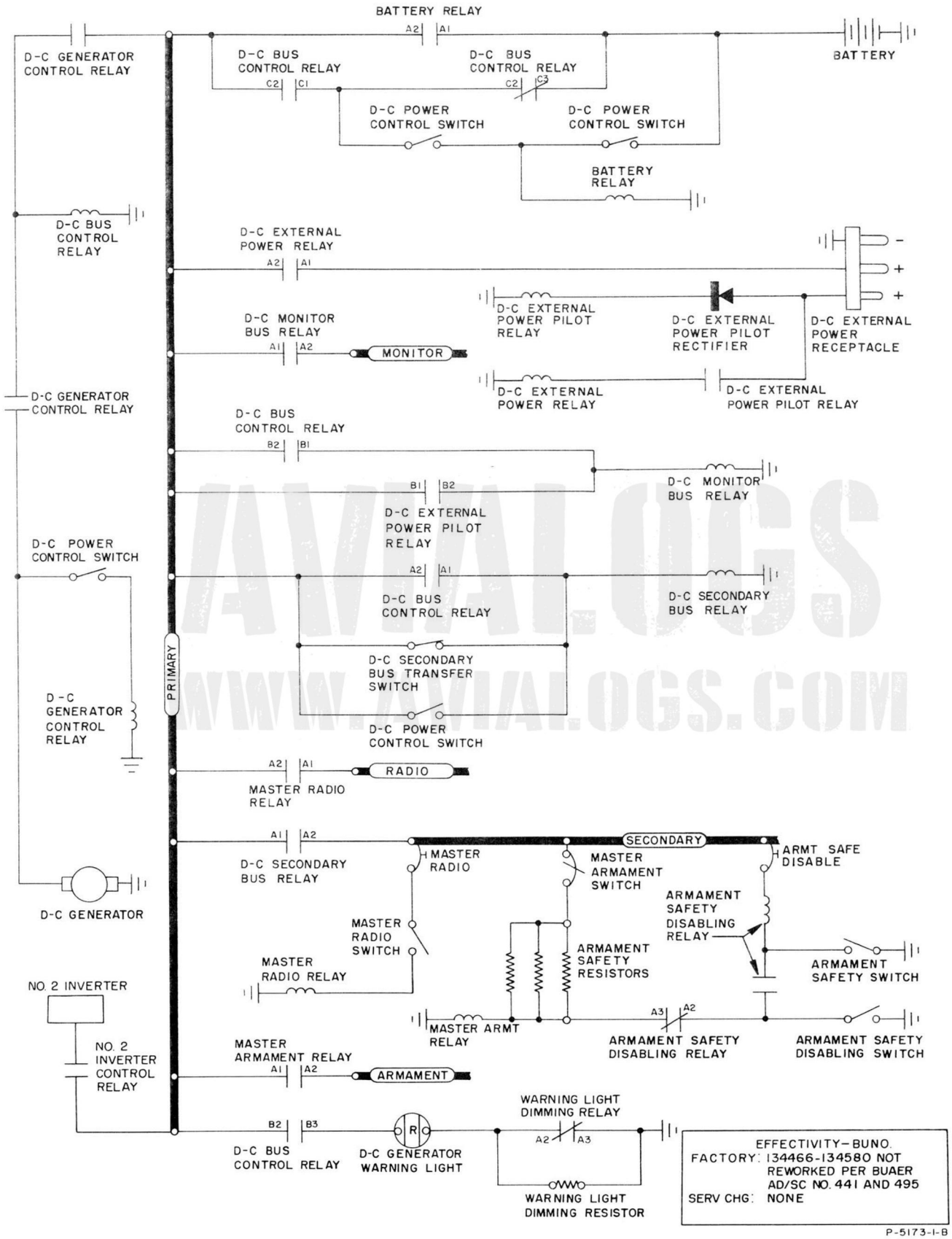


Figure 7–1. D-C Power Supply System—Schematic (Sheet 1)

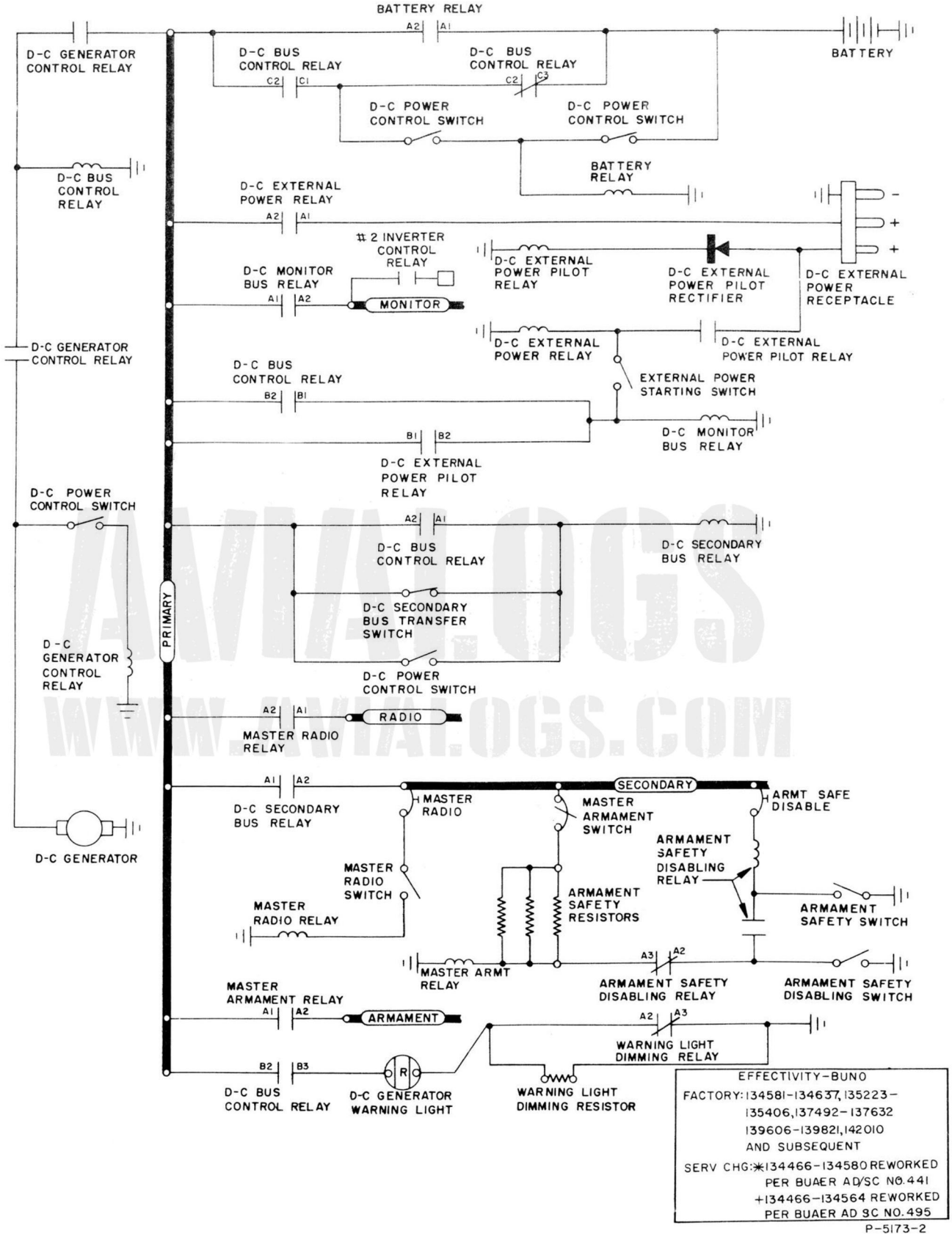


Figure 7–1. D-C Power Supply System—Schematic (Sheet 2)

7–17. The d-c generator field is connected to a carbon-pile voltage regulator which regulates generator output voltage to 27.7 ± 5 volts. This voltage regulator is essentially a generator field rheostat that governs the amount of field current required to maintain a constant generator voltage output.

7–18. A generator warning light, which comes "ON" in the event of generator failure, is included in the d-c power supply system. The light receives power from the primary bus when the generator control relay is open or when the d-c generator is not operating.

7–19. The voltage test jacks are installed to aid in checking d-c generator output.

7–20. The battery d-c generator, and external power source are parallel-connected to the primary bus. The *battery* is connected across the battery relay, the *d-c generator* across the generator control relay, and the *external power* source is connected through the external power receptacle, the selenium rectifier, the external power control relay, the external power relay, and in addition, on airplanes BuNo. 134581 and subsequent, the d-c external power starting switch.

7–21. The primary bus serves as a distribution point for d-c power. With generator power on the primary bus, the bus control relay is energized through the "IND" terminal of the generator control relay. When the bus control relay is energized, primary bus power is supplied to the secondary and monitor buses through their respective relays.

7–22. The armament bus, which utilizes primary bus power, becomes energized when the master armament relay, operated by secondary bus power, is closed.

7–22A. The radio bus receives power from the primary bus through the master radio relay when the master radio switch is closed. Closing the switch energizes the master radio relay with secondary bus power to connect the primary bus to the radio bus.

7–23. TROUBLE SHOOTING. Refer to table 7–1.

7–24. POWER LOADING. (Refer to table 7–2.) The rated output of the d-c generator is 400 amperes; however, due to efficiency losses, such as heat, overspeed and underspeed, the rated output of the generator is never quite obtained, and actual output is about 350 amperes. Therefore, to preclude the possibility of a constant d-c power loading in excess of 350 amperes, the electrical system of the airplane is designed so that when all systems are operating, the total current drain never exceeds 350 amperes. Table 7–2 outlines the maximum d-c power loading, both constant and momentary, for each stage of operation.

7–25. TESTING. Refer to table 7–3.

7–26. BATTERY.

7–27. DESCRIPTION. (See figure 7–2.) The battery, a 24-volt, 34-ampere hour, aircraft type is installed in the radio compartment, at fuselage station 187. The battery rests on a mounting tray and is secured by hold-down rods fitted with screw clamps. Provisions are made for installing two 24-volt, 24-ampere hour batteries, if desired, in place of the single battery installation. Two extra battery hold-down rods, used for dual battery installation, are stored in a clip at fuselage station 200. The battery is connected to the d-c power supply system by connecting the quick-disconnect type plug. A venting system connecting the battery to an airscoop on the left-hand side of the fuselage and to an exhaust outlet on the underside of the fuselage prevents accumulation of hydrogen gas under the battery cover during flight or ground operation.

Note

In the event of battery electrolyte leakage, all controls (cables, push-pull rods, etc.) in the battery compartment, and any controls in adjacent compartments that may have been contaminated shall be replaced.

7–28. TESTING. A periodic check of the battery should be made to determine the specific gravity and level of the electrolyte contained in each cell. A reliable hydrometer reading of each cell should be within the applicable range:

Tropical climate	1.240 to 1.260
Temperate climate	1.275 to 1.300

(For testing during extreme temperatures, refer to the technical publication applicable to the battery.) The electrolyte level should be maintained at ⅜ inch above the plate protector, or at the star-shaped figure in the vent well. Only clean drinking water, preferably distilled, should be added to the battery whenever it is necessary to restore the electrolyte level. It is important to keep the battery free of all corrosion and to periodically apply corrosion-preventive compound (Specification MIL-C-6708) to the terminals.

CAUTION

An external source of power should be utilized for ground checks. Continuous or frequent use of the battery for ground operations requires additional battery maintenance and shortens battery life.

7–29. D-C POWER CONTROL SWITCH.

7–30. DESCRIPTION. (See figure 7–2.) The d-c power control switch is installed in the pilot's right-hand control panel, and is a triple-pole, double-throw type switch with three positions: "BAT ONLY," "OFF," and "BAT & GEN." A 5-ampere circuit breaker identified as BAT SW is connected in series between the battery bus and the d-c power control switch. Placing the switch in the "BAT ONLY" position energizes the battery relay to transfer

TABLE 7–1. TROUBLE SHOOTING D-C POWER SUPPLY SYSTEM

Trouble or Symptom	*Probable Cause*	*Correction*
1. Battery voltage low.	a. Electrolyte level low in battery cells.	Bring electrolyte level to 3/8 inch above plate protector.
	b. Excessive use of battery during ground checks.	Use external power for all but low-load, short-period checks.
2. Battery overheats.	a. Generator voltage regulator defective. (Generator voltage output excessive.)	Repair or replace regulator.
	b. Battery discharging too rapidly.	Operate only for low-load, short-period checks.
3. Battery corroded.	a. Electrolyte level high; spills out of vents.	Reduce electrolyte to correct level.
	b. Excessive gassing of cells due to excessive charging rate or current drain.	Repair or replace generator voltage regulator or eliminate cause of excessive current drain.
4. Generator voltage output low or zero.	a. Generator brushes worn, improperly seated, or binding in brush boxes.	Replace brushes.
	b. Commutator on generator armature rough, pitted, or burned.	Replace generator.
	c. Generator residual field magnetism insufficient or reversed.	Restore or reverse residual field magnetism (per paragraph 7–36).
	d. Generator armature or field coil windings open-circuited, shorted to ground, or short-circuited.	Replace generator.
	e. Generator positive lead shorted to ground between generator and generator control relay.	Replace lead; check generator and replace if damaged.
	f. Connections to carbon pile in generator voltage regulator shorted to ground or open-circuited.	Repair or replace regulator.
	g. Rheostat in generator voltage regulator base shorted to ground.	Repair or replace regulator base.
5. Deleted.		
6. Generator armature or field windings burned out.	a. Armature or field windings short-circuited.	Replace generator.
	b. Generator overloaded.	Remove cause of overload and repair or replace generator.
7. Generator control relay fails to close at stipulated closing voltage.	a. Relay out of adjustment.	Replace relay.
	b. Relay contacts do not make contact when relay closes.	Replace relay.
	c. Relay armature stuck.	Replace relay.
8. Generator control relay fails to open on reverse current.	a. No gap at polarized contacts when relay is de-energized.	Replace relay.
	b. Refer to 7 c.	
9. Reverse current required to open generator control relay is excessive.	a. Insufficient wipe on relay contacts.	Replace relay.
	b. Refer to 7 a.	
10. Generator output voltage rises or falls as load is applied.	Generator voltage regulator out of adjustment.	Repair or replace regulator.
11. Generator output voltage too high.	a. Voltage regulator magnetic coil shorted, grounded, or open.	Replace regulator.
	b. Voltage regulator carbon-pile discs worn (if rise has been gradual).	Repair or replace generator.

TABLE 7-2. POWER LOADING—D-C POWER SUPPLY SYSTEM

Type and Part Name	No. in Airplane	Amperes per Part	Operating Time (Minutes)	Operating Conditions*	Total Amperes	Amperes per Time Unit (Minutes) ½	2	15†
ARMAMENT:								
Armament safety relay	1	0.12						
Inner station release								
Relay "A"	1	0.12		F	Neg			
Relay "B"	1	0.12		F	Neg			
Inner station release solenoid	3	3.3		F	Neg			
Inner station nose and tail arm solenoid	3	0.20	30.0	F	0.6	0.6	0.6	0.6
Interval generator	1	1.0		F	2.0	2.0	2.0	2.0
Interval generator station selector switch	1	3.0		F	3.0	0.6	0.2	Neg
Inner station bomb ejector test light (lamp)	1	0.18						
Gun safe and ready pressure switch	2							
Gun charging valve	1							
Gun firing relay	1	0.39	0.50	F	0.4	0.4	0.1	Neg
Gun firing solenoid	4	10.8	0.50	F	43.2	43.2	10.8	0.7
Gun charge fire control relay	2	0.27						
Gun heat control relay	1	0.12	30.0	A, B, C, D, E, F, G	0.1	0.1	0.1	0.1
Gunsight light (lamp)	1	0.66	30.0	F	0.7	0.7	0.7	0.7
Master armament relay	1	0.39	30.0	F	0.4	0.4	0.4	0.4
Outer station release								
Relay "A"	1	0.12		F	0.2	0.1	Neg	Neg
Relay "B"	1	0.12		F	0.2	0.1	Neg	Neg
Rocket latch solenoid	12	0.17	30.0	F	2.0	2.0	2.0	2.0
Rocket release solenoid	12	4.0		F	8.0	1.6	0.4	0.1
Rocket nose arm solenoid	12	0.20	30.0	F	2.4	2.4	2.4	2.4
Rocket tail arm solenoid	12	0.205	30.0	F	2.4	2.4	2.4	2.4
Special weapon	1							
Condition 1		14.0	30.0	E	14.0	14.0	14.0	14.0
Condition 2		42.0	15.0	F	42.0	42.0	42.0	21.0
PHOTOGRAPHIC:								
Gun camera heat	1	1.8	30.0	A	1.8	1.8	1.8	1.8
				F			1.3	1.8
Gun camera operate	1	2.73	0.50	F	2.7	2.7	0.8	0.1
Gun camera relays	2	0.12	0.50	F	0.1	0.1	Neg	Neg
CONTROL SURFACES:								
Auto pilot (clutch in)	1	2.3	30.0	E	2.3	2.3	2.3	2.3
Auto pilot clutch relay	1	0.12	30.0	A, B, C	0.1	0.1	0.1	0.1
Horizontal stabilizer actuator	1		0.17	C	16.0	5.4	1.4	0.2
				D, E, F	50.0	1.7	0.8	0.8
Horizontal stabilizer manual solenoid	1	0.1	0.17	C, D, E, F	0.1	Neg	Neg	Neg
INSTRUMENTS: (NON-FLIGHT)								
Landing gear and flap position indicator	1	0.20	30.0	All	0.2	0.2	0.2	0.2
Outside air temperature indicator	1	0.11	0.05	E	Neg			
Landing gear position warning light	1	0.04	0.17	D, G	Neg			
ENGINE INSTRUMENTS:								
Fuel pressure warning light (lamp)	1	0.18	30.0	A, G	0.2	0.2	0.2	0.2
Engine gage	1	0.08	30.0	All	0.1	0.1	0.1	0.1
Carburetor air temperature indicator	1	0.11	30.0	All	0.1	0.1	0.1	0.1

TABLE 7-2. POWER LOADING—D-C POWER SUPPLY SYSTEM (Continued)

Type and Part Name	No. in Airplane	Amperes Per Part	Operating Time (Minutes)	Operating Conditions*	Total Amperes	Amperes per Time Unit (Minutes) 1/2	2	15†
FLIGHT INSTRUMENTS:								
Pitot tube heater	1	3.1	30.0	All	3.1	3.1	3.1	3.1
Vertical stabilizer-static pitot tube heater	1	9.1	30.0	All	9.1	9.1	9.1	9.1
G-2 compass	1	1.36	30.0	All	1.4	1.4	1.4	1.4
LANDING GEAR:								
Hydraulic auxiliary pump	1	92.2		A	92.2	92.2	46.2	6.2
Hydraulic auxiliary pump relay	1	0.39		A	0.4	0.4	0.1	Neg
Landing gear lever safety solenoid	1	0.44	30.0	D, E, F	0.5	0.5	0.5	0.5
				G	0.5	0.5	0.3	Neg
Dive brake lever safety solenoid	1	0.44	30.0	D, E, F	0.5	0.5	0.5	0.5
				G	0.5	0.5	0.3	Neg
HEATING:								
Utility receptacle	1	15.0	30.0	B, C, D, E, G	15.0	15.0	15.0	15.0
Antiexposure suit ventilation blower	1	11.0	30.0	(Except A)	11.0	11.0	11.0	11.0
IGNITION:								
Starting vibrator	2	3.3	0.50	B	6.6	6.6	1.6	0.2
ENGINE CONTROL:								
Carburetor air control actuator	1	0.7	0.08	C, E	0.7	0.2	0.1	Neg
Cowl flap actuator front	1	2.64						
Cowl flap actuator rear	1	3.54		D	3.5	1.3	0.3	Neg
				G	3.1	1.0	0.3	0.1
Cowl flap control relay	1	0.12		D, G	0.1	Neg	Neg	Neg
Oil cooler door actuator	1			B	1.7	0.4	0.1	Neg
				E	1.8	0.5	0.1	Neg
Starter	1							
Starter relay	1	2.25	0.50	B	2.3	2.3	0.6	0.1
LIGHTING:								
Anticollision lights	2	2.71	30.00	(Except A)	5.4	5.4	5.4	5.4
Approach light	1	0.69		G	0.7	0.7	0.7	0.7
Approach light relay	1	0.12		G	0.1	0.1	0.1	0.1
Chartboard lights	2	0.18	15.0	A, B	0.4	0.4	0.2	Neg
				E	0.4	0.4	0.4	0.2
Console lights	78	0.04	30.0	All	3.1	3.1	3.1	3.1
Cockpit floodlights	2	0.18	30.0	All	0.4	0.4	0.4	0.4
Emergency lights relay	1	0.12						
Flasher coder	1	0.60	30.0	D, E, F, G	0.6	0.6	0.6	0.6
Flight lights	18	0.04	30.0	All	0.7	0.7	0.7	0.7
Formation lights - wing tip	2	0.18	30.0	D, E, F, G	0.4	0.4	0.4	0.4
Formation lights - fuselage	2	0.18	30.0	D, E, F, G	0.4	0.4	0.4	0.4
Keying indicator light	1	0.04	Neg					
Non-flight lights	27	0.04	30.0	All	1.1	1.1	1.1	1.1
Position lights - wing tip	2	0.75	30.0	D, E, G	1.5	1.5	1.5	1.5
Position lights - tail	4	0.69	30.0	D, E, G	2.8	2.8	2.8	2.8
Position lights - fuselage (bright)	2	2.75	30.0	D, E, G	5.5	5.5	5.5	5.5
Position lights - fuselage (dim)	2	0.18						
Standby compass light	1	0.19	30.0	A, E	0.2	0.2	0.1	Neg
Service lights - forward	2	0.18		A	0.2	0.2	0.2	0.2
Service lights - aft	2	0.69		A	1.4	1.4	1.4	1.4
Tail hook by-pass relay	1	0.12						
Tail hook warning light	1	0.04	Neg					
MISCELLANEOUS:								
Seat actuator	1	7.0	0.08	A,B,C,D,E,G	Neg			
Windshield degreaser pump	1	1.98		E, F	1.5	0.3	Neg	Neg
				G	1.5	1.0	0.3	0.1

TABLE 7–2. POWER LOADING—D-C POWER SUPPLY SYSTEM (Continued)

Type and Part Name	No. in Airplane	Amperes per Part	Operating Time (Minutes)	Operating Conditions*	Total Amperes	Amperes per Time Unit (Minutes) ½	2	15†
D-C POWER:								
Battery relay	1	0.39	30.0	All	0.4	0.4	0.4	0.4
Bus control relay	1	0.20	30.0	All	0.2	0.2	0.2	0.2
External power relay	1	0.39		A	0.4	0.4	0.4	0.4
				B	0.4	0.4	0.2	Neg
External power pilot relay	1	0.12		A, B	0.1	0.1	0.1	0.1
Generator warning light	1	0.18	15.0	A	0.2	0.2	0.2	0.2
Generator control (reverse current) relay	1	0.5	30.0	All	0.5	0.5	0.5	0.5
Monitor bus relay	1	0.39	30.0	B, C, D, E, F, G	0.4	0.4	0.4	0.4
Secondary bus relay	1	0.39	30.0	All	0.4	0.4	0.4	0.4
FUEL AND OIL:								
Engine oil dilution solenoid valve	1	1.30	3.0	G		1.3	1.3	0.8
Engine priming solenoid valve	1	1.3	0.20	B	1.3	0.4	0.1	Neg
Fuel booster pump	1	15.2		A, E	15.2	15.2	3.8	0.5
				B, D, F, G	15.2	15.2	15.2	15.2
Oil diverter relay	1	0.12	3.0	G	0.1	0.1	0.1	0.1
Oil diverter valve	1	0.60	0.10	G	0.6	0.2	Neg	Neg
RADIO:								
Marker beacon	1	1.5	30.0	All	1.5	1.5	1.5	1.5
Marker beacon warning light	1	0.18						
Master radio relay	1	0.255	30.0	All	0.3	0.3	0.3	0.3
Mode control relay	1		30.0					
Radio compass (course indicator)	1	2.8	30.0	A	2.8	2.8	0.7	0.1
				B, C, D, E, F, G	2.8	2.8	2.8	2.8
ID-250 relay (course indicator)	1		30.0					
UHF communications radio (receive)	1	13.9	30.0	A	13.9	13.9	13.9	1.9
				B, C, D, E, F, G	13.9	13.9	13.9	13.9
UHF communications radio (transmit)	1	17.7		A	3.8	3.8	1.0	0.1
				B, C, D, E, F, G	3.8	3.8	1.9	0.8
UHF direction finder	1	1.10	30.0	E, F, G	1.1	1.1	1.1	1.1
RADAR:								
Altimeter	1	1.2	30.0	All	1.2	1.2	1.2	1.2
Recognition	1	0.38	30.0	D, E, F	0.4	0.4	0.4	0.4
Search (standby)	1	3.3	30.0	D, E, F	3.3	3.3	3.3	3.3
Search (receive)	1	4.9	30.0	E, F	1.6	1.6	1.6	1.6
SPECIAL ELECTRONIC:								
Bomb director	1	8.3	30.0	A	8.3	8.3	8.3	8.3
				F	8.6	8.6	8.6	8.6
Bomb director indicator light	1	0.18		A	0.2	Neg	Neg	Neg
WARNING AND EMERGENCY:								
Canopy jettison	2							
A.C. POWER:								
A.C. power switching relay	1	.325/.320	30.0	All	0.3	0.3	0.3	0.3
No. 1 inverter	1	13.0	30.0	All	13.0	13.0	13.0	13.0
No. 2 inverter	1		30.0	A, B, C, D, G	29.9	29.9	29.9	29.9
				E, F	33.7	33.7	30.9	30.0
No. 2 inverter control relay	1	.60	30.0	All	0.6	0.6	0.6	0.6

* Operating condition code:
A—Loading
B—Start and warm-up
C—Taxi
D—Take-off and climb
E—Cruise
F—Combat
G—Landing

† Time unit (15-minute) applicable all conditions except:
E and F—30 minute
G— 5 minute

battery power to the primary bus, which energizes the secondary bus relay to transfer primary bus power to the secondary bus. (The generator control relay and the bus control relay cannot close with the d-c power control switch in "BAT ONLY.") Placing the switch in the "BAT & GEN" position causes the generator control relay to close to transfer generator power to the primary bus if generator voltage is 0.35 to 0.65 volt greater than primary bus voltage.

7–31. BATTERY RELAY.

7–32. DESCRIPTION. (See figure 7–2.) The battery relay, a single-pole, single-throw type, is installed in the radio compartment at fuselage station 185. The coil of the battery relay is connected to the d-c power control switch and ground; the A1-A2 contacts are connected between the primary bus and the battery bus. Since the coil of the battery relay is connected to the battery bus through the d-c power control switch, either position of that switch energizes the coil of the battery relay.

7–33. D-C GENERATOR.

7–34. DESCRIPTION. The 30-volt, 400-ampere, 4-pole generator is installed on the engine supercharger rear cover pad and comprises the normal direct-current power source for the airplane. The generator is engine-driven, by means of a 16-tooth involute spine, at a ratio of 2.8 to 1 and operates through a speed range of 4500 to 8000 rpm. The generator is connected to the primary bus through the generator control relay, and generator output is regulated to 27.7 ± 0.5 volts by the carbon-pile type voltage regulator. Ram air for cooling is ducted to the side of the generator.

7–35. CLEANING AND MINOR REPAIR.

a. Check generator attaching nuts to ascertain they are tight.

b. Remove AN781 nipples from generator terminal block and inspect terminals for dirt or other foreign material.

c. Remove brush inspection band and remove accumulated dust and foreign matter, being careful not to allow particles to enter armature.

d. Disconnect cooling air duct at generator and remove any dust and foreign matter from duct.

e. If brushes are worn to within 1/8 inch of mounting rivets or are chipped, or if brush springs are weak, replace brushes and/or springs.

f. If commutator is burned or pitted, replace generator.

7–36. RESTORING OR REVERSING RESIDUAL FIELD MAGNETISM.

a. Make certain d-c power control switch is off.

b. Connect a jumper lead from terminal "F" on voltage regulator to "BAT" stud on generator control relay.

TABLE 7–3. TESTING D-C POWER SUPPLY SYSTEM

The following test procedure applies to the d-c generator and its associated equipment.

EQUIPMENT REQUIRED

Voltmeter, d-c portable, 0-to-30-volt scale, 1/4 of 1 percent of full-scale accuracy.

Ammeter, zero-centered, 50-millivolt movement, 50-ampere-positive and 50-ampere-negative scale; 1/2 of 1 percent of full-scale accuracy.

Test headset.

PRELIMINARY CONDITIONS

Ammeter shunt (50-millivolt) and ammeter series-connected between generator positive lead and GEN terminal of generator control relay.

Battery installed.

BAT SW circuit breaker closed.

D-c power control switch "OFF."

No electrical load on system.

No external power source connected.

Engine operating.

Operation	*Desired Result*
a. Voltmeter connected to d-c test jacks; headset to "F" and "G" on voltage regulator.	
b. D-c power control switch in "BAT & GEN."	
c. Engine speed increased to 1700 rpm.	Test voltmeter indicates 27.7 ± 0.5 volts steadily; steady roar or hum in headset. Test ammeter indicates positive battery charging current.
d. Load connected (less than 50 amperes: lights, radio, etc.).	Test voltmeter indication remains steady above 27.5 volts; ammeter indicates battery charging and load currents.
e. Test voltmeter connected successively between primary, secondary, and monitor buses and ground.	Voltmeter indicates 27.7 ± 0.5 volts on each bus.
f. Test voltmeter connected between armament bus and ground.	No voltage indication on voltmeter.
g. Airplane engine speed decreased to "idle" rpm while observing voltammeter.	Test ammeter moves across zero to some point between 20 and 35 amperes on the negative scale, then returns to zero; generator warning light comes on; voltmeter indicates battery voltage when ammeter at zero.

c. Move d-c power control switch to "BAT ONLY," (not to exceed 3 seconds) then quickly move switch back to "OFF."

d. Remove jumper from terminals of regulator and generator control relay.

7–37. REMOVAL.

a. Install engine work platform.

b. Remove accessory cowling.

c. Disconnect supercharger control rod at quick-disconnect.

d. Disconnect hydraulic pump drain line at pump.

e. Disconnect hydraulic line support (below generator) at bracket.

f. Remove AN781 nipples and disconnect cable leads from terminal block on generator.

g. Disconnect suction line at hydraulic pump.

h. Disconnect cooling-air duct.

i. Remove nuts from generator mounting studs, using special tool K-32315.

j. Support generator and carefully pull clear of studs.

CAUTION

Do not allow the weight of the generator (approximately 60 pounds) to bear on the spline shaft since the weight of the unit may produce bending in the shaft. Do not pick up or carry the generator by the splined shaft.

7–38. INSTALLATION.

a. Clean generator mounting pad.

b. Insert splined shaft part-way into driving unit. Line up nearest mounting holes with mounting studs. Push generator toward mounting pad until studs extend through holes, and secure attaching washers and nuts.

c. Use special tool K-32315 to torque each nut to 275 to 300 inch-pounds.

d. Connect cooling-air duct.

e. Connect hydraulic pump suction line to pump.

f. Connect cable leads to terminal block on generator and install AN781 nipples on terminals.

g. Connect hydraulic line support at bracket below generator.

h. Connect hydraulic pump drain line to pump.

i. Connect supercharger control rod at quick-disconnect.

7–39. D-C GENERATOR VOLTAGE REGULATOR.

7–40. DESCRIPTION. (See figure 7–2.) The d-c generator voltage regulator is installed in the forward equipment compartment on the left-hand side between fuselage station 96 and 110. The d-c generator voltage regulator is a carbon-pile type, equipped with a base panel which includes a slide-type paralleling resistor and regulator terminal studs. The regulator is attached to the base by positioning slots and spring clips, and maintains generator output voltage at a constant 27.7 ± 0.5 volts, regardless of load conditions. The regulator is essentially a generator field rheostat and regulates generator output voltage by automatically controlling the field current of the generator.

7–41. TESTING. The voltage regulator is tested for stability and proper regulation while the engine is operating.

7–42. *Regulator stability* can be tested as follows:

a. Loosen hose clamp and regulator cover. Connect earphone leads to terminals F+ and G+ on regulator base panel.

b. Listen carefully in earphones and gradually accelerate engine to maximum ground rpm: a smooth, steady hum or roaring noise in earphones indicates a stable regulator; if a rapid succession of clicking or popping noises is heard, the voltage regulator is unstable and should be replaced. (The more unstable the regulator, the louder the clicking or popping noise. Any type of instability causes permanent damage to the regulator carbon discs.)

7–43. *Accuracy of regulation* can be tested as follows:

a. Connect accurate portable d-c voltmeter to d-c generator test jacks and insure that polarity is correct.

b. Run engine between 1550 and 1600 rpm.

c. Turn off all possible d-c loads, place d-c power control switch to "BAT & GEN." Voltmeter should indicate 27.5 to 28.5 volts.

d. Turn on d-c load such as carburetor air control, radio, or lights; voltage indication should not drop below 27 volts.

7–44. ADJUSTMENT. No adjustment of the voltage regulator should be attempted while it is installed in the airplane. A voltage regulator requiring adjustment should be replaced with a serviceable unit.

7–45. D-C GENERATOR CONTROL (REVERSE CURRENT) RELAY.

7–46. DESCRIPTION. (See figure 7–2.) The d-c generator control relay, identified as REVERSE CURRENT RELAY, is installed in the forward equipment compartment on TERM PANEL 17. The relay is a differential type, automatically connecting the generator to the primary bus when the generator voltage becomes at least 0.35 to 0.65 volt greater than battery or primary bus voltage. Conversely, the relay disconnects the generator when a reverse current of 20 to 35 amperes flows from the primary bus to the generator.

7–47. TESTING. Test the d-c generator control relay when the engine is running:

a. Connect leads of an accurate d-c voltmeter (zero-to-50 volt range) to d-c test jacks.

b. Place d-c power control switch in "BAT & GEN."

c. Increase engine speed until relay closes and note value of generator voltage (pick-up). Repeat several times.

d. If relay is not adjusted to pick up at 20 to 24 volts, remove from airplane for testing and adjusting on test stand.

7–48. ADJUSTING. Do not attempt to adjust d-c generator control relay while it is installed in airplane. If relay is not functioning properly, replace it with a serviceable unit.

7–49. D-C BUS CONTROL RELAY.

7–50. DESCRIPTION. (See figure 7–2.) The BUS CONTROL relay, a triple-pole, double-throw type, is installed in the forward equipment compartment on TERM PANEL 17. The coil of the bus control relay is energized by d-c generator power from the IND terminal of the d-c generator control relay. With the d-c power control switch in "BAT & GEN" and the d-c generator functioning normally, the following condition results:

Bus Control Relay Contact Position	*Results*
A1-A2 closed	Connects primary bus power to the coil of the secondary bus relay
B1-B2 closed	Connects primary bus power to the coil of the monitor bus relay
C1-C2 closed	Connects primary bus power to the coil of the battery relay

7–50A. When the coil of the bus control relay is de-energized (because of d-c generator failure) it results in the following conditions:

Bus Control Relay Contact Position	*Results*
A2-A3 closed	Inactive
B2-B3 closed	Connects primary bus power to the d-c generator warning light
C2-C3 closed	Connects the battery bus circuit breaker and the battery

7–51. D-C SECONDARY BUS RELAY.

7–52. DESCRIPTION. (See figure 7–2.) The SECONDARY BUS relay, a single-pole, single-throw, 200-ampere type, is installed in the forward equipment compartment on TERM PANEL 17. The coil of the secondary bus relay is energized by primary bus power in the following manner (1) across the A1-A2 contacts of the bus control relay when the d-c power control switch is in "BAT & GEN" and generator output is normal; (2) across the secondary bus transfer switch when the landing gear lever is in the "WHEELS DOWN" position, and the d-c generator has failed; (3) across the d-c power control switch in the "BAT ONLY" position. When the relay coil is energized the contacts connect primary bus power to the secondary bus.

7–53. D-C SECONDARY BUS TRANSFER SWITCH.

7–54. DESCRIPTION. The SEC BUS TRANSFER switch, a single-pole, double-throw type, is installed in the forward equipment compartment at fuselage station 96, below the cockpit floor. The secondary bus transfer switch is actuated by the landing gear control valve linkage, when the landing gear lever is in a "WHEELS UP" position. With the landing gear lever in "WHEELS DOWN," the secondary bus transfer switch is not actuated, therefore the circuit between the primary bus and the coil of the secondary bus relay is completed, thereby closing the relay contacts to transfer primary bus power to the secondary bus.

7–55. D-C MONITOR BUS RELAY.

7–56. DESCRIPTION. (See figure 7–2.) The monitor bus relay, MONITOR RELAY, a single-pole, single-throw, 200-ampere type, is installed in the forward equipment compartment on TERM PANEL 17. The coil of the monitor bus relay is energized by primary bus power in the following manner: (1) across the B1-B2 contacts of the bus control relay when the d-c power control switch is in "BAT & GEN" and the d-c generator has normal output; (2) by an external d-c power source connected to the airplane. When the monitor bus relay is energized primary bus power is connected to the monitor bus.

7–57. D-C EXTERNAL POWER RECEPTACLE.

7–58. DESCRIPTION. (See figure 7–2.) The d-c external power receptacle is installed in the lower surface of the center wing section, to the right of centerline in the forward equipment compartment. The receptacle provides a means of connecting an external source of d-c power to the primary bus for use during ground operations. Two large and one small pin provide the electrical contacts. The large negative pin is connected to the airplane structure, and the large positive pin is connected to the A1 contact of the d-c external power relay. The small positive pin is connected to the d-c external pilot rectifier to energize the coil of the d-c external power pilot relay. On airplanes BuNo. 134581-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the d-c external power receptacle can be utilized to supply primary bus power for starting of another aircraft. With the d-c generator operating, and the EXT PWR STARTING switch momentarily "ON," primary bus power is connected to the coil of the d-c external power relay, and when energized connects primary bus power to the d-c external power receptacle.

7–59. D-C EXTERNAL POWER STARTING SWITCH.

7–60. DESCRIPTION. (See figure 7–2.) A d-c external power switch is installed on airplanes BuNo. 134581-134637, 135223-135406, 137492-137632, 139606-139821, 142010-142081, and airplanes BuNo. 134467-134581 reworked per BuAer AD/SC No. 441. The d-c external

power switch, identified as EXT PWR STARTING, is installed between the a-c and d-c external power receptacles. The switch is accessible only when the access door to the external power receptacles is open. The switch when momentarily placed to "ON" connects primary bus power (d-c generator operating) to the coil of the d-c external power relay, and when energized connects primary bus power to the d-c external power receptacle. Primary bus power is then available for starting of another aircraft.

7–61. D-C EXTERNAL POWER PILOT RECTIFIER.

7–62. DESCRIPTION. (See figure 7–2.) The d-c external power pilot rectifier, designated as EXT PWR PILOT RECT, is installed in the forward equipment compartment on TERM PANEL 17. The rectifier, a selenium type, is installed to insure that power from an external source applied to the primary bus is of correct polarity. The rectifier is connected in series to the small pin of the d-c external power receptacle and the coil of the d-c external power pilot relay; therefore, when power of correct polarity is applied to the d-c external power receptacle the rectifier permits current flow to energize the coil of the d-c external power pilot relay, and when energized connects external power across the closed A1-A2 contacts to the coil of the d-c external power relay, thus energizing the primary bus. If power of incorrect polarity is applied the rectifier prevents current flow to energize the relay and the primary bus cannot be energized.

7–63. D-C EXTERNAL POWER PILOT RELAY.

7–64. DESCRIPTION. (See figure 7–2.) The d-c external power pilot relay, a double-pole, double-throw type, designated EXT PWR PILOT RELAY, is installed in the forward equipment compartment on TERM PANEL 17. When an external d-c power source of correct polarity is connected, the coil of the external power pilot relay is energized by power received from the small pin of the d-c external power receptacle through the d-c external power pilot rectifier. When the relay coil is energized and the A1-A2, and B1-B2 contacts are closed, the following is accomplished:

a. The A1-A2 contacts connect external d-c power from the small pin of the d-c external power receptacle to the coil of the d-c external power relay, thereby energizing the primary bus.

b. The B1-B2 contacts connect primary bus power to the coil of the monitor bus relay, thereby connecting primary bus power to the monitor bus.

7–64A. D-C EXTERNAL POWER RELAY.

7–64B. DESCRIPTION. (See figure 7–2.) The d-c external power relay, a single-pole, single-throw type, is installed in the forward equipment compartment on TERM PANEL 17. The coil is energized by d-c external power from the small positive pin of the d-c external power receptacle, across the A1-A2 contacts of the energized d-c external power pilot relay. The d-c external power relay when energized connects an external d-c power source to the primary bus. On airplanes BuNo. 134581-134637, 135223-135406, 137492-137632, 139606-139821, 142010-142081, the coil of the external power relay is also connected to the primary bus (d-c generator operating) when the EXT PWR STARTING switch is momentarily closed. The external power relay when energized by primary bus power connects primary bus power to the d-c external power receptacle, thereby permitting a maximum of 200-amperes primary bus power to be available for the starting of other aircraft.

7–65. D-C GENERATOR WARNING LIGHT.

7–66. DESCRIPTION. (See figure 7–2.) The d-c GEN WARNING light is installed in the lower right-hand side of the pilot's instrument panel. The light, a push-to-test type, receives test power from the primary bus. When the d-c generator fails, the light comes "ON" automatically by power received from the primary bus across the closed B2-B3 contacts of the de-energized bus control relay; conversely, when the d-c generator is supplying power to the electrical system, the bus control relay is energized, opening the B2-B3 contacts, thereby disconnecting primary bus power from the d-c generator warning light.

7–67. D-C GENERATOR WARNING LIGHT DIMMING RESISTOR.

7–68. DESCRIPTION. The d-c generator warning light dimming resistor WARN LT DIM, a 220-ohm wire wound type, is installed on a resistor panel in the forward equipment compartment. The generator warning light dimming resistor is series connected between the generator warning light and ground, when the A2-A3 contacts of the warning light dimming relay (interior lights circuit) are open. The coil of the warning light dimming relay is energized when the FLT INST selector switch of the interior light control console is in any position other than "OFF."

7–69. D-C TEST JACKS.

7–70. DESCRIPTION. (See figure 7–2.) D-c test jacks for testing primary bus voltage are provided on the cockpit circuit breaker panel and are identified as "VOLTAGE TEST JACKS"—"D-C." The positive (red) test jack is connected to the primary bus, and the negative (black) test jack is connected to a common ground.

7–71. D-C CIRCUIT-BREAKER PANELS.

7–72. DESCRIPTION. (See figure 7–2.) The d-c circuit breaker panels are installed at two locations: one in the pilot's right-hand control panel, and the other in the forward equipment compartment, right-hand side at fuselage station 110.

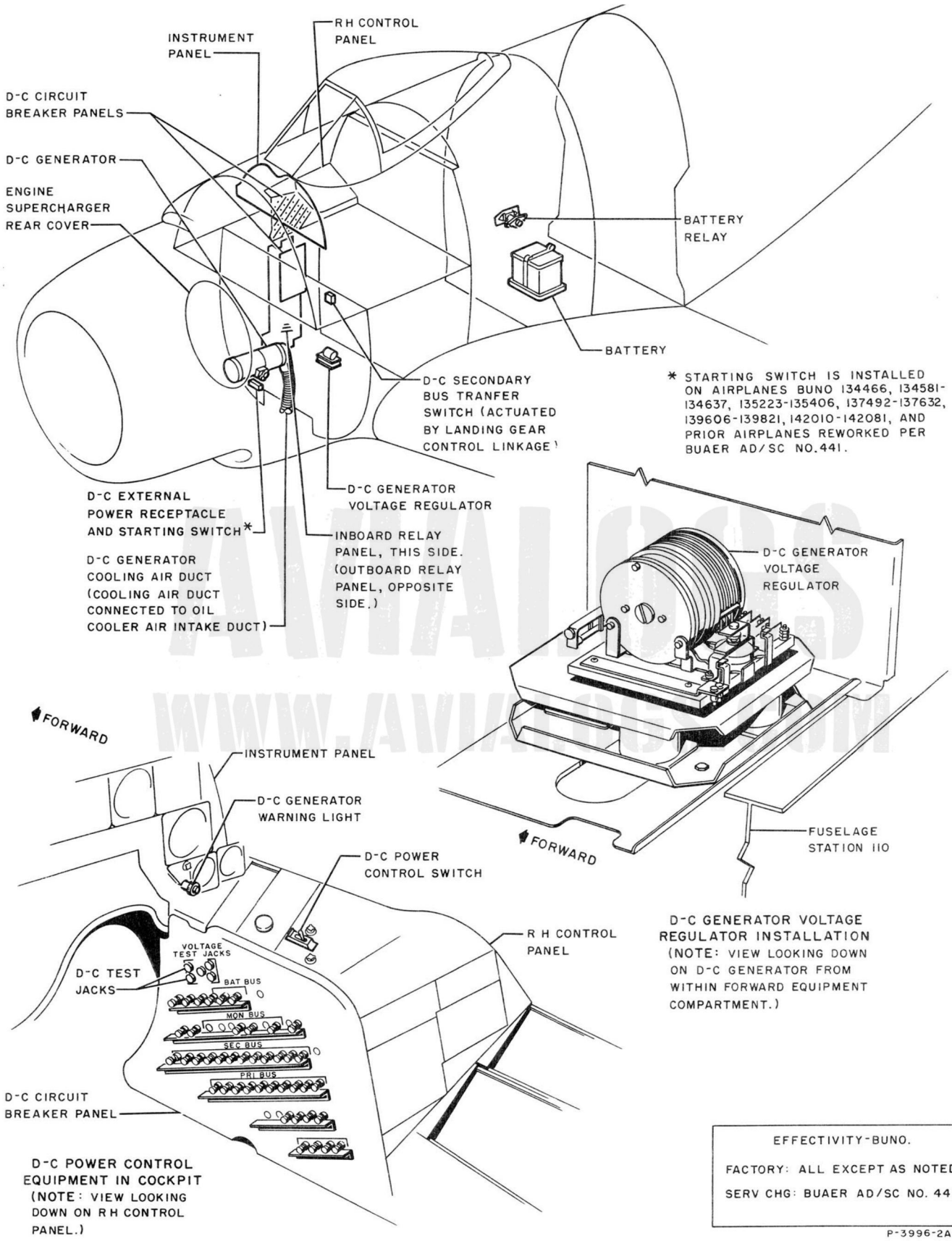
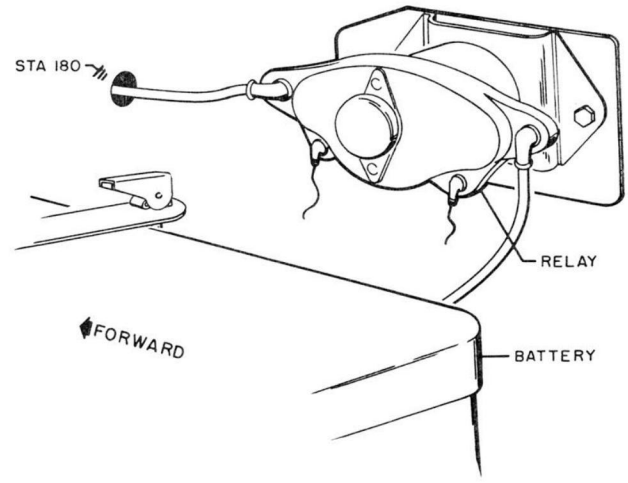
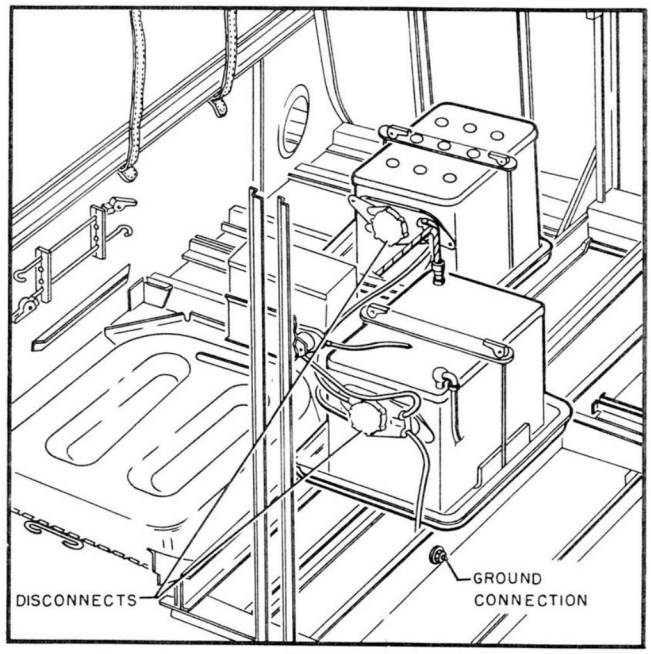


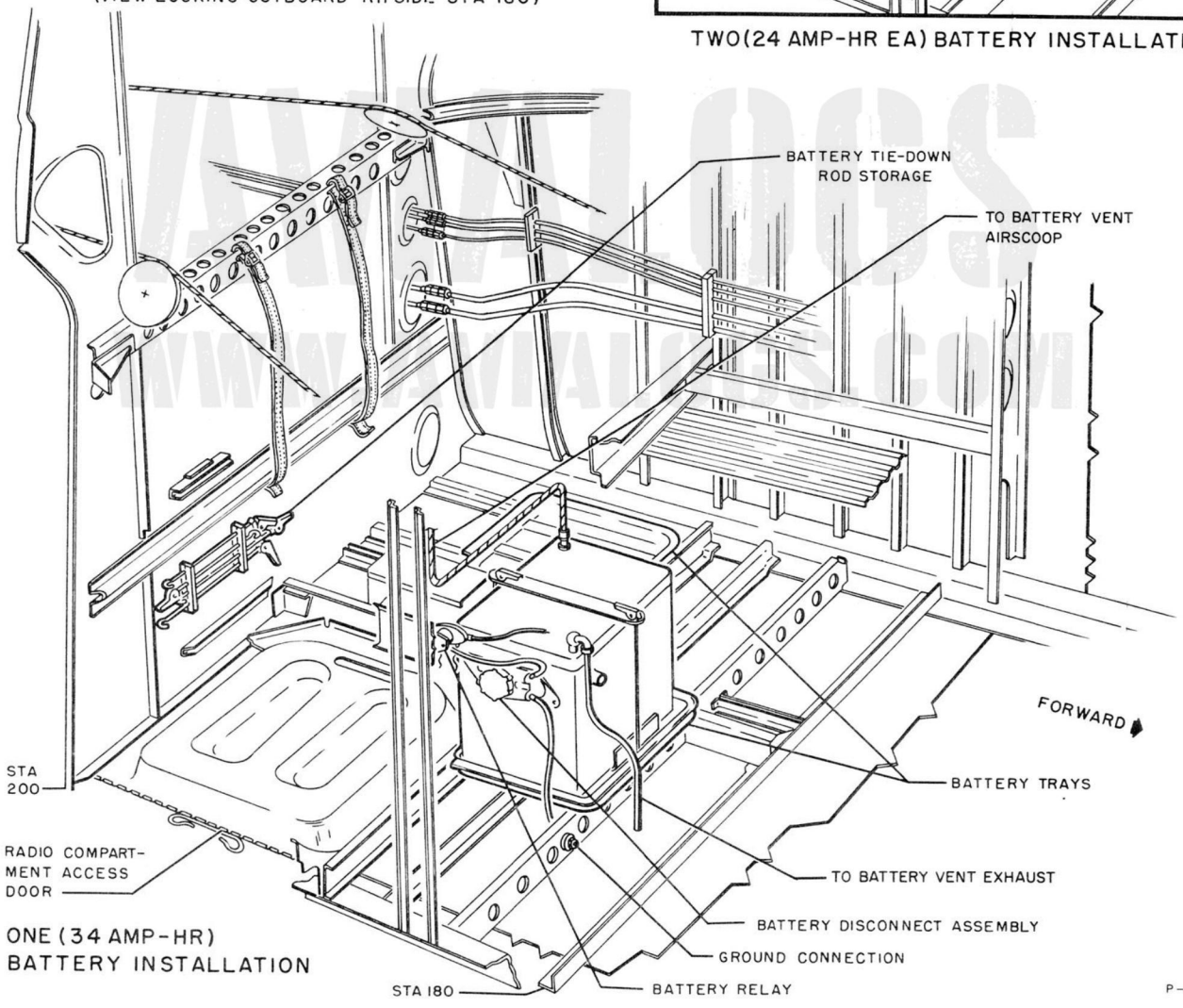
Figure 7–2. D-C Power Supply System—Perspective (Sheet 1)



BATTERY RELAY INSTALLATION
(VIEW LOOKING OUTBOARD RH SIDE STA 180)



TWO(24 AMP-HR EA) BATTERY INSTALLATION



ONE (34 AMP-HR)
BATTERY INSTALLATION

Figure 7–2. D-C Power Supply System—Perspective (Sheet 2)

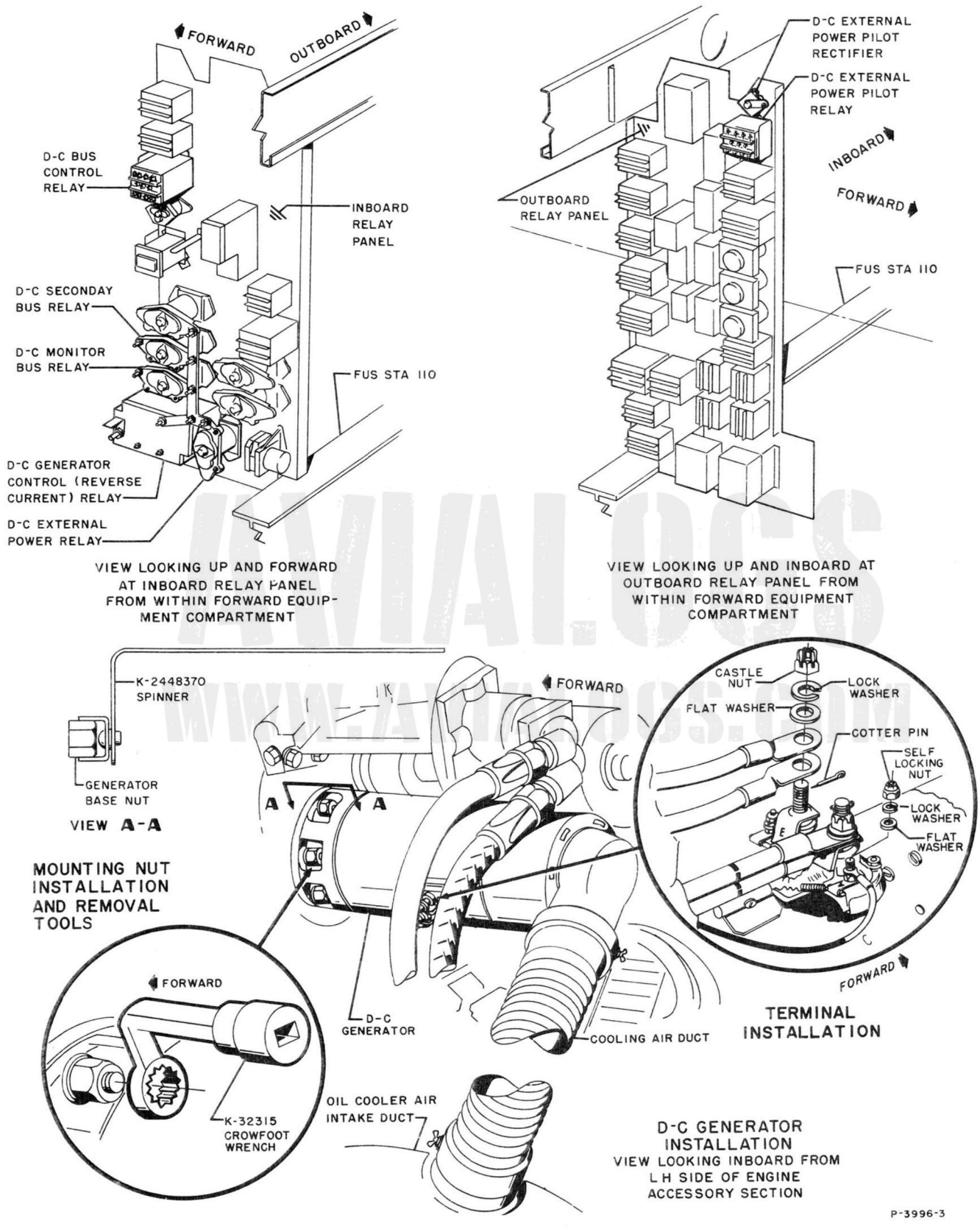


Figure 7–2. D-C Power Supply System—Perspective (Sheet 3)

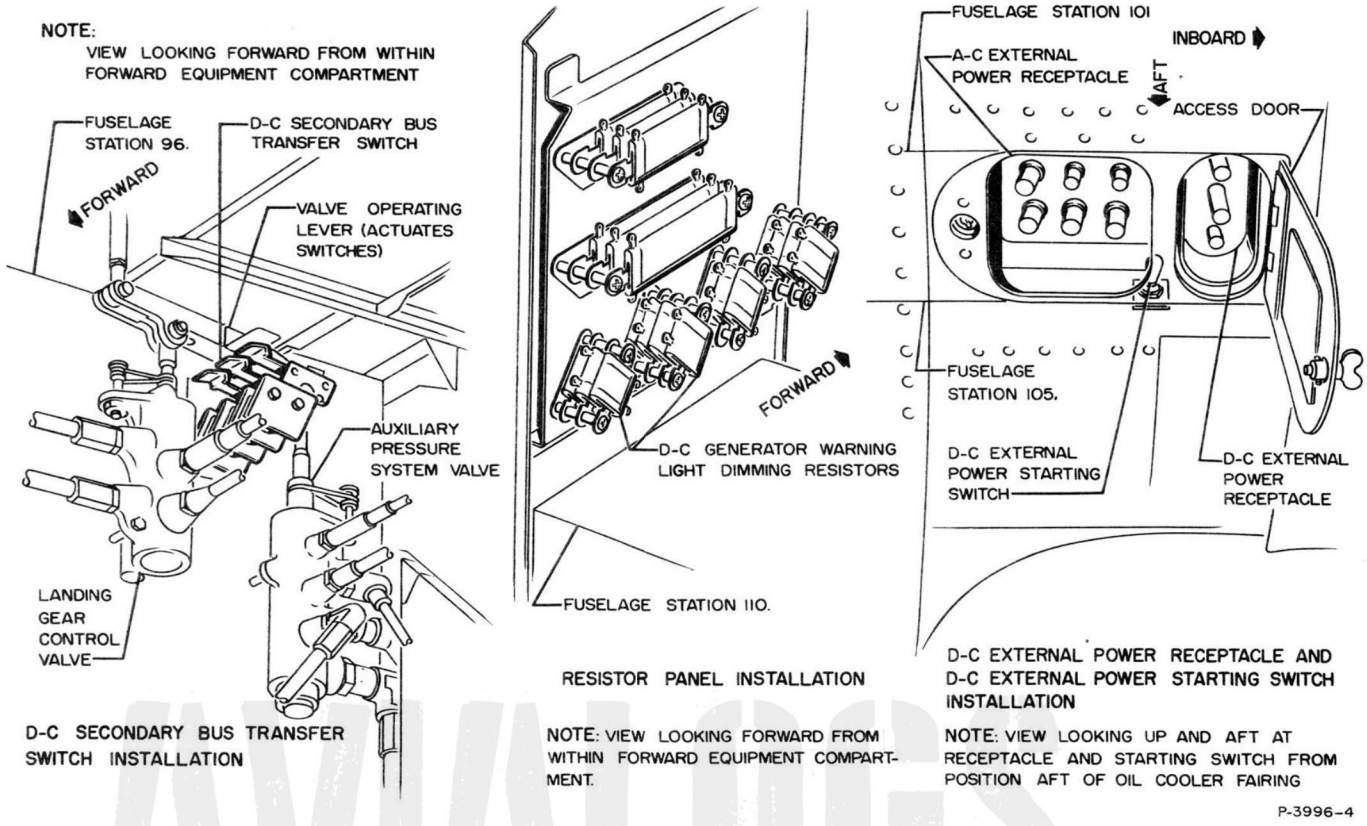


Figure 7–2. D-C Power Supply System — Perspective (Sheet 4)

7–73. D-C POWER DISTRIBUTION.

7–74. DESCRIPTION. (See figure 7–5.) D-c power is distributed to the various circuits throughout the airplane by means of six major buses: *battery, primary, secondary, monitor, armament,* and *radio.* A minor bus such as d-c instruments is located in the cockpit so that a source of power may be established in close proximity to the equipment. The minor buses differ from the major buses in that they supply equipment with fused or protected power from one of the major buses. The actual point of connection between a circuit and a bus is either at the circuit breaker panel, or at a minor bus located in the circuit breaker panel near the equipment.

7–75. The *battery bus* is always energized when a battery is installed, and connected to the airplane.

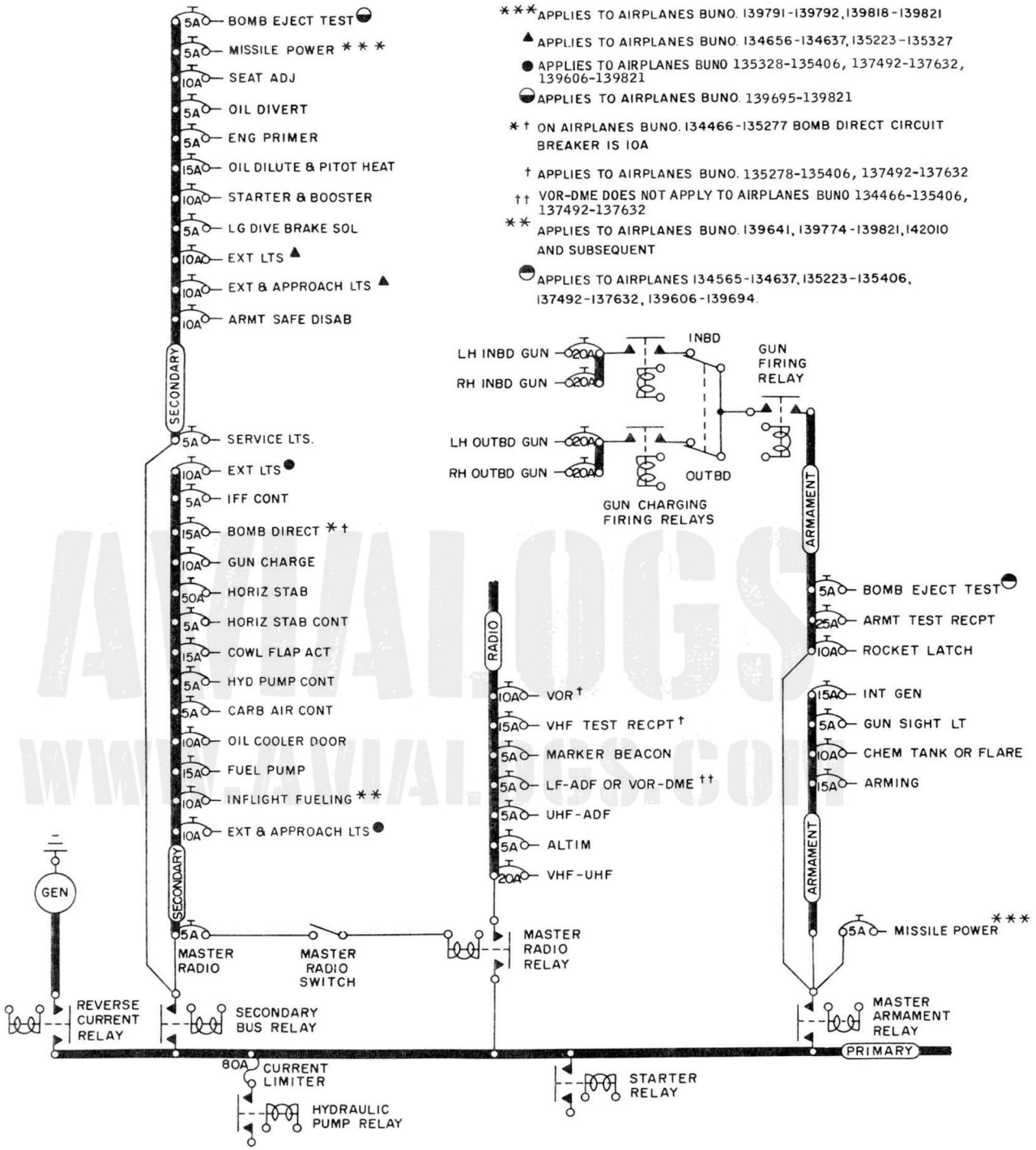
7–76. The *primary bus* is energized by battery power across the battery relay which is energized by battery power when the d-c power control switch is in the "BAT ONLY" position, or with the generator not operating, and the d-c power control switch in "BAT & GEN." The primary bus is also energized by d-c generator power across the d-c generator control (reverse current) relay which is energized by d-c generator power across the d-c power control switch in "BAT & GEN," and the d-c generator voltage is 0.35 to 0.65 volts greater than the battery voltage. The primary bus is also energized by an external d-c power source of correct polarity connected to the d-c external power receptacle.

7–77. The *secondary bus* is energized by generator power from the primary bus when the d-c generator voltage is sufficient to close the d-c generator control (reverse current) relay, or if the d-c generator is not operating, with battery power on the primary bus by placing the d-c power control switch in "BAT ONLY," or by an external d-c power source on the primary bus and the d-c power control switch "OFF" and the landing gear control lever in the "WHEELS DOWN" position.

7–78. The *monitor bus* is energized by primary bus power when d-c generator voltage is sufficient to close the generator control relay, or by external d-c power when an external power source of correct polarity is connected to the d-c external power receptacle.

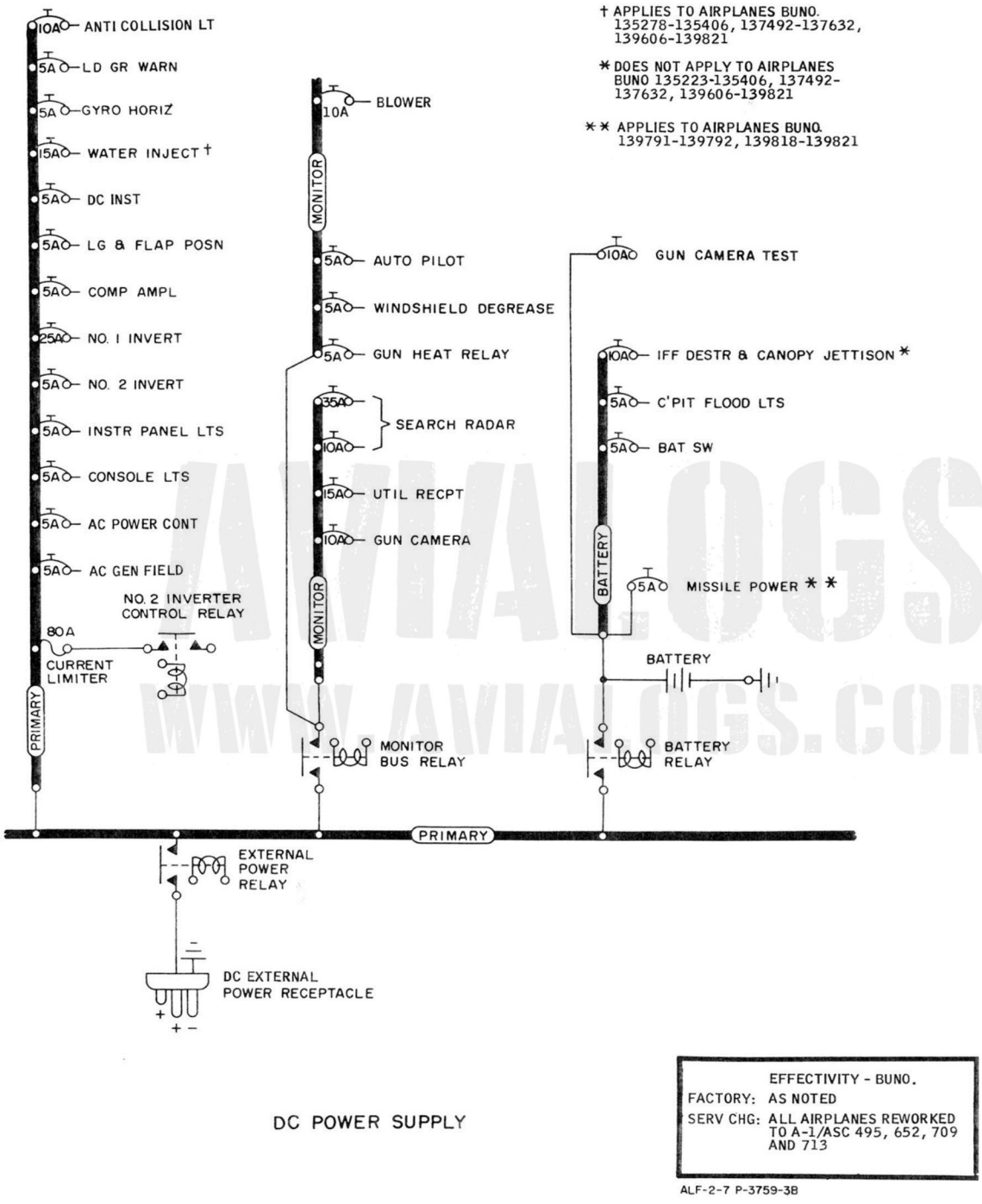
7–79. The *armament bus* is energized when the primary and secondary buses are energized and the master armament switch (circuit-breaker type) is in the "ON" position. To preclude inadvertently firing the guns or releasing external stores during landing maneuvers, an armament safety circuit is incorporated. This circuit includes the master armament safety switch which is actuated to close when the landing gear control lever is in the

Figures 7–3 and 7–4. Deleted



DC POWER SUPPLY

Figure 7-5. DC Power Distribution (Sheet 1)

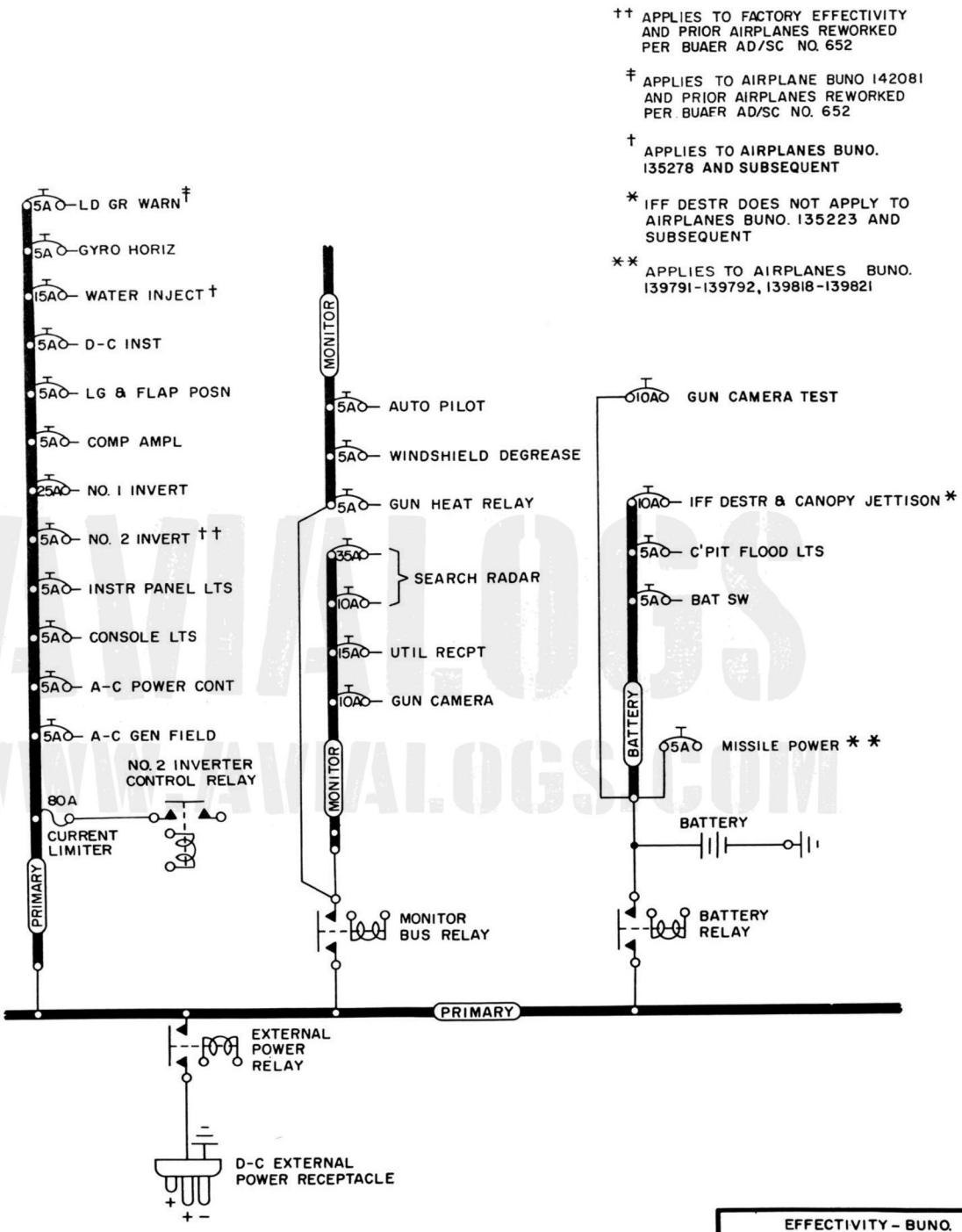


DC POWER SUPPLY

EFFECTIVITY - BUNO.	
FACTORY:	AS NOTED
SERV CHG:	ALL AIRPLANES REWORKED TO A-1/ASC 495, 652, 709 AND 713

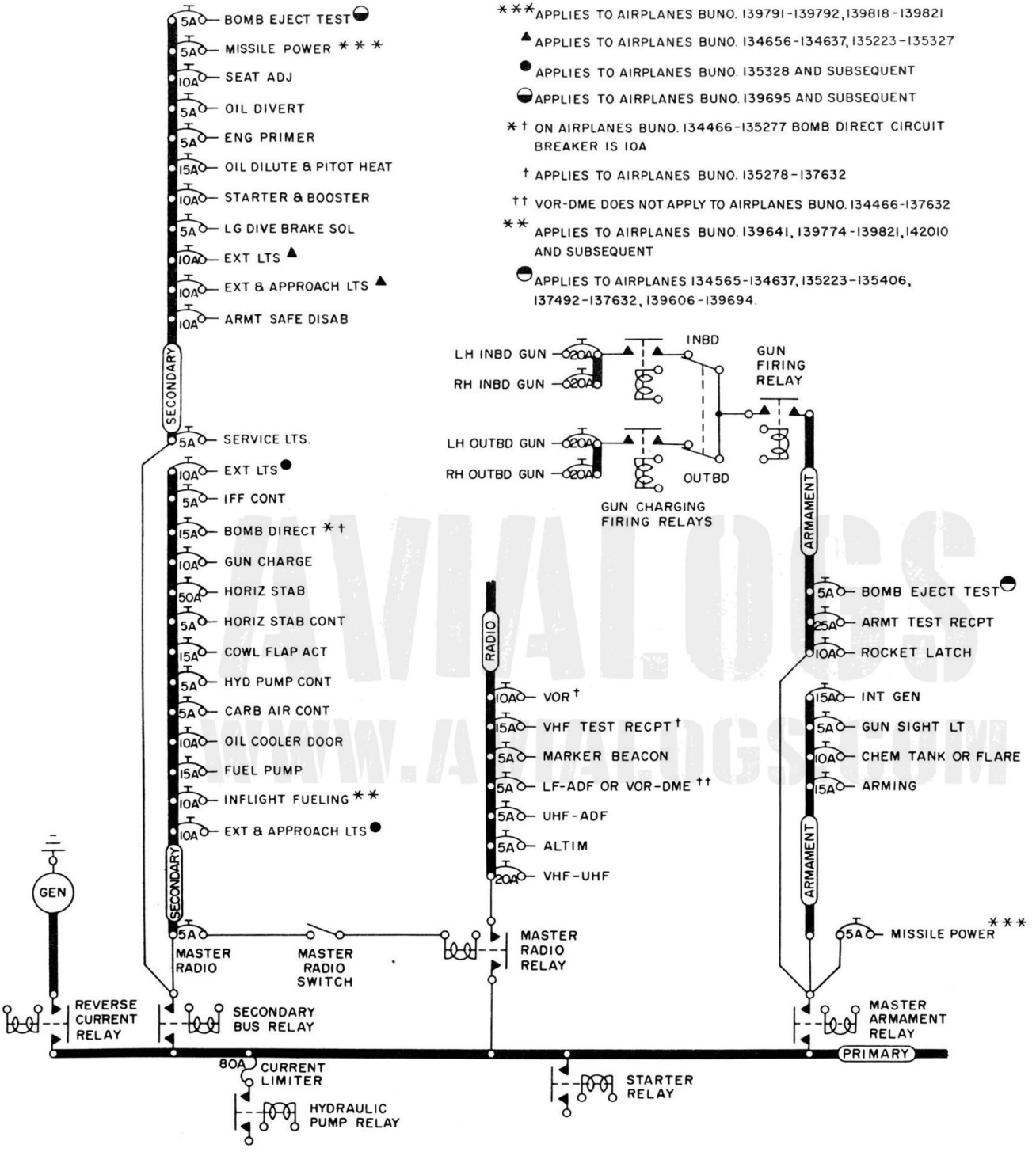
ALF-2-7 P-3759-3B

Figure 7-5. DC Power Distribution (Sheet 2)



D-C POWER SUPPLY

Figure 7–5. D-C Power Distribution (Sheet 3)



D-C POWER SUPPLY

EFFECTIVITY – BUNO.
FACTORY: 134565 - 134637, 135223-135406, 137492 - 137632, 139606 - 139821, 142010 AND SUBSEQUENT EXCEPT AS NOTED
SERV. CHG: NONE

P-3759-4

Figure 7–5. D-C Power Distribution (Sheet 4)

"WHEELS DOWN" position. When closed, the switch connects a resistance to ground, thereby de-energizing the armament bus. An armament safety-disabling circuit, which includes the armament safety-disabling switch and the armament safety-disabling relay, is provided for energizing the armament bus as required during armament ground tests. (Refer to section IX.)

7–80. The *radio bus* is energized by the primary bus when the MASTER RADIO circuit breaker is closed and the RADIO switch on the MASTER control console is "ON." The MASTER RADIO circuit breaker and the RADIO switch are connected in series between the secondary bus and the coil of the master radio relay. Therefore, when the circuit breaker and the switch are closed, the coil of the relay becomes energized by secondary bus power, closing the relay contacts to transfer primary bus power to the radio bus. (Refer to section VIII.)

7–81. A-C POWER SUPPLY SYSTEMS.

7–82. DESCRIPTION. The airplane is equipped with a constant frequency a-c power supply system and a variable frequency a-c power supply system. The constant frequency a-c power supply system utilizes either of two inverters that operate on power received from the d-c power supply system and supplies 115-volt and 26-volt, 400-cycle power to the connected loads. The variable frequency a-c power supply system utilizes an a-c generator, driven by the airplane's engine; therefore, the a-c generator will have an output only when the engine is operating above idle rpm. When the a-c generator has an output it supplies 200-volt line to line and 115-volts line to ground, 400- to 800-cycle power to the connected loads.

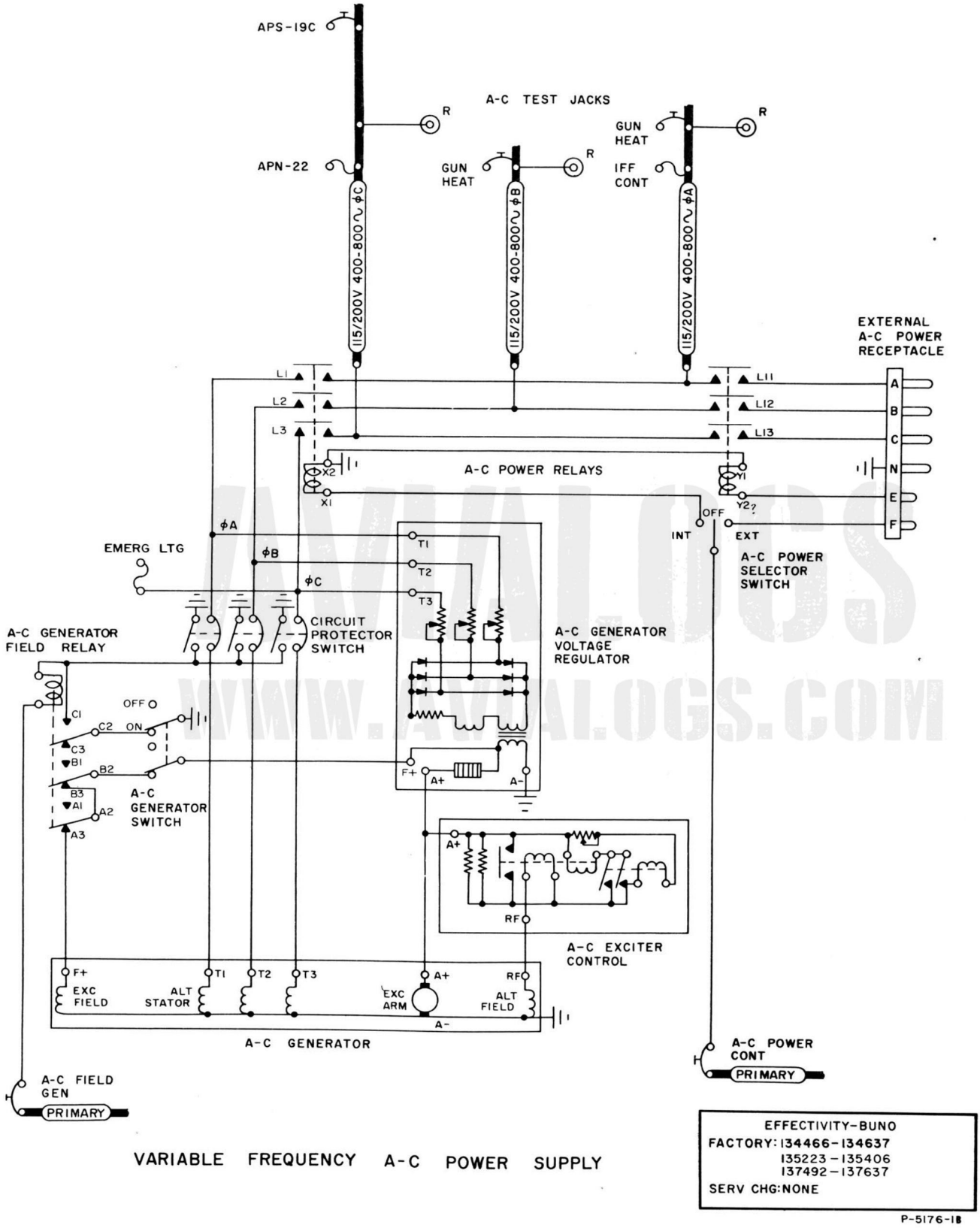
7–83. VARIABLE-FREQUENCY A-C POWER SUPPLY SYSTEM.

7–84. DESCRIPTION. (See figures 7–6 and 7–7.) The variable-frequency a-c power supply system is derived from a 9-KVA, 400-to-800-cycle, engine-driven generator and its associated equipment. The major components of the variable-frequency a-c power supply system are as follows:

Name	*Para Ref*
A-c generator	7–93
A-c voltage regulator	7–98
A-c exciter control unit	7–100
A-c generator field switch	7–102
A-c generator field relay	7–104
Circuit protector switches	7–106
A-c power select switch	7–108
A-c power switching relay	7–110
A-c external power receptacle	7–112
A-c voltage test jacks	7–113A

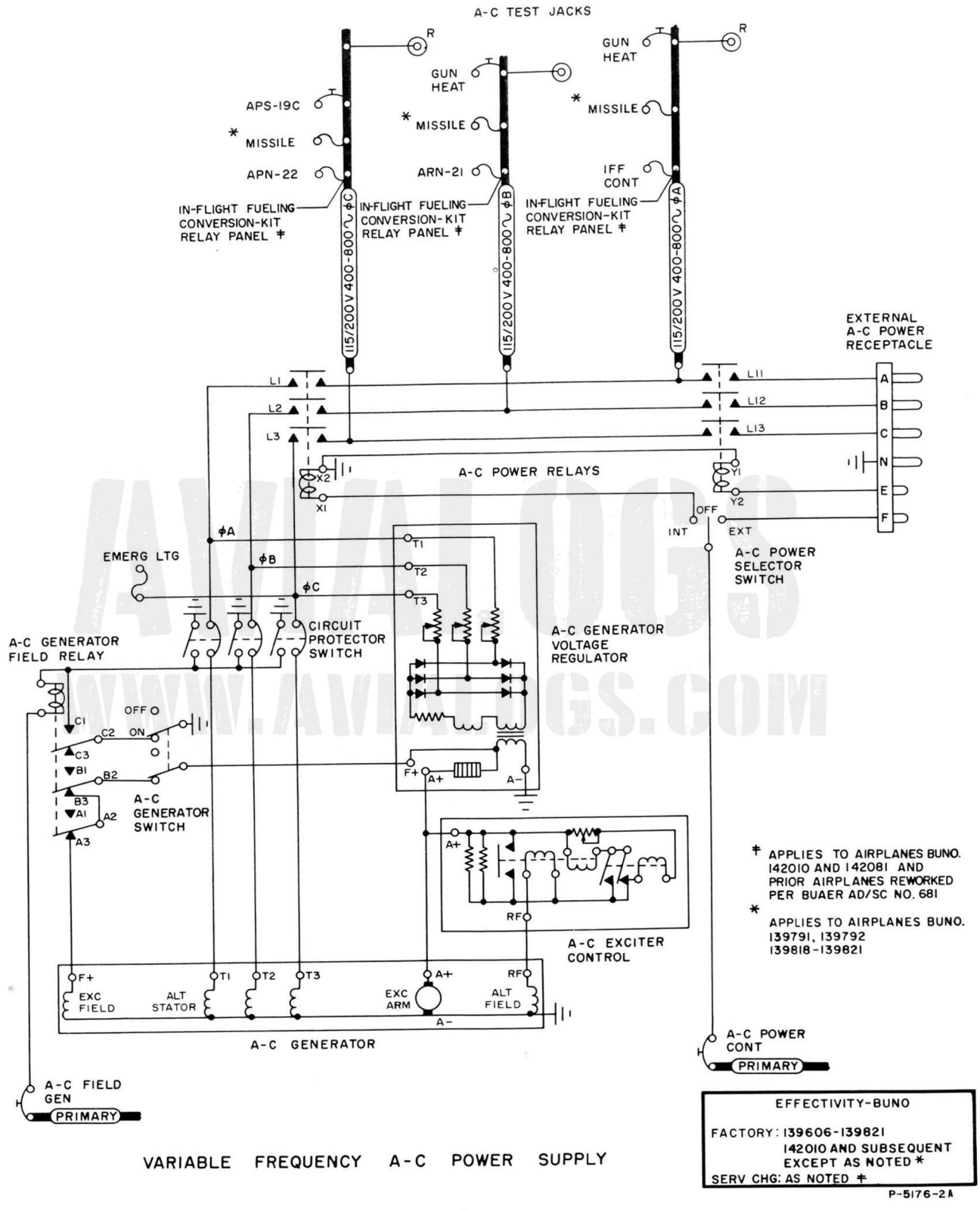
7–85. Variable-frequency a-c power is available at the a-c generator terminals and at the phase A, B, and C buses when the circuit breakers are closed, the a-c generator field switch is "ON," the a-c power selector switch is in "INT," and the circuit protector switches are open.

7–86. The a-c exciter control unit is a fixed resistance which is added to the a-c generator voltage regulator resistance to reduce the a-c generator field current, and thereby stabilizes the voltage output of the a-c generator



VARIABLE FREQUENCY A-C POWER SUPPLY

Figure 7–6. Variable-Frequency A-C Power Supply System—Schematic (Sheet 1)



VARIABLE FREQUENCY A-C POWER SUPPLY

Figure 7–6. Variable-Frequency A-C Power Supply System — Schematic (Sheet 2)

TABLE 7–4. TROUBLE SHOOTING VARIABLE-FREQUENCY A-C POWER SUPPLY SYSTEM

Trouble or Symptom	*Probable Cause*	*Correction*
1. Generator voltage low or zero.	a. Generator exciter field coil open-circuited or shorted to ground.	Replace generator.
	b. Generator field coil open-circuited or shorted to ground.	Replace generator.
	c. Leads connecting generator to exciter control and generator voltage regulator open-circuited or shorted to ground.	Repair or replace leads.
	d. Exciter control relay malfunctioning.	Repair or replace exciter control unit.
	e. Voltage regulator malfunctioning.	Repair or replace regulator.
	f. Generator field switch defective.	Replace switch.
	g. Field switch or field wiring open-circuited.	Replace switch or repair wiring.
	h. Generator shaft broken.	Replace generator.
	i. Voltage regulator not properly adjusted.	Adjust, repair or replace regulator.
	j. Voltage regulator variable resistor shorted.	Repair or replace regulator base.
	k. Connections to voltage regulator variable resistor short-circuited.	Repair short circuit.
2. A-c voltage output too high.	a. Voltage regulator carbon discs worn.	Repair or replace regulator.
	b. Voltage regulator rectifiers short- or open-circuited.	Repair or replace regulator.
3. A-c generator voltage too low when engine rpm normal (cruising).	Refer to 1 d.	
4. Voltage rises as engine rpm increased to maximum.	Refer to 1 d.	
5. Voltage present at generator output terminals but no voltage at A, B, or C buses.	a. A-c generator field relay coil energized.	Correct cause of ground to relay.
	b. A-c power switch in "EXT."	Place switch in "INT."
	c. A-c power relay contacts stuck open.	Replace relay.
	d. Generator control relay contacts open.	Trouble-shoot d-c power supply system.

when the generator is operating at high rpm. At normal generator rpm (engine cruising speed) the a-c exciter control resistance is not included in the circuit.

7–87. The a-c generator voltage regulator resistance varies with changing a-c generator rpm to limit the current in the a-c generator field coil. The amount of current in the a-c generator field coil governs the voltage output of the a-c generator.

7–88. The a-c generator field relay, in conjunction with the circuit protector switches, function as a safety to open the circuit of the a-c generator exciter field coil. When the a-c generator exciter field coil circuit is open the a-c generator has no output, thus preventing damage to the a-c generator when a short circuit occurs on any of the a-c generator bus systems.

7–88A. The a-c power relay consists of two relays in one unit; one relay connects the output of the a-c generator to the a-c buses and the other relay connects an external source of a-c power to the a-c buses. The coil of each relay is energized by primary bus power through the a-c power select switch; consequently no a-c power is available on the a-c buses if the primary bus is de-energized.

7–89. The a-c test jacks provide access points for measuring the voltage on each of the three phases of generator output.

TABLE 7–5. TESTING VARIABLE-FREQUENCY A-C POWER SUPPLY SYSTEM

The following test procedure applies to the a-c generator and its associated equipment.

EQUIPMENT REQUIRED

Voltmeter, a-c, portable 0-to-300-volt scale

PRELIMINARY CONDITIONS

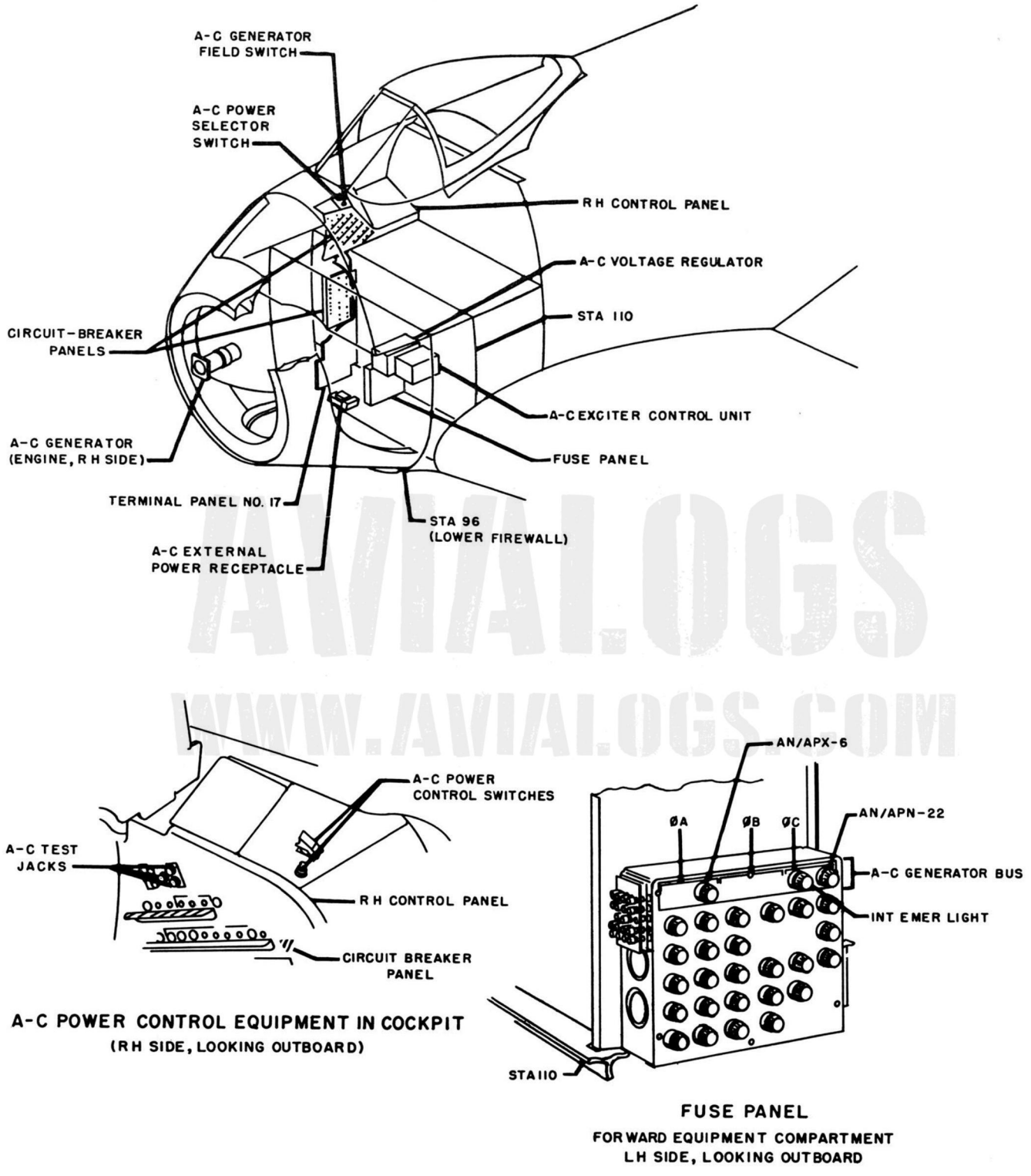
Engine operating at cruise rpm
A-c power selector switch in "INT"
A-c generator field switch "ON"

Operation	*Desired Result*
Connect a-c voltmeter between phase A and ground	Voltmeter indicates 115 ± 5 volts.
Connect a-c voltmeter between phase B and ground	Voltmeter indicates 115 ± 5 volts.
Connect a-c voltmeter between phase C and ground	Voltmeter indicates 115 ± 5 volts.

7–90. TROUBLE SHOOTING. Refer to table 7–4.

7–91. TESTING. Refer to table 7–5.

7–92. POWER LOADING. Refer to table 7–6.

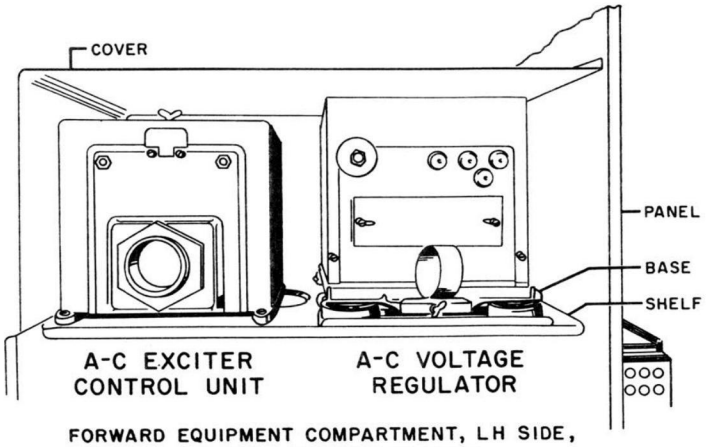


A-C POWER CONTROL EQUIPMENT IN COCKPIT
(RH SIDE, LOOKING OUTBOARD)

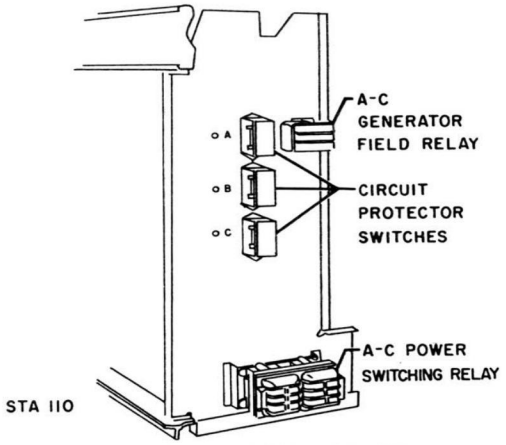
FUSE PANEL
FORWARD EQUIPMENT COMPARTMENT
LH SIDE, LOOKING OUTBOARD

P-4002-1

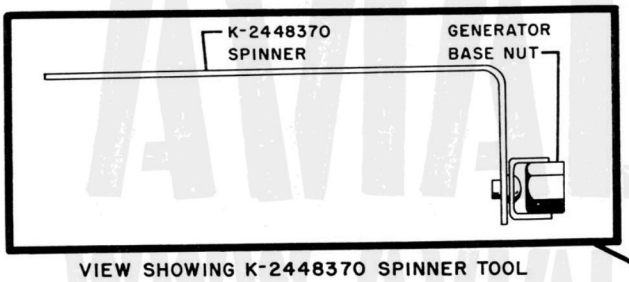
Figure 7–7. Variable-Frequency A-C Power Supply System—Perspective (Sheet 1)



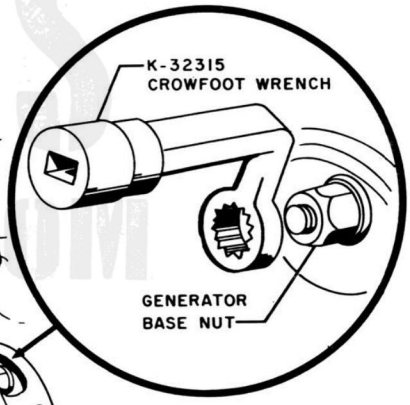
FORWARD EQUIPMENT COMPARTMENT, LH SIDE, STA 110, LOOKING FORWARD

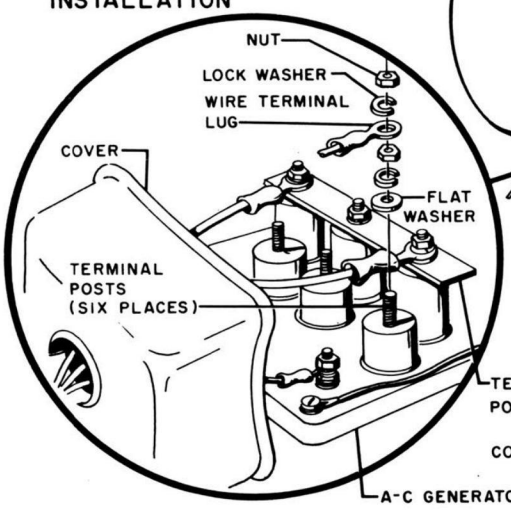


TERMINAL PANEL NO. 17
OUTBOARD FACE
FORWARD EQUIPMENT COMPARTMENT, RH SIDE, LOOKING INBOARD



VIEW SHOWING K-2448370 SPINNER TOOL





VIEW OF A-C GENERATOR INSTALLATION - LOOKING INBOARD FROM LEFT-HAND SIDE OF AIRPLANE

Figure 7–7. Variable-Frequency A-C Power Supply System—Perspective (Sheet 2)

7-93. A-C GENERATOR.

7-94. DESCRIPTION. (See figure 7-7.) The a-c generator is installed on the right-hand side of the engine supercharger rear cover. The a-c generator is wye-connected with neutral at ground and provides 200 volts line-to-line or 115 volts line-to-ground. The total power delivered by the generator is 9 kilovolt-amperes (KVA) at a frequency of 400 to 800 cycles per second. The generator is engine-driven at a ratio of 2.8 to 1 by means of a 16-tooth male involute spline and operates through a speed range of 4000 to 8000 rpm. The generator is cooled and ventilated by ram air ducted to the side of the generator.

7-95. CLEANING AND MINOR REPAIR.

a. Check generator attaching nuts for proper tightness.

b. Remove cover from generator terminals and inspect interior for dirt and foreign matter. Make certain that interior is clean and that generator lead connections are clean and tight before replacing terminal cover.

c. Disconnect cooling-air duct at end cover and remove any accumulated dust and foreign matter from tube.

7-96. REMOVAL.

a. Install engine work platform.

b. Remove accessory cowling.

c. Disconnect cooling-air duct.

d. Disconnect cable leads from terminal posts.

e. Using special tool K-32315, remove nuts from generator attaching studs.

f. Support generator and pull clear of studs.

CAUTION

Do not allow weight of generator (approximately 60 pounds) to bear on splined drive shaft since the generator weight may bend shaft. Do not pick up or carry by shaft.

TABLE 7-6. POWER LOADING—VARIABLE-FREQUENCY A-C POWER SUPPLY SYSTEM

Source and Equipment	*No. in Airplane*	*Operating Time (Minutes)*	*Requirements per Unit* 200 V 3-Phase VA	WATT	VARS	115 V 1-Phase VA	WATT	VARS	*Connected Load* WATTS	VARS
A-C GENERATOR:										
ARMAMENT:										
Gun heaters	4	30			ϕA ϕB	300	300	Neg	1200	Neg
Gun feed heaters	4	30			ϕA ϕB	50	50	Neg	200	Neg
EMERGENCY:										
Cockpit lights	35					.04	.04	Neg	1.4	
RADAR:										
Altimeter	1	30			C	130	126	31	126	31
Recognition (IFF)	1	30			A	188	182	45	182	45
Search (standby)	1	30			C	403	395	78		
Search (operate)	1	30			C	628	615	126	615	126

Source and Equipment	*Operating Conditions**	*Average WATTS* WATT	1/12 MIN ϕA	ϕB	ϕC	5 MIN ϕA	ϕB	ϕC	15 MIN ϕA	ϕB	ϕC	*Average VARS* VARS	1/12 MIN ϕA	ϕB	ϕC	5 MIN ϕA	ϕB	ϕC	15 MIN ϕA	ϕB	ϕC
A-C GENERATOR:																					
ARMAMENT:																					
Gun heaters	All	1200	600	600		600	600		600	600			Neg								
Gun feed heaters	All	1200	100	100		100	100		100	100			Neg								
EMERGENCY:																					
Cockpit lights																					
RADAR:																					
Altimeter	All	126		126			126			126		31		31			31			31	
Recognition (IFF)	D.E.F.	182	182			182			182			45	45			45			45		
Search (standby)	D.E.F.	395		395			395			395		78		78			78			78	
Search (operate)	E.F.	220		220			220			220		48		48			48			48	

* Operating Condition Code:
A—Loading
B—Start and warm-up
C—Taxi
D—Take-off and climb
E—Cruise
F—Combat
G—Landing

7–97. INSTALLATION.

a. Clean generator mounting pad on engine.

b. Position generator and insert splined shaft partway into driving unit. Line up nearest mounting holes with studs. Push generator toward mounting pad until studs extend through holes and install attaching washers and nuts.

c. Use special tool No. K-32315 to torque each nut to 275 to 300 inch-pounds.

d. Connect generator cables to proper terminals.

e. Connect ventilation tubes.

7–98. A-C VOLTAGE REGULATOR.

7–99. DESCRIPTION. (See figure 7–7.) The a-c generator voltage regulator, identified as AC VOLT REG, is installed on the left-hand side of the forward equipment compartment at fuselage station 105. The a-c voltage regulator maintains a constant a-c generator output voltage by varying the generator field coil excitation current. A bridge rectifier circuit within the regulator is connected across the three phases to provide voltage for the control coil; the circuit operates a solenoid which regulates the field coil excitation current by varying the pressure on the carbon pile in the regulator. A constant a-c output voltage is maintained in this manner.

7–100. A-C EXCITER CONTROL UNIT.

7–101. DESCRIPTION. (See figure 7–7.) The a-c exciter control, identified as A-C EXCITER CONT, is installed on the left-hand side of the forward equipment compartment at fuselage station 105. The exciter control unit provides current control of the a-c generator field coil and is used to extend the operating range of the a-c voltage regulator by inserting resistance in series with the exciter field at high generator speeds. At normal generator rpm (engine cruising speed), the exciter control resistance is not included in the circuit.

7–102. A-C GENERATOR FIELD SWITCH.

7–103. DESCRIPTION. (See figure 7–7.) The a-c generator field switch, a double-pole, single-throw type, identified as A-C GEN FIELD and a nameplate designated TURN OFF IN EMERG ONLY, is installed in the pilot's right-hand control panel. The a-c generator field switch, a double-pole, single-throw type, has two positions, "ON" and "RESET." The "ON" position is in the a-c generator field circuit between the voltage regulator and the generator field relay. The "RESET" position de-energizes the coil of the field relay (if the circuit protector switches are in normal position) and the generator field circuit is again completed when the field switch is returned to the "ON" position.

7–104. A-C GENERATOR FIELD RELAY.

7–105. DESCRIPTION. (See figure 7–7.) The a-c generator field relay, a triple-pole, double-throw type, identified as GENERATOR FIELD, is installed in the forward equipment compartment on TERM PANEL 17. The coil of the a-c generator field relay is energized by primary bus power through the AC FIELD GEN circuit breaker. The a-c generator field relay is normally de-energized and directs the a-c generator field coil exciter current across the normally closed A2-A3, B2-B3 contacts. When energized the a-c generator field coil circuit is open. The ground for the coil of the a-c generator field relay is supplied by the closing of a circuit protector switch (refer to paragraph 7–106). Once the coil of the a-c generator field relay has been energized, a holding voltage is applied by grounding the coil across the relays C1-C2 contacts, and the a-c generator field switch in the "ON" position. This holding voltage can only be removed by removing the cause of the circuit protector switch being closed, and by placing the a-c generator field switch in "RESET" momentarily and back to "ON."

7–106. A-C CIRCUIT PROTECTOR SWITCHES.

7–107. DESCRIPTION. (See figure 7–7.) Three circuit protector switches, identified as A-C POWER CIRCUIT BREAKERS with each switch designated PHASE A, PHASE B, and PHASE C respectively, are installed in the forward equipment compartment on TERM PANEL 17. The circuit protector switch is composed of an automatic circuit breaker and a switch, the switch closing when the circuit breaker opens. One unit is connected across each phase of the a-c generator. When an overload condition or a short circuit to ground occurs on any output phase of the a-c generator the appropriate circuit protector switch is actuated. The closed contact of the switch connects the coil of the a-c generator field relay to ground across the a-c generator field switch in the "ON" position, thereby energizing the relay and breaking the a-c generator field circuit. (Refer to paragraph 7–102.)

7–108. A-C POWER SELECT SWITCH.

7–109. DESCRIPTION. (See figure 7–7.) The a-c power select switch, a single-pole, double-throw type, identified as AC PWR, is installed in the pilot's right-hand control panel. The switch has three designated positions, "INT," "OFF," and "EXT." When the switch is in "INT" primary bus power from the 5-ampere AC POWER CONT circuit breaker is connected to one coil of the a-c power switching relay, which when energized, permits the a-c generator to supply the a-c loads. In the "EXT" position primary bus power is connected to the second coil in the a-c power switching relay, thereby connecting an external source of a-c power to supply the a-c loads. The "OFF"

position removes primary bus power from either coil of the a-c power switching relay, thereby removing a-c generator or an external source of a-c power from the a-c buses.

7–110. A-C POWER SWITCHING RELAY.

7–111. DESCRIPTION. (See figure 7–7.) The a-c power switching relay is installed in the forward equipment compartment on TERM PANEL 17. The relay is a dual type, consisting of two triple-pole, single-throw relays identified as AC POWER RELAY. The relay contacts are in parallel and are mechanically linked together so that when the contacts of one relay are closed, the contacts of the other relay are open. The coil of one relay is energized by primary bus power when the a-c power select switch is in "INT," thereby transferring a-c generator power across the closed contacts to the A-, B-, and C-phase buses. The coil of the other relay is energized by primary bus power when the a-c power select switch is in "EXT," thereby transferring external a-c power across the closed contacts of the relay to the A-, B-, and C-phase buses.

7–112. A-C EXTERNAL POWER RECEPTACLE.

7–113. DESCRIPTION. (See figure 7–7.) The a-c external power receptacle is installed in the lower surface of the center wing section, to the right of center line in the forward equipment compartment and is identified as AC EXT PWR RECP. The a-c external power receptacle consists of four large pins, identified as A, B, C and N, and two small pins, identified as E and F. Pins A, B, and C connect phases A, B, and C of an external power source; pin N is connected to airplane structure for ground; pin E is connected to the coil of one a-c power switching relay. When an external a-c power source is connected, pin F is connected to pin E to connect primary bus power from the AC PWR select switch in "EXT" to the coil of one a-c power switching relay, thereby connecting an external source of a-c power to the a-c buses.

7–113A. A-C VOLTAGE TEST JACKS.

7–113B. DESCRIPTION. (See figure 7–7.) A-c test jacks for testing variable frequency a-c voltage are provided in the cockpit circuit breaker panel and are identified as VOLTAGE TEST JACKS—"A-C." One test jack is connected to the A phase, one to the B phase, and one to the C phase buses.

7–114. CONSTANT-FREQUENCY A-C POWER SUPPLY SYSTEM.

7–115. DESCRIPTION. (See figures 7–8 and 7–9.) The constant frequency a-c power supply system supplies a-c power to the following flight instrument (essential) circuits: G-2 compass, turn-and-bank indicator, AN/APN-22 radar altimeter, and fuel quantity indicating. A-c power is also supplied to the following non-essential circuits: AN/ARN-6 radio compass, chemical tank, and P-1 automatic pilot. The following are the major components of the constant-frequency a-c power supply system:

Name	*Para Ref*
No. 1 inverter	7–124
No. 2 inverter	7–126
No. 2 inverter control relay	7–128
No. 2 inverter current-limiter	7–130
Instrument power transformer	7–132
P-1 power junction box	7–134
Flight-instrument power-selector switch	7–136
A-c voltage-sensing relay	7–138
Flight-instrument power-failure warning light	7–140
Flight instrument power failure warning light dimming resistor	7–141A
No. 1 inverter dummy load	7–142
No. 2 inverter dummy load	7–144
Constant frequency load correction relay	7–145A
Constant frequency load corrector	7–145C
Inverter load and torque-meter power relay	7–145E
Constant frequency a-c power supply dummy load	7–145G

7–116. The No. 1 and No. 2 inverters are the power sources of the constant-frequency a-c power supply system. Each operates from d-c power and supplies its respective load with 115-volt, 400-cycle alternating current. The No. 1 and No. 2 inverters receive operating power from the d-c power supply system whenever the primary and monitor buses are energized.

7–117. Two step-down transformers are included in the constant-frequency a-c power supply system to supply power to the 26-volt a-c operated equipment. One transformer functions when the No. 2 inverter is supplying power, the other functions when the No. 1 inverter is supplying power.

7–118. The flight-instrument power-selector switch permits the selection of either the No. 1 or No. 2 inverter to supply the flight instrument (essential) loads. (In addition, one pole of the switch directs 28-volt d-c power to energize the automatic pilot equipment through the normally selected "INVERTER 2 & AUTO PILOT" position.)

7–119. Dummy loads, consisting of resistors connected in a series-parallel arrangement, are incorporated in both inverter output circuits for the purpose of increasing the voltage output efficiency of each inverter.

7–119A. The constant frequency load corrector provides a balanced 3-phase condition for either the No. 1 or No. 2 inverter when either inverter is supplying constant frequency system loads.

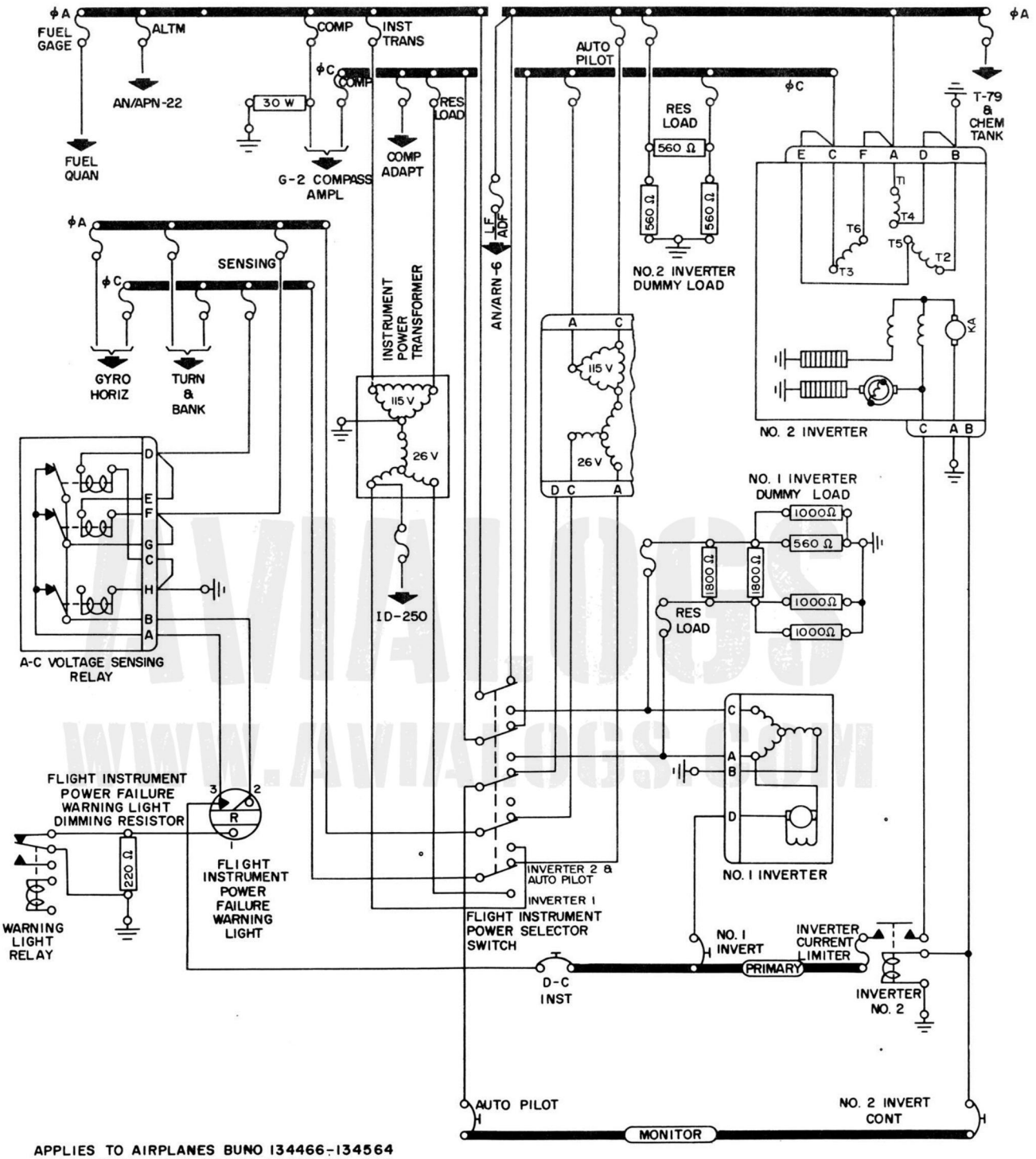


Figure 7–8. Constant-Frequency A-C Power Supply System—Schematic (Sheet 1)

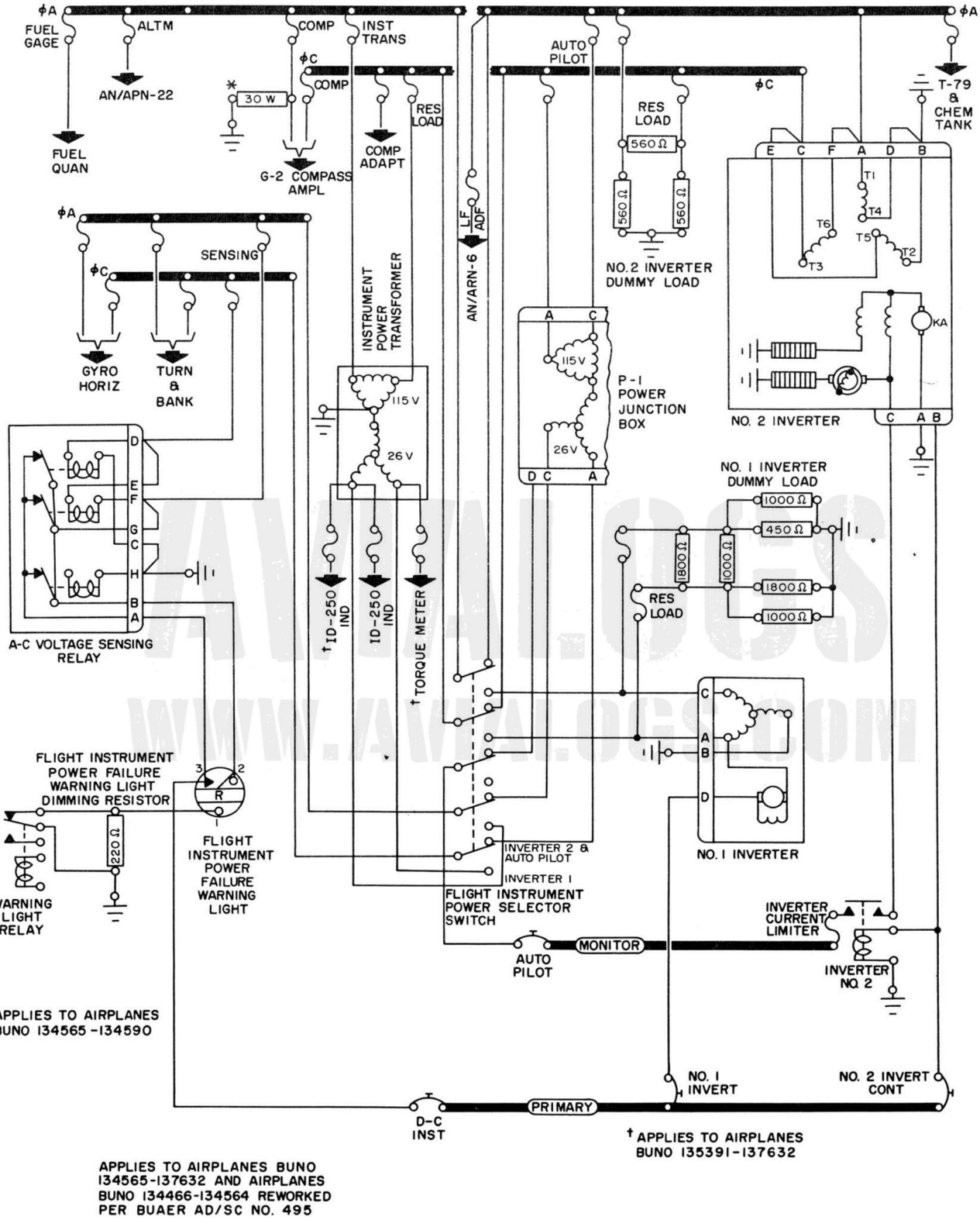


Figure 7–8. Constant-Frequency A-C Power Supply System—Schematic (Sheet 2)

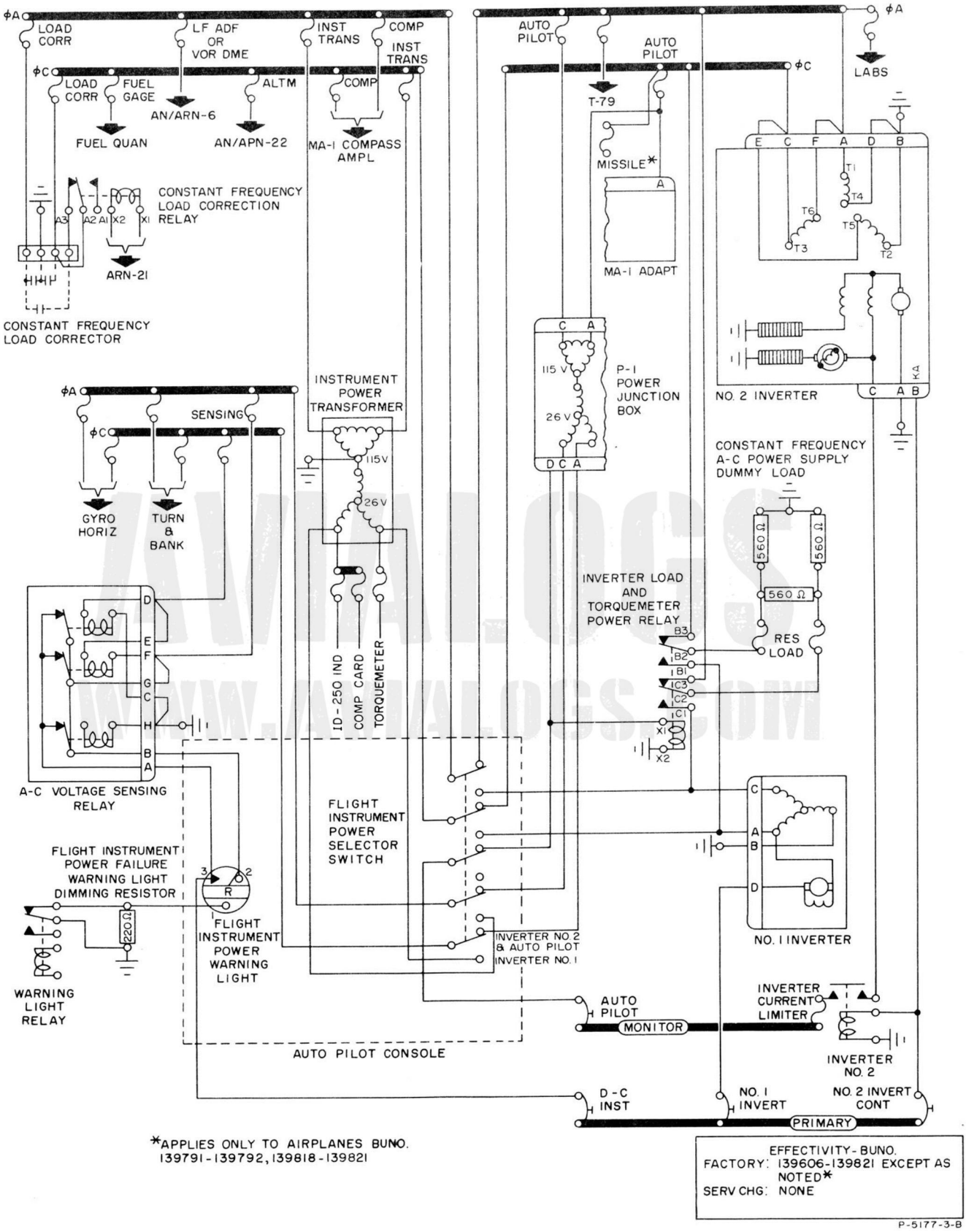


Figure 7–8. Constant-Frequency A-C Power Supply System—Schematic (Sheet 3)

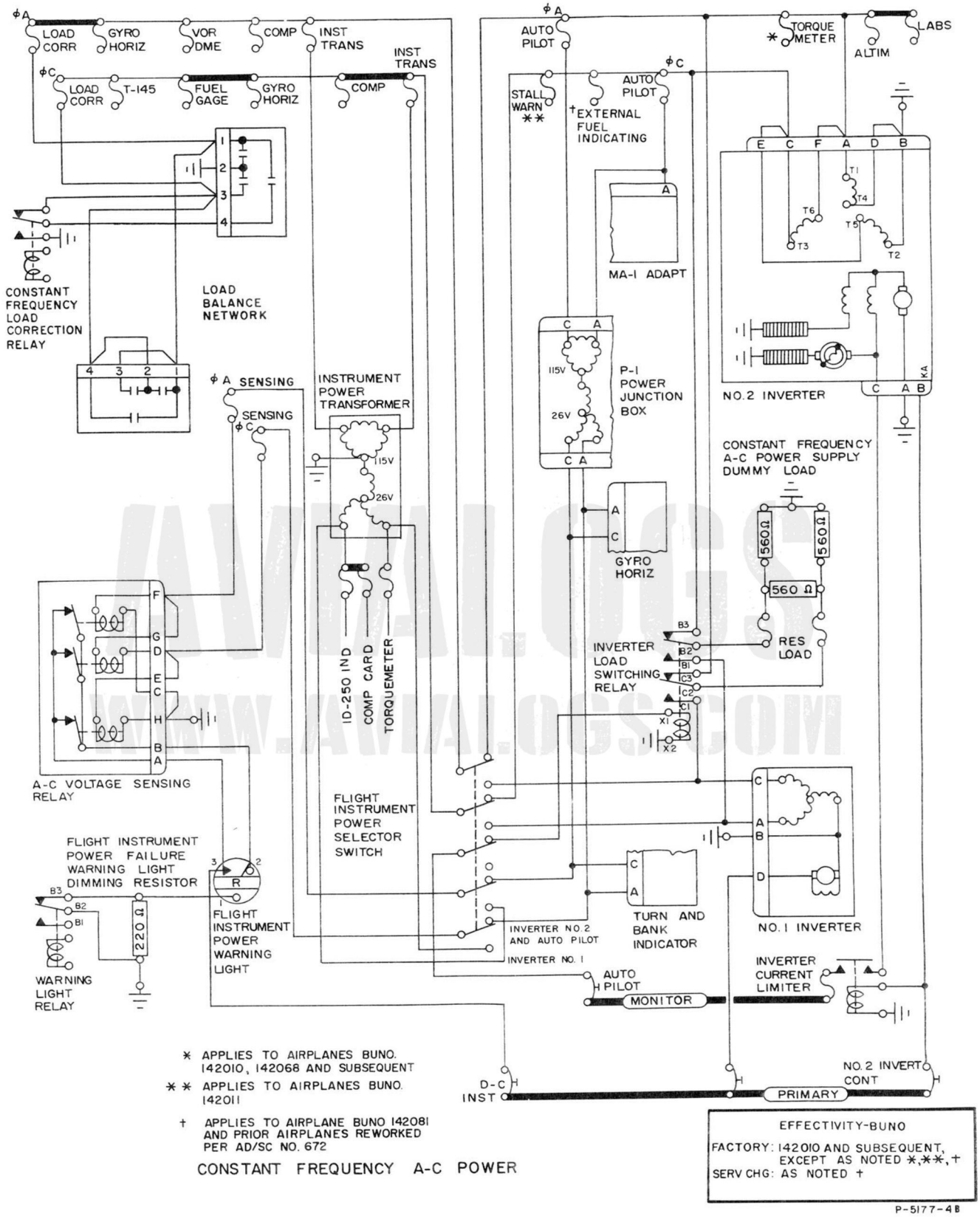


Figure 7–8. Constant-Frequency A-C Power Supply System — Schematic (Sheet 4)

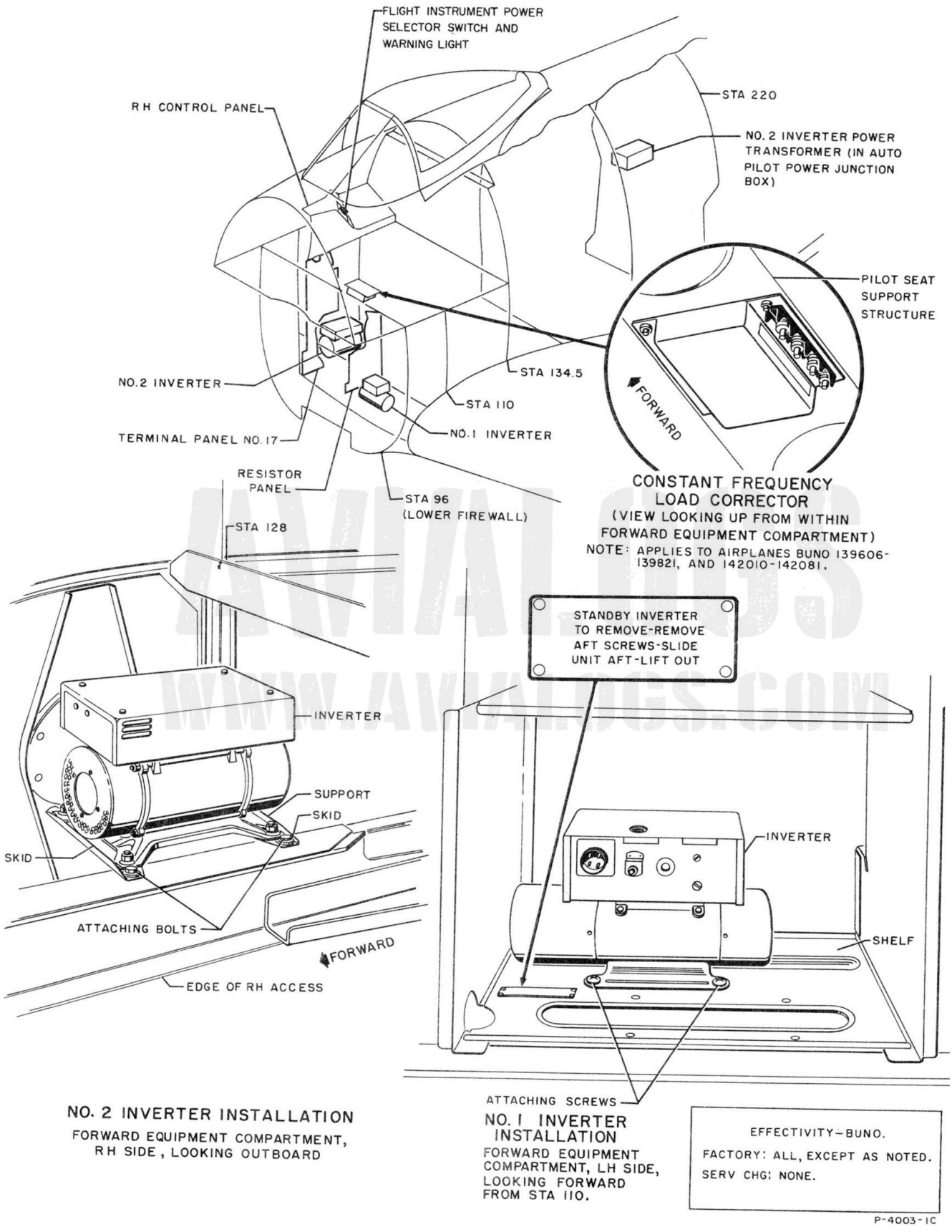
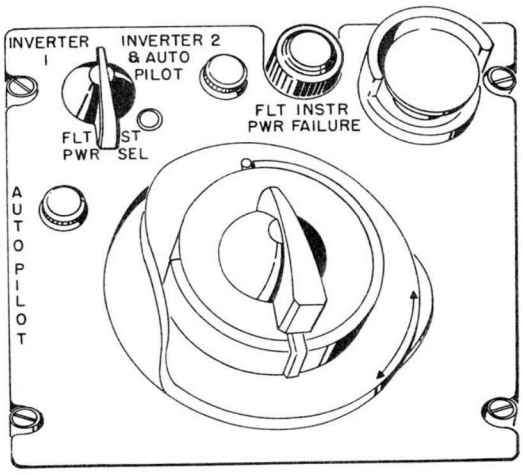
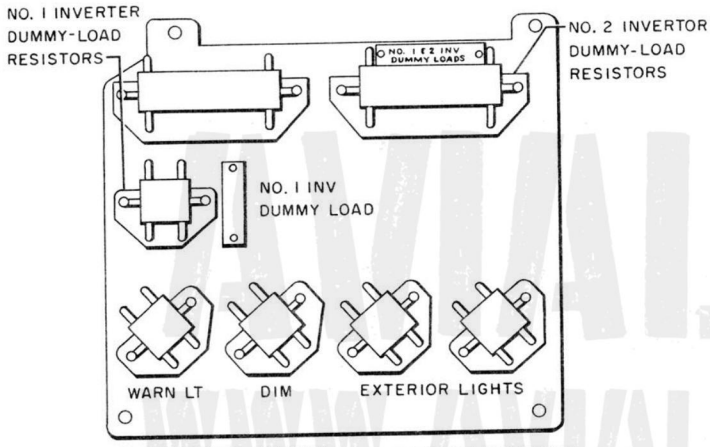


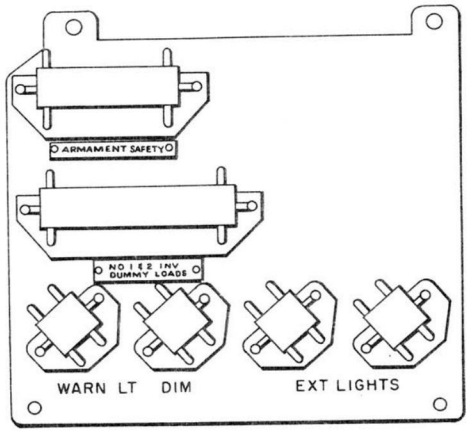
Figure 7–9. Constant-Frequency A-C Power Supply System—Perspective (Sheet 1)



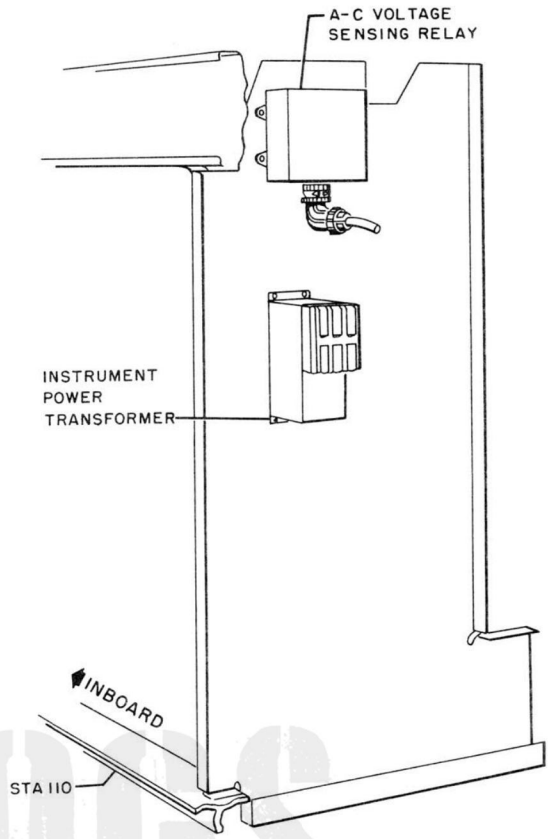
AUTOMATIC PILOT CONTROL CONSOLE
COCKPIT, RH CONTROL PANEL

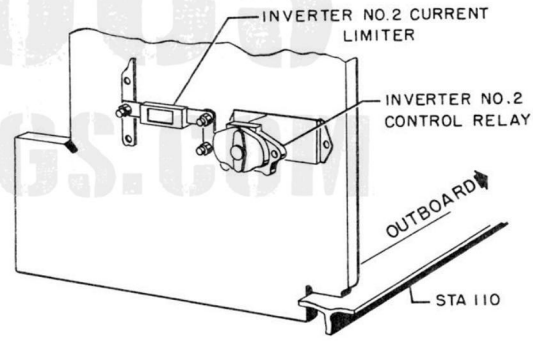


RESISTOR PANEL—LH SIDE OF FORWARD EQUIPMENT COMPARTMENT. VIEW LOOKING OUTBOARD. (APPLIES TO AIRPLANES BUNO 134591-134637, 135223-135406, AND 137492-137632).

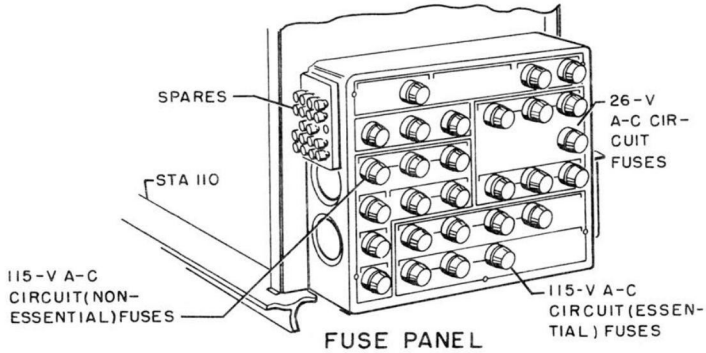


RESISTOR PANEL—LH SIDE OF FORWARD EQUIPMENT COMPARTMENT. VIEW LOOKING OUTBOARD. (APPLIES TO AIRPLANES BUNO 139606-139821, AND 142010-142081).





TERMINAL PANEL NO.17
(FORWARD EQUIPMENT COMPARTMENT, RH SIDE)



FUSE PANEL
FORWARD EQUIPMENT COMPARTMENT
LH SIDE, LOOKING OUTBOARD P-4003-2D

Figure 7-9. Constant-Frequency A-C Power Supply System—Perspective (Sheet 2)

7–119B. The constant frequency load correction relay connects capacitance across the phase AC output of either the No. 1 or No. 2 inverter as required.

7–119C. The inverter load and torquemeter power relay connects the constant frequency a-c power supply dummy load across the No. 1 or No. 2 inverter output when either inverter is utilized.

7–119D. On airplanes BuNo. 139606-139821, and 142010-142081, the constant frequency a-c power supply dummy load provides the minimum required load for either the No. 1 or No. 2 inverter.

7–120. The voltage-sensing relay and the flight-instrument power-failure warning light provide an indication of failure of the selected inverter supplying the flight instrument (essential) circuits. The a-c voltage-sensing relay unit consists of three relays: the coil of one relay is connected across phase "A," the coil of the second relay is connected across phase "C," and the coil of the third relay is connected across phase "AC," respectively, of the selected inverter. Should the coils of either of these relays become de-energized (because of insufficient a-c voltage), a d-c circuit is completed to light the instrument power-failure warning light.

7–121. TROUBLE SHOOTING. Refer to table 7–7.

7–122. TESTING. Refer to table 7–8.

7–123. POWER LOADING. Refer to table 7–9.

7–124. NO. 1 INVERTER.

7–125. DESCRIPTION. (See figure 7–9.) The No. 1 inverter, identified as STANDBY INVERTER, is bracketed to the left-hand side of the forward equipment compartment between fuselage stations 96 and 110. The No. 1 inverter is a 3-phase, 400-cycle type operating from d-c primary bus power supplied through the 25-ampere, No. 1 INVERT circuit breaker. The B-phase is connected to ground to provide a nominal 115-volt, 3-phase, wye-connected source of power with an output of 250 volt-amperes. The A-phase of the inverter is regulated to 115 $\pm$ 7.5 volts by a voltage regulator contained within the inverter housing. The No. 1 inverter is manually switched into operation by placing the flight-instrument power-selector switch in the "INVERTER 1" position. With the switch in this position, the No. 1 inverter supplies power to the constant frequency a-c power supply buses. For loads supplied by the No. 1 inverter see table 7–9A. Failure of any phase of the No. 1 inverter is indicated when the flight-instrument power-failure warning light comes on.

7–126. NO. 2 INVERTER.

7–127. DESCRIPTION. (See figure 7–9.) The No. 2 inverter, identified as NO. 2 INVERTER, is installed on the right-hand side of the forward equipment compartment between fuselage stations 110 and 134. The No. 2 inverter is a three-phase, 400-cycle, wye-connected type with an output of 750 volt-amperes. A vacuum tube voltage regulator senses the output of the No. 2 inverter and regulates the excitation of the No. 2 inverter's rotating field, thus automatically regulating the output voltage of the No. 2 inverter. The No. 2 inverter functions as the power source for all constant-frequency a-c loads when the flight-instrument power-selector switch is placed in the "INVERTER 2 & AUTO PILOT" position. Failure of any phase of the No. 2 inverter is indicated when the flight-instrument power-failure warning light comes on. For loads supplied by the No. 2 inverter refer to table 7–9A.

TABLE 7–7. TROUBLE SHOOTING CONSTANT-FREQUENCY A-C POWER SUPPLY SYSTEM

Trouble or Symptom	*Probable Cause*	*Correction*
1. (No. 1) standby inverter or No. 2 inverter has high, low, or no voltage at output terminals.	a. Defective inverter.	Repair or replace inverter.
	b. Defective constant frequency load corrector capacitor.	Replace load corrector unit.
2. (No. 1) standby or No. 2 inverter frequency high or low.	a. Defective inverter.	Trouble shoot or replace inverter.
3. Flight instrument power failure warning light remains ON when inverter output voltage is normal.	a. Either or both SENSING relay fuses defective.	Replace fuses.
	b. Defective a-c voltage sensing relay.	Replace relay.
4. Turn and bank indicator and gyro horizon indicator circuits receive no power with flight instrument power select switch in INVERTER 1.	a. Either or both T & B or GYRO HORIZ fuses defective.	Replace fuses.
	b. Either or both INST TRANS fuses defective.	Replace fuses.
	c. Defective instrument power transformer.	Replace transformer.
5. Turn and bank indicator and gyro horizon indicator circuits receive no power with flight instrument power select switch in INVERTER 2 AND AUTO PILOT.	a. Either or both AUTO PILOT fuses defective.	Replace fuses.
	b. Either or both T & B or GYRO HORIZ fuses defective.	Replace fuses.
	c. Defective transformer in P-1 power junction box.	Replace junction box.

TABLE 7–8. TESTING CONSTANT-FREQUENCY A-C POWER SUPPLY SYSTEM

EQUIPMENT REQUIRED	PRELIMINARY CONDITIONS
Portable a-c voltmeter, 0-to-300-volt scale, 2 percent full-scale accuracy Portable frequency meter (reed type), 380-to-420-cycles-per-second scale	External d-c power source connected Flight instrument power selector switch in "INVERTER 2 & AUTO PILOT" D-C INST circuit breaker closed

Operation	*Desired Result*
a. No. 2 INVERT and NO. 1 INVERT circuit breakers closed.	No. 1 and No. 2 inverters operating (without load) simultaneously.
b. Voltmeter connected to No. 2 inverter output terminals successively as follows:	
A and B	115 ± 7.5 volt indication
C and B	115 ± 7.5 volt indication
A and C	115 ± 7.5 volt indication
c. Frequency meter connected to No. 2 inverter output terminals successively as follows:	
A and B	380 to 420 cycles-per-second indication
C and B	380 to 420 cycles-per-second indication
A and C	380 to 420 cycles-per-second indication
d. Flight instrument power selector switch in "INVERTER 1."	No. 1 and No. 2 inverters operating (without load) simultaneously.
e. Voltmeter connected to No. 1 inverter terminals successively as follows:	
A and B	115 ± 7.5 volt indication
C and B	115 ± 7.5 volt indication
A and C	115 ± 7.5 volt indication
f. Frequency meter connected to No. 1 inverter terminals successively as follows:	
A and B	380 to 420 cycles-per-second indication
C and B	380 to 420 cycles-per-second indication
A and C	380 to 420 cycles-per-second indication
g. No. 2 INVERT circuit breaker open; flight instrument power selector switch in "INVERTER 2 & AUTO PILOT."	No. 2 inverter stops; flight instrument power-failure warning light comes on.
h. Flight instrument power selector switch in "INVERTER 1."	No. 1 inverter starts operating under load; flight instrument power-failure warning light goes out.
i. No. 1 INVERT circuit breaker open; flight instrument power selector switch in "INVERTER 1."	No. 1 inverter stops; flight instrument power-failure warning light comes on.

TABLE 7–9. POWER LOADING—CONSTANT-FREQUENCY A-C POWER SUPPLY SYSTEM

Source and Equipment	*No. in Airplane*	*Operating Time (Minutes)*	*Requirements per Unit* 200 V 3-Phase VA	WATT	VARS	115 V 1-Phase VA	WATT	VARS	*Connected Load* WATTS	VARS
No. 1 INVERTER:										
CONTROL SURFACE:										
‡ Gyro horizon	1	30	4.7	3.1	3.5				3	3
‡ Turn and bank	1	30	4.7	3.1	3.5				3	3
ENGINE INSTRUMENT:										
Fuel gage	1	30			ϕA	23.4	18.8	−14.0	19	−14
FLIGHT INSTRUMENT:										
Compass	1	30	54.1	44.8	30.6				45	31
G-2 adapter	1	30			ϕC	30.7	10.8	−28.7	11	−29
‡ G-2 adapter	1	30		1.7	27.0					
RADIO:										
Altimeter	1	30			ϕA	17.0	16.0	7.0	16	7
‡ Compass	1	30		0.4	1.6					
‡ Course indicator	1	30		1.5	8.5					
‡ UHF-ADF	1	30		1.4	6.3					
A-C POWER:										
Instrument transformer	1	30	11.7	3.0	11.3	(no load)			3	12

(Continued on page 340)

TABLE 7-9. POWER LOADING - CONSTANT-FREQUENCY AC POWER SUPPLY SYSTEM (Continued)

Source and Equipment	WATT	All Operating Conditions: Average WATTS 1/12 MIN ϕA	ϕB	ϕC	5 MIN ϕA	ϕB	ϕC	15 MIN ϕA	ϕB	ϕC	VARS	Average VARS 1/12 MIN ϕA	ϕB	ϕC	5 MIN ϕA	ϕB	ϕC	15 MIN ϕA	ϕB	ϕC
No. 1 INVERTER:																				
CONTROL SURFACE:																				
† Gyro horizon	3	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1
† Turn and bank	3	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1
ENGINE INSTRUMENT:																				
Fuel gage	19	19			19			19			-14	-14			-14			-14		
FLIGHT INSTRUMENT:																				
Compass	45	6	2	37	6	2	37	6	2	37	31	7	6	18	7	6	18	7	6	18
G-2 adapter	11			11			11			11	-29			-29			-29			-29
RADIO:																				
Altimeter	16	16			16			16			7	7			7			7		
A-C POWER:																				
Instrument transformer	3	1	1	1	1	1	1	1	1	1	12	4	4	4	4	4	4	4	4	4

Source and Equipment	No. in Airplane	Operating Time (Minutes)	Requirements per Unit: 200 V 3-Phase VA	WATT	VARS	115 V 1-Phase VA	WATT	VARS	Connected Load WATTS	VARS
No. 2 INVERTER:										
CONTROL SURFACE:										
† Gyro horizon	1	30	4.7	3.1	3.5				3	4
† Turn and bank	1	30								
Auto pilot	1	30	122	110	53				110	53
ENGINE INSTRUMENT:										
Fuel gage	1	30			ϕA	23.4	18.8	-14	19	-14
Torque meter	1	30			ϕA	2	5.2	0	5.2	0
FLIGHT INSTRUMENT:										
Compass	1	30	54.1	44.8	30.6				45	31
G-2 adapter	1	30			ϕ C	30.7	10.8	-28.7	11	-35
RADIO:										
Altimeter	1	30			ϕ A	17	15.5	7	16	7
Compass	1	30			ϕ A	6	5	3	5	3
UHF-ADF	1	30								
EXTERNAL STORES:										
Special Weapon	1	0 5			¢A	70	70	Neg	70	Neg

Source and Equipment	WATT	All Operating Conditions: Average WATTS 1/12 MIN ϕA	ϕB	ϕC	5 MIN ϕA	ϕB	ϕC	15 MIN ϕA	ϕB	ϕC	VARS	Average VARS 1/12 MIN ϕA	ϕB	ϕC	5 MIN ϕA	ϕB	ϕC	15 MIN ϕA	ϕB	ϕC
No. 2 INVERTER:																				
CONTROL SURFACE:																				
† Gyro horizon	3	1	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1
† Auto pilot	110	37	37	37	37	37	37	37	37	37	53	18	18	18	18	18	18	18	18	18
ENGINE INSTRUMENT:																				
Fuel gage	19	19			19			19			-14	-14			-14			-14		
Torque meter	5.2	5.2			5.2			5.2												
FLIGHT INSTRUMENT:																				
Compass	45	6	2	37	6	2	37	6	2	37	31	7	6	18	7	6	18	7	6	18
G-2 adapter	11			11			11			11	-35			-35			-35			-35
RADIO:																				
Altimeter	16	16			16			16			7	7			7			7		
Compass	5	5			5			5			3	3			3			3		
EXTERNAL STORES:																				
* Special Weapon	70	70			7			1			Neg									

*Operating condition — cruise, combat
†26 Volts

TABLE 7–9A. LOAD DISTRIBUTION—CONSTANT FREQUENCY A-C POWER SUPPLY SYSTEM

Circuit	*Reference*	*Effectivity*
NO. 1 INVERTER		
Fuel Quantity Indicator	Sect. V	All
G-2 Compass	Sect. VI	134565-134637 135223-135406 137492-137632
MA-1 Compass	Sect. VI	139606-139821
ID-250 Indicator	Sect. VIII	All
APN-22 Altimeter	Sect. VIII	All
Gyro Horizon Indicator	Sect. VI	All
Bank and Turn Indicator	Sect. VI	All
ARN-6 Radio Compass	Sect. VIII	134591 and subsequent
Torquemeter	Sect. V	135391 and subsequent
NO. 2 INVERTER		
Fuel Quantity Indicator	Sect. V	All
G-2 Compass	Sect. VI	134565-134637 135223-135406 137492-137632
MA-1 Compass	Sect. VI	139606-139821
ID-250 Indicator	Sect. VIII	All
APN-22 Altimeter	Sect. VIII	All
Gyro Horizon Indicator	Sect. VI	All
Bank and Turn Indicator	Sect. VI	All
ARN-6 Radio Compass	Sect. VIII	All
Torquemeter	Sect. V	135391 and subsequent
Low Altitude Bombing System	Sect. IX	139606-139821
T-79	Sect. IX	All
Auto Pilot	Sect. VI	All

7–127A. On airplanes BuNo. 134466 through 134564 not reworked per BuAer AD/SC No. 495, the No. 2 inverter receives operating power from the primary bus through the INVERTER CURRENT LIMITER and the A1-A2 contacts of the No. 2 inverter control relay. The tube filament circuit of the voltage regulator receives power from the monitor bus, thus the tube filaments are heated and the No. 2 inverter is ready for use whenever the monitor bus is energized.

7–127B. On airplanes BuNo. 134565-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, and airplanes BuNo. 134466 through 134564 reworked per BuAer AD/SC No. 495, the No. 2 inverter receives operating power from the monitor bus through the INVERT No. 2 current limiter and the A1-A2 contacts of the No. 2 inverter control relay. The tube filament circuit of the voltage regulator receives power from the primary bus, thus the tube filaments are heated and the No. 2 inverter is ready for use whenever the primary bus is energized.

7–128. NO. 2 INVERTER CONTROL RELAY.

7–129. DESCRIPTION. The No. 2 inverter control relay, a single-pole, single-throw type, identified as INVERT NO. 2, is installed in the forward equipment compartment on TERM PANEL 17. On airplanes BuNo. 134466 through 134564 not reworked per BuAer AD/SC No. 495, the coil of the No. 2 inverter control relay is energized by monitor bus power through a 5-ampere circuit breaker. When the relay coil is energized, the relay contacts connect primary bus power to the d-c motor of the No. 2 inverter. On airplanes BuNo. 134565-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, and airplanes BuNo. 134466 through 134564 reworked per BuAer AD/SC 495, the coil of the No. 2 inverter control relay is energized by primary bus power through a 5-ampere circuit breaker. When the relay coil is energized, the relay contacts connect monitor bus power to the d-c motor of the No. 2 inverter.

7–130. NO. 2 INVERTER CURRENT-LIMITER.

7–131. DESCRIPTION. (See figure 7–9.) The No. 2 inverter current limiter, an 80-ampere type, identified as INVERTER CURRENT LIMITER, is installed in the forward equipment compartment on TERMINAL PANEL 17. The No. 2 inverter current limiter will momentarily pass current loads exceeding 80 amperes, thus preventing "blowing" during the starting cycle of the No. 2 inverter. On airplanes BuNo. 134466 through 134564 not reworked per BuAer AD/SC No. 495, the current limiter is connected between the primary bus and the A2 contact of the No. 2 inverter control relay. On airplanes BuNo. 134565-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, and prior airplanes reworked per BuAer AD/SC No. 495, the current limiter is connected to the monitor bus and the A2 contact on the No. 2 inverter control relay.

CAUTION

When replacing No. 2 inverter current limiter use only Burndy Engineering Co. part number FLLB-G4. Never use a fuse.

7–132. INSTRUMENT POWER TRANSFORMER.

7–133. DESCRIPTION. (See figure 7–9.) The instrument power transformer, identified as INST TRANSF, is installed in the forward equipment compartment on TERM PANEL 17. When the flight instrument power selector switch is in either INVERTER 2 & AUTO-PILOT or INVERTER 1 position, the 115 V phase A and C voltage from the indicated inverter is connected to the transformer primary coil and 26 V a-c power is supplied from the transformer secondary coil to the following circuits: ID-250 indicator, gyro horizon, bank and turn, and the a-c voltage sensing relay. On airplanes BuNo. 135391-135406, 137492-137632, 139606-139821, 142011-142067, 26 V a-c power is also supplied to the torquemeter circuit.

7–133A. TORQUEMETER TRANSFORMER.

7–133B. DESCRIPTION. On airplanes BuNo. 142010 and 142068 through 142081, the torquemeter circuit re-

ceives 26 V a-c power from its own transformer rather than from the instrument power transformer. When the d-c power control switch is on, the number 2 inverter supplies 115 V phase A power to the torquemeter-transformer primary coil. The secondary coil then steps the voltage down to 26 V a-c for the torquemeter circuit. The torquemeter transformer, identified as TORQUEMETER, is installed on the inboard side of the forward-equipment-compartment relay panel, number 16.

7–134. P-1 POWER JUNCTION BOX.

7–135. DESCRIPTION. (See figure 7–9.) The P-1 power junction box, identified as AUTO PILOT POWER JUNCT, is installed in the radio compartment on the P-1 auto pilot equipment support which is located on the upper right-hand side between fuselage stations 220 and 252. The P-1 power junction box is utilized to step-down the 115-volt a-c output of the No. 2 inverter to a nominal 26-volt a-c power source. The 26-volt a-c output of the P-1 power junction box is connected through the flight instrument power select switch in INVERTER 2 & AUTO PILOT position to the following circuits: gyro horizon, bank and turn, and the a-c voltage sensing relay.

7–136. FLIGHT-INSTRUMENT POWER-SELECTOR SWITCH.

7–137. DESCRIPTION. (See figure 7–9.) The flight instrument power select switch, a five-pole, two-position rotary type, identified as FLT INST PWR SEL, is located in the autopilot controller console, which is installed in the pilot's right-hand control panel. The flight instrument power select switch has two designated positions, INVERTER 2 & AUTO PILOT, and INVERTER 1. When the switch is in INVERTER 2 & AUTO PILOT the flight instrument power select switch connects the following: 115-volt A and C phase output of the No. 2 inverter to the a-c loads, monitor d-c bus power to the P-1 power junction box, and 26-volt a-c power from the P-1 power junction box to the 26-volt a-c loads. When the switch is in INVERTER 1 the flight instrument power select switch connects the following: 115-volt A and C phase output of the No. 1 inverter to the a-c loads.

7–138. A-C VOLTAGE-SENSING RELAY.

7–139. DESCRIPTION. (See figure 7–9.) The a-c voltage-sensing relay, identified as AC SENSING, is installed in the forward equipment compartment on TERM PANEL 17. The a-c voltage-sensing relay consists of three voltage-sensitive relays connected with the 26-volt a-c circuit: one relay coil is connected between phase A and ground, the second between phase C and ground, and the third across phase AC, respectively, of the 26-volt a-c bus which is energized by the selected inverter. The coil of each voltage-sensitive relay has a pick-up of 24 volts, and when so energized, the coil opens the contacts of its respective relay. If any of the three phases supplying the essential loads fails or drops to approximately 22 volts or less, the coil of the applicable relay becomes de-energized, thereby completing a d-c power circuit to the instrument power-failure warning light.

7–140. FLIGHT-INSTRUMENT POWER-FAILURE WARNING LIGHT.

7–141. DESCRIPTION. (See figure 7–9.) The flight instrument power failure warning light, identified as FLT INSTR PWR FAILURE, is located in the autopilot controller console, which is installed in the pilot's right-hand control panel. The light, a push-to-test type, receives test power from the primary bus. When any phase of a selected inverter fails the light comes "ON." The light receives power from the primary bus through the DC INST circuit breaker, and across the closed contacts of the a-c voltage-sensing relay. A dimming resistor is added in series with the light so that when the FLT INST lights are on, the warning light is dimmed.

7–141A. FLIGHT INSTRUMENT POWER FAILURE WARNING LIGHT DIMMING RESISTOR.

7–141B. DESCRIPTION. (See figure 7–9.) The flight instrument power failure warning light dimming resistor, identified as WARN LT DIM is installed in the forward equipment compartment on a resistor panel located on center line at fuselage station 110. The resistor is a wire-wound type and is series connected to the flight instrument power failure warning light and ground through the warning light dimming relay when the flight instrument lights are "ON."

7–142. NO. 1 INVERTER DUMMY LOAD.

7–143. DESCRIPTION. The No. 1 inverter dummy-load, identified as NO. 1 INV DUMMY LOAD, is installed in the forward equipment compartment on a resistor panel located on center line at fuselage station 110. The dummy-load consists of six wire-wound type resistors connected in a series-parallel arrangement across the output of the No. 1 inverter. The purpose of the No. 1 inverter dummy-load is to maintain proper load balance when the No. 1 inverter is connected to its a-c loads and also supplies a 10 percent load for the No. 1 inverter when no a-c loads are connected. With the 10 percent load always connected the inverter will immediately assume the a-c loads when selected.

7–144. NO. 2 INVERTER DUMMY LOAD.

7–145. DESCRIPTION. The No. 2 inverter dummy-load, identified as NO. 1 & NO. 2 INV DUMMY LOADS, is installed in the forward equipment compartment on a resistor panel located on center line at fuselage station 110. The dummy-load consists of three wire-wound type resistors connected in a series-parallel arrangement across the output of the No. 2 inverter. The dummy-load is constantly applied to maintain inverter output efficiency.

Note

On airplanes BuNo. 134466 through 134590 an additional 450-ohm, 30 watt dummy load resistor is connected between phase A and ground and is common to the output circuits of both the No. 1 and No. 2 inverter.

7–145A. CONSTANT FREQUENCY LOAD CORRECTION RELAY.

7–145B. DESCRIPTION. On airplanes BuNo. 139606-139821, and 142010-142081, the constant frequency load correction relay, a single-pole, double-throw type identified as INVERTER LOAD, is installed on terminal panel No. 16 in the forward equipment compartment. The relay coil is energized by radio bus power through a 5-ampere circuit breaker from the monitor bus whenever the ARN-21 equipment is operating. The closed relay contacts A2-A3 (relay coil not energized) connect capacitor C3 of the constant frequency load corrector (see paragraph 7–145D) across the phase AC output of either the No. 1 or No. 2 inverter; the closed A1-A2 contacts (relay coil energized) disconnect the C3 constant frequency load capacitor from across the phase AC output.

7–145C. CONSTANT FREQUENCY LOAD CORRECTOR.

7–145D. DESCRIPTION. On airplanes BuNo. 139606-139821, and 142010-142081, a constant frequency load corrector identified as LOAD CORRECTOR is located in the forward equipment compartment at fuselage station 100. The load corrector comprises three capacitors identified as C1, C2 and C3 mounted in a single unit. C1 is connected between phase A and ground, C2 is connected between phase C and ground, and C3 is connected across phase AC. When the ARN-21 equipment is operating C3 is disconnected from across phase AC. The load corrector provides a means of maintaining a balanced 3-phase load condition for either the No. 1 or No. 2 inverter.

7–145E. INVERTER LOAD AND TORQUEMETER POWER RELAY.

7–145F. DESCRIPTION. On airplanes BuNo. 139606-139821, and 142010-142081, an inverter load and torquemeter power relay, a triple-pole, double-throw type identified as INVERT LOAD SWITCH, is located in the forward equipment compartment on terminal panel No. 16. The relay coil is energized by monitor bus power through a 5-ampere circuit breaker on the monitor bus when the flight instrument power select switch is placed in INVERTER 2 & AUTO PILOT position. When the relay coil is energized the closed B1-B2 and C1-C2 contacts connect the constant frequency a-c power supply dummy load across the No. 1 inverter. When the relay coil is not energized (flight instrument power select switch in INVERTER 1 position) the B2-B3 and C2-C3 contacts connects the dummy load across the No. 2 inverter output. On airplanes BuNo. 135391-135406, 137492-137632, 139606-139821, and 142011-142067, the A1-A2 relay contacts connect 26-volt a-c power to the torquemeter circuit when the relay coil is energized, and disconnect the power when the relay coil is not energized.

7–145G. CONSTANT FREQUENCY A-C POWER SUPPLY DUMMY LOAD.

7–145H. DESCRIPTION. On airplanes BuNo. 139606-139821, and 142010-142081, a constant frequency a-c power supply dummy load, identified as No. 1 & 2 INVERTER DUMMY LOADS, is located on a resistor panel installed on the left-hand side of the forward equipment compartment at fuselage station 110. The dummy load consists of three wire-wound resistors connected in a series-parallel arrangement. The dummy load is placed across the output of either the No. 1 or No. 2 inverter, depending upon the position of the contacts of the inverter load and torquemeter power relay (refer to paragraph 7–145F). The dummy load provides the minimum required load for either the No. 1 or No. 2 inverter.

7–145J. SAFETY CIRCUITS.

7–145K. DESCRIPTION. Safety circuits are provided in the airplane to render certain electrical and electromechanical circuits inoperative during ground handling of the airplane. All of these circuits, if energized or actuated on the ground can cause injury to personnel or damage to the aircraft. The circuits are normally energized only when the airplane is airborne or on jacks. The safety circuits are as follows:

Armament safety circuit.

Landing gear retraction, cowl flap, and dive brake safety circuit.

7–145L. The armament safety circuit is provided to automatically de-energize the armament bus when the landing gear lever is in "WHEELS DOWN" position. However, the armament bus may be energized by actuating the safety disabling switch. For detailed information refer to section IX.

7–145M. LANDING GEAR RETRACTION, COWL FLAP, AND DIVE BRAKE SAFETY CIRCUIT.

7–145N. DESCRIPTION. The landing gear retraction, cowl flap, and dive brake safety circuit is provided to de-energize the landing gear and dive brake safety solenoids, and also to automatically open the cowl flaps during ground handling of the airplane. The major components of the landing gear retraction, cowl flap, and dive brake safety circuit are as follows:

Name	*Para Ref*
Retraction release switch	7–145P
Landing gear safety solenoid	7–145R
Dive brake safety solenoid	7–145T
Horizontal stabilizer and dive brake interlock switch	7–145V

7–145P. RETRACTION RELEASE SWITCH.

7–145Q. DESCRIPTION. The retraction release switch, a single-pole, double-throw, low travel plunger type, is installed on the left-hand landing gear, and is bracketed to the shock strut telescoping mechanism. When the weight of the airplane is resting on the main landing gear struts, the retraction release switch is actuated by the telescoping mechanism, thereby removing the ground and de-energizing the landing gear and dive brake safety solenoids. The retraction release switch when actuated connects secondary bus power to the cowl flap actuators to prevent inadvertent closing of the cowl flaps during engine run-up.

7–145R. LANDING GEAR SAFETY SOLENOID.

7–145S. DESCRIPTION. The landing gear safety solenoid, a low travel, spring-loaded type, is installed outboard and aft of the landing gear control lever. The landing gear safety solenoid is connected to the secondary bus, and is energized only when a ground is provided across the retraction release switch (retraction release switch plunger extended, aircraft airborne). A mechanical release lever, aft of the handle, permits manual disengagement of the solenoid when necessary.

7–145T. DIVE BRAKE SAFETY SOLENOID.

7–145U. DESCRIPTION. The dive brake safety solenoid, a low travel, spring-loaded type, is installed outboard of the dive brake control lever. The dive brake safety solenoid is connected to the secondary bus, and is energized only when a ground is provided across the retraction release switch (retraction release switch plunger extended, aircraft airborne). A mechanical release lever, outboard of the handle, permits manual disengagement of the solenoid when necessary.

7-145V. HORIZONTAL STABILIZER AND DIVE BRAKE INTERLOCK SWITCH.

7-145W. DESCRIPTION. The horizontal stabilizer and dive brake interlock switch is installed adjacent to the horizontal stabilizer intermediate limit switch on airplanes BuNo. 139606-139821 and 142010-142081. The switch is a single-pole, single-throw, low limit travel type and is actuated by the horizontal stabilizer intermediate limit switch tube and guide assembly. When the switch contacts are closed, a ground is provided for the dive brake safety solenoid through the closed contacts of the retraction release switch. When the switch contacts are open, the ground is removed from the dive brake safety solenoid and the solenoid is de-energized, thus making the dive brakes inoperative.

7-146. LIGHTING SYSTEMS.

7-147. DESCRIPTION. The lighting systems of the airplane consist of the exterior light, approach light, interior light, secondary and extension light, and service light systems. The exterior light, interior light, secondary and extension light, and service light systems function independently of each other. Power for the approach light system is supplied from the exterior light system. The approach light system is utilized during arrested landings. The interior light system provides lighting for flight and non-flight instruments and the control consoles. The secondary and extension light system provides cockpit emergency lighting in the event the interior lights are not available because of dc and ac generator failure. The service light system provides illumination in the forward equipment and radio compartments for maintenance purposes.

7-148. EXTERIOR LIGHT SYSTEM.

7-149. DESCRIPTION. (See figure 7-10.) The exterior light system provides visual determination of the position and heading of the airplane and aid in night formation flying. Major components of the system include:

Exterior light master switch
Anticollision light
Exterior light control console
Radio noise filter
Flasher-coder
Fuselage lights
Tail position lights
Wing position lights
Wing tip formation lights
Fuselage formation lights
Exterior light dimming resistors.

7-150. The exterior lights operate on power received from the dc secondary bus through the circuit breakers, the master switch, the control console, and the flasher-coder. Separate toggle switches on the exterior light console permit selective use of the following: fuselage lights, wing positions lights, tail position lights, and formation lights. The flasher-coder unit, for automatic signaling of the fuselage lights and automatic flashing of the position lights, is interconnected with the exterior light control console.

7-151. TROUBLESHOOTING. Except for common troubles, such as burned-out lamps and resistors, the most probable cause of trouble in the exterior light system is either a defective control console or flasher-coder. Therefore, once it has been determined that the circuitry is sound, the most effective troubleshooting procedure is the replacement of first the exterior light control console, and then the flasher-coder.

7-152. TESTING. Refer to table 7-10.

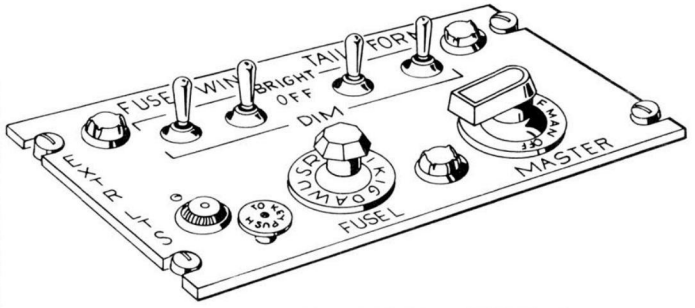
7-153. EXTERIOR LIGHT MASTER SWITCH.

7-154. DESCRIPTION. The master exterior light switch, a double-pole, single-throw type, is installed in the landing gear lever control panel in airplanes BuNo. 134466, 134475-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081. It is identified as MASTER EXT LIGHTS and has two designated positions, ON and OFF. The master exterior lights switch when in the ON position connects secondary bus power from the EXT LIGHTS, and EXT & APPROACH LTS circuit breakers to the exterior light control console. When in the OFF position secondary bus power is removed from the exterior light, and approach light systems.

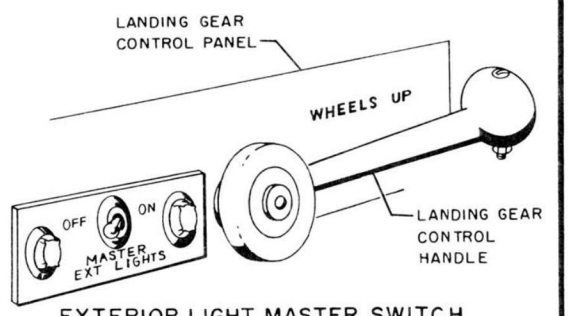
7-155. EXTERIOR LIGHT CONTROL CONSOLE.

7-156. DESCRIPTION. (See figure 7-10.) The exterior light control console is installed in the pilot's right-hand control panel and is identified as EXTR LTS. On airplanes BuNo. 134467 through 134474, secondary bus power is connected to the exterior light control console through the EXT LIGHTS, and EXT & APPROACH LTS circuit breakers, and on airplanes BuNo. 134466, 134475-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, secondary bus power is available at the exterior light control console when the MASTER EXT LIGHTS switch is ON. The exterior light control console provides a means of controlling the exterior light system by the following switches contained on the front panel: (1) MASTER switch, (2) FUSEL code selector switch, (3) manual PUSH TO KEY switch, (4) four brilliance control switches identified as FUSEL, WING, TAIL, and FORM.

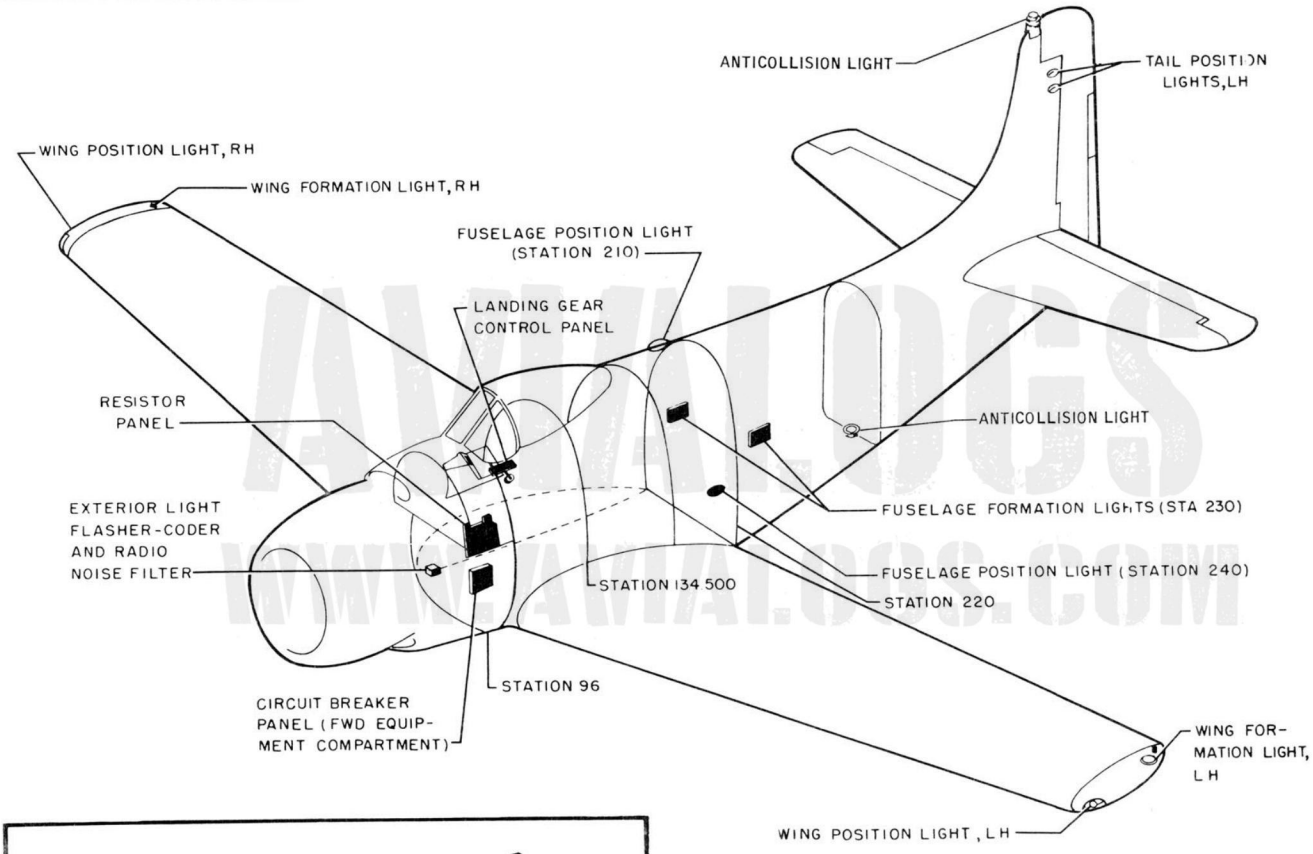
7-157. The MASTER switch, a five-position rotary type, functions as follows: OFF disconnects all power to the exterior lights; MAN directs power to all exterior lights and connects the manual PUSH TO KEY switch and the indicating light in series with the fuselage lights, thereby permitting manual flashing of the fuselage lights and the indicating light; CODE directs power through the flasher-coder to the fuselage lights, which automatically flash the letter selected by the FUSEL code selector switch; FLSH directs power through the flasher-coder to light the wing and the white tail-position lights alternately with the fuselage lights and the yellow tail-position lights. STDY directs power to all the exterior lights.

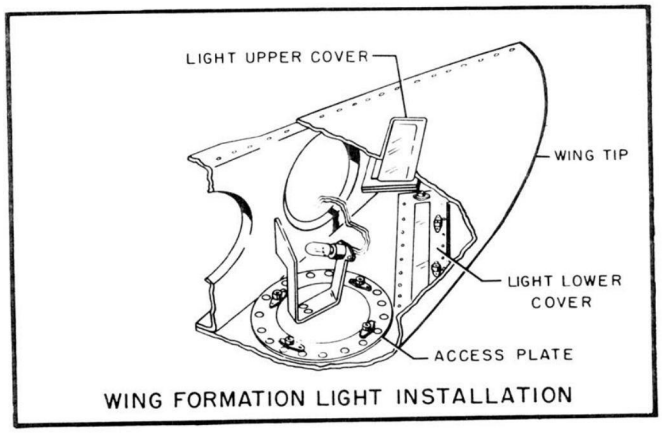


EXTERIOR LIGHT CONTROL CONSOLE



EXTERIOR LIGHT MASTER SWITCH
(APPLIES TO AIRPLANES 134466, 134475-134637, 135223-135406, 137492-137632, 139606-139821, AND 142010-142081).





WING FORMATION LIGHT INSTALLATION

EFFECTIVITY - BUNO

FACTORY: ALL, EXCEPT AS NOTED.

SERV CHG: ALL AIRPLANES REWORKED TO A-1/ASC 709

ALF-2-7 P-4025-1D

Figure 7-10. Exterior Light System

TABLE 7-10. TESTING EXTERIOR LIGHT SYSTEM

PRELIMINARY CONDITIONS

External dc power source connected
EXT LIGHTS and EXT & APPROACH LIGHTS circuit breakers depressed
MASTER EXT LIGHTS switch ON

Operation	Desired Result
a. MASTER switch in STDY FUSEL switch in BRIGHT, DIM. WING switch in BRIGHT, DIM TAIL switch in BRIGHT, DIM. FORM switch in BRIGHT, DIM.	Exterior lights on; intensity bright, then dim.
b. MASTER switch in MAN. PUSH-TO-KEY switch momentarily depressed.	Fuselage lights and indicating light come on when PUSH-TO-KEY switch depressed. All other exterior lights on.
c. MASTER switch in FLSH.	Wing position and white tail position lights flash alternately with fuselage lights and yellow tail position lights.
d. MASTER switch in FLSH; arresting hook lowered or arresting hook position switch bypassed.	Wing position and white tail lights flash; fuselage and yellow tail lights are on steadily.
e. MASTER switch in CODE; FUSEL code switch in any letter.	Fuselage lights flash selected code letter; all other exterior lights are on steadily.
f. ANTI-COLL. LT. switch in ON position	Anticollision lights come on and oscillate.
g. ANTI-COLL. LT. switch in OFF position.	Anticollision lights go out.

7-158. The fuselage, wing position, tail position, and formation lights are controlled by the FUSE, WING, TAIL, and FORM toggle switches, respectively. Each switch, having three positions, BRIGHT, OFF, and DIM, is connected in series with its respective lights. The brilliance of the fuselage lights is controlled by the selective use of a normal or dim lamp. The brilliance of position and formation lights is controlled by varying the resistance in series with the lights.

7-158A. RADIO NOISE FILTER.

7-158B. DESCRIPTION. (See figure 7-10.) On airplanes BuNo. 134466, 134559-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, a RADIO NOISE FILTER is bracketed to the flasher-coder support located in the forward equipment compartment. The filter is connected into the flashing and coding circuit between the exterior light control console, and the flasher-coder. The filter reduces the noise level in the radio communication system during flashing and coding operations of the exterior light system.

7-159. EXTERIOR LIGHT FLASHER-CODER.

7-160. DESCRIPTION. (See figure 7-10.) The FLASHER CODER is installed in the forward equipment compartment aft of fuselage station 96 on centerline. The unit is connected to the exterior light control console to provide flash or code signals necessary during various operations of the exterior light system. On airplanes BuNo. 134466, 134559-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the flasher-coder is connected to the exterior light control console through a radio noise filter to reduce interference in the radio communications system.

7-161. FUSELAGE LIGHTS.

7-162. DESCRIPTION. (See figure 7-10.) One upper fuselage light, and one lower fuselage light are used in the exterior light system. The upper light is installed at fuselage station 210, aft of the cockpit enclosure. The lower fuselage light is installed on centerline at fuselage station 240. Each light assembly is equipped with a clear, non-diffusing lens-cover and contains sockets for bright and dim lamps. The fuselage lights receive secondary bus power through the exterior light control console and the flasher-coder. The exterior and approach light systems are so integrated that when the MASTER switch is in FLSH and the arresting hook is down, the fuselage lights will be on steadily.

7-163. TAIL POSITION LIGHTS.

7-164. DESCRIPTION. (See figure 7-10.) The tail position lights are installed with one yellow, and one white light on each side of the vertical stabilizer at station 94. The lights receive secondary bus power from the exterior light control console and the flasher-coder. With the TAIL position switch in BRIGHT or DIM and the MASTER switch in MAN or STDY, the four tail position lights will be on steadily. With the MASTER switch in FLSH the two yellow tail position lights will flash alternately with the two white

lights. When flashing, the two white lights flash in conjunction with the wing tip lights, while the two yellow lights flash in conjunction with the fuselage lights. However, with all light switches in BRIGHT or DIM, the MASTER switch in FLSH, and the arresting hook down (or the arresting hook position switch by-passed), and the landing gear locked down, the two yellow tail lights and the two fuselage lights will be on steadily.

7-165. WING POSITION LIGHTS.

7-166. DESCRIPTION. (See figure 7-10.) A position light is installed on each wing tip and is supplied by secondary bus power received through the exterior light control console and the flasher-coder. The right-hand wing tip light is equipped with a green cover and the left-hand wing tip light is equipped with a red cover. Both wing tip position lights have the same power source as the white tail position lights, and consequently, operate in conjunction with the white tail position lights at all times. With the WING brilliance control switch in BRIGHT or DIM, and the MASTER switch in MAN or STDY, the lights will be on steadily. With the MASTER switch in FLSH, the wing tip position lights flash in conjunction with the white tail position lights.

7-167. WING TIP FORMATION LIGHTS.

7-168. DESCRIPTION. (See figure 7-10.) A wing tip formation light is installed within each wing tip in the aft section. Diffused light covers are installed flush with the wing tip surface above and below each light; the right-hand light covers are green, and the left-hand light covers are red. The lamp assembly is bracketed to a cover plate within the wing tip lower surface and is accessible when the cover plate is removed. With the MASTER switch in any position but OFF, and the FORM brilliance control switch in BRIGHT or DIM, each light receives secondary bus power from the exterior light control console. The wing tip formation lights are on steadily and cannot be flashed.

7-169. FUSELAGE FORMATION LIGHTS.

7-170. DESCRIPTION. (See figure 7-10.) The fuselage formation lights are installed flush with the side plating, and are opposite each other at fuselage station 230. Each fuselage formation light is equipped with a yellow diffused plastic cover. Access to the lamp is obtained by removing two screws and removing the lamp socket from the top of the light housing. With the MASTER switch in any position but OFF, and the FORM brilliance control switch in BRIGHT or DIM, each light is connected to the secondary bus through the exterior light control console. The fuselage formation lights are on steadily and cannot be flashed.

7-171. EXTERIOR LIGHT DIMMING RESISTORS.

7-172. DESCRIPTION. (See figure 7-10.) The exterior light system contains seven dimming resistors between the DIM contacts of the brilliance control switches and the exterior lights. All are mounted on a resistor panel located in the forward equipment compartment and are identified as EXT LIGHTS. Each resistor is a 15-watt, wire wound type connected in series with its respective exterior light.

7-172A. ANTICOLLISION LIGHT.

7-172B. DESCRIPTION. (See figure 7-10.) Anticollision lights are used as a warning device to help prevent mid-air collisions and are installed on the vertical stabilizer (station 144.000) and the lower fuselage surface (station 319.000). Each light contains two bulbs which oscillate 180 degrees clockwise and counterclockwise continuously during operation. The oscillation gives the illusion of flashing and appears to flash 85 times a minute. The lights are controlled by a single ON/OFF switch located on the pilot's instrument panel glareshield.

7-172C. REMOVAL. (See figure 7-10A.)

a. Verify that no electrical power is applied to airplane and that battery is disconnected.

b. Remove ten screws securing light assembly to structure.

c. Carefully remove sealing compound from mounting flange and remove light assembly to provide access to electrical connector.

d. Remove lockwire and disconnect electrical connector from light assembly. Cap electrical connector.

7-173. INSTALLATION. (See figure 7-10A.)

NOTE

To correct compass deviation error initiated by A-1/ASC 678 and 709, the anticollision lights must be insulated from airplane structure and grounded at station 220.

a. Verify that no electrical power is applied to airplane and that battery is disconnected.

b. Apply antiseize compound (Fed. Spec. TT-A-580) sparingly to threads of light assembly receptacle.

c. Connect electrical connector to light assembly receptacle. Secure with lockwire (MS20995632).

d. Apply light coat of mold release compound (Thalco 500 PVA) to light assembly flange; air dry for 30 minutes.

e. Place rubber seal (supplied with light) between mounting ring and support bracket.

f. Install light fillet of sealing compound (Spec. MIL-S-8784(1), class B2) around edge of skin cutout immediately prior to installing light assembly.

g. Verify that light assembly is insulated from airplane structure.

h. Insulate each securing screw with step washers (QP 21037).

i. Position light assembly in structure access; verify that mounting flange seats evenly on structure.

j. Install ten screws to secure light assembly to nutplates in structure.

k. Orient lens retainer band and screw to avoid contact with mounting screws.

l. Smooth extruded sealant aerodynamically flush to skin.

7-174. TESTING. (Refer to Table 7-10.)

7-175. APPROACH LIGHT AND ARRESTING HOOK WARNING SYSTEM.

7-176. DESCRIPTION. (See figure 7-11.) The principal units of the approach light and arresting hook warning system are as follows:

Approach light

Approach light relay

Arresting hook by-pass relay

Arresting hook by-pass switch

Arresting hook position switch

Arresting hook warning light switch

Arresting hook warning light

Arresting hook warning light dimming resistor.

7-177. When the airplane is in a night carrier-landing approach, the approach light serves to apprise the landing signal officer of the attitude of the airplane, and the position of the landing and arresting gear. The arresting hook warning light, when on, indicates the arresting hook lever is down, and the arresting hook is up. When the landing gear is not down and locked the approach light and the arresting hook warning light is off. When the landing gear is down and locked and the arresting gear control lever is in DOWN and the arresting hook is not down the approach light flashes and the arresting hook warning light is on. When the landing gear is down and the arresting hook control lever is down and the arresting hook is down the approach light burns steadily and the arresting hook warning light is out.

7-178. The approach light system operates on power received from the secondary bus, through the 5-ampere EXT & APPROACH LTS circuit breaker, the exterior light control console, and the flasher-coder. The arresting hook warning light circuit receives power direct from the secondary bus.

7-179. An arresting hook by-pass circuit is provided to permit operation of the approach light during night practice shore landings. When the tail hook by-pass circuit is energized and the landing gear is not down the approach light will be OFF. When the landing gear is down and locked the approach light will be ON steady.

7-180. TROUBLESHOOTING. Refer to table 7-11.

7-181. TESTING. Refer to table 7-12.

7-182. APPROACH LIGHT.

7-183. DESCRIPTION. (See figure 7-11.) The approach light is installed in the leading edge of the left-hand wing at station 128. The approach light is protected by a plastic window which fairs with the contour of the wing. The light is of the conventional type with three beams: green, amber, and red. The amber beam is directed downward at an angle of -2 degrees from the fuselage reference plane; the green beam is directed downward at an angle of 7-1/2 degrees from the amber beam; and the red beam is directed upward at an angle of 7-1/2

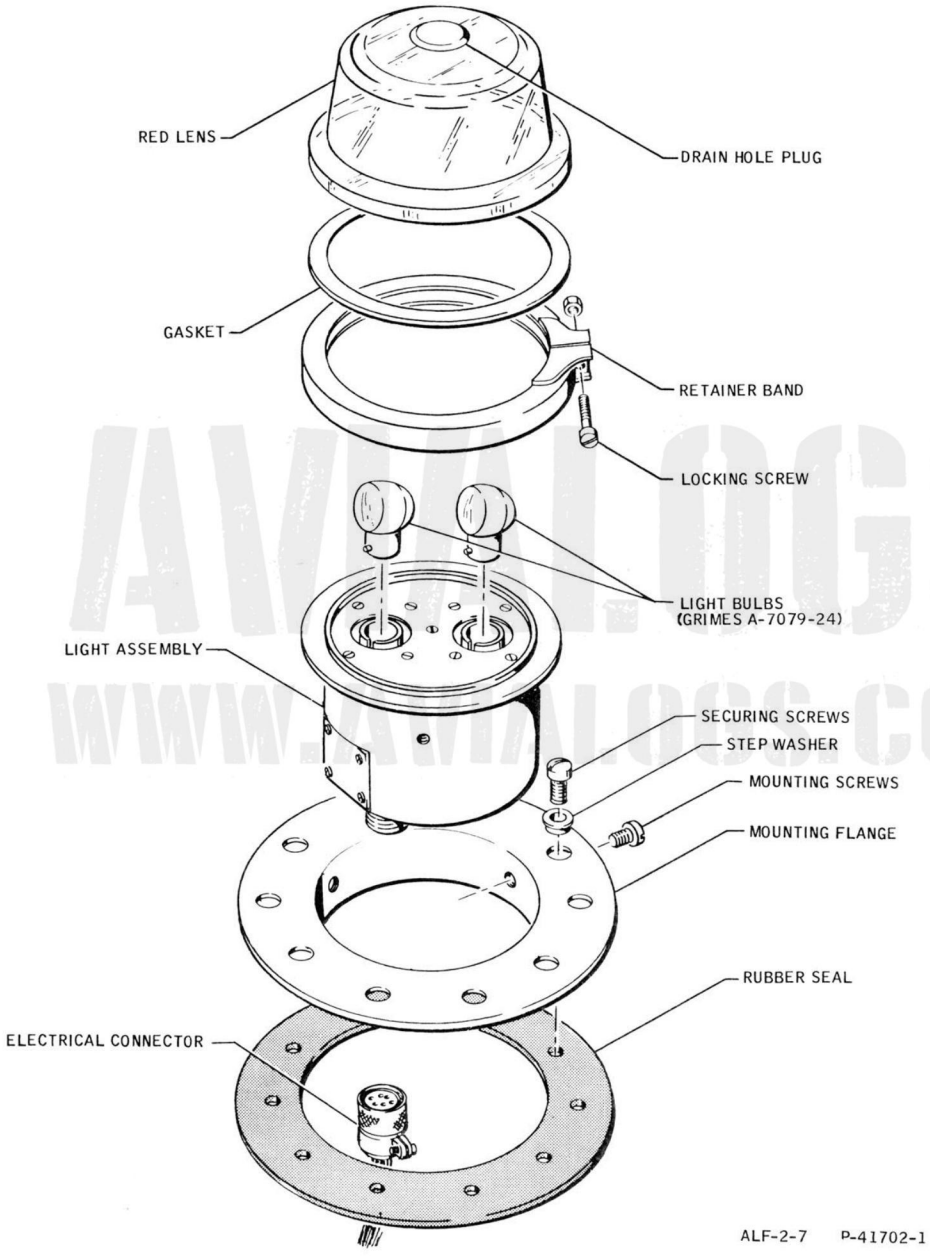


Figure 7-10A. Anticollision Light Assembly

degrees from the amber beam. An adjustment hole is provided in the wing plating beneath the approach light.

7–184. ADJUSTMENT. See figure 7–12.

7–185. REMOVAL.

a. Remove screws securing approach light window to wing plating.

b. Pull light assembly forward and clear of wing.

c. Remove knurled nut on back of light housing and pull lamp free.

d. Separate light housing from mounting brackets by removing window and bracket attaching screws.

7–186. INSTALLATION.

a. Assemble upper and lower mounting brackets to light housing and secure with screws and nuts.

b. Secure window to brackets with screws and nuts.

c. Insert lamp and socket into rear of light housing and tighten knurled nut finger-tight.

d. Place approach light assembly in wing opening and install screws to fasten frame to structure.

7–187. APPROACH LIGHT RELAY.

7–188. DESCRIPTION. (See figure 7–11.) The APPROACH LIGHT RELAY, a double-pole, double-throw type, is installed in the forward equipment compartment on TERM PANEL 17. The coil of the approach light relay receiyes power from the secondary bus through the EXT & APPROACH LTS circuit breaker. The coil of the relay is energized at all times when the landing gear is not in a locked down position. (See figure 7–11.) When the coil of the approach light relay is energized, the circuit to the approach light is open; therefore, the approach light will be off. When the coil of the approach light relay is de-energized the B2-B3 contacts connect intermittent power from the flasher-coder to the approach light and the A2-A3 connects steady power from the exterior light control console if the arresting hook is down.

7–188A. ARRESTING HOOK BY-PASS RELAY.

7–188B. DESCRIPTION. (See figure 7–11.) The arresting hook by-pass relay, a double-pole, double-throw type, identified as HOOK BY-PASS, is installed in the forward equipment compartment on TERM PANEL 17. The purpose of the relay is to by-pass the arresting hook position switch and transfer STEADY power to the approach light when the arresting hook is up. When the arresting hook by-pass switch is momentarily closed and the arresting hook control handle is in "HOOKUP," a ground is supplied to the coil of the arresting hook by-pass relay through the arresting hook warning light switch, which is actuated by the arresting hook control handle. When the coil of the arresting hook by-pass relay

TABLE 7–11. TROUBLE SHOOTING APPROACH LIGHT SYSTEM

Trouble or Symptom	*Probable Cause*	*Correction*
1. Approach light off when landing gear down and locked.	a. Approach light lamp burned out. b. No power to exterior light control console and/or flasher-coder.	Replace lamp. Trouble-shoot exterior light circuit.
2. Approach light flashes when arresting hook down.	Arresting hook position switch out of adjustment.	Adjust switch.
3. Approach light on steadily when arresting hook is up.	Refer to trouble 2.	
4. Arresting hook warning light does not come on when arresting hook control handle down.	a. Arresting hook warning light lamp burned out. b. Refer to trouble 2.	Replace lamp.

TABLE 7–12. TESTING APPROACH LIGHT SYSTEM

PRELIMINARY CONDITIONS

External d-c power source connected
EXT & APPROACH LTS circuit breaker depressed
Exterior light master switch in "ON"
Arresting hook control handle in "HOOK UP"
Exterior light control console MASTER switch in "FLSH"

Operation	*Desired Result*
a. Arresting hook up.	Approach light flashing.
b. Bypass switch in "PUSH TO BYPASS TAIL HOOK FOR FCLP"; arresting hook up.	Approach light on steadily.
c. Arresting hook control handle in "HOOK DOWN," arresting hook supported up.	Approach light flashing, arresting hook warning light on.
d. Arresting hook down.	Approach light on steadily, arresting hook warning light off.

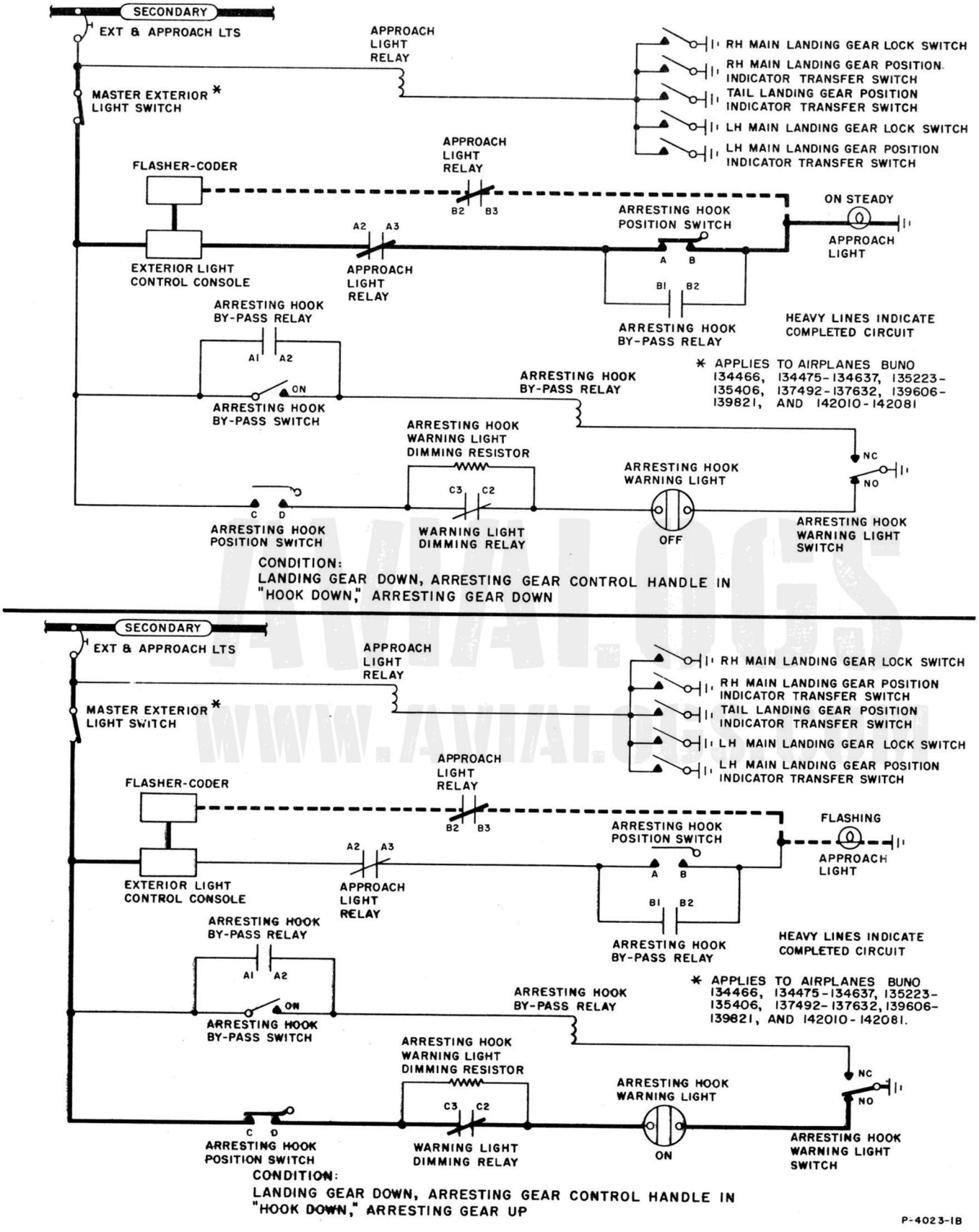
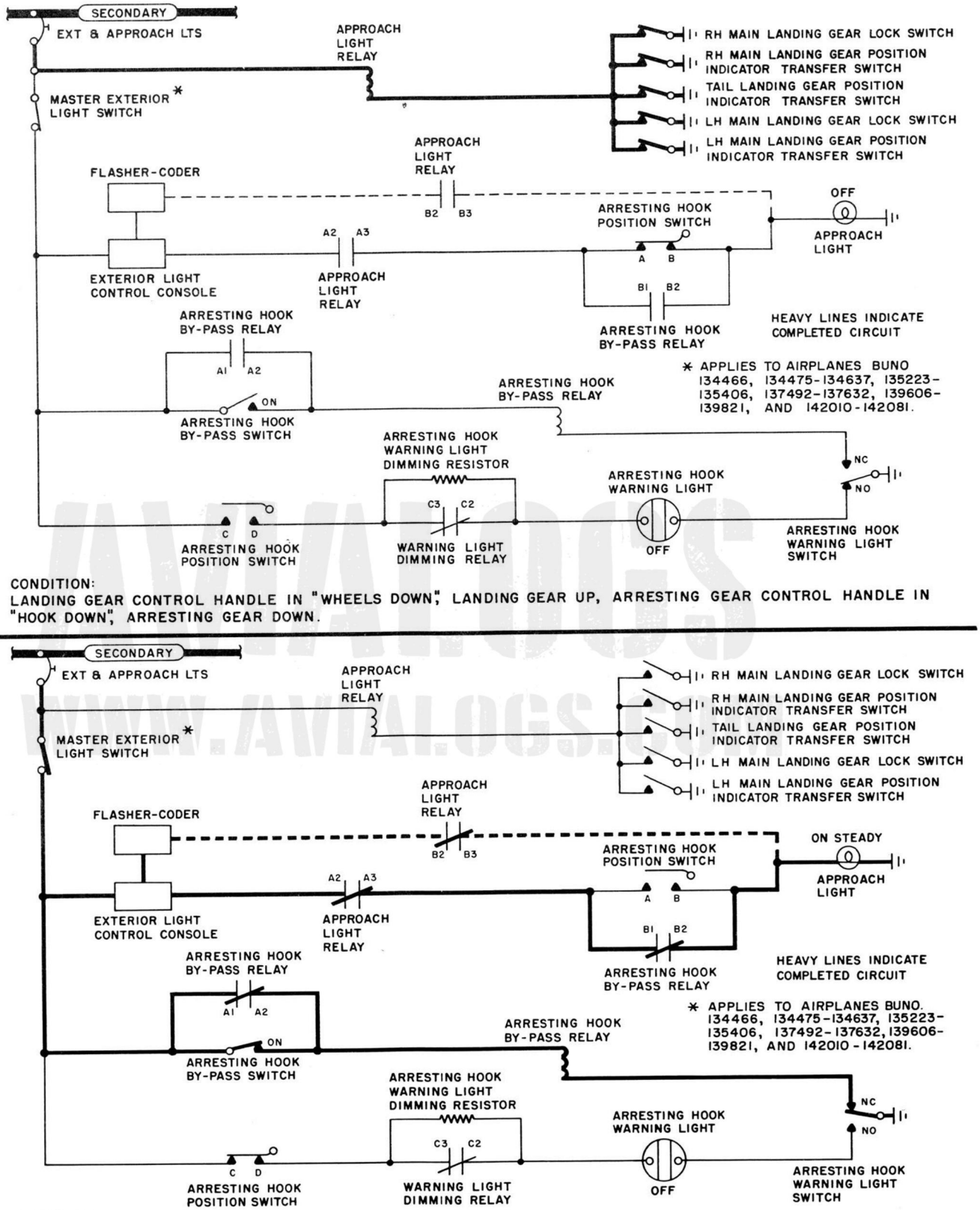


Figure 7–11. Approach Light and Arresting Hook Warning Light—Schematic (Sheet 1)



CONDITION:
LANDING GEAR CONTROL HANDLE IN "WHEELS DOWN", LANDING GEAR UP, ARRESTING GEAR CONTROL HANDLE IN "HOOK DOWN", ARRESTING GEAR DOWN.

CONDITION:
LANDING GEAR DOWN, ARRESTING GEAR CONTROL HANDLE IN "HOOK UP", ARRESTING GEAR UP, ARRESTING HOOK BY-PASS SWITCH IN "PUSH TO BY-PASS TAIL HOOK FOR FCLP."

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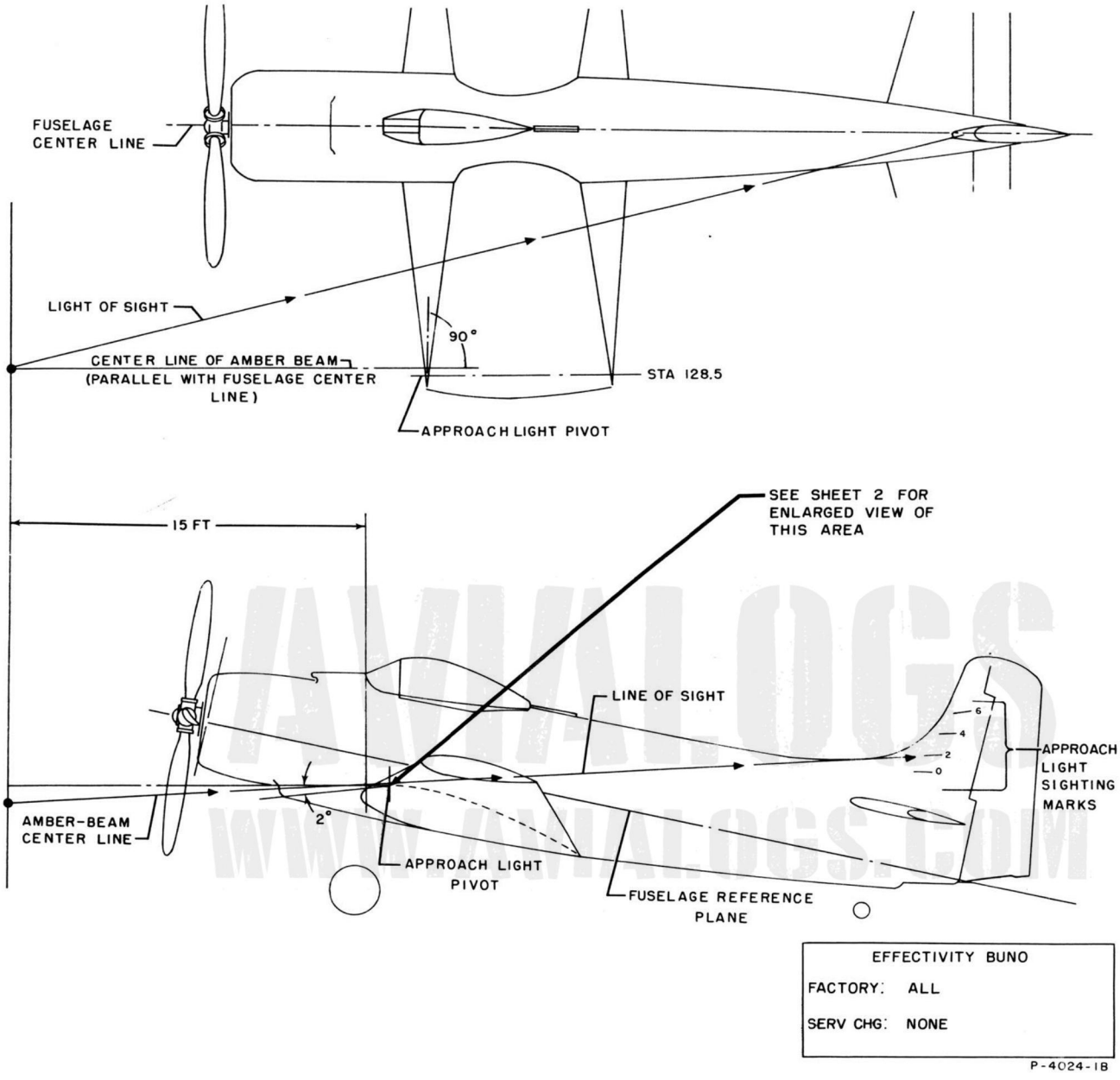
Figure 7–11. Approach Light and Arresting Hook Warning Light—Schematic (Sheet 2)



ADJUSTMENT

(Airplane in 3-point position; approach light on)

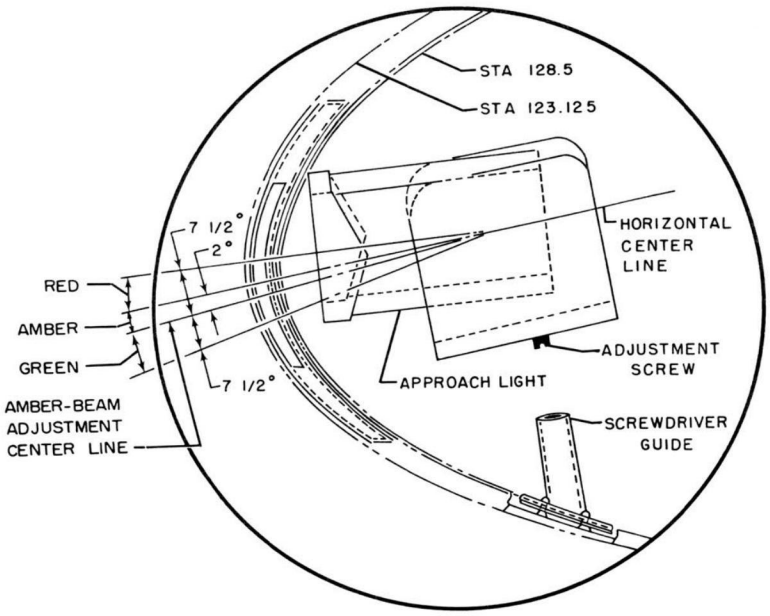
STEP 1. Station observer 15 feet forward of approach light and with eye level adjusted to sight over wing at "—2°" line on vertical stabilizer.

STEP 2. Adjust approach light with screwdriver so that observer (in sighting position) sees center of amber beam.

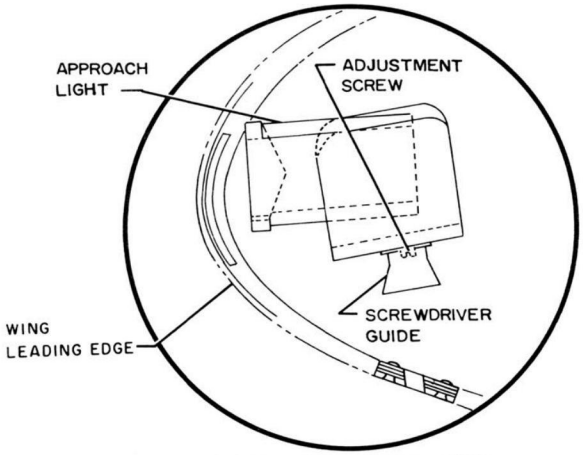
STEP 3. Rotate adjustment screw two full turns each direction from centered position to verify that range is adequate for height variations during carrier landings.

STEP 4. Readjust light to obtain position noted in step 2.

Figure 7–12. Approach Light Adjustment (Sheet 1)



SCREWDRIVER GUIDE INSTALLATION
(APPLIES TO AIRPLANES PRIOR TO BUNO 139606 NOT RE-WORKED PER BUAER AD/SC NO. 590)



SCREWDRIVER GUIDE INSTALLATION
(APPLIES TO AIRPLANES BUNO 139606 AND SUBSEQUENT AND PRIOR AIRPLANES RE-WORKED PER BUAER AD/SC NO. 590)

EFFECTIVITY- BUNO.
FACTORY : AS NOTED
SERV CHG : AD/SC NO.590

P-4024-2

Figure 7–12. Approach Light Adjustment (Sheet 2)

is thus energized by secondary bus power, the A1-A2, B1-B2 contacts close. A holding voltage is maintained on the coil of the arresting hook by-pass relay through the relays closed A1-A2 contacts, and STEADY power is transferred to the approach light through the closed B1-B2 contacts.

7–188C. ARRESTING HOOK BY-PASS SWITCH.

7–188D. DESCRIPTION. (See figure 7–11.) The arresting hook by-pass switch, a single-pole, single-throw, momentary-on type, identified as APPROACH LIGHT, is installed in the left main landing gear wheel-well at wing station 55. The switch has one designated position "PUSH TO BY-PASS TAIL HOOK FOR FCLP." On airplanes BuNo. 134467 through 134474 when the switch is momentarily actuated secondary bus power from the EXT & APPROACH LTS circuit breaker is connected to the coil of the arresting hook by-pass relay. On airplanes BuNo. 134466, 134475-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the MASTER EXT LIGHTS switch located in the landing gear lever control panel must be "ON" to connect secondary bus power to the coil of the arresting hook by-pass relay.

7–189. ARRESTING HOOK POSITION SWITCH.

7–190. DESCRIPTION. (See figure 7–11.) The arresting hook position switch, a single-pole, double-throw, plunger type, is bracketed to the fuselage at station 376.5, and is positioned so that it is actuated by the arresting hook. When the arresting hook is DOWN one set of contacts of the arresting hook position switch is closed thereby connecting "STEADY" power to the approach light, provided the landing gear is down. If the arresting hook is up, no "STEADY" power is available to the approach light through the arresting hook position switch, but secondary bus power is connected to the arresting hook warning light through the arresting hook position switch. Therefore, if the landing gear is down and locked, the "STEADY" circuit to the approach light is completed through the arresting hook position switch when the arresting hook is down.

7–191. ADJUSTMENT.

a. Make certain arresting hook is latched up.

b. Reach through right-hand access and screw in switch adjusting bolt until bolt head clears bellcrank.

c. Screw out adjusting bolt until switch actuates; then out three-and-one-half additional turns.

d. Safety-wire adjusting bolt.

7–192. ARRESTING HOOK WARNING LIGHT SWITCH.

7–193. DESCRIPTION. The arresting hook warning light switch, a single-pole, double-throw type, identified as APPROACH LIGHT, is installed forward of the pilot's right-hand control panel. The switch is actuated by the mechanical linkage of the arresting hook control handle when in the "HOOK DOWN" position. When actuated the switch completes the ground circuit to the arresting hook warning light. When the arresting hook control handle is in "HOOK UP," the switch completes the ground circuit to the coil of the arresting hook by-pass relay.

7–194. ARRESTING HOOK WARNING LIGHT.

7–195. DESCRIPTION. (See figure 7–11.) The arresting hook warning light is installed in the base of the arresting hook control handle, and the light's rays are transmitted through a plastic rod to a red tip on the end of the control handle. The light is "ON" when the arresting hook control handle is "DOWN," but the arresting hook remains up. If the arresting hook remains up, secondary bus power is connected through the arresting hook position switch to the arresting hook warning light. With the arresting hook control handle down, the arresting hook warning light switch is actuated to connect the arresting hook warning light to ground, thereby indicating arresting hook malfunction. Whenever FLT INST lighting is "ON" the arresting hook warning light is connected through the arresting hook warning light dimming resistor.

7–196. ARRESTING HOOK WARNING LIGHT DIMMING RESISTOR.

7–197. DESCRIPTION. (See figure 7–9.) The arresting hook warning light dimming resistor, identified as WARN LT DIM, is installed in the forward equipment compartment on a resistor panel located on centerline at fuselage station 110. The resistor is a wire wound type and is series connected to the arresting hook warning light when the C2-C3 contacts of the warning light dimming relay flight instrument lights are "ON."

7–198 thru 7–201. DELETED.

7–202. INTERIOR SECONDARY LIGHT SYSTEM.

7–203. DESCRIPTION. (See figure 7–13.) The interior secondary light system receives power from the battery bus through a 5-ampere circuit breaker, and the floodlight control console. The primary purpose of the interior secondary light system is to provide lighting (flood) of the pilot's right- and left-hand control panels, chartboard lights, and control of the standby compass light. The principal units of the interior secondary light system are as follows:

Name	*Para Ref*
Interior secondary control console	7–206
Cockpit floodlights	7–208
Chartboard lights	7–210
Chartboard light switch	7–212
Standby compass light	7–214

7-204. TROUBLESHOOTING. Trouble in the interior secondary light system is most likely to result from burned-out lamps or a defective control console. Therefore, once it has been determined that the circuitry is sound, the most effective troubleshooting procedure is the replacement of lamps and/or the control console.

7-205. TESTING. Refer to table 7-13.

7-206. INTERIOR SECONDARY LIGHT CONTROL CONSOLE.

7-207. DESCRIPTION. (See figure 7-13.) The interior secondary light control console is installed in the pilot's right-hand control panel and is identified as FLOOD LIGHTS. Battery bus power is connected to the interior secondary light control console through the C'PIT FLOOD LIGHTS circuit breaker. The interior secondary light control console provides a means of controlling the floodlights and the compass light by the following switches contained on the front panel. A rotary type switch with four designated positions of OFF, DIM, MED, and BRIGHT for the floodlights, and a single-pole, single-throw type switch identified as COMPASS LIGHT, with two designated positions of ON and OFF. With the rotary selector switch in OFF the interior secondary light system is de-energized. With the switch in DIM, battery bus power is connected through a 63-ohm resistor (an integral part of the floodlight control console) to the left- and right-hand cockpit floodlights. In MED, a 22-ohm resistor (also a part of the control console) is connected between the battery bus and the floodlights. In BRIGHT battery bus power is connected directly to the floodlights, and also to the chartboard lights which are utilized as floodlights (provided the chartboard is in). The COMPASS LIGHT switch when ON connects primary bus power from the interior light control console to the light contained on the standby compass.

7-208. COCKPIT FLOODLIGHTS.

7-209. DESCRIPTION. (See figure 7-13.) One cockpit floodlight is installed above the pilot's left-hand control panel at fuselage station 122, and one above the pilot's right-hand control panel at fuselage station 120. Each light is equipped with a cover to provide white or red lighting and is adjustable to direct light on the control panels as desired. The left-hand light is removable and may be utilized as an extension light, the right-hand light is fixed. Brilliance of the floodlights is controlled by the floodlight control console.

7-209A. HIGH INTENSITY COCKPIT FLOODLIGHTS.

7-209B. DESCRIPTION. (See figure 7-13A.) BuWeps AD/ASC No. 698B provides instructions for installation of high intensity cockpit floodlighting. The installation includes two support assemblies on which the floodlights are mounted. The lights are located one on each side of the cockpit above the control consoles between fuselage station 128.23 and 122.25. In addition a switch and circuit breaker are installed on the right-hand high intensity cockpit floodlight.

7-210. CHARTBOARD LIGHTS.

7-211. DESCRIPTION. Two chartboard lights are installed on the lower surface of the glare shield over the instrument panel. Each light is equipped with a cover to provide white or red lighting, and is adjustable to direct light on the chartboard, or on the instrument panel. Both lights are fixed and cannot be removed. During normal operations, the chartboard lights receive primary bus power from the CONSOLE light switch in the interior light control console, and are energized across the chartboard light switch only when the chartboard is extended. Brilliance of the chartboard light is dependent on the position of the CONSOLE light switch. The chartboard lights are also utilized as floodlights, and are energized by battery bus power directed across the chartboard light switch (chartboard not extended) from the FLOOD LIGHTS control console when the rotary selector switch is in BRIGHT.

7-212. CHARTBOARD LIGHT SWITCH.

7-213. DESCRIPTION. (See figure 7-13.) The chartboard light switch, a single-pole, double-throw type, is installed on the forward end of the left-hand chartboard track. The chartboard light switch is actuated only when the chartboard is IN. When the chartboard is IN the chartboard light switch connects battery bus power from the interior secondary light control console to the chartboard lights, which illuminates the pilot's instrument panel. With the chartboard extended the chartboard light switch connects primary bus power from the interior light control console to the chartboard lights.

7-214. STANDBY COMPASS LIGHT.

7-215. DESCRIPTION. (See figure 7-13.) The standby compass light is an integral part of the standby compass instrument and receives primary bus power from the interior primary light system and is controlled by the

TABLE 7-13. TESTING INTERIOR SECONDARY LIGHT SYSTEM

Operation	Desired Result
C'PIT FLOOD LIGHTS circuit breaker depressed. Selector switch on FLOOD LIGHTS control console to DIM, MED, and BRIGHT, successively.	
Chartboard in.	Floodlights come on; light intensity varies with switch setting. Chartboard lights come on when switch in BRIGHT position. (Chartboard lights out when chartboard pulled out.)

COMPASS LIGHT switch located in the FLOOD LIGHTS control console. Brilliance of the standby compass light is controlled by NON-FLT INST lights switch located in the interior light control console.

7–216. INTERIOR PRIMARY LIGHT SYSTEM.

7–217. DESCRIPTION. (See figure 7–13.) The interior primary light system receives power from the primary

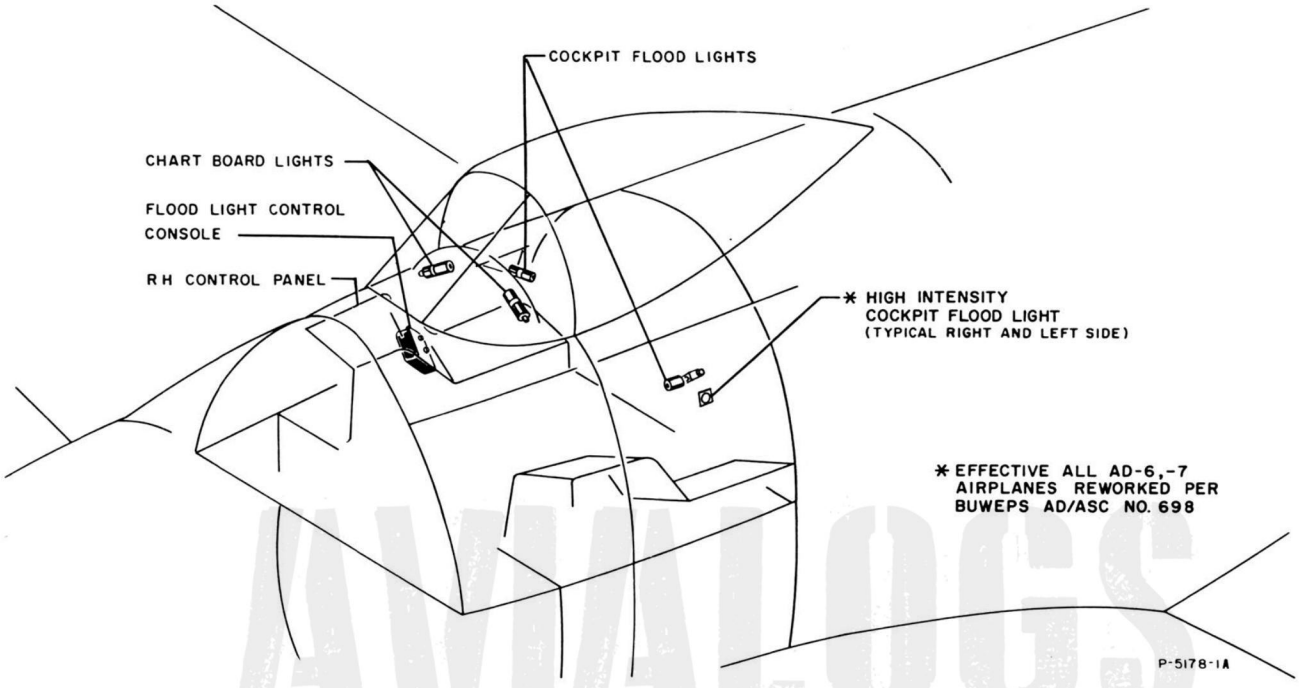
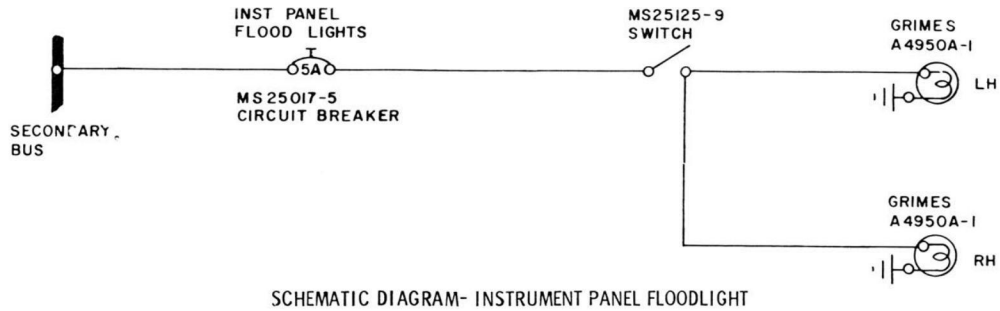
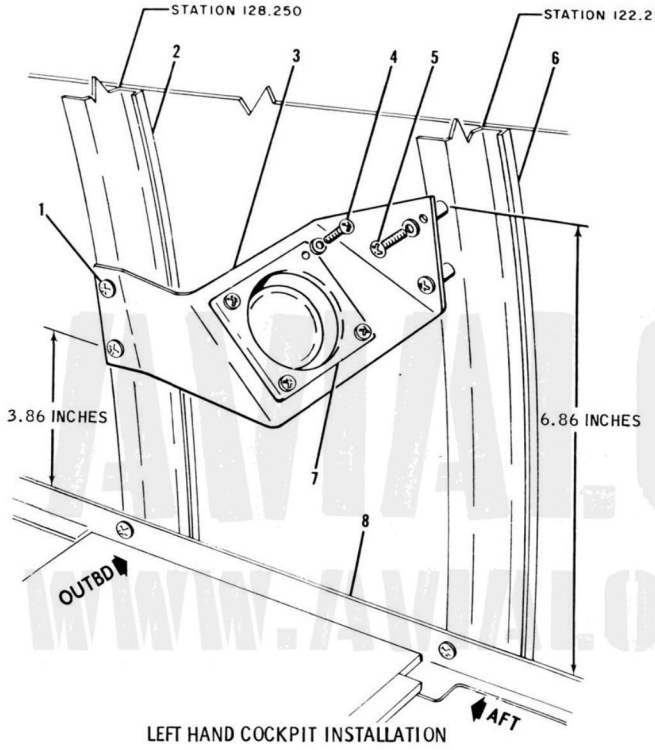


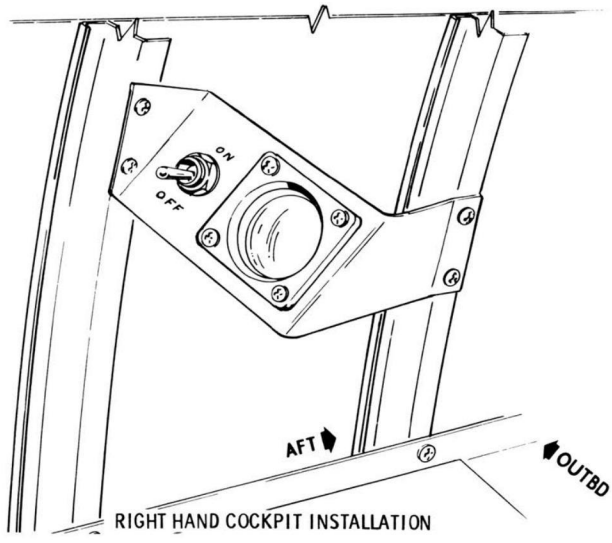
Figure 7-13. Interior Secondary Light System



SCHEMATIC DIAGRAM- INSTRUMENT PANEL FLOODLIGHT



LEFT HAND COCKPIT INSTALLATION



RIGHT HAND COCKPIT INSTALLATION

KIT NO. 1 NAVY STOCK NO. R1510-1-AD-C698

1 DRILL "F" 2 HOLES IN DG-5254149-32
STIFFENER TO MATCH HOLES IN 412322
OR 412322-1 (RH) SUPPORT ASSEMBLY
NAS221-11 SCREW 2 REQUIRED
AN960D10 WASHER 2 REQUIRED
EN-22NA21-02 ANCHOR NUT 2 REQUIRED

2 DG-5254149-32 STIFFENER (REF) *
DG-5254149-33 STIFFENER RH OPPOSITE *

3 412322 SUPPORT ASSEMBLY 1 REQUIRED
412322-1 SUPPORT ASSEMBLY RH OPPOSITE

4 AN526-632R8 SCREW 4 REQUIRED
AN960D6 WASHER 4 REQUIRED

5 DRILL "F" 2 HOLES IN DG-5254149-28
STIFFENER TO MATCH HOLES IN 412322
OR 412322-1 (RH) SUPPORT ASSEMBLY
NAS221-17 SCREW 2 REQUIRED
NAS221-11 SCREW 2 REQUIRED (RH ONLY)
AN960D10 WASHER 2 REQUIRED
STD9D6-10-12 SPACER 2 REQUIRED (LH ONLY)
EN-22 NA21-02 ANCHOR NUT 2 REQUIRED ***

6 DG-5254149-28 STIFFENER (REF) *
DG-5254149-30 STIFFENER RH OPPOSITE *

7 GMC-A-4950A-1-24 FLOODLIGHT ASSEMBLY
1 REQUIRED **

8 DG-9382318-123 ANGLE (REF) *
DG-9382319-61 ANGLE RH OPPOSITE *

* DG DOUGLAS AIRCRAFT DRAWING
** GMC GRIMES MFG. CO.
*** EN-ELASTIC STOP NUT CORP. OF AMERICA

NOTE
TOLERANCE ± .03

EFFECTIVITY - BUNO

FACTORY: NONE

SERV CHG: ALL AIRPLANES REWORKED TO A1/ASC 698B

ALF-2-7 P-18758-1A

Figure 7-13A. High Intensity Cockpit Floodlight Installation

bus through two 5-ampere circuit breakers installed in the cockpit circuit breaker panel and identified as CONSOLE LIGHTS, and INST. PANEL LIGHTS respectively. The major components of the interior primary light system are as follows:

Interior light control console

Interior light dimming resistors

Warning light dimming relays

Warning light dimming resistors

Instrument lighting control relay

Emergency lighting transformer

Emergency lighting relay.

7-218. TROUBLESHOOTING. The most common troubles are burned-out lamps, fuses and dimming resistors. (A dimming resistor may overheat, or burn out, from overloads caused by metal particles or filings within the console light sockets, and care should be taken to keep all light sockets clear of foreign matter.) Trouble not caused by lamps, fuses or resistors may usually be traced to a defective interior light control console. Having determined that the circuitry is satisfactory, the most effective troubleshooting procedure is to replace the interior light control console.

7-219. TESTING – INTERIOR PRIMARY LIGHT SYSTEM. See table 7-14.

7-220. The following circuits receive power from the interior light control console, and the following fuses identified as CONSOLE LTS, NON-FLT LTS, and FLT LTS which are installed on a fuse panel located in the forward equipment compartment.

a. The console light circuit provides lighting for the left-hand, right-hand, landing gear, arresting hook and canopy jettison control panels, and the pilot's armament instrument panel and chartboard lights. Brilliance is controlled by the rotation of the CONSOLE light switch from OFF to BRT.

b. The non-flight instrument light circuit provides lighting for all non-essential to flight instruments in the pilot's instrument panel. Brilliance is controlled by the rotation of the NON-FLT INST light switch from OFF to BRT.

c. The flight instrument light circuit provides lighting for all essential to flight instruments in the pilot's instrument panel. Brilliance is controlled by the rotation of the FLT INST light switch from OFF to BRT.

7-221. INTERIOR LIGHT CONTROL CONSOLE.

7-222. DESCRIPTION. (See figure 7-13.) The interior light control console is installed in the pilot's right-hand control panel and is identified as INT LTS. Primary bus power is connected to the interior light control console through the CONSOLE LIGHTS, and INST PANEL LIGHTS circuit breakers. The interior light control console provides a means of controlling the interior primary light system by the following switch knobs contained on the front panel: (1) CONSOLE lights; (2) NON-FLT INST lights; and (3) FLT INST lights. Each switch knob has seven detent positions, and is connected to its respective cam shaft, whose lobes actuate a switch or switches, depending on the detent position of the switch knob. The switches are connected

to remotely located resistors so that each clockwise rotation reduces the resistance in series with the respective light circuit. The FLT INST switch knob when rotated from the "OFF" position connects a cam actuated switch energized by primary bus power to the coils of the WARNING LT DIMMING RELAYS, so that when the flight instrument lights are on, all warning lights will be dimmed.

7–223. INTERIOR LIGHT DIMMING RESISTORS.

7–224. DESCRIPTION. (See figure 7–13.) The interior primary light system contains a total of fifteen dimming resistors which are connected between the interior light control console and the interior lights. All are mounted in groups of five on a resistor panel located in the forward equipment compartment, and are identified as CONSOLE DIMMING, NON-FLIGHT DIMMING, and FLIGHT DIMMING. Each resistor is a wire wound type and is connected in series with its respective interior light circuit.

7–225. WARNING LIGHT DIMMING RELAYS.

7–226. DESCRIPTION. (See figure 7–13.) The warning light dimming relays are installed in the forward equipment compartment on TERM PANEL 17. Each relay is a triple-pole, double-throw type. The coils of the warning light dimming relays are connected in series to the FLT INST power switch in the interior light control console, and are energized at all times except when the FLT INST switch is "OFF."

7–226A. On airplanes BuNo. 134466 through 134637, 135223 through 135406, and 137492 through 137632 there are two relays identified as WARN LT DIMMING RELAY. One relay coil, when energized, provides dimming by connecting a resistor in series with each of the following warning lights: D-C GEN WARNING, FLT INST PWR FAILURE (inverter failure), and radio altimeter. The other relay when energized connects a dimming resistor to the following warning lights: FUEL WARNING SWITCH TO MAIN, landing gear lever, and arresting hook lever.

7–226B. On airplanes BuNo. 139606-139821, and 142010-142081, an additional relay identified as WARN LT DIM is installed, and when energized it connects a dimming resistor in series with the BOMB DIRECTOR warning light.

7–227. WARNING LIGHT DIMMING RESISTORS.

7–228. DESCRIPTION. (See figure 7–13.) On airplanes BuNo. 134466 through 134637, 135223 through 135406, and 137492 through 137632, six warning light dimming resistors are installed on a resistor panel located in the forward equipment compartment, and are identified as WARN LT DIM. Each resistor is a wire-wound type and is series connected to its respective warning light whenever the FLT INST lights are "ON" and the warning light dimming relay coils are energized.

7–228A. On airplanes BuNo. 139606-139821, and 142010-142081, seven resistors are installed on the resistor panel.

7–229. INSTRUMENT LIGHTING CONTROL RELAY.

7–230. DESCRIPTION. (See figure 7–13.) On airplanes BuNo. 134581-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the instrument lighting control relay, a double-pole, double-throw type identified as INST LIGHTS CONTROL, is installed in the forward equipment compartment on TERM PANEL 17. In the event of d-c power failure the instrument lighting control relay connects 26-volt a-c emergency power to the flight and non-flight instrument lights providing the landing gear lever is in a "WHEELS UP" position. The coil of the instrument lighting control relay is connected across the B2-B3 contacts of the de-energized emergency lighting (EMER LTS) relay to the 26-volt a-c emergency lighting transformer (EMER LTS) which is connected to the a-c generator. A ground is provided for the coil across the armament safety switch, which is actuated by the landing gear lever in a "WHEELS UP" position. When energized there is connected across the A1-A2 contacts 26-volt a-c emergency power to ground to provide a holding voltage on the coil of the instrument lighting control relay, therefore when once energized, the landing gear lever may be placed in a "WHEELS DOWN" position. Connected across the B1-B2 contacts is 26-volt a-c emergency power to the interior light control console, and the flight, and non-flight instrument lights. During normal operating conditions the instrument lighting control relay is de-energized and thereby connects primary bus power across the B2-B3 contacts to the interior light control console and the flight and non-flight instrument lights.

TABLE 7–14. TESTING INTERIOR PRIMARY LIGHT SYSTEM

PRELIMINARY CONDITIONS

External d-c power source connected, CONSOLE LIGHTS, and INST PANEL LIGHTS circuit breaker depressed.

Operation	*Operation*	*Desired Results*
CONSOLE switch	turn clockwise	Console lights brighter with each clockwise detent position
NON-FLT INST switch	turn clockwise	Console lights brighter with each clockwise detent position
FLT INST switch	turn clockwise	Console lights brighter with each clockwise detent position

7-231. EMERGENCY LIGHTING TRANSFORMER.

7-232. DESCRIPTION. (See figure 7-13.) The emergency lighting transformer, a single-phase, 400-cycle 115/26-volt step-down type identified as EMER LTS TRANSFORMER, is installed in the forward equipment compartment on TERM PANEL 17. The emergency lighting transformer is connected to the C-phase output of the variable frequency ac generator through a 3-ampere fuse identified as EMER LTS. On A-IH airplanes BuNo. 134466 through 134580 the emergency lighting transformer 26-volt ac output is connected across the B1-B2 contacts of the energized emergency lighting (EMER LTS) relay to the interior light control console, and the flight and non-flight instrument lights. On airplanes BuNo. 134581-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the 26-volt ac output is connected across the B2-B3 contacts of the de-energized emergency lighting (EMER LTS) relay to the coil of the instrument lighting control (INST LIGHTS CONTROL) relay. The instrument lighting control (INST LIGHTS CONTROL) relay when energized (landing gear lever in WHEELS UP position) connects across its B1-B2 contacts, 26 volt ac power to the interior light control console, and the flight and non-flight instrument lights.

7-233. EMERGENCY LIGHTING RELAY.

7-234. DESCRIPTION. (See figure 7-13.) The emergency lighting relay, a double-pole, double-throw type identified as EMER LTS, is installed in the forward equipment compartment on TERM PANEL 17. On A-IH airplanes BuNo. 134466 through 134580, the coil of the emergency lighting relay receives power from the primary bus across the A2-A3 contacts of the de-energized (due to generator failure) bus control relay. The coil of the emergency lighting relay is energized when a ground is provided across the actuated armament safety switch (see paragraph 9-73), actuated by landing gear lever in WHEELS UP position. When energized there is connected across the B1-B2 contacts 26-volt ac power from the emergency lighting transformer to the interior light control console, and the flight and non-flight instrument lights. A holding voltage of primary bus power is connected across the relays A1-A2 contacts to maintain the relay in an energized condition after the landing gear lever has been placed in a WHEELS DOWN position. On airplanes BuNo. 134581-134637, 135223-135406, 137492-137632, 139606-139821, and 142010-142081, the coil of the emergency lighting relay receives power from the d-c generator. When energized the emergency lighting relay removes the 26-volt ac power from the coil of the instrument lighting control relay. When de-energized (due to dc generator failure) there is connected across the B2-B3 contacts 26-volt ac power to the coil of the instrument lighting control relay.

7-235. SERVICE LIGHT SYSTEM.

7-236. DESCRIPTION. (See figure 7-14.) The service light system receives power from the secondary bus through a 5-ampere circuit breaker installed in the for-

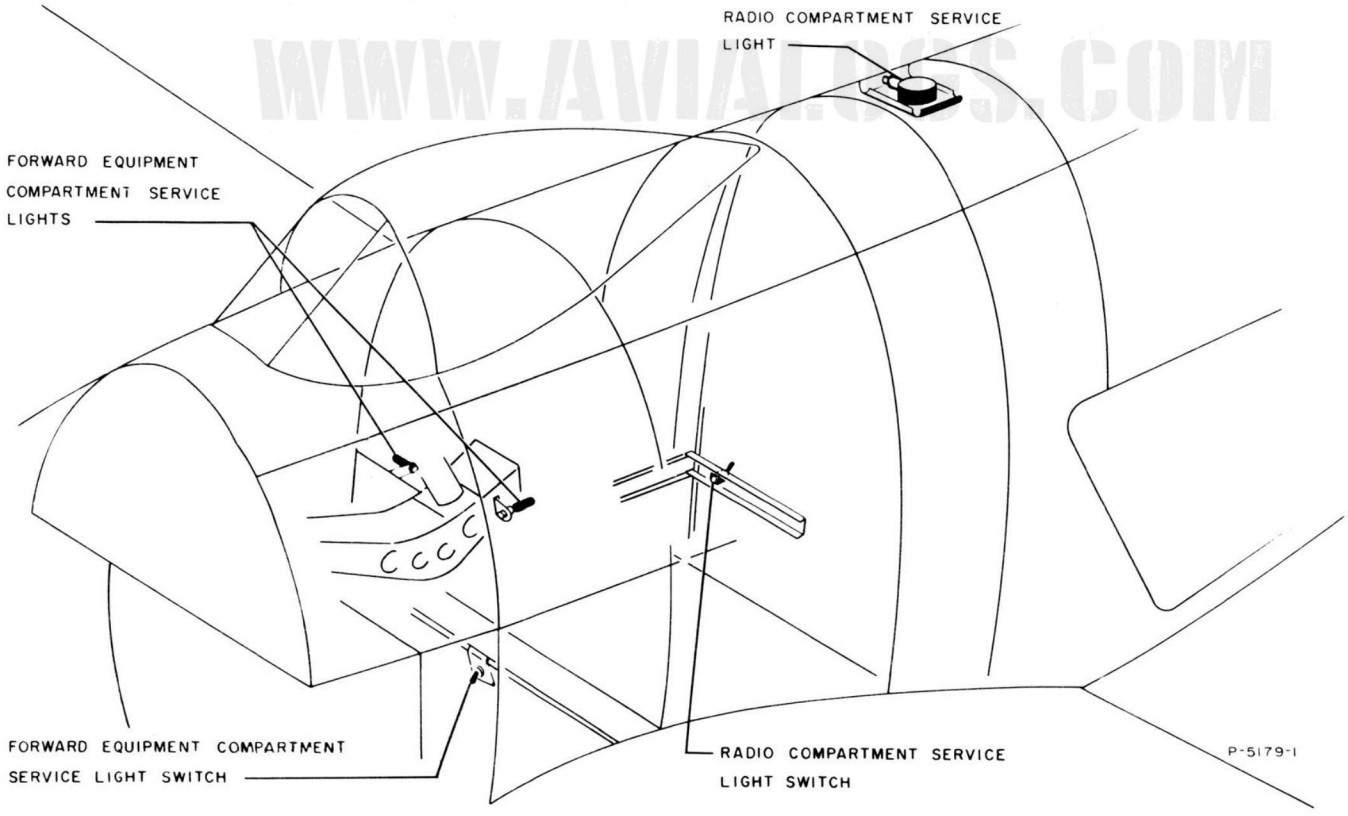


Figure 7-14. Service Light System

ward equipment compartment circuit breaker panel, and identified as SERVICE LIGHTS. The primary purpose of the service light system is to provide lighting for use during ground maintenance of the airplane. The system consists of two parallel circuits, with each circuit controlled by a single-pole, single-throw type switch. One circuit is utilized for forward equipment compartment lighting, and the other for the radio compartment. The principal units of the service light system are as follows:

Name	*Para Ref*
Forward equipment compartment service lights	7–239
Forward equipment compartment service light switch	7–241
Radio compartment service light	7–243
Radio compartment service light switch	7–245

7–237. TROUBLE SHOOTING. Trouble in the service light system can only be of a common nature, and can be corrected by following the applicable steps outlined in the general electrical trouble-shooting procedure.

7–238. TESTING. With the secondary bus energized, and the 5-ampere SERVICE LIGHTS circuit breaker depressed, the service light system may be tested by operating the respective service light switch and observing the function of the lights with respect to the switch position.

7–239. FORWARD EQUIPMENT COMPARTMENT SERVICE LIGHTS.

7–240. DESCRIPTION. (See figure 7–14.) Two separate service lights are installed in the forward equipment compartment. One light is installed on the left-hand side of the pilot's seat support, and the other light is installed on the right-hand side of the forward equipment compartment at fuselage station 110 cockpit floor beam. Each light is equipped with a hood to adjust the direction of the light beam. The lights are parallel connected to the forward equipment compartment service light switch.

7–241. FORWARD EQUIPMENT COMPARTMENT SERVICE LIGHT SWITCH.

7–242. DESCRIPTION. (See figure 7–14.) The forward equipment compartment service light switch, a single-pole, single-throw type, is bracketed at centerline above the compartment access doors (when open), and is identified as SERVICE LIGHTS, with two indicated positions "ON" and "OFF." The switch is parallel connected to the two service lights, and when "ON" connects secondary bus power to the service lights.

7–243. RADIO COMPARTMENT SERVICE LIGHT.

7–244. DESCRIPTION. (See figure 7–14.) The radio compartment service light, a dome light type, is bracketed to the upper fuselage at station 220. The light is equipped with two lamps which are parallel connected to the radio compartment service light switch.

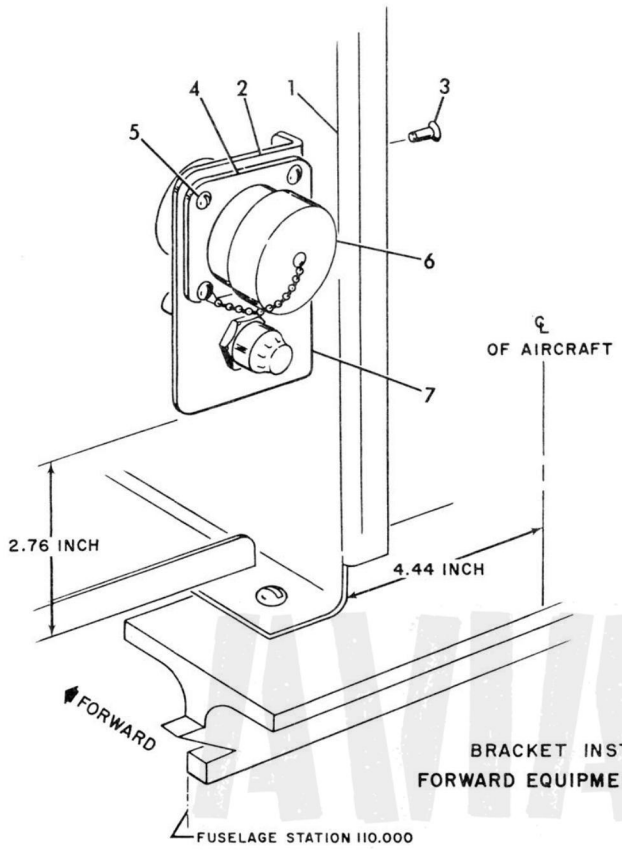
7–245. RADIO COMPARTMENT SERVICE LIGHT SWITCH.

7–246. DESCRIPTION. (See figure 7–14.) The radio compartment service light switch, a single-pole, single-throw type, is installed on the right-hand side of the lower radio equipment shelf, and has two indicated positions "ON" and "OFF." The switch is parallel connected to the two lamps in the service light, and when "ON" connects secondary bus power to the service light.

7–247. IN-FLIGHT FUELING SYSTEM CIRCUITS. For information concerning the in-flight fueling system control circuits, refer to the in-flight fueling system paragraphs in section IV.

7–248. ARMAMENT TEST RECEPTACLE INSTALLATION.

7–249. DESCRIPTION. (See figure 7–15.) BuWeps AD/ASC No. 699 relocates the T-23 armament test receptacle from the aft equipment compartment, fuselage station 200.625 right-hand side to the forward equipment compartment, fuselage station 110.000 left-hand side. The installation includes additional wiring, new mounting bracket, fuse holder, fuse and attaching hardware.



BRACKET INSTALLATION
FORWARD EQUIPMENT COMPARTMENT

NOTE

1 DG. 5438992-3 PANEL (REF) *

2 212521 BRACKET, 1 REQUIRED

3 AN470AD4 RIVET, 3 REQUIRED
(PICK UP PILOT HOLES)

4 MS3100A-16S-95, 1 REQUIRED

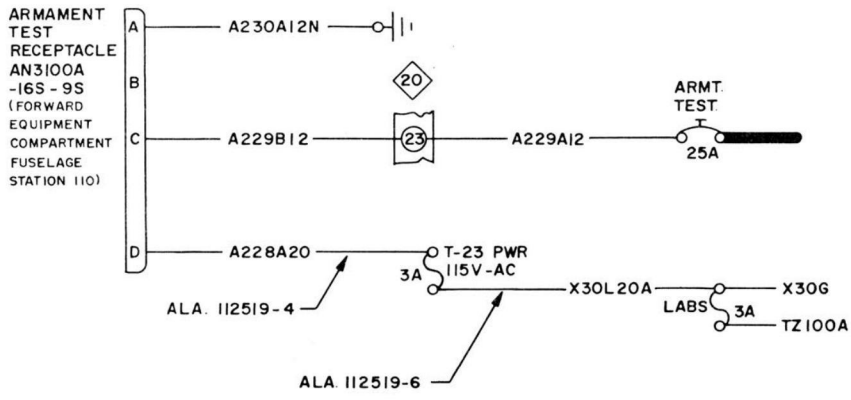
5 AN515-4R8 SCREW, 4 REQUIRED
AN960D4 WASHER, 7 REQUIRED
AN20365-440 NUT, 4 REQUIRED

6 MS25043-16C CAP, REUSE

7 LTF-442001 FUSEHOLDER, 1 REQUIRED *
LTF-413003 FUSE, 1 REQUIRED

* LEGEND

DG. DOUGLAS AIRCRAFT DRAWING
LTF LITTLEFUSE INC.



ARMAMENT TEST RECEPTACLE-WIRING DIAGRAM

CODE	LOCATION
20	FORWARD EQUIPMENT COMPARTMENT STATION 134, RH

EFFECTIVITY-BUNO.
FACTORY: NONE

SERV CHG: MODEL AD-6,-7 AIRPLANES REWORKED PER BUAER AD/ASC NO 699

40ALF-2-7 P-18748-1

Figure 7-15. Armament Test Receptacle Installation