SECTION 15

ELECTRICAL SYSTEMS

NOTE

This Section applies to aircraft thru 1970 Models.
Section 15A applies to aircraft 1971 thru 1973 Models.

TABLE OF CONTENTS

15-1. ELECTRICAL SYSTEMS.

15-2. GENERAL. This section contains service information necessary to maintain the Aircraft Electrical Power Supply System, Battery and External Power Supply System, Aircraft lighting System, Pitot and Stall warning Heaters, Cigar lighter, Emergency Locator Transmitter and Electrical Load Analysis.

15-3. ELECTRICAL POWER SUPPLY SYSTEM.

15-4. DESCRIPTION. Electrical energy for the aircraft is supplied by a 28-volt, direct-current, single-wire, negative ground electrical system. A single 24-volt battery supplies power for starting and furnishes a reserve source of power in the event of alternator failure. Two engine-driven alternators are the normal source of power during flight and maintain a battery charge controlled by a voltage regulator. An external power source receptacle is available to supplement the battery alternator system for starting and ground operation.

15-5. BATTERY AND EXTERNAL POWER SYSTEM.

15-6. AMMETER.

15-7. DESCRIPTION. The ammeter (standard on aircraft thru 1967 models) is connected between the battery and the aircraft bus. The meter indicates the amount of current flowing either to or from the battery. With a low battery and the engine operating at cruise speed the ammeter will show the full alternator output when all electrical equipment is off. When the battery is fully charged and cruise RPM is maintained with all electrical equipment off, the ammeter will show a minimum charging rate.

15-8. SPLIT BUS BAR.

15-9. DESCRIPTION. Beginning with 1967 models a split bus bar is installed on all aircraft utilizing an electrically engaged starter. One side of the bus bar supplies power to the electrical equipment while the other side supplies the electronic installations. When the master switch is closed the battery contactor engages and battery power is supplied to the electrical side of the split bus bar. The electrical bus feeds battery power to the electronics bus through a normally-closed relay; this relay opens when a starter switch is engaged or when an external power source is used, preventing transient voltages from damaging the semiconductor circuitry in the electronic installations.

15-10. BATTERY.

15-11. DESCRIPTION. The battery is 24-volts and is approximately 17 ampere-hour in capacity. The battery is mounted on the forward left side of the firewall and is equipped with non-spill type filler caps.

15-12. REMOVAL AND INSTALLATION. (Refer to figure 15-1.)

a. To gain access to the battery, remove the upper left half of cowling.

b. Remove the battery box lid and disconnect the battery ground cable.

CAUTION

Always remove the ground cable first and connect it last to prevent accidentally shorting the battery to the airframe with tools.

c. Disconnect the positive cable from the battery and remove the battery from the aircraft.

d. To install a battery, reverse this procedure.

15-13. CLEANING THE BATTERY. For maximum efficiency, the battery and connections should be kept clean at all times.

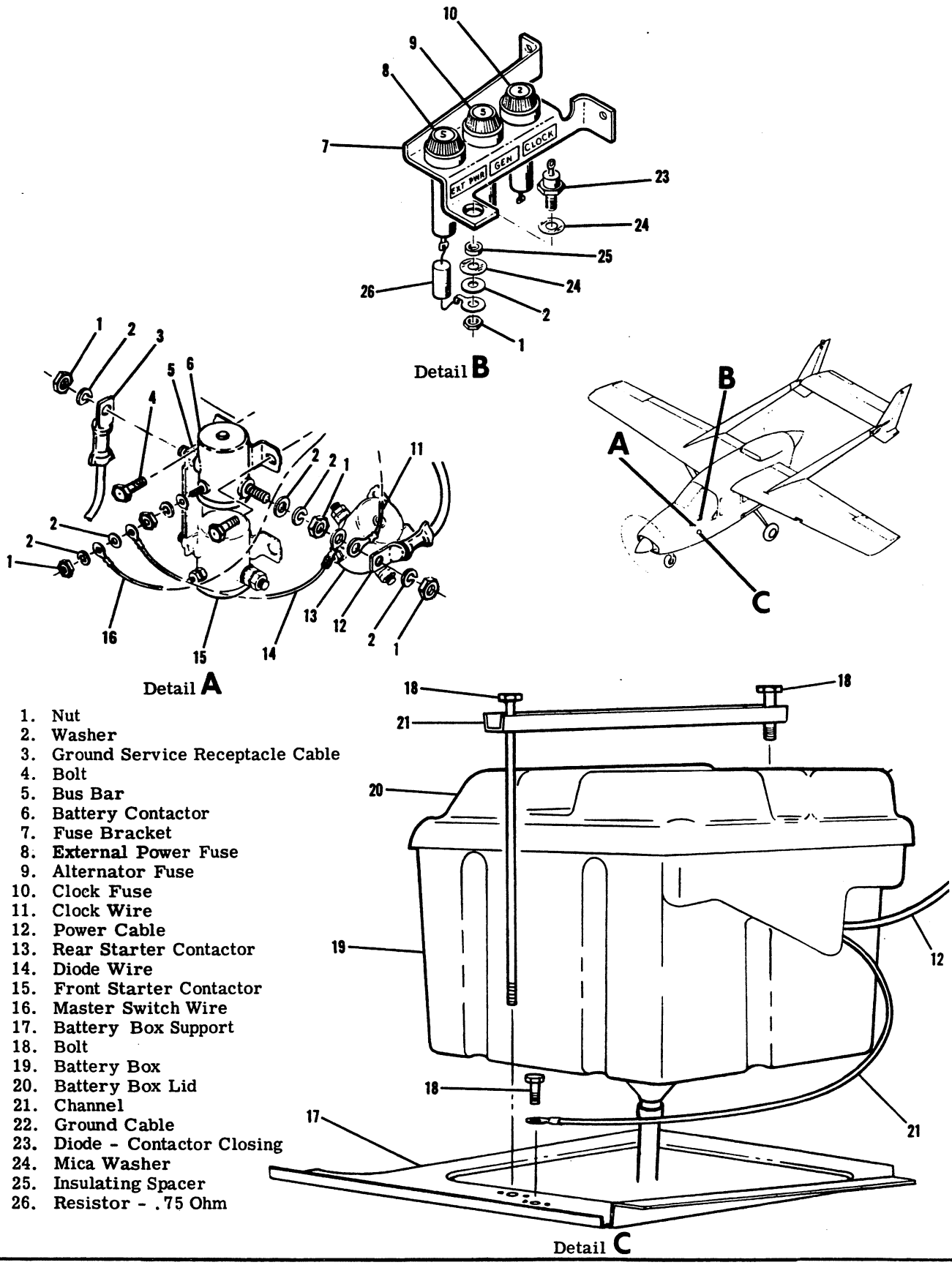
a. Remove the battery in accordance with preceding paragraph.

b. Tighten battery cell filler caps to prevent the cleaning solution from entering the cells.

c. Wipe battery cable ends, battery terminals and entire surface of the battery with a clean cloth moistened with a solution of bicarbonate of soda (baking soda) and water.

d. Rinse with clear water, wipe off excess water and allow battery to dry.

e. Brighten up cable ends and battery terminals with emery cloth or a wire brush.



1. Nut
2. Washer
3. Ground Service Receptacle Cable
4. Bolt
5. Bus Bar
6. Battery Contactor
7. Fuse Bracket
8. External Power Fuse
9. Alternator Fuse
10. Clock Fuse
11. Clock Wire
12. Power Cable
13. Rear Starter Contactor
14. Diode Wire
15. Front Starter Contactor
16. Master Switch Wire
17. Battery Box Support
18. Bolt
19. Battery Box
20. Battery Box Lid
21. Channel
22. Ground Cable
23. Diode - Contactor Closing
24. Mica Washer
25. Insulating Spacer
26. Resistor - .75 Ohm

Figure 15-1. Battery, Battery Contactor and Fuse Installations

f. Install the battery according to the preceding paragraph.

g. Coat the battery terminals and the cable ends with petroleum jelly.

15-14. ADDING ELECTROLYTE OR WATER TO THE BATTERY. A battery being charged and discharged with use will decompose the water from the electrolyte by electrolysis. When the water is decomposed, hydrogen and oxygen gases are formed which escape into the atmosphere through the battery vent system. The acid in the solution chemically combines with the plates of the battery during discharge or is suspended in the electrolyte solution during charge. Unless the electrolyte has been spilled from a battery, acid should not be added to the solution. The water will decompose into gases and should be replaced regularly. Add distilled water as necessary to maintain the electrolyte level even with the horizontal baffle plate inside the battery. When "dry charged" batteries are put into service, fill as directed with electrolyte. However, as the electrolyte level falls below normal with use add only distilled water to maintain the proper level. The battery electrolyte contains approximately 25% sulphuric acid by volume. Any change in this volume will hamper the proper operation of the battery.

CAUTION

Do not add any type of "battery rejuvenator" to the electrolyte. When acid has been spilled from a battery, the acid balance may be adjusted by following instructions published by the Association of American Battery Manufacturers.

15-15. TESTING THE BATTERY. The specific gravity check method of testing the battery is preferred when the condition of the battery is in a questionable state-of-charge. However, when the aircraft has been operated for a period of time with an alternator output voltage which is known to be correct, the question of battery capability may be answered more correctly with a load type tester. If testing the battery is deemed necessary, the specific gravity should be checked first and compared with the following chart.

BATTERY HYDROMETER READINGS

1.280 Specific Gravity	100% Charged
1.250 Specific Gravity	75% Charged
1.220 Specific Gravity	50% Charged
1.190 Specific Gravity	25% Charged
1.160 Specific Gravity	Practically Dead

NOTE

All readings shown are for an electrolyte temperature of 80° Fahrenheit. For higher temperatures the readings will be slightly lower. For cooler temperatures the readings will be slightly higher. Some hydrometers have a built-in temperature compensation chart and a thermometer. If this type tester is used, disregard this chart.

If a specific gravity reading indicates that the battery is not fully charged, the battery should be charged at approximately 10 amperes for 30 minutes, or until the battery voltage rises to 29-volts. After charging, a load type tester will give more meaningful results. A specific gravity check can be used after charging but the check cannot spot cells which short under load, broken connectors between plates of a cell, etc.

15-16. CHARGING THE BATTERY. When the battery is to be charged, the level of electrolyte should be checked and adjusted by adding distilled water to cover the tops of the internal battery plates. The battery cables and connections should be clean.

WARNING

When a battery is charging, hydrogen and oxygen gases are generated. Accumulation of these gases can create a hazardous explosive condition. Always keep sparks and open flame away from the battery. Allow unrestricted ventilation of the battery area during charging.

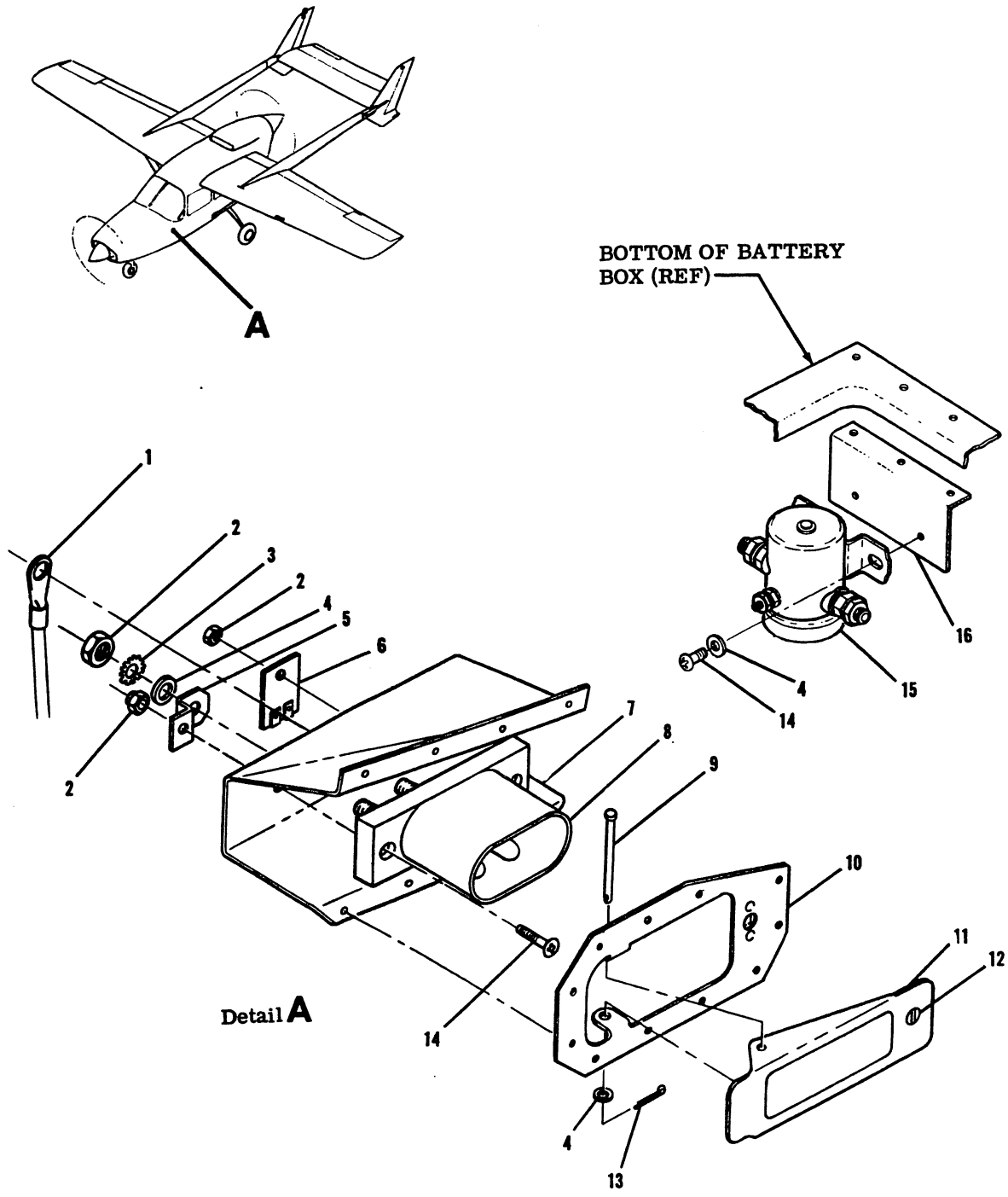
The main points of consideration during a battery charge are excessive battery temperature and violent gassing. Under a reasonable rate of charge (15 amperes or less) the battery temperature should not rise over 125°F nor should gassing be so violent that acid is blown from the vents.

15-17. BATTERY BOX.

15-18. DESCRIPTION. The battery is completely enclosed in an acid resistant plastic box which is located in the front engine compartment, left hand side. The box has a vent tube which protrudes through the bottom of the aircraft allowing battery gases and spilled electrolyte to escape.

15-19. REMOVAL AND INSTALLATION. (Refer to figure 15-1.) The battery box is held in place by two bolts and a channel which also holds the battery box lid. After removing the bolts, the lid and battery may be removed. The box then may also be removed after loosening clamp on drain tube attached to bottom of box.

15-20. MAINTENANCE OF BATTERY BOX. The battery box should be inspected and cleaned periodically. The box and cover should be cleaned with a strong solution of bicarbonate of soda (baking soda) and water. Hard deposits may be removed with a wire brush. When all corrosive deposits have been removed from the box, flush it thoroughly with clean water.



1. Power Cable
2. Nut
3. Lockwasher
4. Washer
5. Ground Strap
6. Diode Board
7. Bracket Assembly
8. Receptacle
9. Pin - Flathead
10. Doubler Assembly
11. Door Assembly
12. Stud
13. Pin - Cotter
14. Screw
15. External Power Contactor
16. Contactor Bracket Assembly

Figure 15-2. Ground Service Receptacle Installation

WARNING

Do not allow acid deposits to come in contact with skin or clothing. Serious acid burns may result unless the affected area is washed immediately with soap and water. Clothing will be ruined upon contact with battery acid.

Inspect the cleaned box and cover for physical damage. A badly damaged box should be replaced.

15-21. BATTERY CONTACTOR.

15-22. DESCRIPTION. The battery contactor is bolted to the firewall above the battery box. The contactor is a solenoid plunger type, which is actuated by turning the master switch on. When the master switch is off, the battery is disconnected from the electrical system. A silicon diode is used to eliminate spiking of the transistorized radio equipment. The cathode (+) terminal of the diode connects to the battery terminal of the battery contactor. The anode (-) terminal of the diode connects to the same terminal on the contactor as the master switch wire. This places the diode directly across the contactor solenoid coil so that inductive spikes originating in the coil are clipped when the master switch is opened. See figure 15-1 for pictorial installation of the battery contactor and diode.

15-23. REMOVAL AND INSTALLATION. (Refer to figure 15-1.)

15-24. MASTER SWITCH.

15-25. DESCRIPTION. The operation of the battery and alternator systems is controlled by a master switch. The switch is a rocker type with double-pole, single-throw contacts. The switch, when operated, connects the battery contactor coil to ground and the alternator field circuit to the battery, activating the power systems. On 1968 models only, the master switch is combined with the two alternator switches in a 3-in-1 combination split rocker switch. On these aircraft, each third of the switch is a single-pole, single-throw type, each controlling only one function. The master switch is located on the stationary instrument panel.

15-26. GROUND SERVICE RECEPTACLE.

15-27. DESCRIPTION. A ground service receptacle may be installed to permit the use of external power for cold weather starting or when performing lengthly electrical maintenance. A reverse polarity protection system is utilized whereby ground power must pass through an external power contactor to be connected to the bus. A silicon junction diode is connected in series with the coil on the external power contactor so that if the ground power source is inadvertently connected with a reversed polarity, the external power contactor will not close. This feature protects the diodes in the alternator, and other semiconductor devices used in the aircraft, from possible reverse polarity damage.

NOTE

Maintenance of the electronic installations cannot be performed when using external power. Application of external power opens the relay supplying voltage to the electronics bus. For lengthy ground testing of electronics systems, connect a well regulated and filtered power supply directly to the battery side of the battery contactor. Adjust the supply for 28-volts and close the master switch.

NOTE

When using ground power to start the aircraft, close the master switch before removing the ground power plug. This will insure closure of the battery contactor and excitation of the alternator field in the event that the battery is completely dead.

15-28. REMOVAL AND INSTALLATION. (Refer to figure 15-2.)

15-29. BATTERY CONTACTOR CLOSING CIRCUIT.

15-30. DESCRIPTION. On 1967 model aircraft and on, a diode, resistor and fuse circuit was added to the clock fuse bracket to shunt a small charge around the battery contactor so that ground power may be used to close the contactor when the battery is too dead to energize the contactor by itself. (Refer to figure 15-1 for removal and installation.)

WARNING

External power receptacle must be functionally checked after wiring, or after replacement of components of the external power or split bus systems. Incorrect wiring or malfunctioned components can cause immediate engagement of starter when ground service plug is inserted.

SHOP NOTES:

15-31. TROUBLE SHOOTING--BATTERY AND EXTERNAL POWER SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
BATTERY WILL NOT SUPPLY POWER TO BUS OR IS INCAPABLE OF CRANKING ENGINE.	Battery discharged.	1. Measure voltage at "BAT" terminal of battery contactor with master switch and a suitable load such as a taxi light turned on. Normal battery will indicate 23.0 volts or more. If voltage is low, proceed to step 2. If voltage is normal, proceed to step 3.
	Battery faulty.	2. Check fluid level in cells and charge battery at 10 amps for approximately 30 minutes or until the battery voltage rises to 29 volts. Check battery with a load type tester. If tester indicates a good battery, the malfunction may be assumed to be a discharged battery. If the tester indicates a faulty battery, replace the battery.
	Faulty contactor or wiring between contactor or master switch.	3. Measure voltage at master switch terminal (smallest) on contactor with master switch closed. Normal indication is zero volts. If voltage reads zero, proceed to step 4. If a voltage reading is obtained check wiring between contactor and master switch. Also check master switch.
	Open coil on contactor.	4. Check continuity between "BAT" terminal and master switch terminal of contactor. Normal indication is 40 to 70 ohms (Master switch open). If ohmmeter indicates an open coil, replace contactor. If ohmmeter indicates a good coil, proceed to step 5.
	Faulty contactor contacts.	5. Check voltage on "BUS" side of contactor with master switch closed. Meter normally indicates battery voltage. If voltage is zero or intermittant, replace contactor. If voltage is normal, proceed to step 6.
	Faulty wiring between contactor and bus.	6. Inspect wiring between contactor and bus. Repair or replace wiring.

15-31. TROUBLE SHOOTING--BATTERY AND EXTERNAL POWER SYSTEM (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
STARTER ENGAGES WHEN GROUND POWER IS CONNECTED.	Shorted or reversed diode in split bus-bar system.	Check wiring to, and condition of diode mounted on the split bus relay bracket adjacent to the magneto switch. Correct wiring. Replace diode board assembly.
GROUND POWER WILL NOT CRANK ENGINE.	Ground service connector wired incorrectly.	1. Check for voltage at all three terminals of external power contactor with ground power connected and master switch off. If voltage is present on input and coil terminals but not on the output terminal, proceed to step 4. If voltage is present on the input terminal but not on the coil terminal, proceed to step 2. If voltage is present on all three terminals, check wiring between contactor and bus.
		2. Check for voltage at small terminal of ground service receptacle. If voltage is not present, check ground service plug wiring. If voltage is present, proceed to step 3.
	Open or mis-wired diode on ground service diode board assembly.	3. Check polarity and continuity of diode on diode board at rear of ground service receptacle. If diode is open or improperly wired, replace diode board assembly.
	Faulty external power contactor.	4. Check resistance from small (coil) terminal of external power contactor to ground (master switch off and ground power unplugged). Normal indication is 40-70 ohms. If resistance indicates an open coil, replace contactor. If resistance is normal, proceed to step 5.
	Faulty contacts in external power contactor.	5. With master switch off and ground power applied, check for voltage drop between two large terminals of external power (turn on taxi light for a load). Normal indication is zero volts. If voltage is intermittently present or present all the time, replace contactor.

15-32. ALTERNATOR POWER SYSTEM.

15-33. DESCRIPTION. The introduction of the high current silicon diode resulted in a reduction of mass required for an alternator rectifier system. This innovation made the alternator practical for use in light aircraft power systems. The alternator, like the generator, produces an ac current by electromagnetic induction. Rectification of the ac is accomplished by silicon diodes rather than by a comutator as in the generator. The alternators higher efficiency arrises from the fact that the ac is produced in a three phase system which means that all of the windings carrying ac are working to produce power most of the time. In the generator, only a small portion of the ac windings are in use at any given time.

The alternator, unlike the generator, is self-limiting in its output current capability. Therefore, no current limiting device is required in the alternator regulator. Also, because of the use of silicon diodes in the output network of an alternator the flow of current back into the alternator is impossible. The alternator field is designed not to retain residual magnetic flux and, therefore, the alternator requires excitation to be applied from an external source (the battery) before the alternator will function.

The alternator system consists of two engine-driven alternators and two solid state regulators in a one-in-use, one-in-standby circuit controlled by the pilot. In models thru 1967 an over-voltage relay and warning light are used which will automatically shut down the alternator system and warn the pilot if an over-voltage condition exists. A voltmeter in the instrument cluster is also provided. An emergency power system is incorporated in the form of a run/standby switch on the pilot's switch panel.

In 1968 models and on, the ammeter, voltmeter, and over-voltage warning system are replaced by a four light system to indicate abnormal voltage and alternator failure. The emergency power system is replaced by an alternator restart push-button near the warning lights. Both systems are discussed in detail later in this section.

15-34. ALTERNATOR.

15-35. DESCRIPTION. The 28-volt alternators used on the 337 series aircraft are rated at 30 amps through 1966 models, 38 amps on 1967 models and 60 amps in 1968 models and on. The moving center part of the alternator (rotor) consists of an axial winding with radial interlocking poles which surround the winding. With excitation applied to the winding through slip rings the pole pieces assume magnetic polarity. The rotor is mounted in bearings and rotates inside the stator which contains the windings in which the ac current is generated. The stator windings are attached to two diode plates, each of which contains three silicon diodes.

The diode plates are connected to accomplish full-wave, rectification of the ac current. The resulting dc output is applied to the aircraft bus and sensed by the voltage regulator. The regulator controls the excitation applied to the alternator field thus controlling the output voltage of the alternator.

15-36. ALTERNATOR REVERSE VOLTAGE DAMAGE. The alternator is very susceptible to reverse polarity damage due to the very low resistance of the output windings and the low resistance of the silicon diodes in the output. If a high current source, such as a battery or heavy duty ground power cart is attached to the aircraft with the polarity inadvertently reversed, the current through the alternator will flow almost without limit and the alternator will be immediately damaged.

15-37. REMOVAL AND INSTALLATION OF FRONT ENGINE ALTERNATOR. (Refer to figure 15-3.)

a. Insure that master switch is off and that negative lead is disconnected from battery.
b. Loosen bracket on right side of torque tube assembly. Lower torque tube to allow removal of alternator.
c. Shut off front fuel selector valve.
d. Remove fuel line at left side of alternator.

WARNING

Fuel draining from disconnected lines or hoses constitutes a fire hazard. Adequate safety precautions should be taken whenever it is necessary to disconnect fuel lines or hoses.

e. Remove three nuts from cooling shroud at rear of alternator and remove shroud. (On later models remove screw holding support strap to clamp and pull blast tube away).
f. Disconnect wiring from alternator and label wires.
g. Remove nuts and washers from alternator mounting bolts.
h. Remove alternator at left side of engine.
i. To replace alternator, reverse this procedure.

15-38. REMOVAL AND INSTALLATION OF REAR ENGINE ALTERNATOR. (Refer to figure 15-3.)

a. Insure that the master switch is off and that the negative lead is removed from the battery.
b. Remove three nuts from cooling shroud at rear of alternator and remove shroud. (On later models remove screw holding support strap to clamp and pull blast tube away).
c. Remove wiring from alternator and label wires.
d. Remove nuts and washers from alternator mounting bolts.
e. Remove alternator.
f. To replace the alternator, reverse the procedure.

15-39. ALTERNATOR VOLTAGE REGULATORS.

15-40. DESCRIPTION. The 28-volt regulators used on the 337 series aircraft are all solid-state devices mounted on the forward firewall. Two regulators are installed but only one regulator is in use at any one time. The regulator in use is selected by a

rocker type switch on the pilot's switch panel. The regulators are identical and either one may be used to operate the system.

15-41. REMOVAL AND INSTALLATION. (Refer to figure 15-4.)

a. Disconnect wires to regulator by pulling connection apart at the junction adjacent to the regulator.

b. Remove three screws attaching regulator to firewall.

c. To replace regulator, reverse the preceeding procedure. Be sure that grounding surfaces on firewall are clean and bright when reassembling.

15-42. ADJUSTMENT.

a. Remove regulator from firewall according to preceding paragraph except that all wires are left connected so that the system is still functional.

b. Remove the four screws on bottom of regulator and remove bottom cover exposing adjustment potentiometer.

c. Start engines and run them at approximately 1000 RPM for several minutes until ammeter shows that the battery is recharged after the starting discharge.

d. Turn on a taxi light and measure voltage at bus. Voltmeter should read 27.5± .2 volts.

e. If necessary, insert a small insulated screwdriver into the adjustment potentiometer on the bottom of the regulator in use. Adjust as required to obtain correct voltage.

f. Repeat for second regulator.

g. Allow a few minutes after adjusting regulator to allow battery to assume new voltage setting and check voltage again. Readjust as required.

NOTE

If the voltage was raised more than 0.3 volts considerable time may be required for the battery to assume full charge. In such cases it may be desirable to check the voltage after the aircraft has been flown.

h. Replace cover on bottom of regulators and reinstall regulators.

15-43. OVER-VOLTAGE RELAY AND WARNING CIRCUIT (THROUGH 1967 MODELS).

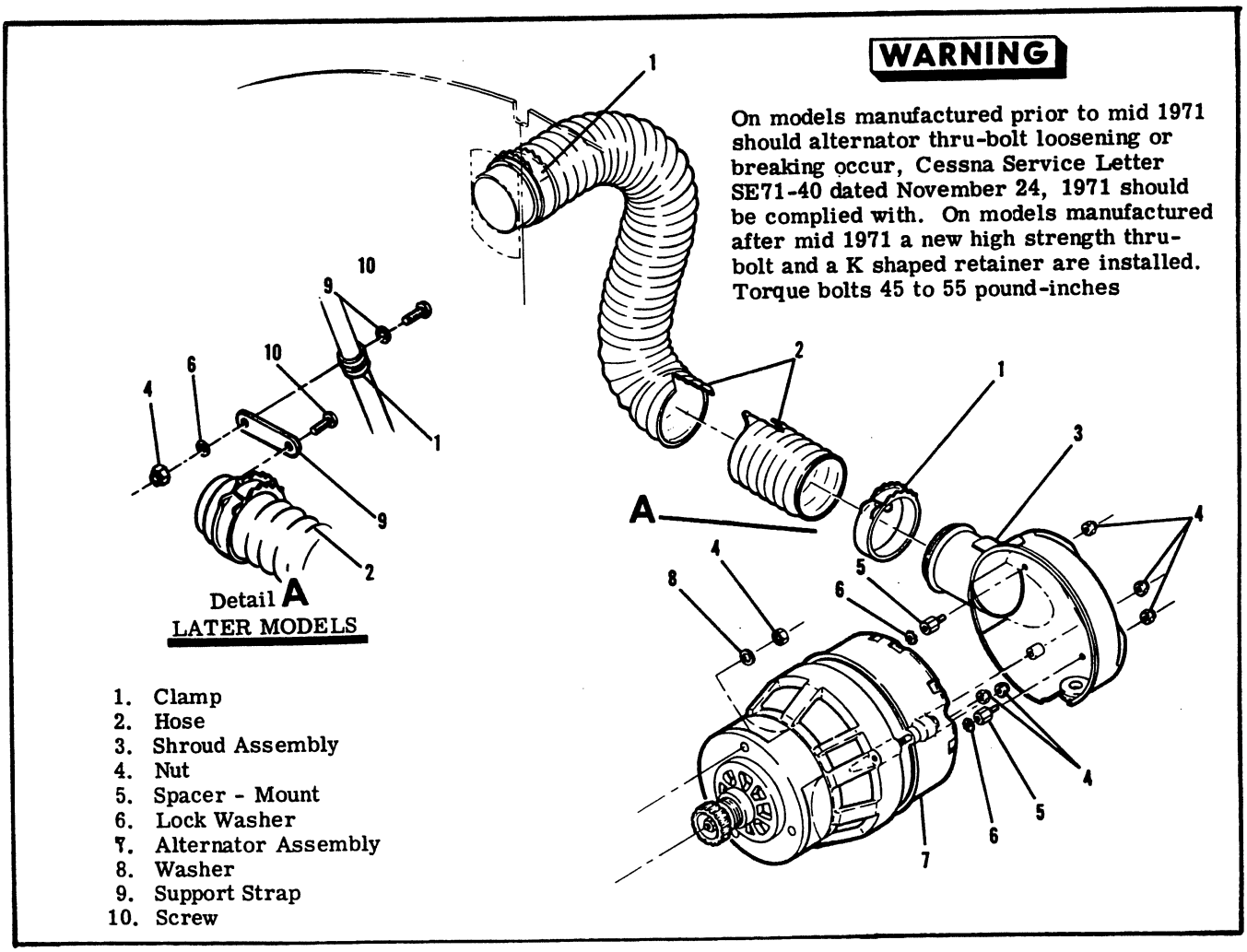
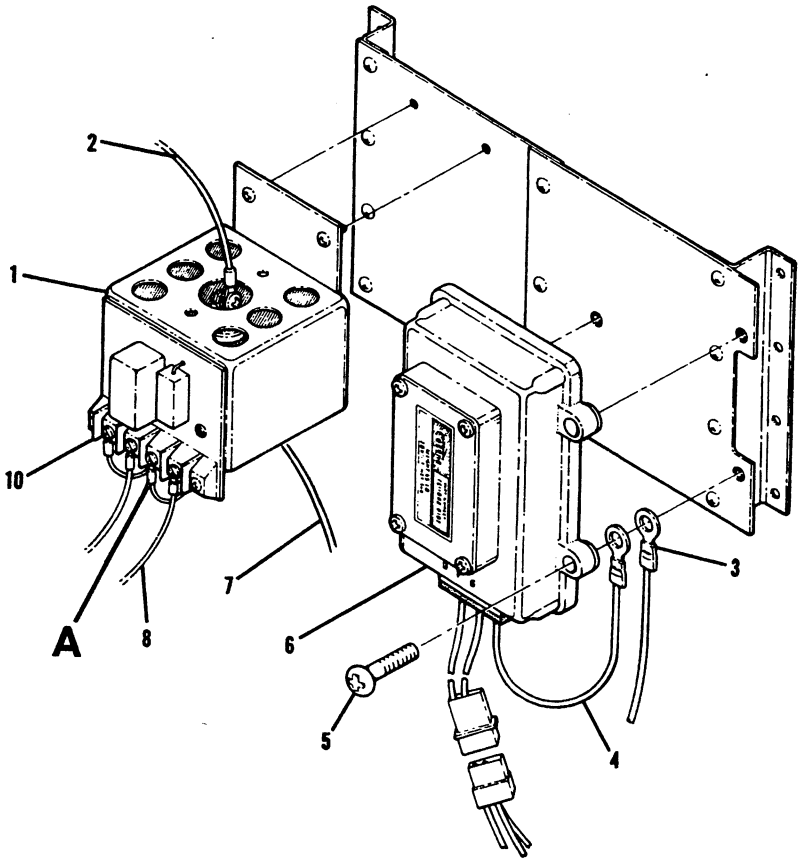
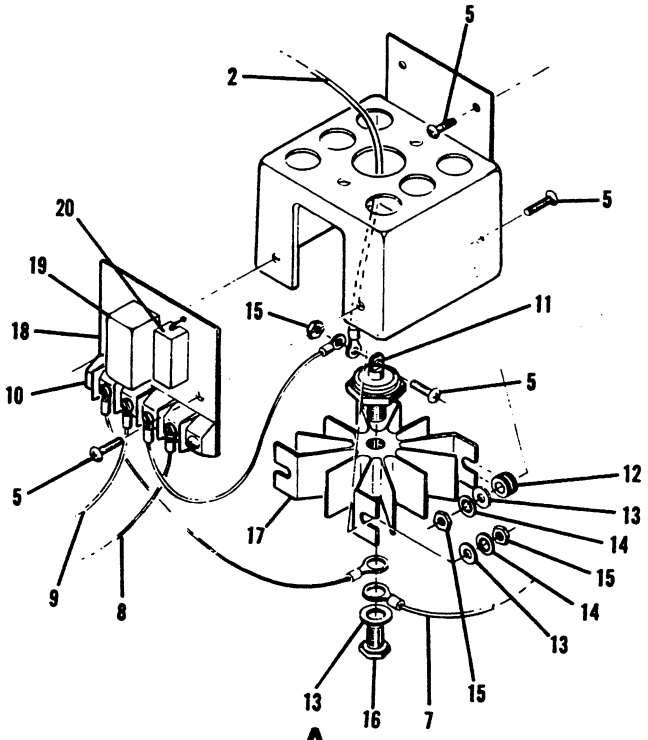


Figure 15-3. Alternator Installation



ALTERNATOR VOLTAGE REGULATOR
(TYPICAL)

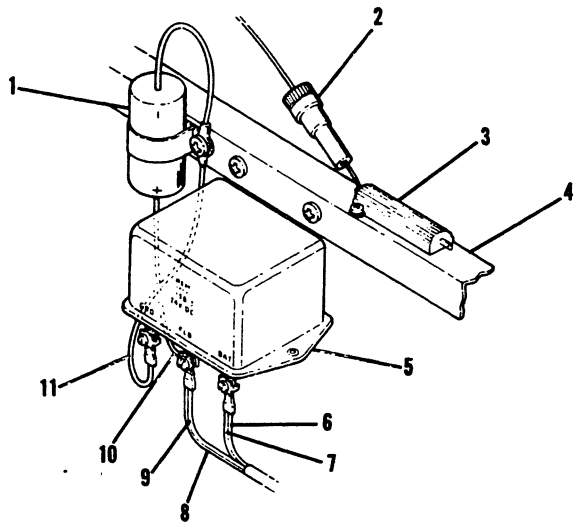


Detail **A**

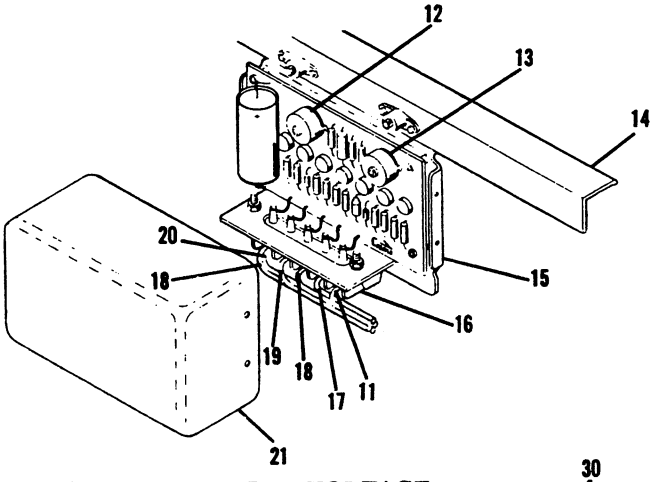
ALTERNATOR FAILURE SENSOR
(1968 MODELS & ON)

1. Alternator Failure Sensor
2. Wire to Alternator Output
3. Alternator Ground Wire
4. Regulator Ground Wire
5. Screw
6. Alternator Regulator
7. Wire to Bus Bar
8. Sensor Ground Wire
9. Wire to Failure Light
10. Terminal Strip
11. 70-Amp Diode
12. Nylon Spacer
13. Flat Washer
14. Lock Washer
15. Nut
16. Bolt
17. Heat Sink
18. Circuit Board
19. Relay
20. Resistor

Figure 15-4. Voltage Regulator and Alternator Failure Warning Sensor

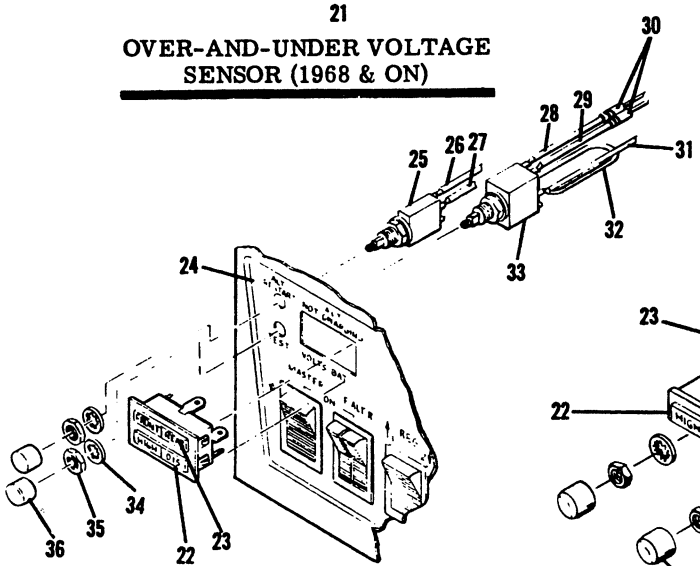


OVER-VOLTAGE RELAY (THRU 1967)

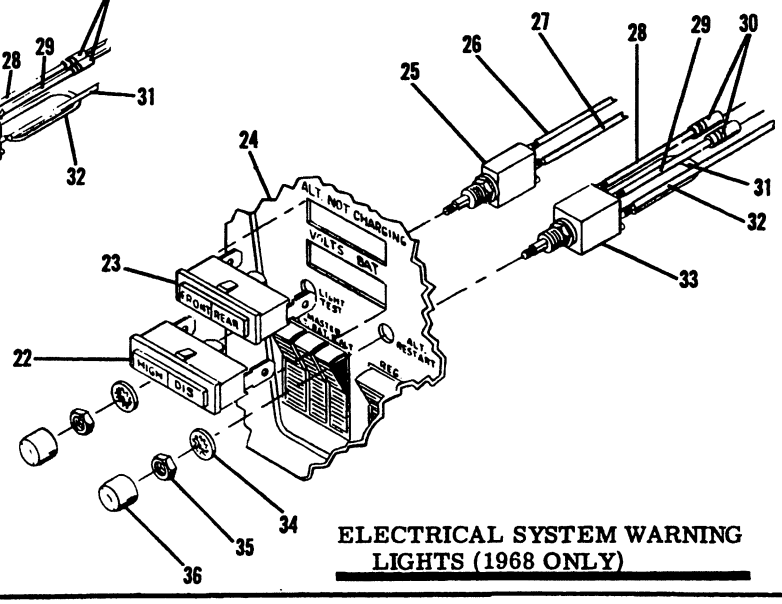


OVER-AND-UNDER VOLTAGE SENSOR (1968 & ON)

1. Capacitor
2. Fuse - 7.5 Amp, Cigar Lighter
3. Resistor - Cigar Lighter
4. Support - Control Quadrant, R.H.
5. Over-Voltage Relay
6. Wire to RUN/STANDBY Switch
7. Wire to Over-Voltage Light, Pin (1)
8. Wire to REGULATOR Switch
9. Wire to Over-Voltage Light, Pin (2)
10. Wire to Capacitor
11. Ground Wire
12. Potentiometer - High Adjust
13. Potentiometer - Low Adjust
14. Support - Control Quadrant, L.H.
15. Over-and-Under Voltage Sensor
16. Terminal Board
17. Wire to DIScharge Light
18. Wire to LIGHT TEST Switch
19. Wire to HIGH Light
20. Wire to Circuit Breaker
21. Cover - Voltage Sensor
22. Indicator Light - Voltage
23. Indicator Light - ALTERNATOR OUT
24. Instrument Panel - Lower
25. LIGHT TEST Switch
26. Wire to Voltage Sensor, Pin (1)
27. Wire to Voltage Sensor, Pin (3)
28. Wire to Voltage Regulator #1
29. Wire to Voltage Regulator #2
30. Resistor, 62 Ohm, 1 Watt
31. Jumper Wire
32. Wire to GEN Fuse
33. ALTernator RESTART Switch
34. Lockwasher
35. Nut
36. Push-Button, Switch



ELECTRICAL SYSTEM WARNING LIGHTS (1969 & ON)



ELECTRICAL SYSTEM WARNING LIGHTS (1968 ONLY)

Figure 15-5. Over-and-Under Voltage Warning Systems

15-44. DESCRIPTION. A voltage sensitive, latching type alternator disable relay is connected in series with the field supply of the alternator system. If the bus voltage should exceed 31.5 volts the relay will energize and latch, thus shutting off the alternators. Simultaneously with alternator shut down, a red, press-to-test light on the pilot's instrument panel will indicate the malfunction. To restart the alternators, the master switch must be momentarily moved to "OFF" and then back "ON". If the overvoltage condition has been corrected (by switching to alternate regulator) the light will remain off and the alternators will continue to function.

15-45. REMOVAL AND INSTALLATION. (Refer to figure 15-5 for removal and installation.)

15-46. ADJUSTMENT.

a. Remove relay from the aircraft according to the preceding paragraph.

b. Attach a variable, well regulated and filtered power supply to terminals "B" (positive) and "G" (negative).

c. Adjust power supply toward 31.5 volts and listen for a "click" inside the relay as it pulls in. Note the voltage at which pull-in occurs.

d. Adjust relay as required to obtain a 31.5 volt pull-in. Seal adjusting screw.

e. Reinstall relay on aircraft.

15-47. ALTERNATOR RUN STANDBY CIRCUIT (THROUGH 1967 MODELS).

15-48. DESCRIPTION. An emergency power supply circuit is used to supply aircraft power in the event of a battery contactor failure. A rocker switch on the pilot's switch panel labeled RUN/STANDBY, is positioned at RUN for normal operation. In the event of a battery contactor failure, the switch is placed at STANDBY. In this position, alternator excitation voltage is taken directly from the battery through a fuse and diode circuit which bypasses the battery contactor. In STANDBY, an amber, press-to-test light on the pilot's instrument panel will indicate that the standby system is in use.

CAUTION

The normal position for the Run/Standby switch is in the RUN position. If the switch is left in the STANDBY position, voltage will be supplied to the alternator field circuit regardless of the position of the aircraft master switch. This can result in overheating of the alternator field windings and discharge of the battery.

NOTE

When the battery contactor fails and the standby field circuit is employed the battery does not receive charge.

15-49. VOLTMETER. (THROUGH 1967 MODELS.)

15-50. DESCRIPTION. A voltmeter is incorporated in the instrument cluster on the right side of the instrument panel. The meter indicates bus voltage any time the bus has power applied to it.

15-51. SELENIUM VOLTAGE TRANSIENT SUPPRESSOR. (THROUGH 1966 MODELS.)

15-52. DESCRIPTION. A selenium transient suppressor is installed on the aircraft structure just forward of the pilot's circuit breaker panel. The device draws no current until the voltage across it exceeds 50 volts whereupon it conducts heavily, shunting any such transient to ground.

15-53. OVER AND UNDER VOLTAGE WARNING CIRCUIT. (1968 THRU 1970 MODELS.)

15-54. DESCRIPTION. Two lights and a push button replace the voltmeter for monitoring bus voltage. The lights are labeled HIGH, implying high bus voltage; and DIS, implying a discharged battery or low bus voltage. A voltage sensor is connected to the bus and is adjusted to illuminate the HIGH light if the bus voltage exceeds 31 volts and the DIS light if the voltage drops below 24 volts. Testing of the DIS lamp is accomplished by observing that the lamp illuminates while cranking on engine. The HIGH lamp is tested by pressing the LIGHT TEST button adjacent to the light fixture.

15-55. REMOVAL AND INSTALLATION. (Refer to figure 15-5.)

a. Remove and tag leads to terminal strip on sensor.

b. Remove two screws holding sensor on control quadrant support angle.

c. To replace, reverse this procedure.

15-56. ADJUSTMENT.

a. The adjustment may be accomplished in the aircraft by disconnecting the wire attached to terminal 1 of the sensor and attaching a well regulated and filtered power supply to pin 1. Remove cover from sensor to expose adjustments.

b. Adjust power supply for 31 volts and turn the HIGH ADJUST pot (item 12, figure 15-5) fully counterclockwise.

c. Turn HIGH ADJUST pot slowly clockwise until the HIGH light just comes on.

d. Readjust power supply for 24-volts and turn the LOW ADJUST pot (item 13, figure 15-5) fully clockwise.

e. Turn LO ADJUST pot slowly counterclockwise until the DIS light just comes on.

f. Seal pots and replace cover.

g. Disconnect power supply and replace lead previously removed from pin 1.

15-57. ALTERNATOR FAILURE WARNING CIRCUIT (BEGINNING WITH 1968 MODELS.)

15-58. DESCRIPTION. A silicon, junction, power diode is wired in series with each alternator output lead. A 28-volt reed type relay is connected across the diode. In normal operation the diode is in forward conduction and the relay sees about 1-volt drop

across the diode and remains de-energized. If the alternator output should fail, the voltage drop across the diode will be approximately equal to bus voltage and the relay will energize. The closed relay contacts will supply power to an alternator out warning light on the pilot's switch panel. The diode assemble for each alternator is mounted on the firewall near each alternator.

15-59. REMOVAL AND INSTALLATION. (Refer to figure 15-4.)

a. Disconnect output wire from alternator at the alternator.
b. Remove bolt from bottom of sensor assembly which attaches two wires to the diode heat sink.
c. Disconnect wires from terminal 2 of the sensor assembly terminal strip.
d. Remove two screws attaching assembly to bracket on firewall.
e. To replace diode, remove four screws attaching heat sink and circuit board to the assembly cover.
f. Remove diode and heat sink from cover.
g. Disconnect leads from anode of diode.
h. Unscrew diode to remove from heat sink.
i. When putting new diode on heat sink, coat bottom surface of diode hex with Dow-Corning DC-4 or a similar heat sink compound. Torque diode to 50 in.-lbs.
j. Reassemble diode and heat sink in cover by reversing above procedure.

CAUTION

Two nylon spacers are used on the two screws opposite the circuit board. These spacers are to insulate the heat sink from ground. After assembly, carefully inspect the installation of these two screws to insure that no shorts exist.

15-60. ELECTRICAL SYSTEM WARNING LIGHTS. (BEGINNING WITH 1968 MODELS.)

15-61. DESCRIPTION. The electrical system warning lights are mounted on the pilot's switch panel adjacent to the master switch. Two dual light assemblies are installed; one for the over-and-under voltage warning system and one for the alternator failure warning system. The bulbs are not replacable in the light assemblies, however, the assemblies are easily snapped out for replacement. See figure 15-5 for removal and installation information.

15-62. ALTERNATOR RESTART SYSTEM (1968 THRU 1970 MODELS.)

15-63. DESCRIPTION. Alternators will run self-excited if battery contactor should fail, however, a small amount of momentary power is required to start the alternators if they should drop out due to a load surge. A momentary push button switch labeled ALT RESTART mounted adjacent to the master switch is wired to provide starting power to the alternators when pushed. Should the alternators drop out during a battery system failure due to the actuation of some heavy drain device (flap motor, landing lights, etc.) they may be restarted by momentarily depressing the ALT RESTART button. See figure 15-5 for removal and replacement information.

15-64. TROUBLE SHOOTING -- ALTERNATOR SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
ALTERNATOR CIRCUIT BREAKER POPS WHEN MASTER SWITCH IS TURNED ON (THROUGH 1967 MODELS ONLY).	Shorted diodes in alternator.	1. Remove output lead from alternator in question and see if breaker will stay in with master switch ON. If breaker stays in, repair or replace alternator. If breaker still pops, proceed to step 2.
	Shorted wiring in alternator output circuit.	2. Inspect wiring between alternator and circuit breaker. Repair or replace wiring.
AMMETER OR ALTERNATOR OUT LIGHT INDICATES ONE ALTERNATOR INOPERATIVE.	Open field winding in alternator.	1. Remove wire to field terminal of alternator in question and check resistance from the field terminal to the alternator case. Ohmmeter should indicate 10-22 ohms (Prestolite alternator). If ohmeter indicates an open field, repair or replace alternator, if resistance is normal proceed to step 2.

15-64. TROUBLE SHOOTING--ALTERNATOR SYSTEM (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
AMMETER OR ALTERNATOR OUT LIGHT INDICATES ONE ALTERNATOR INOPERATIVE (Cont).	Open wiring between regulator and alternator.	2. Inspect wiring between alternator and regulator. Check for bad alternator switch. Repair or replace wiring. Replace switch.
	Shorted diodes in alternator (1968 Models and on only).	3. Remove output lead from alternator in question and check resistance from battery terminal of alternator to alternator case. Ohmmeter should indicate conduction in one direction and infinite resistance in the other direction. If measurement indicates shorted diodes, repair or replace alternator.
AMMETER OR ALTERNATOR OUT LIGHT INDICATES BOTH ALTERNATORS INOPERATIVE.	Faulty regulator.	1. Switch to alternator regulator. If alternator output comes up, replace bad regulator. If alternator regulator has no effect, proceed to step 2 or step 5 as applicable.
	Open field circuit (through 1967 Models only).	2. Check to insure that field circuit breaker is closed. Check for bus voltage at terminal "B" of the over-voltage relay (master switch ON. If voltage is not present, check wiring back to bus. Check master switch (alternator side). Check circuit breaker. If voltage is present, proceed to step 3.
	Faulty over-voltage relay (through 1967 Models only).	3. Check for bus voltage at terminal "F" of relay. If voltage is not present, replace relay. If If voltage is present, proceed to step 4.
	Faulty wiring between over-voltage relay and regulator switch (through 1967 Models only).	4. Check wiring. Replace or repair wiring.
	Open field circuit (1968 Models and on).	5. Check to insure that field circuit breaker is closed. Check for bus voltage at "B" lead of regulator in use (disconnect regulator to measure). If voltage is not present, check wiring back to bus. Check master switch (alternator side). Check circuit breaker. If voltage is present, proceed to step 6.

15-64. TROUBLE SHOOTING--ALTERNATOR SYSTEM (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
AMMETER OR ALTERNATOR OUT LIGHT INDICATES BOTH ALTERNATORS INOPERATIVE (Cont).	Faulty wiring between regulator and regulator switch (1968 Models and on).	6. Check wiring. Repair or replace wiring.
HIGH VOLTAGE WARNING LIGHT ILLUMINATES OR BATTERY USES EXCESSIVE WATER.	Faulty regulator.	1. Check bus voltage using first one regulator then the other. If voltage is normal on the alternate regulator, replace or adjust regulator in question. If voltage is high on both regulators, both regulators are faulty. Replace or adjust. **CAUTION** If replacement of both regulators is required, check aircraft wiring for an intermittent short which may be responsible for damaging both regulators. If voltage is normal on both regulators, proceed to step 2.
	Faulty warning system.	2. Accomplish high voltage calibration of over-voltage relay or warning sensor. If calibration cannot be accomplished, replace the relay (or sensor).
"DIS" (LOW VOLTAGE) LIGHT ILLUMINATES OR ALTERNATOR WILL NOT FULLY CHARGE BATTERY.	Regulator adjustment too low.	1. Check bus voltage using first one regulator then the other. If voltage is low on either regulator, adjust or replace regulator in question. If voltage is normal, proceed to step 2.
	Faulty low voltage warning sensor.	2. Accomplish low-voltage calibration of warning sensor. If calibration cannot be accomplished, replace the sensor.
ALTERNATOR OUT LIGHT INOPERATIVE.	Lamp bulb burned out.	1. Short between terminal 1 and 2 of the alternator failure sensor circuit board for the lamp in question (master switch ON and engines not running). Lamp should light. If lamp does not light, Check wiring between circuit board and lamp assembly, replace lamp assembly. If lamp lights, proceed to step 2.

15-64. TROUBLE SHOOTING--ALTERNATOR SYSTEM (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
ALTERNATOR OUT LIGHT INOPERATIVE (Cont).	Shorted diode or open resistor on alternator failure sensor.	2. Check voltage at terminal 3 of the alternator failure sensor ciruict board. Normal indication is 9 to 11 volts for circuit boards using 1K resistors, 12 to 14 volts for boards using 2K resistors. If voltmeter indicates bus voltage, proceed to step 3. If voltage is zero, replace circuit board. If voltage reading on a board using a 2K resistor is low (about 11 volts with 24 volts on the bus), proceed to step 4. If voltage reading is normal, proceed to step 5.
		3. Disconnect leads to terminals 3 and 4 on the alternator failure sensor circuit board. Check resistance between terminals 3 and 4. Normal resistance is equal to that of the resistor on the circuit board. If resistor is open, replace the resistor. If the resistor is normal, disassemble alternator failure sensor and replace the diode.
	Wrong value of resistor on alternator failure sensor circuit board.	4. Disconnect leads to terminals 1 and 3 on the alternator failure sensor circuit board. Check resu sistance between terminals 1 and 3 (relay coil resistance). A coil resistance of 1500 ohms requires a 2K resistor. A coil resistance of 2300 ohms requires a 1K resistor. Some circuit boards with 1500 ohms relay coils were supplied with 2K resistors. Alternator out warning light operation is irratic at low bus voltage (engines not running). Replace 2K resistor with a 1K resistor as required.
	Faulty relay on alternator sensor circuit board.	5. Short terminal 3 on alternator failure sensor circuit board to ground and observe alternator out light. Lamp should be illuminated. If lamp does not light, replace circuit board.

15-65. AIRCRAFT LIGHTING SYSTEM.

15-66. DESCRIPTION. The aircraft lighting equipment consists of landing and taxi lights (available in both wings), navigation lights, a rotating beacon on models thru 1966 and a flashing beacon on 1967 models and on, courtesy lights, interior cabin lighting and instrument panel lights. An ice detector light is available which is installed on the left-hand side of the fuselage and illuminates the left wing.

On the 1969 models, snap-in type rocker switches are introduced. These switches have a design feature which permits them to snap into the panel from the cabin side and can subsequently be removed for easy maintenance. These switches also feature spade type slip-on terminals.

15-67. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
LANDING OR TAXI LIGHT OUT	Circuit breaker open.	Inspect. Reset.
	Lamp burned out.	Test with voltmeter or new lamp. Replace lamp.
	Defective wiring.	Test circuit for continuity. Repair wiring.
	Defective switch.	Check for continuity. Replace.
	Defective circuit breaker.	Test with voltmeter. Replace.
ONE NAVIGATION LIGHT OUT.	Lamp burned out.	Inspect. Replace lamp.
	Defective wiring.	Check continuity. Replace wiring.
ALL NAVIGATION LIGHTS OUT.	Circuit breaker open.	Inspect. Reset.
	Faulty switch.	Test for continuity. Replace.
	Defective wiring between circuit breaker and switch.	Test for continuity. Repair.
ROTATING BEACON ROTATES BUT DOES NOT LIGHT.	Lamp burned out.	Test with new lamp. Replace lamp.
	Faulty light assembly.	Remove and test. Repair or replace.
ROTATING BEACON LIGHTS BUT WILL NOT ROTATE.	Faulty motor or internal connections.	Remove and test. Repair or replace.

15-67. TROUBLE SHOOTING (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
ROTATING BEACON DOES NOT LIGHT OR ROTATE.	Circuit breaker open.	Inspect. Reset.
	Faulty switch or wiring.	Test for continuity. Replace or repair.
	Faulty circuit breaker.	Test with voltmeter. Replace.
	Faulty rotating beacon.	Test voltage to beacon. Remove beacon and test internal wiring. Repair or replace.
FLASHING BEACON DOES NOT LIGHT.	Lamp burned out.	Test with new lamp. Replace lamp.
	Circuit breaker open.	Inspect. Reset.
	Faulty Flasher assembly.	Remove and test. Repair or replace.
DE-ICE, COURTESY OR DOME LIGHT TROUBLE.	Circuit breaker open.	Inspect. Reset.
	Lamp burned out.	Test with new lamp. Replace lamp.
	Faulty switch or wiring.	Test for continuity. Repair or replace.
	Faulty lamp socket or circuit breaker.	Test with voltmeter. Replace.
MAP, COMPASS OR FLAP INDICATOR LIGHT TROUBLE.	Lamp burned out.	Test with new lamp. Replace.
	Circuit breaker open.	Inspect. Reset.
	Rheostat open.	Test for continuity. Replace.
	Faulty wiring.	Test for continuity. Repair.
	Faulty circuit breaker.	Test with voltmeter. Replace.

15-67. TROUBLE SHOOTING (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
PANEL POST LIGHT TROUBLE. NOTE On models thru 1968 the post lighting is divided into three seperate circuits, flight instrument and radio dial lights, engine instrument lights and switch panel lights. The flight instrument and radio dial light circuit is on a separate circuit breaker while the other circuits are both powered from one circuit breaker. Each of the three circuits are dimmed by individual rheostats. Beginning with the 1969 models all three circuits are powered from one circuit breaker and are dimmed by one rheostat.		
ONE OR TWO POST LIGHTS OUT.	Burned out lamp.	Test with new lamp. Replace lamp.
	Faulty lamp socket or wiring.	Test with voltmeter. Repair or replace.
ALL POST LIGHTS OUT IN CIRCUIT.	Circuit breaker open.	Inspect. Reset.
	Faulty section in series dropping resistor.	Lights will work when switch is placed in brighter position. Replace resistor.
	Faulty section in selector switch.	Inspect. Replace switch.
	Faulty wiring.	Test for continuity. Repair wiring.
POST LIGHTS WILL NOT DIM.	Faulty light dimming transistor.	Test both transistors with new transistor. Replace faulty transistor.
	Open resistor or wiring in minimum intensity end of potentiom meter.	Test for continuity. Replace resistor or repair wiring.
ELECTROLUMINESCENT PANELS WILL NOT LIGHT.	Short circuit in wiring.	Inspect circuit breaker. Repair wiring.
	Defective wiring.	Test for continuity. Repair wiring.

15-67. TROUBLE SHOOTING (CONT).

TROUBLE	PROBABLE CAUSE	REMEDY
ELECTROLUMINESCENT PANELS WILL NOT LIGHT. (Cont).	Defective rheostat or resistor.	Check input voltage at inverter (power pack) with master switch on. Voltmeter should give a smoothly varied reading over the entire control range of the rheostat. If no voltage is present or voltage has a sudden drop befor rheostat has been turned full counterclockwise, replace rheostat.
	Defective inverter.	Check output voltage at inverter with ac voltmeter. Should read about 125 volts ac with rheostat set for full bright. Replace inverter.

15-68. LANDING AND TAXI LIGHTS.

15-69. DESCRIPTION. The landing and taxi lights are mounted in the leading edge of the left wing. A c lear plastic cover provides weather protection for the lamps and is shaped to maintain the leading edge curvature of the wing. The landing lamp is mounted on the inboard side and adjusted to throw its beam further forward than the taxi light. Both lights are controlled by a single switch.

15-70. REMOVAL AND INSTALLATION. (Refer to figure 15-6.)

a. Remove the screws securing the landing light window assembly and the assembly will then be free for removal.

b. Remove the four attaching screws from the bracket assembly and remove the bracket.

NOTE

Do not reposition the landing and taxi light adjustment screws. If readjustment is required refer to figure 15-7.

c. Remove the two screws securing the wiring to the lamp contacts and remove the lamp.

d. Install new lamp and reassemble.

15-71. NAVIGATION LIGHTS.

15-72. DESCRIPTION. The navigation lights are located on each wing tip and the stinger. Operation of the lights is controlled by a single two position switch. A plastic light detector on each wing tip allows the pilot to determine if the lamps are working properly during flight.

15-73. REMOVAL AND INSTALLATION. Figure 15-8 shows in detail all components of the navigation lights. Use this figure as a guide for removal and installation.

15-74. COURTESY LIGHT.

15-75. DESCRIPTION. The courtesy light consists of one light located on the underside of the right wing to provide ground lighting around the cabin area. The courtesy light has a clear lens and is controlled by a slide switch labeled, "Dome-Courtesy" and "Dome," located on the right-hand rear door post. The switch also operates the dome lights.

15-76. REMOVAL AND INSTALLATION. Figure 15-9 shows in detail all components of the courtesy lights installation. Use this figure as a guide for removal and installation.

15-77. ROTATING BEACON.

15-78. DESCRIPTION. Models thru 1966 have a rotating beacon containing a small motor that rotates a shutter with three lens openings around a single bulb to give a flashing warning of the aircraft's position. The beacon is installed in a Fiberglas m ounting atop the vertical fin.

15-79. REMOVAL AND INSTALLATION. (Refer to figure 15-10.)

a. Remove the three screws holding the beacon to the Fiberglas mounting.

b. Withdraw the beacon from the mounting and remove the screw attaching the ground wire to the fin structure.

c. Disconnect the other electrical lead and remove beacon.

d. To replace the beacon, reverse this procedure. Mount the beacon with the light baffle forward.

15-80. FLASHING BEACON LIGHT.

15-81. DESCRIPTION. The 1967 models have a flashing beacon light mounted on the vertical fin tip.

The flashing beacon is an iodine-vapor lamp, electrically switched by a solid-state flasher assembly that is located within the vertical fin tip. The switching frequency of the flasher assembly operates the beacon at approximately 45 flashes per minute. A second flashing beacon may also be installed on the bottom of the fuselage as optional equipment.

15-82. REMOVAL AND INSTALLATION. For removal and installation of the flashing beacon light refer to figure 15-11.

15-82. MAP LIGHTS.

15-83. DESCRIPTION. White map lighting and red, non-glare instrument lighting are provided by an adjustable light mounted on the forward part of the left door post. The lights are controlled by a three-position type switch, with red, white and off positions. The map light contains a white bulb for general purpose lighting and a red bulb for adjustable instrument lighting. The intensity of the red bulb is controlled by a rheostat located on the instrument panel.

15-84. REMOVAL AND INSTALLATION. (Refer to figure 15-12.)

a. For replacement of defective lamp slide the hood and lens from the map light assembly and remove the bayonet type bulb.

b. For removal of the map light assembly remove the screws from the front doorpost shield. Remove the nut and washer attaching the map light to the shield. Remove the ground wire from the map light screw. Detach the wires at the quick disconnect fasteners and remove the map light assembly.

15-85. INSTRUMENT FLOOD LIGHTS.

15-86. DESCRIPTION. Standard instrument flood lighting is provided by four lamps mounted in the glare shield over the instrument panel. A moveable red lens offers either red or white instrument lighting. The intensity of the instrument flood lighting is controlled by a rheostat mounted on the instrument panel.

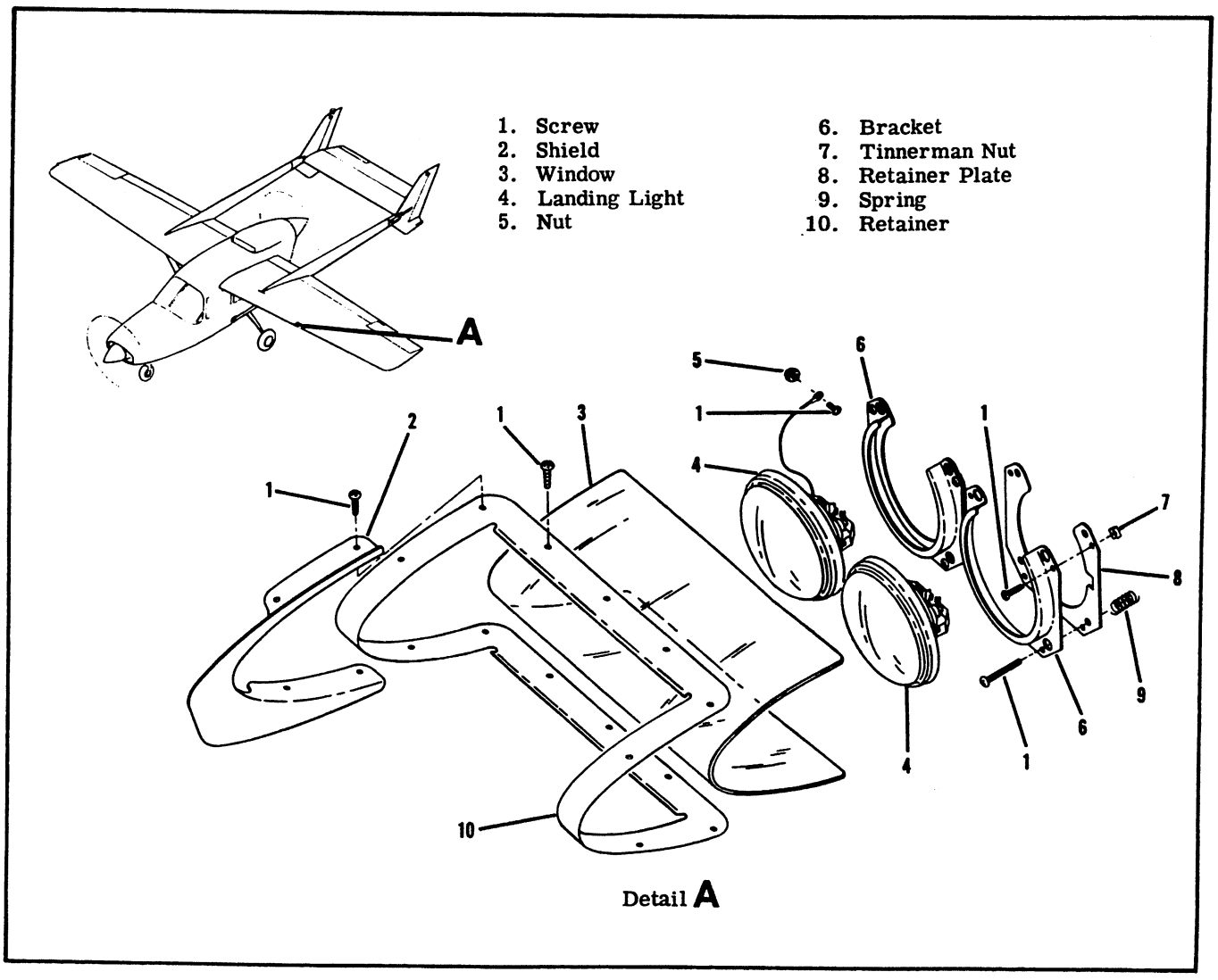
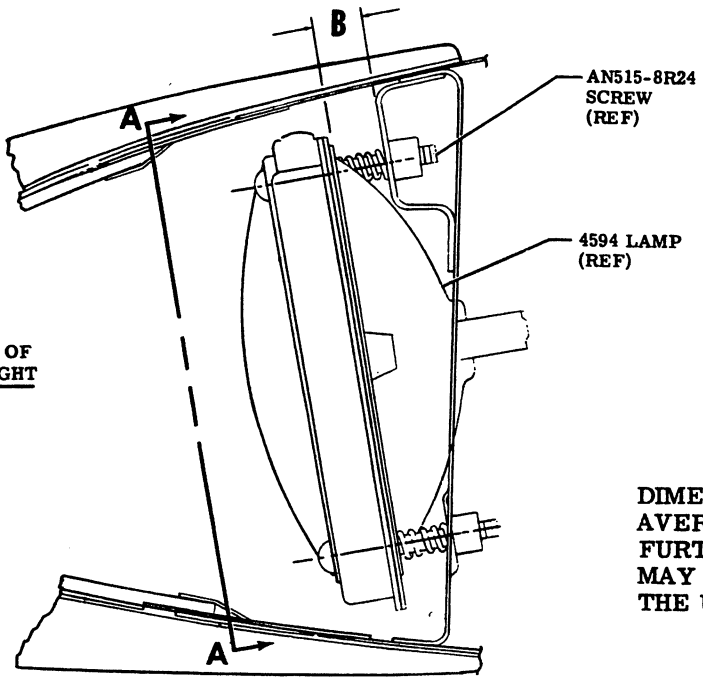


Figure 15-6. Landing and Taxi Light Installation



SIDE VIEW OF
LANDING LIGHT

NOTE
DIMENSIONS SHOWN ARE AVERAGE SETTINGS. FURTHER ADJUSTMENTS MAY BE MADE TO SUIT THE USER'S NEEDS.

ADJUSTMENT CHART						
SCREW NO.	1	2	3	4	5	6
DIMENSION B (RIGHT)	1.00	1.00	.80	.60	1.00	1.10
DIMENSION B (LEFT)	1.10	1.00	.80	.50	.90	1.30

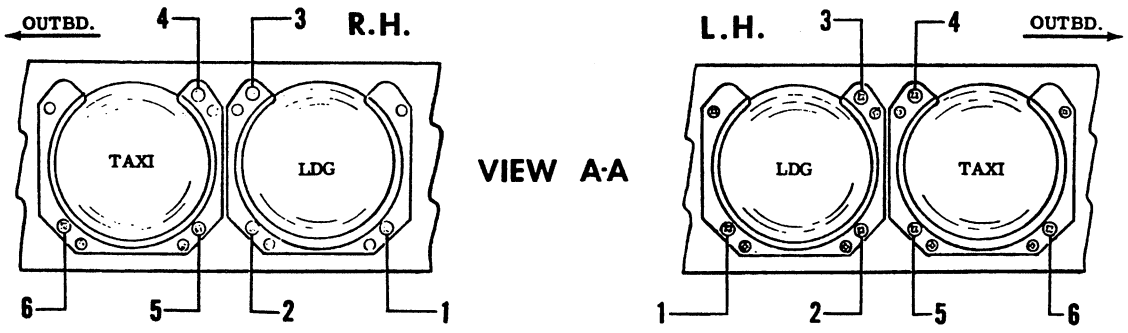


Figure 15-7. Landing and Taxi Light Adjustments

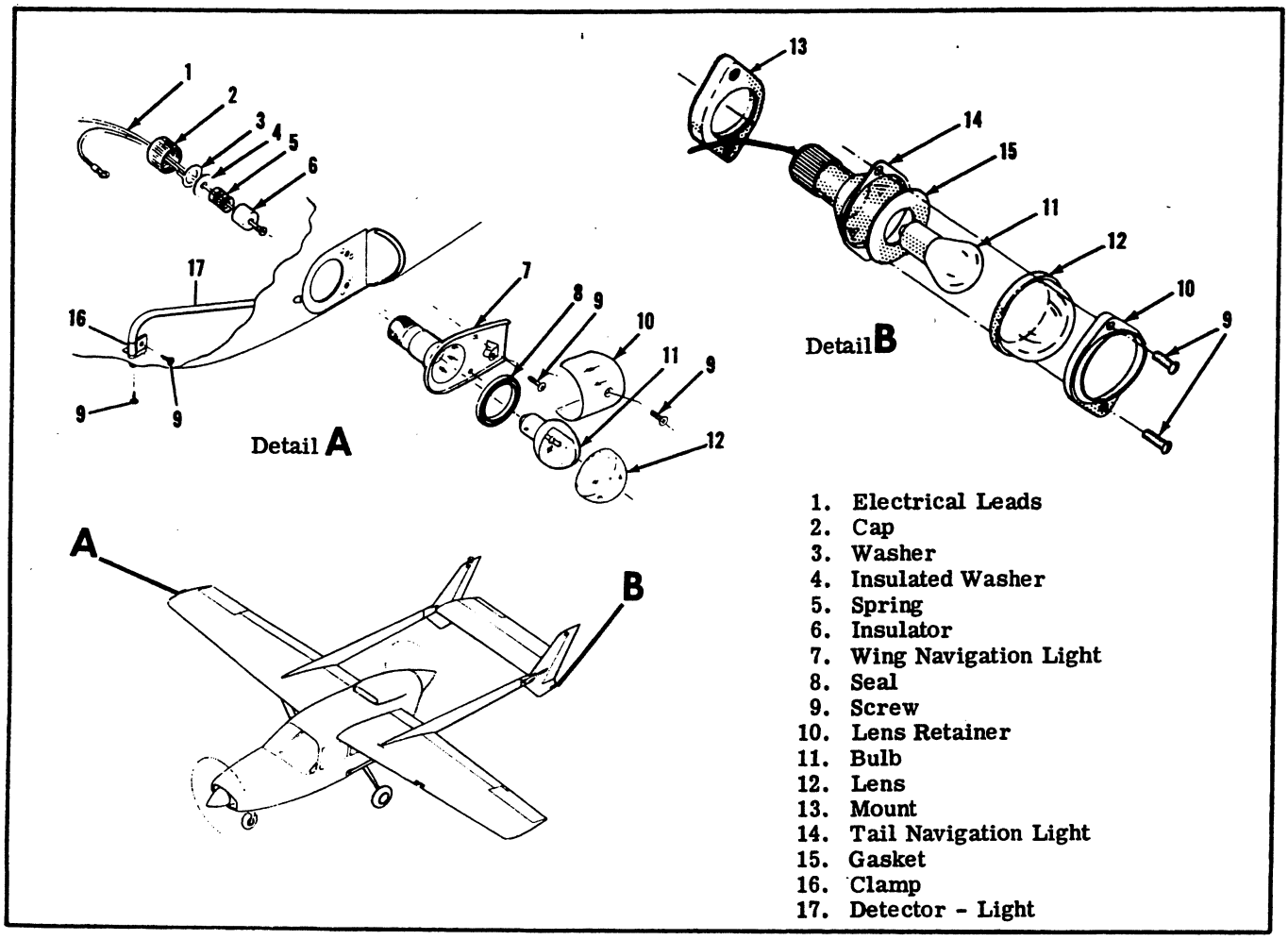


Figure 15-8. Navigation Light Installation

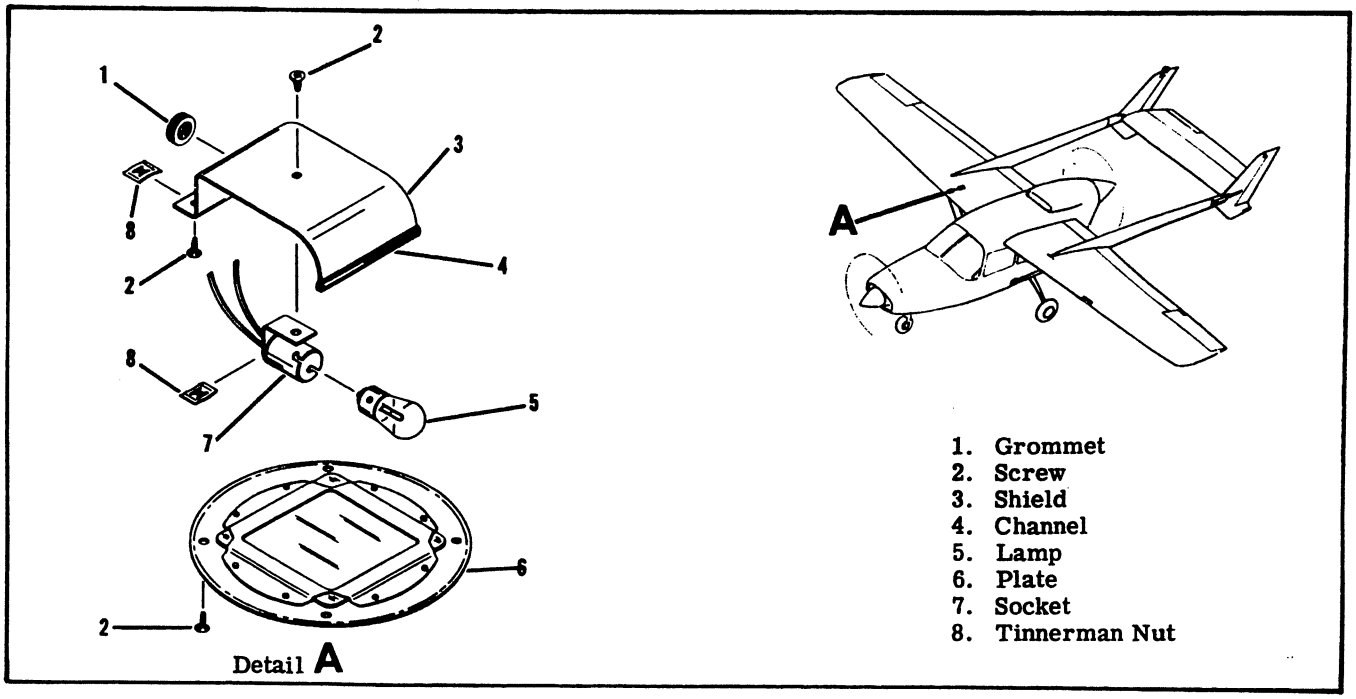
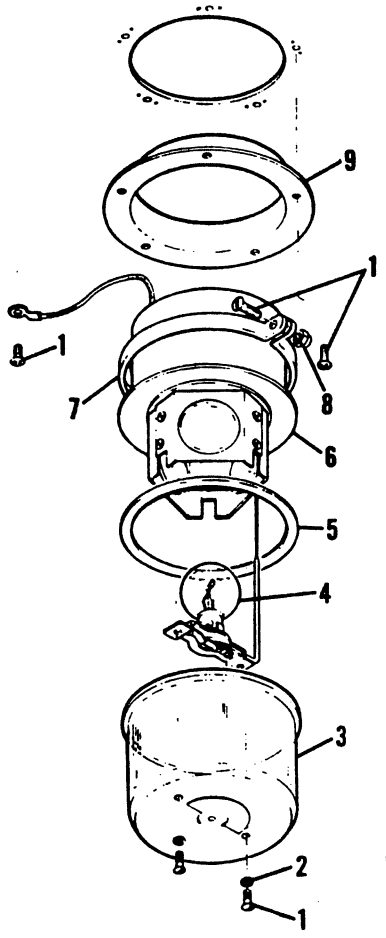


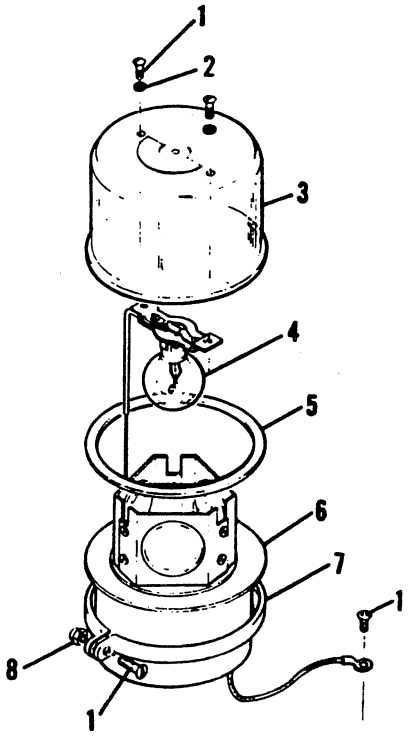
Figure 15-9. Courtesy Light Installation

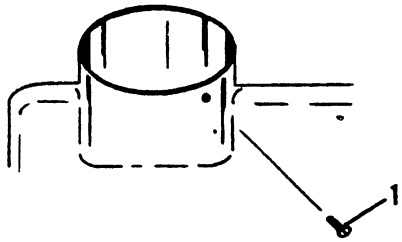
1. Screw
2. Lockwasher
3. Globe
4. Lamp
5. Gasket
6. Motor & Lens Assembly
7. Retaining Ring
8. Nut
9. Mounting Flange



FUSELAGE MOUNTING

OPTIONAL LOCATION





VERTICAL FIN MOUNTING

STANDARD LOCATION

Figure 15-10. Rotating Beacon Installation

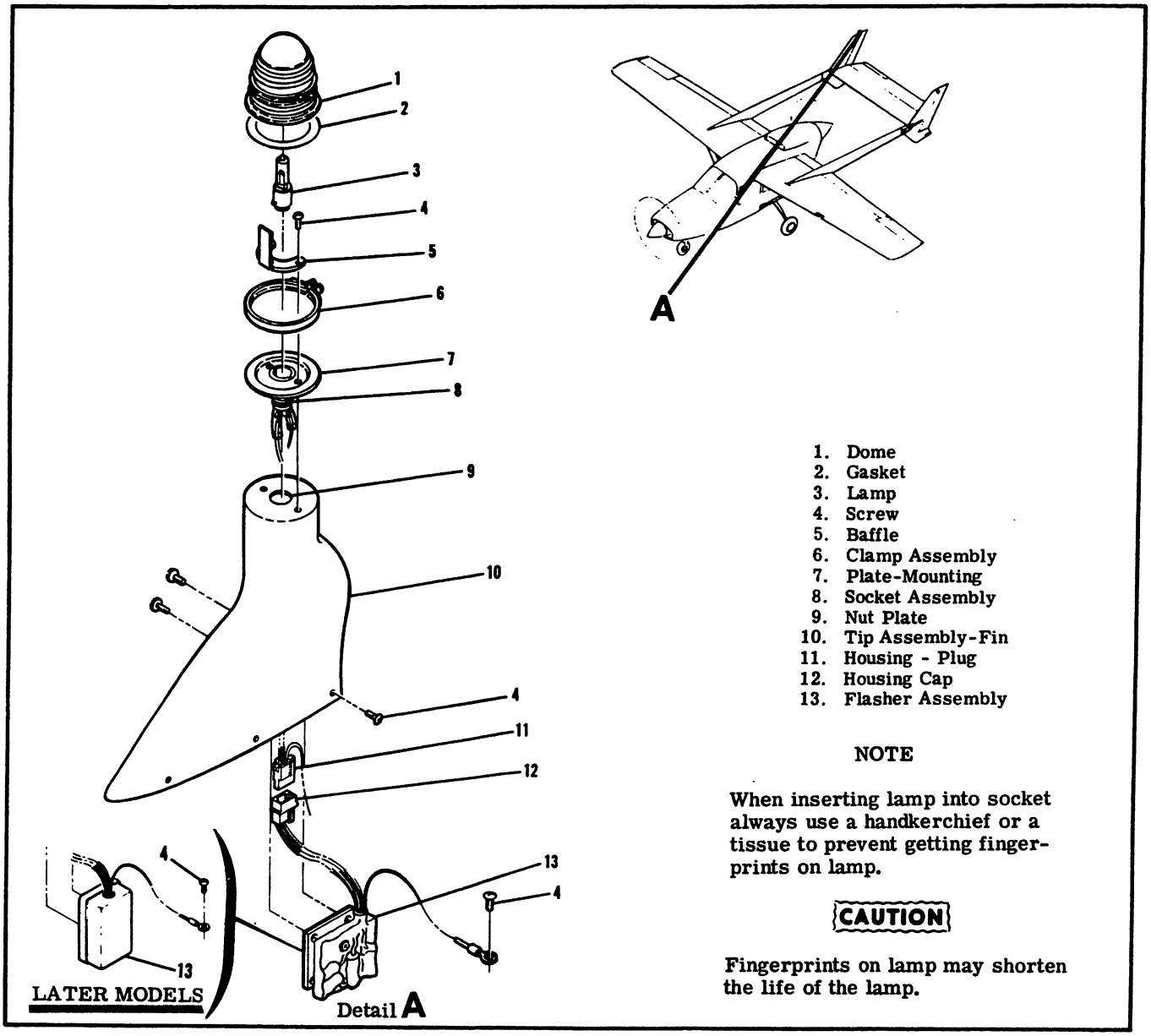


Figure 15-11. Flashing Beacon Installation

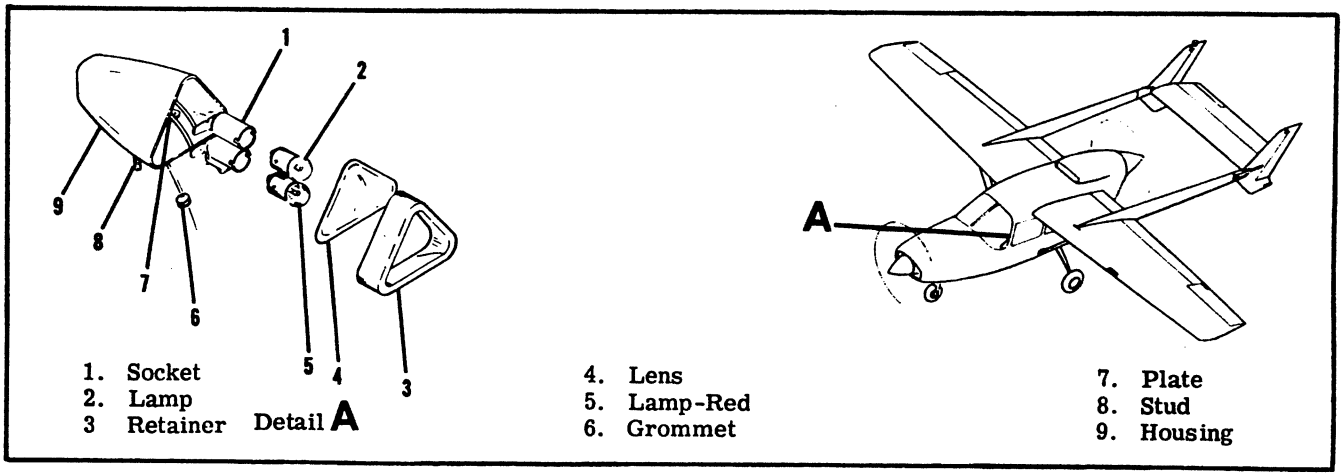


Figure 15-12. Map Light Installation

15-87. REMOVAL AND INSTALLATION.

a. Remove the two screws holding the flood lamp access plate to the underside of the glare shield.

b. Remove the access plate.

c. Pull the lamp socket assembly through the access hole.

d. Replace the defective lamp and reinstall socket assembly.

15-88. ELECTROLUMINESCENT PANEL LIGHTING.

15-89. DESCRIPTION. Electroluminescent panel lighting is introduced on 1969 models and consists of three panels; the switch panel, wing flap control panel and the heater control panel. The electroluminescent panels are composed of a steel plate which is coated with a phosphor coating and sealed with a ceramic glaze. The metal base is one conductor while a small silver strip along one edge of the phosphor coating is the other. This element, when an alternating current is applied, produces light. To protect the phosphor coated steel panel from moisture and abuse, the unit is potted in a vinyl pan. This pan is in the form of a finished electroluminescent panel having all holes and cutouts. The panels are then painted a dull black with the nomenclature masked so the white vinyl and/or the lighted panel will appear through the black. This produces white letters on a black back for daytime use and a soft blue-white light for night use. Even lighting is achieved over the entire surface of the panel without the bright and dim areas that are inherent with the incandescent lighting system.

Power required for the electroluminescent panels is an alternating current of 115 volts 400 Hz. This is provided by a 12-ounce, solid-state inverter located behind the instrument panel on the left-hand side. The intensity of the electroluminescent panel lighting is controlled by a rheostat located on the switch panel. These electroluminescent panels have an expected life of over 16,000 hours and no replacement should be necessary during the life of the aircraft.

15-90. TRANSISTORIZED LIGHT DIMMING.

15-91. DESCRIPTION. A remotely located, two-circuit, transistorized dimmer is installed as standard equipment to control the instrument panel lighting on 1969 models. Two rheostats, one inch in diameter, are mounted on the instrument panel. These rheostats control the transistors which in turn control the lamp voltage. The transistorized light dimming system makes it possible to use the same rheostats regardless of the optional equipment lamp load. The rheostat on the left, controls the instrument post lights and the instrument panel flood lighting. This rheostat has a push-pull switch which in the forward, or "in" position, controls the post lighting system. While in the "out" position the rheostat controls the glare shield flood lights. Both systems do not operate at the same time. The right rheostat knob controls the electroluminescent switch, wing flap and heater control panels.

15-92. REMOVAL AND INSTALLATION. Use figure 15-15 as a guide for removal and installation of the transistorized light dimming components.

15-93. POST LIGHTS.

15-94. DESCRIPTION. As optional equipment individual post lights are available for non-glare instrument lighting. The post light consists of a cap and clear lamp assembly with a tinted lens. 1966 models have red tinted lens and 1967 & on models are blue tinted lens. The intensity of the post lighting is controlled by a rheostat mounted on the instrument panel.

15-95. REMOVAL AND INSTALLATION. For removal of the post lamp slide the cap and lens assembly from the base. Slide the lamp from the socket and replace.

15-96. DOME LIGHTS.

15-97. DESCRIPTION. The dome lights are located on each side of the aft cabin and are controlled by a switch labeled "Dome-Courtesy" and "Dome," located on the right rear door post. This switch also controls the courtesy lights.

15-98. COMPASS AND RADIO DIAL LIGHTS.

15-99. DESCRIPTION. The compass and radio dial lights are contained within the individual units. The light intensity is controlled by the radio dial light dimming rheostat mounted on the lower left side of the instrument panel.

15-100. CONTROL WHEEL MAP LIGHT.

15-101. DESCRIPTION. As optional equipment, a control wheel map light may be installed on the 1968 Model 337. The map light is located on the underside of the control wheel and the intensity is controlled by a thumb-operated potentiometer. For dimming, the potentiometer should be turned clockwise.

15-102. REMOVAL AND INSTALLATION. (Refer to figure 15-14.)

a. For easy access to the map light assembly, rotate the control wheel 90°.

b. Remove the four screws from the map light circuit board. The map light assembly will then be free for removal from the control wheel.

c. Free the printes circuit board from the map light housing and unsolder the leads of the defective lamp from the circuit board.

d. Replace lamp and resolder. Spot-cement bulb to board with RTV or similar adhesive.

15-103. ANTI-COLLISION STROBE LIGHT.

15-104. DESCRIPTION. White strobe lights are offered as optional equipment on 1970 models. The lights are located on each wing tip and mounted in the navigation light retainer. They are vibration re-

sistant and operate on the principle of a capacitor discharge into a zenon tube producing an extremely high intensity flash. Energy is supplied to the strobe lights from a power supply located on the under right side of the aft cabin top.

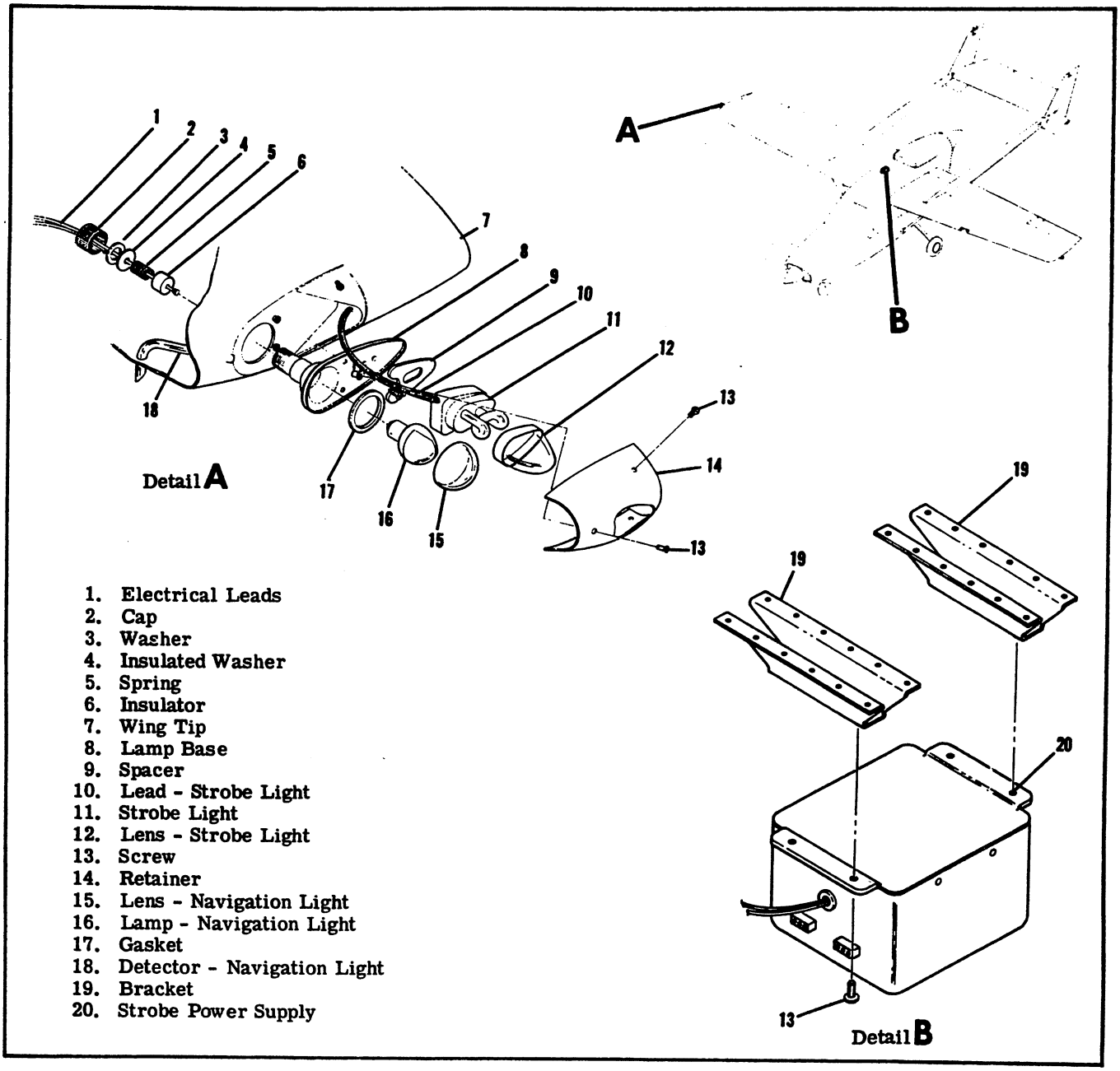
15-105. REMOVAL AND INSTALLATION. Use figure 15-13 as a guide for removal and installation of the anti-collision strobe light components.

WARNING

This anti-collision system is a high voltage device. Do not remove or touch tube assembly while in operation. Wait at least 5 minutes after turning off power before starting work.

15-106. STALL WARNING SYSTEM.

15-107. DESCRIPTION. The stall warning circuit is comprised of a stall and gear warning horn and actuating switch. The switch is installed in the leading edge of the left wing and is actuated by airflow over the surface of the wing. The switch will close as a stall condition is approached, actuating the warning horn attached to the left hand instrument panel bracket which attaches to the bottom of the instrument panel and firewall. The stall warning unit should actuate the stall warning horn approximately



1. Electrical Leads
2. Cap
3. Washer
4. Insulated Washer
5. Spring
6. Insulator
7. Wing Tip
8. Lamp Base
9. Spacer
10. Lead - Strobe Light
11. Strobe Light
12. Lens - Strobe Light
13. Screw
14. Retainer
15. Lens - Navigation Light
16. Lamp - Navigation Light
17. Gasket
18. Detector - Navigation Light
19. Bracket
20. Strobe Power Supply

Figure 15-13. Anti-Collision Strobe Light Installation

five to ten miles per hour above aircraft stall speed. Install the lip of the warning unit approximately one-eighth of an inch below the center line of the wing skin cutout. Test fly the aircraft to determine if the unit actuates the warning horn at the desired speed. If the unit actuates the horn at a speed in excess of ten miles per hour above stall speed, loosen the mounting screws and move the unit down. If the unit actuates the horn at a speed less than five miles per hour above stall speed, loosen the mounting screws and move the unit up. The stall and gear warning unit contains two separate horns. One horn produces a high pitched stall warning signal and the other an interrupted lower pitched gear warning signal.

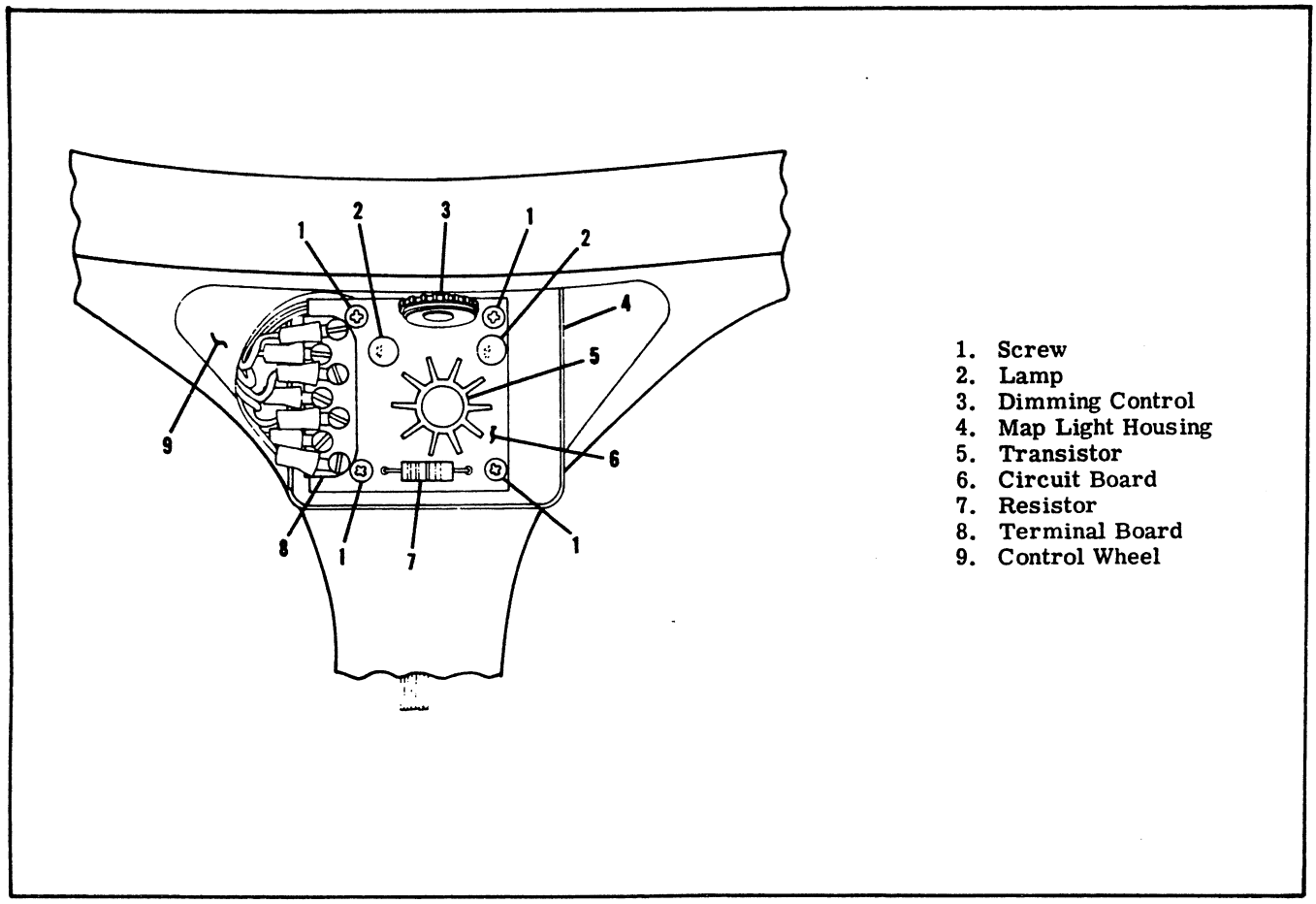
15-108. CIGAR LIGHTER CIRCUIT.

15-109. DESCRIPTION. The cigar lighter is a 12-volt unit and necessitates the use of a dropping resistor to reduce the voltage. The dropping resistor and an inline fuse are attached to the left hand instrument panel bracket which attaches to the bottom of the instrument panel and firewall. The circuit is also protected by a circuit breaker mounted in the circuit breaker panel.

15-110. PITOT AND STALL WARNING HEAT SYSTEMS.

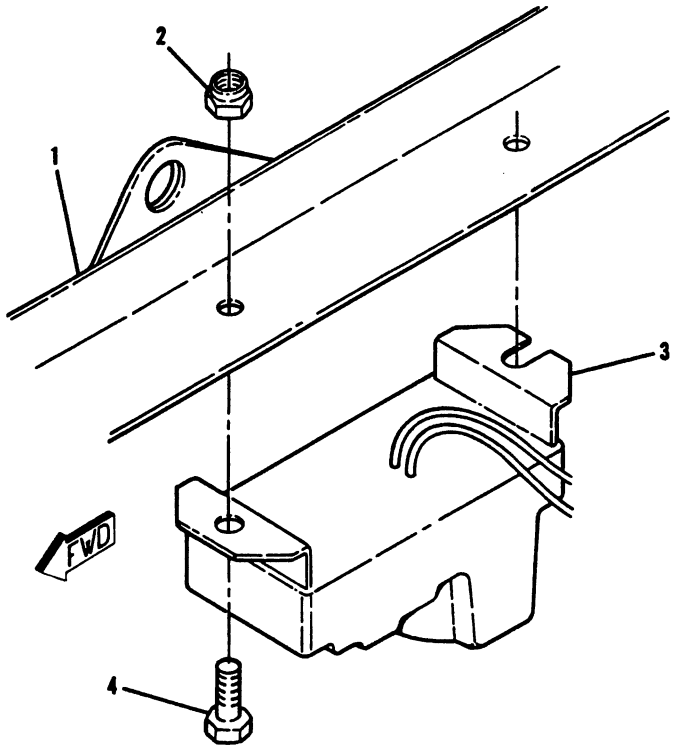
15-111. DESCRIPTION. The pitot and stall warning heaters are resistance units mounted integrally in the pitot tube and stall warning transmitter. Both units are controlled by one switch.

15-112. AUXILIARY FUEL PUMP CIRCUIT ADJUSTMENT. Refer to Section II for adjustment of auxiliary fuel pump circuit.

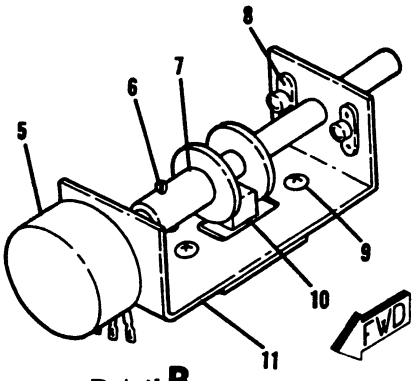


1. Screw
2. Lamp
3. Dimming Control
4. Map Light Housing
5. Transistor
6. Circuit Board
7. Resistor
8. Terminal Board
9. Control Wheel

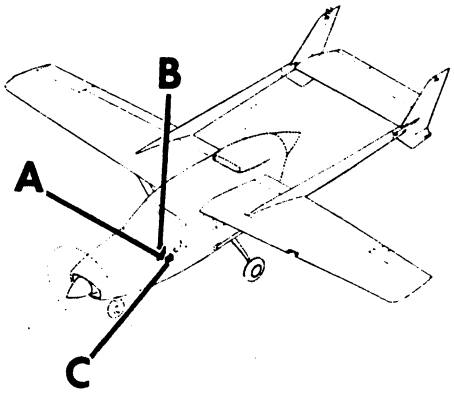
Figure 15-14. Control Wheel Map Light Installation

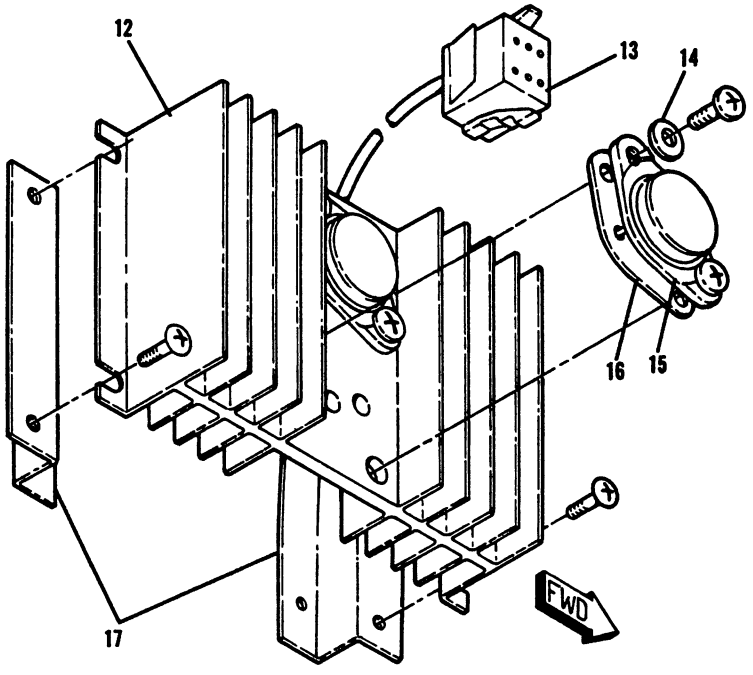


Detail A



Detail B

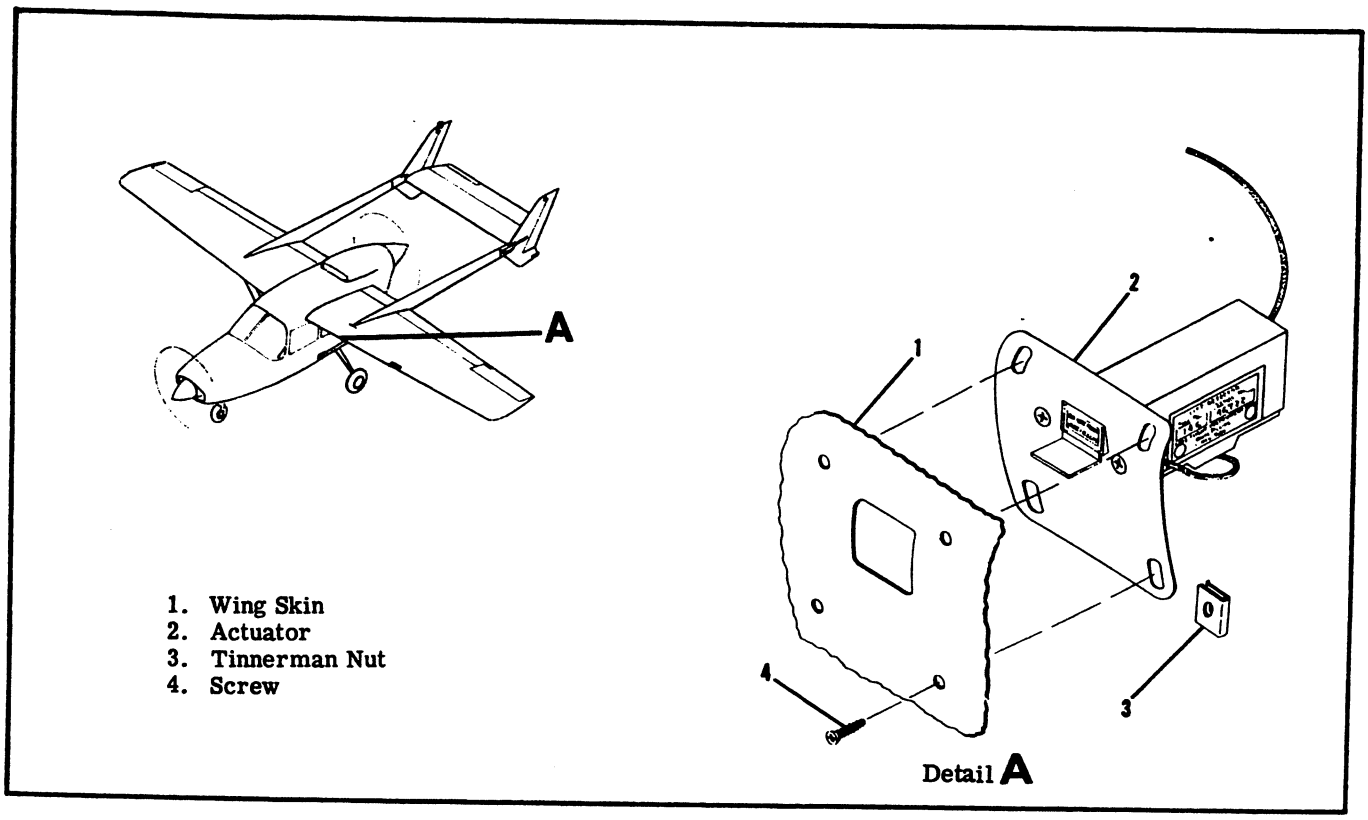




Detail C

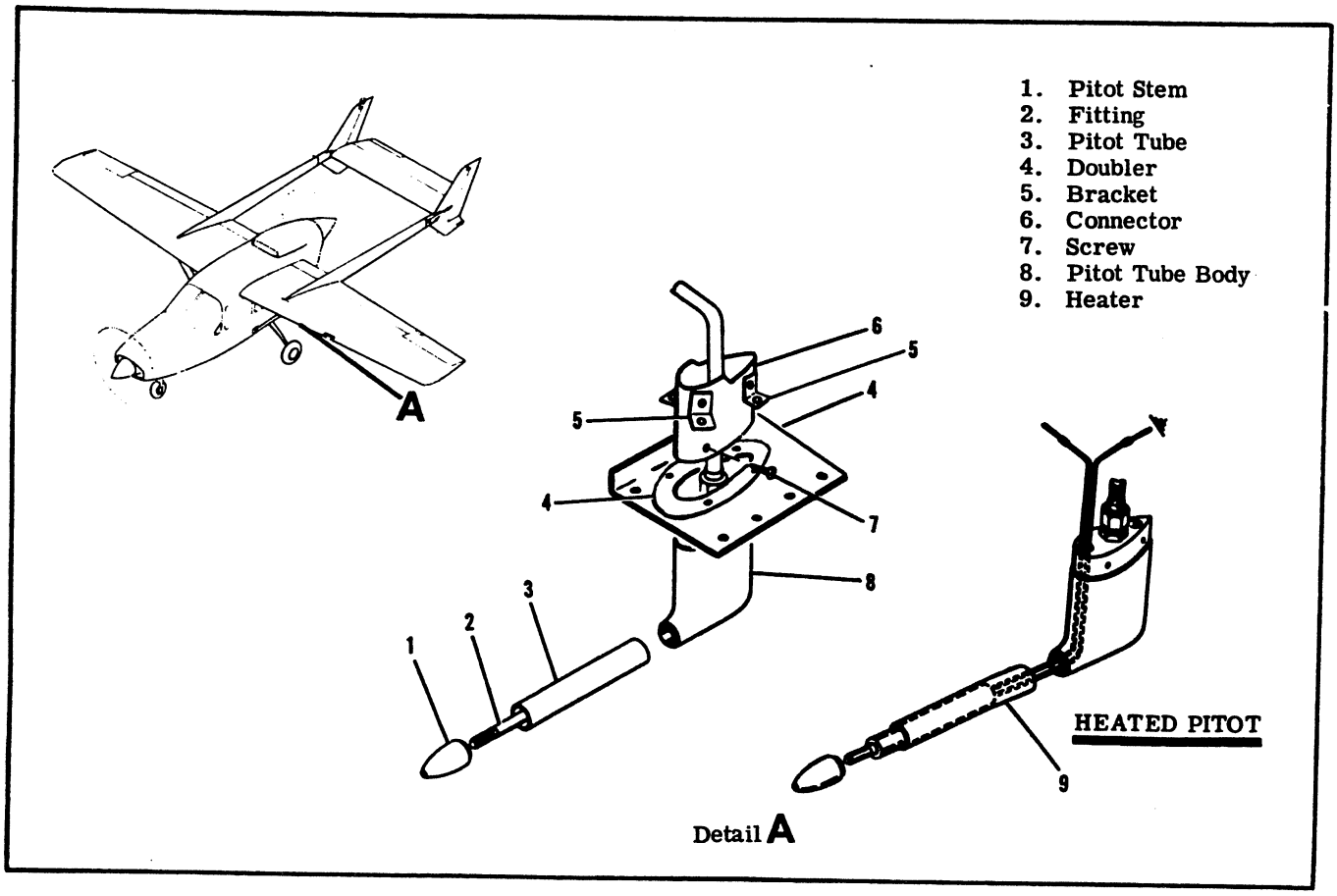
1. Support
2. Locknut
3. Inverter
4. Bolt
5. Potentiometer
6. Cotter Pin
7. Shaft
8. Nutplate
9. Screw
10. Switch
11. Bracket Assembly
12. Heat Sink
13. Housing-Socket
14. Washer
15. Transistor
16. Mica Washer
17. Bracket

Figure 15-15. Transistorized Light Dimming and Electroluminescent Panel Light Installation



1. Wing Skin
2. Actuator
3. Tinnerman Nut
4. Screw

Figure 15-16. Stall Warning Switch Installation



1. Pitot Stem
2. Fitting
3. Pitot Tube
4. Doubler
5. Bracket
6. Connector
7. Screw
8. Pitot Tube Body
9. Heater

Figure 15-17. Pitot Installation

ELECTRICAL LOADING CHART FOR 1965 SUPER SKYMASTER

STANDARD EQUIPMENT	AMPS REQD
Engine Gages - Front	
Cylinder Head Temperature	.039
Oil Temperature	.033
Engine Gages - Rear	
Cylinder Head Temperature	.039
Oil Temperature	.033
Turn and Bank Indicator	.15
Rotating Beacon	2.50
Panel Flood Lights	1.19
Compass Light	.17
Wing Flap Position Indicator	.10
Navigation Lights	1.97
Fuel Gage - Left Main	.06
Fuel Gage - Right Main	.06
Battery Contactor	.60
Wing Flap Position Indicator Light	.17
Tachometer	.05
Clock	Negligible
Solenoid Valve - Door Opening	1.7
Solenoid Valve - Gear Handle Lock*	.25
Lamp (Gear Up or Gear Down)	.04
Total Running Load (Standard)	9.154

*In flight running load.

OPTIONAL ACCESSORIES	AMPS REQD
Outside Air Temperature Gage	.08
Auxiliary Fuel Gages	.12
Pitot Heat	3.00
Stall Warning Heat	3.00
Post Lighting	
Engine Instrument (With Cluster)	.80
Suction Gage Light	.04
Fuel Selector Light	.04
Switch Panel Lights	.25
Flight Instrument Lights	.20
Gyro Lights	.24
Autcpilot Gyro Lights	.16
Radio Switch Panel	.08
Radio Indicators	.08
Radio Dial Lights	
Cessna Transceiver 500	.03
Cessna Nav/Com 500	.03
Cessna Nav/Omni 500	.03
Cessna ADF 500	.05
Cessna Nav/Com 300R	.06
Cessna Nav/Com 300	.12
Cessna Nav/Omni 300	.05
Cessna ADF 300	.04
Cessna Nav-O-Matic 300	.04
Cessna Nav-O-Matic 400	.05
King KY-95	.17
King KX-150	.08
Narco Mark 12	.12
Sunair T-5RA	.04
Sunair T-10R	.04

ELECTRONIC EQUIPMENT	AMPS REQD
Cessna Transceiver 500	3.25
Cessna Nav/Com 500	2.6
Cesssna Nav/Omni 500	3.5
Cessna Nav/Omni 500	2.8
Cessna Nav/Com 300R	3.0
Cessna ADF 300	1.1
Cessna Marker Beacon R-502B	.015
Cessna Nav-O-Matic 200	1.62
Cessna Nav-O-Matic 300	1.75
Cessna Nav-O-Matic 400	1.2
King KA-11	.12
King KX-150	3.0
Narco Mark 12 with VOA-4, -5, or -6	2.20
Narco UGR-1A	1.25
Sunair T-5RA	1.5
Sunair T-10R	1.5

ITEMS NOT CONSIDERED PART OF CONTINUOUS LOAD	AMPS REQD
Wing Flaps	18.0
Dome Lights	.14 Ea. (Approx.)
Landing and Taxi Lights (Left Wing)	3.57 Ea.
Landing and Taxi Lights (Right Wing)	3.57 Ea.
Cigarette Lighter	7.0
Fuel Boost Pumps	3.0 Ea. (Max.)
Stall Warning	1.3
Ice Light	1.43
Oil Dilution	1.2
De-Ice System	3.8
Cowl Flaps	1.8 Ea.
Courtesy Light	.46

ELECTRICAL LOADING CHART FOR 1966 SUPER SKYMASTER

STANDARD EQUIPMENT (Running Load)	AMPS REQD
Engine Gages - Front	
Cylinder Head Temperature	.039
Oil Temperature	.033
Engine Gages - Rear	
Cylinder Head Temperature	.039
Oil Temperature	.033
Turn and Bank Indicator	.15
Rotating Beacon	2.50
Panel Flood Lights	1.19
Compass Light	.04
Wing Flap Position Indicator	.10
Navigation Lights	1.97
Fuel Gage - Left Main	.06
Fuel Gage - Right Main	.06
Battery Contactor	.41
Wing Flap Position Indicator Light	.17
Tachometer	.05
Clock	.Negligible
Solenoid Valve - Door opening	1.7
Solenoid Valve - Gear Handle Lock*	.25
Lamp (Gear Up or Gear Down)	.04
Total Running Load (Standard)	8.834

*In flight running load.

ITEMS NOT CONSIDERED PART OF CONTINUOUS LOAD	AMPS REQD
Wing Flaps	8.5
Dome Lights	.14 Ea. (Approx.)
Landing and Taxi Lights (left wing)	3.57 Ea.
Landing and Taxi Lights (right wing)	3.57 Ea.
Cigarette Lighter	7.0
Fuel Boost Pumps	3.0 Ea. (Max.)
Stall Warning	1.3
Ice Light	1.43
Oil Dilution	1.2
De-Ice System	3.8
Cowl Flaps	1.8 Ea.
Courtesy Light	.46
Prop Anti-Ice	12.0 (Max.)

OPTIONAL ACCESSORIES (Running Load)	AMPS REQD
Prop Synchronizer	1.00
Flight Hour Recorder	.04
Outside Air Temp Gages	.08
Auxiliary Fuel Gages	.12
Pitot Heat	3.00
Stall Warning Heat	3.00
Post Lighting	
Engine Instrument (with Cluster)	.80
Suction Gage	.04
Fuel Selector Light	.04
Switch Panel Lights	.25
Flight Instrument Lights	.20
Gyro Lights	.24
Autopilot Gyro Lights	.16
Radio Switch Panel	.08
Radio Indicators	.08
Radio Dial Lights	
Cessna Transceiver 500	.03
Cessna Nav/Comm 500	.03
Cessna Nav/Omni 500	.03
Cessna ADF 500	.05
Cessna Transceiver 300	.06
Cessna Nav/Comm 300R	.06
Cessna Nav/Omni 300	.05
Cessna ADF 300	.04
Cessna Nav-O-Matic 300	.05
Cessna Nav-O-Matic 400	.05
King KY-95E	2.0
King KN-60	.08
Narco Mark 12	.12
King KX-160E	1.5
Pantronics DX10-DA	.12
Bendix ADF-T12-C	0.5
Electronic Equipment	
Cessna Transceiver 500	3.25
Cessna Nav/Comm 500	2.6
Cessna Nav/Omni 500	3.5
Cessna ADF 500	1.9
Cessna Transceiver 300	2.1
Cessna Nav/Comm 300R	3.0
Cessna Nav/Omni 300	3.0
Cessna ADF 300	1.1
Cessna Marker Beacon R-502B	.015
Cessna Nav-O-Matic 200	1.62
Cessna Nav-O-Matic 300	1.75
Cessna Nav-O-Matic 400	1.2
Bendix ADF-T12C	0.18
King KA-11	.12
King KN-60	2.4
King KX-95E	2.3
King KX-150B	4.5
King KX-160E	1.5
Narco 12 with VOA-4, -5	2.20
Narco UGR-1A	1.25
Pantronics DX10-DA	3.25

ELECTRICAL LOADING CHART FOR 1967 SUPER SKYMASTER

STANDARD EQUIPMENT (Running Load)	AMPS REQD
Engine Gages - Front	
Cylinder Head Temperature	.039
Oil Temperature	.033
Engine Gages - Rear	
Cylinder Head Temperature	.039
Oil Temperature	.033
Turn and Bank Indicator	.15
Flashing Beacon	4.0
Panel Flood Lights	1.31
Compass Light	.04
Navigation Lights	1.97
Fuel Gage - Left Main	.06
Fuel Gage - Right Main	.06
Battery Contactor	.41
Tachometer	.05
Clock	Negligible
Solenoid Valve - Door Opening	1.7
Solenoid Valve - Gear Handle Lock*	.25
Lamp (Gear Up or Gear Down)	.04
Total Running Load (Standard)	10.18

*In flight running load.

ITEMS NOT CONSIDERED PART OF CONTINUOUS LOAD	AMPS REQD
Wing Flaps	8.5
Dome Lights	.14 Ea.
Landing and Taxi Lights (Left Wing)	3.57 Ea.
Landing and Taxi Lights (Right Wing)	3.57 Ea.
Cigarette Lighter	7.0
Fuel Boost Pumps	3.0 Ea.
Stall Warning	.15
Ice Light	1.43
Oil Dilution	1.2
De-Ice System	3.8
Cowl Flaps	1.8 Ea.
Courtesy Light	.46
Prop Anti-Ice	12.0

OPTIONAL ACCESSORIES (Running Load)	AMPS REQD
Prop Synchronizer	1.00
Flight Hour Recorder	.04
Outside Air Temp Gage	.08
Auxiliary Fuel Gages	.12
Pitot Heat	3.00
Stall Warning Heat	3.00
Post Lighting	
Engine Instrument	.24
Suction Gage Light	.04
Switch Panel Lights	.40
Flight Instrument Lights	.24
Gyro Lights	.12
Radio Switch Panel	.08
Radio Indicators	.08
Fuel Economy Indicator Light	.04
Ammeter Sel Light	.04
Flight Hour Recorder Light	.04
Outside Air Temp. Light	.04
Radio Dial Lights	
Cessna Transceiver 500	.03
Cessna Nav/Com 500	.03
Cessna Nav/Omni 500	.03
Cessna ADF 500	.05
Cessna Transceiver 300	.06
Cessna 1 1/2 Nav/Com 300R	.06
Cessna Nav/Omni 300	.05
Cessna ADF 300	.04
Cessna Nav-O-Matic 300	.05
Cessna Nav-O-Matic 400	.05
King KY-95E	.17
Cessna DME 300	.08
Cessna Transponder 800	.12
King KX-160E or KX-160AE	.16
Pantronics DX10-DA	.12
Bendix ADF-T12-C	.17
Electronic Equipment	
Cessna Transceiver 500	3.25
Cessna Nav/Com 500	2.6
Cessna Nav/Omni 500	3.5
Cessna ADF 500	1.9
Cessna Transceiver 300	2.1
Cessna 1 1/2 Nav/Com 300R	3.0
Cessna Nav/Omni 300	3.0
Cessna ADF 300	1.1
Cessna Marker Beacon R-502B	.015
Cessna DME 300	2.4
Cessna Nav-O-Matic 300	1.75
Cessna Nav-O-Matic 400	1.2
Cessna Transponder 800	2.0
Bendix ADF-T12C	0.5
King KA-25C	.12
King KY-95E	2.0
King KX-160E or KX-160AE	1.5
Narco Mark 12A with VOA-4 or -5 Indicator	4.8
Pantronics DX10-DA	3.25

ELECTRICAL LOAD ANALYSIS CHART FOR 1968 SUPER SKYMASTER

STANDARD EQUIPMENT (Running Load)	AMPS REQD
Engine Gages - Front	
Cylinder Head Temperature	.039
Oil Temperature	.033
Engine Gages - Rear	
Cylinder Head Temperature	.039
Oil Temperature	.033
Turn Coordinator	.28
Flashing Beacon	6.0
Panel Flood Lights**	1.31
Compass Light	.04
Navigation Lights	1.97
Fuel Gage - Left Main	.06
Fuel Gage - Right Main	.06
Battery Contactor	.41
Tachometer	.05
Clock	Negligible
Solenoid Valve - Door Opening	1.7
Solenoid Valve - Gear Handle Lock*	.25
Lamp (Gear Up or Gear Down)	.04
Total Running Load (Standard)	12.31

*In flight running load.
**When post lights are installed, subtract 1.19 amps from total running load for flood lighting which will not be used at the same time as post lighting.

ITEMS NOT CONSIDERED PART OF CONTINUOUS LOAD	AMPS REQD
Wing Flaps	8.5
Dome Lights	.14 Ea.
Landing and Taxi Lights (Left Wing)	3.57 Ea.
Landing and Taxi Lights (Right Wing)	3.57 Ea.
Cigarette Lighter	7.0
Fuel Boost Pumps	3.0 Ea.
Stall Warning	.15
Ice Light	1.43
Oil Dilution	1.2
De-Ice System	3.8
Cowl Flaps	1.8 Ea.
Courtesy Light	.46
Prop Anti-Ice	12.0
Electric Trim	1.8

OPTIONAL ACCESSORIES (Running Load)	AMPS REQD
Prop Synchronizer	1.00
Flight Hour Recorder	.04
Outside Air Temp Gage	.08
Pitot Heat	4.05
Stall Warning Heat	1.75
Post Lighting	
Engine Instrument	.24
Suction Gage Light	.04
Switch Panel Light	.40
Flight Instrument Lights	.24
Gyro Lights	.12
Radio Switch Panel	.08
Radio Indicators	.08
Fuel Economy Indicator Light	.04
Flight Hour Recorder Light	.04
Outside Air Temp Light	.04
Radio Dial Lights	
Cessna 400 Transceiver	.23
Cessna 400 Nav/Com	.46
Cessna 400 ADF	.05
Cessna 300 Transceiver	.06
Cessna 300 Nav/Com, 360 Channel	.06
Cessna 300 ADF	.04
Cessna 300 Nav-O-Matic	.05
Cessna 400 Nav-O-Matic	.05
King KY-95E	.17
Cessna 300 DME	.08
Cessna 400 Transponder	.44
King KX-160E AE or AF	.16
Pantronics DX10-DA	.12
Electronic Equipment	
Cessna 400 Transceiver	1.0
Cessna 400 Nav/Com	2.0
Cessna 400 ADF	1.9
Cessna 400 Glide Slope	.50
Cessna 300 Transceiver	2.1
Cessna 300 Nav/Com, 360 Channel	3.0
Cessna 300 ADF	1.1
Cessna Marker Beacon R-502B	.015
Cessna 300 DME	2.4
Cessna 300 Nav-O-Matic	1.75
Cessna 400 Nav-O-Matic	1.2
Cessna 400 Transponder	1.5
King KA-25C	.12
King KY-95E	2.0
King KY-160E, AE or AF	1.50
Pantronics DX10-DA	3.25
Wing Leveler - Brittain	.28

ELECTRICAL LOAD ANALYSIS CHART FOR 1969 SUPER SKYMASTER

STANDARD EQUIPMENT (Running Load)	AMPS REQD
Engine Gages - Front	
Cylinder Head Temperature	.039
Oil Temperature	.033
Engine Gages - Rear	
Cylinder Head Temperature	.039
Oil Temperature	.033
Turn Coordinator	.28
Flashing Beacon	6.0
Panel Flood Lights**	1.31
Compass Light	.04
Navigation Lights	1.97
Fuel Gage - Left Main	.06
Fuel Gage - Right Main	.06
Battery Contactor	.41
Tachometer	.05
Clock	Negligible
Solenoid Valve - Door Opening	1.7
Solenoid Valve - Gear Handle Lock*	.25
Lamp (Gear Up or Gear Down)	.04
Total Running Load (Standard)	12.31

*In flight running load.

**When post lights are installed, subtract 1.19 amps from total running load for flood lighting which will not be used at the same time as post lighting.

ITEMS NOT CONSIDERED PART OF CONTINUOUS LOAD	AMPS REQD
Wing Flaps	8.5
Dome Lights	.14 Ea.
Landing and Taxi Lights (Left Wing)	3.57 Ea.
Landing and Taxi Lights (Right Wing)	3.57 Ea.
Cigarette Lighter	7.0
Fuel Boost Pumps	3.0 Ea.
Stall Warning	.15
Ice Light	1.43
Oil Dilution	1.2
De-Ice System	3.8
Cowl Flaps	1.8 Ea.
Courtesy Light	.46
Prop Anti-Ice	12.0
Electric Trim	1.8

OPTIONAL ACCESSORIES (Running Load)	AMPS REQD
Prop Synchronizer	1.00
Flight Hour Recorder	.04
Outside Air Temp Gage	.08
Pitot Heat	4.05
Stall Warning Heat	1.75
Post Lighting	
Engine Instrument	.24
Suction Gage Light	.04
Switch Panel Light	.40
Flight Instrument Lights	.24
Gyro Lights	.12
Radio Switch Panel	.08
Radio Indicators	.08
Fuel Economy Indicator Light	.04
Flight Hour Recorder Light	.04
Outside Air Temp Light	.04
Radio Dial Lights	
Cessna 400 Transceiver	.23
Cessna 400 Nav/Com	.46
Cessna 400 ADF	.05
Cessna 300 Transceiver	.06
Cessna 300 Nav/Com, 360 Channel	.06
Cessna 300 ADF	.04
Cessna 300 Nav-O-Matic	.05
Cessna 400 Nav-O-Matic	.05
Cessna 300 HF	.12
Cessna 300 DME	.08
Cessna 400 Transponder	.44
Cessna 300 Transponder	.08
Electronic Equipment	
Cessna 400 Transceiver	1.0
Cessna 400 Nav/Com	2.0
Cessna 400 ADF	1.8
Cessna 400 Glideslope	.50
Cessna 300 Transceiver	2.1
Cessna 300 Nav/Com, 360 Channel	3.0
Cessna 300 ADF	1.1
Cessna Marker Beacon R-502B	.015
Cessna 300 DME	2.4
Cessna 300 Nav-O-Matic	1.75
Cessna 400 Nav-O-Matic	1.2
Cessna 400 Transponder	1.5
Cessna 300 Transponder	.07
Cessna 300 HF	3.25
Wing Leveler - Brittain	.28

ELECTRICAL LOAD ANALYSIS CHART FOR 1970 SUPER SKYMASTER

STANDARD EQUIPMENT (Running Load)	AMPS REQD
Engine Gages - Front	
Cylinder Head Temperature	.039
Oil Temperature	.033
Engine Gages - Rear	
Cylinder Head Temperature	.039
Oil Temperature	.033
Turn Coordinator	.28
Flashing Beacon	6.0
Panel Flood Lights**	1.31
Compass Light	.04
Navigation Lights	1.97
Fuel Gage - Left Main	.06
Fuel Gage - Right Main	.06
Battery Contactor	.41
Tachometer	.05
Clock	Negligible
Solenoid Valve - Door Opening	1.7
Solenoid Valve - Gear Handle Lock*	.25
Lamp (Gear Up or Gear Down)	.04
Total Running Load (Standard)	12.31

*In flight running load.

**When post lights are installed, subtract 1.19 amps from total running load for flood lighting which will not be used at the same time as post lighting.

ITEMS NOT CONSIDERED PART OF CONTINUOUS LOAD	AMPS REQD
Wing Flaps	8.5
Dome Lights	.14 Ea.
Landing and Taxi Lights (Left Wing)	3.57 Ea.
Landing and Taxi Lights (Right Wing)	3.57 Ea.
Cigaretter Lighter	7.0
Fuel Boost Pumps	3.0 Ea.
Stall Warning	.15
Ice Light	1.43
Oil Dilution	1.2
De-Ice System	3.8
Cowl Flaps	1.8 Ea.
Courtesy Light	.46
Prop Anti-Ice	12.0
Electric Trim	1.8

OPTIONAL ACCESSORIES (Running Load)	AMPS REQD
Prop Synchronizer	1.00
Flight Hour Recorder	.04
Outside Air Temp Gage	.08
Pitot Heat	4.05
Stall Warning Heat	1.75
Post Lighting	
Engine Instrument	.24
Suction Gage Light	.04
Switch Panel Light	.36
Flight Instrument Lights	.24
Gyro Lights	.12
Radio Switch Panel	.08
Radio Indicators	.08
Fuel Economy Indicator Light	.04
Flight Hour Recorder Light	.04
Outside Air Temp Light	.04
Radio Dial Lights	
Cessna 400 Transceiver	.23
Cessna 400 Nav/Com	.46
Cessna 400 ADF	.05
Cessna 300 Transceiver	.06
Cessna 300 Nav/Com, 360 Channel	.06
Cessna 300 ADF	.04
Cessna 300 Nav-O-Matic	.05
Cessna 400 Nav-O-Matic	.05
Cessna 300 HF	.12
Cessna 300 DME	.08
Cessna 400 Transponder	.44
Cessna 300 Transponder	.08
King KY-95E	.17
King KX-160E, AE or FE	.16
Narco Mark 12B	.07
Electronic Equipment	
Cessna 400 Transceiver	1.0
Cessna 400 Nav/Com	2.0
Cessna 400 ADF	1.8
Cessna 400 Glideslope	.50
Cessna 300 Transceiver	2.1
Cessna 300 Nav/Comm, 360 Channel	3.0
Cessna 300 ADF	1.1
Cessna Marker Beacon R-502B	.015
Cessna 300 DME	2.4
Cessna 300 Nav-O-Matic	1.75
Cessna 400 Nav-O-Matic	1.2
Cessna 400 Transponder	1.5
Cessna 300 Transponder	.07
Cessna 300 HF	3.25
King KY-95E	2.0
King KX-160E, AE or FE	1.5
King KX-160-1	1.5
Narco Mark 12B	2.16
Narco UGR-2 Glideslope	.23
Single Sideband HF Transceiver	2.5
Strobe Lights	1.25
Wing Leveler - Brittain	.28